FCC ID: BMTHSD-5000
Confirmation # EA246131

FCC TYPE ACCEPTANCE REPORT

for the

EMCEE HSD-5000 S-Band Transmitter

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1.0 INTRODUCTION

This test report contains the required information for type acceptance of the EMCEE Model HSD-5000 S-Band Transmitter. The data presented was taken from laboratory tests performed on a production transmitter system designed to transmit in the frequency range of 2500-2690 MHz at up to 50 Watts average power in digital mode or 200 Watts peak power in analog mode and utilized for operation in the MMDS/ITFS/EBS/BRS bands under either Part 21, Part 74 or Part 27. The transmitter system design and test data reflect the rules as prescribed in Part 2, 21, 74, and Part 27 of the Commission's Rules.

2.0 CERTIFICATION OF DATA

I certify that the testing procedures and the accumulated test data contained in this report have been personally supervised by me, and that the test results are true and correct to the best of my knowledge and belief.

_____
James A. Yard, CEO
EMCEE Communications

3.0 TEST EQUIPMENT

The following is a list of major test equipment which was used in testing the HSD-5000 transmitter.

Manufacturer	Model #	Serial Number	Description
HP/Agilent	89431A	US39312280	VSA RF Section
HP/Agilent	89441A	US39313875	Vector Signal Analyzer
HP/Agilent	8753ES	US39171643	Vector Network Analyzer
HP/Agilent	E4433B	US38080113	Signal Generator
HP/Agilent	E4402B	US39010125	Spectrum Analyzer
HP/Agilent	E7405A	US39440172	EMC/Spectrum Analyzer
Tektronix	VM-700A	B030893	Video Measurement Test Set
Tektronix	1450-1	B011060	Precision Demodulator
Tektronix	TSG95	B028349	Video Generator
MFC	12798	9802	Output Band Pass Filter
ATM	C214-20	20dB	Directional Coupler
Narda Microwave	768-10	10dB	Attenuator
HP/Agilent	8903B	3514A15172	Audio Analyzer

4.0 MEASUREMENTS

4.1 RF POWER MEASUREMENTS

4.1.1 Analog RF Power Measurement

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

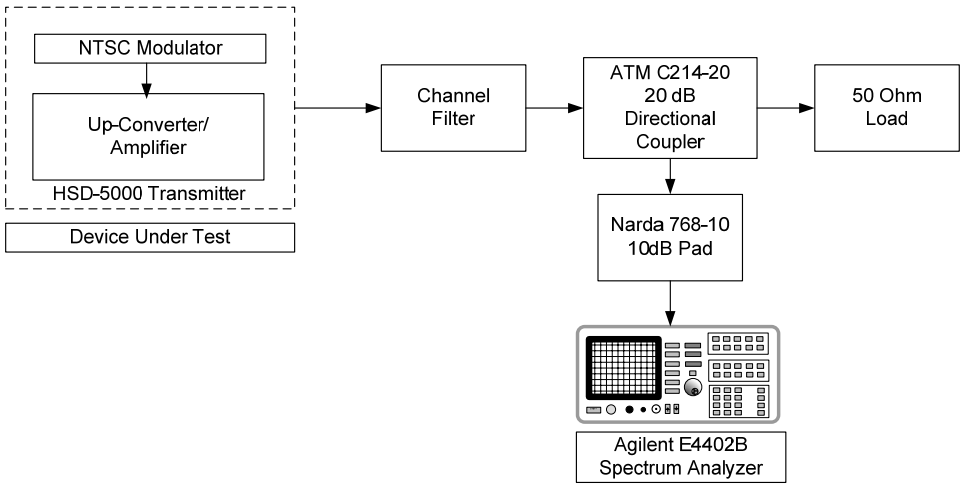

Figure 4-1: Test Setup for Analog Power Measurement

The HSD-5000, modulated with color bars at 87.5%, was adjusted to obtain a 200 Watt Peak Visual (53dBm) and 10 Watt Aural (-13dB) measurement on the spectrum analyzer. The metering circuit was adjusted to obtain a 100% reading on the forward power meter. With the transmitter properly configured for analog operation and the peak visual power set to 200 Watts, all required tests were performed and the analog operation test data recorded in the following sections of the test report. The peak power measurement is shown in the spectrum analyzer plot in Figure 4-2.

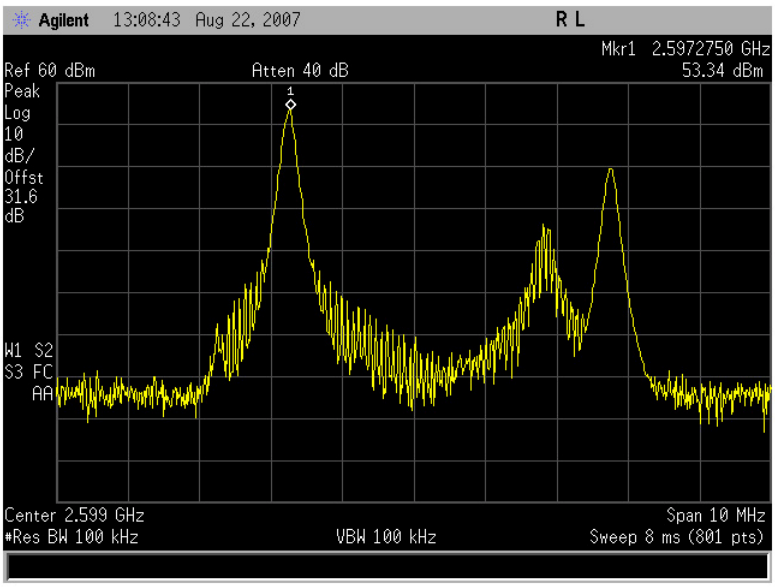

Figure 4-2: Analog Peak Power Measurement Plot

4.1.2 Digital RF Power Measurement

Figure 4-3 shows the test equipment setup for the digital RF power measurements.

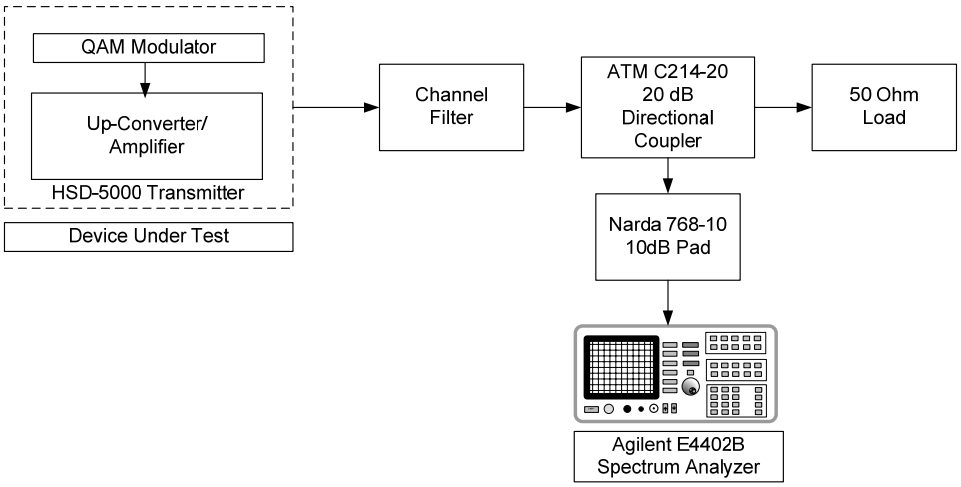

Figure 4-3: Test Setup For Digital Power Measurement

The HSD-5000, modulated with a QAM modulator, was adjusted to obtain a 50 Watt average channel power (47dBm) measurement on the spectrum analyzer. The metering circuit was adjusted to obtain a 100% reading on the forward power meter. With the transmitter properly configured for digital operation and the average power set to 50 Watts, all required tests were performed and the digital operation test data recorded in the following sections of the test report. The results of the digital power measurement test are shown in Figure 4-4.

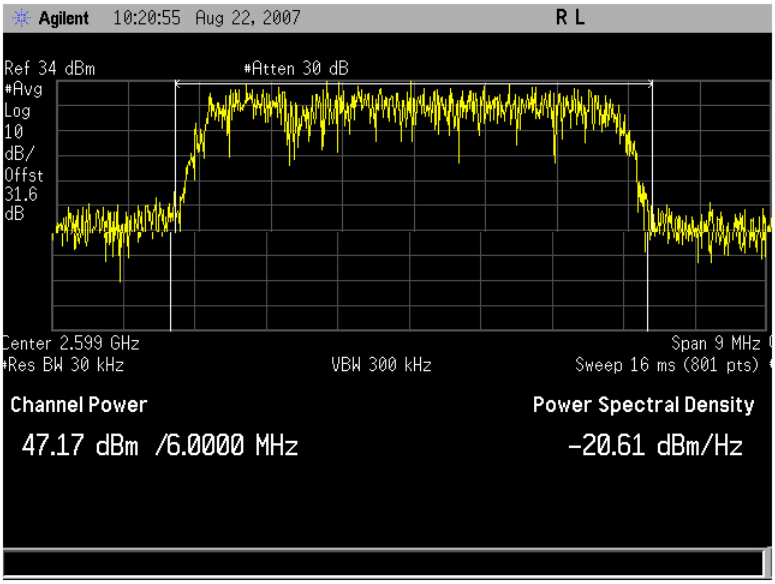

Figure 4-4: Digital Power Measurement Test

4.2 MODULATION CHARACTERISTICS

4.2.1.1 Analog Modulation Characteristics

Figure 4-5 shows the test equipment setup for the analog modulation characteristics measurements.

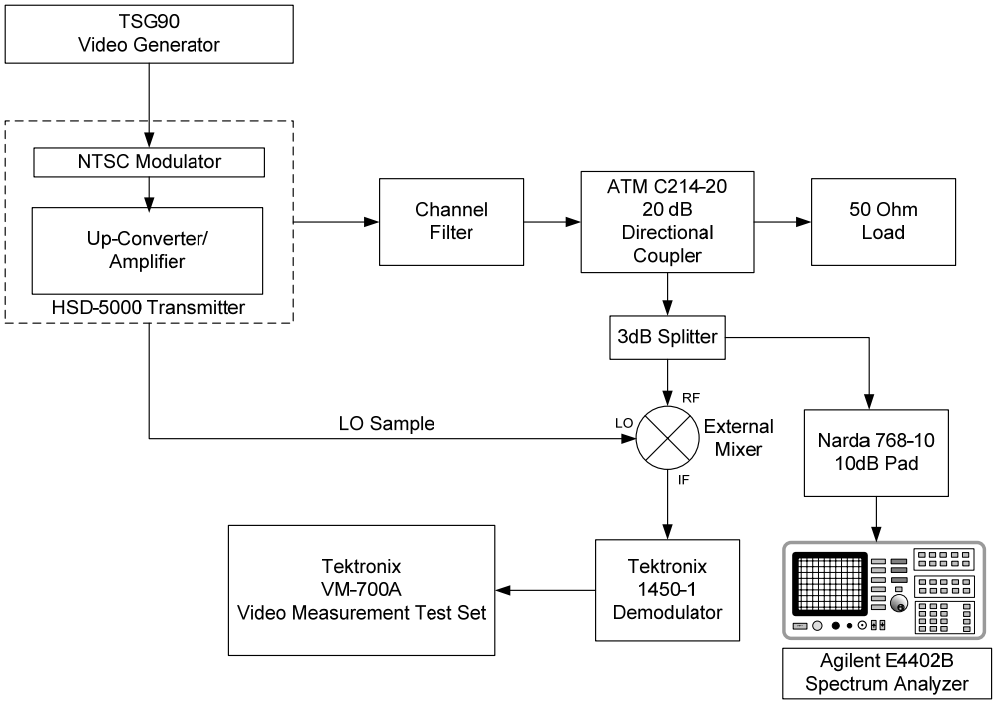

Figure 4-5: Test Setup for Analog Modulation Characteristics

The video signal generator shown in the setup depicted in Figure 4-5 was set to generate NTC color bars at a depth of modulation of 87.5%. Figure 4-6 shows the substantially linear frequency response characteristics of the transmitter in the demodulated video waveform shown on the VM700A measurement plot.

