Thomson Broadcast & Multimedia, Inc.
104 Feeding Hills Road
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FCC Type Certification Report

06/15/07

TEST REPORT

EVALUATION OF THE

AFF2-SERIES, DIGITAL TRANSMITTER SYSTEMS

AFF2k050ADDBUA4AA
AFF2k100ADDBUA4AA
AFF2k200ADDBUA4AA
AFF2k400ADDBUA4AA
AFF2k800ADDBUA4AA

PERFORMED BY:

THOMSON BROADCAST & MULTIMEDIA, INC.
104 Feeding Hills Road
Southwick, MA 01077-9350

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Document #: 35-0009

TABLE OF CONTENTS

TABLE OF FIGURES

TABLE OF TABLES

1.0 INTRODUCTION

FCC Section 2.901 (a) (b), 2.902 (a) (b), 2.907 (a) (b), 2.908, 2.911, 2.913 (c), 2.924

This report contains all the required data for certification of Thomson Affinity® AFF2 k050-800ADDBUA4AA series dual drive digital transmitter system for use in "Flexible Use Fixed and Mobile Service" applications. In accordance with section 2.924 "Marketing of electrically identical equipment having multiple trade names and models or type numbers under the same FCC Identifier" Thomson wishes to certify its AFF2 k050-800ADDBUA4AA series transmitter family comprised of several models of identical construction. The models vary in number of identical parallel amplifiers dependent on the RF output power of the particular model, also in redundancy schemes for power supplies. The equipment's operating power range is scalable between 50-800W average RMS power. The two possible spectral shaping filters are designed for compliance of an 800W transmitter and are the same for all models. The data presented was taken from tests performed on a production transmitter system model AFF2 k800ADDBUA4AA having an 800W nominal rated output power, tuned to operate on a fixed 716-722MHz (6MHz BW) channel and using either mask filters. All products perform identical to the DUT herein, within section 2.908 limits. Other information required for certification, such as circuit diagrams and descriptions, photographs, tune-up and maintenance procedures, and the technical manual are separately enclosed.

2.0 TEST EQUIPMENT

FCC Section 2.947 (d)

The following is a list of major test equipment, which was used in testing the transmitter for this report:

1.	Spectrum Analyzer(s)	HP Models 8593E & E4440B
2.	Biconical Antenna	Com Power
3.	Log Periodic Antenna	Com Power
4.	Horn Antenna	Com Power
5.	LISN	Com Power LI-150
6.	Power Meter	HP Model 436A
7.	Frequency Counter	HP Model 5350B
8.	Digital Multi-meter	Fluke Model 87
9.	Network Analyzer	HP Model 8753ET

3.0 MEASUREMENTS

FCC Section 2.947(b) (c), 2.1033 (c)(14)

3.1 RF POWER OUTPUT

FCC Section 2.1046 (a) (c)

Output Power: 800 watts average

Method of Measurement: Per FCC 2.1046 (a) (c)

The transmitter was operated into a dummy load of substantially zero reactance with a resistance equal to the transmission line characteristic impedance. Average power was indirectly measured using an HP 436A microwave power meter by means of a directional coupler which coupling factor was previously determined. The transmitter's % power meter was found to be within 2% of the indications provided by the external average power meter with output variations of 80% to 110% of the transmitter's rated output. Results of measurements are displayed at Table 3.1-1.

Figure 3.1-1 shows the test setup

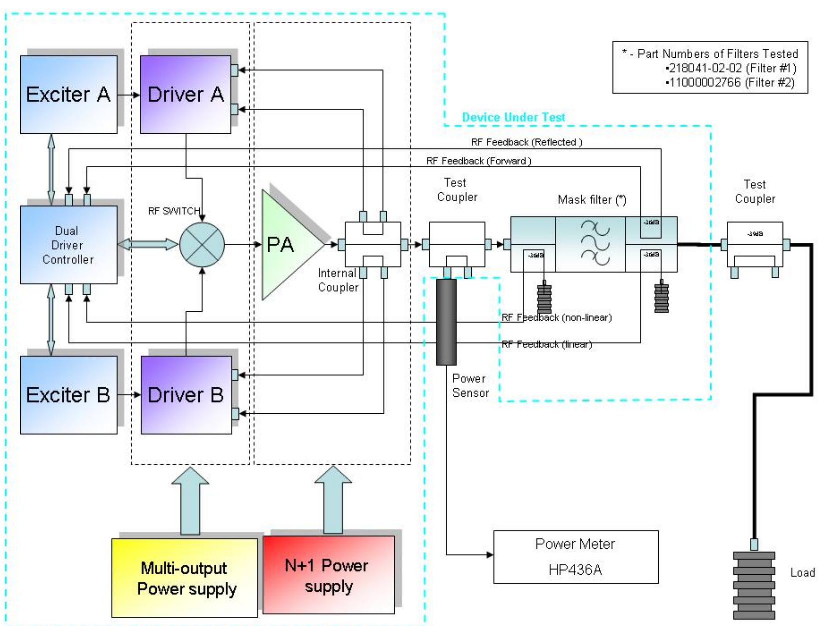

Figure 3.1-1: Test setup for RF power output measurement.

Output Power Calibration: See document 36-0041, tune-up information; section 1.2.3 and 1.2.4 forward power calibration

Table 3.1-1 Output Power and Metering Correlation

Table 3.1 -1 – Output Power Correlation					
		Transmitter Using Exciter/Driver A		Transmitter Using Exciter/Driver B	
Power (%)	Power (W)	Power Meter Reading (W)	Display A Reading (%)	Power Meter Reading (W)	Display B Reading (%)
80	640	640	80	640	80
81	648	648	82	648	81
82	656	656	82	656	82
83	664	664	83	665	83
84	672	672	85	673	84
85	680	680	85	682	85
86	688	688	86	689	86
87	696	696	88	697	87
88	704	703	88	704	88
89	712	712	89	713	89
90	720	720	90	721	90
91	728	728	91	730	91
92	736	736	92	738	92
93	744	744	93	745	93
94	752	752	94	752	94
95	760	760	95	762	95
96	768	768	96	770	96
97	776	776	97	778	97
98	784	783	97	784	97
99	792	793	98	792	99
100	800	803	100	803	100
101	808	808	101	809	100
102	816	817	102	817	101
103	824	825	103	825	102
104	832	832	103	833	103
105	840	841	104	841	104
106	848	848	105	849	105
107	856	857	106	856	106
108	864	864	107	865	106
109	872	872	108	874	107
110	880	880	109	883	109

3.2 MODULATION CHARACTERISTICS

FCC Section 2.1047 (d), subpart-C Emissions 2.201 (a) (b) (c)(6) (d)(8) (e)(8)

See Appendix document #25-0024 Media FLO Digital Modulation Characteristics

3.3 OCCUPIED BANDWIDTH / EMISSIONS

FCC Section 2.1049 (h), 2.202 (a), 2.1047, 27.53 (a)(4) (j)

Occupied bandwidth:

The transmitter is operated at nominal output power, while connected to the spectrum analyzer as shown in Figure 3.3-1 below.

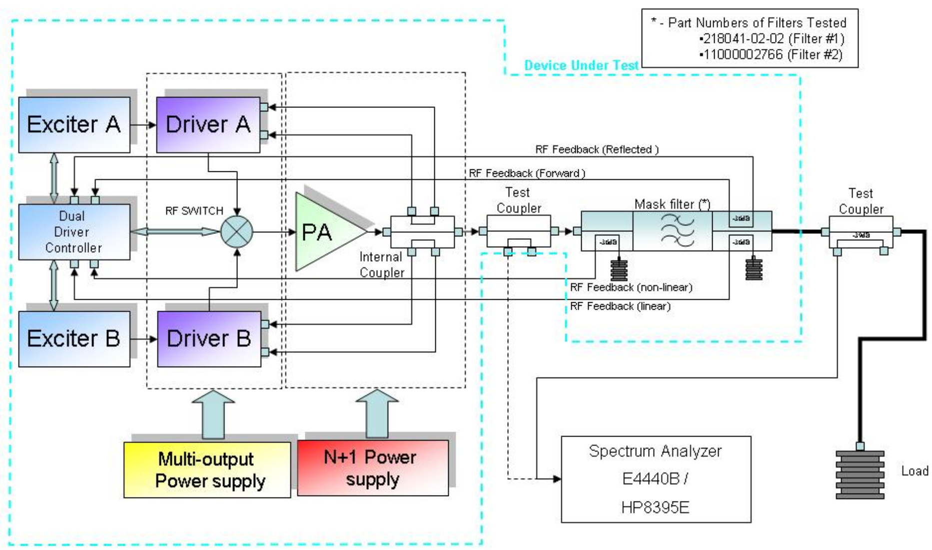

Figure 3.3-1 Spectrum Analyzer Test setup for occupied bandwidth and out-of-band emissions.

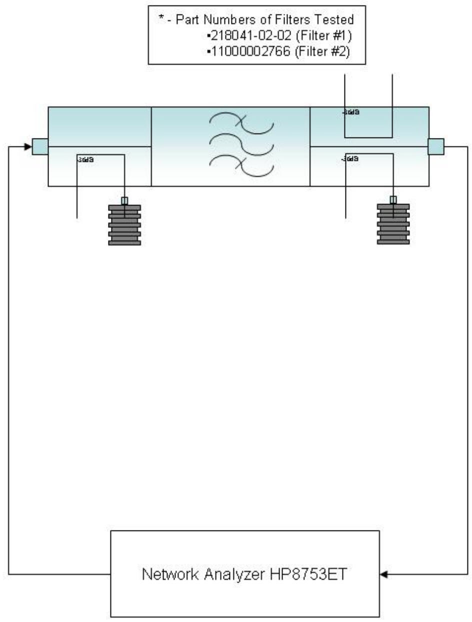

Figure 3.3-2 Network Analyzer Test setup for occupied bandwidth and out-of-band emissions.

Average Output Power:	800 watts
Type Modulation:	Media FLO (COFDM) QPSK/16QAM
Spectrum Analyzer setting:	The spectrum analyzer setting used in conducting the occupied bandwidth at the equipment output terminals was as follows:
Frequency Span:	0.6 MHz per Division
Amplitude Scale:	10dB per Division
Center Frequency:	719MHz
Resolution Bandwidth:	30 KHz
Video Bandwidth:	100kHz
Video Filter:	Out
Average:	10

Occupied bandwidth is dictated by the components responsible for signal modulation. In the AFF2 k050-800 series transmitters these components are the Exciters A and B. The in-band occupied bandwidth is recorded in the following spectral plots, which shows a 5.34MHz BW effective for the Media FLO channel, while using either Exciter/Driver A or B. Figure 3.3-3 shows Exciter and Driver A case while Figure 3.3-4 shows B case.

