

# Frequency Mixer

# TUF-3HSM+

## 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
0.1	30.1	5.71	5.43	5.26	10.1	40.1	29.35	31.52	31.15	10.1	40.1	1.41	0.94	0.68
5.0	35.0	5.24	4.99	4.92	30.6	60.6	27.76	29.93	28.56	30.6	60.6	1.14	0.80	0.59
10.0	40.0	5.17	4.91	4.78	51.1	81.1	30.49	27.55	27.71	51.1	81.1	1.16	0.79	0.57
30.6	60.6	5.65	5.18	4.95	71.6	101.6	28.00	26.25	29.63	71.6	101.6	1.23	0.79	0.55
51.1	81.1	5.56	5.17	4.99	92.1	122.1	24.25	25.69	32.79	92.1	122.1	1.18	0.74	0.51
71.6	101.6	5.51	5.15	4.98	112.5	142.5	28.00	32.52	28.86	112.5	142.5	1.14	0.68	0.47
92.1	122.1	5.61	5.19	5.01	133.0	163.0	23.07	28.48	26.16	133.0	163.0	1.08	0.66	0.47
112.5	142.5	5.52	5.17	5.01	153.5	183.5	25.72	29.72	28.98	153.5	183.5	1.09	0.64	0.46
133.0	163.0	5.53	5.20	5.06	174.0	204.0	29.80	25.81	24.59	174.0	204.0	1.05	0.60	0.43
153.5	183.5	5.61	5.28	5.11	194.5	224.5	31.04	24.15	23.06	194.5	224.5	1.10	0.70	0.52
174.0	204.0	5.55	5.26	5.12	215.0	245.0	24.52	23.15	23.02	215.0	245.0	0.98	0.68	0.52
194.5	224.5	5.57	5.21	5.08	235.5	265.5	23.66	21.59	21.99	235.5	265.5	0.92	0.55	0.45
215.0	245.0	5.70	5.33	5.13	256.0	286.0	25.94	23.53	22.48	256.0	286.0	1.05	0.56	0.45
256.0	286.0	5.89	5.62	5.42	276.4	306.4	29.14	27.61	26.68	276.4	306.4	1.24	0.71	0.55
276.4	306.4	5.83	5.59	5.43	296.9	326.9	30.11	28.87	26.78	296.9	326.9	1.44	0.85	0.63
296.9	326.9	5.78	5.53	5.38	317.4	347.4	30.10	24.59	23.34	317.4	347.4	1.62	1.03	0.71
317.4	347.4	5.83	5.54	5.38	337.9	367.9	21.84	21.96	22.31	337.9	367.9	1.78	1.29	0.82
337.9	367.9	5.91	5.52	5.37	358.4	388.4	18.94	22.12	22.18	358.4	388.4	1.76	1.44	0.94
358.4	388.4	6.15	5.63	5.44	378.9	408.9	15.23	16.74	20.48	378.9	408.9	1.89	1.53	1.11
378.9	408.9	6.38	5.89	5.59	399.4	429.4	14.46	14.09	17.09	399.4	429.4	2.13	1.67	1.28
399.4	429.4	6.43	6.09	5.80	419.9	449.9	13.96	12.94	13.44	419.9	449.9	2.34	1.91	1.45
419.9	449.9	6.63	6.33	6.10	440.3	470.3	13.54	12.79	12.66	440.3	470.3	2.32	1.94	1.55
440.3	470.3	6.92	6.60	6.36	460.8	490.8	13.13	12.74	12.82	460.8	490.8	2.14	1.73	1.39
460.8	490.8	7.31	6.95	6.67	481.3	511.3	12.71	12.82	13.54	481.3	511.3	1.69	1.32	1.04
481.3	511.3	7.85	7.42	6.99	501.8	531.8	12.38	13.04	14.59	501.8	531.8	1.19	0.90	0.75
501.8	531.8	8.52	7.94	7.27	522.3	552.3	12.77	14.10	16.62	522.3	552.3	0.63	0.54	0.70
522.3	552.3	9.14	8.28	7.22	542.8	572.8	13.27	14.88	19.27	542.8	572.8	0.32	0.51	0.96
542.8	572.8	9.47	8.20	6.83	563.3	593.3	13.66	16.12	23.77	563.3	593.3	0.32	0.77	1.20
563.3	593.3	9.52	7.90	6.48	583.8	613.8	14.51	19.45	26.26	583.8	613.8	0.59	1.16	1.21
583.8	613.8	9.27	7.43	6.48	604.2	634.2	15.87	23.91	29.02	604.2	634.2	1.03	1.43	1.23
604.2	634.2	8.98	7.20	6.54	624.7	654.7	19.00	26.81	28.99	624.7	654.7	1.34	1.40	1.11
624.7	654.7	8.67	7.28	6.75	645.2	675.2	22.73	27.01	27.54	645.2	675.2	1.56	1.31	1.00
645.2	675.2	8.64	7.46	7.00	665.7	695.7	24.76	26.90	25.50	665.7	695.7	1.60	1.21	0.93
665.7	695.7	8.59	7.66	7.27	686.2	716.2	23.51	25.56	25.23	686.2	716.2	1.65	1.13	0.91
686.2	716.2	8.69	7.89	7.52	706.7	736.7	24.92	24.89	26.02	706.7	736.7	1.44	1.03	0.88
706.7	736.7	8.82	8.19	7.82	727.2	757.2	24.47	24.56	25.60	727.2	757.2	1.43	0.95	0.82
727.2	757.2	9.07	8.45	8.09	768.1	798.1	23.49	24.88	26.82	768.1	798.1	1.20	0.74	0.63
768.1	798.1	9.37	8.80	8.51	788.6	818.6	24.15	26.97	28.98	788.6	818.6	1.20	0.66	0.52
829.6	859.6	10.42	9.55	9.37	829.6	859.6	21.98	27.73	32.45	829.6	859.6	1.09	0.56	0.38
850.1	880.1	10.72	10.00	9.84	850.1	880.1	21.40	24.66	30.00	850.1	880.1	0.98	0.51	0.31

