Colorimetric and Resolution requirements of cameras

Alan Roberts

ADDENDUM 56 : Tests and Settings on a Sony HDC1500R

This document is a report of the results of tests that are the precursor of those described in the EBU technical document Tech3335. It is not an endorsement of the product.

Data for this section is taken from the handbook and examination of a production model (serial number 400152) of the Sony HDC1500R. The 1400R, 1450R, 1500R and 1550R belong to a family of system cameras built around a common design. The 1500R and 1400R have optical-fibre connection to the CCU and two SDI outputs, the 1550R and 1450R have triax cable connections and one SDI output. The 1400R and 1450R are cut-down versions, having no colour-temperature filter wheel and operate only at 1080/50i and 720/50P (EU types, the SY types run at 59.94Hz), while the 1500R and 1550R have two filter wheels and operate at a wider range of standards, including 1080-progressive at 50 or 59.94Hz, delivered via 2 BNC connections. Other differences are minor.

The cameras have 3 1920x1080 CCDs and an F/1.4 optical block.

The head weighs 4.5kg, excluding lens and viewfinder, and consumes about 85 watts at 12v DC if the head alone is powered separately.

It has many internal menus for setting the performance, with a structure very similar to that in the HDCAM camcorders. The menus can be accessed directly from the camera head, such that it can then be used without external controls, or via the usual remote control panels.

Colorimetric and Resolution requirements of cameras

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ADDENDUM 56 : Tests and Settings on a Sony HDC1500R

Many of the menu items have little or no effect on image quality. Those that have significant effect are highlighted. The full set of menu items is given for completeness. In boxes with a range of numeric settings, e.g. -99~99, the values indicate the nominal range, and zero means no alteration to factory setting, not zero effect, and no scales are given. For each item, the factory setting is underlined, "BBC" settings are in the last column, where appropriate, and the reasons for the values are given in footnotes throughout the tables where necessary.

Where menus are hierarchical (i.e. one menu item opens another menu page), the items are inset.

"BBC" setting values are given for:

Video {v}

Negative film {f}

Where different values are needed for these settings, they are marked e.g. thus: On{v} Off{f}. Note that the film settings are not intended to reproduce precisely the performance of any particular film stock, merely to give a "look" that is representative of a generic film type.

Settings are only starting points, recommendations. They should not be used rigidly, they are starting points for further exploration. However, they do return acceptable image performance.

The results of tests are given after the menu settings.

1   MENU TABLES

TOP MENU

User	Go to daily routine settings, 5 pages that can be customised
User menu customise	Customise user menu pages
All	Go to all menu pages
Operation	Settings for shot-by-shot control
Paint	Settings that normally need lab facilities to control properly
Maintenance	Camera maintenance, usually best avoided
File	Load/save reference files etc
Diagnosis	Check status of hardware/software
Service	Keep out of here if at all possible

OPERATION MENUS

OPERATION01 VF DISPLAY

item	*model*	*range*	*comment*	*BBC*
EX	All	On, Off		
Zoom	All	On, Off		
Disp	All	Left, Right		
Focus	All	On, Off	Only when a 'serial' lens is fitted	
ND	All	On, Off		
CC	1500, 1550	On, Off		
5600K	All	On, Off		
Iris	All	On, Off		
White	All	On, Off		
D.ext	All	On, Off		
Gain	All	On, Off		
Shutt	All	On, Off		
Batt	All	On, Off		
Return	All	On, Off		
Talk	All	On, Off		
Messag	All	All, Wrn, At, Off	Wrn=warnings+, AT=Auto+ higher	

OPERATION02 ! IND

item	*model*	*range*	*comment*	*BBC*
ND	All	On, Off		
Normal	All	1, 2, 3, 4, 5	You can combine any of these	
CC	1500, 1550	On, Off	For 1500R/1550R only	
Normal	All	A, B, C, D, E	Combinations allowed	
White	All	On, Off		
Normal	All	P, A, B	Combinations allowed	
5600K	All	On, Off		
Normal	All	On, Off	Combinations allowed	
Gain	All	On, Off		
Normal	All	L, M, H	Combinations allowed	
Shutt	All	On, Off		
Normal	All	On, Off		
Fan	All	On, Off		
Normal	All	Auto1, Auto2, Min, Max		
Ext	All	On, Off		
Normal	All	On, Off		
Format	All	On, Off		
Normal	1500, 1550	59.94i, 29,.97psf, 50i, 25psf, 24psf, 23.98psf, 59.94p, 50p	This is the major difference between the various models	
	1400 JN3/JN4, 1450 UC7	59.94i, 59.94p		
	1400 CED/E33, 1450 CED	50i, 50p		

OPERATION03 VF MARKER

item	*model*	*range*	*comment*	*BBC*
Marker	All	<u>On</u>, Off		
	All	<u>White</u>, Black, Dot		
Center	All	On, <u>Off</u>	1=full cross, 2=centre hole, 3=centre,	
	All	1, 2, 3, 4	4=centre with hole	
Safety zone	All	On, <u>Off</u>		
	All	80, <u>90</u>, 92.5, 95%		
Effect	All	On, <u>Off</u>, Focus	Focus available only for Focus Assist	
Aspect	All	On, <u>Off</u>		
	All	16:9, 15:9, 14:9, 13:9, <u>4:3</u>		14:9
Mask	All	On, <u>Off</u>		
	All	0~<u>12</u>~15		
Safety	All	On, <u>Off</u> Area		
	All	80, <u>90</u>, 92.5, 95%		