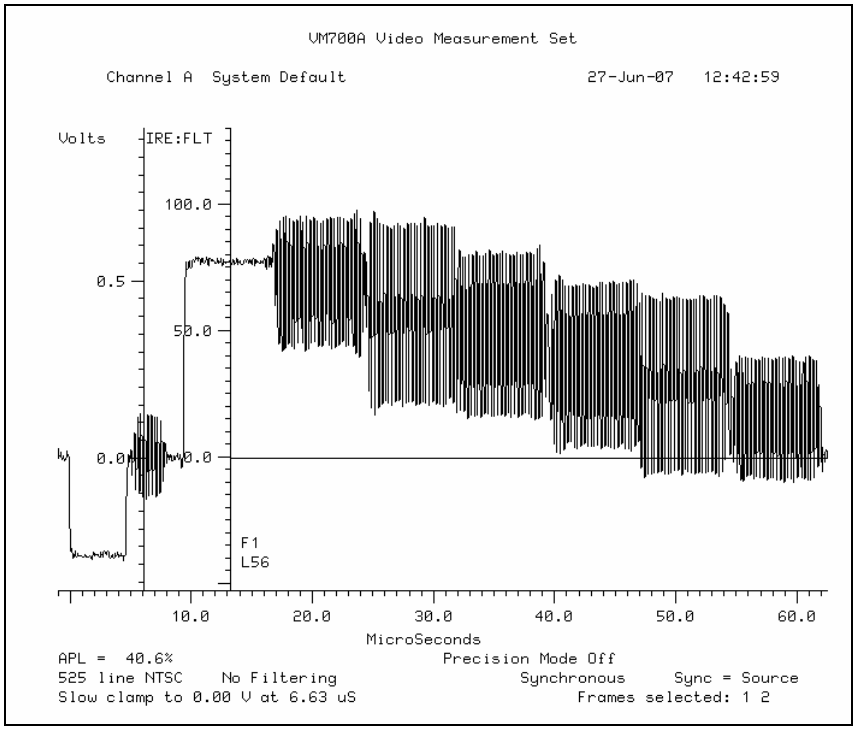

Figure 4-6: Substantially Linear Demodulated Video Waveform Plot

4.2.1.2 Video Envelope Delay

The video signal generator shown in the setup depicted in Figure 4-5 was set to generate a SinX/X test signal so that automated measurements can be made using the VM-700A. Figure 4-7 shows the group delay and gain characteristics of the transmitter in the demodulated video waveform shown on the VM700A measurement plot.

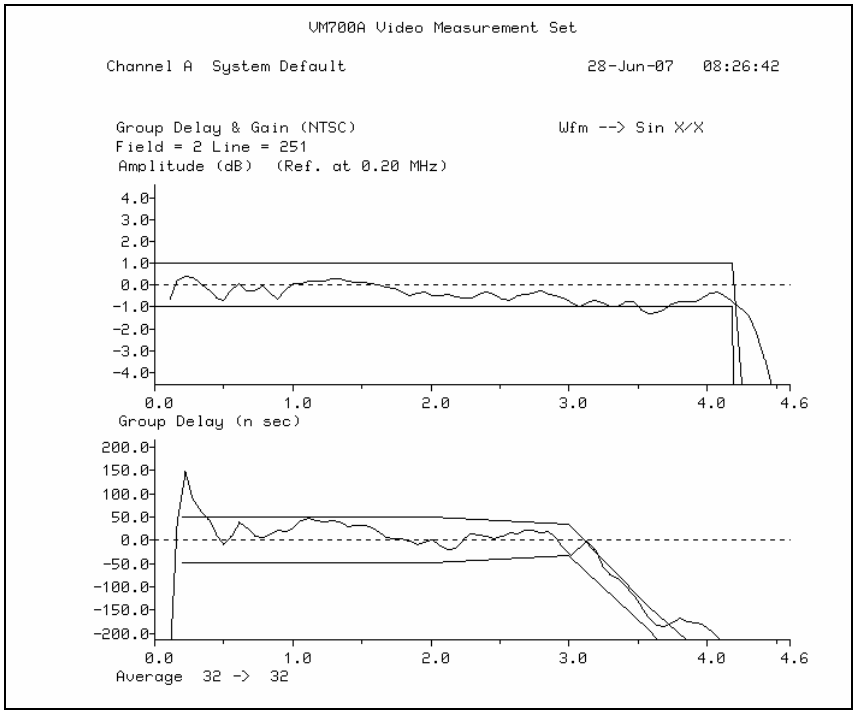

Figure 4-7 Group Delay & Gain Measurement Plot

4.2.1.3 Video Noise

The test setup in Figure 4-5 was used to measure the NTSC video noise spectrum on the VM700A. The noise level was observed to be -58.6 dB rms as shown in Figure 4-8.

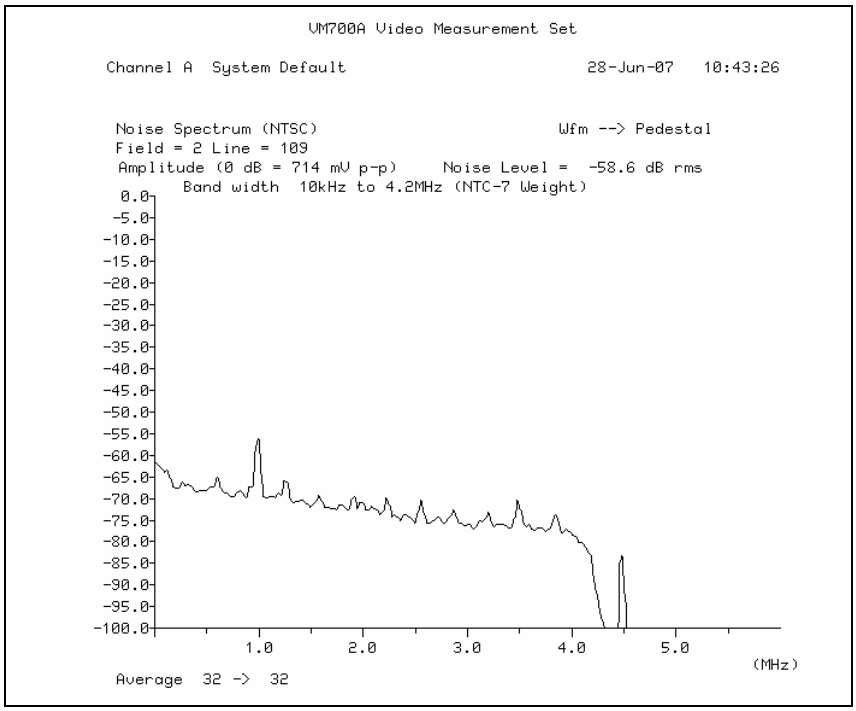

Figure 4-8: NTSC Noise Spectrum Plot

4.2.1.4 Differential Gain & Phase

Using the test setup shown in Figure 4-5 the differential gain and differential phase were measured and recorded. The differential gain was observed to be a maximum of 2.54% peak to peak as shown in Figure 4-9. The differential phase was observed to be a maximum of 1.01 degrees as shown in Figure 4-9.

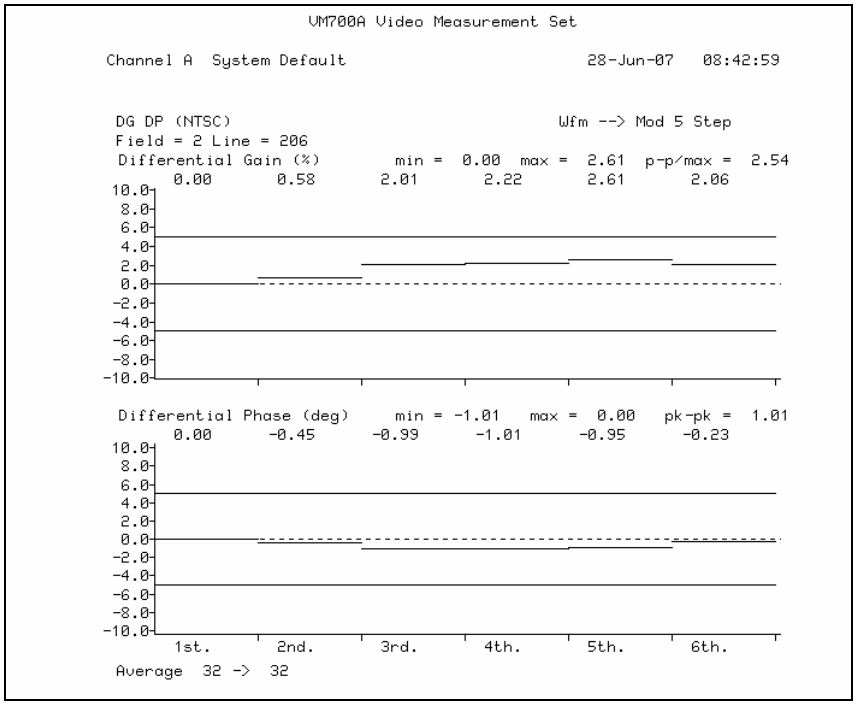

Figure 4-9: Differential Gain & Phase Plot

4.2.1.5 Audio Modulation

The FM audio response and distortion was measured using the test setup shown in Figure 4-10.

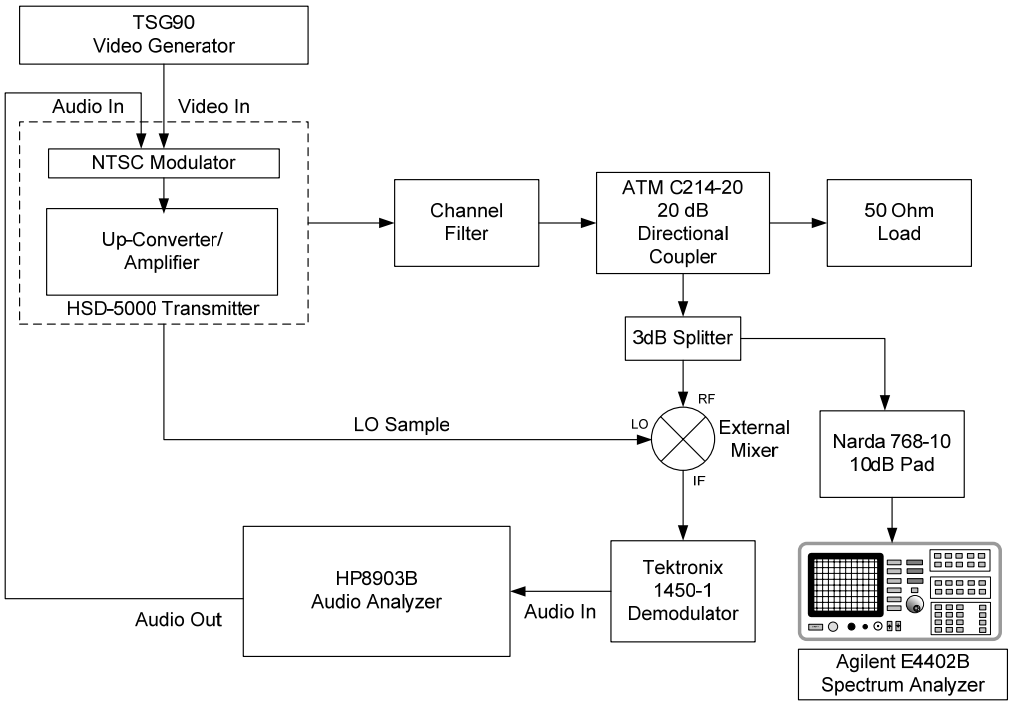

Figure 4-10: Test Setup for Measuring FM Response and Distortion

The transmitter and test equipment was set up to obtain a ±25 KHz deviation with a 15 KHz tone. The audio frequency of the generator was then varied and the resultant measurements were recorded. The results are shown in Table 4-1.

Table 4-1: Audio Distortion Test Data

Frequency	*Distortion*
50Hz	.7%
100Hz	.7%
500Hz	.7%
1 KHz	.5%
5 KHz	.7%
10 KHz	.6%
15 KHz (Reference)	.8%

While maintaining a ±25 KHz deviation, a reference tone of 1 KHz was established, then the audio input frequency and level were varied and the resultant measurements were recorded. The results are shown in Table 4-2.

Table 4-2: Audio Frequency Response Data

Frequency	*Response (Relative to 1 KHz)*
50Hz	-1.1dB
100Hz	-.8dB
500Hz	-.8dB
1 KHz	0dB (Reference)
2 KHz	+.7dB
3 KHz	+2.9dB
4 KHz	+5.6dB
5 KHz	+6.6dB
7 KHz	+9.4dB
10 KHz	+11.8dB
12 KHz	+13.6dB
15 KHz	+15.3dB

4.2.1.6 FM Noise

Using the test setup in Figure 4-10, the FM Noise was measured and found to be -60dB.

4.2.2 Digital Modulation Characteristics

4.2.2.1 Description of Digital Modulation

The digital modulation format is Quadrature Amplitude Modulation with a 64 or 256 point signal constellation (64 QAM and 256 QAM) with the QAM symbol rate and occupied bandwidth optimized for a 6 MHz channel plan. Forward Error Correction (FEC) uses a concatenated coding approach that produces high coding gain at moderate complexity and overhead. The system FEC is optimized for quasi-error free operation at a threshold output error event rate of one error per 15 minutes.

To achieve the appropriate level of error protection required for transmission of digital data, an FEC based on Reed-Solomon coding is used. Protection against burst errors is achieved by use of byte interleaving.

