

TEST REPORT FROM RFI GLOBAL SERVICES LTD

Test of: Zinwave Ltd
Zinwave DAS 2765

To: FCC Part 90: 2006 (Subpart C)

Test Report Serial No:
RFI/RPTE1/RP48954JD18A

This Test Report Is Issued Under The Authority
Of Michael Derby, Wireless Group Leader Radio Performance:

A handwritten signature in black ink, appearing to read 'Michael Derby'.

Tested By: Jamie Huckerby

A handwritten signature in black ink, appearing to read 'J Huckerby'.

Checked By: Tony Henriques

A handwritten signature in black ink, appearing to read 'Tony Henriques'.

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Registered in England and Wales. Company number: 2117901

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1. Client Information

Company Name:	Zinwave Ltd
Address:	Harston Mill Harston Cambridge CB2 5GG
Contact Name:	Mr A Bell

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2. Equipment Under Test (EUT)

The following information (with the exception of the Date of Receipt) has been supplied by the client:

2.1. Identification of Equipment Under Test (EUT)

Description:	Hub Unit (HU)
Brand Name:	Zinwave
Model Name or Number:	2700
Serial Number:	0005256380
FCC ID Number:	UPO2700
Country of Manufacture:	England
Date of Receipt:	23 March 2007

Description:	Antenna Unit (AU)
Brand Name:	Zinwave
Model Name or Number:	2765
Serial Number:	165
FCC ID Number:	UPO2765
Country of Manufacture:	England
Date of Receipt:	23 March 2007

Description:	Antenna Unit (AU)
Brand Name:	Zinwave
Model Name or Number:	2765
Serial Number:	0702007
FCC ID Number:	UPO2765
Country of Manufacture:	England
Date of Receipt:	23 March 2007

Description:	Antenna Unit (AU)
Brand Name:	Zinwave
Model Name or Number:	2765
Serial Number:	06120001
FCC ID Number:	UPO2765
Country of Manufacture:	England
Date of Receipt:	23 March 2007

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Identification of Equipment Under Test (EUT) (Continued)

Description:	Antenna Unit (AU)
Brand Name:	Zinwave
Model Name or Number:	2765
Serial Number:	07020005
FCC ID Number:	UPO2765
Country of Manufacture:	England
Date of Receipt:	23 March 2007

Description:	Antenna Unit (AU)
Brand Name:	Zinwave
Model Name or Number:	2765
Serial Number:	07020004
FCC ID Number:	UPO2765
Country of Manufacture:	England
Date of Receipt:	23 March 2007

Description:	Antenna Unit (AU)
Brand Name:	Zinwave
Model Name or Number:	2765
Serial Number:	07020001
FCC ID Number:	UPO2765
Country of Manufacture:	England
Date of Receipt:	23 March 2007

Description:	Antenna Unit (AU)
Brand Name:	Zinwave
Model Name or Number:	2765
Serial Number:	07020003
FCC ID Number:	UPO2765
Country of Manufacture:	England
Date of Receipt:	23 March 2007

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Identification of Equipment Under Test (EUT) (Continued)

Description:	Antenna Unit (AU)
Brand Name:	Zinwave
Model Name or Number:	2765
Serial Number:	07020006
FCC ID Number:	UPO2765
Country of Manufacture:	England
Date of Receipt:	23 March 2007

2.2. Description of EUT

The equipment under test is a broadband Distributed Antenna System operating from 370 MHz to 2.5 GHz. The system utilises multiple technologies including iDEN, GSM 850 & 1900 and CDMA2000

All of the above technology options were connected and operating during the test. The results of this test report refer only to the measurements made in the 806 to 825 MHz band with iDEN.

2.3. Modifications Incorporated in EUT

During the course of testing the EUT was not modified.

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2.4. Additional Information Related to Testing

Power Supply Requirement:	Nominal 110 V, 60 Hz AC Mains Supply		
Intended Operating Environment:	Residential, Commercial, Light & heavy industry		
Equipment Category:	"Distributed Antenna System" (DAS)		
Type of Unit:	Base Station (Fixed use)		
Transmit Frequency Range:	806.025 MHz to 823.975 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	N/A	806.025
	Middle	N/A	815.500
	Top	N/A	823.975
Maximum Peak Power Output (ERP)	23.6 dBm (measured)		
Average Power Output (Conducted)	12.0 dBm (measured)		
Antenna Gain	8.0 dBi		

2.5. Port Identification

Port	Description
1	4 x Input Ports (HU)
2	4 x Output Ports (HU)
3	Ethernet Port (HU)
4	Serial Port (HU)
5	AC Mains (HU)
6	8 x Fibre Optic I/O Ports (AU)
7	8 x Output Ports (AU)
8	8 x Input Ports (AU)
9	POE Mains (AU)

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2.6. Support Equipment

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

Description:	Laptop
Brand Name:	Dell
Model Name or Number:	Inspiron 1300
Serial Number:	CN-0RJ272-70166-67M-06MU
Cable Length and Type:	CAT 5 2m
Connected to Port:	Ethernet Port

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3. Test Specification, Methods and Procedures

Reference:	FCC Part 90: 2006
Title:	Code of Federal Regulations, Part 15 (47CFR90) Radio Frequency Devices.

3.1. Methods and Procedures

The methods and procedures used were as detailed in:

ANSI/TIA-603-C-2004

Land Mobile Communications Equipment, Measurements and performance Standards

ANSI C63.2 (1987)

Title: American National Standard for Instrumentation - Electromagnetic noise and field strength.

ANSI C63.4 (2001)

Title: American National Standard Methods of Measurement of Electromagnetic Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

ANSI C63.5 (1988)

Title: American National Standard for the Calibration of antennas used for Radiated Emission measurements in Electromagnetic Interference (EMI) control.

ANSI C63.7 (1988)

Title: American National Standard Guide for Construction of Open Area Test Sites for performing Radiated Emission Measurements.

CISPR 16-1: (1999)

Title: Specification For Radio Disturbance and Immunity Measuring Apparatus and Methods. Part 1: Radio Disturbance and Immunity Measuring Apparatus.

3.2. Definition of Measurement Equipment

The measurement equipment used complied with the requirements of the standards referenced in the Methods & Procedures section above. Appendix 1 contains a list of the test equipment used.

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4. Deviations from the Test Specification

As the system is a broadband amplifier covering multiple bands, the system for spurious emissions was only tested on the middle channel. For radiated spurious emissions the system was only tested fully loaded.

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5. Operation of the EUT during Testing

5.1. Operating Modes

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

Operating at maximum output power with all gain settings set to maximum.

5.2. Configuration and Peripherals

The EUT was tested in the following configuration unless otherwise stated:

The equipment was set at maximum gain and the input from iDEN was adjusted to give maximum nominal output power. The equipment was set to 1x2 (1 input on the HU through to 2 outputs on 2 AU) for testing to FCC Part 90.

Additionally, the fully loaded system spurious emissions was tested on the following configuration:

1 – Conducted Emissions, set to maximum gain on a 4x8 configuration with 4 different technology types

2 – Conducted Emissions, set to maximum gain on a 4x8 configuration with the 3 inputs having different iDEN channels

3 – Radiated, set to maximum gain on a 4x8 configuration with 4 different technology types

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6. Summary of Test Results

Range of Measurements	Specification Reference	Port Type	Compliance Status
AC Conducted Emissions (150 kHz to 30 MHz)	C.F.R. 47 FCC Part 15: 2004 Section 15.107 / 15.207	AC Mains	Complied
Transmitter Carrier Output Power (ERP)	C.F.R. 47 FCC Part 90: 2004 Sections 90.219 / 2.1046	Antenna Terminals	Complied
Transmitter Occupied Bandwidth (Bandwidth Limitations)	C.F.R. 47 FCC Part 90: 2004 Sections 90.209 / 2.1049	Antenna Terminals	Complied
Transmitter Conducted Emissions (Out of Band) (9 kHz to 26 GHz)	C.F.R. 47 FCC Part 90: 2004 Sections 90.210 / 2.1051	Antenna Terminals	Complied
Transmitter Radiated Emissions (Out of Band) (30 MHz to 26 GHz)	C.F.R. 47 FCC Part 90: 2004 Sections 90.210 / 2.1053 TIA-603-B Section 2.2.12	Antenna Terminals	Complied
Transmitter Frequency Stability (Temperature & Voltage Variation)	C.F.R. 47 FCC Part 90: 2004 Sections 90.213 / 2.1055 TIA-603-B Section 2.2.2	Antenna Terminals	Complied
Intermodulation	C.F.R 47 FCC Part 90: 2004 Sections 90.210 / 2.1053	Antenna Terminals	Complied
Out-of-Band Rejection	*For reference purposes*	Antenna Terminals	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

FCC Site Registration Number: 90895

IC Site Registration Number: 3485

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7. Measurements, Examinations and Derived Results

7.1. General Comments

This section contains test results only.

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

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7.2. Test Results

7.2.1. Transmitter Mode AC Conducted Spurious Emissions: Section 15.107/ 15.207 - Hub Unit (HU)

The EUT was configured as for AC conducted emission measurements as described in section 9 of this report.

Tests were performed to identify the maximum emission levels present on the ac mains line of the EUT.

Results:

Quasi-Peak Detector Measurements on Live and Neutral Lines

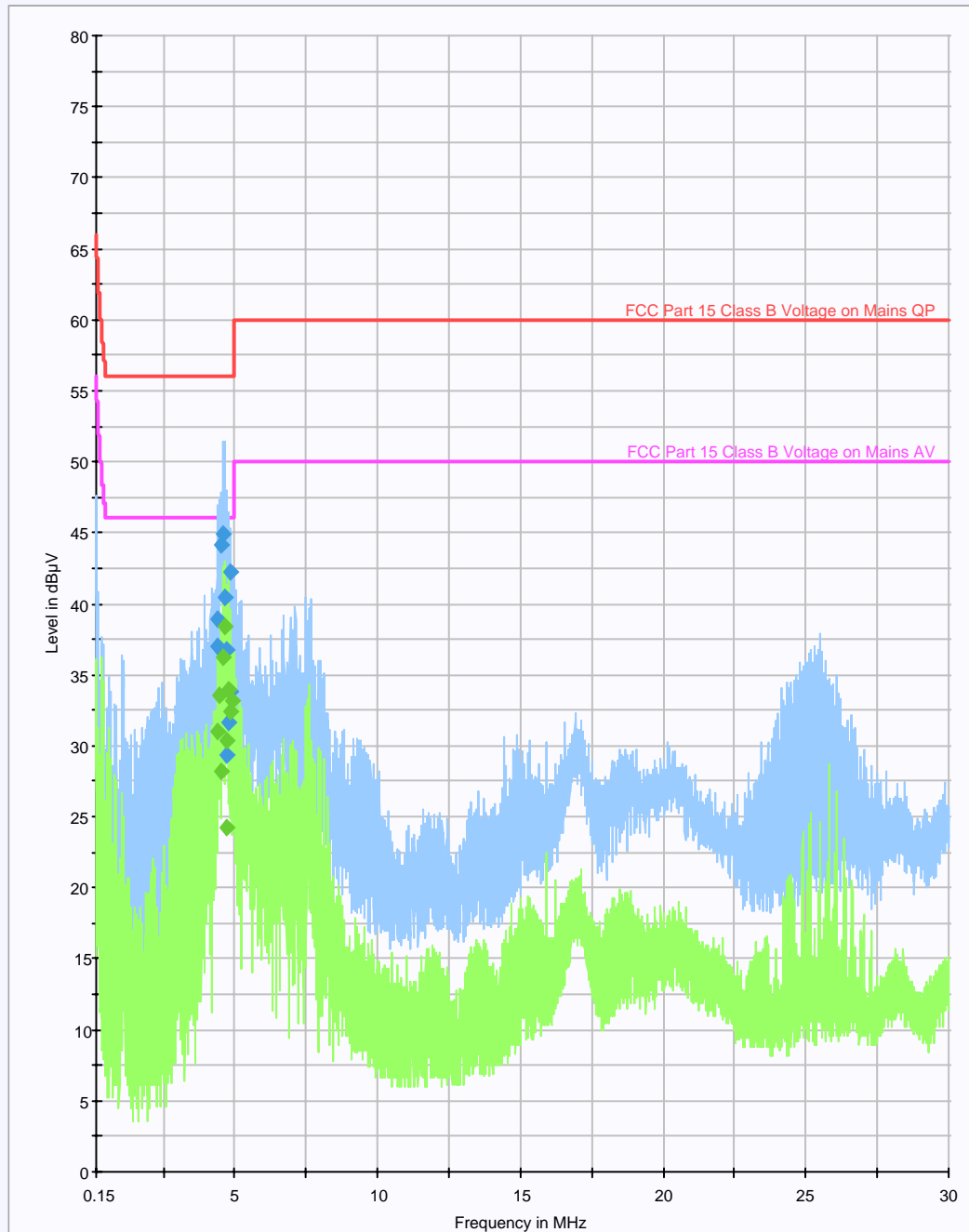
Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
4.366000	Live	37.0	56.0	19.0	Complied
4.426000	Live	38.9	56.0	17.1	Complied
4.518000	Live	44.1	56.0	11.9	Complied
4.570000	Live	44.9	56.0	11.1	Complied
4.626000	Live	40.4	56.0	15.6	Complied
4.690000	Neutral	36.8	56.0	19.2	Complied
4.742000	Live	29.3	56.0	26.7	Complied
4.794000	Live	31.6	56.0	24.4	Complied
4.822000	Live	42.2	56.0	13.8	Complied
4.846000	Live	33.8	56.0	22.2	Complied

Average Detector Measurements on Live and Neutral Lines

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
4.422000	Live	31.0	46.0	15.0	Complied
4.486000	Live	33.5	46.0	12.5	Complied
4.538000	Neutral	28.2	46.0	17.8	Complied
4.570000	Neutral	36.3	46.0	9.7	Complied
4.622000	Neutral	38.5	46.0	7.5	Complied
4.686000	Live	30.3	46.0	15.7	Complied
4.738000	Neutral	24.2	46.0	21.8	Complied
4.770000	Neutral	33.9	46.0	12.1	Complied
4.826000	Live	32.4	46.0	13.6	Complied
4.886000	Live	33.2	46.0	12.8	Complied

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Transmitter Mode AC Conducted Spurious Emissions: Section 15.107 / 15.207 (Continued)



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

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7.2.2. Transmitter Mode AC Conducted Spurious Emissions: Section 15.107 /15.207- Antenna Unit (AU)

The EUT was configured as for AC conducted emission measurements as described in section 9 of this report.

Tests were performed to identify the maximum emission levels present on the ac mains line of the EUT.