OPERATION04 VF DETAIL

item	*model*	*range*	*comment*	*BBC*
VF Detail	All	<u>On</u>, Off		
	All	<u>25</u>~100%		
Crisp	All	-99~<u>0</u>~+99		
Frequency	All	<u>9M</u>, 14M, 18M		
FAT Mode	All	On, <u>Off</u>		
Flicker	All	On, <u>Off</u>		
Zoom link	All	<u>0</u>, 25, 50, 75, 100%		
Color detail	All	On, <u>Off</u>		
Peak color	All	On, <u>Off</u>		
	All	<u>Blue</u>, Red, Yellow		
Chroma level	All	100, 50, <u>25</u>, 0%		

OPERATION05 FOCUS ASSIST

item	*model*	*range*	*comment*	*BBC*
Indicator		On, <u>Off</u>, Effect	Effect applies to Effect, VF Marker	
Mode		<u>Box</u>, B&W, Col		
		<u>Bottom</u>, Left, Top, Right		
Level		1~<u>3</u>~5		
	All	<u>Quick</u>, Smooth		
Gain	All	0~<u>50</u>~99		
Area Marker	All	On, <u>Off</u>, Aspect	Aspect applies to Safety, VF Marker	
Size	All	Small, <u>Middle</u>, Large		
Position	All	Left, <u>Center</u>, Right		
Position H	All	0~<u>50</u>~99		
Position V	All	0~<u>50</u>~99		

OPERATION06 ZEBRA

item	*model*	*range*	*comment*	*BBC*
Zebra	All	On, <u>Off</u>		
	All	<u>1</u>, 2, 1&2		
Zebra1 level	All	50~<u>70</u>~109%		
Width	All	0~<u>10</u>~30%		
Zebra2	All	50~<u>100</u>~109%		

OPERATION07 CURSOR

item	*model*	*range*	*comment*	*BBC*
Cursor	All	On, <u>Off</u>		
	All	<u>White</u>, Black, Dot		
Box/Cross	All	<u>Box</u>, Cross		
H Position	All	0~<u>50</u>~99		
V Position	All	0~<u>50</u>~99		
Width	All	0~<u>50</u>~99		

Height	All	0~50~99		

OPERATION08 VF OUT

item	model	range	comment	BBC
VF out	All	Color, Y, R, G, B	Option fixed when HDLA used	
Ret mix VF	All	On, Off		
Mix direction	All	Main, Ret		
Mix VF mode	All	Y-mix, Wire(W), Wire(B)		
Mix VF level	All	0~80%		
VF scan	All	16:9, 4:3		

OPERATION09 SWITCH ASSIGN1

item	model	range	comment	BBC
Gain				
L	All	-3, 0, 3, 6, 9, 12dB		-3[1]
M	All	-3, 0, 3, 6, 9, 12dB		0
H	All	-3, 0, 3, 6, 9, 12dB		+6
Assignable	JN3, JN4, SYL, UC7	Off, Return1 sw, Return2 sw, Incom1, Incom2, VF detail, Mix VF, 5600K, Fan max, D.Extender		
Assignable	CED, E33	Off, Return1 sw, Return2 sw, Eng, Prod VF detail, Mix VF, 5600K, Fan max, D.Extender		
RE.rotation	All	Std, Rvs	Orientation of Menu Sel knob	

OPERATION10 SWITCH ASSIGN2

item	model	range	comment	BBC
Lens VTR S/S	JN3, JN4, SYL, UC7	Off, Return1 sw, Return2 sw, Incom1, Incom2		
Lens VTR S/S	CED, E33	Off, Return1 sw, Return2 sw, Eng, Prod		
Front ret 1	JN3, JN4, SYL, UC7	Off, Return1 sw, Return2 sw, Incom1, Incom2, D.extender		
Front ret 1	CED, E33	Off, Return1 sw, Return2 sw, Eng, Prod, D.extender		
Front ret 2	JN3, JN4, SYL, UC7	Off, Return1 sw, Return2 sw, Incom1, Incom2, D.extender		
Front ret 2	CED, E33	Off, Return1 sw, Return2 sw, Eng, Prod, D.extender		
Handle sw 1	JN3, JN4, SYL, UC7	Off, Return1 sw, Return2 sw, Incom1, Incom2, D.extender		
Handle sw 1	CED, E33	Off, Return1 sw, Return2 sw, Eng, Prod, D.extender		
Handle sw 2	JN3, JN4, SYL, UC7	Off, Return1 sw, Return2 sw, Incom1, Incom2, Zoom(W)		
Handle sw 2	CED, E33	Off, Return1 sw, Return2 sw, Eng, Prod, Zoom(W)		
Zoom speed	All	0~20~99		
Hkct income mic	JN3, JN4, SYL, UC7	Off, Incom1, Incom2		
Hkct income mic	CED, E33	Off, Eng, Prod		

OPERATION11 HEAD SET

item	model	range	comment	BBC
Intercom1 mic	All	Dynamic, Carbon, Manual		
Level	All	-60,-50,-40,-30,-20dB	Not available for Dynamic or Carbon	
	All	-6, 0, +6dB	Gain control	
Power	All	On, Off	Not available for Dynamic or Carbon	
Unbal	All	On, Off	Not available for Carbon	
Intercom2 mic	All	Dynamic, Carbon, Manual		
Level	All	-60,-50,-40,-30,-20dB	Not available for Dynamic or Carbon	

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[1] Noise levels are rather high, low gain setting should be used wherever possible.

