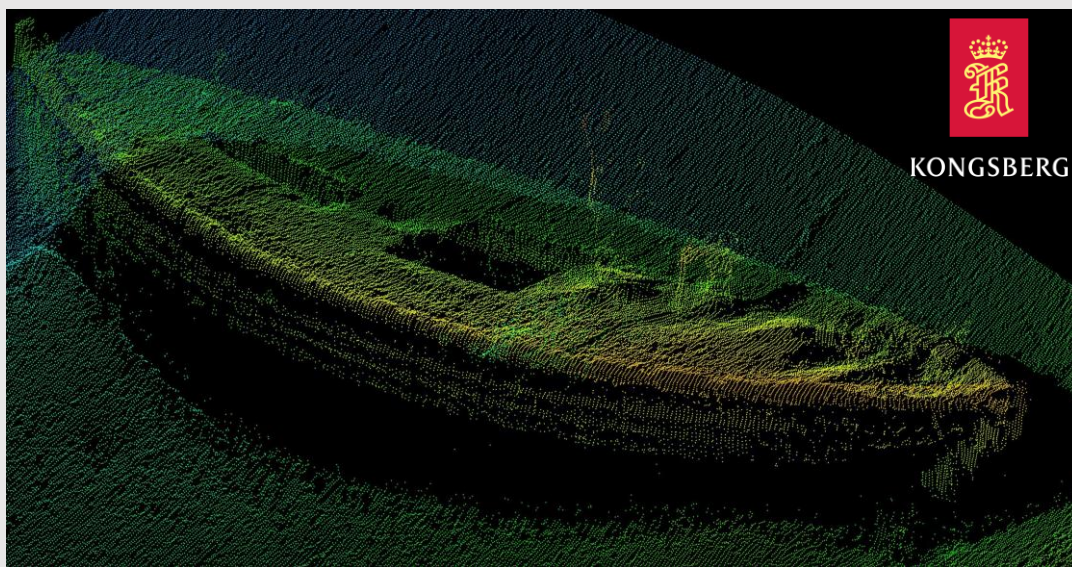




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# APPLICATION NOTE

## EM 2040 HIGH FREQUENCY MAPPING

### 600 kHz AND 700 kHz MODES FOR INSPECTION AND MAPPING

700 kHz providing  $0.225^\circ \times 0.45^\circ$  beamwidths

600 kHz normal mode maintains efficient area surveying with  $100^\circ$  coverage and up to  $120^\circ$  available

Large operational range with 3 depth modes providing more than 40 metres range at high resolution

Available as a licensed software upgrade for existing and new EM 2040 and EM 2040P systems

### EM 2040 HIGH FREQUENCY SOFTWARE UPGRADE

## High frequency upgrade option for EM 2040 and EM 2040P

The EM 2040 was the first 3-sector broadband multibeam echo sounder in the market, originally designated as a 200 – 400 kHz system. The same system now offers a 600-700 kHz upgrade option providing unrivalled beamwidths whilst still maintaining survey efficiency.

Although generally understood that the frequency and length of any array govern the resolution, users can only increase the frequency to a set point before either hardware or physical constraints are a problem; if the frequency is achieved, the effect of grating lobes will restrict the swath width.

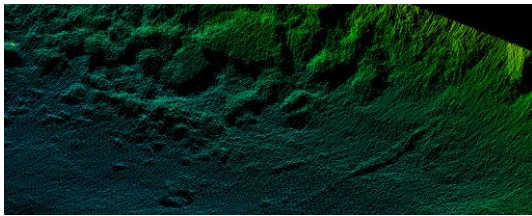
As a result, any market offerings until now have provided a high frequency inspection mode with a detrimentally restricted swath width. Kongsberg Maritime's new software upgrade overcomes both of these constraints by providing operators with two new modes allowing clarity and efficiency never before realized in the shallow water mapping sector.

#### 600 kHz Wide Area High Frequency Mapping

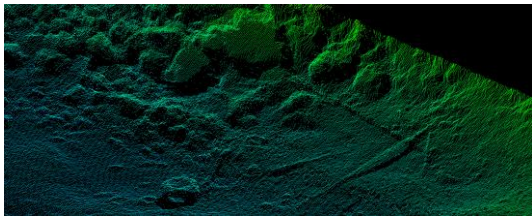
The 600 kHz negates grating lobes from traditional systems by using the sector transmission with  $100^\circ$  coverage and up to  $120^\circ$  available allowing doubling resolution with little sacrifice in efficiency over the standard 400 kHz mode. Three depth modes allow ranges from less than 5 metres through to in excess of 40 metres allowing IHO Special Order requirements to be met within the one 600 kHz mode.

