



Zacta

TEST REPORT

Report number : Z101C-14021

Issue date : April 23, 2014

The device, as described herewith, was tested pursuant to applicable test procedure and complies with the requirements of;

FCC Part15 Subpart C

The test results are traceable to the international or national standards.

| | |
|----------------------------|-----------------------|
| Applicant | : KYOCERA Corporation |
| Equipment under test (EUT) | : Mobile Phone |
| Model number | : KYY23 |
| FCC ID | : JOYKYY23 |

Date of test : March 24, 27, April 1, 3, 21, 2014
 Test place : TÜV SÜD Zacta Ltd. Yonezawa Testing Center
 4149-7 Hachimanpara 5-chome
 Yonezawa-shi Yamagata 992-1128 Japan
 Phone: +81-238-28-2880 Fax: +81-238-28-2888
 Test results : Complied

The results in this report are applicable only to the equipment tested.
 This report shall not be re-produced except in full without the written approval of TÜV SÜD Zacta Ltd.
 This test report must not be used by client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

Tested by : N. Toda
 Nobuyuki Toda

Tested by : Taiki Watanabe
 Taiki Watanabe

Authorized by : Eiji Akiba
 Eiji Akiba
 Deputy General Manager of EMC Technical Department

NVLAP[®]
 NVLAP LAB CODE 200306-0



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1. Summary of Test

1.1 Purpose of test

It is the original test in order to verify conformance to FCC Part 15 Subpart C.

1.2 Standards

CFR47 FCC Part 15 Subpart C

1.2.1 Test Methods

ANSI C63.4-2003, KDB558074

1.2.2 Deviation from standards

None

1.3 List of applied test to the EUT

| Test items Section | Test items | Condition | Result |
|-------------------------------|--|-----------------------|--------|
| 15.247(a)(2) | 6dB Bandwidth | Conducted | PASS |
| 15.247(b)(3) | Maximum Peak Output Power | Conducted | PASS |
| 15.247(d) | Band Edge Compliance of RF Conducted Emissions | Conducted | PASS |
| 15.247(d) 15.205 15.209 | Spurious Emissions | Conducted Radiated | PASS |
| 15.247(d) 15.205 15.209 | Restricted Bands of Operation | Radiated | PASS |
| 15.247(e) | Transmitter Power Spectral Density | Conducted | PASS |
| 15.207 | AC Power Line Conducted Emissions | Conducted | PASS |

1.3.1 Test set up

Table-Top

1.4 Modification to the EUT by laboratory

None



2. Equipment Under Test

2.1 General Description of equipment

EUT is the Mobile Phone.

2.2 EUT information

| | | |
|---------------------------------|---|---|
| Applicant | : | KYOCERA Corporation Yokohama Office 2-1-1 Kagahara, Tsuzuki-ku Yokohama-shi, Kanagawa, Japan Phone: +81-45-943-6253 Fax: +81-45-943-6314 |
| Equipment under test | : | Mobile Phone |
| Trade name | : | Kyocera |
| Model number | : | KYY23 |
| Serial number | : | N/A |
| EUT condition | : | Pre-Production |
| Power ratings | : | Battery: DC 3.8V |
| Size | : | Qi mounted type : (W) 70.3 × (D) 10.3 × (H) 140.3 mm Qi non-mounted type : (W) 70.3 × (D) 9.9 × (H) 140.3 mm |
| Environment | : | Indoor and Outdoor use |
| Terminal limitation | : | -20°C to 60°C |
| RF Specification Protocol | : | Bluetooth 4.0 + EDR |
| Frequency range | : | 2402MHz-2480MHz |
| Number of RF Channels | : | 40 Channels |
| Modulation method/ Data rate | : | GFSK (1Mbps) |
| Channel separation | : | 2MHz |
| Output power | : | 0.553mW |
| Antenna type | : | Internal antenna |
| Antenna gain | : | 0dBi |

2.3 Variation of the family model(s)

KYY23 has Qi mounted type and Qi non-mounted type.

2.4 Operating channels and frequencies

| Channel | Frequency [MHz] | Channel | Frequency [MHz] |
|---------|-----------------|---------|-----------------|
| 0 | 2402 | 20 | 2442 |
| 1 | 2404 | 21 | 2444 |
| 2 | 2406 | 22 | 2446 |
| 3 | 2408 | 23 | 2448 |
| 4 | 2410 | 24 | 2450 |
| 5 | 2412 | 25 | 2452 |
| 6 | 2414 | 26 | 2454 |
| 7 | 2416 | 27 | 2456 |
| 8 | 2418 | 28 | 2458 |
| 9 | 2420 | 29 | 2460 |
| 10 | 2422 | 30 | 2462 |
| 11 | 2424 | 31 | 2464 |
| 12 | 2426 | 32 | 2466 |
| 13 | 2428 | 33 | 2468 |
| 14 | 2430 | 34 | 2470 |
| 15 | 2432 | 35 | 2472 |
| 16 | 2434 | 36 | 2474 |
| 17 | 2436 | 37 | 2476 |
| 18 | 2438 | 38 | 2478 |
| 19 | 2440 | 39 | 2480 |

2.5 Operating mode

The EUT had been tested under operating condition.

There are three channels have been tested as following:

| Tested Channel | Frequency [MHz] |
|----------------|-----------------|
| Low | 2402 |
| Middle | 2440 |
| High | 2480 |

The pre-test has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates.

| Tested Channel | Modulation Type | Data Rate |
|-------------------|-----------------|-----------|
| Low, Middle, High | GFSK | 1Mbps |

The field strength of spurious emissions was measured at each position of all three axis X, Y and Z to compare the level, and the maximum noise.

The worst emission was found in Z axis and the worst case recorded.

Qi non-mounted type is tested only the worst mode at radiated test.

2.6 Operating mode

[Tx mode]

- i) Test program setup to the DM tool
- ii) Select a Test mode
Operating frequency: Channel Low: 2402MHz, Channel Middle: 2440MHz, Channel High: 2480MHz
- iii) Start test mode

[Rx mode]

- i) Test program setup to the DM tool
- ii) Select a Test mode
Operating frequency: Channel Low: 2402MHz, Channel Middle: 2440MHz, Channel High: 2480MHz
- iii) Start test mode

3. Configuration of equipment

3.1 Equipment(s) used

| No. | Equipment | Company | Model No. | Serial No. | FCC ID / DoC | Comment |
|-----|--------------|---------|-----------|------------|--------------|---------|
| 1 | Mobile Phone | KYOCERA | KYY23 | N/A | JOYKYY23 | EUT |
| 2 | AC Adapter | au | N/A | N/A | - | * |

*: AC power line Conducted Emission Test.

3.2 Cable(s) used

| No. | Cable | Length[m] | Shield | Connector | Comment |
|-----|---------------------------------|-----------|--------|-----------|---------|
| a | Micro USB cable(for AC Adapter) | 1.1 | Yes | Metal | * |

*: AC power line Conducted Emission Test.

3.3 System configuration



: Un-detachable cable

Note1: Numbers assigned to equipment or cables on this diagram correspond to the list in "3.1 Equipment(s) used" and "3.2 Cable(s) used".

4. 6dB Bandwidth

4.1 Measurement procedure [FCC 15.247(a)(2), KDB558074]

The bandwidth at 6dB down from the highest inband spectral density is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to;

- RBW=100kHz, VBW=300kHz, Span=3MHz, Sweep=auto, Detector=Peak, Trace mode=Max hold

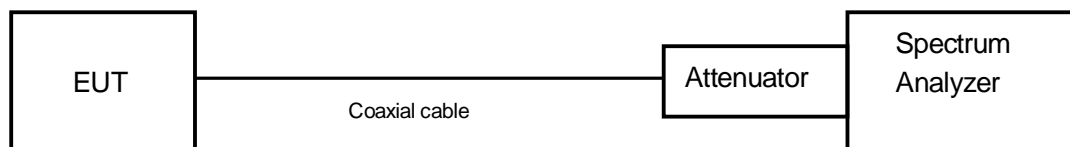
The EUT was set to operate with following conditions.

- Channel Low: 2402MHz, Channel Middle: 2440MHz, Channel High: 2480MHz

The test mode of EUT is as follows.

- Tx mode

- Test configuration



4.2 Limit

The minimum permissible 6dB bandwidth is 500kHz.

4.3 Measurement result

Date : Mar. 27, 2014

Temperature : 24.0 [°C]

Humidity : 51.0 [%]

Test place : Shielded room No.4

Tested by :

Nobuyuki Toda

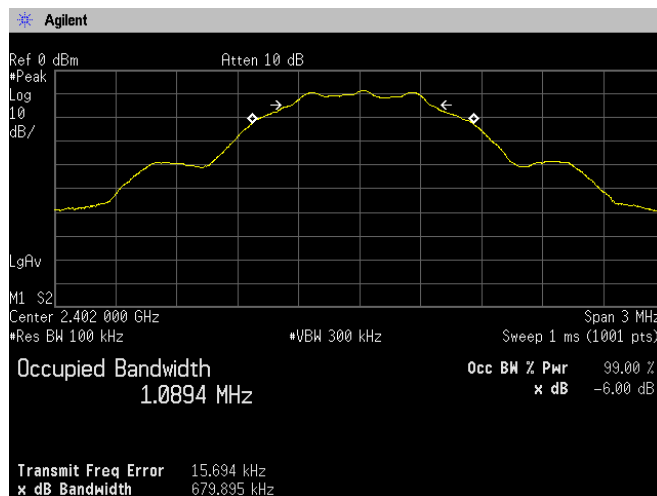
| Channel | Frequency [MHz] | 6dB bandwidth [MHz] |
|---------|-----------------|---------------------|
| Low | 2402 | 0.680 |
| Middle | 2440 | 0.680 |
| High | 2480 | 0.680 |



