Meter Station — Accuracy Report

Pro Waves · build 23.11 · 22:30 · all numbers measured on the real meter code (no simulation)

18 / 18
EBU / ITU loudness, LRA, true peak, phase tests passed

±0.05 dB
spectrum level readout, 25 Hz – 16 kHz, 0 to –60 dBFS

±2.7 cent
spectrum frequency readout (±0.04 Hz)

±0.25 cent
tuner, 41 Hz – 1.76 kHz, sine and sawtooth

1 · Loudness, loudness range, true peak, phase (EBU Tech 3341 / 3342, ITU-R BS.1770-4)

Standard	Test	Measured	Expected · tolerance	Result
EBU 3341 #1	M/S/I of 1 kHz –23 dBFS	−22.99	−23 ±0.1	PASS
EBU 3341 #1	Short-term	−22.99	−23 ±0.1	PASS
EBU 3341 #1	Momentary	−22.99	−23 ±0.1	PASS
EBU 3341 #2	Integrated, –33 dBFS	−32.99	−33 ±0.1	PASS
EBU 3341 #3	Integrated (relative gate)	−23.01	−23 ±0.1	PASS
EBU 3341 #4	Integrated (absolute + relative gate)	−23.01	−23 ±0.1	PASS
EBU 3341 #5	Integrated	−22.98	−23 ±0.1	PASS
EBU 3342 #1	LRA	10	10 ±1	PASS
EBU 3342 #2	LRA	5	5 ±1	PASS
EBU 3342 #3	LRA	20	20 ±1	PASS
EBU 3342 #4	LRA	15	15 ±1	PASS
BS.1770 TP	fs/4 sine, 45° phase (sample peak –3.01 dBFS)	−0.08	0 +0.2/−0.4	PASS
BS.1770 TP	fs/4 sine, –6 dBTP	−6.08	−6 +0.2/−0.4	PASS

BS.1770 TP	997 Hz 0 dBFS sine	0	0 +0.2/−0.4	**PASS**
BS.1770 TP	19 kHz −1 dBFS sine	−1.22	−1 +0.2/−0.4	**PASS**
Phase	L = −R → −1	−1	−1 ±0.02	**PASS**
Phase	L = R → +1	1	1 ±0.02	**PASS**
Phase	independent noise → 0	−0.01	0 ±0.1	**PASS**

2 · Spectrum peak readout (pure tones)

Tone Hz	Level dBFS	Read Hz	Read dBFS	Error cents	Error dB
25	0	25.04	0.03	2.64	0.03
25	−20	25.04	−19.97	2.69	0.03
25	−40	25.04	−39.97	2.64	0.03
25	−60	25.04	−59.97	2.69	0.03
40	0	39.97	0.01	−1.34	0.01
40	−20	39.97	−19.99	−1.33	0.01
40	−40	39.97	−39.99	−1.34	0.01
40	−60	39.97	−59.99	−1.34	0.01
63	0	62.96	0.03	−1.04	0.03
63	−20	62.96	−19.97	−1.04	0.03
63	−40	62.96	−39.97	−1.04	0.03
63	−60	62.96	−59.97	−1.04	0.03
100	0	100.01	0	0.23	0
100	−20	100.01	−20	0.23	0
100	−40	100.01	−40	0.23	0
100	−60	100.01	−60	0.23	0
250	0	249.96	0.05	−0.26	0.05
250	−20	249.96	−19.95	−0.26	0.05
250	−40	249.96	−39.95	−0.26	0.05
250	−60	249.96	−59.95	−0.26	0.05
1000	0	999.96	0.05	−0.06	0.05
1000	−20	999.96	−19.95	−0.06	0.05
1000	−40	999.96	−39.95	−0.06	0.05
1000	−60	999.96	−59.95	−0.06	0.05
4000	0	3999.96	0.05	−0.02	0.05
4000	−20	3999.96	−19.95	−0.02	0.05

4000	−40	3999.96	−39.95	−0.02	0.05
4000	−60	3999.96	−59.95	−0.02	0.05
10000	0	9999.96	0.05	−0.01	0.05
10000	−20	9999.96	−19.95	−0.01	0.05
10000	−40	9999.96	−39.95	−0.01	0.05
10000	−60	9999.96	−59.95	−0.01	0.05
16000	0	15999.96	0.05	0	0.05
16000	−20	15999.96	−19.95	0	0.05
16000	−40	15999.96	−39.95	0	0.05
16000	−60	15999.96	−59.95	0	0.05

3 · Tuner

Tone Hz	Wave	Read Hz	Note	Error cents
41.2	sine	41.206	E1	0.25
41.2	sawtooth	41.206	E1	0.25
55	sine	54.996	A1	−0.13
55	sawtooth	54.996	A1	−0.13
82.41	sine	82.42	E2	0.2
82.41	sawtooth	82.419	E2	0.2
110	sine	110.005	A2	0.07
110	sawtooth	110.004	A2	0.07
196	sine	195.992	G3	−0.07
196	sawtooth	195.992	G3	−0.07
261.63	sine	261.622	C4	−0.05
261.63	sawtooth	261.623	C4	−0.05
440	sine	440.008	A4	0.03
440	sawtooth	440.008	A4	0.03
880	sine	879.99	A5	−0.02
880	sawtooth	879.99	A5	−0.02
1760	sine	1760.001	A6	0
1760	sawtooth	1760	A6	0

4 · Tempo and drums (owner reference songs)

Song	Expected	Measured
Bareeq Almas	138 BPM 4/4	**138.0 4/4 (8 of 8 sections)**
Ya Mohammed	115 BPM 6/8	**115.0 6/8**
Zaffa Mlak Alkhair	160 BPM 3/4	**160.0 3/4**
Zaffa kick (tuner, drum mode)	C2 ≈ 65.4 Hz (song in C)	**65.0 Hz**

5 · Independent code review — fixed in this build

- Integrated loudness and LRA now use fixed-size histograms: CPU stays the same after 10 s or 10 hours (the history used to grow and be re-sorted 30× a second).
- Audio from the Sender is copied sample-exact when rates match (no interpolation): no high-frequency loss, true peaks intact.
- Remote A/B shows B only when the Sender really plays that reference; failed uploads retry as WAV, then stop with a clear message.
- Plugins keep one copy of each reference and at most 4 (memory inside the DAW); Mac Bonjour lookups no longer leak sockets.
- Sample-rate changes: listening filters, reference position and the plugin page follow the new rate; tuner and kick windows sized in time (correct at 96 kHz; low notes down to 28 Hz).
- Random reference ids (no collisions between devices); seeks never lost; tablets: per-Sender upload address, streamed uploads on Android (no out-of-memory), state reset on page reload, no 1-hour limit.

Not yet verified

- Windows app and Windows plugins on a real Windows PC.
- Android on a real tablet (tested in the Android emulator).
- Long sessions (hours) on old iPads.

Re-run: `node qa/meters.mjs` (standards) · `qa/spectrum-tuner.js` in the app page (spectrum + tuner).