TEST REPORT
FROM
RFI GLOBAL SERVICES LTD

Test of: IPWireless (UK) Ltd
2.5 GHz UE PCMCIA V1, Model: FD

To: FCC Part 27: 2006 Subpart C

Test Report Serial No:
RFI/RPTE2/RP49365JD01A

Supersedes Test Report Serial No:
RFI/RPTE1/RP49365JD01A

This Test Report Is Issued Under The Authority Of Brian Watson, Operations Director: 	
Checked By: Michael Derby  **pp**	**Report Copy No: PDF01**
Issue Date: 28 November 2007	**Test Dates: 30 August 2007 03 September 2007**

This report is issued in Adobe Acrobat portable document format (PDF). It is only a valid copy of the report if it is being viewed in PDF format with the following security options not allowed: Changing the document, Selecting text and graphics, Adding or changing notes and form fields. Furthermore, the date of creation must match the issue date stated above. This report may be copied in full. The results in this report apply only to the sample(s) tested.

RFI Global Services Ltd
Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire RG23 8BG
Telephone: +44 (0)1256 312000 Facsimile: +44 (0)1256 312001
Email: info@rfi-global.com Website: www.rfi-global.com

Registered in England and Wales. Company number:2117901

This page has been left intentionally blank.

Table of Contents

1. Client Information

Company Name:	IPWireless (UK) Ltd
Address:	Unit 7 Greenways Business Park Bellinger Close Chippenham Wiltshire SN15 1BN UK
Contact Name:	Mr P Warburg

2. Equipment Under Test (EUT)

The following information has been supplied by the client:

2.1. Identification of Equipment Under Test (EUT)

Description:	Wireless Broadband Modem
Brand Name:	IPWireless
Model Name or Number:	FD
Serial Number:	FD1A730000210
FCC ID Number:	UK
Country of Manufacture:	PKTPCMCIAFD2
Date of Receipt:	29 August 2007

2.2. Description of EUT

The unit under test is a Wireless Broadband Modem

2.3. Modifications Incorporated in EUT

During the course of testing the EUT was not modified.

2.4. Additional Information Related to Testing

Power Supply Requirement:	Powered by PCMCIA Laptop port (3.3V), 1.0A	
Intended Operating Environment:	Residential, Commercial, within TDCDMA Coverage	
Equipment Category:	TDCDMA	
Type of Unit:	Portable	
Chip Rate:	7.68 Mcps	
Bandwidth:	10 MHz	
Modulation Type:	TDCDMA	
Channel Spacing:	10 MHz	
Duty Cycle:	33%	
Highest Fundamental Frequency:	2.6846 GHz	
Antenna Type:	Internal/remote	
Antenna Gain:	2 dBi/3 dBi	
Interface Ports:	SIM PCMCIA 68 Way Connector Conducted RF test Connector.	
Transmitter Output Power:	+24 dBm	
Transmit Frequency Range:	2496 to 2690 MHz	
Transmit Channels Tested:	**Channel ID**	**Channel Frequency (MHz)**
	Bottom	2501.4
	Middle	2593.0
	Top	2684.6
Receive Frequency Range:	2496 to 2690 MHz	
Receive Channels Tested:	**Channel ID**	**Channel Frequency (MHz)**
	Bottom	2501.4
	Middle	2593.0
	Top	2684.6

2.5. Support Equipment

The following support equipment was supplied by the applicant and used to exercise the EUT during testing:

Description:	Laptop PC
Brand Name:	Hewlett Packard
Model Name or Number:	Compaq NX9005
Serial Number:	CNF3200V5C
Cable Length and Type	Not Applicable
Connected to Port:	PCMCIA

Description:	Laptop PC
Brand Name:	Dell
Model Name or Number:	Latitude C840
Serial Number:	CN-03J010-1296
Cable Length and Type	Not Applicable
Connected to Port:	PCMCIA

Description:	Laptop PC
Brand Name:	Sony Vaio
Model Name or Number:	VGN-BX 195VP
Serial Number:	2-656-370-21
Cable Length and Type	Not Applicable
Connected to Port:	PCMCIA

3. Test Specification, Methods and Procedures

3.1. Test Specification

Reference:	FCC Part 27: 2006
Title:	Code of Federal Regulations, Part 27 (47CFR) Subpart C Miscellaneous Wireless Communications Services
Purpose of Test:	To determine whether the equipment complied with the requirements of the specification for the purposes of certification.

Reference:	FCC Part 15: 2006 Class B
Title:	Code of Federal Regulations, Part 15 (47CFR) Radio Frequency Devices: Digital Devices.
Comments:	A description of the test facility used for this test is on file with, and has been accepted by, the Federal Communications Commission as required by Section 2.948 of Federal Rules.

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 for Methods of Measurement of Radio-Noise Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

ANSI C63.5 (1998)
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.

4. Deviations from the Test Specification

There were no deviations from the test specification.

5. Operation of the EUT During Testing

5.1. Operating Modes

The EUT was tested in the following operating modes:

Transmitter Modes:

The EUT was set to transmit on 5 time slots and receive on 10 slots - 33% duty cycle.

Idle Mode

The EUT was set to it's standby mode.

5.2. Configuration and Peripherals

The EUT was tested in the following configuration:

An AC/DC power adaptor was used to supply DC power to a Laptop which in turn powered the EUT.

The EIRP was measured using 3 host laptop's configured with both integral and remote antennae.

Radiated emissions were performed on one host laptop (Sony Vaio).

All antenna port tests were performed with the EUT being exercised via one laptop (Sony Vaio).

All radiated emissions were performed in the integral antenna as this was deemed to be the worst case.

6. Summary of Test Results

Range of Measurements	Specification Reference	Port Type	Compliancy Status
Idle Mode AC Conducted Spurious Emissions (150 kHz to 30 MHz)	FCC Part 15.107	AC Mains	Complied
Idle Mode Spurious Emissions	FCC Part 15.109	Enclosure	Complied
Transmitter Carrier Output Power and EIRP	FCC Part 27.50	Antenna Terminals	Complied
Frequency Stability (Temperature Variation)	FCC Part 2.1055, Part 27.54	Antenna Terminals	Complied
Frequency Stability (Voltage Variation)	FCC Part 2.1055, Part 27.54	Antenna Terminals	Complied
Occupied Bandwidth	FCC Part 2.1049	Antenna Terminals	Complied
Conducted Spurious Emissions, Band Edge and Channel Edge	FCC Part 2.1051, Part 27.53	Antenna Terminals	Complied
Conducted Spurious Emissions	FCC Part 2.1051, Part 27.53	Antenna Terminals	Complied
Radiated Spurious Emissions	FCC Part 2.1051, Part 27.53	Enclosure	Complied
Radiated Spurious Emissions at Band Edge	FCC Part 2.1051, Part 27.53	Enclosure	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, UK.

7. Measurements, Examinations And Derived Results

7.1. General Comments

This section contains test results only. Details of the test methods and procedures can be found in Appendix 2 of this report.

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

7.2. Test Results

7.2.1. Idle Mode AC Conducted Spurious Emissions

The EUT was configured for AC conducted emissions measurements, as described in Appendix 2 of this report.

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

Results: Quasi-Peak Detector Measurements on Live and Neutral Lines

Frequency (MHz)	Line	Quasi Peak Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
Note 1					

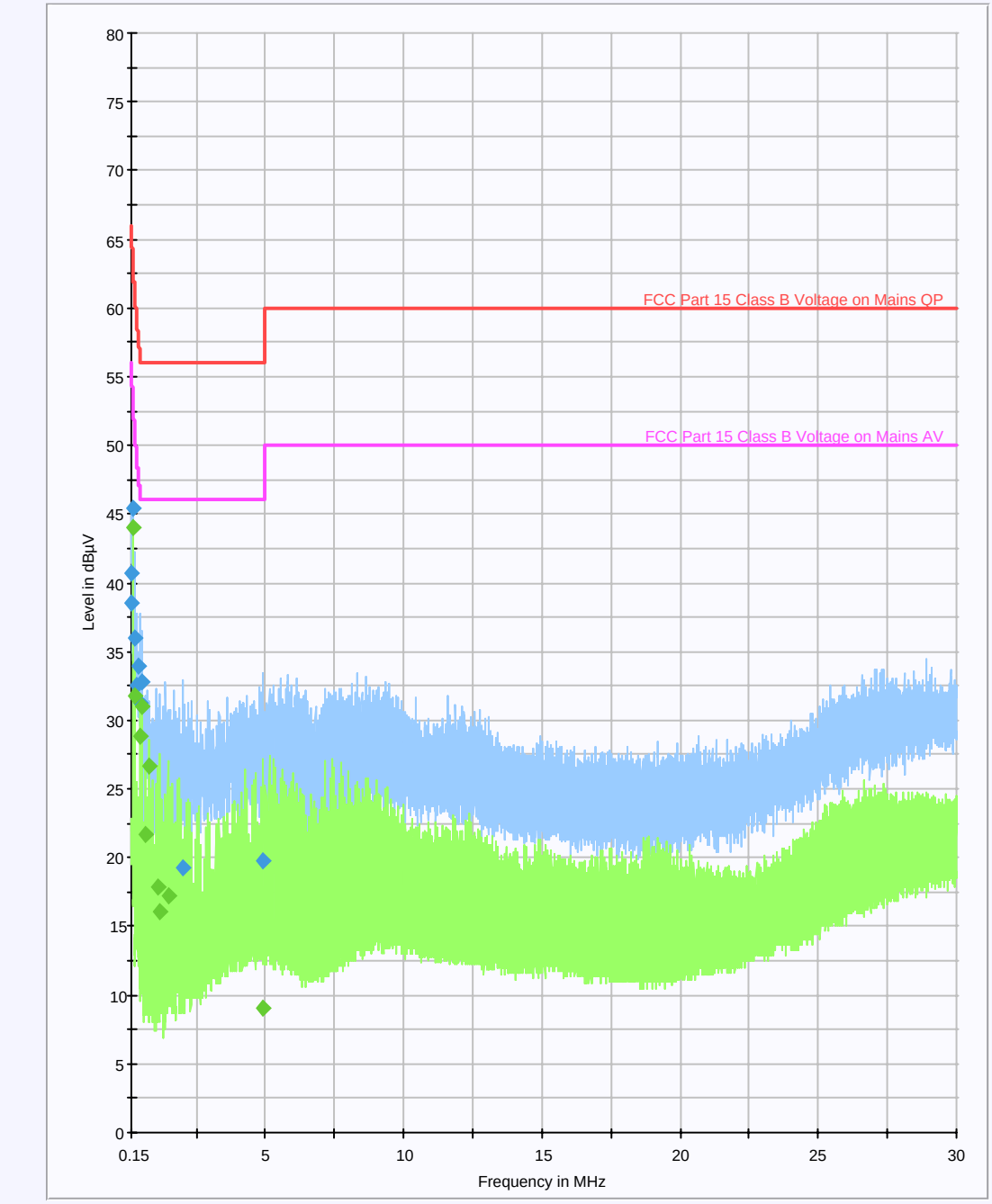
Results: Average Detector Measurements on Live and Neutral Lines

Frequency (MHz)	Line	Average Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
Note 1					

Notes(s):

1. *All emissions were at least 10 dB below the specification limit.*

Idle Mode AC Conducted Spurious Emissions (Continued)



7.2.2. Radiated Emissions (Idle Mode): 30 MHz to 1.0 GHz

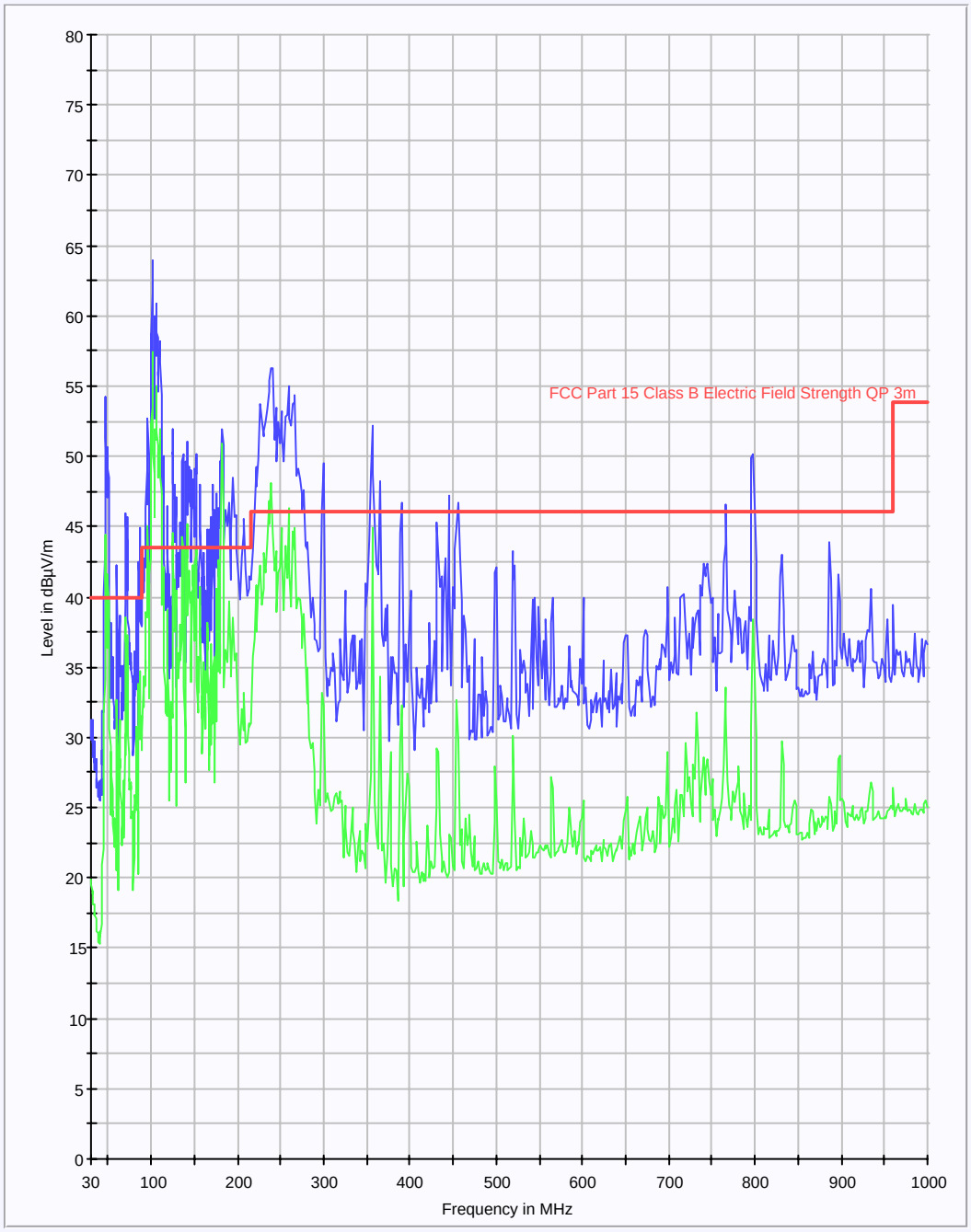
The EUT was configured for receiver-radiated emissions testing, as described in Appendix 2 of this report.

