

# Frequency Mixer

# TUF-5X+

## 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=+1dBm (dB)		
		@LO (dBm)					@LO (dBm)					@LO (dBm)		
		+4	+7	+10			+4	+7	+10			+4	+7	+10
10.1	40.1	6.01	5.72	5.31	10.1	40.1	15.19	17.45	18.29	10.1	40.1	1.01	1.17	0.94
70.1	100.1	6.36	6.07	5.90	70.1	100.1	11.30	13.15	17.16	70.1	100.1	1.23	0.90	0.65
130.1	160.1	6.55	6.22	6.05	130.1	160.1	12.87	17.68	20.98	130.1	160.1	1.25	0.92	0.70
190.1	220.1	6.59	6.28	6.11	190.1	220.1	17.93	14.78	14.99	190.1	220.1	1.51	1.16	0.91
250.1	280.1	6.78	6.44	6.23	250.1	280.1	15.33	14.15	15.18	250.1	280.1	1.37	1.07	0.85
310.1	340.1	6.73	6.39	6.19	310.1	340.1	13.02	13.44	15.39	310.1	340.1	1.48	1.19	0.96
370.1	400.1	6.70	6.36	6.18	370.1	400.1	12.12	12.99	15.22	370.1	400.1	1.74	1.43	1.19
430.1	460.1	6.93	6.54	6.31	430.1	460.1	10.25	11.71	13.57	430.1	460.1	1.59	1.33	1.14
470.1	500.1	6.86	6.51	6.29	470.1	500.1	9.55	11.14	13.59	470.1	500.1	1.74	1.45	1.23
530.1	560.1	7.10	6.69	6.44	530.1	560.1	8.03	9.59	11.50	530.1	560.1	1.62	1.36	1.19
570.1	600.1	7.03	6.66	6.43	570.1	600.1	7.80	9.35	10.72	570.1	600.1	1.67	1.42	1.22
630.1	660.1	7.15	6.76	6.51	630.1	660.1	7.54	9.36	10.85	630.1	660.1	1.63	1.37	1.21
670.1	700.1	7.11	6.77	6.54	670.1	700.1	7.17	8.58	10.01	670.1	700.1	1.62	1.32	1.14
730.1	760.1	7.04	6.67	6.45	730.1	760.1	7.73	9.98	12.16	730.1	760.1	1.65	1.38	1.20
770.1	800.1	7.00	6.62	6.43	770.1	800.1	7.55	9.50	11.93	770.1	800.1	1.64	1.38	1.19
830.1	860.1	7.00	6.57	6.35	830.1	860.1	9.11	10.08	11.69	830.1	860.1	1.58	1.35	1.16
870.1	900.1	7.09	6.63	6.38	870.1	900.1	9.32	10.61	11.77	870.1	900.1	1.52	1.32	1.14
930.1	960.1	7.11	6.62	6.36	930.1	960.1	10.47	12.53	13.62	930.1	960.1	1.47	1.28	1.12
970.1	1000.1	7.24	6.76	6.45	970.1	1000.1	8.97	11.45	12.97	970.1	1000.1	1.34	1.13	1.03
1030.1	1060.1	7.25	6.84	6.54	1030.1	1060.1	7.31	8.71	10.34	1030.1	1060.1	1.29	1.00	0.88
1070.1	1100.1	7.24	6.87	6.59	1070.1	1100.1	6.64	7.54	8.59	1070.1	1100.1	1.30	0.96	0.80
1130.1	1160.1	7.30	6.93	6.68	1130.1	1160.1	6.44	7.06	7.86	1130.1	1160.1	1.30	0.93	0.74
1170.1	1200.1	7.24	6.88	6.63	1170.1	1200.1	6.96	7.86	8.74	1170.1	1200.1	1.42	1.00	0.77
1230.1	1260.1	7.31	6.91	6.66	1230.1	1260.1	8.68	10.81	12.17	1230.1	1260.1	1.36	0.90	0.64
1270.1	1300.1	7.27	6.88	6.67	1270.1	1300.1	8.93	11.12	13.46	1270.1	1300.1	1.49	0.92	0.62
1330.1	1360.1	7.30	6.93	6.75	1330.1	1360.1	9.79	12.92	15.59	1330.1	1360.1	1.35	0.71	0.43
1370.1	1400.1	7.35	7.00	6.84	1370.1	1400.1	9.75	13.09	15.40	1370.1	1400.1	1.41	0.69	0.40
1430.1	1460.1	7.44	7.11	6.95	1430.1	1460.1	10.56	13.96	15.31	1430.1	1460.1	1.19	0.54	0.30
1470.1	1500.1	7.61	7.28	7.14	1470.1	1500.1	9.81	13.54	15.10	1470.1	1500.1	1.27	0.55	0.30
1530.1	1560.1	7.77	7.41	7.27	1530.1	1560.1	9.76	13.68	15.03	1530.1	1560.1	1.17	0.48	0.25
1570.1	1600.1	8.03	7.65	7.52	1570.1	1600.1	9.08	13.52	15.71	1570.1	1600.1	1.25	0.51	0.26
1630.1	1660.1	8.25	7.86	7.73	1630.1	1660.1	9.70	14.13	17.24	1630.1	1660.1	1.13	0.47	0.23
1670.1	1700.1	8.57	8.15	8.01	1670.1	1700.1	9.53	13.88	17.80	1670.1	1700.1	1.18	0.51	0.24
1730.1	1760.1	8.83	8.41	8.29	1730.1	1760.1	11.31	15.03	18.59	1730.1	1760.1	1.09	0.50	0.24
1770.1	1800.1	9.18	8.70	8.58	1770.1	1800.1	12.22	14.84	18.25	1770.1	1800.1	1.13	0.54	0.26
1830.1	1860.1	9.46	8.99	8.87	1830.1	1860.1	10.49	15.09	18.20	1830.1	1860.1	1.16	0.62	0.31
1870.1	1900.1	9.81	9.29	9.13	1870.1	1900.1	8.50	13.63	18.28	1870.1	1900.1	1.25	0.73	0.37
1930.1	1960.1	10.13	9.58	9.38	1930.1	1960.1	6.65	11.55	17.59	1930.1	1960.1	1.30	0.80	0.47
1970.1	2000.1	10.50	9.85	9.59	1970.1	2000.1	5.60	9.82	16.58	1970.1	2000.1	1.39	0.92	0.55
2030.1	2060.1	10.84	10.13	9.80	2030.1	2060.1	5.42	9.33	16.40	2030.1	2060.1	1.42	0.99	0.65