Results:

Quasi-Peak Detector Measurements on Live and Neutral Lines

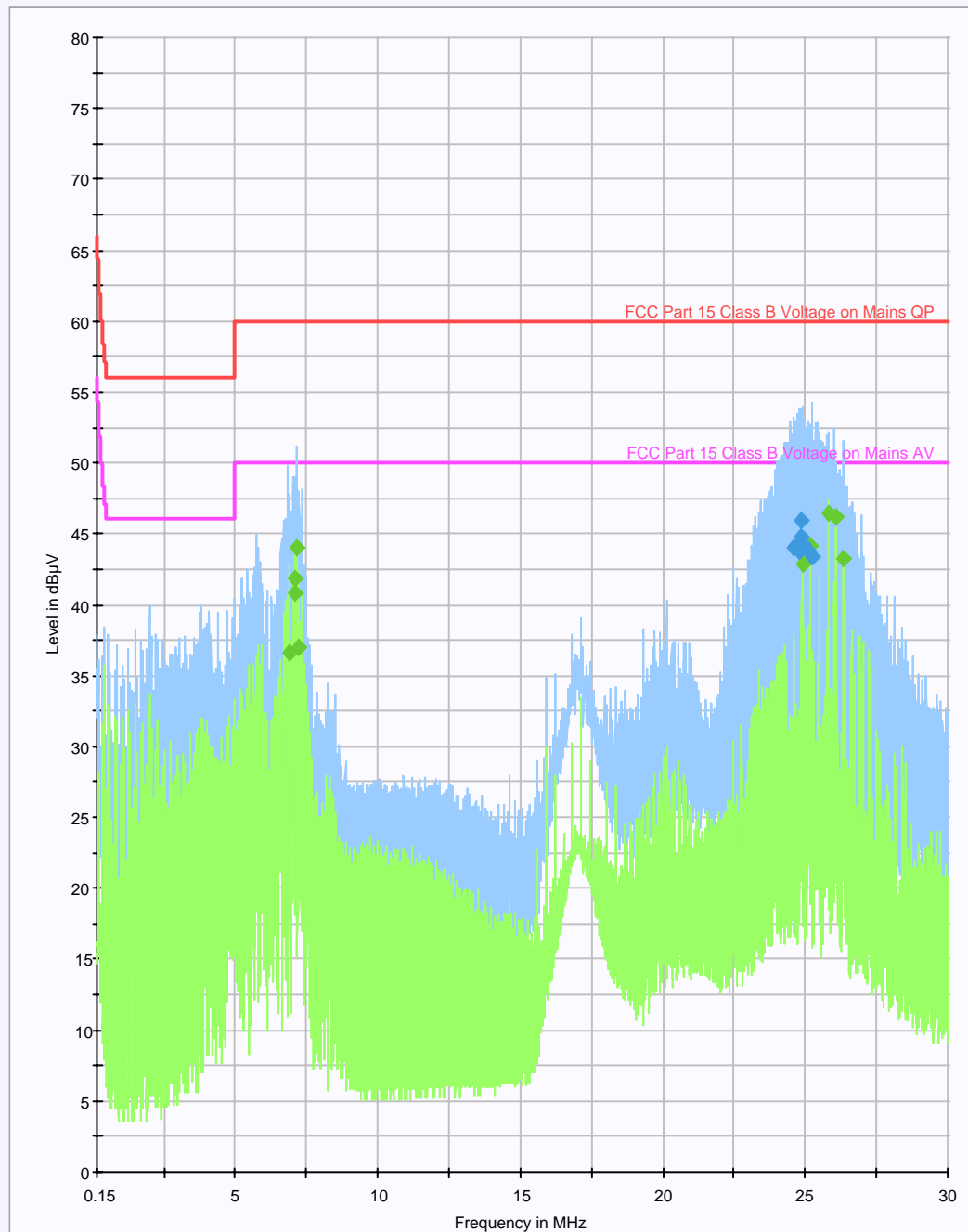
Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
6.910000	Live	36.6	50.0	13.4	Complied
7.082000	Live	41.8	50.0	8.2	Complied
7.130000	Neutral	40.9	50.0	9.1	Complied
7.150000	Neutral	44.0	50.0	6.0	Complied
7.254000	Neutral	37.0	50.0	13.0	Complied
24.886000	Live	42.8	50.0	7.2	Complied
25.190000	Live	44.2	50.0	5.8	Complied
25.798000	Live	46.5	50.0	3.5	Complied
26.098000	Live	46.1	50.0	3.9	Complied
26.326000	Live	43.2	50.0	6.8	Complied

Average Detector Measurements on Live and Neutral Lines

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
24.582000	Live	44.0	60.0	16.0	Complied
24.718000	Live	44.1	60.0	15.9	Complied
24.742000	Neutral	44.1	60.0	15.9	Complied
24.794000	Neutral	43.7	60.0	16.3	Complied
24.850000	Live	44.8	60.0	15.2	Complied
24.882000	Live	45.9	60.0	14.1	Complied
24.902000	Live	44.2	60.0	15.8	Complied
24.938000	Live	44.1	60.0	15.9	Complied
25.122000	Live	43.7	60.0	16.3	Complied
25.234000	Live	43.4	60.0	16.6	Complied

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Transmitter Mode AC Conducted Spurious Emissions: Section 15.107 / 15.207 (Continued)



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

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7.2.3. Transmitter Carrier Output Power: Sections 90.219 / 2.1046

The EUT was configured as for conducted RF output power as described in section 9 of this report.

Tests were performed to identify the EUT's maximum conducted transmit power.

Results:

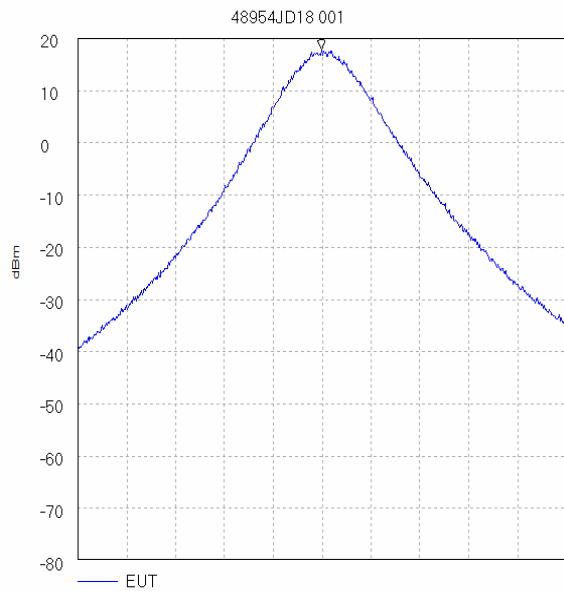
Channel	Frequency (MHz)	Conducted RF O/P Power (dBm)	Stated Antenna Gain (dB)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
Bottom	806.250	17.8	5.8	23.6	37.0	13.4	Complied
Middle	815.500	17.8	5.8	23.6	37.0	13.4	Complied
Top	823.975	17.8	5.8	23.6	37.0	13.4	Complied

Note(s):

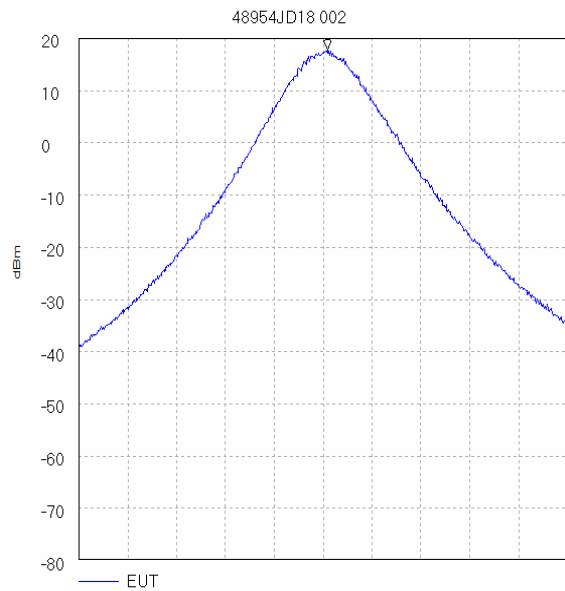
1. EPR limit is for Class A Boosters from section 90.219.

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Transmitter Carrier Output Power: Section 90.219 / 2.1046 (Continued)



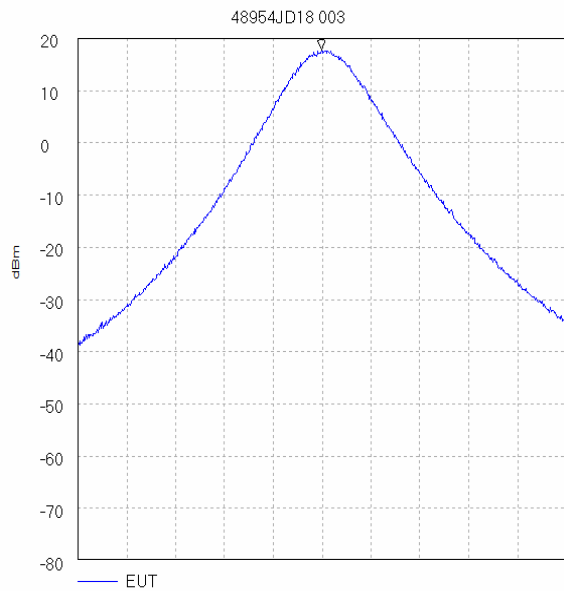
Centre 806.25 MHz; Span 1.0 MHz
Ref 20 dBm; Ref Offset 16.0 dB; 10 dB/div
RBW 100.0 kHz; VBW 300.0 kHz; Att 20 dB; Swp 50.0 mS
Peak 806.248333 MHz, 17.83 dBm
Tested by JXH 15/03/2007 11:36:08



Centre 815.5 MHz; Span 1.0 MHz
Ref 20 dBm; Ref Offset 16.0 dB; 10 dB/div
RBW 100.0 kHz; VBW 300.0 kHz; Att 20 dB; Swp 50.0 mS
Peak 815.51 MHz, 17.83 dBm
Tested by JXH 15/03/2007 11:38:47

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Transmitter Carrier Output Power: Section 90.219 / 2.1046 (Continued)



Centre 823.975 MHz; Span 1.0 MHz
Ref 20 dBm; Ref Offset 16.0 dB; 10 dB/div
RBW 100.0 kHz; VBW 300.0 kHz; Att 20 dB; Swp 50.0 mS
Peak 823.973333 MHz, 17.83 dBm
Tested by JXH 15/03/2007 11:40:41

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7.2.4. Transmitter Occupied Bandwidth: Sections 90.209 / 2.1049

The EUT was configured as for occupied bandwidth measurements as described in section 9 of this report.

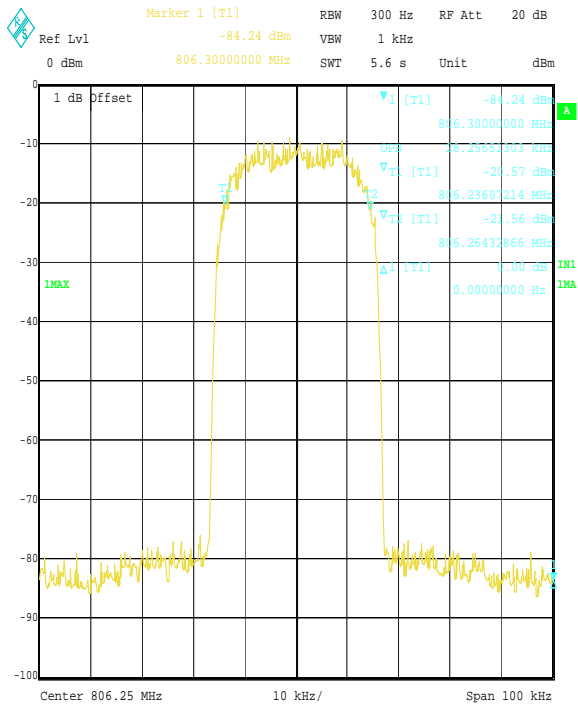
Tests were performed to identify the maximum bandwidth occupied by the fundamental frequency of the EUT.

Results:

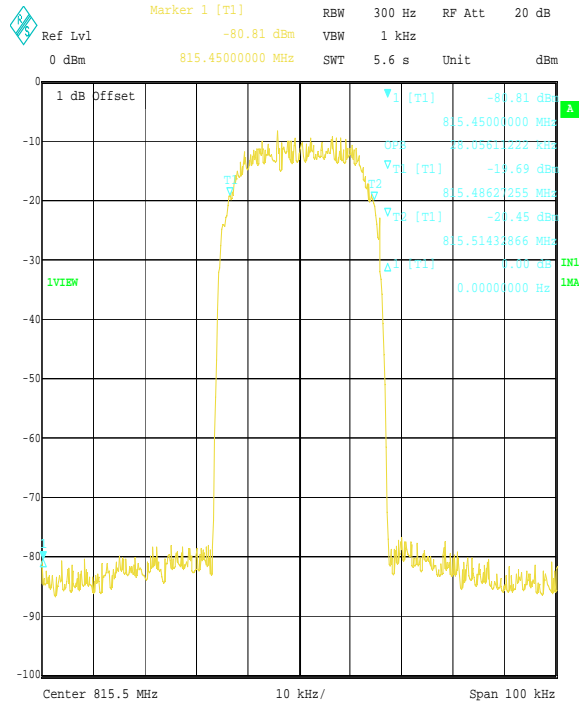
Channel	Frequency (MHz)	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth Before EUT (kHz)	Occupied Bandwidth Through EUT (kHz)	Result
Bottom	806.250	0.3	1.0	28.257	28.056	Complied
Middle	815.500	0.3	1.0	28.056	28.056	Complied
Top	823.975	0.3	1.0	28.257	28.056	Complied

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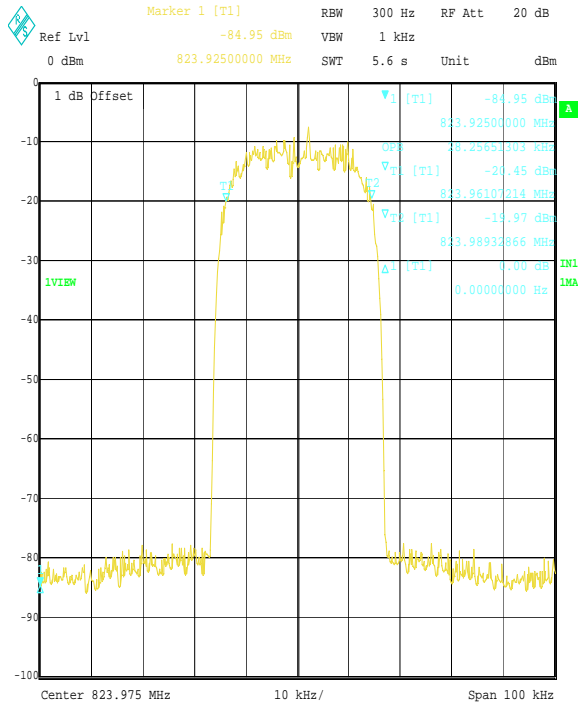
Transmitter Occupied Bandwidth: Section 90.209 / 2.1049 (Continued)