The digital input stream is organized in fixed length packets following the MPEG-2 or MPEG-4 transport multiplexer. To ensure adequate binary transitions for clock recovery, the data at the MPEG transport multiplexer output is randomized according to the Pseudo Random Binary Sequence (PRBS) generator. The randomization process is also active when the modulator input bit stream is non-existent, or when it is non-compliant with the MPEG transport stream format. This avoids emission of an unmodulated carrier from the modulator.

Following the energy dispersal randomization process, systematic shortened Reed-Solomon encoding is performed on each randomized MPEG transport packet with T=8. This means that 8 erroneous bytes per transport packet can be corrected. This process adds 16 parity bytes to the MPEG transport packet to give a codeword.

Convolutional interleaving with depth I=12 is applied to error protected packets. This results in an interleaved frame. The convolutional interleaving process is based on the Forney approach, which is compatible with the Ramsey type III approach. The interleave frame is composed of overlapping error protected packets and is delimited by MPEG sync bytes.

After convolutional interleaving, an exact mapping of bytes into symbols is performed. The mapping relies on the use of byte boundaries in the modulation system. The two most significant bits of each symbol are differentially encoded in order to obtain a p/2 rotation-invariant QAM constellation.

Digital modulation adheres to Quadrature Amplitude Modulation with 64 points in the constellation diagram. Constellation points in Quadrant 1 are converted to Quadrants 2, 3 and 4 by changing the two MS (Ik and Qk) and by rotating the qLSBs according to the table 4-3.

Table 4-3: Quadrant Conversion Constellation

Quadrant	*MSBs*	*LSBs Rotation*
1	**00**	
2	**10**	$+\pi/2$
3	**11**	$+\pi$
4	**01**	$+3\pi/2$

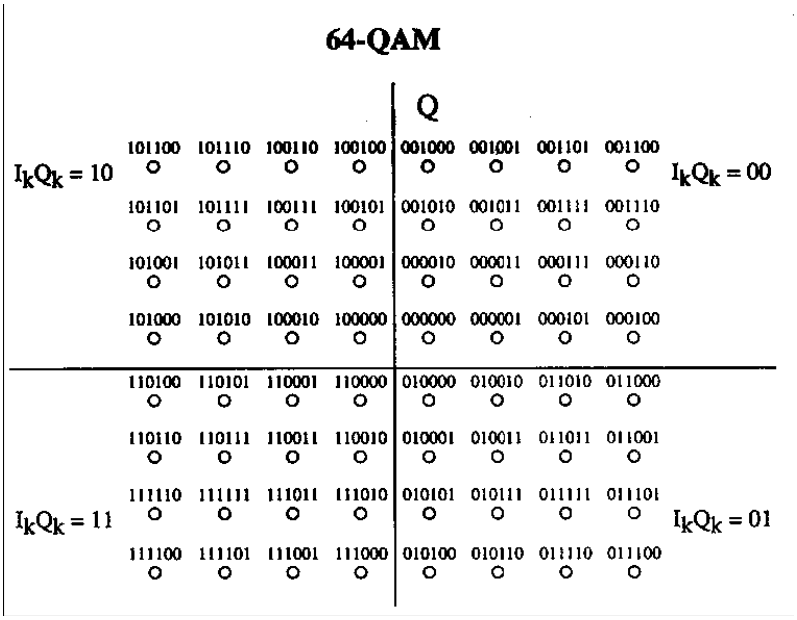

Figure 4-11: 64-QAM Constellation Diagram

The digital modulation format is summarized in the following tables:

Table 4-4: MMDS Digital Transmission Format

PARAMETER	FORMAT
Modulation	64/256 QAM rotationally-invariant coding
Symbol Size	6 bits, 3-bits for “I” and 3 bits for “Q” dimension or 8 bits, 4-bits for “I” and 4 bits for “Q” dimension
Transmission Band	2500 - 2700 MHz
Channel Spacing	6 MHz
Symbol Rate	5.056944 Msps ±3 ppm or 5.06380 Msps ± 3 ppm
Frequency Response	Square-root raised-cosine filter: Roll-off = 0.18 or 0.15

Table 4-5: Typical 64/256 QAM Modulator RF Output

I/Q Phase Offset	< 1.0 degrees
I/Q Crosstalk	-50 dB
I/Q Amplitude Imbalance	0.05 dB max
I/Q Timing Skew	< 3.0 ns

4.2.2.2 Modulator Baseband Filtering

Prior to modulation, the I and Q signals shall be square-root raised-cosine filtered. The roll-off factor shall be 0.15 or 0.18 depending upon modulator symbol rate.

The square-root raised cosine filter shall have a theoretical function defined by the following expression:

$$H(f) = 1 \text{ for } |f| < fN(1-\alpha)$$

$$H(f) = \sqrt{\left\{\frac{1}{2} + \frac{1}{2}\sin\frac{\pi}{2fN}\left[\frac{fN - |f|}{\alpha}\right]\right\}} \text{ for } fN(1-\alpha) \le fN(1+\alpha)$$

Where:

$fN = \frac{1}{2Ts} = \frac{Rs}{2}$ is the Nyquist frequency with a roll-off factor of a =0.15 or 0.18

The value of in-band ripple r_m in the pass-band up to $(1-\alpha)fN$ as well as at the Nyquist frequency fN shall be lower than 0.4 dB. The out-of-band rejection shall be greater than 43 dB after the first up-conversion.

The filter shall be phase-linear with the group delay ripple < 0.1 $Ts(Ns)$ up to fN, where $Ts = 1/Rs$ is the symbol period.

4.3 OCCUPIED BANDWIDTH

4.3.1 Modulation Channel Occupancy

4.3.1.1 Digital Operation vs. Analog (NTSC) Operation:

The digital modulation occupancy of 64/256 QAM is 5.38 MHz measured at the -3 dB roll-off points. This is shown below as compared to a standard NTSC vestigial sideband signal in a standard 6 MHz channel. The 64/256 QAM signal employs a suppressed carrier modulation with a uniform power spectral density as opposed to the usual system M/N (NTSC) signal with separate analog visual, chroma, and aural carriers. A comparison between Analog and Digital occupied bandwidth is shown in Figure 4-12.

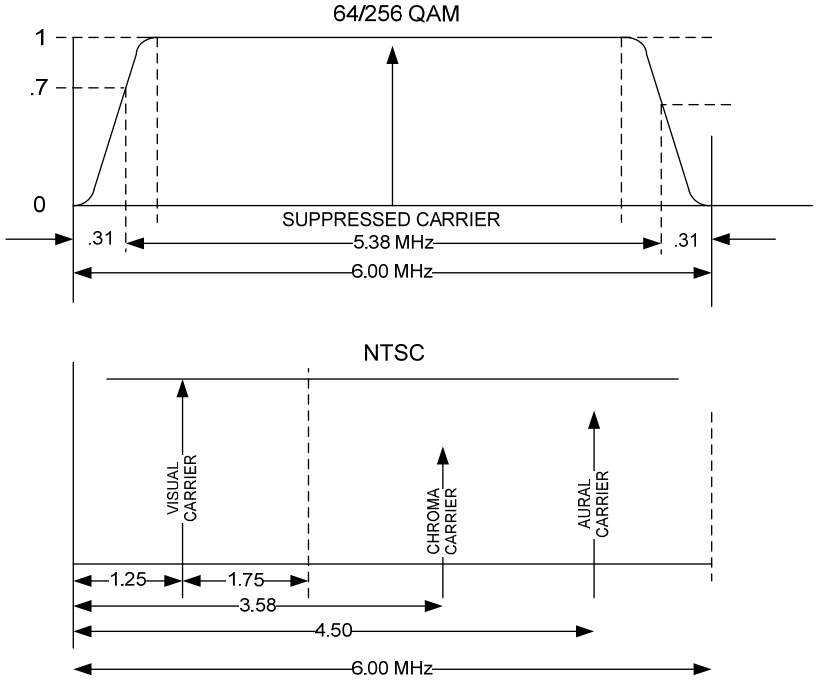

Figure 4-12: Digital & Analog modulation occupancy

4.3.2 Occupied Bandwidth in Analog Operation

Using the test setup in Figure 4-1, the spectrum analyzer was used to capture the occupied bandwidth spectrum of the transmitter in analog operation. The results of the test are shown in Figure 4-13.

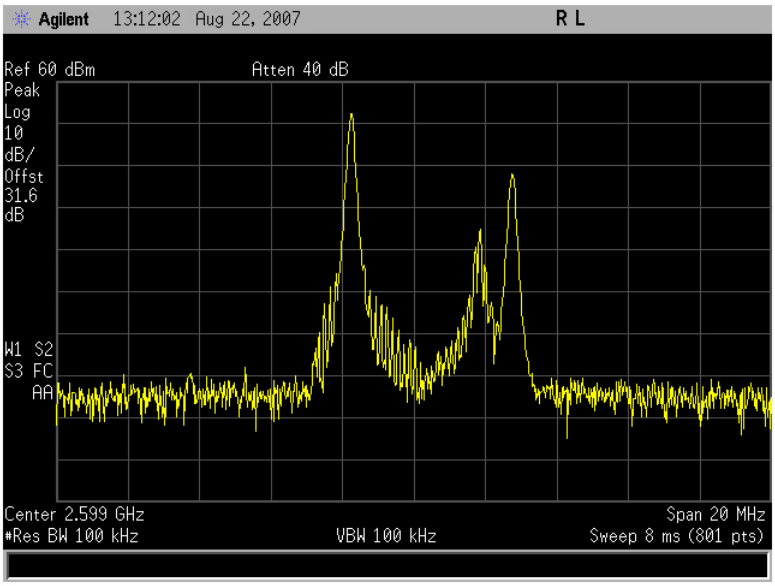

Figure 4-13: Occupied Bandwidth Plot in Analog Operation

4.3.3 Occupied Bandwidth in Digital Operation

Using the test setup in Figure 4-3, the spectrum analyzer was used to capture the occupied bandwidth spectrum of the transmitter in digital operation. The results of the test are shown in Figure 4-14.

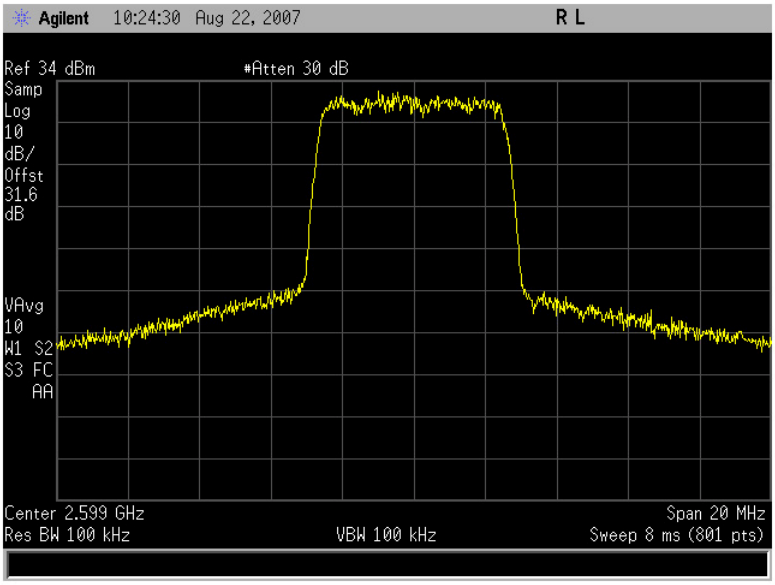

Figure 4-14: Occupied Bandwidth Plot in Digital Operation

4.4 SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Using the test setup in Figure 4-3, the spectrum outside the desired channel was observed and the data was recorded on all spurious above the –60 dB noise floor of the spectrum analyzer as shown in Figure 4-15. The spurious emissions were observed on the analyzer at a span of 1 GHz. With the average in band signal of the desired channel of 2599 MHz set as the reference, the spurious emissions were observed. The measured data is shown in the table 4-6 for 50 Watts average output power.

