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FCC Part 90 Certification Application

FCC Form 731

For The

**TSLM
VHF Wireless MODEM**

FCC ID: NP4-2422210610



NAME OF TEST: ***Transmitter Rated Power Output***

RULE PART NUMBER: 2.1046 (a) (c)

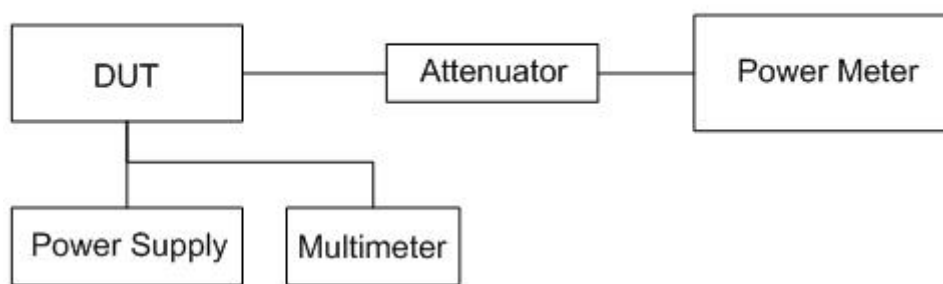
TEST RESULTS: See results below

TEST CONDITIONS: Standard Test Conditions

TEST EQUIPMENT: 50 Ohm Attenuator, Tenuline Model 8340 / 20 dB / 25 Watt
 50 Ohm Attenuator, Tenuline Model 8340 / 10dB / 25 Watt
 Power Supply, Instek Model GPS-2303
 Power Meter, Model HP-436A

TEST SET-UP:

Transmitter Rated Output Power



TEST RESULTS:

Frequency (MHz)	DC Voltage at Final (Vdc)	DC Current into Final (Adc)	DC Power into Final (W)	RF Power Output (W)
150	12.5	1.24	15.50	5
150	7.2	0.68	4.90	0.1

NAME OF TEST: ***Transmitter Occupied Bandwidth for Emission Designator***

RULE PART NUMBER: 2.202, 90.209 (b)(5), 90.210(d), 2.1047 (d), 2.1049 (c) (1)

MINIMUM STANDARDS: **Mask D**
 Sidebands and Spurious [Rule 90.210 (d), P = 5 Watts and P=0.1 Watt]
 Authorized Bandwidth = 11.25 kHz [Rule 90.209(b) (5)]
 From Fo to 5.625 kHz, down 0 dB.
 Greater than 5.625 kHz to 12.5 kHz, down 7.27($f_d - 2.88\text{kHz}$) dB.
 Greater than 12.5 kHz, at least 50+10log₁₀(P) or 70 dB, which ever is the lesser attenuation

Attenuation = 0 dB at Fo to 5.625 kHz
 Attenuation = 20 dB at 5.625 kHz and 70 dB at 12.5 kHz
 Attenuation = 57 dB at greater than 12.5 kHz @ 5 Watts
 Attenuation = 40 dB at greater than 12.5 kHz @ 0.1 Watt

TEST RESULTS: Meets minimum standards (see data on following page)
 With 2.5 kHz deviation

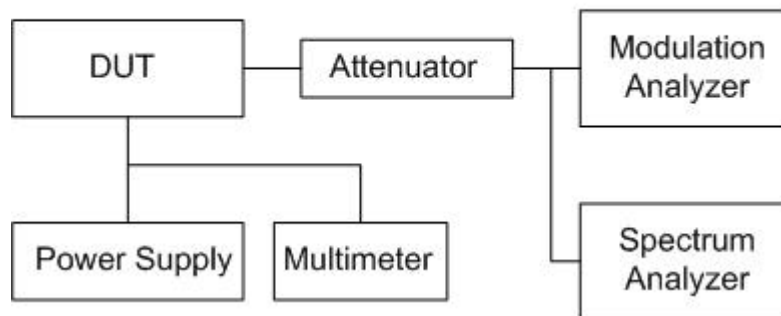
TEST CONDITIONS: Standard Test Conditions, 25 C

TEST PROCEDURE: TIA/EIA – 603-B, 2.2.13, 3.2.11.2

TEST EQUIPMENT: 50 Ohm Attenuators, Pasternack Model PE4131 / 10 dB / 20 Watt
 50 Ohm Attenuators, MCL Model 5W-S20 / 20 dB / 5 Watt
 50 Ohm Attenuators, Inmet Model 6B-10W / 20 dB / 10 Watt
 Power Supply, Instek Model GPS-2303
 Spectrum Analyzer, Agilent Model E4404B
 Modulation Analyzer, Model HP8901A

TEST SET-UP:

Transmitter Occupied Bandwidth for Emission Designator



Modulation description. This equipment is not provided with hardware audio low-pass filters, the transmit filter is a digital 80 tap FIR filter implemented in the firmware.

The digital filter is based on a convolution between two filters, the former built on the raised cosine filter equation and the later built on a brick wall pulse shaping on symbol frequency. The FIR is qualified on the resulting 3dB cut-off frequency. For 9600bps on a half channel, the transmitter filter is a Raised Cosine with Alpha = 1.0, convolved with a rectangular pulse of duration 1/9600 sec. For 4800 bps on a half channel, the transmit filter is a Raised Cosine with Alpha = 1.0.

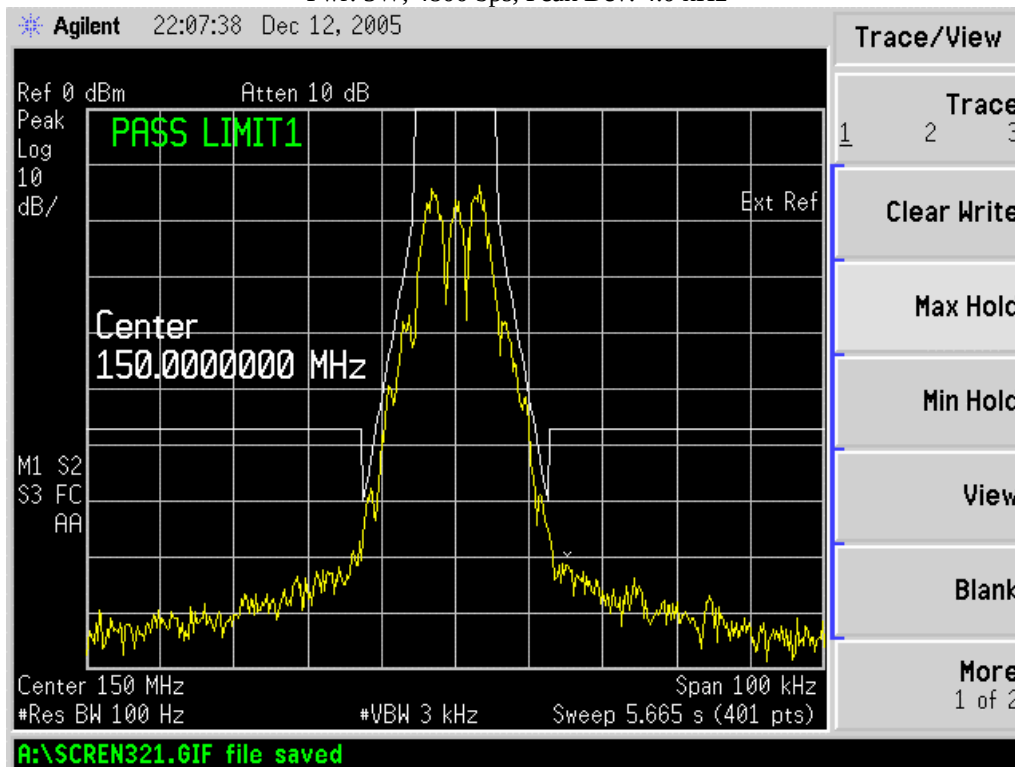
The transmitter deviation level is referenced to a test tone on 1200Hz generated internally. The deviation level and digital filter cutoff frequency are set according to the bit rate selected and channel bandwidth as follows:

