

# Frequency Mixer

# TUF-1MH+

## 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=+9dBm (dB)		
		@LO (dBm)					@LO (dBm)					@LO (dBm)		
		+10	+13	+16			+10	+13	+16			+10	+13	+16
2.0	32.0	7.06	6.55	6.24	10.1	40.1	23.62	26.66	28.16	10.1	40.1	1.42	1.19	1.02
5.0	35.0	6.49	6.06	5.82	50.4	80.4	22.21	25.36	26.08	50.4	80.4	1.22	1.00	0.85
10.0	40.0	6.42	5.98	5.73	90.7	120.7	21.08	22.75	25.58	90.7	120.7	1.11	0.99	0.85
50.4	80.4	6.11	5.76	5.61	131.0	161.0	22.18	24.86	28.27	131.0	161.0	1.22	1.02	0.82
90.7	120.7	6.06	5.72	5.57	171.3	201.3	21.15	25.17	28.52	171.3	201.3	1.16	0.96	0.81
131.0	161.0	5.97	5.66	5.54	211.5	241.5	23.34	28.18	25.34	211.5	241.5	1.16	0.92	0.75
171.3	201.3	6.04	5.68	5.55	251.8	281.8	26.47	23.17	24.20	251.8	281.8	1.16	0.91	0.75
211.5	241.5	5.88	5.63	5.52	292.1	322.1	24.45	22.71	25.31	292.1	322.1	1.16	0.88	0.76
251.8	281.8	5.94	5.68	5.57	332.4	362.4	21.91	24.22	33.79	332.4	362.4	1.12	0.85	0.72
292.1	322.1	5.93	5.67	5.55	372.7	402.7	21.88	21.61	23.26	372.7	402.7	1.09	0.83	0.70
332.4	362.4	5.94	5.69	5.59	413.0	443.0	19.62	23.45	25.86	413.0	443.0	1.01	0.80	0.66
372.7	402.7	5.98	5.73	5.61	453.3	483.3	19.03	20.76	28.05	453.3	483.3	0.95	0.74	0.65
413.0	443.0	5.95	5.69	5.60	493.6	523.6	21.07	22.16	24.38	493.6	523.6	1.05	0.79	0.68
453.3	483.3	6.06	5.79	5.62	533.9	563.9	23.43	28.72	37.10	533.9	563.9	1.05	0.84	0.69
493.6	523.6	6.05	5.82	5.69	574.2	604.2	20.82	27.79	28.58	574.2	604.2	1.20	1.00	0.82
574.2	604.2	6.12	5.82	5.69	614.4	644.4	17.22	22.59	29.92	614.4	644.4	1.25	1.06	0.91
614.4	644.4	6.24	5.92	5.73	654.7	684.7	16.34	17.95	22.24	654.7	684.7	1.40	1.13	0.96
654.7	684.7	6.29	6.05	5.85	695.0	725.0	15.77	16.41	17.85	695.0	725.0	1.55	1.23	1.05
695.0	725.0	6.33	6.12	5.99	735.3	765.3	15.56	16.87	17.52	735.3	765.3	1.75	1.39	1.20
735.3	765.3	6.45	6.27	6.13	775.6	805.6	15.46	17.54	20.13	775.6	805.6	1.93	1.52	1.33
775.6	805.6	6.49	6.30	6.16	815.9	845.9	15.99	19.65	24.40	815.9	845.9	1.97	1.59	1.38
815.9	845.9	6.54	6.31	6.16	856.2	886.2	16.98	21.92	26.93	856.2	886.2	2.08	1.63	1.39
856.2	886.2	6.68	6.29	6.15	896.5	926.5	15.98	23.14	33.25	896.5	926.5	1.98	1.67	1.40
896.5	926.5	6.99	6.36	6.17	916.6	946.6	15.17	24.50	26.29	916.6	946.6	1.86	1.74	1.45
916.6	946.6	7.26	6.49	6.22	956.9	986.9	13.10	21.67	26.43	956.9	986.9	1.62	1.70	1.48
956.9	986.9	7.65	6.66	6.31	977.1	1007.1	11.91	21.28	27.16	977.1	1007.1	1.46	1.72	1.52
977.1	1007.1	8.01	6.79	6.35	1017.3	1047.3	11.80	17.87	27.97	1017.3	1047.3	1.24	1.59	1.53
1017.3	1047.3	8.48	7.20	6.54	1037.5	1067.5	12.19	17.33	26.76	1037.5	1067.5	1.15	1.48	1.50
1037.5	1067.5	8.50	7.28	6.55	1077.8	1107.8	12.86	15.24	25.77	1077.8	1107.8	0.84	1.10	1.33
1077.8	1107.8	9.07	7.93	6.98	1097.9	1127.9	13.54	15.87	22.57	1097.9	1127.9	0.75	0.99	1.22
1097.9	1127.9	9.12	8.10	7.19	1138.2	1168.2	14.10	16.66	20.19	1138.2	1168.2	0.54	0.75	0.95
1138.2	1168.2	9.45	8.53	7.66	1158.4	1188.4	14.59	16.84	21.10	1158.4	1188.4	0.52	0.67	0.89
1158.4	1188.4	9.69	8.81	7.92	1198.7	1228.7	14.94	16.80	20.25	1198.7	1228.7	0.56	0.56	0.74
1218.8	1248.8	9.93	9.34	8.61	1218.8	1248.8	15.70	17.38	21.22	1218.8	1248.8	0.54	0.53	0.67
1259.1	1289.1	10.04	9.51	8.96	1259.1	1289.1	16.02	16.70	20.94	1259.1	1289.1	0.70	0.63	0.70
1279.2	1309.2	10.05	9.60	9.08	1279.2	1309.2	16.13	17.06	21.37	1279.2	1309.2	0.65	0.61	0.69
1319.5	1349.5	10.14	9.72	9.31	1319.5	1349.5	16.27	17.76	22.06	1319.5	1349.5	0.68	0.68	0.72
1339.7	1369.7	10.30	9.87	9.51	1339.7	1369.7	16.50	17.68	21.52	1339.7	1369.7	0.67	0.67	0.68
1380.0	1410.0	10.32	10.04	9.79	1380.0	1410.0	17.02	19.22	22.95	1380.0	1410.0	0.61	0.58	0.57
1400.1	1430.1	10.30	10.07	9.93	1400.1	1430.1	17.05	19.96	23.01	1400.1	1430.1	0.64	0.52	0.44



