



EMC TEST REPORT For CE

Test Report No. : KES-E1-19T0799
Date of Issue : Dec. 16, 2019
Product name : NVR
Model/Type No. : LRN-1610S
Variant Model : -
Applicant : Hanwha Techwin Co., Ltd.
Applicant Address : 6, Pangyo-ro 319Beon-gil, Bundang-gu, Seongnam-si,
Gyeonggi-do, Republic of Korea
Manufacturer : 1. HANWHA TECHWIN (TIANJIN) CO.,LTD.
2. HANWHA TECHWIN SECURITY VIETNAM CO.,LTD.
3. D-TECH CO.,LTD.
Manufacturer Address : 1. No.11 Weiliu Rd, Micro-Electronic Industrial Park, TEDA, Tianjin,
300385, People's Republic of China
2. Lot O-2, Que Vo Industrial Zone extended area,
Nam Son commune, Bac Ninh city, Bac Ninh province, Vietnam
3. 173-25, Saneop-ro, Gwonseon-gu, Suwon-si, Gyeonggi-do,
Korea (Suwon Industrial Complex)
Date of Receipt : Nov. 19, 2019
Test date : Dec. 08, 2019 ~ Dec. 09, 2019
Test Results : ☒ **In Compliance** ☐ **Not in Compliance**

Tested by

Dong In, Kim
EMC Test Engineer

Reviewed by

Dong-Hun, Jang
EMC Technical Manager

This test report is not related to KS Q ISO/IEC 17025 and KOLAS.

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KES-E1-19T0799
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REPORT REVISION HISTORY

Date	Test Report No.	Revision History
Dec. 16, 2019	KES-E1-19T0799	Issued

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1.0 General Product Description

Main Specifications of EUT are:

LRN-1610S			Functions	
Display			Item	IP address, Add profile edit, Bitrate, Compression, GOP, Quality, Camera MD setup, Wisestream, Dynamic GOV/FPS, VA Setup
Network camera	Inputs	Max. 16CH		Camera video setup (Simple focus, Brightness/Contrast, Flip/Mirror, IRIS, WDR, D&N, SSNR, Shutter, SSDR, DIS), Fisheye Dewarping Mode, Hallway View Setup, Camera Webpage
	Resolution	5MP ~ CIF		
	Protocols	Wisenet, ONVIF		
Decoding	Local Display	HDMI: 1920x1080, 1280x720	PTZ	Control
	Resolution	5MP(90fps), 3MP(120fps), 2MP(2400fps), 720p(480fps), D1(480fps)	Smart phone	Support Model
Performance				Protocol Support
Record	Compression	H.265, H.264, MJPEG		Control
	Record Rate(Analog)			Max. Remote Users
	Recording Bandwidth	Max. 100Mbps	Redundancy	Failover
	Resolution	5MP ~ CIF		ARB
	Mode	Normal, Schedule(Continuous/Event), Event (Pre/Post), Dual track Recording	Easy configuration	P2P(QR code)
	Event Trigger	Alarm Input, Video Loss, Camera Event(Alarm, MD, Video Analytics, Defocus)	Coaxial Control	
	Event Action	e-Mail, PTZ Preset, Buzzer, Monitor Out	Interface	
Search & Play	Playback Bandwidth	Max. 32Mbps(16CH simultaneously)	HDMI	1EA
	User	Max. 4 Users (Local 1, Remote 3)	VGA	1EA
	Simultaneous playback	Max. 16CH(Network) Max. 8CH(Local Monitor)	Audio	
	Fisheye Dewarping	WEB / CMS / Mobile	Ethernet	RJ-45(10/100/1000BASE-T) x 1 RJ-45(PoE+) x 16
Storage	Supported HDD	Up to 6TB	Alarm	
	HDD Slot	SATA 2ea(Max. 12TB)	USB	2EA(Front 1, Rear 1)
	External		Power inlet	AC 1EA
Backup	File backup	BU/Exe(GUI), JPG/AVI(Network)	System	
	Function	Multi channel(Upto 8CH) Play, Date-Time/Title display	System Control	Mouse, IR remocon, Web
Network			Language	English, French, German, Italian, Spanish, Russian, Turkish, Polish, Dutch, Swedish, Czech, Portuguese, Danish, Rumanian, Serbian, Croatian, Hungarian, Greek, Norwegian, Finnish, Korean, Chinese, Japanese, Thai, Vietnamese
Protocol		IPv4, IPv6, TCP/IP, UDP/IP, RTP (UDP), RTP (TCP), RTSP, NTP, HTTP, DHCP (Server, Client), PPPoE, SMTP, ICMP, IGMP, ARP, DNS, DDNS, uPnP, HTTPS, SNMP, ONVIF (Profile-S), SUNAPI(Server, Client)	Environmental	
			Operating Temperature	0°C to +40°C(32°F to 104°F)
DDNS		Wisenet DDNS	Operating Humidity	20% ~ 85% RH
Transmission Bandwidth		Max. 100Mbps	Electrical	
Audio	Input/Output	16CH(network)	Power Input	100~240VAC±10%
	Compression	G.711, G.726, AAC(16/48KHz)	Power Consumption	Max. 188.2W(2HDDs, PoE on) Max. 34.6W(2HDDs, PoE off)
Max Remote Users	Audio Communication	2-Way	PoE Budget	Max. 130W
		Search(3), Live Unicast(10), Multicast(20)	Mechanical	
Security		HTTPS(SSL) Login Authentication Digest Login Authentication IP Address Filtering User access log 802.1X Authentication(EAP-TLS, EAP-...	Color / Material	Black / Metal
			Dimension (WxHxD)	W370.0 x H44.0 x D320 mm (14.57" x 1.73" x 12.6") (1U)
			Weight	2.79Kg (6.15lb)

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1.1 Test Voltage & Frequency

Unless indicated otherwise on the individual data sheet or test results, the test voltage and frequency was as indicated below.

Voltage ☒ 230 Vac ☐ 100 Vac ☐ 24 Vac ☐ 12 Vdc ☐ PoE

Frequency ☒ 50 Hz ☐ 60 Hz ☐ Hz

1.2 Variant Model Differences

Not applicable

1.3 Device Modifications

Not applicable

1.4 Equipment Under Test

Description	Model Number	Serial Number	Manufacturer	Remarks
NVR	LRN-1610S	-	HANWHA TECHWIN (TIANJIN) CO., LTD	EUT
HDD	WD10EURX-63C57Y0	-	Western Digital	-
PSU	DPS-200PB185 C	HAPD194104036	DELTA ELECTRONICS, INC.	-

1.5 Support Equipments

Description	Model Number	Serial Number	Manufacturer	Remarks
Notebook	NT730U3E	JJRE91CF200065A	SAMSUNG	-
Notebook Adaptor	PA-1600-66	AD-6019P	LITEON	-
Monitor	24M47VQ	702NTQDA3604	LG	-
Monitor Adaptor	ADS-40FSG-19 19025GPG-1	EAY62768621	Shenzhen Honor Electronic Co., Ltd.	-
Network Camera	QNV-6023R	-	HANWHA TECHWIN (TIANJIN) CO., LTD	-
Mouse	-	-	-	-
USB Memory	-	-	Transcend	16G



1.6 External I/O Cabling

Start		END		Cable Spec.	
Description	I/O Port	Description	I/O Port	Length	Shield
NVR (EUT)	NETWORK 2	Notebook	NETWORK 2	3.0	U
	HDMI	Monitor	HDMI	1.4	S
	NETWORK 1	Network Camera	NETWORK 1	3.0	U
	USB Slot	Mouse	USB	1.2	U
	USB Slot	USB Memory	USB	-	U

* Unshielded=U, Shielded=S

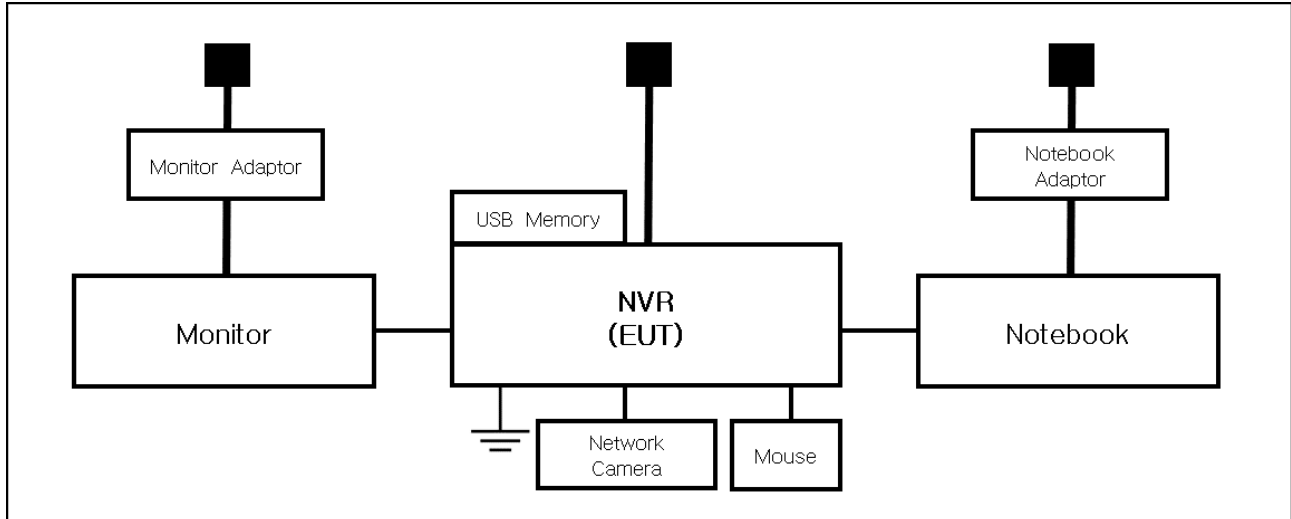
1.7 EUT Operating Mode(s)

Test Mode	operating
Operate	Monitoring EUT, Ping Test

EUT Test operating S/W		
Name	Version	Manufacture Company
-	-	-

1.8 Configuration

■ AC Main
 □ DC Main



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1.9 Remarks when standards applied

N/A

1.10 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less.