Bit rate	Baud rate	FIR filter's 3dB cut-off frequency	Deviation
9600 bps	9600 bauds	4.4 kHz	± 3.0 kHz
4800 bps	4800 bauds	2.4 kHz	± 4.0 kHz

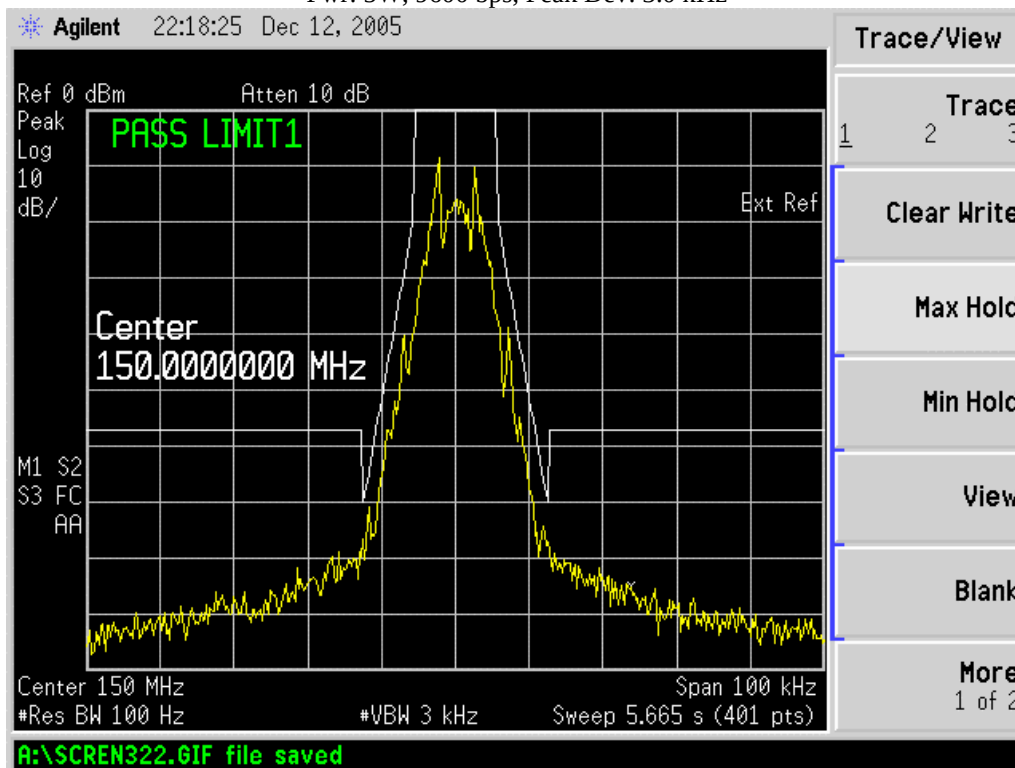
The pseudo random test pattern generated by issuing the K command is created by pseudo random bit generator with a repetition period of $(2^{32})-1$ bits.

Baud Rate	FIR filter's 3dB cut-off Frequency kHz	Bit Rate bps	Deviation on Reference test tone kHz	Peak deviation On random data kHz	Occupied Bandwidth kHz	Authorized Bandwidth kHz	Proposed Emission Designator
9600	4.4	9600	2.7	3.0	9.60	11.25	9K6F1D
4800	2.4	4800	3.7	4.0	9.99	11.25	10K0F1D