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

Results:

Frequency (MHz)	Antenna Polarity	Quasi Peak Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
49.669	Vertical	25.5	40.0	14.5	Complied
69.209	Vertical	18.1	40.0	21.9	Complied
101.633	Vertical	35.1	43.5	8.4	Complied
125.441	Vertical	25.8	43.5	17.7	Complied
141.593	Vertical	26.2	43.5	17.3	Complied
183.437	Vertical	31.7	43.5	11.8	Complied
240.370	Vertical	34.9	46.0	11.1	Complied
256.283	Vertical	29.8	46.0	16.2	Complied
299.789	Vertical	29.3	46.0	16.7	Complied
354.259	Horizontal	39.4	46.0	6.6	Complied
389.068	Horizontal	33.5	46.0	12.5	Complied
431.352	Vertical	29.4	46.0	16.6	Complied
454.208	Vertical	32.2	46.0	13.8	Complied
497.735	Vertical	29.7	46.0	16.3	Complied
521.342	Vertical	33.6	46.0	12.4	Complied
765.992	Horizontal	34.4	46.0	11.6	Complied
797.656	Horizontal	37.3	46.0	8.7	Complied
887.986	Vertical	34.0	46.0	12.0	Complied

Radiated Emissions (Idle Mode): 30 MHz to 1.0 GHz (Continued)



7.2.3. Receiver Radiated Emission (Idle Mode): 1 GHz to 27 GHz

The EUT was configured for receiver radiated emissions testing, as described in Appendix 2 of this report.

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

Results:

Highest Peak Level:

Frequency (MHz)	Antenna Polarity	Peak Detector Level (dBμV)	Transducer Factor (dB)	Actual Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
1058.977	Vertical	49.9	20.0	69.9	74.0	4.1	Complied
1328.998	Vertical	27.7	20.8	48.5	74.0	25.5	Complied
1594.113	Vertical	31.9	19.5	51.4	74.0	22.6	Complied
1858.963	Vertical	36.4	19.4	55.8	74.0	18.2	Complied
2162.946	Vertical	31.8	20.6	52.4	74.0	21.6	Complied
3840.119	Vertical	28.4	18.5	46.9	74.0	27.1	Complied

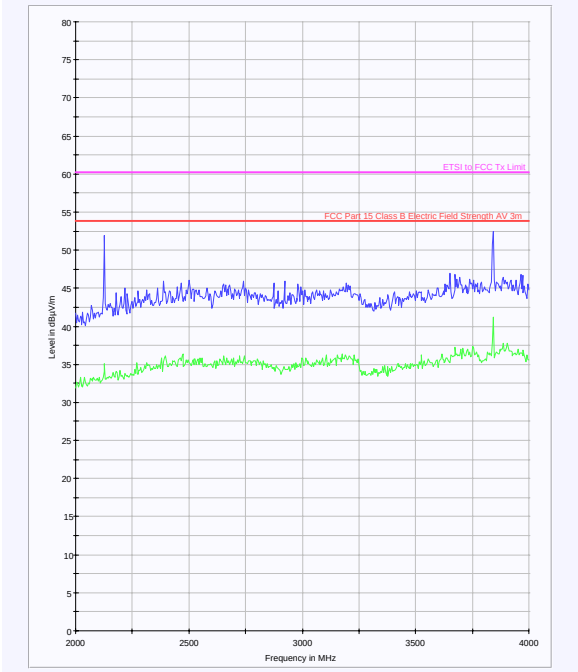
Highest Average Level:

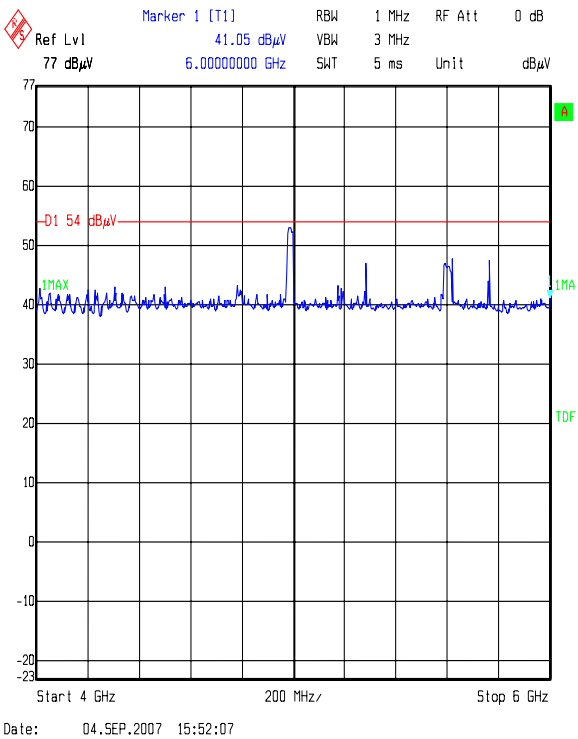
Frequency (MHz)	Antenna Polarity	Average Detector Level (dBμV)	Transducer Factor (dB)	Actual Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
1058.977	Vertical	14.5	20.0	34.5	54.0	19.5	Complied
1328.998	Vertical	12.8	20.8	33.6	54.0	20.4	Complied
1594.113	Vertical	13.1	19.5	32.6	54.0	21.4	Complied
1858.963	Vertical	31.6	19.4	51.0	54.0	3.0	Complied
2162.946	Vertical	17.2	20.6	37.8	54.0	16.2	Complied
3840.119	Vertical	21.3	18.5	39.8	54.0	14.2	Complied

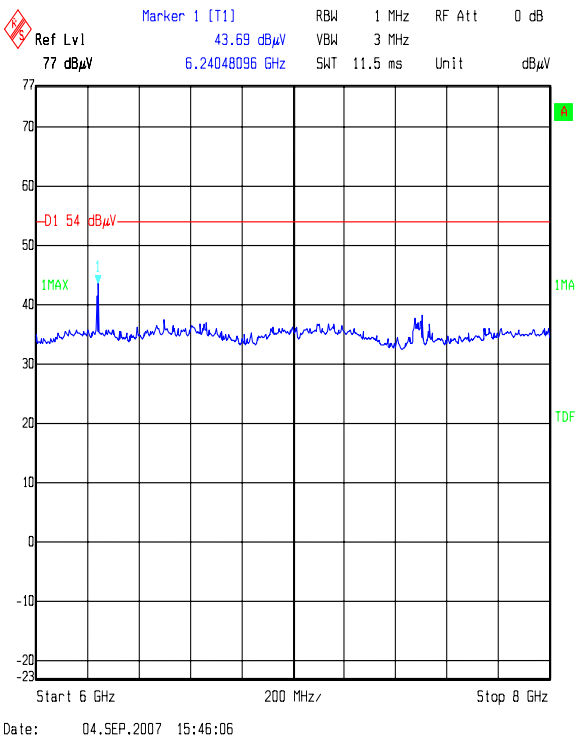
All emissions shown on the following plots that are not listed in the above table are either ambient emissions or the emissions level were at least 20 dB below the limit when measured using appropriate detectors.

Test Of: **IPWireless (UK) Ltd**
2.5 GHz UE PCMCIA V1, Model: FD
To: **FCC Part 27: 2006 Subpart C**

Receiver Radiated Emission (Idle Mode): 1 GHz to 27 GHz (Continued)

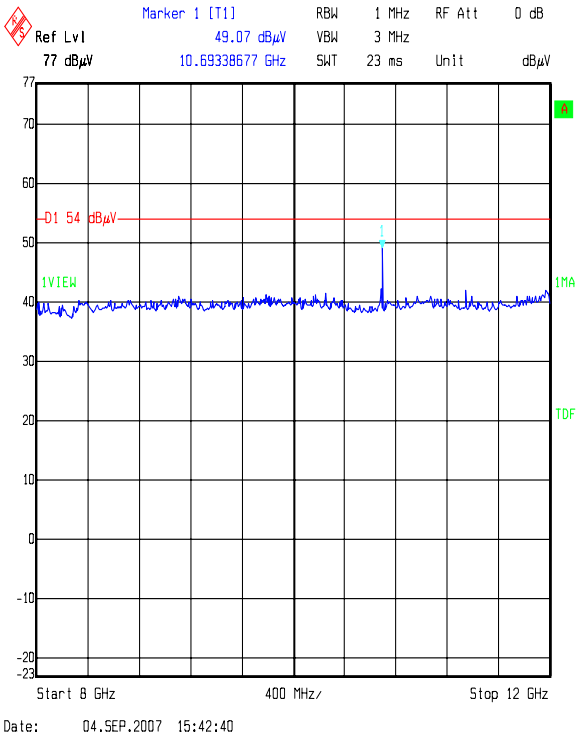


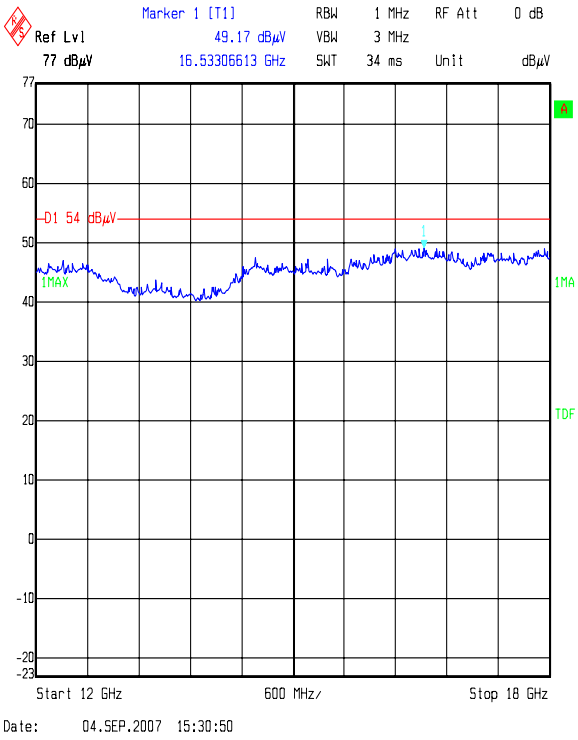


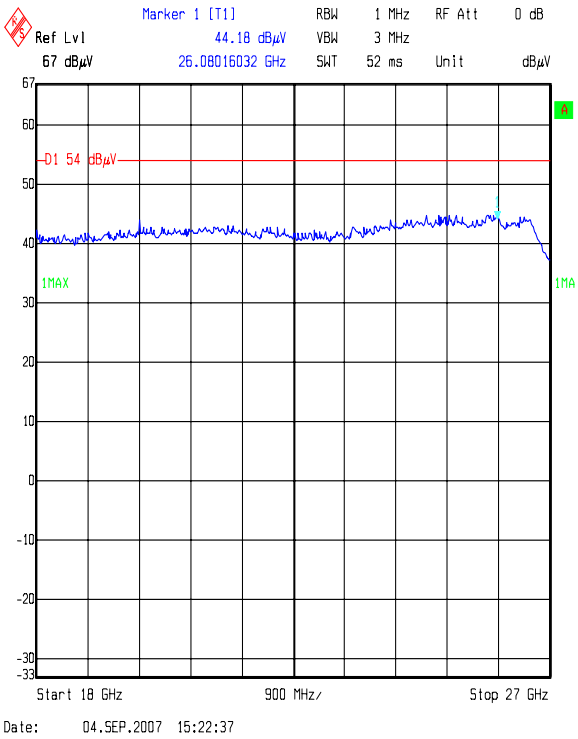


Test Of: **IPWireless (UK) Ltd**
2.5 GHz UE PCMCIA V1, Model: FD
To: **FCC Part 27: 2006 Subpart C**

Receiver Radiated Emission (Idle Mode): 1 GHz to 20 GHz (Continued)







7.2.4. Transmitter Carrier Output Power and Equivalent Isotropic Radiated Power (EIRP)

The EUT was configured for Conducted RF Output Power & Equivalent Isotropic Radiated Power (EIRP) as described in Appendix 2 of this report.

Sony Vaio – Conducted

Channel	Frequency (MHz)	Conducted RF O/P Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	2501.4	23.2	33.0	9.8	Complied
Middle	2593.0	23.9	33.0	9.1	Complied
Top	2684.6	24.2	33.0	8.8	Complied

Sony Vaio – Remote Antenna

Channel	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	2501.4	21.8	33.0	11.2	Complied
Middle	2593.0	20.6	33.0	12.4	Complied
Top	2684.6	23.9	33.0	9.1	Complied

Sony Vaio – Integral Antenna

Channel	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	2501.4	22.5	33.0	10.5	Complied
Middle	2593.0	23.9	33.0	9.1	Complied
Top	2684.6	22.9	33.0	10.1	Complied

Dell – Remote Antenna

Channel	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	2501.4	21.9	33.0	11.1	Complied
Middle	2593.0	21.8	33.0	11.2	Complied
Top	2684.6	23.9	33.0	9.1	Complied

Dell – Integral Antenna

Channel	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	2501.4	21.4	33.0	11.6	Complied
Middle	2593.0	24.5	33.0	8.5	Complied
Top	2684.6	21.4	33.0	11.6	Complied

Transmitter Carrier Output Power and Equivalent Isotropic Radiated Power (EIRP) (Continued)

HP Compaq Remote Antenna

Channel	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	2501.4	24.2	33.0	8.8	Complied
Middle	2593.0	23.3	33.0	9.7	Complied
Top	2684.6	24.3	33.0	8.7	Complied

HP Compaq – Integral Antenna

Channel	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	2501.4	22.0	33.0	11.0	Complied
Middle	2593.0	24.3	33.0	8.7	Complied
Top	2684.6	23.2	33.0	9.8	Complied

7.2.5. Transmitter Frequency Stability - Temperature Variation

The EUT was configured for frequency stability measurements, as described in Appendix 2 of this report. Channel edge and carrier centre frequency measurements were made.

Tests were performed to identify the maximum frequency error of the EUT with variations in ambient temperature.

