

## APPENDIX

### Technical Specifications

#### Generator & Analyzer

*Level flatness of the combined generator & analyzer*

- 100 Hz – 10 kHz < ±0.1 dB
- 20 Hz – 20 kHz < ±0.2 dB

*Temperature coefficient*

0.025 dB / 5 °C in the operation range +5 to +45 °C with minimum 12 mm free rack space above and below the RT unit as well as free air circulation

#### Multitone Generator

*Number of frequencies (signal bins) per multitone signal*

1 – 31

*Sampling rate (fs)*

48 kHz

*Frequency range*

20 Hz – 20 kHz

*Number of channels*

2 independent channels with individual levels

*Level range (balanced)*

–60 to +29 dBVp in 0.1 dB steps (0.1 mVp to 28 Vp)  
–60.8 to +28.1 dBm @ 600 Ω, sine signal (1–tone)

*Level setting resolution*

0.1 dB

*Maximum load*

150 Ω HIGH to LOW (level ≤ 23 dBVp [14.14 Vp])  
2.0 kΩ HIGH to LOW (whole level range)

*Variable BinLevel dynamic range*

60 dB

*Level accuracy @ 1 kHz*

< ±0.1 dB

*Level flatness*

- 100 Hz – 10 kHz < ±0.1 dB
- 20 Hz – 20 kHz < ±0.2 dB

*Frequency resolution*

5.85 – 93.6 Hz (depending on blocklength)

*Frequency accuracy*

< ±50 ppm

*Blocklength*

512, 1024, 2048, 4096, 8192

*Residual distortion*

< –86 dB (16 bit DAC)

*Number of stereo multitone signal memories*

4 programmable

*Selectable output impedance per channel*

150 Ω, 600 Ω

## Stepped Sweep Generator

<i>Number of channels</i>	2 channels with individual levels
<i>Sampling rate (fs)</i>	48 kHz
<i>Frequency range</i>	20 Hz – 20 kHz
<i>Level range (balanced)</i>	–60 to +29 dBVp in 0.1 dB steps (0.1 mVp to 28 Vp) –60.8 to +28.1 dBm @ 600 Ω
<i>Level setting resolution</i>	0.1 dB
<i>Maximum load</i>	150 Ω    HIGH to LOW (level ≤ 23 dBVp [14.14 Vp]) 2.0 kΩ    HIGH to LOW (whole level range)
<i>Amplitude shape dynamic range</i>	60 dB
<i>Level accuracy @ 1 kHz</i>	< ±0.1 dB
<i>Level flatness</i>	
• 100 Hz – 10 kHz	< ±0.1 dB
• 20 Hz – 20 kHz	< ±0.2 dB
<i>Frequency resolution</i>	1 – 500 steps
<i>Frequency accuracy</i>	< ±50 ppm
<i>Residual distortion</i>	< –86 dB (16 bit DAC)

## Chirp Generator

<i>Number of channels</i>	2 channels with individual levels
<i>Sampling rate (fs)</i>	48 kHz
<i>Frequency range</i>	20 Hz – 6 kHz
<i>Level range (balanced)</i>	–60 to +29 dBVp in 0.1 dB steps (0.1 mVp to 28 Vp) –60.8 to +28.1 dBm @ 600 Ω
<i>Level setting resolution</i>	0.1 dB
<i>Level accuracy @ 1 kHz</i>	< ±0.1 dB
<i>Level flatness</i>	
• 100 Hz – 6 kHz	< ±0.1 dB
• 20 Hz – 6 kHz	< ±0.2 dB
<i>Maximum load</i>	150 Ω    HIGH to LOW (level ≤ 23 dBVp [14.14 Vp]) 2.0 kΩ    HIGH to LOW (whole level range)
<i>Frequency accuracy</i>	< ±50 ppm

## External Output Load

<i>Absolute maximum DC load</i>	
• High/Low to GND	±10 V <sub>DC</sub>
• High to Low	±20 V <sub>DC</sub>
<i>Absolute maximum AC load</i>	./ (not permitted)