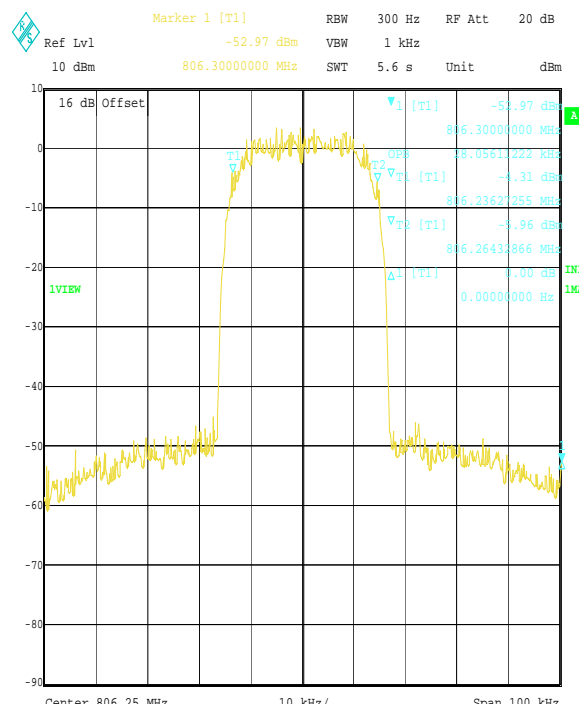
Date: 14.MAR.2007 10:09:46



Date: 14.MAR.2007 10:10:35



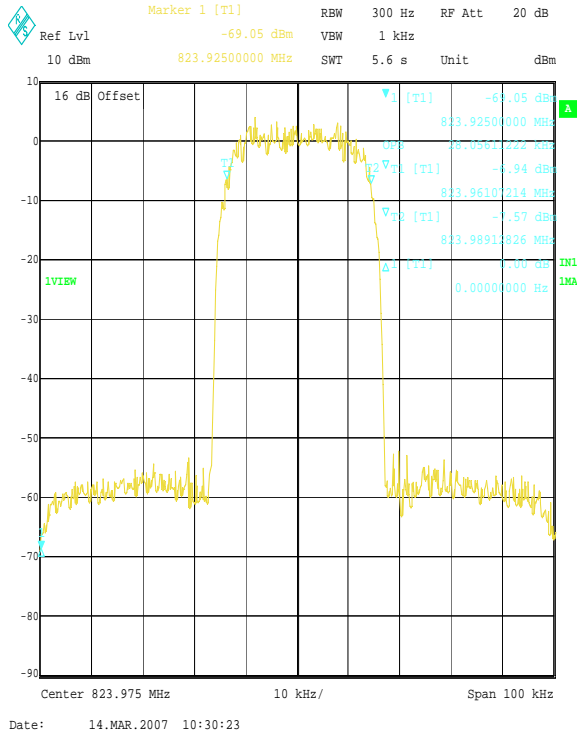
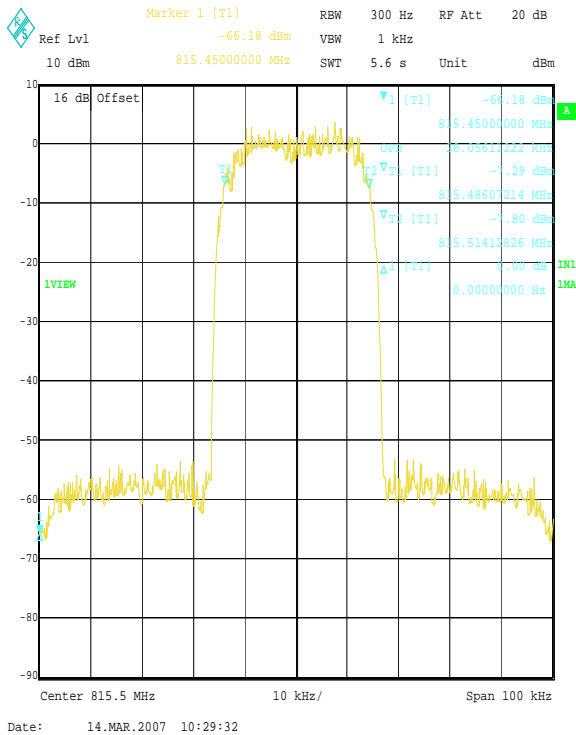
Date: 14.MAR.2007 10:11:33



Date: 14.MAR.2007 10:28:48

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Transmitter Occupied Bandwidth: Section 90.209 / 2.1049 (Continued)



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7.2.5. Transmitter Out of Band Conducted Emissions: Sections 90.210 / 2.1051

The EUT was configured as for transmitter conducted emission measurements as described in section 9 of this report.

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

Results: Fully Loaded (1xiDEN, 1xGSM850, 1xGSM1900, 1xCDMA2000 1900)

Frequency (GHz)	Peak Emission Level (dBm)	Bandwidth (kHz)	Limit (dBm)	Margin (dB)	Result
1.173	-29.3	1000	-13.0	16.3	Complied
3.920	-32.5	1000	-13.0	19.5	Complied
15.283	-42.0	1000	-13.0	29.0	Complied
24.110	-37.8	1000	-13.0	24.8	Complied

Results: iDEN Only (3xiDEN Signals - 806.25 MHz, 815.5 MHz, 823.975 MHz)

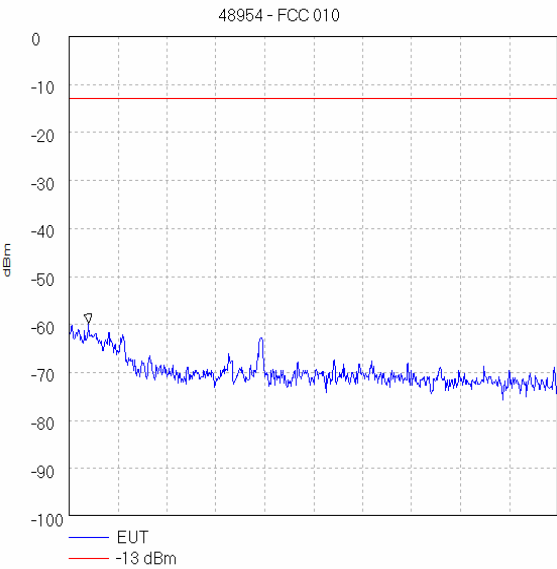
Frequency (GHz)	Peak Emission Level (dBm)	Bandwidth (kHz)	Limit (dBm)	Margin (dB)	Result
0.017712	-41.3	10.0	-22.0	19.3	Complied
0.798717	-38.7	100.0	-22.0	16.7	Complied
0.833500	-40.5	100.0	-22.0	18.5	Complied
1.620	-31.0	1000	-22.0	9.0	Complied
24.030	-37.7	1000	-22.0	15.7	Complied

Note(s):

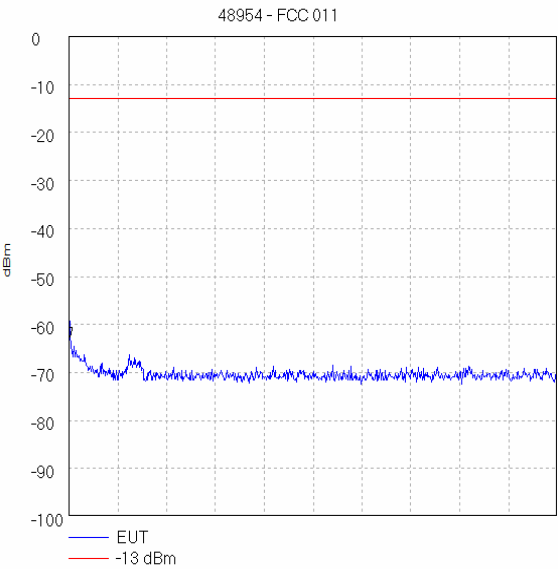
1. Carriers identified on fully loaded (815.5 MHz, 881.6 MHz, 1930.2 MHz & 1988.75) and iDEN only (806.25 MHz, 815.5 MHz, 823.975 MHz) can be disregarded from the measurements as they are wanted signals. All other emission measurements were at least 20dB below the limit.

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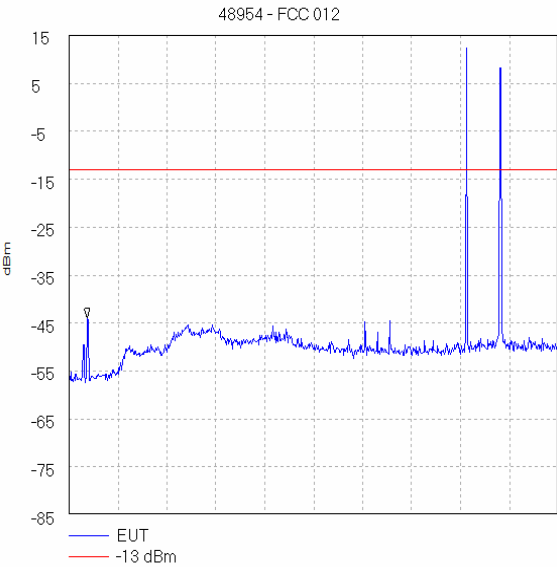
Transmitter Out of Band Conducted Emissions: Sections 90.210 / 2.1051 (Continued) - Fully Loaded



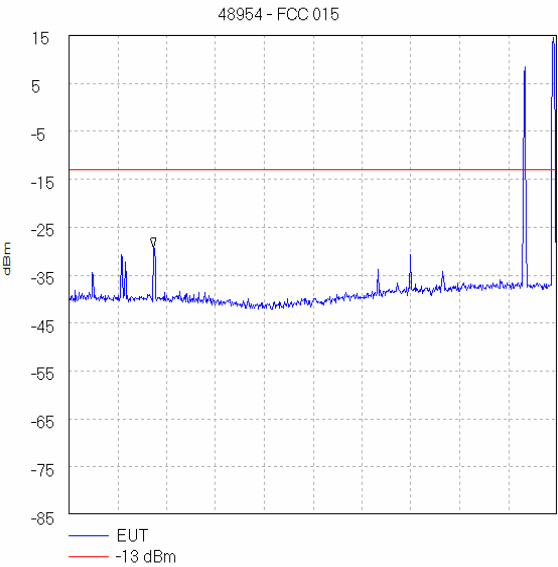
Start 9.0 kHz; Stop 150.0 kHz
Ref 0 dBm; Ref Offset 18.0 dB; 10 dB/div
RBW 1.0 kHz; VBW 1.0 kHz; Att 10 dB; Swp 360.0 mS
Peak 14.64 kHz, -59.67 dBm
Display Line: -13 dBm; ; Limit Test Passed
Tested by jph 16/03/2007 10:25:30



Start 150.0 kHz; Stop 30.0 MHz
Ref 0 dBm; Ref Offset 18.0 dB; 10 dB/div
RBW 10.0 kHz; VBW 10.0 kHz; Att 10 dB; Swp 750.0 mS
Marker 199.75 kHz, -62.67 dBm
Display Line: -13 dBm; ; Limit Test Passed
Tested by jph 16/03/2007 10:26:22



Start 30.0 MHz; Stop 1.0 GHz
Ref 15 dBm; Ref Offset 18.0 dB; 10 dB/div
RBW 100.0 kHz; VBW 100.0 kHz; Att 10 dB; Swp 250.0 mS
Marker 65.566667 MHz, -44.0 dBm
Display Line: -13 dBm; ; Limit Test Passed
Tested by jph 16/03/2007 10:27:22



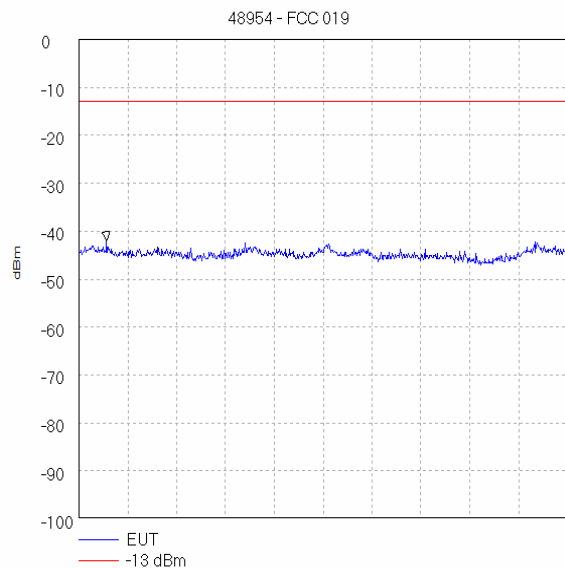
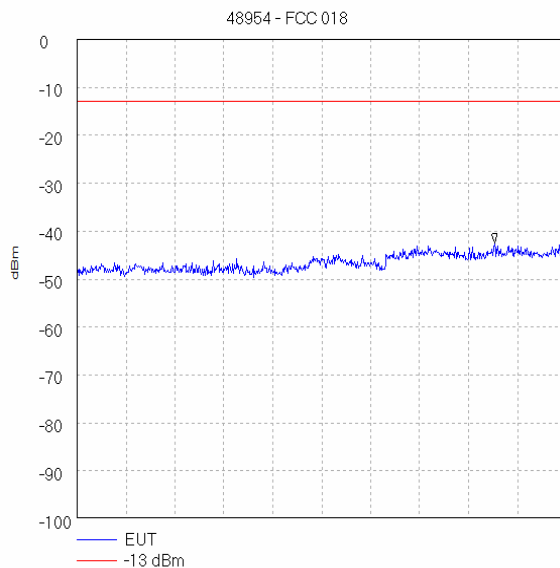
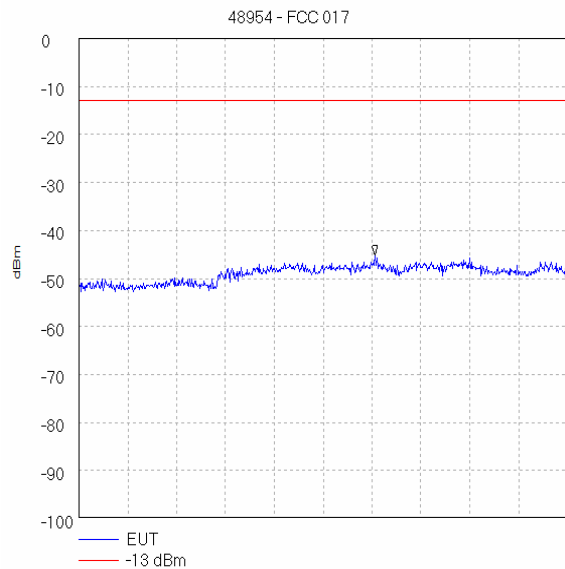
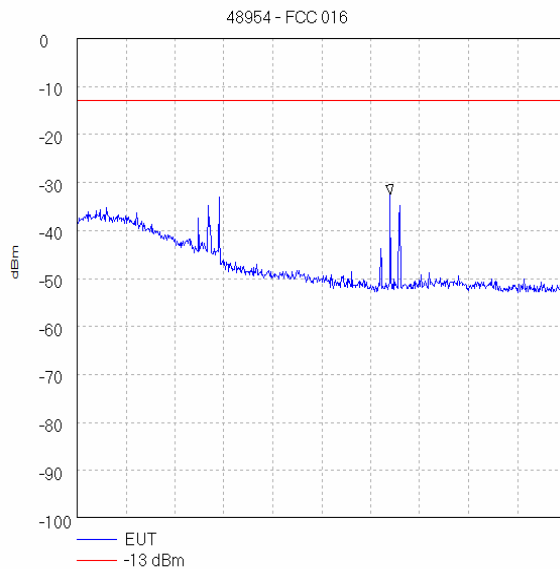
Start 1.0 GHz; Stop 2.0 GHz
Ref 15 dBm; Ref Offset 18.0 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 10 dB; Swp 50.0 mS
Marker 1.1733333 GHz, -29.33 dBm
Display Line: -13 dBm; ; Limit Test Passed
Tested by jph 16/03/2007 10:30:52

Carriers identified are exempt from measurements

Carriers identified are exempt from measurements

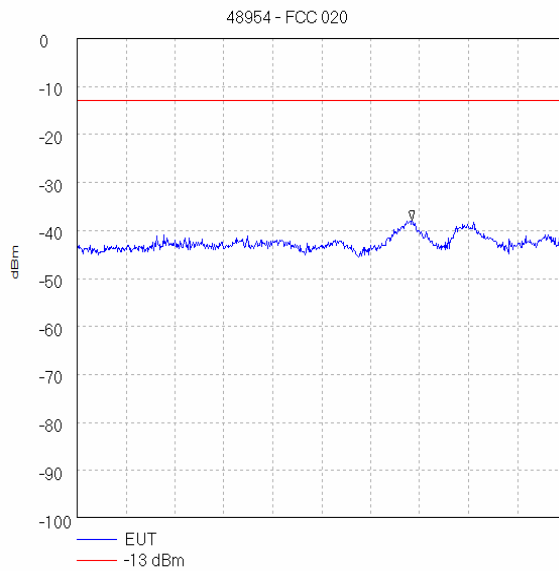
Test of: Zinwave Ltd
Zinwave DAS 2765
To: FCC Part 90: 2006 (Subpart C)

