

APPENDIX

Technical Specifications

Analog 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 (½") free rack space above & below the RT-2X and free air circulation

Analog Multitone Generator

Number of frequencies (signal bins) per multitone signal 1 – 31

Sampling rate (fs) 48 kHz or 8 kHz

Frequency range

- 48 kHz sampling rate 20 Hz – 20 kHz
- 8 kHz sampling rate 20 Hz – 4 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

- 48 kHz sampling rate 5.85 – 93.6 Hz (depending on blocklength)
- 8 kHz sampling rate 3.91 – 62.5 Hz (depending on blocklength)

Frequency accuracy < ±50 ppm

Blocklength

- 48 kHz sampling rate 512, 1024, 2048, 4096, 8192
- 8 kHz sampling rate 128, 256, 512, 1024, 2048

Residual distortion < –86 dB (16 bit DAC)

Number of stereo multitone signal memories 8 programmable (4 per sampling rate)
3 predefined (ERL, SRLLO, SRLHI)

Selectable output impedance per channel 150, 200, 600, 850, 900 Ω; complex (220 + 820 Ω || 115 nF)
optional: 4 custom-defined impedance (real or complex)

Output impedance accuracy

- real impedance Return Loss ≥ 46 dB or 1% of resistor value
- complex impedance Return Loss ≥ 35 dB or 1% of resistor value, 5% of capacitor value

Analog 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)	

Analog 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 (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>Without LCL/RL option</i>	<i>With LCL/RL option</i>
<i>Absolute maximum DC load</i>		
• High/Low to GND	±10 V _{DC}	±77 V _{DC} ⁸ (AC-coupling ON)
• High to Low	±20 V _{DC}	±77 V _{DC} ⁸ (AC-coupling ON)
<i>Absolute maximum AC load</i>	./. (not permitted)	150 V _{AC} ⁸ (refers to standard ringing voltage: 2 sec. ON – 4 sec. OFF, f = 15 – 68 Hz, R _{Source} ≥ 400 Ω)

⁸ Refer to paragraph ***LCL/RL Option → Protection circuit*** for further details



Analog Analyzer

<i>Number of channels</i>	2 independent channels with individual input range	
<i>Sampling rate (fs)</i>	48 kHz or 8 kHz	
<i>Bandwidth</i>	<ul style="list-style-type: none"> • 48 kHz sampling rate 20 Hz – 20 kHz • 8 kHz sampling rate 20 Hz – 3.4 kHz 	
<i>Input range</i>	–60 to +40 dBVp in 0.1 dB steps (1 mVp to 100 Vp)	
<i>Measurement range</i>	< 1 μ Vp to 100 Vp (–120 dBVp to 40 dBVp)	
<i>Level accuracy @ 1 kHz</i>	< \pm 0.1 dB	
<i>Level flatness @ fs = 48 kHz</i>	<ul style="list-style-type: none"> • 100 Hz – 10 kHz < \pm0.1 dB • 20 Hz – 20 kHz < \pm0.2 dB 	
<i>Level flatness @ fs = 8 kHz</i>	<ul style="list-style-type: none"> • 20 Hz – 3.4 kHz < \pm0.2 dB • 3.4 kHz – 4 kHz –3 dB @ 3.55 kHz to –26.5 dB @ 4 kHz 	
<i>Level resolution at full scale</i>	20 bit	
<i>Residual distortion @ fs = 48 kHz</i>	<ul style="list-style-type: none"> level +25 to –20 dBVp • THD+N (1-tone) < –86 dB • Multiton-SINAD (3-tone) > 86 dB 	
<i>Residual noise @ fs = 48 kHz</i>	< –100 dBV (10 μ V)	
<i>Residual input idle channel noise @ fs = 8 kHz, C-message filter active, inputs shorted, input range @ –60 dBVp</i>	< –18 dBrc (–108 dBm @ 600 Ω)	
<i>Phase accuracy (interchannel)</i>	\pm 1 deg @ 20 Hz – 20 kHz	
<i>Residual interchannel crosstalk @ level +25 to –20 dBVp</i>	<ul style="list-style-type: none"> • 20 Hz – 10 kHz < –80dB • 10 kHz – 20 kHz < –75dB 	
<i>Internal frequency resolution @ fs = 48 kHz</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 resolution @ fs = 8 kHz</i>	<i>Blocklength</i>	<i>Frequency resolution</i>
	128	31.3 Hz
	256	15.6 Hz
	512	7.81 Hz
	1024	3.90 Hz
	2048	1.95 Hz
<i>Internal frequency accuracy</i>	\pm 50 ppm	



