4. TEST REPORT

4.1 RF Power Measurements

Figure 4-1 shows the test equipment setup for the RF power measurements.

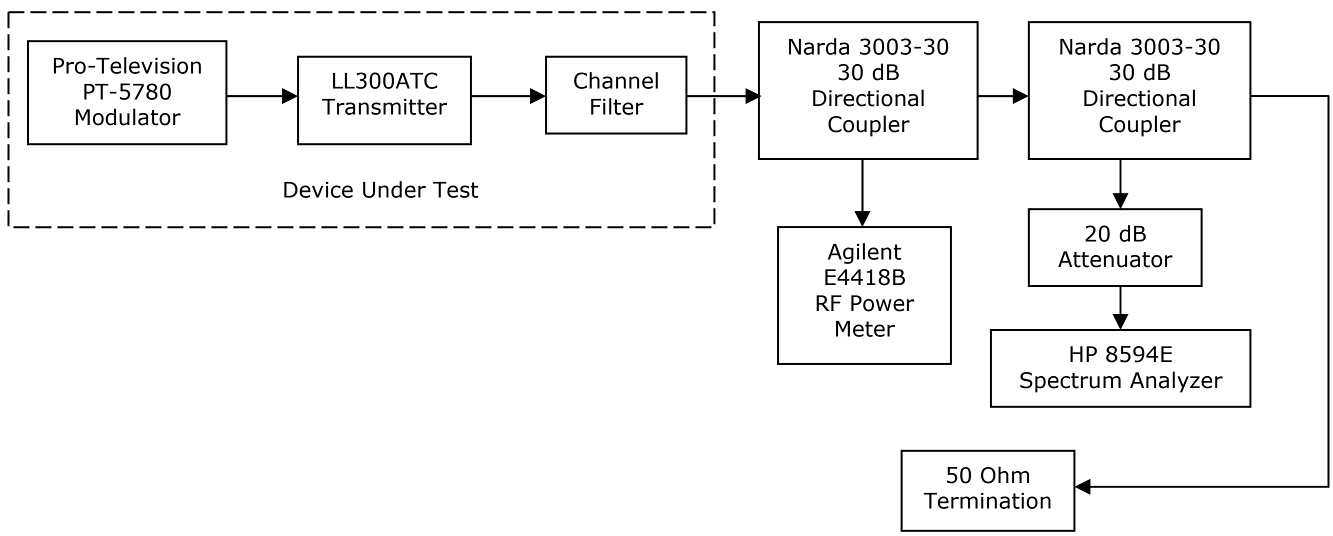

Figure 4-1. Test Equipment Setup for RF Power Measurements

The output power of the LL300ATC was adjusted to obtain 300 watts average RF output as observed on the power meter.

With the power level properly set to 300 watts average, all required tests were performed and recorded in the following sections.

4.2 Modulation Characteristics

The modulator tray incorporates a modulation technique known as COFDM, which uses 2000-8000 carriers, each one modulated with QAM or QPSK. The signal is noise-like in appearance and has a relatively stable average power and a widely varying peak-envelope-power (PEP). The power is normally referred to in average power. COFDM, used in conjunction with digital compression, provides high bandwidth efficiency.

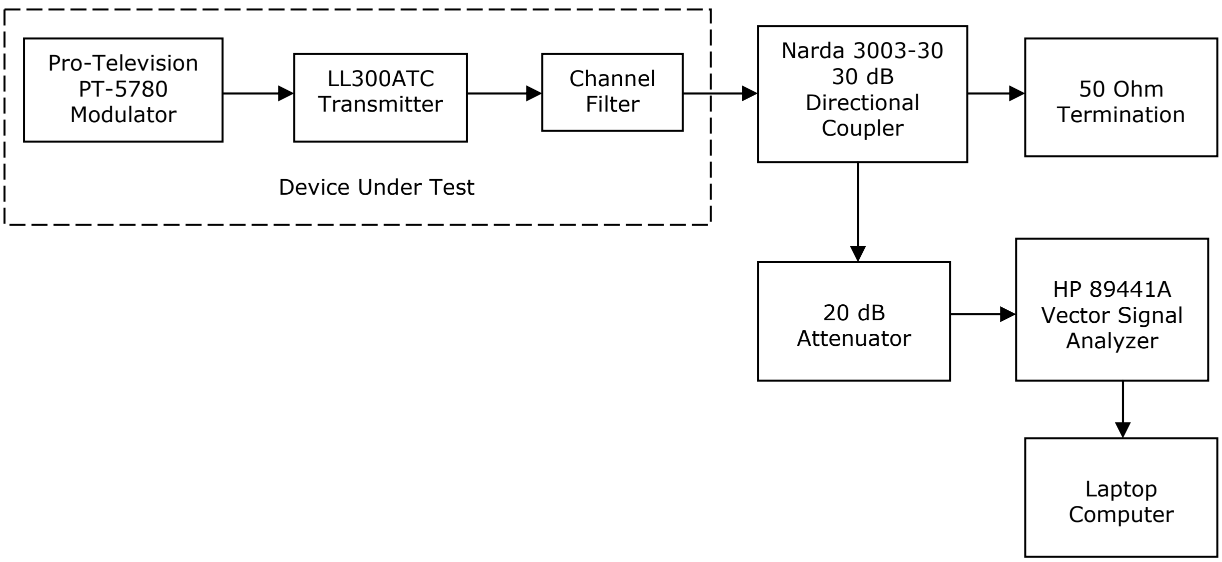

Figure 4-2. Typical Demodulation Test Setup

4.3 Occupied Bandwidth

Using the test setup in Figure 4-4, with the transmitter operating at maximum power, photographs of the transmitter occupied bandwidth spectrum were taken and are shown in Figure 4-5.

