SK TECH CO., LTD.

FCC-Certificate of Compliance

Test Report No.:	**SKTFCE-051214-100**		
NVLAP CODE :	**200220-0**		
Applicant:	**CELLUON, INC.**		
Applicant Address:	IT Venture Tower West 16F, 78 Garak-bondong, Songpa-Gu, Seoul, Korea 138-803		
Manufacturer :	**CELLUON, INC.**		
Manufacturer Address:	IT Venture Tower West 16F, 78 Garak-bondong, Songpa-Gu, Seoul, Korea 138-803		
Product:	**Projection Keyboard**		
FCC ID:	**TCLCL800BT**	**Model No.:**	**CL800BT**
Receipt No.:	SKTEU05-0743	**Date of receipt:**	Nov. 23, 2005
Date of Issue:	Dec. 14, 2005		
Testing location:	**SK TECH CO., LTD.** 820-2, Wolmoon-Ri, Wabu-Up, Namyangju-Si, Kyunggi-Do, Korea		
Test Standards:	**ANSI C63.4 / 2003**		
Rule Parts:	**FCC part 15 Subpart B**		
Equipment Class :	**Class B Digital Device Peripheral**		
Test Result:	The above mentioned product has been tested and passed.		

Prepared by: S.Y.Ye	**Tested by**:*S.B.Ko/Engineer*	**Approved by**: *D.H.Kang /Manager& Chief Engineer*
Signature *Date*	*Signature* *Date*	*Signature* *Date*
Other Aspects :		
Abbreviations :	**· OK, Pass = passed · Fail = failed · N/A = not applicable**	

☞ **•This test report is not permitted to copy partly without our permission.**

•This test result is dependent on only equipment to be used.

•This test result is based on a single evaluation of one sample of the above mentioned.

•This test report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S Government.

• We certify that this test report has been based on the measurement standards that is traceable to the national or International standards.

NVLAP®

NVLAP Lab. Code: 200220-0

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1. General

This equipment has been shown to be capable of compliance with the applicable technical standards and was tested in accordance with the measurement procedures as indicated in this report.

We attest to the accuracy of data. All measurements reported herein were performed by SK Tech Co., Ltd. and were made under Chief Engineer's supervision.
We assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

2. Test Site

SK TECH Co., Ltd.

2.1 Location

820-2, Wolmoon Ri, Wabu-Up, Namyangju-Si, Kyunggi-Do, Korea

The test site is in compliance with ISO/IEC 17025 for general requirements for the competence of testing and calibration laboratories.
This laboratory is accredited by NVLAP for NVLAP Lab. Code : 200220-0
and DATech for DAR-Registration No.:DAT-P-076/97-01

2.2 List of Test and Measurement Instruments

Table 1 : List of Test and Measurement Equipment

- **Conducted Disturbance**

Kind of Equipment	Type	S/N	Calibrated until
EMI Receiver	ESHS10	862970/019	09.2006
Artificial Mains Network	ESH2-Z5	834549/011	08.2006
EMI Receiver	ESHS10	835871/002	09.2006
Artificial Mains Network	ESH3-Z5	836679/018	08.2006

- **Radiated Disturbance**

Kind of Equipment	Type	S/N	Calibrated until
EMI Receiver	ESVS 10	825120/013	09.2006
EMI Receiver	ESVS 10	834468/008	09.2006
Spectrum Analyzer	R3361A	11730187	09.2006
Amplifier	8447F	3113A05153	08.2006
Log Periodic Antenna	UHALP9107	1819	11.2006
Biconical Antenna	BBA9106	91031626	11.2006
Open Site Cable	N/A	N/A	N/A
Antenna Turntable Driver	5907	N/A	N/A
Antenna Turntable controller	5906	N/A	N/A
Amp & Receiver connection cable	N/A	N/A	N/A
Amp & Spectrum connection cable	N/A	N/A	N/A
50Ω Switcher	MP59B	6100214538	N/A

2.3 Test Date

Date of Application : Nov. 23, 2005

Date of Test : Dec. 05, 2005 ~ Dec. 13, 2005

2.4 Test Environment

See each test item's description.

