इलेक्ट्रॉनिकी एवं
सूचना प्रौद्योगिकी मंत्रालय
MINISTRY OF
ELECTRONICS AND
INFORMATION TECHNOLOGY

SAMEER

Tec-Verse 2026
CONNECT · COLLABORATE · INNOVATE

Magnetic Resonance Imaging(MRI) Machine

Control, Monitoring & Interlock system



Superconducting Magnet & Gradient Coil



Spectrometer



IMRI Reconstruction Software





RF Coils



Patient Table



RF Amplifier



SOCIETY FOR APPLIED MICROWAVE ELECTRONICS ENGINEERING AND RESEARCH
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Indian Magnetic Resonance Imaging



- Magnetic Resonance Imaging (MRI) is very effective imaging technique used to visualize internal soft tissue structures of the body with high contrast images. MRI can create 3D high resolution images which helps in diagnosing a broad range of conditions, including cancer, heart and vascular disease, and muscular and bone abnormalities. MRI can detect abnormalities that might be obscured by bone with other imaging methods.
- SAMEER along with its collaborating partners IUAC, CDAC & MIRC has designed and developed 1.5 Tesla MRI system with individual sub-systems like superconducting magnet assembly, High power Amplifier, RF Coils, Spectrometer, Imaging & Visualisation software and integrated complete system to acquire images of objects.

SYSTEM SPECIFICATIONS:

PARAMETERS	SPECIFICATIONS
Magnetic Field	1.5 TESLA
Main Magnetic Field Homogeneity	(40 cm DSV)<10ppm
Transmitted Power	14 kW Peak (max)
Maximum Field of View (mm)	500 (isotropic)
Minimum Field of view (mm)	10
Bore Diameter	60 cm
Number of channels	08
Gradient magnetic field along X, Y, Z (mT.m-1)	33
Gradient field Slew Rate (mT.m-1.ms-1)	120
Coolant	Helium

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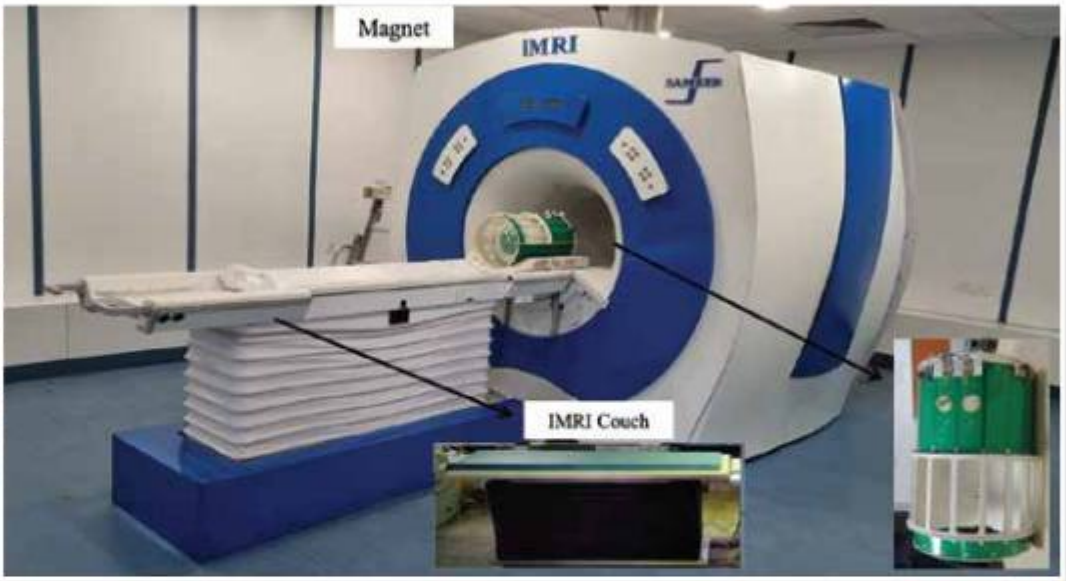
1.5T IMRI System





Specification of the Indigenous 1.5T MRI

Sr.	Parameters	Value
1.	Magnetic Field	1.5 Tesla
2	Frequency of Operation	63.87 MHz
3	Bandwidth	6 kHz to 600 kHz (Variable)
4	Transmitted Power	15 kW Peak (Max.)
5	No. of Rx. Channels	16
6	Imaging Coil Types	✓ Body, Head and Knee Bird Cage Coil ✓ 12 Channel Head(8)-Neck(4) Coil ✓ 20 Channel Array Coils Embedded in the Couch Assembly (Posterior Coil/Spine Coil, 8 Ch) and Overlay (Anterior, 12 Ch.) ✓ General Purpose Flexible 4 Ch. Array Coil ✓ 2", 3" and 5" Single Ch. Coil
7	Imaging Sequences	GRE, SE, IR, EPI(GRE/SE), TSE/FSE, DWI, STIR, FLARE, GRAPPA
8	Main Magnetic Field Homogeneity (45 cm DSV)	<10 ppm
9	Maximum Field of View	450 mm (isotropic)
10	Minimum Field of View	10 mm
11	Minimum Slice Thickness	2 mm
12	Patient Bore Diameter	60 cm (Typical)
13	Bore Length	170 cm (Typical)
14	Gradient Amplitude (mT/m) in all XYZ Axis	33(Typical)
15	Gradient Slew Rate (mT/m/ms)	120(Typical)
16	Power Supply	~80 kVA

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SAMEER

India's First Indigenously Developed 1.5T Whole-body Superconducting MRI Magnet

Salient Features

- ✓ 4K Zero-boil-off cooling technology
- ✓ Smaller 5G stray field region
- ✓ Low quench Design
- ✓ High field stability
- ✓ Passive Shimming





