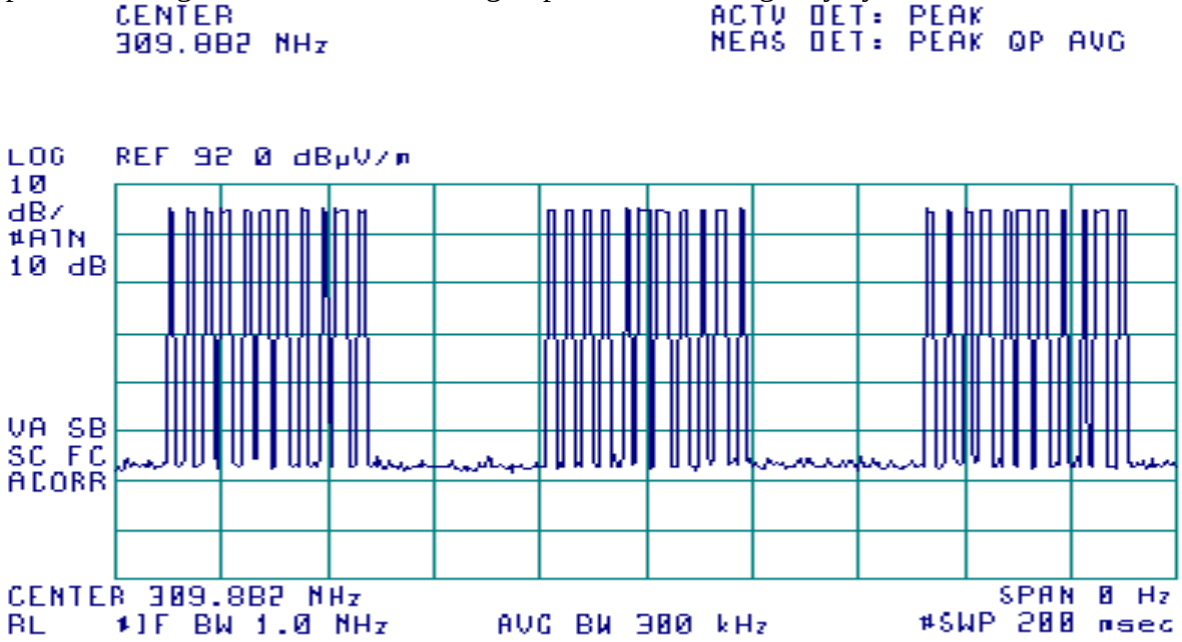
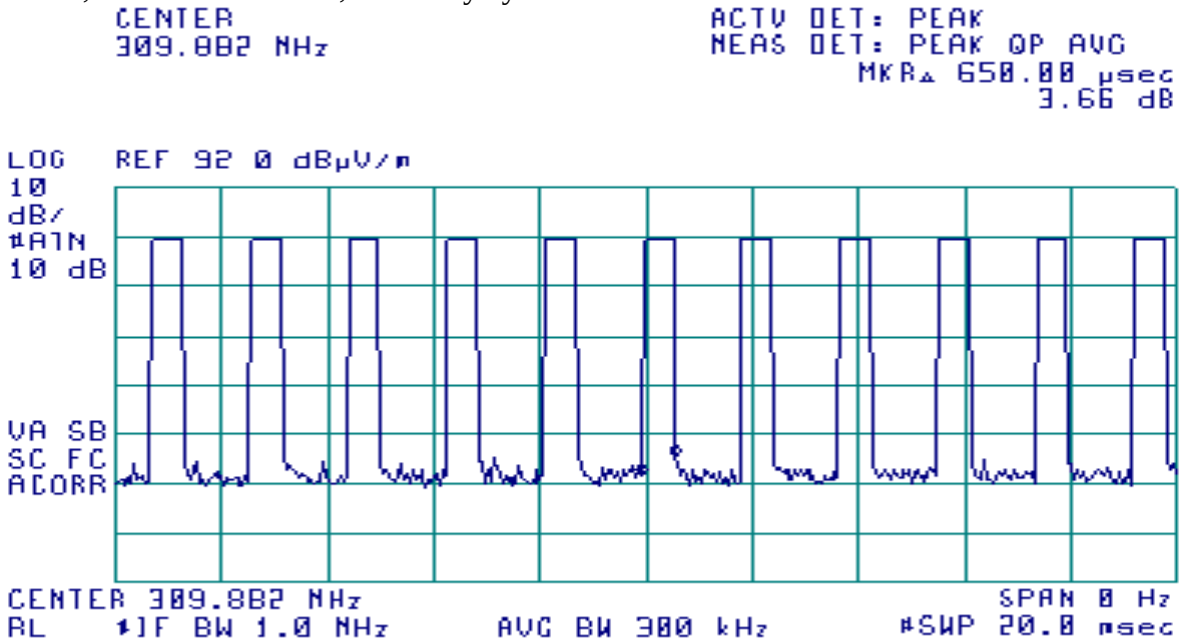
Test Data [2.1033(b6)]

Modulation Characteristics

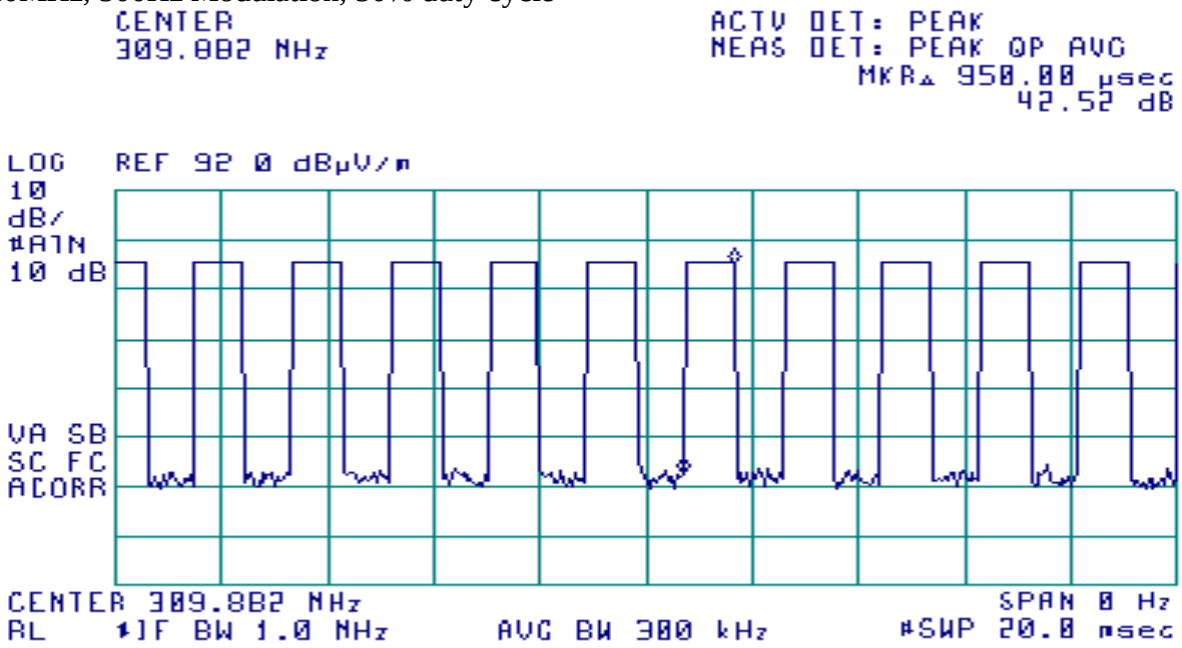
Typical encoding at 310MHz: Consisting of pulses of differing duty cycles.



