

APPENDIX C. TECHNICAL SPECIFICATIONS

C.1 Specification of SVAN 977W as sound level meter

C1.1 Specification of the SVAN 977W as SLM in the standard configuration

The **SVAN 977W** instrument working as the SLM with all listed below accessories meets requirements of the IEC 61672 for the Class 1 instruments.

The configuration of the complete SLM and its normal mode of operation:

SVAN 977W	sound&vibration analyzer,
SV 12L	microphone preamplifier,
A.C.O. 7052E	measuring prepolarized free-field microphone (1/2", nominal sensitivity 35 mV / Pa, polarization 0 V),
SV 35A	acoustic calibrator, B&K 4231 (or equivalent)

Accessories included in SVAN 977W instrument set:

SC 16	USB cable
SA 22	Windscreen

Accessories available:

SV 55	RS 232 interface for SVAN 977W
SA 277	Outdoor protection Unit
SA 15	power supply unit.

Measured quantities

The measured quantities in the sound meter mode are: **PEAK, SPL, MAX, MIN, LEQ, RLeq, SEL, Ltm5, Lden, LEPd, Ln.**

The definitions for parameters are given in Appendix D.

Additional functions

Overload indication:	See Chapter 3 or Appendix A.
Under-range indication:	See Chapter 3 or Appendix A
Battery state indication:	See Chapter 3
High self-vibration warning:	See Chapter 3

Conformance testing

This chapter contains the information needed to conduct conformance testing according to the specified standards.

Mounting for acoustical tests

The microphone must be mounted on the preamplifier.

Electrical substitute for the microphone

To obtain a BNC Class electrical input, the microphone must be replaced by an electrical microphone impedance ST 02 with the serial capacitance 18 pF +/- 10%.



Note: For the conformance of electrical tests the Microphone Compensation must be set to "OFF"! (path: <Menu> / Measurement / Compensation Filter).



Note: For the conformance of acoustical tests the Microphone Compensation must be set to "On"! (path: <Menu> / Measurement / Compensation Filter).

Periodical test upper frequency 8 kHz

Linear Operating Ranges

Two measuring ranges are available: "LOW" and "HIGH"

The starting point at which tests of level linearity shall begin is 94.0 dB for the frequencies specifies below.

Table C.1.1 Linear operating range: "Low" for the sinusoidal signal and microphone sensitivity 35 mV/Pa

[dB]	L _{AS/F}		L _{BS/F}		L _{CS/F}		L _{ZS/F}		L _{AeqT}		L _{BeqT}		L _{CeqT}		L _{AE} (t _{int} = 2 s)		L _{Cpeak}	
	from	to	from	to	from	to	from	to	from	to	from	to	from	to	from	to	from	to
31,5 Hz	25	80	25	103	25	117	30	120	25	80	25	103	25	117	28	83	50	120
500 Hz	25	116	25	119	25	120	30	120	25	116	25	119	25	120	28	119	50	123
1 kHz	25	120	25	120	25	120	30	120	25	120	25	120	25	120	28	123	50	123
4 kHz	25	121	25	119	25	119	30	120	25	121	25	119	25	119	28	124	50	123
8 kHz	25	119	25	117	25	117	30	120	25	119	25	117	25	117	28	122	50	120
12.5 kHz	25	115	25	114	25	114	30	120	25	115	25	114	25	114	28	118	50	117

Table C.1.2 Linear operating range: „High“ (primary level range) for the sinusoidal signal and microphone sensitivity 35 mV/Pa

[dB]	L _{AS/F}		L _{BS/F}		L _{CS/F}		L _{ZS/F}		L _{AeqT}		L _{BeqT}		L _{CeqT}		L _{AE} (t _{int} = 2 s)		L _{Cpeak}	
	from	to	from	to	from	to	from	to	from	to	from	to	from	to	from	to	from	to
31,5 Hz	35	97	35	120	35	134	40	137	35	97	35	120	35	134	38	100	60	137
500 Hz	35	133	35	136	35	137	40	137	35	133	35	136	35	137	38	136	60	140
1 kHz	35	137	35	137	35	137	40	137	35	137	35	137	35	137	38	140	60	140
4 kHz	35	138	35	136	35	136	40	137	35	138	35	136	35	136	38	141	60	139
8 kHz	35	136	35	134	35	134	40	137	35	136	35	134	35	134	38	139	60	137
12.5 kHz	35	132	35	131	35	131	40	137	35	132	35	131	35	131	38	135	60	134



Note: For the signals with the crest factor $n > 1.41$ upper measuring range of the RMS (LEQ and SPL) is reduced. The valid upper limit can be calculated according to the below given formula:

$A_n = 137 - 20 \log(n/\sqrt{2})$, where A is the upper limit for the sinusoidal signal

Example: For the crest factor $n = 10$ the upper limit is $A_{10} = 120 \text{ dB}$

Measuring ranges**Reference measuring range** of the acoustic pressure Low**Measuring frequency range** of the acoustic pressure (-3 dB) 10 Hz ÷ 20 000 Hz.**Basic measurement error** of the acoustic pressure < 0.7 dB (measured for the reference conditions, see below).**Weighting filters** (see part C.3)

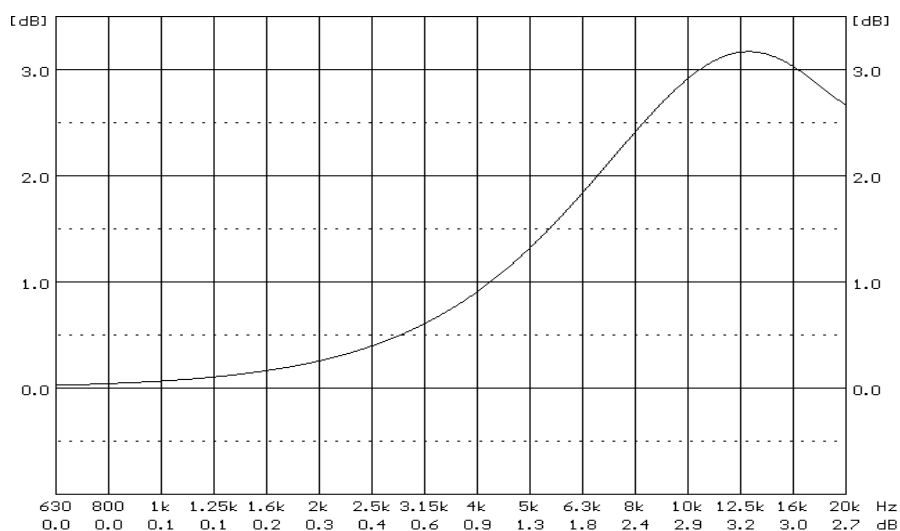
- **Z** meeting requirements of the IEC 61672-1 standard for the Class 1 “Z” filter
- **A** meeting requirements of the IEC 651 and IEC 61672-1 standard for the Class 1 “A” filter
- **B** meeting requirements of the IEC 651 and IEC 61672-1 standard for the Class 1 “B” filter
- **C** meeting requirements of the IEC 651 and IEC 61672-1 standard for the Class 1 “C” filter

Table C.1.3. Self-generated noise for different weighting filters

Range \ Weighting filter	Electrical *)			Acoustical compensated		
	A	C	Z	A	C	Z
Low	< 12 dB	< 12 dB	< 17 dB	< 15 dB	< 15 dB	< 20 dB
High	< 22 dB	< 22 dB	< 26 dB	< 25 dB	< 25 dB	< 30 dB

*) measured with the **ST 02** microphone equivalent impedance **18 pF +/-10%****Special filters**

- **Diffuse field – compensation filter** filter improving the complete instrument frequency response in the diffuse acoustic field (see below)
- **Windscreen – compensation filter** filter improving the instrument frequency response in the free acoustic field when windscreen SA22 is mounted on the microphone (see C.1.2)

**SVAN 977W diffuse field compensation filter**



Note: Using special filters might change the frequency response and measuring ranges of the 977W. Please check the below given specification.

Linear operating ranges for LEQ measurements with Diffuse Filter

Table C.1.4 Linear operating range for the “Diffuse” filter: “LOW” for the sinusoidal signal and microphone sensitivity 35 mV/Pa

[dB]	L _{AS/F}		L _{BS/F}		L _{CS/F}		L _{ZS/F}		L _{AeqT}		L _{BeqT}		L _{CeqT}		L _{AE} (t _{int} = 2 s)		L _{Cpeak}	
	from	to	from	to	from	to	from	to	from	to	from	to	from	to	from	to	from	to
31,5 Hz	26	80	26	103	26	117	32	120	26	80	26	103	26	117	29	83	50	120
500 Hz	26	116	26	119	26	120	32	120	26	116	26	119	26	120	29	119	50	123
1 kHz	26	120	26	120	26	120	32	120	26	120	26	120	26	120	29	123	50	123
4 kHz	26	121	26	119	26	119	32	120	26	121	26	119	26	119	29	124	50	123
8 kHz	26	119	26	117	26	117	32	120	26	119	26	117	26	117	29	123	50	120
12.5 kHz	26	115	26	114	26	114	32	120	26	115	26	114	26	114	29	118	50	117

Table C.1.5 Linear operating range for the “Diffuse” filter: „High“ for the sinusoidal signal and microphone sensitivity 35 mV/Pa

[dB]	L _{AS/F}		L _{BS/F}		L _{CS/F}		L _{ZS/F}		L _{AeqT}		L _{BeqT}		L _{CeqT}		L _{AE} (t _{int} = 2 s)		L _{Cpeak}	
	from	to	from	to	from	to	from	to	from	to	from	to	from	to	from	to	from	to
31,5 Hz	36	97	36	120	36	134	42	137	36	97	36	120	36	134	39	100	60	137
500 Hz	36	133	36	136	36	137	42	137	36	133	36	136	36	137	39	136	60	140
1 kHz	36	137	36	137	36	137	42	137	36	137	36	137	36	137	39	140	60	140
4 kHz	36	138	36	136	36	136	42	137	36	138	36	136	36	136	39	141	60	139
8 kHz	36	136	36	134	36	134	42	137	36	136	36	134	36	134	39	139	60	137
12.5 kHz	36	132	36	131	36	131	42	137	36	132	36	131	36	131	39	136	60	134

See C1.2 for the effect of the SA 22 windscreen

RMS detector

- Digital “True RMS” with Peak detection,
- Resolution 0.1 dB
- Range 327.7 dB
- Crest Factor unlimited (for signals in 20 kHz band).

Overload detector

The instrument has the built-in overload detectors. The overload in the measurement channel (in its analogue part) and the overload of the analogue / digital converter are both detected. The “overload” indication is when the input signal amplitude is **0.5 dB above** the declared “Peak measurement range”.

Underrange detector

The instrument has the built-in underrange detector. The “underrange” indication appears when the minimum value of the RMS detector output goes below the specified lower linear operating range.

Time weighting characteristics (Exponential averaging)

Slow “S” according to IEC 61672 Class 1, Equivalent Time Constant 1000 ms
Fast “F” according to IEC 61672 Class 1, Equivalent Time Constant 125 ms
Imoulse “I” according to IEC 60804 Class 1, Equivalent Time Constant 35 ms, Hold Time 1500 s

Reference conditions

- Class of the acoustic field Free field
- Reference acoustic pressure 114.0 dB (related to 20 µPa)
- Reference frequency 1000 Hz
- Reference temperature +20°C
- Reference relative humidity 65 %
- Reference static pressure 1013 hPa
- Reference incidence direction perpendicular to the microphone diaphragm.

Calibration

Acoustical - with the SV 30A acoustic calibrator (or equivalent):

- Calibration level for the free field 113.87 dB
(See A.C.O. 7052E free field correction table below)
- Calibration level for the diffuse field 114.0 dB
(See A.C.O. 7052E free field correction table below)

Microphone

ACO 7052E prepolarized free-field ½” condenser microphone
 Nominal sensitivity 35 mV/Pa (corresponding to -29 dBV/Pa re 1 V/Pa)
 Capacitance 17 pF.



Note: Maximum level of sound pressure level, which can be affect the microphone without destruction the microphone: 155 dB.

Table C.1.6 ACO 7052E free field correction for electrostatic actuator the 0 deg incidence

Correction factors [dB]	Frequency [Hz]																
	20	25	31,5	40	50	63	80	100	125	160	200	250	315	400	500	630	800
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.06	0.07
	Frequency [Hz]																
	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500	16000	20000			
	0.1	0.13	0.24	0.34	0.48	0.72	1.1	1.55	2.24	3.06	4.37	5.94	7.86	10.57			

Table C.1.7 ACO 7052E free field correction for B&K 4226 calibrator for the 0 deg incidence

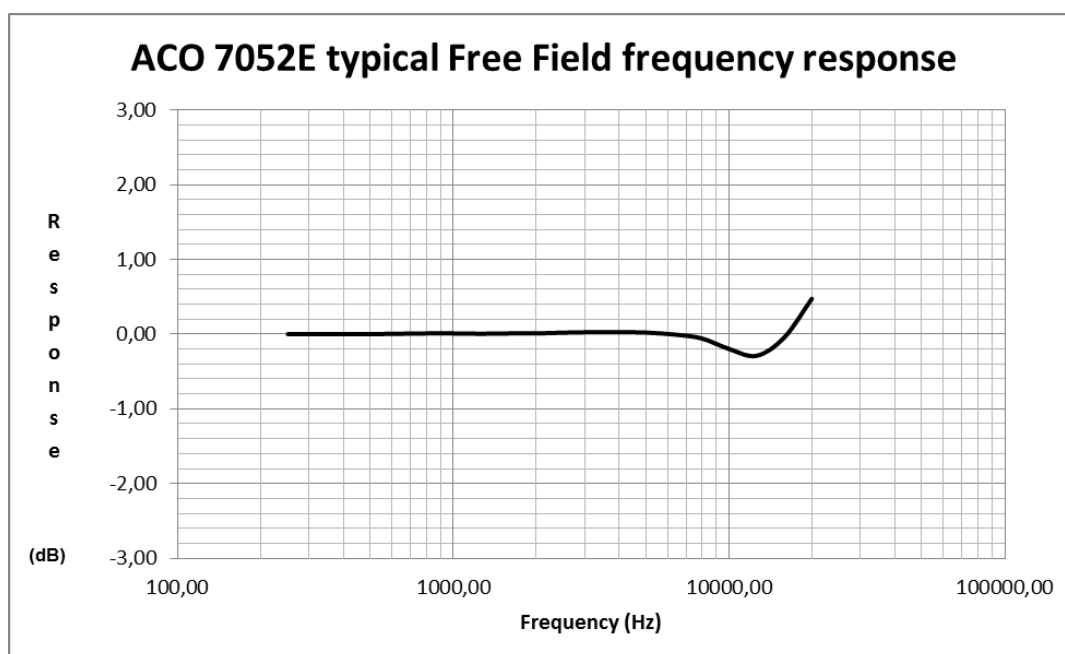
Correction factors [dB]	Frequency [Hz]				
	250	500	1000	2000	4000
	0.0	0.06	0.13	0.58	1.65
Frequency [Hz]					

	8000	12500	16000	20000
	4.24	7.29	9.17	10.95

Typical Free Field frequency response of the microphone

Table C.1.8 ACO 7052E free field response 0 deg incidence - measured

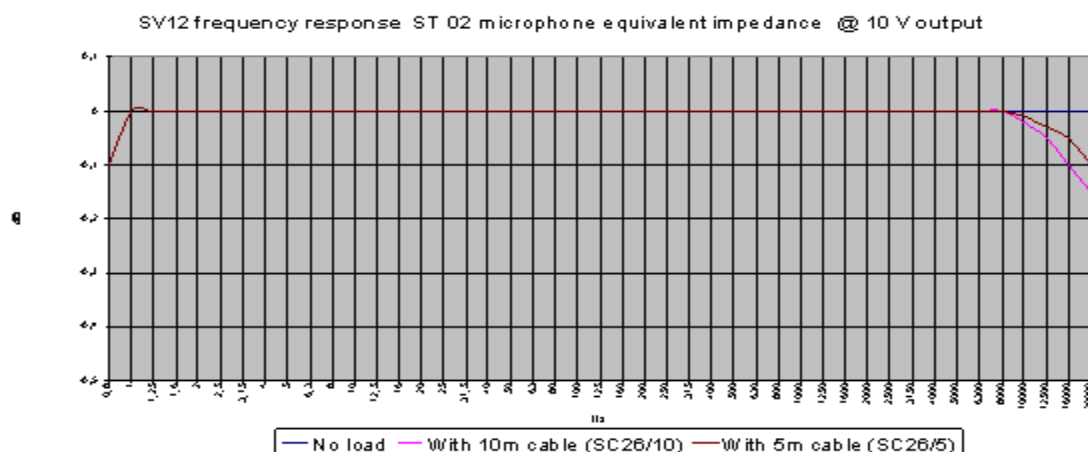
Correction factors [dB]	Frequency [Hz]																
	20	25	31,5	40	50	63	80	100	125	160	200	250	315	400	500	630	800
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.01	0.01	0.01	0.01	0.01
	Frequency [Hz]																
	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500	16000	20000			
	0.01	0.01	0.01	0.01	0.02	0.03	0.03	0.02	0.0	-0.06	-0.2	-0.29	-0.05	0.47			



Preamplifier

SV 12L

nominal preamplifier attenuation: 0.7 dB;
IEPE Type – power supply 1.5 mA@30 V



SV12L typical frequency response

Maximum peak voltage

30 V Peak-Peak (Maximum peak voltage of input sinusoidal signal, which can be lead to the SLM without destruction the meter)

Warm-up time

1 min. (for 0.1 dB accuracy)

Typical stabilization time after change in environmental conditions is 1 minute.

Nominal delay

less than 3 seconds (between operating of the "Reset-Button" and beginning of a new measurement)

Time shift after completion of a measurement, before a measurement is shown

< 1 sec



Note: When the instruments are moved from a warm environment with high humidity, to a colder environment, care should be taken not to produce condensation inside the instruments. In this case, much longer stabilization periods may be necessary.

Environmental, electrostatic and radio frequency criteria

Effect of humidity

< 0.5 dB (for 30%<RH<90% at 40°C and 1000 Hz)

Effect of magnetic field

< 15 dB (A) or < 25 dB (Z) (for 80 A/m and 50 Hz)

Effect of radio frequency fields

< +/-0.5 dB @ 74 dB and 10V/m electromagnetic field

The greatest susceptibility (the least immunity) is achieved when in the SLM the **Z** filter and time weighting **F** are selected and the SPL measurements are considered.

The greatest susceptibility is achieved when the SLM is placed parallel to the radio frequency field. In addition, if there is an extension cable, the greatest susceptibility is achieved when the SLM and cable is placed along field and the cable is coil as solenoid.

Effect of electrostatic discharge

meets requirements of IEC 61672-1

During electrostatic discharge, the influence of the displayed results could be observed.

No changes in instrument operation state, configuration or stored data corruption were found out.

Effect of ambient pressure	< 0.01 dB/kPa
Effect of temperature	< 0.5 dB (from -10°C to + 50°C)
Operating range	from -10°C to + 50°C
Storage	from -20°C to + 60°C

Effect of Vibration

1. For mechanical vibrations with an acceleration of 1 m/s² vertically to the membrane of the microphone for the frequencies 31,5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 630 Hz, 800 Hz and 1000 Hz increases the low level of the linear operation range to 70dB for the frequency weighting "A".
2. For mechanical vibrations with an acceleration of 1 m/s² parallel to the membrane of the microphone for the frequencies 31,5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 630 Hz, 800 Hz and 1000 Hz increases the low level of the linear operation range to 65dB for the frequency weighting "A".

Test conditions

SVAN 977W SLM are mounted on the shaker.

Ref 1. Vibration is applied in a direction perpendicular to the plane of the microphone diaphragm.

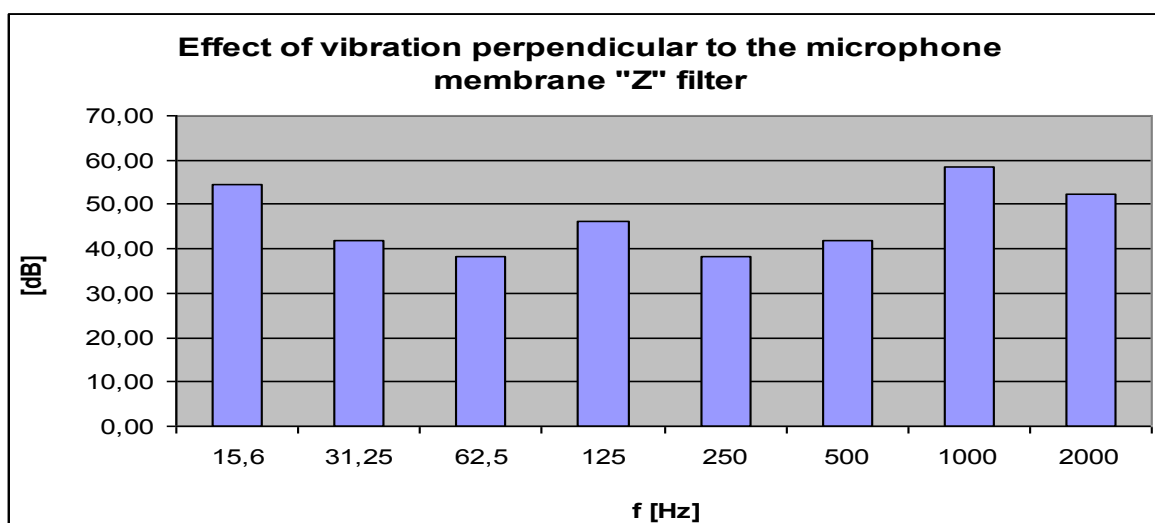
Ref 2. Vibration is applied in a direction parallel to the plane of the microphone diaphragm.

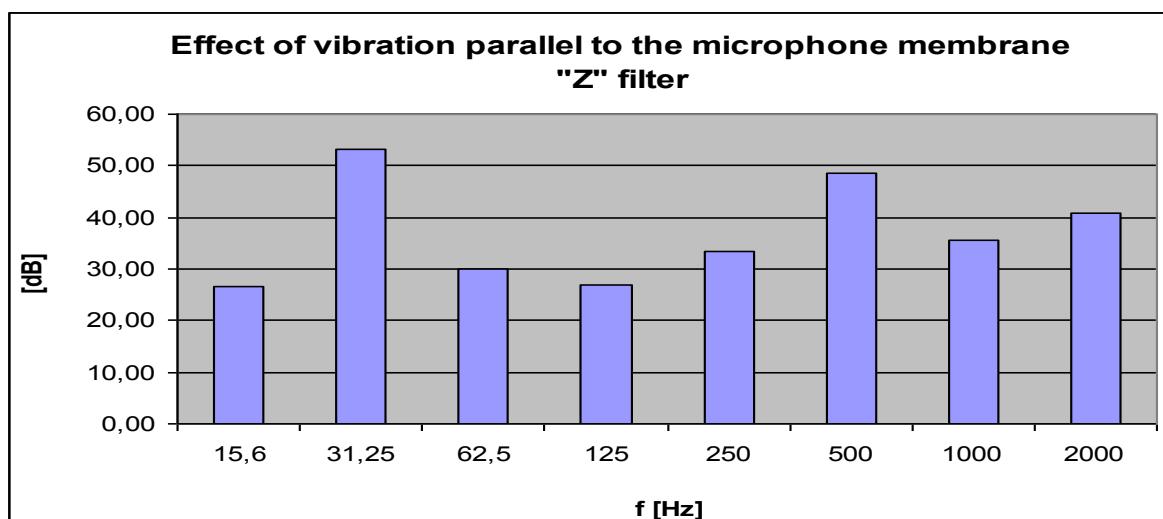
Table C.1.9 Typical effect of vibration perpendicular to the plane of microphone diaphragm

f (Hz)	15.6	31.25	62.5	125	250	500	1000	2000
Typical effect of vibration [dB]	54.6	41.9	38.2	46.2	38.3	42.0	58.6	52.4

Table C.1.10 Typical effect of vibration perpendicular to the plane of microphone diaphragm

f (Hz)	15.6	31.25	62.5	125	250	500	1000	2000
Typical effect of vibration [dB]	26.5	53.1	30.1	27.0	33.3	48.6	35.6	40.7





Frequency response of the SVAN 977W

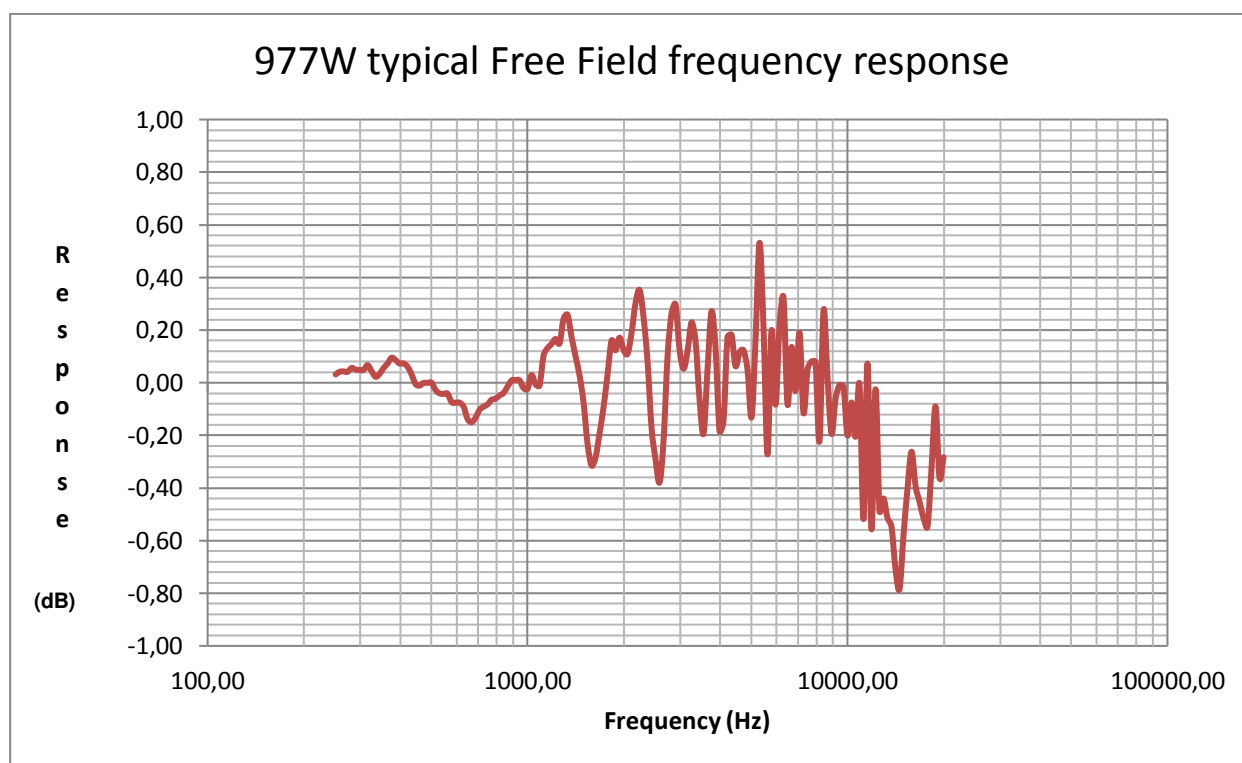


Table C.1.11 SVAN 977W typical frequency response

Frequency [Hz]	Case effect [dB]	Frequency [Hz]	Case effect [dB]	Frequency [Hz]	Case effect [dB]
251,19	0,03	1090,18	-0,01	4731,51	0,12
258,52	0,04	1122,02	0,10	4869,68	0,05
266,07	0,04	1154,78	0,13	5011,87	-0,13
273,84	0,04	1188,50	0,15	5158,22	0,16
281,84	0,06	1223,21	0,17	5308,84	0,53

