



Report No	ED0026-1
Client	Adaptive Instrument Corp. 577 Main street Hudson, MA 01749
Phone	978-562-0154
Fax	978-562-2563
FRN	0007941438
Models	16363
FCC ID	QQN16363
Equipment Type Equipment Code	Low Power Communication Device Transmitter DXX
Results	As detailed within this report
Prepared by	 Mairaj Hussain – Test Engineer
Authorized by	 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

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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
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<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*

<b>EUT Configuration</b>				
<b>Work Order:</b> D0026 <b>Company:</b> Adaptive Instrument Corp. <b>Company Address:</b> 577 Main Street Hudson, MA 01749 <b>Contact:</b> Jeffery Cho <b>Person(s) Present:</b> Jeffery Cho				
<b>MN</b>		<b>SN</b>	<b>FCC ID</b>	
EUT: 16363		-	QQN16363	
<b>EUT Description:</b> 915 MHz FHSS RF Module <b>EUT Max Frequency:</b> 902 - 928 MHz				
<b>Support Equipment:</b>	<b>MN</b>	<b>SN</b>	<b>FCC ID</b>	
Agilent Power supply	E3630A	MY40001033	-	
<b>EUT Cables:</b>	<b>Qty</b>	<b>Shielded?</b>	<b>Length</b>	<b>Ferrites</b>
DC Power cable	1	No	> 1m	None
<b>Unpopulated EUT Ports:</b>	<b>Qty</b>	<b>Reason</b>		
None				
<b>Software / Operating Mode Description:</b>				
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:

47 CFR Part #	47 CFR Part #	Comments
	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 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) (ii) (iii)	EUT does not operate in the specified frequency band(s).
	15.247 (5)	See RF Exposure exhibit.

15.247 (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 (d)		EUT does not use digital modulation.
15.247 (f)		EUT does not qualify as hybrid system.
15.247 (g)		See section 12.247(g) part of the report.
15.247 (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>
Work Order: D0026		Table: 1
Date(s): 1/13/02		
Engineer: Mairaj Hussain		
Date: 1/14/03		
EUT: 915MHz FHSS RF Module		
<b>Voltage</b>	<b>Peak Output Power Measured</b>	
Nominal	-8.8dbm	
3.3V	-8.8dbm	
5.0V	-8.8dbm	

<b>Conclusion:</b>	The peak output power does not change with input voltage.
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*Note: Above PoP readings are off of spectrum analyzer and do not take in account for cables loss and any attenuator used.*

