



# Test Report

|                     |   |
|---------------------|---|
| Report No           | ED0026-1  |
| Client              | Adaptive Instrument Corp.<br>577 Main street<br>Hudson, MA 01749  |
| Phone               | 978-562-0154  |
| Fax                 | 978-562-2563  |
| FRN                 | 0007941438  |
| Models              | 16363   |
| FCC ID              | QQN16363  |
| Equipment Type      | Low Power Communication Device Transmitter  |
| Equipment Code      | DXX   |
| Results             | As detailed within this report  |
| Prepared by         | <br>Mairaj Hussain – Test Engineer |
| Authorized by       | <br>Michael Buchholz – EMC Manager |
| Issue Date          |   |
| Conditions of issue | This Test Report is issued subject to the conditions stated in 'terms and conditions' section of this                 |

Curtis-Straus LLC is accredited by the American Association for Laboratory Accreditation for the specific scope of accreditation under Certificate Number 1627-01. This report may contain data which is not covered by the A2LA accreditation.



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## *Summary*

This report is an application for certification of a transmitter operating under 47 CFR 15.247 of the FCC rules provided for operation of frequency hopping spread spectrum transmitters. The product covered by this report is 915 MHz FHSS RF module. The product was tested using the methods outlined in FCC public notice DA 00-705 (FHSS), released March 30, 2000, FCC public notice DA 00-1407 (modular) released June 26, 2000 and ANSI C63.4 (2000).

The spurious radiated emissions testing was performed with  $\frac{1}{2}$  wave and  $\frac{1}{4}$  wave antennas. Furthermore, the spurious emissions were also checked in the receive mode of operation see table 8.

## *Test Methodology*

All testing was performed according to the procedures specified in ANSI C63.4 (2000).

|                                      |               |
|--------------------------------------|---------------|
| <b>Frequency range investigated:</b> | 30MHz – 10GHz |
|--------------------------------------|---------------|

| <b>Measurement Distance:</b> |                     |                 |
|------------------------------|---------------------|-----------------|
| <i>Frequency (MHz)</i>       | <i>Distance (m)</i> | <i>Comments</i> |
| 902 – 928                    | -                   | Conducted       |
| 30 – 1000                    | 3                   | Spurious        |
| 1000 – 10000                 | 3                   | Spurious        |

The EUT was maximized around three orthogonal axes. EUT antennas were maximized within there range of motion.

This product can be powered via battery or DC provided by the host unit. All testing was performed using an external DC source.

All readings are peak unless otherwise noted.

*EUT Configuration*

| EUT Configuration   |        |            |        |          |                        |     |           |            |                      |                |            |    |      |      |
|---|--------|------------|--------|----------|------------------------|-----|-----------|------------|----------------------|----------------|------------|----|------|------|
| <b>Work Order:</b> D0026<br><b>Company:</b> Adaptive Instrument Corp.<br><b>Company Address:</b> 577 Main Street<br>Hudson, MA 01749<br><b>Contact:</b> Jeffery Cho<br><b>Person(s) Present:</b> Jeffery Cho  |        |            |        |          |                        |     |           |            |                      |                |            |    |      |      |
| <table border="1"> <thead> <tr> <th>MN</th><th>SN</th><th>FCC ID</th></tr> </thead> <tbody> <tr> <td>EUT: 16363</td><td>-</td><td>QQN16363</td></tr> </tbody> </table> <b>EUT Description:</b> 915 MHz FHSS RF Module<br><b>EUT Max Frequency:</b> 902 - 928 MHz  |        |            |        |          | MN                     | SN  | FCC ID    | EUT: 16363 | -                    | QQN16363       |            |    |      |      |
| MN  | SN     | FCC ID     |        |          |                        |     |           |            |                      |                |            |    |      |      |
| EUT: 16363  | -      | QQN16363   |        |          |                        |     |           |            |                      |                |            |    |      |      |
| <table border="1"> <thead> <tr> <th>Support Equipment:</th><th>MN</th><th>SN</th><th>FCC ID</th></tr> </thead> <tbody> <tr> <td>Agilent Power supply</td><td>E3630A</td><td>MY40001033</td><td>-</td></tr> </tbody> </table>  |        |            |        |          | Support Equipment:     | MN  | SN        | FCC ID     | Agilent Power supply | E3630A         | MY40001033 | -  |      |      |
| Support Equipment:  | MN     | SN         | FCC ID |          |                        |     |           |            |                      |                |            |    |      |      |
| Agilent Power supply  | E3630A | MY40001033 | -      |          |                        |     |           |            |                      |                |            |    |      |      |
| <table border="1"> <thead> <tr> <th>EUT Cables:</th><th>Qty</th><th>Shielded?</th><th>Length</th><th>Ferrites</th></tr> </thead> <tbody> <tr> <td>DC Power cable</td><td>1</td><td>No</td><td>&gt; 1m</td><td>None</td></tr> </tbody> </table>  |        |            |        |          | EUT Cables:            | Qty | Shielded? | Length     | Ferrites             | DC Power cable | 1          | No | > 1m | None |
| EUT Cables:   | Qty    | Shielded?  | Length | Ferrites |                        |     |           |            |                      |                |            |    |      |      |
| DC Power cable  | 1      | No         | > 1m   | None     |                        |     |           |            |                      |                |            |    |      |      |
| <table border="1"> <thead> <tr> <th>Unpopulated EUT Ports:</th><th>Qty</th><th>Reason</th></tr> </thead> <tbody> <tr> <td>None</td><td></td><td></td></tr> </tbody> </table>  |        |            |        |          | Unpopulated EUT Ports: | Qty | Reason    | None       |                      |                |            |    |      |      |
| Unpopulated EUT Ports:  | Qty    | Reason     |        |          |                        |     |           |            |                      |                |            |    |      |      |
| None  |        |            |        |          |                        |     |           |            |                      |                |            |    |      |      |
| <b>Software / Operating Mode Description:</b><br>The product was tested for EMI in transmit and receive modes. In transmit mode the product was tested with hopping function enabled and disabled. Furthermore, two data rates 4.8KHz and 76.8 KHz were examined. For each data rate three channels of operation (channel 1, 26, and 50) were tested. |        |            |        |          |                        |     |           |            |                      |                |            |    |      |      |

## *Statement of Conformity*

The 915 MHz FHSS RF Module has been found to conform with the following parts of the 47 CFR as detailed below:

| <b>47 CFR Part #</b> | <b>47 CFR Part #</b>         | <b>Comments</b>   |
|----------------------|------------------------------|---|
|                      | 15.15(b)                     | The product contains no user accessible controls that increase transmission power above allowable levels.   |
| 2.925                | 15.19                        | The label is shown in the label exhibit.  |
|                      | 15.21                        | Information to the user is shown in the instruction manual exhibit.   |
|                      | 15.27                        | No special accessories are required for compliance.   |
|                      | 15.31(e)                     | The input power was varied from its nominal value to 3.3V and 5.0V. The respective radiated power was measured see table 1.                       |
|                      | 15.203                       | The device utilizes reverse sex SMA type antenna connector.   |
|                      | 15.204                       | See attached documentation describing the antenna(s).   |
|                      | 15.205<br>15.209             | The fundamental is not in a Restricted band and the spurious emissions in the Restricted bands comply with the general emission limits of 15.209. |
|                      | 15.207                       | Unit is DC powered. Conducted EMI data is provided in this report, table 9.   |
| 15.247 (a)           | 15.247 (1)                   | The carrier frequencies are separated by a minimum of 20 db bandwidth of hopping channel. See attached plot(s) # 1 & 2.                           |
|                      | 15.247 (1) (i)               | The EUT has 50 hopping frequencies. The EUT complies with the time of occupancy requirements. See attached plot # 3.                              |
|                      | 15.247 (1) (ii)              | The EUT does not operate in the 5725-5850 MHz band.   |
|                      | 15.247 (1) (iii)             | The EUT does not operate in the 2400-2483.5 MHz band.   |
|                      | 15.247 (2)                   | The EUT does not use digital modulation.  |
| 15.247 (b)           | 15.247 (1)                   | The EUT does not operate in the specified bands.  |
|                      | 15.247 (2)                   | The peak output power of EUT is less than 1W. See attached plots 12-17.   |
|                      | 15.247 (3)                   | EUT does not use digital modulation.  |
|                      | 15.247 (4)                   | EUT's antenna gain is less than 6 dbi.  |
|                      | 15.247 (4) (i)<br>(ii) (iii) | EUT does not operate in the specified frequency band(s).  |
|                      | 15.247 (5)                   | See RF Exposure exhibit.  |

|               |  |  |
|---------------|--|--|
| 15.247<br>(c) |  | The EUT meets the band-edge requirements. See attached plots 18-20. No emissions from the product fall within the restricted band. |
| 15.247<br>(d) |  | EUT does not use digital modulation.   |
| 15.247<br>(f) |  | EUT does not qualify as hybrid system.   |
| 15.247<br>(g) |  | See section 12.247(g) part of the report.  |
| 15.247<br>(h) |  | This device does not coordinate its hopping channels.  |

## Test Data and Plots

### Section 15.31(e)

Input Voltage variation

| <b>Section 15.31(e) Voltage Variation</b> |  | <b>Curtis-Straus LLC</b>          |
|---|--|-----------------------------------|
| <b>Work Order:</b> D0026                  |  | <b>Table:</b> 1                   |
| <b>Date(s):</b> 1/13/02                   |  |                                   |
| <b>Engineer:</b> Mairaj Hussain           |  |                                   |
| <b>Date:</b> 1/14/03                      |  |                                   |
| <b>EUT:</b> 915MHz FHSS RF Module         |  |                                   |
| <b>Voltage</b>                            |  | <b>Peak Output Power Measured</b> |
| Nominal                                   |  | -8.8dbm                           |
| 3.3V                                      |  | -8.8dbm                           |
| 5.0V                                      |  | -8.8dbm                           |

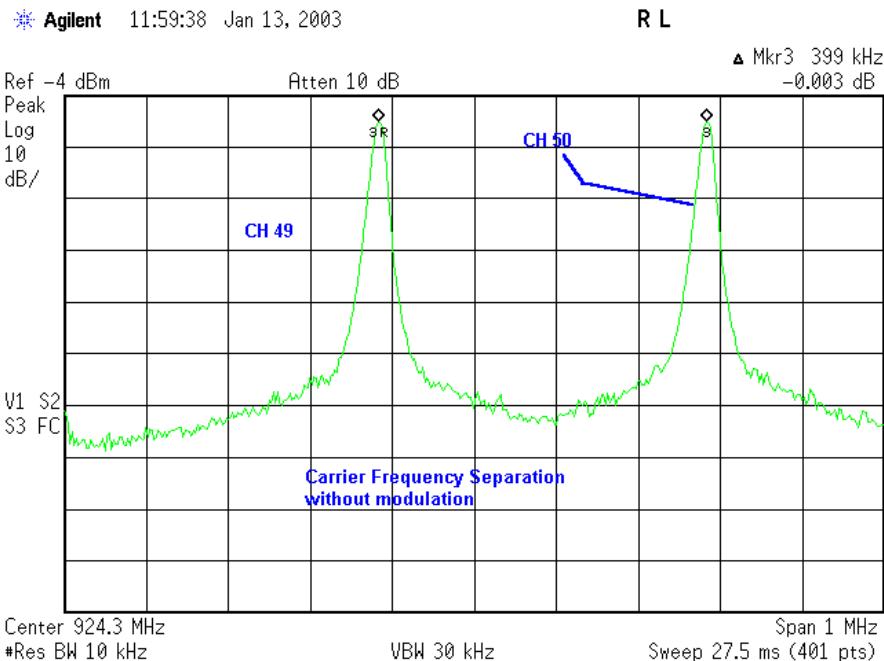
**Conclusion:** The peak output power does not change with input voltage.

