North Carolina Department of Health and Human Services
Division of Health Service Regulation

Pat McCrory
Governor

Aldona Z. Wos, M.D.
Ambassador (Ret.)
Secretary DHHS

Drexdal Pratt
Division Director

November 5, 2014

Mr. Steve Midkiff
Chief Executive Officer
Lake Norman Regional Medical Center
171 Fairview Road
Mooresville, North Carolina 28117

Exempt from Review - Replacement Equipment

Facility:	Lake Norman Regional Medical Center
Project Description:	Replace MRI scanner
County:	Iredell
FID #:	990475

Dear Mr. Midkiff:

In response to your letter of October 14, 2014, the above referenced proposal is exempt from certificate of need review in accordance with N.C.G.S 131E-184(a)(7). Therefore, you may proceed to acquire, without a certificate of need, the GE Optima MR450w 1.5T GEM 24.0 MRI system to replace the existing Symphony 1.5T MRI system, serial #704660SMR, at Lake Norman Regional Medical Center. This determination is based on your representation that the existing unit will be removed from North Carolina and will not be used again in the State without first obtaining a certificate of need.

Moreover, you need to contact the Construction and Acute and Home Care Licensure and Certification Sections to determine if they have any requirements for development of the proposed project.

It should be noted that this Agency's position is based solely on the facts represented by you and that any change in facts as represented would require further consideration by this Agency and a separate determination.

Certificate of Need Section
www.ncdhhs.gov
Telephone: 919-855-3873 • Fax: 919-733-8139
Location: Edgerton Building • 809 Ruggles Drive • Raleigh, NC 27603
Mailing Address: 2704 Mail Service Center •Raleigh, NC 27699-2704
An Equal Opportunity/ Affirmative Action Employer

If you have any questions concerning this matter, please feel free to contact this office.

Sincerely,

Gloria C. Hale

Gloria C. Hale
Project Analyst

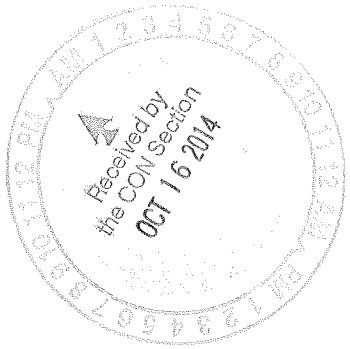
Martha J. Frisone

Martha J. Frisone, Interim Chief
Certificate of Need Section

cc: Construction Section, DHSR
Acute and Home Care Licensure and Certification Section, DHSR
Medical Facilities Planning Branch, DHSR

LAKE NORMAN
REGIONAL MEDICAL CENTER

October 14, 2014



Ms. Martha Frisone, Interim Chief
Certificate of Need Section
Division of Health Services Regulation
N.C. Department of Health & Human Services
809 Ruggles Drive
Raleigh, NC 27603

Re: Lake Norman Regional Medical Center – Exemption Notice for Acquisition of Replacement Magnetic Resonance Imaging Equipment, Iredell County

Dear Ms. Frisone:

Mooresville Hospital Management Associates, LLC d/b/a Lake Norman Regional Medical Center ("LNRMC") seeks to acquire a General Electric ("GE") Optima 450W 1.5 Tesla MRI unit with GEM features ("GE Optima") ("Replacement Equipment"). Please see Attachment A for a copy of LNRMC's current hospital license. The Replacement Equipment will replace LNRMC's current Siemens Magnetom Symphony 1.5 Tesla Magnetic Resonance Imaging unit ("Existing Equipment"). The Existing Equipment is currently housed and in use on the first floor of Lake Norman Regional Medical Center at 171 Fairview Road, Mooresville, NC 28117, and is within LNRMC's main campus (see Attachment B). The Replacement Equipment will be located in the same space.

The purpose of this letter is to provide the Agency with notice to request a determination that LNRMC's purchase of the Replacement Equipment is exempt from Certificate of Need ("CON") review under the replacement equipment exemption provisions contained in Session Law 2013-360, Section 12G.3(b) and Session Law 2013-363, Section 4.6 (which are codified at N.C. Gen. Stat. 131E-184(f)(l)-(3)).

The General Assembly has chosen to exempt certain, otherwise reviewable, events from CON review. Among those exemptions is the acquisition of "replacement equipment," defined as follows in the CON law:

> "Replacement equipment" means equipment that costs less than two million dollars ($2,000,000) and is purchased for the sole purpose of replacing comparable medical equipment currently in use which will be sold or otherwise disposed of when replaced.

See N.C. Gen. Stat. 131 E-176(22a). Under the new provisions found at N.C. Gen. Stat. 131E-184(f)(l)-(3), the CON law provides:

(f) The Department shall exempt from certificate of need review the purchase of any replacement equipment that exceeds the two million dollar ($2,000,000) threshold set forth in G.S. 131E-176(22) if all the following conditions are met:

1) The equipment being replaced is located on the main campus.
2) The Department has previously issued a certificate of need for the equipment being replaced. This subdivision does not apply if a certificate of need was not required at the time the equipment being replaced was initially purchased by the licensed health service facility.
3) The licensed health service facility proposing to purchase the replacement equipment shall provide prior written notice to the Department, along with supporting documentation to demonstrate that it meets the exemption criteria of this subsection.

See Session Law 2013-360, Section 12G.3(b) and Session Law 2013-363, Section 4.6. The term "main campus" was defined in Session Law 2013-360, Section 123G.3(a) (codified N.C. Gen. Stat. 131E-176(14n) as follows:

(14n) "Main campus" means all of the following for the purposes of G.S. 131E-184(f) and (g) only:

a. The site of the main building from which a licensed health service facility provides clinical patient services and exercises financial and administrative control over the entire facility, including the buildings and grounds adjacent to that main building.

The Existing Equipment is currently located on the first floor of Lake Norman Regional Medical Center at 171 Fairview Road, Mooresville, NC, and is within LNRMC's main campus; and the Replacement Equipment will be located within the same space (see Attachment B). This is the same building from which LNRMC exercises financial and administrative control. LNRMC's Chief Executive Officer's office is also located in this building.

In addition to the foregoing, to qualify for this exemption, the replacement equipment must be "comparable" to the equipment it replaces and the equipment being replaced must be "sold or otherwise disposed of when replaced." LNRMC's proposal qualified for this exemption.

A. Cost of the Replacement Equipment

The purchase price of the Replacement Equipment is $1,508,809.45 ($1,441,121.97 for the MRI unit, plus $97,687.48 tax, and $10,000 freight). Quotes for the MRI unit from General Electric are provided in Attachment C. The projected total capital cost of the project is $1,818,909.45 and includes the removal of the existing equipment, renovation of the space, installation of the Replacement Equipment, and training. The total capital cost schedule and the certified cost estimate of the renovation required to install the new equipment are provided in Attachment D.

B. Equipment Being Replaced is Located on the Main Campus

The Existing Equipment is currently located on the first floor of Lake Norman Regional Medical Center and is within LNRMC's main campus. The Replacement Equipment will be located in the same space on the first floor of Lake Norman Regional Medical Center and is within LNRMC's main campus (see Attachment B).

C. Certificate of Need Issued for Equipment Being Replaced

This proposal also fits within the new exemption criterion in Section 131E-184(f)(2) because the Department issued a Certificate of Need (Project Identification Number: F-5815-98 Effective March 2, 1999) for the Existing Equipment (see Attachment E). The Existing Equipment remains in the same original location today.

D. Comparable Equipment

The CON rule codified as 10A N.C.A.C. 14C.0303 (the "Regulation") defines "comparable medical equipment" in subsection (c) as follows:

> "Comparable medical equipment" means equipment which is functionally similar and which is used for the same diagnostic or treatment purposes."

LNRMC intends to use the Replacement Equipment for substantially the same MRI procedures for which it currently uses the Existing Equipment. The Existing Equipment is a Siemens Magnetom Symphony 1.5 Tesla Magnetic Resonance Imaging unit that was installed new in 2000. This Existing Equipment has been used for MRI procedures since installation.

The Replacement Equipment will perform all procedures currently performed on the Existing Equipment. Although it possesses some expanded capabilities due to technological improvements and the ability to accommodate heavier patients, the

Replacement Equipment will perform the same MRI procedures (see Attachment F for the Equipment Brochure). The Replacement Equipment is therefore "comparable medical equipment" as defined in Subsection (c).

Furthermore, LNRMC does not intend to increase patient charges or per procedure operating expenses within the first twelve months after equipment acquisition. For further equipment comparison, please refer to Attachment G, the Equipment Comparison Chart.

Subsection (d) of the regulation further provides:

1) It has the same technology as the equipment currently in use, although it may possess expanded capabilities due to technological improvements; and
2) It is functionally similar and is used for the same diagnostic or treatment purposes as the equipment currently in use and is not used to provide a new health service; and
3) The acquisition of the equipment does not result in more than a 10.0 percent increase in patient charges or per procedure operating expenses within the first twelve months after the replacement equipment is acquired.

The Replacement Equipment will meet all three of the tests set out in Subsection (d). The Replacement Equipment satisfied the technology and functionality tests in Subsection (1) and (2) as discussed above and identified in the Equipment Comparison Chart (Attachment G). Moreover, LNRMC represents the use of the Replacement Equipment will not result in the types of expenses or charge increases described in Subsection (d)(3).

The Existing Equipment is currently in use and documentation provided in Attachment H indicates that 2,162 procedures were performed in 2013.

E. Disposition of Equipment

Please see Attachment I for a letter documenting the Existing Equipment will be taken out of service and will not be re-sold or re-installed in North Carolina without appropriate certificate of need approval.

CONCLUSION:

Based on the foregoing information, LNRMC hereby requests that the Agency provide a written response confirming that the acquisition of the Replacement Equipment described herein is

exempt from CON review. If the Agency needs additional information to assist in its consideration of this request, please let us know.

Thank you for your consideration of this notice.

Sincerely,

Steve Midkiff, Chief Executive Officer

cc: Greg Page, MBA, FACHE, Chief Operating Officer
Bill Greear, MBA/MHA RT-R (CV), Director of Imaging Services

Attachments:

A. Copy of LNRMC Hospital License
B. LNRMC Site Map
C. Quote for Replacement Equipment
D. Capital Cost Schedule & Certified Cost Estimate of Renovation
E. Copy of Original Certificate of Need
F. Replacement Equipment Brochure
G. Equipment Comparison Chart
H. Table of MRI Procedure Volume for 2013
I. Disposition of Equipment

Lake Norman Regional Medical Center
Exemption Notice for Acquisition of Replacement MRI Unit

ATTACHMENT A

Copy of LNRMC Hospital License

State of North Carolina

Department of Health and Human Services
Division of Health Service Regulation

Effective January 01, 2014, this license is issued to

Mooresville Hospital Management Associates, LLC

to operate a hospital known as

Lake Norman Regional Medical Center

located in Mooresville, North Carolina, Iredell County.

This license is issued subject to the statutes of the State of North Carolina, is not transferable and shall remain in effect until amended by the issuing agency.

Facility ID: 990475

License Number: H0259

Bed Capacity: *123*

General Acute 123

Dedicated Inpatient Surgical Operating Rooms: 1
Dedicated Ambulatory Surgical Operating Rooms: 2
Shared Surgical Operating Rooms: 7
Dedicated Endoscopy Rooms: 3

Authorized by:

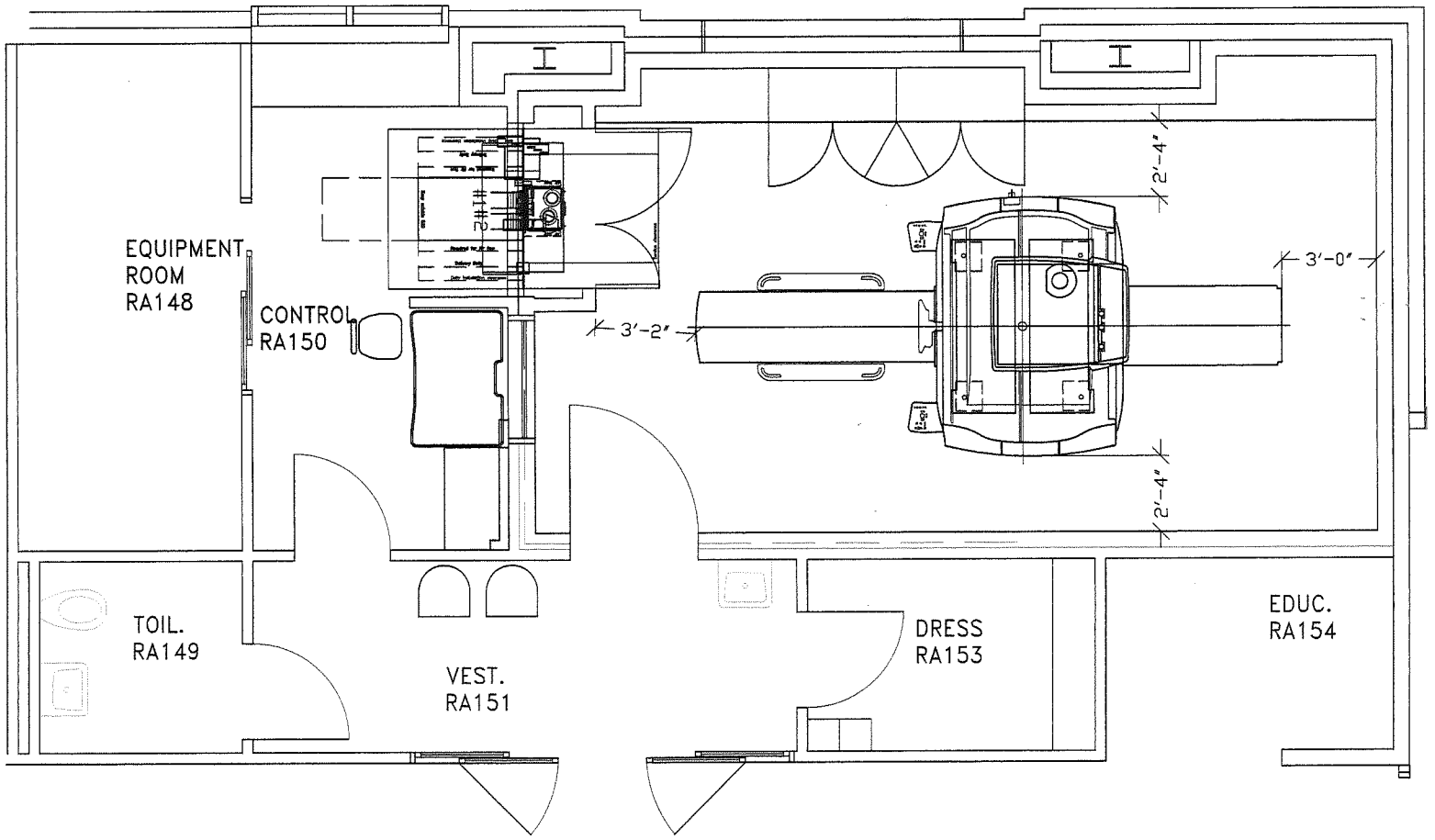
Secretary, N.C. Department of Health and Human Services

Director, Division of Health Service Regulation

Lake Norman Regional Medical Center
Exemption Notice for Acquisition of Replacement MRI Unit

ATTACHMENT B

LNRMC Site Map



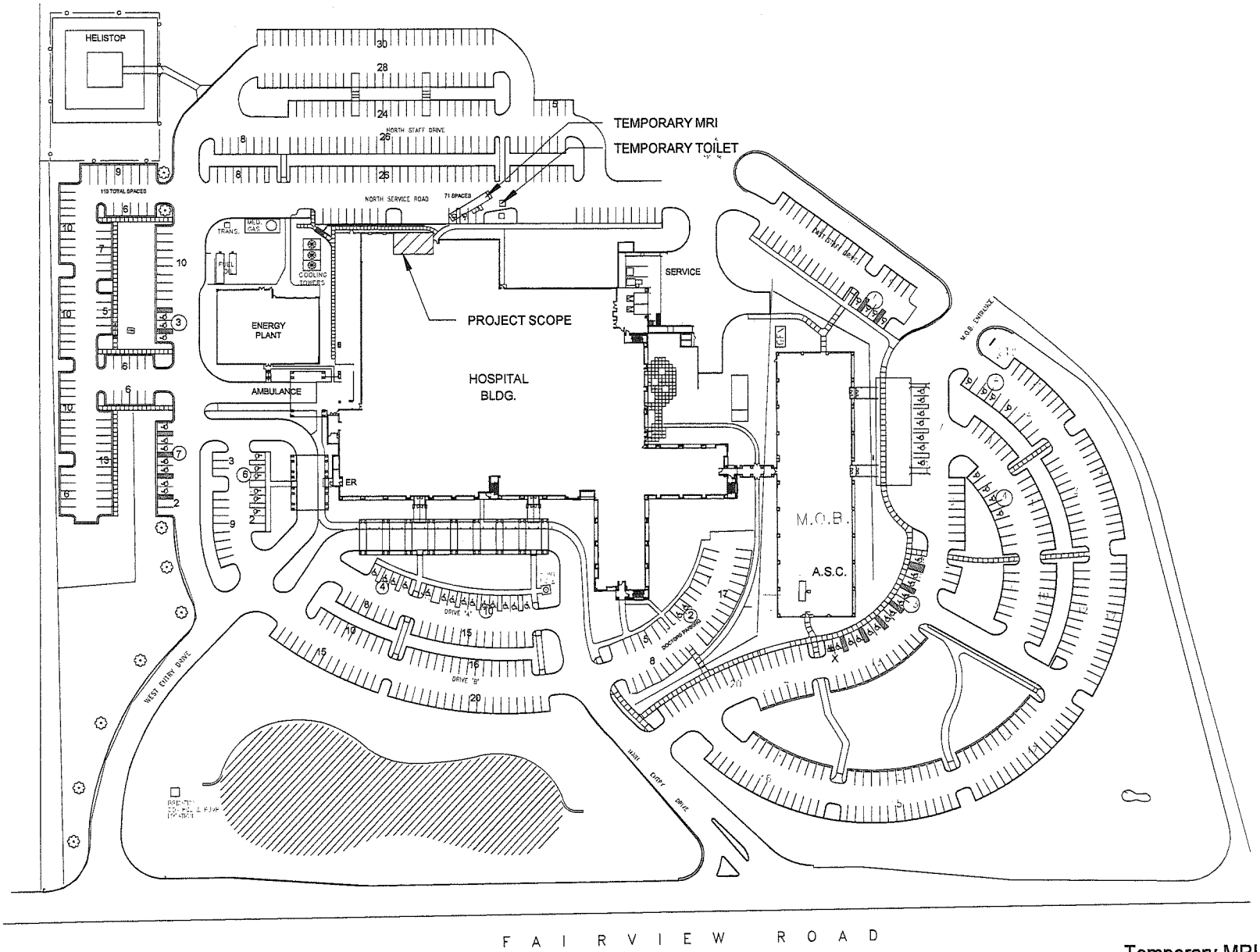
GE Caring MR Suite® – Floor Plan

3/16" = 1'-0"

Lake Norman – alternate

Manufactured by: PDC Facilities, Inc. 700 WALNUT RIDGE DRIVE HARTLAND, WISCONSIN 53029 (262) 367-7700

rev
10/3/14



Temporary MRI Site Plan

WRIGHT McGRAW BEYER ARCHITECTS

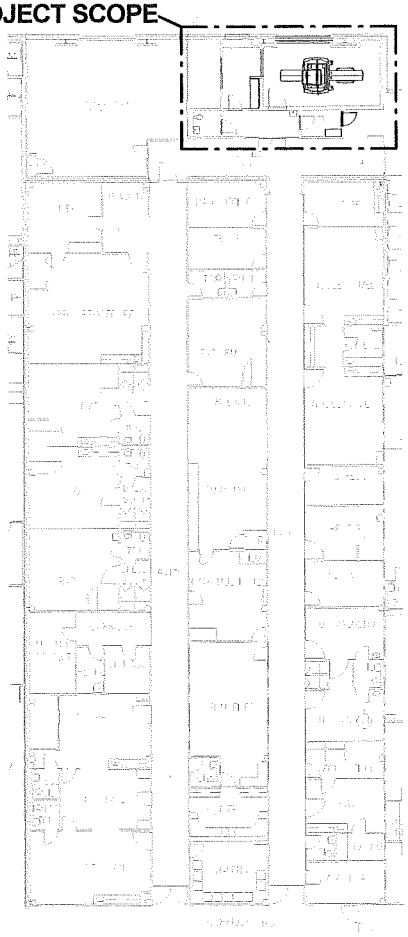
2201 WATER RIDGE PARKWAY
SUITE 550 CHARLOTTE, NC 28217
704.535.6374 FAX 704.535.9827

LNMRC MRI Replacement

171 Fairview Road
Mooresville, NC 28117

PROJECT NO. 2760	A1
OSR #: 0	
DRW:TAS CHK:DAW	DATE:10.09.14

PROJECT SCOPE



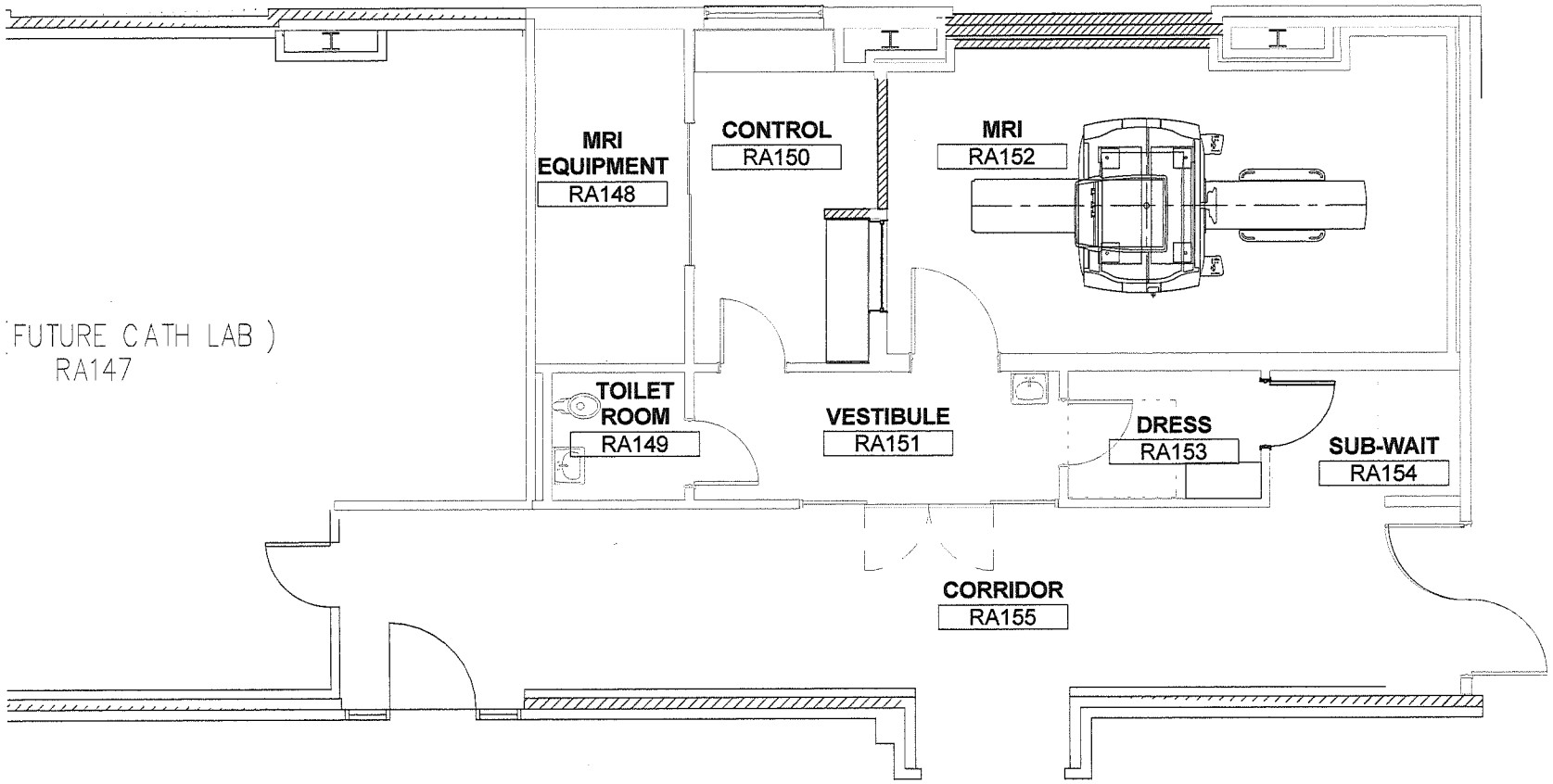
Radiology Deparment

WRIGHT McGRAW BEYER ARCHITECTS
2201 WATER RIDGE PARKWAY
SUITE 550 CHARLOTTE, NC 28217
704.535.6374 FAX 704.535.9827

LNMRC MRI Replacement

171 Fairview Road
Mooresville, NC 28117

PROJECT NO. 2760 OSR #: 0	A3
DRW:TAS CHK:DAW	DATE:10.09.14



MRI Floor Plan

WRIGHT McGRAW BEYER ARCHITECTS
2201 WATER RIDGE PARKWAY
SUITE 550 CHARLOTTE, NC 28217
704.535.6374 FAX 704.535.9827

LNMRC MRI Replacement

171 Fairview Road
Mooresville, NC 28117

PROJECT NO. 2760 OSR #: 0	A2
DRW:TAS CHK:DAW	DATE:10.09.14

Lake Norman Regional Medical Center
Exemption Notice for Acquisition of Replacement MRI Unit

ATTACHMENT C

Quote for Replacement Equipment

PO# 64971

GE Healthcare

QUOTATION

Revised 9/25/14

Quotation Number: PR5-C29294 V 2

Lake Norman Regional Medical Center
171 Fairview Rd
Mooresville NC 28117-9500

Attn: Radiology Director
171 Fairview Rd Mooresville
NC 28117-9500

Date: 09-25-2014

This Agreement (as defined below) is by and between the Customer and the GE Healthcare business ("GE Healthcare"), each as identified herein. GE Healthcare agrees to provide and Customer agrees to pay for the Products listed in this GE Healthcare Quotation ("Quotation"). "Agreement" is defined as this Quotation and the terms and conditions set forth in either (i) the Governing Agreement identified below or (ii) if no Governing Agreement is identified, the following documents:

1) This Quotation that identifies the Product offerings purchased or licensed by Customer;

2) The following documents, as applicable, if attached to this Quotation: (i) GE Healthcare Warranty(ies); (ii) GE Healthcare Additional Terms and Conditions; (iii) GE Healthcare Product Terms and Conditions; and (iv) GE Healthcare General Terms and Conditions.