1.11 Test Facility

The measurement facility is located at 473-21 Gayeo-ro, Yeosu-si, Gyeonggi-do, 12658, Korea. The sites are constructed in conformance with the requirements of ANSI C63.4:2014 and CISPR 16-1-4:2012

1.12 Laboratory Accreditations and Listings

Country	Agency	Scope of Accreditation	Logo
KOREA	RRA	EMI (3 m & 10 m Semi-Anechoic Chamber , 10 m Open Area and conducted test site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	 KR0100
International	KOLAS	EMI (3 m & 10 m Semi-Anechoic Chamber , and conducted test site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	 KT489
USA	FCC	3 m & 10 m Semi-Anechoic Chamber, 10 m Open Area and Conducted test site to perform FCC Part 15/18 measurements.	 KR0100
Canada	ISED	3 m & 10 m Semi-Anechoic Chamber and Conducted test site	 23298-1
JAPAN	VCCI	Mains Ports Conducted Interference Measurement, Telecommunication Ports Conducted Disturbance Measurement and Radiation 10 meter site, Facility for measuring radiated disturbance above 1 GHz	 R-20056, C-20036, T-20040, G-20057
Europe	TÜV SÜD	EMI (3 m & 10 m Semi-Anechoic Chamber , 10 m Open Area and conducted test site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	 CARAT 001633 0003

2.0 Test Regulations

The emissions tests were performed according to following regulations:

☒ **EMC – Directive 2014/30/EU**

☐ EN 61000-6-3:2011

☐ EN 61000-6-1:2007

☐ EN 61000-6-4:2007 +A1:2011

☐ EN 61000-6-2:2005

☐ EN 55011:2007 +A1:2010

☐ Group 1
☐ Class A

☐ Group 2
☐ Class B

☐ EN 55014-1:2006 +A2:2011

☐ EN 55014-2:1997 +A2:2008

☐ EN 55015:2013

☐ EN 61547:2009

☒ EN 55032:2012/AC:2013

☒ Class A

☐ Class B

☐ EN 55024:2010 +A1:2015

☒ EN 50130-4:2011

☒ EN 61000-3-2:2014

☒ EN 61000-3-3:2013

☐ EN 61326-1:2013



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-
- | | | |
|---|----------------------------------|----------------------------------|
| ☐ VCCI-CISPR 32:2016 | ☐ Class A | ☐ Class B |
| ☐ AS/NZS CISPR32:2015 | ☐ Class A | ☐ Class B |
| ☐ 47 CFR Part 15, Subpart B | | |
| ☐ CISPR 22:2009 +A1:2010 | ☐ Class A | ☐ Class B |
| ☐ ANSI C63.4-2014 | | |
| ☐ IC Regulation ICES-003 : 2016 | | |
| ☐ CAN/CSA CISPR 22-10 | ☐ Class A | ☐ Class B |
| ☐ ANSI C63.4-2014 | | |
| ☐ RE- Directive 2014/53/EU | | |
| ☐ EN 301 489-1 V1.9.2 | | |
| ☐ Equipment for fixed use | | |
| ☐ Equipment for vehicular use | | |
| ☐ Equipment for portable use | | |
| ☐ EN 301 489-3 V1.6.1 | | |
| ☐ EN 301 489-17 V2.2.1 | | |
| ☐ EN 60945:2002 | | |

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2.1 Conducted Emissions at Mains Power Ports

Test Date

Dec. 08, 2019

Test Location

Electro wave Shieldroom #6

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test S/W	EMC32	R & S	9.12.00	-
☒	EMI TEST RECEIVER	ESR3	R & S	101781	04, 22, 2020
☒	LISN	ENV216	R & S	101787	01, 04, 2020
☒	LISN	ESH2-Z5	R & S	100450	04, 22, 2020
☒	PULSE LIMITER	ESH3-Z2	R & S	101915	11, 25 2020

Test Conditions

Temperature: 21,8 °C
Relative Humidity: 50,2 % R.H.

Frequency Range of Measurement

150 kHz to 30 MHz

Instrument Settings

IF Band Width: 9 kHz

Test Results

The requirements are:

- ☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

Remarks

See Appendix A for test data.

2.2 Conducted Emissions at Telecommunication Ports

Test Date

Dec. 08, 2019

Test Location

Electro wave Shieldroom #6

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test S/W	EMC32	R & S	9.12.00	-
☒	EMI TEST RECEIVER	ESR3	R & S	101781	04, 22, 2020
☒	LISN	ENV216	R & S	101787	01, 04, 2020
☒	LISN	ESH2-Z5	R & S	100450	04, 22, 2020
☒	PULSE LIMITER	ESH3-Z2	R & S	101915	11, 25, 2020
☐	8-WIRE ISN CAT3,5	ENY81	R & S	100174	01, 07, 2020
☒	8-WIRE ISN CAT6	ENY81-CAT6	R & S	101665	01, 07, 2020

Test Conditions

Temperature: 21,8 °C
Relative Humidity: 50,2 % R.H.

Frequency Range of Measurement

150 kHz to 30 MHz

Instrument Settings

IF Band Width: 9 kHz

Test Results

The requirements are:

- ☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

Remarks

See Appendix A for test data.



2.3 Radiated Electric Field Emissions(Below 1 GHz)

Test Date

Dec. 08, 2019

Test Location

☐ OPEN AREA TEST SITE #2 ☒ SEMI ANECHOIC CHAMBER #4(10m)

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test S/W	EP5/RE	TOYO Corporation	6.0.0	-
☒	EMI TEST RECEIVER	ESU26	R & S	100551	04, 09, 2020
☒	AMPLIFIER	SCU 01	R & S	100603	11, 25, 2020
☒	TRILOG-BROADBAND ANTENNA	VULB9163	Schwarzbeck	715	11, 29, 2020
☒	ATTENUATOR	8491A	HP	32173	03, 11, 2020

Test Conditions

Temperature: 22,2 °C
Relative Humidity: 49,9 % R.H.

Frequency Range of Measurement

30 MHz to 1 GHz

Instrument Settings

IF Band Width: 120 kHz

Test Results

The requirements are:

☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

Remarks

See Appendix A for test data.

2.4 Radiated Electric Field Emissions(Above 1 GHz)

Test Date

Dec. 08, 2019

Test Location

SEMI ANECHOIC CHAMBER #3

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test S/W	EP5/RE	TOYO Corporation	6.0.0	-
☒	EMI TEST RECEIVER	ESR7	R & S	101190	08, 06, 2020
☒	PREAMPLIFIER	8449B	AGILENT	3008A01967	05, 27, 2020
☐	ATTENUATOR	8491A	HP	35496	03, 11, 2020
☒	DOUBLE RIDGED HORN ANTENNA	SAS-571	A.H.SYSTEM,INC	781	03, 12, 2020

Test Conditions

Temperature: 22,2 °C
Relative Humidity: 49,9 % R.H.

Frequency Range of Measurement

1 GHz to 6 GHz

Instrument Settings

IF Band Width: 1 MHz

Test Results

The requirements are:

- ☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

Remarks

See Appendix A for test data.



2.5 Harmonic Current Emissions

Test Date

Dec. 08, 2019

Test Location

Electro wave Shieldroom #3

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test S/W	net.control	EM TEST	2.1.4	-
☒	DIGITAL POWER ANALYZER	DPA 500N	EM TEST	V1024106759	04, 09, 2020
☒	POWER SOURCE	ACS 500N6	EM TEST	V1024106760	-

Test Conditions

Temperature: 20,9 °C
Relative Humidity: 49,1 % R.H.

