

Measuring ^{the} Perfection



Pioneer in Designing Antenna Positioners & Motion Controllers

PATEL
MACHINERY

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Our Story

For more than 18 years, Patel Machinery has been the leading Indian supplier of highly precise multi-axes machineries. We progressively enhanced the machine capabilities to meet the market need. We are well experienced team of Engineers having insight knowledge of machines and control over it to guarantee the delivery of high quality and precision machines to customers. We are also involved and share our expertise and vast exposure to formulate and enhance the production planning with latest technologies.

Our Motto

- High Precision Machine manufacturing
- Customer Satisfaction
- Strong and Bold Leadership
- Efforts to make Self Reliant India
- Cost Effective working
- Maintaining Quality
- Empowering Workforce
- Transparency in Business

Capability

Mechanical Design Engineering

From structural analysis to robotic automation, Patel Machinery applies a range of materials and techniques to find the ideal mechanical solution to the widest array of system requirements.

Software Engineering

Patel Machinery data acquisition and analysis system provide the broadest flexibility in the RF and Microwave industry. And our design expertise delivers application focused custom software solutions for customers.

Complete System Design

Our specialized team of engineers are involved in delivering turnkey solutions. We fulfil the specific need of industry related to integrated RF systems design for Ground Stations.

RF and Microwave Engineering

Patel Machinery RF engineers are well experienced in the field of designing RF, Antenna systems and Microwave components. Our team is capable of analysing and delivering high frequency solutions that unlock the toughest RF and microwave design problems.

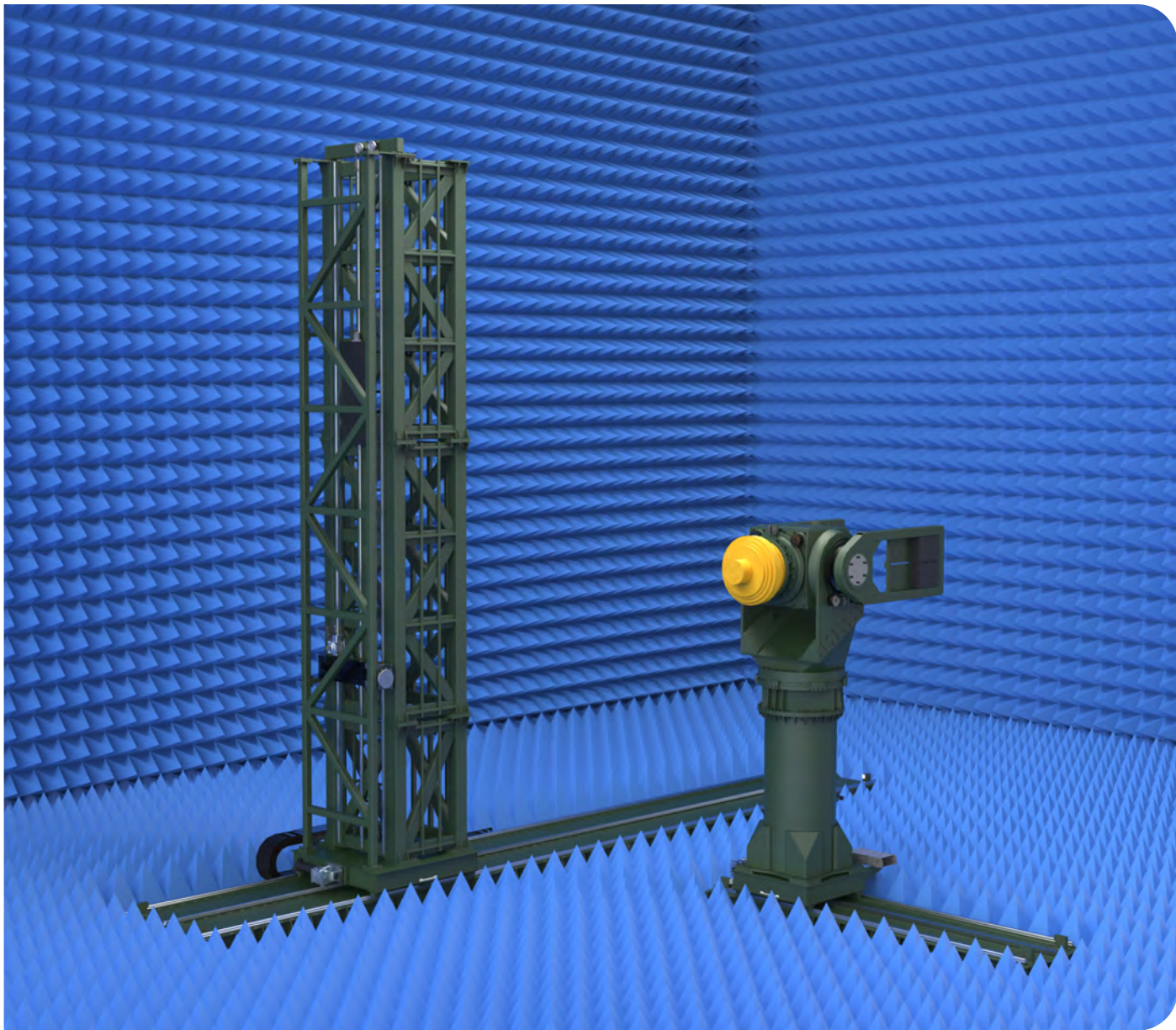
Automated Test and Measurement Solution

We are qualified manufacturer of the automated test and measurement systems for antenna and RCS applications. We deliver a world class custom measurement systems for a broad range of applications.