In the event of conflict among the foregoing items, the order of precedence is as listed above.

This Quotation is subject to withdrawal by GE Healthcare at any time before acceptance. Customer accepts by signing and returning this Quotation or by otherwise providing evidence of acceptance satisfactory to GE Healthcare. Upon acceptance, this Quotation and the related terms and conditions listed above (or the Governing Agreement, if any) shall constitute the complete and final agreement of the parties relating to the Products identified in this Quotation. The parties agree that they have not relied on any oral or written terms, conditions, representations or warranties outside those expressly stated or incorporated by reference in this Agreement in making their decisions to enter into this Agreement. No agreement or understanding, oral or written, in any way purporting to modify this Agreement, whether contained in Customer's purchase order or shipping release forms, or elsewhere, shall be binding unless hereafter agreed to in writing by authorized representatives of both parties. Each party objects to any terms inconsistent with this Agreement proposed by either party unless agreed to in writing and signed by authorized representatives of both parties, and neither the subsequent lack of objection to any such terms, nor the delivery of the Products, shall constitute an agreement by either party to any such terms.

By signing below, each party certifies that it has not made any handwritten modifications. Manual changes or mark-ups on this Agreement (except signatures in the signature blocks and an indication in the form of payment section below) will be void.

- Terms of Delivery: FOB Destination
- Quotation Expiration Date: 09-26-2014
- Billing Terms: 80% delivery / 20% Installation
- Payment Terms: NET 30
- Governing Agreement: HPG Group Buy ✓ - cs

Each party has caused this agreement to be signed by an authorized representative on the date set forth below. Please submit purchase orders to GE Healthcare
Please submit Purchase Orders to: General Electric Company, GE Healthcare, 3000 N. Grandview Blvd., Mail Code WT-897, Waukesha, WI 53188

GE HEALTHCARE

Scott Ramsey
Product Sales Specialist

CUSTOMER

Kimberley C Milliken 9/26/14
Authorized Customer Date

Kimberley Milliken, Capital Coordinator
Print Name and Title

64971
PO #

Desired Equipment First Use Date

GE Healthcare will use reasonable efforts to meet Customer's desired equipment first use date. The actual delivery date will be mutually agreed upon by the parties.

INDICATE FORM OF PAYMENT:

If "GE HFS Loan" or "GE HFS Lease" is NOT selected at the time of signature, then you may NOT elect to seek financing with GE Healthcare Financial Services (GE HFS) to fund this arrangement after shipment.

✓ Cash/Third Party Loan
___ GE HFS Lease
___ GE HFS Loan
___ Third Party Lease (please identify financing company) _____

Quotation Number: PR5-C29294 V 2

Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price
			MR450w 1.5T GEM 24.0			
	1		**Optima MR450w 1.5T GEM 24.0**			
1	1	S7524AA	Optima MR450w GEM 1.5T MR System ES Platform The Optima MR450w GEM 1.5T MRI system from GE Healthcare is designed to deliver a comfortable patient-friendly environment while also delivering uncompromised clinical performance and streamlined workflow. The ES platform package delivers the system electronics, operating software, imaging software, post-processing software and RF coil suite for the Optima MR450w GEM system: • eXtreme Gradient Technology • Acoustic Reduction Technology • OpTix RF Receive Technology • Volume Reconstruction Engine • Computing Platform and DICOMM • GEM Express Patient Table with IntelliTouch • GEM Suite - ES Coil Package • Express 2.0 Workflow and In-Room Operator Console • ScanTools and ES Tools eXtreme Gradient Technology: The Optima MR450w GEM system utilizes the 34/150 gradient driver technology to deliver premium clinical performance. The eXtreme gradients are non-resonant and actively shielded to minimize eddy currents.	$1,392,275.00	61.50%	$536,025.88

Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price
			The gradients deliver high fidelity reproducibility through a digital control architecture that features a dedicated active feedback loop that regulates current errors, and a feed-forward model that matches amplifier output to gradient coil. The gradient coil and the RF body coil are integrated into a single module that is both water and air cooled. • Peak amplitude per axis: 34 mT/m • Peak slew rate per axis: 150 T/m/s • Peak current: 660 Amps • Peak voltage: 1650 Volts • Maximum FOV: 50cm • Duty Cycle: 100% Acoustic Noise Reduction Technology: The Optima MR450w GEM system features five levels of acoustic reduction technology to deliver an enhanced patient environment. Magnet interaction with the building is addressed through the vibro-acoustic dampening pad. Resonance module interaction with support structures within the magnet is addressed through design that clearly separates the components. Mass-dampened acoustic barriers further reduce noise for the patient, and ScanTools provide a user selectable gradient waveform optimization. • Gradient coil isolation • RF coil isolation • Acoustic dampening material • Vibro-acoustic isolation			

Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price

- Gradient waveform optimization

OpTix RF Receive Technology: The Optima MR450w GEM system utilizes the OpTix RF receive chain to enable high bandwidth, high channel count reception with improved SNR over conventional MR receiver designs. The MR signal is digitized within the scan room and then optically transmitted to the reconstruction engine in the electronics room increasing SNR for all volume acquisitions, independent of which surface coil is being used.

- Coil input ports: 138
- Simultaneous channel/receivers: 32
- Receiver sampling per channel: 80 MHz
- Receiver dynamic range at 1 Hz BW: >165 dB
- Receiver resolution: up to 32 bits
- Digital quadrature demodulation

Volume Reconstruction Engine: The Optima MR450w GEM system features a powerful volume reconstruction engine with onboard memory and local raw data storage to support and maintain simultaneous data acquisition and reconstruction under the most demanding applications. VRE uses 64-bit computing, delivering high acquisition memory and fast performance. Parallel processing and high speed interconnects provide scalable memory and throughput. The acquisition to disk feature automatically expands the memory per the demands of the application.

Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price

- 13,000 2D FFTs/second 256x256 full FOV
- 72GB ECC DDR3 1333 memory
- 4 x 146GB hard disk storage

Computing Platform and DICOM: The Optima MR450w GEM system computing platform is designed for efficiency and built upon a parallel, multiprocessor design that delivers the simultaneity and speed needed for advanced clinical operation. Productivity, efficiency and streamlined data management are assured through simultaneous scanning, reconstruction, filming, archiving, networking and post-processing. The scan control keyboard features intercom speaker, microphone, volume controls, start scan, pause scan, stop scan and table advance to iso-center controls. Please refer to the Optima MR450w GEM product data sheet for greater detail.

- Single tower configuration
- 24" flat panel LCD widescreen
- 1920 x 1200 resolution
- 8GB DDR3 memory
- 146GB SAS disk subsystem
- DVD interchange

The Optima MR450w GEM system generates MR Image, Secondary Capture, Structured Report, and Gray Scale Softcopy Presentation State DICOM objects. The DICOM networking supports both send and query retrieve

Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price
			as well as send with storage commit to integrate with PACS archive. Additionally, the Optima MR450w GEM system supports the CT and PET image objects for display allowing the user to refer to previous exams. Please refer to the DICOM Compliance Statement for Optima MR450w GEM for further details. GEM Express Patient Table with IntelliTouch: The Optima MR450w GEM system features the GEM Express table which is a mobile patient transport device with an embedded high-density, GEM Posterior RF Array and touch sensitive IntelliTouch land-marking. The fully detachable GEM Express table is easily docked and undocked by a single operator and simple to move in and out of the exam room for patient transport and preparation. These features can be vital in instances where multiple patient transfers can negatively impact patient care or when emergency extraction is required. The GEM Express table and embedded GEM PA coil are designed to accommodate head-first or feet-first imaging for all supported exams. The table features three high-density coil connection ports: one at each end and one embedded for the GEM PA. Two additional coil connection ports are included in the docking mechanism. The GEM Express table features a set of Patient Comfort pads designed with			

Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price

variable density foam that uniquely compresses based on patient geometry and weight. The pad coating is strong, easily cleaned, and processed with an Ultra-Fresh treatment. An anti-skid undersurface reduces pad movement.

- Maximum patient weight for scanning: 500 lbs
- Maximum patient weight mobile: 500 lbs
- Maximum patient weight for lift: 500 lbs
- 205 cm symmetrical scan range
- Automated vertical and longitudinal power drive
- Fast longitudinal speed: 30 cm/sec
- Slow longitudinal speed: 0.5 cm/sec
- Integrated arm boards
- Integrated non-ferrous IV pole
- IntelliTouch land-marking
- Laser alignment land-marking
- Variable density patient comfort pads with Ultra-Fresh coating and anti-skid undersurface

The Optima MR450w GEM system has automated many routine tasks to simplify patient preparation and gain productivity. With IntelliTouch technology, In-Room Operator Console and dual-sided controls the technologist can touch the table sensor and the advance to scan button to complete the following:

- Landmark the patient
- Activate the surface coil

Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price

- Center the patient in the bore
- Start scanning
- Acquire, process and network images

GEM Suite - ES Coil Package:

The Geometry Embracing Method - GEM - Suite of coils for the Optima MR450w GEM system was designed to enhance patient comfort and image quality while simplifying workflow. The GEM design ensures that the geometry of the surface coil matches the geometry of the patient. In addition, the GEM Suite is fully integrated into the GEM Express table, and the system automatically selects the coil mode configuration that best fits the selected region of interest.

The ES Coil Package includes:

- GEM Posterior Array
- GEM Head and Neck Unit
- GEM Anterior Array
- GEM Standard Flex Suite
- 3-channel Shoulder Array

The GEM Posterior Array is designed to provide optimal element geometry for each targeted anatomy by using different element geometries for the cervical-to-thoracic spine transition, thoracic and lumbar spine, and the body. This approach maximizes the SNR by matching the geometry of the coil elements to the size and shape geometry of the anatomy. The GEM PA supports parallel imaging in all three scan planes.

- Elements: 40

Quotation Number: PR5-C29294 V 2

Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price

- Length: 100 cm
- Width: 40 cm
- S/I coverage: 100cm head-first or feet-first
- Parallel imaging in all three scan planes
- Head-first or feet-first positioning

The GEM PA is designed to be used in conjunction with the GEM HNU, GEM AA or GEM Small AA (purchased separately), and the GEM PV Array (purchased separately), In addition, the GEM PA is invisible to additional surface coils when they are placed directly on top of the surface. Unique electronic decoupling circuits ensure there is no interference between the coils enabling the GEM PA to remain in place for all exams.

The GEM Head and Neck Unit comprises the head base-plate and three anatomically optimized anterior arrays: the anterior Neuro-vascular array, the anterior cervical spine array, the anterior open-face array.

The GEM HNU may be positioned at either end of the GEM Express table to support head-first or feet-first imaging and may remain in place for all body, vascular, spine, and the majority of MSK exams. The GEM HNU base plate supports the patient's head and contains three rows of elements separated in both the superior/inferior and right/left dimensions. The Comfort Tilt variable-degree ramp can be positioned under the HNU base plate to elevate the superior end of the coil

Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price
			to match the patient's head and neck position. • Elements: up to 28 combined with PA and AA • Length: 49.5 cm • Width: 38.8 cm • Height with NV Array: 36.8 cm • Height with Cervical Array: 33.6 cm • Height with Open Array: 25.7 cm • S/I coverage: up to 50 cm with PA and AA • Parallel imaging in all three scan planes • Head-first or feet-first positioning The GEM Large Anterior Array facilitates chest, abdomen, pelvis, and cardiac imaging. The GEM AA is lightweight, thin and flexible, and pre-formed to conform to the patient's size and shape. With 54 cm of S/I coverage, the GEM AA permits upper abdomen and pelvis imaging without repositioning the coil. • Elements: up to 36 combined with PA • Length: 55.6 cm • Width: 67.3 cm • Height: 3.6 cm • S/I coverage: 54 cm • R/L coverage: up to the full 50 cm FOV • Parallel imaging in all three scan planes • Head-first or feet-first positioning The GEM Flex Suite is a versatile set of high-density 16CH receive arrays			

Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price
			designed to provide high quality imaging in a wide range of clinical applications. The high degree of flexibility is particularly advantageous when imaging patients that do not fit the constraints of rigid coils, improving the patient and technologist experience. Consistent with the GEM design philosophy, the size and shape of the elements in each flexible coil have been optimized for high SNR and parallel imaging. This standard set includes two coil sizes and a knee stabilization fixture designed for compatibility with the GEM Express table. • Large Flex Array: 23 cm x 70 cm • Medium Flex Array: 23 cm x 48 cm • GEM Flex Interface Module P-Connector • GEM Flex Knee Stabilization Fixture • GEM Flex Strap and Interface Module Cover • GEM Flex Cable Take-up Pad and General Purpose Stabilization Pad The 3-channel Shoulder Array offers the increased signal-to-noise characteristic of phased-array technology, along with unique sleeve design that delivers exceptional joint-imaging capabilities. Express 2.0 Workflow and In-Room Operator Console: The Optima MR450w GEM system incorporates			

Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price
			features designed to streamline and automate workflow. At the same time, the flexibility of the interface helps ensure the acquisition is tailored to every patient while the steps to set-up are consistent. Express Exam Workflow includes the following: • In-Room Operator Console and controls. • Protocol Management: Protocol Libraries, ProtoCopy, Protocol Notes, Modality Worklist. • Workflow Management and Auto Features: Workflow Manager, Linking, AutoStart, AutoScan, Auto Coil Prescription, AutoVoice, Auto-Calibration. • Inline Processing and Inline Viewing. The In-Room Operator Console mounted on the front of the magnet and dual-sided controls enable interaction with the host computer from the magnet room. The user has direct control or selection of: • Display of patient name, ID, study description • Display and entry of patient weight • Display and entry of patient orientation and position • Cardiac gating waveform display • EKG lead confirmation with gating control: trigger select, invert, and reset • Respiratory waveform display • IntelliTouch Landmarking • AutoStart			

Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price

- Display of coil connection and status
- Display of table location and scan time
- Screen saver

The Optima MR450w GEM system enables complete control of protocols for simple prescription, archiving, searching, and sharing. Protocols are organized into two libraries: GE authored and Site Authored. In addition, ProtoCopy enables a complete exam protocol, from either a library or previous exam, to be shared with a mouse click, and Protocol Notes allows customized notes to be saved with the protocol parameters. The Modality Worklist provides an automated method of linking exam and protocol information for a patient directly from a DICOM Worklist server.

The Workflow Manager controls the execution of scan prescription, acquisition, processing, viewing and networking and may automate these steps, when requested by the user, through the selection of Linking and AutoScan. Auto Coil Prescription will automatically select the optimum subset of elements for scanning based on the prescribed FOV once the landmark has been set, and AutoStart will automatically start the first acquisition as soon as the technologist exits the magnet room. In addition, AutoVoice ensures that consistent and repeatable instructions are delivered to the patient, and Auto Calibration will automatically acquire a calibration

Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price
			scan for ASSET and/or PURE when needed. Processing steps are automatically completed with Inline Processing once the data have been reconstructed and the images saved into the database. For certain tasks, the user must accept the results or complete additional steps prior to saving the images. These automatic Inline Processing steps can be saved into the Protocol Library. Inline Viewing allows the user to conveniently view, compare, and analyze images from the Scan Desktop by selecting the desired series from the Workflow Manager. ScanTools and ES Tools for Optima MR450w GEM comprise a comprehensive package of pulse sequences, core applications, imaging options and post-processing capability optimized for 1.5T performance. Please refer to the Optima MR450w GEM product data sheet for detailed descriptions. • Spin Echo and Fast-Spin Echo suites: SE, FSE, FSE XL, Fast Recovery FSE, FSE Inversion Recovery, 3D FSE, Single-Shot FSE, Single-Shot FSE IR. • T1 FLAIR and T2 FLAIR CNS imaging. • Gradient Echo suite: 2D and 3D GRE, 2D and 3D Fast GRE, 2D and 3D Spoiled PGR, 2D and 3D Fast SPGR. • 2D and 3D Dual Gradient Echo			

Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price
			body imaging. • SPECIAL spectral-spatial, inversion-based fat suppression for 3D FGRE sequences. • Echo Planar Imaging suite: SE-based EPI, GRE-based EPI, Single-Shot EPI, Multi-Shot EPI, Multi-Phase EPI, FLAIR EPI. • Diffusion-Weighted EPI imaging with b-values up to 10,000 s/mm2. • FIESTA steady-state imaging includes 2D FIESTA cardiac imaging, 2D FatSat FIESTA body imaging, 3D FIESTA Neuro imaging, 3D FatSat FIESTA coronary imaging. • PROPELLER 3.0 motion-insensitive imaging with T1 FLAIR, T2, T2 FLAIR or PD-weighted contrast - enabled in all scan planes. • PROPELLER 3.0 DWI FSE-based diffusion weighted imaging with radial k-space filling. • 3D Cube 2.0 high-resolution FSE-based imaging with T1, T2, T2 FLAIR or PD-weighted contrast. • 3D BRAVO high-resolution SPGR-based T1-weighted brain imaging. • ReadyBrain automated scan prescription for brain exams. • 2D and 3D MERGE multi-echo GRE-based CNS imaging. • 3D COSMIC high-resolution GRE-based cervical spine			

Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price
			imaging. • 3D LAVA single breath-hold, high-resolution SPGR-based T1-weighted liver imaging with SPECIAL fat suppression. • Time-of-Flight MRA Suite: 2D TOF, 2D Gated TOF, 3D TOF and Enhanced 3D TOF. • Phase Contrast MRA Suite: 2D PC, 3D PC, Cine PC. • SmartPrep automated bolus detection. • Fluoro-Trigger MRA real time bolus monitoring with interactive triggering. • QuickSTEP automated multi-station acquisition. • iDrive Pro real time interactive imaging. • Double/Triple IR black-blood cardiac imaging with/without fat suppression. • FastCINE functional cardiac imaging with full R-wave coverage. • 2D and 3D GradWarp automated distortion correction. • ARC acceleration 3D data-based, auto calibrating parallel imaging technique with acceleration factors up to 3X and extended factors with Turbo ARC. • ASSET image-based parallel imaging technique with acceleration factors up to 3X. • Cardiac gating/triggering, compensation, blood suppression, flow compensation.			

Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price
			• Respiratory gating/triggering, compensation. • Pencil Beam Body Navigators track diaphragm motion to acquire data when diaphragm is within an acceptable range. • DE Prep, IR Prep, T2 Prep. • ZIP 1024, ZIP 512, 2X Slice ZIP, 4X Slice ZIP. • IVI inline, interactive post-processing for vascular MRA data sets. • Multi-Planar Volume Reformat inline, interactive post-processing for 3D volume data sets. • FuncTool Performance advanced post processing algorithms: ADC maps, eADC maps, Negative Enhancement Integral, Positive Enhance Integral, Mean Time to Enhance, Signal Enhancement Ratio, Maximum Slope Increase, Maximum Difference Function, Correlation Coefficients, Diffusion Tensor, and 2D/3D CSI. • MR Pasting automated integration of multi-station exams into a single image. • Image Fusion overlays multiple images from separate acquisitions on one another for enhanced visualization. • BrainStat GVF automated calculation of parametric maps for Cerebral Blood Flow, Blood Volume, Mean Transit Time and			

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Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price
			Time to Peak signal intensity using a gamma variant fitting algorithm. • BrainStat AIF calculation of parametric maps for Cerebral Blood Flow, Blood Volume, Mean Transit Time and Time-to-Peak signal intensity using an automated or manually specified arterial input function algorithm. • Fast Spin Echo utilizing High Bandwidth, Thin Slice and Long Echo Train to help manage distortion artifacts. Also included is the host computer, keyboard, mouse, monitor, and a quadrature transmit/receive RF head coil.			
2	1	M7000ZR	Optima MR450w with GEM Magnet Design To improve the patient experience and provide high image quality, no other component of an MRI system has greater impact than the magnet. The Optima MR450w system features a short, wide bore magnet that delivers a large field of view. The magnet geometry has been optimized to reduce patient anxiety by providing more space in the bore and more exams with the patient's head outside of the magnet. The 50cm field of view provides uniform image quality and can reduce exam times since fewer acquisitions may be necessary to cover large areas of anatomy. Complemented by GE's active shielding technology, the Optima	$1,185,000.00	61.50%	$456,225.00

Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price

MR450w has very flexible installation specifications to provide easy siting. And with zero-boil-off magnet technology, helium refills are effectively eliminated, thus reducing operating costs and maximizing uptime.

Magnet:

- Manufactured by GE Healthcare.
- Operating field strength 1.5T (63.86 MHz).
- Active magnet shielding.
- Zero boil-off Cryogens.
- Magnet length 145cm.
- Patient Aperture 76 cm.
- Patient Bore Diameter 70cm.
- Patient Bore Length 105cm.
- Maximum Field of View 50 cm x 50 cm x 50 cm.

Magnet Homogeneity: Typical ppm and Guaranteed ppm shown.

- 10cm DSV 0.007 and 0.02.
- 20cm DSV 0.035 and 0.06.
- 30cm DSV 0.11 and 0.18.
- 40cm DSV 0.5 and 0.7.
- 45cm DSV 1.2 and 1.6.
- 50x50x45cm 2.3 and 3.6.
- 50cm DSV 3.3.

DSV = Diameter Spherical Volume. Homogeneity for an elliptical volume of 50cm (x,y) by 45cm (z) dimension volume is shown for reference. Fringe field (axial x radial):

- 5 Gauss = 4.0 m x 2.5 m.
- 1 Gauss = 6.2 m x 3.7 m.

Quiet Technology: GE has

Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price
			implemented Quiet Technology on critical components of the Optima MR system to reduce acoustic noise and improve the patient environment. This technology enables full use of the eXtreme Gradient Platform for excellent image quality, while maintaining a safe environment for the patient. The technology encompasses the gradient coil, RF body coil, and magnet mounting.			
3	1	S7505EK	Preinstallation Collector and Cable Concealment Kit The Preinstallation Collector delivers to the site in advance of the magnet and main electronic components. This facilitates the later delivery and installation of supporting electronics. The following are the main components in the Preinstallation collector: • Heat exchange cabinet for distribution of chilled water. • Primary Penetration wall panel for support of the penetration cabinet. • Secondary Penetration wall panel for support of gradient filters, helium cables, and chilled air and water. • Helium cryocooler hose kit. The Cable Concealment Kit accommodates a wide-range of scan room ceiling heights and is designed to provide a clean-look installation by concealing the overhead cabling from view.	$104,000.00	61.50%	$40,040.00 HCJ

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Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price
4	1	M7004ZP	MR450w Dock and 32-Channel Switch Collector The MR450w Dock and 32-Channel Switch collector provides the interface between the magnet and GEM Express Patient Table with IntelliTouch. Also included is the RF signal switching hardware that routes the input signals to the respective OpTix receivers.	$94,000.00	61.50%	$36,190.00 HW
5	1	S4500YH	Optima MR450w Cable Configuration - A To accommodate various electronic and scan room configurations and sizes, the MR450w has preset lengths of cables and connector kits to speed system installation. This cable collection is compatible with fixed and relocatable building configurations.	$40,000.00	61.50%	$15,400.00 HW
6	1	M7000VM	Vibroacoustic Dampening Kit Material in the Vibroacoustic Dampening Kit can significantly attenuate the transmission of gradient-generated acoustic noise through the building structure to nearby areas, including adjacent rooms and floors above or below the MR suite. If this kit is applied during the installation of a new magnet, no additional service charges are necessary. However, installation of the Vibroacoustic Dampening kit under an existing magnet requires special steps. The steps to prepare the site and steps to install, such as modifications to the RF screen room, and other magnet rigging, modifications to the RF screen room, and other finishing work, are not	$14,700.00	61.50%	$5,659.50 HW

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Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price
			covered in the pricing.			
7	1	M7000WL	Main Disconnect Panel The Main Disconnect Panel safeguards the MR system's critical electrical components, by providing complete power distribution and emergency-off control.	$12,000.00	61.50%	$4,620.00 Hw
8	1	M3335JZ	English Keyboard Required for our operator console. This keyboard is ergonomically designed to keep your staff comfortable even through the longest shifts. The scan control keyboard assembly has an intercom speaker, microphone, volume controls and emergency stop switch.	Incl.	Incl.	Incl.
9	1	M1000MW	Operator's Console Table Wide table designed specifically for the color LCD monitor and keyboard.	$2,550.00	61.50%	$981.75 Hw
10	1	M3335CB	1.5T Calibration Phantom Kit This 1.5T calibration kit contains a large volume shim phantom, a daily quality assurance phantom, an echo-planar calibration phantom, and the associated loader shells.	$7,000.00	61.50%	$2,695.00 Hw
11	1	M3335CA	Calibration Kit Phantom Holder Cart	$3,000.00	61.50%	$1,155.00 Hw
12	1	S7024CB	Neuro Expert Package • eDWI • SWAN • DTI • FiberTrak The eDWI application includes the acquisition sequence and post-processing tools. It is designed to	$79,125.00	61.50%	$30,463.13 Hw

Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price
			provide high signal-to-noise-ratio diffusion images of the brain and liver with short-acquisition time. Its multi-B feature is designed to provide measurement of apparent diffusion coefficient (ADC) map with reduced effect of perfusion. In addition, "3 in 1" B value combining technique, applies diffusion weighting to all three gradients simultaneously, helping improve sensitivity. Its smart NEX feature significantly reduces the acquisition time. Inversion recovery has been deployed to provide robust fat suppression. SWAN is a volumetric 3D acquisition technique that is sensitive to differences in susceptibility between different tissues. This technique acquires multiple-echoes at different echo times to highlight regions with increased T2* (susceptibility-induced) decay. Utilizing multiple-echoes, SWAN generates images with higher SNR when compared with similar techniques that rely on a single echo. Diffusion Tensor Imaging (DTI) creates contrast based on the degree of diffusion anisotropy in cerebral tissues such as white matter. The DTI method expands Echo planar imaging capability to include diffusion imaging sequence using motion sensing gradient pulses along 6 to 155 orientations in order to generate tensor component images. With the Express Workflow, fractional anisotropy (FA) and Volume Ratio Anisotropy (VRA) maps may be			

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Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price
			automatically created after image acquisition without any user intervention. FiberTrak is a host computer post processing tool expands the capability of Diffusion Tensor imaging by generation of 2D color orientation maps, 2D eigenvector maps, and 3D tractography maps from the diffusion tensor image data. The resulting datasets may be easily saved and archived for later use.			
13	1	S7024CD	MSK Elite Package • MAVRIC SL • Cartigram MAVRIC SL is a new advanced magnetic resonance imaging technique for imaging soft tissue and bone near MR conditional metallic devices. MAVRIC SL is designed to greatly reduce susceptibility artifacts, compared to conventional fast spin echo techniques, and is suitable for use on all patients cleared for MR exams. Cartigram is a non-invasive imaging method for early detection of osteoarthritis. It quantifies the T2 relaxation of knee cartilage and can overlay the quantified parametric maps over high resolution images for clear visualization of the anatomy.	$67,500.00	61.50%	$25,987.50 H W
14	1	S7024CN	Body Expert Package • IDEAL & Flex • StarMap IDEAL and Flex generates consistent	$93,750.00	61.50%	$36,093.75 H W

Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price
			tissue contrast and reduces the number of series in an exam. The IDEAL acquisition and reconstruction methods can generate a water-only, fat-only, in-phase and out-of-phase data sets for clear tissue differentiation in a single series. In addition, susceptibility artifacts common to MR imaging such as incomplete or inaccurate fat saturation, and chemical shift can be eliminated. The IDEAL application acquires multiple echoes and uses unique reconstruction routines to generate the four image contrasts and correct for errors due to tissue susceptibility. For fast T1w multi-phase imaging of the abdomen and pelvis, LAVA Flex acquisition uses 2D ARC parallel imaging to reduce artifacts from breath hold misregistration and incorrect FOV placement while providing up to four types of T1w-based tissue contrasts: water-only, fat-only, in-phase and out-of-phase. For fast T1w multi-phase imaging of the breast, VIBRANT Flex acquisition uses 2D ARC parallel imaging to enable higher acceleration factors over ASSET parallel imaging, and reduce artifacts from breath hold misregistration and eliminates artifacts due to incorrect FOV placement, while providing up to four types of T1w-based tissue contrasts: water-only, fat-only, in-phase and out-of-phase. VIBRANT Flex requires VIBRANT, which must be purchased separately.			

