

TEST REPORT

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Date : 21 October 1998

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TESTING
No. 1372

FORMAL REPORT ON RETESTING IN ACCORDANCE WITH

FCC PART 15B : 1997 TV INTERFACE DEVICE

OF A

TOSHIBA VIDEO CASSETTE RECORDER [MODEL : M-785]

TEST FACILITY

PSB Electrical & Electronics Test Centre
1 Science Park Drive
Singapore 118221

FCC FILING

31040/SIT 1300B3

ACCREDITATION

The EETC (EMC) is accredited under UKAS to carry out the above-mentioned test(s). The results reported herein have been performed in accordance with the laboratory's terms of accreditation.

UKAS Cert No : 1372

PREPARED FOR

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TEST JOB NO.

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12 October 98 - 20 October 98

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TEST SUMMARY

The tests were carried out in accordance with the customer's specifications. From the results obtained, the **Toshiba Video Cassette Recorder [model : M-785]** was found to comply with FCC Part 15B : 1997 requirements for TV Interface Device.

A comparison was carried out on the pre-radiated emission plots between tuner 1 (model : TMLH2-032A, s/no : 70121829) and tuner 2 (model : 115-V-A095AQ) for this product (similar brand and model) and noted that tuner 2 demonstrated higher emissions levels. As a result, tuner 2 was chosen and tested at the open area test site. All other emissions were insignificant. However, only six worst case emissions measurements were reported.

Conducted emissions tests were carried out on tuner 1 and tuner 2. Tuner 2 was noted to demonstrate higher emissions levels. All other emissions were insignificant. However, only six worst case emissions measurements were reported.

Output signal level measurement test, output terminal conducted spurious emissions test and antenna transfer switch measurement test were carried out on tuner 2 in view of the technical judgement that tuner 2 demonstrated higher radiated and conducted emissions levels.

The summary of the test results are as follows:

Test Standard	Pass/Fail
Conducted Emissions - FCC Part 15B (1997)	Pass
Radiated Emissions – FCC Part 15B (1997)	Pass
Output Signal Level Measurement	Pass
Output Terminal Conducted Spurious Emissions	Pass
Antenna Transfer Switch Measurement	Pass

Modifications

Nil.

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TEST CONFIGURATION DESCRIPTION

Supporting Equipment Description

The EUT and the following supporting equipment formed the required test system :

<u>Description & Model</u>	<u>Serial No & FCC ID</u>	<u>Cable Description</u>
1)Anritsu Radiation Test Signal Generator (customer) Mdl. MG318A	S/n : M110895I FCC ID : Nil	1.6m unshielded power cord
2)Philips Colour TV Pattern Generator Mdl. PM5518	S/n : Nil FCC ID : Nil	1.75m unshielded power cord
3)* Toshiba Video Cassette Recorder Mdl. M-785	S/n : Nil FCC ID : NA	1.7m unshielded power cord 1.6m standard RCA cable (x6) 1.4m standard F cable (x2)

* denotes Equipment Under Test (EUT)

TEST OPERATING CONDITIONS

The EUT was tested in the following operating modes (at both channel 3 and 4 settings) for the tests mentioned in this report :

1. Playback mode [mode A]

In this test mode, a video tape recorded with VITS signal was played on the EUT.

2. Record mode (1V VITS Signal Input) [mode B]

A 1V peak-to-peak VITS signal was supplied through the Video input connector for recording.

3. Record mode (5V VITS Signal Input) [mode C]

A 5V peak-to-peak VITS signal was supplied through the Video input connector for recording.

4. Record mode (NTSC TV Signal Input) [mode D]

A NTSC signal (colour bar with grey lines) was supplied at channel 10 (193.25MHz) through the Ant. input connector for recording.

Note : The NTSC TV signal input record mode is not applicable to the antenna transfer switch test.

Conducted Emissions Test Instrumentation (3m OATS)

<u>Instrument</u>	<u>Model</u>	<u>S/No</u>	<u>Cal Due Date</u>
R&S Test Receiver (9 kHz - 30 MHz)	ESH3	862301/005	26 Feb 2000
R&S Pulse Limiter	ESH3-Z2	357.8810.52	17 Feb 1999
R&S LISN (for EUT)	ESH2-Z5	862060/017	8 Apr 1999
EMCO LISN (for others)	3825/2	9309-2128	N.A.