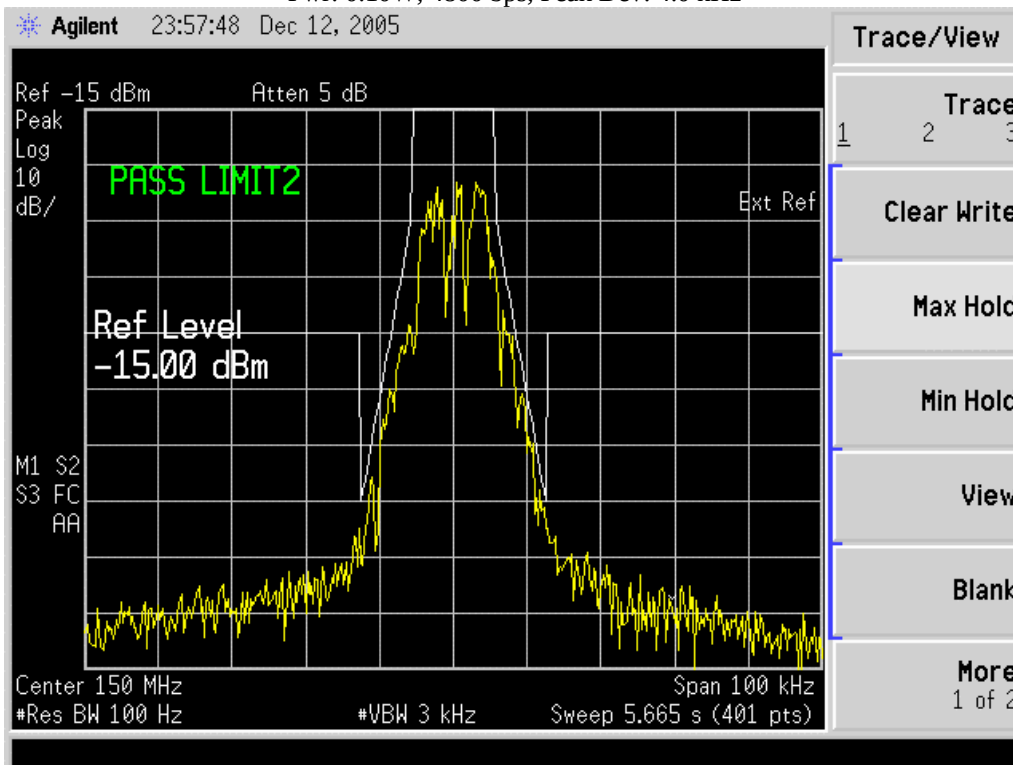
Pwr: 5W, 4800 bps, Peak Dev: 4.0 kHz



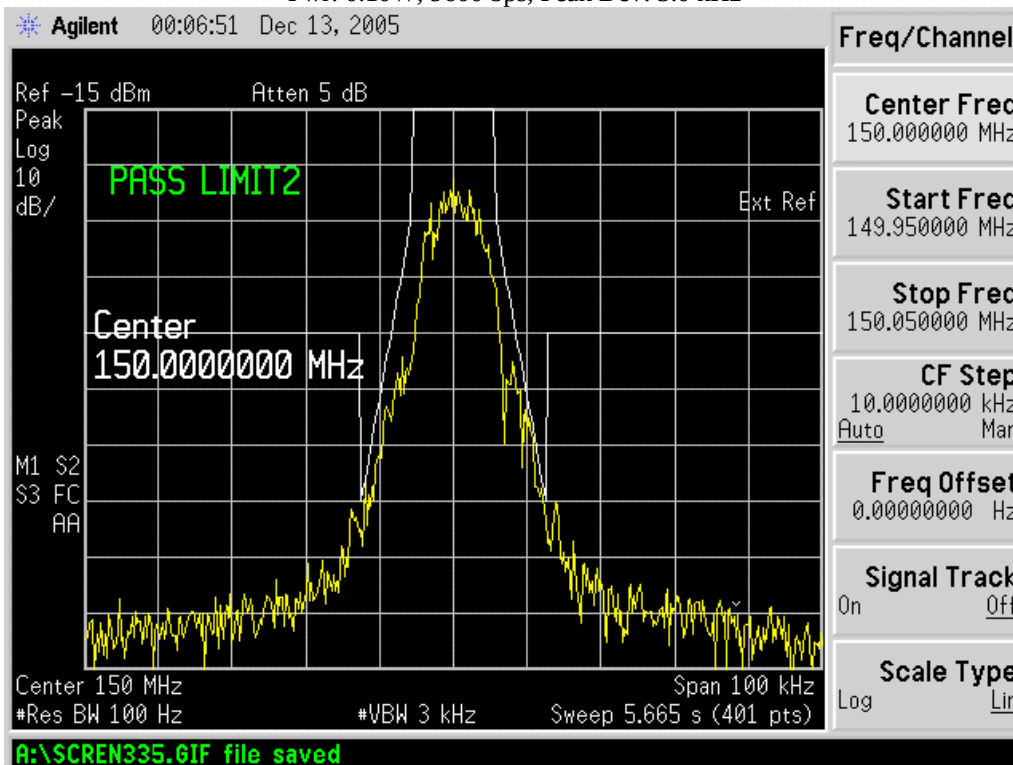
Pwr: 5W, 9600 bps, Peak Dev: 3.0 kHz



Pwr: 0.10W, 4800 bps, Peak Dev: 4.0 kHz

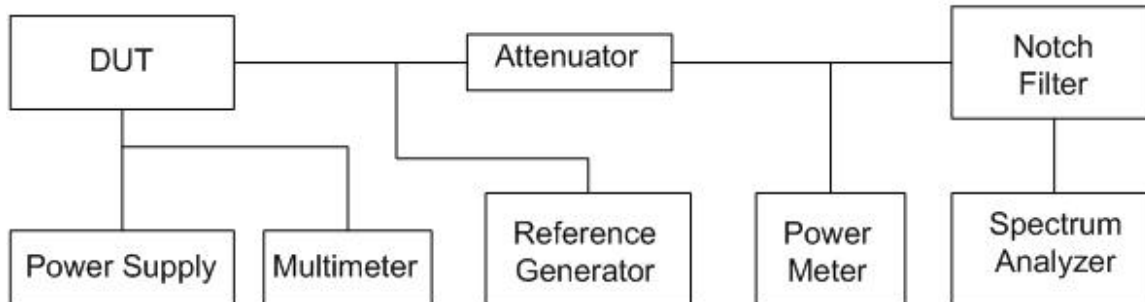


Pwr: 0.10W, 9600 bps, Peak Dev: 3.0 kHz



NAME OF TEST:	<i>Transmitter Spurious and Harmonic Outputs</i>
RULE PART NUMBER:	2.1051, 90.210 (d)(3)
MINIMUM STANDARDS:	For 5 Watts; $50+10\text{Log}_{10}(5 \text{ Watts}) = -57 \text{ dBc}$ For 0.1 Watts; $50+10\text{Log}_{10}(0.1 \text{ Watts}) = -40 \text{ dBc}$ or -70 dBc whichever is the lesser attenuation.
TEST RESULTS:	Meets minimum standards (see data on following page)
TEST CONDITIONS:	Standard Test Conditions, 25 C RF Voltage measured at antenna terminals
TEST PROCEDURE:	TIA/EIA – 603-B, 2.2.13
TEST EQUIPMENT:	50 Ohm Attenuators, Pasternack Model PE4131 / 10 dB / 20 Watt 50 Ohm Attenuators, MCL Model 5W-S20 / 20 dB / 5 Watt 50 Ohm Attenuators, Inmet Model 6B-10W / 20 dB / 10 Watt Power Supply, Instek Model GPS-2303 Spectrum Analyzer, Advantest Model R3265A Reference Generator, Agilent Model E82570 Notch Filter

TEST SET-UP:

Transmitter Spurious and Harmonic Outputs

MEASUREMENT PROCEDURE:

1. The transmitter carrier output frequency is 137.000, 162.000, 150.000, and 174.000. The reference oscillator frequency is 16.000 MHz. The transmitter has voltage levels at 12.5 Volts and 7.2 Volts.
2. After the carrier reference was established on the spectrum analyzer, the notch filter was adjusted to null the carrier fundamental to extend the range of the spectrum analyzer for harmonic measurements.
3. At each spurious frequency, generation substitution was used to establish the true spurious level.
4. The spectrum was scanned to the 10th harmonic

TEST DATA:

Fo 137.000 MHz
 Pwr (@ 12.5 V) 37.00 dBm
 Spec -57 dBc

Harmonic	Freq. (MHz)	Level Relative to Carrier (dBc)	Passed by (dB)
2 nd	274	-62.14	5.137
3 rd	411	-76.03	19.03
4 th	548	-83.74	26.74
5 th	685	-94.38	37.38
6 th	822	-98.99	41.99
7 th	959	-99.01	42.01
8 th	1096	-96.34	39.34
9 th	1233	-97.37	40.37
10 th	1370	-103.13	46.13

Fo 162.000 MHz
 Pwr (@ 12.5 V) 37.00 dBm
 Spec -57 dBc

Harmonic	Freq. (MHz)	Level Relative to Carrier (dBc)	Passed by (dB)
2 nd	324	-59.50	2.50
3 rd	486	-74.35	17.35
4 th	648	-83.35	26.35
5 th	810	-92.08	35.08
6 th	972	-97.38	40.38
7 th	1134	-95.81	38.81
8 th	1296	-96.70	39.70
9 th	1458	-97.41	40.41
10 th	1620	-99.39	42.39

