



RF Exposure Evaluation Report

APPLICANT : MitraStar Technology Corporation
EQUIPMENT : M4G-641 LTE FDD module
BRAND NAME : MitraStar
MODEL NAME : M4G-641
FCC ID : ZMYM4G-641
STANDARD : 47 CFR Part 2.1091

We, SPORTON INTERNATIONAL INC., would like to declare that the device has been evaluated in accordance with 47 CFR Part 2.1091, and pass the limit. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by: Eric Huang / Deputy Manager

Approved by: Jones Tsai / Manager



SPORTON INTERNATIONAL INC.

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Table of Contents

1. ADMINISTRATION DATA	4
1.1. Testing Laboratory	4
1.2. Applicant	4
1.3. Manufacturer.....	4
2. DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)	5
3. MAXIMUM RF AVERAGE OUTPUT POWER AMONG PRODUCTION UNITS	5
4. RF EXPOSURE LIMIT INTRODUCTION	7
5. RADIO FREQUENCY RADIATION EXPOSURE EVALUATION	8
5.1. Standalone Power Density Calculations.....	8
5.2. Collocated Power Density Calculations	8



Revision History



1. Administration Data

1.1. Testing Laboratory

Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No. 52, Hwa Ya 1 st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL: +886-3-327-3456 FAX: +886-3-328-4978

1.2. Applicant

Company Name	MitraStar Technology Corporation
Address	No. 6, Innovation Rd II, Science-Based Industrial, Hsin-Chu, Taiwan

1.3. Manufacturer

Company Name	MitraStar Technology Corporation
Address	No. 6, Innovation Rd II, Science-Based Industrial, Hsin-Chu, Taiwan



2. Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT Type	M4G-641 LTE FDD module
Brand Name	MitraStar
Model Name	M4G-641
FCC ID	ZMYM4G-641
IMEI Code	355968050000776
Wireless Technology and Frequency Range	LTE Band 13: 779.5 MHz ~ 784.5 MHz LTE Band 4: 1710.7 MHz ~ 1754.3 MHz
Mode	• LTE: QPSK, 16QAM
HW Version	ACB
EUT Stage	Production Unit

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

3. Maximum RF average output power among production units

LTE Band 4				
average power(dBm)				
Modulation	BW (MHz)	RB size	Target MPR	Power
QPSK	20	≤ 18	0	24.0
QPSK	20	> 18	1	24.0
16QAM	20	≤ 18	1	24.0
16QAM	20	> 18	2	24.0
QPSK	15	≤ 16	0	24.0
QPSK	15	> 16	1	24.0
16QAM	15	≤ 16	1	24.0
16QAM	15	> 16	2	24.0
QPSK	10	≤ 12	0	24.0
QPSK	10	> 12	1	24.0
16QAM	10	≤ 12	1	24.0
16QAM	10	> 12	2	24.0
QPSK	5	≤ 8	0	24.0
QPSK	5	> 8	1	24.0
16QAM	5	≤ 8	1	24.0
16QAM	5	> 8	2	24.0
QPSK	3	≤ 4	0	24.0
QPSK	3	> 4	1	24.0
16QAM	3	≤ 4	1	24.0
16QAM	3	> 4	2	24.0
QPSK	1.4	≤ 5	0	24.0
QPSK	1.4	> 5	1	24.0
16QAM	1.4	≤ 5	1	24.0
16QAM	1.4	> 5	2	24.0



LTE Band 13				
average power(dBm)				
Modulation	BW (MHz)	RB size	Target MPR	Power
QPSK	10	≤ 12	0	24.0
QPSK	10	> 12	1	24.0
16QAM	10	≤ 12	1	24.0
16QAM	10	> 12	2	24.0
QPSK	5	≤ 8	0	24.0
QPSK	5	> 8	1	24.0
16QAM	5	≤ 8	1	24.0
16QAM	5	> 8	2	24.0

The table below summarized necessary items addressed in KDB 941225 D05 v02.