Radiated Emissions Test Instrumentation (10m OATS)

<u>Instrument</u>	<u>Model</u>	<u>S/No</u>	<u>Cal Due Date</u>
R&S Test Receiver (20 MHz - 1.3 GHz)	ESPC	848553/0005	28 Nov 1998
HP Spectrum Analyser	8593E	3325A00702	13 Aug 1999
EMCO Biconical Antenna	3109	9310-2759	22 Oct 1998
EMCO Log-periodic Antenna	3146	9110-3240	22 Oct 1998

Output Signal Level Measurement Instrumentation

<u>Instrument</u>	<u>Model</u>	<u>S/No</u>	<u>Cal Due Date</u>
HP Spectrum Analyzer	HP8591EM	3536A00316	5 Jun 1999

Output Terminal Conducted Spurious Emission Instrumentation

<u>Instrument</u>	<u>Model</u>	<u>S/No</u>	<u>Cal Due Date</u>
HP Spectrum Analyzer	HP 8591EM	3536A00316	5 Jun 1999

Antenna Transfer Switch Measurement Instrumentation

<u>Instrument</u>	<u>Model</u>	<u>S/No</u>	<u>Cal Due Date</u>
R&S Test Receiver (20 MHz - 1.3 GHz)	ESVP	827419/001	26 Feb 2000

A.C. LINE CONDUCTED EMISSIONS TEST DESCRIPTION

Test Setup

1. The test setup was in accordance with ANSI C63.4: 1992.
2. The EUT and other supporting equipment were arranged on top of a 1.5m x 1m x 0.8m high table, as shown in Appendix B.
3. The 50 Ω /50 μ H EUT LISN was connected to filtered mains.
4. The a.c. power supply for the EUT was tapped from the EUT LISN.
5. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.
6. All other supporting equipment were powered separately from another LISN.

Test Method

The test was performed in the following manner:

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. A quick scan, from 450kHz to 30MHz, was made on the NEUTRAL line.
3. High peaks, relative to the limit line, over the frequency range were then selected.
4. The EMI test receiver was then tuned to the selected frequencies. CISPR quasi-peak measurements with a receiver bandwidth setting of 10kHz, were taken.
5. Steps 2 to 4 were then repeated for the LIVE line.

RADIATED EMISSIONS TEST DESCRIPTION

EUT Characterisation

EUT characterisation, over the frequency range 30MHz to 1GHz, was done in order to minimise radiated emission testing time while still maintaining high confidence in the test results.

The EUT was placed in a shield room, at a height of about 1m on a turntable, and its radiated emissions frequency profile was observed, using a spectrum analyzer with the appropriate broadband antenna placed 1m away from the EUT. Radiated emissions from the EUT were maximised by rotating the turntable manually, changing the antenna polarisation and manipulating the EUT cables while observing the frequency profile on the spectrum analyzer. Frequency points at which maximum emissions occurred, clock frequencies and operating frequencies were then noted for the formal radiated emissions test at PSB's Open Area Test Site (OATS).

Test Setup

1. The test setup was in accordance with ANSI C63.4 : 1992.
2. The EUT and other supporting equipment were setup on a 1.5m X 1.0m X 0.8m high table placed on top of a turntable as shown in Appendix B.
3. The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the ground plane.
4. The relevant broadband antenna was set at the required test distance away from the EUT and supporting equipment boundary.

Test Method

The test was performed in the following manner:

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Emission maximization was carried out by varying the antenna polarization, antenna height and turntable direction in the following manner:
 - a. Vertical or horizontal polarisation (whichever gave the higher emission level) was chosen.
 - b. The turntable was rotated to the direction that gave maximum emissions.
 - c. The antenna height was adjusted to the height that gave maximum emissions.
3. A quasi-peak measurement was then made at the frequency point.
4. Steps 2 and 3 were then repeated for the next frequency point.
5. The frequency range covered was from 30MHz to 1GHz, using the biconical antenna for frequencies up to 200MHz, and the log-periodic antenna for frequencies above 200MHz.

