

Digital Mobile X-Ray System with Wireless FPD

MobileDaRt Evolution

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1. Introduction

As the digitization of radiography systems continues to advance, lighter and more compact flat panel detectors (FPD) can now be used even on mobile X-ray systems, and such FPD-equipped systems are becoming commercially available and more commonly used on wards. Shimadzu launched its MobileDaRt digital mobile X-ray system equipped with a 14" × 17" portable FPD in 2005. The improved MobileDaRt Evolution was then released in 2008, and has proven a popular series with accumulated sales of 800 units throughout the world. This paper explains the new MobileDaRt Evolution with wireless FPD that was designed to meet the requests from various medical facilities, and describes some of the options newly developed for it.

2. Configuration and Basic Specifications of MobileDaRt Evolution with Wireless FPD

Table 1 shows the configuration and basic specifications of the MobileDaRt Evolution with wireless FPD. This system comprises a mobile X-ray system with 32 kW maximum output combined with a 14" × 17" large-view-field wireless FPD and a digital image processor.

The wireless FPD used in this system features an approximately 9.5-megapixel high-resolution sensor (2,800 × 3,408 pixels at 125 μm pitch) to obtain even higher image quality.

The use of highly sensitive cesium iodide (CsI) in the FPD fluorescent screen can reduce the X-ray exposure dose. The wireless FPD is powered by a lithium battery. A single battery can easily handle a single standard day's operation in the wards. The battery can be removed and replaced. Should the battery level become low, operation can be continued by simply replacing the battery. The FPD storage rack at rear of the system can hold two spare batteries for the wireless FPD.

Fig. 1 shows the appearance of the MobileDaRt Evolution with wireless FPD. The FPD and onboard digital processor eliminate preparations before travel, limitations on the number of imaging operations due to the number of cassettes carried, complex cassette-reading operations, and film development after radiography. This system dramatically improves the workflow compared to conventional cassette radiography systems. Travel is controlled using the highly regarded Power Assist Optimized System (PAO). This detects the forces applied to the drive handle and optimally controls the power-assist to the motors directly connected to the left and right drive-wheels to make driving the system as easy as pushing a light cart. The telescopic support column permits a wide range of rotation for easy positioning. The arm can extend up to 1200 mm to support radiography over a wide area. The Inch-Mover buttons located on the collimator face allow the operator to make subtle forward and reverse movements of the unit from the collimator.

System name	MobileDaRt Evolution	
Maximum output	32 kW (20 msec)	
Rated output	16 kW (100 msec)	
Tube voltage	40 to 133 kV	
Maximum tube current	400 mA	
Tube current-time product	0.32 to 320 mAs	
Tube anode heat content	210 kJ (300 kHU)	
Tube focal point	0.7/1.3 mm	
FPD	Imaging method	Scintillator + a-Si
	Scintillator	CsI
	Effective field of view	35 × 43 cm
	Total number of pixels	2800 × 3408
	Pixel pitch	125 × 125 μm
	Output gradation	12 bit (4096 gradations)
	Size	384 (W) × 460 (H) × 15 (D) mm
	Weight	3.4 kg (including a battery)
Power supply	Battery	Lithium-ion battery
	During travel or imaging	Built-in battery 240 V
	During battery charging	Power rating: 1 kVA Voltage: 100/110/120/200/220/230/240 VAC, 50/60 Hz

Table 1 Basic Specifications of MobileDaRt Evolution with Wireless FPD



Fig. 1 MobileDaRt Evolution with Wireless FPD

3. Wireless FPD Offers Easy Operation and High Workflow

The MobileDaRt Evolution combines a digital mobile X-ray system with wireless FPD to achieve superb ease-of-use and excellent workflow in diverse medical facilities.

(1) Operation

The wireless FPD requires no cables between the FPD and mobile X-ray unit. The FPD is 15 mm thick and has the same external dimensions as a 14 × 17-inch cassette (384 × 460 mm). It weighs only 3.4 kg, including the battery, and is as easy to use as a conventional cassette.

It eliminates the tedious cable placement when setting the FPD and subsequent cable stowage that were required with a conventional wire-connected FPD. In addition, as the wireless FPD does not restrict the position or attitude of the mobile X-ray unit, it makes operation easier in confined spaces on wards.

It also eliminates sterilization issues resulting from contact between the cable and people or equipment when used in emergency situations or in an operating room.

(2) Immediacy

The wireless FPD adopts the fast and stable IEEE.802.11n (2.4 GHz) wireless protocol. Images can be observed on the 15-inch touch panel color LCD monitor just three seconds after radiography, as with a conventional wire-connected FPD. The operator can check for problems such as motion blur on the spot and immediately perform re-imaging if it is deemed necessary. The system allows rapid evaluation of re-imaging and subsequent treatments in emergency situations or in an operating room, in particular, where realtime image observation is essential. **Fig. 2** shows an example of a displayed reference image.

(3) Workflow

MobileDaRt Evolution can store up to 3500 images. In addition to the standard wired LAN interface, wireless LAN is available as an option. This wireless LAN makes it simple to connect to the hospital network to transmit the temporarily stored images to the DICOM server or printer, or to receive the examination order and patient list from the DICOM work list.



Fig. 2 Reference Image Display

4. New Options

The MobileDaRt Evolution newly offers the options below to improve work on hospital rounds.

(1) External monitor interface

This optional interface can be added to display images on an external monitor, apart from the monitor in the unit. This permits image observations on an external monitor at a remote location that is connected to this interface. It is useful where multiple people need to observe images, such as in an emergency situation.

(2) Barcode reader

The optional barcode reader can read the patient ID and accession number to automatically search and select the corresponding examination order from the work list. Eliminating manual selection of the examination order from the work list prevents the danger of mistaking patients.

(3) Cable connection

This option enables communications with the FPD via a cable when wireless communications cannot be established for some reason, such as interference from other wireless equipment. The cable is stowed inside the unit to allow simple connection when required.

(4) FPD upgrade

This option upgrades an existing MobileDaRt Evolution with a wire-connected FPD to a wireless FPD.

For a cassette-type, high-power MobileArt Evolution, options are available to upgrade to either a wire-connected FPD or wireless FPD.

5. Design

Models decorated with animal characters are available to alleviate stress in child patients (**Fig. 3**). The animal-character model can be selected for MobileDaRt Evolution or MobileArt Evolution.



Fig. 3 MobileDaRt Evolution
(Animal-character design)

6. Conclusions

Shimadzu developed the MobileDaRt Evolution digital mobile X-ray system with wireless FPD to retain the immediacy and other great features of the conventional wire-connected FPD, while being much easier to use.

The system reduces the burden on operator and patient alike. It should contribute to improved efficiency and quality of diagnosis, not only during normal work on hospital rounds, but also in pediatrics and emergency medicine as well as in the operating room or ICU.