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Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price
			StarMap enables the acquisition of multiple gradient echo images at each 2D slice at a range of echo-times. The resultant images can be processed using FuncTool to provide T2* maps within the anatomy of interest.			
15	1	S7524DH	MSK Elite Coil Package - GEM 1.5T • 1.5T 8-Channel Wrist Array • 1.5T 8-Channel Foot/Ankle Array The 8-Channel Wrist Array generates high definition images of the hand and wrist. The one-piece, ovoid, hinged design is optimal for small-FOV imaging and provides 12-cm S/I coverage. The coil can be positioned overhead or at the patient's side in either a vertical or horizontal orientation. The 8-Channel Foot/Ankle Array produces high-resolution images of the foot and ankle by incorporating an 8-channel phased array design in a unique "ski" boot design. The unique coil design has excellent distal coverage and supports multiple foot positions for optimizing studies. Parallel imaging is supported to reduce acquisition times.	$82,500.00	61.50%	$31,762.50
16	1	E8911CG	GE MR Heat Exchanger Manual Cryogen Compressor Water Bypass Option Add a level of magnet protection with a Manual Cryogen Compresor Bypass. In case of a power failure, you can cycle municipal or facility water through the cryogen compresor and	$6,250.00	21.00%	$4,937.50

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Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price
			reduce cryogen loss and reduce the likelihood of quenching. FEATURES AND BENEFITS • Easy to install and simple to use • Helps switch over water supply to your cryogen compressor in the event of loss of power to reduce cryogen loss • Includes fluid supply pressure gauge, temperature gauge and flow rate meter for easy verification of operation • Manual operation reduces unintentional switch-overs and coolant dumping during brown-outs and supply power glitches COMPATIBILITY Must be used with a GE MR Heat Exchanger: • E8911CA • E8911CB • E8911CC • E8911CD • E8912CA • E8912CB • E8912CC • E8912CD NOTES: • Item is NON-RETURNABLE and NON-REFUNDABLE			
17	1	E8912CA	GE Optima MR450w Heat Exchangers - 49kW (20 Tons) Cooling for your GE Healthcare MR system has never been so easy. GE	$56,250.00	21.00%	$44,437.50

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Healthcare has partnered with the Glen Dimplex Group, a world leader in cooling systems, to offer heat exchangers designed to meet the needs of your Discovery MR System. Now you can look to GE Healthcare for your entire MR purchase and support.

This heat exchanger is highly reliable and the only unit verified to perform with the new platform of GE Healthcare MR systems. As part of your integrated GE Healthcare solution, you'll work with a single contact throughout the whole installation. A Project Manager of Installation will help with building layout, room designs, delivery and installation - every step until your system is ready to scan. Our team will work seamlessly with architects, contractors and your internal team to help ensure timely, cost-effective completion.

Once your cooling system is running, you'll get fast, highly-skilled service support managed through GE Healthcare - with the same quality and response time you expect from your MR system.

FEATURES AND BENEFITS

- Designed to provide stable fully dedicated cooling for your MR system's needs
- Water/glycol outdoor-air-cooled heat exchangers to support your highest exam volumes and your full range of diagnostic procedures

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Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price
			• Redundant fluid pumps with automatic switchover let you keep operating with no loss of cooling even if one pump goes down • Quad compressor, dual tandem refrigeration circuit design saves on energy while your system smoothly transitions through the 10% to 100% heat load capacity cycles of patient scanning and idling • Quiet operation between patient exams and overnight - ideal for facilities in residential areas • Comes with installation support, installation visits, preventative maintenance visit and 1 full year of parts and labor warranty • Installation support includes: support through GE's Project Manager of Install, GE's Design Center, technical support from the Glen Dimplex company, two (2) installation visits • Comprehensive and quality service rapidly delivered through our CARES service solution • 65 gallons of 100% glycol concentrate for complete system filling and diluting • Wall mounted remote display panel provides the ability to monitor the system's operation and indicates possible system errors • Filter kit with flow meter helps to ensure purity of water prior to entry to the MR system			

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Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price
			• Highly recommended that Vibration Isolation Spring Kit (E8911CJ) be added for systems that will be roof top mounted SPECIFICATIONS • Net Cooling Capacity: 49 kW / 20 Ton • Maximum Coolant Flow: 35 gpm (132 l/m) • Coolant Outlet Temperature: 48 F (8.9 C) • Coolant Temp Stability: E 1.8 F (E1.0 C) • Max Coolant Pressure : 70 Psi (4.8 Bar) • Refrigerant: R407C • Ambient Temp Range: -20 to 120 F (-30 to 50 C) • Condenser Air Flow (Approx): 18,000 Cfm • Tank Capacity: 100 gal (378 l) • Flow Meter Range: 4-40 gpm • Filters: 50 micron cartridge filters • Supply Voltage: 460v / 3 phase / 60 Hz • Coolant Connections: 2" NPTF • Overall Size (L x W x H) 44" x 136" x 84.5" COMPATIBILITY: • GE Optima MR450w 1.5T MR System NOTES: • Item is NON-RETURNABLE and NON-REFUNDABLE			

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Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price
18	1	E8804SB	Medrad Spectris Solaris EP MR Injection System Medrad Spectris Solaris EP MR injector for use use in all MR scanner field strengths up to and including 3.0T. Optimized touch-screen for fewer keystrokes, KVO (keep vein open) allows patient to be prepared before beginning the scan. Larger 115 ml saline syringe for longer KVO or multiple flushes. Includes cables and starter kit...E NOTE: GE is responsible for unpacking, assembly, and installation of equipment. Medrad will be available for technical assistance by phone at (412)767-2400. An additional charge will apply for on-site installation assistance. Medrad will be responsible for operational checkout, final calibration, in-service of the equipment, and initial applications training. Please contact the local Medrad office two weeks in advance of installation.	$49,375.00	21.00%	$39,006.25
19	1	E8823M	Magnacoustics Genesis ULTRA Communication & Music System The Magnacoustics Genesis ULTRA is the only MRI Communication & Music System to interface directly with GE's MRI hardware and software. This allows software driven Auto Voice Commands from GE's computer to be delivered directly into the patient's ears for breath-hold sequences. This same interface allows the Technologist to talk directly to the patient through the console Mic even while the scan is	$14,250.00	21.00%	$11,257.50

Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price
			in progress. The Genesis ULTRA also features an exclusive Patient Ready Signal. By simply depressing a small button on the handheld control an audible and visual signal is transmitted to the Technologist indicating the patient's readiness for the scan to begin. This simple step streamlines the breath-hold exam which amounts to approximately 30% of all exams. Patient Handheld Volume and Media Selection Controls with Voice Feedback interface with an FM/AM stereo, CD player, and iPod interface. This distracts even the most apprehensive of your patients by allowing them to be in control of their own environment. Additionally, the Auto Gain feature automatically raises and lowers the volume level for the patient based on the Sound Pressure Level of the MRI. Magnacoustics also provides the only patented 8-driver transducer that provides the highest sound directly to the patients ears with the MagnaLink Headset System. This patented system includes a stethoscope-style headset with the MagnaPlug (replaceable earplug) that provides 29dB of attenuation and complies with GE Healthcare MR Safety Guide Operator Manual. The Genesis ULTRA's See-In-the-Dark GUI Electroluminescent Backlit Technologist Control Unit enhances operation in the normally low-lit MRI environment allowing the Technologist to operate the entire system with the touch of a button.			

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Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price
			The Genesis ULTRA includes an integral interface for fMRI with built-in input for audio stimulation and output for responses...E			
20	1	E4504FM	700 VA Partial System UPS - MR Tested with all MR system computers, the 700VA Partial System UPS provides reliable, clean, consistent power for the data processing portion of the MR imaging system. The use of the double conversion UPS enables the MR system data processing portion electronics to operate when there is a power anomaly or total power loss. Valuable data and the system operating software are protected, if there is an extended outage the UPS allows for an orderly shutdown of the system. FEATURES/BENEFITS • True double-conversion, online technology provides reliable operation and uninterrupted glitch free power • Automatic frequency selection eases startup, i.e., 50 or 60 Hz compatible • Integral Electronic Static Bypass switch means zero transfer time • Improves user productivity, system reliability, reduces service costs and increases system uptime • Advanced Battery Management (ABM) software monitors / indicates battery health and improves battery service life	$1,499.00	21.00%	$1,184.21 H(J

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Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price
			SPECIFICATIONS • Dimensions (H x W x D): 9.09" x 6.3" x 13.9" • Weight: 26 lbs. • Input Voltage Range: Single Phase 80-138 V • Input Frequency Range: 47-70 Hz • Rating: 700 VA / 630 W COMPATIBILITY • MR Systems NOTES • This is a partial system UPS - it covers only the computer, not the entire MR imaging system. After a power event portions of the system will have to be reset before operation can resume • Customer is responsible for rigging and arranging for installation with a certified electrician • ITEM IS NON-RETURNABLE AND NON-REFUNDABLE			
21	1	W0106MR	TiP Discovery and Optima Family Training 10 Days Onsite Plus 10 Hrs TVA The TiP Training Choices program is designed for CURRENT GE customers WITHOUT HDx experience who purchase a Discovery or Optima system. Training is delivered onsite at the customer's facility and instructs students in start-up operation of the system and introduces participants to	$23,000.00	0.00%	$23,000.00

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Item No.	Qty	Catalog No.	Description	Contract Price	Discount	Ext Sell Price
			the system design, workflow, new options and clinical applications included. Extended TVA support ensures learners maintain performance over the long term. This training program must be scheduled and completed within 36 months after the date of product delivery.			
22	1	W0012MR	TiP Applications Onsite MR Training 2 Days per year over 3 Years Two consecutive days of TiP Applications Onsite MR training presented during the 2nd, 3rd, and 4th year after system purchase. Onsite training provided from 8AM to 5PM, Monday through Friday. Includes T&L expenses.	$13,100.00	0.00%	$13,100.00
			Discounted Configuration Price			$1,360,221.97
	1		**Caring MR Suite** **NonProducts**			
23	1		PDC Caring MR Suite $117,000	$117,000.00	0.00%	$117,000.00
			Discounted Configuration Price			$117,000.00
			Quote Summary:			
			Total Contract List Price:			**$3,458,124.00**
			Total Extended Selling Price:			**$1,477,221.97**
			2002 Siemens Symphony 1.5T			**($40,000.00)**
			Total Quote Net Selling Price			**$1,437,221.97**
			(Quoted prices do not reflect state and local taxes if applicable. Total Net Selling Price Includes Trade In allowance, if applicable.)			

"CHS Q3 Diagnostic Imaging Bulk Buy Promotion – Expiration Date: September 26th, 2014".

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Options

(These items are not included in the total quotation amount)

Item No.	Qty	Catalog No.	Description	List Price	Discount	Ext Sell Price	Initial To Accept
24	1	S7024CK	**MR450w 1.5T GEM 24.0** Angio-Vascular Expert Package • Inhance Suite 2.0 • TRICKS • Flow Analysis The Inhance Suite application consists of several sequences designed to provide high-resolution images of the vasculature with short-acquisition times and excellent vessel detail. These sequences include: Inhance Inflow IR: Inhance Inflow IR is an angiographic method, which has been developed to image renal arteries with ability to suppress static background tissue and venous flow. This sequence is based on 3D FIESTA, which improves SNR, as well as produce bright blood images. Inhance 3D Velocity: Inhance 3D Velocity is designed to acquire angiography images in brain and renal arteries with excellent background suppression in a short scan time. By combining a volumetric 3D phase contrast acquisition with parallel imaging, efficient k-space	$113,100.00	61.50%	$43,543.50	X_____

Item No.	Qty	Catalog No.	Description	List Price	Discount	Ext Sell Price	Initial To Accept
			traversal, and pulse sequence optimization, Inhance 3D Velocity is capable of obtaining complete Neurovascular imaging in 5-6 minutes. Inhance 3D Deltaflow is a 3D non-contrast enhanced MRA application for peripheral arterial imaging. Inhance 3D Deltaflow is based on the 3D Fast Spin Echo technique and it utilizes the systolic and diastolic flow differences to help generate arterial signal contrast. A subtraction of the systolic phase from the diastolic phase images results in arterial only images, with venous and background suppression. Inhance 2D Inflow: The Inhance 2D Inflow pulse sequence is designed to acquire angiography images of arteries, which follow almost a straight path, i.e. femoral, popliteal, carotid arteries, etc. TRICKS provides high resolution multi-phase 3D volumes of any anatomy for fast accurate visualization of the vasculature. With segmented complex data recombination, TRICKS can accelerate 3D dynamic vascular imaging without compromising spatial detail.				

Item No.	Qty	Catalog No.	Description	List Price	Discount	Ext Sell Price	Initial To Accept
			TRICKS also uses elliptic centric data collection for optimized contrast resolution and auto-subtraction for optimized background suppression. The result is time course imaging that does not require timing or triggering, provides high temporal and high spatial resolution, and enables the extraction of optimum phases of data. As a result, TRICKS enables reliable, high quality vascular imaging.				
			Flow Analysis automates the review and analysis of gated phase contrast magnetic resonance (MR) images and generates a report for the referring physician. This version is available on the host computer.				
			Flow Analysis has an automated edge detection algorithm that propagates through all the phases of the cine phase contrast series.				
			The flow analysis measurement tab displays a summary chart of peak velocities in addition to individual velocity results from each phase of the cardiac cycle. A background correction may also be applied which is particularly suited to slow flowing fluid such as cerebrospinal fluid.				

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Item No.	Qty	Catalog No.	Description	List Price	Discount	Ext Sell Price	Initial To Accept
			Customizable Macros are a feature of Flow Analysis 4.0. These Marcos allow the user to quickly write a report specific to the patient being assessed with simple mouse clicks. The macros are customizable to reflect the language used by the reporting physician. Flow Analysis offers the capability to archive reports or cine images as seen in a DICOM format so they may be viewed on any DICOM viewer.				

(Quoted prices do not reflect state and local taxes if applicable. Total Net Selling Price Includes Trade In allowance, if applicable.)

Lake Norman Regional Medical Center
Exemption Notice for Acquisition of Replacement MRI Unit

ATTACHMENT D

Capital Cost Schedule
Certified Cost Estimate of Renovation

October 9, 2014

Ms. Martha Frisone
Interim Chief
Certificate of Need
N.C. Department of Health and Human Services
Division of Health Service Regulation
809 Ruggles Drive
Raleigh, NC 27603

Re: Lake Norman Regional Medical Center-
Exemption Notice for Acquisition of Replacement Magnet Residence Imaging Equipment, Iredell County

Dear Ms. Frisone:

Having worked with Lake Norman Regional Medical Center to develop the scope for the replacement of the existing MRI, Wright McGraw Beyer Architects, is pleased to provide the cost certification letter. The estimated construction cost is based on the program, preliminary pricing from the contractor and our experience with similar healthcare projects. Wright McGraw Beyer Architects certifies to the best of our knowledge the construction cost of $245,000.

Please call me if you have any questions or comments.

Sincerely,
Wright McGraw Beyer Architects, p.a.

David A. Wright, AIA
Managing Principal

DW/hh

H:\2760 Lake Norman MRI Replacement\Design\III - Approvals\DHSR\MFrisone Exemption Notice DHSR 10.9.14.doc

2201 Water Ridge Pkwy.
Suite 550
Charlotte, NC 28217
P. 704.535.6374
F. 704.535.9827

www.wmba.net

PROPOSED TOTAL CAPITAL COST OF PROJECT

Project Name: Lake Norman Regional Medical Center-Hospital MRI Replacement

Provider/Company: Lake Norman Regional Medical Center, Mooresville, NC. 28117

A. **Site Costs**			
(1) Full purchase price of land.....			$ N/A
Acres _____ Price per Acre	$ N/A		
(2) Closing costs.....			$ N/A
(3) Site Inspection and Survey.....			$ N/A
(4) Legal fees and subsoil investigation		$ N/A	
(5) Site Preparation Costs			
Soil Borings.....	$ N/A		
Clearing-Earthwork...	$ N/A		
Fine Grade For Slab...	$ N/A		
Roads-Paving.....	$ N/A		
Concrete Sidewalks....	$		
Water and Sewer.....	$		
Footing Excavation....	$ N/A		
Footing Backfill.....	$ N/A		
Termite Treatment....	$ N/A		
Other (Specify).....	$ N/A		
Sub-Total Site Preparation Costs		$ N/A	
(6) Other (Specify)		$ N/A	
(7) **Sub-Total Site Costs**			$ N/A
B. **Construction Contract**			
(8) Cost of Materials			
General Requirements	$ 51000.00		
Concrete/Masonry	$ 8000.00		
Woods/Doors & Windows/Finishes	$ 1500.00		
Thermal & Moisture Protection	$ 1000.00		
Equipment/Specialty Items	$ 20000.00		
Mechanical/Electrical	$ 80000.00		
Other (Specify) Testing and Certifications	$ 12000.00		
Sub-Total Cost of Materials.....		$ 173,500.00	
(9) Cost of Labor.....		$ 36,500.00	
(10) Other (Specify).....		$ 35,000.00	
(11) **Sub-Total Construction Contract**			$ 245,000.00
C. **Miscellaneous Project Costs**			
(12) Building Purchase.....		$ N/A	
(13) Fixed Equipment Purchase/Lease		$ 1,508,809.45	
(14) Movable Equipment Purchase/Lease		$	
(15) Furniture		$ N/A	
(16) Landscaping		$ N/A	
(17) Consultant Fees			
Architect and Engineering Fees	$28,500.00		
Legal Fees.....	$ 500.00		
Market Analysis.....	$ N/A		
Other (Specify).....	$ N/A		
Other (Specify).....	$ N/A		
Sub-Total Consultant Fees.....		$ N/A	
(18) Financing Costs (e.g. Bond, Loan, etc.).		$ N/A	
(19) Interest During Construction.		$ N/A	
(20) Other (MRI Applications Training)		$ 36,100.00	
(21) **Sub-Total Miscellaneous..**			$1,573,909.45
(22) **Total Capital Cost of Project** (Sum A-C above)			$1,818,909.45

I certify that, to the best of my knowledge, the above construction related costs of the proposed project named above are complete and correct.

Richard A. Mitt NC 3970

(signature of Licensed Architect or Engineer)

I assure that, to the best of my knowledge, the above capital costs for the proposed project are complete and correct and that it is my intent to carry out the proposed project as described.

_____

_____ Signature of Office Authorized to Represent Provider/Company)

(Title of Officer)

Lake Norman Regional Medical Center
Exemption Notice for Acquisition of Replacement MRI Unit

ATTACHMENT E

Copy of Original Certificate of Need

State of North Carolina

Department Of Health and Human Services
Division Of Facility Services
Certificate Of Need

FID #943296

Project Identification Number F-5815-98 Effective Date March 2, 1999

Issued to: Mooresville Hospital Associates, Inc. d/b/a Lake Norman Regional Medical Center
610 E. Center Ave., P.O. Box 360
Mooresville, NC 28115

The North Carolina Department of Health and Human Services, pursuant to the North Carolina Health Planning and Resource Development Act of 1978, G.S. § 131-175, et seq., as amended and recodified, G.S. § 131E-175, et seq., hereby finds and certifies that the new institutional health service proposed by the person listed above is consistent with, or as conditioned is consistent with the plans, standards, and criteria prescribed by the Act and the rules and regulations promulgated thereunder. The findings of the Department are attached hereto and incorporated by reference.

This Certificate affords the person listed above the opportunity to proceed with development of the proposed new institutional health service in a manner consistent with the plans, standards, and criteria prescribed by the Act and the rules and regulations promulgated thereunder. This Certificate includes and is limited to:

SCOPE: Acquire a fixed 1.5 Tesla magnetic resonance imaging scanner to be housed in the replacement Lake Norman Regional Medical Center/Iredell County

CONDITIONS: See Attached

PHYSICAL LOCATION: 171 Fairview Road
Mooresville, NC 28115

MAXIMUM CAPITAL EXPENDITURE: $2,113,600.00

TIMETABLE: See Reverse Side

FIRST PROGRESS REPORT DUE: October 1, 1999

This Certificate is limited to the person listed above and is not transferable or assignable. This Certificate may be withdrawn as provided in G.S. § 131E-189, and the rules and regulations promulgated thereunder.

Issuance of this Certificate does not supplant provisions or requirements embodied in codes, ordinances, statutes other than G.S. § 131E-175, et seq., rules regulations or guidelines administered or enforced by municipal, state or federal agencies or the agent thereof.

Chief, Certificate of Need Section
Division of Facility Services

DFS-8001CN (Rev. 9/97)

Lake Norman Regional Medical Center
Exemption Notice for Acquisition of Replacement MRI Unit

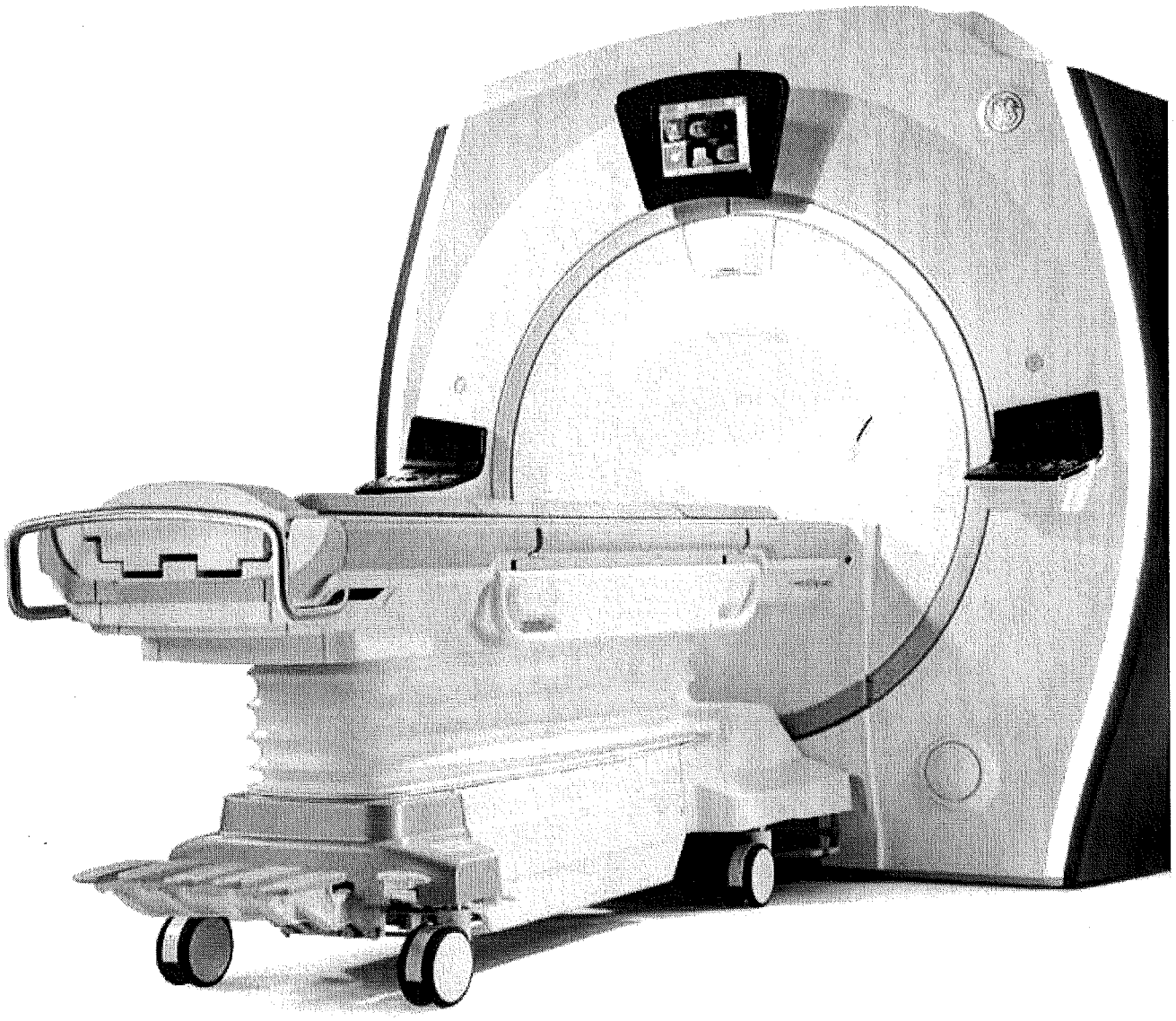
ATTACHMENT F

Replacement Equipment Brochure

GE Healthcare

Optima MR450w with GEM

Technical Data



This Datasheet is intended for US Healthcare Professionals.

Contents

The world of MR is always changing.

