



HURSLEY
EMC
SERVICES

EMC TEST REPORT

No. 11R329 FR

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UKAS Accredited
EU Notified Body
FCC & VCCI Registered
BSMI Lab ID: SL2-IN-E-3008

FCC Part 15C Certification Report

for the

ZBD Displays Limited Ethernet Communicator

Project Engineer: R. P. St John James

Approval Signatory

Approved signatories: S. M. Connolly ☒ J. A. Jones ☐

The above named are authorised Hursley EMC Services engineers.

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1.0 DECLARATION

1.1 FCC Part 15C Statement

The Equipment Under Test (EUT), as described and reported within this document, complies with the parts 15.109, 15.209 and 15.249 of the CFR 47:2010 FCC rules in accordance with ANSI C63.4:2003. The EUT operates at frequencies of 902.5 to 927.5 MHz and complies with part 15C emission requirements.

1.2 Related Submittal(s) Grants

This is an application for certification of an Ethernet Communicator (transmitting at 902.5 to 927.5 MHz), described in this report.

The sections of FCC Part 15 that apply to the EUT are:

15.209 General requirements

15.249 Operation within the band 902 to 928 MHz

15.109 applied to the EUT in receive mode and as a PC peripheral.

Note: The EUT in receiver mode and as a PC peripheral complies with part 15B of the FCC rules for unintentional radiators.

1.3 EUT Manufacturer

Trade name:	ZBD Displays Limited
Company name:	ZBD Displays Limited
Company address:	Longford Business Centre Orchard Lea Winkfield Lane Windsor SL4 4RU
Manufacturing address:	As above.
Company representative:	Mr Mike Moore Tel: +44 (0) 1344 887685

2.0 EUT DESCRIPTION

2.1 Identity

EUT:	Ethernet Communicator
Model:	Bounce
Serial numbers:	ZE00000020
Sample build:	Production

2.2 Product Operation

The EUT is part of a system for electronic shelf labels to be used within retail outlets such as shops and super markets. The EUT transmits retail information to shelf labels on the shop floor. The EUT has two identical transmitters either of which can operate but not both together. The EUT transmits with GFSK (Gaussian Frequency Shift Keying) modulation operating on any one channel in the frequency band 902.5 to 927.5 MHz. The EUT operates on a preset channel which can be changed to one of a number of channels within this frequency range. The EUT is controlled via an Ethernet connection, the preferred method of powering the EUT is via PoE (Power over Ethernet), alternatively the EUT can be powered via local mains adaptor.

2.3 Support Equipment

SUPPORTING EQUIPMENT	PART/MODEL NUMBER	SERIAL NUMBER
Toshiba Laptop	Satellite Pro A120	Y6043523H
Toshiba Power Supply	G71C0006R210	060521-11
NetGear Hub	FS 108P	ZHK116360079F
NetGear Power Supply	NU60-F-480125	I1NU
Tenwei Mains Adaptor	TAV03-0532500	10

2.4 Exerciser Program

The EUT was connected to a Laptop via an Ethernet switch, the laptop was used to control the operation of the EUT. Both radios within the EUT were tested at the top, middle and bottom frequencies as well as powered over the Ethernet and via the mains adapter. The EUT was connected remotely to the laptop via a 40m unscreened Ethernet cable. The Ethernet hub provided both PoE ports and normal Ethernet ports (not powered), the EUT was tested in both modes with an AC adapter used to power the EUT in normal Ethernet mode.

The EUT was also tested in receive mode, with the transmitter in standby.

3.0 MEASUREMENT PROCEDURE AND INSTRUMENTATION

3.1 EMI Site Address & Test Date

EMI Company Offices	Hursley EMC Services Ltd Unit 16, Brickfield Lane, Chandlers Ford, Hampshire
EMI Measurement Site	Hursley EMC Services Ltd Hursley Park, Winchester; FCC Registered UK Designation number: UK0006
Test Dates	7 th to the 19 th July 2011
HEMCS References:	11R329

3.2 General Operating Conditions

Testing was performed according to the procedures in ANSI C63.4:2003. Final radiated testing was performed at a EUT to antenna distance of three metres.

