



FCC Report

Applicant: ABUS USA LLC

Address of Applicant: 23910 N. 19th Ave., Unit #56, Phoenix, AZ 85085-1850 United States

Equipment Under Test (EUT)

Product Name: Digital Wireless Surveillance System

Model No.: TVAC16000C-Monitor

FCC ID: 2AB47TVAC16000C

Applicable standards: FCC CFR Title 47 Part 15 Subpart C Section 15.247:2013

Date of sample receipt: March 17, 2014

Date of Test: March 30-April 16, 2014

Date of report issued: April 16, 2014

Test Result : PASS *

* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:

Robinson Lo

Laboratory Manager

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product and does not permit the use of the GTS product certification mark. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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2 Version

| Version No. | Date | Description |
|-------------|----------------|-------------|
| 00 | April 16, 2014 | Original |
| | | |
| | | |
| | | |
| | | |

Prepared By:



Date:

April 16, 2014

Project Engineer

Check By:



Date:

April 16, 2014

Reviewer

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4 Test Summary

| Test Item | Section in CFR 47 | Result |
|---|-------------------|--------|
| Antenna Requirement | 15.203/15.247 (c) | Pass |
| AC Power Line Conducted Emission | 15.207 | Pass |
| Conducted Peak Output Power | 15.247 (b)(1) | Pass |
| 20dB Occupied Bandwidth | 15.247 (a)(1) | Pass |
| Carrier Frequencies Separation | 15.247 (a)(1) | Pass |
| Hopping Channel Number | 15.247 (a)(1) | Pass |
| Dwell Time | 15.247 (a)(1) | Pass |
| Pseudorandom Frequency Hopping Sequence | 15.247(b)(4) | Pass |
| Radiated Emission | 15.205/15.209 | Pass |
| Band Edge | 15.247(d) | Pass |

Pass: The EUT complies with the essential requirements in the standard.

5 General Information

5.1 Client Information

| | |
|--------------------------------------|--|
| Applicant: | ABUS USA LLC |
| Address of Applicant: | 23910 N. 19th Ave., Unit #56, Phoenix, AZ 85085-1850 United States |
| Manufacturer/Factory: | ABUS USA LLC |
| Address of Manufacturer/ Factory: | 23910 N. 19th Ave., Unit #56, Phoenix, AZ 85085-1850 United States |

5.2 General Description of EUT

| | |
|----------------------|--|
| Product Name: | Digital Wireless Surveillance System |
| Model No.: | TVAC16000C-Monitor |
| Operation Frequency: | 2414.25MHz~2461.5MHz |
| Channel numbers: | 15 |
| Channel separation: | 3.375MHz |
| Modulation type: | GFSK |
| Antenna Type: | Integral antenna |
| Antenna gain: | 2dBi (declare by Applicant) |
| Power supply: | Adapter 1: Model No.: KSAS0050500100VUD Input: AC 100-240V, 50/60Hz, 0.18A Output: DC 5V, 1.0A Adapter 2: Model No.: CS6D050100FU Input: AC 100-240V, 50/60Hz, 200mA Output: DC 5V, 1.0A Adapter 3: Model No.: SSA021F050100USD Input: AC 100-240V, 50/60Hz, 0.2A Output: DC 5V, 1.0A |
| Remark: | All adapter were tested, only the worse adapter's (Adapter 1) data was exhibited in the report. |

| Operation Frequency each of channel | | | | | |
|-------------------------------------|-------------|---------|-------------|---------|-------------|
| Channel | Frequency | Channel | Frequency | Channel | Frequency |
| 1 | 2414.250MHz | 6 | 2431.125MHz | 11 | 2448.000MHz |
| 2 | 2417.625MHz | 7 | 2434.500MHz | 12 | 2451.375MHz |
| 3 | 2421.000MHz | 8 | 2437.875MHz | 13 | 2454.750MHz |
| 4 | 2424.375MHz | 9 | 2441.250MHz | 14 | 2458.125MHz |
| 5 | 2427.750MHz | 10 | 2444.625MHz | 15 | 2461.500MHz |

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

| Channel | Frequency |
|---------------------|-------------|
| The lowest channel | 2414.250MHz |
| The middle channel | 2437.875MHz |
| The Highest channel | 2461.500MHz |

5.3 Test mode

| | |
|-------------------|---|
| Transmitting mode | Keep the EUT in continuously transmitting mode (for Peak power, 20dB Bandwidth, Band edge and Spurious Emissions test) |
| Hopping on mode | Keep the EUT in hopping on mode (for Frequencies Separation, Hopping channel number, Dwell time test) |

5.4 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **CNAS —Registration No.: CNAS L5775**

CNAS has accredited Global United Technology Services Co., Ltd. To ISO/IEC 17025 General Requirements for the competence of testing and calibration laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

- **FCC —Registration No.: 600491**

Global United Technology Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in files. Registration 600491, June 28, 2013.

- **Industry Canada (IC) —Registration No.: 9079A-2**

The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 9079A-2, June 26, 2013.

5.5 Test Location

All tests were performed at:

Global United Technology Services Co., Ltd.

Address: 2nd Floor, Block No.2, Laodong Industrial Zone, Xixiang Road Baoan District, Shenzhen, China

Tel: 0755-27798480

Fax: 0755-27798960

5.6 Other Information Requested by the Customer

None.

5.7 Description of Support Units

None.

6 Test Instruments list


| Radiated Emission: | | | | | | |
|--------------------|-------------------------------|--------------------------------|-----------------------------|---------------|---------------------|-------------------------|
| Item | Test Equipment | Manufacturer | Model No. | Inventory No. | Cal.Date (mm-dd-yy) | Cal.Due date (mm-dd-yy) |
| 1 | 3m Semi- Anechoic Chamber | ZhongYu Electron | 9.2(L)*6.2(W)* 6.4(H) | GTS250 | Mar. 28 2014 | Mar. 27 2015 |
| 2 | Control Room | ZhongYu Electron | 6.2(L)*2.5(W)* 2.4(H) | GTS251 | N/A | N/A |
| 3 | Spectrum Analyzer | Agilent | E4440A | GTS533 | Dec. 5, 2013 | Dec. 4 2014 |
| 4 | EMI Test Receiver | Rohde & Schwarz | ESU26 | GTS203 | Jul. 02 2013 | Jul. 01 2014 |
| 5 | BiConiLog Antenna | SCHWARZBECK MESS-ELEKTRONIK | VULB9163 | GTS214 | Jul. 02 2013 | Jul. 01 2014 |
| 6 | Double -ridged waveguide horn | SCHWARZBECK MESS-ELEKTRONIK | 9120D-829 | GTS208 | June 28 2013 | June 27 2014 |
| 7 | Horn Antenna | ETS-LINDGREN | 3160 | GTS217 | Mar. 28 2014 | Mar. 27 2015 |
| 8 | EMI Test Software | AUDIX | E3 | N/A | N/A | N/A |
| 9 | Coaxial Cable | GTS | N/A | GTS213 | Mar. 29 2014 | Mar. 28 2015 |
| 10 | Coaxial Cable | GTS | N/A | GTS211 | Mar. 29 2014 | Mar. 28 2015 |
| 11 | Coaxial cable | GTS | N/A | GTS210 | Mar. 29 2014 | Mar. 28 2015 |
| 12 | Coaxial Cable | GTS | N/A | GTS212 | Mar. 29 2014 | Mar. 28 2015 |
| 13 | Amplifier(100kHz-3GHz) | HP | 8347A | GTS204 | Jul. 02 2013 | Jul. 01 2014 |
| 14 | Amplifier(2GHz-20GHz) | HP | 8349B | GTS206 | Jul. 02 2013 | Jul. 01 2014 |
| 15 | Amplifier (18-26GHz) | Rohde & Schwarz | AFS33-18002 650-30-8P-44 | GTS218 | June 28 2013 | June 27 2014 |
| 16 | Band filter | Amindeon | 82346 | GTS219 | Mar. 29 2014 | Mar. 28 2015 |

| Conducted Emission: | | | | | | |
|---------------------|-------------------|--------------------------------|----------------------|---------------|---------------------|-------------------------|
| Item | Test Equipment | Manufacturer | Model No. | Inventory No. | Cal.Date (mm-dd-yy) | Cal.Due date (mm-dd-yy) |
| 1 | Shielding Room | ZhongYu Electron | 7.0(L)x3.0(W)x3.0(H) | GTS264 | Sep. 07 2013 | Sep. 06 2015 |
| 2 | EMI Test Receiver | Rohde & Schwarz | ESCS30 | GTS223 | Jul. 02 2013 | Jul. 01 2014 |
| 3 | 10dB Pulse Limita | Rohde & Schwarz | N/A | GTS224 | Jul. 02 2013 | Jul. 01 2014 |
| 4 | Coaxial Switch | ANRITSU CORP | MP59B | GTS225 | Jul. 02 2013 | Jul. 01 2014 |
| 5 | LISN | SCHWARZBECK MESS-ELEKTRONIK | NSLK 8127 | GTS226 | Jul. 02 2013 | Jul. 01 2014 |
| 6 | Coaxial Cable | GTS | N/A | GTS227 | Jul. 02 2013 | Jul. 01 2014 |
| 7 | EMI Test Software | AUDIX | E3 | N/A | N/A | N/A |

| General used equipment: | | | | | | |
|-------------------------|----------------|--------------|-----------|---------------|---------------------|-------------------------|
| Item | Test Equipment | Manufacturer | Model No. | Inventory No. | Cal.Date (mm-dd-yy) | Cal.Due date (mm-dd-yy) |
| 1 | Barometer | ChangChun | DYM3 | GTS257 | July 09 2013 | July 08 2014 |