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	All	-6, 0, +6dB	Gain control	
Power	All	On, Off	Not available for Dynamic or Carbon	
Unbal	All	On, Off	Not available for Carbon	

OPERATION12 INTERCOM LEVEL

item	model	range	comment	BBC
Side tone	All			
Intercom1	All	MU, 1~50~99		
Intercom2	All	MU, 1~50~99		

OPERATION13 RECEIVE SEL1

item	model	range	comment	BBC
Intercom1 receive select	All	Separate, Mix		
Intercom	JN3, JN4, SYL, UC7	Left, Right, Both		
Eng	CED, E33	Left, Right, Both		
Prod	CED, E33	Left, Right, Both		
PGM1	All	Left, Right, Both		
PGM2	All	Left, Right, Both		
Tracker	All	Left, Right, Both		

OPERATION14 RECEIVE SEL2

item	model	range	comment	BBC
Intercom2 receive select	All	Separate, Mix		
Intercom	JN3, JN4, SYL, UC7	Left, Right, Both		
Eng	CED, E33	Left, Right, Both		
Prod	CED, E33	Left, Right, Both		
PGM1	All	Left, Right, Both		
PGM2	All	Left, Right, Both		
Tracker	All	Left, Right, Both		

OPERATION15 RECEIVE SEL3

item	model	range	comment	BBC
Tracker receive select	All	Separate, Mix		
Intercom	JN3, JN4, SYL, UC7	Left, Right, Both		
Eng	CED, E33	Left, Right, Both		
Prod	CED, E33	Left, Right, Both		
PGM1	All	Left, Right, Both		
PGM2	All	Left, Right, Both		

OPERATION16 RECEIVE SEL4

item	model	range	comment	BBC
Earphone receive select	All	Separate, Mix		
Intercom	JN3, JN4, SYL, UC7	Left, Right, Both		
Eng	CED, E33	Left, Right, Both		
Prod	CED, E33	Left, Right, Both		
PGM1	All	Left, Right, Both		
PGM2	All	Left, Right, Both		

OPERATION17 OPERATOR FILE

item	model	range	comment	BBC
Read (MS-CAM)	All		Execute, copy from stick to camera	
Write (Cam-MS)	All		Execute, copy from camera to stick	
Preset	All		Execute, reset to internal memory file	
File ID	All		Max 16 characters	
Cam mode	All		Display only	
Date	All		Display only	

OPERATION18 LENS FILE

item	model	range	comment	BBC

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File	All	1~17	16 files normally, 17 with a 'serial' lens	
	All		Lens file name, non-'serial' lenses	
	All		Stop value, non-'serial' lens	
Center marker	All		Set the image centre point	
H.Pos	All	-20~0~+20		
V.Pos	All	-20~0~+20		
Store	All		Execute	

PAINT

PAINT01 SW STATUS   main controls

item	*model*	*range*	*comment*	*BBC*
Flare	All	On, Off		On
Gamma	All	On, Off		On
Blk gamma	All	On, Off		On{v} Off{f}
Knee	All	On, Off		On{v} Off{f}
White clip	All	On, Off		
Detail	All	On, Off		On{v} Off{f}
Lvl dep	All	On, Off		
Skin dtl	All	On, Off		
Matrix	All	On, Off		On

PAINT02 VIDEO LEVEL

item	*model*	*range*	*comment*	*BBC*
White	All	-99~+99	RGB values	
Black	All	-99~+99	RGBM values	
Flare	All	-99~+99	RGB values	
Gamma	All	-99~+99	RGBM values	
V mod	All	-99~+99	RGBM values	
Flare	All	On, Off		
V.mod	All	On, Off		
D.shad	All	On, Off		
Test	All	Off, Saw, 3step, 10step		

PAINT03 COLOR TEMP

item	*model*	*range*	*comment*	*BBC*
White	All	-99~+99	RGB values	
Auto white bal	All		Execute, press Enter	
Color temp	All	0~3200~65535K		
Balance	All	-99~+99		
Master	All	-3.0~0.0~+12.0dB		

PAINT04 GAMMA

item	*model*	*range*	*comment*	*BBC*
Level	All	-99~+99	RGBM values	0
Coarse	All	0.35~0.45~0.90		0.45
Table	All	Standard, Hyper	Same choices as for other Sonys	Standard {v}, Hyper {f}
Standard	All	1, 2, 3, 4, 5, 6, 7	1=camcorder, 2+4.5x, 3=3.5x, 4=SMPTE240M, 5-ITU709, 6=BBC0.4, 7=5x 709	6 {v}
Hyper	All	1, 2, 3, 4	1=325%(100%), 2=460%(100%), 3=325%(109%), 4=460%(109%)	1~4 {f} [2]
Gamma	All	On, Off		
Test	All	Off, Saw, 3step, 10step		

PAINT05 BLACK GAMMA

item	*model*	*range*	*comment*	*BBC*
Level	All	-99~+99	RGBM values	
Range	All	Low, L.mid, H.mid, High		
	All	On, Off		Off[3]

---

[2] Hyper gamma curves 1 and 3 handle 1.5 stops, curves 2 and 4 handle 2.3 stops. Curve 1 and 2 are suitable for line/as-line use in that they clip at 100%, curves 3 and 4 use the full video signal range and thus are suitable only when post-production grading can deal with the over-signal range.

[3] Camera noise levels are rather high, use of Black Gamma, while revealing detail near black, will emphasise noise.

