# **FCC RF Test Report**

APPLICANT : HMD Global Oy

**EQUIPMENT**: GSM/WCDMA/LTE Mobile Phone

BRAND NAME : Nokia MODEL NAME : TA-1093

FCC ID : 2AJOTTA-1093

STANDARD : FCC Part 15 Subpart C §15.247

CLASSIFICATION : (DTS) Digital Transmission System

The product testing was completed on May 25, 2018. We, Sporton International (Kunshan) Inc., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International (Kunshan) Inc., the test report shall not be reproduced except in full.

James Huarg

Approved by: James Huang / Manager



# Sporton International (Kunshan) Inc.

No.3-2 Ping-Xiang Rd, Kunshan Development Zone Kunshan City Jiangsu Province 215335 China

Sporton International (Kunshan) Inc.

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Report No.: FR832104-01C

Report Issued Date : Jun. 13, 2018
Report Version : Rev. 01

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# **REVISION HISTORY**

Report No. : FR832104-01C

| REPORT NO.   | VERSION | DESCRIPTION             | ISSUED DATE   |
|--------------|---------|-------------------------|---------------|
| FR832104-01C | Rev. 01 | Initial issue of report | Jun. 13, 2018 |
|              |         |                         |               |
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# **SUMMARY OF TEST RESULT**

| Report<br>Section | FCC Rule     | Description                 | Limit       | Result | Remark                                  |
|-------------------|--------------|-----------------------------|-------------|--------|---|
| 3.1               | 15.247(a)(2) | 6dB Bandwidth               | ≥ 0.5MHz    | Pass   | -                                       |
| 3.1               | -            | 99% Bandwidth               | -           | Pass   | -                                       |
| 3.2               | 15.247(b)    | Power Output Measurement    | ≤ 30dBm     | Pass   | -                                       |
| 3.3 15.247(e)     |              | Power Spectral Density      | ≤ 8dBm/3kHz | Pass   | -                                       |
| 0.4               | 15.247(d)    | Conducted Band Edges        | < 20 dD a   | Pass   | -                                       |
| 3.4               |              | Conducted Spurious Emission | ≤ 20dBc     | Pass   | -                                       |
| 0.5               | 15.247(d)    | Radiated Band Edges and     | 15.209(a) & | Dave   | Under limit                             |
| 3.5               |              | Radiated Spurious Emission  | 15.247(d)   | Pass   | 0.28 dB at<br>2483.560 MHz              |
| 3.6               | 15.207       | AC Conducted Emission       | 15.207(a)   | Pass   | Under limit<br>10.89 dB at<br>3.399 MHz |
| 3.7               | 15.203 &     |                             | N/A         | Pass   |   |
| 3.1               | 15.247(b)    |                             |             | Pass   | -                                       |

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# 1 General Description

# 1.1 Applicant

**HMD Global Oy** 

Karaportti 2 02610 Espoo FINLAND

### 1.2 Manufacturer

**HMD Global Oy** 

Karaportti 2 02610 Espoo FINLAND

# 1.3 Product Feature of Equipment Under Test

|                                  | Product Feature                         |
|----------------------------------|---|
| Equipment                        | GSM/WCDMA/LTE Mobile Phone              |
| Brand Name                       | Nokia                                   |
| Model Name                       | TA-1093                                 |
| FCC ID                           | 2AJOTTA-1093                            |
|                                  | GSM/GPRS/EGPRS/WCDMA/HSPA/LTE           |
| ELIT cumparts Badica application | WLAN 2.4GHz 802.11b/g/n HT20/HT40       |
| EUT supports Radios application  | Bluetooth v3.0 + EDR/Bluetooth v4.0 LE/ |
|                                  | Bluetooth v4.1 LE/Bluetooth v4.2 LE     |
| HW Version                       | HW0343                                  |
| SW Version                       | 000C_0_146                              |
| EUT Stage                        | Identical Prototype                     |

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### Remark:

- 1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
- 2. This project is FCC change ID application (original report FCC ID: 2AJOTTA-1084) and changed dual SIM card slot to single SIM card slots, changed Model Name and HW Version. Since the test result is not affected by the changes, so all the test results release from original report which can be referred to Sporton report number FR832104C, FCC ID: 2AJOTTA-1084.

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# 1.4 Product Specification of Equipment Under Test

| Standards-related Product Specification |   |  |  |  |
|---|---|--|--|--|
| Tx/Rx Channel Frequency Range           | 2412 MHz ~ 2462 MHz                           |  |  |  |
|   | 802.11b : 18.18 dBm (0.0658 W)                |  |  |  |
| Maximum (Peak) Output Power to          | 802.11g : 23.18 dBm (0.2080 W)                |  |  |  |
| antenna                                 | 802.11n HT20 : 23.04 dBm (0.2014 W)           |  |  |  |
|   | 802.11n HT40 : 23.29 dBm (0.2133 W)           |  |  |  |
|   | 802.11b : 12.39MHz                            |  |  |  |
| 00% Occupied Bandwidth                  | 802.11g : 19.03MHz                            |  |  |  |
| 99% Occupied Bandwidth                  | 802.11n HT20 : 20.03MHz                       |  |  |  |
|   | 802.11n HT40 : 36.96MHz                       |  |  |  |
| Antenna Type / Gain                     | PIFA Antenna with gain -3.00 dBi              |  |  |  |
| Type of Medulation                      | 802.11b: DSSS (DBPSK / DQPSK / CCK)           |  |  |  |
| Type of Modulation                      | 802.11g/n: OFDM (BPSK / QPSK / 16QAM / 64QAM) |  |  |  |

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# 1.5 Modification of EUT

No modifications are made to the EUT during all test items.

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# 1.6 Testing Location

Sporton International (Kunshan) Inc. is accredited to ISO 17025 by National Voluntary Laboratory Accreditation Program (NVLAP code: 600155-0) and the FCC designation No. is CN5013.

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| Test Site          | Sporton International (Kunshan) Inc.  |  |   |  |  |
|--------------------|---|--|---|--|--|
| Test Site Location | No.3-2 Ping-Xiang Rd, Kunshan Development Zone Kunshan City Jiangsu Province 215335 China TEL: +86-512-57900158 FAX: +86-512-57900958 |  |   |  |  |
| Test Site No.      | Sporton Site No.  TH01-KS 03CH04-KS CO01-KS   |  | FCC Test Firm  Registration No.  630927 |  |  |

Note: The test site complies with ANSI C63.4 2014 requirement.

# 1.7 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart C §15.247
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04
- ANSI C63.10-2013

### Remark:

- All test items were verified and recorded according to the standards and without any deviation during the test.
- 2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

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# 2 Test Configuration of Equipment Under Test

a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (X plane) were recorded in this report.

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b. AC power line Conducted Emission was tested under maximum output power.

# 2.1 Carrier Frequency and Channel

| Frequency Band   | Channel | Freq.<br>(MHz) | Channel | Freq.<br>(MHz) |
|------------------|---------|----------------|---------|----------------|
|                  | 1       | 2412           | 7       | 2442           |
|                  | 2       | 2417           | 8       | 2447           |
| 0400 0400 F MILE | 3       | 2422           | 9       | 2452           |
| 2400-2483.5 MHz  | 4       | 2427           | 10      | 2457           |
|                  | 5       | 2432           | 11      | 2462           |
|                  | 6       | 2437           |         |                |

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# 2.2 Test Mode

Final test modes are considering the modulation and worse data rates as below table.

| Modulation   | Data Rate |
|--------------|-----------|
| 802.11b      | 1 Mbps    |
| 802.11g      | 6 Mbps    |
| 802.11n HT20 | MCS0      |
| 802.11n HT40 | MCS0      |

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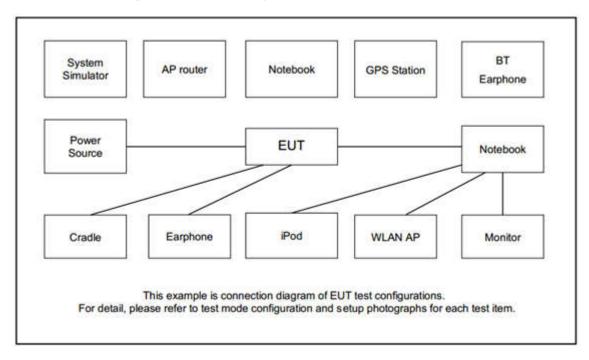
|   | Test Cases   |  |  |  |  |
|---|--|--|--|--|--|
| AC<br>Conducted<br>Emission   | Mode 1 :GSM850 Idle + Bluetooth Link + WLAN (2.4G) Link + Earphone + USB Cable (Charging from Adapter) |  |  |  |  |
| Remark: For Radiated Test Cases, The tests were performed with Adapter, Earphone and Cable. |  |  |  |  |  |

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# 2.3 Connection Diagram of Test System



# 2.4 Support Unit used in test configuration and system

| Item | Equipment             | Trade Name | Model Name | FCC ID      | Data Cable | Power Cord   |
|------|-----------------------|------------|------------|-------------|------------|--|
| 1.   | System Simulator      | Anritsu    | MT8820C    | N/A         | N/A        | Unshielded,1.8m  |
| 2.   | WLAN AP               | D-Link     | DIR-855    | KA2DIR855A2 | N/A        | Unshielded, 1.8 m  |
| 3.   | Bluetooth<br>Earphone | Lenovo     | LBH308     | N/A         | N/A        | N/A  |
| 4.   | Notebook              | Lenovo     | G480       | N/A         | N/A        | AC I/P:<br>Unshielded, 1.8 m<br>DC O/P:<br>Shielded, 1.8 m |

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# 2.5 EUT Operation Test Setup

For WLAN RF test items, an engineering test program was provided and enabled to make EUT continuously transmit/receive.

For AC power line conducted emissions, the EUT was set to connect with the WLAN AP under large package sizes transmission.

# 2.6 Measurement Results Explanation Example

### For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

### Example:

The spectrum analyzer offset is derived from RF cable loss.

Offset = RF cable loss .

Following shows an offset computation example with cable loss 5.8 dB.

 $Offset(dB) = RF \ cable \ loss(dB).$ 

= 5.8 (dB)

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### 3 Test Result

### 3.1 6dB and 99% Bandwidth Measurement

### 3.1.1 Limit of 6dB and 99% Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

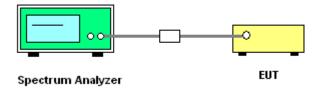
### 3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

### 3.1.3 Test Procedures

- 1. The testing follows FCC KDB Publication No. 558074 DTS D01 Meas. Guidance v04.
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
- 5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) = 1MHz and set the Video bandwidth (VBW) = 3MHz.
- 6. Measure and record the results in the test report.

### 3.1.4 Test Setup



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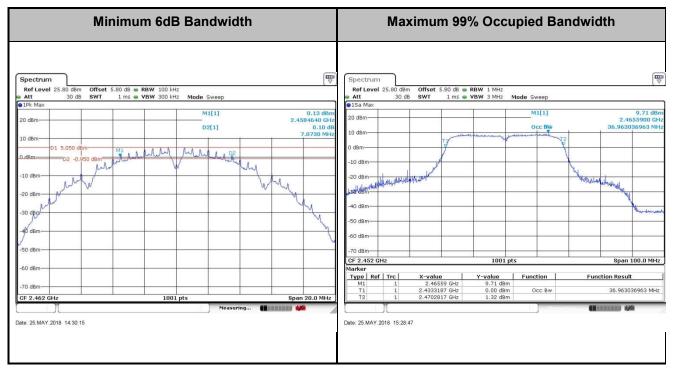
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### 3.1.5 Test Result of 6dB and 99% Occupied Bandwidth

Please refer to Appendix A.



Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

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# 3.2 Output Power Measurement

### 3.2.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm. If transmitting antenna with directional gain greater than 6dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

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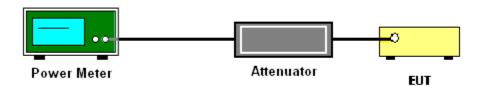
# 3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

### 3.2.3 Test Procedures

- 1. The testing follows the Measurement Procedure of FCC KDB No. 558074 DTS D01 Meas. Guidance v04 section 9.1.3 PKPM1 Peak power meter method.
- 2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Measure the conducted output power and record the results in the test report.

### 3.2.4 Test Setup



### 3.2.5 Test Result of Peak Output Power

Please refer to Appendix A.

### 3.2.6 Test Result of Average output Power (Reporting Only)

Please refer to Appendix A.

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# 3.3 Power Spectral Density Measurement

### 3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.

### 3.3.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

### 3.3.3 Test Procedures

- The testing follows Measurement Procedure 10.2 Method PKPSD of FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
- 5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
- 6. Measure and record the results in the test report.