<i>Frequency measurement range and accuracy of an external signal, $f_s = 48$ kHz</i>	<i>Blocklength</i>	<i>Measurement range</i>	<i>Measurement accuracy</i> ⁹
	512	187.5 – 19968.8 Hz	$\pm (0.4 \text{ Hz} + 25 \text{ ppm of } f_m)$
	1024	93.8 – 19968.8 Hz	$\pm (0.2 \text{ Hz} + 25 \text{ ppm of } f_m)$
	2048	46.8 – 19992.2 Hz	$\pm (0.1 \text{ Hz} + 25 \text{ ppm of } f_m)$
	4096	23.45 – 19992.2 Hz	$\pm (0.05 \text{ Hz} + 25 \text{ ppm of } f_m)$
	8192	23.43 – 19998.05 Hz	$\pm (0.025 \text{ Hz} + 25 \text{ ppm of } f_m)$
<i>Frequency measurement range and accuracy of an external signal, $f_s = 8$ kHz</i>	<i>Blocklength</i>	<i>Measurement range</i>	<i>Measurement accuracy</i> ⁹
	128	115 Hz – 3.55 kHz	$\pm (0.28 \text{ Hz} + 25 \text{ ppm of } f_m)$
	256	62.5 Hz – 3.55 kHz	$\pm (0.14 \text{ Hz} + 25 \text{ ppm of } f_m)$
	512	31.25 Hz – 3.55 kHz	$\pm (0.07 \text{ Hz} + 25 \text{ ppm of } f_m)$
	1024	23.43 Hz – 3.55 kHz	$\pm (0.035 \text{ Hz} + 25 \text{ ppm of } f_m)$
	2048	23.43 Hz – 3.55 kHz	$\pm (0.018 \text{ Hz} + 25 \text{ ppm of } f_m)$
<i>Selectable input impedance per channel</i>	100 k, 900, 850, 600, 200, 150 Ω ; complex (220 + 820 Ω 115 nF) optional: 4 custom-defined impedance (real or complex)		
<i>Input impedance accuracy</i>	Return Loss ≥ 46 dB or 1% of resistor value		
▪ <i>real impedance</i>	Return Loss ≥ 35 dB or 1% of resistor value, 5% of capacitor value		
▪ <i>complex impedance</i>			
<i>Input impedance coupling</i>	DC coupled		
▪ <i>real impedance</i>	AC coupled		
▪ <i>complex impedance</i>			
<i>Phantom power voltage</i>	48 V _{DC} or 15 V _{DC}		
<i>Phantom voltage accuracy</i>	± 1 V _{DC}		
<i>Phantom power inward resistance</i>	6.8 k Ω @ 48 V 1.0 k Ω @ 15 V		
<i>ICP power supply option</i>	25.7 V $\pm 5\%$		
▪ <i>Open circuit voltage</i>	3.6 mA $\pm 20\%$		
▪ <i>Current Source</i>			
<i>Signal transmission time</i>	260 – 1500 ms (depending on sampling rate and blocklength)		
<i>Synchronization & trigger modes</i>	<ul style="list-style-type: none"> ▪ Internal with header (analyzer triggers to proprietary header of the same RT-2X) ▪ Internal without header (analyzer triggers to generator of the same RT-2X; no proprietary header involved) ▪ External with header (analyzer triggers to proprietary header that was generated by an external signal source) ▪ Threshold (analyzer triggers as soon as the input signal exceeds the custom-defined threshold level) 		
<i>Filters</i>	<ul style="list-style-type: none"> ▪ C-message weighting filter according to north american standard ▪ CCITT psophometric weighting filter according to ITU O.41 ▪ A-weighting filter according to IEC 651 ▪ 750 μs De-emphasis 		
<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)		

