
TEST REPORT

Limited FCC Part 15 C Testing in Support of a Class 2 Permissive Change Application
for a Symbol WSM-5030 RF Module using a SKYNET SNP-PA5T Power Supply
with Various Antennas
FCC ID: H9PWSM5030

Report Number: OR610776/14 Issue 4

July 2004

REPORT ON

Limited FCC Part 15 C Testing in support of a Class 2
Permissive Change Application for a Symbol WSM-5030 RF
Module using a Skynet SNP-PA5T Power Supply and Various
Antennas

Report No OR610776/14 Issue 4

July 2004

EQUIPMENT:

WSM-5030 RF Module

FCC ID:

H9PWSM5030

SPECIFICATION:

FCC Part 15 C

PREPARED FOR:

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DATED:

1st July 2004

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STATUS

OBJECTIVE	To undertake measurements to determine the Equipment Under Test's (EUT's) compliance with the specification.
MANUFACTURING DESCRIPTION	RLAN Radio Module
APPLICANT	Symbol Technologies Symbol Place Winnersh Triangle Berkshire RG41 5TP
MANUFACTURERS TYPE NUMBER	WSM-5030
MANUFACTURERS PART NUMBER	WSM-5030
SERIAL NUMBER	No 5
HARDWARE REVISION	DVT3.1
TEST SPECIFICATION NUMBER	FCC Part 15 C, 2002-08
REGISTRATION NUMBER	OR610776
QUANTITY OF ITEMS TESTED	One
SECURITY CLASSIFICATION OF EUT	Unclassified
INCOMING RELEASE SERIAL NUMBER DATE	Declaration of Build Status 610776 29 th June 2003
DISPOSAL REFERENCE NUMBER DATE	Held pending disposal N/A N/A
START OF TEST FINISH OF TEST	14 th August 2003 29 th January 2004
TEST ENGINEERS	R Bennett S Hartley A Guy A Rushworth
RELATED DOCUMENTS	ANSI C63.4 2001. Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.



TEST RATIONALE

This report has been re-issued to cover an error in the Antenna Gains for the Antennas on page 6. This report is intended to replace the original report OR610776/14/Issue 3 issued in June 2004.

The information contained within this report is intended to show verification of limited compliance of the Symbol Technologies Inc WSM-5030 RLAN Radio Module to the requirements of FCC Specification Part 15 C for a Class 2 Permissive Change Application for additional antennas. For details of the Antennas covered by this application please see "System Configuration" in this Test Report.

FCC ID H9PWSAP5030 & H9PWSM5030

The unit supplied for testing was a WSAP-5030 Access Port, which offers 5GHz 802.11a Wireless LAN connectivity fitted with a WSM-5030 RLAN Radio Module, which offers 2.4GHz 802.11b Wireless LAN connectivity. For practical reasons it is not possible to test the WSM-5030 and therefore it has been tested within its intended "Host" unit the WSAP-5030.

All testing was carried out using the WSAP-5030 Access Port and WSM-5030 RLAN Radio Module fitted with additional Antennas on the WSM-5030 and Dipole (Rubber Duck) Antennas on the WSAP-5030. A 120V, 60Hz Power Supply Unit Symbol Part No SNP-PA5T was powering the WSAP-5030. This Power Supply Unit was selected because it was found to produce the worst-case emissions during previous testing.

Testing was performed on the top, middle and bottom channel of the band, as required by FCC Specification Part 15 C Intentional Radiators.

This report details testing carried out in accordance with:

- FCC: Part 15.205, 15.209, Measurement at Band Edge (Marker Delta Method)
- FCC: Part 15.209 Spurious Radiated Emissions
- FCC: Part 15.247(c) Spurious Radiated Emissions

Location Of Testing

BABT Engineers, Anthony Guy, and Steve Hartley, conducted all testing (except Spurious Radiated Emissions from 30MHz to 1GHz, which were performed at our Bearley Site) at the premises BABT, Segensworth Road, Fareham, Hampshire, PO15 5RH. Radiated Emissions measurements were performed in a 3 metre Anechoic Chamber. A complete site description is on file with the FCC Laboratory Division, Registration Number: 90987. See Annex A.

BABT Engineers Arthur Rushworth and Robert Bennett conducted all Spurious Radiated Emissions (from 30MHz to 1GHz) testing at the premises BABT, Snitterfield Road, Bearley, Stratford upon Avon, Warwickshire, CV37 0EX. A complete site description is on file with the FCC Laboratory Division, Registration Number: 90986. See Annex A.



SYSTEM CONFIGURATION DURING EMC TESTING

The EUT was set-up simulating a typical user installation on the Alternative Open Field Test Site identified in “Location of Testing” in this Test Report, and tested in accordance with the specification.

The test software in the EUT enabled the Test Engineer to select full power on the following channels;

2.4GHz functionality

TX on 2412MHz

TX on 2437MHz

TX on 2462MHz

The Output Power level (controlled by application software) was set as given in the table below.



SYSTEM CONFIGURATION DURING EMC TESTING - continued

For Fixed applications: Where the new antenna is of less gain (or equal) and of the same type then it can be added as a Permissive Change Type II with only the data sheet as evidence. For Antennas of higher gain or different type testing is required. Therefore Antenna numbers 1-6 and 8 have not been tested as part of this Class 2 Permissive Change application because the highest gain antenna only of each type has been tested.

Ant No	Symbol Part No	Type	Gain (dBi)	Output Power Level (Note 1)	Cable Loss (dB)	Lightning Arrestor & Extender Cable Loss (dB)	Total Loss (dB)	Net Gain (dBi)	Net EIRP (dBm)	Comments
1	ML-2499-11PNA2-01	Panel	11.2	4	2.7	0	2.7	8.5	17.8	See Ant No 11
2	ML-2499-12PNA2-01	Panel	12.2	4	2.7	0	2.7	9.5	18.8	See Ant No 11
3	ML-2499-7PNA2-01	Panel	7.6	3	1.3	0	1.3	6.3	18.3	See Ant No 11
5	ML-2499-HPA3-01-	Dipole	4.6	3	1.3	0	1.3	3.3	15.3	See Ant No 9
6	ML-2499-PNAHD-01	Panel	7.6	3	1.3	0	1.3	6.3	18.3	See Ant No 11
7	ML-2499-SD3-01	Patch	4.8	1	1.3	0	1.3	3.5	22.2	For Testing of this Antenna see Section 3
8	ML-2499-SDD1-01	Patch	3.6	2	1.3	0	1.3	2.3	18.8	See Ant No 7
9*	ML-2499-BMMA1-01	Dipole	7.45	1	0.75	3.25	4	3.45	22.15	For Testing of this Antenna see Section 3
11**	ML-2499-BPNA3-01	Panel	13.6	5	7.5	3.25	10.75	2.85	7.45	For Testing of this Antenna see Section 3
12**	ML-2499-BYGA2-01	Yagi	14.2	5	7.5	3.25	10.75	3.45	8.05	For Testing of this Antenna see Section 3
0	WSM-5030-210-WW	Integral	0	1	0	0	0	0	18.7	For Testing of this Antenna see Section 3

* This item was also tested with a 3m (10ft) co-axial cable and Lightning Arrestor (LAC4NI 200W) in line between the WSM-5030 and the particular Antenna under test.

** These items were also tested with a 30m (100ft) co-axial cable and Lightning Arrestor (LAC4NI 200W) in line between the WSM-5030 and the particular Antenna under test.

Note 1 The Output Power Level given in the table above is the Symbol Software Controlled Output Power Level that must be programmed for each Antenna type.