# Frequency Mixer

# TUF-1MH+

## 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)
		+13			+13			+13
290.0	10.1	5.86	10.0	20.1	5.46	590.0	10.1	6.18
282.8	17.3	5.88	24.9	35.0	5.44	575.1	25.0	6.07
275.6	24.5	5.81	39.7	49.8	5.47	560.3	39.8	6.07
268.5	31.6	5.83	54.6	64.7	5.52	545.4	54.7	6.04
261.3	38.8	5.76	69.5	79.6	5.55	530.5	69.6	6.00
254.1	46.0	5.81	84.4	94.5	5.58	515.6	84.5	6.01
246.9	53.2	5.73	99.2	109.3	5.55	500.8	99.3	5.95
239.7	60.4	5.80	114.1	124.2	5.57	485.9	114.2	5.91
232.6	67.5	5.79	129.0	139.1	5.56	471.0	129.1	5.84
225.4	74.7	5.75	143.8	153.9	5.55	456.2	143.9	5.87
218.2	81.9	5.74	158.7	168.8	5.63	441.3	158.8	5.87
211.0	89.1	5.74	173.6	183.7	5.62	426.4	173.7	5.88
203.8	96.3	5.73	188.5	198.6	5.64	411.5	188.6	5.82
196.7	103.4	5.75	203.3	213.4	5.62	396.7	203.4	5.81
189.5	110.6	5.72	218.2	228.3	5.59	381.8	218.3	5.84
182.3	117.8	5.69	233.1	243.2	5.59	366.9	233.2	5.82
175.1	125.0	5.67	247.9	258.0	5.63	352.1	248.0	5.86
167.9	132.2	5.66	262.8	272.9	5.62	337.2	262.9	5.84
160.8	139.3	5.68	277.7	287.8	5.62	322.3	277.8	5.89
153.6	146.5	5.62	292.6	302.7	5.64	307.4	292.7	5.88
146.4	153.7	5.65	307.4	317.5	5.61	292.6	307.5	5.86
139.2	160.9	5.64	322.3	332.4	5.66	277.7	322.4	5.86
132.1	168.0	5.69	337.2	347.3	5.62	262.8	337.3	5.85
124.9	175.2	5.65	352.1	362.2	5.63	247.9	352.2	5.91
117.7	182.4	5.63	366.9	377.0	5.67	233.1	367.0	5.87
110.5	189.6	5.63	381.8	391.9	5.67	218.2	381.9	5.91
103.3	196.8	5.65	396.7	406.8	5.70	203.3	396.8	5.91
96.2	203.9	5.68	411.5	421.6	5.62	188.5	411.6	5.92
89.0	211.1	5.63	426.4	436.5	5.68	173.6	426.5	5.92
81.8	218.3	5.63	441.3	451.4	5.70	158.7	441.4	5.92
74.6	225.5	5.62	456.2	466.3	5.67	143.8	456.3	5.92
67.4	232.7	5.66	471.0	481.1	5.72	129.0	471.1	5.93
60.3	239.8	5.63	485.9	496.0	5.71	114.1	486.0	5.95
53.1	247.0	5.63	500.8	510.9	5.76	99.2	500.9	5.90
45.9	254.2	5.61	515.6	525.7	5.72	84.4	515.7	5.90
38.7	261.4	5.66	530.5	540.6	5.76	69.5	530.6	5.91
31.5	268.6	5.67	545.4	555.5	5.74	54.6	545.5	5.89
24.4	275.7	5.67	560.3	570.4	5.79	39.7	560.4	5.88