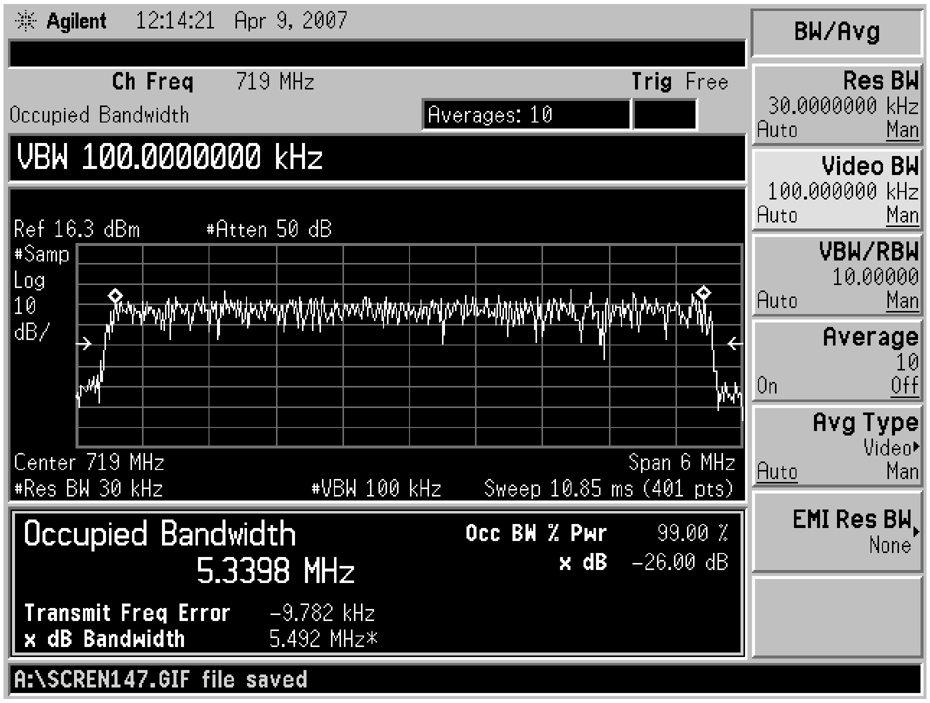

Figure 3.3-3: Channel occupied bandwidth of the FLO transmitter, using Exciter/Driver A.

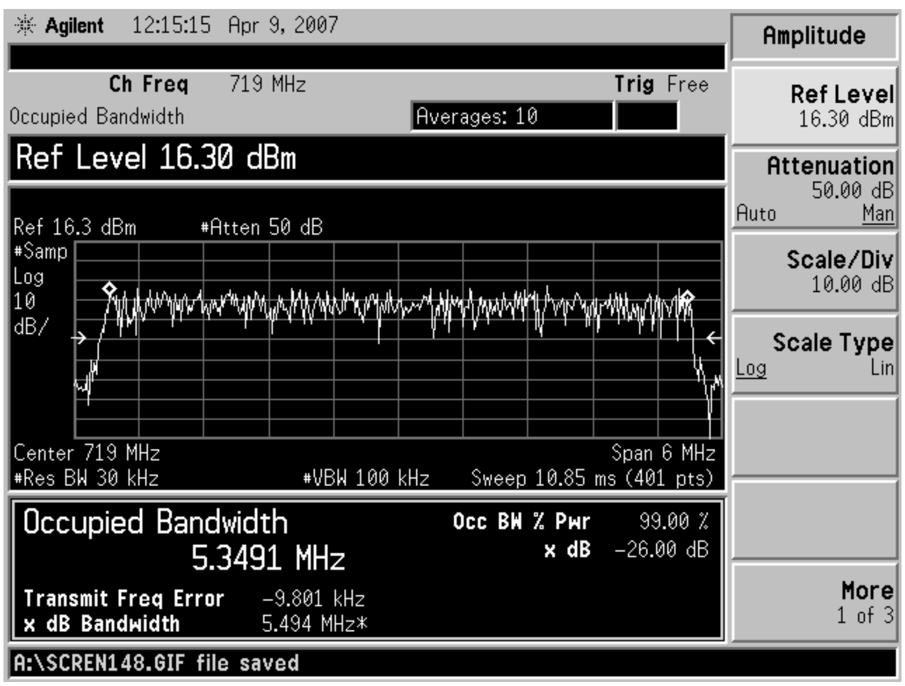

Figure 3.3-4: Channel occupied bandwidth of the FLO transmitter, using Exciter/Driver B.

Emissions:
The following measurement demonstrates the occupied bandwidth as related to the emissions of the FLO signal at the output of the spectral mask filters at the maximum rated average power. Emissions compliance is based on the use of measurement instrumentation employing a resolution bandwidth of at least 30 kHz, for the frequency interval of 100 kHz immediately outside the authorized channel. For frequencies 100 kHz away from the authorized channel edge and beyond a resolution bandwidth of at least 100 kHz is used. Emissions power levels must be lower than the authorized channel average power (P) by at least 43+ 10 log (P) dB in accordance to section 27.53.f of the FCC rules. Emissions are measured for transmitter having either exciter/driver as the operating devices.
An 800W Transmitter must have those emissions attenuated by 72.03 dB per calculations of the above formula. Emissions evaluation is divided in three steps, because of limitations of measurement instrumentation:

a. Between channel edges and frequencies up to 100 kHz away.

b. Between previous outer limits and 13MHz away from channel edges.

c. Between previous outer limits and maximum instrument span under designated resolution bandwidth.

Transmitter operating with Filter #1 (Part Number 218041-02-02):

a. Between channel edges and frequencies up to 100 kHz away:
   This is a straight forward measurement from the Spectrum Analyzer E4440B as shown by Figure 3.3-5 and Figure 3.3-6. While the first Figure shows the Channel Power measurement, the second uses the value obtained in the first figure as a top of scale reference. Figure 3.3-6 also shows power level of first 100 kHz stretches outside the channel. Observe the position of markers and their levels in regard to the reference. Power-levels are lower the 72.03 dB below channel power. Note the 30 kHz resolution bandwidth setting of the instrument.

Emissions limit ≤ 7.51dBm (Power Reference) – 72.03 dB = -64.52 dBm

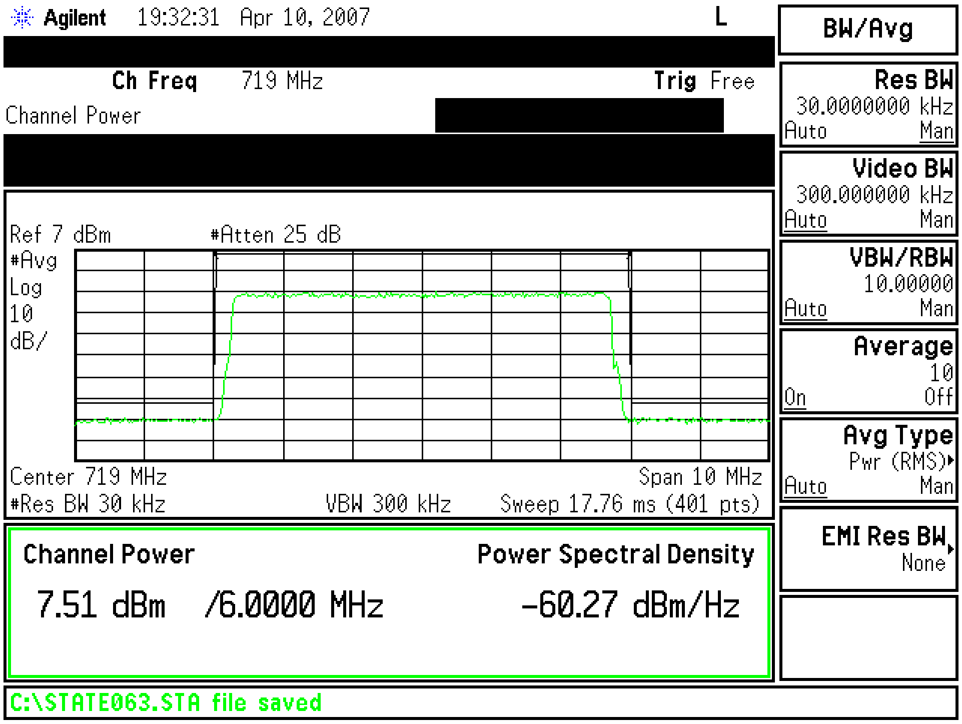

Figure 3.3-5: Channel Power of TX, using filter #1

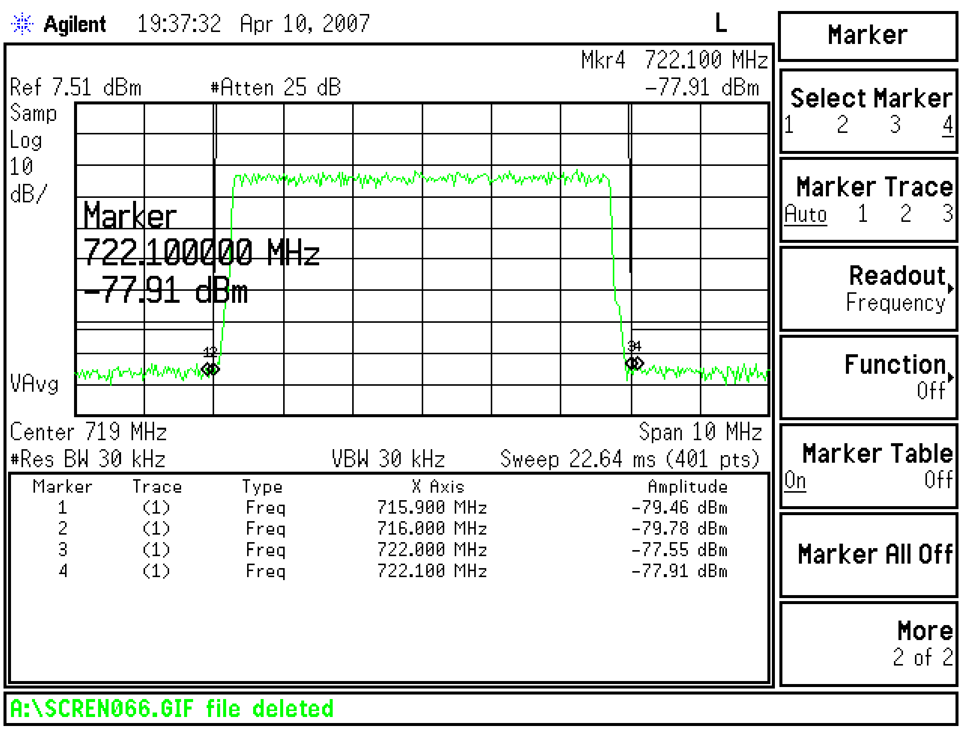

Figure 3.3-6: Emissions up to 100 kHz away from channel edges

b. Between 100 kHz and 13 MHz away from channel edges

This is an indirect measurement, once the required 100 kHz resolution bandwidth allows “a power spill” into the frequency stretch under test. To accomplish the evaluation, FLO signal data is obtained from a point before the band-pass filter at the required resolution setting, and to it, the attenuation of the filter is applied. This method requires that data extracted from the Spectrum Analyzer and from the Network Analyzer be imported and further processed in spreadsheets.

Figure 3.3-7 captured the channel power value that is used to as a reference to measurement. Figure 3.3-8, Figure 3.3-9, and Figure 3.3-10 show data obtained from instruments while Figure 3.3-11 and Figure 3.3-12 their spreadsheet equivalent, respectively.

