RF EXPOSURE EVALUATION REPORT

FCC ID	:	A4RG020I
Equipment	:	Phone
Model Name	:	G020I
Applicant	:	Google LLC 1600 Amphitheatre Parkway, Mountain View, California, 94043 USA
Manufacturer	:	Google LLC 1600 Amphitheatre Parkway, Mountain View, California, 94043 USA
Standard	:	47 CFR Part 2.1091

We, SPORTON INTERNATIONAL INC has been evaluated in accordance with 47 CFR Part 2.1091 for the device and pass the limit.

The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

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Cona Huang

Approved by: Cona Huang / Deputy Manager

SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory

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History of this test report

Report No.	Version	Description	Issued Date
FA8N0616-05B	Rev. 01	Initial issue of report	Jun. 27, 2019
FA8N0616-05B	Rev. 02	1. Add 60GHz transmitter assessment. 2. Correct typo in page 9	Jul. 08, 2019

1. Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT Type	Phone
Model Name	G020I
FCC ID	A4RG020I
Wireless Technology and Frequency Range	GSM850: 824.2 MHz ~ 848.8 MHz GSM1900: 1850.2 MHz ~ 1909.8 MHz WCDMA Band II: 1852.4 MHz ~ 1907.6 MHz WCDMA Band IV: 1712.4 MHz ~ 1752.6 MHz WCDMA Band V: 826.4 MHz ~ 846.6 MHz CDMA2000 BC0: 824.7 MHz ~ 848.31 MHz CDMA 2000 BC1: 1851.25 MHz ~ 1908.75 MHz CDMA 2000 BC10: 817.9 MHz ~ 823.1 MHz LTE Band 2: 1850.7 MHz ~ 1909.3 MHz LTE Band 4: 1710.7 MHz ~ 1754.3 MHz LTE Band 5: 824.7 MHz ~ 848.3 MHz LTE Band 7: 2502.5 MHz ~ 2567.5 MHz LTE Band 12: 699.7 MHz ~ 715.3 MHz LTE Band 13: 779.5 MHz ~ 784.5 MHz LTE Band 14: 790.5 MHz ~ 795.5 MHz LTE Band 17: 706.5 MHz ~ 713.5 MHz LTE Band 25: 1850.7 MHz ~ 1914.3 MHz LTE Band 26: 814.7 MHz ~ 848.3 MHz LTE Band 30: 2307.5 MHz ~ 2312.5 MHz LTE Band 38: 2572.5 MHz ~ 2617.5 MHz LTE Band 41: 2498.5 MHz ~ 2687.5 MHz LTE Band 66: 1710.7 MHz ~ 1779.3 MHz LTE Band 71: 665.5 MHz ~ 695.5 MHz LTE Band 48: 3552.5 MHz ~ 3697.5 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2472 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5720 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz NFC : 13.56 MHz 60 GHz Low Power Transmitter: 60GHz:58-63.5GHz
Mode	GSM/GPRS/EGPRS/DTM RMC/AMR 12.2Kbps HSDPA HSUPA DC-HSDPA CDMA2000 : 1xRTT/1xEv-Do(Rev.0)/1xEv-Do(Rev.A) LTE: QPSK, 16QAM, 64QAM WLAN: 802.11a/b/g/n/ac HT20 / HT40 / VHT20 / VHT40 / VHT80 Bluetooth BR/EDR/LE NFC:ASK
EUT Stage	Identical Prototype

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

Reviewed by: Jason Wang

Report Producer: Wan Liu

2. Maximum Tune-up Limit

General Note:

1. For each cellular band, the device has 4 antennas, the antenna selection is based on the connection quality condition, and only one antenna will transmit at a time.
2. The maximum power of the WWAN antenna will be selected to evaluate the power density

<WWAN Maximum Power>

Antenna	Ant 0a	Ant 0b	Ant 0c	WWAN Ant 1
Band	Maximum Tune Up Power (dBm)	Maximum Tune Up Power (dBm)	Maximum Tune Up Power (dBm)	Maximum Tune Up Power (dBm)
GSM850 (GSM/GPRS 1TX)	34.00			34.00
GSM850 (GPRS 2TX)	32.50			32.50
GSM850 (GPRS 3TX)	31.50			31.50
GSM850 (GPRS4TX)	30.50			30.50
GSM850 (EGPRS 1TX)	28.00			28.00
GSM850 (EGPRS 2TX)	27.50			27.50
GSM850 (EGPRS 3TX)	27.50			27.50
GSM850 (EGPRS 4TX)	25.50			25.50
GSM1900 (GSM/GPRS 1TX)		30.00	30.00	30.00
GSM1900 (GPRS 2TX)		29.50	29.50	29.50
GSM1900 (GPRS 3TX)		29.00	29.00	29.00
GSM1900 (GPRS4TX)		28.00	28.00	28.00
GSM1900 (EGPRS 1TX)		26.00	26.00	26.00
GSM1900 (EGPRS 2TX)		25.00	25.00	25.00
GSM1900 (EGPRS 3TX)		25.00	25.00	25.00
GSM1900 (EGPRS 4TX)		24.00	24.00	24.00
WCDMA II		24.75	24.75	24.75
WCDMA IV		24.75	24.75	24.75
WCDMA V	25.00			25.00
CDMA BC0	25.00			25.00
CDMA BC1		24.75	24.75	24.75
CDMA BC10	25.00			25.00
LTE Band 7		24.80	24.80	24.80
LTE Band 12/17	25.00			25.00
LTE Band 13	25.00			25.00
LTE Band 14	25.00			25.00
LTE Band 25/2		24.75	24.75	24.75
LTE Band 26/5	25.00			25.00
LTE Band 30		24.80	24.80	24.80
LTE Band 41/38		24.80	24.80	24.80
LTE Band 41 HPUE		26.80	26.80	26.80
LTE Band 48		23.00	23.00	26.80
LTE Band 66/4		24.75	24.75	24.75
LTE Band 71	25.00			25.00