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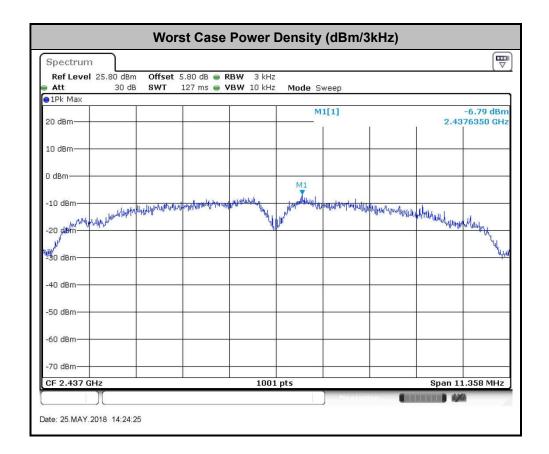
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### 3.3.4 Test Setup



# 3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.



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# 3.4 Conducted Band Edges and Spurious Emission Measurement

### 3.4.1 Limit of Conducted Band Edges and Spurious Emission Measurement

In any 100 kHz bandwidth outside of the authorized frequency band, the emissions which fall in the non-restricted bands shall be attenuated at least 20 dB / 30dB relative to the maximum PSD level in 100 kHz by RF conducted measurement.

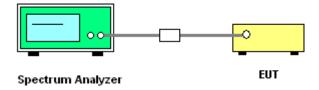
### 3.4.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

### 3.4.3 Test Procedures

- 1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04.
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).
- 5. Measure and record the results in the test report.
- 6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

### 3.4.4 Test Setup



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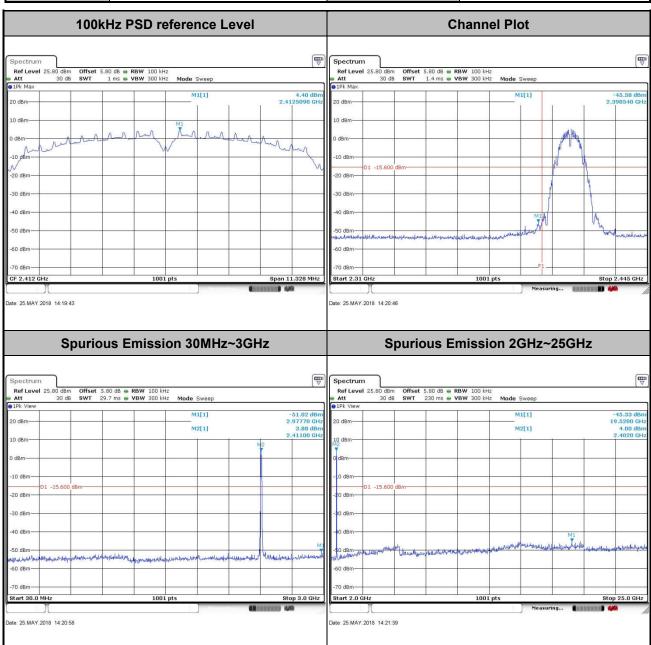
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# 3.4.5 Test Result of Conducted Band Edges and Spurious Emission

| Test Engineer : | Carry Nong  | Temperature :       | 22~23℃ |
|-----------------|-------------|---------------------|--------|
| rest Engineer.  | Garry Norig | Relative Humidity : | 41~44% |

Test Mode: 802.11b Test Channel: 01



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Test Mode: 802.11b Test Channel: 06 100kHz PSD reference Level **Channel Plot** 7.12 dB -40 dBm -50 dBm -60 dBm -70 dBm CF 2.437 GH: Date: 25.MAY.2018 14:24:40 Spurious Emission 30MHz~3GHz Spurious Emission 2GHz~25GHz Spectrum

Ref Level 25.80 dBm

Att 30 dB Spectrum Ref Level 25.80 dBm Att 30 dB M1[1] M1[1] M2[1] M2[1] 5.86 dBr .4250 GH 10 dBm

Start 2.0 GHz

late: 25.MAY.2018 14:27:10

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ate: 25.MAY.2018 14:26:26

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Test Mode : 802.11b

Test Channel : 11

100kHz PSD reference Level

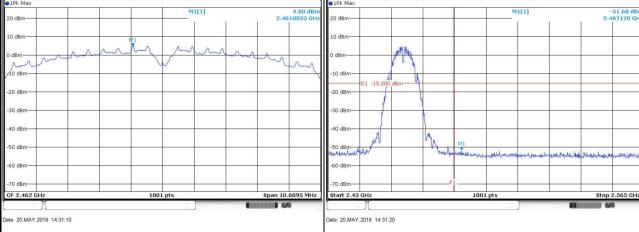
Channel Plot

Spectrum
Ref Level 25.80 dBm Offset 5.80 dB @ RBW 100 kHz
Att 30 dB SWT 1.1 ms @ VBW 300 kHz Mode Sweep

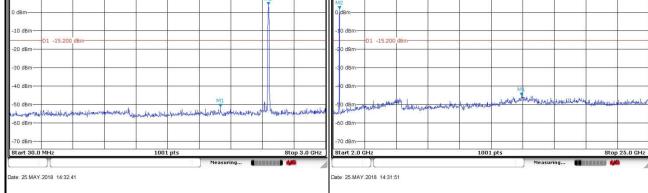
Ply Max

10 dBm M1[1]

1.10 dBm M1[



# Spectrum Ref Level 25.80 d8m Offset 5.80 d8 RBW 100 kHz Att 30 d8 SWT 29.7 ms VBW 300 kHz Mode Sweep P1Pk View 20 d8m M2[1] 3.76 d8m 01-15.200 d8m



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1.70 dBr 4710 GH Test Mode: 802.11g Test Channel: 01 100kHz PSD reference Level **Channel Plot** Spectrum 34.02 d -40 dBm -50 dBm -60 dBm CF 2.412 GH Start 2.31 G Date: 25.MAY.2018 14:39:55 late: 25.MAY.2018 14:40:40 Spurious Emission 30MHz~3GHz Spurious Emission 2GHz~25GHz Spectrum

Ref Level 25.80 dBm

Att 30 dB Ref Level 25.80 dBm Att 30 dB M1[1] M2[1] M2[1] 1.86 dBi 10 dBm

Start 2.0 GHz

late: 25.MAY.2018 14:42:35

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Start 30.0 MHz

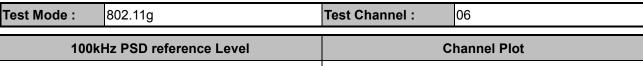
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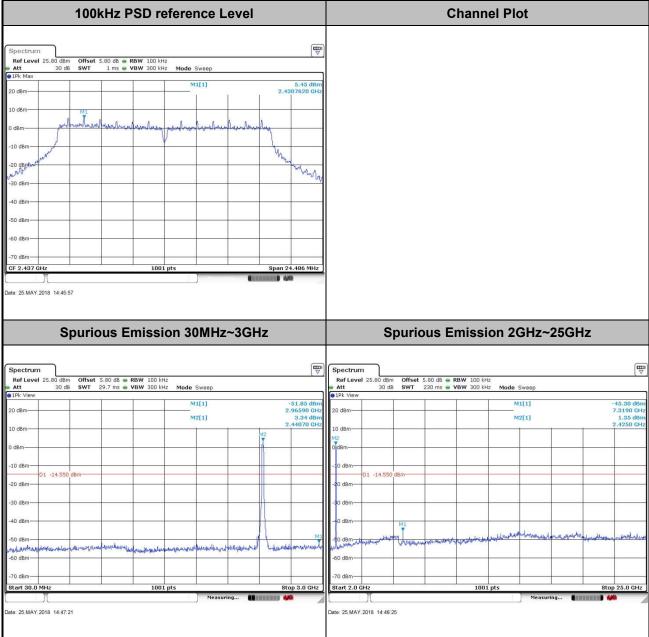
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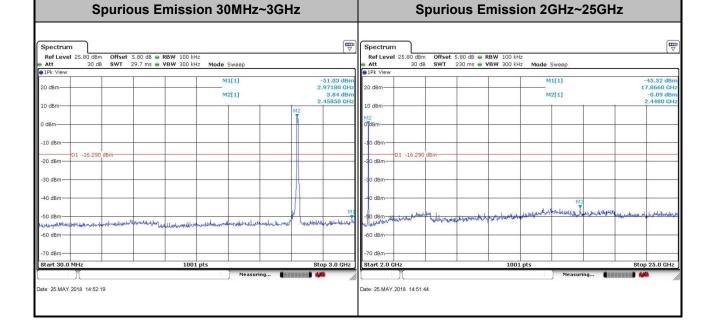
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Test Mode: 802.11g Test Channel: 11 100kHz PSD reference Level **Channel Plot** Spectrum 3.71 dB 2.4570100 G -40 dBm -50 dBm -60 dBm -70 dBm Span 24.486 MH CF 2.462 GH Start 2.43 G Date: 25.MAY.2018 14:50:59 late: 25.MAY.2018 14:51:09



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Test Mode: 802.11n HT20 Test Channel: 01 100kHz PSD reference Level **Channel Plot** Spectrum 1.72 dB HILL HILL 40 dBm -50 dBm -60 dBm CF 2.412 GH Start 2.31 G Date: 25.MAY.2018 14:58:28 late: 25.MAY.2018 14:59:31 Spurious Emission 30MHz~3GHz Spurious Emission 2GHz~25GHz Spectrum

Ref Level 25.80 dBm

Att 30 dB Ref Level 25.80 dBm Att 30 dB M1[1] -51.73 dB 2.95400 GI M2[1] M2[1] 0.29 dBi 2.41700 GH -1.30 dBr :.4020 GH 10 dBm -70 dBm

Start 2.0 GHz

late: 25.MAY.2018 15:00:44

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Start 30.0 MHz

ate: 25.MAY.2018 14:59:53

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Test Mode: 802.11n HT20 Test Channel: 06 100kHz PSD reference Level **Channel Plot** 5.31 dB 2.4307625 GF MANA -40 dBm -50 dBm -60 dBm -70 dBm CF 2.437 GH: Date: 25.MAY.2018 15:04:01 Spurious Emission 30MHz~3GHz Spurious Emission 2GHz~25GHz Spectrum

Ref Level 25.80 dBm

Att 30 dB Ref Level 25.80 dBm Att 30 dB -52.09 dBr 2.95990 GH 4.41 dBr 2.44370 GH M1[1] M1[1] M2[1] M2[1] 10 dBm 01 -14.69

Start 2.0 GHz

Date: 25.MAY.2018 15:04:26

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-60 dBm

Start 30.0 MHz

ate: 25.MAY.2018 15:04:13

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Test Mode: 802.11n HT20 Test Channel: 11 100kHz PSD reference Level **Channel Plot** Spectrum بيداليدلا -40 dBm -50 dBm -60 dBm Span 26.283 MH CF 2.462 GH Date: 25.MAY.2018 15:08:23 late: 25.MAY.2018 15:08:32 Spurious Emission 30MHz~3GHz Spurious Emission 2GHz~25GHz Spectrum

Ref Level 25.80 dBm

Att 30 dB Ref Level 25.80 dBm Att 30 dB -51.32 dBr 2.65730 GH 3.07 dBr 2.46740 GH -45.25 dBr 16.0960 GH -1.20 dBr 2.4480 GH M1[1] M2[1] M2[1] 10 dBm

Start 2.0 GHz

late: 25.MAY.2018 15:09:15

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-60 dBm

Start 30.0 MHz

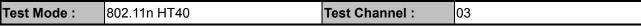
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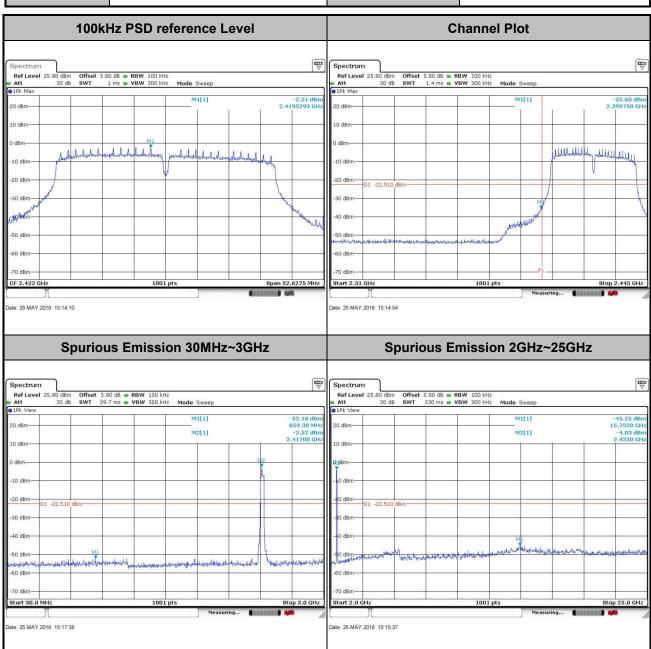
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Test Mode: 802.11n HT40 Test Channel: 06 100kHz PSD reference Level **Channel Plot** 39 dB/ Munder -40 dBm -50 dBm -60 dBm -70 dBm CF 2.437 GH: Date: 25.MAY.2018 15:21:25 Spurious Emission 30MHz~3GHz Spurious Emission 2GHz~25GHz Spectrum

Ref Level 25.80 dBm

Att 30 dB Spectrum Ref Level 25.80 dBm Att 30 dB -45.70 dBr 15.7520 GH 1.33 dBr 2.4250 GH M1[1] M1[1] M2[1] M2[1] 10 dBm

