

# Frequency Mixer

# RAY-3+

## Typical Performance Data

RF (IN) (MHz)	LO (MHz)	CONVERSION LOSS IF FIXED @IF(OUT)=30MHz (dB)			RF (IN) (MHz)	LO (MHz)	IP3 INPUT (dBm)			RF (IN) (MHz)	LO (MHz)	COMPRESSION @RF IN=+15dBm (dB)		
		@LO (dBm)					@LO (dBm)					@LO (dBm)		
		+20	+23	+26			+20	+23	+26			+20	+23	+26
0.1	30.1	5.89	5.77	5.83	10.1	40.1	33.36	32.21	33.61	10.1	40.1	1.07	1.12	0.90
0.2	30.2	5.65	5.58	5.67	22.7	52.7	29.70	31.63	34.32	22.7	52.7	1.14	1.35	1.14
1.0	31.0	5.40	5.29	5.40	35.2	65.2	29.29	36.54	29.99	35.2	65.2	1.16	1.00	0.76
5.0	35.0	5.13	5.23	5.19	47.8	77.8	29.67	32.76	28.74	47.8	77.8	1.18	0.90	0.68
10.1	40.1	4.93	4.83	4.78	60.4	90.4	42.35	28.51	27.12	60.4	90.4	1.16	0.83	0.62
22.7	52.7	4.88	4.82	4.79	72.9	102.9	31.18	26.91	26.63	72.9	102.9	1.09	0.71	0.55
35.2	65.2	4.91	4.84	4.81	85.5	115.5	30.70	27.29	26.54	85.5	115.5	1.12	0.56	0.39
47.8	77.8	4.91	4.85	4.82	98.0	128.0	27.17	25.18	25.05	98.0	128.0	1.06	0.54	0.40
60.4	90.4	4.89	4.84	4.82	110.6	140.6	24.02	23.15	23.48	110.6	140.6	0.94	0.58	0.47
72.9	102.9	4.91	4.85	4.82	123.2	153.2	24.33	23.68	24.23	123.2	153.2	0.91	0.44	0.33
85.5	115.5	4.93	4.89	4.86	135.7	165.7	24.76	23.92	25.09	135.7	165.7	0.91	0.44	0.33
98.0	128.0	4.98	4.92	4.91	148.3	178.3	24.69	24.55	25.70	148.3	178.3	0.91	0.36	0.25
110.6	140.6	4.94	4.89	4.88	160.9	190.9	22.91	22.59	23.58	160.9	190.9	0.95	0.36	0.26
123.2	153.2	4.97	4.93	4.93	173.4	203.4	24.45	23.07	23.41	173.4	203.4	1.07	0.43	0.30
148.3	178.3	5.10	4.99	4.95	186.0	216.0	23.14	21.99	24.33	186.0	216.0	1.22	0.47	0.28
160.9	190.9	5.20	5.10	5.02	198.6	228.6	21.29	22.63	25.47	198.6	228.6	1.41	0.49	0.29
173.4	203.4	5.22	5.16	5.15	211.1	241.1	21.41	23.08	24.93	211.1	241.1	1.54	0.69	0.54
186.0	216.0	5.29	5.25	5.27	223.7	253.7	21.47	22.91	23.57	223.7	253.7	1.70	0.85	0.66
