m:explore – datasheet

m:explore - our next generation ultra-wideband (UWB) sensor. The versatile device is using our innovative m-Sequence pseudo-noise design.
Suitable for many applications, such as

- high resolution short range radar
- vector network analyser
- time domain reflectometer
- Coherent MIMO measurements by coupling multiple devices
- impedance spectroscopy

The compact device includes 1 UWB baseband transmitter and 2 UWB baseband receivers working in parallel. It combines high speed measurements with excellent signal and timebase stability.

Configuration options

- Two stimulus lengths
  - MLBS9: 511 M-sequence chips
  - MLBS12: 4095 M-sequence chips
- Two clocking/bandwidth options
  - 13.312 GHz system clock | 6 GHz bandwidth in baseband
  - 10.240 GHz system clock | 4 GHz bandwidth in baseband

RF properties

UWB baseband transmitter:

- UWB pseudo-noise signal
  - no high voltage peaks: 0.8 V_{pp} max.
  - low field strength operation (when connected to antennas)
  - low crest factor / PAPR: CF ≈ 2.6 typ. (PAPR ≈ 8.3 dB)
- extremely stable generation driven by phase locked RF system clock
- instantaneous 10 dB bandwidth
  - 0.1 - 6 GHz (@13.312 GHz system lock)
  - 0.1 – 4 GHz (@10.240 GHz system lock)
- Ambiguity time and range: (1-way range in air)
  - MLBS9 / 13.312 GHz: T_{amb} ≈ 38.4 ns R_{amb} ≈ 11.5 m
  - MLBS9 / 10.240 GHz: T_{amb} ≈ 49.9 ns R_{amb} ≈ 15.0 m
  - MLBS12 / 13.312 GHz: T_{amb} ≈ 307.6 ns R_{amb} ≈ 92.3 m
  - MLBS12 / 10.240 GHz: T_{amb} ≈ 399.9 ns R_{amb} ≈ 120.0 m
- total output power: ca. -7 dBm
- Tx RF-port: SMA-Female
- output power-down feature (software controlled)

UWB baseband receivers:

- 2 coherent Rx working in parallel
- continuous, synchronous sub-sampling operation: 1:512 pre-scaler
- UWB analogue input bandwidth:
  - 0.1 - 6 GHz (@13.312 GHz system lock)
  - 0.1 – 4 GHz (@10.240 GHz system lock)
- input 1 dB compression point: P_{1dB} ≈ -14 dBm
- system performance:
  - MLBS9: ≈ 155 dB
  - MLBS12: ≈ 164 dB
  - Tx output power referred to Rx noise floor at maximum integration time
  - can be extended by external amplifiers
- instantaneous dynamic range: > 135 dB(s)
  - measured from P1dB to receiver noise floor with 1 s integration time
- extremely stable timebase derived from transmitter clock:
  - timebase jitter: < 20 fs (rms)
- RF-ports: SMA-F

Resolution and accuracy:

- Measurement setup: Tx → SMA cable → 20 dB → SMA cable → Rx
- Resolution: pulse width 2-way resolution air
  - 3 dB @13.312 GHz: 117.4 ps 17.6 mm
  - 10 dB @13.312 GHz: 207.8 ps 31.2 mm
- Random variation of pulse delay (1000 repetitions@maximum measurement speed)
  - 13.312 GHz: σ_{del} ≈ 10.7 fs (rms) σ_R ≈ 1.6 µm

Digital backend

- USB2.0 High-speed interface
- USB-B socket
- integrated buffer memory: 128 MBytes
- configurable measurement timing
  - synchronous averaging to improve SNR
  - wait cycles to balance measurement rate and averaging aperture
- measurement speed:
  - MLBS9 / 13.312 GHz: $MR_{max} \approx 1038$ measurements / s
  - MLBS9 / 10.240 GHz: $MR_{max} \approx 799$ measurements / s
  - MLBS12 / 13.312 GHz: $MR_{max} \approx 130$ measurements / s
  - MLBS12 / 10.240 GHz: $MR_{max} \approx 100$ measurements / s
  - Actual max. speed depends on capabilities of control computer
  - Optional increased measurement speed upon request (* consult factory)
- digital correlation in control computer to suppress noise

Dimensions and power supply

- Dimensions (WxDxH): 115 mm x 215 mm x 55 mm
- Power supply rating : DC +12 V, 1 A
- Operating temp. range: 0 .. +35°C (< 90% rel. humidity, non-condensing)
- Storage temp. range : -10.. +60°C (< 90% rel. humidity, non-condensing)
- convection/active cooling by integrated fan

Software

- MatLab support (Windows™ 7, 8.1, 10):
  - MEX-API for device control and data transfer with demonstration code
  - GUI for easy measurements and continuous data storage
- Programming interface via dynamic library: HAL API
  - Support for Windows™ 7, 8.1, 10 on x32 and x64 architectures
  - Support for Debian™ and Ubuntu™ Linux on x32, x64, and armhf architectures

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