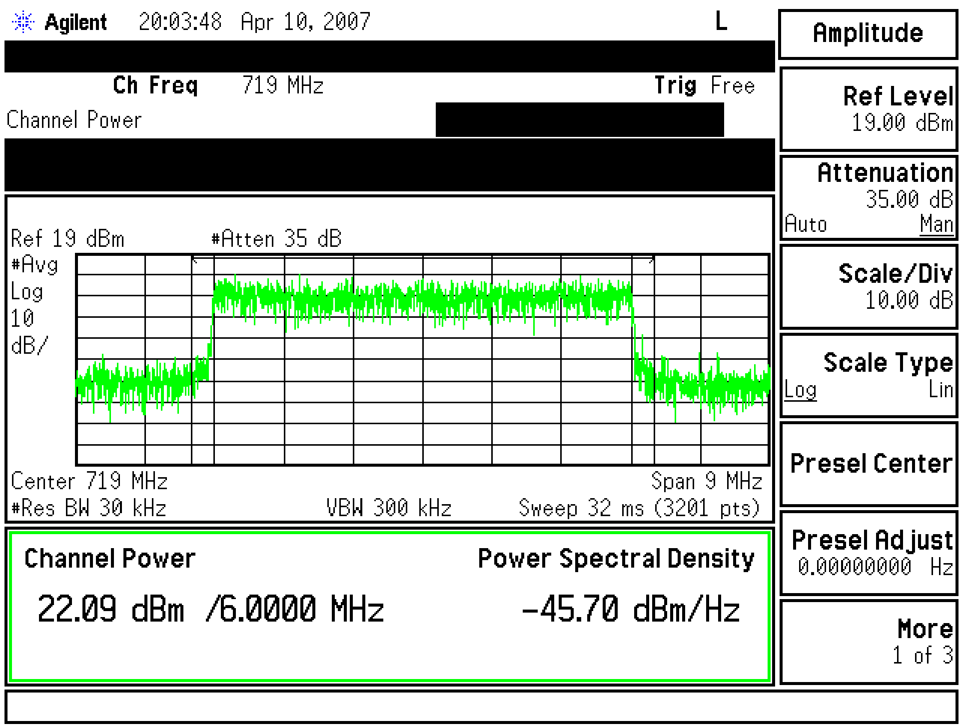

Figure 3.3-7: Channel Power to be used as reference

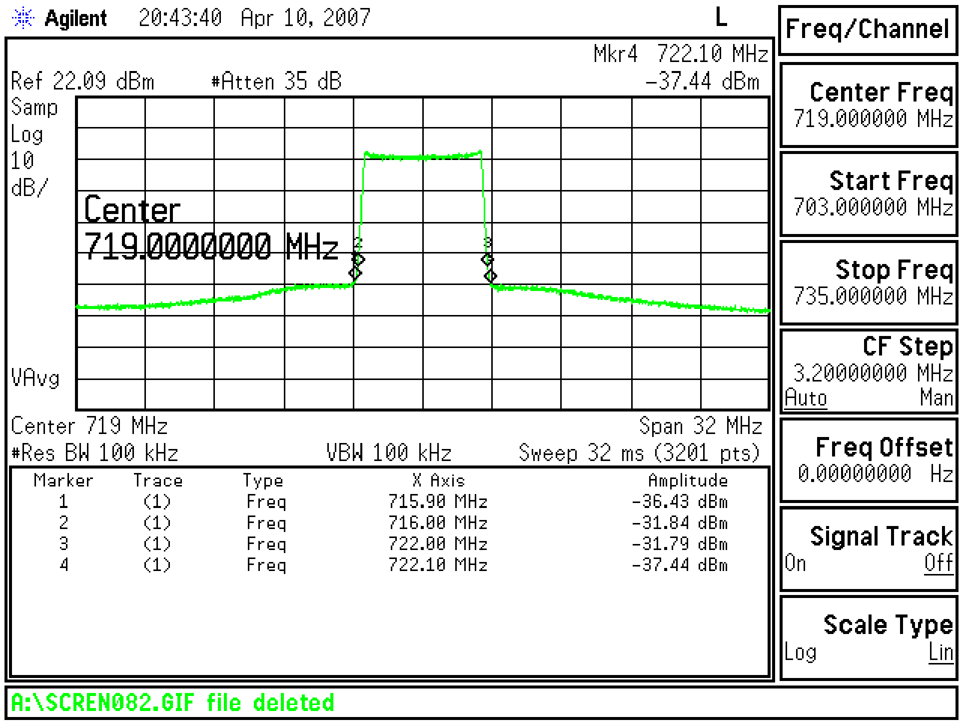

Figure 3.3-8: Emission levels at 100 kHz resolution bandwidth from Spectrum Analyzer

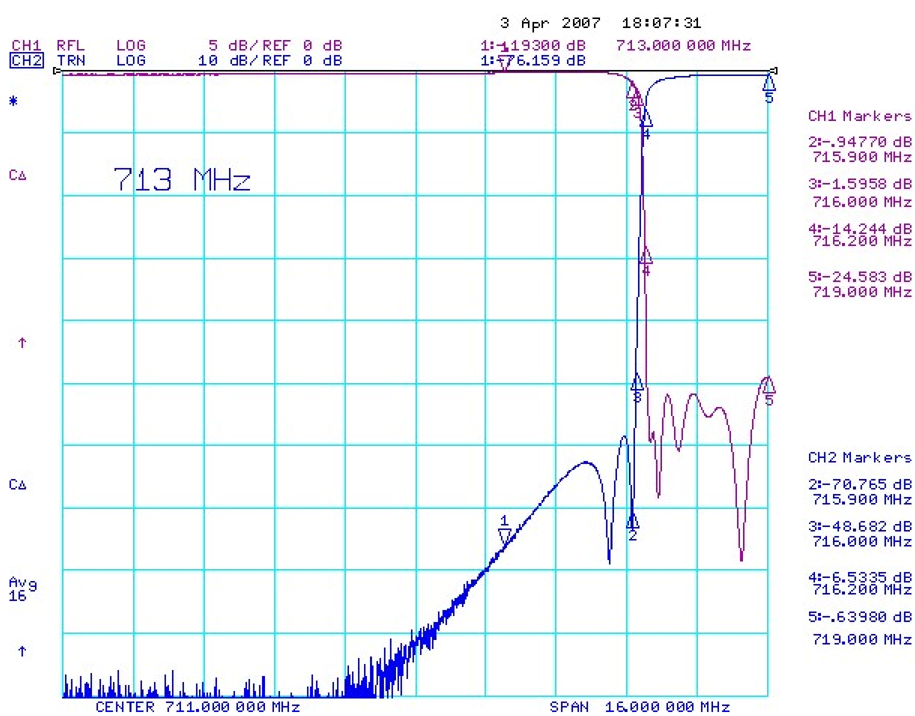

Figure 3.3-9: Lower Half of Mask Filter from Network Analyzer

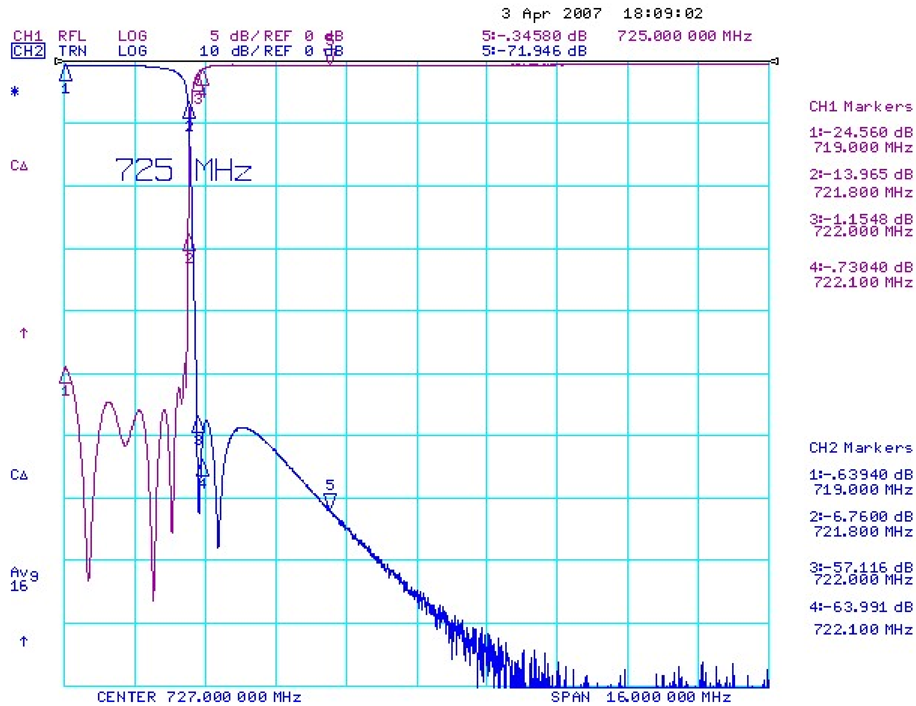

Figure 3.3-10: Upper Half of Mask Filter from Network Analyzer

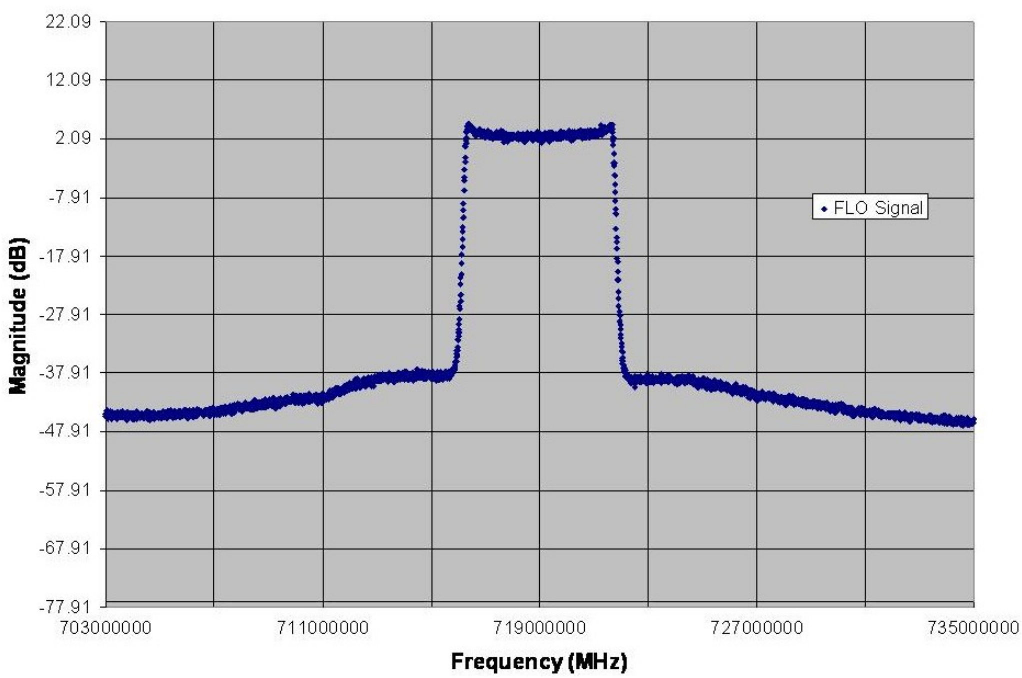

Figure 3.3-11: Emission levels at 100 kHz resolution bandwidth in the spreadsheet format

