

# PRODUCT DATA

## Hand-held FFT Analyzer Types 2250-H and 2270-H with FFT Analysis Software BZ-7230 and Tone Assessment Option BZ-7231

Types 2250 and 2270 are the easy, safe and clever approach to machinery noise and vibration assessment, diagnostics and quality control. The analyzers combine high frequency resolution (up to 6400 lines of analysis), tap-and-drag operation and a wide dynamic range to become the perfect on-location machine noise and vibration tool.

Frequency analysis based on the Fast Fourier Transform (FFT) algorithm is the tool of choice for measurement and diagnostics of machinery noise and vibration. The frequency "profile" of a machine is its fingerprint, revealing its sources of noise and vibration and their paths to the measurement position.

FFT Analysis Software and FFT-based Tone Assessment Software enable objective and subjective tone assessments.

FFT Analyzer Type 2250-H-D01 (photo) is focused on vibration measurements and includes the FFT Analysis Software only (no Sound Level Meter Software or microphone). It may be upgraded for other applications.



### Uses and Features

#### Uses

- Single-channel FFT analysis of sound or vibration
- Tone assessment in accordance with ISO 1996-2 (optional)
- Machinery troubleshooting
- Product development
- Quality control and inspection
- Automotive component analysis

#### Features

- Wide dynamic range
- PC software for analysis, reporting and archiving included
- User-defined Metadata to aid documentation

#### FFT Spectra

- Up to 6400 lines of analysis
- Spans from 100 Hz to 20 kHz in a traditional 1-2-5 sequence
- Improved frequency resolution:
  - Resolution down to 16 mHz, broadband or zoom
  - Frequency correction for high precision on tones
- Dual overlay spectrum display
- Compare spectrum to reference spectrum
- Auto peak finding
- Max. hold spectrum
- A-weighting in pre- or post-processing

#### Measurements

- Transducer database
- CCLD input for accelerometers
- Capture transient events with signal level trigger, including pre-trigger
- Measure continuous signals with no data loss, 67% overlap
- Linear and exponential averaging
- Internal and external trigger
- Relate noise or vibration to rotational speed with simultaneous tachometer
- Measurements in SI (metric) and UK/US units
- Unit scaling (RMS, Pwr, PSD, ESD, Peak, P-P)

#### Quality Control

- Tolerance windows with check against preset limits
- Quality Check template for quick and clear results
- TTL output for control of external devices

#### Signal Recording (optional)

- Record input signal for later playback or analysis, 16 or 24 bit
- Export signal recording to PULSE for analysis

#### Tone Assessment (optional)

- Tone assessment on hand-held analyzer
- Measurement quality indicators on tone assessment
- Tone generator output

## Types 2250 and 2270

**Fig. 1**

Left: Type 2270

Right: Type 2250)



**Fig. 2**

FFT Analyzer Type 2250-H-D01, accessories and shoulder bag



Type 2250 and 2270 hand-held analyzers are both innovative, 4th generation analyzers from Brüel & Kjær with an award winning design based on extensive research amongst sound and vibration technicians, engineers and consultants from around the world.

Type 2270, with its dual-channel measurement capability (when installed with an appropriate dual-channel license), and the single-channel Type 2250, can host many of the same measurement application modules.

Two such modules are FFT Analysis Software BZ-7230 and Tone Assessment Option BZ-7231. BZ-7320 and BZ-7231 are single-channel applications so can use one of the Type 2270's channels at a time. The measurement procedure and functionality are the same regardless of the analyzer and will therefore be described collectively.

See Ordering Information on page 16 for all available application modules.

FFT Analyzer Type 2250-H-D01 is primarily for vibration measurements and includes FFT Analysis Software BZ-7230 only (no Sound Level Meter Software or microphone). However, it is possible to use a CCLD powered microphone with the analyzer to also measure noise. Type 2250-H-D01 comes with Shoulder Bag KE-0459, which has dedicated space for both the analyzer and basic vibration analysis accessories.

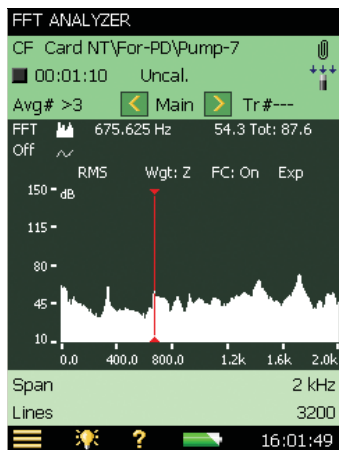
Once you have taken your measurements, you need to do something with them. Your hand-held analyzer offers three storage options: internal disk, Secure Device (SD) memory cards or USB stick. From there, the included USB or LAN cable makes data transfer to an archive on your PC, or network location, easy. Alternatively, if you have used an external memory card, just insert it into the computer's card reader.

## FFT Analysis Software BZ-7230

The Fast Fourier Transform (FFT) is a digital signal processing technique that converts a time record into a narrow-band constant bandwidth filtered spectrum. The measurement is defined by specifying a frequency span and a number of lines (or filters). A zoom facility allows you to focus on any part of the frequency range by specifying the centre frequency for the analysis span. FFT Analysis Software BZ-7230 allows resolutions down to 1/64 Hz, when you use a 100 Hz frequency span and 6400 lines of analysis.

**Fig. 3**

Spectrum view showing high dynamic range and high frequency resolution



FFT spectrum analysis (Fig.3) is ideal for noise or vibration source identification with 6400 lines of real-time frequency analysis at better than 5 Hz resolution – all the way to 20 kHz. Tapping the screen turns on the Frequency Correction algorithm\*, which computes peak frequencies with ten times better resolution. The wide dynamic range (over 150 dB) allows accurate sound and vibration measurement on the first attempt.

FFT analysis is all about the details and the beauty of Hand-held Analyzers Type 2250 and 2270 is their details: secure in your hand, solid in construction and pleasantly intuitive. Each analyzer's high-resolution touch-screen colour display brings enhanced usability and enables easy cursor and display parameter transition. Setup is also easy. Connect and position your transducer, press Start/Pause and view your spectrum. If you want to zoom in, drag the stylus across the desired frequency span, tap *Zoom* and you can now measure using the correct range – *Easy, Safe, Clever.*

The FFT Analysis Software comes with two additional templates.

\* Brüel & Kjær Technical Review No. 4 1987, "Use of Weighting Functions in DFT/FFT Analysis" (Part II), Appendix F

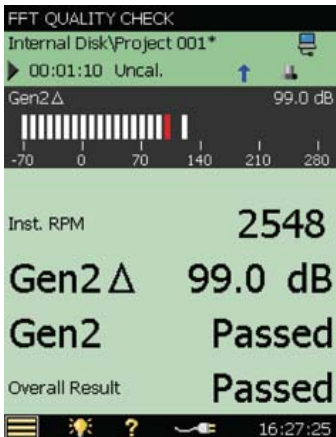
**Fig. 4**  
**FFT Analyzer**  
 Advanced provides two additional tabs with detailed test result information



**FFT Analyzer Advanced Template**  
 The Results tab offers a view with 11 selectable results, which can be configured by tapping on any parameter label.

The XL View tab provides a bar graph and three selectable results. The bar graph shows the FFT spectrum total, a user-selectable delta sum or a single-value parameter. The bar graph also incorporates a quick view of the maximum value (white line) and upper limit (red line) into its display.

**Fig. 5**  
 The FFT Quality Check template provides specific customisable information for well-established tasks



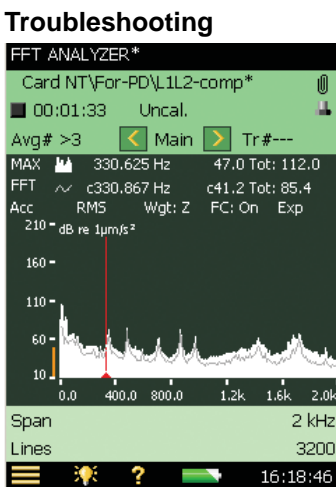
**FFT Quality Check Template**

The FFT Quality Check template provides a bar graph and four selectable results in an easily readable large font. The bar graph shows the FFT spectrum total, a user-selectable delta sum or a single-value parameter. The bar graph also incorporates a quick view of the maximum value (white line) and upper limit (red line) into its display.

This template is particularly useful when tolerance windows are well established and FFT spectra are not needed for viewing, which is often the case with quality inspection tasks.

## FFT Analysis Applications

**Fig. 6**  
 View showing the overlay of resonance on operation frequencies



FFT Analysis Software BZ-7230 includes the analysis tools and measurement units for a wide range of troubleshooting applications. For example:

- Measuring an engine mount's movement at idle RPM as displacement. Simply attach an accelerometer and set up the tachometer trigger input and the running speed will be displayed
- Spot-checking the output of a random vibration shaker is also easy. Use the stylus to set the delta cursor for the desired frequency span and read out the Power Spectral Density (PSD), then select  $g^2/Hz$  or  $(m/s^2)^2/Hz$  as your reference units
- You can also easily find a component's resonant frequencies. Switch the analyzer's FFT from continuous to transient signals and tap the component to excite its resonances. The internal trigger starts the measurement, and the FFT software will use a rectangular time window to capture the entire transient. Save the resonance spectrum as a reference then measure a machine's vibration spectrum to see if any resonance lines up with the operational frequencies (Fig. 6)

### Quality Testing and Inspection – Tolerance Windows

Rotating or reciprocating elements (such as pistons, shafts and gears) in many machines, tools and vehicles lead to vibrations and noise. Measurements and analyses of that noise and vibration can be used to detect assembly faults and ensure compliance with required standards.