Classification of Equipment for Harmonic Current Emissions

- ☒ Class A
☐ Class B
☐ Class C(Below 25 W)
☐ Class C(Above 25 W)
☐ Class D

Test Results

The requirements are:

- ☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

Remarks

See Appendix A for test data.



2.6 Voltage Fluctuations and Flicker

Test Date

Dec. 08, 2019

Test Location

Electro wave Shieldroom #3

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test S/W	net.control	EM TEST	2.1.4	-
☒	DIGITAL POWER ANALYZER	DPA 500N	EM TEST	V1024106759	04, 09, 2020
☒	POWER SOURCE	ACS 500N6	EM TEST	V1024106760	-

Test Conditions

Temperature: 20,9 °C
Relative Humidity: 49,1 % R.H.

Test Results

The requirements are:

- ☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

Remarks

See Appendix A for test data.

3.0 Criteria for compliance

Criteria for compliance was based on the following guidelines:

EN 50130-4:2011 Alarm systems-Part 4: Electromagnetic compatibility Product family standard: Immunity requirements for components of fire, intruder and social alarm systems

The variety and the diversity of the apparatus within the scope of this document makes it difficult to define precise criteria for the evaluation of the immunity test results.

If as a result of the application of the tests defined in this standard, the apparatus becomes dangerous or unsafe then the apparatus shall be deemed to have failed the test.

A functional description and a definition of performance by the manufacture and noted in the test report, based on the following criteria:

Electrostatic discharge

There shall be no damage, malfunction or change of status due to the conditioning.

Flickering of an indicator during the application of discharge is permissible, providing that is no residual change in the EUT or any change in outputs, which could be interpreted by associated equipment as a change.

Radiated electromagnetic fields

There shall be no damage, malfunction or change of status due to the conditioning.

Flickering of an indicator during the application of discharge is permissible, providing which could be interpreted by associated equipment as a change, and no such

Flickering of indicators occurs at a field strength of 3 V/m.

For components of CCTV systems, where the picture is allowed at 10 V/m, providing.

(a) there is no permanent damage or change to EUT

(e.g. no corruption of memory or changes to programmable setting etc.)

(b) at 3 V/m, any deterioration of the picture is so minor that the system could still be used; and

(c) there is no observable deterioration of the picture at 1 V/m.

Fast transient burst / slow high energy voltage surge

There shall be no damage, malfunction or change of status due to the conditioning.
Flickering of an indicator during the application of discharge is permissible, providing
That there is no residual is permissible, providing that there is no residual change in the EUT or
any
change in outputs, which could be interpreted by associated equipment as a change.

Conducted RF immunity

There shall be no damage, malfunction or change of status due to the conditioning.
Flickering of an indicator during the application of discharge is permissible, providing
That there is no residual is permissible, providing that there is no residual change in the EUT or
any
change in outputs, which could be interpreted by associated equipment as a change,
and no such flickering of indicators oeuvres at $U = 130 \text{ dB}\mu\text{V}$.
For component of CCTV systems, where the status is monitored by observing the TV picture,
then deterioration of the picture is allowed at $U = 140 \text{ dB}\mu\text{V}$, providing:
(a) there is no permanent damage or change to the EUT
(e.g. no corruption of memory or changes to programmable settings etc.)
(b) at $U = 130 \text{ dB}\mu\text{V}$, any deterioration of the picture is so minor that the system could
still be used; and
(c) there in no observable deterioration of the picture at $U = 120 \text{ dB}\mu\text{V}$.

Voltage dip/interruption / Voltage variation

There shall be no damage, malfunction or change of status due to the conditioning.
Flickering of an indicator during the conditioning is permissible, providing that there is no
residual
change in the EUT or any change in outputs, which could be interpreted by associated
equipment
as a change. The EUT shall meet the acceptance criteria for the functional test, after the
conditioning.

3.1 Electrostatic Discharge

Reference Standard

EN 61000-4-2:2009

Test Date

Dec. 09, 2019

Test Location

EMS-ESD: Electro wave Shieldroom #7

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	ESD SIMULATOR	ESS-2000	Noise Ken	ESS05X4620	02, 22, 2022
☒	HCP	-	KES	-	-
☒	VCP	-	Noise Ken	-	-

Test Conditions

Temperature: 22,0 °C
Relative Humidity: 49,9 % R.H.
Atmospheric Pressure: 100,9 kPa

Test Specifications

Discharge Factor: ≥ 1 s

Discharge Impedance: 330 ohm / 150 pF

Kind of Discharge: Air, Contact (direct and indirect)

Polarity: Positive and Negative

Number of Discharge: 10 at all locations for Air discharge
10 at all locations for Contact discharge

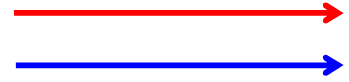
Discharge Voltage:	Contact ☐ 2 kV ☐ 4 kV ☒ 6 kV ☐ 8 kV ☐ 15 kV	Air ☒ 2 kV ☒ 4 kV ☐ 6 kV ☒ 8 kV ☐ 15 kV	HCP ☐ 2 kV ☐ 4 kV ☒ 6 kV ☐ 8 kV ☐ 15 kV	VCP ☐ 2 kV ☐ 4 kV ☒ 6 kV ☐ 8 kV ☐ 15 kV
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Notes: HCP: Horizontal coupling plane
VCP: Vertical coupling plane

Required Performance Criteria: ☒ Complied

Location of Discharge:

Air
Contact



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Test Data

Indirect Discharge

No.	Test Point	Discharge Method	Observations	Remarks
1	HCP Contact	Contact Discharge	Complied	-
2	VCP Contact	Contact Discharge	Complied	-

Direct Discharge

No.	Test Point	Discharge Method	Observations	Remarks
1	Enclosure	Contact Discharge	Complied	-
2	Port	Contact Discharge	Complied	-

Note: "Blank" = Not performed

Observations:

Complied – No degradation of function

Test Results

- ☒ PASS Required Performance Criteria
☐ NOT PASS Required Performance Criteria

RemarksPASS Required Performance Criteria

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3.2 Radiated Electric Field Immunity

Reference Standard

EN 61000-4-3:2006 +A2:2010

Test Date

Dec. 09, 2019

Test Location

EMS-RS: ☐ SEMI ANECHOIC CHAMBER #2 ☒ SEMI ANECHOIC CHAMBER #3

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMS Test S/W	EMC32	R & S	10.10.02	-
☒	SIGNAL GENERATOR	SMB 100A	R & S	177586	08, 06, 2020
☒	BROADBAND AMPLIFIER	BBA100	R & S	101239	08, 06, 2020
☒	BROADBAND AMPLIFIER	100S1G6M1	AR	579931	08, 06, 2020
☒	POWER METER	NRP2	R & S	103475	08, 06, 2020
☒	AVG POWER SENSOR	NRP-Z91	R & S	102526	08, 06, 2020
☒	AVG POWER SENSOR	NRP-Z91	R & S	102527	08, 06, 2020
☒	STACKED DOUBLE LOG-PER- ANTENNA	STPL9128 E	Schwarzbeck	9128ES-121	-
☒	DIRECTIONAL COUPLER	KYDC-D1070-DX40	KY TELECOM	KY150001	08, 06, 2020
☒	DOUBLE RIDGED HORN ANTENNA	SAS-571	A.H.SYSTEM,INC	781	03, 12, 2020

Test Conditions

Temperature: 22,4 °C
Relative Humidity: 50,2 % R.H.
Atmospheric Pressure: 101,3 kPa



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Test Specifications

Antenna Polarization: Horizontal & vertical unless indicated otherwise

Antenna Distance: ☒ 3 m

Field Strength: ☐ 1 V/m ☐ 3 V/m
☒ 10 V/m

Frequency Range: ☐ 80 MHz to 1 GHz ☐ 1,4 GHz to 2,7 GHz
☒ 80 MHz to 2,7 GHz

Modulation: ☒ AM, 80 %, 1 kHz sine wave
☒ PM, 1 Hz (0,5 s ON : 0,5 s OFF)

Frequency step: ☒ 1 % step

Dwell Time: ☒ 1 s ☐ 3 s

of Sides Radiated: ☒ 4

Required Performance Criteria: ☒ Complied

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Test Data

Side Exposed	Observations	
	Horizontal	Vertical
Front	Complied	Complied
Right	Complied	Complied
Back	Complied	Complied
Left	Complied	Complied

Note: "Blank" = Not performed

Observations:

Complied – No degradation of function

Test Results

- ☒ PASS Required Performance Criteria
☐ NOT PASS Required Performance Criteria

Remarks

PASS Required Performance Criteria

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3.3 Electrical Fast Transients/Bursts

Reference Standard

EN 61000-4-4:2012

Test Date

Dec. 09, 2019

Test Location

EMS-EFT: Electro wave Shieldroom #7

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMS Test S/W	iec.control	EM TEST	5.4.7	-
☒	ULTRA COMPACT SIMULATOR	UCS 500N7	EM TEST	P1608172950	11, 27, 2020
☒	MOTOR VARIAC	MV2616	EM TEST	P1552169719	11, 27, 2020
☒	CAPACITIVE COUPLING CLAMP	HFK	EM TEST	P1633183115	11, 27, 2020

