Exhibit 18: Test Report – Unit 2

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Exhibit 18.0 : REPORT OF MEASUREMENTS – UNIT 2

18.1 General Test Procedures

18.1.1 In General

The test procedures used in determining compliance with applicable FCC regulations were in accordance with applicable FCC test procedure requirements, and more specifically, with ANSI C63.4.[1] All measurements were performed using the peak, CISPR quasi-peak, or average detector function of the test receiver or spectrum analyzer. The detector bandwidths were as follows:

1. Frequencies Range - 10kHz to 150kHz
   Quasi-Peak : 200 Hz
   Peak : 200 Hz
   Average : 200 Hz
2. Frequency Range - 150kHz to 30kHz
   Quasi-Peak : 9 kHz
   Peak : 10 kHz
   Average : 10 kHz
3. Frequency Range - 30MHz to 1GHz
   Quasi-Peak : 120 kHz
   Peak : 100 kHz
   Average : 100 kHz
4. Frequency Range - > 1GHz
   Quasi-Peak : N/A
   Peak : 1 MHz
   Average : 1 MHz

- Measurement Detector Functions and Bandwidths - **§ 15.35**
  The conducted and radiated emission limits presented in 47 CFR Part 15 are based on the following, unless other wise specified elsewhere in this part:
  (a) Frequencies below 1 GHz: **Quasi-Peak Detector**; Bandwidth – 120 kHz;
  (b) Frequencies above 1 GHz: **Average Detector**; Bandwidth – 1 MHz;
  Please note that there is also a limit on the radio frequency emissions, as measured using a **Peak Detector** function, corresponding to **20dB above the maximum permitted average limit** for the frequency being investigated.

[1] ANSI, *Methods of Measurement of Radio-Noise Emissions form Low-Voltage Electrical Equipment in the Range of 9kHz to 40GHz*, C63.4 (1992).

18.1.2 TEST EQUIPMENT

The tables below present the test equipment used to collect the data present in this exhibit:

DESCRIPTION	MANUFACTURER	MODEL	LAST CAL	CAL DUE	START FREQUENCY	STOP FREQUENCY
RECEIVER I	Rohde & Schwarz	ESMI	**06-22 -99**	06-22-00	20 Hz	26.5 GHz
RECEIVER II	Rohde & Schwarz	ESMI	**07-23-99**	07-23-00	20 Hz	26.5 GHz
Receiver	Rohde & Schwarz	ESVP	**N/A**	N/A	20 MHz	1.3 GHz
BiLog Antenna	Chase 1044	CBL6111	**02-15-99**	02-15-00	20 MHz	2.0 GHz
Horn Antenna	Spectrum Tech.	DRH-0118	**01-03-99**	01-03-00	1 GHz	25 GHz
Antenna Mast	EMCO	1050	**N/A**	N/A	N/A	N/A
Turntable	Macton		**N/A**	N/A	N/A	N/A
Antenna Mast	CTL	N/A	**N/A**	N/A	N/A	N/A
LISN	CHASE	ALN2070A	**08-24-99**	08-24-00	0 Hz	30 MHz
PULSE LIMITER	CHASE	CFL9206	**N/A**	N/A	0 Hz	30 MHz

18.2 Peak Transmit Power

18.2.1 Controlling FCC Regulation - § 15.247(b)(1)

The FCC limits the maximum peak output power of spread spectrum intentional radiators that use:

- a frequency hopping system;
- operating in the 2400-2483.5 MHz band;

to 1 watt.

The EUT described in this report, however, is to be certified as an RF MODULE, not a complete system. Consequently, due to safety concerns, the FCC limits the maximum peak output power (for RF Modules) to 250 mWatts.

18.2.2 Test Procedure

The following Test Procedures / Measurement Standards were followed:

- Direct Connection
  The EUT's antenna port was connected directly to the input of a Rohde & Swartz EMI analyzer via a short Cable. The EUT has two antenna ports labeled Port 0 and Port 1. Each port was tested.

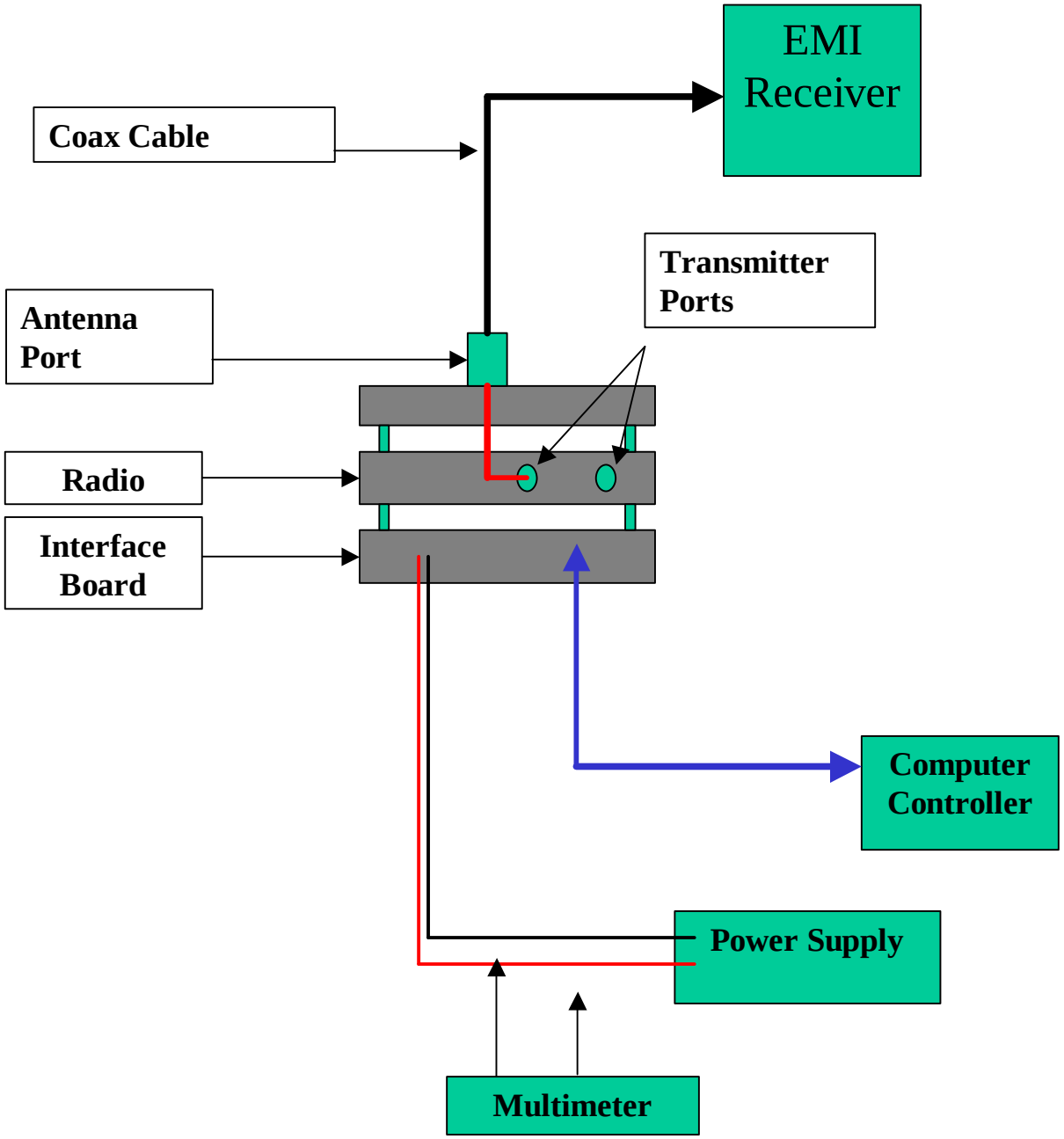
- Hopping Turned Off - **§ 15.31(c)**
  For swept frequency equipment, measurements shall be made with the frequency sweep stopped at those frequencies chosen for the measurements to be reported.

- Number of Test Frequency - **§ 15.31(m)**
  Measurements at three different frequencies are required on intentional radiators or receivers, other than TV broadcast receivers, that have a frequency range of operation of more than 10 MHz: (1) one near the top, (2) one near the middle, (3) one near the bottom.

- The EUT in this report transmits over a frequency range of approximately 80 MHz (2.4005 GHz to 2.4820 GHz). **Consequently, the output power will be measured at the following frequencies: (1) 2.4820 GHz, (2) 2.4405 GHz, (3) 2.4005 GHz.**

- Supply Voltage Variation - **§ 15.31(e)**
  For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. The supply voltage for the module is 5.0 Volts dc. **Consequently, the supply voltage shall be varies from 4.25 Volts to 5.75 Volts.**

18.2.3 Test Setup Block Diagram



18.2.4 Test Results – Peak Transmit Power

Test Date: January 12, 2000
Equipment Under Test: OverAir Solutions OS2400
Manufacturer: Locus Incorporated

Conversion Formulas

- $P_{dBm} = 30 + 10 \times Log_{10}(P_{Watts})$;
- $P_{(watts)} = 10^{[(P_{dbm} - 30)/10]}$;
- $P_{(dBm)} + 107 = V_{(dB\mu V)}$;

Fundamental Frequency (GHz)	EUT Transmitter Port	Measurement (dBm)	Measurement (dBµV)	Converted To (Watts)	FCC Limit (Watts)
2.4005	0	23.61	130.6	0.230	0.250
2.4405	0	22.95	130.0	0.200	0.250
2.4820	0	22.74	129.7	0.190	0.250
2.4010	1	23.28	130.3	0.210	0.250
2.4410	1	22.95	130.0	0.200	0.250
2.4810	1	22.59	129.6	0.180	0.250

18.2.5 Test Results – Supply Voltage Variations

Test Date: January 12, 2000
Equipment Under Test: OverAir Solutions OS2400
Manufacturer: Locus Incorporated

TEST PARAMATERS
The manufacturer specifications require a 5.0 Vdc supply voltage for the module.
Consequently, the supply voltage shall be varied from 4.25 Volts to 5.75 Volts (from 85% to 115%).

