**Annexure-A**

**Technical Specifications:**

**Vector Signal Generator (VSG) and Vector Signal Analyzer (VSA)**

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| **Specifications for Vector Signal Generator (VSG)** | | |
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| **SL NO.** | **Parameter** | **Specifications** |
| 1 | Frequency Range | 100 KHz to 30 GHz both CW & VSG mode |
| 2 | Frequency Resolution | ≤ 0.001 Hz |
| 3 | Frequency Aging | ≤ 0.1 ppm/year |
| 4 | Frequency Switching Speed | ≤ 1.5 msec (SCPI & list mode) |
| 5 | RF Output Power | -120 dBm to +15 dBm, @ f> 10 MHz |
| 6 | Power Level Accuracy(CW) | ≤ 1.2 dB |
| 7 | Harmonics Level (@+10 dbm Level) | f≤ 4GHz: < -30dBc f>4GHz: < -53 dBc |
| 8 | Modulation Capability | a. ASK,FSK,QAM,PSK, QPSK b.Custom Digital Modulations. c. 5G NR Uplink and Downlink Signal Generation as per 3GPP Release 15 & 16. d. Deviation error: <0.8%,16QAM for symbol rate upto 100MSym/s e.Multicarrier Support upto 400 Carrier with provision to add arb waveform for each carrier within RF Bandwidth |
| 9 | Phase Noise | at 20 KHz offset 100MHz: ≤ -133 dBc 6GHz: ≤ -117 dBc 20GHz: ≤ -107 dBc 30 GHz: ≤ -103 dBc |
| 10 | Sample Rate and Memory | ≥ 600MSa/s with 16 bit resolution & 250 Msa |
| 11 | Internal Modulation Bandwidth | ≥ 500 MHz & Future upgradable option to 2 GHz |
| 12 | Real Time I/Q Baseband Generator | It includes a built-in real time I/Q baseband generator |
| 13 | Wide band Analog IQ outputs | Required |
| 14 | External Wideband IQ inputs | Required with upto 2 GHz Bandwidth |
| 15 | Advanced Signal Scenarios | VSG should support the generation of advanced signal scenarios  a) Hardware fading Simulator with Minimum 16 fading paths and 160 Mhz bandwidth upgradable to 500 MHz in future b) fading path loss 0 to 45dB c) Rayliegh, pure doppler, rice,Constant phase fading profiles d) Doppler frequency range: 0 to 3500Hz e) Dynamic fading functions like Moving Delay,Birth-death,High-Speed train modes to be supported f) hardware fader should be available atleast on min. one RF path |
| 16 | External Digital Baseband Inputs | a) VSG should have digital input ports for synchronizing with vector signal analyser for seamless import functionality b) all required accessories to connect with vector signal analyzer should be quoted |
| 17 | Remote Control and Automation | a) VSG should support remote control and automation through standard SCPI(standard commands for programmable instruments) commands,enabling integrationinto automated test systems b) Generator should have built-in SCPI recorder to record manual operation steps & to generate the code in matlab, Labwindows. |
| 18 | Real-Time Signal Generation | VSG should have capability of Real-time signal generation |
| 19 | Triggering and Synchronization | Various triggering and synchronization options to coordinate signal generation with other instruments or events. |
| 20 | Sweep Function | Mode : Frequency Sweep,Level Sweep Dwell time : 5 ms to 100 s |
| 21 | Connectivity | USB, LAN, GPIB |
| 22 | Software and Programming Interfaces | Should Support Comprehensive software Suite including drivers and APIs for easy programming and automation using popular languages such as python, Labview and MATLAB |
| 23 | Size and Form Factor | Single Box benchtop form factor suitable for lab environments |
| 24 | Display & Non-Volatile Memory | 6 inch inbuilt display and 500 GB SSD |
| 25 | operating temperature | 5 to 45 deg |
| 26 | Main Power Supply | 220/240 VAC,50/60 Hz |
| 27 | Warranty | 01 Year |
| 28 | No of RF outputs | one, 50Ω impedence, 2.92 mm or better, female connector |