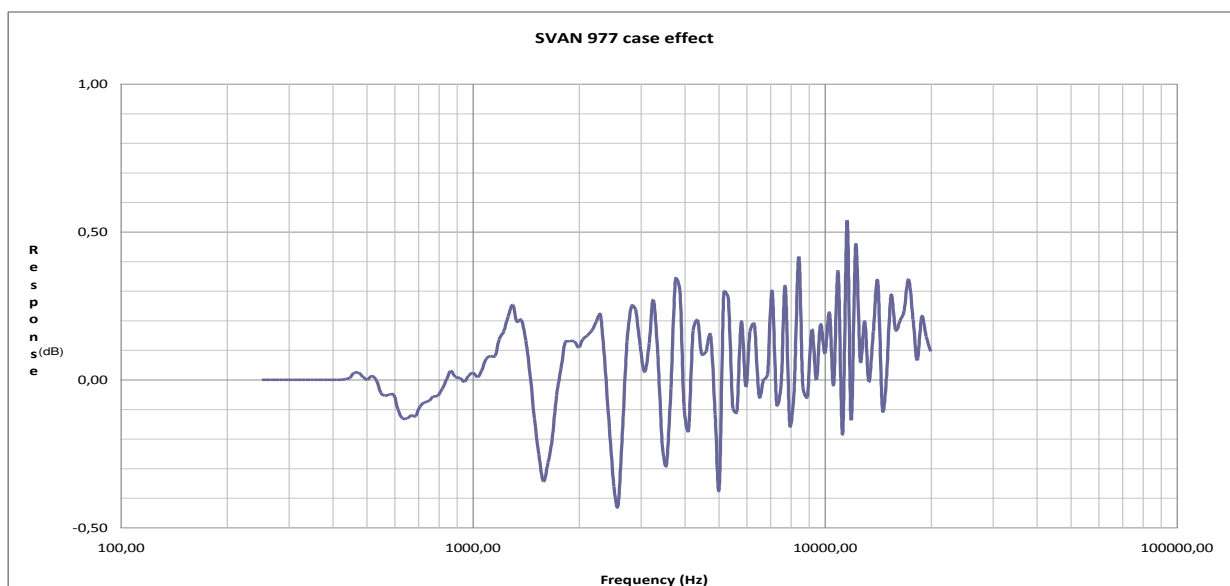
290,07	0,05	1258,93	0,15	5463,87	0,21
298,54	0,05	1295,69	0,24	5623,41	-0,27
307,26	0,05	1333,52	0,26	5787,62	0,20
316,23	0,07	1372,46	0,17	5956,62	-0,08
325,46	0,04	1412,54	0,10	6130,56	0,22
334,97	0,02	1453,78	0,03	6309,57	0,32
344,75	0,03	1496,24	-0,08	6493,82	-0,08
354,81	0,06	1539,93	-0,23	6683,44	0,14
365,17	0,07	1584,89	-0,31	6878,60	-0,03
375,84	0,10	1631,17	-0,28	7079,46	0,19
386,81	0,09	1678,80	-0,19	7286,18	-0,11
398,11	0,07	1727,83	-0,09	7498,94	0,05
409,73	0,07	1778,28	0,03	7717,92	0,08
421,70	0,06	1830,21	0,16	7943,28	0,08
434,01	0,03	1883,65	0,12	8175,23	-0,22
446,68	0,00	1938,65	0,17	8413,95	0,28
459,73	-0,01	1995,26	0,13	8659,64	0,02
473,15	0,00	2053,53	0,11	8912,51	-0,19
486,97	0,00	2113,49	0,19	9172,76	-0,06
501,19	0,00	2175,20	0,30	9440,61	-0,01
515,82	-0,03	2238,72	0,35	9776,28	-0,02
530,88	-0,04	2304,09	0,25	10000,00	-0,20
546,39	-0,04	2371,37	0,08	10292,01	-0,08
562,34	-0,04	2440,62	-0,17	10592,54	-0,20
578,76	-0,07	2511,89	-0,29	10901,84	-0,01
595,66	-0,08	2585,23	-0,38	11220,18	-0,52
613,06	-0,08	2660,73	-0,22	11547,82	0,07
630,96	-0,09	2738,42	0,10	11885,02	-0,56
649,38	-0,14	2818,38	0,26	12232,07	-0,02
668,34	-0,15	2900,68	0,30	12589,25	-0,49
687,86	-0,13	2985,38	0,13	12956,87	-0,44
707,95	-0,10	3072,56	0,05	13335,21	-0,51
728,62	-0,09	3162,28	0,12	13724,61	-0,55
749,89	-0,08	3254,62	0,23	14125,38	-0,71
771,79	-0,06	3349,65	0,16	14537,84	-0,78
794,33	-0,06	3447,47	-0,06	14962,36	-0,58
817,52	-0,05	3548,13	-0,19	15399,27	-0,40
841,40	-0,04	3651,74	0,05	15848,93	-0,26
865,96	-0,01	3758,37	0,27	16311,73	-0,39
891,25	0,01	3868,12	0,13	16788,04	-0,45
917,28	0,01	3981,07	-0,18	17278,26	-0,51
944,06	0,01	4097,32	-0,14	17782,79	-0,55
977,63	-0,02	4216,97	0,17	18302,06	-0,33
1000,00	-0,02	4340,10	0,18	18836,49	-0,09
1029,20	0,03	4466,84	0,06	19386,53	-0,36
1059,25	-0,01	4597,27	0,12	19952,62	-0,28

Case effect

Effect of reflections and diffraction of the acoustic plane wave from the case of the SVAN 977W ("case effect")

Table C.12 SVAN 977W "Case effect"

Frequency [Hz]	Case effect [dB]	Frequency [Hz]	Case effect [dB]	Frequency [Hz]	Case effect [dB]
251,19	0,00	1090,18	0,07	4731,51	0,15
258,52	0,00	1122,02	0,08	4869,68	-0,12
266,07	0,00	1154,78	0,08	5011,87	-0,36
273,84	0,00	1188,50	0,14	5158,22	0,30
281,84	0,00	1223,21	0,16	5308,84	0,28
290,07	0,00	1258,93	0,21	5463,87	-0,10
298,54	0,00	1295,69	0,25	5623,41	-0,11
307,26	0,00	1333,52	0,20	5787,62	0,20
316,23	0,00	1372,46	0,20	5956,62	-0,02
325,46	0,00	1412,54	0,13	6130,56	0,16
334,97	0,00	1453,78	0,01	6309,57	0,19
344,75	0,00	1496,24	-0,13	6493,82	-0,05
354,81	0,00	1539,93	-0,25	6683,44	0,00
365,17	0,00	1584,89	-0,34	6878,60	0,02
375,84	0,00	1631,17	-0,28	7079,46	0,30
386,81	0,00	1678,80	-0,20	7286,18	-0,08
398,11	0,00	1727,83	-0,05	7498,94	-0,02
409,73	0,00	1778,28	0,04	7717,92	0,32
421,70	0,00	1830,21	0,13	7943,28	-0,15
434,01	0,00	1883,65	0,13	8175,23	-0,02
446,68	0,01	1938,65	0,13	8413,95	0,42
459,73	0,02	1995,26	0,11	8659,64	-0,03
473,15	0,02	2053,53	0,14	8912,51	-0,06
486,97	0,01	2113,49	0,15	9172,76	0,17
501,19	0,00	2175,20	0,17	9440,61	0,00
515,82	0,01	2238,72	0,20	9776,28	0,19
530,88	0,00	2304,09	0,22	10000,00	0,09
546,39	-0,04	2371,37	0,05	10292,01	0,23
562,34	-0,05	2440,62	-0,16	10592,54	-0,02
578,76	-0,05	2511,89	-0,36	10901,84	0,37
595,66	-0,05	2585,23	-0,43	11220,18	-0,18
613,06	-0,10	2660,73	-0,17	11547,82	0,54
630,96	-0,13	2738,42	0,13	11885,02	-0,14
649,38	-0,13	2818,38	0,25	12232,07	0,46
668,34	-0,12	2900,68	0,24	12589,25	0,07
687,86	-0,12	2985,38	0,12	12956,87	0,20
707,95	-0,09	3072,56	0,03	13335,21	-0,01
728,62	-0,08	3162,28	0,12	13724,61	0,16
749,89	-0,07	3254,62	0,27	14125,38	0,33
771,79	-0,06	3349,65	0,09	14537,84	-0,10
794,33	-0,05	3447,47	-0,22	14962,36	0,01
817,52	-0,03	3548,13	-0,29	15399,27	0,28
841,40	0,00	3651,74	-0,03	15848,93	0,17
865,96	0,03	3758,37	0,34	16311,73	0,20
891,25	0,01	3868,12	0,30	16788,04	0,23
917,28	0,01	3981,07	-0,09	17278,26	0,34
944,06	-0,01	4097,32	-0,17	17782,79	0,20
977,63	0,01	4216,97	0,17	18302,06	0,07
1000,00	0,02	4340,10	0,20	18836,49	0,21
1029,20	0,01	4466,84	0,09	19386,53	0,15
1059,25	0,03	4597,27	0,10	19952,62	0,10

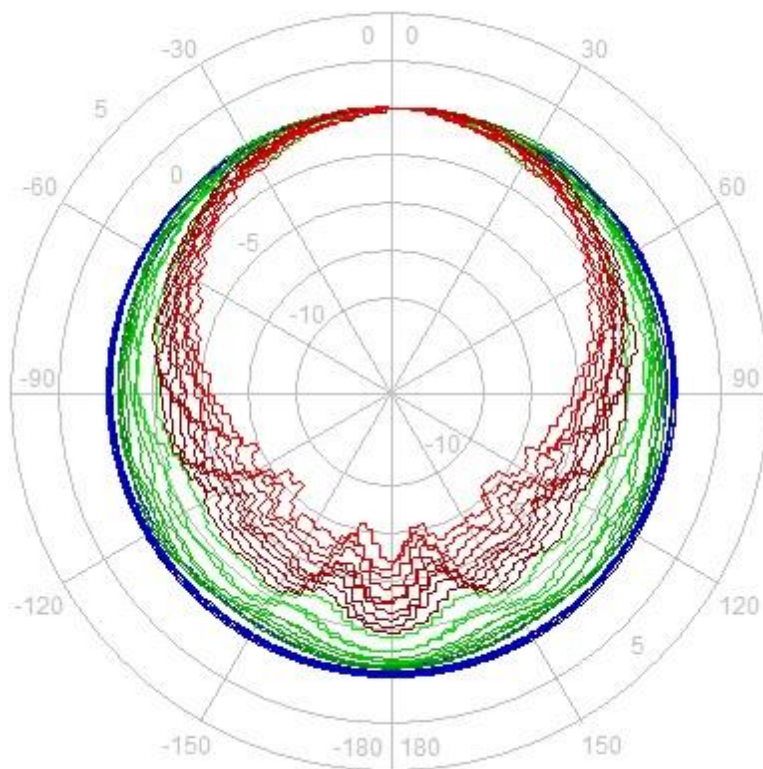


SVAN 977W case effect

Directional characteristics of the SVAN 977W

Directional response for SLM Class **SVAN 977W** with microphone **ACO 7052E** and preamplifier **SV 12L** for specified frequencies:

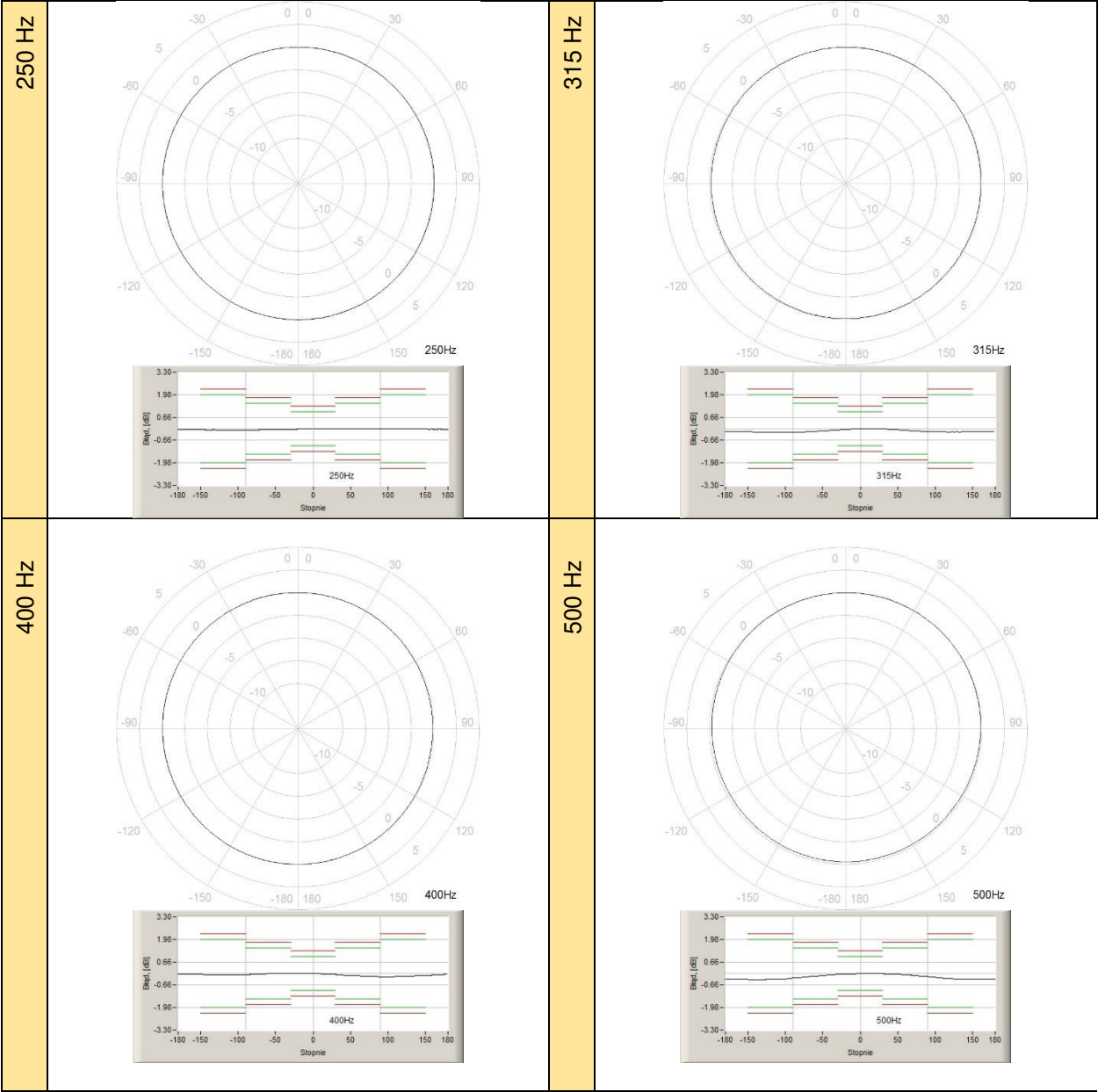
Total directional characteristics

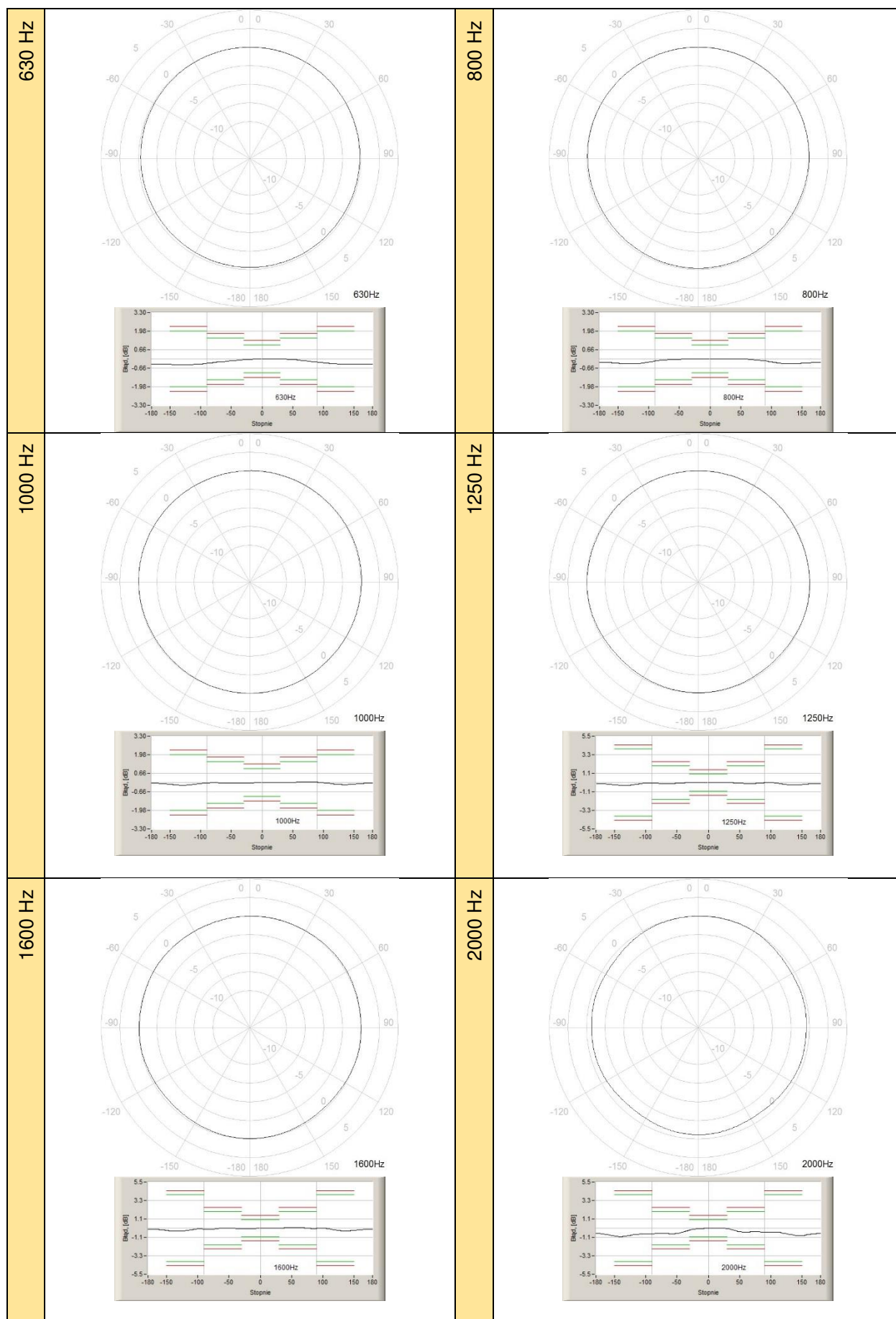


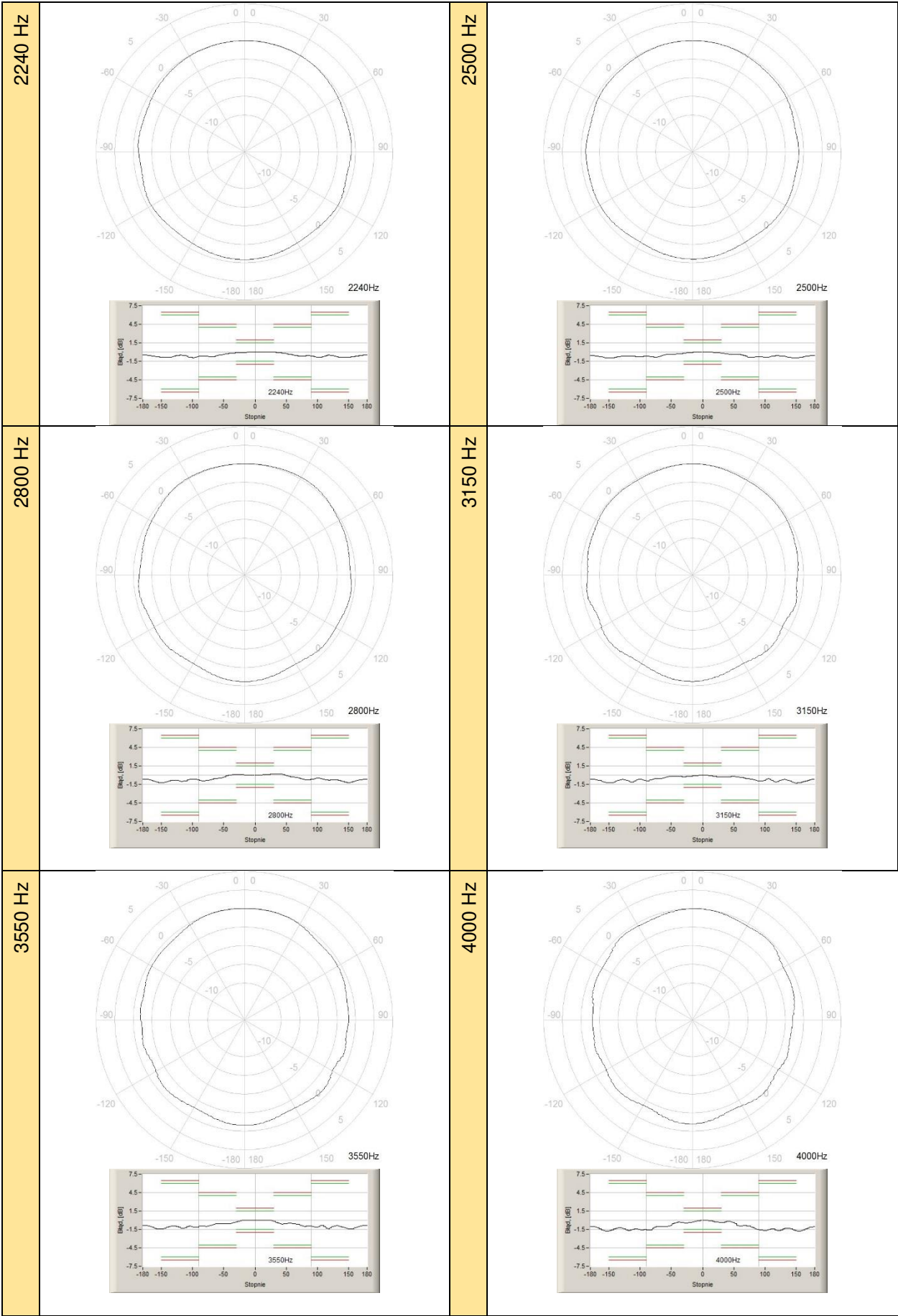
LEGEND

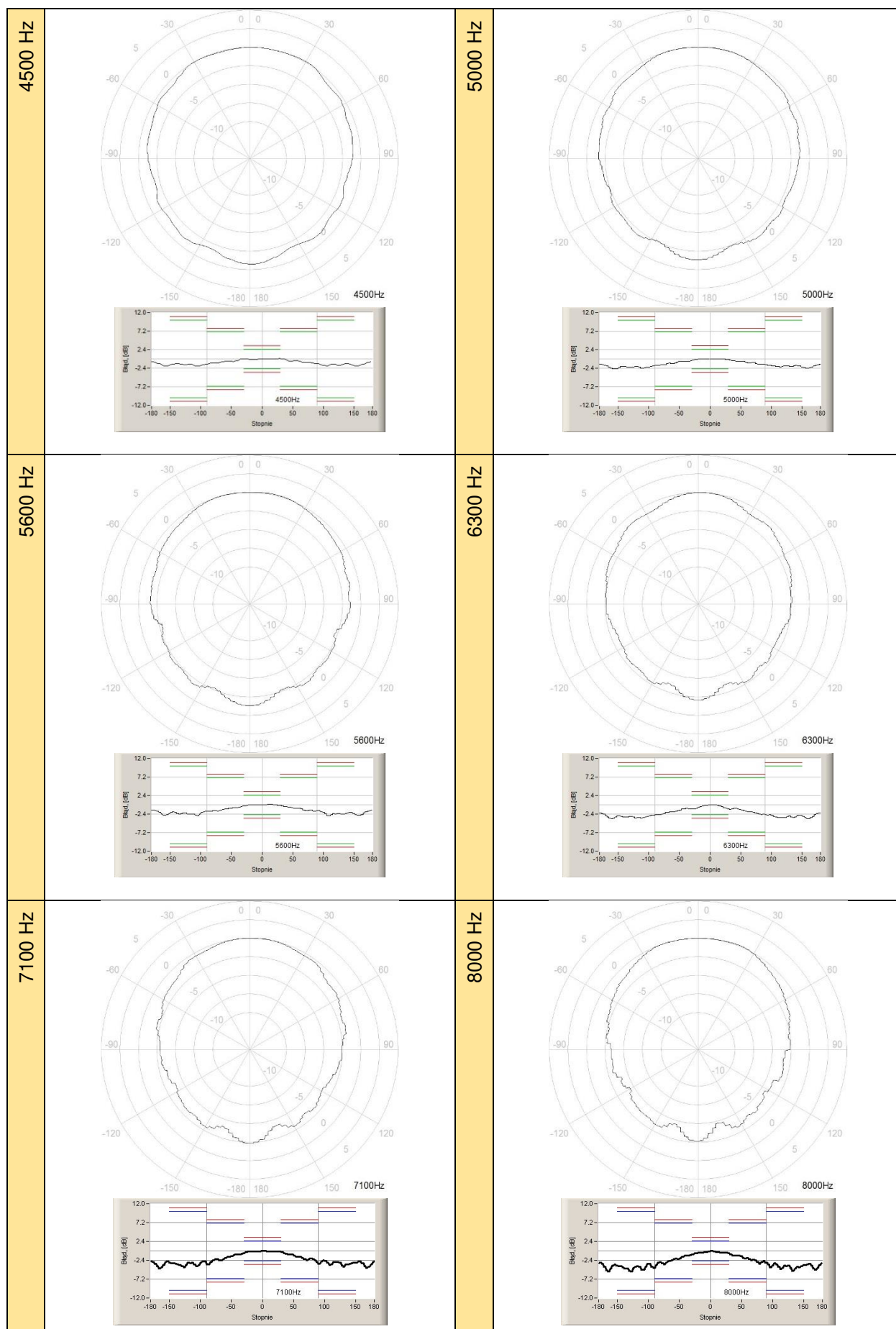
Fmin (250Hz)  Fmax (12,5kHz)

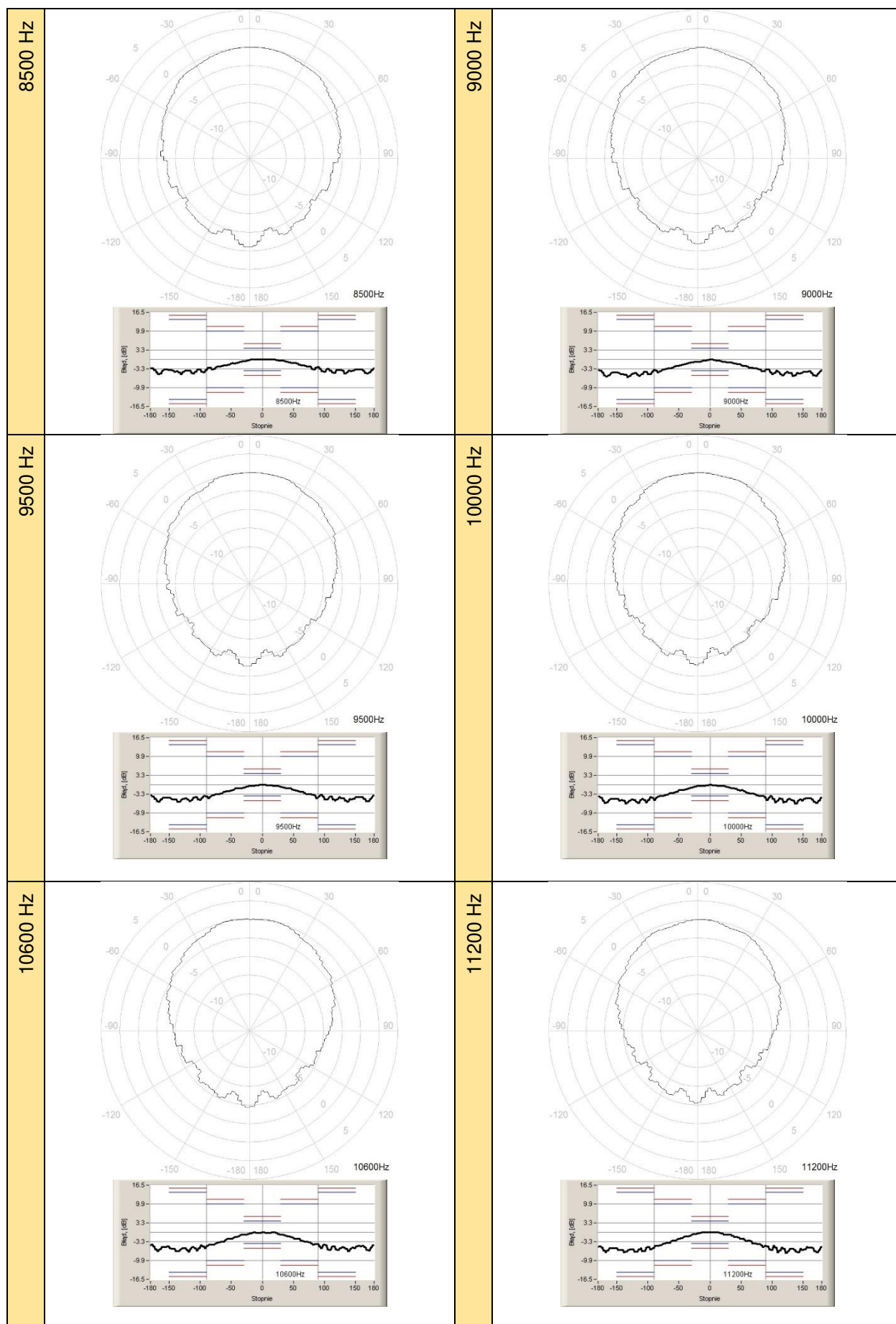
The round charts show the directional characteristic and the charts below shows the errors for angles.

