



TEST REPORT FROM RFI GLOBAL SERVICES LTD

Test of: 3000 DAS

To: FCC Part 90: 2008 Subpart I

Test Report Serial No:
RFI/RPT2/RP76527JD01A

Supersedes Test Report Serial No:
RFI-RPT1-RP76527JD01A

This Test Report Is Issued Under The Authority Of Brian Watson, Operations Director: 	
Checked By:	Tony Henriques
Signature:	 pp
Date of Issue:	23 December 2009

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Table of Contents

1. Customer Information 4

2. Summary of Testing 5

3. Equipment Under Test (EUT) 6

4. Operation and Monitoring of the EUT during Testing 8

5. Measurements, Examinations and Derived Results 9

6. Measurement Uncertainty 25

Appendix 1. Test Equipment Used 26

1. Customer Information








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

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR90
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications) 2008: Part 90 Subpart I
Site Registration:	FCC: 209735
Location of Testing:	RFI Global Services Ltd, Wade Road, Basingstoke, Hampshire, RG24 8AH.
Test Dates:	21 November to 16 December 2009

2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Port Type	Result
Parts 90.205(d) & 2.1046	Transmitter Carrier Output Power (EIRP)	Antenna Port	
Parts 90.209 & 2.1049	Transmitter Occupied Bandwidth (Bandwidth Limitations)	Antenna Port	
Parts 90.210 & 2.1051	Transmitter Conducted Emissions (Out of Band)	Antenna Port	
Parts 90.210 & 2.1053	Transmitter Radiated Emissions (Out of Band)	Enclosure	
Part 90.214	Transmitter Transient Frequency Behaviour	Antenna Port	
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:

3000 DAS: FCC test plan to parts 74 part H and 90 part I

Document Number: DS09_ZIN_TP01_C; Issue Date: 11 November 2009

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
FCC ID Number:	UPO302-0007 or UPO302-0006*

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:	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

**The FCC ID for the Primary Hub when matched with the Fibre Remote Unit as a system is UPO302-0007 and when matched as a system with the Coaxial Remote Unit the FCC ID is UPO302-0006*

3.2. Description of EUT

The 3000 Hub and wideband remote unit is a bi-directional wide-band repeater station with a pass band of 136 – 2700 MHz.

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing

Power Supply Requirement:	120 V AC, 60 Hz		
Equipment Category:	Base Station		
Type of Unit:	DAS (Distributed Antenna System)		
Transmit Frequency Range:	136 MHz to 174 MHz		
Transmit Channels Tested:	Modulation	Bandwidth	Channel Frequency (MHz)
	C4FM	12.5 kHz	136 MHz See note 1
	±2.5 kHz FM	12.5 KHz	136 MHz See note 1
Maximum Power Output (EIRP)	28.0 dBm		

Note(s):

1. Tests of Transmitter Transient Frequency Behaviour were performed using a test frequency of 150 MHz whilst all other tests were performed using a test frequency of 136 MHz as per the requirements of the test plan referenced in section 2.4 of this report.

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 to. 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 three input signals into the separate input ports. The levels were adjusted to give a composite 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 Carrier Output Power (EIRP)

Test Summary:

FCC Part:	90.205(d) & 2.1046
Test Method:	As detailed in TIA-603-C Section 2.2.1

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	35

Results: - C4FM

Frequency (MHz)	Conducted RF O/P Power (dBm)	Declared Antenna Gain (dB)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)	Result
136.0	20.0	8.0	28.0	32.2*	4.2	Complied

Results: - ±2.5 kHz FM

Frequency (MHz)	Conducted RF O/P Power (dBm)	Declared Antenna Gain (dB)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)	Result
136.000	20.0	8.0	28.0	32.2*	4.2	Complied

Note(s):

1. * The ERP limit is 30.0 dBm. In order to convert this to an EIRP limit 2.2 dB was added giving an EIRP limit of 32.2 dBm.

5.2.2. Transmitter Occupied Bandwidth (Bandwidth Limitations)**Test Summary:**

FCC Part:	90.209 & 2.1049
Test Method:	As detailed in ANSI C63.4 Section 13.1.7 and relevant annexes (see note below)

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	36

Results: Input Signal

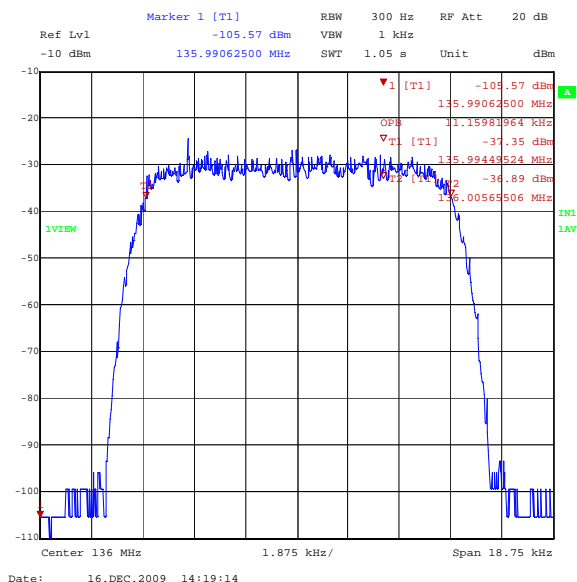
Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)
136.0	11.160	11.250

Results: Output Signal

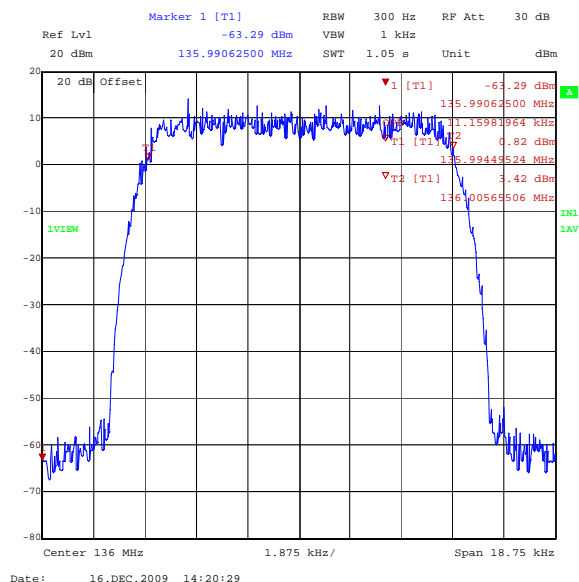
Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)
136.0	11.160	11.250