7 Test results and Measurement Data

7.1 Antenna requirement

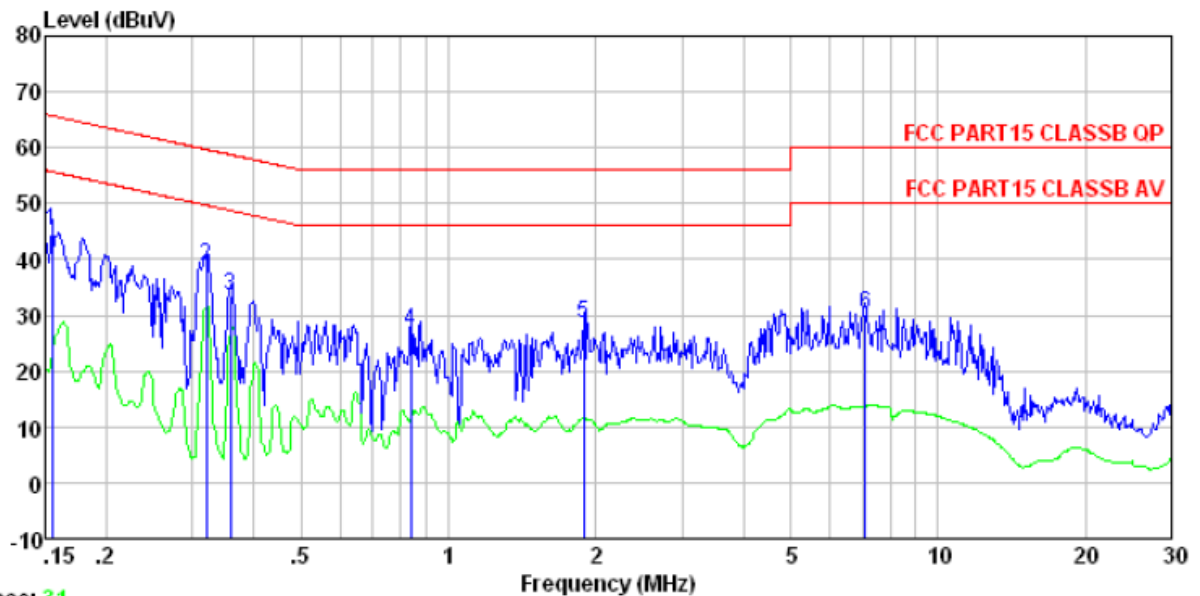
| Standard requirement: | FCC Part15 C Section 15.203 /247(c) |
|--|-------------------------------------|
| <p>15.203 requirement:</p> <p>An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.</p> <p>15.247(c) (1)(i) requirement:</p> <p>(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.</p> | |
| E.U.T Antenna: | |
| <p><i>The antenna is Integral antenna, the best case gain of the antenna is 2dBi</i></p>  | |

7.2 Conducted Emissions

| | | | | |
|--|--|--------------|-----------|-----------|
| Test Requirement: | FCC Part15 C Section 15.207 | | | |
| Test Method: | ANSI C63.4:2003 | | | |
| Test Frequency Range: | 150KHz to 30MHz | | | |
| Class / Severity: | Class B | | | |
| Receiver setup: | RBW=9KHz, VBW=30KHz, Sweep time=auto | | | |
| Limit: | Frequency range (MHz) | Limit (dBuV) | | |
| | | Quasi-peak | Average | |
| | | 0.15-0.5 | 66 to 56* | 56 to 46* |
| | | 0.5-5 | 56 | 46 |
| | | 5-30 | 60 | 50 |
| * Decreases with the logarithm of the frequency. | | | | |
| Test setup: | <div><p style="text-align: center;">Reference Plane</p><p style="text-align: center;">Test table/Insulation plane</p><p><i>Remark</i> E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m</p></div> | | | |
| Test procedure: | <div><div>1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment.</div><div>2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs).</div><div>3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4: 2003 on conducted measurement.</div></div> | | | |
| Test Instruments: | Refer to section 6.0 for details | | | |
| Test mode: | Refer to section 5.3 for details | | | |
| Test results: | Pass | | | |

Measurement data:

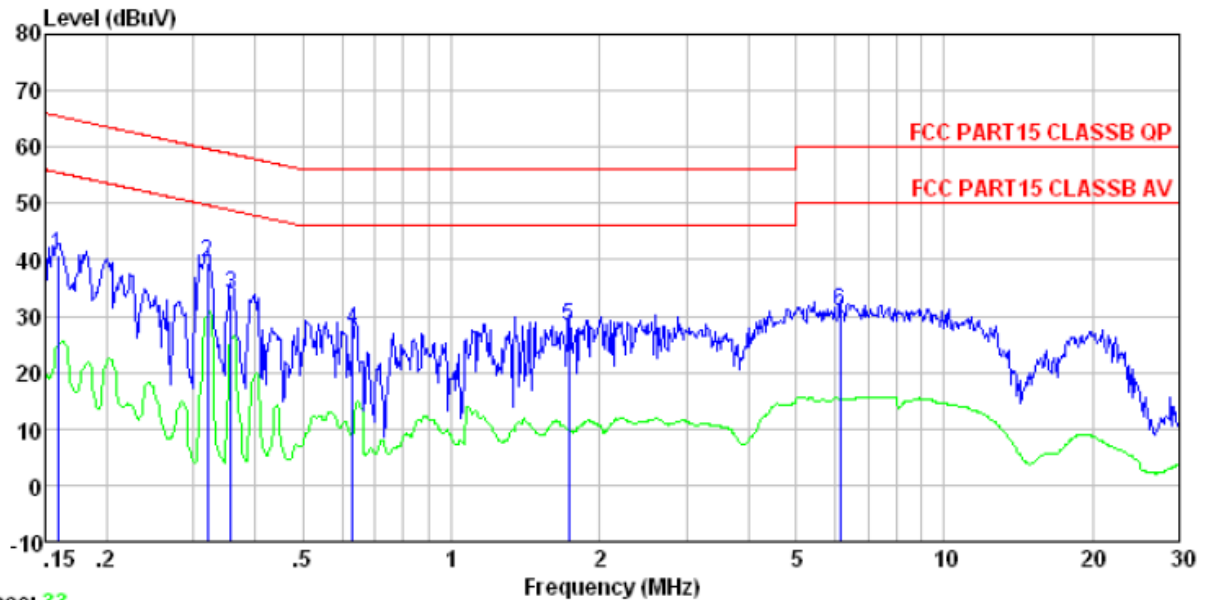
Line:



Condition : FCC PART15 CLASSB QP LISN-2013 LINE
 Job No. : 0341RF
 Test mode : Transmitting mode
 Test Engineer: Liu

| | Freq | Read Level | LISN Factor | Cable Loss | Level | Limit Line | Over Limit | Remark |
|---|-------|------------|-------------|------------|-------|------------|------------|--------|
| | MHz | dBuV | dB | dB | dBuV | dBuV | dB | |
| 1 | 0.155 | 44.75 | 0.15 | 0.12 | 45.02 | 65.74 | -20.72 | QP |
| 2 | 0.320 | 38.48 | 0.11 | 0.10 | 38.69 | 59.71 | -21.02 | QP |
| 3 | 0.360 | 33.36 | 0.11 | 0.10 | 33.57 | 58.74 | -25.17 | QP |
| 4 | 0.839 | 27.04 | 0.14 | 0.13 | 27.31 | 56.00 | -28.69 | QP |
| 5 | 1.888 | 28.40 | 0.12 | 0.14 | 28.66 | 56.00 | -27.34 | QP |
| 6 | 7.100 | 29.87 | 0.25 | 0.17 | 30.29 | 60.00 | -29.71 | QP |

Neutral:



Trace: 33

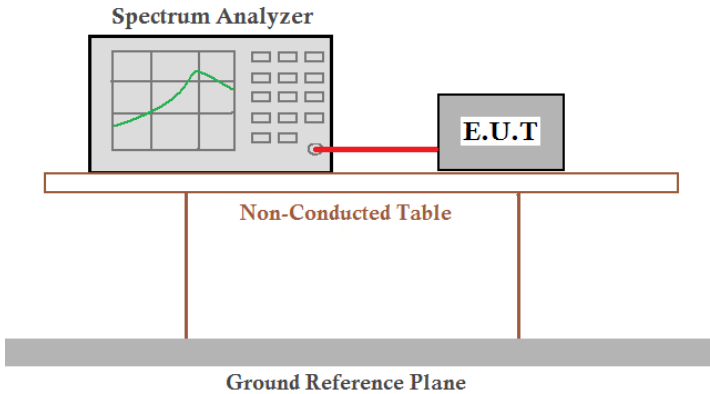
Condition : FCC PART15 CLASSB QP LISN-2013 NEUTRAL
 Job No. : 0341RF
 Test mode : Transmitting mode
 Test Engineer: Liu

| | Freq | Read Level | LISN Factor | Cable Loss | Level | Limit Line | Over Limit | Remark |
|---|-------|------------|-------------|------------|-------|------------|------------|--------|
| | MHz | dBuV | dB | dB | dBuV | dBuV | dB | |
| 1 | 0.159 | 40.75 | 0.07 | 0.12 | 40.94 | 65.52 | -24.58 | QP |
| 2 | 0.320 | 39.30 | 0.06 | 0.10 | 39.46 | 59.71 | -20.25 | QP |
| 3 | 0.358 | 33.51 | 0.06 | 0.10 | 33.67 | 58.78 | -25.11 | QP |
| 4 | 0.630 | 27.31 | 0.07 | 0.13 | 27.51 | 56.00 | -28.49 | QP |
| 5 | 1.734 | 27.86 | 0.09 | 0.14 | 28.09 | 56.00 | -27.91 | QP |
| 6 | 6.153 | 30.48 | 0.17 | 0.16 | 30.81 | 60.00 | -29.19 | QP |

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level = Receiver Read level + LISN Factor + Cable Loss
4. If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits and measurement with the average detector receiver is unnecessary.

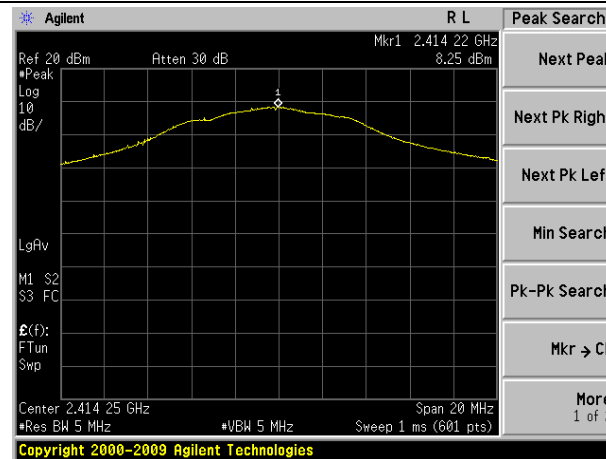
7.3 Conducted Peak Output Power

| | |
|-------------------|--|
| Test Requirement: | FCC Part15 C Section 15.247 (b)(3) |
| Test Method: | ANSI C63.4:2003 |
| Limit: | 20.96 |
| Test setup: |  <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. The table is positioned above a Ground Reference Plane.</p> |
| Test Instruments: | Refer to section 6.0 for details |
| Test mode: | Refer to section 5.3 for details |
| Test results: | Pass |

