



UL Korea, Ltd

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Project: 07CA28586  
File: MC15663  
Date: July 5, 2007  
Model: NS 16 1G NN

# Evaluation Report

## For

# FCC Certification

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to public safety and committed to  
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## TEST REPORT DETAILS

Test Report No. 07CA28586-FCC

Tests Performed By: UL Korea Ltd.  
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Kangnam-ku, Seoul, 135-984, Korea

Test site: BWS TECH INC.  
611-1, Maesan-ri, Mohyeon-myeon, Cheoin-gu, Yongin-si,  
Gyeonggi-do 449-853, Korea

Applicant: Novera Optics Korea Inc.  
KT Second Research Center 463-1 Jeonmin-dong, Yuseong-gu,  
Daejeon, 305-811 Korea

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Test Report Date: July 5, 2007

Product Type: WDM-PON ONT

FCC ID: VFWNS161GNN

Product standards: FCC Part 15 Subpart B Class B

FCC Classification : Class B Computing Device Peripheral

FCC Procedure : Certification

Model Number: NS 16 1G NN(Basic), PNY16-ONT-1250

Trade Name: TurboLIGHT16, PONY Express™ 16

Sample Serial Number: None (Proto type)

Sample Receive Date: June 18, 2007

Testing Start Date: June 25, 2007

Date Testing Complete: June 25, 2007

**Overall Results: PASS**

UL Korea Ltd. reports apply only to the specific samples tested under stated test conditions. All samples tested were in good operating condition throughout the entire test program. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. UL Korea Ltd. shall have no liability for any deductions, inferences or generalizations drawn by the client or others from UL Korea Ltd. issued reports.

## TEST SUMMARY


### Test Result

Requirement – Test	Reference standards	Result	Verdict
Conducted Disturbance at the mains ports	FCC Part 15 Subpart B, Class B	Pass	Complied
Radiated Disturbance		Pass	Complied

The tests listed in the Summary of Testing section of this report have been performed and the results recorded by UL Korea, Ltd. in accordance with the procedures stated in each test requirement and specification. The applicant determined the list of tests performed were applicable to the Equipment Under Test. As a result, the subject product has been verified to comply or not comply as noted in the Summary of Testing with each test specification. The test results relate only to the items tested.

The equipment under test has

- ☒ met the technical requirements  
☐ not met the technical requirements



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UL Korea Ltd.  
July 23, 2007



Reviewed by  
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## 1. EQUIPMENT UNDER TEST(EUT)