Test Conditions

Temperature: 22,0 °C
Relative Humidity: 49,9 % R.H.
Atmospheric Pressure: 100,9 kPa

Test Specifications

Pulse Amplitude & Polarity:
(AC Power Lines) ☐ ± 1.0 kV ☒ ± 2.0 kV
☐ ± 4.0 kV

Pulse Amplitude & Polarity:
(Other supply / Signal Lines) ☐ ± 0.5 kV ☒ ± 1.0 kV
☐ ± 2.0 kV

Burst Period: ☒ 300 ms ☐ 2 s

Repetition Rate: ☐ 5 klz ☒ 100 klz

Duration of Test Voltage: ☒ ≥ 1 min

Required Performance Criteria: ☒ Complied

Test Data

☒ Input a.c. power ports – Coupling/Decoupling Network used

Mode of Application	Observations	
	(+) Burst (kV)	(-) Burst (kV)
L	Complied	Complied
N	Complied	Complied
PE	Complied	Complied
L – N	Complied	Complied
L – PE	Complied	Complied
N – PE	Complied	Complied
L – N – PE	Complied	Complied

☐ Input d.c. power ports – Coupling/Decoupling Network used

Mode of Application	Observations	
	(+) Burst (kV)	(-) Burst (kV)
-	-	-

☒ Signal ports and telecommunication ports – Coupling Clamp used

Mode of Application	Observations	
	(+) Burst (kV)	(-) Burst (kV)
NETWORK 1	Complied	Complied
NETWORK 2	Complied	Complied

Note: "Blank" = Not performed

Observations:

Complied – No degradation of function

Test Results

- ☒ PASS Required Performance Criteria
☐ NOT PASS Required Performance Criteria

Remarks

PASS Required Performance Criteria

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3.4 Surge Transients

Reference Standard

EN 61000-4-5:2014

Test Date

Dec. 09, 2019

Test Location

EMS-EFT: Electro wave Shieldroom #7

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMS Test S/W	iec.control	EM TEST	5.4.7	-
☒	ULTRA COMPACT SIMULATOR	UCS 500N7	EM TEST	P1608172950	11, 27, 2020
☒	MOTOR VARIAC	MV2616	EM TEST	P1552169719	11, 27, 2020
☐	CDN	CNV 508N1	EM TEST	P1610176296	11, 27, 2020

Test Conditions

Temperature: 22,0 °C
Relative Humidity: 49,9 % R.H.
Atmospheric Pressure: 100,9 kPa

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Test Specifications

AC Power Lines

Source Impedance: 12 ohm for common Mode and 2 ohm for differential Mode

Surge Amplitude : Common Mode
☒ (0,5 / 1,0 / 2,0) kV
Differential Mode
☒ (0,5 / 1,0) kV

Number of Surges: ☒ 5 surges per angle

Angle: ☒ 0°, 90°, 180°, 270° (input a.c. power port)

Polarity: ☒ Positive & Negative

Repetition Rate: ☒ 1 surge per min ☐ 1 surge per 30 sec.

Required Performance Criteria: ☒ Complied

Other supply / Signal Lines

Source Impedance: 42 ohm for common Mode

Surge Amplitude: Common Mode
☐ (0,5 / 1,0) kV

Number of Surges: ☐ 5 Surges

Polarity: ☐ Positive & Negative

Repetition Rate: ☐ 1 surge per min ☐ 1 surge per 30 sec.

Required Performance Criteria: ☐ Complied

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Test Data☒ Line to Line – Differential Mode

Mode of Application	Observations	
	(+) Surge (kV)	(-) Surge (kV)
L – N	Complied	Complied

☒ Line to Earth – Common Mode

Mode of Application	Observations	
	(+) Surge (kV)	(-) Surge (kV)
L – PE	Complied	Complied
N – PE	Complied	Complied

Signal Lines☐ Line to Earth – Common Mode

Mode of Application	Observations	
	(+) Surge (kV)	(-) Surge (kV)
-	-	-

Note: "Blank" = Not performed

Observations:

Complied – No degradation of function

Test Results

- ☒ PASS Required Performance Criteria
☐ NOT PASS Required Performance Criteria
☐ NOT APPLICABLE

RemarksPASS Required Performance Criteria

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3.5 Conducted Disturbance

Reference Standard

EN 61000-4-6:2014

Test Date

Dec. 08, 2019

Test Location

EMS-CS: Electro wave Shieldroom #6

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMS Test S/W	icd.control	EM TEST	5.3.11	-
☒	CONTINUOUS WAVE SIMULATOR	CWS 500N1.4	EM TEST	P1602169880	11, 25, 2020
☒	ATTENUATOR	ATT 6/80	EM TEST	P1614178148	11, 25, 2020
☒	CDN	CDN M016	TESEQ	43694	11, 25, 2020
☐	CDN	CDN M016	TESEQ	43697	11, 25, 2020
☒	CDN	CDN T800	TESEQ	42800	11, 25, 2020
☐	EM CLAMP	KEMZ 801A	TESEQ	44099	11, 26, 2020

Test Conditions

Temperature: 21,8 °C
Relative Humidity: 50,2 % R.H.
Atmospheric Pressure: 101,1 kPa

Test Specifications

Frequency range: ☒ 150 kHz to 100 MHz ☐ 150 kHz to 80 MHz

Voltage Level: ☐ 1 Vrms ☐ 3 Vrms
☒ 10 Vrms

Modulation: ☒ AM, 80 %, 1 kHz sine wave
☒ PM, 1 Hz (0,5 s ON : 0,5 s OFF)

Frequency step: ☒ 1 % step

Dwell Time: ☒ 1 s ☐ 3 s

Required Performance Criteria: ☒ Complied

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Test Data☒ Input a.c. power ports

Coupling Location (Line Stressed)	Coupling Method	Observations
L - N - PE	CDN	Complied

☐ Input d.c. power ports

Coupling Location (Line Stressed)	Coupling Method	Observations
-	-	-

☒ Signal ports and telecommunication ports

Coupling Location (Line Stressed)	Coupling Method	Observations
NETWORK 1	CDN	Complied
NETWORK 2	CDN	Complied

Notes: CDN = Coupling Decoupling Network
"blank" = Not performed

Observations:

Complied - No degradation of function

Test Results☒ PASS Required Performance Criteria☐ NOT PASS Required Performance Criteria**Remarks**PASS Required Performance Criteria

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3.6 Voltage Dips and Short Interruptions

Reference Standard

EN 61000-4-11:2004

Test Date

Dec. 09, 2019

Test Location

EMS-Voltage dip: Electro wave Shieldroom

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMS Test S/W	iec.control	EM TEST	5.4.7	-
☒	ULTRA COMPACT SIMULATOR	UCS 500N7	EM TEST	P1608172950	11, 27, 2020
☒	MOTOR VARIAC	MV2616	EM TEST	P1552169719	11, 27, 2020

Test Conditions

Temperature: 22,0 °C
Relative Humidity: 49,9 % R.H.
Atmospheric Pressure: 100,9 kPa

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Test Specifications & Observations/Remarks

- Voltage Dips and Short Interruptions

<u>Test Level</u>	<u>Duration [in period/ms (50 Hz)]</u>	<u>Results</u>
☒ 20 % dip	☒ 250 / 5 000	<u>Complied</u>
☒ 30 % dip	☒ 25 / 500	<u>Complied</u>
☒ 60 % dip	☒ 10 / 200	<u>Complied</u>
☒ 100 % dip	☒ 250 / 5 000	<u>Complied</u>

- Voltage variations

☒ Unom + 10 %	☒ 253.0 V (ac)	<u>Complied</u>
☒ Unom - 15 %	☒ 195.5 V (ac)	<u>Complied</u>

Observations:

Complied – No degradation of function

Test Results

- ☒ PASS Required Performance Criteria
☐ NOT PASS Required Performance Criteria
☐ NOT APPLICABLE

