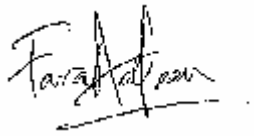
TEST REPORT
FROM
RFI GLOBAL SERVICES LTD

Test of: Coronis Systems.
Waveport Modem.

To: FCC Part 15.247

Test Report Serial No:
RFI/MPTE3/RP46762JD06B
Supersedes Test Report Serial No:
RFI/MPTE2/RP46762JD06B

This Test Report Is Issued Under The Authority Of Andrew Brown, Operations Manager: 	
Tested By: Steve Wong  **pp**	**Checked By:** Nigel Davison 
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To: FCC Part 15.247

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1. Client Information

Company Name:	Coronis Systems.
Address:	290 rue Alfred Nobel 3400 Montpellier France
Contact Name:	Fabien Bonjour

2. Equipment Under Test (EUT)

The following information (with the exception of the Date of Receipt) has been supplied by the client:

2.1. Identification of Equipment Under Test (EUT)

Brand Name:	Coronis Systems
Model Name or Number:	Waveport
Unique Type Identification:	US
Serial Number:	012E604600003
FCC ID Number:	S28 WPO
Country of Manufacture:	China and France
Date of Receipt:	10 November 2004

2.2. Description of EUT

The equipment under test is a Radio modem to communicate with the Coronis products: Wavetherm, Waveflow, and Wavesense.

2.3. Modifications Incorporated in the EUT

During the course of testing the EUT was not modified.

2.4. Additional Information Related to Testing

Power Supply Requirement:	DC supply of 6 V		
Intended Operating Environment:	Residential, Commercial and Light Industry		
Equipment Category:	Short Range (Low Power)		
Type of Unit:	Base Station (Fixed Use)		
Interface Ports:	Enclosure RS232 Serial Interface DC supply		
Transmit Frequency Range:	907.0272 MHz to 921.4848 MHz		
Transmit Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	01	907.0272
	Middle	79	913.9392
	Top	FA	921.3696
Highest Unintentionally Generated Frequency:	1842.9696 MHz		
Receive Frequency Range:	907.0272 MHz to 921.4848 MHz		
Receive Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	01	907.0272
	Middle	79	913.9392
	Top	FA	921.3696
Highest Unintentionally Generated Frequency:	1842.9696 MHz		
Highest Fundamental Frequency:	921.3696 MHz		
Occupied Bandwidth:	40 kHz		

2.5. Support Equipment

The following support equipment was used to exercise the EUT during testing:

Description:	AC Adaptor
Brand Name:	FRIWO
Model Name or Number:	FW7600/05
Serial Number:	Not Supplied
Cable Length and Type:	Not Supplied
Connected to Port:	Charge Port

Description:	Serial Cable
Brand Name:	None Stated
Model Name or Number:	None Stated
Serial Number:	None Stated
Cable Length and Type:	9 Pin Serial, 1.5m
Connected to Port:	Serial Port of Waveport

3. Test Specification, Methods and Procedures

3.1. Test Specifications

Reference:	FCC Part 15 Subpart C: 2004 (Sections 15.247).
Title:	Code of Federal Regulations, Part 15 (47CFR215) Radio Frequency Devices.

3.2. Methods and Procedures

The methods and procedures used were as detailed in:

ANSI/TIA-603-B-2003
Land Mobile Communications Equipment, Measurements and performance Standards

ANSI C63.2 (19896)
Title: American National Standard for Instrumentation - Electromagnetic noise and field strength.

ANSI C63.4 (2003)
Title: American National Standard Methods of Measurement of Electromagnetic Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

ANSI C63.5 (1988)
Title: American National Standard for the Calibration of antennas used for Radiated Emission measurements in Electromagnetic Interference (EMI) control.

ANSI C63.7 (1988)
Title: American National Standard Guide for Construction of Open Area Test Sites for performing Radiated Emission Measurements.

CISPR 16-1: (1999)
Title: Specification For Radio Disturbance and Immunity Measuring Apparatus and Methods. Part 1: Radio Disturbance and Immunity Measuring Apparatus.

DA00-705 (2000)
Title: Filing and Frequency Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

3.3. Definition of Measurement Equipment

The measurement equipment used complied with the requirements of the standards referenced in the Methods & Procedures section above. Appendix 1 contains a list of the test equipment used.

4. Deviations from the Test Specification

None.

5. Operation of the EUT During Testing

5.1. Operating Modes

The EUT was tested in the following operating modes, unless otherwise stated.

The EUT was set to maximum power on top, bottom and middle channels and hopping mode.

5.2. Configuration and Peripherals

The EUT was tested in the following configuration:

The EUT was connected to the PC via a RS232 link to set the EUT in test mode and powered by DC supply of 6 V

6. Summary of Test Results

Range of Measurements	Specification Reference	Port Type	Compliancy Status
Receiver AC Conducted Emissions (150 kHz to 30 MHz)	C.F.R. 47 FCC Part 15: 2004 Section 15.107	AC Mains	Complied
Receiver Radiated Spurious Emissions	C.F.R. 47 FCC Part 15: 2004 Section 15.109	Antenna	Complied
Transmitter AC Conducted Emissions (150 kHz to 30 MHz)	C.F.R. 47 FCC Part 15: 2004 Section 15.207	AC Mains	Complied
Transmitter 20 dB Bandwidth	C.F.R. 47 FCC Part 2: 2004 Section 2.1049	Antenna	Complied
Transmitter Carrier Frequency Separation	C.F.R. 47 FCC Part 15: 2004 Section 15.247(a)(1)(i)	Antenna	Complied
Transmitter Average Time of Occupancy	C.F.R. 47 FCC Part 15: 2004 Section 15.247(a)(1)(i)	Antenna	Complied
Transmitter Maximum Peak Output Power	C.F.R. 47 FCC Part 15: 2004 Section 15.247(b)(3)	Antenna	Complied
Transmitter Radiated Emissions	C.F.R. 47 FCC Part 15: 2004 Sections 15.247(d) & 15.209(a)	Antenna	Complied
Transmitter Band Edge Radiated Emissions	C.F.R. 47 FCC Part 15: 2004 Sections 15.247(d) & 15.209(a)	Antenna	Complied

6.1. Location of Tests

All the measurements described in this report were performed at the premises of
RFI Global Services Ltd, Ewhurst Park, Ramsdell, Basingstoke, Hampshire, RG26 5RQ, England.

7. Measurements, Examinations and Derived Results

7.1. General Comments

This section contains test results only.

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%.
Please refer to Section 8 for details of measurement uncertainties.

7.2. Receiver AC Conducted Spurious Emissions: Section 15.107

The EUT was configured as for AC conducted emissions measurements as described in Section 8 of this report.

Tests were performed to identify the maximum emissions levels on the AC mains line of the EUT.

Results:

Quasi-Peak Detector Measurements on Live and Neutral Lines

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.15579	Neutral	38.5	65.7	27.2	Complied
0.20817	Live	32.5	63.3	30.8	Complied
0.47926	Neutral	34.8	56.4	21.6	Complied
3.01092	Live	31.8	56.0	24.2	Complied
5.19532	Neutral	32.9	60.0	27.1	Complied
24.87296	Live	31.4	60.0	28.6	Complied

Average Detector Measurements on Live and Neutral Lines

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.15579	Neutral	15.5	55.7	40.2	Complied
0.20817	Neutral	13.2	53.3	40.1	Complied
0.47926	Neutral	17.8	46.4	28.6	Complied
3.01092	Neutral	19.4	46.0	26.6	Complied
5.19532	Live	20.3	50.0	29.7	Complied
24.87296	Neutral	18.9	50.0	31.1	Complied

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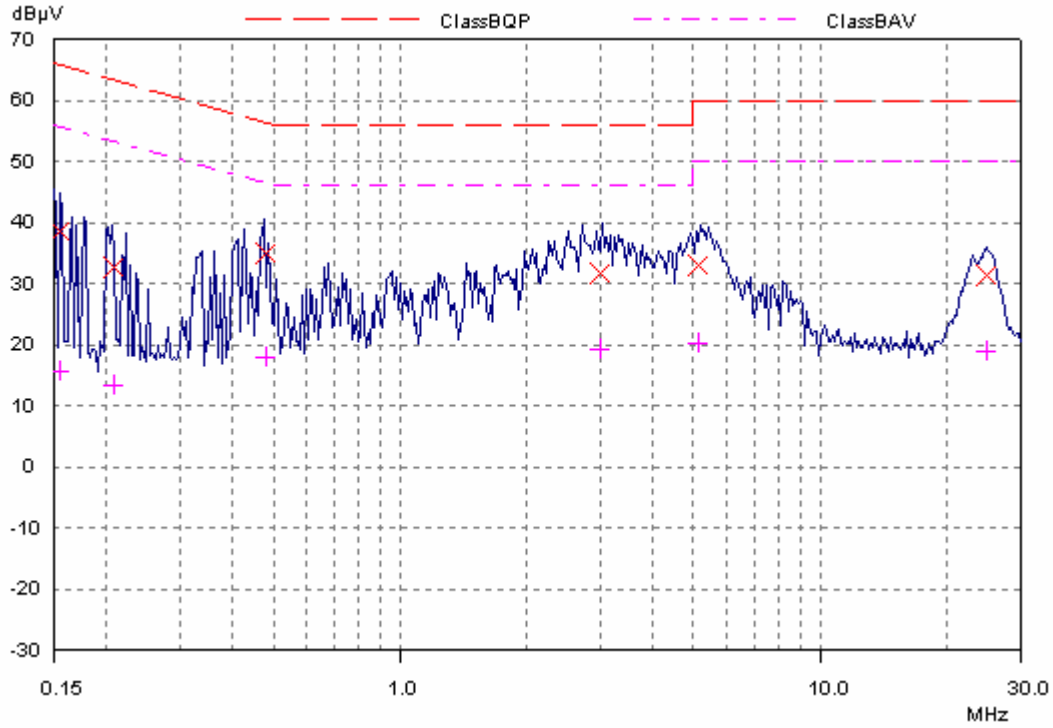
Receiver AC Conducted Spurious Emissions: Section 15.107 (Continued)



Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying tables.