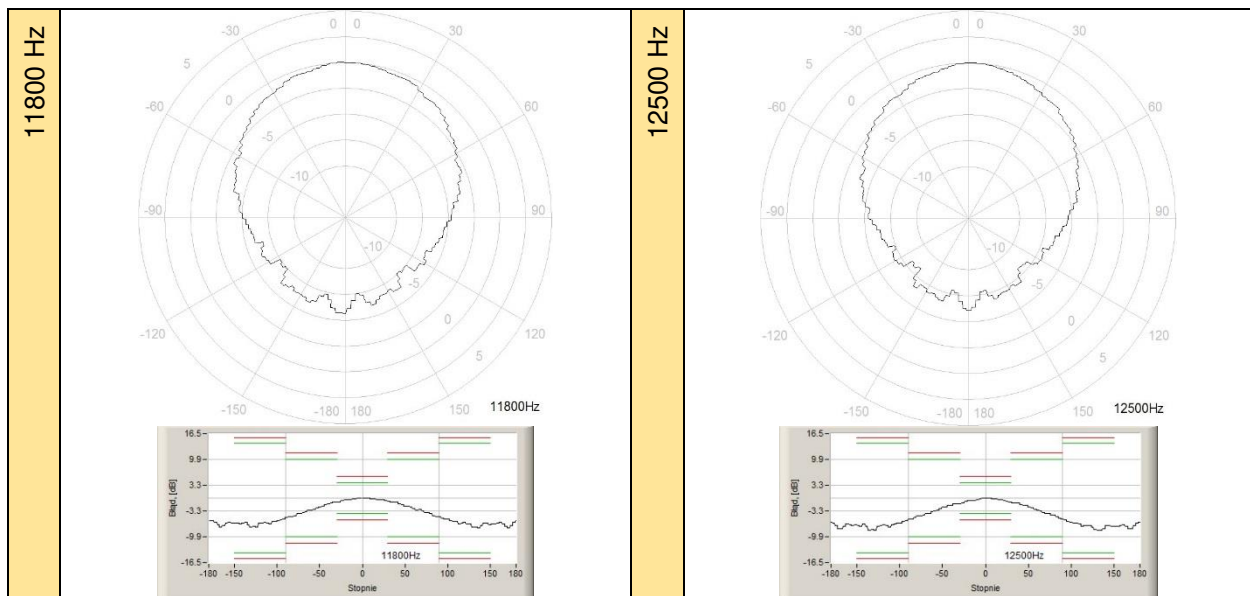










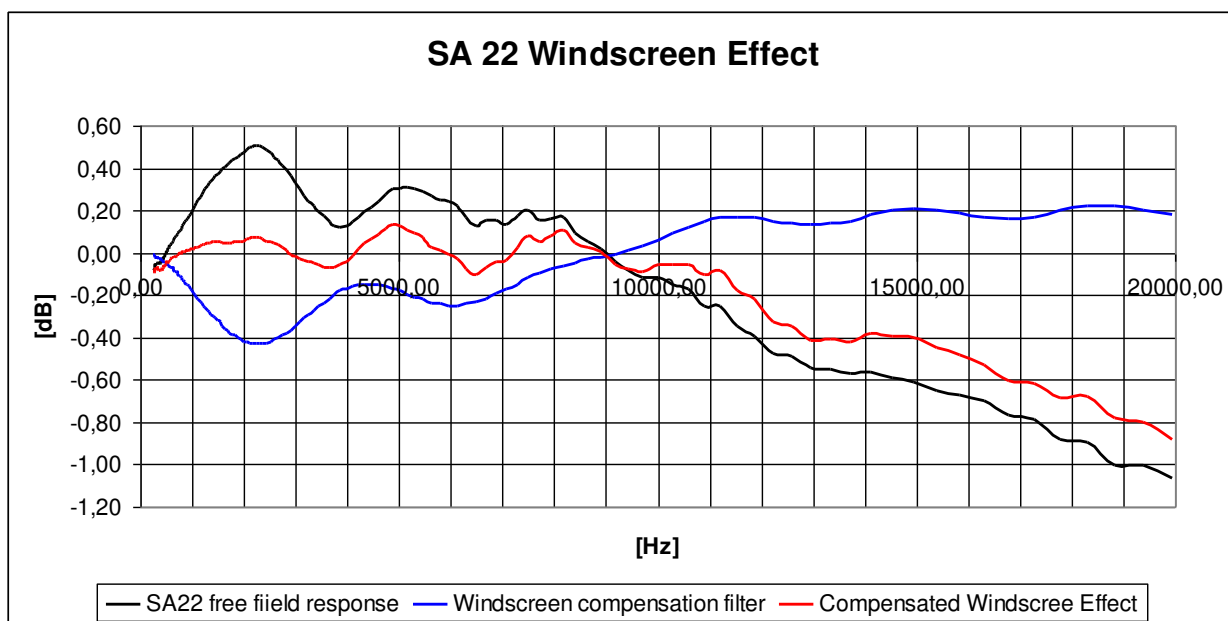
**Table C.1.13** Directional response for SVAN 977W with microphone ACO 7052E

f [Hz]	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
250	0	0	0,01	0,01	0,01	0	0	-0,01	-0,01	-0,01
315	0	0	0,01	-0,02	-0,04	-0,06	-0,09	-0,11	-0,14	-0,16
400	0	-0,02	-0,04	-0,06	-0,09	-0,12	-0,14	-0,16	-0,18	-0,19
500	0	0	0	-0,01	-0,03	-0,06	-0,08	-0,11	-0,15	-0,18
630	0	0	0	-0,01	-0,02	-0,05	-0,09	-0,13	-0,19	-0,23
800	0	0,01	0,01	0	0	-0,01	-0,02	-0,05	-0,09	-0,14
1000	0	0,01	0,01	0,01	0,01	0,02	0,04	0,05	0,05	0,05
1250	0	0	0	-0,01	-0,04	-0,08	-0,12	-0,13	-0,12	-0,08
1600	0	0	0	0,01	0,04	0,08	0,1	0,09	-0,03	-0,04
2000	0	0,02	0,02	-0,05	-0,2	-0,39	-0,48	-0,48	-0,42	-0,48
2240	0	0	0	-0,01	-0,08	-0,28	-0,46	-0,63	-0,65	-0,61
2500	0	-0,02	-0,07	-0,19	-0,31	-0,35	-0,41	-0,69	-0,86	-0,86
2800	0	0,04	0,11	0,2	0,22	0,2	-0,32	-0,48	-0,73	-0,77
3150	0	-0,08	-0,22	-0,3	-0,3	-0,26	-0,33	-0,53	-0,66	-0,9
3550	0	0,03	0,03	-0,22	-0,56	-0,61	-0,54	-0,7	-1	-1
4000	0	-0,06	-0,25	-0,37	-0,37	-0,4	-0,9	-0,91	-1,08	-1,51
4500	0	-0,03	-0,04	0,08	-0,39	-0,58	-0,61	-0,96	-1,02	-1,25
5000	0	0,03	0,03	-0,22	-0,47	-0,55	-0,83	-1	-1,34	-1,52
5600	0	0,08	0,09	-0,22	-0,49	-0,74	-0,88	-1,47	-1,47	-1,67
6300	0	-0,07	-0,47	-1,12	-1,15	-1,23	-1,8	-1,89	-2,46	-2,57
7100	0	-0,02	-0,21	-0,41	-0,5	-1,26	-1,27	-1,94	-1,98	-2,66
8000	0	0	0,06	-0,11	-0,61	-1,06	-1,5	-2,06	-2,55	-3,32
8500	0	-0,03	-0,21	-0,51	-0,56	-1,21	-1,6	-2,22	-2,69	-3,12
9000	0	-0,2	-0,55	-0,57	-1,13	-1,25	-2,07	-2,52	-3,08	-3,7
9500	0	-0,06	-0,1	-0,72	-0,81	-1,45	-2,04	-2,67	-2,99	-3,84
10000	0	-0,14	-0,19	-0,44	-1,19	-1,4	-1,96	-2,76	-3,21	-3,95
10600	0	0,09	0,1	-0,74	-1,03	-1,84	-2,16	-2,98	-3,72	-4,37
11200	0	-0,13	-0,54	-0,72	-1,39	-1,95	-2,49	-3,18	-4,16	-4,82
11800	0	-0,14	-0,42	-0,84	-1,11	-1,99	-2,67	-3,27	-3,99	-4,77

12500	0	-0,13	-0,49	-0,99	-1,64	-2,21	-3,07	-3,86	-4,4	-5,4
f [Hz]	100-110	110-120	120-130	130-140	140-150	150-160	160-170	170-180	180-190	190-200
250	-0,01	-0,01	-0,01	-0,01	-0,02	-0,02	-0,03	-0,03	-0,04	-0,05
315	-0,18	-0,18	-0,19	-0,19	-0,19	-0,18	-0,18	-0,17	-0,17	-0,17
400	-0,19	-0,19	-0,18	-0,18	-0,16	-0,14	-0,11	-0,09	-0,08	-0,06
500	-0,22	-0,28	-0,28	-0,31	-0,32	-0,33	-0,33	-0,33	-0,34	-0,34
630	-0,27	-0,31	-0,34	-0,36	-0,36	-0,37	-0,36	-0,36	-0,36	-0,37
800	-0,21	-0,29	-0,32	-0,34	-0,34	-0,33	-0,3	-0,27	-0,25	-0,25
1000	0,02	-0,06	-0,13	-0,16	-0,16	-0,14	-0,11	-0,08	-0,06	-0,06
1250	-0,02	-0,09	-0,2	-0,28	-0,3	-0,3	-0,24	-0,17	-0,13	-0,15
1600	-0,02	-0,1	-0,22	-0,31	-0,32	-0,32	-0,28	-0,2	-0,14	-0,14
2000	-0,5	-0,49	-0,59	-0,74	-0,87	-0,89	-0,88	-0,79	-0,66	-0,69
2240	-0,86	-0,88	-0,73	-0,66	-0,86	-0,88	-0,82	-0,67	-0,54	-0,56
2500	-0,81	-0,84	-0,69	-0,7	-0,88	-0,95	-0,94	-0,8	-0,63	-0,62
2800	-0,7	-0,65	-0,81	-0,79	-0,9	-1,18	-1,18	-0,97	-0,73	-0,76
3150	-0,96	-0,86	-1,1	-1,02	-0,97	-1,27	-1,27	-1,11	-0,81	-0,73
3550	-1,15	-1,14	-1,36	-1,25	-1,14	-1,39	-1,4	-1,26	-0,97	-0,95
4000	-1,66	-1,67	-1,7	-1,7	-1,4	-1,72	-1,81	-1,73	-1,3	-1,14
4500	-1,66	-1,86	-1,41	-1,62	-1,31	-1,8	-1,8	-1,28	-0,85	-1,21
5000	-1,77	-2,02	-2,11	-1,99	-1,99	-2,06	-2,45	-2,45	-1,81	-1,58
5600	-1,97	-2,9	-2,9	-2,36	-2,44	-2,22	-2,73	-2,72	-1,86	-1,72
6300	-2,69	-3,3	-3,37	-3,37	-3,28	-3,13	-3,61	-3,61	-2,56	-2,78
7100	-2,86	-3,45	-3,86	-3,82	-3,66	-3,66	-4,19	-4,15	-2,79	-3
8000	-3,49	-3,4	-4,11	-4,47	-3,97	-3,92	-4,1	-4,74	-3,61	-3,68
8500	-3,87	-3,87	-4,52	-5,01	-4,29	-4,38	-4,71	-5,25	-4,48	-3,88
9000	-4,18	-4,4	-5,2	-5,45	-4,76	-4,8	-5,03	-5,58	-4,71	-4,6
9500	-4,57	-4,57	-5,44	-5,55	-5,33	-4,98	-4,93	-5,83	-5,55	-4,73
10000	-4,11	-4,85	-5,04	-5,83	-5,83	-5,26	-5,19	-6,13	-5,61	-5,31
10600	-4,93	-5,59	-5,6	-6,51	-6,42	-5,87	-5,73	-6,77	-6,21	-6,24
11200	-5,18	-6,21	-6,21	-6,98	-7,07	-6,32	-6,26	-7,18	-6,78	-6,77
11800	-5,43	-6,08	-6,55	-7,52	-7,64	-6,8	-6,69	-7,55	-7,55	-6,88
12500	-6,1	-6,67	-7,29	-8,15	-8,18	-7,32	-7,15	-7,89	-7,82	-7,75
f [Hz]	200-210	210-220	220-230	230-240	240-250	250-260	260-270	270-280	280-290	290-300
250	-0,05	-0,05	-0,07	-0,07	-0,08	-0,08	-0,08	-0,08	-0,08	-0,07
315	-0,18	-0,18	-0,19	-0,2	-0,21	-0,22	-0,22	-0,22	-0,21	-0,19
400	-0,06	-0,06	-0,07	-0,08	-0,08	-0,09	-0,09	-0,08	-0,07	-0,06
500	-0,35	-0,35	-0,36	-0,36	-0,36	-0,35	-0,33	-0,31	-0,26	-0,23
630	-0,38	-0,39	-0,41	-0,41	-0,41	-0,41	-0,39	-0,36	-0,3	-0,25
800	-0,27	-0,3	-0,33	-0,34	-0,34	-0,32	-0,29	-0,21	-0,14	-0,09
1000	-0,09	-0,13	-0,17	-0,19	-0,19	-0,17	-0,13	-0,07	-0,03	-0,03
1250	-0,2	-0,27	-0,33	-0,34	-0,33	-0,27	-0,16	-0,07	-0,12	-0,15
1600	-0,19	-0,3	-0,35	-0,36	-0,35	-0,28	-0,18	-0,11	-0,13	-0,12
2000	-0,82	-0,95	-1	-1	-0,92	-0,79	-0,7	-0,68	-0,68	-0,61
2240	-0,71	-0,84	-0,87	-0,85	-0,67	-0,7	-0,91	-0,91	-0,69	-0,74
2500	-0,85	-0,97	-0,97	-0,86	-0,68	-0,7	-0,76	-0,75	-0,78	-0,82
2800	-1,02	-1,23	-1,23	-1,06	-0,95	-0,99	-0,9	-0,79	-0,93	-0,88
3150	-0,99	-1,24	-1,26	-0,97	-0,82	-1,1	-0,95	-0,93	-0,93	-0,67
3550	-1,28	-1,44	-1,39	-1,16	-1,17	-1,34	-1,11	-1,16	-0,97	-1
4000	-1,55	-1,81	-1,72	-1,3	-1,66	-1,66	-1,62	-1,62	-1,59	-1,35
4500	-1,76	-1,79	-1,3	-1,51	-1,55	-1,75	-1,87	-1,57	-1,13	-1,09
5000	-2,33	-2,62	-2,24	-2,17	-2,17	-2,43	-2,43	-2,12	-1,64	-1,51
5600	-2,63	-2,74	-1,97	-2,34	-2,34	-2,44	-2,83	-1,94	-1,64	-1,61

6300	-3,62	-3,62	-3,14	-3,18	-3,41	-3,45	-3,31	-2,84	-2,62	-2,53
7100	-4,04	-3,78	-3,45	-3,46	-3,9	-3,96	-3,48	-3,06	-2,87	-2,45
8000	-4,51	-4,33	-3,68	-3,86	-4,47	-4,47	-3,49	-3,38	-3,2	-2,75
8500	-4,96	-4,34	-4,05	-4,2	-4,94	-4,49	-3,83	-3,88	-3,44	-3,19
9000	-5,32	-4,86	-4,47	-4,6	-5,37	-4,93	-4,35	-4,21	-3,69	-3,14
9500	-5,66	-5,28	-4,92	-5,19	-5,71	-5,42	-4,68	-4,68	-4,13	-3,55
10000	-5,75	-4,94	-5,27	-5,38	-5,97	-5,75	-5,07	-5,07	-4,26	-3,57
10600	-6,53	-5,65	-5,78	-6,51	-6,51	-6,26	-5,67	-4,94	-4,71	-4,05
11200	-6,93	-5,93	-6,29	-7,07	-7,07	-6,1	-6,16	-5,4	-5,15	-4,26
11800	-7,34	-6,38	-6,58	-7,49	-7,49	-6,47	-6,66	-5,75	-5,05	-4,49
12500	-7,94	-7,11	-7,17	-8,31	-8,24	-7,41	-6,78	-6,42	-5,45	-4,63
f [Hz]	300-310	310-320	320-330	330-340	340-350	350-360				
250	-0,06	-0,06	-0,06	-0,05	-0,03	-0,02				
315	-0,18	-0,15	-0,12	-0,1	-0,07	-0,04				
400	-0,04	-0,02	-0,01	0,02	0,02	0,02				
500	-0,19	-0,15	-0,12	-0,09	-0,06	-0,03				
630	-0,22	-0,16	-0,12	-0,09	-0,06	-0,04				
800	-0,05	-0,04	-0,04	-0,02	-0,01	0				
1000	-0,05	-0,05	-0,05	-0,05	-0,05	-0,03				
1250	-0,15	-0,13	-0,09	-0,05	-0,02	-0,01				
1600	-0,06	0,02	-0,04	-0,07	-0,08	-0,07				
2000	-0,68	-0,68	-0,6	-0,39	-0,21	-0,1				
2240	-0,74	-0,57	-0,37	-0,22	-0,12	-0,06				
2500	-0,74	-0,38	-0,34	-0,32	-0,21	-0,06				
2800	-0,63	-0,49	-0,24	0,11	0,11	0,05				
3150	-0,56	-0,36	-0,18	-0,24	-0,24	-0,17				
3550	-0,73	-0,55	-0,58	-0,55	-0,26	-0,03				
4000	-1,02	-1,02	-0,81	-0,41	-0,46	-0,36				
4500	-0,82	-0,67	-0,72	-0,21	-0,12	-0,13				
5000	-1,27	-1,2	-0,66	-0,66	-0,44	-0,04				
5600	-1,56	-1,03	-0,86	-0,7	-0,23	-0,06				
6300	-1,89	-1,8	-1,29	-1,09	-1,1	-0,67				
7100	-2,29	-1,61	-1,39	-0,89	-0,47	-0,36				
8000	-2,1	-1,66	-1,2	-0,83	-0,36	-0,03				
8500	-2,48	-2,04	-1,56	-0,83	-0,62	-0,36				
9000	-2,72	-2,25	-1,41	-1,32	-0,76	-0,56				
9500	-2,91	-2,29	-1,77	-1,15	-0,92	-0,17				
10000	-2,98	-2,13	-1,55	-1,29	-0,52	-0,13				
10600	-2,93	-2,5	-1,95	-1,31	-0,88	-0,32				
11200	-3,33	-2,51	-2,06	-1,42	-0,74	-0,59				
11800	-3,68	-3,16	-2,24	-1,44	-1,1	-0,47				
12500	-3,99	-3,22	-2,36	-1,92	-1,4	-0,72				

C1.2 Effect of the SA 22 windscreen



Windscreed SA22 free field response and compensated effect.

Table C.1.14 SVAN 977W effect of the SA 22 windscreen

Frequency [Hz]	SA 22 Free Field [dB]	Compensation filter [dB]	SA 22 Effect Compensation [dB]	Frequency [Hz]	SA 22 Free Field [dB]	Compensation filter [dB]	SA 22 Effect Compensation [dB]
251,19	-0,08	-0,01	-0,09	2440,62	0,48	-0,43	0,05
258,52	-0,08	-0,01	-0,09	2511,89	0,47	-0,42	0,05
266,07	-0,08	-0,01	-0,09	2585,23	0,45	-0,41	0,04
273,84	-0,07	-0,02	-0,09	2660,73	0,44	-0,4	0,04
281,84	-0,07	-0,02	-0,09	2738,42	0,41	-0,39	0,02
290,07	-0,06	-0,02	-0,08	2818,38	0,39	-0,38	0,01
298,54	-0,06	-0,02	-0,08	2900,68	0,36	-0,37	-0,01
307,26	-0,05	-0,02	-0,07	2985,38	0,33	-0,35	-0,02
316,23	-0,05	-0,02	-0,07	3072,56	0,30	-0,33	-0,03
325,46	-0,05	-0,02	-0,07	3162,28	0,27	-0,31	-0,04
334,97	-0,05	-0,02	-0,07	3254,62	0,24	-0,29	-0,05
344,75	-0,05	-0,02	-0,07	3349,65	0,22	-0,27	-0,05
354,81	-0,05	-0,03	-0,08	3447,47	0,20	-0,25	-0,05
365,17	-0,05	-0,03	-0,08	3548,13	0,17	-0,24	-0,07
375,84	-0,05	-0,03	-0,08	3651,74	0,15	-0,22	-0,07
386,81	-0,05	-0,03	-0,08	3758,37	0,13	-0,2	-0,07
398,11	-0,05	-0,03	-0,08	3868,12	0,12	-0,18	-0,06
409,73	-0,05	-0,03	-0,08	3981,07	0,13	-0,17	-0,04
421,70	-0,04	-0,04	-0,08	4097,32	0,15	-0,16	-0,01
434,01	-0,03	-0,04	-0,07	4216,97	0,17	-0,15	0,02
446,68	-0,03	-0,04	-0,07	4340,10	0,19	-0,15	0,04
459,73	-0,02	-0,04	-0,06	4466,84	0,21	-0,15	0,06
473,15	-0,01	-0,05	-0,06	4597,27	0,24	-0,15	0,09
486,97	-0,01	-0,05	-0,06	4731,51	0,27	-0,16	0,11
501,19	0,00	-0,05	-0,05	4869,68	0,30	-0,17	0,13
515,82	0,01	-0,05	-0,04	5011,87	0,31	-0,18	0,13
530,88	0,01	-0,06	-0,05	5158,22	0,31	-0,2	0,11
546,39	0,02	-0,06	-0,04	5308,84	0,30	-0,21	0,09
562,34	0,03	-0,06	-0,03	5463,87	0,29	-0,22	0,07

578,76	0,03	-0,07	-0,04	5623,41	0,27	-0,24	0,03
595,66	0,04	-0,07	-0,03	5787,62	0,25	-0,24	0,01
613,06	0,05	-0,07	-0,02	5956,62	0,24	-0,25	-0,01
630,96	0,05	-0,08	-0,03	6130,56	0,22	-0,25	-0,03
649,38	0,06	-0,08	-0,02	6309,57	0,17	-0,24	-0,07
668,34	0,07	-0,09	-0,02	6493,82	0,12	-0,23	-0,11
687,86	0,08	-0,09	-0,01	6683,44	0,15	-0,22	-0,07
707,95	0,08	-0,1	-0,02	6878,60	0,15	-0,19	-0,04
728,62	0,09	-0,1	-0,01	7079,46	0,14	-0,17	-0,03
749,89	0,10	-0,11	-0,01	7286,18	0,17	-0,15	0,02
771,79	0,11	-0,11	0,00	7498,94	0,20	-0,12	0,08
794,33	0,12	-0,12	0,00	7717,92	0,15	-0,1	0,05
817,52	0,12	-0,13	-0,01	7943,28	0,16	-0,08	0,08
841,40	0,13	-0,13	0,00	8175,23	0,17	-0,06	0,11
865,96	0,14	-0,14	0,00	8413,95	0,09	-0,05	0,04
891,25	0,15	-0,15	0,00	8659,64	0,05	-0,03	0,02
917,28	0,16	-0,15	0,01	8912,51	0,02	-0,02	0,00
944,06	0,17	-0,16	0,01	9172,76	-0,04	-0,01	-0,05
977,63	0,18	-0,17	0,01	9440,61	-0,09	0,01	-0,08
1000,00	0,19	-0,18	0,01	9776,28	-0,12	0,03	-0,09
1029,20	0,21	-0,19	0,02	10000,00	-0,12	0,06	-0,06
1059,25	0,22	-0,2	0,02	10292,01	-0,15	0,09	-0,06
1090,18	0,23	-0,21	0,02	10592,54	-0,17	0,12	-0,05
1122,02	0,25	-0,22	0,03	10901,84	-0,25	0,15	-0,10
1154,78	0,26	-0,23	0,03	11220,18	-0,25	0,17	-0,08
1188,50	0,28	-0,24	0,04	11547,82	-0,35	0,17	-0,18
1223,21	0,29	-0,25	0,04	11885,02	-0,39	0,17	-0,22
1258,93	0,30	-0,26	0,04	12232,07	-0,47	0,15	-0,32
1295,69	0,31	-0,27	0,04	12589,25	-0,49	0,14	-0,35
1333,52	0,33	-0,28	0,05	12956,87	-0,54	0,13	-0,41
1372,46	0,34	-0,29	0,05	13335,21	-0,55	0,14	-0,41
1412,54	0,35	-0,3	0,05	13724,61	-0,57	0,15	-0,42
1453,78	0,36	-0,31	0,05	14125,38	-0,56	0,18	-0,38
1496,24	0,37	-0,32	0,05	14537,84	-0,59	0,2	-0,39
1539,93	0,38	-0,33	0,05	14962,36	-0,61	0,21	-0,40
1584,89	0,39	-0,35	0,04	15399,27	-0,65	0,2	-0,45
1631,17	0,40	-0,36	0,04	15848,93	-0,67	0,19	-0,48
1678,80	0,41	-0,37	0,04	16311,73	-0,70	0,17	-0,53
1727,83	0,42	-0,38	0,04	16788,04	-0,77	0,16	-0,61
2053,53	0,48	-0,42	0,06	17278,26	-0,79	0,17	-0,62
2113,49	0,50	-0,43	0,07	17782,79	-0,88	0,2	-0,68
2175,20	0,50	-0,43	0,07	18302,06	-0,90	0,22	-0,68
2238,72	0,50	-0,43	0,07	18836,49	-1,00	0,22	-0,78
2304,09	0,50	-0,43	0,07	19386,53	-1,00	0,2	-0,80
2371,37	0,50	-0,43	0,07	19952,62	-1,06	0,18	-0,88



Note: When using windscreen SA22 the “windscreen compensation filter” must be ON to ensure good tolerances margin of the 977W frequency response

C1.3 Effect of the SA 277 Outdoor Protection Unit

See chapter C.7 for the details related to using of the SA277 Outdoor Protection Unit .

C.2 Specification of the SVAN 977W as vibration level meter

The configuration of the complete VLM and its normal mode of operation:

SVAN 977W	sound&vibration analyzer,
SV 80	10mV/m/s ² , IEPE accelerometer (see C.6 for details)
SC 27	coiled cable for accelerometer 2 m,

Accessories included in SVAN 977W instrument set:

SC 77	output cable for I/O connector, Stereo Jack to 2 x BNC
SC 16	USB 1.1 cable,

Accessories available:

SV 55	RS 232 interface for SVAN 95x instrument series
SC 61	TNC to BNC integrated connector
SC 27	TNC (plug) to TNC (plug) 2 m coil cable
SA 17A	external battery pack,
SA 27-FF	permanent magnet.
SA 15	power supply unit.
SV 110	vibration calibrator (or equivalent).

Measured quantities

The measured quantities in the vibration meter mode are: **RMS**, **PEAK**, **P-P** and **MAX**. The definitions for mentioned parameters are given in Appendix D.

Mounting for vibration tests

The accelerometer can be connected with the VLM using proper cable provided by the manufacturer.

The accelerometer can be mounted on the plate in various ways:

- using threaded stud onto a flat, smooth surface,
- using thin layer of bees-wax for sticking the accelerometer into the plate,
- using mica washer and isolates stud, where the body of accelerometer should be electrically isolated from the measuring object,
- using permanent magnet.

Values of the measured acceleration

Linear operating ranges for the acceleration (with the SV80 sensitivity equal to 10mV / ms⁻² accelerometer).

Two ranges with the nominal values: **100 ms⁻² (LOW)**, (140 dB, related to 10⁻⁶ ms⁻²).

352 ms⁻² (HIGH) (151 dB related to 10⁻⁶ ms⁻²).

