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The Quick Reference Guide to Multichannel Microphone Arrays Design Part II : using Supercardioid and Hypocardioid Microphones

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ABSTRACT

This paper is the second part of a paper presented at the 110th AES Convention in Amsterdam. A selection of different Multichannel Microphone Arrays are again presented but this time using Supercardioid and Hypocardioid microphones. Five-channel array configurations are described with respect to their particular characteristic: microphone directivity, specific segment coverage, segment offset values where necessary, microphone coordinates and orientations. Arrays have been chosen so as to assist the sound engineer in the search for the optimum microphone array for a given recording situation.

INTRODUCTION

The Multichannel Microphone Array Design (MMAD) process has been described in previous papers^{[1][2][4]} presented at AES Conventions over the last 4 years. Terms such as Front Triplet Coverage (FTC), Lateral Segment Coverage (LSC) and Back Pair Coverage (BPC) have been fully explained, together with design tools such as Microphone Position Time Offset (MPTO), Electronic Time Offset (ETO) and Electronic Intensity Offset (EIO) needed to obtain Critical Linking. The MMAD process gives rise to a multitude of microphone array possibilities thereby transferring the difficulty from the basic design of an array, to the choice of one array from many thousands of possibilities. A set of selection criteria was proposed in a paper^[5] presented to the 24th AES Conference in Banff, which described a specific selection path to find the optimum array for a given recording environment. This selection procedure was illustrated with a CD-ROM containing over 5000 plan diagrams of arrays, and using an HTML based search procedure to find the optimum array in 5 stages in a minimum of time (under a minute).

The quick reference guide to MMAD applied to arrays using cardioid microphones^[3] was present at the 110th AES Convention in Amsterdam. This present paper is a follow-on to the previous paper but widening the choice to other directivity patterns by applying the MMAD process to hypocardioid and supercardioid microphones. Over 2500 arrays using hypocardioid or supercardioid microphones are described using a table form of presentation showing the specific 'X' and 'Y' coordinates for each microphone together with individual microphone compass orientations and Electronic Time Offset values. A few arrays (the highlighted combinations in the tables) are presented in plan view as illustrations after each table, but as it is impossible to present the plan views of every single array in a paper presentation, an update to the Banff CD-ROM (SOS MMAD CD-ROM 0.3) will be available at the Convention presentation of this paper or from soundsscot@aol.com - a web-site is also under preparation at www.soundsscot.com.

DIRECTIVITY PATTERN SELECTION CRITERIA

Much attention has been focused in the past on the use of omnidirectional, cardioid and bi-directional microphones for stereophonic sound recording^[6]. Two channel or stereophonic microphone arrays using omnidirectional microphones have become very popular in classical music recording mainly due to their linear response in the low frequency range, however at least half of the Stereophonic Recording Angle is almost unusable due to considerable crushing of the sound image towards the loudspeakers (around 10° of Angular Distortion). The original Blumlein patent using crossed bi-directional microphones (the stereosonic configuration) has on the other hand very little Angular Distortion, but unfortunately suffers from a low frequency roll-off of 6dB/octave. These two systems also illustrate the basic differences between Time Difference only stereophony with omnidirectional microphones, as against Intensity Difference (or level difference) only stereophony with the stereosonic system. The intermediate cardioid directivity pattern would seem to provide a satisfactory compromise between the two approaches, combining the advantages of time and intensity difference stereophony reproduction, with a minimum of low frequency roll-off, and a minimum of Angular Distortion.

However the different sound recording environments sometimes need the sound recording engineer to bias this compromise choice more towards a better low frequency response solution^[6], or on the other hand more towards a greater degree of low frequency roll-off. This is where the hypocardioid and hyper/supercardioid microphone directivity patterns can play an important role. The advantages and disadvantages of the different directivity patterns also apply in exactly the same way to multichannel microphone arrays.

The instinctive reaction when considering the use of these directivities for a multichannel array is to exclude the hypo- and hyper-cardioid directivity patterns on the grounds of an increased acoustic cross-talk due to their increased pick-up in the back of the microphones directivity pattern. Although this analysis would be valid for the coincident microphone array system - in spaced microphone arrays it neglects totally the impact of the precedence effect which will give priority to localization information using the Intensity and Time Differences perceived within the first two arriving wave fronts.

Figure 1 shows the comparison of the low frequency response for a series of microphones with different directivity patterns from the same manufacturer.

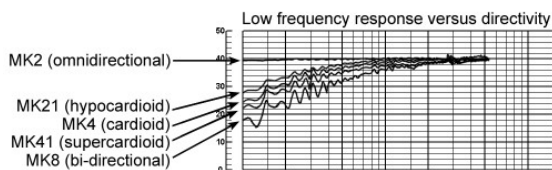


Figure 1 showing the low frequency response curves for microphones from omnidirectional to bi-directional frequency response curves by courtesy of Schoeps

In omnidirectional, cardioid, hypercardioid and supercardioid directivity patterns it is almost impossible to maintain the same timbre balance at all angles of incidence. The two exceptions are small diaphragm hypocardioids with about 10dB back attenuation, and of course the bidirectional directivity pattern, again with a small diaphragm. Figure 2 shows the remarkably regular frequency response at almost all angles of incidence that can be achieved with careful design of a hypocardioid microphone. This is manifest in the perception of timbre with such a microphone - the perception of timbre is as

much dependant on the pick-up of the reverberant field as it is on the pick-up of direct sound.

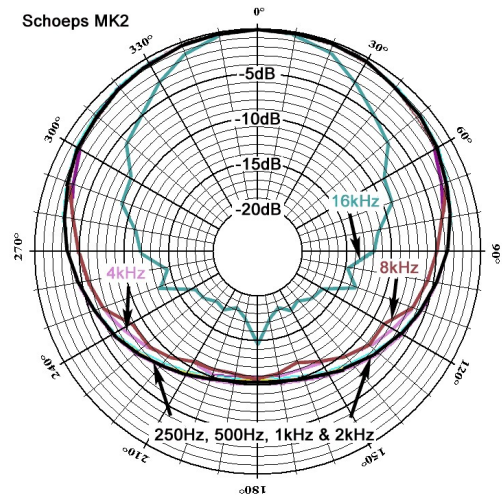


Figure 2 – Hypocardioid polar diagram of a Schoeps MK21 directivity response curves by courtesy of Schoeps

THE TABLES

Each page of tables is in two parts, the first table concerns the Front Triplet Coverage, whereas the second table gives data for the Lateral Segment Coverage and Back Pair Coverage. It is a fortunate characteristic of MMAD that any combination from the first table will critically link with any combination from the second table. However a table from one page should not be combined with a table from another page.

Tables A to M concern microphones with hypocardioid directivity with a back attenuation (at 180°) of 10dB.

Tables N to Y concern microphones with supercardioid directivity i.e. with a back attenuation (at 180°) of 11.5dB

In Figures 3 to 26, the microphones are not drawn to the same scale as the microphone coordinates. Figures 3 and 4 show the natural equal segment microphone arrays for hypocardioid and supercardioid microphones respectively - neither of these arrays need electronic offset to achieve critical linking. These arrays were originally described in a paper^[7] presented at the 91st AES Convention in New York.

REFERENCES :

- (1) 107th AES Convention in New York (1999) preprint 4997 Microphone Array Analysis for Multichannel Sound Recording, by M.Williams & G.Le Du
- (2) 108th AES Convention in Paris (2000) preprint 5157 Multichannel Microphone Array Design, by M.Williams & G.Le Du
- (3) 110th AES Convention in Amsterdam (2001) preprint 5336 The Quick Reference Guide to Multichannel Microphone Arrays Part 1 : using Cardioid Microphones, by M.Williams & G.Le Du
- (4) 112th AES Convention in Munich (2002) preprint 5567 Multichannel Microphone Array Design: Segment Coverage Analysis above and below the Horizontal Reference Plane, by M.Williams
- (5) 24th AES Conference in Banff, Canada (2003), Multichannel Sound Recording Practice, by M.Williams
- (6) 82nd AES Convention in London (1987) preprint 2466 Unified Theory of Microphone Systems for Stereophonic Sound Recording, by M.Williams
- (7) 91st AES Convention in New York (1991), preprint 3157 Microphone Arrays for Natural Multiphony by M.Williams

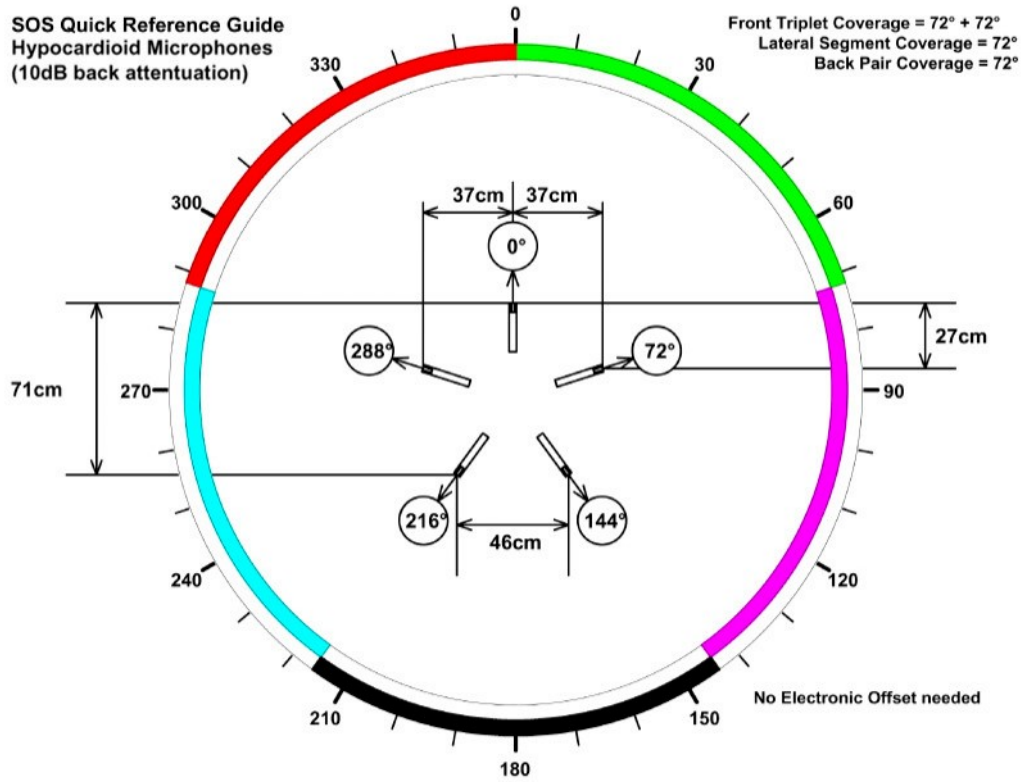


Figure 3 – Equal Segment Hypocardioid Array – No electronic offset needed
 FTC $72^\circ + 72^\circ$ ($b = 72^\circ$), LSC 72° , BPC 72° ($b = 72^\circ$), ETO 0mS

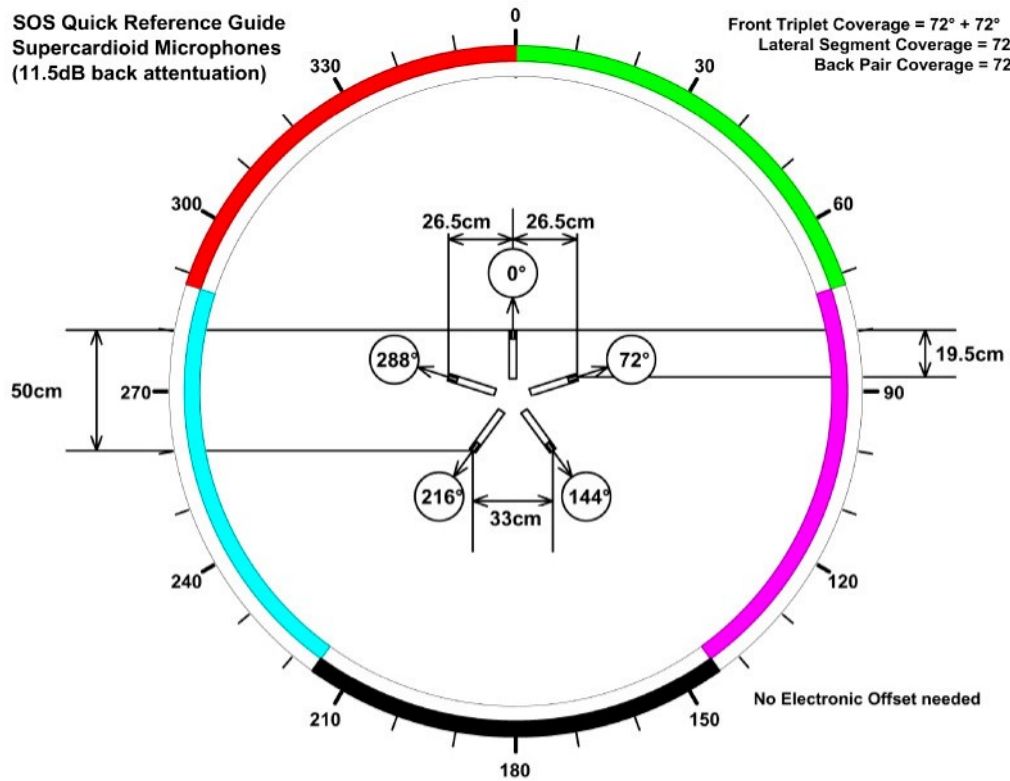


Figure 4 – Equal Segment Supercardioid Array – No electronic offset needed
 FTC $72^\circ + 72^\circ$ ($b = 72^\circ$), LSC 72° , BPC 72° ($b = 72^\circ$), ETO 0mS

Combinations for HYPOCARDIOID Microphones (10dB back attenuation)

FTC = Front Triplet coverage BPC = Back Pair Coverage LSC = Lateral Segment Coverage

TABLE A : 100° + 100° FTC for Hypocardioid Microphones (10dB back attenuation)										
100° + 100°	Angle	100°	90°	80°	70°	60°	50°	40°		Angle
	Distance	27,5 cm	29 cm	31 cm	32,5 cm	34,5	36,5 cm	39 cm		Distance
	MPTO	0°	9°	17°	23°	29°	34°	39°		MPTO
	X coord	17,7 cm	17 cm	16,9 cm	17,5 cm	17,8 cm	18,8 cm	20 cm		X coord
	Y coord	21 cm	26,5 cm	26 cm	27,6 cm	29,6 cm	31,3 cm	33,4 cm		Y coord
	Orient.	100°/ 260°	90°/ 270°	80°/ 280°	70°/ 290°	60°/ 300°	50°/ 310°	40°/ 320°		Orient.

