Dayalbagh Educational Institute
(DEEMED TO BE UNIVERSITY)
Dayalbagh, Agra

Ref: DEI/SC/PHY/KSD/2018-19/EOI   **Date: 02.02.2019**

Notice for Inviting Expression of Interest

Letter of Intent for "Setting up a 5G and Telematics Lab"

We give the opportunity to all interested Manufacturers/Vendor/Entrepreneurs to submit their "Expression of Interest" with the tentative specifications for our exact requirements of various products/equipment/jobs etc.

The objective of this Letter of Intent is to select Manufacturers/Vendor/Entrepreneurs for setting up a 5G and Telematics Lab" at Dayalbagh Educational Institute, AGRA.
 We require Bidder for undertaking project for setting up a 5G and Telematics Lab - AGRA.
Detailed Technical Specifications have been specified in **Annexure-I** (Technical Specifications) of this tender document.

All interested Manufacturers/Vendor/Entrepreneurs are requested to submit their comments on the objectives and scope of the work and alternative better proposals could also be submitted.

All interested Manufacturers/Vendor/Entrepreneurs are requested to submit their proposals at the office of the undersigned as per following Schedule:

Time and last date of submission of the Proposal: 11.00 am on 12.02.2019
Time of Bid Proposal: 11.30 am on 12.02.2019 CAO,
Venue of Bid Proposal: Dayalbagh Educational Institute, Dayalbagh Agra-5
Pre-Bid Meeting: 11.00 am on 13.02.2019

Interested Contractors/Suppliers/Authorized dealers may put the proposal/document complete in all respect and other requisite documents in the tender box kept in the General Section, CAO, Dayalbagh Educational Institute, Dayalbagh, Agra- 282005.

The tenders shall not be entertained after this deadline under any circumstances what so ever. For more details please visit the institute's website http://www.dei.ac.in or
contact Dr. K. Soami Daya (email: sdayak@gmail.com, Mob: 9411403166)

Registrar
Dayalbagh Educational Institute
Dayalbagh, Agra-282005

DAYALBAGH EDUCATIONAL INSTITUTE
DAYALBAGH, AGRA – 282 005

S.No	Parameter	Specifications
Technical Specifications for 5G Radio, Connected Car and Intelligent Transport System Research Lab with Communication System Software , Lab Management Solution &Test Automation Solution	
A.1	**Vector Signal Analyzer Frequency range**	**2Hz to 50GHz performance spectrum Analyzer , counter resolution 0.001Hz, built in IF Bandwidth output 300MHz with smart mixer 55GHz to 90GHz & support for external mixer covering frequency range 90GHz to 140GHz.**
2.1	55GHz to 90GHz smart mixer features:	
	* Automatic amplitude correction and transfer of conversion loss data through USB plug and play features *Automatic LO amplitude adjustment to compensate the cables loss (up to 3 m or 10 dB loss) * Auto calibration when time and temperature changes Spectrum Analyzer should have External mixing feature with single for LO out and IF in (SMA female) *wideband millimeter-wave signal analysis of more than 2 GHz, * 2 Qty WR-12 WR-12 Std gain horn antenna (60-90 GHz) should be provided
2.2	Suitable WR-08 (90 to140 GHz) harmonic mixer to be provided along with 2 Qty WR-08 Std gain horn antenna (90-140 GHz) with following features *Automatic amplitude correction and transfer of conversion loss data through USB plug and play features *Automatic LO amplitude adjustment to compensate the cables loss (up to 3 m or 10 dB loss)
3	Maximum Safe input level	+30 dBm (1 W)
4	Input attenuator range	0 to 70 dB in 2 dB steps
5	Aging	Better than $\pm 1 \times 10^{-7}$/year : $\pm 1.5 \times 10^{-7}$ / 2 years
6	Temperature Stability	
7	20 to 30deg cel	$\pm 1.5 \times 10^{-8}$
8	Resolution bandwidth	1Hz to 8MHz
9	Bandwidth Accuracy 1 Hz to 1.3 MHz $\pm$	2%
	Selectivity (–60 dB/–3 dB)	4.1:1
10	Demodulation Analysis Bandwidth	25MHz& future upgradeable till 500MHz