Patient expectations of MR have shifted in recent years, as people have begun demanding a better, more comfortable scanning experience. Increasing the size of the bore is a good first step — but it's only the beginning. The right system should offer both excellent images and a user-friendly experience. Patients should be more comfortable during their scan, and clinicians more comfortable in making a definitive diagnosis. All the while, organizations should expect their MR system to help them deliver solid financial returns, maintain a high standard of patient safety, and increase the quality of their care.

The Optima* MR450w with GEM Suite is wide-bore MR done right. Thanks to cutting-edge technologies, we've advanced the capabilities of wide-bore MR by delivering both uncompromised image quality and high productivity — all with an expansive 50cm field of view. The Optima MR450w offers a range of advanced functionality, making it a workhorse system for practices of all sizes and specialties. In addition, the new GEM Suite of coils takes the MR experience to new levels. The system is also extremely accessible. Its cost and capabilities make it ideal for first-time MR customers who can make it their only scanner, as well as established MR users seeking a versatile, hard-working system.

The right capabilities

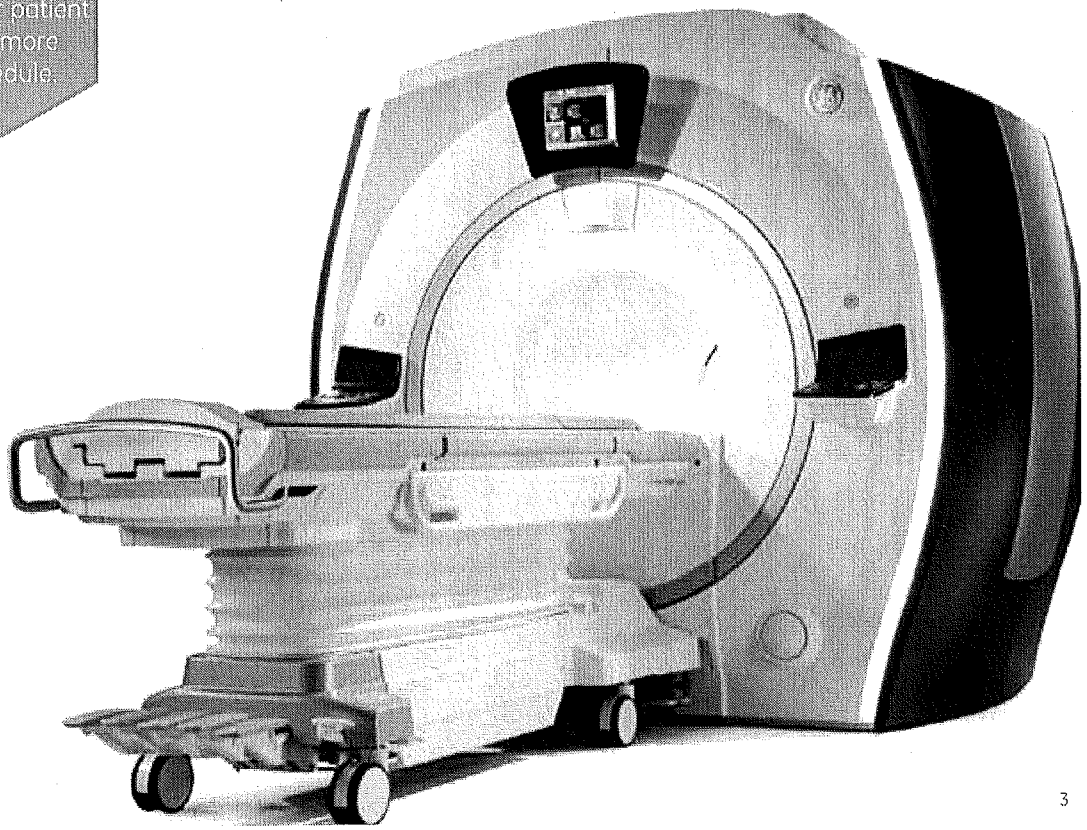
Advanced functionality gives clinicians the tools they need to make definitive diagnoses — and help grow practices.

The right experience

Exclusive ease-of-use features and the new GEM Suite of coils help make life easier for both patients and technologists.

The right investment

Administrators can drive new levels of productivity, scanning a broader patient population on a more predictable schedule.



Magnet

The foundation for quality and flexibility

When it comes to improving the patient experience and providing high image quality no other component of an MRI system has greater impact than the magnet. The Optima MR450w with GEM system features a short, wide bore magnet that delivers a large field of view. The magnet geometry has been optimized to reduce patient anxiety by providing more space in the bore and more exams with the patient's head out of the magnet. The 50cm field of view provides uniform image quality and may reduce exam times since fewer acquisitions may be necessary to cover large anatomy.

Easy siting and affordable operation:

Complemented by GE's active shielding technology, the Optima MR450w with GEM has very flexible installation specification for easy siting. And with zero-boil-off technology helium refills are effectively eliminated, thus reducing operating costs and maximizing uptime (versus previous generation products).

Magnet enclosures

This magnet enclosure system is designed to provide several benefits for the patient and technologist:

- Patient anxiety is eased, resulting in reduced exam time for uncooperative patients
- Technologists have easy access to the patient

Magnet shim

High homogeneity is assured – our Optima MR450w with GEM magnet provides excellent results for:

- Large FOV imaging up to 50 cm
- Off-center FOV imaging such as elbow, shoulder and wrist imaging
- Robust fat saturation required for abdominal, breast and musculoskeletal imaging
- High-performance applications, such as cardiac, fMRI, diffusion tensor and spectroscopy

Spatial accuracy

Optima MR450w provides a high degree of spatial accuracy, especially important for biopsy and for MR-enabled therapies. An MR systems' spatial accuracy is a result of magnet homogeneity, gradient accuracy, and software.

Optima MR450w also features 3D Gradwarp, a technique integrated into image reconstruction that helps reduce image distortion by compensating for gradient non-linearities in all three dimensions. This correction differs from the default 2D correction that is conventionally performed by incorporating the slice direction into the processing.

Magnet Specifications	
Magnet Length	145 cm
Operating field strength	1.5T (63.86 MHz)
Magnet shielding	Active
EMI shielding factor	96%
Size (W x L x H)	2.10 m x 1.45 m x 2.36 m
Magnet weight	3,692 kg
Magnet cooling	Cryogenic (liquid helium)
Long-term stability	< 0.1 ppm/hour
Cryogen refill period	Zero boil off*
Fringe field (axial x radial)	5 Gauss = 4.0 m x 2.5 m 1 Gauss = 5.7 m x 3.4 m
Manufacturer	GE Healthcare

*Under normal operating conditions

Patient focused design	
Patient Bore (L x W x H)	105 cm x 70 cm x 70 cm
Patient Aperture	76 cm
Patient comfort module	Head or feet first entry Dual-flared patient bore 2 way in-bore intercom system Adjustable in-bore lighting system Adjustable in-bore patient ventilation system

Diameter Volume (x, y, z)	Typical ppm	Guaranteed ppm
10cm DSV	0.007	0.02
20cm DSV	0.035	0.06
30cm DSV	0.11	0.18
40cm DSV	0.5	0.7
45cm DSV	1.2	1.6
50 x 50 x 45cm	2.3	3.6
50cm DSV	3.3	

Volume Root-Mean-Square (V-RMS) values are computed from 24 measurements on each of 32 planes with linear terms set to zero.

Spatial accuracy	
Mean absolute distortion error	0.63%

As measured using the Magphan phantom

Gradients

Premium clinical performance is enhanced with the Optima MR450w with GEM gradient system. Gradient speed, accuracy, and reproducibility are critical for all acquisitions, but the performance is especially important in challenging acquisitions, such as fMRI, diffusion, and PROPELLER.

Gradient performance	
Amplitude per axis	34 mT/m
Slew Rate per axis	150 T/m/s
Maximum FOV (x, y, z)	50 cm
Gradient Duty Cycle	100%

Gradient amplifier (water cooled)	
Gradient Amplifier Current and Voltage	660 Amps/1650 Volts Peak
Control	• Frequency dependent feed-forward model • Digital PI feedback control loop

The gradients are non-resonant and actively shielded to minimize eddy currents. The gradient coil and the RF body coil are integrated into a single module, which is both water and air cooled for excellent duty-cycle performance and patient comfort.

Fidelity, accuracy, and reproducibility

Gradient systems have historically been defined in terms of peak amplitude (mT/m) and slew rate of the generated field (T/m/s). While these parameters are important in achieving high temporal resolution parameters such as TR's and TE's, applications such as fMRI, Propeller, TRICKS, and spectroscopy rely more heavily on gradient fidelity, accuracy, and reproducibility.

Fidelity is defined as the degree to which an electronics system accurately and reproducibly amplifies an input signal. Applied to MR gradient systems, gradient fidelity refers to the system's ability to generate requested waveforms. The high fidelity of the Optima MR450w gradients is achieved through the use of innovative design of the digital control architecture within the gradient amplifier. This architecture has two digital control paths.

- Dedicated active feedback loop to regulate current errors
- Innovative feed-forward model to match amplifier output to gradient coil

Gradient subsystem gradient fidelity, accuracy, reproducibility parameters	
Maximum integrated error*	0.48 ppmFS-s
Shot-to-shot*	0.16 ppmFS-s
Symmetry error*	0.32 ppmFS-s

* Typical gradient fidelity expressed in a relative scale is derived from the following measurements of integrated errors in micro-Amperes-second (μAs). Maximum Error is the maximum integrated current error over a full-scale, echo-planar gradient waveform. Shot-to-Shot is the largest difference between integrated errors across waveforms,. Symmetry Error is the largest difference in integrated current error when comparing positive and negative gradient waveforms.

ART (Acoustic Reduction Technology)

State-of-the-art clinical imaging demands the routine use of ultra-fast imaging techniques. At 1.5T, the strong gradients interact with the magnetic field to create mechanical forces resulting in acoustic noise. GE has introduced ART to reduce acoustic noise by up to 75%, improving the patient environment.

Gradient Coil Isolation and Acoustic Dampening

The full performance of the Extreme Gradient Driver is used while helping to maintain a safe environment for the patient. Clear separation between the gradient coil, RF body coil, and patient support structures ensures minimal component interactions. In addition, mass-damped acoustic barriers are used under the system enclosures to further reduce acoustic noise for the patient.

RF Coil Isolation

During gradient pulses, the RF body coil acts as a secondary source of noise. To further reduce the noise heard by the patient, the RF body coil has been optimally designed with mass-damped copper traces.

Vibro-acoustic Isolation

To isolate the magnet from the building and reduce the transmission of acoustic noise in the structure, GE has designed a vibroacoustic-dampening pad that sits under the feet of the magnet. The dampening characteristics of the pad are optimized based on the magnet geometry and weight.

Gradient Waveform Optimization

User selectable mode to further reduce acoustic noise.

Optical RF

The new RF acquisition technology of the Optima MR450w with GEM enables greater clinical performance and higher image quality especially for data-intensive applications and provides an improvement in SNR versus previous generation systems.

OpTix (Optical RF receive technology)

The OpTix RF system enables high-bandwidth, high channel count reception with improved SNR over conventional MR receiver designs. Conventional MR scanner designs place the RF receivers in the electronics room where the MR signal is subject to significant electrical noise prior to being digitized. The OpTix optical RF receivers are located on the magnet system inside the shielded scan room, isolated from external noise sources.

The MR signal is digitized within the scan room and then optically transmitted to the reconstruction engine in the electronics room.

Since losses are inherent with conventional wire designs, the close proximity of the receivers to the patient reduces noise and improves image quality.

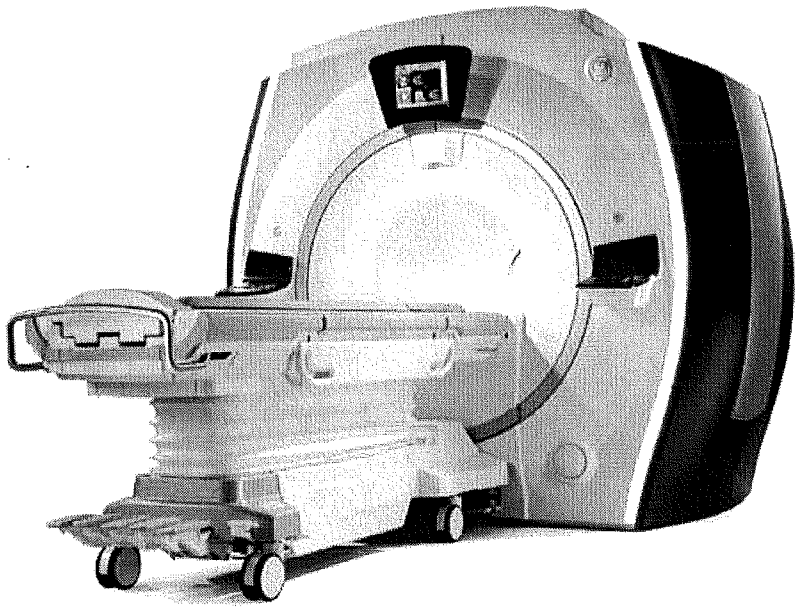
The OpTix acquisition technology enables higher image quality especially for data-intensive (3D) applications. When combined with GE's use of high-density surface coils, the optical receive chain is a critical path for ensuring clear signal reception and data analysis. To help ensure that the high-density approach will be maintained, the scalable Optima MR450w with GEM architecture is designed to expand in the future.

Optical RF technology increases SNR for all volume acquisitions, independent of which surface coil is being used.

OpTix optical RF architecture	
Coil input ports	138
Simultaneous RF receivers	16 or 32
Quadrature demodulation	Digital
Receiver sampling frequency per channel	80 MHz
Receiver dynamic range at 1Hz BW	>165 dB
Receiver resolution	Up to 32 bits

Transmit RF

Standard RF transmit architecture	
RF amplifier	Air cooled, small footprint
Maximum output power	16 kW Body 2 kW Head
Maximum RF field with integrated body coil	>20 uT
Transmit gain	>100 dB (40 dB coarse/ >84 dB instantaneous)
RF exciter frequency range	63.86 ± 0.650 MHz
Frequency resolution	<0.6 Hz/step
Frequency stability	14 part per billion (0 to 50C)
Phase resolution	0.005 degree/step
Amplitude control	16 bit with 12.5 ns resolution
Amplitude stability	<0.1 dB over one min. at rated power
Digital RF pulse control	2 amplitude modulators, 2 frequency/phase modulators



Volume reconstruction engine

Reconstruction performance today is challenged by explosive growth in data, and increased computational complexity. The amount of data to be stored and processed continues to increase with the advances in MR system technology. The Optima MR450w with GEM meets that challenge head-on with innovations in reconstruction to take full advantage of computing power by leveraging both software and hardware technology.

The Optima MR450w with GEM features a powerful volume reconstruction engine (VRE) that enables real-time image generation, even when massive parallel-imaging datasets are involved.

The reconstruction engine features onboard memory and local raw data storage to support and maintain simultaneous data acquisition and reconstruction under the most demanding applications.

VRE uses 64-bit computing, delivering high acquisition memory and fast performance. Parallel processing and high-speed interconnects provide scalable memory and throughput.

The acquisition-to-disk feature automatically expands the memory capacity per the demands of the application.

Reconstruction engine	
2D FFT/second (256 x 256 full FOV)	13,000 2D FFTs/second
CPU	Dual Intel Xeon Nehalem Quad Core Processors
Memory	72 GB ECC DDR3 1333
Hard disk storage	4x146 GB

Specifications shown above are minimum performance levels.

GEM Suite

Each patient who requires an MR examination is unique—with respect not only to age and gender, but dimensions of size, proportion, physical frailty, tendency towards claustrophobia, and of course, unique clinical circumstances that require the exam. With the uniqueness of the patient in mind, GE Healthcare engineered the new GEM Suite surface coil technology. GEM, or Geometry Embracing Method, incorporates an approach to MR imaging that reflects the importance of conforming the geometry of the equipment and technology to that of the patients.

The combined features of the entire Suite are designed to facilitate high-resolution, high signal-to-noise (SNR) imaging from the top of the head down to the feet, while maximizing the comfort of patients across many different shapes, sizes, and situations. In general, a significant source of patient motion during an MR exam is the result of discomfort or anxiety. By addressing the sources of discomfort and anxiety, the GEM Suite approach aims to help reduce patient motion and improve the quality of the overall exam.

Coil Mode Configuration

The 1.5T GEM Suite was designed to reduce multiple physical coil changes within a single exam and between different exams, and to improve patient comfort. The system will automatically select the coil mode configuration that best fits the selected region of interest.

GEM Express Table & Posterior Array (PA)

The GEM Express Patient Table is a mobile patient transport device that includes an embedded high-density, posterior RF array. Fully detachable, the GEM Express patient table offers numerous benefits, described below in the Workflow section.

Geometric Optimization

The GEM PA has optimal coil element geometry for each patient and targeted anatomy. The GEM PA uses optimized element layouts for the cervical-to-thoracic spine transition, thoracic and lumbar spine, and the body. This approach maximizes the signal-to-noise ratio by matching the geometry of the coil elements to the anatomical size and shape of the anatomy.

The PA is designed to support parallel imaging in all 3 scan planes, and the system will automatically select the appropriate subset of coil elements based upon the prescribed field-of-view.

The Express patient table also includes an innovative and adjustable comfort tilt feature to lift the patient's neck and conform to the patient's natural anatomy, to increase patient comfort.

Symmetric Scan

The Express patient table and embedded GEM coil is designed to accommodate head-first or feet-first imaging for all supported exams.

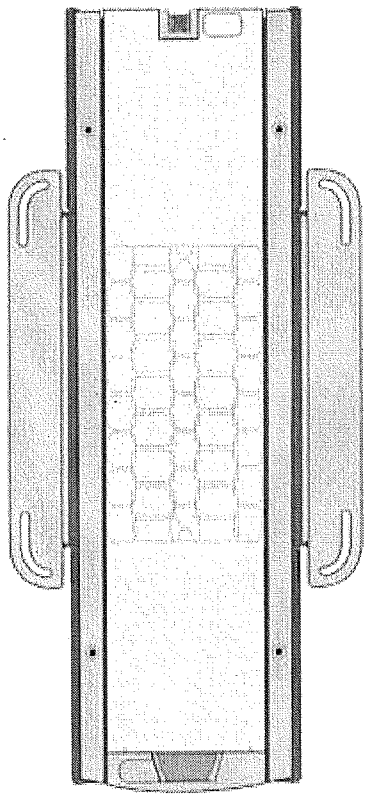
The integrated PA is symmetrically positioned within the patient supporting cradle, and coil connection ports are located at both ends of the detachable table. This design enables all components of the GEM Suite to support either patient orientation and help ensure the most comfortable patient position.

Whole body imaging may also be supported in the feet-first orientation.

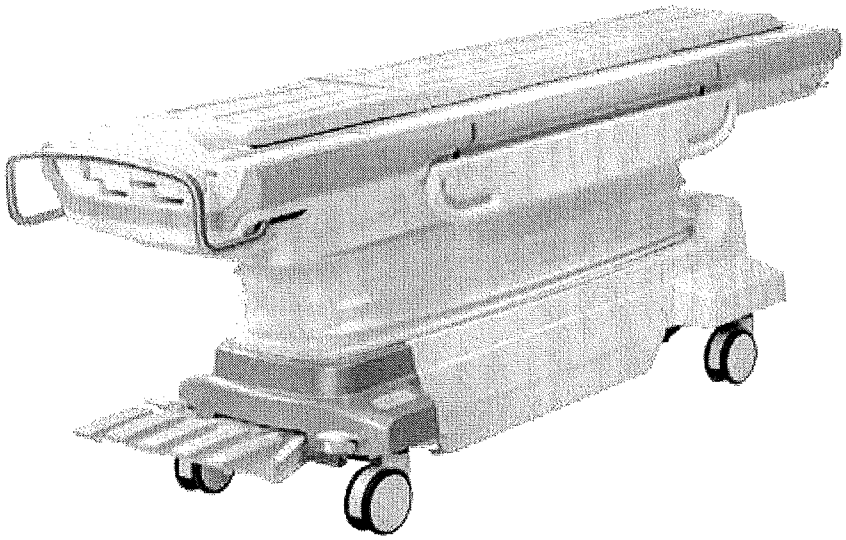
GEM Posterior Array Specifications

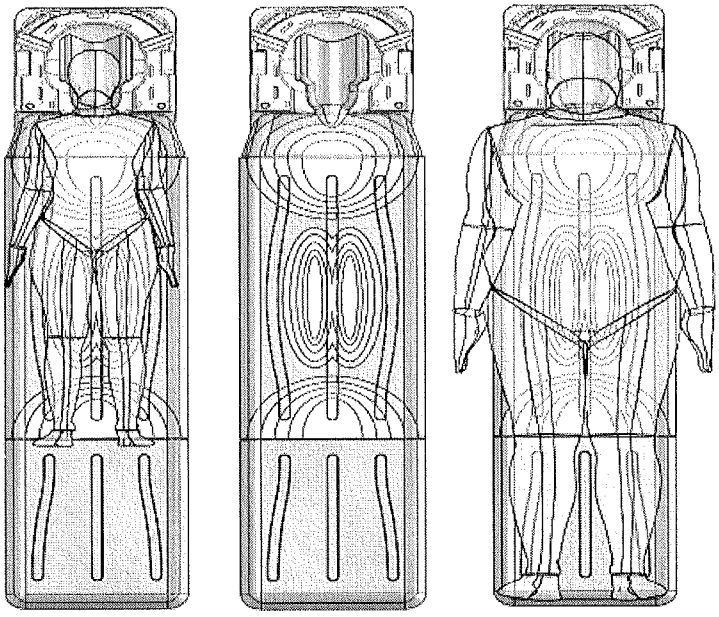
Length: 100 cm (39.4 in)
Width: 40 cm (15.7 in)
S/I Coverage: 100 cm (39.4 in)
Head-first or feet-first imaging
Elements: 40

Additional patient tables may be purchased for use with the same Optima MR450w with GEM Suite system. The integrated posterior array is an optional accessory with each additional table.



GEM Express Table illustrating layout of the PA elements





Petite Female

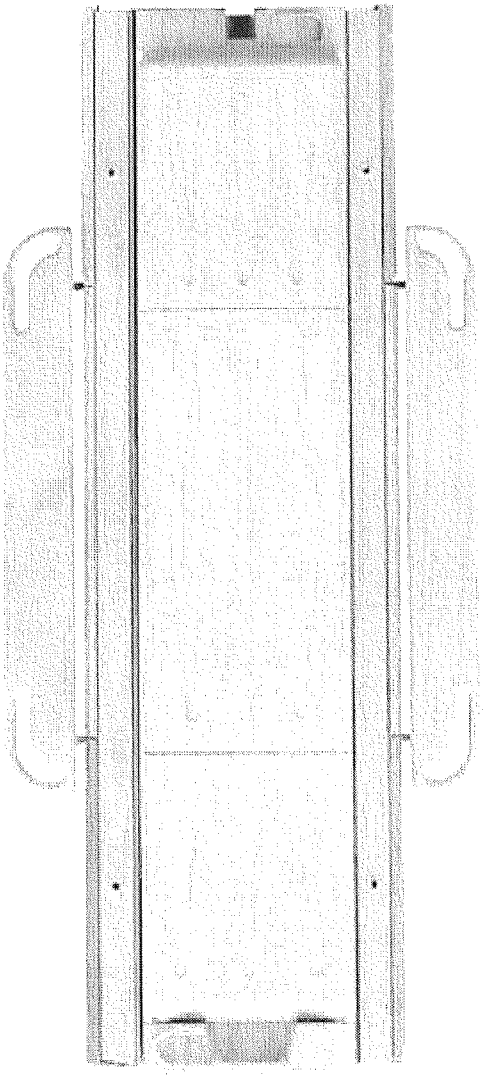
Comfort Pad Stiffness map

Very Large Male

To improve patient comfort and safety, the GEM Suite includes an innovative set of Patient Comfort pads.

The pads are designed with variable density foam that uniquely compresses based on patient geometry and weight. Certain sections of the GEM Suite pads are designed to compress more easily than others and this optimal design may minimize pressure points and improve patient comfort. The pads have been designed to support a wide range of patient sizes and weights.

The pad coating is strong, easily cleanable, and processed with an Ultra-Fresh treatment. An anti-skid undersurface reduces pad movement and thus may simplify setup and egress.



GEM Express Table with Patient Comfort Pads

GEM Head & Neck Unit (HNU)

The GEM HNU is a standard component of the GEM Suite. The HNU consists of four imaging components: a head base-plate, an anterior neuro-vascular face-array, the GEM cervical array, and the open face adapter. The coil maybe positioned at either end of the GEM table to support head-first or feet-first imaging.

The open-face design provides a patient-friendly feel. The base plate may be used with the dedicated GEM cervical array for C-spine imaging. Alternatively, the base plate may be used with the open face adapter to accommodate cervical spine exams in large or claustrophobic patients. Improved access and patient comfort may be achieved through elevation of the superior end of the coil. The HNU with anterior NV Face-Array consists of 21 elements arranged to provide parallel imaging support in all 3 planes.