# Frequency Mixer

# TUF-3HSM+

## Typical Performance Data

IF (OUT) (MHz)	LO (MHz)	CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=200.1MHz (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)=400.1MHz (dB)
		@LO (dBm)			@LO (dBm)			@LO (dBm)
		+17			+17			+17
190.0	10.1	5.46	10.0	20.1	5.01	390.0	10.1	6.13
185.4	14.7	5.48	19.7	29.8	4.96	380.3	19.8	6.06
180.8	19.3	5.42	29.5	39.6	4.86	370.5	29.6	5.99
176.2	23.9	5.34	39.2	49.3	4.92	360.8	39.3	5.92
171.5	28.6	5.36	49.0	59.1	4.97	351.0	49.1	5.87
166.9	33.2	5.30	58.7	68.8	4.90	341.3	58.8	5.80
162.3	37.8	5.29	68.5	78.6	4.99	331.5	68.6	5.74
157.7	42.4	5.30	78.2	88.3	5.04	321.8	78.3	5.79
153.1	47.0	5.34	87.9	98.0	5.02	312.1	88.0	5.72
148.5	51.6	5.27	97.7	107.8	5.03	302.3	97.8	5.62
143.8	56.3	5.21	107.4	117.5	5.08	292.6	107.5	5.65
139.2	60.9	5.24	117.2	127.3	5.08	282.8	117.3	5.64
134.6	65.5	5.19	126.9	137.0	5.11	273.1	127.0	5.62
130.0	70.1	5.18	136.7	146.8	5.10	263.3	136.8	5.60
125.4	74.7	5.25	146.4	156.5	5.17	253.6	146.5	5.64
120.8	79.3	5.20	156.2	166.3	5.22	243.8	156.3	5.63
116.2	83.9	5.18	165.9	176.0	5.19	234.1	166.0	5.62
111.5	88.6	5.18	175.6	185.7	5.23	224.4	175.7	5.69
106.9	93.2	5.15	185.4	195.5	5.29	214.6	185.5	5.72
102.3	97.8	5.08	195.1	205.2	5.20	204.9	195.2	5.72
97.7	102.4	5.10	204.9	215.0	5.23	195.1	205.0	5.77
93.1	107.0	5.15	214.6	224.7	5.22	185.4	214.7	5.84
88.5	111.6	5.14	224.4	234.5	5.19	175.6	224.5	5.84
83.8	116.3	5.14	234.1	244.2	5.27	165.9	234.2	5.84
79.2	120.9	5.14	243.8	253.9	5.33	156.2	243.9	5.91
74.6	125.5	5.10	253.6	263.7	5.45	146.4	253.7	5.89
70.0	130.1	5.09	263.3	273.4	5.48	136.7	263.4	5.82
65.4	134.7	5.10	273.1	283.2	5.46	126.9	273.2	5.81
60.8	139.3	5.13	282.8	292.9	5.51	117.2	282.9	5.79
56.2	143.9	5.15	292.6	302.7	5.51	107.4	292.7	5.72
51.5	148.6	5.17	302.3	312.4	5.50	97.7	302.4	5.72
46.9	153.2	5.18	312.1	322.2	5.60	87.9	312.2	5.74
42.3	157.8	5.16	321.8	331.9	5.60	78.2	321.9	5.74
37.7	162.4	5.15	331.5	341.6	5.54	68.5	331.6	5.74
33.1	167.0	5.16	341.3	351.4	5.51	58.7	341.4	5.76
28.5	171.6	5.17	351.0	361.1	5.50	49.0	351.1	5.81