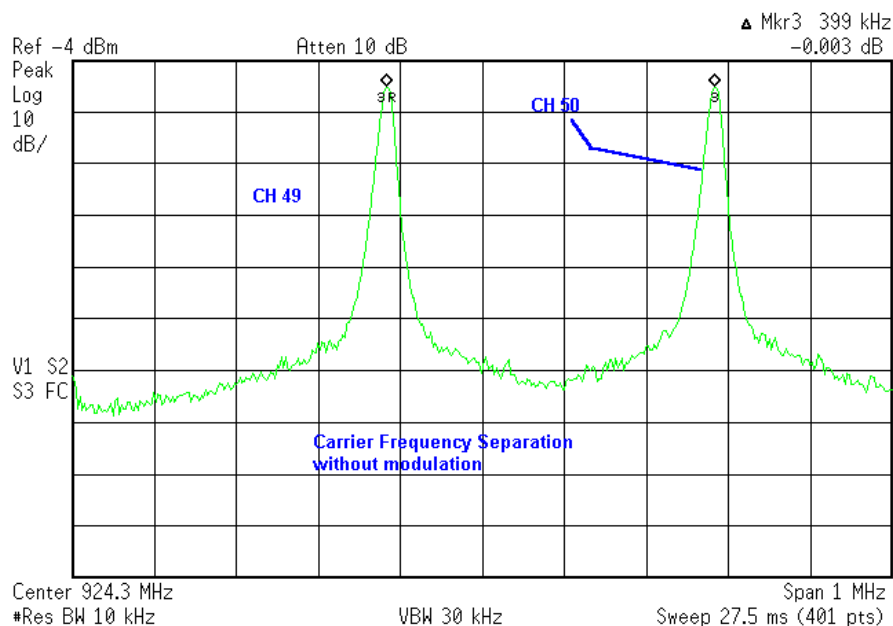
**Section 15.247 (a) (1)**

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

Agilent 11:59:38 Jan 13, 2003

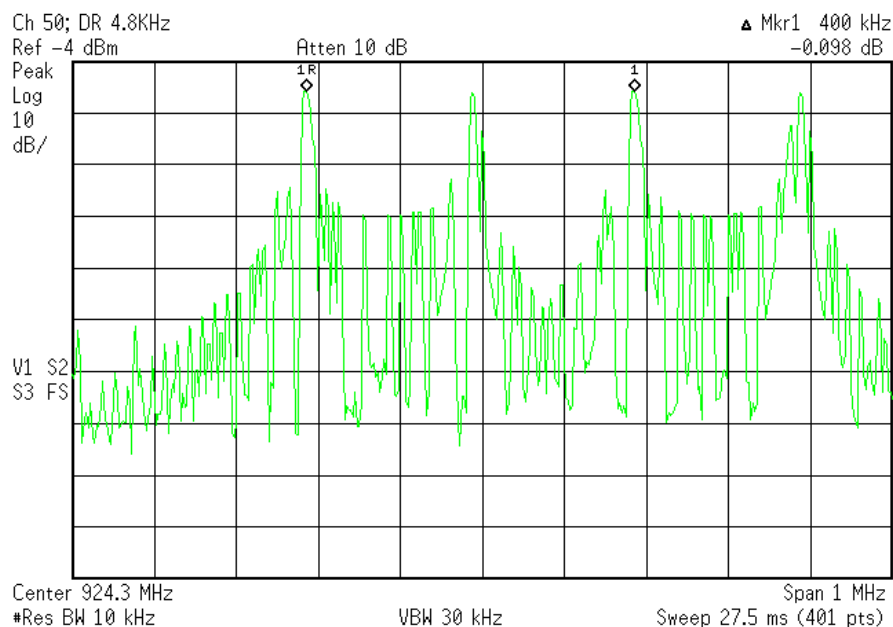
R L



Plot #1 Showing carrier frequency separation (hopping disabled)

Agilent 11:51:26 Jan 13, 2003

R L



Plot #2 Showing carrier frequency separation (hopping enabled)

Channel separation = 400 KHz

20dB BW = 368.6 KHz (See next section)

### Conclusion:

Hopping channel carrier frequencies are separated by a minimum of 20db bandwidth.

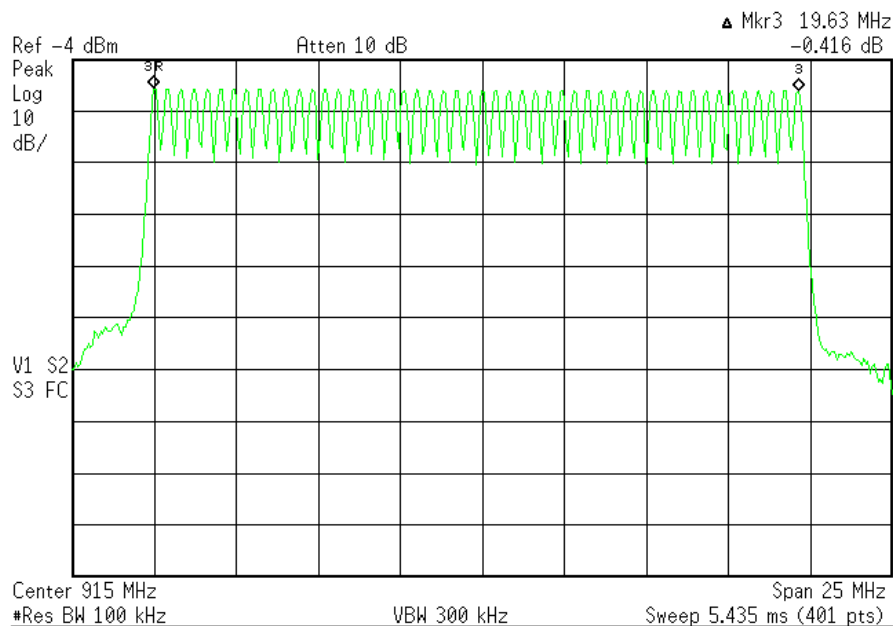


**Section 15.247 (a) (1) (i)**

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

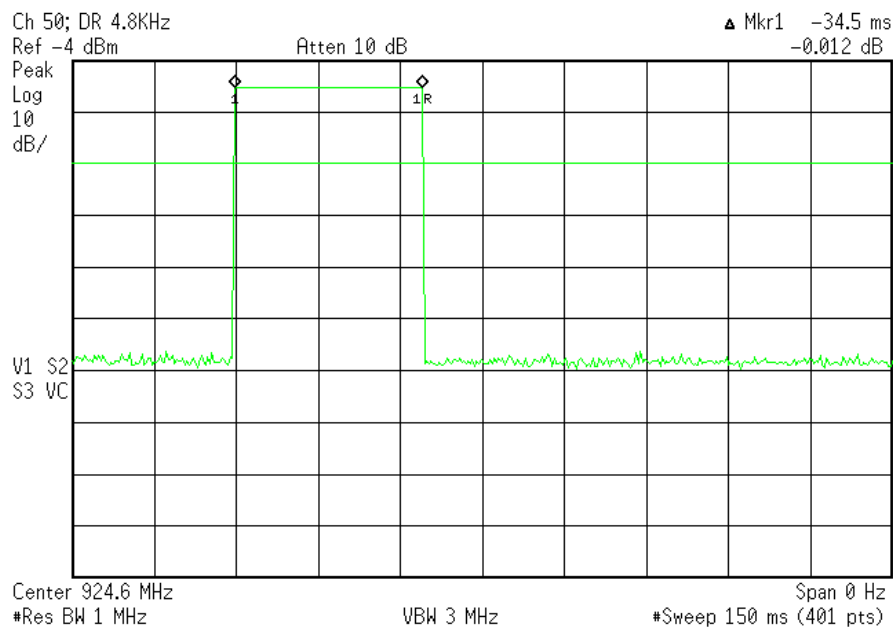
Agilent 13:10:23 Jan 13, 2003

R L

**Plot # 3 Showing 50 hopping frequencies**

Agilent 13:21:13 Jan 13, 2003

R L

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

Agilent 13:24:46 Jan 13, 2003

R L

Ch 50; DR 76.8KHz

Mkr1 2.75 ms

Ref -4 dBm

Atten 10 dB

-0.017 dB

Peak

Log

10

dB/

V1 S2

S3 VC

Center 924.6 MHz

Span 0 Hz

#Res BW 1 MHz

VBW 3 MHz

#Sweep 10 ms (401 pts)

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

<b>Conclusion:</b>	The time of occupancy is less than 0.4 sec
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Agilent 10:38:34 Jan 13, 2003

R L

Ch 1; DR 4.8KHz

Ref -4 dBm

Atten 10 dB

Peak

Log

10

dB/

Center 905.1 MHz

Span 3 MHz

#Res BW 30 kHz

#VBW 300 kHz

Sweep 9.167 ms (401 pts)

Emission Bandwidth Results (measuring..)