7.3. Receiver Radiated Spurious Emissions: Section 15.109

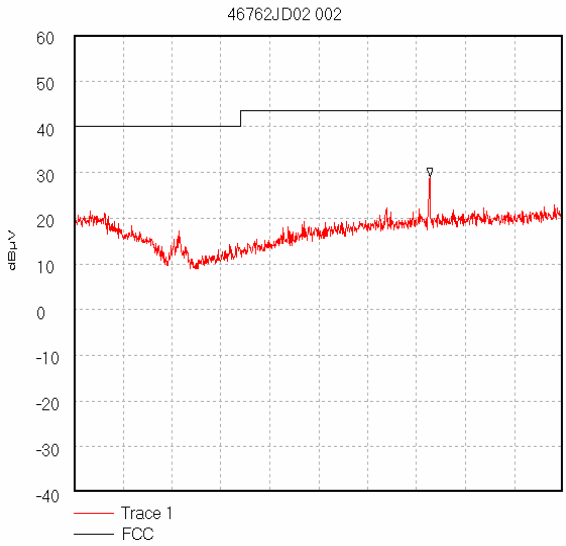
7.3.1. Electric Field Strength Measurements (Frequency Range: 30 to 1000 MHz)

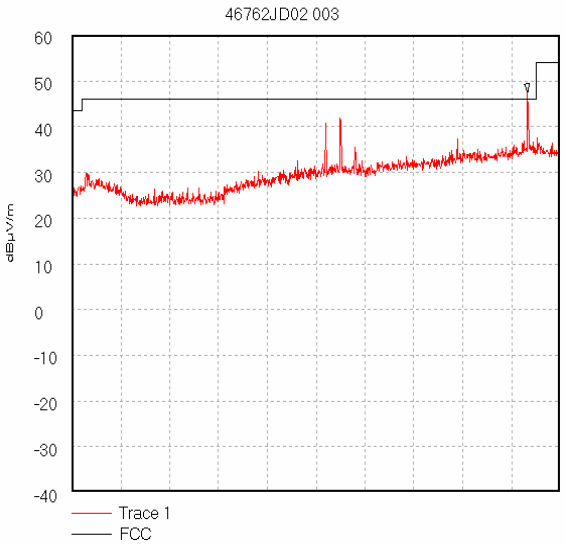
The EUT was configured as for radiated emissions testing as described in Section 8 of this report.

Tests were performed to identify the maximum receiver or standby radiated emissions levels.

Results:

Frequency (MHz)	Antenna Polarity	Q-P Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
153.294	Vert.	28.9	43.5	14.6	Complied





Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying tables.

Test of: Coronis Systems.
Waveport Modem.
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Receiver Radiated Emissions: Section 15.109 (Continued)

7.3.2. Electric Field Strength Measurements (Frequency Range: 1 to 9.5 GHz)

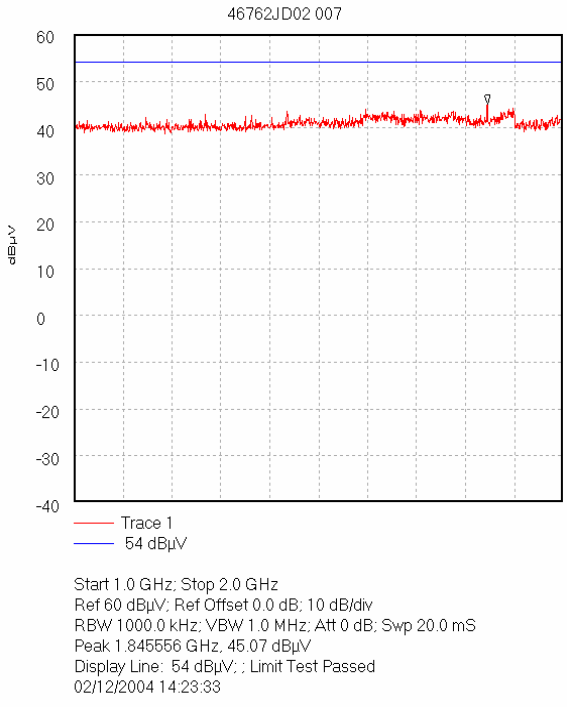
Results:

Highest Peak Level:

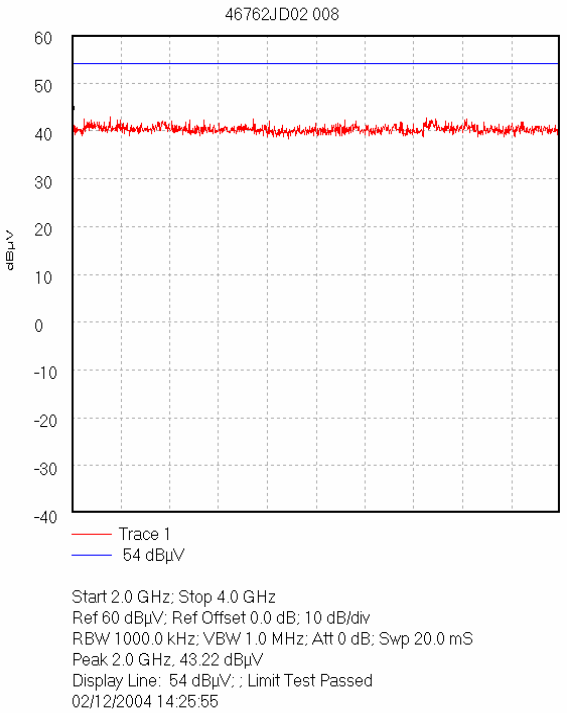
Frequency (GHz)	Antenna Polarity	Detector Level (dBµV)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
8.603	Vert.	12.9	30.5	2.5	45.9	54.0	8.1	Complied

Note(s):

The peak level was compared to the average limit as opposed to being compared to the peak limit as this is the more onerous limit.



Start 1.0 GHz; Stop 2.0 GHz
Ref 60 dBµV; Ref Offset 0.0 dB; 10 dB/div
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 1.845556 GHz, 45.07 dBµV
Display Line: 54 dBµV; ; Limit Test Passed
02/12/2004 14:23:33



Start 2.0 GHz; Stop 4.0 GHz
Ref 60 dBµV; Ref Offset 0.0 dB; 10 dB/div
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 2.0 GHz, 43.22 dBµV
Display Line: 54 dBµV; ; Limit Test Passed
02/12/2004 14:25:55

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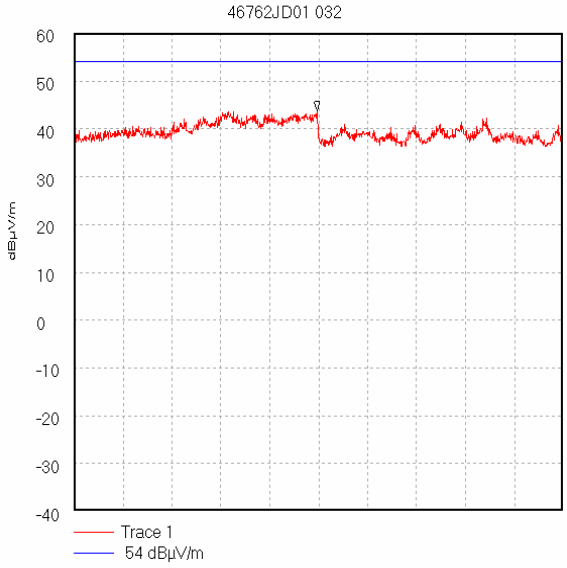
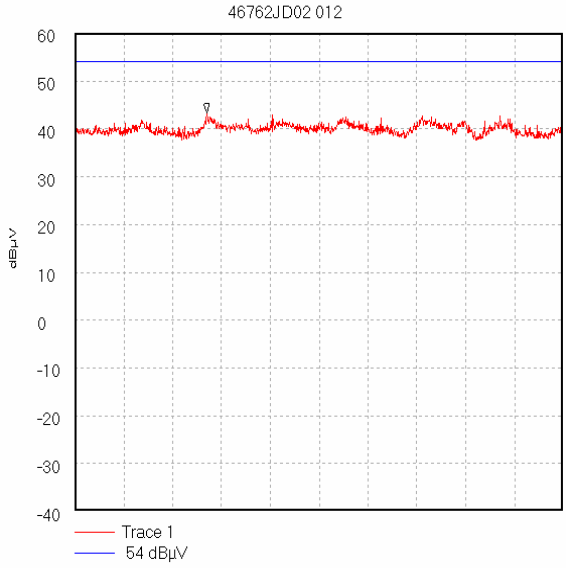
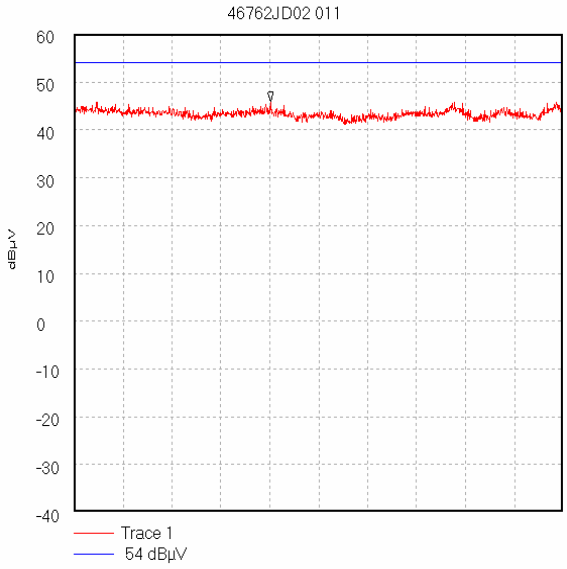
Receiver Radiated Emissions: Section 15.109 (Continued)