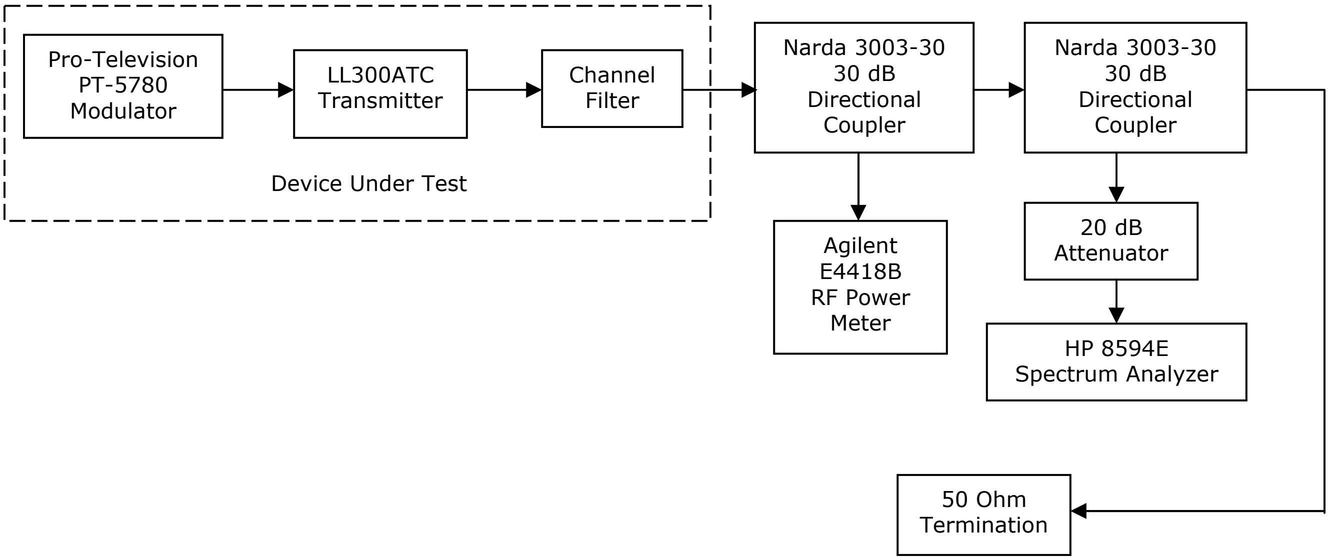

Figure 4-4. Test Setup for Occupied Bandwidth Spectrum Analysis

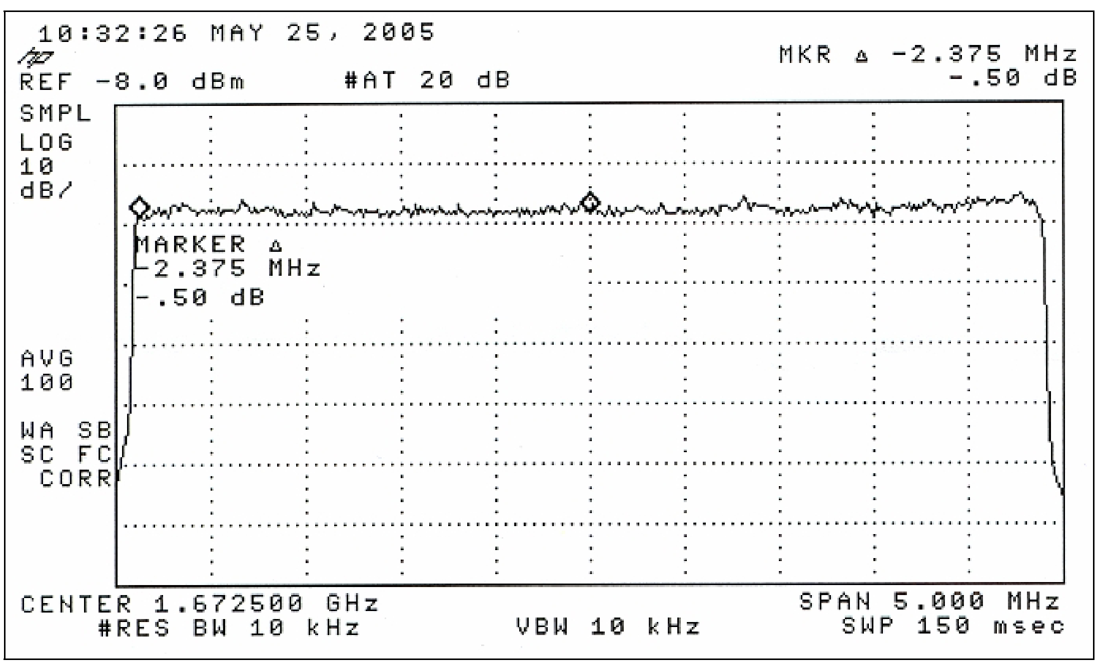

Figure 4-5. Channel Occupied Bandwidth (lower channel edge)

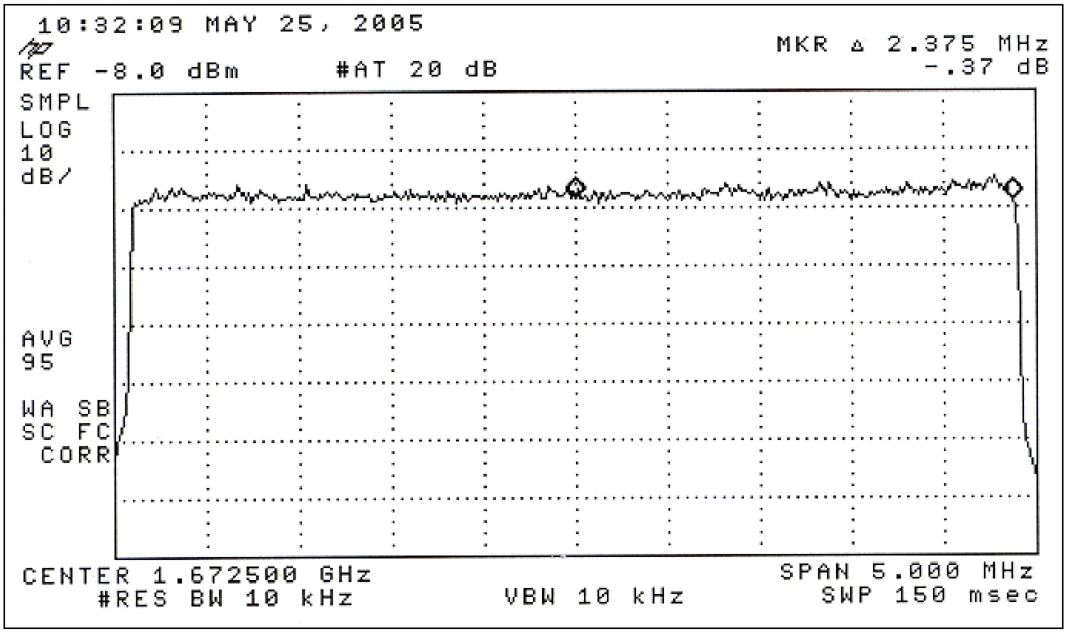

Figure 4-6. Channel Occupied Bandwidth (upper channel edge)

4.4 Conducted Spurious Emissions

Using the test setup shown in section 4.1, the spectrum outside of the specified channel was observed and the data was taken on all products above the -61 dB noise floor of the spectrum analyzer.

Spurious Emissions were observed on the analyzer at a 2.900 GHz span (see spectrum plots on the following page). With the average in band signal set as the reference, the spurious emissions were observed. The measured data is shown in the table below for 300 watts (average) output power.

This data is shown in Table 4-1 and is presented as a graph in Figure 4-7.