Start 2.0 GHz

late: 25.MAY.2018 15:21:54

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-70 dBm Start 30.0 MHz

ate: 25.MAY.2018 15:22:28

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Test Mode: 802.11n HT40 Test Channel: 09 100kHz PSD reference Level **Channel Plot** Spectrum Printelling with the Why Marley -40 dBm -50 dBm -60 dBm -70 dBm CF 2.452 GH Date: 25.MAY.2018 15:25:44 late: 25.MAY.2018 15:25:53 Spurious Emission 30MHz~3GHz Spurious Emission 2GHz~25GHz Spectrum Spectrum Ref Level 25.80 dBm Att 30 dB Ref Level 25.80 dBm Att 30 dB -51.90 dBn 966.50 MH 0.55 dBn 2.43810 GH -46.00 dBr 16.5330 GH 0.59 dBr 2.4480 GH M1[1] M2[1] M2[1] 10 dBm

Start 2.0 GHz

late: 25.MAY.2018 15:26:18

ate: 25.MAY.2018 15:26:49

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# 3.5 Radiated Band Edges and Spurious Emission Measurement

### 3.5.1 Limit of Radiated band edge and Spurious Emission Measurement

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

| Frequency     | Field Strength     | Measurement Distance |
|---------------|--------------------|----------------------|
| (MHz)         | (microvolts/meter) | (meters)             |
| 0.009 - 0.490 | 2400/F(kHz)        | 300                  |
| 0.490 – 1.705 | 24000/F(kHz)       | 30                   |
| 1.705 – 30.0  | 30                 | 30                   |
| 30 – 88       | 100                | 3                    |
| 88 – 216      | 150                | 3                    |
| 216 - 960     | 200                | 3                    |
| Above 960     | 500                | 3                    |

### 3.5.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

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### 3.5.3 Test Procedures

- The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04.
- 2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
- 3. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
- 4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
- 5. Corrected Reading: Antenna Factor + Cable Loss + Read Level Preamp Factor = Level
- 6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
- 7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
- 8. Use the following spectrum analyzer settings:
  - (1) Span shall wide enough to fully capture the emission being measured;
  - (2) Set RBW=100 kHz for f < 1 GHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold:
  - (3) Set RBW = 1 MHz, VBW= 3MHz for  $f \ge 1$  GHz for peak measurement. For average measurement:
    - VBW = 10 Hz, when duty cycle is no less than 98 percent.
    - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

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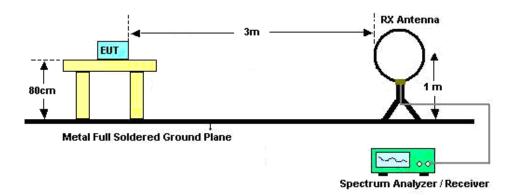
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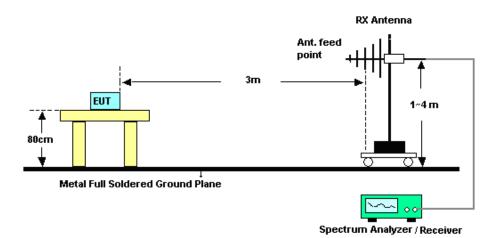
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# 3.5.4 Test Setup

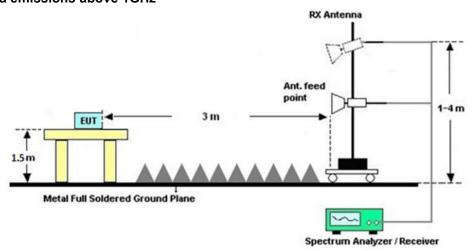
### For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



### For radiated emissions above 1GHz



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### 3.5.5 Test Results of Radiated Spurious Emissions (9kHz ~ 30MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

### 3.5.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C.

### 3.5.7 Duty Cycle

Please refer to Appendix D.

# 3.5.8 Test Result of Radiated Spurious Emission (30MHz ~ 10<sup>th</sup> Harmonic)

Please refer to Appendix C.

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### 3.6 AC Conducted Emission Measurement

### 3.6.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

| Frequency of Emission | Conducted Limit (dΒμV) |           |
|-----------------------|------------------------|-----------|
| (MHz)                 | Quasi-Peak             | Average   |
| 0.15-0.5              | 66 to 56*              | 56 to 46* |
| 0.5-5                 | 56                     | 46        |
| 5-30                  | 60                     | 50        |

<sup>\*</sup>Decreases with the logarithm of the frequency.

### 3.6.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

### 3.6.3 Test Procedures

- 1. The EUT was placed 0.4 meter from the conducting wall of the shielding room, and it was kept at least 80 centimeters from any other grounded conducting surface.
- 2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
- 3. All the support units are connecting to the other LISN.
- 4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
- 5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
- 6. Both sides of AC line were checked for maximum conducted interference.
- 7. The frequency range from 150 kHz to 30 MHz was searched.
- 8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF bandwidth = 9kHz) with Maximum Hold Mode.

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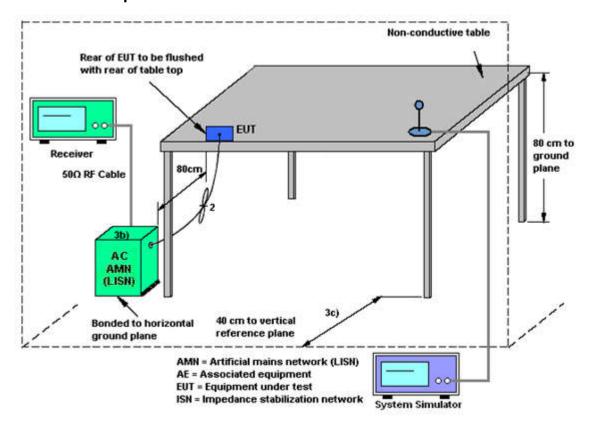
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### 3.6.4 Test Setup



### 3.6.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

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# 3.7 Antenna Requirements

### 3.7.1 Standard Applicable

If directional gain of transmitting Antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi, The use of a permanently attached Antenna or of an Antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the rule.

### 3.7.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

### 3.7.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

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# 4 List of Measuring Equipment

| Instrument                              | Manufacturer | Model No.                  | Serial No.       | Characteristics            | Calibration<br>Date | Test Date    | Due Date      | Remark                   |  |  |  |  |
|---|--------------|----------------------------|------------------|----------------------------|---------------------|--------------|---------------|--------------------------|--|--|--|--|
| Spectrum<br>Analyzer                    | R&S          | FSV40                      | 101040           | 10Hz~40GHz                 | Aug. 08, 2017       | May 25, 2018 | Aug. 07, 2018 | Conducted<br>(TH01-KS)   |  |  |  |  |
| Pulse Power<br>Senor                    | Anritsu      | MA2411B                    | 0917070          | 300MHz~40GH<br>z           | Jan. 18, 2018       | May 25, 2018 | Jan. 17, 2019 | Conducted<br>(TH01-KS)   |  |  |  |  |
| Power Meter                             | Anritsu      | ML2495A                    | 1005002          | 50MHz<br>Bandwidth         | Jan. 18, 2018       | May 25, 2018 | Jan. 17, 2019 | Conducted<br>(TH01-KS)   |  |  |  |  |
| EMI Test Receiver                       | Keysight     | N9038A                     | MY564000<br>23   | 3Hz~8.5GHz;M<br>ax 30dBm   | Oct. 19, 2017       | May 08, 2018 | Oct. 18, 2018 | Radiation<br>(03CH04-KS) |  |  |  |  |
| EXA Spectrum<br>Analyzer                | Keysight     | N9010A                     | MY553705<br>28   | 10Hz-44GHz                 | Oct. 10, 2017       | May 08, 2018 | Oct. 09, 2018 | Radiation<br>(03CH04-KS) |  |  |  |  |
| Loop Antenna                            | R&S          | HFH2-Z2                    | 100321           | 9kHz~30MHz                 | Oct. 22, 2017       | May 08, 2018 | Oct. 21, 2018 | Radiation<br>(03CH04-KS) |  |  |  |  |
| Bilog Antenna                           | TeseQ        | CBL6111D                   | 44483            | 30MHz-1GHz                 | Jan. 29, 2018       | May 08, 2018 | Jan. 28, 2019 | Radiation<br>(03CH04-KS) |  |  |  |  |
| Horn Antenna                            | Schwarzbeck  | BBHA9120D                  | 1648             | 1GHz~18GHz                 | Dec. 16, 2017       | May 08, 2018 | Dec. 15, 2018 | Radiation<br>(03CH04-KS) |  |  |  |  |
| SHF-EHF Horn                            | Schwarzbeck  | BBHA 9170                  | BBHA1702<br>49   | 15GHz~40GHz                | Feb. 07, 2018       | May 08, 2018 | Feb. 06, 2019 | Radiation<br>(03CH04-KS) |  |  |  |  |
| Amplifier                               | Burgeon      | BPA-530                    | 102219           | 0.01MHz<br>~3000MHz        | Dec. 16, 2017       | May 08, 2018 | Dec. 15, 2018 | Radiation<br>(03CH04-KS) |  |  |  |  |
| Amplifier                               | MITEQ        | TTA1840-35-<br>HG          | 2014749          | 18~40GHz                   | Feb. 08, 2018       | May 08, 2018 | Feb. 07, 2019 | Radiation<br>(03CH04-KS) |  |  |  |  |
| high gain Amplifier                     | MITEQ        | AMF-7D-0010<br>1800-30-10P | 2025788          | 1Ghz-18Ghz                 | Apr. 17, 2018       | May 08, 2018 | Apr. 16, 2019 | Radiation<br>(03CH04-KS) |  |  |  |  |
| Amplifier                               | Keysight     | 83017A                     | MY532702<br>03   | 500MHz~26.5G<br>Hz         | Dec. 16, 2017       | May 08, 2018 | Dec. 15, 2018 | Radiation<br>(03CH04-KS) |  |  |  |  |
| AC Power Source                         | Chroma       | 61601                      | F1040900<br>04   | N/A                        | NCR                 | May 08, 2018 | NCR           | Radiation<br>(03CH04-KS) |  |  |  |  |
| Turn Table                              | ChamPro      | EM 1000-T                  | 060762-T         | 0~360 degree               | NCR                 | May 08, 2018 | NCR           | Radiation<br>(03CH04-KS) |  |  |  |  |
| Antenna Mast                            | ChamPro      | EM 1000-A                  | 060762-A         | 1 m~4 m                    | NCR                 | May 08, 2018 | NCR           | Radiation<br>(03CH04-KS) |  |  |  |  |
| EMI Receiver                            | R&S          | ESCI7                      | 100768           | 9kHz~7GHz;                 | Apr. 19, 2018       | May 15, 2018 | Apr. 18, 2019 | Conduction<br>(CO01-KS)  |  |  |  |  |
| AC LISN                                 | MessTec      | AN3016                     | 060103           | 9kHz~30MHz                 | Oct. 13, 2017       | May 15, 2018 | Oct. 12, 2018 | Conduction<br>(CO01-KS)  |  |  |  |  |
| AC LISN<br>(for auxiliary<br>equipment) | MessTec      | AN3016                     | 060105           | 9kHz~30MHz                 | Oct. 13, 2017       | May 15, 2018 | Oct. 12, 2018 | Conduction<br>(CO01-KS)  |  |  |  |  |
| AC Power Source                         | Chroma       | 61602                      | ABP00000<br>0811 | AC 0V~300V,<br>45Hz~1000Hz | Oct. 12, 2017       | May 15, 2018 | Oct. 11, 2018 | Conduction<br>(CO01-KS)  |  |  |  |  |

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## 5 Uncertainty of Evaluation

#### **Uncertainty of Conducted Emission Measurement (150kHz ~ 30MHz)**

| Measuring Uncertainty for a Level of Confidence | 2.9dB |
|---|-------|
| of 95% (U = 2Uc(y))                             | 2.900 |

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#### <u>Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)</u>

| Measuring Uncertainty for a Level of Confidence | 4.1dB  |
|---|--------|
| of 95% (U = 2Uc(y))                             | 4. IUD |

#### <u>Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)</u>

| Measuring Uncertainty for a Level of Confidence | 4.1dB  |
|---|--------|
| of 95% (U = 2Uc(y))                             | 4. IUD |

#### Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

| Measuring Uncertainty for a Level of Confidence | 4.6 dB |
|---|--------|
| of 95% (U = 2Uc(y))                             | 4.0 UB |

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## Appendix A. Conducted test results

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#### A1 - DTS Part

| Test Engineer: | Silent Hai | Temperature:       | 21~25 | °C |
|----------------|------------|--------------------|-------|----|
| Test Date:     | 2018/5/25  | Relative Humidity: | 51~55 | %  |