Specialising in the development of the most accurate

Near-Field Antenna Measurement System

to cater the high frequency measurement requirement



Near Field Antenna Test Range

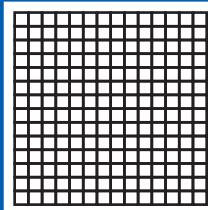
Space & Defence Engineering Section of **Patel Machinery** developed a **most accurate Planar Near-Field scanner systems to cater the high frequency measurement upto 200 GHz.**

It can also be configured in horizontal scan plane to cater the characterization of large size, bulky in weight & gravitational sensitive antennas.

We have a wide range of Near-Field scanners available in sizes with a travel range from 0.5 m to 30 m. The developed scanner is a four axes assembly having Polarization positioner to support waveguide probe, linear Z-slide to manage distance between AUT (DUT) and probe, linear Y-slide (vertical axis in case of vertical scanner) and precision linear X-slide (floor slide).

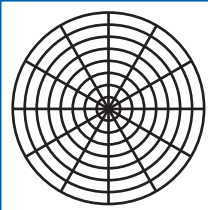
it's a lightweight vertical structure with high rigidity travels and load balancing mechanism to avoid the deflection due to gravity. The scanners are fitted with drive system based on customer applications. After installation at customer site, we do verify the planarity through laser alignment, calibration and our controller offers the real time position error correction algorithm to correct the measured data.

Planar Near-Field Measurement System is an ideal system for measuring medium and high gain antenna systems. The Scanner is 4-axes (Lin Horizontal Slide axis 'X', Lin Vertical Slide axis 'Y', Lin Slide axis 'Z' perpendicular to X-Y plane & Rotational axis to rotate the probe mounted on scanner). Similarly, the DUT Positioner is 4-axes (Azimuth, Elevation, Polarization & Linear Slide axis parallel to Scanner Z-axis). The combination of these 8-axes provides different type of Near-Field scanning like Planar, Plane-Polar, Bi-Polar, Cylindrical and Spherical.



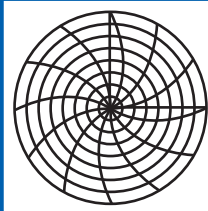
Planar

Scan axis - Scanner Lin X
Step axis - Scanner Lin Y
DUT Pos. stationary



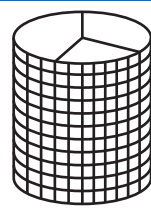
Plane-Polar

Scan axis - Scanner Lin Y
Step axis - DUT Pos.
Polarization



Bi-Polar

Scan axis - Scanner Lin Y
and DUT Pos. Polarization
Step-axis - DUT Pos.
Polarization



Cylindrical

Scan axis - Scanner Lin Y
Step axis - DUT Pos.
Azimuth



Spherical

Scan axis - DUT Pos.
Azimuth
Step axis - DUT Pos.
Elevation

		PMIT- VS- 1.0/0.8	PMIT- VS- 2.5/2.0	PMIT- VS- 3.0/3.0	PMIT- VS- 5.4/5.4	PMIT- VS- 9.0/7.0	PMIT- VS- 12/10
Construction		Inverted T-Frame Structure					
Drive System		Precision Servo Drive					
Scan Area	X	1.0 m	2.5 m	3.0 m	5.4 m	9.0 m	12.0 m
	Y	0.8 m	2.0 m	3.0 m	5.4 m	7.0 m	10.0 m
	Z	0.2 m	0.25 m	0.3 m	0.4 m	0.5 m	0.6 m
Planarity (RMS)		Mechanical < 0.10 mm RMS (Software Pos. Corr. < 0.05mm)					
Resolution		Better than 0.03 mm					
Position Repeatability		Better than 0.05 mm					
Scan Speed		Maximum: 0.25 m/sec & Minimum: 0.01 m/sec					

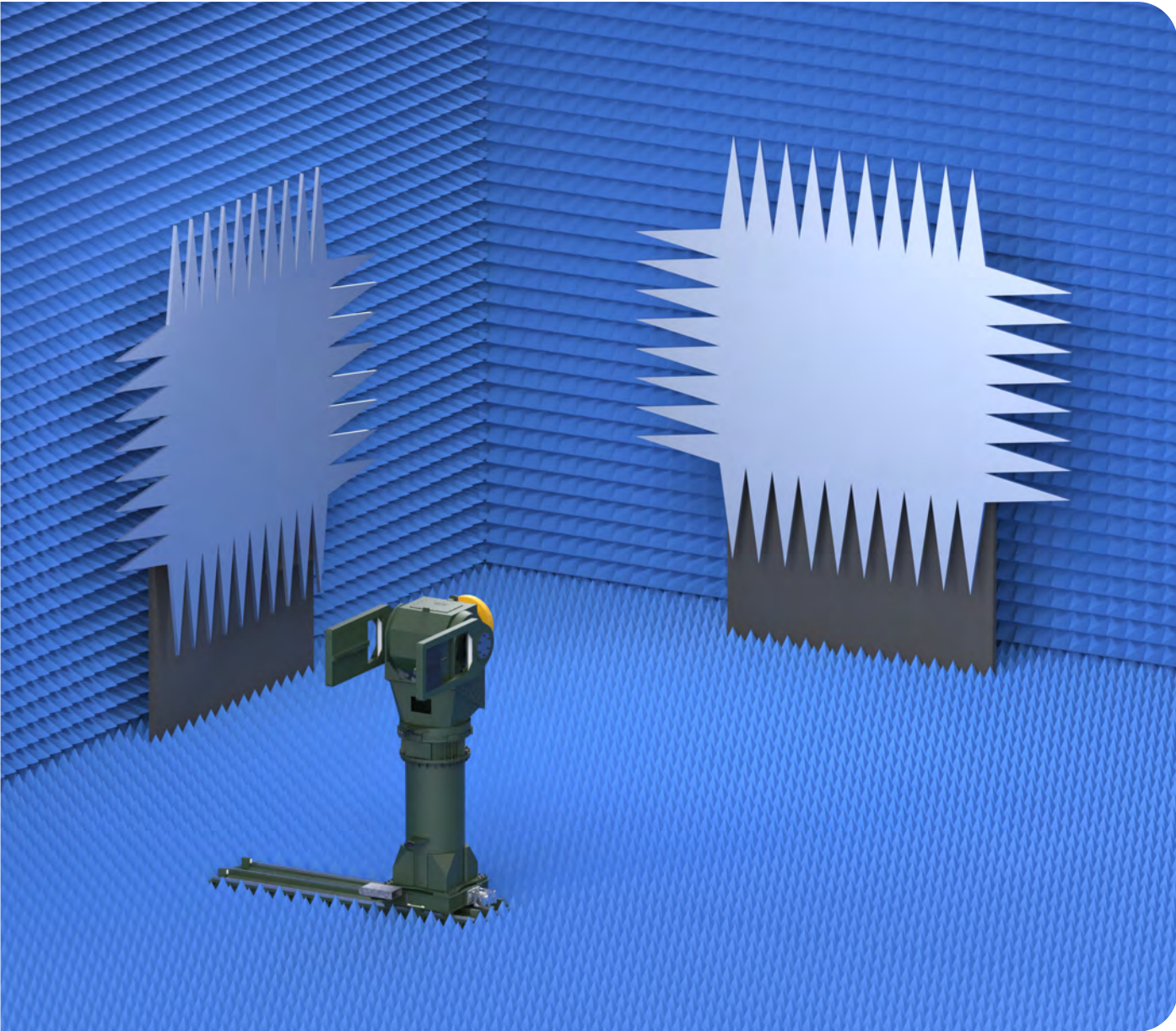
Patel Machinery have capability to deliver high planarity (<30 micron RMS) reflectors panels upto size of 7.0 m X 3.0 m to construct the range reflector optics. We are capable to take turnkey project including the engineering, manufacturing and installation of reflectors, multi-axes positioning system, and integrated measurement test setup and data acquisition system software.

