# 5.5. Spurious RF Conducted Emissions

#### **Ambient Condition**

| Temperature | Relative humidity |  |  |
|-------------|-------------------|--|--|
| 15°C ~ 35°C | 20% ~ 80%         |  |  |

#### **Method of Measurement**

The EUT was connected to the spectrum analyzer with a known loss. The spectrum analyzer scans from 30MHz to the 10th harmonic of the carrier. The peak detector is used. Set RBW to 100 kHz and VBW to 300 kHz, Sweep is set to AUTO.

The test is in transmitting mode.

# **Test Setup**



# Limits

Rule Part 15.247(d) pacifies that "In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB."

#### Antenna 1

| Test Mode       | Carrier frequency<br>(MHz) | Reference value (dBm) | Limit  |  |
|-----------------|----------------------------|-----------------------|--------|--|
|                 | 2412                       | 0.630                 | -29.37 |  |
| 802.11b         | 2437                       | 0.670                 | -29.33 |  |
|                 | 2462                       | 0.480                 | -29.52 |  |
| 802.11g         | 2412                       | 2.020                 | -27.98 |  |
|                 | 2437                       | 1.360                 | -28.64 |  |
|                 | 2462                       | 1.780                 | -28.22 |  |
| 802.11n<br>HT20 | 2412                       | 2.060                 | -27.94 |  |
|                 | 2437                       | 2.200                 | -27.80 |  |
|                 | 2462                       | -0.140                | -30.14 |  |
| 802.11ax        | 2412                       | 1.290                 | -28.71 |  |
| HE20            | 2437                       | 0.840                 | -29.16 |  |

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|----------------|-----------------------------------|--------|--------|
|                | 2462                              | -0.630 | -30.63 |
| Bluetooth      | 2402                              | -2.030 | -32.03 |
| (Low Energy)   | 2440                              | -1.390 | -31.39 |
| (1M)           | 2480                              | -1.480 | -31.48 |
| Bluetooth      | 2402                              | -2.380 | -32.38 |
| (Low Energy)   | 2440                              | -1.650 | -31.65 |
| (2M)           | 2480                              | -1.890 | -31.89 |
| Bluetooth      | 2402                              | -2.470 | -32.47 |
| (Low Energy)   | 2440                              | -2.090 | -32.09 |
| (S=2)          | 2480                              | -2.040 | -32.04 |
| Bluetooth      | 2402                              | -5.460 | -35.46 |
| (Low Energy)   | 2440                              | -5.020 | -35.02 |
| (S=8)          | 2480                              | -5.200 | -35.20 |

# **Measurement Uncertainty**

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 1.96.

| Frequency   | Uncertainty |  |  |
|-------------|-------------|--|--|
| 100kHz-2GHz | 0.684 dB    |  |  |
| 2GHz-26GHz  | 1.407 dB    |  |  |



#### **Test Results:**



#### Tx. Spurious 802.11ax(HE20) 2412MHz Emission





# Tx. Spurious 802.11ax(HE20) 2437MHz Ref



#### Tx. Spurious 802.11ax(HE20) 2437MHz Emission





#### Tx. Spurious 802.11ax(HE20) 2462MHz Ref



#### Tx. Spurious 802.11ax(HE20) 2462MHz Emission





#### Tx. Spurious 802.11b 2412MHz Ref



# Tx. Spurious 802.11b 2412MHz Emission





#### Tx. Spurious 802.11b 2437MHz Ref



#### Tx. Spurious 802.11b 2437MHz Emission





#### Tx. Spurious 802.11b 2462MHz Ref



# Tx. Spurious 802.11b 2462MHz Emission





# Tx. Spurious 802.11g 2412MHz Ref



# Tx. Spurious 802.11g 2412MHz Emission





#### Tx. Spurious 802.11g 2437MHz Ref



# Tx. Spurious 802.11g 2437MHz Emission





#### Tx. Spurious 802.11g 2462MHz Ref



# Tx. Spurious 802.11g 2462MHz Emission





# Tx. Spurious 802.11n(HT20) 2412MHz Ref



# Tx. Spurious 802.11n(HT20) 2412MHz Emission





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#### Tx. Spurious 802.11n(HT20) 2437MHz Ref



#### Tx. Spurious 802.11n(HT20) 2437MHz Emission





Tx. Spurious 802.11n(HT20) 2462MHz Ref



#### Tx. Spurious 802.11n(HT20) 2462MHz Emission





# Tx. Spurious BLE 1M 2402MHz Ref



# Tx. Spurious BLE 1M 2402MHz Emission





# Tx. Spurious BLE 1M 2440MHz Ref



# Tx. Spurious BLE 1M 2440MHz Emission





# Tx. Spurious BLE 1M 2480MHz Ref



# Tx. Spurious BLE 1M 2480MHz Emission





#### Tx. Spurious BLE 2M 2402MHz Ref



# Tx. Spurious BLE 2M 2402MHz Emission





#### Tx. Spurious BLE 2M 2440MHz Ref



# Tx. Spurious BLE 2M 2440MHz Emission





#### Tx. Spurious BLE 2M 2480MHz Ref



# Tx. Spurious BLE 2M 2480MHz Emission





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Tx. Spurious BLE S=2 2402MHz Ref



#### Tx. Spurious BLE S=2 2402MHz Emission





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Tx. Spurious BLE S=2 2440MHz Ref



#### Tx. Spurious BLE S=2 2440MHz Emission





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Tx. Spurious BLE S=2 2480MHz Ref



#### Tx. Spurious BLE S=2 2480MHz Emission





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Tx. Spurious BLE S=8 2402MHz Ref



# Tx. Spurious BLE S=8 2402MHz Emission





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Tx. Spurious BLE S=8 2440MHz Ref



# Tx. Spurious BLE S=8 2440MHz Emission





Report No.: R2408A1111-R1

Tx. Spurious BLE S=8 2480MHz Ref



# Tx. Spurious BLE S=8 2480MHz Emission



# 5.6. Unwanted Emission

# **Ambient Condition**

| Temperature | Relative humidity |  |  |
|-------------|-------------------|--|--|
| 15°C ~ 35°C | 20% ~ 80%         |  |  |

# Method of Measurement

The test set-up was made in accordance to the general provisions of ANSI C63.10. The Equipment Under Test (EUT) was set up on a non-conductive table in the semi-anechoic chamber. The test was performed at the distance of 3 m between the EUT and the receiving antenna.

The turntable shall be rotated from 0 to 360 degrees for detecting the maximum of radiated spurious signal level. The measurements shall be repeated with orthogonal polarization of the test antenna. The data of cable loss and antenna factor has been calibrated in full testing frequency range before the testing. Sweep the Restricted Band and the emissions less than 20 dB below the permissible value are reported.

The radiated emissions measurements were made in a typical installation configuration.

Sweep the whole frequency band through the range from 9 kHz to the 10th harmonic of the carrier, and the emissions less than 20 dB below the permissible value are reported.

This method refer to ANSI C63.10. The procedure for peak unwanted emissions measurements above 1000 MHz is as follows: Set the spectrum analyzer in the following: 9kHz~150 kHz RBW=200Hz, VBW=1kHz/ Sweep=AUTO 150 kHz~30MHz RBW=9KHz, VBW=30KHz,/ Sweep=AUTO Below 1GHz RBW=100kHz / VBW=300kHz / Sweep=AUTO a) Peak emission levels are measured by setting the instrument as follows: Above 1GHz PEAK: RBW=1MHz VBW=3MHz/ Sweep=AUTO b) Average emission levels are measured by setting the instrument as follows: Above 1GHz AVERAGE: RBW=1MHz / VBW=3MHz / Sweep=AUTO c) Detector: The measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

d) Averaging type = power (i.e., rms) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage

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averaging. Log or dB averaging shall not be used.)

e) Sweep time = auto.

f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of 1 / D, where D is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)

g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:

1) If power averaging (rms) mode was used in the preceding step e), then the correction factor is [10  $\log (1 / D)$ ], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB shall be added to the measured emission levels.

2) If linear voltage averaging mode was used in the preceding step e), then the correction factor is [20 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels.

3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission.

The test is in transmitting mode.



#### Test Setup









Above 1GHz



Note: Area side:2.4mX3.6m

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#### Limits

Rule Part 15.247(d) specifies that "In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c))."

