SenseTek Light Sensor Mechanical Design Guide

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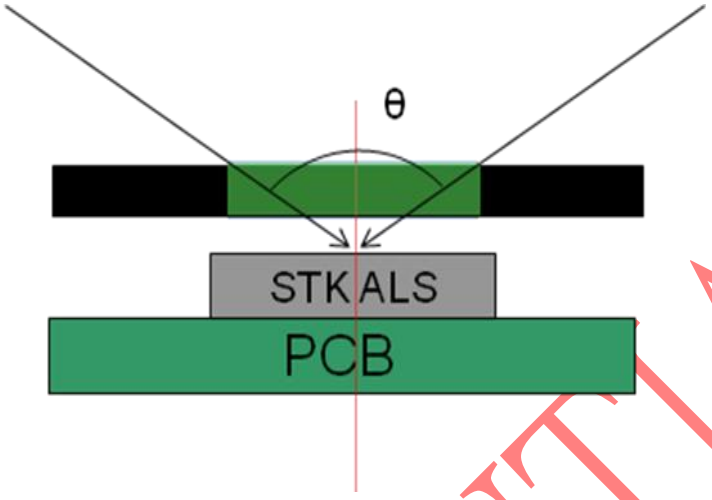
Contents

Change Log

Date	Version	Change log	Sponsor	Remark
6/23/2010	0.5	Preliminary Release	Patrick Chang	
10/18/2010	0.6	Added Light Pipe Material Properties Added FOV Factor Added Recommended Position for ALS	Patrick Chang	
11/10/2010	0.7	Added Lookup Table	Patrick Chang	
11/17/2010	0.7.1	Modify Lookup Table (Android)	Patrick Chang	
3/28/2011	1.0	Modify Lookup Table Added Reference Mechanical Design	Patrick Chang	

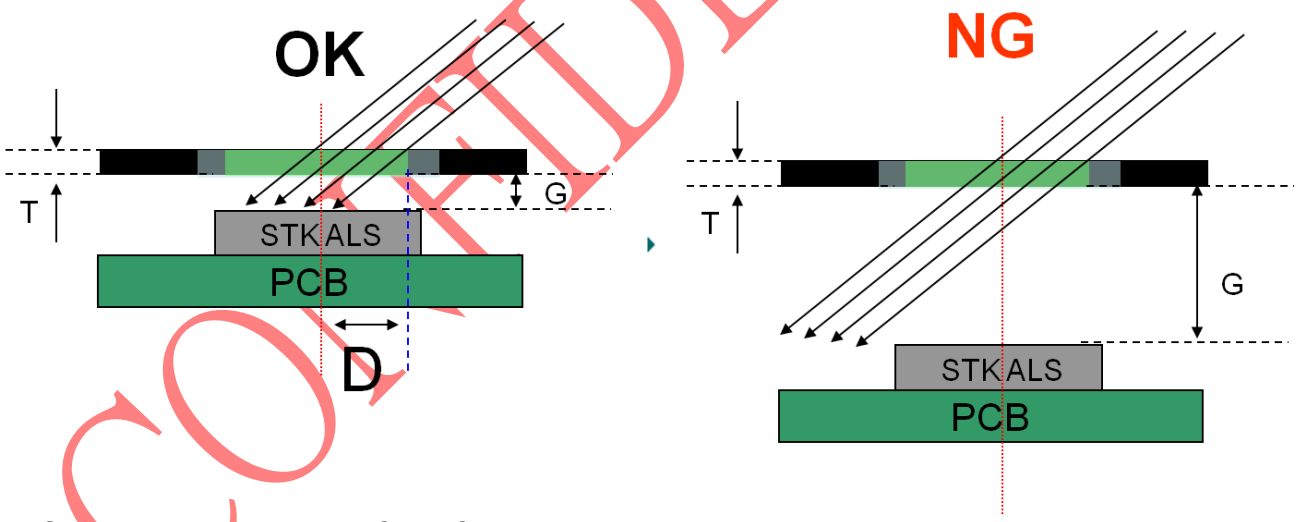
1. Basic Design Concept and Description of Technical Expression

1.1. Field of view (FOV)



View angle θ is the angle of view describes the angular extent that ambient lights illuminate the sensor. Larger FOV is better. For more details, see the FOV report of bare die in the datasheet.