Table 4-6 Products above the -60dB Analyzer Noise Floor

FREQUENCY (MHz)	SOURCE	PEAK LEVEL (dB)
2599	Reference Channel	0dB Reference
10	10 MHz Reference	None Observed
44	IF Frequency	None Observed
374	1st LO	None Observed
2225	2nd LO	None Observed
5198	2nd Harmonic	None Observed
7797	3rd Harmonic	None Observed
10396	4th Harmonic	None Observed
12995	5th Harmonic	None Observed
15594	6th Harmonic	None Observed
18193	7th Harmonic	None Observed
20792	8th Harmonic	None Observed
23391	9th Harmonic	None Observed
25990	10th Harmonic	None Observed

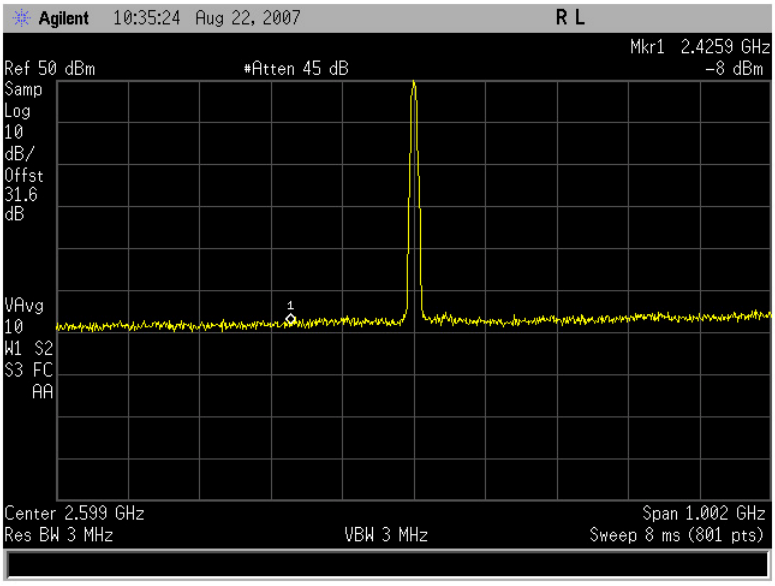

Figure 4-15: Spurious Emissions Spectrum Analyzer Plot

4.4.1 Spurious Emissions Tests with Digital Modulation

Part 27.53 of the Rules states:

27.53 (l) For BRS and EBS stations, the power of any emissions outside the licensee's frequency bands of operation shall be attenuated below the transmitter power (P) measured in watts.

27.53 (l)(2) For fixed and temporary fixed digital stations, the attenuation shall be not less than 43 + 10 log (P) dB.

27.53 (l)(6) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power. With respect to television operations, measurements must be made of the separate visual and aural operating powers at sufficiently frequent intervals to ensure compliance with the rules.

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

50 Watt Transmitter (+47dBm Average):
43 + 10*log(.1)=59.99dB

With regard to §27.53 (l)(6), the 1% emission bandwidth option has been chosen so as to provide for the most accurate measurement of the out of band emissions. The amount of out-of-band power in 1% (60KHz) of the emission bandwidth (6MHz) relative to the transmitter power can be automatically measured by the channel power function of the 4402B Spectrum Analyzer integrated into a 60 KHz (1%) bandwidth. With 64 QAM digital modulation, the out of band emissions we sampled at various points outside the band, and no emissions above -60dB relative to the carrier power were observed. The test setup in Figure 4-3 was used to obtain the measurements recorded into Table 4-6.

The performance of the mask (output) filter was also measured and the resultant data was recorded into Table 4-6 for its attenuation vs. frequency. The test equipment setup for measuring the output filter is shown in Figure 4-12.

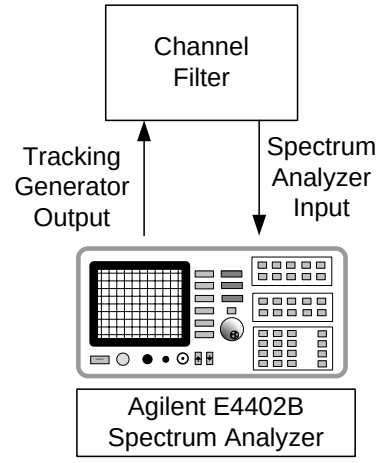

Figure 4-12: Output Filter Measurement Setup

The transmitter's output was measured and the measurement results were recorded into Table 4-6. The first column of the table is the measurement frequency indicating measurements from 1 MHz below the band edge to 1 MHz above the band edge in 5 KHz increments. The second column of the table is the measured channel power integrated into a 1% bandwidth of 60 KHz at the measurement center frequency. The third column is the spectral power attenuation relative to the average in-band power of 47dBm. The fourth column is the attenuation of the filter at the specified frequency. The fifth column is the total attenuation below the carrier power with the filter in circuit.

Table 4-6 indicates that the worst case attenuation in the lower 1 MHz band is -60.86dB after the filter and -60.06dB before the filter. And, the worst case attenuation in the upper 1 MHz band is -65.46dB after the filter and -64.47 before the filter. It should be noted that while the output filter provides some slight improvement in the attenuation, the transmitter's spurious output before the filter is in no case above the -59.99 dB attenuation requirement. As such, the use of the filter for digital services is optional.

Table 4-7: Spurious Emissions for Digital Operations

Measurement Center Frequency	Measured Power	Relative Spectral Regrowth	Filter Attenuation	Attenuation of Regrowth + Filter
2595.000	**Lower Adjacent 1 MHz**			
2595.005	-15.36	-62.65	-1.52	-64.17
2595.010	-15.78	-63.07	-1.51	-64.59
2595.015	-15.84	-63.13	-1.50	-64.63
2595.020	-15.74	-63.03	-1.48	-64.51
2595.025	-15.21	-62.50	-1.47	-63.97
2595.030	-15.43	-62.72	-1.46	-64.18
2595.035	-15.13	-62.42	-1.45	-63.87
2595.040	-16.22	-63.51	-1.44	-64.95
2595.045	-15.53	-62.82	-1.42	-64.25
2595.050	-15.96	-63.25	-1.41	-64.66
2595.055	-15.64	-62.93	-1.40	-64.33
2595.060	-15.18	-62.47	-1.39	-63.86
2595.065	-15.33	-62.62	-1.38	-64.00
2595.070	-15.19	-62.48	-1.37	-63.85

2595.075	-16.19	-63.48	-1.36	-64.85
2595.080	-15.40	-62.69	-1.34	-64.03
2595.085	-14.70	-61.99	-1.34	-63.33
2595.090	-15.40	-62.69	-1.33	-64.02
2595.095	-14.76	-62.05	-1.32	-63.37
2595.100	-14.82	-62.11	-1.31	-63.42
2595.105	-15.69	-62.98	-1.30	-64.28
2595.110	-14.60	-61.89	-1.29	-63.17
2595.115	-15.53	-62.82	-1.28	-64.10
2595.120	-15.03	-62.32	-1.27	-63.58
2595.125	-15.07	-62.36	-1.25	-63.62
2595.130	-14.92	-62.21	-1.25	-63.46
2595.135	-15.46	-62.75	-1.23	-63.98
2595.140	-15.64	-62.93	-1.23	-64.16
2595.145	-15.35	-62.64	-1.22	-63.87
2595.150	-15.82	-63.11	-1.21	-64.32
2595.155	-15.41	-62.70	-1.20	-63.91
2595.160	-15.49	-62.78	-1.20	-63.98
2595.165	-15.78	-63.07	-1.19	-64.26
2595.170	-15.17	-62.46	-1.18	-63.64
2595.175	-15.60	-62.89	-1.18	-64.07
2595.180	-15.71	-63.00	-1.17	-64.17
2595.185	-14.88	-62.17	-1.16	-63.33
2595.190	-15.72	-63.01	-1.15	-64.16
2595.195	-15.16	-62.45	-1.15	-63.60
2595.200	-15.06	-62.35	-1.14	-63.49
2595.205	-15.60	-62.90	-1.13	-64.02
2595.210	-15.12	-62.41	-1.12	-63.53
2595.215	-15.12	-62.41	-1.12	-63.53
2595.220	-15.57	-62.86	-1.10	-63.97
2595.225	-15.48	-62.77	-1.10	-63.87
2595.230	-15.38	-62.67	-1.10	-63.76
2595.235	-14.98	-62.27	-1.09	-63.36
2595.240	-15.34	-62.63	-1.08	-63.71
2595.245	-14.91	-62.20	-1.08	-63.27
2595.250	-15.06	-62.35	-1.07	-63.42
2595.255	-15.53	-62.82	-1.07	-63.89
2595.260	-14.95	-62.24	-1.06	-63.30
2595.265	-15.17	-62.46	-1.05	-63.51
2595.270	-15.16	-62.45	-1.04	-63.50
2595.275	-14.52	-61.81	-1.04	-62.85
2595.280	-14.47	-61.76	-1.04	-62.80
2595.285	-14.27	-61.56	-1.03	-62.60
2595.290	-14.40	-61.69	-1.03	-62.71
2595.295	-15.34	-62.63	-1.01	-63.64
2595.300	-14.76	-62.05	-1.01	-63.06
2595.305	-14.86	-62.15	-1.01	-63.16
2595.310	-15.29	-62.58	-1.00	-63.58
2595.315	-15.09	-62.38	-1.00	-63.38
2595.320	-14.06	-61.36	-0.99	-62.34
2595.325	-14.47	-61.76	-0.98	-62.74
2595.330	-14.89	-62.19	-0.99	-63.17
2595.335	-13.73	-61.03	-0.98	-62.01
2595.340	-14.91	-62.20	-0.98	-63.18
2595.345	-14.56	-61.85	-0.97	-62.82

2595.350	-14.52	-61.81	-0.96	-62.77
2595.355	-14.58	-61.87	-0.96	-62.83
2595.360	-14.37	-61.66	-0.96	-62.62
2595.365	-14.10	-61.39	-0.96	-62.35
2595.370	-14.41	-61.70	-0.95	-62.66
2595.375	-14.90	-62.19	-0.95	-63.14
2595.380	-14.76	-62.05	-0.94	-63.00
2595.385	-14.91	-62.21	-0.94	-63.14
2595.390	-14.23	-61.52	-0.94	-62.46
2595.395	-15.03	-62.32	-0.94	-63.26
2595.400	-15.41	-62.70	-0.93	-63.63
2595.405	-14.01	-61.30	-0.93	-62.23
2595.410	-14.32	-61.61	-0.92	-62.53
2595.415	-14.22	-61.51	-0.92	-62.43
2595.420	-14.60	-61.89	-0.92	-62.81
2595.425	-14.18	-61.47	-0.91	-62.38
2595.430	-14.49	-61.78	-0.92	-62.70
2595.435	-15.43	-62.72	-0.91	-63.63
2595.440	-14.41	-61.70	-0.90	-62.60
2595.445	-14.92	-62.21	-0.90	-63.12
2595.450	-14.89	-62.18	-0.90	-63.08
2595.455	-14.48	-61.77	-0.90	-62.67
2595.460	-14.93	-62.22	-0.89	-63.11
2595.465	-14.82	-62.11	-0.90	-63.01
2595.470	-14.40	-61.69	-0.89	-62.59
2595.475	-14.14	-61.43	-0.89	-62.32
2595.480	-14.67	-61.96	-0.89	-62.85
2595.485	-14.21	-61.50	-0.88	-62.38
2595.490	-14.17	-61.46	-0.88	-62.34
2595.495	-14.17	-61.47	-0.88	-62.34
2595.500	-14.29	-61.58	-0.88	-62.46
2595.505	-14.61	-61.90	-0.88	-62.78
2595.510	-14.16	-61.45	-0.87	-62.32
2595.515	-14.63	-61.92	-0.87	-62.79
2595.520	-14.55	-61.84	-0.87	-62.70
2595.525	-13.71	-61.00	-0.87	-61.86
2595.530	-14.64	-61.93	-0.87	-62.79
2595.535	-13.75	-61.04	-0.86	-61.90
2595.540	-14.42	-61.71	-0.86	-62.57
2595.545	-14.61	-61.90	-0.86	-62.77
2595.550	-14.52	-61.82	-0.86	-62.67
2595.555	-14.62	-61.91	-0.85	-62.77
2595.560	-14.64	-61.93	-0.85	-62.78
2595.565	-13.77	-61.06	-0.85	-61.91
2595.570	-14.68	-61.97	-0.85	-62.82
2595.575	-14.30	-61.59	-0.85	-62.44
2595.580	-13.82	-61.11	-0.85	-61.96
2595.585	-13.99	-61.28	-0.84	-62.12
2595.590	-14.77	-62.06	-0.84	-62.90
2595.595	-14.23	-61.52	-0.84	-62.36
2595.600	-14.18	-61.47	-0.84	-62.32
2595.605	-14.25	-61.54	-0.84	-62.37
2595.610	-13.94	-61.23	-0.84	-62.07
2595.615	-14.16	-61.45	-0.84	-62.29
2595.620	-13.50	-60.79	-0.84	-61.62