⁹ f_m = measured frequency (e.g.: $f_s = 48$ kHz, blocklength = 2048, $f_m = 2'100$ Hz \Rightarrow accuracy = ± 0.1525 Hz)

Test cycle time @ $f_s = 48$ kHz, 500 ms typical
 blocklength 512, 3 signal
 bins

Test cycle time @ $f_s = 8$ kHz, 620 ms typical
 blocklength 128, 3 signal
 bins

External Input Load

	Without LCL/RL option	With LCL/RL option
Absolute maximum DC load		
▪ input impedance = 100 k Ω , HIGH/LOW to GND	± 120 V _{DC}	± 77 V _{DC} ¹⁰ (AC-coupling ON)
▪ input impedance \neq 100 k Ω , HIGH/LOW to GND	± 30 V _{DC} (overvoltage protection switches to 100 k Ω if $U_{In} > \pm 30$ V _{DC})	
Absolute maximum AC load		
▪ input impedance = 100 k Ω , HIGH/LOW to GND	± 120 V _{AC} (sine signal)	150 V _{AC} (refers to standard ringing voltage: 2 sec. ON – 4 sec. OFF, $f = 15 - 68$ Hz, $R_{Source} \geq 400$ Ω)
▪ input impedance \neq 100 k Ω , HIGH/LOW to GND or HIGH to LOW	± 30 V _{pAC} ¹¹ (overvoltage protection switches to 100 k Ω if $U_{In} > \pm 30$ V _{DC})	

¹⁰ Refer to paragraph **LCL/RL Option** → **Protection circuit** for further details