### TEST RESULTS DATA 6dB and 99% Occupied Bandwidth

|      | 2.4GHz Band  |     |     |   |       |                          |           |      |  |  |  |  |  |  |
|------|--------------|-----|-----|---|-------|--------------------------|-----------|------|--|--|--|--|--|--|
| Mod. | Data<br>Rate | NTX | CH. | H. Freq. Occupied BW (MHz) 6dB BW (MHz) |       | 6dB BW<br>Limit<br>(MHz) | Pass/Fail |      |  |  |  |  |  |  |
| 11b  | 1Mbps        | 1   | 1   | 2412                                    | 12.19 | 7.55                     | 0.50      | Pass |  |  |  |  |  |  |
| 11b  | 1Mbps        | 1   | 6   | 2437                                    | 12.39 | 7.57                     | 0.50      | Pass |  |  |  |  |  |  |
| 11b  | 1Mbps        | 1   | 11  | 2462                                    | 11.99 | 7.07                     | 0.50      | Pass |  |  |  |  |  |  |
| 11g  | 6Mbps        | 1   | 1   | 2412                                    | 18.48 | 16.36                    | 0.50      | Pass |  |  |  |  |  |  |
| 11g  | 6Mbps        | 1   | 6   | 2437                                    | 19.03 | 16.32                    | 0.50      | Pass |  |  |  |  |  |  |
| 11g  | 6Mbps        | 1   | 11  | 2462                                    | 18.23 | 16.32                    | 0.50      | Pass |  |  |  |  |  |  |
| HT20 | MCS0         | 1   | 1   | 2412                                    | 19.38 | 17.56                    | 0.50      | Pass |  |  |  |  |  |  |
| HT20 | MCS0         | 1   | 6   | 2437                                    | 20.03 | 17.56                    | 0.50      | Pass |  |  |  |  |  |  |
| HT20 | MCS0         | 1   | 11  | 2462                                    | 19.03 | 17.52                    | 0.50      | Pass |  |  |  |  |  |  |
| HT40 | MCS0         | 1   | 3   | 2422                                    | 36.46 | 35.09                    | 0.50      | Pass |  |  |  |  |  |  |
| HT40 | MCS0         | 1   | 6   | 2437                                    | 36.86 | 35.45                    | 0.50      | Pass |  |  |  |  |  |  |
| HT40 | MCS0         | 1   | 9   | 2452                                    | 36.96 | 35.33                    | 0.50      | Pass |  |  |  |  |  |  |

# TEST RESULTS DATA Peak Power Table

|      | 2.4GHz Band  |     |     |                |                                     |                                      |             |                        |                                 |               |  |  |  |  |
|------|--------------|-----|-----|----------------|-------------------------------------|--------------------------------------|-------------|------------------------|---------------------------------|---------------|--|--|--|--|
| Mod. | Data<br>Rate | NTX | CH. | Freq.<br>(MHz) | Peak<br>Conducted<br>Power<br>(dBm) | Conducted<br>Power<br>Limit<br>(dBm) | DG<br>(dBi) | EIRP<br>Power<br>(dBm) | EIRP<br>Power<br>Limit<br>(dBm) | Pass<br>/Fail |  |  |  |  |
| 11b  | 1Mbps        | 1   | 1   | 2412           | 18.18                               | 30.00                                | -3.00       | 15.18                  | 36.00                           | Pass          |  |  |  |  |
| 11b  | 1Mbps        | 1   | 6   | 2437           | 17.51                               | 30.00                                | -3.00       | 14.51                  | 36.00                           | Pass          |  |  |  |  |
| 11b  | 1Mbps        | 1   | 11  | 2462           | 17.94                               | 30.00                                | -3.00       | 14.94                  | 36.00                           | Pass          |  |  |  |  |
| 11g  | 6Mbps        | 1   | 1   | 2412           | 22.02                               | 30.00                                | -3.00       | 19.02                  | 36.00                           | Pass          |  |  |  |  |
| 11g  | 6Mbps        | 1   | 6   | 2437           | 23.18                               | 30.00                                | -3.00       | 20.18                  | 36.00                           | Pass          |  |  |  |  |
| 11g  | 6Mbps        | 1   | 11  | 2462           | 23.07                               | 30.00                                | -3.00       | 20.07                  | 36.00                           | Pass          |  |  |  |  |
| HT20 | MCS0         | 1   | 1   | 2412           | 21.78                               | 30.00                                | -3.00       | 18.78                  | 36.00                           | Pass          |  |  |  |  |
| HT20 | MCS0         | 1   | 6   | 2437           | 23.04                               | 30.00                                | -3.00       | 20.04                  | 36.00                           | Pass          |  |  |  |  |
| HT20 | MCS0         | 1   | 11  | 2462           | 23.01                               | 30.00                                | -3.00       | 20.01                  | 36.00                           | Pass          |  |  |  |  |
| HT40 | MCS0         | 1   | 3   | 2422           | 21.21                               | 30.00                                | -3.00       | 18.21                  | 36.00                           | Pass          |  |  |  |  |
| HT40 | MCS0         | 1   | 6   | 2437           | 23.29                               | 30.00                                | -3.00       | 20.29                  | 36.00                           | Pass          |  |  |  |  |
| HT40 | MCS0         | 1   | 9   | 2452           | 22.83                               | 30.00                                | -3.00       | 19.83                  | 36.00                           | Pass          |  |  |  |  |

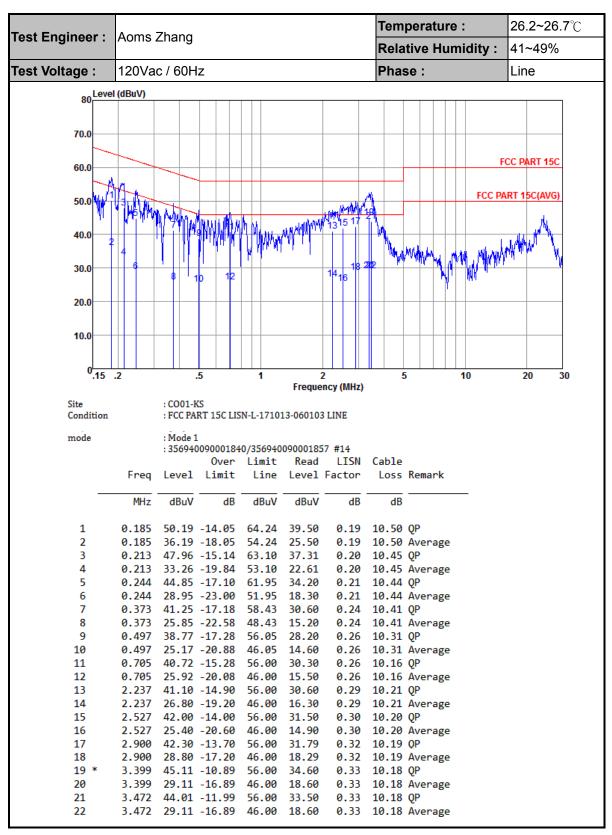
## TEST RESULTS DATA Average Power Table (Reporting Only)

|      | 2.4GHz Band  |     |     |                |                        |  |  |  |  |  |  |  |  |
|------|--------------|-----|-----|----------------|------------------------|--|--|--|--|--|--|--|--|
| Mod. | Data<br>Rate | N⊤x | CH. | Freq.<br>(MHz) | Duty<br>Factor<br>(dB) | Average<br>Conducted<br>Power<br>(dBm) |  |  |  |  |  |  |  |
| 11b  | 1Mbps        | 1   | 1   | 2412           | 0.11                   | 14.63                                  |  |  |  |  |  |  |  |
| 11b  | 1Mbps        | 1   | 6   | 2437           | 0.11                   | 14.52                                  |  |  |  |  |  |  |  |
| 11b  | 1Mbps        | 1   | 11  | 2462           | 0.11                   | 14.50                                  |  |  |  |  |  |  |  |
| 11g  | 6Mbps        | 1   | 1   | 2412           | 0.58                   | 12.71                                  |  |  |  |  |  |  |  |
| 11g  | 6Mbps        | 1   | 6   | 2437           | 0.58                   | 15.63                                  |  |  |  |  |  |  |  |
| 11g  | 6Mbps        | 1   | 11  | 2462           | 0.58                   | 14.74                                  |  |  |  |  |  |  |  |
| HT20 | MCS0         | 1   | 1   | 2412           | 0.64                   | 12.79                                  |  |  |  |  |  |  |  |
| HT20 | MCS0         | 1   | 6   | 2437           | 0.64                   | 15.68                                  |  |  |  |  |  |  |  |
| HT20 | MCS0         | 1   | 11  | 2462           | 0.64                   | 14.76                                  |  |  |  |  |  |  |  |
| HT40 | MCS0         | 1   | 3   | 2422           | 0.64                   | 11.49                                  |  |  |  |  |  |  |  |
| HT40 | MCS0         | 1   | 6   | 2437           | 0.64                   | 14.45                                  |  |  |  |  |  |  |  |
| HT40 | MCS0         | 1   | 9   | 2452           | 0.64                   | 14.06                                  |  |  |  |  |  |  |  |

# TEST RESULTS DATA Peak Power Density

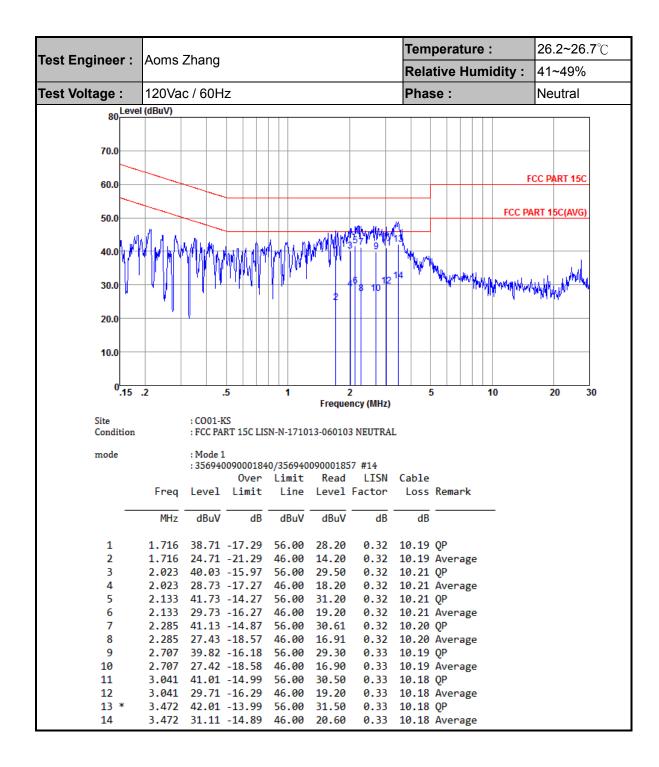
|      | 2.4GHz Band  |     |     |                |                            |             |                                     |           |  |  |  |  |  |
|------|--------------|-----|-----|----------------|----------------------------|-------------|-------------------------------------|-----------|--|--|--|--|--|
| Mod. | Data<br>Rate | NTX | CH. | Freq.<br>(MHz) | Peak PSD<br>(dBm<br>/3kHz) | DG<br>(dBi) | Peak PSD<br>Limit<br>(dBm<br>/3kHz) | Pass/Fail |  |  |  |  |  |
| 11b  | 1Mbps        | 1   | 1   | 2412           | -9.59                      | -3.00       | 8.00                                | Pass      |  |  |  |  |  |
| 11b  | 1Mbps        | 1   | 6   | 2437           | -6.79                      | -3.00       | 8.00                                | Pass      |  |  |  |  |  |
| 11b  | 1Mbps        | 1   | 11  | 2462           | -9.42                      | -3.00       | 8.00                                | Pass      |  |  |  |  |  |
| 11g  | 6Mbps        | 1   | 1   | 2412           | -12.12                     | -3.00       | 8.00                                | Pass      |  |  |  |  |  |
| 11g  | 6Mbps        | 1   | 6   | 2437           | -7.14                      | -3.00       | 8.00                                | Pass      |  |  |  |  |  |
| 11g  | 6Mbps        | 1   | 11  | 2462           | -10.50                     | -3.00       | 8.00                                | Pass      |  |  |  |  |  |
| HT20 | MCS0         | 1   | 1   | 2412           | -12.66                     | -3.00       | 8.00                                | Pass      |  |  |  |  |  |
| HT20 | MCS0         | 1   | 6   | 2437           | -8.82                      | -3.00       | 8.00                                | Pass      |  |  |  |  |  |
| HT20 | MCS0         | 1   | 11  | 2462           | -10.09                     | -3.00       | 8.00                                | Pass      |  |  |  |  |  |
| HT40 | MCS0         | 1   | 3   | 2422           | -17.30                     | -3.00       | 8.00                                | Pass      |  |  |  |  |  |
| HT40 | MCS0         | 1   | 6   | 2437           | -12.58                     | -3.00       | 8.00                                | Pass      |  |  |  |  |  |
| HT40 | MCS0         | 1   | 9   | 2452           | -13.63                     | -3.00       | 8.00                                | Pass      |  |  |  |  |  |

## **Appendix B. AC Conducted Emission Test Results**



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# Appendix C. Radiated Spurious Emission