The Tolerance Windows feature in BZ-7230 makes quality control measurements easy.

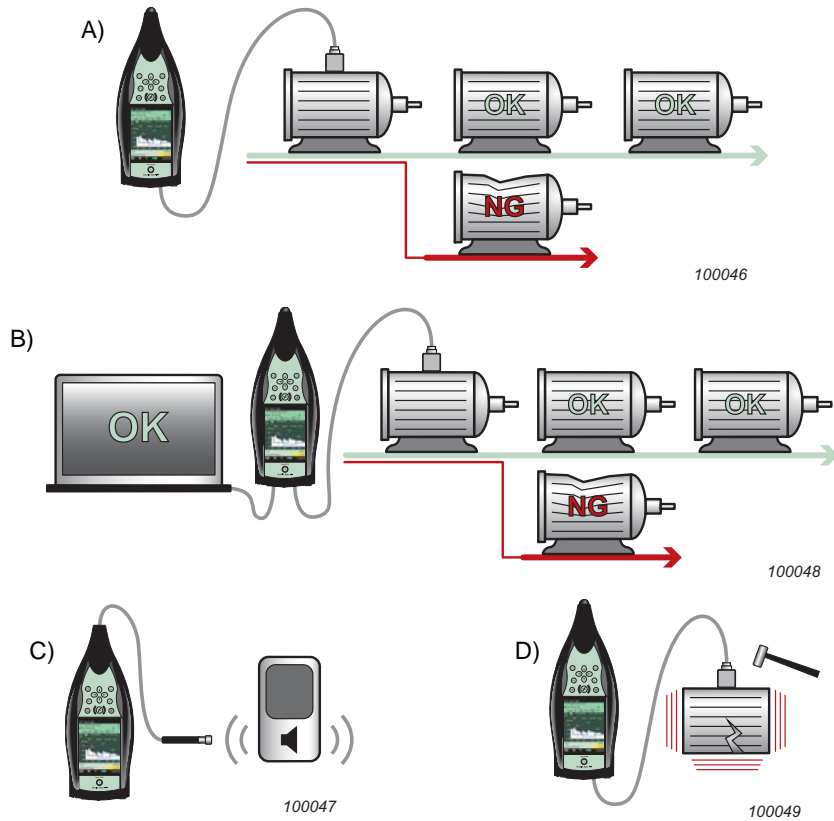
**Fig. 7**  
Examples of quality testing applications using Type 2250-H-D01

A) Spot checks:  
Perform quick quality checks anywhere

B) Dedicated QC:  
Link the analyzer to a PC using the 2250/70 SDK

C) Audio quality:  
Measure audio spectra and then compare the sound level and harmonics to set limits

D) Material inspection:  
Using a test hammer, measure the resonance pattern and compare it to acceptance limits



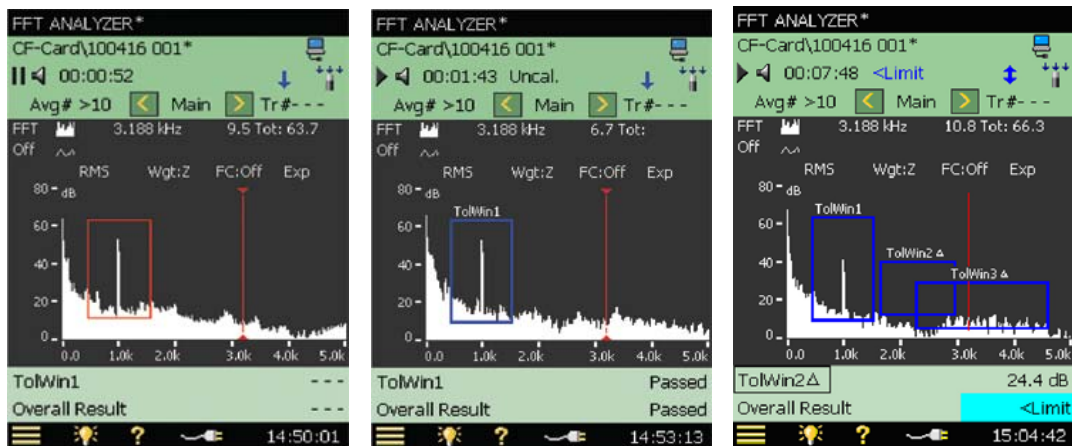
The designers of the machine, tool or vehicle specify limits for permissible deviations. These specifications can be set up on Type 2250/2270 using one or several tolerance windows, each of which defines an upper and lower limit for the levels over a specific frequency range.

The value checked can be set to the level of the FFT lines or to the sum of FFT lines (delta sum).

**Fig. 8**  
Left:  
Drawing the tolerance window by dragging the stylus

Centre:  
Resulting tolerance window (set to check FFT lines)

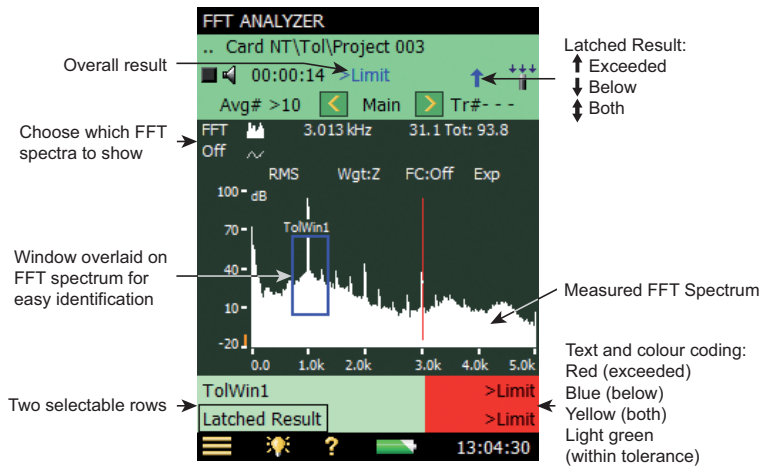
Right:  
Additional tolerance windows (set to delta sum) – up to 10 windows can be active and may overlap



Settings and preferences for a particular application can be saved collectively in templates. By recalling a template, Type 2250/2270 is ready for specific measurements in just seconds, including the specification of tolerances. Up to 10 tolerance windows per template can be active at the same time, making it possible to test different tolerances for different frequency ranges in one measurement. In addition, it is possible to test for two limit ranges over the same frequency range, which is as easy as overlapping tolerance windows. In addition you can define tolerances for four non-FFT values; for example, two instantaneous parameters ( $L_{AF}$  and Instantaneous RPM) and two average parameters ( $L_{Aeq}$  and Average RPM).

During measurement, the FFT spectrum and single values are compared to set limits (indicating 'above upper limit', 'within limits', 'below lower limit', 'above and below limits'). The test is performed and indicated for each window. An overall result is also indicated. It will indicate 'failed' if the spectrum or single parameters crossed the upper or lower tolerances for any window or 'passed' if within the tolerances for all windows.

**Fig. 9**  
 BZ-7230 provides comprehensive indication of the test result



The pass/fail indication is also available as an electrical signal at Type 2250/2270's output socket. A 3.3 VDC output indicates an exceeded upper limit, a -3.3 VDC indicates levels below the lower limit, and an alternating  $\pm 3.3$  V indicates violation of both limits. This feature makes it easy to utilise Type 2250/2270 in production control systems where the output signal can trigger warnings or start specific actions for the failed item. Being able to listen to the signal makes it easier to identify the problem source.

You can therefore configure the analyzer to start recording automatically when data exceed tolerances (license for Signal Recording Option BZ-7226 is required). The input signal, which will be attached to the specific project, can be played back or exported to a PC for further analysis. For more information on BZ-7226, see page 7.

### Quality Testing and Inspection – Programmable Automation

Types 2250 and 2270 can also be controlled from a PC over a standard USB or Ethernet port. With the analyzer connected to your PC, you can download the 2250/70 Software Development Kit (SDK) via [www.bksv.com](http://www.bksv.com). The SDK provides an interface and tools to connect to your analyzer, set up and control it, readout values from the current measurement, transfer saved configurations, and convert projects to XML files for easy interpretation. Examples of use with C# for Visual Studio® 2008 and Visual Basic® 6 programs are also available.

In a quality testing environment, the SDK enables development of a quality control system with a complete measurement system including a full interface: signal conditioning, FFT analysis, speed measurement, and tolerance windows. Once the pass/fail criteria are determined, the system can be automated using the SDK and the analyzer's display and keys locked to prevent accidental operator changes to the system.

In addition, using Type 2250/2270 for quality testing and inspection gives you access to Brüel & Kjær's sound and vibration knowledge. Support for the entire measurement – from couplers for the correct acoustic impedance for headphones to analysis techniques to reject failed units and pass the good ones.