Fo 150.000 MHz
 Pwr (@ 12.5 V) 37.00 dBm
 Spec -57 dBc

Harmonic	Freq. (MHz)	Level Relative to Carrier (dBc)	Passed by (dB)
2 nd	300	-60.40	3.40
3 rd	450	-74.54	17.54
4 th	600	-84.59	27.59
5 th	750	-94.29	37.29
6 th	900	-99.44	42.44
7 th	1050	-98.70	41.70
8 th	1200	-97.16	40.16
9 th	1350	-99.38	42.38
10 th	1500	-99.58	42.58

Fo 174.000 MHz
Pwr (@ 12.5 V) 37.00 dBm
Spec -57 dBc

Harmonic	Freq. (MHz)	Level Relative to Carrier (dBc)	Passed by (dB)
2 nd	348	-60.26	3.26
3 rd	522	-73.81	16.81
4 th	696	-102.80	45.80
5 th	870	-94.32	37.32
6 th	1044	-97.40	40.40
7 th	1218	-97.68	40.68
8 th	1392	-95.56	38.56
9 th	1566	-98.65	41.65
10 th	1740	-100.76	43.76

Fo 137.000 MHz
Pwr (@ 7.2 V) 20.00 dBm
Spec -40 dBc

Harmonic	Freq. (MHz)	Level Relative to Carrier (dBc)	Passed by (dB)
2 nd	274	-71.41	31.41
3 rd	411	-78.02	38.02
4 th	548	-78.52	38.52
5 th	685	-86.46	46.46
6 th	822	-88.10	48.10
7 th	959	-88.30	48.30
8 th	1096	-87.30	47.30
9 th	1233	-88.82	48.82
10 th	1370	-90.13	50.13

Fo 162.000 MHz
Pwr (@ 7.2 V) 20.00 dBm
Spec -40 dBc

Harmonic	Freq. (MHz)	Level Relative to Carrier (dBc)	Passed by (dB)
2 nd	324	-72.47	32.47
3 rd	486	-73.66	33.66
4 th	648	-74.22	34.22
5 th	810	-86.20	46.20
6 th	972	-89.00	49.00
7 th	1134	-89.70	49.70
8 th	1296	-89.38	49.38
9 th	1458	-89.00	49.00
10 th	1620	-89.66	49.66

Fo 150.000 MHz
 Pwr (@ 7.2 V) 20.00 dBm
 Spec -40 dBc

Harmonic	Freq. (MHz)	Level Relative to Carrier (dBc)	Passed by (dB)
2 nd	300	-68.50	28.50
3 rd	450	-82.50	42.50
4 th	600	-83.50	43.50
5 th	750	-87.10	47.10
6 th	900	-89.90	49.90
7 th	1050	-87.40	47.40
8 th	1200	-89.10	49.10
9 th	1350	-89.80	49.80
10 th	1500	-88.50	48.50

Fo 174.000 MHz
 Pwr (@ 7.2 V) 20.00 dBm
 Spec -40 dBc

Harmonic	Freq. (MHz)	Level Relative to Carrier (dBc)	Passed by (dB)
2 nd	348	-72.30	32.30
3 rd	522	-79.44	39.44
4 th	696	-86.80	46.80
5 th	870	-88.44	48.44
6 th	1044	-88.50	48.50
7 th	1218	-88.74	48.74
8 th	1392	-87.40	47.40
9 th	1566	-89.60	49.60
10 th	1740	-89.50	49.50

NAME OF TEST: ***Field Strength of Spurious Radiation***

RULE PART NUMBER: 2.1053, 90.210 (d)(3)

MINIMUM STANDARDS: For 5 Watts; $50 + 10\log_{10}(5 \text{ Watts}) = -57 \text{ dBc}$
 For 0.1 Watts; $50 + 10\log_{10}(0.1 \text{ Watts}) = -40 \text{ dBc}$
 or -70 dBc whichever is the lesser attenuation.

TEST RESULTS: Meets minimum standards (see data on following page)

TEST CONDITIONS: Standard Test Conditions, 25 C

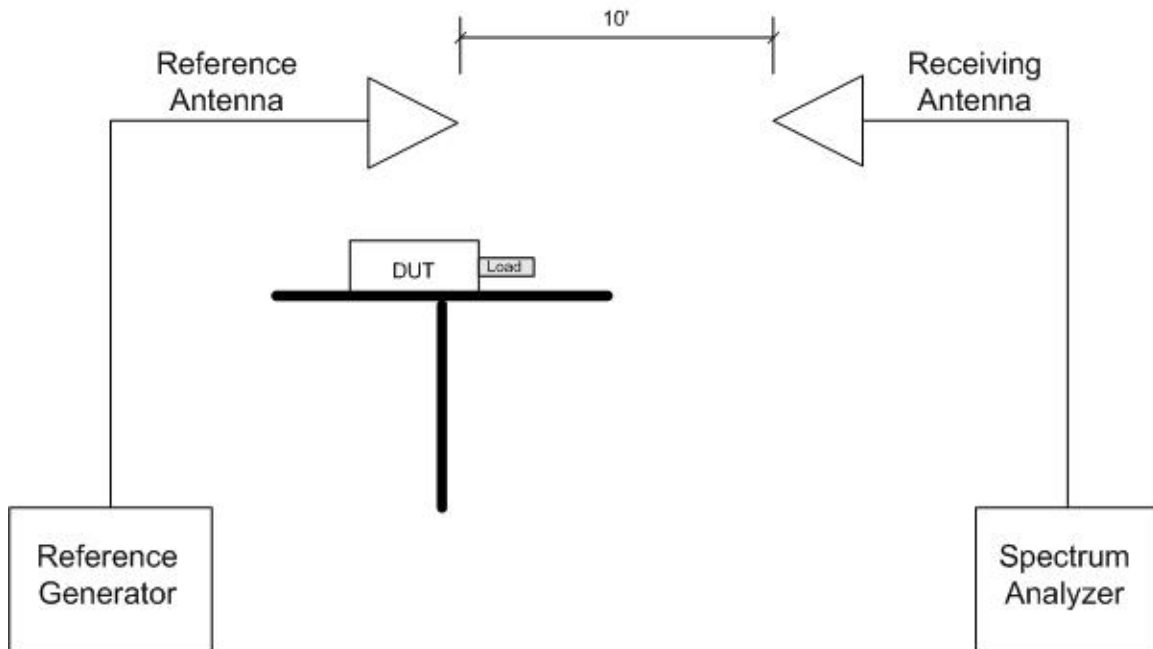
TEST PROCEDURE: TIA/EIA – 603-B, 2.2.12

TEST EQUIPMENT: Waveguide Horn Antenna, EMCO Model 3115
 Bilog Antenna, Chase Model CBL6111B
 Log Periodic Linear Polarization Antenna, AILTECH Model 94612-1
 Dipole Antenna, Electro-Metrics Model EM-6924
 Power Supply, Model HP-6284A
 Spectrum Analyzer, Model Hp-8561B
 Reference Generator, Agilent Model E82570
 Power Meter, Model HP436A
 50-Ohm Load, Lucas Weinschel 58-30-43