### 1.1 Equipment Description SPEC

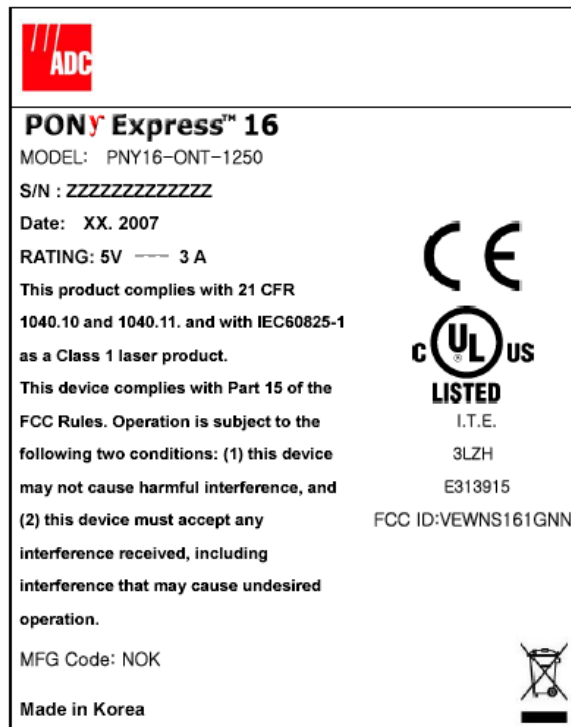
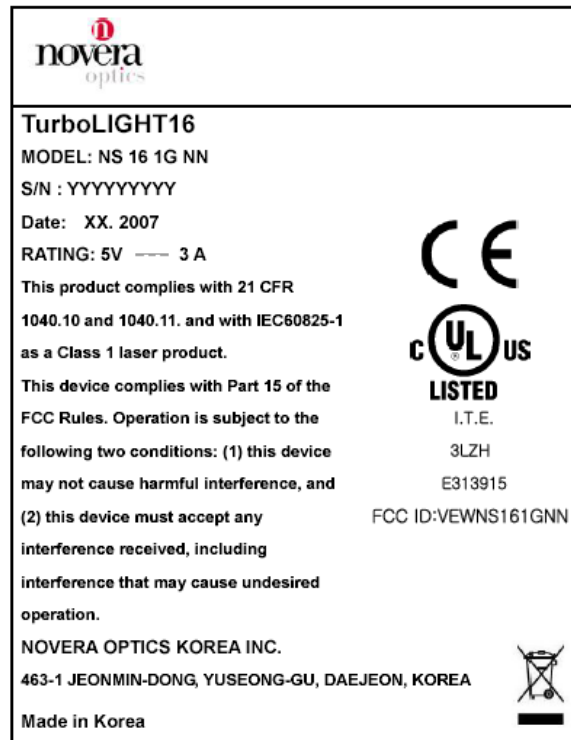
SpeedLIGHT 16 and T urboLIGHT 16 are designed for the realization of high-speed access networks. The equipment enables symmetric and dedicated high-band width optical data links to deliver services such as video, Internet and voice communications. Existing subscriber devices such as xDSL or cable-modems have limitations in distance and data rates. SpeedLIGHT 16 and T urboLIGHT 16 are optimum solutions for complementing these limitations by enabling efficient and cost-effective optical connectivity for FTTC and FTTB network applications.

SpeedLIGHT 16 and/or TurboLIGHT 16 system consists of Optical Line Terminals (OLT ), Remote Nodes (RN) and Optical Network Terminals (ONT ). A fiber trunk path is used from CO to the passive RN in the subscriber area. A fiber trunk path is used from the RN to each ONT . The ONT can be connected to an electrical switch for connectivity to multiple users. The ONT converts the optical signal from the OLT into an electric signal at the remote location. It also converts the electric signal into an optical signal for transmission to the OLT . The ONT is automatically allocated with a dense WDM optical wavelength for a dedicated and independent connection to the OLT .

The following are the technical specification of the ONT product

Optical Interface	
Optical cable	Single mode optical fiber
Line Rate	1.25 Gbps
Optical Interface	SC/APC connetor
Input optical data power	-20 dBm to -2 dBm(E-band)
Output optical data power	-1.5 dBm to +6 dBm(C-band)
BLS input power	-7.5 dBm to +5 dBm(C-band)
Ethernet Port	
Operation mode	Giga bit Ethernet / Auto-Negotiation Mode
Electrical interface	RJ-45 connector
Environmental Conditions	
Operating temperature	0℃ ~ 50℃
Operating humidity	5% ~ 85%

## 1.2 Equipment Marking Plate



### 1.3 Equipment Used During Test

Use*	Product Type	Manufacturer	Model	Comments
EUT	WDM-PON ONT	Novera Optics Korea Inc.	NS 16 1G NN	
AE	WDM-PON OLT	Novera Optics Korea Inc.	NS 16 1G CO	
AE	Adapter	AULT KOREA Corp	PW118	2(EA)
AE	RN	Novera Optics Korea Inc.	RN AWG 1:16B	
AE	Performance Analysis System	Spirent Communications	SMB-600B	
* Note: <b>EUT</b> - Equipment Under Test , <b>AE</b> - Auxiliary/Associated Equipment, <b>SIM</b> - Simulator (Not Subjected to Test)				

### 1.4 Input/Output Ports

Port #	Name	Type*	Cable Max. >3m	Cable Shielded	Comments
1	Mains	AC	1.5m	Unshielded	Connected with EUT/Adaptor
2	100 Base-FX	TP	10.0m	Optic cable	Connected to RN (OPTICAL)
3	Ethernet	TP	10.0m	Shielded	Connected to Performance Analysis System
Note: *AC = AC Power Port                      DC = DC Power Port                      N/E = Non-Electrical I/O = Signal Input or Output Port (Not Involved in Process Control) TP = Telecommunication Ports					

