

# EMF TEST REPORT

**Test Report No.** : OT-22O-RWD-024  
**Reception No.** : 2209003110  
**Applicant** : LG Electronics USA  
**Address** : 111 Sylvan Avenue North Building, Englewood Cliffs, New Jersey, United States  
**Manufacturer** : Hitachi-LG Data Storage Korea, Inc.  
**Address** : (Gasan-dong), 189, Gasandigital1-ro, Geumcheon-gu, Seoul, Korea  
**Type of Equipment** : Network Webcam  
**FCC ID.** : BEJAN-VC22PR  
**Model Name** : AN-VC22PR  
**Multiple Model Name** : HL-GE1  
**Serial number** : N/A  
**Total page of Report** : 19 pages (including this page)  
**Date of Incoming** : August 12, 2022  
**Date of issue** : October 21, 2022

## SUMMARY

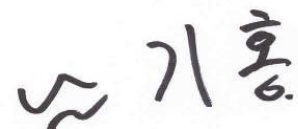
The equipment complies with the regulation; *FCC PART 15 SUBPART C Section 15.247 and FCC PART 15 SUBPART E Section 15.407*

This test report only contains the result of a single test of the sample supplied for the examination.

It is not a generally valid assessment of the features of the respective products of the mass-production.

**This report is not correlated with the "KS Q ISO/IEC 17025 and KOLAS accreditation" of Korean Laboratory Accreditation Scheme.**





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**Revision History**

| Rev. No. | Issue Report No. | Issued Date      | Revisions       | Section Affected |
|----------|------------------|------------------|-----------------|------------------|
| 0        | OT-22O-RWD-024   | October 21, 2022 | Initial Release | All              |
|          |                  |                  |                 |                  |
|          |                  |                  |                 |                  |

### 1. VERIFICATION OF COMPLIANCE

Applicant : LG Electronics USA  
 Address : 111 Sylvan Avenue North Building, Englewood Cliffs, New Jersey, United States  
 Contact Person : Sung Soo, Kim / Director, Regulatory and Environmental Affairs  
 Telephone No. : 201-266-2215  
 FCC ID : BEJAN-VC22PR  
 Model Name : AN-VC22PR  
 Brand Name : LG  
 Serial Number : N/A  
 Date : October 21, 2022

|  |  |
|--|--|
| EQUIPMENT CLASS                                      | DTS – DIGITAL TRNSMISSION SYSTEM<br>DSS – PART 15 SPREAD SPECTRUM TRANSMITTER<br>Unlicensed National Information infrastructure (UNII)   |
| E.U.T. DESCRIPTION                                   | Network Webcam   |
| THIS REPORT CONCERNS                                 | Original Grant   |
| MEASUREMENT PROCEDURES                               | ANSI C63.10: 2013  |
| TYPE OF EQUIPMENT TESTED                             | Pre-Production   |
| KIND OF EQUIPMENT AUTHORIZATION REQUESTED            | Certification  |
| EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)   | FCC PART 15 SUBPART C Section 15.247<br>KDB 558074 D01 15.247 Meas Guidance v05r02<br>FCC PART 15 SUBPART E Section 15.407<br>789033 D02 General UNII Test Procedures New Rules v02r01 |
| Modifications on the Equipment to Achieve Compliance | None   |
| Final Test was Conducted On                          | 3 m, Semi Anechoic Chamber   |

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

## 2. GENERAL INFORMATION

### 2.1 Product Description

The LG Electronics USA, Model AN-VC22PR (referred to as the EUT in this report) is a Network Webcam. The product specification described herein was obtained from product data sheet or user’s manual.

| DEVICE TYPE                 | Network Webcam   |  |
|-----------------------------|--|--|
| OPERATING<br>FREQUENCY      | Bluetooth  | 2 402 MHz ~ 2 480 MHz  |
|                             | WLAN 2.4 GHz   | 2 412 MHz ~ 2 462 MHz (802.11b/g/n(HT20))                          |
|                             |  | 2 422 MHz ~ 2 452 MHz (802.11n(HT40))                              |
|                             | WLAN<br>5 150 MHz ~<br>5 250 MHz Band  | 5 180 MHz ~ 5 240 MHz (802.11a/n(HT20)/ac(VHT20))                  |
|                             |  | 5 190 MHz ~ 5 230 MHz (802.11n(HT40)/ac(VHT40))                    |
|                             |  | 5 210 MHz (802.11ac(VHT80))  |
|                             | WLAN<br>5 250 MHz ~<br>5 350 MHz Band  | 5 260 MHz ~ 5 320 MHz (802.11a/n(HT20)/ac(VHT20))                  |
|                             |  | 5 270 MHz ~ 5 310 MHz (802.11n(HT40)/ac(VHT40))                    |
|                             |  | 5 290 MHz (802.11ac(VHT80))  |
|                             | WLAN<br>5 470 MHz ~<br>5 725 MHz Band  | 5 500 MHz ~ 5 720 MHz (802.11a/n(HT20)/ac(VHT20))                  |
|                             |  | 5 510 MHz ~ 5 710 MHz (802.11n(HT40)/ac(VHT40))                    |
|                             |  | 5 530 MHz ~ 5 690 MHz (802.11ac(VHT80))                            |
|                             | WLAN<br>5 725 MHz ~<br>5 850 MHz Band  | 5 745 MHz ~ 5 825 MHz (802.11a/n(HT20)/ac(VHT20))                  |
|                             |  | 5 755 MHz ~ 5 795 MHz (802.11n(HT40)/ac(VHT40))                    |
| 5 775 MHz (802.11ac(VHT80)) |  |  |
| MODULATION<br>TYPE          | Bluetooth  | GFSK for 1Mbps, $\pi/4$ -DQPSK for 2Mbps, 8-DPSK for 3Mbps         |
|                             | WLAN 2.4 GHz   | 802.11b:<br>DSSS Modulation(DBPSK/DQPSK/CCK)                       |
|                             |  | 802.11g/n(HT20)/n(HT40):<br>OFDM Modulation(BPSK/QPSK/16QAM/64QAM) |
| WLAN 5 GHz                  | 802.11a/n(HT20)/n(HT40)/ac(VHT80):<br>OFDM Modulation(BPSK/QPSK/16QAM/64QAM) |  |