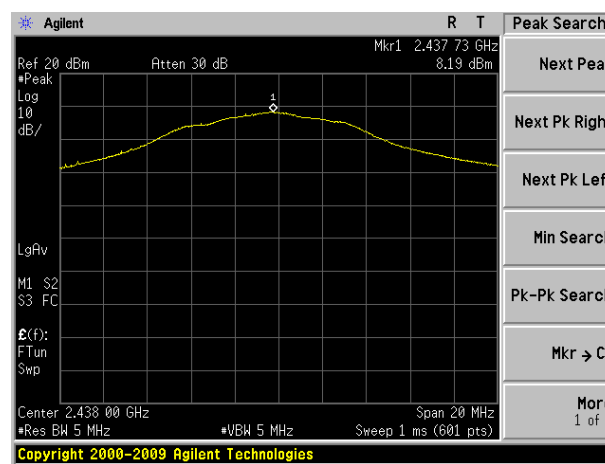
Measurement Data

| Test channel | Peak Output Power (dBm) | Limit (dBm) | Result |
|--------------|-------------------------|-------------|--------|
| Lowest | 8.25 | 20.96 | Pass |
| Middle | 8.19 | | |
| Highest | 8.19 | | |

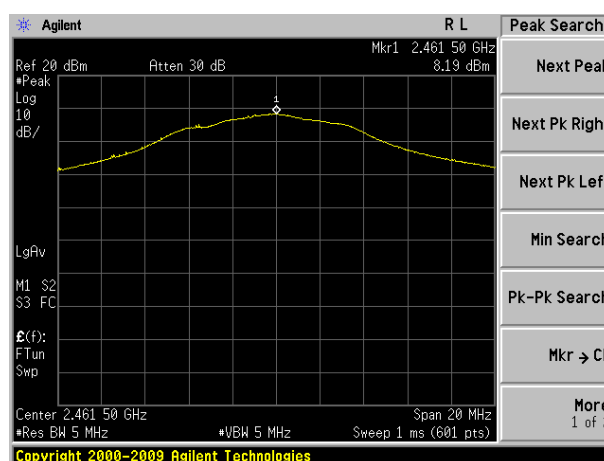
Test plot as follows:



Lowest channel

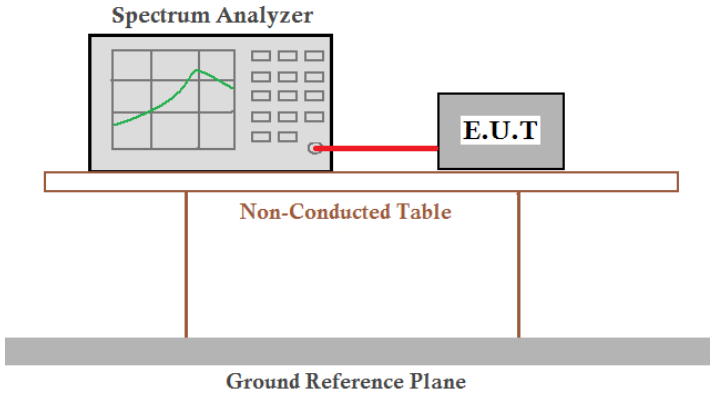


Middle channel



Highest channel

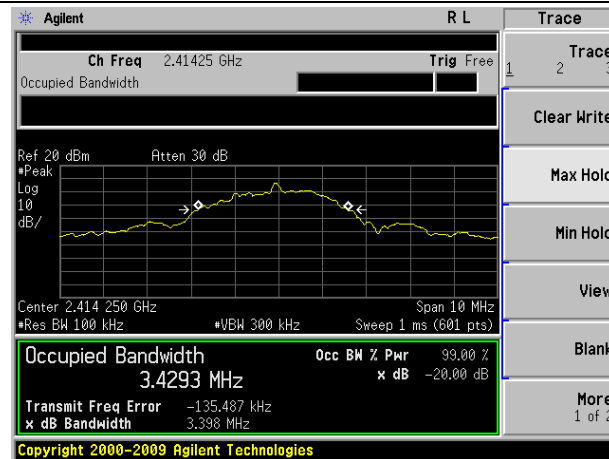
7.4 20dB Emission Bandwidth

| | |
|-------------------|---|
| Test Requirement: | FCC Part15 C Section 15.247 (a)(2) |
| Test Method: | ANSI C63.4:2003 |
| Limit: | N/A |
| Test setup: |  <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. Below the table is a Ground Reference Plane.</p> |
| Test Instruments: | Refer to section 6.0 for details |
| Test mode: | Refer to section 5.3 for details |
| Test results: | Pass |

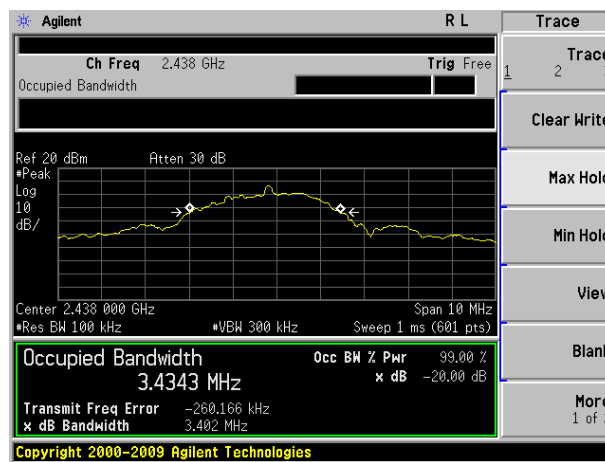
Measurement Data

| Test channel | 20dB Emission Bandwidth (MHz) | Result |
|--------------|-------------------------------|--------|
| Lowest | 3.398 | Pass |
| Middle | 3.402 | |
| Highest | 3.407 | |

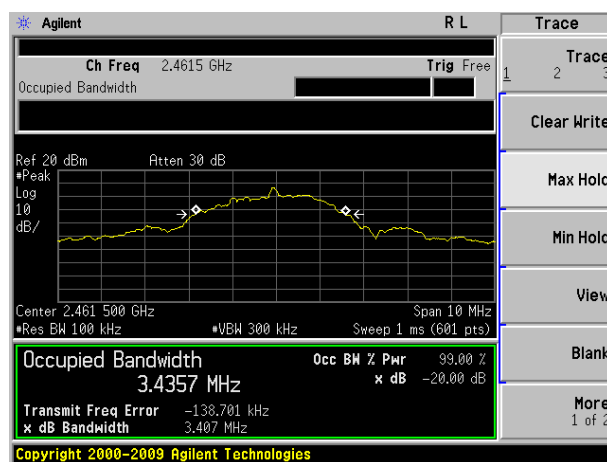
Test plot as follows:



Lowest channel

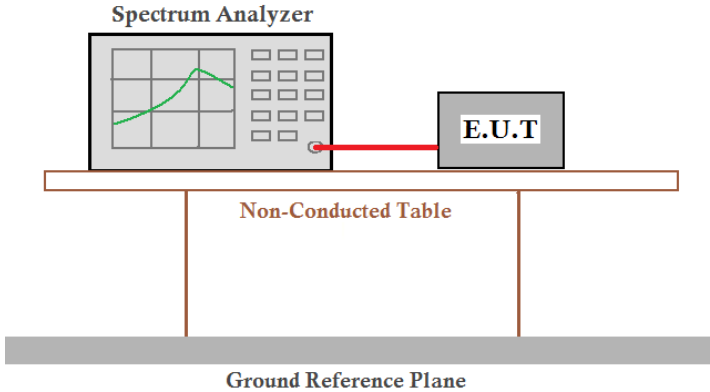


Middle channel



Highest channel

7.5 Carrier Frequencies Separation

| | |
|-------------------|---|
| Test Requirement: | FCC Part15 C Section 15.247 (a)(1) |
| Test Method: | ANSI C63.4:2003 |
| Receiver setup: | RBW=100KHz, VBW=300KHz, detector=Peak |
| Limit: | 0.025MHz or 2/3 of the 20dB bandwidth (whichever is greater) |
| Test setup: |  <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both are placed on a Non-Conducted Table, which is supported by a Ground Reference Plane.</p> |
| Test Instruments: | Refer to section 6.0 for details |
| Test mode: | Refer to section 5.3 for details |
| Test results: | Pass |

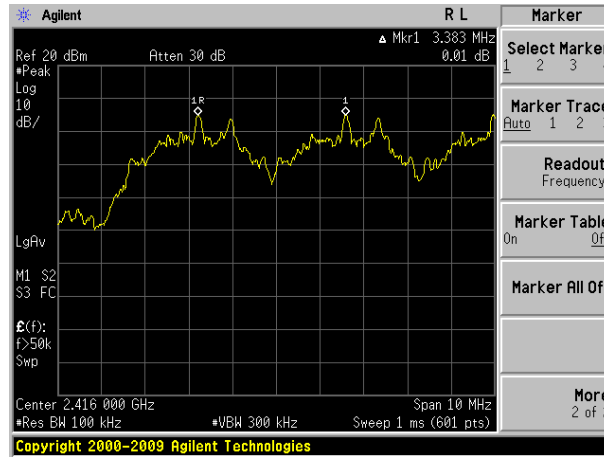
Measurement Data

| Test channel | Carrier Frequencies Separation (MHz) | Limit (MHz) | Result |
|--------------|--------------------------------------|-------------|--------|
| Lowest | 3.383 | 2.27 | Pass |
| Middle | 3.367 | 2.27 | Pass |
| Highest | 3.367 | 2.27 | Pass |

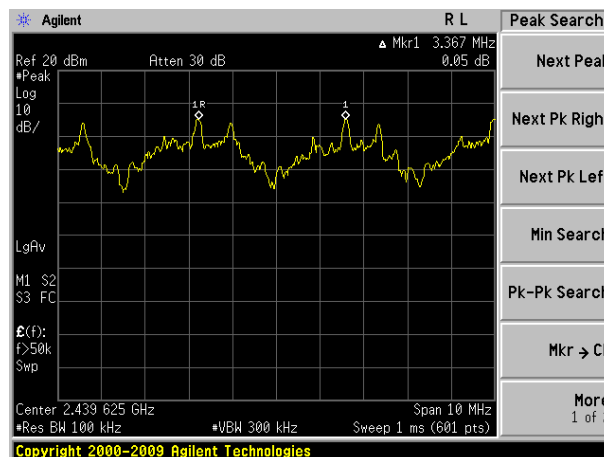
Note: According to section 7.4

| 20dB bandwidth (MHz) (worse case) | Limit (MHz) (Carrier Frequencies Separation) |
|--------------------------------------|---|
| 3.407 | 2.27 |