XMIT POWER CONTROL DESIGNATOR	TARGET POWER LEVEL (dBm)
1	+18.7
2	+16.5
3	+12.0
4	+9.3
5	+4.6

All Net EIRPs for the above Antennas have been calculated to be less than the +30dBm limit for section 15.247(b)(1)

TEST SETUP PHOTOGRAPH

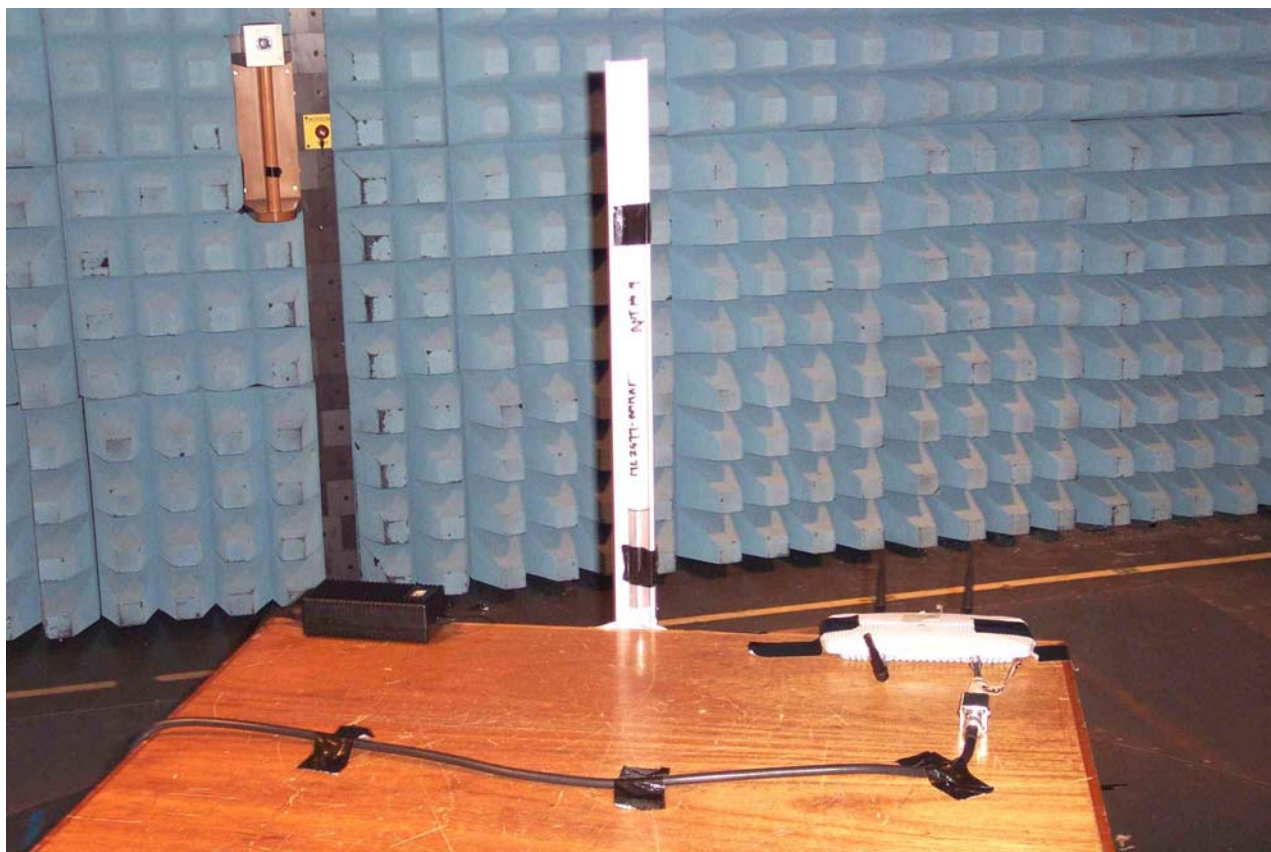
The photograph below shows the EUT configuration for the Patch Antenna for Radiated Emission testing



Photograph 1

TEST SETUP PHOTOGRAPH - continued

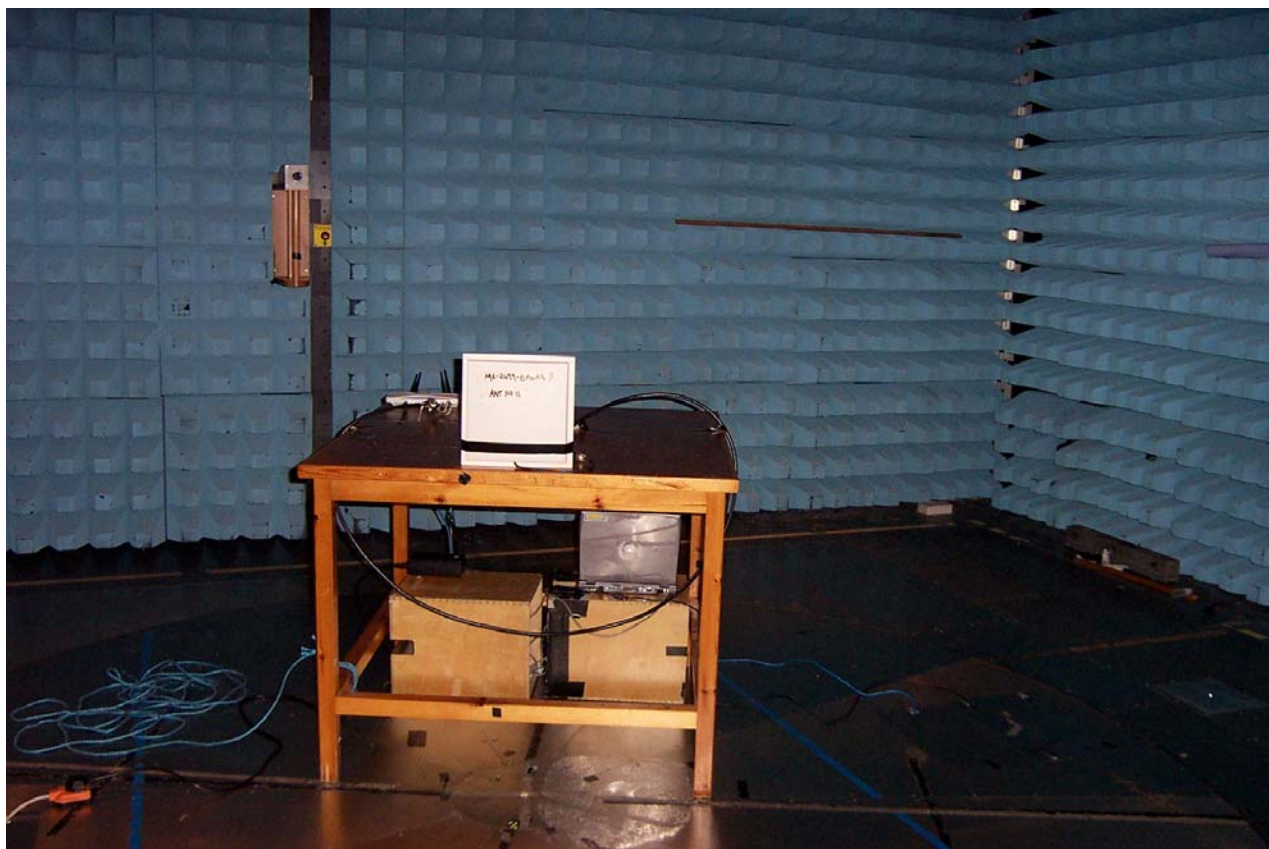
The photograph below shows the EUT configuration for Dipole Antenna during Radiated Emission testing



Photograph 2

TEST SETUP PHOTOGRAPH - continued

The photograph below shows the EUT configuration for Panel Antenna during Radiated Emission testing