17.2	282.9	5.64	575.1	585.2	5.78	24.9	575.2	5.88
10.0	290.1	5.81	590.0	600.1	5.75	10.0	590.1	6.05

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# Frequency Mixer

# TUF-1MH+

## Typical Performance Data

LO (MHz)	LO-RF ISOLATION (dB)			LO-IF ISOLATION (dB)		
	@LO (dBm)			@LO (dBm)		
	+10	+13	+16	+10	+13	+16
2.0	65.69	61.53	59.57	70.00	62.13	57.11
5.0	64.70	60.97	59.24	70.00	60.92	56.61
10.0	64.09	60.65	59.12	70.00	60.61	56.57
50.4	61.80	62.59	63.40	60.04	57.75	56.52
90.7	56.73	57.49	58.19	54.93	53.01	51.75
131.0	53.32	54.45	55.06	51.61	49.54	48.40
171.3	51.03	51.93	52.78	49.36	47.38	46.45
211.5	49.19	50.29	50.95	47.23	45.82	45.10
251.8	47.66	48.93	49.55	45.75	44.79	44.07
292.1	46.65	47.67	48.06	45.17	44.27	43.27
332.4	45.89	46.53	46.96	44.53	43.12	42.12
372.7	44.34	45.43	45.87	43.83	42.40	40.48
413.0	43.44	43.93	44.07	43.37	41.54	40.31
453.3	42.87	43.39	43.26	44.28	41.09	38.73
493.6	42.35	42.49	42.89	41.62	40.51	38.68
574.2	43.71	42.98	42.24	40.09	37.18	35.87
614.4	43.85	44.14	43.33	40.06	35.76	33.81
654.7	42.75	43.24	42.73	41.29	36.86	33.46
695.0	41.71	42.06	41.92	39.97	37.82	34.81
735.3	40.37	40.72	40.74	37.54	35.75	34.10
775.6	39.22	39.48	39.52	37.00	34.90	33.04
815.9	38.45	38.72	39.10	35.64	33.26	31.14
856.2	39.11	40.43	41.15	33.56	31.14	28.91
896.5	39.73	41.37	41.86	33.04	29.83	27.74
916.6	39.02	41.28	42.39	33.64	29.50	27.37
956.9	38.49	40.53	41.41	34.40	29.87	27.08
977.1	39.15	41.18	42.03	33.66	29.32	26.65
1017.3	38.86	40.55	41.49	33.55	30.33	26.92
1037.5	39.13	40.19	40.56	32.47	30.54	27.40
1077.8	39.23	39.83	39.92	31.24	30.62	28.34
1097.9	39.29	40.14	40.06	29.68	29.37	28.01
1138.2	38.80	39.50	39.32	28.84	28.16	26.79
1158.4	38.67	39.24	39.11	28.11	27.31	26.02
1218.8	36.83	37.01	36.92	27.36	26.53	25.11
1259.1	35.80	35.61	35.59	27.04	25.99	24.46
1279.2	35.39	35.17	35.14	26.74	26.11	24.42
1319.5	34.10	33.74	33.35	26.25	25.70	23.76
1339.7	33.58	33.12	32.66	25.91	25.14	22.81
1380.0	32.42	31.79	31.07	25.37	24.32	21.63
1400.1	31.68	31.03	30.11	25.07	23.29	20.61