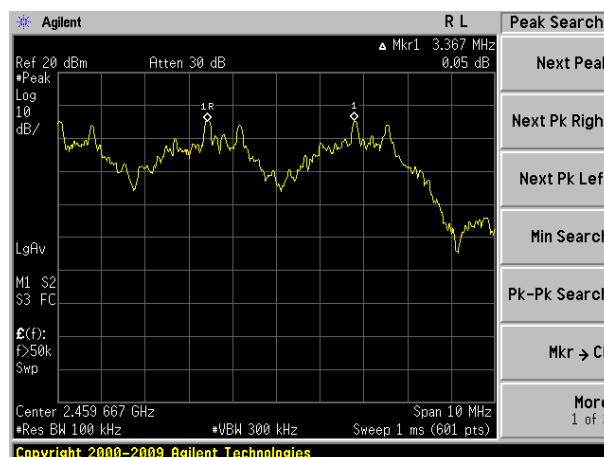
Test plot as follows:



Lowest channel

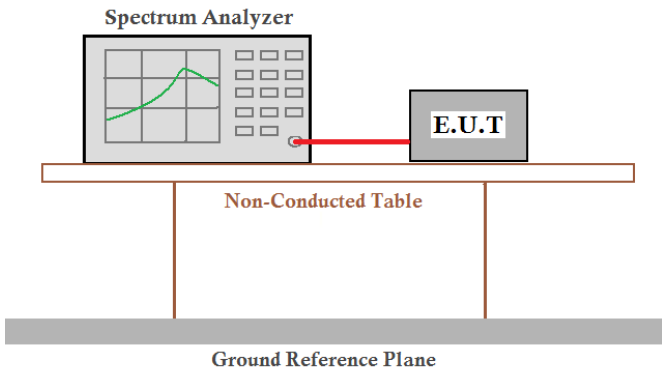


Middle channel



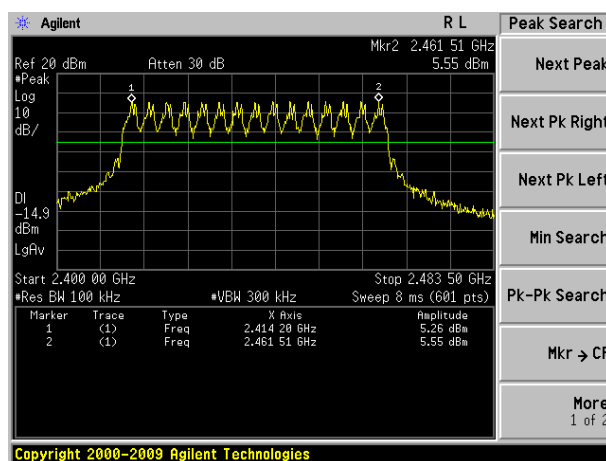
Highest channel

7.6 Hopping Channel Number

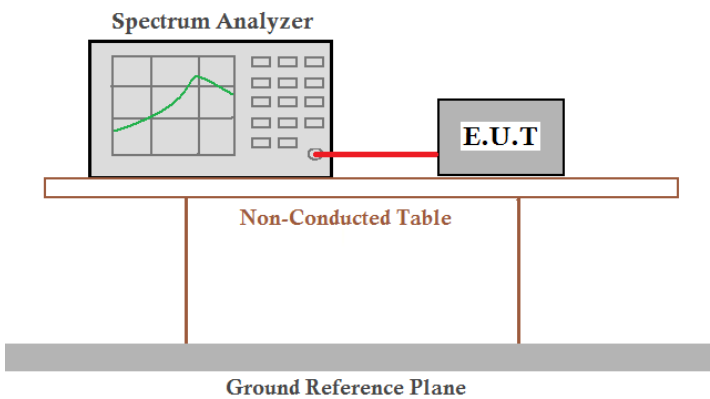
| | |
|-------------------|--|
| Test Requirement: | FCC Part15 C Section 15.247 (a)(1) |
| Test Method: | ANSI C63.4:2003 |
| Receiver setup: | RBW=100kHz, VBW=300kHz, Frequency range=2400MHz-2483.5MHz, Detector=Peak |
| Limit: | 15 channels |
| Test setup: |  |
| Test Instruments: | Refer to section 6.0 for details |
| Test mode: | Refer to section 5.3 for details |
| Test results: | Pass |

Measurement Data:

| Hopping channel numbers | Limit | Result |
|-------------------------|-------|--------|
| 15 | 15 | Pass |



7.7 Dwell Time

| | |
|-------------------|--|
| Test Requirement: | FCC Part15 C Section 15.247 (a)(1) |
| Test Method: | ANSI C63.4:2003 |
| Receiver setup: | RBW=1MHz, VBW=1MHz, Span=0Hz, Detector=Peak |
| Limit: | 0.4 Second |
| Test setup: |  |
| Test Instruments: | Refer to section 6.0 for details |
| Test mode: | Refer to section 5.3 for details |
| Test results: | Pass |

Measurement Data

| Frequency | Dwell time(ms) | Limit(ms) | Result |
|-------------|----------------|-----------|--------|
| 2414.250MHz | 312.12 | 400 | Pass |
| 2437.875MHz | 397.44 | 400 | Pass |
| 2461.500MHz | 276.48 | 400 | Pass |

Dwell time = Ton * Np * Test period

Test period: T= 0.4 Second/Channel x 15 Channel = 6 s

Ton: Duration Time of single pulse

Np: Number of the pulse in 1 second

Thus, the Dwell time at each channel is blow:

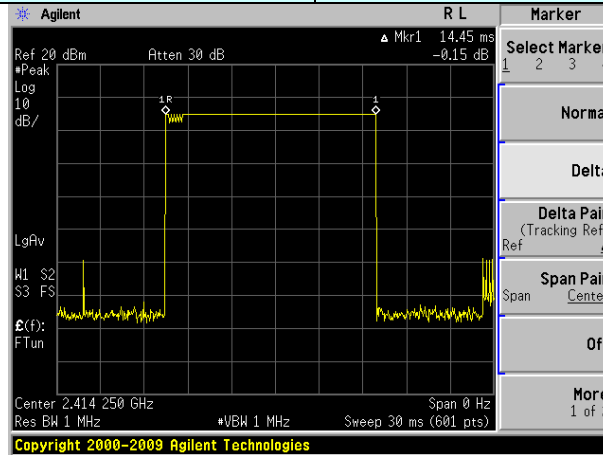
Lowest: $14.45\text{ms} * 18 / 5 * 6 = 312.12\text{ms}$

Middle: $14.4\text{ms} * 23 / 5 * 6 = 397.44\text{ms}$

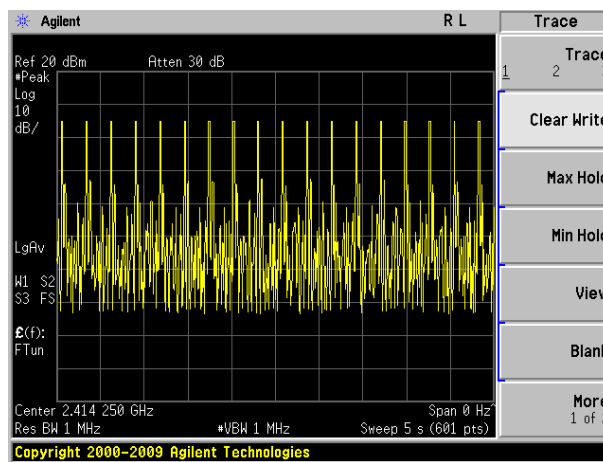
Highest: $12.8\text{ms} * 18 / 5 * 6 = 276.48\text{ms}$

Test plot as follows:

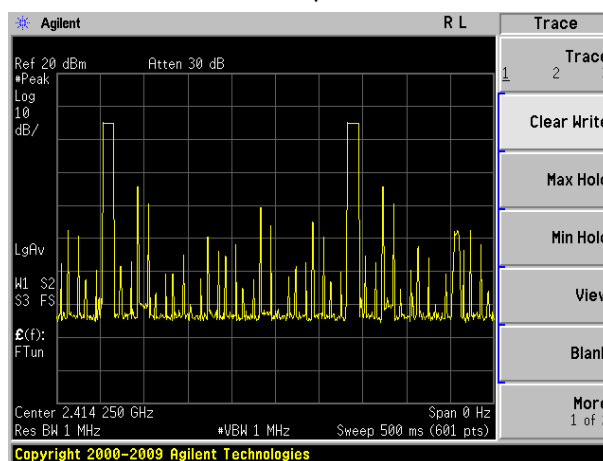
| | |
|---------------|----------------|
| Test Channel: | Lowest Channel |
|---------------|----------------|



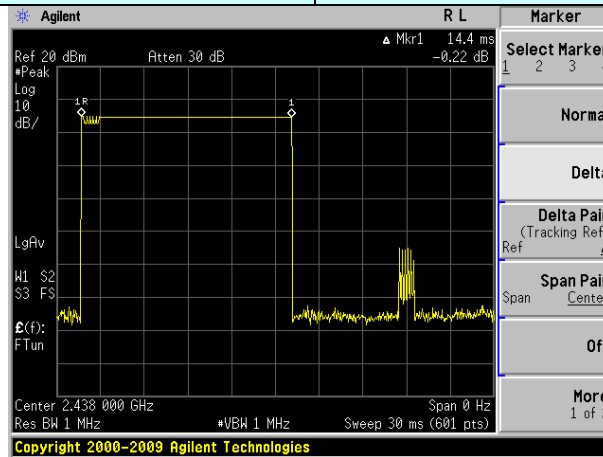
Ton



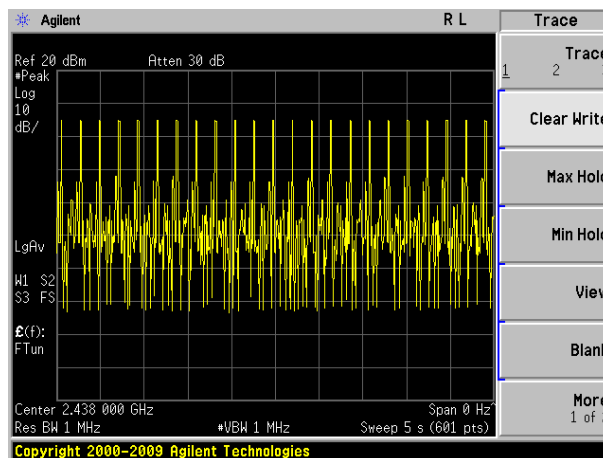
Np



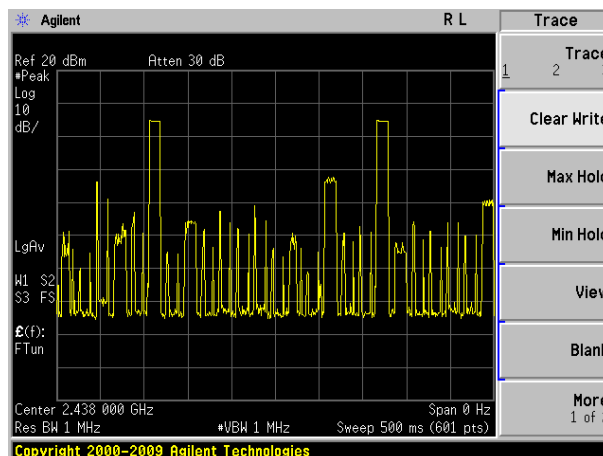
| | |
|---------------|----------------|
| Test Channel: | Middle Channel |
|---------------|----------------|