## 1.5 EUT Internal Operating Frequencies:

Frequency (MHz)	Description	Frequency (MHz)	Description
100.0	I <sup>2</sup> C	1250.0	Data(Tranceiver to 88E6185 SW)
100.0	MII Ethernet	1250.0	Data(88E1149 PHY to 88E6185 SW)
133.0	SDRam bus	25.0	SW/PHY Clock
25.0	CPU Clock	250.0	TX

## 1.6 Power Interface:

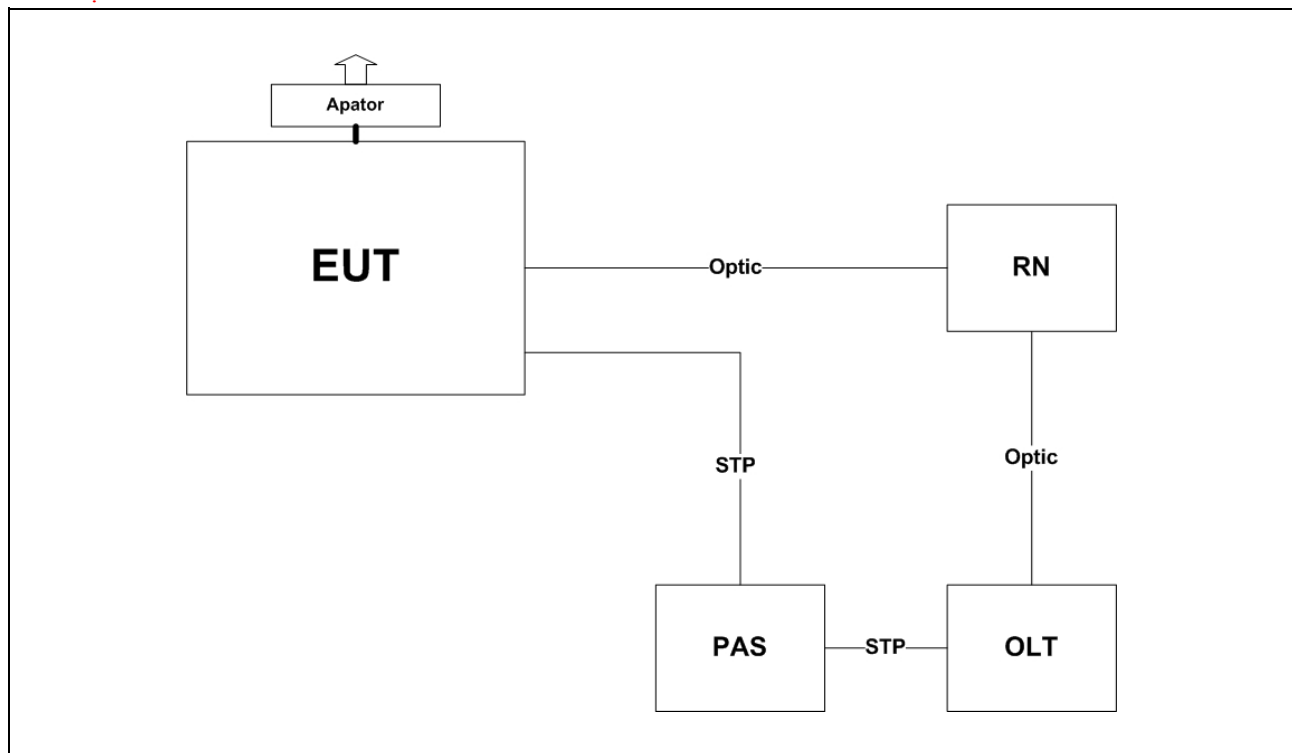
Mode #	Voltage (V)	Current (A)	Power (W)	Frequency (DC/AC-Hz)	Phases (#)	Comments
Rated	100-250Vac	0.5	-	50 - 60HZ	Single Phase	Input of AC/DC Adapter
Rated	+5 DC	3.0	-	-	-	Output of AC/DC Adapter
Rated	+5 DC	2.0	10.0	-	-	EUT



## 2. EUT Operation Modes:

Mode #	Description
1	<b>Communication link and Data transmission function</b> Emission & Immunity tests have been performed by establishing optic communication links between ONT and OLT OCU through RN interface. To simulator and check the optic communication link quality, the Performance Analysis System(SMB-600B)) was used for Ethernet packet data sending / receiving of 100 Mbps LAN port and 1000 Mbps optic port of EUT FX, TX ports.