Emission Bandwidth

Emiss BW X dB -20.0 dB

341.6 kHz

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

\* Agilent 10:42:38 Jan 13, 2003

R L

Ch 1; DR 76.8KHz

Ref -4 dBm

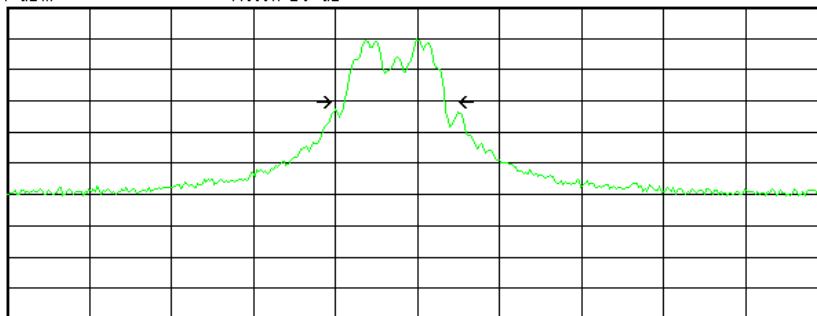
Atten 10 dB

Peak

Log

10

dB/



Center 905.1 MHz

Span 3 MHz

#Res BW 30 kHz

#VBW 300 kHz

Sweep 9.167 ms (401 pts)

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

Ch 26; DR 4.8KHz

Ref -21 dBm

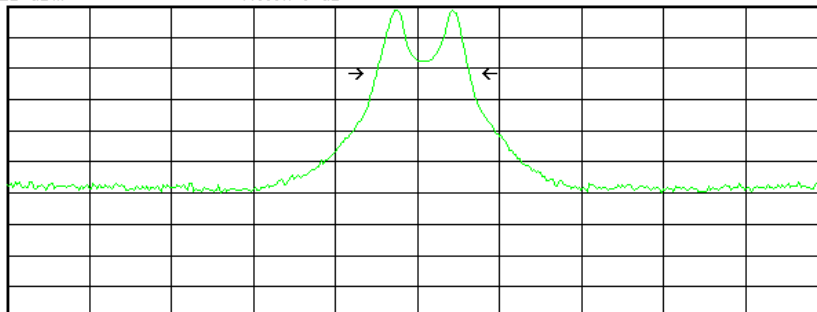
#Atten 0 dB

Peak

Log

10

dB/



Center 915 MHz

Span 3 MHz

#Res BW 30 kHz

#VBW 300 kHz

Sweep 9.167 ms (401 pts)

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

Ch 26; DR76.8K;

Ref -21 dBm

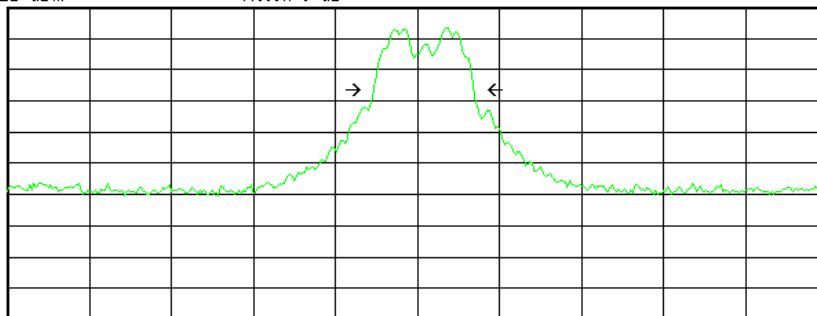
#Atten 0 dB

Peak

Log

10

dB/



Center 915 MHz

Span 3 MHz

#Res BW 30 kHz

#VBW 300 kHz

Sweep 9.167 ms (401 pts)

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

Ch 50; DR 4.8KHz

Ref -4 dBm

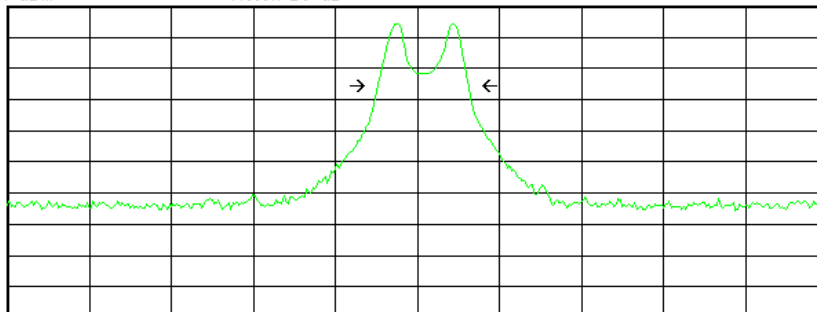
Atten 10 dB

Peak

Log

10

dB/



Center 924.6 MHz

Span 3 MHz

#Res BW 30 kHz

#VBW 300 kHz

Sweep 9.167 ms (401 pts)

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

Ch 50; DR 76.8KHz

Ref -4 dBm

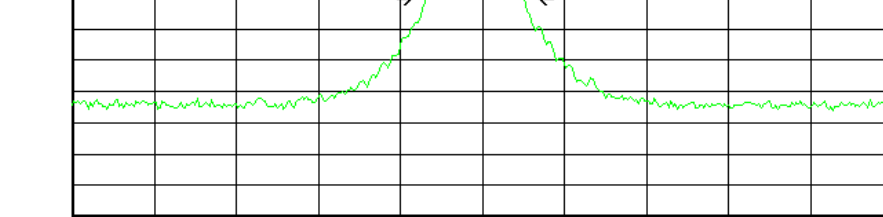
Atten 10 dB

Peak

Log

10

dB/



Center 924.6 MHz

Span 3 MHz

#Res BW 30 kHz

#VBW 300 kHz

Sweep 9.167 ms (401 pts)

Emission Bandwidth Results (measuring..)