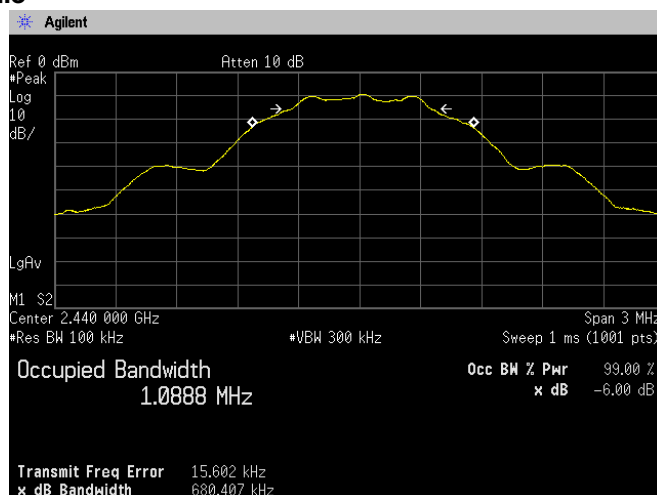
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4.4 Trace data

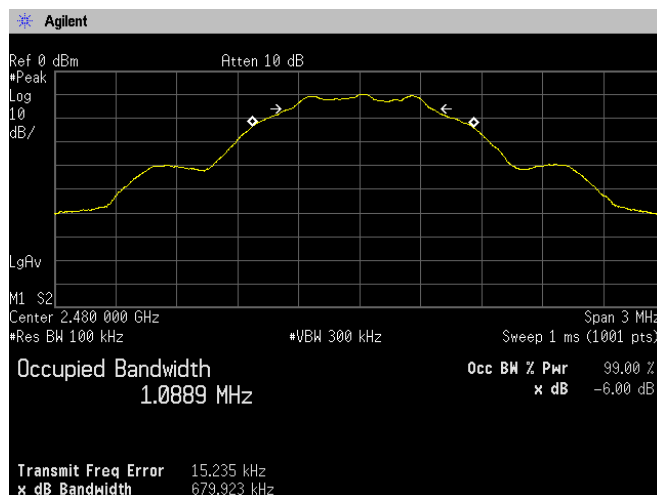
Channel Low



Channel Middle



Channel High



5. Maximum Peak Output Power

5.1 Measurement procedure

[FCC 15.247(b)(3), 15.31(e), KDB558074]

The peak power is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to;

- RBW=1MHz, VBW=8MHz, Span=3MHz, Sweep=auto, Detector=Peak, Trace mode=Max hold

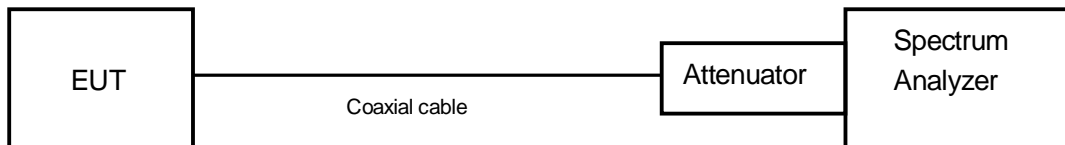
The EUT was set to operate with following conditions.

- Channel Low: 2402MHz, Channel Middle: 2440MHz, Channel High: 2480MHz

The test mode of EUT is as follows.

- Tx mode

- Test configuration



5.2 Limit

1W (1000mW) or less

5.3 Measurement result

Date : Mar. 27, 2014

Temperature : 24.0 [°C]

Humidity : 51.0 [%]

Test place : Shielded room No.4

Tested by :

Nobuyuki Toda

Battery Full

| Channel | Center Frequency (MHz) | Reading (dBm) | Factor (dB) | Level (dBm) | Peak Output Power (mW) | Limit (mW) | Result |
|---------|------------------------|---------------|-------------|-------------|------------------------|------------|--------|
| Low | 2402.00 | -13.19 | 10.62 | -2.57 | 0.553 | ≤1000 | PASS |
| Middle | 2440.00 | -13.80 | 10.62 | -3.18 | 0.481 | ≤1000 | PASS |
| High | 2480.00 | -14.10 | 10.62 | -3.48 | 0.449 | ≤1000 | PASS |

Calculation;

$$\text{Reading (dBm)} + \text{Factor (dB)} = \text{Level (dBm)}$$

$$10 \log P = \text{Level (dBm)}$$

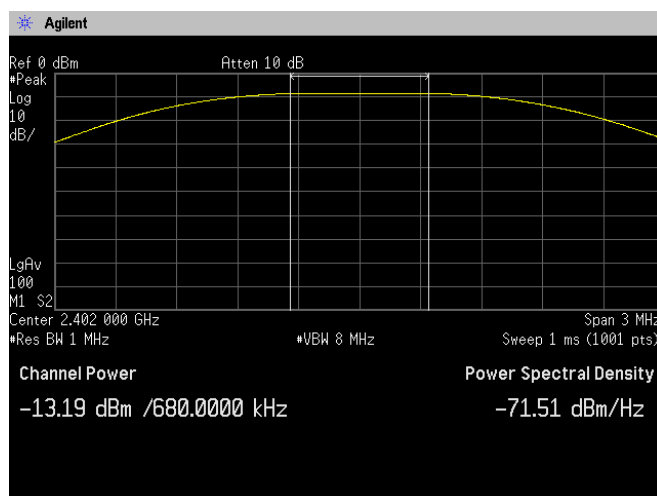
$$P = 10^{(\text{Maximum Peak Output Power} / 10)} \text{ (mW)}$$



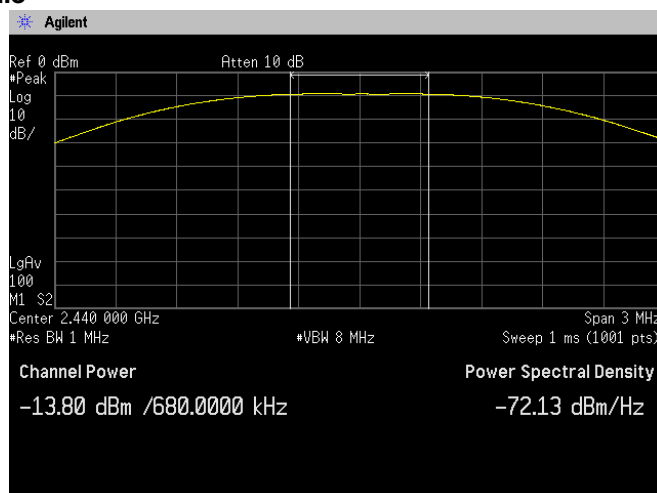
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5.4 Trace data

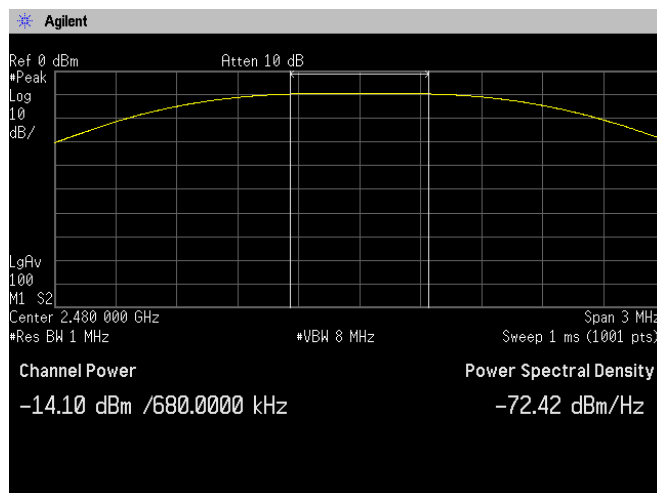
[Battery Full] Channel Low



Channel Middle



Channel High



6. Band Edge Compliance of RF Conducted Emissions

6.1 Measurement procedure [FCC 15.247(d), KDB558074]

The Band Edge is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to;

- RBW=100kHz, VBW=100kHz, Span=Arbitrary setting, Sweep=auto, Detector=Peak, Trace mode=Max hold

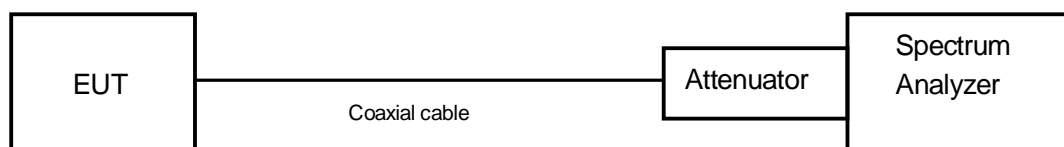
The EUT was set to operate with following conditions.

- Channel Low: 2402MHz, Channel High: 2480MHz

The test mode of EUT is as follows.

- Tx mode

- Test configuration



6.2 Limit

In any 100kHz bandwidth outside the frequency band the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.