Instrumentation, including receiver and spectrum analyser bandwidth, comply with the requirements of ANSI C63.2:1996.

3.3 Environmental Ambient

Test Type	Temperature	Humidity	Atmospheric Pressure
Radiated & Conducted	21 to 24 degrees Celsius	40 to 54% relative	997 to 1017 millibars

3.4 Radiated Emissions

Initial Scan

A radiated profile scan was taken at a three metre distance on eight azimuths of the system under test in both vertical and horizontal polarities of the antenna in a semi-anechoic chamber. Instrumentation used in the chamber as below:

#ID	CP	Manufacturer	Type	Serial No	Description	Calibration due date
009	1	HP	8447D	1937A01808	Pre-amplifier (30-1000MHz)	31/05/2012
013	LAB	Schaffner	CBL6140A	1235	Antenna X-wing (20-2000MHz)	Internal
070	1	HP+short cable	8449B	3008A00481	Pre-amplifier (1.0-26.5GHz) + 0.5m cable	08/11/2011
073	3	Schwarzbeck	BBHA9120B	237	Horn antenna (1-10GHz)	17/06/2013
099	1	HP	8596-EM	3911A00146	Spectrum analyser (9kHz-12.8GHz)	03/02/2012
240	1	Sucoflex	106	52427/6	Cable SMA (18GHz)	14/02/2012

The data obtained from the profile scan was used as a guide for the final Open Area Test Site (OATS) measurements.

Final Measurements

The system under test was transferred to the OATS from the semi-anechoic chamber. The data obtained from the chamber profile-scan was used to guide the test engineer. Above 30 MHz, each emission from the transmitter was maximised by revolving the system on the turntable and moving the antennae in height and azimuth. The worst-case data is presented in this report. Test instrumentation used in the OAT's measurements was as follows:

#ID	CP	Manufacturer	Type	Serial No	Description	Calibration due date
033	1	HP	8593EM	3726U00203	Spectrum analyser (9kHz-26.5GHz)	28/03/2012
092	2	Schwarzbeck	VULB 9163	232 (grey)	Trilog antenna (30-3000MHz)	03/08/2011
127	3	Schwarzbeck	BBHA9120B	391	Horn antenna (1-10GHz)	15/12/2012
250	1	HP	8449B	3008A01077	Pre-amplifier (1.0-26.5GHz)	03/03/2012
271	1	Sucoflex	106		Cable SMA (18GHz)	10/01/2012
288	1	Rohde Schwarz	ESVP	894276/008	Receiver	17/03/2012

CP = Interval period [year] prescribed for external calibrations

Note: 'Calibration due date' means that the instrument is certified with a UKAS or traceable calibration certificate.
 'Internal' means internally calibrated using HEMCS procedures

3.5 Conducted Emissions

Test Configuration

A filtered 115V/60Hz supply was fed to the system under test, via a 50 Ω /50 μ H Line Impedance Stabilisation Network (LISN). The LISN was directly bonded to a conductive ground plane.

Test Measurement

The worst-case emissions were identified on both the neutral and phase(s) with a spectrum analyser set to scan from 0.15 MHz to 30 MHz.

The worst-case peaks were then identified and measured using an RF receiver using a quasi-peak detector and compared to the frequency range and limits of CISPR 22 as specified by ANSI C63.4-2003. Quasi-peak values that exceeded the average limit were then re-measured using the average signal detector.

The worst-case results are presented in this report.

Test instrumentation used in the conducted test was as follows:

#ID	CP	Manufacturer	Type	Serial No	Description	Calibration due date
003	1	Rohde Schwarz	ESH-3	872994/027	Test receiver (9kHz-30MHz)	17/06/2012
006	1	HP	8568B	2841A04350	Spectrum analyser	14/02/2012
116	1	Rohde Schwarz	ESH-3 Z2	M458	Pulse limiter BNC type	09/08/2011
265	1	Rohde Schwarz	ESH3-Z5	861189/003	Two Line V Network	02/09/2011

CP = Interval period [year] prescribed for external calibrations

Note: 'Calibration due date' means that the instrument is certified with a UKAS or traceable calibration certificate.