198.6	228.6	5.34	5.36	5.43	236.3	266.3	20.72	22.21	23.43	236.3	266.3	1.77	0.91	0.66
211.1	241.1	5.48	5.47	5.49	248.8	278.8	18.81	22.36	25.06	248.8	278.8	1.81	1.04	0.73
223.7	253.7	5.58	5.53	5.52	261.4	291.4	15.59	20.29	25.49	261.4	291.4	1.81	1.20	0.85
248.8	278.8	5.84	5.62	5.56	273.9	303.9	14.71	17.61	22.45	273.9	303.9	1.82	1.27	0.95
261.4	291.4	6.12	5.72	5.51	286.5	316.5	15.44	17.06	20.64	286.5	316.5	1.78	1.35	1.03
273.9	303.9	6.28	5.88	5.62	299.1	329.1	15.59	16.52	18.41	299.1	329.1	1.68	1.43	1.12
286.5	316.5	6.29	5.99	5.84	311.6	341.6	16.56	17.63	18.73	311.6	341.6	1.56	1.48	1.24
299.1	329.1	6.43	6.22	6.14	324.2	354.2	17.15	18.76	20.00	324.2	354.2	1.47	1.34	1.22
311.6	341.6	6.69	6.41	6.30	336.8	366.8	17.44	19.50	22.64	336.8	366.8	1.47	1.27	1.27
324.2	354.2	6.80	6.56	6.41	349.3	379.3	18.35	21.73	27.23	349.3	379.3	1.63	1.35	1.45
349.3	379.3	6.71	6.55	6.34	361.9	391.9	20.12	26.80	26.68	361.9	391.9	1.73	1.29	1.47
361.9	391.9	6.84	6.67	6.49	374.5	404.5	22.88	28.16	23.90	374.5	404.5	1.81	1.21	1.39
374.5	404.5	7.09	6.99	6.92	387.0	417.0	25.65	25.45	22.42	387.0	417.0	1.82	1.15	1.36
387.0	417.0	7.21	7.20	7.26	399.6	429.6	24.49	23.63	22.80	399.6	429.6	1.74	1.20	1.34
399.6	429.6	7.32	7.36	7.53	412.2	442.2	23.89	24.11	24.48	412.2	442.2	1.68	1.13	1.17
412.2	442.2	7.64	7.71	7.94	424.7	454.7	22.87	23.83	24.26	424.7	454.7	1.71	0.85	0.85
424.7	454.7	8.16	8.27	8.53	437.3	467.3	21.52	22.66	23.96	437.3	467.3	1.73	0.59	0.64
437.3	467.3	8.48	8.66	8.88	449.8	479.8	21.20	22.19	23.96	449.8	479.8	1.71	0.49	0.57
449.8	479.8	8.71	8.90	9.11	462.4	492.4	20.32	21.42	22.68	462.4	492.4	1.65	0.49	0.60
475.0	505.0	9.73	9.84	10.02	475.0	505.0	20.47	21.63	22.79	475.0	505.0	1.58	0.53	0.71
487.5	517.5	10.24	10.31	10.45	487.5	517.5	20.22	21.24	22.40	487.5	517.5	1.50	0.53	0.80
500.1	530.1	10.57	10.57	10.64	500.1	530.1	21.20	21.05	21.79	500.1	530.1	1.37	0.62	1.03