|                    |                      |                                       |   |  |
|--------------------|----------------------|---------------------------------------|---|--|
| RF OUTPUT<br>POWER | Bluetooth            | 1 Mbps                                |   | 8.01 dBm   |
|                    |                      | 2 Mbps                                |   | 7.60 dBm   |
|                    |                      | 3 Mbps                                |   | 7.89 dBm   |
|                    | WLAN 2.4 GHz         | Antenna 1                             |   | 17.75 dBm(802.11b)<br>15.27 dBm(802.11g)<br>14.52 dBm(802.11n_HT20)<br>14.54 dBm(802.11n_HT40) |
|                    |                      | Antenna 2                             |   | 18.81 dBm(802.11b)<br>16.59 dBm(802.11g)<br>15.56 dBm(802.11n_HT20)<br>16.44 dBm(802.11n_HT40) |
|                    |                      | Multiple<br>Transmit                  | Antenna 1   | 11.57 dBm(802.11n_HT20)<br>12.02 dBm(802.11n_HT40)   |
|                    |                      |                                       | Antenna 2   | 12.90 dBm(802.11n_HT20)<br>13.22 dBm(802.11n_HT40)   |
|                    |                      |                                       | Antenna 1<br>+ Antenna 2  | 15.30 dBm(802.11n_HT20)<br>15.60 dBm(802.11n_HT40)   |
|                    |                      | WLAN<br>5 150 MHz ~<br>5 250 MHz Band | Antenna 1   |  |
|                    | Antenna 2            |                                       | 15.77 dBm(802.11a)<br>15.62 dBm(802.11n_HT20)<br>15.13 dBm(802.11n_HT40)<br>12.96 dBm(802.11ac_VHT80) |  |
|                    | Multiple<br>Transmit |                                       | Antenna 1   | 13.48 dBm(802.11n_HT20)<br>13.01 dBm(802.11n_HT40)<br>11.60 dBm(802.11ac_VHT80)                |
|                    |                      |                                       | Antenna 2   | 12.61 dBm(802.11n_HT20)<br>12.07 dBm(802.11n_HT40)<br>10.25 dBm(802.11ac_VHT80)                |
|                    |                      |                                       | Antenna 1<br>+ Antenna 2  | 16.08 dBm(802.11n_HT20)<br>15.58 dBm(802.11n_HT40)<br>13.99 dBm(802.11ac_VHT80)                |

|                 |                                       |                                       |   |   |
|-----------------|---------------------------------------|---------------------------------------|---|---|
| RF OUTPUT POWER | WLAN<br>5 250 MHz ~<br>5 350 MHz Band | Antenna 1                             |   | 17.43 dBm(802.11a)<br>17.35 dBm(802.11n_HT20)<br>13.64 dBm(802.11n_HT40)<br>13.94 dBm(802.11ac_VHT80) |
|                 |                                       | Antenna 2                             |   | 16.61 dBm(802.11a)<br>16.41 dBm(802.11n_HT20)<br>13.35 dBm(802.11n_HT40)<br>12.73 dBm(802.11ac_VHT80) |
|                 |                                       | Multiple Transmit                     | Antenna 1   | 14.26 dBm(802.11n_HT20)<br>13.26 dBm(802.11n_HT40)<br>11.76 dBm(802.11ac_VHT80)                       |
|                 |                                       |                                       | Antenna 2   | 13.65 dBm(802.11n_HT20)<br>12.93 dBm(802.11n_HT40)<br>10.67 dBm(802.11ac_VHT80)                       |
|                 |                                       |                                       | Antenna 1 + Antenna 2   | 16.93 dBm(802.11n_HT20)<br>16.11 dBm(802.11n_HT40)<br>14.26 dBm(802.11ac_VHT80)                       |
|                 |                                       | WLAN<br>5 470 MHz ~<br>5 725 MHz Band | Antenna 1   |   |
|                 | Antenna 1_Straddle                    |                                       | 15.10 dBm(802.11a)<br>14.87 dBm(802.11n_HT20)<br>15.08 dBm(802.11n_HT40)<br>13.68 dBm(802.11ac_VHT80) |   |
|                 | Antenna 2                             |                                       | 15.22 dBm(802.11a)<br>15.10 dBm(802.11n_HT20)<br>15.08 dBm(802.11n_HT40)<br>13.63 dBm(802.11ac_VHT80) |   |
|                 | Antenna 2_Straddle                    |                                       | 13.92 dBm(802.11a)<br>13.62 dBm(802.11n_HT20)<br>13.67 dBm(802.11n_HT40)<br>12.03 dBm(802.11ac_VHT80) |   |