Any combination from Table A will critically link with any combination from Table B

TABLE B : BPC and LSC for Hypocardioid Microphones (10dB back attenuation)											
BPC	LSC										
80°	40°	100°	90°	80°	70°	60°	50°	40°	30°	Angle	
		36cm	38cm	39,5cm	41cm	43cm	45cm	47cm	49,5cm	Distance	
		-1,65 mS	-1,65 mS	-1,65 mS	-1,6 mS	-1,6 mS	-1,6 mS	-1,6 mS	-1,6 mS	-1,6 mS	ETO
		18cm	19cm	19,7cm	20,5cm	21,5cm	22,5cm	23,5cm	24,7cm	X coord	
		137cm	137cm	135,5cm	134cm	133cm	132cm	132cm	132cm	Y coord	
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Orient.	
70°	45°	100°	90°	80°	70°	60°	50°	40°	30°	Angle	
		43cm	44,5cm	46cm	48cm	50cm	52cm	54cm	56,5cm	Distance	
		-1,65mS	-1,65 mS	-1,7 mS	-1,7 mS	-1,7 mS	-1,65 mS	-1,65 mS	-1,65 mS	ETO	
		21,5cm	22,25cm	23cm	24cm	25cm	26cm	27cm	28,2cm	X coord	
		128cm	127cm	126cm	126cm	125,5cm	125cm	123,5cm	123cm	Y coord	
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Orient.	
60°	50°	100°	90c)	80°	70°	60°	50°	40°	30°	Angle	
		52cm	53,5cm	55,5cm	57cm	59cm	61cm	63,5cm	66cm	Distance	
		-1,8 mS	-1,8 mS	-1,8 mS	-1,8mS	-1,8mS	-1,8mS	-1,8 mS	-1,8 mS	ETO	
		26cm	26,7cm	27,7cm	28,5cm	29,5cm	30,5cm	31,7cm	33cm	X coord	
		125cm	123cm	122,5cm	121,5cm	121cm	120,5cm	120cm	119,5cm	Y coord	
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Orient.	
50°	55°	100°	90°	80°	70°	60°	50°	40°	30°	Angle	
		64,5cm	66,5cm	68,5cm	70,5cm	72,5cm	74,5cm	77cm	79,5cm	Distance	
		-1,92mS	-1,98mS	-2mS	-2mS	-2mS	-2mS	-2mS	-2mS	ETO	
		32,2cm	33,25cm	34,25cm	35,25cm	35,25cm	37,25cm	38,5cm	39,8cm	X coord	
		124cm	123cm	122cm	121,5cm	121cm	120cm	120cm	119,5cm	Y coord	
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Orient.	

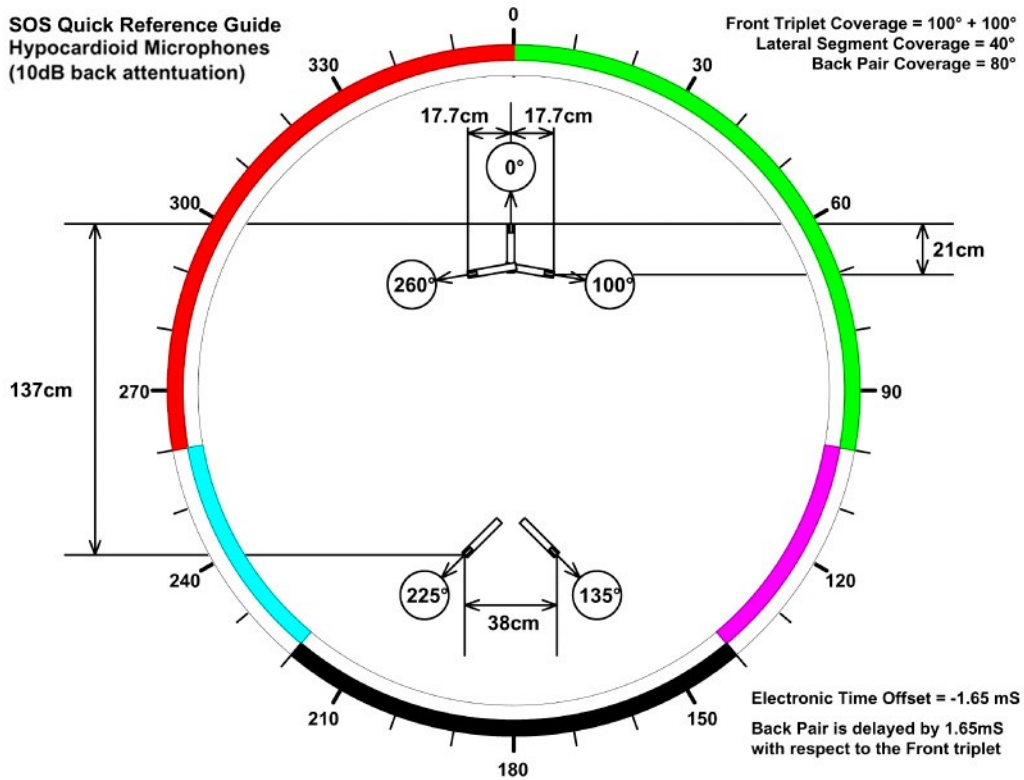


Figure 5 - FTC $100^\circ+100^\circ$ ($b = 100^\circ$), LSC 40° , BPC 80° ($b = 90^\circ$), ETO -1.65mS

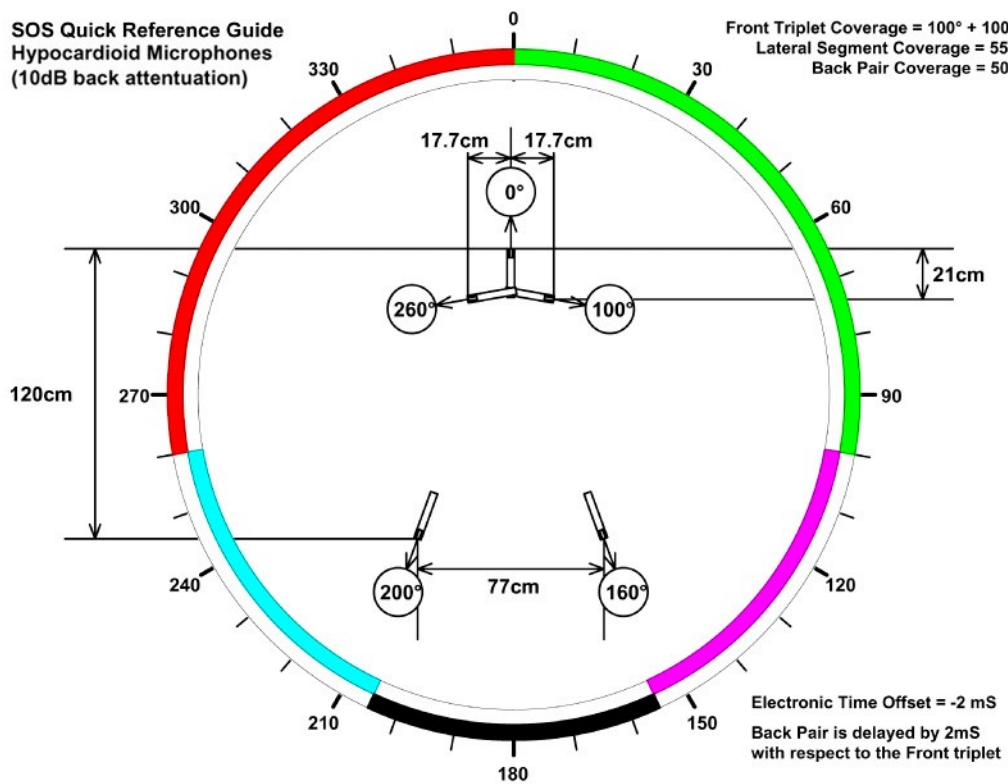


Figure 6 - FTC $100^\circ+100^\circ$ ($b = 100^\circ$), LSC 55° , BPC 50° ($b = 40^\circ$), ETO -2mS

Combinations for HYPOCARDIROID Microphones (10dB back attenuation)

FTC = Front Triplet coverage BPC = Back Pair Coverage LSC = Lateral Segment Coverage

TABLE C : 90° + 90° FTC for Hypocardioid Microphones (10dB back attenuation)										
90° + 90°	Angle	100°	90°	80°	70°	60°	50°	40°	30°	Angle
	Distance	31,5 cm	33 cm	34,5 cm	36,5 cm	38,5 cm	40,5 cm	42,5 cm	45 cm	Distance
	MPTO	-8°	0°	7°	15°	21°	26°	32°	37°	MPTO
	X coord	23,4 cm	23,3 cm	23,5 cm	23,5 cm	24,2 cm	26,5 cm	26,17 cm	27,7 cm	X coord
	Y coord	21 cm	23,3 cm	25,2 cm	28 cm	29,9 cm	31,5 cm	33,5 cm	35,5 cm	Y coord
	Orient.	100°/ 260°	90°/ 270°	80°/ 280°	70°/ 290°	60°/ 300°	50°/ 310°	40°/ 320°	30°/ 330°	Compass

Any combination from Table C will critically link with any combination from Table D

TABLE D : BPC and LSC for Hypocardioid Microphones (10dB back attenuation)										
BPC	LSC									
90°	45°			80°	70°	60°	50°	40°	30°	Angle
				34,5cm	36,5cm	38cm	40cm	42cm	44cm	Distance
				-1,1mS	-1,05cm	-1mS	-0,95mS	-0,9mS	-0,8mS	ETO
				17,25cm	18,25cm	19cm	20cm	21cm	22cm	X coord
				115,5cm	114,5cm	113cm	112cm	110,5cm	110cm	Y coord
				140°/ 220°	145°/ 215°	150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Compass
80°	50°	100°	90°	80°	70°	60°	50°	40°	30°	Angle
		36,5cm	38cm	39,5cm	41cm	43cm	45cm	47cm	49,5cm	Distance
		-1,15 mS	-1,1mS	-1,05mS	-1mS	-0,95 mS	-0,85 mS	-0,8 mS	-0,85mS	ETO
		18,25cm	19cm	19,75cm	20,5cm	21,5cm	22,5cm	23,5cm	24,75cm	X coord
		110,5cm	108,5cm	106,5cm	105,5cm	103,5cm	102cm	102cm	102,5cm	Y coord
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Compass
70°	55°	100°	90°	80°	70°	60°	50°	40°	30°	Angle
		43cm	44,5cm	46cm	48cm	49,5cm	52cm	54cm	56,5cm	Distance
		-1,05mS	-1mS	-0,95 mS	-0,9 mS	-0,9 mS	-0,9 mS	-0,9 mS	-0,9 mS	ETO
		21,5cm	22,25cm	23cm	24cm	24,75cm	26cm	27cm	28,25cm	X coord
		103cm	102cm	100,5cm	99cm	97,5cm	97cm	96,5cm	96cm	Y coord
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Compass
60°	60°	100°	90°	80°	70°	60°	50°	40°	30°	Angle
		56cm	53,5cm	55,5cm	57cm	59cm	61cm	63,5cm	66cm	Distance
		-1,1 mS	-1,05 mS	-1,05 mS	-1,05 mS	-1,05 mS	-1,05 mS	-1,05 mS	-1,05 mS	ETO
		26cm	26,75cm	27,75cm	28,5cm	29,5cm	30,5cm	31,75cm	33cm	X coord
		99cm	97,5cm	96,5cm	96cm	95cm	94,5cm	94cm	94cm	Y coord
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Compass
50°	65°	100°	90°	80°	70°	60°	50°	40°	30°	Angle
		64,5cm	66,5cm	68,5cm	70,5cm	72,5cm	74,5cm	77cm	79,5cm	Distance
		-1,25 mS	-1,25 mS	-1,25 mS	-1,25 mS	-1,25 mS	-1,25 mS	-1,25 mS	-1,25 mS	ETO
		32,25cm	33,25cm	34,25cm	35,25cm	36,25cm	37,25cm	38,5cm	39,75cm	X coord
		98,5cm	97,5cm	97cm	96,5cm	95,5cm	95cm	95cm	94,5cm	Y coord
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Compass
40°	70°	100°	90°	80°	70°	60°	50°	40°	30°	Angle
		84,5cm	86,5cm	88,5cm	90,5cm	93cm	95cm	97,5cm	100,5cm	Distance
		-1,55 mS	-1,55 mS	-1,55 mS	-1,55 mS	-1,55 mS	-1,55 mS	-1,55 mS	-1,55 mS	ETO
		42,2cm	43,2cm	44,2cm	45,2cm	46,5cm	47,5cm	48,7cm	50,2cm	X coord
		103cm	102,5cm	102cm	101cm	100,5cm	100cm	99,5cm	99cm	Y coord
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Compass