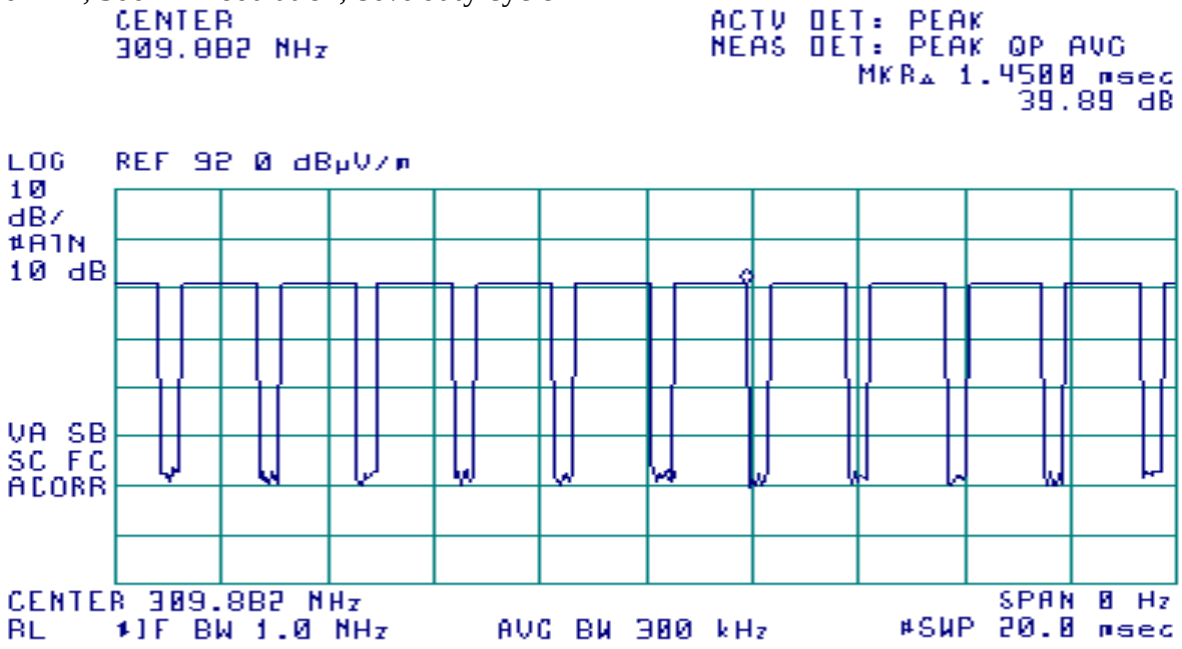
310MHz, 500Hz Modulation, 30% duty cycle



310MHz, 500Hz Modulation, 50% duty cycle



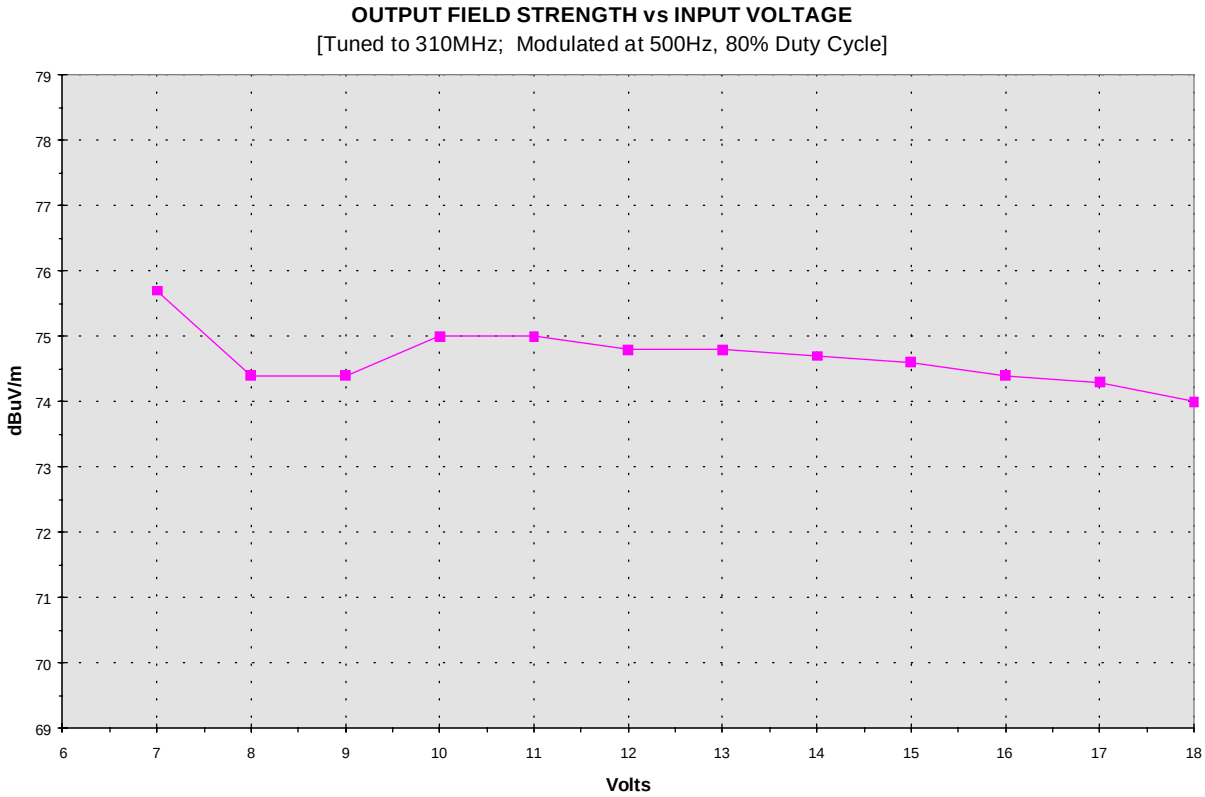
310MHz, 500Hz Modulation, 80% duty cycle



Relative Emission Level vs. Supply Voltage [15.31(e)]

The relative emission level as the supply voltage varied is presented in the charts below.

TX OUTPUT vs. Voltage LEVEL DUT= CB2OHHL3, 310MHz, 80%duty cycle	
Volt In	TX OutPut Pk dBuV/m
6	no-op
7	75.7
8	74.4
9	74.4
10	75.0
11	75.0
12	74.8
13	74.8
14	74.7
15	74.6
16	74.4
17	74.3
18	74.0



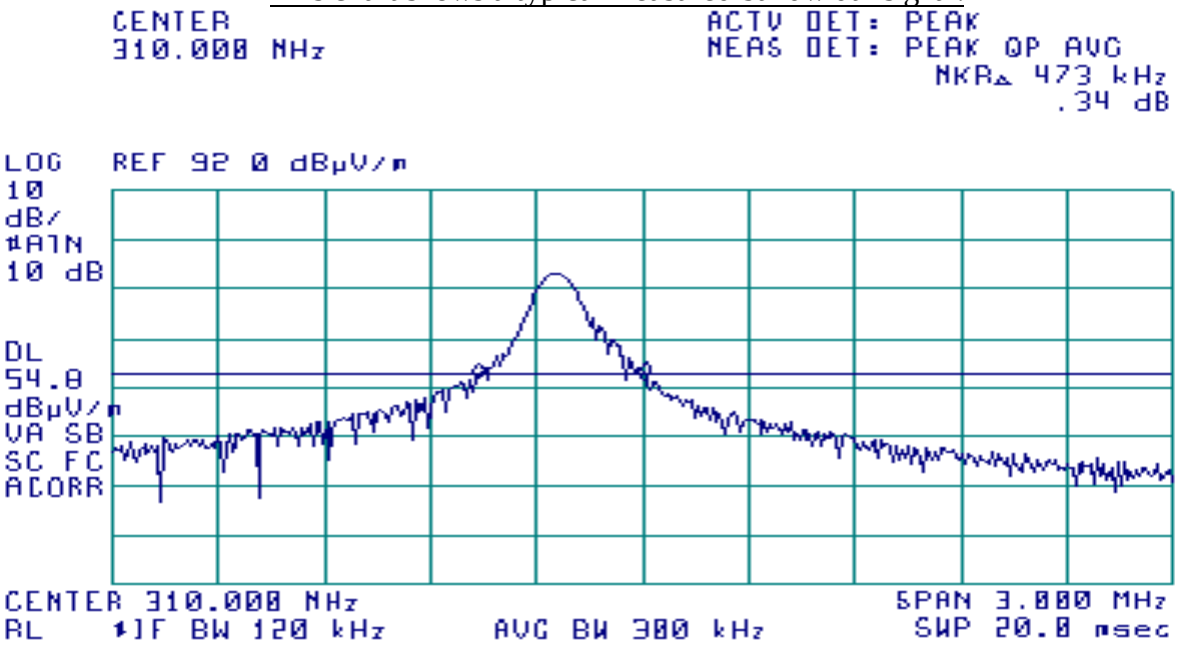
Occupied Bandwidth [15.231(c)]

The maximum allowed 20dB bandwidth is determined pursuant to 15.23(c). For fundamental signals between 70MHz and 900MHz the bandwidth allowed is 0.25% of the fundamental.

Formula 2: Allowed bandwidth = [Fundamental] x [.0025]

Fundamental (MHz)	Duty Cycle	Measured 20dB Bandwidth	LIMIT Fundamental * .0025
288	30%	585 KHz	720 KHz
"	50%	565 KHz	720 KHz
"	80%	550 KHz	720 KHz
310	30%	550 KHz	775 KHz
"	50%	525 KHz	775 KHz
"	80%	473 KHz	775 KHz
418	30%	555 KHz	1045 KHz
"	50%	485 KHz	1045 KHz
"	80%	500 KHz	1045 KHz

This chart shows a typical measured bandwidth signal.