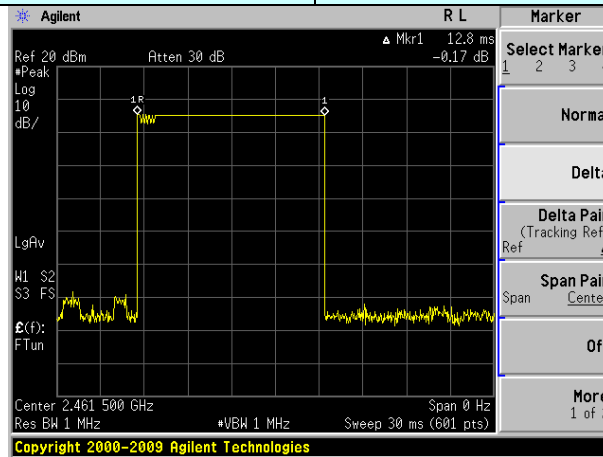
Ton



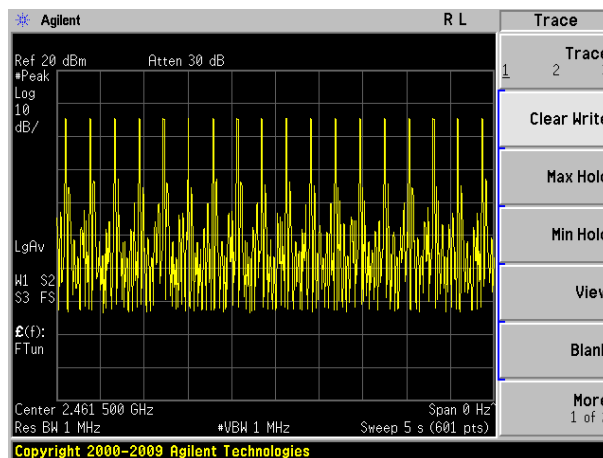
Np



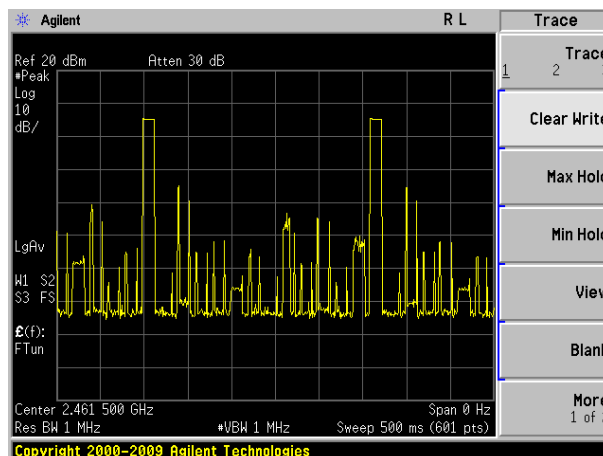
| | |
|---------------|-----------------|
| Test Channel: | Highest Channel |
|---------------|-----------------|



Ton

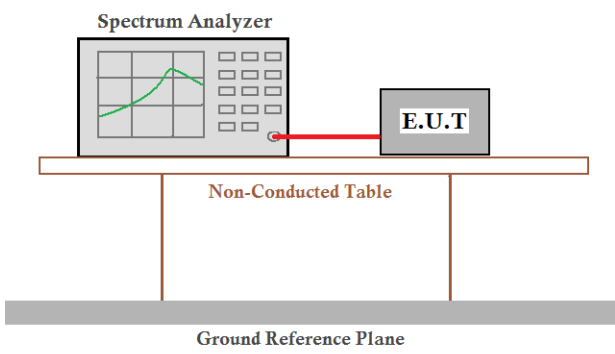


Np

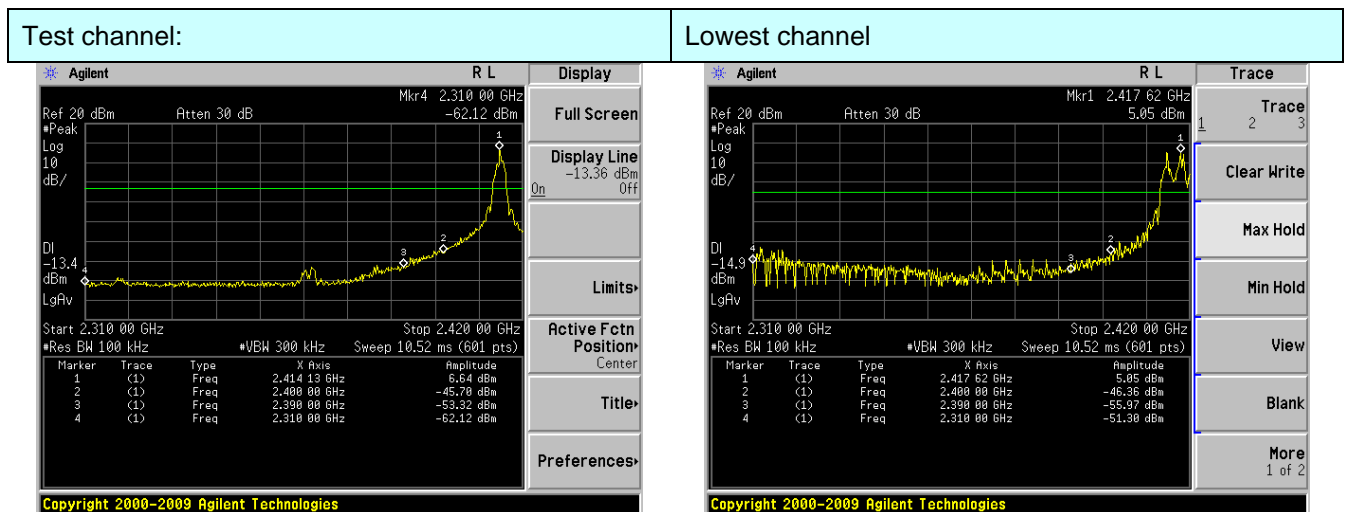


7.8 Band Edge

7.8.1 Conducted Emission Method

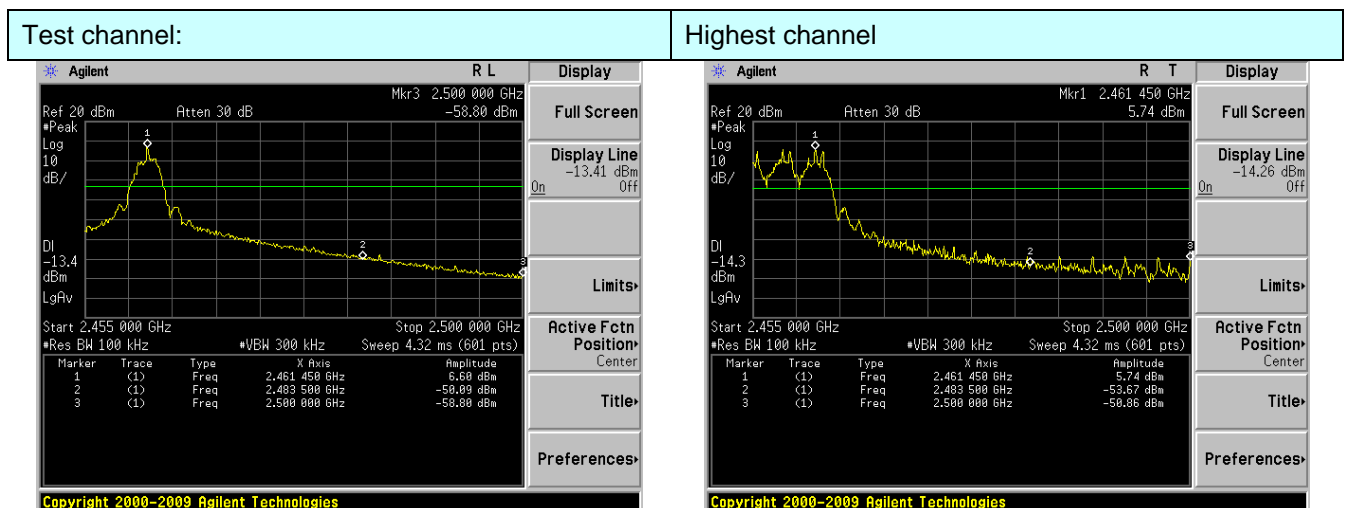
| | |
|-------------------|---|
| Test Requirement: | FCC Part15 C Section 15.247 (d) |
| Test Method: | ANSI C63.4:2003 |
| Receiver setup: | RBW=100kHz, VBW=300kHz, Detector=Peak |
| Limit: | In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, 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. |
| Test setup: |  <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. The table is supported by a Ground Reference Plane.</p> |
| Test Instruments: | Refer to section 6.0 for details |
| Test mode: | Refer to section 5.3 for details |
| Test results: | Pass |

Test plot as follows:



No-hopping mode

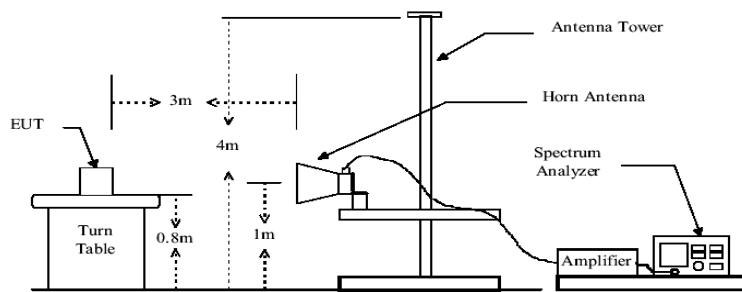
Hopping mode



No-hopping mode

Hopping mode

7.8.2 Radiated Emission Method

| | | | | | |
|-----------------------|--|----------|--------------------|------|---------------|
| Test Requirement: | FCC Part15 C Section 15.209 and 15.205 | | | | |
| Test Method: | ANSI C63.4: 2003 | | | | |
| Test Frequency Range: | All restriction band have been tested, and 2.3GHz to 2.5GHz band is the worse case | | | | |
| Test site: | Measurement Distance: 3m | | | | |
| Receiver setup: | Frequency | Detector | RBW | VBW | Remark |
| | Above 1GHz | Peak | 1MHz | 3MHz | Peak Value |
| | | Peak | 1MHz | 10Hz | Average Value |
| Limit: | Frequency | | Limit (dBuV/m @3m) | | Remark |
| | Above 1GHz | | 54.00 | | Average Value |
| | | | 74.00 | | Peak Value |
| Test setup: |  | | | | |
| Test Procedure: | <div>1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.</div> <div>2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.</div> <div>3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.</div> <div>4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.</div> <div>5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</div> <div>6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.</div> | | | | |
| Test Instruments: | Refer to section 6.0 for details | | | | |
| Test mode: | Refer to section 5.3 for details | | | | |
| Test results: | Pass | | | | |