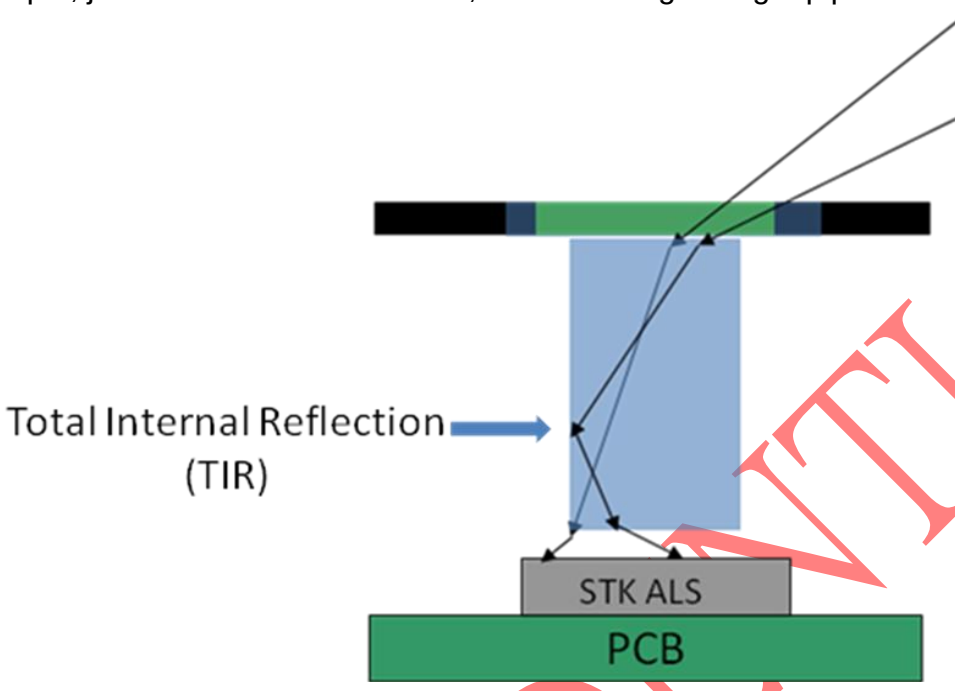
1.2. Poor design



ALS is simulated humans' feel of ambient light. FOV is an important factor for this purpose. If the FOV is too small and not uniform, ALS can't response the real condition. We strongly recommend FOV > 90°.

1.3. Light pipe

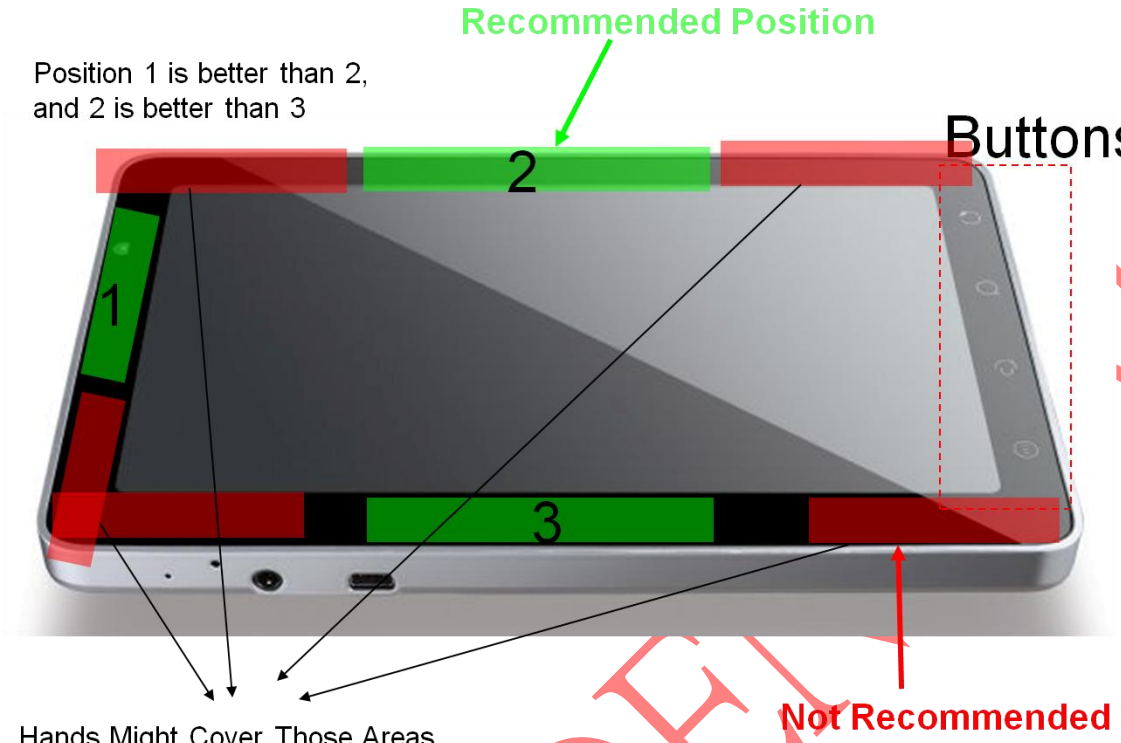
Light pipe is a simple and good design to increase FOV. The structure of light pipe is quiet simple, just a rod. For more details, see the design of light pipe.