Results:

Transmitter Frequency Stability - Temperature Variation (Continued)

Bottom Channel – Carrier Centre

Temp (ºC)	Measured Frequency (MHz)	Frequency Error (kHz)
-30	2501.400	0.000
-20	2501.408	0.008
-10	2501.409	0.009
0	2501.399	-0.001
10	2501.400	0.000
20	2501.400	0.000
30	2501.400	0.000
40	2501.401	0.001
50	2501.402	0.002

Middle Channel – Carrier Centre

Temp (ºC)	Measured Frequency (MHz)	Frequency Error (kHz)
-30	2593.000	0.000
-20	2593.000	0.000
-10	2593.005	0.005
0	2593.000	0.000
10	2593.002	0.002
20	2593.000	0.000
30	2593.000	0.000
40	2593.001	0.001
50	2593.002	0.002

Transmitter Frequency Stability - Temperature Variation (continued)

Top Channel – Carrier Centre

Temp (ºC)	Measured Frequency (MHz)	Frequency Error (kHz)
-30	2684.603	0.003
-20	2684.600	0.000
-10	2684.600	0.000
0	2684.602	0.002
10	2684.600	0.000
20	2684.600	0.000
30	2684.600	0.000
40	2684.601	0.001
50	2684.602	0.002

7.2.6. Transmitter Frequency Stability – Voltage Variation

The EUT was configured for frequency stability measurements, as described in Appendix 2 of this report.

Tests were performed to identify the maximum frequency error of the EUT with variations in nominal operating voltage.

Bottom Channel – Carrier Centre

Voltage	Measured Frequency (MHz)	Frequency Error (kHz)
2.97	2501.400	0.000
3.3	2501.400	0.000
3.63	2501.400	0.000

Middle Channel – Carrier Centre

Voltage	Measured Frequency (MHz)	Frequency Error (kHz)
2.97	2593.000	0.000
3.3	2593.000	0.000
3.63	2593.000	0.000

Top Channel – Carrier Centre

Voltage	Measured Frequency (MHz)	Frequency Error (kHz)
2.97	2684.601	0.001
3.3	2684.600	0.000
3.63	2684.600	0.000

7.2.7. Transmitter Occupied Bandwidth

The EUT was configured for Occupied Bandwidth measurements, as described in Appendix 2 of this report.

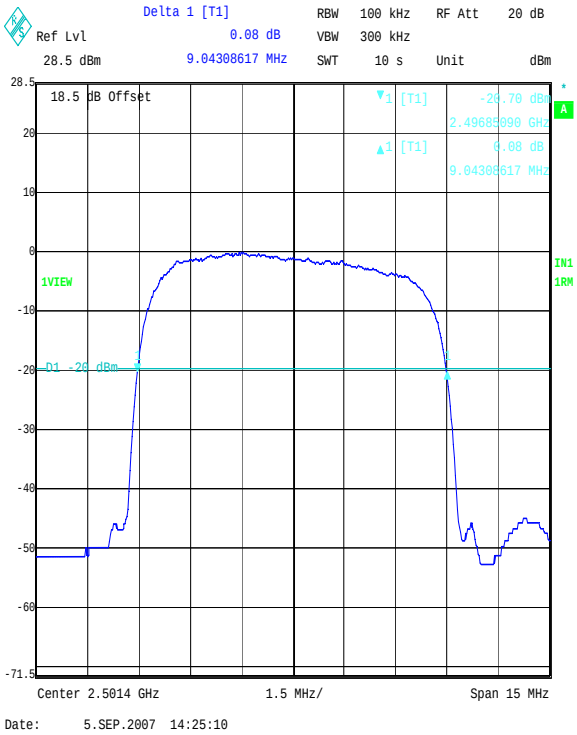
Tests were performed to identify the maximum bandwidth occupied by the fundamental frequency of the EUT.

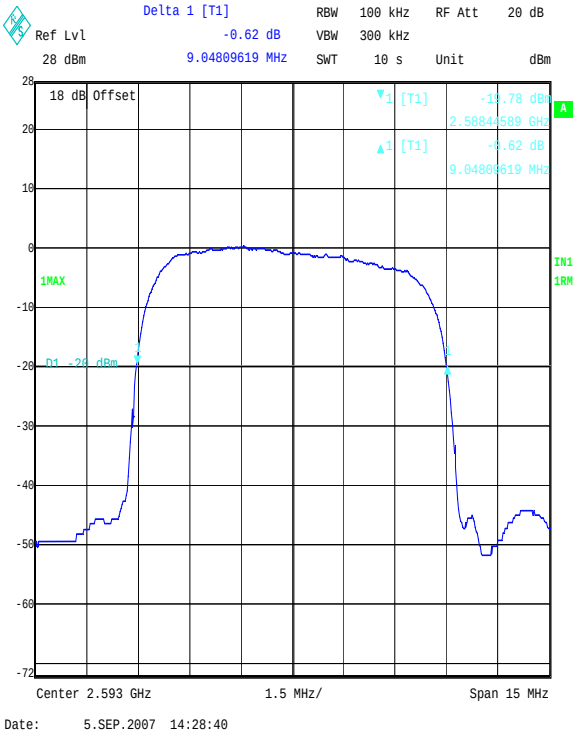
Results:

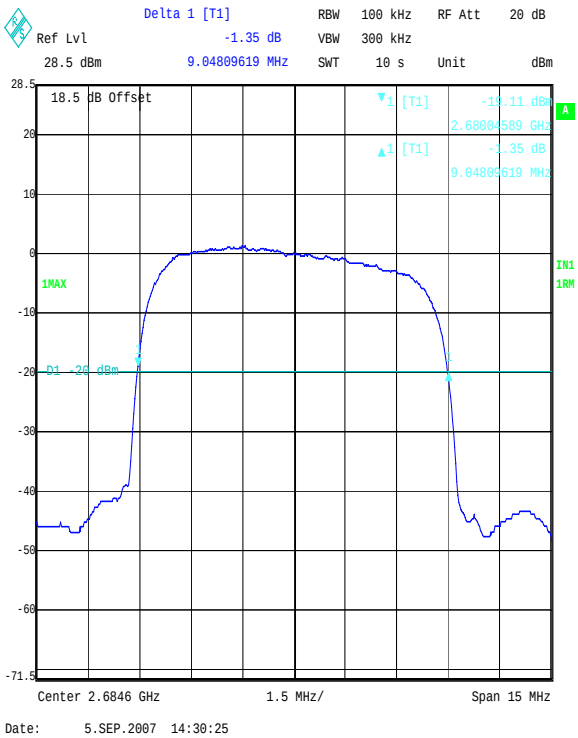
Channel	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth (MHz)
Bottom	100	300	9.043
Middle	100	300	9.048
Top	100	300	9.048

Test Of: IPWireless (UK) Ltd
2.5 GHz UE PCMCIA V1, Model: FD
To: FCC Part 27: 2006 Subpart C

Transmitter Occupied Bandwidth (Continued)







7.2.8. Transmitter Conducted Emissions - Channel Edge

The EUT was configured for conducted emissions measurements, as described in Appendix 2 of this report.

Tests were performed to determine compliance with the out of band power requirements at frequencies adjacent to the channel occupied by the fundamental frequency of the EUT.

Result: Bottom Channel

Frequency (MHz)	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
2490.500	-45.1	-25	20.1	Complied
2493.456	-51.3	-13	38.3	Complied
4998.943	-49.3	-25	24.3	Complied

Result: Middle Channel

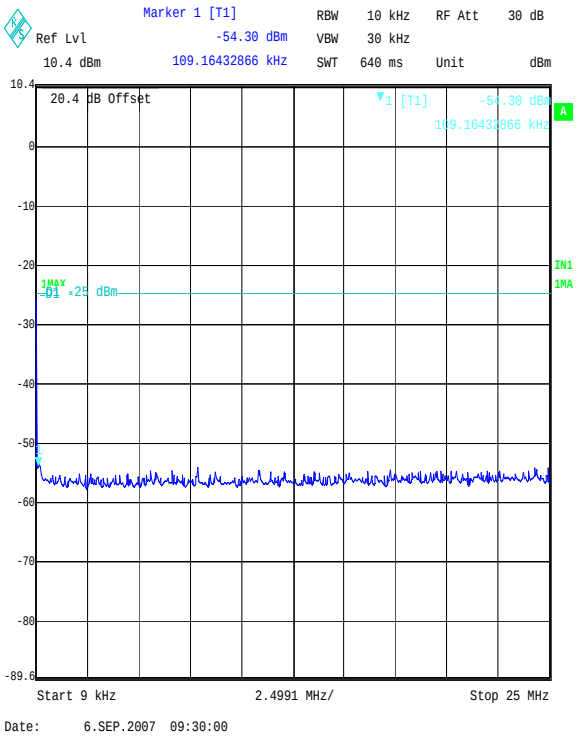
Frequency (MHz)	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
756.153	-54.1	-25	29.1	Complied
1834.393	-45.6	-25	20.6	Complied
2476.779	-50.6	-25	25.6	Complied
2726.343	-51.8	-25	26.8	Complied
5182.165	-38.6	-25	13.6	Complied
7772.054	-59.2	-25	34.2	Complied

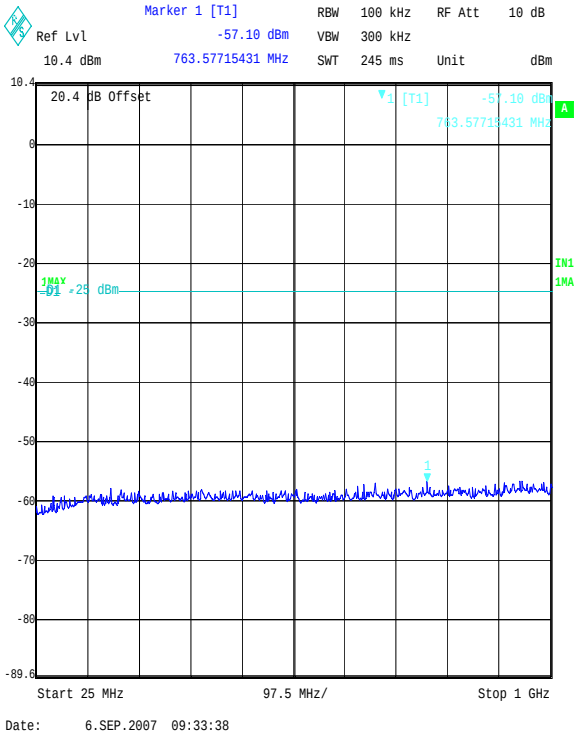
Result: Top Channel

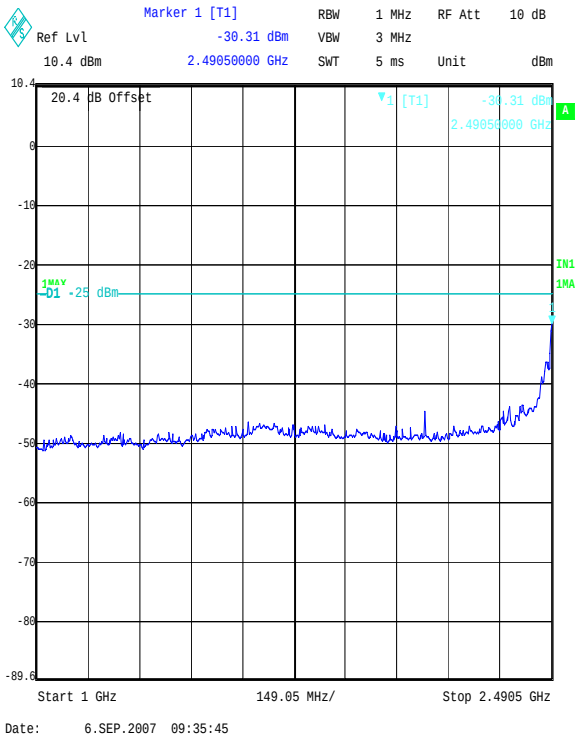
Frequency (MHz)	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
755.762	-55.0	-25	30.0	Complied
1925.342	-55.9	-25	30.9	Complied
2304.599	-44.7	-25	19.7	Complied
2477.410	-44.7	-25	19.7	Complied
2695.352	-48.2	-13	35.2	Complied
5365.369	-46.8	-25	21.8	Complied

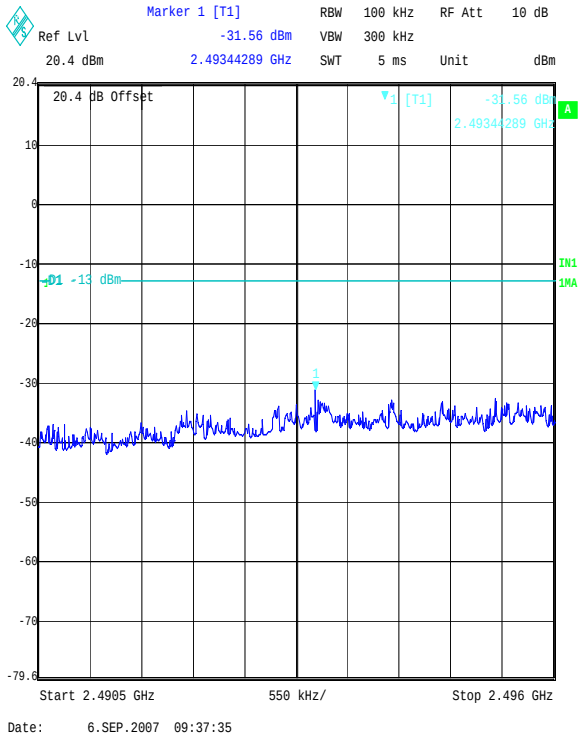
Note: For some of the plots a 100 kHz resolution bandwidth was used in error, it should be noted that this would not effect any narrowband emission and would result in an increase of 10 dB maximum for any wideband signal. So compliance to the limit can still be shown by a margin of 15 dB.