Limit in restricted band

| Frequency of emission (MHz) | Field strength(µV/m) | Field strength(dBµV/m) |
|-----------------------------|----------------------|------------------------|
| 0.009–0.490                 | 2400/F(kHz)          | 1                      |
| 0.490–1.705                 | 24000/F(kHz)         | 1                      |
| 1.705–30.0                  | 30                   | 1                      |
| 30-88                       | 100                  | 40                     |
| 88-216                      | 150                  | 43.5                   |
| 216-960                     | 200                  | 46                     |
| Above960                    | 500                  | 54                     |

# §15.35(b)

There is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit. Peak Limit=74 dB $\mu$ V/m

Average Limit=54 dBµV/m

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Spurious Radiated Emissions are permitted in any of the frequency bands listed below:

| MHz                      | MHz                 | MHz           | GHz         |
|--------------------------|---------------------|---------------|-------------|
| 0.090-0.110              | 16.42-16.423        | 399.9-410     | 4.5-5.15    |
| <sup>1</sup> 0.495-0.505 | 16.69475-16.69525   | 608-614       | 5.35-5.46   |
| 2.1735-2.1905            | 16.80425-16.80475   | 960-1240      | 7.25-7.75   |
| 4.125-4.128              | 25.5-25.67          | 1300-1427     | 8.025-8.5   |
| 4.17725-4.17775          | 37.5-38.25          | 1435-1626.5   | 9.0-9.2     |
| 4.20725-4.20775          | 73-74.6             | 1645.5-1646.5 | 9.3-9.5     |
| 6.215-6.218              | 74.8-75.2           | 1660-1710     | 10.6-12.7   |
| 6.26775-6.26825          | 108-121.94          | 1718.8-1722.2 | 13.25-13.4  |
| 6.31175-6.31225          | 123-138             | 2200-2300     | 14.47-14.5  |
| 8.291-8.294              | 149.9-150.05        | 2310-2390     | 15.35-16.2  |
| 8.362-8.366              | 156.52475-156.52525 | 2483.5-2500   | 17.7-21.4   |
| 8.37625-8.38675          | 156.7-156.9         | 2690-2900     | 22.01-23.12 |
| 8.41425-8.41475          | 162.0125-167.17     | 3260-3267     | 23.6-24.0   |
| 12.29-12.293             | 167.72-173.2        | 3332-3339     | 31.2-31.8   |
| 12.51975-12.52025        | 240-285             | 3345.8-3358   | 36.43-36.5  |
| 12.57675-12.57725        | 322-335.4           | 3600-4400     | (2)         |
| 13.36-13.41              |                     |               |             |

# **Measurement Uncertainty**

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 1.96.

| Frequency     | Uncertainty |  |  |
|---------------|-------------|--|--|
| 9KHz-30MHz    | 3.55 dB     |  |  |
| 30MHz-200MHz  | 4.17 dB     |  |  |
| 200MHz-1GHz   | 4.84 dB     |  |  |
| 1-18GHz       | 4.35 dB     |  |  |
| 18-26.5GHz    | 5.90 dB     |  |  |
| 26.5GHz~40GHz | 5.92 dB     |  |  |



#### **Test Results:**

The following graphs display the maximum values of horizontal and vertical by software. Blue trace uses the peak detection, Green trace uses the average detection.

A symbol (  $^{dB-V\prime}$  ) in the test plot below means (dBµV/m)



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#### After the pretest, Bluetooth LE (S=2) was selected as the worst Mode for Bluetooth LE.



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# Result of RE

#### Test result

Sweep the whole frequency band through the range from 9kHz to the 10th harmonic of the carrier.

The following graphs display the maximum values of horizontal and vertical by software. For above 1GHz, Blue trace uses the peak detection, Green trace uses the average detection.

# Continuous TX mode:

# Wi-Fi 2.4G

During the test, the Radiates Emission from 9MHz to 1GHz was performed in all modes with all channels, 802.11g CH11 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

A symbol (dB W) in the test plot below means (dBµV/m)



# Radiates Emission from 9KHz to 90KHz





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Radiates Emission from 110KHz to 490KHz



Radiates Emission from 490KHz to 30MHz





#### Radiates Emission from 30MHz to 1GHz

| Frequency<br>(MHz) | Quasi-Peak<br>(dBµV/m) | Limit<br>(dBµV/m) | Margin<br>(dB) | Height<br>(cm) | Polarization | Azimuth<br>(deg) | Correct<br>Factor (dB) |
|--------------------|------------------------|-------------------|----------------|----------------|--------------|------------------|------------------------|
| 45.558750          | 24.11                  | 40.00             | 15.89          | 125.0          | V            | 184.0            | 20.9                   |
| 130.917500         | 17.14                  | 43.50             | 26.36          | 100.0          | V            | 165.0            | 15.7                   |
| 289.718750         | 26.95                  | 46.00             | 19.05          | 125.0          | Н            | 126.0            | 20.7                   |
| 400.013750         | 30.57                  | 46.00             | 15.43          | 100.0          | Н            | 329.0            | 23.4                   |
| 620.077500         | 28.76                  | 46.00             | 17.24          | 100.0          | V            | 46.0             | 27.3                   |
| 674.437500         | 31.94                  | 46.00             | 14.06          | 125.0          | V            | 222.0            | 27.8                   |

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain) 2. Margin = Limit – Quasi-Peak
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| Frequency<br>(MHz) | MaxPeak<br>(dBµV/m) | Average<br>(dBµV/m) | Limit<br>(dBµV/m) | Margin<br>(dB) | Meas. Time<br>(ms) | Height<br>(cm) | Pol | Azimuth<br>(deg) | Corr.<br>(dB/m) |
|--------------------|---------------------|---------------------|-------------------|----------------|--------------------|----------------|-----|------------------|-----------------|
| 1151.750000        |                     | 29.66               | 54.00             | 24.34          | 500.0              | 200.0          | Н   | 63.0             | -9.8            |
| 1198.250000        | 41.11               |                     | 74.00             | 32.89          | 500.0              | 100.0          | Н   | 0.0              | -8.8            |
| 1395.000000        | 41.66               |                     | 74.00             | 32.34          | 500.0              | 200.0          | V   | 290.0            | -7.6            |
| 1400.250000        |                     | 29.75               | 54.00             | 24.25          | 500.0              | 100.0          | V   | 311.0            | -7.6            |
| 1544.250000        | 42.50               |                     | 74.00             | 31.50          | 500.0              | 100.0          | V   | 352.0            | -6.7            |
| 1682.000000        |                     | 30.81               | 54.00             | 23.19          | 500.0              | 100.0          | V   | 352.0            | -6.0            |
| 1766.750000        | 41.60               |                     | 74.00             | 32.40          | 500.0              | 100.0          | V   | 218.0            | -5.7            |
| 1875.500000        |                     | 29.70               | 54.00             | 24.30          | 500.0              | 200.0          | V   | 7.0              | -5.1            |
| 1995.000000        | 45.21               |                     | 74.00             | 28.79          | 500.0              | 200.0          | V   | 3.0              | -4.6            |
| 2070.500000        |                     | 32.69               | 54.00             | 21.31          | 500.0              | 200.0          | V   | 64.0             | -4.0            |
| 2908.000000        | 47.60               |                     | 74.00             | 26.40          | 500.0              | 200.0          | V   | 16.0             | -1.0            |
| 2978.250000        |                     | 35.48               | 54.00             | 18.52          | 500.0              | 200.0          | V   | 0.0              | -0.7            |

