Omnidirectional Spherical Transducer

BII7520 series spherical transducers ranging from 2 to 300kHz provide omnidirectional directivity response and broadband response.

Typical Applications

Remote Control, Telemetry, Drifting Array Artificial Acoustic Target, Echo-Repeater Acoustic Deterrent to Marine Animals Playback Marine Animal Voices/Calls/Whistles/Songs/Clicks	Underwater Acoustic Network, Spherical Point Source Diver Communication, Underwater Telephone Pinger/Tag/Locator/Transponder/Beacon/Acoustic Release Marine Animal Behavior Research, Bioacoustic Stimuli

Specification

Part Number:	BII7520-15	BII7520-15IM
Impedance Matching:	No	Built-in, Impedance matching to 50Ω by default.
	TVR and FFVS variation of a transducer with built-in Impedance Matching Network: 1. When $R_{IM} < 1/G$, TVR increases, FFVS decreases. Generally, this is true for low frequency transducers. 2. When $R_{IM} > 1/G$, TVR decreases, FFVS increases. Generally, this is true for high frequency transducers. R_{IM}: Impedance-Matched Resistance such as 50 Ω. G: Transducer Conductance at Operating Frequency.	
Signal Type:	Pulsed SINE, Chirp, PSK, FSK, Pulsed Square Waveform, etc.	
Directivity Pattern:	Omnidirectional Beam	
-3dB Beam Width:	Omnidirectional	
Side Lobe Level:	No side lobes	
Free Capacitance C_f:	170nF ± 10% @ 1kHz, 1m cable.	N/A
Dissipation D:	0.005 @ 1kHz, 1m cable.	N/A
Resonant Frequency f_s:	15 kHz ± 10%	
Operating Frequency:	N/A	Minimum, 2 kHz.
Quality Factor Q_m at f_s:	3	2.5
	-3dB bandwidth $\Delta f = f_s/Q_m$. Qm determines the transient response or the rise and fall rings of steady-state response.	
$\eta_{ea\ at\ fs}$ at f_s:	0.8 in Water, Electroacoustic Efficiency, Load Medium Dependent.	
η_{ea} at $f << f_s$:	at f << fs, $\eta_{ea} / \eta_{ea\ at\ fs} \approx 0.25*(k*\Phi D)^2$. Wave Number $k = 2\pi/\lambda$; ΦD = Transducer Diameter.	
	1. Electroacoustic Efficiency η_{ea} is quite low at f << f_s and drops gradually at f > f_s, so it is NOT recommended for transducers to emit high power sounds at frequencies far from f_s. **2. Transducer can emit low power sounds at frequencies far from f_s such as input power $P_i \le \eta_{ea}$ * MIPP at $f \le 0.8*f_s$ and $P_i \le 0.2$ * MIPP at $f \ge 1.3*f_s$.**	
Power Factor at f_s:	≥ 0.7	≥ 0.94
TVR at f_s:	147.0 dB µPa/V at 1m. Transmitting Voltage Response.	144.0 dB µPa/V at 1m
Radiation Sound Level SL:	$SL = 20*\log V_i + TVR$, dB µPa@1m. Driving Voltage V_i is in unit of V_{rms}.	
Admittance or Impedance:	G_{max}=28.0 mS, B=11.2 mS at f_s.	$Z = 50*e^{j\theta}$, in Ω, and Phase Angle $\lvert\theta\rvert \le 20°$ at f_s.
Driving Voltage V_i at f_s:	**Transducer without Impedance Matching Unit**	**Transducer with Impedance Matching Unit**
	Pulsed Driving Signal and Duty Cycle D < 100%: Maximum V_i, $V_{imax} = \sqrt{MIPP/G_{max}}$ or 600, whichever is less, in V_{rms}.	**Pulsed Driving Signal and Duty Cycle D < 100%:** Maximum V_i, $V_{imax} = \sqrt{MIPP * \lvert Z\rvert}$, in V_{rms}. Z is impedance at fs.
	Continuous Operation at 100% Duty Cycle: Maximum V_i, $V_{imax} = \sqrt{MCIP/G_{max}}$, in V_{rms}.	**Continuous Operation at 100% Duty Cycle:** Maximum V_i, $V_{imax} = \sqrt{MCIP * \lvert Z\rvert}$, in V_{rms}.
	To achieve higher sound level, built-in impedance matching is recommended to step up driving voltage inside the transducer.	
Input Power P_i:	$P_i = V_i^2 * G$. Refer to **G-B Graph:** G is conductance.	$P_i = V_i^2 / 50\Omega$ at fs.
MIPP at f_s:	Maximum Input Pulse Power at f_s: $P_i = V_i^2 * G_{max}$ or 800 Watts, whichever is less.	
MPW at MIPP and f_s:	100 Seconds, Maximum Pulse Width at MIPP and at f_s.	
MCIP at f_s:	500 Watts, Maximum Continuous Input Power at f_s.	
How to determine pulse width, duty cycle and off-time with input pulse power (peak power) at f_s: 1. Determine the input pulse power (IPP, peak power) with sound intensity required by the project. IPP MUST be less than MIPP. 2. Pulse Width ≤ (MIPP * MPW*(120°c-T)/103°c)/IPP. T: Water Temperature in °c. 3. Duty Cycle D ≤ MCIP*(120°c-T)/103°c)/IPP. 4. Off-time ≥ PW*(1-D)/D.		
FFVS at f_s:	-195.6 ± 2 dB V/µPa, Free-field Voltage Sensitivity.	-192.6 ± 2 dB V/µPa.
	$Sensitivity\ Loss\ over\ extension\ cable\ at\ f_s\ (dB) = 20 * \log\{(1 + 2\pi f_s C_c/B)/\sqrt{[G^2 + (B + 2\pi f_s C_c)^2]/(G^2 + B^2)}\}$ G: Conductance at f_s; B: Susceptance at f_s; C_c: Capacitance of Extension Cable. Cable is of 100 pF/meter roughly. Please refer to online document **AcousticSystem.pdf** for conversion between G-B and Z-θ, if necessary.	
Receiving Sound Level SL:	$SL = 20*\log V_o - FFVS$, dB µPa. Receiving Voltage V_o is in unit of V_{rms}.	
Operating Depth:	Maximum, 200 m or 2 MPa Pressure.	Maximum, 200 m or 2 MPa Pressure.
	Limited by the cable length if the cable has wire leads or a non-waterproof connector.	
Mounting Options:	1. Default: Free Hanging (**FH**) 2. Thru-hole Mounting with Single O-ring (**THSO**)	