<WLAN Maximum Power>

Frequency Band	Modulation	Maximum Tune Up Power (dBm) SISO		Maximum Tune Up Power (dBm) MIMO		
		Ant 2	Ant 3	Ant 2	Ant 3	Ant 2+3
WLAN 2.4GHz	802.11b	23.0	23.0	16	15	18.5
	802.11g	22.5	22.5	16	15	18.5
	802.11n HT20	22.5	22.5	16	15	18.5
	802.11ac VHT20	22.5	22.5	16	15	18.5

Frequency Band	Modulation	Maximum Tune Up Power (dBm) SISO		Maximum Tune Up Power (dBm) MIMO		
		Ant 2	Ant 5	Ant 2	Ant 5	Ant 2+5
WLAN5GHz UNII1	802.11a	19	19	19	19	22
	802.11n HT20	19	19	19	19	22
	802.11n HT40	21	21	21	21	24
	802.11n VHT20	19	19	19	19	22
	802.11n VHT40	21	21	21	21	24
	802.11n VHT80	15	15	15	15	18
WLAN5GHz UNII 2A	802.11a	19	19	19	19	22
	802.11n HT20	19	19	19	19	22
	802.11n HT40	21	21	21	21	24
	802.11n VHT20	19	19	19	19	22
	802.11n VHT40	21	21	21	21	24
	802.11n VHT80	16.5	16.5	16.5	16.5	19.5
WLAN5GHz UNII 2C	802.11a	19	19	19	19	22
	802.11n HT20	19.5	19.5	19.5	19.5	22.5
	802.11n HT40	21	21	21	21	24
	802.11n VHT20	19.5	19.5	19.5	19.5	22.5
	802.11n VHT40	21	21	21	21	24
	802.11n VHT80	21	21	21	21	24
WLAN5GHz UNII 3	802.11a	20	20	20	20	23
	802.11n HT20	20	20	20	20	23
	802.11n HT40	20	20	20	20	23
	802.11n VHT20	20	20	20	20	23
	802.11n VHT40	20	20	20	20	23
	802.11n VHT80	20	20	20	20	23

Frequency Band	Modulation		Maximum Tune Up Power Table (dBm)
Bluetooth	BR/EDR	1Mbps	19.5
		2Mbps	19.5
		3Mbps	19.5
	LE	1Mbps	13.5
		2Mbps	13.5

Frequency Band	Maximum EIRP Power Table (dBm)
60GHz Transmitter	11.65

3. RF Exposure Limit Introduction

According to ANSI/IEEE C95.1-1992, the criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in §1.1310.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f2)	6
30-300	61.4	0.163	1.0	6
300-1500			f/300	6
1500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f2)	30
30-300	27.5	0.073	0.2	30
300-1500			f/1500	30
1500-100,000			1.0	30

The MPE was calculated at 20 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

$$S = \frac{PG}{4\pi R^2}$$

Where:
S = Power Density
P = Output Power at Antenna Terminals
G = Gain of Transmit Antenna (linear gain)
R = Distance from Transmitting Antenna