Head Neck Unit NV Specifications

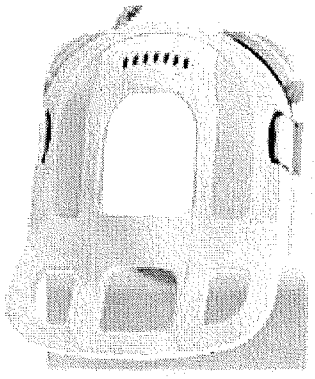
Length: 49.5 cm (19.5 in)
Width: 38.8 cm (15.3 in)
Height: 36.8 cm (14.5 in)
Weight of HNU base: 5.0 kgs (11.0 lbs)
Weight of Anterior Adapter: 2.6 kgs (5.8 lbs)
S/I Coverage: 50 cm (19.7 in), when combined with the PA and AA
R/L Coverage in head mode: 24 cm (9.4 in)
R/L Coverage for NV: 50 cm (19.7 in), when combined with the PA and AA
Head-first or feet-first imaging
Up to 28 elements in the FOV, when combined with the PA and AA

Head Neck Unit Cervical Specifications

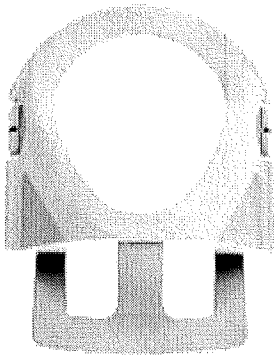
Length: 49.5 cm (19.5 in)
Width: 38.8 cm (15.3 in)
Height: 33.6 cm (13.2 in)
Weight of Cervical Adapter: 1.7 kgs (3.7 lbs)
S/I Coverage: 28 cm (11 in)
R/L Coverage: 24 cm (9.4 in)
Head-first or feet-first imaging
Up to 20 elements in the FOV, when combined with the PA

Head Neck Unit with Open Face Adapter Specifications

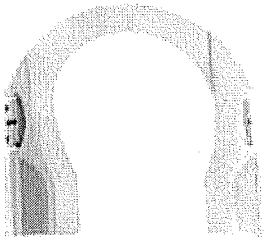
Length: 49.5 cm (19.5 in)
Width: 38.8 cm (15.3 in)
Height: 25.7 cm (10.1 in)
Weight of Open Face Adapter: 1.3 kbs (2.8 lbs)
S/I Coverage: 28 cm (11.0 in) with all 7 elements
R/L Coverage: 24 cm (9.4 in)
Head or Feet-first imaging
Up to 12 elements in the FOV, when combined with the PA



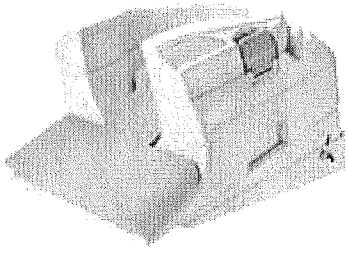
HNU with anterior NV Face-Array



HNU Cervical Array



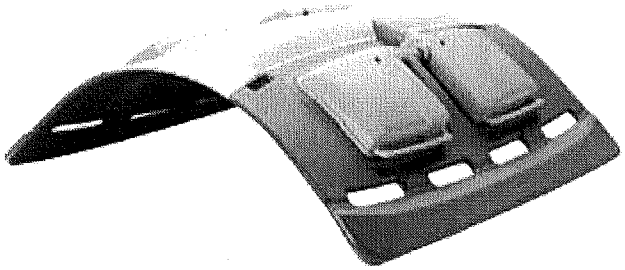
HNU Open Face Adapter



HNU with comfort tilt adapter

GEM Anterior Array (AA)

The GEM AA is a standard component of the GEM Suite that facilitates chest, abdomen, pelvis, and cardiac imaging. The GEM AA is lightweight, flexible, thin and pre-formed to conform to the patient's size and shape. With 54 cm of S/I coverage, the coil permits upper abdominal and pelvic imaging without repositioning the patient. The 16 element electrical design supports parallel imaging in all 3 planes.



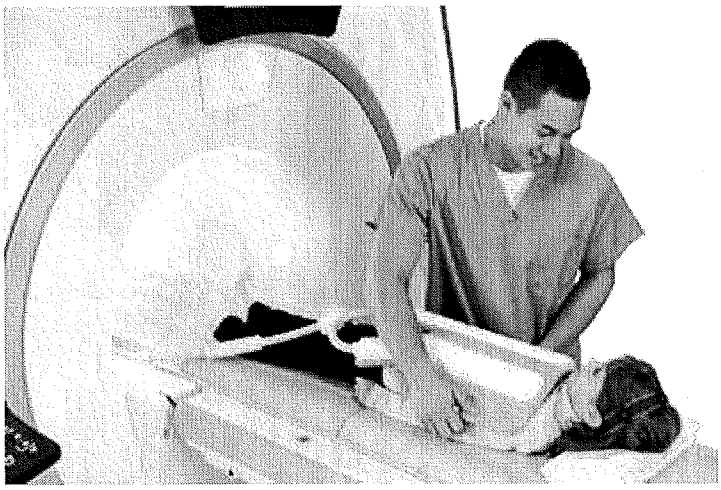
GEM Anterior Array

Anterior Array Specifications

Length: 55.6 cm (21.9 in)
Width: 67.3 cm (26.5 in)
Height: 3.6 cm (1.4 in)
Weight: 2.8 kgs (6.1 lbs) resting on patient
4.1 kgs (9.0 lbs) with cable
S/I Coverage: 54 cm (21.3 in)
R/L Coverage: to the full 50 cm (19.7 in) FOV of the system
Head or Feet-first imaging
Up to 36 elements in the FOV, when combined with the PA

GEM Small Anterior Array

The GEM Small Anterior Array is a receive-only, high-density RF coil designed to produce images with optimal signal to noise ratio and uniform coverage for cardiovascular, pulmonary, renal, and abdominal imaging. The light-weight coil design contains 16 channels, with parallel imaging capability in all three dimensions to speed up high-resolution, breath-held, and free breathing cardiovascular exams.



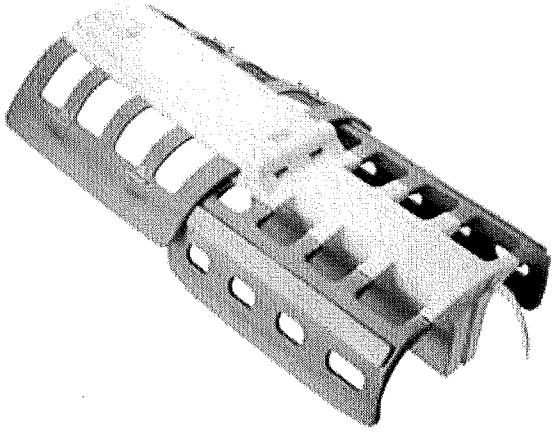
GEM Small Anterior Array

Small Anterior Array Specifications

Length: 45 cm (17.7 in)
Width: 40.5 cm (15.9 in)
Height: 4.5 cm (1.8 in)
Weight: 2.94 kgs (6.5 lbs)
S/I Coverage: 27 cm (10.6 in)
R/L Coverage: 35 cm (13.8 in)
Head-first or feet-first imaging
Up to 33 elements in the FOV, when combined with the PA

GEM Peripheral Vascular/Lower Extremity Array (PVA)

The GEM PVA is an optional component of the GEM Suite that facilitates imaging of the thighs and lower legs. The high-density layout supports parallel imaging in all 3 planes. The coil incorporates an innovative hinge design between the upper & lower elements to simplify patient setup. In addition, to improve patient comfort, the lower leg section of the coil is fully supported by the GEM table and not the patient.

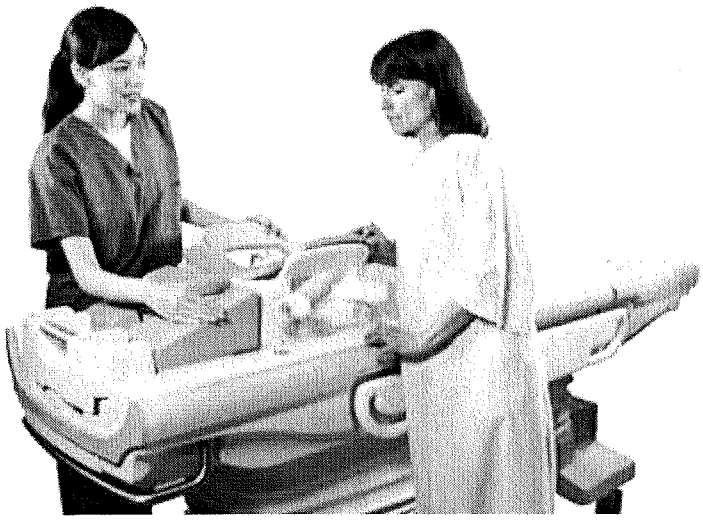


GEM PVA in un-folded position

Optional Peripheral Vascular/Lower Extremity Array Specifications
Length: 105 cm (41.3 in)
Width: 2nd station - 51.6 cm (20.3 in)
3rd station - 64.2 cm (25.3 in)
Height: 24.8 cm (9.8 in)
Weight: 8.4 kgs (18.6 lbs.)
S/I Coverage: 104 cm (49.9 in) overall
2nd station - 52.0 cm (20.5 in)
3rd station - 52.0 cm (20.5 in)
R/L Coverage: to the full 50 cm (19.7 in) FOV of the system
Head-first or feet-first imaging
Up to 36 elements in the FOV, when combined with the PA

PA Invisibility and Compatible Features

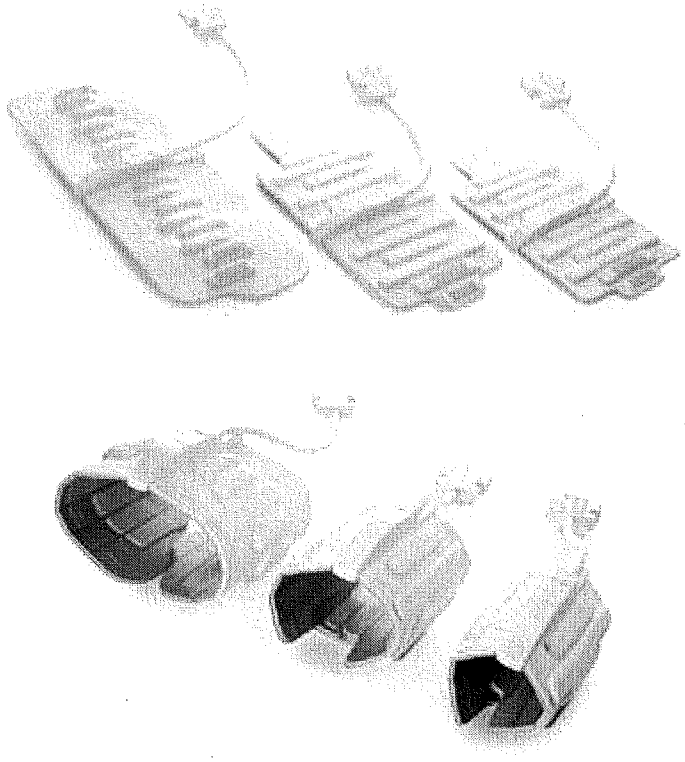
The GEM PA is designed to be used in conjunction with the GEM head-neck and cervical imaging unit, the GEM AA, and GE peripheral vascular array. When needed, the GEM PA has also been designed to become invisible when additional surface coils are placed directly on top of the table. With innovatively designed electronic decoupling circuits, the PA can support additional coils directly on top of its surface with no impact to image quality. This feature is critically important for technologist workflow, especially for breast and musculoskeletal exams.



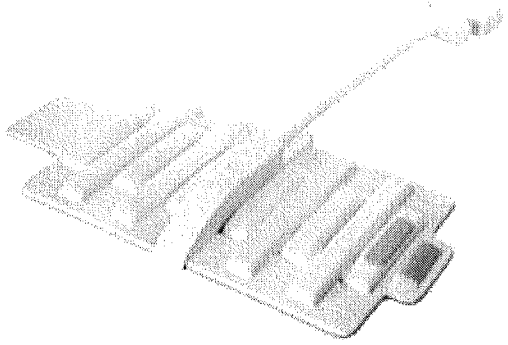
GEM Flex Suite

The GEM Flex Suite is a versatile set of high density 16ch coils designed to give high quality images in a wide range of applications. The high degree of flexibility is particularly advantageous when imaging patients that do not fit the constraints of rigid coils, improving the patient and technologist experience, and enabling most exams to be completed with the same level of image quality expected from dedicated coils.

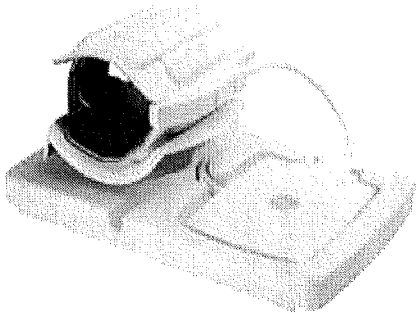
The coils are available in Small, Medium, and Large. The full Flex Suite is intended to cover a broad range of muscular skeletal applications, including upper and lower extremities of hand, wrist, elbow, shoulder, knee, ankle, and foot.



GEM Flex Suite



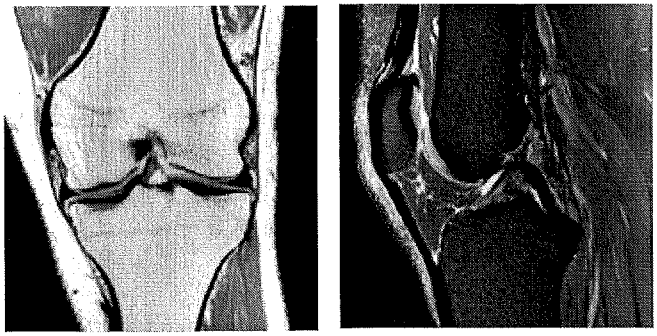
16ch GEM Flex Coil (M)



Interface and Knee Base

GEM Flex Suite specifications

Component	Coverage (W x L)	Wrap Diameter	Elements	Weight
GEM Flex Coil, Large	23cm x 70cm	15.5cm - 21.5cm	16	1.0kg
GEM Flex Coil, Medium	23cm x 48cm	11.5cm - 15.5cm	16	0.8kg
GEM Flex Coil, Small	23cm x 38cm	9.0cm - 12.5cm	16	0.8kg



High resolution knee imaging with GEM Flex Suite

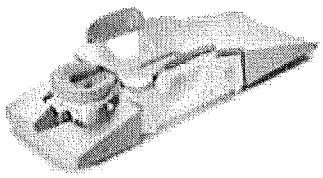
Additional high-density surface coils

The Optima MR450w with GEM provides compatibility with an array of surface coils developed by GE as well as coils developed by other vendors.

Surface coils are developed to provide anatomical coverage with optimized image quality. Coverage is maintained while providing high-density arrays focused around the anatomy of interest to promote high image quality and short scan times.

The scanner comes with a split-top, transmit/receive head coil as standard.

Optional coils are shown here. A comprehensive list of compatible surface coils from GE and 3rd party vendors is available from your GE sales representative.

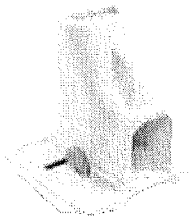


HD Breast Array

- 8-channel, 8-element phased-array design
- Optimized for uniformity, parallel imaging and VIBRANT
- Bilateral and unilateral breast imaging
- Biopsy plates available
- Coil dimensions: 53 x 53 x 24 cm (21 x 21 x 9 in)

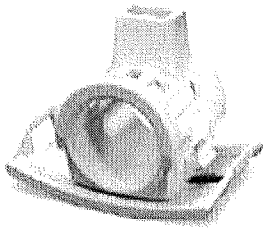
HD Knee Array

- Hybrid transmit/tapered phased-array design
- 8-channel, 9-element phased-array design
- High SNR for knee imaging
- Coil dimensions: 39 x 32 x 19 cm (16 x 13 x 8 in)



HD Foot/Ankle Array

- 8-channel, 8-element phased-array design
- "Chimney" design adds versatility for high SNR foot and ankle imaging
- Coil dimensions: 41 x 33 x 39 cm (16 x 13 x 15 in)



Quad Lower Extremity Coil

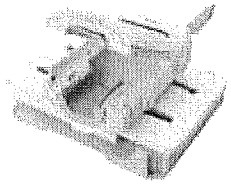
- 12-rung, transmit/receive birdcage coil
- "Chimney" design adds versatility for ankle and foot imaging
- Sensitive volume covers 22 cm FOV for knee imaging and 28 cm FOV for foot imaging
- Coil dimensions: 48 x 31 x 36 cm (19 x 12 x 14 in)

8-channel HD Shoulder Array

- 8-channel, 8-element concentric array design offers uniform depth penetration while maximizing signal-to-noise ratio
- Optimized for off-center imaging and joint visualization
- Homogenous imaging FOV and robust fat saturation
- Flexible housing contours to shoulder anatomy designed for easy set up and patient comfort
- 20 cm S-I coverage
- 25 x 23 x 25 cm (10 x 9 x 10 in)

3-channel HD Shoulder Array

- 3-channel, 3-element open phased array design
- Optimized for off-center imaging
- Homogenous imaging FOV and robust fat saturation
- PURE compatible



HD Wrist Array Coil

- 8-channel, 8-element phased-array coil
- High SNR to enable high spatial resolution images
- Position overhead or at patient's side
- Coil dimensions, including base: 34 x 23 x 21 cm (13 x 9 x 6 in)

Endo-Rectal

- 1 Channel, inflatable and auto-tuned coil
- Offers high resolution imaging of prostate, colon, rectum, cervix, and surrounding areas
- Inflatable design conforms to prostate shape and size to help with immobilization and optimal placement
- Disposable RF Probe heads connect quickly to interface box to allow for rapid setup and disassembly
- Interface box dimensions: 44.4 x 44.4 x 21.5 cm (17.5 x 17.5 x 8.5 in)
- Coil Coverage: 10 – 20 cm (Sagittal, Axial, and Coronal)

MR Enabled Therapy Accessories

Radiation Oncology Options

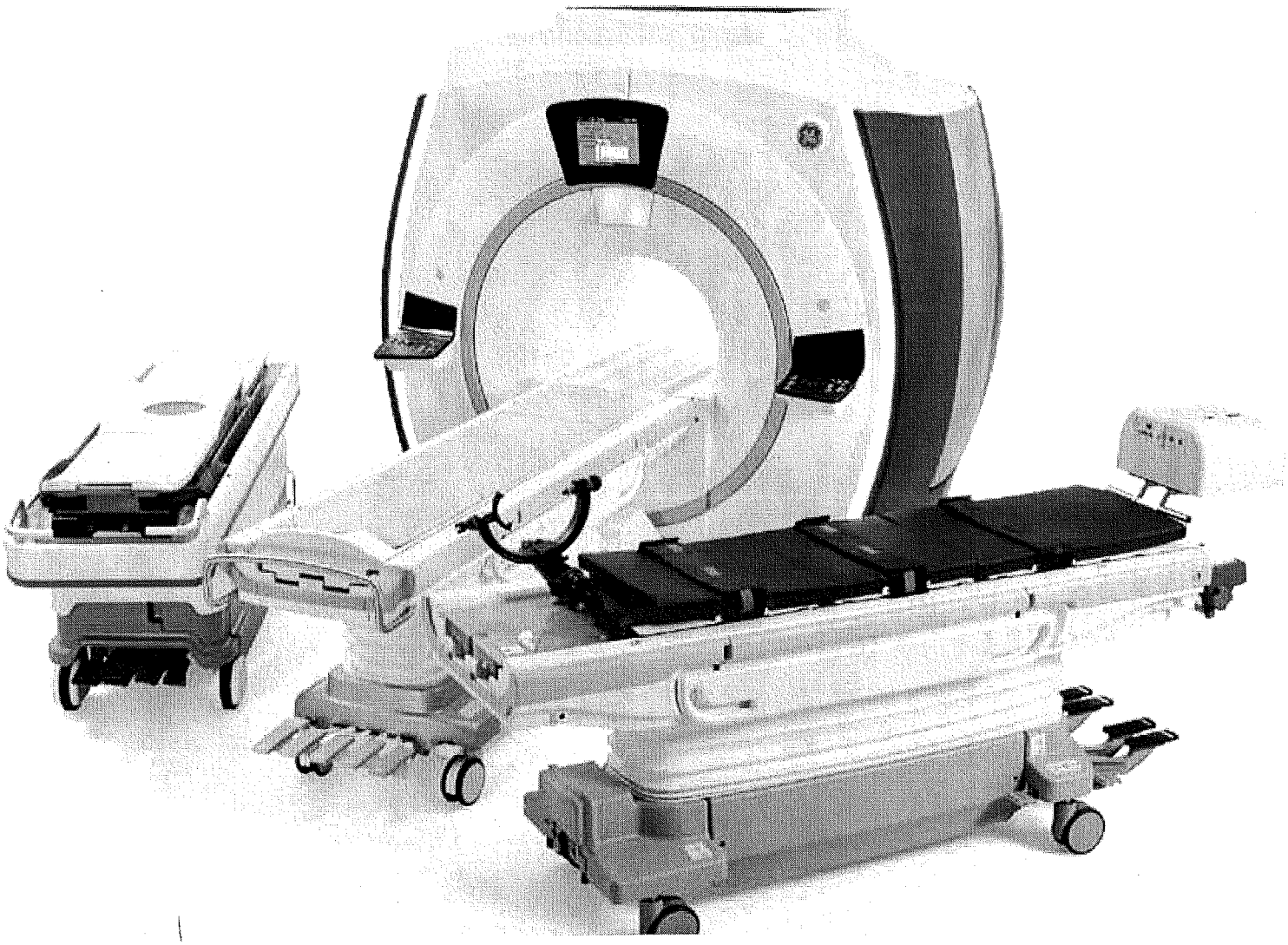
Combining the Optima MR450w with GEM advanced imaging capabilities with the Radiation Oncology Options offering helps minimize potential registration errors between MR and CT within radiation treatment plans, for improved confidence in tumor targeting and preservation of healthy tissue. Additionally, seamless integration with AdvantageSim MDtm simulation software and Integrated Registration on the GE AW workstation allows MR images to be to easily incorporated into the Radiation Oncology workflow.

MR Guided Focused Ultrasound

Your facility can offer a completely non-invasive treatment for uterine fibroids with the addition of an Exablate MR guided Focused Ultrasound therapy table to your MR system, which has been used in 6,500 procedures worldwide.

Surgical Suite

The Surgical Suite offering is an effective solution for incorporating MR imaging into your surgery center. Through seamless integration with surgical navigation systems, surgeons can retrieve archived images and fuse them with newly acquired intra-operative MR images. This advanced technology can assist in real-time surgical decision making and improved tumor resections.



Workflow

eXpress PreScan

Optimized PreScan step leading to an increase in efficiency of the calibration process enabled by the new GEM eXpress algorithm. This leads to as much as a 30% reduction in pre-scan time, translating to a time savings per exam of up to 3 minutes.*

Express exam streamlined workflow

The GEM Suite, Express Patient Table, IntelliTouch technology and in-room operator console (iROC) streamline the Optima MR450w workflow and help you improve patient care by letting you keep your focus where it's needed most - on your patient.

With Express Exam, entire exams are completed in just a few mouse-clicks due to the automated acquisition, processing, and networking capabilities of the patient setup and workflow features of the Optima MR450w.

GEM Suite

The GEM Suite of coils helps dramatically improve patient setup and workflow. Because the posterior arrayis embedded in the table and because the coils are significanlty lighter than previous generations, MR technologists are required to lift and handle less weight. Also, the posterior array becomes invisible to the system when other surface coils are deployed, so that special handling and configuration steps are not required to scan with options such as the breast array. Finally, to help reduce anxiety and improve compliance, the symmetric scan feature of GEM Suite means that patients can be scanned feet-first for any exam.

Express patient table

The fully detachable GEM Express patient table, which features the embedded Posterior Array, helps improve safety, exam efficiency, and patient comfort.

Safety

Easily docked and undocked by a single operator, the patient table is simple to move in and out of the exam room for patient transport and preparation. These become vital features in those instances where multiple patient transfers can negatively impact patient care or when emergency evacuation is required; the table can be undocked and removed in under 30 seconds with just one technologist. In time-sensitive situations there is no need to remove or disconnect surface coils as the system can automatically disconnect the coils for you. The mobility and safety features of Optima MR450w with GEM patient table can obviate the need for MR-compatible emergency equipment or a second technologist.

Exam efficiency

In addition to being fully detachable, the Optima MR450w with GEM Express patient table can offer multiple surface coil connectors. With high density connectors at each end of the table, the patient and coils can be fully prepared for an exam outside of the scan room, thus further reducing the necessary steps before starting acquisition.

With a second table, the next patient can be positioned outside the magnet room while the current patient is undergoing an examination.

Patient comfort

The Express detachable table can reduce patients' anxiety and provide patients personal discretion by preparing them for the exam outside the scan room. Reduced patient table transfers for inpatients or trauma patients can improve overall patient care.

The Express patient table offers optional head- or feet-first imaging. Additionally, feet-first positioning facilitates run-off studies and set-up for claustrophobic patients.

Ergonomics

With one hand and one simple motion, the integrated arm boards and IV pole can be optimally positioned to support the patient for safe transport and injections. This unique capability of the Optima MR450w with GEM table also makes it ideally suited for multi-station exams with no scan room intervention, such as time-resolved vascular imaging.

High-density coil interface

Optima MR450w with GEM technology takes the guesswork out of coil plug-in and identification by automatically identifying the coil that is connected. Prominent visual indicators near the coil connection port allow the technologist to ensure a secure coil connection, every time.

GEM Express patient table	
Patient table	Detachable and mobile
Min/max table height	70 to 93 cm, continuous
Patient table drive	Automated, power driven vertical and longitudinal
Longitudinal speed	30 cm/sec (fast) and 0.5 cm/sec (slow) 15 cm/sec for patient positioning
Total cradle length	210.8 cm
Total cradle travel	278.1 cm
Scannable range	205 cm
Maximum patient weight for scanning	227 kgs (500 lbs)
Maximum patient weight (detached and mobile)	227 kgs (500 lbs)
Maximum lift capacity	227 kgs (500 lbs)
Patient transport accessories	Self-storing non-ferrous IV pole Positioning pads Immobilization straps
Landmarking	- Laser alignment with S/I and R/L alignment - IntelliTouch Landmarking Capability (optional)
Coil connection ports	Two high density auto-coil sensing connection ports

*Based on a comparison to DV22 software.

IntelliTouch patient positioning

IntelliTouch technology can enhance exam productivity by eliminating the need for laser alignment and reduces the number of steps for patient preparation.

For those patients where more precise alignment is desired, lasers may be used for either the selection or confirmation of landmark positioning.

The Optima MR450w with GEM system has automated many routine tasks to both simplify patient preparation and reduce errors. With IntelliTouch technology, the following tasks can be completed by simply touching the side of the table and pressing the advance to scan button.

- Landmark the patient
- Activate the surface coil
- Center the patient in the bore
- Start scanning
- Acquire, process and network images

Dual system control panels

For operation on either side of the scanner, two ergonomically designed control panels are integrated into the front of the system enclosures. These panels incorporate backlit buttons to guide the user to the next logical step in exam setup.

A trackball and select buttons guide the use of the in-room operator console.

From the system control panels you can:

- Position the table
- Home position
- Stop table
- Control multiple levels of in-bore ventilation and lighting
- Enter patient weight
- Enter patient orientation and patient position
- AutoStart – initiate the scanner to automatically acquire, process, and network images

In-room operator console (iROC)

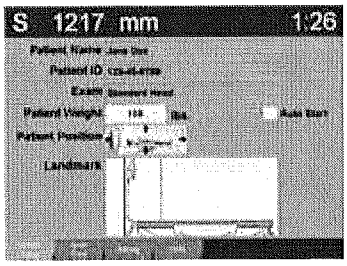
Simplify exam preparation and reduce the time between patients with the Optima MR450w with GEM high-resolution, color in-room operator console.