#### 700 kHz Cable and Pipeline Inspection

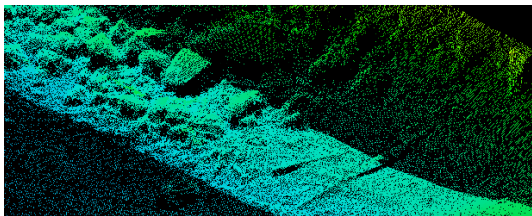
The 700 kHz option provides the highest resolution available contained within a narrow  $30^\circ$  coverage. Designed for cable route surveys where single pass is required the user focuses all sounding into the narrow spread, an ideal solution for AUV and ROV.



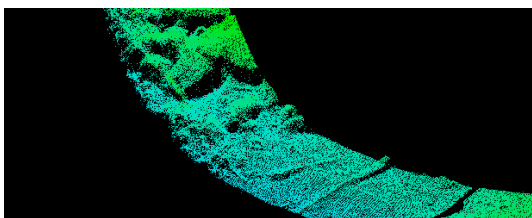
400 kHz



600 kHz



700 kHz Overlaid



700 kHz

## Compatibility and Flexibility

Using KONGSBERG's unique sector transmission this upgrade option is available for both standard EM 2040 and the EM 2040P, more than doubling each system's respective angular resolution. In addition to the improved resolution the option also provides compatibility with extra options such as Extra Detections and Water Column logging.

## TECHNICAL DATA

### EM 2040

Beamwidth:

	0.4° TX	0.7° TX
700 kHz:	0.225° x 0.45°	0.45° x 0.45°
600 kHz:	0.25° x 0.5°	0.5° x 0.5°