23.8	176.3	5.20	360.8	370.9	5.48	39.2	360.9	5.82
19.2	180.9	5.21	370.5	380.6	5.45	29.5	370.6	5.83
14.6	185.5	5.27	380.3	390.4	5.48	19.7	380.4	5.89
10.0	190.1	5.30	390.0	400.1	5.49	10.0	390.1	5.97

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# TUF-3HSM+

## Typical Performance Data

LO (MHz)	LO-RF ISOLATION (dB)			LO-IF ISOLATION (dB)		
	@LO (dBm)			@LO (dBm)		
	+14	+17	+20	+14	+17	+20
0.1	64.78	66.42	66.35	68.59	66.28	63.03
5.0	60.18	61.64	63.09	64.99	64.07	62.71
10.0	59.08	60.33	61.40	61.56	61.62	60.74
30.6	71.60	74.47	77.21	60.61	56.39	54.07
51.1	69.13	73.22	78.25	57.25	52.88	50.58
71.6	67.99	72.62	77.65	53.85	50.40	47.96
92.1	68.20	76.87	77.22	51.78	48.75	46.56
112.5	69.20	76.84	76.17	49.54	46.71	44.72
133.0	67.22	74.79	65.19	45.80	44.19	42.83
153.5	71.99	77.06	68.10	44.93	43.62	41.91
174.0	74.28	69.16	65.89	42.23	42.31	41.41
194.5	90.00	60.27	56.07	39.48	39.83	39.83
215.0	68.35	62.08	56.68	38.49	38.79	38.51
256.0	59.64	63.30	63.48	35.60	35.36	35.47
276.4	57.49	64.15	66.74	35.35	36.09	35.75
296.9	55.73	59.70	57.44	33.98	35.20	35.49
317.4	51.74	54.74	54.42	32.89	34.51	35.30
337.9	46.20	46.88	47.18	32.09	34.56	36.04
358.4	45.67	46.29	48.30	30.55	32.64	34.19
378.9	44.00	43.91	46.02	29.03	31.36	33.26
399.4	46.22	43.90	47.26	27.97	29.46	31.37
419.9	51.68	47.25	48.32	28.85	28.48	29.71
440.3	51.96	48.19	47.66	28.47	28.22	28.50
460.8	56.15	51.92	49.84	28.56	28.47	28.32
481.3	58.49	51.66	47.42	28.32	28.70	28.87
501.8	51.33	49.16	46.75	27.84	28.25	28.40
522.3	48.59	46.52	43.75	28.00	28.68	28.69
542.8	44.79	43.81	42.12	27.62	28.45	28.58
563.3	43.06	42.32	40.82	27.64	28.42	28.45
583.8	40.59	40.05	40.28	27.89	28.45	28.58
604.2	40.24	40.37	40.98	28.07	28.19	28.45
624.7	38.47	37.92	37.82	28.40	27.53	28.00
645.2	37.89	37.53	37.88	28.45	26.98	27.44
665.7	36.50	35.38	34.97	27.78	26.11	26.50
686.2	35.71	35.01	35.43	26.88	25.51	25.95
706.7	34.73	33.70	33.09	26.04	25.06	25.09
727.2	34.31	33.55	33.27	26.52	25.24	24.88
768.1	34.23	32.56	31.66	28.93	25.94	24.56
829.6	32.20	30.66	28.99	25.41	24.26	22.38
850.1	29.75	29.36	27.68	23.02	23.64	21.98