*Note: Above PoP readings are off of spectrum analyzer and do not take in account for cables loss and any attenuator used.*

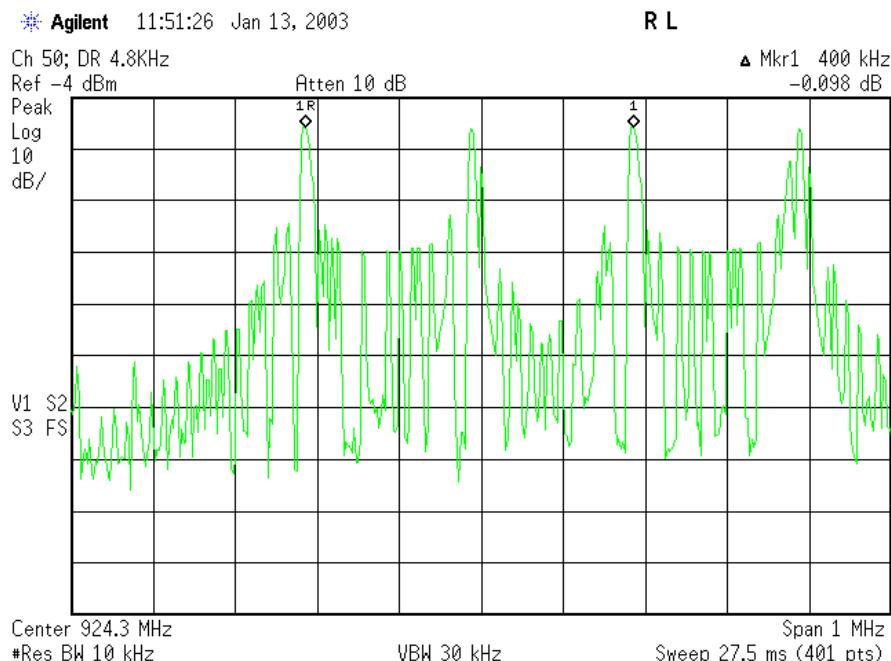
### Section 15.247 (a) (1)

System Receiver Input Bandwidth – The IF bandwidth of the receiver is 200KHz. The Transmitter bandwidth is less than 400KHz (as measured) or less than +/- 200KHz. In the receiver, when the RF is down-converted to IF, one half of the spectrum is removed in a Single Side Band (SSB) conversion so recovered IF signal bandwidth is less than 200KHz which matches the receiver IF bandwidth.

## Carrier Frequency Separation



Plot #1 Showing carrier frequency separation (hopping disabled)



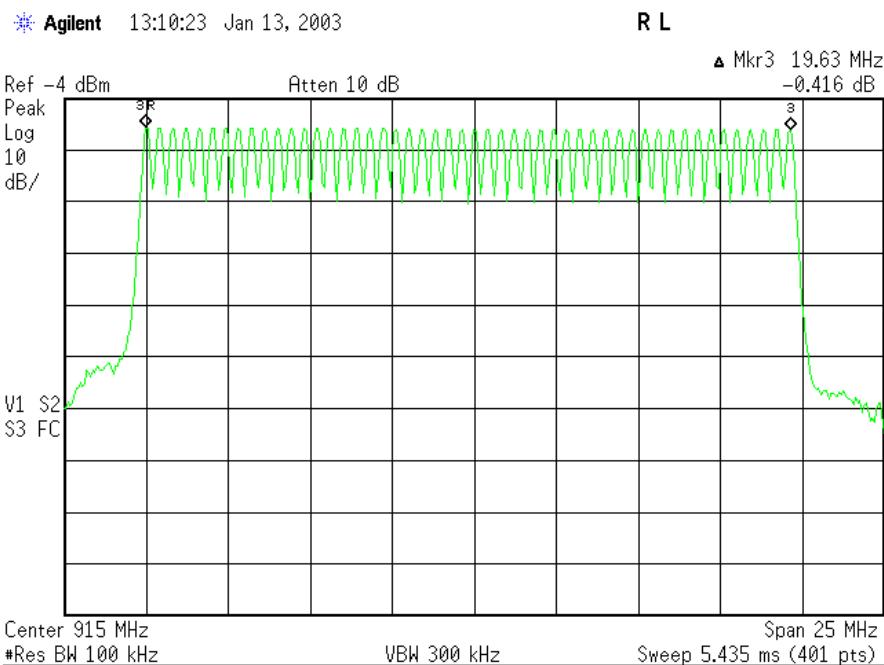
Plot #2 Showing carrier frequency separation (hopping enabled)

Channel separation = 400 KHz

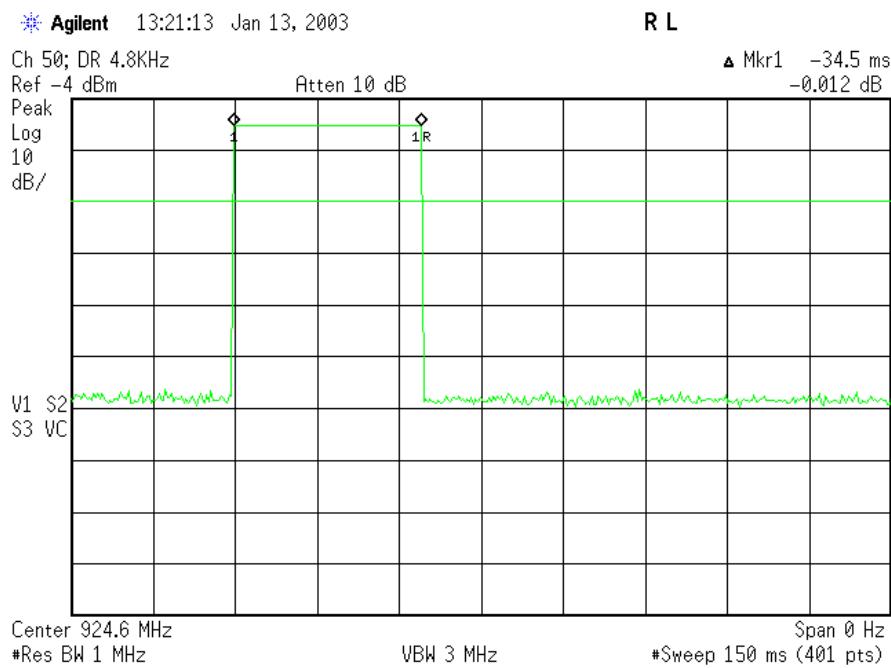
20dB BW = 368.6 KHz (See next section)

|                    |   |
|--------------------|---|
| <b>Conclusion:</b> | Hopping channel carrier frequencies are separated by a minimum of 20db bandwidth. |
|--------------------|---|

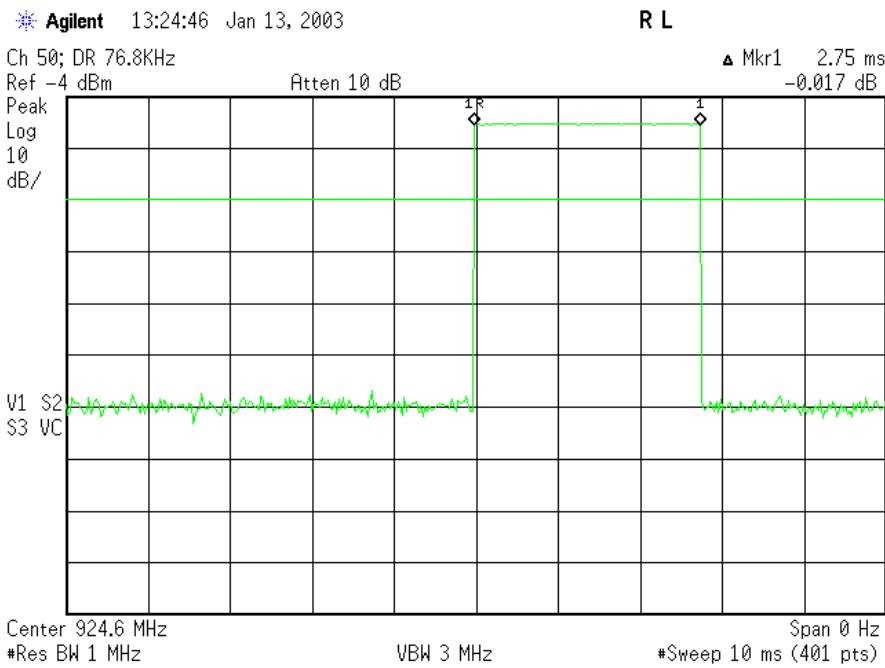
Number of Hopping Frequencies/Time of Occupancy/20 db Bandwidth



Plot # 3 Showing 50 hopping frequencies

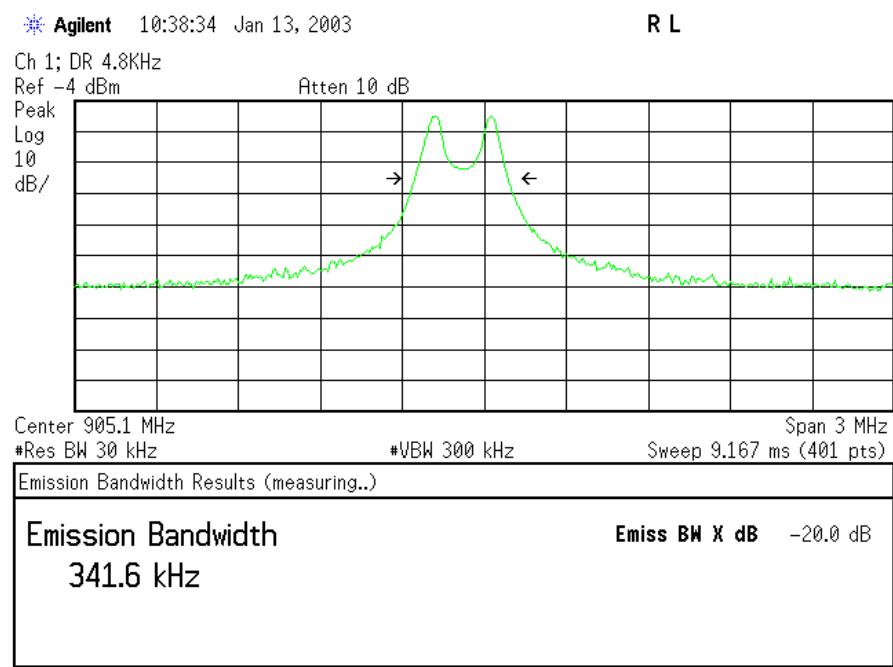


Plot #4 Showing Time of Occupancy (@ data rate 4.8KHz)



Plot #5 Showing Time of Occupancy (@ data rate 76.8KHz)

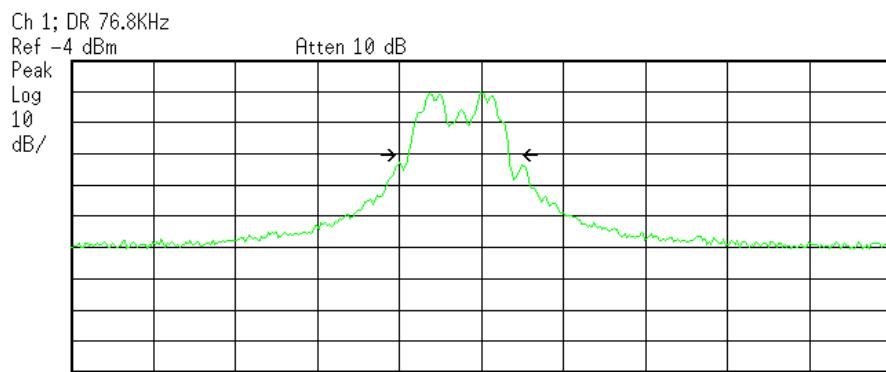
|                    |  |
|--------------------|--|
| <b>Conclusion:</b> | The time of occupancy is less than 0.4 sec |
|--------------------|--|



Plot #6 Showing 20 db Bandwidth (Ch #1 Data Rate 4.8KHz)

Agilent 10:42:38 Jan 13, 2003

R L



Emission Bandwidth Results (measuring..)