	QZ: 1.0 m	QZ: 2.0 m	QZ: 3.0 m	QZ: 4.0 m	QZ: 5.0 m	QZ: 8.0 m
Type	Reflector Optics					
Freq Range (GHz)	FL: 3.5	FL: 2.4	FL: 1.4	FL: 1.0	FL: 1.0	FL: 1.0
	FH: 110	FH: 220	FH: 220	FH: 220	FH: 220	FH: 220
Edge Treatment	Serrated					
Range Feed	Corrugated Horn Dual Linear Polarized (1-40 GHz)					
Chamber Size (m³)	8 x 7	14 x 12	19 x 16	24 x 18	30 x 20	48 x 32
	x 6	x 10	x 13	x 14	x 15	x 19
Quiet Zone Size	1.0 m	2.0 m	3.0 m	4.0 m	5.0 m	8.0 m
Amplitude Taper	≤ 1.0 dB					
Phase Taper	≤ 6.0 deg					

In Reflector based Compact Ranges the plane wave is synthesized by a reflector system that collimates the spherical wave generated by range feed. And the quality of plane wave generated in antenna test zone are far better than traditional far-field.

The range operational high frequency will be decided based on reflector surface RMS finish (better than $\lambda/55$, where λ is the shortest wavelength corresponding to highest operational frequency). Similar the low frequency operations will be limited by the length of serrations (minimum 5λ), reflector dimension (minimum 20λ) in terms of electrical wavelength and the height of pyramidal absorbers

The dual reflector system will be illuminated by dual polarized corrugated range feed having cross-polarization better than 40dB.



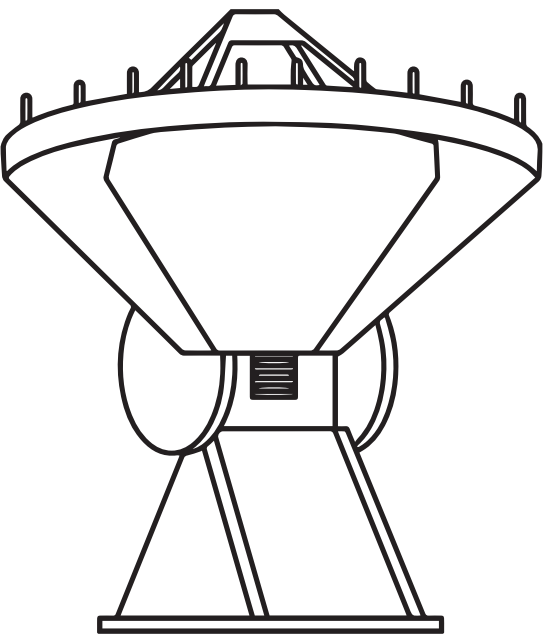
Reflector based Compact Range

Now a days the reflector based compact antenna test ranges are in demand due to increasing measurement accuracy requirements, large size antenna characterization in controlled environment and considering fast and real time measurement requirement

The far-field antenna measurement offers a quick estimation of antenna performance. The traditional far-field concept demands a large separation between transmit and receive side, which is practically impossible for large size of antenna at higher frequencies. The reflector-based compact antenna range offers all the advantages of far-field and simulate a far-field equivalent environment in a very compact indoor test chamber.

The additional advantages offered by Compact range are control temperature, no wind deflection, avoided rain, 24x7 operation ability and also reduces the maintenance costs. Patel Machinery offers Custom models of different sizes can also be manufactured to meet specific customer requirements upto 200GHz.

Ground Stations



We are manufacture of components (mainly mechanical parts) for Antenna Systems for satellite communications, microwave communications, presently the company is manufacturing wide range of large steerable Earth Station Antenna with Cassegrain / Gregorian configuration for hub / teleports and VSAT Antenna in C / Ext.-C / Ku / Ka bands both prime focus and offset types.

