RF EXPOSURE EVALUATION REPORT

FCC ID	:	GKRRMMG1
Equipment	:	5G Module
Brand Name	:	COMPAL
Model Name	:	RMM-G1
Applicant	:	Compal Electronics, Inc. No.581 & 581-1, Ruiguang Rd., Neihu District, Taipei, (114) Taiwan
Manufacturer	:	Compal Electronics, Inc. No.581 & 581-1, Ruiguang Rd., Neihu District, Taipei, (114) Taiwan
Standard	:	47 CFR Part 2.1091

We, SPORTON INTERNATIONAL INC has been evaluated this product in accordance with 47 CFR Part2.1091 and it complies with applicable limit.

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code: 1190) and the FCC designation No. TW1190 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC evaluation.

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Approved by: Cona Huang / Deputy Manager

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History of this test report

Report No.	Version	Description	Issued Date
FA432920-02	Rev. 01	Initial issue of report	Jul. 10, 2024

1. Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT Type	5G Module
Brand Name	COMPAL
Model Name	RMM-G1
FCC ID	GKRRMMG1
Wireless Technology and Frequency Range	WCDMA Band II: 1850 MHz ~ 1910 MHz WCDMA Band IV: 1710 MHz ~ 1755 MHz WCDMA Band V: 824 MHz ~ 849 MHz LTE Band 2: 1850 MHz ~ 1910 MHz LTE Band 4: 1710 MHz ~ 1755 MHz LTE Band 5: 824 MHz ~ 849 MHz LTE Band 7: 2500 MHz ~ 2570 MHz LTE Band 12: 699 MHz ~ 716 MHz LTE Band 13: 777 MHz ~ 787 MHz LTE Band 14: 788 MHz ~ 798 MHz LTE Band 17: 704 MHz ~ 716 MHz LTE Band 25: 1850 MHz ~ 1915 MHz LTE Band 26: 814 MHz ~ 849 MHz LTE Band 30: 2305 MHz ~ 2315 MHz LTE Band 38: 2570 MHz ~ 2620 MHz LTE Band 41: 2496 MHz ~ 2690 MHz LTE Band 48: 3550 MHz ~ 3700 MHz LTE Band 66: 1710 MHz ~ 1780 MHz LTE Band 71: 663 MHz ~ 698 MHz 5G NR n2 : 1850 MHz ~ 1910 MHz 5G NR n5 : 824 MHz ~ 849 MHz 5G NR n7 : 2500 MHz ~ 2570 MHz 5G NR n25 : 1850 MHz ~ 1915 MHz 5G NR n30 : 2305 MHz ~ 2315 MHz 5G NR n38 : 2570 MHz ~ 2620 MHz 5G NR n41 : 2496 MHz ~ 2690 MHz 5G NR n48 : 3550 MHz ~ 3700 MHz 5G NR n66 : 1710 MHz ~ 1780 MHz 5G NR n71 : 663 MHz ~ 698 MHz 5G NR n77: 3700 MHz ~ 3980 MHz, 3450MHz ~ 3550MHz 5G NR n78: 3700 MHz ~ 3800 MHz, 3450MHz ~ 3550MHz
Mode	RMC 12.2Kbps HSDPA HSUPA DC-HSDPA HSPA+ (16QAM uplink) LTE: QPSK, 16QAM, 64QAM, 256QAM 5G NR: DFT-s-OFDM/CP-OFDM, Pi/2 BPSK/QPSK/16QAM/64QAM/256QAM
HW Version	1.0

Reviewed by: Jason Wang

Report Producer: Daisy Peng

2. Maximum RF average output power among production units

Band		Maximum Tune-up Power (dBm)
WCDMA	Band 2	25.0
	Band 4	25.0
	Band 5	25.0
LTE	Band 2	25.0
	Band 4	25.0
	Band 5	25.0
	Band 7	25.0
	Band 12	25.0
	Band 13	25.0
	Band 14	25.0
	Band 17	25.0
	Band 25	25.0
	Band 26	25.0
	Band 30	22.98
	Band 38	25.0
	Band 41 PC3	25.0
	Band 41 PC2	27.5
	Band 48	22.0
	Band 66	25.0
	Band 71	25.0
FR1	n2	25.0
	n5	25.0
	n7	25.0
	n25	25.0
	n30	22.98
	n38	25.0
	n41 PC3	25.0
	n41 PC2	27.5
	n48	22.0
	n66	25.0
	n71	25.0
	n77 PC3	25.0
	n77 PC2	27.0
	n78 PC3	25.0
	n78 PC2	27.0