Inbuilt Vector Signal Analysis capability with demodulation bandwidth of atleast 25MHz in the Signal Analyzer capable of Digital Demodulation of various standards :
-Radar analysis: FMCW radar analysis for multi-chirp linear FM modulated signals, automotive radar & Pulse analysis.
- Cellular communications: 5G New Radio(NR), Verizon 5GTF, LTEAdvanced, LTE, W-CDMA HSPA+, GSM/EDGE Evolution, cdma2000®, TD-SCDMA, NB-IoT modulation analysis, 3G modulation analysis bundle
- Wireless connectivity: WLAN 802.11ax, 802.11n/ac, 802.11a/b/g/ j/p, WiMAXTM, Bluetooth®, Zigbee, RFID
– Aerospace, defense and satellite application: AM, FM, PM, BPSK, QPSK, QAM, APSK, FSK, VSB, SOQPSK, APCO 25 – Cable TV such as DOCSIS 3.0 and 3.1
 – Custom modulation: Evaluate non-standard or proprietary OFDM and APSK signals Custom IQ modulation analysis, Channel quality measurements
5G NR measurements as per 3GPP TS 38 series v15.0.0 or higher with following features:
CP-OFDM waveform for DL and UL and Transform precoding (DFT-S-OFDM) waveform for UL
All signal bandwidths for frequency range 1 (FR1) and frequency range 2 (FR2)
LDPC decoding for PDSCH and PUSCH

Polar decoding for PBCH, PDCCH and PUCCH
Coupled markers measurements to allow the user to understand the identity and characteristics of a symbol simultaneously in time, frequency, and error SS/PBCH power trace
Displays: vector/ constellation diagrams, EVM, magnitude/phase error, eye and trellis diagrams, demodulated data tables and I-Q measurements , frequency, and time domain.

The VSA software should also run on PC /laptop (desired) with record / replay capability with 16 licenses.
It should be possible to run the same VSA software on any separate/other work station to analyze recorded/offline signals as well as real time signals when connected to the signal analyzers, oscilloscope through ethernet port.
- It ensures repeatable measurements from baseband to RF, from simulation to design validation, run multiple independent measurements, simultaneously.

11	Future Upgradability Analysis Bandwidth	up to 500 MHz
12	Video bandwidth	1Hz to 8MHz or more
13	Sweep time	
14	Span = 0 Hz	1 μs to 6000 s
	Span ≥ 10 Hz	1 ms to 4000 s
	Time Gating	Gated LO; Gated video; Gated FFT
15	Gate delay range	0 to 100.0 s
16	Maximum Sweep (trace) point range	40001
17	Total absolute amplitude accuracy	± 0.2Db
18	Second Harmonic Intercept (SHI)	
	Up to 25GHz	+42dBm
19	Trace detectors	Normal, peak, sample, negative peak, log power average, RMS average, and voltage average
20	1 dB gain compression (two-tone)	+0dBm up to 44GHz
21	Phase Noise at 1GHz	
22	@ 30KHz offset :	-130 dBc / Hz (nominal)
	@ 10 MHz offset :	-150 dBc / Hz (nominal)
23	Effective Dispalyed Average Noise Floor with Preamplifier Off	
	>9kHz to 3.6 GHz	-150 dBm
	>3.6GHz to 34 GHz	-140 dBm
	>34 GHz to 44 GHz	-132 dBm
	>60 GHz to	-135 dBm