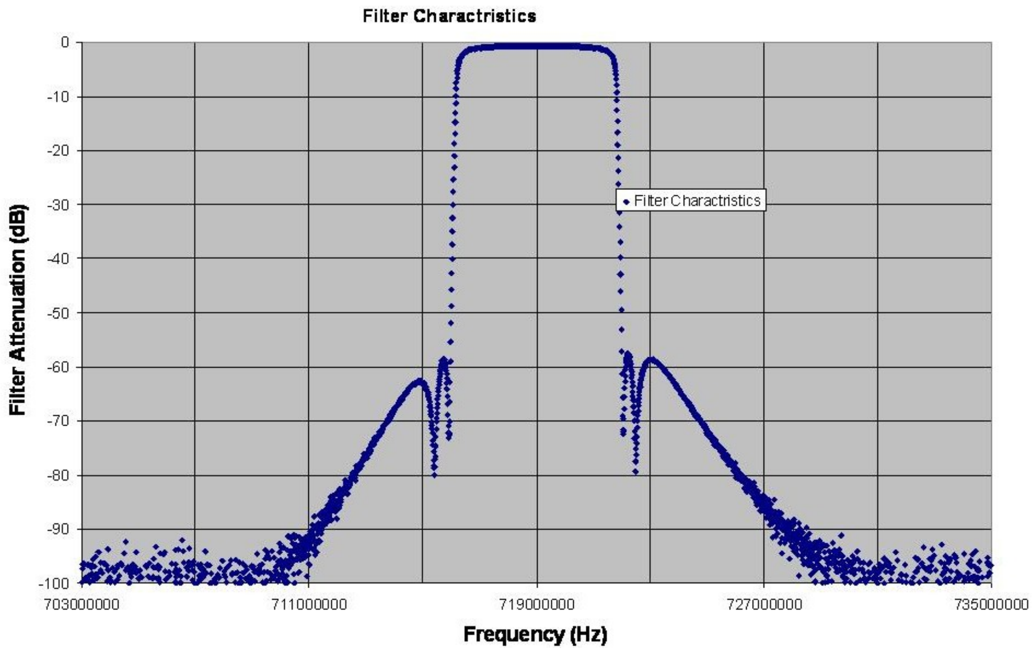

Figure 3.3-12: Mask Filter in the spreadsheet format

After processing the data, it is possible to generate a plot showing the results. Figure 3.3-13 captures compliant emission levels at the output of the filter. Note the "pink" limit line beneath which all emissions remain. Power-levels are lower the 72.03 dB below channel power. Note the 100 kHz resolution bandwidth setting of the instrument back at Figure 3.3-8.

Emissions limit ≤ 22.09dBm (Power Reference) – 72.03 dB = -49.94 dBm

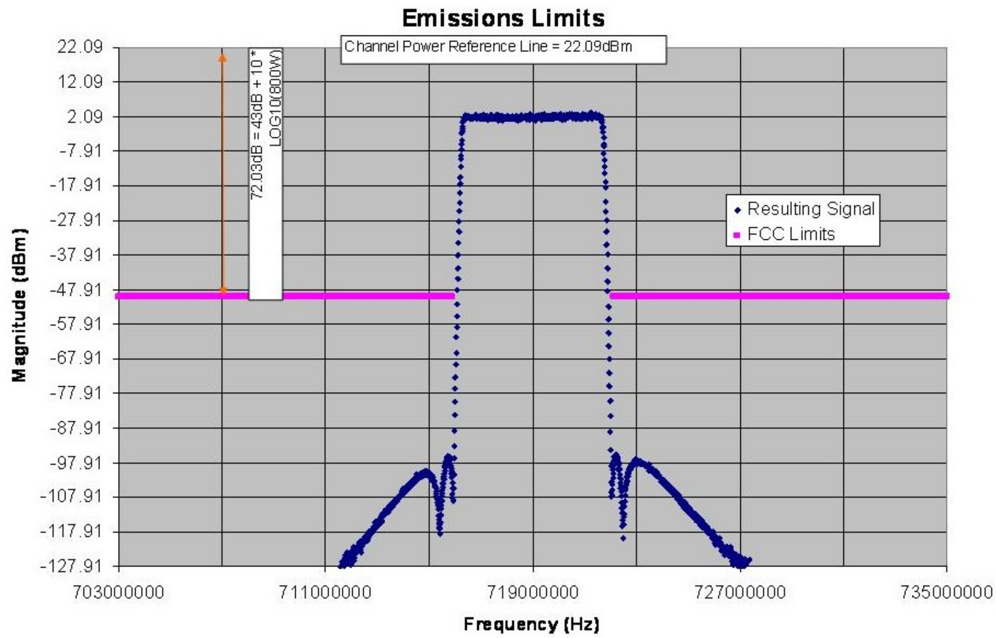

Figure 3.3-13: Masked signal in the spreadsheet format

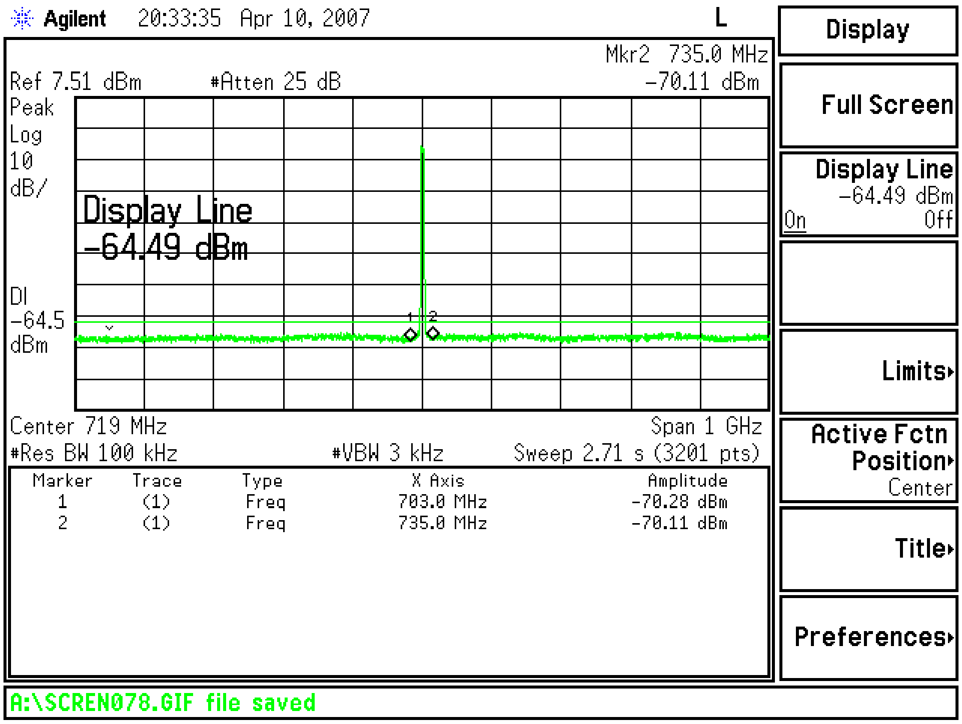

Figure 3.3-14: Emission levels beyond 13 MHz away from channel edges

c. Between 13 MHz from channel edges and Spectrum Analyzer maximum span
This is also a straight forward measurement from the Spectrum Analyzer E4440B as shown by Figure 3.3-7 and Figure 3.3-14. While the first Figure shows the Channel Power measurement, the second uses the value obtained in the first figure as a top of scale reference. Figure 3.3-14 also shows power level of emissions 13 MHz away from the channel edge and beyond. Observe the position of markers and their levels in regard to the reference. Power-levels are lower the 72.03 dB below channel power. Note the 30 kHz resolution bandwidth setting of the instrument.

$$\text{Emissions limit} \leq 7.51\text{dBm (Power Reference)} - 72.03\text{ dB} = -64.52\text{ dBm}$$

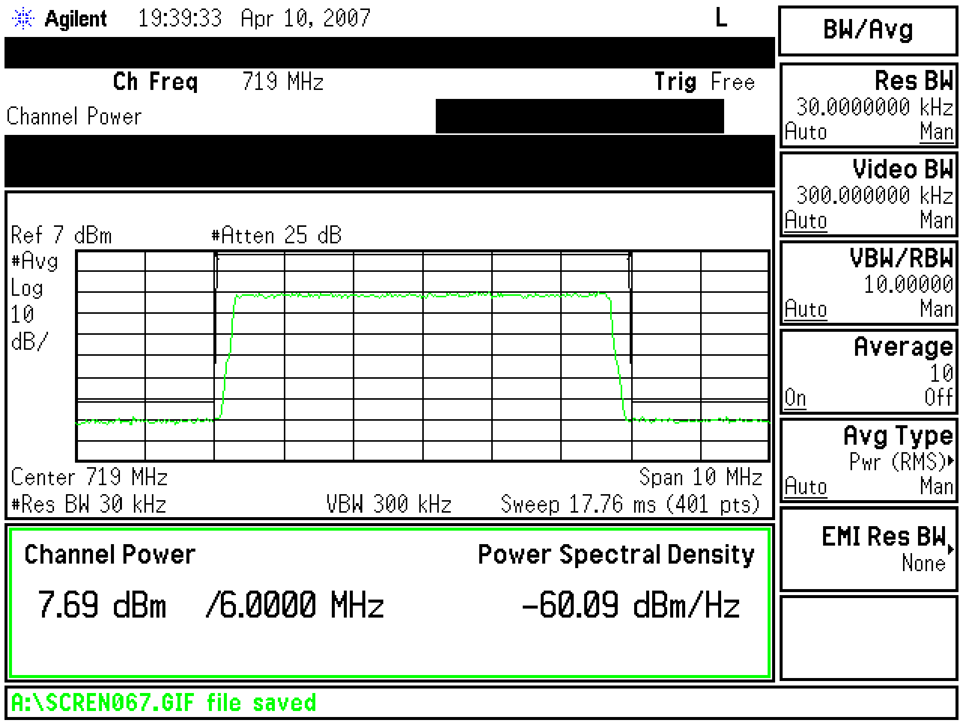

Figure 3.3-15: Channel Power of TX, using filter #2.

Transmitter operating with Filter #2 (Part Number 11000002766):

a. Between channel edges and frequencies up to 100 kHz away:
This is a straight forward measurement from the Spectrum Analyzer E4440B as shown by Figure 3.3-15 and Figure 3.3-16. While the first Figure shows the Channel Power measurement, the second uses the value obtained in the first figure as a top of scale reference. Figure 3.3-16 also shows power level of first 100 kHz stretches outside the channel. Observe the position of markers and their levels in regard to the reference. Power-levels are lower the 72.03 dB below channel power. Note the 30 kHz resolution bandwidth setting of the instrument.