1.4. The recommended position of final product

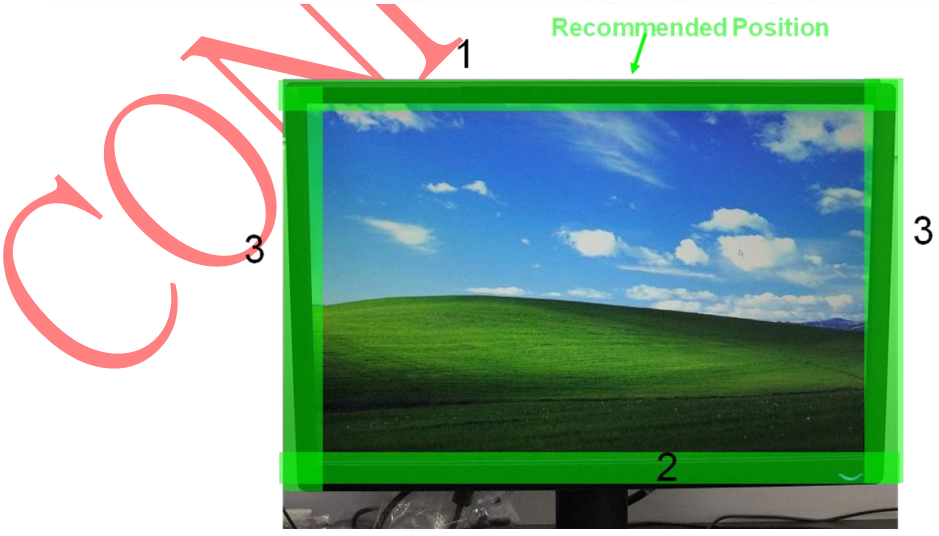
Handset Products (3~5″)

Tablet Products (5 ~ 11″)



NB (5 ~ 18″ w/ Keyboard)

LCD Monitor/TV/AIO PC (18 ~ 100")
You should prevent the stray light carefully, if your LCD Monitor/TV is a sidelight backlight design.

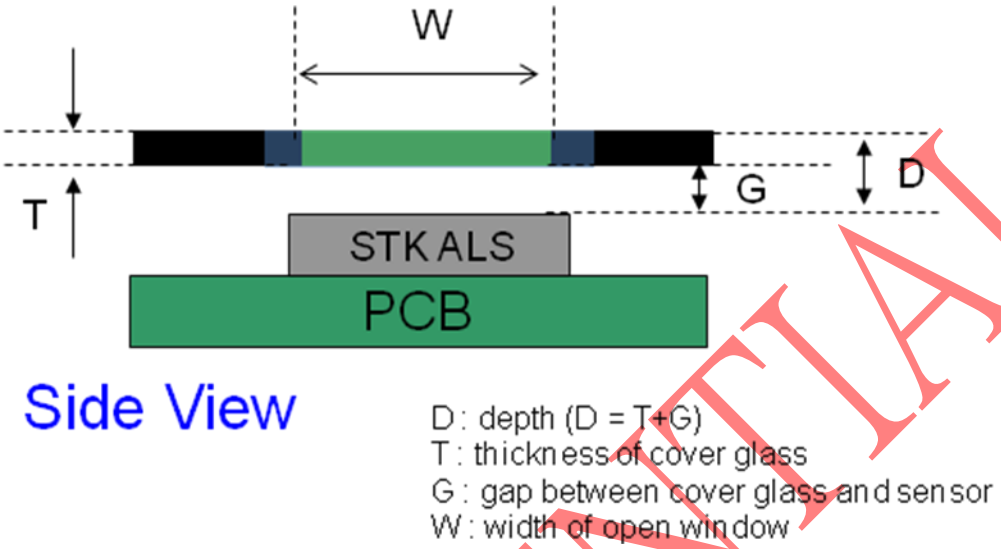


1.5. Width to depth ratio (WDR)

For lower cost design, we would not use any light pipe but we still want larger FOV.