Restricted Bands: [15.205]

The following frequency bands are restricted. Only spurious emissions are permitted at levels limited by 15.209:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.25
0.490-0.510	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

LIMIT @ 3meter: [15.209(a)]

30-88MHz	100uV/m	40dBuV/m
88-216MHz	150uV/m	43.5dBuV/m
216-960MHz	200uV/m	46dBuV/m
above 960MHz	500uV/m	54dBuV/m

Verification of EUT inability to tune within the Restricted Bands.

The unit is designed capable of tuning from 285MHz to 420MHz. Except that the Homelink® III firmware prevents the possibility of tuning to the restricted regions of 322-325.4MHz, 399.9-410MHz, and 240-285MHz.

An exercise which attempted to train the units into the restricted bands demonstrated how well the firmware functioned. The unit could not be trained any closer to the restricted band area than 1MHz outside the restricted bands edges.

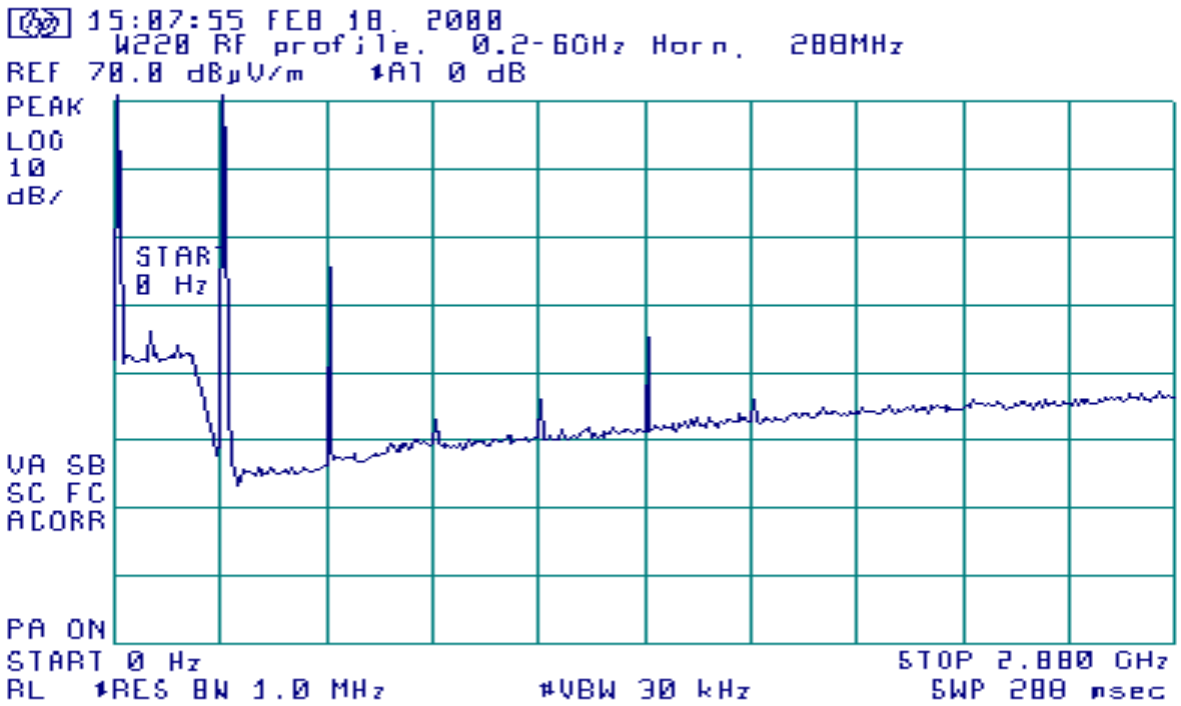
The spurious emissions observed in the restricted bands did not exceed the allowed limits for the restricted bands.

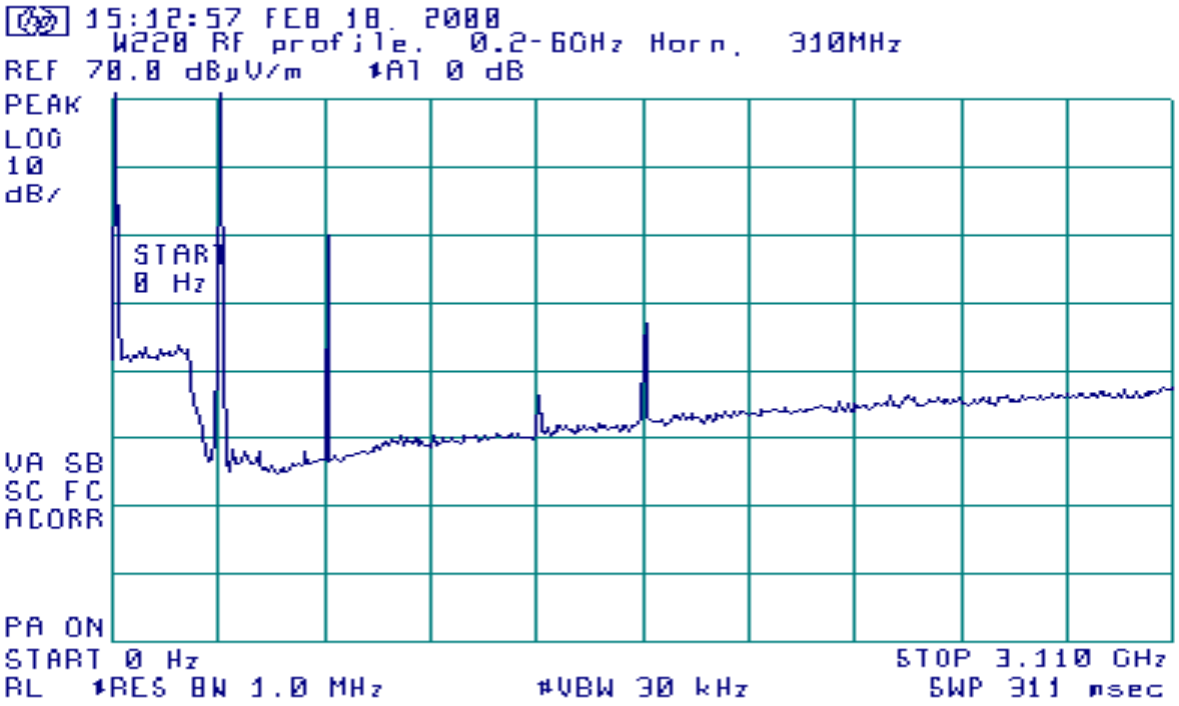
Radiated Field Strength Measurements: [15.231(b), 15.205]

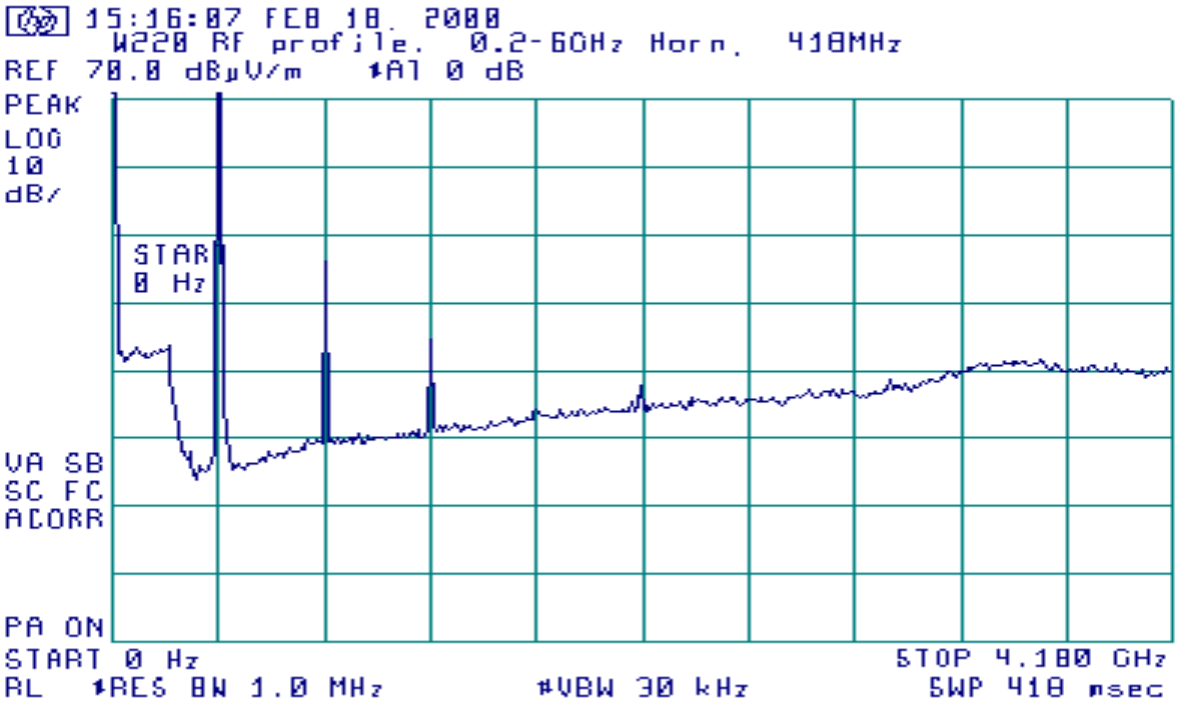
A scan of the CB2OHHL3 was made in a shielded room to study the emission profile of the EUT. These scans indicate there are no emissions from the unit other than the fundamental and its associated harmonics.