Table 4-1. Products Above the -61 dB Noise Floor of the Spectrum Analyzer

FREQUENCY (MHz)	SOURCE	PEAK LEVEL OBSERVED (dB)
1672.50	Center of Channel	0 dB (Reference)
36.00	IF Frequency	None Observed
1708.50	Local Oscillator	None Observed
3345.00	2nd Harmonic	None Observed
5017.50	3rd Harmonic	None Observed
6690.00	4th Harmonic	None Observed
8362.50	5th Harmonic	None Observed
10035.00	6th Harmonic	None Observed
11707.50	7th Harmonic	None Observed
13380.00	8th Harmonic	None Observed
15052.50	9th Harmonic	None Observed
16725.00	10th Harmonic	None Observed

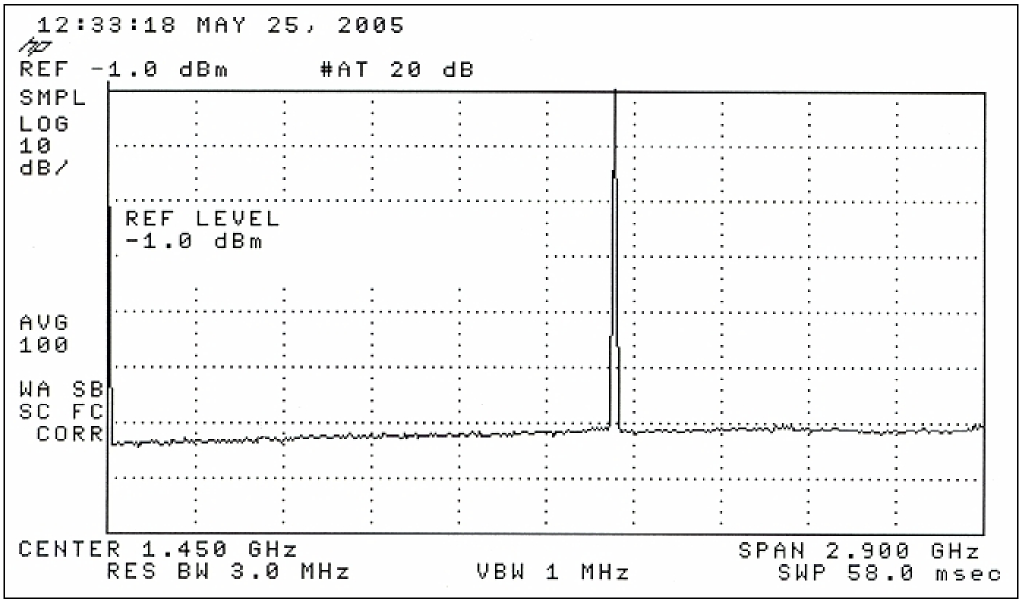

Figure 4-7. Products Above the -61 dB Noise Floor of the Spectrum Analyzer (2.900 GHz Span)

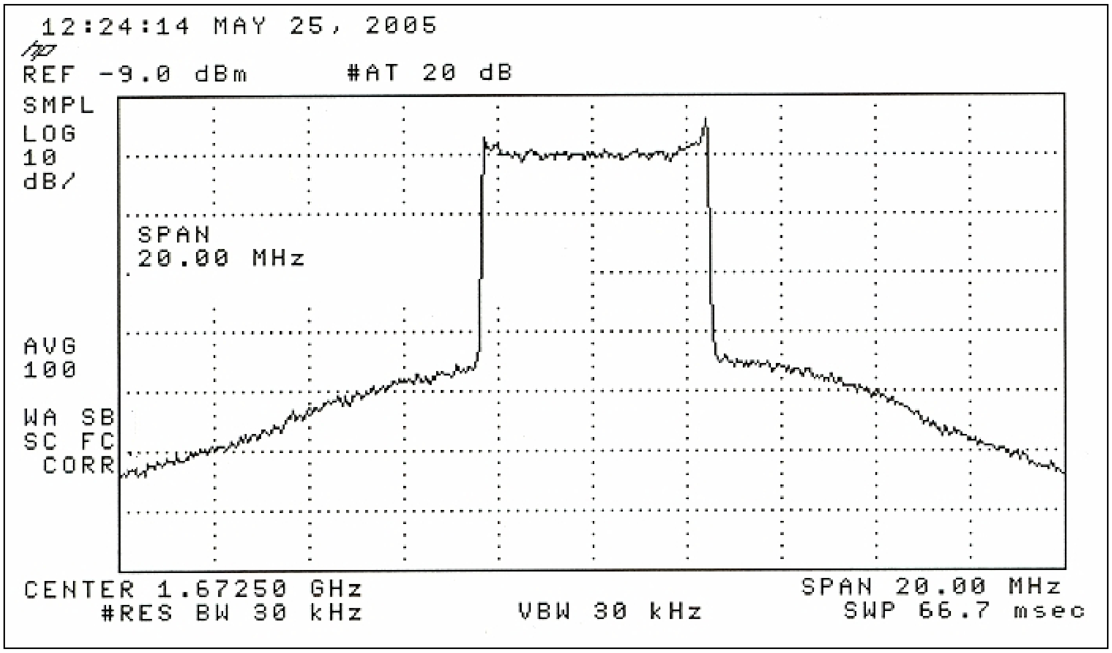

Figure 4-8. Conducted Spurious Emissions (before channel filter)

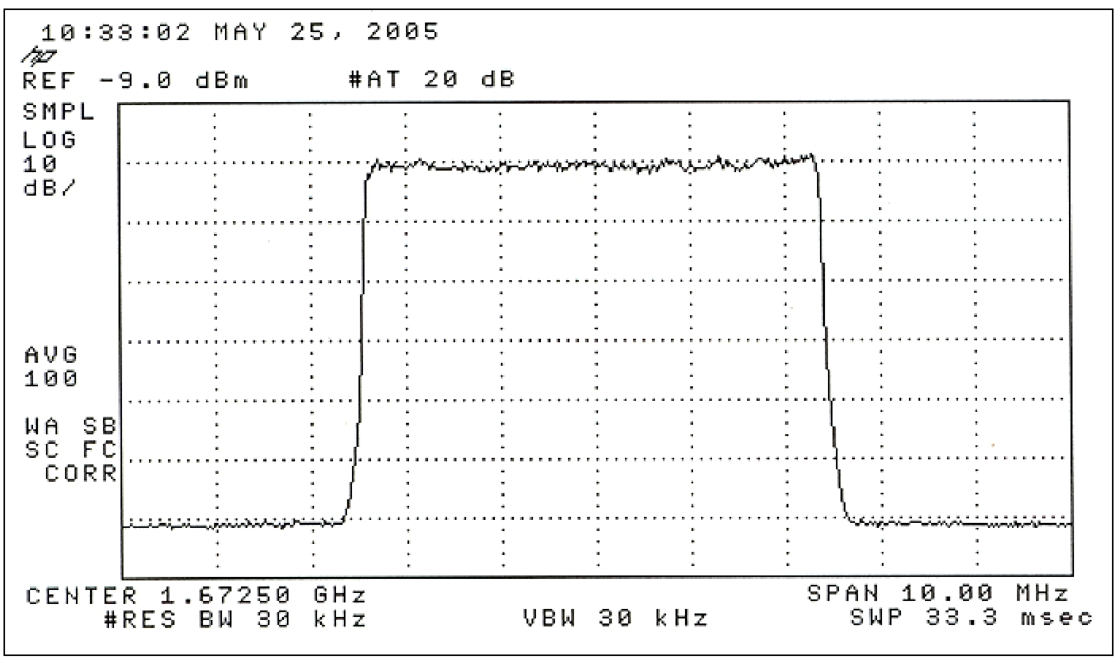

Figure 4-9. Conducted Spurious Emissions (after channel filter)

Part 27.53 of the Rules states:

(i) For operations in the 1670-1675 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB. Compliance with these provisions is based on the procedures described in paragraph (a)(4) of this section.