¹¹ Example: 30 V_{pAC} \cong 28.8 dBm @ 600 Ω , sine signal

LCL / RL Option

<i>Measuring standard</i>	IEEE 455-1985			
<i>Reference impedance</i>	736 Ω			
<i>Protection circuit</i>	<ul style="list-style-type: none"> • <i>Threshold output AC load</i> 28.28 Vp (20 V_{RMS})¹² • <i>Threshold input AC load</i> 125 Vp (88.4 V_{RMS})¹² • <i>Maximum DC load</i> ± 77 VDC (AC-coupling ON) or 0 VDC (AC-coupling OFF) • <i>Maximum AC load</i> 150 V_{RMS} (refers to standard ringing voltage: 2 sec. ON – 4 sec. OFF, f = 15 – 68 Hz, R_{Source} \geq 400 Ω) 			
<i>Maximum output level</i>	<ul style="list-style-type: none"> • <i>LCL, LCTL A-A, A-D mode</i> 7.0 Vp (16.9 dBVp, 15.2 dBm) @ 736 Ω • <i>LCTL D-A mode</i> 200.0 %FSp (6.0 dBFSp, 9.2 dBm0) 			
<i>Maximum input level</i>	<ul style="list-style-type: none"> • <i>LCL mode</i> 15.2 dBm @ 736 Ω • <i>LCTL A-A mode</i> 12.0 Vp (21.6 dBVp, 20.0 dBm) @ 736 Ω • <i>LCTL A-D mode</i> 15.2 dBm0 @ 736 Ω • <i>LCTL D-A mode</i> 7.0 Vp (16.9 dBVp, 15.2 dBm) @ 736 Ω 			
<i>LCL, LCTL measuring accuracy</i>	<i>LCL range</i>	<i>20 – 200 Hz</i>	<i>200 Hz – 4 kHz</i>	<i>4 – 20 kHz</i>
	0 – 60 dB	< 0.5 dB	< 0.3 dB	< 0.5 dB
	60 – 70 dB	< 1.5 dB	< 0.8 dB	< 1.5 dB
	70 – 80 dB	< 5.5 dB	< 3.0 dB	< 5.5 dB
	80 – 85 dB	< 8.5 dB	< 6.0 dB	< 8.5 dB
<i>RL output level</i>	–20 to +14 dBVp			
<i>RL measuring accuracy with a real DUT</i>	<i>RL range</i>	<i>fs = 8 kHz, i.e. bandwidth 200 Hz – 4 kHz</i>	<i>fs = 48 kHz, i.e. bandwidth 200 Hz – 20 kHz</i>	
	0 – 30	± 0.5	± 0.6	
	30 – 35	± 0.9	± 1.0	
	35 – 40	± 1.5	± 1.6	
<i>RL measuring accuracy with a complex DUT</i>	<i>RL range</i>	<i>fs = 8 kHz, i.e. bandwidth 200 Hz – 4 kHz</i>	<i>fs = 48 kHz, i.e. bandwidth 200 Hz – 20 kHz</i>	
	0 – 20	± 1.0	± 1.1	
	20 – 25	± 1.6	± 1.7	
	25 – 30	± 2.8	± 3.0	
<i>Measuring error due to active AC-coupling</i>	<i>frequency</i>	<i>maximum level measuring error</i>	<i>maximum phase measuring error</i>	<i>maximum RL measuring error</i>
	20 Hz	–0.62 dB	4.93 deg	4.70 dB
	50 Hz	–0.18 dB	2.01 deg	1.20 dB
	100 Hz	–0.09 dB	1.01 deg	0.30 dB
	200 Hz	–0.06 dB	0.34 deg	0.10 dB
	1000 Hz	–0.05 dB	0.10 deg	0.05 dB

¹² RAPID-TEST activates an internal protection circuit if an external voltage exceeds the threshold level. In this case, the output / input connectors of RAPID-TEST are shorted, i.e. the resulting current is only limited by the source resistance of the DUT

Digital Physical Interface

	<i>ISDN BRI Interface</i>	<i>E1 Interface</i>	<i>T1 Interface</i>
<i>Interface characteristics</i>	S ₀ Bus (2B+D) according to ITU I.430	according to ITU rec. G.703	according to ITU G.703, ANSI T1.403
<i>RT-2X subscriber type</i>	Terminal Equipment (TE)	./.	./.
<i>Signaling</i>	./.	CAS (channel associated signaling) ABCD bit signaling in channel 16 according to ITU G704 und G732	CAS (channel associated signaling) "robbed bit" signaling
<i>Framing format</i>	./.	CAS multiframe / CAS&CRC-4 multiframe	D4 / ESF
<i>Line coding</i>	AMI	HDB3 / AMI	B8ZS / AMI
<i>Impedance (terminated)</i>	100 Ω or open	120 Ω balanced	100 Ω
<i>Connectors</i>	2* RJ45	TX & RX Bantam jacks (TF-jacks) or RJ45	TX & RX Bantam jacks or RJ45
<i>Voice channels</i>	2* B-channel	30	24
<i>Clock source</i>		Recovered or internal (± 25 ppm)	Recovered or internal (± 25 ppm)
<i>Voice channel coding (companding)</i>		μ-Law, A-law according to ITU rec. G.711	μ-Law, A-law according to ITU rec. G.711