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| **Specifications for Vector Signal Analyzer (VSA)** | | |
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| **Sl.No** | **Parameter** | **Specifications** |
| 1 | Frequency Range | AC Coupled : 10 MHz to 43.5 GHz DC Coupled : 2 Hz to 43.5 GHz |
| 2 | Frequency Span | 0 Hz,10 Hz to 43.5 GHz |
| 3 | Frequency Counter Resolution | 0.001 Hz or Better |
| 4 | Aging Rate | ± 0.1 ppm/yr |
| 5 | Temperature Drift(0 to 50 °C) | ±0.1 ppm |
| 6 | No. of Sweep Points | Upto 100001 |
| 7 | SSB Phase Noise @  1 GHz | -110 dBc/Hz at 100 Hz Offset  -125 dBc/Hz at 1 KHz Offset -135 dBc/Hz at 10 KHz Offset -137 dBc/Hz at 100 KHz Offset -140 dBc/Hz at 1 MHz offset |
| 8 | Sweep Time | Span = 0 Hz : 1 µs to 10000 s Span ≥ 10 Hz : 10 ms to 10000 s |
| 9 | Resolution & Video Bandwidth | 1 Hz to 10 MHz in steps |
| 10 | Maximum Input Level | DC Voltage : 50 V (AC Coupled),0 V (DC Coupled) |
| CW RF Power : 30 dBm RF Attenuation ≥ 10 dB |
| 11 | 1 dB Compression at Input Mixer | +15 dBm(nom) @ 1 GHz +10 dBm(nom) @ 5 GHz +5 dBm(nom) @ 20 GHz +5 dBm(nom) @ 43.5 GHz |
| 12 | TOI @ 100 KHz Spacing | 500 MHz @ 25 dBm 5 GHz @ 15 dBm 40 GHz @ 10 dBm |
| 13 | SHI @ level -10 dBm | 60 dBm @ 3.5 GHz  65 dBm(nom) @ 21.75 GHz |
| 14 | Displayed Average Noise Level RF attenuation = 0 dB, termination = 50 Ω | With Preamp OFF 10 MHz to 40 GHz : -135 dBm/Hz |
| With Preamp ON 10 MHz to 40 GHz : -160 dBm/Hz |
| Noise Cancellation | To be available |
| 15 | Amplitude level measurement uncertainty for input levels of -70dBm to 0dBm | ≤ 1.5 dB @ 21.75 GHz for input attenuation at 10dB, S/N > 20dB. |
| 16 | Trigger | Free Run,Video,External,IF Power,RF Power |
| 17 | I/Q Analyzer | Analysis Bandwidth : 510 MHz and Future upgradable option to 6000 MHz Record Length : Max 400 Msa I and Q |
| 18 | RF INPUT |  |
| Connector & Impedance | 2.92 mm or Compatible Connector,50 Ω |
| Attenuator Range | 0 to 75 dB in 1 dB steps |
| External Reference Input | Should have provision to input 1 MHz to 50 MHz in steps,100 MHz & 1 GHz |
| Reference Output | 10 MHz,100 MHz |
| 19 | IF Output Frequency | 10 MHz to 200 MHz |
| 20 | Video Output | Logarthmic,Linear |
| 21 | 5G NR Analysis | Should support for both Uplink & Downlink as per the 3GPP Release 15 & 16 |
| 22 | Power Suite Measurements | Channel Power,Adjacent Channel Power ratio,Occupied Bandwidth,Carrier to noise ratio,Spurious Emission Measurement,Time Domain Power Measurement,Harmonic Distortion Measurement,Third Order Intercept Measurement,Statistical Measurement(APD,CCDF),Spectrogram |
| 23 | Instrument should support LO Output & IF Input to extend the frequency range for mmWave Frequency Range using external Frequency conveter modules | |
| 24 | Digital Baseband Interface | VSA should have digital input & output ports for synchronizing with vector signal generator for seamless import & export functionality |
| 25 | Operating Temperature | +10 to 50 °C |
| 26 | Storage | Windows Based with 100 GB SSD |
| 27 | Interfaces | USB,LAN,GPIB |
| 28 | Display | 12 Inch Touch Screen Display |
| 29 | Warranty | 01 Year |
| 30 | Power Supply | 230 VAC,50 Hz/60 Hz |

**Notes to bidder**

1. The bidder shall provide a compliance statement as per the format provided in Annexure-C of the tender. Each item not mentioned here but required for proper functioning of the instrument shall be quoted with the cost.
2. Proper combined specifications should be provided with the bid with pagination and index. The bidder shall clearly provide the model number or decoding sheet for the quoted model.
3. The bidder shall quote in a modular form as detailed in Annexure-E of the tender.
4. A minimum of one year guarantee/warrantee shall be provided for all items from the date of installation for manufacturing defects.