		90GHz	
24	Measurement Speed		10 ms (100/s) nominal
25	Desirable Features		
26	Peak Table with live update		Should be Available
a	Auto-tune functionality		Should be Available
b	One Button Measurements		Should be Available
d	Power		220 to 240 V, 50/60 Hz
27	Display		10.6 in. diagonal (nominal) capacitive multi-touch screen with resolution 1280 x 800
28	Operating System		Open Windows 7 or better
29	Data interface		USB, LAN, GPIB
30	Internal Hard Disk		> 100 GB SSD or better
31	Future Upgradability		
	External source control for signal generators; supports external mixing; includes 3 BNC cables and 1 crossover LAN cable		
	Arbitrary IF output , 10 to 75 MHz (user selectable)		
	10 bit Digitizer , 10 GSa/s (4 channels) , 100 Mpts (4 channels) should be provided and compatible with offered Vector Signal Analysis software		
B.	**5G and Communication System Software Specifications**		
	Software should provide block based design environment with following libraries: DSP Blocks, Analog/RF blocks, Communication blocks, Adaptive Equalizers blocks Filters – Digital and Analog, Math – Scalar and Matrix, ZigBee Transmitter, ZigBee Receiver and ZigBee Channel model, OFDM Library blockset, Data Conversions models set.		
	Software should provide Digital Filter Design Wizard to design digital IIR/FIR filters based on the specified frequency response, design method and other relevant parameters, such as the data type (floating, complex, fixed point or envelope). The UI should generate according frequency-, time, pole/zero- domain responses and permit coefficients import/export with other design tools		
	Software should provide complete communication Channel Models as below: a. Generic AWGN and fading channel models, such as Ricean & Rayleigh b. Standard compliant, e.g. 3GPP, channel models and scenarios c. User defined channel models		
	Software should provide following capabilities for Communication System Design: 1. Fully integrated MATLAB script engine which shall allow designers to write codes directly inside the SW platform rather than linking to other interface using Dynamic link or Socket etc. approach 2. Additional capability to include external MATLAB programs for additional DSP IP verifications using various Toolboxes and compiled MATLAB programs		
	Software should provide Fixed Point DSP library which shall allow users to implement fixed point DSP/Digital design using the blocks available.		
	Software should provide automatic VHDL and Verilog code generation from the Fixed Point block design in the software. Generated HDL code should have following features: 1. Generated HDL code should be bit-true and cycle accurate 2. HDL code should be fully synthesizable and user modifiable 3. HDL code should not be vendor specific and it should be possible to port the HDL code to various FPGA platform such as Xilinx, Altera or custom FPGA platforms etc.		
	Software should be able to provide whole-platform scripting & control by external software, such as C#, MATLAB and Visual Basic. Software should provide floating point C++ code generation facility.		
	Software should provide direct links to various instruments so that it can download or read the data on/from:1. Vector Signal Generators (VSG)2. Arbitrary Waveform Generators (AWG)3. Spectrum Analyzers 4. Oscilloscopes 5. Vector Signal Analysis Tools 6. Compatibility with waveform data generated/recorded with above equipment.		