6.3 Measurement result

Date : Mar. 27, 2014

Temperature : 24.0 [°C]

Humidity : 51.0 [%]

Test place : Shielded room No.4

Tested by :

Nobuyuki Toda

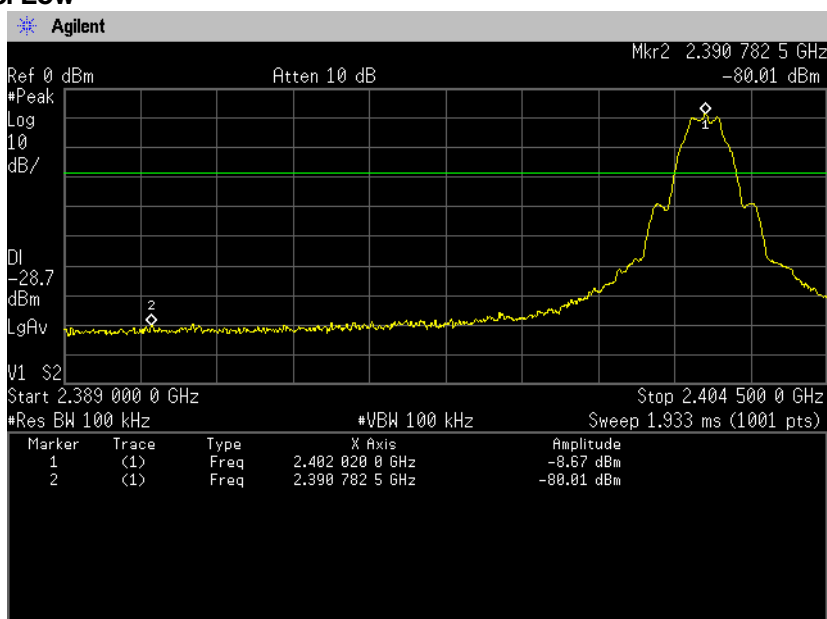
| Channel | Frequency (MHz) | RF Power Level (dBm) | Band-edge Frequency (MHz) | Band-edge Level (dBm) | Difference Level (dBm) | Limit (dBm) | Result |
|---------|-----------------|----------------------|---------------------------|-----------------------|------------------------|-------------------------------------|--------|
| Low | 2402.02 | -8.67 | 2390.78 | -80.01 | 71.34 | At least 20dB below from peak of RF | PASS |
| High | 2480.02 | -9.65 | 2483.56 | -75.78 | 66.13 | At least 20dB below from peak of RF | PASS |



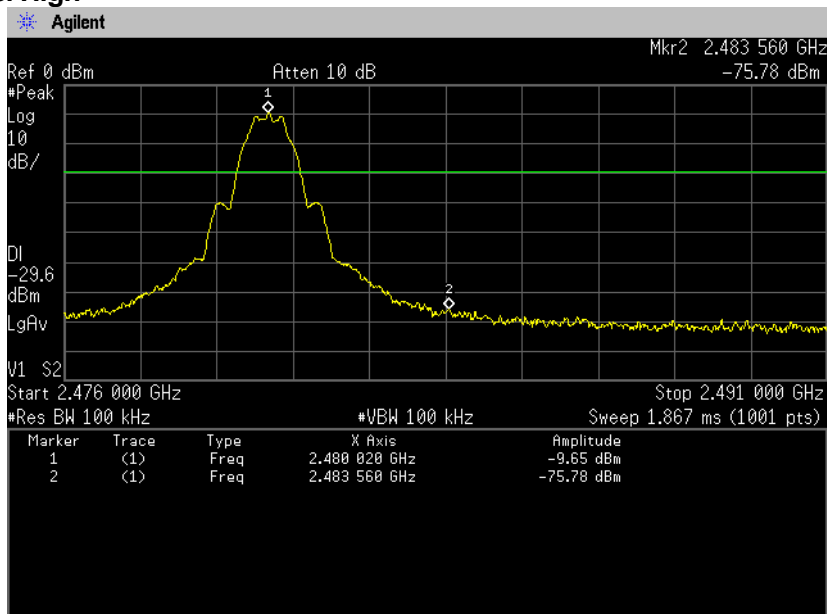
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6.4 Trace data

Channel Low



Channel High



7. Spurious emissions - Conducted -

7.1 Measurement procedure [FCC 15.247(d), KDB558074]

The spurious emissions (Conducted) are measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to;

- RBW=100kHz, VBW=300kHz, Span=Arbitrary setting, Sweep=auto, Detector=Peak, Trace mode=Max hold

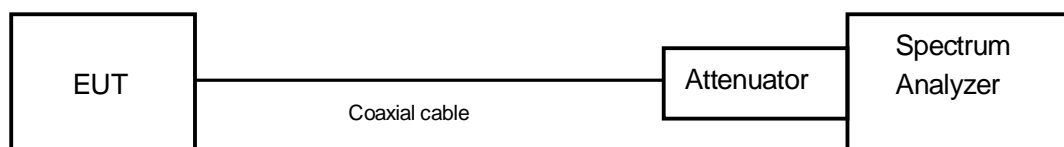
The EUT was set to operate with following conditions.

- Channel Low: 2402MHz, Channel Middle: 2440MHz, Channel High: 2480MHz

The test mode of EUT is as follows.

- Tx mode

- Test configuration



7.2 Limit

In any 100kHz bandwidth outside the frequency band the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.

7.3 Measurement result

Date : Mar. 27, 2014

Temperature : 24.0 [°C]

Humidity : 51.0 [%]

Test place : Shielded room No.4

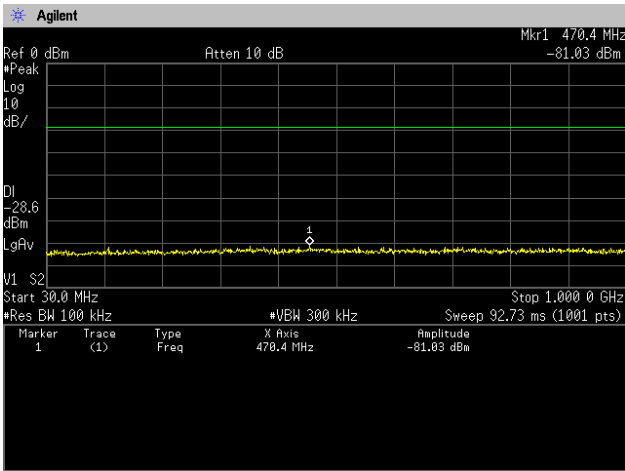
Tested by :

Nobuyuki Toda

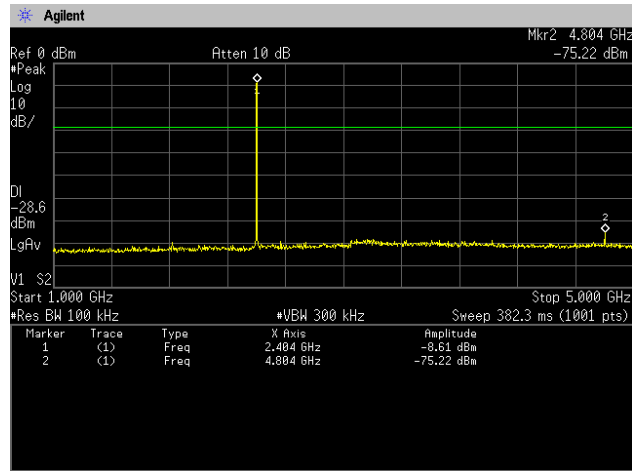
| Channel | Frequency [MHz] | Limit [dB] | Results Chart | Result |
|---------|-----------------|-------------------------------------|--------------------|--------|
| Low | 2402 | At least 20dB below from peak of RF | See the trace Data | PASS |
| Middle | 2440 | At least 20dB below from peak of RF | See the trace Data | PASS |
| High | 2480 | At least 20dB below from peak of RF | See the trace Data | PASS |