|                    |                                       |                                   |                          |   |
|--------------------|---------------------------------------|-----------------------------------|--------------------------|---|
| RF OUTPUT<br>POWER | WLAN<br>5 470 MHz ~<br>5 725 MHz Band | Multiple<br>Transmit              | Antenna 1                | 13.19 dBm(802.11n_HT20)<br>12.61 dBm(802.11n_HT40)<br>11.54 dBm(802.11ac_VHT80)                       |
|                    |                                       |                                   | Antenna 2                | 12.27 dBm(802.11n_HT20)<br>12.00 dBm(802.11n_HT40)<br>10.54 dBm(802.11ac_VHT80)                       |
|                    |                                       |                                   | Antenna 1<br>+ Antenna 2 | 15.76 dBm(802.11n_HT20)<br>15.33 dBm(802.11n_HT40)<br>14.08 dBm(802.11ac_VHT80)                       |
|                    |                                       | Multiple<br>Transmit<br>_Straddle | Antenna 1                | 11.69 dBm(802.11n_HT20)<br>11.65 dBm(802.11n_HT40)<br>11.09 dBm(802.11ac_VHT80)                       |
|                    |                                       |                                   | Antenna 2                | 10.91 dBm(802.11n_HT20)<br>10.87 dBm(802.11n_HT40)<br>9.37 dBm(802.11ac_VHT80)                        |
|                    |                                       |                                   | Antenna 1<br>+ Antenna 2 | 14.33 dBm(802.11n_HT20)<br>14.29 dBm(802.11n_HT40)<br>13.32 dBm(802.11ac_VHT80)                       |
|                    | WLAN<br>5 725 MHz ~<br>5 850 MHz Band | Antenna 1                         |                          | 15.92 dBm(802.11a)<br>15.56 dBm(802.11n_HT20)<br>15.00 dBm(802.11n_HT40)<br>14.39 dBm(802.11ac_VHT80) |
|                    |                                       | Antenna 1_Straddle                |                          | 8.87 dBm(802.11a)<br>9.05 dBm(802.11n_HT20)<br>4.69 dBm(802.11n_HT40)<br>-0.56 dBm(802.11ac_VHT80)    |
|                    |                                       | Antenna 2                         |                          | 14.31 dBm(802.11a)<br>14.01 dBm(802.11n_HT20)<br>13.63 dBm(802.11n_HT40)<br>13.07 dBm(802.11ac_VHT80) |
|                    |                                       | Antenna 2_Straddle                |                          | 7.52 dBm(802.11a)<br>7.72 dBm(802.11n_HT20)<br>2.92 dBm(802.11n_HT40)<br>-2.64 dBm(802.11ac_VHT80)    |



|                    |                                       |                                   |                          |   |
|--------------------|---------------------------------------|-----------------------------------|--------------------------|---|
| RF OUTPUT<br>POWER | WLAN<br>5 725 MHz ~<br>5 850 MHz Band | Multiple<br>Transmit              | Antenna 1                | 12.57 dBm(802.11n_HT20)<br>11.97 dBm(802.11n_HT40)<br>10.44 dBm(802.11ac_VHT80) |
|                    |                                       |                                   | Antenna 2                | 11.25 dBm(802.11n_HT20)<br>11.03 dBm(802.11n_HT40)<br>9.05 dBm(802.11ac_VHT80)  |
|                    |                                       |                                   | Antenna 1<br>+ Antenna 2 | 14.92 dBm(802.11n_HT20)<br>14.54 dBm(802.11n_HT40)<br>12.81 dBm(802.11ac_VHT80) |
|                    |                                       | Multiple<br>Transmit<br>_Straddle | Antenna 1                | 5.84 dBm(802.11n_HT20)<br>1.19 dBm(802.11n_HT40)<br>-2.93 dBm(802.11ac_VHT80)   |
|                    |                                       |                                   | Antenna 2                | 4.86 dBm(802.11n_HT20)<br>0.04 dBm(802.11n_HT40)<br>-5.19 dBm(802.11ac_VHT80)   |
|                    |                                       |                                   | Antenna 1<br>+ Antenna 2 | 8.39 dBm(802.11n_HT20)<br>3.66 dBm(802.11n_HT40)<br>-0.90 dBm(802.11ac_VHT80)   |

| ANTENNA TYPE | SLOT Antenna  |                          |           |  |
|--------------|---|--------------------------|-----------|--|
| ANTENNA GAIN | Bluetooth   | -0.71 dBi                |           |  |
|              | WLAN 2.4 GHz  | Antenna 1                | -0.71 dBi |  |
|              |   | Antenna 2                | 1.11 dBi  |  |
|              |   | Multiple Transmit        | 3.30 dBi  |  |
|              | 5 150 MHz ~<br>5 250 MHz Band                         | Antenna 1                | 2.48 dBi  |  |
|              |   | Antenna 2                | 0.71 dBi  |  |
|              |   | Multiple Transmit        | 4.69 dBi  |  |
|              | 5 250 MHz ~<br>5 350 MHz Band                         | Antenna 1                | 2.48 dBi  |  |
|              |   | Antenna 2                | 0.71 dBi  |  |
|              |   | Multiple Transmit        | 4.69 dBi  |  |
|              | 5 470 MHz ~<br>5 725 MHz Band                         | Antenna 1                | 2.78 dBi  |  |
|              |   | Antenna 2                | 0.51 dBi  |  |
|              |   | Multiple Transmit        | 4.80 dBi  |  |
|              | 5 725 MHz ~<br>5 850 MHz Band                         | Antenna 1                | 2.32 dBi  |  |
|              |   | Antenna 2                | 1.02 dBi  |  |
|              |   | Multiple Transmit        | 4.73 dBi  |  |
|              | List of each Osc. or crystal<br>Freq.(Freq. >= 1 MHz) | 48 MHz, 27 MHz, 38.4 MHz |           |  |

