

METRICS: TIME & FREQUENCY ACCURACY

MINIMUM ACCURACY

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GREG ARMSTRONG

RENESAS ELECTRONICS CORPORATION

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Highly recommend to follow ITU-T clock recommendations, specifically ITU-T G.812

- G.812 provides metric and targets for frequency accuracy, noise generation, noise tolerance and noise transfer
 - Can also be used for hold-over performance

For minimum frequency accuracy, recommend using Type III – also maps to OCP-TAP oscillator minimum recommendations

- Frequency accuracy: 4.6×10^{-6} (1 year)
- Noise Generation (recommend using both MTIE & TDEV for metrics)

Table 4/G.812 – Wander generation (MTIE) for Types II and III node clocks at constant temperature (within ± 1 K)

MTIE limit (ns)	Observation interval τ (s)
40	$0.1 < \tau \leq 1$
$40 \times \tau^{0.4}$	$1 < \tau \leq 10$
100	$\tau > 10$

Table 7/G.812 – Wander generation (TDEV) for Types II and III node clocks at constant temperature (within ± 1 K)

TDEV limit (ns)	Observation interval τ (s)
$3.2 \times \tau^{-0.5}$	$0.1 < \tau \leq 2.5$
2	$2.5 < \tau \leq 40$
$0.32 \times \tau^{0.5}$	$40 < \tau \leq 1000$
10	$\tau > 1000$

- For noise transfer, recommend using a bandwidth of 0.001 Hz and maximum gain peaking of 0.2 dB
 - Again, allows reuse of metrics and performance targets from G.812
 - Existing test equipment that can be used to measure – may place requirements at faceplate for measurement output (i.e. SMA (10MHz), ETH (SyncE), ...)

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The OCP-TAP Oscillator Workstream defined a Class G1 Oscillator Normative Specifications

- Target was to provide minimum 250ns (when locked to GNSS)

Recommend to follow IEEE 1588-2019 *clockAccuracy* for reporting accuracy

Recommend following ITU-T for time accuracy metrics

For minimum time accuracy:

- When locked to GNSS input source, recommend using wander generation from G.8272 but extending MTIE to 250 ns (i.e. OCP-TAP target)
 - Minimum time accuracy would be 0x22 (meaning accuracy range of 100 ns ~ 250 ns)

Table 1 – Wander generation (MTIE) for PRTC-A

MTIE limit [μs]	Observation interval τ [s]
$0.275 \times 10^{-3}\tau + 0.025$	$0.1 < \tau \leq 818$
0.25	$\tau > 818$

- When locked to non-GNSS time sources, recommend using metric max|TE| (like ITU-T G.8273.x recommendations)
 - Minimum time accuracy would be 0x23 (meaning accuracy range of 250 ns ~ 1 μs)
 - Recommend defining max|TE| of 1 μs as a minimum
 - Metrics may want to also look at sub-components, cTE and dTE
 - Again, there is existing test equipment that can be used to measure max|TE|, cTE, dTE

Table 5—clockAccuracy enumeration

Value (hex)	Specification
00 to 16	Reserved
17	The time is accurate to within 1 ps
18	The time is accurate to within 2.5 ps
19	The time is accurate to within 10 ps
1A	The time is accurate to within 25 ps
1B	The time is accurate to within 100 ps
1C	The time is accurate to within 250 ps
1D	The time is accurate to within 1 ns
1E	The time is accurate to within 2.5 ns
1F	The time is accurate to within 10 ns
20	The time is accurate to within 25 ns
21	The time is accurate to within 100 ns
22	The time is accurate to within 250 ns
23	The time is accurate to within 1 μs

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