$$WDR \equiv W/D$$

We strongly recommend WDR > 2.0



Side View

D : depth (D = T+G)
T : thickness of cover glass
G : gap between cover glass and sensor
W : width of open window

WDR	FOV (deg)	WDR	FOV (deg)
0.5	28.1	1.6	77.3
0.6	33.4	1.8	84.0
0.7	38.6	2.0	90.0
0.8	43.6	2.2	95.5
0.9	48.5	2.4	100.4
1.0	53.1	2.6	104.9
1.2	61.9	2.8	108.9
1.4	70.0	3.0	112.6

1.6. The recommended material for optical window/light pipe

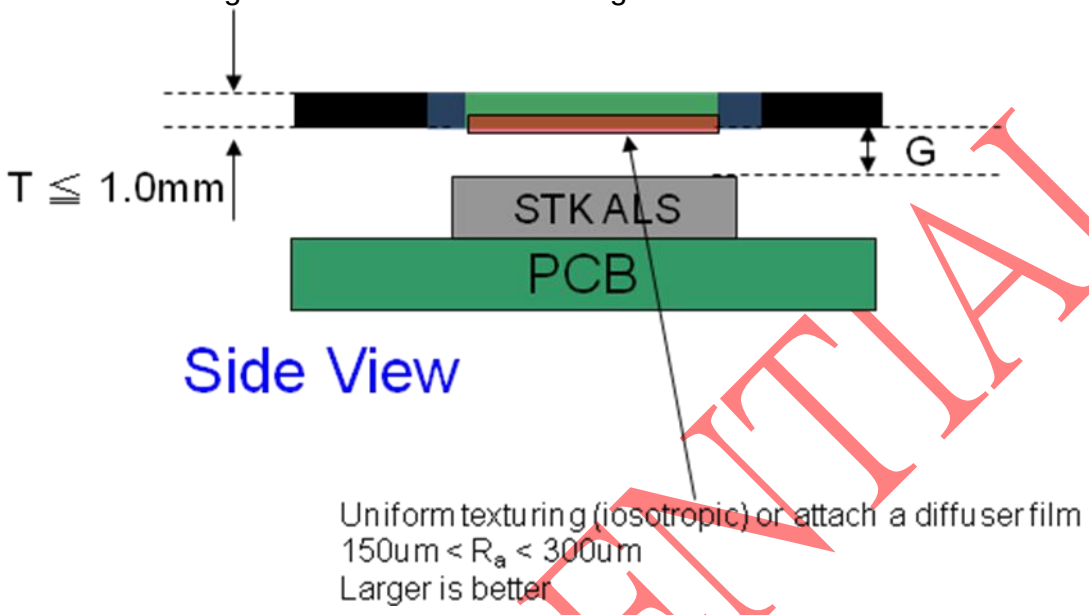
For optical window, we recommend using “glass” with a black coating that transmittance > 1.25%[*1]. Besides, we also recommend using transparent plastic (e.g. polycarbonate) with black coating and the transmittance still is above than 1.25%.
For light pipe, we recommend using transparent plastic and its optical refractive index should be above than 1.4. The net transmittance over the total thickness of the rod and optical window should also be above 1.25%.

*[*1]: For lower transmittance, you should use higher gain/longer exposure time (means slower responding), and sensing range will be reduced. For transmittance = 1.25%, sensing range might be around 0 ~ 875lux. (For a normal condition, i.e. transmittance ≧ 5%, typical sensing range is around 0 ~ 3500lux)*

1.7. The other way to increase FOV

The following way also improves the FOV.

