




TEST REPORT FROM RFI GLOBAL SERVICES LTD

Test of: Omitec Instrumentation Limited
OmiPro WiFi Module

To: FCC Part 15.247

Test Report Serial No:
RF\IMPTE2\RP47028JD01A

Supersedes Test Report Serial No:
RF\IMPTE1\RP47028JD01A

This Test Report Is Issued Under The Authority Of Andrew Brown, Operations Manager:  pp	
Tested By: Fara Razally  pp	Checked By: Nigel Davison 
Report Copy No: PDF01	
Issue Date: 01 June 2005	Test Dates: 14 February 2005 to 22 February 2005

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The results in this report apply only to the sample(s) tested.

RFI Global Services Ltd

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Registered in England and Wales. Company number: 2117901

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1. Client Information

Company Name:	Omitec Instrumentation Ltd
Address:	Hopton Industrial Estate London Road Devizes Wiltshire SN10 2EU
Contact Name:	Mr S. Rivers

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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:	Omittec Omipro
Model Name or Number:	Omittec Wi-Fi Module
Unique Type Identification:	None Stated
Serial Number:	None Stated
FCC ID	SV4-OMWF01
Country of Manufacture:	UK
Date of Receipt:	14 February 2005

2.2. Description of EUT

The EUT is a Wi-Fi Module for use in a range of Omittec hosts.

2.3. Modifications Incorporated in the EUT

During the course of testing the EUT was not modified.

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2.4. Additional Information Related to Testing

Power Supply Requirement:	12V Lead Acid		
Intended Operating Environment:	Light Industrial & Commercial		
Equipment Category:	WiFi Module		
Type of Unit:	Portable (Standalone battery powered device)		
Interface Ports:	None		
Transmit Frequency Range:	2412 MHz to 2484 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	1	2412.709
	Middle	6	2437.645
	Top	11	2461.787
Highest Unintentionally Generated Frequency:	33 MHz		
Highest Fundamental Frequency:	2461.787 MHz		
Occupied Bandwidth:	17034.068 kHz (Measured)		
EIRP:	14.9 dBm (Measured)		

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2.5. Support Equipment

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

Description:	PC
Brand Name:	Dell Inspiration 1100
Model Name or Number:	PP07L
Serial Number:	(01) 07898 34989922
Cable Length and Type:	Not Applicable
Connected to Port:	WLAN

Description:	DDS Function Generator
Brand Name:	Tti
Model Name or Number:	TG1010
Serial Number:	173368
Cable Length and Type:	0.75 m
Connected to Port:	(Auto meters) YEL

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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 (1996)

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.

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.

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4. Deviations from the Test Specification

Testing of the receiver spurious emissions was not performed due to the fact that the EUT could not be set into receive only mode.

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5. Operation of the EUT During Testing

5.1. Operating Modes

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

Transmit only

5.2. Configuration and Peripherals

The EUT was tested in the following configuration:

Installed in a supplied Omitec host.

Two similar hosts were supplied, by the client, to RFI for testing. Emissions pre-scans were performed using both host systems and then all final measurements were made using the host which demonstrated the worst RF emissions performance. These were the only hosts supplied to RFI for this approval test.

The EUT was configured with 12v lead acid battery and communicating with the laptop via Wireless LAN link.

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6. Summary of Test Results

Range of Measurements	Specification Reference	Port Type	Compliance Status
Transmitter Minimum 6 dB Bandwidth	C.F.R. 47 FCC Part 15: 2004 Section 15.247(a)(2)	Antenna	Complied
Transmitter 20 dB Bandwidth	C.F.R. 47 FCC Part 2: 2004 Section 2.1049	Antenna	Complied
Transmitter Peak Power Spectral Density	C.F.R. 47 FCC Part 15: 2004 Section 15.247(e)	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(c) & 15.209(a)	Antenna	Complied
Transmitter Band Edge Radiated Emissions	C.F.R. 47 FCC Part 15: 2004 Sections 15.247(c) & 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.

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7. Measurements, Examinations and Derived Results

7.1. General Comments

7.1.1. This section contains test results only.

7.1.2. 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.

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7.2. Test Results:

7.2.1. Transmitter Minimum 6 dB Bandwidth: Section 15.247(a)(2)

7.2.1.1. The EUT was configured for transmitter minimum bandwidth measurements as described in Section 9 of this report.

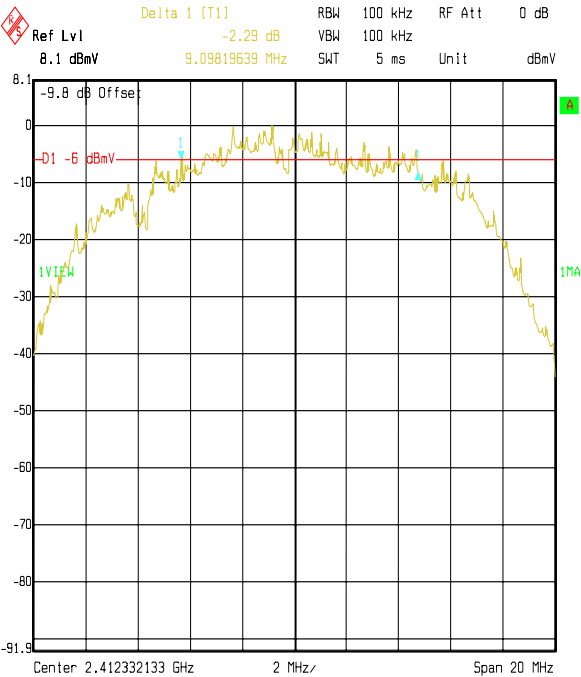
7.2.1.2. Tests were performed to identify the 6 dB bandwidth of the fundamental emission.

Results:

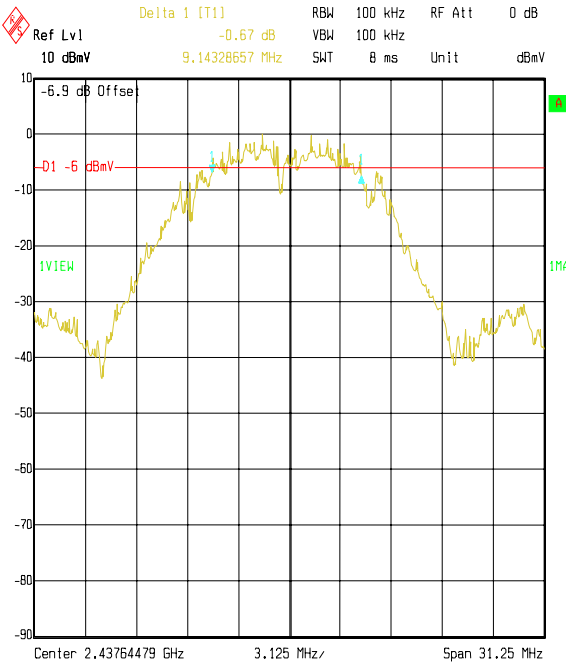
Channel	Transmitter 6 dB Bandwidth (MHz)	Limit (MHz)	Margin (MHz)	Result
Bottom	9.0982	≥ 0.5	8.5982	Complied
Middle	9.1432	≥ 0.5	8.6432	Complied
Top	8.8302	≥ 0.5	8.3302	Complied