## Typical Performance Data

IF (OUT) (MHz)	LO (MHz)	CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=750.1MHz (dB)
		@LO (dBm)
		+7
740.0	10.1	6.76
720.0	30.1	6.79
700.0	50.1	6.77
680.0	70.1	6.77
660.0	90.1	6.71
640.0	110.1	6.70
620.0	130.1	6.72
600.0	150.1	6.65
580.0	170.1	6.67
560.0	190.1	6.55
540.0	210.1	6.58
520.0	230.1	6.56
500.0	250.1	6.64
480.0	270.1	6.61
460.0	290.1	6.52
440.0	310.1	6.54
420.0	330.1	6.48
400.0	350.1	6.44
380.0	370.1	6.53
360.0	390.1	6.47
340.0	410.1	6.58
320.0	430.1	6.53
300.0	450.1	6.46
280.0	470.1	6.50
260.0	490.1	6.51
240.0	510.1	6.40
220.0	530.1	6.56
200.0	550.1	6.53
180.0	570.1	6.48
160.0	590.1	6.48
140.0	610.1	6.52
130.0	620.1	6.62
110.0	640.1	6.58
100.0	650.1	6.65
80.0	670.1	6.72
70.0	680.1	6.58
50.0	700.1	6.61
40.0	710.1	6.59
20.0	730.1	6.58
10.0	740.1	6.98

