dB Technology
|---------- (Cambridge Ltd.) ----------|
EMC Testing | EMC Consultancy | EMC Training

23, Headington Drive,
Cambridge.
CB1 9HE
Tel : 01954 251974 (test site)
or : 01223 241140 (accounts)
Fax : 01954 251907
web : www.dbtechnology.co.uk
email: mail@dbtechnology.co.uk

REPORT ON ELECTROMAGNETIC COMPATIBILITY TESTS

Performed at:
TWENTY PENCE TEST SITE

Twenty Pence Road,
Cottenham,
Cambridge
U.K.
CB4 8PS

on

Controlled Speed Engineering

CSE305

dated

28 January 2005

Document History

Issue	Date	Affected page(s)	Description of modifications	Revised by	Approved by
1	03/02/05		Initial release		

Based on report template:
v031111

Equipment Under Test (EUT):	**CSE305**
Test Commissioned by:	**Controlled Speed Engineering St Pegs House Thornhill Beck Lane Brighouse N. Yorkshire**
Representative:	**Alan Hurst**
Test Started:	**27 January 2005**
Test Completed:	**27 January 2005**
Test Engineer:	**Dave Smith**
Date of Report:	**28 January 2005**
Report:	

Written by:	**Dave Smith**	**Checked by:**	**Derek Barlow**
Signature:	D. A. Smith	**Signature:**	D. Barlow
Date:	**28th January 2005**	**Date:**	**3rd February 2005**

dB Technology can only report on the specific unit(s) tested at its site. The responsibility for extrapolating this data to a product line lies solely with the manufacturer.

Test Standards Applied

CFR 47 : 2004	***Code of Federal Regulations: Pt 15 Subpart C - Radio Frequency Devices - Intentional Radiators***

Emissions Test Results Summary

CFR 47 : 2004 **PASS**

Test	Port	Method	Limit	PASS/FAIL	*Notes*
Conducted Emissions	ac power	ANSI C63.4:2001	CISPR22(B)	N/A	#1
Radiated Emissions		ANSI C63.4:2001	FCC(C)	PASS	

fcc_v040903

#1 Test not applicable because EUT was battery powered and had no ac power port.

Contents

1 EUT Details

1.1 General

The EUT was a CSE305 remote control unit for a stair lift. The unit is an intentional transmitter operating at 433.9MHz. The transmitter operation is periodic and intended to operate under the provisions of CFR 47 part 15.231.

The unit was battery powered and had no ports for the connection of external cables.

Details of the EUT are listed below.

Item	Manufacturer	Model	Description	Serial No:	Notes
	CSE	CSE305	EUT		

1.2 Modifications to EUT

Details of any modifications that were required to achieve compliance are listed below. The modification numbers are referred to in the results sections as appropriate.

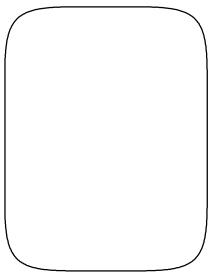
Mod No:	Details	Implemented for
1	Resistor value changed to reduce carrier level.	Harmonic levels

1.3 EUT Operating Modes

The EUT was tested in the following operating mode or modes. Generally, operating modes are chosen that will exercise the functions of the EUT as fully as possible and in a manner likely to produce maximum emission levels or susceptibility. Individual test result sheets reference the operating mode of the EUT.

Operating Mode	Details
1	Button held down to produce continuous transmissions.

Figure 1 Arrangement of EUT



EUT had no ports for connection to external cables.

Photograph 1 Arrangement of EUT

2 Test Equipment

The test equipment used during the tests was one or more of the items listed below. Individual test result sheets indicate which items were used.

