

# Frequency Mixer

# TUF-1H+

## 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=+14dBm (dB)		
		@LO (dBm)					@LO (dBm)					@LO (dBm)		
		+14	+17	+20			+14	+17	+20			+14	+17	+20
2.0	32.0	6.99	6.30	5.96	10.1	40.1	25.21	28.66	31.80	10.1	40.1	0.69	0.35	0.19
5.0	35.0	6.55	5.95	5.64	50.9	80.9	24.57	27.53	30.56	50.9	80.9	0.58	0.29	0.16
10.0	40.0	6.49	5.92	5.61	91.7	121.7	23.70	26.84	28.51	91.7	121.7	0.54	0.27	0.16
50.9	80.9	7.00	6.37	6.04	132.6	162.6	26.82	27.64	26.87	132.6	162.6	0.70	0.31	0.17
91.7	121.7	7.02	6.33	6.00	173.4	203.4	24.60	25.19	26.14	173.4	203.4	0.51	0.25	0.15
132.6	162.6	6.84	6.19	5.91	214.2	244.2	24.45	24.15	32.74	214.2	244.2	0.57	0.32	0.18
173.4	203.4	6.94	6.28	5.96	255.0	285.0	23.78	26.63	28.03	255.0	285.0	0.67	0.33	0.18
214.2	244.2	6.83	6.16	5.89	295.9	325.9	21.59	26.22	26.21	295.9	325.9	0.64	0.31	0.19
255.0	285.0	6.79	6.16	5.92	336.7	366.7	23.97	27.99	25.33	336.7	366.7	0.71	0.30	0.17
295.9	325.9	6.82	6.16	5.93	377.5	407.5	24.18	26.21	26.54	377.5	407.5	0.75	0.33	0.18
336.7	366.7	6.72	6.17	5.97	418.3	448.3	23.81	23.10	22.85	418.3	448.3	0.76	0.36	0.23
377.5	407.5	6.68	6.15	5.98	459.1	489.1	27.30	22.95	22.62	459.1	489.1	0.79	0.31	0.20
418.3	448.3	6.67	6.15	5.96	500.0	530.0	24.50	23.68	24.84	500.0	530.0	0.82	0.33	0.21
459.1	489.1	6.73	6.24	6.05	540.8	570.8	21.98	21.70	24.62	540.8	570.8	0.78	0.36	0.25
500.0	530.0	6.73	6.26	6.05	581.6	611.6	22.23	21.66	23.87	581.6	611.6	0.88	0.40	0.30
540.8	570.8	6.87	6.39	6.12	622.4	652.4	22.40	21.78	22.60	622.4	652.4	1.07	0.47	0.32
581.6	611.6	6.88	6.43	6.14	663.3	693.3	21.85	22.08	22.33	663.3	693.3	1.15	0.52	0.34
622.4	652.4	6.85	6.47	6.21	704.1	734.1	20.92	22.13	23.06	704.1	734.1	1.32	0.62	0.39
663.3	693.3	6.89	6.51	6.29	744.9	774.9	19.25	21.14	23.46	744.9	774.9	1.29	0.67	0.39
704.1	734.1	6.85	6.48	6.30	785.7	815.7	17.61	20.05	23.17	785.7	815.7	1.35	0.79	0.48