2595.625	-14.08	-61.37	-0.83	-62.20
2595.630	-13.69	-60.99	-0.83	-61.82
2595.635	-13.94	-61.23	-0.83	-62.06
2595.640	-14.57	-61.87	-0.83	-62.70
2595.645	-14.11	-61.41	-0.83	-62.24
2595.650	-13.97	-61.26	-0.82	-62.09
2595.655	-14.45	-61.74	-0.83	-62.57
2595.660	-14.29	-61.58	-0.82	-62.40
2595.665	-14.19	-61.48	-0.82	-62.31
2595.670	-14.67	-61.96	-0.83	-62.79
2595.675	-14.31	-61.61	-0.82	-62.43
2595.680	-14.48	-61.77	-0.82	-62.60
2595.685	-14.36	-61.65	-0.82	-62.47
2595.690	-13.50	-60.79	-0.82	-61.61
2595.695	-14.59	-61.88	-0.82	-62.70
2595.700	-14.03	-61.32	-0.82	-62.14
2595.705	-14.48	-61.77	-0.82	-62.58
2595.710	-14.10	-61.39	-0.82	-62.20
2595.715	-14.73	-62.02	-0.82	-62.84
2595.720	-14.06	-61.35	-0.82	-62.16
2595.725	-14.49	-61.78	-0.82	-62.60
2595.730	-14.24	-61.53	-0.82	-62.34
2595.735	-14.53	-61.83	-0.82	-62.64
2595.740	-13.72	-61.01	-0.82	-61.82
2595.745	-14.46	-61.75	-0.82	-62.57
2595.750	-14.37	-61.66	-0.81	-62.47
2595.755	-14.02	-61.31	-0.82	-62.13
2595.760	-14.48	-61.77	-0.82	-62.59
2595.765	-13.86	-61.15	-0.81	-61.96
2595.770	-14.24	-61.53	-0.81	-62.34
2595.775	-13.56	-60.85	-0.81	-61.66
2595.780	-13.94	-61.24	-0.81	-62.05
2595.785	-14.29	-61.58	-0.81	-62.39
2595.790	-14.99	-62.28	-0.81	-63.08
2595.795	-13.56	-60.85	-0.81	-61.66
2595.800	-14.22	-61.52	-0.81	-62.32
2595.805	-14.25	-61.54	-0.81	-62.35
2595.810	-14.28	-61.57	-0.81	-62.38
2595.815	-14.04	-61.33	-0.81	-62.14
2595.820	-14.12	-61.41	-0.81	-62.22
2595.825	-13.40	-60.69	-0.81	-61.49
2595.830	-13.91	-61.21	-0.81	-62.02
2595.835	-14.06	-61.35	-0.81	-62.16
2595.840	-13.92	-61.21	-0.81	-62.02
2595.845	-13.82	-61.11	-0.80	-61.91
2595.850	-13.71	-61.00	-0.81	-61.81
2595.855	-14.42	-61.72	-0.81	-62.52
2595.860	-13.77	-61.06	-0.81	-61.86
2595.865	-14.16	-61.45	-0.81	-62.26
2595.870	-13.02	-60.31	-0.81	-61.11
2595.875	-13.47	-60.76	-0.81	-61.57
2595.880	-13.64	-60.94	-0.81	-61.74
2595.885	-13.78	-61.07	-0.81	-61.88
2595.890	-13.57	-60.86	-0.81	-61.67
2595.895	-13.43	-60.72	-0.81	-61.53

2595.900	-13.27	-60.56	-0.81	-61.36
2595.905	-13.32	-60.61	-0.81	-61.42
2595.910	-13.23	-60.52	-0.80	-61.32
2595.915	-13.72	-61.01	-0.81	-61.81
2595.920	-13.39	-60.68	-0.81	-61.49
2595.925	-13.61	-60.90	-0.80	-61.70
2595.930	-12.91	-60.20	-0.81	-61.01
2595.935	-13.01	-60.30	-0.81	-61.11
2595.940	-12.77	-60.06	-0.81	-60.87
2595.945	-13.32	-60.61	-0.81	-61.41
2595.950	-13.48	-60.77	-0.81	-61.58
2595.955	-14.16	-61.45	-0.81	-62.26
2595.960	-13.14	-60.43	-0.81	-61.24
2595.965	-12.90	-60.19	-0.80	-60.99
2595.970	-13.76	-61.05	-0.81	-61.85
2595.975	-13.17	-60.46	-0.81	-61.26
2595.980	-12.90	-60.19	-0.81	-61.00
2595.985	-13.16	-60.45	-0.81	-61.26
2595.990	-13.71	-61.00	-0.81	-61.81
2595.995	-13.41	-60.70	-0.81	-61.51
2596.000 (Lower Band Edge)	-13.31	-60.60	-0.81	-61.41
2599.000 (Channel Center)	**47.29**	**0.00 (Ref Level)**	**-0.70**	**-0.70**
2602.000 (Upper Band Edge)	-17.60	-64.89	-0.98	-65.87
2602.005	-18.10	-65.39	-0.98	-66.37
2602.010	-17.64	-64.93	-0.98	-65.91
2602.015	-17.74	-65.03	-0.99	-66.02
2602.020	-17.75	-65.05	-0.99	-66.03
2602.025	-17.18	-64.47	-0.99	-65.46
2602.030	-17.22	-64.51	-1.00	-65.51
2602.035	-17.82	-65.11	-1.00	-66.11
2602.040	-17.75	-65.05	-1.00	-66.04
2602.045	-18.14	-65.43	-1.00	-66.43
2602.050	-18.54	-65.83	-1.01	-66.83
2602.055	-17.89	-65.18	-1.00	-66.18
2602.060	-17.48	-64.77	-1.01	-65.78
2602.065	-17.95	-65.25	-1.01	-66.25
2602.070	-17.64	-64.93	-1.01	-65.95
2602.075	-17.85	-65.14	-1.01	-66.16
2602.080	-17.80	-65.09	-1.02	-66.11
2602.085	-17.94	-65.23	-1.02	-66.25
2602.090	-17.94	-65.23	-1.02	-66.25
2602.095	-18.34	-65.63	-1.03	-66.66
2602.100	-17.49	-64.78	-1.03	-65.81
2602.105	-18.13	-65.42	-1.03	-66.45
2602.110	-17.87	-65.16	-1.03	-66.19
2602.115	-17.57	-64.86	-1.04	-65.89
2602.120	-18.52	-65.81	-1.04	-66.84
2602.125	-17.57	-64.86	-1.04	-65.90
2602.130	-18.32	-65.61	-1.05	-66.66
2602.135	-18.08	-65.37	-1.05	-66.42
2602.140	-17.36	-64.65	-1.05	-65.70
2602.145	-18.40	-65.69	-1.06	-66.75
2602.150	-18.03	-65.32	-1.06	-66.37
2602.155	-18.56	-65.85	-1.06	-66.91
2602.160	-18.19	-65.48	-1.06	-66.54

2602.165	-17.71	-65.00	-1.07	-66.07
2602.170	-18.05	-65.34	-1.07	-66.41
2602.175	-18.02	-65.31	-1.07	-66.38
2602.180	-18.02	-65.31	-1.08	-66.39
2602.185	-18.06	-65.35	-1.08	-66.43
2602.190	-18.15	-65.44	-1.08	-66.52
2602.195	-18.12	-65.41	-1.08	-66.49
2602.200	-18.25	-65.54	-1.09	-66.63
2602.205	-18.84	-66.13	-1.09	-67.22
2602.210	-18.03	-65.32	-1.09	-66.41
2602.215	-18.12	-65.41	-1.10	-66.51
2602.220	-18.59	-65.88	-1.11	-66.99
2602.225	-18.22	-65.51	-1.10	-66.61
2602.230	-18.07	-65.36	-1.11	-66.47
2602.235	-18.45	-65.74	-1.11	-66.85
2602.240	-18.15	-65.44	-1.12	-66.55
2602.245	-17.50	-64.80	-1.12	-65.92
2602.250	-18.65	-65.94	-1.12	-67.06
2602.255	-17.55	-64.84	-1.13	-65.96
2602.260	-18.55	-65.85	-1.13	-66.98
2602.265	-18.66	-65.95	-1.13	-67.08
2602.270	-19.09	-66.38	-1.14	-67.52
2602.275	-18.52	-65.81	-1.14	-66.94
2602.280	-18.31	-65.60	-1.15	-66.75
2602.285	-18.48	-65.77	-1.15	-66.93
2602.290	-18.65	-65.94	-1.16	-67.10
2602.295	-18.56	-65.85	-1.16	-67.01
2602.300	-18.70	-65.99	-1.16	-67.15
2602.305	-18.52	-65.82	-1.16	-66.98
2602.310	-18.38	-65.67	-1.17	-66.84
2602.315	-18.14	-65.43	-1.18	-66.61
2602.320	-18.56	-65.85	-1.18	-67.03
2602.325	-18.22	-65.51	-1.19	-66.70
2602.330	-18.59	-65.88	-1.19	-67.07
2602.335	-18.17	-65.46	-1.20	-66.66
2602.340	-19.03	-66.32	-1.20	-67.52
2602.345	-18.62	-65.91	-1.21	-67.12
2602.350	-19.15	-66.45	-1.20	-67.65
2602.355	-18.19	-65.49	-1.20	-66.69
2602.360	-18.32	-65.61	-1.21	-66.82
2602.365	-18.46	-65.75	-1.21	-66.96
2602.370	-18.57	-65.86	-1.22	-67.08
2602.375	-18.48	-65.77	-1.23	-67.00
2602.380	-18.33	-65.62	-1.24	-66.86
2602.385	-18.34	-65.63	-1.24	-66.87
2602.390	-18.27	-65.57	-1.24	-66.80
2602.395	-18.15	-65.44	-1.25	-66.69
2602.400	-18.72	-66.01	-1.25	-67.27
2602.405	-18.65	-65.94	-1.27	-67.21
2602.410	-18.64	-65.93	-1.26	-67.19
2602.415	-18.47	-65.77	-1.27	-67.03
2602.420	-18.25	-65.54	-1.28	-66.82
2602.425	-18.33	-65.62	-1.28	-66.90
2602.430	-18.51	-65.80	-1.29	-67.09
2602.435	-18.08	-65.38	-1.29	-66.66

2602.440	-18.41	-65.70	-1.29	-67.00
2602.445	-18.29	-65.58	-1.30	-66.88
2602.450	-18.27	-65.56	-1.31	-66.87
2602.455	-19.27	-66.56	-1.32	-67.88
2602.460	-18.60	-65.89	-1.32	-67.21
2602.465	-18.70	-65.99	-1.33	-67.32
2602.470	-19.02	-66.32	-1.33	-67.65
2602.475	-18.78	-66.07	-1.34	-67.42
2602.480	-18.50	-65.79	-1.34	-67.13
2602.485	-19.32	-66.61	-1.35	-67.96
2602.490	-18.55	-65.85	-1.35	-67.20
2602.495	-18.82	-66.12	-1.37	-67.48
2602.500	-18.93	-66.22	-1.37	-67.59
2602.505	-19.01	-66.30	-1.37	-67.67
2602.510	-18.63	-65.92	-1.38	-67.30
2602.515	-18.44	-65.73	-1.39	-67.12
2602.520	-19.33	-66.62	-1.40	-68.01
2602.525	-18.55	-65.84	-1.41	-67.25
2602.530	-19.09	-66.38	-1.41	-67.79
2602.535	-18.98	-66.27	-1.42	-67.69
2602.540	-19.09	-66.38	-1.42	-67.80
2602.545	-19.44	-66.73	-1.43	-68.17
2602.550	-18.65	-65.94	-1.44	-67.38
2602.555	-18.84	-66.14	-1.45	-67.59
2602.560	-19.05	-66.34	-1.45	-67.80
2602.565	-18.91	-66.20	-1.46	-67.66
2602.570	-18.71	-66.00	-1.48	-67.47
2602.575	-18.90	-66.19	-1.48	-67.67
2602.580	-18.95	-66.24	-1.49	-67.73
2602.585	-19.29	-66.58	-1.49	-68.07
2602.590	-19.00	-66.29	-1.50	-67.80
2602.595	-19.04	-66.33	-1.51	-67.84
2602.600	-19.17	-66.46	-1.52	-67.98
2602.605	-18.76	-66.05	-1.53	-67.57
2602.610	-19.13	-66.42	-1.53	-67.95
2602.615	-19.03	-66.32	-1.55	-67.86
2602.620	-19.20	-66.50	-1.55	-68.05
2602.625	-19.13	-66.43	-1.56	-67.98
2602.630	-19.36	-66.65	-1.57	-68.22
2602.635	-19.39	-66.68	-1.58	-68.26
2602.640	-19.33	-66.62	-1.59	-68.21
2602.645	-19.26	-66.55	-1.60	-68.16
2602.650	-19.48	-66.77	-1.60	-68.38
2602.655	-18.82	-66.11	-1.62	-67.73
2602.660	-19.51	-66.80	-1.63	-68.43
2602.665	-19.17	-66.46	-1.63	-68.09
2602.670	-19.47	-66.76	-1.64	-68.40
2602.675	-19.23	-66.52	-1.66	-68.18
2602.680	-19.40	-66.69	-1.67	-68.36
2602.685	-18.87	-66.16	-1.68	-67.84
2602.690	-19.45	-66.74	-1.69	-68.43
2602.695	-19.05	-66.34	-1.70	-68.04
2602.700	-19.30	-66.59	-1.71	-68.30
2602.705	-19.38	-66.68	-1.72	-68.39
2602.710	-19.63	-66.92	-1.73	-68.65

