

# Frequency Mixer

# TUF-R1MHSM+

## 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=4dBm (dB)		
		@LO (dBm)					@LO (dBm)					@LO (dBm)		
		+10	+13	+16			+10	+13	+16			+10	+13	+16
0.30	30.30	11.72	11.08	10.70	0.30	30.30	18.38	21.48	23.07	0.30	30.30	0.09	0.23	0.30
0.49	30.49	10.10	9.51	9.17	0.49	30.49	17.89	21.03	22.98	0.49	30.49	0.14	0.24	0.30
0.68	30.68	9.23	8.68	8.36	0.68	30.68	18.33	21.28	23.70	0.68	30.68	0.04	0.08	0.13
0.87	30.87	8.67	8.14	7.85	0.87	30.87	18.39	21.15	23.37	0.87	30.87	0.03	0.04	0.05
1.06	31.06	8.28	7.77	7.50	1.06	31.06	18.12	21.19	24.37	1.06	31.06	0.08	0.06	0.04
1.25	31.25	7.99	7.50	7.24	1.25	31.25	18.26	21.45	24.38	1.25	31.25	0.16	0.11	0.06
2.00	32.00	7.33	6.88	6.64	2.00	32.00	18.75	22.23	27.92	2.00	32.00	0.50	0.36	0.29
4.00	34.00	6.68	6.28	6.07	4.00	34.00	18.84	22.73	27.63	4.00	34.00	0.98	0.78	0.67
6.00	36.00	6.47	6.10	5.90	6.00	36.00	18.66	22.69	26.56	6.00	36.00	1.18	0.93	0.80
8.00	38.00	6.39	5.99	5.81	8.00	38.00	18.79	22.22	26.33	8.00	38.00	1.25	1.03	0.89
10.00	40.00	6.34	5.95	5.77	10.00	40.00	18.20	21.94	25.51	10.00	40.00	1.33	1.08	0.90
16.00	46.00	6.28	5.91	5.74	16.00	46.00	18.23	21.07	23.44	16.00	46.00	1.29	1.04	0.89
33.00	63.00	6.32	5.93	5.76	33.00	63.00	17.79	20.42	22.28	33.00	63.00	1.27	1.03	0.88
50.00	80.00	6.29	5.91	5.74	50.00	80.00	19.15	22.69	24.72	50.00	80.00	1.22	0.99	0.85
67.00	97.00	6.30	5.93	5.76	67.00	97.00	18.08	21.11	19.79	67.00	97.00	1.29	1.03	0.89
84.00	114.00	6.29	5.93	5.75	84.00	114.00	18.16	22.27	23.18	84.00	114.00	1.26	0.99	0.85
101.00	131.00	6.30	5.93	5.76	101.00	131.00	19.11	19.01	21.69	101.00	131.00	1.22	0.97	0.83
131.00	161.00	6.30	5.93	5.77	131.00	161.00	18.23	19.26	22.68	131.00	161.00	1.20	0.96	0.80
171.00	201.00	6.27	5.92	5.77	171.00	201.00	16.75	21.37	19.65	171.00	201.00	1.13	0.88	0.73
211.00	241.00	6.26	5.94	5.80	211.00	241.00	16.71	20.99	21.32	211.00	241.00	1.27	1.01	0.86
251.00	281.00	6.23	5.93	5.80	251.00	281.00	19.73	19.19	21.82	251.00	281.00	1.18	0.90	0.75
271.00	301.00	6.24	5.95	5.81	271.00	301.00	20.81	17.40	19.23	271.00	301.00	1.09	0.81	0.67
331.00	361.00	6.23	5.97	5.83	331.00	361.00	18.11	18.18	20.92	331.00	361.00	1.07	0.76	0.63
355.00	385.00	6.22	5.98	5.84	355.00	385.00	17.68	19.30	21.05	355.00	385.00	1.16	0.84	0.72
376.50	406.50	6.23	5.97	5.85	376.50	406.50	15.34	17.93	19.89	376.50	406.50	1.10	0.80	0.65
398.00	428.00	6.24	5.96	5.84	398.00	428.00	15.59	19.63	25.42	398.00	428.00	1.09	0.83	0.68
419.50	449.50	6.32	6.02	5.85	419.50	449.50	14.71	16.30	19.75	419.50	449.50	1.06	0.81	0.70
441.00	471.00	6.36	6.07	5.88	441.00	471.00	16.28	17.51	21.44	441.00	471.00	1.01	0.77	0.69
462.50	492.50	6.39	6.11	5.92	462.50	492.50	16.39	18.01	20.32	462.50	492.50	1.03	0.78	0.68
484.00	514.00	6.39	6.12	5.94	484.00	514.00	17.74	21.47	25.91	484.00	514.00	1.01	0.77	0.68
505.50	535.50	6.38	6.11	5.93	505.50	535.50	17.63	21.11	23.27	505.50	535.50	1.05	0.80	0.69
527.00	557.00	6.40	6.11	5.94	527.00	557.00	17.71	25.13	25.50	527.00	557.00	1.20	0.93	0.79
548.50	578.50	6.45	6.11	5.94	548.50	578.50	16.10	21.90	23.30	548.50	578.50	1.23	1.00	0.82
570.00	600.00	6.46	6.08	5.92	570.00	600.00	15.11	18.92	25.20	570.00	600.00	1.30	1.10	0.92
585.00	615.00	6.50	6.12	5.95	585.00	615.00	16.21	20.01	28.16	585.00	615.00	1.26	1.10	0.93
600.00	630.00	6.53	6.17	5.98	600.00	630.00	16.03	18.49	23.71	600.00	630.00	1.30	1.13	0.96