Voltage Level (Vdc)	Port 0 – Output Power (dBm)			Port 1 – Output Power (dBm)		
	2.4005 (GHz)	2.4405 (GHz)	2.4820 (GHz)	2.4010 (GHz)	2.4410 (GHz)	2.4810 (GHz)
4.25	22.54	20.76	21.47	21.83	21.68	21.27
4.40	23.20	22.26	21.68	23.05	22.39	21.98
4.60	23.28	22.56	22.03	23.17	22.59	22.21
4.80	23.50	22.79	22.26	23.20	22.74	22.39
5.00	**23.61**	**22.95**	**22.74**	**23.28**	**22.95**	**22.59**
5.20	23.73	23.10	22.72	23.30	23.10	22.77
5.40	23.89	23.20	22.97	23.38	23.07	22.97
5.60	23.81	23.10	23.17	23.40	23.10	23.12
5.75	23.96	23.12	23.30	23.96	23.10	23.22

Port 0 : Software Power Code : 40
Port 1 : Software Power Code : 40

(Software Power Code can be changed from 10 to 63)

The manufacturer shall individually calibrate each module so that varying the supply voltage does not allow the module to transmit above 24 dBm. The end user cannot change the power code set by the manufacturer.

18.3 Bandwidth (20dB) & Adjacent Channel Separation

18.3.1 Controlling FCC Regulation - §15.247(a)(1)

Operation under the provisions of §15.247 is limited to frequency hopping and direct sequence spread spectrum intentional radiators that comply with the following provisions:

- Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, **whichever is greater**. [§15.247(a)(1)];

- The maximum 20dB bandwidth of the hopping channel is 1 MHz; [§15.247(a)(1)(ii)];

Consequently, one must determine the transmitter's 20dB bandwidth to determine if the transmitter complies with the channel separation requirements of §15.247.

18.3.2 Test Procedure

The following Test Procedures / Measurement Standards were followed:

- Direct Connection
  The EUT's antenna port was connected directly to the input of a Rohde & Swartz EMI analyzer via a short Cable. The EUT has two antenna ports labeled Port 0 and Port 1. Each port was tested.
- Hopping Turned Off - **§ 15.31(c)**
  For swept frequency equipment, measurements shall be made with the frequency sweep stopped at those frequencies chosen for the measurements to be reported.

- **Bandwidth Measurement Only**
  Number of Test Frequencies - **§ 15.31(m)**
  Measurements at three different frequencies are required on intentional radiators or receivers, other than TV broadcast receivers, that have a frequency range of operation of more than 10 MHz: (1) one near the top, (2) one near the middle, (3) one near the bottom.

  The EUT in this report transmits over a frequency range of approximately 80 MHz (2.4005 GHz to 2.4820 GHz). **Consequently, the output power will be measured at the following frequencies: (1) 2.482 GHz, (2) 2.4405 GHz, (3) 2.4005 GHz.**

- **Channel Separation Measurement Only**
  The EUT was setup to transmit continuously for the frequency corresponding to Channel One. Next, the transmitter frequency was manually stepped up one Channel to Channel Two.

18.3.3 Test Setup Block Diagram

The test setup block diagram is identical to the test setup block diagram presented on Page 207 of this exhibit.

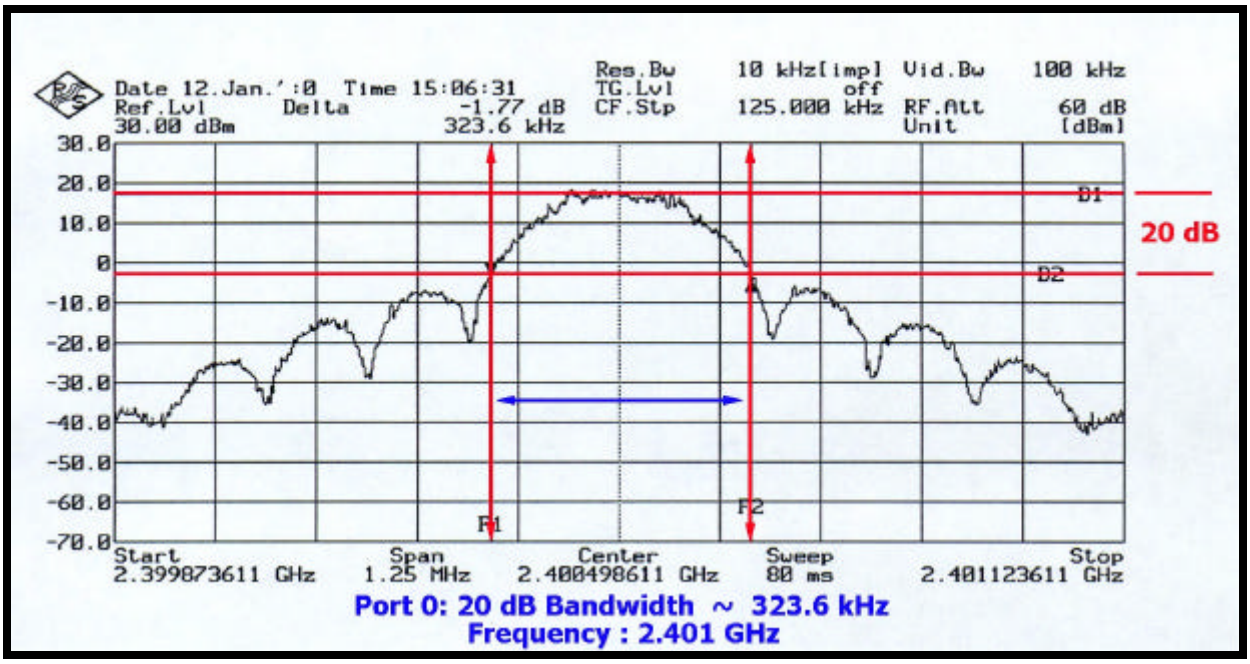
18.3.4 Test Results – Bandwidth (20dB)

Test Date: January 12, 2000
Equipment Under Test: OverAir Solutions OS2400
Manufacturer: Locus Incorporated

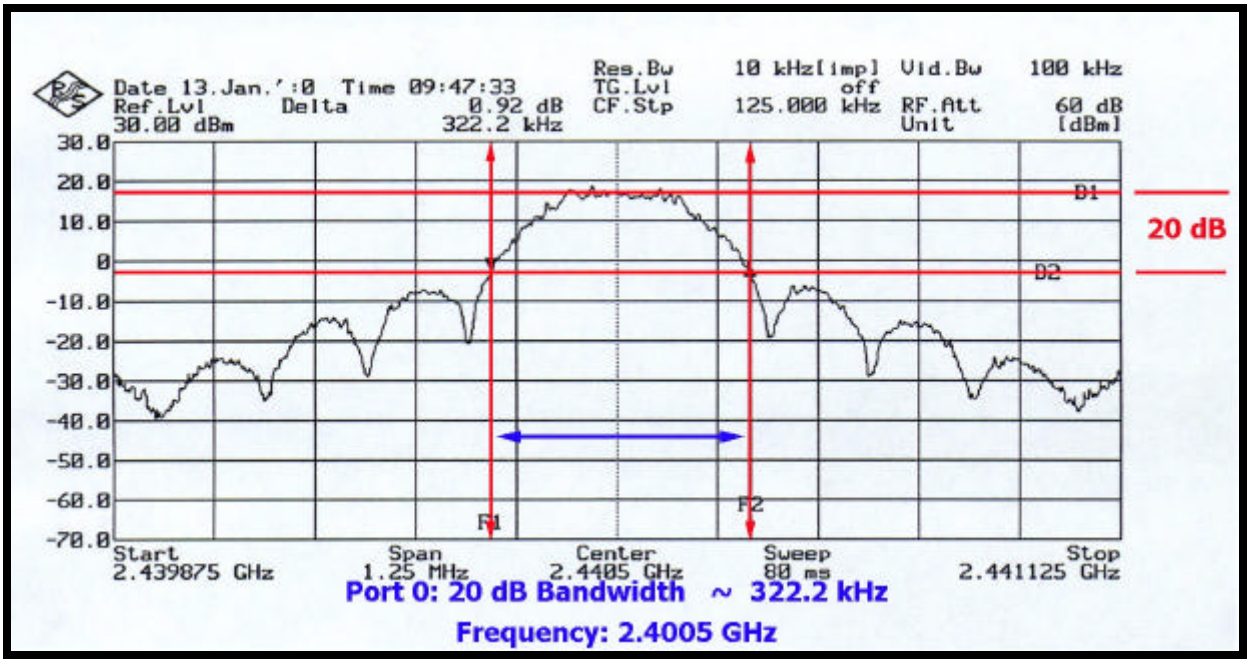
Note: The resolution bandwidth of the test receiver was set to 10 kHz over a frequency span of 1 MHz to 3 MHz.

Fundamental Frequency (GHz)	EUT Transmitter Port	Measured 20dB Bandwidth (MHz)	FCC Limit[2] (MHz)	Measured Bandwidth Complies (Y/N)
2.4005	0	0.3236	1.0	YES
2.4405	0	0.3222	1.0	YES
2.4820	0	0.3222	1.0	YES
2.4005	1	0.3236	1.0	YES
2.4405	1	0.3235	1.0	YES
2.4820	1	0.3197	1.0	YES

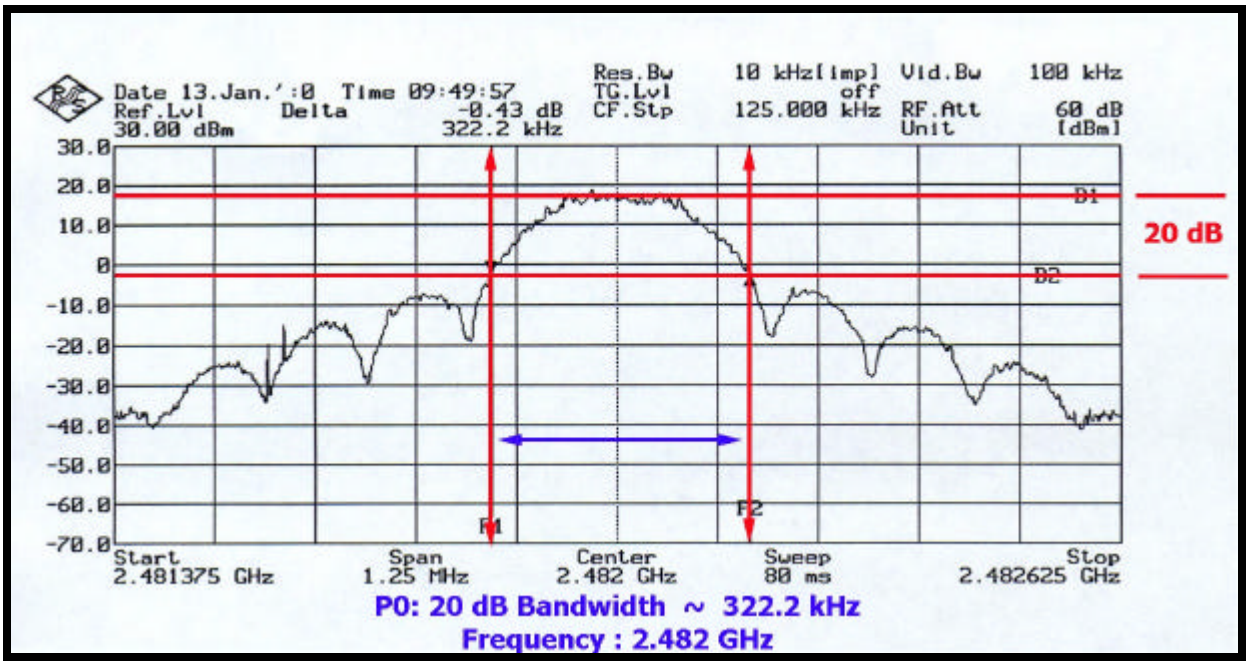
[2] *See* 47 CFR §15.247(a)(1)(ii)



