# INDIAN INSTITUTE OF TECHNOLOGY BOMBAY

## MATERIALS MANAGEMENT DIVISION

**Corrigendum- I**

**Corrigendum is issued for detailed technical specifications.**

**Brief Tender Specifications for Source and Measurement unit ,Signal Source Analyser , Benchtop Signal Analyser , Shield enclosure with 6x triaxial & 1x CV feedthrough with probes and accessories:**

1) Source and Measure Unit (SMU)

| **Item 1 : Source and Measure unit (SMU ) -1 Qty** | |
|---|---|
| Measurement system | Should have 2 independent sourcing & measurement inputs with triaxial adapters having 6.5 digit resolution for 4 quadrant operation |
| Sensing Mode | 2 or 4 wire, grounded or floating type must be selectable |
| Type of sourcing | DC, Pulsed, linear, logarithmic, custom list for voltage & current both |
| Maximum sourcing | DC mode : ± 210 V and ± 3 A<br>Pulsed mode : ± 200 V and ± 10 A with 50 µs to 1ms settable pulse width |
| Resolution | Current sourcing : 1pA<br>Voltage sourcing : 1uV<br>Current measure : 100fA<br>Voltage measure : 100nV |
| Resistance measurement | 2 ohm to 200M ohm |
| Display | 4.3” Graphical Color LCD to display both voltage & current simultaneously of both channels |
| Types of curves | I vs V, V vs time, I vs time, with adjustable scaling |
| Trigger interval | Atleast 20us |
| Timer | Programmable having resolution of 1us to 100ms, selectable |
| Common mode isolation | > 1G ohm, < 4500 pF |
| Maximum buffer memory | 100,000 points/channel |
| Sweep points | 1 to 100,000 |
| Interface | USB, LXI (LAN), GPIB, Digital IO |
| Software | Must be compatible with easy expert software for detailed device |

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| | characterization & analysis of devices, circuits & materials which has facilities such as sweep the output, calculate parameters & display characteristics. |
| Accessories | Triaxial adapters, Triaxial cables, Alligator cables, USB cable, GPIB adapter, easy expert software, Power cord, User manual, Driver CD, calibration certificate |
| After sales & service support | The vendor or OEM shall have dedicated service center & accredited calibration laboratory in India |
| Training | The vendor shall be able to demonstrate the capabilities & demonstration of the complete system |

**Item 2 : Signal Source Analyzer 7GHz**

| | **Technical Specifications for Signal Source Analyzer 7GHz to characterize a free-running VCO and Measure phase noise of a wandering oscillator** | |
|---|---|---|
| **Sl** | **Parameter** | **Specifications** |
| | **Parameters Measured** | Full analysis capability available for<br>Frequency [Hz, ΔHz, %, ppm],<br>Tuning sensitivity (Δf/ΔVc)[Hz/V],<br>frequency pushing (Δf/ΔVs)[Hz/V],<br>RF power level [dBm],<br>DC supply current [A], |
| (a ) | Frequency Range | 10 MHz to 7GHz , frequency upgradeable to 26.5GHz using downconverter |
| (b) | Frequency Resolution | 10 Hz, 1 kHz, 64 kHz |
| (c) | Sweep parameters | DC control voltage (Vc) , DC supply voltage (Vs) |

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|---|---|---|
| (d) | Phase noise Sensitivity for CW signal | At carrier frequency of 1 GHz, noise floor/sensitivity at offset frequency:<br>1 kHz = -128 dBc/Hz<br>10kHz = -137 dBc/Hz<br>100 kHz = -144 dBc/Hz<br>1MHz = - 168 dBc/Hz<br>10 MHz= -170 dBc/Hz<br>40 MHz= - 168 dBc/Hz<br>100 MHz= -169 dBc/Hz |
| (e) | Phase noise offset Measurement Range | 1 Hz to 100 MHz at carrier frequency of 7 GHz |
| (f) | Amplitude Noise sensitivity for CW signal | At carrier frequency of 1 GHz, noise floor/sensitivity for the below mentioned offset frequency:-<br>1 kHz = -127 dBc/Hz<br>10 kHz = -138 dBc/Hz<br>100 kHz= -147 dBc/Hz<br>1 MHz= -150 dBc/Hz<br>10 MHz= -154 dBc/Hz<br>40 MHz= -155 dBc/Hz |
| (g) | Amplitude Noise offset measurement Range | 10 Hz to 40 MHz at carrier frequency of 7 GHz |
| (h) | Baseband Noise Measurement range | 1 Hz to 100 MHz with noise floor/sensitivity for the below mentioned offset freqency:-<br>1 kHz = -151dBm/Hz<br>10 kHz = -158 dBm/Hz<br>100 kHz= -163 dBm/Hz<br>1 MHz= -160 dBm/Hz<br>10 MHz= -160dBm/Hz<br>40 MHz= -156 dBm/Hz<br>100 MHz= -156 dBm/Hz |
| | **Inbuilt Spectrum Analyzer** | |
| | Maximum RF input level | +23 dBm |
| | Frequency Range | 10 MHz to 7GHz |
| | Attenuator | 0 dB to 35 dB in 5 dB steps up to 7GHz |
| | **Miscellaneous** | |