Photograph 3

TEST SETUP PHOTOGRAPH - continued

The photograph below shows the EUT configuration for Yagi Antenna during Radiated Emission testing



Photograph 4

TEST SETUP PHOTOGRAPH - continued

The photograph below shows the EUT configuration for Integral Antenna during Radiated Emission testing



Photograph 5



EQUIPMENT INFORMATION

Equipment under Test (EUT):

Equipment	Access Port Host Unit	RLAN Module for use with host unit WSAP-5030	100-250V AC Power Supply Unit	Dipole Rubber Duck Antenna 5GHz	Patch Antenna 2.4GHz
Manufacturer	Symbol Technologies Inc	Symbol Technologies Inc	Skynet	Cushcraft	Cushcraft
Country of origin	Taiwan	Taiwan	Taiwan	Taiwan	Taiwan
UK Agent	Symbol Technologies Ltd	Symbol Technologies Ltd	Symbol Technologies Ltd	Symbol Technologies Ltd	Symbol Technologies Ltd
Type No	WSAP-5030	WSM-5030	SNP-PA5T	ML 5499-APA	ML 2499-SD3-01
Part No	WSAP-5030	WSM-5030	Not Applicable	Not Applicable	Not Applicable
Serial No	No 5	Not Applicable	1119327	Not Applicable	Not Applicable
Build Status	DVT3.1	DVT3.1	Not Applicable	Not Applicable	Not Applicable
Software Issue	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Equipment	Dipole Antenna 2.4GHz	Panel Antenna 2.4GHz	Yagi Antenna 2.4GHz	Integral Antenna 2.4GHz	
Manufacturer	Cushcraft	Cushcraft	Cushcraft	Cushcraft	
Country of origin	Taiwan	Taiwan	Taiwan	Taiwan	
UK Agent	Symbol Technologies Ltd	Symbol Technologies Ltd	Symbol Technologies Ltd	Symbol Technologies Ltd	
Type No	ML 2499-BMMA1-01	ML 2499-BPNA3-01	ML 2499-BYGA2-01	WSM-5030-210-WW	
Part No	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Serial No	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Build Status	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Software Issue	Not Applicable	Not Applicable	Not Applicable	Not Applicable	



EQUIPMENT INFORMATION - continued

Test Equipment and Ancillaries Used For Test

Instrument	Manufacturer	Type No	EMC	Cal. Due
EMI Test Receiver	HEW	8542E	2286	13 Dec 03
Bilog Antenna	CHA	CBL643	2860	11 Apr 04
Turntable & Controller	VAR	Hd 050	2528	TU
Mast Controller	EMC	2090	----	TU
Antenna Mast	EMC	2070	----	TU
High Pass Filter	RLC	F-1000-4000-5-R	INV4468	TU
Spectrum Analyser	ROH	EISB 26	2958	05-Aug-04
Signal Generator	HEW	8673B	953	05 June 04
Test Receiver	ROH	ESH3	1020	16 Aug 04
Emi Test Receiver	ROH	ESIB40	2917	04 Feb 02
Horn Ant	EMC	3115	2397	04 July 04
Horn Ant	EMC	3115	2297	04 July 04
RF Power Meter	HEW	8990A	1670	14-Aug-04
Attenuator 10dB	MAR	6534/3	1494	TU
Attenuator 3dB	HEW	8491B	----	TU
Screened Room 5	SIE	EAC 54300	2533	TU
Low Noise Amplifier (1-8GHz)	MIT	AMF-3D-001080-18-13P	2457	TU
Signal Generator	HEW	8672A	411	26 Feb 04
Amplifier (8-18GHz)	AVA	AWT-18036	1081	26 June 04
YIG Filter (4GHz-40GHz)	FIL	FD 3103	----	TU
Horn (18-40GHz)	ADV	AM180HA-K-TU2	2945	15 May 05
Amplifier (18-40GHz)	NAR	DB02-0447	2936	23 Apr 04
Spectrum Monitor	ROH	EZM	1416	TU
Plotter	HEW	7550A	----	TU
Transient Limiter	HEW	11947A	2243	23 Jan 04
Three Phase LISN	ROH	ESH2-Z5	2380	09 Jan 04
Test Receiver	ROH	ESVP	1807	24-Jan-04
Bilog Antenna	CHA	CBL6111B	2451	7 Oct 04
Turntable & Controller	BRI	RH253	1858	TU
Mast Controller	EMC	1050	1844/5	TU
Printer	EPS	Colour 660	7023	TU
Open Area Test Site	ASS	OATS 2	2280	28 Nov 05
Barometer	DIP	-	1938	TU
Hygrometer	RTC	A1	INV4066	28 Oct 03
Thermohydrograph	RTC	A1 Hygromer	3162	15 Nov 03
Signal Generator	ROH	SMR40	2768	18 Sept 04
ESIB Receiver	ROH	ESIB40	2972	8 Nov 04
High Pass Filter (7GHz)	LOR	9HP7-7000-SR	INV4903	14 Sept 04

Note(s)

All items are calibrated annually, except where labelled TU (Traceability Unscheduled). These items are calibrated within the test configurations using calibrated equipment.

Instrumentation Used For Exercising The EUT

Instrument	Manufacturer	Type No	INV No
Laptop Computer	Dell	Latitude CPI	N/A
Laptop Computer	Dell	Latitude C400	N/A



EQUIPMENT INFORMATION - continued

Key To Manufacturers

ADV	Advanced Microtek
ASS	Assessment Services
AVA	Avantek
BRI	British Turntables
CHA	Chase
DIP	Diplex
EMC	Emco
EPS	Epson
FIL	Filtronic
HEW	Hewlett Packard
LOR	Lorch
H-D	No Data
MAR	Marconi
MIT	Miteq
NAR	Narda
RLC	RLC Electronics
SIE	Siemens
ROH	Rohde & Schwarz
RTC	Rotronic
VAR	Various
YRK	York Electronics



**TEST RESULTS
PATCH ANTENNA
ANTENNA NO 7**



Test Case : Radiated Emissions
Test Date : 27th October 2003
Rule Parts : 15.205

Measurement At The Band Edge

Testing to the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.205, for Restricted Bands of Operation was carried out on the Measurement Test Facility detailed in Annex A.

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.205 for Band Edge Measurements.

Measurements were made at the Band Edges with the following results;

Channel Frequency	Band Edge Frequency	Antenna Polarisation	Height	Azimuth	Peak Field Strength	Limit Peak Field Strength	Average Field Strength	Limit Average Field Strength
MHz	MHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
2412	2390.0	H	199	57	57.0	74.0	48.7	54.0
2462	2483.5	H	159	54	58.1	74.0	50.4	54.0

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: A Guy, EMC Engineer.



Test Case : Radiated Emissions - continued
Test Date : 20th October 2003
Rule Parts : 15.247(c)

Measurement Method

Testing to the requirements of FCC CFR 47: Part 15 Subpart c, Section 15.247 (c) for Radiated Emissions was carried out on the Measurement Test Facility detailed in Annex A. Section 15.247 (c) also requires Rule parts 15.205 and 15.209 to be applied.

A preliminary profile of the Radiated Emissions was obtained by operating the Equipment Under Test (EUT) on a remotely controlled turntable within a semi-anechoic chamber; measurements were taken at a 3m distance unless otherwise stated. Measurements of emissions from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations. The profiling produced a list of the worst-case emissions together with the EUT azimuth and antenna polarisation.

Using the information from the preliminary profiling of the EUT, a search was made in the frequency range 30MHz to 25GHz. The list of worst-case emissions was then confirmed or updated under Open Site conditions. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth.

30MHz – 1GHz emissions levels were then formally measured using a CISPR Quasi-Peak detector.
1GHz – 25GHz emissions levels were then formally measured using Peak and Average detectors.