Ref No:	Details	Serial Number
A12	Chase Bilog CBL6111A	1012
A5	Chase Bilog CBL6111A	1760
A8	EMCO 3115 DR Guide	6070
PRE3	dB Tech 100M-20G 36dB pre-amp	3
R2	CHASE UHR 4000	6111
R4	R&S ESVS10	421872
R5	HP 8595E Spec. Analyser	3412A00701
R5B	dB Technology Pre-amp	dB001
R6	Marconi 2390 Spec Analyser	23901010

3 Tests

3.1 Radiated Emissions - Fundamental and Spurious

Initial scans were performed in a semi-anechoic screened room at a distance of 3m. Scans were performed over the frequency range specified in the test standard with the antenna both horizontally and vertically polarised. Scans were performed to frequencies exceeding the 10th harmonic of the carrier, which for this product required scans to frequencies above 4.44GHz. These scans were performed using a peak detector.

The results of these scans are shown in Plot 1 and Plot 2.

Significant emissions identified by the scans were measured on an open area test site at a test distance of 3m. Maximised readings were obtained by rotating the EUT through 360° and adjusting the height of the antenna from 1m to 4m. Measurements were made with the antenna both horizontally and vertically polarised and the results tabulated.

For measurements below 1GHz a CISPR quasipeak detector was used. For measurements above 1GHz a spectrum analyser with a peak detector was used. The standard specifies an average detector for measurement above 1GHz. Where necessary, average levels were calculated from the peak levels using the method described below.

The results of the measurements are shown in sections 4.1 and 4.2 of this report. All emissions complied with Section 15.231 of CFR 47.

Calculating Average Field Strengths

The duty cycle of the emissions was assessed by taking a scan with 0Hz span at the carrier centre frequency.

The results of this scan are shown in plot 3. The scan shows the transmitter to be on for 60msec out of a total period of 109.5msec.

Section 15.35 (c) of CFR 47 states that, for pulsed operation with a pulse train exceeding 100msec, the field strength is determined by the average absolute voltage during a 100msec period which gives maximum field strength. In this case a maximum 100msec period would have a pulse on for 60msec and off for 40msec. The average voltage will be 0.6 * peak voltage. The average field strength would differ from the peak field strength by 20*log(0.6). The average field strength would therefore be -4.43dB relative to the peak field strength.

3.2 Emissions Bandwidth

A scan was performed around the carrier centre frequency. This was performed at close distance in a screened room. A 120kHz resolution bandwidth average detector with 1000 msec dwell time was used. The results are shown in plot 4.

The mask shown on the plot is based on the allowable bandwidth of 0.25% of carrier frequency with bandwidth determined at points 20dB below the carrier.

The plot shows the bandwidth to be less than 250kHz and is compliant with Section 15.231 of CFR 47.

4 Test Data

The following sections contain tabulated test results. Plots of various scans are included at the back of this section.

4.1 Radiated Emissions Results - below 1GHz

Factor Set 1:	A5_10m_04A	-	-	RG214_04A	25 m cable
Factor Set 2:	-	-	-	-	
Factor Set 3:	-	-	-	-	
Test Equipment:	R4 A12 CSET005				

Radiated_Emissions

Company:	Controlled Speed Engineering	*Product:*	CSE305
Date:	27/01/2005	*Test Eng:*	DS
Ports:			
Test:	ANSI C63.4:2001 using limits of		FCC(C)
Ports:			
Test:	using limits of		

Plot	Op Mode	Mod State	Dist m	Fact Set	Freq. MHz	Ant Pol	Rec. Level dBuV	Corr'n Factor dB/m	Corr'n Factor dB	Total Level dBuV/m	Limit FCC(C) dBuV/m	Margin FCC(C) dB	Notes
1	1	1	3	1	433.871	V	49.1	20.7		69.8	80.8	11.0	#1
1	1	1	3	1	433.871	H	44.1	20.7		64.8	80.8	16.0	#1
1	1	1	3	1	867.720	V	18.8	29.0		47.8	60.8	13.0	#2
1	1	1	3	1	867.720	H	7.2	29.0		36.2	60.8	24.6	#2

Results	Minimum Margin	11.0	dB
	PASS/FAIL	PASS	

Notes	Comments and Observations
	Results of scan shown in plot 1.
	Measurement made with quasipeak detector.
#1	Fundamental limit - 15.231(b)
#2	Limit for harmonics -15.231(b) (except in restricted bands).
	Correction factor 1 is combination of antenna and cable.
	Field strength (dBuV/m) = reciver reading (dBuV) + CF1.