7.4 Trace data

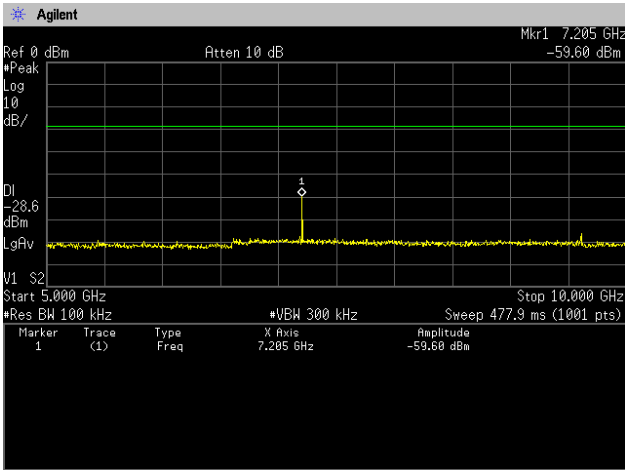
Channel Low 30MHz-1GHz



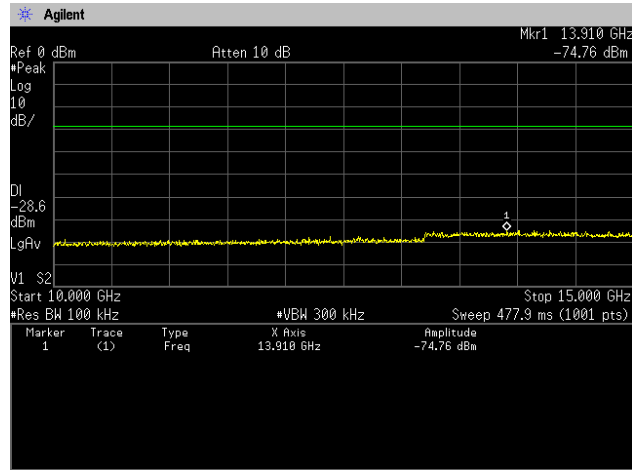
1GHz-5GHz



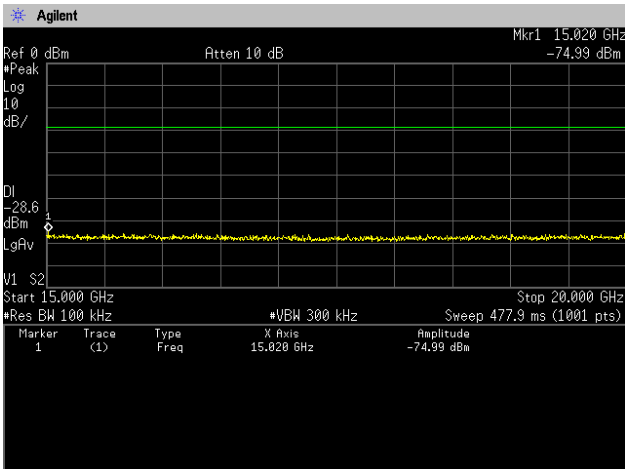
5GHz-10GHz



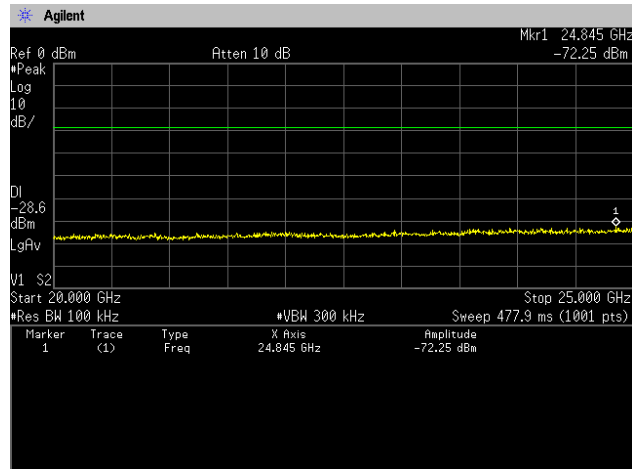
10GHz-15GHz



15GHz-20GHz



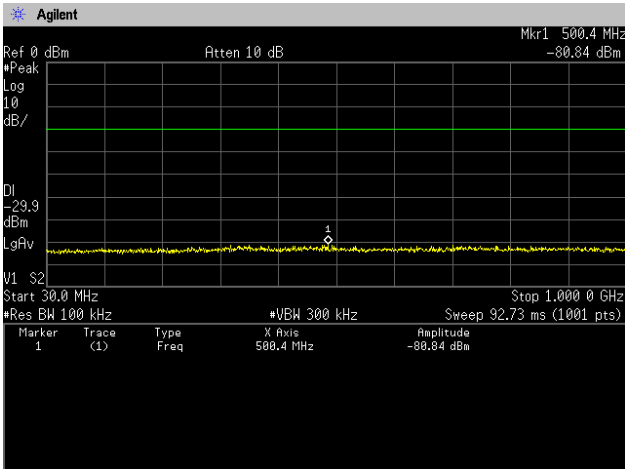
20GHz-25GHz



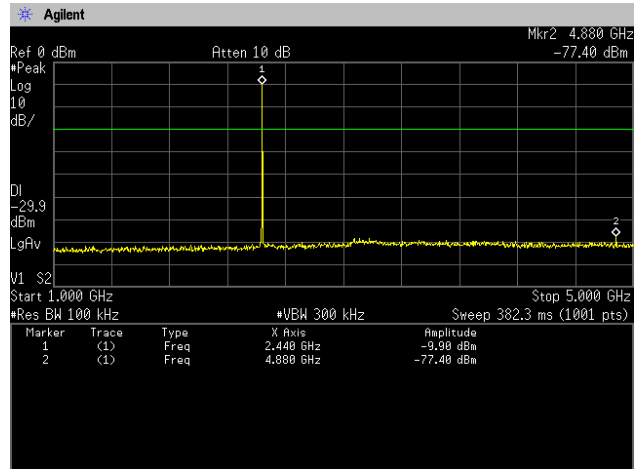


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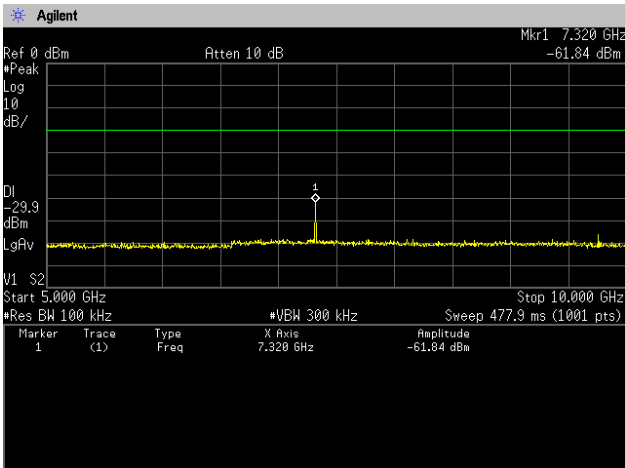
**Channel Middle
30MHz-1GHz**



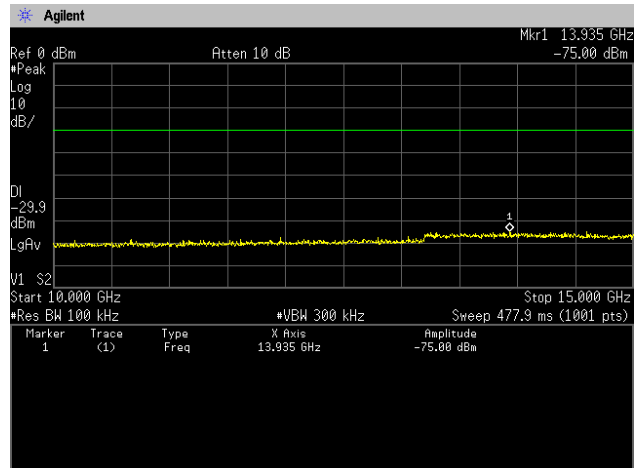
1GHz-5GHz



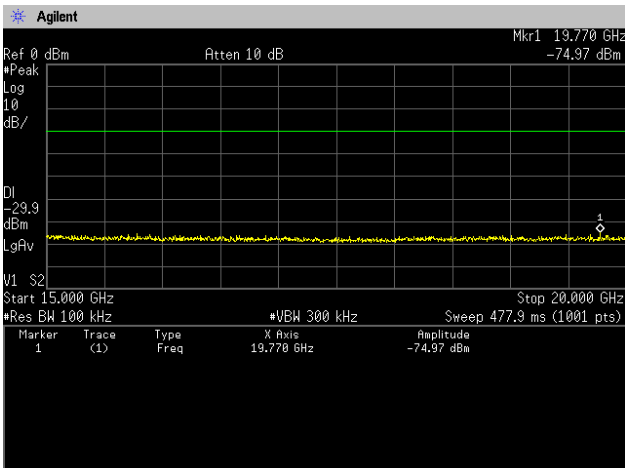
5GHz-10GHz



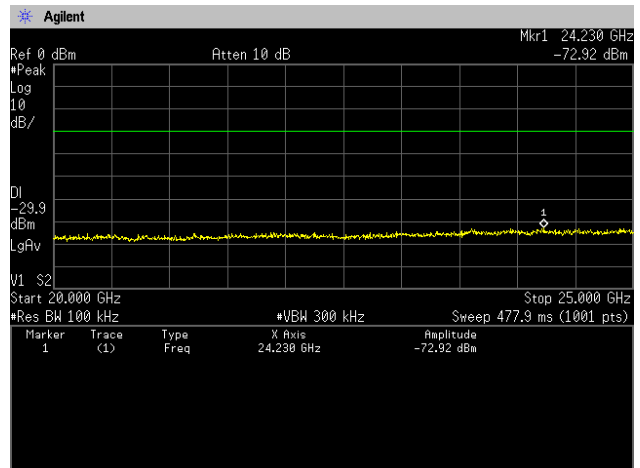
10GHz-15GHz



15GHz-20GHz



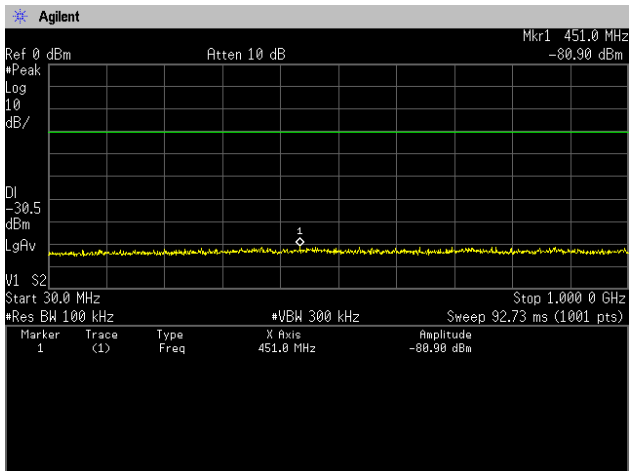
20GHz-25GHz



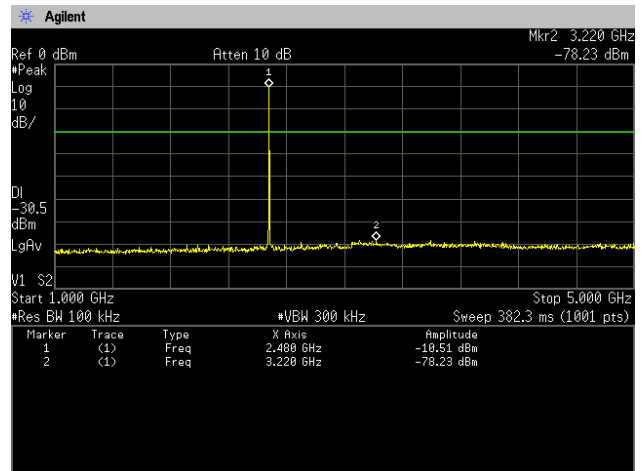


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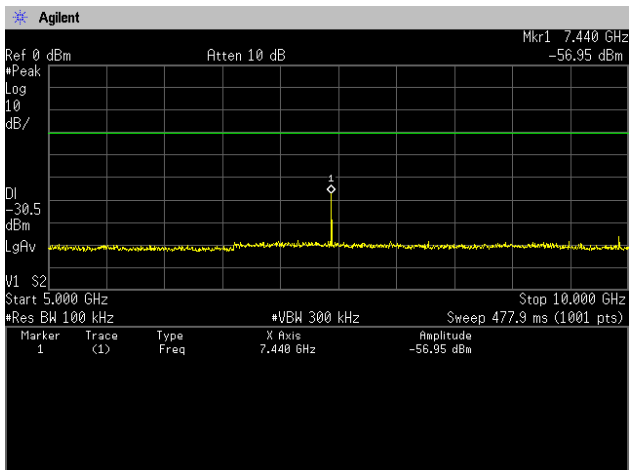
Channel High 30MHz-1GHz