### Product Development

**Fig. 10**  
 Type 2250-H-D01 with Laser Tacho Probe Type 2981 in product vibration testing



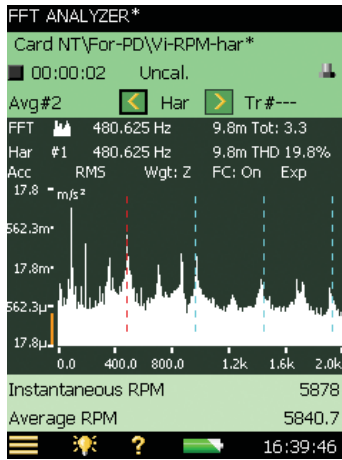
Early component performance evaluation can greatly improve product design. The FFT analyzer's dual-overlay display makes it easy to compare measurements between design iterations.

You can also benchmark competitive and previous generation products. Use narrow-band analysis to identify forcing functions and resonances to aid in setting the standards for the next generation product.

Measurement Partner Suite BZ-5503 makes it easy to transfer measurement data to a PC where data viewing, exporting and archiving complete the analysis and reporting project.

## Machinery Analysis and Troubleshooting

**Fig. 11**  
View showing an RPM readout, with harmonic cursors and vibration measurement units



The portability of the analyzer gives you easy access to any product, lets you recall a baseline reference spectrum, and then compare it instantly with a spectrum you have just measured.

You can set the tolerance window feature over a range of frequencies to warn of machinery failure. Harmonic and delta cursors help you identify rotational and mesh frequencies, steering you efficiently toward operational deficiencies.

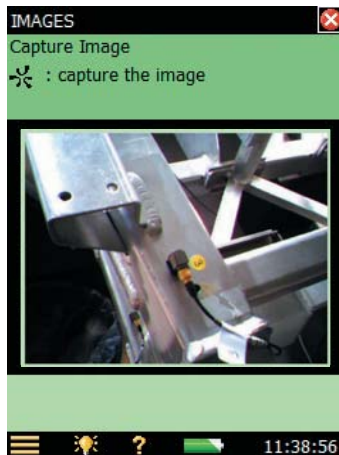
The analyzer's trigger input can even accept a tachometer input – providing a direct readout of RPM (see Fig. 11) with a gear ratio you define. The unique commentary feature of the analyzer lets you verbally record your field observations and attach them directly to the measurement result. The analyzer's multi-user facility allows you to define user-specific configurations and measurement points, so you can organise your field measurements, and the included Measurement Partner Suite program makes it easy to review the results on your PC.

## Building Vibration and Noise Measurements

Type 2250/2270 is already a comprehensive tool for the consultant or engineer. FFT Analysis Software BZ-7230 adds vibration and sound measurement technology that traditional 1/3-octave analysis cannot provide. Low frequencies can be analysed down to 7 Hz (at -1 dB) using the standard Microphone Type 4189; down to 0.6 Hz (at -1 dB) using optional Microphone Type 4193; and down to 1.3 Hz (at -10%) using one of the recommended accelerometers. Now, with suitable transducers, the rumble and rattle of HVAC installations or the contribution of nearby rail or road traffic can easily be measured.

## Annotations – Filling in the Blanks

**Fig. 12**  
Use the built-in camera in Type 2270 to photograph the device under test

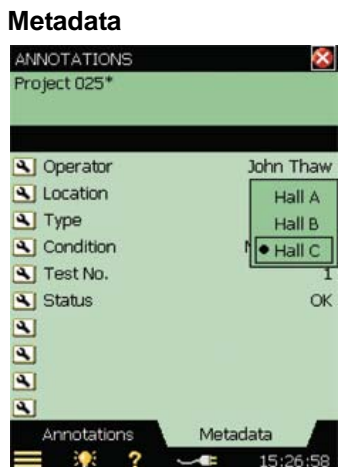


Whatever your application – product development, troubleshooting, quality check or tone assessment – there is more to your measurements than just the bare numbers of your results. With annotations it is easy to attach comments, notes and images to measurement results by:

- Tapping in notes using the on-screen QWERTY keyboard
- Pressing the Commentary pushbutton to record using the built-in commentary microphone
- Press the Manual Event pushbutton and take a photo of the device under test or measurement configuration (Type 2270 only)

All annotations are automatically saved with the project and can be reviewed at any time.

**Fig. 13**  
The Annotations page showing six user-defined metadata items and a picklist for the Location entry



Metadata are supplementary information entries about your measurement that make archiving, retrieving and post-processing data easier and more efficient. Examples of metadata are file name, date and time, setup and annotations made by the operator.

In addition you can define the names and types of up to 10 text strings. The entry format may be editable text, a user-defined picklist, numeric or an index number that automatically increments when a measurement is saved.

Metadata functionality can also be used for sorting measurements in Measurement Partner Suite BZ-5503.

## Signal Recording Option BZ-7226

Signal Recording Option BZ-7226 enables input signal recording for later playback or analysis. The recording can be automatic (lasting for the duration of the measurement), controlled manually, or last as long as the limit level is exceeded. Pre- and post-recording delays and duration limits may be set. The recording upper frequency limit can be reduced from the full 20 kHz in four steps to save memory. To optimise memory space or dynamic range, 16 or 24 bit recording resolution is available.

Signal recording files can be quite large, so you will be directed to store your measurements (and recording) on a memory card in either of the hand-held analyzer's integrated SD card slot or on an attached USB stick. Type 2250/2270 hand-held analyzers support SDHC cards, which provide memory capacity of up to 32 GB. The standard recorded .WAV files are easily input into other analysis tools, for example Brüel & Kjær's PULSE™ Multi-analyzer platform.

## Tone Assessment Option BZ-7231

**Fig. 14**  
Performing an outdoor  
tone assessment  
measurement



Noise can be described as tonal if it contains a noticeable or discrete, continuous note. This can include noises such as hums, hisses, screeches, drones, etc. Any such subjective description is open to discussion and contradiction when reported.

ISO 1996–2 (2007) Annex C, *Objective method for assessing the audibility of tones in noise-reference method*, provides measurement procedures to be used to verify the audibility of tones and to quantify them. Measurement results can therefore be compounded and help explain subjective reactions.

### Automatically Configured for ISO 1996 Assessments

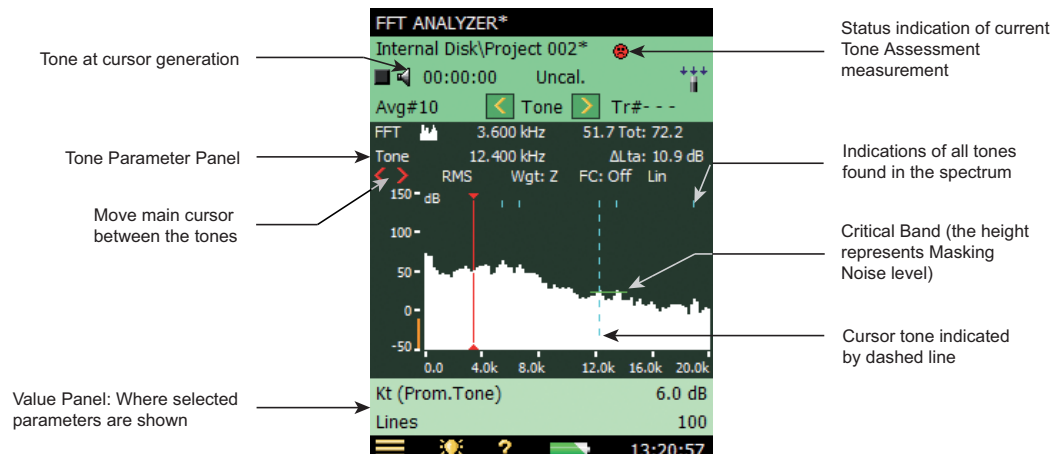
Tone Assessment Option BZ-7231 offers a quick and easy 'in-the-field' objective assessment of tonal noise components, in compliance with ISO 1996 assessments. The facility to carry out the ISO standard tone assessment offers objective feedback about whether you have 'found the problem' or need to take further measurements. In addition, the analyzer offers an easy way of setting up the FFT analysis to follow the ISO 1996–2 standard. When this option is selected, simply press Start and the analyzer automatically selects the appropriate measurement configuration and the measurement and analysis are in progress.

On completion of the measurement, the calculation of tonal parameters for all the possible tonal candidates in the analysis takes only a few seconds, after which the following comprehensive list of results can be displayed on the spot:

- Kt – the value added to the LAeq to give the tone-corrected rating level
- ΔLta – the audibility of all tones found in the same critical band as the selected tone
- Lpn – the Total level of the masking noise in the band containing the selected tone
- Lpti – the Level of the selected tone
- Lpt – the total Level of all tones in the critical band containing the prominent tone
- Critical Band – the start and end of the critical band containing the selected tone

The  $L_{Aeq}$  and other broadband parameters are measured simultaneously by the analyzer and the tone corrected rating level can be calculated on the spot.