4.2 Radiated Emissions Results - above 1GHz

Factor Set 1:	A8_04A	PRESET2_04A	-	-
Factor Set 2:	-	-	-	-
Factor Set 3:	-	-	-	-
Test Equipment:	R6 A8 CSET002 PRE3			

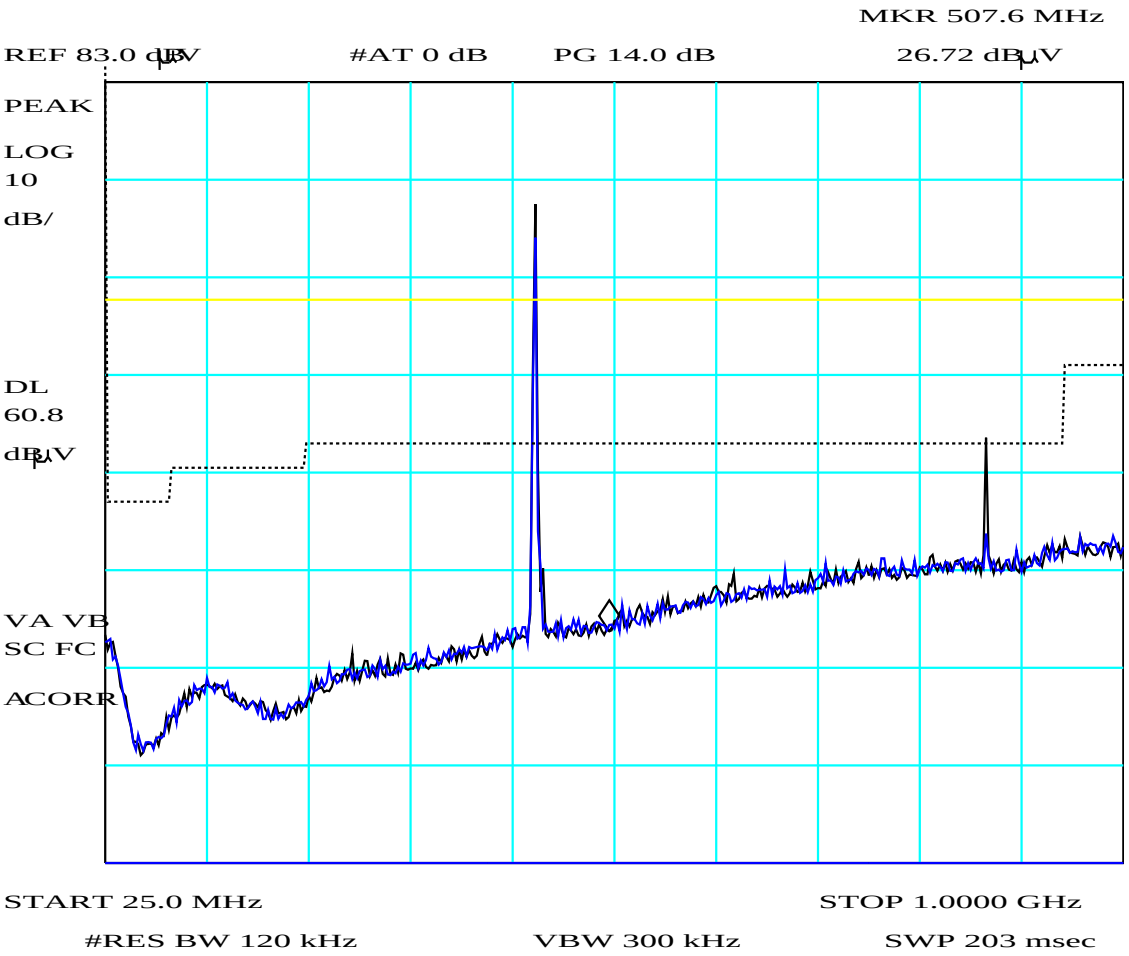
Radiated_Emissions

Company:	Controlled Speed Engineering	*Product:*	CSE305
Date:	27/01/2005	*Test Eng:*	Dave Smith
Ports:			
Test:	ANSI C63.4:2001 using limits of		FCC(C)
Ports:			
Test:	using limits of		