RF (IN) (MHz)	LO (MHz)	RF-IF ISOLATION (dB)		
		@LO (dBm)		
		+10	+13	+16
10.1	40.1	48.16	47.69	48.31
50.4	80.4	36.45	36.16	36.35
90.7	120.7	31.53	31.70	31.81
131.0	161.0	28.78	29.07	29.12
171.3	201.3	27.02	27.29	27.50
211.5	241.5	25.95	26.25	26.35
251.8	281.8	25.24	25.56	25.67
292.1	322.1	25.09	25.40	25.56
332.4	362.4	25.02	25.48	25.75
372.7	402.7	25.01	25.60	26.02
413.0	443.0	25.51	26.02	26.49
453.3	483.3	26.48	26.71	26.91
493.6	523.6	27.75	27.98	28.08
533.9	563.9	28.46	28.98	29.42
574.2	604.2	27.21	28.43	29.43
614.4	644.4	24.88	25.61	26.64
654.7	684.7	22.78	22.87	23.11
695.0	725.0	21.27	21.08	20.92
735.3	765.3	20.03	19.67	19.33
775.6	805.6	18.94	18.46	17.97
815.9	845.9	18.02	17.42	16.98
856.2	886.2	17.16	16.62	16.32
896.5	926.5	16.67	16.09	15.76
916.6	946.6	16.53	16.01	15.70
956.9	986.9	16.13	15.71	15.46
977.1	1007.1	16.13	15.67	15.38
1017.3	1047.3	15.86	15.63	15.41
1037.5	1067.5	15.75	15.63	15.55
1077.8	1107.8	15.64	15.60	15.61
1097.9	1127.9	15.54	15.51	15.55
1138.2	1168.2	15.49	15.48	15.50
1158.4	1188.4	15.42	15.42	15.43
1198.7	1228.7	15.25	15.34	15.42
1218.8	1248.8	15.18	15.28	15.34
1259.1	1289.1	14.88	15.02	15.06
1279.2	1309.2	14.76	14.93	14.96
1319.5	1349.5	14.43	14.47	14.46
1339.7	1369.7	14.26	14.25	14.23
1380.0	1410.0	13.82	13.76	13.71
1400.1	1430.1	13.63	13.51	13.34