IF (OUT) (MHz)	LO (MHz)	CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=10.1MHz (dB)
		@LO (dBm)
		+7
10.0	20.1	6.33
50.0	60.1	5.83
90.0	100.1	5.36
130.0	140.1	5.71
170.0	180.1	5.59
210.0	220.1	5.45
250.0	260.1	5.37
290.0	300.1	5.66
330.0	340.1	5.89
370.0	380.1	5.48
410.0	420.1	5.61
450.0	460.1	5.67
490.0	500.1	5.78
530.0	540.1	5.51
570.0	580.1	5.66
610.0	620.1	5.69
650.0	660.1	5.90
690.0	700.1	6.24
730.0	740.1	5.87
770.0	780.1	6.08
810.0	820.1	5.81
850.0	860.1	6.20
890.0	900.1	6.28
930.0	940.1	6.61
970.0	980.1	6.90
1010.0	1020.1	6.76
1050.0	1060.1	7.13
1090.0	1100.1	7.14
1130.0	1140.1	7.69
1170.0	1180.1	7.90
1210.0	1220.1	8.18
1250.0	1260.1	8.24
1290.0	1300.1	8.25
1330.0	1340.1	8.71
1370.0	1380.1	8.92
1430.0	1440.1	9.09
1470.0	1480.1	9.53
1530.0	1540.1	10.07
1570.0	1580.1	10.35
1630.0	1640.1	10.47

IF (OUT) (MHz)	LO (MHz)	CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=1500.1MHz (dB)
		@LO (dBm)
		+7
1490.0	10.1	10.39
1450.0	50.1	10.04
1410.0	90.1	9.62
1370.0	130.1	9.25
1330.0	170.1	9.08
1290.0	210.1	8.76
1250.0	250.1	8.50
1210.0	290.1	8.35
1170.0	330.1	8.12
1130.0	370.1	8.01
1090.0	410.1	7.84
1050.0	450.1	7.69
1010.0	490.1	7.59
970.0	530.1	7.48
930.0	570.1	7.41
890.0	610.1	7.25
850.0	650.1	7.16
810.0	690.1	7.09
770.0	730.1	7.03
730.0	770.1	6.95
690.0	810.1	7.04
650.0	850.1	7.05
610.0	890.1	7.10
570.0	930.1	7.15
530.0	970.1	7.15
490.0	1010.1	7.07
450.0	1050.1	7.16
410.0	1090.1	7.10
370.0	1130.1	6.96
330.0	1170.1	7.09
290.0	1210.1	7.16
250.0	1250.1	7.16
210.0	1290.1	7.21
190.0	1310.1	7.21
150.0	1350.1	7.23
130.0	1370.1	7.23
90.0	1410.1	7.26
70.0	1430.1	7.25
30.0	1470.1	7.31
10.0	1490.1	7.67