Transmitter Out of Band Conducted Emissions: Sections 90.210 / 2.1051 (Continued) - Fully Loaded



Test of: Zinwave Ltd
Zinwave DAS 2765
To: FCC Part 90: 2006 (Subpart C)

Transmitter Out of Band Conducted Emissions: Sections 90.210 / 2.1051 (Continued) - Fully Loaded

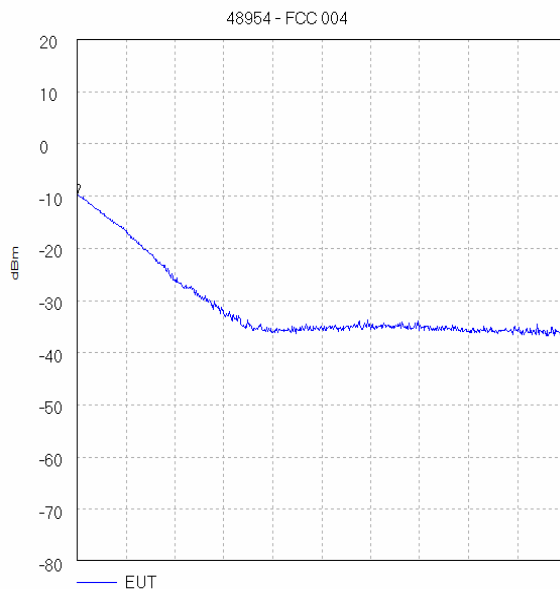


Start 20.0 GHz; Stop 26.0 GHz
Ref 0 dBm; Ref Offset 18.0 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 10 dB; Swp 120.0 mS
Peak 24.11 GHz, -37.83 dBm
Display Line: -13 dBm; ; Limit Test Passed
Tested by jph 16/03/2007 10:33:53

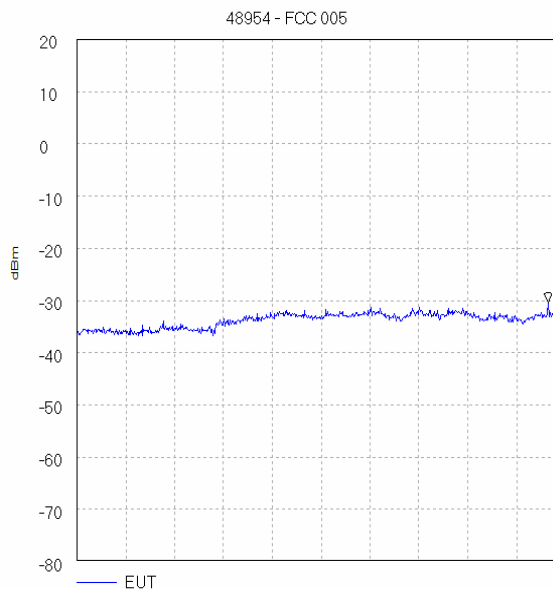
Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Test of: Zinwave Ltd
Zinwave DAS 2765
To: FCC Part 90: 2006 (Subpart C)

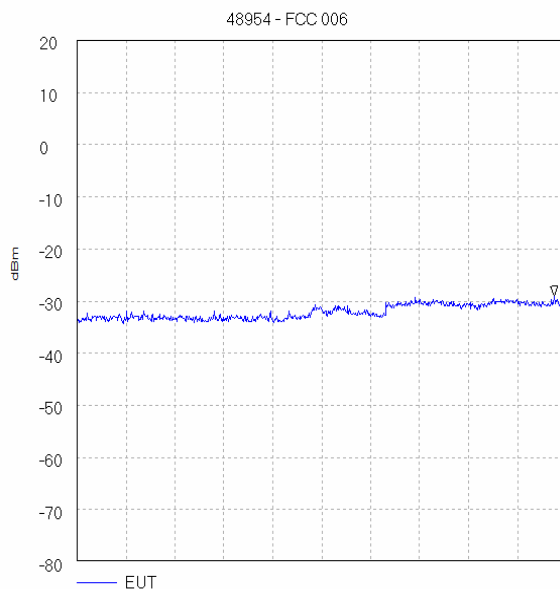
Transmitter Out of Band Conducted Emissions: Sections 90.210 / 2.1051 (Continued) - iDEN Only



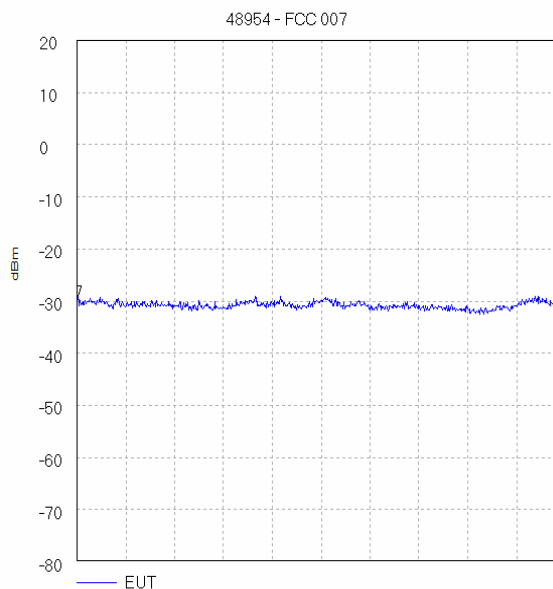
Start 3.0 GHz; Stop 5.0 GHz
Ref 20 dBm; Ref Offset 16.0 dB; 10 dB/div
RBW 2.0 MHz; VBW 3.0 MHz; Att 20 dB; Swp 50.0 mS
Peak 3.0 GHz, -9.83 dBm
Tested by jph 15/03/2007 14:00:04



Start 5.0 GHz; Stop 10.0 GHz
Ref 20 dBm; Ref Offset 16.0 dB; 10 dB/div
RBW 2.0 MHz; VBW 3.0 MHz; Att 20 dB; Swp 100.0 mS
Peak 9.825 GHz, -30.5 dBm
Tested by jph 15/03/2007 14:26:34



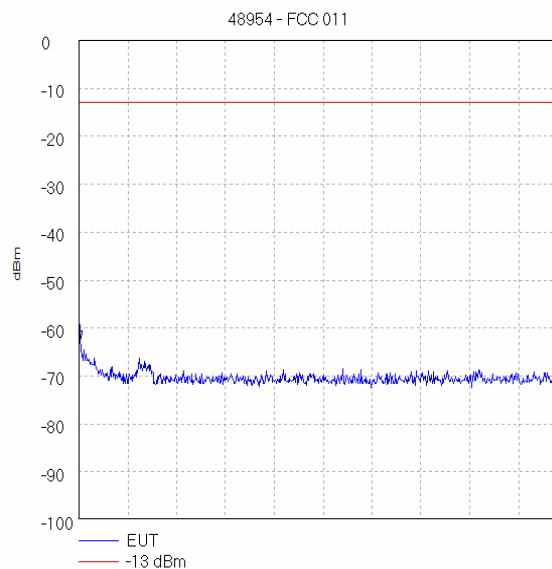
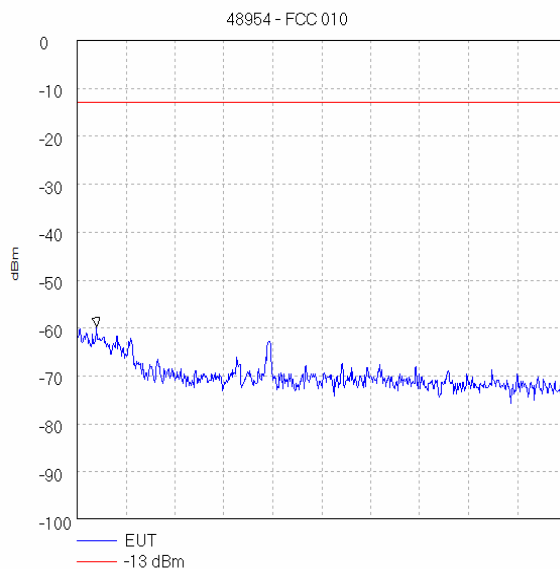
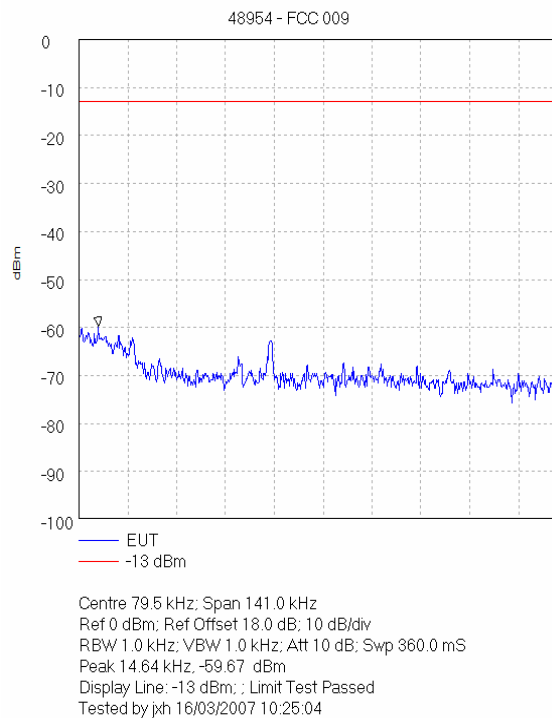
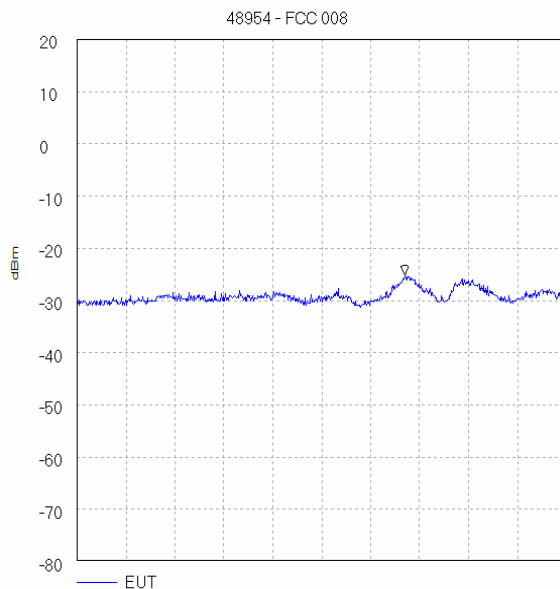
Start 10.0 GHz; Stop 15.0 GHz
Ref 20 dBm; Ref Offset 16.0 dB; 10 dB/div
RBW 2.0 MHz; VBW 3.0 MHz; Att 20 dB; Swp 100.0 mS
Peak 14.875 GHz, -29.0 dBm
Tested by jph 15/03/2007 14:37:48



Start 15.0 GHz; Stop 20.0 GHz
Ref 20 dBm; Ref Offset 16.0 dB; 10 dB/div
RBW 2.0 MHz; VBW 3.0 MHz; Att 20 dB; Swp 100.0 mS
Peak 15.0083333 GHz, -29.0 dBm
Tested by jph 15/03/2007 14:40:21

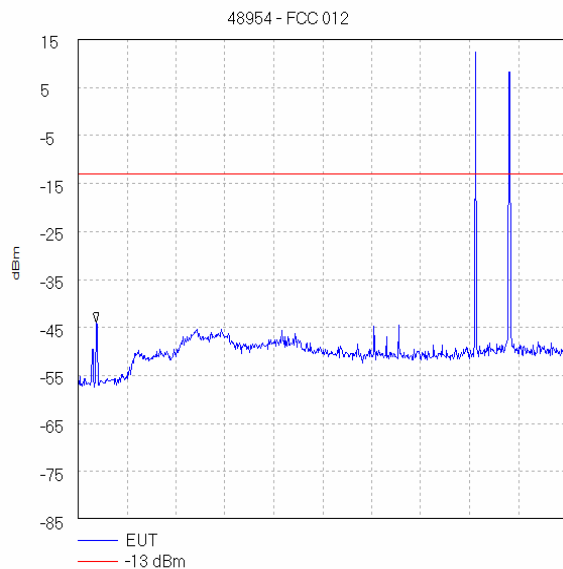
Test of: Zinwave Ltd
Zinwave DAS 2765
To: FCC Part 90: 2006 (Subpart C)

Transmitter Out of Band Conducted Emissions: Sections 90.210 / 2.1051 (Continued) - iDEN Only

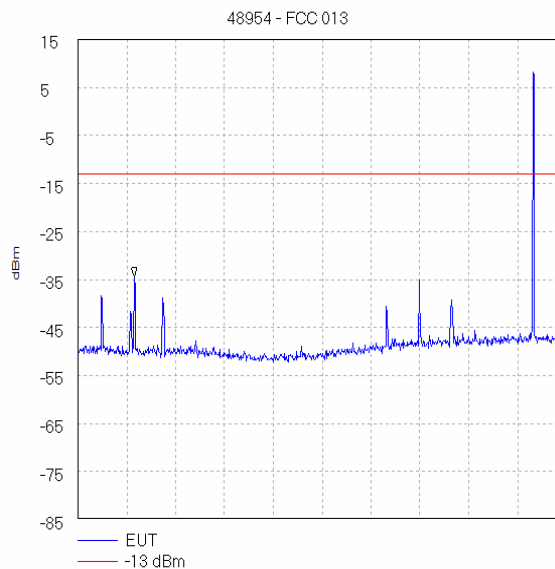


Test of: Zinwave Ltd
Zinwave DAS 2765
To: FCC Part 90: 2006 (Subpart C)

Transmitter Out of Band Conducted Emissions: Sections 90.210 / 2.1051 (Continued) - iDEN Only



Start 30.0 MHz; Stop 1.0 GHz
Ref 15 dBm; Ref Offset 18.0 dB; 10 dB/div
RBW 100.0 kHz; VBW 100.0 kHz; Att 10 dB; Swp 250.0 mS
Marker 65.566667 MHz, -44.0 dBm
Display Line: -13 dBm; : Limit Test Passed
Tested by jph 16/03/2007 10:27:22



Start 1.0 GHz; Stop 2.0 GHz
Ref 15 dBm; Ref Offset 18.0 dB; 10 dB/div
RBW 100.0 kHz; VBW 100.0 kHz; Att 10 dB; Swp 250.0 mS
Marker 1.115 GHz, -34.5 dBm
Display Line: -13 dBm; : Limit Test Passed
Tested by jph 16/03/2007 10:28:28

Carriers identified are exempt from measurements

Carriers identified are exempt from measurements

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

Test of: Zinwave Ltd
Zinwave DAS 2765
To: FCC Part 90: 2006 (Subpart C)

7.2.6. Transmitter Radiated Emissions: Sections 90.210 / 2.1051

The EUT was configured as for transmitter conducted emission testing described in section 9 of this report.

Tests were performed to identify the maximum emissions level at the band edges of the frequency block that the EUT will operate over.