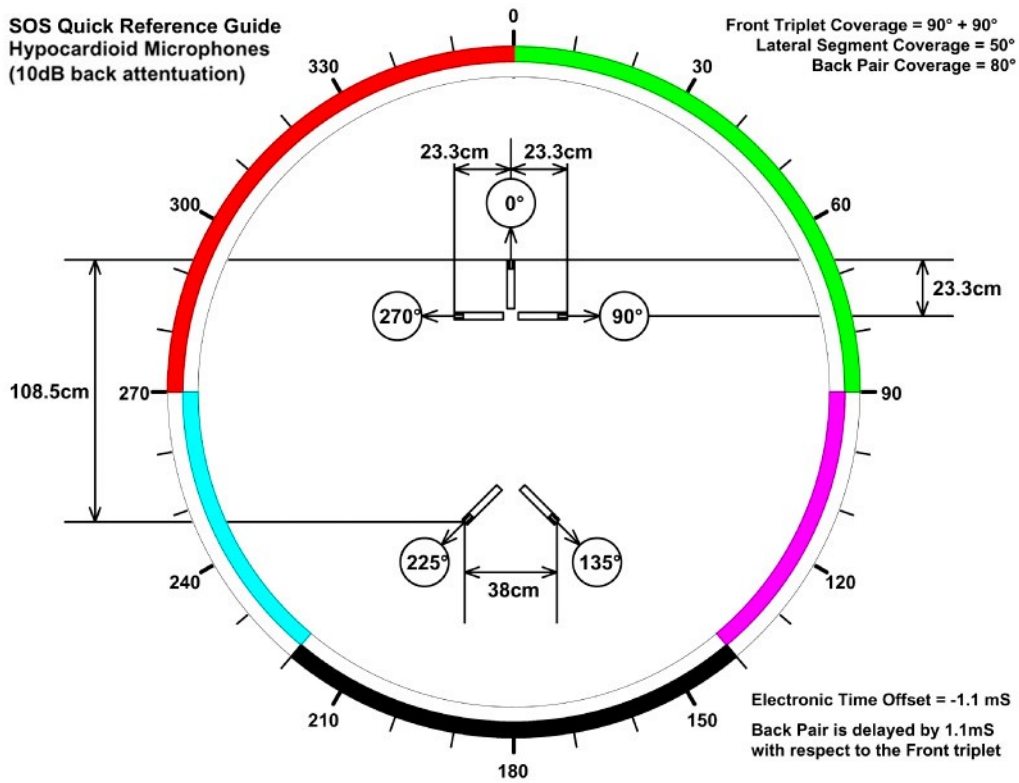


Figure 7 - FTC $90^\circ+90^\circ$ ($b = 90^\circ$), LSC 50° , BPC 80° ($b = 90^\circ$), ETO -1.1mS

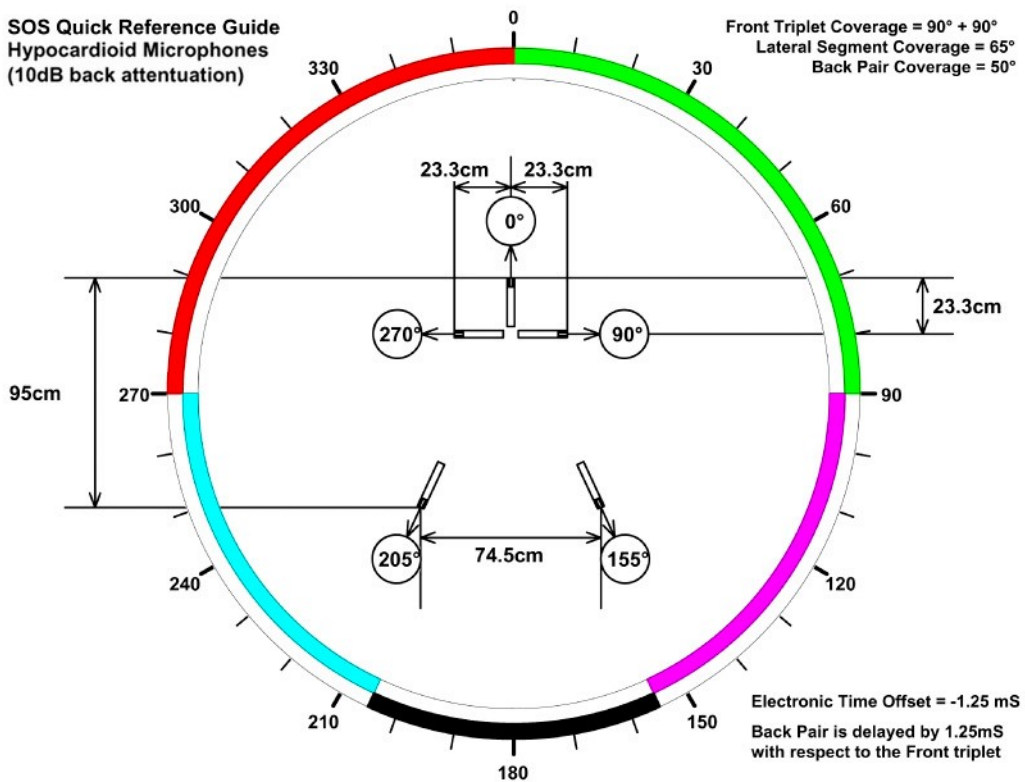


Figure 8 - FTC $90^\circ+90^\circ$ ($b = 90^\circ$), LSC 65° , BPC 50° ($b = 50^\circ$), ETO -1.25mS

Combinations for HYPOCARDIOID Microphones (10dB back attenuation)

FTC = Front Triplet coverage BPC = Back Pair Coverage LSC = Lateral Segment Coverage

80° + 80°	Angle	100°	90°	80°	70°	60°	50°	40°	30°	Angle
	Distance	36,5 cm	38 cm	39,5 cm	41,5 cm	43 cm	45,5 cm	47,5 cm	50 cm	Distance
	MPTO	-14°	-7°	0°	7°	14°	20°	25°	30°	MPTO
	X coord	39,5 cm	29,9 cm	30,2 cm	30,8 cm	30,9 cm	32,2 cm	33,6 cm	35,6 cm	X coord
	Y coord	21,5 cm	23,4 cm	25,4 cm	27,8 cm	29,9 cm	32,2 cm	33,6	35,6 cm	Y coord
	Compass	100°/260°	90°/270°	80°/280°	70°/290°	60°/300°	50°/310°	40°/320°	30°/330°	Compass

Any combination from Table E will critically link with any combination from Table F

BPC	LSC										
90°	55°		90°	80°	70°	60°	50°	40°	30°	Angle	
			33cm	34,5cm	36,5cm	38cm	39,5cm	42cm	44cm	Distance	
			-0,9mS	-0,9mS	-0,85mS	-0,8mS	-0,75mS	-0,65mS	-0,6mS	ETO	
			16,5cm	17,25cm	18,25cm	19cm	19,75cm	21cm	22cm	X coord	
			99cm	97,5cm	96cm	95,5cm	93,5cm	92,5cm	92cm	Y coord	
			135°/225°	140°/220°	145°/215°	150°/210°	155°/205°	160°/200°	165°/195°	Compass	
80°	60°	100°	90°	80°	70°	60°	50°	40°	30°	Angle	
			36cm	38cm	39,5cm	41cm	43cm	45cm	47cm	49,5cm	Distance
			-0,95mS	-0,9mS	-0,8mS	-0,25mS	-0,25mS	-0,25mS	-0,25mS	-0,25mS	ETO
			18cm	19cm	19,75cm	20,5cm	21,5cm	22,5cm	23,5cm	24,75cm	X coord
			95,5cm	94cm	84,5cm	83,5cm	83cm	82,5cm	82cm	82cm	Y coord
			130°/230°	135°/225°	140°/220°	145°/215°	150°/210°	155°/205°	160°/200°	165°/195°	Compass
70°	65°	100°	90°	80°	70°	60°	50°	40°	30°	Angle	
			43cm	44,5cm	46cm	48cm	50cm	52cm	54cm	56,5cm	Distance
			-0,4mS	-0,4mS	-0,4mS	-0,35mS	-0,35mS	-0,35mS	-0,4mS	-0,4mS	ETO
			21,5cm	22,25cm	23cm	24cm	25cm	26cm	27cm	28,25cm	X coord
			83cm	82cm	81cm	80,5cm	79,5cm	79cm	78,5cm	78,5cm	Y coord
			130°/230°	135°/225°	140°/220°	145°/215°	150°/210°	155°/205°	160°/200°	165°/195°	Compass
60°	70°	100°	90°	80°	70°	60°	50°	40°	30°	Angle	
			52cm	53,5cm	55,5cm	57cm	59cm	61cm	63,5cm	66cm	Distance
			-0,5mS	-0,5mS	-0,5mS	-0,5mS	-0,5mS	-0,5mS	-0,45mS	-0,4mS	ETO
			26cm	26,75cm	27,75cm	28,5cm	29,5cm	30,5cm	31,75cm	33cm	X coord
			80,5cm	79,5cm	79cm	78,5cm	77,5cm	76,5cm	75cm	71cm	Y coord
			130°/230°	135°/225°	140°/220°	145°/215°	150°/210°	155°/205°	160°/200°	165°/195°	Compass
50°	75°	100°	90°	80°	70°	60°	50°	40°	30°	Angle	
			64,5cm	66,5cm	68,5cm	70,5cm	72,5cm	74,5cm	77cm	79,5cm	Distance
			-0,6mS	-0,55mS	-0,5mS	-0,45mS	-0,4mS	-0,35mS	-0,3mS	-0,2mS	ETO
			32,25cm	33,25cm	34,25cm	35,25cm	36,25cm	37,25cm	38,5cm	39,75cm	X coord
			79cm	78cm	75,5cm	74,5cm	72,5cm	71,5cm	69,5cm	68cm	Y coord
			130°/230°	135°/225°	140°/220°	145°/215°	150°/210°	155°/205°	160°/200°	165°/195°	Compass
40°	80°	100°	90°	80°	70°	60°				Angle	
			84,5cm	86,5cm	88,5cm	90,5cm	93				Distance
			-0,35 mS	-0,3mS	-0,25mS	-0,2mS	-0,15mS				ETO
			42,25cm	43,25cm	44,25cm	45,25cm	46,5cm				X coord
			70,5cm	69cm	67cm	65,5cm	63,5cm				Y coord
			130°/230°	135°/225°	140°/220°	145°/215°	150°/210°				Compass

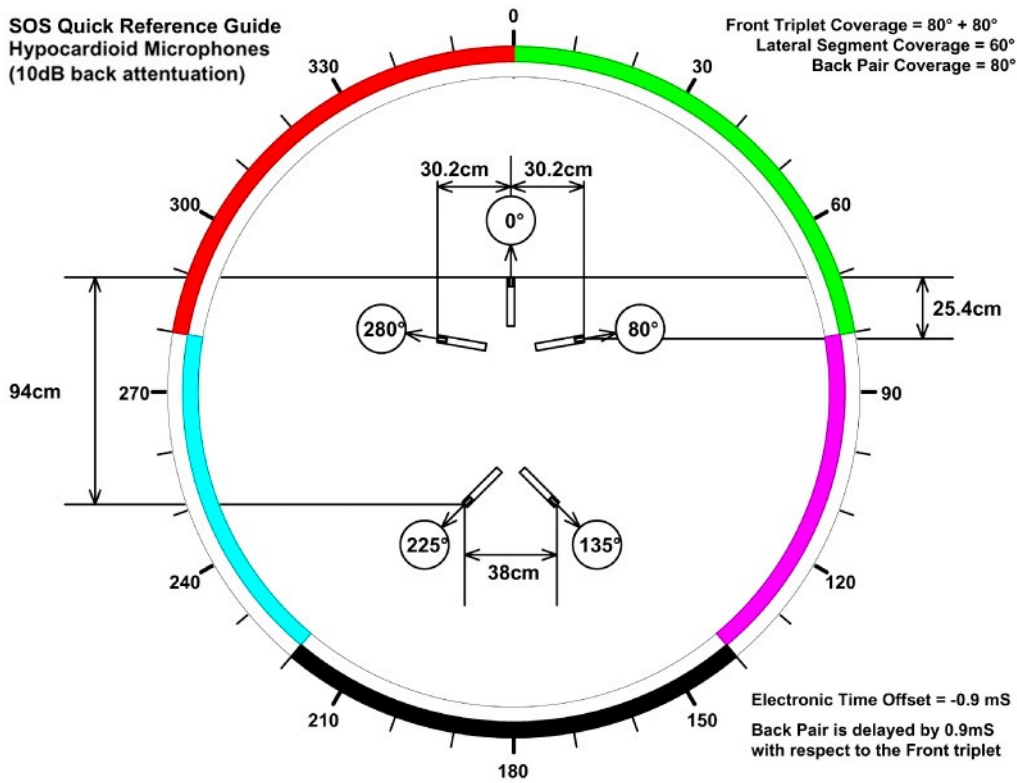


Figure 9 - FTC $80^\circ + 80^\circ$ ($b = 80^\circ$), LSC 60° , BPC 80° ($b = 90^\circ$), ETO -0.9mS

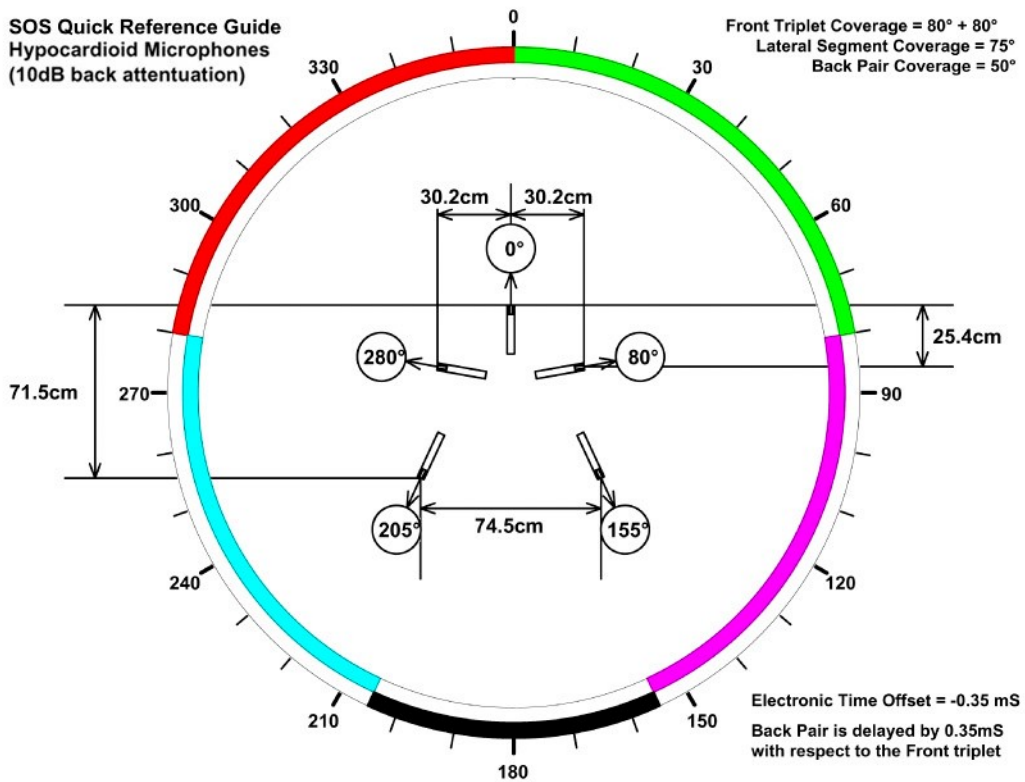


Figure 10 - FTC $80^\circ + 80^\circ$ ($b = 80^\circ$), LSC 75° , BPC 50° ($b = 50^\circ$), ETO -0.35mS