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. Standalone Power Density Calculation

Band	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum ERP (dBm)	Maximum ERP (W)	Maximum EIRP (dBm)	Maximum EIRP (W)	Maximum Output Power Limit (W)	Average EIRP (mW)	Power Density at 20cm (mW/cm^2)	Limit (mW/cm^2)
WCDMA Band 2	8.00	25.00	30.850	1.216	33.000	1.995	2.000	1995.262	0.397	1.000
WCDMA Band 4	5.00	25.00	27.850	0.610	30.000	1.000	1.000	1000.000	0.199	1.000
WCDMA Band 5	6.00	25.00	28.850	0.767	31.000	1.259	7.000	1258.925	0.251	0.549
LTE Band 2	8.00	25.00	30.850	1.216	33.000	1.995	2.000	1995.262	0.397	1.000
LTE Band 4	5.00	25.00	27.850	0.610	30.000	1.000	1.000	1000.000	0.199	1.000
LTE Band 5	6.00	25.00	28.850	0.767	31.000	1.259	7.000	1258.925	0.251	0.549
LTE Band 7	8.00	25.00	30.850	1.216	33.000	1.995	2.000	1995.262	0.397	1.000
LTE Band 12	5.50	25.00	28.350	0.684	30.500	1.122	3.000	1122.018	0.223	0.466
LTE Band 13	5.50	25.00	28.350	0.684	30.500	1.122	3.000	1122.018	0.223	0.518
LTE Band 14	5.50	25.00	28.350	0.684	30.500	1.122	3.000	1122.018	0.223	0.525
LTE Band 17	5.50	25.00	28.350	0.684	30.500	1.122	3.000	1122.018	0.223	0.469
LTE Band 25	8.00	25.00	30.850	1.216	33.000	1.995	2.000	1995.262	0.397	1.000
LTE Band 26	6.00	25.00	28.850	0.767	31.000	1.259	7.000	1258.925	0.251	0.543
LTE Band 30	1.00	22.98	21.830	0.152	23.980	0.250	0.250	250.035	0.050	1.000
LTE Band 38	5.50	25.00	28.350	0.684	30.500	1.122	2.000	1122.018	0.223	1.000
LTE Band 41_PC3	5.50	25.00	28.350	0.684	30.500	1.122	2.000	1122.018	0.223	1.000
LTE Band 41_PC2	5.50	27.50	30.850	1.216	33.000	1.995	2.000	1995.262	0.397	1.000
LTE Band 48	1.00	22.00	20.850	0.122	23.000	0.200	0.200	199.526	0.040	1.000
LTE Band 66	5.00	25.00	27.850	0.610	30.000	1.000	1.000	1000.000	0.199	1.000
LTE Band 71	5.00	25.00	27.850	0.610	30.000	1.000	3.000	1000.000	0.199	0.442
FR1 Band n2	8.00	25.00	30.850	1.216	33.000	1.995	2.000	1995.262	0.397	1.000
FR1 Band n5	6.00	25.00	28.850	0.767	31.000	1.259	7.000	1258.925	0.251	0.549
FR1 Band n7	8.00	25.00	30.850	1.216	33.000	1.995	2.000	1995.262	0.397	1.000
FR1 Band n25	8.00	25.00	30.850	1.216	33.000	1.995	2.000	1995.262	0.397	1.000
FR1 Band n30	1.00	22.98	21.830	0.152	23.980	0.250	0.250	250.035	0.050	1.000
FR1 Band n38	5.50	25.00	28.350	0.684	30.500	1.122	2.000	1122.018	0.223	1.000
FR1 Band n41_PC3	5.50	25.00	28.350	0.684	30.500	1.122	2.000	1122.018	0.223	1.000
FR1 Band n41_PC2	5.50	27.50	30.850	1.216	33.000	1.995	2.000	1995.262	0.397	1.000
FR1 Band n48	1.00	22.00	20.850	0.122	23.000	0.200	0.200	199.526	0.040	1.000
FR1 Band n66	5.00	25.00	27.850	0.610	30.000	1.000	1.000	1000.000	0.199	1.000
FR1 Band n71	5.00	25.00	27.850	0.610	30.000	1.000	3.000	1000.000	0.199	0.442
FR1 Band n77_PC3	5.00	25.00	27.850	0.610	30.000	1.000	1.000	1000.000	0.199	1.000
FR1 Band n77_PC2	3.00	27.00	27.850	0.610	30.000	1.000	1.000	1000.000	0.199	1.000
FR1 Band n78_PC3	5.00	25.00	27.850	0.610	30.000	1.000	1.000	1000.000	0.199	1.000
FR1 Band n78_PC2	3.00	27.00	27.850	0.610	30.000	1.000	1.000	1000.000	0.199	1.000