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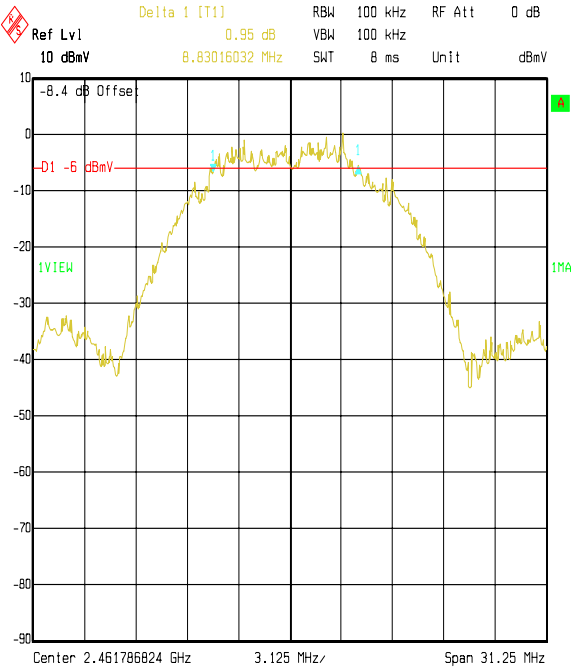
Transmitter Minimum 6 dB Bandwidth: Section 15.247(a)(2) (Continued)



Title: 47028JD01 Omitec EUT: WiFi Module FCC Part C 15.247
Comment A: 6dB Bandwidth Bottom Channel
Date: 22.FEB.2005 17:15:41



Title: 47028JD01 Omitec EUT: WiFi Module FCC Part C 15.247
Comment A: 6dB Bandwidth Middle Channel
Date: 22.FEB.2005 16:33:35



Title: 47028JD01 Omitec EUT: WiFi Module FCC Part C 15.247
Comment A: 6dB Bandwidth Top Channel
Date: 22.FEB.2005 16:57:15

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7.2.2. Transmitter 20 dB Bandwidth: Section 2.1049

7.2.2.1. The EUT was configured for 20 dB bandwidth measurements as described in Section 9 of this report.

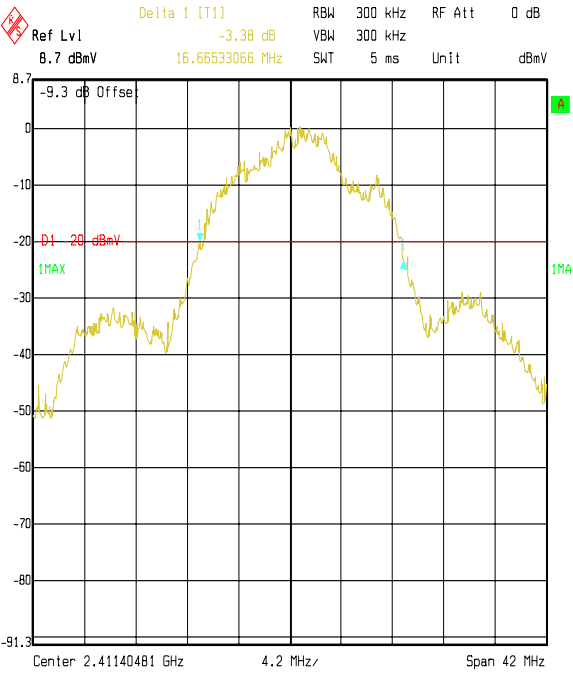
7.2.2.2. Tests were performed to identify the 20 dB bandwidth.

Results:

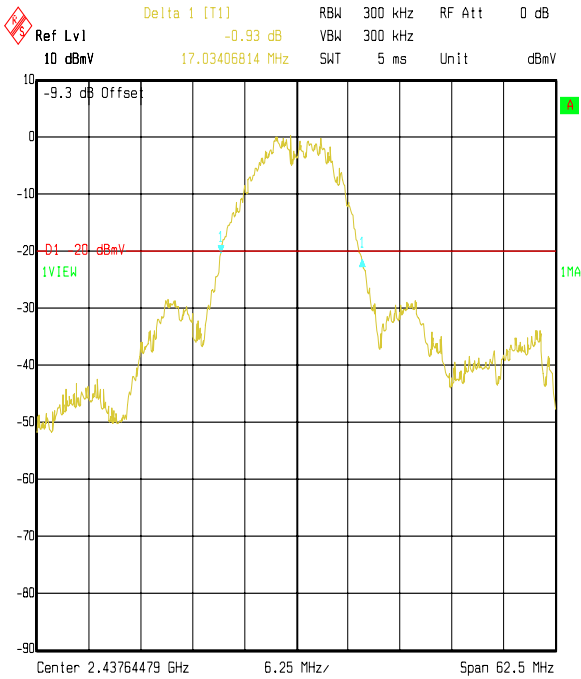
Transmitter 20 dB Bandwidth Middle Channel (kHz)
17034.068

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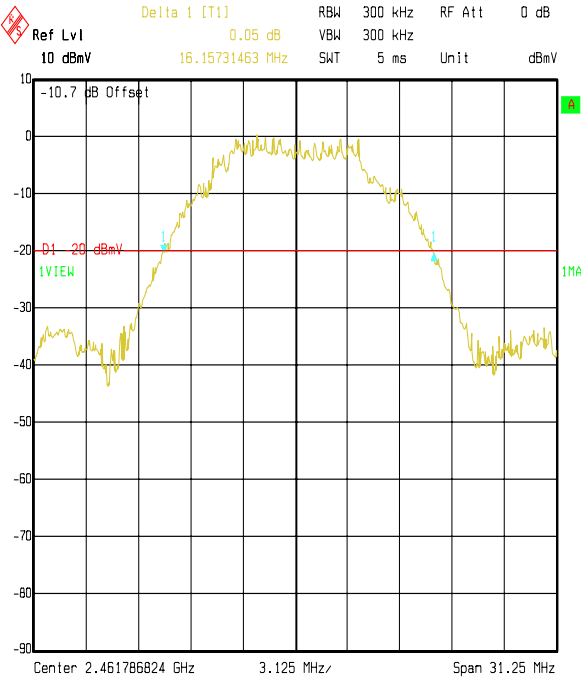
Transmitter 20 dB Bandwidth: Section 2.1049 (Continued)



Title: 47028JD01 Omitec EUT: WiFi Module FCC Part C 15.247
Comment A: 20dB Bandwidth Bottom Channel
Date: 22.FEB.2005 15:57:14



Title: 47028JD01 Omitec EUT: WiFi Module FCC Part C 15.247
Comment A: 20dB Bandwidth Middle Channel
Date: 22.FEB.2005 16:28:23



Title: 47028JD01 Omitec EUT: WiFi Module FCC Part C 15.247
Comment A: 20dB Bandwidth Top Channel
Date: 22.FEB.2005 16:59:49

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7.2.3. Transmitter Peak Power Spectral Density: Section 15.247(e)

7.2.3.1. The EUT was configured for transmitter peak power spectral density measurements as described in Section 9 of this report.