Plot	Op Mode	Mod State	Dist m	Fact Set	Freq. MHz	Ant Pol	Rec. Level dBuV	Corr'n Factor dB/m	Corr'n Factor* dB	Total Level dBuV/m	Limit FCC(C) dBuV/m	Margin FCC(C) dB	Notes
2	1	1	3	1	1301.531	V	47.4	-8.5	-4.4	34.4	54.0	19.6	#2
2	1	1	3	1	1735.986	V	66.9	-6.8	-4.4	55.7	60.8	5.1	#1
2	1	1	3	1	2169.425	V	48.0	-4.8	-4.4	38.9	60.8	21.9	#1
2	1	1	3	1	2603.695	V	42.4	-3.2	-4.4	34.8	60.8	26.0	#1
2	1	1	3	1	3037.491	V	47.1	-1.1	-4.4	41.6	60.8	19.2	#1
2	1	1	3	1	3469.874	H	53.4	0.1	-4.4	49.1	60.8	11.7	#1
2	1	1	3	1	3905.351	V	48.7	0.1	-4.4	44.4	54.0	9.6	#2
2	1	1	3	1	4340.058	V	45.2	-0.4	-4.4	40.4	54.0	13.6	#2

Results	Minimum Margin	5.1 dB	
	PASS/FAIL	PASS	

Notes	Comments and Observations
*	Results of scan shown in plot 2. Measurements made with peak detector. As decribed in section 3.1 of this report, average measurements can be calculated as 4.43dB below peak measurements. This has been included as the second correction factor in the table above.
#1	Limit for harmonics -15.231(b) (except in restricted bands).
#2	Limit for restricted bands.
	Correction factor 1 is combination of antenna, cable and preamp. Correction factor 2 is peak to average adjustment. Field strength (dBuV/m) = reciver reading (dBuV) + CF1 + CF2.



