APPENDIX I
RADIO FREQUENCY EXPOSURE

LIMIT

According to §Part 22 and Part 24 of the FCC rules are subject to routine environmental evaluation for RF exposure prior to equipment authorization.

EUT Specification

EUT	Module
Model	HL8549, HL8549-G
Frequency band (Operating)	☒ GSM 850MHz: 824.2MHz ~ 848.8MHz ☒ GSM 1900MHz: 1850.2MHz ~ 1909.8MHz ☒ WCDMA Band II: 1852.4MHz ~ 1907.6MHz ☒ WCDMA Band V: 826.4MHz ~ 846.6MHz ☐ Others
Device category	☐ Portable (<20cm separation) ☒ Mobile (>20cm separation) ☐ Others
Exposure classification	☐ Occupational/Controlled exposure (S = 5mW/cm^2) ☒ General Population/Uncontrolled exposure (S=1mW/cm^2)

Measurement Average output power

System	Power	
GSM850	31.90 dBm	(1548.82 mW)
GPRS850	31.10 dBm	(1288.25 mW)
EDGE850	25.50 dBm	(354.81 mW)
GSM1900	28.80 dBm	(758.58 mW)
GPRS1900	27.80 dBm	(602.56 mW)
EDGE1900	24.30 dBm	(269.15 mW)
WCDMA Band II	22.97 dBm	(198.15 mW)
HSDPA Band II	22.98 dBm	(198.61 mW)
HSUPA Band II	22.94 dBm	(196.79 mW)
WCDMA Band V	22.73 dBm	(187.50 mW)
HSDPA Band V	22.70 dBm	(186.21 mW)
HSUPA Band V	22.62 dBm	(182.81 mW)

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	System	Target Power	Tolerance
Power Target / Tolerance	GSM850	32.0 dBm	± 1 dB
	GPRS850	32.0 dBm	± 1 dB
	EGPRS850	27.0 dBm	± 1 dB
	GSM1900	29.0 dBm	± 1 dB
	GPRS1900	29.0 dBm	± 1 dB
	EGPRS1900	26.0 dBm	± 1 dB
	WCDMA Band II	23.0 dBm	± 1 dB
	WCDMA Band V	23.0 dBm	± 1 dB

	System	Max Tune up Power	Time Average Power
Max tune up Power / Max time Average Power GPRS/EGPRS 1 slot: -9dB 2 slot: -6dB 3 slot: -4dB 4 slot: -3dB	GSM850	33.0dBm (1995.262mW)	24.0dBm (251.189mW)
	GPRS850	33.0dBm (1995.262mW)	24.0dBm (251.189mW)
	EGPRS850	28.0dBm (630.957mW)	19.0dBm (79.433mW)
	GSM1900	29.0dBm (794.328mW)	20.0dBm (100.000mW)
	GPRS1900	29.0dBm (794.328mW)	20.0dBm (100.000mW)
	EGPRS1900	27.0dBm (501.187mW)	18.0dBm (63.096mW)
	WCDMA Band II	24.0dBm (251.189mW)	24.0dBm (251.189mW)
	WCDMA Band V	24.0dBm (251.189mW)	24.0dBm (251.189mW)

Evaluation applied	☒ MPE Evaluation* ☐ SAR Evaluation ☐ N/A

Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	2014/12/15	Initial Issue	ALL	Scott Hsu

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Rev.00

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TEST RESULTS

No non-compliance noted.

Calculation

Given $E = \dfrac{\sqrt{30 \times P \times G}}{d}$ & $S = \dfrac{E^2}{377}$

Where   E = Field strength in Volts / meter
P = Power in Watts
G = Numeric antenna gain
d = Distance in meters
S = Power density in milliwatts / square centimeter

Combining equations and re-arranging the terms to express the distance as a function of the remaining variables yields:

$$S = \frac{30 \times P \times G}{377 d^2}$$

Changing to units of mW and cm, using:

P (mW) = P (W) / 1000 and

d (cm) = d(m) / 100

Yields

$$S = \frac{30 \times (P/1000) \times G}{377 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2} \quad \textbf{\textit{Equation 1}}$$