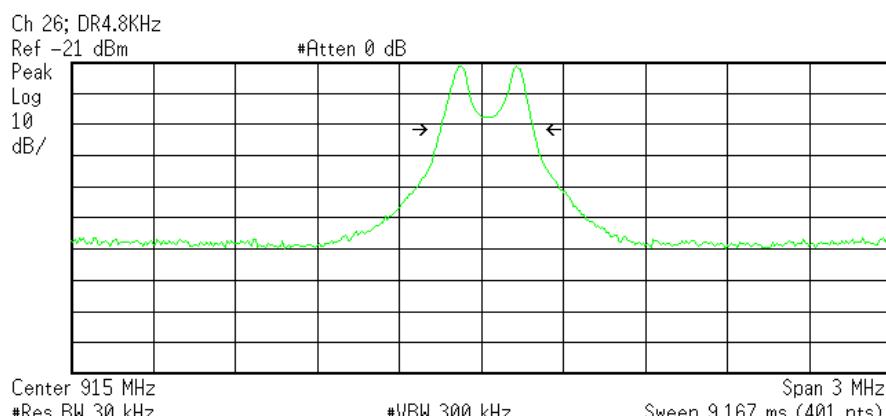
**Emission Bandwidth**  
368.6 kHz

Emiss BW X dB -20.0 dB

Plot #7 Showing 20 db Bandwidth (Ch #1 Data Rate 76.8KHz)

Agilent 09:45:11 Jan 13, 2003

R L



Emission Bandwidth Results (measuring..)

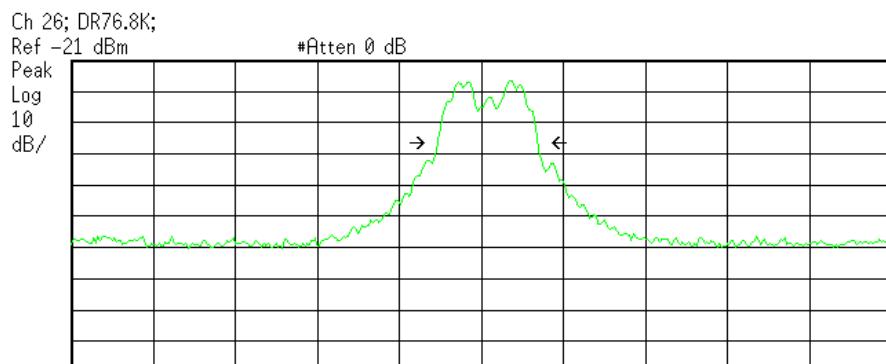
**Emission Bandwidth**  
340.2 kHz

Emiss BW X dB -20.0 dB

Plot #8 Showing 20 db Bandwidth (Ch #26 Data Rate 4.8KHz)

Agilent 09:37:25 Jan 13, 2003

R L



Emission Bandwidth Results (measuring..)

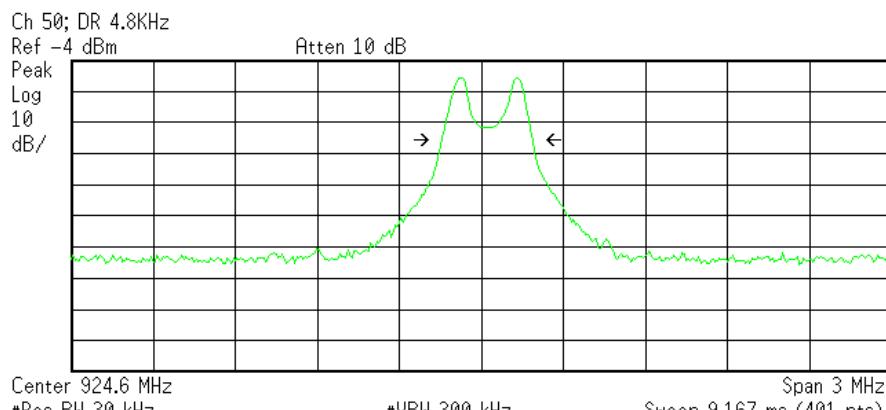
**Emission Bandwidth**  
366.7 kHz

**Emiss BW X dB** -20.0 dB

Plot #9 Showing 20 db Bandwidth (Ch #26 Data Rate 76.8KHz)

Agilent 11:23:51 Jan 13, 2003

R L



Emission Bandwidth Results (measuring..)

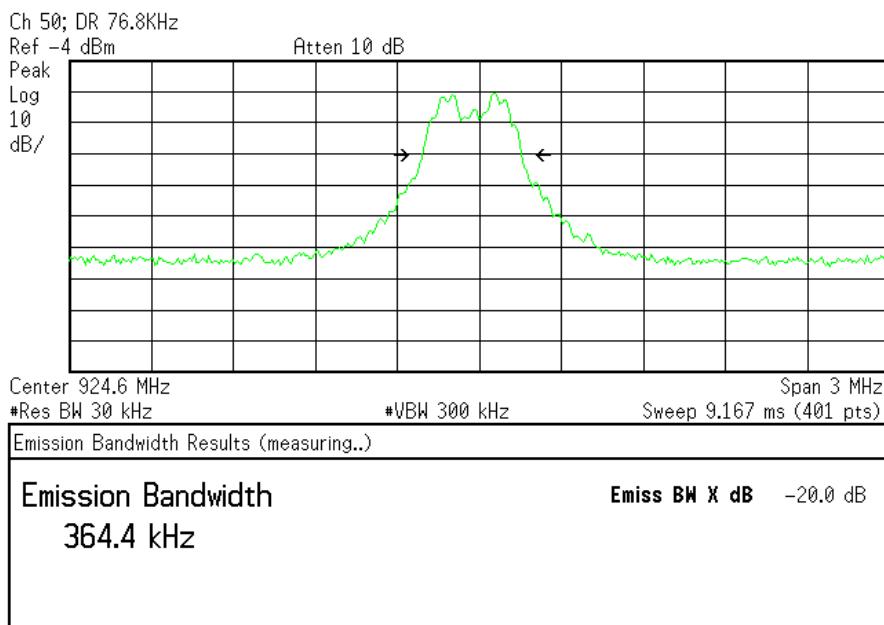
**Emission Bandwidth**  
331.9 kHz

**Emiss BW X dB** -20.0 dB

Plot #10 Showing 20 db Bandwidth (Ch #50 Data Rate 4.8KHz)

\* Agilent 10:55:06 Jan 13, 2003

R L



Plot #11 Showing 20 db Bandwidth (Ch #50 Data Rate 76.8KHz)

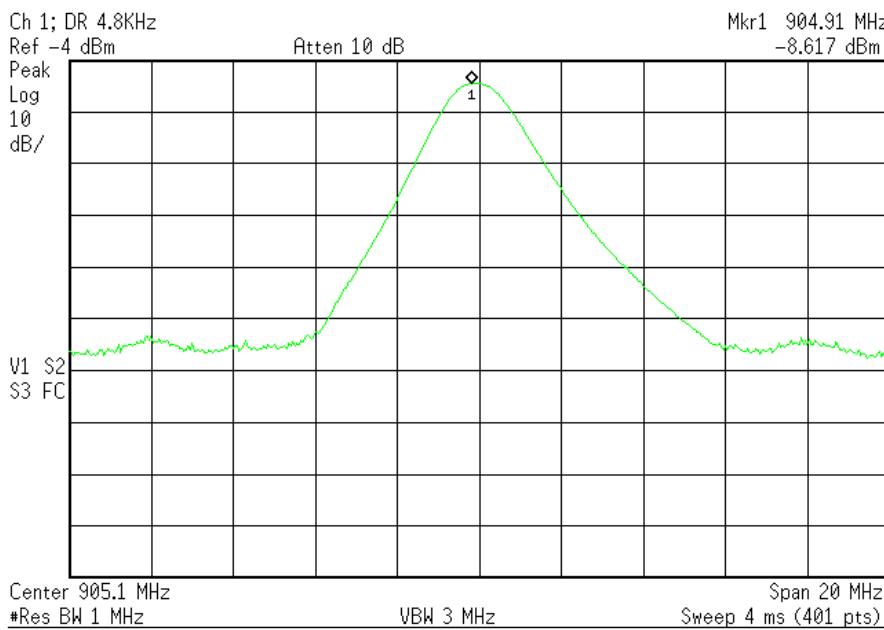
|                    |  |
|--------------------|--|
| <b>Conclusion:</b> | The 20db bandwidth is > 250KHz and < 500 KHz |
|--------------------|--|

### Section 15.247 (b)

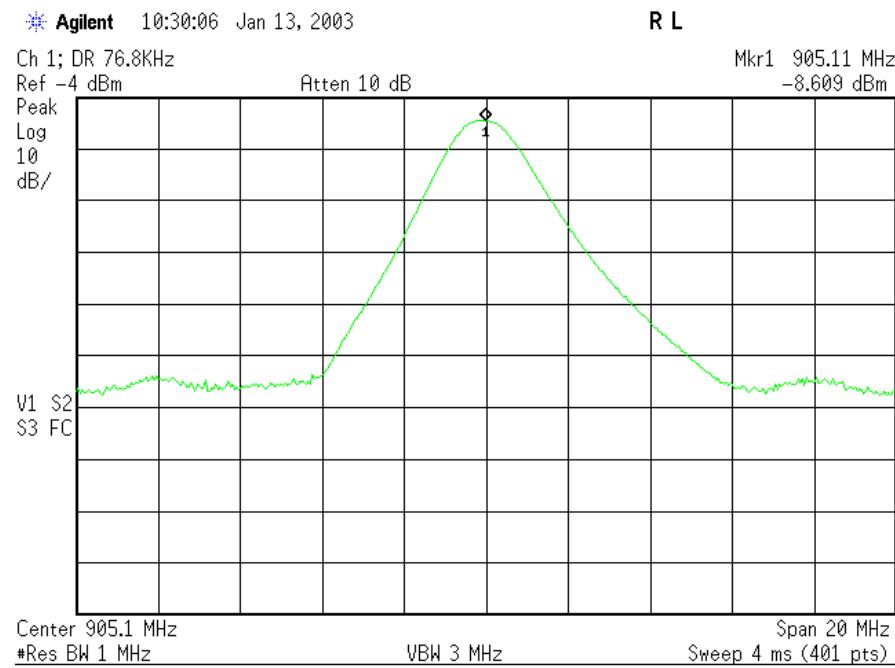
#### Peak OutPut Power (POP)