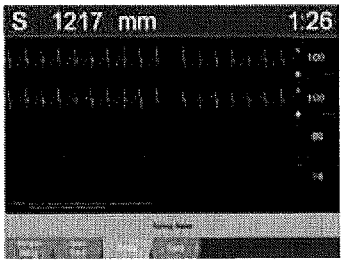
By consolidating all controls into one place, the iROC provides real-time feedback to the user to help ensure that any necessary changes in patient setup are quickly and clearly related back to the user. The iROC enables the user to visualize cardiac and respiratory waveforms directly in the exam room – eliminating the need for the technologist to leave the room and improving the patient experience. The iROC also allows for the integration of third-party interfaces and tools.

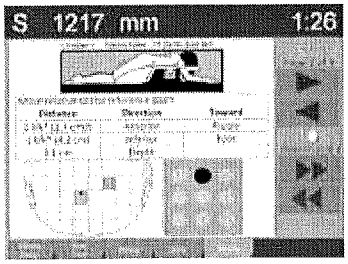
Mounted on the front of the magnet, the display provides realtime interaction with the scanner and the host computer. The user has direct control or selection of the following:

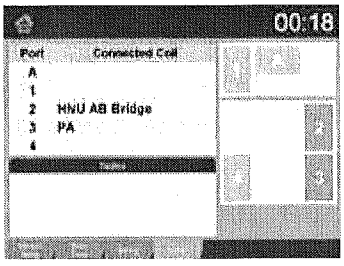
- Display of patient name, ID, study description
- Display and entry of patient weight
- Display and entry of patient orientation and patient position
- Cardiac waveform display and EKG lead confirmation with gating control: trigger select, invert and reset
- Respiratory waveform display
- IntelliTouch technology landmarking
- AutoStart – initiate the scanner to automatically acquire, process, and network images
- Display connected coils and coil status
- Display of table location and scan time remaining
- Screen saver
- Display and navigate through a CADstream SureLoc report

The iROC simplifies patient workflow by reducing the time burden of today's most challenging exams. Together, the significant advances of the Optima MR450w with GEM improve careby enabling technologists to help maintain their focus where it is needed the most – on the patient.









Optima MR450w with GEM Express Exam

The Optima MR450w with GEM scan interface incorporates many features designed to lighten the workload by automating many routine steps.

The Optima MR450w with GEM includes an automated protocol-driven user interface designed for consistency in generating high-quality imaging for all patients and from all technologists. Designed for efficiency, the Optima MR450w with GEM computer platform is built upon a parallel, multiprocessor design that delivers the simultaneity and speed needed for advanced clinical operation. Productivity, efficiency and streamlined data management are achieved through simultaneous scanning, reconstruction, filming, archiving, networking and post-processing.

Though the protocol-driven workflow can dramatically simplify and automate image acquisition and processing, the flexibility that is synonymous with GE systems is maintained. If desired, the user can have complete control of exact sequence parameters for site optimization and patient specific situations.

Modality worklist

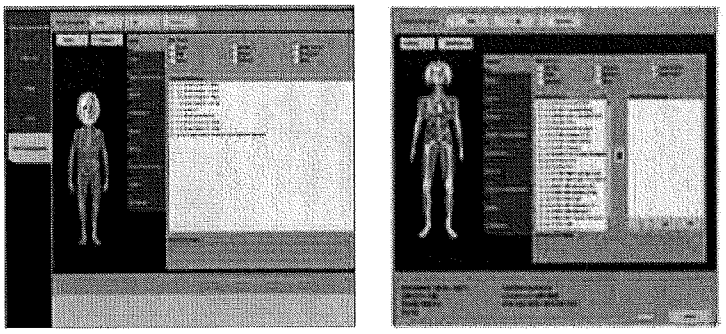
The modality worklist (MWL) provides an automated method of obtaining exam and protocol information for a patient directly from a DICOM Worklist server. For sites with full DICOM connectivity, once a patient has been selected from the MWL, a new session can be opened on the host interface and the iROC will highlight the relevant exam details. For sites that do not have full connectivity, minimal data entry (patient number and weight) is necessary prior to starting a new session. Additional data fields for patient-sensitive information such as allergies, pre-medication, pregnancy status, and history are provided

The Optima MR450w with GEM MWL provides complete control of the MRI protocol prescription. The protocol may be selected well in advance of the patient's arrival at the MR suite, thereby simplifying exam preparation and reducing necessary work by the technologist during the time-critical procedure.

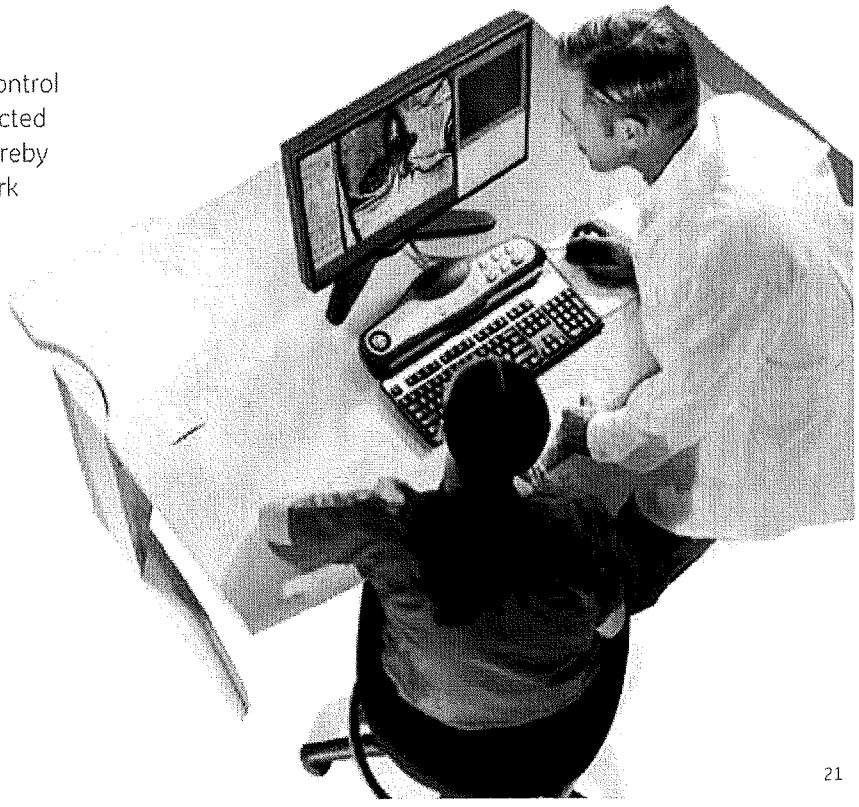
The ConnectPro software enables the DICOM worklist server class for the Optima MR450w with GEM Operator's Console. This software may require separate gateway hardware to connect non-DICOM-compatible HIS/RIS systems to the MR system.

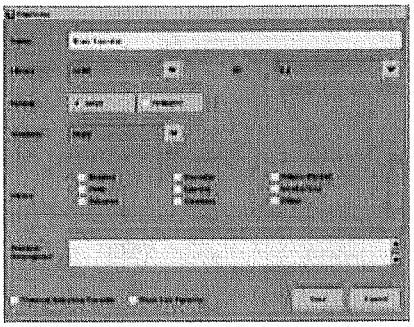
Protocol libraries and properties

The Optima MR450w with GEM system provides the user with complete control of protocols for simple prescription, archiving, searching, and sharing. The protocols are organized into two main libraries, GE Optimized and Site Authored. For quick search and selection, each protocol may be archived with independent properties based on patient demographics, anatomy, type of acquisition, or identification number. For commonly used protocols, a favorites flag may be used for quick selection from the Modality Worklist or for sharing across other libraries.



Adult and Pediatric Protocol libraries for simple management of exams.





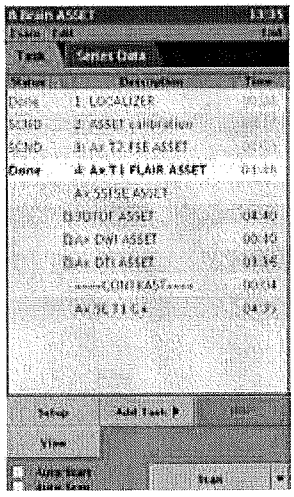
Each protocol or series can be saved with user-defined properties to simplify search and selection for future use.Favorite protocols can be highlighted for quick selection from the Modality Worklist or other libraries.

ProtoCopy

Standard on every Optima MR450w with GEM system, the ProtoCopy feature enables a complete exam protocol to be shared with the click of a mouse. The exam protocol can originate from either a library or previously acquired exam. This enables routine archive of protocols for emergency backup and simple management of libraries across multiple systems.

Workflow manager

Once a protocol has been selected for an exam, it is automatically loaded into the Workflow Manager. The Workflow Manager controls image prescription, acquisition, processing, visualization, and networking and may fully automate these steps if requested.



The Workflow Manager automatically loads the protocol and controls image prescription, acquisition, processing,and visualization

AutoStart*

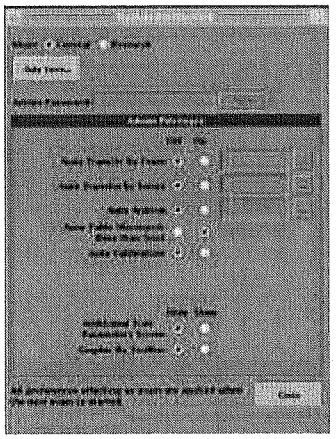
If AutoStart is selected, once the landmark position has been set and the technologist exits the scan room, the Workflow Manager will automatically start the acquisition.

AutoScan*

With AutoScan enabled, the Workflow Manager will sequentially go through the list of prescribed series without any user interaction. Once a series has been completed, the next series will be scanned automatically. For series requiring contrast, the system will await user interaction.

Auto calibration

A calibration scan is necessary for any acquisition that uses either ASSET parallel imaging or PURE surface coil intensity correction. A system preference can be selected to automatically acquire calibration data if desired. When needed, a calibration scan is automatically prescribed and acquired based on the clinical imaging volumes saved by the user. The reduced time lapse between the calibration and clinical scan minimizes possibility of patient movement and this improves image quality



Automatic Calibration screen

Auto coil prescription

Once the patient has been landmarked on the GEM Express Patient table with the appropriate components of the GEM Suite, the system will automatically determine the optimum subset of elements to enable for scanning. The optimization of the elements is based upon the prescribed FOV and will automatically adjust if the FOV changes in either size or position over the anatomy. The user has the option to view and edit the physical coil extents and the optimally selected element coverage.

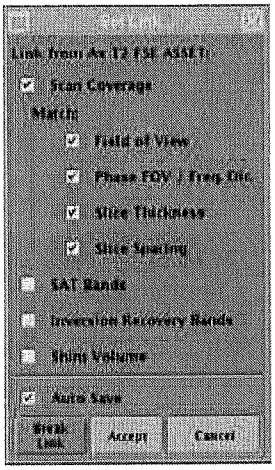
Ready Brain Application

An MRI examination of the brain consists of a number of connected steps. Ready Brain provides the flexibility to automate a number of these connected steps ranging from acquiring a localizer image, prescribing acquisition planes, scanning relevant series, performing post-processing up to transferring the final image data to a reading station. By standardizing the steps of an exam and the location of the scan planes, such automation could result in greater consistency, especially in longitudinal follow-up.

Ready Brain features an automatic localizer, automatic calculation of the mid-sagittal plane for 2D/3D prescription and determination of the AC-PC line, and correction for extreme (>45 degree) rotation.

Linking

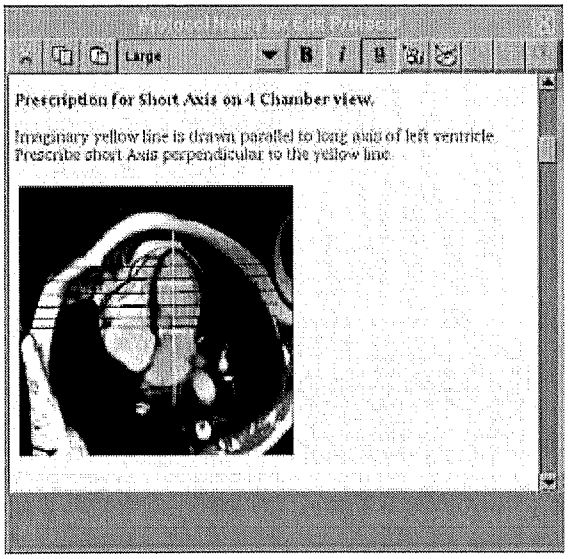
Linking automates the prescription of images for each series in an exam. Once the targeted anatomical region has been located the Linking feature combines information from a prescribed imaging series to all subsequent series in the Workflow Manager. All series that have been linked may automatically be prescribed (Rx) and no further interaction will be needed by the technologist to initiate the scan. The user has control over which specific parameters can be linked together. Series can have common fields of view, obliquity, slice thickness, anatomical coverage, saturation bands, or shim volumes. Multiple series can be linked together and saved in the Protocol Library or edited in real time. Linking may be used with any anatomy and with any acquisition. Once the first volume is prescribed, all other subsequent series with the same planes can be automatically prescribed and acquired.



Linking.

Protocol notes

Each protocol defined by the MR staff includes Protocol Notes. The content the MR staff adds to the Protocol Notes, on a series-by-series, basis can include text and images. Protocol Notes allow the MR staff to communicate protocol parameters, graphic prescription locations, etc. that are specific to your site. Protocol Notes appear below AutoView.



AutoVoice*

The AutoVoice feature will ensure that consistent and repeatable instructions are presented to the patient for each and every exam. User selectable, pre-recorded instructions are presented at defined points in the acquisition. This helps ensure that the patient is in the right position and is fully aware of the next step in the acquisition process. AutoVoice is particularly helpful during breath-hold exams. The AutoVoice feature includes instructions in over 14 languages and the user can create and include their own unique voice instructions for local needs.

Inline viewing

Inline viewing allows the user to conveniently view, compare, and analyze images without having to switch to the Browser.

Simply select the series to view from the Workflow Manager and the images are displayed along with standard image display tools. Image comparisons can be easily done by selecting multiple series at a time. The integrated viewer allows the user to seamlessly move between scanning and image viewing.

Inline processing

The Optima MR450w with GEM workflow automates many of the routine tasks that previously required user interaction. This dramatically reduces the workload for the user and helps ensure that consistent and repeatable images are presented for review. Processing steps are automatically completed immediately after the data has been reconstructed and the images saved into the database. These automated processing steps can be saved in the Protocol Library to ensure consistent exam workflow for each type of patient.

For certain tasks, such as vascular segmentation, the user must accept the results, or complete additional steps prior to saving the images to the database. In these cases the data is automatically loaded into the appropriate tool, then the system will await further instruction by the user. Examples of fully automated and partially automated inline processing include:

Inline processing capabilities	
Diffusion Weighted Images ADC/ eADC Maps	Automatic compute and save
Diffusion Tensor Images FA/ADC Maps	Automatic compute and save
Image Filtering: A-E, SCIC, PURE	Automatic compute and save
Maximum/MinimumIntensity Projection	Automatic compute and save
Reformat to orthogonal planes	Automatic compute and save
T2 Map for cartilage evaluation	Automatic compute and save
FiberTrak	Automatic load
Spectroscopy - Single voxel brain and breast metabolite	Automatic compute and save
3D Volume Viewer	Automatic load
Spectroscopy - 2D/3D Chemical Shift Imaging	Automatic load
BrainStat (Functool)	Automatic load
Image Fusion	Automatic load
IVI (Volume Viewer)	Automatic load
Pasting	Automatic load
SER (Functool)	Automatic load
eDWI	Automatic compute and save
3D ASL	Automatic compute and save

Image fusion

To better visualize tissue and contrast, multiple images from separate acquisitions can be overlaid on one another. With the new Optima MR450w with GEM workflow, high-resolution 2D and 3D anatomical images can be fused with functional data or parametric maps for improved visualization for the user. The data is registered using translation and rotation to ensure accurate fusion.

The automated workflow features of the system can be used for any anatomy and for any sequence. When combining the technology of AutoStart,™ Linking, Inline Processing, AutoVoice,™ and the AutoScan™ features, an entire exam can be completed with just a few actions. The flexibility of the Optima MR450w with GEM user interface and acquisition parameters helps ensure that each acquisition is tailored for every patient. However, the technologist steps are kept consistent.

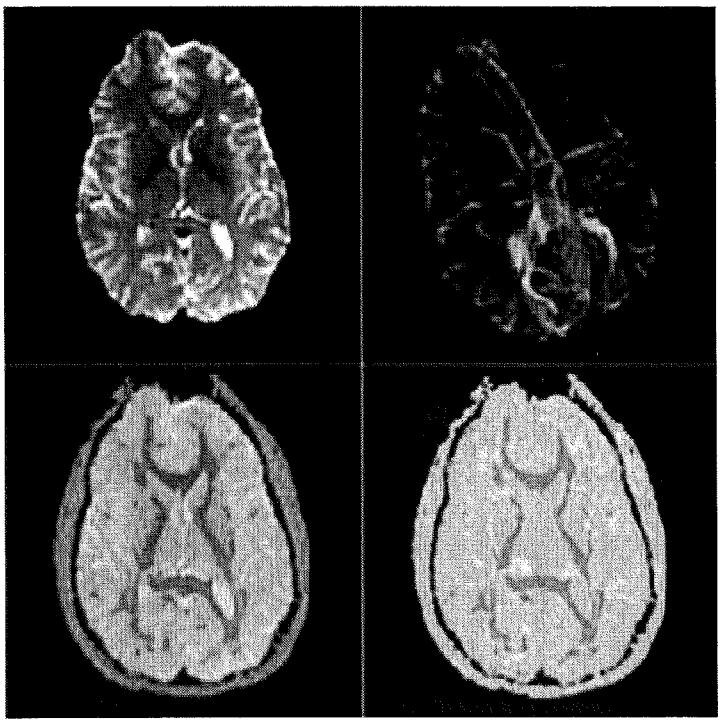
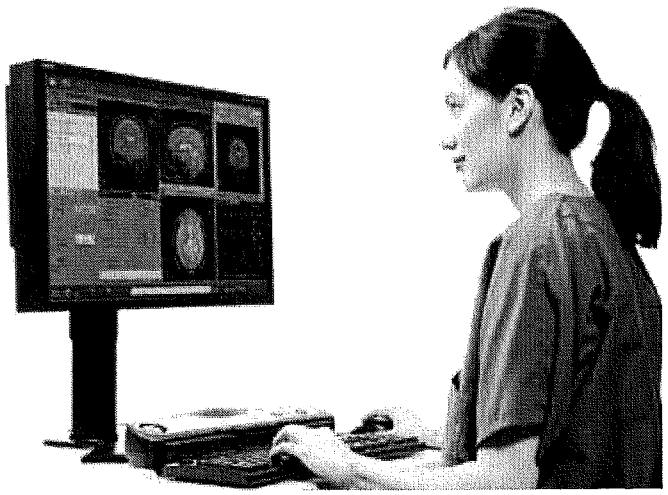


Image fusion	
MR Standard	3D Registration
ADC/eADC	3D Registration
Diffusion Tensor	3D Registration
Functional MRI	Reformat
BrainSTAT	3D Registration
SER (Signal Enhancement Ratio)	Reformat
T2 Mapping	Reformat
Spectroscopy (Brain, Prostate and Breast)	Reformat



Computing platform

Operator console

The Optima MR450w with GEM system comes equipped with a scan control keyboard assembly that contains intercom speaker, microphone and volume controls, and an emergency stopswitch. Start-scan, pause-scan, stop-scan, and table advance to isocenter hot keys are also included.

DICOM

The Optima MR450w with GEM system generates MR Image, Secondary Capture, Structured Report, and Gray Scale Softcopy Presentation State (GSPS) DICOM objects. The DICOM networking supports both send and query retrieve as well as send with storage commit to integrate with the site's PACS archive. DICOM filming support includes both Basic Grayscale and Basic Color Print Service Classes. Additionally, the Optima MR450w with GEM system supports the CT and PET image objects for display allowing the user to refer to previous studies.

Computing platform	
CPU	Intel Xeon Nehalem Dual Core Processor
Memory	8GB DDR3 Memory
Graphics subsytem	PCI-Express x16 512MB Single DVI-I 3D
Cabinets	Single, tower configuration
Disk Subsystem	146GB SAS
Network	Gigabit (10/100/1000) Ethernet

Image interchange	
DVD Interchange	DVD+/-R Average 35,000 images per 4,7GB DVD

Filming	
Filming	Drag and drop filming One-button print series One-button print page Multi-image formats From 1 to 24 images displayed simultaneously in various layouts DICOM basic grayscale print service class DICOM basic color print service class

Wide-screen display monitor	
Screen Size	24" Flat Panel LCD Widescreen
Resolution	1920 x 1200

Display	
AutoView	Dedicated image review window
Window/Level (W/L)	6 programmable window/level preset keys in viewer, plus one key for returning to prior setting 6 user-programmable buttons in image viewer Arrow keys on scan control keyboard On-image through middle mouse button Save State stores user-selected image orientation, user annotation and window level.
Image display	Zoom/Roam/Flip/Rotate/Scroll Explicit Magnify and Magnifying Glass Image Measurement Tools Grid On/Off Cross Reference/User Annotation Exam/Series Page Hide Graphics/Erase Annotation/ Screen Save Accelerator Command Bar Compare Mode/Reference Image/ Image Enhance ClariView Image Filtering Smooth and Sharpen Edge Filters Minified Reference Scoutview Cine Paging (up to 4 windows and 128 images/window) Add/Subtract/Edit Patient Data
Image display	256 Image buffer (256 x 256) at 30 fps
Image annotation	Shadowed to permit ease in reading Two graphic/text planes overlay the entire screen. Grid placement with anatomical reference on an image. Drawing and annotation may be added to and removed from images

Specifications shown on this page are minimum performance levels.

ScanTools

The Optima MR450w with GEM scanner comes standard with a package of pulse sequences and applications optimized for 1.5T performance.

Pulse sequences and imaging options	
Spin Echo	The gold standard for generating T1, proton density and T2 images.
Fast-Spin Echo (FSE) Fast-Spin Echo XL (FSE XL)	These techniques use echo-train technology to reduce the time for image acquisition. T2 image blurring is minimized by shorter echo spacing.
Fast-Recovery Fast-Spin Echo (FRFSE-XL)	The sequence of choice for high-quality, high-speed, and high-contrast T2-weighted imaging in neurological, body, orthopedic, and pediatric applications. Compared to FSE, FRFSE allows shorter acquisition times or increased slice coverage.
3D FRFSE	3D FRFSE is a sequence for creating high-resolution, three-dimensional T2-weighted images of all anatomies and is especially useful for MR cholangiopancreatography (MRCP) studies.
Single-Shot Fast-Spin Echo (SSFSE)	An ultra-fast technique that permits complete image acquisition following a single RF excitation. It can acquire slices in less than one second, making it an excellent complement to T2-weighted brain and abdominal imaging and MRCP studies.
GRE FGRE SPGR FSPGR	This suite of gradient-echo techniques uses short TR and TE to generate T1- or T2-weighted images in far less time than conventional SE. The ultra-short TR and TE possible with these sequences also ensure the performance needed for state-of-the-art vascular and contrast-enhanced MRA studies.
2D and 3D Dual Echo Gradient Echo	A vital tool for abdominal imaging. This variation on conventional gradient echo provides a pair of images for which the signals from water and fat either are in-phase or out-of-phase. By design, all of the images acquired within a single breath-hold are in perfect registration.
SPECIAL	Spectral Inversion at Lipids (SPECIAL) is a spectral spatial inversion technique for fat saturation in 3D FGRE pulse sequences.
T1 FLAIR T2 FLAIR	T1 and T2 Fluid Attenuated Inversion Recovery (FLAIR) pulse sequences have been designed expressly for neuro applications. FLAIR allows suppression of signal from cerebrospinal fluid (CSF). In addition to this capability, T1 and T2 FLAIR add extraordinary contrast between white and gray matter to T1- and T2-weighted brain and spine imaging.
Echo Planar Imaging (EPI) FLAIR Echo-Planar Imaging	Essential tools for any high-throughput site employing advanced techniques. Echo planar imaging is what enables rapid imaging. And both echo planar and FLAIR echo planar techniques make it easier to generate neuro studies from uncooperative patients who simply refuse to stay still long enough for conventional techniques.
2D and 3D Time of Flight (TOF) Imaging 2D-Gated TOF Imaging	2D TOF Imaging, 2D Gated TOF Imaging, 3D TOF Imaging and Enhanced 3D TOF Imaging are all ideal for MR angiography. Based on conventional gradient echo scanning, TOF imaging techniques rely primarily on flow-related enhancements to distinguish moving from stationary spins.
2D Phase Contrast (2DPC) 3D Phase Contrast (3DPC)	These techniques demonstrate flow velocities and directional properties in vessels and other moving fluids such as cerebral spinal fluid and aortic flow.
SmartPrep*	SmartPrep uses a special tracking pulse sequence to monitor the MR signal through a user-prescribed volume to detect the arrival of an injected contrast bolus and to trigger the acquisition, for optimum contrast enhancement.
Double/Triple IR	These pulse sequences are included to allow black-blood imaging for studies of cardiac morphology. Triple IR adds fat suppression to black-blood imaging.