Remarks

PASS Required Performance Criteria

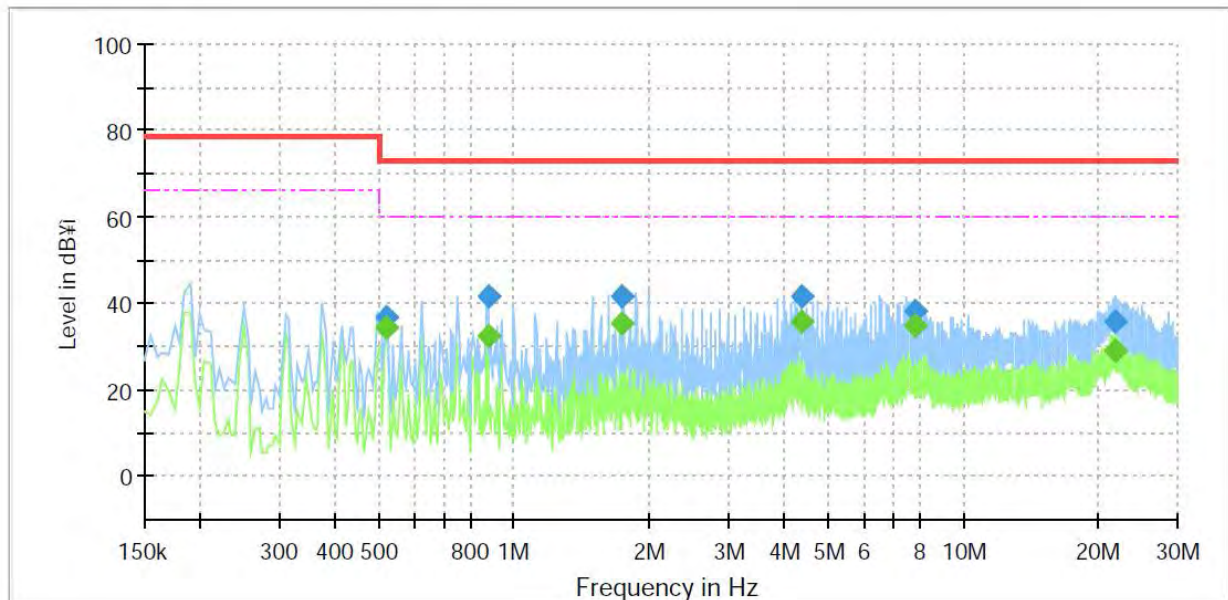
APPENDIX A – TEST DATA

Conducted Emissions at Mains Power Ports

[HOT]

Common Information

Test Description:	Conducted Emission
Model No.:	LRN-1610S
Phase:	L1
Mode:	
Operator Name:	KES



Final Result

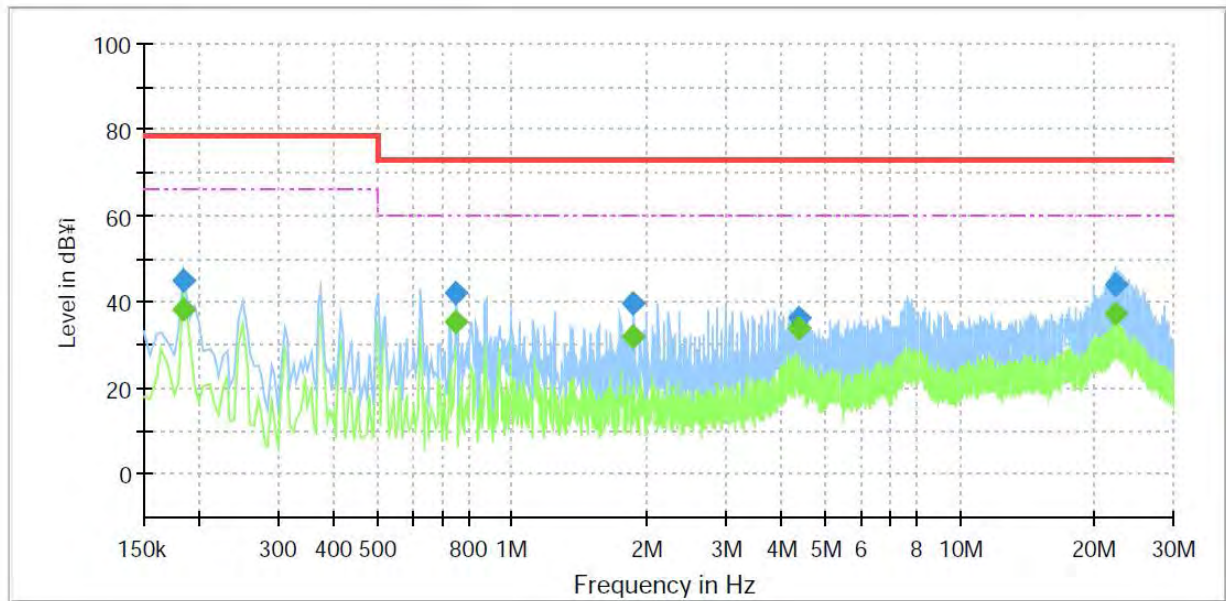
Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.520000	---	34.26	60.00	25.74	1000.0	9.000	L1	19.9
0.520000	36.59	---	73.00	36.41	1000.0	9.000	L1	19.9
0.875000	---	32.41	60.00	27.59	1000.0	9.000	L1	20.3
0.875000	41.42	---	73.00	31.58	1000.0	9.000	L1	20.3
1.745000	---	35.29	60.00	24.71	1000.0	9.000	L1	20.4
1.745000	41.42	---	73.00	31.58	1000.0	9.000	L1	20.4
4.365000	---	35.96	60.00	24.04	1000.0	9.000	L1	19.7
4.365000	41.41	---	73.00	31.59	1000.0	9.000	L1	19.7
7.790000	---	34.65	60.00	25.35	1000.0	9.000	L1	20.1
7.790000	38.08	---	73.00	34.92	1000.0	9.000	L1	20.1
21.700000	---	28.94	60.00	31.06	1000.0	9.000	L1	20.4
21.700000	35.98	---	73.00	37.02	1000.0	9.000	L1	20.4

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[NEUTRAL]

Common Information

Test Description: Conducted Emission
 Model No.: LRN-1610S
 Phase: N
 Mode:
 Operator Name: KES



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.185000	---	38.15	66.00	27.85	1000.0	9.000	N	19.5
0.185000	45.24	---	79.00	33.76	1000.0	9.000	N	19.5
0.750000	---	35.33	60.00	24.67	1000.0	9.000	N	20.1
0.750000	42.29	---	73.00	30.71	1000.0	9.000	N	20.1
1.870000	---	32.13	60.00	27.87	1000.0	9.000	N	20.5
1.870000	39.93	---	73.00	33.07	1000.0	9.000	N	20.5
4.360000	---	33.68	60.00	26.32	1000.0	9.000	N	19.7
4.360000	36.55	---	73.00	36.45	1000.0	9.000	N	19.7
22.320000	---	37.48	60.00	22.52	1000.0	9.000	N	20.5
22.320000	44.00	---	73.00	29.00	1000.0	9.000	N	20.5

◆ Calculation

QuasiPeak[dBuV] / CAverage [dBuV] = Reading Value[dBuV] + Corr. [dB]

QuasiPeak / CAverage : The Final Value

Reading Value : Not shown in the table.

Corr. : Correction values (LISN FACTOR + (Cable Loss + Pulse Limiter FACTOR))

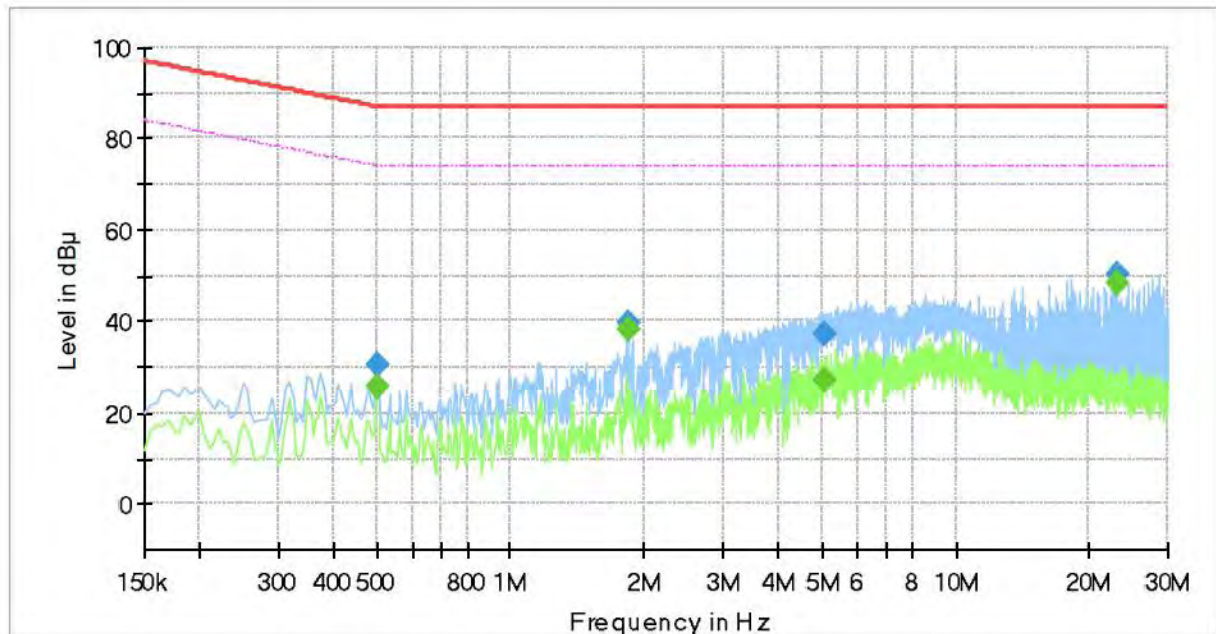
Conducted Emissions at Telecommunication Ports