## Analyzer

<i>Number of channels</i>	2 independent channels with individual input range		
<i>Sampling rate (fs)</i>	48 kHz		
<i>Bandwidth</i>	20 Hz – 20 kHz		
<i>Level range</i>	–60 to +40 dBVp (0.1 mVp to 100 Vp)		
<i>Level accuracy @ 1 kHz</i>	< ±0.1 dB		
<i>Level flatness</i>	< ±0.1 dB @ 100 Hz – 10 kHz < ±0.2 dB @ 20 Hz – 20 kHz		
<i>Level resolution at full scale</i>	20 bit		
<i>Residual distortion @ level +25 to –20 dBVp</i>			
▪ <i>THD+N (1-tone)</i>	< –86 dB		
▪ <i>Multiton-SINAD (3-tone)</i>	> 86 dB		
<i>Residual noise</i>	< –100 dBV (10 µV)		
<i>Residual input idle channel noise @ C-message filter active, inputs shorted, input range @ –60 dBVp</i>	< –18 dBnc (–108 dBm @ 600 Ω)		
<i>Phase accuracy (interchannel)</i>	±1.0 deg @ 20 Hz – 17 kHz ±1.3 deg @ 17 kHz – 20 kHz		
<i>Residual interchannel crosstalk @ level +25 to –20 dBVp</i>	< –80dB @ 20 Hz – 10 kHz < –75dB @ 10 kHz – 20 kHz		
<i>Internal frequency resolution</i>	<i>Blocklength</i>	<i>Frequency resolution</i>	
	512	46.9 Hz	
	1024	23.4 Hz	
	2048	11.7 Hz	
	4096	5.86 Hz	
	8192	2.93 Hz	
<i>Internal frequency accuracy</i>	±50 ppm		
<i>Frequency measurement range and accuracy of an external signal</i>	<i>Blocklength</i>	<i>Measurement range</i>	<i>Measurement accuracy</i> <sup>5</sup>
	512	187.5 – 19968.8 Hz	± (0.4 Hz + 25 ppm of $f_m$ )
	1024	93.8 – 19968.8 Hz	± (0.2 Hz + 25 ppm of $f_m$ )
	2048	46.8 – 19992.2 Hz	± (0.1 Hz + 25 ppm of $f_m$ )
	4096	23.45 – 19992.2 Hz	± (0.05 Hz + 25 ppm of $f_m$ )
	8192	23.43 – 19998.05 Hz	± (0.025 Hz + 25 ppm of $f_m$ )
<i>Selectable input impedance per channel</i>	100 kΩ, 600 Ω		
<i>Input impedance accuracy</i>	Return Loss ≥ 46 dB or 1% of resistor value		
<i>Input impedance coupling</i>	DC coupled		
<i>Phantom power voltage</i>	48 V <sub>DC</sub> or 15 V <sub>DC</sub>		
<i>Phantom voltage accuracy</i>	±1 V <sub>DC</sub>		
<i>Phantom power inward resistance</i>			
▪ 48 V	6.8 kΩ		
▪ 15 V	1.0 kΩ		

<sup>5</sup>  $f_m$  = measured frequency (e.g.:  $f_s = 48$  kHz, blocklength = 2048,  $f_m = 2'100$  Hz ⇒ accuracy = ±0.1525 Hz)

<i>ICP power supply option</i>	
▪ <i>Open circuit voltage</i>	25.7 V $\pm$ 5%
▪ <i>Current Source</i>	3.6 mA $\pm$ 20%
<i>Signal transmission time</i>	260 – 1500 ms (depending on blocklength)
<i>Synchronization &amp; trigger modes</i>	<ul style="list-style-type: none"> <li>▪ Internal with header (analyzer triggers to proprietary header of the same <i>RT-2M</i>)</li> <li>▪ Internal without header (analyzer triggers to generator of the same <i>RT-2M</i>; no proprietary header involved)</li> <li>▪ External with header (analyzer triggers to proprietary header that was generated by an external signal source)</li> <li>▪ Threshold (analyzer triggers as soon as the input signal exceeds the custom-defined threshold level)</li> </ul>
<i>Filters</i>	<ul style="list-style-type: none"> <li>▪ C-message weighting filter according to north american standard</li> <li>▪ CCITT psophometric weighting filter according to ITU O.41</li> <li>▪ A-weighting filter according to IEC 651</li> <li>▪ 750 <math>\mu</math>s De-emphasis</li> </ul>
<i>Standard measurements</i>	Level vs. frequency, Selective Level, Gain vs. frequency, Distortion vs. frequency, Noise vs. frequency, Phase vs. frequency, Crosstalk vs. frequency, MT-SINAD, Frequency (full band or selective)
<i>Optional measurements</i>	Longitudinal Conversion Loss (LCL), Longitudinal Conversion Transfer Loss (LCTL), Return Loss (RL), Echo Return Loss (ERL), Singing Return Loss (SRL high, SRL low)  Transient Steepness (Rub & Buzz, sound correlation)
<i>Test cycle time @ blocklength 512, 3 signal bins</i>	500 ms typical