Emission Bandwidth  
364.4 kHz

Emiss BW X dB -20.0 dB

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

<b>Conclusion:</b>	The 20db bandwidth is > 250KHz and < 500 KHz
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**Section 15.247 (b)****Peak OutPut Power (POP)**

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

R L

Ch 1; DR 4.8KHz

Ref -4 dBm

Atten 10 dB

Peak

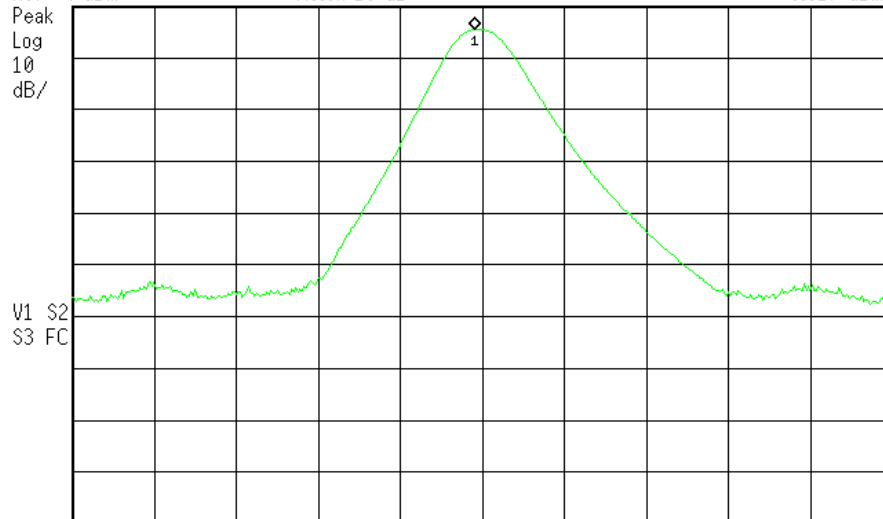
Log

10

dB/

Mkr1 904.91 MHz

-8.617 dBm



Center 905.1 MHz

Span 20 MHz

#Res BW 1 MHz

VBW 3 MHz

Sweep 4 ms (401 pts)

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

Agilent 10:30:06 Jan 13, 2003

R L

Ch 1; DR 76.8KHz

Mkr1 905.11 MHz

Ref -4 dBm

Atten 10 dB

-8.609 dBm

Peak

Log

10

dB/

V1 S2

S3 FC

Center 905.1 MHz

Span 20 MHz

#Res BW 1 MHz

VBW 3 MHz

Sweep 4 ms (401 pts)

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

Agilent 10:00:08 Jan 13, 2003

R L

Ch 26; DR 4.8KHz

Mkr1 915.00 MHz

Ref -4 dBm

Atten 10 dB

-8.833 dBm

Peak

Log

10

dB/

M1 S2

S3 FC

Center 915 MHz

Span 20 MHz

#Res BW 1 MHz

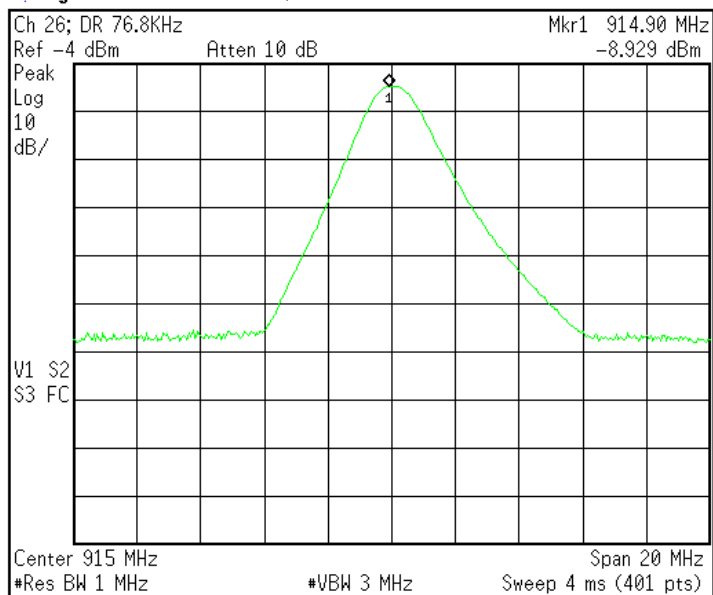
#VBW 3 MHz

Sweep 4 ms (401 pts)