Digital Generator

	<i>ISDN BRI Interface</i>	<i>E1/T1 Interface</i>
<i>Generator type</i>		Multitone arbitrary
<i>Sampling rate</i>		8 kHz
<i>Frequency range</i>		20 Hz – 4 kHz
<i>No. of frequencies per signal</i>		1 – 31
<i>Frequency resolution</i>		3.91 – 62.5 Hz (depending on blocklength)
<i>Blocklength</i>		128, 256, 512, 1024, 2048
<i>Level range</i>		
• <i>in dBFSp</i>		–72.3 to +6 dBFSp ¹³
• <i>in dBm0, μ-law, sine signal</i>		–69.1 to +9.17 dBm0 ¹³
<i>Level setting resolution</i>	0.1 dB	
<i>Number of channels</i>	2 independent channels with individual levels are assigned to B1 and B2 of the BRI	2 independent channels with individual levels can be assigned to any of the 24 channels
<i>Output clock source</i>	Recovered	Recovered or internal \pm 25 ppm
<i>Companding</i>	μ -Law / A-law according to ITU G.711 or none (8 bit linear)	
<i>Number of signal memories</i>		4 dual-channel
<i>Signaling</i>	Activation/deactivation control, no D-channel signaling supported	Robbed bit signaling <ul style="list-style-type: none"> • full access to ABCD bits • user-defined slot-independent sequences

¹³ 0 – 6 dBFSp (3.17 – 9.17 dBm0) for the determination of the DUT's coder overload capacity

Digital Analyzer

	<i>ISDN BRI Interface</i>	<i>E1/T1 Interface</i>																		
<i>Bandwidth</i>		20 Hz – 4 kHz																		
<i>Frequency resolution</i>		1.95 – 31.25 Hz (depending on blocklength)																		
<i>Filters</i>		Refer to analog analyzer specs																		
<i>Synchronization & trigger modes</i>	<ul style="list-style-type: none"> • Internal with header (analyzer triggers to proprietary header of the same <i>RT-2X</i>) • Internal without header (analyzer triggers to generator of the same <i>RT-2X</i>; no proprietary header involved) • Threshold (analyzer triggers as soon as the input signal exceeds the custom-defined threshold level) 																			
<i>Sampling rate</i>		8 kHz																		
<i>Measurement functions</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>Frequency measurement range and accuracy of an external signal, $f_s = 8$ kHz, internal clock source</i>	<table border="0"> <thead> <tr> <th><i>Blocklength</i></th> <th><i>Measurement range</i></th> <th><i>Measurement accuracy</i>¹⁴</th> </tr> </thead> <tbody> <tr> <td>128</td> <td>115 Hz – 3.55 kHz</td> <td>$\pm (0.28 \text{ Hz} + 25 \text{ ppm of } f_m)$</td> </tr> <tr> <td>256</td> <td>62.5 Hz – 3.55 kHz</td> <td>$\pm (0.14 \text{ Hz} + 25 \text{ ppm of } f_m)$</td> </tr> <tr> <td>512</td> <td>31.25 Hz – 3.55 kHz</td> <td>$\pm (0.07 \text{ Hz} + 25 \text{ ppm of } f_m)$</td> </tr> <tr> <td>1024</td> <td>23.43 Hz – 3.55 kHz</td> <td>$\pm (0.035 \text{ Hz} + 25 \text{ ppm of } f_m)$</td> </tr> <tr> <td>2048</td> <td>23.43 Hz – 3.55 kHz</td> <td>$\pm (0.018 \text{ Hz} + 25 \text{ ppm of } f_m)$</td> </tr> </tbody> </table>	<i>Blocklength</i>	<i>Measurement range</i>	<i>Measurement accuracy</i> ¹⁴	128	115 Hz – 3.55 kHz	$\pm (0.28 \text{ Hz} + 25 \text{ ppm of } f_m)$	256	62.5 Hz – 3.55 kHz	$\pm (0.14 \text{ Hz} + 25 \text{ ppm of } f_m)$	512	31.25 Hz – 3.55 kHz	$\pm (0.07 \text{ Hz} + 25 \text{ ppm of } f_m)$	1024	23.43 Hz – 3.55 kHz	$\pm (0.035 \text{ Hz} + 25 \text{ ppm of } f_m)$	2048	23.43 Hz – 3.55 kHz	$\pm (0.018 \text{ Hz} + 25 \text{ ppm of } f_m)$	
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2048	23.43 Hz – 3.55 kHz	$\pm (0.018 \text{ Hz} + 25 \text{ ppm of } f_m)$																		
<i>Measurement accuracy</i>	Depending on current coding (μ - or A-law ITU G.711)																			
<i>Number of channels</i>	2 independent channels with individual levels are assigned to B1 and B2 of the BRI	2 independent channels with individual levels can be assigned to any of the 24 channels																		
<i>Companding</i>	μ -Law / A-law according to ITU G.711 or none (8 bit linear)																			
<i>Signal transmission time</i>	400 – 1500 ms (depending on blocklength)																			
<i>Test cycle time @ blocklength 128, 3 signal bins</i>	620 ms typical																			
<i>Signaling</i>	No D-channel signaling supported	Robbed Bit signaling <ul style="list-style-type: none"> • full access to ABCD bits • sequence recorder records all signaling transitions in each slot 																		
<i>Alarm detection</i>	none	<ul style="list-style-type: none"> • Red alarm: 192 consecutive zeros • Blue alarm: < 5 zeros within 3 ms • Yellow alarm: S-Bit, bit 2 for 256 consecutive channels set to zero or 16 consecutive patterns 00FF in the FDL (depending on mode) • Loss of synchronization (LOS) • Frame error • Changed frame alignment • Pulse violation 																		