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# Frequency Mixer

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## Typical Performance Data

IF (OUT) (MHz)	LO (MHz)	CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=100.1MHz (dB)	IF (OUT) (MHz)	LO (MHz)	CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=10.1MHz (dB)	IF (OUT) (MHz)	LO (MHz)	CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=200.1MHz (dB)
		@LO (dBm)			@LO (dBm)			@LO (dBm)
		+23			+23			+23
0.5	99.6	4.89	0.5	10.6	4.80	0.5	199.6	5.28
0.6	99.5	4.88	0.6	10.7	4.78	0.6	199.5	5.26
0.7	99.4	4.86	0.7	10.8	4.76	0.7	199.4	5.25
0.7	99.4	4.85	0.8	10.9	4.74	0.8	199.3	5.23
0.9	99.2	4.83	0.9	11.0	4.74	0.9	199.2	5.22
1.0	99.1	4.83	1.1	11.2	4.72	1.1	199.0	5.21
1.1	99.0	4.82	1.2	11.3	4.72	1.2	198.9	5.21
1.3	98.8	4.82	1.5	11.6	4.72	1.5	198.6	5.21
1.5	98.6	4.82	1.7	11.8	4.72	1.7	198.4	5.21
1.7	98.4	4.82	2.0	12.1	4.71	2.0	198.1	5.20
1.9	98.2	4.81	2.3	12.4	4.71	2.3	197.8	5.20
2.2	97.9	4.81	2.7	12.8	4.70	2.7	197.4	5.19
2.5	97.6	4.80	3.1	13.2	4.72	3.1	197.0	5.20
2.8	97.3	4.80	3.6	13.7	4.72	3.6	196.5	5.20
3.2	96.9	4.80	4.2	14.3	4.73	4.2	195.9	5.20
3.7	96.4	4.79	4.9	15.0	4.72	4.9	195.2	5.20
4.2	95.9	4.79	5.7	15.8	4.72	5.7	194.4	5.20
4.8	95.3	4.80	6.7	16.8	4.72	6.7	193.4	5.21
5.5	94.6	4.80	7.8	17.9	4.73	7.8	192.3	5.21
6.3	93.8	4.81	9.0	19.1	4.73	9.0	191.1	5.21
7.2	92.9	4.82	10.5	20.6	4.74	10.5	189.6	5.23
8.2	91.9	4.80	12.2	22.3	4.74	12.2	187.9	5.24
9.4	90.7	4.81	14.3	24.4	4.74	14.3	185.8	5.28
10.7	89.4	4.80	16.6	26.7	4.76	16.6	183.5	5.26
12.2	87.9	4.80	19.3	29.4	4.76	19.3	180.8	5.26
14.0	86.1	4.80	22.5	32.6	4.77	22.5	177.6	5.24
15.9	84.2	4.80	26.2	36.3	4.78	26.2	173.9	5.24
18.2	81.9	4.82	30.5	40.6	4.80	30.5	169.6	5.26
20.8	79.3	4.82	35.6	45.7	4.80	35.6	164.5	5.28
23.8	76.3	4.83	41.4	51.5	4.80	41.4	158.7	5.30
27.2	72.9	4.84	48.2	58.3	4.84	48.2	151.9	5.30
31.0	69.1	4.86	56.2	66.3	4.86	56.2	143.9	5.25
35.4	64.7	4.86	65.4	75.5	4.87	65.4	134.7	5.26
40.5	59.6	4.88	76.2	86.3	4.90	76.2	123.9	5.25
46.2	53.9	4.87	88.7	98.8	4.93	88.7	111.4	5.30
52.8	47.3	4.87	103.3	113.4	5.01	103.3	96.8	5.34
60.4	39.7	4.91	120.3	130.4	5.13	120.3	79.8	5.40
69.0	31.1	4.93	140.1	150.2	5.08	140.1	60.0	5.43
78.8	21.3	4.97	163.2	173.3	5.20	163.2	36.9	5.54
90.0	10.1	5.05	190.0	200.1	5.55	190.0	10.1	5.78