MEASUREMENT PROCEDURE: Radiated spurious attenuation was measured according to TIA/EIA Standard 603-B Section 2.2.12

TEST SET-UP:

Field Strength of Spurious Radiation



Frequency 137 MHz
Power 5W @ 12.5 V

Spurious Frequency (MHz)	Polarization (Horz/Vert)	Spurious Level (dBm)	Substitution Generator (dBm)	Cable Loss (dB)	Antenna Gain (dBd)	Spurious Attenuation dBc
274	H	-87.00	-63.5	1.17	-0.47	-102.14
	V	-87.50	-63.5	1.17	-0.47	-102.14
411	H	-104.70	-76.4	1.50	-0.47	-115.34
	V	-103.80	-70.8	1.50	-0.47	-109.77
548	H	-104.20	-74.2	2.00	-0.47	-113.67
	V	-105.20	-72.5	2.00	-0.47	-112.00
685	H	-106.30	-70.8	2.17	-0.47	-110.44
	V	-104.30	-67.8	2.17	-0.47	-107.44
822	H	-105.00	-68.7	2.50	-0.47	-108.64
	V	-104.30	-69.1	2.50	-0.47	-109.10
959	H	-104.50	-66.3	2.50	-0.47	-106.30
	V	-105.00	-66.8	2.50	-0.47	-106.80
1096	H	-104.70	-73.2	3.17	3.40	-109.97
	V	-105.50	-71.8	3.17	3.40	-108.60
1233	H	-104.50	-64.7	3.33	4.50	-100.50
	V	-104.70	-68.5	3.33	4.50	-104.36
1370	H	-103.50	-69.7	3.50	4.35	-105.82
	V	-104.70	-68.5	3.50	4.35	-104.68

Frequency 137 MHz
Power 0.1W @ 7.2 V

Spurious Frequency (MHz)	Polarization (Horz/Vert)	Spurious Level (dBm)	Substitution Generator (dBm)	Cable Loss (dB)	Antenna Gain (dBd)	Spurious Attenuation dBc
274	H	-105.50	-82.0	1.17	-0.47	-103.64
	V	-105.50	-81.5	1.17	-0.47	-103.14
411	H	-105.80	-77.5	1.50	-0.47	-99.44
	V	-105.30	-72.3	1.50	-0.47	-94.27
548	H	-105.70	-75.7	2.00	-0.47	-98.17
	V	-105.20	-72.5	2.00	-0.47	-95.00
685	H	-105.30	-69.8	2.17	-0.47	-92.44
	V	-104.30	-67.8	2.17	-0.47	-90.44
822	H	-104.50	-68.2	2.50	-0.47	-91.14
	V	-105.00	-69.8	2.50	-0.47	-92.80
959	H	-104.80	-66.6	2.50	-0.47	-89.60
	V	-105.70	-67.5	2.50	-0.47	-90.50
1096	H	-105.80	-74.3	3.17	3.40	-94.07
	V	-105.30	-71.6	3.17	3.40	-91.40
1233	H	-105.70	-65.9	3.33	4.50	-84.70
	V	-105.20	-69.0	3.33	4.50	-87.86
1370	H	-104.80	-71.0	3.50	4.35	-90.12
	V	-105.70	-69.5	3.50	4.35	-88.68

Frequency 162 MHz
Power 5W @ 12.5 V

Spurious Frequency (MHz)	Polarization (Horz/Vert)	Spurious Level (dBm)	Substitution Generator (dBm)	Cable Loss (dB)	Antenna Gain (dBd)	Spurious Attenuation dBc
324	H	-102.00	-77.5	1.33	-0.47	-116.30
	V	-101.70	-76.2	1.33	-0.47	-115.00
486	H	-100.00	-68.2	1.83	-0.47	-107.47
	V	-103.30	-70.8	1.83	-0.47	-110.10
648	H	-104.70	-69.2	2.17	-0.47	-108.84
	V	-104.80	-68.3	2.17	-0.47	-107.94
810	H	-104.80	-68.5	2.67	-0.47	-108.61
	V	-105.20	-70.0	2.67	-0.47	-110.17
972	H	-105.00	-66.8	2.50	-0.47	-106.80
	V	-105.30	-67.1	2.50	-0.47	-107.10
1134	H	-104.30	-72.6	3.17	3.60	-109.20
	V	-105.30	-72.6	3.17	3.60	-109.20
1296	H	-104.30	-69.1	3.33	4.60	-104.86
	V	-105.00	-67.0	3.33	4.60	-102.73
1458	H	-103.20	-66.9	3.67	4.20	-103.34
	V	-103.00	-68.3	3.67	4.20	-104.80
1620	H	-104.30	-69.8	3.67	3.65	-106.82
	V	-104.00	-67.8	3.67	3.65	-104.85

Frequency 162 MHz
Power 0.1W @ 7.2 V

Spurious Frequency (MHz)	Polarization (Horz/Vert)	Spurious Level (dBm)	Substitution Generator (dBm)	Cable Loss (dB)	Antenna Gain (dBd)	Spurious Attenuation dBc
324	H	-104.20	-79.7	1.33	-0.47	-101.50
	V	-105.80	-80.3	1.33	-0.47	-102.10
486	H	-105.00	-73.2	1.83	-0.47	-95.47
	V	-105.70	-73.2	1.83	-0.47	-95.50
648	H	-105.20	-69.7	2.17	-0.47	-92.34
	V	-103.30	-66.8	2.17	-0.47	-89.44
810	H	-103.80	-67.5	2.67	-0.47	-90.61
	V	-105.70	-70.5	2.67	-0.47	-93.67
972	H	-104.50	-66.3	2.50	-0.47	-89.30
	V	-104.00	-65.8	2.50	-0.47	-88.80
1134	H	-105.00	-73.3	3.17	3.60	-92.90
	V	-105.70	-73.0	3.17	3.60	-92.60
1296	H	-105.20	-70.0	3.33	4.60	-88.76
	V	-104.50	-66.5	3.33	4.60	-85.23
1458	H	-104.00	-67.7	3.67	4.20	-87.14
	V	-105.00	-70.3	3.67	4.20	-89.80
1620	H	-105.70	-71.2	3.67	3.65	-91.22
	V	-103.30	-67.1	3.67	3.65	-87.15