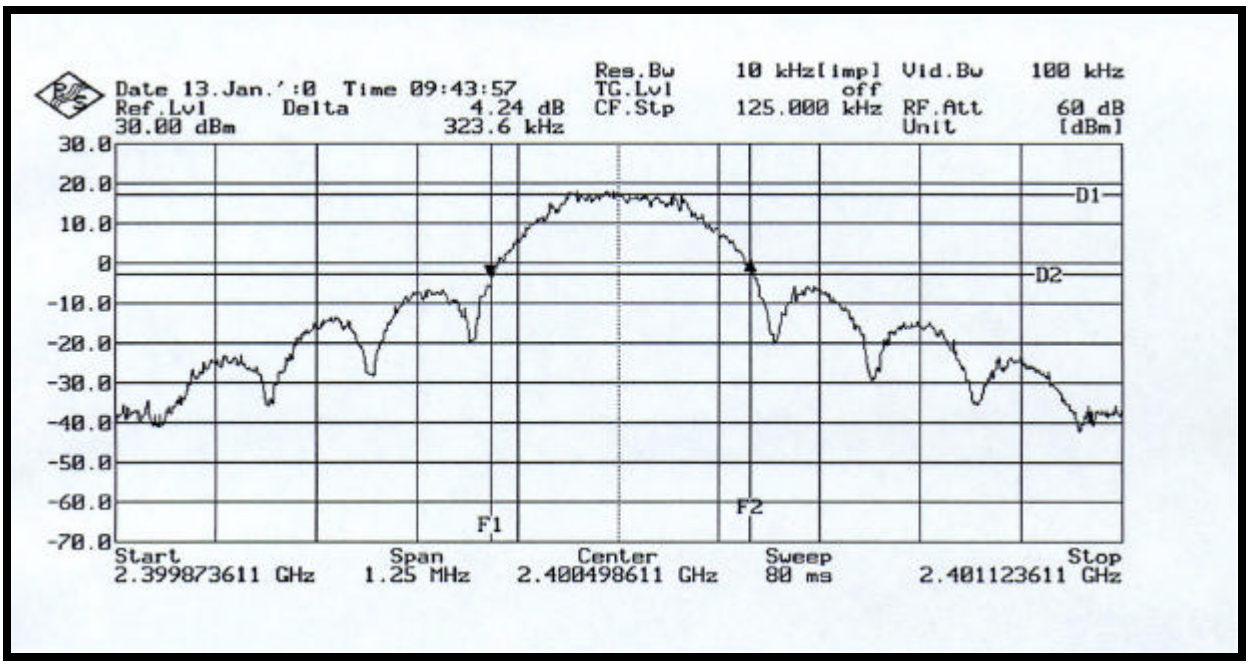
Test Data : Plot – Port 0: Fo = 2.4005 GHz



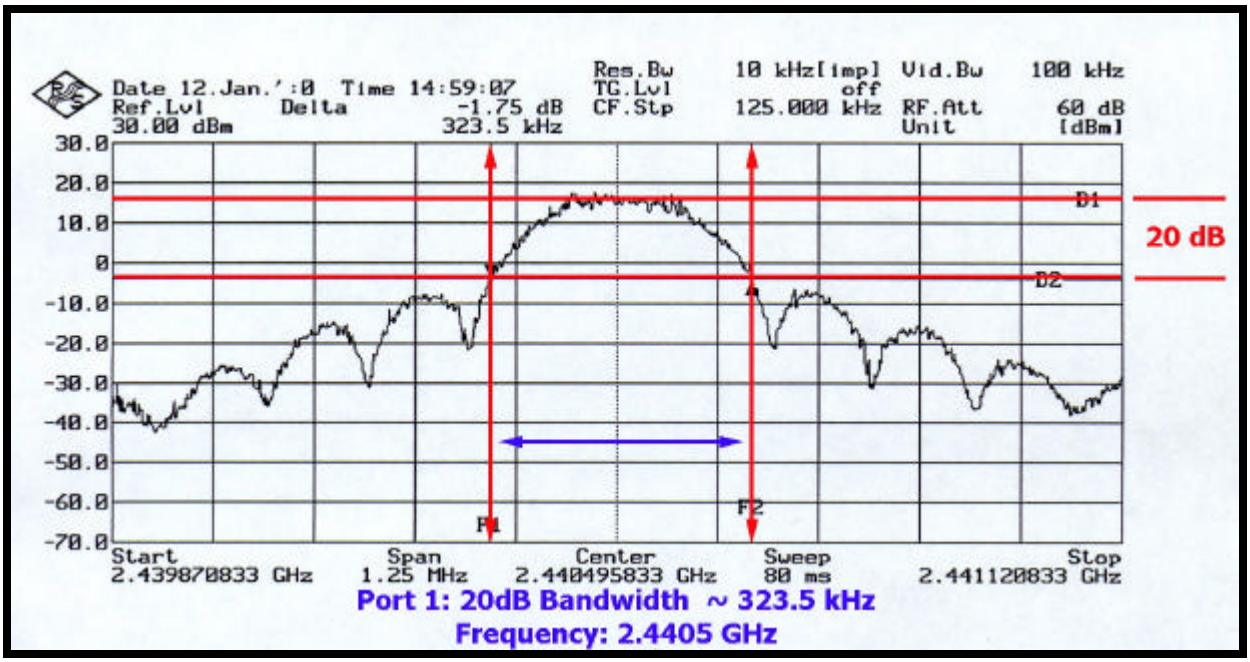
Test Data : Plot – Port 0: Fo = 2.4405 GHz



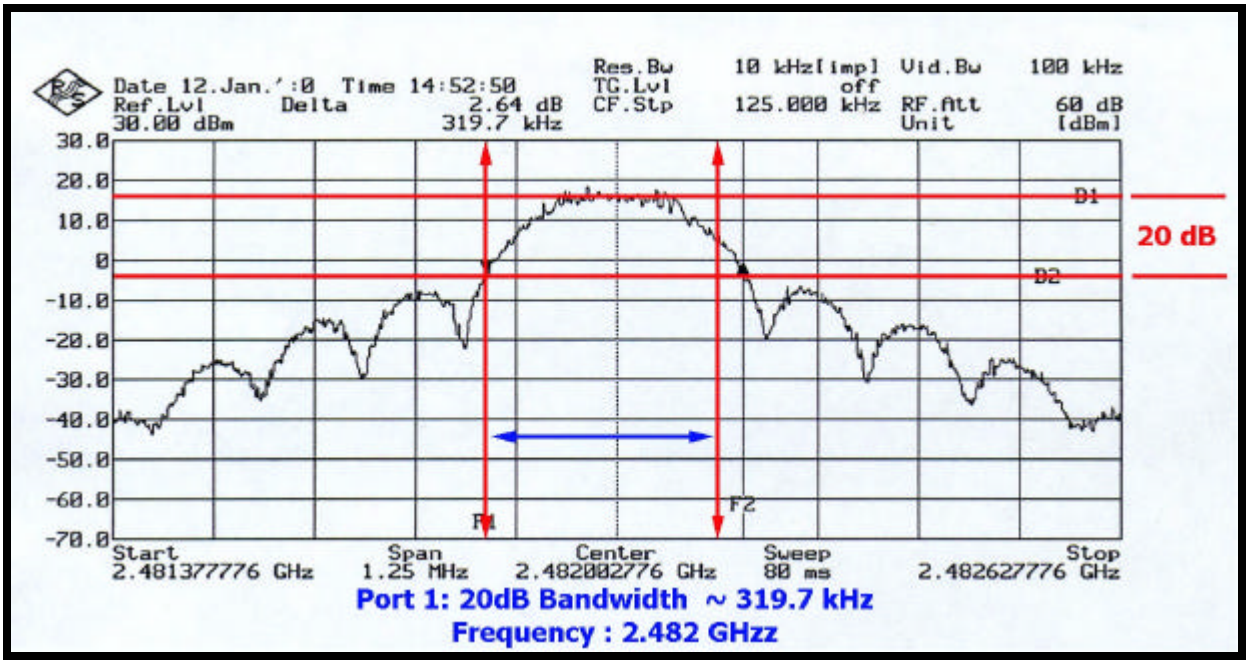
Test Data : Plot – Port 0: Fo = 2.4820 GHz



Test Data : Plot – Port 1: Fo = 2.4005 GHz



Test Data : Plot – Port 1: Fo = 2.4405 GHz



Test Data : Plot – Port 1: Fo = 2.482 GHz

18.3.5 Test Results – Adjacent Channel Separation

Test Date: January 12, 2000
Equipment Under Test: OverAir Solutions OS2400
Manufacturer: Locus Incorporated

Note: The resolution bandwidth of the test receiver was set to 10 kHz over a frequency span of 1 MHz to 2 MHz. [See next page for Plots]

Test Results - Port 0

For Port 0, the adjacent channel separation was measured to be 700 kHz;

