TEST REPORT
FROM
RFI GLOBAL SERVICES LTD

Test of: 3000 DAS – Coaxial Remote Unit

To: FCC Part 27: 2009 Subpart C

Test Report Serial No:
RFI/RPT2/RP77098JD03A

Supersedes Test Report Serial No:
RFI/RPT1/RP77098JD03A

This Test Report Is Issued Under The Authority of Brian Watson, COO Payments and Consultancy:	pp R. Graham
Checked By: R. Graham	R. Graham
Date of Issue:	04 March 2010

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1. Customer Information

Company Name:	Zinwave Ltd.
Address:	Harston Mill Harston Cambridge CB22 7GG

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR27
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications) 2009: Part 27 Subpart H (Miscellaneous Wireless Communication Services)
Site Registration:	209735
Location of Testing:	RFI Global Services Ltd, Wade Road, Basingstoke, Hampshire, RG24 8AH.
Test Dates:	05 February 2010 to 09 February 2010

2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Port Type	Result
FCC 27.50(c)(1)	Transmitter Effective Radiated Power (ERP)	Antenna Terminals	✓
FCC 2.1049	Transmitter Occupied Bandwidth	Antenna Terminals	✓
FCC 2.1051/27.53(g)	Transmitter Conducted Emissions (Out of Band)	Antenna Terminals	✓
FCC 2.1053/27.53(g)	Transmitter Radiated Emissions (Out of Band)	Enclosure	✓

Key to Results

✓ = Complied ✗ = Did not comply

2.3. Methods and Procedures

Reference:	ANSI/TIA-603-C-2004
Title:	Land Mobile Communications Equipment, Measurements and performance Standards
Reference:	ANSI C63.4 (2003)
Title:	American National Standard Methods of Measurement of Electromagnetic Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

2.4. Deviations from the Test Specification

The testing has been performed in accordance with the following test plan produced by DheaniSulis for Zinwave for the Part 27, 728 MHz – 763 MHz band only:

3000 DAS: FCC test plan to parts 22H and 27
Document Number: DS09_ZIN_TP02_A; Issue Date: 25 January 2010

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Description:	Distributed Antenna System – Primary Hub
Brand Name:	Zinwave
Model Name or Number:	3000 DAS
Part Number:	302-0001
Serial Number:	000006
Hardware Version Number:	3.13

Description:	Distributed Antenna System – Remote Unit - Coaxial
Brand Name:	Zinwave
Model Name or Number:	Coaxial RU
Part Number:	302-0006
Serial Number:	140130000126
FCC ID Number:	UPO302-0006

3.2. Support Equipment

Description:	Distributed Antenna System – Remote Unit - Fibre
Brand Name:	Zinwave
Model Name or Number:	Fibre RU
Part Number:	302-0007
Serial Number:	310230001218
FCC ID Number:	UPO302-0007

Description:	Remote Unit – Fibre, Power Supply Unit
Brand Name:	Ideal Power
Model Name or Number:	HK-HP-A12
Serial Number:	None stated

3.3. Description of EUT

The 3000 Hub and wideband remote unit is a bi-directional wide-band repeater station with a pass band of 136 MHz to 2700 MHz. Signals are transferred between the hub and remote unit via coaxial cable.

3.4. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.5. Additional Information Related to Testing

Power Supply Requirement:	120 V AC, 60 Hz		
Equipment Category:	Control Station		
Type of Unit:	DAS (Distributed Antenna System)		
Transmit Frequency Range:	728 MHz to 763 MHz		
Transmit Channels Tested:	**Modulation**	**Bandwidth (MHz)**	**Channel Frequency (MHz)**
	OFDM 64QAM	5	728.0
	OFDM 64QAM	10	728.0
Maximum Power Output (ERP)	28.0 dBm		

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

The EUT was tested in the following operating mode(s):

- . Transmit mode, (maximum output power/gain).

4.2. Configuration and Peripherals

The EUT was tested in the following configuration(s):

- The EUT comprises of three separate units. One Primary Hub and two Remote Units [1x Fibre Optic, 1x Coaxial Unit]. The primary hub was connected to the remote unit via fibre optic cables and coaxial cables depending on the unit connected. An input signal was fed into the primary hub and was measured from the output of the remote unit. The remote unit was operating at maximum output power with the maximum gain settings allowed.
- For radiated emissions testing, the EUT was connected to an input signal. The input level was adjusted to give a signal output level of +20.0 dBm. Testing was performed on both the fibre unit and coaxial units with the antenna ports on the remote units terminated.
- For conducted testing, the EUT was connected with one input signal which was fed into the unit with the antenna port on the remote unit used as the measurement point. Measurements were performed on the coaxial unit only. The fibre unit remained terminated throughout the testing.

5. Measurements, Examinations and Derived Results

5.1. General Comments

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 6. Measurement Uncertainty* for details.