Results:**Fully Loaded**

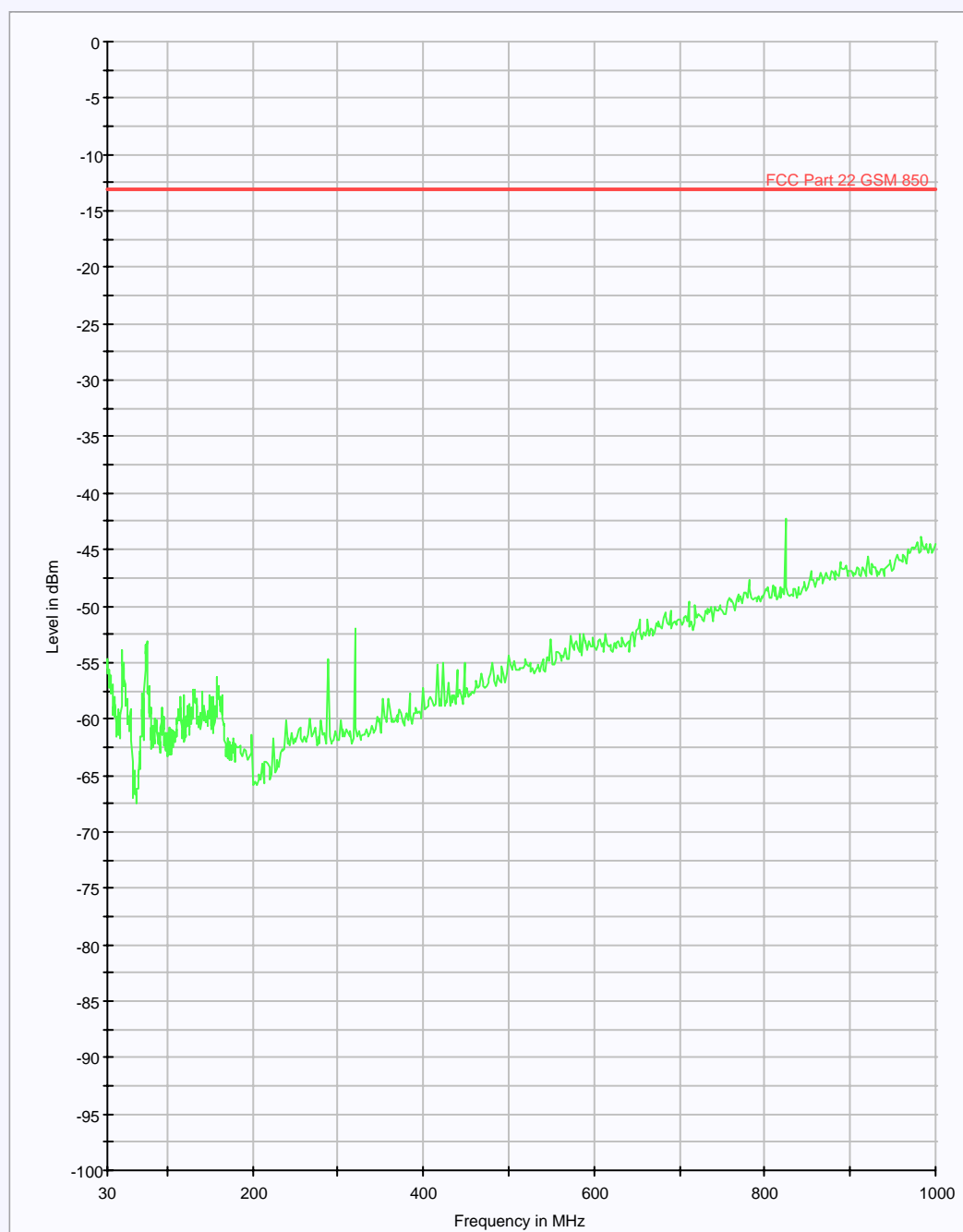
Frequency (MHz)	Peak Emission Level (dBm)	Peak Emission Level (dBc)	Limit (dBc)	Margin (dB)	Result
17842.0	-41.0	-64.7	-47.0	17.7	Complied
25792.0	-45.2	-68.9	-47.0	21.9	Complied

Note(s):

1. All other emissions were at least 20dB below the limit.

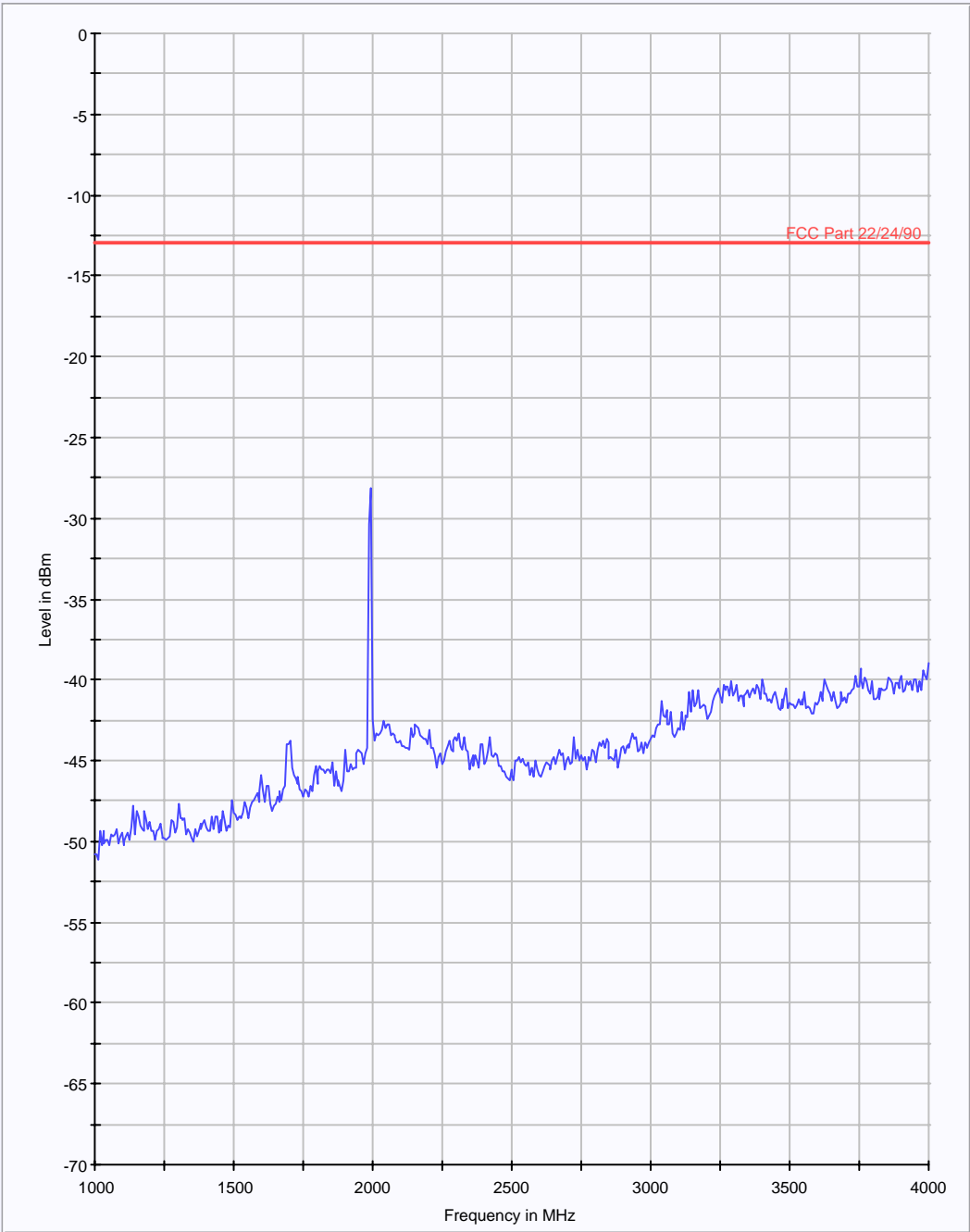
Test of: Zinwave Ltd
Zinwave DAS 2765
To: FCC Part 90: 2006 (Subpart C)

Transmitter Radiated Emissions at Band Edges: Sections 90.210 / 2.1051 (Continued) - Fully Loaded



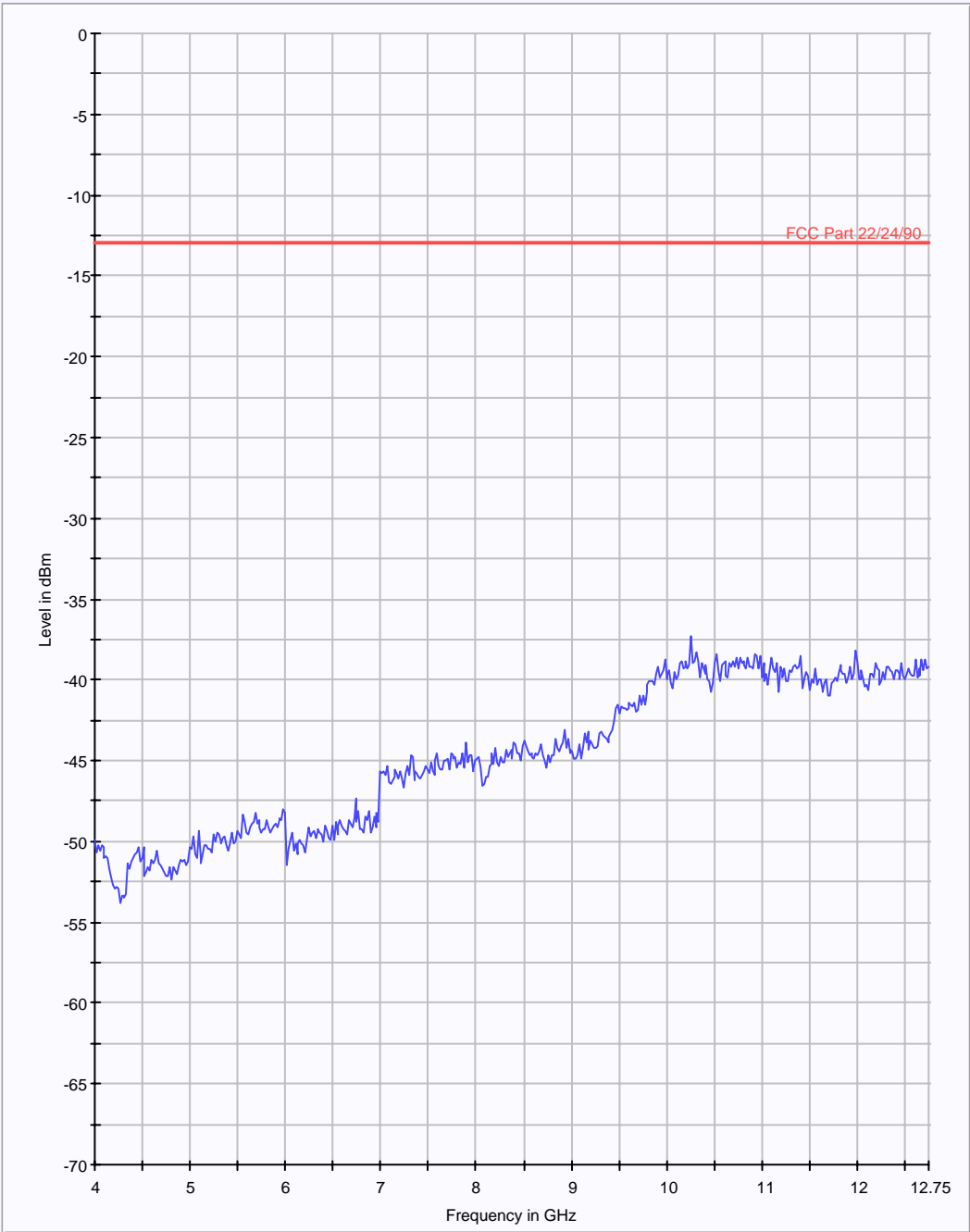
Test of: Zinwave Ltd
Zinwave DAS 2765
To: FCC Part 90: 2006 (Subpart C)

Transmitter Radiated Emissions at Band Edges: Sections 90.210 / 2.1051 (Continued) - Fully Loaded



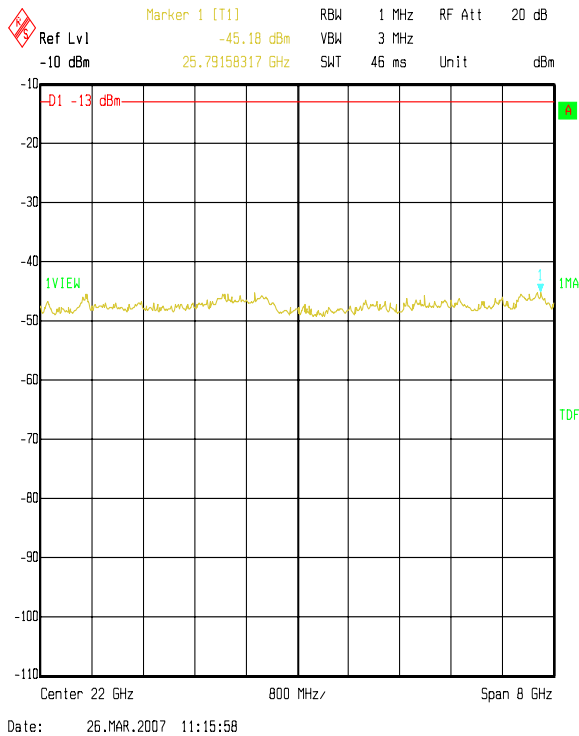
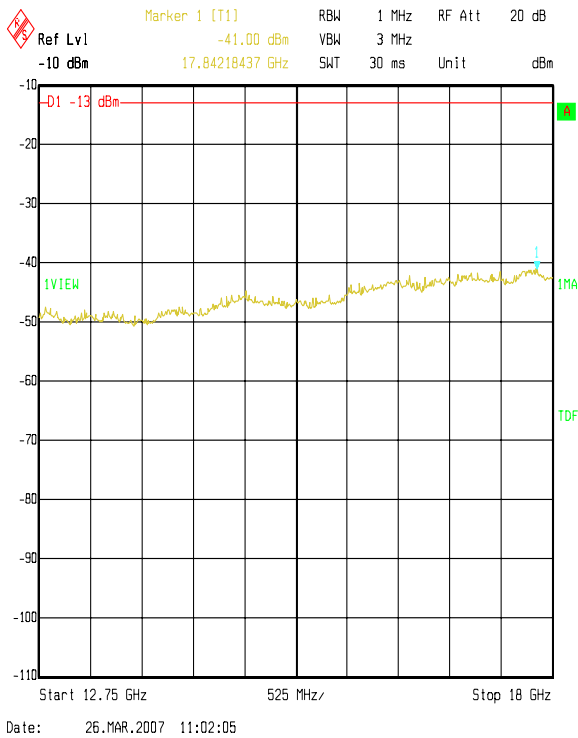
Test of: Zinwave Ltd
Zinwave DAS 2765
To: FCC Part 90: 2006 (Subpart C)

Transmitter Radiated Emissions at Band Edges: Sections 90.210 / 2.1051 (Continued) - Fully Loaded



Test of: Zinwave Ltd
Zinwave DAS 2765
To: FCC Part 90: 2006 (Subpart C)

Transmitter Radiated Emissions at Band Edges: Sections 90.210 / 2.1051 (Continued) - Fully Loaded



Test of: Zinwave Ltd
Zinwave DAS 2765
To: FCC Part 90: 2006 (Subpart C)

7.2.7. Transmitter Frequency Stability (Temperature Variation): Sections 90.213 / 2.1055

The EUT was configured as for transmitter radiated emission testing as described in section 9 of this report.