2602.715	-19.51	-66.80	-1.73	-68.53
2602.720	-19.08	-66.37	-1.74	-68.11
2602.725	-19.47	-66.76	-1.76	-68.52
2602.730	-19.11	-66.40	-1.77	-68.16
2602.735	-19.69	-66.98	-1.78	-68.76
2602.740	-19.51	-66.80	-1.78	-68.58
2602.745	-19.22	-66.51	-1.80	-68.32
2602.750	-19.29	-66.58	-1.81	-68.39
2602.755	-19.58	-66.88	-1.82	-68.70
2602.760	-19.59	-66.88	-1.83	-68.71
2602.765	-19.95	-67.24	-1.84	-69.07
2602.770	-19.55	-66.85	-1.85	-68.69
2602.775	-19.38	-66.67	-1.86	-68.54
2602.780	-19.71	-67.00	-1.87	-68.87
2602.785	-19.32	-66.62	-1.88	-68.50
2602.790	-19.33	-66.62	-1.90	-68.52
2602.795	-19.42	-66.71	-1.90	-68.61
2602.800	-20.02	-67.31	-1.92	-69.22
2602.805	-19.49	-66.78	-1.93	-68.70
2602.810	-19.20	-66.49	-1.94	-68.43
2602.815	-19.18	-66.47	-1.96	-68.43
2602.820	-19.63	-66.92	-1.97	-68.89
2602.825	-18.96	-66.25	-1.98	-68.23
2602.830	-19.31	-66.60	-1.98	-68.59
2602.835	-19.50	-66.79	-2.01	-68.79
2602.840	-19.25	-66.54	-2.02	-68.56
2602.845	-19.21	-66.50	-2.03	-68.53
2602.850	-19.25	-66.55	-2.04	-68.59
2602.855	-19.81	-67.11	-2.05	-69.16
2602.860	-18.96	-66.25	-2.07	-68.32
2602.865	-19.92	-67.21	-2.08	-69.29
2602.870	-19.48	-66.77	-2.10	-68.87
2602.875	-19.38	-66.67	-2.11	-68.77
2602.880	-19.97	-67.26	-2.12	-69.38
2602.885	-19.52	-66.81	-2.14	-68.95
2602.890	-19.52	-66.81	-2.15	-68.96
2602.895	-19.41	-66.71	-2.17	-68.87
2602.900	-19.63	-66.92	-2.18	-69.10
2602.905	-19.60	-66.89	-2.19	-69.07
2602.910	-19.40	-66.69	-2.22	-68.91
2602.915	-19.71	-67.00	-2.23	-69.23
2602.920	-19.65	-66.94	-2.24	-69.18
2602.925	-19.94	-67.23	-2.26	-69.49
2602.930	-19.47	-66.76	-2.28	-69.04
2602.935	-19.69	-66.98	-2.29	-69.27
2602.940	-18.90	-66.19	-2.31	-68.50
2602.945	-19.72	-67.02	-2.32	-69.33
2602.950	-19.78	-67.07	-2.33	-69.40
2602.955	-19.46	-66.76	-2.35	-69.11
2602.960	-19.97	-67.26	-2.38	-69.63
2602.965	-19.31	-66.60	-2.39	-68.99
2602.970	-19.42	-66.71	-2.41	-69.12
2602.975	-19.74	-67.03	-2.42	-69.45
2602.980	-19.74	-67.03	-2.44	-69.47
2602.985	-19.69	-66.98	-2.46	-69.44

2602.990	-19.61	-66.90	-2.47	-69.37
2602.995	-19.55	-66.84	-2.49	-69.33
2603.000	**Upper Adjacent 1 MHz**			

To confirm compliance with the above rule for analog television operations, tests were then run on the separate visual and aural carriers at their rated output levels using the test setup in Figure 4-1. Measurements were taken after the output filter. The results of the measurements were recorded into Table 4-7. The measurements indicated no spurious emissions above -70dB relative to the carrier level.

Table 4-8: Spurious Emissions for Analog Operations

Measurement Center Frequency	Measured Power (Visual only)	Relative Out of Band Emissions	Measured Power (Aural only)	Relative Out of Band Emissions
2595.000	**Lower Adjacent 1 MHz**			
2595.005	-25.288	-78.558	-28.95	-69.2
2595.010	-25.049	-78.319	-29.074	-69.3
2595.015	-24.935	-78.205	-29.035	-69.3
2595.020	-24.943	-78.213	-29.273	-69.5
2595.025	-23.558	-76.828	-29.168	-69.4
2595.030	-24.836	-78.106	-29.09	-69.3
2595.035	-23.969	-77.239	-29.098	-69.3
2595.040	-23.89	-77.160	-28.929	-69.2
2595.045	-24.713	-77.983	-28.869	-69.1
2595.050	-24.606	-77.876	-28.937	-69.2
2595.055	-23.334	-76.604	-28.973	-69.2
2595.060	-24.436	-77.706	-29.09	-69.3
2595.065	-24.112	-77.382	-29.283	-69.5
2595.070	-23.826	-77.096	-28.776	-69.0
2595.075	-23.699	-76.969	-28.908	-69.2
2595.080	-24.026	-77.296	-28.978	-69.2
2595.085	-23.765	-77.035	-29.023	-69.3
2595.090	-24.56	-77.830	-29.055	-69.3
2595.095	-24.259	-77.529	-29.058	-69.3
2595.100	-23.875	-77.145	-29.219	-69.5
2595.105	-23.67	-76.940	-29.169	-69.4
2595.110	-23.833	-77.103	-29.037	-69.3
2595.115	-24.244	-77.514	-29.249	-69.5
2595.120	-24.026	-77.296	-28.919	-69.2
2595.125	-24.279	-77.549	-28.945	-69.2
2595.130	-24.689	-77.959	-28.873	-69.1
2595.135	-25.313	-78.583	-28.988	-69.2
2595.140	-25.302	-78.572	-29.049	-69.3
2595.145	-26.497	-79.767	-29.005	-69.3
2595.150	-26.314	-79.584	-29.184	-69.4
2595.155	-26.625	-79.895	-29.142	-69.4
2595.160	-26.562	-79.832	-29.054	-69.3
2595.165	-26.16	-79.430	-29.115	-69.4
2595.170	-26.705	-79.975	-28.859	-69.1
2595.175	-26.791	-80.061	-29.097	-69.3
2595.180	-26.273	-79.543	-28.978	-69.2
2595.185	-25.786	-79.056	-29.021	-69.3
2595.190	-26.056	-79.326	-29.062	-69.3

2595.195	-26.265	-79.535	-28.867	-69.1
2595.200	-25.264	-78.534	-29.137	-69.4
2595.205	-25.535	-78.805	-28.985	-69.2
2595.210	-25.387	-78.657	-28.855	-69.1
2595.215	-24.086	-77.356	-29.048	-69.3
2595.220	-25.182	-78.452	-29.013	-69.3
2595.225	-24.135	-77.405	-28.905	-69.2
2595.230	-21.95	-75.220	-28.85	-69.1
2595.235	-21.961	-75.231	-28.908	-69.2
2595.240	-22.186	-75.456	-29.073	-69.3
2595.245	-21.86	-75.130	-28.869	-69.1
2595.250	-21.52	-74.790	-28.883	-69.1
2595.255	-22.082	-75.352	-28.795	-69.0
2595.260	-21.735	-75.005	-28.714	-69.0
2595.265	-21.759	-75.029	-28.986	-69.2
2595.270	-21.826	-75.096	-29.186	-69.4
2595.275	-21.709	-74.979	-28.952	-69.2
2595.280	-23.957	-77.227	-29.068	-69.3
2595.285	-24.097	-77.367	-29.069	-69.3
2595.290	-23.552	-76.822	-29.228	-69.5
2595.295	-24.384	-77.654	-28.85	-69.1
2595.300	-24.891	-78.161	-29.173	-69.4
2595.305	-24.798	-78.068	-28.955	-69.2
2595.310	-24.756	-78.026	-29.067	-69.3
2595.315	-24.773	-78.043	-29.191	-69.4
2595.320	-25.024	-78.294	-29.064	-69.3
2595.325	-25.808	-79.078	-28.702	-68.9
2595.330	-25.163	-78.433	-29.363	-69.6
2595.335	-25.431	-78.701	-29.106	-69.4
2595.340	-25.736	-79.006	-28.908	-69.2
2595.345	-26.394	-79.664	-28.96	-69.2
2595.350	-26.392	-79.662	-29.062	-69.3
2595.355	-25.361	-78.631	-29.313	-69.6
2595.360	-26.258	-79.528	-28.918	-69.2
2595.365	-26.492	-79.762	-28.79	-69.0
2595.370	-26.391	-79.661	-28.952	-69.2
2595.375	-26.37	-79.640	-29.071	-69.3
2595.380	-26.941	-80.211	-28.998	-69.2
2595.385	-26.077	-79.347	-28.872	-69.1
2595.390	-26.135	-79.405	-29.217	-69.5
2595.395	-25.646	-78.916	-29.107	-69.4
2595.400	-25.587	-78.857	-29.06	-69.3
2595.405	-24.868	-78.138	-28.9	-69.1
2595.410	-24.887	-78.157	-29.088	-69.3
2595.415	-25.228	-78.498	-28.995	-69.2
2595.420	-24.401	-77.671	-29.011	-69.3
2595.425	-24.946	-78.216	-28.869	-69.1
2595.430	-24.547	-77.817	-28.8	-69.0
2595.435	-23.41	-76.680	-28.828	-69.1
2595.440	-23.746	-77.016	-28.873	-69.1
2595.445	-23.697	-76.967	-28.929	-69.2
2595.450	-23.51	-76.780	-28.819	-69.1
2595.455	-23.407	-76.677	-28.829	-69.1
2595.460	-23.409	-76.679	-28.815	-69.1
2595.465	-22.891	-76.161	-29.143	-69.4

2595.470	-22.825	-76.095	-29.049	-69.3
2595.475	-23.184	-76.454	-29.245	-69.5
2595.480	-22.743	-76.013	-28.977	-69.2
2595.485	-22.975	-76.245	-28.901	-69.1
2595.490	-23.785	-77.055	-29.069	-69.3
2595.495	-23.301	-76.571	-28.892	-69.1
2595.500	-23.327	-76.597	-29.108	-69.4
2595.505	-23.515	-76.785	-28.624	-68.9
2595.510	-24.067	-77.337	-29.094	-69.3
2595.515	-24.168	-77.438	-28.623	-68.9
2595.520	-24.17	-77.440	-29.067	-69.3
2595.525	-24.41	-77.680	-29.115	-69.4
2595.530	-25.43	-78.700	-29.162	-69.4
2595.535	-25.28	-78.550	-29.079	-69.3
2595.540	-25.518	-78.788	-28.871	-69.1
2595.545	-26.131	-79.401	-28.976	-69.2
2595.550	-26.021	-79.291	-29.005	-69.3
2595.555	-26.338	-79.608	-28.668	-68.9
2595.560	-25.927	-79.197	-28.762	-69.0
2595.565	-26.67	-79.940	-29.118	-69.4
2595.570	-26.52	-79.790	-28.42	-68.7
2595.575	-26.729	-79.999	-28.761	-69.0
2595.580	-26.736	-80.006	-29.011	-69.3
2595.585	-27.062	-80.332	-28.866	-69.1
2595.590	-25.817	-79.087	-28.777	-69.0
2595.595	-26.283	-79.553	-29.001	-69.2
2595.600	-26.403	-79.673	-29.032	-69.3
2595.605	-24.977	-78.247	-29.095	-69.3
2595.610	-25.21	-78.480	-29.067	-69.3
2595.615	-25.288	-78.558	-29.252	-69.5
2595.620	-24.632	-77.902	-29.183	-69.4
2595.625	-23.996	-77.266	-28.944	-69.2
2595.630	-23.688	-76.958	-28.821	-69.1
2595.635	-23.39	-76.660	-29.044	-69.3
2595.640	-23.491	-76.761	-28.682	-68.9
2595.645	-23.06	-76.330	-29.075	-69.3
2595.650	-22.921	-76.191	-29.213	-69.5
2595.655	-22.178	-75.448	-29.066	-69.3
2595.660	-22.41	-75.680	-28.705	-69.0
2595.665	-22.429	-75.699	-28.84	-69.1
2595.670	-21.575	-74.845	-28.768	-69.0
2595.675	-21.923	-75.193	-28.801	-69.0
2595.680	-22.303	-75.573	-28.71	-69.0
2595.685	-21.175	-74.445	-28.686	-68.9
2595.690	-22.209	-75.479	-28.817	-69.1
2595.695	-22.097	-75.367	-28.939	-69.2
2595.700	-22.222	-75.492	-28.89	-69.1
2595.705	-22.815	-76.085	-28.873	-69.1
2595.710	-22.724	-75.994	-28.999	-69.2
2595.715	-21.812	-75.082	-28.987	-69.2
2595.720	-23.662	-76.932	-29.066	-69.3
2595.725	-23.174	-76.444	-28.984	-69.2
2595.730	-23.217	-76.487	-28.829	-69.1
2595.735	-24.298	-77.568	-29.052	-69.3
2595.740	-24.774	-78.044	-29.039	-69.3