PLOT 1 Radiated Emissions - 25MHz to 1GHz

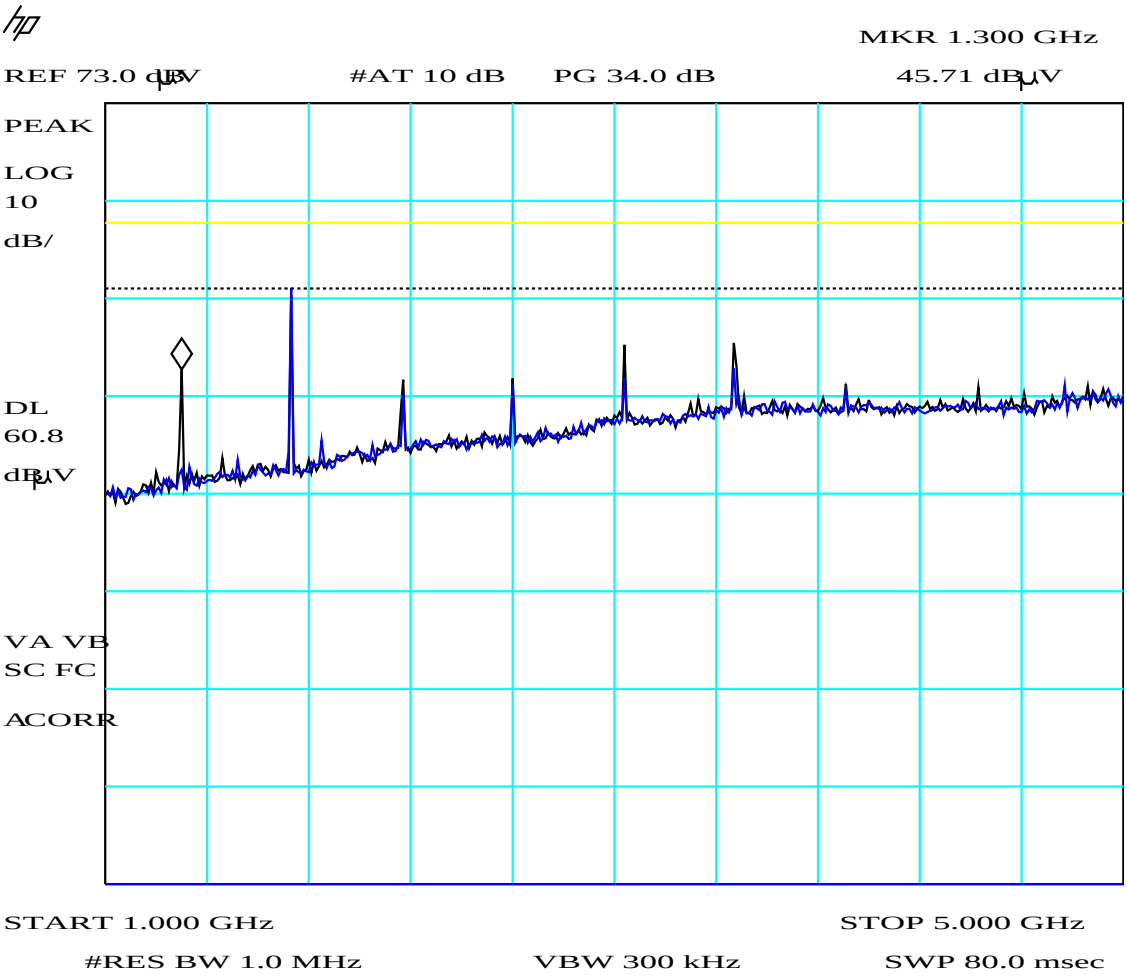
Company:	Controlled Speed Engineering	Product:	CSE305
Date:	27 Jan 05	Test Engineer:	Dave Smith
Test:	FCC Pt 15 Sub Pt C	Limit:	FCC (C)

Notes:
433.92MHz. Output lowered. WITH PREAMP.
Fundamental limit = 80.8dBuV/m. Upper limit = 60.8dBuV applied to harmonics except
in restricted bands where lower limit applies.
Equip: R5,R5B,CBL002,Patch1,CBL003,A5. Vertical - Black Trace, Horizontal - Blue Trace.

Polarisation:	V + H	Orientation:	0 - 360°	Operating Mode:	1
Distance:	3m	Antenna:	Bilog	Mod. State:	1
Height:	1m	Filename:	H5127571.plt		

Frequency List (MHz)