Transmitter Conducted Emissions – Bottom Channel (Continued)



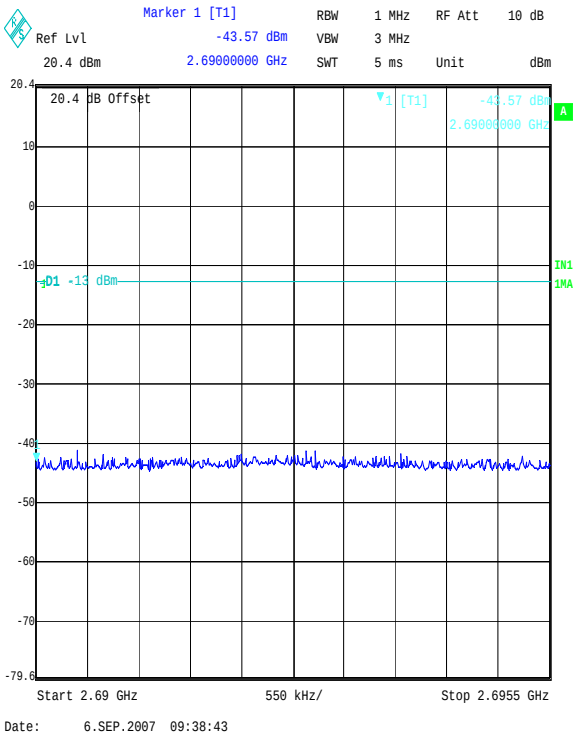


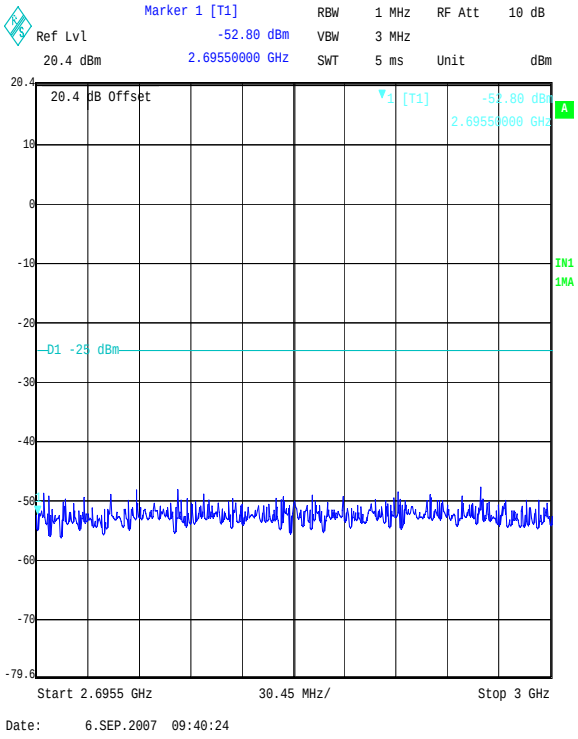


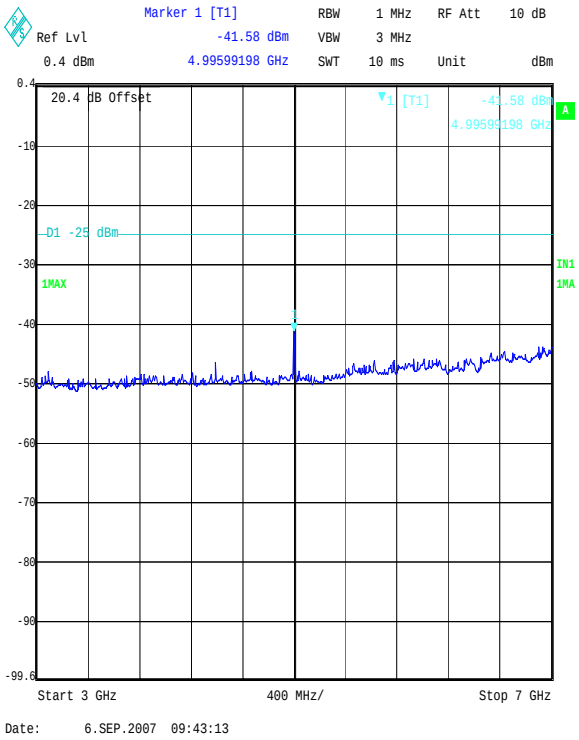


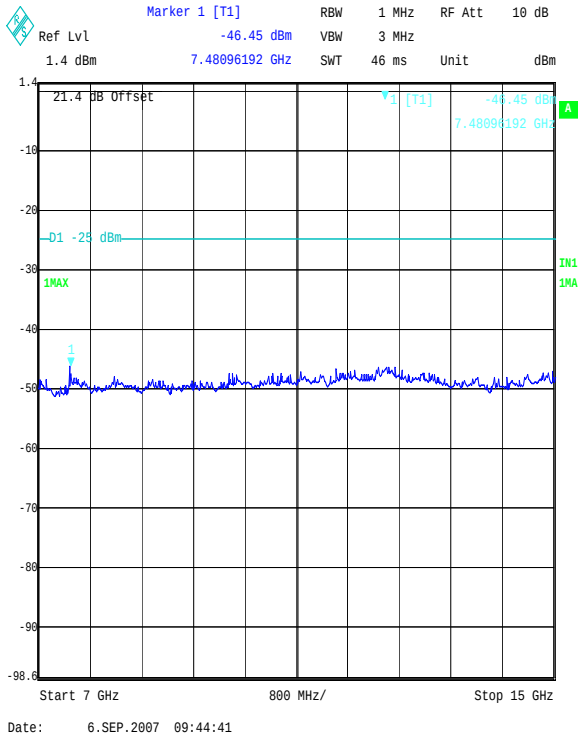
Test Of: IPWireless (UK) Ltd
2.5 GHz UE PCMCIA V1, Model: FD
To: FCC Part 27: 2006 Subpart C

Transmitter Conducted Emissions – Bottom Channel (Continued)

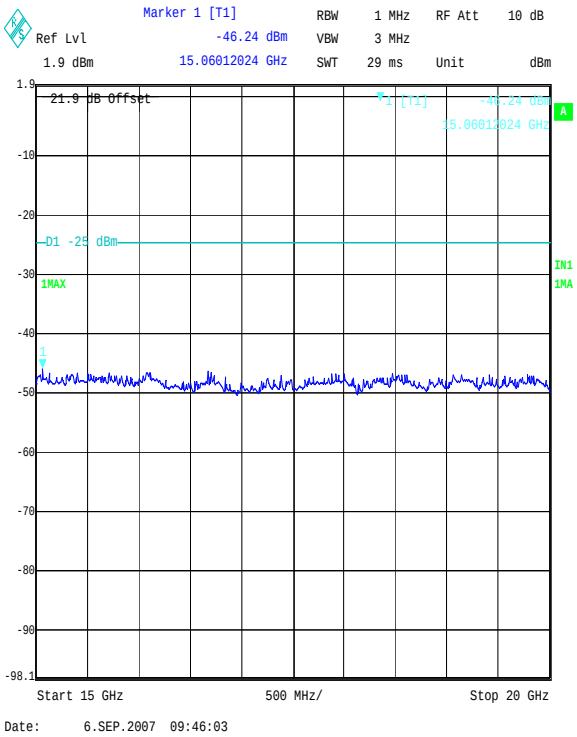


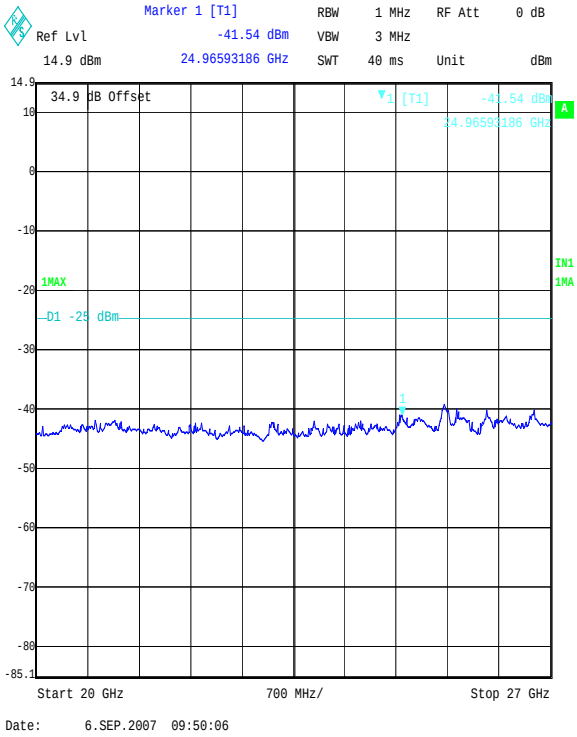




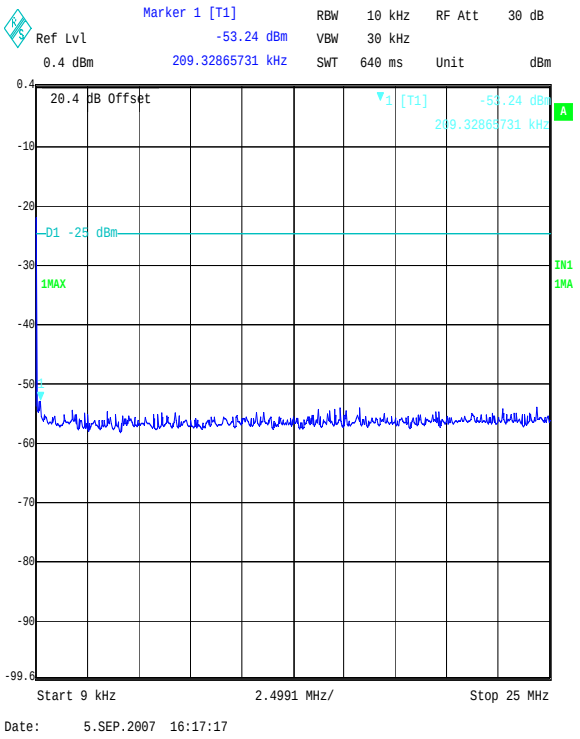


Transmitter Conducted Emissions – Bottom Channel (Continued)

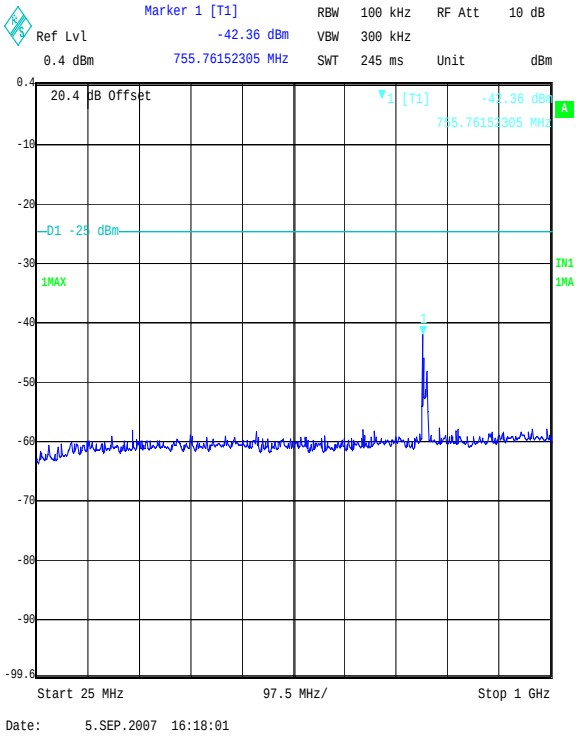




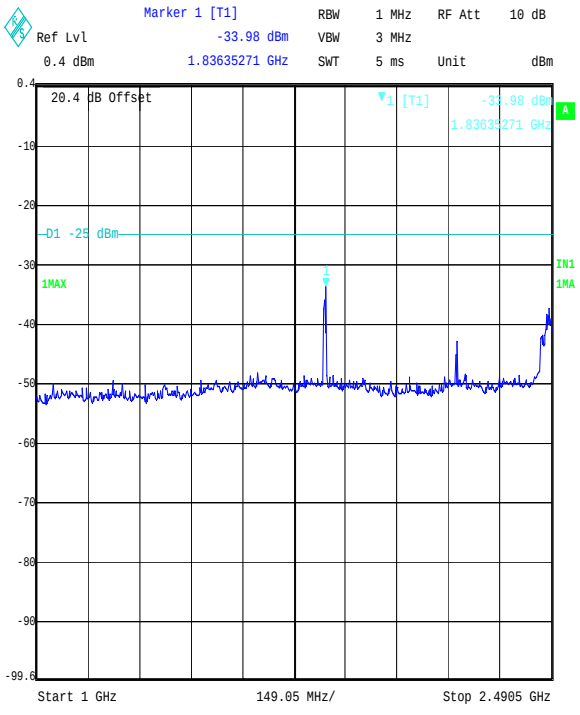
Transmitter Conducted Emissions – Middle Channel (Continued)



