EVALUATING CHARACTERISTICS OF ULTRASONIC SEARCH UNITS BY TRACSS

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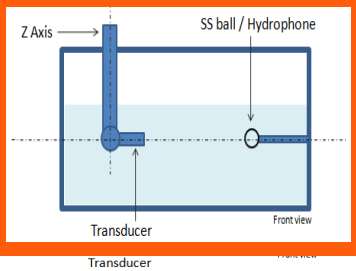
Ultrasonic testing is widely used for quality control, structural health monitoring, and life assessment of assets in various industries. The quality of the ultrasonic transducer directly affects the accuracy of ultrasonic inspection results. The quality of these ultrasonic transducers deteriorates in service due to a variety of reasons. If the inspector continues using the ultrasonic transducer without realizing these detoriations, it can easily cause sizing which may result in a catastrophic failure.

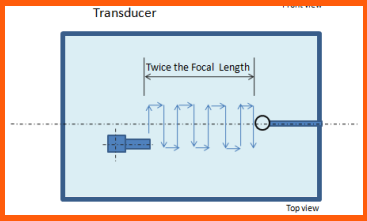
To guarantee the reliability of detection precision, we need to measure the characteristics of ultrasonic transducers quickly and conveniently. Calibration is one way to ensure that the relative quality of the transducer is maintained. However, there are certain parameters of the transducer which are established on manufacture that needs to be verified.

ASTM E 1065 is a standard established to describe the measurement procedures for evaluating certain characteristics of ultrasonic search units that are used with ultrasonic examination instrumentation. Based on the standard we have established a software **TraCSS** (Transducer Characterization Software

By using the system **SHRUTI** C-scan is done either in the horizontal or vertical plane of the transducer using the ball target or hydrophone. The '.aqd' file obtained at the end of the scan is loaded to the TraCSS software for further analysis.

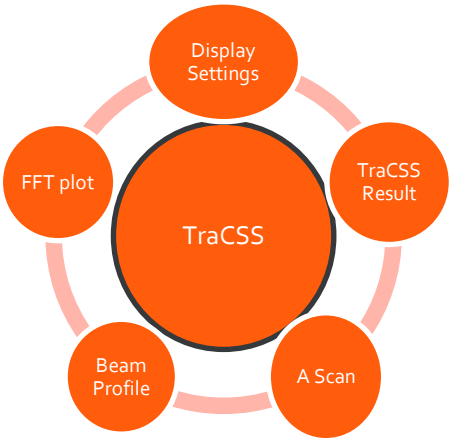
The diagrams shown below are the schematic on how to experiment.





Once the file is loaded the user gets a window with the A-scan, FFT, C-scan, on-axis, and transverse profiles of the scanned transducer along with the sound field and frequency response parameters displayed.

TraCSS is a tool developed to characterize a given transducer, both immersion and contact. Calculations are based on the ASTM Standard Guide for evaluating characteristics of ultrasonic search units.



Using the time-frequency analysis technology based on FFT, the testing method and module are built up to realize the measurement of time-frequency response parameters, **Peak frequency, Center frequency, Lower frequency, Higher frequency, and bandwidth** and sound field parameters, **Focal depth, Depth of focus, Focal spot size, Aperture size**.

The results of transducer characterization according to ASTM standards are populated in the form of a report.

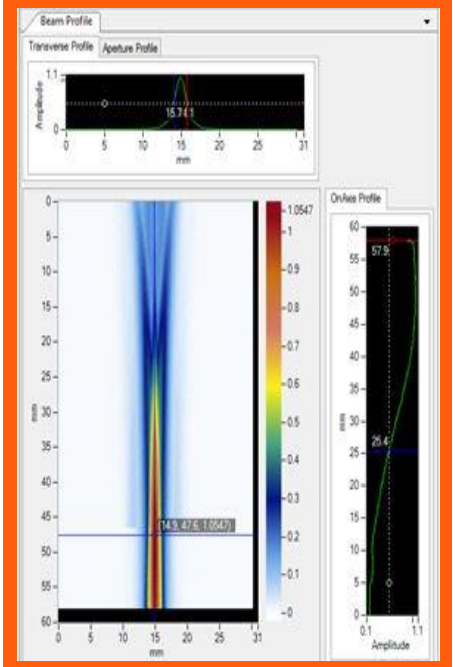
TraCSS Results

TraCSSResult

Item	Value
Measurements	
Centre Frequency	5.31 MHz
Peak Frequency	5.11 MHz
Lower Frequency	4.24 MHz
Higher Frequency	6.38 MHz
BandWidth	40.28 %
Focal Depth	47.60 mm
Depth Of Focus	32.50 mm
Focal Size	1.60 mm
Aperture Size	6.90 mm
Waveform Duration	0.42uS

The beam profile window has the Complete pressure field plot of the transducer, Transverse Profile, Aperture profile, and On-Axis Profile. The pressure field is a C Scan which has crosshairs and the amplitude along the transverse direction of the cross-hair is assembled to form the transverse profile and the amplitudes along the axis are assembled to form the On-Axis plot. Aperture profile is produced according to the standard code.