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

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| Frequency<br>(MHz) | MaxPeak<br>(dBµV/m) | Average<br>(dBµV/m) | Limit<br>(dBµV/m) | Margin<br>(dB) | Meas. Time<br>(ms) | Height<br>(cm) | Pol | Azimuth<br>(deg) | Corr.<br>(dB/m) |
|--------------------|---------------------|---------------------|-------------------|----------------|--------------------|----------------|-----|------------------|-----------------|
| 1147.000000        | 40.41               |                     | 74.00             | 33.59          | 500.0              | 100.0          | V   | 303.0            | -9.8            |
| 1151.750000        |                     | 29.55               | 54.00             | 24.45          | 500.0              | 100.0          | Н   | 6.0              | -9.8            |
| 1339.500000        | 41.22               |                     | 74.00             | 32.78          | 500.0              | 200.0          | V   | 176.0            | -8.0            |
| 1408.250000        |                     | 29.66               | 54.00             | 24.34          | 500.0              | 100.0          | Н   | 88.0             | -7.5            |
| 1542.500000        |                     | 29.41               | 54.00             | 24.59          | 500.0              | 200.0          | V   | 176.0            | -6.8            |
| 1583.250000        | 42.42               |                     | 74.00             | 31.58          | 500.0              | 100.0          | V   | 155.0            | -6.5            |
| 1714.250000        |                     | 30.50               | 54.00             | 23.50          | 500.0              | 200.0          | V   | 9.0              | -5.9            |
| 1804.750000        | 41.60               |                     | 74.00             | 32.40          | 500.0              | 200.0          | н   | 337.0            | -5.4            |
| 1993.250000        | 44.67               |                     | 74.00             | 29.33          | 500.0              | 200.0          | V   | 162.0            | -4.6            |
| 2072.000000        |                     | 32.32               | 54.00             | 21.68          | 500.0              | 200.0          | V   | 13.0             | -4.0            |
| 2768.500000        |                     | 34.53               | 54.00             | 19.47          | 500.0              | 100.0          | V   | 197.0            | -1.4            |
| 2801.250000        | 47.62               |                     | 74.00             | 26.38          | 500.0              | 100.0          | Н   | 24.0             | -1.2            |

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

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| Frequency<br>(MHz) | MaxPeak<br>(dBµV/m) | Average<br>(dBµV/m) | Limit<br>(dBµV/m) | Margin<br>(dB) | Meas. Time<br>(ms) | Height<br>(cm) | Pol | Azimuth<br>(deg) | Corr.<br>(dB/m) |
|--------------------|---------------------|---------------------|-------------------|----------------|--------------------|----------------|-----|------------------|-----------------|
| 1197.250000        | 40.51               |                     | 74.00             | 33.49          | 500.0              | 200.0          | V   | 127.0            | -8.9            |
| 1200.000000        |                     | 28.93               | 54.00             | 25.07          | 500.0              | 200.0          | V   | 310.0            | -8.8            |
| 1407.250000        | 41.88               |                     | 74.00             | 32.13          | 500.0              | 100.0          | Н   | 147.0            | -7.5            |
| 1441.750000        |                     | 29.83               | 54.00             | 24.17          | 500.0              | 100.0          | V   | 114.0            | -7.3            |
| 1684.250000        | 42.87               |                     | 74.00             | 31.13          | 500.0              | 200.0          | н   | 218.0            | -6.0            |
| 1715.500000        |                     | 31.53               | 54.00             | 22.47          | 500.0              | 100.0          | н   | 48.0             | -5.9            |
| 2016.500000        |                     | 33.14               | 54.00             | 20.86          | 500.0              | 100.0          | Н   | 0.0              | -4.4            |
| 2071.000000        | 44.79               |                     | 74.00             | 29.21          | 500.0              | 100.0          | V   | 288.0            | -4.0            |
| 2381.500000        | 44.86               |                     | 74.00             | 29.14          | 500.0              | 100.0          | Н   | 62.0             | -2.7            |
| 2386.250000        |                     | 33.88               | 54.00             | 20.12          | 500.0              | 100.0          | н   | 6.0              | -2.7            |
| 2802.000000        | 47.69               |                     | 74.00             | 26.31          | 500.0              | 100.0          | Н   | 2.0              | -1.2            |
| 2833.000000        |                     | 35.95               | 54.00             | 18.05          | 500.0              | 100.0          | Н   | 0.0              | -1.1            |

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

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#### 802.11g CH1







RF Test Report

| Frequency<br>(MHz) | MaxPeak<br>(dBµV/m) | Average<br>(dBµV/m) | Limit<br>(dBµV/m) | Margin<br>(dB) | Meas. Time<br>(ms) | Height<br>(cm) | Pol | Azimuth<br>(deg) | Corr.<br>(dB/m) |
|--------------------|---------------------|---------------------|-------------------|----------------|--------------------|----------------|-----|------------------|-----------------|
| 1036.250000        | 39.14               |                     | 74.00             | 34.86          | 500.0              | 200.0          | V   | 40.0             | -10.5           |
| 1056.000000        |                     | 29.73               | 54.00             | 24.27          | 500.0              | 100.0          | V   | 314.0            | -10.4           |
| 1181.750000        | 40.37               |                     | 74.00             | 33.63          | 500.0              | 100.0          | V   | 229.0            | -9.2            |
| 1188.000000        |                     | 28.48               | 54.00             | 25.52          | 500.0              | 200.0          | V   | 294.0            | -9.0            |
| 1403.500000        |                     | 30.13               | 54.00             | 23.87          | 500.0              | 200.0          | Н   | 0.0              | -7.6            |
| 1418.500000        | 41.72               |                     | 74.00             | 32.28          | 500.0              | 200.0          | Н   | 0.0              | -7.4            |
| 1684.500000        | 43.73               |                     | 74.00             | 30.27          | 500.0              | 200.0          | Н   | 311.0            | -6.0            |
| 1720.000000        |                     | 31.61               | 54.00             | 22.39          | 500.0              | 200.0          | Н   | 201.0            | -5.9            |
| 2071.500000        |                     | 33.12               | 54.00             | 20.88          | 500.0              | 200.0          | Н   | 316.0            | -4.0            |
| 2078.250000        | 44.86               |                     | 74.00             | 29.14          | 500.0              | 100.0          | V   | 43.0             | -3.9            |
| 2698.750000        | 47.61               |                     | 74.00             | 26.39          | 500.0              | 200.0          | Н   | 244.0            | -1.6            |
| 2718.250000        |                     | 35.64               | 54.00             | 18.36          | 500.0              | 100.0          | Н   | 104.0            | -1.5            |

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

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RF Test Report

| Frequency<br>(MHz) | MaxPeak<br>(dBµV/m) | Average<br>(dBµV/m) | Limit<br>(dBµV/m) | Margin<br>(dB) | Meas. Time<br>(ms) | Height<br>(cm) | Pol | Azimuth<br>(deg) | Corr.<br>(dB/m) |
|--------------------|---------------------|---------------------|-------------------|----------------|--------------------|----------------|-----|------------------|-----------------|
| 1056.000000        |                     | 29.56               | 54.00             | 24.44          | 500.0              | 100.0          | V   | 265.0            | -10.4           |
| 1063.750000        | 38.88               |                     | 74.00             | 35.12          | 500.0              | 200.0          | V   | 34.0             | -10.3           |
| 1196.250000        |                     | 28.69               | 54.00             | 25.31          | 500.0              | 200.0          | V   | 288.0            | -8.9            |
| 1199.250000        | 39.92               |                     | 74.00             | 34.08          | 500.0              | 200.0          | V   | 255.0            | -8.8            |
| 1379.500000        | 41.56               |                     | 74.00             | 32.44          | 500.0              | 100.0          | Н   | 147.0            | -7.7            |
| 1430.500000        |                     | 30.24               | 54.00             | 23.76          | 500.0              | 100.0          | Н   | 108.0            | -7.4            |
| 1655.750000        | 43.85               |                     | 74.00             | 30.15          | 500.0              | 200.0          | Н   | 203.0            | -6.1            |
| 1730.250000        |                     | 31.62               | 54.00             | 22.38          | 500.0              | 200.0          | Н   | 294.0            | -5.8            |
| 1991.000000        | 45.46               |                     | 74.00             | 28.54          | 500.0              | 200.0          | V   | 206.0            | -4.6            |
| 2074.250000        |                     | 33.12               | 54.00             | 20.88          | 500.0              | 100.0          | Н   | 137.0            | -4.0            |
| 2948.250000        |                     | 36.40               | 54.00             | 17.60          | 500.0              | 200.0          | Н   | 303.0            | -0.9            |
| 2949.750000        | 48.42               |                     | 74.00             | 25.58          | 500.0              | 100.0          | Н   | 0.0              | -0.9            |