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Test	All	Off, Saw, 3step, 10step		

PAINT06 SATURATION

item	model	range	comment	BBC
Saturation	All	-99~0~+99		
	All	On, Off		
Low key sat	All	-99~0~+99		
Range	All	Low, L.mid, H.mid, High		
	All	On, Off		
Test	All	Off, Saw, 3step, 10step		

PAINT07 KNEE   highlight compression

item	model	range	comment	BBC
Knee point	All	-99~+99	RGBM values	
Knee slope	All	-99~+99	RGBM values	
Knee	All	On, Off		
Knee max	All	On, Off		
Knee sat	All	-99~0~+99		
		On, Off		
Auto knee	All	Off, Auto		
Point limit	All	-99~+99		
Slope	All	-99~+99		
ABS	All		Toggle between relative and absolute values	

PAINT08 WHITE CLIP

item	model	range	comment	BBC
W clip	All	-99~+99	RGBM values	
	All	On, Off		
ABS	All		Toggle between relative and absolute values	

PAINT09 DETAIL1   Sharpening only

item	model	range	comment	BBC
Detail	All	On, Off		On {v}, Off {f}
Level	All	-99~0~+99		0[4]
Limiter M	All	-99~0~+99		0
Limiter wht	All	-99~0~+99		0
Limiter blk	All	-99~0~+99		0
Crisp	All	-99~0~+99		0
Lvl dep	All	-99~0~+99		0
ABS	All		Toggle between relative and absolute values	

PAINT10 DETAIL2   Sharpening only

item	model	range	comment	BBC
H/V ratio	All	-99~0~+99		0
Freq	All	-99~0~+99		+99
Mix ratio	All	-99~0~+99		0
Knee aperture	All	-99~0~+99		0
ABS	All		Toggle between relative and absolute values	

PAINT11 SKIN DETAIL   Softening only

item	model	range	comment	BBC
Skin dtl	All	On, Off		
Skin gate	All	Off, 1, 2, 3, Mat	Mat only if Multi-Matrix Gate is on	
ABS	All		Toggle between relative and absolute values	
Ch sw	All	On, Off	3 separate skin gates	
Hue	All	Auto	Execute	
Phase	All	0~359	Gate 1, 2, 3	
Width	All	0~29~90	Gate 1, 2, 3	
Sat	All	-99~-89~+99	Gate 1, 2, 3	
Level	All	-99~0~+99	Gate 1, 2, 3	

PAINT12 USER MATRIX

item	model	range	comment	BBC

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[4] Setting level zero does not mean no effect, in all cases this only means the factory default value.

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R-G	All	-99~0~+99		
R-B	All	-99~0~+99		
G-R	All	-99~0~+99		
G-B	All	-99~0~+99		
B-R	All	-99~0~+99		
B-G	All	-99~0~+99		
Matrix	All	On, Off		
Preset	All	On, Off		
	All	SMPTE240M, ITU709, SMPTEwide, NTSC, EBU, ITU601		ITU-709
User	All	On, Off		
Multi	All	On, Off		

PAINT13 MULTI MATRIX

item	model	range	comment	BBC
Phase	All	0, 23, 45, 68, 90, 113, 135, 158, 180, 203, 225, 248, 270, 293, 315, 338	Colour axis to operate on	
Hue	All	-99~0~+99		
Sat	All	-99~0~+99		
All clear	All		Execute	
Gate	All	On, Off, Skin	Skin shows if Gate of Skin Dtl is on	
Matrix	All	On, Off		
Preset	All	On, Off		
	All	SMPTE240M, ITU709, SMPTEwide, NTSC, EBU, ITU601		
User	All	On, Off		
Multi	All	On, Off		

PAINT14 SHUTTER

item	model		range	comment	BBC
Shutter	All		On, Off		
	59.94i	see comment	1/100, 1/125, 1/250. 1/500, 1/1000, 1/2000	Defaults to 1/100 for JN3, JN4, SYL, UC7 models, 1/60 for CED, E33 models. 1400 and 1450 don't do all these formats	
	50i		1/60 1/100, 1/125, 1/250. 1/500, 1/1000, 1/2000		
	29.97psf		1/40, 1/60, 1/125, 1/250. 1/500, 1/1000, 1/2000		
	25psf		1/33, 1/50, 1/125, 1/250. 1/500, 1/1000, 1/2000		
	24/23.98psf		1/32, 1/48, 1/96, 1/125, 1/250. 1/500, 1/1000		
	59.94P		1/125, 1/250. 1/500, 1/1000, 1/2000		
	50p:		1/60, 1/125, 1/250. 1/500, 1/1000, 1/2000		
ECS freq	59.94i	see comment	60~4300Hz	1400 and 1450 don't do all these formats	
	50i		50~4700Hz		
	29.97psf		30~2700Hz		
	25psf		25~2300Hz		
	24/23.98psf		24~2200Hz		
	59.94P		59.96~4600Hz		
	50p		50.03~4600Hz		

PAINT15 NOISE SUP

item	model	range	comment	BBC
Noise sup	All	0~100%		
	All	On, Off		

PAINT16 SCENE FILE

item	model	range	comment	BBC
1	All		Select scene file or factory STANDARD.	
2	All		Always load STANDARD first when setting	
3	All		up a camera.	
4	All		Open box indicator to read from camera,	
5	All		filled box indicator to read from stick.	
Standard	All		Back to standard PAINT data	
Read (MS-cam)	All		Load 5 scene files from stick	
Write (Cam-MS)	All		Save 5 scene files to stick	
File ID	All		16 characters	
Cam code	All		Display only	
Date	All		Display only	

9

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MAINTENANCE
MAINTENANCE01 AUTO SETUP

item	model	range	comment	BBC
Auto black	All		Execute	
Auto white	All		Execute	
Auto level	All		Execute	
Auto white shading	All		Execute	
Auto black shading	All		Execute	
Test	All	Off, Saw, 3step, 10step		