**2.2 Alternative type(s)/model(s); also covered by this test report.**

-. The following lists consist of the added model and their differences.

| Model Name | Differences   | Tested                              |
|------------|---|-------------------------------------|
| AN-VC22PR  | Basic Model   | <input checked="" type="checkbox"/> |
| HL-GE1     | This model is identical to the basic model except for the model name. | <input type="checkbox"/>            |

Note: 1. Applicant consigns only basic model to test. Therefore, this test report just guarantees the units, which have been tested.

2. The Applicant/manufacturer is responsible for the compliance of all variants.

**3. EUT MODIFICATIONS**

-. None

## 4. MAXIMUM PERMISSIBLE EXPOSURE

### 4.1 RF Exposure Calculation

According to the FCC rule 1.1310 table 1B, the limit for the maximum permissible RF exposure for an uncontrolled environment are  $f/1500$  mW/cm<sup>2</sup> for the frequency range between 300 MHz and 1 500 MHz and 1.0 mW/cm<sup>2</sup> for the frequency range between 1 500 MHz and 100 000 MHz.

The electric field generated for a 1 mW/cm<sup>2</sup> exposure is calculated as follows:

$$E = \sqrt{(30 * P * G) / d}, \text{ and } S = E^2 / Z = E^2 / 377, \text{ because } 1 \text{ mW/cm}^2 = 10 \text{ W/m}^2$$

Where

S = Power density in mW/cm<sup>2</sup>, Z = Impedance of free space, 377 Ω

E = Electric field strength in V/m, G = Numeric antenna gain, and d = distance in meter

Combining equations and rearranging the terms to express the distance as a function of the remaining variable

$$d = \sqrt{(30 * P * G) / (377 * 10 S)}$$

Changing to units of mW and cm, using P (mW) = P (W) / 1 000, d (cm) = 0.01 \* d (m)

$$d = 0.282 * \sqrt{(P * G) / S}$$

Where

d = distance in cm, P = Power in mW, G = Numeric antenna gain, and S = Power density in mW/cm<sup>2</sup>

### 4.2 EUT Description

|                             |  |
|-----------------------------|--|
| Kind of EUT                 | Network Webcam   |
| Device Category             | <input type="checkbox"/> Portable (< 20 cm separation)<br><input type="checkbox"/> Mobile (> 20 cm separation)<br><input checked="" type="checkbox"/> Others |
| Exposure Evaluation Applied | <input checked="" type="checkbox"/> MPE<br><input type="checkbox"/> SAR<br><input type="checkbox"/> N/A  |

### 4.3 Calculated MPE Safe Distance

#### 4.3.1 Bluetooth

According to above equation, the following result was obtained.

| Operating Freq. Band (MHz) | Operating Mode | Target Power W/tolerance (dBm) | Max tune up power |      | Antenna Gain |        | Safe Distance (cm) | Power Density (mW/cm <sup>2</sup> ) @ 20 cm Separation | Limit (mW/cm <sup>2</sup> ) |
|----------------------------|----------------|--------------------------------|-------------------|------|--------------|--------|--------------------|--|-----------------------------|
|                            |                |                                | (dBm)             | (mW) | Log          | Linear |                    |  |                             |
| 2 402 ~ 2 480              | 1 Mbps         | 8.01 ± 1.0                     | 9.01              | 7.96 | -0.71        | 0.85   | 0.73               | 0.001 3  | 1.00                        |
|                            | 2 Mbps         | 7.60 ± 1.0                     | 8.60              | 7.24 |              |        | 0.70               | 0.001 2  | 1.00                        |
|                            | 3 Mbps         | 7.89 ± 1.0                     | 8.89              | 7.74 |              |        | 0.72               | 0.001 3  | 1.00                        |

According to above table, for 2 402 ~ 2480 MHz Band(1 Mbps), safe distance,

$$D = 0.282 * \sqrt{(7.96 * 0.85)/1.00} = 0.73 \text{ cm.}$$

For getting power density at 20 cm separation in above table, following formula was used.

$$S = P * G / (4\pi * R^2) = 7.96 * 0.85 / (4 * \pi * 20^2) = 0.001 3$$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

### 4.3.2 WLAN

#### 4.3.2.1 DATA for Antenna 1

According to above equation, the following result was obtained.