Beam Profile



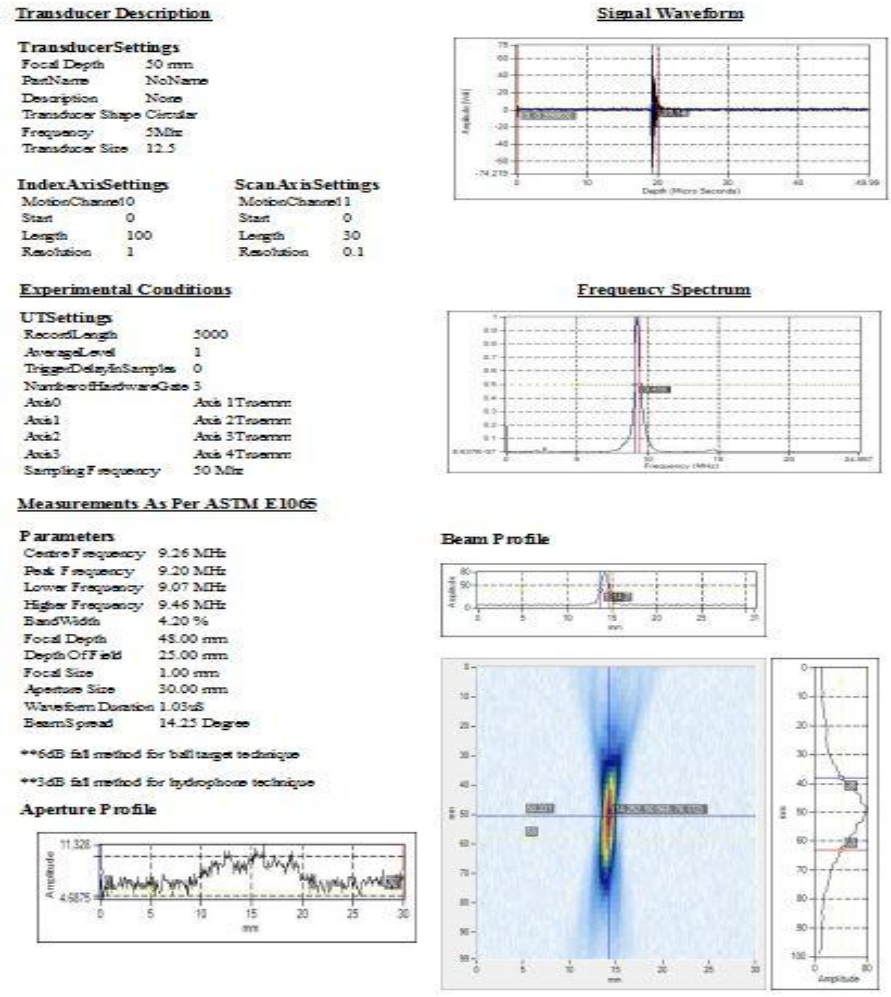
There is provision for custom report building and a standard pre-defined format is provided along with the S/W which is customizable on request. This includes all the UT, motion, and TraCSS parameters.

This software is of particular use to industries that make custom transducers such as aerospace, defense, and nuclear industries. The software can be used to test whether the manufactured transducers have the features as expected in the design.

Evaluating Characteristics of UT search units by TRACSS – Application Note

A Dhvani Research Application Note

Chennai, INDIA



Transducer Description

TransducerSettings

Focal Depth	50 mm
PartName	NoName
Description	None
Transducer Shape	Circular
Frequency	5Mhz
Transducer Size	12.5

IndexAxisSettings

MotionChannel	0
Start	0
Length	100
Resolution	1

ScanAxisSettings

MotionChannel	1
Start	0
Length	30
Resolution	0.1

Experimental Conditions

UTSettings

RecordLength	5000
AverageLevel	1
TriggerDelayInSamples	0
NumberofHardwareGate	3
Axis0	Axis 1Traces
Axis1	Axis 2Traces
Axis2	Axis 3Traces
Axis3	Axis 4Traces
SamplingFrequency	50 Mhz

Measurements As Per ASTM E1065

Parameters

CentreFrequency	9.26 MHz
Peak Frequency	9.20 MHz
Lower Frequency	9.07 MHz
Higher Frequency	9.46 MHz
BandWidth	4.20 %
Focal Depth	45.00 mm
DepthOfField	25.00 mm
Focal Size	1.00 mm
Aperture Size	30.00 mm
Waveform Duration	1.03uS
BeamSpread	14.25 Degree

**6dB fall method for ball target technique

**3dB fall method for hydrophone technique

Aperture Profile

Signal Waveform

Frequency Spectrum

Beam Profile

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