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|---|---|---|
| (i) | External interfaces | GPIB(IEEE488.2), USB, LAN<br>USB can also be used for data extraction for record keeping |
| (j) | Application Software | Display of data in graphical format with data storage at run -time |
| (k) | HMI Interface | hard key interface, a touch-screen interface, or a mouse interface. |
| (l) | Comprehensive warranty & calibration | 1 years, repair and calibration (AMC) facility in India |
| (m) | Power Supply | 90 to 132 V, or 198 to 264 V (automatically selected), 47 Hz to 63 Hz |
| (aa) | Participating Firm | OEM Authorised |
| | Inbuilt swept DC control voltage source | -15V DC to +35VDC @ 20mA (max), <10nVrms/ sqrt Hz noise level |
| | Inbuilt swept DC supply voltage source | 0 VDC to +16VDC @ 80mA (max), <1.5nVrms/ sqrt Hz noise level |
| | Operating temperature | +10deg to +40deg |
| | Digital I/O interface | USB, GPIB and LAN |

**Item 3: Technical Specifications of Benchtop Signal Analyzer**

| Sl | features | Technical Specifications |
|---|---|---|
| 1 | Frequency Range | 10Hz to 13.6GHz and frequency upgradeable to 40GHz and above |
| 2 | Frequeny Resolution | 0.01Hz , Selectivity (–60 dB/–3 dB) 4.1:1 nominal |
| 3 | Resolution Bandiwdth (RBW) | 1 Hz to 3 MHz (10 % steps) upto 8 MHz |
| 4 | Video bandwidth (VBW) | 1 Hz to 8 MHz, and wide open (labeled 50 MHz) |
| 5 | Analysis Bandwidth | 25 MHz |
| 6 | Fequency Points | 1 to 100,001 |
| | | |
| 8 | Maximum safe input level | DANL to 30dBm |
| 9 | Phase Noise at 10KHz offset ( 1GHz center frequency ) | <-107dBc /Hz |
| 10 | Total attenuator range | 0 to 60dB in 10dB Steps |
| 10 b | Displayed average noise level (DANL) at 1Hz measurement bandwidth | -145dBm: 1MHz to 7GHz<br>-140dBm : 7GHz to 13.6GHz |
| 11 | Input voltage standing wave ratio | <1.9 |

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|---|---|---|
| 12 | Selectivity (–60 dB/–3 dB) | 4.1:1 nominal |
| 13 | Type of Instrument , Display | Benchtop , 10.6'' multi touch screen |
| 14 | Digital Modulation Signal Analysis | Basic vector signal and analog modulation analysis in time, frequency and modulation domains with atleast 5 License should be provided to demodulate signals as per 5G NR modulation techniques , custom IQ , custom OFDM , LTE , NB-IOT , Radar pulse analysis with Record and playback signals for thorough analysis |
| 15 | IQ Analyzer | Standard |
| 16 | Multiple Spectrum window | Yes |
| 17 | future upgradeable | Frequency upgrade till 44GHz within the unit ,Phase Noise application license provided |
| 19 | warranty | 1 years |
| 20 | Frequency counter resolution | 0.001Hz |
| 21 | Aging per year | 1ppm |
| 22 | Display | TFT Color display |
| 23 | Input Connector | N , Female type |
| 24 | Operating Temperature Range | 10 to 50 °C |
| 25 | Power Requirement | 220 to 240 V, 50 Hz |
| 26 | Scale units | dBm, dBmV, dBµV, dBmA, dBµA, V, W, A |
| 27 | Interfaces | GPIB, LAN, USB, Audio phone Jack, Speaker |
| 28 | Rack Mount KIT with Handles | Suitable for 19” Rack |
| 29 | Maximum Input RF Level | 30dBm |
| 30 | 1 dB gain compression (two-tone) | +9 dBm nominal |
| 31 | Third-order intermodulation distortion (TOI) | +13 dBm from 100MHz to 13.6GHz |
| 32 | Marker Peak Table | All the peak signals in the captured spectrum should be marked and tabulated to a live updating marker table with editable peak-qualifying criteria |

4) EMI shielding Unit for RF probe station with 4 electrical probes.
Shield enclosure with 6x triaxial and 1x C-V feedthrough suitable for EPS 150.