■ NETWORK 1

[1 000 Mbps]

Common Information

Test Description:	Telecommunication Emission
Model No.:	LRN-1610S
Mode :	RJ-45 1
Speed :	1 000 Mbps
Operator Name:	KES



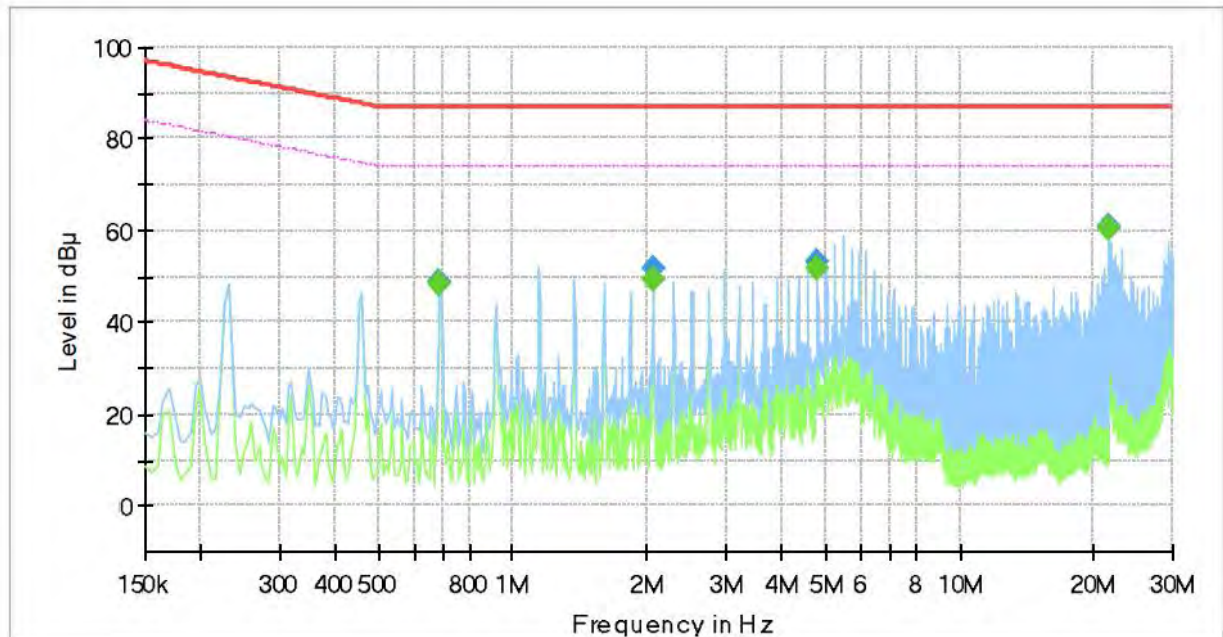
Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.500000	---	25.71	74.00	48.29	1000.0	9.000	Single Line	19.6
0.500000	30.63	---	87.00	56.37	1000.0	9.000	Single Line	19.6
1.830000	---	38.23	74.00	35.77	1000.0	9.000	Single Line	19.5
1.830000	39.78	---	87.00	47.22	1000.0	9.000	Single Line	19.5
5.050000	---	27.36	74.00	46.64	1000.0	9.000	Single Line	19.5
5.050000	37.34	---	87.00	49.66	1000.0	9.000	Single Line	19.5
23.130000	---	48.35	74.00	25.65	1000.0	9.000	Single Line	19.7
23.130000	50.16	---	87.00	36.84	1000.0	9.000	Single Line	19.7

■ NETWORK 2 [1 000 Mbps]

Common Information

Test Description:	Telecommunication Emission
Model No.:	LRN-1610S
Mode :	RJ-45 2
Speed :	1 000 Mbps
Operator Name:	KES



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.685000	---	48.59	74.00	25.41	1000.0	9.000	Single Line	19.6
0.685000	48.84	---	87.00	38.16	1000.0	9.000	Single Line	19.6
2.060000	---	49.54	74.00	24.46	1000.0	9.000	Single Line	19.5
2.060000	51.62	---	87.00	35.38	1000.0	9.000	Single Line	19.5
4.810000	---	51.67	74.00	22.33	1000.0	9.000	Single Line	19.5
4.810000	53.01	---	87.00	33.99	1000.0	9.000	Single Line	19.5
21.665000	---	60.24	74.00	13.76	1000.0	9.000	Single Line	19.7
21.665000	60.97	---	87.00	26.03	1000.0	9.000	Single Line	19.7

◆ Calculation

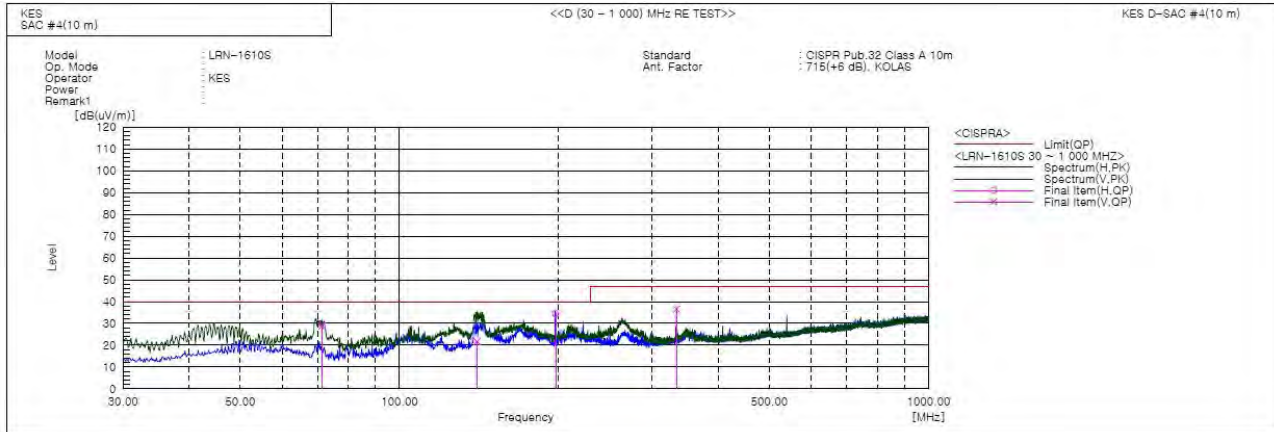
QuasiPeak[dBuV] / CAverage [dBuV] = Reading Value[dBuV] + Corr. [dB]

QuasiPeak / CAverage : The Final Value

Reading Value : Not shown in the table.

Corr. : Correction values (ISN FACTOR + (Cable Loss + Pulse Limiter FACTOR))

Radiated Electric Field Emissions(Below 1 GHz)



Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	71.303	V	54.2	-25.4	28.8	40.0	11.2	105.0	241.0	
2	140.155	V	47.8	-26.1	21.7	40.0	18.3	114.0	163.0	
3	197.431	H	56.5	-22.0	34.5	40.0	5.5	389.0	161.0	
4	334.116	V	53.2	-16.7	36.5	47.0	10.5	126.0	163.0	

◆ Calculation – SEMI ANECHOIC CHAMBER #4(10 m)

Result(QP) [dB(μ V/m)] = (Reading(QP)[dB(μ V)] + c.f[dB(1/m)]

Margin(QP)[dB] = Limit[dB(μ V/m)] - Result(QP) [dB(μ V/m)]

Reading(QP) : Reading value, Result(QP) : Reading value + Factor value

Limit(QP) : Limit value, c.f : (ANT Factor + Cable Loss - Preamp Factor), Margin: Margin value



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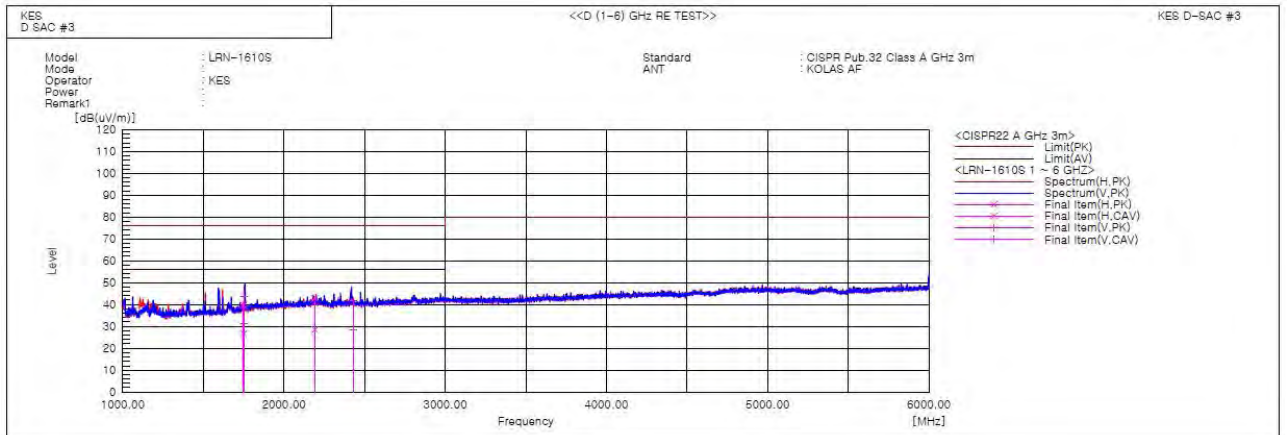
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Radiated Electric Field Emissions(Above 1 GHz)