We have multiple workshops with the required electronic and mechanical test equipment's to manufacture various types of antennas, feed systems, mounts, masts, towers, and wave guides. We manufactures Antenna Control Systems, Beacon Tracking Receivers, Motor Controllers, Feed & Control Electronics Systems to suit customer requirements. The company will responsible to characterize such components at different test facilities available in India.

3.8m Tx/Rx VSAT Antenna System (Series: PM-XX-3800-PF-AI-SF-DAM)

Electrical Spec.		C-Band Linear	Ku-Band Linear	C-Band Circular	X-Band Circular
XX		CL	KuL	CC	XC
Model No.		PM-CL-3800	PM-KuL-3800	PM-CC-3800	PM-XC-3800
Antenna Size		3.8 m	3.8 m	3.8 m	3.8 m
Frequency (GHz)	Rx	3.625 – 4.20	10.95 – 12.75	3.625 – 4.20	7.25 – 7.75
	Tx	5.845 – 6.425	13.75 – 14.50	5.845 – 6.425	7.90 – 8.40
Midband Gain (+/-0.3 dB)	Rx	41.5 dBi	51.00 dBi	41.4 dBi	47.20 dBi
	Tx	45.0 dBi	52.50 dBi	45.1 dBi	48.00 dBi
Antenna Noise Temp.	10° EI	45 K	60 K	52 K	51 K
	20° EI	38 K	55 K	45 K	47 K
	40° EI	36 K	45 K	43 K	45 K
Output W.g. Interf.	Rx	CPR 229	WR 75	CPR 229	WR 112
	Tx	CPR 137	WR 75	CPR 137	WR 112
Reflector Material		Aluminium			
Antenna Optics		Prime Focal			
Elevation Range		5° to 88° minimum			
Azimuth Range		180° bidirectional or 360° continuous			
Wind Loading		Operational: 50 mph & Survival: 125 mph			
Temp. Range		-35° to 60° C			
Rain		13 mm per hour			
Atmos. Cond.		Salt, Pollutants & Contaminants as encountered in Coastal Areas			

Radomes (Radar Enclosures)



Radome covers are an ideal way to provide additional protection to our radar antenna from environmental or wireless interferences. A radome will be designed in order to maintain the radiation characteristics of antenna in terms of transmission loss and beam-pointing error.

Material used to construct radomes must be dry and electrically isolating. PTFE is among the most effective materials available for radome construction. The material is fully machinable and maintain the uniform wall thickness throughout the part.

The presence of radome can affect gain (transmission loss), beam deflection, pattern distortion and reflected power.

Band	L	S	C	X	Ku	K	Ka
Transmission Loss (dB)	0.05	0.07	0.10	0.12	0.15	0.20	0.24
Pointing Error (milli-rad)	<1	<1	<1	<1	<1	<1	<1

Provides Protection Against

- Rain and snow
- Wind
- Blowing sand and debris
- Corrosion

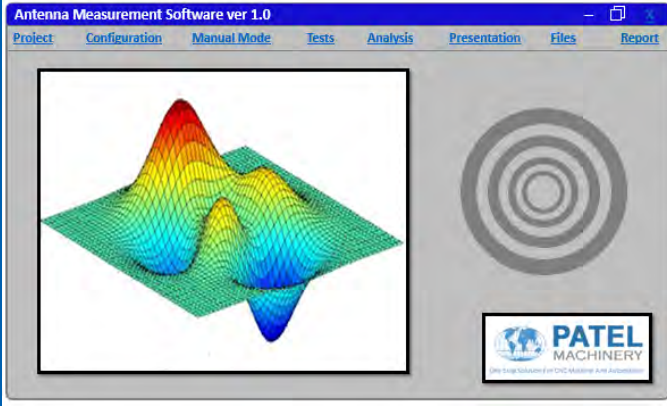
Features

- Antenna Polarization Neutral
- No Metal Framework, Rigid and Self-supporting
- Easy to install, directly attached with any type of antenna
- Lightweight construction
- UV Stable finish
- Drain holes in radomes to prevent inside build moisture

Sizing

Radome diameters and truncation are primarily driven by antenna type and size. For horn antennas the radome inner diameter must be equal to horn aperture outer diameter, similarly for Prime Focal antenna radome diameter equals to 1.5 times of reflector diameter and for Offset Geometries its 2.0 to 2.3 times of reflector diameter.