**Item 4.1: The system shall also consist of following probe and accessories:**

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| **GSSG Probe** | Air-Coplanar Probe with ACP-Dual standard body style, 2.92 mm, tungsten tip, GSSG contact sequence, 100um uniform pitch – 1 nos |
| **GSG 40GHz Probe** | 40GHz Probe, custom version of non-linear ACPQ probes configured with a reduced contact RF probe (GSG,Tungsten, 100um uniform pitch) and 8 DC needles placed on a wide PCB, SMA connectors, verified for quadrant compatibility, reduced OT of 50um – 1 nos |
| **GSG 40GHz Probe** | 40GHz Probe, custom version of non-linear ACPQ configured with a reduced contact RF probe (GSG, Tungsten, 100um pitch) and 6 DC needles placed on a narrow pad PCB, SMA connectors, tungsten tip, verified for quadrant compatibility, reduced OT of 50um – 1 nos |
| **DC Probe** | DC Probes, custom version of non-linear DCQ with 10 DC needles configured in a tight array, SMA connectors, verified for quadrant compatibility, reduced OT of 50um – 1 nos |
| **GSSG Cal Substrate** | Impedance Standard Calibration Substrate for GSSG, having 100um to 150um pitch – 1 nos |
| **GSG Cal Substrate** | Impedance Standard Calibration Substrate for GSG & GS/SG, having narrow pitch – 1 nos |
| **GSG 40GHz Probe** | 40GHz Probe, custom version of non-linear ACPQ configured with a reduced contact RF probe (GSG, Tugsten, 100um pitch) and 4 DC needles placed on a narrow pad PCB, SMA connectors, verified for quadrant compatibility, reduced OT of 50um is recommended - 1 nos. |

**Item 4.2:**

| **Shielding Chamber for Radio Frequency Measurements** | |
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| Connectors | Should have 6 nos Triaxial connectors & 1x12mm RF feedthrough |
| Low current measurement | up to 100fA measurements |
| Should be able to provide | light tight & EMI Shielding environment for RF measurements |
| Compatibility | must be compatible with EPS150RF probe station |
| Dimensions (in mm) | 750 mm x 750 mm x |

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| | 1620 mm(open door) |
| Appx Weight | < 80 kg |

**Bid Evaluation / Special Terms for Bidders :**

1. Bidders must provide point-by-point compliance to all tendered Technical Specifications, Technical Requirements and Special Terms. Where required, vendor must provide compliance, deviation if any and requisite justification to meet tender requirements in total. Without such details, bids may be summarily rejected at discretion of IIT-Bombay. (Annexure II of NIT document)

2. Bids complying to only part requirements of tendered specifications are liable to be rejected. Bidder is accountable for supply, integration, installation and support of all quoted parts including any third party parts not manufactured by them, akin to a turnkey bid. All necessary authorisations must be obtained from third party/part suppliers confirming support to the primary bidder to quote, honour OEM warranty and support during integration, warranty period and for life of the product.

3. Only vendors with necessary experience and competence to supply, integrate and install such functional system with all its hardware and software components will be selected as eligible bidders.

4. Vendors for main test equipment and probe stations must have their own technically equipped application engineer / engineering team to provide installation, training and after sales support.

5. Software supplied should be capable of functioning on equipment

6. Wherever called for within the specifications, the offered equipment must be upgradable to higher performance thresholds as defined.

7. Primary vendor OEM should have well established repair and calibration facility for all supplied main equipment within India.

8. Warranty: One year on the complete integrated solution.

9. At least 5 similar major equipment's / setup should be found in India.

10. Vendor to deliver total solution to meet the test needs for the intended research and development. Vendors may be asked to provide necessary evidence to establish their experience & expertise and it is at institute's discretion to accept/reject the same.