Final Result

No.	Frequency [MHz]	(P)	Reading PK [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Result CAV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin CAV [dB]	Height [cm]	Angle [deg]	Remark
1	1749.101	H	43.8	30.7	-4.1	39.7	26.6	76.0	56.0	36.3	29.4	100.0	71.9	
2	1750.101	V	47.9	35.5	-4.0	43.9	31.5	76.0	56.0	32.1	24.5	100.0	120.9	
3	2191.331	H	44.2	29.8	-1.3	42.9	28.5	76.0	56.0	33.1	27.5	100.0	143.7	
4	2427.658	V	42.2	28.7	-0.5	41.7	28.2	76.0	56.0	34.3	27.8	100.0	10.2	

◆ Calculation

Result(PK/CAV) [dB(μV/m)] = (Reading(PK/CAV)[dB(μV)] + c.f[dB(1/m)])

Margin(PK/CAV)[dB] = Limit[dB(μV/m)] - Result(PK/CAV) [dB(μV/m)]

Reading(PK/CAV) : Reading value, Result(PK/CAV) : Reading value + Factor value

Limit(QP) : Limit value, c.f : (ANT Factor + Cable Loss - Preamp Factor), Margin: Margin value

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Harmonic Current Emissions and Voltage Fluctuations and Flicker

Average harmonic current results

Hn	I _{eff} [A]	% of Limit	Limit [A]	Result
1	0.131			
2	0.001	0.065	1.080	n/a
3	0.023	1.010	2.300	PASS
4	0.001	0.180	0.430	n/a
5	0.009	0.803	1.140	PASS
6	0.001	0.247	0.300	n/a
7	0.004	0.503	0.770	n/a
8	0.001	0.313	0.230	n/a
9	0.003	0.738	0.400	n/a
10	0.001	0.444	0.184	n/a
11	0.004	1.157	0.330	n/a
12	0.001	0.450	0.153	n/a
13	0.003	1.466	0.210	n/a
14	0.001	0.556	0.131	n/a
15	0.003	2.158	0.150	n/a
16	0.001	0.634	0.115	n/a
17	0.003	2.249	0.132	n/a
18	0.001	0.717	0.102	n/a
19	0.001	0.946	0.118	n/a
20	0.001	0.831	0.092	n/a
21	0.001	0.773	0.161	n/a
22	0.001	0.773	0.084	n/a
23	0.001	0.941	0.147	n/a
24	0.001	0.928	0.077	n/a
25	0.002	1.453	0.135	n/a
26	0.001	0.937	0.071	n/a
27	0.002	1.560	0.125	n/a
28	0.001	1.053	0.066	n/a
29	0.002	1.580	0.116	n/a
30	0.001	1.131	0.061	n/a
31	0.001	0.990	0.109	n/a
32	0.001	1.199	0.058	n/a
33	0.002	1.801	0.102	n/a
34	0.001	1.442	0.054	n/a
35	0.002	1.768	0.096	n/a
36	0.001	1.282	0.051	n/a
37	0.002	1.690	0.091	n/a
38	0.001	1.441	0.048	n/a
39	0.001	1.546	0.087	n/a
40	0.001	1.590	0.046	n/a

Harmonic currents less than 0.6% of the input current measured under the test conditions, or less than 5 mA, whichever is greater, are disregarded.



Test Data - Harmonics (continued)

Maximum harmonic current results

Hn	I _{eff} [A]	% of Limit	Limit [A]	Result
1	0.133			
2	0.001	0.054	1.620	n/a
3	0.024	0.683	3.450	PASS
4	0.001	0.136	0.645	n/a
5	0.009	0.550	1.710	PASS
6	0.001	0.198	0.450	n/a
7	0.004	0.348	1.155	n/a
8	0.001	0.237	0.345	n/a
9	0.003	0.535	0.600	n/a
10	0.001	0.333	0.276	n/a
11	0.004	0.811	0.495	n/a
12	0.001	0.335	0.230	n/a
13	0.003	1.021	0.315	n/a
14	0.001	0.406	0.197	n/a
15	0.003	1.515	0.225	n/a
16	0.001	0.480	0.173	n/a
17	0.003	1.587	0.199	n/a
18	0.001	0.532	0.153	n/a
19	0.001	0.693	0.178	n/a
20	0.001	0.618	0.138	n/a
21	0.001	0.890	0.161	n/a
22	0.001	0.583	0.125	n/a
23	0.002	1.033	0.147	n/a
24	0.001	0.700	0.115	n/a
25	0.002	1.533	0.135	n/a
26	0.001	0.689	0.106	n/a
27	0.002	1.723	0.125	n/a
28	0.001	0.807	0.099	n/a
29	0.002	1.757	0.116	n/a
30	0.001	0.871	0.092	n/a
31	0.001	1.185	0.109	n/a
32	0.001	0.897	0.086	n/a
33	0.002	1.975	0.102	n/a
34	0.001	1.081	0.081	n/a
35	0.002	1.891	0.096	n/a
36	0.001	0.979	0.077	n/a
37	0.002	1.840	0.091	n/a
38	0.001	1.101	0.073	n/a
39	0.002	1.900	0.087	n/a
40	0.001	1.213	0.069	n/a

Harmonic currents less than 0.6% of the input current measured under the test conditions, or less than 5 mA, whichever is greater, are disregarded.

**KES Co., Ltd.**

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Report No.:
KES-E1-19T0799
Page (42) of (55)

Test Data - Voltage Fluctuations

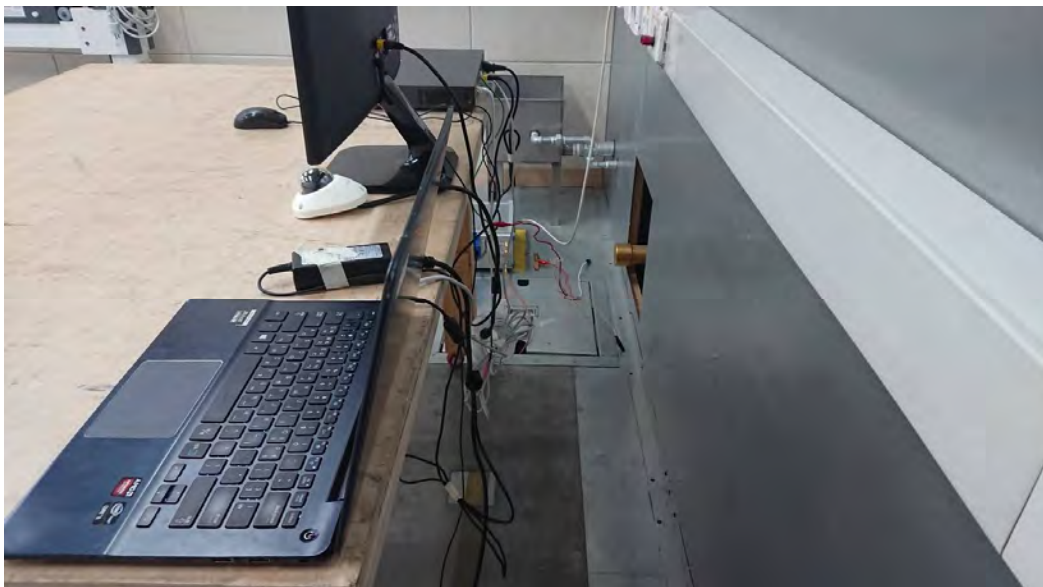
Maximum Flicker results

Flicker Measurements					
	Plt	Max Pst	Max Dc	Max Dmax	Max Tmax
Line 1:	0.028	0.028	0	< 0.2	0
Limits:	0.65	1	3.3	4	0.5
Results:	PASS	PASS	PASS	PASS	PASS

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Test Setup Photos and Configuration

Conducted Emissions at Mains Power Ports



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Conducted Emissions at Telecommunication Ports



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Radiated Electric Field Emissions(Below 1 GHz)



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Radiated Electric Field Emissions(Above 1 GHz)



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Harmonic Current Emissions and Voltage Fluctuations and Flicker