¹⁴ f_m = measured frequency (e.g. blocklength = 2048, $f_m = 2'100$ Hz \Rightarrow accuracy = ± 0.1525 Hz)

PCM Interface - Timing

The PCM timing specifications are divided into four applications, depending whether the BCLK-Master or FrameSync is generated externally or internally.

The setup & hold periods are expressed in [% of T] or [ns], whereby the value of T is given by the current BCLK-mode according to following table:

PCM mode [kHz]	T [ns]
2048	488.28
1544	647.67
1024	976.56
512	1953.1
256	3906.3
128	7812.5
104	9615.3
64	15625

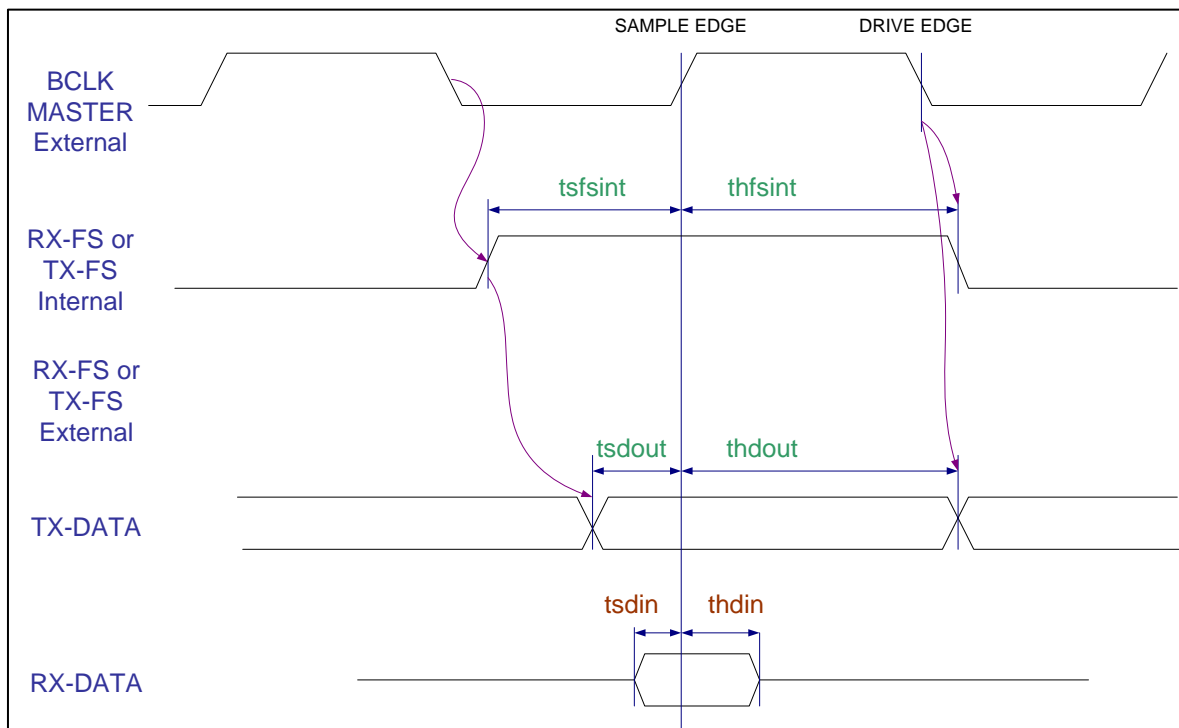
BCLK Master internal – FrameSync internal