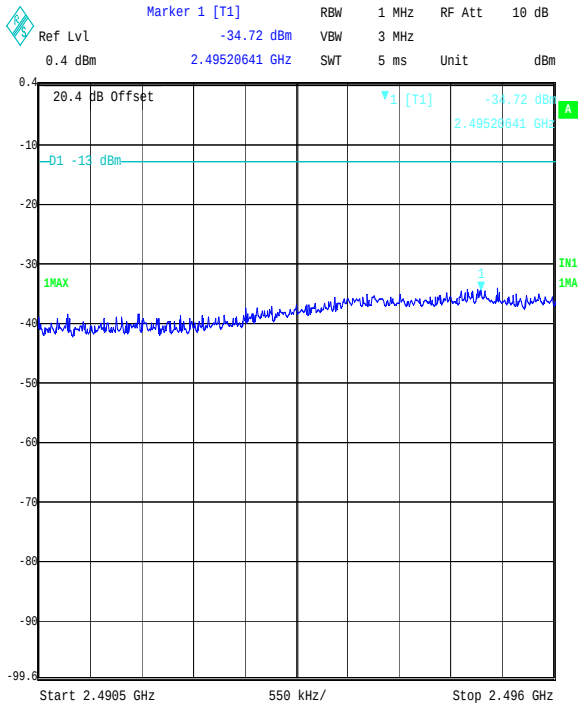
Date: 5.SEP.2007 16:17:17



Date: 5.SEP.2007 16:18:01

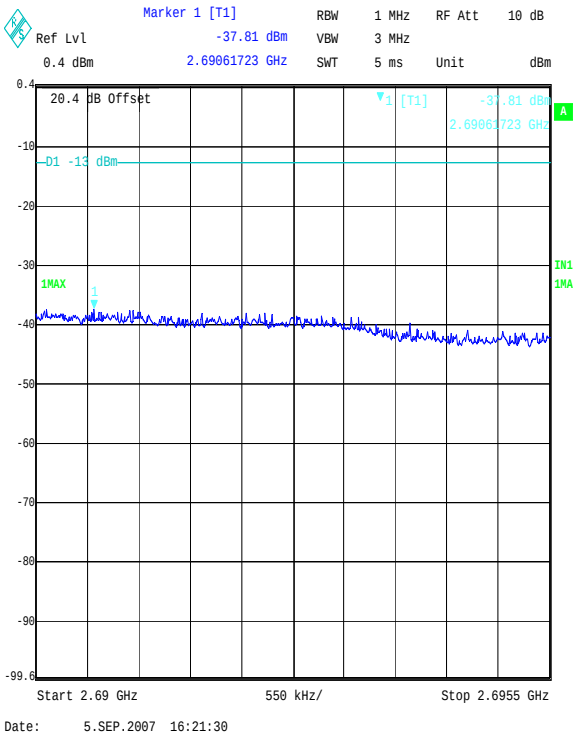


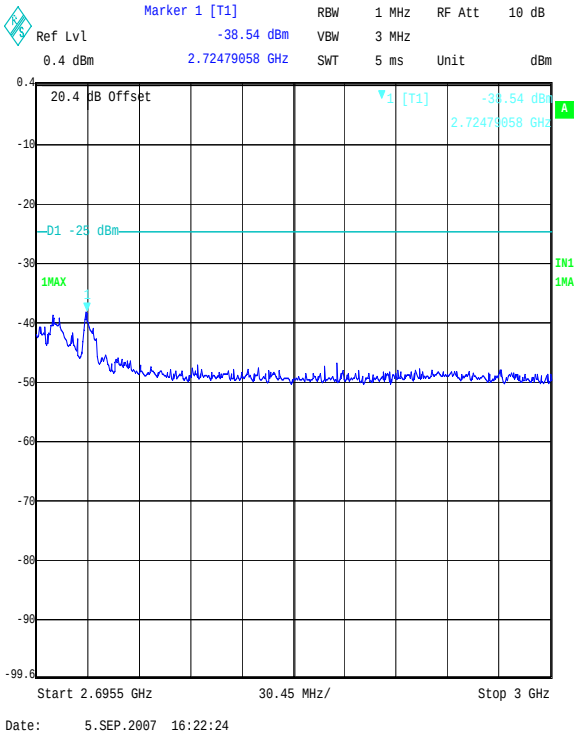
Date: 5.SEP.2007 16:19:49

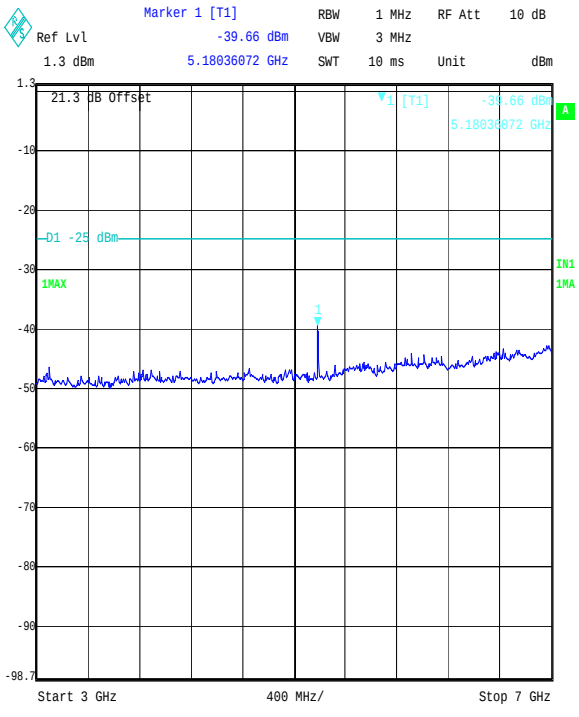


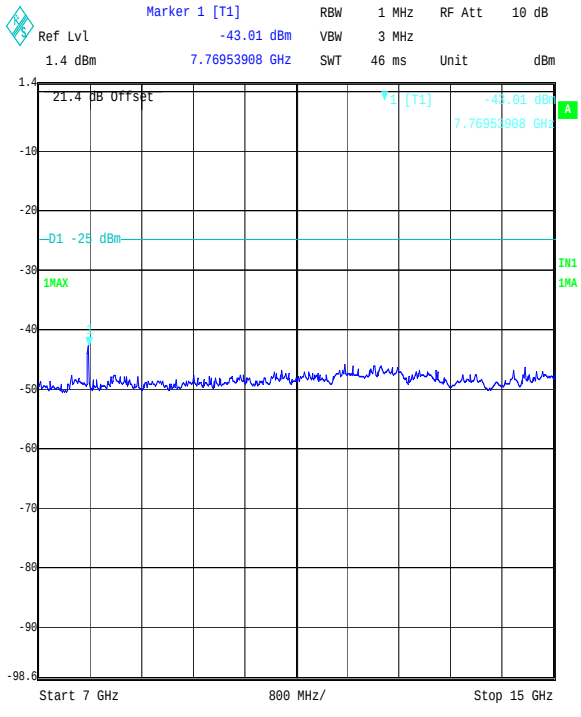
Date: 5.SEP.2007 16:20:39

Transmitter Conducted Emissions – Middle Channel (Continued)

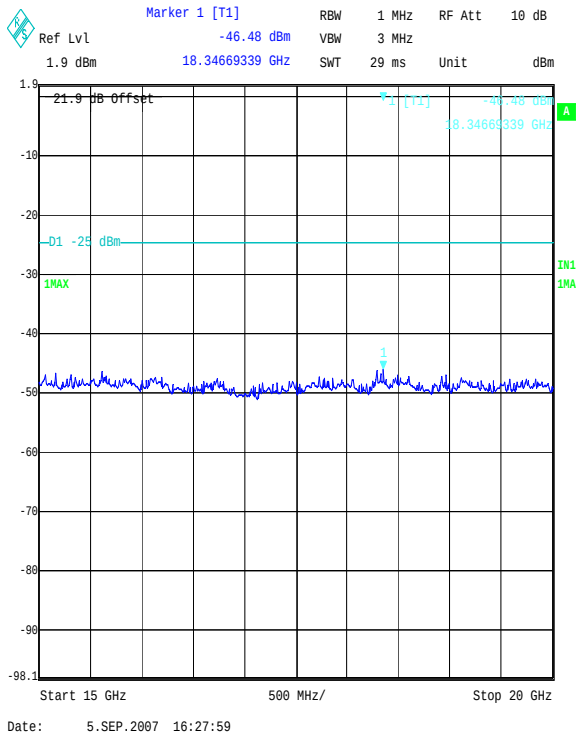


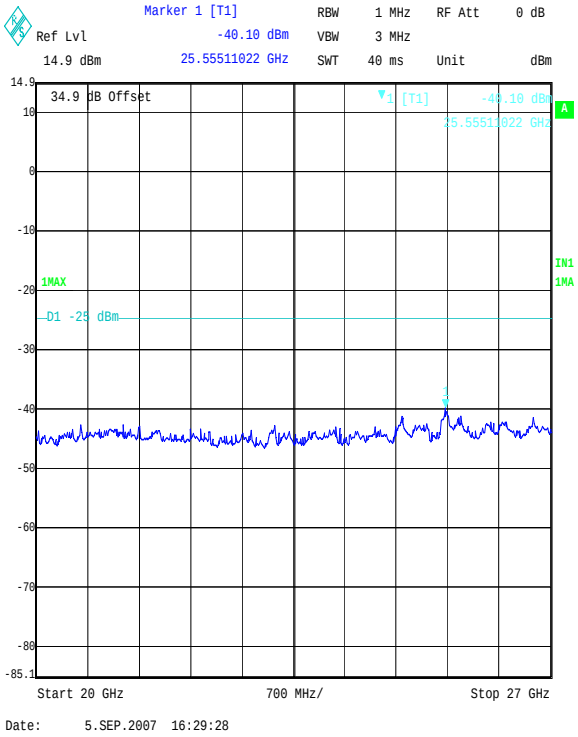




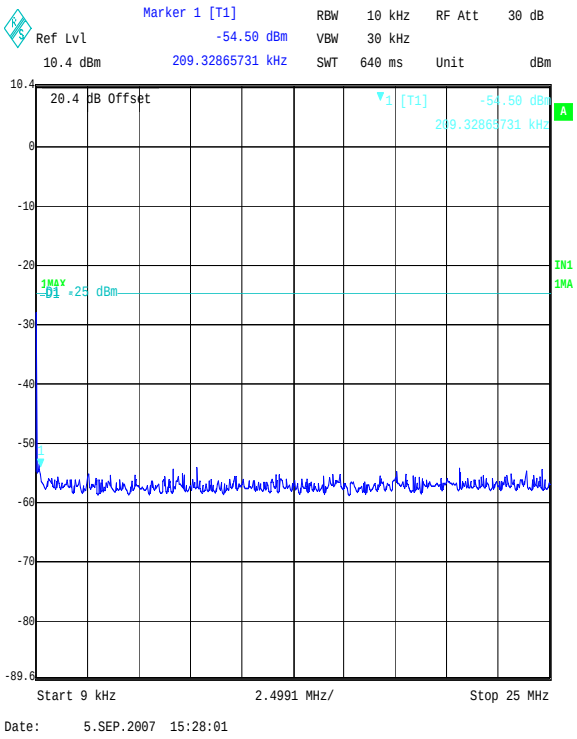


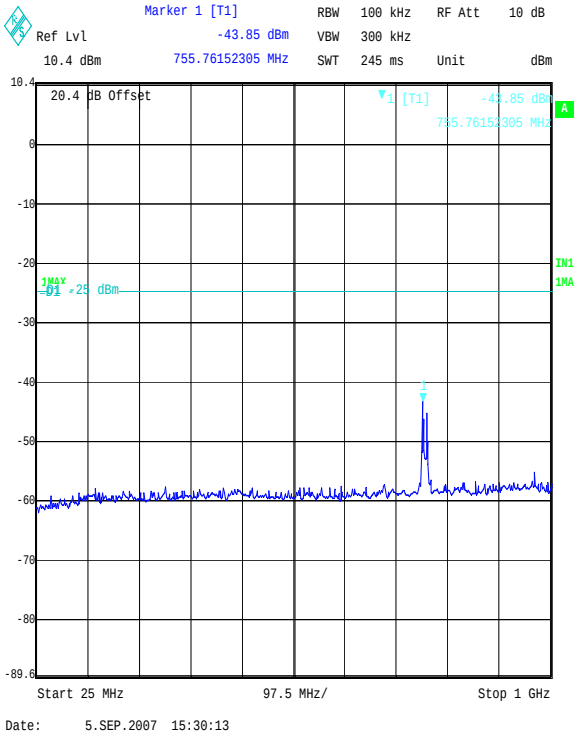
Transmitter Conducted Emissions – Middle Channel (Continued)

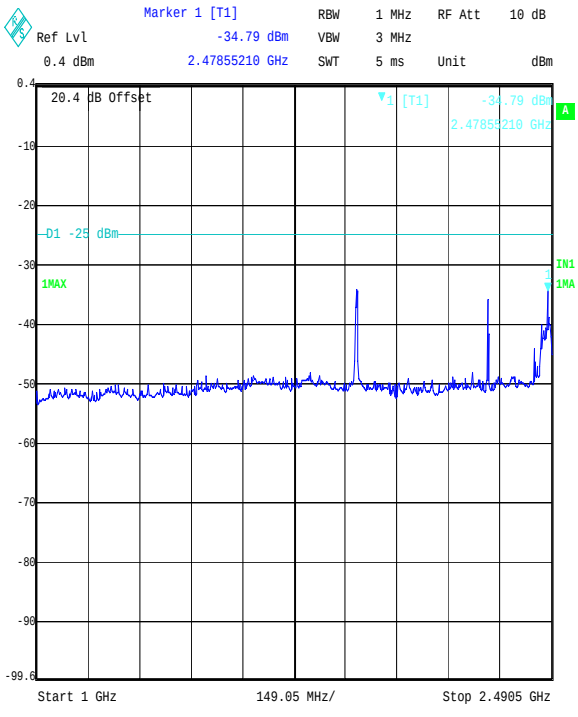


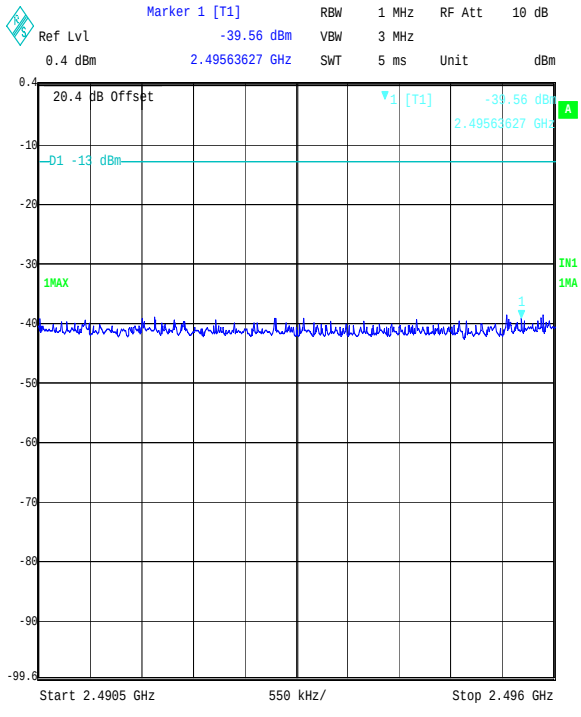


Transmitter Conducted Emissions – Top Channel (Continued)