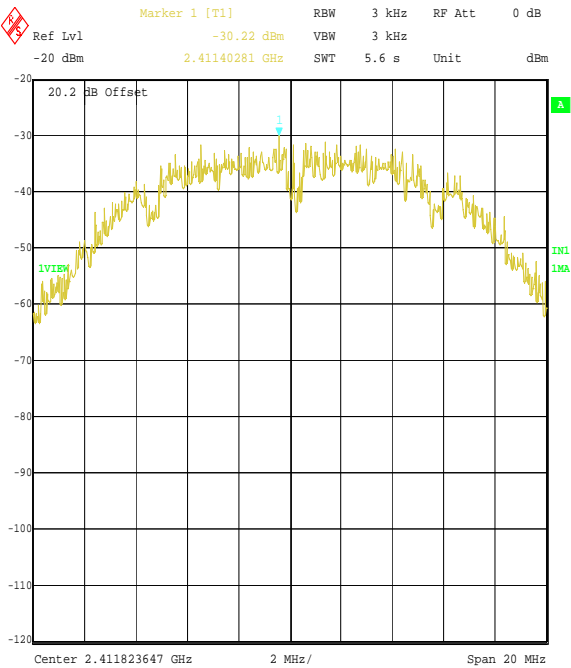
7.2.3.2. Tests were performed to identify the maximum peak power spectral density of the Fundamental.

Results:

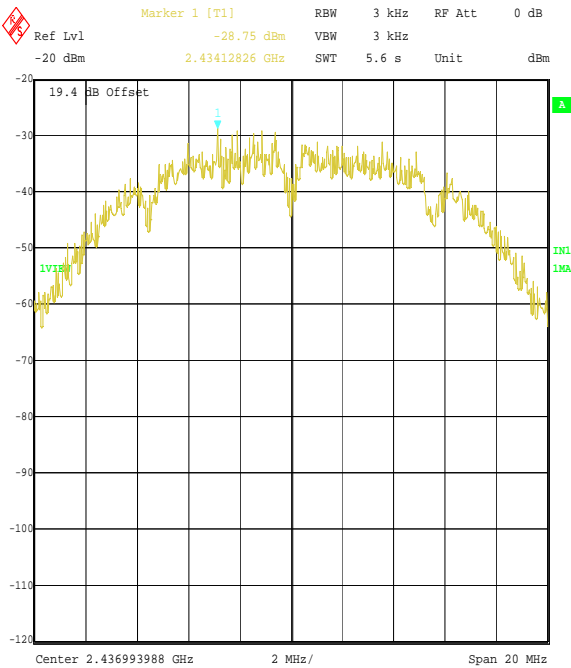
Channel	Output Power (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Result
Bottom	-30.2	8.0	38.2	Complied
Middle	-28.8	8.0	36.8	Complied
Top	-32.2	8.0	40.2	Complied

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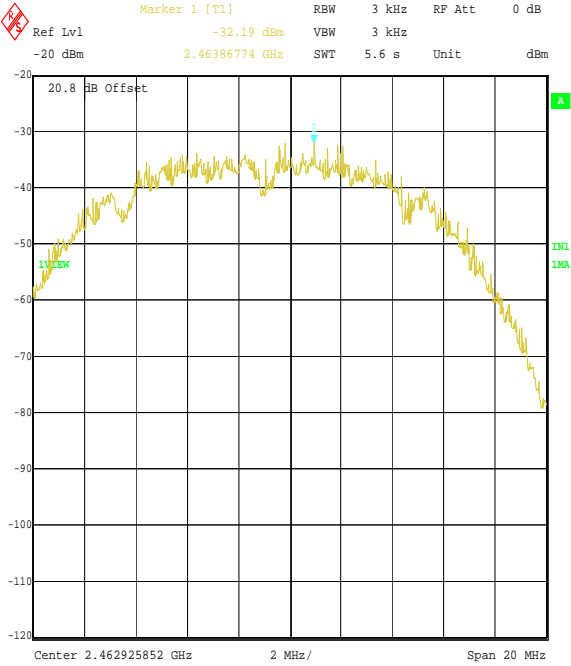
Transmitter Peak Power Spectral Density: Section 15.247(e) (Continued)



Title: 47028JD01 Omitec EUT: Wifi Module FCC Part 15.247
Comment A: Omitec Spectral Power Density Bottom Channel
Date: 24.FEB.2005 20:51:55



Title: 47028JD01 Omitec EUT: Wifi Module FCC Part 15.247
Comment A: Omitec Spectral Power Density Middle Channel
Date: 24.FEB.2005 21:00:28



Title: 47028JD01 Omitec EUT: Wifi Module FCC Part 15.247
Comment A: Omitec Spectral Power Density Top Channel
Date: 24.FEB.2005 20:42:13

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

7.2.4.1. The EUT was configured for transmitter peak output power measurements as described in Section 9 of this report.

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

Results:**Battery Powered Devices**

Channel	EIRP (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	14.8	30.0	15.2	Complied
Middle	14.9	30.0	15.1	Complied
Top	12.9	30.0	17.1	Complied

Note(s):

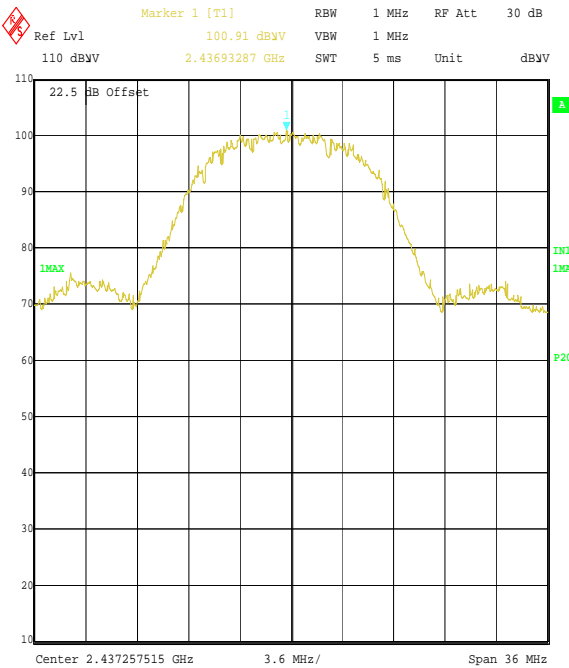
1. *These tests were performed radiated; therefore the EUT antenna gain is encompassed in the final result.*
2. *The measurement was performed using a 1 MHz bandwidth detector and then calculated out to a measurement in 18 MHz, which is wider than the 20 dB bandwidth of the transmit signal. Please refer to Section 9.5 of this test report for greater detail of test method.*