785.7	815.7	7.15	6.67	6.42	826.5	856.5	15.96	19.36	23.41	826.5	856.5	1.33	0.88	0.48
826.5	856.5	7.37	6.83	6.54	867.4	897.4	14.52	18.37	22.27	867.4	897.4	1.19	0.83	0.46
867.4	897.4	7.76	7.03	6.69	908.2	938.2	13.66	16.29	21.08	908.2	938.2	1.08	0.79	0.51
908.2	938.2	8.18	7.33	6.76	949.0	979.0	13.25	14.81	20.16	949.0	979.0	0.73	0.55	0.49
949.0	979.0	8.75	7.79	6.94	989.8	1019.8	13.21	14.31	19.28	989.8	1019.8	0.51	0.37	0.44
989.8	1019.8	9.23	8.12	7.08	1030.6	1060.6	13.26	14.70	17.01	1030.6	1060.6	0.13	0.19	0.28
1030.6	1060.6	9.84	8.54	7.51	1071.5	1101.5	13.13	15.35	17.47	1071.5	1101.5	-0.40	-0.07	0.12
1071.5	1101.5	10.39	8.96	7.80	1112.3	1142.3	13.50	15.90	19.28	1112.3	1142.3	-0.73	-0.33	0.08
1112.3	1142.3	10.77	9.27	7.95	1153.1	1183.1	13.91	15.95	20.05	1153.1	1183.1	-1.05	-0.59	0.01
1153.1	1183.1	11.14	9.64	8.19	1193.9	1223.9	14.51	15.70	19.57	1193.9	1223.9	-1.08	-0.62	0.10
1193.9	1223.9	11.26	9.81	8.24	1234.8	1264.8	15.07	16.00	20.53	1234.8	1264.8	-0.97	-0.40	0.35
1234.8	1264.8	11.23	9.69	8.13	1255.2	1285.2	14.94	15.94	20.72	1255.2	1285.2	-0.84	-0.24	0.46
1255.2	1285.2	11.23	9.57	8.03	1296.0	1326.0	15.56	17.15	22.30	1296.0	1326.0	-0.67	0.05	0.63
1296.0	1326.0	11.21	9.47	8.10	1316.4	1346.4	15.71	17.86	22.67	1316.4	1346.4	-0.50	0.23	0.71
1316.4	1346.4	11.17	9.36	8.07	1357.2	1387.2	16.70	19.66	23.42	1357.2	1387.2	-0.16	0.40	0.73
1357.2	1387.2	10.96	9.35	8.33	1377.6	1407.6	17.45	20.42	23.91	1377.6	1407.6	-0.07	0.41	0.72
1377.6	1407.6	10.85	9.46	8.53	1418.5	1448.5	18.75	21.23	24.14	1418.5	1448.5	0.08	0.31	0.56
1438.9	1468.9	10.91	9.97	9.26	1438.9	1468.9	19.63	21.59	24.23	1438.9	1468.9	0.18	0.23	0.44
1479.7	1509.7	10.97	10.38	9.80	1479.7	1509.7	21.39	22.27	23.95	1479.7	1509.7	0.20	0.05	0.21
1500.1	1530.1	11.00	10.52	10.03	1500.1	1530.1	22.01	22.49	24.10	1500.1	1530.1	0.26	0.03	0.15