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# TUF-5X+

## Typical Performance Data

LO (MHz)	LO-RF ISOLATION (dB)			LO-IF ISOLATION (dB)			RF (IN) (MHz)	LO (MHz)	RF-IF ISOLATION (dB)		
	@LO (dBm)			@LO (dBm)					@LO (dBm)		
	+4	+7	+10	+4	+7	+10			+4	+7	+10
40.1	54.68	51.61	49.88	51.07	50.36	49.85	10.1	40.1	47.97	48.17	46.72
100.1	50.10	46.12	44.01	44.13	43.59	43.10	70.1	100.1	32.73	32.65	32.61
160.1	47.93	43.74	41.37	40.68	40.02	39.47	130.1	160.1	28.34	28.34	28.35
220.1	45.81	42.17	39.72	38.47	37.77	37.21	190.1	220.1	25.66	25.72	25.77
280.1	42.38	40.14	38.01	36.57	35.83	35.29	250.1	280.1	24.51	24.63	24.74
340.1	38.69	37.67	36.16	35.04	34.39	33.88	310.1	340.1	23.79	24.00	24.15
400.1	36.05	35.99	35.10	33.63	33.00	32.52	370.1	400.1	23.38	23.65	23.85
460.1	33.49	33.90	33.38	32.51	32.01	31.60	430.1	460.1	23.58	23.82	23.99
500.1	32.26	32.98	32.74	31.65	31.18	30.81	470.1	500.1	23.40	23.67	23.80
560.1	30.29	31.05	31.16	30.78	30.28	29.91	530.1	560.1	23.21	23.54	24.05
600.1	29.58	30.29	30.34	30.31	29.89	29.56	570.1	600.1	22.69	23.02	23.34
660.1	28.09	29.06	29.20	29.56	29.17	28.87	630.1	660.1	20.92	21.12	21.06
700.1	27.54	28.92	29.24	29.15	28.87	28.60	670.1	700.1	20.05	20.07	20.10
760.1	26.10	27.90	28.76	28.48	28.29	28.08	730.1	760.1	18.59	18.60	18.74
800.1	25.81	27.54	28.43	28.18	28.00	27.82	770.1	800.1	17.76	17.88	17.89
860.1	24.82	26.59	27.87	27.81	27.74	27.57	830.1	860.1	17.33	17.30	17.30
900.1	24.46	26.05	27.34	27.57	27.55	27.44	870.1	900.1	17.12	17.11	17.12
960.1	23.98	25.59	27.08	27.36	27.35	27.37	930.1	960.1	16.99	16.99	16.94
1000.1	23.75	25.15	26.40	27.32	27.38	27.32	970.1	1000.1	17.09	17.06	17.06
1060.1	23.99	25.64	26.84	27.30	27.47	27.50	1030.1	1060.1	17.18	17.13	17.09
1100.1	23.85	25.65	26.90	27.40	27.60	27.63	1070.1	1100.1	17.32	17.38	17.31
1160.1	23.62	25.83	27.58	27.67	27.92	28.00	1130.1	1160.1	17.59	17.76	17.73
1200.1	23.17	25.42	27.35	27.93	28.19	28.33	1170.1	1200.1	17.60	17.71	17.71
1260.1	23.01	25.26	27.21	28.44	28.72	28.82	1230.1	1260.1	17.28	17.24	17.16
1300.1	22.61	24.71	26.57	28.89	29.15	29.31	1270.1	1300.1	16.77	16.66	16.48
1360.1	22.65	24.56	26.15	29.62	29.89	29.96	1330.1	1360.1	15.50	15.18	14.92
1400.1	22.48	24.27	25.71	30.14	30.49	30.61	1370.1	1400.1	14.65	14.22	13.94
1460.1	22.67	24.22	25.34	31.16	31.71	32.01	1430.1	1460.1	13.43	12.92	12.59
1500.1	22.65	24.14	25.15	31.50	32.15	32.64	1470.1	1500.1	12.76	12.11	11.68
1560.1	22.88	24.00	24.75	32.98	33.90	34.81	1530.1	1560.1	11.64	10.96	10.56
1600.1	22.84	23.88	24.59	33.53	34.53	35.66	1570.1	1600.1	11.09	10.33	9.87
1660.1	23.06	23.84	24.31	35.68	37.30	39.25	1630.1	1660.1	10.10	9.40	8.97
1700.1	22.91	23.63	23.95	36.73	38.65	40.97	1670.1	1700.1	9.71	8.92	8.51
1760.1	23.10	23.60	23.82	40.21	43.93	49.81	1730.1	1760.1	9.02	8.31	7.96
1800.1	22.96	23.31	23.58	42.08	46.96	50.57	1770.1	1800.1	8.75	7.99	7.61
1860.1	23.01	23.35	23.54	45.91	49.29	44.66	1830.1	1860.1	8.36	7.67	7.34
1900.1	22.78	23.19	23.32	42.25	42.84	40.18	1870.1	1900.1	8.28	7.59	7.25
1960.1	22.65	23.10	23.31	39.49	39.29	37.31	1930.1	1960.1	7.96	7.42	7.13
2000.1	22.32	22.74	23.08	35.86	36.05	35.08	1970.1	2000.1	7.91	7.46	7.20
2060.1	21.68	22.22	22.62	33.27	33.50	32.71	2030.1	2060.1	7.50	7.19	6.98