4.0 TEST DATA

4.1 Power Line Conducted Emissions

4.1.1 Data

A search was made of the frequency spectrum between 0.15 MHz to 30 MHz and the measurements reported here are the highest emissions relative to the CISPR 22 Class B limits. Emissions that meet the average limit on a quasi-peak measurement are deemed to meet both the average and quasi-peak specification.

MAINS – LINE

Frequency (MHz)	Quasi-peak value (dB μ V)		Average value (dB μ V)		Status
	Measured	Limit	Measured	Limit	
0.167	47.4	65.1	22.2	55.1	Pass
0.334	42.1	59.4	29.3	49.4	Pass
0.545	32.6	56.0	18.7	46.0	Pass

MAINS – NEUTRAL

Frequency (MHz)	Quasi-peak value (dB μ V)		Average value (dB μ V)		Status
	Measured	Limit	Measured	Limit	
0.150	48.2	66.0	22.9	56.0	Pass
0.222	42.0	62.7	21.9	52.7	Pass
0.238	41.4	59.5	25.7	49.5	Pass

Uncertainty of measurement: ± 3.22 dB μ V for a 95% confidence level.

Measurements made according to the FCC rules and Hursley EMC Services test procedure CON-02.

TEST ENGINEER: Rob St John James

4.2 FCC – Radiated Emissions (Transmitting)

A search was made of the frequency spectrum from 30 MHz to 10 GHz and the measurements reported are the highest emissions relative to the 'FCC CFR 47 Section 15.209 and 15.249 Limits' at a measuring distance of three metres.

Testing was performed on both the EUT radios, powered by Ethernet and again with an AC adaptor as well as top, bottom and middle transmitter operating frequencies. Below 1 GHz a quasi-peak detector was used (bandwidth 120 kHz), above 1 GHz a peak and average detector was used (bandwidth 1 MHz). The worst-case results from all tests are presented here.

RESULTS - 30 MHz to 1000 MHz

Frequency MHz	Receiver amplitude dBμV	Antenna factor dB	Cable loss dB	Actual quasi-peak value @ 3m dBμV/m	Specified limit @ 3m dBμV/m
39.81	17.0	12.6	0.8	30.43	40.00
45.07	7.3	13.5	0.8	21.60	40.00
45.58	13.6	13.5	0.8	27.89	40.00
69.30	21.9	8.7	1.0	31.57	40.00
128.33	27.2	8.5	1.5	37.16	43.50
129.91	27.3	8.5	1.5	37.27	43.50
129.93	8.6	8.5	1.5	18.57	43.50
249.80	14.1	11.8	2.2	28.11	46.00
249.81	27.3	11.8	2.2	41.32	46.00
385.56	3.0	15.3	2.8	21.09	46.00
385.78	-18.1	15.3	2.8	33.00	46.00
390.00	19.8	15.5	2.8	38.12	46.00
902.00#	18.6	21.9	5.0	45.53	46.00
902.00	13.0	21.9	5.0	39.93	46.00
*902.50	57.6	21.9	5.0	84.53	94.00
*902.50#	66.2	21.9	5.0	93.13	94.00
*914.50#	66.8	21.9	5.0	93.66	94.00
*914.50	59.6	21.9	5.0	86.46	94.00
*927.50#	64.5	22.0	5.1	91.56	94.00
*927.50	56.7	22.0	5.1	83.76	94.00
928.00#	17.4	22.0	5.1	44.46	46.00
928.00	14.7	22.0	5.1	41.76	46.00

*Transmitter frequency

Uncertainty of measurements: ± 4.2 dBμV for a 95% confidence level.

The measured result is below the specification limit by a margin less than the measurement uncertainty; it is not therefore possible to determine compliance at a level of confidence of 95%. However, the measured result indicates a higher probability that the EUT tested complies with the specification limit.