# Frequency Mixer

# TUF-1H+

## Typical Performance Data

IF (OUT) (MHz)	LO (MHz)	CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=300.1MHz (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)=600.1MHz (dB)
		@LO (dBm)			@LO (dBm)			@LO (dBm)
		+17			+17			+17
290.0	10.1	6.35	10.0	20.1	6.29	590.0	10.1	6.61
282.8	17.3	6.42	24.9	35.0	6.14	575.1	25.0	6.49
275.6	24.5	6.33	39.7	49.8	6.19	560.3	39.8	6.48
268.5	31.6	6.37	54.6	64.7	6.24	545.4	54.7	6.45
261.3	38.8	6.26	69.5	79.6	6.26	530.5	69.6	6.46
254.1	46.0	6.36	84.4	94.5	6.32	515.6	84.5	6.44
246.9	53.2	6.27	99.2	109.3	6.25	500.8	99.3	6.38
239.7	60.4	6.33	114.1	124.2	6.31	485.9	114.2	6.34
232.6	67.5	6.27	129.0	139.1	6.26	471.0	129.1	6.26
225.4	74.7	6.28	143.8	153.9	6.27	456.2	143.9	6.30
218.2	81.9	6.24	158.7	168.8	6.37	441.3	158.8	6.29
211.0	89.1	6.29	173.6	183.7	6.37	426.4	173.7	6.27
203.8	96.3	6.29	188.5	198.6	6.37	411.5	188.6	6.20
196.7	103.4	6.27	203.3	213.4	6.35	396.7	203.4	6.17
189.5	110.6	6.26	218.2	228.3	6.33	381.8	218.3	6.16
182.3	117.8	6.19	233.1	243.2	6.35	366.9	233.2	6.10
175.1	125.0	6.24	247.9	258.0	6.39	352.1	248.0	6.12
167.9	132.2	6.16	262.8	272.9	6.41	337.2	262.9	6.04
160.8	139.3	6.23	277.7	287.8	6.40	322.3	277.8	6.14
153.6	146.5	6.11	292.6	302.7	6.39	307.4	292.7	6.08
146.4	153.7	6.18	307.4	317.5	6.36	292.6	307.5	6.05
139.2	160.9	6.14	322.3	332.4	6.43	277.7	322.4	6.06
132.1	168.0	6.23	337.2	347.3	6.37	262.8	337.3	6.05
124.9	175.2	6.17	352.1	362.2	6.39	247.9	352.2	6.11
117.7	182.4	6.16	366.9	377.0	6.46	233.1	367.0	6.06
110.5	189.6	6.14	381.8	391.9	6.42	218.2	381.9	6.11
103.3	196.8	6.14	396.7	406.8	6.48	203.3	396.8	6.12
96.2	203.9	6.20	411.5	421.6	6.36	188.5	411.6	6.16
89.0	211.1	6.10	426.4	436.5	6.46	173.6	426.5	6.20
81.8	218.3	6.12	441.3	451.4	6.49	158.7	441.4	6.22
74.6	225.5	6.05	456.2	466.3	6.52	143.8	456.3	6.26
67.4	232.7	6.15	471.0	481.1	6.52	129.0	471.1	6.30
60.3	239.8	6.08	485.9	496.0	6.46	114.1	486.0	6.33
53.1	247.0	6.12	500.8	510.9	6.50	99.2	500.9	6.30
45.9	254.2	6.03	515.6	525.7	6.44	84.4	515.7	6.32
38.7	261.4	6.10	530.5	540.6	6.48	69.5	530.6	6.33
31.5	268.6	6.13	545.4	555.5	6.46	54.6	545.5	6.33
24.4	275.7	6.17	560.3	570.4	6.53	39.7	560.4	6.38
17.2	282.9	6.13	575.1	585.2	6.53	24.9	575.2	6.38
10.0	290.1	6.18	590.0	600.1	6.50	10.0	590.1	6.48