# Frequency Mixer

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## Typical Performance Data

RF (IN) (MHz)	LO (MHz)	RF VSWR (:1)		
		@LO (dBm)		
		+4	+7	+10
10.1	40.1	1.43	1.09	1.06
70.1	100.1	1.18	1.05	1.03
130.1	160.1	1.22	1.09	1.03
190.1	220.1	1.31	1.19	1.12
250.1	280.1	1.36	1.24	1.17
310.1	340.1	1.41	1.28	1.20
370.1	400.1	1.51	1.38	1.30
430.1	460.1	1.58	1.45	1.36
470.1	500.1	1.62	1.49	1.41
530.1	560.1	1.67	1.54	1.46
570.1	600.1	1.72	1.59	1.51
630.1	660.1	1.75	1.64	1.58
670.1	700.1	1.77	1.68	1.63
730.1	760.1	1.75	1.68	1.67
770.1	800.1	1.74	1.66	1.66
830.1	860.1	1.73	1.65	1.66
870.1	900.1	1.74	1.63	1.62
930.1	960.1	1.75	1.64	1.60
970.1	1000.1	1.77	1.66	1.60
1030.1	1060.1	1.77	1.71	1.66
1070.1	1100.1	1.73	1.69	1.66
1130.1	1160.1	1.70	1.68	1.67
1170.1	1200.1	1.61	1.60	1.61
1230.1	1260.1	1.54	1.56	1.62
1270.1	1300.1	1.46	1.51	1.58
1330.1	1360.1	1.42	1.52	1.60
1370.1	1400.1	1.35	1.46	1.55
1430.1	1460.1	1.33	1.46	1.57
1470.1	1500.1	1.26	1.40	1.52
1530.1	1560.1	1.24	1.40	1.53
1570.1	1600.1	1.19	1.38	1.51
1630.1	1660.1	1.19	1.38	1.51
1670.1	1700.1	1.17	1.39	1.54
1730.1	1760.1	1.19	1.41	1.55
1770.1	1800.1	1.19	1.44	1.58
1830.1	1860.1	1.21	1.43	1.57
1870.1	1900.1	1.22	1.44	1.58
1930.1	1960.1	1.21	1.41	1.52
1970.1	2000.1	1.21	1.40	1.51
2030.1	2060.1	1.15	1.30	1.39

LO (MHz)	LO VSWR (:1)		
	@LO (dBm)		
	+4	+7	+10
40.1	1.95	2.96	4.36
100.1	1.90	2.78	3.92
160.1	1.87	2.68	3.68
220.1	1.81	2.54	3.45
280.1	1.92	2.71	3.67
340.1	2.03	2.87	3.90
400.1	2.01	2.80	3.74
460.1	2.04	2.80	3.71
500.1	2.15	2.98	4.02
560.1	2.21	3.02	4.03
600.1	2.30	3.14	4.18
660.1	2.35	3.18	4.20
700.1	2.45	3.30	4.35
760.1	2.51	3.31	4.34
800.1	2.60	3.43	4.47
860.1	2.69	3.51	4.53
900.1	2.78	3.61	4.63
960.1	2.88	3.70	4.72
1000.1	2.95	3.76	4.77
1060.1	3.07	3.86	4.87
1100.1	3.10	3.85	4.83
1160.1	3.18	3.91	4.88
1200.1	3.16	3.83	4.75
1260.1	3.20	3.83	4.75
1300.1	3.20	3.79	4.66
1360.1	3.40	3.95	4.80
1400.1	3.54	4.00	4.77
1460.1	3.83	4.20	4.91
1500.1	4.03	4.27	4.89
1560.1	4.29	4.42	4.98
1600.1	4.51	4.50	4.96
1660.1	4.72	4.60	4.99
1700.1	4.95	4.68	4.96
1760.1	5.13	4.77	4.96
1800.1	5.33	4.82	4.92
1860.1	5.42	4.87	4.89
1900.1	5.61	4.92	4.84
1960.1	5.65	4.92	4.79
2000.1	5.74	4.92	4.72
2060.1	5.72	4.89	4.64