Frequency 150 MHz
Power 5W @ 12.5 V

Spurious Frequency (MHz)	Polarization (Horz/Vert)	Spurious Level (dBm)	Substitution Generator (dBm)	Cable Loss (dB)	Antenna Gain (dBd)	Spurious Attenuation dBc
300	H	-90.67	-67.7	1.50	-0.47	-106.64
	V	-91.83	-66.3	1.50	-0.47	-105.30
450	H	-100.20	-71.7	1.83	-0.47	-111.00
	V	-104.00	-69.0	1.83	-0.47	-108.30
600	H	-104.80	-76.3	2.00	-0.47	-115.77
	V	-105.80	-71.3	2.00	-0.47	-110.77
750	H	-104.70	-71.4	2.50	-0.47	-111.34
	V	-104.70	-68.9	2.50	-0.47	-108.84
900	H	-104.80	-66.3	2.67	-0.47	-106.44
	V	-105.70	-64.7	2.67	-0.47	-104.84
1050	H	-104.20	-72.4	2.83	2.56	-109.64
	V	-104.50	-67.7	2.83	2.56	-104.94
1200	H	-104.30	-66.1	2.83	4.30	-101.66
	V	-105.20	-71.9	2.83	4.30	-107.40
1350	H	-104.70	-71.7	3.33	4.45	-107.58
	V	-104.50	-67.5	3.33	4.45	-103.38
1500	H	-105.00	-67.8	3.33	4.03	-104.13
	V	-104.70	-69.9	3.33	4.03	-106.17

Frequency 150 MHz
Power 0.1W @ 7.2 V

Spurious Frequency (MHz)	Polarization (Horz/Vert)	Spurious Level (dBm)	Substitution Generator (dBm)	Cable Loss (dB)	Antenna Gain (dBd)	Spurious Attenuation dBc
300	H	-105.80	-82.8	1.50	-0.47	-104.77
	V	-104.00	-78.5	1.50	-0.47	-100.47
450	H	-105.30	-76.8	1.83	-0.47	-99.10
	V	-103.70	-68.7	1.83	-0.47	-91.00
600	H	-104.80	-76.3	2.00	-0.47	-98.77
	V	-105.70	-71.2	2.00	-0.47	-93.67
750	H	-105.70	-72.4	2.50	-0.47	-95.34
	V	-105.70	-69.9	2.50	-0.47	-92.84
900	H	-104.20	-65.7	2.67	-0.47	-88.84
	V	-105.30	-64.3	2.67	-0.47	-87.44
1050	H	-105.00	-73.2	2.83	2.56	-93.44
	V	-103.70	-66.9	2.83	2.56	-87.14
1200	H	-104.80	-66.6	2.83	4.30	-85.16
	V	-105.70	-72.4	2.83	4.30	-90.90
1350	H	-105.70	-72.7	3.33	4.45	-91.58
	V	-105.30	-68.3	3.33	4.45	-87.18
1500	H	-105.00	-67.8	3.33	4.03	-87.13
	V	-103.70	-68.9	3.33	4.03	-88.17

Frequency 174 MHz
Power 5W @ 12.5 V

Spurious Frequency (MHz)	Polarization (Horz/Vert)	Spurious Level (dBm)	Substitution Generator (dBm)	Cable Loss (dB)	Antenna Gain (dBd)	Spurious Attenuation dBc
348	H	-97.83	-71.5	1.50	-0.47	-110.47
	V	-98.67	-70.3	1.50	-0.47	-109.31
522	H	-103.50	-71.7	1.83	-0.47	-110.97
	V	-104.00	-71.5	1.83	-0.47	-110.80
696	H	-105.30	-73.5	2.17	-0.47	-113.11
	V	-105.70	-69.7	2.17	-0.47	-109.34
870	H	-104.70	-66.2	2.17	-0.47	-105.84
	V	-105.30	-64.3	2.17	-0.47	-103.94
1044	H	-105.00	-73.3	2.83	2.56	-110.60
	V	-104.30	-67.8	2.83	2.56	-105.07
1218	H	-104.70	-65.0	3.00	4.40	-100.63
	V	-104.00	-69.7	3.00	4.40	-105.27
1392	H	-103.30	-68.8	3.50	4.30	-105.00
	V	-105.30	-68.6	3.50	4.30	-104.83
1566	H	-103.50	-67.8	3.50	3.85	-104.48
	V	-105.20	-68.5	3.50	3.85	-105.18
1740	H	-105.70	-65.5	3.50	3.15	-102.88
	V	-104.20	-66.5	3.50	3.15	-103.88

Frequency 150 MHz
Power 0.1W @ 7.2 V

Spurious Frequency (MHz)	Polarization (Horz/Vert)	Spurious Level (dBm)	Substitution Generator (dBm)	Cable Loss (dB)	Antenna Gain (dBd)	Spurious Attenuation dBc
348	H	-105.80	-79.5	1.50	-0.47	-101.44
	V	-105.30	-77.0	1.50	-0.47	-98.94
522	H	-106.00	-74.2	1.83	-0.47	-96.47
	V	-105.00	-72.5	1.83	-0.47	-94.80
696	H	-106.20	-74.4	2.17	-0.47	-97.01
	V	-105.00	-69.0	2.17	-0.47	-91.64
870	H	-105.20	-66.7	2.17	-0.47	-89.34
	V	-105.00	-64.0	2.17	-0.47	-86.64
1044	H	-106.00	-74.3	2.83	2.56	-94.60
	V	-105.00	-68.5	2.83	2.56	-88.77
1218	H	-106.20	-66.5	3.00	4.40	-85.13
	V	-106.20	-71.9	3.00	4.40	-90.47
1392	H	-106.20	-71.7	3.50	4.30	-90.90
	V	-105.00	-68.3	3.50	4.30	-87.53
1566	H	-105.20	-69.5	3.50	3.85	-89.18
	V	-105.00	-68.3	3.50	3.85	-87.98
1740	H	-105.00	-64.8	3.50	3.15	-85.18
	V	-105.20	-67.5	3.50	3.15	-87.88

NAME OF TEST: ***Frequency Stability with Variation in Ambient Temperature***

RULE PART NUMBER: 2.1055 (a) (b), 90.213 (a)

MINIMUM STANDARD: Shall not exceed ± 0.000250 % form test frequency, or 2.50 ppm

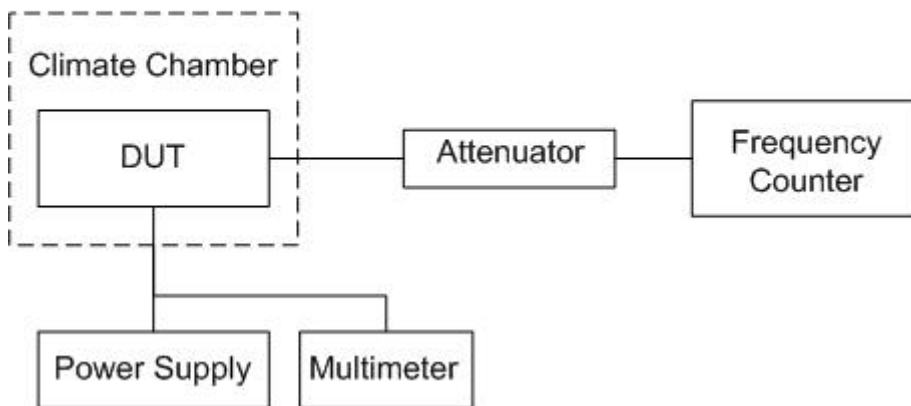
TEST RESULTS: Meets minimum standard, see data on following page