433.871	867.720					



PLOT 2 Radiated Emissions - 1GHz to 5GHz

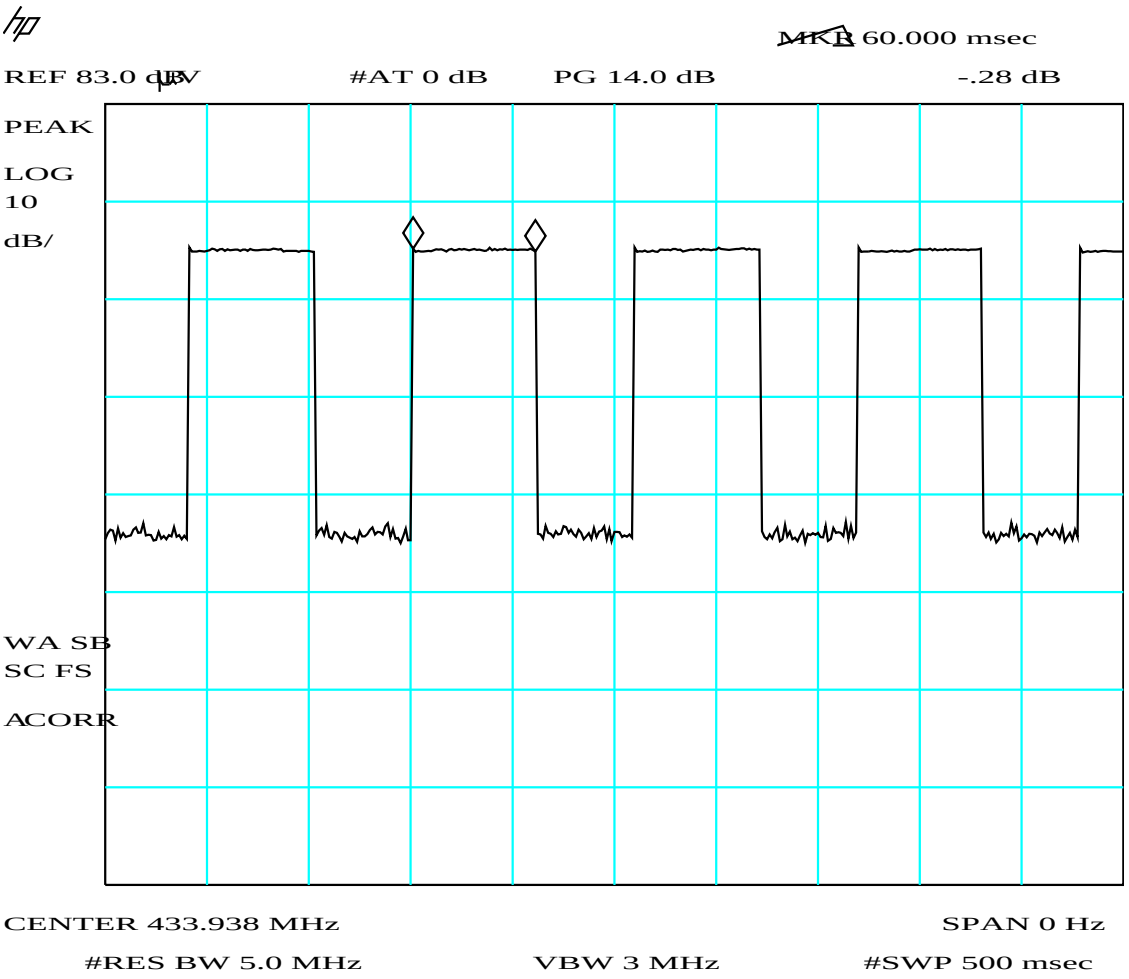
Company:	Controlled Speed Engineering	Product:	CSE305
Date:	27 Jan 05	Test Engineer:	Dave Smith
Test:	FCC Pt 15 Sub Pt C	Limit:	FCC (C)

Notes:
433.92MHz. Output reduced. WITH PREAMP.
Fundamental limit = 80.8dBuV/m. Upper limit = 60.8dBuV applied to harmonics except
in restricted bands where lower limit applies.
Equip: R5,PRE3,CBL043,CBL044,A8. Vertical - Black Trace, Horizontal - Blue Trace.

Polarisation:	V + H	Orientation:	0 - 360°	Operating Mode:	1
Distance:	3m	Antenna:	DRG	Mod. State:	1
Height:	1m	Filename:	H51275C3.plt		

Frequency List (MHz)