Note(s):

- 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

5.2.3. Transmitter Occupied Bandwidth (Bandwidth Limitations)**Test Summary:**

FCC Part:	90.209 & 2.1049
Test Method:	As detailed in ANSI C63.4 Section 13.1.7 and relevant annexes (see note below)

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	36

Results: Input Signal - ± 2.5 kHz

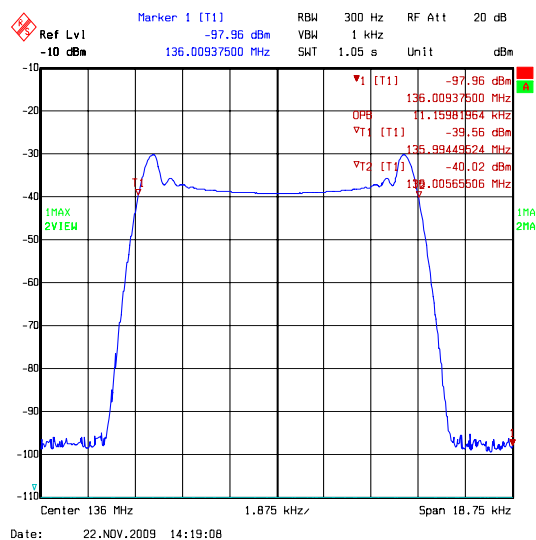
Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)
136.0	11.160	11.250

Results: Output Signal - ± 2.5 kHz

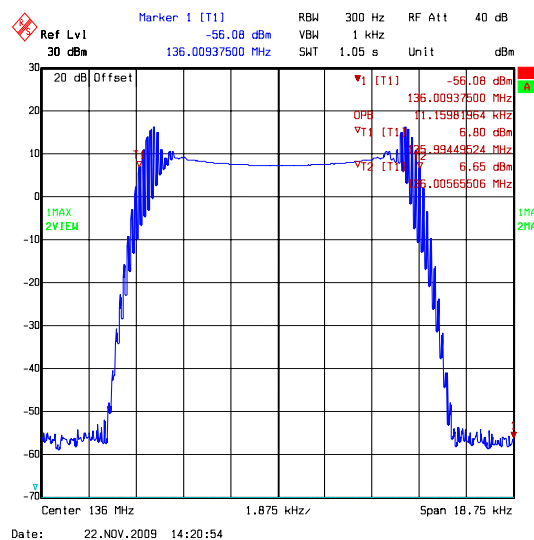
Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)
136.0	11.160	11.250

Note(s):

- 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

5.2.4. Transmitter Conducted Emissions (Out of Band)**Test Summary:**

FCC Part:	90.210 & 2.1051
Test Method:	As detailed in TIA-603-C Section 2.2.13

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	35

Results: - C4FM

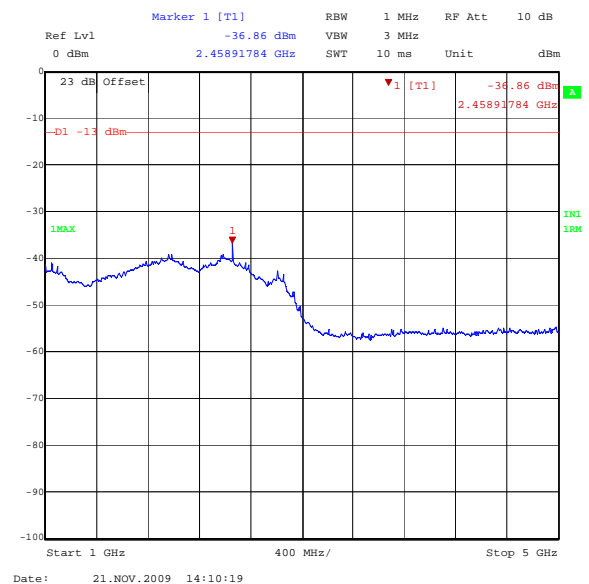
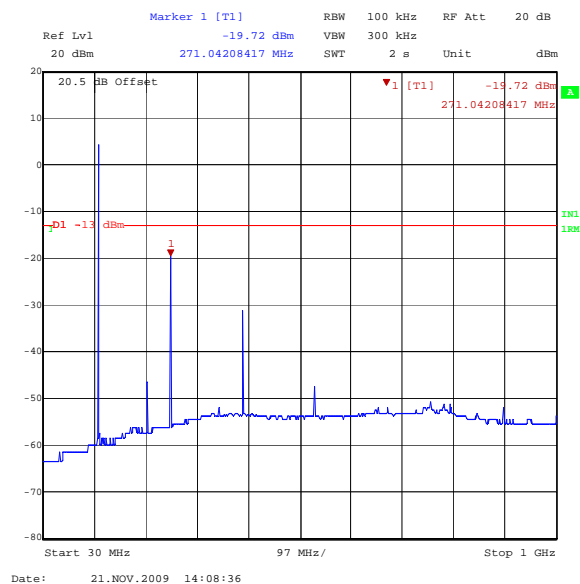
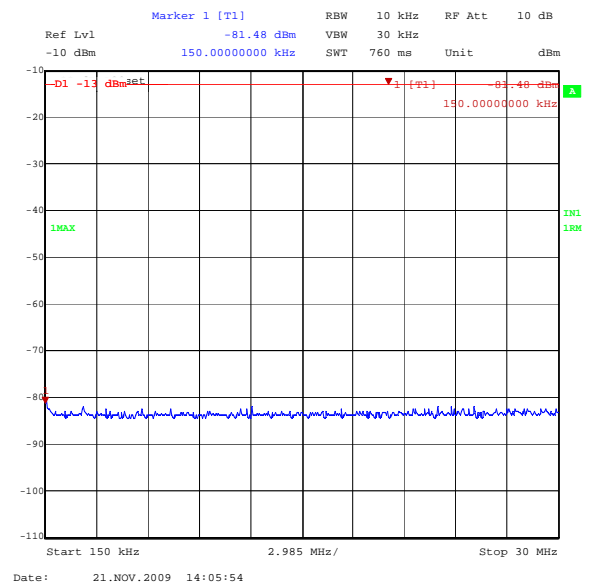
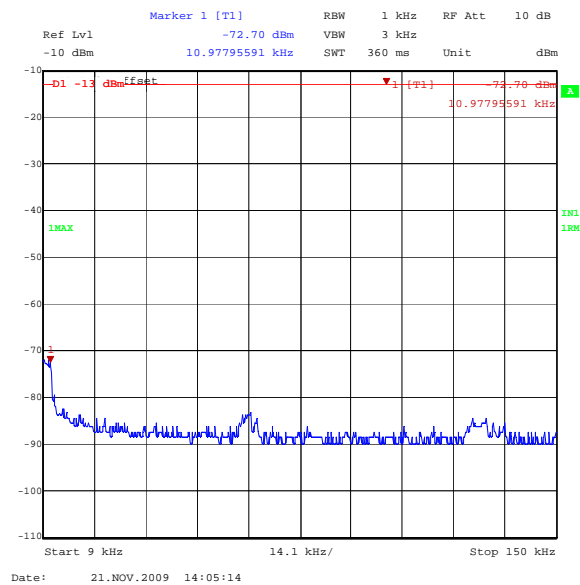
Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
272.000	-19.7	-13.0	6.7	Complied
408.000	-28.0	-13.0	15.0	Complied