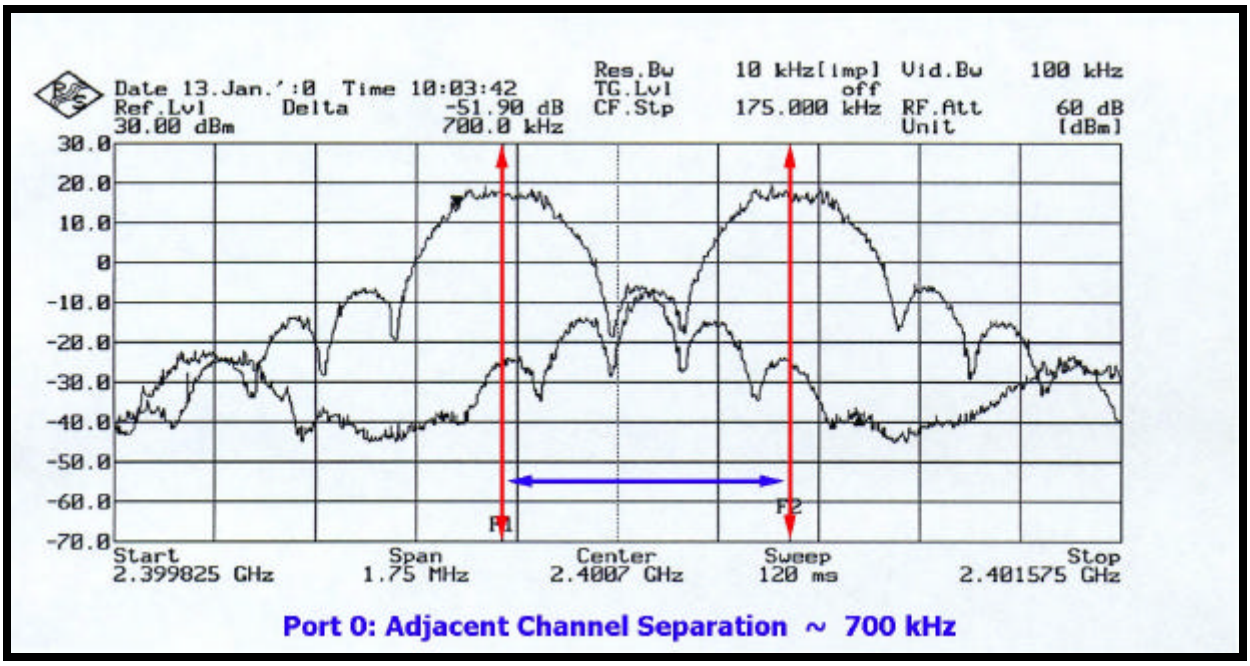
Test Results – Port 1

For Port 1, the adjacent channel separation was measured to be 500 kHz;

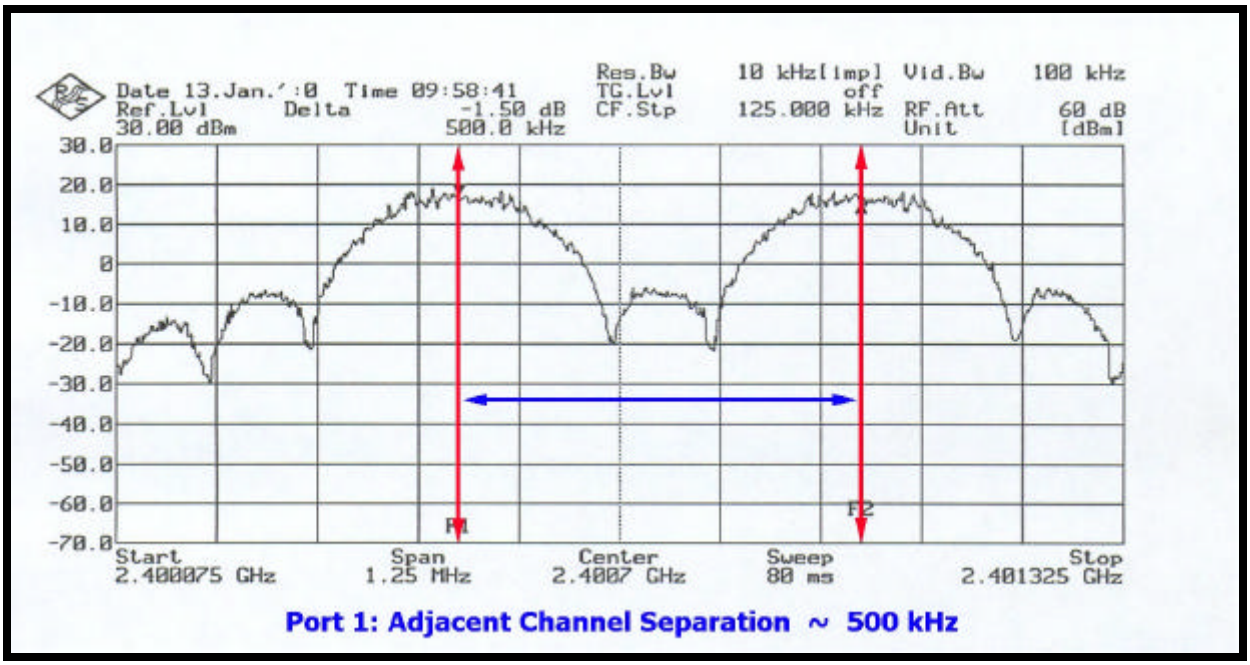
Judgment of Test Results

As stated in Section 18.3.1 of this exhibit, frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, **whichever is greater**. [§15.247(a)(1)]. The 20dB bandwidth proved to be approximately 320kHz, which is less than 495 kHz. In addition, 25 kHz is less than 495 kHz.

The EUT complies with the frequency hopping adjacent channel requirements of §15.247(a)(1).



Test Data : Port 0 – Channels 1 and 2



Test Data : Port 1 – Channels 1 and 2

18.4 Number of Hopping Channels

18.4.1 Controlling FCC Regulation - §15.247(a)(1)(ii)

- Frequency hopping systems operating in the 2400-2483.5 MHz band shall use at least 75 hopping frequencies.

18.4.2 Test Procedure

The following Test Procedures / Measurement Standards were followed:

- Direct Connection
  The EUT's antenna port is connected directly to the input of a Rohde & Swartz EMI analyzer via a short Cable. The EUT has two antenna ports labeled Port 0 and Port 1. Both ports shall be tested.

- The EUT is set to transmit in the normal hopping mode.

- The EMI analyzer START frequency is set to approximately 2.395 GHz and STOP frequency set to approximately 2.484 GHz for a frequency span of 89 MHz. The EMI analyzer's peak detector is used in the Max Hold mode.

18.4.3 Test Setup Block Diagram

The test setup block diagram is identical to the test setup block diagram presented on Page 207 of this exhibit.

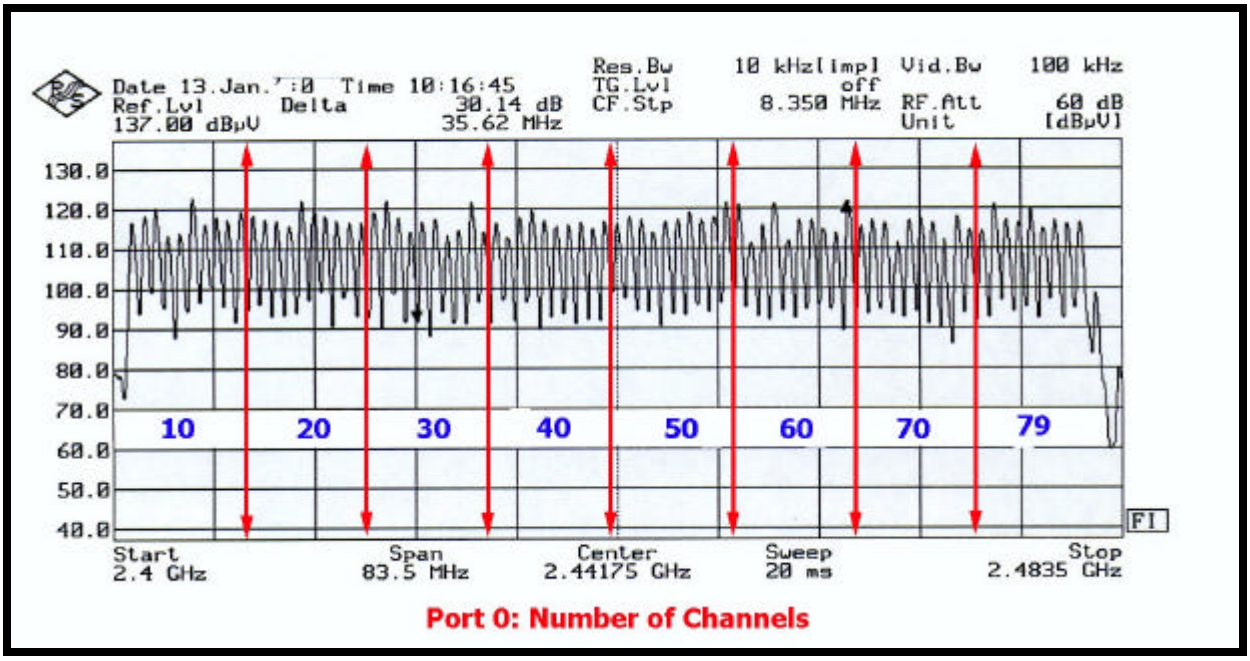
18.4.4 Test Results – Number of Hopping Channels

Test Date: January 12, 2000
Equipment Under Test: OverAir Solutions OS2400
Manufacturer: Locus Incorporated

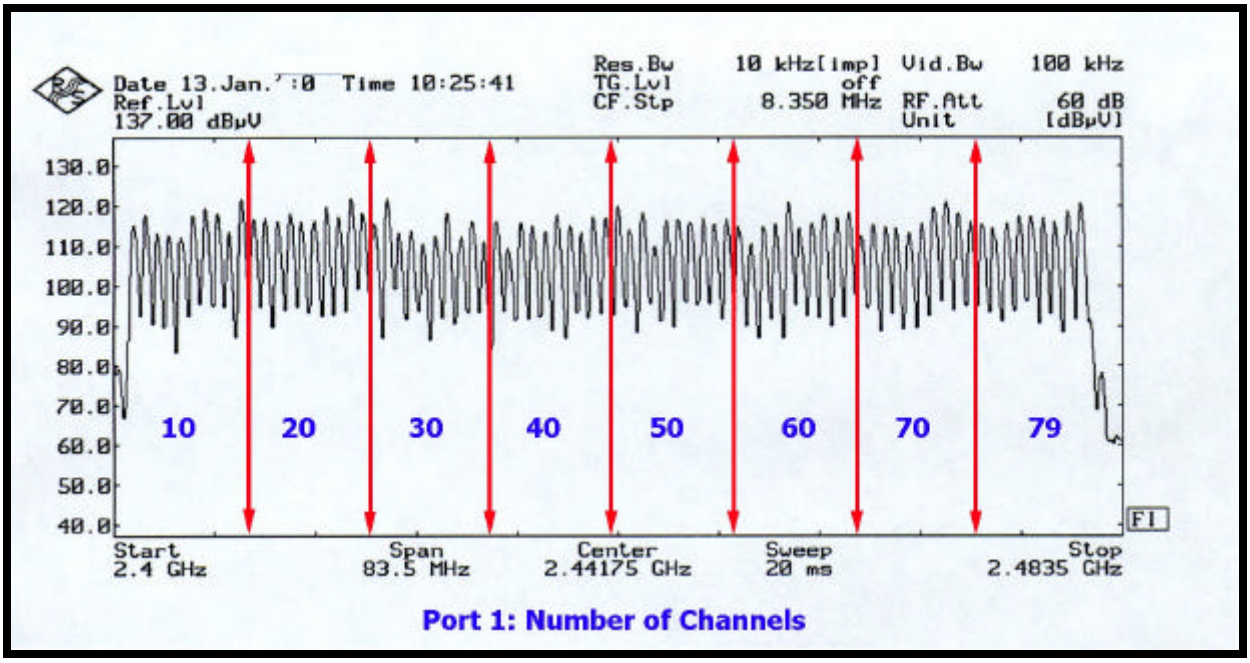
Test Results - Port 0
For Port 0, there were 79 separate hopping channels detected.