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# Frequency Mixer

# TUF-1H+

## Typical Performance Data

LO (MHz)	LO-RF ISOLATION (dB)			LO-IF ISOLATION (dB)		
	@LO (dBm)			@LO (dBm)		
	+14	+17	+20	+14	+17	+20
2.0	59.73	62.98	64.42	49.91	52.28	53.48
5.0	58.95	62.06	63.57	50.65	52.79	53.94
10.0	58.36	60.47	61.17	50.51	52.35	53.27
50.9	65.34	67.61	69.89	69.42	70.04	61.48
91.7	60.76	62.94	65.51	63.23	66.32	57.55
132.6	57.85	60.75	63.76	58.23	61.09	53.89
173.4	56.03	58.83	61.61	55.53	59.18	52.40
214.2	54.64	57.75	60.81	51.91	56.05	51.15
255.0	53.73	56.82	60.19	50.29	53.53	49.70
295.9	53.05	55.87	60.03	48.14	50.83	48.52
336.7	52.10	55.47	59.46	45.29	46.60	45.69
377.5	51.43	56.27	61.47	43.13	44.32	44.40
418.3	50.21	56.45	65.91	41.57	42.66	43.27
459.1	49.06	54.19	60.60	38.95	40.32	41.08
500.0	48.19	51.79	55.16	37.45	38.88	39.78
540.8	47.64	50.03	52.94	35.93	37.09	38.30
581.6	47.07	49.30	52.07	34.57	35.74	36.97
622.4	47.38	51.05	56.59	33.63	35.34	36.65
663.3	49.01	53.41	61.67	32.67	34.69	36.22
704.1	50.46	55.90	60.48	31.66	34.08	35.84
785.7	60.58	61.12	55.99	30.05	32.34	34.58
826.5	56.86	57.47	53.89	29.22	31.19	33.18
867.4	50.66	52.58	51.10	28.51	30.08	31.92
908.2	46.49	48.86	48.70	28.14	29.16	30.81
949.0	44.27	45.55	45.96	27.89	28.38	29.69
989.8	42.62	42.80	43.13	27.69	27.88	28.74
1030.6	41.77	41.82	41.98	27.18	27.64	28.14
1071.5	40.72	40.72	40.93	26.88	27.52	28.18
1112.3	39.55	39.80	39.80	26.54	27.48	28.09
1153.1	38.58	39.30	39.30	26.11	27.47	28.44
1193.9	37.59	38.67	39.10	25.67	27.25	28.57
1234.8	36.40	37.61	38.40	25.13	26.78	28.27
1255.2	36.30	37.50	38.55	25.22	26.75	28.26
1296.0	35.14	36.54	38.16	24.53	25.92	27.47
1316.4	34.75	36.02	37.44	24.48	25.64	27.09
1357.2	33.84	35.51	37.21	23.77	24.94	26.60
1377.6	33.15	35.04	36.91	23.55	24.69	26.46
1438.9	32.00	34.26	36.03	22.69	24.17	25.99
1479.7	31.62	33.98	35.60	22.47	24.16	26.00
1500.1	31.67	33.80	35.25	22.57	24.22	25.98

RF (IN) (MHz)	LO (MHz)	RF-IF ISOLATION (dB)		
		@LO (dBm)		
		+14	+17	+20
10.1	40.1	48.39	49.59	50.09
50.9	80.9	34.61	34.95	35.22
91.7	121.7	29.88	30.27	30.62
132.6	162.6	27.21	27.58	27.93
173.4	203.4	25.30	25.71	26.09
214.2	244.2	24.03	24.63	24.97
255.0	285.0	23.36	23.83	24.26
295.9	325.9	22.91	23.59	23.91
336.7	366.7	22.59	23.64	24.03
377.5	407.5	22.46	23.39	24.12
418.3	448.3	22.65	23.28	24.03
459.1	489.1	23.39	24.13	24.47
500.0	530.0	24.50	25.15	25.32
540.8	570.8	25.17	25.37	25.64
581.6	611.6	24.53	24.78	25.55
622.4	652.4	22.80	23.11	23.93
663.3	693.3	21.03	21.14	21.62
704.1	734.1	19.62	19.53	19.58
744.9	774.9	18.49	18.09	17.79
785.7	815.7	17.56	16.83	16.33
826.5	856.5	16.80	15.88	15.32
867.4	897.4	16.26	15.24	14.59
908.2	938.2	15.98	14.90	14.18
949.0	979.0	15.67	14.71	13.84
989.8	1019.8	15.22	14.46	13.54
1030.6	1060.6	14.91	14.34	13.67
1071.5	1101.5	14.65	14.25	13.81
1112.3	1142.3	14.41	14.08	13.76
1153.1	1183.1	14.18	13.93	13.66
1193.9	1223.9	13.85	13.69	13.50
1234.8	1264.8	13.46	13.41	13.30
1255.2	1285.2	13.29	13.25	13.14
1296.0	1326.0	12.88	12.89	12.80
1316.4	1346.4	12.64	12.70	12.62
1357.2	1387.2	12.19	12.18	12.06
1377.6	1407.6	11.98	11.89	11.76
1418.5	1448.5	11.47	11.21	11.06
1438.9	1468.9	11.22	10.88	10.71
1479.7	1509.7	10.68	10.28	10.07
1500.1	1530.1	10.37	9.93	9.70