RF (IN) (MHz)	LO (MHz)	RF-IF ISOLATION (dB)		
		@LO (dBm)		
		+14	+17	+20
10.1	40.1	40.80	41.23	41.18
30.6	60.6	32.31	32.48	32.83
51.1	81.1	28.31	28.70	28.90
71.6	101.6	25.80	26.19	26.57
92.1	122.1	24.33	24.83	25.15
112.5	142.5	23.04	23.55	24.02
133.0	163.0	22.40	22.73	22.93
153.5	183.5	21.97	22.75	23.21
174.0	204.0	21.35	22.15	22.72
194.5	224.5	21.12	21.95	22.61
215.0	245.0	21.14	21.69	22.33
235.5	265.5	21.96	22.24	22.55
256.0	286.0	23.12	23.48	23.59
276.4	306.4	23.35	23.99	24.28
296.9	326.9	23.18	24.18	25.32
317.4	347.4	21.98	23.11	24.46
337.9	367.9	20.17	20.95	21.72
358.4	388.4	18.70	19.17	19.42
378.9	408.9	17.62	17.66	17.50
399.4	429.4	16.83	16.62	16.25
419.9	449.9	16.34	16.08	15.61
440.3	470.3	15.58	15.31	14.95
460.8	490.8	15.37	15.01	14.71
481.3	511.3	15.20	14.96	14.80
501.8	531.8	15.33	15.11	14.90
522.3	552.3	16.10	15.85	15.53
542.8	572.8	16.53	16.17	15.64
563.3	593.3	16.83	16.21	15.52
583.8	613.8	16.52	15.77	15.12
604.2	634.2	15.82	14.94	14.39
624.7	654.7	14.88	14.17	13.81
645.2	675.2	14.02	13.43	13.14
665.7	695.7	13.10	12.75	12.50
686.2	716.2	12.48	12.13	11.89
706.7	736.7	11.76	11.46	11.22
727.2	757.2	11.15	10.78	10.59
768.1	798.1	10.08	9.56	9.22
788.6	818.6	9.48	8.90	8.60
829.6	859.6	8.58	7.89	7.44
850.1	880.1	8.04	7.40	6.93