Emissions limit ≤ 7.69dBm (Power Reference) – 72.03 dB = -64.34 dBm

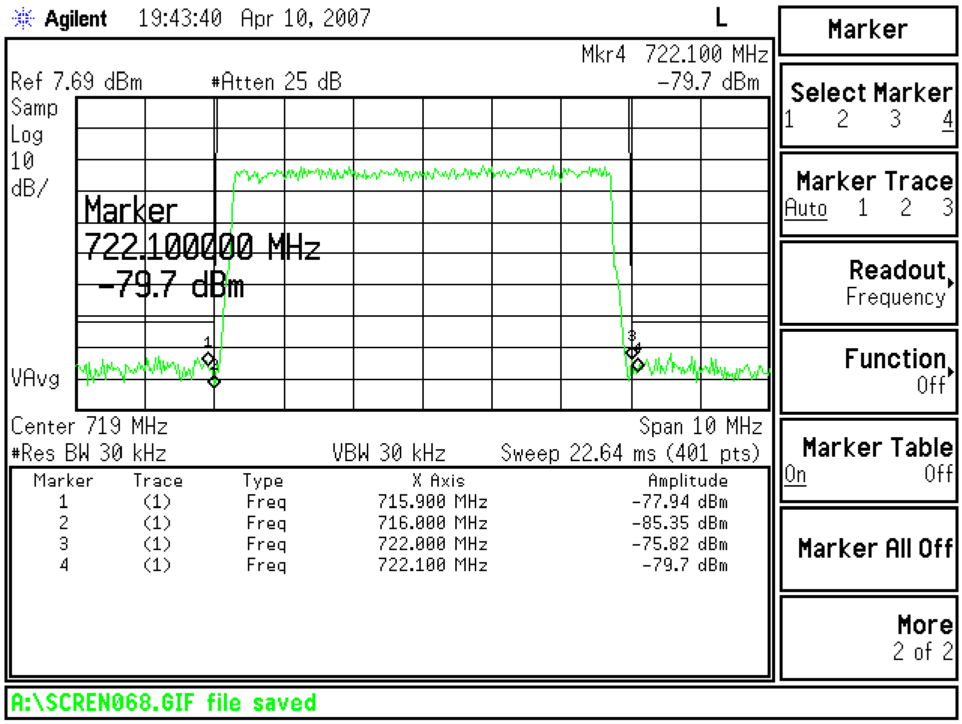

Figure 3.3-16: Emissions up to 100 kHz away from channel edges

d. Between 100 kHz and 13 MHz away from channel edges

This is an indirect measurement, once the required 100 kHz resolution bandwidth allows "a power spill" into the frequency stretch under test. To accomplish the evaluation, FLO signal data is obtained from a point before the band-pass filter at the required resolution setting, and to it, the attenuation of the filter is applied. This method requires that data extracted from the Spectrum Analyzer and from the Network Analyzer be imported and further processed in spreadsheets.

Figure 3.3-17 captured the channel power value that is used to as a reference to measurement. Figure 3.3-18, Figure 3.3-19, and Figure 3.3-20 show data obtained from instruments while Figure 3.3-21 and Figure 3.3-22 their spreadsheet equivalent, respectively.

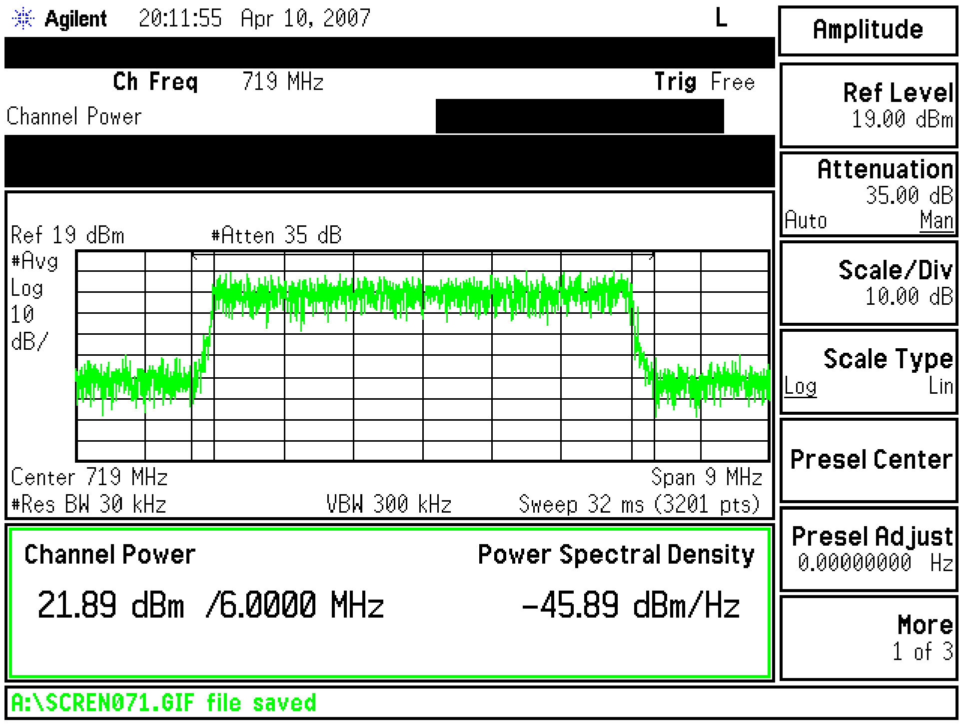

Figure 3.3-17: Channel Power to be used as reference

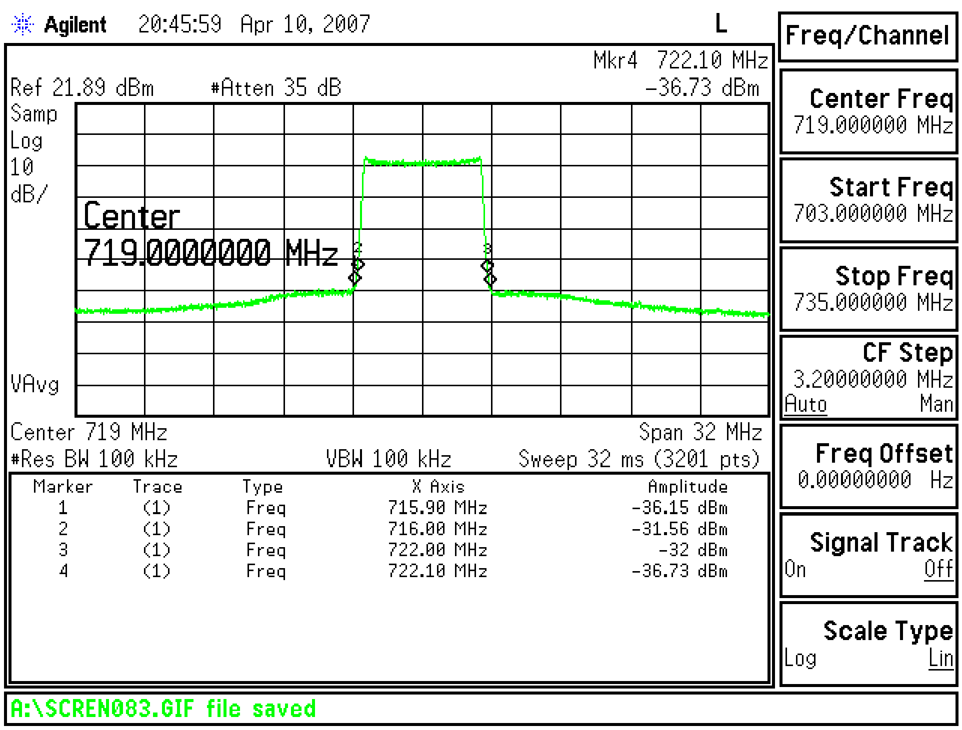

Figure 3.3-18: Emission levels at 100 kHz resolution bandwidth from Spectrum Analyzer

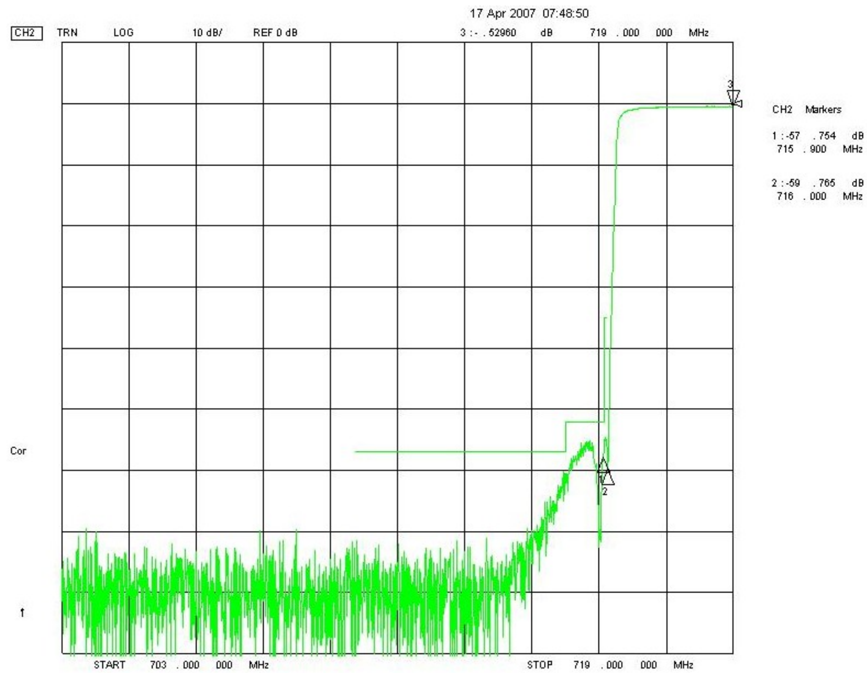

Figure 3.3-19: Lower Half of Mask Filter from Network Analyzer

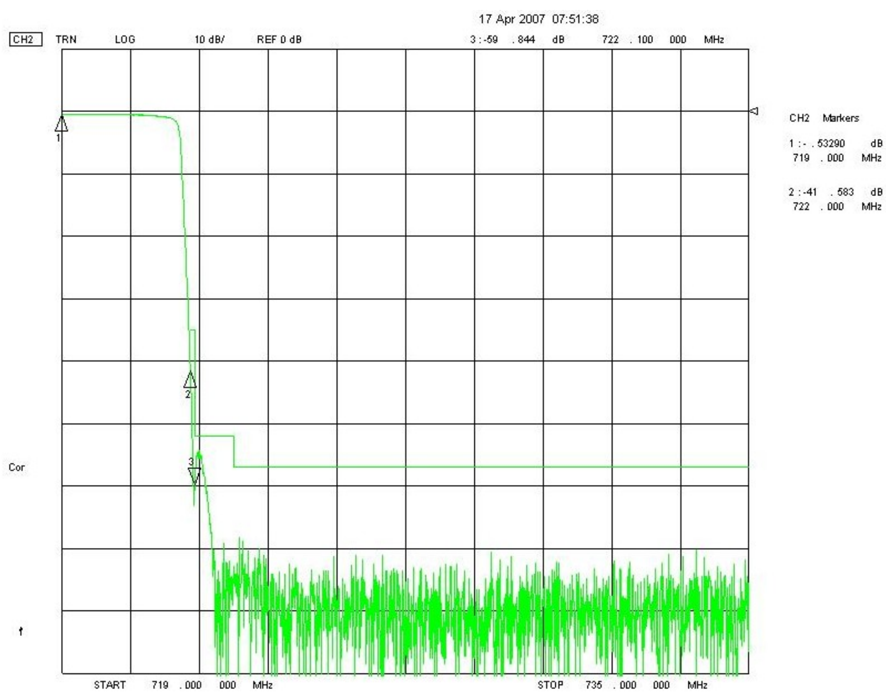

Figure 3.3-20: Lower Half of Mask Filter from Network Analyzer

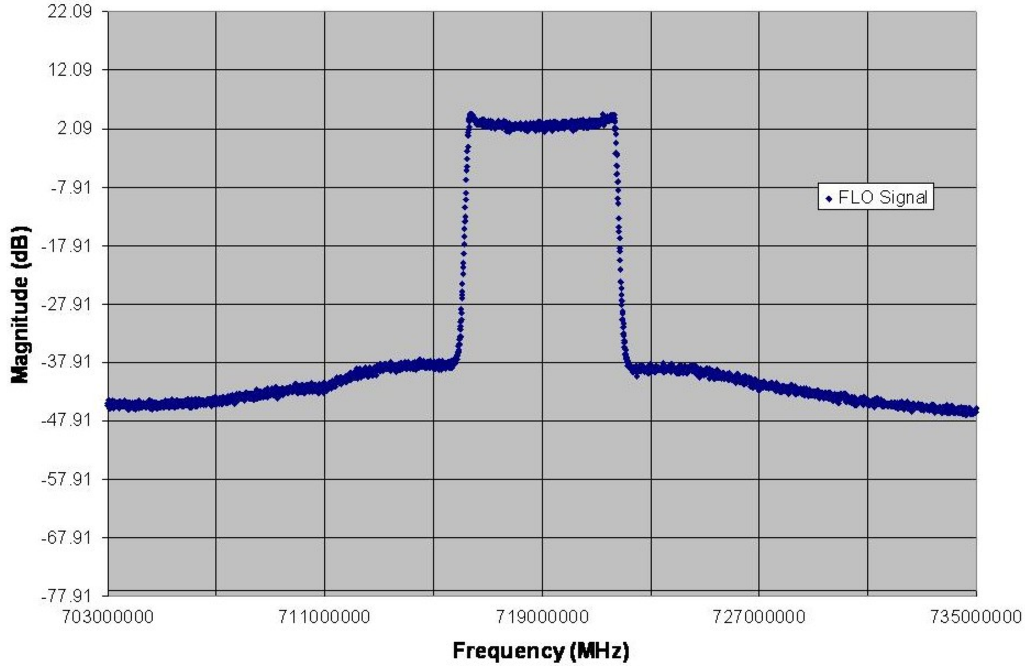

Figure 3.3-21: Emission levels at 100 kHz resolution bandwidth in the spreadsheet format