\* Agilent 10:34:55 Jan 13, 2003

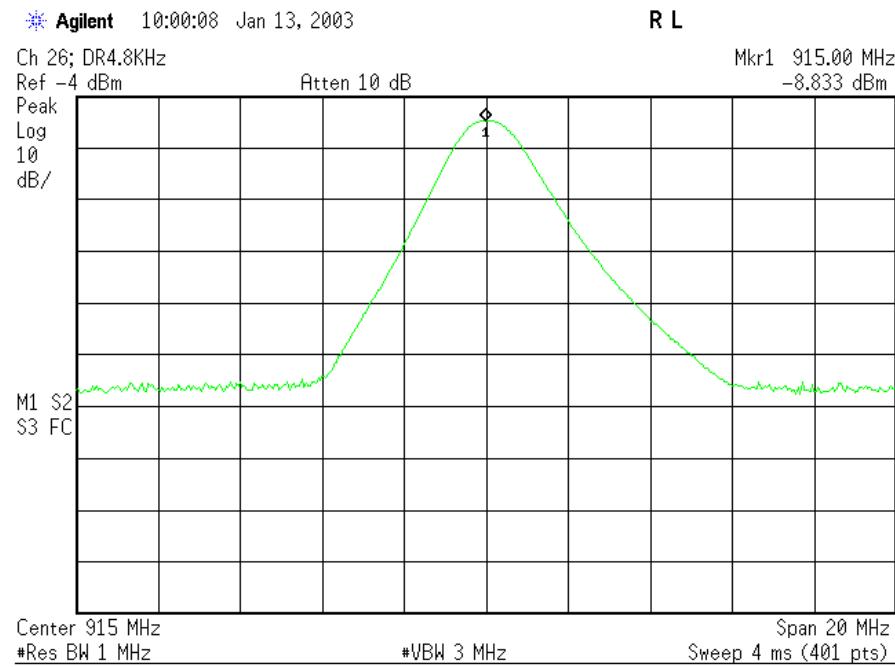
R L



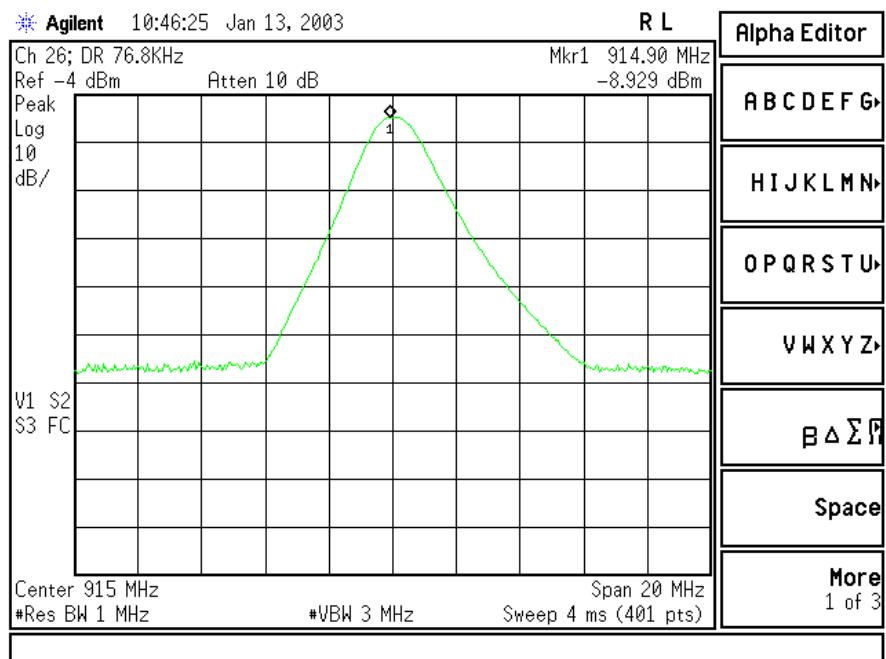
Plot #12 Showing POP (Ch 1, Data Rate 4.8KHz)



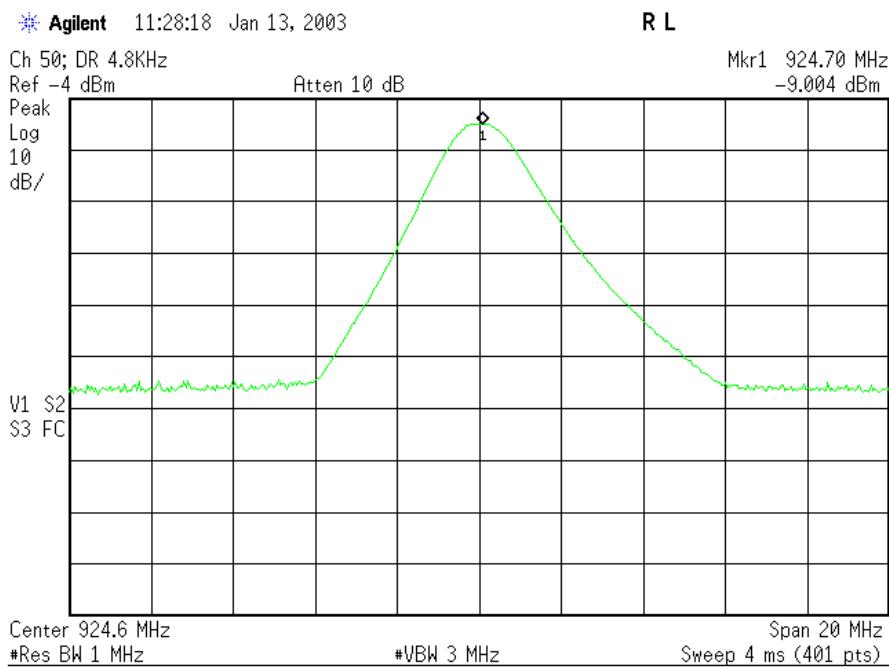
Plot #13 Showing POP (Ch 1, Data Rate 76.8KHz)



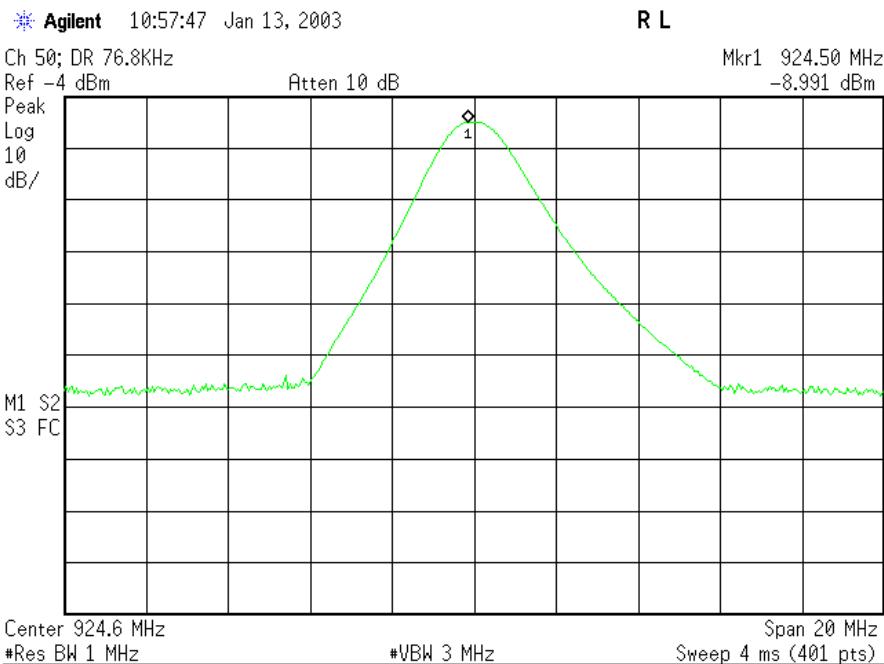
Plot #14 Showing POP (Ch 26, Data Rate 4.8KHz)



Plot #15 Showing POP (Ch 26, Data Rate 76.8KHz)



Plot #16 Showing POP (Ch 50, Data Rate 4.8KHz)



Plot #17 Showing POP (Ch 50, Data Rate 76.8KHz)

| Peak Output Power/20db Bandwidth Measurement |           |        |             |           |           |       | Curtis-Straus LLC                          |  |
|--|-----------|--------|-------------|-----------|-----------|-------|--|--|
| Work Order: D0026                            |           |        |             |           |           |       | Table: 2                                   |  |
| Date(s): 1/13/02                             |           |        |             |           |           |       |  |  |
| Engineer: Mairaj Hussain                     |           |        |             |           |           |       |  |  |
| EUT: 915MHz FHSS RF Module                   |           |        |             |           |           |       |  |  |
| Company: Adaptive Instrument Corp.           |           |        |             |           |           |       |  |  |
| CH   | DR        | 20dbBW | Cab fac/Pad | POP(meas) | Final POP | Limit | Limit                                      |  |
|  | (KHz)     | (KHz)  | (db)        | (dbm)     | (dbm)     | (w)   | (dbm)                                      |  |
| 26   | 4.8       | 340.2  | 21.1        | -8.8      | 12.3      | 1     | 30   |  |
| 26   | 76.8      | 366    | 21.1        | -8.9      | 12.2      | 1     | 30   |  |
| 1  | 76.8      | 368.6  | 21.1        | -8.6      | 12.5      | 1     | 30   |  |
| 1  | 4.8       | 341.6  | 21.1        | -8.62     | 12.48     | 1     | 30   |  |
| 50   | 76.8      | 364.4  | 21.1        | -9        | 12.1      | 1     | 30   |  |
| 50   | 4.8       | 331.9  | 21.1        | -9        | 12.1      | 1     | 30   |  |
| CH   | Channel   |        |             |           |           |       | POP (measured) = Cable + Attenuator factor |  |
| DR   | Data Rate |        |             |           |           |       |  |  |
| Spectrum Analyzer:                           | Orange    |        |             |           |           |       |  |  |