5.2. Test Results

5.2.1. Transmitter Effective Radiated Power (ERP)

Test Summary:

FCC Part:	27.50 (c) (9)
Test Method Used:	ANSI TIA-603-C-2004 Section 2

Environmental Conditions:

Temperature (°C):	21
Relative Humidity Variation (%):	34

Results: 5 MHz Bandwidth

Frequency (MHz)	Conducted RF O/P Power (dBm)	Declared Antenna Gain (dB)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
728	19.9	8.0	27.9	44.8	16.9	Complied

Results: 10 MHz Bandwidth

Frequency (MHz)	Conducted RF O/P Power (dBm)	Declared Antenna Gain (dB)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
728	20.0	8.0	28.0	44.8	16.8	Complied

5.2.2. Transmitter Occupied Bandwidth

Test Summary:

FCC Part:	2.1049
Test Method Used:	As detailed in ANSI C63.4 Section 13.1.7 and relevant annexes

Environmental Conditions:

Temperature Variation (°C):	21
Relative Humidity Variation (%):	34

Results: Input Signal 5 MHz Bandwidth

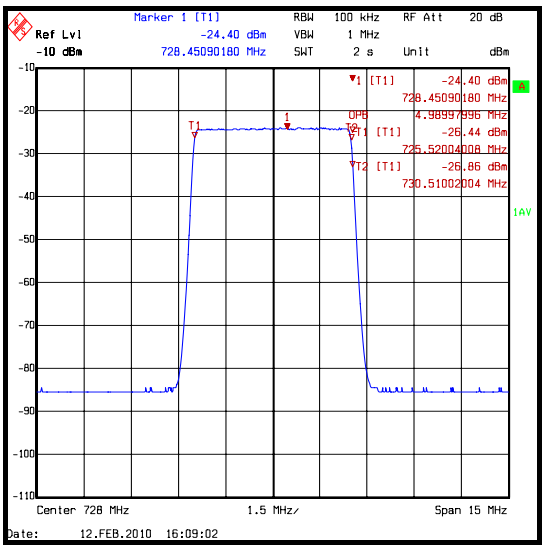
Frequency (MHz)	Occupied Bandwidth (kHz)
728.000	4989.980

Results: Output Signal 5 MHz Bandwidth

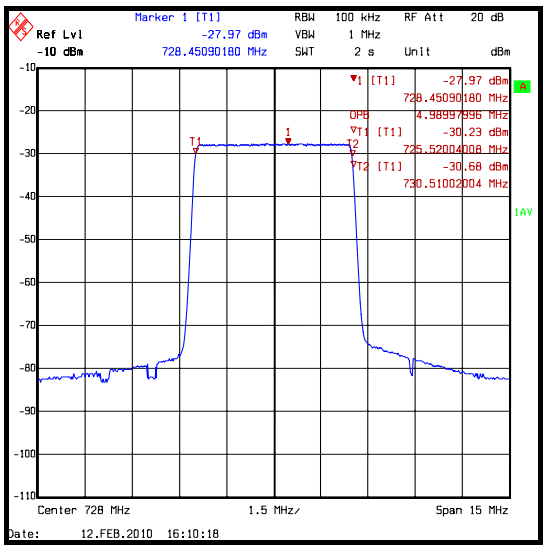
Frequency (MHz)	Occupied Bandwidth (kHz)
728.000	4989.980

Note(s):

1. In lieu of the test method detailed in ANSI C63.4 Section 13.1.7 the occupied bandwidth was measured using the Occupied Bandwidth function of the spectrum analyser.



Input Signal



Output Signal

NB: The signal level indicated in the 'Input Signal' graph above was taken with A1418 (30dB attenuator) removed from the measurement set up. The spectrum analyser reference level offset was not modified to reflect this change as the measurement result is independent of the actual signal level.

5.2.3. Transmitter Occupied Bandwidth (Bandwidth Limitations)

Test Summary:

FCC Part:	2.1049
Test Method:	As detailed in ANSI C63.4 Section 13.1.7 and relevant annexes

Environmental Conditions:

Temperature (°C):	21
Relative Humidity (%):	34

Results: Input Signal 10 MHz Bandwidth

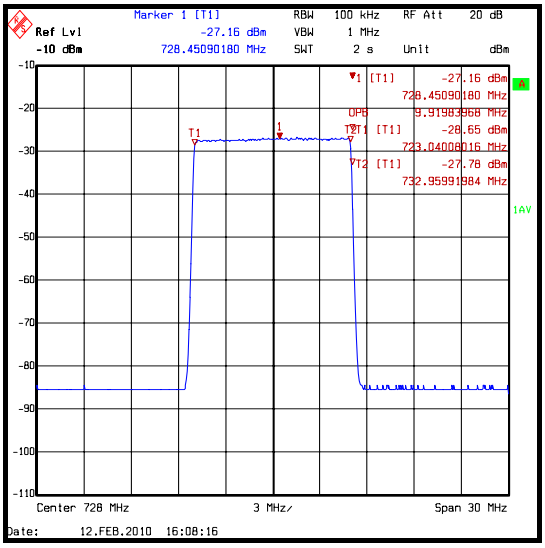
Frequency (MHz)	Occupied Bandwidth (kHz)
728.000	9919.840

Results: Output Signal 10 MHz Bandwidth

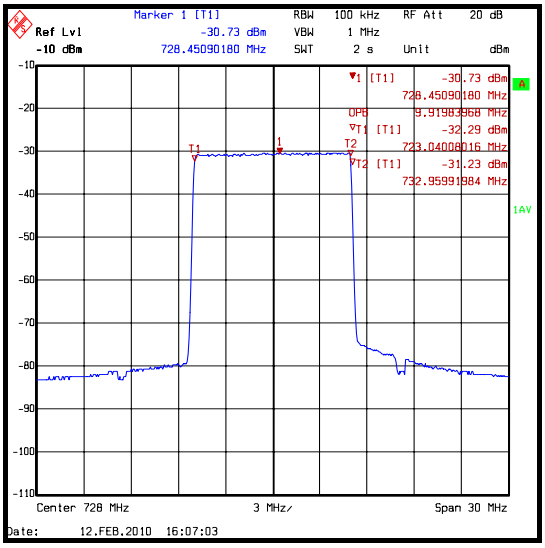
Frequency (MHz)	Occupied Bandwidth (kHz)
728.000	9919.840

Note(s):

1. In lieu of the test method detailed in ANSI C63.4 Section 13.1.7 the occupied bandwidth was measured using the Occupied Bandwidth function of the spectrum analyser.



