

REPORT NUMBER 1903
(*PERMISSIVE CHANGE CLASS 2*)

August 2003

RADIO PERFORMANCE MEASUREMENTS
ON THE T2010-K27 MOBILE TRANSCEIVER
(12.5 kHz Channel Spacing)

FCC ID: CASTEL 0057

SERIAL # 17242085

In accordance with

FCC 47 CFR Part 90,22

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NAME OF TEST: TRANSMITTER OUTPUT POWER (CONDUCTED)

TEST CONDITIONS: Ambient Temperature 22.5 °C
 Relative Humidity 48 %
 Standard Voltage 13.8 V DC

SPECIFICATION: FCC 47 CFR 2.1046 (a)

GUIDE: TIA/EIA-603 2.2.1

MEASUREMENT PROCEDURE:

- The Equipment Under Test (EUT) was set up as shown on the following diagram.
- The coaxial attenuator used has an impedance of 50Ω.
- The unmodulated output power was measured with an RF Power Meter.

MEASUREMENT RESULTS

Manufacturer's Rated Output Power: Switchable 5 W and 15 W

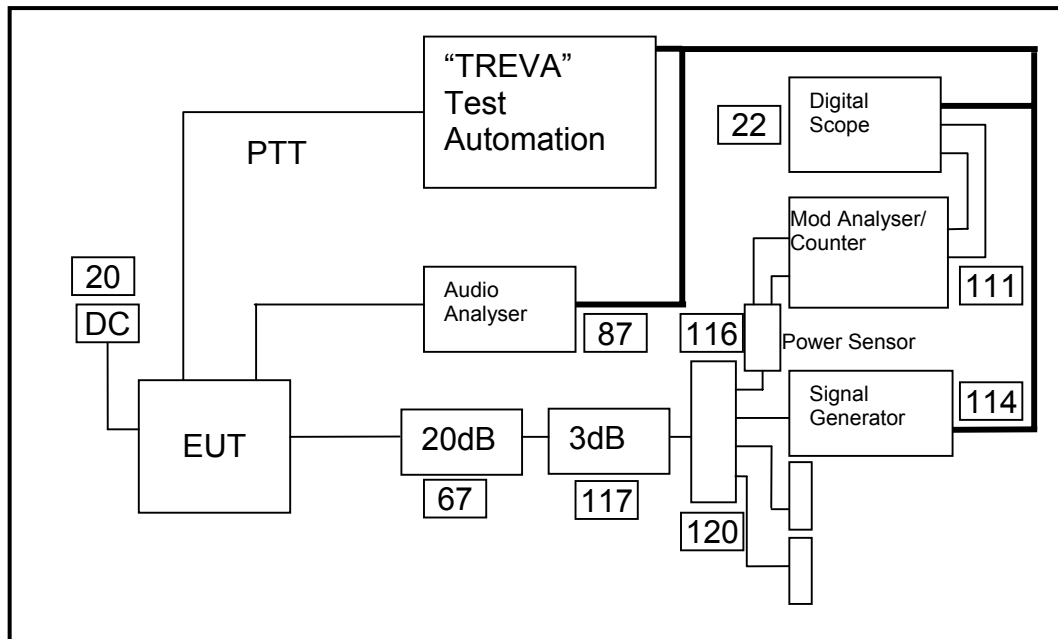
Frequency 896.1 MHz	5 W nominal	15 W nominal
Power (W)	4.4	14.8
Variation from nom (%)	-12.0	-1.3
Frequency 939.9 MHz	5 W nominal	15 W nominal
Power (W)	4.1	13.5
Variation from nom (%)	-18.0	-10.0
Measurement Uncertainty (dB)	+ 0.63 - 0.68	

LIMIT CLAUSE: FCC 47 CFR 90.205

Radio Type: Mobile Frequency Band: 896 MHz ~ 940 MHz

(n) "The output power shall not exceed by more than 20% the manufacturer's rated output power for the particular transmitter."

TEST SETUP: (See page 13 for test equipment information.)



NAME OF TEST: OCCUPIED BANDWIDTH

TEST CONDITIONS: Ambient Temperature 23 °C
 Relative Humidity 45 %
 Standard Voltage 13.8 V DC

SPECIFICATION: FCC 47 CFR 2.1049 (c) (1)

GUIDE: TIA/EIA-603 2.2.11

MEASUREMENT PROCEDURE:

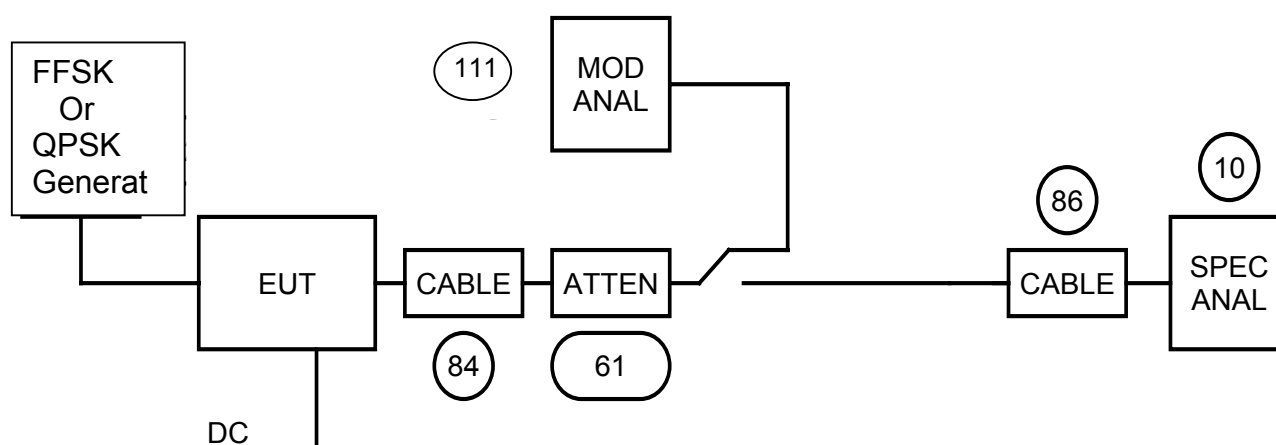
- The Equipment Under Test (EUT) was set up as shown on the following diagram.
- The EUT was modulated by either a 2400 bits per second FFSK or a 4800 bits per second QPSK signal to produce 60% modulation.
- The Occupied Bandwidth was measured on the Spectrum Analyser with the controls set as shown on the following plots.