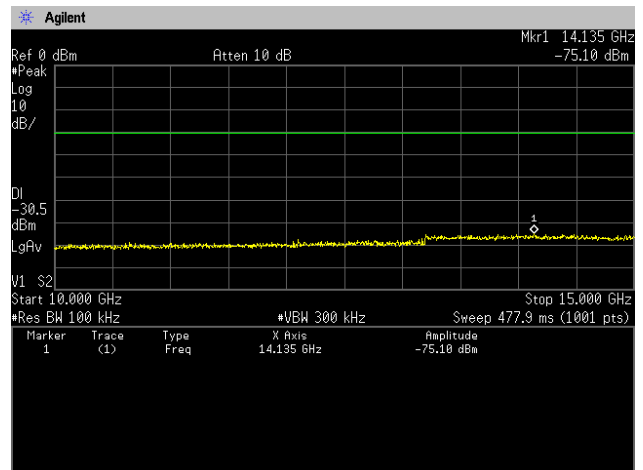
1GHz-5GHz



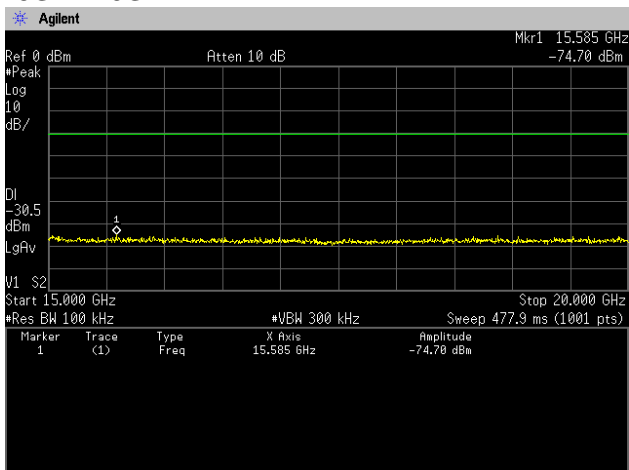
5GHz-10GHz



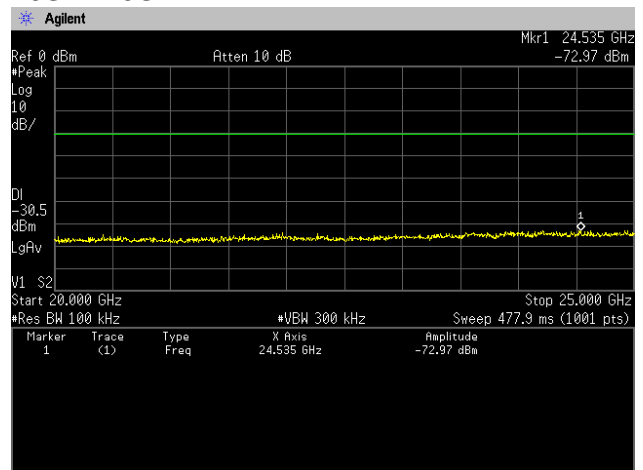
10GHz-15GHz



15GHz-20GHz



20GHz-25GHz



8. Spurious Emissions - Radiated -

8.1 Measurement procedure [FCC 247(d), 15.205, 15.209]

Test was applied by following conditions.

| | |
|---------------------------|---|
| Test method | : ANSI C63.4 |
| Frequency range | : 9kHz to 25GHz |
| Test place | : 3m Semi-anechoic chamber |
| EUT was placed on | : FRP table / (W)2.0m x (D)1.0m x (H)0.8m |
| Antenna distance | : 3m |
| Test receiver setting | Below 1GHz |
| - Detector | : Average (9kHz-90kHz, 110kHz-490kHz), Quasi-peak |
| - Bandwidth | : 200Hz, 120kHz |
| Spectrum analyzer setting | Above 1GHz |
| - Peak | : RBW=1MHz, VBW=3MHz, Span=0Hz, Sweep=auto |
| - Average | : RBW=1MHz, VBW=10Hz, Span=0Hz, Sweep=auto |
| | Display mode=Linear |

Radiated emission measurements are performed at 3m distance with the broadband antenna (Loop antenna, TRILOG antenna and Double ridged guide antenna). The antenna is positioned both the horizontal and vertical planes of polarization and height is varied 1m to 4m and stopped at height producing the maximum emission. As for the Loop antenna, it is positioned with its plane vertical, and the center of the Loop antenna is 1m above the ground plane.

The EUT is Placed on a turntable, which is 0.8m above ground plane. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level. The test results represent the worst case emission for each emission with manipulating the EUT, support equipment, interconnecting cables and varying the mode of operation. Sufficient time for the EUT, support equipment, and test equipment are allowed in order for them to warm up to their normal operating condition.

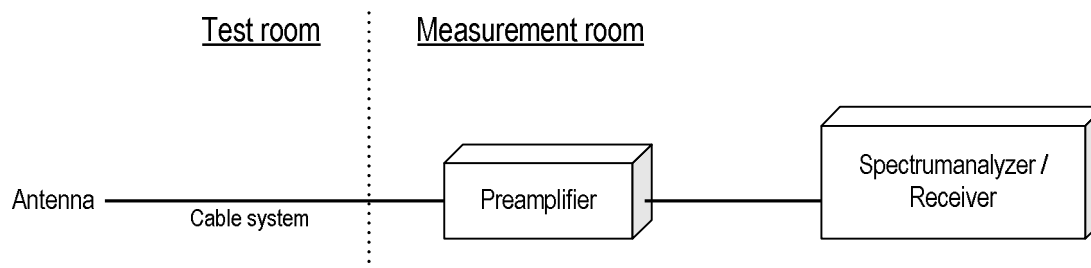
The EUT was set to operate with following conditions.

- Channel Low: 2402MHz, Channel Middle: 2440MHz, Channel High: 2480MHz

The test mode of EUT is as follows.

- Tx mode, Rx mode

- Test configuration



8.2 Calculation method

[9kHz to 150kHz]

Emission level = Reading + (Ant. factor + Cable system loss)

Margin = Limit – Emission level

[150kHz to 25GHz]

Emission level = Reading + (Ant. factor + Cable system loss – Amp. Gain)

Margin = Limit – Emission level

8.3 Limit

| Frequency [MHz] | Field strength | | Distance [m] |
|--------------------|-----------------|---------------|-----------------|
| | [uV/m] | [dBuV/m] | |
| 0.009-0.490 | 2400 / F [kHz] | 20logE [uV/m] | 300 |
| 0.490-1.705 | 24000 / F [kHz] | 20logE [uV/m] | 30 |
| 1.705-30 | 30 | 29.5 | 30 |
| 30-88 | 100 | 40.0 | 3 |
| 88-216 | 150 | 43.5 | 3 |
| 216-960 | 200 | 46.0 | 3 |
| Above 960 | 500 | 54.0 | 3 |

Note:

1. The lower limit shall apply at the transition frequencies.
2. Emission level [dBuV/m] = 20log Emission [uV/m]
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition modulation.

8.4 Test data

Date : Mar. 24, 2014
 Temperature : 22.0 [°C]
 Humidity : 33.0 [%]
 Test place : 3m Semi-anechoic chamber

Tested by : Nobuyuki Toda

【Qi mounted type】

Channel Low

| No. | Frequency [MHz] | (P) | Reading PK [dB(μV)] | Reading CAV [dB(μV)] | c. f [dB(1/m)] | Result PK [dB(μV/m)] | Result CAV [dB(μV/m)] | Limit PK [dB(μV/m)] | Limit AV [dB(μV/m)] | Margin PK [dB] | Margin CAV [dB] | Height [cm] | Angle [°] |
|-----|-----------------|-----|---------------------|----------------------|----------------|----------------------|-----------------------|---------------------|---------------------|----------------|-----------------|-------------|-----------|
| 1 | 4803.975 | V | 40.7 | 27.5 | 8.6 | 49.3 | 36.1 | 74.0 | 54.0 | 24.7 | 17.9 | 100.0 | 170.0 |
| 2 | 4804.039 | H | 41.1 | 27.7 | 8.6 | 49.7 | 36.3 | 74.0 | 54.0 | 24.3 | 17.7 | 100.0 | 147.0 |
| 3 | 7206.800 | V | 41.8 | 28.6 | 13.4 | 55.2 | 42.0 | 74.0 | 54.0 | 18.8 | 12.0 | 100.0 | 324.0 |
| 4 | 7206.805 | H | 42.6 | 29.0 | 13.4 | 56.0 | 42.4 | 74.0 | 54.0 | 18.0 | 11.6 | 100.0 | 45.0 |