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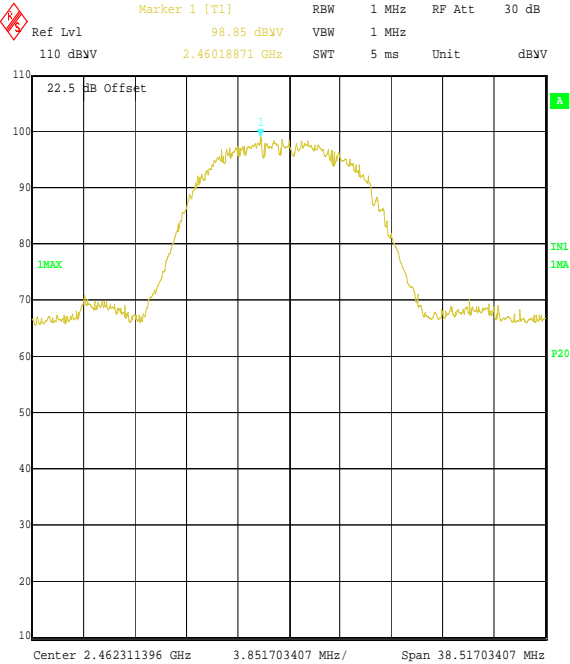
Transmitter Maximum Peak Output Power: (EIRP) Section 15.247(b)(3) (Continued)



Title: Omitec 47028JD01 EUT: Wifi Module FCC Part 15.247
Comment A: Peak Output Power EUT operating on Bottom Channel
Date: 23.FEB.2005 16:51:41



Title: Omitec 47028JD01 EUT: Wifi Module FCC Part 15.247
Comment A: Peak Output Power EUT operating on middle channel
Date: 23.FEB.2005 16:55:07



Title: Omitec 47028JD01 EUT: Wifi Module FCC Part 15.247
Comment A: Peak Output Power EUT operating on Top Channel
Date: 23.FEB.2005 16:27:13

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7.2.5. Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) - Electric Field Strength Measurements: 30 to 1000 MHz (emissions occurring in the restricted bands)

7.2.5.1. The EUT was configured as for radiated emissions testing as described in Section 9 of this report.

7.2.5.2. Tests were performed to identify the maximum transmitter radiated emission levels.

Results:

Middle Channel

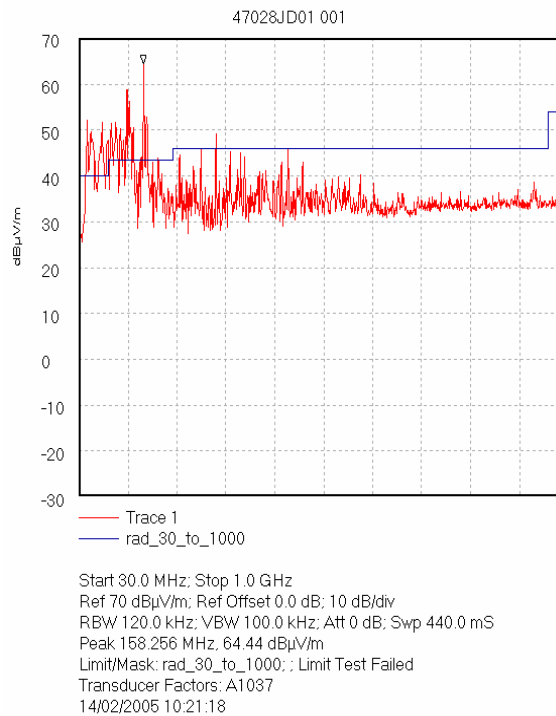
Frequency (MHz)	Antenna Polarity	Q-P Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
128.517	Vert	38.6	43.5	4.9	Complied

Note(s):

1. 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 middle channel only.

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Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) - Electric Field Strength Measurements: 30 to 1000 MHz (emissions occurring in the restricted bands) (Continued)



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

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7.2.6. Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) - Electric Field Strength Measurements (Frequency Range: 1 to 25 GHz) (emissions occurring in the restricted bands)

7.2.6.1. The EUT was configured as for radiated emissions testing as described in Section 9 of this report.

7.2.6.2. Tests were performed to identify the maximum transmitter radiated emission levels.

Results:

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
1.08899	Vert	5.4	21.2	1.2	27.8	74.0	46.2	Complied
1.19269	Horiz	3.4	20.8	1.2	25.4	74.0	48.6	Complied
4.82405	Horiz	38.1	24.4	2.0	64.5	74.0	9.5	Complied
18.85897	Vert	21.1	37.1	3.6	61.8	74.0	12.2	Complied

Highest Average 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
1.08899	Vert	0.6	21.2	1.2	23.0	54.0	31.0	Complied
1.19269	Horiz	0.1	20.8	1.2	22.1	54.0	31.9	Complied
4.82405	Horiz	13.1	24.4	2.0	39.5	54.0	14.5	Complied
18.85897	Vert	11.1	37.1	3.6	51.8	54.0	2.2	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
1.08899	Vert	4.1	21.2	1.2	26.5	74.0	47.5	Complied
1.19269	Horiz	1.3	20.8	1.2	23.3	74.0	50.7	Complied
4.87398	Horiz	38.1	24.4	2.0	64.5	74.0	9.5	Complied
18.861191	Horiz	21.0	37.1	3.6	61.7	74.0	12.3	Complied

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Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) - Electric Field Strength Measurements (Frequency Range: 1 to 25 GHz) (emissions occurring in the restricted bands) (Continued)

Highest Average 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
1.08899	Vert	1.0	21.2	1.2	23.4	54.0	30.6	Complied
1.19269	Horiz	0.3	20.8	1.2	22.3	54.0	31.7	Complied
4.87398	Horiz	10.9	24.4	2.0	37.3	54.0	16.7	Complied
18.861191	Horiz	7.9	37.1	3.6	48.6	54.0	5.4	Complied