TEST CONDITIONS: Standard Test Conditions

TEST EQUIPMENT: 50 Ohm Attenuator, Tenuline Model 8340 / 20dB / 25 Watt
 50 Ohm Attenuator, Tenuline Model 8340 / 10 dB / 25 Watt
 Frequency Counter, Fluke Model 1920A
 Power Supply, Model HP-6284A
 Digital Voltmeter, Fluke 8840A
 Climate Chamber, Tenney Jr. Model R-404

TEST SET-UP:

Frequency Stability with Variation in Ambient Temperature



Channel Frequency: 150.00250 MHz
 Voltage & Power Level: 12.5 Volts @ 5.0 Watts
 Highest Variation: 0.93

Temperature (Deg C)	Measured Frequency (MHz)	Frequency Error (Hz)	Frequency Error (ppm)
-30	150.002610	110	0.73
-20	150.002640	140	0.93
-10	150.002620	120	0.80
0	150.002600	100	0.67
10	150.002570	70	0.47
20	150.002540	40	0.27
30	150.002520	20	0.13
40	150.002540	40	0.27
50	150.002520	20	0.13
60	150.002450	-50	-0.33

Channel Frequency: 150.00250 MHz
 Voltage & Power Level: 7.2 Volts @ 0.1 Watts
 Highest Variation: 0.93

Temperature (Deg C)	Measured Frequency (MHz)	Frequency Error (Hz)	Frequency Error (ppm)
-30	150.002640	140	0.93
-20	150.002630	130	0.87
-10	150.002630	130	0.87
0	150.002590	90	0.60
10	150.002580	80	0.53
20	150.002540	40	0.27
30	150.002510	10	0.07
40	150.002530	30	0.20
50	150.002510	10	0.07
60	150.002410	-90	-0.60

NAME OF TEST: ***Frequency Stability with Variation in Supply Voltage***

RULE PART NUMBER: 2.1055 (d) (1), 90.213 (a)

MINIMUM STANDARD: Shall not exceed ± 0.000250 % from the test frequency, 2.50 ppm for $\pm 15\%$ change in supply voltage.

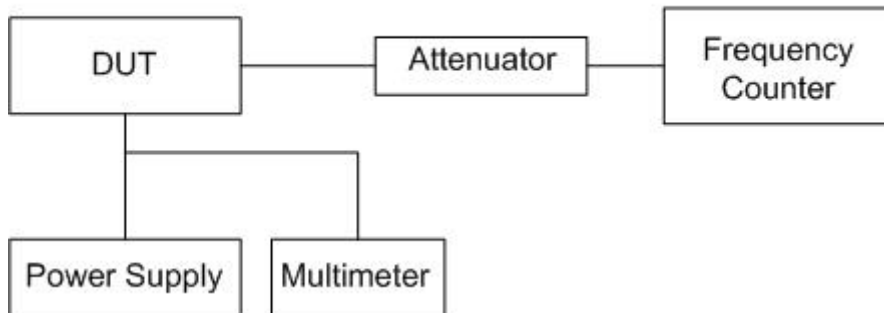
TEST RESULTS: Meets minimum standard, see data on following page

TEST CONDITIONS: Standard Test Conditions, 25 C

TEST EQUIPMENT: 50 Ohm Attenuator, Tenuline Model 8340 / 20dB / 25 Watt
50 Ohm Attenuator, Tenuline Model 8340 / 10dB / 25 Watt
Frequency Counter, Fluke Model 1920A
Digital Voltmeter, Fluke Model 8012A
DC Power Supply, Instek Model GPS-2303

TEST SET-UP:

Frequency Stability with Variation in Supply Voltage



Channel Frequency: 137.000 MHz
Tolerance Requirements: 0.00025%
Highest Variation: 0.00

Input Voltage (Vdc)	Frequency (MHz)	Delta Freq (% of assigned Freq)	ppm from assigned Frequency
6.0	137.000	0.00	0.00
12.5	137.000	0.00	0.00
15.0	137.000	0.00	0.00

Channel Frequency: 150.000 MHz
Tolerance Requirements: 0.00025%
Highest Variation: 0.00

Input Voltage (Vdc)	Frequency (MHz)	Delta Freq (% of assigned Freq)	ppm from assigned Frequency
6.0	150.000	0.00	0.00
12.5	150.000	0.00	0.00
15.0	150.000	0.00	0.00

NAME OF TEST: ***Transient Frequency Behavior***

RULE PART NUMBER: 90.214

TEST CONDITIONS: Transient tests were conducted by modulating a 1 kHz tone with 1.5 kHz deviation through the loader audio input.

MINIMUM STANDARD: 12.5 kHz channel (used worst case numbers from 137 to 174 MHz)

<u>TIME INTERVAL</u>	<u>MAXIMUM FREQUENCY DIFFERENCE (kHz)</u>	<u>TIME (ms)</u>
T1	+/- 12.5	5
T2	+/- 6.25	20
T3	+/- 12.5	5

TEST RESULTS: Meets minimum standards, see data on following pages

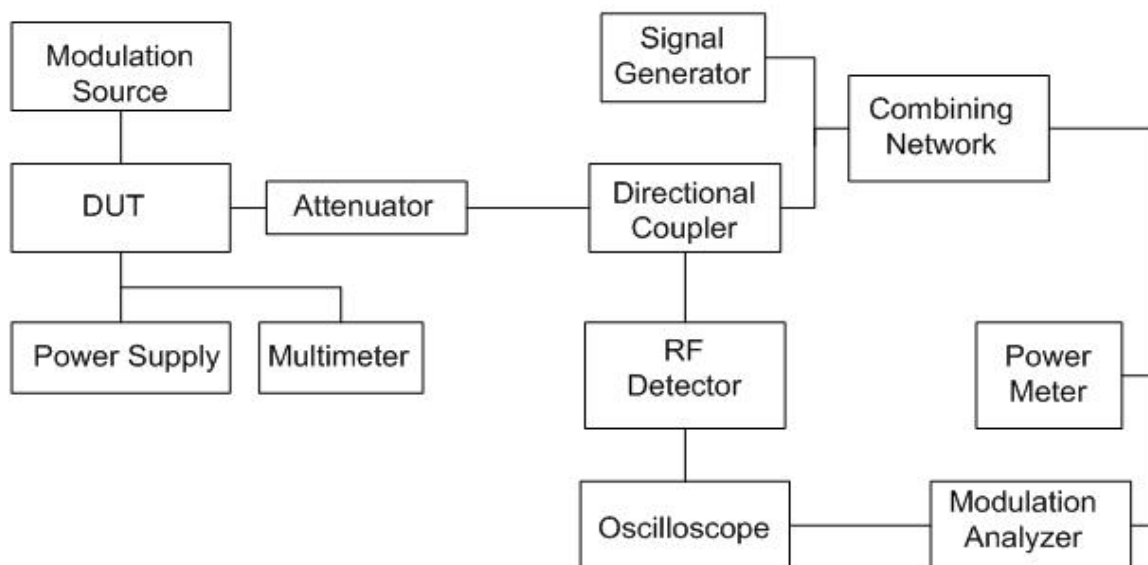
TEST CONDITIONS: RF Power Level = 5 Watts and 0.1 Watt
Standard Test Conditions, 25 C