3. Description of the tested samples

The EUT is a Projection Keyboard with Bluetooth communication.

This model is made possible by electronic perception technology.

The electronic perception technology shows your fingers move and translates into keystrokes in the devices.

3.1 Rating and Physical Characteristics

Keyboard Project

Items	**Specifications**
Light source	Red Laser diode
Keyboard layout	17mm QWERTY layout
Keyboard size	Approx. 241mm* 106mm
Keyboard position	Approx. 100mm from keyboard device
Projection surface	Non-reflective, opaque flat surface
Visibility	Visible in 1000-5000 lux ambient light
Keyboard Sensor	
Items	**Specifications**
Illumination	Visible in incandescent light of 1800 lux or more
Detection rate	Up to 400 characters per minute
Effective Key stroke	Approx.2mm
Operating surface	Any flat surface
Electrical Condition	
Items	**Specifications**
Power source	Integral lithium battery
Battery capacity	830mAH(Max)@3.7V
Adapter	Rating 1A@ 5 V
Interface	RS232C serial
Bluetooth	v1.1 class2
Power consumption	Max. 3W @5V
Environmental Condition	
Items	**Specifications**
Operating temperature	Approx. 0~35℃
Storage temperature	Approx. –20~50℃

3.2 Submitted Documents

N/A

4. Measurement Conditions

The power of EUT is supplied by rechargeable battery or AC/DC adaptor that is supplied "DC 5 V/ 1A".

4.1 Modes of Operation

The EUT is connected to Personal computer, using ATM manager program, via serial cable. And the EUT operated to the following each mode during all tests;

1. Bluetooth mode
2. Serial mode

4.2 List of Peripherals

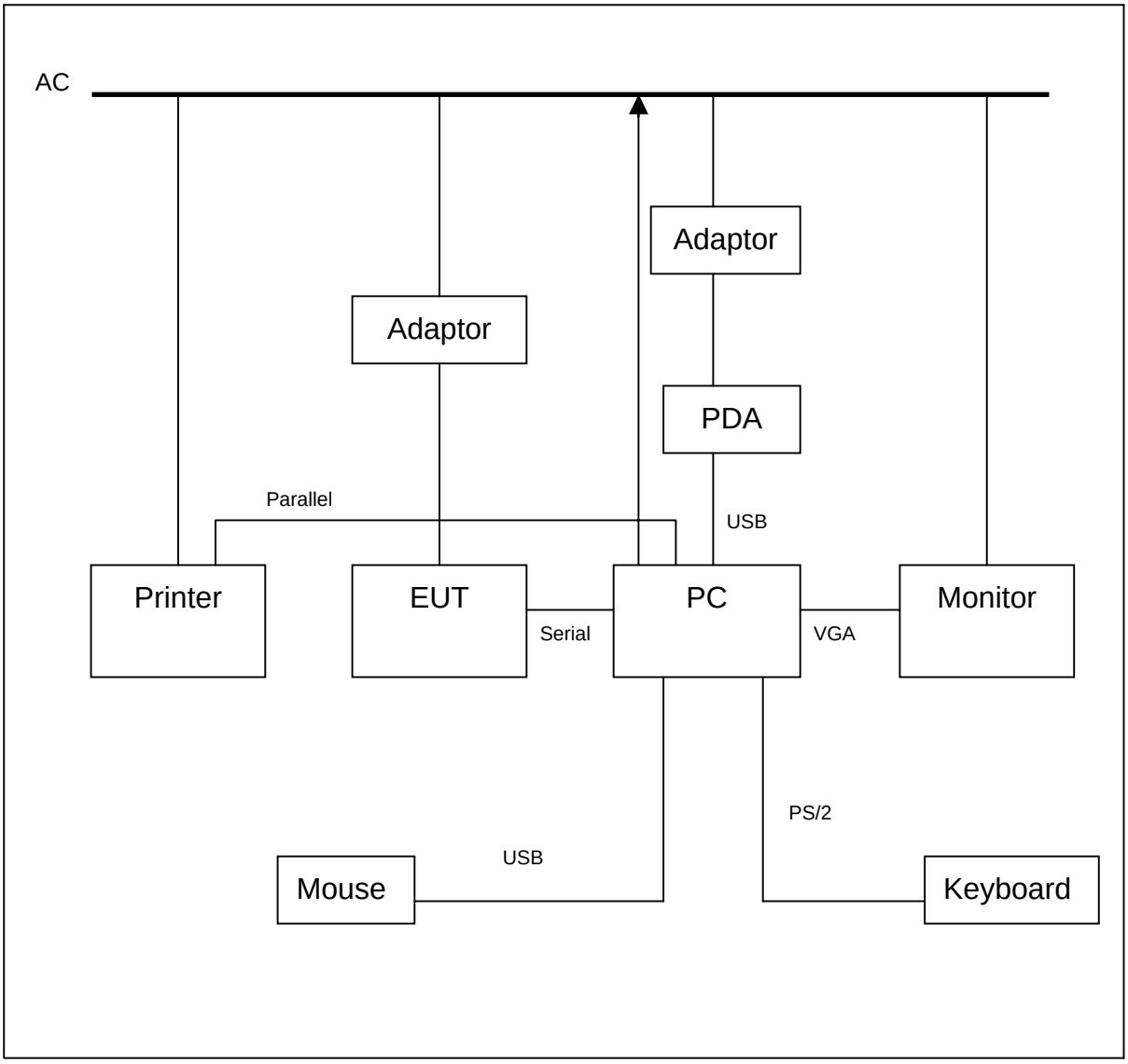
Equipment	Manufacturer	Model Name	Serial No.
Keyboard(PS2)	Jing Mold Enterprise Co., Ltd.	LKB-0107	20103814
Mouse(USB)	LG	LMULBGS01I	04CU000258
Printer(Parallel)	EPSON PRECISION (PHILLINES),INC.	EPSON STYLUS PHOTO 830	ELTK014637
LCD Monitor	LG	1510TFT Rev B	304KG04862
Personal Computer	SAMSUNG	ZMP35	X71498DX900234E
Adaptor (for EUT)	DVE	DSA-0051-03FEU	N/A
PDA	FUJITSU	PL 720MD	YEHD018106
Adaptor (for PDA)	HUA JUNG	HAPU05B1	N/A