minimum timing provided by RT-2X PCM interface	tsdout	36 [% of T]
	thdout	50 [% of T]
	tsfsint	43 [% of T]
	thfsint	49 [% of T]
minimum timing required by customer	tsdin	57 [ns]
	thdin	42 [ns]

BCLK Master external – FrameSync internal

minimum timing provided by RT-2X PCM interface	tsdout	22 [% of T]
	thdout	51 [% of T]
	tsfsint	29 [% of T]
	thfsint	50 [% of T]
minimum timing required by customer	tsdin	0 [ns]
	thdin	46 [ns]

Maximum allowed setup/hold times = 1 BCLK period



<i>Tsdout</i>	TX-data setup time before BCLK Master	(guaranteed by PCM Interface)
<i>Thdout</i>	TX-data hold time after BCLK Master	(guaranteed by PCM Interface)
<i>Tsfsint</i>	RX-FS, TX-FS setup time before BCLK Master	(guaranteed by PCM Interface)
<i>Thfsint</i>	RX-FS, TX-FS hold time after BCLK Master	(guaranteed by PCM Interface)
<i>Tsdin</i>	RX-data setup time before BCLK Master	(required at DUT)
<i>Thdin</i>	RX-data hold time after BCLK Master	(required at DUT)



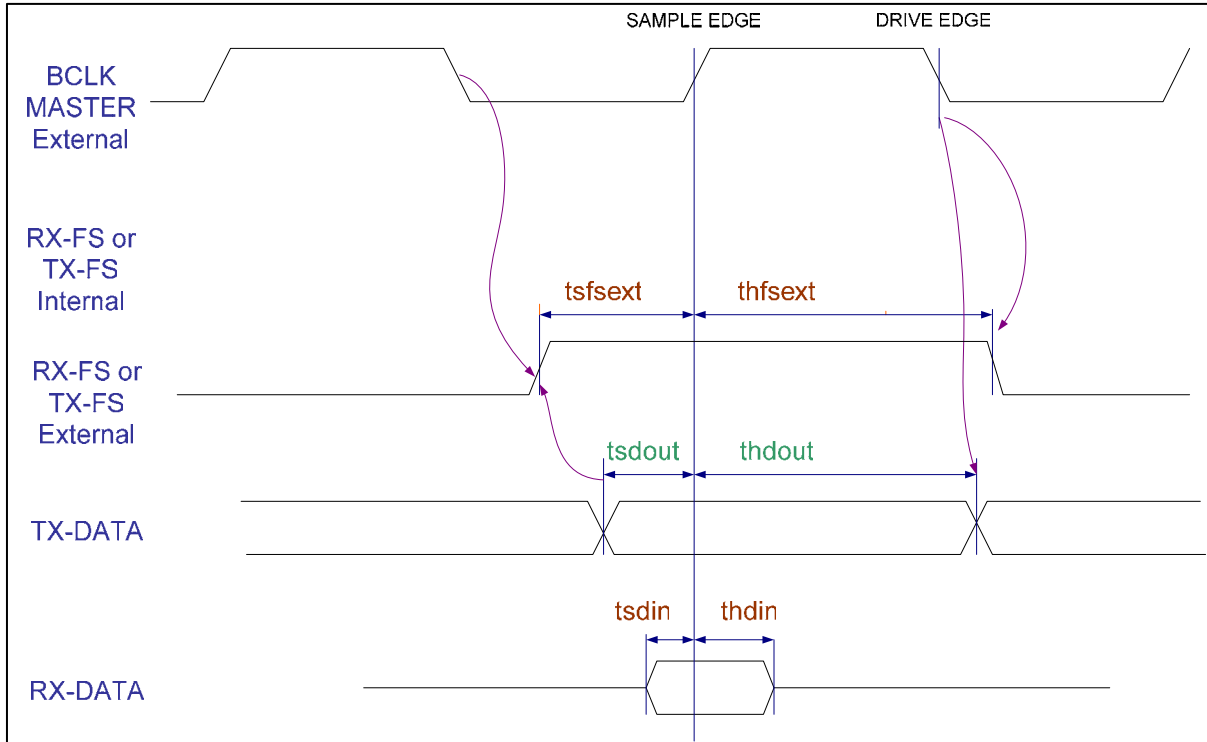
**BCLK Master internal –
FrameSync external**