(Note: Peak measurements performed using a Resolution and Video Bandwidth of 1MHz, Average measurements performed using a Resolution Bandwidth of 1MHz and a Video Bandwidth of 10Hz)

The EUT was connected to a 120V 60Hz supply.

Measurements were made with the EUT transmitting at the following frequencies in turn.

2412MHz
2437MHz
2462MHz

Radiated Emissions from 30MHz to 1GHz were made using a HP 8542E Test Receiver.

Radiated Emissions from 1GHz to 25GHz were made using a Rhode and Schwarz ESIB 40 Test Receiver.

The test was performed in accordance with ANSI C63.4.

The measurements were performed at a 3m distance unless otherwise stated.



Test Case : Radiated Emissions - continued
Test Date : 20th October 2003
Rule Parts : 15.247(c)

30MHz - 1GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (30MHz – 1GHz).

EUT Tx on 2.412GHz

30MHz – 1GHz Alternative Open Area Test Site Results: The levels of the highest emissions measured in accordance with the specification are presented below: -

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBµV/m	µV/m	dBµV/m	µV/m
32.593	V	100	114	29.4	29.5	40.0	100.0
37.523	V	100	221	36.5	66.9	40.0	100.0
39.548	V	100	262	39.5	94.4	40.0	100.0
40.338	V	100	216	38.2	81.3	40.0	100.0
47.789	V	100	302	34.7	54.3	40.0	100.0
374.992	H	100	306	30.8	34.7	46.0	200.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation
deg degree

V Vertical Polarisation
Hgt Height
Azm Azimuth

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: A Rushworth, EMC Engineer.



Test Case : Radiated Emissions - continued
Test Date : 20th October 2003
Rule Parts : 15.247(c)

30MHz - 1GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (30MHz – 1GHz).

EUT Tx on 2.437GHz

30MHz – 1GHz Alternative Open Area Test Site Results: The levels of the highest emissions measured in accordance with the specification are presented below: -

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBµV/m	µV/m	dBµV/m	µV/m
37.522	V	100	201	36.3	65.3	40.0	100.0
39.548	V	100	126	38.5	84.1	40.0	100.0
40.338	V	100	97	37.5	75.0	40.0	100.0
47.789	V	100	243	33.1	45.2	40.0	100.0
249.995	V	100	154	28.6	26.9	46.0	200.0
374.993	H	100	313	26.5	21.1	46.0	200.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation
deg degree

V Vertical Polarisation
Hgt Height
Azm Azimuth

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: A Rushworth, EMC Engineer.



Test Case : Radiated Emissions - continued
Test Date : 20th October 2003
Rule Parts : 15.247(c)

30MHz - 1GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (30MHz – 1GHz).

EUT Tx on 2.462GHz

30MHz – 1GHz Alternative Open Area Test Site Results: The levels of the six highest emissions measured in accordance with the specification are presented below: -

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBµV/m	µV/m	dBµV/m	µV/m
37.523	V	100	55	36.3	65.3	40.0	100.0
39.548	V	100	354	37.7	76.7	40.0	100.0
40.338	V	100	4	36.7	68.4	40.0	100.0
47.789	V	100	207	31.1	35.9	40.0	100.0
249.996	V	100	35	29.0	28.2	46.0	200.0
374.988	H	100	303	25.9	19.7	46.0	200.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation
deg degree

V Vertical Polarisation
Hgt Height
Azm Azimuth

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: A Rushworth, EMC Engineer.



Test Case : Radiated Emissions - continued
Test Date : 27th October 2003
Rule Parts : 15.247(c)

1GHz - 25GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (1GHz – 25GHz).

EUT Tx on 2.412GHz

1GHz – 25GHz Alternative Open Area Test Site Results: The levels of the highest emissions measured in accordance with the specification are presented below: -

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
2.038	V	100	20	54.4	74.0	52.0	54.0
2.287	V	100	346	62.2	74.0	47.4	54.0
4.075	V	100	155	44.8	74.0	37.2	54.0
4.824	V	100	217	51.8	74.0	38.3	54.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation

V Vertical Polarisation
deg degree

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: A Guy, EMC Engineer.



Test Case : Radiated Emissions - continued
Test Date : 27 October 2003
Rule Parts : 15.247(c)

1GHz - 25GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (1GHz – 25GHz).

EUT Tx on 2.4370GHz

1GHz – 25GHz Alternative Open Area Test Site Results: The levels of the highest emissions measured in accordance with the specification are presented below: -

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
2.063	V	100	21	54.5	74.0	50.1	54.0
2.311	V	100	351	61.5	74.0	49.9	54.0
4.126	V	100	211	46.8	74.0	38.1	54.0
4.874	V	100	216	52.3	74.0	42.5	54.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation

V Vertical Polarisation
deg degree

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: A Guy, EMC Engineer.



Test Case : Radiated Emissions - continued
Test Date : 27th October 2003
Rule Parts : 15.247(c)

1GHz - 25GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (1GHz – 25GHz).

EUT Tx on 2.462GHz

1GHz – 25GHz Alternative Open Area Test Site Results: The levels of the highest emissions measured in accordance with the specification are presented below: -

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
2.088	V	100	30	53.6	74.0	47.5	54.0
2.331	V	100	350	60.2	74.0	48.2	54.0
4.176	V	100	212	48.0	74.0	39.4	54.0
4.924	V	100	204	56.0	74.0	42.5	54.0

ABBREVIATIONS FOR ABOVE 3TABLES

H Horizontal Polarisation
Pol Polarisation

V Vertical Polarisation
deg degree

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: A Guy, EMC Engineer.



**TEST RESULTS
DIPOLE ANTENNA
ANTENNA NO 9**



Test Case : Radiated Emissions
Test Date : 19th October 2003
Rule Parts : 15.205

Measurement At The Band Edge

Testing to the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.205, for Restricted Bands of Operation was carried out on the Measurement Test Facility detailed in Annex A.

Measurements were made at the Band Edges with the following results;

Channel Frequency	Band Edge Frequency	Antenna Polarisation	Height	Azimuth	Peak Field Strength	Limit Peak Field Strength	Average Field Strength	Limit Average Field Strength
MHz	MHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
2412	2390.0	V	100	221	52.4	74.0	46.5	54.0
2462	2483.5	V	103	97	54.3	74.0	48.3	54.0

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: S Hartley, EMC Engineer.



Test Case : Radiated Emissions - continued
Test Date : 19th October 2003
Rule Parts : 15.247(c)

Measurement Method

Testing to the requirements of FCC CFR 47: Part 15 Subpart c, Section 15.247 (c) for Radiated Emissions was carried out on the Measurement Test Facility detailed in Annex A. Section 15.247 (c) also requires Rule parts 15.205 and 15.209 to be applied.

A preliminary profile of the Radiated Emissions was obtained by operating the Equipment Under Test (EUT) on a remotely controlled turntable within a semi-anechoic chamber; measurements were taken at a 3m distance unless otherwise stated. Measurements of emissions from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations. The profiling produced a list of the worst-case emissions together with the EUT azimuth and antenna polarisation.

Using the information from the preliminary profiling of the EUT, a search was made in the frequency range 30MHz to 25GHz. The list of worst-case emissions was then confirmed or updated under Open Site conditions. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth.

30MHz – 1GHz emissions levels were then formally measured using a CISPR Quasi-Peak detector.
1GHz – 25GHz emissions levels were then formally measured using Peak and Average detectors.

(Note: Peak measurements performed using a Resolution and Video Bandwidth of 1MHz, Average measurements performed using a Resolution Bandwidth of 1MHz and a Video Bandwidth of 10Hz)

The EUT was connected to a 120V 60Hz supply.