OUTPUT SIGNAL LEVEL MEASUREMENT TEST DESCRIPTION

Test Setup

1. The test setup was in accordance with ANSI C63.4 (1992).
2. The EUT and other supporting equipment were arranged on top of a 1.5m x 1m x 0.8m high non-conducting table, as shown in Appendix B.
3. The a.c. power supply for the EUT was tapped from filtered mains.
4. The 75 Ω RF output connector from the EUT was directly connected to the spectrum analyzer's 50 Ω input via a 30cm long, high quality coaxial cable and a 75 Ω /50 Ω matching pad, as shown in Appendix B.

Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The required output channel (channel 3/4) was selected.
3. Measurements were then made on the visual and aural carrier frequencies specified by the channel using the spectrum analyzer in the peak detection mode. The spectrum analyzer was set for a resolution bandwidth of 100 kHz and a video bandwidth of 1 MHz.
4. The 75 Ω /50 Ω matching pad insertion loss of 6.10dB (maximum value) was then added to the peak level measured. The resultant was then compared with the limit requirements.
5. For emissions that were not detectable above the ambient noise floor, the noise floor level at that particular frequency was noted for reference.
6. Steps "3" to "5" were then repeated until all selected channels and modes were tested.

OUTPUT TERMINAL CONDUCTED SPURIOUS EMISSION TEST DESCRIPTION

Test Setup

1. The test setup was in accordance with ANSI C63.4 (1992).
2. The EUT and other supporting equipment were arranged on top of a 1.5m x 1m x 0.8m high non-conducting table, as shown in Appendix B.
3. The a.c. power supply for the EUT was tapped from filtered mains.
4. The 75 Ω RF output connector from the EUT was directly connected to the spectrum analyzer's 50 Ω input via a 30cm long, high quality coaxial cable and a 75 Ω /50 Ω matching pad, as shown in Appendix B.

Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The required output channel (channel 3/4) was selected.
3. Measurements were then made on any detected emission in the frequency range specified in S/N 7 below, using the spectrum analyzer in the peak detection mode. The spectrum analyzer was set for a resolution bandwidth of 100 kHz and a video bandwidth of 1 MHz.
4. The 75 Ω /50 Ω matching pad insertion loss of 6.10dB (maximum value) was then added to the peak level measured. The resultant was then compared with the limit requirements.
5. For emissions that were not detectable above the ambient noise floor, the noise floor level at that particular frequency was noted for reference.
6. Steps "3" to "5" were then repeated for the next emission or local oscillator frequency until all selected channels and modes were tested.
7. The frequency range of interest was from 30 MHz to 4.6 MHz below the visual carrier frequency and 7.4 MHz above visual carrier frequency, up to 1 GHz.

ANTENNA TRANSFER SWITCH TEST DESCRIPTION

Test Setup

1. The test setup was in accordance with ANSI C63.4 (1992).
2. The EUT and other supporting equipment were arranged on top of a 1.5m x 1m x 0.8m high non-conducting table, as shown in Appendix B.
3. The 50 Ω /50 μ H EUT LISN was connected to filtered mains.
4. The a.c. power supply for the EUT was tapped from the EUT LISN.
5. The EUT's 75 Ω Ant. input connector from the EUT was connected to the EMI test receiver's 50 Ω input via a 75 Ω RF cable provided by the EUT manufacturer. A 75 Ω /50 Ω matching pad, as shown in Appendix A was used to connect to the test receiver's 50 Ω input.

Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The required output channel (channel 3/4) was selected.
3. Measurements were then made on the visual frequencies determined by the channel, with the EMI test receiver in the peak detection mode. The test receiver was set for a resolution bandwidth of 120 kHz.
4. The 75 Ω /50 Ω matching pad insertion loss of 6.10dB (maximum value) was then added to the peak level measured. The resultant was then compared with the limit requirements.
5. For emissions that were not detectable above the ambient noise floor, the noise floor level at that particular frequency was noted for reference.
6. Steps "3" to "5" were then repeated until all selected channels and modes were tested.