Input Signal



Output Signal

NB: The signal level indicated in the 'Input Signal' graph above was taken with A1418 (30dB attenuator) removed from the measurement set up. The spectrum analyser reference level offset was not modified to reflect this change as the measurement result is independent of the actual signal level.

5.2.4. Transmitter Conducted Emissions (Out of Band)

Test Summary:

FCC Part:	2.1051 & 27.53 (g)
Test Method:	As detailed in ANSI C63.4 Section 8 and relevant annexes

Environmental Conditions:

Temperature (°C):	21
Relative Humidity (%):	34

Results: 5 MHz Bandwidth

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
1787	-15.3	-13.0	2.3	Complied
2683	-21.3	-13.0	8.3	Complied

Results: 10 MHz Bandwidth

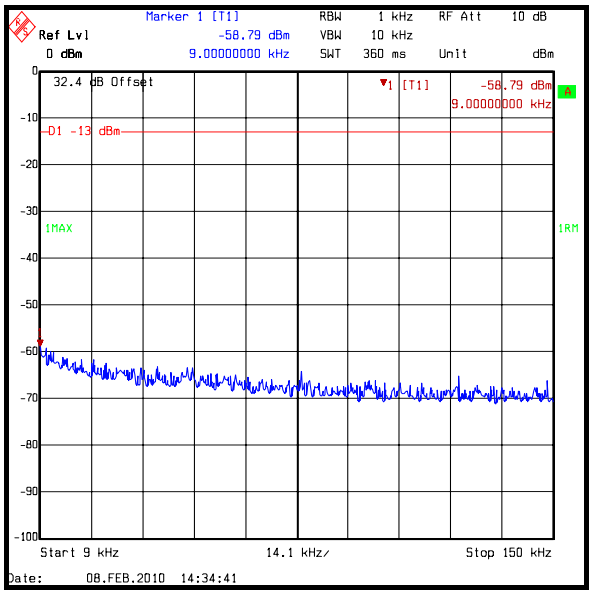
Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
1791.227	-17.7	-13.0	4.7	Complied
2681.215	-24.8	-13.0	11.8	Complied

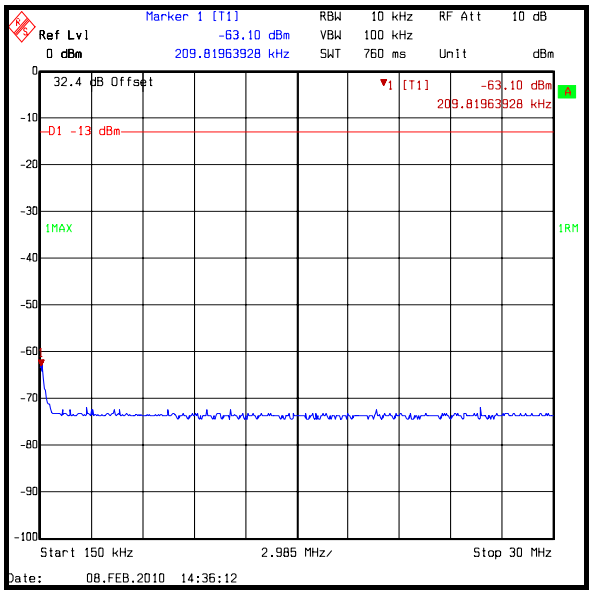
Note(s):

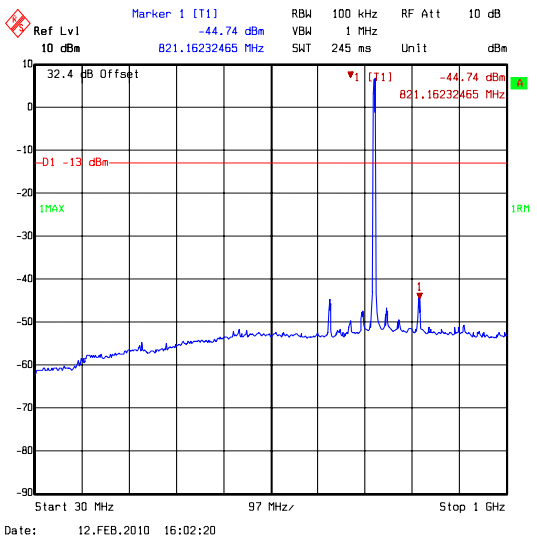
1. All other emissions were at least 20 dB below the limit.
2. The emission shown exceeding the limit in the 30 MHz to 1 GHz plot is the 728 MHz fundamental.