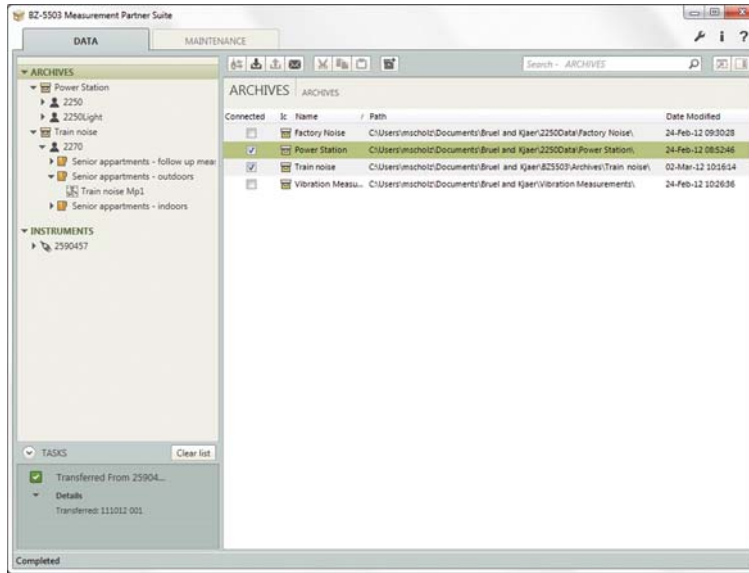
**Fig. 15**  
Typical FFT spectrum  
display for the Tone  
Assessment option,  
showing the various  
fields and parameters



## Measurement Partner Suite BZ-5503

Measurement Partner Suite BZ-5503 is the next step in the evolution of Utility Software for Hand-held Analyzers BZ-5503. Its standard configuration is included with your hand-held analyzer and provides data archive, preview and export capabilities as well as software maintenance and remote online display.

**Fig. 16**  
A typical BZ-5503 display



In addition to the free, standard configuration, valuable data analysis and post-processing functionalities are also available in a growing suite of optional applications. Measurement Partner Suite offers these applications on a subscription basis: only pay for what you need, when you need it. For more information, please consult [Product Data BP 2430](#).

## Other Type 2250/2270 Software

Your hand-held analyzer has generous hardware and software specifications creating an extremely flexible instrument to cover your current and future measurement and analysis needs.

All instruments (except FFT Analyzer Type 2250-H-D01) come with Sound Level Meter Software BZ-7222 enabled. This makes the analyzer into a modern Class 1 Sound Level Meter (SLM). It fulfils the requirements of the latest standard, IEC 61672–1, as well as earlier standards. Even in its most basic configuration, the analyzer is delivered with a number of predefined measurement and display setups tailored to suit specific requirements. For more information on BZ-7222 as well as the entire Type 2250/70 platform, see [Product Data BP 2199](#).

### Optional Application Software Modules

The Type 2250/70 analyzer platform allows you to choose different combinations of software modules (applications). Modules can be purchased when needed and are delivered as easily installed licenses. In this way your investment in the analyzer platform is securely protected: when your need for measurements and analyses expands, the analyzer can accommodate them. Brüel & Kjær is committed to maintaining an ever-growing range of Type 2250/70 applications.

Currently, you can select from the following optional software modules:

- **Frequency Analysis Software BZ-7223**, providing real-time analysis of the 1/1- and 1/3-octave filter bands over a wide frequency range. For more information, see [Product Data BP 2199](#)
- **Logging Software BZ-7224**, allows free selection of parameters to log at periods from 1 s to 24 h. Run together with the Sound Level Meter Software, all broadband parameters can be logged. If Frequency Analysis Software is also enabled, spectra can be logged at the same rates. For more information, see [Product Data BP 2199](#)
- **Enhanced Logging Software BZ-7225**, provides continuous logging of periodic reports in addition to the features of Logging Software. Parameters like Ldn and Lden are calculated. For more information, see [Product Data BP 2199](#)
- **Signal Recording Option BZ-7226**, provides you with a versatile facility to attach samples of the measured signal to your measurements. This option works with all software modules. For more information, see [Product Data BP 2199](#)
- **Reverberation Time Software BZ-7227**, allows you to perform reverberation time measurements, which are used in assessing acoustics in the workplace, auditoria, halls, public spaces, etc. It can also be used to calculate room corrections for building acoustics and sound power, as well as absorption coefficients. For more information, see [Product Data BP 2152](#)
- **Building Acoustics Software BZ-7228/7229 and Type 8780**, transform your hand-held analyzer into a measurement system for the assessment of sound insulation of partitions in a building such as walls and ceilings. For more information, see [Product Data BP 2190](#)



## Recommended Post-processing Software – For Use on a PC

For comprehensive data management, post-processing and reporting, consider using Type 2250/2270 data together with one of following PC software packages:

- **Noise Explorer™ Type 7815**, data viewing software that helps you manage measurements made with a hand-held analyzer. Noise Explorer deals with the download of data from the analyzer, storage on the PC, printing and exporting to other programs. For more information, see [Product Data BP 1749](#)
- **Evaluator™ Type 7820**, environmental noise software with built-in calculation algorithms that allow you to produce compound sound level figures from several contributions. Some may have impulse or pure tone penalties, depending on which measurement standard you choose, for example, ISO 1996, DIN 45645, TA Lärm, NF S 31-010, or BS 4142. For more information, see [Product Data BP 1752](#)
- **Protector™ Type 7825**, noise at work software that calculates noise exposure according to ISO 9612–2. For situations where only workpoint noise measurements are available, Protector can combine these measurements with a profile of a person's movements, simulating their personal noise exposure. For more information, see [Product Data BP 1717](#)
- **PULSE Reflex™ Building Acoustics Type 8780**, software in which measured building acoustics data can be directly imported from Type 2250/2270 for viewing, further analysis and reporting. In addition to being a post-processing tool, Type 8780 allows you to control Type 2250/2270 software upgrades and licensing of the Type 2250/2270 applications. For more information, see [Product Data BP 2190](#)

All of these environmental post-processing software support a wide range of user-definable graphic and tabular displays. Graphs and tables can be imported into standard Windows® applications such as Excel® and Word.

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## Accredited Calibration and Hardware Maintenance at Brüel & Kjær

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For Types 2250 and 2270, you can order accredited calibration and choose between DANAK, A2LA, UKAS, Eichamt (Austria), RvA, ENAC, NATA and Inmetro. We recommend you order accredited calibration together with a new instrument.

Should the technician detect the need for repair during calibration, this can be performed while it is in our hands so you do not have to be without your analyzer. You can minimise the risk of unexpected costs by purchasing a hardware maintenance contract with a five-year warranty.

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## Compliance with Standards

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	CE-mark indicates compliance with the EMC Directive and Low Voltage Directive. C-Tick mark indicates compliance with the EMC requirements of Australia and New Zealand.
<b>Safety</b>	EN/IEC 61010–1, ANSI/UL 61010–1 and CSA C22.2 No. 1010.1: Safety requirements for electrical equipment for measurement, control and laboratory use.
<b>EMC Emission</b>	EN/IEC 61000–6–3: Generic emission standard for residential, commercial and light industrial environments. CISPR 22: Radio disturbance characteristics of information technology equipment. Class B Limits. FCC Rules, Part 15: Complies with the limits for a Class B digital device. IEC 61672–1, IEC 61260, IEC 60651 and IEC 60804: Instrumentation standards. Complies with Canadian standard ICES–001
<b>EMC Immunity</b>	EN/IEC 61000–6–2: Generic standards – Immunity for industrial environments. EN/IEC 61326: Electrical equipment for measurement, control and laboratory use – EMC requirements. IEC 61672–1, IEC 61260, IEC 60651 and IEC 60804: Instrumentation standards.

## Specifications – Type 2270 and 2250 Platforms

These specifications refer to Types 2270 and 2250 unless otherwise stated.

### DUAL-CHANNEL MEASUREMENTS (TYPE 2270)

Two independent measurement channels are available on Type 2270 to enable you to measure various acoustic parameters, subject to having a dual-channel application license.

### REFERENCE ENVIRONMENTAL CONDITIONS

**Air Temperature:** 23°C

**Static Pressure:** 101.325 kPa

**Relative Humidity:** 50%

### SUPPLIED MICROPHONE

**Type 4189:** Prepolarized Free-field ½" Condenser Microphone

**Nominal Open-circuit Sensitivity:** 50 mV/Pa (corresponding to –26 dB re 1 V/Pa) ± 1.5 dB

**Capacitance:** 14 pF (at 250 Hz)

### MICROPHONE PREAMPLIFIER ZC-0032

**Nominal Preamp Amplifier Attenuation:** 0.25 dB

**Connector:** 10-pin LEMO

**Extension Cables:** Up to 100 m in length between the microphone preamplifier and the Hand-held Analyzer, without degradation of the specifications

**Note:** EMC is only tested with a 10 m cable (AO-0441-D-100)

**Accessory Detection:** Windscreen UA-1650 can be automatically detected when fitted over ZC-0032

### MICROPHONE POLARIZATION VOLTAGE

Selectable between 0 V and 200 V

### TRANSDUCER DATABASE

Transducers are described in a transducer database with information on Serial Number, Preamp Amplifier ID No., Nominal Sensitivity, and CCLD required.

For microphones, Polarization Voltage, Free-field Type and Capacitance are also included.

For Accelerometers, Weight is also included.

