

TECHNICAL SPECIFICATION

LSSS - LN0120-00

FOR

4 PAIR U/UTP CABLES (Ultra Super Slim Augmented Category 6)

(Ref : IEC 61156-6 Ed. 3.0, ISO/IEC 11801 Ed. 2.0 ANSI/TIA-568-C.2 & UL444)

Prepared by : D. W. Kang
Dong-wan Kang
Engineer
SCS & Wireless Development Team

Checked by : T. W. Kim
Tae-woo, Kim
Manager
SCS & Wireless Development Team

Approved by : J. Baek K.
Jong-seb, Baek
Manager
SCS & Wireless Development Team

1. SCOPE

This Specification is based on the standards of IEC 61156-6 Ed.3.0, ANSI/TIA-568C.2, ISO/IEC 11801 Ed. 2.0 and UL444 covers the requirements for Segmented Shield twisted pair cables of 100Ω, Ultra Super Slim (USS) augmented category 6 (Cat.6A).

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

2. CABLE CONSTRUCTION

2.1 Conductor

The conductors shall be solid, annealed and bare copper with a diameter of AWG26

2.2 Insulation

Each conductor shall be insulated with solid high density polyethylene.
 The insulation shall be uniform and shall not have any defects.

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 and the separator shall be applied into the cable core.

2.5 Non-continuous Shield

The non-continuous aluminum tape which is segmented each 2 meter periodic length shall be applied over the core wrapping to increase alien crosstalk performances.

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 outer sheath and cable diameter shall be shown as table 2.

Table.2 thickness of sheath and cable diameter

Outer sheath thickness (Nom. mm)	Cable diameter (Nom. mm)
0.45 ± 0.05	5.8 ± 0.2

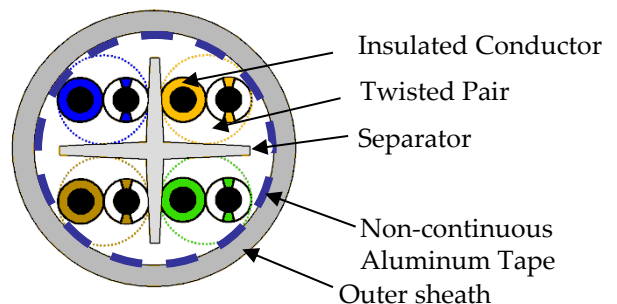


Fig 1. Cross Sectional Diagram of Cable

3. ELECTRICAL CHARACTERISTICS

3.1 Electrical Performances

Characteristics	units	Specification
DC Resistance	Ω/100m	≤ 14.8
DC Resistance Unbalance	%	≤ 2.00
Capacitance Unbalance (Pair to Ground)	pF/100m (800~1000Hz)	≤ 1600
Insulation Resistance	MΩ-100m	≥ 5000
Dielectric Strength	DC kV/sec	2.5 / 2
Impedance (Characteristic mean)	Ω	100 ± 5% (at 100MHz)
Return Loss	dB/100m	≥ 20 + 5 * log(freq) , 4 ≤ f < 10MHz ≥ 25 , 10 ≤ f < 20MHz ≥ 25 - 8.6* log(freq/20) , 20 ≤ f ≤ 500MHz
Attenuation (Insertion Loss)	dB/100m	≤ 2.73*√(freq) + 0.0136*(freq) + 0.375/√(freq) , 4 ~ 500 MHz
NEXT Loss	dB/100m	≥ 75.3 - 15*log(freq) , 4 ~ 500MHz
Power sum NEXT Loss	dB/100m	≥ 72.3 - 15*log(freq) , 4 ~ 500MHz
ACRF Loss	dB/100m	≥ 68 - 20*log(freq) , 4 ~ 500MHz
Power sum ACRF Loss	dB/100m	≥ 65 - 20*log(freq) , 4 ~ 500MHz
Power sum Alien NEXT Loss	dB/100m	≥ 92.5 - 15*log(freq) , Max. 67, 4 ~ 500MHz
Power sum Alien ACRF Loss	dB/100m	≥ 78.2 - 20*log(freq) , Max. 67, 4 ~ 500MHz
Propagation Delay	ns/100m	≤ 534 + 36 / √ (Freq) , 4 ~ 500MHz
Propagation Delay Skew	ns/100m	≤ 45 , 4 ~ 500MHz