#### 2.4GHz 2400~2483.5MHz

## WIFI 802.11b (Band Edge @ 3m)

| WIFI             | Note | Frequency      | Level      | Over     | Limit         | Read     | Antenna  | Cable | Preamp | Ant    | Table | Peak  | Pol.     |
|------------------|------|----------------|------------|----------|---------------|----------|----------|-------|--------|--------|-------|-------|----------|
| Ant.             |      |                |            | Limit    | Line          | Level    | Factor   | Loss  | Factor | Pos    | Pos   | Avg.  |          |
| 1                |      | (MHz)          | ( dBµV/m ) | (dB)     | ( dBµV/m )    | (dBµV)   | ( dB/m ) | (dB)  | (dB)   | ( cm ) | (deg) | (P/A) | (H/V)    |
|                  |      | 2387.48        | 54.31      | -19.69   | 74            | 51.5     | 31.3     | 5.65  | 34.14  | 138    | 77    | Р     | Н        |
|                  |      | 2389.04        | 43.79      | -10.21   | 54            | 40.98    | 31.3     | 5.65  | 34.14  | 138    | 77    | Α     | Н        |
|                  | *    | 2412           | 107.72     | -        | -             | 104.88   | 31.33    | 5.67  | 34.16  | 138    | 77    | Р     | Н        |
| 802.11b          | *    | 2410           | 104.41     | -        | -             | 101.57   | 31.33    | 5.67  | 34.16  | 138    | 77    | Α     | Н        |
| CH 01<br>2412MHz |      | 2381.76        | 53.16      | -20.84   | 74            | 50.4     | 31.27    | 5.63  | 34.14  | 309    | 93    | Р     | <b>V</b> |
| 2412WHZ          |      | 2389.17        | 42.58      | -11.42   | 54            | 39.77    | 31.3     | 5.65  | 34.14  | 309    | 93    | Α     | ٧        |
|                  | *    | 2412           | 103.03     | -        | -             | 100.19   | 31.33    | 5.67  | 34.16  | 309    | 93    | Р     | ٧        |
|                  | *    | 2410           | 100.1      | -        | -             | 97.26    | 31.33    | 5.67  | 34.16  | 309    | 93    | Α     | ٧        |
|                  | *    | 2462           | 102.08     | -        | -             | 99.19    | 31.41    | 5.73  | 34.25  | 165    | 75    | Р     | Н        |
|                  | *    | 2460           | 98.95      | -        | -             | 96.06    | 31.41    | 5.73  | 34.25  | 165    | 75    | Α     | Н        |
| 000 441-         |      | 2489.98        | 52.9       | -21.1    | 74            | 49.96    | 31.47    | 5.77  | 34.3   | 165    | 75    | Р     | Н        |
| 802.11b          |      | 2488.18        | 41.99      | -12.01   | 54            | 39.05    | 31.47    | 5.77  | 34.3   | 165    | 75    | Α     | Н        |
| CH 11<br>2462MHz | *    | 2462           | 98.78      | -        | -             | 95.89    | 31.41    | 5.73  | 34.25  | 340    | 105   | Р     | V        |
| 2402WITI2        | *    | 2460           | 95.59      | -        | -             | 92.7     | 31.41    | 5.73  | 34.25  | 340    | 105   | Α     | V        |
|                  |      | 2493.28        | 53.01      | -20.99   | 74            | 50.07    | 31.47    | 5.77  | 34.3   | 340    | 105   | Р     | ٧        |
|                  |      | 2483.5         | 41.84      | -12.16   | 54            | 38.93    | 31.44    | 5.75  | 34.28  | 340    | 105   | Α     | V        |
| Remark           |      | other spurious |            | Peak and | l Average lim | it line. |          |       |        |        |       |       |          |

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## 2.4GHz 2400~2483.5MHz WIFI 802.11b (Harmonic @ 3m)

| WIFI      | Note | Frequency | Level      | Over         | Limit              | Read              | Antenna            | Cable          | Preamp        | Ant           | Table          | Peak          | Pol |
|-----------|------|-----------|------------|--------------|--------------------|-------------------|--------------------|----------------|---------------|---------------|----------------|---------------|-----|
| Ant.<br>1 |      | (MHz)     | ( dBµV/m ) | Limit ( dB ) | Line<br>( dBµV/m ) | Level<br>( dBµV ) | Factor<br>( dB/m ) | Loss<br>( dB ) | Factor ( dB ) | Pos<br>( cm ) | Pos<br>( deg ) | Avg.<br>(P/A) | ł   |
| 802.11b   |      | 4824      | 55.38      | -18.62       | 74                 | 76.4              | 35.65              | 7.86           | 64.53         | 125           | 68             | Р             | Н   |
| CH 01     |      | 4824      | 52.19      | -1.81        | 54                 | 73.21             | 35.65              | 7.86           | 64.53         | 125           | 68             | Α             | Н   |
| 2412MHz   |      | 4824      | 44.79      | -29.21       | 74                 | 65.81             | 35.65              | 7.86           | 64.53         | 100           | 360            | Р             | ٧   |
|           |      | 4872      | 52.37      | -21.63       | 74                 | 73.46             | 35.61              | 7.9            | 64.6          | 127           | 353            | Р             | Н   |
| 802.11b   |      | 4872      | 49.33      | -4.67        | 54                 | 70.42             | 35.61              | 7.9            | 64.6          | 127           | 353            | Α             | Н   |
| CH 06     |      | 7308      | 44.72      | -29.28       | 74                 | 64.34             | 35.89              | 9.5            | 65.01         | 100           | 360            | Р             | Н   |
| 2437MHz   |      | 4872      | 45.4       | -28.6        | 74                 | 66.49             | 35.61              | 7.9            | 64.6          | 100           | 360            | Р             | V   |
|           |      | 7308      | 43.01      | -30.99       | 74                 | 62.63             | 35.89              | 9.5            | 65.01         | 100           | 360            | Р             | V   |
|           |      | 4926      | 53.54      | -20.46       | 74                 | 74.71             | 35.57              | 7.94           | 64.68         | 110           | 357            | Р             | Н   |
| 802.11b   |      | 4926      | 50.48      | -3.52        | 54                 | 71.65             | 35.57              | 7.94           | 64.68         | 110           | 357            | Α             | Н   |
| CH 11     |      | 7386      | 42.71      | -31.29       | 74                 | 62.29             | 35.94              | 9.53           | 65.05         | 100           | 360            | Р             | Н   |
| 2462MHz   |      | 4926      | 45.9       | -28.1        | 74                 | 67.07             | 35.57              | 7.94           | 64.68         | 100           | 360            | Р             | V   |
|           |      | 7386      | 42.08      | -31.92       | 74                 | 61.66             | 35.94              | 9.53           | 65.05         | 100           | 360            | Р             | V   |

### Remark

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All results are PASS against Peak and Average limit line.

## 2.4GHz 2400~2483.5MHz WIFI 802.11g (Band Edge @ 3m)

| WIFI      | Note | Frequency                                     | Level      | Over          | Limit              | Read              | Antenna            | Cable        | Preamp      | Ant           | Table          | Peak          | Pol. |
|-----------|------|---|------------|---------------|--------------------|-------------------|--------------------|--------------|-------------|---------------|----------------|---------------|------|
| Ant.<br>1 |      | (MHz)   | ( dBµV/m ) | Limit<br>(dB) | Line<br>( dBµV/m ) | Level<br>( dBµV ) | Factor<br>( dB/m ) | Loss<br>(dB) | Factor (dB) | Pos<br>( cm ) | Pos<br>( deg ) | Avg.<br>(P/A) | 1    |
|           |      | 2389.56                                       | 67.18      | -6.82         | 74                 | 64.37             | 31.3               | 5.65         | 34.14       | 133           | 76             | Р             | Н    |
|           |      | 2389.95                                       | 51.13      | -2.87         | 54                 | 48.32             | 31.3               | 5.65         | 34.14       | 133           | 76             | Α             | Н    |
|           | *    | 2410  | 107.4      | -             | -                  | 104.56            | 31.33              | 5.67         | 34.16       | 133           | 76             | Р             | Н    |
| 802.11g   | *    | 2408  | 99.51      | -             | -                  | 96.67             | 31.33              | 5.67         | 34.16       | 133           | 76             | Α             | Н    |
| CH 01     |      | 2389.04                                       | 62.7       | -11.3         | 74                 | 59.89             | 31.3               | 5.65         | 34.14       | 359           | 91             | Р             | ٧    |
| 2412MHz   |      | 2389.95                                       | 49.12      | -4.88         | 54                 | 46.31             | 31.3               | 5.65         | 34.14       | 359           | 91             | Α             | V    |
|           | *    | 2408  | 103.63     | -             | -                  | 100.79            | 31.33              | 5.67         | 34.16       | 359           | 91             | Р             | V    |
|           | *    | 2408  | 95.86      | -             | -                  | 93.02             | 31.33              | 5.67         | 34.16       | 359           | 91             | Α             | V    |
|           | *    | 2456  | 106.2      | -             | -                  | 103.31            | 31.41              | 5.73         | 34.25       | 116           | 81             | Р             | Н    |
|           | *    | 2454  | 98.46      | -             | -                  | 95.57             | 31.41              | 5.73         | 34.25       | 116           | 81             | Α             | Н    |
|           |      | 2483.5  | 61.9       | -12.1         | 74                 | 58.99             | 31.44              | 5.75         | 34.28       | 116           | 81             | Р             | Н    |
| 802.11g   |      | 2483.51                                       | 47.36      | -6.64         | 54                 | 44.45             | 31.44              | 5.75         | 34.28       | 116           | 81             | Α             | Н    |
| CH 11     | *    | 2456  | 104.31     | -             | -                  | 101.42            | 31.41              | 5.73         | 34.25       | 344           | 89             | Р             | V    |
| 2462MHz   | *    | 2454  | 96.72      | -             | -                  | 93.83             | 31.41              | 5.73         | 34.25       | 344           | 89             | Α             | V    |
| _         |      | 2483.62                                       | 57.13      | -16.87        | 74                 | 54.22             | 31.44              | 5.75         | 34.28       | 344           | 89             | Р             | V    |
|           |      | 2483.62                                       | 44.81      | -9.19         | 54                 | 41.9              | 31.44              | 5.75         | 34.28       | 344           | 89             | Α             | V    |
| Remark    |      | 2483.62<br>o other spurious<br>results are PA | s found.   |               |                    |                   | 31.44              | 5.75         | 34.28       | 344           | 89             | A             |      |

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## 2.4GHz 2400~2483.5MHz WIFI 802.11g (Harmonic @ 3m)

| WIFI             | Note | Frequency      | Level      | Over          | Limit              | Read              | Antenna            | Cable        | Preamp         | Ant           | Table | Peak          | Pol. |
|------------------|------|----------------|------------|---------------|--------------------|-------------------|--------------------|--------------|----------------|---------------|-------|---------------|------|
| Ant.<br>1        |      | ( MHz )        | ( dBµV/m ) | Limit<br>(dB) | Line<br>( dBµV/m ) | Level<br>( dBµV ) | Factor<br>( dB/m ) | Loss<br>(dB) | Factor<br>(dB) | Pos<br>( cm ) |       | Avg.<br>(P/A) | i    |
| 802.11g<br>CH 01 |      | 4824           | 49.44      | -24.56        | 74                 | 70.46             | 35.65              | 7.86         | 64.53          | 100           | 360   | Р             | Н    |
| 2412MHz          |      | 4824           | 43.83      | -30.17        | 74                 | 64.85             | 35.65              | 7.86         | 64.53          | 100           | 360   | Р             | ٧    |
|                  |      | 4872           | 57.44      | -16.56        | 74                 | 78.53             | 35.61              | 7.9          | 64.6           | 100           | 360   | Р             | Н    |
| 802.11g          |      | 4872           | 44.48      | -9.52         | 54                 | 65.57             | 35.61              | 7.9          | 64.6           | 197           | 354   | Α             | Н    |
| CH 06            |      | 7308           | 45.23      | -28.77        | 74                 | 64.85             | 35.89              | 9.5          | 65.01          | 100           | 360   | Р             | Н    |
| 2437MHz          |      | 4872           | 45.58      | -28.42        | 74                 | 66.67             | 35.61              | 7.9          | 64.6           | 100           | 360   | Р             | V    |
|                  |      | 7308           | 44.39      | -29.61        | 74                 | 64.01             | 35.89              | 9.5          | 65.01          | 100           | 360   | Р             | V    |
|                  |      | 4926           | 50.59      | -23.41        | 74                 | 71.76             | 35.57              | 7.94         | 64.68          | 100           | 360   | Р             | Н    |
| 802.11g          |      | 7386           | 41.32      | -32.68        | 74                 | 60.9              | 35.94              | 9.53         | 65.05          | 100           | 360   | Р             | Н    |
| CH 11<br>2462MHz |      | 4926           | 43.35      | -30.65        | 74                 | 64.52             | 35.57              | 7.94         | 64.68          | 100           | 360   | Р             | V    |
| 2402IVITI2       |      | 7386           | 42.65      | -31.35        | 74                 | 62.23             | 35.94              | 9.53         | 65.05          | 100           | 360   | Р             | V    |
| Remark           |      | other spurious |            | Peak and      | I Average lim      | it line.          |                    |              |                |               |       |               |      |