Results: - ±2.5 kHz FM

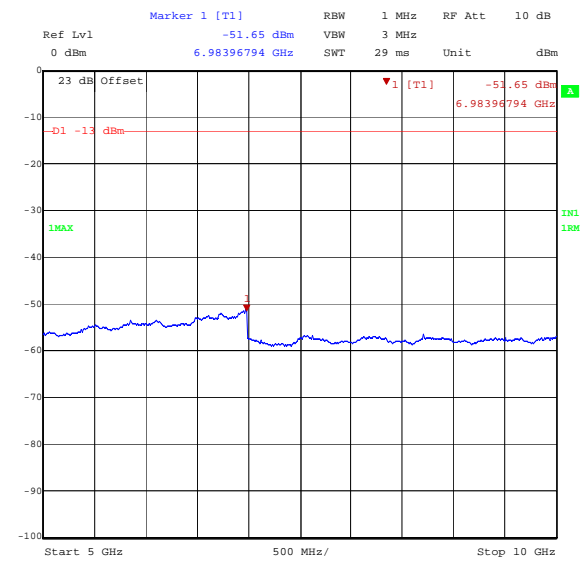
Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
272.000	-18.6	-13.0	5.6	Complied
408.000	-26.3	-13.0	13.3	Complied

Note(s):

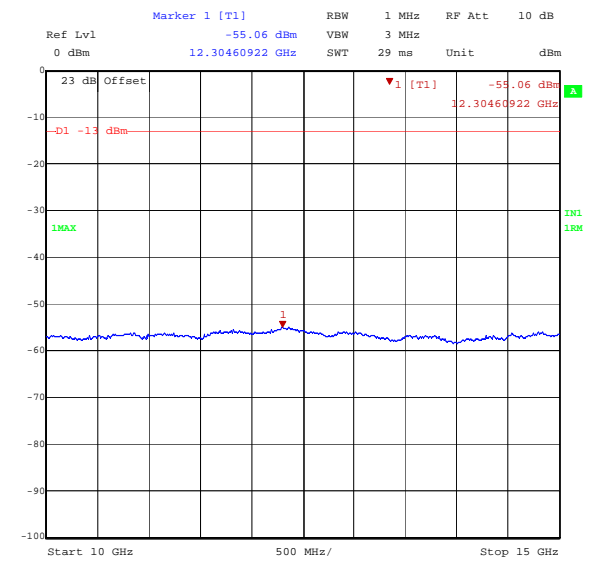
1. All other emissions were at least 20 dB below the limit
2. The emission shown exceeding the limit in the 30 MHz to 1 GHz plot is the 136 MHz fundamental.

Transmitter Conducted Emissions (Out of Band) (continued) - C4FM

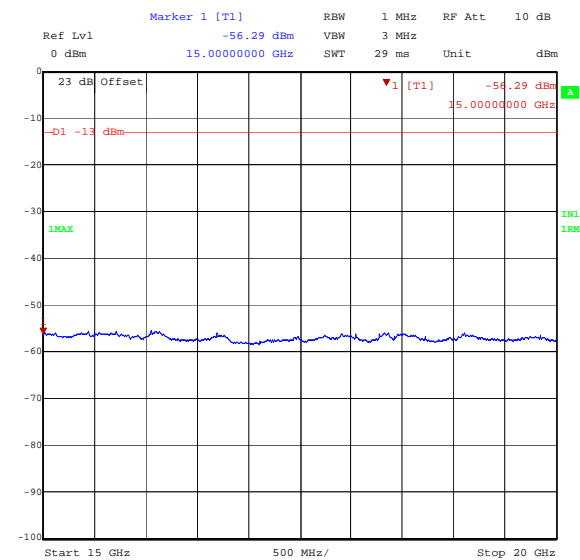
Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Transmitter Conducted Emissions (Out of Band) (continued)