Start 4.0 GHz; Stop 6.0 GHz
Ref 60 dBµV/m; Ref Offset 15.8 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 4.993 GHz, 43.78 dBµV/m
Display Line: 54 dBµV/m;
09/12/2004 11:52:23



Start 6.0 GHz; Stop 8.0 GHz
Ref 60 dBµV; Ref Offset 18.8 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 6.54 GHz, 43.35 dBµV
Display Line: 54 dBµV;
09/12/2004 13:46:31



Start 8.0 GHz; Stop 9.5 GHz
Ref 60 dBµV; Ref Offset 22.8 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 8.603 GHz, 45.91 dBµV
Display Line: 54 dBµV;
09/12/2004 13:43:26

Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying tables.

7.4. Transmitter AC Conducted Spurious Emissions: Section 15.207

The EUT was configured as for AC conducted emissions measurements as described in Section 8 of this report.

Tests were performed to identify the maximum emissions levels on the AC mains line of the EUT.

Results:

Quasi-Peak Detector Measurements on Live and Neutral Lines

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.15048	Neutral	40.8	66.0	25.2	Complied
0.20178	Neutral	34.1	63.5	29.4	Complied
0.47907	Neutral	36.6	56.4	19.8	Complied
2.73898	Live	32.7	56.0	23.3	Complied
5.37701	Neutral	33.9	60.0	26.1	Complied
25.12866	Neutral	31.9	60.0	28.1	Complied

Average Detector Measurements on Live and Neutral Lines

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.15048	Live	18.8	56.0	37.2	Complied
0.20178	Neutral	15.0	53.5	38.5	Complied
0.4907	Neutral	20.8	46.4	25.6	Complied
2.73898	Neutral	22.9	46.0	23.1	Complied
5.37701	Neutral	24.1	50.0	25.9	Complied
25.12866	Neutral	21.5	50.0	28.5	Complied

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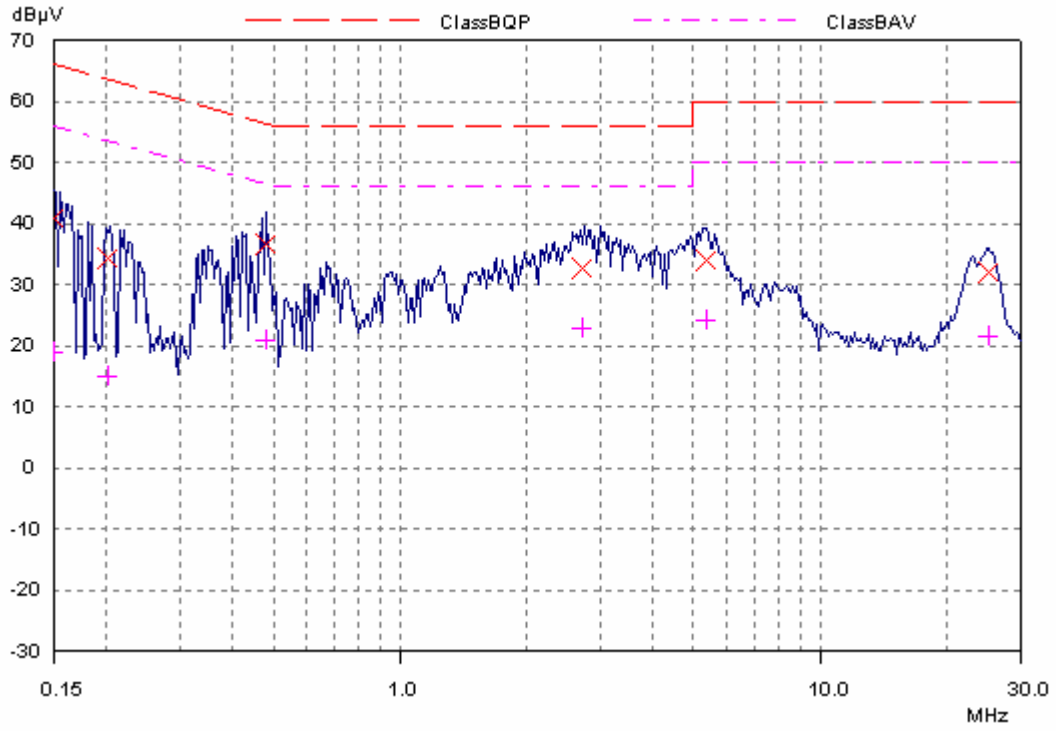
Transmitter AC Conducted Spurious Emissions: Section 15.207 (Continued)



Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying tables.

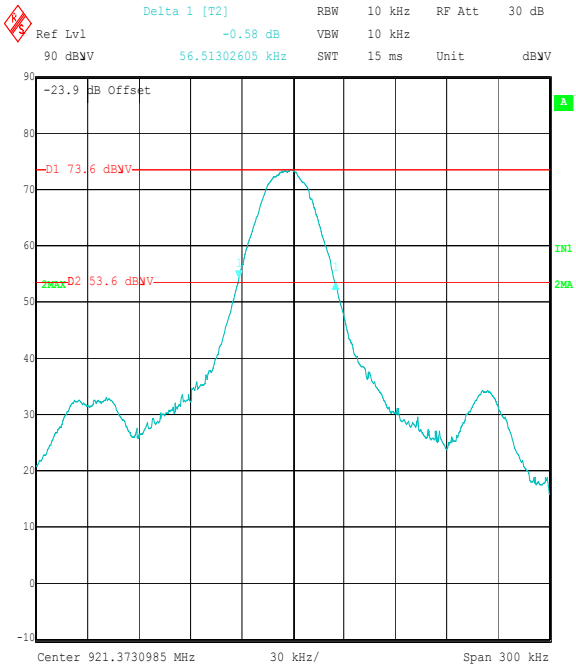
7.5. Transmitter 20 dB Bandwidth: Section 2.1049

The EUT was configured as for 20 dB bandwidth measurements as described in Section 8 of this report.

Tests were performed to identify the 20 dB bandwidth.

Results:

Transmitter 20 dB Bandwidth (kHz)	Limit (kHz)
56.5	≤500



Title: Coronis Systems EUT: Waveport. FCC P15.247. 20 dB Bandwidth
Comment A: 46762JD02 hopping
Date: 10.DEC.2004 10:46:25

7.6. Transmitter Carrier Frequency Separation: Section 15.247(a)(1)(i)

The EUT was configured as for carrier frequency separation measurements as described in Section 8 of this report.

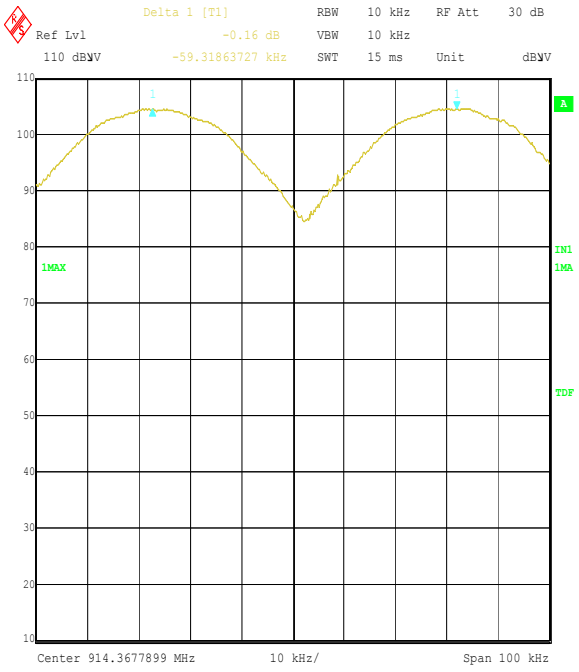
Tests were performed to identify the carrier frequency separation.