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## 2.4GHz 2400~2483.5MHz WIFI 802.11n HT20 (Band Edge @ 3m)

| Note | Frequency | Level   | Over  | Limit  | Read  | Antenna   | Cable   | Preamp  | Ant   | Table  | Peak   | Pol   |
|------|-----------|---|---|--|---|---|---|---|---|--|--|---|
|      | ( MHz )   | ( dBµV/m )  | Limit<br>( dB )   | Line<br>( dBµV/m )   | Level<br>( dBµV )   | Factor ( dB/m )   | Loss<br>(dB)  | Factor ( dB )   | Pos<br>( cm )   | Pos<br>( deg )   | Avg.<br>(P/A)  | (H/V  |
|      | 2389.82   | 65.83   | -8.17   | 74   | 63.02   | 31.3  | 5.65  | 34.14   | 134   | 73   | Р  | Н   |
|      | 2389.95   | 50.87   | -3.13   | 54   | 48.06   | 31.3  | 5.65  | 34.14   | 134   | 73   | Α  | Н   |
| *    | 2408      | 106.36  | -   | -  | 103.52  | 31.33   | 5.67  | 34.16   | 134   | 73   | Р  | Н   |
| *    | 2408      | 98.29   | -   | -  | 95.45   | 31.33   | 5.67  | 34.16   | 134   | 73   | Α  | Н   |
|      | 2389.56   | 64.68   | -9.32   | 74   | 61.87   | 31.3  | 5.65  | 34.14   | 355   | 90   | Р  | V   |
|      | 2389.82   | 50.27   | -3.73   | 54   | 47.46   | 31.3  | 5.65  | 34.14   | 355   | 90   | Α  | V   |
| *    | 2410      | 104.69  | -   | -  | 101.85  | 31.33   | 5.67  | 34.16   | 355   | 90   | Р  | V   |
| *    | 2408      | 95.58   | -   | -  | 92.74   | 31.33   | 5.67  | 34.16   | 355   | 90   | Α  | V   |
|      | 2454      | 105.91  | -   | -  | 103.02  | 31.41   | 5.73  | 34.25   | 116   | 80   | Р  | Н   |
|      | 2454      | 98.3  | -   | -  | 95.41   | 31.41   | 5.73  | 34.25   | 116   | 80   | Α  | Н   |
|      | 2483.74   | 63.71   | -10.29  | 74   | 60.8  | 31.44   | 5.75  | 34.28   | 116   | 80   | Р  | Н   |
|      | 2483.51   | 48.69   | -5.31   | 54   | 45.78   | 31.44   | 5.75  | 34.28   | 116   | 80   | Α  | Н   |
|      | 2454      | 104.17  | -   | -  | 101.28  | 31.41   | 5.73  | 34.25   | 343   | 90   | Р  | V   |
|      | 2454      | 96.47   | -   | -  | 93.58   | 31.41   | 5.73  | 34.25   | 343   | 90   | Α  | V   |
|      | 2483.92   | 59.89   | -14.11  | 74   | 56.98   | 31.44   | 5.75  | 34.28   | 343   | 90   | Р  | V   |
|      | 2484.16   | 46.45   | -7.55   | 54   | 43.54   | 31.44   | 5.75  | 34.28   | 343   | 90   | Α  | V   |
|      | *         | (MHz) 2389.82 2389.95 * 2408 * 2408 2389.56 2389.82 * 2410 * 2408 2454 2454 2483.74 2483.51 2454 2454 2483.92 | (MHz) (dBμV/m) 2389.82 65.83 2389.95 50.87  * 2408 106.36  * 2408 98.29 2389.56 64.68 2389.82 50.27  * 2410 104.69  * 2408 95.58 2454 105.91 2454 98.3 2483.74 63.71 2483.51 48.69 2454 104.17 2454 96.47 2483.92 59.89 | (MHz) (dBµV/m) (dB)  2389.82 65.83 -8.17  2389.95 50.87 -3.13  * 2408 106.36 -  * 2408 98.29 -  2389.56 64.68 -9.32  2389.82 50.27 -3.73  * 2410 104.69 -  * 2408 95.58 -  2454 105.91 -  2454 98.3 -  2483.74 63.71 -10.29  2483.51 48.69 -5.31  2454 96.47 -  2483.92 59.89 -14.11 | (MHz)     (dBμV/m)     Limit (dB)     Line (dBμV/m)       2389.82     65.83     -8.17     74       2389.95     50.87     -3.13     54       *     2408     106.36     -     -       *     2408     98.29     -     -       2389.56     64.68     -9.32     74       2389.82     50.27     -3.73     54       *     2410     104.69     -     -       *     2408     95.58     -     -       2454     105.91     -     -       2454     98.3     -     -       2483.74     63.71     -10.29     74       2483.51     48.69     -5.31     54       2454     104.17     -     -       2454     96.47     -     -       2483.92     59.89     -14.11     74 | (MHz)         (dBμV/m)         Limit (dB)         Line (dBμV/m)         Level (dBμV)           2389.82         65.83         -8.17         74         63.02           2389.95         50.87         -3.13         54         48.06           *         2408         106.36         -         -         103.52           *         2408         98.29         -         -         95.45           2389.56         64.68         -9.32         74         61.87           2389.82         50.27         -3.73         54         47.46           *         2410         104.69         -         -         101.85           *         2408         95.58         -         -         92.74           2454         105.91         -         -         103.02           2454         98.3         -         -         95.41           2483.74         63.71         -10.29         74         60.8           2483.51         48.69         -5.31         54         45.78           2454         104.17         -         -         93.58           2454         96.47         -         -         93.58 <t< td=""><td>(MHz)         (dBμV/m)         Limit (dB)         Line (dBμV/m)         Level (dBμV)         Factor (dB/m)           2389.82         65.83         -8.17         74         63.02         31.3           2389.95         50.87         -3.13         54         48.06         31.3           *         2408         106.36         -         -         103.52         31.33           *         2408         98.29         -         -         95.45         31.33           *         2408         98.29         -         -         95.45         31.33           *         2408         98.29         -         -         95.45         31.33           *         2408         98.29         -         -         95.45         31.33           *         2410         104.69         -         -         101.85         31.33           *         2408         95.58         -         -         92.74         31.33           *         2454         105.91         -         -         103.02         31.41           2483.74         63.71         -10.29         74         60.8         31.44           2483.51         4</td><td>(MHz)         (dBμV/m)         Limit (dB)         Line (dBμV/m)         Level (dBμV)         Factor (dB/m)         Loss (dB)           2389.82         65.83         -8.17         74         63.02         31.3         5.65           2389.95         50.87         -3.13         54         48.06         31.3         5.65           *         2408         106.36         -         -         103.52         31.33         5.67           *         2408         98.29         -         -         95.45         31.33         5.67           2389.56         64.68         -9.32         74         61.87         31.3         5.65           2389.82         50.27         -3.73         54         47.46         31.3         5.65           *         2410         104.69         -         -         101.85         31.33         5.67           *         2408         95.58         -         -         92.74         31.33         5.67           *         2454         105.91         -         -         103.02         31.41         5.73           2454         98.3         -         -         95.41         31.41         5.75</td><td>(MHz)         (dBμV/m)         Limit (dB)         Line (dBμV/m)         Level (dBμV)         Factor (dB/m)         Loss (dB)         Factor (dB/m)           2389.82         65.83         -8.17         74         63.02         31.3         5.65         34.14           2389.95         50.87         -3.13         54         48.06         31.3         5.65         34.14           *         2408         106.36         -         -         103.52         31.33         5.67         34.16           *         2408         98.29         -         -         95.45         31.33         5.67         34.16           2389.86         64.68         -9.32         74         61.87         31.3         5.65         34.14           2389.82         50.27         -3.73         54         47.46         31.3         5.65         34.14           *         2410         104.69         -         -         101.85         31.33         5.67         34.16           *         2408         95.58         -         -         92.74         31.33         5.67         34.16           *         2454         105.91         -         -         103.02         &lt;</td><td>(MHz)         (dBµV/m)         Limit (dB)         Line (dBµV/m)         Level (dBµV)         Factor (dB)         Pos (cm)           2389.82         65.83         -8.17         74         63.02         31.3         5.65         34.14         134           2389.95         50.87         -3.13         54         48.06         31.3         5.65         34.14         134           *         2408         106.36         -         -         103.52         31.33         5.67         34.16         134           *         2408         98.29         -         -         95.45         31.33         5.67         34.16         134           *         2408         98.29         -         -         95.45         31.33         5.67         34.16         134           *         2389.56         64.68         -9.32         74         61.87         31.3         5.65         34.14         355           *         2410         104.69         -         -         101.85         31.33         5.67         34.16         355           *         2408         95.58         -         -         92.74         31.33         5.67         34.16</td><td>(MHz)         (dBμV/m)         Limit (dB)         Line (dBμV/m)         Level (dBμV/m)         Factor (dB)m/m         Loss (dB) (dB)         Factor (dB) (cm)         Pos (deg)           2389.82         65.83         -8.17         74         63.02         31.3         5.65         34.14         134         73           2389.95         50.87         -3.13         54         48.06         31.3         5.65         34.14         134         73           * 2408         106.36         -         -         103.52         31.33         5.67         34.16         134         73           * 2408         98.29         -         -         95.45         31.33         5.67         34.16         134         73           2389.56         64.68         -9.32         74         61.87         31.3         5.65         34.14         355         90           2389.82         50.27         -3.73         54         47.46         31.3         5.65         34.14         355         90           * 2410         104.69         -         -         101.85         31.33         5.67         34.16         355         90           * 2454         105.91         -</td><td>(MHz)         (dBµV/m)         Limit (dBµV/m)         Line (dBµV/m)         Level (dBµV/m)         Factor (dB/m)         Loss (dB)         Factor (dB)         Pos (dB)         Avg. (P/A)           2389.82         65.83         -8.17         74         63.02         31.3         5.65         34.14         134         73         P           2389.95         50.87         -3.13         54         48.06         31.3         5.65         34.14         134         73         A           * 2408         106.36         -         -         103.52         31.33         5.67         34.16         134         73         P           * 2408         98.29         -         -         95.45         31.33         5.67         34.16         134         73         A           * 2408         98.29         -         -         95.45         31.33         5.65         34.14         355         90         P           2389.56         64.68         -9.32         74         61.87         31.3         5.65         34.14         355         90         A           * 2410         104.69         -         -         101.85         31.33         5.67         34.16</td></t<> | (MHz)         (dBμV/m)         Limit (dB)         Line (dBμV/m)         Level (dBμV)         Factor (dB/m)           2389.82         65.83         -8.17         74         63.02         31.3           2389.95         50.87         -3.13         54         48.06         31.3           *         2408         106.36         -         -         103.52         31.33           *         2408         98.29         -         -         95.45         31.33           *         2408         98.29         -         -         95.45         31.33           *         2408         98.29         -         -         95.45         31.33           *         2408         98.29         -         -         95.45         31.33           *         2410         104.69         -         -         101.85         31.33           *         2408         95.58         -         -         92.74         31.33           *         2454         105.91         -         -         103.02         31.41           2483.74         63.71         -10.29         74         60.8         31.44           2483.51         4 | (MHz)         (dBμV/m)         Limit (dB)         Line (dBμV/m)         Level (dBμV)         Factor (dB/m)         Loss (dB)           2389.82         65.83         -8.17         74         63.02         31.3         5.65           2389.95         50.87         -3.13         54         48.06         31.3         5.65           *         2408         106.36         -         -         103.52         31.33         5.67           *         2408         98.29         -         -         95.45         31.33         5.67           2389.56         64.68         -9.32         74         61.87         31.3         5.65           2389.82         50.27         -3.73         54         47.46         31.3         5.65           *         2410         104.69         -         -         101.85         31.33         5.67           *         2408         95.58         -         -         92.74         31.33         5.67           *         2454         105.91         -         -         103.02         31.41         5.73           2454         98.3         -         -         95.41         31.41         5.75 | (MHz)         (dBμV/m)         Limit (dB)         Line (dBμV/m)         Level (dBμV)         Factor (dB/m)         Loss (dB)         Factor (dB/m)           2389.82         65.83         -8.17         74         63.02         31.3         5.65         34.14           2389.95         50.87         -3.13         54         48.06         31.3         5.65         34.14           *         2408         106.36         -         -         103.52         31.33         5.67         34.16           *         2408         98.29         -         -         95.45         31.33         5.67         34.16           2389.86         64.68         -9.32         74         61.87         31.3         5.65         34.14           2389.82         50.27         -3.73         54         47.46         31.3         5.65         34.14           *         2410         104.69         -         -         101.85         31.33         5.67         34.16           *         2408         95.58         -         -         92.74         31.33         5.67         34.16           *         2454         105.91         -         -         103.02         < | (MHz)         (dBµV/m)         Limit (dB)         Line (dBµV/m)         Level (dBµV)         Factor (dB)         Pos (cm)           2389.82         65.83         -8.17         74         63.02         31.3         5.65         34.14         134           2389.95         50.87         -3.13         54         48.06         31.3         5.65         34.14         134           *         2408         106.36         -         -         103.52         31.33         5.67         34.16         134           *         2408         98.29         -         -         95.45         31.33         5.67         34.16         134           *         2408         98.29         -         -         95.45         31.33         5.67         34.16         134           *         2389.56         64.68         -9.32         74         61.87         31.3         5.65         34.14         355           *         2410         104.69         -         -         101.85         31.33         5.67         34.16         355           *         2408         95.58         -         -         92.74         31.33         5.67         34.16 | (MHz)         (dBμV/m)         Limit (dB)         Line (dBμV/m)         Level (dBμV/m)         Factor (dB)m/m         Loss (dB) (dB)         Factor (dB) (cm)         Pos (deg)           2389.82         65.83         -8.17         74         63.02         31.3         5.65         34.14         134         73           2389.95         50.87         -3.13         54         48.06         31.3         5.65         34.14         134         73           * 2408         106.36         -         -         103.52         31.33         5.67         34.16         134         73           * 2408         98.29         -         -         95.45         31.33         5.67         34.16         134         73           2389.56         64.68         -9.32         74         61.87         31.3         5.65         34.14         355         90           2389.82         50.27         -3.73         54         47.46         31.3         5.65         34.14         355         90           * 2410         104.69         -         -         101.85         31.33         5.67         34.16         355         90           * 2454         105.91         - | (MHz)         (dBµV/m)         Limit (dBµV/m)         Line (dBµV/m)         Level (dBµV/m)         Factor (dB/m)         Loss (dB)         Factor (dB)         Pos (dB)         Avg. (P/A)           2389.82         65.83         -8.17         74         63.02         31.3         5.65         34.14         134         73         P           2389.95         50.87         -3.13         54         48.06         31.3         5.65         34.14         134         73         A           * 2408         106.36         -         -         103.52         31.33         5.67         34.16         134         73         P           * 2408         98.29         -         -         95.45         31.33         5.67         34.16         134         73         A           * 2408         98.29         -         -         95.45         31.33         5.65         34.14         355         90         P           2389.56         64.68         -9.32         74         61.87         31.3         5.65         34.14         355         90         A           * 2410         104.69         -         -         101.85         31.33         5.67         34.16 |