## 3. EUT Configurations:



#### 4. CONDUCTED EMISSION

	<b>TEST:</b> Limits of mains terminal disturbance voltage				
Method	Measurements were made on a ground plane that extends 1-meter minimum beyond all sides of the system under test. All power was connected to the system through Artificial Mains Network (AMN). Conducted voltage measurements on mains lines were made at the output of the AMN.				—
Parameters required prior to the test		Laboratory Ambient Temperature		10 to 40 °C	
		Relative Humidity		10 to 90 %	
Parameters recorded during the test		Laboratory Ambient Temperature		25°C	
		Relative Humidity		40 %	
		Frequency range on each side of line		Measurement Point	
Fully configured sample scanned over the following frequency range		150kHz to 30MHz		Mains	
Limits - Class A					
Frequency (MHz)	Limit (dBµV)				
	Quasi-Peak	Results	Average	Results	
0.15 to 0.50	79	N/A	66	N/A	
0.50 to 30	73	N/A	60	N/A	
Limits - Class B					
Frequency (MHz)	Limit (dBµV)				
	Quasi-Peak	Results	Average	Results	
0.15 to 0.50	66 to 56	Pass	56 to 46	Pass	
0.50 to 5	56	Pass	46	Pass	
5 to 30	60	Pass	50	Pass	
Supplementary information:					

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Test Receiver	Rohde&Schwarz	ESPI	100063	2006. 11. 09	2007. 11. 09
Artificial Mains Network	PMM	L3-25	1110K70403	2006. 09. 09	2007. 09. 09
LISN multiline	Com-power	L1-115	241017	2006. 11. 16	2007. 11. 16