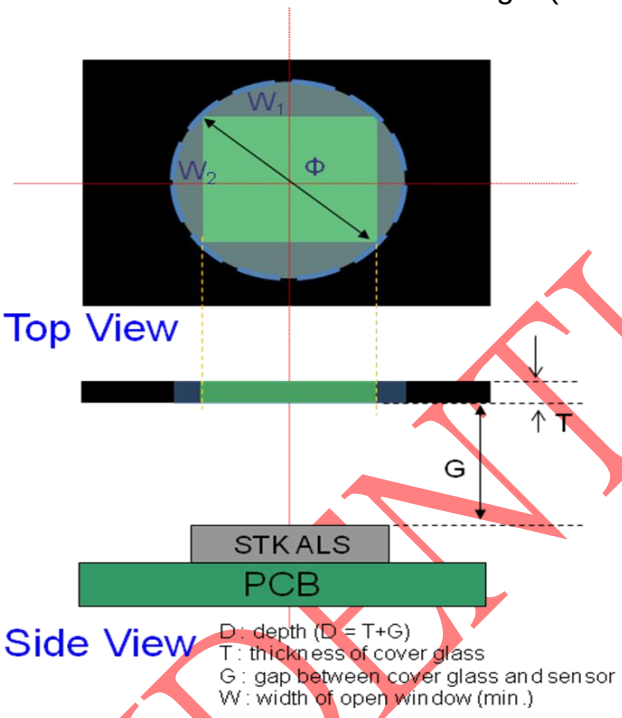
a. Texturing under cover lens (for thin cover lens, i.e. thickness <1.0mm)
b. Attach a hazing/ diffuser film under cover glass



2. Reference Design

2.1. Flat window cover glass design

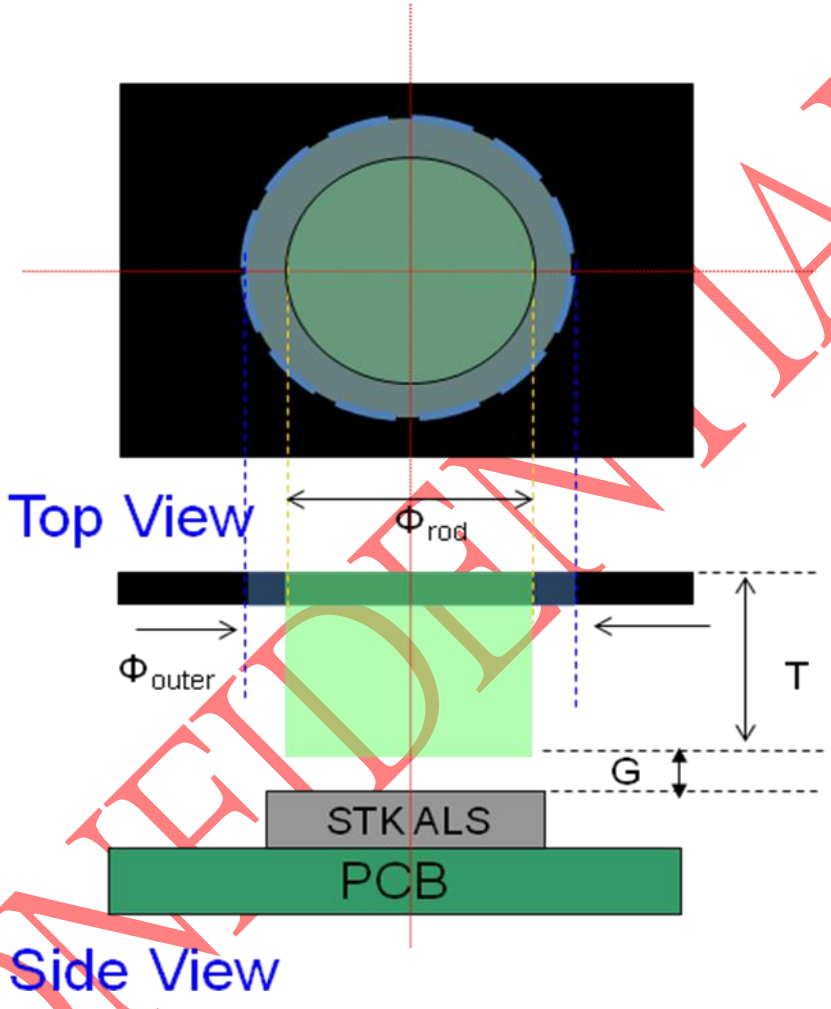
The thickness of cover glass T = 0.6~ 1.1mm (0.7 typical) is recommended for flat window cover lens design. The window could be a circle or a rectangle (including square),