After processing the data, it is possible to generate a plot showing the results. Figure 3.3-23 captures compliant emission levels at the output of the filter. Note the "pink" limit line beneath which all emissions remain. Power-levels are lower the 72.03 dB below channel power. Note the 100 kHz resolution bandwidth setting of the instrument back at Figure 3.3-18.

Emissions limit ≤ 21.89dBm (Power Reference) – 72.03 dB = -50.14 dBm

b. Between 13 MHz from channel edges and Spectrum Analyzer maximum span
This is also a straight forward measurement from the Spectrum Analyzer E4440B as shown by Figure 3.3-17 and Figure 3.3-23. While the first Figure shows the Channel Power measurement, the second uses the value obtained in the first figure as a top of scale reference. Figure 3.3-24 also shows power level of emissions 13 MHz away from the channel edge and beyond. Observe the position of markers and their levels in regard to the reference. Power-levels are lower the 72.03 dB below channel power. Note the 30 kHz resolution bandwidth setting of the instrument.

Emissions limit ≤ 7.69dBm (Power Reference) – 72.03 dB = -64.34 dBm

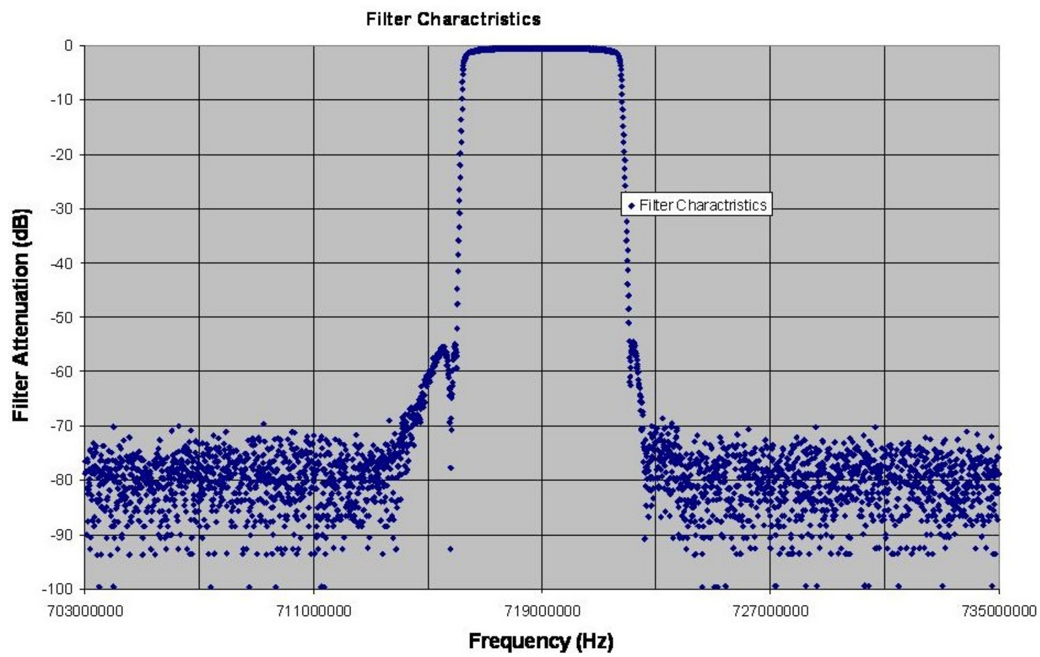

Figure 3.3-22: Mask Filter in the spreadsheet format

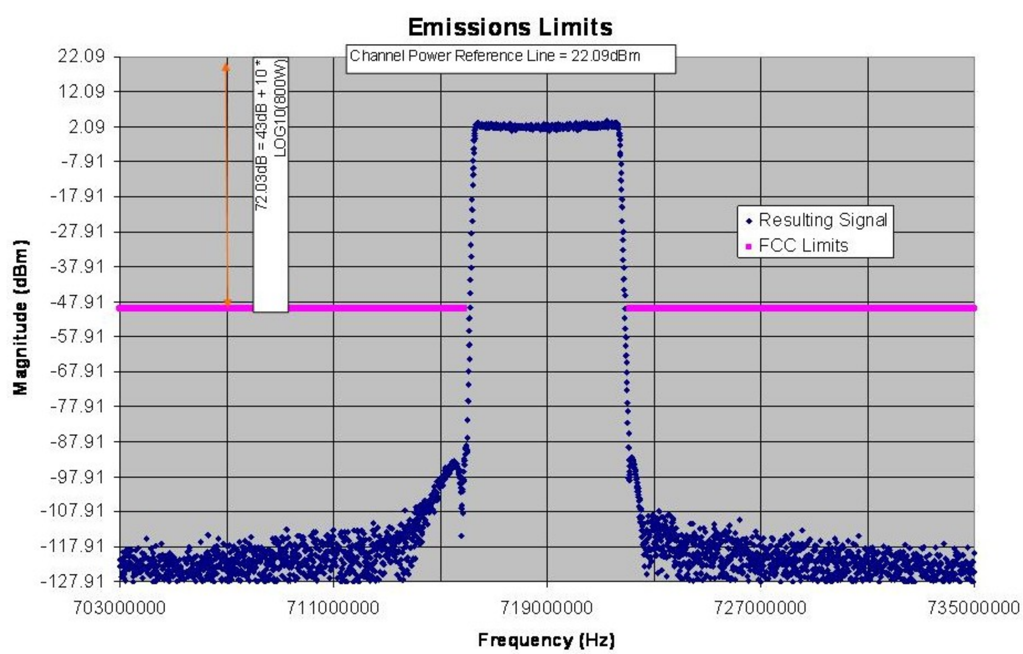

Figure 3.3-23: Masked signal in the spreadsheet format

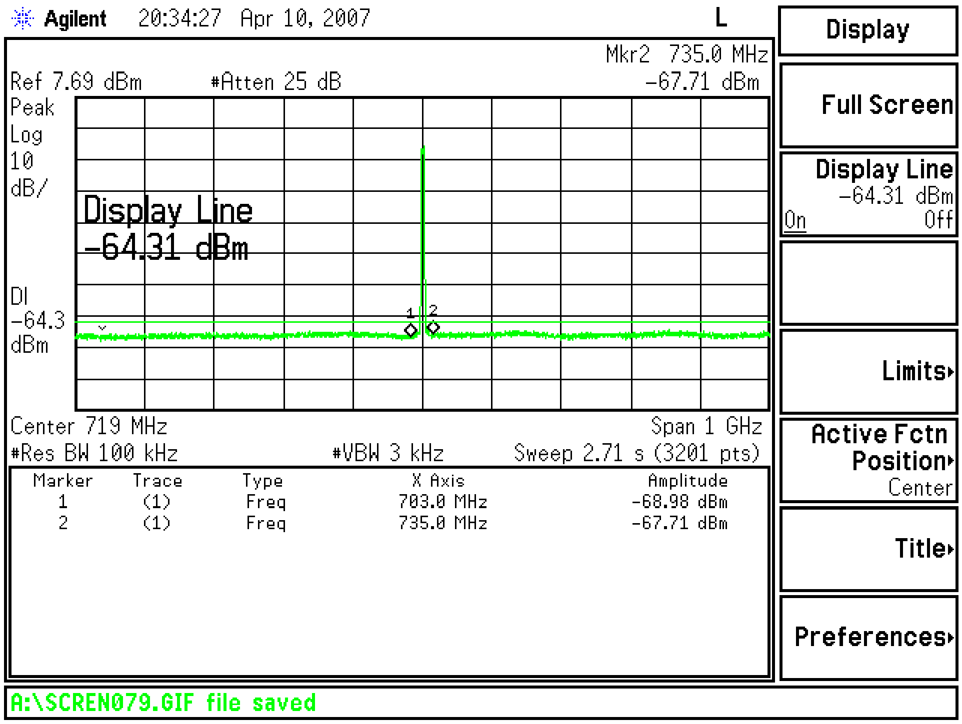

Figure 3.3-24: Emission levels beyond 13 MHz away from channel edges

The setup for conducting emissions limits tests is shown in Figure 3.3-1 and Figure 3.3-2.

3.4 SPURIOUS EMISSIONS AT ANTENNA TERMINALS

FCC Section 2.1051/2.1057 (a)(1) (b) (c)

The setup for conducting the spurious emissions test is shown in Figure 3.4-1. Note that the directional coupler is removed for this test. A directional coupler is a device which is frequency selective. Therefore a high power -30dB broadband attenuator is used to sample the output. The attenuator is characterized across the measurement band of 10MHz to 7.2GHz. The results of this measurement can be seen in Table 3.4-1and Table 3.4-2 (for either filter). Note also the High Pass filter in Figure 3.4-1, which helps prevent generation of harmonic inside the Spectrum Analyzer due to instrument overload.

