

SPEC : LSSS-LN0088-02  
ISSUED: 05, July. 2012  
PAGE : 1 / 6

# TECHNICAL SPECIFICATION

LSSS-LN0088-02

FOR

**4 PAIR U/UTP CABLES (ENHANCED CATEGORY 5E)**

**(Ref : UL444 , ANSI/TIA-568-C.2, ISO/IEC 11801 & IEC 61156-5)**

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**1. SCOPE**

This Specification is based on the standards of UL444 , ANSI/TIA-568-C.2 and ISO/IEC 11801 and covers the requirements for unshielded twisted pair (U/UTP) cables of 100Ω , enhanced category 5E (Cat.5E).

- Applicable cable size & type ; 4 Pairs,  
 PVC sheath (CMX,CM,CMR,CMP) or LSZH sheath (332-1, 332-3)

**2. CABLE CONSTRUCTION**

**2.1 Conductor**

The conductors shall be solid , annealed and bare copper with a diameter of AWG24 and minimum acceptable diameter shall be 0.485mm.

**2.2 Insulation**

Each conductor shall be insulated with solid high density polyethylene or FEP(only CMP cable). The insulation shall be uniform and shall not have any defects. The diameter over the insulation shall be maximum 1.22mm.

**2.3 Color code**

The color code of insulation shall be shown as Table 1.

Table 1. Color code of insulation

Pair No	A - wire		B - wire	
	Base	Stripe	Base	Stripe
1	White	Blue	Blue	-
2	White	Orange	Orange	-
3	White	Green	Green	-
4	White	Brown	Brown	-

\*Note) The Stripe Marking shall be applied on the white color

**2.4 Core Assembly**

Two insulated conductors shall be twisted into a pair.  
 Four twisted pairs shall be assembled into a cable core.

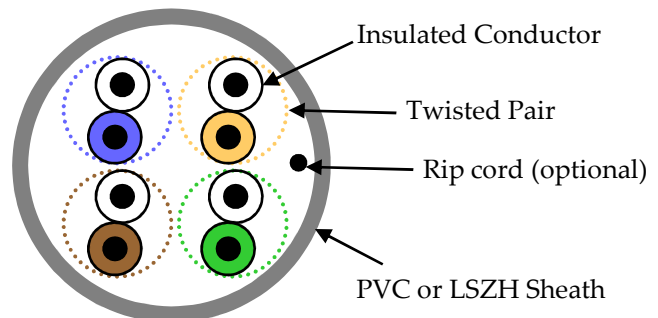
**2.5 Sheath**

The flame retardant PVC or LSZH (Low Smoke Zero Halogen) compound colored grey or other colors shall be applied over the cable core. The sheath shall be uniform and shall not have any defects.

The thickness of sheath and cable diameter shall be shown as table 2.

Table.2 thickness of sheath and cable diameter

Type	Thickness (mm)	OD (mm)
CMP	<u>0.35 ± 0.05</u>	<u>4.7 ± 0.2</u>
Others	<u>0.45 ± 0.05</u>	<u>4.9 ± 0.2</u>



**Fig 1. Cross-Sectional Diagram of Cable**

- The drawing appearing on this page may be subject to change or modification without any prior notice -

### 3. ELECTRICAL CHARACTERISTICS

#### 3.1 Electrical Performances

Characteristics	units	Cat.5e
DC Resistance	$\Omega/100\text{m}$	$\leq 9.38$
DC Resistance Unbalance	%	$\leq 5.00$
Mutual Capacitance	$\text{nF}/100\text{m}$	$\leq 5.60$
Capacitance Unbalance (Pair to Ground)	$\text{pF}/100\text{m}$	$\leq 330$
Insulation Resistance	$\text{M}\Omega\text{-}100\text{m}$	$\geq 500$
Dielectric Strength	DC kV/sec	2.5 / 2
Impedance (Characteristic mean)	$\Omega$	$100 \pm 15\%$ ( $1 \leq f \leq 100\text{MHz}$ )
Return Loss	$\text{dB}/100\text{m}$	$\geq 20 + 5 * \log(\text{freq})$ $1 \leq f < 10\text{MHz}$ $\geq 25$ $10 \leq f < 20\text{MHz}$ $\geq 25 - 7 * \log(\text{freq}/20)$ $20 \leq f \leq 100\text{MHz}$
Attenuation (Insertion Loss)	$\text{dB}/100\text{m}$	$\leq 1.967*\sqrt{(\text{freq})} + 0.023*(\text{freq}) + 0.05/\sqrt{(\text{freq})}$ 1 ~ 100 MHz
NEXT Loss	$\text{dB}/100\text{m}$	$\geq 35.3 - 15*\log(\text{freq}/100)$ , $1 < f \leq 100\text{MHz}$
Power sum NEXT Loss	$\text{dB}/100\text{m}$	$\geq 32.3 - 15*\log(\text{freq}/100)$ , $1 < f \leq 100\text{MHz}$
ELFEXT Loss	$\text{dB}/100\text{m}$	$\geq 23.8 - 20*\log(\text{freq}/100)$ , $1 \sim 100\text{MHz}$
Power sum ELFEXT Loss	$\text{dB}/100\text{m}$	$\geq 20.8 - 20*\log(\text{freq}/100)$ , $1 \sim 100\text{MHz}$
Propagation Delay	$\text{ns}/100\text{m}$	$\leq 534 + 36 / \sqrt{(\text{Freq})}$ , $1 \sim 100\text{MHz}$
Propagation Delay Skew	$\text{ns}/100\text{m}$	$\leq 45$