Results:

Transmitter Carrier Frequency Separation (kHz)	Limit* (> 20 dB BW) (kHz)	Margin (kHz)	Result
59.32	56.50	2.82	Complied

Note(s):

**Limit is > 20 dB bandwidth or 25 kHz whichever is the greater.*



Title: 46762JD02 Coronis System EUT: Waveport FCC P15.247
Comment A: Carrier Separation.
Date: 7.JAN.2005 11:57:03

7.7. Transmitter Average Time of Occupancy: Section 15.247(a)(1)(i)

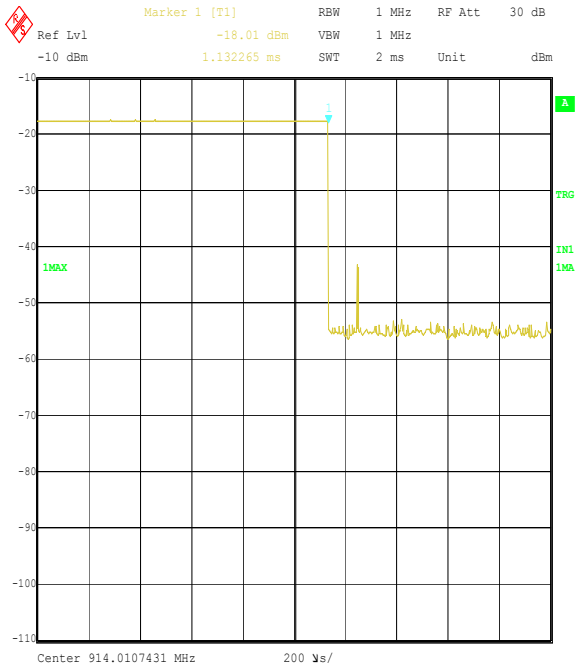
The EUT was configured as for average time of occupancy measurements as described in Section 8 of this report.

Results:

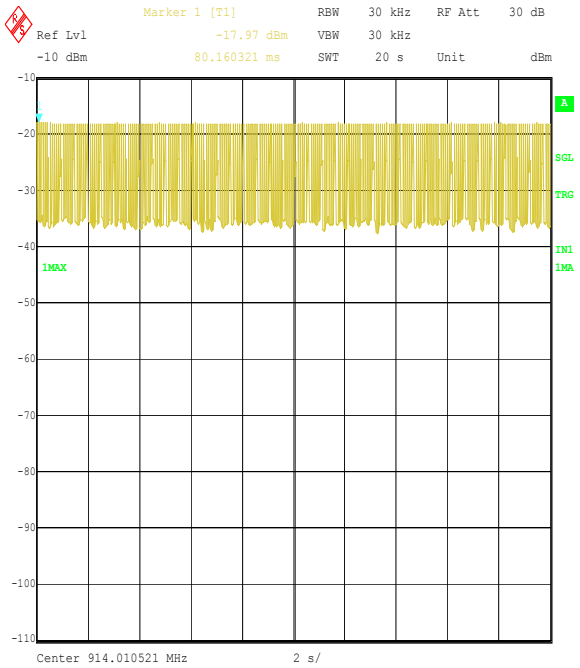
Emission Width (μs)	Number of Hops in 20 Seconds	Average Time of Occupancy (s)	Limit (s)	Margin (s)	Result
1132.265	242	0.274	≤0.4	0.126	Complied

Note(s):

Plot EM20s.wmf shows a 30 kHz bandwidth instead of 1 MHz. This is due to the narrow channel spacing of the EUT, therefore a 30 kHz resolution bandwidth was used instead to a 1 MHz to better resolve the emissions for counting purposes.



Title: 46762JD02 Coronis System EUT: Waveport FCC P15.247
Comment A: Emission Width
Date: 7.JAN.2005 12:15:07



Title: 46762JD02 Coronis System EUT: Waveport FCC P15.247
Comment A: Number of Hops in 20 Seconds
Date: 7.JAN.2005 12:42:19

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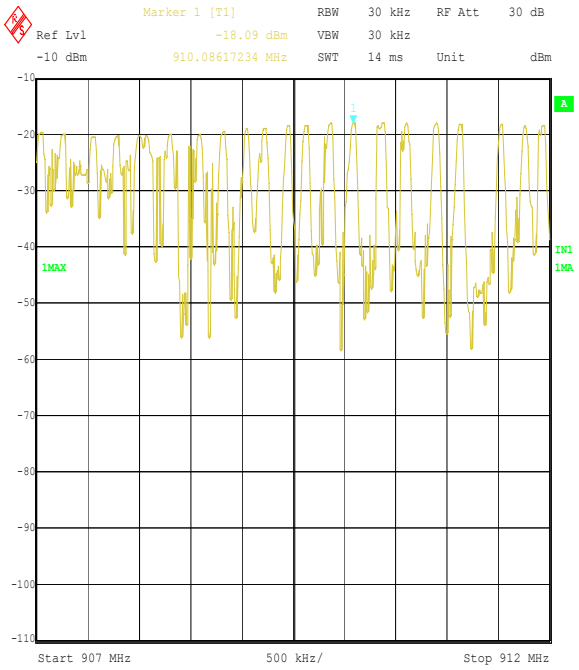
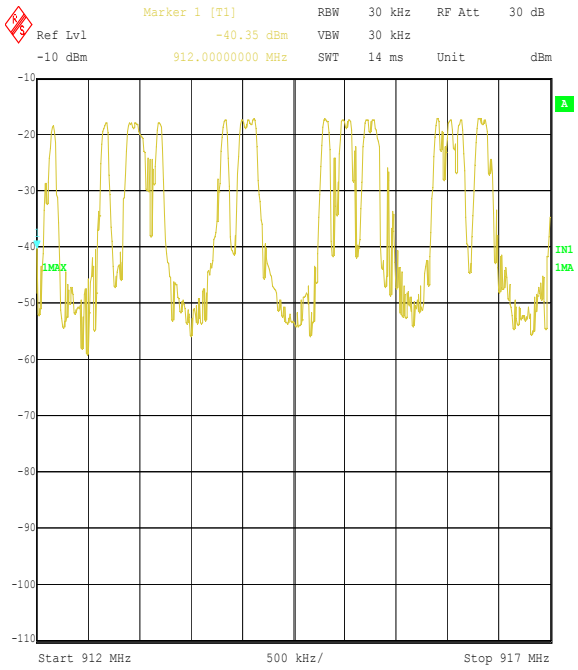
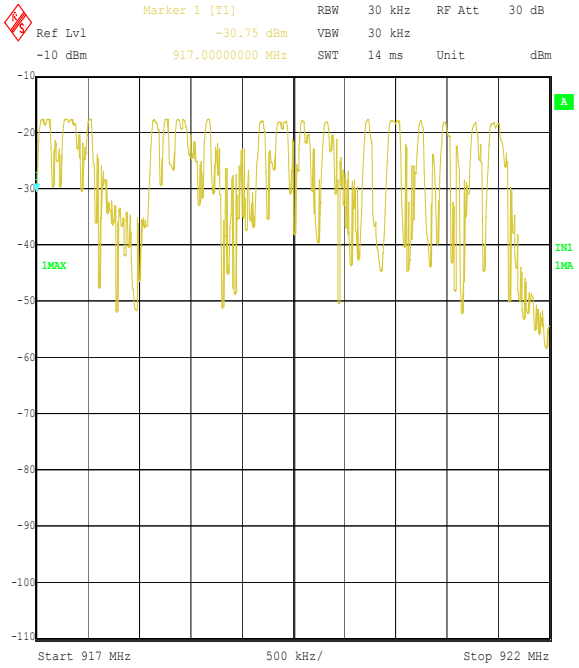
Transmitter Average Time of Occupancy: Section 15.247(a)(1)(i) (Continued)



Title: 46762JD02 Coronis System EUT: Waveport FCC P15.247
Comment A: Number of Hopping Channels
Date: 7.JAN.2005 12:29:06



Title: 46762JD02 Coronis System EUT: Waveport FCC P15.247
Comment A: Number of Hopping Channels
Date: 7.JAN.2005 12:38:28



Title: 46762JD02 Coronis System EUT: Waveport FCC P15.247
Comment A: Number of Hopping Channels
Date: 7.JAN.2005 12:40:13

7.8. Transmitter Maximum Peak Output Power: (EIRP) Section 15.247(b)(3)

The EUT was configured as for transmitter peak output power measurements as described in Section 8 of this report.

Tests were performed to identify the transmitter maximum peak output power (EIRP) of the EUT.

The effective isotropic radiated power (EIRP) was calculated by adding the manufacturer's declared antenna gain to the figure measured for conducted RF output power.

Results:

AC Powered Devices

Channel	Input Voltage (AC)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	93.50	8.8	30.0	21.2	Complied
Bottom	110.00	8.8	30.0	21.2	Complied
Bottom	126.50	8.8	30.0	21.2	Complied
Middle	93.50	7.4	30.0	22.6	Complied
Middle	110.00	7.4	30.0	22.6	Complied
Middle	126.50	7.4	30.0	22.6	Complied
Top	93.50	7.0	30.0	23.0	Complied
Top	110.00	7.0	30.0	23.0	Complied
Top	126.50	7.0	30.0	23.0	Complied

Note(s):

These tests were performed radiated; therefore the EUT antenna gain is encompassed in the final result and not measurable.