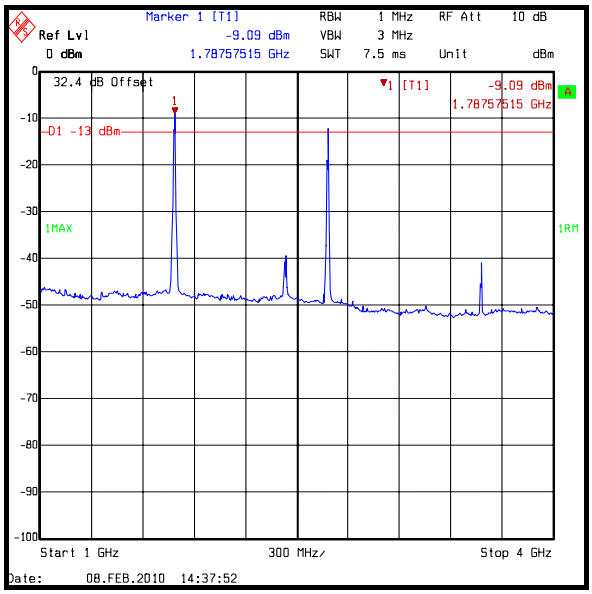
Transmitter Conducted Emissions (Out of Band) (continued)

5 MHz Bandwidth





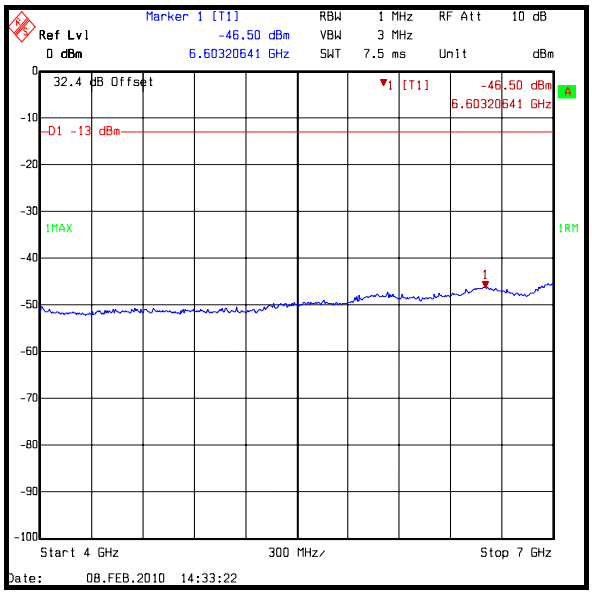


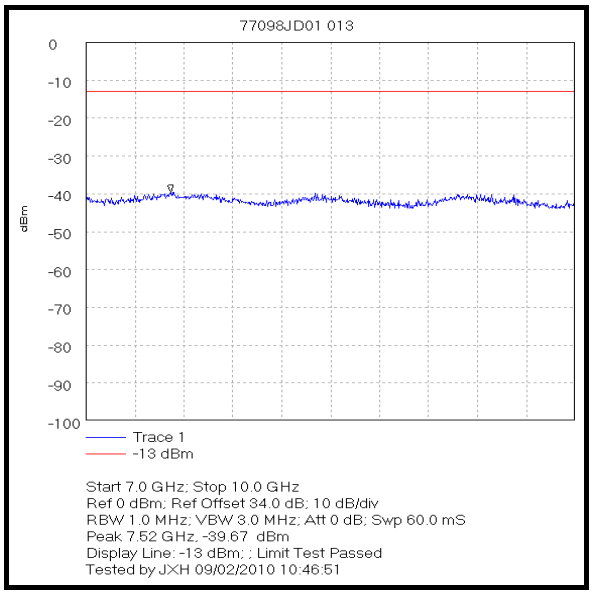


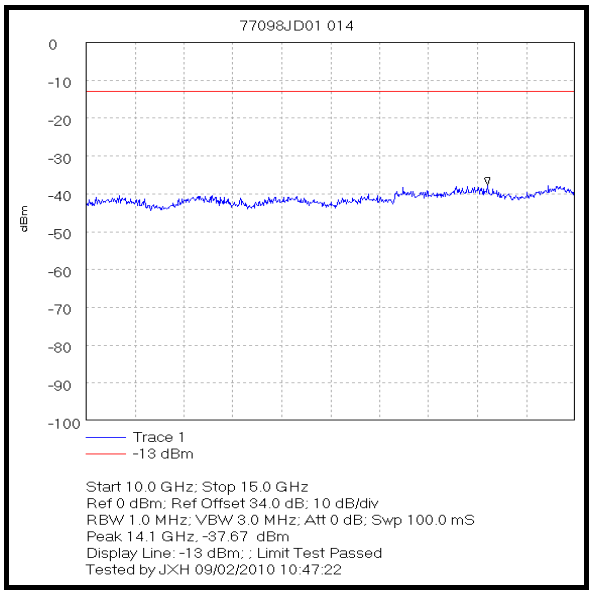
Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

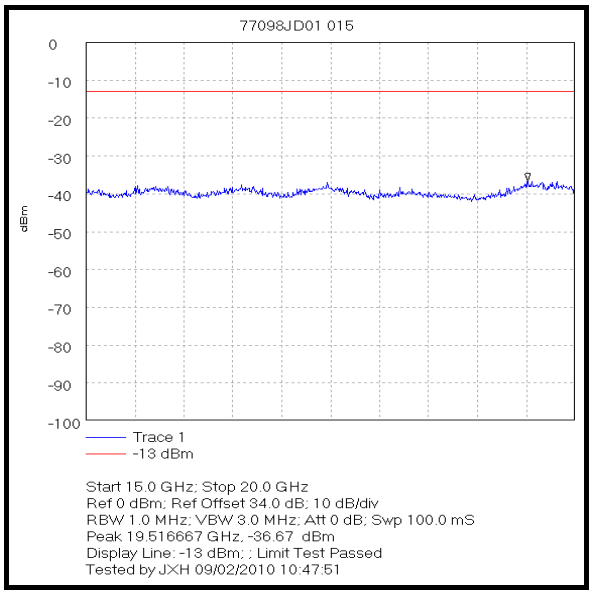
Transmitter Conducted Emissions (Out of Band) (continued)