Measurements were made with the EUT transmitting at the following frequencies in turn.

2412MHz
2437MHz
2462MHz

Radiated Emissions from 30MHz to 1GHz were made using a HP 8542E Test Receiver.

Radiated Emissions from 1GHz to 25GHz were made using a Rhode and Schwarz ESIB 40 Test Receiver.

The test was performed in accordance with ANSI C63.4.

The measurements were performed at a 3m distance unless otherwise stated.



Test Case : Radiated Emissions - continued
Test Date : 21st October 2003
Rule Parts : 15.247(c)

30MHz - 1GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (30MHz – 1GHz).

EUT Tx on 2.412GHz

30MHz – 1GHz Alternative Open Area Test Site Results: The levels of the highest emissions measured in accordance with the specification are presented below: -

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBµV/m	µV/m	dBµV/m	µV/m
37.552	V	100	60	34.1	50.7	40.0	100.0
39.406	V	100	35	35.3	58.2	40.0	100.0
40.338	V	100	54	35.6	60.3	40.0	100.0
47.789	V	100	118	32.4	41.7	40.0	100.0
74.987	V	100	328	30.0	31.6	40.0	100.0
249.987	V	100	243	30.7	34.3	46.0	200.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation
deg degree

V Vertical Polarisation
Hgt Height
Azm Azimuth

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: A Rushworth, EMC Engineer.



Test Case : Radiated Emissions - continued
Test Date : 21st October 2003
Rule Parts : 15.247(c)

30MHz - 1GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (30MHz – 1GHz).

EUT Tx on 2.437GHz

30MHz – 1GHz Alternative Open Area Test Site Results: The levels of the highest emissions measured in accordance with the specification are presented below: -

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBµV/m	µV/m	dBµV/m	µV/m
37.564	V	100	57	34.1	50.7	40.0	100.0
39.406	V	100	77	35.1	56.9	40.0	100.0
40.338	V	100	43	35.5	59.6	40.0	100.0
47.789	V	100	164	32.3	41.2	40.0	100.0
74.987	V	126	322	30.0	31.6	40.0	100.0
249.987	V	101	246	30.7	34.3	46.0	200.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation
deg degree

V Vertical Polarisation
Hgt Height
Azm Azimuth

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: A Rushworth, EMC Engineer.



Test Case : Radiated Emissions - continued
Test Date : 21st October 2003
Rule Parts : 15.247(c)

30MHz - 1GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (30MHz – 1GHz).

EUT Tx on 2.462GHz

30MHz – 1GHz Alternative Open Area Test Site Results: The levels of the six highest emissions measured in accordance with the specification are presented below: -

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBµV/m	µV/m	dBµV/m	µV/m
37.552	V	100	49	34.3	51.9	40.0	100.0
39.560	V	100	62	35.7	61.0	40.0	100.0
47.789	V	100	178	31.9	39.4	40.0	100.0
64.182	V	100	269	27.1	22.6	40.0	100.0
74.994	V	123	313	30.1	32.0	40.0	100.0
249.996	V	100	253	30.9	35.1	46.0	200.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation
deg degree

V Vertical Polarisation
Hgt Height
Azm Azimuth

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: A Rushworth, EMC Engineer.



Test Case : Radiated Emissions - continued
Test Date : 19th October 2003
Rule Parts : 15.247(c)

1GHz - 25GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (1GHz – 25GHz).

EUT Tx on 4.412GHz

1GHz – 25GHz Alternative Open Area Test Site Results: The levels of the highest emissions measured in accordance with the specification are presented below: -

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
2.273	V	100	49	53.0	74.0	43.9	54.0
2.287	V	100	97	58.1	74.0	44.6	54.0
4.076	V	122	169	44.2	74.0	34.3	54.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation

V Vertical Polarisation
deg degree

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: S C Hartley, EMC Engineer.



Test Case : Radiated Emissions - continued
 Test Date : 19th October 2003
 Rule Parts : 15.247(c)

1GHz - 25GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (1GHz – 25GHz).

EUT Tx on 2.437GHz

1GHz – 25GHz Alternative Open Area Test Site Results: The levels of the highest emissions measured in accordance with the specification are presented below: -

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
2.298	V	105	291	55.3	74.0	47.5	54.0
2.312	V	100	96	58.3	74.0	45.3	54.0
4.126	V	119	173	44.0	74.0	34.2	54.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
 Pol Polarisation

V Vertical Polarisation
 deg degree

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: S C Hartley, EMC Engineer.



Test Case : Radiated Emissions - continued
Test Date : 19th October 2003
Rule Parts : 15.247(c)

1GHz - 25GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (1GHz – 25GHz).

EUT Tx on 2.462GHz

1GHz – 25GHz Alternative Open Area Test Site Results: The levels of the highest emissions measured in accordance with the specification are presented below: -

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
2.323	V	100	87	55.4	74.0	47.1	54.0
2.337	V	102	81	59.6	74.0	46.5	54.0
2.352	V	100	93	54.0	74.0	45.0	54.0
2.484	V	124	225	57.5	74.0	47.5	54.0
2.499	V	126	216	56.2	74.0	44.6	54.0
4.176	V	121	168	44.3	74.0	34.6	54.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation

V Vertical Polarisation
deg degree

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: S C Hartley, EMC Engineer.



**TEST RESULTS
PANEL ANTENNA
ANTENNA NO 11**



Test Case : Radiated Emissions
Test Date : 15th January 2004
Rule Parts : 15.205

Measurement At The Band Edge

Testing to the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.205, for Restricted Bands of Operation was carried out on the Measurement Test Facility detailed in Annex A.

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.205 for Band Edge Measurements.

Measurements were made at the Band Edges with the following results;

Channel Frequency	Band Edge Frequency	Antenna Polarisation	Height	Azimuth	Peak Field Strength	Limit Peak Field Strength	Average Field Strength	Limit Average Field Strength
MHz	MHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
2412	2390.0	V	129	0	58.7	74.0	46.8	54.0
2462	2483.5	V	127	0	58.3	74.0	46.1	54.0

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: S Hartley, EMC Engineer.



Test Case : Radiated Emissions - continued
Test Date : 28th January 2004
Rule Parts : 15.247(c)

Measurement Method

Testing to the requirements of FCC CFR 47: Part 15 Subpart c, Section 15.247 (c) for Radiated Emissions was carried out on the Measurement Test Facility detailed in Annex A. Section 15.247 (c) also requires Rule parts 15.205 and 15.209 to be applied.

A preliminary profile of the Radiated Emissions was obtained by operating the Equipment Under Test (EUT) on a remotely controlled turntable within a semi-anechoic chamber; measurements were taken at a 3m distance unless otherwise stated. Measurements of emissions from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations. The profiling produced a list of the worst-case emissions together with the EUT azimuth and antenna polarisation.

Using the information from the preliminary profiling of the EUT, a search was made in the frequency range 30MHz to 25GHz. The list of worst-case emissions was then confirmed or updated under Open Site conditions. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth.

30MHz – 1GHz emissions levels were then formally measured using a CISPR Quasi-Peak detector.
1GHz – 25GHz emissions levels were then formally measured using Peak and Average detectors.

(Note: Peak measurements performed using a Resolution and Video Bandwidth of 1MHz, Average measurements performed using a Resolution Bandwidth of 1MHz and a Video Bandwidth of 10Hz)

The EUT was connected to a 120V 60Hz supply.

Measurements were made with the EUT transmitting at the following frequencies in turn.

2412MHz
2437MHz
2462MHz

Radiated Emissions from 30MHz to 1GHz were made using a HP 8542E Test Receiver.

