

Maximum Permissible Exposure (MPE)

Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended to comply with § 2.1091 Radiofrequency radiation exposure evaluation: mobile devices of the FCC CFR 47 Rules, CFR 1.1310 (b) Radio frequency Radiation Exposure Requirement.

Special Accessories

Not available for this EUT intended for grant

Equipment Modifications

Not available for this EUT intended for grant.

Limitation

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minute)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	F/1500	30
1500-15000	/	/	1.0	30

F = frequency in MHz

* = Plane-wave equipment power density

Exposure (MPE) Evaluation

The evaluation and calculation as deduces below presents only worst-case that produces highest value of the result:

Operation Configuration of the Worst-Case picked up to evaluate:

LTE Band 4 / 13

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留 90 天。本報告未經本公司書面許可，不可部份複製。

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at www.sgs.com/terms_and_conditions.htm and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

Operation in LTE Band 4 (1710 to 1755 MHz)

BAND 4 / BW: 20M / QPSK / RB: 1,0

EUT			Measurement					
Operation Band	Fundamental Frequency	CH	Antenna Pol.	S.G. Output	Antenna Gain	Cable Loss	EIRP	Limit
	MHz		V/H	dBm	dBi	dB	dBm	dBm
LTE BAND 4	1720	20050	V	12.25	9.17	-2.49	18.93	30
			H	16.43	9.17	-2.49	23.11	30
	1732.5	20175	V	13.59	9.21	-2.5	20.3	30
			H	16.52	9.21	-2.5	23.23	30
	1745	20300	V	10.96	9.25	-2.51	17.7	30
			H	14.55	9.25	-2.51	21.29	30

$$\text{Power Density} = \text{EIRP} \cdot \text{Duty Cycle} / (4\pi R^2)$$

Duty Cycle is 1 for LTE band operation and R is 20cm.

EIRP	23.23	(dBm)
EIRP	210.378	(mW)
Duty cycle:	100	(%)
Maximum Pav :	210.377844	(mW)
Prediction distance:	20	(cm)
Prediction frequency:	1732.5	(MHz)
MPE limit for uncontrolled exposure at prediction	1.0000	(mW/cm ²)
Power density at predication frequency at 20 (cm)	0.04187	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.04187 mW/cm².

This is below the uncontrolled exposure limit of 1 mW/cm² at 1732.5MHz.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留 90 天。本報告未經本公司書面許可，不可部份複製。

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at www.sgs.com/terms_and_conditions.htm and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

Operation in LTE Band 13 (777 to 787 MHz)

BAND 13 / BW: 10M / 16QAM / RB: 1,0

EUT			Measurement					
Operation Band	Fundamental Frequency	CH	Antenna Pol.	S.G. Output	Antenna Gain	Cable Loss	ERP	Limit
	MHz		V/H	dBm	dBd	dB	dBm	dBm
LTE BAND 13	782.0	23230	V	24.31	0.03	-1.63	22.71	44.77
			H	20.19	0.03	-1.63	18.59	44.77

$$\text{Power Density} = \text{EIRP} \cdot \text{Duty Cycle} / (4\pi R^2)$$

Duty Cycle is 1 for LTE band operation and R is 20cm.

ERP	22.71	(dBm)
ERP	186.638	(mW)
Duty cycle:	100	(%)
Maximum Pav :	186.637969	(mW)
Prediction distance:	20	(cm)
Prediction frequency:	782	(MHz)
MPE limit for uncontrolled exposure at prediction	0.5213	(mW/cm ²)
Power density at predication frequency at 20 (cm)	0.03715	(mW/cm ²)

Measurement Result

The predicted power density level at 20 cm is 0.03715 mW/cm².

This is below the uncontrolled exposure limit of 0.5213 mW/cm² at 782MHz.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留 90 天。本報告未經本公司書面許可，不可部份複製。

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at www.sgs.com/terms_and_conditions.htm and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

Collocated MPE Analysis

The modem may transmit simultaneously with other collocated radio transmitters within a host device, provided the following conditions are met:

- Each collocated radio transmitter has been certified by FCC for mobile application (that will be met since SQNS module will have its own FCC ID and host device will have its own FCC ID)
- At least 20 cm separation distance between the antennas of the collocated transmitters and the user's body must be maintained at all times (host installation should taking care of that)

The output power and antenna gain in a collocated configuration must not exceed the limits and configurations stipulated in the following table 1. The power density calculations for the individual transmitters per wireless technology at an exposure minimum separation distance of 20cm.

Exclusion of test condition:

Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on calculated or measured field strengths or power density, is ≤ 1.0 .

$$MPE\ ratio1 + MPE\ ratio2 + MPE\ ration \leq 1.0$$

The spreadsheet as FCC deduces, and releases is employed to conduct the measurement:

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留 90 天。本報告未經本公司書面許可，不可部份複製。

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at www.sgs.com/terms_and_conditions.htm and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

Table 1: Collocated MPE Calculation (Worst Case Table)

Technology	Frequency (MHz)	Max. Conducted Power (dBm)	Max. Gain (dBi)	Duty Cycle	FCC Power Density @20cm (mW/cm ²)	FCC MPE Limit (mW/cm ²)
WLAN 2.4G	2412	15.53	0.4	48.34	0.004	1.000
LTE Band 4	1732.5	24.15	0.8	100	0.062	1.000
LTE Band 13	782	23.40	-1.2	100	0.033	0.521

Scenario 1:

WLAN 2.4G + LTE B4 + LTE B13

WLAN (mW/cm ²)	WLAN / MPE limit	(WLAN) / MPE limit	LTE B4 (mW/cm ²)	LTE B4 / MPE limit	LTE B4 / MPE limit	LTE B13 (mW/cm ²)	LTE B13 / MPE limit	LTE B13 / MPE limit	WLAN+ LTE B4+ LTE B13	FCC Limit (mW/cm ²)
0.004	1.00	0.004	0.062	1.00	0.062	0.033	0.521	0.063	0.129	1.000

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留 90 天。本報告未經本公司書面許可，不可部份複製。

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at www.sgs.com/terms_and_conditions.htm and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.