Antenna Measurement Software

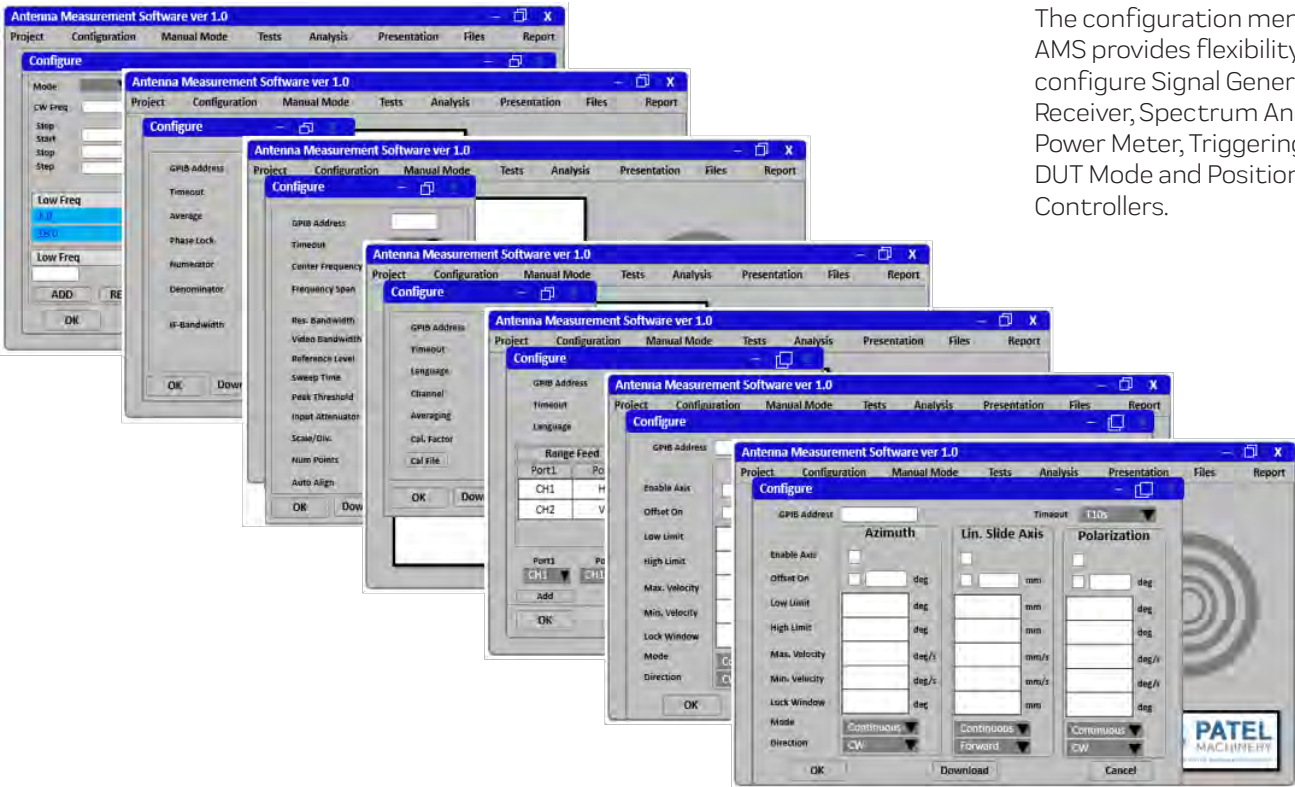


Antenna Measurement Software (AMS) developed by Patel Machinery satisfies the most demanding applications of antenna, radome and RCS measurements.

The integrated analysis part gives a real time report of measured antenna system.

Antenna Measurement Software

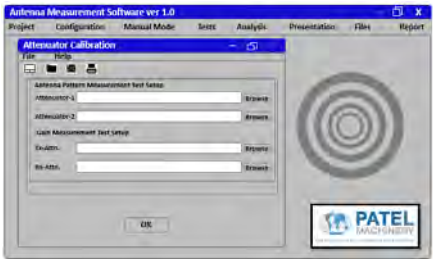
The configuration menu of AMS provides flexibility to configure Signal Generator(s), Receiver, Spectrum Analyzer, Power Meter, Triggering Unit, DUT Mode and Positioner Controllers.



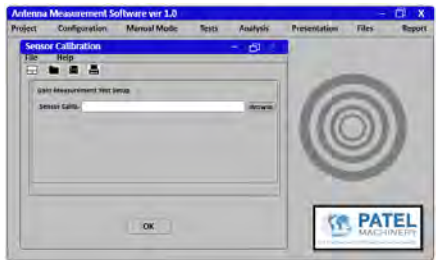
Project Details



Antenna Details



Attenuator Calibration



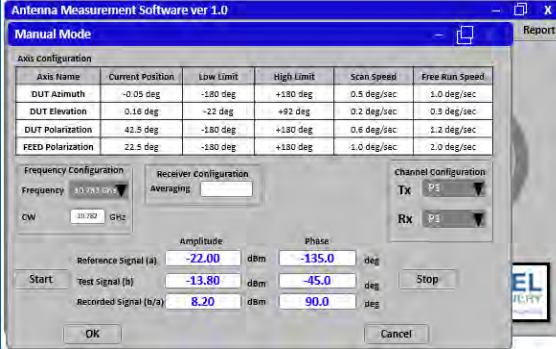
Sensor Calibration



Motion Corr. Profile



Range Probe Pattern



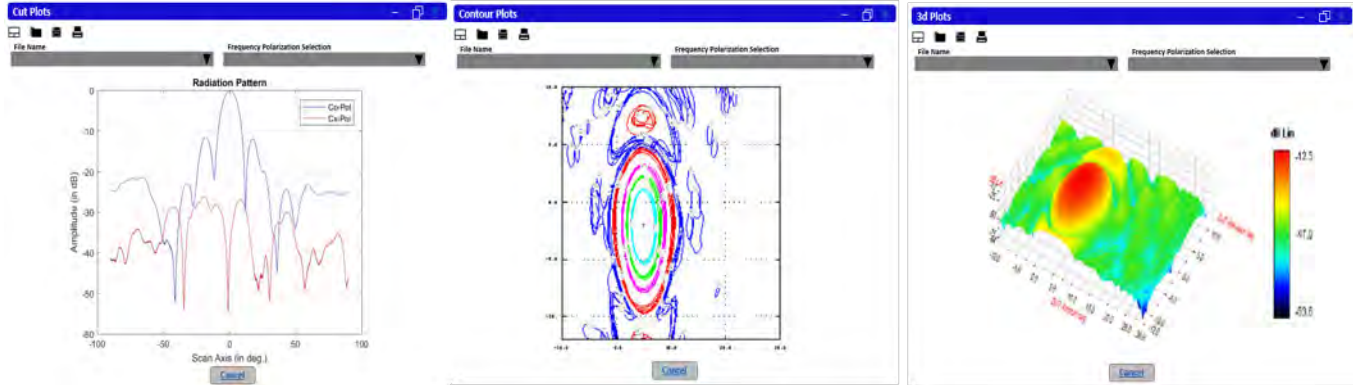
It gives quick verification of defined test configurations. Provide feasibility to select any configuration and move any axis of positioner. Easy to record reference and test signal amplitude and phase before every measurement.