MEASUREMENT RESULTS: See the plots on the following pages.

LIMIT CLAUSE: FCC 47 CFR 90.210

EMISSION MASK “ I “	ATTENUATION (dBc)	
	5 W	15 W
$F_c \pm 6.8 \text{ kHz to } \pm 9.0 \text{ kHz}$	25	25
$F_c \pm 9.0 \text{ kHz to } \pm 15.0 \text{ kHz}$	35	35
$F_c > \pm 15.0 \text{ kHz}$	49.99	54.76

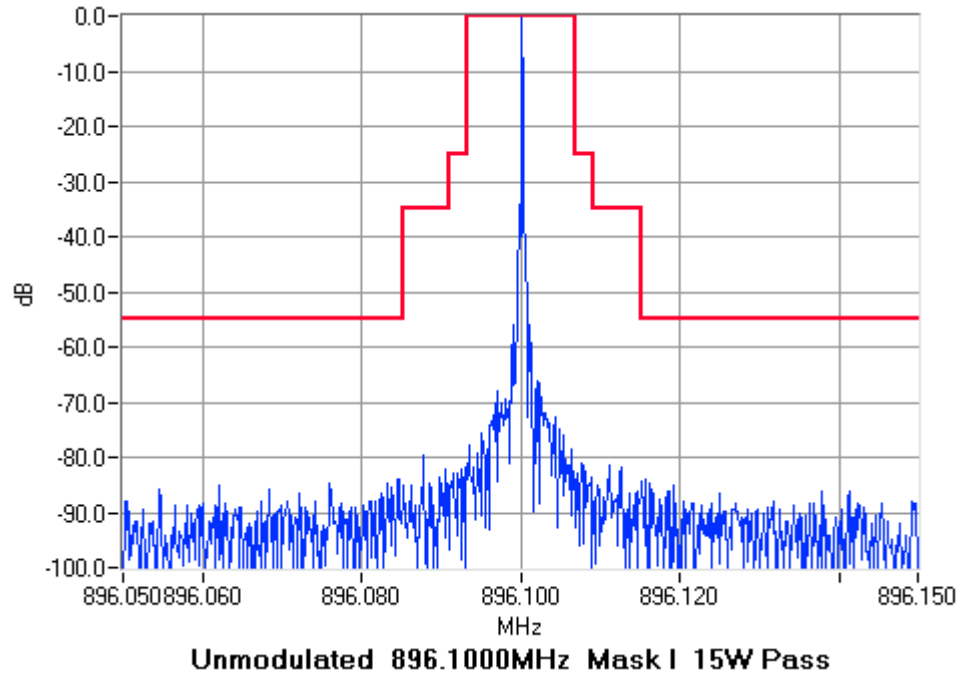
TEST SETUP: See page 13 for test equipment information.



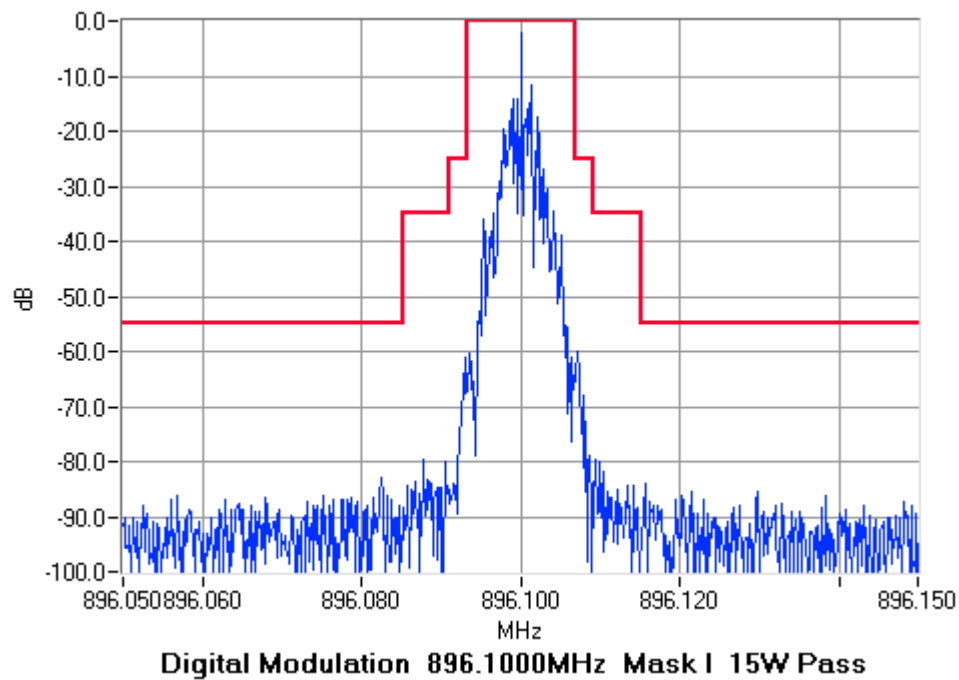
NAME OF TEST: OCCUPIED BANDWIDTH

SPECIFICATION: FCC CFR 2.1049 (c) (1)