**Figure 1 Conducted Emission Test Setup**

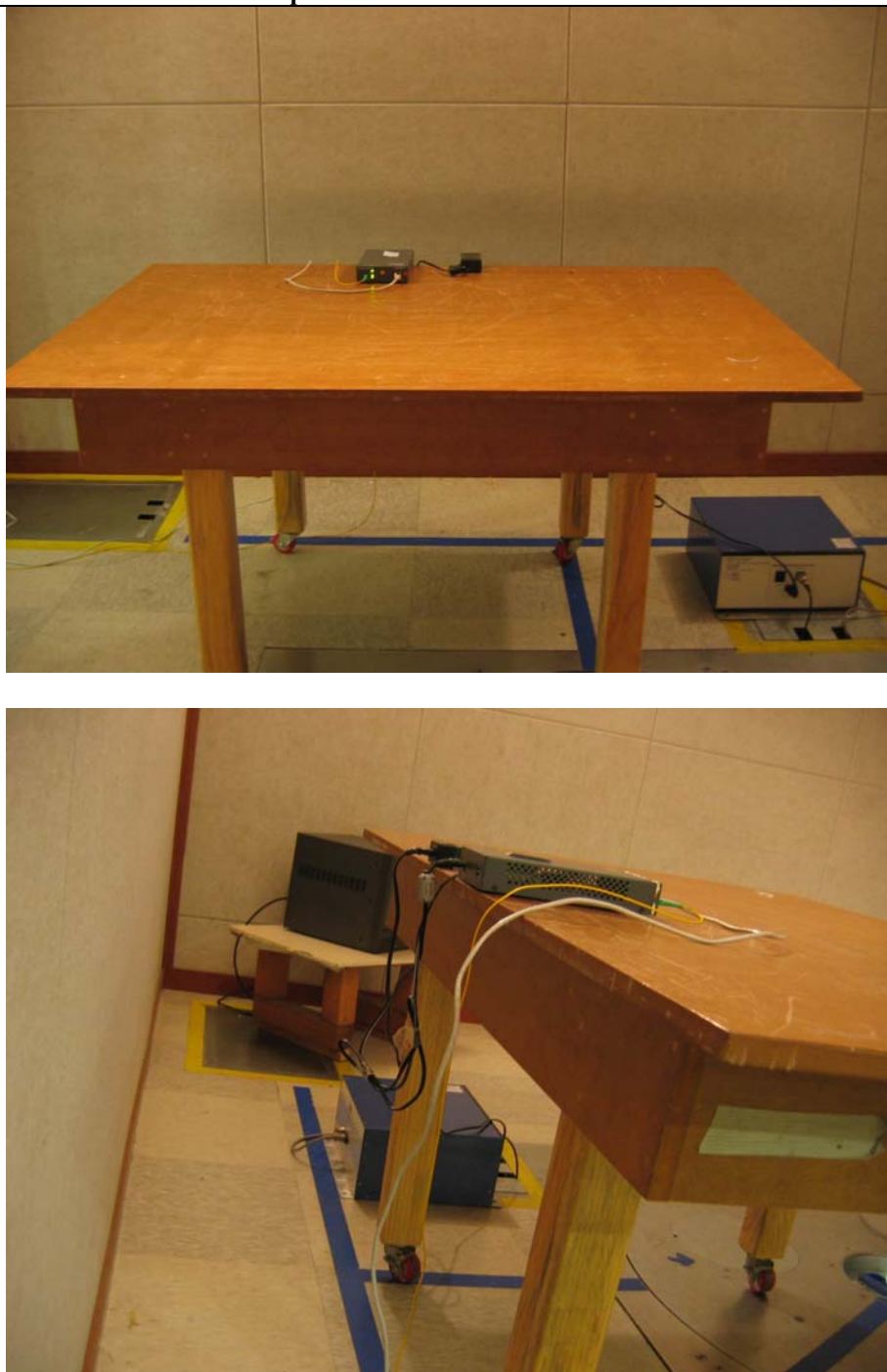


Table 1. Test data for conducted emission :

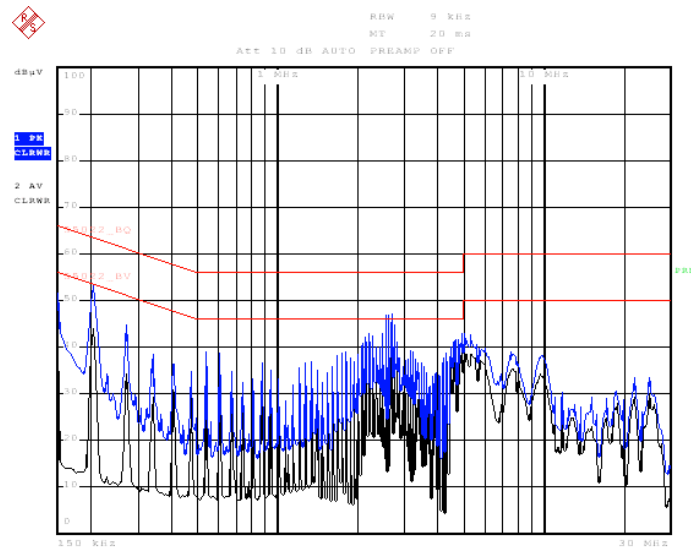
Test Frequency (MHz)	Correction Factor		Reading value(dBuV)		Line	Level(dBuV)		Limit(dBuV)		Margin(dB)	
	Cable	LISN	QP	AV		QP	AV	QP	AV	QP	AV
0.150	0.03	0.06	51.49	-	H	51.58	-	66.00	56.00	14.42	-
0.202	0.10	0.07	53.26	44.00	H	53.43	44.17	64.60	54.60	11.17	1.17
0.270	0.16	0.07	45.62	-	N	45.85	-	62.60	52.60	16.75	-
0.338	0.22	0.08	43.55	-	N	43.85	-	60.70	50.70	16.85	-
0.402	0.26	0.08	40.22	-	N	40.56	-	58.90	48.90	18.34	-
0.670	0.30	0.07	43.38	-	N	43.75	-	56.00	46.00	12.25	-
1.142	0.42	0.04	42.20	-	N	42.66	-			13.34	-
1.678	0.50	0.03	41.42	-	N	41.95	-			14.05	-
2.150	0.56	0.03	44.33	-	N	44.92	-			11.08	-
2.554	0.58	0.03	48.48	41.15	N	49.09	41.76			6.91	4.24
5.978	0.90	0.06	43.57	-	N	44.53	-	60.00	50.00	15.47	-
9.674	1.02	0.07	41.34	-	N	42.43	-			17.57	-
24.986	1.48	0.10	38.90	-	N	40.48	-			19.52	-