Highest Peak Level: Top Channel

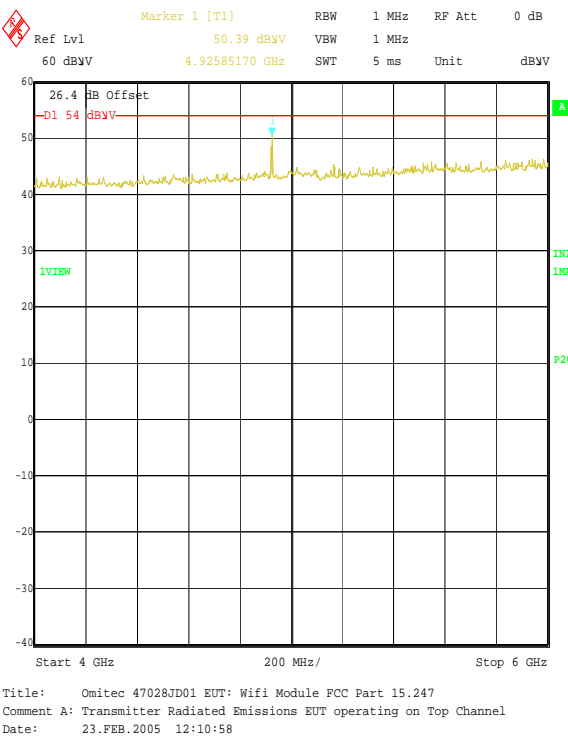
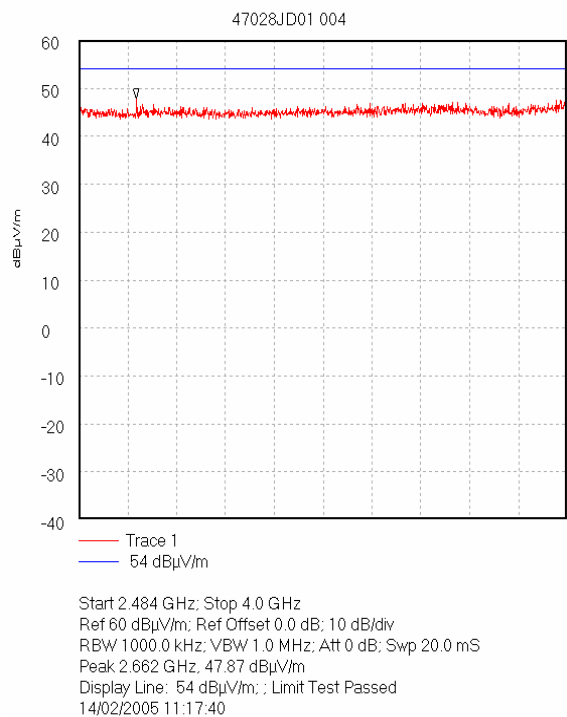
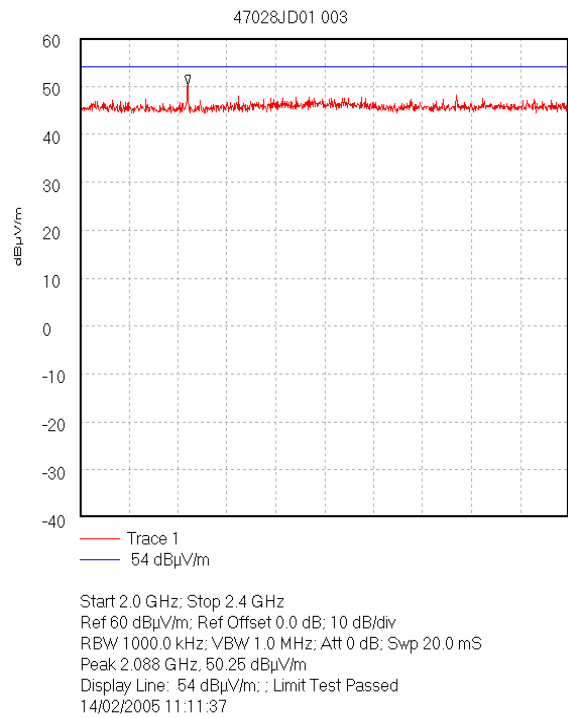
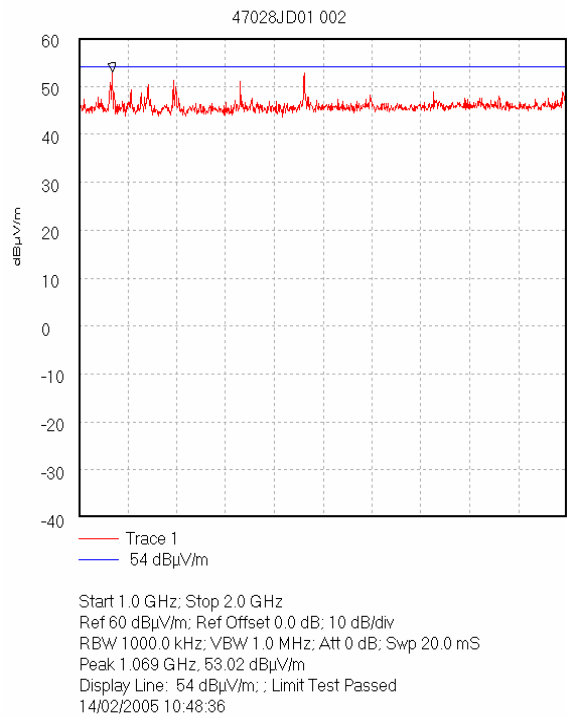
Frequency (GHz)	Antenna Polarity	Detector Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
1.08899	Vert	18.5	21.2	1.2	40.9	74.0	33.1	Complied
1.19269	Horiz	5.6	20.8	1.2	27.6	74.0	46.4	Complied
4.92400	Horiz	31.2	24.4	2.0	57.6	74.0	16.4	Complied
18.86068	Horiz	18.8	37.1	3.6	59.5	74.0	14.5	Complied

Highest Average 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
1.08899	Vert	1.2	21.2	1.2	23.6	54.0	30.4	Complied
1.19269	Horiz	0.5	20.8	1.2	22.5	54.0	31.5	Complied
4.92400	Horiz	10.3	24.4	2.0	36.7	54.0	17.3	Complied
18.86068	Horiz	9.1	37.1	3.6	49.8	54.0	4.2	Complied

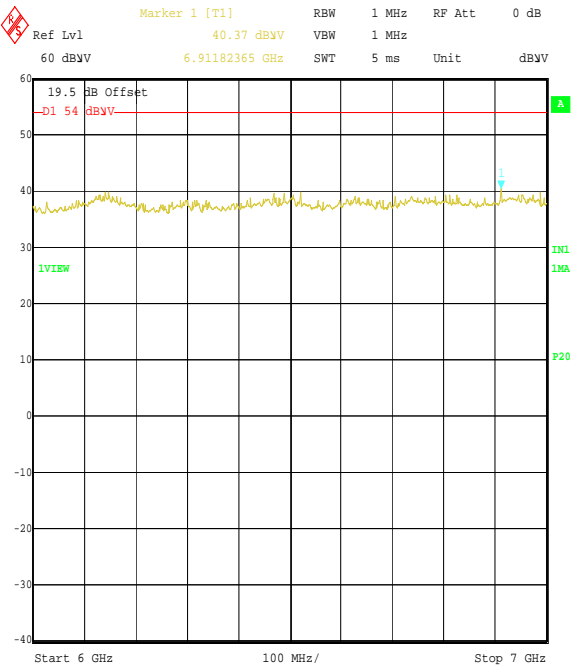
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Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) - Electric Field Strength Measurements (Frequency Range: 1 to 25 GHz) (emissions occurring in the restricted bands) (Continued)