Combinations for HYPOCARDIOID Microphones (10dB back attenuation)

FTC = Front Triplet coverage BPC = Back Pair Coverage LSC = Lateral Segment Coverage

70° + 70°	Angle	100°	90°	80°	70°	60°	50°	40°	30°	Angle
	Distance	43,6cm	45,3cm	46,5cm	48cm	49,8cm	52cm	54,2cm	56,6cm	Distance
	MPTO	-21,2°	-14,3°	-7°	0	6,3°	12,2°	18,1°	23,4°	MPTO
	X coord	38,2cm	39cm	39cm	29,4cm	40,1cm	41,5cm	42,6cm	44,3cm	X coord
	Y coord	21cm	23,1cm	25,3cm	27,5cm	29,5cm	31,5cm	33,4cm	35,1cm	Y coord
	Compass	100°/ 260°	90°/ 270°	80°/ 280°	70°/ 290°	60°/ 300°	50°/ 310°	40°/ 320°	30°/ 330°	Compass

Any combination from Table G will critically link with any combination from Table H

BPC	LSC									
90°	65°	100°	90°	80°	70°	60°	50°	40°	30°	Angle
		31	33cm	34,5cm	36,5cm	38cm	39,5cm	42cm	44cm	Distance
		0,25mS	0,3mS	0,3mS	0,3mS	0,3mS	0,3 mS	0,3 mS	0,3 mS	ETO
		16cm	16,5cm	17,25cm	18,25cm	19cm	19,75cm	21cm	22cm	X coord
		78cm	77cm	76cm	75,5cm	75cm	74cm	74cm	73,5cm	Y coord
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Compass
80°	70°	100°	90°	80°	70°	60°	50°	40°	30°	Angle
		36,5cpm	38cm	39,5cm	41cm	43cm	45cm	47cm	49,5cm	Distance
		0,15mS	0,2mS	0,2mS	0,2mS	0,2mS	0,2mS	0,15mS	0,15mS	ETO
		18,25cm	19cm	19,75cm	20,5cm	21,5cm	22,5cm	23,5cm	24,75cm	X coord
		73,5cm	73cm	72cm	71,5cm	70,5cm	70cm	69,5cm	69cm	Y coord
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Compass
70°	75°	100°	90°	80°	70°	60°	50°	40°	30°	Angle
		43cm	44,5cm	46cm	47,5cm	50cm	52cm	54cm	56,5cm	Distance
		0	0	0	0	0	0	0	0	ETO
		21,5cm	22,25cm	23cm	23,75cm	25cm	26cm	27cm	28,25cm	X coord
		70,5cm	70,5cm	69cm	68cm	67,5cm	67cm	66,5cm	66cm	Y coord
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Compass
60°	80°	100°	90°	80°	70°	60°	50°	40°	30°	Angle
		52cm	53,5cm	55cm	57cm	59cm	61cm	63,5cm	66cm	Distance
		-0,1mS	-0,1mS	-0,1mS	-0,1mS	-0,1mS	-0,1mS	-0,1mS	-0,1mS	ETO
		26cm	26,75cm	27,5cm	28,5cm	29,5cm	30,5cm	31,75cm	33cm	X coord
		68,5cm	68cm	67cm	66,5cm	66cm	65,5cm	65cm	65cm	Y coord
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Compass
50°	85°	100°	90°	80°	70°	60°	50°	40°	30°	Angle
		64,5cm	66,5cm	68,5cm	70,5cm	72,5cm	74,5cm	77cm	80cm	Distance
		-0,25mS	-0,25mS	-0,25mS	-0,25mS	-0,25mS	-0,25mS	-0,3mS	-0,25mS	ETO
		32,25cm	33,25cm	34,25cm	35,25cm	36,25cm	37,25cm	38,5cm	40cm	X coord
		68,5cm	68,5cm	67cm	66,5cm	66cm	65,5cm	65,5cm	64,5cm	Y coord
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Compass
40°	90°	100°	90°	80°	70°	60°	50°	40°	30°	Angle
		84,5cm	86,5cm	88,5cm	90,5cm	93cm	95cm	98cm	100,5cm	Distance
		-0,4mS	-0,35mS	-0,3mS	-0,25mS	-0,2mS	-0,15mS	-0,1mS	-0,05mS	ETO
		42,25cm	43,25cm	44,25cm	45,25cm	46,5cm	47,5cm	49cm	50,25cm	X coord
		69cm	66,5cm	65cm	63cm	62cm	60,5cm	59cm	57,5cm	Y coord
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Compass

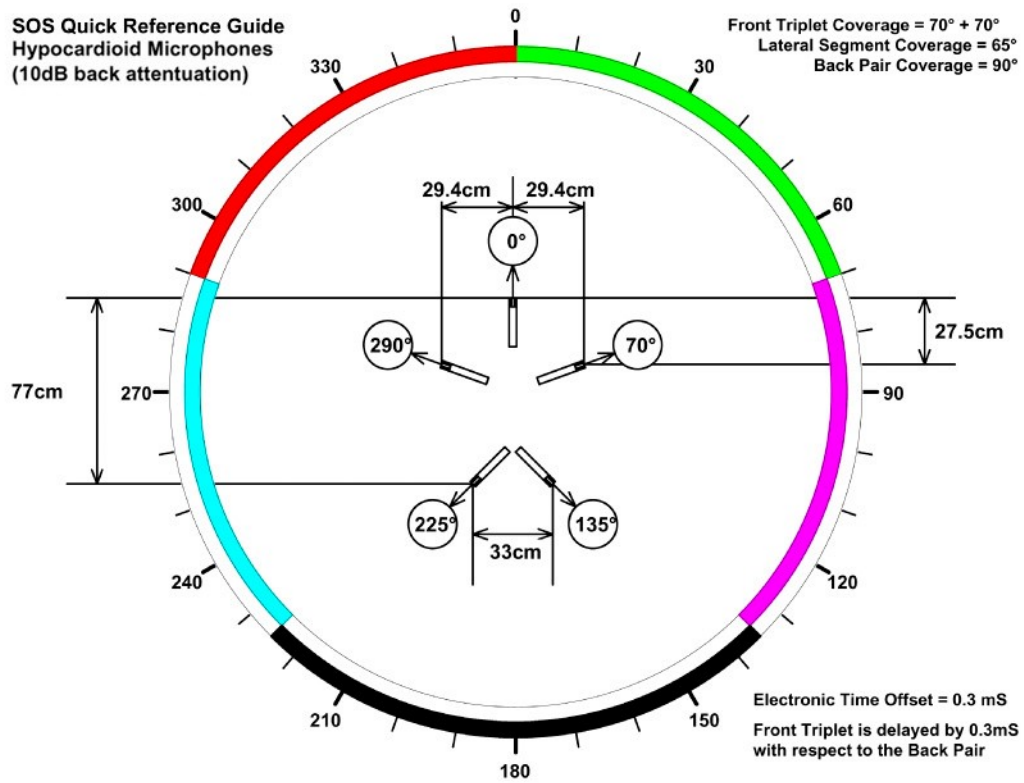


Figure 11 - FTC $70^\circ + 70^\circ$ ($b = 70^\circ$), LSC 65° , BPC 90° ($b = 90^\circ$), ETO 0.3mS

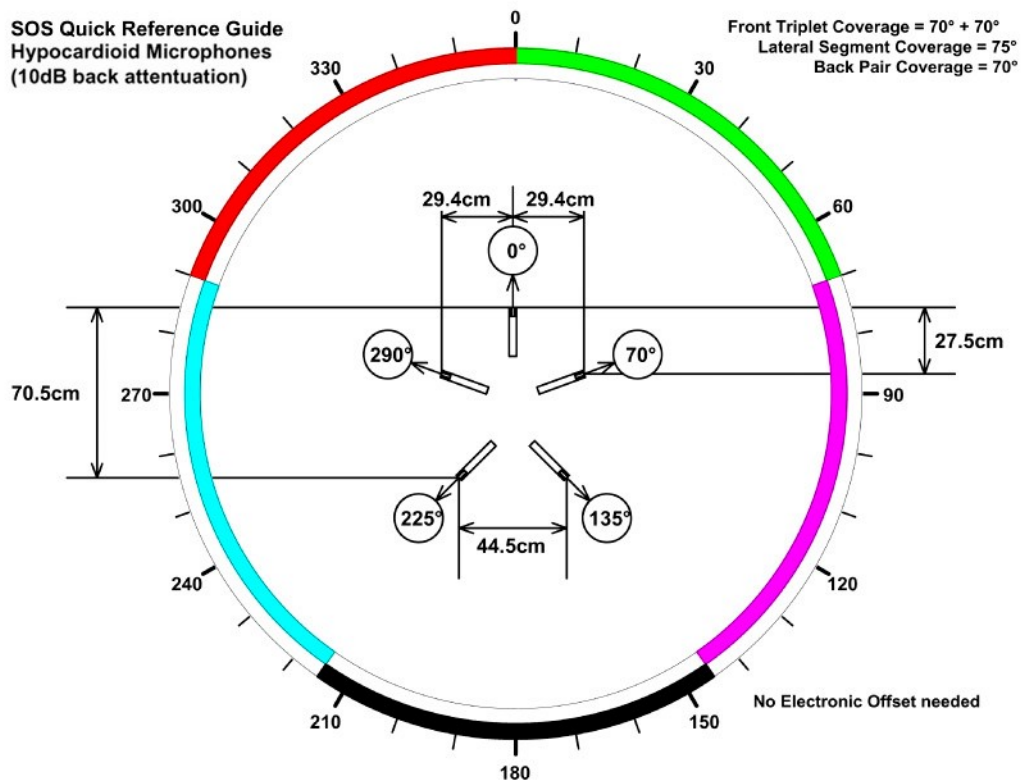


Figure 12 - FTC $70^\circ + 70^\circ$ ($b = 70^\circ$), LSC 75° , BPC 70° ($b = 90^\circ$), ETO 0mS

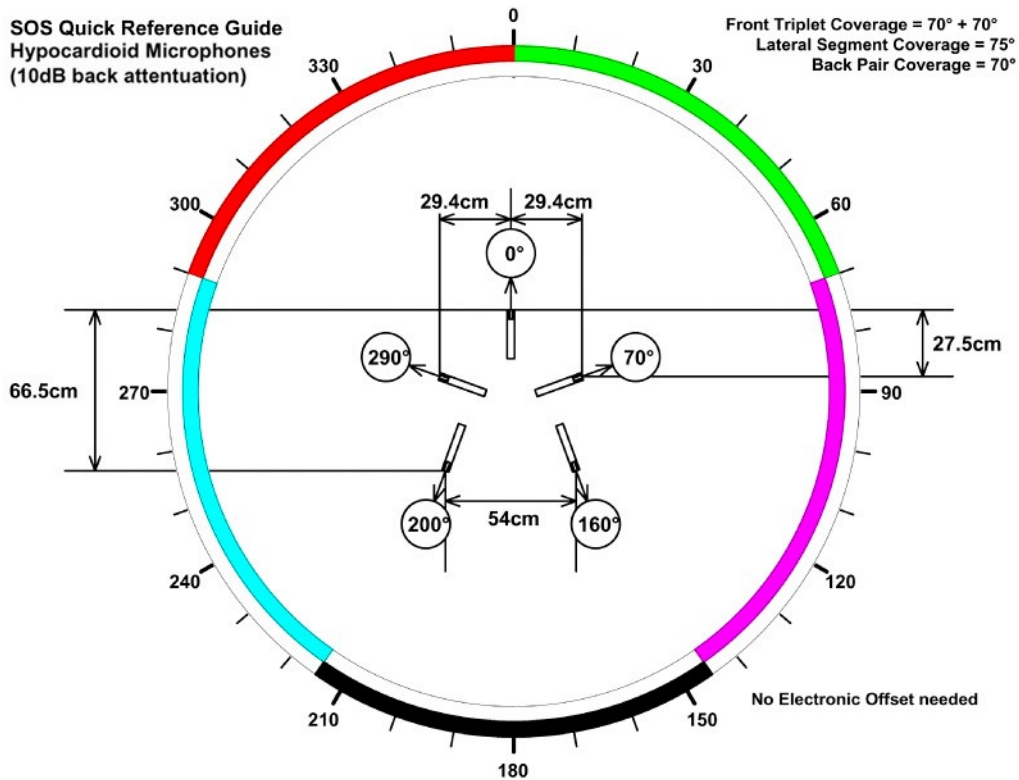


Figure 13 - FTC 70° + 70° (b = 70°), LSC 75°, BPC 70° (b = 40°), ETO 0mS

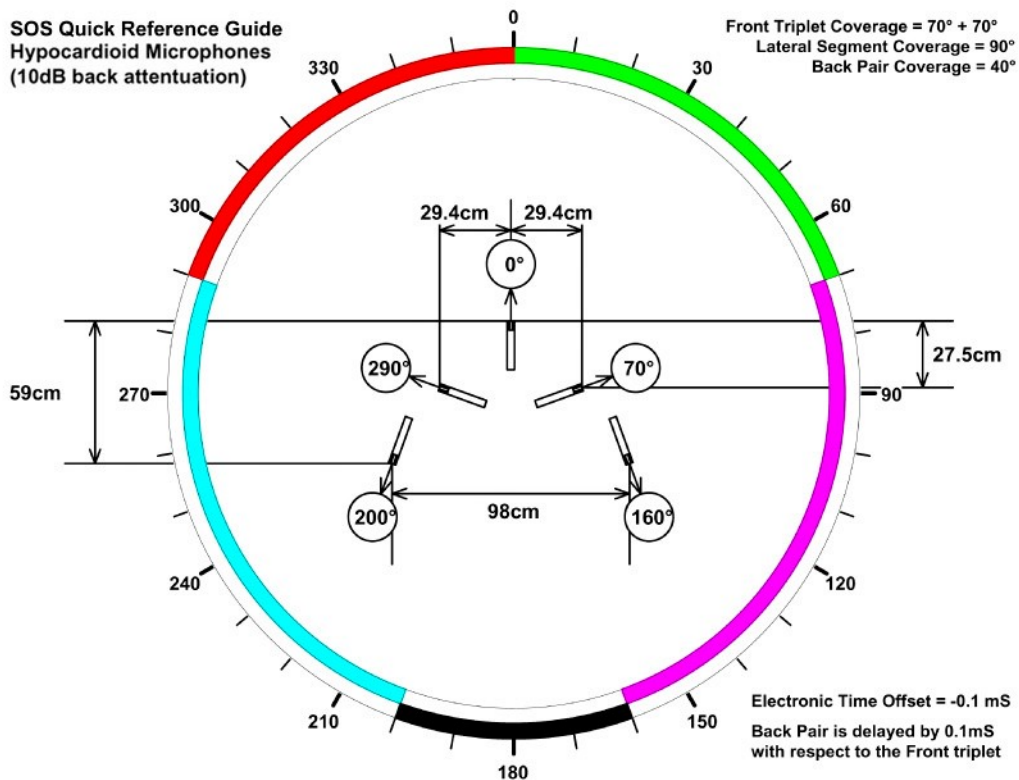


Figure 14 - FTC 70° + 70° (b = 70°), LSC 90°, BPC 40° (b = 40°), ETO -0.1mS

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Combinations for HYPOCARDIOID Microphones (10dB back attenuation)