Radiated emissions (continued)**RESULTS - 1.0 GHz to 10.0 GHz**

Frequency GHz	Receiver amplitude dB μ V	Antenna factor dB	Cable loss dB	Pre-amp gain dB	Actual average value @ 3m dB μ V/m	Specified average limit @ 3m dB μ V/m
1.805	57.4	26.7	2.2	39.0	47.3	54.0
1.829	55.4	26.7	2.2	39.0	45.3	54.0
1.855	56.4	26.7	2.2	39.0	46.3	54.0
5.415	47.8	29.5	4.0	37.9	43.4	54.0
5.487	46.5	29.5	4.0	37.9	42.1	54.0
5.565	46.9	29.9	4.1	37.9	43.0	54.0

Frequency GHz	Receiver amplitude dB μ V	Antenna factor dB	Cable loss dB	Pre-amp gain dB	Actual peak value @ 3m dB μ V/m	Specified limit @ 3m dB μ V/m
1.805	59.3	26.7	2.2	39.0	49.2	74.0
1.829	58.4	26.7	2.2	39.0	48.3	74.0
1.855	58.3	26.7	2.2	39.0	48.2	74.0
5.415	50.7	29.5	4.0	37.9	46.3	74.0
5.487	51.6	29.5	4.0	37.9	47.2	74.0
5.656	50.6	29.9	4.1	37.9	46.7	74.0

Procedure: In accordance with ANSI C63.4:2003

Measurements below 1.0 GHz performed with a quasi-peak detector. Measurements above 1.0 GHz performed with an average and peak detector.

Note: To meet the limit the transmitter amplitude was turned down from level 7 to level 5.

TEST ENGINEER: Rob St John James

4.3 FCC – Radiated Emissions (Receive Mode)

A search was made of the frequency spectrum from 30 MHz to 10.0 GHz and the measurements reported are the highest emissions relative to the 'FCC CFR 47 Section 15.109 Limits' at a measuring distance of three metres. The worst-case results with the EUT powered by the AC Adaptor or PoE are presented here.

RESULTS 30 MHz to 1000 MHz

Frequency MHz	Receiver amplitude dB μ V	Antenna factor dB	Cable loss dB	Actual quasi-peak value @ 3m dB μ V/m	Specified limit @ 3m dB μ V/m
41.13	18.4	12.9	0.8	32.14	40
61.17	7.9	12.3	1.0	21.16	40
126.02	19.8	8.5	1.5	29.75	43.5
126.02	22.2	8.5	1.5	32.15	43.5
130.51	24.0	8.5	1.5	33.97	43.5
215.92	22.3	10.5	2.0	34.83	43.5
215.94	21.4	10.5	2.0	33.93	43.5
223.59	21.8	10.9	2.0	34.70	46
390.00	20.1	15.5	2.8	38.42	46
442.00	12.2	16.3	3.1	31.58	46
892.80	4.5	21.8	5.0	31.25	46