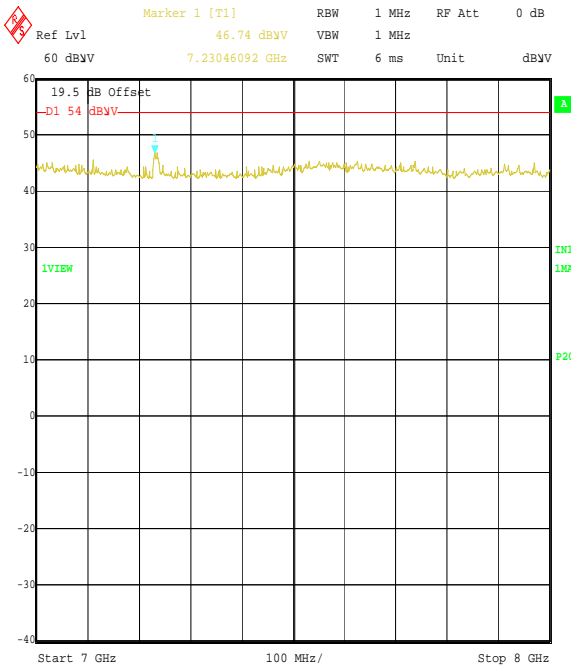


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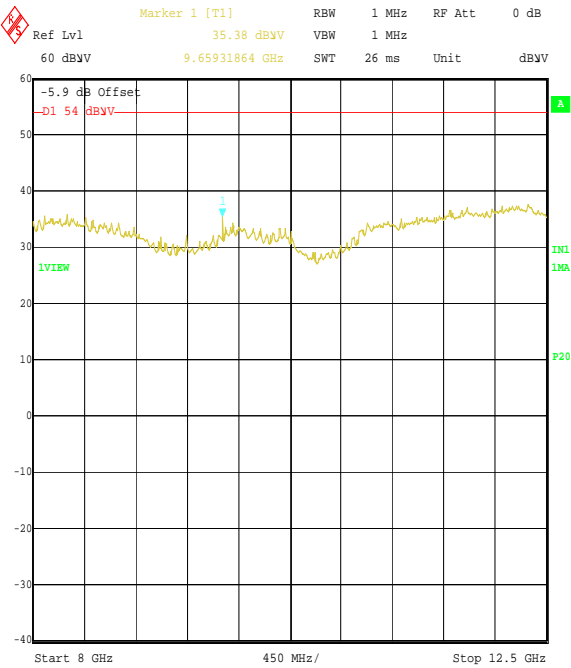
Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) - Electric Field Strength Measurements (Frequency Range: 1 to 25 GHz) (emissions occurring in the restricted bands) (Continued)



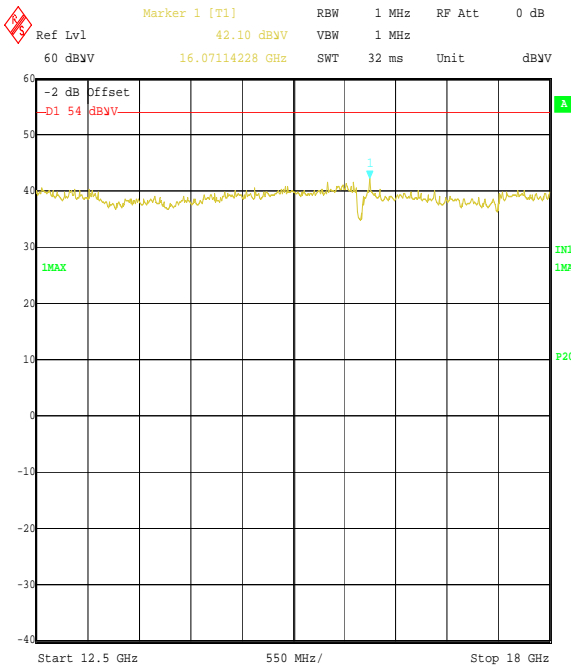
Title: Omitec 47028JD01 EUT: Wifi Module FCC Part 15.247
Comment A: Transmitter Radiated Emissions EUT operating on Top Channel
Date: 23.FEB.2005 13:18:20



Title: Omitec 47028JD01 EUT: Wifi Module FCC Part 15.247
Comment A: Transmitter Radiated Emissions EUT operating on Top Channel
Date: 23.FEB.2005 13:19:39



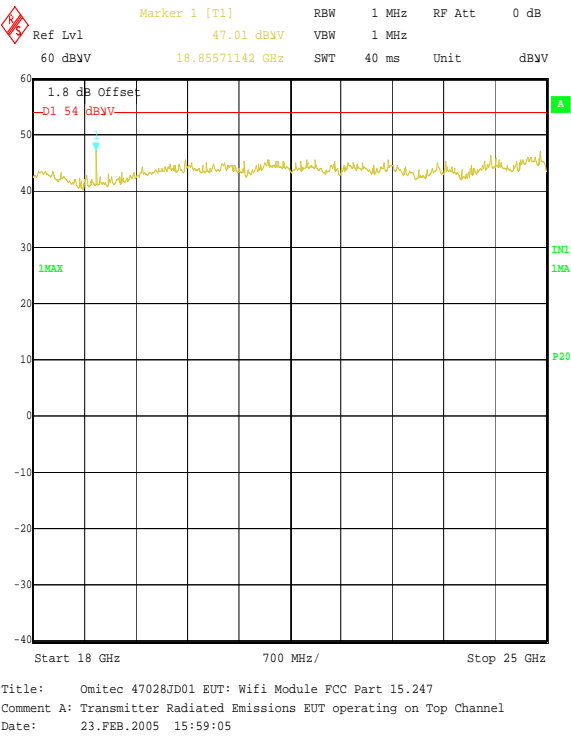
Title: Omitec 47028JD01 EUT: Wifi Module FCC Part 15.247
Comment A: Transmitter Radiated Emissions EUT operating on Top Channel
Date: 23.FEB.2005 15:41:11



Title: Omitec 47028JD01 EUT: Wifi Module FCC Part 15.247
Comment A: Transmitter Radiated Emissions EUT operating on Top Channel
Date: 23.FEB.2005 15:55:53

Test of: Omitec Instrumentation Limited
OmiPro WiFi Module
To: FCC Part 15.247

Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) - Electric Field Strength Measurements (Frequency Range: 1 to 25 GHz) (emissions occurring in the restricted bands) (Continued)



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

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7.2.7. Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) - Electric Field Strength Measurements (Frequency Range: 1 to 25 GHz) (emissions outside the restricted bands)

7.2.7.1. The EUT was configured as for radiated emissions testing as described in Section 9 of this report.

7.2.7.2. Tests were performed to identify the maximum transmitter radiated emission levels.

Results:

Highest Peak Level: Bottom Channel

Frequency (GHz)	Antenna Polarity	Detector Level (dB μ V)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dB μ V/m)	-20 dBc Limit (dB μ V/m)	Margin (dB)	Result
1.26780	Horiz	0.0	21.6	1.2	22.8	80.8	58.0	Complied
2.08755	Horiz	6.5	23.4	1.2	31.1	80.8	49.7	Complied
7.23923	Horiz	21.3	26.9	2.3	50.5	80.8	30.2	Complied
9.64786	Horiz	7.0	30.8	3.0	40.8	80.8	40.0	Complied