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## Typical Performance Data

LO (MHz)	LO-RF ISOLATION (dB)			LO-IF ISOLATION (dB)		
	@LO (dBm)			@LO (dBm)		
	+20	+23	+26	+20	+23	+26
0.1	55.50	55.55	56.16	56.70	56.68	56.98
0.2	53.87	53.15	52.66	56.88	57.09	57.21
1.0	53.43	52.74	52.25	56.80	57.07	57.32
5.0	53.20	52.57	51.95	56.66	56.88	57.11
10.1	75.42	75.64	81.10	67.26	65.43	64.69
22.7	69.15	69.18	75.05	62.79	61.36	61.68
35.2	65.33	65.21	71.10	57.84	58.40	59.83
47.8	62.72	62.82	70.06	55.63	57.58	58.92
60.4	61.26	61.49	66.50	52.68	54.62	55.97
72.9	59.11	59.22	66.18	51.78	53.19	53.87
85.5	59.46	59.62	65.69	50.52	51.66	51.81
98.0	58.97	59.08	66.90	47.56	48.48	49.05
110.6	54.81	54.83	58.90	48.64	49.24	48.69
123.2	55.36	55.36	57.68	46.35	47.42	46.99
148.3	53.82	53.91	50.53	45.12	45.75	45.42
160.9	51.89	51.85	48.72	44.37	44.83	42.59
173.4	46.67	46.68	52.43	43.92	43.59	41.61
186.0	46.43	46.49	55.18	41.42	40.47	38.73
198.6	46.24	46.25	50.99	39.29	38.35	36.89
211.1	44.71	44.77	45.37	39.41	37.09	34.69
223.7	45.23	45.30	40.51	38.85	35.37	33.60
248.8	47.98	48.04	37.10	36.67	33.22	32.29
261.4	55.75	55.72	49.35	36.90	32.86	31.29
273.9	53.31	53.33	41.90	36.32	31.63	29.49
286.5	50.56	50.66	40.45	35.77	30.65	27.85
299.1	44.67	44.80	39.40	32.37	29.02	26.31
311.6	42.11	42.15	37.71	31.57	28.11	24.70
324.2	42.11	42.11	37.71	31.62	28.22	25.13
349.3	46.49	46.52	37.65	31.10	26.00	23.12
361.9	40.60	40.63	31.88	29.00	23.62	20.67
374.5	35.40	35.43	28.06	25.08	20.59	17.95
387.0	31.56	31.58	25.69	21.61	17.93	15.87
399.6	28.93	28.96	24.05	19.25	16.25	14.45
412.2	27.67	27.70	23.35	18.28	15.55	13.83
424.7	27.70	27.74	24.47	18.65	15.97	14.50
437.3	27.52	27.55	24.76	19.10	16.43	14.96
449.8	26.52	26.53	23.48	18.93	16.33	14.75
475.0	22.83	22.85	19.69	16.27	14.24	12.77
487.5	20.69	20.71	18.13	14.61	12.85	11.61
500.1	19.29	19.31	17.16	13.53	11.98	10.84

RF (IN) (MHz)	LO (MHz)	RF-IF ISOLATION (dB)		
		@LO (dBm)		
		+20	+23	+26
10.1	40.1	35.61	33.91	30.85
22.7	52.7	30.62	29.88	27.84
35.2	65.2	28.69	28.46	28.17
47.8	77.8	26.96	27.05	27.20
60.4	90.4	25.61	25.75	26.23
72.9	102.9	25.02	25.19	25.59
85.5	115.5	25.43	25.58	25.78
98.0	128.0	25.17	25.70	26.09
110.6	140.6	24.61	25.08	25.08
123.2	153.2	24.89	25.58	26.15
135.7	165.7	25.22	25.93	26.80
148.3	178.3	25.45	26.11	26.80
160.9	190.9	25.67	26.23	26.81
173.4	203.4	24.59	25.37	26.38
186.0	216.0	22.52	23.05	23.55
198.6	228.6	20.21	20.49	21.22
211.1	241.1	18.63	18.82	19.79
223.7	253.7	17.25	17.36	17.52
236.3	266.3	16.50	16.63	16.58
248.8	278.8	15.93	16.10	16.17
261.4	291.4	15.61	15.90	16.18
273.9	303.9	15.79	16.24	16.58
286.5	316.5	15.49	16.15	17.05
299.1	329.1	14.92	15.33	16.06
311.6	341.6	15.05	15.26	15.40
324.2	354.2	15.23	15.37	15.27
336.8	366.8	14.76	14.84	14.57
349.3	379.3	14.31	14.14	13.85
361.9	391.9	13.64	13.23	12.94
374.5	404.5	12.55	12.09	11.73
387.0	417.0	11.43	11.00	10.58
399.6	429.6	10.61	10.13	9.36
412.2	442.2	9.93	9.39	8.72
424.7	454.7	9.08	8.62	8.19
437.3	467.3	8.39	7.98	7.66
449.8	479.8	7.74	7.45	7.18
462.4	492.4	7.15	6.98	6.80
475.0	505.0	6.67	6.59	6.51
487.5	517.5	6.33	6.28	6.26
500.1	530.1	6.28	6.19	6.17