The analogue hardware is set up automatically in accordance with the selected transducer

### CORRECTION FILTERS

For Microphone Types 4189, 4190, 4191, 4193, 4950 and 4952, BZ-7230 is able to correct the frequency response to compensate for sound field and accessories:

**Sound Field:** Free-field or Diffuse-field (for Type 4952 only: 0° (Top) reference direction and 90° (Side) reference direction)

**Accessories** (Type 4189 only): None, Windscreen UA-1650 or Outdoor Microphone Kit UA-1404

**Accessories** (Types 4191 and 4193 only): None or Windscreen UA-1650

**Accessories** (Type 4950 only): None or Windscreen UA-0237

### CALIBRATION

For accelerometer Types 4397-A, 4513, 4513-001, 4513-002, 4514, 4514-001, 4514-002, 8341, and 8324, the lower frequency limit will be optimized to match the specifications for the accelerometer.

Initial calibrations for each transducer are stored for comparison with later calibrations

**Acoustic:** Using Sound Calibrator Type 4231 or custom calibrator. The calibration process automatically detects the calibration level when Sound Calibrator Type 4231 is used

**Mechanical:** Using Calibrator Exciter Type 4294 or custom calibrator

**Direct Electrical:** Using an external Voltage Reference

**Electrical:** Uses internally generated electrical signal combined with a typed-in value of the sensitivity

**Calibration History:** Up to 20 of the last calibrations made are listed and can be viewed on the instrument

### KEYBOARD

**Pushbuttons:** 11 keys with backlight, optimised for measurement control and screen navigation

### ON-OFF BUTTON

**Function:** Press 1 s to turn on; press 1 s to enter standby; press for more than 5 s to switch off

### TRAFFIC LIGHT

Red, yellow and green LEDs show measurement status and instantaneous overload as follows:

- Yellow LED flashing every 5 s = stopped, ready to measure
- Green LED flashing slowly = awaiting trigger or calibration signal
- Green LED on constantly = measuring
- Yellow LED flashing slowly = paused, measurement not stored
- Red LED flashing quickly = intermittent overload, calibration failed

### DISPLAY

**Type:** Transflective back-lit colour touch screen

240 × 320 dot matrix

**Colour Schemes:** Five different – optimised for different usage scenarios (day, night, etc.)

**Backlight:** Adjustable level and on-time

### USER INTERFACE

**Measurement Control:** Using pushbuttons on keyboard

**Setup and Display of Results:** Using stylus on touch screen or pushbuttons on keyboard

**Lock:** Keyboard and touch screen can be locked and unlocked

### VOICE ANNOTATIONS

Voice annotations can be attached to measurements so that verbal comments can be stored together with the measurement

**Playback:** Playback of voice annotations or signal recordings can be listened to using an earphone/headphones connected to the headphone socket

**Gain Adjustment:** –60 dB to 60 dB

### TEXT ANNOTATIONS

Text annotations can be attached to measurements so that written comments can be stored with the measurement

### IMAGE ANNOTATIONS (TYPE 2270 ONLY)

Image annotations can be attached to measurements. Images can be viewed on the screen

### GPS ANNOTATIONS

A text annotation with GPS information can be attached (Latitude, Longitude, Altitude and position error). Requires connection to a GPS receiver

### DATA MANAGEMENT

**Metadata:** Upto 10 Metadata annotations can be set per project (text from keyboard or text from pick list, number from keyboard or auto generated number)

**Project Template:** Defines the display and measurement setups. Setups can be locked

**Project:** Measurement data stored with the Project Template

**Job:** Projects are organised in Jobs

Explorer facilities for easy management of data (copy, cut, paste, delete, rename, view data, open project, create job, set default project name)

### USB INTERFACE

USB 2.0 OTG Micro AB and USB 2.0 Standard A sockets

### MODEM INTERFACE

Connection to Internet through GPRS/EDGE/HSPA modem connected through:

- the USB Standard A Socket

Supports DynDNS for automatic update of IP address of host name

### PRINTER INTERFACE

PCL printers, Mobile Pro Spectrum thermal printer or Seiko DPU S245/S445 thermal printers can be connected to USB socket

### SECURE DIGITAL SOCKET

- 2 × SD sockets

Connect SD and SDHC memory cards

#### LAN INTERFACE SOCKET

- Connector: RJ45 Auto-MDIX
- Speed: 100 Mbps
- Protocol: TCP/IP

#### REAR INPUT SOCKET (TYPE 2270 HAS TWO)

**Connector:** Triaxial LEMO used for Direct input as well as input with Constant-Current Line Drive (CCLD) power supply

**Input Impedance:**  $\geq 1 \text{ M}\Omega$

**Direct Input:** Max. input voltage:  $\pm 14.14 V_{\text{Peak}}$ ,  $10 V_{\text{RMS}}$  for sinusoidal input signals, no damage for signals up to  $\pm 20 V_{\text{Peak}}$ . Source Impedance  $\leq 1 \text{ k}\Omega$

**CCLD Input:** Max. input voltage:  $\pm 7.07 V_{\text{Peak}}$  (no indication for violation of this level), no damage for signals in the range  $-10$  to  $+25 V_{\text{Peak}}$

**CCLD Current/Voltage:** 4 mA/25 V

**CCLD Cable Break/Short Indication:** Checked before and after measurements

#### TRIGGER SOCKET

**Connector:** Triaxial LEMO

**Max. Input Voltage:**  $\pm 20 V_{\text{Peak}}$ , no damage for signals up to  $\pm 50 V_{\text{Peak}}$

**Input Impedance:**  $> 47 \text{ k}\Omega$

**CCLD Current/Voltage:** 4 mA/25 V

#### OUTPUT SOCKET

**Connector:** Triaxial LEMO

**Max. Peak Output Level:**  $\pm 4.46 \text{ V}$

**Output Impedance:**  $50 \Omega$

**Load Impedance:**  $>15 \text{ k}\Omega \parallel < 1 \text{ nF}$  for  $< 0.2 \text{ dB}$  attenuation from DC to 20 kHz, short-circuit proof without affecting the measurement results

**Max DC Offset:**  $\pm 15 \text{ mV}$

**Source:** Input conditioned (gain adjustment  $-60 \text{ dB}$  to  $60 \text{ dB}$ )

#### HEADPHONE SOCKET

**Connector:** 3.5 mm Minijack stereo socket

**Max. Peak Output Level:**  $\pm 1.4 \text{ V}$  (no load)

**Output Impedance:**  $32 \Omega$  in each channel, short-circuit proof without affecting the measurement results

**Sources:** Input conditioned (gain adjustment  $-60 \text{ dB}$  to  $60 \text{ dB}$ ), playback of voice annotations and signal recordings (gain adjustment  $-60 \text{ dB}$  to  $0 \text{ dB}$ ) and playback of recordings (gain adjustment  $-60 \text{ dB}$  to  $60 \text{ dB}$ ); however, max. gain is  $0 \text{ dB}$  for 16-bit wav-files

#### MICROPHONE FOR COMMENTARY

Microphone, which utilises Automatic Gain Control (AGC), is incorporated in underside of instrument. Used to create voice annotations for attaching to measurements

#### CAMERA (2270 ONLY)

Camera with fixed focus and automatic exposure is incorporated in underside of instrument.

Used to create image annotations for attaching to measurements

**Image Size:** 2048 x 1536 pixels

**Viewfinder Size:** 212 x 160 pixels

**Format:** jpg with exif information

#### EXTERNAL DC POWER SUPPLY REQUIREMENTS

Used to charge the battery pack in the instrument

**Voltage:** 8 – 24 V DC, ripple voltage  $< 20 \text{ mV}$

**Current Requirement:** min. 1.5 A

**Power Consumption:**  $< 2.5 \text{ W}$ , without battery charging,  $< 10 \text{ W}$  when charging

**Cable Connector:** LEMO Type FFA.00, positive at centre pin

#### EXTERNAL AC MAIN SUPPLY ADAPTOR

**Part No.:** ZG-0426

**Supply Voltage:** 100 – 120/200 – 240 VAC; 47 – 63 Hz

**Connector:** 2-pin IEC 320

#### BATTERY PACK

**Part No.:** QB-0061 Rechargeable Li-Ion battery

**Voltage:** 3.7 V

**Capacity:** 5200 mAh nominal

#### Typical Operating Time:

- Single-channel:  $>11 \text{ h}$  (screen backlight dimmed);  $>8.5 \text{ h}$  (full screen backlight)

- Dual-channel:  $>7.5 \text{ h}$  (full screen backlight)

Use of external interfaces (LAN, USB, WLAN) will decrease battery operating time

**Battery Cycle Life:**  $> 500$  complete charge/discharge cycles

**Battery Aging:** Approximately 20% loss in capacity per year

**Battery Indicator:** Remaining battery capacity and expected working time may be read out in % and in time

**Battery Fuel Gauge:** The battery is equipped with a built-in fuel gauge, which continuously measures and stores the actual battery capacity in the battery unit

**Charge Time:** In analyzer, typically 10 hours from empty at ambient temperatures below  $30^\circ\text{C}$ . To protect the battery, charging will be terminated completely at ambient temperatures above  $40^\circ\text{C}$ . At  $30$  to  $40^\circ\text{C}$  charging time will be prolonged. With External Charger ZG-0444 (optional accessory), typically 5 hours

**Note:** It is not recommended to charge the battery at temperatures below  $0^\circ\text{C}$  ( $32^\circ\text{F}$ ) or over  $50^\circ\text{C}$  ( $122^\circ\text{F}$ ). Doing this will reduce battery lifetime

#### CLOCK

Back-up battery powered clock. Drift  $< 0.45 \text{ s}$  per 24 hour period

#### Storage

##### INTERNAL FLASH-RAM (NON-VOLATILE)

For user setups and measurement data

- 512 MB

##### EXTERNAL SECURE DIGITAL MEMORY CARD

**SD and SDHC Card:** For store/recall of measurement data

##### USB MEMORY STICK

For store/recall of measurement data

##### REAL-TIME CLOCK

Back-up battery powered clock. Drift  $< 0.45 \text{ s}$  per 24 hour period

##### WARM-UP TIME

After reaching equilibrium with the ambient environment and switching on power

**From Power Off:**  $< 2$  minutes

**From Standby:**  $< 10$  seconds for prepolarized microphones

##### TEMPERATURE

IEC 60068–2–1 & IEC 60068–2–2: Environmental Testing. Cold and Dry Heat.