Unmodulated:

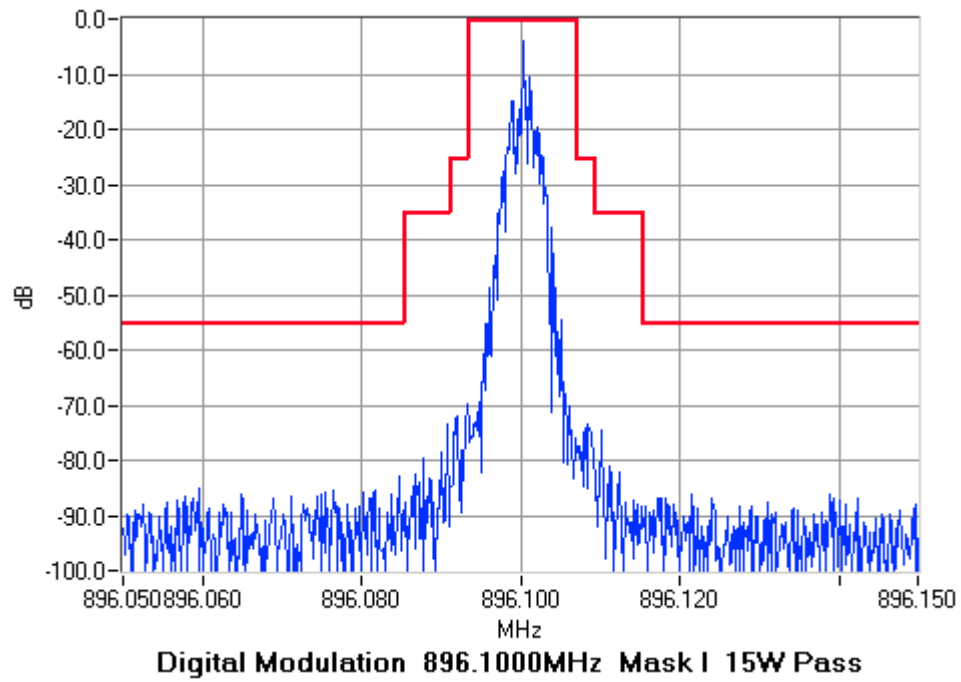


2400 Bits per second FFSK:

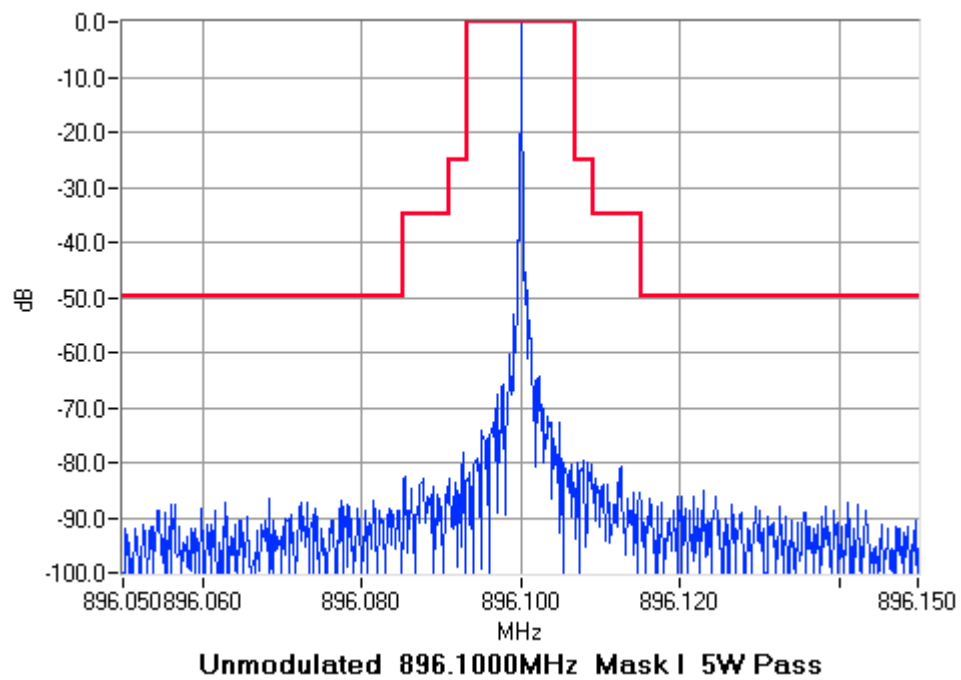


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