# Frequency Mixer

# TUF-3HSM+

## Typical Performance Data

RF (IN) (MHz)	LO (MHz)	RF VSWR (:1)		
		@LO (dBm)		
		+14	+17	+20
5.0	35.0	1.66	1.40	1.24
10.1	40.1	1.48	1.29	1.19
30.6	60.6	1.53	1.32	1.21
51.1	81.1	1.49	1.31	1.20
71.6	101.6	1.48	1.30	1.19
92.1	122.1	1.49	1.29	1.17
112.5	142.5	1.42	1.24	1.13
133.0	163.0	1.42	1.25	1.14
153.5	183.5	1.42	1.25	1.13
174.0	204.0	1.35	1.19	1.09
194.5	224.5	1.36	1.16	1.07
215.0	245.0	1.37	1.18	1.07
235.5	265.5	1.34	1.20	1.09
256.0	286.0	1.29	1.17	1.09
276.4	306.4	1.25	1.12	1.06
296.9	326.9	1.18	1.06	1.05
317.4	347.4	1.16	1.01	1.10
337.9	367.9	1.16	1.04	1.14
358.4	388.4	1.21	1.07	1.15
378.9	408.9	1.26	1.09	1.13
399.4	429.4	1.29	1.17	1.15
419.9	449.9	1.35	1.26	1.21
440.3	470.3	1.42	1.36	1.30
460.8	490.8	1.55	1.48	1.42
481.3	511.3	1.69	1.61	1.54
501.8	531.8	1.87	1.78	1.66
522.3	552.3	2.04	1.90	1.73
542.8	572.8	2.17	1.96	1.75
563.3	593.3	2.25	2.00	1.80
583.8	613.8	2.27	2.00	1.87
604.2	634.2	2.31	2.06	1.97
624.7	654.7	2.34	2.17	2.09
645.2	675.2	2.39	2.27	2.20
665.7	695.7	2.45	2.36	2.31
686.2	716.2	2.51	2.43	2.38
706.7	736.7	2.55	2.49	2.43
727.2	757.2	2.60	2.53	2.48
768.1	798.1	2.66	2.55	2.48
788.6	818.6	2.70	2.57	2.49
829.6	859.6	2.84	2.62	2.53
850.1	880.1	2.86	2.67	2.57

LO (MHz)	LO VSWR (:1)		
	@LO (dBm)		
	+14	+17	+20
5.0	1.32	1.51	2.55
10.1	1.09	1.44	2.11
30.6	1.10	1.53	2.32
51.1	1.09	1.52	2.28
71.6	1.12	1.48	2.16
92.1	1.11	1.45	2.15
112.5	1.15	1.48	2.17
133.0	1.19	1.53	2.25
153.5	1.15	1.52	2.21
174.0	1.20	1.51	2.15
194.5	1.25	1.53	2.17
215.0	1.24	1.56	2.23
235.5	1.29	1.61	2.26
256.0	1.30	1.63	2.25
276.4	1.29	1.62	2.25
296.9	1.35	1.63	2.26
317.4	1.40	1.68	2.31
337.9	1.44	1.70	2.30
358.4	1.54	1.73	2.28
378.9	1.58	1.80	2.32
399.4	1.56	1.87	2.42
419.9	1.54	1.94	2.53
440.3	1.53	1.94	2.56
460.8	1.55	1.97	2.59
481.3	1.55	1.92	2.53
501.8	1.57	1.93	2.56
522.3	1.58	1.94	2.56
542.8	1.61	1.92	2.52
563.3	1.63	1.89	2.48
583.8	1.65	1.89	2.49
604.2	1.66	1.88	2.52
624.7	1.69	1.89	2.54
645.2	1.73	1.94	2.58
665.7	1.84	1.99	2.60
686.2	1.97	2.10	2.70
706.7	2.14	2.22	2.79
727.2	2.36	2.34	2.86
768.1	2.92	2.62	3.01
788.6	3.15	2.78	3.13
829.6	3.73	3.18	3.42
850.1	4.62	3.46	3.48