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

RF Test Report

Report No.: R2408A1111-R1

#### 802.11g CH11







RF Test Report

| Frequency<br>(MHz) | MaxPeak<br>(dBµV/m) | Average<br>(dBµV/m) | Limit<br>(dBµV/m) | Margin<br>(dB) | Meas. Time<br>(ms) | Height<br>(cm) | Pol | Azimuth<br>(deg) | Corr.<br>(dB/m) |
|--------------------|---------------------|---------------------|-------------------|----------------|--------------------|----------------|-----|------------------|-----------------|
| 1055.750000        |                     | 29.79               | 54.00             | 24.21          | 500.0              | 200.0          | V   | 0.0              | -10.4           |
| 1082.000000        | 39.71               |                     | 74.00             | 34.29          | 500.0              | 200.0          | Н   | 98.0             | -10.3           |
| 1191.750000        |                     | 29.34               | 54.00             | 24.66          | 500.0              | 200.0          | Н   | 98.0             | -9.0            |
| 1193.250000        | 41.09               |                     | 74.00             | 32.91          | 500.0              | 100.0          | V   | 169.0            | -8.9            |
| 1412.250000        | 42.23               |                     | 74.00             | 31.77          | 500.0              | 200.0          | Н   | 33.0             | -7.5            |
| 1412.500000        |                     | 30.51               | 54.00             | 23.49          | 500.0              | 200.0          | Н   | 70.0             | -7.5            |
| 1644.250000        | 43.35               |                     | 74.00             | 30.65          | 500.0              | 200.0          | V   | 354.0            | -6.2            |
| 1709.250000        |                     | 32.00               | 54.00             | 22.00          | 500.0              | 100.0          | Н   | 329.0            | -5.9            |
| 2010.250000        | 45.20               |                     | 74.00             | 28.80          | 500.0              | 200.0          | Н   | 0.0              | -4.4            |
| 2058.500000        |                     | 33.41               | 54.00             | 20.59          | 500.0              | 200.0          | V   | 287.0            | -4.1            |
| 2886.750000        |                     | 36.83               | 54.00             | 17.17          | 500.0              | 200.0          | V   | 210.0            | -1.1            |
| 2953.500000        | 48.54               |                     | 74.00             | 25.46          | 500.0              | 100.0          | Н   | 321.0            | -0.8            |

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)



#### 802.11n (HT20) CH1







RF Test Report

| Frequency<br>(MHz) | MaxPeak<br>(dBµV/m) | Average<br>(dBµV/m) | Limit<br>(dBµV/m) | Margin<br>(dB) | Meas. Time<br>(ms) | Height<br>(cm) | Pol | Azimuth<br>(deg) | Corr.<br>(dB/m) |
|--------------------|---------------------|---------------------|-------------------|----------------|--------------------|----------------|-----|------------------|-----------------|
| 1031.750000        |                     | 29.34               | 54.00             | 24.66          | 500.0              | 100.0          | Н   | 247.0            | -10.6           |
| 1062.000000        | 41.84               |                     | 74.00             | 32.16          | 500.0              | 100.0          | Н   | 326.0            | -10.4           |
| 1195.750000        | 39.46               |                     | 74.00             | 34.54          | 500.0              | 200.0          | V   | 200.0            | -8.9            |
| 1203.250000        |                     | 29.25               | 54.00             | 24.75          | 500.0              | 200.0          | V   | 200.0            | -8.8            |
| 1389.250000        | 41.94               |                     | 74.00             | 32.06          | 500.0              | 200.0          | Н   | 27.0             | -7.6            |
| 1436.250000        |                     | 30.24               | 54.00             | 23.76          | 500.0              | 200.0          | Н   | 126.0            | -7.3            |
| 1658.500000        | 43.28               |                     | 74.00             | 30.72          | 500.0              | 100.0          | V   | 92.0             | -6.1            |
| 1703.750000        |                     | 31.68               | 54.00             | 22.32          | 500.0              | 200.0          | Н   | 36.0             | -6.0            |
| 2028.250000        |                     | 33.19               | 54.00             | 20.81          | 500.0              | 100.0          | Н   | 98.0             | -4.4            |
| 2075.750000        | 45.18               |                     | 74.00             | 28.82          | 500.0              | 100.0          | V   | 28.0             | -4.0            |
| 2781.750000        | 48.54               |                     | 74.00             | 25.46          | 500.0              | 200.0          | Н   | 159.0            | -1.4            |
| 2811.250000        |                     | 35.91               | 54.00             | 18.09          | 500.0              | 200.0          | Н   | 13.0             | -1.2            |

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)



#### 802.11n (HT20) CH6







RF Test Report

| Frequency<br>(MHz) | MaxPeak<br>(dBµV/m) | Average<br>(dBµV/m) | Limit<br>(dBµV/m) | Margin<br>(dB) | Meas. Time<br>(ms) | Height<br>(cm) | Pol | Azimuth<br>(deg) | Corr.<br>(dB/m) |
|--------------------|---------------------|---------------------|-------------------|----------------|--------------------|----------------|-----|------------------|-----------------|
| 1056.250000        |                     | 28.56               | 54.00             | 25.44          | 500.0              | 100.0          | V   | 282.0            | -10.4           |
| 1058.500000        | 41.77               |                     | 74.00             | 32.23          | 500.0              | 200.0          | Н   | 236.0            | -10.4           |
| 1264.750000        |                     | 29.10               | 54.00             | 24.90          | 500.0              | 200.0          | V   | 36.0             | -8.5            |
| 1267.500000        | 41.94               |                     | 74.00             | 32.06          | 500.0              | 200.0          | V   | 31.0             | -8.5            |
| 1529.000000        | 41.48               |                     | 74.00             | 32.52          | 500.0              | 100.0          | Н   | 56.0             | -6.8            |
| 1544.250000        |                     | 29.75               | 54.00             | 24.25          | 500.0              | 100.0          | V   | 335.0            | -6.7            |
| 1861.000000        | 43.28               |                     | 74.00             | 30.72          | 500.0              | 200.0          | Н   | 260.0            | -5.2            |
| 1867.750000        |                     | 31.08               | 54.00             | 22.92          | 500.0              | 100.0          | V   | 239.0            | -5.1            |
| 2231.750000        |                     | 33.88               | 54.00             | 20.12          | 500.0              | 200.0          | Н   | 269.0            | -3.2            |
| 2234.250000        | 45.28               |                     | 74.00             | 28.72          | 500.0              | 100.0          | Н   | 23.0             | -3.2            |
| 2701.250000        | 47.74               |                     | 74.00             | 26.26          | 500.0              | 100.0          | Н   | 14.0             | -1.6            |
| 2759.250000        |                     | 35.39               | 54.00             | 18.62          | 500.0              | 100.0          | Н   | 60.0             | -1.5            |

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)



#### 802.11n (HT20) CH11







RF Test Report

| Frequency<br>(MHz) | MaxPeak<br>(dBµV/m) | Average<br>(dBµV/m) | Limit<br>(dBµV/m) | Margin<br>(dB) | Meas. Time<br>(ms) | Height<br>(cm) | Pol | Azimuth<br>(deg) | Corr.<br>(dB/m) |
|--------------------|---------------------|---------------------|-------------------|----------------|--------------------|----------------|-----|------------------|-----------------|
| 1104.000000        |                     | 29.77               | 54.00             | 24.23          | 500.0              | 100.0          | V   | 34.0             | -10.0           |
| 1184.250000        | 41.03               |                     | 74.00             | 32.97          | 500.0              | 200.0          | V   | 314.0            | -9.1            |
| 1247.000000        | 46.35               |                     | 74.00             | 27.65          | 500.0              | 200.0          | V   | 263.0            | -8.6            |
| 1254.500000        |                     | 29.43               | 54.00             | 24.57          | 500.0              | 200.0          | Н   | 62.0             | -8.6            |
| 1413.000000        | 40.74               |                     | 74.00             | 33.26          | 500.0              | 200.0          | Н   | 28.0             | -7.5            |
| 1416.000000        |                     | 30.63               | 54.00             | 23.37          | 500.0              | 100.0          | V   | 195.0            | -7.4            |
| 1687.250000        | 43.46               |                     | 74.00             | 30.54          | 500.0              | 200.0          | V   | 200.0            | -6.0            |
| 1699.000000        |                     | 31.95               | 54.00             | 22.05          | 500.0              | 200.0          | V   | 347.0            | -6.0            |
| 2067.000000        |                     | 33.67               | 54.00             | 20.33          | 500.0              | 200.0          | V   | 133.0            | -4.1            |
| 2070.500000        | 44.63               |                     | 74.00             | 29.37          | 500.0              | 200.0          | V   | 221.0            | -4.0            |
| 2860.750000        |                     | 36.56               | 54.00             | 17.44          | 500.0              | 200.0          | V   | 334.0            | -1.1            |
| 2879.500000        | 47.61               |                     | 74.00             | 26.39          | 500.0              | 200.0          | V   | 314.0            | -1.1            |