4.3 Type of Used Cables

Equipment	Manufacturer	M/N	S/N	Cables &connectors
Keyboard(PS2)	Jing Mold Enterprise Co., Ltd.	LKB-0107	20103814	0.8m unshielded PS/2 cable
Mouse(USB)	LG	LMULBGS01I	04CU000258	1.1m unshielded USB cable
Printer(Parallel)	EPSON PRECISION (PHILLINES),INC.	EPSON STYLUS PHOTO 830	ELTK014637	1.3m unshielded Power cable 1.2m shielded Parallel cable
LCD Monitor	LG	1510TFT Rev B	304KG04862	1.3m unshielded Power cable 1.2m shielded VGA cable
Personal Computer	SAMSUNG	ZMP35	X71498DX900234E	0.6m shielded USB cable 1.2m shielded VGA cable 1.2m shielded Parallel cable
PDA	FUJITSU	PL 720MD	YEHD018106	1.3m unshielded Adaptor cable 0.6m shielded USB cable

4.4 Test Setup

The test setup photographs showed the external supply connections and interfaces.



[System Block Diagram of Test Configuration]

4.5 Uncertainty

1) Radiated disturbance

⊙ **Horizontally polarized radiated disturbances from 30MHz to 1000MHz at a distance of 10m**

Input quantity	Uncertainty of Xi		U(Xi)	Ci	Ciu(xi)	**CISPR 16-4**
	dB	Probability distribution function	dB			
1) Receiver reading	±0.1	K =1	0.1	1	**0.1**	0.10
2) Attenuation: antenna-receiver	±0.18	K=2	0.09	1	**0.09**	0.05
3) Antenna factor	±1.5	K=2	0.75	1	**0.75**	1.00
RECEIVER CORRECTIONS:						
4) Sine wave voltage	±0.56	K=2	0.28	1	**0.50**	0.50
5) Pulse amplitude response	±1.5	Rectangular (√3)	0.87	1	**0.87**	0.87
6) Pulse repetition rate response	±1.5	Rectangular (√3)	0.87	1	**0.87**	0.87
7) Noise floor proximity	±0.5	K=2	0.25	1	**0.25**	0.25
8) AF frequency interpolation	±0.3	Rectangular (√3)	0.17	1	**0.17**	0.17
9) Balance	±0.3	Rectangular (√3)	0.17	1	**0.17**	0.53
10) AF height deviations	±0.5	Rectangular (√3)	0.29	1	**0.29**	0.29
11) Phase center location	±0.3	Rectangular (√3)	0.17	1	**0.17**	0.17
12) Directive difference	+1.0	Rectangular (√3)	0.29	1	**0.29**	0.29
13) Cross polarization	±0.9	Rectangular (√3)	0.52	1	**0.52**	0.52
14) Site corrections	±2.6	Rectangular (√3)	1.5	1	**1.5**	1.63
15) Mismatch (ant-receiver)	±1.06	U-shaped (√2)	0.75	1	**0.75**	0.67

Combined Uncertainty

$Uc(xi)= \sqrt{(1)^2+(2)^2+(3)^2+(4)^2+(5)^2+(6)^2+(7)^2+(8)^2+(9)^2+(10)^2+(11)^2+(12)^2}$

$+(13)^2+(14)^2+(15)^2 = 2.37$

Expanded Uncertainty

U= k*Uc(xi) = 2 * 2.37= 4.74dB (The coverage factor k =2 yields approximately a 95% level of confidence)

⊙ **Vertically polarized radiated disturbances from 30MHz to 1000 MHz at a distance of 10 m**

Input quantity	Uncertainty of Xi		U(Xi)	Ci	Ciu(xi)	**CISPR 16-4**
	dB	Probability distribution function	dB			
1) Receiver reading	±0.1	K =1	0.1	1	**0.1**	0.10
2) Attenuation: antenna-receiver	±0.18	K=2	0.09	1	**0.09**	0.05
3) Antenna factor	±1.5	K=2	0.75	1	**0.75**	1.00
RECEIVER CORRECTIONS:						
4) Sine wave voltage	±0.56	K=2	0.28	1	**0.50**	0.50
5) Pulse amplitude response	±1.5	Rectangular (√3)	0.87	1	**0.87**	0.87
6) Pulse repetition rate response	±1.5	Rectangular (√3)	0.87	1	**0.87**	0.87
7) Noise floor proximity	±0.5	K=2	0.25	1	**0.25**	0.25
8) AF frequency interpolation	±0.3	Rectangular (√3)	0.17	1	**0.17**	0.17
9) Balance	±0.9	Rectangular (√3)	0.52	1	**0.52**	0.52
10)AF height deviations	±0.3	Rectangular (√3)	0.17	1	**0.17**	0.17
11) phase center location	±0.3	Rectangular (√3)	0.17	1	**0.17**	0.17
12) directive difference	+1.0	Rectangular (√3)	0.29	1	**0.29**	0.29
13)cross polarization	±0.9	Rectangular (√3)	0.52	1	**0.52**	0.52
14) site corrections	±2.6	Rectangular (√3)	1.5	1	**1.5**	1.63
15) Mismatch (ant-receiver)	±1.06	U-shaped (√2)	0.75	1	**0.75**	0.67

Combined Uncertainty

$$Uc(xi)= \sqrt{(1)^2+(2)^2+(3)^2+(4)^2+(5)^2+(6)^2+(7)^2+(8)^2+(9)^2+(10)^2+(11)^2+(12)^2+(13)^2+(14)^2+(15)^2} = \mathbf{2.43}$$

Expanded Uncertainty

U= k*Uc(xi) = 2 * 2.43 = 4.86dB

(The coverage factor k =2 yields approximately a 95% level of confidence)