- Linear measurement with the **HP**, **HP1**, **HP3** and **HP10** filters:
 - from 0.01 ms⁻² to 352 ms⁻² (the sinusoidal signal RMS)
 - from 0.1 ms⁻² to 500 ms⁻² (PEAK)
- Linear measurement with the **Wh** filter:
 - from 0.003 ms⁻² to 352 ms⁻² (the sinusoidal signal RMS)
 - from 0.03 ms⁻² to 500 ms⁻² (PEAK)

Table C.2.1 Linear operating ranges with the **Wh** filter

Range (RMS)	Linear operating ranges (RMS)	
	With the SV80 (10 mV / ms ⁻²) accelerometer sensitivity @ 79.58 Hz Measured at the reference environmental conditions	
LOW	from 3.16 mms ⁻² (70 dB)	to 100 ms ⁻² (140 dB)
HIGH	from 31.6 mms ⁻² (100 dB)	to 352 ms ⁻² (151 dB)

Table C.2.2 Linear operating ranges with the **HP**, **HP1**, **HP3** and **HP10** filters

Range (RMS)	Linear operating ranges (RMS)	
	With the SV80 (10 mV / ms ⁻²) accelerometer sensitivity @ 79.58 Hz Measured at the reference environmental conditions	
LOW	from 0.01 ms ⁻² (80.0 dB)	to 100 ms ⁻² (140.0 dB)
HIGH	from 0.1 ms ⁻² (100.0 dB)	to 352 ms ⁻² (151.0 dB)

- Linear measurement with the **Vel1** filter:
from 0.002 ms⁻¹ to 56 ms⁻¹ (the sinusoidal signal RMS)
from 0.02 ms⁻¹ to 79 ms⁻¹ (PEAK)

Table C.2.3 Linear operating ranges with the **Vel1** filter

Range (RMS)	Linear operating ranges (RMS)	
	With the SV80 (10 mV / ms ⁻²) accelerometer sensitivity @ 79.58 Hz Measured at the reference environmental conditions	
LOW	from 2 mms ⁻¹	to 15.9 ms ⁻¹
HIGH	from 20 mms ⁻¹	to 56 ms ⁻¹

- Linear measurement with the **Vel3** filter:
from 0.001 ms⁻¹ to 26.5 ms⁻¹ (the sinusoidal signal RMS)
from 0.01 ms⁻¹ to 37.4 ms⁻¹ (PEAK)

Table C.2.4 Linear operating ranges with the **Vel3** filter

Range (RMS)	Linear operating ranges (RMS)	
	With the SV80 (10 mV / ms ⁻²) accelerometer sensitivity @ 79.58 Hz Measured at the reference environmental conditions	
LOW	from 1 mms ⁻¹	to 5.3 ms ⁻¹
HIGH	from 10 mms ⁻¹	to 26.5 ms ⁻¹

- Linear measurement with the **Vel10** and **MFVel** filters:
from 0.001 ms⁻¹ to 5.6 ms⁻¹ (the sinusoidal signal RMS)
from 0.01 ms⁻¹ to 7.9 ms⁻¹ (PEAK)

Table C.2.5 Linear operating ranges with the **Vel10** filter

Range (RMS)	Linear operating ranges (RMS) With the SV80 (10 mV / ms ⁻²) accelerometer sensitivity @ 79.58 Hz Measured at the reference environmental conditions	
	LOW	HIGH
LOW	from 1 mms ⁻¹	to 1.59 ms ⁻¹
HIGH	from 10 ms ⁻¹	to 5.6 ms ⁻¹

- Linear measurement with the **Dil1** filter
from 32 µm to 8.9 m (the sinusoidal signal RMS)
from 320 µm to 12.6 m (PEAK)

Table C.2.6 Linear operating ranges with the **Dil1** filter

Range (RMS)	Linear operating ranges (RMS) With the SV80 (10 mV / ms ⁻²) accelerometer sensitivity @ 79.58 Hz Measured at the reference environmental conditions	
	LOW	HIGH
LOW	from 32 µm	to 2.53 m
HIGH	from 320 µm	to 8.9 m

- Linear measurement with the **Dil3** filter
from 10 µm to 3 m (the sinusoidal signal RMS)
from 100 µm to 4.2 m (PEAK)

Table C.2.7 Linear operating ranges with the **Dil3** filter

Range (RMS)	Linear operating ranges (RMS) With the SV80 (10 mV / ms ⁻²) accelerometer sensitivity @ 79.58 Hz Measured at the reference environmental conditions	
	LOW	HIGH
LOW	from 10 µm	to 4 cm
HIGH	from 100 µm	to 300 cm

- Linear measurement with the **Dil10** filter
from 1.6 µm to 47 cm (the sinusoidal signal RMS)
from 16 µm to 67 cm (PEAK)

Table C.2.8 Linear operating ranges with the **Dil10** filter

Range (RMS)	Linear operating ranges (RMS) With the SV80 (10 mV / ms ⁻²) accelerometer sensitivity @ 79.58 Hz Measured at the reference environmental conditions	
	LOW	HIGH
LOW	from 1.6 µm	to 6 cm
HIGH	from 16 µm	to 47 cm



Note: In the measurement of the signal with the **crest factor** $n > 1.41$ the **upper linear operating range for the RMS value is reduced**. Its value can be calculated from the equation: $A_n = A + 10 - 20 \log(n / \sqrt{2})$ [m], where **A** is the given range for the sinusoidal signal. E.g. for $n = 10$ and $A = 180$ the value of A_{10} is equal to $= 173$ dB.

Measuring ranges

Frequency range for the acceleration measurement (+/- 10%) 1 Hz ÷ 5 kHz (in the linear measurements with the **HP** or **HP1** filter)



Note: With the application of another vibration transducer, the frequency range given above for the **HP** filter can be different (i.e. wider).

See C 4 for the **Wh** and **VelMF** filters characteristics

Basic error for the acceleration measurement $< \pm 0.5$ dB

Calibration

Direct: by the measurement of the standard signal generated by the external vibration calibrator.

Indirect: by the declaration of the transducer's sensitivity (according to the calibration chart).



Note: Calibration procedure is given in Chapter 4 of the Manual.

Accelerometer input

Connector	TNC
Impedance	40 k Ω / 100 pF (typical)
Vibration transducers powering	IEPE type, 28 V / 1.5 mA current source

Range of the measured voltage

Range LOW	1 V _{RMS} (120 dB related to 1 μ V _{RMS})
Range HIGH	7 V _{RMS} (137 dB related to 1 μ V _{RMS})

Maximum input voltage

The **SVAN 977W** is the instrument with the II security class according to the international standard IEC 348. The input voltage should be within the 30 V Peak – Peak

RMS detector (Linear averaging)

• Digital	“True RMS” with Peak detection
• Resolution	0.1 dB
• Range	327.7 dB
• Crest Factor	unlimited for signals within 40 kHz band.

Overload detector

The instrument has the built-in overload detectors. The overload in the measurement channel (in its analogue part) and the overload of the analogue / digital converter are both detected. The “overload” indication is when the input signal amplitude **is 0.5 dB above** the declared “Peak measurement range”.

Underrange detector

The instrument has the built-in underrange detector. The “underrange” indication appears when the minimum value of the RMS detector output goes below the specified lower linear operating range.

Analogue/Digital conversion 24 bits resolution.

Antialiasing filter

Built-in antialiasing filter (eighth-order elliptic type) ensuring correct sampling of the measured signal.

Pass band(-1 dB) 22.200 kHz or 44.4 kHz

Pass band(-3 dB) 23.520 kHz or 47.0 kHz

Stop band 26.256 kHz or 52.53 kHz

Attenuation in the stop band > 100 dB.

Reference conditions

- Reference frequency 79.58 Hz
- Reference temperature +23°C
- Reference relative humidity 50 %
- Reference range HIGH.

Pre-heating time 1 minute (for 0.1 dB accuracy).

Typical stabilization time after change in environmental conditions is 1 minute.



Note: When the instruments are moved from a warm environment with high humidity, to a colder environment, care should be taken not to produce condensation inside the instruments. In this case, much longer stabilization periods may be necessary.

Digital filters

High-pass filters

HP filter (see part C.5 for the filter characteristics).

HP1 filter (see part C.5 for the filter characteristics).

HP3 filter (see part C.5 for the filter characteristics).

HP10 filter (see part C.5 for the filter characteristics).

Frequency weighting filters (filter includes Band Limiting filter).

(Conforms to ISO 8041:2005 , see part C.5 for the frequency response characteristics).

- **Wh** from 0.8 Hz to 4000 Hz

Integrating filters (see part C.5 for the frequency response characteristics):

- **Vel1** from 0.2 Hz to 4100 Hz
- **Vel3** from 0.2 Hz to 4100 Hz
- **Vel10** from 0.2 Hz to 4100 Hz
- **Dil1** from 0.1 Hz to 260 Hz
- **Dil3** from 0.2 Hz to 510 Hz
- **Dil10** from 1 Hz to 2050 Hz

Special filter

Filter for the evaluation of the machinery condition:

- **VelMF** from 0.2 Hz to 4100 Hz; conforms to the ISO 10816 standard (see part C.5 for the frequency response characteristics)

Environmental, electrostatic and radio frequency criteria



Note: In the measurement conditions with the strong electromagnetic disturbances (e.g. near the high-voltage transmission lines) the lower measurement limit can be drastically shifted as the result of the external field influence on the measurement cables. In such cases, the careful shielding of the measurement cables is strongly recommended. It is worth to underline that the estimation of the external influence can be performed in-site by the observations of the measurement signal spectrum.

Effect of humidity < **0.5 dB** (for 30% < RH < 90% at 40°C and 1000 Hz)

Effect of radio frequency fields (meets requirements of the ISO 8041:2005)

The greatest susceptibility (the least immunity) is achieved when in the VLM the **HP1** filter is selected and the RMS measurements are considered.

The greatest susceptibility is achieved when the VLM and accelerometer with cable is placed along field and the cable is coil as solenoid.

Effect of electrostatic discharge (meets requirements of the ISO 8041:2005)

During electrostatic discharge, the influence of the displayed results could be observed.

No changes in instrument operation state, configuration or stored data corruption were found out.

Operating range from -10°C to + 50°C

Storage and Transportation from -20°C to + 60°C

Effect of temperature < **0.5 dB** (from -10°C to + 50°C)

Operating range from -10°C to + 50°C

Storage from -20°C to + 60°C

Effect of Vibration < **0.1 dB** (measured at the instrument vibration 1m/s² in the 2 kHz band)

C.3 Specification of the SVAN 977W as 1/1 OCTAVE and 1/3 OCTAVE analyzer

The **SVAN 977W** instrument can operate as an **1/1 OCTAVE** or **1/3 OCTAVE** analyzer conforming to the international IEC 61260:1995 standard for the pass band filters.



Note: Simultaneously to the frequency analysis SVAN 977W operates as Sound Level Meter! See Chapters C.1 for specification.

Signal input

- SV12L preamplifier throughout ST02 adapter
- Maximum input voltage: the **SVAN 977W** meets the requirements IEC 348 for the 2nd class device. The input voltage shall not exceed the limits between -15 V and +15 V.
- Impedance: 10 GΩ / 2 pF.

Linear Operating Ranges

Two measuring ranges are available: "LOW" and "HIGH"

Table C.3.1 Linear operating range

Range	Linear operating range (with 10 dB margin from noise) (RMS for the sinusoidal signal at reference conditions @ 1 kHz, 0.0 dB calibration factor)	
LOW	from 9 μV_{RMS} "A"-weighting	to 0.99 V_{RMS} "A"-weighting
LOW	from 9 μV_{RMS} "B"-weighting	to 0.99 V_{RMS} "B"-weighting
LOW	from 9 μV_{RMS} "C"-weighting	to 0.99 V_{RMS} "C"-weighting
LOW	from 22 μV_{RMS} "Z"-weighting	to 0.99 V_{RMS} "Z"-weighting
HIGH	from 22 μV_{RMS} "A"-weighting	to 4.96 V_{RMS} "A"-weighting
HIGH	from 22 μV_{RMS} "B"-weighting	to 4.96 V_{RMS} "B"-weighting
HIGH	from 22 μV_{RMS} "C"-weighting	to 4.96 V_{RMS} "C"-weighting
HIGH	from 56 μV_{RMS} "Z"-weighting	to 4.96 V_{RMS} "Z"-weighting

Table C.3.2 Peak for the sinusoidal signal 1 kHz, at reference conditions

Peak for the sinusoidal signal 1 kHz, at reference conditions @ 1 kHz (0.0 dB calibration factor)	
Range	Max Peak value
LOW	1.4 V "A"-weighting
LOW	1.4 V "B"-weighting
LOW	1.4 V "C"-weighting
LOW	1.4 V "Z"-weighting
HIGH	7 V "A"-weighting
HIGH	7 V "B"-weighting
HIGH	7 V "C"-weighting
HIGH	7 V "Z"-weighting



Note: For the signals with the crest factor $n > 1.41$ upper measuring range of the RMS is reduced. The valid upper limit can be calculated according to the below given formula:

$A_n = 137 - 20 \log(n/\sqrt{2})$, where **A** is the upper limit for the sinusoidal signal

Example: For the crest factor $n = 10$ the upper limit is **$A_{10} = 120 \text{ dB}$**

Measuring frequency range

10 Hz ÷ 22.4 kHz with the **Z** filter (-3 dB)

Measuring frequency range

1 Hz ÷ 44.4 kHz with the **HP1** filter (-3 dB)



Note: When another vibration transducer is used, the frequency range given above for the HP filter can be different.

Maximum peak voltage

30 V Peak-Peak (Maximum peak voltage of input sinusoidal signal, which can be lead to the SLM without destruction the meter)

RMS detector

- | | |
|----------------|--|
| • Digital | "True RMS" with Peak detection |
| • Resolution | 0.1 dB |
| • Range | 327.7 dB |
| • Crest Factor | unlimited (for signals in 20 kHz band) |

Reference conditions

- | | |
|-------------------------------|---------|
| • Reference frequency | 1000 Hz |
| • Reference level | 114dB |
| • Reference temperature | +20°C |
| • Reference relative humidity | 65 % |

Calibration

Electrical

Calibration level

0.5 V_{RMS}

Basic accuracy

< ± 0.2 dB (for the temperature T=+23°C ± 5°C for sinusoidal signal 120 dB_{RMS} in the band 10 Hz ÷ 20 kHz with the **HP** input filter)

Measurement error in the full temperature range

< ± 0.1 dB (when the temperature is from -10°C to +50°C for the sinusoidal signal 120 dB_{RMS} in the band 10 Hz ÷ 20 kHz with the **Z** input filter).

Overload detector

The instrument has the built-in overload detectors. The overload in the measurement channel (in its analogue part) and the overload of the analogue / digital converter are both detected. The "overload" indication is when the input signal amplitude is **0.5 dB above** the declared "Peak measurement range"

Warm-up time

1 min. (for 0.1 dB accuracy).

Effect of humidity	< 0.5 dB (for 30%<RH<90% at 40°C re Reference conditions).
Effect of magnetic field	< 15 dB (A) or < 25 dB (Z) (for 80 A/m and 50 Hz).
Effect of Vibration	< 0.1 dB (from 20 Hz to 1000 Hz at 1 m/s ²).

Antialiasing filter

Built-in antialiasing filter. Second-order analogue filter, passive Class, combined with on-chip FIR digital filter of the analog-to-digital converter, ensuring correct sampling of the measured signal.

Pass band(-1 dB)	22.200 kHz or 44.4 kHz
Pass band(-3 dB)	23.520 kHz or 47.0 kHz
Stop band	26.256 kHz or 52.53 kHz
Attenuation in the stop band	> 80 dB.

Sampling frequency	48 kHz or 96 kHz (internal only).
Analogue to digital converter	1 x 24 bit.
Reference range	LOW.
Input attenuator accuracy	± 0.1 dB (for f = 1 kHz and T = +23°C)
Internal oscillator accuracy	0.01 % (for f = 1 kHz and T = +23°C).

Digital Filters**Weighting filters**

- A meeting requirements of the IEC 61672-1 standard for the Class 1 "A" filter,
- C meeting requirements of the IEC 61672-1 standard for the Class 1 "C" filter,
- Z meeting requirements of the IEC 61672-1 standard for the Class 1 "Z" filter,
- B meeting IEC651 for the Type 1 filter

See part C.3 for the A , C, B and Z filters characteristics,

Noise voltage measured with SV18 preamplifier, equivalent impedance -adapter Class of ST02 and 50 Ω input impedance, 20kHz Bandwith.

Range Low

- "A" weighting < 2.8 μV_{RMS}
- "B" weighting < 2.8 μV_{RMS}
- "C" weighting < 2.8 μV_{RMS}
- "Z" weighting < 7 μV_{RMS}.

Range High

- "A" weighting < 7 μV_{RMS}
- "B" weighting < 7 μV_{RMS}
- "C" weighting < 7 μV_{RMS}.
- "Z" weighting < 17.6 μV_{RMS}

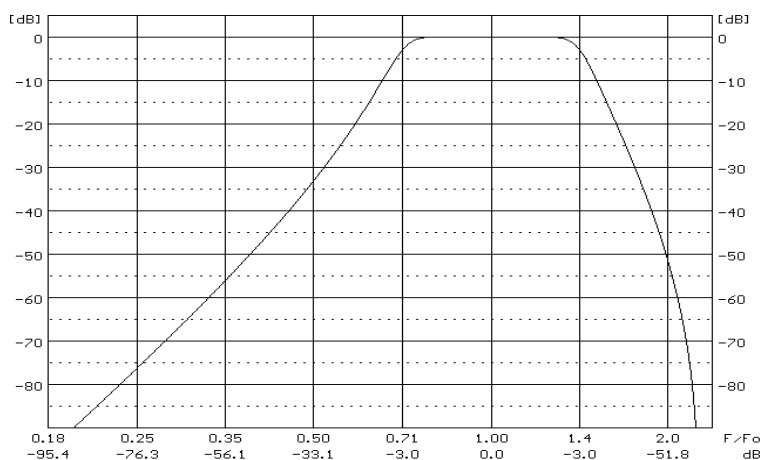
Low-pass filters

8 eighth-order elliptic filters with the cut-off frequencies from 10 kHz to 78.125 Hz in the binary sequence.
Ripple in the pass band ± 0.1 dB.

Attenuation in the stop band > 100 dB.

1/1 Octave filters

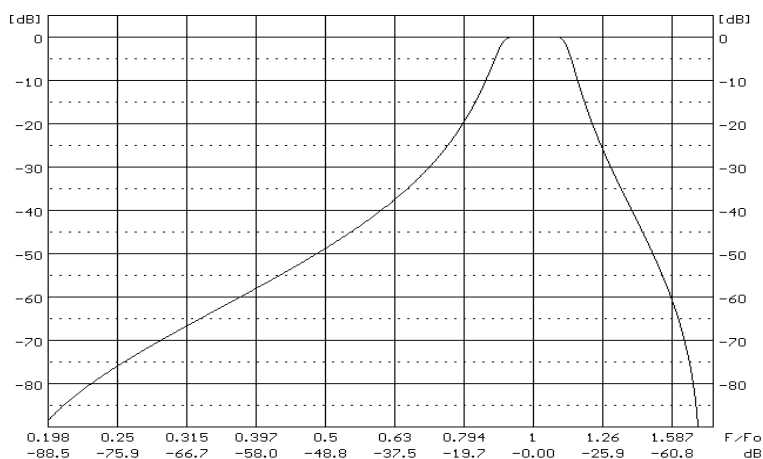
11 filters with centre frequencies from 32 Hz to 32 kHz (base 2), meeting DIN 45651, IEC 61260:1995 and ANSI S1.11-1986 for Class 1.



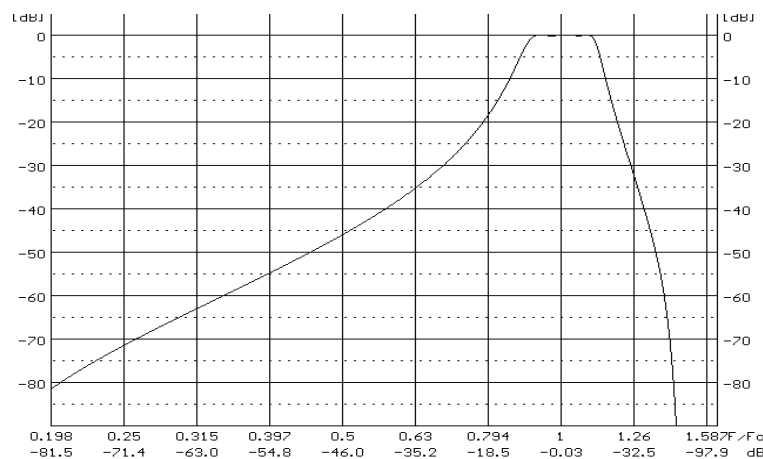
SVAN 977W 1/1 octave filters characteristic

1/3 Octave filters

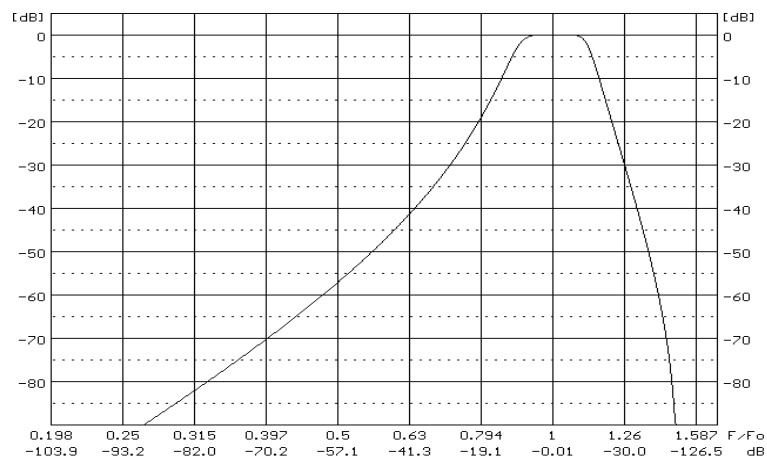
34 filters with centre frequencies from 20 Hz to 40 kHz (base 2), meeting DIN 45651, IEC 61260:1995 and ANSI S1.11-1986 for Class 1.



SVAN 977W 1/3 octave filters characteristic – “lower” filter for each octave band.



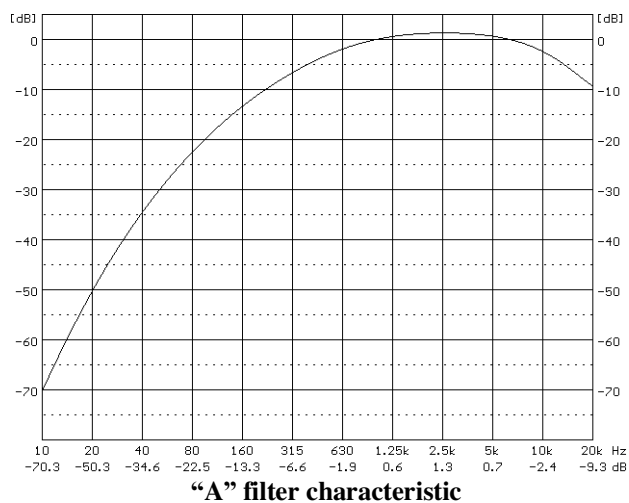
SVAN 977W 1/3 octave filters characteristic – “middle” filter for each octave band



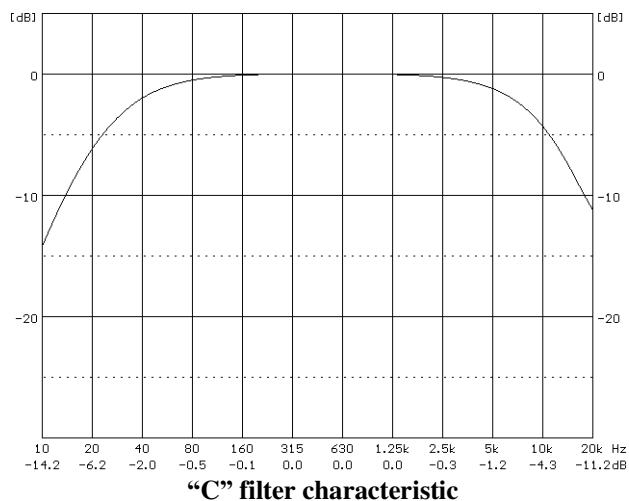
SVAN 977W 1/3 octave filters characteristic – “upper” filter for each octave band.

C.4 Frequency characteristics of the implemented broadband digital filters

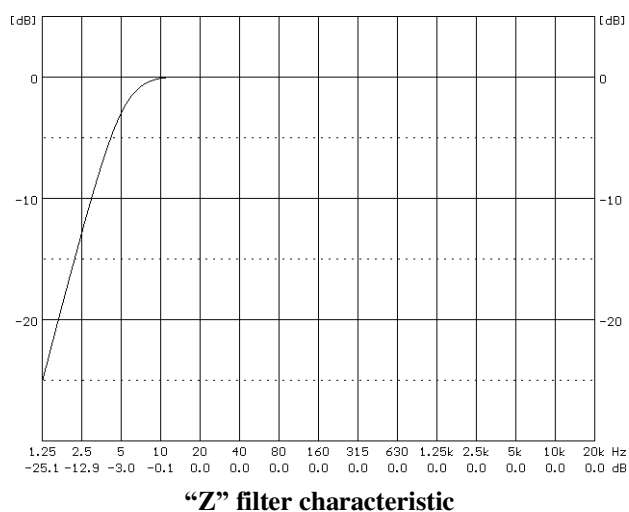
“A” filter Class 1 according to the IEC 651& and IEC 61672-1 standard.

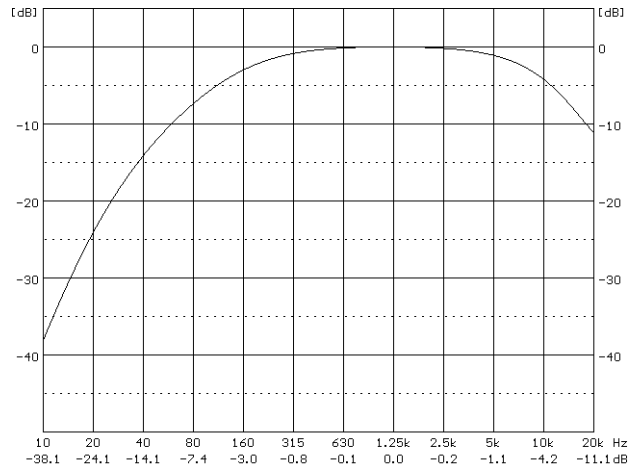


“C” filter Class 1 according to the IEC 651 and IEC 61672-1 standard.

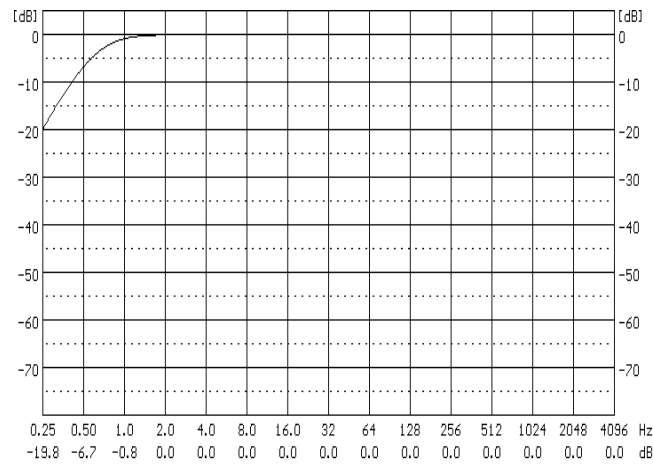


“Z” filter Class 1 according to the IEC 61672-1 standard.

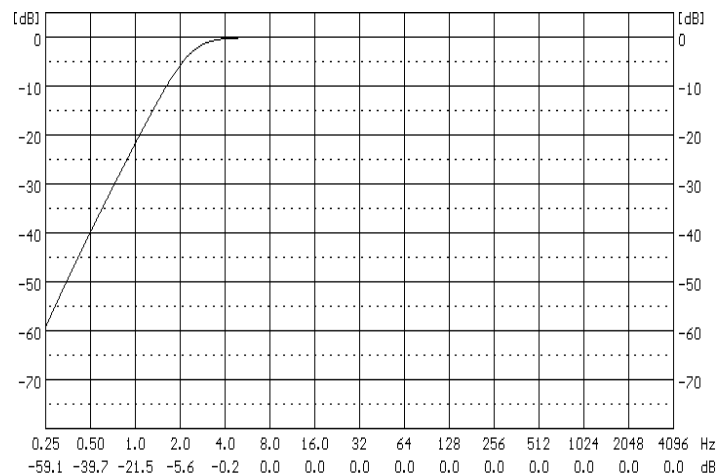


“B” filter Class 1 according to the IEC 651**“B” filter characteristic**

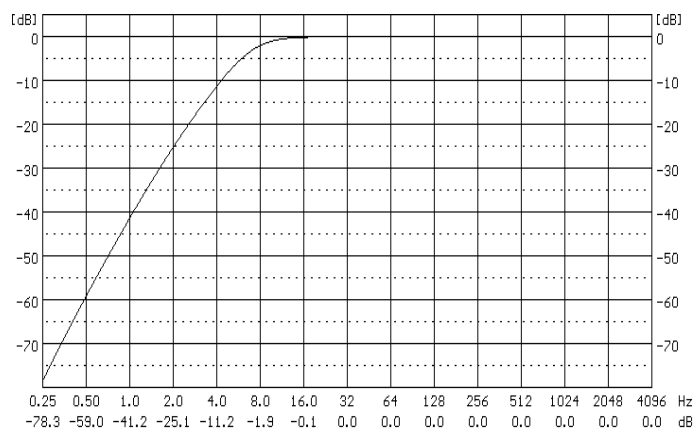
“HP1” filter is used for the acceleration measurements (the vibration signal) in the frequency range from 1 Hz to 20 kHz.