Radiated Emissions from 1GHz to 25GHz were made using a Rhode and Schwarz ESIB 40 Test Receiver.

The test was performed in accordance with ANSI C63.4.

The measurements were performed at a 3m distance unless otherwise stated.



Test Case : Radiated Emissions - continued
Test Date : 29th January 2004
Rule Parts : 15.247(c)

30MHz - 1GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (30MHz – 1GHz).

EUT Tx on 2412MHz

30MHz – 1GHz Alternative Open Area Test Site Results: The levels of the highest emissions measured in accordance with the specification are presented below: -

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBµV/m	µV/m	dBµV/m	µV/m
38.9485	V	100	42	36.5	66.8	40.0	100.0
39.5603	V	100	66	36.5	66.8	40.0	100.0
40.3451	V	100	99	37.8	77.6	40.0	100.0
40.8125	V	100	131	36.6	67.6	40.0	100.0
60.8141	V	100	101	35.0	56.2	40.0	100.0
62.2120	V	100	123	34.9	55.6	40.0	100.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation
deg degree

V Vertical Polarisation
Hgt Height
Azm Azimuth

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: R Bennett, EMC Engineer.



Test Case : Radiated Emissions - continued
Test Date : 29th January 2004
Rule Parts : 15.247(c)

30MHz - 1GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (30MHz – 1GHz).

EUT Tx on 2437MHz

30MHz – 1GHz Alternative Open Area Test Site Results: The levels of the highest emissions measured in accordance with the specification are presented below: -

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBµV/m	µV/m	dBµV/m	µV/m
37.5355	V	100	24	33.7	48.4	40.0	100.0
39.5603	V	100	66	36.1	63.8	40.0	100.0
40.3381	V	100	99	37.4	74.1	40.0	100.0
40.8125	V	100	134	35.4	58.9	40.0	100.0
62.1820	V	100	124	34.2	51.3	40.0	100.0
81.2163	V	100	162	35.3	58.2	40.0	100.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation
deg degree

V Vertical Polarisation
Hgt Height
Azm Azimuth

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: R Bennett, EMC Engineer.



Test Case : Radiated Emissions - continued
Test Date : 28th January 2004
Rule Parts : 15.247(c)

30MHz - 1GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (30MHz – 1GHz).

EUT Tx on 2462MHz

30MHz – 1GHz Alternative Open Area Test Site Results: The levels of the highest emissions measured in accordance with the specification are presented below: -

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBµV/m	µV/m	dBµV/m	µV/m
39.5603	V	100	359	36.3	65.3	40.0	100.0
39.5603	V	100	2	36.3	65.3	40.0	100.0
40.3381	V	100	73	36.9	70.0	40.0	100.0
60.2045	V	100	52	37.1	71.6	40.0	100.0
62.2060	V	100	128	34.0	50.1	40.0	100.0
77.2056	V	100	354	33.9	49.5	40.0	100.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation
deg degree

V Vertical Polarisation
Hgt Height
Azm Azimuth

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: R Bennett, EMC Engineer.



Test Case : Radiated Emissions - continued
Test Date : 15th January 2004
Rule Parts : 15.247(c)

1GHz - 25GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (1GHz – 25GHz).

EUT Tx on 2412MHz

1GHz – 25GHz Alternative Open Area Test Site Results: The levels of the highest emissions measured in accordance with the specification are presented below: -

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
2.287	V	155	0	59.8	74.0	47.8	54.0
2.273	V	135	0	53.5	74.0	45.2	54.0
4.076	V	101	167	51.9	74.0	43.5	54.0
8.152	V	100	193	51.5	74.0	42.5	54.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation

V Vertical Polarisation
deg degree

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: S Hartley, EMC Engineer.



Test Case : Radiated Emissions - continued
Test Date : 15th January 2004
Rule Parts : 15.247(c)

1GHz - 25GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (1GHz – 25GHz).

EUT Tx on 2437MHz

1GHz – 25GHz Alternative Open Area Test Site Results: The levels of the highest emissions measured in accordance with the specification are presented below: -

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
2.297	V	133	0	59.4	74.0	52.8	54.0
2.312	V	129	0	62.7	74.0	48.0	54.0
4.126	H	103	211	49.6	74.0	39.6	54.0
8.252	V	100	193	54.4	74.0	42.3	54.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation

V Vertical Polarisation
deg degree

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: S Hartley, EMC Engineer.



Test Case : Radiated Emissions - continued
Test Date : 15th January 2004
Rule Parts : 15.247(c)

1GHz - 25GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (1GHz – 25GHz).

EUT Tx on 2462MHz

1GHz – 25GHz Alternative Open Area Test Site Results: The levels of the six highest emissions measured in accordance with the specification are presented below: -

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
2.322	V	133	0	57.6	74.0	50.5	54.0
2.331	V	133	0	63.6	74.0	49.8	54.0
4.176	H	100	198	48.9	74.0	39.1	54.0
8.352	V	100	175	52.0	74.0	43.2	54.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation

V Vertical Polarisation
deg degree

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: S Hartley, EMC Engineer.



**TEST RESULTS
YAGI ANTENNA
ANTENNA NO 12**



Test Case : Radiated Emissions
Test Date : 11th January 2004
Rule Parts : 15.205

Measurement At The Band Edge

Testing to the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.205, for Restricted Bands of Operation was carried out on the Measurement Test Facility detailed in Annex A.

Measurements were made at the Band Edges with the following results;

Channel Frequency	Band Edge Frequency	Antenna Polarisation	Height	Azimuth	Peak Field Strength	Limit Peak Field Strength	Average Field Strength	Limit Average Field Strength
MHz	MHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
2412	2390.0	V	105	350	51.1	74.0	38.2	54.0
2462	2483.5	V	105	350	52.3	74.0	40.5	54.0

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: S Hartley, EMC Engineer.



Test Case : Radiated Emissions - continued
Test Date : 28th January 2004
Rule Parts : 15.247(c)

Measurement Method

Testing to the requirements of FCC CFR 47: Part 15 Subpart c, Section 15.247 (c) for Radiated Emissions was carried out on the Measurement Test Facility detailed in Annex A. Section 15.247 (c) also requires Rule parts 15.205 and 15.209 to be applied.

A preliminary profile of the Radiated Emissions was obtained by operating the Equipment Under Test (EUT) on a remotely controlled turntable within a semi-anechoic chamber; measurements were taken at a 3m distance unless otherwise stated. Measurements of emissions from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations. The profiling produced a list of the worst-case emissions together with the EUT azimuth and antenna polarisation.

Using the information from the preliminary profiling of the EUT, a search was made in the frequency range 30MHz to 25GHz. The list of worst-case emissions was then confirmed or updated under Open Site conditions. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth.

30MHz – 1GHz emissions levels were then formally measured using a CISPR Quasi-Peak detector.
1GHz – 25GHz emissions levels were then formally measured using Peak and Average detectors.

(Note: Peak measurements performed using a Resolution and Video Bandwidth of 1MHz, Average measurements performed using a Resolution Bandwidth of 1MHz and a Video Bandwidth of 10Hz)

The EUT was connected to a 120V 60Hz supply.

Measurements were made with the EUT transmitting at the following frequencies in turn.

2412MHz
2437MHz
2462MHz

Radiated Emissions from 30MHz to 1GHz were made using a HP 8542E Test Receiver.

Radiated Emissions from 1GHz to 25GHz were made using a Rhode and Schwarz ESIB 40 Test Receiver.

The test was performed in accordance with ANSI C63.4.

The measurements were performed at a 3m distance unless otherwise stated.



Test Case : Radiated Emissions - continued
Test Date : 28th January 2004
Rule Parts : 15.247(c)

30MHz - 1GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (30MHz – 1GHz).