**Operating Temperature:**  $-10$  to  $+50^\circ\text{C}$  ( $14$  to  $122^\circ\text{F}$ ),  $< 0.1 \text{ dB}$

**Storage Temperature:**  $-25$  to  $+70^\circ\text{C}$  ( $-13$  to  $+158^\circ\text{F}$ )

##### HUMIDITY

IEC 60068–2–78: Damp Heat: 90% RH (non-condensing at  $40^\circ\text{C}$  ( $104^\circ\text{F}$ )).

**Effect of Humidity:**  $< 0.1 \text{ dB}$  for  $0\% < \text{RH} < 90\%$  (at  $40^\circ\text{C}$  ( $104^\circ\text{F}$ ) and  $1 \text{ kHz}$ )

##### MECHANICAL

Environmental Protection: IP44

Non-operating:

IEC 60068–2–6: Vibration:  $0.3 \text{ mm}$ ,  $20 \text{ m/s}^2$ ,  $10 - 500 \text{ Hz}$

IEC 60068–2–27: Shock:  $1000 \text{ m/s}^2$

IEC 60068–2–29: Bump: 4000 bumps at  $400 \text{ m/s}^2$

##### WEIGHT AND DIMENSIONS

650 g (23 oz.) including rechargeable battery

$300 \times 93 \times 50 \text{ mm}$  ( $11.8 \times 3.7 \times 1.9''$ ) including preamplifier and microphone

##### USERS

Multi-user concept with login. Users can have their own settings with jobs and projects totally independent of other users

##### PREFERENCES

Date, Time and Number formats can be specified per user

## LANGUAGE

User Interface in Catalan, Chinese (People's Republic of China), Chinese (Taiwan), Croatian, Czech, Danish, English, Flemish, French, German, Hungarian, Japanese, Italian, Korean, Polish, Portuguese, Romanian, Russian, Serbian, Slovenian, Spanish, Swedish and Turkish

## HELP

Concise context-sensitive help in English, French, German, Italian, Japanese, Korean, Polish, Portuguese, Romanian, Serbian, Slovenian and Spanish

## UPDATE OF SOFTWARE

Update to any version using BZ-5503 through USB or update via Internet:

- any version from 4.0 and up

## WEB PAGE

Connect to the instrument using an Internet Browser supporting Java script. The connection is password protected

### Two levels of protection:

- Guest level: for viewing only
- Administrator level: for viewing and full control of the instrument

## NOTIFICATIONS

Sends an SMS or e-mail if an alarm condition is fulfilled.

### Alarm Conditions:

- Disk Space below set value
- Trig. Input Voltage below set value
- Internal Battery enters set state
- Change in Measurement State
- Reboot of instrument

## Software Specifications – FFT Analysis Software BZ-7230

Specifications for FFT analysis are given for the Hand-held Analyzer with software BZ -7230 installed and fitted with one of the recommended transducers (see Table 0.1)

### FFT ANALYSIS

**Sampling Frequency:** Downsampling from 51.2 kHz

**Frequency Span:** 100 Hz, 200 Hz, 500 Hz, 1 kHz, 2 kHz, 5 kHz, 10 kHz, 20 kHz

**Lines:** 100, 200, 400, 800, 1600, 3200, 6400\*

**Zoom Centre Frequency:** Can be set so that the Frequency Span is placed in the range 0 to 20 kHz

**Spectrum:** Averaged and Maximum

**Pre-weighting:** Z (none), A, B or C

### MEASUREMENT CONTROL

#### Manual Start

Measurements can be manually started and stopped using a pushbutton or an external signal

**Exponential Averaging:** With an averaging time of up to 999 spectra, measured with Hanning window and 67% overlap

**Linear Averaging:** Up to 8388607 spectra measured with Hanning window and 67% overlap

### Triggered Start

**Transient Signal Type:** Linear averaging of up to 32767 triggered spectra measured with rectangular window and 0% overlap

**Continuous Signal Type:** Linear averaging of up to 32767 spectra measured with Hanning window and 67% overlap. Up to 32767 spectra are averaged on each trigger

**Auto-start:** A total of 10 timers allow set up of measurement start times up to a month in advance.

Each timer can be repeated. Measurements are automatically stored when completed

### TRIGGERS

**Delay:** From 16383 samples before the trigger time to 300 seconds after  
**Hold Off:** 0 to 300 s

**Internal Trigger:** Uses the time signal from the measurement transducer. The Internal Level is set in the relevant measurement units

**External Trigger:** Uses the Trigger Input. The External Level is set in the range -20 to 20 V

**Hysteresis (Only for External Trigger):** 0 to 10 V

**Slope (Only for External Trigger):** Rising, Falling

**Pull-up (Only for External Trigger):** For Type 2250 serial numbers between 2479653 and 2630265, the Trigger Input is pulled up to +5 V through a 7.5 kΩ resistor when this parameter field is set to *On*. For instruments with serial number 2630266 and above the Pull-up has been changed to a CCLD power supply

### MEASUREMENT RANGE

(See Table 0.1)

\* The actual number of lines is one more than stated, to provide symmetry around the centre frequency.

Table 0.1 Measurement ranges with the recommended transducers

Transducer	Nominal Sensitivity	Spurious Free Dynamic Range for High Levels	Spurious Free Dynamic Range for Low Levels	Typical Frequency Response Extended Low Frequency On/Off
Direct Input	1 V/V	3 μV – 14.1 V <sub>Peak</sub>	300 nV – 75 mV <sub>Peak</sub>	1.5/6.3 Hz – 20 kHz
4189	50 mV/Pa	10 dB – 143 dB <sub>Peak</sub>	-10 dB – 97.5 dB <sub>Peak</sub>	6.8/7.8 Hz – 20 kHz
4190	50 mV/Pa	10 dB – 143 dB <sub>Peak</sub>	-10 dB – 97.5 dB <sub>Peak</sub>	4.0/6.7 Hz – 20 kHz
4191	12.5 mV/Pa	22 dB – 155 dB <sub>Peak</sub>	2 dB – 109.5 dB <sub>Peak</sub>	3.6/6.6 Hz – 20 kHz
4193	12.5 mV/Pa	22 dB – 155 dB <sub>Peak</sub>	2 dB – 109.5 dB <sub>Peak</sub>	0.56/6.3 Hz – 20 kHz
4950	50 mV/Pa	10 dB – 143 dB <sub>Peak</sub>	-10 dB – 97.5 dB <sub>Peak</sub>	4.3/6.3 Hz – 19 kHz
4952	31.6 mV/Pa	14 dB – 146 dB <sub>Peak</sub>	-6 dB – 101.5 dB <sub>Peak</sub>	4.3/6.3 Hz – 14 kHz
4397-A	1 mV/ms <sup>-2</sup>	3 mm/s <sup>2</sup> – 7.1 km/s <sup>2</sup> <sub>Peak</sub>	300 μm/s <sup>2</sup> – 75 m/s <sup>2</sup> <sub>Peak</sub>	1.25/6.3 Hz – 20 kHz
4513/4514	1 mV/ms <sup>-2</sup>	3 mm/s <sup>2</sup> – 7.1 km/s <sup>2</sup> <sub>Peak</sub>	300 μm/s <sup>2</sup> – 75 m/s <sup>2</sup> <sub>Peak</sub>	1.25/6.3 Hz – 10 kHz
4513-001/4514-001	10 mV/ms <sup>-2</sup>	300 μms <sup>-2</sup> – 710 ms <sup>-2</sup> <sub>Peak</sub>	30 μms <sup>-2</sup> – 7.5 ms <sup>-2</sup> <sub>Peak</sub>	1.25/6.3 Hz – 10 kHz
4513-002/4514-002	50 mV/ms <sup>-2</sup>	60 μms <sup>-2</sup> – 141 ms <sup>-2</sup> <sub>Peak</sub>	6 μms <sup>-2</sup> – 1.5 ms <sup>-2</sup> <sub>Peak</sub>	1.25/6.3 Hz – 10 kHz
8324+ 2647-D	1 mV/ms <sup>-2</sup>	3 mms <sup>-2</sup> – 7.1 kms <sup>-2</sup> <sub>Peak</sub>	300 μms <sup>-2</sup> – 75 ms <sup>-2</sup> <sub>Peak</sub>	1.25/6.3 Hz – 10 kHz
8341	10 mV/ms <sup>-2</sup>	300 μms <sup>-2</sup> – 710 ms <sup>-2</sup> <sub>Peak</sub>	30 μms <sup>-2</sup> – 7.5 ms <sup>-2</sup> <sub>Peak</sub>	0.7/6.3 Hz – 10 kHz