**“HP1” filter characteristics**

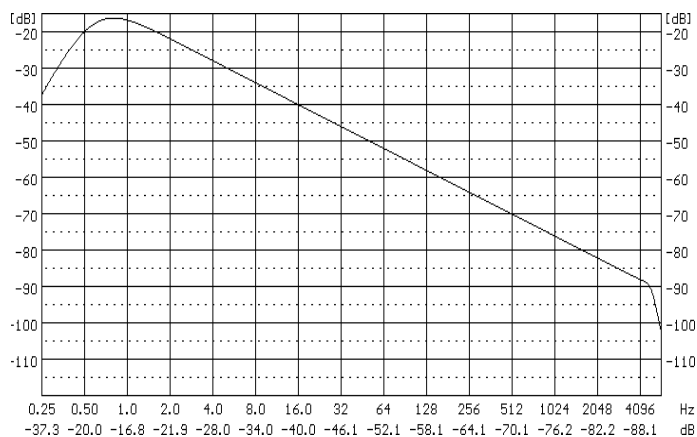
“HP3” filter is used for the acceleration measurements (the vibration signal) in the frequency range from 3.5 Hz to 20 kHz.

**“HP3” filter characteristics**

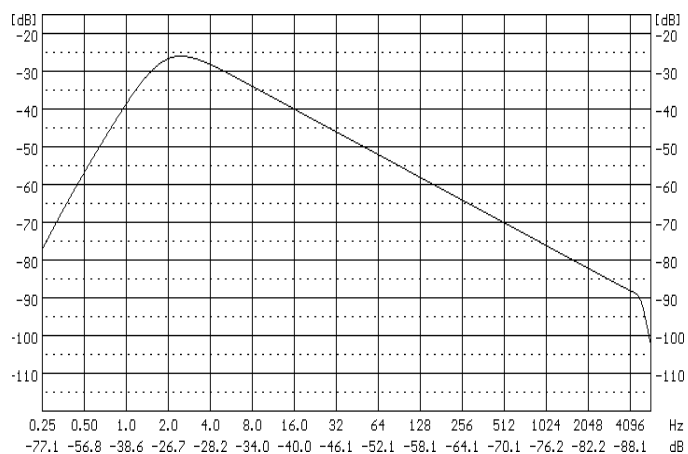
“HP10” filter is used for the acceleration measurements (the vibration signal) in the frequency range from 10 Hz to 20 kHz.

**“HP10” filter characteristics**

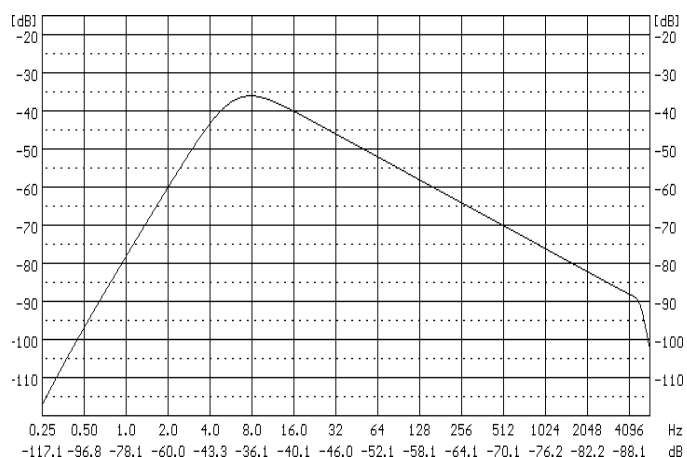
“Vel1” filter is used for the velocity measurements (the vibration signal) in the frequency range from 1 Hz to 20 kHz.

**“Vel1” filter characteristics**

“Vel3” filter is used for the velocity measurements in the frequency range from 1 Hz to 20 kHz.

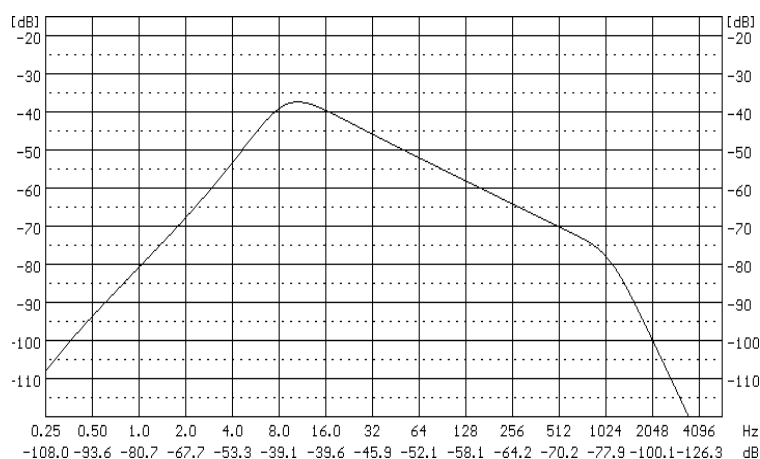
**“Vel3” filter characteristics**

“Vel10” filter is used for the velocity measurements in the frequency range from 1 Hz to 20 kHz.



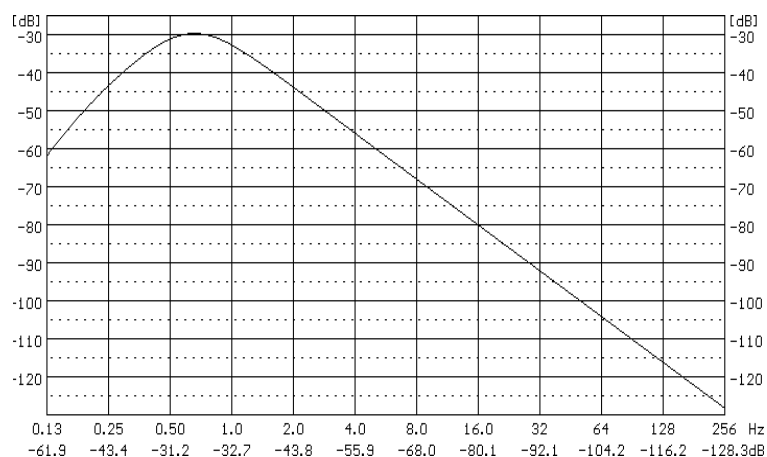
“Vel10” filter characteristics

“VelMF” filter is used for the evaluation of the state of the machines. This filter is used for the measurements in the frequency range from 10 Hz to 1000 Hz and conforms to the ISO 10816 standard.



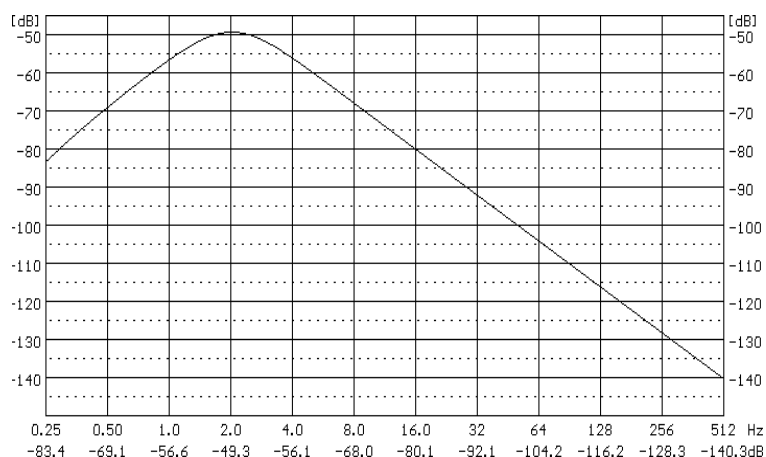
“VelMF” filter characteristics

“Dil1” filter is used for the displacement measurements in the frequency range [1 Hz to 20 kHz].



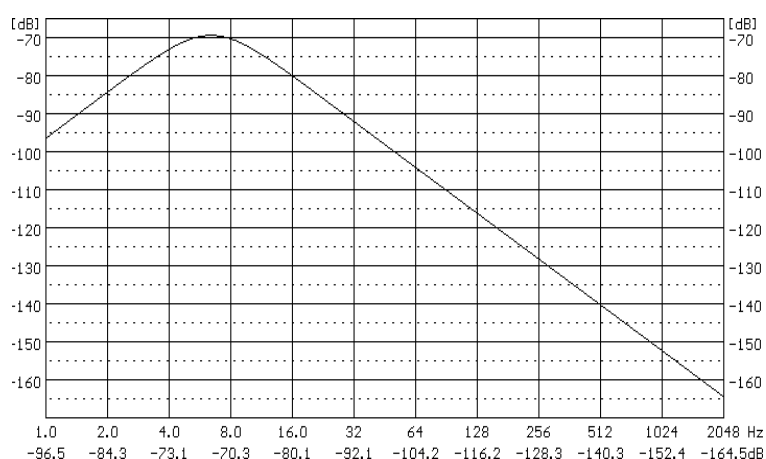
“Dil1” filter characteristics

“Dil3” filter is used for the displacement measurements in the frequency range [1 Hz to 20 kHz].



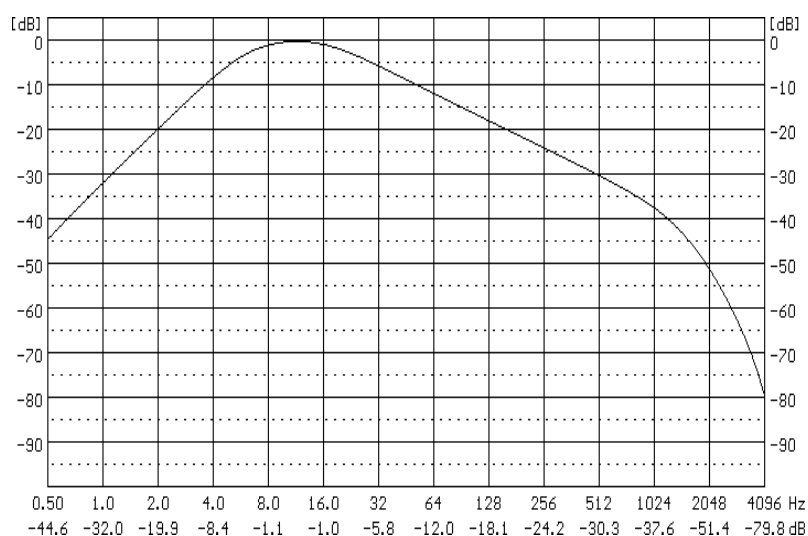
“Dil3” filter characteristics

“Dil10” filter is used for the displacement measurements in the frequency range [1 Hz to 20 kHz].



“Dil10” filter characteristics

“Wh” filter is used for the assessment of the influence of the vibration signal on the human body. It conforms to the ISO 5349 and ISO 8041:2001 standards.



“Wh” filter characteristics

C.5 Miscellaneous specification of the SVAN 977W

Display

Super contrast OLED color display (320 x 240 pixels).

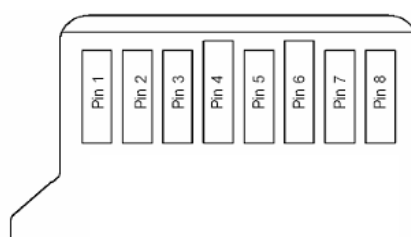
Memory

2 MB of the RAM memory.

64 MB of the FLASH memory allocated to the program and the WELMEC legal data.

Memory card

Can be used typical Micro SD or Micro SDHC cards. Supported for up to 16 GB.



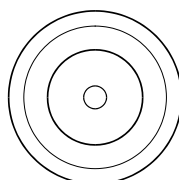
MicroSD contact pad assignment - outer view

Table C.5.1 Pin out of the MicroSD contact

Pin No.	Name	Description
1	DAT2	Data Line [Bit 2]
2	CD/DAT3	Card Detect / Data Line [Bit 3]
3	CMD	Command / Response
4	V _{DD}	Supply voltage
5	CLK	Clock
6	V _{SS}	Supply voltage ground
7	DAT0	Data Line [Bit 0]
8	DAT1	Data Line [Bit 1]

Signal input

The input of the measured signal (taken form the microphone preamplifier or the vibration transducer):



TNC connector (external view)

Table C.5.2 Pin out of the TNC connector

Pin number	TNC
Central	Input
Shield	Ground

Power supply

Instrument is dedicated for the operation from the internal replaceable battery.
Power consumption from the 6V source is approx. **130 mA (at + 20°C)**

So, typical operating time from 4 x AA alkaline batteries will be about **12 hours**.

SVAN 977W can be also powered from the AA Type rechargeable batteries.



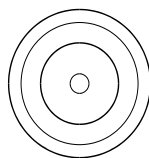
Note: For the temperatures below 0°C operating time can decrease (depending on the batteries)!

Instrument can be also powered from the external source (e.g. SA 17A or car battery) with the DC Voltage from 7 V to 16 V.

Voltage ripple should not exceed $\pm 5\%$.

External Power requirement is voltage dependent:

for 7 V - 110 mA DC,
for 15.5 V - 60 mA DC.

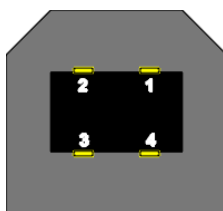


Power Supply connector 5.5 / 2.1 mm (external view)

Table C.5.3 Pin out of the power supply connector

Internal Pin	5.5/2.1
Shield	Ground
1	+ 7 V ÷ 16 V

USB Device port



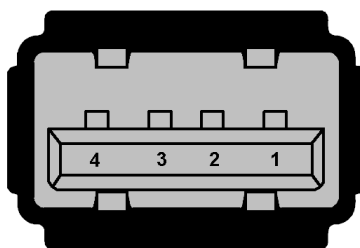
USB socket (external view)

Table C.5.4 Pin-out of the USB-Device connector

Pin number	USB
1	Vbus
2	D-
3	D+
4	GND
Shield	Ground

Serial port

SVAN 977W Serial Port provides data transfer using RS232 data format but in TTL logic standard



Serial Port socket (external view)

Table C.5.5 Pin-out of the Serial Port (USB-Host connector)

Pin number	USB
1	Vbus
2	TxD
3	RxD
4	GND
Shield	Ground

RS 232 interface (optional)

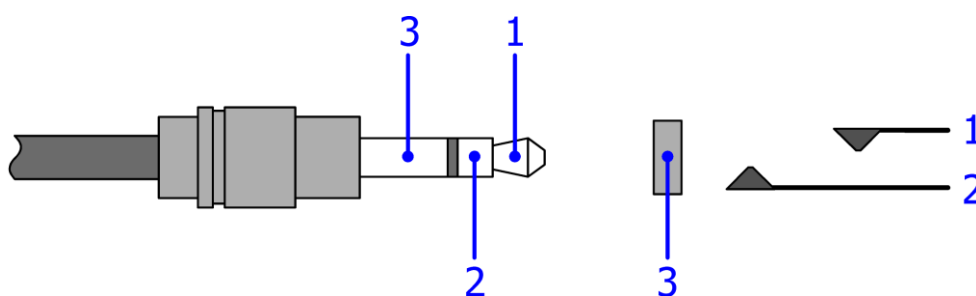
The RS 232 interface option for the **SVAN 977W** is provided by means of the **SV 55** interface. It conforms to the EIA Standard RS 232C. It enables the user to programme remotely all instrument functions and the transmissions to and from the meter with the speed from 300 bit/s to 115200 bit/s.

The SV 55 must be connected to the SVAN 977W Serial Port

The SV 55 - DB 09 F - pin female connector pin-out is given below.

Table C.5.6 SV 55 interface description

PC RS 232, 9 - pin connector Signal name	SV 55 connector (DB 09 F) Pin number
1 – LSD	1 (not connected)
2 – RXD	3
3 – TXD	2
4 – DTR	6 connected to pin 4
5 – GND	5
6 – DSR	4 connected to pin 6
7 – RTS	8
8 – CTS	7
9 – GND	9 (not connected)



3.5 mm Mini Stereo Jack type (cable plug and instrument socket are shown)

Table C.5.7 Pin out of the 3.5 mm Mini Stereo Jack

Pin Number	Function
1	Analog Output
2	Digital Input / Output (*)
Chassis (3)	Ground

*depending on instrument set-up

The user may set-up Modes in window **<Menu> / Instrument / Multifunction I/O**, which are available in the instrument:

1. **I/O Mode – Analog Out** – when this option is selected, the measured signal from the selected channel is fed to the terminal [1] of the I/O connector. Output voltage, frequency band and the output impedance are following:
 - a) Output Voltage:

The output voltage is equal to 1.0 V_{RMS} (± 5 %) at:

 - 120 dB indication of the instrument, on measurement range “L”
 - 137 dB, indication of the instrument, on measurement range “H”, when calibration factor is set to 0.0 dB.
 - b) Frequency Band (-3 dB): 0.02 Hz ÷ 40 kHz.
 - c) Output Impedance: 51 Ω / 5%
2. **I/O Mode – Analog In** – future feature.
3. **I/O Mode – Digital In**, when the **Ext. Trigger** function is activated, the external triggering of the instrument may be provided. In order to do that the user has to select **Trigger – External** (path: **Menu \ Measurement \ Measure Trigger**). The external signal for triggering is specified as follows:
 - a) Trigger voltage threshold level is set to +1 V,
 - b) Trigger voltage slope (path: **Menu \ Measurement \ Measure Trigger**) set by the user as **Slope+** (uprising as default) or **Slope-** (falling, auxiliary),
 - c) Minimal duration of the trigger impulse: 10 µsec,
 - d) 100 µsec. release time after previous measurement is necessary before next trigger,
 - e) Recommended trigger voltage should not exceed ± 5 V,
 - f) Input impedance in the **Digital In** mode – ca. 10 kΩ / 100 pF, ESD type safety,
 - g) When the instrument is switched-off in the **Digital In** mode, the voltage impulse on the pin [1] will be able to switch-on the instrument, however in this case the minimal duration of the trigger impulse of 100 msec is necessary, with uprising voltage slope.

4. **I/O Mode – Digital Out** - two different functions are available in this mode:
- 4.1. **Function – Trigger Pulse**, when this function is selected, the terminal [1] is set as output, which enables one to trigger another instrument (one instrument or more with trigger inputs connected together in parallel), output trigger impulse meets specification given below:
- a) trigger impulse is generated before every measurement,
 - b) output voltage range from 0 V or 3 V,
 - c) triggering slope: uprising,
 - d) output impedance: 51 Ω ,
 - e) duration of the impulse: ca. 30 μ sec.
- 4.2. **Function – Alarm Pulse**, when this function is selected, the terminal [1] is set as an output, which changes its output level, when current result of measurement exceeds user-programmable threshold level. In this case the terminal [1] output operates as an output of analogue comparator with user-programmable threshold. This feature enables one to control an external device as alarm-indicator or similar.
- a) electrical specification of this output are as follows: 0 V to 3 V voltage range, 51 Ω output impedance,
 - b) output produces a voltage level (not impulse),
 - c) **Active Level** setting may be selected by the user in menu as **Low** or **High**. When **High** is selected, the output alternates from 0 V to 3 V till measurement result is greater than threshold value,
 - d) **Source** setting selects source of measurement result to be compared with the threshold value. One of three results sources may be selected **Leq(1)**, **Peak(1)**, **Max(1)**, **Spl(1)**,
 - e) **Source Type** setting selects **Current** or **Periodic**, according to last result became of settled **Integr. Period** (path: **Menu** \ **Measurement** \ **General Settings**).
 - f) **LEVEL** enables one setting-up threshold value

Real Time Clock

Built-in real time. Accuracy better than 1 minute/month. Additional built-in CR1220 battery provides power to the RTC for a minimum of 2 years (typically 10 years).

Weight with the battery 600 g (without accelerometer).

Dimensions 39x79x305 mm (with microphone and preamplifier).

Electromagnetic Compatibility (EMC)

The product described above is compliant with the following EMC standards:

1. For the EMC emissions specification:
 - a) according to EN-61672-1 (Chapter 5.18) and EN-61672-2 (Chapter 9), applying test methods in accordance with CISPR 22:1997, Clause 10 and CISPR 16-1:1999,
 - b) according to EN ISO8041: 2005 (Chapters 7.5, 12.20.7), applying test methods in accordance with CISPR 22: 2003, Clause 10 and CISPR 16-1-1,
2. For the EMC immunity specification:
 - a) according to EN-61672-1 (Chapters 6.5 and 6.6) and EN-61672-2 (Chapter 7.9 and 7.10), applying test methods in accordance with IEC 61000-4-2, IEC 61000-4-3:2002 and IEC 61000-4-8.
 - b) according to EN ISO8041: 2005 (Chapters 7.4, 7.6, 12.20.6, 12.20.8), applying test methods in accordance with IEC 61000-4-2:2001, IEC 61000-4-3:2002 and IEC 61000-4-8.



Note: EMC compatibility is guaranteed only with the original accessories supplied by SVANTEK!

Safety

The product described above is compliant with following standards:
EN 61010-1:2001 and IEC 61010-1:2001

Compliance with EU Directives

CE mark indicates compliance with EMC Directive 89/336/EEC and Low Voltage Directive 2006/95/EC.

Environmental parameters

- Working temperature range -10°C ÷ +50°C
- Storing temperature range -20°C ÷ +50°C (-30°C ÷ +60°C without batteries)
- Humidity 90% RH in 40°C (uncondensed vapour)

Wireless Bluetooth® 2.0+EDR (Enhanced Data Rates)

This instrument supports wireless connection via Fully Qualified Bluetooth system v2.0 + EDR, CE and FCC. This connectivity is compatible with mobile and PC devices that support Bluetooth® 2.0.

- TX power: up to 3 dBm
- Receiver sensitivity: -86 dBm
- Range: typically >30m line-of-sight and depending on local RF conditions.

The instrument contains a wireless transmission module, WT12-A from Bluegiga technologies. Copies of the modules regional approvals certificates may be obtained from Svantek or Bluegiga.

FCC and IC

This product contains an FCC and Industry Canada certified Bluetooth® Low energy wireless transmission module:

- **FCC ID:** QQQWT12
- **Industry Canada ID:** 5123A-BGTWT12A
- Producer: Bluegiga Technologies Oy
- Model: WT12-A Bluetooth Module

FCC Statements:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

¹ "The Bluetooth® word mark and logos are registered trademarks owned by Bluetooth SIG, Inc. and any use of such marks by SVANTEK is under license. Other trademarks and trade names are those of their respective owners.

Operation is subject to the following two conditions:

- This device may not cause interference and
- This device must accept any interference, including interference that may cause undesired operation of the device.

GPS

The instrument has a built-in GPS module intended for logging position and time definition.

GPS is an antenna module with SiRF Star IV ROM based chip and an on-board integrated antenna.

- Position Accuracy (horizontal): < 2.5 m CEP (autonomous),
- Tracking Sensitivity: -163dBm

C.6 Specification of SV 80 accelerometer

Performance:

Number of axis	1
Sensitivity ($\pm 5\%$)	10 mV/(ms ⁻²) ~ 100 mV/g
Measurement range	0.01 ms ⁻² RMS ÷ 500 ms ⁻² Peak
Frequency response (by design guideline, ± 3 dB)	0.5 Hz ÷ 14 000 Hz
Linearity	$\pm 1\%$
Residual noise (1 Hz, 24°C)	30 μ g RMS
Residual noise (1 Hz to 25 kHz, 24°C)	300 μ g RMS
Transverse response sensitivity (20 Hz, 50 m/s ²)	< 5 %
Resonant frequency	25 kHz

Electrical:

Electrical grounding	Isolated from machine grounding
Isolation (Case to Shield)	> 100 M Ω
Capacitance to ground (Nominal)	70 pF
Supply current	2 mA ÷ 10 mA
Supply voltage	22 V ÷ 28 V
Bias voltage	+12 VDC
Output impedance (Nominal)	50 Ω
Charge / discharge time constant (start-up time).....	< 1 sec. typ.

Environmental Conditions:

Maximum vibration (shock survival)	50 000 ms ⁻² Peak
Thermal sensitivity coefficient	0.07 %/° C F.S.
Operating temperature range	from -55 °C to +120 °C
Operating temperature range (recommended)	from -10 °C to +50 °C
Humidity / Enclosure	IP67, epoxy sealed

Physical:

Connector.....	TNC socket, top radially mounted
Material housing & connector.....	Stainless steel
Dimensions.....	drawing above
Mounting thread.....	10-32 UNF 2B
Weight.....	40 grams

Accessories:

Mounting stud 10-32 to M5 (included)	
SA 27/10-32.....	Mounting magnet base (optional)
SC 27.....	Coil cable TNC plug – TNC plug, 2 meters (optional)

C.7 Using of the SA 277 Outdoor Microphone Protection Unit

The **SA 277** outdoor protection unit protects the SVAN 977 preamplifier and microphone from weather conditions. The use of the outdoor kit requires an extension cable between the instrument and its preamplifier (**SC 277**). The SA 277 is made of lightweight materials and is easy to install on a tripod. This solution is recommended for short term and semi-permanent outdoor noise measurements.

The outdoor microphone kit has $\frac{3}{4}$ " screw on its bottom which enables the use of standard tripods or other user specific mountings.

As an option the user may use desiccator - Silikogel. The desiccator absorbs moisture commonly contained in the air. The desiccator should be regenerated after some period of use, when it changes colour to red, by drying it for 3 hours in a temperature of 150°C. The colour of the silica gel is visible through the hole on the top of the dessicator



Note: See also SA 277 Assembly Guide to learn how to assemble and disassemble the microphone's outdoor protection.



Note: Using SA277 changes the frequency response and measuring ranges of the SVAN 977W. Please check the below given specification.

Depending on the measurement task SA 277 can be used in two operation "modes":

1. With reference incidence angle 90 deg. – so called "environmental mode"
2. With reference incidence angle 0 deg. – so called "airport mode"

The wave incidence angle is oriented to the microphone membrane surface. 0 deg. means direction orthogonal to the membrane surface. 90 deg. means direction parallel to the membrane surface.

Frequency response of the SVAN 977W with SA277 outdoor protection unit is compensated by means of two digital filters:

- **Environmental**

compensation filter improving the complete instrument frequency response in the free field for the reference acoustic wave incidence angle 90 deg

- **Airport**

compensation filter improving the complete instrument frequency response in the free field for the reference acoustic wave incidence angle 0 deg

Linear Operating Ranges with Environmental filter**Table C.7.1** Self-generated noise for different weighting filters

Range \ Weighting filter	Electrical *)			Acoustical compensated		
	A	C	Z	A	C	Z
Low	< 15 dB	< 15 dB	< 20 dB	< 16 dB	< 16 dB	< 21 dB
High	< 26 dB	< 26 dB	< 31 dB	< 27 dB	< 27 dB	< 31 dB

*) measured with the **ST 02** microphone equivalent impedance **18 pF +/-10%**

The starting point at which tests of level linearity shall begin is 94.0 dB for the frequencies specifies below.