EUT Tx on 2412MHz

30MHz – 1GHz Alternative Open Area Test Site Results: The levels of the highest emissions measured in accordance with the specification are presented below: -

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBµV/m	µV/m	dBµV/m	µV/m
40.0255	V	100	132	36.4	66.1	40.0	100.0
41.4540	V	100	130	33.8	49.0	40.0	100.0
42.9332	V	100	119	33.9	49.5	40.0	100.0
60.8061	V	100	100	34.7	54.3	40.0	100.0
62.1640	V	100	112	32.3	41.2	40.0	100.0
81.1774	V	100	130	34.6	53.7	40.0	100.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation
deg degree

V Vertical Polarisation
Hgt Height
Azm Azimuth

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: R Bennett, EMC Engineer.



Test Case : Radiated Emissions - continued
Test Date : 28th January 2004
Rule Parts : 15.247(c)

30MHz - 1GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (30MHz – 1GHz).

EUT Tx on 2437MHz

30MHz – 1GHz Alternative Open Area Test Site Results: The levels of the highest emissions measured in accordance with the specification are presented below: -

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBµV/m	µV/m	dBµV/m	µV/m
38.9485	V	100	20	35.9	62.4	40.0	100.0
39.5563	V	100	54	37.0	70.8	40.0	100.0
40.3531	V	100	93	35.7	61.0	40.0	100.0
58.6647	V	100	44	35.5	59.6	40.0	100.0
60.8081	V	100	98	34.8	55.0	40.0	100.0
81.1774	V	100	130	35.2	57.5	40.0	100.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation
deg degree

V Vertical Polarisation
Hgt Height
Azm Azimuth

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: R Bennett, EMC Engineer.



Test Case : Radiated Emissions - continued
Test Date : 28th January 2004
Rule Parts : 15.247(c)

30MHz - 1GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (30MHz – 1GHz).

EUT Tx on 2462MHz

30MHz – 1GHz Alternative Open Area Test Site Results: The levels of the six highest emissions measured in accordance with the specification are presented below: -

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBµV/m	µV/m	dBµV/m	µV/m
40.3381	V	100	128	37.1	71.6	40.0	100.0
41.2924	V	100	165	33.1	45.2	40.0	100.0
42.9332	V	100	151	32.6	42.7	40.0	100.0
60.8061	V	100	111	34.1	50.7	40.0	100.0
77.2026	V	100	354	34.1	50.7	40.0	100.0
81.1774	V	100	149	34.6	53.7	40.0	100.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation
deg degree

V Vertical Polarisation
Hgt Height
Azm Azimuth

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: R Bennett, EMC Engineer.



Test Case : Radiated Emissions - continued
Test Date : 11th January 2004
Rule Parts : 15.247(c)

1GHz - 25GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (1GHz – 25GHz).

EUT Tx on 2412MHz

1GHz – 25GHz Alternative Open Area Test Site Results: The levels of the highest emissions measured in accordance with the specification are presented below: -

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
2.273	V	106	348	62.5	74.0	47.8	54.0
2.287	V	106	348	53.0	74.0	44.3	54.0
4.076	V	100	80	50.8	74.0	40.9	54.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation

V Vertical Polarisation
deg degree

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: S Hartley, EMC Engineer.



Test Case : Radiated Emissions - continued
Test Date : 11th January 2004
Rule Parts : 15.247(c)

1GHz - 25GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (1GHz – 25GHz).

EUT Tx on 2437MHz

1GHz – 25GHz Alternative Open Area Test Site Results: The levels of the highest emissions measured in accordance with the specification are presented below: -

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
2.298	V	104	347	59.6	74.0	52.0	54.0
2.312	V	104	347	61.8	74.0	47.7	54.0
4.126	H	100	227	47.9	74.0	36.9	54.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation

V Vertical Polarisation
deg degree

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: S Hartley, EMC Engineer.



Test Case : Radiated Emissions - continued
 Test Date : 11th January 2004
 Rule Parts : 15.247(c)

1GHz - 25GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (1GHz – 25GHz).

EUT Tx on 2462MHz

1GHz – 25GHz Alternative Open Area Test Site Results: The levels of the highest emissions measured in accordance with the specification are presented below: -

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
2.293	V	108	347	55.8	74.0	45.9	54.0
2.323	V	108	347	56.7	74.0	47.9	54.0
2.337	V	108	347	60.2	74.0	47.1	54.0
2.484	V	107	0	52.7	74.0	41.0	54.0
4.176	H	100	192	48.5	74.0	37.9	54.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
 Pol Polarisation

V Vertical Polarisation
 deg degree

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: S Hartley, EMC Engineer.



**TEST RESULTS
INTEGRAL ANTENNA
ANTENNA NO 0**



Test Case : Radiated Emissions

Test Date : 14th August 2003

Rule Parts : 15.205

Measurement At The Band Edge

Testing to the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.205, for Restricted Bands of Operation was carried out on the Measurement Test Facility detailed in Annex A.

Measurements were made at the Band Edges with the following results;

Channel Frequency	Band Edge Frequency	Antenna Polarisation	Height	Azimuth	Peak Field Strength	Limit Peak Field Strength	Average Field Strength	Limit Average Field Strength
MHz	MHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
2412	2390.0	V	147	2	45.5	74.0	36.4	54.0
2462	2483.5	V	143	181	46.6	74.0	37.4	54.0

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: A Guy, EMC Engineer.



Test Case : Radiated Emissions - continued
Test Date : 6th September 2003
Rule Parts : 15.247(c)

Measurement Method

Testing to the requirements of FCC CFR 47: Part 15 Subpart c, Section 15.247 (c) for Radiated Emissions was carried out on the Measurement Test Facility detailed in Annex A. Section 15.247 (c) also requires Rule parts 15.205 and 15.209 to be applied.

A preliminary profile of the Radiated Emissions was obtained by operating the Equipment Under Test (EUT) on a remotely controlled turntable within a semi-anechoic chamber; measurements were taken at a 3m distance unless otherwise stated. Measurements of emissions from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations. The profiling produced a list of the worst-case emissions together with the EUT azimuth and antenna polarisation.

Using the information from the preliminary profiling of the EUT, a search was made in the frequency range 30MHz to 25GHz. The list of worst-case emissions was then confirmed or updated under Open Site conditions. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth.

30MHz – 1GHz emissions levels were then formally measured using a CISPR Quasi-Peak detector.
1GHz – 25GHz emissions levels were then formally measured using Peak and Average detectors.

(Note: Peak measurements performed using a Resolution and Video Bandwidth of 1MHz, Average measurements performed using a Resolution Bandwidth of 1MHz and a Video Bandwidth of 10Hz)

The EUT was connected to a 120V 60Hz supply.

Measurements were made with the EUT receiving on the following frequency.

2437MHz

Measurements were also made with the EUT transmitting at the following frequencies in turn.

2412MHz
2437MHz
2462MHz

Radiated Emissions from 30MHz to 1GHz were made using a HP 8542E Test Receiver.

Radiated Emissions from 1GHz to 25GHz were made using a Rhode and Schwarz ESIB 40 Test Receiver.

The test was performed in accordance with ANSI C63.4.

The measurements were performed at a 3m distance unless otherwise stated.



Test Case : Radiated Emissions - continued
Test Date : 6th September 2003
Rule Parts : 15.247(c)

30MHz - 1GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (30MHz – 1GHz).