7.9. Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a)

7.9.1. Electric Field Strength Measurements: 30 to 1000 MHz *(emissions occurring outside the restricted bands)*

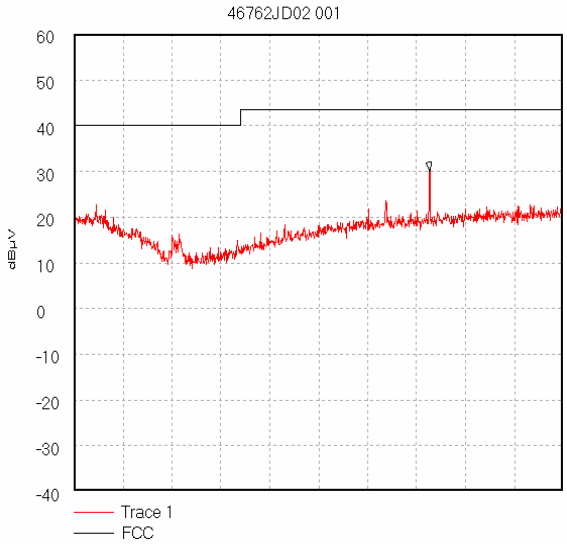
Results:

Top Channel

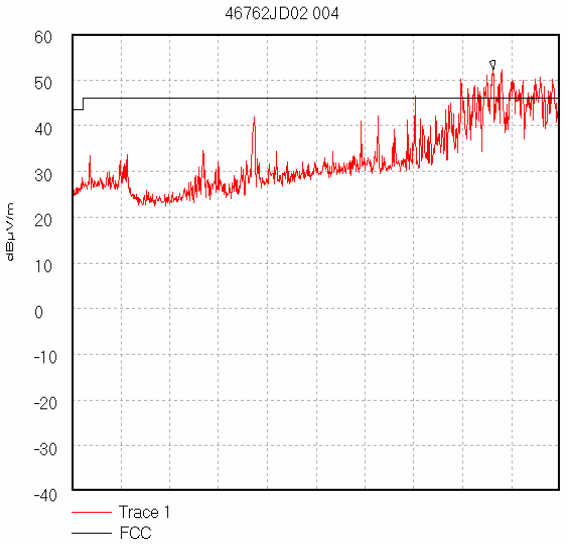
Frequency (MHz)	Antenna Polarity	Q-P Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
153.294	Vert.	29.3	84.4	55.1	Complied
460.801	Horiz.	49.2	84.4	35.2	Complied
759.166	Vert.	37.0	84.4	47.4	Complied
805.278	Horiz.	42.1	84.4	42.3	Complied
818.146	Horiz.	42.7	84.4	41.7	Complied
928.613	Vert.	49.9	84.4	34.5	Complied
953.949	Vert.	46.5	84.4	37.9	Complied

Note(s):

The preliminary scans showed similar emission levels for each mode below 1 GHz, therefore final radiated emissions measurements were performed with the EUT set to the top channel only.



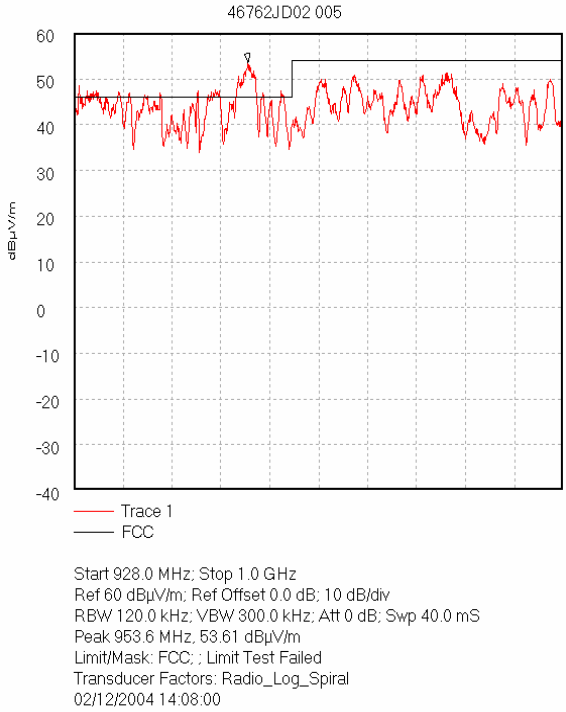
Start 30.0 MHz; Stop 200.0 MHz
Ref 60 dBµV; Ref Offset 0.0 dB; 10 dB/div
RBW 120.0 kHz; VBW 300.0 kHz; Att 0 dB; Swp 80.0 mS
Peak 153.533333 MHz, 30.04 dBµV
Limit/Mask: FCC; ; Limit Test Failed
Transducer Factors: Radio_Bicon
02/12/2004 13:54:34



Start 200.0 MHz; Stop 902.0 MHz
Ref 60 dBµV/m; Ref Offset 0.0 dB; 10 dB/div
RBW 120.0 kHz; VBW 300.0 kHz; Att 0 dB; Swp 320.0 mS
Peak 806.06 MHz, 52.23 dBµV/m
Limit/Mask: FCC; ; Limit Test Failed
Transducer Factors: Radio_Log_Spiral
02/12/2004 14:03:44

Test of: **Coronis Systems.**
Waveport Modem.
To: **FCC Part 15.247**

Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) (Continued)



Start 928.0 MHz; Stop 1.0 GHz
Ref 60 dBµV/m; Ref Offset 0.0 dB; 10 dB/div
RBW 120.0 kHz; VBW 300.0 kHz; Att 0 dB; Swp 40.0 mS
Peak 953.6 MHz, 53.61 dBµV/m
Limit/Mask: FCC; ; Limit Test Failed
Transducer Factors: Radio_Log_Spiral
02/12/2004 14:08:00

"*Note: these plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.*"

Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) (Continued)

Results:

7.9.2. Electric Field Strength Measurements (Frequency Range: 1 to 9.5 GHz) (emissions occurring in the restricted bands)

Highest Peak Level: Bottom Channel

Frequency (GHz)	Antenna Polarity	Detector Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
3.6741	Horiz.	0.5	22.5	1.6	24.66	54.0	49.4	Complied

Highest Peak Level: Middle Channel

Frequency (GHz)	Antenna Polarity	Detector Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
3.6999	Horiz.	0.4	22.5	1.6	24.5	54.0	49.5	Complied

Note(s):

The Peak level was compared to the average limit as opposed to being compared to the peak limit, as this is the more onerous limit.

Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) (Continued)

7.9.3. Electric Field Strength Measurements (Frequency Range: 1 to 9.5 GHz) *(emissions occurring in the restricted bands)*

Results:

Highest Peak Level: Top Channel

Frequency (GHz)	Antenna Polarity	Detector Level (dBµV)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2.7639	Horiz.	21.0	21.8	1.4	44.2	54.0	29.8	Complied
3.6853	Horiz.	24.0	22.4	1.6	46.8	54.0	27.2	Complied

Highest Average Level: Hopping Mode

Frequency (GHz)	Antenna Polarity	Detector Level (dBµV)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2.7783	Vert.	-0.9	21.8	1.4	24.8	54.0	49.2	Complied
3.6959	Vert.	1.64	22.4	1.6	21.8	54.0	52.2	Complied

Note(s):

The Peak level was compared to the average limit as opposed to being compared to the peak limit, as this is the more onerous limit.

Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) (Continued)

Results:

7.9.4. Electric Field Strength Measurements (Frequency Range: 1 to 9.5 GHz)
(emissions outside the restricted bands)

Highest Peak Level: Bottom Channel

Frequency (GHz)	Antenna Polarity	Detector Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dBμV/m)	-20 dBc Limit (dBμV/m)	Margin (dB)	Result
1.8425	Vert.	-0.6	21.2	1.2	21.8	84.0	62.2	Complied

Highest Peak Level: Middle Channel

Frequency (GHz)	Antenna Polarity	Detector Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dBμV/m)	-20 dBc Limit (dBμV/m)	Margin (dB)	Result
1.8425	Vert.	-1.9	21.2	1.2	20.5	82.6	62.1	Complied

Highest Peak Level: Top Channel

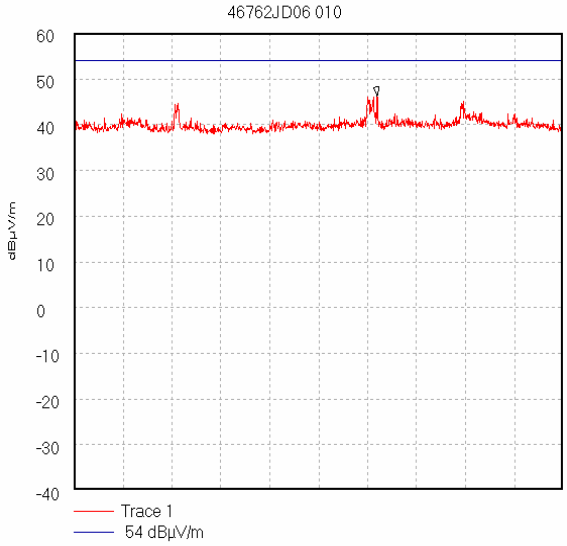
Frequency (GHz)	Antenna Polarity	Detector Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dBμV/m)	-20 dBc Limit (dBμV/m)	Margin (dB)	Result
1.8425	Vert.	16.8	21.2	1.2	40.5	82.2	41.7	Complied