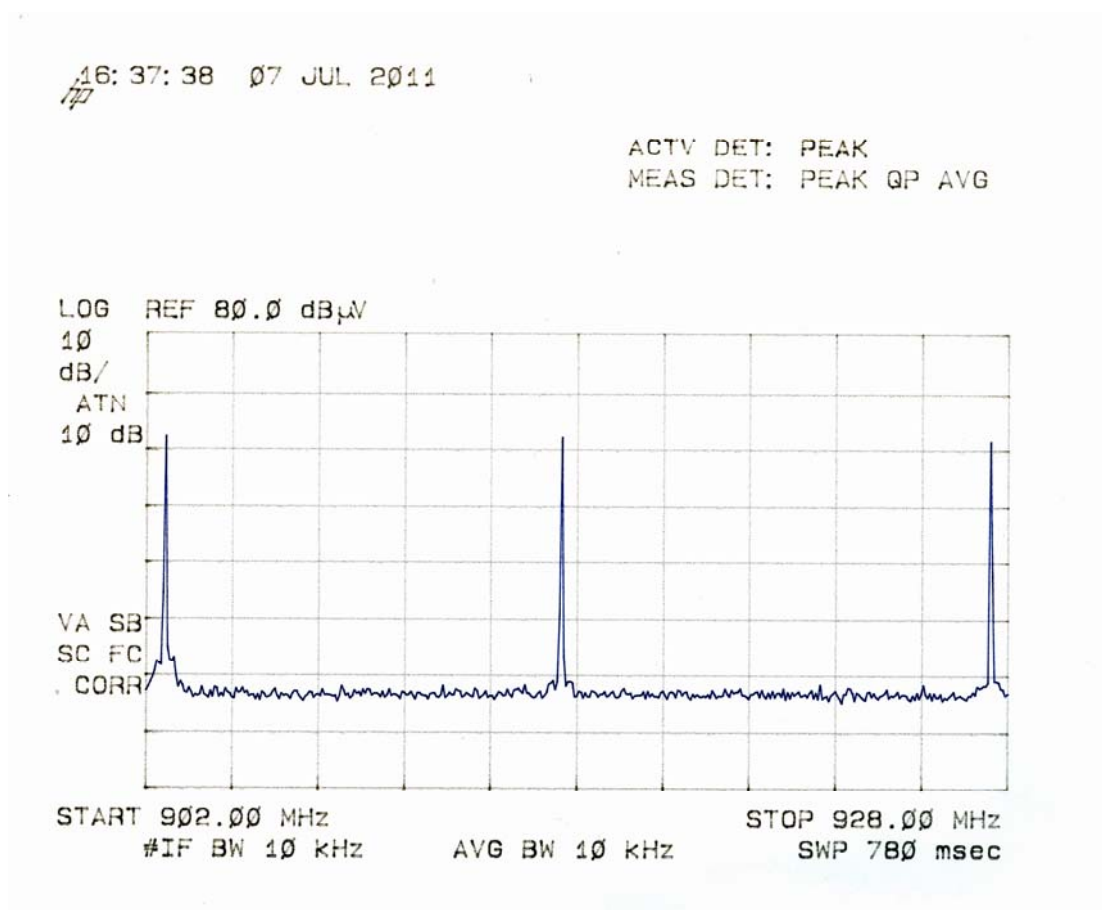
Procedure: In accordance with ANSI C63.4:2003

Measurements below 1000 MHz performed with a quasi-peak detector. Measurements above 1000 MHz performed with an average and peak detector.

TEST ENGINEER: Rob St John James

4.4 FCC –Transmitter Emissions Plot (Occupied Band)

Max Hold Scan showing the three different transmitter frequencies within the 902 to 928 MHz Band.