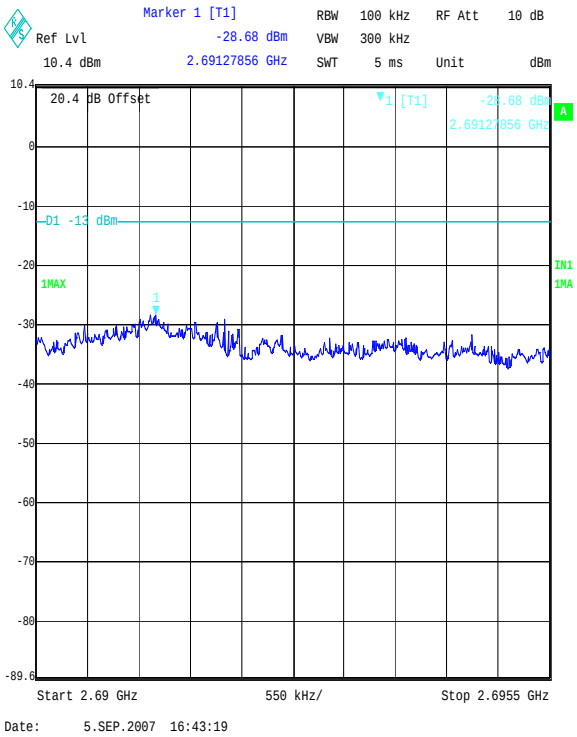


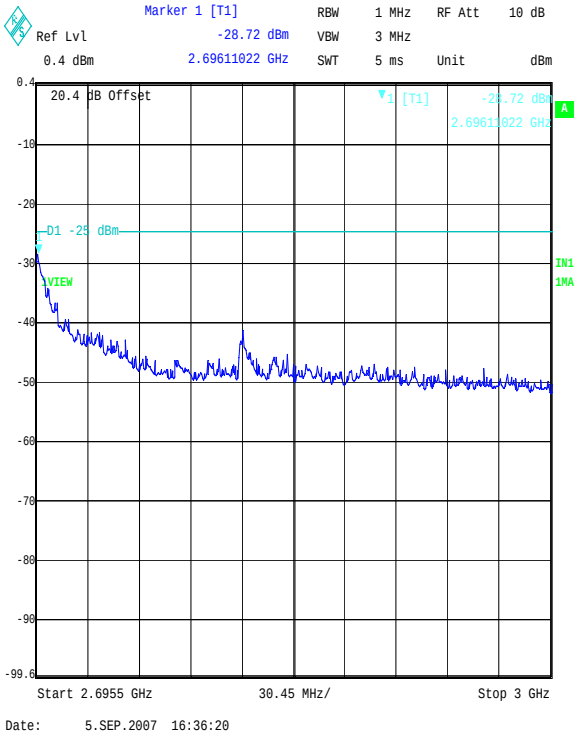


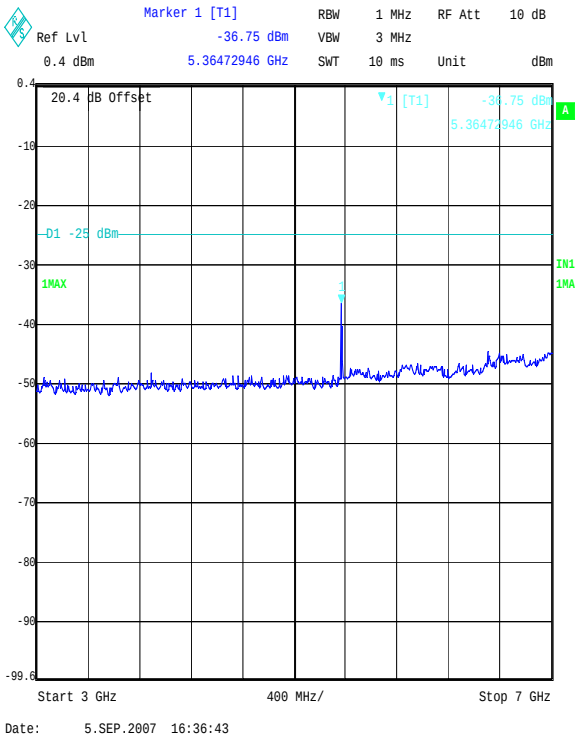


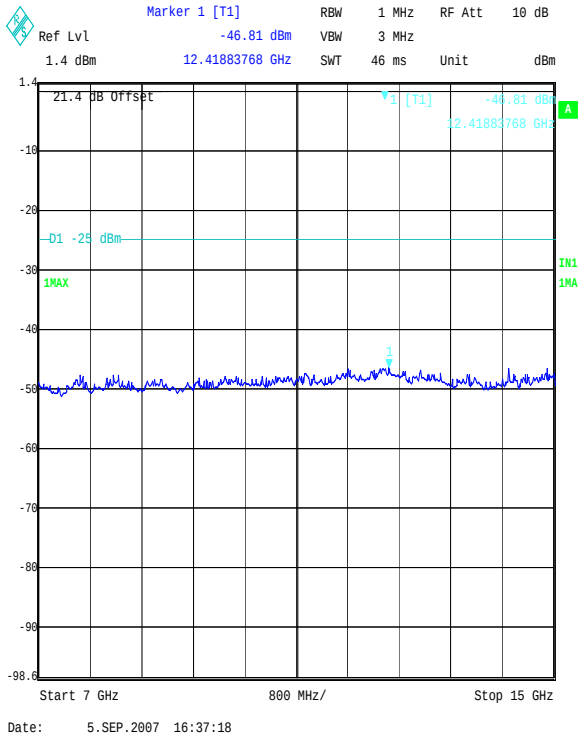


Transmitter Conducted Emissions – Top Channel (Continued)

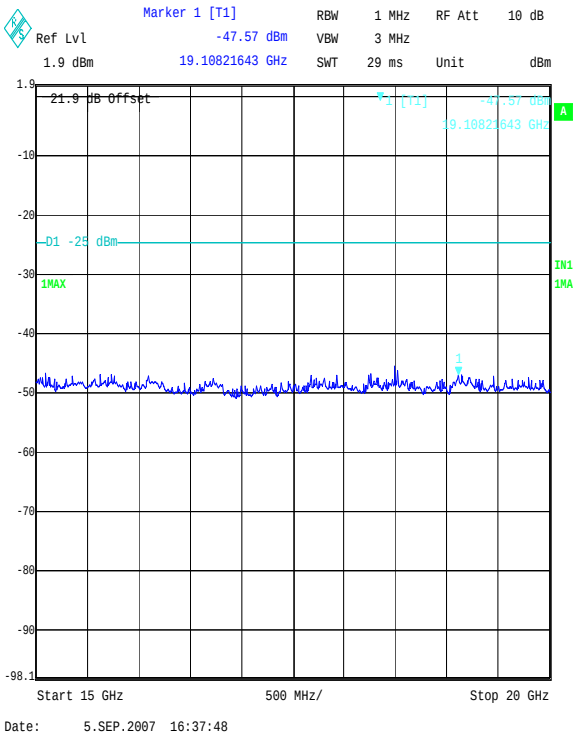


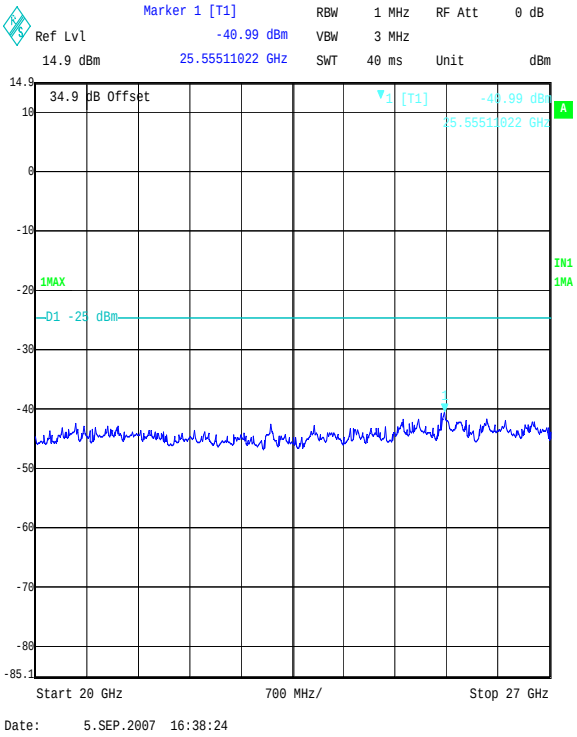






Transmitter Conducted Emissions – Top Channel (Continued)





7.2.9. Transmitter Conducted Emissions at Band Edges

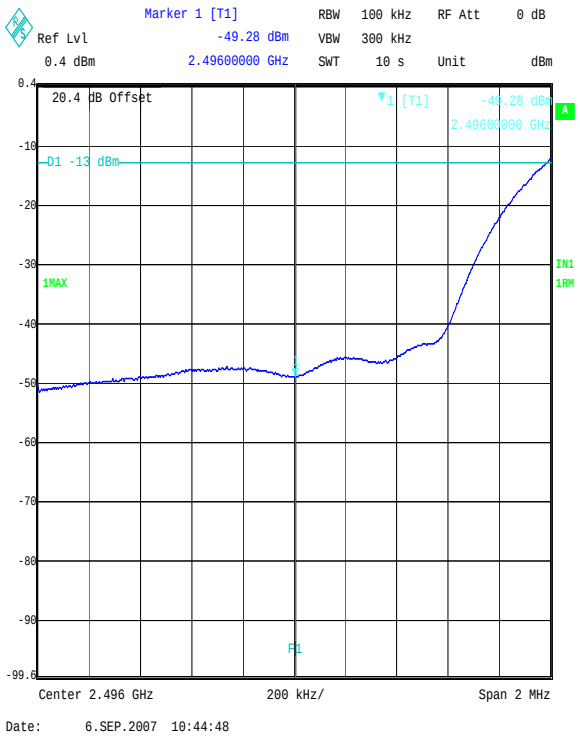
Results:

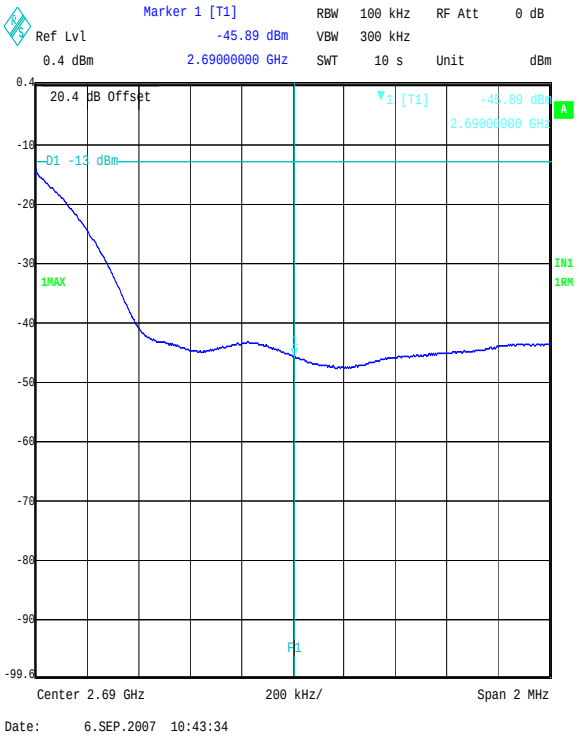
Bottom Band Edge

Frequency (MHz)	Spurious Emission (dBm)	Limit (dBm)	Margin (dB)	Result
2495	-49.3	-13.0	36.3	Complied

Top Band Edge

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
2690	-45.9	-13.0	32.9	Complied





7.2.10. Transmitter Radiated Emissions

The EUT was configured for transmitter radiated emissions testing, as described in Appendix 2 of this report.

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

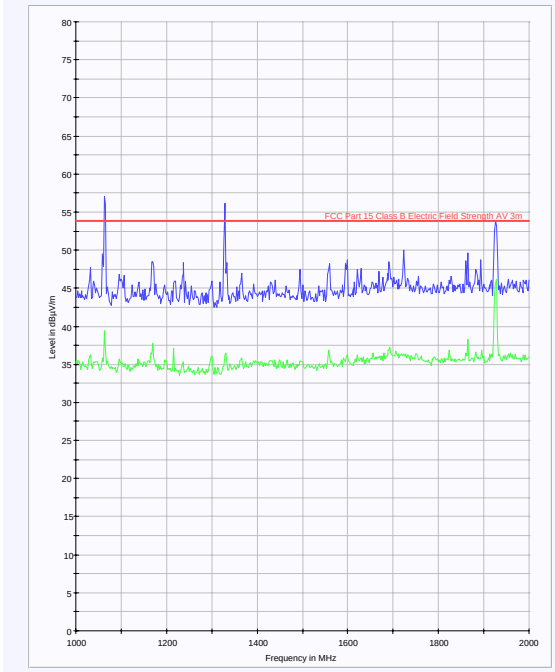
It should be noted that the 1 GHz to 4 GHz plots show a 54 dBuV/m limit line. The correct limit line is -13 dBm or 82.2 dBuV/m, 28.2 dB above the indicated 54 dBuV/m. The out of band emissions were all found to be at least 20 dB below the correct limit. Also refer to the radiated band edge plots later in this report.

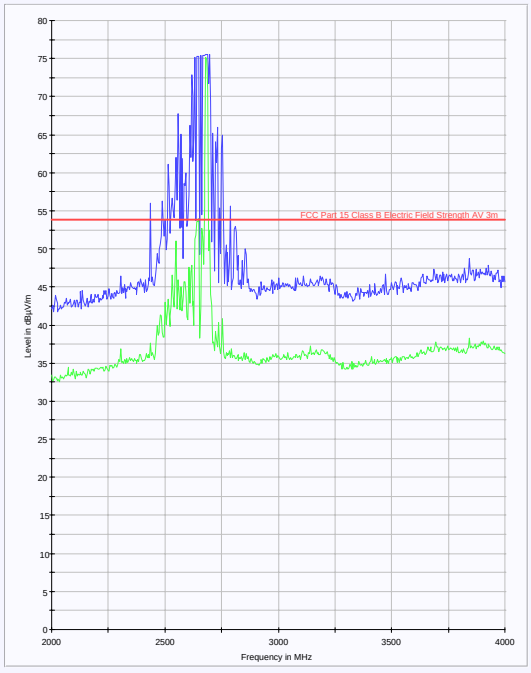
Results:

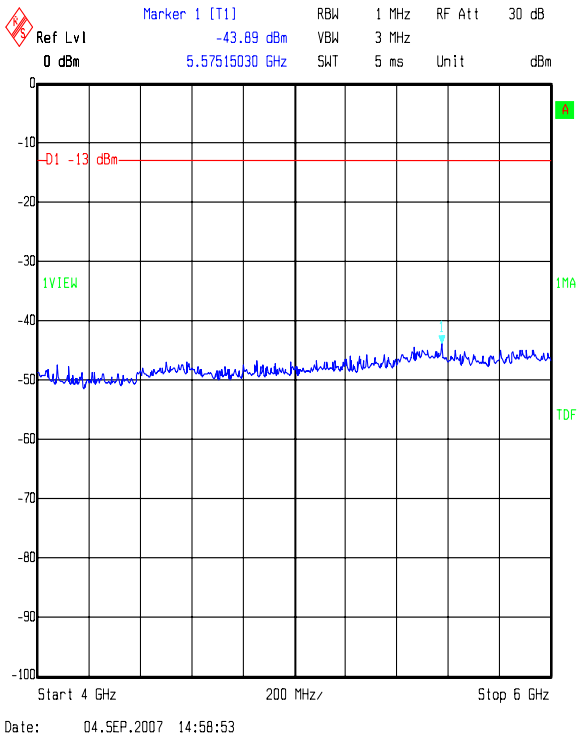
Frequency (MHz)	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
48.347	25.3	40.0	14.7	Complied
72.074	19.4	40.0	20.6	Complied
101.933	35.5	43.5	8.0	Complied
147.014	27.8	43.5	15.7	Complied
177.597	32.7	43.5	10.8	Complied
234.761	36.9	46.0	9.1	Complied
325.831	31.1	46.0	14.9	Complied
353.197	28.9	46.0	17.1	Complied
390.931	33.8	46.0	12.2	Complied
455.882	33.5	46.0	12.5	Complied
519.849	29.9	46.0	16.1	Complied
600.029	30.3	46.0	15.7	Complied
763.838	44.8	46.0	1.2	Complied
799.309	41.0	46.0	5.0	Complied