**Coverage:** 100° nominal coverage in 600 kHz with 120° available, 30° with 700 kHz mode

**Range:** 3 pulse modes 5 – 40 metres+

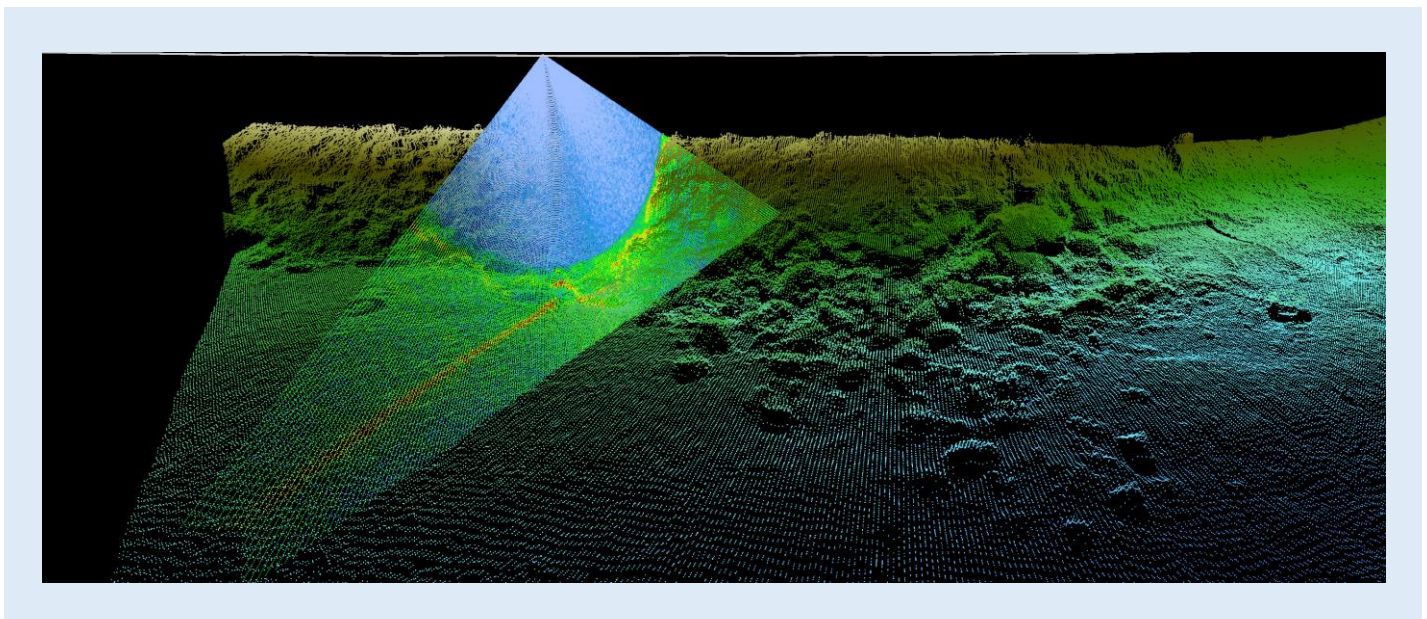
### EM 2040P

Beamwidth: 700 kHz: 0.6° x 0.6°  
600 kHz: 0.65° x 0.65°

**Coverage:** 100° nominal coverage in 600 kHz with 120° available, 30° with 700 kHz mode

**Range:** 3 pulse modes 5 – 40 metres+

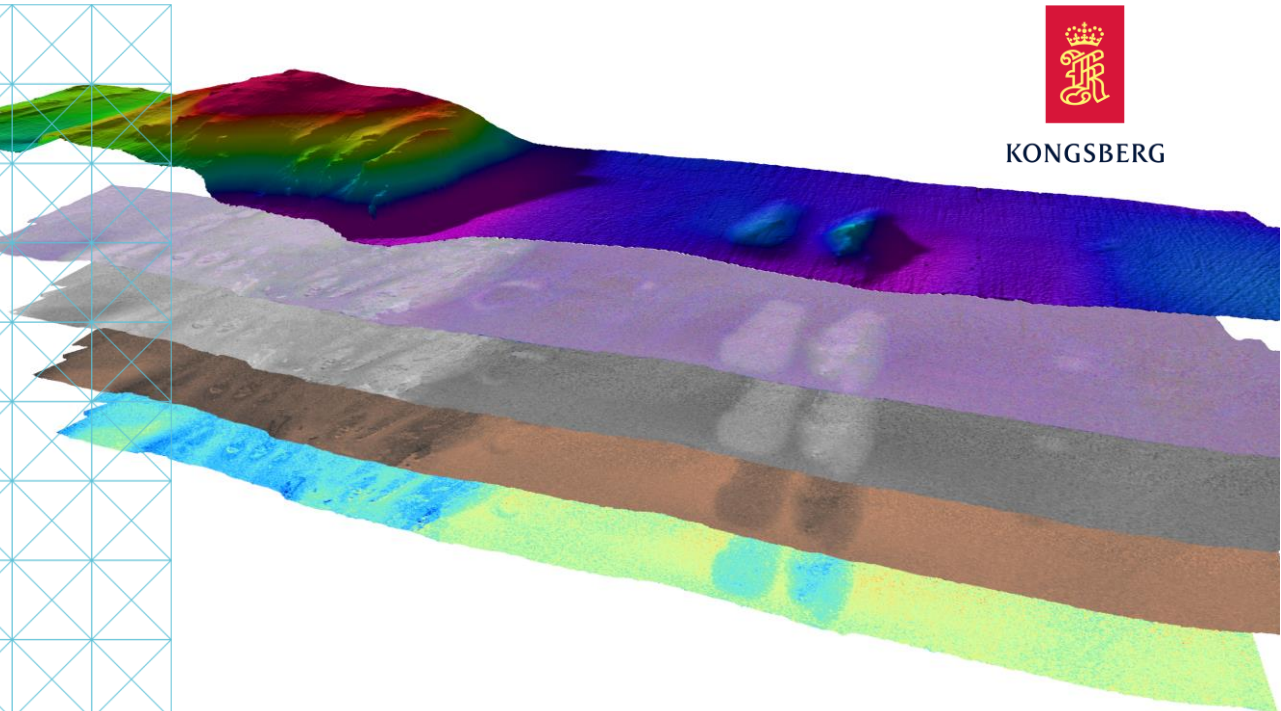
*The high frequency options are only available for single receiver systems. Options **not** available for EM 2040C*





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# EM<sup>®</sup> MULTIFREQUENCY MODE