Adaptor Loss



Measurement Conditions



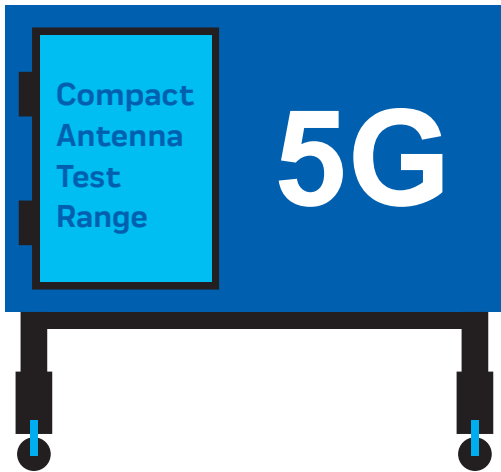
Portable OTA Measurement Range

Despite the benefits and market potential of mmWave technology, 5G faces many challenges. High frequencies and wide bandwidths create more path loss, noise, and frequency responses, impacting measurement accuracy.

Patel Machinery portable Compact Antenna Test Range (CATR) is optimized to provide the most accurate over-the-air measurements for 5G testing.

Quiet Zone Performance		Reflector		Positioning System	
Dimensions	0.30 m	Optics	Dual Refl.	Type	Roll/EI/Az
Cross Pol.	-30 dB	Edge Treat.	Serrated	Pos.	0.01o
Ampl. Taper	1 dB	Freq Range	6-110 GHz	Accuracy	0.1o
Ampl. Ripple	0.5 dB	Focal Length	1.40 m	Max	0.1o
Phase Ripple	10 deg	Surface RMS	20 μm	Load	5 Kg

Range Feed		Test Setup	
Freq Range	22 – 45 GHz	Type	RF Based
Gain	15 dBi		IF Based
Type	Corrugated Dual Lin. Pol.	DAQ	Java or C#



Size of QZ	QZ: 0.3 m	QZ: 0.5 m	QZ: 0.8 m	QZ: 0.3 m	QZ: 0.5 m	QZ: 0.8 m
Type	Single Reflector Optics			Dual Reflector Optics		
Freq Range (GHz)	5-110					
Reflector Surface RMS	20 μm					
Range Feed	5-40					
Amplitude Taper	≤ 1 db					
Phase Taper	≤ 10 deg			≤ 6 deg		

Over all Chamber Dimensions: 2.85 m X 1.7 m X 2.0 m
Mass ≤ 550 Kg

Portable Vector Network Analyzer



pocketVNA portable vector network analyzer

- 2-port Vector Network Analyzer
- Fully bidirectional (S11, S21, S12, S22) – magnitude and phase.

Applications

- Antenna analyzer
- Impedance scanning
- Cable length measurement
- filter tuning

Technical Specifications

Frequency Range	500 kHz to 4 GHz
Typical dynamic range	@350 MHz up to 70 dB
(System dynamic range)	@4 GHz up to 40 dB
Impedance range	3 to 1000 Ohms
Measurement speed	10 ms per step plus communication (for example a 1001 points scan S11 only takes 12 seconds)
Number of steps	1 to 10001 (Limited by measurement time)
Frequency setting resolution	1 Hz

General Information

- Connection to PC: mini-USB
- RF connectors: SMA female

Software Features

- Available for Windows, MacOS and Linux, Android, Raspberry Pi.
- Open API to access hardware with third-party software (Windows, MacOS, Linux, Raspbian, LabView).
- OSL calibration functionality.
- Time domain measurements.
- Plot S-Parameter, Impedance, Phase, Resistance, Reactance, VSWR.
- Plot in Smith chart.
- Export to Excel, Touchstone.
- Save complete sets of measurement together in one proprietary project file.

Authorized Indian representative of

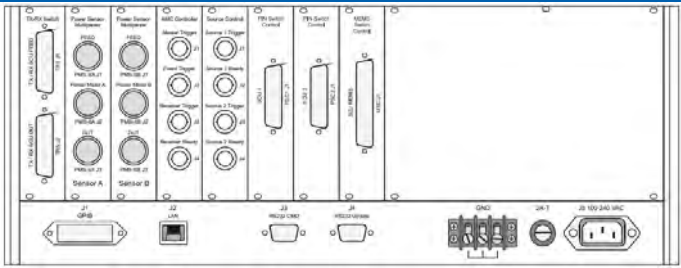


Measurement System Controller

19" rack device with 4U height and approx. 360mm depth. Front panel with power switch and 5.7" LCD graphic touch panel with 320 x 240 pixel. Touch panel with CFL illumination in blue negative. Main power switch with green indicator light.



Front Panel of MSC3001



Rear Panel of MSC3001

Rear mounting of max. 11 plug-in cards in European format 3 HE / 30.5 mm. Mainboard with I2C bus for parameterization, fast-trigger bus for event transmission between the plug-in cards and lines for power supply. Additional lines for FPGA setup on plugin-cards subsystems per processor.

Integrated microcontroller as central control unit for all device functions. Additional flash memory for configuration data of FPGAs on plugin-in card subsystems, which are loaded by the processor after power-on.

Antenna Measurement Controller Subsystem consist of four plugin-cards:

Measurement controller as central unit with two isolated BNC sockets for Master- and Event-Trigger and two isolated BNC sockets for Receiver Trigger / Ready.

Source Control with two isolated BNC sockets each for two sources Trigger / Ready.

Two pin switch control plugin-cards with one D-Sub 25 connector each for 8 pin switches.