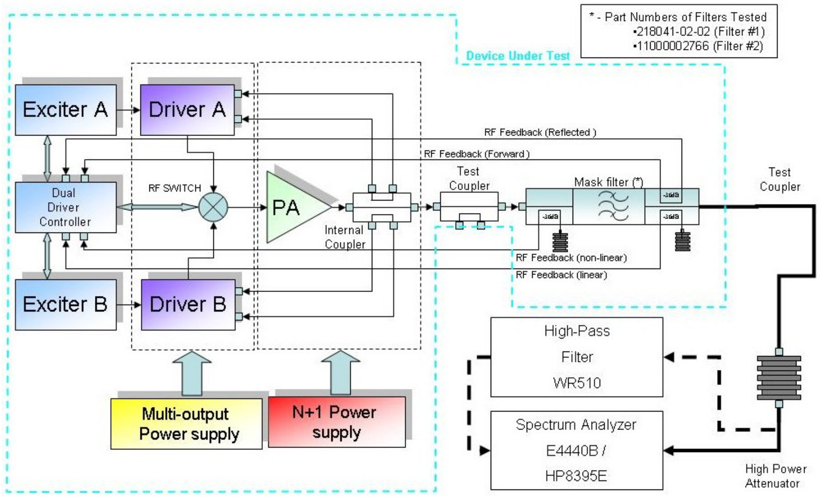

Figure 3.4-1: The setup for conducting the spurious emissions test

Average Output Power:	800 watts
Type Modulation:	Media FLO COFDM w/QPSK
Spectrum Analyzer Setting:	The Spectrum Analyzer setting used in conducting the spurious emissions test at the equipment output terminals was as follows
Frequency Span:	2 MHz per Division
Center Frequency:	Adjusted continuously for 10 MHz to 7.2 GHz
Resolution Bandwidth:	100 KHz
Video Bandwidth:	30kHz
Video Filter:	Out
Input Attenuator Setting:	Input level was set for a full-scale calibration of the average digital power. All other frequencies were referenced to this point.
Spurious Emissions:	See chart; measured values account for attenuator curve.

Table 3.4-1: Spurious Emissions after Filter #1.

Spurious Analysis for Transmitter Connected to Filter #1					
Frequency (MHz)	Power Measurement From Analyzer (dBm)	High Power Attenuator Insertion Loss (dB)	High-Pass Filter Insertion Loss (dB)	Total Adjustment of Measurement (dB)	Relative to Fundamental (dB) ≤-72.03dB
719	19.18	39.3	n/a	0	0
27.5	-75.2	45.1	n/a	+5.8	-88.6
746.5	-75.2	42.3	n/a	+3.0	-91.4
1438	-71.0	33.0	33.5	-5.8	-96.0
2157	-75.71	29.4	29.8	-9.5	-104.4
2876	-74.8	25.6	34.7	-4.6	-98.6
3595	-68.6	21.8	24.5	-14.8	-102.6
4314	-70.8	15.4	21.3	-18.0	-108.0
5033	-71.5	13.4	16.1	-23.2	-113.9
5752	-70.3	17.5	36.4	-2.9	-92.4
6471	-62.1	31.5	32.2	-7.1	-88.4
7190	-61.5	19.3	25.5	-13.8	-94.5

Table 3.4-2: Spurious Emissions after Filter #2

Spurious Analysis for Transmitter Connected to Filter #2					
Frequency (MHz)	Power Measurement From Analyzer (dBm)	High Power Attenuator Insertion Loss (dB)	High-Pass Filter Insertion Loss (dB)	Total Adjustment of Measurement (dB)	Relative to Fundamental (dB) ≤-72.03dB
719	19.73	39.3	n/a	0	0
27.5	-75.2	45.1	n/a	+5.8	-89.1
746.5	-75.2	42.3	n/a	+3.0	-91.9
1438	-71.9	33.0	33.5	-5.8	-97.4
2157	-76.0	29.4	29.8	-9.5	-105.2
2876	-70.5	25.6	34.7	-4.6	-94.8
3595	-68.2	21.8	24.5	-14.8	-102.7
4314	-69.8	15.4	21.3	-18.0	-107.5
5033	-71.3	13.4	16.1	-23.2	-114.2
5752	-62.4	17.5	36.4	-2.9	-85.0
6471	-61.9	31.5	32.2	-7.1	-88.7
7190	-61.3	19.3	25.5	-13.8	-94.8

No other spurious emissions detected.

3.5 FIELD STRENGTH OF SPURIOUS RADIATION

FCC Section 2.1053, 2.1057 (a)(1) (b) (c)

The setup for conducting radiated emissions test is shown in Figure 3.5-1. The transmitter is mounted in an equipment rack and operated at full rated power into a 50-ohm terminating load, while half-wave dipole antenna was connected to the spectrum analyzer and used to measure radiated emissions at a distance of 10-meters away from the transmitter on all sides. The transmitter was rotated 360 degrees so the emissions could be maximized with each frequency scan. A set of measurements were made for each of the mask filters chosen (filter #1 and filter #2).

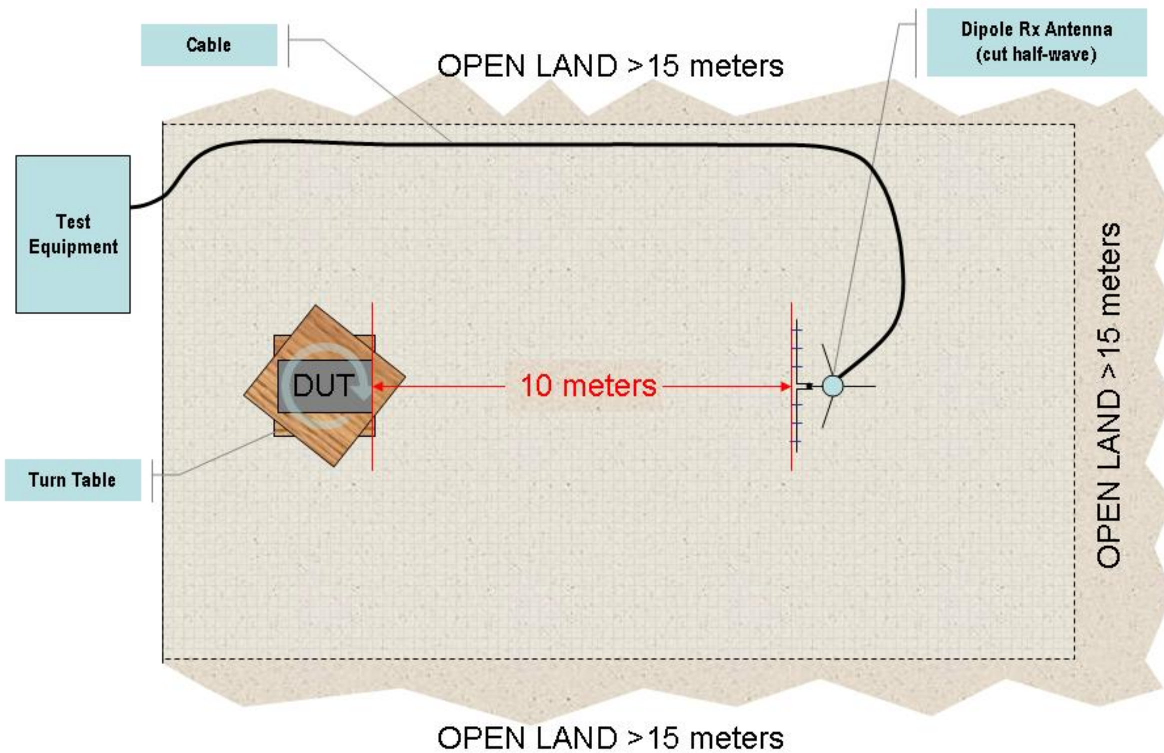

Figure 3.5-1: Test setup for radiated emissions measurement

Average Output Power:	800 watts
Type Modulation:	Media FLO COFDM w/QPSK
Spectrum Analyzer Settings:	A spectrum analyzer used to measure the spurious emissions at a distance of 10 meters from the transmitter was set as follows:
Reference Level:	0 dBm
Attenuation:	10 dB
Frequency Span:	1.5 MHz per division
Center Frequency:	Adjusted continuously from 10 MHz to 2.2 GHz
Resolution Bandwidth:	100 KHz
Video Bandwidth:	30 KHz
Video Average:	ON
Analyzer Noise Threshold:	<-77 dBm

Method of Measurement:

An open field test site was used for radiated emissions testing. The antenna was placed at a distance of 10 meters from the transmitter. A turn table allowed the Device Under Test (DUT) to be rotated 360 degrees in order to maximize emissions. Also, the antenna mast allows height variations of between 1 and 3 meters and both horizontal and vertical antenna positioning. At each reading, the DUT was rotated 360 degrees and the antenna height and polarization varied. Absolute power of the spurious radiation was measured on a spectrum analyzer and the highest emission level was recorded in a spreadsheet considering the antenna gain and cable loss over the frequency bands of interest.

The analyzer was used to capture the highest emission level with each successive frequency scan. The frequency span was narrowed during preliminary investigations as deemed necessary to distinguish between emissions from the DUT and any ambients.

The presence of ambient signals was verified by turning off the DUT and observing that the signal remains. In cases where ambient signals were observed the measurement bandwidth was temporarily reduced to verify that an adjacent peak did not exist. This method ensured that the ambient signal did not mask any emission from the DUT.

The relative levels of the received spurious signals were calculated with respect to the absolute power level of the transmitter's output received. The radiation was received with a half-wave dipole antenna (gain = 2.15 dB) and measured as an absolute power level; therefore, all measurements include the dipole gain. The relative levels of the received spurious signals were calculated with respect to the absolute power level of the transmitter's output received with a dipole at 10 meters. The received power level was calculated as shown:

System Parameters	RX Antenna feed loss	-5.5	dB
	TX Antenna feed loss	0.5	dB
	Operating Frequency	719	MHz
	Transmit Antenna Gain	2.15	dBi
	Transmitter Output Power	59	dBm
	Receive Antenna Gain	2.15	dBi
Link Parameters	Link Distance	0.01	Km
Constants	Speed of light	3.00E+08	m/s
Link Calculation			
Transmitted ERP Calculation	Transmitted Signal Power	59	dBm
	Antenna Feed Loss	0.5	dB
	TX Antenna Gain	2.15	dB
	Effective Radiated Power(ERP)	60.65	dBm
Path Loss Calculation	Link Frequency	719	MHz
	Link Distance	0.01	Km
	Path Loss *(for line of sight with no fade)*	-49.58	dB
Received Power Calculation	Receiver Antenna Gain	2.15	dBi
	Antenna Feed Loss	-5.5	dB
	Received Signal Power	7.72	dBm

The dipole receiving antenna is a set to measure each of the following internally generated frequencies: intermediate frequency(s), local oscillator(s), carrier frequency, and 2nd and 3rd harmonics of the 800W UHF transmitter.

The measurement results were extracted from measurements of FCC part 15 present in document "35-0010 AFF2k050to800"and are presented in Table 3.5-1 and Table 3.5-2.

Spurious Radiation:

The following measurements of radiation were taken and are given in terms of absolute and relative dBm to the average digital signal power.

Table 3.5-1: Spurious Products/Harmonics Field Measurements for Filter #1.