FTC = Front Triplet coverage BPC = Back Pair Coverage LSC = Lateral Segment Coverage

60° + 60°	Angle	100°	90°	80°	70°	60°	50°	40°	30°	Angle
	Distance	54cm	54,5cm	55,7cm	57,2cm	59,1cm	61,3cm	63,7cm	66,4cm	Distance
	MPTO	-27,2°	-19,9°	-12,9°	-6,3°	0°	5,9°	11,6°	16,9°	MPTO
	X coord	49,8cm	49,4cm	49,6cm	50,2cm	51,2cm	52,6cm	54,3cm	56,4cm	X coord
	Y coord	20,9cm	23,1cm	25,4cm	27,5cm	29,5cm	31,5cm	33,4cm	35,1cm	Y coord
	Compass	100°/ 260°	90°/ 270°	80°/ 280°	70°/ 290°	60°/ 300°	50°/ 310°	40°/ 320°	30°/ 330°	Compass

Any combination from Table J will critically link with any combination from Table K

BPC	LSC									
90°	75°	90°	80°	70°	60°	50°	40°	30°	Angle	
		33cm	34,5cm	36cm	38cm	40cm	42cm	44cm	Distance	
		0,65mS	0,65mS	0,65mS	0,65mS	0,65mS	0,65mS	0,65mS	ETO	
		16,5cm	17,25cm	18cm	19cm	20cm	21cm	22cm	X coord	
		68cm	67cm	66,5cm	66cm	65,5cm	65cm	64,5cm	Y coord	
		135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Compass	
80°	80°	100°	90°	80°	70°	60°	50°	40°	30°	Angle
		36,5cm	38cm	39,5cm	41cm	43cm	45cm	47cm	49,5cm	Distance
		0,55mS	0,55mS	0,55mS	0,55mS	0,55mS	0,55mS	0,55mS	0,55mS	ETO
		18,25cm	19cm	19,75cm	20,5cm	21,5cm	22,5cm	23,5cm	24,75cm	X coord
		65,5cm	64,5cm	64cm	63cm	62,5cm	62cm	61,5cm	61,5cm	Y coord
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Compass
70°	85°	100°	90°	80°	70°	60°	50°	40°	30°	Angle
		43cm	44,5cm	46cm	48cm	50	52cm	54cm	56,5cm	Distance
		0,42mS	0,42mS	0,42mS	0,42mS	0,42mS	0,42mS	0,42mS	0,42mS	ETO
		21,5cm	22,25cm	23cm	24cm	25cm	26cm	27cm	28,25mS	X coord
		63	62cm	61cm	60,5cm	61cm	59,5cm	58,5cm	58,5cm	Y coord
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Compass
60°	90°	100°	90°	80°	70°	60°	50°	40°	30°	Angle
		52cm	53,5cm	55,5cm	57cm	59cm	61cm	63,5cm	66cm	Distance
		0,28 mS	0,28 mS	0,28 mS	0,28 mS	0,28 mS	0,28 mS	0,29 mS	0,29 mS	ETO
		26cm	29,75cm	27,75cm	28,5cm	29,5cm	30,5cm	31,75cm	33cm	X coord
		60,5cm	59,5cm	59cm	58cm	57,5cm	57cm	57cm	56,5cm	Y coord
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Compass
50°	95°	100°	90°	80°	70°	60°	50°	40°	30°	Angle
		64,5cm	66,5cm	68cm	70,5cm	72cm	74,5cm	77cm	79,5cm	Distance
		0,12mS	0,1 mS	0,1 mS	0,1 mS	0,1 mS	0,1 mS	0,11 mS	0,12mS	ETO
		32,25cm	33,25cm	34cm	35,25cm	36cm	37,25cm	38,5cm	39,75cm	X coord
		59,5cm	58,5cm	58cm	57,5cm	57cm	59cm	58,5cm	58,5cm	Y coord
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Compass
40°	100°	100°	90°	80°	70°	60°	50°	40°	30°	Angle
		84,5cm	86,5cm	88,5cm	90,5cm	93cm	95cm	98cm	100,5cm	Distance
		-0,1mS	-0,12mS	-0,12mS	-0,12mS	-0,14mS	-0,14 mS	-0,14 mS	-0,16mS	ETO
		42,25cm	43,25cm	44,25cm	45,25cm	46,5cm	47,5cm	49cm	50,25cm	X coord
		60,5cm	60cm	59,5cm	59cm	58,5cm	58,5cm	58cm	57,5cm	Y coord
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Compass

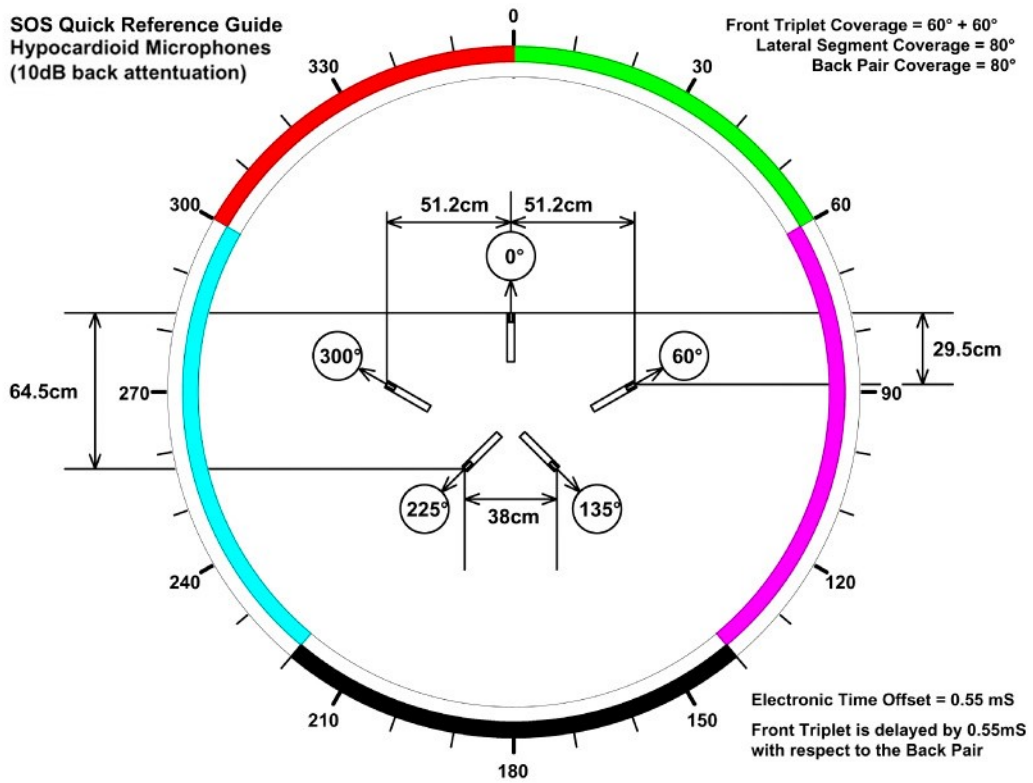


Figure 15 - FTC $60^\circ + 60^\circ$ ($b = 60^\circ$), LSC 80° , BPC 80° ($b = 90^\circ$), ETO 0.55mS

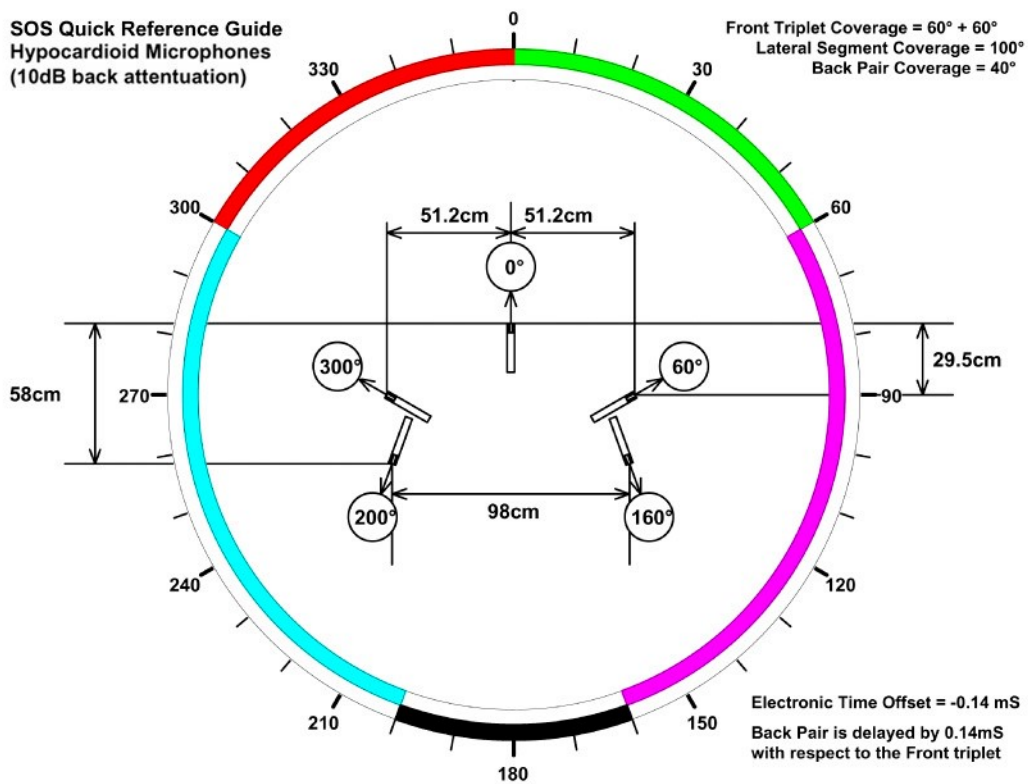


Figure 16 - FTC $60^\circ + 60^\circ$ ($b = 60^\circ$), LSC 100° , BPC 40° ($b = 40^\circ$), ETO -0.14mS

Combinations for HYPOCARDIOID Microphones (10dB back attenuation)

FTC = Front Triplet coverage BPC = Back Pair Coverage LSC = Lateral Segment Coverage

TABLE L : 50° + 50° FTC for Hypocardioid Microphones (10dB back attenuation)										
50° + 50°	Angle	100°	90°	80°	70°	60°	50°	40°	30°	Angle
	Distance	70,5cm	69,4cm	69,7cm	70,9cm	73,6cm	74,7cm	77,2cm	80cm	Distance
	MPTO	-32,7°	-25,5°	-18,7°	-12,3°	-6°	0°	5,6°	11,1°	MPTO
	X coord	67,4cm	65,4cm	65cm	65,4cm	66,3cm	67,7cm	69,6cm	71,8cm	X coord
	Y coord	21cm	23,1cm	25,3cm	27,4cm	29,5cm	31,6cm	33,3cm	35,2cm	Y coord
	Compass	100°/ 260°	90°/ 270°	80°/ 280°	70°/ 290°	60°/ 300°	50°/ 310°	40°/ 320°	30°/ 330°	Compass

Any combination from Table L will critically link with any combination from Table M

TABLE M : BPC and LSC for Hypocardioid Microphones (10dB back attenuation)											
BPC	LSC						60°	50°	40°	30°	Angle
40°	110°						93cm	95cm	98cm	100,5cm	Distance
							0,22mS	0,22mS	0,22mS	0,22mS	ETO
							46,5cm	47,5cm	49cm	50,25cm	X coord
							50,5cm	50,5cm	50cm	50cm	Y coord
							150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Compass