Highest Peak Level: Hopping Mode

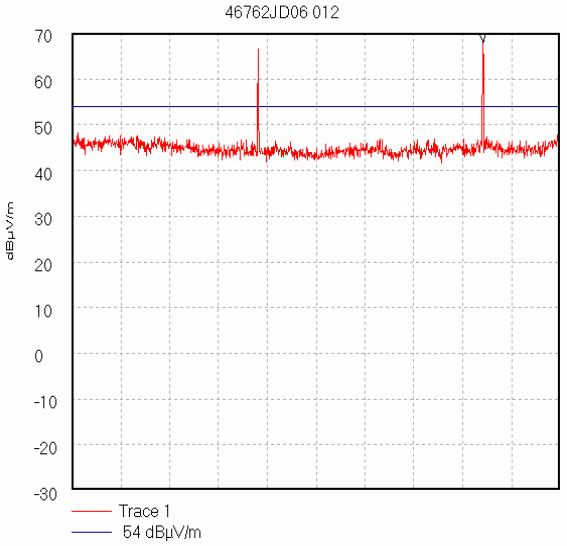
Frequency (GHz)	Antenna Polarity	Detector Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dBμV/m)	-20 dBc Limit (dBμV/m)	Margin (dB)	Result
1.8425	Vert.	-1.7	21.2	1.2	21.2	82.6	61.4	Complied

Test of: **Coronis Systems.**
Waveport Modem.
To: **FCC Part 15.247**

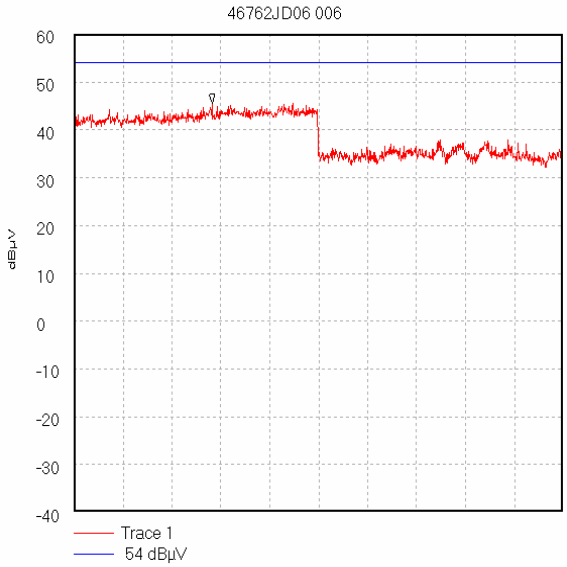
Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) (Continued)



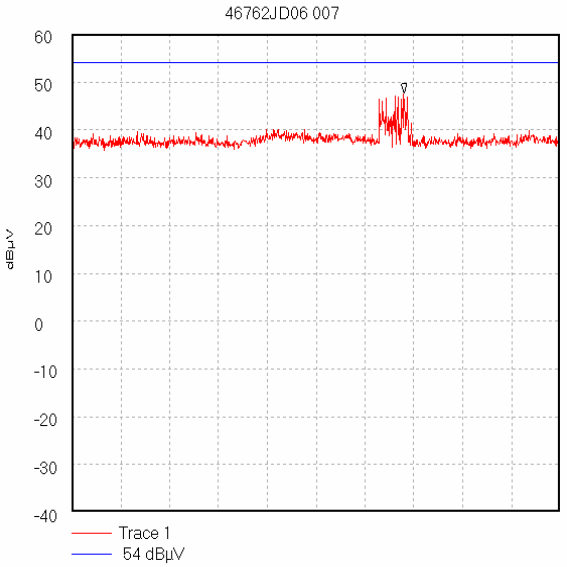
Start 1.0 GHz; Stop 2.0 GHz
Ref 60 dBµV/m; Ref Offset 0.0 dB; 10 dB/div
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 1.62 GHz, 46.32 dBµV/m
Display Line: 54 dBµV/m; ; Limit Test Passed
Transducer Factors: 1 to 2
11/02/2005 14:22:05



Start 2.0 GHz; Stop 4.0 GHz
Ref 70 dBµV/m; Ref Offset 0.0 dB; 10 dB/div
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 3.684 GHz, 67.97 dBµV/m
Display Line: 54 dBµV/m; ; Limit Test Failed
Transducer Factors: 2 to 4
11/02/2005 15:17:02

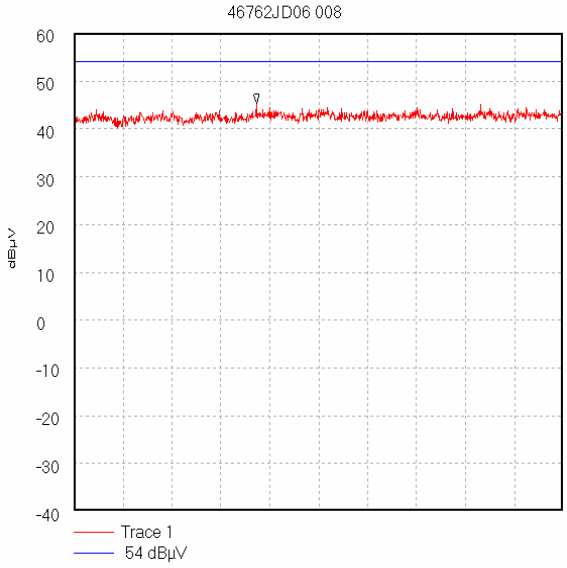


Start 4.0 GHz; Stop 6.0 GHz
Ref 60 dBµV; Ref Offset 26.4 dB; 10 dB/div
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 4.564444 GHz, 45.63 dBµV
Display Line: 54 dBµV; ; Limit Test Passed
01/02/2005 16:06:43



Start 6.0 GHz; Stop 8.0 GHz
Ref 60 dBµV; Ref Offset 29.3 dB; 10 dB/div
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 7.36 GHz, 47.64 dBµV
Display Line: 54 dBµV; ; Limit Test Passed
01/02/2005 16:11:54

Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) (Continued)



Start 8.0 GHz; Stop 12.0 GHz
Ref 60 dBµV; Ref Offset 33.5 dB; 10 dB/div
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 40.0 mS
Peak 9.493333 GHz, 45.3 dBµV
Display Line: 54 dBµV; ; Limit Test Passed
01/02/2005 16:14:36

"*Note: these plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.*"

7.10. Transmitter Band Edge Radiated Emissions: Section 15.247(d) & 15.209(a)

7.10.1. Electric Field Strength Measurements

The EUT was configured as for transmitter conducted emissions measurements as described in Section 9 of this report.

Tests were performed to identify the maximum conducted band edge emissions levels.

The limit lines shown in the plots below are set to a level 20 dB below the measured fundamental peak power of the channels closest to the lower and upper band edge.

Results:

Peak Power Level Hopping Mode

Frequency (MHz)	Antenna Polarity	Detector Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
902	Vert.	27.6	23.0	4.4	55.0	86.2*	31.2	Complied
928	Vert.	25.6	23.0	4.4	53.0	84.4*	31.4	Complied

Peak Power Level Static Mode

Frequency (MHz)	Antenna Polarity	Detector Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
902	Vert.	31.6	23.0	4.4	59.0	86.2*	27.2	Complied
928	Vert.	30.9	23.0	4.4	58.3	84.4*	26.1	Complied

Note(s):

** -20 dBc limit.*

8. Measurement Uncertainty

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently, the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor, such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	+/- 3.25 dB
Transmitter Maximum Peak Output Power	Not applicable	95%	+/- 1.78 dB
Transmitter Carrier Frequency Separation	Not applicable	95%	+/- 0.01 dB
20 dB Bandwidth	Not applicable	95%	+/- 0.12 %
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	+/- 5.26 dB
Radiated Spurious Emissions	1 GHz to 40 GHz	95%	+/- 1.78 dB

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty, the published guidance of the appropriate accreditation body is followed.

9. Measurement Methods

9.1. AC Mains Conducted Emissions

AC mains conducted emissions measurements were performed in accordance with the standard, against appropriate limits for each detector function.

The test was performed in a shielded enclosure with the equipment arranged as detailed in the standard on a wooden bench using the floor of the screened enclosure as the ground reference plane. The EUT was powered with 110V 60 Hz AC mains supplied via a Line Impedance Stabilisation Network (LISN).

Initial measurements in the form of swept scans covering the entire measurement band were performed in order to identify frequencies on which the EUT was generating interference. In order to minimise the time taken for these swept measurements, a Peak detector was used in conjunction with the appropriate detector IF measuring bandwidths (see table below). Repetitive scans were performed to allow for emissions with low repetition rates, and the duty cycle of the EUT. The test configuration was the same for the initial scans as for the final measurements.

Following the initial scans, a graph was produced giving an overview of the emissions from the EUT plotted against the appropriate specification limit. A tolerance line was set 6 dB below the specification limit and levels above the tolerance line were re-tested (at individual frequencies) using the appropriate detector function.

The test equipment settings for conducted emissions measurements were as follows:

Receiver Function	Initial Scan	Final Measurements
Detector Type:	Peak	Quasi-Peak (CISPR)/Average
Mode:	Max Hold	Not applicable
Bandwidth:	10 kHz	9 kHz
Amplitude Range:	60 dB	20 dB
Measurement Time:	Not applicable	> 1 s
Observation Time:	Not applicable	> 15 s
Step Size:	Continuous sweep	Not applicable
Sweep Time:	Coupled	Not applicable

9.2. Radiated Emissions

Radiated emissions measurements were performed in accordance with the standard, against appropriate limits for each detector function.

Initial measurements covering the entire measurement band in the form of swept scans in a shielded enclosure were performed in order to identify frequencies on which the EUT was generating interference. This determined the frequencies on which the EUT should be re-measured in full on the open area test site. In order to minimise the time taken for the swept measurements, a Peak detector was used in conjunction with the appropriate detector IF measuring bandwidth (see table below). Repetitive scans were performed to allow for emissions with low repetition rates.