4.5 Bandwidth Plot

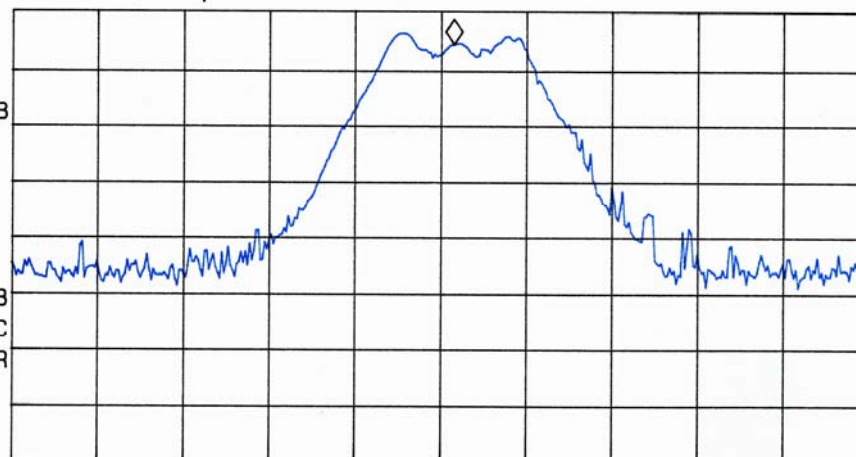
06:58:07 12 JUL 2011

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 902.4995 MHz
90.30 dB μ V

LOG REF 96.0 dB μ V

10
dB/
ATN
10 dB

VA SB
SC FC
CORR



CENTER 902.4950 MHz

#IF BW 10 kHz

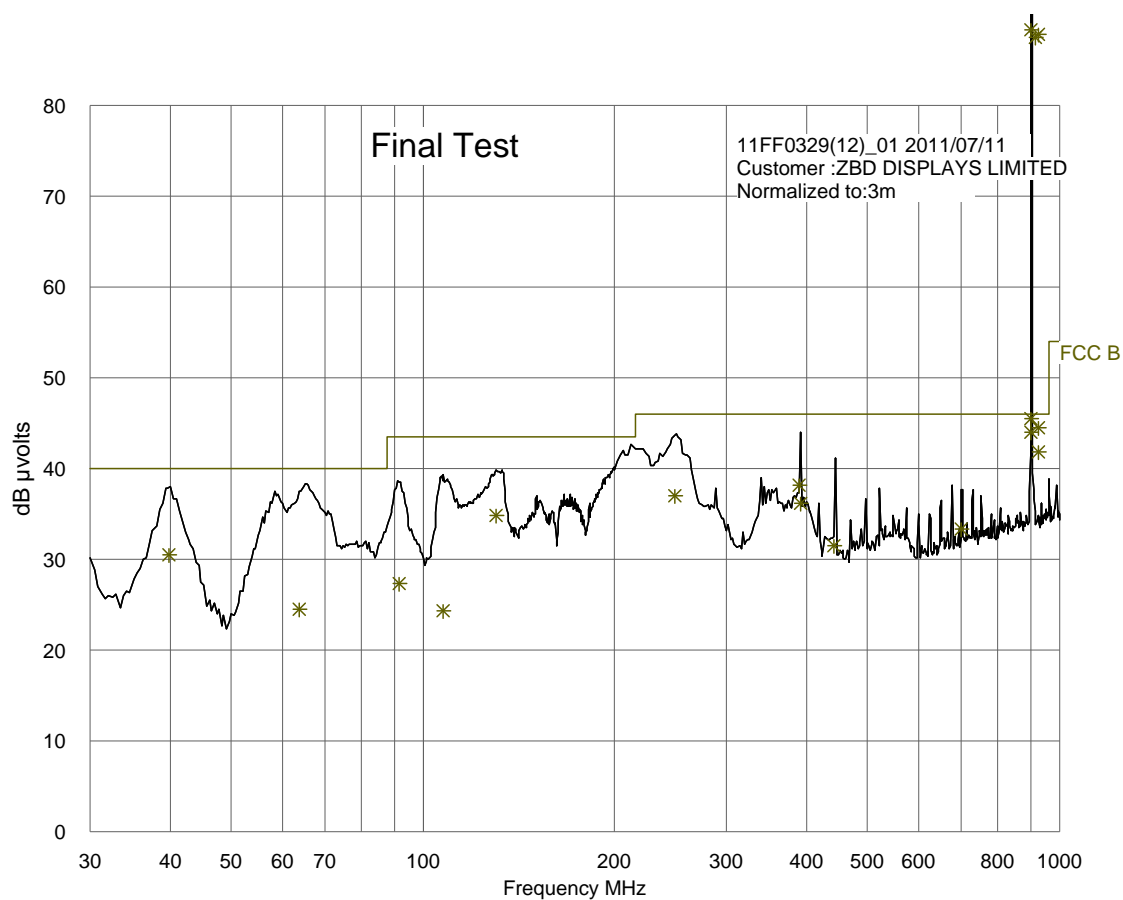
#AVG BW 30 kHz

SPAN 300.0 kHz

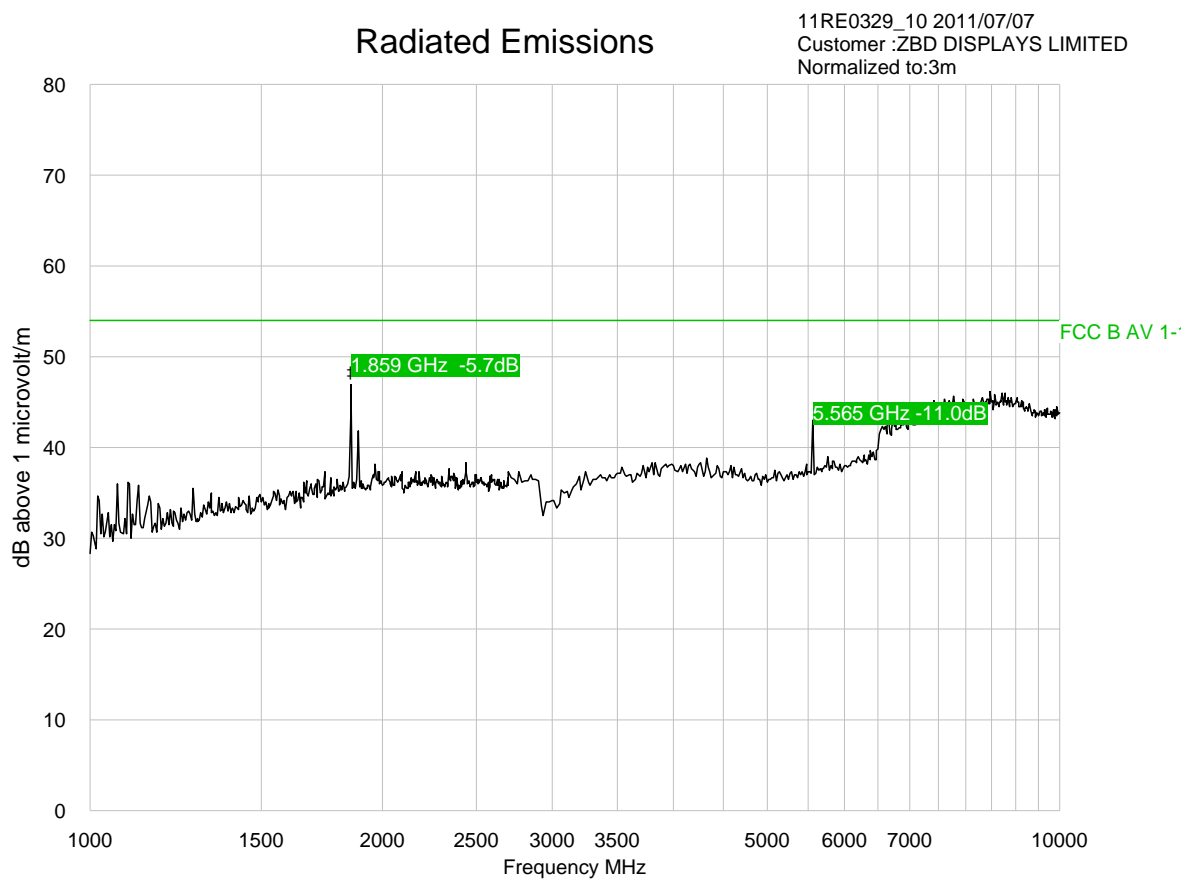
SWP 30.0 msec

5.0 TEST PLOTS

5.1 Radiated Emission Plot, 30 to 1000 MHz

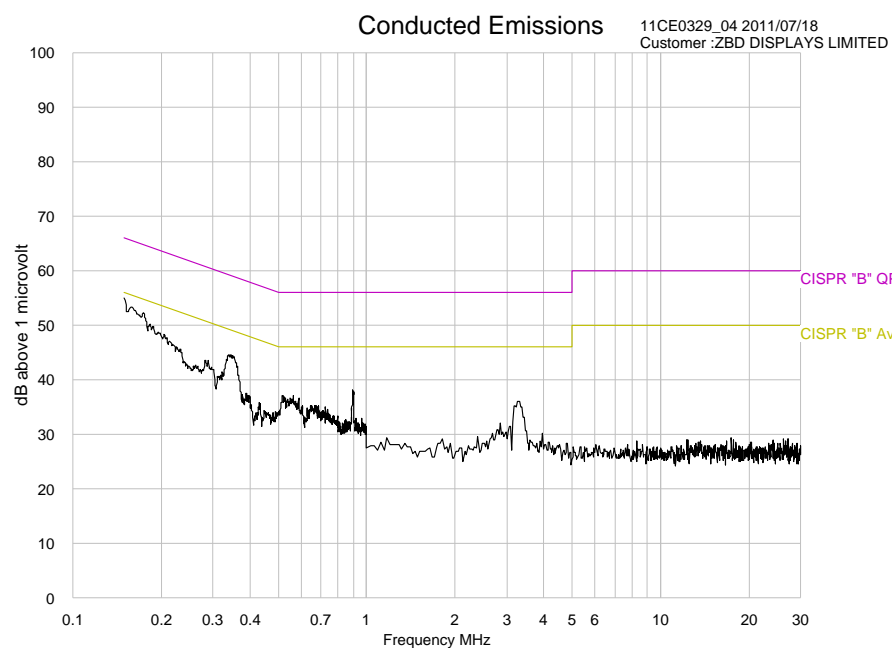


5.2 Radiated Emissions Plot, 1.0 to 10.0 GHz