The following three charts show the spectrum pattern of the EUT emissions in the W220 configuration. The levels indicated are not calibrated levels.

The are no detectable spurious emissions associated with the digital portion of the W220 configuration of the model CB2OHHL3.

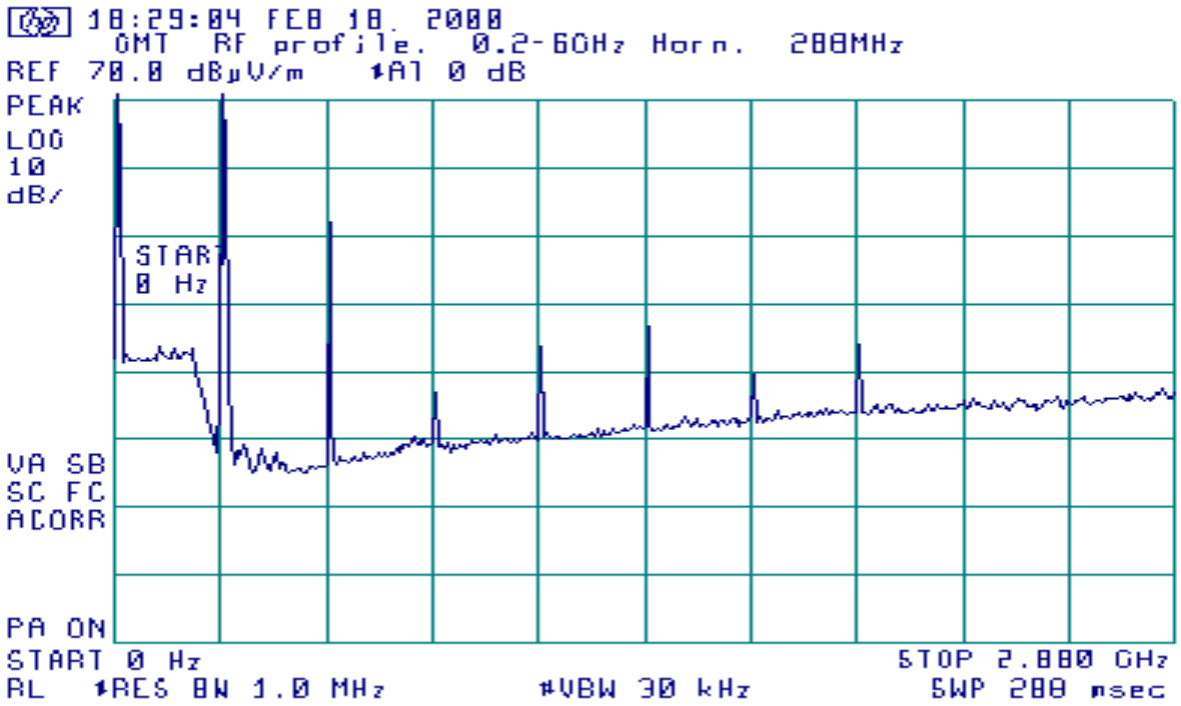


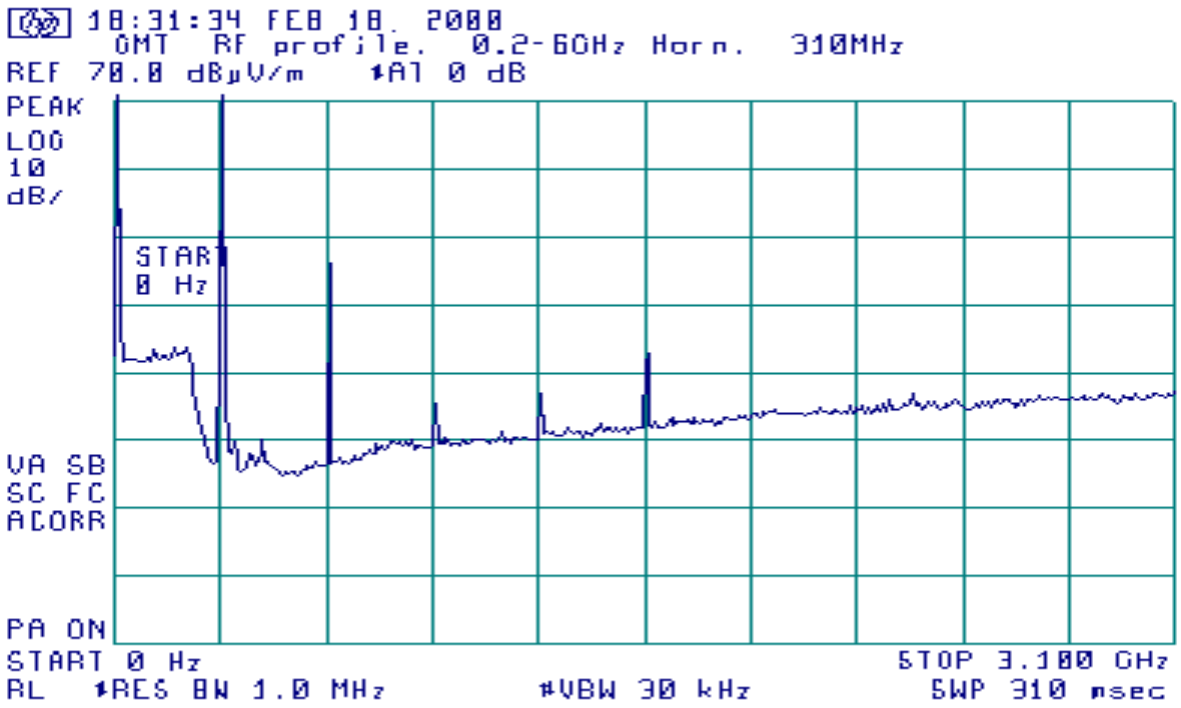

15:12:57 FEB 18, 2000
W220 RF profile, 0.2-6GHz Horn, 310MHz
REF 70.0 dBµV/m
#Atl 0 dB
PEAK
LOG
10
dB/
STAR
0 Hz
VA SB
SC FC
ACORR
PA ON
START 0 Hz
STOP 3.110 GHz
RL #RES BW 1.0 MHz
#VBW 30 kHz
SWP 311 msec

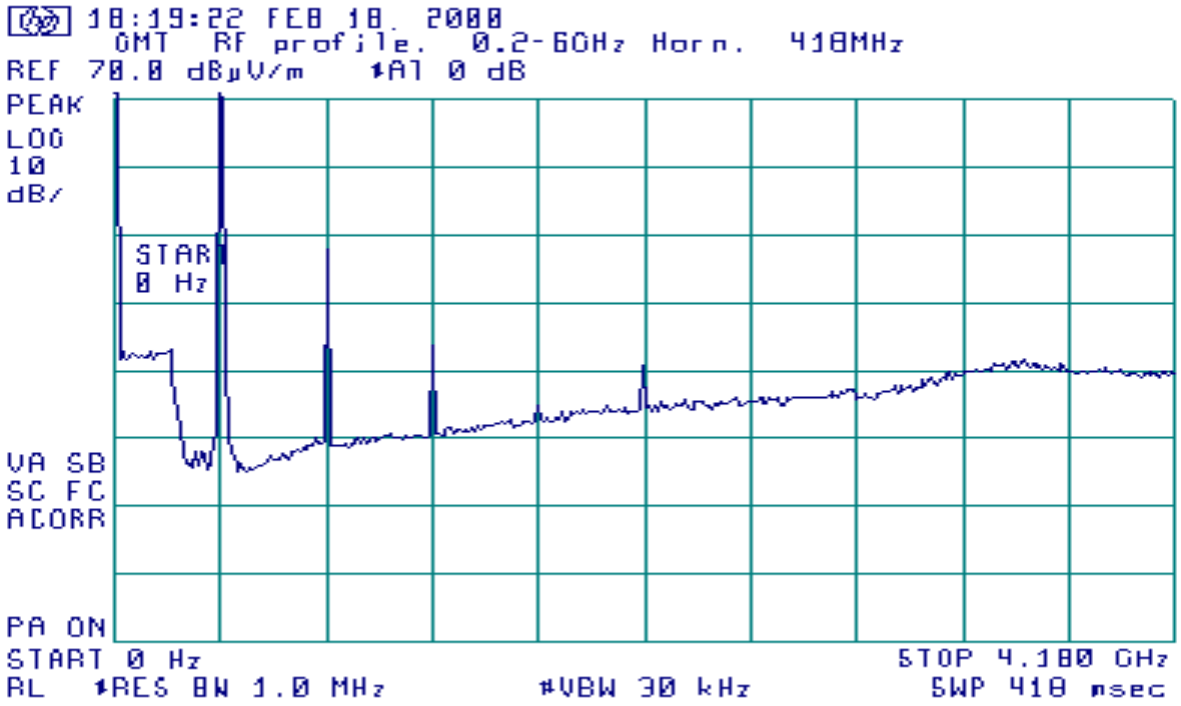

15:16:07 FEB 18, 2000
W220 RF profile, 0.2-6GHz Horn, 418MHz
REF 70.0 dBµV/m
#Atl 0 dB
PEAK
LOG
10
dB/
STAR
0 Hz
VA SB
SC FC
ACORR
PA ON
START 0 Hz
STOP 4.180 GHz
RL #RES BW 1.0 MHz
#VBW 30 kHz
SWP 418 msec