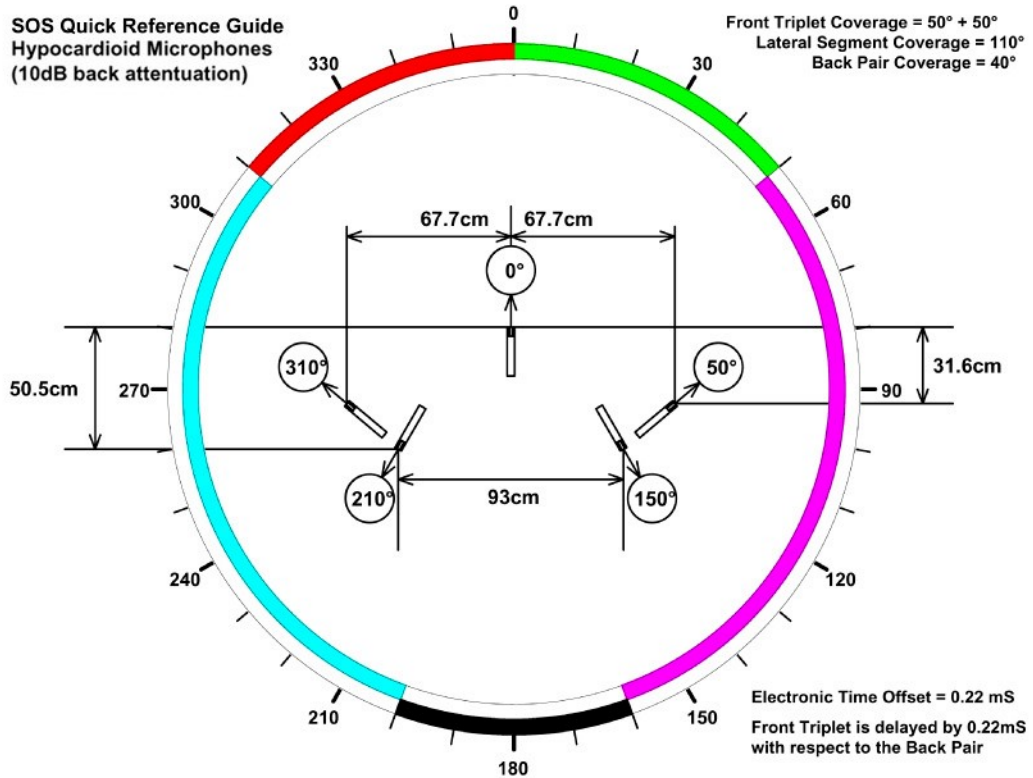


Figure 17 - FTC 50°+ 50° (b = 50°), LSC 110°, BPC 40° (b = 60°), ETO 0.22mS

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Combinations for SUPERCARDIOID Microphones
(11.5dB back attenuation)

FTC = Front Triplet coverage BPC = Back Pair Coverage LSC = Lateral Segment Coverage

TABLE N : 100° + 100° FTC for Supercardioid Microphones (11.5dB back attenuation)										
100° + 100°	Angle	100°	90°	80°	70°					Angle
	Distance	7,5cm	12,5cm	17cm	21,5cm					Distance
	MPTO	0°	26°	37°	51°					MPTO
	X coord	4,8cm	4cm	3,8cm	0,4cm					X coord
	Y coord	5,7cm	11,8cm	16,6cm	21,5cm					Y coord
	Compass	100°/ 260°	90°/ 270°	80°/ 280°	70°/ 290°					Compass

Any combination from Table N will critically link with any combination from Table P

TABLE P : BPC and LSC for Supercardioid Microphones (11.5dB back attenuation)										
BPC	LSC									
90°	35°	100°	90°	80°	70°	60°	50°	40°	30°	Angle
		12,5cm	16cm	20cm	23,5cm	26,5cm	30cm	33,5cm	37,5cm	Distance
		-1,67mS	-1,67mS	-1,67mS	-1,66mS	-1,65mS	-1,65mS	-1,65mS	-1,65mS	ETO
		6,25cm	8cm	10cm	11,75cm	13,25cm	15cm	16,75cm	18,75cm	X coord
		128cm	126cm	125cm	124cm	123cm	122cm	122cm	122cm	Y coord
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Compass
80°	40°	100°	90°	80°						Angle
		18cm	22cm	25,5cm						Distance
		-1,67mS	-1,67mS	-1,67mS						ETO
		9cm	11cm	12,75cm						X coord
		116cm	114,5cm	113cm						Y coord
		130°/ 230°	135°/ 225°	140°/ 220°						Compass
70°	45°	100°								Angle
		25cm								Distance
		-1,71mS								ETO
		12,5cm								X coord
		108cm								Y coord
		130°/ 230°								Compass
60°	50°	100°	90°	80°	70°	60°	50°	40°	30°	Angle
		34cm	37,5cm	41cm	44,5cm	48cm	51,5cm	55,5cm	59,5cm	Distance
		-1,87mS	-1,84mS	-1,84mS	-1,84mS	-1,84mS	-1,84mS	-1,84mS	-1,84mS	ETO
		17cm	18,75cm	20,5cm	22,25cm	24cm	25,75cm	27,75cm	29,75cm	X coord
		104,5cm	102,5cm	101cm	100cm	98,5cm	97,5cm	96,5cm	96cm	Y coord
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Compass
50°	55°	100°	90°	80°	70°	60°	50°	40°	30°	Angle
		46,5cm	50,5cm	54cm	57,5cm	61cm	65cm	68,5cm	73cm	Distance
		-2mS	-2,02mS	-2,02mS	-2,02mS	-2,03mS	-2,05mS	-2,05mS	-2,05mS	ETO
		23,25cm	25,25cm	27cm	28,75cm	30,5cm	32,5cm	34,25cm	36,5cm	X coord
		103cm	101,5cm	100,5cm	99,5cm	98,5cm	99,53cm	97cm	96,5cm	Y coord
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Compass
40°	60°	100°	90°	80°	70°	60°				Angle
		65,5cm	69,5cm	73,5cm	77cm	81cm				Distance
		-2,32mS	-2,36mS	-2,36mS	-2,36mS	-2,36mS				ETO
		32,75cm	34,75cm	26,75cm	38,5cm	40,5cm				X coord
		107,5cm	107,5cm	106cm	105cm	104cm				Y coord
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°				Compass

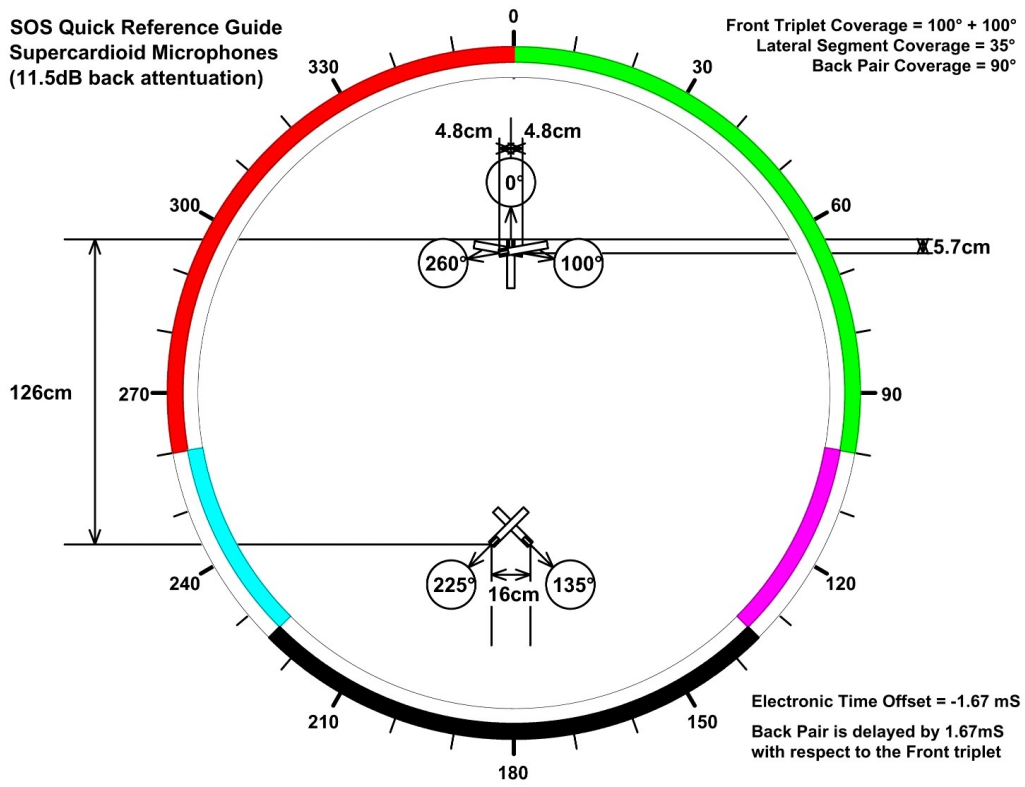


Figure 18 - FTC 100°+ 100° (b = 100°), LSC 35°, BPC 90° (b = 90°), ETO -1.67mS

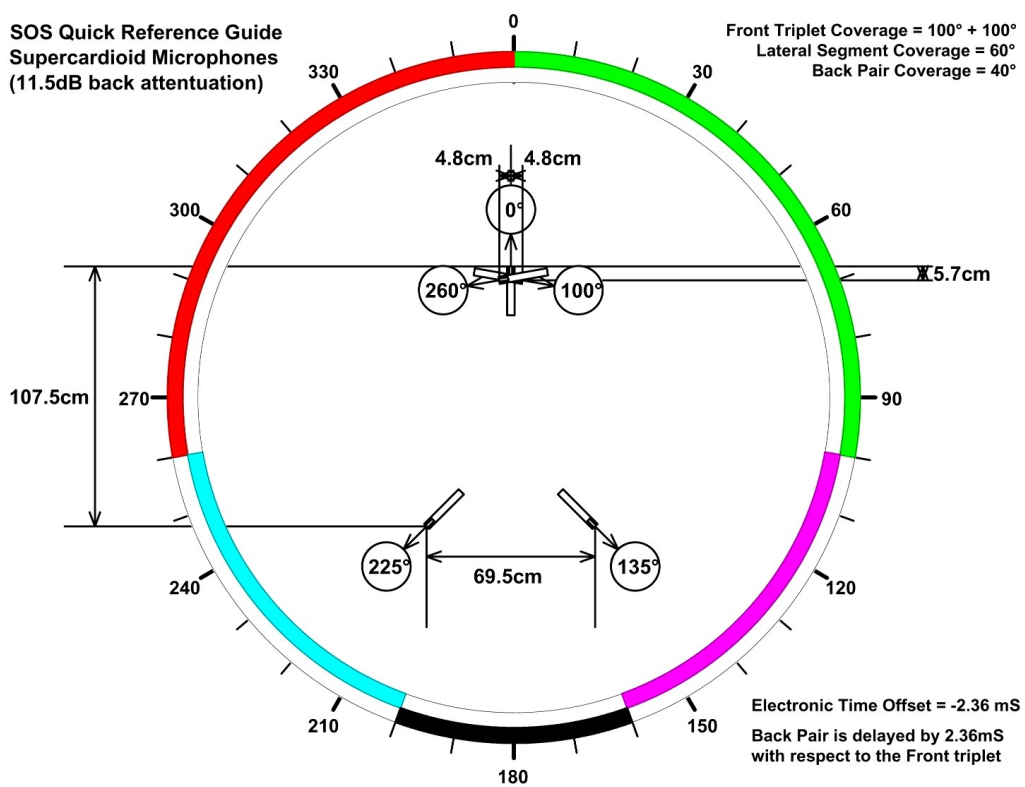


Figure 19 - FTC 100°+ 100° (b = 100°), LSC 60°, BPC 40° (b = 90°), ETO -2.36mS

Combinations for SUPERCARDIOID Microphones (11.5dB back attenuation)

FTC = Front Triplet coverage BPC = Back Pair Coverage LSC = Lateral Segment Coverage

TABLE Q : 90° + 90° FTC for Supercardioid Microphones (11.5dB back attenuation)										
90° + 90°	Angle	100°	90°	80°	70°	60°	50°	40°	30°	Angle
	Distance	12,5cm	16cm	20cm	23,5cm	27cm	31cm	34,5cm	38cm	Distance
	MPTO	-24°	0°	15°	25°	33°	37°	42°	45°	MPTO
	X coord	11,2cm	11,3cm	11,5cm	11,8cm	12,3cm	14,6cm	16,2cm	19cm	X coord
	Y coord	5,5cm	11,3cm	13,4cm	20,4cm	24cm	27,4cm	30,46cm	32,9cm	Y coord
	Compass	100°/ 260°	90°/ 270°	80°/ 280°	70°/ 290°	60°/ 300°	50°/ 310°	40°/ 320°	30°/ 330°	Compass

Any combination from Table Q will critically link with any combination from Table R

TABLE R : BPC and LSC for Supercardioid Microphones (11.5dB back attenuation)											
BPC	LSC										
90°	45°	100°	90°	80°	70°	60°				Angle	
		12cm	16cm	20cm	23,5cm	26,5cm				Distance	
		-1,04mS	-1mS	-0,89mS	-0,81mS	-0,81mS				ETO	
		6cm	8cm	10cm	11,75cm	13,25cm				X coord	
		97,5cm	95,5cm	92,5cm	90cm	88,5cm				Y coord	
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°				Compass	
80°	50°	100°	90°	80°						Angle	
		18cm	16cm	25,5cm						Distance	
		-0,96mS	-0,96mS	-0,86mS						ETO	
		9cm	8cm	12,75cm						X coord	
		88,5cm	87cm	84cm						Y coord	
		130°/ 230°	135°/ 225°	140°/ 220°						Compass	
70°	55°	100°								Angle	
		25cm								Distance	
		-0,94mS								ETO	
		12,5cm								X coord	
		81,5cm								Y coord	
		130°/ 230°								Compass	
60°	60°	100°	90°	80°	70°	60°	50°	40°	30°	Angle	
		34cm	37,5cm	41cm	44,5cm	48cm	51,5cm	55,5cm	59,5cm	Distance	
		-1,06mS	-1,07mS	-1,08mS	-1,09mS	-1,09mS	-1,09mS	-1,09mS	-1,09mS	-1,09mS	ETO
		17cm	18,75cm	20,5cm	22,25cm	24cm	25,75cm	27,75cm	29,75cm	X coord	
		78,5cm	77,5cm	76,5cm	75,5cm	74,5cm	73,5cm	72,5cm	72cm	Y coord	
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Compass	
50°	65°	100°	90°	80°	70°	60°	50°	40°	30°	Angle	
		46,5cm	50,5cm	54cm	57,5cm	61cm	65cm	68,5cm	73cm	Distance	
		-1,28mS	-1,28mS	-1,28mS	-1,28mS	-1,28mS	-1,28mS	-1,28mS	-1,29mS	ETO	
		23,25cm	25,25cm	27cm	28,75cm	30,5cm	32,5cm	34,25cm	36,5cm	X coord	
		79,5cm	78cm	77cm	76cm	75cm	74cm	73cm	72,5cm	Y coord	
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Compass	
40°	70°	100°	90°	80°						Angle	
		65,5cm	69,5cm	73,5cm						Distance	
		-1,53mS	-1,53mS	-1,53mS						ETO	
		32,75cm	34,75cm	36,75cm						X coord	
		82,5cm	81,5cm	80cm						Y coord	
		130°/ 230°	135°/ 225°	140°/ 220°						Compass	