\* Note: Margin (dB)= Limit (dBuV) - Level (dBuV)

\* Note: If no frequencies are specified in the tables, no measurement for quasi-peak or average was necessary.

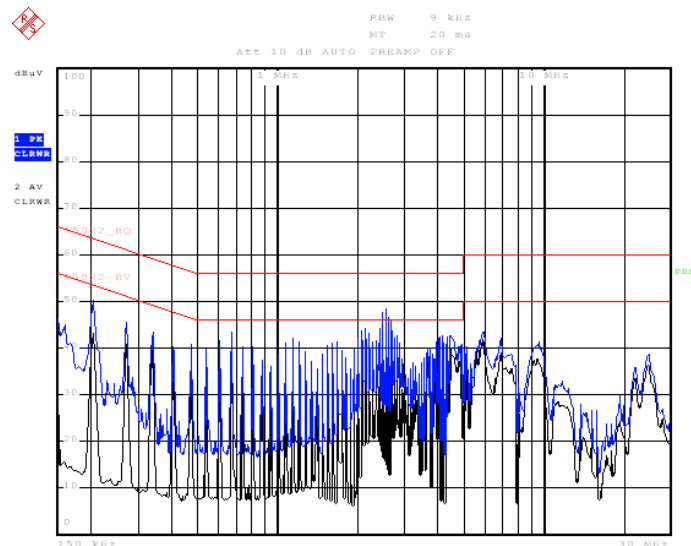
**Figure 2. Operating condition :**

**Graphical representation of conducted emissions \_ Hot line**



**Figure 3 Operating condition :**

**Graphical representation of conducted emissions data \_ Neutral line**



## 5. RADIATED EMISSION

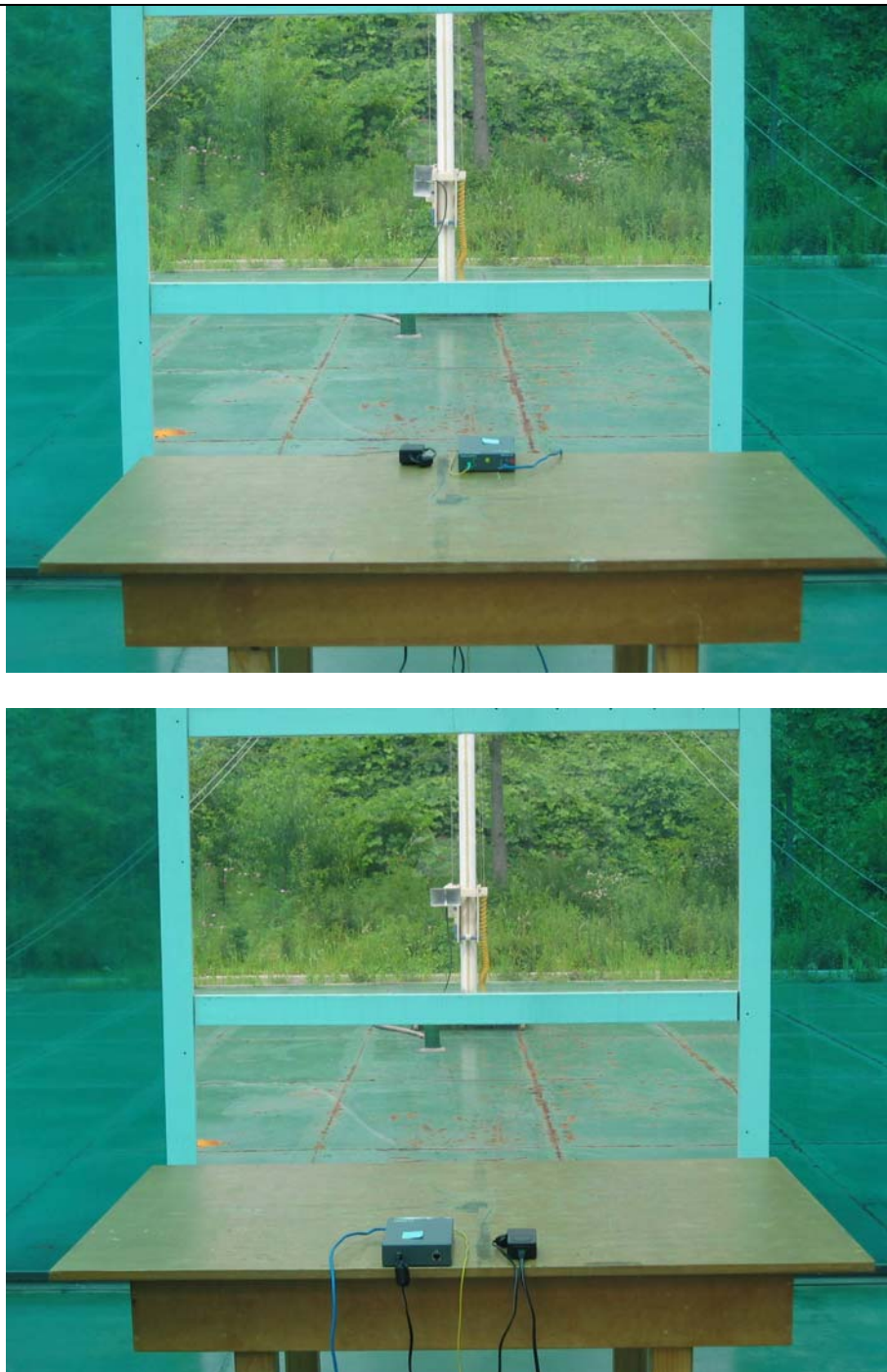
	<b>TEST:</b> Limits for radiated disturbance		
Method	Measurements were made at Open area test site that complies to CISPR 16/ANSI C63.4. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 10-meter. The EUT was rotated 360° about its azimuth with the receive antenna located at 1, 2, 3 and 4 meter heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4-meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.		—
Parameters required prior to the test	Laboratory Ambient Temperature	10 to 40 °C	
	Relative Humidity	10 to 90 %	
Parameters recorded during the test	Laboratory Ambient Temperature	27°C	
	Relative Humidity	49 %	
	Frequency range	Measurement Point	
Fully configured sample scanned over the following frequency range	30MHz – 6.25GHz	(10 meter measurement distance)	
Limits - Class A			
Frequency (MHz)	Limit (dBµV/m)		
	Quasi-Peak	Results	
30 to 230	40	N/A	
230 to 1000	47	N/A	
Limits - Class B			
Frequency (MHz)	Limit (dBµV/m)		
	Quasi-Peak	Results	
30 to 230	30	Pass	
230 to 1000	37	Pass	
1000 to 6250	43.5(Average)	Pass	
Supplementary information:			

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Test Receiver	Rohde&Schwarz	ESPI	100063	2006. 11. 09	2007. 11. 09
Bilog antenna	Rohde & Schwarz	VULB9160	9160-3122	2006. 12. 29	2007. 12. 29
Antenna mast	DEAIL	JAC-3	N/A	N/A	N/A
Antenna Turtable Controller	DEAIL	JAC-2	N/A	N/A	N/A