2) Conducted disturbance

⊙ **Conducted disturbance from 150 KHz to 30 MHz using a 50 Ω/ 50 uH AMN**

input quantity	Uncertainty of Xi		U(Xi) dB	Ci	Ciu(xi)	**CISPR 16-4**
	dB	Probability distribution function				
1) Receiver Readeing	±0.1	K =1	0.1	1	**0.1**	0.10
2) Attenuation:AMN-receiver	±0.36	Triangular (√6)	0.15	1	**0.15**	0.05
RECEIVER CORRECTIONS:						
3) Sine wave voltage	±0.5	K=2	0.25	1	**0.25**	0.50
4) Pulse amplitude response	±1.5	Rectangular (√3)	0.87	1	**0.87**	0.87
5) Pulse repetition rate response	±1.5	Rectangular (√3)	0.87	1	**0.87**	0.87
6) AMN voltage division factor	±0.07	K=2	0.04	1	**0.04**	0.1
7) Mismatch : AMN-receiver	±0.55	U-shaped (√2)	0.39	1	**0.39**	0.53
8) AMN impedance	±1.52	Triangular (√6)	0.62	1	**0.62**	1.08

- 1)~8) For numbered comments, refer to following articles

Combined Uncertainty

Uc(xi)= √ (1) ²+(2) ²+(3) ²+(4) ²+(5) ²+(6) ²+(7) ²+(8) ² = **1.47**

Expanded uncertainty

U= k*Uc(xi) = 2 * 1.47 = 2.94dB

The coverage factor k =2 yields approximately a 95% level of confidence

⊙ **Refer**

1) receiver's resolution capacity

2) refer to the sub clause 11. of a calibration report

3) quoted from CISPR 16-4

4) refer to a calibration report

5) refer to CISPR 16-4 article 5. 7)

6) refer to a calibration report and a measured AMN impedance data

5. EMISSION Test

5.1 Conducted Emissions

Result: **PASS**

The line-conducted facility is located inside a 2.6M x 3.6M x 7.0M shielded enclosure.
The shielding effectiveness of the shielded room is in accordance with MIL-Std-285 or NSA 604-05.
A 1 m x 1.5 m wooden table 80 cm high is placed 40 cm. away from the vertical wall and 1.5 m away from the side wall of the shielded room. ROHDE & SCHWARZ Model ESH3-Z5 (10 kHz-30 MHz) 50 ohm/50 uH Line-Impedance Stabilization Networks(LISNs) are bonded to the shielded room.
The EUT is powered from the ROHDE & SCHWARZ LISN and the support equipment is powered from the ROHDE & SCHWARZ LISN. Power to the LISNs are filtered by a high-current high-insertion loss Lindgren enclosures power line filters (100dB 14 kHz-10 GHz).
The purpose of the filter is to attenuate ambient signal interference and this filter is also bonded to the shielded enclosure.
All electrical cables are shielded by braided tinned copper zipper tubing with inner diameter of 1/2".
If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply lines will be connected to the ROHDE & SCHWARZ LISN.
All interconnecting cables more than 1 meter were shortened by non-inductive bundling (serpentine fashion) to a 1-meter length.
Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer to determine the frequency producing the maximum EME from the EUT.
The spectrum was scanned from 150 kHz to 30 MHz with 100msec. sweep time.
The frequency producing the maximum level was reexamined using EMI/field Intensity Meter (ESHS 10) and Quasi-Peak adapter. The detector function was set to CISPR quasi-peak mode.
The bandwidth of the receiver was set to 10 kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each EME emission.
Each emission was maximized by: switching power lines; varying the mode of operation or resolution; clock or data exchange speed; if applicable; whichever determined the worst-case emission.
Photographs of the worst-case emission can be seen in photograph of conducted test.
Each EME reported was calibrated using self-calibrating mode.

Figure 1 : Spectral Diagram, LINE – PE

CELLUON

13 Dec 2005 16:15

CONDUCTED DISTURBANCE

EUT: CL800BT
Manuf:
Op Cond:
Operator:
Test Spec: QK
Comment: LINE-PE
AC 110V/ 60 Hz
Result File: ce-qk_l.dat : Projection Keyboard

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	5kHz	10kHz	PK	100msec	Auto	OFF	60dB