# Frequency Mixer

# TUF-1MH+

## Typical Performance Data

RF (IN) (MHz)	LO (MHz)	RF VSWR (:1)		
		@LO (dBm)		
		+10	+13	+16
5.0	32.0	1.31	1.24	1.23
10.0	35.0	1.23	1.12	1.11
50.4	80.4	1.07	1.04	1.10
90.7	120.7	1.09	1.07	1.12
131.0	161.0	1.11	1.12	1.16
171.3	201.3	1.15	1.15	1.19
211.5	241.5	1.17	1.19	1.22
251.8	281.8	1.21	1.22	1.25
292.1	322.1	1.25	1.25	1.27
332.4	362.4	1.26	1.27	1.30
372.7	402.7	1.29	1.29	1.32
413.0	443.0	1.31	1.31	1.34
453.3	483.3	1.34	1.34	1.36
493.6	523.6	1.37	1.38	1.39
533.9	563.9	1.40	1.41	1.43
574.2	604.2	1.42	1.43	1.46
614.4	644.4	1.45	1.45	1.48
654.7	684.7	1.45	1.45	1.47
695.0	725.0	1.43	1.43	1.44
735.3	765.3	1.43	1.42	1.42
775.6	805.6	1.43	1.42	1.43
815.9	845.9	1.47	1.46	1.46
856.2	886.2	1.57	1.54	1.54
896.5	926.5	1.71	1.66	1.64
916.6	946.6	1.79	1.73	1.70
956.9	986.9	1.98	1.87	1.83
977.1	1007.1	2.11	1.96	1.91
1017.3	1047.3	2.30	2.13	2.04
1037.5	1067.5	2.39	2.22	2.11
1077.8	1107.8	2.59	2.43	2.28
1097.9	1127.9	2.66	2.51	2.37
1138.2	1168.2	2.82	2.67	2.55
1158.4	1188.4	2.88	2.75	2.63
1198.7	1228.7	2.98	2.88	2.78
1218.8	1248.8	3.00	2.92	2.83
1259.1	1289.1	3.05	2.98	2.92
1279.2	1309.2	3.07	3.01	2.95
1319.5	1349.5	3.10	3.05	2.99
1339.7	1369.7	3.12	3.08	3.03
1380.0	1410.0	3.11	3.07	3.05
1400.1	1430.1	3.08	3.05	3.05

LO (MHz)	LO VSWR (:1)		
	@LO (dBm)		
	+10	+13	+16
5.0	1.25	1.92	2.86
10.0	1.15	1.78	2.68
50.4	1.59	2.51	3.70
90.7	1.56	2.37	3.49
131.0	1.55	2.41	3.54
171.3	1.53	2.31	3.29
211.5	1.53	2.32	3.34
251.8	1.54	2.35	3.38
292.1	1.60	2.32	3.26
332.4	1.61	2.36	3.37
372.7	1.67	2.46	3.50
413.0	1.64	2.36	3.31
453.3	1.67	2.36	3.27
493.6	1.67	2.34	3.22
533.9	1.72	2.39	3.30
574.2	1.76	2.32	3.18
614.4	1.84	2.43	3.24
654.7	1.89	2.53	3.41
695.0	1.87	2.46	3.28
735.3	1.89	2.46	3.27
775.6	1.88	2.38	3.15
815.9	1.90	2.37	3.11
856.2	1.97	2.35	3.02
896.5	2.04	2.40	3.06
916.6	2.06	2.44	3.10
956.9	2.11	2.50	3.13
977.1	2.17	2.59	3.22
1017.3	2.15	2.60	3.25
1037.5	2.20	2.63	3.21
1077.8	2.20	2.65	3.25
1097.9	2.14	2.57	3.18
1138.2	2.14	2.57	3.19
1158.4	2.18	2.63	3.26
1198.7	2.12	2.53	3.14
1218.8	2.15	2.57	3.16
1259.1	2.17	2.59	3.21
1279.2	2.09	2.46	3.05
1319.5	2.07	2.40	2.95
1339.7	2.06	2.41	3.00
1380.0	2.00	2.30	2.84
1400.1	1.99	2.35	2.89