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Electrostatic Discharge



Radiated Electric Field Immunity



Electrical Fast Transients/Bursts



Surge Transients



Conducted Disturbance



Voltage Dips and Short Interruptions



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EUT External Photographs

(Top)



(Bottom)



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EUT Internal Photographs

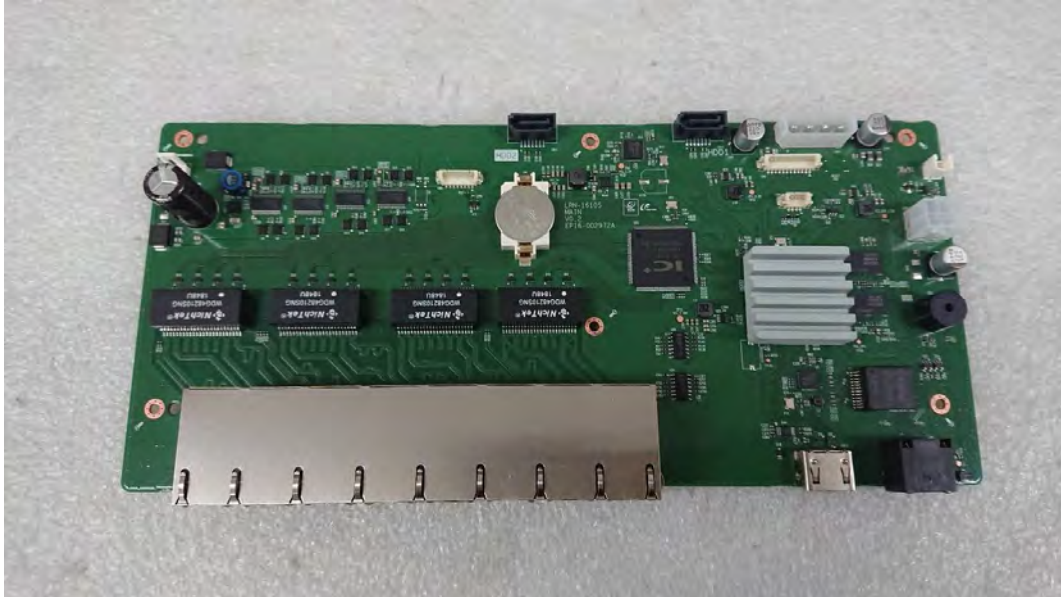
(Internal View)



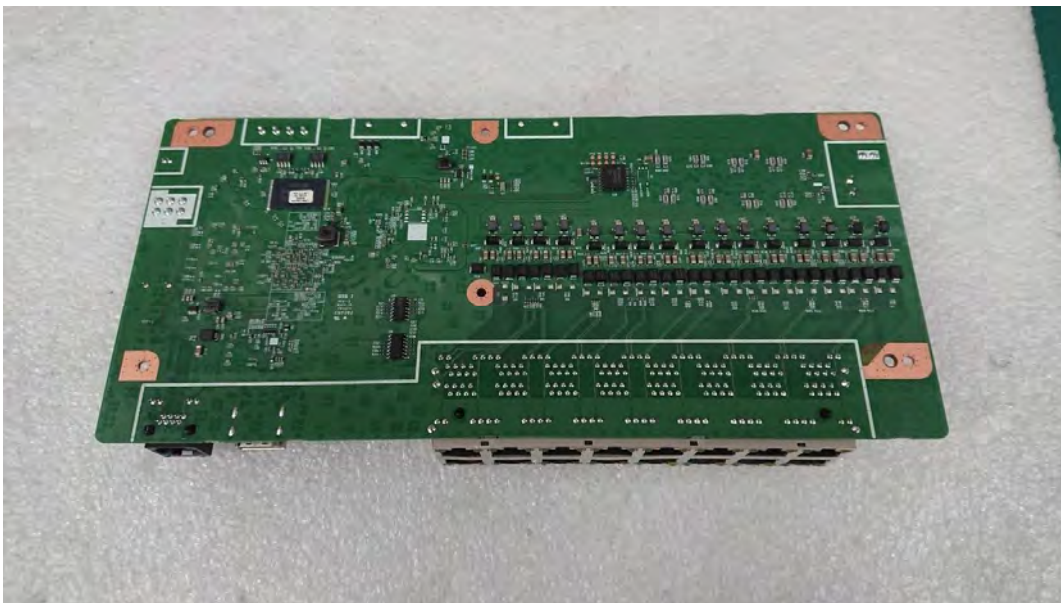
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EUT Internal View – Main Board

(Top)



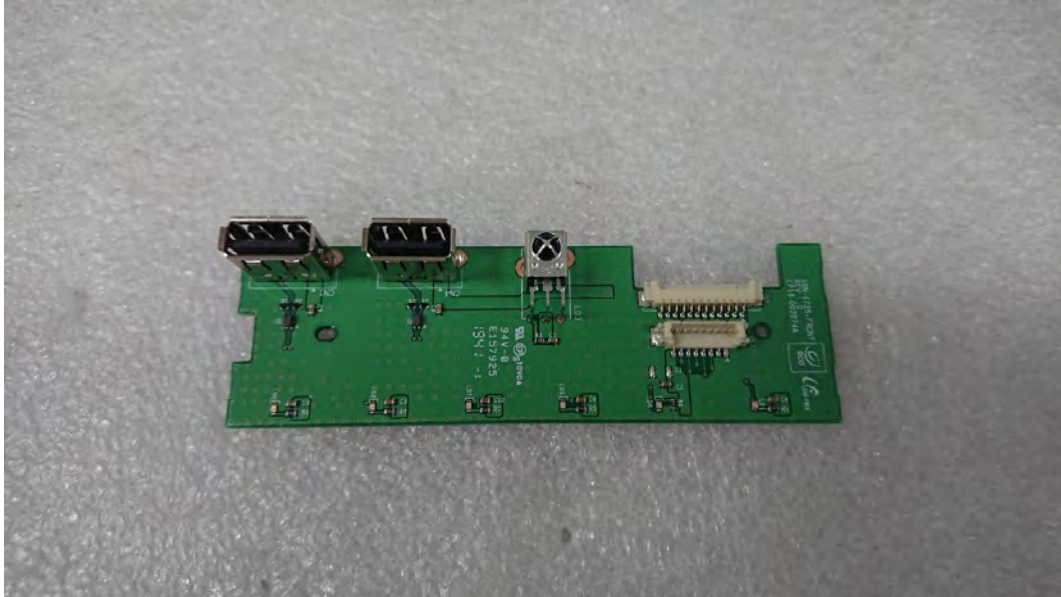
(Bottom)



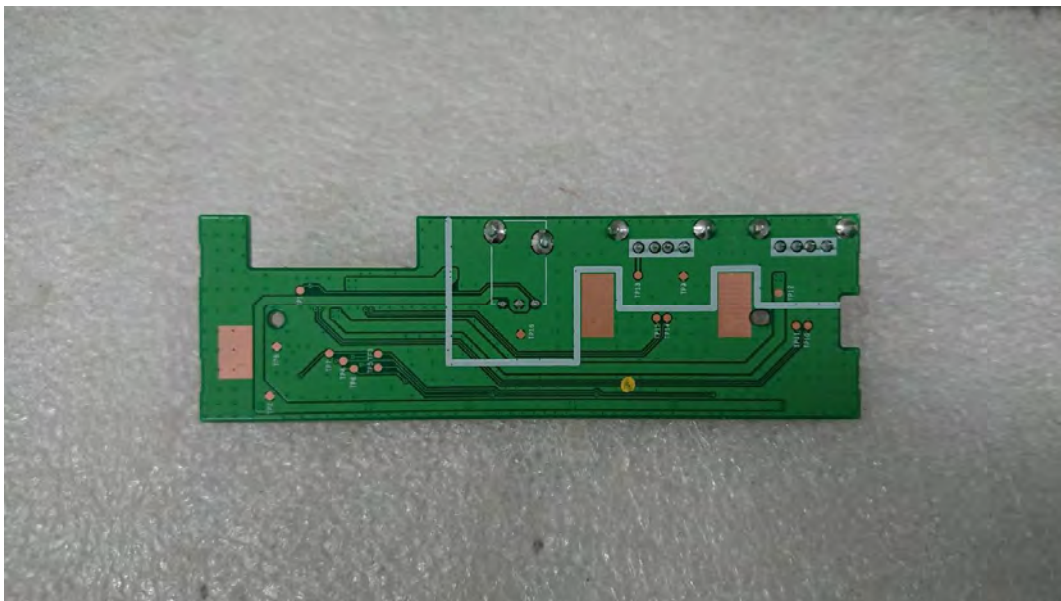
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EUT Internal View – Sub Board

(Top)



(Bottom)



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Label and Location



NVR

Model No : LRN-1610S

Manufacturer : HANWHA TECHWIN (TIANJIN) CO.,LTD.

Made in China