Final Measurement: Detector: X QP
Meas Time: 1sec
Peaks: 16
Acc Margin: 35 dB

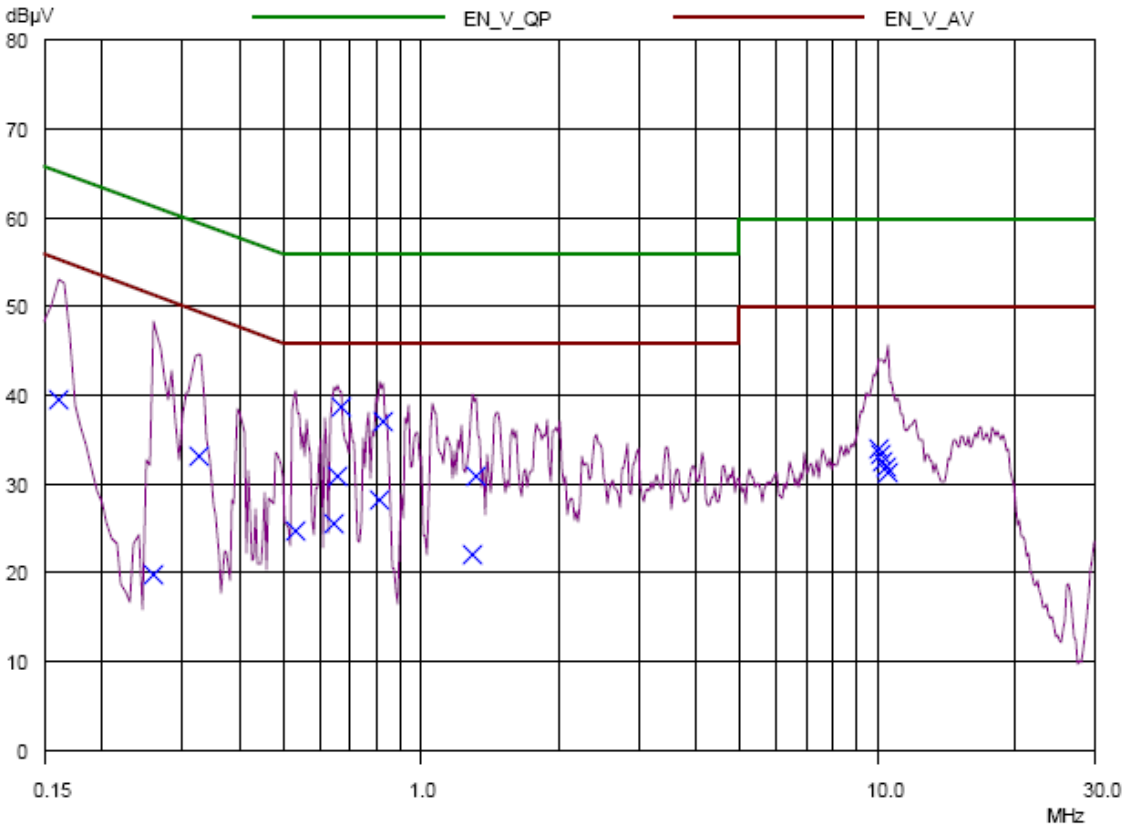


Figure 2: Test Data, LINE – PE

CELLUON

13 Dec 2005 16:15

CONDUCTED DISTURBANCE

EUT: CL800BT
Manuf:
Op Cond:
Operator:
Test Spec: QK
Comment: LINE-PE
AC 110V/ 60 Hz
Result File: ce-qk_l.dat : Projection Keyboard

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	5kHz	10kHz	PK	100msec	Auto	OFF	60dB

Final Measurement: Detector: X QP
Meas Time: 1sec
Peaks: 16
Acc Margin: 35 dB

Final Measurement Results

Frequency MHz	QP Level dBµV	QP Limit dBµV	QP Delta dB
0.16	39.71	65.46	25.75
0.26	19.99	61.43	41.44
0.325	33.21	59.58	26.37
0.53	24.78	56.00	31.22
0.645	25.65	56.00	30.35
0.655	31.02	56.00	24.98
0.67	38.78	56.00	17.22
0.81	28.25	56.00	27.75
0.825	37.05	56.00	18.95
1.3	22.15	56.00	33.85
1.32	31.02	56.00	24.98
10.09	34.08	60.00	25.92
10.19	33.38	60.00	26.62
10.3	32.67	60.00	27.33
10.435	31.93	60.00	28.07
10.56	31.44	60.00	28.56