MAINTENANCE02 WHITE SHADING

item	model	range	comment	BBC
V saw	All	-99~+99	RGB values	
V para	All	-99~+99	RGB values	
H saw	All	-99~+99	RGB values	
H para	All	-99~+99	RGB values	
White	All	-99~+99	RGB values	
Auto white shading	All		Execute	
White shad mode	All	RGB, RB		
3d white shad	All	On, Off		

MAINTENANCE03 BLACK SHADING

item	model	range	comment	BBC
V saw	All	-99~+99	RGB values	
V para	All	-99~+99	RGB values	
H saw	All	-99~+99	RGB values	
H para	All	-99~+99	RGB values	
Blk set	All	-99~+99	RGB values	
Black	All	-99~+99	RGBM values	
Master gain	All	-3, 0, 3, 6, 9, 12dB		
Auto black shading	All		Execute	
2d black shad	All	On, Off		

MAINTENANCE04 OHB MATRIX

item	model	range	comment	BBC
Phase	All	0, 23, 45, 68, 90, 113, 135, 158, 180, 203, 225, 248, 270, 293, 315, 338	Degrees around the hue circle	
Hue	All	-99~0~+99		
Sat	All	-99~0~+99		
All clear	All		Execute, reset data	
OHB matrix	All	On, Off		
Matrix	All	On, Off		On

MAINTENANCE05 AUTO IRIS

item	model	range	comment	BBC
Auto iris	All	On, Off		
Window	All	1, 2, 3, 4, 5, 6	1=low 2/3, 2=mid, 3=mid 2/3, 4=full, 5=low mid, 6=jigh 2/3	
Override	All	-99~+99		
Iris level	All	-99~0~+99		
APL ratio	All	-99~+65~+99		
Iris gain	All	-99~0~+99		
Iris close	All	On, Off		

MAINTENANCE06 MIC GAIN

item	model	range	comment	BBC
Mic 1	All	20, 30, 40, 50, 60dB	Relevant only without MCP/OCP	
Mic 2	All	20, 30, 40, 50, 60dB		

MAINTENANCE07 UP TALLY

item	model	range	comment	BBC
Tally brightness	All	0~50~100		
Number brightness	All	0~50~100		
Camera number	All	1~96		
Number display	All	On, Off, Auto		

10

MAINTENANCE08 CALL/TALLY

item	model	range	comment	BBC
CCU call	All	On, Off		
Cam call	All	On, Off		

MAINTENANCE09 OUTPUT FORMAT

item	model	range	comment	BBC
Current	All		Show current format	
Active line	All	1080, 720		
	All		For format options see OPERATION02 ! LED	

MAINTENANCE10 DOWN CONVERTER

item	model	range	comment	BBC
Output signal	All	Main, Ret, VF		
Aspect	All	SQ, EC		

MAINTENANCE11 TEST OUT

item	model	range	comment	BBC
Output	All	SD sync, HD sync, VF, VBS		
Pwr save	All			
VBS-out	All			
Character	All	On, Off		
Gain	All	-127~0~+127		
Chroma	All	-127~0~+127		
Setup	JN3, JN4, SYL, UC7	On, Off	Only when output format is NTSC	
HD-sync-out	All			
V phase	All	-127~0~+127		
H phase	All	-127~0~+127		

MAINTENANCE12 SDI 2 OUT (1500)

item	model	range	comment	BBC
Output	1500	Main, VF, Link-B, Ret, SD-SDI	SD-SDI output as selected in MAINTENANCE10	
Pwr save	1500			
Character	1500	On, Off	Not on VF or Link-B	
EMB audio	1500	On,Off	Embedded audio	
	1500	1-Mic, 2-Mic2, 3-AES1, 4-AES2	Display for Main or Link-B	
	1500	1-PGM1, 2-PGM2, 3-Eng, 4-Prod	Display for VF, Ret or SD-SDI	

MAINTENANCE12 SDI OUT (1550, 1400, 1450)

item	model	range	comment	BBC
Output		Main, VF, Ret, SD-SDI		
Pwr save				
Character	1550, 1400, 1450	On, Off	Not on VF	
EMB audio		On,Off	Embedded audio	
		1-Mic, 2-Mic2, 3-AES1, 4-AES2	Display for Main	
		1-PGM1, 2-PGM2, 3-Eng, 4-Prod	Display for VF, Ret or SD-SDI	

MAINTENANCE13 POWER SAVE

item	model	range	comment	BBC
SDI-2 out	1500	Pwr save, Active		
SDI out	1550, 1400, 1450	Pwr save, Active		
Down converter	All	Pwr save, Active		

MAINTENANCE14 TRUNK

item	model	range	comment	BBC
Trunk	All	On, Off		
IF	All	232c, 422A		

MAINTENANCE15 GENLOCK (1500, 1550)

item	model	range	comment	BBC
Reference	1500, 1550		Display only, sync condition	
Genlock	1500, 1550		Shown only when there's no CCU	
Status	1500, 1550			

11

This document is a report of the results of tests that are the precursor of those described in the EBU technical document Tech3335. It is not an endorsement of the product.

