

**RF EXPOSURE EVALUATION**
Maximal Permissible Exposure [MPE]**Applicant Name:**Seowon Intech Co., Ltd
69, LS-ro
115beon-gil, Gunpo-si,
Gyeonggi-do, 15809 Korea**Date of Testing:**

02/11/2022 ~ 04/05/2022

Test Report Issue Date:

04/19/2022

Test Site/Location:PCTEST KOREA Lab. Yongin-si,
Gyeonggi-do, Korea**Test Report Serial No.:**

1M2202090014-05.V7M

FCC ID:**V7MESLCTGA****APPLICANT:****Seowon Intech Co., Ltd****Application Type:**

Certification

Model:

SLC-150T42GA

EUT Type:

Indoor CPE

FCC Classification:

Citizens Band End User Devices (CBE)

Digital Transmission System (DTS)

Unlicensed National Information Infrastructure TX (NII)

FCC Rule Part:

FCC Part 1 (§1.1310) and Part 2 (§2.1091)

Test Procedure(s):

KDB 447498 D01

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in §2.947. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Prepared by Ian Kim
Test EngineerReviewed by Charles Shin
Technical Manager

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1.0 REVISION RECORD

Issue Number	Issued Date	Revision History
1M2202090014-05.V7M	04/19/2022	Initial Issue

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2.0 RF EXPOSURE EVALUATION – MAXIMUM PERMISSIBLE EXPOSURE (MPE)

2.1 Introduction

This document is prepared to show compliance with the RF Exposure requirements as required in §1.1310 of the FCC Rules and Regulations.

The limit for Maximum Permissible Exposure (MPE), specified in FCC §1.1310, is listed in Table 1-1. According to FCC §1.1310: the criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b).

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 (f = frequency)				
30-300	61.4	0.163	1.0	6
300-1500	...	...	f/300	6
1500-100,000	...	...	5.0	6
(B) Limits For General Population / Uncontrolled Exposure (f = frequency)				
30-300	27.5	0.073	0.2	30
300-1500	...	...	f/1500	30
1500-100,000	...	...	1.0	30

Table 2-1. Limits for Maximum Permissible Exposure (MPE)

2.2 EUT Description

The Equipment Under Test (EUT) is the **Seowon Intech Indoor CPE FCC ID: V7MESLCTGA** is a device that supports LTE Band 48, and WLAN DTS 2.4GHz and UNII 5GHz operation. For this MPE evaluation, the maximum antenna gain was used with the maximum output power to determine the maximum power density.

The device employs MIMO technology in WLAN operation. Below are the possible configurations.

WiFi Configurations		SISO		SDM		CDD	
		ANT1	ANT2	ANT1	ANT2	ANT1	ANT2
2.4GHz	11b	✓	✓	✗	✗	✓	✓
	11g	✓	✓	✗	✗	✓	✓
	11n	✓	✓	✓	✓	✓	✓
5GHz	11a	✓	✓	✗	✗	✓	✓
	11n/ac (20MHz)	✓	✓	✓	✓	✓	✓
	11n/ac (40MHz)	✓	✓	✓	✓	✓	✓
	11ac (80MHz)	✓	✓	✓	✓	✓	✓

Table 2-2. WLAN signal operations

. ✓ = Support ; ✗ = NOT Support

SISO = Single Input Single Output

SDM = Spatial Diversity Multiplexing – MIMO function

CDD = Cyclic Delay Diversity - 2Tx Function

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Following maximum antenna gains were used for the MPE evaluation.

Frequency [GHz]	Antenna 1 Gain [dBi]	Antenna 2 Gain [dBi]
2.4	1.89	1.77
5.50	4.5	5.1

Table 2-3. WLAN Antenna Peak Gain

Per ANSI C63.10-2013 Section 14.4.3, the directional gain is calculated using the following formula, where G_N is the gain of the nth antenna and N_{ANT} , the total number of antennas used.

$$\text{Directional gain} = 10 \log[(10^{G_1/20} + 10^{G_2/20} + \dots + 10^{G_N/20})^2 / N_{ANT}] \text{ dBi}$$

For WLAN DTS 2.4GHz, Directional gain = 4.84 dBi.