* limit exceeded

Figure 3 : Spectral Diagram, NEUTRAL – PE

CELLUON

CONDUCTED DISTURBANCE

13 Dec 2005 19:10

EUT: CL800BT
Manuf:
Op Cond:
Operator:
Test Spec: QK
Comment: NEUTRAL-PE
AC 110 V/ 60 Hz
Result File: ce-qk_l.dat : Projection Keyboard

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	5kHz	10kHz	PK	100msec	Auto	OFF	60dB

Final Measurement: Detector: X QP
Meas Time: 1sec
Peaks: 16
Acc Margin: 35 dB

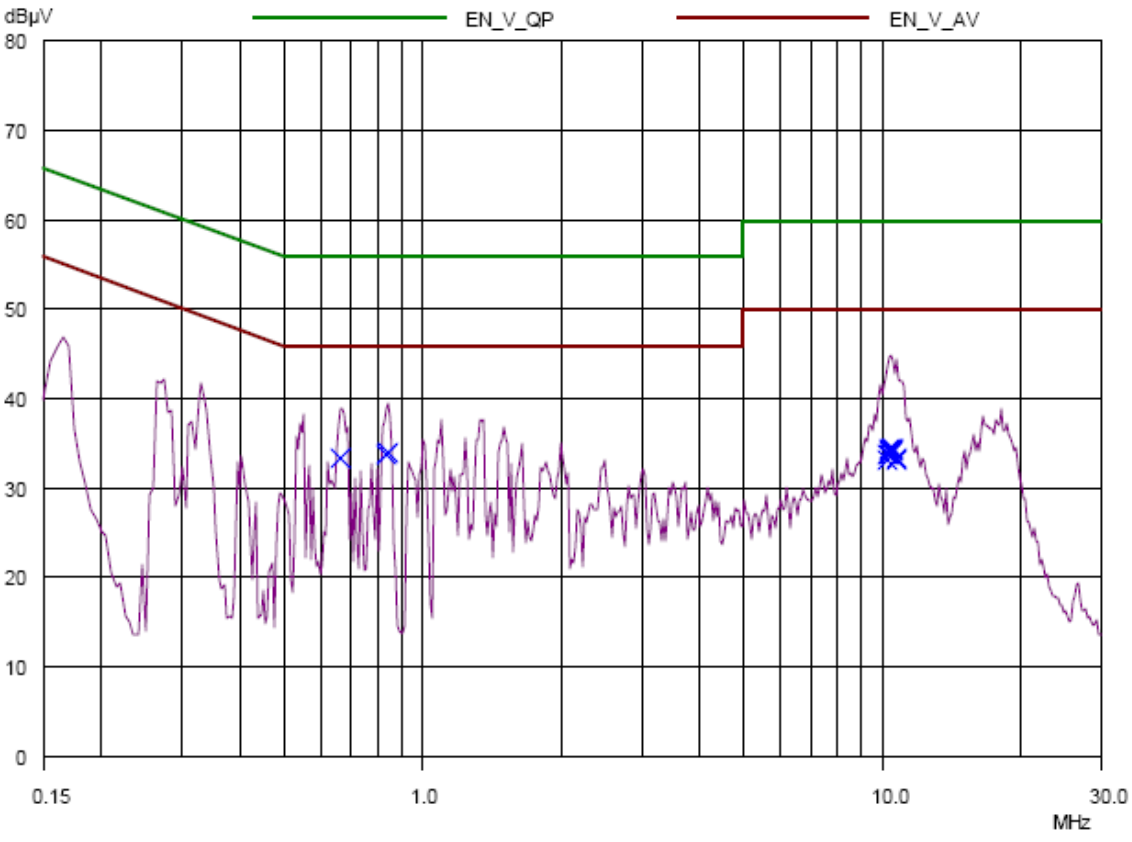


Figure 4: Test Data, NEUTRAL – PE

CELLUON

13 Dec 2005 19:10

CONDUCTED DISTURBANCE

EUT: CL800BT
Manuf:
Op Cond:
Operator:
Test Spec: QK
Comment: NEUTRAL-PE
AC 110 V/ 60 Hz
Result File: ce-qk_l.dat : Projection Keyboard