The following three charts show the spectrum pattern of the EUT emissions in the GMT configuration. The levels indicated are not calibrated levels.

The are no detectable spurious emissions associated with the digital portion of the GMT configuration of the model CB2OHHL3.






18:19:22 FEB 18, 2000
OMT RF profile. 0.2-6GHz Horn. 418MHz
REF 70.0 dBµV/m #Atl 0 dB
PEAK
LOG
10
dB/
STAR
0 Hz
VA SB
SC FC
ACORR
PA ON
START 0 Hz
STOP 4.180 GHz
RL #RES BW 1.0 MHz
#VBW 30 kHz
SWP 418 msec

Field Strength Measurements of Fundamental - GMT unit: [15.231(b)]

MEASUREMENT PROCEDURE:

1. The EUT was trained to one of the three test frequencies.
2. The EUT was trained to one of the three test duty cycles.
3. The EUT was setup to one of the three orthogonal positions.
4. Steps 1-3 were repeated to cover all positions, duty cycles, and frequencies.

DUT Tuned to transmit at 288MHz

Freq. MHz	DUT position	Ant. Pol.	Corrected Data Peak Detector dBuV/m	Duty Cycle %	Duty Cycle Factor dB	Calculated Average Level dBuV/m	FCC Limit dBuV/m	Margin dB	Cable +Ant. Factor dB+dB/m
288	side	H	83.00	30%	-10.46	72.54	73.8	**1.3**	14.29
"	"	"	78.05	50%	-6.02	72.03	73.8	**1.8**	"
"	"	"	73.89	80%	-1.94	71.95	73.8	**1.8**	"

DUT Tuned to transmit at 310MHz

Freq. MHz	DUT position	Ant. Pol.	Corrected Data Peak Detector dBuV/m	Duty Cycle %	Duty Cycle Factor dB	Calculated Average Level dBuV/m	FCC Limit dBuV/m	Margin dB	Cable +Ant. Factor dB+dB/m
310	side	H	84.40	30%	-10.46	73.94	75.3	**1.4**	14.94
"	"	"	80.16	50%	-6.02	74.14	75.3	**1.2**	"
"	"	"	75.27	80%	-1.94	73.33	75.3	**2.0**	"

DUT Tuned to transmit at 418MHz

Freq. MHz	DUT position	Ant. Pol.	Corrected Data Peak Detector dBuV/m	Duty Cycle %	Duty Cycle Factor dB	Calculated Average Level dBuV/m	FCC Limit dBuV/m	Margin dB	Cable +Ant. Factor dB+dB/m
418	end	V	88.54	30%	-10.46	78.08	80.3	**2.2**	17.44
"	"	"	83.07	50%	-6.02	77.05	80.3	**3.2**	"
"	"	"	79.74	80%	-1.94	77.80	80.3	**2.5**	"

Field Strength Measurements of Harmonics: GMT and W220 unit [15.231(b), 15.205]

DUT Tuned to transmit at 288MHz

Freq. MHz	unit ID	DUT position	Ant. Pol.	Corrected Data Peak Detector dBuV/m	Duty Cycle 6 %	Duty Cycle Factor dB	Calculated Average Level dBuV/m	FCC Limit dBuV/m	Margin dB	Cable +Ant. Factor dB+dB/m
576	GMT	flat	H	44.65	30%	-10.46	34.2	53.8	**19.6**	21.03
"	"	"	"	40.35	50%	-6.02	34.3	53.8	**19.5**	"
"	"	"	"	29.56	80%	-1.94	27.6	53.8	**26.2**	"
576	W220	flat	V	50.10	30%	-10.46	39.6	53.8	**14.2**	21.03
"	"	"	H	42.51	50%	-6.02	36.5	53.8	**17.3**	"
"	"	"	"	37.09	80%	-1.94	35.2	53.8	**18.6**	"
864	"	side	V	33.38	30%	-10.46	22.9	53.8	**30.9**	24.82
"	"	"	"	28.17	50%	-6.02	22.2	53.8	**31.6**	"
"	"	"	"	22.66	80%	-1.94	20.7	53.8	**33.1**	"
1152	"	flat	H	31.63	30%	-10.46	21.2	54.0	**32.8**	20.80
"	"	"	"	29.79	50%	-6.02	23.8	54.0	**30.2**	"
"	"	"	"	30.41	80%	-1.94	28.5	54.0	**25.5**	"
1440	"	end	H	37.6	30%	-10.46	27.1	54.0	**26.9**	22.13
"	"	"	"	35.2	50%	-6.02	29.2	54.0	**24.8**	"
"	"	"	"	34.9	80%	-1.94	33.0	54.0	**21.0**	"
1728	"	end	H	33.7	30%	-10.46	23.2	54.0	**30.8**	23.47
"	"	"	"	33.1	50%	-6.02	27.1	54.0	**26.9**	"
"	"	"	"	32.9	80%	-1.94	31.0	54.0	**23.0**	"
2016	"	end	H	32.3	30%	-10.46	21.8	54.0	**32.2**	24.60
"	"	"	"	31.5	50%	-6.02	25.5	54.0	**28.8**	"
"	"	"	"	30.7	80%	-1.94	28.8	54.0	**25.2**	"
2304	"	-	H	31.5*^{NF}	30%	-10.46	<21.0	54.0	**>33.0**	25.41
"	"	-	"	30.7*^{NF}	50%	-6.02	<24.7	54.0	**>29.3**	"
"	"	-	"	31.5*^{NF}	80%	-1.94	<29.6	54.0	**>24.4**	"
2592	"	-	H	31.8*^{NF}	30%	-10.46	<21.3	54.0	**>32.7**	26.17
"	"	-	"	32.3*^{NF}	50%	-6.02	<26.3	54.0	**>27.7**	"
"	"	-	"	32.1*^{NF}	80%	-1.94	<30.2	54.0	**>23.8**	"
2880	"	-	H	32.2*^{NF}	30%	-10.46	<21.7	54.0	**>32.3**	26.98
"	"	-	"	32.3*^{NF}	50%	-6.02	<26.3	54.0	**>27.7**	"
"	"	-	"	32.0*^{NF}	80%	-1.94	<30.1	54.0	**>23.9**	"

*^{NF} indicates these data numbers are the noise floor of the measurement system
The are no detectable spurious emissions associated with the digital portion of the CB2OHHL3.