Table C.7.2 Linear operating range: "LOW" with **Environmental** filter for the sinusoidal signal and microphone sensitivity 35 mV/Pa

[dB]	LAS/F		LBS/F		LCS/F		LZS/F		LAeqT		LBeqT		LCeqT		LAE (t _{int} = 2 s)		LCpeak	
	from	to	from	to	from	to	from	to	from	to	from	to	from	to	from	to	from	to
31,5 Hz	26	80	26	103	26	117	31	120	26	80	26	103	26	117	29	83	51	120
500 Hz	26	116	26	119	26	120	31	120	26	116	26	119	26	120	29	119	50	123
1 kHz	26	120	26	120	26	120	31	120	26	120	26	120	26	120	29	123	50	123
4 kHz	26	121	26	119	26	119	31	120	26	121	26	119	26	119	29	124	50	123
8 kHz	26	119	26	117	26	117	31	120	26	119	26	117	26	117	29	122	50	120
12.5 kHz	26	115	26	114	26	114	31	120	26	115	26	114	26	114	29	118	50	117

Table C.7.3 Linear operating range: "HIGH" with **Environmental** filter for the sinusoidal signal and microphone sensitivity 35 mV/Pa

[dB]	LAS/F		LBS/F		LCS/F		LZS/F		LAeqT		LBeqT		LCeqT		LAE (t _{int} = 2 s)		LCpeak	
	from	to	from	to	from	to	from	to	from	to	from	to	from	to	from	to	from	to
31,5 Hz	37	97	37	120	37	134	41	137	37	97	37	120	37	134	40	100	64	137
500 Hz	37	133	37	136	37	137	41	137	37	133	37	136	37	137	40	136	60	140
1 kHz	37	137	37	137	37	137	41	137	37	137	37	137	37	137	40	140	60	140
4 kHz	37	138	37	136	37	136	41	137	37	138	37	136	37	136	40	141	60	139
8 kHz	37	136	37	134	37	134	41	137	37	136	37	134	37	134	40	139	60	137
12.5 kHz	37	132	37	131	37	131	41	137	37	132	37	131	37	131	40	135	60	134

Microphone response

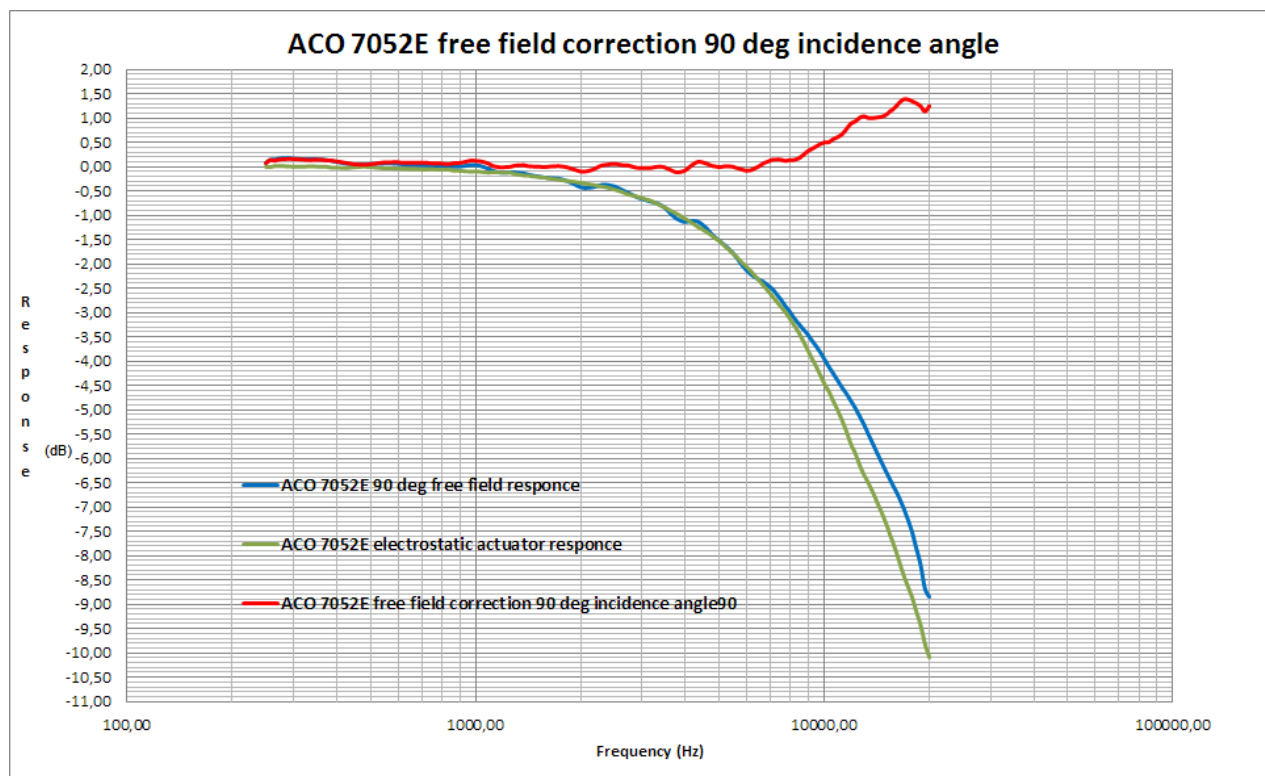


Table C.7.4 ACO 7052E free field correction 90 deg incidence angle

f [Hz]	ACO 7052E Actuator to Free Field correction for the 90 deg incidence angle	ACO 7052E Typical electrostatic actuator response	ACO 7052E Free Field response for the 90 deg incidence angle
251.19	0,08	0,00	0,08
258.52	0,15	0,00	0,15
266.07	0,14	0,02	0,15
273.84	0,16	0,02	0,18
281.84	0,17	0,02	0,18
290.07	0,17	0,01	0,18
298.54	0,17	0,01	0,18
307.26	0,17	0,00	0,17
316.23	0,16	0,01	0,17
325.46	0,16	0,01	0,16
334.97	0,15	0,02	0,16
344.75	0,15	0,01	0,16
354.81	0,15	0,01	0,16
365.17	0,15	0,00	0,15
375.84	0,14	0,00	0,14
386.81	0,14	-0,01	0,13
398.11	0,12	-0,01	0,11
409.73	0,11	-0,02	0,09

f [Hz]	ACO 7052E Actuator to Free Field correction for the 90 deg incidence angle	ACO 7052E Typical electrostatic actuator response	ACO 7052E Free Field response for the 90 deg incidence angle
421.70	0,10	-0,02	0,08
434.01	0,08	-0,02	0,06
446.68	0,06	-0,01	0,06
459.73	0,06	0,00	0,06
473.15	0,05	0,00	0,06
486.97	0,06	0,00	0,06
501.19	0,06	0,00	0,06
515.82	0,08	-0,01	0,06
530.88	0,09	-0,02	0,07
546.39	0,10	-0,03	0,07
562.34	0,10	-0,03	0,07
578.76	0,11	-0,03	0,07
595.66	0,10	-0,04	0,07
613.06	0,10	-0,04	0,06
630.96	0,09	-0,04	0,05
649.38	0,10	-0,05	0,05
668.34	0,09	-0,04	0,05
687.86	0,09	-0,05	0,04
707.95	0,09	-0,05	0,04
728.62	0,09	-0,05	0,04
749.89	0,08	-0,05	0,03
771.79	0,08	-0,06	0,03
794.33	0,08	-0,06	0,02
817.52	0,07	-0,05	0,01
841.40	0,07	-0,06	0,01
865.96	0,08	-0,08	0,01
891.25	0,09	-0,08	0,01
917.28	0,10	-0,08	0,02
944.06	0,12	-0,09	0,03
971.63	0,14	-0,09	0,04
1000.00	0,13	-0,09	0,04
1029.20	0,13	-0,10	0,03
1059.25	0,11	-0,11	0,00
1090.18	0,08	-0,12	-0,04
1122.02	0,03	-0,11	-0,08
1154.78	0,01	-0,11	-0,10
1188.50	0,00	-0,11	-0,12
1223.21	0,01	-0,12	-0,11
1258.93	0,01	-0,12	-0,11
1295.69	0,04	-0,15	-0,11

f [Hz]	ACO 7052E Actuator to Free Field correction for the 90 deg incidence angle	ACO 7052E Typical electrostatic actuator response	ACO 7052E Free Field response for the 90 deg incidence angle
1333.52	0,04	-0,16	-0,12
1372.46	0,05	-0,17	-0,13
1412.54	0,02	-0,18	-0,15
1453.78	0,02	-0,19	-0,17
1496.24	0,01	-0,20	-0,19
1539.93	0,01	-0,21	-0,20
1584.89	0,00	-0,22	-0,22
1631.17	0,02	-0,24	-0,22
1678.80	0,02	-0,25	-0,23
1727.83	0,02	-0,26	-0,24
1778.28	0,02	-0,27	-0,26
1830.21	0,00	-0,29	-0,29
1883.65	-0,03	-0,30	-0,32
1938.65	-0,06	-0,31	-0,37
1995.26	-0,08	-0,33	-0,41
2053.53	-0,09	-0,34	-0,43
2113.49	-0,07	-0,35	-0,43
2175.20	-0,04	-0,37	-0,41
2238.72	0,00	-0,39	-0,39
2304.09	0,04	-0,41	-0,37
2371.37	0,05	-0,42	-0,37
2440.62	0,07	-0,44	-0,38
2511.89	0,07	-0,47	-0,40
2585.23	0,06	-0,50	-0,44
2660.73	0,04	-0,53	-0,49
2738.42	0,04	-0,57	-0,53
2818.38	0,01	-0,59	-0,58
2900.68	-0,01	-0,61	-0,62
2985.38	-0,02	-0,64	-0,65
3072.56	-0,01	-0,67	-0,68
3162.28	-0,01	-0,69	-0,70
3254.62	0,00	-0,73	-0,73
3349.65	0,01	-0,78	-0,76
3447.47	0,01	-0,82	-0,81
3548.13	-0,03	-0,86	-0,89
3651.74	-0,07	-0,91	-0,98
3758.37	-0,10	-0,96	-1,06
3868.12	-0,09	-1,01	-1,10
3981.07	-0,07	-1,06	-1,13
4097.32	0,00	-1,12	-1,11

f [Hz]	ACO 7052E Actuator to Free Field correction for the 90 deg incidence angle	ACO 7052E Typical electrostatic actuator response	ACO 7052E Free Field response for the 90 deg incidence angle
4216.97	0,07	-1,18	-1,11
4340.10	0,11	-1,24	-1,12
4466.84	0,10	-1,29	-1,18
4597.27	0,08	-1,34	-1,26
4731.51	0,03	-1,40	-1,37
4869.68	0,02	-1,47	-1,45
5011.87	0,00	-1,53	-1,53
5158.22	0,02	-1,62	-1,60
5308.84	0,02	-1,70	-1,68
5463.87	0,01	-1,78	-1,77
5623.41	-0,02	-1,87	-1,89
5787.62	-0,04	-1,96	-2,01
5956.62	-0,07	-2,04	-2,11
6130.56	-0,06	-2,14	-2,20
6309.57	-0,02	-2,24	-2,26
6493.82	0,02	-2,34	-2,32
6683.44	0,08	-2,44	-2,36
6878.60	0,12	-2,55	-2,43
7079.46	0,15	-2,66	-2,51
7286.18	0,16	-2,77	-2,61
7498.94	0,16	-2,88	-2,73
7717.92	0,13	-2,99	-2,86
7943.28	0,15	-3,12	-2,97
8175.23	0,15	-3,26	-3,10
8413.95	0,18	-3,40	-3,22
8659.64	0,24	-3,57	-3,33
8912.51	0,32	-3,75	-3,42
9172.76	0,37	-3,93	-3,56
9440.61	0,42	-4,10	-3,68
9716.28	0,48	-4,29	-3,81
10000.00	0,51	-4,47	-3,96
10292.01	0,51	-4,63	-4,11
10592.54	0,58	-4,83	-4,25
10901.84	0,62	-5,01	-4,39
11220.18	0,68	-5,21	-4,54
11547.82	0,78	-5,44	-4,66
11885.02	0,90	-5,70	-4,81
12232.07	0,94	-5,89	-4,95
12589.25	1,01	-6,13	-5,12
12956.87	1,05	-6,34	-5,29

f [Hz]	ACO 7052E Actuator to Free Field correction for the 90 deg incidence angle	ACO 7052E Typical electrostatic actuator response	ACO 7052E Free Field response for the 90 deg incidence angle
13335.21	1,01	-6,50	-5,49
13724.61	1,01	-6,69	-5,68
14125.38	1,02	-6,90	-5,88
14537.84	1,04	-7,10	-6,06
14962.36	1,07	-7,32	-6,25
15399.27	1,15	-7,58	-6,43
15848.93	1,22	-7,82	-6,61
16311.73	1,31	-8,09	-6,78
16788.04	1,39	-8,38	-6,99
17278.26	1,39	-8,62	-7,23
17782.79	1,36	-8,85	-7,49
18302.06	1,31	-9,15	-7,84
18836.49	1,25	-9,44	-8,18
19386.53	1,15	-9,82	-8,67
19952.62	1,26	-10,10	-8,84

Frequency response of the SA 277 (90 deg incidence angle)

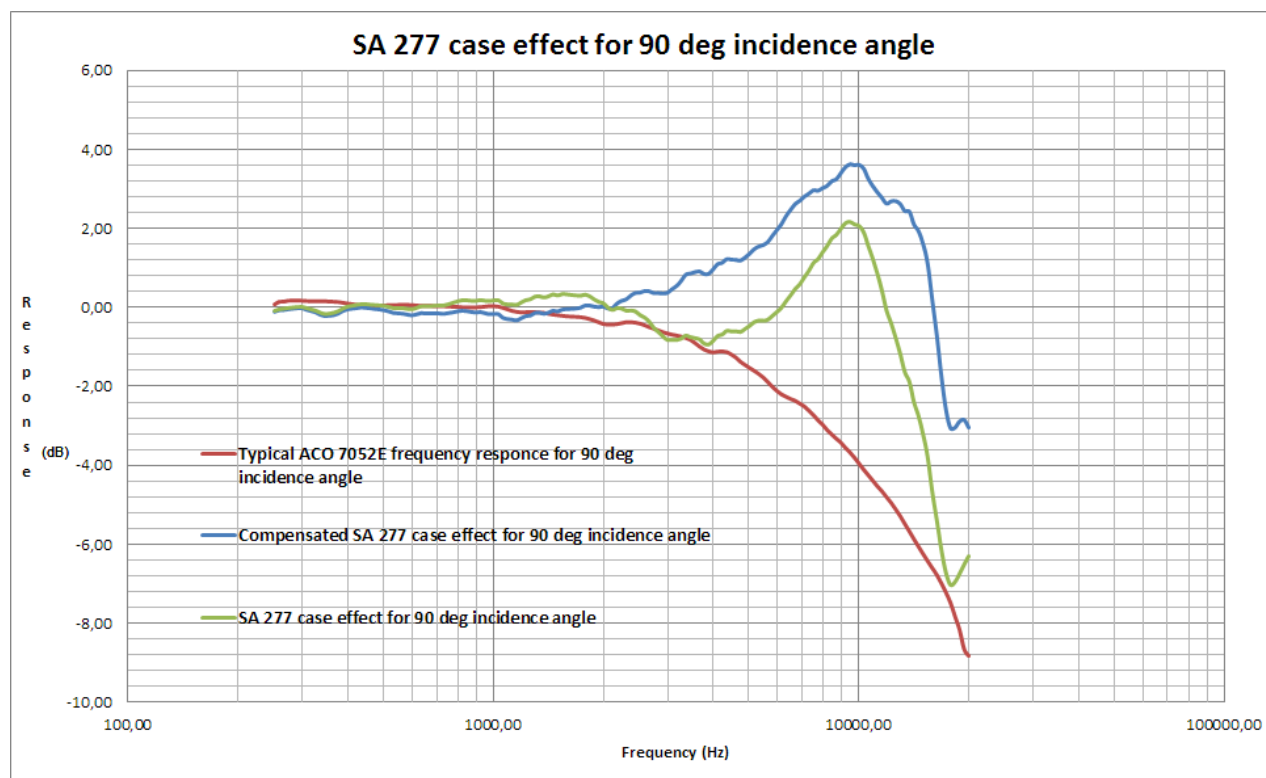


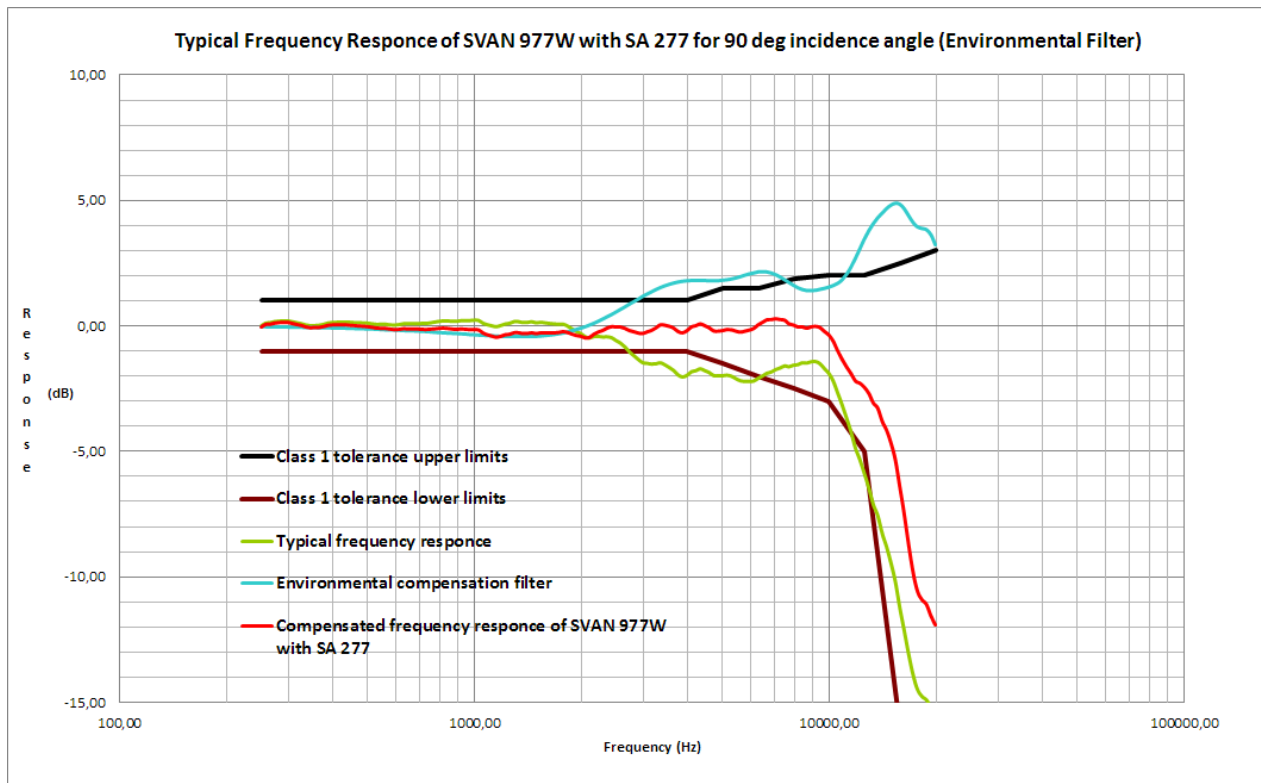
Table C.7.5 SA 277 case effect and ACO 7052E frequency response for 90 deg incidence angle

f [Hz]	Typical ACO 7052E frequency response for 90 deg	SA 277Case effect for the 90 deg incidence angle (Environmental)	Compensated case effect for the 90 deg incidence angle (Environmental)
251.19	0,08	-0,09	-0,12
258.52	0,15	-0,06	-0,09
266.07	0,15	-0,04	-0,08
273.84	0,18	-0,02	-0,06
281.84	0,18	-0,01	-0,05
290.07	0,18	0,01	-0,03
298.54	0,18	0,01	-0,03
307.26	0,17	-0,02	-0,07
316.23	0,17	-0,06	-0,11
325.46	0,16	-0,09	-0,14
334.97	0,16	-0,14	-0,20
344.75	0,16	-0,17	-0,23
354.81	0,16	-0,16	-0,22
365.17	0,15	-0,14	-0,21
375.84	0,14	-0,10	-0,17
386.81	0,13	-0,03	-0,10
398.11	0,11	0,02	-0,06
409.73	0,09	0,04	-0,04
421.70	0,08	0,06	-0,03
434.01	0,06	0,08	-0,01
446.68	0,06	0,07	-0,03
459.73	0,06	0,06	-0,04
473.15	0,06	0,06	-0,05
486.97	0,06	0,05	-0,06
501.19	0,06	0,03	-0,09
515.82	0,06	0,00	-0,12
530.88	0,07	-0,02	-0,15
546.39	0,07	-0,02	-0,16
562.34	0,07	-0,02	-0,17
578.76	0,07	-0,04	-0,19
595.66	0,07	-0,05	-0,21
613.06	0,06	-0,02	-0,19
630.96	0,05	0,02	-0,16
649.38	0,05	0,02	-0,17
668.34	0,05	0,02	-0,17
687.86	0,04	0,04	-0,16
707.95	0,04	0,04	-0,17
728.62	0,04	0,04	-0,18

f [Hz]	Typical ACO 7052E frequency response for 90 deg	SA 277Case effect for the 90 deg incidence angle (Environmental)	Compensated case effect for the 90 deg incidence angle (Environmental)
749.89	0,03	0,07	-0,16
771.79	0,03	0,11	-0,14
794.33	0,02	0,15	-0,11
817.52	0,01	0,17	-0,10
841.40	0,01	0,17	-0,11
865.96	0,01	0,16	-0,13
891.25	0,01	0,16	-0,14
917.28	0,02	0,18	-0,13
944.06	0,03	0,16	-0,16
971.63	0,04	0,15	-0,19
1000.00	0,04	0,17	-0,18
1029.20	0,03	0,18	-0,18
1059.25	0,00	0,09	-0,28
1090.18	-0,04	0,07	-0,31
1122.02	-0,08	0,07	-0,32
1154.78	-0,10	0,06	-0,34
1188.50	-0,12	0,12	-0,29
1223.21	-0,11	0,18	-0,23
1258.93	-0,11	0,20	-0,22
1295.69	-0,11	0,27	-0,15
1333.52	-0,12	0,27	-0,15
1372.46	-0,13	0,25	-0,17
1412.54	-0,15	0,28	-0,14
1453.78	-0,17	0,32	-0,10
1496.24	-0,19	0,30	-0,11
1539.93	-0,20	0,33	-0,07
1584.89	-0,22	0,32	-0,06
1631.17	-0,22	0,31	-0,05
1678.80	-0,23	0,30	-0,04
1727.83	-0,24	0,29	-0,02
1778.28	-0,26	0,31	0,03
1830.21	-0,29	0,27	0,03
1883.65	-0,32	0,20	0,01
1938.65	-0,37	0,13	-0,01
1995.26	-0,41	0,10	0,01
2053.53	-0,43	-0,01	-0,04
2113.49	-0,43	-0,07	-0,03
2175.20	-0,41	-0,02	0,09
2238.72	-0,39	-0,04	0,15
2304.09	-0,37	-0,09	0,19
2371.37	-0,37	-0,08	0,29

f [Hz]	Typical ACO 7052E frequency response for 90 deg	SA 277Case effect for the 90 deg incidence angle (Environmental)	Compensated case effect for the 90 deg incidence angle (Environmental)
2440.62	-0,38	-0,11	0,35
2511.89	-0,40	-0,20	0,36
2585.23	-0,44	-0,26	0,40
2660.73	-0,49	-0,36	0,40
2738.42	-0,53	-0,52	0,35
2818.38	-0,58	-0,62	0,35
2900.68	-0,62	-0,73	0,34
2985.38	-0,65	-0,83	0,35
3072.56	-0,68	-0,82	0,45
3162.28	-0,70	-0,83	0,53
3254.62	-0,73	-0,80	0,65
3349.65	-0,76	-0,72	0,81
3447.47	-0,81	-0,75	0,85
3548.13	-0,89	-0,78	0,88
3651.74	-0,98	-0,81	0,90
3758.37	-1,06	-0,91	0,84
3868.12	-1,10	-0,94	0,84
3981.07	-1,13	-0,85	0,95
4097.32	-1,11	-0,73	1,08
4216.97	-1,11	-0,69	1,12
4340.10	-1,12	-0,60	1,21
4466.84	-1,18	-0,61	1,20
4597.27	-1,26	-0,61	1,19
4731.51	-1,37	-0,63	1,17
4869.68	-1,45	-0,55	1,25
5011.87	-1,53	-0,47	1,35
5158.22	-1,60	-0,38	1,46
5308.84	-1,68	-0,34	1,53
5463.87	-1,77	-0,34	1,57
5623.41	-1,89	-0,32	1,64
5787.62	-2,01	-0,22	1,80
5956.62	-2,11	-0,12	1,95
6130.56	-2,20	-0,01	2,10
6309.57	-2,26	0,15	2,30
6493.82	-2,32	0,30	2,46
6683.44	-2,36	0,46	2,61
6878.60	-2,43	0,58	2,69
7079.46	-2,51	0,76	2,80
7286.18	-2,61	0,92	2,87
7498.94	-2,73	1,12	2,96
7717.92	-2,86	1,22	2,95

f [Hz]	Typical ACO 7052E frequency response for 90 deg	SA 277Case effect for the 90 deg incidence angle (Environmental)	Compensated case effect for the 90 deg incidence angle (Environmental)
7943.28	-2,97	1,39	3,01
8175.23	-3,10	1,55	3,07
8413.95	-3,22	1,74	3,19
8659.64	-3,33	1,83	3,24
8912.51	-3,42	1,98	3,39
9172.76	-3,56	2,12	3,54
9440.61	-3,68	2,15	3,61
9716.28	-3,81	2,09	3,59
10000.00	-3,96	2,05	3,60
10292.01	-4,11	1,89	3,50
10592.54	-4,25	1,55	3,25
10901.84	-4,39	1,22	3,06
11220.18	-4,54	0,84	2,90
11547.82	-4,66	0,41	2,76
11885.02	-4,81	-0,08	2,62
12232.07	-4,95	-0,41	2,67
12589.25	-5,12	-0,78	2,68
12956.87	-5,29	-1,18	2,61
13335.21	-5,49	-1,64	2,43
13724.61	-5,68	-1,89	2,41
14125.38	-5,88	-2,40	2,09
14537.84	-6,06	-2,75	1,92
14962.36	-6,25	-3,22	1,59
15399.27	-6,43	-3,79	1,09
15848.93	-6,61	-4,66	0,18
16311.73	-6,78	-5,38	-0,72
16788.04	-6,99	-6,12	-1,74
17278.26	-7,23	-6,71	-2,60
17782.79	-7,49	-7,02	-3,08
18302.06	-7,84	-6,94	-3,06
18836.49	-8,18	-6,73	-2,90
19386.53	-8,67	-6,50	-2,87
19952.62	-8,84	-6,29	-3,06

Frequency response of SVAN 977W with SA 277 (90 deg incidence angle)**Linear Operating Ranges with Airport filter****Table C.7.6** Self-generated noise for different weighting filters

Range \ Weighting filter	Electrical *)			Acoustical compensated		
	A	C	Z	A	C	Z
Low	< 15 dB	< 14 dB	< 20 dB	< 16 dB	< 16 dB	< 22 dB
High	< 26 dB	< 25 dB	< 32 dB	< 26 dB	< 26 dB	< 32 dB

*) measured with the **ST 02** microphone equivalent impedance **18 pF +/-10%**

Table C.7.8 Linear operating range: "LOW" with **Airport** filter for the sinusoidal signal and microphone sensitivity 35 mV/Pa

[dB]	LAS/F		LBS/F		LCS/F		LZS/F		LAeqT		LBeqT		LCeqT		L _{AE} (t _{int} = 2 s)		LC _{peak}	
	from	to	from	to	from	to	from	to	from	to	from	to	From	to	from	to	from	to
31,5 Hz	26	80	26	103	26	117	32	120	26	80	26	103	26	117	29	83	50	120
500 Hz	26	116	26	119	26	120	32	120	26	116	26	119	26	120	29	119	50	123
1 kHz	26	120	26	120	26	120	32	120	26	120	26	120	26	120	29	123	50	123
4 kHz	26	121	26	119	26	119	32	120	26	121	26	119	26	119	29	124	50	123
8 kHz	26	119	26	117	26	117	32	120	26	119	26	117	26	117	29	123	50	120
12.5 kHz	26	115	26	114	26	114	32	120	26	115	26	114	26	114	29	118	50	117

Table C.7.9 Linear operating range: "HIGH" with **Airport** filter for the sinusoidal signal and microphone sensitivity 35 mV/Pa

[dB]	LAS/F		LBS/F		LCS/F		LZS/F		LAeqT		LBeqT		LCeqT		LAE ($t_{int} = 2\text{ s}$)		LCpeak	
	from	to	from	to	from	to	from	to	from	to	from	to	from	to	from	to	from	to
31,5 Hz	36	97	36	120	36	134	42	137	36	97	36	120	36	134	39	100	60	137
500 Hz	36	133	36	136	36	137	42	137	36	133	36	136	36	137	39	136	60	140
1 kHz	36	137	36	137	36	137	42	137	36	137	36	137	36	137	39	140	60	140
4 kHz	36	138	36	136	36	136	42	137	36	138	36	136	36	136	39	141	60	139
8 kHz	36	136	36	134	36	134	42	137	36	136	36	134	36	134	39	139	60	137
12.5 kHz	36	132	36	131	36	131	42	137	36	132	36	131	36	131	39	136	60	134