IF (OUT) (MHz)	IF VSWR @LO=1500.1MHz (:1)		
	@LO (dBm)		
	+4	+7	+10
10.1	1.13	1.11	1.13
30.1	1.06	1.04	1.09
50.1	1.05	1.02	1.08
70.1	1.04	1.03	1.08
90.1	1.07	1.01	1.07
110.1	1.05	1.03	1.09
130.1	1.05	1.03	1.09
150.1	1.06	1.03	1.08
190.1	1.06	1.04	1.08
210.1	1.05	1.06	1.12
250.1	1.07	1.08	1.12
270.1	1.06	1.09	1.15
310.1	1.09	1.11	1.16
330.1	1.09	1.10	1.15
370.1	1.13	1.16	1.21
390.1	1.15	1.18	1.22
430.1	1.17	1.19	1.23
450.1	1.22	1.25	1.29
490.1	1.28	1.31	1.35
510.1	1.27	1.30	1.34
550.1	1.37	1.40	1.44
570.1	1.40	1.42	1.45
610.1	1.45	1.47	1.50
630.1	1.53	1.55	1.57
670.1	1.63	1.65	1.67
690.1	1.70	1.72	1.74
730.1	1.83	1.85	1.87
750.1	1.87	1.89	1.90
790.1	2.02	2.03	2.04
810.1	2.09	2.10	2.10
850.1	2.24	2.25	2.25
870.1	2.39	2.41	2.41
910.1	2.53	2.54	2.54
930.1	2.65	2.67	2.67
970.1	2.85	2.88	2.87
990.1	2.86	2.88	2.87
1030.1	3.12	3.14	3.14
1050.1	3.23	3.25	3.25
1090.1	3.35	3.37	3.37
1110.1	3.57	3.60	3.59

## Harmonics Tables

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	-	-	1	10	20	24	14	30	29	41	38	50
1	-	12	+0	39	17	28	31	40	38	40	48	44
2	78	52	54	45	51	59	52	53	44	56	50	57
3	>90	62	61	>69	59	>69	67	60	>69	66	66	64
4	>90	>69	>69	>69	>69	>69	>69	>69	>69	>69	>69	>69
5	>90	>69	>69	>69	>69	>69	>69	>69	>69	>69	>69	>69
6	>90	>69	>69	>69	>69	>69	>69	>69	>69	>69	>69	>69
7	>90	>69	>69	>69	>69	>69	>69	>69	>69	>69	>69	>69
8	>90	>69	>69	>69	>69	>69	>69	>69	>69	>69	>69	>69
9	>90	>69	>69	>69	>69	>69	>69	>69	>69	>69	>69	>69
10	>90	>69	>69	>69	>69	>69	>69	>69	>69	>69	>69	>69
	RF CAL	0	1	2	3	4	5	6	7	8	9	10

### LO HARMONICS ORDER

Test conditions: RF IN: 750.1 MHz; -14.00 dBm.  
 LO IN: 780.1 MHz; +7.00 dBm  
 IF OUT: 30 MHz; -20.69 dBm

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	-	-	10	20	28	38	28	48	50	65	59	63
1	-	11	+0	36	17	33	35	43	47	52	65	64
2	58	52	49	43	46	52	56	51	41	54	54	65
3	>90	40	40	59	39	54	51	45	54	57	57	58
4	>90	71	71	55	59	51	58	65	60	61	53	64
5	>90	72	>79	72	64	65	56	77	63	59	74	69
6	>90	76	78	>79	76	66	76	61	70	73	69	71
7	>90	>79	>79	>79	>79	>79	73	78	67	76	73	74
8	>90	>79	>79	>79	>79	>79	>79	>79	>79	76	>79	>79
9	>90	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79
10	>90	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79	>79
	RF CAL	0	1	2	3	4	5	6	7	8	9	10

### LO HARMONICS ORDER

Test conditions: RF IN: 750.1 MHz; -4.00 dBm.  
 LO IN: 780.1 MHz; +7.00 dBm  
 IF OUT: 30 MHz; -10.75 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.