Where   d = Distance in cm
P = Power in mW
G = Numeric antenna gain
S = Power density in mW / cm^2

Maximum Permissible Exposure

Substituting the MPE safe distance using d = 20 cm into Equation 1:

$$S = 0.000199 \times P \times G$$

Where   P = Power in mW

G = Numeric antenna gain

S = Power density in mW / cm^2

GSM850 mode:

Ch.	Frq.(MHz)	P (mW)	D (cm)	MPE Limit (mW/cm2)	ERP/EIRP Limit (W/cm2)	Gain (num.)	Antenna Gain (dBi)	Max Ant. Gain to complay MPE and ERP/EIRP limits
190	836.4	251.189	20	0.56		11.20	10.49	7.60 dBi
190	836.4	1995.26	20		7.0	5.75	7.60	

GPRS850 mode:

Ch.	Frq.(MHz)	P (mW)	D (cm)	MPE Limit (mW/cm2)	ERP/EIRP Limit (W/cm2)	Gain (num.)	Antenna Gain (dBi)	Max Ant. Gain to complay MPE and ERP/EIRP limits
251	848.8	251.189	20	0.57		11.40	10.57	7.60 dBi
251	848.8	1995.26	20		7.0	5.75	7.60	

EGPRS850 mode:

Ch.	Frq.(MHz)	P (mW)	D (cm)	MPE Limit (mW/cm2)	ERP/EIRP Limit (W/cm2)	Gain (num.)	Antenna Gain (dBi)	Max Ant. Gain to complay MPE and ERP/EIRP limits
251	848.8	79.433	20	0.57		36.06	15.57	12.60 dBi
251	848.8	630.96	20		7.0	18.19	12.60	

GSM1900 mode:

Ch.	Frq.(MHz)	P (mW)	D (cm)	MPE Limit (mW/cm2)	ERP/EIRP Limit (W/cm2)	Gain (num.)	Antenna Gain (dBi)	Max Ant. Gain to complay MPE and ERP/EIRP limits
661	1880.0	100.000	20	1.00		50.25	17.01	4.01 dBi
661	1880.0	794.33	20		2.0	2.52	4.01	

GPRS1900 mode:

Ch.	Frq.(MHz)	P (mW)	D (cm)	MPE Limit (mW/cm2)	ERP/EIRP Limit (W/cm2)	Gain (num.)	Antenna Gain (dBi)	Max Ant. Gain to complay MPE and ERP/EIRP limits
512	1850.2	100.000	20	1.00		50.25	17.01	4.01 dBi
512	1850.2	794.33	20		2.0	2.52	4.01	

EGPRS1900 mode:

Ch.	Frq.(MHz)	P (mW)	D (cm)	MPE Limit (mW/cm2)	ERP/EIRP Limit (W/cm2)	Gain (num.)	Antenna Gain (dBi)	Max Ant. Gain to complay MPE and ERP/EIRP limits
512	1850.2	63.096	20	1.00		79.64	19.01	6.01 dBi
512	1850.2	501.19	20		2.0	3.99	6.01	

WCDMA Band II mode:

Ch.	Frq.(MHz)	P (mW)	D (cm)	MPE Limit (mW/cm2)	ERP/EIRP Limit (W/cm2)	Gain (num.)	Antenna Gain (dBi)	Max Ant. Gain to complay MPE and ERP/EIRP limits
9262	1852.4	251.189	20	1.00		20.01	13.01	9.01 dBi
9262	1852.4	251.189	20		2.0	7.96	9.01	

WCDMA Band V mode:

Ch.	Frq.(MHz)	P (mW)	D (cm)	MPE Limit (mW/cm2)	ERP/EIRP Limit (W/cm2)	Gain (num.)	Antenna Gain (dBi)	Max Ant. Gain to complay MPE and ERP/EIRP limits
4182	836.4	251.189	20	0.56		11.20	10.49	10.49 dBi
4182	836.4	251.189	20		7.0	45.70	16.60	

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