Technical Data Measurement Microphones

	M2230 Class 1 Certified	M2230-WP Class 1 Outdoor Microphone (M2230+WP30)	M2211 Frequency Response Class 1	M2215 High SPL Frequency Response Class 1	M4261 Class 2
Consisting of	PreAmplfier MA220 + MC230 or MC230A Capsule	PreAmplfier MA220 + MC230 or MC230A Capsule + WP30	PreAmplfier MA220 + M2211 Capsule	PreAmplfier MA220 + M2215 Capsule	M4261 microphone with permanently installed capsule
Microphone Type	Omnidirectional, pre-polarized condenser, free field microphone				
Classification according IEC 61672 and ANSI S1.4	Class 1 Certified	Class 1	Frequency Response Class 1		Class 2
Capsule / Transducer	1/2" detachable with 60UNS2 thread, type WS2F according IEC 61094-4				1/4" permanently installed
PreAmplifier Type	MA220				-
Flatness tolerance bands typical	±1 dB @ 5 Hz - 20 Hz ±1 dB @ >20 Hz - 4 kHz ±1.5 dB @ >4 kHz - 10 kHz ±2 dB @ >10 kHz - 16 kHz ±3 dB @ >16 kHz - 20 kHz				+1/-4.5 dB @ 5 Hz - 20 Hz ±1.5 dB @ >20 Hz - 4 kHz ±3 dB @ >4 kHz - 10 kHz ±4.5 dB @ >10 kHz - 16 kHz ±5 dB @ >16 kHz - 20 kHz
Actual Frequency Response	freely available as Excel-data, register microphone at My NTi Audio and contact info@nti-audio.com				
Frequency Range	5 Hz - 20 kHz				
Residual Noise Floor typical	16 dB(A)		21 dB(A)	25 dB(A)	27 dB(A)
Maximum SPL @ THD 3%, 1 kHz	137 dBSPL		144 dBSPL	153 dBSPL	142 dBSPL