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)



802.11ax HE20 CH 1







RF Test Report

| Frequency<br>(MHz) | MaxPeak<br>(dBµV/m) | Average<br>(dBµV/m) | Limit<br>(dBµV/m) | Margin<br>(dB) | Meas. Time<br>(ms) | Height<br>(cm) | Pol | Azimuth<br>(deg) | Corr.<br>(dB/m) |
|--------------------|---------------------|---------------------|-------------------|----------------|--------------------|----------------|-----|------------------|-----------------|
| 1056.000000        |                     | 29.41               | 54.00             | 24.59          | 500.0              | 100.0          | V   | 220.0            | -10.4           |
| 1077.750000        | 41.74               |                     | 74.00             | 32.26          | 500.0              | 200.0          | Н   | 93.0             | -10.3           |
| 1202.500000        |                     | 28.75               | 54.00             | 25.25          | 500.0              | 200.0          | V   | 326.0            | -8.8            |
| 1205.500000        | 39.36               |                     | 74.00             | 34.64          | 500.0              | 100.0          | V   | 164.0            | -8.8            |
| 1401.750000        | 41.97               |                     | 74.00             | 32.03          | 500.0              | 100.0          | Н   | 162.0            | -7.6            |
| 1441.500000        |                     | 30.46               | 54.00             | 23.54          | 500.0              | 200.0          | Н   | 206.0            | -7.3            |
| 1683.250000        |                     | 31.66               | 54.00             | 22.34          | 500.0              | 100.0          | Н   | 302.0            | -6.0            |
| 1700.000000        | 43.49               |                     | 74.00             | 30.51          | 500.0              | 100.0          | Н   | 219.0            | -6.0            |
| 1997.000000        | 46.24               |                     | 74.00             | 27.76          | 500.0              | 200.0          | V   | 206.0            | -4.6            |
| 2048.500000        |                     | 33.46               | 54.00             | 20.54          | 500.0              | 200.0          | Н   | 118.0            | -4.2            |
| 2904.250000        |                     | 36.69               | 54.00             | 17.31          | 500.0              | 100.0          | Н   | 0.0              | -1.0            |
| 2941.500000        | 48.08               |                     | 74.00             | 25.92          | 500.0              | 100.0          | Н   | 0.0              | -0.9            |

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)



#### 802.11ax HE20 CH 6







RF Test Report

| Frequency<br>(MHz) | MaxPeak<br>(dBµV/m) | Average<br>(dBµV/m) | Limit<br>(dBµV/m) | Margin<br>(dB) | Meas. Time<br>(ms) | Height<br>(cm) | Pol | Azimuth<br>(deg) | Corr.<br>(dB/m) |
|--------------------|---------------------|---------------------|-------------------|----------------|--------------------|----------------|-----|------------------|-----------------|
| 1071.000000        | 41.20               |                     | 74.00             | 32.80          | 500.0              | 100.0          | Н   | 260.0            | -10.3           |
| 1079.750000        |                     | 29.45               | 54.00             | 24.55          | 500.0              | 200.0          | Н   | 175.0            | -10.3           |
| 1233.000000        | 40.02               |                     | 74.00             | 33.98          | 500.0              | 200.0          | V   | 0.0              | -8.7            |
| 1236.750000        |                     | 28.86               | 54.00             | 25.14          | 500.0              | 200.0          | V   | 235.0            | -8.7            |
| 1431.250000        | 42.32               |                     | 74.00             | 31.68          | 500.0              | 100.0          | Н   | 101.0            | -7.4            |
| 1433.250000        |                     | 30.46               | 54.00             | 23.54          | 500.0              | 200.0          | Н   | 14.0             | -7.4            |
| 1731.750000        |                     | 31.80               | 54.00             | 22.20          | 500.0              | 200.0          | Н   | 161.0            | -5.8            |
| 1733.500000        | 42.20               |                     | 74.00             | 31.80          | 500.0              | 100.0          | Н   | 324.0            | -5.8            |
| 1991.000000        | 45.86               |                     | 74.00             | 28.14          | 500.0              | 100.0          | V   | 337.0            | -4.6            |
| 2074.000000        |                     | 33.30               | 54.00             | 20.70          | 500.0              | 100.0          | Н   | 324.0            | -4.0            |
| 2758.750000        |                     | 35.07               | 54.00             | 18.93          | 500.0              | 100.0          | Н   | 287.0            | -1.5            |
| 2778.250000        | 46.07               |                     | 74.00             | 27.93          | 500.0              | 200.0          | Н   | 14.0             | -1.4            |

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)



802.11ax HE20 CH11







RF Test Report

| Frequency<br>(MHz) | MaxPeak<br>(dBµV/m) | Average<br>(dBµV/m) | Limit<br>(dBµV/m) | Margin<br>(dB) | Meas. Time<br>(ms) | Height<br>(cm) | Pol | Azimuth<br>(deg) | Corr.<br>(dB/m) |
|--------------------|---------------------|---------------------|-------------------|----------------|--------------------|----------------|-----|------------------|-----------------|
| 1056.000000        |                     | 29.75               | 54.00             | 24.25          | 500.0              | 200.0          | V   | 325.0            | -10.4           |
| 1145.000000        | 40.70               |                     | 74.00             | 33.30          | 500.0              | 200.0          | V   | 334.0            | -9.8            |
| 1254.000000        | 40.59               |                     | 74.00             | 33.41          | 500.0              | 100.0          | Н   | 92.0             | -8.6            |
| 1261.500000        |                     | 29.19               | 54.00             | 24.81          | 500.0              | 100.0          | Н   | 255.0            | -8.5            |
| 1398.250000        | 42.43               |                     | 74.00             | 31.57          | 500.0              | 200.0          | V   | 321.0            | -7.6            |
| 1408.250000        |                     | 30.60               | 54.00             | 23.40          | 500.0              | 200.0          | V   | 330.0            | -7.5            |
| 1705.000000        |                     | 32.16               | 54.00             | 21.84          | 500.0              | 200.0          | V   | 219.0            | -6.0            |
| 1717.750000        | 43.50               |                     | 74.00             | 30.50          | 500.0              | 200.0          | V   | 203.0            | -5.9            |
| 2065.250000        | 44.83               |                     | 74.00             | 29.17          | 500.0              | 200.0          | V   | 156.0            | -4.1            |
| 2067.500000        |                     | 33.35               | 54.00             | 20.65          | 500.0              | 200.0          | V   | 223.0            | -4.0            |
| 2816.500000        | 47.85               |                     | 74.00             | 26.15          | 500.0              | 200.0          | V   | 346.0            | -1.2            |
| 2937.750000        |                     | 36.80               | 54.00             | 17.20          | 500.0              | 200.0          | V   | 321.0            | -1.0            |

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

#### **RF Test Report**

During the test, the Radiates Emission from 18GHz to 26.5GHz was performed in all modes with all channels, 802.11g CH11 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.



| Radiates | Emission | from | 18GHz to | 26.5GHz  |
|----------|----------|------|----------|----------|
| radiates |          | nom  |          | 20.00112 |

| Frequency<br>(MHz) | MaxPeak<br>(dBµV/m) | Average<br>(dBµV/m) | Limit<br>(dBµV/m) | Margin<br>(dB) | Meas.<br>Time<br>(ms) | Height<br>(cm) | Pol | Azimuth<br>(deg) | Corr.<br>(dB/m) |
|--------------------|---------------------|---------------------|-------------------|----------------|-----------------------|----------------|-----|------------------|-----------------|
| 18147.687500       | 48.43               |                     | 74.00             | 25.57          | 500.0                 | 200.0          | V   | 96.0             | -3.9            |
| 18197.625000       |                     | 35.88               | 54.00             | 18.12          | 500.0                 | 200.0          | V   | 26.0             | -3.9            |
| 19227.187500       |                     | 36.67               | 54.00             | 17.33          | 500.0                 | 100.0          | V   | 137.0            | -4.1            |
| 19301.562500       | 48.21               |                     | 74.00             | 25.79          | 500.0                 | 200.0          | Н   | 292.0            | -4.2            |
| 20798.625000       |                     | 36.16               | 54.00             | 17.84          | 500.0                 | 100.0          | V   | 123.0            | -3.8            |
| 20817.750000       | 47.94               |                     | 74.00             | 26.06          | 500.0                 | 100.0          | Н   | 35.0             | -3.9            |
| 22189.437500       | 49.13               |                     | 74.00             | 24.87          | 500.0                 | 100.0          | V   | 359.0            | -2.7            |
| 22464.625000       |                     | 37.07               | 54.00             | 16.93          | 500.0                 | 200.0          | Н   | 0.0              | -2.5            |
| 24040.312500       |                     | 36.93               | 54.00             | 17.07          | 500.0                 | 100.0          | V   | 225.0            | -2.0            |
| 24065.812500       | 48.52               |                     | 74.00             | 25.48          | 500.0                 | 100.0          | V   | 170.0            | -2.0            |
| 25397.125000       | 49.13               |                     | 74.00             | 24.87          | 500.0                 | 100.0          | V   | 243.0            | -1.2            |
| 25741.375000       |                     | 37.54               | 54.00             | 16.46          | 500.0                 | 200.0          | V   | 36.0             | -1.0            |