Format	1500, 1550			
Phase	1500, 1550			
V	1500, 1550	-1024~<u>0</u>~+1023		
HD H	1500, 1550	-1700~<u>0</u>~+1700		
SD H	1500, 1550	-1024~<u>0</u>~+1023		

MAINTENANCE16 DATE

item	*model*	*range*	*comment*	*BBC*
Date/time	All	yyyy/mm/dd hh:mm	2000 to 2099, a bit optimistic ☺	

MAINTENANCE17 BATTERY ALARM

item	*model*	*range*	*comment*	*BBC*
Before end	All	<u>11.5</u>~17.0V		
End	All	<u>11.0</u>~11.5V		

MAINTENANCE18 OTHERS 1

item	*model*	*range*	*comment*	*BBC*
Fan mode	All	Off, <u>Auto1</u>, Auto2, Min, Max	Auto1=normal, Auto2=slow	
Cam bars	All	On,<u>Off</u>		
V dtl creation	All	NAM, G, R+G, <u>Y</u>		
Dtl HV mode	All	<u>H/V</u>, V		
Test 2 mode	All	<u>3step</u>, 10setp		
White setup mode	All	AWB, <u>A.lvl</u>		
ALAC	All	<u>Auto</u>, Off	Auto starts process, chromatic aberration correction, see the manual for details	

MAINTENANCE19 OTHERS 2

item	*model*	*range*	*comment*	*BBC*
Date type	All	1 Y/Mn/D, 2 Mn/D, 3 D/M/Y, 4 D/M, <u>5 M/D/Y</u>, 6 M/D	Y=year, Mn=month as number, M=month as text, D=day	
Filter wht mem	All	On, <u>Off</u>	Store white balance for filter positions	
F no. disp	All	<u>Control</u>, Return	Where the iris data comes from	

MAINTENANCE20 OPTION KEY

item	*model*	*range*	*comment*	*BBC*
Read (MS-cam)	All		Read Install key from memory stick	
Installed option	All		Display of installed option cards	

FILE

FILE01 OPERATOR FILE

item	*model*	*range*	*comment*	*BBC*
Read (MS-cam)	All		The usual stuff, doesn't affect pictures	
Write (Cam-MS)	All			
Preset	All			
Store preset file	All			
File ID	All		Maximum 16 characters	
Cam code	All		Display only	
Date	All		Display only	

FILE02 SCENE FILE picture stuff

item	*model*	*range*	*comment*	*BBC*
1	All		The usual stuff, all picture-related	
2	All			
3	All			
4	All			
5	All			
STORE	All			
Read (MS-cam)	All			
Write (cam-MS)	All			
File ID	All		Maximum 16 characters	
Cam code	All		Display only	
Date	All		Display only	

FILE03 REFERENCE FILE

item	model	range	comment	BBC
Store file	All		Store current settings as Reference	
Standard	All		Reset to Standard	
All preset	All		Back to factory settings	
Read (MS-cam)	All			
Write (cam-MS)	All			
File ID	All		Maximum 16 characters	
Cam code	All		Display only	
Date	All		Display only	

FILE04 LENS FILE   lens corrections

item	model	range	comment	BBC
Store file	All			
No.	All	1~17	Only 16 for non'serial' lenses	
Name	All		Changeable only for non'serial' lens	
F No	All	F1.0~F1.7~F3.4	Changeable only for non'serial' lens	
Center marker	All			
H Pos	All			
V Pos	All			
Store	All			

FILE05 OHB FILE   sensor file

item	model	range	comment	BBC
Store file	All		Store offset data for CCDs	

FILE06 FILE CLEAR

item	model	range	comment	BBC
Preset operator	All			
Reference (all)	All			
10 sec clear	All	On, Off		
OHB white shad (all)	All			
OHB white shad (3D)	All			
OHB black shad	All			
OHB ND shad	All			
OHB matrix	All			
M.S. format	All		Format the Memory Stick	

DIAGNOSIS

DIAGNOSIS01 OPTICAL LEVEL   Indicators only, no options

item	model	range	comment	BBC
CCU-cam	All	Green, Yellow, Red, NG, No signal	Only when CCU connected	
Cam-CCU	All			

DIAGNOSIS02 BOARD STATUS   Indicators only, no options

item	model	range	comment	BBC
OHB	All			
DPR	All			
VDA	All			
DAP	All			
AU	All	Ok, NG		
AT	All			
PS	All			
SDI	1500, 1400			
TR	1500, 1400			

DIAGNOSIS03 PDL VERSION   Indicators only, no options

item	model	range	comment	BBC
TD	All			
VDA	All			
DAP	All	Vx.xx		
AT	All			
SDI	All			

TR	1550, 1450			
DPR	All			
HKCT	All		Only when HKC-T1500 installed	

DIAGNOSIS04 ROM VERSION   Indicators only, no options

item	*model*	*range*	*comment*	*BBC*
AT	All			
Panel	All	Vx.xx	Only with HDLA attached	
HKCT	All		Only when HKC-T1500 installed	

DIAGNOSIS05 SERIAL NO   Indicators only, no options

item	*model*	*range*	*comment*	*BBC*
Model	All	HDCxxxxR		
No	All			
Option	All		Shows what options are installed	

2   MEASUREMENTS

All measurements were made at BBC R&D, using a Sony 32" crt Grade 1 HDTV monitor and a digital waveform monitor. Frame files were grabbed via HDSDI for software analysis. Importing recordings into editing software is unreliable because the decoding and transcoding is not fully specified. The lens was a Canon HJ22x7.6.

2.1 Gamma and Headroom range

The camera has seven 'standard' gamma curves and four 'hyper'gammas. Colour performance, with the ITU.709 gamma curve, was good, although a little over-saturated.

The Hyper-gamma curves are those of the HDWF900R and other similar Sony cameras, providing for film-like transfer over either 325% or 460% headroom, delivered into either 100% or 109% video signal range. They are known to perform well, there was no need to examine them in this camera.