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# Frequency Mixer

# TUF-R1MHSM+

## Typical Performance Data

IF (OUT) (MHz)	LO (MHz)	CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=300MHz (dB)	IF (OUT) (MHz)	LO (MHz)	CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=2MHz (dB)	IF (OUT) (MHz)	LO (MHz)	CONVERSION LOSS VS. IF FREQUENCY @RF(IN)=600MHz (dB)
		@LO (dBm)			@LO (dBm)			@LO (dBm)
		13			13			13
299.70	0.30	7.65	0.30	2.30	6.79	599.70	0.30	6.84
299.51	0.49	6.47	0.49	2.49	6.79	599.51	0.49	6.42
299.32	0.68	6.16	0.68	2.68	6.76	599.32	0.68	6.31
299.13	0.87	6.03	0.87	2.87	6.79	599.13	0.87	6.24
298.94	1.06	5.93	1.06	3.06	6.78	598.94	1.06	6.17
298.75	1.25	5.88	1.25	3.25	6.78	598.75	1.25	6.15
298.00	2.00	5.82	2.00	4.00	6.84	598.00	2.00	6.08
296.00	4.00	5.80	4.00	6.00	6.79	596.00	4.00	6.04
294.00	6.00	5.78	6.00	8.00	6.75	594.00	6.00	6.04
292.00	8.00	5.76	8.00	10.00	6.74	592.00	8.00	6.01
290.00	10.00	5.73	10.00	12.00	6.68	590.00	10.00	5.98
280.00	20.00	5.83	13.00	15.00	6.67	585.00	15.00	5.96
270.00	30.00	5.78	30.00	32.00	6.72	568.00	32.00	5.95
259.00	41.00	5.70	47.00	49.00	6.76	551.00	49.00	5.93
244.00	56.00	5.71	64.00	66.00	6.71	534.00	66.00	5.88
229.00	71.00	5.65	81.00	83.00	6.70	517.00	83.00	5.84
214.00	86.00	5.63	98.00	100.00	6.72	500.00	100.00	5.16
199.00	101.00	5.61	131.00	133.00	6.82	469.00	131.00	5.74
184.00	116.00	5.61	171.00	173.00	6.80	429.00	171.00	5.66
169.00	131.00	5.57	211.00	213.00	6.84	389.00	211.00	5.71
144.00	156.00	5.57	251.00	253.00	6.78	349.00	251.00	5.95
119.00	181.00	5.54	271.00	273.00	6.80	329.00	271.00	5.97
94.00	206.00	5.57	291.00	293.00	6.78	314.00	286.00	5.98
69.00	231.00	5.60	311.00	313.00	6.78	299.00	301.00	5.93
44.00	256.00	5.61	331.00	333.00	6.78	284.00	316.00	6.02
19.00	281.00	5.62	355.00	357.00	6.78	269.00	331.00	6.01
16.50	283.50	5.64	378.50	380.50	6.86	245.00	355.00	6.06
14.00	286.00	5.66	402.00	404.00	6.87	221.50	378.50	6.09
11.50	288.50	5.65	425.50	427.50	6.85	198.00	402.00	6.14
9.00	291.00	5.66	449.00	451.00	6.85	174.50	425.50	6.19
7.00	293.00	5.67	472.50	474.50	6.79	151.00	449.00	6.22
5.00	295.00	5.68	496.00	498.00	6.80	127.50	472.50	6.11
3.00	297.00	5.68	519.50	521.50	6.85	104.00	496.00	6.11
1.00	299.00	5.70	543.00	545.00	6.86	80.50	519.50	6.13
0.90	299.10	5.70	566.50	568.50	6.85	57.00	543.00	6.15
0.80	299.20	5.69	590.00	592.00	6.85	33.50	566.50	6.09
0.70	299.30	5.70	591.60	593.60	6.86	10.00	590.00	6.12
0.60	299.40	5.69	593.20	595.20	6.86	5.50	594.50	6.11
0.50	299.50	5.69	594.80	596.80	6.86	1.00	599.00	6.17
0.40	299.60	5.71	596.40	598.40	6.88	0.65	599.35	6.18
0.30	299.70	5.58	598.00	600.00	6.88	0.30	599.70	6.20