| Operating Freq. Band (MHz) | Operating Mode | Target Power W/tolerance (dBm) | Max tune up power |       | Antenna Gain |        | Safe Distance (cm) | Power Density (mW/cm <sup>2</sup> ) @ 20 cm Separation | Limit (mW/cm <sup>2</sup> ) |
|----------------------------|----------------|--------------------------------|-------------------|-------|--------------|--------|--------------------|--|-----------------------------|
|                            |                |                                | (dBm)             | (mW)  | Log          | Linear |                    |  |                             |
| 2 400 ~ 2 483.5            | 802.11b        | 17.75 ± 1.0                    | 18.75             | 74.99 | -0.71        | 0.76   | 2.25               | 0.012 7  | 1                           |
|                            | 802.11g        | 15.27 ± 1.0                    | 16.27             | 42.36 |              |        | 1.69               | 0.007 2  | 1                           |
|                            | 802.11n_HT20   | 14.52 ± 1.0                    | 15.52             | 35.65 |              |        | 1.55               | 0.006 0  | 1                           |
|                            | 802.11n_HT40   | 14.54 ± 1.0                    | 15.54             | 35.81 |              |        | 1.56               | 0.006 0  | 1                           |
| 5 150 ~ 5 250              | 802.11a        | 16.73 ± 1.0                    | 16.62             | 45.92 | 2.48         | 1.77   | 2.54               | 0.016 2  | 1                           |
|                            | 802.11n_HT20   | 16.62 ± 1.0                    | 15.84             | 38.37 |              |        | 2.32               | 0.013 5  | 1                           |
|                            | 802.11n_HT40   | 15.99 ± 1.0                    | 14.51             | 28.25 |              |        | 1.99               | 0.009 9  | 1                           |
|                            | 802.11ac80     | 14.35 ± 1.0                    | 11.45             | 13.96 |              |        | 1.40               | 0.004 9  | 1                           |
| 5 250 ~ 5 350              | 802.11a        | 17.43 ± 1.0                    | 18.43             | 69.66 | 2.48         | 1.77   | 3.13               | 0.024 5  | 1                           |
|                            | 802.11n_HT20   | 17.35 ± 1.0                    | 18.35             | 68.39 |              |        | 3.10               | 0.024 1  | 1                           |
|                            | 802.11n_HT40   | 13.64 ± 1.0                    | 14.64             | 29.11 |              |        | 2.02               | 0.010 3  | 1                           |
|                            | 802.11ac80     | 13.94 ± 1.0                    | 14.94             | 31.19 |              |        | 2.10               | 0.011 0  | 1                           |
| 5 470 ~ 5 725              | 802.11a        | 16.54 ± 1.0                    | 17.54             | 56.75 | 2.78         | 1.90   | 2.93               | 0.021 4  | 1                           |
|                            | 802.11n_HT20   | 16.21 ± 1.0                    | 17.21             | 52.60 |              |        | 2.82               | 0.019 8  | 1                           |
|                            | 802.11n_HT40   | 15.83 ± 1.0                    | 16.83             | 48.19 |              |        | 2.70               | 0.018 2  | 1                           |
|                            | 802.11ac80     | 14.47 ± 1.0                    | 15.47             | 35.24 |              |        | 2.31               | 0.013 3  | 1                           |
| 5 725 ~ 5 850              | 802.11a        | 15.92 ± 1.0                    | 16.92             | 49.20 | 2.32         | 1.71   | 2.58               | 0.016 7  | 1                           |
|                            | 802.11n_HT20   | 15.56 ± 1.0                    | 16.56             | 45.29 |              |        | 2.48               | 0.015 4  | 1                           |
|                            | 802.11n_HT40   | 15.00 ± 1.0                    | 16.00             | 39.81 |              |        | 2.32               | 0.013 5  | 1                           |
|                            | 802.11ac80     | 14.39 ± 1.0                    | 15.39             | 34.59 |              |        | 2.17               | 0.011 7  | 1                           |

According to above table, for 5 250 ~ 5 350 MHz Band(802.11 a), safe distance,

$$D = 0.282 * \sqrt{(69.66 * 1.77/1.00)} = 3.13 \text{ cm.}$$

For getting power density at 20 cm separation in above table, following formula was used.

$$S = P * G / (4\pi * R^2) = 69.66 * 1.77 / (4 * \pi * 20^2) = 0.024 5$$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

### 4.3.2.2 DATA for Antenna 2

According to above equation, the following result was obtained.