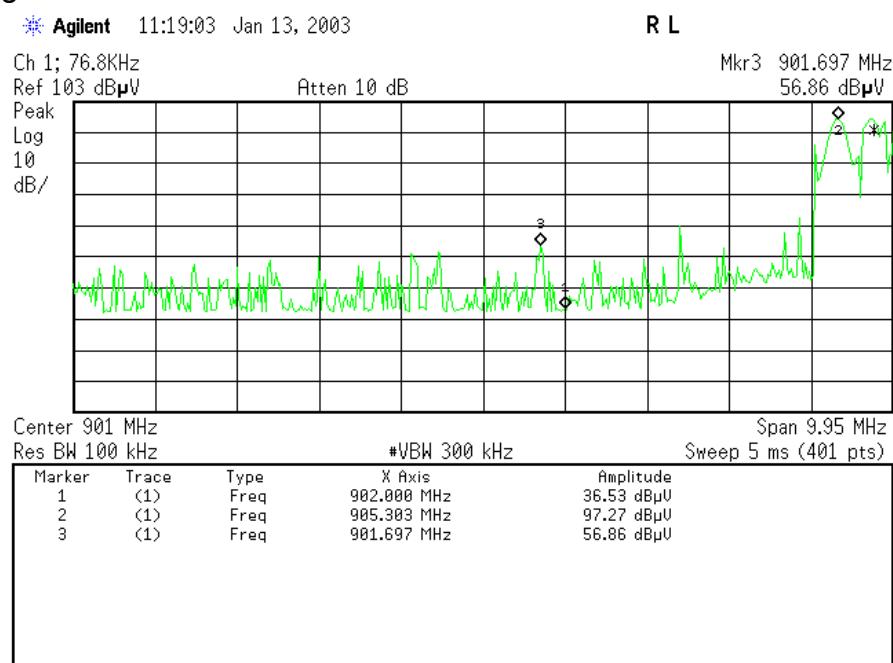
Note: Antenna gain is &lt; 6dBi

**Sample Calculation:**

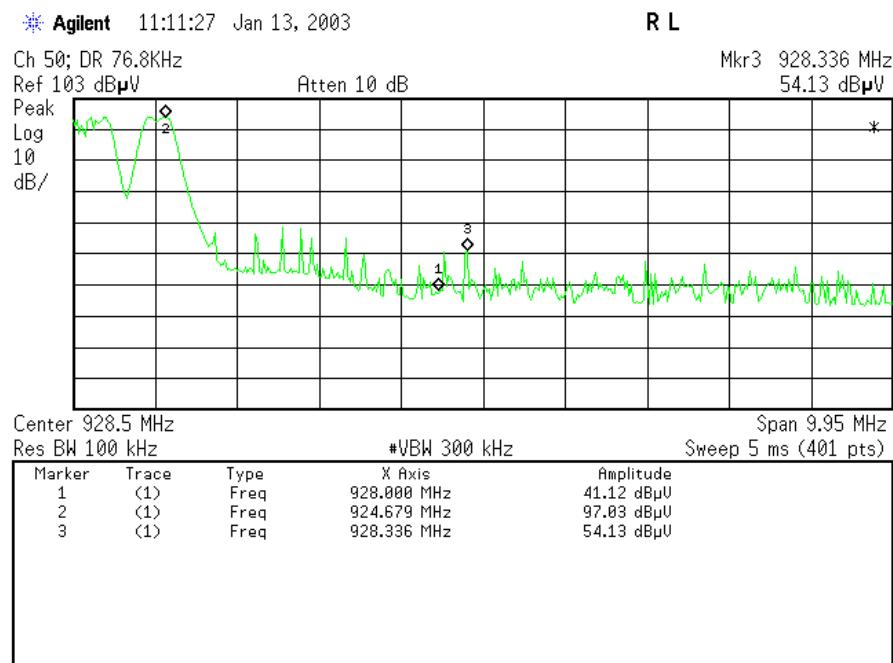
Final POP = Measured POP + Cable Factor/Pad factor

## Section 15.247 (c)

### Band-Edge Plots

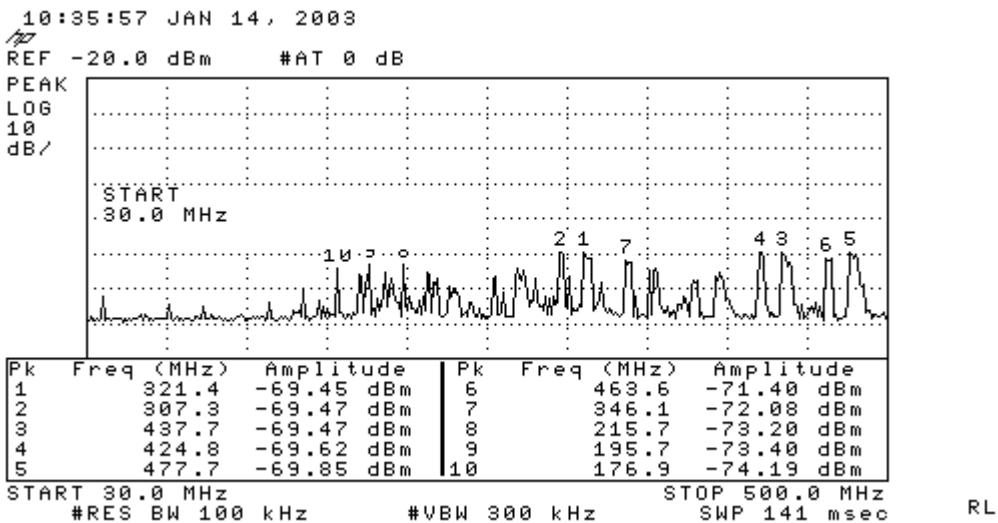


Plot #18 Showing Lower Band-Edge (Ch 1, Data Rate 76.8KHz)

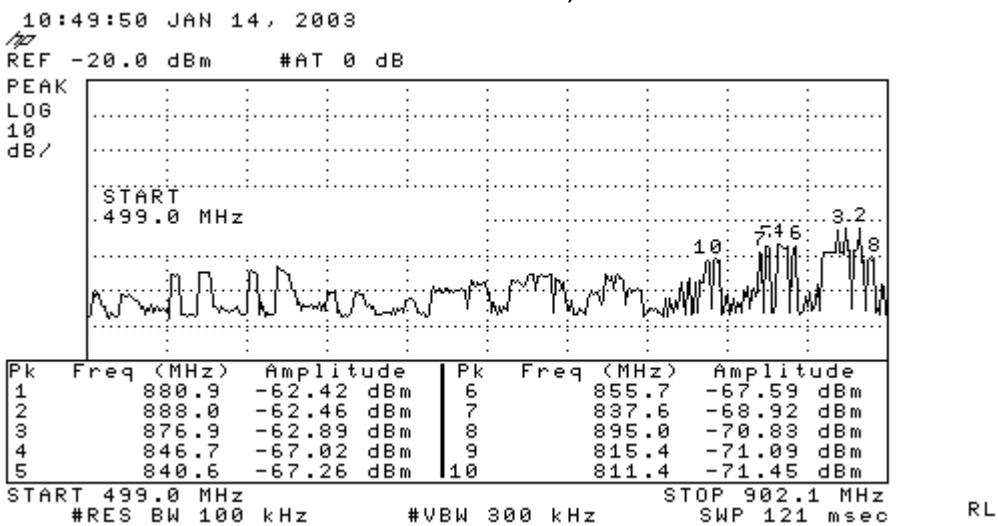


Plot #19 Showing Upper Band-Edge (Ch 50, Data Rate 76.8KHz)

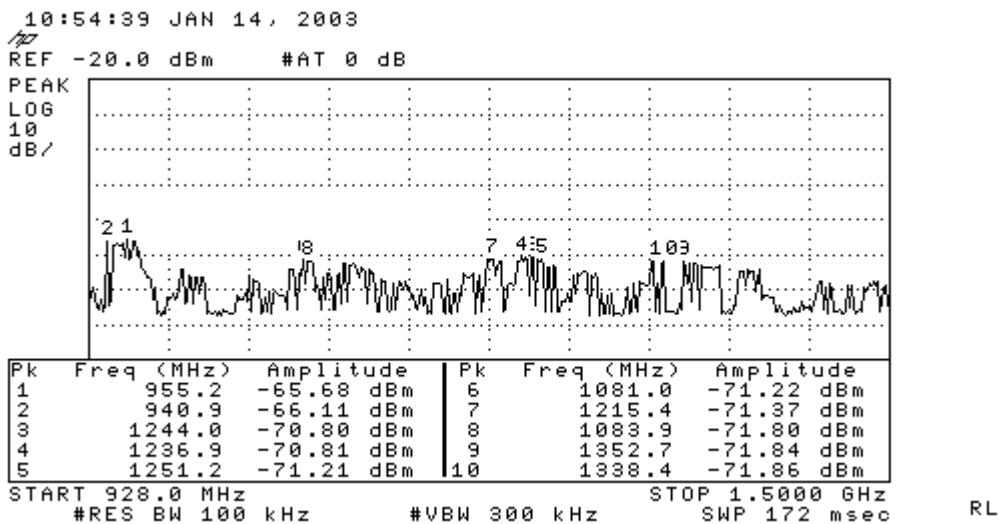
## Section 15.247 (c) Spurious RF Conducted Emissions



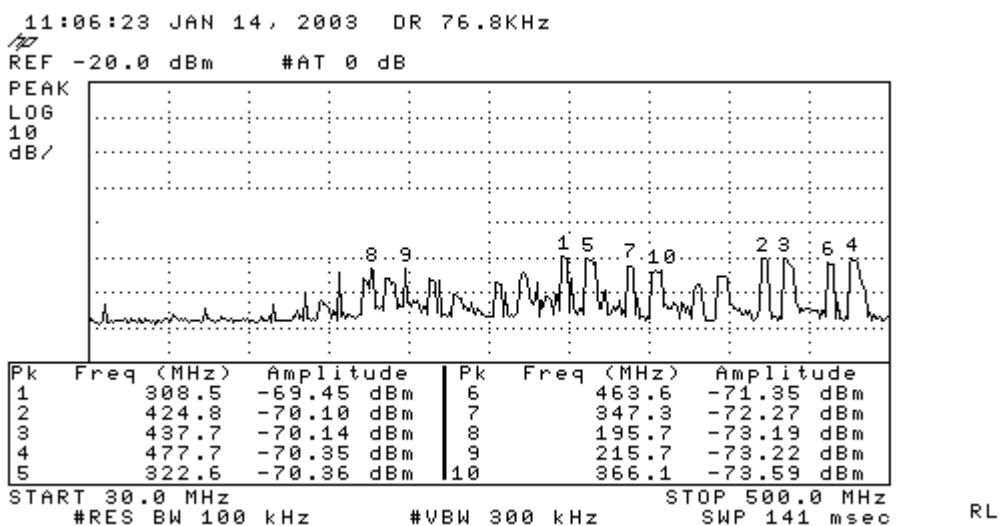
Plot #20 Showing Spurious RF Conducted Emissions 30-500MHz (data rate 4.8KHz)



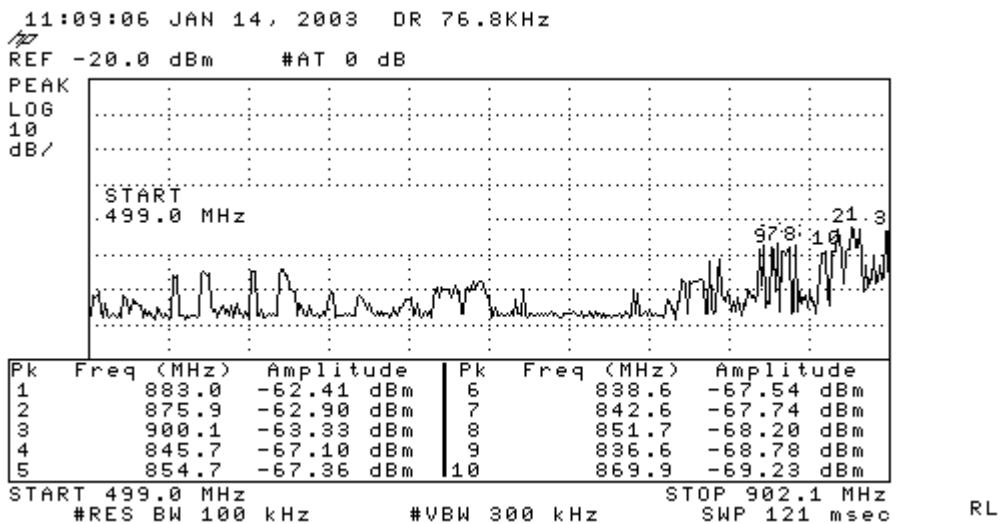
Plot #21 Showing Spurious RF Conducted Emissions 500-902MHz (data rate 4.8Khz)