## Typical Performance Data

RF (IN) (MHz)	LO (MHz)	RF VSWR (:1)			LO (MHz)	LO VSWR (:1)			IF (OUT) (MHz)	IF VSWR @LO=200.1MHz (:1)		
		@LO (dBm)				@LO (dBm)				@LO (dBm)		
		+20	+23	+26		+20	+23	+26		+20	+23	+26
5.0	35.0	1.25	1.17	1.15	35.0	1.79	2.42	3.01	0.5	1.49	1.41	1.33
10.0	40.0	1.25	1.18	1.15	40.0	1.79	2.40	3.09	0.6	1.47	1.37	1.27
22.7	52.7	1.22	1.15	1.10	22.7	1.59	2.14	2.55	0.7	1.48	1.38	1.25
35.2	65.2	1.22	1.15	1.09	35.2	1.47	1.85	2.09	0.8	1.51	1.40	1.26
47.8	77.8	1.18	1.11	1.07	47.8	1.45	1.84	2.10	0.9	1.59	1.46	1.30
60.4	90.4	1.15	1.08	1.04	60.4	1.59	2.11	2.50	1.1	1.65	1.50	1.34
72.9	102.9	1.14	1.07	1.02	72.9	1.80	2.63	3.36	1.3	1.70	1.55	1.38
85.5	115.5	1.09	1.04	1.03	85.5	1.94	2.99	4.09	1.5	1.73	1.58	1.40
98.0	128.0	1.08	1.03	1.05	98.0	1.88	2.78	3.68	1.7	1.76	1.60	1.42
110.6	140.6	1.09	1.06	1.08	110.6	1.72	2.33	2.81	2.0	1.77	1.62	1.43
123.2	153.2	1.09	1.07	1.09	123.2	1.60	2.04	2.30	2.3	1.77	1.61	1.43
135.7	165.7	1.09	1.11	1.14	135.7	1.58	1.98	2.25	2.7	1.76	1.60	1.43
148.3	178.3	1.07	1.12	1.18	148.3	1.70	2.18	2.52	3.2	1.74	1.59	1.41
160.9	190.9	1.08	1.14	1.21	160.9	1.96	2.70	3.28	3.7	1.72	1.57	1.40
173.4	203.4	1.14	1.20	1.26	173.4	2.20	3.19	4.28	4.3	1.70	1.56	1.38
186.0	216.0	1.21	1.29	1.33	186.0	2.19	3.11	4.04	5.0	1.69	1.55	1.37
198.6	228.6	1.29	1.36	1.39	198.6	2.04	2.73	3.26	5.8	1.68	1.52	1.36
211.1	241.1	1.37	1.41	1.43	211.1	1.90	2.43	2.77	6.8	1.66	1.51	1.35
223.7	253.7	1.38	1.40	1.39	223.7	1.84	2.32	2.65	7.9	1.65	1.51	1.35
236.3	266.3	1.34	1.35	1.33	236.3	1.91	2.42	2.78	9.3	1.65	1.51	1.34
248.8	278.8	1.34	1.36	1.33	248.8	2.17	2.87	3.37	10.8	1.65	1.50	1.33
261.4	291.4	1.34	1.33	1.28	261.4	2.49	3.43	4.43	12.6	1.65	1.51	1.34
273.9	303.9	1.31	1.26	1.18	273.9	2.61	3.51	4.38	14.7	1.65	1.51	1.34
286.5	316.5	1.25	1.20	1.17	286.5	2.54	3.30	3.90	17.1	1.66	1.52	1.35
299.1	329.1	1.26	1.21	1.17	299.1	2.43	3.08	3.52	20.0	1.66	1.51	1.35
311.6	341.6	1.28	1.18	1.08	311.6	2.37	2.95	3.34	23.3	1.67	1.53	1.36
324.2	354.2	1.21	1.12	1.09	324.2	2.39	2.96	3.34	27.1	1.68	1.53	1.36
336.8	366.8	1.13	1.09	1.13	336.8	2.52	3.13	3.48	31.7	1.70	1.55	1.37
349.3	379.3	1.12	1.11	1.16	349.3	2.69	3.38	3.91	36.9	1.71	1.56	1.38
361.9	391.9	1.22	1.21	1.25	361.9	2.79	3.52	4.11	43.0	1.73	1.58	1.40
374.5	404.5	1.35	1.34	1.39	374.5	2.85	3.58	4.16	50.2	1.76	1.60	1.42
387.0	417.0	1.40	1.42	1.51	387.0	2.91	3.63	4.15	58.5	1.80	1.63	1.44
399.6	429.6	1.46	1.47	1.61	399.6	2.92	3.58	4.00	68.2	1.83	1.68	1.49
412.2	442.2	1.57	1.60	1.72	412.2	2.76	3.34	3.70	79.6	1.88	1.72	1.54
424.7	454.7	1.71	1.73	1.85	424.7	2.48	2.91	3.15	92.8	1.94	1.78	1.59
437.3	467.3	1.76	1.77	1.88	437.3	2.40	2.75	2.93	108.2	2.04	1.87	1.67
449.8	479.8	1.77	1.78	1.86	449.8	2.52	2.93	3.25	126.1	2.15	1.96	1.77
475.0	505.0	1.87	1.85	1.90	475.0	3.02	3.58	4.01	147.1	2.31	2.12	1.89
487.5	517.5	1.91	1.90	1.93	487.5	3.16	3.70	4.01	171.5	2.49	2.31	2.09
500.1	530.1	1.92	1.89	1.91	500.1	2.85	3.26	3.48	200.0	2.78	2.61	2.38