Channel Middle

| No. | Frequency [MHz] | (P) | Reading PK [dB(μV)] | Reading CAV [dB(μV)] | c. f [dB(1/m)] | Result PK [dB(μV/m)] | Result CAV [dB(μV/m)] | Limit PK [dB(μV/m)] | Limit AV [dB(μV/m)] | Margin PK [dB] | Margin CAV [dB] | Height [cm] | Angle [°] |
|-----|-----------------|-----|---------------------|----------------------|----------------|----------------------|-----------------------|---------------------|---------------------|----------------|-----------------|-------------|-----------|
| 1 | 4880.061 | H | 40.9 | 30.3 | 9.0 | 49.9 | 39.3 | 74.0 | 54.0 | 24.1 | 14.7 | 100.0 | 0.0 |
| 2 | 4880.095 | V | 40.6 | 27.6 | 9.0 | 49.6 | 36.6 | 74.0 | 54.0 | 24.4 | 17.4 | 100.0 | 194.0 |
| 3 | 7320.062 | H | 43.2 | 30.9 | 14.1 | 57.3 | 45.0 | 74.0 | 54.0 | 16.7 | 9.0 | 100.0 | 210.0 |
| 4 | 7320.074 | V | 42.4 | 29.6 | 14.1 | 56.5 | 43.7 | 74.0 | 54.0 | 17.5 | 10.3 | 100.0 | 139.0 |

Channel High

| No. | Frequency [MHz] | (P) | Reading PK [dB(μV)] | Reading CAV [dB(μV)] | c. f [dB(1/m)] | Result PK [dB(μV/m)] | Result CAV [dB(μV/m)] | Limit PK [dB(μV/m)] | Limit AV [dB(μV/m)] | Margin PK [dB] | Margin CAV [dB] | Height [cm] | Angle [°] |
|-----|-----------------|-----|---------------------|----------------------|----------------|----------------------|-----------------------|---------------------|---------------------|----------------|-----------------|-------------|-----------|
| 1 | 4960.000 | V | 41.1 | 27.8 | 9.3 | 50.4 | 37.1 | 74.0 | 54.0 | 23.6 | 16.9 | 100.0 | 193.0 |
| 2 | 4960.063 | H | 41.1 | 28.0 | 9.3 | 50.4 | 37.3 | 74.0 | 54.0 | 23.6 | 16.7 | 147.0 | 151.0 |
| 3 | 7439.420 | V | 42.5 | 29.9 | 14.3 | 56.8 | 44.2 | 74.0 | 54.0 | 17.2 | 9.8 | 100.0 | 121.0 |
| 4 | 7439.550 | H | 43.7 | 31.6 | 14.3 | 58.0 | 45.9 | 74.0 | 54.0 | 16.0 | 8.1 | 100.0 | 232.0 |

Note:

1. Emission Level (Margin) = Limit - [Reading + Factor (Antenna + Cable – Amp)]
2. No emission were detected in frequency range 9kHz to 1000MHz at the 3 meters distance.
3. No emission was detected in the receive mode.

【Qi non-mounted type (Worst Only)】

Channel High

| No. | Frequency [MHz] | (P) | Reading PK [dB(μV)] | Reading CAV [dB(μV)] | c. f [dB(1/m)] | Result PK [dB(μV/m)] | Result CAV [dB(μV/m)] | Limit PK [dB(μV/m)] | Limit AV [dB(μV/m)] | Margin PK [dB] | Margin CAV [dB] | Height [cm] | Angle [°] |
|-----|-----------------|-----|---------------------|----------------------|----------------|----------------------|-----------------------|---------------------|---------------------|----------------|-----------------|-------------|-----------|
| 1 | 4960.000 | H | 41.0 | 27.9 | 9.3 | 50.3 | 37.2 | 74.0 | 54.0 | 23.7 | 16.8 | 147.0 | 151.0 |
| 2 | 4960.000 | V | 41.1 | 27.8 | 9.3 | 50.4 | 37.1 | 74.0 | 54.0 | 23.6 | 16.9 | 100.0 | 193.0 |
| 3 | 7439.550 | H | 43.5 | 31.5 | 14.3 | 57.8 | 45.8 | 74.0 | 54.0 | 16.2 | 8.2 | 100.0 | 232.0 |
| 4 | 7439.590 | V | 42.0 | 29.0 | 14.3 | 56.3 | 43.3 | 74.0 | 54.0 | 17.7 | 10.7 | 100.0 | 121.0 |

Note:

1. Emission Level (Margin) = Limit - [Reading + Factor (Antenna + Cable – Amp)]
2. No emission were detected in frequency range 9kHz to 1000MHz at the 3 meters distance.
3. No emission was detected in the receive mode.

9. Restricted Band of Operation

9.1 Measurement procedure [FCC 247(d), 15.205, 15.209]

Test was applied by following conditions.

Test method : ANSI C63.4
 Test place : 3m Semi-anechoic chamber
 EUT was placed on : FRP table / (W)2.0m x (D)1.0m x (H)0.8m
 Antenna distance : 3m

Spectrum analyzer setting
 - Peak : RBW=1MHz, VBW=3MHz, Span=Arbitrary setting, Sweep=auto
 - Average : RBW=1MHz, VBW=3kHz, Span=Arbitrary setting, Sweep=auto
 Display mode=Linear

Average Measurement Setting [VBW]

| Mode | Duty Cycle (%) | T _{on} (us) | T _{off} (us) | 1/T _{on} (kHz) | Determined VBW Setting |
|------------------|----------------|----------------------|-----------------------|-------------------------|------------------------|
| Bluetooth 4.0 LE | 62.5 | 391 | 234.6 | 2.6 | 3kHz |

Radiated emission measurements are performed at 3m distance with the broadband antenna (Double ridged guide antenna). The antenna is positioned both the horizontal and vertical planes of polarization and height is varied 1m to 4m and stopped at height producing the maximum emission.

The EUT is Placed on a turntable, which is 0.8m above ground plane. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level. The test results represent the worst case emission for each emission with manipulating the EUT, support equipment, interconnecting cables and varying the mode of operation. Sufficient time for the EUT, support equipment, and test equipment are allowed in order for them to warm up to their normal operating condition.

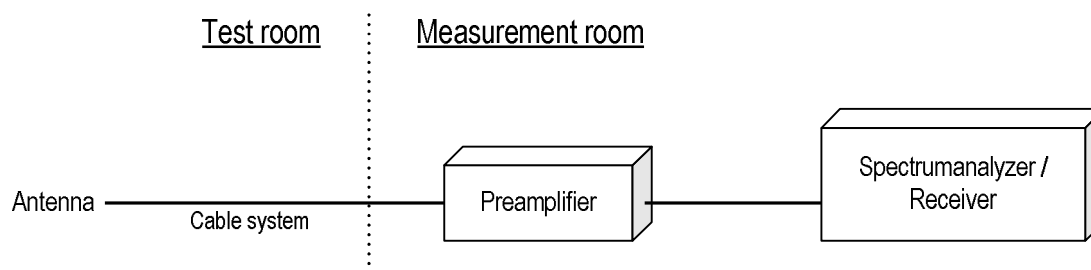
The EUT was set to operate with following conditions.

- Channel Low: 2402MHz, Channel High: 2480MHz

The test mode of EUT is as follows.

- Tx mode

- Test configuration



9.2 Limit

Emission at the boundary of the restricted band provided by 15.205 shall be lower than 15.209 limit.



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9.3 Measurement Result

| Channel | Frequency [MHz] | Results Chart | Result |
|---------|-----------------|--------------------|--------|
| Low | 2402 | See the Trace Data | Pass |
| High | 2480 | See the Trace Data | Pass |

9.4 Test data

Date : Apr. 1, 2014
 Temperature : 21.0 [°C]
 Humidity : 32.5 [%]
 Test place : 3m Semi-anechoic chamber

Tested by : Taiki Watanabe

Date : Apr. 21, 2014
 Temperature : 22.0 [°C]
 Humidity : 33.5 [%]
 Test place : 3m Semi-anechoic chamber

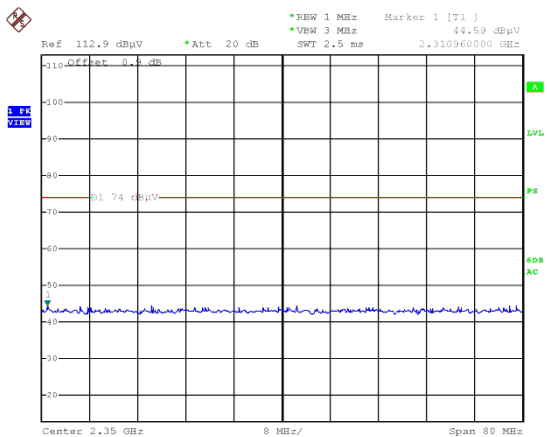
Tested by : Taiki Watanabe



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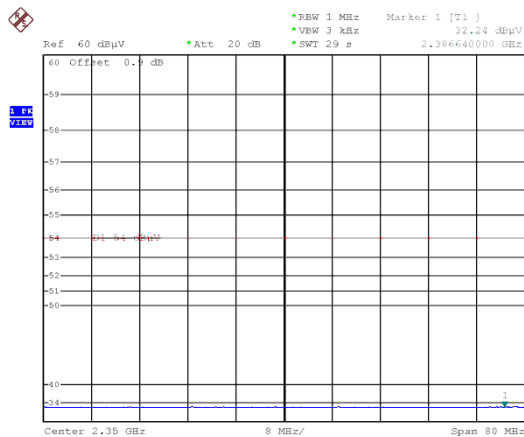
【Qi mounted type】