TEST PROCEDURE: TIA/EIA – 603-B, 2.2.19

TEST EQUIPMENT:

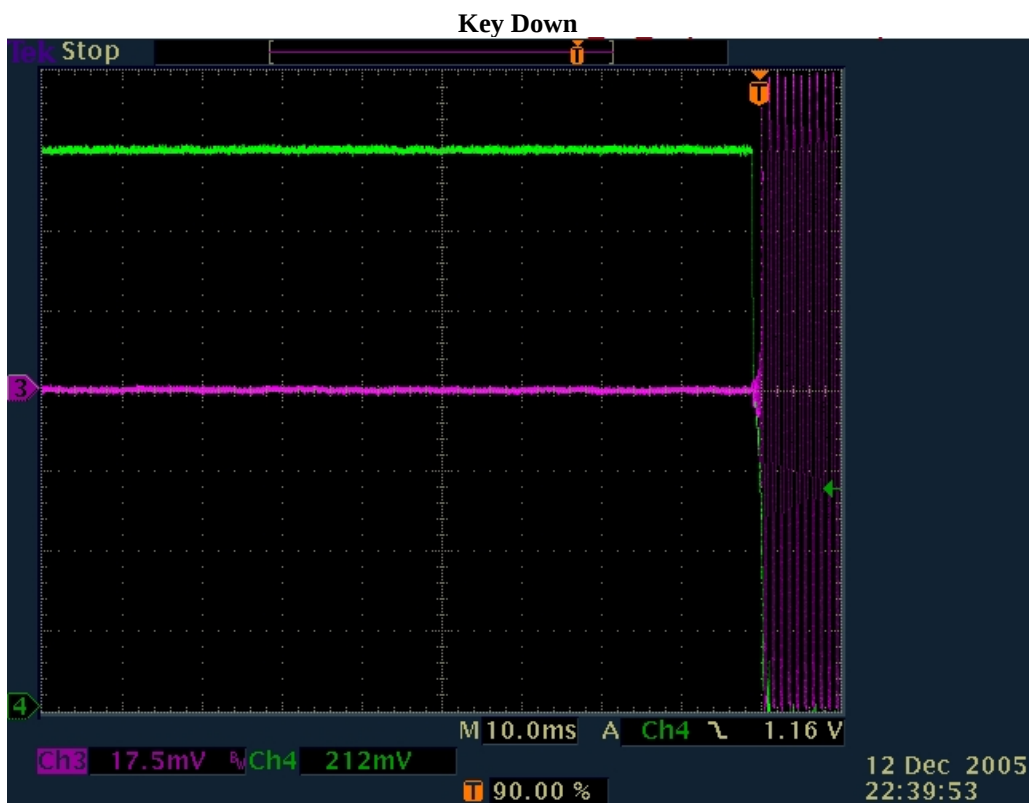
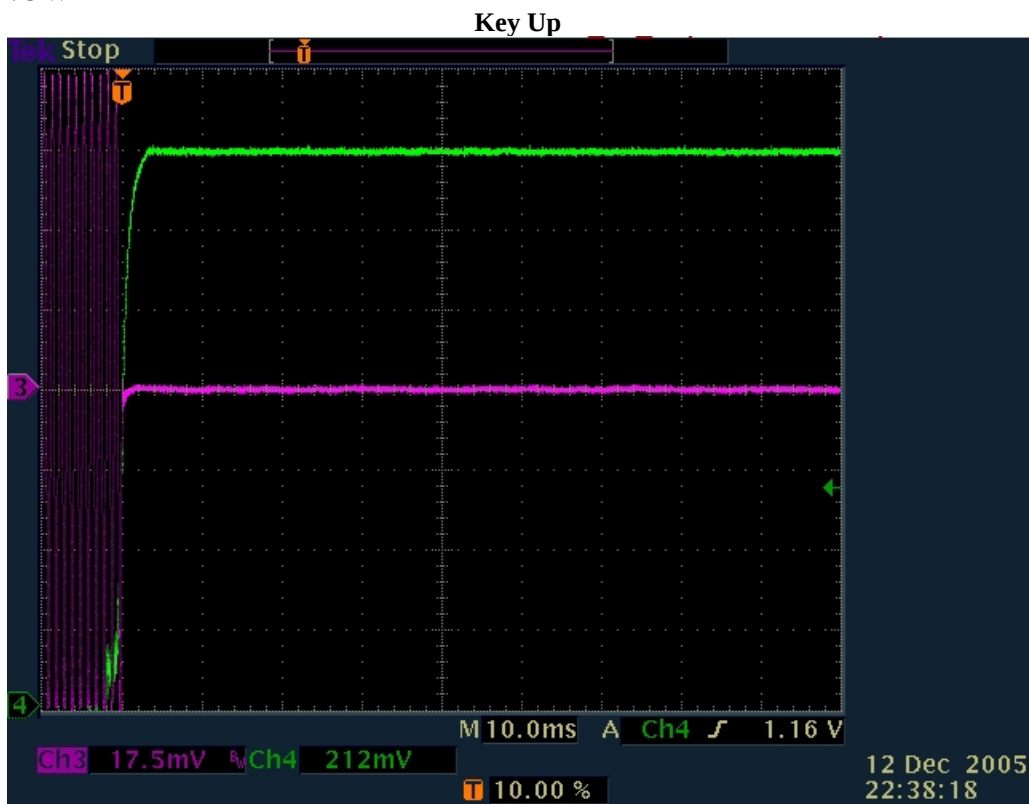
- 50 Ohm Attenuator, Tenuline Model 8340 / 20 dB / 25 Watt
- 50 Ohm Attenuator, Tenuline Model 8340 / 10 dB / 25 Watt
- Power Supply, Instek Model GPS-2303
- Digital Voltmeter, Fluke Model 8012A
- Power Combiner, Model MCL ZFSC-4-1
- Modulation Analyzer, Model HP8901A
- Power Meter, Model HP436
- Oscilloscope, Tektronix Model TDS 3014B
- Power Detector, Model JDT lab made
- Directional Coupler, Model HP778D
- Signal Generator, Model HP8657B
- Audio Analyzer, Model HP8903A

TEST SET-UP:
Transient Frequency Behavior



Transient Frequency Response

Frequency : 150.000000 MHz
Power: 5 W



Frequency: 150.000000 MHz
Power: 0.10W