FCC ID	ZMYM4G-641								
EUT	M4G-641 LTE FDD module								
Operating Frequency Range of each LTE transmission band	LTE Band 13: 779.5 MHz ~ 784.5 MHz LTE Band 4: 1710.7 MHz ~ 1754.3 MHz								
Channel Bandwidth	LTE Band 13: 5MHz, 10MHz LTE Band 4: 1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz								
Transmission (H, M, L) channel numbers and frequencies in each LTE band									
Band 13									
L	Bandwidth 5 MHz		Bandwidth 10 MHz						
	Channel #	Frequency (MHz)	Channel #	Frequency (MHz)					
L	23205	779.5	23230	782					
M	23230	782							
H	23255	784.5							
LTE Band 4									
L	Bandwidth 1.4 MHz	Bandwidth 3 MHz	Bandwidth 5 MHz	Bandwidth 10 MHz	Bandwidth 15 MHz	Bandwidth 20 MHz			
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)			
L	19957	1710.7	19965	1711.5	19975	1712.5			
M	20175	1732.5	20175	1732.5	20175	1732.5			
H	20393	1754.3	20385	1753.5	20375	1752.5			
E category, uplink modulations used		Category 3, QPSK, and 16QAM							
LTE Voice / Data requirements		Data only							
		Yes, per 3GPP TS 36.101 v11.0.0							
LTE MPR permanently built-in by design		Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3							
		Modulation		Channel bandwidth / Transmission bandwidth (RB)			MPR (dB)		
		1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz			
		QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
		16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
		16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2



4. 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/f ²)	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/f ²)	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



5. Radio Frequency Radiation Exposure Evaluation

5.1. Standalone Power Density Calculations

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (W)	Maximum EIRP Limit (W)	Average EIRP (mW)	Power Density at 20cm (mW/cm ²)	Limit (mW/cm ²)
LTE Band 13	779.5	10.0	24.0	1.53	3.0	2511.89	0.50	0.52
LTE Band 4	1710.7	5.5	24.0	0.89	1.0	891.25	0.18	1.00

Note: For conservativeness, the lowest uplink frequency of each band is used to determine the MPE limit of that band

5.2. Collocated Power Density Calculations

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (W)	Average EIRP (mW)	Power Density at 20cm (mW/cm ²)	Limit (mW/cm ²)	Power Density / Limit
LTE Band 13	779.5	6.5	24.0	1.12	1122.02	0.22	0.52	0.43
LTE Band 4	1710.7	5.5	24.0	0.89	891.25	0.18	1.00	0.18
WLNA2.4GHz Band	2412.0	5.0	29.0	2.51	2511.89	0.50	1.00	0.50
WLNA5GHz Band	5180.0	5.0	29.0	2.51	2511.89	0.50	1.00	0.50
Bluetooth	2402.0	5.0	15.0	0.10	100.00	0.02	1.00	0.02

Note:

1. For conservativeness, the lowest uplink frequency of each band is used to determine the MPE limit of that band.
2. This MPE analysis is applicable to any collocated transmitters with transmit power for WLAN is less than or equal to 29dBm and for Bluetooth is less than or equal to 15dBm.
3. A maximum antenna gain of 5 dBi for WLAN/BT has been assumed for all collocated antennas.

Max WLAN Power Density / Limit	Max Bluetooth Power Density / Limit	Max WWAN Power Density / Limit	Σ (Power Density / Limit) of WWAN + WLAN + Bluetooth
0.43	0.50	0.02	0.95

Note:

1. For colocation analysis, LTE Band 13 is chosen for summation due to the highest (power density/limit) among all WWAN wireless modes.
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 other transmitters 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 47 CFR §2.1091, 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:

Technology	Band	Maximum Conducted Power (dBm)	Maximum Standalone Antenna Gain (dBi)	Maximum Collocated Antenna Gain (dBi)
LTE	Band 13	24.0	10.0	6.5
	Band 4	24.0	5.5	5.5