4. Radio Frequency Radiation Exposure Evaluation

4.1. Power Density Calculation

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Average EIRP (mW)	Power Density at 20cm (mW/cm^2)	Limit (mW/cm^2)	Power Density / Limit
GSM 850 (1 Tx slot)	824	-3.50	34.00	141.25	0.028	0.549	0.051
GPRS 850 (1 Tx slot)	824	-3.50	34.00	141.25	0.028	0.549	0.051
GPRS 850 (2 Tx slots)	824	-3.50	32.50	198.58	0.040	0.549	0.072
GPRS 850 (3 Tx slots)	824	-3.50	31.50	236.59	0.047	0.549	0.086
GPRS 850 (4 Tx slots)	824	-3.50	30.50	251.19	0.050	0.549	0.091
EGPRS 850 (1 Tx slot)	824	-3.50	28.00	35.48	0.007	0.549	0.013
EGPRS 850 (2 Tx slots)	824	-3.50	27.50	62.80	0.012	0.549	0.023
EGPRS 850 (3 Tx slots)	824	-3.50	27.50	94.20	0.019	0.549	0.034
EGPRS 850 (4 Tx slots)	824	-3.50	25.50	79.24	0.016	0.549	0.029
GSM 1900 (1 Tx slot)	1850	-0.50	30.00	112.20	0.022	1.000	0.022
GPRS 1900 (1 Tx slot)	1850	-0.50	30.00	112.20	0.022	1.000	0.022
GPRS 1900 (2 Tx slots)	1850	-0.50	29.50	198.58	0.040	1.000	0.040
GPRS 1900 (3 Tx slots)	1850	-0.50	29.00	265.46	0.053	1.000	0.053
GPRS 1900 (4 Tx slots)	1850	-0.50	28.00	281.84	0.056	1.000	0.056
EGPRS 1900 (1 Tx slot)	1850	-0.50	26.00	44.67	0.009	1.000	0.009
EGPRS 1900 (2 Tx slots)	1850	-0.50	25.00	70.46	0.014	1.000	0.014
EGPRS 1900 (3 Tx slots)	1850	-0.50	25.00	105.69	0.021	1.000	0.021
EGPRS 1900 (4 Tx slots)	1850	-0.50	24.00	111.94	0.022	1.000	0.022
CDMA2000 BC0	824	-3.50	25.00	141.25	0.028	0.549	0.051
CDMA2000 BC1	1850	-0.50	24.75	266.07	0.053	1.000	0.053
CDMA2000 BC10	817	-3.50	25.00	141.25	0.028	0.545	0.052
WCDMA Band 2	1850	-0.50	24.75	266.07	0.053	1.000	0.053
WCDMA Band 4	1710	-1.50	24.75	211.35	0.042	1.000	0.042
WCDMA Band 5	804	-3.50	25.00	141.25	0.028	0.536	0.052
LTE Band 2	1850	-0.50	24.75	266.07	0.053	1.000	0.053
LTE Band 4	1710	-1.50	24.75	211.35	0.042	1.000	0.042
LTE Band 5	824	-3.50	25.00	141.25	0.028	0.549	0.051
LTE Band 7	2500	2.00	24.80	478.63	0.095	1.000	0.095
LTE Band 12	699	-3.50	25.00	141.25	0.028	0.466	0.060
LTE Band 13	777	-3.50	25.00	141.25	0.028	0.518	0.054
LTE Band 14	788	-3.50	25.00	141.25	0.028	0.525	0.054
LTE Band 17	704	-3.50	25.00	141.25	0.028	0.469	0.060
LTE Band 25	1850	-0.50	24.75	266.07	0.053	1.000	0.053
LTE Band 26	814	-3.50	25.00	141.25	0.028	0.543	0.052
LTE Band 30	2305	-2.00	24.80	190.55	0.038	1.000	0.038
LTE Band 38	2570	2.00	24.80	478.63	0.095	1.000	0.095
LTE Band 41	2496	2.00	26.80	758.58	0.151	1.000	0.151
LTE Band 48	3550	1.00	23.00	251.19	0.050	1.000	0.050
LTE Band 66	1710	-1.50	24.75	211.35	0.042	1.000	0.042
LTE Band 71	663	-3.50	25.00	141.25	0.028	0.442	0.064
WLAN2.4GHz Band	2412	-0.5	26.0	354.81	0.071	1.000	0.071
WLAN5GHz Band	5180	3.0	24.0	501.19	0.100	1.000	0.100
Bluetooth	2402	-0.5	19.5	79.43	0.016	1.000	0.016
Band	**Frequency (MHz)**		**Maximum EIRP Power (dBm)**	**Average EIRP (mW)**	**Power Density at 20cm (mW/cm^2)**	**Limit (mW/cm^2)**	**Power Density / Limit**
60GHz Low power transmitter	58000		11.65	14.62	0.003	1.000	0.003

WWAN Power Density / Limit	2.4GHz WLAN Power Density / Limit	5GHz WLAN Power Density / Limit	60GHz Low Power Transmitter Power Density / Limit	Σ(Power Density / Limit)
0.151	0.071	0.100	0.003	0.325
WWAN Power Density / Limit	**5GHz WLAN Power Density / Limit**	**Bluetooth Power Density / Limit**	**60GHz Low Power Transmitter Power Density / Limit**	**Σ(Power Density / Limit)**
0.151	0.100	0.016	0.003	0.297

Note:

1. For colocation analysis, the highest (power density/limit) among all WWAN wireless modes is chosen for summation.
2. The maximum power of 60GHz low power transmitter refer to 15.255 Test report (report no.: RF190315C04).
3. Σ(Power Density / Limit): This is a summation of [(power density for each transmitter/antenna included in the simultaneous transmission)/ (corresponding MPE limit)], for WWAN + 2.4GHz WLAN + 5GHz WLAN + 60GHz low power transmitter or WWAN + 5GHz WLAN + Bluetooth + 60GHz low power transmitter.
4. Considering the WWAN collocation with the WLAN / Bluetooth / 60GHz low power transmitter of the EIRP performance listed in the table above, the aggregated (power density /limit) is smaller than 1, and MPE of 4 collocated transmitters is compliant

Conclusion:

According to 47 CFR §2.1091, the RF exposure analysis concludes that the RF Exposure is FCC compliant.