	Software should provide capability to include: 1. Touchstone S-Parameter File 2. X-Parameter models
	Software should provide RF System Simulator tool with following capabilities: a. RF System Front End design b. RF Budget Planning capability with automated measurements such as Cascaded Gain, Noise Figure, IIP3, SNR, SFDR etc. c. Software should have RF troubleshooting tool which allows taking care of spectral propagation path to troubleshoot spurious problems in complex multichannel System development. d. True RF blocks library with atleast following blocks: Frequency Multipliers, Upconverters & Downconverters, RF LNA &, Power Amplifiers, Attenuators & Phase Shifters, RF Switches, RF Oscillator sources with Phase Noise
	Software should provide dynamic graph plotting 3D graph plotting capability.
	Software should provide below libraries SerDes Model Library , AMI Modeling Kit , MIMO Channel Builder ,DPD Builder , Hardware Design Kit C++ Code Generator , RF System Design Kit , Phased Array Beamforming Kit ,Digital Modem library Radar Model Library , LTE Baseband Verification Library , WiMAX Baseband Verification Library DVB-S2 Baseband Verification Library ,mmWave WPAN Baseband Verification Library ,3G Baseband Verification Library , WLAN Baseband Verification Library , LTE-A Baseband Verification Library GNSS baseband Verification Library
	Software should provide 5G library with following capabilities: 1. 3GPP NR features conform to 3GPP V15.0.0 (2017-12) I. NR downlink baseband sources and receivers: • Support data transmission with 15kHz, 30kHz, 60kHz and 120kHz numerologies • Support 60kHz numerology with normal cyclic prefix and extended cyclic prefix • Support SSB with different periodicity and time offset, as well as multiple numerologies (15kHz, 30kHz and 120kHz)
	II. 3GPP NR uplink source: • Support 15kHz, 30kHz, 60kHz and 120kHz numerologies • Support PUSCH with PUSCH DMRS transmission • Support channel coding, scrambling, layer mapping, precoding, modulation 2. 3D channel model (0.5GHz ~ 100GHz) • Support 3GPP channel model (TR38.901) with user-defined scenario • Support up to 256x256 MIMO channel configuration • Support custom EMpro, HFSS and CST antenna pattern import Flexible OFDM MIMO source and receiver • Support flexible OFDM structure consistent with FlexOFDM source • Support 8x8 MIMO configuration • Support non-overlapping and overlapping pilot structure and corresponding channel estimation in the receiver 3. Hybrid beamforming simulation • Support configurable and flexible hybrid beamforming architecture. • Support Narrowband system and OFDM-based wideband system. • Support ideal and practical beam training. • Support Taylor window for beamforming. 4. Channel sounding simulation • Support reference signal generation for channel sounding measurement • Support channel profile extraction for channel sounding data, including path number, path delay, path power, AoA and AoD. 5. F-OFDM SISO transmitter and receiver • Support flexible F-OFDM structure, such as FFT size, subcarrier spacing, pilot and data allocation • Support different shaping filter for F-OFDM • Support F-OFDM EVM measurement • Support BER measurement in AWGN 6. UF-OFDM SISO transmitter and receiver • Support flexible UF-OFDM structure, such as FFT size, subcarrier spacing, pilot and data allocation • Support multiple sub-bands for each UF-OFDM source

	• Support different shaping filter for UF-OFDM
	Software should support Phased array module for Digital Beamforming and RF Beamforming
	OS Support: Microsoft Windows 7 & Windows 10
	Version: Latest version of the software should be provided
C.	**mmwave Vector Signal Generator should be able to generate 3GPP 5G NR standard-compliant signals for testing base stations, mobile terminal transmitters and receivers with channel coding and multi-antenna port .should Support single-carrier and/or multi-carriers , download and playback 5G NR signal waveforms with a signal generator.**

1	Frequency range	250 kHz to 44GHz with module covering 60GHz to 90GHz WR12 signal generator frequency extender , 90GHz to 140Ghz WR 08 frequency extender with 9V DC power supply
2	RF modulation Bandwidth	2 to 5 GHz
3	Resolution	0.001 Hz
4	Aging rate	$< \pm 3 \times 10e{-}8$/year
5	Output Power range	10 MHz to 44 GHz
		-130dBm to +10dBm
6	Harmonics	100MHz to 4 GHz: -30dBc
		>=4 GHz to 20GHz: -55dBc
		F > 20 to 44 GHz: -45 dBc (typ)
7	SSB Phase noise @ 20KHz offset from carrier	-130 dBc/Hz at f = 1 GHz
		-104dBc/Hz at f = 2GHz to 20GHz
		-96dBc/Hz at f = >=20GHz to 44GHz
8	Vector Modulation Software for capabilities	Modulation Types Supported:
		16QAM, 32QAM, 64QAM,128QAM,256QAM
		Simulate single satellite with C/A code for GPS, GLONASS, Galileo, Beidou, SBAS (WAAS, EGNOS, MSAS, GAGAN), or QZSS
		5G NR as per the 38 series > = release 15.0.0 or higher
		for uplink and downlink and for both TDD and FDD to be supported.
		ARB Baseband Generation capabilities with BW 2GHz from files is supported.
		5G NR standard-compliant signals creation for testing gNB or UE and software should have following 5G NR features.
		Subcarrier spacing 15 kHz, 30 kHz, 60 kHz, 120 kHz, 240 kHz Downlink channels and signals: PDSCH, PDSCH-DMRS, PDSCH-PTRS, PDCCH, CSI-RS Downlink SSBlock: PBCH, PSS, SSS, MIB auto generation for PBCH Downlink: SSBlock boosting per burst Uplink channels and signals : PUSCH, PUSCH-DMRS, PUSCH-PTRS, PUCCH (Format 0/1/2/3/4), PRACH (single burst), SRS Multi-user PUSCH and PDSCH LDPC channel coding for DL-SCH, UL-SCH Polar coding for BCH, DCI and UCI Support transform pre-coding (DFT-S-OFDM) and Pi/2-BPSK for PUSCH Uplink and downlink configuration with flexible subframe allocations Support for single carrier and multi-carriers Graphical display for frame resource allocation Export waveform files Crest factor reduction Channel filter with windowing Mixed numerology in single carrier Multiple BWP in single carrier FRC quick setup for FR1 (A1-1 to A1-9 and A2-1 to A2-6) and FR2 (A1-1 to A1-5) Predefined Configuration for FRC1 and FRC2 (downlink and uplink) Phase compensation for transmitted RF frequency in waveform generation