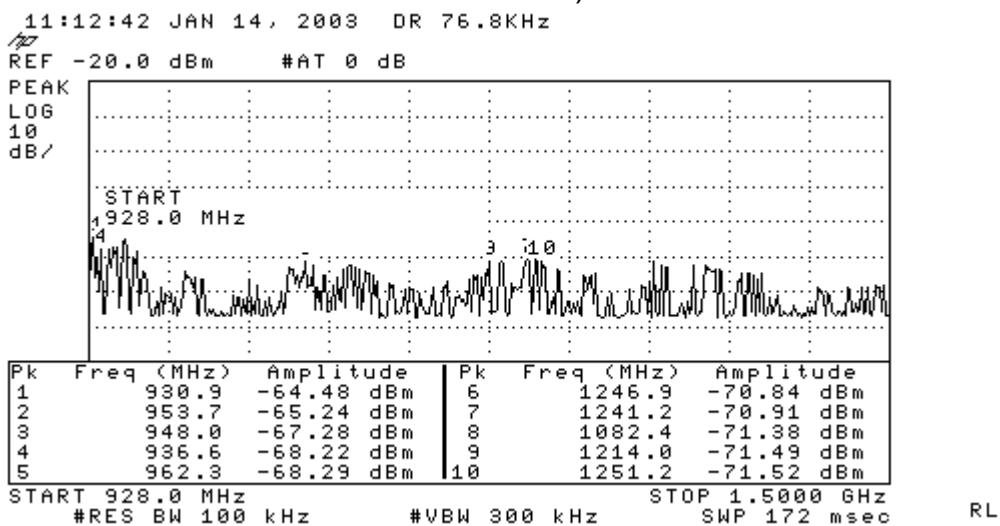
Plot #22 Showing Spurious RF Conducted Emissions 928-1.5GHz (data rate 4.8Khz)



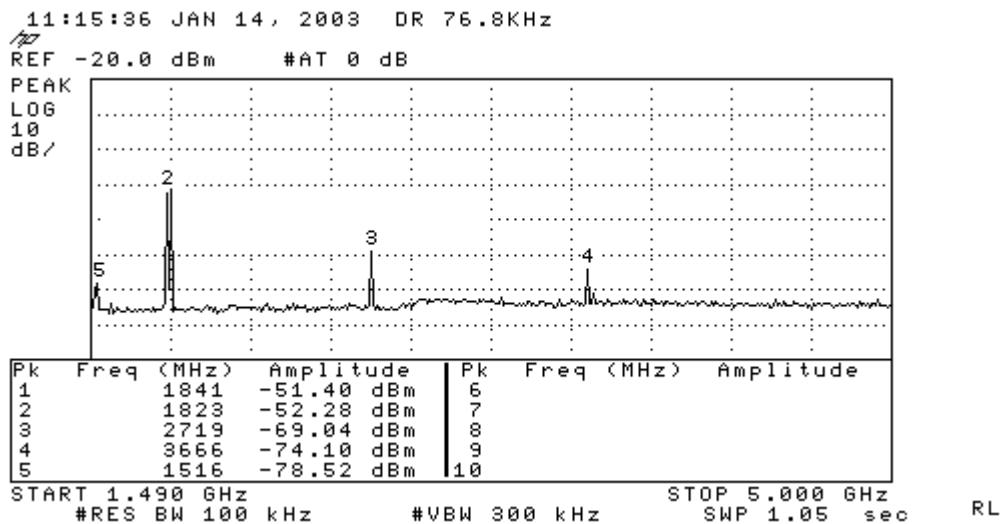
Plot #23 Showing Spurious RF Conducted Emissions 30-500MHz (data rate 76.8Khz)



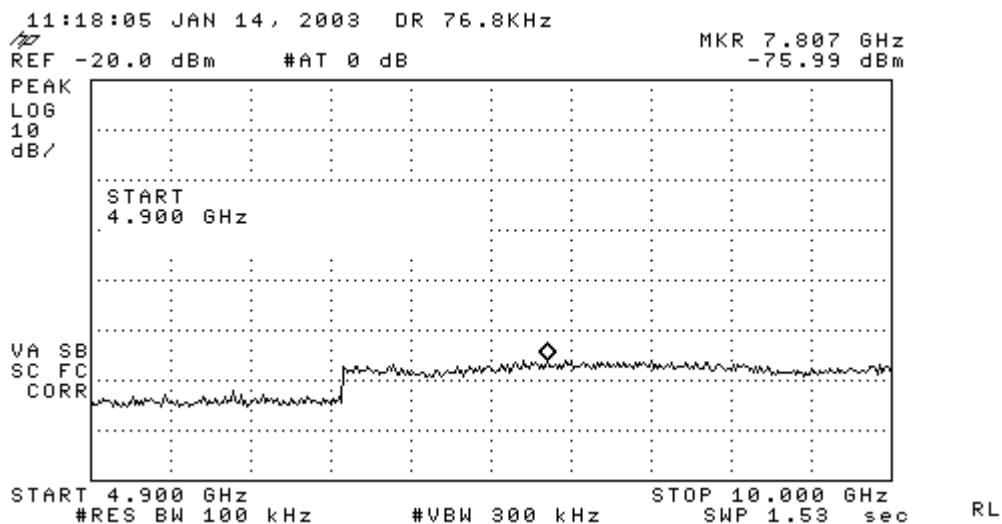
Plot #24 Showing Spurious RF Conducted Emissions 500-902MHz (data rate 76.8Khz)



Plot #25 Showing Spurious RF Conducted Emissions 928-1500MHz (data rate 76.8Khz)



Plot #26 Showing Spurious RF Conducted Emissions 1.5-5GHz (data rate 76.8Khz)



Plot #27 Showing Spurious RF Conducted Emissions 5-10GHz (data rate 76.8Khz)

**Conducted RF Spurious Emissions****Curtis-Straus LLC**

**Work Order:** D0026  
**Date(s):** 1/13/02  
**Engineer:** Mairaj Hussain  
**Date:** 1/14/03  
**EUT:** 915MHz FHSS RF Module

**Table: 3**

**Frequency Range:** 30MHz-902MHz; 928MHz-10GHz

**DR:** 4.8KHz

| <b>Freq</b><br>(MHz)      | <b>Peak Reading</b><br>(dbm) | <b>Cab/Pad</b><br>(db) | <b>Adjusted Reading</b><br>(dbm) | <b>Limit (Max POP)</b><br>(dbm) | <b>Result</b> |
|---------------------------|------------------------------|------------------------|----------------------------------|---------------------------------|---------------|
| 321.4                     | -69.5                        | 21.1                   | -48.4                            | -7.55                           | Pass          |
| 307                       | -69.5                        | 21.1                   | -48.4                            | -7.55                           | Pass          |
| 880.9                     | -62.4                        | 21.1                   | -41.3                            | -7.55                           | Pass          |
| 888                       | -62.5                        | 21.1                   | -41.4                            | -7.55                           | Pass          |
| 955                       | -65.7                        | 21.1                   | -44.6                            | -7.55                           | Pass          |
| 940.9                     | -66.1                        | 21.1                   | -45                              | -7.55                           | Pass          |
| 1815                      | -51.3                        | 21.4                   | -29.9                            | -7.55                           | Pass          |
| 2719                      | -68                          | 21.7                   | -46.3                            | -7.55                           | Pass          |
| 8649                      | -75.6                        | 23.4                   | -52.2                            | -7.55                           | Pass          |
| <b>DR:</b> 76.8KHz        |                              |                        |                                  |                                 |               |
| 308.5                     | -69.5                        | 21.1                   | -48.4                            | -7.55                           | Pass          |
| 883                       | -62.4                        | 21.1                   | -41.3                            | -7.55                           | Pass          |
| 930.9                     | -64.5                        | 21.1                   | -43.4                            | -7.55                           | Pass          |
| 1841                      | -51.4                        | 21.4                   | -30                              | -7.55                           | Pass          |
| <b>CH</b>                 | Channel                      |                        |                                  |                                 |               |
| <b>DR</b>                 | Data Rate                    |                        |                                  |                                 |               |
| <b>Spectrum Analyzer:</b> | Black                        | <b>Cable:</b>          | Microflex                        |                                 |               |

## Spurious Radiated Emissions

### Spurious Radiated Emissions (Restricted Band)

Curtis-Straus LLC

Date: 14-Jan-03 Company: Adaptive  
 Engineer: Mairaj Hussain EUT Desc: 915 MHz FHSS RF Module

Table 4  
 Work Order: D0026

Frequency Range: Restricted Band (30 - 1000 MHz) Measurement Distance: 3 m  
 Notes: 1/4 Wave Antenna EUT Max Freq: 915MHz  
 DR 76.8KHz

| Antenna<br>Polarization<br>(H / V) | Frequency<br>(MHz) | Reading<br>(dB $\mu$ V) | Preamp<br>Factor<br>(dB) | Antenna<br>Factor<br>(dB/m) | Cable<br>Factor<br>(dB) | Adjusted<br>Reading<br>(dB $\mu$ V/m) | ---                     |                |                       | FCC Class B             |                |                       |
|------------------------------------|--------------------|-------------------------|--------------------------|-----------------------------|-------------------------|---------------------------------------|-------------------------|----------------|-----------------------|-------------------------|----------------|-----------------------|
|                                    |                    |                         |                          |                             |                         |                                       | Limit<br>(dB $\mu$ V/m) | Margin<br>(dB) | Result<br>(Pass/Fail) | Limit<br>(dB $\mu$ V/m) | Margin<br>(dB) | Result<br>(Pass/Fail) |
| V                                  | 75.2               | 45.0                    | 21.6                     | 7.5                         | 0.7                     | 31.6                                  | ---                     | ---            | ---                   | 40.0                    | -8.4           | Pass                  |
| V                                  | 110.6              | 47.7                    | 21.8                     | 7.0                         | 1.0                     | 33.9                                  | ---                     | ---            | ---                   | 43.5                    | -9.6           | Pass                  |
| V                                  | 169.5              | 40.4                    | 21.8                     | 9.4                         | 1.3                     | 29.3                                  | ---                     | ---            | ---                   | 43.5                    | -14.2          | Pass                  |
| V(qp)                              | 961.0              | 34.0                    | 21.6                     | 24.0                        | 4.2                     | 40.6                                  | ---                     | ---            | ---                   | 54.0                    | -13.4          | Pass                  |
| V(qp)                              | 977.0              | 33.5                    | 21.6                     | 23.9                        | 4.3                     | 40.1                                  | ---                     | ---            | ---                   | 54.0                    | -13.9          | Pass                  |
| V(qp)                              | 995.0              | 35.4                    | 21.6                     | 23.8                        | 4.3                     | 41.9                                  | ---                     | ---            | ---                   | 54.0                    | -12.1          | Pass                  |

**Table Result:** Pass by -8.4 dB **Worst Freq:** 75.2 MHz

Test Site: "T" Pre-Amp: Black Cable: 65 ft RG8A/U Analyzer: Black Antenna: Blue

### Spurious Radiated Emissions (Restricted Band)

Curtis-Straus LLC

Date: 14-Jan-03 Company: Adaptive  
 Engineer: Mairaj Hussain EUT Desc: 915 MHz FHSS RF Module