# Frequency Mixer

# TUF-1H+

## Typical Performance Data

RF (IN) (MHz)	LO (MHz)	RF VSWR (:1)			LO (MHz)	LO VSWR (:1)			IF (OUT) (MHz)	IF VSWR @LO=600.1MHz (:1)		
		@LO (dBm)				@LO (dBm)				@LO (dBm)		
		+14	+17	+20		+14	+17	+20		+14	+17	+20
2.0	32.0	1.28	1.22	1.25	2.0	1.27	1.67	2.71	5.0	1.51	1.33	1.25
5.0	35.0	1.20	1.10	1.14	5.0	1.20	1.60	2.58	10.0	1.51	1.34	1.25
10.0	40.0	1.16	1.03	1.09	10.0	1.07	1.63	2.60	25.1	2.01	1.70	1.46
50.9	80.9	1.19	1.06	1.03	50.9	1.04	1.58	2.38	40.3	1.88	1.59	1.37
91.7	121.7	1.23	1.08	1.05	91.7	1.06	1.50	2.24	55.4	1.85	1.57	1.35
132.6	162.6	1.20	1.08	1.09	132.6	1.10	1.54	2.30	70.5	1.87	1.59	1.37
173.4	203.4	1.24	1.12	1.11	173.4	1.11	1.50	2.19	85.6	1.90	1.62	1.40
214.2	244.2	1.25	1.15	1.14	214.2	1.17	1.52	2.21	100.8	1.95	1.66	1.43
255.0	285.0	1.27	1.17	1.17	255.0	1.18	1.52	2.22	115.9	1.99	1.68	1.45
295.9	325.9	1.31	1.20	1.19	295.9	1.21	1.50	2.15	131.0	2.01	1.70	1.46
336.7	366.7	1.31	1.21	1.20	336.7	1.27	1.56	2.23	146.2	1.98	1.68	1.45
377.5	407.5	1.32	1.22	1.22	377.5	1.28	1.53	2.21	161.3	1.93	1.64	1.42
418.3	448.3	1.33	1.22	1.22	418.3	1.31	1.55	2.19	176.4	1.94	1.64	1.42
459.1	489.1	1.34	1.23	1.22	459.1	1.38	1.58	2.21	191.5	2.00	1.70	1.46
500.0	530.0	1.35	1.24	1.24	500.0	1.40	1.56	2.15	206.7	2.06	1.75	1.51
540.8	570.8	1.38	1.27	1.26	540.8	1.44	1.61	2.18	221.8	2.04	1.74	1.50
581.6	611.6	1.38	1.29	1.28	581.6	1.50	1.62	2.14	236.9	2.00	1.70	1.47
622.4	652.4	1.38	1.31	1.29	622.4	1.52	1.62	2.17	252.1	1.99	1.70	1.46
663.3	693.3	1.37	1.30	1.29	663.3	1.55	1.63	2.14	267.2	2.05	1.74	1.50
704.1	734.1	1.35	1.27	1.27	704.1	1.63	1.65	2.13	282.3	2.08	1.78	1.54
744.9	774.9	1.33	1.24	1.23	744.9	1.66	1.66	2.12	297.4	2.09	1.78	1.55
785.7	815.7	1.33	1.21	1.21	785.7	1.72	1.65	2.06	312.6	2.09	1.78	1.54
826.5	856.5	1.36	1.24	1.23	826.5	1.77	1.70	2.09	327.7	2.12	1.81	1.56
867.4	897.4	1.43	1.31	1.29	867.4	1.81	1.74	2.09	342.8	2.15	1.83	1.58
908.2	938.2	1.55	1.42	1.40	908.2	1.80	1.77	2.12	357.9	2.15	1.84	1.59
949.0	979.0	1.71	1.58	1.53	949.0	1.78	1.80	2.14	373.1	2.14	1.84	1.59
989.8	1019.8	1.88	1.74	1.67	989.8	1.78	1.79	2.14	388.2	2.17	1.86	1.60
1030.6	1060.6	2.08	1.93	1.83	1030.6	1.77	1.79	2.16	403.3	2.21	1.89	1.63
1071.5	1101.5	2.28	2.11	1.99	1071.5	1.78	1.76	2.12	418.5	2.23	1.91	1.66
1112.3	1142.3	2.45	2.26	2.11	1112.3	1.78	1.71	2.06	433.6	2.23	1.92	1.66
1153.1	1183.1	2.62	2.42	2.24	1153.1	1.77	1.68	2.02	448.7	2.22	1.91	1.65
1193.9	1223.9	2.75	2.55	2.34	1193.9	1.76	1.63	1.96	463.8	2.26	1.94	1.67
1234.8	1264.8	2.83	2.62	2.40	1234.8	1.77	1.59	1.90	479.0	2.32	1.99	1.71
1255.2	1285.2	2.86	2.65	2.42	1255.2	1.71	1.59	1.94	494.1	2.34	2.00	1.73
1296.0	1326.0	2.92	2.69	2.48	1296.0	1.76	1.52	1.83	509.2	2.31	1.98	1.72
1316.4	1346.4	2.94	2.71	2.51	1316.4	1.69	1.51	1.82	524.4	2.30	1.97	1.71
1357.2	1387.2	2.93	2.72	2.55	1357.2	1.69	1.52	1.84	539.5	2.33	2.00	1.73
1377.6	1407.6	2.92	2.73	2.57	1377.6	1.78	1.51	1.82	554.6	2.38	2.05	1.78
1438.9	1468.9	2.88	2.75	2.62	1438.9	1.84	1.55	1.83	569.7	2.41	2.08	1.81
1479.7	1509.7	2.85	2.75	2.65	1479.7	1.87	1.60	1.85	584.9	2.40	2.08	1.81
1500.1	1530.1	2.82	2.74	2.65	1500.1	1.85	1.62	1.85	600.0	2.07	1.86	1.71