Test Results – Port 1
For Port 1, there were 79 separate hopping channels detected.

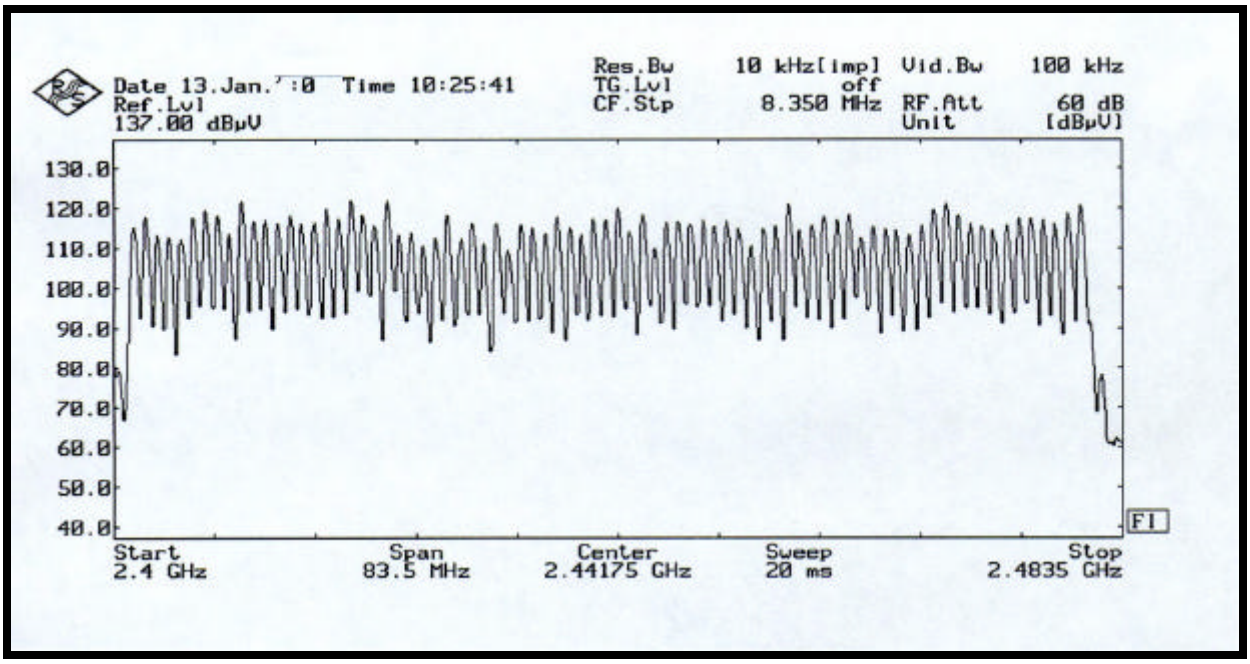
Judgment of Test Results
The EUT complies with the §15.247(a)(1)(ii) requirements for the number of hopping channels used by the EUT.



Test Data : Plot - Number of Hopping Channels – Port 0



Port 1: Number of Channels



Test Data : Plot - Number of Hopping Channels – Port 1

18.5 Average Time of Occupancy Per Channel

18.5.1 Controlling FCC Regulation - §15.247(a)(1)(ii)

- The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

18.5.2 Test Procedure

The following Test Procedures / Measurement Standards were followed:

- Direct Connection
  The EUT's antenna port is connected directly to the input of a Rohde & Swartz EMI analyzer via a short Cable. The EUT has two antenna ports labeled Port 0 and Port 1. Both ports shall be tested.

- The EUT is set to transmit in the normal hopping mode;

- **DWELL TIME**: Set the EMI analyzer to a Zero Frequency Span with the center frequency set to the first channel of the EUT's transmitter band;
- Use the EMI analyzer's Peak Detector in the Max Hold mode;
- Set the appropriate sweep time to capture one complete transmission. This measurement will be called the Dwell Time.

- **TIME BETWEEN TRANSMISSIOINS**: Now increase the sweep time so that two consecutive transmissions are captured. Measure the time between the two transmissions. This measurement will be called the Time Between Transmissions;

18.5.3 Test Setup Block Diagram

The test setup block diagram is identical to the test setup block diagram presented on Page 207 of this exhibit.

18.5.4 Test Results – Average Time of Occupancy

Test Date: January 12, 2000
Equipment Under Test: OverAir Solutions OS2400
Manufacturer: Locus Incorporated

Test Results - Port 0

Dwell Time (DT)
The DT on a particular frequency, while transmitting, was measured to be approximately 4.944ms.

Time Between Transmissions (TBT)
The TBT was measured to be approximately 866.666ms.

Average Time of Occupancy (ATO)
The ATO, for a 30 second Total Time (TT), can be calculated as follows:

(1) DT + TBT = period = (4.944ms) + (866.666ms) = 871.610 ms;

(2) (TT) / period = Number of on/off cycles = (30) / 0.87161 = 34.42 on/off cycles;

(3) # of ON cycles = 34 + 1 (if 0.42 > DT/Period); DT/Period = 0.00567 seconds

(4) Since (0.42 > 0.00567) --- # of ON cycles = 35;

(5) ATO = (DT) x (# of ON cycles) = (0.004944 s) x (35) = 173 ms

Judgment of Test Results

The EUT, for Port 0, complies with the Average Time of Occupancy requirement stated in §15.247(a)(1)(ii).

Test Results - Port 1

Dwell Time (DT)
The DT on a particular frequency, while transmitting, was measured to be approximately 0.004866 seconds.

Time Between Transmissions (TBT)
The TBT was measured to be approximately 0.869555 seconds.

Average Time of Occupancy (ATO)
The ATO, for a 30 second Total Time (TT), can be calculated as follows:

(1) DT + TBT = period = (0.004866) + (0.869555) = 0.874 seconds;

(2) (TT) / period = Number of on/off cycles = (30) / 0.874 = 34.308 on/off cycles;

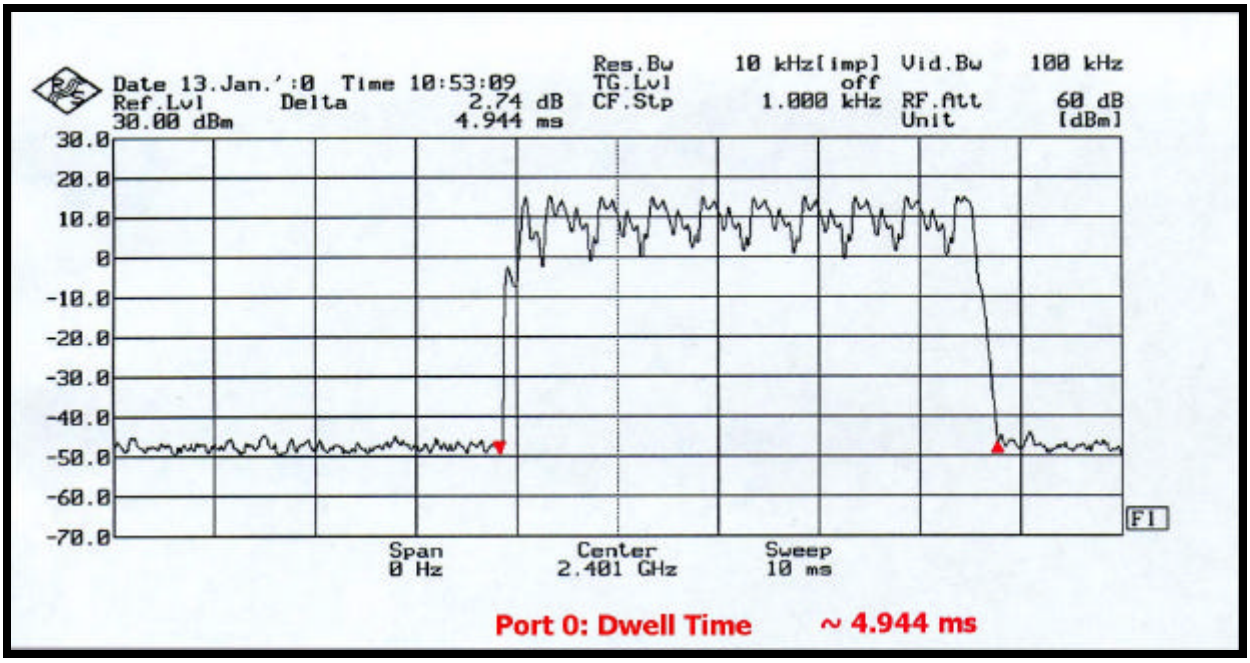
(3) # of ON cycles = 34 + 1 (if 0.308 > DT/Period);
DT/Period = .004866 / 0.874 seconds = 0.0056

(4) Since (0.308) ? # of ON cycles = 34 + 1 = 35;