Table 5  
 Work Order: D0026

Frequency Range: Restricted Band (1000 - 10000 MHz) Measurement Distance: 3 m

Notes: 1/4 Wave Antenna EUT Max Freq: 915MHz  
 DR 76.8 KHz

| Antenna<br>Polarization<br>(H / V) | Frequency<br>(MHz) | Reading<br>(dB $\mu$ V) | Preamp<br>Factor<br>(dB) | Antenna<br>Factor<br>(dB/m) | Cable<br>Factor<br>(dB) | Adjusted<br>Reading<br>(dB $\mu$ V/m) | ---                     |                |                       | FCC Class B             |                |                       |
|------------------------------------|--------------------|-------------------------|--------------------------|-----------------------------|-------------------------|---------------------------------------|-------------------------|----------------|-----------------------|-------------------------|----------------|-----------------------|
|                                    |                    |                         |                          |                             |                         |                                       | Limit<br>(dB $\mu$ V/m) | Margin<br>(dB) | Result<br>(Pass/Fail) | Limit<br>(dB $\mu$ V/m) | Margin<br>(dB) | Result<br>(Pass/Fail) |
| V                                  | 2746.0             | 32.1                    | 20.1                     | 31.1                        | 1.5                     | 44.6                                  | ---                     | ---            | ---                   | 54.0                    | -9.4           | Pass                  |

**Table Result:** Pass by -9.4 dB **Worst Freq:** 2746.0 MHz

Test Site: "T" Pre-Amp: White Cable: 3m Microflex Analyzer: Black Antenna: Black Horn

### Spurious Radiated Emissions (Restricted Band)

Curtis-Straus LLC

Date: 14-Jan-03 Company: Adaptive  
 Engineer: Mairaj Hussain EUT Desc: 915 MHz FHSS RF Module

Table 6  
 Work Order: D0026

Frequency Range: Restricted Band (30 - 1000 MHz) Measurement Distance: 3 m

Notes: 1/2 Wave Dipole Antenna EUT Max Freq: 915MHz  
 DR 76.8 KHz

| Antenna<br>Polarization<br>(H / V) | Frequency<br>(MHz) | Reading<br>(dB $\mu$ V) | Preamp<br>Factor<br>(dB) | Antenna<br>Factor<br>(dB/m) | Cable<br>Factor<br>(dB) | Adjusted<br>Reading<br>(dB $\mu$ V/m) | ---                     |                |                       | FCC Class B             |                |                       |
|------------------------------------|--------------------|-------------------------|--------------------------|-----------------------------|-------------------------|---------------------------------------|-------------------------|----------------|-----------------------|-------------------------|----------------|-----------------------|
|                                    |                    |                         |                          |                             |                         |                                       | Limit<br>(dB $\mu$ V/m) | Margin<br>(dB) | Result<br>(Pass/Fail) | Limit<br>(dB $\mu$ V/m) | Margin<br>(dB) | Result<br>(Pass/Fail) |
| V(qp)                              | 131.2              | 37.7                    | 21.9                     | 8.2                         | 1.1                     | 25.1                                  | ---                     | ---            | ---                   | 43.5                    | -18.4          | Pass                  |
| V(qp)                              | 169.7              | 39.3                    | 21.8                     | 9.4                         | 1.3                     | 28.2                                  | ---                     | ---            | ---                   | 43.5                    | -15.3          | Pass                  |
| V(qp)                              | 401.4              | 39.8                    | 21.8                     | 16.7                        | 2.4                     | 37.1                                  | ---                     | ---            | ---                   | 46.0                    | -8.9           | Pass                  |
| V(qp)                              | 963.7              | 43.8                    | 21.6                     | 24.0                        | 4.3                     | 50.5                                  | ---                     | ---            | ---                   | 54.0                    | -3.5           | Pass                  |
| V(qp)                              | 976.6              | 36.7                    | 21.6                     | 23.9                        | 4.3                     | 43.3                                  | ---                     | ---            | ---                   | 54.0                    | -10.7          | Pass                  |

**Table Result:** Pass by -3.5 dB **Worst Freq:** 963.7 MHz

Test Site: "T" Pre-Amp: Black Cable: 65 ft RG8A/U Analyzer: Black Antenna: Blue

### Spurious Radiated Emissions (Restricted Band)

Curtis-Straus LLC

Date: 14-Jan-03 Company: Adaptive

Engineer: Mairaj Hussain EUT Desc: 915 MHz FHSS RF Module

Table 7  
 Work Order: D0026

Frequency Range: Restricted Band (1000 - 10000 MHz) Measurement Distance: 3 m

Notes: 1/2 Wave Dipole Antenna EUT Max Freq: 915MHz  
 DR 76.8 KHz

| Antenna<br>Polarization<br>(H / V) | Frequency<br>(MHz) | Reading<br>(dB $\mu$ V) | Preamp<br>Factor<br>(dB) | Antenna<br>Factor<br>(dB/m) | Cable<br>Factor<br>(dB) | Adjusted<br>Reading<br>(dB $\mu$ V/m) | ---                     |                |                       | FCC Class B             |                |                       |
|------------------------------------|--------------------|-------------------------|--------------------------|-----------------------------|-------------------------|---------------------------------------|-------------------------|----------------|-----------------------|-------------------------|----------------|-----------------------|
|                                    |                    |                         |                          |                             |                         |                                       | Limit<br>(dB $\mu$ V/m) | Margin<br>(dB) | Result<br>(Pass/Fail) | Limit<br>(dB $\mu$ V/m) | Margin<br>(dB) | Result<br>(Pass/Fail) |
| H                                  | 2715.0             | 35.5                    | 20.0                     | 31.1                        | 1.5                     | 48.1                                  | ---                     | ---            | ---                   | 54.0                    | -5.9           | Pass                  |
| V                                  | 2745.0             | 34.1                    | 20.1                     | 31.1                        | 1.5                     | 46.6                                  | ---                     | ---            | ---                   | 54.0                    | -7.4           | Pass                  |

**Table Result:** Pass by -5.9 dB **Worst Freq:** 2715.0 MHz

Test Site: "T" Pre-Amp: White Cable: 3m Microflex Analyzer: Black Antenna: Black Horn

## Spurious Radiated Emissions (Restricted Band)

Curtis-Straus LLC

| Date: 14-Jan-03                      |                 |                      | Company: Adaptive                |                       |                   | Table 8                         |                      |             |                    |                      |             |                    |
|--------------------------------------|-----------------|----------------------|----------------------------------|-----------------------|-------------------|---------------------------------|----------------------|-------------|--------------------|----------------------|-------------|--------------------|
| Engineer: Mairaj Hussain             |                 |                      | EUT Desc: 915 MHz FHSS RF Module |                       |                   | Work Order: D0026               |                      |             |                    |                      |             |                    |
| Frequency Range: 30MHz-10GHz         |                 |                      |                                  |                       |                   | Measurement Distance: 3 m       |                      |             |                    |                      |             |                    |
| Notes: 1/4 Wave Antenna REC MODE     |                 |                      | EUT Max Freq: 915MHz             |                       |                   |                                 |                      |             |                    |                      |             |                    |
| DR 76.8 KHz                          |                 |                      |                                  |                       |                   |                                 |                      |             |                    |                      |             |                    |
| Antenna Polarization (H / V)         | Frequency (MHz) | Reading (dB $\mu$ V) | Preamp Factor (dB)               | Antenna Factor (dB/m) | Cable Factor (dB) | Adjusted Reading (dB $\mu$ V/m) | ---                  |             |                    | FCC Class B          |             |                    |
|                                      |                 |                      |                                  |                       |                   |                                 | Limit (dB $\mu$ V/m) | Margin (dB) | Result (Pass/Fail) | Limit (dB $\mu$ V/m) | Margin (dB) | Result (Pass/Fail) |
| H                                    | 438.0           | 35.5                 | 21.7                             | 17.1                  | 2.5               | 33.4                            | ---                  | ---         | ---                | 46.0                 | -12.6       | Pass               |
| H                                    | 447.3           | 33.0                 | 21.7                             | 17.2                  | 2.5               | 31.0                            | ---                  | ---         | ---                | 46.0                 | -15.0       | Pass               |
| H                                    | 477.0           | 32.3                 | 21.6                             | 17.5                  | 2.7               | 30.9                            | ---                  | ---         | ---                | 46.0                 | -15.1       | Pass               |
| V                                    | 915.0           | 37.0                 | 21.6                             | 24.2                  | 4.1               | 43.7                            | ---                  | ---         | ---                | 46.0                 | -2.3        | Pass               |
| <b>Table Result:</b> Pass by -2.3 dB |                 |                      |                                  |                       |                   | <b>Worst Freq:</b> 915.0 MHz    |                      |             |                    |                      |             |                    |
| Test Site: "T"                       |                 |                      | Pre-Amp: Black                   |                       |                   | Analyzer: Black                 |                      |             | Antenna: Blue      |                      |             |                    |

## Sample Calculation:

$$\text{Adjusted Reading} = \text{Reading} - \text{Pre Amp}_{(\text{factor})} + \text{Antenna}_{(\text{factor})} + \text{Cable}_{(\text{factor})}$$

## AC Line Conducted Emission Measurements

| AC Mains Conducted Emissions           |                  |                  |                                  |                  |                       |                                      |           |                         | Curtis-Straus LLC |                        |               |                            |
|--|------------------|------------------|----------------------------------|------------------|-----------------------|--------------------------------------|-----------|-------------------------|-------------------|------------------------|---------------|----------------------------|
| Date: 13-Jan-03                        |                  |                  | Company: Adaptive                |                  |                       | Table No:9                           |           |                         |                   |                        |               |                            |
| Engineer: Mairaj Hussain               |                  |                  | EUT Desc: 915 MHz FHSS RF Module |                  |                       | Work Order: D0026                    |           |                         |                   |                        |               |                            |
| Notes:                                 |                  |                  |                                  |                  |                       |                                      |           |                         |                   |                        |               |                            |
| Range: 0.15-30Mhz                      |                  | LISN(s): Blue    |                                  |                  | Other Equipment:---   |                                      |           | Spectrum Analyzer: Blue |                   |                        |               |                            |
| Frequency (MHz)                        | Q.P. Readings    |                  | Ave. Readings                    |                  | Impedance Factor (dB) | FCC B Applicable until July 12, 2004 |           | FCC/CISPR B             |                   | FCC/CISPR B            |               | Overall Result (Pass/Fail) |
|  | QP1 (dB $\mu$ V) | QP2 (dB $\mu$ V) | AV1 (dB $\mu$ V)                 | AV2 (dB $\mu$ V) |                       | Limit (dB $\mu$ V)                   | Margin dB | qp Limit (dB $\mu$ V)   | qp Margin dB      | AVE Limit (dB $\mu$ V) | AVE Margin dB |                            |
| 0.15                                   | 22.8             | 12.0             |                                  |                  | 20.0                  | ---                                  | ---       | 66.0                    | -23.2             | 56.0                   | -13.2         | Pass                       |
| 0.70                                   | 6.5              | 6.4              |                                  |                  | 20.0                  | 47.9                                 | -21.4     | 56.0                    | -29.5             | 46.0                   | -19.5         | Pass                       |
| 2.76                                   | 4.4              | 4.4              |                                  |                  | 20.0                  | 47.9                                 | -23.5     | 56.0                    | -31.6             | 46.0                   | -21.6         | Pass                       |
| 6.10                                   | 5.0              | 1.9              |                                  |                  | 20.0                  | 47.9                                 | -22.9     | 60.0                    | -35.0             | 50.0                   | -25.0         | Pass                       |
| 10.00                                  | 1.5              | 1.3              |                                  |                  | 20.0                  | 47.9                                 | -26.4     | 60.0                    | -38.5             | 50.0                   | -28.5         | Pass                       |
| 15.00                                  | 1.3              | 1.4              |                                  |                  | 20.0                  | 47.9                                 | -26.5     | 60.0                    | -38.6             | 50.0                   | -28.6         | Pass                       |
| 15.84                                  | 6.0              | 6.1              |                                  |                  | 20.0                  | 47.9                                 | -21.8     | 60.0                    | -33.9             | 50.0                   | -23.9         | Pass                       |
| 18.28                                  | 9.4              | 9.8              |                                  |                  | 20.0                  | 47.9                                 | -18.1     | 60.0                    | -30.2             | 50.0                   | -20.2         | Pass                       |
| 20.72                                  | 15.3             | 14.9             |                                  |                  | 20.0                  | 47.9                                 | -12.6     | 60.0                    | -24.7             | 50.0                   | -14.7         | Pass                       |
| <b>Table Result:</b> Pass by -12.60 dB |                  |                  |                                  |                  |                       | <b>Worst Freq:</b> 20.72 MHz         |           |                         |                   |                        |               |                            |

## LIMITS

Quasi-Peak: 250 $\mu$ V = 47.9dB $\mu$ V in the range 450kHz to 30MHz

[47 CFR 15.207(a) Revised as of October 1, 2001]

**Note:** On July 12, 2004, FCC adopts the conducted emissions limits of the European CISPR 22 standard as outlined below

| Frequency of emission (MHz) | Quasi-peak limit (dB $\mu$ V) | Average limit (dB $\mu$ V) |
|-----------------------------|-------------------------------|----------------------------|
| 0.15-0.5                    | 66 to 56*                     | 56 to 46*                  |
| 0.5-5                       | 56                            | 46                         |
| 5-30                        | 60                            | 50                         |

\*Decreases with the logarithm of the frequency.