Highest Peak Level: Middle Channel

Frequency (GHz)	Antenna Polarity	Detector Level (dB μ V)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dB μ V/m)	-20 dBc Limit (dB μ V/m)	Margin (dB)	Result
1.26780	Horiz	-0.4	21.6	1.2	22.4	80.9	58.5	Complied
2.08755	Horiz	7.5	23.4	1.2	32.1	80.9	48.8	Complied
7.31022	Horiz	21.2	26.9	2.3	50.3	80.9	30.6	Complied
9.70136	Horiz	15.9	30.8	3.0	49.7	80.9	31.2	Complied

Highest Peak Level: Top Channel

Frequency (GHz)	Antenna Polarity	Detector Level (dB μ V)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dB μ V/m)	-20 dBc Limit (dB μ V/m)	Margin (dB)	Result
1.26780	Horiz	-0.9	21.6	1.2	21.9	78.9	57.0	Complied
2.08755	Horiz	6.3	23.4	1.2	30.9	78.9	48.0	Complied
7.38416	Horiz	15.4	26.9	2.3	44.6	78.9	34.3	Complied
9.85620	Horiz	9.4	30.8	3.0	43.2	78.9	35.7	Complied

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7.2.8. Transmitter Band Edge Radiated Emissions: Section 15.247(c) & 15.209(a) - Electric Field Strength Measurements

7.2.8.1. The EUT was configured for as for band edge compliance of radiated emission measurements as described in Section 9 of this report.

7.2.8.2. Tests were performed to identify the maximum radiated band edge emissions.

Results:

Peak Power Level:

Frequency (MHz)	Antenna Polarity	Detector Level (dB μ V)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2.4000	Horiz	39.1	21.5	1.4	62.0	70.8*	8.8	Complied
2.4835	Horiz	26.2	21.1	1.4	48.7	74.0	25.3	Complied

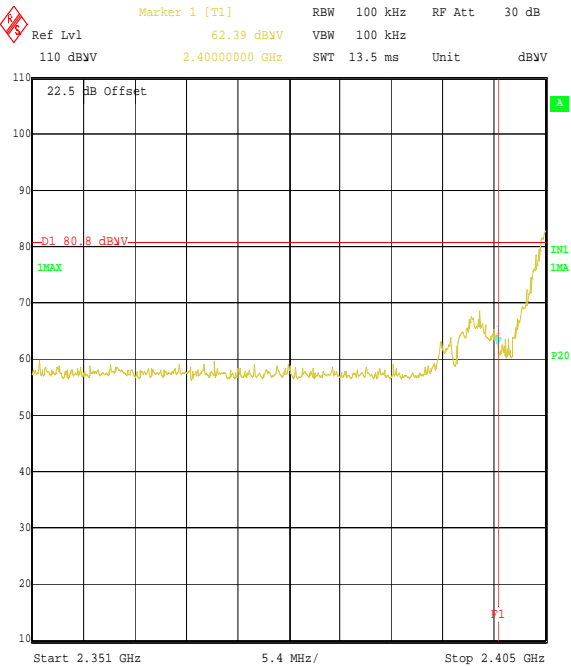
**Note: -20 dBc limit*

Average Power Level:

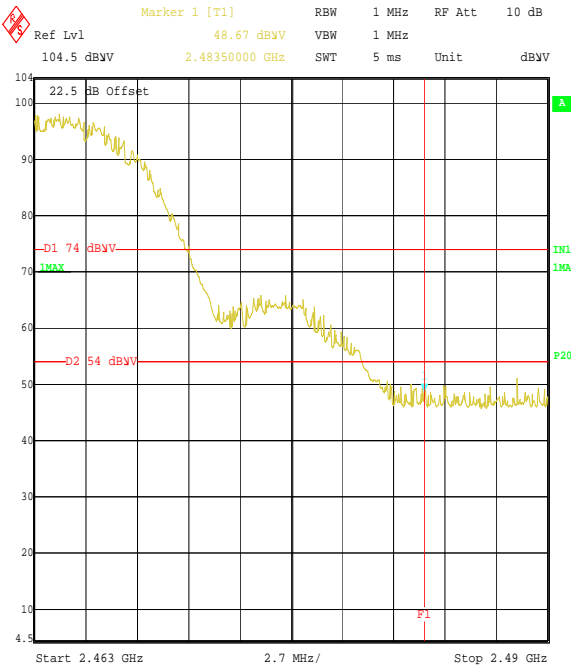
Frequency (GHz)	Antenna Polarity	Detector Level (dB μ V)	Antenna Factor (dB)	Cable Loss (dB)	Actual Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2.4835	Horiz	15.7	21.1	1.4	38.2	54.0	15.8	Complied

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Transmitter Band Edge Radiated Emissions: Section 15.247(c) & 15.209(a) - Electric Field Strength Measurements (Continued)



Title: Omitec 47028JD01 EUT: Wifi Module FCC Part 15.247
Comment A: Transmitter Band Edge RE EUT operating on bottom channel
Date: 23.FEB.2005 17:09:06



Title: Omitec 47028JD01 EUT: Wifi Module FCC Part 15.247
Comment A: Transmitter Band Edge RE EUT operating on bottom channel
Date: 23.FEB.2005 17:15:26

Note 1: The low frequency (bottom channel) plot shows a limit of 80.8 dBμV. The dBc limit with regard to the signal in a 100 kHz bandwidth is 70.8 dBμV.

Note 2: Both plots have titles stating “bottom channel”. Clearly on the second (high frequency) plot, the channel tested is actually the top channel. This is only a typographical error on the plot itself.

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8. Measurement Uncertainty

8.1. 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 measured (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

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

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

8.4. 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
Transmitter Maximum Peak Output Power	Not applicable	95%	+/- 0.46 dB
Spectral Power Density	Not applicable	95%	+/- 1.2 dB
6 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

8.5. 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.

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9. Measurement Methods

9.1. 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.

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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 dB μ V 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

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9.2. Minimum 6 dB Bandwidth

To determine the 6 dB bandwidth, a resolution bandwidth of 100 kHz was used, which is approximates to 1% of the 6 dB bandwidth. A video bandwidth of 100 kHz was used. The analyser was set to a span of greater than twice the 6 dB bandwidth and for a maximum hold scan to capture the profile of the signal. The peak level was then determined, and a reference established 6 dB below the peak level. The bandwidth was determined at the points where the 6 dB reference crossed the profile of the emission.

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9.3. Transmitter 20 dB Bandwidth

The EUT and spectrum analyser was configured for transmitter radiated emissions measurements.

To determine the occupied bandwidth, a resolution bandwidth of 300 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 crossed the profile of the emission.

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9.4. Spectral Power Density

The EUT and spectrum analyser were configured for conducted antenna port emissions measurements.

Prior to testing being performed a suitable RF attenuator and cable were calibrated for the required frequencies. For each frequency the calibrated level of the attenuator and cable were entered as an offset into the spectrum analyser to compensate for the losses in the measurement set up.

Prior to the measurement being taken the spectrum analyser was tuned to the fundamental frequency of the EUT.

A resolution bandwidth of 3 kHz was selected and the analyser was set to a span of greater than twice the 6 dB bandwidth. The trace was max held and a reading was taken at the peak point of the trace.