TEST RESULTS

A.C. Line Conducted Emissions FCC Part 15B:1997 Results

FREQUENCY (MHz)	Q-P VALUE (dB μ V)	Q-P MARGIN (dB)	LINE	TEST MODE/CH
3.5797	36.1	-11.8	N	B/3
3.5796	35.8	-12.1	L	B/3
3.5480	35.9	-12.0	L	D/3
3.5480	35.6	-12.3	N	D/3
3.5480	35.7	-12.2	N	D/4
3.5480	35.7	-12.2	L	D/4

A.C. Line Conducted Emissions Results

NOTES

1. All possible modes of operation were investigated and repeated for channel 3 and 4.
2. The 6 worst case emission measurements using CISPR quasi-peak are reported. All other emissions were insignificant.
3. The FCC Part 15B (1997) conducted emissions limit is 250 μ V(47.9dB μ V) from 450kHz to 30MHz.
4. A "-ve" Q-P indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
5. All measuring equipment are calibrated with traceability to NPL (UK) or NIST (USA).

MEASUREMENT UNCERTAINTIES

All test measurements carried out are traceable to UK National Standards where obtainable. The uncertainty of the measurement is ± 2.4 dB at a confidence level of approximately 95%, with a coverage factor of 2.

Conducted emissions (Voltage)

9 kHz - 30 MHz (Average and Quasi-peak) ± 2.4 dB

TEST RESULTS

Radiated Emissions FCC Part 15B:1997 Results

FREQUENCY (MHz)	Q-P VALUE (dB μ V/m)	Q-P MARGIN (dB)	POL (h/v)	HEIGHT (m)	AZIMUTH (Degrees)	TEST MODE/ CH
487.5000	37.8	-8.2	h	1.00	0	A/4
140.6900	27.3	-16.2	v	1.00	0	B/3
337.9000	31.5	-14.5	h	1.00	0	B/4
367.8000	31.5	-14.5	h	1.00	0	B/4
69.7700	24.6	-15.4	v	1.00	0	D/3
80.8600	27.8	-12.2	v	1.00	0	D/3

Radiated Emission at 3-metres

NOTES

- All possible modes of operation were investigated and repeated for channel 3 and 4.
- The 6 worst case emission measurements using CISPR quasi-peak are reported. All other emissions were insignificant.
- The above Q-P values were measured at a 3m test distance.
- The FCC Part 15B (1997) Radiated Emission limit (@ 3m) is:

100 μ V/m (40.0dB μ V/m)	from	30MHz to 88MHz
150 μ V/m (43.5dB μ V/m)	from	88MHz to 216MHz
200 μ V/m (46.0dB μ V/m)	from	216MHz to 960MHz
500 μ V/m (54.0dB μ V/m)	above	960MHz
- A "-ve" Q-P margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
- All measuring equipment are calibrated with traceability to NPL (UK) or NIST (USA).

MEASUREMENT UNCERTAINTIES

All test measurements carried out are traceable to UK National Standards where obtainable. The uncertainty of the measurement is ± 4 . 3dB at a confidence level of approximately 95%, with a coverage factor of 2.

Radiated emission (OATS)

30 MHz - 1 GHz (QP only @ 3m and 10 m) ± 4 . 3dB (For EUT not bigger than 0.5m X 0.5m X 0.5m)

TEST RESULTS

Output Signal Level

MODE	CHANNEL 3				CHANNEL 4			
	Visual (61.25 MHz)		Aural (65.75 MHz)		Visual (67.25 MHz)		Aural (71.75 MHz)	
	PEAK VALUE (dB μ V /75 Ω)	Margin (dB)	PEAK VALUE (dB μ V /75 Ω)	Margin (dB)	PEAK VALUE (dB μ V /75 Ω)	Margin (dB)	PEAK VALUE (dB μ V /75 Ω)	Margin (dB)
A	65.0	-4.5	52.3	-4.2	65.3	-4.2	50.9	-5.6
B	64.9	-4.6	51.2	-5.3	65.1	-4.4	51.6	-4.9
C	64.5	-5.0	52.1	-4.4	64.7	-4.8	51.9	-4.6
D	65.0	-4.5	50.7	-5.8	65.2	-4.3	50.2	-6.3

Output Signal Level

NOTES

1. All possible modes of operation were investigated and repeated for channel 3 and 4.
2. The emission measurements using peak mode (100kHz bandwidth) are reported. All other emissions were insignificant.
3. The FCC Part 15B (1997) output signal level limits (for TV interface devices at 75 ohms output) are 69.5dB μ V for visual signals and 56.5dB μ V for aural signals.
4. A "-ve" margin indicates a **PASS** as it refers to the margin present below the limit line at the particular frequency.
5. All measuring equipment are calibrated with traceability to NPL (UK) or NIST (USA).