| Operating Freq. Band (MHz) | Operating Mode | Target Power W/tolerance (dBm) | Max tune up power |       | Antenna Gain |        | Safe Distance (cm) | Power Density (mW/cm <sup>2</sup> ) @ 20 cm Separation | Limit (mW/cm <sup>2</sup> ) |
|----------------------------|----------------|--------------------------------|-------------------|-------|--------------|--------|--------------------|--|-----------------------------|
|                            |                |                                | (dBm)             | (mW)  | Log          | Linear |                    |  |                             |
| 2 400 ~ 2 483.5            | 802.11b        | 18.81 ± 1.0                    | 19.81             | 95.72 | 1.11         | 1.29   | 3.14               | 0.024 6  | 1                           |
|                            | 802.11g        | 16.59 ± 1.0                    | 17.59             | 57.41 |              |        | 2.43               | 0.014 7  | 1                           |
|                            | 802.11n_HT20   | 15.56 ± 1.0                    | 16.56             | 45.29 |              |        | 2.16               | 0.011 6  | 1                           |
|                            | 802.11n_HT40   | 16.44 ± 1.0                    | 17.44             | 55.46 |              |        | 2.39               | 0.014 2  |                             |
| 5 150 ~ 5 250              | 802.11a        | 15.77 ± 1.0                    | 15.66             | 36.81 | 0.71         | 1.18   | 1.86               | 0.008 6  | 1                           |
|                            | 802.11n_HT20   | 15.62 ± 1.0                    | 14.84             | 30.48 |              |        | 1.69               | 0.007 1  | 1                           |
|                            | 802.11n_HT40   | 15.13 ± 1.0                    | 13.65             | 23.17 |              |        | 1.47               | 0.005 4  | 1                           |
|                            | 802.11ac80     | 12.96 ± 1.0                    | 10.06             | 10.14 |              |        | 0.97               | 0.002 4  | 1                           |
| 5 250 ~ 5 350              | 802.11a        | 16.61 ± 1.0                    | 17.61             | 57.68 | 0.71         | 1.18   | 2.32               | 0.013 5  | 1                           |
|                            | 802.11n_HT20   | 16.41 ± 1.0                    | 17.41             | 55.08 |              |        | 2.27               | 0.012 9  | 1                           |
|                            | 802.11n_HT40   | 13.35 ± 1.0                    | 14.35             | 27.23 |              |        | 1.60               | 0.006 4  | 1                           |
|                            | 802.11ac80     | 12.73 ± 1.0                    | 13.73             | 23.60 |              |        | 1.49               | 0.005 5  | 1                           |
| 5 470 ~ 5 725              | 802.11a        | 15.22 ± 1.0                    | 16.22             | 41.88 | 0.51         | 1.12   | 1.94               | 0.009 4  | 1                           |
|                            | 802.11n_HT20   | 15.10 ± 1.0                    | 16.10             | 40.74 |              |        | 1.91               | 0.009 1  | 1                           |
|                            | 802.11n_HT40   | 15.08 ± 1.0                    | 16.08             | 40.55 |              |        | 1.90               | 0.009 1  | 1                           |
|                            | 802.11ac80     | 13.63 ± 1.0                    | 14.63             | 29.04 |              |        | 1.61               | 0.006 5  | 1                           |
| 5 725 ~ 5 850              | 802.11a        | 14.31 ± 1.0                    | 15.31             | 33.96 | 1.02         | 1.26   | 1.85               | 0.008 5  | 1                           |
|                            | 802.11n_HT20   | 14.01 ± 1.0                    | 15.01             | 31.70 |              |        | 1.79               | 0.008 0  | 1                           |
|                            | 802.11n_HT40   | 13.63 ± 1.0                    | 14.63             | 29.04 |              |        | 1.71               | 0.007 3  | 1                           |
|                            | 802.11ac80     | 13.07 ± 1.0                    | 14.07             | 25.53 |              |        | 1.60               | 0.006 4  | 1                           |

According to above table, for 2 400 ~ 2 480 MHz Band(802.11 b), safe distance,

$$D = 0.282 * \sqrt{(95.72 * 1.29)/1.00} = 3.14 \text{ cm.}$$

For getting power density at 20 cm separation in above table, following formula was used.

$$S = P * G / (4\pi * R^2) = 95.72 * 1.29 / (4 * \pi * 20^2) = 0.024 6$$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

### 4.3.2.3 DATA for Multiple Transmit

#### 4.3.2.3.1 DATA for Antenna 1

According to above equation, the following result was obtained.

| Operating Freq. Band (MHz) | Operating Mode | Target Power W/tolerance (dBm) | Max tune up power |       | Antenna Gain |        | Safe Distance (cm) | Power Density (mW/cm <sup>2</sup> ) @ 20 cm Separation | Limit (mW/cm <sup>2</sup> ) |
|----------------------------|----------------|--------------------------------|-------------------|-------|--------------|--------|--------------------|--|-----------------------------|
|                            |                |                                | (dBm)             | (mW)  | Log          | Linear |                    |  |                             |
| 2 400 ~ 2 483.5            | 802.11n_HT20   | 11.57 ± 1.0                    | 12.57             | 18.07 | -0.71        | 0.85   | 1.10               | 0.003 1  | 1                           |
|                            | 802.11n_HT40   | 12.02 ± 1.0                    | 13.02             | 20.04 |              |        | 1.16               | 0.003 4  | 1                           |
| 5 150 ~ 5 250              | 802.11n_HT20   | 13.48 ± 1.0                    | 14.48             | 28.05 | 2.48         | 1.77   | 1.99               | 0.009 9  | 1                           |
|                            | 802.11n_HT40   | 13.01 ± 1.0                    | 14.01             | 25.18 |              |        | 1.88               | 0.008 9  | 1                           |
|                            | 802.11ac80     | 11.60 ± 1.0                    | 12.60             | 18.20 |              |        | 1.60               | 0.006 4  | 1                           |
| 5 250 ~ 5 350              | 802.11n_HT20   | 14.26 ± 1.0                    | 15.26             | 33.57 | 2.48         | 1.77   | 2.17               | 0.011 8  | 1                           |
|                            | 802.11n_HT40   | 13.26 ± 1.0                    | 14.26             | 26.67 |              |        | 1.94               | 0.009 4  | 1                           |
|                            | 802.11ac80     | 11.76 ± 1.0                    | 12.76             | 18.88 |              |        | 1.63               | 0.006 6  | 1                           |
| 5 470 ~ 5 725              | 802.11n_HT20   | 13.19 ± 1.0                    | 14.19             | 26.24 | 2.78         | 1.90   | 1.99               | 0.009 9  | 1                           |
|                            | 802.11n_HT40   | 12.61 ± 1.0                    | 13.61             | 22.96 |              |        | 1.86               | 0.008 7  | 1                           |
|                            | 802.11ac80     | 11.54 ± 1.0                    | 12.54             | 17.95 |              |        | 1.65               | 0.006 8  | 1                           |
| 5 725 ~ 5 850              | 802.11n_HT20   | 12.57 ± 1.0                    | 13.57             | 22.75 | 2.32         | 1.71   | 1.76               | 0.007 7  | 1                           |
|                            | 802.11n_HT40   | 11.97 ± 1.0                    | 12.97             | 19.82 |              |        | 1.64               | 0.006 7  | 1                           |
|                            | 802.11ac80     | 10.44 ± 1.0                    | 11.44             | 13.93 |              |        | 1.37               | 0.004 7  | 1                           |