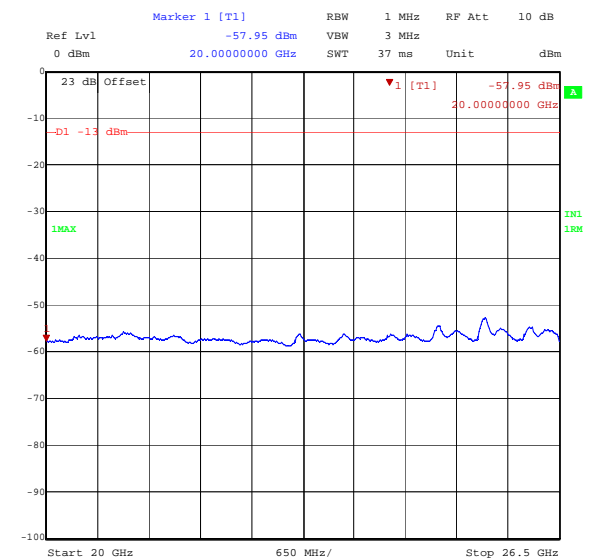
Date: 21.NOV.2009 14:10:52



Date: 21.NOV.2009 14:12:00

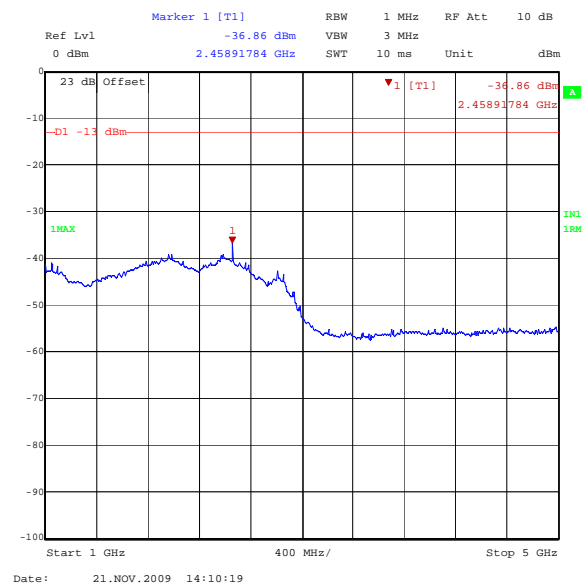
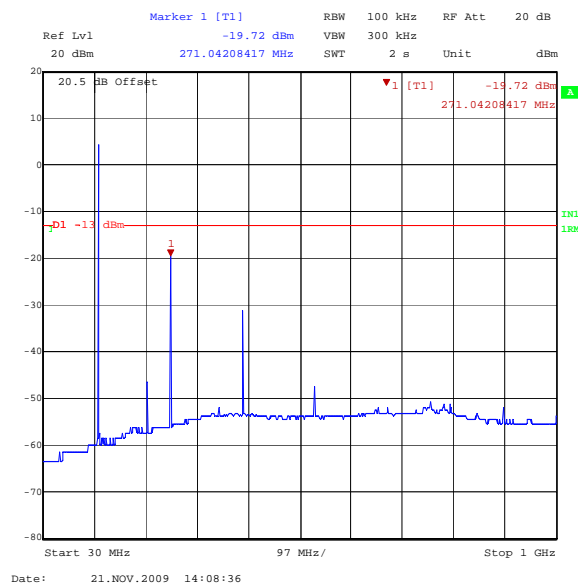
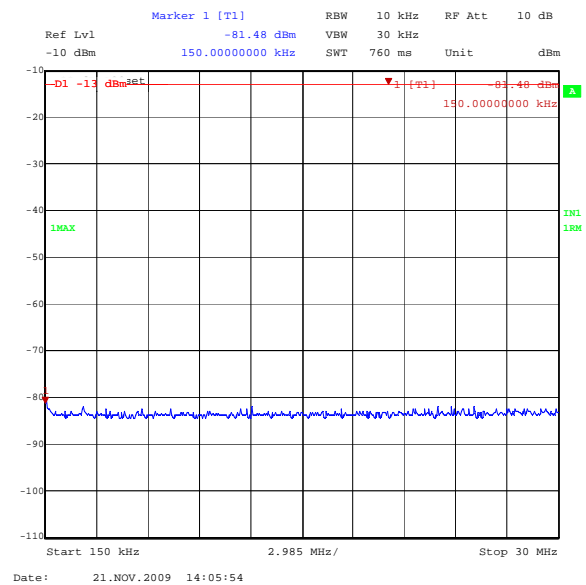
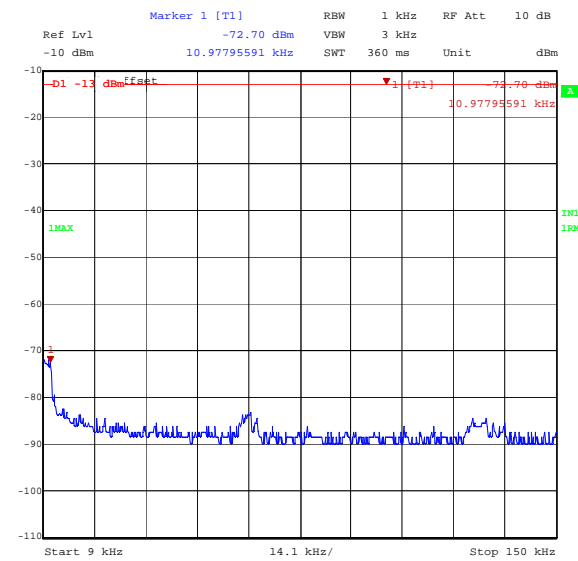