MEASUREMENT UNCERTAINTIES

All test measurements carried out are traceable to UK National Standards where obtainable. The uncertainties are for an estimated confidence probability of not less than 95%.

Output Signal Level (Voltage)

30 MHz - 1 GHz ± 0.52 dB

TEST RESULTS

Output Terminal Conducted Spurious Emissions

FREQUENCY (MHz)	PEAK VALUE (dB μ V/75 Ω)	MARGIN (dB)	CHANNEL	TEST MODE
43.3	26.7	-12.8	3	A
534.3	25.8	-13.7	3	A
46.3	26.5	-13.0	4	A
537.3	26.7	-12.8	4	A
43.3	26.3	-13.2	3	B
534.3	27.0	-12.5	3	B
46.3	26.3	-13.2	4	B
537.3	26.4	-13.1	4	B
43.3	25.5	-14.0	3	C
534.3	26.3	-13.2	3	C
46.3	26.6	-12.9	4	C
537.3	26.9	-12.6	4	C
54.3	32.8	-6.7	3	D
534.3	26.8	-12.7	3	D
60.3	31.2	-8.3	4	D
537.3	27.4	-12.1	4	D

Output Terminal Conducted Spurious Emissions

NOTES

1. All possible modes of operation were investigated and repeated for channel 3 and 4.
2. The emission measurements using peak mode (100kHz bandwidth) are reported. All other emissions were insignificant.
3. The FCC Part 15B (1997) output terminal conducted spurious emissions limits (for TV interface devices at 75 ohms output) is 39.5dB μ V.
4. A "-ve" margin indicates a **PASS** as it refers to the margin present below the limit line at the particular frequency.
5. All measuring equipment are calibrated with traceability to NPL (UK) or NIST (USA).

MEASUREMENT UNCERTAINTIES

All test measurements carried out are traceable to UK National Standards where obtainable. The uncertainties are for an estimated confidence probability of not less than 95%.

Output Terminal Conducted Spurious Emissions (Voltage)

30 MHz - 1 GHz ± 0.52 dB

TEST RESULTS

Antenna Transfer Switch Measurements

FREQUENCY (MHz)	PEAK VALUE (dB μ V/75 Ω)	MARGIN (dB)	CHANNEL	TEST MODE
61.25	6.0	-3.5	3	A
61.25	7.5	-2.0	3	B
61.25	6.0	-3.5	3	C
67.25	6.4	-3.1	4	A
67.25	7.3	-2.2	4	B
67.25	8.0	-1.5	4	C

Antenna Transfer Switch Measurements

NOTES

1. All possible modes of operation were investigated and repeated for channel 3 and 4.
2. The emission measurements using peak mode (120kHz bandwidth using R&S test receiver) are reported. All other emissions were insignificant.
3. The FCC Part 15B (1997) antenna transfer switch limit (for TV interface devices at 75 ohms output) is 9.5dB μ V.
4. A "-ve" margin indicates a **PASS** as it refers to the margin present below the limit line at the particular frequency.
5. All measuring equipment are calibrated with traceability to NPL (UK) or NIST (USA).

MEASUREMENT UNCERTAINTIES

All test measurements carried out are traceable to UK National Standards where obtainable. The uncertainties are for an estimated confidence probability of not less than 95%.

Antenna Terminal Disturbance Voltage

30 MHz - 1 GHz (Average and Peak) ± 1.4 dB

$$\text{dB}\mu\text{V/m} = 20 \log (\mu\text{V/m})$$

i.e. 7.96 dB below limit

i.e. 6 dB below limit