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

Results:

Bottom Channel (806.025 MHz)

Temperature (°C)	Measured Frequency (MHz)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)	Margin (ppm)	Result
-30	806.025170	170	0.21	1.5	1.29	Complied
-20	806.025001	1	0.0	1.5	1.5	Complied
-10	806.025000	0	0.0	1.5	1.5	Complied
0	806.025000	0	0.0	1.5	1.5	Complied
10	806.025000	0	0.0	1.5	1.5	Complied
20	806.025001	1	0.0	1.5	1.5	Complied
30	806.025001	1	0.0	1.5	1.5	Complied
40	806.025000	0	0.0	1.5	1.5	Complied
50	806.025000	0	0.0	1.5	1.5	Complied

Middle Channel (815.500 MHz)

Temperature (°C)	Measured Frequency (MHz)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)	Margin (ppm)	Result
-30	815.500170	170	0.21	1.5	1.29	Complied
-20	815.500001	1	0.0	1.5	1.5	Complied
-10	815.500000	0	0.0	1.5	1.5	Complied
0	815.500001	1	0.0	1.5	1.5	Complied
10	815.500001	1	0.0	1.5	1.5	Complied
20	815.500000	0	0.0	1.5	1.5	Complied
30	815.500000	0	0.0	1.5	1.5	Complied
40	815.500000	0	0.0	1.5	1.5	Complied
50	815.500000	0	0.0	1.5	1.5	Complied

Test of: Zinwave Ltd
Zinwave DAS 2765
To: FCC Part 90: 2006 (Subpart C)

Transmitter Frequency Stability (Temperature Variation): Sections 90.213 / 2.1055 (Continued)

The EUT was configured as for transmitter radiated emission testing as described in section 9 of this report.

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

Results:**Top Channel (823.975 MHz)**

Temperature (°C)	Measured Frequency (MHz)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)	Margin (ppm)	Result
-30	823.975170	170	0.21	1.5	1.29	Complied
-20	823.975000	0	0.0	1.5	1.5	Complied
-10	823.975001	1	0.0	1.5	1.5	Complied
0	823.975000	0	0.0	1.5	1.5	Complied
10	823.975001	1	0.0	1.5	1.5	Complied
20	823.975000	0	0.0	1.5	1.5	Complied
30	823.975000	0	0.0	1.5	1.5	Complied
40	823.975000	0	0.0	1.5	1.5	Complied
50	823.975001	1	0.0	1.5	1.5	Complied

Test of: Zinwave Ltd
Zinwave DAS 2765
To: FCC Part 90: 2006 (Subpart C)

7.2.8. Transmitter Frequency Stability (Voltage Variation): Sections 90.213 / 2.1055**Results:****Bottom Channel (806.25 MHz)**

Supply Voltage (V)	Measured Frequency (MHz)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)	Margin (ppm)	Result
99.0	806.250001	1	0.0	1.5	1.5	Complied
110.0	806.250001	1	0.0	1.5	1.5	Complied
121.0	806.250001	1	0.0	1.5	1.5	Complied

Middle Channel (815.5 MHz)

Supply Voltage (V)	Measured Frequency (MHz)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)	Margin (ppm)	Result
99.0	815.500000	0	0.0	1.5	1.5	Complied
110.0	815.500001	1	0.0	1.5	1.5	Complied
121.0	815.500001	1	0.0	1.5	1.5	Complied

Top Channel (823.975 MHz)

Supply Voltage (V)	Measured Frequency (MHz)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)	Margin (ppm)	Result
99.0	823.975001	1	0.0	1.5	1.5	Complied
110.0	823.975001	1	0.0	1.5	1.5	Complied
121.0	823.975000	0	0.0	1.5	1.5	Complied

Test of: Zinwave Ltd
 Zinwave DAS 2765
 To: FCC Part 90: 2006 (Subpart C)

7.2.9. Intermodulation: Section 90.210 / 2.1053**Results:****Fully Loaded**

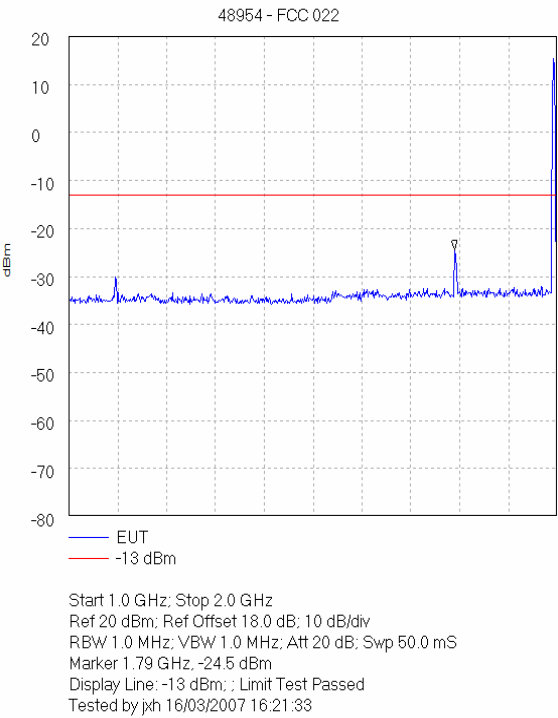
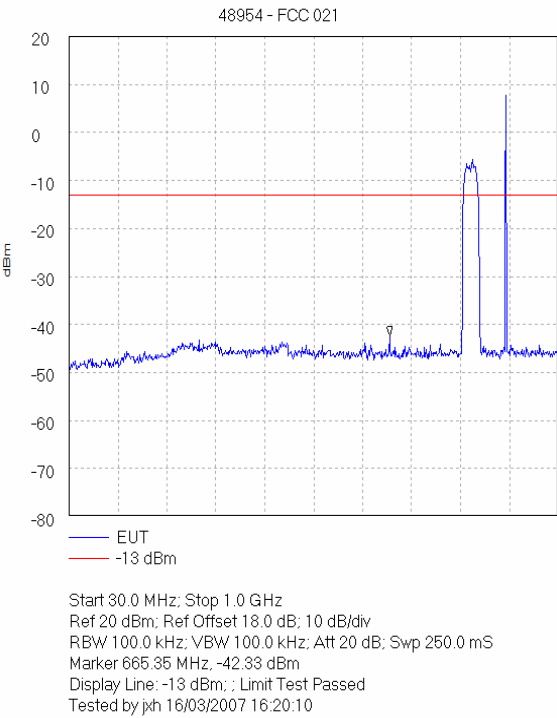
Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
665.35	-42.3	-13.0	29.3	Complied
1790.0	-24.5	-13.0	11.5	Complied
2148.0	-32.2	-13.0	19.2	Complied
3980.0	-31.2	-13.0	18.2	Complied
4430.0	-34.5	-13.0	21.5	Complied
5435.0	-36.8	-13.0	23.8	Complied

iDEN – 3 Signals

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm) (-47.0 dBc)	Margin (dB)	Result
665.25	-43.0	-23.3	19.7	Complied
802.65	-43.5	-23.3	20.2	Complied
841.05	-41.5	-23.3	18.2	Complied
1633.0	-29.5	-23.3	6.2	Complied
2225.0	-35.8	-23.3	12.5	Complied
3180.0	-46.2	-23.3	22.9	Complied

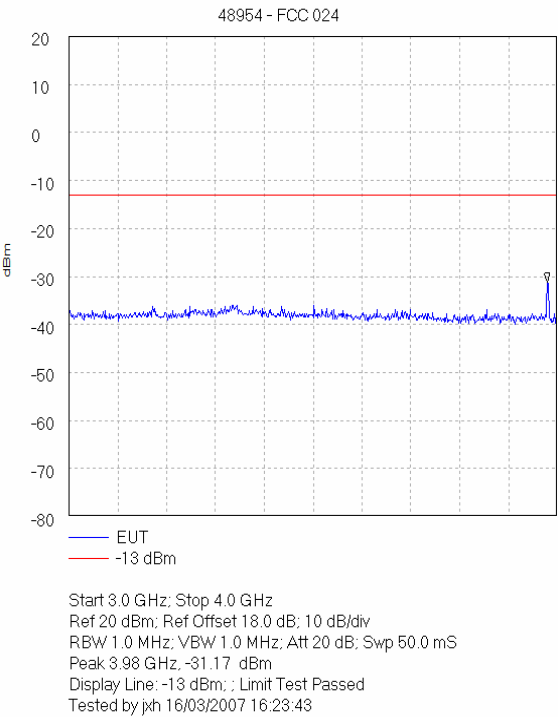
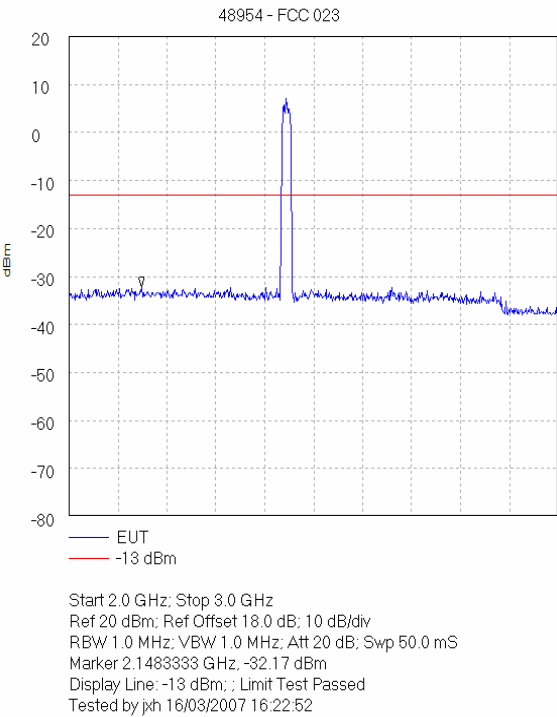
Test of: Zinwave Ltd
Zinwave DAS 2765
To: FCC Part 90: 2006 (Subpart C)

Intermodulation: Section 90.210 / 2.1053 (Continued) - Fully Loaded



Carriers identified are exempt from measurements

Carrier identified is exempt from measurements



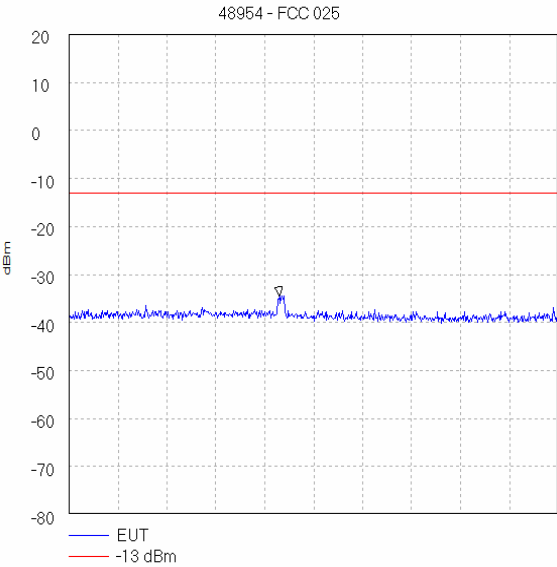
Carrier identified exempt from measurements

Test of: Zinwave Ltd
 Zinwave DAS 2765

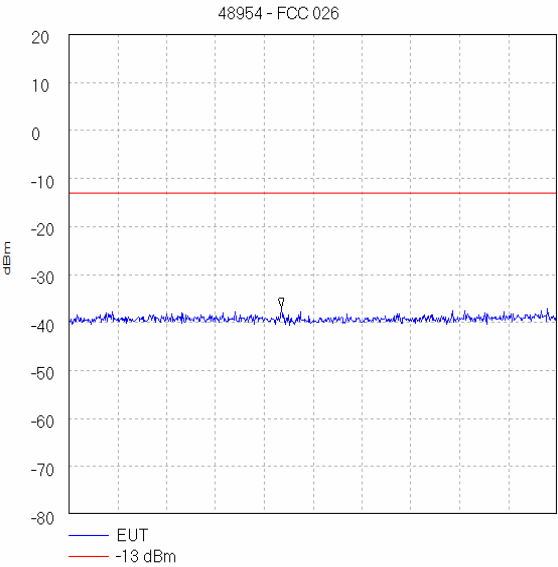
To: FCC Part 90: 2006 (Subpart C)

Test of: Zinwave Ltd
Zinwave DAS 2765
To: FCC Part 90: 2006 (Subpart C)

Intermodulation: Section 90.210 / 2.1053 (Continued) - Fully Loaded



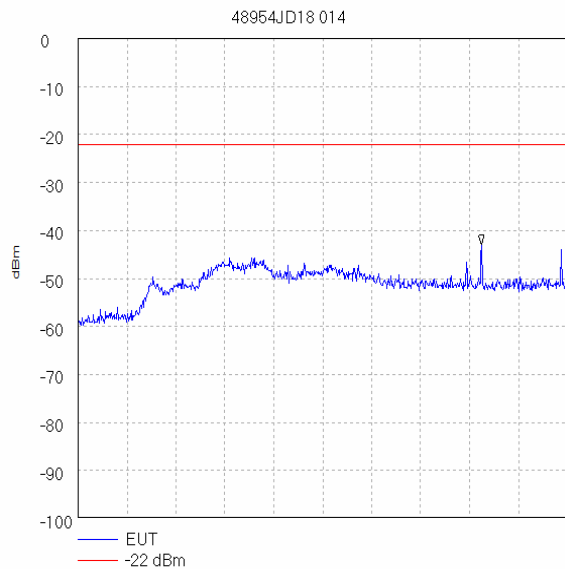
Start 4.0 GHz; Stop 5.0 GHz
Ref 20 dBm; Ref Offset 18.0 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 20 dB; Swp 50.0 mS
Peak 4.43 GHz, -34.5 dBm
Display Line: -13 dBm; ; Limit Test Passed
Tested by jph 16/03/2007 16:24:11



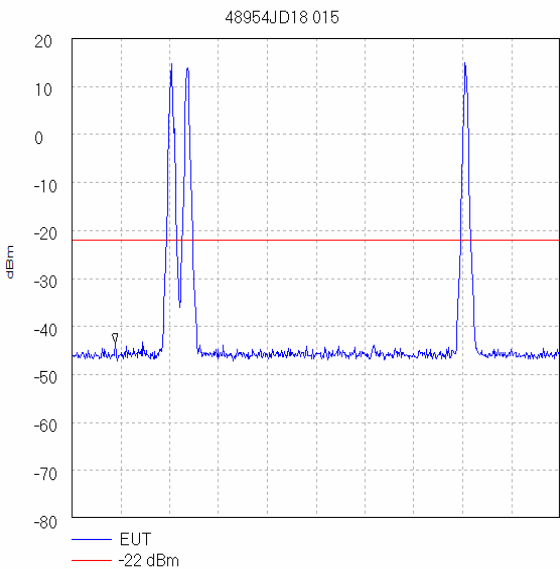
Start 5.0 GHz; Stop 6.0 GHz
Ref 20 dBm; Ref Offset 18.0 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 20 dB; Swp 50.0 mS
Peak 5.435 GHz, -36.83 dBm
Display Line: -13 dBm; ; Limit Test Passed
Tested by jph 16/03/2007 16:24:36

Test of: Zinwave Ltd
Zinwave DAS 2765
To: FCC Part 90: 2006 (Subpart C)