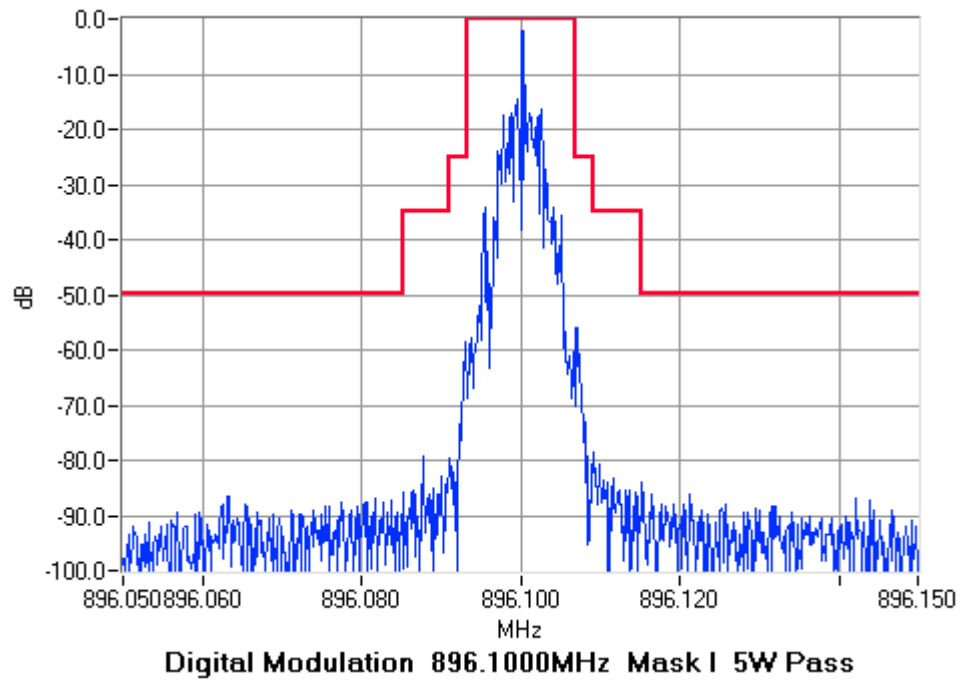
4800 Bits per second QPSK:



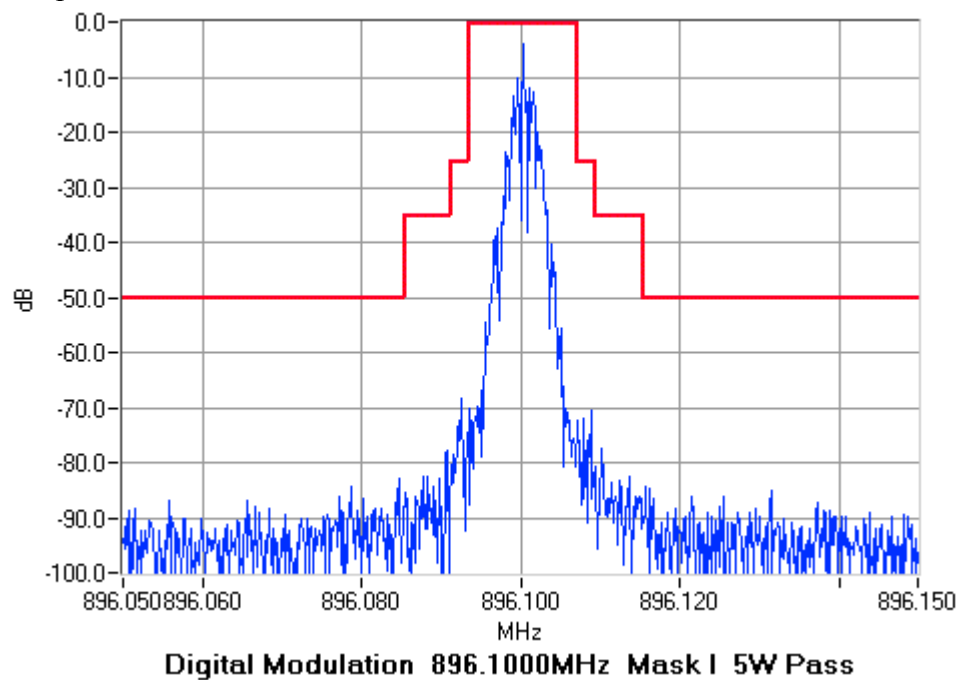
Unmodulated:



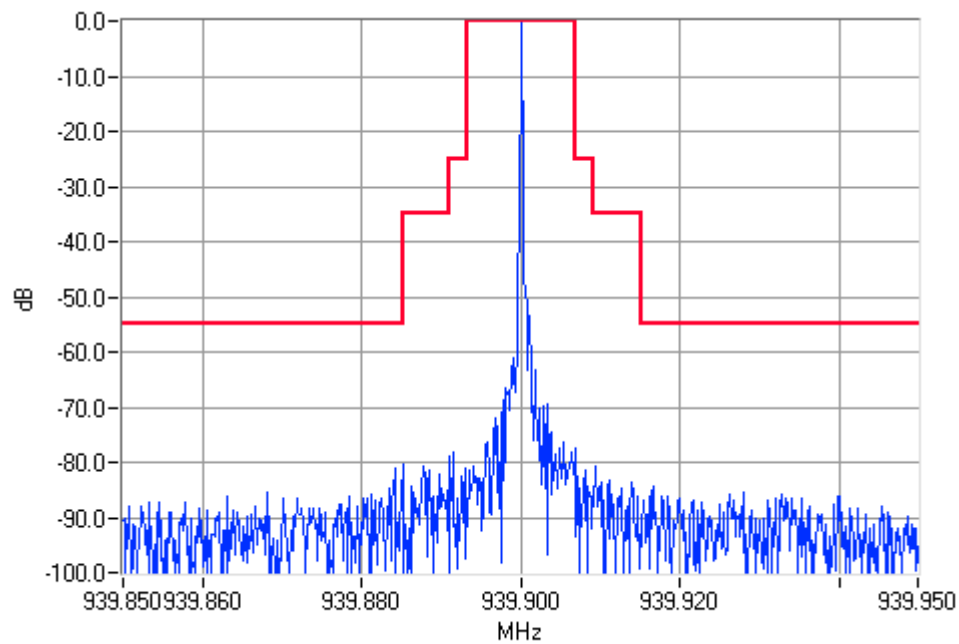
2400 Bits per second FFSK:



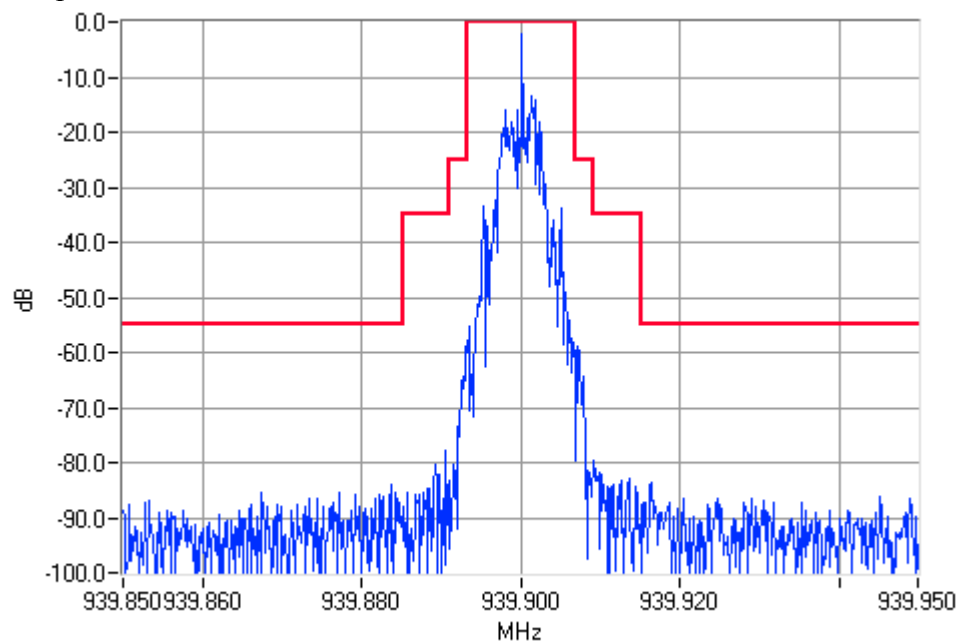
4800 Bits per second QPSK:



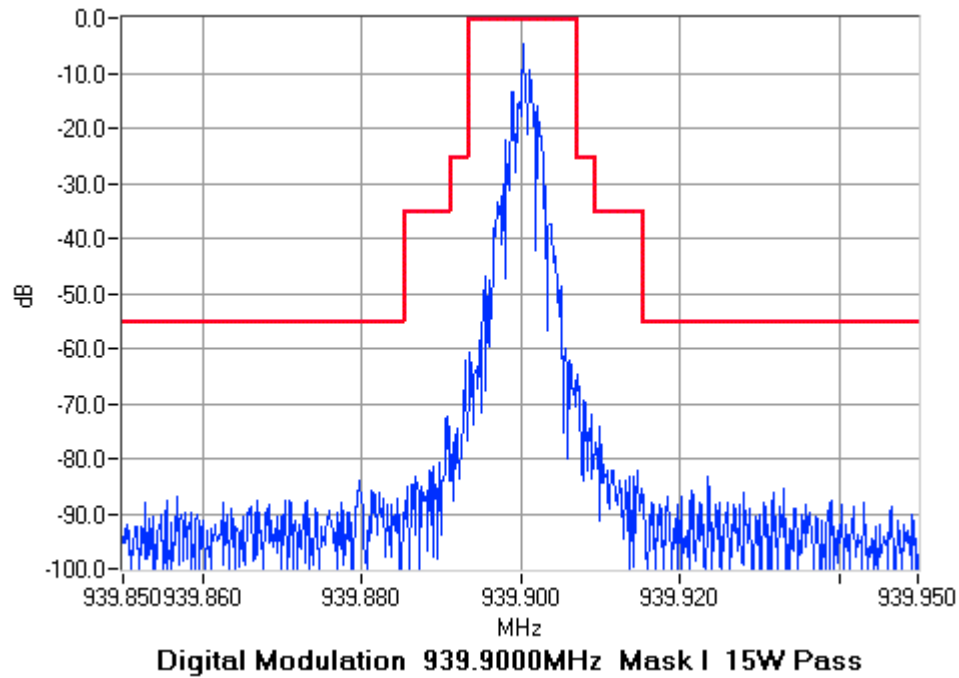
Unmodulated:

**Unmodulated 939.9000MHz Mask I 15W Pass**

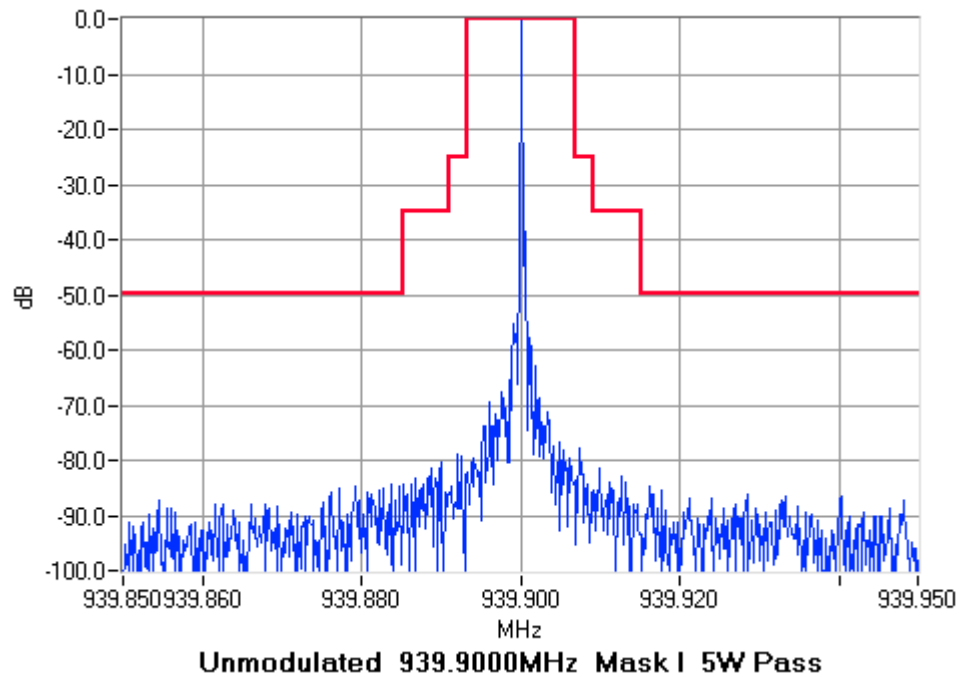
2400 Bits per second FFSK:

**Digital Modulation 939.9000MHz Mask I 15W Pass**

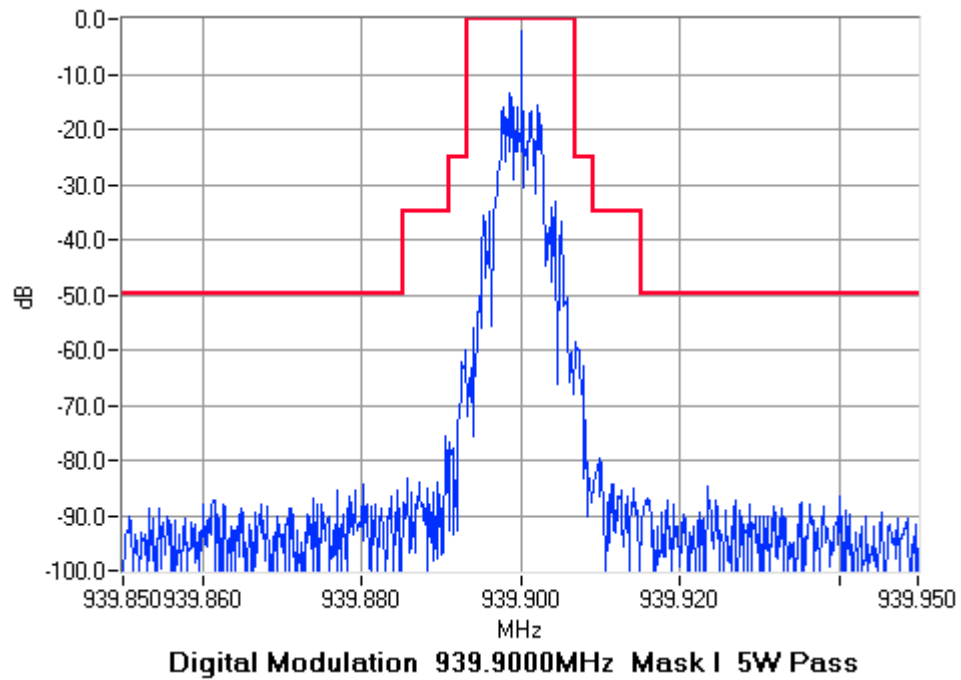
4800 Bits per second QPSK:



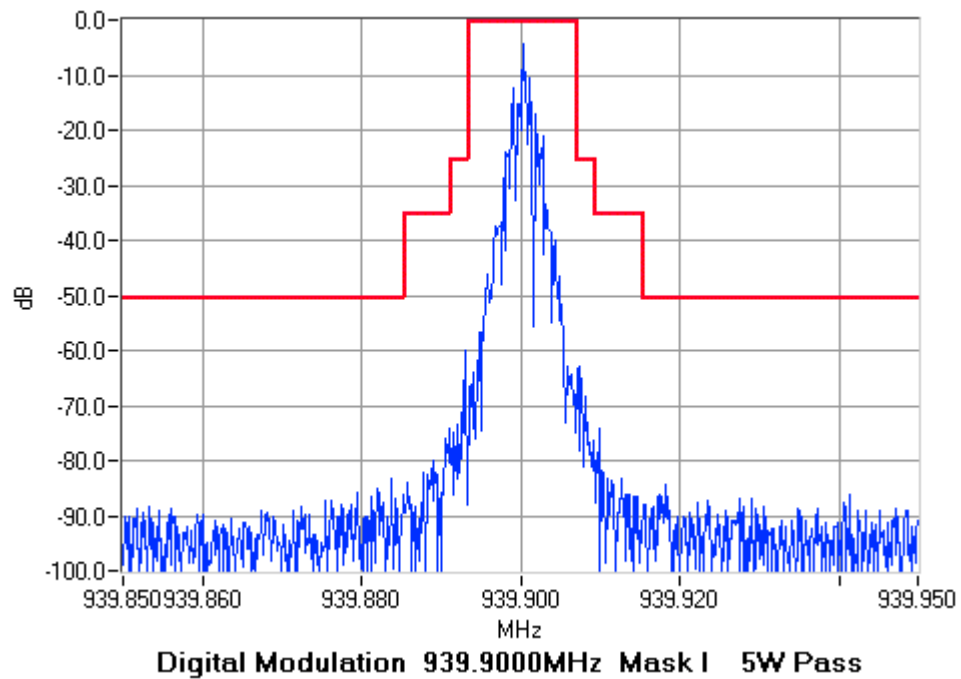
Unmodulated:



2400 Bits per second FFSK:



4800 Bits per second QPSK:



NAME OF TEST: TRANSMITTER FREQUENCY STABILITY
(VOLTAGE)

TEST CONDITIONS: Ambient Temperature 23 °C
Relative Humidity 45 %
Standard Voltage 13.8 V DC

SPECIFICATION: FCC 47 CFR 2.1055 (d) (2)

GUIDE: TIA/EIA-603 2.2.2

MEASUREMENT PROCEDURE:

- The Equipment Under test was set up as shown in the following diagram.
- The EUT was tested for frequency error at a nominal battery voltage of 13.8V and $V_{nom} \pm 15\%$. (11.7V and 15.9V).
- The frequency error was recorded in parts per million (ppm).