Test Of: IPWireless (UK) Ltd
2.5 GHz UE PCMCIA V1, Model: FD
To: FCC Part 27: 2006 Subpart C

Transmitter Radiated Emissions (Continued)

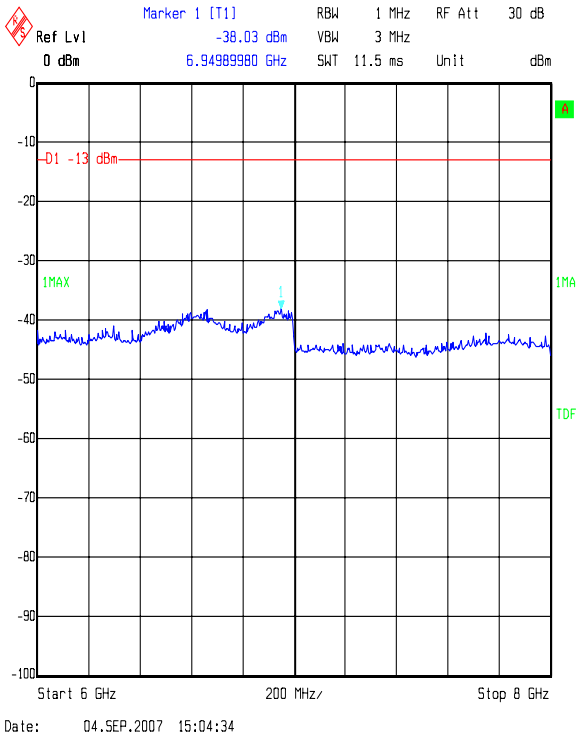




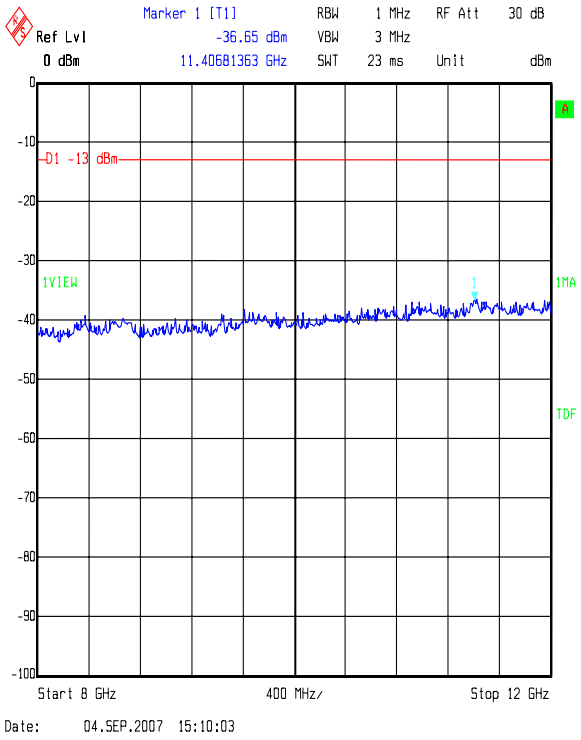


Test Of: **IPWireless (UK) Ltd**
2.5 GHz UE PCMCIA V1, Model: FD
To: **FCC Part 27: 2006 Subpart C**

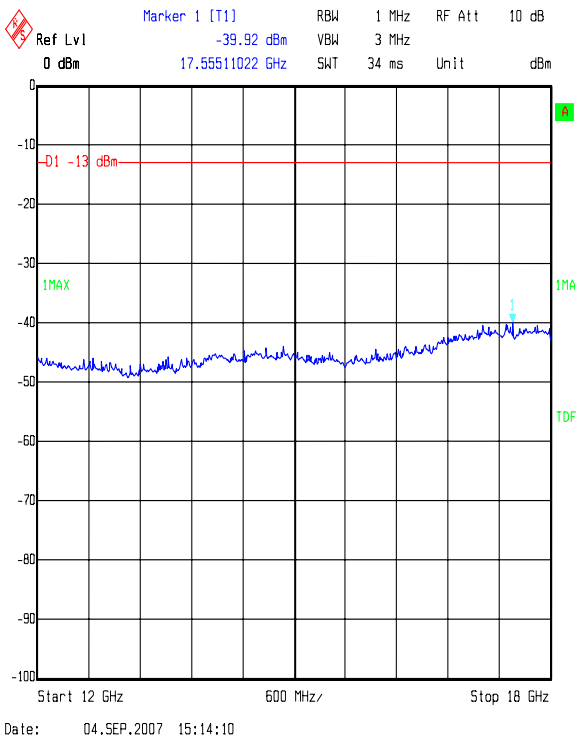
Transmitter Radiated Emissions (Continued)



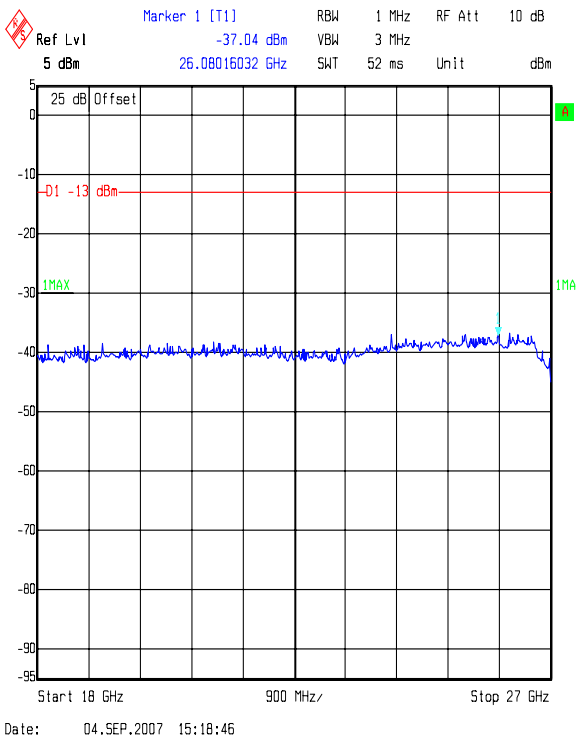
Date: 04.SEP.2007 15:04:34



Date: 04.SEP.2007 15:10:03



Date: 04.SEP.2007 15:14:10



Date: 04.SEP.2007 15:18:46

7.2.11. Transmitter Radiated Emissions at Band Edges

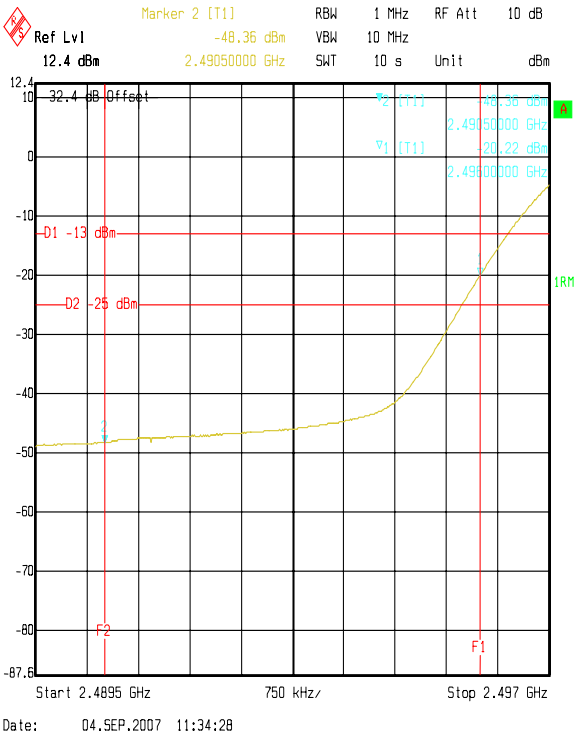
Results:

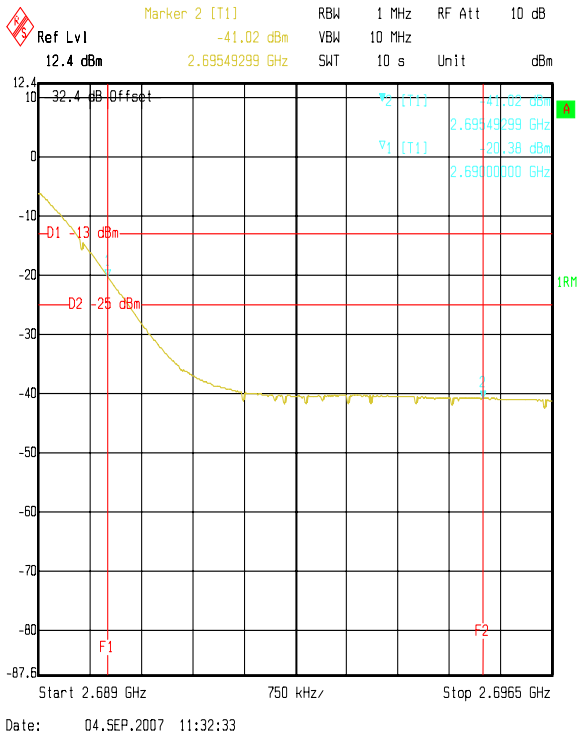
Bottom Band Edge

Frequency (MHz)	Spurious Emission (dBm)	Limit (dBm)	Margin (dB)	Result
2496	-20.0	-13.0	7.0	Complied

Top Band Edge

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
2690	-20.0	-13.0	7.0	Complied





8. Measurement Uncertainty

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

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

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

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

Measurement Type	Range	Confidence Level	Calculated Uncertainty
Carrier Output Power	Not applicable	95%	± 0.46 dB
Frequency Stability	Not applicable	95%	± 20 Hz
Occupied Bandwidth	Not applicable	95%	± 0.12 %
Conducted Emissions	9 kHz to 26 GHz	95%	± 1.2 dB
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	± 5.26 dB
Radiated Spurious Emissions	1 GHz to 26 GHz	95%	± 1.78 dB
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	± 3.25 dB

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

Appendix 1. Test Equipment Used

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval (Months)
A028	Horn Antenna	Eaton	91888-2	304	08 Jun 2006	36
A031	Horn Antenna	Eaton	91889-2	557	08 Jun 2006	36
A1037	Bilog Antenna	Chase EMC Ltd	CBL6112B	2413	20 Sep 2006	12
A1069	Single Phase LISN	Rohde & Schwarz	ESH3-Z5	837469/012	09 Feb 2007	12
A1426	20dB Attenuator	Narda	4779-20	9	31 May 2007	12
A1534	Preamplifier	Hewlett Packard	8449B OPT H02	3008A00405	Calibrated before use	-
A253	Microwave Horn	Flann Microwave	12240-20	128	17 Nov 2006	36
A254	Microwave Horn	Flann Microwave	14240-20	139	17 Nov 2006	36
A255	Microwave Horn	Flann Microwave	16240-20	519	17 Nov 2006	36
A256	Microwave Horn	Flann Microwave	18240-20	400	17 Nov 2006	36
A425	18 to 40 GHz	EMCO	3116	9611-2330	10 Apr 2006	36
A436	Microwave Horn	Flann	20240-20	330	24 Apr 2006	36
C1027	Cable	Rosenberger	FA210B-1-010M-30X30	FA00C 7587	31 May 2007	12
G085	10MHz - 50GHz CW Generator	Hewlett Packard	83650L	3614A00104	03 Nov 2006	24
M1124	ESIB Spectrum Analyser	Rohde & Schwarz	ESIB26	100046K	20 Dec 2006	12
M1175	Power Sensor	HP	8485A	2942A10299	03 Nov 2006	12
M1242	Spectrum Analyser	Rohde & Schwarz	FSEM30	845986/022	08 Sep 2006	12
M1253	Spectrum Analyser	HP	8564E	3442A00262	30 Oct 2006	12
M1263	EMI Test Receiver	Rohde & Schwarz	ESIB7	100265	25 Jan 2007	12
M281	Power Meter	Hewlett Packard	E4418A (EPM441A)	GB37170210-01	06 Jun 2007	12
S202	OATS	RFI	2	S202-15011990	17 Nov 2006	12
S212	Screened Room	RFI	12	None	Calibrated before use	-

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

Appendix 2. Measurement Methods

A2.1. AC Mains Conducted Emissions

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

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

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

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

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

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

A2.2. Receiver Radiated Emissions

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

Initial pre-scans covering the entire measurement band from the lowest generated frequency declared up to 5 times the highest unintentionally generated frequency were performed within a screened chamber in order to identify frequencies on which the EUT was generating interference. This determined the frequencies from the EUT which required further examination. In order to minimise the time taken for the swept measurements, a peak detector was used in conjunction with the appropriate detector measuring bandwidth (see table below). Repetitive scans were performed to allow for emissions with low repetition rates, and for the duty cycle of the EUT.

The initial scans were performed using an antenna height of 1.5 m and a measurement distance of 3 m. A limit line was set to the specification limit. Levels within 20 dB of this limit were measured where possible, on occasion; the receiver noise floor came within the 20 dB boundary. On these occasions, the system noise floor may have been recorded.

An open area test site using the appropriate test distance and measuring receiver with a Quasi-Peak detector was used for measurements below 1000 MHz, for measurements above 1000 MHz average and peak detectors were used.

For the final measurements the EUT was arranged on a non-conducting turn table on a standard test site compliant with ANSI C63.4 – 2003 Clause 5.4.

On the open area test site, at each frequency where a signal was found, the levels were maximised by initially rotating the turntable through 360° and then varying the antenna height between 1 m and 4 m in the horizontal polarisation. 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. The procedure was repeated for the vertical polarisation.

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

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

Receiver Function	Initial Scan	Final Measurements Below 1 GHz	Final Measurements Above 1 GHz
Detector Type:	Peak	Quasi-Peak (CISPR)	Peak/Average
Mode:	Max Hold	Not applicable	Not applicable
Bandwidth:	(120 kHz < 1 GHz) (1 MHz > 1 GHz)	120 kHz	1 MHz (If Applicable)
Amplitude Range:	60 dB	20 dB	20 dB (typical)
Step Size:	Continuous sweep	Not applicable	Not applicable
Sweep Time:	Coupled	Not applicable	Not applicable

A2.3. Conducted RF Output Power & Equivalent Isotropic Radiated Power (EIRP)

There are no conducted power limits specified in Part 27, therefore measurements were performed as a requirement of Part 2.1046.