Remark:

1. Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.

| | |
|---------------|--------|
| Test channel: | Lowest |
|---------------|--------|

Peak value:

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamplifier Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|-----------------|-------------------|-----------------------|-----------------|--------------------------|----------------|---------------------|-----------------|--------------|
| 2390.00 | 52.59 | 27.59 | 5.38 | 30.18 | 55.38 | 74.00 | -18.62 | Horizontal |
| 2400.00 | 61.77 | 27.58 | 5.39 | 30.18 | 64.56 | 74.00 | -9.44 | Horizontal |
| 2390.00 | 55.15 | 27.59 | 5.38 | 30.18 | 57.94 | 74.00 | -16.06 | Vertical |
| 2400.00 | 65.88 | 27.58 | 5.39 | 30.18 | 68.67 | 74.00 | -5.33 | Vertical |

Average value:

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamplifier Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|-----------------|-------------------|-----------------------|-----------------|--------------------------|----------------|---------------------|-----------------|--------------|
| 2390.00 | 34.22 | 27.59 | 5.38 | 30.18 | 37.01 | 54.00 | -16.99 | Horizontal |
| 2400.00 | 38.64 | 27.58 | 5.39 | 30.18 | 41.43 | 54.00 | -12.57 | Horizontal |
| 2390.00 | 36.43 | 27.59 | 5.38 | 30.18 | 39.22 | 54.00 | -14.78 | Vertical |
| 2400.00 | 42.86 | 27.58 | 5.39 | 30.18 | 45.65 | 54.00 | -8.35 | Vertical |

| | |
|---------------|---------|
| Test channel: | Highest |
|---------------|---------|

Peak value:

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamplifier Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|-----------------|-------------------|-----------------------|-----------------|--------------------------|----------------|---------------------|-----------------|--------------|
| 2483.50 | 55.88 | 27.53 | 5.47 | 29.93 | 58.95 | 74.00 | -15.05 | Horizontal |
| 2500.00 | 44.57 | 27.55 | 5.49 | 29.93 | 47.68 | 74.00 | -26.32 | Horizontal |
| 2483.50 | 60.63 | 27.53 | 5.47 | 29.93 | 63.70 | 74.00 | -10.30 | Vertical |
| 2500.00 | 45.95 | 27.55 | 5.49 | 29.93 | 49.06 | 74.00 | -24.94 | Vertical |

Average value:

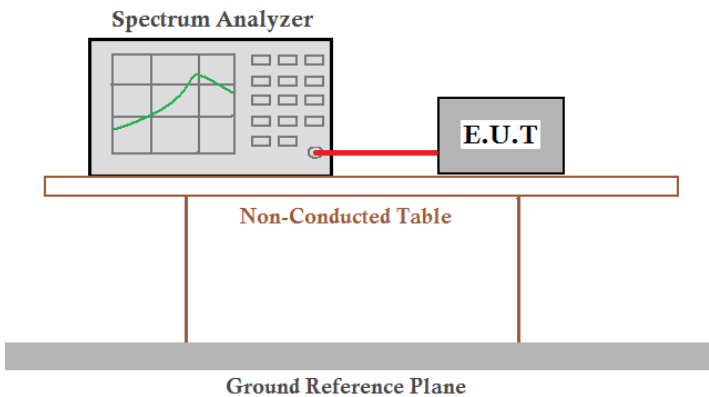
| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamplifier Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|-----------------|-------------------|-----------------------|-----------------|--------------------------|----------------|---------------------|-----------------|--------------|
| 2483.50 | 35.80 | 27.53 | 5.47 | 29.93 | 38.87 | 54.00 | -15.13 | Horizontal |
| 2500.00 | 33.55 | 27.55 | 5.49 | 29.93 | 36.66 | 54.00 | -17.34 | Horizontal |
| 2483.50 | 38.52 | 27.53 | 5.47 | 29.93 | 41.59 | 54.00 | -12.41 | Vertical |
| 2500.00 | 33.96 | 27.55 | 5.49 | 29.93 | 37.07 | 54.00 | -16.93 | Vertical |

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. The emission levels of other frequencies are very lower than the limit and not show in test report.

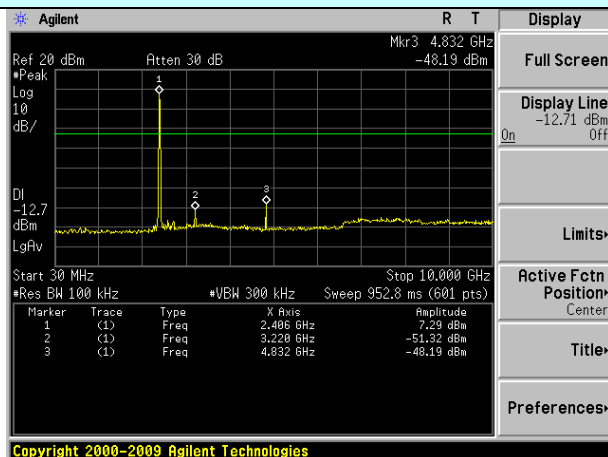
7.9 Spurious Emission

7.9.1 Conducted Emission Method

| | |
|-------------------|--|
| Test Requirement: | FCC Part15 C Section 15.247 (d) |
| Test Method: | ANSI C63.4:2003 and D01 Meas Guidance |
| Limit: | In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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. |
| Test setup: |  <p>The diagram illustrates the test setup for conducted emission measurement. A Spectrum Analyzer is connected via a red cable to an E.U.T. (Equipment Under Test). Both are placed on a Non-Conducted Table, which is supported by two vertical legs. Below the table is a Ground Reference Plane, represented by a thick grey bar.</p> |
| Test Instruments: | Refer to section 6.0 for details |
| Test mode: | Refer to section 5.3 for details |
| Test results: | Pass |

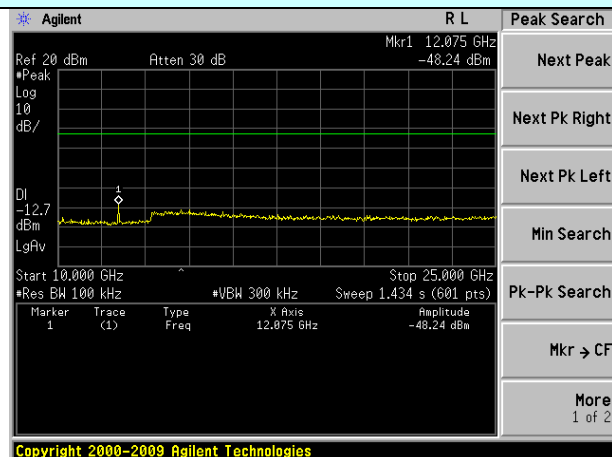
Remark:

Test channel:



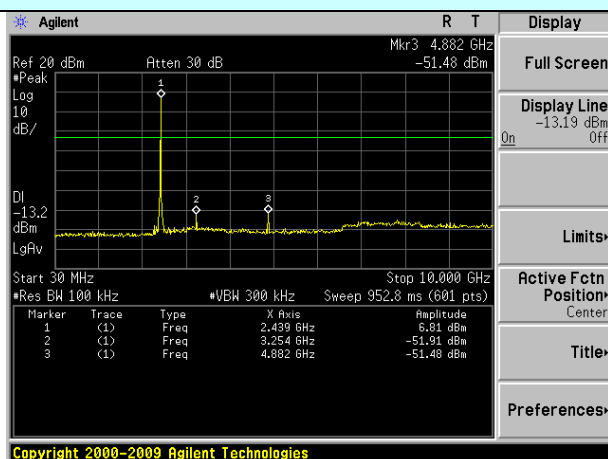
30MHz~10GHz

Lowest channel



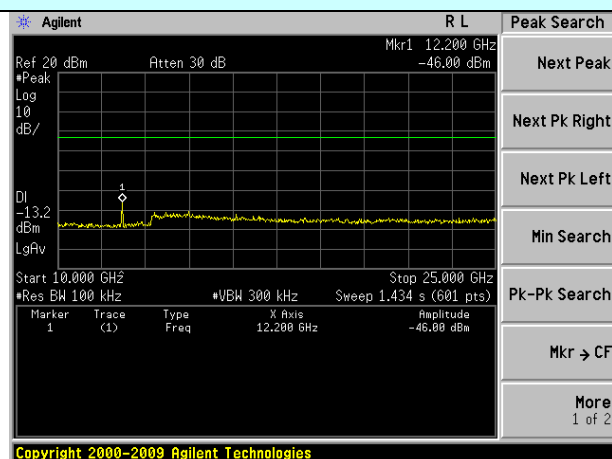
10GHz~25GHz

Test channel:



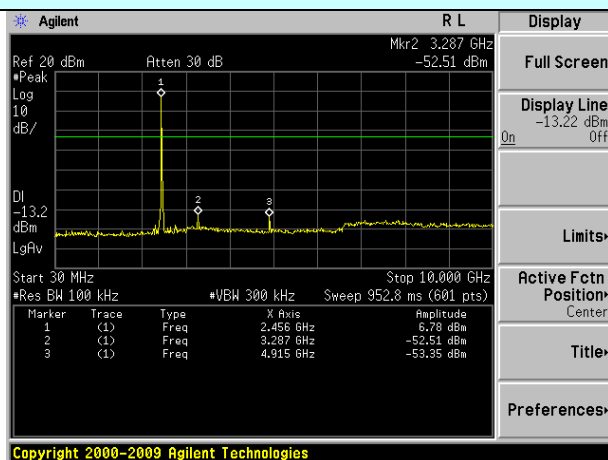
30MHz~10GHz

Middle channel



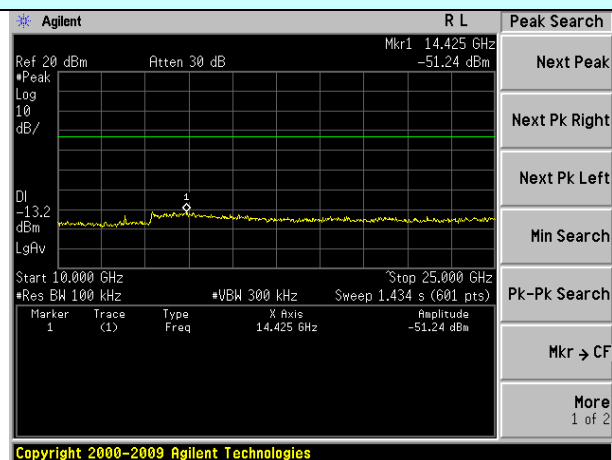
10GHz~25GHz

Test channel:



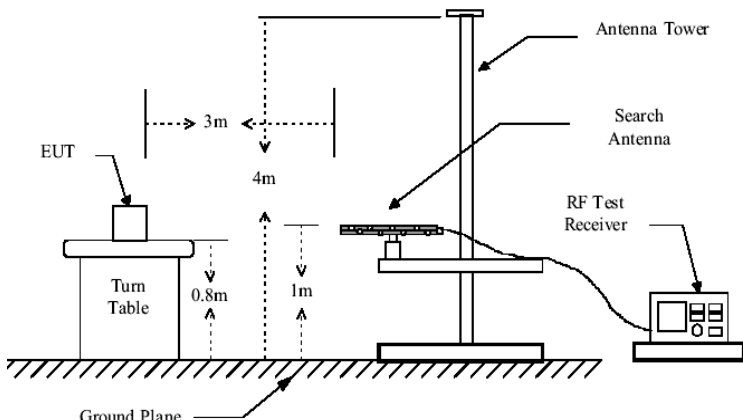
30MHz~10GHz

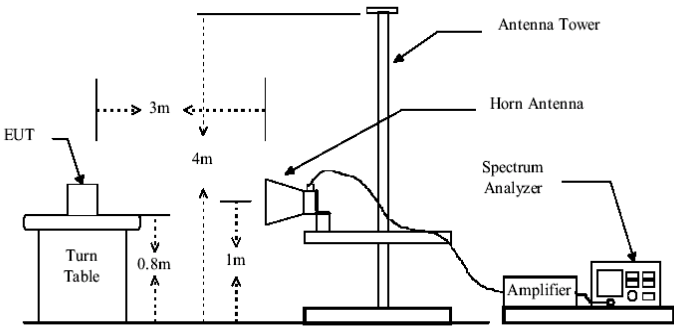
Highest channel



10GHz~25GHz

7.9.2 Radiated Emission Method

| | | | | | |
|-----------------------|---|------------|--------------------|--------|------------------|
| Test Requirement: | FCC Part15 C Section 15.209 | | | | |
| Test Method: | ANSI C63.4: 2003 | | | | |
| Test Frequency Range: | 30MHz to 25GHz | | | | |
| Test site: | Measurement Distance: 3m | | | | |
| Receiver setup: | Frequency | Detector | RBW | VBW | Remark |
| | 30MHz-1GHz | Quasi-peak | 120KHz | 300KHz | Quasi-peak Value |
| | Above 1GHz | Peak | 1MHz | 3MHz | Peak Value |
| | | Peak | 1MHz | 10Hz | Average Value |
| Limit: | Frequency | | Limit (dBuV/m @3m) | | Remark |
| | 30MHz-88MHz | | 40.0 | | Quasi-peak Value |
| | 88MHz-216MHz | | 43.5 | | Quasi-peak Value |
| | 216MHz-960MHz | | 46.0 | | Quasi-peak Value |
| | 960MHz-1GHz | | 54.0 | | Quasi-peak Value |
| | Above 1GHz | | 54.0 | | Average Value |
| | | | 74.0 | | Peak Value |
| Test setup: | Below 1GHz | | | | |
| | <div></div> | | | | |
| | Above 1GHz | | | | |

| | |
|--------------------------|---|
| |  <p>The diagram illustrates the test setup. An EUT (Equipment Under Test) is placed on a turn table at a height of 0.8m. The turn table is rotated 360 degrees. The EUT is positioned 3m away from the antenna tower. The antenna tower has a horn antenna at a height of 4m. The antenna height is varied from 1m to 4m. The spectrum analyzer is connected to the antenna tower via an amplifier.</p> |
| <p>Test Procedure:</p> | <ol style="list-style-type: none"> 1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. 4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. |
| <p>Test Instruments:</p> | <p>Refer to section 6.0 for details</p> |
| <p>Test mode:</p> | <p>Refer to section 5.3 for details</p> |
| <p>Test results:</p> | <p>Pass</p> |

Remark:

1. Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.

Measurement data:

■ **Below 1GHz**

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamplifier Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | polarization |
|-----------------|-------------------|-----------------------|-----------------|--------------------------|----------------|---------------------|-----------------|--------------|
| 96.10 | 55.53 | 14.90 | 1.16 | 31.75 | 39.84 | 43.50 | -3.66 | Vertical |
| 167.82 | 55.11 | 10.90 | 1.67 | 32.04 | 35.64 | 43.50 | -7.86 | Vertical |
| 191.75 | 54.82 | 12.56 | 1.80 | 32.12 | 37.06 | 43.50 | -6.44 | Vertical |
| 287.99 | 54.38 | 14.84 | 2.31 | 32.18 | 39.35 | 46.00 | -6.65 | Vertical |
| 866.09 | 43.41 | 22.78 | 4.73 | 31.23 | 39.69 | 46.00 | -6.31 | Vertical |
| 962.16 | 45.29 | 23.49 | 5.09 | 31.22 | 42.65 | 54.00 | -11.35 | Vertical |
| 96.10 | 47.77 | 14.90 | 1.16 | 31.75 | 32.08 | 43.50 | -11.42 | Horizontal |
| 143.83 | 53.11 | 10.22 | 1.53 | 31.96 | 32.90 | 43.50 | -10.60 | Horizontal |
| 287.99 | 53.53 | 14.84 | 2.31 | 32.18 | 38.50 | 46.00 | -7.50 | Horizontal |
| 672.85 | 45.01 | 20.72 | 3.99 | 31.15 | 38.57 | 46.00 | -7.43 | Horizontal |
| 912.86 | 45.93 | 23.18 | 4.90 | 31.19 | 42.82 | 46.00 | -3.18 | Horizontal |
| 962.16 | 46.34 | 23.49 | 5.09 | 31.22 | 43.70 | 54.00 | -10.30 | Horizontal |

■ Above 1GHz

| | |
|---------------|--------|
| Test channel: | Lowest |
|---------------|--------|

Peak value:

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamplifier Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|-----------------|-------------------|-----------------------|-----------------|--------------------------|----------------|---------------------|-----------------|--------------|
| 4828.50 | 41.15 | 31.79 | 8.62 | 32.10 | 49.46 | 74.00 | -24.54 | Vertical |
| 7242.75 | 30.06 | 36.24 | 11.68 | 31.97 | 46.01 | 74.00 | -27.99 | Vertical |
| 9657.00 | 28.25 | 38.07 | 14.18 | 31.56 | 48.94 | 74.00 | -25.06 | Vertical |
| 12071.25 | * | | | | | 74.00 | | Vertical |
| 14485.50 | * | | | | | 74.00 | | Vertical |
| 4828.50 | 32.32 | 31.79 | 8.62 | 32.10 | 40.63 | 74.00 | -33.37 | Horizontal |
| 7242.75 | 30.86 | 36.24 | 11.68 | 31.97 | 46.81 | 74.00 | -27.19 | Horizontal |
| 9657.00 | 27.75 | 38.07 | 14.18 | 31.56 | 48.44 | 74.00 | -25.56 | Horizontal |
| 12071.25 | * | | | | | 74.00 | | Horizontal |
| 14485.50 | * | | | | | 74.00 | | Horizontal |

Average value:

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamplifier Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|-----------------|-------------------|-----------------------|-----------------|--------------------------|----------------|---------------------|-----------------|--------------|
| 4828.50 | 30.40 | 31.79 | 8.62 | 32.10 | 38.71 | 54.00 | -15.29 | Vertical |
| 7242.75 | 18.92 | 36.24 | 11.68 | 31.97 | 34.87 | 54.00 | -19.13 | Vertical |
| 9657.00 | 17.25 | 38.07 | 14.18 | 31.56 | 37.94 | 54.00 | -16.06 | Vertical |
| 12071.25 | * | | | | | 54.00 | | Vertical |
| 14485.50 | * | | | | | 54.00 | | Vertical |
| 4828.50 | 21.25 | 31.79 | 8.62 | 32.10 | 29.56 | 54.00 | -24.44 | Horizontal |
| 7242.75 | 20.62 | 36.24 | 11.68 | 31.97 | 36.57 | 54.00 | -17.43 | Horizontal |
| 9657.00 | 18.32 | 38.07 | 14.18 | 31.56 | 39.01 | 54.00 | -14.99 | Horizontal |
| 12071.25 | * | | | | | 54.00 | | Horizontal |
| 14485.50 | * | | | | | 54.00 | | Horizontal |

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. “*”, means this data is the too weak instrument of signal is unable to test.
3. The emission levels of other frequencies are very lower than the limit and not show in test report.

| | |
|---------------|--------|
| Test channel: | Middle |
|---------------|--------|

Peak value:

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamplifier Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|-----------------|-------------------|-----------------------|-----------------|--------------------------|----------------|---------------------|-----------------|--------------|
| 4875.75 | 40.30 | 31.85 | 8.66 | 32.12 | 48.69 | 74.00 | -25.31 | Vertical |
| 7313.63 | 29.50 | 36.37 | 11.72 | 31.89 | 45.70 | 74.00 | -28.30 | Vertical |
| 9751.50 | 27.75 | 38.27 | 14.25 | 31.59 | 48.68 | 74.00 | -25.32 | Vertical |
| 12189.38 | * | | | | | 74.00 | | Vertical |
| 14627.25 | * | | | | | 74.00 | | Vertical |
| 4875.75 | 31.30 | 31.85 | 8.66 | 32.12 | 39.69 | 74.00 | -34.31 | Horizontal |
| 7313.63 | 30.22 | 36.37 | 11.72 | 31.89 | 46.42 | 74.00 | -27.58 | Horizontal |
| 9751.50 | 27.17 | 38.27 | 14.25 | 31.59 | 48.10 | 74.00 | -25.90 | Horizontal |
| 12189.38 | * | | | | | 74.00 | | Horizontal |
| 14627.25 | * | | | | | 74.00 | | Horizontal |

Average value:

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamplifier Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|-----------------|-------------------|-----------------------|-----------------|--------------------------|----------------|---------------------|-----------------|--------------|
| 4875.75 | 30.18 | 31.85 | 8.66 | 32.12 | 38.57 | 54.00 | -15.43 | Vertical |
| 7313.63 | 18.77 | 36.37 | 11.72 | 31.89 | 34.97 | 54.00 | -19.03 | Vertical |
| 9751.50 | 17.11 | 38.27 | 14.25 | 31.59 | 38.04 | 54.00 | -15.96 | Vertical |
| 12189.38 | * | | | | | 54.00 | | Vertical |
| 14627.25 | * | | | | | 54.00 | | Vertical |
| 4875.75 | 21.00 | 31.85 | 8.66 | 32.12 | 29.39 | 54.00 | -24.61 | Horizontal |
| 7313.63 | 20.45 | 36.37 | 11.72 | 31.89 | 36.65 | 54.00 | -17.35 | Horizontal |
| 9751.50 | 18.16 | 38.27 | 14.25 | 31.59 | 39.09 | 54.00 | -14.91 | Horizontal |
| 12189.38 | * | | | | | 54.00 | | Horizontal |
| 14627.25 | * | | | | | 54.00 | | Horizontal |

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. “*”, means this data is the too weak instrument of signal is unable to test.
3. The emission levels of other frequencies are very lower than the limit and not show in test report.

| | |
|---------------|---------|
| Test channel: | Highest |
|---------------|---------|

Peak value:

| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamplifier Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|-----------------|-------------------|-----------------------|-----------------|--------------------------|----------------|---------------------|-----------------|--------------|
| 4923.00 | 40.11 | 31.89 | 8.70 | 32.15 | 48.55 | 74.00 | -25.45 | Vertical |
| 7384.50 | 29.37 | 36.49 | 11.76 | 31.84 | 45.78 | 74.00 | -28.22 | Vertical |
| 9846.00 | 27.63 | 38.62 | 14.31 | 31.74 | 48.82 | 74.00 | -25.18 | Vertical |
| 12307.50 | * | | | | | 74.00 | | Vertical |
| 14769.00 | * | | | | | 74.00 | | Vertical |
| 4923.00 | 31.07 | 31.89 | 8.70 | 32.15 | 39.51 | 74.00 | -34.49 | Horizontal |
| 7384.50 | 30.08 | 36.49 | 11.76 | 31.84 | 46.49 | 74.00 | -27.51 | Horizontal |
| 9846.00 | 27.04 | 38.62 | 14.31 | 31.74 | 48.23 | 74.00 | -25.77 | Horizontal |
| 12307.50 | * | | | | | 74.00 | | Horizontal |
| 14769.00 | * | | | | | 74.00 | | Horizontal |

Average value:

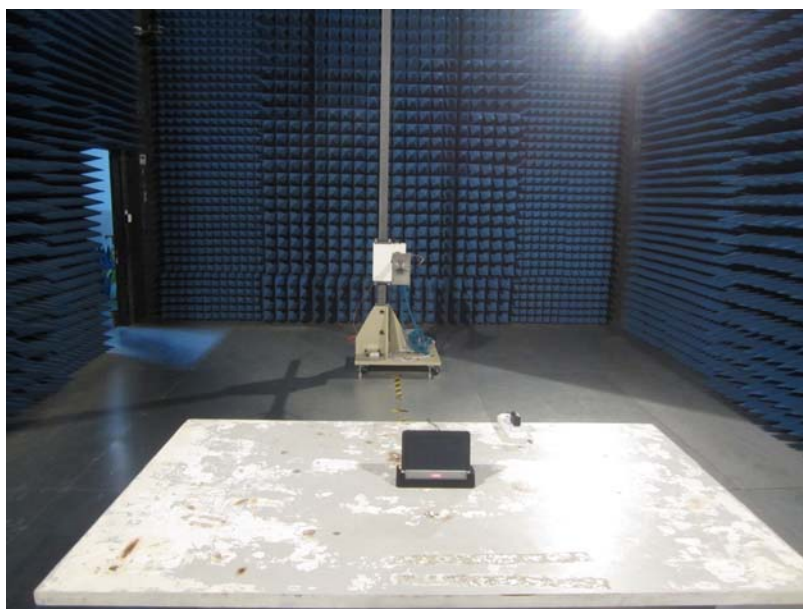
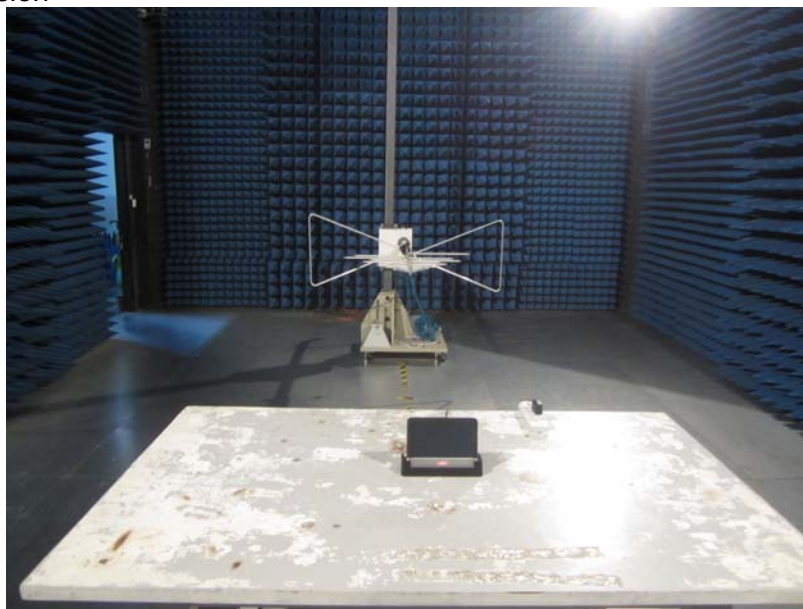
| Frequency (MHz) | Read Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamplifier Factor (dB) | Level (dBuV/m) | Limit Line (dBuV/m) | Over Limit (dB) | Polarization |
|-----------------|-------------------|-----------------------|-----------------|--------------------------|----------------|---------------------|-----------------|--------------|
| 4923.00 | 29.99 | 31.89 | 8.70 | 32.15 | 38.43 | 54.00 | -15.57 | Vertical |
| 7384.50 | 18.64 | 36.49 | 11.76 | 31.84 | 35.05 | 54.00 | -18.95 | Vertical |
| 9846.00 | 17.00 | 38.62 | 14.31 | 31.74 | 38.19 | 54.00 | -15.81 | Vertical |
| 12307.50 | * | | | | | 54.00 | | Vertical |
| 14769.00 | * | | | | | 54.00 | | Vertical |
| 4923.00 | 20.79 | 31.89 | 8.70 | 32.15 | 29.23 | 54.00 | -24.77 | Horizontal |
| 7384.50 | 20.31 | 36.49 | 11.76 | 31.84 | 36.72 | 54.00 | -17.28 | Horizontal |
| 9846.00 | 18.03 | 38.62 | 14.31 | 31.74 | 39.22 | 54.00 | -14.78 | Horizontal |
| 12307.50 | * | | | | | 54.00 | | Horizontal |
| 14769.00 | * | | | | | 54.00 | | Horizontal |

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. “*”, means this data is the too weak instrument of signal is unable to test.
3. The emission levels of other frequencies are very lower than the limit and not show in test report.

8 Test Setup Photo

Radiated Emission



Conducted Emission



9 EUT Constructional Details

Adapter1



Adapter2

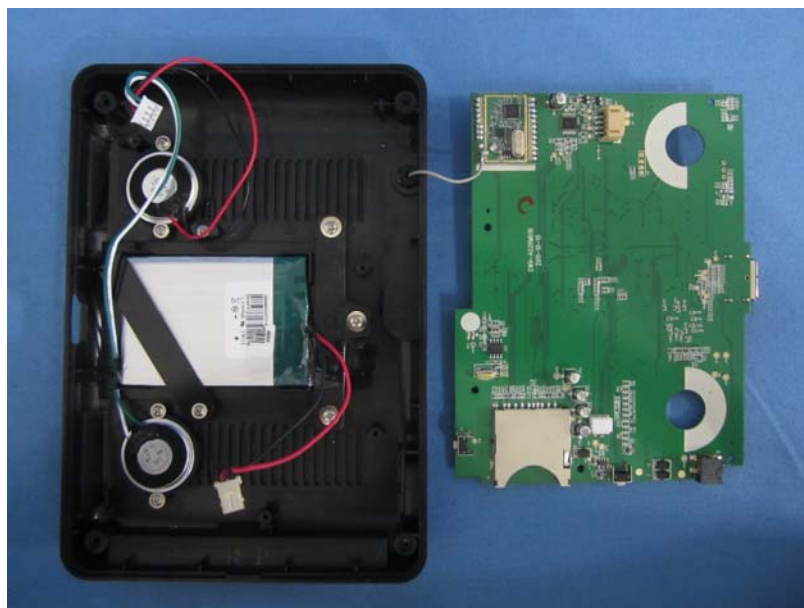


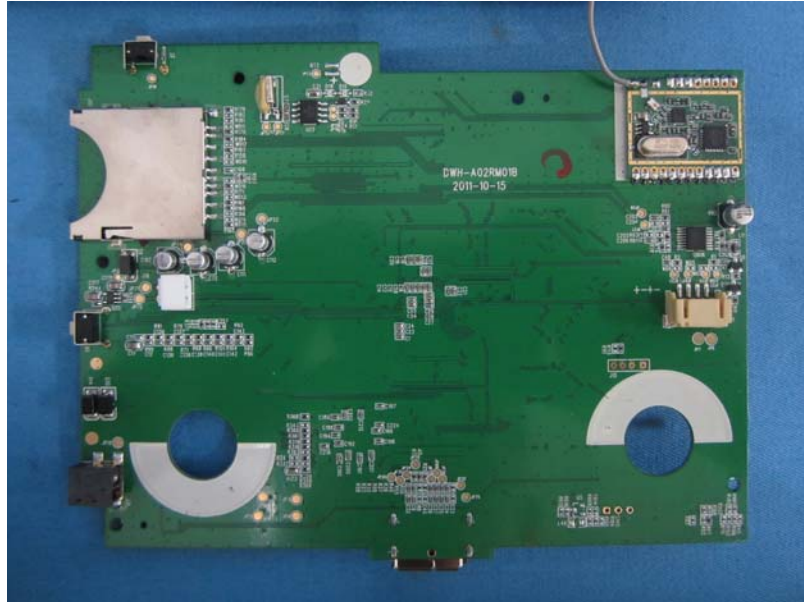
Adapter3













Adapter1



Adapter2



Adapter3



-----end-----