		RA Type 0 for PUSCH and PDSCH
9	Memory	2 Gsa
10	IQ adjustments	I & Q offsets: ± 50%
		I/Q gain balance: ± 4dB
		I/Q quadrature skew: ± 10° range (typ)
11	External I/Q analog output (diff)	Available
12	External I/Q analog input (diff)	Available
13	External Baseband Generator	Arbitrary Waveform Generator module with 2 Channels with analog Bandwidth 5GHz , 14 bit resolution with 8 GSa/s , 2 GSa Memory /Channel , SFDR up to –90 dBc (typ), optimized for serial data/time domain applications & to generate high bandwidth signals for mmwave 5G New Radio and Advanced Driver Assistance Systems (ADAS).
14	Power Supply	220/240 V AC, 50/60 Hz
15	Warranty	3 to 5 years
16	Interface	LAN, USB
17	Accessories to be supplied:	a. 2.4mm female to 2.4mm female adapter 2 qty
18	Cables	b. 2.4mm female to 2.92mm female adapter-2qty c. RF attenuator 3.5mm – 20dB / 40Db -1 qty d. BNC to BNC cables – 4qty , 2meter each e. 2.4mm male to male cable – 1 qty
		2.92mm male to male cable – 2qty 1.2m 3.5mm (f) to 3.5mm (f) – adapter 2 qty 9V DC power supply – 2 qty
D.	**10 bit Digitizer , 20 GSa/s (2 channels) , 200 Mpts (2 channels) with Vector Signal Analysis software for digital demodulation of various cellular, wireless and automotive radar & Pulse analysis.**	
1	Type	10 bit Digitizer
2	No. of Analog Channels	Four
3	Bandwidth	1GHz, upgradable upto 8GHz in future through software itself
4	Sampling Rate	Minimum 10 GSa/s on All 4 Channels working simultaneously (20GSa/s in two channels)
5	ADC	10 bit hardware ADC
6	Record Length	Minimum 100 Mpts per channel
7	Rise/Fall Time(20% to 80%)	< 80ps
8	Time Base range	5 ps/div to 50 s/div
9	Time Base Accuracy	atleast ±12ppb
10	Effective number of bits	7.2
11	RMS Noise Floor(V ac rms) for 50 ohm input at 1mV/div	< 155uV
12	Minimum detectable pulse width(for analog channels)	50 ps
13	Input Impedance	50 ohm & 1M ohm