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

\* Agilent 10:46:25 Jan 13, 2003

R L

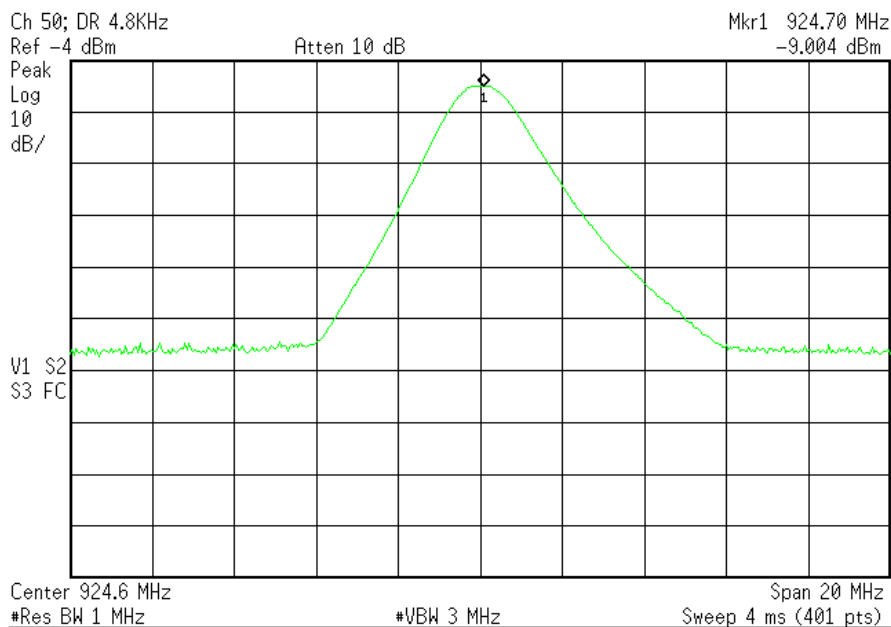


Alpha Editor									
A	B	C	D	E	F	G	H	I	J
K	L	M	N	O	P	Q	R	S	T
U	V	W	X	Y	Z				
β	Δ	Σ	Π						
Space									
More									
1 of 3									

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

\* Agilent 11:28:18 Jan 13, 2003

R L



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

\* Agilent 10:57:47 Jan 13, 2003

R L

Ch 50; DR 76.8KHz

Mkr1 924.50 MHz

Ref -4 dBm

Atten 10 dB

-8.991 dBm

Peak

Log

10

dB/

M1 S2

S3 FC

Center 924.6 MHz

Span 20 MHz

#Res BW 1 MHz

#VBW 3 MHz

Sweep 4 ms (401 pts)

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**

Agilent 11:19:03 Jan 13, 2003

R L

Ch 1; 76.8KHz

Mkr3 901.697 MHz

Ref 103 dBμV

Atten 10 dB

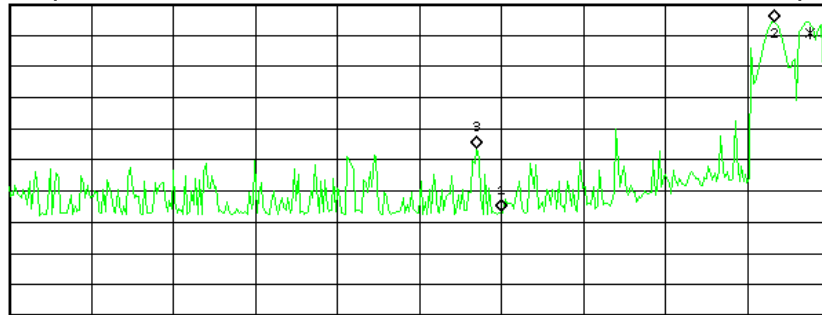
56.86 dBμV

Peak

Log

10

dB/



Center 901 MHz

Span 9.95 MHz

Res BW 100 kHz

#VBW 300 kHz

Sweep 5 ms (401 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	902.000 MHz	36.53 dBμV
2	(1)	Freq	905.303 MHz	97.27 dBμV
3	(1)	Freq	901.697 MHz	56.86 dBμV

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

Agilent 11:11:27 Jan 13, 2003

R L

Ch 50; DR 76.8KHz

Mkr3 928.336 MHz

Ref 103 dBμV

Atten 10 dB

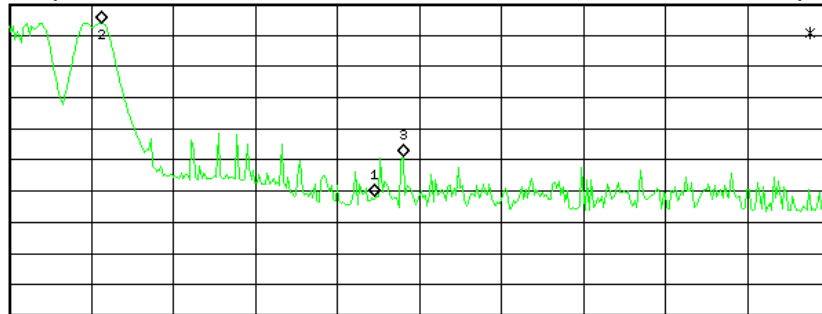
54.13 dBμV

Peak

Log

10

dB/



Center 928.5 MHz

Span 9.95 MHz

Res BW 100 kHz

#VBW 300 kHz

Sweep 5 ms (401 pts)