[47 CFR 15.207(a) Revised as of October 1, 2002; amended by ET Docket 98-80; FCC 02-157, published in the Federal Register Vol. 67, No. 132, on Wednesday, July 10, 2002]

**Section 12.247(g)**

System Receiver Hopping Capability – The receiver's microcontroller uses the same hopping table that is used by the transmitter. At power-up, the receiver will stay on one channel and listen. Once it receives a valid transmission, the receiver then knows where in the hopping table the next transmission will occur. Once the “channel lock” is achieved, the receiver then moves to the next channel in the hopping table.

## Test Equipment Used

| REV. 1/15/03              |              |        |     |            |       |                 |
|---------------------------|--------------|--------|-----|------------|-------|-----------------|
| <b>SPECTRUM ANALYZERS</b> | RANGE        | MN     | MFR | SN         | ASSET | CALIBRATION DUE |
| BLUE                      | 9kHz-1.8GHz  | 8591E  | HP  | 3223A00227 | 00070 | 04-SEP-2003     |
| BLACK                     | 9kHz-12.8GHz | 8596E  | HP  | 3710A00944 | 00337 | 08-JUL-2003     |
| ORANGE                    | 9kHz-26.5GHz | E4407B | HP  | US39440975 | 00394 | 07-JUN-2003     |

| <b>LISN</b>                       | RANGE | MN       | MFR       | SN        | ASSET           | CALIBRATION DUE |
|-----------------------------------|-------|----------|-----------|-----------|-----------------|-----------------|
| <b>OPEN AREA TEST SITE (OATS)</b> |       | FCC CODE | IC CODE   | VCCI CODE | CALIBRATION DUE |                 |
| SITE T                            |       | 93448    | IC 2762-T | R-905     | 04-FEB-2004     |                 |

| <b>LINE CONDUCTED TEST SITES</b> | RANGE | MN    | MFR | SN    | ASSET       | CALIBRATION DUE |
|----------------------------------|-------|-------|-----|-------|-------------|-----------------|
| EMI 2                            |       | 93448 | N/A | C-480 | 31-MAR-2003 |                 |

| <b>ANTENNAS</b> | RANGE      | MN   | MFR  | SN        | ASSET | CALIBRATION DUE |
|-----------------|------------|------|------|-----------|-------|-----------------|
| BLUE BILOG      | 30MHz-1GHz | 3143 | EMCO | 1271      | 00803 | 11-JUL-2004     |
| BLACK HORN      | 1-18GHz    | 3115 | EMCO | 9703-5148 | 00056 | 12-JUN-2003     |

| <b>PREAMPS / ATTENUATORS / FILTERS</b> | RANGE        | MN          | MFR        | SN     | ASSET | CALIBRATION DUE |
|--|--------------|-------------|------------|--------|-------|-----------------|
| BLACK                                  | 0.01-2000MHz | ZFL-1000-LN | C-S        | N/A    | 00799 | 22-MAR-2003     |
| WHITE                                  | 1-20GHz      | SMC-12A     | C-S        | 426643 | 00760 | 27-AUG-2003     |
| 20dB ATTENUATOR                        | 0.03-20 GHz  | PE 7019-20  | PASTERNACK | 01     | 00791 | 13-JUN-2003     |

*Unless otherwise noted the calibration interval is one year. All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.*

## ***Terms And Conditions***

**Paragraph 1. SERVICES.** LABORATORY will:

- 1.1 Use the degree of care and skill ordinarily exercised by and consistent with the standards of the profession.
- 1.2 Perform all technical services in substantial accordance with the generally accepted laboratory principles and practices.
- 1.3 Retain all pertinent records relating to the services performed for a period of three (3) years following submission of the report describing such services, during which period the records will be made available to CLIENT upon reasonable request.

**Paragraph 2. CLIENT'S RESPONSIBILITIES.** CLIENT or his authorized representative will:

- 2.1 Provide LABORATORY with all plans, schematics, specifications, addenda, change orders, drawings and other information for the proper performance of technical services.
- 2.2 Designate a person to act as CLIENT's representative with respect to LABORATORY's services to be performed on behalf of the CLIENT; such person or firm to have complete authority to transmit instructions, receive information and data, interpret and define CLIENT's policies and decisions with respect to the LABORATORY's work on behalf of the CLIENT and to order, at CLIENT's expense, such technical services as may be required.
- 2.3 Designate a person who is authorized to receive copies of LABORATORY's reports.
- 2.4 Undertake the following:
  - (a) Secure and deliver to LABORATORY, without cost to LABORATORY, preliminary representative samples of the equipment proposed to require technical services, together with any relevant data.
  - (b) Furnish such labor and equipment needed by LABORATORY to handle samples at the LABORATORY and to facilitate the specified technical services.

**Paragraph 3. GENERAL CONDITIONS:**

- 3.1 LABORATORY, by the performance of services covered hereunder, does not in any way assume any of those duties or responsibilities customarily vested in the CLIENT, its employees, or any other party, agency or authority.
- 3.2 LABORATORY shall not be responsible for acts of omissions of any other party or parties involved in the design, manufacture or maintenance of the equipment or the failure of any employee, contractor or subcontractor to undertake any aspect of equipment's design, manufacture or maintenance.
- 3.3 LABORATORY is not authorized to revoke, alter, release, enlarge or release any requirement of the equipment's design, manufacture or maintenance unless specifically authorized by CLIENT or his authorized representative.
- 3.4 THE ONLY WARRANTY MADE BY LABORATORY IN CONNECTION WITH ITS SERVICE PERFORMED HEREUNDER IS THAT IT WILL USE THAT DEGREE OF CARE AND SKILL AS SET FORTH IN PARAGRAPH 1 ABOVE. NO OTHER WARRANTY, EXPRESS OR IMPLIED, IS MADE OR INTENDED FOR SERVICES PROVIDED HEREUNDER.
- 3.5 Where the LABORATORY indicates that additional testing is advisable to obtain more valid or useful data, and where such testing has not been authorized, CLIENT agrees to view such test reports as inconclusive and preliminary.
- 3.6 The LABORATORY will supply technical service and prepare a report based solely on the sample submitted to the LABORATORY by the CLIENT. The CLIENT understands that application of the data to other devices is highly speculative and should be applied with extreme caution.
- 3.7 The LABORATORY agrees to exercise ordinary care in receiving, preserving and shipping (F.O.B. Littleton, MA) any sample to be tested, but assumes no responsibility for damages, either direct or consequential, which arise from loss, damage or destruction of the samples due to the act of examination, modification or testing, or technical services or circumstances beyond LABORATORY's control.
- 3.8 The LABORATORY will hold samples for thirty (30) days after tests are completed, or until the CLIENT's outstanding debts to the LABORATORY are satisfied, whichever is later.
- 3.9 The CLIENT recognizes that generally accepted error variances apply and agrees to consider such error variances in its use of test data.
- 3.10 It is agreed between LABORATORY and CLIENT that no distribution of any tests, reports or analysis other than that described below shall be made to any third party without the prior written consent of both parties unless such distribution is mandated by operation of law. It is agreed that tests, reports, or analysis results may be disclosed to third party auditors of the laboratory at the laboratory facility in the course of accreditation maintenance audits. No reference to reports or technical services of the LABORATORY shall be made in any advertising or promotional literature without the express written permission of the LABORATORY.
- 3.11 The CLIENT acknowledges that all employees of LABORATORY operate under employment contracts with the LABORATORY and CLIENT agrees not to solicit employment of such employees or to solicit information related to other clients from said employees.
- 3.12 In recognition of the relative risks and benefits of the project to both CLIENT and LABORATORY, the risks have been allocated such that the CLIENT agrees, to the fullest extent permitted by law, to limit the liability of the LABORATORY to the CLIENT for any and all claims, losses, costs, damages of any nature whatsoever or claims expenses from any cause or causes, including attorneys' fees and costs and expert witness fees and costs, so that the total aggregate liability of the LABORATORY to the CLIENT shall not exceed \$100,000, or the LABORATORY'S total fee for services rendered on this project, whichever is greater. It is intended that this limitation apply to any and all liability or cause of action however alleged or arising, unless otherwise prohibited by law.

**Paragraph 4. INSURANCE:**

- 4.1 LABORATORY shall secure and maintain throughout the full period of the services provided to the CLIENT adequate insurance to protect it from claims under applicable Workmen's Compensation Acts and also shall maintain one million dollars of general liability coverage to cover claims for bodily injury, death or property damage as may arise from the performance of its services.
- 4.2 The CLIENT hereby warrants that it has sufficient insurance to protect its employees adequately under applicable Workmen's Compensation Acts and for bodily injury, death, or property damage.

4.3 No insurance of whatever kind or type, which may be carried by either party is to be considered as in any way limiting any other party's responsibility for damages resulting from their operations or for furnishing work and materials.

**Paragraph 5. PAYMENT:**

- 5.1 CLIENT shall pay to LABORATORY such fees for services as previously agreed, orally or in writing, within 30 days of presentment of a bill for such services performed. In the event CLIENT ordered, orally or in writing, services but such services were not assigned a rate for billing, such services shall be billed at the LABORATORY's reasonable and customary rate.
- 5.2 CLIENT shall be responsible for all shipping, customs and other expenses related to services provided by LABORATORY to the CLIENT, and shall fully insure any test sample or other equipment provided to LABORATORY by the CLIENT.
- 5.3 Amounts overdue from CLIENT to LABORATORY shall be charged interest at a rate of 1½% per month.

**Paragraph 6. ISO/IEC GUIDE 17025 ADDITIONS:**

- 6.1 CLIENT agrees that this test report will not be reproduced except in full, without written approval from the LABORATORY.
- 6.2 CLIENT agrees that this test report shall not be used to claim product endorsement by A2LA or ANSI or any agency of the U.S. Government.
- 6.3 CLIENT agrees that test results presented herein relate only to the sample tested by the LABORATORY.