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain) 2. Margin = Limit –MAX Peak/ Average

RF Test Report

#### Bluetooth LE

During the test, the Radiates Emission from 9MHz to 1GHz was performed in all modes with all channels, Bluetooth LE-Channel 39 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

A symbol (dB  $\vee$ ) in the test plot below means (dBµV/m)



#### Radiates Emission from 9KHz to 90KHz



Radiates Emission from 90KHz to 110KHz

RF Test Report



#### Radiates Emission from 110KHz to 490KHz



Radiates Emission from 490KHz to 30MHz





#### Radiates Emission from 30MHz to 1GHz

| Frequency<br>(MHz) | Quasi-Peak<br>(dBµV/m) | Limit<br>(dBµV/m) | Margin<br>(dB) | Height<br>(cm) | Polarization | Azimuth<br>(deg) | Correct<br>Factor (dB) |
|--------------------|------------------------|-------------------|----------------|----------------|--------------|------------------|------------------------|
| 45.761250          | 23.53                  | 40.00             | 16.47          | 100.0          | V            | 314.0            | 21.0                   |
| 129.227500         | 21.37                  | 43.50             | 22.13          | 100.0          | V            | 8.0              | 15.8                   |
| 284.098750         | 29.38                  | 46.00             | 16.62          | 125.0          | Н            | 300.0            | 20.6                   |
| 450.010000         | 31.93                  | 46.00             | 14.07          | 125.0          | V            | 70.0             | 23.9                   |
| 620.967500         | 36.65                  | 46.00             | 9.35           | 100.0          | V            | 239.0            | 27.4                   |
| 674.565000         | 34.33                  | 46.00             | 11.67          | 110.0          | Н            | 103.0            | 27.8                   |

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain) 2. Margin = Limit – Quasi-Peak



Report No.: R2408A1111-R1

#### RF Test Report Bluetooth LE-Channel 0



Note: The signal beyond the limit is carrier. Radiates Emission from 1GHz to 3GHz





| Frequency<br>(MHz) | MaxPeak<br>(dBµV/m) | Average<br>(dBµV/m) | Limit<br>(dBµV/m) | Margin<br>(dB) | Meas.<br>Time<br>(ms) | Height<br>(cm) | Pol | Azimuth<br>(deg) | Corr.<br>(dB/m) |
|--------------------|---------------------|---------------------|-------------------|----------------|-----------------------|----------------|-----|------------------|-----------------|
| 1104.000000        |                     | 30.30               | 54.00             | 23.70          | 500.0                 | 200.0          | V   | 225.0            | -10.0           |
| 1165.250000        | 41.03               |                     | 74.00             | 32.97          | 500.0                 | 200.0          | V   | 164.0            | -9.5            |
| 1240.500000        |                     | 28.53               | 54.00             | 25.47          | 500.0                 | 100.0          | Н   | 355.0            | -8.6            |
| 1359.500000        | 41.89               |                     | 74.00             | 32.11          | 500.0                 | 100.0          | V   | 288.0            | -7.8            |
| 1415.750000        |                     | 30.32               | 54.00             | 23.68          | 500.0                 | 100.0          | Н   | 75.0             | -7.5            |
| 1530.750000        | 42.31               |                     | 74.00             | 31.69          | 500.0                 | 200.0          | Н   | 327.0            | -6.8            |
| 1718.750000        |                     | 31.84               | 54.00             | 22.16          | 500.0                 | 200.0          | V   | 71.0             | -5.9            |
| 1731.000000        | 43.87               |                     | 74.00             | 30.13          | 500.0                 | 100.0          | Н   | 222.0            | -5.8            |
| 2049.500000        |                     | 32.82               | 54.00             | 21.18          | 500.0                 | 100.0          | V   | 309.0            | -4.2            |
| 2059.500000        | 44.81               |                     | 74.00             | 29.19          | 500.0                 | 200.0          | Н   | 92.0             | -4.1            |
| 2952.000000        | 47.68               |                     | 74.00             | 26.32          | 500.0                 | 200.0          | Н   | 199.0            | -0.9            |
| 2980.000000        |                     | 35.83               | 54.00             | 18.17          | 500.0                 | 100.0          | Н   | 243.0            | -0.7            |

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)



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#### Bluetooth LE-Channel 19

**RF Test Report** 



Note: The signal beyond the limit is carrier. Radiates Emission from 1GHz to 3GHz



RF Test Report

| Frequency<br>(MHz) | MaxPeak<br>(dBµV/m) | Average<br>(dBµV/m) | Limit<br>(dBµV/m) | Margin<br>(dB) | Meas.<br>Time<br>(ms) | Height<br>(cm) | Pol | Azimuth<br>(deg) | Corr.<br>(dB/m) |
|--------------------|---------------------|---------------------|-------------------|----------------|-----------------------|----------------|-----|------------------|-----------------|
| 1055.750000        |                     | 29.81               | 54.00             | 24.19          | 500.0                 | 100.0          | Н   | 285.0            | -10.4           |
| 1056.000000        | 39.88               |                     | 74.00             | 34.12          | 500.0                 | 200.0          | Н   | 279.0            | -10.4           |
| 1179.500000        | 40.63               |                     | 74.00             | 33.37          | 500.0                 | 100.0          | V   | 267.0            | -9.2            |
| 1203.750000        |                     | 28.55               | 54.00             | 25.45          | 500.0                 | 200.0          | Н   | 163.0            | -8.8            |
| 1408.500000        |                     | 30.34               | 54.00             | 23.66          | 500.0                 | 100.0          | V   | 64.0             | -7.5            |
| 1412.750000        | 42.26               |                     | 74.00             | 31.74          | 500.0                 | 100.0          | Н   | 82.0             | -7.5            |
| 1670.500000        | 43.03               |                     | 74.00             | 30.97          | 500.0                 | 100.0          | Н   | 247.0            | -6.1            |
| 1732.000000        |                     | 31.34               | 54.00             | 22.66          | 500.0                 | 200.0          | Н   | 101.0            | -5.8            |
| 1914.750000        | 44.57               |                     | 74.00             | 29.43          | 500.0                 | 200.0          | V   | 153.0            | -4.9            |
| 2066.500000        |                     | 33.01               | 54.00             | 20.99          | 500.0                 | 200.0          | Н   | 50.0             | -4.1            |
| 2800.000000        |                     | 35.44               | 54.00             | 18.56          | 500.0                 | 200.0          | V   | 359.0            | -1.3            |
| 2826.750000        | 46.28               |                     | 74.00             | 27.72          | 500.0                 | 200.0          | Н   | 63.0             | -1.1            |

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)



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#### **Bluetooth LE-Channel 39**

**RF Test Report** 



Note: The signal beyond the limit is carrier. Radiates Emission from 1GHz to 3GHz