5 MHz Bandwidth









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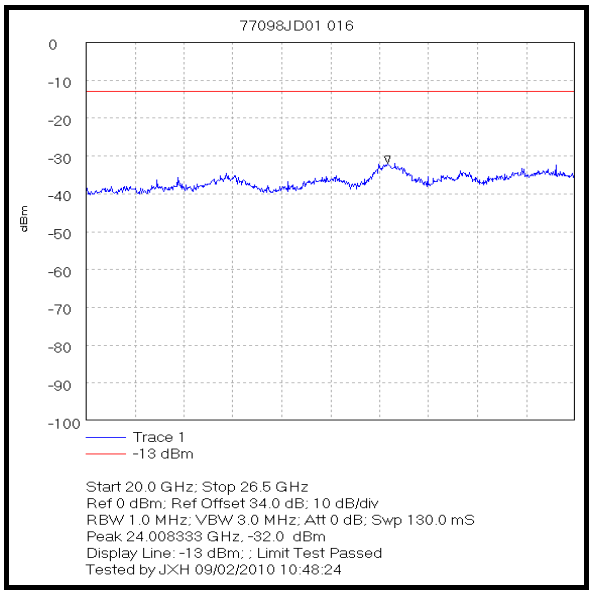
Transmitter Conducted Emissions (Out of Band) (continued)

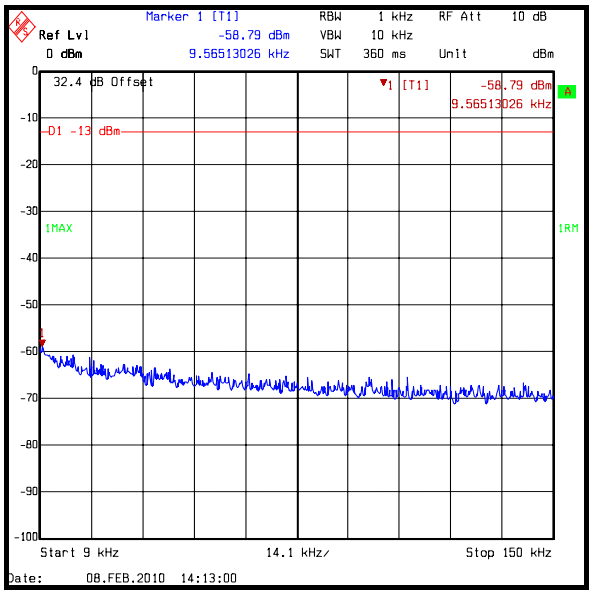
5 MHz Bandwidth

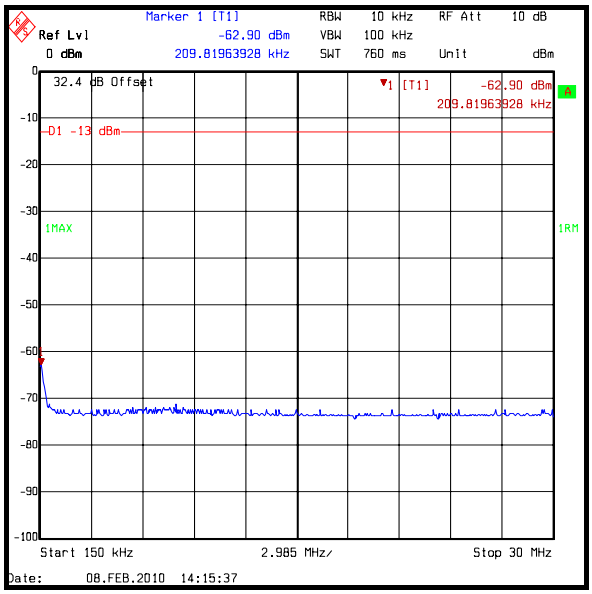


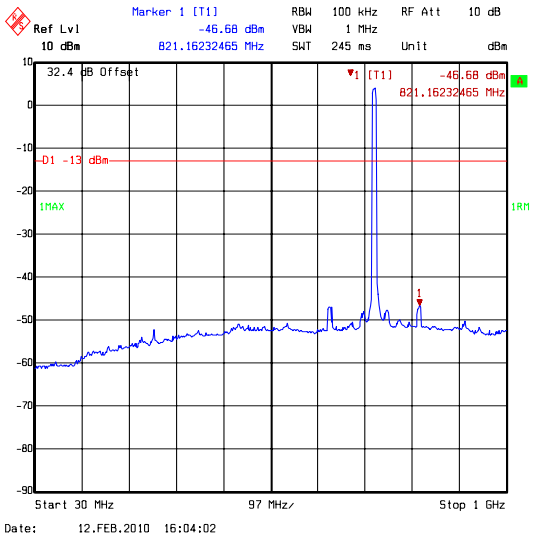
Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