Freq. (MHz)	Attenuation (dB/100m) Max.	NEXT (dB/100m) Min.	PSNEXT (dB/100m) Min.	ELFEXT (dB/100m) Min.	PSELFEXT (dB/100m) Min.	RL (dB/100m) Min.	P.Delay (ns/100m) Max.
1	2.0	65.3	62.3	63.8	60.8	20.0	570
4	4.1	56.3	53.3	51.8	48.8	23.0	552
8	5.8	51.8	48.8	45.7	42.7	24.5	547
10	6.5	50.3	47.3	43.8	40.8	25.0	545
16	8.2	47.2	44.2	39.7	36.7	25.0	543
20	9.3	45.8	42.8	37.8	34.8	25.0	542
25	10.4	44.3	41.3	35.8	32.8	24.3	541
31.25	11.7	42.9	39.9	33.9	30.9	23.6	540
62.5	17.0	38.4	35.4	27.9	24.9	21.5	539
100	22.0	35.3	32.3	23.8	20.8	20.1	538

#### 3.2 Measurements Precaution

All electrical characteristics specified in clause 3.1 shall be tested on one sample length of 100 meter or greater removed from the package.

## **4. PHYSICAL PROPERTIES**

### **4.1 Insulation**

The un-aged tensile strength and elongation of HDPE insulation, measured in accordance with clause 7.3 of UL 444 shall be minimum 16.5MPa and 300%, respectively.

The un-aged tensile strength and elongation of FEP insulation, measured in accordance with clause 7.3 of UL 444 shall be minimum 17.2MPa and 200%, respectively.

The heat-aged tensile strength and elongation, measured in accordance with clause 7.3 of UL 444 shall be minimum 75% and 75% of un-aged, respectively.

The shrinkage of insulation , measured in accordance with clause 7.4 of UL 444 , shall not exceed 9.5mm.

The bending test of insulation at low temperature, measured in accordance with clause 7.5 of UL 444 , shall show no visible cracks.

### **4.2 Sheath**

The un-aged tensile strength and elongation of PVC sheath, measured in accordance with clause 7.8 of UL 444 shall be minimum 17.24MPa and 100%, respectively.

The heat-aged tensile strength and elongation of PVC sheath, measured in accordance with clause 7.8 of UL 444 shall be minimum 85% and 50% of un-aged, respectively.

The un-aged tensile strength and elongation of LSZH sheath, measured in accordance with clause 6.4.6 & 6.4.7 of IEC 61156-5 shall be minimum 9.0MPa and 100%, respectively.

The heat-aged tensile strength and elongation of LSZH sheath, measured in accordance with clause 6.5.4 & 6.5.5 of IEC 61156-5 shall be minimum 70% and 50% of un-aged, respectively.

The LSZH compound shall be complied with IEC 60754-2 and IEC 61034.

### **4.3 Cable Cold Bend**

All cables shall meet the requirements of clause 7.10 of UL 444.

### **4.4 Flame Requirements**

A cable marked CMX shall comply with the VW-1 flame test specified in section 1080 of UL 1581 or IEC 60332-1.

A cable marked CM shall comply with the vertical flame test specified in UL 1685 or IEC 60332-3.

A cable marked CMR shall comply with the riser test specified in UL 1666.

A cable marked CMP shall comply with the CMP test specified in NFPA 262.

## 5. PACKING AND IDENTIFICATION

### 5.1 Cable Marking

The cable shall be marked on the sheath to designate the transmission performance and/or others (if ordered by purchaser).

The marking shall be repeated through the outer sheath clearly.

### 5.2 Cable Packing

5.2.1 The standard delivery length of cable is 305m.

5.2.2 Each length of completed cable shall be wound on box.

### 5.3 Marking on tag or box

The following details shall be marked on a tag affixed to each shipping length of cable in a box, or directly printed on the outer surface of the box.

- AWG size and number of pairs
- Flame test classification
- Manufacturer name and logo
- length
- Others

- End of Specification -

LS Cable & System



SPEC : LSSS-LN0088-02  
 ISSUED: 05, July. 2012  
 PAGE : 6/ 6

※ APPENDIX – PRODUCT PART NUMBER

Description	Part Number
Category 5e U/UTP 4Pair CMX	UTP-E-C5G-E1VN-X 0.5X004P/xx
Category 5e U/UTP 4Pair CM	UTP-E-C5G-E1VN-M 0.5X004P/xx
Category 5e U/UTP 4Pair CMR	UTP-E-C5G-E1VN-R 0.5X004P/xx
Category 5e U/UTP 4Pair CMP	UTP-E-C5G-F1VN-P 0.5X004P/xx
Category 5e U/UTP 4Pair LSZH 332-1	UTP-E-C5G-E1ZN-X 0.5X004P/xx
Category 5e U/UTP 4Pair LSZH 332-3	UTP-E-C5G-E1ZN-M 0.5X004P/xx

- xx denotes color: WH=White, BL=Blue, GY=Gray, VI=Violet, OR=Orange, RD=Red, GN=Green, YL=Yellow, BK=Black  
 - Other colors are available

REV.	Date	Prepared By	Checked By	Approved By	Remark
00	2012.05.22	K. H. Ha	T.W. Kim	Y.H. Lee	1. Issued
01	2012.05.30	K. H. Ha	T.W. Kim	Y.H. Lee	1. Specification layout is changed
02	2012.07.05	D. W. Kang	T.W. Kim	Y.H. Lee	1. Added LSZH 332-3 product to Clause 1 2. Changed sheath thickness & OD deviation range, Clause 2.5 3. Added product part number to Appendix 4. Specification layout is changed