(a)(4) Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or less, but at least one percent of the emission bandwidth of the fundamental emission of the transmitter, provided the measured energy is integrated over a 1 MHz bandwidth.

Applying the formula above, the maximum amount of out-of-band power in a 1MHz bandwidth relative to the transmitter power can be calculated:

300W Transmitter:
43 +10*log(300)=68 dB.

The performance of the Mask Filter was measured, and data was generated for its attenuation vs. frequency.

This attenuation was added to the Power Spectral Density of the transmitter's IMD products, and the resulting energy integrated across a 1MHz bandwidth. The energy in the channel was integrated across the channel and the ratio between the in band and out of band energy calculated. The following tables present the data.

The first column is the measurement frequency. The second column shows the measured attenuation of the filter. The third column adds the amplifier's IMD reduced by the filter attenuation. The final column converts the ratio in the third column to power. The energy in the fourth column was then added up across the entire 1 MHz bandwidth adjacent to the channel and compared to the integrated power in the channel. The ratio of the two powers was taken and converted back to decibels. The Out of Band power for the adjacent 1 MHz Spectrum was:

Upper Adjacent 1MHz: 76.09 dB
Lower Adjacent 1 MHz: 75.98 dB

Table 4-2. Upper Adjacent 1MHz

Filter for 300W	Upper Side		
Frequency (MHz)	**Filter S21 (dB)**	**Filter+ Regrowth (dB)**	**Energy**
1675	-21.24	-56.24	2.37684E-06
1675.005	-21.76	-56.76	2.10863E-06
1675.01	-22.48	-57.48	1.78649E-06
1675.015	-22.74	-58.19	1.51705E-06
1675.02	-23.19	-58.73	1.33968E-06
1675.025	-23.73	-59.3	1.1749E-06
1675.03	-24.3	-59.83	1.03992E-06
1675.035	-24.83	-60.33	9.2683E-07
1675.04	-25.33	-60.89	8.14704E-07
1675.045	-25.89	-61.4	7.24436E-07
1675.05	-26.4	-61.94	6.39735E-07
1675.055	-26.94	-62.69	5.3827E-07

1675.06	-27.69	-62.69	5.3827E-07
1675.065	-28.21	-63.21	4.77529E-07
1675.07	-28.77	-63.77	4.19759E-07
1675.075	-29.3	-64.3	3.71535E-07
1675.08	-29.8	-64.8	3.31131E-07
1675.085	-30.34	-65.34	2.92415E-07
1675.09	-30.85	-65.85	2.60016E-07
1675.095	-31.39	-66.39	2.29615E-07
1675.1	-31.92	-66.92	2.03236E-07
1675.105	-32.41	-67.41	1.81552E-07
1675.11	-32.97	-67.97	1.59588E-07
1675.115	-33.5	-68.5	1.41254E-07
1675.12	-34.03	-69.03	1.25026E-07
1675.125	-34.53	-69.53	1.11429E-07
1675.13	-35.05	-70.05	9.88553E-08
1675.135	-35.61	-70.61	8.6896E-08
1675.14	-36.12	-71.12	7.72681E-08
1675.145	-36.65	-71.65	6.83912E-08
1675.15	-37.2	-72.2	6.0256E-08
1675.155	-37.69	-72.69	5.3827E-08
1675.16	-38.22	-73.22	4.76431E-08
1675.165	-38.74	-73.74	4.22669E-08
1675.17	-39.33	-74.33	3.68978E-08
1675.175	-39.85	-74.85	3.27341E-08
1675.18	-40.35	-75.35	2.91743E-08
1675.185	-40.95	-75.95	2.54097E-08
1675.19	-41.4	-76.4	2.29087E-08
1675.195	-41.96	-76.96	2.01372E-08
1675.2	-42.54	-77.54	1.76198E-08
1675.205	-43.12	-78.12	1.5417E-08
1675.21	-43.66	-78.66	1.36144E-08
1675.215	-44.19	-79.19	1.20504E-08
1675.22	-44.78	-79.78	1.05196E-08
1675.225	-45.37	-80.37	9.18333E-09
1675.23	-45.92	-80.92	8.09096E-09
1675.235	-46.49	-81.49	7.09578E-09
1675.24	-47.08	-82.08	6.19441E-09
1675.245	-47.7	-82.7	5.37032E-09
1675.25	-48.26	-83.26	4.72063E-09
1675.255	-48.87	-83.87	4.10204E-09
1675.26	-49.54	-84.54	3.5156E-09
1675.265	-50.24	-85.24	2.99226E-09
1675.27	-50.83	-85.83	2.61216E-09
1675.275	-51.45	-86.45	2.26464E-09
1675.28	-52.13	-87.13	1.93642E-09
1675.285	-52.78	-87.78	1.66725E-09
1675.29	-53.42	-88.42	1.4388E-09