## Harmonics Tables

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	-	-	24	37	18	40	27	48	36	61	39	49
1	-	17	+0	28	16	40	46	40	23	42	30	45
2	95	75	49	68	49	70	51	70	62	72	59	74
3	>100	59	54	63	48	59	44	62	43	56	44	63
4	>100	83	79	86	81	84	85	82	75	83	70	80
5	>100	72	70	76	68	75	65	75	67	82	67	83
6	>100	>93	92	>93	91	>93	90	89	90	>93	89	>93
7	>100	90	86	88	88	91	85	90	88	90	88	>93
8	>100	>93	>93	>93	>93	>93	>93	>93	90	>93	>93	>93
9	>100	>93	>93	>93	>93	>93	>93	>93	>93	>93	>93	>93
10	>100	>93	>93	>93	>93	>93	>93	>93	>93	>93	82	>93
	RF CAL	0	1	2	3	4	5	6	7	8	9	10

### LO HARMONICS ORDER

Test conditions: RF IN: 300.1 MHz; -1.00 dBm.  
 LO IN: 330.01 MHz; +17.00 dBm  
 IF OUT: 29.91 MHz; -7.38 dBm

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	-	-	34	51	32	57	47	60	49	64	50	57
1	-	17	+0	29	15	40	28	41	35	49	43	54
2	80	69	47	60	46	59	45	69	49	64	63	79
3	>100	45	45	49	57	59	41	54	40	50	38	57
4	>100	68	60	73	60	73	61	71	62	75	68	77
5	>100	64	66	65	56	61	49	55	46	57	45	60
6	>100	72	70	75	69	80	72	81	76	77	70	90
7	>100	68	79	71	73	68	64	65	59	64	59	68
8	>100	100	81	81	78	88	79	100	81	84	80	80
9	>100	83	76	74	73	70	69	72	66	71	67	74
10	>100	101	>103	>103	95	99	97	101	93	90	88	84
	RF CAL	0	1	2	3	4	5	6	7	8	9	10

### LO HARMONICS ORDER

Test conditions: RF IN: 300.1 MHz; 9.00 dBm.  
 LO IN: 330.01 MHz; +17.00 dBm  
 IF OUT: 29.91 MHz; 2.68 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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