Frequency (MHz)	Attenuation (dB/100m)	NEXT (dB/100m)	PSNEXT (dB/100m)	ACRF (dB/100m)	PSACRF (dB/100m)	RL (dB/100m)	PSANEXT (dB/100m)	PSACRF (dB/100m)	PD (ns)	PD Skew (ns)
4	5.7	66.3	63.3	56.0	53.0	23.0	67.0	66.2	580	45
10	8.9	60.3	57.2	48.0	45.0	25.0	67.0	58.2	570	45
16	11.2	57.2	54.2	43.9	40.9	25.0	67.0	54.1	567	45
20	12.6	55.8	52.8	42.0	39.0	25.0	67.0	52.2	566	45
31.25	15.8	52.9	49.9	38.1	35.1	23.3	67.0	48.3	563	45
62.75	22.5	48.4	45.4	32.1	29.1	20.7	65.6	42.3	561	45
100	28.7	45.3	42.3	28.0	25.0	19.0	62.5	38.2	559	45
200	41.4	40.8	37.8	22.0	19.0	16.4	58.0	32.3	558	45
250	46.6	39.8	36.3	20.0	17.0	15.6	56.5	30.2	557	45
400	60.1	36.3	33.3	16.0	13.0	15.6	53.5	26.2	556	45
500	67.9	34.8	31.8	14.0	11.0	15.6	52.0	24.2	556	45

*Note) The values above table are provided for information only.

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, measured in accordance with clause 7.3 of UL 444 shall be minimum 16.5MPa and 300% , 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.

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

5. PACKING AND IDENTIFICATION

5.1 Cable Marking

The marking on the sheath shall be applied by black ink printing and repeated through the outer sheath clearly.

The following details shall be marked on the sheath,

- Length marking (Meter and/or Feet intervals)
- Manufacturer name
- Transmission performance, AWG size and number of pairs, Flame test classification
- others (if ordered by purchaser).

5.2 Cable Packing

5.2.1 The standard delivery length of cable is 305m.

Other length of cable shall be applied, if ordered by purchaser.

5.2.2 Each length of completed cable shall be wound on a wooden reel or plastic reel with box.

5.3 Marking on tag or reel

The following details shall be marked on a tag affixed to each shipping item.

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

Appendix 1. Product Part Number

Appendix 2. Augmented Category 6 Channel Performances

- Specification End -

REV.	Date	Prepared By	Checked By	Approved By	Remark
00	2013.11.28	D.W. Kang	T.W. Kim	J.S. Baeck	1. New specification

Appendix 1 – PRODUCT PART NUMBER

Description	Part Number
USS Category 6A U/UTP 4Pair CMX	UTP-A-C6G-E1VL-X 26AWGx004P/xx
USS Category 6 A U/UTP 4Pair CM	UTP-A-C6G-E1VL-M 26AWGx004P/xx
USS Category 6 A U/UTP 4Pair CMR	UTP-A-C6G-E1VL-R 26AWGx004P/xx
USS Category 6 A U/UTP 4Pair LSZH 332-1	UTP-A-C6G-E1ZL-X 26AWGx004P/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

Appendix 2. AUGMENTED CATEGORY 6 CHANNEL PERFORMANCES

It complies to "ANSI/TIA-568-C.2" and "ISO/IEC 11801 Ed. 2.0" for channels of max. 70m or permanent links of max. 60m transmission by using LS's horizontal cable and other accessories.
 The information of LS's products for 10Gbps channel transmission are given below,

Items	LS Part Number	Remark
Horizontal Cable	UTP-A-C6G-E1VL-# 26AWGx004P/** UTP-A-C6G-E1ZL-# 26AWGx004P/**	#: Flame grade, **: Jacket Color
Patch Cord	LS-PC-UC6A-xx-yyy	xx : Color, yyy : Length
Patch Panel	LS-PP-UC6A-24P-WM-ERI	Empty Panel + UTP ERI type Jack Configuration
Modular Jack	LS-MJ-UC6A-xx-ERI	xx: Color