Date: 21.NOV.2009 14:13:05

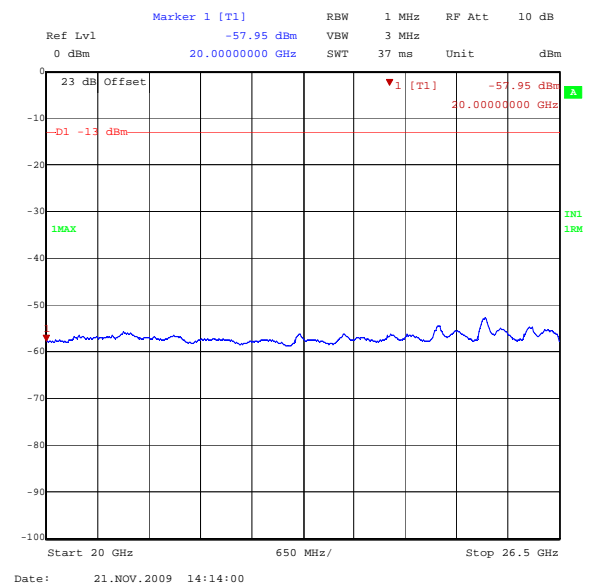
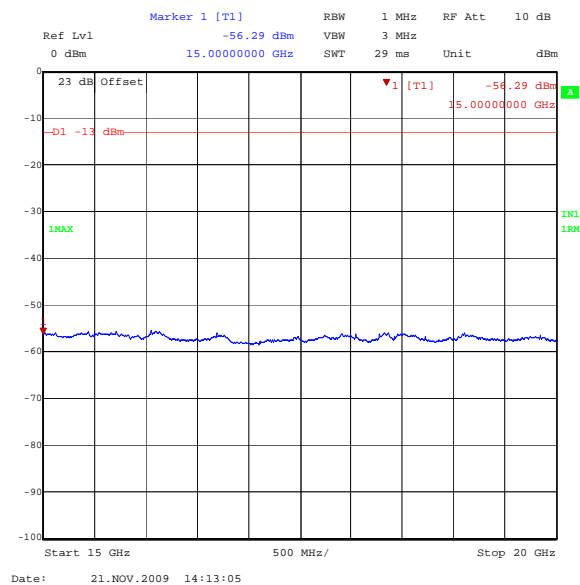
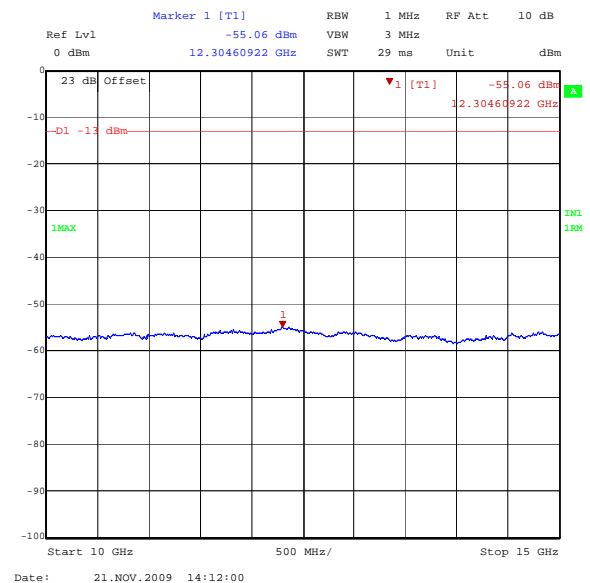
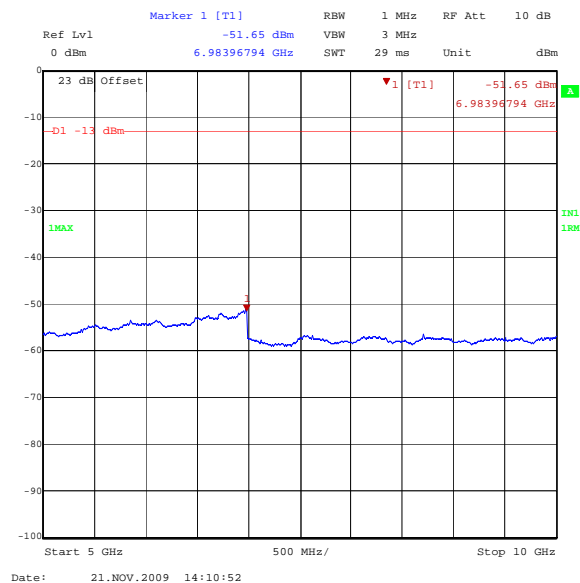


Date: 21.NOV.2009 14:14:00

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

Transmitter Conducted Emissions (Out of Band) (continued) - ± 2.5 kHz FM

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

Transmitter Conducted Emissions (Out of Band) (continued)

Note: These plots are 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:	90.210 & 2.1053
Test Method:	As detailed in TIA-603-C Section 2.2.12.2

Environmental Conditions:

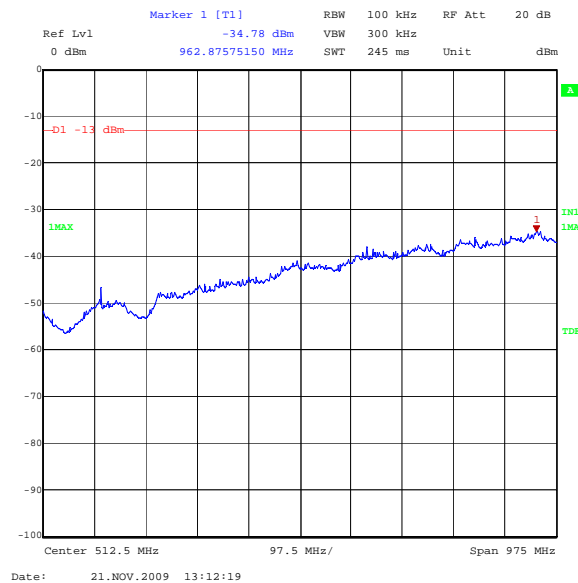
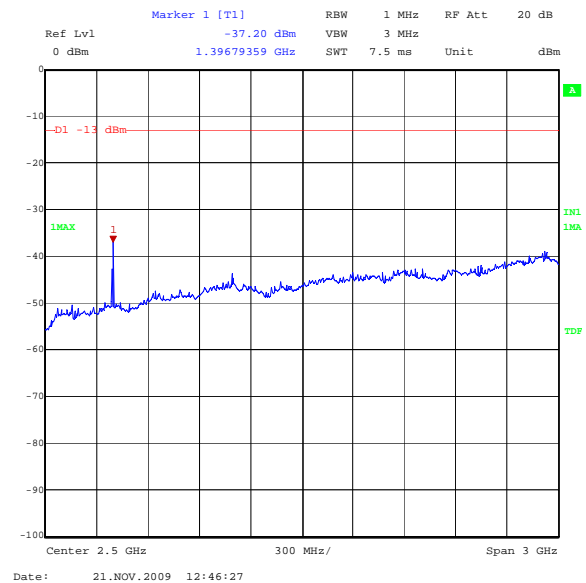
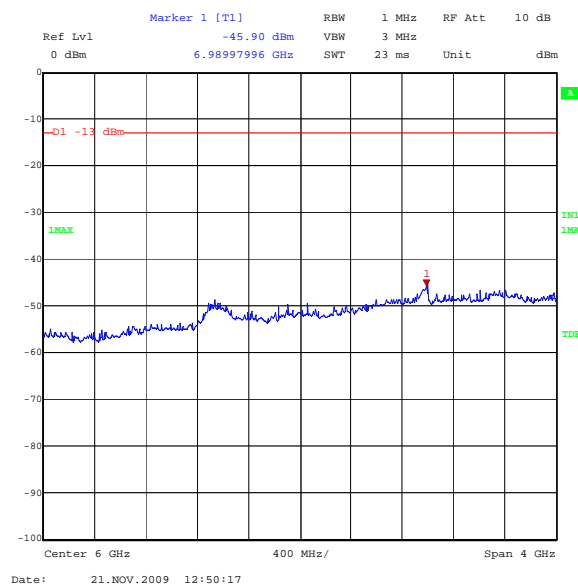
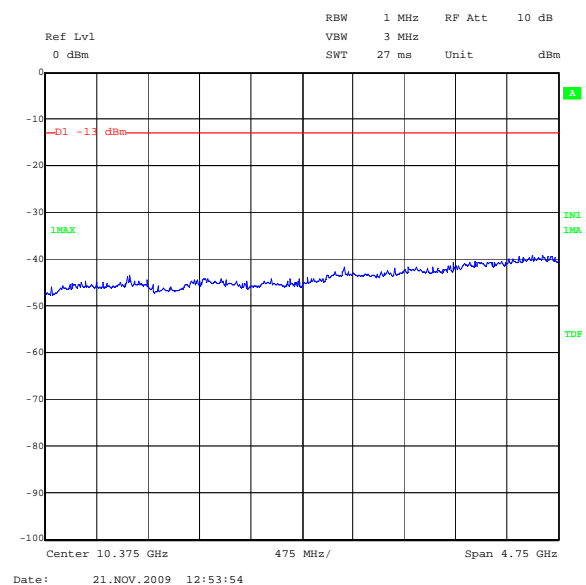
Temperature (°C):	23
Relative Humidity (%):	39

Results:

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

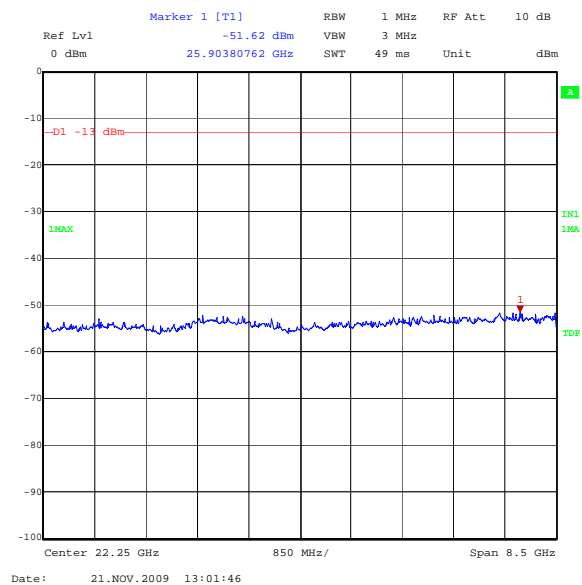
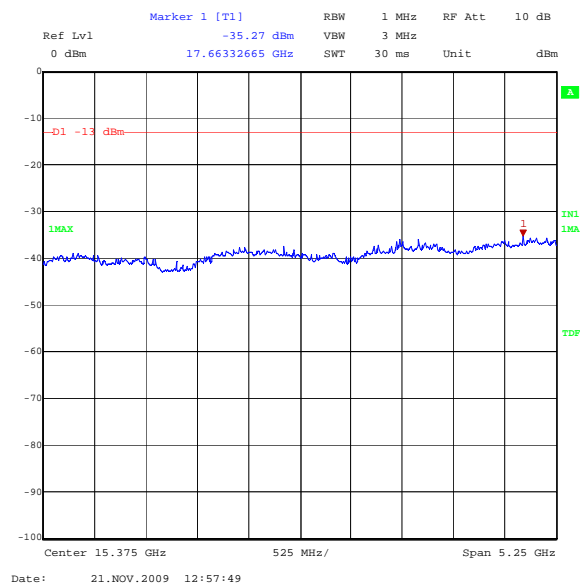
Note(s):

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)



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

5.2.6. Transmitter Transient Frequency Behaviour**Test Summary:**

FCC Part:	90.214
Test Method:	As detailed in TIA-603-C Section 2.2.19

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	37

Results:

Time Intervals	FREQUENCY DIFFERENCE (kHz)
	Single Channel
t1	5.1
t2	1.3
t3	0.7

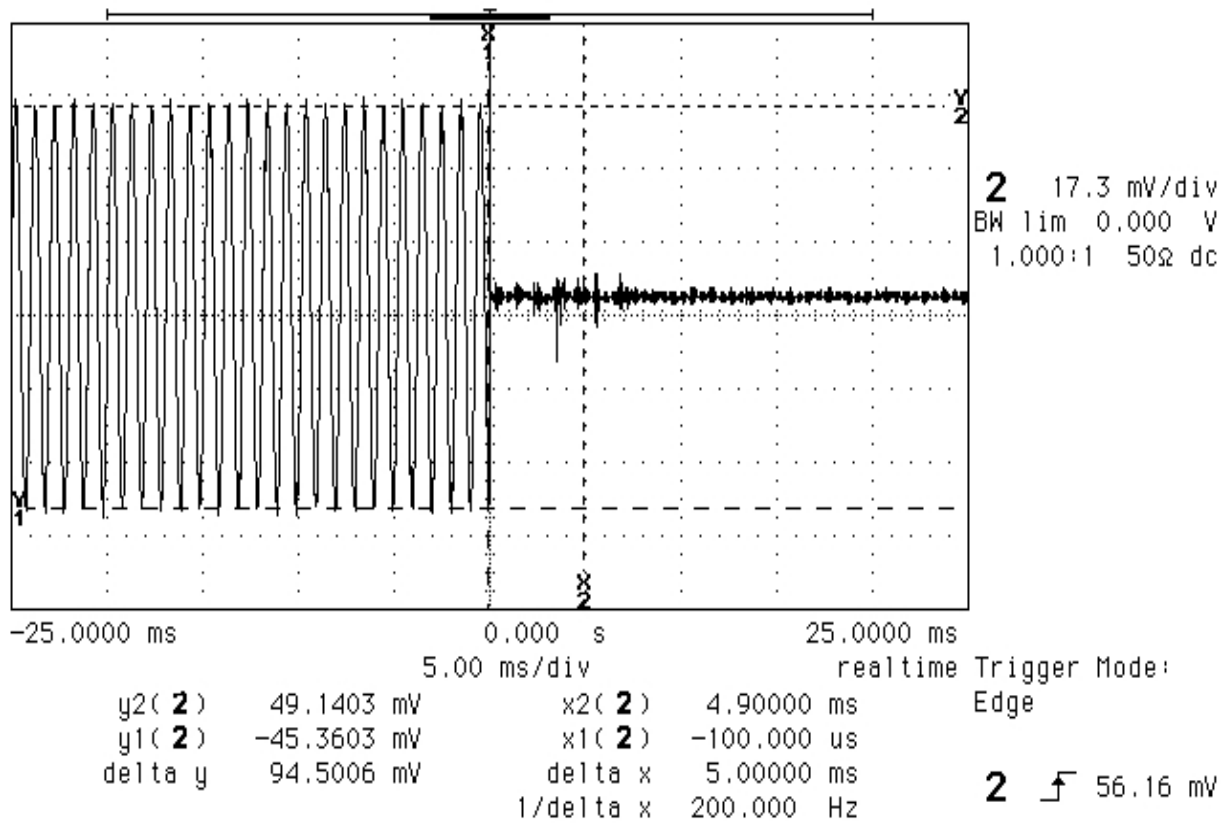
Limits:

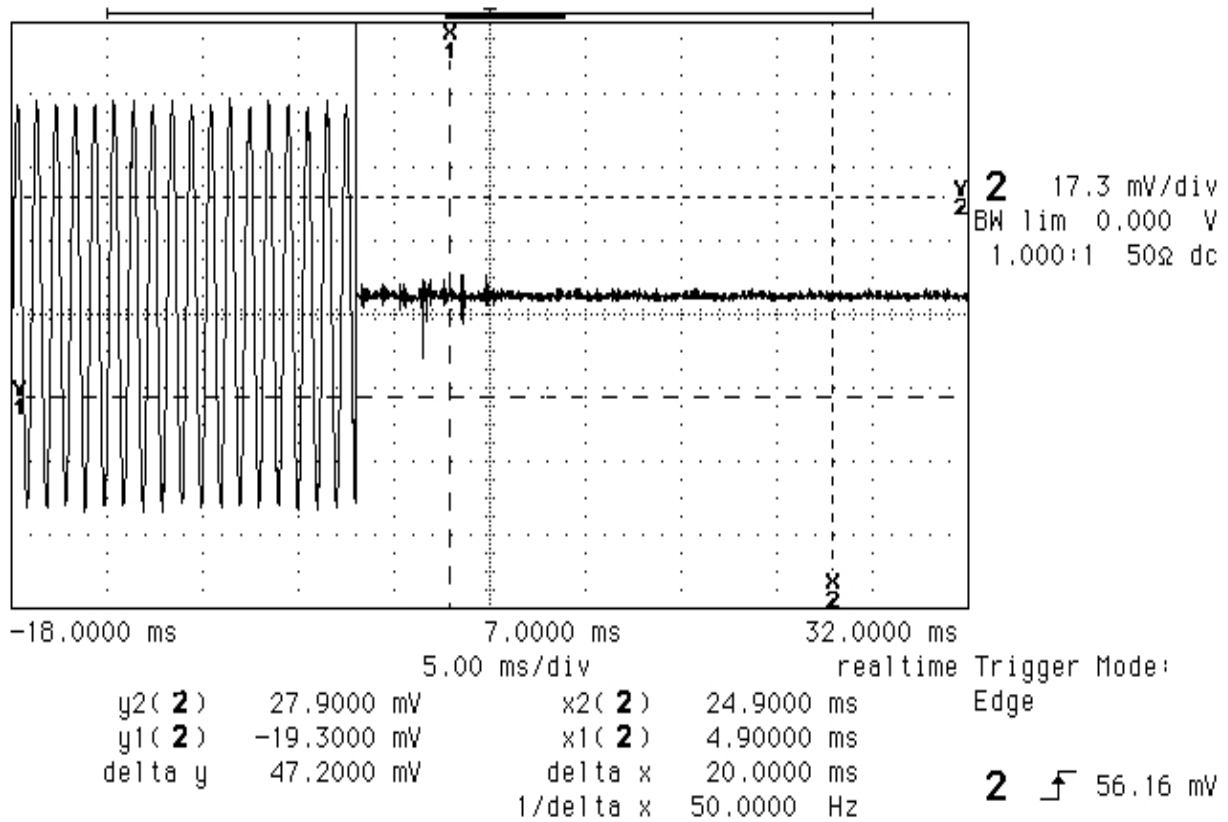
Time Intervals	Maximum frequency difference	Frequency Range
		150 to 174 MHz
t1	+/- 12.5 kHz	≤5.0 mS
t2	+/- 6.25 kHz	≤20.0 mS
t3	+/- 12.5 kHz	≤5.0 mS