# Frequency Mixer

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## 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)		
	+10	+13	+16	+10	+13	+16			+10	+13	+16
30.30	62.11	61.08	54.67	55.55	53.75	52.68	0.30	30.30	60.04	56.29	53.94
30.49	62.02	54.17	54.64	55.57	53.72	52.69	0.49	30.49	59.17	55.02	52.63
30.68	62.11	54.43	54.65	55.52	53.72	52.66	0.68	30.68	57.49	54.58	51.85
30.87	62.09	54.53	54.68	55.52	53.69	52.65	0.87	30.87	58.03	53.70	51.21
31.06	62.05	54.64	54.63	55.53	53.66	52.64	1.06	31.06	57.23	53.45	50.92
31.25	61.99	54.74	54.64	55.49	53.68	52.61	1.25	31.25	56.68	53.19	50.48
32.00	61.95	54.73	54.58	55.32	53.60	52.56	2.00	32.00	55.78	52.47	50.20
34.00	61.76	54.64	54.50	55.18	53.43	52.41	4.00	34.00	53.05	50.62	48.65
36.00	61.63	54.57	54.38	54.97	53.25	52.24	6.00	36.00	53.61	47.62	49.65
38.00	61.46	54.47	54.27	54.73	53.04	52.05	8.00	38.00	49.88	48.07	46.44
40.00	61.25	54.33	54.13	54.52	52.89	51.91	10.00	40.00	44.18	44.63	42.05
46.00	60.72	53.83	53.59	53.88	52.27	51.29	16.00	46.00	45.07	44.11	43.16
63.00	59.18	51.68	51.23	51.49	49.67	48.57	33.00	63.00	39.55	39.14	38.91
80.00	57.70	49.58	48.97	49.64	47.41	45.99	50.00	80.00	36.36	36.17	36.11
97.00	56.90	48.69	48.10	48.61	46.41	45.09	67.00	97.00	34.16	34.08	34.01
114.00	56.07	48.04	47.52	47.86	45.81	44.67	84.00	114.00	32.44	32.42	32.38
131.00	55.45	47.52	46.97	47.27	45.29	44.31	101.00	131.00	31.16	31.17	31.14
161.00	54.29	45.98	45.12	45.97	43.86	42.73	131.00	161.00	29.39	29.46	29.46
201.00	53.11	44.67	43.77	44.91	43.26	41.85	171.00	201.00	27.84	27.96	28.03
241.00	52.11	43.69	42.79	44.32	42.58	40.93	211.00	241.00	26.82	27.05	27.16
281.00	51.14	42.16	41.34	42.66	40.86	39.39	251.00	281.00	26.23	26.33	26.48
301.00	50.83	41.96	41.31	42.42	40.86	39.52	271.00	301.00	26.24	26.35	26.41
361.00	49.89	40.35	39.61	39.45	38.43	37.39	331.00	361.00	26.23	26.69	26.93
385.00	50.00	40.29	39.61	38.44	38.20	37.21	355.00	385.00	26.24	26.89	27.35
406.50	49.21	39.58	38.87	37.21	37.16	36.50	376.50	406.50	26.45	27.09	27.60
428.00	48.20	38.93	38.25	36.57	36.42	36.15	398.00	428.00	26.87	27.41	27.86
449.50	47.13	38.24	37.72	35.74	35.31	35.04	419.50	449.50	27.27	27.52	27.84
471.00	46.34	37.56	37.13	34.61	34.30	34.01	441.00	471.00	27.76	27.80	27.84
492.50	46.16	37.17	36.70	34.19	34.13	33.62	462.50	492.50	27.91	27.94	27.98
514.00	46.10	36.97	36.52	33.88	34.19	33.71	484.00	514.00	27.84	28.11	28.37
535.50	45.92	36.70	36.27	32.82	33.71	33.86	505.50	535.50	27.62	28.32	29.03
557.00	46.61	36.47	35.98	32.26	33.20	33.44	527.00	557.00	26.91	28.18	29.50
578.50	47.43	36.19	35.56	31.63	32.30	32.56	548.50	578.50	25.99	27.68	29.31
600.00	48.27	36.00	35.39	31.18	31.73	31.92	570.00	600.00	24.95	26.56	28.00
615.00	48.27	36.00	35.39	31.18	31.73	31.92	585.00	615.00	24.14	25.39	26.59
630.00	50.80	35.53	34.83	30.46	30.83	30.81	600.00	630.00	23.32	24.17	25.04