1675.295	-54.17	-89.17	1.2106E-09
1675.3	-54.79	-89.79	1.04954E-09
1675.305	-55.59	-90.59	8.72971E-10
1675.31	-56.46	-91.46	7.14496E-10
1675.315	-57.27	-92.27	5.92925E-10
1675.32	-58.07	-93.07	4.93174E-10
1675.325	-58.85	-93.85	4.12098E-10
1675.33	-59.66	-94.66	3.41979E-10
1675.335	-60.39	-95.39	2.89068E-10
1675.34	-61.37	-96.37	2.30675E-10
1675.345	-62.38	-97.38	1.8281E-10
1675.35	-63.33	-98.33	1.46893E-10
1675.355	-64.48	-99.48	1.1272E-10
1675.36	-65.69	-100.69	8.531E-11
1675.365	-66.8	-101.8	6.60693E-11
1675.37	-68.32	-103.32	4.65586E-11
1675.375	-69.51	-104.51	3.53997E-11
1675.38	-70.68	-105.68	2.70396E-11
1675.385	-71.32	-106.32	2.33346E-11
1675.39	-72.27	-107.27	1.87499E-11
1675.395	-73.15	-108.15	1.53109E-11
1675.4	-74.48	-109.48	1.1272E-11
1675.405	-74.46	-109.46	1.1324E-11
1675.41	-73.3	-108.3	1.47911E-11
1675.415	-72.98	-107.98	1.59221E-11
1675.42	-72.13	-107.13	1.93642E-11
1675.425	-71.38	-106.38	2.30144E-11
1675.43	-70.85	-105.85	2.60016E-11
1675.435	-70.18	-105.18	3.03389E-11
1675.44	-69.36	-104.36	3.66438E-11
1675.445	-68.63	-103.63	4.33511E-11
1675.45	-68.59	-103.59	4.37522E-11
1675.455	-68.39	-103.39	4.58142E-11
1675.46	-68.33	-103.33	4.64515E-11
1675.465	-67.71	-102.71	5.35797E-11
1675.47	-66.99	-101.99	6.32412E-11
1675.475	-66.75	-101.75	6.68344E-11
1675.48	-66.56	-101.56	6.98232E-11
1675.485	-66.34	-101.34	7.34514E-11
1675.49	-66.03	-101.03	7.8886E-11
1675.495	-66.03	-101.03	7.8886E-11
1675.5	-65.8	-100.8	8.31764E-11
1675.505	-65.63	-100.63	8.64968E-11
1675.51	-65.72	-100.72	8.47227E-11
1675.515	-65.65	-100.65	8.60994E-11
1675.52	-65.45	-100.45	9.01571E-11
1675.525	-65.16	-100.16	9.63829E-11

1675.53	-64.74	-99.74	1.0617E-10
1675.535	-64.9	-99.9	1.02329E-10
1675.54	-65.01	-100.01	9.977E-11
1675.545	-64.98	-99.98	1.00462E-10
1675.55	-65.02	-100.02	9.95405E-11
1675.555	-64.97	-99.97	1.00693E-10
1675.56	-65.01	-100.01	9.977E-11
1675.565	-64.98	-99.98	1.00462E-10
1675.57	-64.99	-99.99	1.00231E-10
1675.575	-64.8	-99.8	1.04713E-10
1675.58	-64.61	-99.61	1.09396E-10
1675.585	-64.88	-99.88	1.02802E-10
1675.59	-65.16	-100.16	9.63829E-11
1675.595	-65.38	-100.38	9.1622E-11
1675.6	-65.52	-100.52	8.87156E-11
1675.605	-65.45	-100.45	9.01571E-11
1675.61	-65.34	-100.34	9.24698E-11
1675.615	-65.35	-100.35	9.22571E-11
1675.62	-65.26	-100.26	9.4189E-11
1675.625	-65.48	-100.48	8.95365E-11
1675.63	-65.62	-100.62	8.66962E-11
1675.635	-65.6	-100.6	8.70964E-11
1675.64	-65.73	-100.73	8.45279E-11
1675.645	-65.92	-100.92	8.09096E-11
1675.65	-66.1	-101.1	7.76247E-11
1675.655	-65.88	-100.88	8.16582E-11
1675.66	-65.76	-100.76	8.3946E-11
1675.665	-65.99	-100.99	7.96159E-11
1675.67	-65.98	-100.98	7.97995E-11
1675.675	-66.19	-101.19	7.60326E-11
1675.68	-66.32	-101.32	7.37904E-11
1675.685	-66.12	-101.12	7.72681E-11
1675.69	-66.37	-101.37	7.29458E-11
1675.695	-66.49	-101.49	7.09578E-11
1675.7	-66.64	-101.64	6.85488E-11
1675.705	-66.9	-101.9	6.45654E-11
1675.71	-66.8	-101.8	6.60693E-11
1675.715	-66.53	-101.53	7.03072E-11
1675.72	-66.78	-101.78	6.63743E-11
1675.725	-66.99	-101.99	6.32412E-11
1675.73	-67.33	-102.33	5.8479E-11
1675.735	-67.24	-102.24	5.97035E-11
1675.74	-67.18	-102.18	6.05341E-11
1675.745	-67.53	-102.53	5.5847E-11
1675.75	-67.65	-102.65	5.4325E-11
1675.755	-67.73	-102.73	5.33335E-11
1675.76	-67.8	-102.8	5.24807E-11

1675.765	-68.09	-103.09	4.90908E-11
1675.77	-68.11	-103.11	4.88652E-11
1675.775	-68.19	-103.19	4.79733E-11
1675.78	-68.57	-103.57	4.39542E-11
1675.785	-68.71	-103.71	4.25598E-11
1675.79	-68.63	-103.63	4.33511E-11
1675.795	-68.26	-103.26	4.72063E-11
1675.8	-68.43	-103.43	4.53942E-11
1675.805	-69.26	-104.26	3.74973E-11
1675.81	-69.75	-104.75	3.34965E-11
1675.815	-69.87	-104.87	3.25837E-11
1675.82	-69.53	-104.53	3.52371E-11
1675.825	-69.87	-104.87	3.25837E-11
1675.83	-69.7	-104.7	3.38844E-11
1675.835	-69.95	-104.95	3.1989E-11
1675.84	-70.15	-105.15	3.05492E-11
1675.845	-70.08	-105.08	3.10456E-11
1675.85	-70.37	-105.37	2.90402E-11
1675.855	-70.98	-105.98	2.52348E-11
1675.86	-71.29	-106.29	2.34963E-11
1675.865	-71.15	-106.15	2.42661E-11
1675.87	-71.32	-106.32	2.33346E-11
1675.875	-70.66	-105.66	2.71644E-11
1675.88	-70.53	-105.53	2.79898E-11
1675.885	-70.78	-105.78	2.64241E-11
1675.89	-71.12	-106.12	2.44343E-11
1675.895	-71.31	-106.31	2.33884E-11
1675.9	-71.77	-106.77	2.10378E-11
1675.905	-72.05	-107.05	1.97242E-11
1675.91	-71.95	-106.95	2.01837E-11
1675.915	-72.42	-107.42	1.81134E-11
1675.92	-72.55	-107.55	1.75792E-11
1675.925	-72.37	-107.37	1.83231E-11
1675.93	-71.68	-106.68	2.14783E-11
1675.935	-71.88	-106.88	2.05116E-11
1675.94	-72.57	-107.57	1.74985E-11
1675.945	-73.33	-108.33	1.46893E-11
1675.95	-73.38	-108.38	1.45211E-11
1675.955	-73.36	-108.36	1.45881E-11
1675.96	-74	-109	1.25893E-11
1675.965	-73.96	-108.96	1.27057E-11
1675.97	-73.77	-108.77	1.32739E-11
1675.975	-73.73	-108.73	1.33968E-11
1675.98	-73.57	-108.57	1.38995E-11
1675.985	-73.88	-108.88	1.2942E-11
1675.99	-74.49	-109.49	1.1246E-11
1675.995	-75.64	-110.64	8.62979E-12