minimum timing provided by RT-2X	tsdout	137 [ns]
	thdout	50 [% of T]
minimum timing required by customer	tsfsext	186 [ns]
	thfsext	42 [% of T]
	tsdin	57 [ns]
	thdin	67 [ns]

**BCLK Master external –
FrameSync external**

minimum timing provided by RT-2X	tsdin	76 [ns]
	thdin	51 [% of T]
minimum timing required by customer	tsfsext	125 [ns]
	thfsext	50 [% of T]
	tsdin	0 [ns]
	thdin	46 [ns]

Maximum allowed setup/hold times = 1 BCLK period



PCM Interface – Jitter

Maximum allowed jitter (no THD+N degradation)

<i>Jitter frequency [kHz]</i>	<i>maximum BCLK jitter pp [ns] *</i>	<i>maximum BCLK jitter [mUI]</i>
0.50	41	
1.00	35	
2.00	21	
5.00		8
10.00		16
20.00		35
50.00		70
100.00		140
200.00		280
500.00		500
1000.00		500

PCM Interface – Logic Level

		<i>5.0 V</i>	<i>3.3 V</i>	<i>2.5 V</i>
VIHmin		2.0	2.0	2.0
VILmax		0.8	0.8	0.8
VOHmin	IOH = -50 μ A	4.6	3.0	2.4
	IOH = -12 mA	3.9	2.3	1.7
VOLmax	IOH = +50 μ A	0.2	0.2	0.2
	IOH = +12 mA	0.4	0.4	0.4

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>RCIO impedance module</i>	Additional, 2-chn. user-defined input & output impedance (real or complex). Maximum 4 pcs. RCIO impedances. <ul style="list-style-type: none"> • CA: 300 Ω + (1000 Ω // 220 nF) • CB: 200 Ω + (1000 Ω // 220 nF) • CC: 240 Ω + (164 Ω // 55 nF) • CD: 270 Ω + (750 Ω // 147 nF) • CE: 370 Ω + (620 Ω // 320 nF) • CF: 200 Ω + (680 Ω // 100 nF) • CG: 287 Ω + (847Ω // 96nF) • DA: 900 Ω + 2.16 μF • DB: 600 Ω + 2.16 μF • RA: 1200 Ω Other configurations available upon request.
<i>XLR adapter</i>	Hook-up box for <i>RT-2X</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 1.5), 10 – 48 V Phantom power



General

<i>Dimensions</i>	483 x 318 x 88 mm (19" x 12.5" x 3.5", i.e. 2 rack units high)
<i>Weight</i>	11 kg (24 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>	<ul style="list-style-type: none">• 100, 120, 230 V_{AC}• 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