Description	Specification
Central Field	1.5 T
Field of View (FOV)	45 cm
Field Homogeneity	± 4 ppm
Stray Field Region (5G)	3.4 m (Z) x 2.4 m (R)
Operating Current	~500 A
Field Stability	< 0.1 ppm/hr
Operating temp	4.2-4.3 K
Warm Bore diameter	~86 cm
Patient Bore Dia	≥ 60 cm

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RF Power Amplifier

15 kW RF Power Amplifier

Parameter	Values
Frequency of Operation	63.87 MHz
Bandwidth	600 kHz
Gain Variation (Flatness)	±0.2 dB over the bandwidth
Output Power (Peak power)	15 kW for Body coil 4 kW for Head/Knee coil
Duty Cycle	10% (Max.)
Typical Gain	72 dB/ 66 dB
Class of Operation	AB
Efficiency	>50%
Nominal Input Impedance	50 Ohm
Input VSWR	1.5:1 (Max.)
Output VSWR(Load)	3:1 (Max)
Gain Linearity (Dynamic range)	<0.5 dB Variations over 20 dB range <1.0 dB Variation over 50 dB range
Phase Linearity	<5 degree over 20 dB range <10 degree over 50 dB range
Short term stability (5mins) Gain stability Phase stability	 <0.2 dB <5 degree
Input Signal pulse width	4µs to 10ms
Harmonics	< 20 dBc at rated power
Output Noise, Blanked	<-130 dBm/Hz
Output Noise, Un-blanked	<-65 dBm/Hz
Spurious noise	<-40 dBc
Droop	< 8% over a 10 ms rectangular pulse







RF Power Amplifier (Sub-Components)



Variable Gain Amplifier(VGA)

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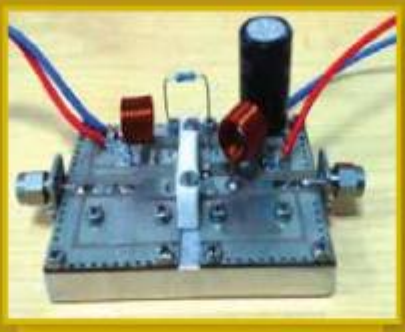
RF Power Amplifier (Sub-Components)



Pre-driver Amplifier



Driver Amplifier



High Power Amplifier



4-way 4kW RF Power Combiner



4-way 16 kW RF Power Combiner



High Power Amplifier, packeged



High Power Dual Directional Coupler



Developed 2-Way Power Divider



4-way Input Power Divider

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MRI Spectrometer

Fully functional 08 channel FPGA based Transceiver



MRI Spectrometer Tx. Specifications

RF Frequency	63.87 MHz ± 1 MHz
RF Pulse Width	Minimum width 5 ns, Max 5 ms
RF Pulse Shape	Sinc, Rectangular, Gaussian in Time Domain
Output power	0 dBm to 7 dBm with step of 0.1 dBm
Duty Cycle	2% to 15%
Phase noise (dBc/Hz)	Better than -110 dBc/Hz @10kHz offset
Stability	Better than $\pm$10 ppm
Gradient DAC Resolution	20 bit
Gradient DAC Sampling Rate	1 MHz
Pulse Width	Any
Number of Waveforms	Three (Independent of each other)
Gradient of Pulse Shape	Arbitrary

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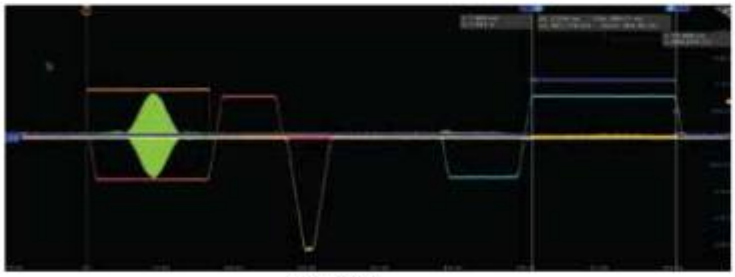
MRI Spectrometer Tx. Specifications

Signal Frequency	63.866777 MHz
Number of channel	08
Bandwidth	Programmable ± 500 KHz
Frequency Encodes	128 / 256 / 512 / 1024
Phase Encodes	128 / 256 / 512 / 1004
Digitiser (ADC)	16 bit
Dynamic range	90 dB
Minimum detectable signal	-110 dBm
Noise floor	-115 dBm
Front end System noise:	2 dB
Input power Clipping Level	-30 dBm
DDC specifications	Resolution = 1Hz (min); Freely tuneable within window
Digital data O/P type	I, Q of all 8 channels
Data Output	K space Data transferred to the PC via TCP Protocol
Environmental parameters	Temperature: 10°~ 40°C
	Storage: 10°~ 40°C
	Humidity: Up to 95% non - condensing
Connectors	SMA for signal connectivity
Connectivity Impedance	50Ω

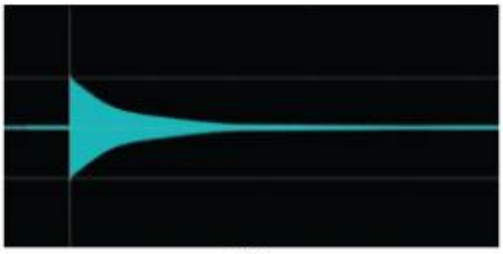
Flow of IMRI



RF Pulse



RF with Gradients



FID



Pineapple Scan



Volunteer's Knee

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