1676	-75.44	-110.44	9.03649E-12	
			1.96764E-05	**Total Energy in 1MHz**
		-0.8	0.831763771	**Filter Loss**
			799.324984	**Total Energy in 5 MHz**
			40623610.15	**Ratio**
			76.08778516	**Ratio (dB)**

Table 4-3. Lower Adjacent 1MHz

Filter for 300W	**Lower Side**		
Frequency (MHz)	**Filter S21 (dB)**	**Filter+ Regrowth (dB)**	**Energy**
1669	-88.13	-123.13	4.86407E-13
1669.005	-88.13	-123.13	4.86407E-13
1669.01	-86.9	-121.9	6.45654E-13
1669.015	-86.96	-121.96	6.36796E-13
1669.02	-86.68	-121.68	6.79204E-13
1669.025	-85.91	-120.91	8.10961E-13
1669.03	-85.32	-120.32	9.28966E-13
1669.035	-84.45	-119.45	1.13501E-12
1669.04	-82.81	-117.81	1.65577E-12
1669.045	-82.87	-117.87	1.63305E-12
1669.05	-83.58	-118.58	1.38676E-12
1669.055	-83.12	-118.12	1.5417E-12
1669.06	-82.28	-117.28	1.87068E-12
1669.065	-82.14	-117.14	1.93197E-12
1669.07	-82.65	-117.65	1.71791E-12
1669.075	-82.31	-117.31	1.8578E-12
1669.08	-80.93	-115.93	2.5527E-12
1669.085	-80.64	-115.64	2.72898E-12
1669.09	-81.34	-116.34	2.32274E-12
1669.095	-80.58	-115.58	2.76694E-12
1669.1	-80.1	-115.1	3.0903E-12
1669.105	-79.32	-114.32	3.69828E-12
1669.11	-79.05	-114.05	3.9355E-12
1669.115	-78.68	-113.68	4.28549E-12
1669.12	-78.83	-113.83	4.14E-12
1669.125	-78.97	-113.97	4.00867E-12
1669.13	-78.61	-113.61	4.35512E-12
1669.135	-78.17	-113.17	4.81948E-12
1669.14	-78.01	-113.01	5.00035E-12
1669.145	-78.3	-113.3	4.67735E-12
1669.15	-77.38	-112.38	5.78096E-12
1669.155	-76.8	-111.8	6.60693E-12
1669.16	-76.71	-111.71	6.74528E-12
1669.165	-76.8	-111.8	6.60693E-12
1669.17	-76.38	-111.38	7.2778E-12
1669.175	-75.66	-110.66	8.59014E-12

1669.18	-75.45	-110.45	9.01571E-12
1669.185	-75.35	-110.35	9.22571E-12
1669.19	-75.21	-110.21	9.52796E-12
1669.195	-74.97	-109.97	1.00693E-11
1669.2	-74.83	-109.83	1.03992E-11
1669.205	-74.68	-109.68	1.07647E-11
1669.21	-74.64	-109.64	1.08643E-11
1669.215	-74.43	-109.43	1.14025E-11
1669.22	-74.05	-109.05	1.24451E-11
1669.225	-73.8	-108.8	1.31826E-11
1669.23	-73.42	-108.42	1.4388E-11
1669.235	-73.33	-108.33	1.46893E-11
1669.24	-72.9	-107.9	1.62181E-11
1669.245	-72.71	-107.71	1.69434E-11
1669.25	-72.6	-107.6	1.7378E-11
1669.255	-72.28	-107.28	1.87068E-11
1669.26	-72.05	-107.05	1.97242E-11
1669.265	-71.66	-106.66	2.15774E-11
1669.27	-71.71	-106.71	2.13304E-11
1669.275	-71.76	-106.76	2.10863E-11
1669.28	-71.56	-106.56	2.208E-11
1669.285	-71.15	-106.15	2.42661E-11
1669.29	-70.89	-105.89	2.57632E-11
1669.295	-70.86	-105.86	2.59418E-11
1669.3	-70.5	-105.5	2.81838E-11
1669.305	-70.25	-105.25	2.98538E-11
1669.31	-70.18	-105.18	3.03389E-11
1669.315	-69.87	-104.87	3.25837E-11
1669.32	-69.81	-104.81	3.3037E-11
1669.325	-69.65	-104.65	3.42768E-11
1669.33	-69.44	-104.44	3.59749E-11
1669.335	-69.33	-104.33	3.68978E-11
1669.34	-69.18	-104.18	3.81944E-11
1669.345	-69.02	-104.02	3.96278E-11
1669.35	-68.82	-103.82	4.14954E-11
1669.355	-68.62	-103.62	4.3451E-11
1669.36	-68.46	-103.46	4.50817E-11
1669.365	-68.22	-103.22	4.76431E-11
1669.37	-68.02	-103.02	4.98884E-11
1669.375	-67.81	-102.81	5.236E-11
1669.38	-67.6	-102.6	5.49541E-11
1669.385	-67.42	-102.42	5.72796E-11
1669.39	-67.5	-102.5	5.62341E-11
1669.395	-67.4	-102.4	5.7544E-11
1669.4	-67.24	-102.24	5.97035E-11
1669.405	-67.01	-102.01	6.29506E-11
1669.41	-66.89	-101.89	6.47143E-11

1669.415	-66.95	-101.95	6.38263E-11
1669.42	-66.68	-101.68	6.79204E-11
1669.425	-66.48	-101.48	7.11214E-11
1669.43	-66.34	-101.34	7.34514E-11
1669.435	-66.33	-101.33	7.36207E-11
1669.44	-66.2	-101.2	7.58578E-11
1669.445	-65.94	-100.94	8.05378E-11
1669.45	-65.84	-100.84	8.24138E-11
1669.455	-65.79	-100.79	8.33681E-11
1669.46	-65.72	-100.72	8.47227E-11
1669.465	-65.73	-100.73	8.45279E-11
1669.47	-65.65	-100.65	8.60994E-11
1669.475	-65.53	-100.53	8.85116E-11
1669.48	-65.45	-100.45	9.01571E-11
1669.485	-65.47	-100.47	8.97429E-11
1669.49	-65.36	-100.36	9.2045E-11
1669.495	-65.28	-100.28	9.37562E-11
1669.5	-65.16	-100.16	9.63829E-11
1669.505	-65.18	-100.18	9.59401E-11
1669.51	-65.18	-100.18	9.59401E-11
1669.515	-64.99	-99.99	1.00231E-10
1669.52	-64.94	-99.94	1.01391E-10
1669.525	-65.06	-100.06	9.86279E-11
1669.53	-65.11	-100.11	9.7499E-11
1669.535	-65.09	-100.09	9.7949E-11
1669.54	-65.18	-100.18	9.59401E-11
1669.545	-65.3	-100.3	9.33254E-11
1669.55	-65.4	-100.4	9.12011E-11
1669.555	-65.45	-100.45	9.01571E-11
1669.56	-65.56	-100.56	8.79023E-11
1669.565	-65.71	-100.71	8.4918E-11
1669.57	-65.73	-100.73	8.45279E-11
1669.575	-65.82	-100.82	8.27942E-11
1669.58	-66.15	-101.15	7.67361E-11
1669.585	-66.36	-101.36	7.31139E-11
1669.59	-66.65	-101.65	6.83912E-11
1669.595	-66.91	-101.91	6.44169E-11
1669.6	-67.21	-102.21	6.01174E-11
1669.605	-67.58	-102.58	5.52077E-11
1669.61	-68.16	-103.16	4.83059E-11
1669.615	-68.79	-103.79	4.1783E-11
1669.62	-69.31	-104.31	3.70681E-11
1669.625	-69.9	-104.9	3.23594E-11
1669.63	-70.49	-105.49	2.82488E-11
1669.635	-71.33	-106.33	2.32809E-11
1669.64	-72.15	-107.15	1.92752E-11
1669.645	-72.8	-107.8	1.65959E-11