The Standard curves, also, are those of other cameras, with a few additions. The most important curves are numbers 6 and 7 in the table, ITU.709 and BBC0.4. Since this is a HDTV camera, the 709 curve should be regarded as the normal option, unless there is a specific need to change it to achieve specific picture performance. Since the Hyper-gammas handle headroom well, there is little need to explore the knee function, using Standard curves. Knee curves should be able to cope with about 2 stops of over-exposure.

2.2   Resolution

Resolution was tested using a test card of circular zone plate patterns, calculated for 1920x1080 standard. The zone plate presents a spatial map of all the frequencies the camera should have to deal with, dc and low frequencies in the middle of each pattern, rising to the Nyquist limits horizontally and vertically. The test chart has sinusoidal modulation to avoid sampling problems, and has patterns for luminance, chrominance, R G and B. Only the luminance pattern is presented here, the other patterns revealed no surprises.

2.2.1   Resolution at 1080-line

With detail enhancement switched off, the results for 1080-line interlace are as expected. Horizontal resolution droops gracefully towards the edge of the pattern, as it should do, due to the effect of the optical horizontal low-pass filter. Vertical resolution also falls, but this time due to the line-pairing implicit in interlaced scanning. There are no null zones or alias patterns visible at all.

Performance in 1080-line progressive is also as expected, with no null zones or aliasing. There is more vertical resolution, but horizontal and vertical resolution are now inter-changeable, indicating that the optical spatial filtering is symmetrical, as it should be.

As a result, detail enhancement produces no unexpected effects. The values given in the menus for detail enhancement are similar to those developed for the HDWF900R, and produce clean images without overshooting (ringing) edges, although there is a 'grittiness' at higher frequencies.
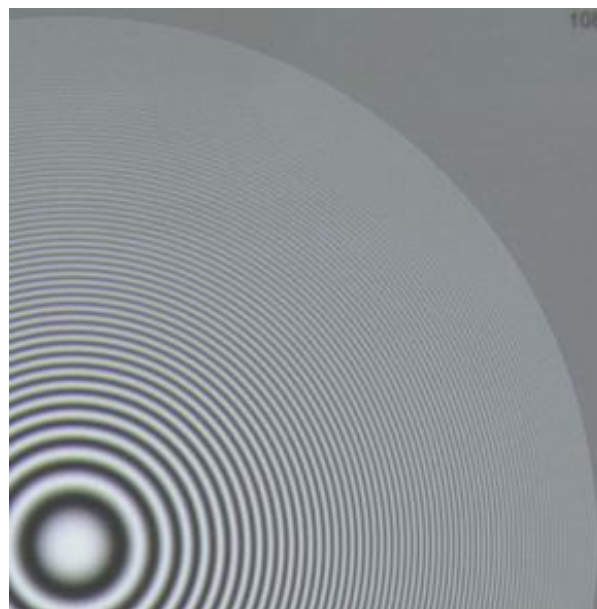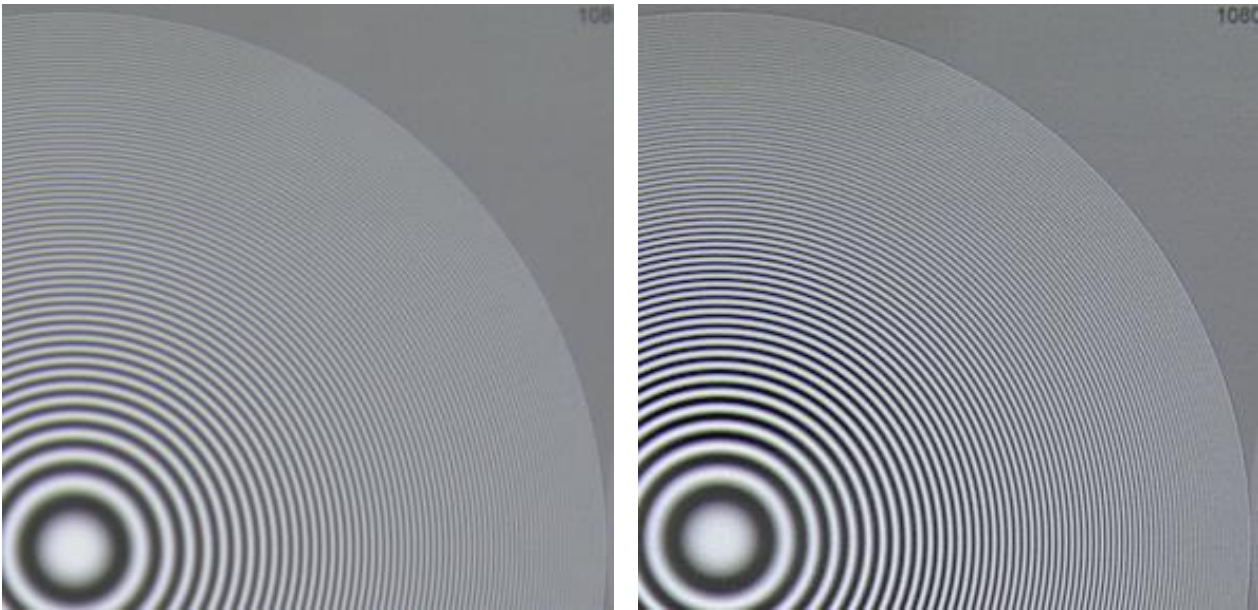

Figure 1 Resolution, 1080i, detail off

Figure 2 Resolution, 1080 interlaced (a) detail off   (b) detail on

2.2.1   Resolution at 720p

There is faint aliasing in the picture, both horizontally and vertically. This is inevitable in any camera, since the conversion to 720p is a standards-conversion, which cannot be done satisfactorily in any camera at an economic price.