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Report No. : FR832104-01C

Report Version : Rev. 01 Report Template No.: BU5-FR15CWL AC MA Version 2.0

## 2.4GHz 2400~2483.5MHz WIFI 802.11n HT20 (Harmonic @ 3m)

| 4824<br>4824 | ( <b>dBμV/m</b> )<br>49.6<br>43.01                   | -24.4   | <b>( dBμV/m )</b> 74  | 70.62  | ( dB/m )<br>35.65   | ( <b>dB</b> )<br>7.86   | ( <b>dB</b> )   | ( <b>cm</b> )  | ( deg )  | (P/A)  |  |
|--------------|--|---|---|--|---|---|---|--|--|--|--|
| 4824         | 43.01  |   |   |  |   |   | 01.00   | 100  | 360  | Р  | Н  |
|              |  | -30.99  | 74  | 64.03  | 35.65   | 7.86  | 64.53   | 100  | 360  | Р  | V  |
| 4872         | 53.17  | -20.83  | 74  | 74.26  | 35.61   | 7.9   | 64.6  | 100  | 360  | Р  | Н  |
| 4872         | 44.39  | -9.61   | 54  | 65.48  | 35.61   | 7.9   | 64.6  | 100  | 360  | Α  | Н  |
| 7308         | 44.4   | -29.6   | 74  | 64.02  | 35.89   | 9.5   | 65.01   | 100  | 360  | Р  | Н  |
| 4872         | 45.17  | -28.83  | 74  | 66.26  | 35.61   | 7.9   | 64.6  | 100  | 360  | Р  | ٧  |
| 7308         | 46.43  | -27.57  | 74  | 66.05  | 35.89   | 9.5   | 65.01   | 100  | 360  | Р  | V  |
| 4926         | 50.22  | -23.78  | 74  | 71.39  | 35.57   | 7.94  | 64.68   | 100  | 360  | Р  | Н  |
| 7386         | 41.79  | -32.21  | 74  | 61.37  | 35.94   | 9.53  | 65.05   | 100  | 360  | Р  | Н  |
| 4926         | 44.62  | -29.38  | 74  | 65.79  | 35.57   | 7.94  | 64.68   | 100  | 360  | Р  | V  |
| 7386         | 41.82  | -32.18  | 74  | 61.4   | 35.94   | 9.53  | 65.05   | 100  | 360  | Р  | V  |
|              | 7308<br>4872<br>7308<br>4926<br>7386<br>4926<br>7386 | 7308 44.4<br>4872 45.17<br>7308 46.43<br>4926 50.22<br>7386 41.79<br>4926 44.62 | 7308     44.4     -29.6       4872     45.17     -28.83       7308     46.43     -27.57       4926     50.22     -23.78       7386     41.79     -32.21       4926     44.62     -29.38       7386     41.82     -32.18 | 7308     44.4     -29.6     74       4872     45.17     -28.83     74       7308     46.43     -27.57     74       4926     50.22     -23.78     74       7386     41.79     -32.21     74       4926     44.62     -29.38     74       7386     41.82     -32.18     74 | 7308     44.4     -29.6     74     64.02       4872     45.17     -28.83     74     66.26       7308     46.43     -27.57     74     66.05       4926     50.22     -23.78     74     71.39       7386     41.79     -32.21     74     61.37       4926     44.62     -29.38     74     65.79       7386     41.82     -32.18     74     61.4 | 7308     44.4     -29.6     74     64.02     35.89       4872     45.17     -28.83     74     66.26     35.61       7308     46.43     -27.57     74     66.05     35.89       4926     50.22     -23.78     74     71.39     35.57       7386     41.79     -32.21     74     61.37     35.94       4926     44.62     -29.38     74     65.79     35.57       7386     41.82     -32.18     74     61.4     35.94 | 7308         44.4         -29.6         74         64.02         35.89         9.5           4872         45.17         -28.83         74         66.26         35.61         7.9           7308         46.43         -27.57         74         66.05         35.89         9.5           4926         50.22         -23.78         74         71.39         35.57         7.94           7386         41.79         -32.21         74         61.37         35.94         9.53           4926         44.62         -29.38         74         65.79         35.57         7.94           7386         41.82         -32.18         74         61.4         35.94         9.53 | 7308         44.4         -29.6         74         64.02         35.89         9.5         65.01           4872         45.17         -28.83         74         66.26         35.61         7.9         64.6           7308         46.43         -27.57         74         66.05         35.89         9.5         65.01           4926         50.22         -23.78         74         71.39         35.57         7.94         64.68           7386         41.79         -32.21         74         61.37         35.94         9.53         65.05           4926         44.62         -29.38         74         65.79         35.57         7.94         64.68           7386         41.82         -32.18         74         61.4         35.94         9.53         65.05 | 7308       44.4       -29.6       74       64.02       35.89       9.5       65.01       100         4872       45.17       -28.83       74       66.26       35.61       7.9       64.6       100         7308       46.43       -27.57       74       66.05       35.89       9.5       65.01       100         4926       50.22       -23.78       74       71.39       35.57       7.94       64.68       100         7386       41.79       -32.21       74       61.37       35.94       9.53       65.05       100         4926       44.62       -29.38       74       65.79       35.57       7.94       64.68       100         7386       41.82       -32.18       74       61.4       35.94       9.53       65.05       100 | 7308         44.4         -29.6         74         64.02         35.89         9.5         65.01         100         360           4872         45.17         -28.83         74         66.26         35.61         7.9         64.6         100         360           7308         46.43         -27.57         74         66.05         35.89         9.5         65.01         100         360           4926         50.22         -23.78         74         71.39         35.57         7.94         64.68         100         360           7386         41.79         -32.21         74         61.37         35.94         9.53         65.05         100         360           4926         44.62         -29.38         74         65.79         35.57         7.94         64.68         100         360           7386         41.82         -32.18         74         61.4         35.94         9.53         65.05         100         360 | 7308         44.4         -29.6         74         64.02         35.89         9.5         65.01         100         360         P           4872         45.17         -28.83         74         66.26         35.61         7.9         64.6         100         360         P           7308         46.43         -27.57         74         66.05         35.89         9.5         65.01         100         360         P           4926         50.22         -23.78         74         71.39         35.57         7.94         64.68         100         360         P           7386         41.79         -32.21         74         61.37         35.94         9.53         65.05         100         360         P           4926         44.62         -29.38         74         65.79         35.57         7.94         64.68         100         360         P           7386         41.82         -32.18         74         61.4         35.94         9.53         65.05         100         360         P |

All results are PASS against Peak and Average limit line.

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: Rev. 01

Report No. : FR832104-01C

Report Version Report Template No.: BU5-FR15CWL AC MA Version 2.0

## 2.4GHz 2400~2483.5MHz WIFI 802.11n HT40 (Band Edge @ 3m)

| WIFI      | Note | Frequency | Level      | Over          | Limit                | Read              | Antenna         | Cable        | Preamp      | Ant           | Table          | Peak               | Pol.              |
|-----------|------|-----------|------------|---------------|----------------------|-------------------|-----------------|--------------|-------------|---------------|----------------|--------------------|-------------------|
| Ant.<br>1 |      | (MHz)     | ( dBµV/m ) | Limit<br>(dB) | Line<br>( dBµV/m )   | Level<br>( dBµV ) | Factor ( dB/m ) | Loss<br>(dB) | Factor (dB) | Pos           | Pos<br>( deg ) | Avg.<br>(P/A)      |                   |
|           |      | 2389.69   | 64.31      | -9.69         | ( <b>авµv</b> /III ) | 61.5              | 31.3            | 5.65         | 34.14       | ( <b>cm</b> ) | 72             | ( <b>P/A)</b><br>P | <u>(п/v)</u><br>Н |
|           |      |           |            |               |                      |                   |                 |              |             |               |                | -                  |                   |
|           |      | 2389.82   | 52.45      | -1.55         | 54                   | 49.64             | 31.3            | 5.65         | 34.14       | 397           | 72             | A                  | Н                 |
|           | *    | 2412      | 100.44     | -             | -                    | 97.6              | 31.33           | 5.67         | 34.16       | 397           | 72             | Р                  | Н                 |
|           | *    | 2410      | 92.75      | -             | -                    | 89.91             | 31.33           | 5.67         | 34.16       | 397           | 72             | Α                  | Н                 |
| 802.11n   |      | 2489.68   | 52.5       | -21.5         | 74                   | 49.56             | 31.47           | 5.77         | 34.3        | 397           | 72             | Р                  | Н                 |
| HT40      |      | 2484.82   | 42.19      | -11.81        | 54                   | 39.28             | 31.44           | 5.75         | 34.28       | 397           | 72             | Α                  | Н                 |
| CH 03     |      | 2389.3    | 60.91      | -13.09        | 74                   | 58.1              | 31.3            | 5.65         | 34.14       | 313           | 134            | Р                  | ٧                 |
| 2422MHz   |      | 2389.95   | 47.91      | -6.09         | 54                   | 45.1              | 31.3            | 5.65         | 34.14       | 313           | 134            | Α                  | V                 |
|           | *    | 2410      | 98.59      | -             | -                    | 95.75             | 31.33           | 5.67         | 34.16       | 313           | 134            | Р                  | ٧                 |
|           | *    | 2410      | 91.04      | -             | -                    | 88.2              | 31.33           | 5.67         | 34.16       | 313           | 134            | Α                  | V                 |
|           |      | 2496.64   | 52.88      | -21.12        | 74                   | 49.94             | 31.47           | 5.77         | 34.3        | 313           | 134            | Р                  | ٧                 |
|           |      | 2495.32   | 42.17      | -11.83        | 54                   | 39.23             | 31.47           | 5.77         | 34.3        | 313           | 134            | Α                  | ٧                 |
|           |      | 2388.52   | 66.23      | -7.77         | 74                   | 63.42             | 31.3            | 5.65         | 34.14       | 111           | 74             | Р                  | Н                 |
|           |      | 2389.69   | 52.9       | -1.1          | 54                   | 50.09             | 31.3            | 5.65         | 34.14       | 111           | 74             | Α                  | Н                 |
|           | *    | 2446      | 104.93     | -             | -                    | 102.05            | 31.39           | 5.71         | 34.22       | 111           | 74             | Р                  | Н                 |
|           | *    | 2448      | 97.22      | -             | -                    | 94.34             | 31.39           | 5.71         | 34.22       | 111           | 74             | Α                  | Н                 |
| 802.11n   |      | 2484.16   | 62.07      | -11.93        | 74                   | 59.16             | 31.44           | 5.75         | 34.28       | 111           | 74             | Р                  | Н                 |
| HT40      |      | 2483.5    | 46.34      | -7.66         | 54                   | 43.43             | 31.44           | 5.75         | 34.28       | 111           | 74             | Α                  | Н                 |
| CH 06     |      | 2388.65   | 64.45      | -9.55         | 74                   | 61.64             | 31.3            | 5.65         | 34.14       | 344           | 88             | Р                  | V                 |
| 2437MHz   |      | 2389.95   | 49.18      | -4.82         | 54                   | 46.37             | 31.3            | 5.65         | 34.14       | 344           | 88             | Α                  | V                 |
|           | *    | 2448      | 102.04     | -             | -                    | 99.16             | 31.39           | 5.71         | 34.22       | 344           | 88             | Р                  | V                 |
|           | *    | 2448      | 94.44      | -             | -                    | 91.56             | 31.39           | 5.71         | 34.22       | 344           | 88             | Α                  | V                 |
|           |      | 2483.8    | 59.75      | -14.25        | 74                   | 56.84             | 31.44           | 5.75         | 34.28       | 344           | 88             | Р                  | V                 |
|           |      | 2483.5    | 44.53      | -9.47         | 54                   | 41.62             | 31.44           | 5.75         | 34.28       | 344           | 88             | Α                  | ٧                 |