ScanTools

Pulse sequences and imaging options continued	
FastCINE	This pulse sequence is included specifically for studies of cardiac function. Through the use of retrospective gating, it allows full R-R coverage.
iDrive Pro	iDrive Pro brings real-time interactive imaging to the MR system, making it easier to generate detaile diagnostic information on just about any anatomy. This includes organs that are subject to motion artifacts, such as spine, heart, diaphragm and GI tract. The iDrive Pro technique allows the user to change scan parameters on the fly, during scanning, to evaluate the results immediately.
IVI	An interactive user interface that allows operators to remove background from MR angiography images. The result: angiographic and maximum intensity (MIP) projections in multiple scan planes. The processed images are saved automatically as a distinct series for quick recall.
Reformat	An online tool that allows the operator to convert image data sets from the acquired plane into orthogonal or oblique views. The reformat tool is easy to use and particularly useful for the interrogation of 3D datasets with complex anatomy. Reformatted images can be saved into the database for further review or filming.
FuncTool Performance	FuncTool Performance provides advanced capabilities by using a wide range of sophisticated algorithms, including: - ADC maps and eADC maps - Correlation Coefficients for mapping of motor strip and visual/auditory stimuli - Maximum Difference Function - Difference Function
Auto TR	Auto TR dropdown menu replaces the TR dropdown menu located on the Graphic Rx desktop. Displays lowest TR value of each series.
EPI and DW-EPI	Standard on all systems are gradient echo, spin echo, flair, and diffusion-weighted echo planar imaging. The standard EPI sequence supports single and multi-shot imaging, multi-phase imaging, as well as cardiac gating. Diffusion EPI produces images that can detect acute and hyper-acute stroke with b-value up to 10,000 s/mm2, multi-NEX compatibility and the ability to generate ADC and T2-weighted TRACE images. The FLAIR option suppresses the CSF signal component to ease interpretation.
LAVA	LAVA is a three-dimensional (3D) spoiled gradient echo technique designed specifically to image the liver with unprecedented definition, coverage, and speed. Excellent fat suppression, through a version of the SPECIAL technique customized for the liver, is one of the reasons for the high definition of anatomical structures. The coverage and speed of LAVA are the result of short TR, innovative use of partial k-space acquisition, and advanced parallel imaging. What is the clinical benefit of LAVA? It enables the high-quality 3D MR imaging of the liver during short breath-holding periods.
BRAVO	Brain Volume imaging is a high-resolution 3D imaging technique designed to produce heavily T1-weighted isotropic images of the brain. BRAVO uses 1D ARC to reduce scan time and minimize parallel imaging artifacts.
2D and 3D MERGE	Multiple Echo Recombined Gradient Echo (MERGE) uses multiple echoes to generate high-resolution images of the C-spine with excellent gray-white matter differentiation. By combining early echoes with high SNR and late echoes with improved contrast, the result is improved cord contrast within the spinal column.

Imaging options

Imaging options

Pulse sequence imaging options

- ASSET
- ARC
- ART
- Blood Suppression
- Cardiac Gating/Triggering
- Cardiac Compensation
- Classic
- DE Prepared
- EDR
- Flow Compensation
- Fluoro Trigger
- Full Echo Train
- IDEAL
- IR Preparation
- Magnetization Transfer
- MRCP
- Multi-Station
- Multi-Phase/Dynaplan
- Navigator
- No Phase Wrap
- Real Time
- Respiratory Compensation
- Respiratory Gating/Triggering
- Sequential
- SmartPrep™
- Spectral Spatial RF
- Square Pixel
- T2 Prep
- Tailored RF
- Zip 512/Zip 1024
- 3D Slice Zip x 2 (Z2)/Zip x 4 (Z4)

Parallel imaging

Array Spatial Sensitivity Encoding Technique (ASSET) imaging option is a 1D image-based parallel imaging technique used to speed data acquisition. For temporally sensitive acquisitions, ASSET reduces image blurring and motion, and enables greater anatomical coverage. Parallel imaging acceleration factors ranging from 1-3.0 are supported depending on the coil selected.

ASSET 3.0

Next generation reference scan algorithm which provides improved control over motion related artifacts and dephasing which can occur during the reference scan step. The new ASSET 3.0 reference algorithm leads to a reduction in artifacts caused by motion or dephasing in clinical results. The improvement is also utilized in the PURE image uniformity correction.

ARC Parallel Imaging

Auto-Calibrating Reconstruction (ARC*) is a data driven parallel imaging technique that synthesizes missing data from neighboring source data in all three imaging dimensions: slice, phase and frequency. Fewer calibration lines are required and reconstruction accuracy and speed is improved resulting in highly accelerated MR data acquisition with improved image quality and reduced artifacts.

ARC is auto-calibrating, which means that it requires no coil sensitivity map and is therefore less sensitive to motion artifacts that would occur between the calibration and accelerated scan. It can be used with tight FOVs that are smaller than the anatomy being imaged and thus allow high resolution imaging.

Since there is no calibration scan required and fewer artifacts, the ARC exam is typically shorter in comparison to other parallel imaging techniques.

ARC is compatible with most PSDs and coils. It does not require a calibration scan.

The following applications are parallel imaging enabled.

- 2D FSE
- 2D FRFSE
- 2D FSE-IR
- 2D T1 FLAIR
- 2D FSE Double IR
- 2D FSE Triple IR
- 2D T2 MAP
- 2D FSE-XL IDEAL
- 2D FRFSE-XL IDEAL
- 2D SSFSE
- 2D SSFSE-IR
- 2D SSFSE MRCP
- 2D SSFSE 3-plane
- 3D FRFSE
- 3D FRFSE HYDRO
- 2D FGRE
- 2D FSPGR
- 2D FIESTA
- 2D FIESTA Fat Sat
- 2D FIESTA Fast CARD
- 2D FIESTA Fast CINE
- 2D MDE
- 2D MFGRE
- 3D TOF GRE
- 3D TOF SPGR
- 3D Cube (PD, T1, T2, T2 FLAIR)
- 3D Heart
- 3D FGRE
- 3D FSPGR
- 3D FGRE IDEAL
- 3D FSPGR IDEAL
- 3D BRAVO
- 3D Quick STEP
- 3D Fast TOF GRE
- 3D Fast TOF SPGR
- 3D FIESTA
- 3D MDE
- 3D MERGE
- 3D TRICKS
- 3D LAVA
- 3D LAVA-FLEX
- 3D Dual Echo
- 3D VIBRANT
- 3D VIBRANT-Flex
- 2D GRE-EPI
- 2D SE-EPI
- 2D DW-EPI
- 2D DT-EPI
- 2D FMRI EPI
- Cine IR
- eDWI
- Fast GRE Timecourse
- Inhance Application Suite
- MR Echo Fast GRE Timecourse
- MR Echo FIESTA Timecourse
- MR Echo MDE
- MR Echo Realtime
- MR Echo Function
- SWAN 2.0
- BB SSFSE

Applications

3D GradWarp

3D GradWarp is a technique integrated into image reconstruction that helps reduce image distortion by compensating for gradient non-linearities in all three dimensions. This correction differs from the default 2D correction that is conventionally performed by incorporating the slice direction into the processing.

Neuro Applications

The Silent Neuro Exam Package

The Silent Neuro Exam Package includes a completed set of sequences designed to generate high-resolution images which delivers T1, T2, Flair and PD weighted contrasts. The Silenz imaging sequence delivers 3D isotropic images with T1 and/or PD contrast with sound levels that are within 3dB(A) of the ambient conditions. Newly enhanced gradient waveforms have been employed to minimize the acoustic signature of FSE, 3D Cube and Propeller-based acquisitions to generate T2 and T2 Flair weighted images. In addition, the localizer and pre-scan sequences have been optimized as well to deliver a complete neuro exam at near fully silent levels.

3D ASL (Arterial Spin Labeling)

3D ASL utilizes water in arterial blood as an endogenous contrast media to help visualize tissue perfusion and provide quantitative assessment of cerebral blood flow (CBF) in ml/100 g/min. The quantitative CBF maps can be generated and stored in DICOM format.

3D ASL deploys stacked spiral FSE readout with modulated flip angle to acquire 3D volumetric data with increased SNR and minimal image distortion. The 3D data can be reformatted to axial, sagittal, coronal or oblique planes. A pulsed-continuous labeling is applied to label arterial blood close to the imaging volume thus improving conspicuity of flowing blood

Selective, interwoven pulses are then used to saturate and invert the imaging volume, in order to achieve better background suppression, and reduce sensitivity to motion.

3D ASL helps generate robust, reproducible images and perfusion maps with high SNR, reduced motion artifacts and less distortion in high magnetic susceptibility regions.

PROPELLER 3.0

PROPELLER 3.0 has been developed to reduce effect of patient voluntary and physiologic motion (breathing, flow, peristaltis), and reduce magnetic susceptibility artifacts. PROPELLER 3.0 helps generate consistently good, diagnostic quality images even for challenging patients and difficult to image anatomies. PROPELLER 3.0 uses innovative radial k space filling pattern that, compared to the Cartesian method, is inherently less sensitive to motions such as CSF and blood flow, breathing, patient tremor or voluntary movements. In addition, a sophisticated motion correction post-processing algorithm is deployed to further reduce effects of rigid motions. The oversampling of the k space center typical for radial k-space filling also yields increased SNR and an excellent tissue contrast.

PROPELLER 3.0 has been enabled for T1 FLAIR, T2, T2 FLAIR imaging in all planes, axial diffusion weighted imaging for brain, T2 weighted imaging for cervical spine, excellent T2 weighted imaging for Body, and T2/PD weighted imaging for MSK.

IDEAL

IDEAL provides consistent, robust fat and water separation every time, also in difficult to scan anatomies and presence of high magnetic susceptibility effect. Four different contrasts: water only, fat only, in-phase, out-of-phase are generated from a single acquisition, to help facilitate more confident diagnoses and reduce repeat exams. IDEAL acquires multiple echoes at different TE times to generate phase shifts between water and fat, allowing for more accurate pixel-by-pixel water and fat separation, while retaining maximum of SNR. IDEAL can be utilized with FSE-based contrasts such as T1, T2, PD.

3D Cube

Cube is a technique and replaces several slice-by-slice, plane-after-plane 2D FSE acquisitions with a single 3D volume scan – providing you with T1, T2, T2 FLAIR or PD contrast. You can easily reformat sub-millimeter isotropic volume data from a single acquisition into any plane – without gaps and with the same resolution as the original plane. ARC parallel imaging helps eliminate artifacts while accelerating image acquisition.

3D BRAVO

BRAVO incorporates ARC parallel imaging with 3D IR-prepared FSPGR acquisition to produce isotropic T1-weighted volumes. The center of k-space is over sampled and serves as the calibration data for the parallel imaging reconstruction.

eDWI

The enhanced Diffusion Weighted Imaging technqiues has been designed to provide high signal-to-noise-ratio diffusion images of the liver and brain with short-acquisition time. Its multi-B feature is designed to provide measurement of apparent diffusion coefficient (ADC) map with reduced effect on perfusion. In addition, "3 in 1" tehcnique applies diffusion weighting to all three gradients simultaneously, helping improve sensitivity. Built in tetrahedral feature applies four different diffusion weighing combinations of x, y, and z gradients simultaneously to acquire isotropic diffusion weighted images with high signal to noise ratio and shorter TE. Its smart NEX feature significantly reduces the acquistion time. Inversion recovery has been deployed to provide robust fat suppression. Enhanced DWI package includes the acquisition sequence and postprocessing tools.

SWAN 2.0

SWAN 2.0 is a high-resolution 3D multi-echo gradient echo sequence that produces weighted averaging across images with different TE's to achieve higher susceptibility weighting. It provides minimum intensity projections over neighboring slices, enhancing contrast for certain tissues containing iron, venous blood, and other substances with susceptibilities that are different than the background tissues. SWAN 2.0 outputs an unwrapped phase image leading to increased delineation between diamagnetic products and paramagnetic products (such as blood or iron). Due to the nature of the weighted averaging of the multi-echo sequence, the SNR of SWAN is higher than that of a single-echo acquisition.

Applications

3D COSMIC

This is a 3D sequence used to image axial c-spine. COSMIC uses modified fast GRE pulse sequence with steady-state free precession segmented multi-shot centric k-space acquisition. This improves the CNR and SNR of c-spine tissue including the spinal cord, vertebral disks, nerve root canal and contrast between CSF and nerve roots.

2D and 3D MERGE

Multiple Echo Recombined Gradient Echo (MERGE) uses multiple echoes to generate high-resolution images of the C-spine with excellent gray-white matter differentiation. By combining early echoes with high SNR and late echoes with improved contrast, the result is improved cord contrast within the spinal column.

3D FIESTA-C

This phase-cycled FIESTA reduces sensitivity to susceptibilities that may be encountered when imaging in the posterior fossa. It provides exquisite contrast that is ideally equated for visualization of the internal auditory canal. It is also ideally suited for T1 imaging through the cervical spine.

3D FIESTA

3D FIESTA (Fast Imaging Employing Steady-state Acquisition is a technique that uses an extremely short repetition time (TR) between RF pulses such that high-resolution 3D volume images can be acquired rapidly. The 3D FIESTA technique is especially useful for the rapid acquisition of high-spatial-resolution images of static structures such as cochlea, internal auditory canal, or joints.

Diffusion Tensor Imaging with Fiber Tracking

This package expands EPI capability to include diffusion tensor imaging, a technique that acquires diffusion information in up to 150 different diffusion directions. It generates image contrast based on the degree of diffusion anisotropy in cerebral tissues such as white matter. FuncTool capabilities on the console (included with ScanTools) create Fractional Anisotropy (FA), Apparent Diffusion Weighted (ADC) and T2-Weighted TRACE maps.

The optional FiberTrak post-processing utility generates eigen-vector information from the diffusion tensor acquisition and processing. Using a robust and efficient seeding process, three-dimensional renderings of the diffusion along white matter tracts are generated.

BrainSTAT

BrainSTAT is a standard post processing application that automatically generates parametric maps for Cerebral Blood Flow, Blood Volume, Mean Transit Time, and Time to Peak signal intensity. A Gamma Variate Fitting algorithm is used to automatically calculate the values for the four parametric maps. The maps may be saved in DICOM format and fused with high-resolution anatomic datasets to provide reference to tissue and anatomy.

An optional add-on to the Brain STAT package enables the user to automatically, or manually specify the arterial-input function (AIF) based on the temporal form of the signal, to calculate normalized values of the Blood Flow, Blood Volume, Mean Transit Time, and Time to Peak signal intensity based on the vascular flow dynamics of a specific patient.

BrainWave Real Time

ScanTools pulse sequences include the ability to detect the signal intensity changes (BOLD) during pre-determined tasks (paradigm) using single-shot EPI and then Map these changes as color maps with FuncTool on host and/or on AW.

BrainWave RT offers further enhancement to the above functionality with real time applications and image database. It allows a single technologist to acquire, process and display BOLD (Blood Oxygen Level Dependent) fMRI studies acquired with synchronized stimuli. It is very comprehensive, interfacing with the host's database and equipping you with all the real-time functionality you need – including paradigm control and development, and real-time display of color activation, overlaid on source EPI images.

The main features are:

- 50,000 image storage per series with data acquisition rates up to 20 image/s
- Display of 2D activation maps overlaid over echo planar source images in real time.
- Multiple 2x2 and 4x4 display.
- Optional saving of raw data in research mode for off-line analysis with 200,000 images.

Applications

BrainWave Post-Acquisition on console

This high-performance software allows you to produce, from raw fMRI data, phenomenally detailed brain images displaying functional activation. Display alternatives for these maps include cross-sectional displays, activation Z-maps and composite paradigm displays.

The features include:

- Integration in to the operator console.
- Special graphic user interface for image analysis.
- Data quality check, motion correction, temporal filtering and spatial smoothing to optimize statistical analysis and mapping.
- Multiple regression analysis.
- The structural MRI scan is segmented using completely automatic threshold and histogram methods and mathematical morphology techniques.
- Rapid retrospective motion correction.
- Sophisticated visualization techniques including true volume rendering, light box and orthogonal displays.

BrainWave Advanced A.V.

BrainWave Advanced visualistion delivers simplified processing workflow tools for fMRI analysis including segmentation and skull stripping of anatomical structures. Paradigm processing support for simple block, complex block, event related and free form conditions in a simplified processing environment including motion detection, exclusion and dismiss options. Registration of 2D/3D anatomical image with the bold overlay maps in color output is supported through BIP (Burned In Pixel) map format as support for incremental image roation batch movie generation.

BrainWave Fusion

BrainWave Fusion is an optional package that provides the ability to fuse high-resolution anatomical images with fMRI activation maps and diffusion tensor fiber maps. This package is useful for evaluating the spatial relationship between activation patterns, fiber tracts, and underlying anatomy and pathology.

Brainwave Advanced DTI

The advanced DTI package provides 3 plane directionally encoded FA maps presentated in both grey and colour scales in a 3 dimensional presentation. Seed placement can be performed in plane and in non-acquired plane for 3D seeded ROI's, inclusion and/or exclusion roi's are now possible. In addition, real-time fiber bundle adjustments can be made through a change of FA, fiber length or angle settings. The output format supports DICOM format.

BrainWave Report

Reporting of cases is provided in simplified format that streamlines the report structure and process while providing a detailed description of experiment methods, output of patient centric feedback (task response, motion plot and activation curves), delivery of color screenshots of results and clinical report fields for summary outcome. The export format provides user-defined threshold DICOM format activations maps for reformation and display for surgical navigation or PACS review.

BrainWave Lite Hardware

The image processing algorithms in BrainWave packages such as BrainWave RT and BrainWave PA, depend heavily on proper synchronization of scanning with stimulus presentation to the subject (patient) being scanned.

BrainWave Lite Hardware provides this GE-designed hardware that provides trigger signal to support this synchronization – thereby paving the way for convenient compatibility and selection of vendor-supplied sensory equipment such as headphone, microphone and glasses. (Not included)

BrainWave Lite Hardware includes:

- A dedicated computer workstation.
- Equipment rack and penetration panel waveguide insert.
- Cedrus patient response pads, and related cabling and connectors.
- It is designed to deliver visual and auditory stimuli and receive a tactile response. The computer includes preset paradigms and software tools to generate custom protocols.
- The visual and auditory output can be coupled to fMRI delivery systems purchased separately from other vendors.

Spectroscopy Applications

PROBE PRESS single voxel spectroscopy

PROBE PRESS single-voxel spectroscopy allows you to non-invasively evaluate the relative concentrations of in-vivo metabolites and lets you acquire and display volume-localized, water-suppressed H1 spectra in single voxel mode. The package includes automated recon, acquisition set-up and graphic prescription of spectroscopic volumes.

The standard sequence consists of three slice-selective RF pulses with crusher gradients. The PRESS sequence makes use of reduced flip angles to decrease minimum TE time of the sequence. The key advantage of PRESS (over STEAM) is that it provides up to twice the SNR and hence decreased exam time or voxel size. It is the sequence of choice for all Hydrogen single voxel spectroscopy data acquisitions with
TE values ≥ 35 ms.

Applications

PROBE – STEAM single voxel spectroscopy

Stimulated Echo Acquisition Mode acquires a stimulated echo from the localized volume. The basic sequence consists of three slice selective 90-deg RF pulses and a set of crusher gradients. Though STEAM provides more accurate voxel localization, it has inherently lower SNR compared to PRESS. Moreover, since echo times available with STEAM can be shorter, it is better suited than PRESS for chemical species that have shorter T2.

PROBE – 2D CSI

This extends the PROBE-PRESS capabilities with simultaneous multi-voxel in-plane acquisitions. Post- processing, including the generation of metabolite maps is automatically generated with FuncTool Performance package.

PROBE – 3D CSI

This extends the PROBE-2D CSI capabilities to add 3D multi-voxel acquisitions. (PROBE 2D CSI is mandatory).

BREASE

This is a TE averaged PRESS spectroscopy acquisition that provides the necessary biochemical information to help characterize breast tissue.

PROSE

PROSE (PROstate Spectroscopy and imaging Examination), is a noninvasive imaging technique to evaluate prostate lesions.

Cardio-vascular Applications

Inhance Application Suite

The Inhance application suite consists of several new sequences designed to provide high-resolution images of the vasculature with short-acquisition times and excellent vessel detail. These new sequences include:

Inhance Inflow IR 2.0

Inhance inflow IR is a non-contrast-enhanced MR angiography technique that has been developed to image arteries with ability to suppress static background tissue and venous flow. This sequence is based on 3D FIESTA, which improves SNR and produces bright blood images. Selective inversion pulses are applied over the region of interest to invert arterial, venous, and static tissue. At the null point of the background tissue, an excitation pulse is applied to generate signal. The net result is an angiographic image with excellent background suppression.

Uniform fat suppression is achieved using a spectrally selective chemical saturation (SPECIAL) technique while respiratory gating compatibility reduces respiratory motion artifacts during free-breathing renal exams.

Inhance 3D Velocity

Inhance 3D Velocity is designed to acquire angiographic images in brain and renal arteries with excellent background suppression in a short scan time. By combining a volumetric 3D phase contrast acquisition with parallel imaging, efficient k-space sampling, and pulse sequence optimization, Inhance 3D Velocity is capable of obtaining the whole neurovascular anatomy in approximately 5~6 minutes. Furthermore, background suppression is improved by the optimized pulse sequence design, resulting in better visualization of small branches. Respiratory triggering is also compatible with Inhance 3D Velocity to enable abdominal angiography, specifically renal arteries. The results are excellent productivity and image quality.

Inhance 3D DeltaFlow

Inhance 3D DeltaFlow is a 3D non-contrast-enhanced MRA application for peripheral arterial imaging. It is based on cardiac gated 3D fast spin echo and acquires two echoes viz., one in diastole and the other in systole. Slow arterial flow during diastole results in bright arteries in the diastole images while faster arterial flow during systole results in dark arteries in the systole images. A subtraction of the systole images from diastole images provides arterial only images with excellent suppression of venous and background signal. Interleaved acquisition and parallel imaging (ASSET) with optimized k-space trajectory helps reduce motion misregistration and improve vessel visualization respectively. In addition the use of partial-Fourier and coronal plane acquisition allows for considerably reduced scan time.

Inhance 2D Inflow

The Inhance 2D Inflow pulse sequence is designed to acquire angiographic images of arteries that follow almost a straight path (i.e. femoral, popliteal, and carotid arteries). Arterial blood flow is faster during the systolic phase and slows down during the diastolic phase. Therefore, Inhance 2D inflow is designed to acquire data during the systolic phase. It features an optimized spatial saturation gap to improve fat suppression and background suppression. Peripheral Gating is deployed to minimize the pulsate artifacts. Inhance 2D inflow is compatible with ASSET acceleration to reduce scan time.

3D Heart

3D Heart is a 3D FatSat FIESTA or 3D IR Prep FGRE sequence optimized to provide whole-heart coverage with excellent image quality. 3D FastSat FIESTA is aimed for coronary artery imaging or cardiac chamber imaging and 3D IR Prep FGRE is aimed for a high resolution myocardial viability assessment with delayed enhancement techniques. The whole heart volume is acquired in several slabs, using a multi-slab localizer that allows easy whole-heart prescription, compared to prescribing specific anatomical views in 2D acquisitions. A T2 preparation is deployed to improve the contrast to noise ratio between myocardium and the coronary for 3D FatSat Fiesta. A navigator echo pulse that detects motion of the diaphragm is utilized to enable free breathing acquisition. The navigator has been optimized to improve robustness, and includes a slab-tracking feature that automatically shifts slab positions based on the detected diaphragm location to improve motion suppression and increase scan efficiency. The multi-slab acquisition minimizes the effect of respiratory drift and heart rate variability on image quality. Furthermore, the SNR is improved with mulit-slab due to less blood saturation effect. An optimized phase ordering and steady state preparation has also been used to improve CNR and SNR.

Cine IR (Cine Inversion Recovery)

Cine IR can be very useful for approximating the myocardial null point for a subsequent myocardial viability assessment with delayed enhancement (MDE) techniques.

Cine IR is a conventional ECG-gated, gradient-recalled echo FASTCARD or FASTCINE acquisition sequence with a multi-phase readout and an inversion recovery (IR) preparation.

A single adiabatic inversion pulse is generated upon detection of the cardiac R-wave to trigger the multi-phase readout.

Multi-phase images are generated within the cardiac cycle, each at a progressively longer TI time.

FGRE Time Course (Fast Gradient Recalled Echo Time Course)

The FGRE Time Course PSD is a fast gradient-echo sequence optimized for time-course studies. FGRE TC utilizes single-echo acquisition to help reduce sensitivity to echo mis-alignment or system calibrations variations, which can result in robust image quality with less ghosting and artifact reduction. ASSET parallel imaging and shortened RF pulse design are incorporated to help improve temporal resolution and reduce motion related artifacts. In addition to selective notch pulse, it also supports non-selective saturation pulse for excellent background suppression and multi-plane imaging capability.

Applications

iDrive Pro Plus

iDRIVE Pro Plus expands the capabilities of standard iDrive Pro with:

- Geometric changes to image plane location, obliquity, rotation, center FOV and FOV size
- Contrast parameters such as spatial pre-saturation on/off, special sat pulses, flow comp and RF spoiling
- Application of a non-selective IR pulse
- Swapping phase and frequency

It starts with an intuitive point-and-click user interface and live, on-image navigation icons. It continues with click-of-the-mouse image book-marking and a suite of localization and drawing tools, and includes capabilities from 10-level undo/redo, built-in time, autoNEX and click-of-the-mouse display/review/save, all to streamline even the most complex exams and manipulations.

MR Echo

MR Echo expands on the capability provided by I-Drive Pro Plus. Presently, patients have to undergo multiple breath-holds to achieve the 'whole heart coverage' for wall motion and other studies. MR Echo employs a bright blood ultra-fast FIESTA sequence, which virtually eliminates the need for breathholding. An intuitive interface enables the operator to quickly scan the heart in any orientation and to save real time images to the browser through bookmarks. Additionally, a Scan and Save mode enables high resolution heart imaging with VCG and enables multiple functional images over many slices to be prescribed and scanned in a single breath-hold. The operator immediately visualizes scan time for the number of prescribed slices enabling each scan to be tailored to the patient's breath-hold capability. All images acquired in Scan and Save are stored in the browser while the operator immediately continues with real time scanning. MR Echo is able to significantly reduce typical cardiac exam times (compared to previous generation techniques).

TRICKS

Time Resolved Imaging of Contrast KineticS (TRICKS) technology uses intricate temporal sampling with complex data recombination to accelerate the temporal resolution of 3D dynamic imaging – with virtually no compromise in spatial resolution. This technology is integrated with Elliptical-Centric data sampling to create an excellent imaging technique for MRA in even the most challenging circumstances.

Easy to set up, TRICKS rapidly generates time-resolved 3D images of blood vessels to help meet the challenge of capturing peak arterial phases with minimal venous contamination. With TRICKS, the different vascular phases can be extracted after image acquisition.

Fluoro-Triggered MRA

Fluoro-triggered MRA (FTMRA) is designed to capture angiographic images at the precise moment of peak opacification. Rather than automating the image-acquisition upon detection of the bolus arrival, FTMRA allows the operator to trigger each acquisition almost instantly as soon as the operator is satisfied with the level of vessel enhancement. The result is an interactive, ASSET compatible, approach to contrast-enhanced MRA.

2D FIESTA CINE

Fast Imaging Employing STeady state Acquisitions is a fully balanced steady-state coherent imaging pulse sequence that has been designed to produce high SNR images at very short TR. The pulse sequence uses fully balanced gradients to re-phase the transverse magnetization at the end of each TR interval. This sequence accentuates the contrast of anatomy with high T2/T1 ratios (such as the cardiac blood pool), while suppressing the signal from tissues with low T2/T1 ratios (such as muscle and myocardium). This enhances the contrast between the myocardium and the blood pool.