EM<sup>®</sup> MULTIFREQUENCY MODE - FLEXIBILITY WITHOUT COMPROMISE

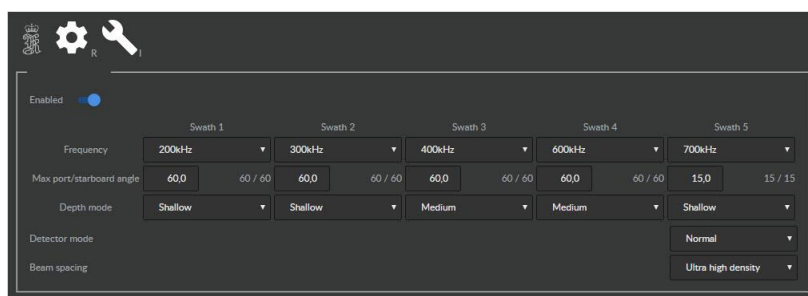
## HIGHLIGHTS

- Up to five different frequencies available
- Configure frequency, pulse and swath width for each ping
- Flexible and easy to use
- Available for EM 2040 Single RX and EM 2040P

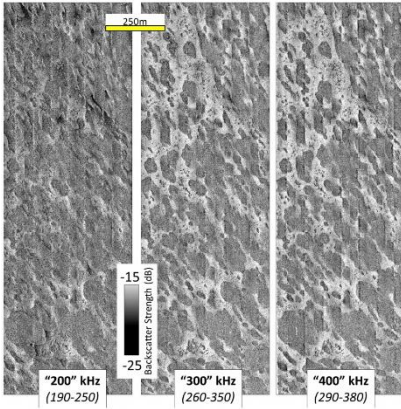
## EM<sup>®</sup> MultiFrequency mode

MultiFrequency mode enables the EM 2040 system to change the swath configuration between multibeam pings. This allows the user to dynamically define the frequency, swath width (coverage) and pulse mode for up to five consecutive pings, generating a true multi-layered dataset.

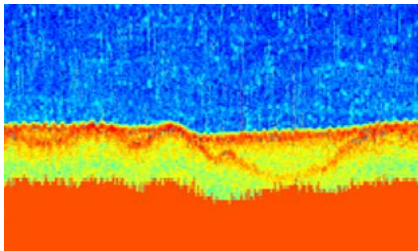
This solution provides a flexibility that extends to a wide range of applications from habitat mapping to engineering analysis and general mapping.



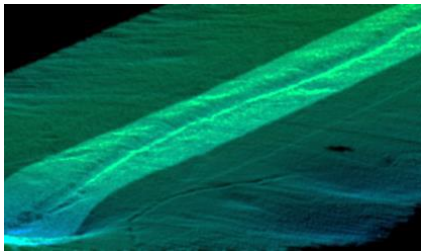
EM<sup>®</sup> MultiFrequency mode user interface



Obtain all the facets of backscatter with EM® MultiFrequency Backscatter



Understand the ambiguity of the sediments using EM® MultiFrequency Bathymetry



Alternate between wide and narrow swaths with EM® MultiFrequency Inspection

## EM® MultiFrequency Backscatter

MultiFrequency Backscatter allows the user to sonify the seabed with different frequencies to accurately map the seafloors dependency to frequency variation. Users can choose 1 to 5 sequential pings of fully configurable frequency and pulse length settings resulting in an efficient, uncompromised solution. KONGSBERG offers backscatter calibration services for all of our EM multibeam, ensuring consistent backscatter levels across your vessel and multibeam portfolio.

## EM® MultiFrequency Bathymetry

Bathymetry acquired over challenging sediment types can often be ambiguous dependent on the frequency of the multibeam, as penetration may vary with frequency and pulse length. MultiFrequency Bathymetry helps resolve that ambiguity by accurately defining, in a single pass, the deltas of the depth measurement within the swath collected. This has particular application in dynamic environments with high silt content and high sediment transportation, whereby all previous solutions required different multibeam and high temporal variation. No other solution allows a dynamic model of sediment transportation and sediment build up to be constructed.

## EM® MultiFrequency Pulse

The flexibility of the MultiFrequency mode includes the option to select which pulse length mode to send for each frequency. With MultiFrequency Pulse the user can select the same frequency for all pings but vary the pulse lengths. By doing this, users will be able to monitor how the seabed characteristics change with the pulse length, adding another layer to the seabed classification effort.

## EM® MultiFrequency Inspection

With MultiFrequency Inspection, the user sets the EM to alternate between a wide swath frequency and a narrow swath high resolution frequency, thus maintaining the coverage requirement and the resolution requirement of the inspection. Combined with the new Ultra High Frequency modes for the EM 2040, the flexibility of the EM® MultiFrequency mode will allow users to freely select when to focus on resolution and when to focus on coverage.