EUT Tx on 2412MHz

30MHz – 1GHz Alternative Open Area Test Site Results: The levels of the highest emissions measured in accordance with the specification are presented below: -

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBµV/m	µV/m	dBµV/m	µV/m
36.129	V	100	256	31.4	37.2	40.0	100.0
39.549	V	100	241	32.3	41.2	40.0	100.0
56.773	V	100	149	38.7	86.1	40.0	100.0
60.224	V	100	314	38.3	82.2	40.0	100.0
79.743	V	100	76	31.6	38.0	40.0	100.0
81.219	V	100	81	32.7	43.2	40.0	100.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation
deg degree

V Vertical Polarisation
Hgt Height
Azm Azimuth

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: A Rushworth, EMC Engineer.



Test Case : Radiated Emissions - continued
Test Date : 6th September 2003
Rule Parts : 15.247(c)

30MHz - 1GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (30MHz – 1GHz).

EUT Tx on 2.437GHz

30MHz – 1GHz Alternative Open Area Test Site Results: The levels of the six highest emissions measured in accordance with the specification are presented below: -

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBµV/m	µV/m	dBµV/m	µV/m
36.129	V	100	234	31.5	37.6	40.0	100.0
39.549	V	100	241	32.2	40.7	40.0	100.0
56.773	V	100	160	38.9	88.1	40.0	100.0
60.224	V	100	311	38.1	80.4	40.0	100.0
79.743	V	100	78	30.8	34.7	40.0	100.0
81.219	V	100	83	32.0	39.8	40.0	100.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation
deg degree

V Vertical Polarisation
Hgt Height
Azm Azimuth

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: A Rushworth, EMC Engineer.



Test Case : Radiated Emissions - continued
Test Date : 6th September 2003
Rule Parts : 15.247(c)

30MHz - 1GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (30MHz – 1GHz).

EUT Tx on 2.462GHz

30MHz – 1GHz Alternative Open Area Test Site Results: The levels of the six highest emissions measured in accordance with the specification are presented below: -

Emission Frequency	Pol	Hgt	Azm	Field Strength at 3m		Specification Limit	
MHz	H/V	cm	deg	dBµV/m	µV/m	dBµV/m	µV/m
36.129	V	100	234	31.5	37.6	40.0	100.0
39.549	V	100	241	32.3	41.2	40.0	100.0
56.773	V	100	149	38.2	81.3	40.0	100.0
60.224	V	100	311	38.0	79.4	40.0	100.0
79.743	V	100	76	30.8	34.7	40.0	100.0
81.219	V	126	60	32.5	42.2	40.0	100.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation
deg degree

V Vertical Polarisation
Hgt Height
Azm Azimuth

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: A Rushworth, EMC Engineer.



Test Case : Radiated Emissions - continued
Test Date : 14th August 2003
Rule Parts : 15.247(c)

1GHz - 25GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (1GHz – 25GHz).

EUT Tx on 2.412GHz

1GHz – 25GHz Alternative Open Area Test Site Results: The levels of the highest emission measured in accordance with the specification is presented below: -

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
4.076	V	114	158	55.9	74.0	49.6	54.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation

V Vertical Polarisation
deg degree

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: A Guy, EMC Engineer.



Test Case : Radiated Emissions - continued
Test Date : 14th August 2003
Rule Parts : 15.247(c)

1GHz - 25GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (1GHz – 25GHz).

EUT Tx on 2.437GHz

1GHz – 25GHz Alternative Open Area Test Site Results: The levels of the highest emissions measured in accordance with the specification are presented below: -

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
2.062	V	102	65	55.6	74.0	N/A	N/A
4.124	V	112	156	56.3	74.0	50.4	54.0

N/A - Average Results are only taken for frequencies that fall inside the Restricted Band in accordance 15.205.

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation

V Vertical Polarisation
deg degree

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: A Guy, EMC Engineer.



Test Case : Radiated Emissions - continued
Test Date : 14th August 2003
Rule Parts : 15.247(c)

1GHz - 25GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: The EUT met the requirements of FCC Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (1GHz – 25GHz).

EUT Tx on 2.462GHz

1GHz – 25GHz Alternative Open Area Test Site Results: The levels of the highest emission measured in accordance with the specification is presented below: -

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
4.176	V	100	96	54.0	74.0	48.4	54.0

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation

V Vertical Polarisation
deg degree

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: A Guy, EMC Engineer.

PHOTOGRAPHS OF EQUIPMENT



Photograph 6
Front View of Patch Antenna

PHOTOGRAPHS OF EQUIPMENT



Photograph 7
Rear View of Patch Antenna

PHOTOGRAPHS OF EQUIPMENT



Photograph 8
Front View of Dipole Antenna



PHOTOGRAPHS OF EQUIPMENT



Photograph 9
View of Surge Arrester

PHOTOGRAPHS OF EQUIPMENT



Photograph 10
Front View of Panel Antenna



PHOTOGRAPHS OF EQUIPMENT



Photograph 11
Rear View of Panel Antenna

PHOTOGRAPHS OF EQUIPMENT



Photograph 12
Front View of Yagi Antenna

PHOTOGRAPHS OF EQUIPMENT



Photograph 13
Rear View of Yagi Antenna

PHOTOGRAPHS OF EQUIPMENT



Photograph 17
Front View of Integral Antenna

PHOTOGRAPHS OF EQUIPMENT



Photograph 18
Rear View of Integral Antenna



MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are: -

In the frequency range 30MHz to 1000MHz

For Radiated Emissions, Quasi-Peak Measurements using the ESVP Test Receiver and Bilog Antenna: -

Frequency	$\pm 5\text{ppm} + 500\text{Hz}$
Amplitude	$\pm 4.1\text{dB}$

In the frequency range 1GHz to 25GHz

For Radiated Emissions, using the Rohde and Schwarz ESIB 40 Test Receiver: -

Frequency	$\pm 2 \times 10^{-7} \times \text{Centre Frequency}$
Amplitude	$\pm 3.4\text{dB}$



This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA
(Not UKAS Accredited).

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ANNEX A
FCC SITE COMPLIANCE LETTERS

FEDERAL COMMUNICATIONS COMMISSION

**Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046**

October 18, 2002

Registration Number: 90987

TUV Product Service Ltd
Segensworth Road
Titchfield
Fareham, Hampshire, PO15 5RH
United Kingdom
Attention: Kevan Adsetts

Re: Measurement facility located at Titchfield
Anechoic chamber (3 meters) and 3 & 10 meter OATS
Date of Listing: October 18, 2002

Gentlemen:

Your request for registration of the subject measurement facility has been reviewed and found to be in compliance with the requirements of Section 2.948 of the FCC rules. The information has, therefore, been placed on file and the name of your organization added to the list of facilities whose measurement data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Please note that the file must be updated for any changes made to the facility and the registration must be renewed at least every three years.

Measurement facilities that have indicated that they are available to the public to perform measurement services on a fee basis may be found on the FCC website www.fcc.gov under E-Filing, OET Equipment Authorization Electronic Filing, Test Firms.

Sincerely,



Thomas W Phillips
Electronics Engineer

FEDERAL COMMUNICATIONS COMMISSION

Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

August 22, 2003

Registration Number: 90986

TUV Product Service
Snitterfield Road
Bearley, Stratford-upon-Avon
Warwickshire, CV37 0EX
United Kingdom
Attention: John Laydon

Re: Measurement facility located at Bearley
3 & 10 meter site
Date of Renewal: August 22, 2003

Dear Sir or Madam:

Your request for renewal of the registration of the subject measurement facility has been received. The information submitted has been placed in your file and the registration has been renewed. The name of your organization will remain on the list of facilities whose measurement data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Please note that the file must be updated for any changes made to the facility and the registration must be renewed at least every three years.

Measurement facilities that have indicated that they are available to the public to perform measurement services on a fee basis may be found on the FCC website www.fcc.gov under E-Filing, OET Equipment Authorization Electronic Filing, Test Firms.

Sincerely,



Ms. Phillis Parish
Information Technician