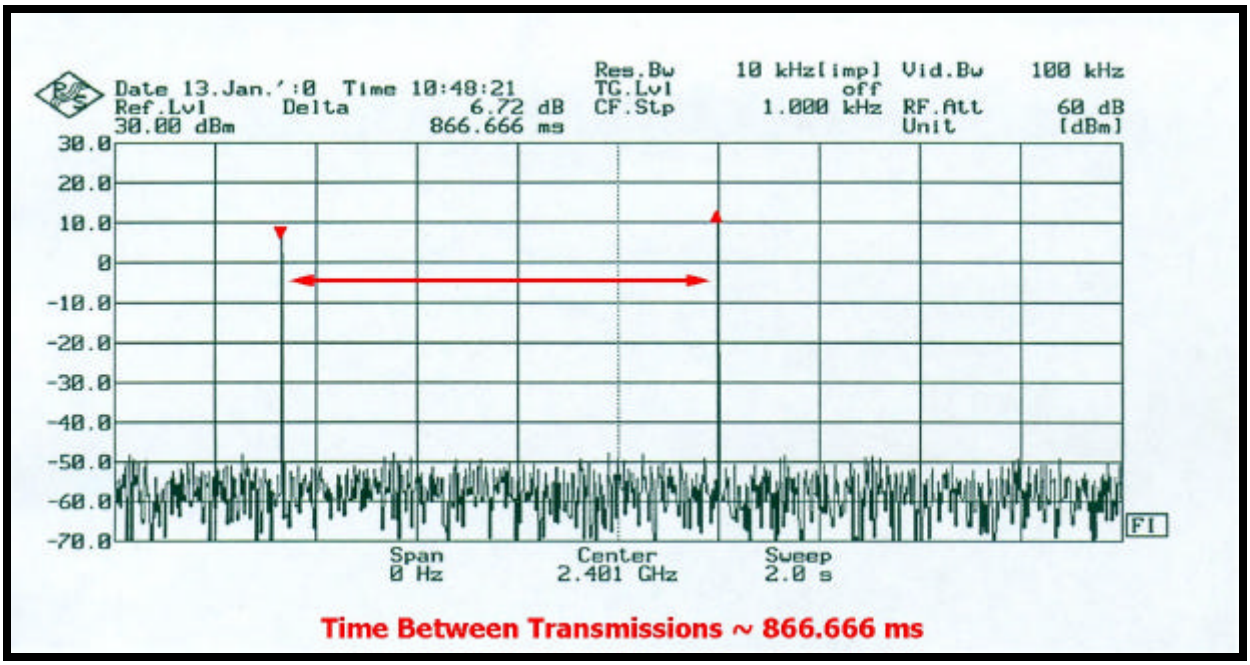
(5) ATO = (DT) x (# of ON cycles) = (0.004866x (35) = 170.3

Judgment of Test Results

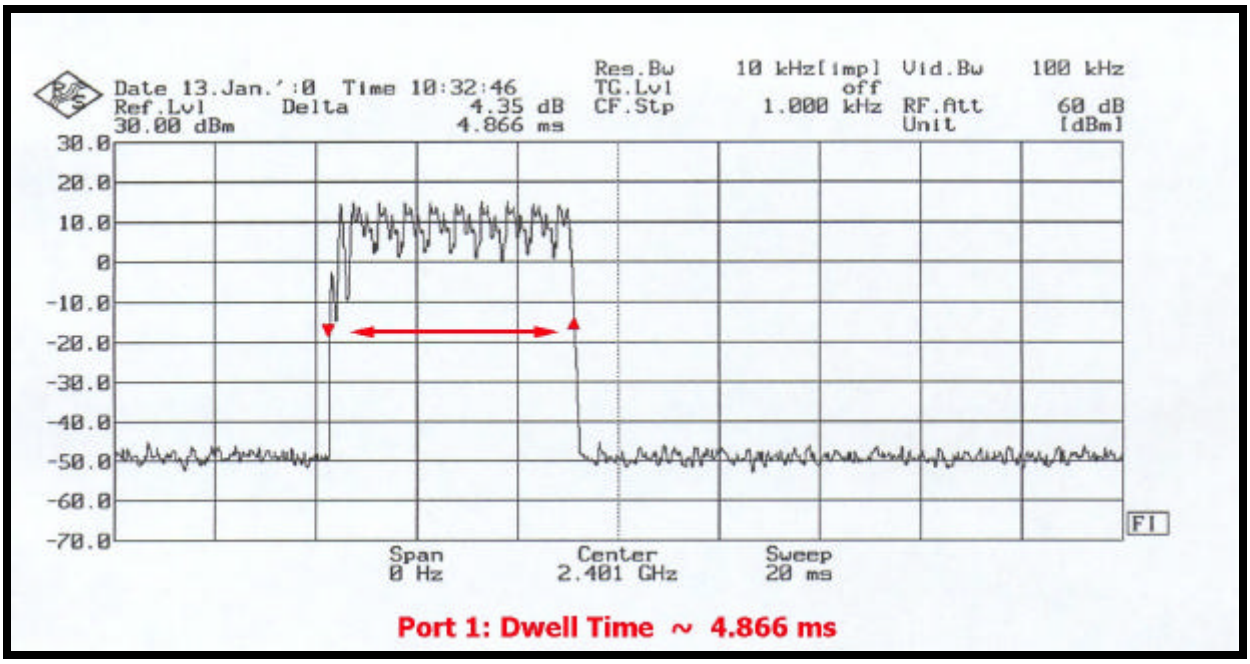
The EUT, for Port 1, complies with the Average Time of Occupancy requirement stated in §15.247(a)(1)(ii).



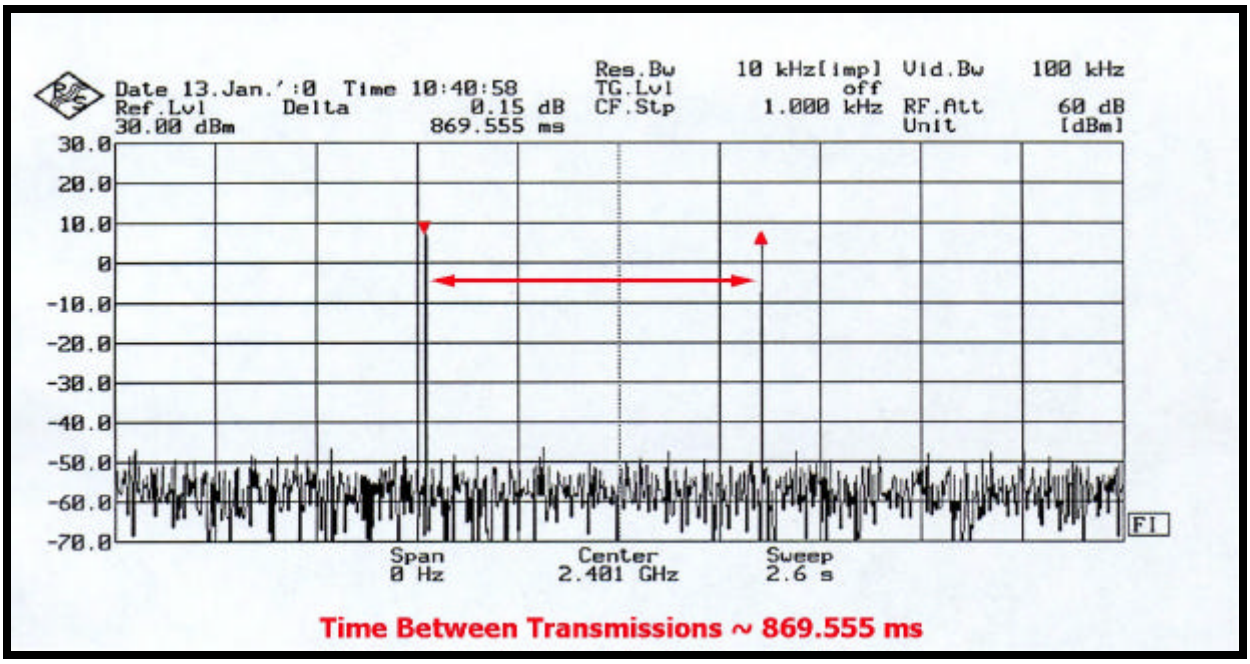
Test Data : Plot – Dwell Time – Port 0



Test Data : Plot – Time Between Transmissions – Port 0



Test Data : Plot – Dwell Time – Port 1



Test Data : Plot – Time Between Transmissions – Port 1

18.6 Conducted Spurious Emissions

18.6.1 Controlling FCC Regulation - § 15.247(c)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required.

18.6.2 Test Procedure

The following Test Procedures / Measurement Standards were followed:

- Direct Connection
  The EUT's antenna port was connected directly to the input of a Rohde & Swartz EMI analyzer via a short Cable. The EUT has two antenna ports labeled Port 0 and Port 1. Each port was tested.

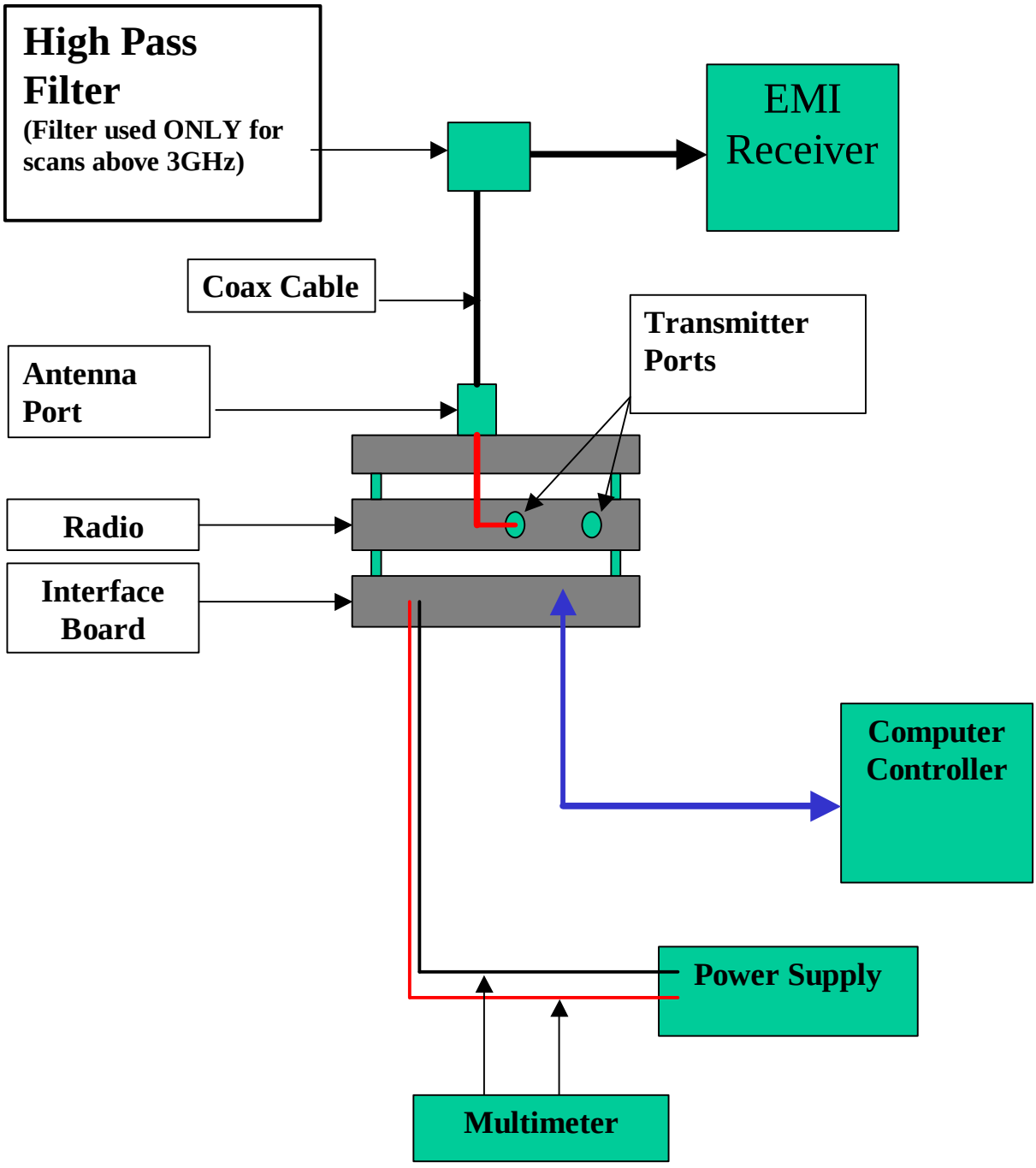
- Hopping Turned Off - **§ 15.31(c)**
  For swept frequency equipment, measurements shall be made with the frequency sweep stopped at those frequencies chosen for the measurements to be reported.