IF (OUT) (MHz)	IF VSWR @LO=600.1MHz (:1)		
	@LO (dBm)		
	+10	+13	+16
5.0	1.54	1.35	1.25
10.0	1.55	1.35	1.26
25.1	1.63	1.40	1.25
40.3	1.53	1.30	1.17
55.4	1.48	1.25	1.15
70.5	1.50	1.28	1.18
85.6	1.54	1.34	1.23
100.8	1.60	1.38	1.26
115.9	1.62	1.39	1.27
131.0	1.62	1.39	1.27
146.2	1.61	1.38	1.27
161.3	1.58	1.36	1.27
176.4	1.59	1.37	1.27
191.5	1.64	1.42	1.30
206.7	1.69	1.47	1.34
221.8	1.69	1.47	1.35
236.9	1.66	1.44	1.33
252.1	1.65	1.42	1.32
267.2	1.70	1.47	1.36
282.3	1.73	1.52	1.40
297.4	1.74	1.53	1.41
312.6	1.74	1.53	1.41
327.7	1.77	1.54	1.42
342.8	1.80	1.57	1.45
357.9	1.81	1.59	1.49
373.1	1.82	1.60	1.49
388.2	1.83	1.61	1.50
403.3	1.86	1.64	1.51
418.5	1.89	1.67	1.54
433.6	1.91	1.70	1.57
448.7	1.92	1.70	1.58
463.8	1.95	1.72	1.60
479.0	1.98	1.75	1.63
494.1	2.00	1.77	1.64
509.2	1.98	1.76	1.63
524.4	1.97	1.76	1.63
539.5	2.01	1.79	1.66
554.6	2.07	1.85	1.72
569.7	2.13	1.90	1.77
584.9	2.14	1.90	1.77
600.0	2.12	2.08	2.10

## Harmonics Tables

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	-	-	17	28	20	31	20	34	31	53	37	46
1	-	19	+0	28	12	33	19	33	34	45	39	43
2	>100	66	57	64	58	67	57	65	51	63	60	75
3	>100	72	74	75	63	72	56	84	55	69	57	77
4	>100	86	84	84	82	84	80	>88	80	>88	82	>88
5	>100	85	82	>88	82	87	78	88	80	>88	78	88
6	>100	>88	>88	>88	>88	>88	88	86	>88	>88	>88	>88
7	>100	>88	>88	>88	>88	>88	>88	>88	>88	>88	>88	>88
8	>100	>88	>88	>88	>88	>88	>88	>88	>88	>88	>88	>88
9	>100	>88	>88	>88	>88	>88	>88	>88	>88	>88	>88	>88
10	>100	>88	>88	>88	>88	>88	>88	>88	>88	>88	80	>88
	RF CAL	0	1	2	3	4	5	6	7	8	9	10

### LO HARMONICS ORDER

Test conditions: RF IN: 300.1 MHz; -6.00 dBm.  
 LO IN: 330.01 MHz; +13.00 dBm  
 IF OUT: 29.91 MHz; -11.98 dBm

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	-	-	26	38	32	45	33	51	52	61	63	65
1	-	19	+0	29	12	34	20	35	33	52	49	53
2	95	64	49	70	50	65	50	57	45	58	54	93
3	>100	48	47	51	48	53	43	52	47	61	51	60
4	>100	66	87	64	70	65	68	66	62	91	60	71
5	>100	70	66	59	55	60	52	58	49	63	48	63
6	>100	82	77	84	77	79	87	76	79	77	72	90
7	>100	86	70	77	66	79	71	75	79	71	72	71
8	>100	96	93	92	93	96	91	89	86	86	88	82
9	>100	94	83	87	76	83	77	83	81	75	89	76
10	>100	>98	>98	>98	94	89	87	86	86	89	>98	>98
	RF CAL	0	1	2	3	4	5	6	7	8	9	10

### LO HARMONICS ORDER

Test conditions: RF IN: 300.1 MHz; 4.00 dBm.  
 LO IN: 330.01 MHz; +13.00 dBm  
 IF OUT: 29.91 MHz; -1.92 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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