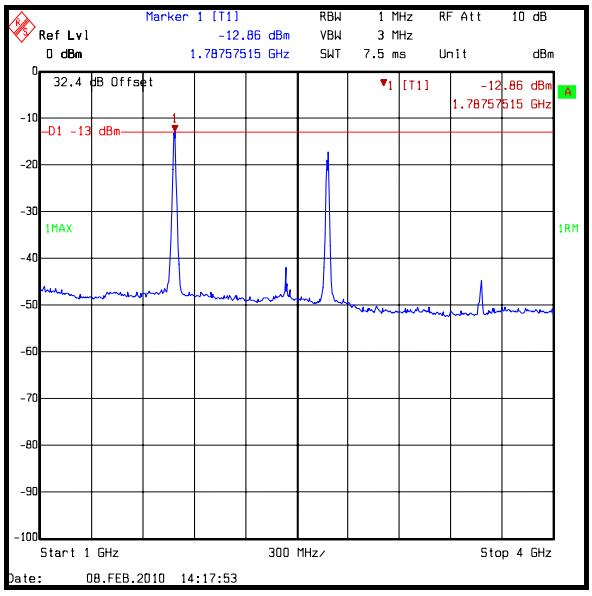
Transmitter Conducted Emissions (Out of Band) (continued)

10 MHz Bandwidth





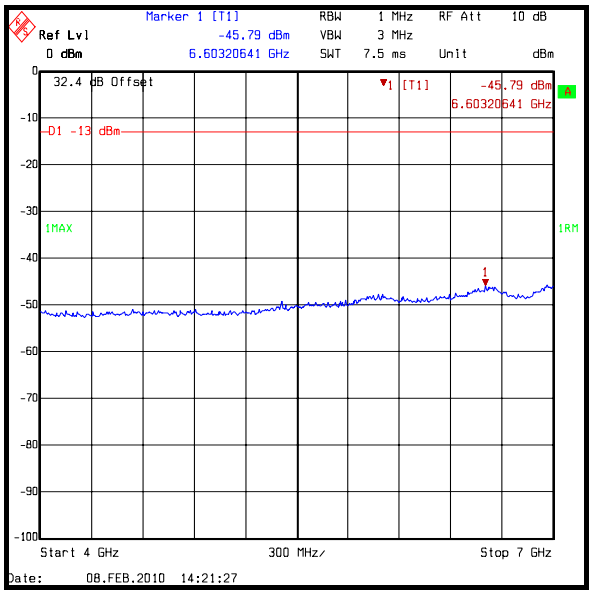


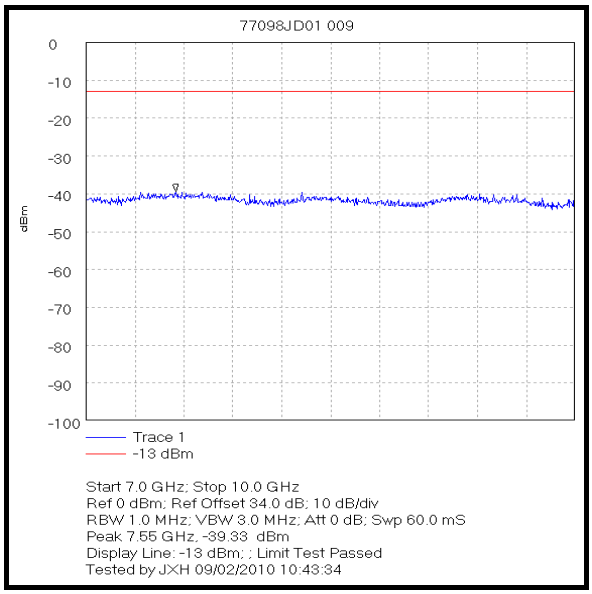


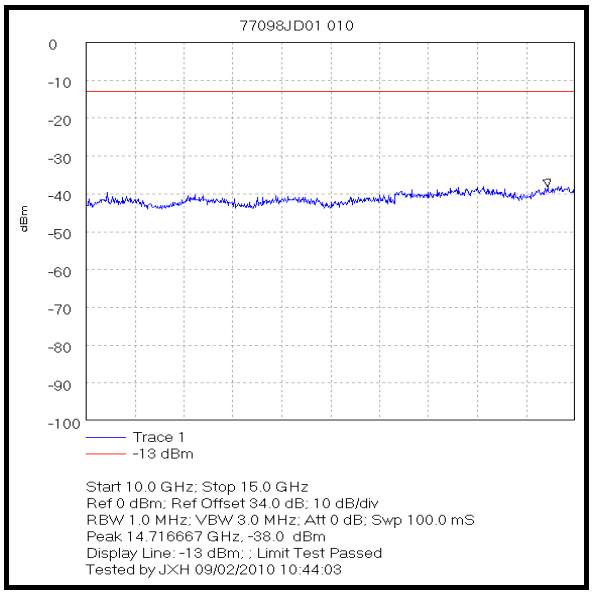
Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

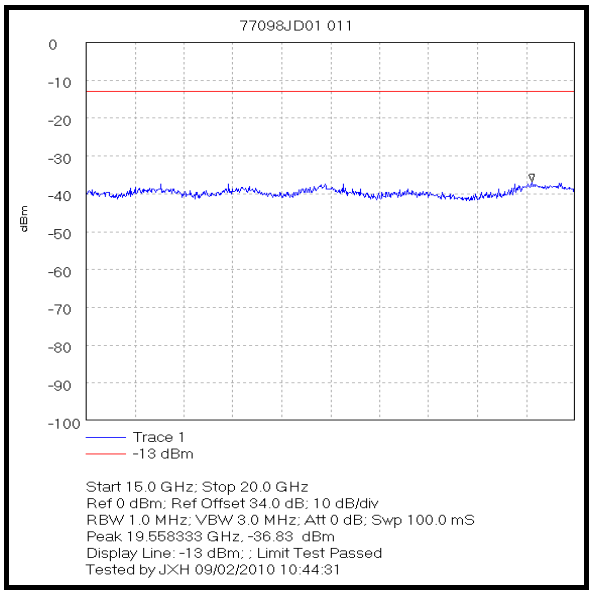
Transmitter Conducted Emissions (Out of Band) (continued)