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## Typical Performance Data

RF (IN) (MHz)	LO (MHz)	RF VSWR (:1)			LO (MHz)	LO VSWR (:1)			IF (OUT) (MHz)	IF VSWR @LO=MHz (:1)		
		@LO (dBm)				@LO (dBm)				@LO (dBm)		
		+10	+13	+16		+10	+13	+16		+10	+13	+16
0.30	30.30	5.23	5.13	5.06	30.30	1.51	2.35	3.40	0.30	1.56	1.30	1.16
0.49	30.49	3.65	3.60	3.56	30.49	1.51	2.35	3.40	0.68	1.61	1.34	1.20
0.68	30.68	2.97	2.93	2.92	30.68	1.51	2.36	3.40	0.87	1.62	1.35	1.20
0.87	30.87	2.57	2.55	2.54	30.87	1.51	2.36	3.39	1.25	1.63	1.36	1.21
1.06	31.06	2.31	2.30	2.30	31.06	1.51	2.36	3.39	2.00	1.64	1.36	1.21
1.25	31.25	2.13	2.12	2.12	31.25	1.51	2.36	3.39	6.00	1.64	1.37	1.22
2.00	32.00	1.75	1.74	1.76	32.00	1.50	2.35	3.38	8.00	1.65	1.37	1.22
4.00	34.00	1.40	1.40	1.42	34.00	1.52	2.34	3.41	10.00	1.65	1.37	1.22
6.00	36.00	1.28	1.28	1.29	36.00	1.51	2.37	3.40	15.00	1.65	1.37	1.22
8.00	38.00	1.22	1.21	1.23	38.00	1.50	2.36	3.43	32.00	1.65	1.37	1.22
10.00	40.00	1.18	1.16	1.19	40.00	1.52	2.35	3.44	49.00	1.65	1.38	1.22
16.00	46.00	1.12	1.10	1.13	46.00	1.52	2.37	3.46	66.00	1.67	1.38	1.23
33.00	63.00	1.08	1.04	1.10	63.00	1.51	2.35	3.44	83.00	1.67	1.39	1.23
50.00	80.00	1.07	1.03	1.09	80.00	1.49	2.28	3.27	100.00	1.68	1.39	1.24
67.00	97.00	1.08	1.02	1.09	97.00	1.50	2.28	3.27	131.00	1.69	1.40	1.25
84.00	114.00	1.07	1.03	1.09	114.00	1.48	2.30	3.33	171.00	1.72	1.42	1.26
101.00	131.00	1.08	1.04	1.10	131.00	1.48	2.33	3.34	211.00	1.74	1.44	1.28
131.00	161.00	1.10	1.05	1.11	161.00	1.47	2.23	3.18	251.00	1.77	1.47	1.30
171.00	201.00	1.12	1.08	1.14	201.00	1.49	2.30	3.31	271.00	1.78	1.48	1.31
211.00	241.00	1.13	1.11	1.15	241.00	1.47	2.19	3.06	286.00	1.80	1.49	1.33
251.00	281.00	1.14	1.13	1.17	281.00	1.50	2.30	3.34	301.00	1.81	1.50	1.33
271.00	301.00	1.14	1.13	1.17	301.00	1.48	2.26	3.27	316.00	1.82	1.51	1.34
331.00	361.00	1.16	1.16	1.20	361.00	1.51	2.27	3.23	331.00	1.83	1.52	1.35
355.00	385.00	1.16	1.17	1.20	385.00	1.51	2.22	3.09	350.00	1.84	1.53	1.36
376.50	406.50	1.17	1.17	1.21	406.50	1.54	2.25	3.12	370.00	1.87	1.55	1.38
398.00	428.00	1.17	1.17	1.20	428.00	1.55	2.27	3.15	390.00	1.88	1.56	1.39
419.50	449.50	1.18	1.17	1.20	449.50	1.53	2.21	3.09	410.00	1.90	1.58	1.41
441.00	471.00	1.18	1.17	1.19	471.00	1.54	2.26	3.12	430.00	1.92	1.60	1.42
462.50	492.50	1.19	1.19	1.20	492.50	1.59	2.30	3.17	450.00	1.94	1.61	1.44
484.00	514.00	1.20	1.20	1.21	514.00	1.61	2.27	3.09	470.00	1.97	1.63	1.45
505.50	535.50	1.21	1.21	1.23	535.50	1.61	2.23	3.04	510.00	2.01	1.67	1.49
527.00	557.00	1.22	1.22	1.25	557.00	1.65	2.30	3.14	550.00	2.05	1.71	1.52
548.50	578.50	1.23	1.23	1.26	578.50	1.65	2.33	3.21	590.00	2.11	1.77	1.58
570.00	600.00	1.23	1.23	1.26	600.00	1.66	2.23	3.03	593.00	2.12	1.78	1.60
585.00	615.00	1.23	1.23	1.26	615.00	1.66	2.23	3.03	597.00	2.13	1.81	1.63
600.00	630.00	1.22	1.22	1.25	630.00	1.73	2.40	3.33	599.70	1.96	1.76	1.69