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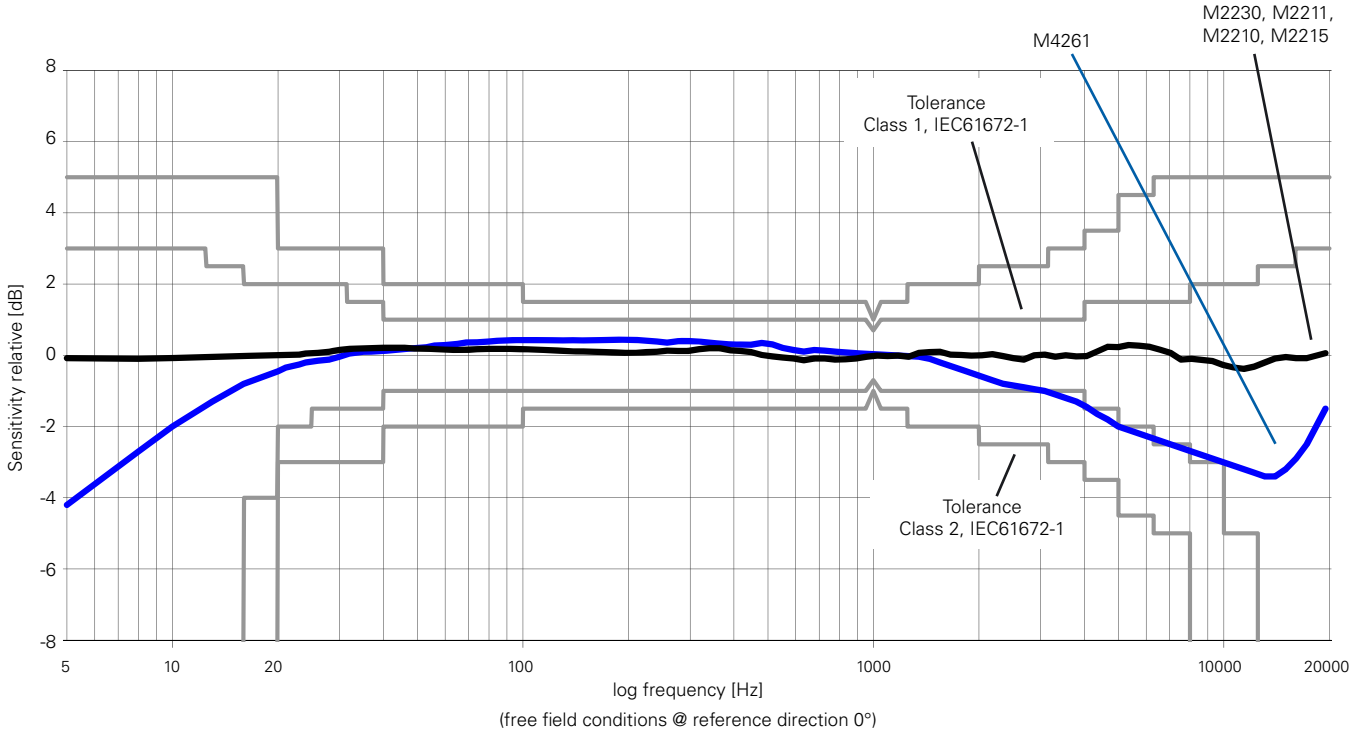
Sensitivity typical @ 1 kHz	-27.5 dBV/Pa ±2 dB (42 mV/Pa)		-34 dBV/Pa ±3 dB (20 mV/Pa)	-42 dBV/Pa ±3 dB (8 mV/Pa)	-36 dBV/Pa ±3 dB (16 mV/Pa)
Temperature Coefficient	< -0.01 dB / °C		< ±0.015 dB / °C		< ±0.02 dB / °C
Temperature Range	-10°C to +50°C (14°F to 122°F)				0°C to +40°C (32°F to 104°F)
Pressure Coefficient	-0.005 dB / kPa		-0.02 dB / kPa		-0.04 dB / kPa
Influence of Humidity (non-condensing)	< ±0.05 dB				< ±0.4 dB
Humidity	5% to 90% RH, non-condensing				
Long Term Stability	> 250 years / dB				-
Power Supply	48 VDC phantom power				
Current Consumption	2.3 mA typical				1.7 mA typical
Electronic Data Sheet	NTi Audio ASD in accordance with IEEE P1451.4 V1.0, Class 2, Template 27				
Output Impedance	100 Ohm balanced				
Connector	Balanced 3-pole XLR				
Diameter Dimensions	20.5 mm (0.8")	36 mm (1.4")	20.5 mm (0.8")		
Length Dimensions	154 mm (6.1")	378 mm (14.9")	150 mm (5.9")		
Weight	100 g, 3.53 oz	430 g, 15.17 oz	100 g, 3.53 oz		83 g, 2.93 oz
Environmental Protection	IP51	IP54 in vertical position	IP51		
NTi Audio #	600 040 050	600 040 055	600 040 022	600 040 045	600 040 070

Typical Frequency Response of Measurement Microphones



Free Field - Pressure Correction Factors

If a measurement microphone is held in a free-field environment, then the measurement microphone acts at high frequencies like a reflector. The sound pressure increases in front of the microphone capsule membrane. M2230, M2211 and M2215 are free-field equalized measurement microphones, they compensate for the increased pressure internally.

The calibrator offers no longer free-field conditions. Therefore, the free-field equalization of the microphone must be compensated. This needs to be considered prior the calibration. The correction value needs to be added to the pressure response of the microphone.

Example:

- During the calibration, the XL2 measures the sound level in the calibrator. If the B&K4226 calibrator is used and it is set to 16 kHz, then the XL2+M2230 reads just 86.7 dBA.
- The free-field sound level is calculated by summing the XL2 measurement value and the correction value (= 86.7 dB + 7.3 dB = 94.0 dB).