DUT Tuned to transmit at 310MHz

Freq. MHz	unit ID	DUT position	Ant. Pol.	Corrected Data Peak Detector dBuV/m	Duty Cycle %	Duty Cycle Factor dB	Calculated Average Level dBuV/m	FCC Limit dBuV/m	Margin dB	Cable +Ant. Factor dB+dB/m
620	GMT	flat	H	43.43	30%	-10.46	33.0	55.3	**22.3**	21.73
"	"	"	"	37.61	50%	-6.02	31.6	55.3	**23.7**	"
"	"	"	"	33.71	80%	-1.94	31.8	55.3	**23.5**	"
620	W220	flat	H	47.89	30%	-10.46	37.4	55.3	**17.9**	21.73
"	"	"	"	41.46	50%	-6.02	35.4	55.3	**19.9**	"
"	"	"	"	37.37	80%	-1.94	35.4	55.3	**19.9**	"
930	"	flat	H	29.94	30%	-10.46	19.5	55.3	**35.8**	25.34
"	"	side	"	21.43	50%	-6.02	15.4	55.3	**39.9**	"
"	"	"	"	21.18	80%	-1.94	19.2	55.3	**36.1**	"
1240	"	side	H	29.54	30%	-10.46	19.1	54.0	**31.9**	21.24
"	"	end	"	29.47	50%	-6.02	23.4	54.0	**30.6**	"
"	"	"	"	29.03	80%	-1.94	27.1	54.0	**26.9**	"
1550	"	flat	H	38.52	30%	-10.46	28.1	54.0	**25.9**	22.65
"	"	"	"	37.52	50%	-6.02	31.5	54.0	**22.5**	"
"	"	end	"	37.61	80%	-1.94	35.7	54.0	**18.3**	"
1860	"	end	H	32.00	30%	-10.46	21.5	55.3	**33.8**	24.01
"	"	"	"	32.29	50%	-6.02	26.3	55.3	**29.0**	"
"	"	"	"	33.30	80%	-1.94	31.4	55.3	**23.9**	"
2170	"	flat	H	32.75	30%	-10.46	22.3	55.3	**33.0**	25.07
"	"	"	"	31.65	50%	-6.02	25.6	55.3	**29.7**	"
"	"	"	"	31.61	80%	-1.94	29.7	55.3	**25.6**	"
2480	"	-	H	32.5*^{NF}	30%	-10.46	<22.0	55.3	**>33.3**	25.83
"	"	-	"	32.7*^{NF}	50%	-6.02	<26.7	55.3	**>28.6**	"
"	"	-	"	32.2*^{NF}	80%	-1.94	<30.3	55.3	**>25.0**	"
2790	"	-	H	34.2*^{NF}	30%	-10.46	<23.7	54.0	**>30.3**	26.74
"	"	-	"	33.7*^{NF}	50%	-6.02	<27.7	54.0	**>26.3**	"
"	"	-	"	33.9*^{NF}	80%	-1.94	<32.0	54.0	**>22.0**	"
3100	"	-	H	32.9*^{NF}	30%	-10.46	<22.4	54.0	**>31.6**	28.34
"	"	-	"	34.7*^{NF}	50%	-6.02	<28.7	54.0	**>25.3**	"
"	"	-	"	34.6*^{NF}	80%	-1.94	<32.7	54.0	**>21.3**	"

*^{NF} indicates these data numbers are the noise floor of the measurement system
The are no detectable spurious emissions associated with the digital portion of the CB2OHHL3.

DUT Tuned to transmit at 418MHz

Freq. MHz	unit ID	DUT position	Ant. Pol.	Corrected Data Peak Detector dBuV/m	Duty Cycle %	Duty Cycle Factor dB	Calculated Average Level dBuV/m	FCC Limit dBuV/m	Margin dB	Cable +Ant. Factor dB+dB/m
836	GMT	flat	H	50.96	30%	-10.46	40.5	60.3	**19.8**	24.62
"	"	"	"	44.85	50%	-6.02	38.8	60.3	**21.5**	"
"	"	"	"	39.87	80%	-1.94	37.9	60.3	**22.4**	"
836	W220	flat	H	48.30	30%	-10.46	37.8	54.0	**16.2**	24.62
"	"	"	"	43.00	50%	-6.02	37.0	54.0	**17.0**	"
"	"	"	"	38.67	80%	-1.94	36.7	54.0	**17.3**	"
1254	"	flat	H	39.0	30%	-10.46	28.5	54.0	**25.5**	21.31
"	"	end	"	37.1	50%	-6.02	31.1	54.0	**22.9**	"
"	"	"	"	37.4	80%	-1.94	35.5	54.0	**18.5**	"
1672	"	end	H	39.2	30%	-10.46	28.7	54.0	**25.3**	23.23
"	"	"	"	37.2	50%	-6.02	31.2	54.0	**22.8**	"
"	"	"	"	37.2	80%	-1.94	35.3	54.0	**18.7**	"
2090	"	flat	H	36.6	30%	-10.46	26.1	60.3	**34.2**	24.83
"	"	"	"	36.0	50%	-6.02	30.0	60.3	**30.3**	"
"	"	"	"	35.7	80%	-1.94	33.8	60.3	**26.5**	"
2508	"	-	H	31.7*^{NF}	30%	-10.46	21.2	60.3	**39.1**	25.91
"	"	end	"	33.3	50%	-6.02	27.3	60.3	**33.0**	"
"	"	-	"	33.2*^{NF}	80%	-1.94	<31.3	60.3	**>29.0**	"
2926	"	flat	H	33.3*^{NF}	30%	-10.46	<22.8	60.3	**>37.5**	27.10
"	"	"	"	33.0*^{NF}	50%	-6.02	<27.0	60.3	**>33.3**	"
"	"	-	"	33.7*^{NF}	80%	-1.94	<31.8	60.3	**>28.5**	"
3344	"	-	H	36.4*^{NF}	30%	-10.46	<25.9	60.3	**>34.4**	30.71
"	"	-	"	36.7*^{NF}	50%	-6.02	<30.7	60.3	**>29.6**	"
"	"	-	"	36.8*^{NF}	80%	-1.94	<34.9	60.3	**>25.4**	"
3762	"	-	H	36.8*^{NF}	30%	-10.46	<26.3	54.0	**>27.7**	31.51
"	"	-	"	37.3*^{NF}	50%	-6.02	<31.3	54.0	**>22.7**	"
"	"	-	"	37.3*^{NF}	80%	-1.94	<35.4	54.0	**>18.6**	"
4180	"	-	H	37.4*^{NF}	30%	-10.46	<26.9	54.0	**>27.1**	31.42
"	"	-	"	37.8*^{NF}	50%	-6.02	<31.8	54.0	**>22.2**	"
"	"	-	"	37.1*^{NF}	80%	-1.94	<35.2	54.0	**>18.8**	"

*^{NF} indicates these data numbers are the noise floor of the measurement system
The are no detectable spurious emissions associated with the digital portion of the CB2OHHL3.

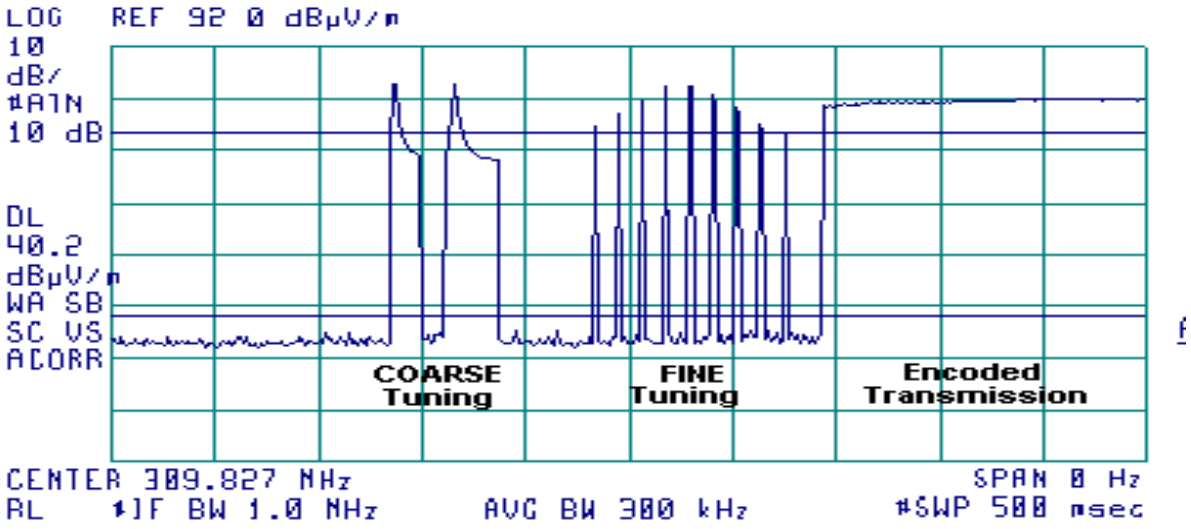
Calculation of Field Strength of Tuning Pulses: [15.231(b)], 15.31(c)]

The tuning pulses are generated each time the CB2OHHL3 is activated.

The tuning pulse sequence is: During the first 100mSec of activation two pulses of a 'coarse' tune. During the second 100mSec of activation are nine pulses of a 'fine' tune. At approximately 200mSec after activation the encoded transmission begins.

The signal levels of the tuning pulses were maximized by maximizing the signal levels of the pulse modulated transmission. The antenna height and turntable azimuth for maximum emission levels were adjusted while measuring the field strength of the pulse modulated transmissions.

A typical tuning pulse sequence is presented in this figure below.



To determine level of the tuning pulses for comparison to the limits, the following procedure was used.