REV. X2

TUF-R1MHSM+

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IF/RF MICROWAVE COMPONENTS • ISO 9001 ISO 14001 AS 9100 CERTIFIED • RoHS compliant

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## Harmonics Tables

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	-	-	19	37	21	42	22	36	32	54	42	50
1	-	24	+0	33	12	33	17	36	33	39	38	39
2	76	74	52	73	53	75	54	> 78	53	64	64	76
3	> 90	74	65	68	62	67	53	72	54	63	56	75
4	> 90	> 78	> 78	> 78	> 78	> 78	> 78	> 78	> 78	> 78	> 78	> 78
5	> 90	> 78	> 78	> 78	> 78	> 78	> 78	> 78	> 78	> 78	> 78	> 78
6	> 90	> 78	> 78	> 78	> 78	> 78	> 78	> 78	> 78	> 78	> 78	> 78
7	> 90	> 78	> 78	> 78	> 78	> 78	> 78	> 78	> 78	> 78	> 78	> 78
8	> 90	75	56	63	54	72	53	68	62	70	65	74
9	> 90	76	64	64	53	> 78	54	76	53	74	52	74
10	> 90	39	38	39	33	36	17	33	12	33	+0	24
	RF CAL	0	1	2	3	4	5	6	7	8	9	10

### LO HARMONICS ORDER

Test conditions: RF IN: 300.00 MHz; -6.00 dBm.  
 LO IN: 330.00 MHz; +13.00 dBm  
 IF OUT: 30.00 MHz; -11.99 dBm

RF HARMONICS ORDER

	(-dBm)	(-dBc)										
0	-	-	27	46	35	52	37	56	50	62	59	73
1	-	24	+0	31	12	36	19	40	35	48	50	50
2	56	63	46	63	47	63	47	64	47	60	62	71
3	85	49	42	57	42	60	40	51	39	55	47	54
4	> 90	> 88	70	73	69	73	63	72	56	77	57	69
5	> 90	69	64	57	51	60	48	59	45	86	46	59
6	> 90	59	46	85	45	59	48	60	51	57	64	69
7	> 90	69	57	77	56	72	63	72	69	74	69	> 88
8	> 90	54	47	55	39	51	40	60	42	57	42	49
9	> 90	71	62	60	47	65	47	63	47	64	46	63
10	> 90	50	50	48	35	40	19	36	12	31	+0	24
	RF CAL	0	1	2	3	4	5	6	7	8	9	10

### LO HARMONICS ORDER

Test conditions: RF IN: 300.00 MHz; +4.00 dBm.  
 LO IN: 330.00 MHz; +13.00 dBm  
 IF OUT: 30.00 MHz; -2.05 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.