The following corrections apply with the B&K4226 calibrator:

Nominal Frequency [Hz]	M2230 Measurement Microphone [dB]	M2211 Measurement Microphone [dB]	M2215 Measurement Microphone [dB]	Measurement Uncertainty U [dB]
31.5	0.0	0.0	0.0	0.3
63	0.0	0.0	0.0	0.3
125	0.0	0.0	0.0	0.3
250	0.0	0.0	0.0	0.3
500	0.0	0.1	0.0	0.3
1000	0.0	0.1	0.0	0.3
2000	0.3	0.6	0.2	0.3
4000	0.7	1.7	1.2	0.3
8000	2.6	4.2	3.9	0.4
12500	6.0	7.3	6.7	0.7
16000	7.3	9.2	9.0	0.8

Correction values for other calibrators for M2230:

Type	Correction Value	Calibration Frequency	Calibration Level
NTi Audio CAL200	0.1	1 kHz	114 dB
B&K 4231	0.2	1 kHz	114 dB
Norsonic Nor-1251	0.2	1 kHz	114 dB

Diffuse Field Correction Factors

A diffuse sound field is characterized by the sound arriving at the receiver from all directions with more or less equal probability. The M2230, M2211, M2215 and M4261 are free-field equalized measurement microphones. The default frequency response refers to a 0° sound incidence. The diffuse-field frequency response is calculated by averaging the directional characteristics; this results in a reduction at the high frequencies. The individual third-octave band correction values for diffuse-field conditions are documented in the following table. The directional response of the M2230 is described in the appendix.

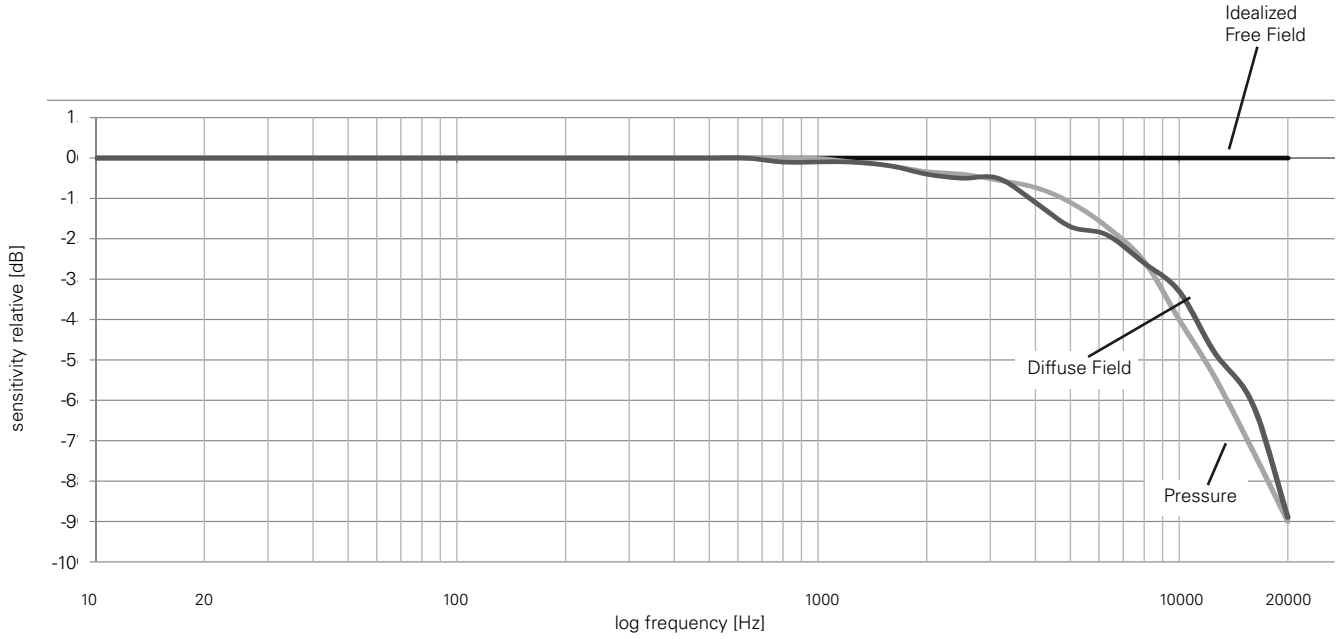
Example:

- The sound pressure level in a diffuse sound field shall be determined. The display of the XL2 with the M2230 reads 80.0 dBA for the 20 kHz third-octave band.
- The diffuse sound level is now calculated from the sum of the XL2 measurement value and the correction value (80.0 dB + 8.7 dB = 88.7 dB).