Channel Low Horizontal Peak



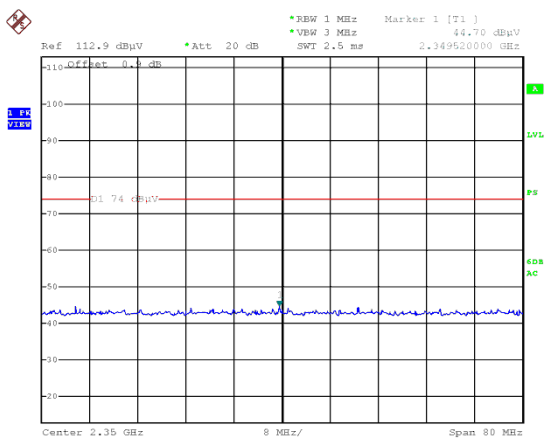
Date: 1.APR.2014 00:53:52

Average



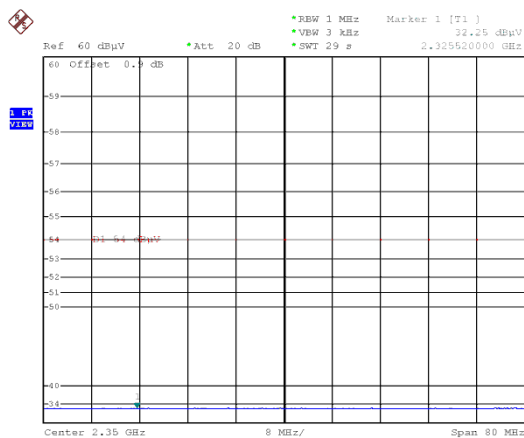
Date: 1.APR.2014 00:57:08

Vertical Peak



Date: 1.APR.2014 01:01:57

Average



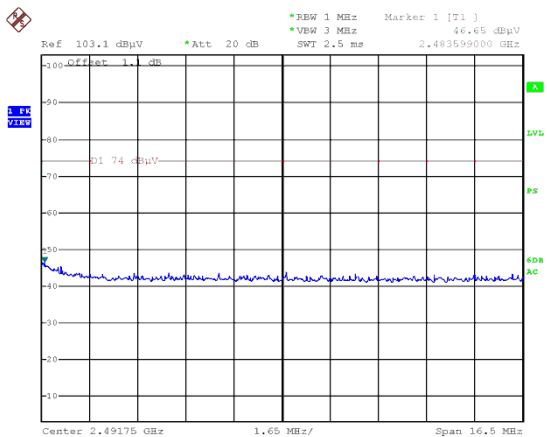
Date: 1.APR.2014 01:05:36



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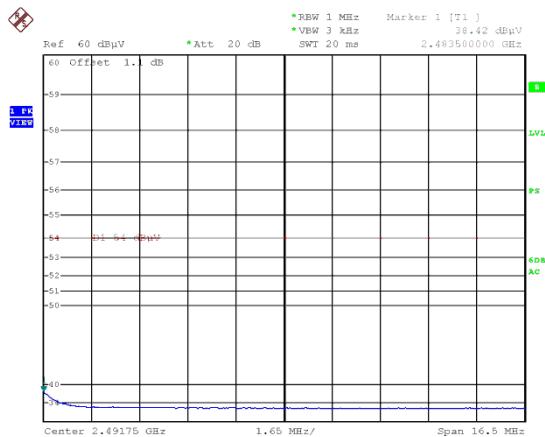
【Qi mounted type】