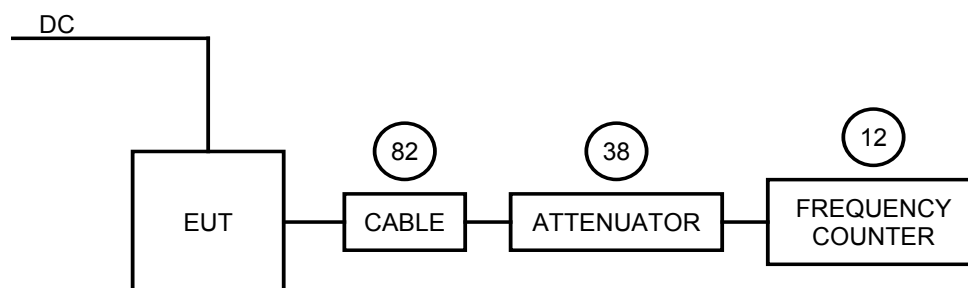
MEASUREMENT RESULTS:

Channel Frequency (MHz)	Frequency Error (ppm)		
	11.7V DC	13.8 V DC	15.9 V DC
896.1 MHz (at 15 Watts)	-0.17	-0.11	-0.14
896.1 MHz (at 5 Watts)	-0.27	-0.21	-0.25
939.9 MHz (at 15 Watts)	-0.35	-0.31	-0.33
939.9 MHz (at 5 Watts)	-0.39	-0.37	-0.40

LIMIT CLAUSE: FCC 47 CFR 90.213

Frequency Range	Frequency Error (ppm)
896 MHz to 940 MHz	± 1.5

TEST SETUP: See page 13 for test equipment information.



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TEST EQUIPMENT LIST

To facilitate inclusion on each page, the test equipment used is identified (numbered) and listed against the related test in the report.

No	Equipment Type	Manufacturer	Model Number	Serial No	Tait ID
1	Signal Generator	Hewlett Packard	HP8642B (Opt 001)	2512A00176	E3064
2	Signal Generator	Hewlett Packard	HP8648A	3430U00344	E3579
3	Signal Generator	Agilent	E4422B	GB40050320	E3788
4	Signal Generator	Hewlett Packard	HP8648C	3443U00543	E3558
5	Signal Generator	Rohde & Schwarz	SMY01 1062.5502.11	841736/019	E3553
10	Spectrum Analyser	Hewlett Packard	HP8596E (Opt 140)	3346A00213	E3427
11	Modulation Analyser	Hewlett Packard	HP8901B (Opt 002)	2441A00393	E3073
12	Modulation Analyser	Rohde & Schwarz	FMA0852.8500.52	842541/001	E3554
13	Audio Analyser	Hewlett Packard	HP8903A	2308A02597	E3074
14	Power Head	Hewlett Packard	HP11722A	2320A00688	E3307
15	Power Meter	Rohde & Schwarz	NRVS 1020.1809.02	841954/005	E3555
16	Power Sensor	Rohde & Schwarz	URV5- Z4 395.1619. 55	841.498/003	E3557
20	Power Supply	Hewlett Packard	HP6032A	2441A-0041Z	E3075
21	Power Supply	Rohde & Schwarz	NGS M32/10 192.0810.31	Fnr 434	E3556
22	Oscilloscope	Tektronics	TDS340	B013611	E3585
23	Universal Counter	Goldstar	FC2015U -	600801	E3550
24	Environ. Chamber	Contherm	Spatial Cal	E3397	E3397
24	Environ. Chamber	Contherm	Temp Control	E3397	E3397
25	Whirling Hygrometer	Casella	3156/82	TA004	TA004
30	Directional Coupler	Hewlett Packard	HP778D-012	1144 07392	E3292
31	4 Port Combiner (CAST)	Rohde & Schwarz	DVU4,3W 201.4018.03	300.729/47	E3623
32	4 Port Combiner	Rohde & Schwarz	DVU4, 3W 201.4018. 03	300.971/28	E3572
33	3 Port Combiner	Weinschel	1506A, 1W	LD858	E3672
34	Mixer Spurious Emission	Tait	(3. 2GHz# Rfx#4.0 GHz)	E3661	E3661
35	Mixer Transient ACP	Minicircuits	ZAD-1177031	ZAD-11	E3394
36	Voltmeter	Hewlett Packard	HP3478A	2545A25838	1559
37	Variac	Yamabishi	S-260-5	TX-533	E1737
38	Rx & Tx, RF Paths	Tait	CAST Interface	E3067	E3067
40	Reference Dipoles	Emco	3121C DB1	9510-1164	E3559
41	Biconical Antenna	Emco	3110B	9307-1680	E3033
42	Reference Horn Antenna	Emco	DRG3115	9512-4638	E3560
43	Horn Antenna	Emco	DRG3115	2084	E3076
44	Corner 175-420 MHz	Ailtech	DM105A-T2	J1417-103	E3031
45	Corner 400-1000 MHz	Ailtech	DM105A-T3	J1418-108	E3036
46	S-LINE TEM CELL	Rohde & Schwarz	1089.9296.02	338232/003	E3636
50	Amplifier 1MHz-1000MHz	Amplifier Research	25W1000A	20444	E3637
51	Amplifier 10kHz-250MHz	Amplifier Research	25A250	16373	E3570
52	Amplifier +21.7 dB	Tait	ZFL-1000LN	E3660	E3360
53	RF Filter 21.4M (CAST)	Tait	NDK21G-6DT	E3069	E3069
54	RF Filter 21.4M (ACP)	Tait	NDK21G-6DT	RA-7'	E3249
55	Filter Notch	Tait		N/A	-
56	Filter High Pass	Tait	4 MHz	N/A	-
57	Filter Low Pass	Tait	MHz	N/A	-
60	RF Attenuator 250W	Weinschel	45-30-34	JW663	E3386
61	RF Attenuator 150W	Weinschel	40-20-33	CJ404	E3387
62	RF Attenuator 150W	Weinschel	57-10-34	LB590	E3674
63	RF Attenuator 150W	Weinschel	40-06-34	KV457	E3561
64	RF Attenuator 50W	Weinschel	24-10-34	AZ0401	E3388
65	RF Attenuator 50W	Weinschel	24-20-44	AW1266	E3562
66	RF Attenuator 25W	Weinschel	33-20-33	BD5871	E3673
67	RF Attenuator 150W	Weinschel	40-20-33	CJ405	E3733
70	RF Load 150W	Bird	8166	524	E3625
71	RF Load 50W	Weinschel	F1426	BF0487	E3675
72	RF Load 50W	Weinschel	F1426	AE2490	E3624