IF (OUT) (MHz)	IF VSWR @LO=400.1MHz (:1)		
	@LO (dBm)		
	+14	+17	+20
5.0	1.78	1.56	1.47
10.0	2.72	2.14	1.75
20.0	2.62	2.05	1.67
30.0	2.60	2.06	1.67
40.0	2.41	1.90	1.55
50.0	2.31	1.84	1.50
60.0	2.26	1.80	1.47
70.0	2.27	1.81	1.49
80.0	2.43	1.92	1.58
90.0	2.49	1.98	1.62
100.0	2.58	2.05	1.69
110.0	2.63	2.10	1.73
120.0	2.58	2.05	1.70
130.0	2.51	1.99	1.64
140.0	2.48	1.97	1.63
150.0	2.51	1.99	1.65
160.0	2.56	2.04	1.70
170.0	2.59	2.07	1.74
180.0	2.59	2.09	1.76
190.0	2.61	2.10	1.78
200.0	2.63	2.10	1.78
210.0	2.64	2.10	1.78
220.0	2.67	2.12	1.80
230.0	2.70	2.15	1.83
240.0	2.71	2.18	1.85
250.0	2.70	2.17	1.86
260.0	2.66	2.15	1.85
270.0	2.66	2.14	1.84
280.0	2.73	2.17	1.87
290.0	2.81	2.24	1.91
300.0	2.87	2.29	1.96
310.0	2.88	2.30	1.98
320.0	2.86	2.27	1.96
330.0	2.82	2.24	1.93
340.0	2.82	2.23	1.91
350.0	2.84	2.24	1.91
360.0	2.89	2.27	1.94
370.0	2.96	2.33	1.98
380.0	2.99	2.36	2.01
390.0	2.97	2.35	2.01
400.0	2.91	2.35	2.05

## Harmonics Tables

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	-	-	14	35	18	36	20	54	25	41	41	52
1	-	16	+0	25	13	38	24	36	38	48	30	51
2	98	63	54	62	51	76	54	65	48	68	55	62
3	>100	52	53	56	58	61	50	56	49	79	55	71
4	>100	83	79	81	77	80	71	76	71	81	77	79
5	>100	78	77	80	75	83	67	78	65	86	69	82
6	>100	>94	92	92	>94	90	>94	92	89	93	84	>94
7	>100	>94	>94	93	91	>94	90	90	87	91	85	90
8	>100	>94	>94	>94	>94	>94	>94	>94	82	>94	>94	>94
9	>100	>94	>94	>94	>94	>94	>94	>94	>94	87	>94	>94
10	>100	>94	>94	>94	>94	>94	>94	>94	>94	>94	92	>94
	RF CAL	0	1	2	3	4	5	6	7	8	9	10

### LO HARMONICS ORDER

Test conditions: RF IN: 200.1 MHz; -1.00 dBm.  
 LO IN: 230.01 MHz; +17.00 dBm  
 IF OUT: 29.91 MHz; -6.18 dBm

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	-	-	24	44	30	45	33	61	40	60	52	62
1	-	17	+0	28	13	39	22	43	46	56	43	59
2	82	55	47	55	45	63	47	67	45	70	48	69
3	>100	41	37	43	39	44	38	45	52	53	51	58
4	>100	66	70	72	62	77	57	79	58	77	61	73
5	>100	62	52	53	55	53	50	61	47	53	52	71
6	>100	87	71	95	68	78	69	75	65	69	66	88
7	>100	89	75	65	61	61	64	64	60	65	57	68
8	>100	95	83	96	74	93	73	78	70	76	70	71
9	>100	80	82	85	89	73	69	71	70	75	64	67
10	>100	98	89	98	93	97	81	90	77	83	76	80
	RF CAL	0	1	2	3	4	5	6	7	8	9	10

### LO HARMONICS ORDER

Test conditions: RF IN: 200.1 MHz; 9.00 dBm.  
 LO IN: 230.01 MHz; +17.00 dBm  
 IF OUT: 29.91 MHz; 3.72 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.

REV. X2  
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 Page 5 of 5



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