The levels obtained were also used in conjunction with spurious attenuation measurements where the results are based on the conducted carrier power (P).

The EUT's antenna port was connected to a spectrum analyser containing a channel power function via suitable attenuation.

The total loss of the cables & attenuators were measured and entered as a reference level offset into the spectrum analyser to correct for these losses.

The EUT was set to a specified channel and the transmitter set to operate at full power.

This test was carried out on the bottom, middle and top channels.

For EIRP measurements the output power was measured radiated on an open area test site. The fundamental was maximised by rotating the EUT though 360 degrees and height searching. The highest reported level was recorded and compared to the lomit.

A2.4. Frequency Stability

The EUT was situated within an environmental test chamber and its antenna port was connected to a spectrum analyser via suitable cables and RF attenuators.

Measurements were performed with the EUT operating under extremes of temperature in 10 degree increments within the range -30°C to +50°C.

Measurements were also performed at voltage extremes by varying the voltage at the battery terminal between the nominal value and the lower end point cut off voltage. The nominal value is the value of a fully charged battery.

The requirement was to determine the frequency stability of the device under specified environmental operating conditions and ensure they remained within specified operating parameters.

Measurements were made on the top, middle and bottom channels.

The environmental chamber was stabilised at each temperature within the stated temperature range for 30 minutes before testing commenced.

Once the environmental chamber had reached thermal equilibrium, the nominal frequency of the EUT was measured and recorded.

The reported data shows the nominal frequency drift and its' margin from the declared frequency or channel edge.

A2.5. Occupied Bandwidth

The EUT was connected to a spectrum analyser enabled with an occupied bandwidth function via its antenna port.

Measurements were performed to determine the occupied bandwidth in accordance with FCC Part 2.1049. The occupied bandwidth was measured from the fundamental emission at the bottom, middle and top channels.

The occupied bandwidth was measured using the built in occupied bandwidth function of the Rohde and Schwarz FSEB or ESIB spectrum analyser. It was set to measure the bandwidth where 99% of the signal power was contained. The analyser automatically configures the measurement bandwidths to make an accurate measurement based on the channel bandwidth and channel spacing of the EUT.

A2.6. Conducted Emissions

Spurious emission measurements at the antenna port were performed from the lowest declared frequency to 10 times the highest EUT fundamental frequency.

A spectrum analyser was connected to the antenna port of the EUT via a suitable cable and RF attenuator. The total loss of both the cable and the attenuator were measured and entered as a reference level offset into the measuring receiver to correct for the losses.

The frequency band described above was investigated with the transmitter operating at full power on the bottom, middle and top channels. Any spurious emissions noted were then measured.

The recorded emission level was then calculated as a spurious attenuation level using the following formula as described in TIA-EIA-603B.

$$dB = 10 \log_{10} \left(\frac{TX\ power\ in\ watts}{0.001} \right) - \text{spurious level (dBm)}$$

The limit in the standard states that emissions shall be attenuated by not less than 43 + 10 log (P) dB at the channel edge and 55 + 10 log (P) dB at 5.5 MHz from the channel edges, where (P) is the maximum measured fundamental power in Watts for the channel under test. These calculations give absolute levels of -13 dBm and -25 dBm.

The frequency band described above was investigated with the transmitter operating at full power. Any spurious observed were then recorded and compared to the limit. The margin between emission and limit is recorded and should always be positive to indicate compliance.

It should be noted that FCC Part 27.53 states that in the 1 MHz bands immediately outside and adjacent to the applicants declared frequency block may be measured using a resolution bandwidth of at least 1% of the emission bandwidth. The resolution bandwidth used was 100 kHz which exceeded the 1% value for the 7.68 Mcps chip rate.

For the measurements of emissions at the channel edge, plots of the spectral distribution including the fundamental frequency were recorded using a spectrum analyser for the EUT transmitting on bottom, middle and top channels. The method is in accordance with the measurement method detailed in Part 27.53(l) for measurements in the 1 MHz bands immediately outside and adjacent to the channel edge. A resolution bandwidth of 1 MHz was used.

The test equipment settings for conducted antenna port measurements were as follows:

Receiver Function	Settings
Detector Type:	Average
Mode:	Max Hold
Bandwidth:	1 MHz >1 GHz
Bandwidth:	100 kHz <1 GHz
Bandwidth:	10 kHz <30 MHz
Bandwidth:	1 kHz <150 kHz
Amplitude Range:	100 dB
Sweep Time:	Coupled

A2.7. Transmitter Radiated Emissions

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

Initial pre-scans covering the entire measurement band from the lowest generated frequency declared up to 10 times the highest fundamental frequency were performed in order to identify frequencies on which the EUT was generating spurious emissions. This determined the frequencies from the EUT that required further examination. Repetitive scans were performed to allow for emissions with low repetition rates, and for the duty cycle of the EUT.

The initial scans were performed using an antenna height of 1.5 metres and a measurement distance of 3 metres, below 4 GHz; above 18 GHz a 1 metre measurement distance was used, above 26.5 GHz a 0.3 metre measurement distance was used. A limit line was set to the specification limit. Levels within 20 dB of this limit were measured where possible, on occasion; the receiver noise floor came within the 20 dB boundary. On these occasions, the system noise floor may have been recorded.

An open area test site using the appropriate test distance and spectrum analyser with an average detector was used for final measurements.

On the open area test site, at each frequency where a signal was found, the levels were maximised by initially rotating the turntable through 360° and then varying the antenna height between 1 m and 4 m in the horizontal polarisation. 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. The procedure was repeated for the vertical polarisation.

Once the final amplitude (maximised) had been obtained and noted, the EUT was replaced by a substitution antenna, and a substitution method applied. The substitution antennas used were a horn antenna for measurements greater then or equal to 1 GHz and a dipole for measurements below 1 GHz. The centre of the substitution antenna was set to approximately the same centre location as the EUT. The substitution antenna was set to the horizontal polarity. The substitution antenna was matched into a signal generator using a 6 dB or greater attenuator. The signal generator was tuned to the EUT's frequency under test.

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

EIRP = Signal Generator Level - Cable Loss + Antenna Gain

Once the EIRP was obtained, the difference between it and the level of the fundamental emission for the EIRP of the channel under test was noted at the spurious attenuation level in dBc. The following formula was used as described in TIA_EIA_603B

$$dB = 10 \log_{10}\left(\frac{TX\ power\ in\ watts}{0.001}\right) - \text{spurious level (dBm)}$$

Transmitter Radiated Emissions (Continued)

The limit in the standard states that emissions shall be attenuated by not less than 43 + 10 log (P) dB at the channel edge and 55 + 10 log (P) dB at 5.5 MHz from the channel edges, where (P) is the maximum measured fundamental power in Watts for the channel under test. These calculations give absolute levels of -13 dBm and -25 dBm.

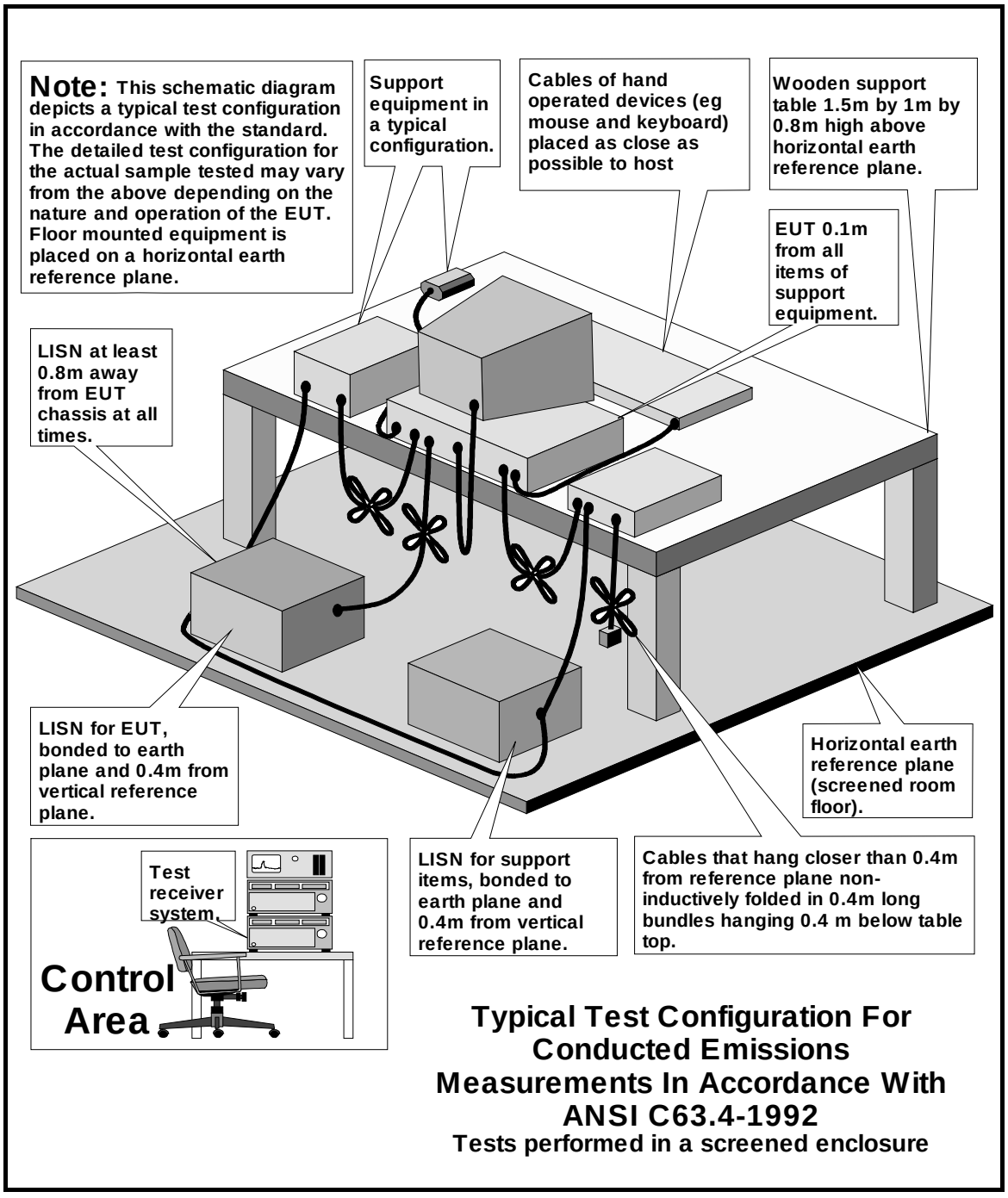
The frequency band described above was investigated with the transmitter operating at full power. Any spurious observed were then recorded and compared to the limit. The margin between emission and limit is recorded and should always be positive to indicate compliance.

Appendix 3. Test Configuration Drawings

This Appendix contains the following drawings:

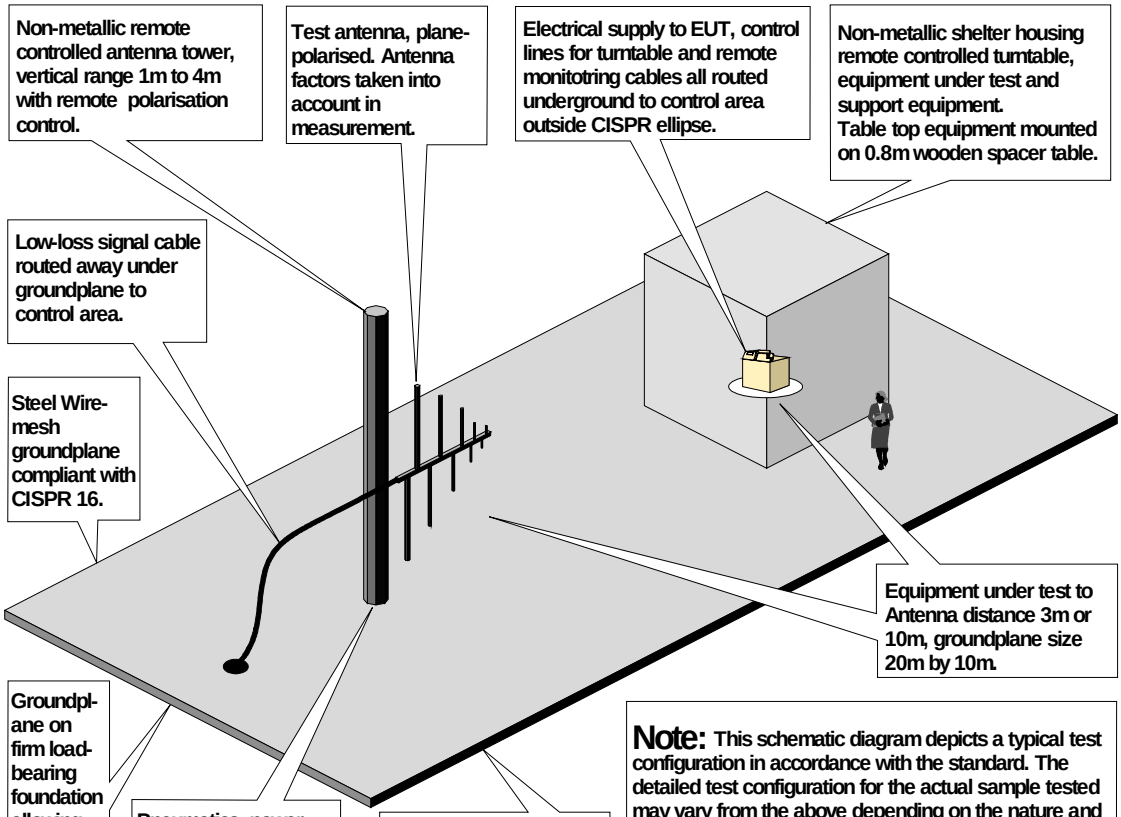
Drawing Reference Number	Title
DRG\49365JD01\EMICON	Test configuration for measurement of conducted emissions
DRG\49365JD01\EMIRAD	Test configuration for measurement of radiated emissions

DRG\49365JD01\EMICON



This diagram is also valid for the latest version of ANSI C63.4-2003

DRG\49365JD01\EMIRAD



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

Test Configuration For Radiated Emissions Measurements

Reflection-free area: >60m by 52m (CISPR ellipse)
Groundplane Earthed
Control room outside CISPR ellipse