Power Sensor Multiplexer Subsystem

consist of two plugin-cards, each with a relay multiplexer for 7 potential-free PSM signals with the switch positions Feed and Duty Load. - Sensor A Unit & - Sensor B Unit

Tx/Rx Switch Unit consist of two plugin-cards with two pin switch control connectors

Microwave Absorbers



High performance Expanded Polypropylene Flat absorbers for applying on corners of Anechoic chambers, to cover positioner and for Shielding cabinets

Dimension and weight

Model Number	Overall length	Overall Width	Thickness	Weight
DMC-PP-FLT-40	1200 mm	300 mm	40 mm	1.11 Kg
DMC-PP-FLT-100	600 mm	300 mm	100 mm	0.77 Kg

Typical Reflectivity over Frequency Range In-db

Model Number	Thickness	1 GHz	3 GHz	6 GHz	10 GHz	18 GHz	40 GHz
DMC-PP-FLT-40	40 mm	15	24	26	29	33	34
DMC-PP-FLT-100	100 mm	21	27	28	33	37	39

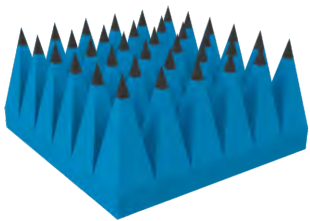
Expect the Best from DMC EPP Microwave Absorbers. Unbreakable, Clean test site, 35+ years of electrical performance with Broadband frequency range of operation from 80 MHz to 100 GHz

Typical Reflectivity at normal Incidence over Frequency Range In-db

Model Number	80 MHz	250 MHz	500 MHz	1 GHz	3 GHz	5 GHz	10 GHz	18 GHz	40 GHz	100 GHz
DMC-PP-PY-MI-300	1	24	29	35	49	49	50	50	50	50
DMC-PP-PY-MI-500	7	29	35	45	50	50	50	50	50	50
DMC-PP-PY-MI-750	10	32	38	47	50	50	50	50	50	50



High performance polyurethane Microwave absorbers for Wireless, Antenna, RADAR, Radome test chambers with wide frequency range of operation from 80 MHz to 100 GHz.



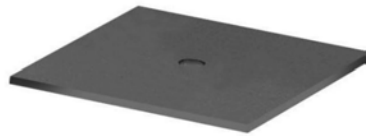
Typical Reflectivity at normal Incidence over Frequency Range In-db

Model Number	30 MHz	80 MHz	250 MHz	500 MHz	1 GHz	3 GHz	6 GHz	10 GHz	18 GHz	40 GHz	100 GHz
DMC-PP-PY-MI-50	-	-	-	-	-	-	30	35	40	50	45
DMC-PP-PY-MI-100	-	-	-	-	-	30	35	40	45	50	45
DMC-PP-PY-MI-200	-	-	-	-	27	35	40	45	50	50	48
DMC-PP-PY-MI-300	-	-	-	25	35	40	50	50	50	50	47
DMC-PP-PY-MI-500	-	-	20	30	40	50	50	50	50	50	48
DMC-PP-PY-MI-700	-	8	25	35	40	50	50	50	50	50	48
DMC-PP-PY-MI-1000	-	11	30	40	45	50	50	50	50	50	47
DMC-PP-PY-MI-1200	5	13	35	40	45	50	50	50	50	50	47

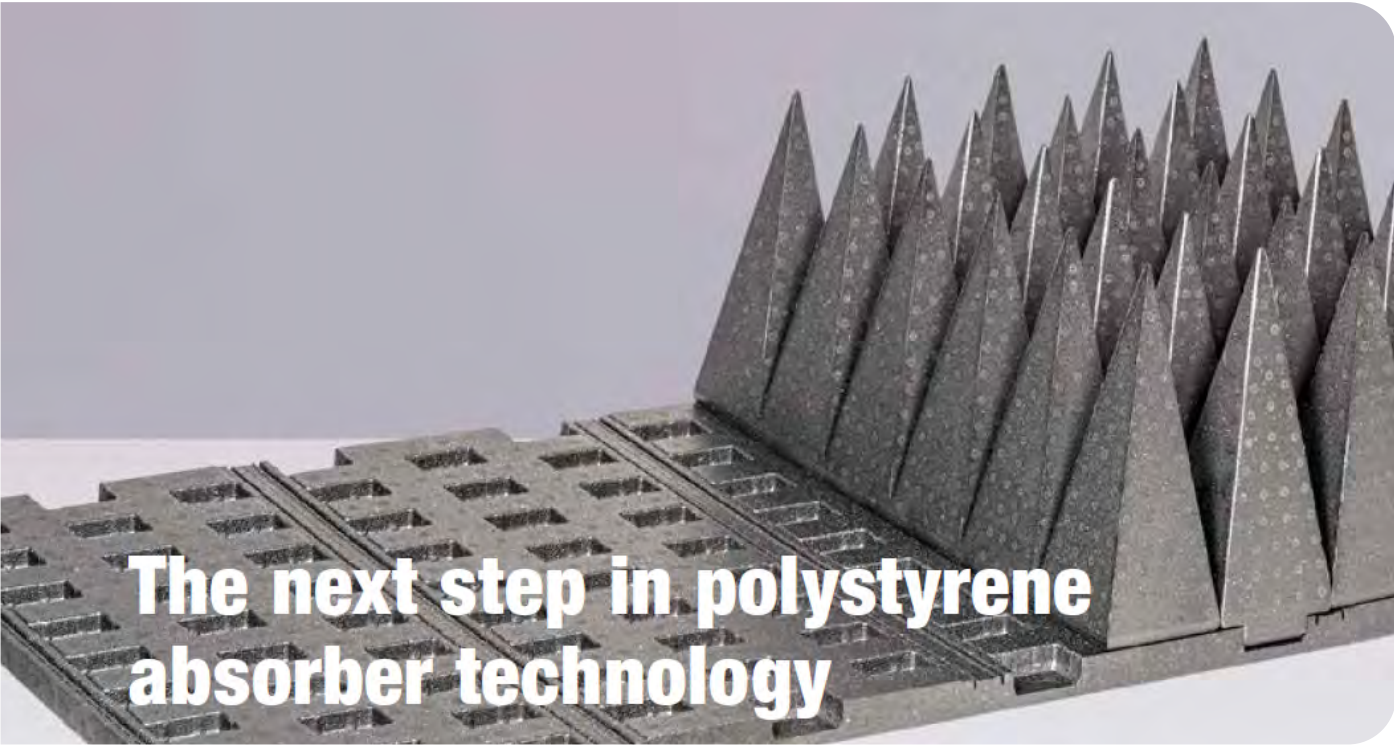
Precision machined ferrite tiles and panels for EMC chambers to support from 30 MHz to 1 GHz.