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73	RF Termination 20W	Deltec		118.001	E3626
74	RF Termination 2W	MCL	NTRM-50	951215	E3574
75	RF Termination 2W	MCL	NTRM-50	954214	E3575
76	RF Termination 2W	MCL	NTRM-50	954214	E3576
80	20m Coax Cable	Intelcom	RG214/U-50(Ext Cal)	CBL01	E3659
81	2m Coax Cable	Intelcom	RG213/U-50 (Ext Cal)	CBL02	E3658
82	3m Coax Cable BLUE)	Suhner	Sucoflex 104A	25033/4A	E3694
83	1m Coax Cable (BLUE)	Suhner	Sucoflex 104A	25006/4A	E3693
84	1m Coax Cable (BLUE)	Suhner	Sucoflex 104A	25005/4A	E3692
85	1m Coax Cable (BLUE)	Suhner	Sucoflex 104A	25004/4A	E3691
86	1m Coax Cable (BLUE)	Suhner	Sucoflex 104A	25003/4A	E3690
87	Audio Analyser	Hewlett Packard	HP8903B	2818A04275	E3710
88	Spectrum Analyser	Hewlett Packard	HP8562E	3821A00779	E3715
89	Field Strength Meter	Holaday	HI-422	95661	E3630
90	Power Supply	Hewlett Packard	HP6012B	2524A00616	E3712
91	20m Coax Cable		RG214/U-50 (Ext Cal)	CBL01	E3404
92	LISN	Emco	3825/2	9204-1961	E3040
93	EMC Test Instr	Schaffner	BEST +A	199825-010SC	AT183
94	ESD Test Set	Haefely	PSD 25B	082 999 24	E3629
95	Vehicle Conducted Immunity Test Set	Schaffner	NSG 5000	IN5094-090	E3506
96	Burst Generator	Schaffner	NSG5003	AR5194-151	E3508
97	Battery Simulator	Schaffner	NSG 5004	IN1695-003	-
98	RF Injection Probe	Fischer	F120-9	121	-
99	BER Meter	Datatool	5000	9405003	-
100	Oscilloscope	Tektronics	TDS380	B017095	E3782
101	Coupler Decoupler Network	MEB	S15	10344	E3563
102	Coupler Decoupler Network	MEB	S1/50	10328	E3564
103	Coupler Decoupler Network	MEB	AF2	10967	E3565
104	Coupler Decoupler Network	MEB	M3-1	12207	E3566
105	Coupler Decoupler Network	MEB	S25	10762	E3567
105	Coupler Decoupler Network	MEB	T2	10778	E3568
106	Coupler Decoupler Network	MEB	M2	10701	E3569
107	Benchlink	Hewlett Packard	E4444A Ver A.01.06	19980701	
108	GPIO Software	National Instruments	Ver 1.6	500739A-00	
109	Labview	National Instruments	Ver 5.1.1	500573J-00	
110	Wavestar	Tektronix	WSTR31 Ver 2.4	063-2173-04	
111	Modulation Analyser	Hewlett Packard	HP8901B (Opt 002)	3704A05837	E3786
112	Signal Generator	Agilent	E4433B	US384440446	E4147
113	Hi Level Mixer	Tait			E3393
114	Signal Generator	Rohde & Schwarz	SML03 1090.3000.13	100597	E4050
115	Environ. Chamber	Contherm	5400 RHSLT.M	1416	E4051
116	Power Head	Hewlett Packard	HP11722A	2716A02037	1575
117	RF Attenuator	Weinschel	Model 1	BL9950	E4080
118	RF Attenuator	Weinschel	Model 1	BL9958	E4081
119	RF Attenuator 150W	Weinschel	40-20-23	MF817	E4082
120	RF Splitter Combiner	Minicircuits	ZFSC-4-1	-	E4083
121	RF Splitter Combiner	Minicircuits	ZFSC-4-1	-	E4084
122	RF Splitter Combiner	Minicircuits	ZFSC-4-1	-	E4085
123	Spectrum Analyser	Agilent	E4445A	MY42510072	E4139
124	3 Port Combiner	Weinschel	1506A, 1W	MD719	
125	3 Port Combiner	Weinschel	1506A, 1W	MC166	
126	3 Port Combiner	Weinschel	1506A, 1W	MD714	