SA 277 case effect (0 deg incidence angle)

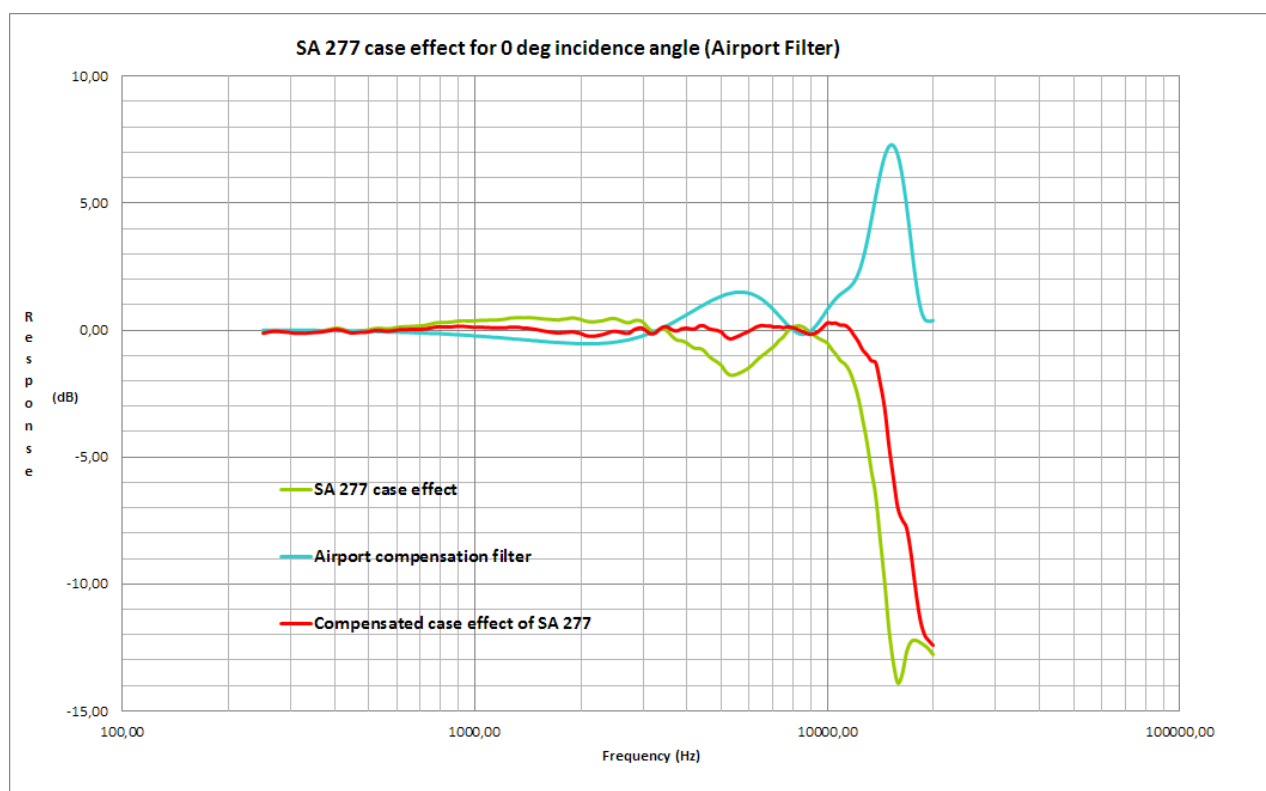


Table C.7.10 SA 277 case effect

f [Hz]	SA 277 Case effect for the 0 deg incidence angle	Compensation filter for the 0 deg incidence angle (Airport)	SA 277 Compensated case effect for the 0 deg incidence angle
251.19	-0,10	-0.02	-0,12
258.52	-0,06	-0.02	-0,08
266.07	-0,03	-0.02	-0,05
273.84	-0,02	-0.02	-0,04
281.84	-0,03	-0.02	-0,05

f [Hz]	SA 277 Case effect for the 0 deg incidence angle	Compensation filter for the 0 deg incidence angle (Airport)	SA 277 Compensated case effect for the 0 deg incidence angle
290.07	-0,05	-0.02	-0,07
298.54	-0,07	-0.02	-0,09
307.26	-0,08	-0.03	-0,11
316.23	-0,09	-0.03	-0,12
325.46	-0,09	-0.03	-0,12
334.97	-0,08	-0.03	-0,11
344.75	-0,07	-0.03	-0,10
354.81	-0,05	-0.03	-0,08
365.17	-0,03	-0.04	-0,07
375.84	-0,01	-0.04	-0,05
386.81	0,03	-0.04	-0,01
398.11	0,06	-0.04	0,02
409.73	0,07	-0.05	0,02
421.70	0,04	-0.05	-0,01
434.01	-0,02	-0.05	-0,07
446.68	-0,05	-0.06	-0,11
459.73	-0,04	-0.06	-0,10
473.15	-0,02	-0.06	-0,08
486.97	-0,01	-0.07	-0,08
501.19	0,01	-0.07	-0,06
515.82	0,05	-0.07	-0,02
530.88	0,08	-0.08	0,00
546.39	0,07	-0.08	-0,01
562.34	0,05	-0.09	-0,04
578.76	0,06	-0.09	-0,03
595.66	0,10	-0.10	0,00
613.06	0,12	-0.10	0,02
630.96	0,13	-0.11	0,02
649.38	0,14	-0.11	0,03
668.34	0,15	-0.12	0,03
687.86	0,16	-0.13	0,03
707.95	0,17	-0.13	0,04
728.62	0,20	-0.14	0,06
749.89	0,24	-0.15	0,09
771.79	0,28	-0.16	0,12
794.33	0,30	-0.16	0,14
817.52	0,30	-0.17	0,13
841.40	0,31	-0.18	0,13
865.96	0,32	-0.19	0,13
891.25	0,35	-0.20	0,15
917.28	0,36	-0.21	0,15
944.06	0,36	-0.22	0,14

f [Hz]	SA 277 Case effect for the 0 deg incidence angle	Compensation filter for the 0 deg incidence angle (Airport)	SA 277 Compensated case effect for the 0 deg incidence angle
971.63	0,36	-0.23	0,13
1000.00	0,36	-0.25	0,11
1029.20	0,38	-0.26	0,12
1059.25	0,38	-0.27	0,11
1090.18	0,39	-0.28	0,11
1122.02	0,39	-0.30	0,09
1154.78	0,40	-0.31	0,09
1188.50	0,41	-0.32	0,09
1223.21	0,43	-0.34	0,09
1258.93	0,47	-0.35	0,12
1295.69	0,48	-0.37	0,11
1333.52	0,49	-0.38	0,11
1372.46	0,48	-0.40	0,08
1412.54	0,49	-0.41	0,08
1453.78	0,48	-0.43	0,05
1496.24	0,47	-0.44	0,03
1539.93	0,45	-0.46	-0,01
1584.89	0,43	-0.47	-0,04
1631.17	0,42	-0.49	-0,07
1678.80	0,41	-0.50	-0,09
1727.83	0,40	-0.51	-0,11
1778.28	0,43	-0.52	-0,09
1830.21	0,44	-0.53	-0,09
1883.65	0,48	-0.54	-0,06
1938.65	0,46	-0.55	-0,09
1995.26	0,42	-0.55	-0,13
2053.53	0,36	-0.56	-0,20
2113.49	0,32	-0.56	-0,24
2175.20	0,32	-0.56	-0,24
2238.72	0,34	-0.55	-0,21
2304.09	0,37	-0.54	-0,17
2371.37	0,41	-0.53	-0,12
2440.62	0,46	-0.51	-0,05
2511.89	0,45	-0.49	-0,04
2585.23	0,38	-0.46	-0,08
2660.73	0,32	-0.43	-0,11
2738.42	0,29	-0.40	-0,11
2818.38	0,36	-0.35	0,01
2900.68	0,39	-0.31	0,08
2985.38	0,33	-0.25	0,08
3072.56	0,15	-0.19	-0,04
3162.28	-0,02	-0.13	-0,15

f [Hz]	SA 277 Case effect for the 0 deg incidence angle	Compensation filter for the 0 deg incidence angle (Airport)	SA 277 Compensated case effect for the 0 deg incidence angle
3254.62	-0,05	-0.06	-0,11
3349.65	0,03	0.02	0,05
3447.47	0,05	0.10	0,15
3548.13	-0,09	0.19	0,10
3651.74	-0,28	0.28	0,00
3758.37	-0,40	0.38	-0,02
3868.12	-0,42	0.48	0,06
3981.07	-0,50	0.58	0,08
4097.32	-0,63	0.68	0,05
4216.97	-0,72	0.78	0,06
4340.10	-0,72	0.89	0,17
4466.84	-0,80	0.98	0,18
4597.27	-1,01	1.08	0,07
4731.51	-1,15	1.17	0,02
4869.68	-1,26	1.25	-0,01
5011.87	-1,40	1.32	-0,08
5158.22	-1,65	1.39	-0,26
5308.84	-1,77	1.43	-0,34
5463.87	-1,76	1.47	-0,29
5623.41	-1,70	1.48	-0,22
5787.62	-1,61	1.48	-0,13
5956.62	-1,51	1.45	-0,06
6130.56	-1,36	1.40	0,04
6309.57	-1,18	1.32	0,14
6493.82	-1,03	1.22	0,19
6683.44	-0,91	1.08	0,17
6878.60	-0,76	0.93	0,17
7079.46	-0,63	0.75	0,12
7286.18	-0,42	0.56	0,14
7498.94	-0,27	0.37	0,10
7717.92	-0,05	0.18	0,13
7943.28	0,10	0.01	0,11
8175.23	0,16	-0.11	0,05
8413.95	0,16	-0.18	-0,02
8659.64	0,07	-0.17	-0,10
8912.51	-0,07	-0.09	-0,16
9172.76	-0,20	0.07	-0,13
9440.61	-0,32	0.28	-0,04
9716.28	-0,41	0.53	0,12
10000.00	-0,51	0.79	0,28
10292.01	-0,76	1.03	0,27
10592.54	-0,96	1.24	0,28

f [Hz]	SA 277 Case effect for the 0 deg incidence angle	Compensation filter for the 0 deg incidence angle (Airport)	SA 277 Compensated case effect for the 0 deg incidence angle
10901.84	-1,20	1.40	0,20
11220.18	-1,34	1.53	0,19
11547.82	-1,59	1.66	0,07
11885.02	-2,04	1.86	-0,18
12232.07	-2,64	2.20	-0,44
12589.25	-3,49	2.72	-0,77
12956.87	-4,41	3.45	-0,96
13335.21	-5,53	4.33	-1,20
13724.61	-6,55	5.27	-1,28
14125.38	-8,23	6.14	-2,09
14537.84	-9,88	6.83	-3,05
14962.36	-11,79	7.23	-4,56
15399.27	-13,10	7.27	-5,83
15848.93	-13,89	6.89	-7,00
16311.73	-13,55	6.08	-7,47
16788.04	-12,67	4.89	-7,78
17278.26	-12,26	3.46	-8,80
17782.79	-12,20	2.04	-10,16
18302.06	-12,29	0.97	-11,32
18836.49	-12,40	0.43	-11,97
19386.53	-12,55	0.33	-12,22
19952.62	-12,76	0.36	-12,40

Frequency response of SA 277 (0 deg incidence angle)

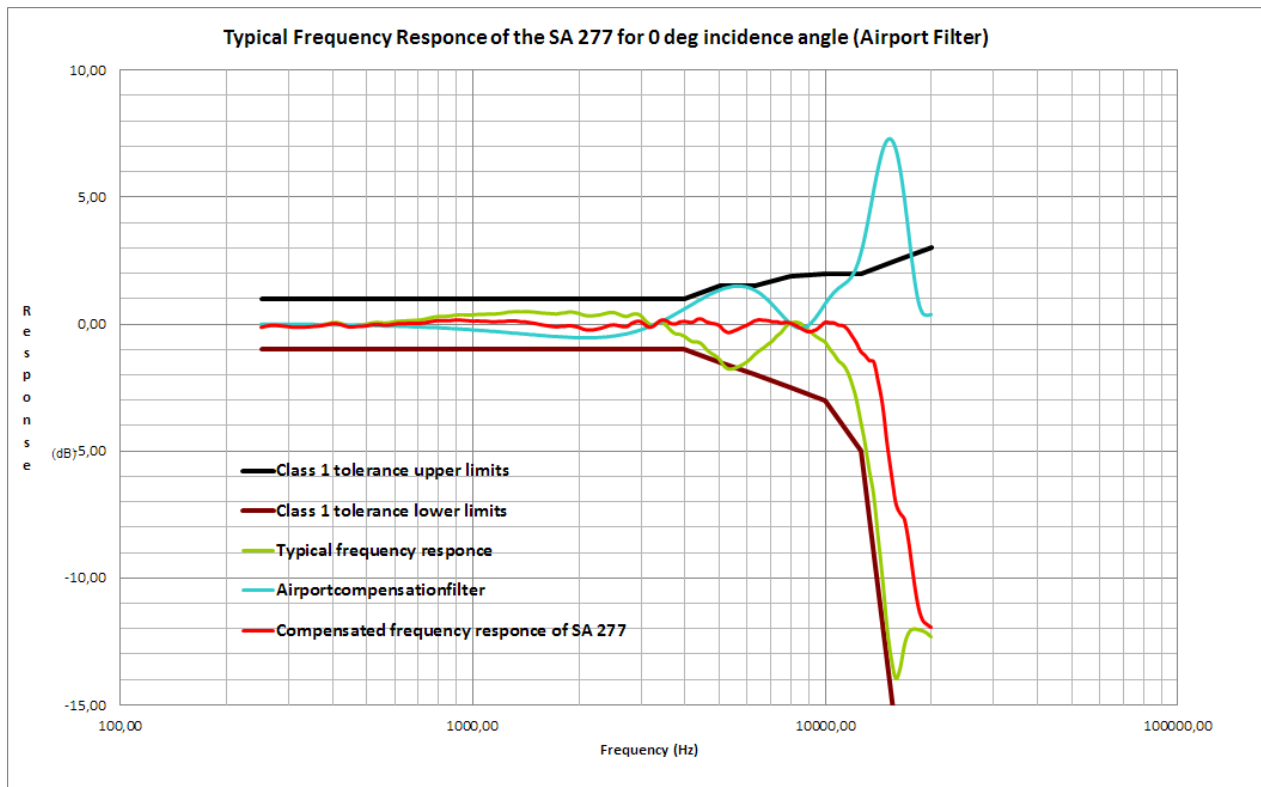


Table C.7.11 SV 277 + SA277 frequency response

f [Hz]	SV 277W with SA277 Typical non-compensated frequency response for the 0 deg incidence angle	Compensation filter 0 deg (Airport)	SV 277W with SA277 Typical compensated frequency response for the 0 deg incidence angle
251.19	-0,10	-0.02	-0.12
258.52	-0,06	-0.02	-0.08
266.07	-0,03	-0.02	-0.05
273.84	-0,02	-0.02	-0.04
281.84	-0,03	-0.02	-0.05
290.07	-0,05	-0.02	-0.07
298.54	-0,07	-0.02	-0.09
307.26	-0,08	-0.03	-0.11
316.23	-0,09	-0.03	-0.12
325.46	-0,09	-0.03	-0.12
334.97	-0,08	-0.03	-0.11
344.75	-0,07	-0.03	-0.10
354.81	-0,05	-0.03	-0.08
365.17	-0,03	-0.04	-0.07
375.84	-0,01	-0.04	-0.05
386.81	0,03	-0.04	-0.01
398.11	0,06	-0.04	0.02
409.73	0,07	-0.05	0.02
421.70	0,04	-0.05	-0.01

f [Hz]	SV 277W with SA277 Typical non-compensated frequency response for the 0 deg incidence angle	Compensation filter 0 deg (Airport)	SV 277W with SA277 Typical compensated frequency response for the 0 deg incidence angle
434.01	-0,02	-0.05	-0.07
446.68	-0,05	-0.06	-0.11
459.73	-0,04	-0.06	-0.10
473.15	-0,02	-0.06	-0.08
486.97	-0,01	-0.07	-0.08
501.19	0,01	-0.07	-0.06
515.82	0,05	-0.07	-0.02
530.88	0,08	-0.08	0.00
546.39	0,07	-0.08	-0.01
562.34	0,05	-0.09	-0.04
578.76	0,06	-0.09	-0.03
595.66	0,10	-0.10	0.00
613.06	0,12	-0.10	0.02
630.96	0,13	-0.11	0.02
649.38	0,14	-0.11	0.03
668.34	0,15	-0.12	0.03
687.86	0,16	-0.13	0.03
707.95	0,17	-0.13	0.04
728.62	0,20	-0.14	0.06
749.89	0,24	-0.15	0.09
771.79	0,28	-0.16	0.12
794.33	0,31	-0.16	0.15
817.52	0,31	-0.17	0.14
841.40	0,32	-0.18	0.14
865.96	0,33	-0.19	0.14
891.25	0,36	-0.20	0.16
917.28	0,37	-0.21	0.16
944.06	0,37	-0.22	0.15
971.63	0,37	-0.23	0.14
1000.00	0,37	-0.25	0.12
1029.20	0,39	-0.26	0.13
1059.25	0,39	-0.27	0.12
1090.18	0,40	-0.28	0.12
1122.02	0,40	-0.30	0.10
1154.78	0,41	-0.31	0.10
1188.50	0,42	-0.32	0.10
1223.21	0,44	-0.34	0.10
1258.93	0,48	-0.35	0.13
1295.69	0,49	-0.37	0.12
1333.52	0,50	-0.38	0.12
1372.46	0,49	-0.40	0.09
1412.54	0,50	-0.41	0.09

f [Hz]	SV 277W with SA277 Typical non-compensated frequency response for the 0 deg incidence angle	Compensation filter 0 deg (Airport)	SV 277W with SA277 Typical compensated frequency response for the 0 deg incidence angle
1453.78	0,49	-0.43	0.06
1496.24	0,48	-0.44	0.04
1539.93	0,46	-0.46	0.00
1584.89	0,44	-0.47	-0.03
1631.17	0,43	-0.49	-0.06
1678.80	0,42	-0.50	-0.08
1727.83	0,41	-0.51	-0.10
1778.28	0,44	-0.52	-0.08
1830.21	0,45	-0.53	-0.08
1883.65	0,49	-0.54	-0.05
1938.65	0,47	-0.55	-0.08
1995.26	0,43	-0.55	-0.12
2053.53	0,37	-0.56	-0.19
2113.49	0,33	-0.56	-0.23
2175.20	0,33	-0.56	-0.23
2238.72	0,35	-0.55	-0.20
2304.09	0,38	-0.54	-0.16
2371.37	0,42	-0.53	-0.11
2440.62	0,47	-0.51	-0.04
2511.89	0,47	-0.49	-0.02
2585.23	0,40	-0.46	-0.06
2660.73	0,34	-0.43	-0.09
2738.42	0,31	-0.40	-0.09
2818.38	0,38	-0.35	0.03
2900.68	0,41	-0.31	0.10
2985.38	0,36	-0.25	0.11
3072.56	0,18	-0.19	-0.01
3162.28	0,01	-0.13	-0.12
3254.62	-0,02	-0.06	-0.08
3349.65	0,06	0.02	0.08
3447.47	0,08	0.10	0.18
3548.13	-0,06	0.19	0.13
3651.74	-0,25	0.28	0.03
3758.37	-0,37	0.38	0.01
3868.12	-0,39	0.48	0.09
3981.07	-0,47	0.58	0.11
4097.32	-0,60	0.68	0.08
4216.97	-0,69	0.78	0.09
4340.10	-0,69	0.89	0.20
4466.84	-0,78	0.98	0.20
4597.27	-0,98	1.08	0.10
4731.51	-1,13	1.17	0.04

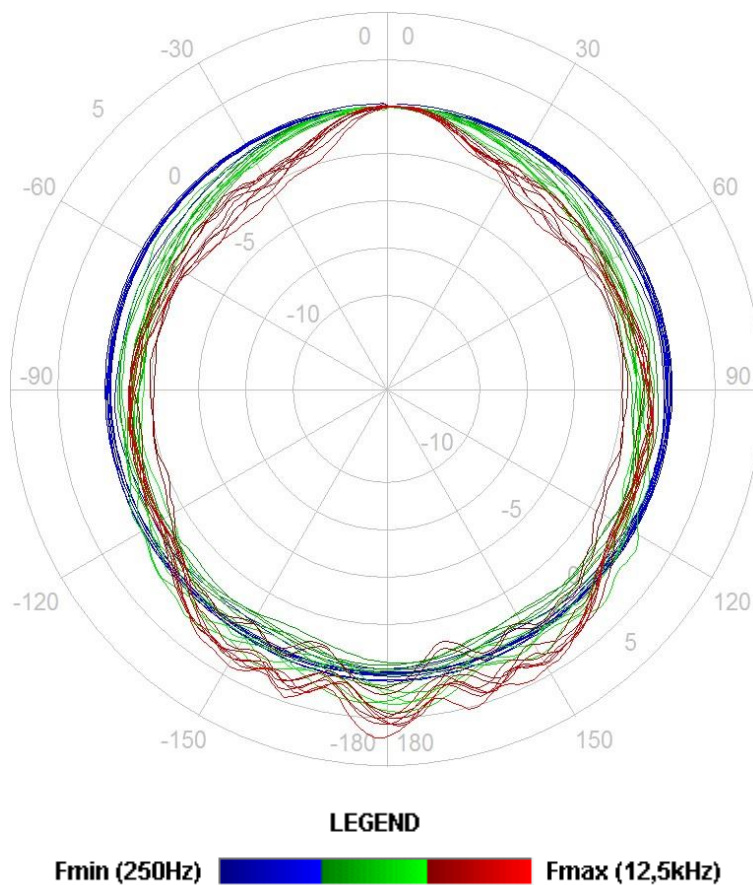
f [Hz]	SV 277W with SA277 Typical non-compensated frequency response for the 0 deg incidence angle	Compensation filter 0 deg (Airport)	SV 277W with SA277 Typical compensated frequency response for the 0 deg incidence angle
4869.68	-1,23	1.25	0.02
5011.87	-1,38	1.32	-0.06
5158.22	-1,63	1.39	-0.24
5308.84	-1,76	1.43	-0.33
5463.87	-1,75	1.47	-0.28
5623.41	-1,69	1.48	-0.21
5787.62	-1,61	1.48	-0.13
5956.62	-1,50	1.45	-0.05
6130.56	-1,36	1.40	0.04
6309.57	-1,18	1.32	0.14
6493.82	-1,04	1.22	0.18
6683.44	-0,93	1.08	0.15
6878.60	-0,78	0.93	0.15
7079.46	-0,66	0.75	0.09
7286.18	-0,46	0.56	0.10
7498.94	-0,32	0.37	0.05
7717.92	-0,10	0.18	0.08
7943.28	0,04	0.01	0.05
8175.23	0,09	-0.11	-0.02
8413.95	0,06	-0.18	-0.12
8659.64	-0,04	-0.17	-0.21
8912.51	-0,20	-0.09	-0.29
9172.76	-0,35	0.07	-0.28
9440.61	-0,49	0.28	-0.21
9716.28	-0,60	0.53	-0.07
10000.00	-0,71	0.79	0.08
10292.01	-0,97	1.03	0.06
10592.54	-1,19	1.24	0.05
10901.84	-1,44	1.40	-0.04
11220.18	-1,58	1.53	-0.05
11547.82	-1,85	1.66	-0.19
11885.02	-2,31	1.86	-0.45
12232.07	-2,92	2.20	-0.72
12589.25	-3,78	2.72	-1.06
12956.87	-4,67	3.45	-1.22
13335.21	-5,76	4.33	-1.43
13724.61	-6,75	5.27	-1.48
14125.38	-8,40	6.14	-2.26
14537.84	-10,02	6.83	-3.19
14962.36	-11,90	7.23	-4.67
15399.27	-13,18	7.27	-5.91
15848.93	-13,94	6.89	-7.05

f [Hz]	SV 277W with SA277 Typical non-compensated frequency response for the 0 deg incidence angle	Compensation filter 0 deg (Airport)	SV 277W with SA277 Typical compensated frequency response for the 0 deg incidence angle
16311.73	-13,53	6.08	-7.45
16788.04	-12,59	4.89	-7.70
17278.26	-12,12	3.46	-8.66
17782.79	-11,99	2.04	-9.95
18302.06	-12,01	0.97	-11.04
18836.49	-12,06	0.43	-11.63
19386.53	-12,14	0.33	-11.81
19952.62	-12,29	0.36	-11.93

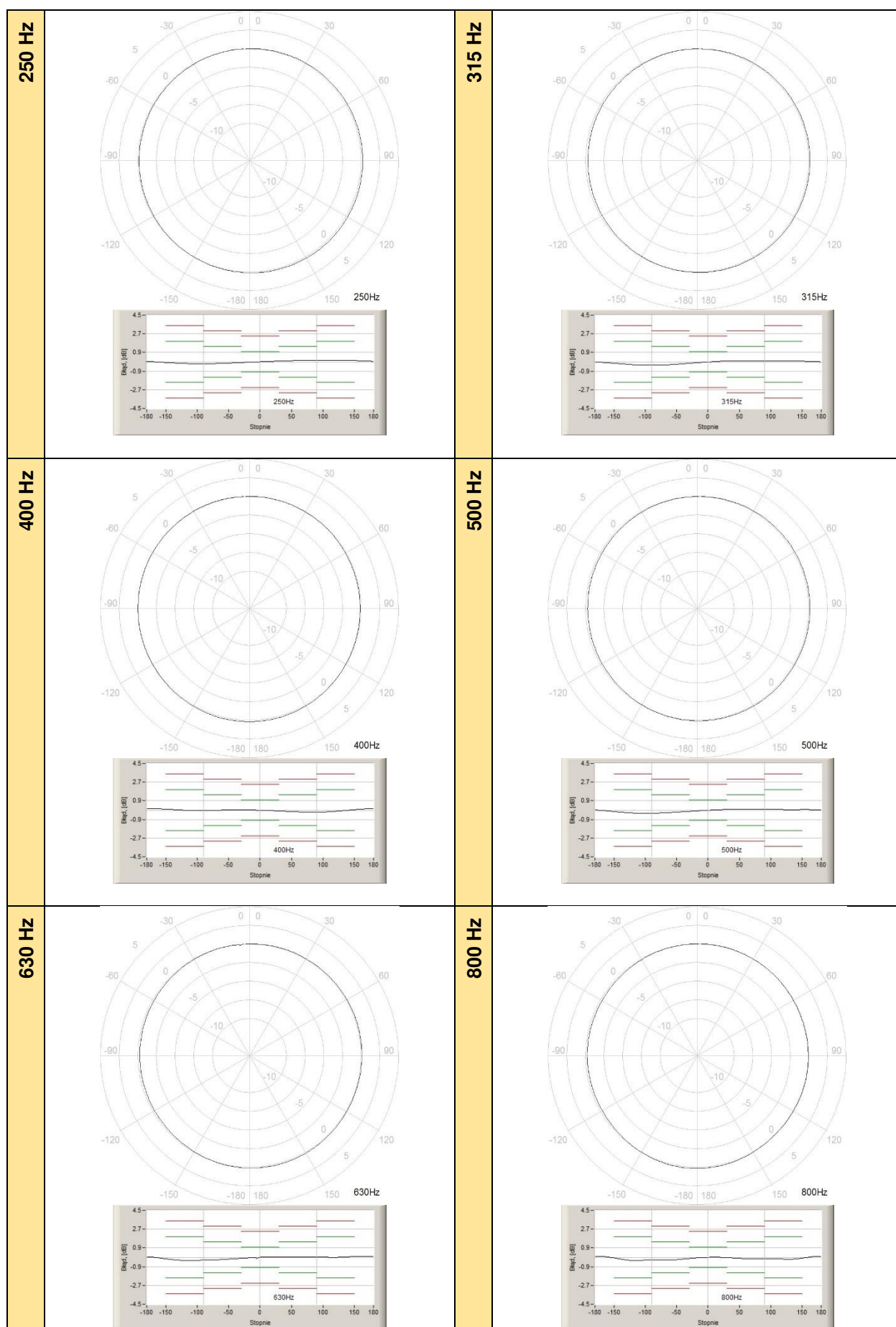
Directional characteristics of the SVAN 977W with SA 277