	3. Thru-hole Mounting with Double O-ring (**THDO**) 4. Bolt Fastening Mounting (Stainless Steel) (**BFMSS**) 5. End-face Mounting (**EFM**) Please refer to online document **AcousticSystem.pdf** for a complete list of Mounting Options and more details.	
Cable:	1. Two Conductor Shielded Cable (**SC**), Rubber or PVC Jacket. 2. 50 Ω RG58 Coax (**RG58**) 3 Shielded Cable with Twisted Pair and Teflon (PTFE) Jacket, ΦD=4.0 mm (**SC40**), up to 200°C, AWG20 Conductors (Not Water-proofed, ONLY for Dry Air Use).	
	Handling: Do not use the cable to support transducer weight in air and water if the transducer has a mounting part. Do not bend the cable.	
Cable Length:	1. Default: 1 m. 2. Custom-fit.	
Connector:	1. Default: Wire Leads (**WL**) 2. Male BNC (**BNC**) (Max. Diameter Φ14.3 mm) 3. MIL-5015 Style (pin) (**MIL**) (Max. Diameter Φ30 mm with 3 contacts) 4. Underwater Mateable Connector (pin) (**UMC**) (Max. Diameter Φ21.5 to Φ35 mm) Note: Underwater Mateable Connector is for uses underwater. Other connectors and wire leads are for dry uses and are not waterproofed.	
Size:	Refer to Mechanical Drawing.	
Weight in Air:	1.5 kg, 10 m cable.	2.0 kg, 10 m cable.
Operation Temperature:	-10 °C to +75 °C or 14 °F to 167 °F.	
Storage Temperature:	-20 °C to +60 °C or -4 °F to 140 °F.	
Power Amplifier:	BII5000 Power Amplifiers for SONAR, NDT, HIFU. Order Separately as standalone devices.	
Impedance Matching:	BII6000 Bespoke Impedance Matching between transducers and power amplifiers. Order Separately as standalone devices, or append **-IM** to the part number for integrating BII6000 into the transducer, and specify impedance in Ω. For example, BIIxxxxIM8Ω: BIIxxxx transducer with built-in Impedance Matching unit as 8Ω load.	
TR Switch:	BII2100 Transmitting & Receiving Switch. Order Separately as standalone devices.	
Temperature Sensor:	1. Default: No built-in temperature sensor. 2. Built-in temperature sensor. Append **-TS** to part number (BIIxxxxTS) for integrating a temperature sensor in the transducer.	
Potable Transmitter:	BII8030 series portable acoustic transmitters.	
Portable T/R System:	BII8080 series portable transmit and receive systems.	

WARNING: DANGER — HIGH VOLTAGE on wires. Wires shall be insulated for safety. DO NOT TOUCH THE WIRES BEFORE THE DRIVING SIGNAL IS SHUT DOWN. Cable shield must be grounded firmly for safety.

for 50Ω BNC connector, it is buyer's sole responsibility to make sure that the BNC shield of the signal source is firmly grounded for operating safety before hooking up transducer/hydrophone to the signal source. Coax with BNC is not intended for hand-held use at voltages above 30Vac/60Vdc.

Transducer Wiring:	**Two Conductor Shielded Cable**	**Coax/BNC**	**Underwater Connector**	**MIL-5015 Connector**
Signal	White or Red	Center Contact	Contact 2	Contact C
Signal Common	Black	Shield	Contact 1	Contact B
Shielding and Grounding	Shield	Shield	Contact 3	Contact A

How to Order

Part Number	**-Mounting Part**	**-Cable Length in Meter**	**-Cable Type**	**-Connector Type**
Example:	Description			
BII7520-15-FH-0.6m-SC-UMC	BII7520-15 Transducer, Free Hanging, 0.6m Shielded Cable, Male Underwater Mateable Connector.			
BII7520-15IM-FH-10m-RG58-BNC	BII7520-15IM Transducer, Built-in Impedance Matching Network to 50Ω, Free Hanging, 10m RG58 Coax, Male BNC.			
BII7520-15-IM8Ω-FH-10m-SC-WL	BII7520-15 Transducer, Built-in Impedance Matching Network to 8Ω, Free Hanging, 10m Shielded Cable, Wire Leads.			
BII7520-15-TS-IM8Ω-FH-10m-SC-WL	BII7520-15 Transducer, Built-in Temperature Sensor, Built-in Impedance Matching Network to 8Ω, Free Hanging, 10m Shielded Cable, Wire Leads.			

Physical Size (unit: mm):