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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 substitution antenna. For EIRP measurements a Horn antenna whose gain was based on an isotropic antenna was used, ERP measurements were done using a dipole. 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:-

$$\text{EIRP} = \text{Signal Generator Level} - \text{Cable Loss} + \text{Antenna Gain}$$

All measurements were performed using broadband Horn antennas.

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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.

$$\text{Delta (dB)} = \text{EUT} - \text{SG}$$

where :

EUT = spectrum analyser indicated EUT raw level

SG = spectrum analyser indicated signal generator raw level

The signal generator actual EIRP is calculated as:

$$\text{EIRP SG} = \text{Signal Generator Level} - \text{Cable Loss} + \text{Antenna Gain}$$

The EUT EIRP is calculated as:

$$\text{EIRP EUT} = \text{EIRP SG} + \text{Delta.}$$

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

The EUT signal was measured to have a 20 dB bandwidth of 17 MHz, as per section 7.2.2. of this test report. RFI's measurement analyser did not have a 17 MHz resolution bandwidth, therefore eighteen sets of 1 MHz measurements were made, centred around the carrier frequency. These eighteen 1 MHz measurements were then integrated (converted to linear units (Watts), added together, then converted back to logarithmic), to enable us to ascertain the EUT power in an 18 MHz bandwidth.

To ensure that 18 MHz was a sufficient bandwidth, a second measurement was made with thirty six 1 MHz measurements (centred around the carrier frequency), to ascertain the power in a 36 MHz bandwidth. The power in a 36 MHz bandwidth was found to be only 0.02 dB greater than the power calculated in 18 MHz, thus confirming to us that 18 MHz was a sufficient measurement bandwidth for this measurement.

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Appendix 1. Test Equipment Used

RFI No.	Instrument	Manufacturer	Type No.	Serial No.
A027	Horn Antenna	Eaton	9188-2	301
A031	2 to 4 GHz Eaton Horn Antenna	Eaton	91889-2	557
A1127	WG22 - WG26 Taper	Credowan	4036	None
A254	WG 14 Microwave Horn	Flann Microwave	14240-20	139
A276	OATS Positioning Controller	Rohde & Schwarz	HCC	
A428	WG 12 horn	Flann	12240-20	134
A429	WG 16 horn	Flann	16240-20	561
A430	WG 18 horn	Flann	18240-20	425
A436	WG 20 horn	Flann	20240-20	330
A553	Bi-log Antenna	Chase	CBL6111A	1593
M003	Spectrum Monitor	Rohde & Schwarz	EZM	883 580/008
M023	ESVP Receiver	Rohde & Schwarz	ESVP	872 991/027
M1124	Rohde & Schwarz	Rohde & Schwarz	ESIB26	100046K
M127	Spectrum Analyser	Rohde & Schwarz	FSEB 30	842 659/016
M173	Turntable Controller	R.H.Electrical Services	RH351	3510020
M506	RF unit	Rohde & Schwarz	ESBI-RF	827060/004

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

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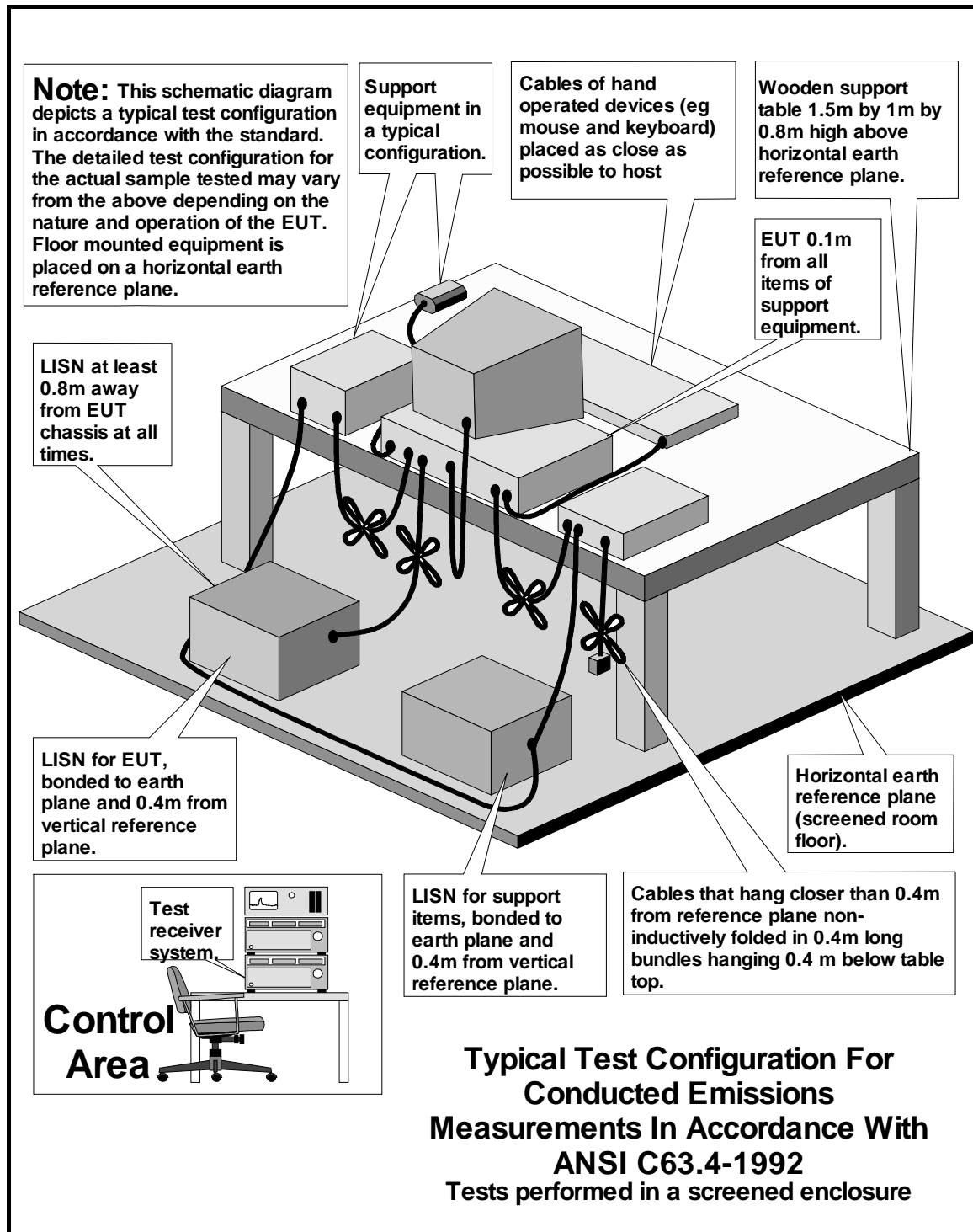
Appendix 2. Test Configuration Drawings

This appendix contains the following drawings:

Drawing Reference Number	Title
DRG\47028JD01\EMICON	Test configuration for measurement of conducted emissions.
DRG\47028JD01\EMIRAD	Test configuration for measurement of radiated emissions.

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DRG\47028JD01\EMICON



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DRG\47028JD01\EMIRAD