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	5kHz	10kHz	PK	100msec	Auto	OFF	60dB

Final Measurement: Detector: X QP
Meas Time: 1sec
Peaks: 16
Acc Margin: 35 dB

Final Measurement Results

Frequency MHz	QP Level dBµV	QP Limit dBµV	QP Delta dB
0.665	33.52	56.00	22.48
0.835	33.85	56.00	22.15
0.845	33.96	56.00	22.04
10.285	33.27	60.00	26.73
10.295	33.77	60.00	26.23
10.34	33.89	60.00	26.11
10.35	34.17	60.00	25.83
10.4	34.37	60.00	25.63
10.42	34.05	60.00	25.95
10.435	34.57	60.00	25.43
10.505	34.15	60.00	25.85
10.525	34.19	60.00	25.81
10.55	34.46	60.00	25.54
10.56	34.38	60.00	25.62
10.735	33.40	60.00	26.60
10.79	33.28	60.00	26.72

* limit exceeded

5.2 Radiated Emissions

Result : **PASS**

Preliminary measurements were made indoors at 3 meter using broadband antennas, broadband amplifier, and spectrum analyzer to determine the frequency producing the maximum EME. Appropriate precaution was taken to ensure that all EME from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, turntable azimuth with respect to the antenna were noted for each frequency found.
The spectrum was scanned from 30 to 300 MHz using biconical antenna and from 300 to 1000 MHz using log-periodic antenna. Above 1 GHz, linearly polarized double ridge horn antennas were used.

Final measurements were made outdoors at 3-meter test range using SCHWARZBECK dipole antennas. The test equipment was placed on a wooden table situated on a 4x4 meter area adjacent to the measurement area. Turntable was to protect from weather in the dome that made with FRP. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. Each frequency found during pre-scan measurements was re-examined and investigated using EMI/Field Intensity Meter(ESVS 10) and Quasi-Peak Adapter. The detector function was set to CISPR quasi-peak mode and the bandwidth of the receiver was set to 100 kHz or 1 MHz depending on the frequency or type of signal.

The half-wave dipole antenna was tuned to the frequency found during preliminary radiated measurements. The EUT, support equipment and interconnecting cables were re-configured to the set-up producing the maximum emission for the frequency and were placed on top of a 0.8-meter high non-metallic 1 x 1.5 meter table.
The EUT, support equipment, and interconnecting cables were re-arranged and manipulated to maximize each EME emission. The turntable containing the system was rotated; the antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the maximum emission. Each emission was maximized by: varying the mode of operation or resolution; clock or data exchange speed, and/or support equipment, if applicable; and changing the polarity of the antenna, whichever determined the worst-case emission.
Photographs of the worst-case emission can be seen in photograph of radiated emission test.
Each EME reported was calibrated using self-calibrating mode.

Table 2 : Test Data, Radiated Emissions

Frequency [MHz]	Pol.	Height [m]	Real Reading	Correction Factor		T-Fact [dB]	Data [dBuV/m]	Limits [dBuV/m]	Margin [dB]
				Antenna	Cable				
88.23	H	4.0	11.7	7.9	1.3	9.2	20.9	30.0	9.1
190.75	V	1.0	4.7	15.9	2.3	18.2	22.9	30.0	7.1
209.41	V	1.4	2.5	16.6	2.3	18.9	21.4	30.0	8.6
241.37	V	3.2	12.4	17.4	2.6	20.0	32.4	37.0	4.6
289.92	H	2.6	7.3	18.8	3.1	21.9	29.2	37.0	7.8
384.54	V	1.7	9.1	18.0	3.4	21.4	30.5	37.0	6.5

NOTES:

1. All modes of operation were investigated and the worst-case emission are reported.
2. All other emission are non-significant.
3. All readings are calibrated by self-mode in receiver.
4. Measurements using CISPR quasi-peak mode.
5. H = Horizontal, V = Vertical Polarization
6. DATA = Real Reading + T - FACTOR(=Antenna+Cable)
7. Margin = Limits - DATA