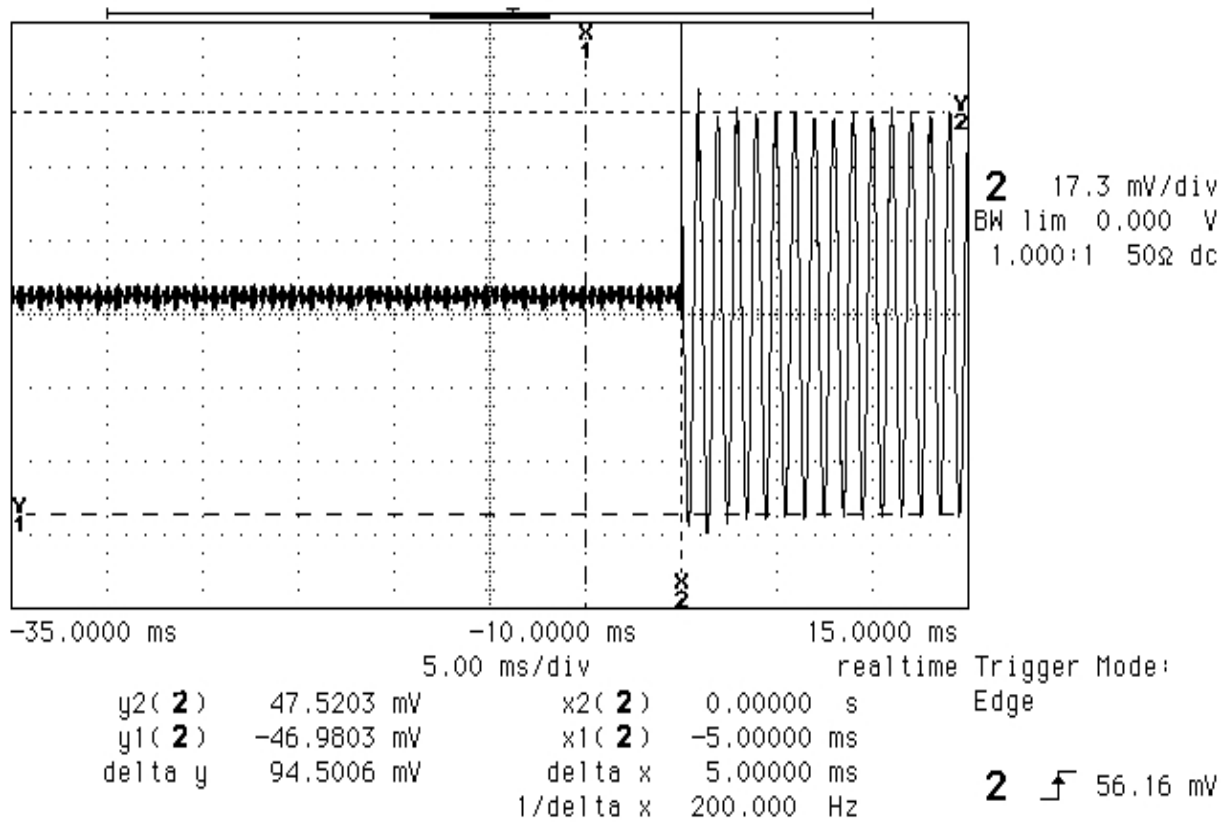
Statement to confirm that during the period from the end of t2 to the beginning of t3, the frequency difference does not exceed 2.5 ppm of the carrier frequency.

YES**Note(s):**

1. Tests were performed using a test frequency of 150 MHz as per the test plan detailed in section 2.4 of this report.

Transmitter Transient Frequency Behaviour (continued)*hp* stopped**T1**

Transmitter Transient Frequency Behaviour (continued)*hp* stopped**T2**

Transmitter Transient Frequency Behaviour (continued)*hp* stopped**T3**

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
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	±4.64 dB
Radiated Spurious Emissions	1 GHz to 40 GHz	95%	±2.94 dB
Carrier Output Power	30 MHz to 2 GHz	95%	±0.28 dB
Occupied Bandwidth	Not applicable	95%	±0.92 ppm
Transient Frequency Behaviour	Not applicable	95%	± 0.32% (Amplitude) ±3.53nS (Time)

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)
A1391	Attenuator	Huber + Suhner	757987	6810.17.B	Calibrated before use	-
A1534	Pre Amplifier	Hewlett Packard	8449B OPT H02	3008A00405	Calibrated before use	-
A1737	Attenuator	Atlantic Microwave	BBS40-20	R4722	Calibrated before use	-
A436	Antenna	Flann	20240-20	330	24 Apr 2009	36
A288	Antenna	Chase	CBL6111A	1589	13 Mar 2009	12
A1818	Antenna	EMCO	3115	00075692	27 Nov 2009	12
G085	Signal Generator	Hewlett Packard	83650L	3614A00104	27 Oct 2008	24
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	01 Sep 2009	12
M1124	Spectrum Analyser	Rohde & Schwarz	ESIB26	100046K	09 Mar 2009	12
M1242	Spectrum Analyser	Rohde & Schwarz	FSEM30	845986/022	19 Dec 2008	12
M166	Thermometer	EuroCom	None	None	30 Apr 2009	12

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