For WLAN UNII 5GHz, Directional gain = 7.82 dBi.

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2.3 Procedure

The procedure used to determine the RF power density was based upon a calculation for determining compliance with the MPE requirements.

The power generated by each operating mode used in this product was initially measured with a spectrum analyzer and powers were recored. Through use of the Friis transmission formula and knowledge of the maximum antenna gain to be used, the power density level is calculated for the safe distance which must be maintained during installation based on maximum power and antenna gain.

Friis Transmission Formula

Friis transmission formula: $P_d = (P_{out} * G) / (4\pi r^2)$

Where,

P_d = Power Density (mW/cm²)

P_{out} = output power to antenna (mW)

G = gain of antenna in linear scale

π = 3.1416

r = distance between observation point and center of the radiator (cm)

Calculated MPE

The power density limit for General Population/Uncontrolled Exposure at each frequency is determined based on the information in Table 1-1.

Frequency:	3690	MHz	
Limit:	1.000	mW/cm ²	
Distance (cm), R =	20	cm	
Target Power (dBm) =	15	dBm	
Maximum Tolerance (dB) =	3	dB	
Power (dBm), P =	18	dBm	63.10 mW
TX Ant Gain (dBi), G =	4.88	dBi	
Power Density (S) =	0.039	mW/cm ²	(at 20cm)
Minimum Distance =	3.9	cm	

Table 2-4. Maximum Calculated MPE Data for LTE Band 48

Frequency:	2437	MHz	
Limit:	1.000	mW/cm ²	
Distance (cm), R =	20	cm	
Target Power (dBm) =	17	dBm	
Maximum Tolerance (dB) =	1	dB	
Power (dBm), P =	18	dBm	63.10 mW
TX Ant Gain (dBi), G =	4.84	dBi	
Power Density (S) =	0.038	mW/cm ²	(at 20cm)
Minimum Distance =	3.9	cm	

Table 2-5. Maximum Calculated MPE Data for WLAN DTS 2.4GHz

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Frequency :	5500	MHz	
Limit:	1.000	mW/cm ²	
Distance (cm), R =	20	cm	
Target Power (dBm) =	14	dBm	
Maximum Tolerance (dB) =	1	dB	
Power (dBm), P =	15	dBm	31.62 mW
TX Ant Gain (dB), G =	7.82	dBi	
Power Density (S) =	0.038	mW/cm ²	(at 20cm)
Minimum Distance =	3.9	cm	

Table 2-6. Maximum Calculated MPE Data for WLAN UNII 5GHz

Note: Power (dBm) = Target Power (dBm) + Maximum Tolerance (dB)

Simultaneous Transmission Analysis

Due to the co-location of all of the antennas within the EUT, a simultaneous transmission analysis is also provided to assess compliance with the power density requirement when all radios are on and transmitting at the maximum allowed power. This analysis is shown in the table below.

	Power Density (mW/cm ²)	Limit (mW/cm ²)	Percent MPE Used (%)
Transmitter #1 - LTE Band 48	0.039	1.000	3.86
Transmitter #2 – WLAN DTS 2.4GHz	0.038	1.000	3.83
Transmitter #3 – WLAN UNII 5GHz	0.038	1.000	3.81
Total			11.50

Table 2-7. Co-location MPE Data for Simultaneous Transmission

2.4 Summary of Results

Frequency Band [MHz]	Maximum Antenna Gain [dBi]	MPE @ 20cm (mW/cm ²)	Test Result
3550.0 – 3700.0	4.88	0.039	PASS
2412.0 – 2462.0	4.84	0.038	PASS
5180.0 – 5825.0	7.82	0.038	PASS

Table 2-8. Maximum Permissible Exposure Summary Table

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3.0 CONCLUSION

The device meets the mobile RF exposure limit at a 20cm separation distance as specified in §2.1091 of the FCC Rules and Regulations. An appropriate RF exposure compliance statement will be placed in the user's manual.

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