According to above table, for 5 250 ~ 5 350 MHz Band(802.11 a), safe distance,

$$D = 0.282 * \sqrt{(33.57 * 1.18)/1.00} = 2.17 \text{ cm.}$$

For getting power density at 20 cm separation in above table, following formula was used.

$$S = P * G / (4\pi * R^2) = 33.57 * 1.18 / (4 * \pi * 20^2) = 0.011 8$$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna



### 4.3.2.3.2 DATA for Antenna 2

According to above equation, the following result was obtained.

| Operating Freq. Band (MHz) | Operating Mode | Target Power W/tolerance (dBm) | Max tune up power |       | Antenna Gain |        | Safe Distance (cm) | Power Density (mW/cm <sup>2</sup> ) @ 20 cm Separation | Limit (mW/cm <sup>2</sup> ) |
|----------------------------|----------------|--------------------------------|-------------------|-------|--------------|--------|--------------------|--|-----------------------------|
|                            |                |                                | (dBm)             | (mW)  | Log          | Linear |                    |  |                             |
| 2 400 ~ 2 483.5            | 802.11n_HT20   | 12.90 ± 1.0                    | 13.90             | 24.55 | 1.11         | 1.29   | 1.59               | 0.006 3  | 1                           |
|                            | 802.11n_HT40   | 13.22 ± 1.0                    | 14.22             | 26.42 |              |        | 1.65               | 0.006 8  | 1                           |
| 5 150 ~ 5 250              | 802.11n_HT20   | 12.61 ± 1.0                    | 13.61             | 22.96 | 0.71         | 1.18   | 1.47               | 0.005 4  | 1                           |
|                            | 802.11n_HT40   | 12.07 ± 1.0                    | 13.07             | 20.28 |              |        | 1.38               | 0.004 8  | 1                           |
|                            | 802.11ac80     | 10.25 ± 1.0                    | 11.25             | 13.34 |              |        | 1.12               | 0.003 1  | 1                           |
| 5 250 ~ 5 350              | 802.11n_HT20   | 13.65 ± 1.0                    | 14.65             | 29.17 | 0.71         | 1.18   | 1.65               | 0.006 8  | 1                           |
|                            | 802.11n_HT40   | 12.93 ± 1.0                    | 13.93             | 24.72 |              |        | 1.52               | 0.005 8  | 1                           |
|                            | 802.11ac80     | 10.67 ± 1.0                    | 11.67             | 14.69 |              |        | 1.17               | 0.003 4  | 1                           |
| 5 470 ~ 5 725              | 802.11n_HT20   | 12.27 ± 1.0                    | 13.27             | 21.23 | 0.51         | 1.12   | 1.38               | 0.004 8  | 1                           |
|                            | 802.11n_HT40   | 12.00 ± 1.0                    | 13.00             | 19.95 |              |        | 1.34               | 0.004 5  | 1                           |
|                            | 802.11ac80     | 10.54 ± 1.0                    | 11.54             | 14.26 |              |        | 1.13               | 0.003 2  | 1                           |
| 5 725 ~ 5 850              | 802.11n_HT20   | 11.25 ± 1.0                    | 12.25             | 16.79 | 1.02         | 1.26   | 1.30               | 0.004 2  | 1                           |
|                            | 802.11n_HT40   | 11.03 ± 1.0                    | 12.03             | 15.96 |              |        | 1.27               | 0.004 0  | 1                           |
|                            | 802.11ac80     | 9.05 ± 1.0                     | 10.05             | 10.12 |              |        | 1.01               | 0.002 5  | 1                           |

According to above table, for 5 250 ~ 5 350 MHz Band(802.11 a), safe distance,

$$D = 0.282 * \sqrt{(29.17 * 1.18)/1.00} = 1.65 \text{ cm.}$$

For getting power density at 20 cm separation in above table, following formula was used.

$$S = P * G / (4\pi * R^2) = 29.17 * 1.18 / (4 * \pi * 20^2) = 0.006 8$$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

### 4.3.2.3.3 DATA for Antenna 1 + Antenna 2

According to above equation, the following result was obtained.