10 MHz Bandwidth





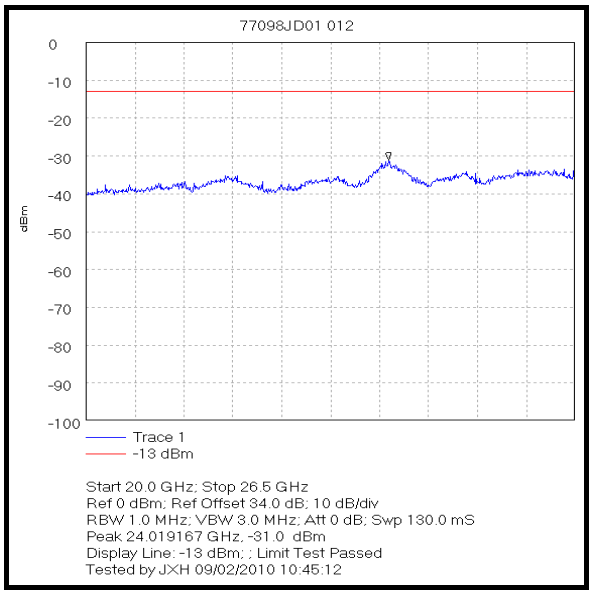




Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables

Transmitter Conducted Emissions (Out of Band) (continued)

10 MHz Bandwidth



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

5.2.5. Transmitter Radiated Emissions (Out of Band)

Test Summary:

FCC Part:	2.1053 & 27.53 (g)
Test Method:	As detailed in ANSI C63.4 Section 8 and relevant annexes

Environmental Conditions:

Temperature (°C):	21
Relative Humidity (%):	31

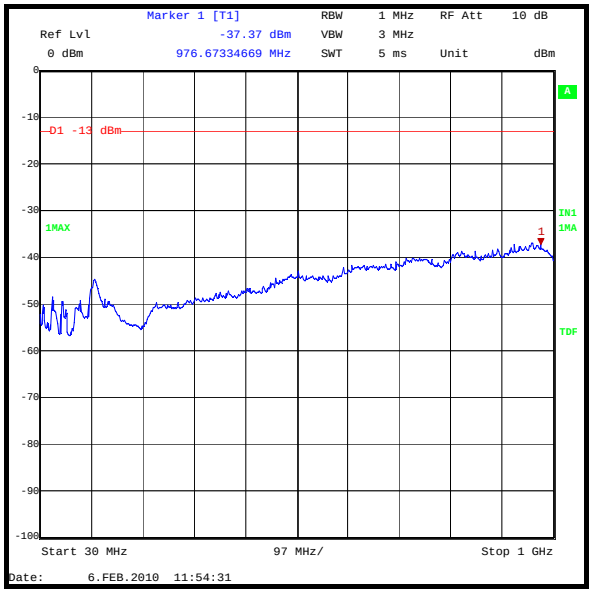
Results:

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
Refer to note 1				

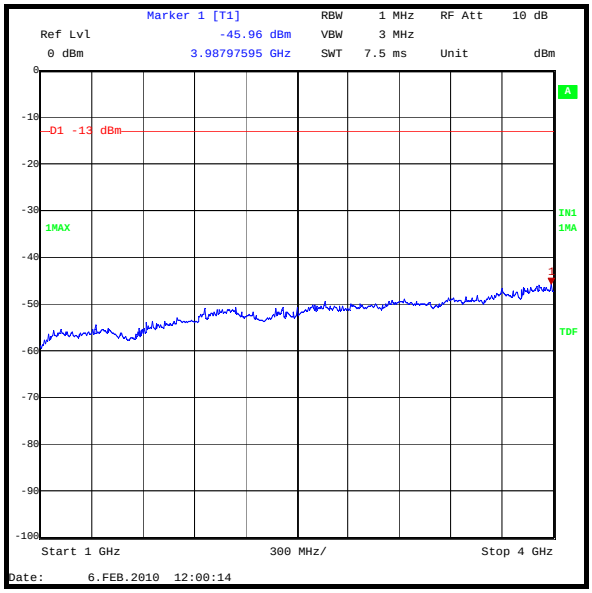
Note(s):

1. All emissions were greater than 20 dB below the limit.

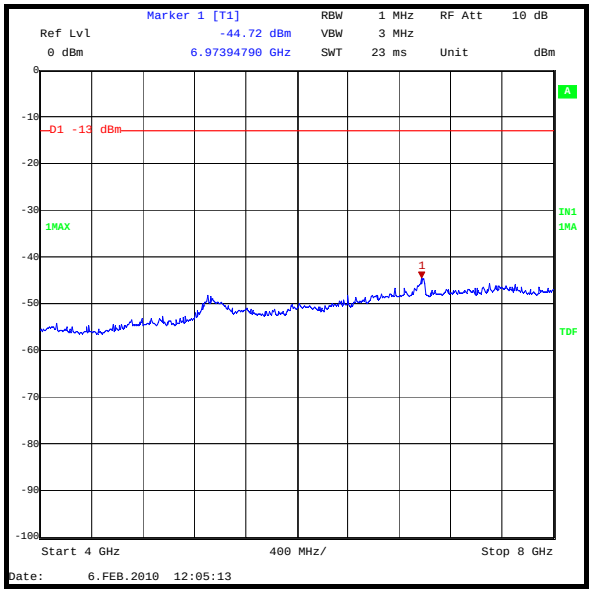
Transmitter Radiated Emissions (Out of Band) (continued)