## Harmonics Tables

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	-	-	19	34	18	29	20	38	26	55	35	55
1	-	20	+0	28	12	39	17	36	31	42	60	48
2	98	60	50	59	50	61	51	61	59	76	76	76
3	111	61	52	62	53	66	54	63	65	66	63	76
4	>125	81	81	81	77	82	77	82	75	105	85	87
5	>125	86	79	82	79	82	80	85	81	83	88	86
6	>126	103	97	106	96	103	94	99	95	96	94	100
7	>126	109	103	107	113	102	109	102	100	106	99	104
8	>125	117	111	108	103	109	102	105	102	106	104	105
9	>125	119	123	117	112	118	110	114	109	>115	111	118
10	>126	>129	125	>126	121	118	116	116	113	115	113	120
	RF CAL	0	1	2	3	4	5	6	7	8	9	10

### LO HARMONICS ORDER

Test conditions: RF IN: 100.1 MHz; .02.00 dBm.  
 LO IN: 130.01 MHz; +23.00 dBm  
 IF OUT: 29.91 MHz; -5 dBm

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	-	-	28	45	29	40	31	48	37	68	46	72
1	-	21	+0	28	12	37	18	39	30	45	45	50
2	89	58	52	58	53	57	55	59	63	82	64	76
3	100	48	42	53	41	52	41	51	47	51	57	58
4	119	72	62	75	60	73	60	71	59	71	67	77
5	>121	73	54	64	56	62	56	60	57	59	62	66
6	>121	81	70	77	73	75	71	77	74	76	74	90
7	121	79	75	78	67	74	64	78	65	73	65	79
8	>121	88	85	83	82	86	82	84	80	86	79	82
9	>121	88	80	83	87	80	79	78	81	81	79	79
10	>120	107	108	101	105	94	96	95	88	94	87	101
	RF CAL	0	1	2	3	4	5	6	7	8	9	10

### LO HARMONICS ORDER

Test conditions: RF IN: 100.1 MHz; 10.00 dBm.  
 LO IN: 130.01 MHz; +23.00 dBm  
 IF OUT: 29.91 MHz; 5.01 dBm

- Notes: 1. All Harmonics are in (dBc) relative to IF OUTPUT.  
 2. + entry denotes harmonics are in (dBc) above IF OUTPUT.  
 3. RF Cal represent the Harmonics level of the RF input signal to the mixer.

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