| Operating Freq. Band (MHz) | Operating Mode | Target Power W/tolerance (dBm) | Max tune up power |       | Power Density (mW/cm <sup>2</sup> ) @ 20 cm Separation | Sum Power Density (mW/cm <sup>2</sup> ) @ 20 cm Separation | Limit (mW/cm <sup>2</sup> ) |
|----------------------------|----------------|--------------------------------|-------------------|-------|--|--|-----------------------------|
|                            |                |                                | (dBm)             | (mW)  |  |  |                             |
| 2 400 ~ 2 483.5            | 802.11n_HT20   | 11.57 ± 1.0                    | 12.57             | 18.07 | 0.003 1  | 0.009 4  | 1                           |
|                            |                | 12.90 ± 1.0                    | 13.90             | 24.55 | 0.006 3  |  |                             |
|                            | 802.11n_HT40   | 12.02 ± 1.0                    | 13.02             | 20.04 | 0.003 4  | 0.010 2  | 1                           |
|                            |                | 13.22 ± 1.0                    | 14.22             | 26.42 | 0.006 8  |  |                             |
| 5 150 ~ 5 250              | 802.11n_HT20   | 13.48 ± 1.0                    | 14.48             | 28.05 | 0.009 9  | 0.015 3  | 1                           |
|                            |                | 12.61 ± 1.0                    | 13.61             | 22.96 | 0.005 4  |  |                             |
|                            | 802.11n_HT40   | 13.01 ± 1.0                    | 14.01             | 25.18 | 0.008 9  | 0.013 6  | 1                           |
|                            |                | 12.07 ± 1.0                    | 13.07             | 20.28 | 0.004 8  |  |                             |
|                            | 802.11ac80     | 11.60 ± 1.0                    | 12.60             | 18.20 | 0.006 4  | 0.009 5  | 1                           |
|                            |                | 10.25 ± 1.0                    | 11.25             | 13.34 | 0.003 1  |  |                             |
| 5 250 ~ 5 350              | 802.11n_HT20   | 14.26 ± 1.0                    | 15.26             | 33.57 | 0.011 8  | 0.018 7  | 1                           |
|                            |                | 13.65 ± 1.0                    | 14.65             | 29.17 | 0.006 8  |  |                             |
|                            | 802.11n_HT40   | 13.26 ± 1.0                    | 14.26             | 26.67 | 0.009 4  | 0.015 2  | 1                           |
|                            |                | 12.93 ± 1.0                    | 13.93             | 24.72 | 0.005 8  |  |                             |
|                            | 802.11ac80     | 11.76 ± 1.0                    | 12.76             | 18.88 | 0.006 6  | 0.010 1  | 1                           |
|                            |                | 10.67 ± 1.0                    | 11.67             | 14.69 | 0.003 4  |  |                             |
| 5 470 ~ 5 725              | 802.11n_HT20   | 13.19 ± 1.0                    | 14.19             | 26.24 | 0.009 9  | 0.014 7  | 1                           |
|                            |                | 12.27 ± 1.0                    | 13.27             | 21.23 | 0.004 8  |  |                             |
|                            | 802.11n_HT40   | 12.61 ± 1.0                    | 13.61             | 22.96 | 0.008 7  | 0.013 1  | 1                           |
|                            |                | 12.00 ± 1.0                    | 13.00             | 19.95 | 0.004 5  |  |                             |
|                            | 802.11ac80     | 11.54 ± 1.0                    | 12.54             | 17.95 | 0.006 8  | 0.010 0  | 1                           |
|                            |                | 10.54 ± 1.0                    | 11.54             | 14.26 | 0.003 2  |  |                             |
| 5 725 ~ 5 850              | 802.11n_HT20   | 12.57 ± 1.0                    | 13.57             | 22.75 | 0.007 7  | 0.011 9  | 1                           |
|                            |                | 11.25 ± 1.0                    | 12.25             | 16.79 | 0.004 2  |  |                             |
|                            | 802.11n_HT40   | 11.97 ± 1.0                    | 12.97             | 19.82 | 0.006 7  | 0.010 7  | 1                           |
|                            |                | 11.03 ± 1.0                    | 12.03             | 15.96 | 0.004 0  |  |                             |
|                            | 802.11ac80     | 10.44 ± 1.0                    | 11.44             | 13.93 | 0.004 7  | 0.007 3  | 1                           |
|                            |                | 9.05 ± 1.0                     | 10.05             | 10.12 | 0.002 5  |  |                             |

5 250 ~ 5 350 MHz Band(802.11n\_HT20), = (0.011 8/1) + (0.006 8/1) = 0.018 7

### 4.3.3 Intermodulation Transmit

According to above equation, the following result was obtained.

| Operating Freq. Band (MHz) | Operating Mode                   | Target Power W/tolerance (dBm) | Max tune up power |       | Power Density (mW/cm <sup>2</sup> ) @ 20 cm Separation | Sum Power Density (mW/cm <sup>2</sup> ) @ 20 cm Separation | Limit (mW/cm <sup>2</sup> ) |
|----------------------------|----------------------------------|--------------------------------|-------------------|-------|--|--|-----------------------------|
|                            |                                  |                                | (dBm)             | (mW)  |  |  |                             |
| Bluetooth + WLAN 2G        | Bluetooth (1 Mbps)               | 8.01 ± 1.0                     | 9.01              | 7.96  | 0.001 3  | 0.025 9  | 1.00                        |
|                            | WLAN 2 G (802.11b_Ant 2)         | 18.81 ± 1.0                    | 19.81             | 95.72 | 0.024 6  |  |                             |
| Bluetooth + WLAN 5G        | Bluetooth (1 Mbps)               | 8.01 ± 1.0                     | 9.01              | 7.96  | 0.001 3  | 0.014 8  | 1.00                        |
|                            | WLAN 5 G (UNII 2A 802.11a Ant 2) | 16.61 ± 1.0                    | 17.61             | 57.68 | 0.013 5  |  |                             |
| WLAN 2 G + WLAN 5 G        | WLAN 2 G (802.11b_Ant 2)         | 18.81 ± 1.0                    | 19.81             | 95.72 | 0.024 6  | 0.049 1  | 1.00                        |
|                            | WLAN 5 G (UNII 2A 802.11a Ant 1) | 17.43 ± 1.0                    | 18.43             | 69.66 | 0.024 5  |  |                             |