2595.745	-24.299	-77.569	-29.107	-69.4
2595.750	-25.169	-78.439	-28.794	-69.0
2595.755	-24.861	-78.131	-29.021	-69.3
2595.760	-25.61	-78.880	-29.031	-69.3
2595.765	-25.419	-78.689	-28.808	-69.1
2595.770	-26.019	-79.289	-29.282	-69.5
2595.775	-25.575	-78.845	-28.833	-69.1
2595.780	-25.534	-78.804	-29.172	-69.4
2595.785	-26.523	-79.793	-28.601	-68.8
2595.790	-26.266	-79.536	-29.041	-69.3
2595.795	-25.665	-78.935	-28.783	-69.0
2595.800	-25.407	-78.677	-28.739	-69.0
2595.805	-26.355	-79.625	-28.92	-69.2
2595.810	-23.317	-76.587	-28.884	-69.1
2595.815	-24.16	-77.430	-29.017	-69.3
2595.820	-24.234	-77.504	-28.933	-69.2
2595.825	-24.41	-77.680	-28.934	-69.2
2595.830	-22.686	-75.956	-28.9	-69.1
2595.835	-23.422	-76.692	-29.248	-69.5
2595.840	-22.93	-76.200	-29.324	-69.6
2595.845	-22.596	-75.866	-29.135	-69.4
2595.850	-21.681	-74.951	-29.195	-69.4
2595.855	-22.123	-75.393	-28.73	-69.0
2595.860	-21.57	-74.840	-28.963	-69.2
2595.865	-21.237	-74.507	-28.891	-69.1
2595.870	-21.457	-74.727	-29.09	-69.3
2595.875	-20.347	-73.617	-28.733	-69.0
2595.880	-21.229	-74.499	-28.891	-69.1
2595.885	-20.801	-74.071	-28.92	-69.2
2595.890	-19.627	-72.897	-28.915	-69.2
2595.895	-20.793	-74.063	-28.927	-69.2
2595.900	-20.568	-73.838	-29.175	-69.4
2595.905	-20.086	-73.356	-28.908	-69.2
2595.910	-21.151	-74.421	-29.304	-69.6
2595.915	-21.337	-74.607	-28.984	-69.2
2595.920	-21.318	-74.588	-28.796	-69.0
2595.925	-21.436	-74.706	-28.949	-69.2
2595.930	-21.839	-75.109	-28.891	-69.1
2595.935	-21.651	-74.921	-28.981	-69.2
2595.940	-22.967	-76.237	-28.984	-69.2
2595.945	-22.774	-76.044	-28.955	-69.2
2595.950	-23.072	-76.342	-29.001	-69.2
2595.955	-23.932	-77.202	-29.246	-69.5
2595.960	-24.047	-77.317	-29	-69.2
2595.965	-23.881	-77.151	-29.005	-69.3
2595.970	-25.25	-78.520	-28.96	-69.2
2595.975	-25.149	-78.419	-29.21	-69.5
2595.980	-24.981	-78.251	-29.036	-69.3
2595.985	-25.424	-78.694	-29.027	-69.3
2595.990	-25.459	-78.729	-29.035	-69.3
2595.995	-25.261	-78.531	-28.929	-69.2
2596.000 (Lower Band Edge)	-23.693	-76.963	-28.942	-69.2
2599.000 (Channel Center)	**53.27**	**0.00 (Ref Level)**	**40.247**	**0.0**
2602.000 (Upper Band Edge)	-27.325	-80.595	-28.533	-68.8
2602.005	-27.25	-80.520	-28.667	-68.9

2602.010	-27.483	-80.753	-28.852	-69.1
2602.015	-27.333	-80.603	-29.008	-69.3
2602.020	-27.35	-80.620	-29.007	-69.3
2602.025	-27.5	-80.770	-28.756	-69.0
2602.030	-27.603	-80.873	-28.93	-69.2
2602.035	-27.465	-80.735	-28.754	-69.0
2602.040	-27.171	-80.441	-28.65	-68.9
2602.045	-27.265	-80.535	-28.93	-69.2
2602.050	-27.417	-80.687	-28.76	-69.0
2602.055	-27.467	-80.737	-28.978	-69.2
2602.060	-27.685	-80.955	-28.809	-69.1
2602.065	-27.587	-80.857	-29.086	-69.3
2602.070	-27.384	-80.654	-28.681	-68.9
2602.075	-27.42	-80.690	-28.911	-69.2
2602.080	-27.161	-80.431	-28.793	-69.0
2602.085	-27.42	-80.690	-28.948	-69.2
2602.090	-27.584	-80.854	-28.885	-69.1
2602.095	-27.393	-80.663	-28.709	-69.0
2602.100	-27.461	-80.731	-29.045	-69.3
2602.105	-27.357	-80.627	-28.995	-69.2
2602.110	-27.286	-80.556	-28.879	-69.1
2602.115	-27.549	-80.819	-28.82	-69.1
2602.120	-27.3	-80.570	-28.669	-68.9
2602.125	-27.171	-80.441	-29.061	-69.3
2602.130	-27.175	-80.445	-29.097	-69.3
2602.135	-27.432	-80.702	-28.979	-69.2
2602.140	-27.246	-80.516	-28.799	-69.0
2602.145	-27.259	-80.529	-28.788	-69.0
2602.150	-27.506	-80.776	-28.898	-69.1
2602.155	-27.584	-80.854	-28.937	-69.2
2602.160	-27.339	-80.609	-28.695	-68.9
2602.165	-27.274	-80.544	-28.826	-69.1
2602.170	-27.038	-80.308	-28.879	-69.1
2602.175	-27.325	-80.595	-28.839	-69.1
2602.180	-27.502	-80.772	-28.903	-69.2
2602.185	-27.325	-80.595	-28.918	-69.2
2602.190	-27.502	-80.772	-28.837	-69.1
2602.195	-27.457	-80.727	-28.725	-69.0
2602.200	-27.256	-80.526	-29.09	-69.3
2602.205	-27.201	-80.471	-28.998	-69.2
2602.210	-27.446	-80.716	-28.948	-69.2
2602.215	-27.249	-80.519	-29.069	-69.3
2602.220	-27.257	-80.527	-28.865	-69.1
2602.225	-27.53	-80.800	-29.08	-69.3
2602.230	-27.764	-81.034	-29.085	-69.3
2602.235	-27.529	-80.799	-28.891	-69.1
2602.240	-27.816	-81.086	-28.84	-69.1
2602.245	-27.125	-80.395	-28.761	-69.0
2602.250	-27.582	-80.852	-28.763	-69.0
2602.255	-27.145	-80.415	-28.85	-69.1
2602.260	-27.133	-80.403	-29.06	-69.3
2602.265	-27.354	-80.624	-28.962	-69.2
2602.270	-27.624	-80.894	-28.898	-69.1
2602.275	-27.145	-80.415	-29.051	-69.3
2602.280	-27.532	-80.802	-28.827	-69.1

2602.285	-27.556	-80.826	-28.9	-69.1
2602.290	-27.403	-80.673	-29.09	-69.3
2602.295	-27.578	-80.848	-28.875	-69.1
2602.300	-27.368	-80.638	-29.093	-69.3
2602.305	-27.289	-80.559	-28.427	-68.7
2602.310	-27.355	-80.625	-28.895	-69.1
2602.315	-27.595	-80.865	-28.953	-69.2
2602.320	-27.265	-80.535	-28.708	-69.0
2602.325	-27.124	-80.394	-28.917	-69.2
2602.330	-27.461	-80.731	-28.976	-69.2
2602.335	-27.542	-80.812	-28.952	-69.2
2602.340	-27.41	-80.680	-28.694	-68.9
2602.345	-27.358	-80.628	-28.396	-68.6
2602.350	-27.424	-80.694	-28.303	-68.6
2602.355	-27.343	-80.613	-28.488	-68.7
2602.360	-27.542	-80.812	-28.548	-68.8
2602.365	-27.623	-80.893	-28.627	-68.9
2602.370	-27.215	-80.485	-28.788	-69.0
2602.375	-27.545	-80.815	-28.537	-68.8
2602.380	-27.415	-80.685	-28.635	-68.9
2602.385	-27.113	-80.383	-28.798	-69.0
2602.390	-27.197	-80.467	-29.089	-69.3
2602.395	-27.733	-81.003	-28.893	-69.1
2602.400	-27.535	-80.805	-28.922	-69.2
2602.405	-27.54	-80.810	-29.127	-69.4
2602.410	-27.296	-80.566	-28.936	-69.2
2602.415	-27.274	-80.544	-28.922	-69.2
2602.420	-27.52	-80.790	-28.873	-69.1
2602.425	-27.323	-80.593	-28.663	-68.9
2602.430	-27.886	-81.156	-28.962	-69.2
2602.435	-27.751	-81.021	-28.874	-69.1
2602.440	-27.782	-81.052	-28.663	-68.9
2602.445	-27.154	-80.424	-29.087	-69.3
2602.450	-27.655	-80.925	-28.99	-69.2
2602.455	-27.633	-80.903	-29.082	-69.3
2602.460	-27.624	-80.894	-28.767	-69.0
2602.465	-27.4	-80.670	-28.916	-69.2
2602.470	-27.249	-80.519	-28.975	-69.2
2602.475	-27.534	-80.804	-28.847	-69.1
2602.480	-27.728	-80.998	-28.858	-69.1
2602.485	-27.425	-80.695	-28.76	-69.0
2602.490	-27.351	-80.621	-29.076	-69.3
2602.495	-27.744	-81.014	-28.879	-69.1
2602.500	-27.603	-80.873	-29.078	-69.3
2602.505	-27.584	-80.854	-28.926	-69.2
2602.510	-27.583	-80.853	-28.914	-69.2
2602.515	-27.433	-80.703	-28.941	-69.2
2602.520	-27.538	-80.808	-29.038	-69.3
2602.525	-27.452	-80.722	-28.869	-69.1
2602.530	-27.621	-80.891	-29.16	-69.4
2602.535	-27.537	-80.807	-29.198	-69.4
2602.540	-27.615	-80.885	-28.947	-69.2
2602.545	-27.487	-80.757	-28.854	-69.1
2602.550	-27.286	-80.556	-28.905	-69.2
2602.555	-27.332	-80.602	-28.966	-69.2

2602.560	-27.035	-80.305	-29.053	-69.3
2602.565	-27.235	-80.505	-29.13	-69.4
2602.570	-27.218	-80.488	-28.711	-69.0
2602.575	-27.439	-80.709	-29.083	-69.3
2602.580	-27.365	-80.635	-28.857	-69.1
2602.585	-27.378	-80.648	-28.816	-69.1
2602.590	-27.263	-80.533	-28.867	-69.1
2602.595	-27.343	-80.613	-28.816	-69.1
2602.600	-26.926	-80.196	-29.036	-69.3
2602.605	-27.442	-80.712	-29.037	-69.3
2602.610	-27.714	-80.984	-29.052	-69.3
2602.615	-27.504	-80.774	-29.119	-69.4
2602.620	-27.482	-80.752	-28.862	-69.1
2602.625	-27.733	-81.003	-28.984	-69.2
2602.630	-27.258	-80.528	-28.797	-69.0
2602.635	-27.251	-80.521	-28.995	-69.2
2602.640	-27.716	-80.986	-29.066	-69.3
2602.645	-27.287	-80.557	-28.756	-69.0
2602.650	-27.656	-80.926	-29.047	-69.3
2602.655	-27.352	-80.622	-28.848	-69.1
2602.660	-27.325	-80.595	-28.589	-68.8
2602.665	-27.634	-80.904	-28.76	-69.0
2602.670	-27.693	-80.963	-28.801	-69.0
2602.675	-27.552	-80.822	-28.839	-69.1
2602.680	-27.688	-80.958	-29.151	-69.4
2602.685	-27.338	-80.608	-28.919	-69.2
2602.690	-27.624	-80.894	-29.045	-69.3
2602.695	-27.465	-80.735	-28.75	-69.0
2602.700	-27.452	-80.722	-28.707	-69.0
2602.705	-27.457	-80.727	-28.907	-69.2
2602.710	-27.366	-80.636	-28.74	-69.0
2602.715	-27.492	-80.762	-28.971	-69.2
2602.720	-27.311	-80.581	-29.124	-69.4
2602.725	-27.817	-81.087	-24.5	-64.7
2602.730	-27.595	-80.865	-20.697	-60.9
2602.735	-27.428	-80.698	-20.742	-61.0
2602.740	-27.577	-80.847	-20.61	-60.9
2602.745	-27.714	-80.984	-20.685	-60.9
2602.750	-27.119	-80.389	-20.59	-60.8
2602.755	-27.179	-80.449	-20.642	-60.9
2602.760	-27.156	-80.426	-20.693	-60.9
2602.765	-27.124	-80.394	-20.531	-60.8
2602.770	-27.205	-80.475	-20.797	-61.0
2602.775	-27.422	-80.692	-21.699	-61.9
2602.780	-27.358	-80.628	-28.846	-69.1
2602.785	-27.024	-80.294	-28.762	-69.0
2602.790	-27.543	-80.813	-28.796	-69.0
2602.795	-27.107	-80.377	-28.936	-69.2
2602.800	-27.443	-80.713	-29.348	-69.6
2602.805	-27.21	-80.480	-28.764	-69.0
2602.810	-27.475	-80.745	-28.797	-69.0
2602.815	-27.259	-80.529	-28.942	-69.2
2602.820	-27.167	-80.437	-28.854	-69.1
2602.825	-27.251	-80.521	-29.047	-69.3
2602.830	-27.268	-80.538	-28.746	-69.0