RF Test Report

| Frequency<br>(MHz) | MaxPeak<br>(dBµV/m) | Average<br>(dBµV/m) | Limit<br>(dBµV/m) | Margin<br>(dB) | Meas.<br>Time<br>(ms) | Height<br>(cm) | Pol | Azimuth<br>(deg) | Corr.<br>(dB/m) |
|--------------------|---------------------|---------------------|-------------------|----------------|-----------------------|----------------|-----|------------------|-----------------|
| 1056.000000        |                     | 29.92               | 54.00             | 24.08          | 500.0                 | 100.0          | Н   | 286.0            | -10.4           |
| 1057.250000        | 39.71               |                     | 74.00             | 34.29          | 500.0                 | 200.0          | V   | 0.0              | -10.4           |
| 1190.500000        | 40.39               |                     | 74.00             | 33.61          | 500.0                 | 200.0          | V   | 142.0            | -9.0            |
| 1192.500000        |                     | 28.63               | 54.00             | 25.37          | 500.0                 | 100.0          | Н   | 298.0            | -9.0            |
| 1427.750000        |                     | 30.39               | 54.00             | 23.61          | 500.0                 | 200.0          | V   | 167.0            | -7.4            |
| 1440.500000        | 42.33               |                     | 74.00             | 31.67          | 500.0                 | 100.0          | V   | 116.0            | -7.3            |
| 1641.500000        | 43.56               |                     | 74.00             | 30.44          | 500.0                 | 100.0          | V   | 0.0              | -6.2            |
| 1731.500000        |                     | 31.44               | 54.00             | 22.56          | 500.0                 | 200.0          | Н   | 353.0            | -5.8            |
| 2012.000000        | 44.38               |                     | 74.00             | 29.62          | 500.0                 | 100.0          | V   | 300.0            | -4.4            |
| 2056.250000        |                     | 32.65               | 54.00             | 21.35          | 500.0                 | 100.0          | Н   | 265.0            | -4.2            |
| 2936.250000        | 47.98               |                     | 74.00             | 26.02          | 500.0                 | 100.0          | Н   | 218.0            | -1.0            |
| 2973.250000        |                     | 35.86               | 54.00             | 18.14          | 500.0                 | 100.0          | Н   | 298.0            | -0.7            |

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

#### **RF Test Report**

During the test, the Radiates Emission from 18GHz to 26.5GHz was performed in all modes with all channels, Bluetooth LE-Channel 39 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.



| Radiates | Emission | from | 18GHz to | 26.5GHz  |
|----------|----------|------|----------|----------|
| radiates |          | nom  |          | 20.00112 |

| Frequency<br>(MHz) | MaxPeak<br>(dBµV/m) | Average<br>(dBµV/m) | Limit<br>(dBµV/m) | Margin<br>(dB) | Meas.<br>Time<br>(ms) | Height<br>(cm) | Pol | Azimuth<br>(deg) | Corr.<br>(dB/m) |
|--------------------|---------------------|---------------------|-------------------|----------------|-----------------------|----------------|-----|------------------|-----------------|
| 18183.812500       | 47.67               |                     | 74.00             | 26.33          | 500.0                 | 100.0          | V   | 46.0             | -3.9            |
| 18199.750000       |                     | 36.04               | 54.00             | 17.96          | 500.0                 | 100.0          | Н   | 104.0            | -3.9            |
| 19515.125000       | 48.02               |                     | 74.00             | 25.98          | 500.0                 | 200.0          | V   | 260.0            | -4.4            |
| 19536.375000       |                     | 36.75               | 54.00             | 17.25          | 500.0                 | 200.0          | V   | 154.0            | -4.4            |
| 20857.062500       |                     | 36.21               | 54.00             | 17.79          | 500.0                 | 100.0          | Н   | 16.0             | -3.9            |
| 21132.250000       | 48.18               |                     | 74.00             | 25.82          | 500.0                 | 200.0          | Н   | 0.0              | -3.7            |
| 22492.250000       | 49.52               |                     | 74.00             | 24.48          | 500.0                 | 200.0          | V   | 1.0              | -2.5            |
| 22525.187500       |                     | 37.13               | 54.00             | 16.87          | 500.0                 | 200.0          | Н   | 312.0            | -2.5            |
| 24021.187500       | 48.82               |                     | 74.00             | 25.18          | 500.0                 | 200.0          | V   | 135.0            | -2.0            |
| 24363.312500       |                     | 36.94               | 54.00             | 17.06          | 500.0                 | 200.0          | Н   | 215.0            | -1.9            |
| 25357.812500       | 49.14               |                     | 74.00             | 24.86          | 500.0                 | 200.0          | Н   | 102.0            | -1.2            |
| 25747.750000       |                     | 37.52               | 54.00             | 16.48          | 500.0                 | 200.0          | Н   | 206.0            | -1.0            |

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain) 2. Margin = Limit –MAX Peak/ Average

### 5.7. Conducted Emission

#### **Ambient Condition**

| Temperature | Relative humidity |
|-------------|-------------------|
| 15°C ~ 35°C | 20% ~ 80%         |

#### Methods of Measurement

The EUT is placed on a non-metallic table of 80cm height above the horizontal metal reference ground plane. During the test, the EUT was operating in its typical mode. The test method is according to ANSI C63.10. Connect the AC power line of the EUT to the L.I.S.N. Use EMI receiver to detect the average and Quasi-peak value. RBW is set to 9 kHz, VBW is set to 30kHz. The measurement result should include both L line and N line. The test is in transmitting mode.

#### **Test Setup**



Note: AC Power source is used to change the voltage 110V/60Hz.

| L | im | nits |
|---|----|------|
| _ |    |      |

| Frequency        | Conducted Limits(dBµV)                           |           |  |  |  |  |  |
|------------------|--|-----------|--|--|--|--|--|
| (MHz)            | Quasi-peak                                       | Average   |  |  |  |  |  |
| 0.15 - 0.5       | 66 to 56 *                                       | 56 to 46* |  |  |  |  |  |
| 0.5 - 5          | 56   | 46        |  |  |  |  |  |
| 5 - 30           | 60 50  |           |  |  |  |  |  |
| *: Decreases wit | * Decreases with the logarithm of the frequency. |           |  |  |  |  |  |

#### **Measurement Uncertainty**

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 1.96, U= 2.69 dB.
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#### **Test Results:**

Following plots, Blue trace uses the peak detection and Green trace uses the average detection.

## Wi-Fi 2.4G

During the test, the Conducted Emission was performed in all modes with all channels, 802.11g CH11 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.



| Frequency<br>(MHz) | QuasiPeak<br>(dBµV) | Average<br>(dBμV) | Limit<br>(dBµV) | Margin<br>(dB) | Meas.<br>Time<br>(ms) | Bandwidth<br>(kHz) | Line | Filter | Corr.<br>(dB) |
|--------------------|---------------------|-------------------|-----------------|----------------|-----------------------|--------------------|------|--------|---------------|
| 0.35               | 25.98               |                   | 58.96           | 32.98          | 1000.0                | 9.000              | L1   | ON     | 21.0          |
| 0.35               |                     | 18.91             | 48.90           | 29.99          | 1000.0                | 9.000              | L1   | ON     | 21.0          |
| 0.45               |                     | 29.23             | 46.85           | 17.62          | 1000.0                | 9.000              | L1   | ON     | 20.9          |
| 0.45               | 37.00               |                   | 56.85           | 19.85          | 1000.0                | 9.000              | L1   | ON     | 20.9          |
| 0.93               | 34.39               |                   | 56.00           | 21.61          | 1000.0                | 9.000              | L1   | ON     | 20.3          |
| 0.93               |                     | 27.35             | 46.00           | 18.65          | 1000.0                | 9.000              | L1   | ON     | 20.3          |
| 2.13               |                     | 19.07             | 46.00           | 26.93          | 1000.0                | 9.000              | L1   | ON     | 19.7          |
| 2.95               | 23.09               |                   | 56.00           | 32.91          | 1000.0                | 9.000              | L1   | ON     | 19.6          |
| 5.84               |                     | 15.84             | 50.00           | 34.16          | 1000.0                | 9.000              | L1   | ON     | 19.5          |
| 7.79               | 21.36               |                   | 60.00           | 38.64          | 1000.0                | 9.000              | L1   | ON     | 19.5          |
| 15.50              |                     | 16.72             | 50.00           | 33.28          | 1000.0                | 9.000              | L1   | ON     | 19.6          |
| 22.70              | 21.01               |                   | 60.00           | 38.99          | 1000.0                | 9.000              | L1   | ON     | 19.7          |