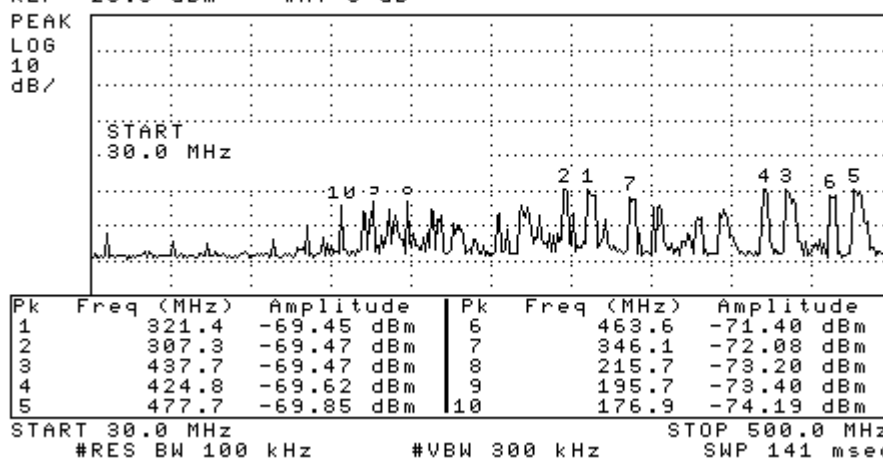
Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	928.000 MHz	41.12 dBμV
2	(1)	Freq	924.679 MHz	97.03 dBμV
3	(1)	Freq	928.336 MHz	54.13 dBμV

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

## Section 15.247 (c) Spurious RF Conducted Emissions

10:35:57 JAN 14, 2003

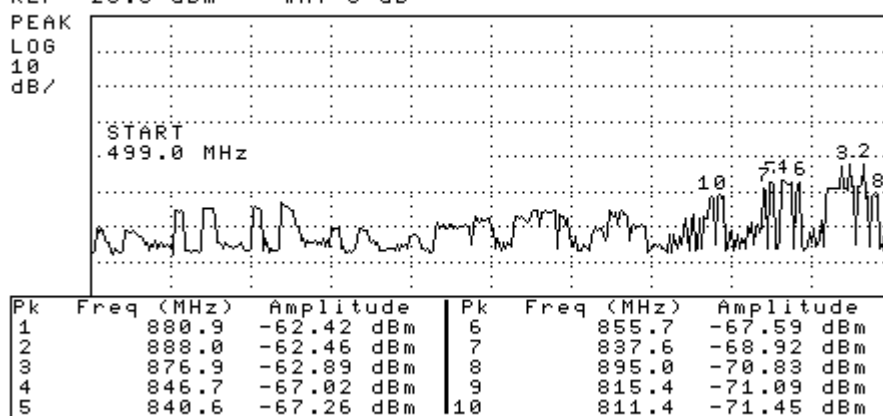
REF -20.0 dBm #AT 0 dB

PEAK  
LOG  
10  
dB/START 30.0 MHz STOP 500.0 MHz  
#RES BW 100 kHz #VBW 300 kHz SWP 141 msec RL

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

10:49:50 JAN 14, 2003

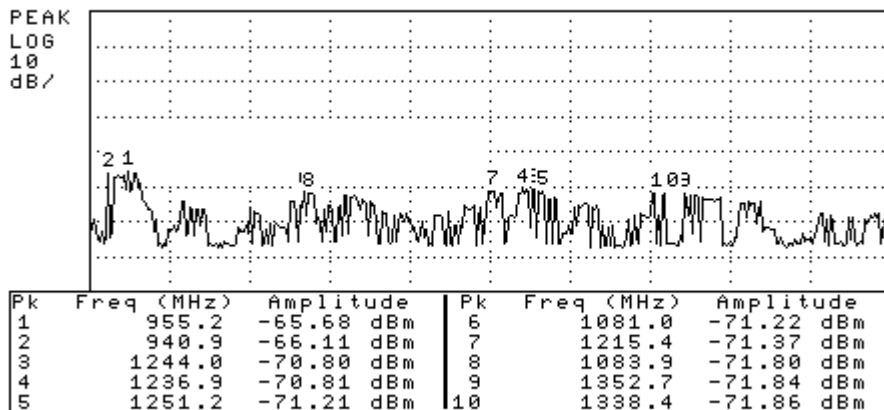
REF -20.0 dBm #AT 0 dB

PEAK  
LOG  
10  
dB/START 499.0 MHz STOP 902.1 MHz  
#RES BW 100 kHz #VBW 300 kHz SWP 121 msec RL

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

10:54:39 JAN 14, 2003

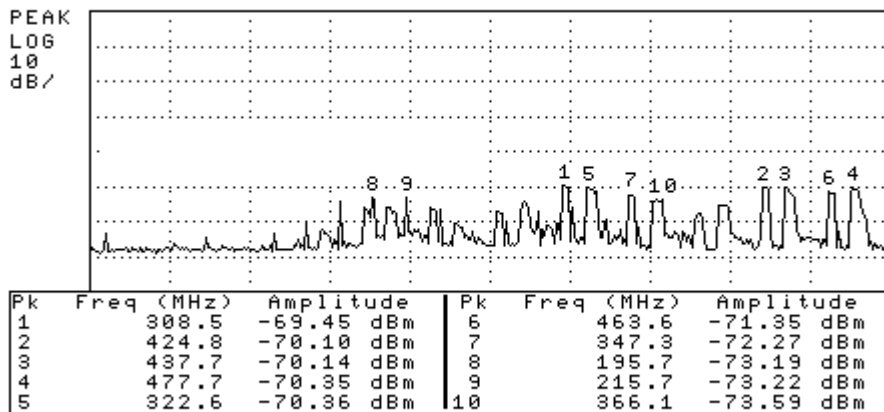
REF -20.0 dBm #AT 0 dB

PEAK  
LOG  
10  
dB/START 928.0 MHz STOP 1.5000 GHz  
#RES BW 100 kHz #VBW 300 kHz SWP 172 msec RL