The lower limit of the measurement range is influenced by self-generated random noise and self-generated tones called spurious signals. The influence of the random part can be reduced to a level below the spurious signals by selecting a small analysis bandwidth (small span and many lines). Therefore, the lower limit is specified as the maximum Peak level of the spurious signal lines

BZ-7230 has only one measuring range but the spurious level depends on the peak level of the signal. Therefore, two specifications are given. One for high levels, where the upper limit is the overload limit, and one for low levels

The Typical Frequency Response shows the  $\pm 1$  dB limits for Direct Input and microphones, and the  $\pm 10\%$  limits for accelerometers

#### RPM MEASUREMENT

RPM is measured on the signal connected to Trigger input when Tacho is set to *On*

**Range:** 1 to 6000000 RPM

**Instantaneous RPM:** Instantaneous RPM is only displayed (and not stored)

**Average RPM:** Displayed and stored together with each Spectrum result. In Linear Averaging it is an average over the same time as the spectrum. In Exponential averaging it is the last measured RPM

**Gear Ratio:**  $10^{-5}$  to  $10^{38}$ . The displayed RPM are the measured RPM divided by the RPM Gear Ratio.

#### OVERLOAD

**Instantaneous Overload:** Instantaneous Overload is displayed as an icon on the display and is also indicated by the Traffic Light

**Spectrum Overload:** Displayed and stored together with each Spectrum result

#### DISPLAY SPECTRA

Two spectra superimposed

**Scaling:** RMS, Peak, Peak-to-Peak, Power, PSD, ESD

**Reference Spectrum:** Compare spectrum to stored (measured) reference

**Axis:** Logarithmic or Linear Y-axis, Logarithmic or Linear X-axis

**X-axis:** Display full frequency range or expand the X-axis until only 20 FFT lines are displayed. Scroll available

**Y-axis Display Range:** 5, 10, 20, 40, 60, 80, 100, 120, 140, 160, 180 or 200 dB. Auto-zoom or Auto-scale available

**Digital Post-weighting:** Z (none) or A-weighting

#### DISPLAY PARAMETERS

**Sound:** Sound Pressure Level in dB

**Vibration:** Acceleration, velocity or displacement in dB or physical units. SI units ( $m/s^2$ , m/s or m) or US/UK units (g, m/s or Mil)

**Direct:** Voltage in dB or V

#### CURSORS

**Readings:** Total level within the spectrum.

**Frequency Correction:** For spectra measured with a Hanning Window, spectral peaks are interpolated to a higher precision

**Main:** Reads level versus frequency

**Symmetrical Delta and Delta:** Defines lower and upper frequency limit for any part of the spectrum and calculates the level sum within that frequency range

**Harmonic:** Identifies fundamental frequency and harmonics in the spectrum and calculates the Total Harmonic Distortion\* (THD)

**Reference:** Reads the difference between the main cursor Y-value and the reference cursor Y-value

\* Total Harmonic Distortion (THD) is the sum (in %) of all the harmonics relative to the sum of the fundamental and all the harmonics.

#### TOLERANCE CHECK

**Tolerance Window:** Determines the upper and lower levels and the top and bottom frequency at which the spectrum is checked. The check can either be made on all the FFT Lines within the specified range or on the Delta Sum of the lines.

The following parameters are measured for check on Delta Sum with exponential averaging:

- Delta Sum
- Max Delta Sum
- RPM at time for Max Delta Sum
- LAF at time for Max Delta Sum
- FFT Spectrum at time for Max Delta Sum

Up to 10 tolerance windows can be specified per template.

**Single Values Check:** Tolerances can be set for the parameters:  $L_{AF}$ , Instantaneous RPM,  $L_{Aeq}$  and Average RPM.

**Indication:** Results for each tolerance window and for the four single values can be displayed. An Overall Result (combination of all results) and a Latched Result (latched during measurement) can be displayed and are indicated in the status panel.

When tolerance limits are violated, a recording can be started (license for BZ-7226 required) and a 3.3 V DC signal (above upper limit), a  $-3.3$  V DC (below lower limit) or a signal alternating between 3.3 V and  $-3.3$  V (both above and below limits) can be output to the Output Socket

#### BAR GRAPH

LAF, LZP, Total of Spectrum and Delta Sum can be displayed on a bar graph with indication of Max Delta Sum and Upper and Lower Limits. For engineering units, the axis on Bar Graph can be logarithmic or Linear and can be zoomed

#### Sound Level Meter Parameters

Sound level meter (broadband) parameters are measured simultaneously with the FFT parameters, however, their measurement starts when the Start/Pause pushbutton is pressed and it ends at the nearest whole second after the end of the FFT measurement

Specifications for the Sound Level Meter parameters apply to Type 2270/2250 Hand-held Analyzer fitted with Microphone Type 4189 and Microphone Preamplifier ZC-0032

#### SELF-GENERATED NOISE LEVEL

Typical values at 23°C for nominal microphone open-circuit sensitivity:

Weighting	Microphone	Electrical	Total
"A"	14.6 dB	12.4 dB	16.6 dB
"B"	13.4 dB	11.5 dB	15.6 dB
"C"	13.5 dB	12.9 dB	16.2 dB
"Z" 5 Hz–20 kHz	15.3 dB	18.3 dB	20.1 dB
"Z" 3 Hz–20 kHz	15.3 dB	25.5 dB	25.9 dB

Conforms with the following National and International Standards:

- IEC 61672 –1 (2002–05) Class 1
- IEC 60651 (1979) plus Amendment 1 (1993–02) and Amendment 2 (2000–10), Type 1
- IEC 60804 (2000–10), Type 1
- DIN 45657 (1997–07)
- ANSI S1.4–1983 plus ANSI S1.4A–1985 Amendment, Type 1
- ANSI S1.43–1997, Type 1

**Note:** The International IEC Standards are adopted as European standards by CENELEC. When this happens, the letters IEC are replaced with EN and the number is retained. The analyzer also conforms to these EN Standards

#### DETECTORS

**Parallel Detectors** on every measurement:

**A- or B-weighted** (switchable) broadband detector channel with 'Fast' time weighting, one linearly averaging detector and one peak detector

**C- or Z-weighted** (switchable) as for A- or B-weighted

**Overload Detector:** Monitors the overload outputs of all the frequency weighted channels

## MEASUREMENTS

X = frequency weightings A or B

Y = frequency weightings C or Z

V = frequency weightings A, B, C or Z

### For Display and Storage

Start Time	Stop Time	Overload %
Elapsed Time	$L_{Xeq}$	$L_{Yeq}$
$L_{XFmax}$	$L_{YFmax}$	$L_{XFmin}$
$L_{YFmin}$	$L_{Xleq}$	$L_{Yleq}$
$L_{AFTeq}$	$L_{Vpeak}$	

### Only for Display as Numbers

$L_{XF}$        $L_{YF}$

### Weather Data (requires connection to a weather station):

Wind Dir. avg.

Wind Dir. min.

Wind Dir. max.

Wind Speed avg.

Wind Speed min.

Wind Speed max.

Amb. Temperature

Amb. Humidity

Amb. Pressure

Amb. Rain Gauge

### Instantaneous Weather Data:

Wind Dir.

Wind Speed

### Instantaneous GPS Data:

Latitude

Longitude

## MEASURING RANGES

When using Microphone Type 4189:

**Dynamic Range:** From typical noise floor to max. level for a 1 kHz pure tone signal, A-weighted: 16.6 to 140 dB

**Primary Indicator Range:** In accordance with IEC 60651, A-weighted: 23.5 dB to 123 dB

**Linearity Range:** In accordance with IEC 60804, A-weighted: 21.4 dB to 140 dB

**Linear Operating Range:** In accordance with IEC 61672, A-weighted: 1 kHz: 24.8 dB to 140 dB

**Peak C Range:** In accordance with IEC 61672: 42.3 dB to 143 dB

**Broadband parameters for Accelerometer inputs:** When Type 2270/2250 Hand-held Analyzer is fitted with an accelerometer, the following broadband parameters can be displayed in engineering units:

- $L_{Xeq}$
- $L_{Yeq}$
- $L_{XFmax}$
- $L_{YFmax}$
- $L_{XFmin}$
- $L_{YFmin}$
- $L_{Vpeak}$
- $L_{XF}$
- $L_{YF}$

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## Software Specifications – Tone Assessment Option BZ-7231

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### LICENSE

Tone Assessment Option BZ-7231 is enabled with a separate license and can be used with the FFT template

### STANDARD

Tone assessment is based on the measured FFT spectrum in accordance with "ISO 1996 – 2:2007 Acoustics - Description, assessment and measurement of environmental noise - part 2: Determination of environmental noise levels. Annex C (informative) Objective method for assessing the audibility of tones in noise - Reference method" or with "Denmark 1984/1991: Vejledning nr. 6, 1984 fra miljøstyrelsen: Måling af ekstern støj fra virksomheder, Orientering nr 13, 1991 fra miljøstyrelsens referencelaboratorium for støjmålinger: Måling af hørbare toner i støj"

### SPECTRA ASSESSED

Any displayed sound FFT spectrum (FFT, Ref, MAX or spectrum obtained at Max Delta Sum) may be assessed  
Assessment is made as post-processing, i.e., when measurement is paused or stopped

### SETUP ACCORDING TO STANDARD

**Default Setup:** please refer to Table 7.1

Setups in violation of the standard are indicated as such on the display, you may then accept to apply the default setup

Tone assessment will be made if possible, in spite of standard violations

**Tone Seek Criterion:** 0.1 to 4.0 dB in 0.1 dB steps

### TONE AT CURSOR

A sinusoidal tone is available at the Headphone output, to help confirm identified tones

**Frequency:** the frequency is selected by the Main cursor

**Gain:** -70 dB to +10 dB

**Options:** The generated tone may be mixed with the input signal, please refer to the Preferences/Headphone Settings described in section 7.7.3

### TONE ASSESSMENT CURSOR

All tones found are indicated in the display.