MEASUREMENT PROCEDURE:

1. The EUT was trained to each of the three test frequencies at 30% duty cycle of the 500Hz modulating pulse.
2. The HP8456A EMI Receiver was adjusted to a fundamental frequency and set at 0Hz span, with 1MHz IF Bandwidth.
3. The trigger level was adjusted to capture the pulses of interest.
4. The EUT was activated and a single trace recorded on the Receiver in order to capture the tuning pulses.
5. The captured trace was digitally stored. The stored data points (400 data points for a full screen trace) were then used in calculations to determine the levels of the pulses.

CALCULATION OF THE FIELD STRENGTH OF THE TUNING PULSES.[15.35(c)]

Pursuant to 47 CFR 15.35(c), the field strength is determined by averaging over ONE complete pulse train up to 100mSec, including blanking intervals.

1. First was determined the number of data points captured which represented 100mSec span of time. There are 400 data points stored for one complete trace. The scan rate of the HP8546A receiver was set to capture the tuning pulses.

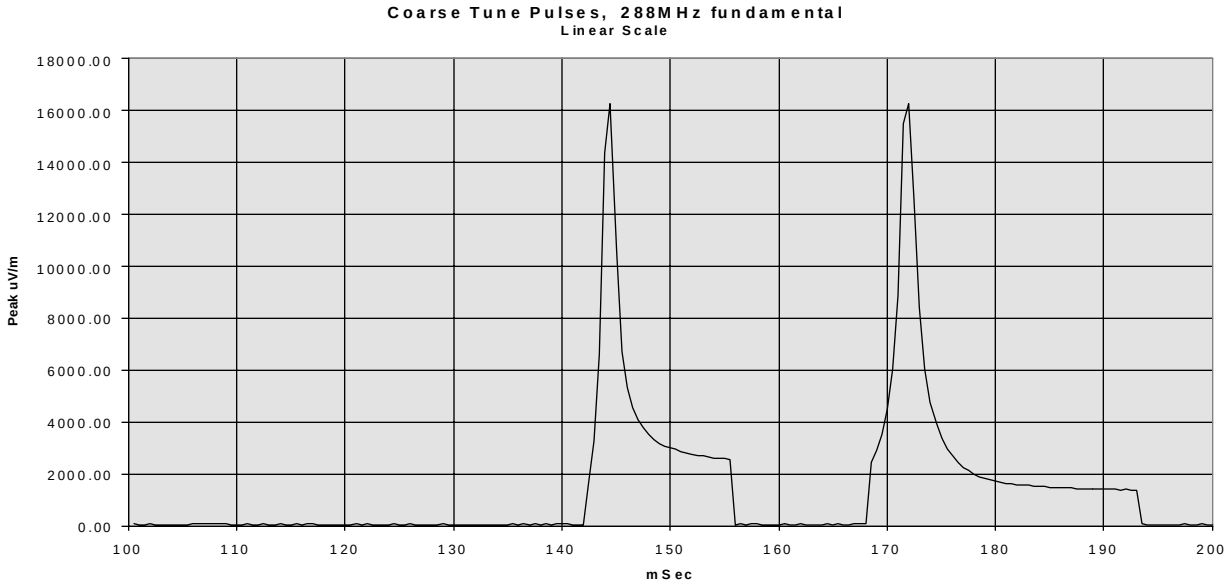
   Therefore: Number of data points per 100mSec
   = 100mSec * (400pts/scan) / (No. of mSec/scan).
   Example: If the scan rate is set at 240mSec, then the number of data points per 100mSec is 100mSec * (400pts / 240mSec) = 167 pts.

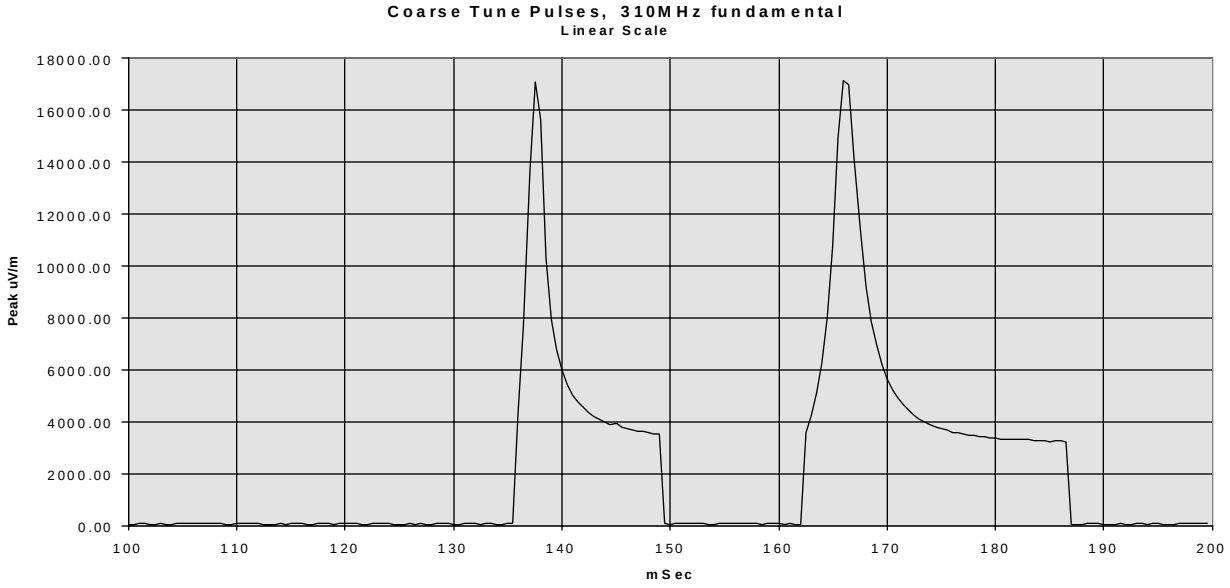
2. The AVERAGE field strength level (uV/m) within the 100mSec is then determined by dividing SUM of the levels (uV/m) of all data points by the number of data points.