The initial scans were performed using an antenna height of 1.5 m and a measurement distance of 3 m. Following the initial scans, graphs were produced giving an overview of the emissions from the EUT plotted against the appropriate specification limit. Any emission within 20 dB of the limit were then measured on the open area test site, except in cases where the noise floor was within 20 dB of the limit, in these cases the highest point of the noise floor was measured.

Where an emission fell inside a restricted band, measurements were made at the appropriate test distance using a measuring receiver with a Quasi-Peak detector for measurements below 1000 MHz and an Average and Peak detector for measurements above 1000 MHz. A peak detector was used for all other measurements.

For the final measurements the EUT was arranged on a non-conducting turn table on a standard test site compliant with ANSI C63.4 – 2001 Clause 5.4.

All measurements on the open area test site were performed using broadband antennas.

On the open area test site, at each frequency where a signal was to be measured, the trace was maximised by rotating a turntable through 360°. The angle at which the maximum signal was observed was locked out. For frequencies below 1000 MHz the test antenna was varied in height between 1 m and 4 m in order to further maximise the target emission.

For frequencies above 1000 MHz where a horn antenna was used, height searching was performed to locate the optimal height of the horn with respect to the EUT. At this point the horn was locked off and the turntable was again rotated through 360° to maximise the target signal. It should be noted that the received signal from the EUT would diminish very quickly after it exits the beam width of the horn antenna, for this reason it may not be necessary to fully height search with the horns.

At this point, any signals found to be between the limit and a level 6 dB below it were further maximised by changing the configuration of the EUT, e.g. re-routing cables to peripherals and moving peripherals with respect to the EUT.

Radiated Emissions (Continued)

Scans were performed to the upper frequency limits as stated in Section 15.33

The final field strength was determined as the indicated level in dBμV plus cable loss and antenna factor.

The test equipment settings for radiated emissions measurements were as follows:

Receiver Function	**Initial Scan**	**Final Measurements Below 1 GHz**	**Final Measurements Above 1 GHz**
Detector Type:	Peak	Quasi-Peak (CISPR)	Peak / Average
Mode:	Max Hold	Not applicable	Max Hold
Bandwidth:	(120 kHz < 1 GHz) (1 MHz > 1 GHz)	120 kHz	1 MHz
Amplitude Range:	100 dB	100 dB	100 dB
Step Size:	Continuous sweep	Not applicable	Not applicable
Sweep Time:	Coupled	Not applicable	Not applicable

9.3. Carrier Frequency Separation / 20 dB Bandwidth

The EUT and spectrum analyser was configured as for radiated measurements, and as per FCC Public Notice DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

To determine the bandwidth and separation of each transmission channel the measurement analyser was configured to measure two adjacent channels whilst the EUT was in hopping mode. The spectrum analyser was configured with a resolution bandwidth and video bandwidth greater than 1% of the frequency span.

The analyser was set for a maximum hold scan to capture the profile of the signal. The peak points on the two adjacent channels were noted and the separation between them recorded.

To determine the occupied bandwidth, a resolution bandwidth of 10 kHz was used, which is greater than 1% of the 20 dB bandwidth. A video bandwidth of, at least, the same value was used.

The analyser was set for a maximum hold scan to capture the profile of the signal. The peak level was then determined, and a reference line was drawn 20 dB below the peak level.

The bandwidth was determined at the points where the 20 dB reference line intercepted the power envelope of the emission.

9.4. Average Time of Occupancy

The EUT and spectrum analyser was configured as for radiated measurements, and as per FCC Public Notice DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

First the maximum packet length was determined on the centre channel.

The measurement analyser was configured to the time domain mode by setting the span to zero with a sweep time sufficiently wide enough to measure one pulse.

The EUT was configured to operate in normal mode of operation. The pulse width of one transmission was then recorded. The measurement analyser was then configured in zero span i.e. in the time domain and the sweep time was set to 20 seconds.

The number of transmissions within this period was noted and multiplied by the pulse width recorded earlier. This gives the maximum occupancy over 20 seconds.

9.5. Effective Isotropic Radiated Power (EIRP)

EIRP measurements were performed in accordance with the standard, against appropriate limits.

The EIRP was measured with the EUT arranged on a non-conducting turn table on a standard test site compliant with ANSI C63.4 – 2001 Clause 5.4. The transmitter was fitted with an integral antenna; therefore all radiated tests were performed with the unit operating into the integral antenna.

The level of the EIRP was measured using a spectrum analyser.

The test antenna was positioned in the horizontal plane. The EUT was oriented in the X plane. The test antenna was then raised and lowered until a maximum peak was observed. The turntable was then rotated through 360 degrees and the maximum peak reading obtained. The height search was then repeated to take into consideration the new angular position of the turntable. The maximum reading observed was then recorded. This procedure was then repeated with the EUT oriented in the Y and Z planes. The highest reading taken in all 3 planes was recorded. The entire procedure was then repeated with the test antenna set in the Vertical polarity.

Once the final amplitude (maximised) had been obtained, the EUT was substituted with a horn antenna. The centre of the substitution antenna was set to approximately the same centre location as the EUT. The substitution antenna was set to the horizontal polarity. The substitution antenna was matched into a signal generator using a 6 dB or greater attenuator. The signal generator was tuned to the EUT's frequency under test.

The test antenna was then raised and lowered to obtain a maximum reading on the spectrum analyser. The level of the signal generator output was then adjusted until the maximum recorded EUT level was observed. The signal generator level was noted. This procedure was repeated with both test antenna and substitution antenna vertically polarised. The EIRP was calculated as:-

EIRP = Signal Generator Level - Cable Loss + Antenna Gain

Effective Isotropic Radiated Power (EIRP) (Continued)

Circumstances where the signal generator could not produce the desired power substitution was performed with the signal generator set to 0 dBm. The radiated signal was maximised as previously described. The level indicated on the measuring receiver was noted. The delta between this level and the maximum level for the EUT was calculated and also noted. The EIRP of the signal generator was calculated using the above formulae. The recorded delta was added to the calculated EIRP to obtain the substituted EUT EIRP.

Delta (dB) = EUT – SG

where :

EUT = spectrum analyser indicated EUT raw level

SG = spectrum analyser indicated signal generator raw level

The signal generator actual EIRP is calculated as:

EIRP SG= Signal Generator Level - Cable Loss + Antenna Gain

The EUT EIRP is calculated as:

EIRP EUT = EIRP SG + Delta.

The test equipment settings for EIRP measurements were as follows:

Receiver Function	**Setting**
Detector Type:	Peak
Mode:	Not applicable
Bandwidth:	1 MHz
Amplitude Range:	100 dB
Sweep Time:	Coupled

9.6. Band Edge Compliance of RF Radiated Emissions

The EUT and spectrum analyser were configured as for radiated measurements and as per FCC Public Notice DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

To determine band edge compliance, the analyser resolution bandwidth was set to >= 1% of the analyser span. The video bandwidth was set to be $\geq$ to the resolution bandwidth. The sweep was set to auto and the detector to peak. The trace was set to max hold and a trace was produced.

The lower band edge of the allocated frequency band was selected and a marker was set to the level of the highest in band emission with a further limit line set to 20 dB below this. The marker was then placed on the highest out of band emission (the specification states that either the band edge level must be measured or the highest out of band emission, whichever is the greater). A table was produced showing the recorded data. The above was repeated for the upper band edge.

Appendix 1. Test Equipment Used

RFI No.	Instrument	Manufacturer	Type No.	Serial No.
A003	ESH3-Z2 Pulse Limiter	Rohde & Schwarz	ESH3-Z2	357 881/052
A027	Horn Antenna	Eaton	9188-2	301
A059	3146 Log Periodic Antenna	EMCO	3146	8902-2378
A067	LISN	Rohde & Schwarz	ESH3-Z5	890603/002
A091	EMCO 3110 Biconical Antenna	EMCO	3110	9008-1182
A1362	Eaton	Stoddart Aircraft Radio Co., Inc.	91889-1	N/A
A253	WG 12 Microwave Horn	Flann Microwave	12240-20	128
A255	WG 16 Microwave Horn	Flann Microwave	16240-20	519
A259	Bilog Antenna	Chase	CBL6111	1513
A427	WG 14 horn	Flann	14240-20	150
A428	WG 12 horn	Flann	12240-20	134
A429	WG 16 horn	Flann	16240-20	561
C1023	Rosenberger Cable	Rosenberger	FA210A-1-020m	FA00B 7567
C1065	Rosenberger	Rosenberger	UFA210-1-7872	0985
C1079	Rosenberger 1m Cable	Rosenberger	FA210A1010M5050	28462-1
C363	BNC Cable	Rosenberger	RG142	None
C364	BNC Cable	Rosenberger	RG142	None
M003	Spectrum Monitor	Rohde & Schwarz	EZM	883 580/008
M028	FSB Spectrum Analyser	Rohde & Schwarz	FSB	860 001/009 (RF), 860 161/007 (Display)
M044	ESVP Receiver	Rohde & Schwarz	ESVP	891 845/026
M056	Data Communications Analyser	Marconi	2871	310120/034
M058	Multimeter	Fluke	79	54940691
M069	ESMI Spectrum Analyser / Receiver	Rohde & Schwarz	ESMI	829 808/007 (DU) / 827 063/008 (RU)
M1124	Rohde & Schwarz	Rohde & Schwarz	ESIB26	100046K

Test Equipment Used (Continued)

RFI No.	Instrument	Manufacturer	Type No.	Serial No.
M505	Analyser Display Unit	Rohde & Schwarz	ESAI-D	825316/010
M506	RF unit	Rohde & Schwarz	ESBI-RF	827060/004
S202	Site 2	RFI	2	S202-15011990
S209	Site 9	RFI	9	

NB In accordance with UKAS requirements, all the measurement equipment is on a calibration schedule.