Resolution up to the limits (1280x720) is clean, with low-level aliasing above. Vertical aliasing is less well suppressed than horizontal, hinting that the vertical down-sampling filter has fewer terms (contributions from adjacent lines) than has the horizontal filter. This is not unusual, better vertical filtering would result in a greater camera delay, which could be unacceptable in live programme-making. **This document is a report of the results of tests that are the precursor of those described in the EBU technical document Tech3335. It is not an endorsement of the product.**
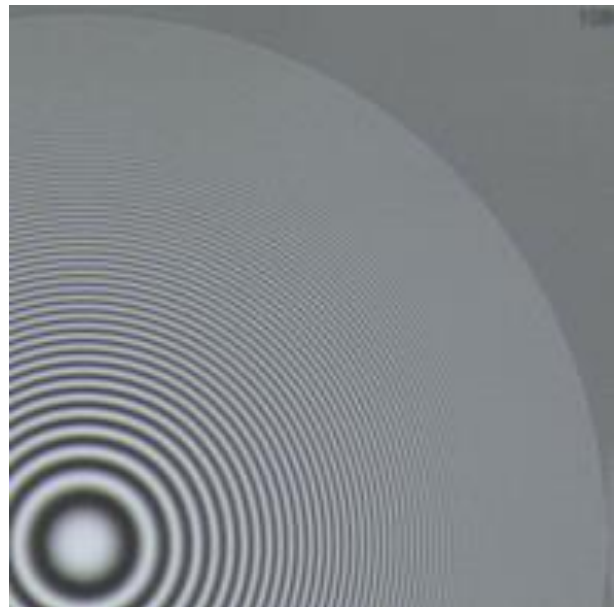well at 720p.

Figure 3 Resolution, 720p

2.3   Noise

Noise was measured by exposing the camera to an evenly illuminated white card, and exposure adjusted to get 4 luma values between 10% and 100%. Noise suppression was switched off for this test. Gain was set to +6dB, and the results compensated accordingly in the calculations, therefore they represent the noise levels at 0dB gain. The grabbed frames were processed with a high-pass filter to remove any residual shading effects. Vignetting was avoided by adjusting the lighting level such that the extremes of the aperture range were not used.

The plot of measured noise versus signal level for 1080p shows that noise in the middle range (where the slope of the gamma curve is unity) is at about -43dB, which is adequate but a rather disappointing. This was confirmed by direct observation during the tests, both off-screen and on the waveform monitor. The general shapes of the curves are as expected, since the primary source of noise is the analogue circuitry of the sensor and pre-amplifiers, which is non-linearly amplified by the gamma-corrector. Blue noise is a few dB worse than red or green, this is normal.
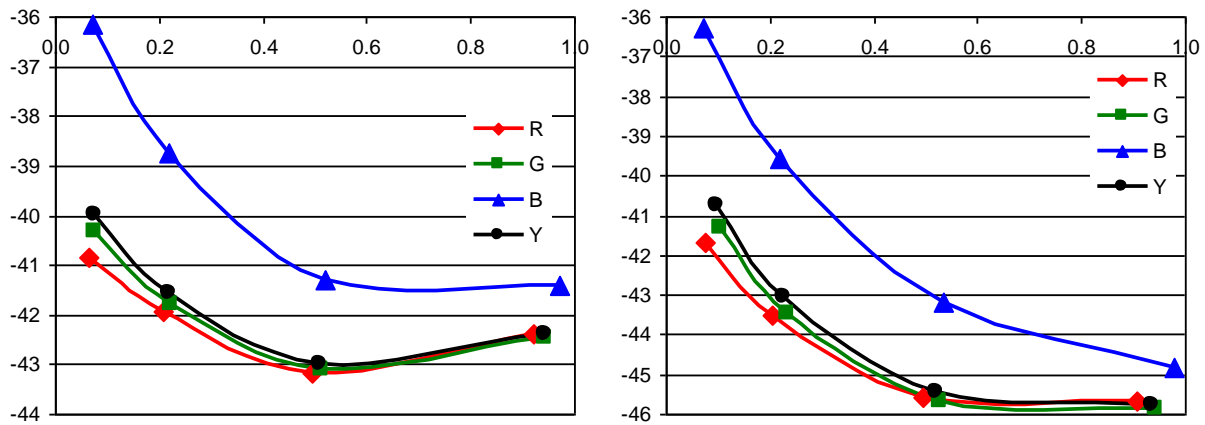
Figure 4 Noise levels, (a) 1080p   **(b) 720p**

Noise at 720p is about 2dB lower than for 1080p, primarily to the reduced bandwidth.

The noise levels are surprisingly high for a camera with full-resolution ⅔" CCD sensors. Noise suppression can reduce the levels by about 3dB, but there will inevitably be some affect on resolution due to the spatial filtering involved. Studio cameras should normally be capable of noise levels about 10dB better than this, and these high levels mean that the maximum exposure range is only about 10 stops, and that high gain settings should be avoided wherever possible.

2.4   Iris Diffraction and Chromatic Aberration

The camera has an adaptive chromatic aberration correction system, which works only horizontally.

The lens used for the tests was not of the type which provides the camera with sufficient data to correct aberrations, but over the normal range of iris aperture settings (closing to about F/8), no corner aberrations were noticed.

2.5 Conclusion

The HDC1500R performs well, but is rather noisy. There is no reason to suppose that the results would be any different for the 1550R, 1400R or 1450R.