Remark: Correct factor=cable loss + LISN factor

L line Conducted Emission from 150 KHz to 30 MHz

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| Frequency<br>(MHz) | QuasiPeak<br>(dBµV) | Average<br>(dΒμV) | Limit<br>(dBµV) | Margin<br>(dB) | Meas.<br>Time<br>(ms) | Bandwidth<br>(kHz) | Line | Filter | Corr.<br>(dB) |
|--------------------|---------------------|-------------------|-----------------|----------------|-----------------------|--------------------|------|--------|---------------|
| 0.35               | 28.56               |                   | 58.96           | 30.40          | 1000.0                | 9.000              | Ν    | ON     | 21.0          |
| 0.35               |                     | 27.34             | 48.90           | 21.56          | 1000.0                | 9.000              | Ν    | ON     | 21.0          |
| 0.45               |                     | 40.26             | 46.85           | 6.59           | 1000.0                | 9.000              | Ν    | ON     | 20.9          |
| 0.45               | 41.61               |                   | 56.85           | 15.24          | 1000.0                | 9.000              | Ν    | ON     | 20.9          |
| 1.00               | 28.77               |                   | 56.00           | 27.23          | 1000.0                | 9.000              | Ν    | ON     | 20.2          |
| 1.31               |                     | 25.90             | 46.00           | 20.10          | 1000.0                | 9.000              | Ν    | ON     | 20.0          |
| 2.49               |                     | 22.98             | 46.00           | 23.02          | 1000.0                | 9.000              | Ν    | ON     | 19.6          |
| 4.94               | 25.88               |                   | 56.00           | 30.12          | 1000.0                | 9.000              | Ν    | ON     | 19.5          |
| 5.52               | 24.61               |                   | 60.00           | 35.39          | 1000.0                | 9.000              | Ν    | ON     | 19.5          |
| 5.54               |                     | 20.48             | 50.00           | 29.52          | 1000.0                | 9.000              | Ν    | ON     | 19.5          |
| 12.42              | 17.74               |                   | 60.00           | 42.26          | 1000.0                | 9.000              | Ν    | ON     | 19.6          |
| 15.57              |                     | 16.29             | 50.00           | 33.71          | 1000.0                | 9.000              | Ν    | ON     | 19.7          |

Remark: Correct factor=cable loss + LISN factor

N line Conducted Emission from 150 KHz to 30 MHz



RF Test Report

#### Bluetooth LE

During the test, the Conducted Emission was performed in all modes with all channels, Bluetooth LE-Channel 39 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.



| Frequency<br>(MHz) | QuasiPeak<br>(dBµV) | Average<br>(dBμV) | Limit<br>(dBµV) | Margin<br>(dB) | Meas.<br>Time<br>(ms) | Bandwidth<br>(kHz) | Line | Filter | Corr.<br>(dB) |
|--------------------|---------------------|-------------------|-----------------|----------------|-----------------------|--------------------|------|--------|---------------|
| 0.35               |                     | 18.91             | 48.96           | 30.05          | 1000.0                | 9.000              | L1   | ON     | 21.0          |
| 0.35               | 26.20               |                   | 58.96           | 32.76          | 1000.0                | 9.000              | L1   | ON     | 21.0          |
| 0.45               | 37.06               |                   | 56.89           | 19.83          | 1000.0                | 9.000              | L1   | ON     | 20.9          |
| 0.45               |                     | 29.26             | 46.85           | 17.59          | 1000.0                | 9.000              | L1   | ON     | 20.9          |
| 0.93               | 33.11               |                   | 56.00           | 22.89          | 1000.0                | 9.000              | L1   | ON     | 20.3          |
| 0.93               |                     | 27.24             | 46.00           | 18.76          | 1000.0                | 9.000              | L1   | ON     | 20.3          |
| 2.13               |                     | 19.14             | 46.00           | 26.86          | 1000.0                | 9.000              | L1   | ON     | 19.7          |
| 2.98               | 23.15               |                   | 56.00           | 32.85          | 1000.0                | 9.000              | L1   | ON     | 19.6          |
| 5.83               |                     | 16.29             | 50.00           | 33.71          | 1000.0                | 9.000              | L1   | ON     | 19.5          |
| 6.05               | 20.13               |                   | 60.00           | 39.87          | 1000.0                | 9.000              | L1   | ON     | 19.5          |
| 15.52              |                     | 16.50             | 50.00           | 33.50          | 1000.0                | 9.000              | L1   | ON     | 19.6          |
| 23.37              | 21.08               |                   | 60.00           | 38.92          | 1000.0                | 9.000              | L1   | ON     | 19.7          |

Remark: Correct factor=cable loss + LISN factor

L line Conducted Emission from 150 KHz to 30 MHz



Report No.: R2408A1111-R1



| Frequency<br>(MHz) | QuasiPeak<br>(dBµV) | Average<br>(dBµV) | Limit<br>(dBµV) | Margin<br>(dB) | Meas.<br>Time<br>(ms) | Bandwidth<br>(kHz) | Line | Filter | Corr.<br>(dB) |
|--------------------|---------------------|-------------------|-----------------|----------------|-----------------------|--------------------|------|--------|---------------|
| 0.35               |                     | 26.96             | 48.96           | 22.00          | 1000.0                | 9.000              | Ν    | ON     | 21.0          |
| 0.35               | 28.50               |                   | 58.96           | 30.46          | 1000.0                | 9.000              | Ν    | ON     | 21.0          |
| 0.45               | 41.27               |                   | 56.89           | 15.62          | 1000.0                | 9.000              | Ν    | ON     | 20.9          |
| 0.45               |                     | 40.28             | 46.85           | 6.57           | 1000.0                | 9.000              | Ν    | ON     | 20.9          |
| 0.95               | 28.92               |                   | 56.00           | 27.08          | 1000.0                | 9.000              | Ν    | ON     | 20.3          |
| 1.30               |                     | 25.84             | 46.00           | 20.16          | 1000.0                | 9.000              | Ν    | ON     | 20.0          |
| 2.48               |                     | 23.02             | 46.00           | 22.98          | 1000.0                | 9.000              | Ν    | ON     | 19.6          |
| 4.66               | 25.34               |                   | 56.00           | 30.66          | 1000.0                | 9.000              | Ν    | ON     | 19.5          |
| 5.67               | 24.43               |                   | 60.00           | 35.57          | 1000.0                | 9.000              | Ν    | ON     | 19.5          |
| 5.83               |                     | 20.29             | 50.00           | 29.71          | 1000.0                | 9.000              | Ν    | ON     | 19.5          |
| 14.28              | 18.51               |                   | 60.00           | 41.49          | 1000.0                | 9.000              | Ν    | ON     | 19.6          |
| 15.46              |                     | 16.24             | 50.00           | 33.76          | 1000.0                | 9.000              | Ν    | ON     | 19.7          |

Remark: Correct factor=cable loss + LISN factor

N line Conducted Emission from 150 KHz to 30 MHz

## 6. Main Test Instruments

| Name                        | Manufacturer | inufacturer Type      |            | Calibration<br>Date | Expiration<br>Date |  |
|-----------------------------|--------------|-----------------------|------------|---------------------|--------------------|--|
| Power Sensor                | R&S          | NRP18S                | 101954     | 2024-05-07          | 2025-05-06         |  |
| Spectrum Analyzer           | KEYSIGHT     | N9020A                | MY51330870 | 2024-05-07          | 2025-05-06         |  |
| EMI Test Receiver           | R&S          | ESR                   | 102389     | 2024-05-07          | 2025-05-06         |  |
| Signal Analyzer             | R&S          | FSV40                 | 101298     | 2024-05-07          | 2025-05-06         |  |
| TRILOG Broadband<br>Antenna | SCHWARZBECK  | VULB 9163             | 1023       | 2023-07-14          | 2026-07-13         |  |
| Horn Antenna                | R&S          | HF 907                | 102723     | 2023-11-24          | 2026-11-23         |  |
| Horn Antenna                | ETS-Lindgren | 3160-09               | 00102643   | 2021-10-10          | 2024-10-09         |  |
| Horn Antenna                | STEATITE     | QSH-SL-26<br>-40-K-15 | 16779      | 2023-01-17          | 2026-01-16         |  |
| Software                    | R&S          | EMC32                 | 9.26.01    | /                   | /                  |  |
| Artificial main<br>network  | R&S          | ENV216                | 102191     | 2022-12-10          | 2024-12-09         |  |
| EMI Test Receiver           | R&S          | ESR                   | 101667     | 2024-05-07          | 2025-05-06         |  |
| Software                    | R&S          | EMC32                 | 10.35.10   | /                   | /                  |  |

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## **ANNEX A: The EUT Appearance**

The EUT Appearance are submitted separately.

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### **ANNEX B: Test Setup Photos**

The Test Setup Photos are submitted separately.

\*\*\*\*\*\* END OF REPORT \*\*\*\*\*\*