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

11:06:23 JAN 14, 2003 DR 76.8KHz

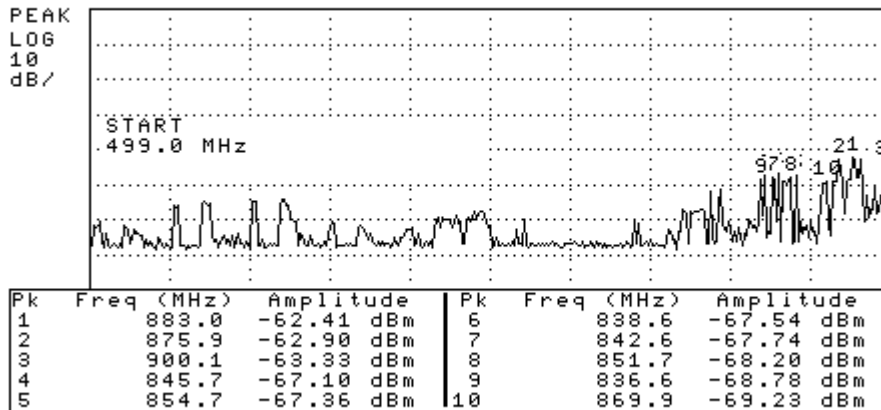
REF -20.0 dBm #AT 0 dB

PEAK  
LOG  
10  
dB/START 30.0 MHz STOP 500.0 MHz  
#RES BW 100 kHz #VBW 300 kHz SWP 141 msec RL

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

11:09:06 JAN 14, 2003 DR 76.8KHz

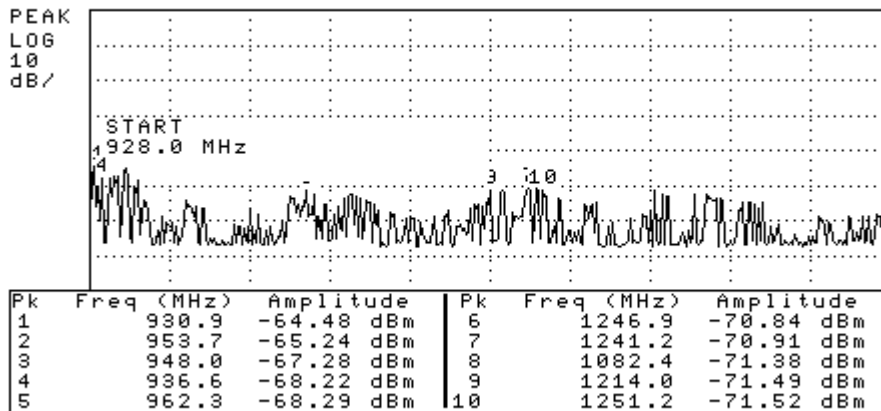
REF -20.0 dBm #AT 0 dB

PEAK  
LOG  
10  
dB/START 499.0 MHz STOP 902.1 MHz  
#RES BW 100 kHz #VBW 300 kHz SWP 121 msec RL

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

11:12:42 JAN 14, 2003 DR 76.8KHz

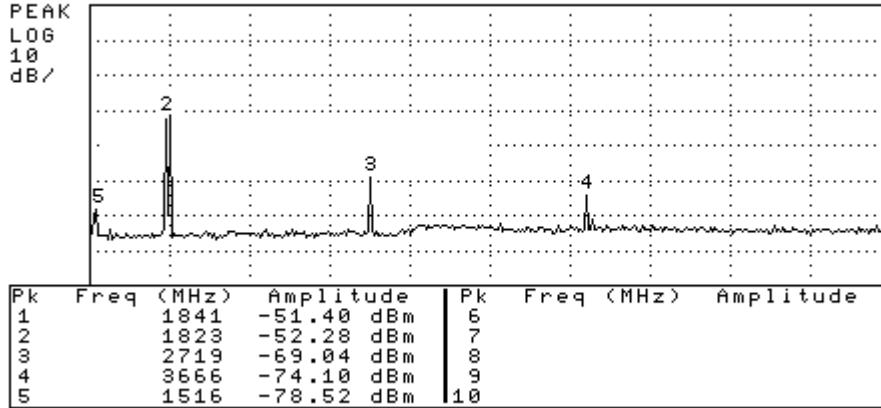
REF -20.0 dBm #AT 0 dB

PEAK  
LOG  
10  
dB/START 928.0 MHz STOP 1.5000 GHz  
#RES BW 100 kHz #VBW 300 kHz SWP 172 msec RL

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

11:15:36 JAN 14, 2003 DR 76.8KHz

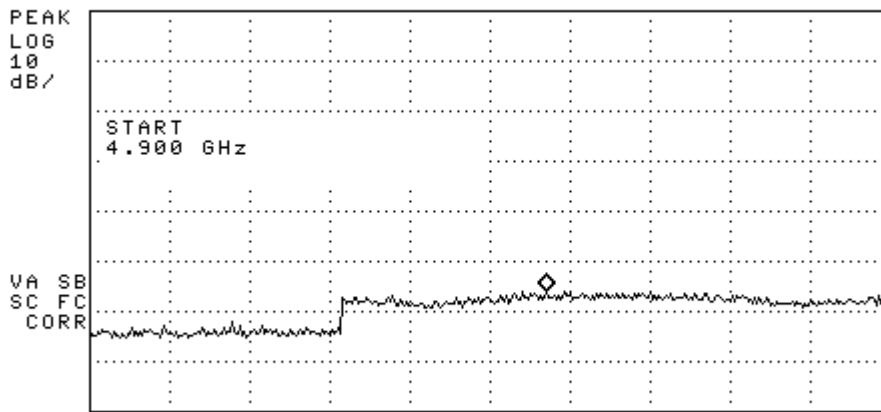
REF -20.0 dBm #AT 0 dB

PEAK  
LOG  
10  
dB/START 1.490 GHz STOP 5.000 GHz  
#RES BW 100 kHz #VBW 300 kHz SWP 1.05 sec RL