1669.65	-73.46	-108.46	1.42561E-11
1669.655	-73.59	-108.59	1.38357E-11
1669.66	-73.39	-108.39	1.44877E-11
1669.665	-72.44	-107.44	1.80302E-11
1669.67	-70.89	-105.89	2.57632E-11
1669.675	-69.36	-104.36	3.66438E-11
1669.68	-67.85	-102.85	5.188E-11
1669.685	-66.3	-101.3	7.4131E-11
1669.69	-64.96	-99.96	1.00925E-10
1669.695	-63.61	-98.61	1.37721E-10
1669.7	-62.41	-97.41	1.81552E-10
1669.705	-61.3	-96.3	2.34423E-10
1669.71	-60.21	-95.21	3.01301E-10
1669.715	-59.18	-94.18	3.81944E-10
1669.72	-58.27	-93.27	4.70977E-10
1669.725	-57.26	-92.26	5.94292E-10
1669.73	-56.25	-91.25	7.49894E-10
1669.735	-55.33	-90.33	9.2683E-10
1669.74	-54.49	-89.49	1.1246E-09
1669.745	-53.62	-88.62	1.37404E-09
1669.75	-52.85	-87.85	1.64059E-09
1669.755	-52.03	-87.03	1.98153E-09
1669.76	-51.28	-86.28	2.35505E-09
1669.765	-50.52	-85.52	2.80543E-09
1669.77	-49.71	-84.71	3.38065E-09
1669.775	-49	-84	3.98107E-09
1669.78	-48.28	-83.28	4.69894E-09
1669.785	-47.57	-82.57	5.5335E-09
1669.79	-46.88	-81.88	6.48634E-09
1669.795	-46.19	-81.19	7.60326E-09
1669.8	-45.52	-80.52	8.87156E-09
1669.805	-44.81	-79.81	1.04472E-08
1669.81	-44.15	-79.15	1.21619E-08
1669.815	-43.48	-78.48	1.41906E-08
1669.82	-42.79	-77.79	1.66341E-08
1669.825	-42.16	-77.16	1.92309E-08
1669.83	-41.56	-76.56	2.208E-08
1669.835	-40.92	-75.92	2.55859E-08
1669.84	-40.3	-75.3	2.95121E-08
1669.845	-39.63	-74.63	3.4435E-08
1669.85	-39.03	-74.03	3.95367E-08
1669.855	-38.43	-73.43	4.53942E-08
1669.86	-37.81	-72.81	5.236E-08
1669.865	-37.16	-72.16	6.08135E-08
1669.87	-36.58	-71.58	6.95024E-08
1669.875	-35.92	-70.92	8.09096E-08
1669.88	-35.33	-70.33	9.2683E-08

1669.885	-34.71	-69.71	1.06905E-07	
1669.89	-34.11	-69.11	1.22744E-07	
1669.895	-33.52	-68.52	1.40605E-07	
1669.9	-32.88	-67.88	1.6293E-07	
1669.905	-32.31	-67.31	1.8578E-07	
1669.91	-31.71	-66.71	2.13304E-07	
1669.915	-31.11	-66.11	2.44906E-07	
1669.92	-30.51	-65.51	2.8119E-07	
1669.925	-29.87	-64.87	3.25837E-07	
1669.93	-29.3	-64.3	3.71535E-07	
1669.935	-28.7	-63.7	4.2658E-07	
1669.94	-28.08	-63.08	4.9204E-07	
1669.945	-27.48	-62.48	5.64937E-07	
1669.95	-26.86	-61.86	6.51628E-07	
1669.955	-26.26	-61.26	7.4817E-07	
1669.96	-25.67	-60.67	8.57038E-07	
1669.965	-25.05	-60.05	9.88553E-07	
1669.97	-24.44	-59.44	1.13763E-06	
1669.975	-23.83	-58.83	1.30918E-06	
1669.98	-23.23	-58.23	1.50314E-06	
1669.985	-22.61	-57.61	1.7338E-06	
1669.99	-22	-57	1.99526E-06	
1669.995	-21.38	-56.38	2.30144E-06	
1670	-20.81	-55.81	2.62422E-06	
			2.01761E-05	**Total Energy in 1MHz**
		-0.8	0.831763771	**Filter Loss**
			799.324984	**Total Energy in 5 MHz**
			39617503.8	**Ratio**
			75.97887108	**Ratio (dB)**

4.5 Radiated Emissions

Using the test setup shown in Figure 4-10, with the transmitter operating at full power, the spectrum analyzer was moved 20 meters from the transmitter and connected to a dipole antenna cut to the IF frequency (36 MHz). This antenna was oriented to maximize the received level and the data was recorded. The antenna was then cut to the carrier frequency, local oscillator frequency and the second through tenth harmonic frequencies of the transmitter, and all of the signals received, were maximized by antenna orientation and their absolute levels were recorded.

The spectrum analyzer had a maximum sensitivity of -110 dBm during these tests.