**Figure 4. Photo of Radiated emission test setup**









**Table 2 Radiated emission Test data :**

Test Frequency (MHz)	Meter Reading (dB $\mu$ V)	Detector (Pk/QP)	Polarity (V/H)	Azimuth (Degrees)	Antenna Height (m)	Gain/Loss Factor(dB)	Transducer Factor (dB/m)	Level dBuV/m	Limit dBuV/m	Margin [dB]
125.01	13.20	QP	V	90	1.0	2.44	11.96	27.60	30.00	2.40
249.99	17.16	QP	H	110	2.1	3.51	11.83	32.50	37.00	4.50
350.01	10.55	QP	H	100	1.8	4.15	14.60	29.30	37.00	7.70
375.01	11.35	QP	H	90	1.7	4.35	15.20	30.90	37.00	6.10
399.99	13.96	QP	H	90	1.5	4.55	15.79	34.30	37.00	2.70
500.01	10.33	QP	H	90	1.4	5.09	17.68	33.10	37.00	3.90
625.01	6.54	QP	H	100	1.3	5.73	20.13	32.40	37.00	4.60
Supplementary information: This table is to be use when Gain/Loss and Transducer Factors are provided separately.										

**Above 1G**

Test Frequency (MHz)	Meter Reading (dBuV)	Detector (Pk)	Polarity (V/H)	Azimuth (Degrees)	Antenna Height (m)	Gain/Loss Factor (dB)	Transducer Factor (dB/m)	Level dBuV/m	Limit dBuV/m	Margin (dB)
<b>Peak</b>										
1273.46	18.01	PK	V	180	1.00	9.23	24.4	41.6	63.5	21.9
1726.76	19.26	PK	V	180	1.00	9.9	25.6	44.8	63.5	18.7
<b>Aaverage</b>										
1273.46	2.41	AV	V	180	1.00	9.23	24.4	26.1	43.5	17.4
1726.76	3.87	AV	V	180	1.00	9.9	25.6	29.4	43.5	14.1
Supplementary information: This table is to be use when Gain/Loss and Transducer Factors are provided separately.										

\* Note: Margin (dB)= Limit (dBuV) - Level (dBuV)

\* Note: If no frequencies are specified in the tables, no measurement for quasi-peak or average was necessary.

## Appendix A

### Accreditations and Authorizations



MIC: Designated as a testing laboratory by Radio Research Laboratory in accordance with the Regulation on Designation of Testing Laboratory for Information and Communication Equipment. Registration No. : KR0017



KOLAS: Accredited by Korea Laboratory Accreditation Scheme (KOLAS) as Testing Laboratory in accordance with the provisions of Article 23 of the National Standards Act. These criteria encompass the requirements of ISO/IEC 17025:2000. For a scope listing search at [http://kolas.kats.go.kr/02\\_english/m02\\_01\\_s01.asp?OlapCode=KOLU19](http://kolas.kats.go.kr/02_english/m02_01_s01.asp?OlapCode=KOLU19)



FCC: Details of the measurement facilities used for these tests have been filed with the Federal Communications Commission's Laboratory in Columbia, Maryland and accepted in a letter dated July 17, 2005 (Reg. No. 553281). As a Conformity Assessment Body (CAB), our organization is designated to perform compliance testing on equipment subject to Declaration Of Conformity (DOC) and Certification under Part 15 and 18 of the Commission's Rules in a letter dated July 14, 2005.



VCCI: Accepted as an Associate Member to the VCCI. The measurement facilities detailed in this test report have been registered in accordance with Regulations for Voluntary Control Measures, Article 8. Registration Nos.: (Radiated Emissions) R-2414, (Conducted Emissions) C-2641.

## Appendix B

### Measurement Uncertainties

Test	Uncertainty
Radiated Emissions	$\pm 3.56$ dB
Conducted Emissions	$\pm 5.52$ dB

## Appendix C

### EUT Modifications

Items	Description
#1	Added two Clamp type ferrite core(E-TECH Electronics / RU65B) on the DC input cable of AC/DC Adapter with 1turn.
#2	Added 2 copper tape between external shield case and main PCB GND.
#3	Added 3 ferrite bead(TDK/HF70R6H6X10H0.8) on the DC input port.
#4	Added 2 bonding wires between the shield case of transceiver and GND pattern.
#5	Attached an aluminum tape at the front edge of the bottom shield case.