14	Maximum input voltage	At 50 Ω: ± 5 V; At 1 MΩ: 300 Vrms
15	Extreme Low current Measurement	Should support for current measurements in 10's of nA in future.
13	Touch Screen Size	Minimum 15" Capacitive Type, Color Display
14	Line voltage supply	230-240 V, 50-60 Hz
15	After Sales, Service & Support	The Vendor shall have NABL accredited calibration Lab & repair facility in India itself
E.	Automotive Serial Triggering and Analysis Lab : Automotive Serial Triggering and Analysis (CAN, CAN-dbc, CAN FD, LIN) lab solution using hardware-based architecture should be offered: - Solution for triggering on and analyzing CAN/CAN FD/LIN serial busses - Ability to trigger and decode ISO CAN FD and non-ISO CAN FD - CAN-dbc and Lin-ldf symbolic trigger and decode by importing an industry-standard .dbc and .ldf files (standard capability) - Mixed-signal measurements across analog sensors, serial buses, and digital ECU signals - Multiple bus decode triggering and listing display and on-screen serial decode time-correlated with the serial data waveform - Real-time frame and error frame counters/totalizers including bus load	
F.	Lab Management and Test Automation Solution: suitable software platform with an intuitive interface , making it simple to control, analyze measurements and quickly build automatedtests with offered instruments & other available already . The Lab application builds upon this foundation and is designed as a lab management solution, providing centralized instrument lab configuration, data logging and automation for educators managing teaching labs. Lab Manager and Lab Station are lab management software should enable Efficient Lab Management: - Centralized lab configuration + support for various instruments. - Remote monitoring and bench desktop sharing for student assistance. - Asset tracking and management with calibration updates Better Learning Experiences: - Control instruments, capture data and screenshot, and view result easily. - Simplify and automate test sequences. Improved Teaching Process : - Preload lab and instrument settings.Remote monitoring and remote teaching	
	Mandatory Requirements:	
	The above mmwave Vector Signal generator and Vector signal analyzer should be interworking with each other	
	a. 5G NR signals that are generated by the VSG should be decoded by the VSA.	
	b. The VSA and VSG, AWG ,Digitizer, other software offered should be from the same manufacturer.	
	c. All interconnecting cables , adapters , suitable display should be quoted.	
	d. System warranty : 3 years	

Specifications for Connected Car and Intelligent Transport System Lab Setup

1. **General Description**

Connected Car and Intelligent Transport System lab setup should include Emergency Call and Vehicle location tracking (VLT) system test setup. It should be a Commercially Off the Shelf (COTS) test equipment setup with capability to emulate 2G (GSM, GPRS, EGPRS), 3G (WCDMA, HSPA+) and 4G (LTE FDD and TDD) base stations.

2. **Credential required / Eligibility criteria:**

1	Supplier must have established setup in India for local repair and calibration activity and documentary evidence is required to establish the same
2	Supplier to provide at least 1installed base for such set up in India in automotive segment and at least 3 setup for cellular simulator installed base in India.

3. **List of Deliverables**

S. No.	Item	Quantity
1	Wireless Communication Test Set for emulation of 2G, 3G and 4G networks	1
2	Test Automation software	1
3	Test SIM Cards	10
4	RF Shield Box	1
5	RF Accessories supporting up to 3 GHz RF cable (SMA male to SMA male) RF adapter (N male to SMA female) RF attenuator: 20 dB RF attenuator: 40 dB Antenna coupler RF signal combiner (2 to 1) u-Blox DUT for automotive with GPS and GSM capability 3.5mm (male) to 3.5mm (male) cable N (m) to 3.5mm (f) adapter	 4 4 1 1 3 2 1 6 6
6	Set up must be software upgradeable to support cellular technologies NB-IoT, Cat M1 and LTE-Advance with VoLTE.	
7	Set up must be software upgradeable to support signal fading for cellular signals to simulate real world mobility scenarios.	
8	Set up must be upgradeable to two cell configuration for handover test scenarios for cellular testing with GSM, WCDMA and LTE.	
9	Public Safety Answering Point (PSAP) emulator software should be provided to decode MSD data and respond to the IVS as per CEN/ETSI for eCall and should support a voice connection with the PSAP.	
10	Supplier shall provide necessary training for all the supplied products at least 2 times each of 2-days at mutually agreed time schedule	
11	Public Safety Answering Point (PSAP) emulator software should be provided to decode MSD data and respond to the IVS.	