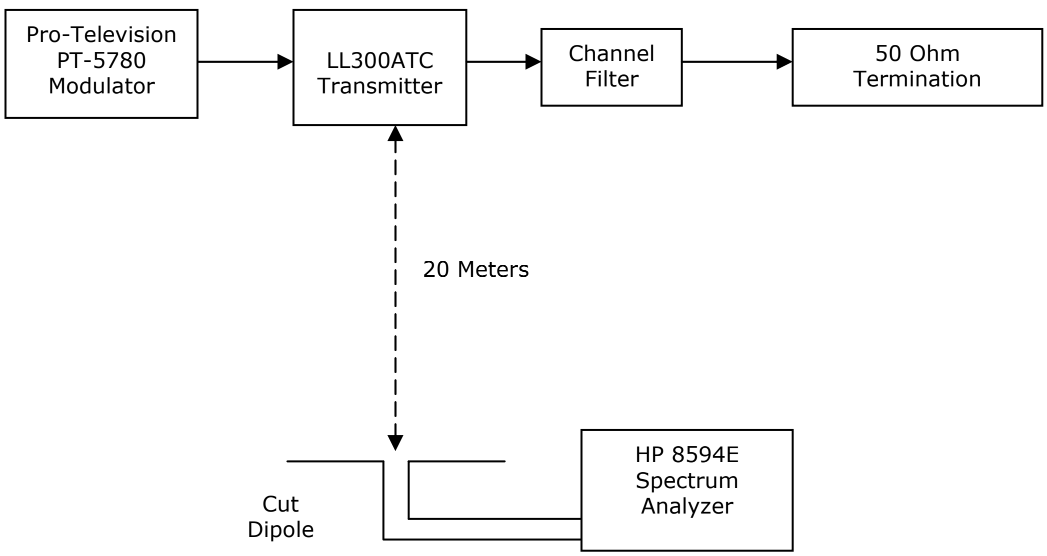

Figure 4-10. Test Setup for Measuring Radiated Emissions

FREQUENCY (MHz)	SOURCE	PEAK LEVEL OBSERVED (dB)
36.00	IF Frequency	None Observed
1672.50	Center of Channel	-58 dBm
1708.50	Local Oscillator	None Observed
3345.00	2nd Harmonic	None Observed
5017.50	3rd Harmonic	None Observed
6690.00	4th Harmonic	None Observed
8362.50	5th Harmonic	None Observed
10035.00	6th Harmonic	None Observed
11707.50	7th Harmonic	None Observed
13380.00	8th Harmonic	None Observed
15052.50	9th Harmonic	None Observed
16725.00	10th Harmonic	None Observed

Table 4-4. Radiated Emissions Data

With these various antennas, and with an adjustable length dipole for 36 to 16725 MHz, the frequency spectrum from 36 MHz to 16725 MHz was observed. The only measurable level observed was at 1672.50 MHz. The levels are shown below in Table 4-5 and an analysis of the relative field and strength are provided in the following paragraphs.

Table 4-5. Measurable Levels Observed in Frequency Spectrum

FREQUENCY	**MEASURED LEVEL (INTO 50 Ω)**
1672.5 MHz	-58 dBm

Three levels were compared to the following reference level.

If all of the power of the transmitter was radiated by an isotropic radiator, the power density at 20 meters would be:

$$P = Pt/4\pi R^2 = 300/4\pi \bullet (20)^2 = 0.06 \text{ w/m}^2$$

Using a dipole-transmitting antenna increases this by 1.64 to:

$$1.64 \times 0.06 = 0.098 \text{ w/m}^2$$

If a dipole-receive antenna of area 1.64 x $\lambda^2/4\pi$ is used to receive the signal, the received level would be +10 dBm.

The receive levels at –58 dBm was therefore at –68 dB relative to this level.

The cabinet radiation was also checked with the receive dipole antenna cut to 1672.5 MHz, within very close proximity to the trays of the transmitters, and the received level, that was recorded at no time exceeded a power density in excess of +0.0 dBm:

This level is far less than the current or proposed standard for safe radiation levels.

4.6 Frequency Stability

The LL300ATC is designed to operate using an either an internal or external 10 MHz precise reference oscillator. The frequency stability of this reference determines the frequency stability of the transmitter.

The frequency determining variables of the transmitter may be defined as follows:
F_{LO} = Desired local oscillator 1 frequency
F_{IF} = Desired IF oscillator frequency
F_R = Desired external reference oscillator frequency
F_{RF} = Desired RF output frequency
E_{LO1} = Local oscillator 1 frequency offset error
E_{IF} = IF oscillator frequency offset error
E_R = External reference oscillator frequency offset error
E_{RF} = RF output frequency error

The PLL circuitry maintains a constant ratio between the external reference frequency and the output frequency of the oscillator. This ratio is defined below for both the LO and IF oscillators.

$G_{LO1} = F_{LO1} / F_R$
$G_{IF} = F_{IF} / F_R$

Any change in the 10 MHz reference will effect a corresponding change in the output frequency such that the above ratios are maintained.

$G_{LO1} = (F_{LO1} + E_{LO1}) / (F_R + E_R) = F_{LO1} / F_R$
$G_{IF} = (F_{IF} + E_{IF}) / (F_R + E_R) = F_{IF} / F_R$

Solving for the change in output frequency yields:

$E_{LO1} = E_R * (F_{LO1} / F_R) = E_R * G_{LO1}$
$E_{IF} = E_R * (F_{IF} / F_R) = E_R * G_{IF}$

The desired RF carrier frequency is equal to the LO1 frequency minus the IF frequency:

$F_{RF} = F_{LO1} - F_{IF}$
The actual RF frequency, including any error introduced by the external reference, may be defined as follows:

$F_{RF} + E_{RF} = (F_{LO1} + E_{LO1}) - (F_{IF} + E_{IF})$
$F_{RF} + E_{RF} = (F_{LO1} - F_{IF}) - (E_{LO1} - E_{IF})$
$F_{RF} + E_{RF} = F_{RF} + (E_{LO1} - -E_{IF})$

Calculating for the error of the carrier yields:

$E_{RF} = (E_{LO1} - E_{IF})$
$E_{RF} = E_R (G_{LO1} - G_{IF})$
$E_{RF} = E_R / F_R * (F_{LO1} - F_{IF})$
$E_{RF} = E_R / F_R * F_{RF}$

Therefore, the error of the RF carrier is a function of the 10 MHz reference error.

The internal 10 MHz reference oscillator used in the LL300ATC has a stability of 1.000 x 10^{-6} (See included Crystek Crystals Corporation Datasheet, Part Number CXOH-APY-10.00) which insures a frequency stability within tolerance specified in the Rules and Regulations for this service.

The required reference oscillator stability may be calculated as follows:

Stability = E_R / F_R
Stability = $\pm$1672.50 Hz

Therefore, the RF frequency error of the LL300ATC will not exceed $\pm$1672.50 Hz when operated with a precise reference oscillator with a stability equal to or better than 1 x 10^{-6}.

4.7 Test Equipment

The test equipment that was used to analyze the Axcera LL300ATC system is listed in Table 4-6.

Table 4-6. Test Equipment

MODEL	MANUFACTURER	DESCRIPTION	SERIAL #
89441A	Hewlett-Packard	Vector Signal Analyzer	3416A03278
E4418BB	Agilent	Power Meter	GB39513814
E9301B	Agilent	RF Power Sensor	US40010126
8401	Bird	600W, 50 Ω Termination	6195
3003-30	Narda	30 dB Directional Coupler	568
3003-30	Narda	30 dB Directional Coupler	1033
8594E	Hewlett-Packard	Spectrum Analyzer	3649A03740