4.2. Collocated Power Density Calculation

Note:

1. This MPE analysis is applicable to any collocated transmitters with transmit power for WLAN is less than or equal to 25dBm and for Bluetooth is less than or equal to 15dBm.
2. A maximum antenna gain of 5 dBi for WLAN/BT has been assumed for all collocated antennas.

Band	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Maximum EIRP (W)	Average EIRP (mW)	Power Density at 20cm (mW/cm^2)	Limit (mW/cm^2)	Power Density / Limit
WCDMA Band 2	8.00	25.00	33.0	2.00	1995.26	0.397	1.000	0.397
WCDMA Band 4	5.00	25.00	30.0	1.00	1000.00	0.199	1.000	0.199
WCDMA Band 5	6.00	25.00	31.0	1.26	1258.93	0.251	0.549	0.456
LTE Band 2	8.00	25.00	33.0	2.00	1995.26	0.397	1.000	0.397
LTE Band 4	5.00	25.00	30.0	1.00	1000.00	0.199	1.000	0.199
LTE Band 5	6.00	25.00	31.0	1.26	1258.93	0.251	0.549	0.456
LTE Band 7	8.00	25.00	33.0	2.00	1995.26	0.397	1.000	0.397
LTE Band 12	5.50	25.00	30.5	1.12	1122.02	0.223	0.466	0.479
LTE Band 13	5.50	25.00	30.5	1.12	1122.02	0.223	0.518	0.431
LTE Band 14	5.50	25.00	30.5	1.12	1122.02	0.223	0.525	0.425
LTE Band 17	5.50	25.00	30.5	1.12	1122.02	0.223	0.469	0.476
LTE Band 25	8.00	25.00	33.0	2.00	1995.26	0.397	1.000	0.397
LTE Band 26	6.00	25.00	31.0	1.26	1258.93	0.251	0.543	0.462
LTE Band 30	1.00	22.98	24.0	0.25	250.03	0.050	1.000	0.050
LTE Band 38	5.50	25.00	30.5	1.12	1122.02	0.223	1.000	0.223
LTE Band 41_PC3	5.50	25.00	30.5	1.12	1122.02	0.223	1.000	0.223
LTE Band 41_PC2	5.50	27.50	33.0	2.00	1995.26	0.397	1.000	0.397
LTE Band 48	1.00	22.00	23.0	0.20	199.53	0.040	1.000	0.040
LTE Band 66	5.00	25.00	30.0	1.00	1000.00	0.199	1.000	0.199
LTE Band 71	5.00	25.00	30.0	1.00	1000.00	0.199	0.442	0.450
FR1 Band n2	8.00	25.00	33.0	2.00	1995.26	0.397	1.000	0.397
FR1 Band n5	6.00	25.00	31.0	1.26	1258.93	0.251	0.549	0.456
FR1 Band n7	8.00	25.00	33.0	2.00	1995.26	0.397	1.000	0.397
FR1 Band n25	8.00	25.00	33.0	2.00	1995.26	0.397	1.000	0.397
FR1 Band n30	1.00	22.98	24.0	0.25	250.03	0.050	1.000	0.050
FR1 Band n38	5.50	25.00	30.5	1.12	1122.02	0.223	1.000	0.223
FR1 Band n41_PC3	5.50	25.00	30.5	1.12	1122.02	0.223	1.000	0.223
FR1 Band n41_PC2	5.50	27.50	33.0	2.00	1995.26	0.397	1.000	0.397
FR1 Band n48	1.00	22.00	23.0	0.20	199.53	0.040	1.000	0.040
FR1 Band n66	5.00	25.00	30.0	1.00	1000.00	0.199	1.000	0.199
FR1 Band n71	5.00	25.00	30.0	1.00	1000.00	0.199	0.442	0.450
FR1 Band n77_PC3	5.00	25.00	30.0	1.00	1000.00	0.199	1.000	0.199
FR1 Band n77_PC2	3.00	27.00	30.0	1.00	1000.00	0.199	1.000	0.199
FR1 Band n78_PC3	5.00	25.00	30.0	1.00	1000.00	0.199	1.000	0.199
FR1 Band n78_PC2	3.00	27.00	30.0	1.00	1000.00	0.199	1.000	0.199
WLAN2.4GHz Band	5.0	25.0	30.0	1.00	1000.00	0.199	1.000	0.199
WLAN5GHz Band	5.0	25.0	30.0	1.00	1000.00	0.199	1.000	0.199
Bluetooth	5.0	15.0	20.0	0.10	100.00	0.020	1.000	0.020