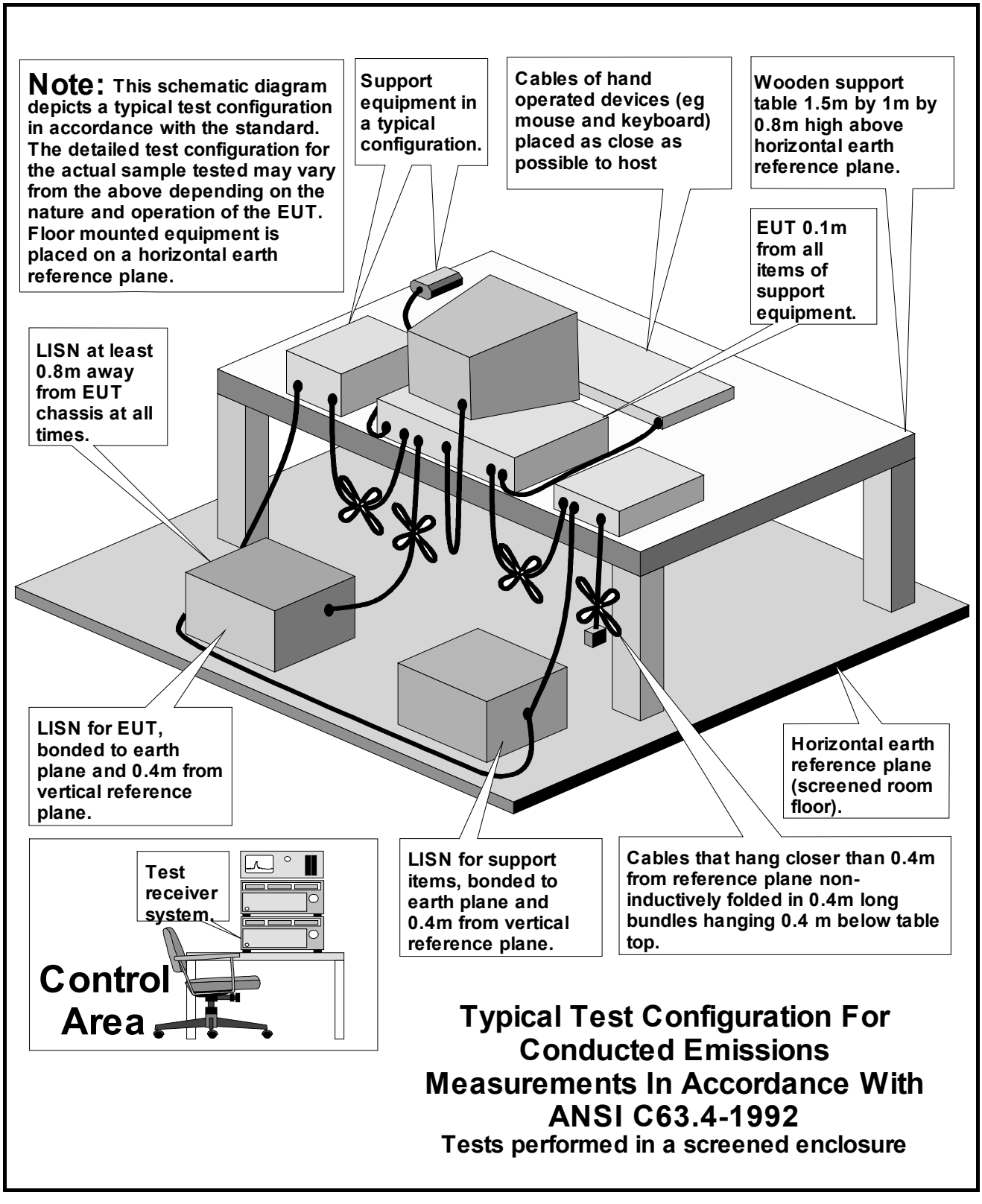
Appendix 2. Test Configuration Drawings

This appendix contains the following drawings:

Drawing Reference Number	Title
DRG\46762JD06\EMICON	Test configuration for measurement of conducted emissions.
DRG\46762JD06\EMIRAD	Test configuration for measurement of radiated emissions.

Test of: Coronis Systems.
Waveport Modem.
To: FCC Part 15.247

DRG\46762JD06\EMICON

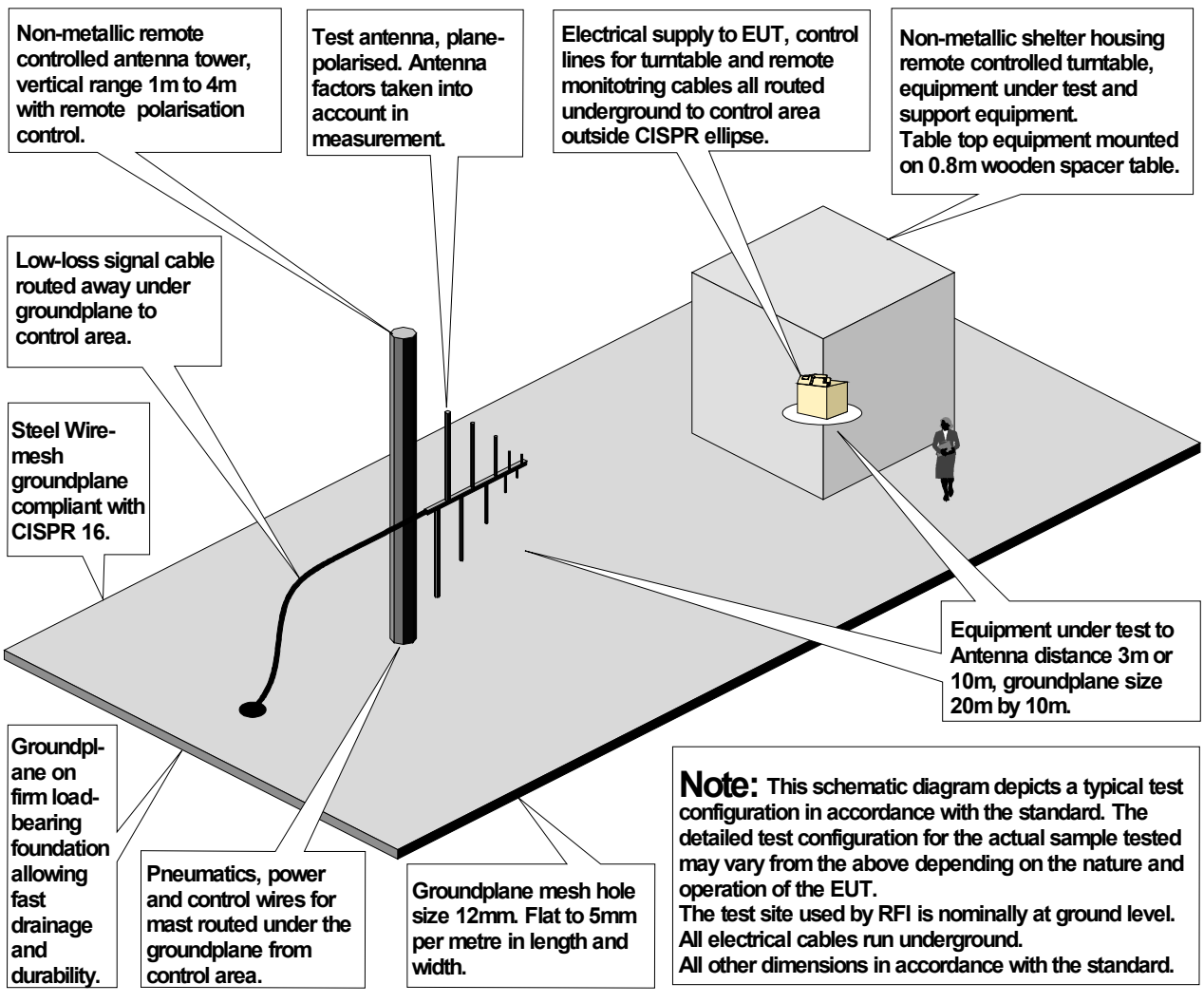


Typical Test Configuration For Conducted Emissions Measurements In Accordance With ANSI C63.4-1992

Tests performed in a screened enclosure

Test of: Coronis Systems.
Waveport Modem.
To: FCC Part 15.247

DRG\46762JD06\EMIRAD



Note: This schematic diagram depicts a typical test configuration in accordance with the standard. The detailed test configuration for the actual sample tested may vary from the above depending on the nature and operation of the EUT.
The test site used by RFI is nominally at ground level.
All electrical cables run underground.
All other dimensions in accordance with the standard.

Test Configuration For Radiated Emissions Measurements

Reflection-free area: >60m by 52m (CISPR ellipse)

Groundplane Earthed

Control room outside CISPR ellipse