RF Exposure Evaluation Report

Product Name : LTE SOM Module

Model No. : MS-01 PRO

FCC ID : 2ABTU-MS01PRO

Applicant : RuggON Corporation

Address : 4F, No. 298, Yang Guang St., Neihu Dist., Taipei City, Taiwan

Date of Receipt : Mar. 30, 2020

Date of Declaration : Apr. 29, 2020

Report No. : 2030820R-E3082100013

Report Version : V1.0

Issued Date: Apr. 29, 2020
Report No.: 2030820R-E3082100013

Product Name	LTE SOM Module	
Applicant	RuggON Corporation	
Address	4F, No. 298, Yang Guang St., Neihu Dist., Taipei City, Taiwan	
Manufacturer	RuggON Corporation	
Model No.	MS-01 PRO	
FCC ID.	2ABTU-MS01PRO	
Trade Name	RuggON	
Applicable Standard	KDB 447498 D01 v06	☒ Minimum test separation distance ≥ 20 cm ☐ For low power devices
Test Result	Complied	

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Approved By :
(Director / Vincent Lin)

1. GENERAL INFORMATION

1.1. EUT Description

Product Name	LTE SOM Module
Trade Name	RuggON
Model No.	MS-01 PRO
FCC ID.	2ABTU-MS01PRO
Frequency Range	802.11b/g/n-20: 2412-2472 MHz, 802.11n-40: 2422-2462 MHz 802.11a/n-20/ac-20: 5180-5320 MHz, 5500-5720 MHz, 5745-5825MHz 802.11n-40/ac-40: 5190-5310 MHz, 5510-5710 MHz, 5755-5795MHz 802.11ac-80 MHz: 5210-5290 MHz, 5530-5610 MHz, 5775MHz BT：2402-2480 MHz
Number of Channels	802.11b/g/n-20: 13CH, 802.11n-40: 9CH 802.11a/n-20/ac-20: 25CH, 802.11n-40/ac40: 12CH 802.11ac-80:6CH , BT: 79, BLE: 40
Data Rate	802.11b: 1-11Mbps, 802.11a/g: 6-54Mbps, 802.11n: up to 300Mbps 802.11ac-80MHz: up to 866.7Mbps, BT : 3Mbps , BLE : 1Mpbs
Channel Separation	802.11b/g/n-20/n-40:5MHz; 802.11a/n/ac-20:20MHz 802.11n/ac-40:40MHz; 802.11ac-80:80MHz BT：1 MHz; BLE: 2 MHz
Type of Modulation	802.11b:DSSS, DBPSK, DQPSK, CCK 802.11a/g/n/ac: OFDM, BPSK, QPSK, 16QAM, 64QAM, 256QAM FHSS: GFSK(1Mbps) / π /4DQPSK(2Mbps) / 8DPSK(3Mbps)
Antenna Type	PIFA Antenna
Channel Control	Auto
Antenna Gain	Refer to the table “Antenna List”

Antenna List

No.	Manufacturer	Part No.	Antenna Type	Peak Gain
1	AnJie	AJDP1J-B0006	PIFA	3.46dBi for 2.4 GHz 4.37dBi for 5150-5250MHz 4.64dBi for 5250-5350MHz 4.58dBi for 5470-5725MHz 4.90dBi for 5725-5850MHz

2. RF Exposure Evaluation

2.1. Standard Applicable

According to KDB 447498 D01 (7.1), A minimum test separation distance ≥ 20 cm is required between the antenna and radiating structures of the device and nearby persons to apply mobile device exposure limits.

2.2. Limits

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in 1.1307(b)
LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Average Time (Minutes)
(A) Limits for Occupational/ Control Exposures				
300-1500	--	--	F/300	6
1500-100,000	--	--	5	6
(B) Limits for General Population/ Uncontrolled Exposures				
300-1500	--	--	F/1500	6
1500-100,000	--	--	1	30

F= Frequency in MHz

Friis Formula

Friis transmission formula: $Pd = (Pout*G)/(4*pi*r^2)$

Where

Pd = power density in mW/cm^2

Pout = output power to antenna in mW

G = gain of antenna in linear scale

Pi = 3.1416

R = distance between observation point and center of the radiator in cm

Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneously transmitting antennas incorporated in a host device is ≤ 1.0

2.3. Test Result of RF Exposure Evaluation

Product : LTE SOM Module
Test Item : RF Exposure Evaluation

WLAN 2.4G Peak Gain: 3.46dBi

Band	Frequency (MHz)	Conducted maximum Peak Power (dBm)	Worst case Duty Cycle (%)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm2)	Limit (mW/cm2)	Pass/Fail
2.4G	2417	21.05	87.41	145.693	0.0643	1	Pass
BT	2402	6.21	32.56	12.833	0.0057	1	Pass

Note: The conducted output power is refer to report No.: 2030820R-RFUSP69V00, 2030820R-E3032110108, 2030820R-E3032110108-A from the DEKRA.

WLAN 5G Peak Gain: 4.90dBi

Band	Frequency (MHz)	Conducted maximum Average Power (dBm)	Worst case Duty Cycle (%)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm^2)	Limit (mW/cm^2)	Pass/Fail
5G	5720	21.45	78.38	178.154	0.1095	1	Pass

Note: The conducted output power is refer to report No.: 2030820R-RFUSP52V00 from the DEKRA.

WWAN Worst Case Power Density Configurations LTE Band 12 Peak Gain: 2dBi

Band	Frequency (MHz)	Conducted Peak Power (pre tune-up) (dBm)	Maximum EIRP (W)	Maximum EIRP Limit(W)	Duty Cycle (%)	Conducted Average Power (dBm)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm2)	Limit (mW/cm2)	Pass/Fail
12	699	25	0.3055	3	100	25	316.2	0.10	0.47	Pass

Note: The Worst Case Power Density is refer to Original RF Exposure Report for FCC ID: COF-MS01PRO.

2.4. Calculations for Multi-Transsmitter

Mode	Exposure Calculations	result	Limit	Pass/Fail
WLAN	0.110	0.330	1	Pass
WWAN	0.214			
BT	0.006			