1301.531	1735.986	2169.425	2603.695	3037.491	3469.874	3905.351
4340.058						



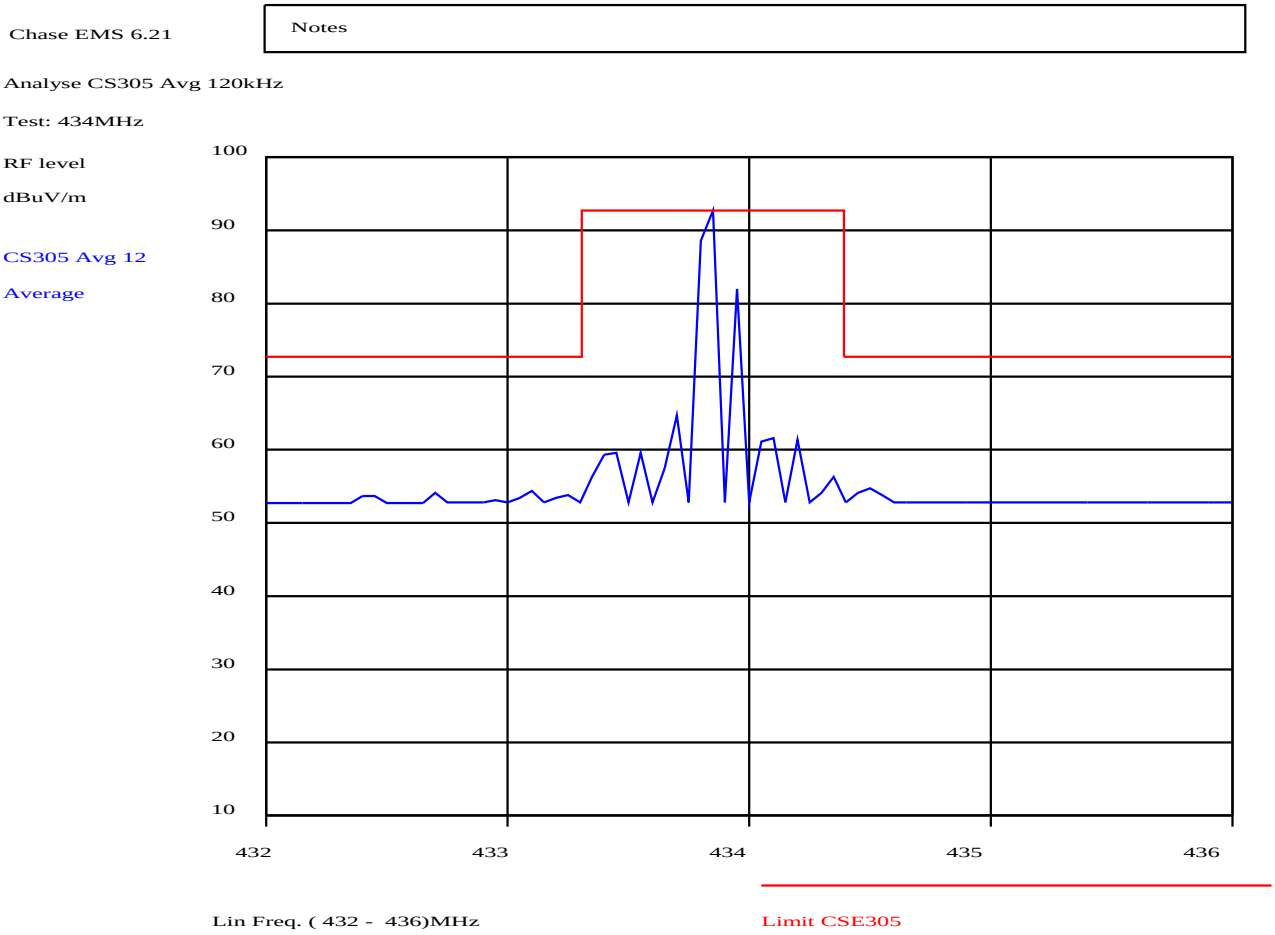
PLOT 3 Duty Cycle

Company:	Controlled Speed Engineering	Product:	CSE305
Date:	27 Jan 05	Test Engineer:	Dave Smith
Test:	FCC Pt 15 Sub Pt C	Limit:	

Notes:
433.92MHz. Output lowered.
WITH PREAMP.
Centred on carrier. Time base.
Equip: R5,R5B,CBL002,Patch1,CBL003,A5.

Polarisation:	V + H	Orientation:	0 - 360°	Operating Mode:	1
Distance:	3m	Antenna:	Bilog	Mod. State:	1
Height:	1m	Filename:	H512757C.plt		

On time = 60msec
Total time = 109.5msec



PLOT 4 Emission Bandwidth

Centre frequency =433.85MHz
Allowable bandwidth = 0.25% of centre frequency = 1.0846MHz.

Bandwidth determined by points 20dB down from modulated carrier.

Red line shows allowable bandwidth mask.

Measured with 120kHz average detector with dwell time of 1000msec.