The Tone cursor is initially placed at the most prominent tone, and may then be stepped through the tones found

You can also use the Main cursor to step through the tones

### RESULTS

Results are displayed in the Tone panel and in the Value panel  
They are not saved with the measurement

**All Tones:** Frequency, Tone level  $L_{pti}$ , Masking noise level  $L_{pn}$ , Audibility  $\Delta L_{ta}$ , Critical band CB,  
Critical band  $f_c$

**Most Prominent Tone:** Tone Level  $L_{pt}$ , Adjustment  $K_t$

### QUALITY INDICATORS

In the display, a quality indicator (smiley) will indicate that a hint is available for tone assessment quality. Click on the indicator to see the hint (listed in Table 7.2)

## Software Specifications – Signal Recording Option BZ-7226

### RECORDING

Recording Option BZ-7226 is enabled with a separate license  
Recording requires a CF- or SD-Card for data storage

### AUTOMATIC GAIN CONTROL

The average level of the signal is kept within a 40 dB range, or the gain can be fixed.

### SAMPLING RATE AND PRE-RECORDING

The signal is buffered for the pre-recording of the signal. This allows the beginnings of events to be recorded even if they are only detected later.

Sampling Rate (kHz)	Maximum Pre-recording (s) 16 bit	Maximum Pre-recording (s) 24 bit	Memory (KB/s) 16 bit	Memory (KB/s) 24 bit
8	470	310	16	24
16	230	150	32	48
24	150	96	48	72
48	70	43	96	144

**Manual Control of Recording:** Recording can be manually started and stopped during a measurement using a pushbutton

**Automatic Control of Recording:** Start of recording when measurement is started. Minimum and Maximum recording time can be preset

**Tolerance Level:** Recording is started when the tolerance limits are violated

### PLAYBACK

Playback of signal recordings can be listened to using the earphone/headphones connected to the headphone socket

### RECORDING FORMAT

The recording format is 24-bit or 16-bit wave files (extension .wav) attached to the data in the project, easily played-back afterwards on a PC using BZ-5503 or 7820. Calibration information is stored in the wav file, allowing PULSE to analyse the recordings

### RECORDED SIGNAL

The Z-weighted signal from the measurement transducer

## Software Specifications – Measurement Partner Suite BZ-5503

BZ-5503 is included with the Hand-held Analyzer for easy synchronisation of setups and data between PC and Analyzer. BZ-5503 is supplied on CD-ROM BZ-5298

### ON-LINE DISPLAY OF TYPE 2270/2250 DATA

Measurements on the analyzer can be controlled from the PC and displayed on-line with the PC, using the same user interface on the PC as on the analyzer

### DATA MANAGEMENT

**Explorer:** Facilities for easy management of analyzers, users, jobs, projects and project templates (copy, cut, paste, delete, rename, create)

**Data Viewer:** View measurement data (content of projects)

**Template Editor:** Editor for changing setups in Project Templates

**Synchronisation:** Project Templates and Projects for a specific user can be synchronised between the PC and Type 2250/2270

### USERS

Users of the analyzer can be created or deleted

### EXPORT FACILITIES

**Excel:** FFT Projects can be exported to Microsoft® Excel®

**Type 7820:** FFT Projects can be exported to Evaluator Type 7820

### HAND-HELD ANALYZER SOFTWARE UPGRADES AND LICENSES

Utility software controls the analyzer software upgrades and licensing of the analyzer applications

### INTERFACE TO HAND-HELD ANALYZER

USB ver. 1.1 or Hayes compatible GSM or standard analogue modem

### PC REQUIREMENT

**Operating System:** Windows® 7/XP or Windows Vista® (32 and 64 bit versions) and Microsoft® .NET

**Recommended PC:** Pentium® III (or equivalent) processor, 2048 Mbyte RAM, SVGA graphics display/adaptor, sound card, DVD drive, mouse, USB, Windows® 7

## Ordering Information

**2250-H-D01** Hand-held Analyzer Type 2250 with BZ-7230 FFT Analysis Software

Included with 2250-H-D01:

- AO-1476: USB Standard A to USB Mini B Interface Cable for hardware versions 1 – 3, 1.8 m (6 ft)
- AO-1494: USB Standard A to USB Micro B Interface Cable for hardware version 4, 1.8 m (6 ft)
- BZ-5298: Environmental Software, including BZ-5503 Measurement Partner Suite
- BZ-7230: FFT Analysis Software
- DD-0594: Protection Plugs for Top Socket
- FB-0679: Hinged Cover for Hand-held Analyzer
- KE-0459: Shoulder Bag
- QB-0061: Battery Pack
- UA-1654: 5 Extra Styli
- UA-1673: Adaptor for Standard Tripod Mount
- ZG-0426: Mains Power Supply

**2270-H-D02** Hand-held Analyzer Type 2270 with BZ-7222 Sound Level Meter and BZ-7230 FFT Analysis Software

**2250-H-D02** Hand-held Analyzer Type 2250 with BZ-7222 Sound Level Meter and BZ-7230 FFT Analysis Software

Included with 2270-H-D02 and 2250-H-D02:

- Type 4189: Prepolarized Free-field 1/2" Microphone
- ZC-0032: Microphone Preamplifier
- BZ-7222: Sound Level Meter software
- BZ-7230: FFT Analysis Software
- KE-0440: Travel Bag
- KE-0441: Protective Cover for Type 2250
- DH-0696: Wrist Strap
- UA-1650: 90 mm dia. Windscreen with AutoDetect
- UA-1651: Tripod Extension for Hand-held Analyzer
- UA-1654: 5 Extra Styli
- UA-1673: Adaptor for Standard Tripod Mount
- QB-0061: Battery Pack
- ZG-0426: Mains Power Supply
- AO-1476: USB Standard A to USB Mini B Interface Cable for hardware versions 1 – 3, 1.8 m (6 ft)
- AO-1494: USB Standard A to USB Micro B Interface Cable for hardware version 4, 1.8 m (6 ft)
- HT-0015: Earphones
- BZ-5298: Environmental Software, including BZ-5503 Measurement Partner Suite
- FB-0679: Hinged Cover for Hand-held Analyzer

**2270-H-D03** Hand-held Analyzer Type 2270 with BZ-7222 Sound Level Meter Software, BZ-7223 Frequency Analysis Software, BZ-7226 Signal Recording Option and BZ-7230 FFT Analysis Software

**2250-H-D03** Hand-held Analyzer Type 2250 with BZ-7222 Sound Level Meter Software, BZ-7223 Frequency Analysis Software, BZ-7226 Signal Recording Option and BZ-7230 FFT Analysis Software

Included with 2270-H-D03 and 2250-H-D03:

- Type 4189: Prepolarized Free-field 1/2" Microphone
- ZC-0032: Microphone Preamplifier
- BZ-7222: Sound Level Meter software
- BZ-7223: Frequency Analysis Software
- BZ-7226: Signal Recording Option
- BZ-7230: FFT Analysis Software
- KE-0440: Travel Bag
- KE-0441: Protective Cover for Type 2250
- DH-0696: Wrist Strap
- UA-1650: 90 mm dia. Windscreen with AutoDetect
- UA-1651: Tripod Extension for Hand-held Analyzer
- UA-1654: 5 Extra Styli
- UA-1673: Adaptor for Standard Tripod Mount
- QB-0061: Battery Pack
- ZG-0426: Mains Power Supply
- AO-1476: USB Standard A to USB Mini B Interface Cable for hardware versions 1 – 3, 1.8 m (6 ft)
- AO-1494: USB Standard A to USB Micro B Interface Cable for hardware version 4, 1.8 m (6 ft)
- HT-0015: Earphones
- BZ-5298: Environmental Software, including BZ-5503 Measurement Partner Suite
- UL-1009: SD Memory Card for Hand-held Analyzers
- FB-0679: Hinged Cover for Hand-held Analyzer

### TRADEMARKS

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