Characteristics	units	Specification
Impedance (Characteristic mean)	Ω	$100 \pm 15\%$ ($1 \leq f \leq 500\text{MHz}$)
Return Loss	dB/100m	≥ 19 , $1 \leq f < 10\text{MHz}$ $\geq 24 - 5 \cdot \log(\text{freq})$, $10 \leq f < 40\text{MHz}$ $\geq 32 - 10 \cdot \log(\text{freq})$, $40 \leq f < 400\text{MHz}$ ≥ 6 , $400 \leq f \leq 500\text{MHz}$
Attenuation (Insertion Loss)	dB/100m	$\leq 1.05[1.82 \cdot \sqrt{(\text{freq})} + 0.0091 \cdot (\text{freq}) + 0.25/\sqrt{(\text{freq})}]$ $+ 4 \cdot 0.02 \cdot \sqrt{(\text{freq})}$, $1 \sim 500\text{MHz}$
NEXT Loss	dB/100m	$\geq -20 \cdot \log[10^{(44.3-15 \cdot \log(\text{freq}/100))/-20} + 2 \cdot 10^{(54-20 \cdot \log(\text{freq}/100))/-20}]$, Max. 65 , $1 \leq f < 330\text{MHz}$ $\geq 31 - 27.15 \cdot \log(\text{freq}/330)$, $330 \leq f \leq 500\text{MHz}$
Power sum NEXT Loss	dB/100m	$\geq -20 \cdot \log[10^{(42.3-15 \cdot \log(\text{freq}/100))/-20} + 2 \cdot 10^{(50-20 \cdot \log(\text{freq}/100))/-20}]$ Max. 62 , $1 \leq f < 330\text{MHz}$ $\geq 28 - 26.43 \cdot \log(\text{freq}/330)$, $330 \leq f \leq 500\text{MHz}$
ACRF Loss	dB/100m	$\geq -20 \cdot \log[10^{(27.8-20 \cdot \log(\text{freq}/100))/-20} + 4 \cdot 10^{(43.1-20 \cdot \log(\text{freq}))/-20}]$, $1 \sim 500\text{MHz}$
Power sum ACRF Loss	dB/100m	$\geq -20 \cdot \log[10^{(24.8-20 \cdot \log(\text{freq}/100))/-20} + 4 \cdot 10^{(40.1-20 \cdot \log(\text{freq}))/-20}]$, $1 \sim 500\text{MHz}$
Power sum Alien NEXT Loss	dB/100m	$\geq 62 - 10 \cdot \log(\text{freq}/100)$, Max. 67, $1 \leq f < 100\text{MHz}$ $\geq 62 - 15 \cdot \log(\text{freq}/100)$, $100 \leq f \leq 500\text{MHz}$
Power sum Alien ACRF Loss	dB/100m	$\geq 37.9 - 20 \cdot \log(\text{freq}/100)$, Max. 67, , $1 \sim 500\text{MHz}$
Propagation Delay	ns/100m	$\leq 544 + 36 / \sqrt{(\text{Freq})}$, $1 \sim 500\text{MHz}$
Propagation Delay Skew	ns/100m	≤ 50 , $1 \sim 500\text{MHz}$

Frequency (MHz)	Attenuation (dB/100m)	NEXT (dB)	PSNEXT (dB)	ACRF (dB/100m)	PSACRF (dB/100m)	RL (dB)	PSANEXT (dB)	PSAACRF (dB/100m)	PD (ns/100m)	PD skew (ns/100m)
1	2.3	65.0	62.0	63.3	60.3	19.0	67.0	67.0	580	50.0
4	4.2	63.0	60.5	51.2	48.2	19.0	67.0	65.0	562	50.0
8	5.8	58.2	55.6	45.2	42.2	19.0	67.0	58.9	557	50.0
10	6.5	56.6	54.0	43.3	40.3	19.0	67.0	57.0	555	50.0
16	8.2	53.2	50.6	39.2	36.2	18.0	67.0	52.9	553	50.0
20	9.2	51.6	49.0	37.2	34.2	17.5	67.0	51.0	552	50.0
25	10.2	50.0	47.3	35.3	32.3	17.0	66.0	49.0	551	50.0
31.25	11.5	48.4	45.7	33.4	30.4	16.5	65.1	47.1	550	50.0
62.5	16.4	43.4	40.6	27.3	24.3	14.0	62.0	41.1	549	50.0
100	20.9	39.9	37.1	23.3	20.3	12.0	60.0	37.0	548	50.0
200	30.1	34.8	31.9	17.2	14.2	9.0	55.5	31.0	547	50.0
250	33.9	33.1	30.2	15.3	12.3	8.0	54.0	29.0	546	50.0
300	37.4	31.7	28.8	13.7	10.7	7.2	52.8	27.5	546	50.0
400	43.7	28.7	25.8	11.2	8.2	6.0	51.0	25.0	546	50.0
500	49.3	26.1	23.2	9.3	6.3	6.0	49.5	23.0	546	50.0

*Note) The values above table are provided for information only