	Technical Specifications for Cellular Network Emulator/Wireless Communication Test Set	
S. No.	**Parameter**	**Specification**
1	Support for cellular technologies	GSM, GPRS, EGPRS, W-CDMA, HSPA+, LTE FDD and LTE TDD
2	No. of emulated cellular cells	Test set should be able to emulate one cellular cell. Vendor to quote for 2 cells as well.
3	MIMO Support	Test set should support 2x2 MIMO. It must be upgradeable to 8x4 MIMO.
4	**Signal Analyzer Performance**	
	Frequency Range	300 MHz to 3.7 GHz
	Frequency Setting Resolution	100 kHz
	CW Level Accuracy	≤±1.1 dB at -50 dBm to 0 dBm
	Level Flatness	≤±0.3dB typical over 100 MHz bandwidth
	Noise Floor	<-140 dBm/Hz nominal
	Maximum CW I/p level at RF connectors	≥+33 dBm
5	**Vector Signal Generator Performance**	
	Frequency Range	300 MHz to 3.7 GHz
	Frequency Setting Resolution	100 kHz
	CW output power range	-110 dBm to -10 dBm nominal
	CW output level accuracy	≤±1 dB

	Output Level Setting Resolution	≤0.1 dB
	Output flatness	≤±0.3dB typical over 100 MHz bandwidth
	Harmonics at duplex port Attenuation of 2nd harmonic	>30 dB nominal
	Phase Noise	≤ -90 dBc at 10 kHz offset nominal
	Maximum Reverse Power at duplex port	≤ +33 dBm
6	**CW Generator Specifications**	
	No. of independent channels	2
	Support for AWGN	Built-in AWGN generator should be present in the instrument to test devices with desired S/N
7	**LTE Measurement Specifications** (upgradeable)	
	Duplex Support	FDD and TDD
	Bandwidth	1.4, 3, 5, 10, 15, 20 MHz
8	**WCDMA/HSPA+ Measurement Specifications** (upgradeable)	
	Supported Modulation Types	DL: QPSK, 16QAM, 64QAM UL: QPSK, 16QAM
	Bands	1 to 14, 19 to 21, 25, 26
9	**GSM/GPRS/EGPRS Measurement Specifications**	
	Supported Modulation Types	GMSK and 8PSK
	Bands	GSM450, GSM480, GSM750, PGSM, EGSM, RGSM, TGSM810, GSM850, DCS, PCS
10	CPU	Built-in CPU with Windows 7 or higher
11	Display	15.4" color Active Matrix color, 1280X800 pixel resolution TFT-LCD flat panel with touch panel controls (Single Touch Capacitive Touch Screen) or equivalent
12	Interfaces	USB ports: 2 each on rear panel and front panel 1 Gbps LAN port at rear panel and front panel
13	Test automation	Test automation software with following features should be provided. - Capability to create and configure test plans consisting of test steps - Should support simple flow operations such as If, While and Loop - Should provide development environment for new test case automation
14	Protocol Capture (upgradeable)	Protocol information to be sent to a standalone logging application like Wireshark should be provided.
15	Capability for future software based upgradation in same hardware	a. Frequency upgrade to 6 GHz b. Support for next generation eCall over IMS c. Support for end to end VoLTE call between two devices d. Support for fading for mobility scenario testing
16	Warranty	3 To 5 Years (Performance Guarantee for the above period + 3months @ 10% of the total cost)
17	Payment Terms	70% to 100 % advance (vendor will submit a Bank Guarantee for the said amount valid up to one month from the tentative date of installation)

2. Technical Specification for RF Shield Box:

S. No.	Parameter	Specification
1	Shielding effectiveness (dB)	> 70 dB, 100MHz-3000MHz
2	RF Ports	2xN-SMA
3	Interface port	1xUSB 2.0
4	DC Power input	1Pair of Banana Jack for DC power Adapter
5	Dimension	Inside--220(W) x280(D) x 170(H) mm

3. Payment Terms and Performance Guarantee for all the items

Warranty	3 To 5 Years (Performance Guarantee for the above period + 3months @ 10% of the total cost)
Payment Terms	70% to 100 % advance (vendor will submit a Bank Guarantee for the said amount valid up to one month from the tentative date of installation)

<u>NOTE: Vendors are free to quote for equipment with specifications better than the above, however, the basic requirements as specified in this annexure should be met.</u>