2602.835	-27.632	-80.902	-28.836	-69.1
2602.840	-27.108	-80.378	-29.05	-69.3
2602.845	-27.297	-80.567	-28.546	-68.8
2602.850	-26.884	-80.154	-28.801	-69.0
2602.855	-27.676	-80.946	-28.967	-69.2
2602.860	-27.436	-80.706	-29.025	-69.3
2602.865	-27.448	-80.718	-28.991	-69.2
2602.870	-27.452	-80.722	-28.904	-69.2
2602.875	-27.225	-80.495	-28.902	-69.1
2602.880	-27.551	-80.821	-28.869	-69.1
2602.885	-27.463	-80.733	-28.518	-68.8
2602.890	-26.983	-80.253	-29.182	-69.4
2602.895	-27.126	-80.396	-29.013	-69.3
2602.900	-27.443	-80.713	-28.775	-69.0
2602.905	-27.268	-80.538	-28.994	-69.2
2602.910	-27.517	-80.787	-29.185	-69.4
2602.915	-27.471	-80.741	-28.911	-69.2
2602.920	-26.994	-80.264	-28.771	-69.0
2602.925	-27.646	-80.916	-29.018	-69.3
2602.930	-27.493	-80.763	-28.821	-69.1
2602.935	-27.322	-80.592	-28.932	-69.2
2602.940	-27.22	-80.490	-28.868	-69.1
2602.945	-27.582	-80.852	-28.728	-69.0
2602.950	-27.563	-80.833	-28.879	-69.1
2602.955	-27.491	-80.761	-29.012	-69.3
2602.960	-27.327	-80.597	-29.079	-69.3
2602.965	-27.141	-80.411	-28.929	-69.2
2602.970	-27.479	-80.749	-28.877	-69.1
2602.975	-27.452	-80.722	-29.026	-69.3
2602.980	-27.326	-80.596	-28.8	-69.0
2602.985	-27.522	-80.792	-29.136	-69.4
2602.990	-27.306	-80.576	-28.911	-69.2
2602.995	-27.369	-80.639	-29.045	-69.3
2603.000	**Upper Adjacent 1 MHz**			

Part 27.53 of the Rules also states:

27.53 (l)(1) Prior to the transition, and thereafter, solely within the MBS, for analog operations with an EIRP in excess of -9 dBW, the signal shall be attenuated at the channel edges by at least 38 dB relative to the peak visual carrier, then linearly sloping from that level to at least 60 dB of attenuation at 1 MHz below the lower band edge and 0.5 MHz above the upper band edge, and attenuated at least 60 dB at all other frequencies.

For the analog television test, the test setup depicted in 4-1 was utilized. The transmitter was modulated with color bars at 87.5% and at a peak sync visual output of 200 watts (53dBm). The results of the test are displayed on the spectrum analyzer plot labeled Figure 4-13. The measurements were taken before the channel filter. The markers are set to show emissions relative to the peak visual carrier at the band edges and 1 MHz above and below the band edge. In no case are the out of band emissions attenuated less than 60dB.

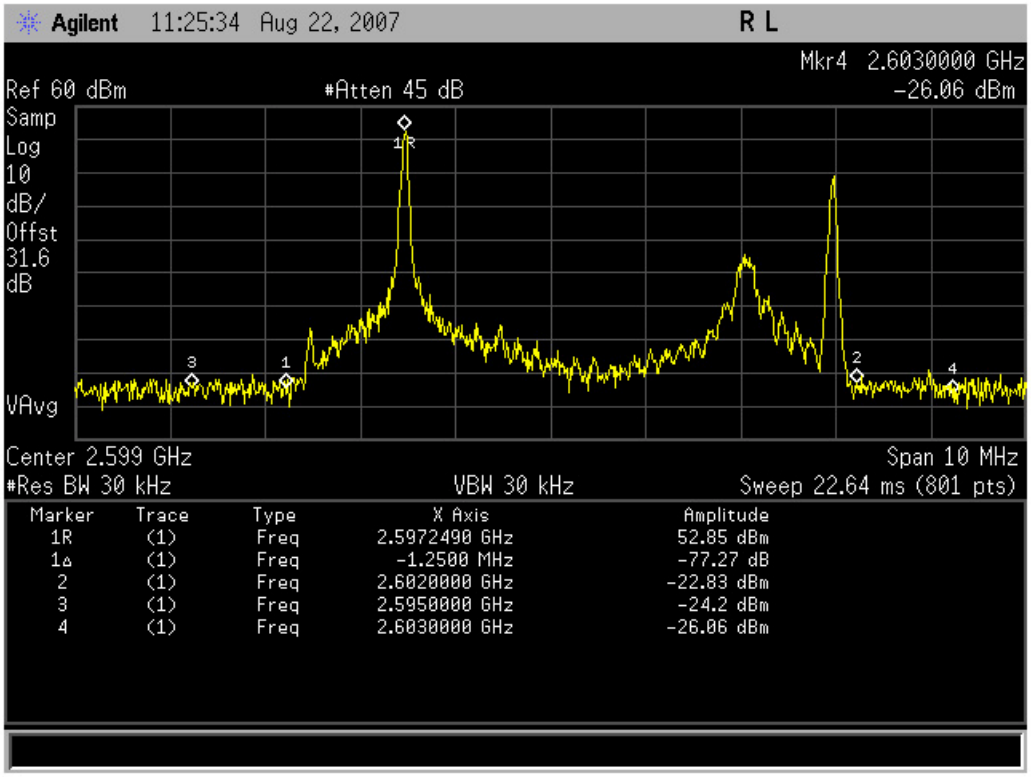

Figure 4-13: Out of Band Attenuation for Analog Operations

4.5 FREQUENCY STABILITY

The HSD transmitter series utilizes a dual conversion architecture to generate the output channel frequency from the 44 MHz IF input. The first conversion mixes the 44 MHz signal with the first Local Oscillator (LO1) and creates a second IF (IF2) centered at 374 MHz. The IF2 signal is the mixed with a second local oscillator (LO2) to produce the output channel. The local oscillators are locked to a 10 MHz ovenized crystal oscillator (F_{ref}) which provides the required frequency stability.

The first local oscillator frequency is 418 MHz and is generated in the following way. The 10 MHz oscillator is divided by 5 and is used as the reference for a phase locked loop. The divide ratio of the loop is 836, so when locked, the VCO is at 1672 MHz which is divided by 4 and fed to the mixer in the first converter.

The equation for the output frequency is LO1=((Fref/5)*836)/4 = Fref*41.8.

Therefore, LO1= 41.8*F_{ref}

The second local oscillator is variable and generates frequencies between 2129 and 2309 MHz in the following way. The 10 MHz oscillator is divided by 10 and used as the reference in a phase locked loop circuit. The VCO output is divided by N with N variable between 2129 and 2309 and this is fed to the phase detector. The frequency of the VCO will be N MHz. The equation for the frequency is LO2= (Fref/10)*N = Fref*(N/10).

The transmitter output frequency (Fout) is determined by the following equations:

IF2= LO1-IF
Fout= LO2+IF2
Fout= LO2+LO1-IF
Fout= Fref*(N/10)+41.8*Fref-IF
Fout=F_{ref}*((N/10)+41.8)-IF
Fout=F_{ref}*((N+418)/10)-IF N=2127 to 2309

Fref= 10MHZ +/- dF, where dF is frequency Variance of 10 MHz oscillator.
So for the frequency stability term of the output is dFout= +/- dF*((418+N)/10.

The frequency stability of the 10 MHz oscillator over temperature is +/- 2e-7 so for the 10 MHz oscillator dF= 2 Hz. The worst case frequency is when N=2309 so worst case stability is:

dFout= +/- 2*((418+2309)/10)=+/- 545.4 Hz.

Alternatively, the 10MHz reference oscillator may be locked to an external precision 10 MHz reference source such as a GPS or LORAN receiver to provide an even higher stability.

4.6 FIELD STRENGTH OF SPURIOUS EMISSIONS

Visual Carrier or QAM Output Power: 200 Watts Peak or 50 Watts Average Power

Modulation: NTSC Composite Television Signals or QAM Modulated Carriers

Spectrum Analyzer Settings:

Frequency Span:	1 MHz/Division
Center Frequency:	Adjusted Continuously from 10 MHz to 26 GHz
Resolution Bandwidth:	100 KHz
Video Bandwidth:	100 KHz
Analyzer Noise Floor	<-89dBm

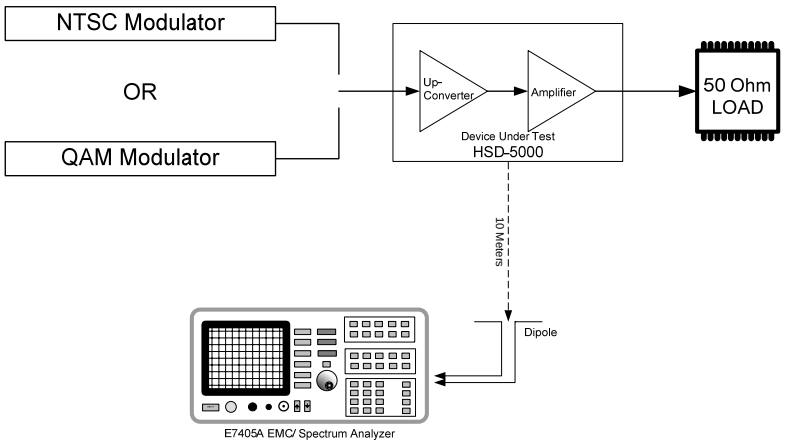

Figure 4-14: Test Setup for Measuring Radiated Emissions

Method of Measurement:

Using the test setup in Figure 4-14, the transmitter was driven to full power (53dBm) with analog visual and aural modulation. The test was repeated using QAM modulation at an average power of 47dBm on the channel, and no difference was noted. A center frequency of 2599 MHz was used as a reference. The spectrum analyzer was moved 10 meters from the unit under test. A dipole antenna was cut to the 10 MHz reference oscillator frequency and oriented to maximize the received level and the data was recorded into Table 4-8. Then the dipole was cut to the 44 MHz IF frequency, then the 1st and 2nd LO frequencies, where each time the antenna was oriented to achieve the maximum signal and the data then recorded. Then the antenna was cut to the 2599 MHz output reference frequency and then the 2nd through 10th harmonic frequencies where each time the antenna was connected to the spectrum analyzer and oriented to achieve a maximum receive level and the data recorded.

Table 4-8: Radiated Emissions Data

FREQUENCY (MHz)	SOURCE	PEAK LEVEL (dB)
10	10 MHz Reference	None Observed
44	IF Frequency	None Observed
374	1st LO	None Observed
2225	2nd LO	None Observed
2599	Reference Channel	None Observed
5198	2nd Harmonic	None Observed
7797	3rd Harmonic	None Observed
10396	4th Harmonic	None Observed
12995	5th Harmonic	None Observed
15594	6th Harmonic	None Observed
18193	7th Harmonic	None Observed
20792	8th Harmonic	None Observed
23391	9th Harmonic	None Observed
25990	10th Harmonic	None Observed

Spurious Radiation:

The system is comprised of fully enclosed modules, encapsulated in a doubly enclosed casing. Due to the design techniques employed for the very high gain of the system and the mitigation of signal leakage, no radiated signals were detected to the threshold of the Spectrum Analyzer of -89dB.

5.0 SUMMARY

This report demonstrates that the HSD-5000 transmitter system meets or exceeds the FCC Type Acceptance Criteria for devices utilized under FCC Rule Parts 21, 74, and 27. Peak and average power outputs were verified with direct power measurements at microwave. Measurements of spurious emissions at the RF output indicated no emissions above that specified in the applicable rules. Field strength measurements of spurious emissions revealed no detectable emissions down to the measurement equipment threshold of <-89 dBm.