- Number of Test Frequency - **§ 15.31(m)**
  Measurements at three different frequencies are required on intentional radiators or receivers, other than TV broadcast receivers, that have a frequency range of operation of more than 10 MHz: (1) one near the top, (2) one near the middle, (3) one near the bottom.

  The EUT in this report transmits over a frequency range of approximately 80 MHz (2.4005 GHz to 2.4820 GHz). **Consequently, the output power will be measured at the following frequencies: (1) 2.481 GHz, (2) 2.441 GHz, (3) 2.401 GHz.**

- There is a danger that the strong carrier signal will overload the receiver front end causing harmonic distortion resulting in inaccurate data. To prevent harmonic distortion, a high pass filter was placed between the EUT antenna terminal and the receiver. The high pass filter is manufactured by Trilithic (M/N: 4HC3500/5000-1-KK). **Please note that the Trilihic Filter was only used for measurements made above 3GHz.**

18.6.3 Test Setup Block Diagram



18.6.4 TEST RESULTS – Conducted Spurious Emissions

Test Date : January 12, 2000
Equipment Under Test: OverAir Solutions OS2400
Manufacturer: Locus Incorporated

PORT 0 – F_O = 2.401 GHz

	Frequency (GHz)	Measured Reading (dBuV)	Corrected Reading (dBuV)	FCC Limit (dB)	Margin (Limit – Reading) (dB)
F_o	2.401	130.5	131.0	131.0	**0.0**
2	4.802	56.5	58.0	111.0	**53.0**
3	7.203	56.0	57.6	111.0	**53.4**
4	9.604	67.4	69.3	111.0	**41.7**
5	12.005	36.12	38.12	111.0	**72.9**
6	14.406	-----	------	-----	-----
7	16.807	29.0	33.0	111.0	**78.0**
8	19.208	-----	------	-----	-----
9	21.609	-----	------	-----	------
10	24.010	-----	------	-----	------

Calculations

- FCC Limit = (Fo corrected reading) – 20dB;
- Corrected Reading = (Measured Reading) + (Filter Loss) + (Cable Loss);
- Margin = (FCC Limit) – (Corrected Reading);

PORT 0 – F_O = 2.441 GHz

	Frequency (GHz)	Measured Reading (dBµV)	Corrected Reading (dB)	FCC Limit (dB)	Margin (Limit – Reading) (dB)
F_o	2.441	129.7	130.2	131.0	**0.8**
2	4.882	63.8	65.3	120.2	**54.9**
3	7.323	56.9	58.5	120.2	**61.7**
4	9.764	55.6	57.5	120.2	**62.7**
5	12.205	30.4	32.7	120.2	**87.5**
6	14.646	34.1	36.9	120.2	**83.3**
7	17.087	31.0	35.0	120.2	**85.2**
8	19.528	-----	------	-----	------
9	21.969	-----	------	-----	------
10	24.410	-----	------	-----	------

Calculations

- FCC Limit = (Fo corrected reading) – 20dB;
- Corrected Reading = (Measured Reading) + (Filter Loss) + (Cable Loss);
- Margin = (FCC Limit) – (Corrected Reading);

PORT 0 – F_O = 2.481 GHz

	Frequency (GHz)	Measured Reading (dBµV)	Corrected Reading (dB)	FCC Limit (dB)	Margin (Limit – Reading) (dB)
F_o	2.481	129.5	130.0	131.0	**1.0**
2	4.962	56.9	58.4	120.0	**61.6**
3	7.443	69.5	71.1	120.0	**48.9**
4	9.924	59.4	61.3	120.0	**58.7**
5	12.405	-----	------	-----	-----
6	14.886	46.1	48.9	120.0	**71.1**
7	17.367	39.9	43.9	120.0	**76.1**
8	19.848	-----	------	-----	------
9	22.329	-----	------	-----	------
10	24.810	-----	------	-----	------

Calculations

- FCC Limit = (Fo corrected reading) – 20dB;
- Corrected Reading = (Measured Reading) + (Filter Loss) + (Cable Loss);
- Margin = (FCC Limit) – (Corrected Reading);

PORT 1 – F_O = 2.401 GHz

	Frequency (GHz)	Measured Reading (dBuV)	Corrected Reading (dBuV)	FCC Limit (dB)	Margin (Limit – Reading) (dB)
F_o	2.401	130.0	130.5	131.0	**0.5**
2	4.802	72.0	73.5	110.5	**37.0**
3	7.203	58.0	59.6	110.5	**50.9**
4	9.604	68.7	70.6	110.5	**39.9**
5	12.005	42.2	44.5	110.5	**66.0**
6	14.406	-----	------	-----	-----
7	16.807	28.1	32.1	110.5	**78.4**
8	19.208	-----	------	-----	------
9	21.609	-----	------	-----	------
10	24.010	-----	------	-----	------

Calculations

- FCC Limit = (Fo corrected reading) – 20dB;
- Corrected Reading = (Measured Reading) + (Filter Loss) + (Cable Loss);
- Margin = (FCC Limit) – (Corrected Reading);

PORT 1 – F_O = 2.441 GHz

	Frequency (GHz)	Measured Reading (dBµV)	Corrected Reading (dB)	FCC Limit (dB)	Margin (Limit – Reading) (dB)
F_o	2.441	129.5	130.0	131.0	**1.0**
2	4.882	74.2	75.7	110.0	**34.3**
3	7.323	57.0	58.6	110.0	**51.4**
4	9.764	69.8	71.7	110.0	**38.3**
5	12.205	-----	------	-----	-----
6	14.646	31.7	34.5	110.0	**75.5**
7	17.087	35.2	39.2	110.0	**70.8**
8	19.528	29.9	36.3	110.0	**73.7**
9	21.969	-----	------	-----	------
10	24.410	-----	------	-----	------

Calculations

- FCC Limit = (Fo corrected reading) – 20dB;
- Corrected Reading = (Measured Reading) + (Filter Loss) + (Cable Loss);
- Margin = (FCC Limit) – (Corrected Reading);

PORT 1 – F_O = 2.481 GHz

	Frequency (GHz)	Measured Reading (dBµV)	Corrected Reading (dB)	FCC Limit (dB)	Margin (Limit – Reading) (dB)
F_o	2.481	129.4	129.9	131.0	1.1
2	4.962	66.6	68.1	109.9	41.8
3	7.443	81.6	83.2	109.9	26.7
4	9.924	65.9	67.8	109.9	42.1
5	12.405	-----	------	-----	-----
6	14.886	41.5	44.3	109.9	65.6
7	17.367	43.8	47.8	109.9	62.1
8	19.848	21.7	27.9	109.9	82.0
9	22.329	-----	------	-----	------
10	24.810	-----	------	-----	------

Calculations

- FCC Limit = (Fo corrected reading) – 20dB;
- Corrected Reading = (Measured Reading) + (Filter Loss) + (Cable Loss);
- Margin = (FCC Limit) – (Corrected Reading);

18.7 Radiated Spurious Emissions

18.7.1 Controlling FCC Regulation - §15.205

The FCC permits ONLY spurious emissions in any of the frequency bands listed in the table of frequencies listed in §15.205(a).

- The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209;
- At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a **CISPR quasi-peak detector**;
- Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the **average** value of the measured emissions. **The provisions in §15.35 apply to these measurements.**

§15.209 – Radiated Emission Limits; General Requirements

- The emissions from an intentional radiator shall not exceed the field strength levels specified in the table presented in §15.209(a) at a distance of 3 meters from the EUT.
  30 MHz – 88 MHz : Limit = 100 µV/m;
  88 MHz – 216 MHz : Limit = 150 µV/m;
  216 MHz – 960MHz: Limit = 200 µV/m;
  Above 960MHz: Limit = 500 µV/m;

- The tighter limit applies at the band edges.

- The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission.

§15.35 Measurement Detector Functions and Bandwidths.

The conducted and radiated emission limits shown in this Part are based on the following, unless otherwise specified elsewhere in this Part: . . .

Unless otherwise specified, when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, **the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds.** The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to notification or verification.

18.7.2 Antennas Tested

The EUT was tested with each antenna listed below. Please refer to the "Exhibit 6 – Antennas" for more details concerning antenna characteristics.

(1) Whip Antenna
- Name Used : Whip I (Name use on data sheets)
- Manufacturer : NCC
- Model Number : N24ARSMAI

(2) Whip Antenna
- Name Used : Whip II
- Manufacturer : NCC
- Model Number : N24HGASMIB

(3) Colliner Array
- Name Used : Mobile Mark
- Manufacturer : Mobile Mark
- Model Number : OD9-2400

(4) YAGI
- Name Used : YAGI
- Manufacturer : ASTRON
- Model Number : P-2415

(5) Patch
- Name Used : Patch
- Manufacturer : Maxrad
- Model Number : MP24013FSMA

18.7.3 Test Procedure

- **Test Setup**
  The EUT is setup on a RF transparent table that rests on an EMCO turntable capable of rotating from 0 to 360 degrees. EUT cables are oriented to maximize the field strength amplitudes. Three meters from the EUT is an EMCO antenna mast capable of moving the receiving antenna up and down (from 1 meter to 4 meters).

- **Hopping Turned Off - § 15.31(c)**
  For swept frequency equipment, measurements shall be made with the frequency sweep stopped at those frequencies chosen for the measurements to be reported.