Intermodulation: Section 90.210 / 2.1053 (Continued) - iDEN – 3 Signals



Start 30.0 MHz; Stop 800.0 MHz
Ref 0 dBm; Ref Offset 18.0 dB; 10 dB/div
RBW 100.0 kHz; VBW 100.0 kHz; Att 10 dB; Swp 200.0 mS
Peak 665.25 MHz, -43.0 dBm
Display Line: -22 dBm; ; Limit Test Passed
Tested by JXH 16/03/2007 17:02:27

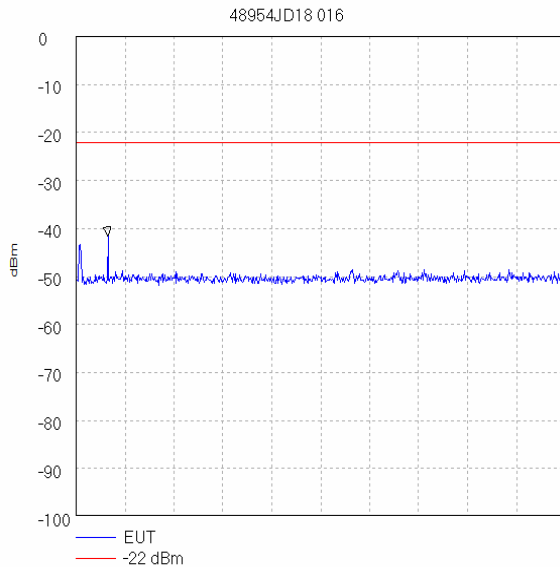


Start 800.0 MHz; Stop 830.0 MHz
Ref 20 dBm; Ref Offset 18.0 dB; 10 dB/div
RBW 100.0 kHz; VBW 100.0 kHz; Att 20 dB; Swp 50.0 mS
Marker 802.65 MHz, -43.5 dBm
Display Line: -22 dBm; ; Limit Test Passed
Tested by JXH 16/03/2007 17:03:12

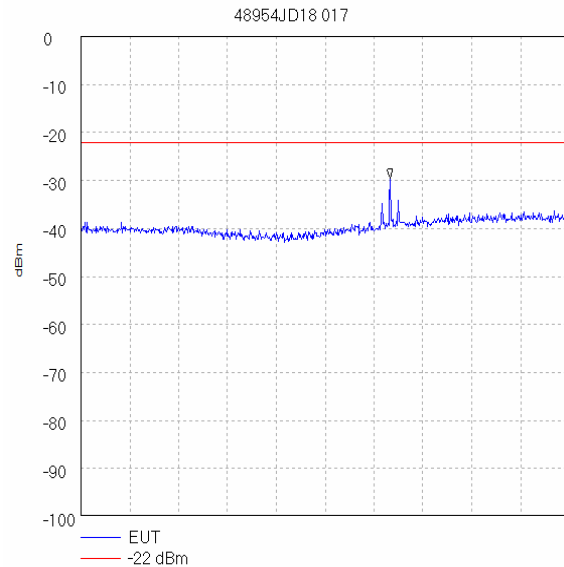
Carriers identified are exempt from measurements

Test of: Zinwave Ltd
Zinwave DAS 2765
To: FCC Part 90: 2006 (Subpart C)

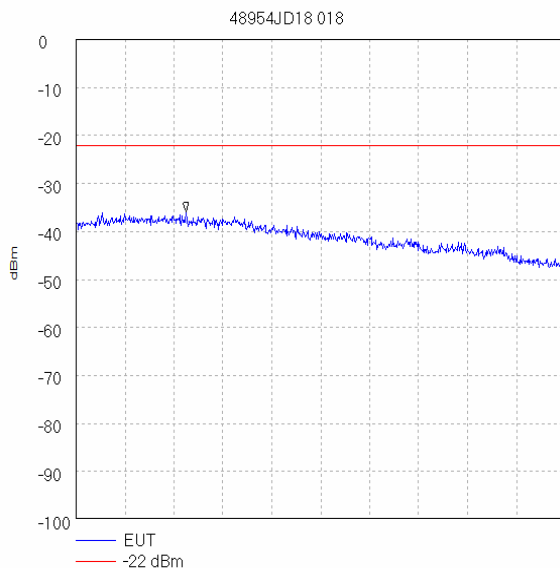
Intermodulation: Section 90.210 / 2.1053 (Continued) - iDEN – 3 Signals



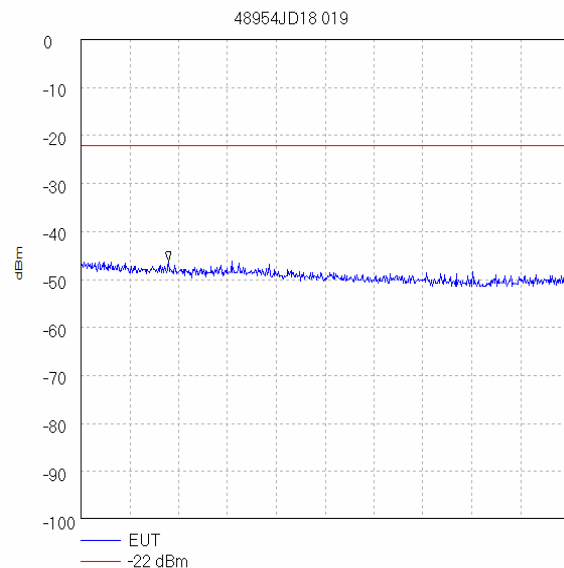
Start 830.0 MHz; Stop 1.0 GHz
Ref 0 dBm; Ref Offset 18.0 dB; 10 dB/div
RBW 100.0 kHz; VBW 100.0 kHz; Att 10 dB; Swp 50.0 mS
Peak 841.05 MHz, -41.5 dBm
Display Line: -22 dBm; ; Limit Test Passed
Tested by JXH 16/03/2007 17:04:15



Start 1.0 GHz; Stop 2.0 GHz
Ref 0 dBm; Ref Offset 18.0 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 10 dB; Swp 50.0 mS
Peak 1.6333333 GHz, -29.5 dBm
Display Line: -22 dBm; ; Limit Test Passed
Tested by JXH 16/03/2007 17:04:44



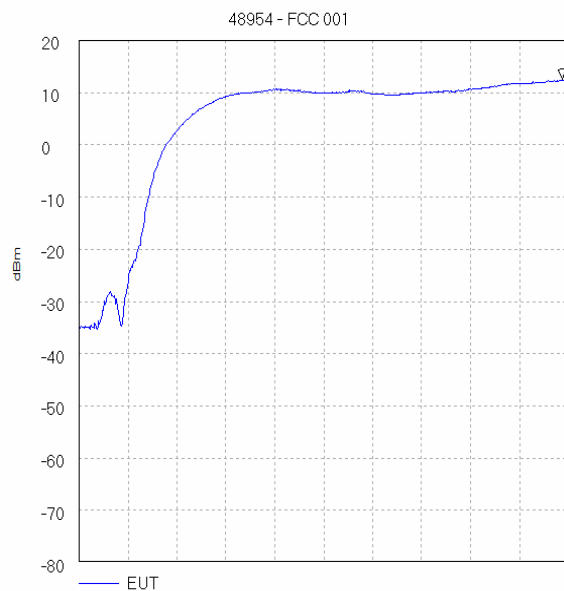
Start 2.0 GHz; Stop 3.0 GHz
Ref 0 dBm; Ref Offset 18.0 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 10 dB; Swp 50.0 mS
Peak 2.225 GHz, -35.83 dBm
Display Line: -22 dBm; ; Limit Test Passed
Tested by JXH 16/03/2007 17:05:14



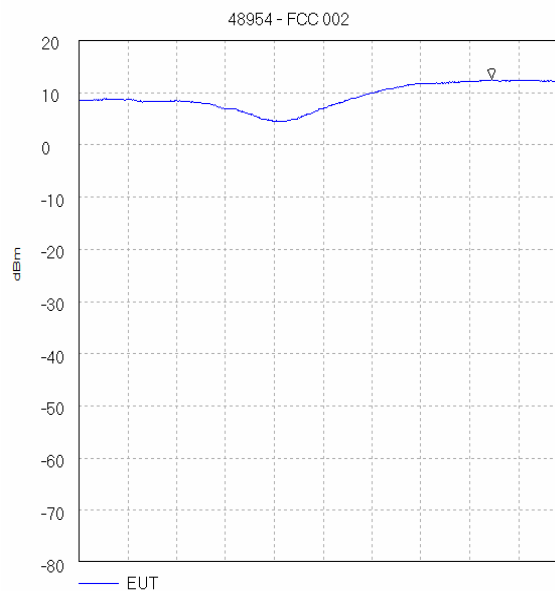
Start 3.0 GHz; Stop 4.0 GHz
Ref 0 dBm; Ref Offset 18.0 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 10 dB; Swp 50.0 mS
Peak 3.18 GHz, -46.17 dBm
Display Line: -22 dBm; ; Limit Test Passed
Tested by JXH 16/03/2007 17:05:40

Test of: Zinwave Ltd
Zinwave DAS 2765
To: FCC Part 90: 2006 (Subpart C)

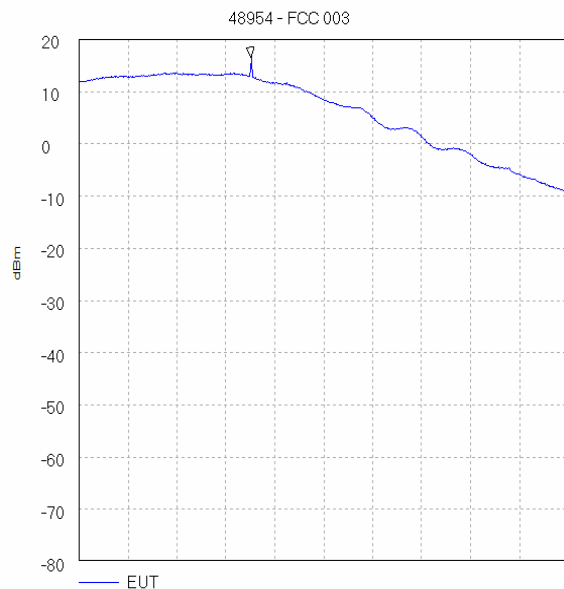
7.2.10. Out-of-Band Rejection



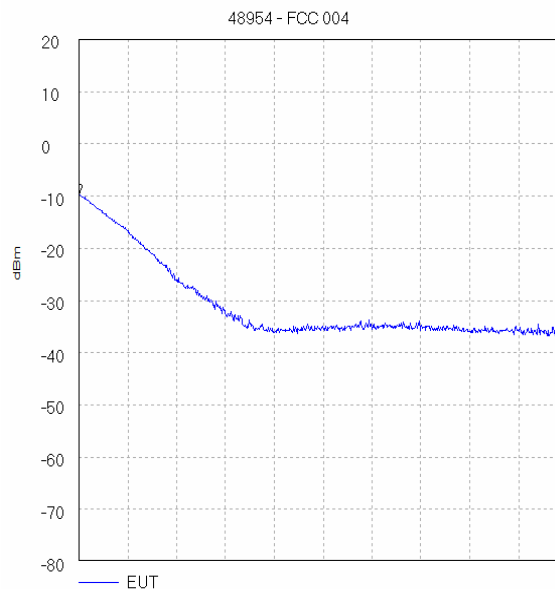
Start 30.0 MHz; Stop 1.0 GHz
Ref 20 dBm; Ref Offset 16.0 dB; 10 dB/div
RBW 2.0 MHz; VBW 3.0 MHz; Att 20 dB; Swp 50.0 mS
Peak 988.683333 MHz, 12.5 dBm
Tested by jkh 15/03/2007 11:59:23



Start 1.0 GHz; Stop 2.0 GHz
Ref 20 dBm; Ref Offset 16.0 dB; 10 dB/div
RBW 2.0 MHz; VBW 3.0 MHz; Att 20 dB; Swp 50.0 mS
Peak 1.845 GHz, 12.5 dBm
Tested by jkh 15/03/2007 12:16:16

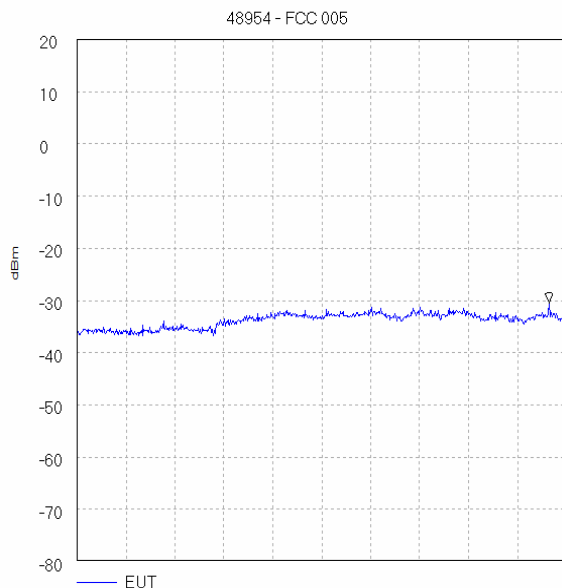


Start 2.0 GHz; Stop 3.0 GHz
Ref 20 dBm; Ref Offset 16.0 dB; 10 dB/div
RBW 2.0 MHz; VBW 3.0 MHz; Att 20 dB; Swp 50.0 mS
Peak 2.3516667 GHz, 16.5 dBm
Tested by jkh 15/03/2007 13:38:40

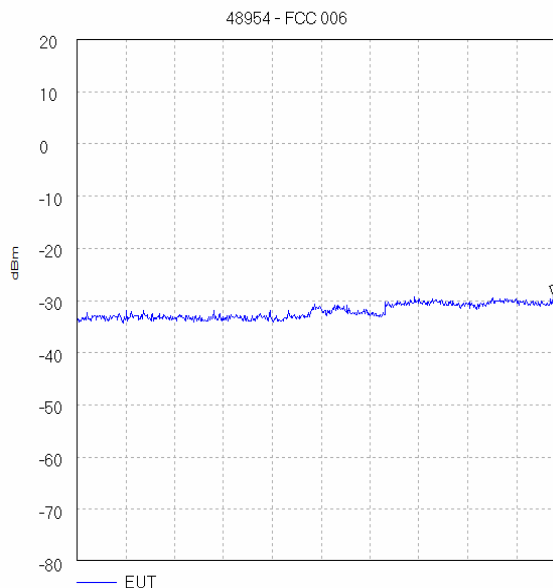


Start 3.0 GHz; Stop 5.0 GHz
Ref 20 dBm; Ref Offset 16.0 dB; 10 dB/div
RBW 2.0 MHz; VBW 3.0 MHz; Att 20 dB; Swp 50.0 mS
Peak 3.0 GHz, -9.83 dBm
Tested by jkh 15/03/2007 14:00:04

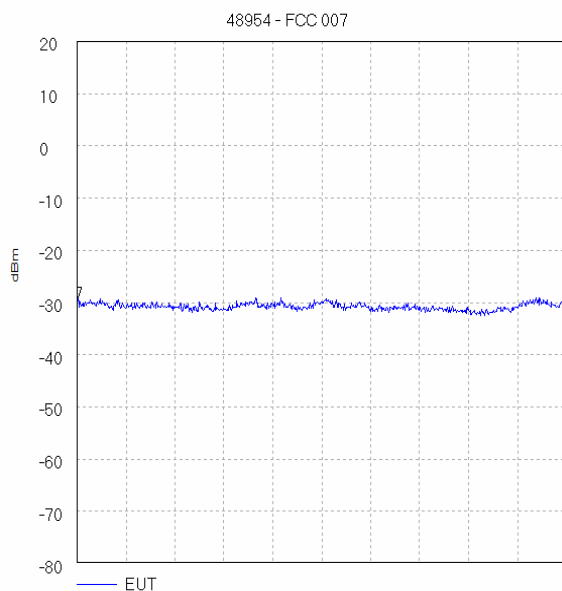
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Out-of-Band Rejection (Continued)