T = 0.7 mm			
G(mm)	W (mm) @ 105° FOV	W (mm) @ 90° FOV	W (mm) @ 76° FOV
0.5	3.9	3.0	2.4
0.6	4.2	3.2	2.6
0.7	4.4	3.4	2.7
0.8	4.7	3.6	2.9
0.9	4.9	3.8	3.0
1.0	5.2	4.0	3.2
1.2	5.7	4.4	3.5
1.4	6.2	4.8	3.8
1.5	6.5	5.0	4.0
1.6	6.8	5.2	4.2
1.8	7.3	5.6	4.5
2.0	7.8	6.0	4.8
2.2	8.3	6.4	5.1
2.4	8.8	6.8	5.4
2.5	9.1	7.0	5.6

2.2. Window with light pipe design

Thickness of cover glass = 0.6 ~ 1.2 mm
G = 0.2 ~ 0.6 mm
Φ_{rod} = 1.5 ~ 2.5 mm
$\Phi_{outer} \geqq \Phi_{rod}$
n (optical refractive index) ≧ 1.4



3. Automatic Backlight/Brightness Control Setting

For more brilliant display (max > 400 nits), we recommend using power saving profile. You could always adjust those settings according your requirement.

3.1. Brightness setting for power saving profile

Ambient light level (lux)	Suggested screen brightness (%)	Android Lookup Table (Code)	Suggested screen brightness (nits, or candelas per square meter)					
			Max 250 nits	Max 300 nits	Max 350nits	Max 400nits	Max 450 nits	Max 500 nits
10	30	77	75.0	90	105.0	120.0	135.0	150.0
40	42	107	105.0	126	147.0	168.0	189.0	210.0
65	55	140	137.5	165	192.5	220.0	247.5	275.0
145	60	153	150.0	180	210.0	240.0	270.0	300.0
300	65	166	162.5	195	227.5	260.0	292.5	325.0
550	75	191	187.5	225	262.5	300.0	337.5	375.0
930	80	204	200.0	240	280.0	320.0	360.0	400.0
1,250	90	230	225.0	270	315.0	360.0	405.0	450.0
1,700	100	255	250.0	300	350.0	400.0	450.0	500.0

3.2. Brightness setting for balance profile

Ambient light level (lux)	Suggested screen brightness (%)	Android Lookup Table (Code)	Suggested screen brightness (nits, or candelas per square meter)					
			Max 250 nits	Max 300 nits	Max 350nits	Max 400nits	Max 450 nits	Max 500 nits
10	42	107	104.9	125.9	146.9	167.8	188.8	209.8
40	53	135	132.4	158.8	185.3	211.8	238.2	264.7
65	71	181	177.5	212.9	248.4	283.9	319.4	354.9
145	76	194	190.2	228.2	266.3	304.3	342.4	380.4
300	85	217	212.7	255.3	297.8	340.4	382.9	425.5
550	93	237	232.4	278.8	325.3	371.8	418.2	464.7
930	98	250	245.1	294.1	343.1	392.2	441.2	490.2
1,250	100	255	250.0	300	350.0	400.0	450.0	500.0
1,700	100+	255	250.0	300	350.0	400.0	450.0	500.0

3.3. Brightness setting for brilliant profile

Ambient light level (lux)	Suggested screen brightness (%)	Android Lookup Table (Code)	Suggested screen brightness (nits, or candelas per square meter)					
			Max 250 nits	Max 300 nits	Max 350nits	Max 400nits	Max 450 nits	Max 500 nits
10	50	128	125.0	150.0	175.0	200.0	225.0	250.0
40	58	148	145.0	174.0	203.0	232.0	261.0	290.0
65	75	191	187.5	225.0	262.5	300.0	337.5	375.0
145	80	204	200.0	240.0	280.0	320.0	360.0	400.0
300	90	230	225.0	270.0	315.0	360.0	405.0	450.0
550	95	242	237.5	285.0	332.5	380.0	427.5	475.0
930	100	255	250.0	300.0	350.0	400.0	450.0	500.0
1,250	100	255	250.0	300.0	350.0	400.0	450.0	500.0
1,700	100	255	250.0	300.0	350.0	400.0	450.0	500.0