This correction is not necessary using a diffuse field equalized measurement microphone.

Nominal Frequency [Hz]	1/2" Microphone M2230, M2211, M2215 [dB]	1/4" Microphone M4261 [dB]
<63	0.0	0.0
63	0.0	0.0
80	0.0	0.0
100	0.0	0.0
125	0.0	0.0
160	0.0	0.0
200	0.0	0.0
250	0.1	0.0
315	0.1	0.0
400	0.1	0.0
500	0.1	0.1
630	0.1	0.1
800	0.2	0.1
1000	0.2	0.1
1250	0.3	0.1
1600	0.4	0.1
2000	0.5	0.1
2500	0.6	0.2
3150	0.8	0.2
4000	1.1	0.3
5000	1.4	0.5
6300	1.9	0.7
8000	2.5	1.0
10000	3.4	1.4
12500	4.6	1.9
16000	6.4	2.5
20000	8.7	3.2

M2230 Frequency Response for Free Field, Diffuse Field and Pressure



Spectral Correction for horizontal Sound Incidents using the Outdoor Microphone

The outdoor microphone M2230-WP fulfills Class 1 requirements of IEC 61672 and ANSI S1.4 for vertical sound incidence. For compliance with horizontal sound incidence a spectral correction is employed in the associated XL2 Sound Level Meter.

Nominal Frequency [Hz]	Spectral Correction for horizontal Sound Incidents with Firmware V4.20 or higher [dB]	
	1/3 Octave	1/1 Octave
<800	0.0	0.0
800 1000 1250	0.0 0.0 0.1	0.0
1600 2000 2500	0.1 0.3 0.7	0.4
3150 4000 5000	1.3 2.0 2.6	2.1
6300 8000 10000	2.7 3.2 3.7	3.3
12500 16000 20000	4.3 6.1 6.4	5.9

Technical Data PreAmplifier

	MA220 PreAmplifier
Microphone PreAmplifier	Compatible with 1/2" microphone capsules type WS2F in accordance with IEC61094-4
Frequency Range	4 Hz - 100 kHz
Residual Noise Floor typical	1.6 µV(A) at C_in 18pF ≙ 12 dBA @ 20 mV/Pa
Frequency Response Flatness	±0.2 dB
Phase Linearity	< 1° @ 20 Hz - 20 kHz
Maximum Output Voltage	21 Vpp ≙ 7.4 Vrms ≙ 145 dBSPL @ 20 mV/Pa, THD 3%, 1 kHz
Electronic Data Sheet	• Containing user calibration data • Default factory sensitivity = 4.9 V/Pa • Read/write by XL2 Audio and Acoustic Analyzer • NTi Audio ASD in accordance with IEEE P1451.4 V1.0, Class 2, Template 27
Impedance	Input: 20 GOhm // 0.26 pF, Output: 100 Ohm balanced
Power Supply	48 VDC phantom power, 2.3 mA typical
Attenuation	< 0.17 dB (Rphantom 2x 6.8 kOhm)
Connector	Balanced 3-pole XLR
Thread for Capsule	60 UNS2
Weight	90 g, 3.17 oz
Dimensions	Length 142.5 mm (5.6"), diameter 20.5 mm (0.8")
Temperature Range	-10°C to +50°C (14°F to 122°F)
Humidity	5% to 90% RH, non-condensing
NTi Audio #	600 040 040

The product specifications may vary based on the mounted microphone capsule type.