- **Number of Test Frequency - § 15.31(m)**
  Measurements at three different frequencies are required on intentional radiators or receivers, other than TV broadcast receivers, that have a frequency range of operation of more than 10 MHz: (1) one near the top, (2) one near the middle, (3) one near the bottom. The EUT in this report transmits over a frequency range of approximately 80 MHz (2.4005 GHz to 2.4820 GHz). **Consequently, the output power will be measured at the following frequencies: (1) 2.481 GHz, (2) 2.441 GHz, (3) 2.401 GHz.**

- **Use Filter** - For this test, when measuring signals above 3 GHz, an HP Preamp is utilized. Calculations indicate that the strong carrier signal will overload the preamp, causing harmonic distortion, resulting in inaccurate data. To prevent harmonic distortion, a high pass filter was placed between the receive antenna and the preamp input. The high pass filter is manufactured by Trilithic (M/N: 4HC3500/5000-1-KK). **Please note that the Trilihic Filter was only used for measurements made above 3GHz.**

- **30MHz to 2GHz**: The frequency band from 30MHz to 2GHz was scanned and the spurious EMI emissions measured (using a Quasi-Peak detector) and recorded;

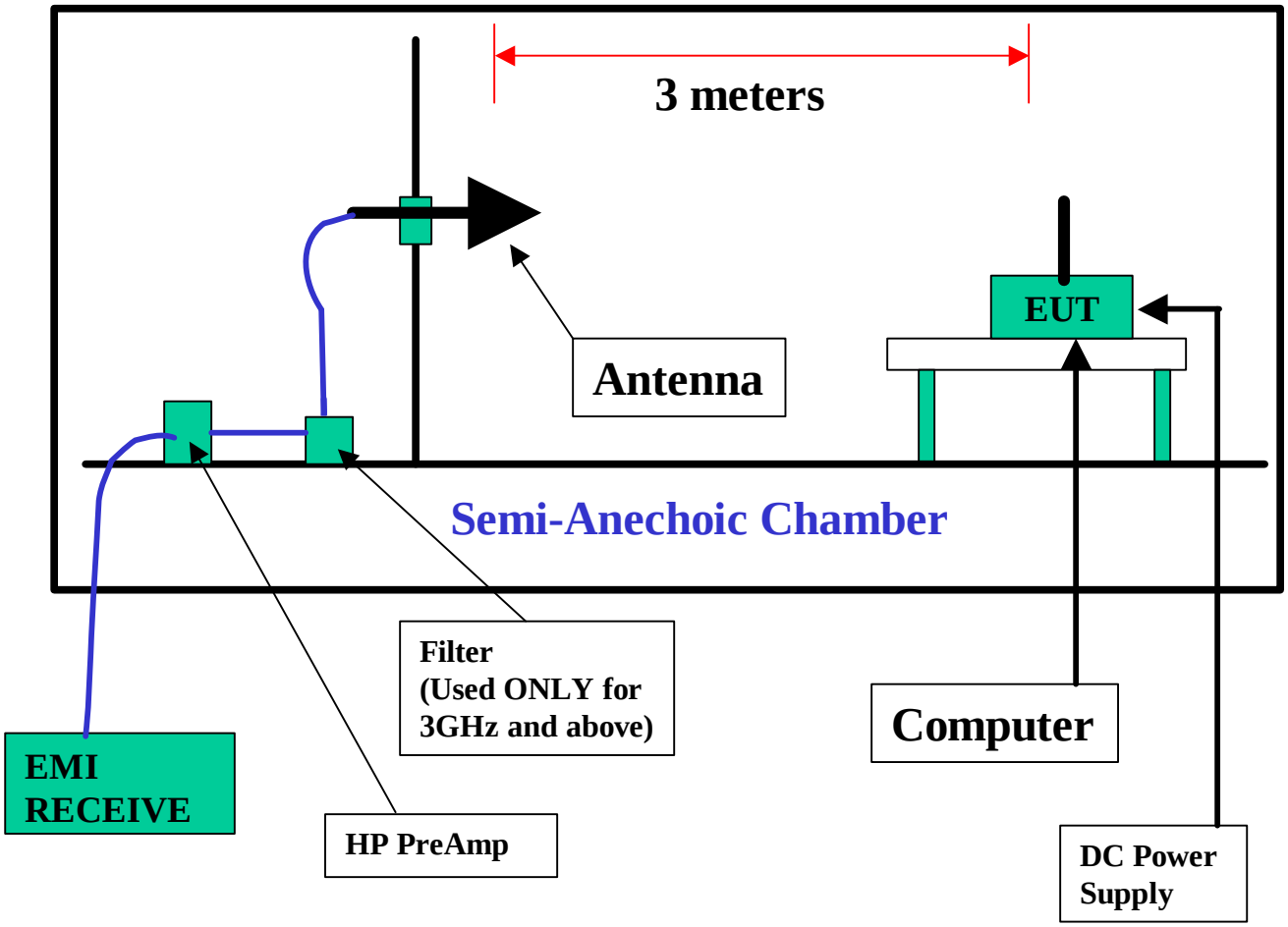
- **2GHz to 25GHz**: The measurement procedure used to verify compliance to the above-referenced regulations is given below:

  (1) Set EUT to transmit, continuously, at the desired frequency;
  (2) Tune the receiver to the Harmonic of interest;
  (3) Setup measurement instrumentation in proper measurement mode;
  (4) Place the antenna in the horizontal position and move to find height where maximum reception occurs;
  (5) Rotate EUT and record the maximum emission level detected, antenna height, antenna polarization, and turntable angle;
  (6) Place the antenna in the vertical position and move to find height where maximum reception occurs;
  (7) Rotate EUT and record the maximum emission level detected, antenna height, antenna polarization, and turntable angle;
  (8) Return to step (2) and repeat for each harmonic;
  (9) Return to step (1) for each fundamental frequency;

  Create a report presenting the test results;

  (This procedure was used as scans above 2GHz proved that the only detectable emissions above 2GHz were harmonics of the fundamental transmitter frequency)

18.7.4 Test Setup Block Diagram



18.7.5 Calculations – Duty Cycle Corrections

As stated previously, under certain conditions, **§15.35 (**Measurement detector functions and bandwidths) authorizes duty cycle corrections.

For the EUT described in this report, for any 100ms interval, in normal hopping mode, the EUT only transmits for 5ms. During the test, however, hopping is turned off. Consequently, a duty cycle correction is required to determine the true AVERAGE value. There are no duty cycle corrections required for PEAK measurements.

Duty Cycle Correction (DCC)

Let TT = the EUT's transmission time duration, in any 100ms interval (when EUT is operated as designed).

- DCC = 20 Log_{10} (TT/.1)

For the EUT described in this report, the DCC to be added to the AVERAGE measurements is calculated as follows:

- EUT's TT = 5 ms; DCC = 20 Log_{10}(.005/.1) = - 26.02 dB
- True Average Reading = (Measured Average Reading) + (- 26 dB);

Finally, for the reading presented in this section, "**Correction Factors**" are calculated as follows:

"Correction Factors" = (Antenna Factor) + (Cable Loss) – (Preamp Gain) + (DCC)

18.7.6 Test Results – Radiated Spurious Emissions

Test Data : Port 0 : Parabolic Grid - (PMANT 25)

January 13, 2000

Equipment : OS2400 DSS Transmitter
Manufacturer : Locus
Test Distance : 3 meters

Frequency (MHz)	Detector	Measured EMI (dBµV/m)	Correction Factors (dB)	FCC LIMIT (dBµV/m)	Margin (dB)	Height (cm)	Azimuth (Degrees)	Ant. Pol.
30.00	Q-Peak	-0.5	21.0	40.0	**19.5**	125	83	V
40.64	Q-Peak	-1.4	15.7	40.0	**25.7**	231	179	V
54.56	Q-Peak	8.0	9.2	43.5	**26.3**	101	348	V
80.00	Q-Peak	18.3	9.6	46.0	**18.1**	101	108	V
120.00	Q-Peak	3.2	13.7	46.0	**29.1**	107	213	H
145.20	Q-Peak	1.9	14.4	46.0	**29.7**	325	109	H
190.08	Q-Peak	13.5	12.9	46.0	**19.6**	101	33	H
265.52	Q-Peak	0.8	16.1	46.0	**29.1**	225	314	H
373.28	Q-Peak	0.8	20.4	46.0	**24.8**	275	78	H
459.84	Average	11.0	22.9	54.0	**20.1**	176	34	V
Fo = 2.401 GHz								
4,801.00	Average	30.5	.01	54.0	**23.5**	100	0	H
4,801.00	Peak	39.0	26.1	74.0	**8.9**	100	0	H
Fo = 2.441 GHz								
4,881.0	Average	30.1	.01	54.0	**23.9**	120	10	H
4,881.0	Peak	39.0	26.1	74.0	**8.9**	120	10	H
Fo = 2.481 GHz								
4,964.0	Average	-30.0	-.01	54.0	**24.0**	100	0	H
4,964.0	Peak	-39.0	-26.1	74.0	**8.9**	100	0	H

Calculation Formula: Margin = Limit – Measurement – Correction Factor

Test Data : Port 1: Parabolic Grid - (PMANT 25)

January 13, 2000

Equipment : OS2400 DSS Transmitter
Manufacturer : Locus
Test Distance : 3 meters

Frequency (MHz)	Detector	Measured EMI (dBµV/m)	Correction Factors (dB)	FCC LIMIT (dBµV/m)	Margin (dB)	Height (cm)	Azimuth (Degrees)	Ant. Pol.
30.00	Q-Peak	-1.1	21.0	40.0	**20.1**	175	74	V
40.64	Q-Peak	0.2	15.7	40.0	**24.1**	125	66	V
54.56	Q-Peak	8.9	9.2	43.5	**25.4**	140	54	V
80.00	Q-Peak	16.3	9.6	46.0	**20.1**	101	97	H
120.00	Q-Peak	2.2	13.7	46.0	**30.1**	125	70	V
145.20	Q-Peak	2.0	14.4	46.0	**29.6**	107	57	V
190.08	Q-Peak	13.6	12.9	46.0	**19.5**	115	77	V
265.52	Q-Peak	1.0	16.1	46.0	**28.9**	200	54	H
373.28	Average	9.1	20.4	54.0	**24.5**	101	81	V
459.84	Average	10.9	22.9	54.0	**20.2**	165	73	V
Fo = 2.401GHz								
4,801.00	Average	-31.34	-.01	54.0	22.65	110	0	H
4,801.00	Peak	-39.00	-26.1	74.0	8.9	110	0	H
Fo = 2.441GHz								
4,8820	Average	-36.8	-.01	54.0	17.19	100	10	H
4,8820	Peak	-42.0	-26.1	74.0	5.9	100	10	H
Fo = 2.481GHz								
4,9620	Average	-32.8	-.01	54.0	21.19	100	10	H
4,9620	Peak	-40.0	-26.1	74.0	7.9	100	10	H

Calculation Formula: Margin = Limit – Measurement – Correction Factor