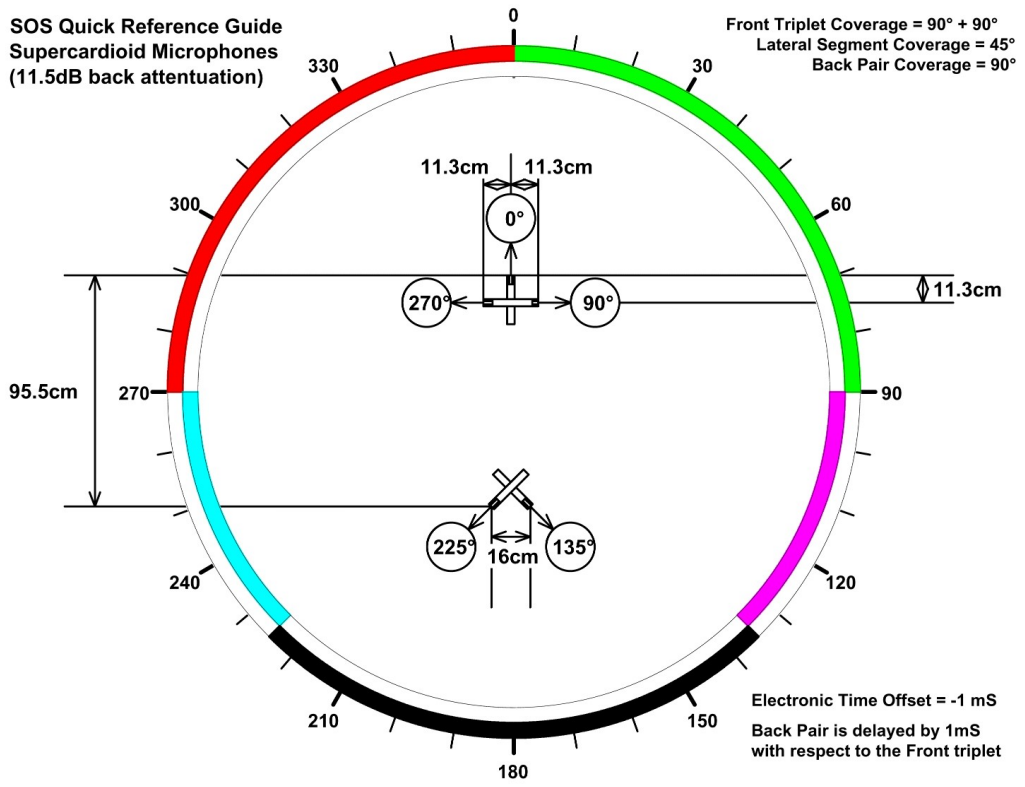


Figure 20 - FTC $90^\circ + 90^\circ$ ($b = 90^\circ$), LSC 45° , BPC 90° ($b = 90^\circ$), ETO -1mS

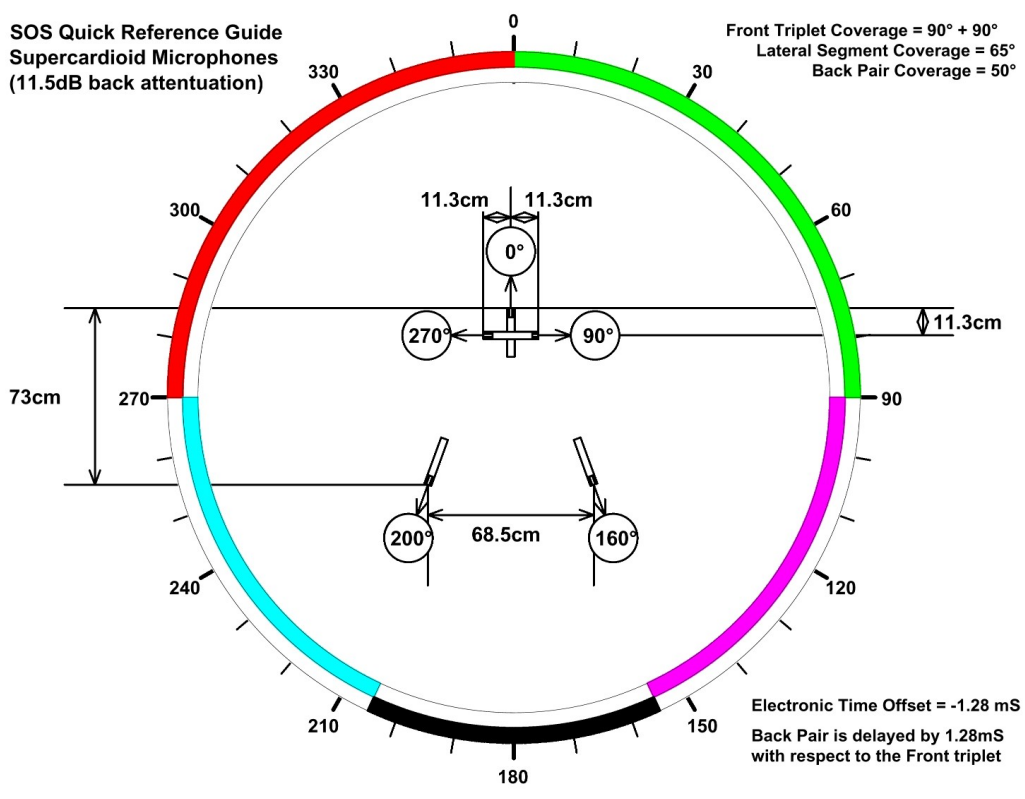


Figure 21 - FTC $90^\circ + 90^\circ$ ($b = 90^\circ$), LSC 65° , BPC 50° ($b = 40^\circ$), ETO -1.28mS

Combinations for SUPERCARDIOID Microphones (11.5dB back attenuation)

FTC = Front Triplet coverage BPC = Back Pair Coverage LSC = Lateral Segment Coverage

80° + 80°	Angle	100°	90°	80°	70°	60°	50°	40°	30°	Angle
	Distance	19cm	22cm	25,5cm	29cm	32,5cm	36cm	39,5cm	43,5cm	Distance
	MPTO	-32°	-13°	0°	11°	18°	25°	31°	35°	MPTO
	X coord	18cm	18,7cm	19,5cm	20,2cm	21,75cm	23,1cm	24,9cm	28cm	X coord
	Y coord	5,9cm	11,7cm	16,4cm	20,9cm	24,2cm	27,6cm	30,7cm	33,3cm	Y coord
	Compass	100°/ 260°	90°/ 270°	80°/ 280°	70°/ 290°	60°/ 300°	50°/ 310°	40°/ 320°	30°/ 330°	Compass

Any combination from Table S will critically link with any combination from Table T

BPC	LSC									Angle
90°	55°	100°	90°	80°	70°	60°	50°			Angle
		12cm	16cm	20cm	23,5cm	26,5cm	30cm			Distance
		-0,87mS	-0,77mS	-0,68mS	-0,58mS	-0,49mS	-0,39mS			ETO
		6cm	8cm	10cm	11,75cm	13,25cm	15cm			X coord
		81cm	78,5cm	76cm	73,5cm	71,5cm	69cm			Y coord
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°	155°/ 205°			Compass
80°	60°	100°	90°	80°	70°	60°			Angle	
		12cm	16cm	19,5cm	23,5cm	26,5cm			Distance	
		-0,88mS	-0,76mS	-0,67mS	-0,59mS	-0,49mS			ETO	
		6cm	8cm	9,75cm	11,75cm	13,25cm			X coord	
		81,5cm	78,5cm	76cm	73,5cm	71,5cm			Y coord	
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°			Compass	
70°	65°	100°							Angle	
		25cm							Distance	
		-0,74mS							ETO	
		12,5cm							X coord	
		70cm							Y coord	
		130°/ 230°							Compass	
60°	70°	100°	90°	80°	70°	60°			Angle	
		34cm	37,5cm	41cm	44,5cm	48cm			Distance	
		-0,64mS	-0,54mS	-0,5mS	-0,51mS	-0,52mS			ETO	
		17cm	18,75mS	20,5cm	22,25cm	24cm			X coord	
		64,5cm	61,5cm	89,5cm	58,5cm	57,5cm			Y coord	
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°			Compass	
50°	75°	100°	90°	80°	70°	60°			Angle	
		46,5cm	50,5cm	54cm	57,5cm	61cm			Distance	
		-0,68mS	-0,68mS	-0,71mS	-0,7mS	-0,71mS			ETO	
		23,25cm	25,25cm	27cm	28,75cm	30,5cm			X coord	
		62cm	61cm	60cm	59cm	58cm			Y coord	
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°			Compass	
40°	80°	100°							Angle	
		65,5cm							Distance	
		-0,94mS							ETO	
		32,75cm							X coord	
		65cm							Y coord	
		130°/ 230°							Compass	

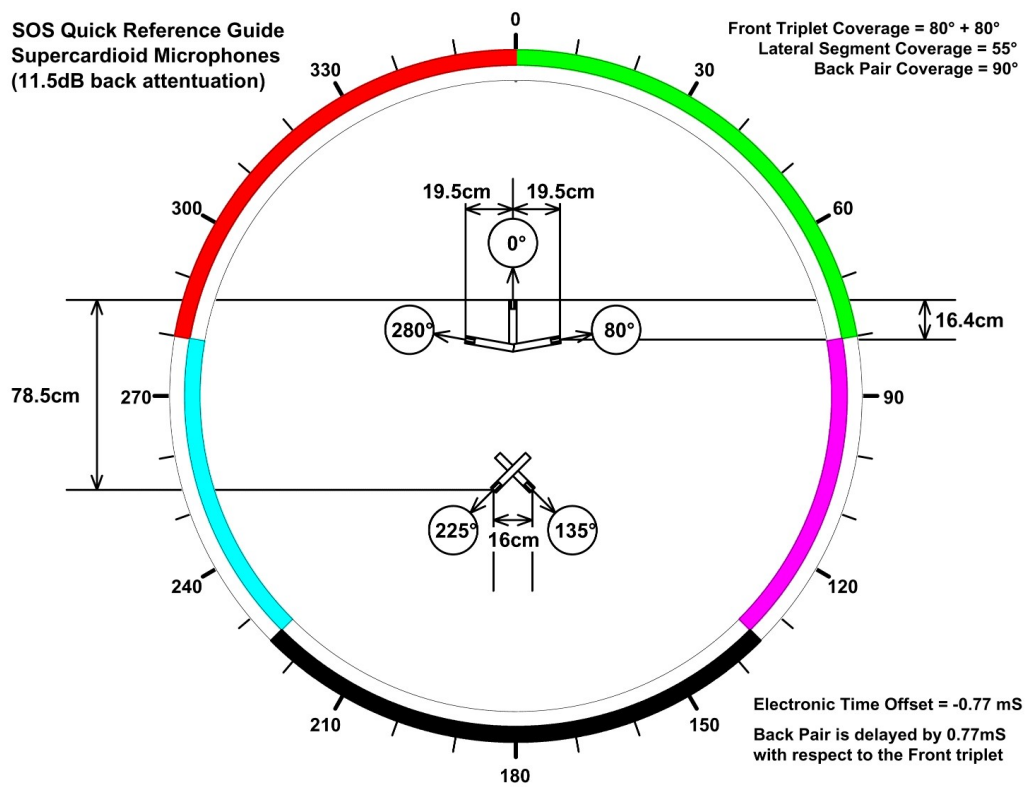


Figure 22 - FTC $80^\circ + 80^\circ$ ($b = 80^\circ$), LSC 55° , BPC 90° ($b = 90^\circ$), ETO -0.77mS

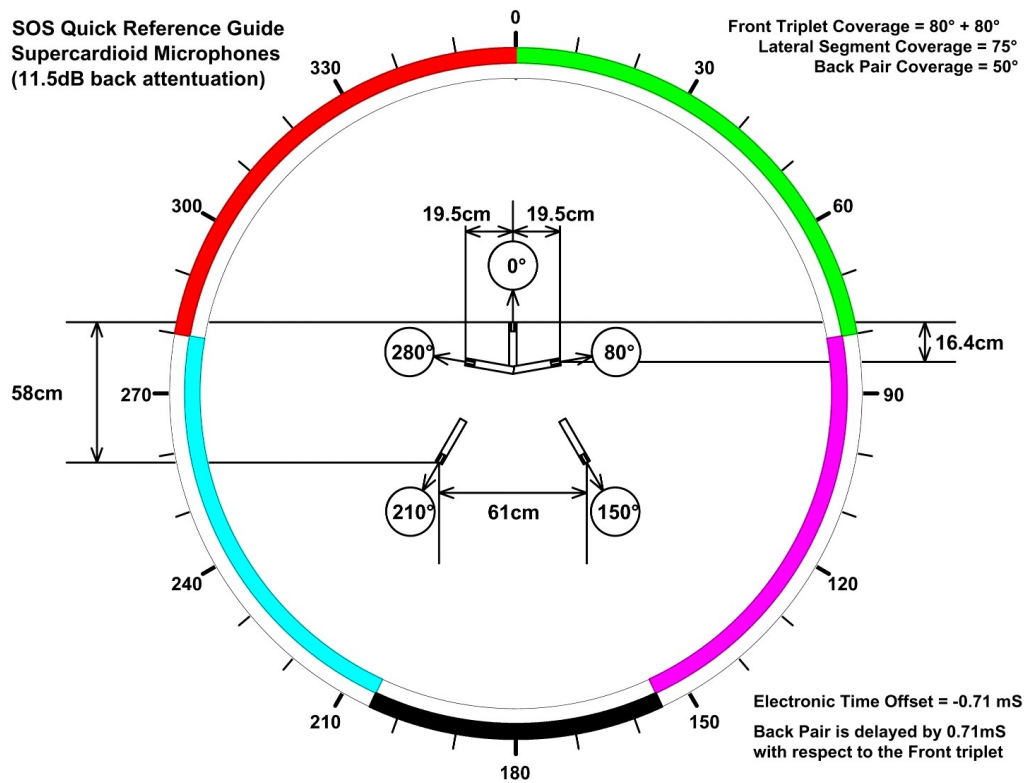


Figure 23 - FTC $80^\circ + 80^\circ$ ($b = 80^\circ$), LSC 75° , BPC 50° ($b = 60^\circ$), ETO -0.71mS