WWAN	WLAN Power Density / Limit	Bluetooth Power Density / Limit	Σ(Power Density / Limit) of WWAN+WLAN+Bluetooth
0.479	0.199	0.020	0.698

Note:

1. The device implanted DPS (Dynamic Power Share) function to achieve higher uplink data rate keeping the total power unchanged in 5G NR NSA EN-DC mode according to 3GPP 38.213, when the equipment has a dynamic power sharing capability, it adjusts the LTE or NR transmission power so that the instantaneous total power does not exceed the specified value, when the maximum transmission power of NR (P LTE, P NR) and the specified total power (P total) have been set and the instantaneous calculated total transmission power exceeds P total, the NR transmission power is reduced so that the actual transmission power of the user equipment will not exceed Ptotal power.
2. 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 + WLAN + Bluetooth.
3. Considering the WWAN module collocation with the WLAN and Bluetooth transmitter of the EIRP performance listed in the table above, the aggregated (power density /limit) is smaller than 1, and MPE of 3 collocated transmitters is compliant

Conclusion:

Based on FCC 47 CFR §1.1307, the analysis concludes that this product when transmitting in standalone within a host device, is compliant with the FCC RF exposure requirements in mobile exposure condition, provided the conducted power and antenna gain do not exceed the limits for each given frequency band per wireless technology as follow table:

Device	Technology	Band	Maximum Conducted Power (dBm)	Stanalone Maximum Antenna Gain (dBi)	Collocated Maximum Antenna Gain (dBi)
RMM-G1	UMTS	WCDMA Band 2	25.0	8.0	8.0
		WCDMA Band 4	25.0	5.0	5.0
		WCDMA Band 5	25.0	6.0	6.0
	LTE	LTE Band 2	25.0	8.0	8.0
		LTE Band 4	25.0	5.0	5.0
		LTE Band 5	25.0	6.0	6.0
		LTE Band 7	25.0	8.0	8.0
		LTE Band 12	25.0	5.5	5.5
		LTE Band 13	25.0	5.5	5.5
		LTE Band 14	25.0	5.5	5.5
		LTE Band 17	25.0	5.5	5.5
		LTE Band 25	25.0	8.0	8.0
		LTE Band 26	25.0	6.0	6.0
		LTE Band 30	22.98	1.0	1.0
		LTE Band 38	25.0	5.5	5.5
		LTE Band 41_PC3	25.0	5.5	5.5
		LTE Band 41_PC2	27.5	5.5	5.5
		LTE Band 48	22.0	1.0	1.0
		LTE Band 66	25.0	5.0	5.0
		LTE Band 71	25.0	5.0	5.0
	FR1	FR1 Band n2	25.0	8.0	8.0
		FR1 Band n5	25.0	6.0	6.0
		FR1 Band n7	25.0	8.0	8.0
		FR1 Band n25	25.0	8.0	8.0
		FR1 Band n30	22.98	1.0	1.0
		FR1 Band n38	25.0	5.5	5.5
		FR1 Band n41_PC3	25.0	5.5	5.5
		FR1 Band n41_PC2	27.5	5.5	5.5
		FR1 Band n48	22.0	1.0	1.0
		FR1 Band n66	25.0	5.0	5.0
		FR1 Band n71	25.0	5.0	5.0
		FR1 Band n77_PC3	25.0	5.0	5.0
		FR1 Band n77_PC2	27.0	3.0	3.0
		FR1 Band n78_PC3	25.0	5.0	5.0
		FR1 Band n78_PC2	27.0	3.0	3.0