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|         |   | 2388.78        | 62.42  | -11.58   | 74          | 59.61     | 31.3  | 5.65 | 34.14 | 114 | 78 | Р | Н |
|---------|---|----------------|--------|----------|-------------|-----------|-------|------|-------|-----|----|---|---|
|         |   | 2389.3         | 46.94  | -7.06    | 54          | 44.13     | 31.3  | 5.65 | 34.14 | 114 | 78 | Α | Н |
|         | * | 2448           | 105.42 | -        | -           | 102.54    | 31.39 | 5.71 | 34.22 | 114 | 78 | Р | Н |
|         | * | 2448           | 97.61  | -        | -           | 94.73     | 31.39 | 5.71 | 34.22 | 114 | 78 | Α | Н |
| 802.11n |   | 2485.96        | 69.71  | -4.29    | 74          | 66.8      | 31.44 | 5.75 | 34.28 | 114 | 78 | Р | Н |
| HT40    |   | 2483.56        | 53.72  | -0.28    | 54          | 50.81     | 31.44 | 5.75 | 34.28 | 114 | 78 | Α | Н |
| CH 09   |   | 2389.82        | 57.8   | -16.2    | 74          | 54.99     | 31.3  | 5.65 | 34.14 | 341 | 89 | Р | ٧ |
| 2452MHz |   | 2389.56        | 44.37  | -9.63    | 54          | 41.56     | 31.3  | 5.65 | 34.14 | 341 | 89 | Α | ٧ |
|         | * | 2450           | 103.61 | -        | -           | 100.73    | 31.39 | 5.71 | 34.22 | 341 | 89 | Р | V |
|         | * | 2448           | 94.94  | -        | -           | 92.06     | 31.39 | 5.71 | 34.22 | 341 | 89 | Α | ٧ |
|         |   | 2483.56        | 66.5   | -7.5     | 74          | 63.59     | 31.44 | 5.75 | 34.28 | 341 | 89 | Р | ٧ |
|         |   | 2483.68        | 50.66  | -3.34    | 54          | 47.75     | 31.44 | 5.75 | 34.28 | 341 | 89 | Α | V |
| Remark  |   | other spurious |        | Peak and | Average lir | nit line. |       |      |       |     |    |   | , |

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## 2.4GHz 2400~2483.5MHz WIFI 802.11n HT40 (Harmonic @ 3m)

| WIFI      | Note  | Frequency        | Level      | Over          | Limit              | Read              | Antenna            | Cable        | Preamp      | Ant           | Table          | Peak          | Pol. |
|-----------|-------|------------------|------------|---------------|--------------------|-------------------|--------------------|--------------|-------------|---------------|----------------|---------------|------|
| Ant.<br>1 |       | ( MHz )          | ( dBµV/m ) | Limit<br>(dB) | Line<br>( dBµV/m ) | Level<br>( dBµV ) | Factor<br>( dB/m ) | Loss<br>(dB) | Factor (dB) | Pos<br>( cm ) | Pos<br>( deg ) | Avg.<br>(P/A) | i .  |
| 802.11n   |       | 4842             | 43.82      | -30.18        | 74                 | 64.87             | 35.63              | 7.87         | 64.55       | 100           | 360            | Р             | Н    |
| HT40      |       | 7266             | 41.23      | -32.77        | 74                 | 60.87             | 35.87              | 9.48         | 64.99       | 100           | 360            | Р             | Н    |
| CH 03     |       | 4842             | 42.27      | -31.73        | 74                 | 63.32             | 35.63              | 7.87         | 64.55       | 100           | 360            | Р             | ٧    |
| 2422MHz   |       | 7266             | 41.28      | -32.72        | 74                 | 60.92             | 35.87              | 9.48         | 64.99       | 100           | 360            | Р             | ٧    |
| 802.11n   |       | 4872             | 46.47      | -27.53        | 74                 | 67.56             | 35.61              | 7.9          | 64.6        | 100           | 360            | Р             | Н    |
| HT40      |       | 7308             | 42.18      | -31.82        | 74                 | 61.8              | 35.89              | 9.5          | 65.01       | 100           | 360            | Р             | Н    |
| CH 06     |       | 4874             | 42.7       | -31.3         | 74                 | 63.79             | 35.61              | 7.9          | 64.6        | 100           | 360            | Р             | V    |
| 2437MHz   |       | 7308             | 41.98      | -32.02        | 74                 | 61.6              | 35.89              | 9.5          | 65.01       | 100           | 360            | Р             | ٧    |
| 802.11n   |       | 4908             | 50.14      | -23.86        | 74                 | 71.28             | 35.58              | 7.93         | 64.65       | 100           | 360            | Р             | Н    |
| HT40      |       | 7356             | 41.56      | -32.44        | 74                 | 61.15             | 35.92              | 9.52         | 65.03       | 100           | 360            | Р             | Н    |
| CH 09     |       | 4904             | 43.36      | -30.64        | 74                 | 64.5              | 35.58              | 7.93         | 64.65       | 100           | 360            | Р             | V    |
| 2452MHz   |       | 7356             | 42.83      | -31.17        | 74                 | 62.42             | 35.92              | 9.52         | 65.03       | 100           | 360            | Р             | V    |
|           | 1. No | o other spurious |            | -31.17        | /4                 | 02.42             | 35.92              | 9.52         | 05.03       | 100           | 300            | ٢             |      |

## Remark

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All results are PASS against Peak and Average limit line.

#### **Emission below 1GHz**

## 2.4GHz WIFI 802.11n HT40 (LF)

| WIFI    | Note | Frequency                         | Level      | Over         | Limit      | Read   | Antenna  | Cable | Preamp | Ant    | Table | Peak  | Pol.  |
|---------|------|-----------------------------------|------------|--------------|------------|--------|----------|-------|--------|--------|-------|-------|-------|
| Ant.    |      |                                   |            | Limit        | Line       | Level  | Factor   | Loss  | Factor | Pos    | Pos   | Avg.  |       |
| 1       |      | (MHz)                             | ( dBµV/m ) | (dB)         | ( dBµV/m ) | (dBµV) | ( dB/m ) | (dB)  | (dB)   | ( cm ) | (deg) | (P/A) | (H/V) |
|         |      | 30                                | 24.05      | -15.95       | 40         | 29.38  | 25.2     | 0.57  | 31.1   | -      | -     | Р     | Н     |
|         |      | 74.62                             | 25.98      | -14.02       | 40         | 43.5   | 12.96    | 0.92  | 31.4   | 120    | 85    | Р     | Н     |
|         |      | 148.34                            | 21.47      | -22.03       | 43.5       | 34.06  | 16.99    | 1.31  | 30.89  | -      | -     | Р     | Н     |
|         |      | 486.87                            | 24.36      | -21.64       | 46         | 30.01  | 23.5     | 2.45  | 31.6   | -      | -     | Р     | Н     |
| 2.4GHz  |      | 697.36                            | 28.8       | -17.2        | 46         | 30.36  | 26.38    | 2.94  | 30.88  | -      | -     | Р     | Н     |
| 802.11n |      | 893.3                             | 30.78      | -15.22       | 46         | 29.53  | 28.95    | 3.41  | 31.11  | -      | -     | Р     | Н     |
| HT40    |      | 30                                | 24.24      | -15.76       | 40         | 29.57  | 25.2     | 0.57  | 31.1   | -      | -     | Р     | ٧     |
| LF      |      | 296.75                            | 22.21      | -23.79       | 46         | 32.68  | 19.12    | 1.89  | 31.48  | -      | -     | Р     | ٧     |
|         |      | 371.44                            | 24.33      | -21.67       | 46         | 32.81  | 20.92    | 2.1   | 31.5   | -      | -     | Р     | V     |
|         |      | 445.16                            | 25.34      | -20.66       | 46         | 32.01  | 22.59    | 2.33  | 31.59  | -      | -     | Р     | ٧     |
|         |      | 767.2                             | 30.29      | -15.71       | 46         | 30.3   | 27.67    | 3.09  | 30.77  | -      | -     | Р     | ٧     |
|         |      | 946.65                            | 31.1       | -14.9        | 46         | 29.42  | 29.51    | 3.46  | 31.29  | 100    | 0     | Р     | ٧     |
| Remark  |      | o other spurio<br>I results are F |            | st limit liı | ne.        |        |          |       |        |        |       |       |       |

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## Note symbol

| *   | Fundamental Frequency which can be ignored. However, the level of any       |
|-----|---|
|     | unwanted emissions shall not exceed the level of the fundamental frequency. |
| !   | Test result is <b>not under limit 6dB.</b> .                                |
| P/A | Peak or Average   |
| H/V | Horizontal or Vertical  |

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#### A calculation example for radiated spurious emission is shown as below:

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| WIFI    | Note | Frequency | Level      | Over   | Limit      | Read                | Antenna  | Cable  | Preamp | Ant    | Table | Peak  | Pol.  |
|---------|------|-----------|------------|--------|------------|---------------------|----------|--------|--------|--------|-------|-------|-------|
| Ant.    |      |           |            | Limit  | Line       | Level               | Factor   | Loss   | Factor | Pos    | Pos   | Avg.  |       |
| 1+2     |      | (MHz)     | ( dBµV/m ) | (dB)   | ( dBµV/m ) | (dB <sub>µ</sub> V) | ( dB/m ) | ( dB ) | ( dB ) | ( cm ) | (deg) | (P/A) | (H/V) |
| 802.11b |      | 2390      | 55.45      | -18.55 | 74         | 54.51               | 32.22    | 4.58   | 35.86  | 103    | 308   | Р     | Н     |
| CH 01   |      |           |            |        |            |                     |          |        |        |        |       |       |       |
| 2412MHz |      | 2390      | 43.54      | -10.46 | 54         | 42.6                | 32.22    | 4.58   | 35.86  | 103    | 308   | Α     | Н     |

1. Level( $dB\mu V/m$ ) =

Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBµV) - Preamp Factor(dB)

2. Over Limit(dB) = Level(dB $\mu$ V/m) – Limit Line(dB $\mu$ V/m)

#### For Peak Limit @ 2390MHz:

- Level(dBµV/m)
- = Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBµV) Preamp Factor(dB)
- $= 32.22(dB/m) + 4.58(dB) + 54.51(dB\mu V) 35.86 (dB)$
- $= 55.45 (dB\mu V/m)$
- 2. Over Limit(dB)
- = Level(dBµV/m) Limit Line(dBµV/m)
- $= 55.45(dB\mu V/m) 74(dB\mu V/m)$
- = -18.55(dB)

#### For Average Limit @ 2390MHz:

- Level(dBµV/m)
- = Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBµV) Preamp Factor(dB)
- $= 32.22(dB/m) + 4.58(dB) + 42.6(dB\mu V) 35.86 (dB)$
- $= 43.54 (dB\mu V/m)$
- 2. Over Limit(dB)
- = Level( $dB\mu V/m$ ) Limit Line( $dB\mu V/m$ )
- $= 43.54(dB\mu V/m) 54(dB\mu V/m)$
- = -10.46(dB)

Both peak and average measured complies with the limit line, so test result is "PASS".

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Appendix D. Duty Cycle Plots

| Band         | Duty Cycle(%) | T(ms) | 1/T(kHz) | VBW Setting |
|--------------|---------------|-------|----------|-------------|
| 802.11b      | 97.59         | 8.232 | 0.121    | 300Hz       |
| 802.11g      | 87.50         | 1.370 | 0.730    | 1KHz        |
| 802.11n HT20 | 86.27         | 1.275 | 0.784    | 1KHz        |
| 802.11n HT40 | 86.29         | 1.232 | 0.812    | 1KHz        |

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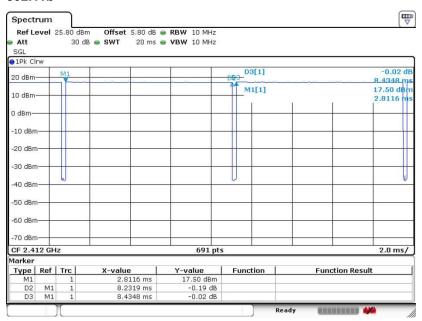
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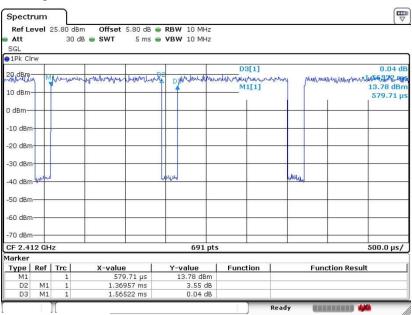


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#### 802.11b



#### 802.11g



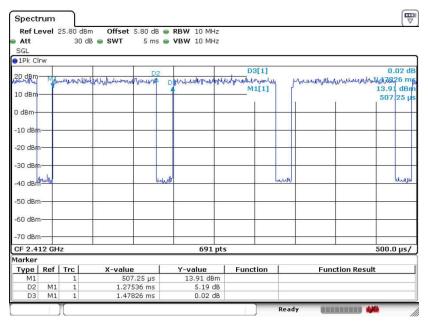
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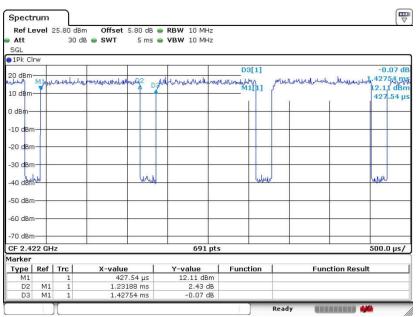


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#### 802.11n HT20



#### 802.11n HT40



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