Combinations for SUPERCARDIOID Microphones (11.5dB back attenuation)

FTC = Front Triplet coverage BPC = Back Pair Coverage LSC = Lateral Segment Coverage

TABLE U : 70° + 70° FTC for Supercardioid Microphones (11.5dB back attenuation)

70° + 70°	Angle	100°	90°	80°	70°	60°	50°	40°		Angle
	Distance	26cm	29cm	32,5cm	35,5cm	39cm	42,5cm	46cm		Distance
	MPTO	-38°	-22°	-10°	0°	8°	15°	22°		MPTO
	X coord	25,4cm	26,7cm	28,2cm	29cm	30,7cm	32,6cm	34,2cm		X coord
	Y coord	5,4cm	11,3cm	16,25cm	20,4cm	24cm	27,3cm	30,8cm		Y coord
	Compass	100°/ 260°	90°/ 270°	80°/ 280°	70°/ 290°	60°/ 300°	50°/ 310°	40°/ 320°		Compass

Any combination from Table U will critically link with any combination from Table W

TABLE W : BPC and LSC for Supercardioid Microphones (11.5dB back attenuation)

BPC	LSC									
90°	65°	100°	90°	80°	70°					v
		12,5cm	16cm	20cm	23cm					Distance
		0,32mS	0,32mS	0,3mS	0,3mS					ETO
		6,25cm	8cm	10cm	11,5cm					X coord
		59,5cm	58,5cm	57cm	55,5cm					Y coord
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°					Compass
80°	70°	100°	90°	80°						Angle
		18cm	22cm	25,5cm						Distance
		0,19mS	0,19mS	0,18mS						ETO
		9cm	11cm	12,75cm						X coord
		55,5cm	54cm	53cm						Y coord
		130°/ 230°	135°/ 225°	140°/ 220°						Compass
70°	75°	100°			70°	60°	50°	40°	30°	Angle
		25cm			35,5cm	39cm	42,5cm	44,5cm	50cm	Distance
		0,07mS			0,05mS	0,05mS	0,05mS	0,06mS	0,08mS	ETO
		12,5cm			17,75cm	19,5cm	21,25cm	23cm	25cm	X coord
		52cm			48,5cm	47cm	46cm	44,5cm	43cm	Y coord
		130°/ 230°			145°/ 215°	150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Compass
60°	80°	100°	90°	80°	70°	60°	50°	40°	30°	Angle
		34cm	37,5cm	41cm	44,5cm	48cm	51,5cm	55,5cm	59,5cm	Distance
		-0,08mS	-0,08mS	-0,09mS	-0,09mS	-0,09mS	-0,09mS	0,08mS	0,03mS	ETO
		17cm	18,75cm	20,5cm	22,25cm	24cm	25,75cm	27,75cm	29,75cm	X coord
		50cm	49cm	48cm	46,5cm	45,5cm	44,5cm	43cm	41,5cm	Y coord
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Compass
50°	85°	100°	90°	80°	70°	60°	50°	40°	30°	Angle
		46,5cm	50,5cm	54cm	57,5cm	61cm	65cm	68,5cm	73cm	Distance
		-0,24mS	-0,28mS	-0,28mS	-0,28mS	-0,18mS	-0,11mS	-0,02mS	0,11mS	ETO
		23,25cm	25,25cm	27cm	28,75cm	30,5cm	32,5cm	34,25cm	36,5cm	X coord
		49,5cm	48,5cm	47,5cm	46,5cm	44cm	41,5cm	41,5cm	35,5cm	Y coord
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Compass
40°	90°	100°	90°	80°	70°	60°	50°	40°	30°	Angle
		65,5cm	69,5cm	73,5cm	77cm	81cm	85cm	89cm	93,5cm	Distance
		-0,33mS	-0,25mS	-0,17mS	-0,09mS	-0,01mS	0,09mS	0,2mS	0,31mS	ETO
		32,75cm	34,75cm	36,75cm	38,5cm	40,5cm	42,5cm	44,5cm	46,75cm	X coord
		47,5cm	45cm	42cm	39,5cm	36,5cm	34cm	31cm	28cm	Y coord
		130°/ 230°	135°/ 225°	140°/ 220°	145°/ 215°	150°/ 210°	155°/ 205°	160°/ 200°	165°/ 195°	Compass

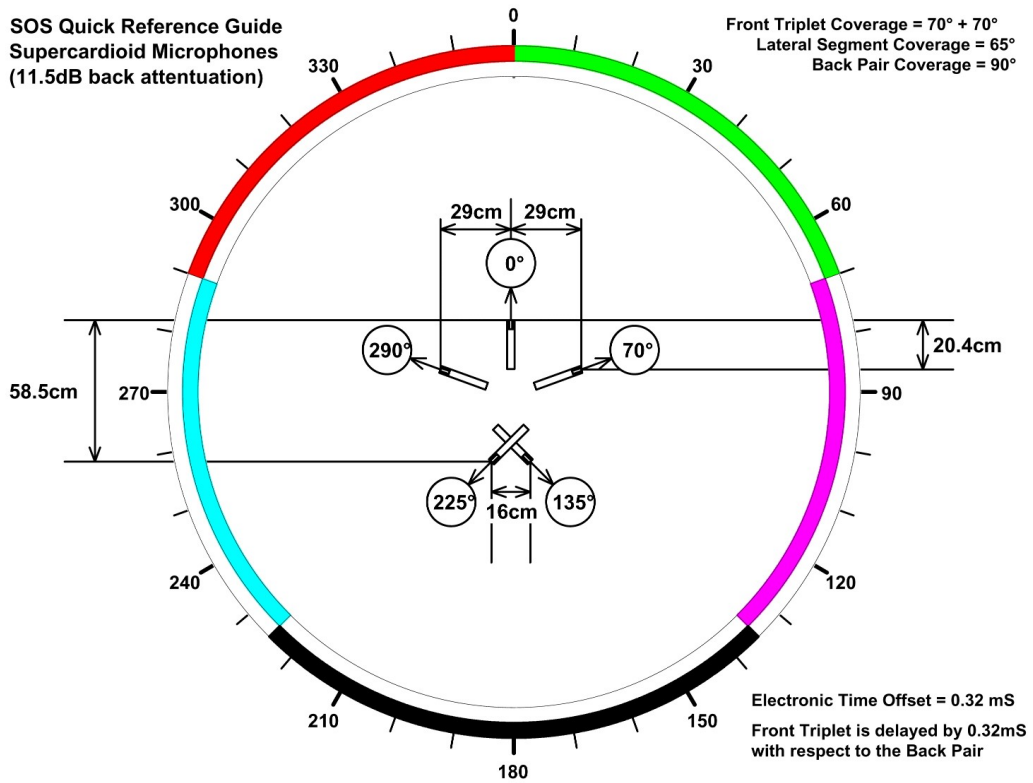


Figure 24 - FTC $70^\circ + 70^\circ$ ($b = 70^\circ$), LSC 65° , BPC 90° ($b = 90^\circ$), ETO 0.32mS

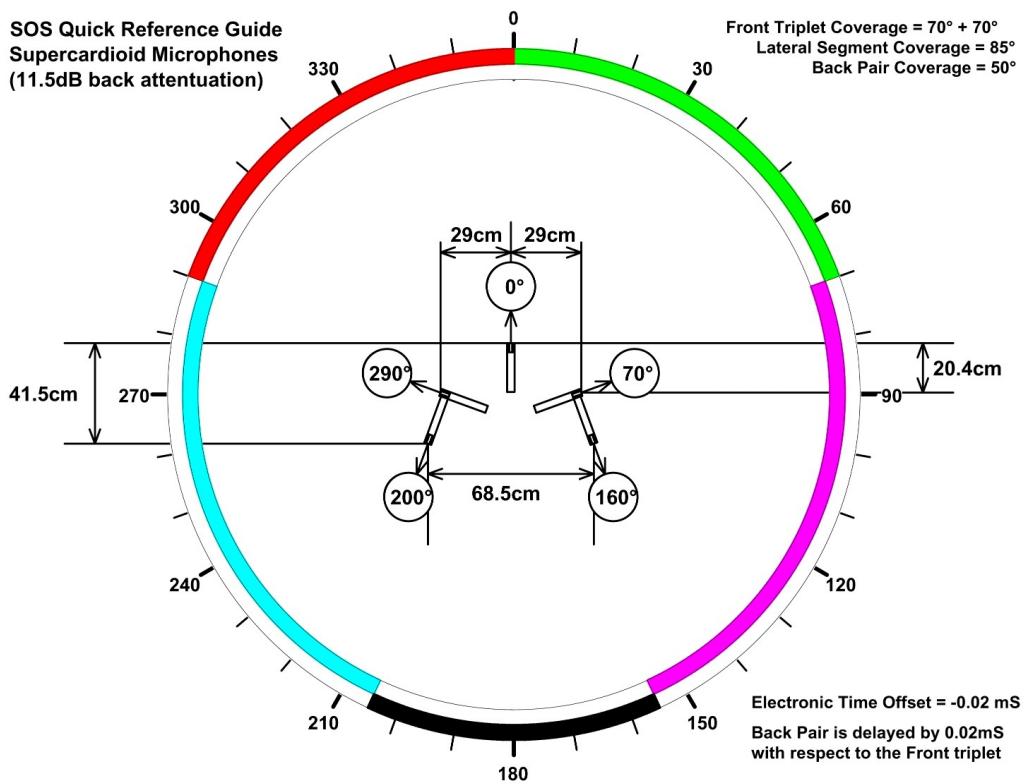


Figure 25 - FTC $70^\circ + 70^\circ$ ($b = 70^\circ$), LSC 85° , BPC 50° ($b = 40^\circ$), ETO 0.02mS

Combinations for SUPERCARDIOID Microphones (11.5dB back attenuation)

FTC = Front Triplet coverage BPC = Back Pair Coverage LSC = Lateral Segment Coverage

TABLE X : 60° + 60° FTC for Supercardioid Microphones (11.5dB back attenuation)

60° + 60°	Angle	100°	90°	80°	70°	60°	50°	40°		Angle
	Distance	36,5cm	39cm	41,5cm	45	48cm	51,5cm	55,5cm		Distance
	MPTO	-41°	-28°	-17°	-8°	0°	7°	13°		MPTO
	X coord	36cm	37,3cm	38,2cm	40,1cm	41,6cm	43,7cm	46,6cm		X coord
	Y coord	5,7cm	11,4cm	16,2cm	20,4cm	24cm	27,3cm	30,2cm		Y coord
	Compass	100°/260°	90°/270°	80°/280°	70°/290°	60°/300°	50°/310°	40°/320°		Compass

Any combination from Table X will critically link with any combination from Table Y

TABLE Y : BPC and LSC for Supercardioid Microphones (11.5dB back attenuation)

BPC	LSC									
90°	75°	100°	90°	80°	70°	60°				Angle
		12,5cm	16cm	20cm	23,5cm	26,5cm				Distance
		0,72mS	0,71mS	0,71mS	0,69mS	0,69mS				ETO
		6,25cm	8cm	10cm	11,75cm	13,25cm				X coord
		52cm	50cm	49cm	47cm	45cm				Y coord
		130°/230°	135°/225°	140°/220°	145°/215°	150°/210°				Compass

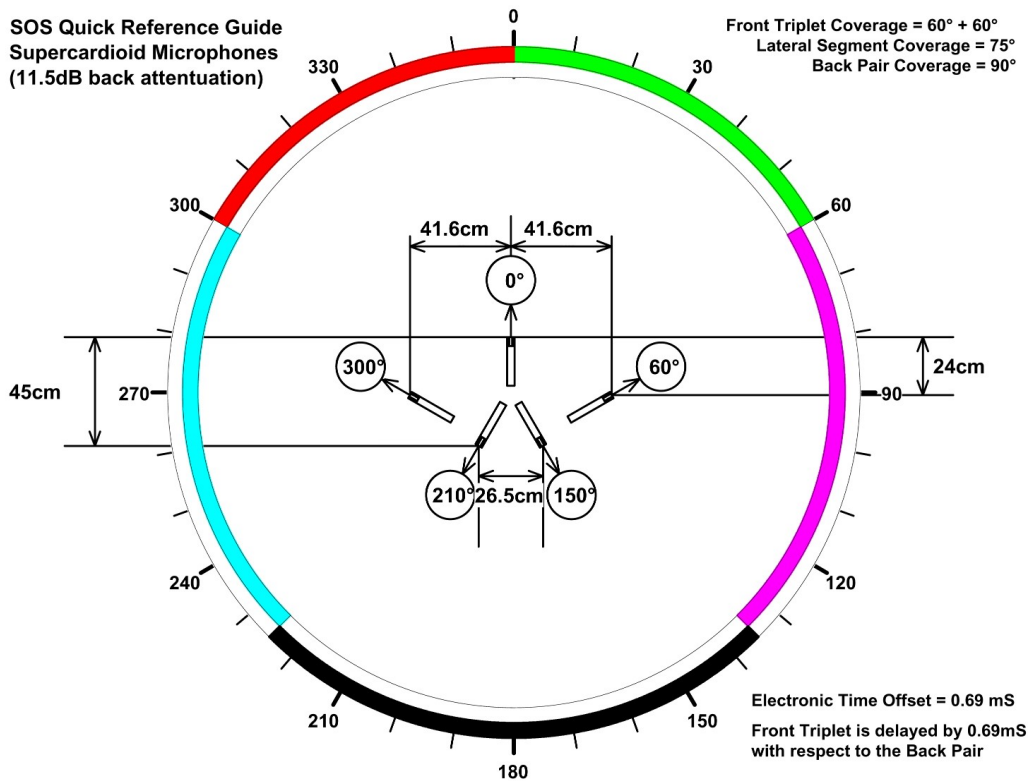


Figure 26 - FTC 60°+60° (b = 60°), LSC 75°, BPC 90° (b = 60°), ETO 0.69mS