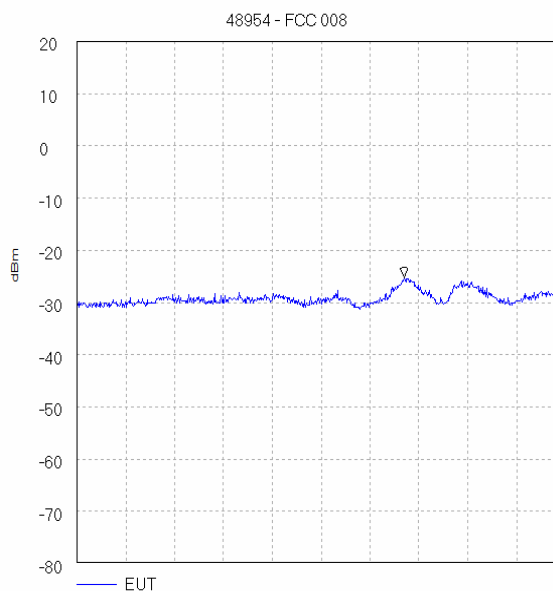
Start 5.0 GHz; Stop 10.0 GHz
Ref 20 dBm; Ref Offset 16.0 dB; 10 dB/div
RBW 2.0 MHz; VBW 3.0 MHz; Att 20 dB; Swp 100.0 mS
Peak 9.825 GHz, -30.5 dBm
Tested by jph 15/03/2007 14:26:34



Start 10.0 GHz; Stop 15.0 GHz
Ref 20 dBm; Ref Offset 16.0 dB; 10 dB/div
RBW 2.0 MHz; VBW 3.0 MHz; Att 20 dB; Swp 100.0 mS
Peak 14.875 GHz, -29.0 dBm
Tested by jph 15/03/2007 14:37:48



Start 15.0 GHz; Stop 20.0 GHz
Ref 20 dBm; Ref Offset 16.0 dB; 10 dB/div
RBW 2.0 MHz; VBW 3.0 MHz; Att 20 dB; Swp 100.0 mS
Peak 15.0083333 GHz, -29.0 dBm
Tested by jph 15/03/2007 14:40:21



Start 20.0 GHz; Stop 26.0 GHz
Ref 20 dBm; Ref Offset 16.0 dB; 10 dB/div
RBW 2.0 MHz; VBW 3.0 MHz; Att 20 dB; Swp 120.0 mS
Peak 24.02 GHz, -25.33 dBm
Tested by jph 15/03/2007 14:41:48

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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
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	±3.72 dB
Carrier Output Power	Not applicable	95%	±0.28 dB
Conducted Emissions	9 kHz to 26 GHz	95%	±0.46 dB
Conducted Emissions Antenna Port	30 MHz to 40 GHz	95%	±0.28 dB
Frequency Stability	Not applicable	95%	±0.121 ppm
Minimum Bandwidth	Not applicable	95%	±0.12 %
Occupied Bandwidth	824 to 849 MHz	95%	±0.12 %
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	±4.64 dB
Radiated Spurious Emissions	1 GHz to 26 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.

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9. Measurement Methods

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 110V 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

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Transmitter Carrier Output Power (ERP)

The EUT and communications analyser were configured as per ANSI TIA-603-B, Land Mobile FM or PM Communications Equipment; Measurement and Performance Standards.

A communications analyser was connected to the antenna port of the EUT via a suitable cable. Prior to testing being performed the cable was calibrated for loss at the required frequency. For each frequency the calibrated level of cable loss was noted and then added to the indicated result on the communications analyser to compensate for the losses in the measurement set up.

To determine the transmitter output power, the EUT was operated at maximum power and a result was obtained taken from the display of the communications analyser.

The effective radiated power (ERP) was calculated by adding the manufacturer's declared antenna gain to the figure measured for conducted RF output power.

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Occupied (20 dB) Bandwidth

The EUT was connected to a spectrum analyser enabled with an occupied bandwidth function via a direct connection (via suitable attenuation) **(as applicable)**.

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 and top channels. The Occupied Bandwidth was measured in line with the requirements of 2.1049 i.e. with the EUT modulated with a signal representing the maximum rated conditions under which it will operate (worst case)

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.

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Transmitter Conducted Emissions

The EUT and spectrum analyser were configured as per ANSI TIA-603-B, Land Mobile FM or PM Communications Equipment; Measurement and Performance Standards.

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 was 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-603-B.

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

For frequencies further than 12.5 kHz from the centre of the authorised bandwidth (fc) the emissions shall be attenuated by at least $50 + 10 \log (P \text{ in Watts})$ dB or 70 dB (whichever is the lesser attenuation) relative to the transmitter output power level measured for the channel under test. The tabulated results in the results section of this report show the spurious emission in dBm and as attenuation relative to the carrier in dBc.

For the frequency ranges close to and including the fundamental frequency, plots of the spectral distribution (emission masks) were recorded using a spectrum analyser for the EUT transmitting on bottom, middle and top channels. The method used was in accordance with the methods detailed in FCC Part 90.210.

FCC Part 90.210 states the appropriate emission mask that shall be used for a given channel bandwidth. Measurements were performed using the appropriate emission mask for the channel bandwidth declared i.e. Emission Mask D for a channel bandwidth of 12.5 kHz.

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

Receiver Function	Settings
Detector Type:	Peak
Mode:	Max Hold
Bandwidth:	As per Part 90.210 <50 kHz away from fc
Bandwidth:	1 MHz >1 GHz
Bandwidth:	10 kHz <1 GHz
Amplitude Range:	100 dB
Sweep Time:	Coupled

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Transmitter Radiated Emissions

The EUT and spectrum analyser were configured as per ANSI TIA-603-B, Land Mobile FM or PM Communications Equipment; Measurement and Performance Standards.

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 m and a measurement distance of 3 m, below 4 GHz; above 4 GHz a 1 m 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.

For the final measurements the EUT was arranged on a non-conducting turn table on a standard test site compliant with ANSI C63.4 – 2001 Clause 5.4.

An open area test site using the appropriate test distance and spectrum analyser with an peak detector was used for final measurements. All measurements on the open area test site were performed using broadband antennas.

On the open area test site, at each frequency where a signal was 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 than 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:-

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

Once the ERP was obtained, the difference between it and the level of the fundamental emission for the ERP of the channel under test was noted at the spurious attenuation level in dBc. The following formula was used as described in TIA-603-B.

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

For frequencies further than 12.5 kHz from the centre of the authorised bandwidth (fc) the emissions shall be attenuated by at least 50 + 10 log (P in Watts) dB or 70 dB (whichever is the lesser attenuation) relative to the transmitter output power level measured for the channel under test. The tabulated results in the results section of this report show the spurious emission in dBm and as attenuation relative to the carrier in dBc.

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Transmitter Radiated Emissions (continued)

For the frequency ranges close to and including the fundamental frequency, plots of the spectral distribution (emission masks) were recorded using a spectrum analyser for the EUT transmitting on bottom, middle and top channels. The method used was in accordance with the methods detailed in FCC Part 90.210.

FCC Part 90.210 states the appropriate emission mask that shall be used for a given channel bandwidth. Measurements were performed using the appropriate emission mask for the channel bandwidth declared i.e. Emission Mask D for a channel bandwidth of 12.5 kHz.

Receiver Function	Settings
Detector Type:	Peak
Mode:	Max Hold
Bandwidth:	As per Part 90.210 <50 kHz away from fc
Bandwidth:	1 MHz >1 GHz
Bandwidth:	10 kHz <1 GHz
Amplitude Range:	100 dB
Sweep Time:	Coupled

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Transmitter Frequency Stability

The EUT and communications analyser were configured as per ANSI TIA-603-B, Land Mobile FM or PM Communications Equipment; Measurement and Performance Standards.

The EUT was situated within an environmental test chamber and monitored on the communications analyser via a direct connection **(as applicable)**.

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 between the declared nominal supply voltage and at the declared endpoint voltage (for hand carried battery operated equipment) or by varying the primary supply voltage from 85% to 115% of the nominal value for all other equipment types.

The requirement was to determine the frequency stability of the device under specified environmental operating conditions.

The EUT was switched off for a minimum of 30 minutes between each stage of testing while the environmental chamber stabilised at the next temperature within the stated temperature range.

Once the environmental chamber had reached thermal equilibrium, the nominal frequency of the EUT was measured and recorded. The recorded frequency was compared to the declared nominal operating frequency of the channel being tested.

The frequency error measured was converted to an error in ppm using the following formula as defined by TIA_EIA_603A :-

$$\text{ppm error} = \left(\frac{MCF_{\text{MHz}}}{ACF_{\text{MHz}}} - 1 \right) * 10^6$$

where MCF_{MHz} is the measured carrier frequency in MHz
 ACF_{MHz} is the assigned carrier frequency in MHz

The measured ppm had to be less then the relevant limits in order to comply.

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Appendix 1. Test Equipment Used

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval
A028	Horn Antenna	Eaton	91888-2	304	08 Jun 2006	36
A031	Horn Antenna	Eaton	91889-2	557	08 Jun 2006	36
A067	LISN	Rohde & Schwarz	ESH3-Z5	890603/002	27 Mar 2006	12
A1227	Pre Amp	Agilent	8449B	3008A01566	30 Aug 2006	12
A1534	Preamplifier	Hewlett Packard	8449B OPT H02	3008A00405	Cal Before Use	N/A
A1536	Variable Attenuator	Hewlett Packard	9494B & 9496B	3308A30801 & 3308A19649	Cal Before Use	N/A
A1738	Attenuator	Atlantic Microwave	BBS40-10	R1379	05 May 2006	12
A1747	Attenuator	Atlantic Microwave	BBS40-06	R7016	26 May 2006	12
A1818	Antenna	EMCO	3115	00075692	3 Nov 2006	12
A1829	Pulse Limiter	Rhode & Schwarz	ESH3-Z2	100671	8 Jan 2007	12
A253	Horn Antenna	Flann Microwave	12240-20	128	17 Nov 2006	36
A254	Horn Antenna	Flann Microwave	14240-20	139	17 Nov 2006	36
A255	Horn Antenna	Flann Microwave	16240-20	519	17 Nov 2006	36
A256	Horn Antenna	Flann Microwave	18240-20	400	17 Nov 2006	36
A436	Horn Antenna	Flann	20240-20	330	24 Apr 2006	36
M023	Test Receiver	Rohde & Schwarz	ESVP	872 991/027	10 Apr 2006	12
M1009	RF Power Meter	Hewlett Packard	437B	3125U13706	30 Oct 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
M1273	Test Receiver	Rhode & Schwarz	ESIB 26	100275	20 Feb 2007	12
M1379	Test Receiver	Rhode & Schwarz	ESIB7	100330	3 July 2006	12
S201	3m OATS	RFI	1	None	18 July 2006	12
S202	3m OATS	RFI	2	None	17 Nov 2006	12

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

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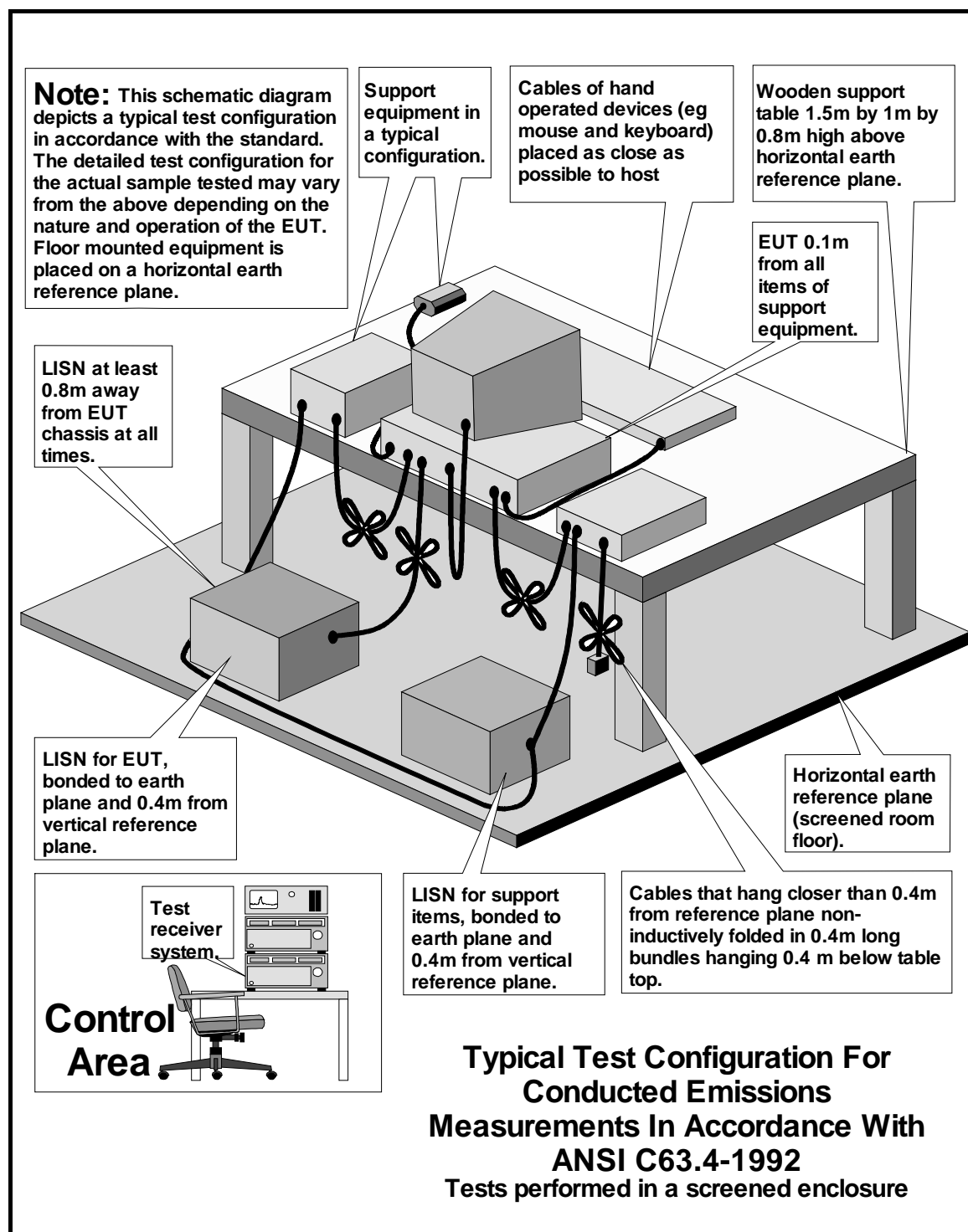
Appendix 2. Test Configuration Drawings

This appendix contains the following drawings:

Drawing Reference Number	Title
DRG\48954JD01\EMICON	Test configuration for measurement of conducted emissions.
DRG\48954JD01\EMIRAD	Test configuration for measurement of radiated emissions.

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DRG\48954JD01\EMICON



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DRG\48954JD01\EMIRAD