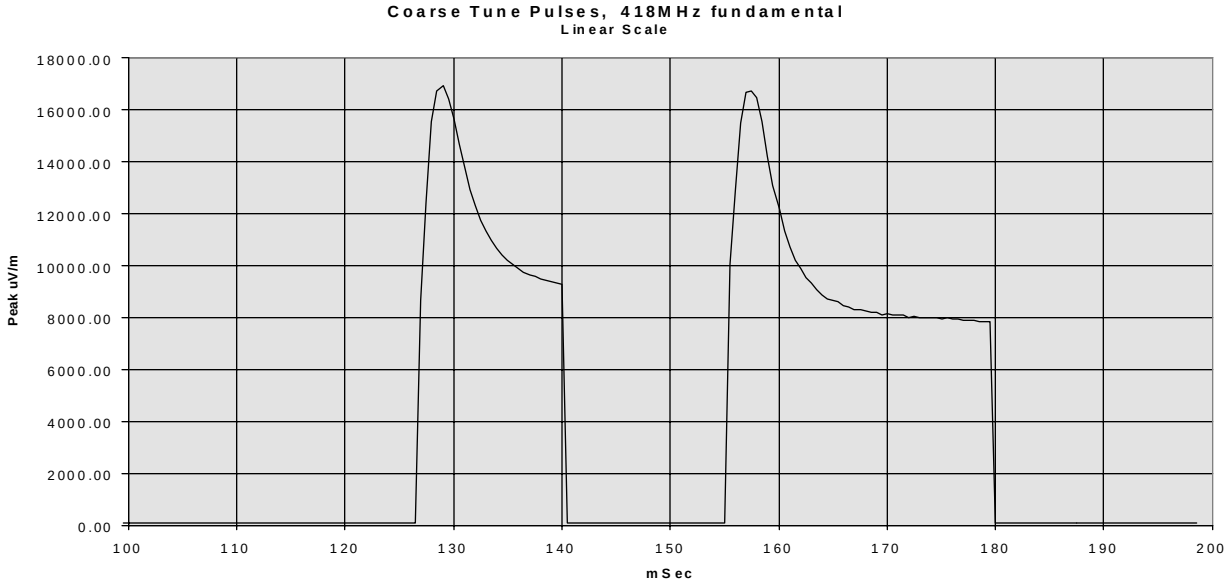
   Formula 3: Average Field Intensity

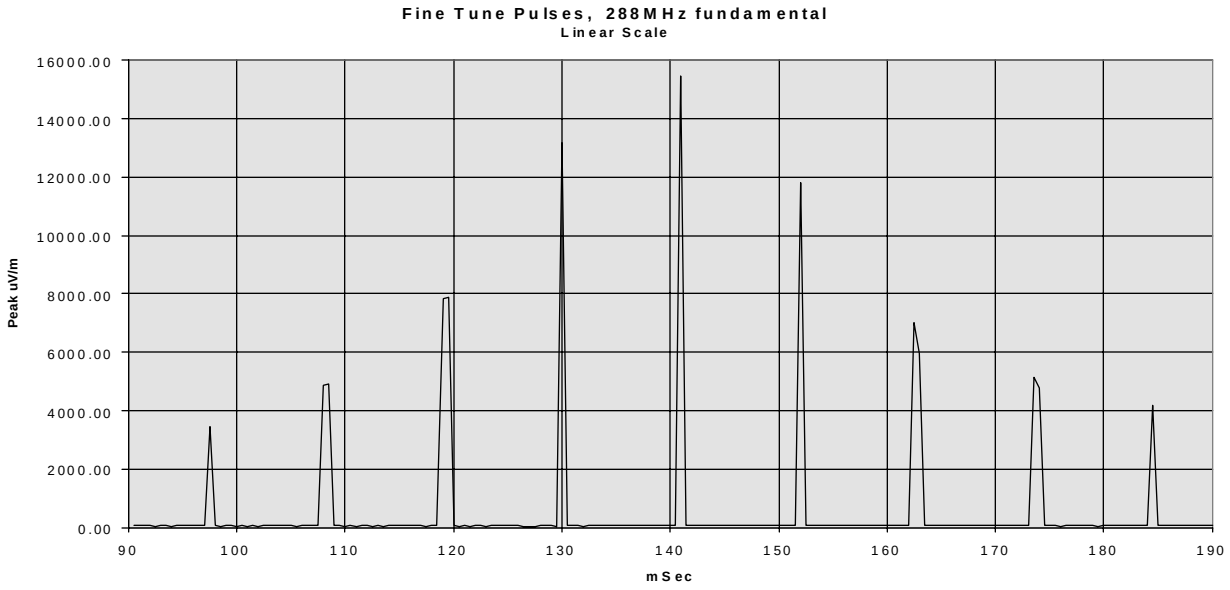
$$\text{Avg. F.I.} = \frac{\sum_{n=1}^{\text{no. of data pts}} (\text{Level}_n)\text{uV/m}}{\text{(number of data points)}}$$

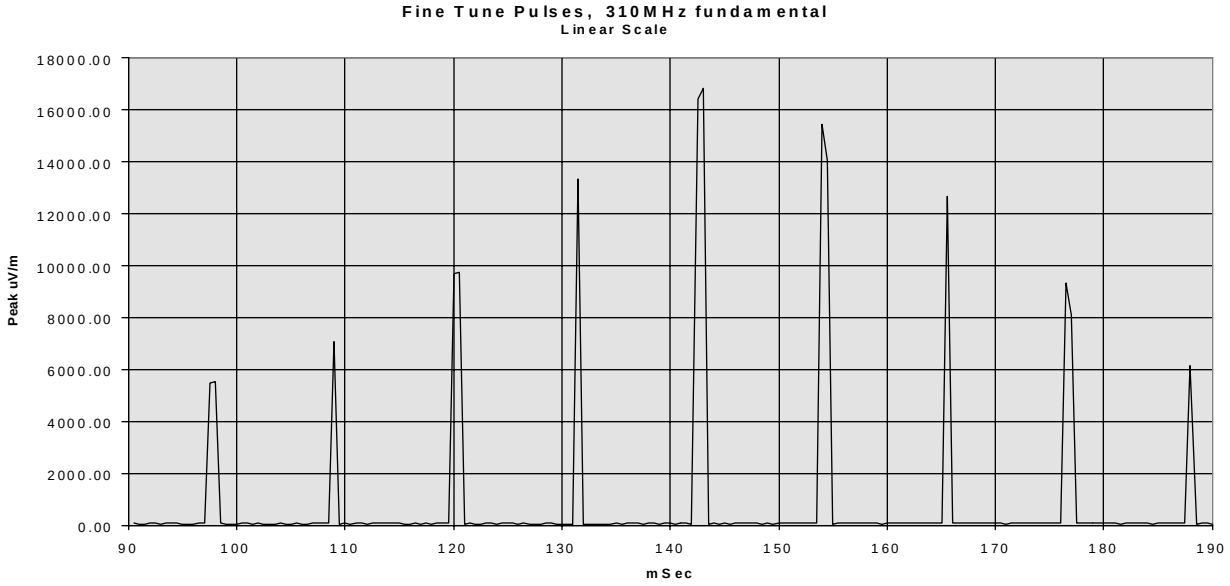
The charts that follow are the reproduction of the coarse tune pulse traces using number of data points representing 100mSec sweep time from the screen display of the HP8546A EMI receiver.

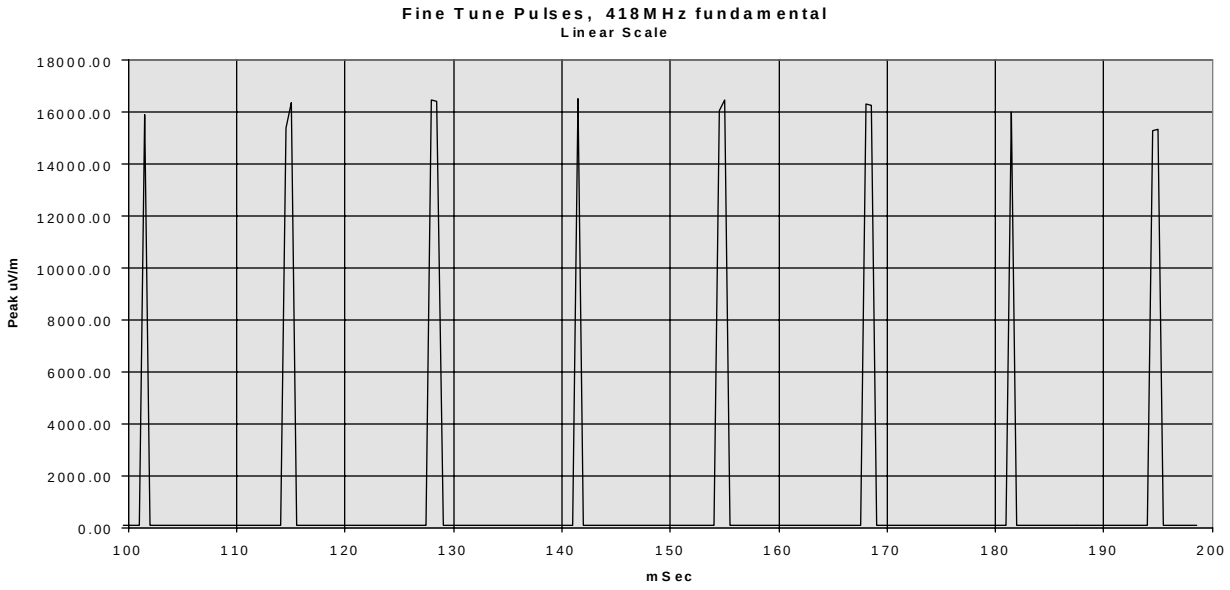



Coarse Tune Pulses, 310MHz fundamental
Linear Scale
Peak uV/m
18000.00
16000.00
14000.00
12000.00
10000.00
8000.00
6000.00
4000.00
2000.00
0.00
100
110
120
130
140
150
160
170
180
190
200
mSec


Coarse Tune Pulses, 418MHz fundamental
Linear Scale
Peak uV/m
18000.00
16000.00
14000.00
12000.00
10000.00
8000.00
6000.00
4000.00
2000.00
0.00
100
110
120
130
140
150
160
170
180
190
200
mSec


Fine Tune Pulses, 288MHz fundamental
Linear Scale
16000.00
14000.00
12000.00
10000.00
8000.00
6000.00
4000.00
2000.00
0.00
Peak uV/m
90
100
110
120
130
140
150
160
170
180
190
mSec


Fine Tune Pulses, 310MHz fundamental
Linear Scale
18000.00
16000.00
14000.00
12000.00
10000.00
8000.00
6000.00
4000.00
2000.00
0.00
Peak uV/m
90
100
110
120
130
140
150
160
170
180
190
mSec



The raw data used in calculating the average field intensity of the tuning pulses are presented in the Appendix of this test report.

COARSE TUNE PULSES, Calculated average over 100mSec

TX Freq. (MHz)	SUM of the levels of all data points in 100mSec span (uV/m)	Number of Data points in 100mSec span N	Average SUM/N (uV/m)	LIMIT (uV/m)	MARGIN (dB)
288	288,530	200	1443	4917	**10.7**
310	438,339	200	2192	5833	**8.5**
418	800,812	200	4004	10333	**8.2**

FINE TUNE PULSES, Calculated average over 100mSec

TX Freq. (MHz)	SUM of the levels of all data points in 100mSec span (uV/m)	Number of Data points in 100mSec span N	Average SUM/N (uV/m)	LIMIT (uV/m)	MARGIN (dB)
288	106,219	200	531	4917	**19.3**
310	160,279	200	801	5833	**17.2**
418	222,835	200	1114	10333	**19.3**