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

11:18:05 JAN 14, 2003 DR 76.8KHz

REF -20.0 dBm #AT 0 dB

MKR 7.807 GHz  
-75.99 dBmPEAK  
LOG  
10  
dB/START 4.900 GHz STOP 10.000 GHz  
#RES BW 100 kHz #VBW 300 kHz SWP 1.53 sec RL

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

Conducted RF Spurious Emissions				Curtis-Straus LLC	
Work Order: D0026			Table: 3		
Date(s): 1/13/02					
Engineer: Mairaj Hussain					
Date: 1/14/03					
EUT: 915MHz FHSS RF Module					
Frequency Range: 30MHz-902MHz; 928MHz-10GHz					
DR: 4.8KHz					
Freq	Peak Reading	Cab/Pad	Adjusted Reading	Limit (Max POP)	Result
(MHz)	(dbm)	(db)	(dbm)	(dbm)	
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
DR: 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
CH	Channel				
DR	Data Rate				
Spectrum Analyzer:		Black	Cable:	Microflex	

## Spurious Radiated Emissions

Spurious Radiated Emissions (Restricted Band)											Curtis-Straus LLC		
Date: 14-Jan-03			Company: Adaptive						Table 4				
Engineer: Mairaj Hussain			EUT Desc: 915 MHz FHSS RF Module						Work Order: D0026				
Frequency Range:			Restricted Band (30 - 1000 MHz)					Measurement Distance: 3 m					
Notes: 1/4 Wave Antennna DR 76.8KHz			EUT Max Freq: 915MHz										
Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBμV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Reading (dBμV/m)	---			FCC Class B			
							Limit (dBμV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBμV/m)	Margin (dB)	Result (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						Table 5				
Engineer: Mairaj Hussain			EUT Desc: 915 MHz FHSS RF Module						Work Order: D0026				
Frequency Range:			Restricted Band (1000 - 10000 MHz)					Measurement Distance: 3 m					
Notes: 1/4 Wave Antennna DR 76.8 KHz			EUT Max Freq: 915MHz										
Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBμV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Reading (dBμV/m)	---			FCC Class B			
							Limit (dBμV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBμV/m)	Margin (dB)	Result (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						Table 5				
Engineer: Mairaj Hussain			EUT Desc: 915 MHz FHSS RF Module						Work Order: D0026				
Frequency Range: Restricted Band (1000 - 10000 MHz)							Measurement Distance: 3 m						
Notes: 1/4 Wave Antennna DR 76.8 KHz							EUT Max Freq: 915MHz						
Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBμV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Reading (dBμV/m)	---			FCC Class B			
							Limit (dBμV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBμV/m)	Margin (dB)	Result (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					Table 6				
Engineer: Mairaj Hussain			EUT Desc: 915 MHz FHSS RF Module					Work Order: D0026				
Frequency Range:			Restricted Band (30 - 1000 MHz)					Measurement Distance: 3 m				
Notes: 1/2 Wave Dipole Antenna DR 76.8 KHz								EUT Max Freq: 915MHz				
Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBμV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Reading (dBμV/m)	---			FCC Class B		
							Limit (dBμV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBμV/m)	Margin (dB)	Result (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					Table 7				
Engineer: Mairaj Hussain				EUT Desc: 915 MHz FHSS RF Module					Work Order: D0026				
Frequency Range: Restricted Band (1000 - 10000 MHz)							Measurement Distance: 3 m						
Notes: 1/2 Wave Dipole Antenna DR 76.8 KHz							EUT Max Freq: 915MHz						
Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBμV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Reading (dBμV/m)	---			FCC Class B			
							Limit (dBμV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBμV/m)	Margin (dB)	Result (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 (dBμV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Reading (dBμV/m)	---			FCC Class B		
							Limit (dBμV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBμV/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
Table Result:		Pass		by		-2.3 dB		Worst Freq:		915.0 MHz		
Test Site: "T"		Pre-Amp: Black		Cable: 65 ft RG8A/U		Analyzer: Black		Antenna: Blue				

**Sample Calculation:**Adjusted Reading = Reading – Pre Amp<sub>(factor)</sub> + Antenna<sub>(factor)</sub> + Cable<sub>(factor)</sub>**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	FCC B Applicable until July 12, 2004		FCC/CISPR B		FCC/CISPR B		Overall Result (Pass/Fail)
	QP1 (dBµV)	QP2 (dBµV)	AV1 (dBµV)	AV2 (dBµV)		Limit (dBµV)	Margin dB	qp Limit (dBµV)	qp Margin dB	AVE Limit (dBµV)	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
Table Result: Pass by -12.60 dB Worst Freq: 20.72 MHz												

**LIMITS**

Quasi-Peak: 250μV = 47.9dBμV 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 (dBμV)	Average limit (dBμV)
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>		FCC CODE	IC CODE	VCCI CODE		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	PASTERNAK	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.