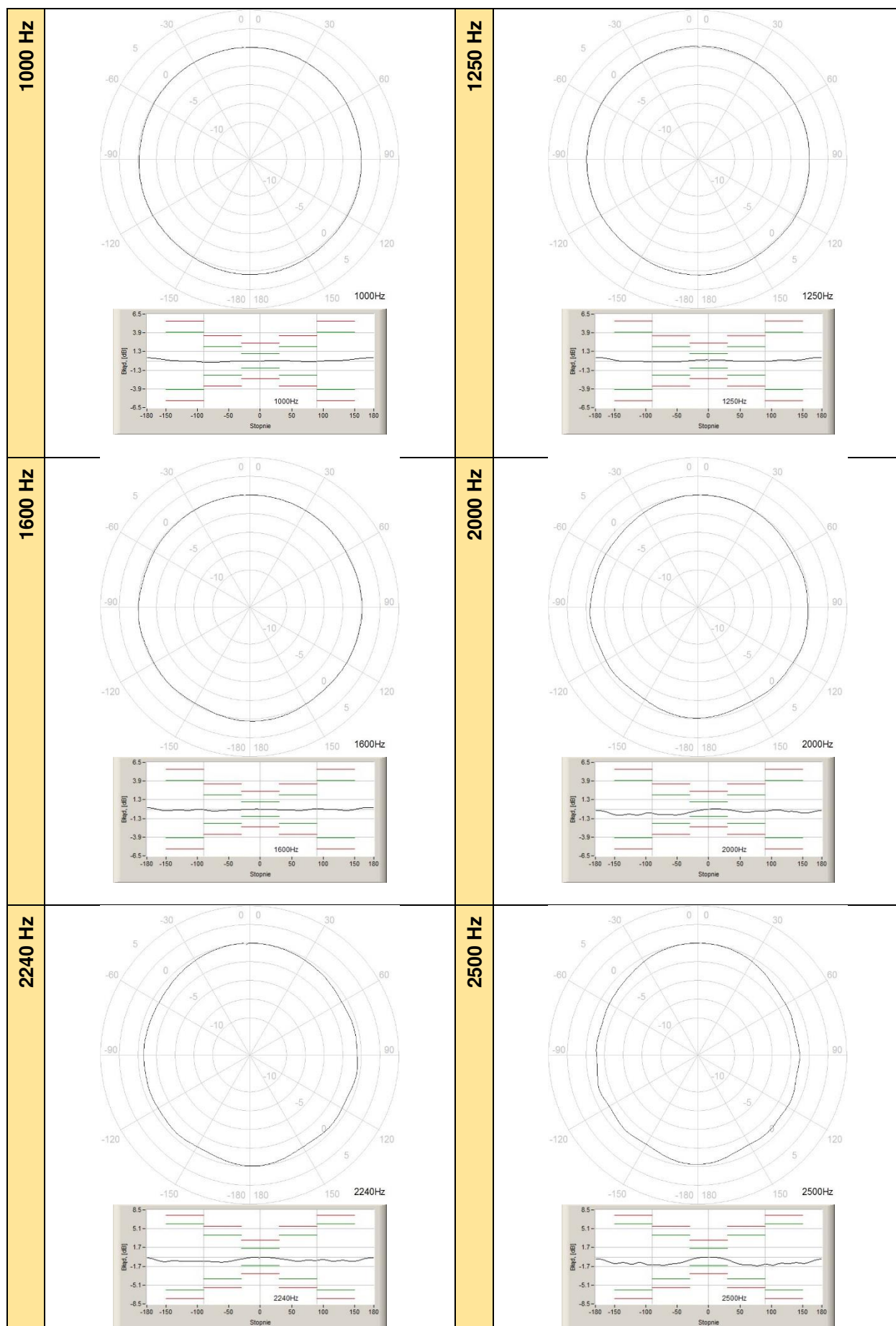
Directional response for SLM Class SVAN 977W with microphone ACO 7052E, preamplifier SV 12L and outdoor microphone kit SA 277 for specified frequencies:

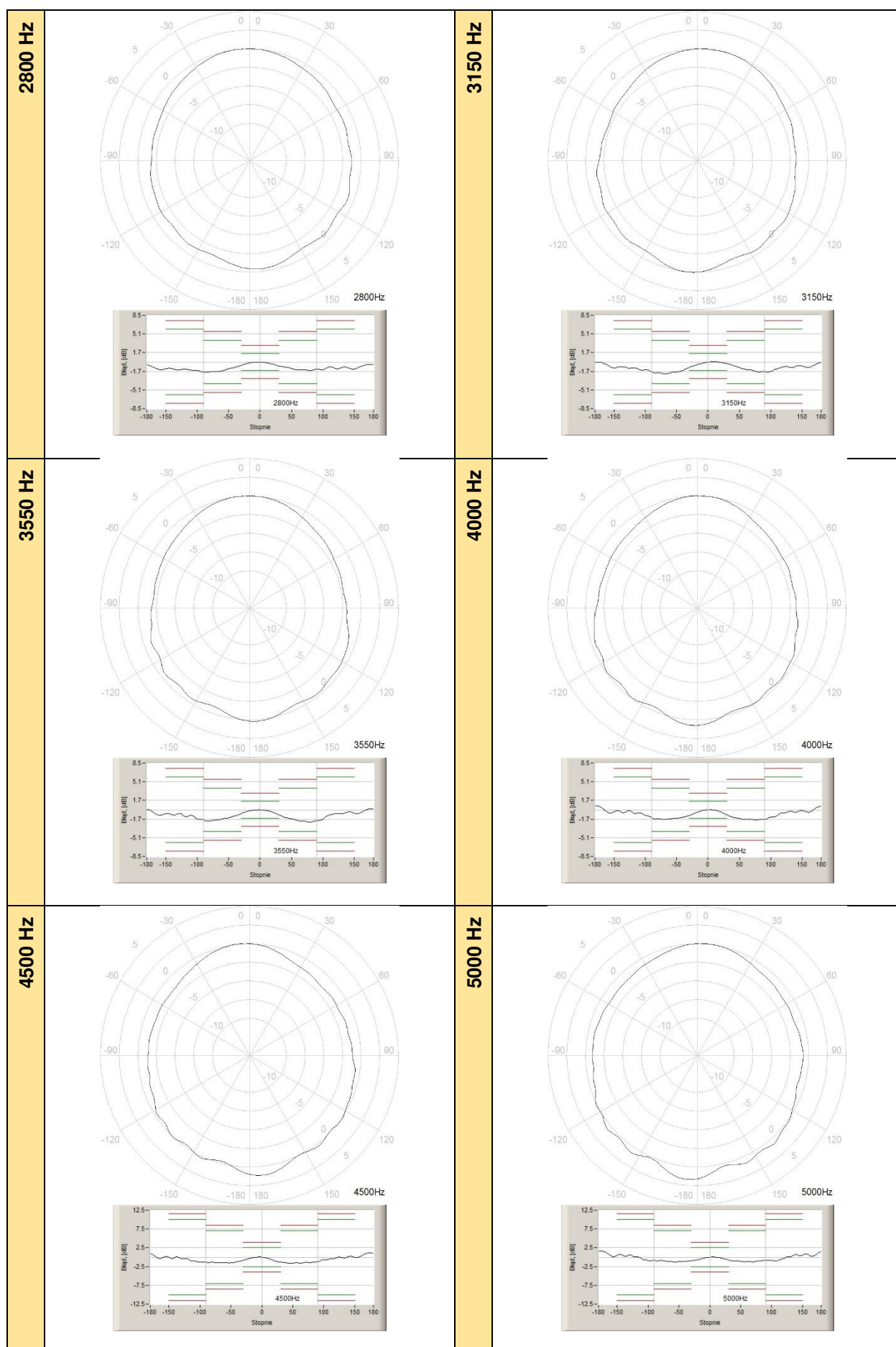
Total directional characteristics

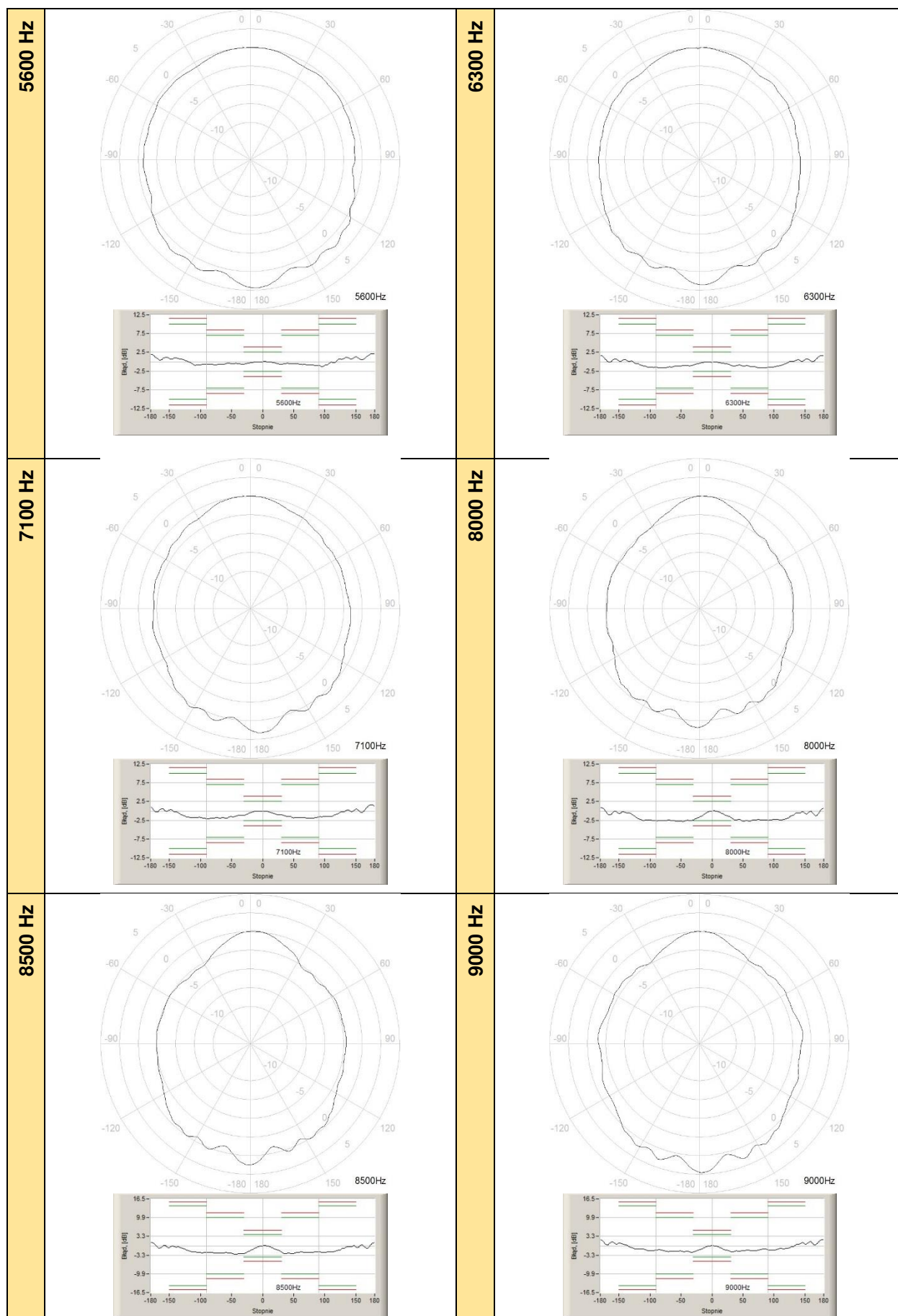


The round charts show the directional characteristic and the charts below shows the errors for particular angles.









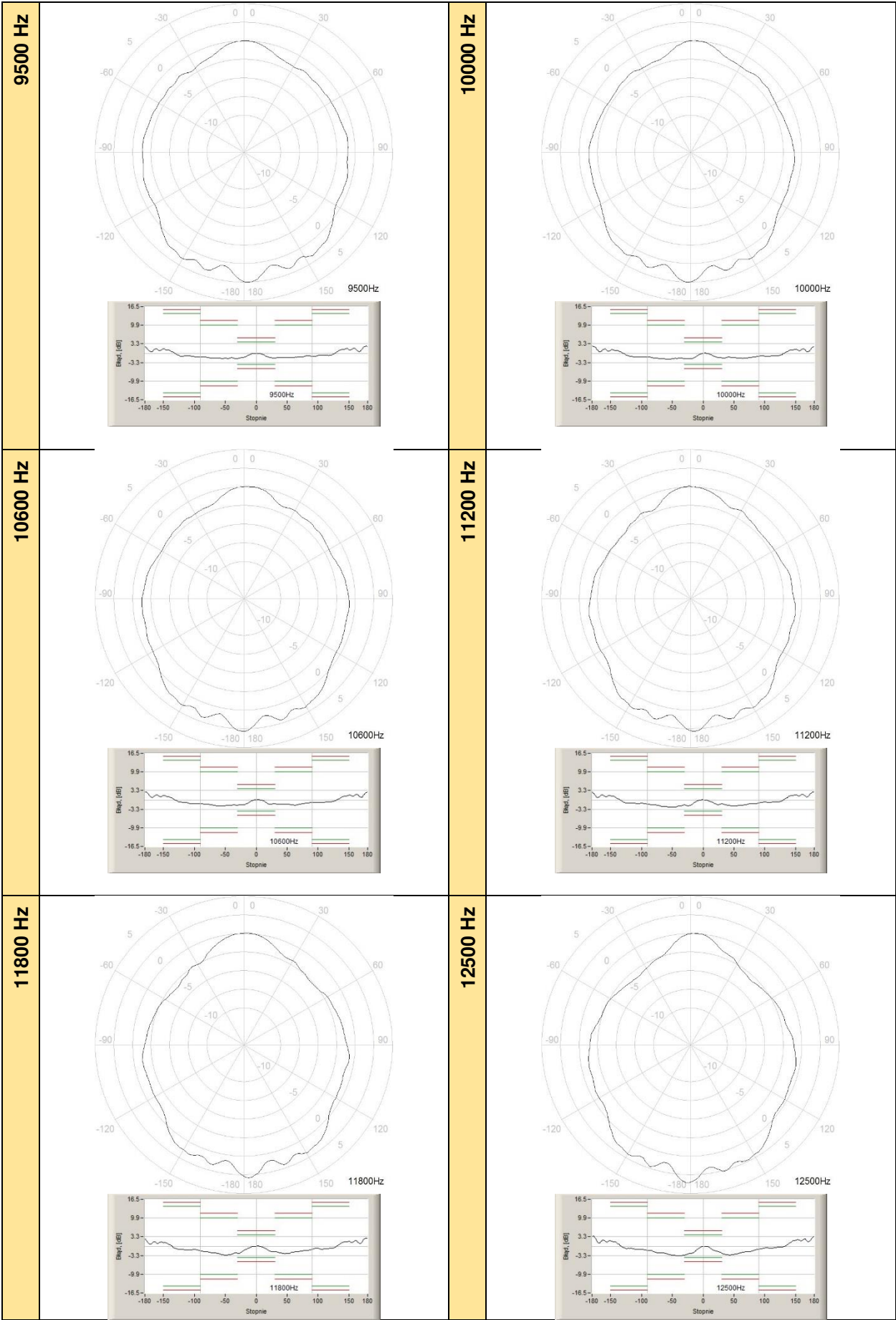


Table C.7.12 Directional response for SVAN 977W with microphone ACO 7052E, preamplifier SV 12L and outdoor protection unit SA 277

f [Hz]	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
250	0,03	0,06	0,08	0,1	0,12	0,13	0,14	0,15	0,16	0,16
315	-0,04	0,07	0,08	0,1	0,11	0,11	0,11	0,11	0,1	0,09
400	-0,02	-0,04	-0,07	-0,11	-0,14	-0,16	-0,18	-0,19	-0,2	-0,19
500	0,03	0,05	0,07	0,08	0,1	0,1	0,1	0,1	0,1	0,09
630	0,03	0,04	0,04	0,05	0,05	0,05	0,06	0,06	0,06	0,04
800	0	-0,01	-0,04	-0,08	-0,12	-0,15	-0,17	-0,17	-0,15	-0,13
1000	0	0,01	0,01	0,02	0,01	-0,05	-0,1	-0,13	-0,13	-0,09
1250	-0,01	-0,06	-0,12	-0,19	-0,23	-0,23	-0,21	-0,2	-0,22	-0,21
1600	-0,02	-0,06	-0,09	-0,12	-0,14	-0,17	-0,18	-0,15	0,04	0,04
2000	-0,01	-0,03	-0,12	-0,27	-0,42	-0,46	-0,45	-0,31	-0,31	-0,26
2240	0,22	0,18	-0,08	-0,23	-0,42	-0,57	-0,57	-0,43	-0,44	-0,4
2500	-0,09	-0,31	-0,59	-1,12	-1,37	-1,41	-1,56	-1,61	-1,45	-1,53
2800	-0,09	-0,37	-0,73	-0,93	-1,2	-1,46	-1,47	-1,6	-1,6	-1,45
3150	0,03	-0,13	-0,35	-0,77	-1,14	-1,4	-1,61	-1,83	-1,82	-1,85
3550	-0,13	-0,39	-0,89	-1,38	-1,62	-1,94	-2,07	-2,29	-2,29	-1,98
4000	-0,14	-0,49	-1,1	-1,42	-1,67	-1,76	-1,79	-1,92	-1,78	-1,67
4500	-0,33	-0,83	-1,37	-1,51	-1,72	-1,6	-1,66	-1,52	-1,47	-1,29
5000	-0,1	-0,38	-0,87	-1,06	-1,22	-1,27	-1,3	-1,2	-1	-0,95
5600	-0,03	-0,26	-0,69	-0,71	-0,62	-0,68	-0,81	-0,96	-1,15	-1,46
6300	-0,29	-0,52	-1,06	-1,23	-1,21	-1,41	-1,51	-1,78	-1,78	-1,57
7100	-0,16	-0,77	-1,02	-1,5	-1,95	-1,95	-1,89	-2,08	-2	-1,63
8000	-0,47	-1,19	-1,95	-2,5	-2,86	-2,92	-2,64	-2,48	-2,6	-2,61
8500	-0,18	-1,01	-1,86	-2,89	-2,97	-2,6	-2,43	-2,44	-2,4	-2,37
9000	-0,59	-1,54	-2,26	-2,26	-2,14	-1,85	-1,97	-1,6	-1,57	-1,7
9500	-0,25	-1,28	-1,68	-1,72	-1,71	-1,71	-1,6	-1,43	-1,12	-1,22
10000	-0,68	-1,5	-1,73	-1,8	-1,71	-2,01	-2,01	-1,69	-1,32	-1,14
10600	-0,08	-1,35	-1,7	-1,68	-1,71	-1,79	-1,99	-1,53	-1,32	-0,95
11200	-0,69	-1,67	-1,8	-1,98	-2,24	-2,07	-2,04	-1,4	-1,33	-0,93
11800	-0,22	-1,46	-2,05	-2,53	-2,81	-2,76	-2,14	-1,92	-1,54	-1,28
12500	-0,8	-1,85	-2,66	-3,3	-3,29	-2,74	-2,23	-2,01	-1,27	-1,03
f [Hz]	100-110	110-120	120-130	130-140	140-150	150-160	160-170	170-180	180-190	190-200
250	0,16	0,16	0,16	0,15	0,14	0,13	0,11	0,08	0,05	0,02
315	0,09	0,08	0,08	0,07	0,07	0,06	0,04	0,02	-0,05	-0,1
400	-0,18	-0,16	-0,11	-0,06	0,04	0,08	0,12	0,13	0,14	0,13
500	0,07	0,06	0,05	0,05	0,06	0,06	0,05	0,03	-0,03	-0,09
630	0,03	0,01	0,02	0,05	0,08	0,1	0,1	0,09	0,07	-0,05
800	-0,16	-0,19	-0,19	-0,19	-0,13	-0,05	0,08	0,1	0,1	0,07
1000	0,04	0,06	0,07	0,13	0,22	0,35	0,4	0,43	0,42	0,38
1250	-0,14	-0,03	-0,07	-0,09	-0,06	0,21	0,31	0,32	0,31	0,23
1600	-0,04	-0,06	-0,14	-0,19	-0,18	0,12	0,22	0,24	0,22	0,12
2000	-0,13	-0,33	-0,34	-0,43	-0,57	-0,57	-0,42	-0,26	-0,28	-0,55
2240	-0,41	-0,57	-0,54	-0,5	-0,62	-0,61	-0,25	0,08	-0,08	-0,45
2500	-1,51	-1,2	-1,24	-1,1	-1,2	-1,19	-0,84	-0,45	-0,55	-1
2800	-1,45	-1,23	-1,3	-1,02	-1,32	-1,32	-0,79	-0,48	-0,81	-1,35
3150	-1,5	-1,12	-1,05	-1,04	-0,79	-1,05	-0,92	-0,28	-0,17	-0,8
3550	-1,68	-1,03	-0,72	-0,72	-0,56	-0,76	-0,54	0,16	-0,19	-1,05
4000	-1,37	-0,83	-0,48	-0,53	-0,31	-0,49	0,36	0,71	0,7	-0,64

4500	-0,78	-0,56	-0,17	-0,29	0,26	-0,17	0,99	1,14	1,02	-0,42
5000	-1,13	-0,65	0,2	0,74	0,69	0,86	0,76	1,65	1,67	1,18
5600	-0,86	-0,37	0,92	1,33	1,29	1,39	1,53	2,16	2,14	1,03
6300	-1,3	-1,06	0,21	0,62	0,82	0,81	1,37	1,76	1,55	0,8
7100	-1,6	-1,55	-0,89	0,43	0,47	0,65	1,27	1,67	1,33	0,77
8000	-2,55	-2,53	-1,57	-0,86	-1,14	-0,9	-1,45	0,9	0,87	-1,28
8500	-2,38	-2,18	-1,73	-0,95	-0,6	-0,9	-1,08	1,2	1,28	-1,08
9000	-1,58	-1,25	-1,1	0,56	1,3	1,63	1,61	2,26	1,76	1,52
9500	-0,95	-1,01	-0,81	1,47	1,94	2	1,59	2,6	2,56	1,89
10000	-1,23	-1,15	-0,88	1,33	1,61	1,83	1,56	2,54	2,49	1,64
10600	-1,08	-0,93	-0,82	0,73	1,54	2,01	2,23	2,55	2,86	1,95
11200	-1,1	-0,79	-0,67	1,68	2,15	2,23	1,74	2,91	2,38	2,08
11800	-1,18	-1	-0,96	1,06	1,67	2,17	2,18	2,97	2,79	1,84
12500	-0,73	-0,76	-0,48	1,36	2,19	2,78	2,78	3,63	3,34	2,53
f [Hz]	200-210	210-220	220-230	230-240	240-250	250-260	260-270	270-280	280-290	290-300
250	-0,05	-0,08	-0,11	-0,14	-0,16	-0,18	-0,18	-0,18	-0,17	-0,16
315	-0,15	-0,19	-0,25	-0,29	-0,31	-0,33	-0,34	-0,34	-0,33	-0,3
400	0,12	0,09	0,06	0,03	-0,02	-0,03	-0,03	-0,03	-0,02	-0,01
500	-0,14	-0,2	-0,25	-0,29	-0,31	-0,31	-0,31	-0,3	-0,28	-0,25
630	-0,12	-0,19	-0,26	-0,29	-0,29	-0,29	-0,28	-0,26	-0,25	-0,23
800	-0,08	-0,19	-0,28	-0,32	-0,32	-0,3	-0,27	-0,26	-0,27	-0,27
1000	0,26	0,15	0,05	0	-0,01	-0,08	-0,16	-0,21	-0,21	-0,19
1250	-0,08	-0,22	-0,23	-0,22	-0,2	-0,28	-0,3	-0,3	-0,27	-0,27
1600	-0,22	-0,22	-0,18	-0,15	-0,2	-0,17	-0,05	-0,22	-0,28	-0,27
2000	-0,85	-0,89	-0,85	-0,84	-0,86	-0,75	-0,63	-0,78	-0,77	-0,8
2240	-0,66	-0,65	-0,48	-0,61	-0,6	-0,59	-0,6	-0,61	-0,71	-0,74
2500	-1,23	-1,22	-1,19	-1,33	-1,2	-1,43	-1,49	-1,49	-1,52	-1,43
2800	-1,45	-1,26	-1,46	-1,5	-1,44	-1,52	-1,8	-1,88	-1,78	-1,78
3150	-1,12	-1,1	-1,12	-1,2	-1,5	-1,54	-1,87	-2,05	-2,21	-2,2
3550	-1,07	-0,81	-1,03	-1,11	-1,36	-1,46	-1,73	-2,1	-2,07	-1,9
4000	-0,64	-0,44	-0,62	-0,73	-0,77	-1,1	-1,59	-1,71	-1,75	-1,71
4500	-0,23	-0,43	-0,32	-0,57	-1,1	-1,37	-1,42	-1,5	-1,56	-1,57
5000	0,66	0,81	0,66	0,61	-0,73	-0,98	-1,06	-1,01	-1,13	-1,32
5600	1,27	1,02	1,18	0,68	-0,95	-1,04	-0,91	-0,8	-0,92	-0,82
6300	0,81	0,67	0,28	-0,62	-1,2	-1,55	-1,64	-1,72	-1,67	-1,45
7100	0,69	0,54	-0,91	-1,79	-1,93	-1,79	-2	-2,22	-2	-2,02
8000	-0,93	-0,77	-1,26	-2,17	-2,7	-2,41	-2,79	-2,7	-2,62	-2,79
8500	-0,75	-0,96	-0,8	-1,72	-2,26	-2,34	-2,6	-2,48	-2,71	-2,68
9000	1,16	0,66	-0,7	-1,31	-1,29	-1,94	-1,79	-1,86	-2,18	-2,17
9500	1,66	1,81	1,38	-1,23	-1,23	-1,21	-1,45	-1,42	-1,69	-1,93
10000	1,45	1,33	0,59	-1,19	-1,4	-1,52	-1,41	-1,82	-2,04	-2,27
10600	2,06	1,8	1,3	-0,97	-1,06	-1,41	-1,39	-1,62	-1,87	-2,21
11200	1,93	1,43	-1,01	-1,13	-1,45	-1,41	-1,68	-1,82	-2,21	-2,56
11800	1,71	1,36	-0,62	-1,2	-1,41	-1,43	-1,48	-2,03	-2,4	-2,62
12500	2,32	1,75	0,81	-0,92	-1,24	-1,21	-1,56	-2,22	-2,56	-2,88
f [Hz]	300-310	310-320	320-330	330-340	340-350	350-360				
250	-0,14	-0,12	-0,09	-0,07	-0,04	-0,01				
315	-0,26	-0,23	-0,17	-0,13	-0,08	-0,03				
400	0,01	0,02	0,02	0,02	0,02	0,01				
500	-0,22	-0,18	-0,15	-0,11	-0,07	-0,03				
630	-0,2	-0,17	-0,13	-0,09	-0,05	-0,14				
800	-0,26	-0,22	-0,16	-0,1	-0,05	-0,03				

1000	-0,14	-0,1	-0,06	-0,04	-0,02	-0,01				
1250	-0,27	-0,26	-0,2	-0,12	-0,06	-0,16				
1600	-0,2	-0,16	-0,12	-0,09	-0,04	0,01				
2000	-0,83	-0,79	-0,62	-0,38	-0,22	-0,08				
2240	-0,74	-0,63	-0,39	-0,17	0,13	0,21				
2500	-1,25	-1,15	-0,79	-0,47	-0,18	-0,02				
2800	-1,63	-1,27	-0,98	-0,61	-0,31	-0,06				
3150	-1,86	-1,81	-1,31	-0,91	-0,5	-0,17				
3550	-1,73	-1,51	-1,2	-0,75	-0,32	-0,1				
4000	-1,59	-1,5	-1,31	-0,91	-0,44	-0,12				
4500	-1,59	-1,59	-1,33	-0,92	-0,39	-0,09				
5000	-1,32	-1,23	-1,13	-0,91	-0,58	-0,23				
5600	-0,7	-0,54	-0,68	-0,68	-0,33	-0,09				
6300	-1,2	-1,1	-1,13	-0,73	-0,27	-0,2				
7100	-2,05	-1,63	-1,22	-1,2	-0,67	-0,1				
8000	-2,86	-2,87	-2,58	-2,13	-1,37	-0,47				
8500	-2,71	-3,07	-2,92	-2,89	-1,74	-0,86				
9000	-2,08	-2,3	-2,47	-1,94	-1,27	-0,28				
9500	-2,07	-1,96	-2,07	-1,9	-1,53	-0,62				
10000	-2,27	-1,96	-2,05	-1,97	-1,87	-0,76				
10600	-2,36	-2,21	-2,01	-1,95	-1,82	-0,88				
11200	-2,71	-2,75	-2,25	-2,23	-1,35	-0,27				
11800	-3,28	-3,4	-3,04	-2,67	-1,69	-0,53				
12500	-3,17	-3,58	-3,47	-3,03	-2,47	-0,73				