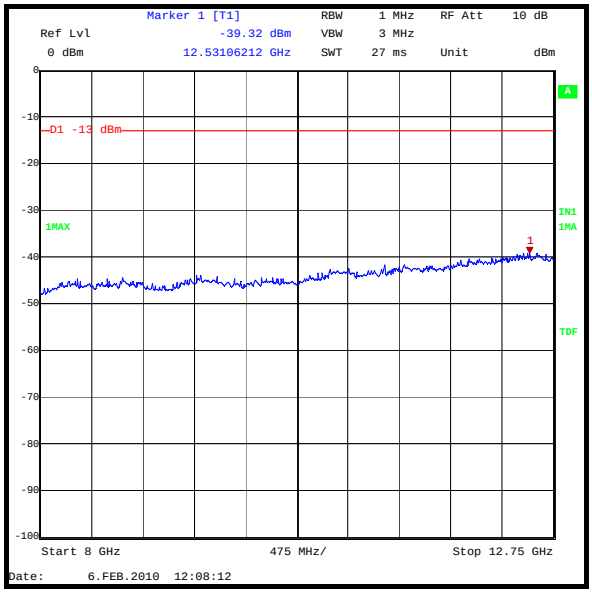
30 MHz to 1 GHz



1 GHz to 4 GHz



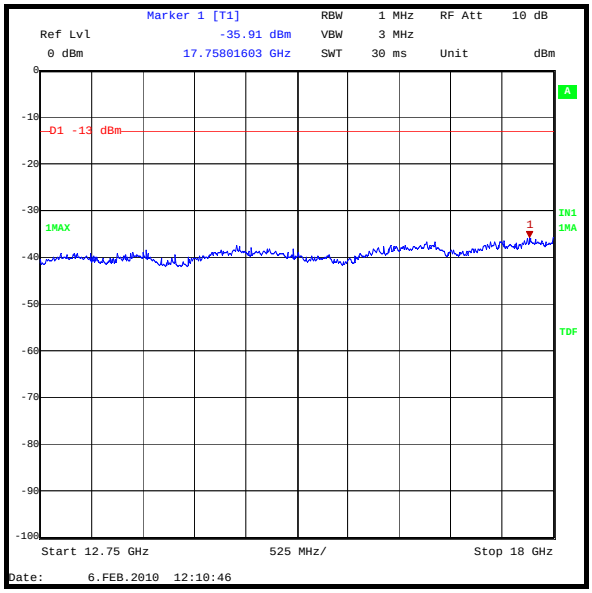
4 GHz to 8 GHz



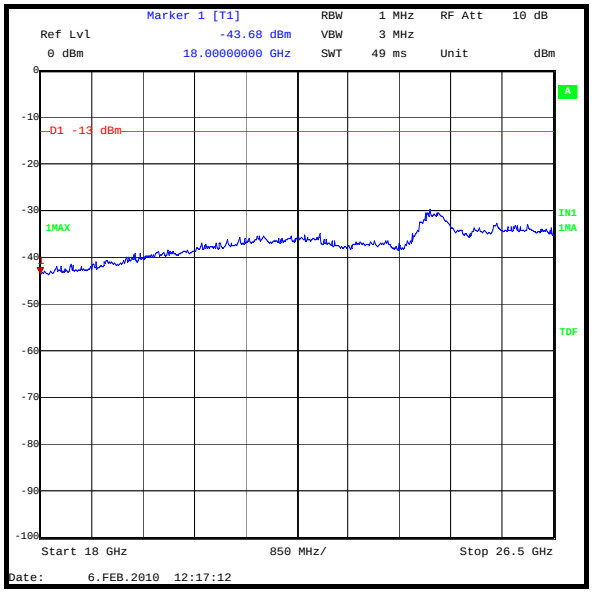
8 GHz to 12.75 GHz

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

Transmitter Radiated Emissions (Out of Band) (continued)



12.75 GHz to 18 GHz



18 GHz to 26.5 GHz

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

6. 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
Effective Radiated Power (ERP)	728 - 763 MHz	95%	±2.94 dB
Occupied Bandwidth	728 - 763 MHz	95%	±0.92ppm
Conducted Spurious Emissions	9 kHz to 26.5 GHz	95%	± 2.62 dB
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	±3.53 dB
Radiated Spurious Emissions	30 MHz to 26.5 GHz	95%	±2.94 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)
A1418	Attenuator	HP	N/A	CSC21296	Calibrated before use	-
C1263	Cable	Rosenberger	FA210A1020005050	49316-01	29 Mar 2009	12
C151	Cable	Rosenberger	UFA210A-1-1181-70x70	None	20 Apr 2009	12
L1000	R&S SFU	Rhode and Schwarz	2110.250K02	100865	Calibrated before use	-
M127	Spectrum Analyser	Rohde & Schwarz	FSEB 30	842 659/016	10 Jul 2009	12
M166	Thermometer/ Barometer/ Hygrometer	EuroCom	None	None	30 Apr 2009	12

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