FCC Part 27 Measurements with Worst Case Polarization						
Frequency (MHz)	Antenna Factor (dB/1/m)	Field Strength Meas (dBµV/m)	Power (dBm)	Measured Power (dBm)	Received Power of the Fundamental (dBm)	Ratio to the Fundamental (dB)
30.4	12	29.8	-89.2	-77.0	7.7	**84.7**
50	12	27.4	-91.6	-77.0	7.7	**84.7**
55.1	11	27.1	-90.9	-77.0	7.7	**84.7**
78.3	6.5	31.3	-82.2	-77.0	7.7	**84.7**
84.1	8	34.7	-80.3	-77.0	7.7	**84.7**
89.6	9	36.3	-79.7	-77.0	7.7	**84.7**
92.5	9.5	36.8	-79.7	-77.0	7.7	**84.7**
105	10.5	32.9	-84.6	-77.0	7.7	**84.7**
118	13	30.2	-89.8	-77.0	7.7	**84.7**
166	14	32	-89.0	-77.0	7.7	**84.7**
173	15	32.3	-89.7	-77.0	7.7	**84.7**
194	16.5	35.5	-88.0	-77.0	7.7	**84.7**
281	18.5	33.6	-91.9	-77.0	7.7	**84.7**
299.1	20	37	-90.0	-77.0	7.7	**84.7**
368.3	15.5	30.1	-92.4	-77.0	7.7	**84.7**
391	16	30	-93.0	-77.0	7.7	**84.7**
452	17	36.1	-87.9	-77.0	7.7	**84.7**
549.6	20	26.4	-100.6	-77.0	7.7	**84.7**
646	21.5	28.8	-99.7	-77.0	7.7	**84.7**
658	21.5	31.5	-97.0	-77.0	7.7	**84.7**
746.5	21.5	43.7	-84.8	-77.0	7.7	**84.7**
766	21.5	36.8	-91.7	-77.0	7.7	**84.7**
785	21.5	34.8	-93.7	-77.0	7.7	**84.7**
835	22	32.6	-96.4	-77.0	7.7	**84.7**
846	22.5	31.9	-97.6	-77.0	7.7	**84.7**
904.9	23	30.3	-99.7	-77.0	7.7	**84.7**
948.2	23.5	29.3	-101.2	-77.0	7.7	**84.7**
1320	26.5	34.6	-98.9	-77.0	7.7	**84.7**
1390	27	34.9	-99.1	-77.0	7.7	**84.7**
1438	27	57.1	-76.9	-74.7	7.7	**82.5**
1780	29	37.6	-98.4	-77.0	7.7	**84.7**
2157	30	42.4	-94.6	-77.0	7.7	**84.7**
2280	30	42.3	-94.7	-77.0	7.7	**84.7**
2876	30.5	40.3	-97.2	-77.0	7.7	**84.7**
3420	31	47.2	-90.8	-77.0	7.7	**84.7**
3595	31.5	44	-94.5	-77.0	7.7	**84.7**
3920	31	48.9	-89.1	-77.0	7.7	**84.7**
4210	32.5	49.2	-90.3	-77.0	7.7	**84.7**
4314	33	46.1	-93.9	-77.0	7.7	**84.7**
4400	33	49.9	-90.1	-77.0	7.7	**84.7**

* Analyzer threshold = -77 dBm

Table 3.5-2: Spurious Products/Harmonics Field Measurements for Filter #2.

FCC Part 27 Measurements with Worst Case Polarization						
Frequency (MHz)	Antenna Factor (dB/1/m)	Field Strength Meas (dBµV/m)	Power (dBm)	Measured Power (dBm)	Received Power of the Fundamental (dBm)	Ratio to the Fundamental (dB)
30.4	12	30.2	-88.8	-77.0	7.7	**84.7**
48.1	12	33.6	-85.4	-77.0	7.7	**84.7**
55.5	11	30.2	-87.8	-77.0	7.7	**84.7**
73.8	6	25.5	-87.5	-77.0	7.7	**84.7**
81.3	6.5	28.8	-84.7	-77.0	7.7	**84.7**
89.3	9	30.8	-85.2	-77.0	7.7	**84.7**
91.7	9	31.3	-84.7	-77.0	7.7	**84.7**
95.3	9.5	32.6	-83.9	-77.0	7.7	**84.7**
99.8	10	32.4	-84.6	-77.0	7.7	**84.7**
104	10	36.9	-80.1	-77.0	7.7	**84.7**
108	11	32.2	-85.8	-77.0	7.7	**84.7**
121	13	34.1	-85.9	-77.0	7.7	**84.7**
135	13	30.6	-89.4	-77.0	7.7	**84.7**
149	13	29.2	-90.8	-77.0	7.7	**84.7**
160	13.5	31.9	-88.6	-77.0	7.7	**84.7**
170	14.5	32	-89.5	-77.0	7.7	**84.7**
171	14.5	32.2	-89.3	-77.0	7.7	**84.7**
188	16.5	31	-92.5	-77.0	7.7	**84.7**
196	17	33.8	-90.2	-77.0	7.7	**84.7**
208	16.5	35.5	-88.0	-77.0	7.7	**84.7**
224	16	32.2	-90.8	-77.0	7.7	**84.7**
265	17	35.8	-88.2	-77.0	7.7	**84.7**
286	19	36.9	-89.1	-77.0	7.7	**84.7**
300	20	38.1	-88.9	-77.0	7.7	**84.7**
464	17.5	33.2	-91.3	-77.0	7.7	**84.7**
556	20.5	41.2	-86.3	-77.0	7.7	**84.7**
702	21	34.9	-93.1	-77.0	7.7	**84.7**
727	21.5	36.7	-91.8	-77.0	7.7	**84.7**
746.5	21.5	28.8	-99.7	-77.0	7.7	**84.7**
750	21.5	34.8	-93.7	-77.0	7.7	**84.7**
799	22	34.8	-94.2	-77.0	7.7	**84.7**
869	23	34.8	-95.2	-77.0	7.7	**84.7**
960	23.5	40.2	-90.3	-77.0	7.7	**84.7**
1438	27	57.6	-76.4	-74.2	7.7	**82.0**
2157	30	41.1	-95.9	-77.0	7.7	**84.7**
2160	30	42.4	-94.6	-77.0	7.7	**84.7**
2260	30	47.8	-89.2	-77.0	7.7	**84.7**
2500	30	41.3	-95.7	-77.0	7.7	**84.7**
2876	30.5	40.6	-96.9	-77.0	7.7	**84.7**
3595	31.5	45.2	-93.3	-77.0	7.7	**84.7**
3970	32	49.8	-89.2	-77.0	7.7	**84.7**
4314	33	47.3	-92.7	-77.0	7.7	**84.7**
4450	33	48.3	-91.7	-77.0	7.7	**84.7**

* Analyzer threshold = -77 dBm

3.6 FREQUENCY STABILITY

FCC Section 2.1055 (a) (1) (b)(c)(d), 27.54

Method of Measurement: The exciters were tested per FCC guideline, wherein measuring the local oscillator frequency conversion RF chain across both temperature and AC line variation derives the on-channel frequency stability.

Transmitter frequency plan
First conversion:

UHF L.O. (Synthesized) 746.50 MHz
1st IF Frequency -27.50 MHz
On Channel Frequency 719.0MHz

Frequency Stability over Temperature: The units were place inside a temperature chamber to control the ambient temperature; each measurement was recorded after approx 1 hour at each temperature interval. The channel frequency is derived by the method shown above. The measured results of each stage are compared to the nominal channel frequency of 719.0MHz and are recorded in Table 3.6-1 and Table 3.6-2; where the right most column reflects the total channel error at each temperature.

Table 3.6-1: Frequency stability of exciter A measured over temperature -30° to +50°C.

Temperature (°C)	Exciter I.F.		Local Oscillator		Total Channel Error (Hz)
	Frequency (Hz)	Error (Hz)	Frequency (Hz)	Error (Hz)	
+25	27,500,001	1	746,500,002	2	3
-30	27,500,011	11	746,500,055	55	66
-20	27,500,009	9	746,500,033	33	42
-10	27,500,006	6	746,500,010	10	16
0	27,500,004	4	746,500,005	5	9
+10	27,500,003	3	746,499,998	-2	1
+20	27,500,001	1	746,499,995	-5	-4
+30	27,499,999	-1	746,499,993	-7	-8
+40	27,499,998	-2	746,499,992	-8	-10
+50	27,499,995	-4	746,499,992	-8	-12

Table 3.6-2: Frequency stability of exciter B measured over temperature -30° to +50°C.

Temperature (°C)	Exciter I.F.		Local Oscillator		Total Channel Error (Hz)
	Frequency (Hz)	Error (Hz)	Frequency (Hz)	Error (Hz)	
+25	27,500,003	3	746,500,005	5	8
-30	27,500,016	16	746,500,050	50	66
-20	27,500,010	10	746,500,037	37	47
-10	27,500,008	8	746,500,015	15	23
0	27,500,005	5	746,500,002	2	7
+10	27,500,003	3	746,499,997	-3	0
+20	27,500,000	0	746,499,998	-2	-2
+30	27,499,998	-2	746,499,998	-2	-4
+40	27,499,996	-4	746,499,991	-9	-13
+50	27,499,993	-7	746,499,990	-10	-17

NOTE:
Frequency stability of the transmitter system during this test was totally dependent on the accuracy and stability of the internal 10 MHz reference oscillator. This is a purchased item with ±0.15 ppm stability over temperature range. The worse case condition is presented in these measurements. In normal operation the transmitter will be phase-locked to a GPS receiver source, eliminating the drift of the internal OCXO. Frequency error recorded over -30C to +50C when phase locked to GPS reference yields less than 1Hz error.

Frequency Stability over AC Input Voltage: The error due to AC line variation was measured, while the units were stabilized at room temperature of 25°C. Table 3.6-3 and Table 3.6-4 show the measured results.

Table 3.6-3 Frequency stability of exciter A measured over AC Line variation.

AC Line (Vac)	Exciter I.F.		Local Oscillator		Total Channel Error (Hz)
	Frequency (Hz)	Error (Hz)	Frequency (Hz)	Error (Hz)	
200	27,500,002	2	746,500,000	0	2
205	27,500,002	2	746,500,000	0	2
210	27,500,001	1	746,500,000	0	1
215	27,500,001	1	746,499,999	-1	0
220	27,500,001	1	746,499,999	-1	0
225	27,500,001	1	746,499,998	-2	-1
230	27,500,002	2	746,499,998	-2	0
235	27,500,003	3	746,499,997	-3	0
240	27,500,001	1	746,499,999	-1	0
245	27,500,001	1	746,499,999	-1	0
250	27,500,001	1	746,499,999	-1	0
253	27,500,001	1	746,499,998	-2	-1

Table 3.6-4: Frequency stability of exciter B measured over AC Line variation.

AC Line (Vac)	Exciter I.F.		Local Oscillator		Total Channel Error (Hz)
	Frequency (Hz)	Error (Hz)	Frequency (Hz)	Error (Hz)	
200	27,500,005	5	746,500,007	7	12
205	27,500,005	5	746,500,007	7	12
210	27,500,006	6	746,500,008	8	14
215	27,500,006	6	746,500,007	7	13
220	27,500,005	5	746,500,008	8	13
225	27,500,005	5	746,500,008	8	13
230	27,500,005	5	746,500,008	8	13
235	27,500,005	5	746,500,007	7	12
240	27,500,004	4	746,500,007	7	11
245	27,500,005	5	746,500,006	6	11
250	27,500,005	5	746,500,006	6	11
253	27,500,006	6	746,500,006	6	12

* Total deviation of 2Hz error with AC line voltage

4.0 SUMMARY

This report demonstrates that the AFF2 k050-800 series digital television transmitter meets or exceeds the FCC certification criteria. The specified is based upon Media FLO compliant COFDM modulation with a QPSK constellation. The occupied bandwidth conforms to the required emissions limits of 27.53 wherein the power of any emission outside the 6MHz band of operation shall be attenuated below the transmitter power (P) by at least 43+ 10 log (P) dB. Measurement of spurious emissions at the RF output revealed no emissions above -72.03dBc. Field strength measurements of spurious emissions revealed no detectable emissions down to the analyzer noise threshold of < - 77 dBm. Frequency stability tests of the synthesizer and modulator over variations in temperature or input AC line voltage showed a maximum worst-case frequency shift of 66 hertz.