StarMap

StarMap is a technique that acquires multiple echoes at different TE times at each location resulting in images that represent variations of T2* weighting. Post-processing of the images is employed to generate gray scale and color maps of the T2* signal decay across the echoes, which can be useful in the assessment of the presence of iron.

QuickSTEP

QuickSTEP is an automated multi-station acquisition. This application automatically prescribes, acquires, and combines images from multiple stations for fast acquisition and exam completion. To complete the entire exam in as little as 7 minutes, the system will automatically acquire mask datasets from multiple stations without any user intervention. Secondary images are then acquired at the same independent table positions. The system will automatically subtract the mask images from the secondary dataset and combine the resulting images from the multiple stations into one series. The user only needs to complete a quick review of the data prior to insertion of images into the database.

Applications

3D FatSat FIESTA

3D FatSat FIESTA is software designed for imaging of the coronary arteries. The software acquires 3D images using FIESTA (Fast Imaging Employing STeady-state Acquisition). Fat suppression is applied to accentuate the coronary arteries. The use of VAST (Variable Sampling in Time) technology greatly shortens breath-holding requirements or allows for higher spatial resolution.

2D IR Prepared Gated FGRE

Vital to MRI myocardial assessments, this technique can help distinguish living tissue from dead and therefore have a major impact on patient management – particularly on revascularization strategies. This pulse sequence uses an IR prepared, cardiac-gated fast gradient echo sequence to acquire images whose appearance depends on the tissue's T1 relaxation time. The IR-preparation step allows various tissues to be suppressed or enhanced. The IR prep pulse in this sequence is non-selective; i.e., it excites the entire volume inside the body coil, rather than a specific slice. That means that it can suppress both the myocardium and the blood flowing into the slice.

3D IR Prepared Gated FGRE

3D IR Prepared Gated FGRE is an advanced tool for myocardial assessment. It acquires extensive volumes of data, rather than merely single slices, during breath holds, with acquisitions gated to the cardiac cycle. The software applies a non-selective inversion recovery magnetization preparation step to create T1-weighted tissue contrast and suppress the signal from certain tissues.

Navigators

This software package is designed for use in conjunction with 3D IR Prepared FGRE or 3D FatSat FIESTA for Cardiac Imaging. It consists of navigators that make it possible to track the diaphragm and use the information to acquire crisp 3D gradient echo images of the heart even while the patient breathes.

Cardiac Tagging

Used to improve visualization of contractile function, this tagging application combines cardiac-gated FastCINE gradient-recalled echo to acquire data throughout the cardiac cycle, with spatial SAT pulses applied throughout the FOV. Using the operator's choice of diagonal stripes or a grid pattern, tagging is applied once per R-R interval immediately following the R-wave ECG trigger, just before the start of data acquisition.

Fast Gradient Echo using EPI Echo Train

This technique combines a short-TR FGRE (Fast GRadient Echo) pulse sequence with an EPI echo train to acquire multiple views, or phase encoding steps, per TR. It features uniform RF excitation, centric phase encoding, segmented k-space filling, retrospective gating in FastCARD-ET, EPI-caliber interleaving, and EPI-like acquisition of multiple views in one TR. Multi-phase FGRET is useful for applications such as multi-slice, multi-phase imaging of myocardial function.

Real Time FGRE-ET

Also known as Fluoro MRI, this pulse sequence (whose name is an acronym for Fast Gradient Echo using an EPI EchoTrain) uses a short TR FGRE pulse sequence with the ability to acquire multiple views, or phase-encoding steps, per TR via an EPI echo train. The result is a highly useful combination of gradient-echo and EPI features, such as:

- Uniform RF excitation
- Centric phase encoding
- Segmented K-space filling
- Retrospective gating in FastCARD-ET
- Interleaving, as in EPI
- Acquisition of multiple views in a single TR

Used in conjunction with iDrive Pro Plus, the real-time version of this pulse sequence is essentially a single-slice version of standard FGRET. That makes it especially useful for obtaining higher-resolution interactive cardiac images.

Applications

Spiral Imaging

Developed to acquire high-resolution images in far less than one second, Spiral Imaging is ideally suited for imaging moving structures such as the coronary arteries. Instead of collecting data in the conventional rectilinear grid pattern, it simultaneously applies the x and y gradients in conjunction with a 2D GRE or SPGR pulse sequence, and then interpolates the data onto a rectilinear grid for image generation. Non-gated sequences can be used with one or more slice locations; gated acquisitions can be conducted in sequential or non-sequential mode.

The advantages of Spiral Imaging include fast acquisition from the more efficient k-space data collection, high SNR from over-sampling of the center of k-space, and intrinsic flow- and motion-compensation from the short echo times.

Body Applications

LAVA-Flex

LAVA Flex is a 3D FSPGR imaging technique that acquires fat/water in phase and out of phase echoes in a single acquisition. Up to 4 types of image may be reconstructed within one acquisition: in phase, out of phase, water only, fat only. The water only contrast differs from a conventional fat suppressed image in that an inversion prep pulse is not applied for fat suppression. In fact, the fat information is removed leaving a water only image that may potentially be used in place of a LAVA type image. LAVA Flex uses ARC. (Auto Calibrating Reconstruction for Cartesian Sampling), a 2D self-calibrated parallel imaging technique that allows for acceleration in both phase and slice directions for supported coils.

PROPELLER 3.0

PROPELLER 3.0 has been developed to reduce effect of patient voluntary and physiologic motion (breathing, flow, peristaltis), and reduce magnetic susceptibility artifacts. PROPELLER 3.0 helps generate consistently good, diagnostic quality images even for challenging patients and difficult to image anatomies. PROPELLER 3.0 uses innovative radial k space filling pattern that, compared to the Cartesian method, is inherently less sensitive to motions such as CSF and blood flow, breathing, patient tremor or voluntary movements. In addition, a sophisticated motion correction post-processing algorithm is deployed to further reduce effects of rigid motions. The oversampling of the k space center typical for radial k-space filling also yields increased SNR and an excellent tissue contrast.

PROPELLER 3.0 has been enabled for T1 FLAIR, T2, T2 FLAIR imaging in all planes, axial diffusion weighted imaging for brain, T2 weighted imaging for cervical spine, excellent T2 weighted imaging for Body, and T2/PD weighted imaging for MSK.

eDWI

The enhanced Diffusion Weighted Imaging techniqu has been designed to provide high signal-to-noise-ratio diffusion images of the liver and brain with short-acquisition time. Its multi-B feature is designed to provide measurement of apparent diffusion coefficient (ADC) map with reduced effect of perfusion. In addition, "3 in 1" technique applies diffusion weighting to all three gradients simultaneously, helping improve sensitivity. Built in tetrahedral feature applies four different diffusion weighing combinations of x, y, and z gradients simultaneously to acquire isotropic diffusion weighted images with high signal to noise ration and shorter TE. Its smart NEX feature significantly reduces the acquisition time. Inversion recovery has been deployed to provide robust fat suppression. Enhanced DWI package includes the acquisition sequence and post-processing tools.

Real Time Field Adjustment

The RTFA algorithm leads to a reduction in distortion of the diffusion image per diffusion axis. RTFA is designed to reduce image blurring and distortions typically associated with diffusion imaging throughout the body. RTFA also allows for increased utilization of single spin echo DWI which results in an increase in SNR by up to 50% compared to dual spin echo and, when combined with the improved resolution leads to an increase in image quality that can be utilized for image presentation, fusion and ADC map outputs.

Applications

MR-Touch

MR-Touch is a non-invasive method to measure relative tissue stiffness with MR.

MR Touch is a new acquisition and reconstruction technique that combines hardware, and acquisition and reconstruction algorithms to produce Elastograms, color-coded anatomical images showing varying degrees of elasticity or stiffness. The image contrast is related to relative stiffness of soft tissue and is generated from the real-time data acquisition during tissue palpation with low amplitude and low frequency sound waves. The hardware component is comprised of an active sound wave generator and a passive transducer that produces small vibrations in the area of the patient to be scanned.

The MR-Touch acquisition software is an evolutionary improvement to the gradient echo sequence. The acquisition software also triggers the sound wave generator to produce synchronized vibrations on the surface of the patient during the data acquisition. The reconstruction algorithms generate images that show the propagation of waves through the tissue (phase images) and also the corresponding strain wave and relative stiffness images. Parallel imaging is used to accelerate image acquisition.

MR Touch is designed to enable physicians to evaluate relative liver and muscle tissue stiffness.

IDEAL IQ

IDEAL IQ is a GE exclusive technique that builds upon the original IDEAL (Iterative Decomposition of water and fat with Echo Asymmetry and Least-squares estimation) technique that acquires multiple images of the anatomy at separate echo times to calculate the phase differences and determine triglyceride fat and water content per pixel. It exploits the resonance frequency differences between triglyceride fat and water, measured as phase differences in multiple echoes, to resolve triglyceride fat and water. It provides reliable and uniform water-fat separation in the presence of B0 field inhomogeneity and improves the accuracy of water-fat separation by estimating and correcting for T2* decay between echoes and by more accurately modeling triglyceride fat's spectral profile as multiple peaks rather than a single peak. The result is a triglyceride fat-fraction map image that reflects the spatial distribution of relative concentration of triglyceride fat within a voxel.

3D Dual Echo

With improvements in parallel imaging and RF coil arrays, volumetric imaging in the body is becoming a standard of care. The 3D Dual Echo sequence produces in-phase and out-of-phase images in a single breath-hold. As a result, the high-resolution images are in perfect alignment simplifying the diagnostic process. In addition, 3D Dual Echo ensures that the out-of-phase echo is acquired first. The result is improved SNR compared to 2D Dual Echo. 3D Dual Echo also permits thinner slice imaging.

2D FatSat FIESTA

Fast Imaging Employing STeady-state Acquisition (FIESTA) is designed to produce high SNR images extremely rapidly and with excellent contrast between tissues. The contrast relies on a steady state for the transverse magnetization, which builds as a series of radio frequency pulses and special gradient pulses are repeated after an extremely short repetition time, TR. FIESTA accentuates the signal from tissues that have a long T2 and short T1. FIESTA has the capability to suppress the signal from fat, especially to create more contrast between the vasculature and surrounding tissues.

Applications

Single-Shot Fast-Spin Echo

An ultra-fast technique that permits complete image acquisition following a single RF excitation. It can acquire slices in less than one second, making it an excellent complement to T2-weighted brain and abdominal imaging and MRCP studies.

3D Cube

Cube is a 3D isotropic imaging technique with sub-millimeter spatial resolution and excellent contrast to help visualize even diminutive lesions. Cube can replace several slice-by-slice, plane-after-plane 2D FSE acquisitions with one single 3D scan. You can easily reformat sub-millimeter isotropic volume data into any plane - without gaps, and with the same resolution as the original plane. Cube is enabled for T1, T2, T2 FLAIR or PD contrasts. Our new self-calibrating parallel imaging engine ARC helps eliminate artifacts while accelerating image acquisition.

Respiratory Triggering

For patients that cannot hold their breath, respiratory triggering provides the answer. By synchronizing the acquisition to the respiratory cycle, high-resolution images virtually free of breathing artifacts are obtained.

StarMap

StarMap is a technique that acquires multiple echoes at different TE times at each location resulting in images that represent variations of T2* weighting. Post-processing of the images is employed to generate gray scale and color maps of the T2* signal decay across the echoes, which can be useful in the assessment of the presence of iron.

Breast Applications

MRI has been shown to be beneficial in the evaluation of the breast providing high-resolution images of breast anatomy. The Optima MR450w with GEM system provides a full compliment of breast imaging applications and protocols that generate both temporal and spatial resolution for highly detailed diagnostic breast.

VIBRANT

VIBRANT (Volume Imaging for Breast AssessmeNT) permits high definition bilateral imaging of both breasts in the time that it normally takes to image a single breast. VIBRANT integrates ASSET technology with bilateral shimming and a patented fat-suppression technique developed specifically for breast imaging. This enhanced version of VIBRANT for Optima MR450w with GEM allows the slices to be acquired in either the sagittal or axial orientation.

VIBRANT Flex

VIBRANT Flex uses a time-efficient dual-echo acquisition with 2D ARC parallel imaging to produce water-only, fat-only, in-phase, and out-of-phase images of the breast in a single scan. The Flex processing eliminates fat saturation failures in inhomogeneous regions to provide a clear depiction of the underlying breast anatomy.

BREASE

BREASE is a TE averaged PRESS spectroscopy acquisition that provides the necessary biochemical information to help characterize breast tissue.

Musculoskeletal Applications

PROPELLER 3.0

PROPELLER 3.0 has been developed to reduce effect of patient voluntary and physiologic motion (breathing, flow, peristaltis), and reduce magnetic susceptibility artifacts. PROPELLER 3.0 helps generate consistently good, diagnostic quality images even for challenging patients and difficult to image anatomies. PROPELLER 3.0 uses innovative radial k space filling pattern that, compared to the Cartesian method, is inherently less sensitive to motions such as CSF and blood flow, breathing, patient tremor or voluntary movements. In addition, a sophisticated motion correction post-processing algorithm is deployed to further reduce effects of rigid motions. The oversampling of the k space center typical for radial k-space filling also yields increased SNR and an excellent tissue contrast.

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Applications

IDEAL

Areas such as the foot/ankle, shoulder, and off-isocenter wrist make fat saturation a challenge. With IDEAL, water, fat, in-phase, and out-of-phase images can be generated even in the presence of large static field variations. This sequence can produce consistent and reliable images in challenging anatomical areas.

3D FIESTA

3D FIESTA (Fast Imaging Employing Steady-state Acquisition) inherent sensitivity to fluids makes this an ideal sequence for orthopedic applications. In knee imaging, 3D FIESTA uses an extremely short repetition time (TR) between RF pulses such that high-resolution 3D volume images can be acquired rapidly. The 3D FIESTA technique is especially useful for the rapid acquisition of high-spatial-resolution images of static structures such as cochlea, internal auditory canal, or joints.

CartiGram

CartiGram is a non-invasive T2 mapping package that provides high-resolution maps of the T2 values in cartilage and other tissues. The imaging results are color coded to highlight those structures with increased water-content yielding elevated T2 values.

Pediatric Applications

3D ASL (Arterial Spin Labeling)

3D ASL utilizes water in arterial blood as an endogenous contrast media to help visualize tissue perfusion and provide quantitative assessment of cerebral blood flow (CBF) in ml/100 g/min. The quantitative CBF maps can be generated and stored in DICOM format.

3D ASL deploys stacked spiral FSE readout with modulated flip angle to acquire 3D volumetric data with increased SNR and minimal image distortion. The 3D data can be reformatted to axial, sagittal, coronal or oblique planes. A pulsed-continuous labeling is applied to label arterial blood close to the imaging volume thus improving conspicuity of flowing blood.

Selective, interwoven pulses are then used to saturate and invert the imaging volume, in order to achieve better background suppression, and reduce sensitivity to motion.

3D ASL helps generate robust, reproducible images and perfusion maps with high SNR, reduced motion artifacts and less distortion in high magnetic susceptibility regions.

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Diffusion Tensor Imaging with Fiber Tracking

This package expands EPI capability to include diffusion tensor imaging, a technique that acquires diffusion information in up to 150 different diffusion directions. It generates image contrast based on the degree of diffusion anisotropy in cerebral tissues such as white matter. Functool capabilities on the console (included with ScanTools) create Fractional Anisotropy (FA), Apparent Diffusion Weighted (ADC) and T2-Weighted TRACE maps.

The optional FiberTrak post-processing utility generates eigenvector information from the diffusion tensor acquisition and processing. Using a robust and efficient seeding process, three-dimensional renderings of the diffusion along white matter tracts are generated.

3D Cube

Cube is a 3D isotropic imaging technique with sub-millimeter spatial resolution and excellent contrast to help visualize even diminutive lesions. Cube can replace several slice-by-slice, plane-after-plane 2D FSE acquisitions with one single 3D scan. You can easily reformat sub-millimeter isotropic volume data into any plane - without gaps, and with the same resolution as the original plane. Cube is enabled for T1, T2, T2 FLAIR or PD contrasts. Our self-calibrating parallel imaging engine ARC helps eliminate artifacts while accelerating image acquisition.

BRAVO

BRAVO incorporates ARC parallel imaging with 3D IR-pre-pared FSPGR acquisition to product isotropic T1-weighted volumes. The center of k-space is over sampled and serves as the calibration data for the parallel imaging reconstruction.

eDWI

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Scan parameters

Slice thickness, FOV, matrix	
Minimum slice thickness in 2D	0.3 mm
Minimum slice thickness in 3D	0.1 mm
Minimum FOV	10 mm
Maximum FOV	500 mm
Min/max matrix	32–1024

2D Spin Echo	
Minimum TR (128x128)	4.6 ms
Minimum TR (256x256)	5.2 ms
Minimum TE (128x128)	1.7 ms
Minimum TE (256x256)	2.0 ms

2D Fast-Gradient Echo	
Minimum TR (128x128)	0.9 ms
Minimum TR (256x256)	1.1 ms
Minimum TE (128x128)	0.3 ms
Minimum TE (256x256)	0.4 ms

3D Fast-Gradient Echo	
Minimum TR (128x128)	0.7 ms
Minimum TR (256x256)	0.9 ms
Minimum TE (128x128)	0.2 ms
Minimum TE (256x256)	0.2 ms
Minimum slice thickness	0.1 mm

Echo Planar Imaging	
Minimum TR (64x64)	4.0 ms
Minimum TR (128x128)	5.0 ms
Minimum TR (256x256)	6.0 ms
Minimum TE (64x64)	1.1 ms
Minimum TE (128x128)	1.4 ms
Minimum TE (256x256)	1.8 ms
Minimum slice thickness	0.6 mm
ESP at 25 cm FOV	64x64: 0.456 ms 128x128: 0.656 ms 256x256: 1.096 ms
ESP at 50 cm FOV	64x64: 0.320 ms 128x128: 0.452 ms 256x256: 0.712 ms
ESP at 99 cm FOV	64x64: 0.228 ms 128x128: 0.320 ms 256x256: 0.556 ms
Maximum b value s/mm2	10,000
Images/second (64x64)	101
Images/second (128x128)	41
Images/second (256x256)	19
Maximum diffusion tensor directions	150
Minimum shots	1

2D Fast-Spin Echo	
Minimum TR (128x128)	5.0 ms
Minimum TR (256x256)	6.0 ms
Minimum TE (128x128)	1.7 ms
Minimum TE (256x256)	2.0 ms
Minimum slice thickness	0.3 mm
Minimum ESP 128x128	1.7 ms
Maximum ETL for SSFSE	264

Note: Optional software packages may be required to achieve certain specifications above.

Siting and other specifications

This section provides an overview of the siting requirements for a Optima MR450w with GEM MR system. More detailed information is available upon on request.

Typical room layouts	
Magnet room	3.6 m x 6.2 m 2.5 m (8 ft 2.4 in) min ceiling height
Equipment Room	10.8 sq m
Control room	3.2 sq m

Fringe field		
	Axial	Radial
0.5 mT (5 Gauss)	4.0 m	2.5 m
0.1 mT (1 Gauss)	5.7 m	3.4 m

Electrical supply requirements

Supply system recommended configuration:

- 3-phase DELTA with ground (4-wire)

Alternate configuration:

- 3-phase grounded WYE with neutral and ground (5-wire system)
- Note: Neutral must be terminated inside main disconnected control.

Voltage:

- 480 / 415 / 400 / 380 Vrms

Frequency:

- 50 ± 3.0 Hz or 60 ± 3.0 Hz (Local voltage adaption may be required)

Power consumption

Power consumption depends on actual usage. The following values are an approximation.

Power consumption	
Maximum continuous sustained power (> 5 seconds)	91 kVA
Heat shield compressor	9 kVA
Optima MR450w with GEM water requirements	
Maximum heat removal to customer-supplied water	49 kW
Water flow	114 liters/min (30 gpm) minimum at a maximum temperature of 10 degrees C
Workspace monitor position	
	Maximum field strength
LCD flat panel monitor	5 mT(50 Gauss)

Alternative environments

Modular buildings may also be available (including air-conditioning, heating, chiller, RF shielding, additional magnetic shielding in walls). Contact your local GE representative for GE certified designs and vendors. Please ask your local GE sales representative for a comprehensive installation and siting manual.

Filming considerations

DICOM Print will be used exclusively for software filming to DICOM Print peripheral devices

Accessory package

- SPT phantom set with storage cart
- Customer diagnostic software
- Operator manuals
- Patient log books

Emergency stop

Disconnects electrical power from RF and gradient components in the magnet room (duplicate control at the magnet).

InSite* remote diagnostics

GE remote service and applications support including magnet monitoring. Also allows downloading of applications software such as eFlex trials program. Connectivity to InSite allows for use of TiP Virtual Assist (TiP VA) in order to receive real-time applications help from a GE expert.

Other miscellaneous

Accessories package

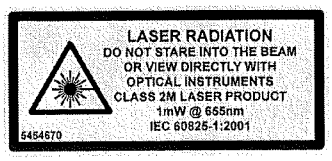
A comprehensive suite of MR compatible accessories are available on the Optima MR450w with GEM. Please contact your GE representative for details.

Warranty

The published GE warranty in effect on the date of shipment shall apply. GE reserves the right to make changes.

GE regulatory compliance

The Optima MR450w with GEM system is designed to comply with all applicable safety standards, including but not limited to IEC 60601-1 and IEC60601-1-2 (Electromagnetic Compatibility). Laser alignment devices contained within this system are appropriately labeled according to the requirements of the FDA's Center for Devices and Radiological Health (CDRH) and IEC 60825-1.



About GE Healthcare:

GE Healthcare provides transformational medical technologies and services that are shaping a new age of patient care. Our broad expertise in medical imaging and information technologies, medical diagnostics, patient monitoring systems, drug discovery, biopharmaceutical manufacturing technologies, performance improvement and performance solutions services help our customers to deliver better care to more people around the world at a lower cost. In addition, we partner with healthcare leaders, striving to leverage the global policy change necessary to implement a successful shift to sustainable healthcare systems.

Our "healthymagination" vision for the future invites the world to join us on our journey as we continuously develop innovations focused on reducing costs, increasing access and improving quality around the world. Headquartered in the United Kingdom, GE Healthcare is a unit of General Electric Company (NYSE: GE). Worldwide, GE Healthcare employees are committed to serving healthcare professionals and their patients in more than 100 countries. For more information about GE Healthcare, visit our website at www.gehealthcare.com.

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imagination at work

MWS DOC0927682 May 2013

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Exemption Notice for Acquisition of Replacement MRI Unit

ATTACHMENT G

Equipment Comparison Chart

EQUIPMENT COMPARISON

	EXISTING EQUIPMENT	*REPLACEMENT EQUIPMENT*
Type of Equipment (List Each Component)	Siemens Magnetom Symphony MRI Unit	GE 450W with GEM Suite
Manufacturer of Equipment	Siemens	GE
Tesla Rating for MRIs	1.5	1.5
Model Number	Symphony	450W
Serial Number	22075	
Provider's Method of Identifying Equipment	Model & Serial Number	Model & Serial Number
Specify if Mobile or Fixed	Fixed	Fixed
Mobile Trailer Serial Number/VIN #	n/a	n/a
Mobile Tractor Serial Number/VIN #	n/a	n/a
Date of Acquisition of Each Component		P.O. Issued 9-26-14
Does Provider Hold Title to Equipment or Have a Capital Lease?	Title	Lease
Specify if Equipment Was/Is New or Used When Acquired	New	New
Total Capital Cost of Project (Including Construction, etc.)		$1,919,909.45
Total Cost of Equipment		$1,544909.40
Fair Market Value of Equipment	$40,000.00 (trade in)	
Net Purchase Price of Equipment		$1,508,809.45
Locations Where Operated	Lake Norman Reg. Med. Ctr.	Lake Norman Reg. Med. Ctr.
Number Days In Use/To be Used in N.C. Per Year	365	365
Percent of Change in Patient Charges (by Procedure)	No Change	No Change
Percent of Change in Per Procedure Operating Expenses (by Procedure)	No Change	No Change
Type of Procedures Currently Performed on Existing Equipment	Standard Diagnostic MRI Imaging	
Type of Procedures New Equipment is Capable of Performing		Standard Diagnostic MRI Imaging

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ATTACHMENT H

Table of MRI Procedure Volume for 2013

LAKE NORMAN REGIONAL MEDICAL CENTER
MRI SYMPHONY VOLUMES - 2013

Month	E.R.	Inpatients	Outpatients	Total
January	10	82	70	162
February	4	55	77	136
March	7	71	94	172
April	12	64	120	196
May	9	42	137	188
June	7	29	117	153
July	13	49	126	188
August	17	51	133	201
September	8	38	143	189
October	12	44	146	202
November	9	38	127	174
December	19	45	137	201
TOTALS	**127**	**608**	**1427**	**2162**

Lake Norman Regional Medical Center
Exemption Notice for Acquisition of Replacement MRI Unit

ATTACHMENT I

Disposition of Equipment

October 10, 2014

Bill Greear
Director, Radiology Services
Lake Norman Regional Medical Center
171 Fairview Road
Mooresville, NC 28117

RE: 2002 Symphony 1.5T MRI

Dear Customer,

General Electric Company, by and through its GE Healthcare Division ("GE Healthcare"), sincerely thanks you for your continued business and support. GE Healthcare values the relationship that we have with Lake Norman Regional Medical Center ("Customer")

The purpose of this letter is to inform Customer that GE Healthcare will be responsible for removing Customer's existing 2002 Symphony 1.5T MRI system with System Id. # 704660SMR as part of the upcoming purchase of a GE Optima MR450w 1.5T GEM 24.0 system as described in GE Healthcare Quotation No. PR5-C29294 (Version 2) dated September 25, 2014 and the Trade In Addendum attached hereto as Exhibit A and executed by the parties. GE Healthcare will coordinate with Customer regarding the de-installation and removal of the 2002 Symphony 1.5T MRI system. The 2002 Symphony 1.5T MRI system will be de-installed, removed, and shipped by the GE Healthcare team to its GoldSeal business located in Waukesha, Wisconsin. GE Healthcare understands and confirms that this unit may not be returned to the State of North Carolina without proper authorization from the Certificate of Need (CON) Section of the North Carolina Division of Health Services Regulation.

Thank you again for the opportunity to earn your business. If you have any additional questions, feel free to call me at any time.

Sincerely,

F. Scott Ramsey
MR Product Manager, NC
General Electric Healthcare
919-621-1657
scott.ramsey@ge.com