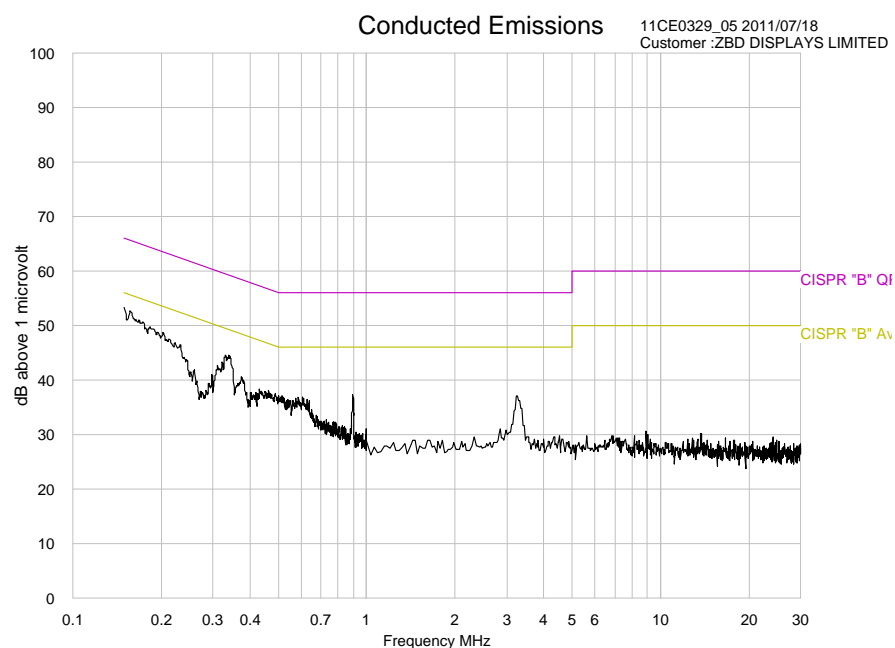


5.3 Conducted Emissions Plots

Shown here is the mains-line plot.



Shown here is the mains-neutral plot.



6.0 FCC DETAILS

FEDERAL COMMUNICATIONS COMMISSION

Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

February 13, 2006

Hursley EMC Services Ltd.
Unit 16
Brickfield Lane
Chandlers Ford - Hampshire, SO53 4DB
United Kingdom
Attention: R P St John James

Re: Accreditation of Hursley EMC Services Ltd.
Designation Number: UK0006

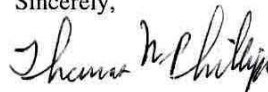
Dear Sir or Madam:

We have been notified by Department of Trade and Industry (DTI) that Hursley EMC Services Ltd. has been accredited as a Conformity Assessment Body (CAB).

At this time your organization is hereby designated to perform compliance testing on equipment subject to Declaration Of Conformity (DOC) and Certification under Parts 15 and 18 of the Commission's Rules.

This designation will expire upon expiration of the accreditation or notification of withdrawal of designation.

Sincerely,



Thomas Phillips
Electronics Engineer