Typical Reflectivity over Frequency Range In-db

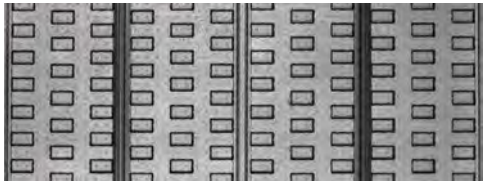
Model Number	30 MHz	100 MHz	300 MHz	500 MHz	700 MHz	1000 MHz
DMC-FT-6.7	25.5	38	19.5	16	12	10



Polystyrene Absorbers



Polystyrene absorbers have always been far more durable and stable than their polyurethane foam counterparts.



Frequency (MHz)

	500MHz	1GHz	3GHz	5GHz	10GHz	18GHz	30GHz	50GHz		
MT30-JT	≤ -25dB	≤ -30dB	≤ -45dB	≤ -45dB	≤ -45dB	≤ -45dB	≤ -40dB	≤ -40dB		
	300MHz	500MHz	1GHz	3GHz	5GHz	10GHz	18GHz	30GHz	50GHz	
MT45-JT	≤ -20dB	≤ -25dB	≤ -35dB	≤ -45dB	≤ -45dB	≤ -45dB	≤ -45dB	≤ -45dB	≤ -45dB	
	200MHz	300MHz	500MHz	1GHz	3GHz	5GHz	10GHz	18GHz	30GHz	50GHz
MT65-JT	≤ -20dB	≤ -20dB	≤ -35dB	≤ -40dB	≤ -50dB	≤ -50dB	≤ -45dB	≤ -45dB	≤ -45dB	≤ -45dB

RF Instruments

LOW-LOSS DIGITAL WIDEBAND MICROWAVE ATTENUATOR



USB-POWERED VARIABLE-GAIN AMPLIFIER



WIDEBAND MICROWAVE SIGNAL GENERATOR



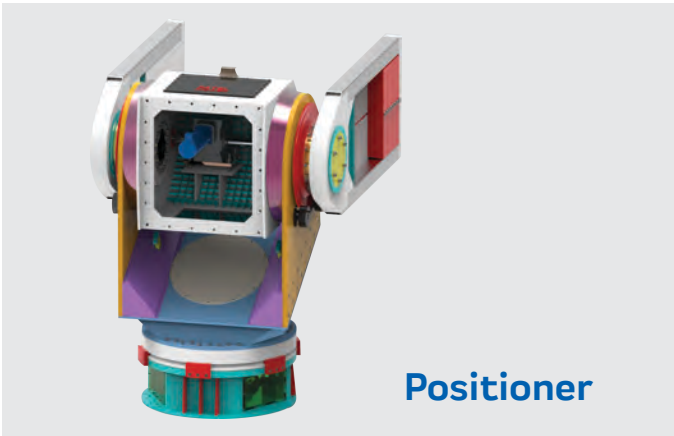
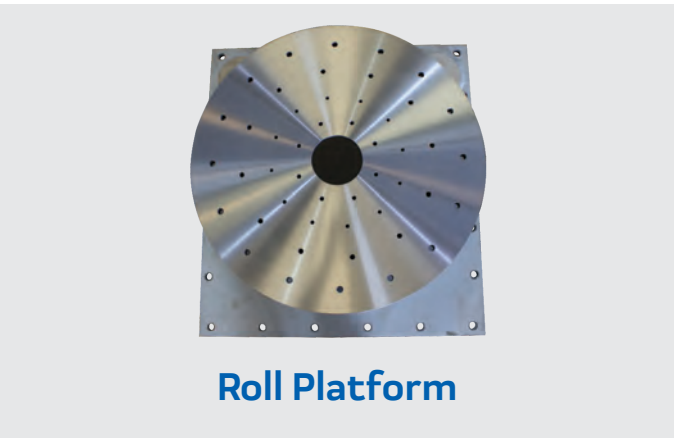
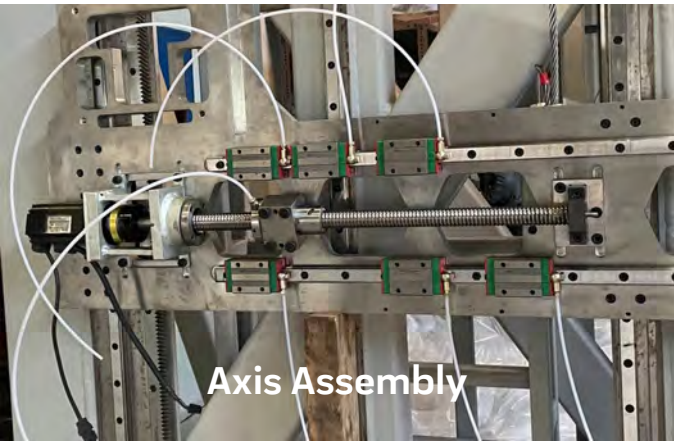
USB ACTIVE WIDEBAND RF PHASE SHIFTER



USB POWERED WIDEBAND INTEGRATED-LO MICROWAVE MIXER



System Components



Electronics Research Lab



Customized Controller for Rf measurement