## External Input Load

<i>Absolute maximum DC load</i>	
▪ <i>input impedance = 100 k<math>\Omega</math>, HIGH/LOW to GND</i>	$\pm$ 120 V <sub>DC</sub>
▪ <i>input impedance <math>\neq</math> 100 k<math>\Omega</math>, HIGH/LOW to GND</i>	$\pm$ 30 V <sub>DC</sub> (overvoltage protection switches to 100 k $\Omega$ if U <sub>in</sub> > $\pm$ 30 V <sub>DC</sub> )
<i>Absolute maximum AC load</i>	
▪ <i>input impedance = 100 k<math>\Omega</math>, HIGH/LOW to GND</i>	$\pm$ 120 V <sub>AC</sub> (sine signal)
▪ <i>input impedance <math>\neq</math> 100 k<math>\Omega</math>, HIGH/LOW to GND or HIGH to LOW</i>	$\pm$ 30 V <sub>pAC</sub> <sup>6</sup> (overvoltage protection switches to 100 k $\Omega$ if U <sub>in</sub> > $\pm$ 30 V <sub>DC</sub> )

<sup>6</sup> Example: 30 V<sub>pAC</sub>  $\cong$  28.8 dBm @ 600  $\Omega$ , sine signal

## DTMF Generator

<i>DTMF availability</i>	Analog and digital mode
<i>DTMF tones (4 x 4 keys)</i>	1 – 9, *, 0, #, A – D
<i>Frequency deviation</i>	±5 % selectable in 0.01% steps
<i>Frequency accuracy</i>	±25 ppm
<i>Amplitude ratio</i>	0.1 – 10 selectable
<i>DTMF tone length</i>	1 – 5000 ms selectable

## DTMF Analyzer

<i>DTMF key recognition</i>	Analog
<i>Valid input signal levels</i>	maximum –20 dB below input range
<i>Freq. deviation acceptance</i>	±1.5 %
<i>Tone duration acceptance</i>	minimum 50 ms
<i>Interdigit pause acceptance</i>	minimum 50 ms

## Options & Accessories

<i>PureSound™ license</i>	Key code to enable the transient steepness analysis functions. Required for Rub & Buzz and sound correlation measurements. Also includes RT-Speaker software for production applications.
<i>XLR adapter</i>	Hook-up box for <i>RT-2M</i> input connectors. Provides 2 pcs. XLR inputs, e.g. for the operation of the 3382 and 3384 measuring microphones.
<i>M2010 measuring microphone</i>	Balanced ½" omni-directional microphone, 20 Hz – 20 kHz, flatness ±0.5 dB (class 1), 48 V Phantom power required.

## General

<i>Dimensions</i>	483 x 318 x 44 mm (19" x 12.5" x 1.75", i.e. 1 rack unit high)
<i>Weight</i>	7 kg (15 lbs.)
<i>Remote control interfaces</i>	GPIB (IEEE-488.2) RS232 (38400 bps, 8 databits, 1 stopbit, no parity; protocol RTS/CTS; requires NTI RS232 cable)
<i>Standard software</i>	RT-EVAL evaluation software package National Instruments LabView and LabWindows CVI drivers
<i>Mains power requirements</i>	100, 120, 230 V <sub>AC</sub> / 50, 60 Hz / 60 VA
<i>Calibration</i>	1 year recommend calibration interval
<i>Operating temperature</i>	+5 to +45 °C (+40 to +110 F), R.H. < 90 % non condensing