Channel High Horizontal Peak



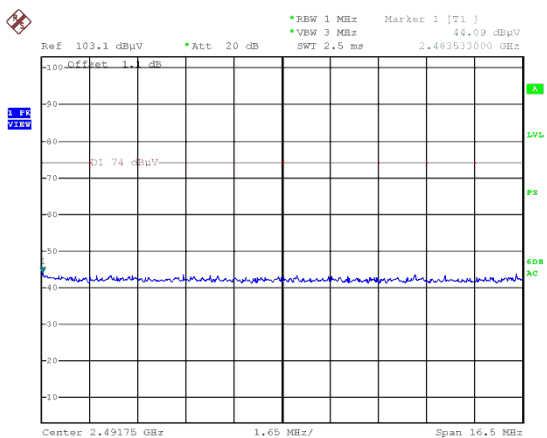
Date: 1.APR.2014 01:09:56

Average



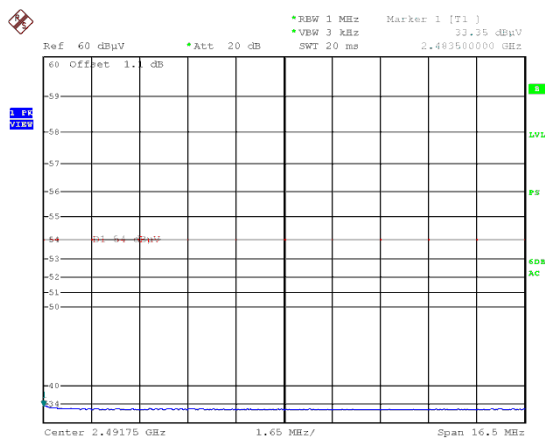
Date: 1.APR.2014 01:10:28

Vertical Peak



Date: 1.APR.2014 01:15:10

Average



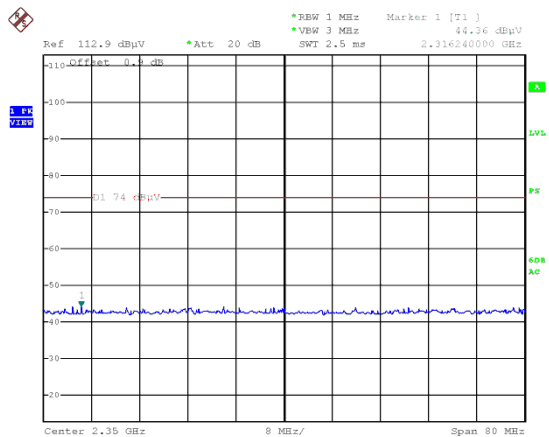
Date: 1.APR.2014 01:15:38



Zacta

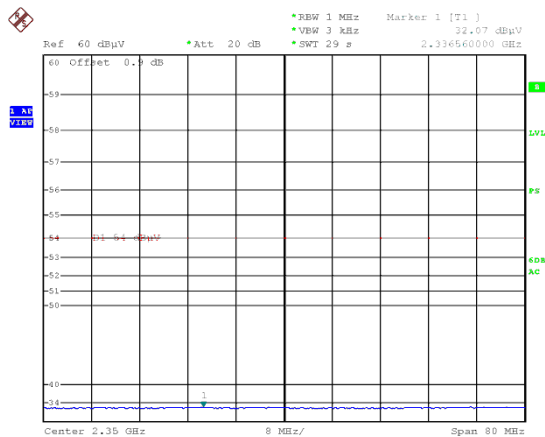
【Qi non-mounted type】

Channel Low Horizontal Peak



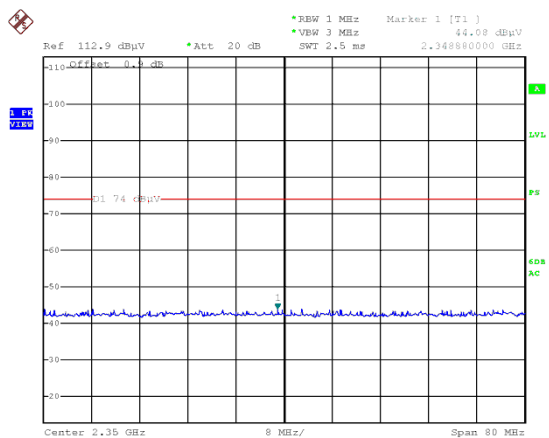
Date: 21.APR.2014 21:10:48

Average



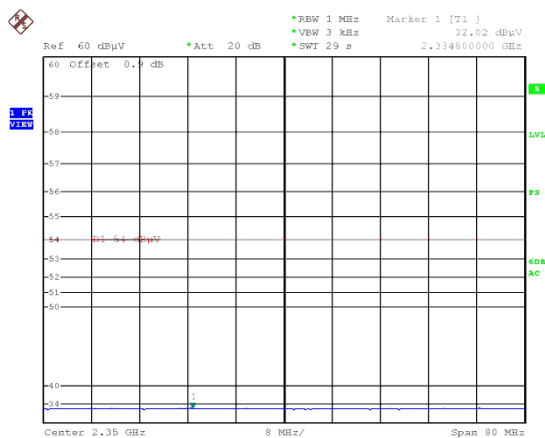
Date: 21.APR.2014 21:40:23

Vertical Peak



Date: 21.APR.2014 21:12:45

Average



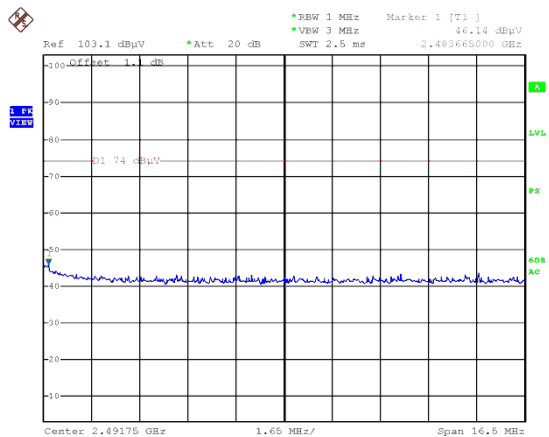
Date: 21.APR.2014 21:38:27



Zacta

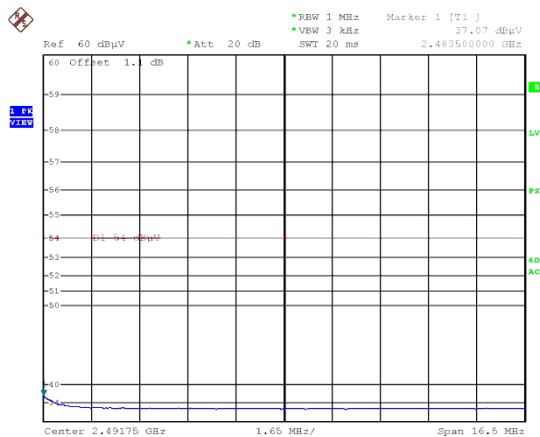
【Qi non-mounted type】

Channel High Horizontal Peak



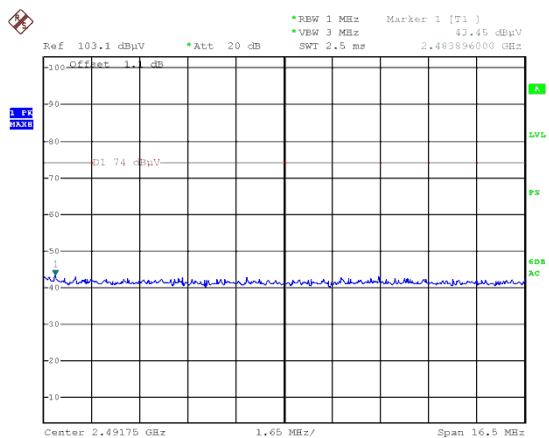
Date: 21.APR.2014 21:20:44

Average



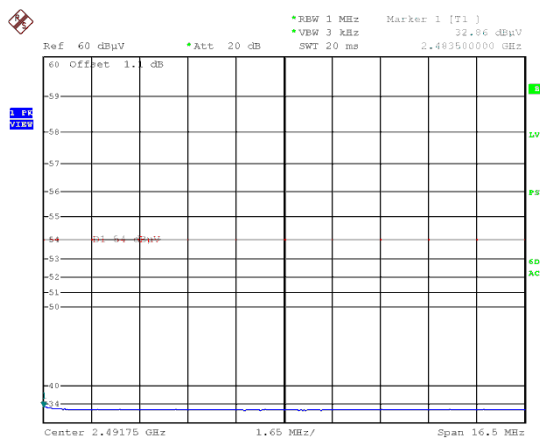
Date: 21.APR.2014 21:32:21

Vertical Peak



Date: 21.APR.2014 21:24:30

Average



Date: 21.APR.2014 21:33:39

10. Transmitter Power Spectral Density

10.1 Measurement procedure [FCC 15.247(e), KDB558074]

The peak power is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to;

- RBW=3kHz, VBW=10kHz, Span=1.1MHz, Sweep=Auto, Detector=Peak, Trace mode=Max hold

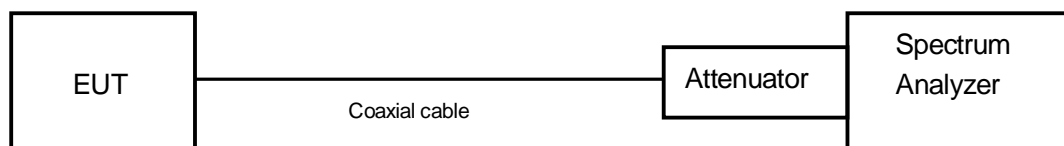
The EUT was set to operate with following conditions.

- Channel Low: 2402MHz, Channel Middle: 2440MHz, Channel High: 2480MHz

The test mode of EUT is as follows.

- Tx mode

- Test configuration



10.2 Limit

The peak power spectral density shall not be greater than 8dBm in any 3kHz band.

10.3 Measurement result

Date : Mar. 27, 2014

Temperature : 24.0 [°C]

Humidity : 51.0 [%]

Test place : Shielded room No.4

Tested by :

Nobuyuki Toda

| Channel | Frequency (MHz) | Reading (dBm) | Factor (dB) | Level (dBm) | Limit (dBm) | Margin (dBm) | Result |
|---------|-----------------|---------------|-------------|-------------|-------------|--------------|--------|
| Low | 2412.00 | -23.62 | 10.67 | -12.95 | 8.00 | 20.95 | PASS |
| Middle | 2440.00 | -24.31 | 10.67 | -13.64 | 8.00 | 21.64 | PASS |
| High | 2480.00 | -24.68 | 10.67 | -14.01 | 8.00 | 22.01 | PASS |

Calculation;

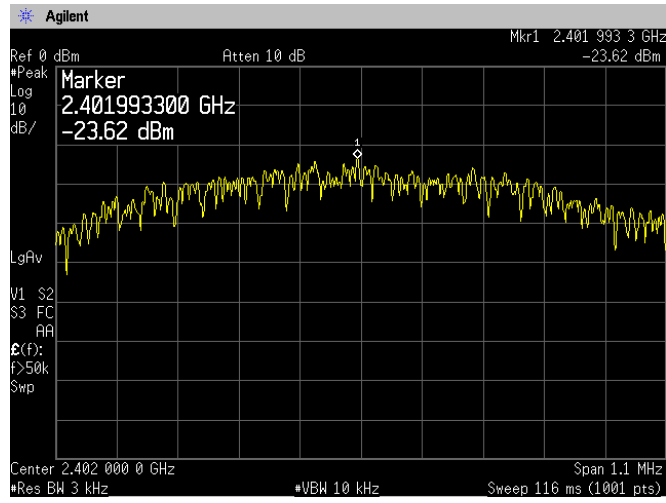
Transmitter Power Spectral Density Level (Margin) = Limit – (Reading + Factor)



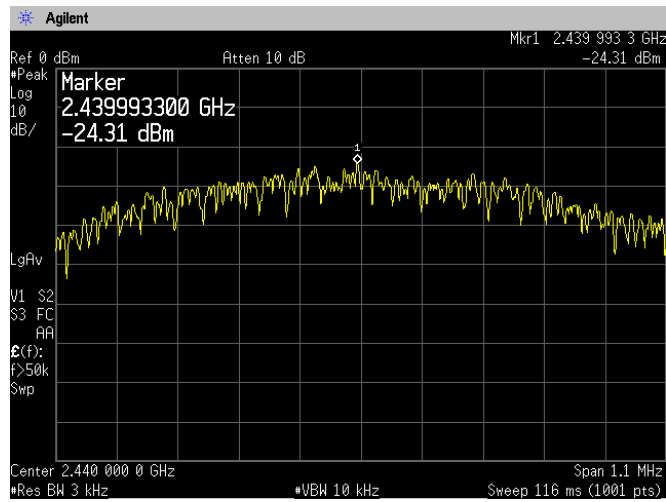
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10.4 Trace data

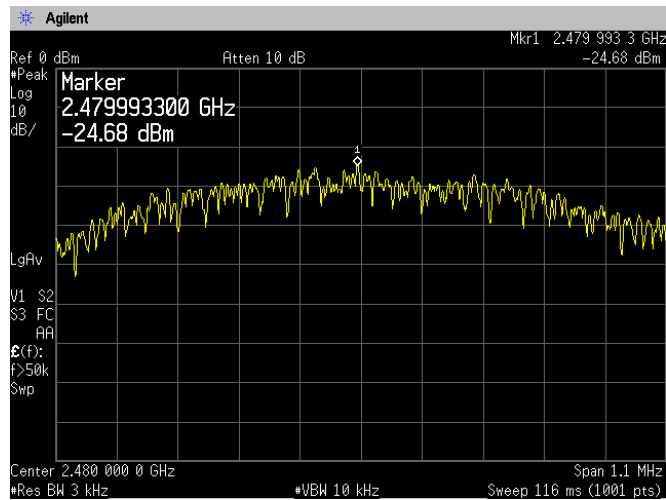
Channel Low



Channel Middle



Channel High



11. AC Power Line Conducted Emissions

11.1 Measurement procedure [FCC 15.207]

Test was applied by following conditions.

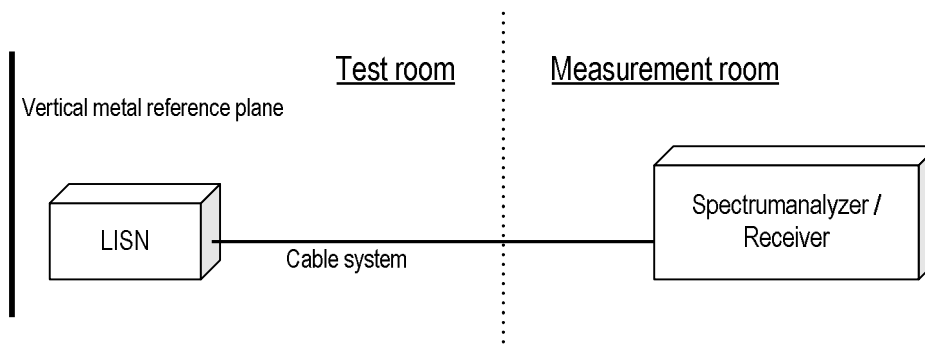
| | |
|--------------------------------|---|
| Test method | : ANSI C63.4 |
| Frequency range | : 0.15MHz to 30MHz |
| Test place | : 10m Semi-anechoic chamber |
| EUT was placed on | : FRP table / (W)2.0m × (D)1.0m × (H)0.8m |
| Vertical Metal Reference Plane | : (W)2.0m × (H)2.0m 0.4m away from EUT |
| Test receiver setting | |
| - Detector | : Quasi-peak, Average |
| - Bandwidth | : 9kHz |

EUT and peripherals are connected to 50Ω/50μH Line Impedance Stabilization Network (LISN) which are connected to reference ground plane, and are placed 80cm away from EUT. Excess of AC power cable is bundled in center.

LISN for peripheral is terminated in 50Ω.

EUT operating mode is selected to emit the maximum noise. Overall frequency range is investigated with spectrum analyzer using peak detector. Maximum emission configuration is determined by manipulating the EUT, peripherals, interconnecting cables. Then, emission measurements are performed with test receiver in above setting to each current-carrying conductor of the mains port. Sufficient time for EUT, peripherals and test equipment is provided in order for them to warm up to their normal operating condition. If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits.

- Test configuration



11.2 Calculation method

Emission level = Reading + (LISN. factor + Cable system loss)

Margin = Limit – Emission level

11.3 Limit

| Frequency [MHz] | Limit | |
|--------------------|-----------|-----------|
| | QP [dBuV] | AV [dBuV] |
| 0.15-0.5 | 66-56* | 56-46* |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |

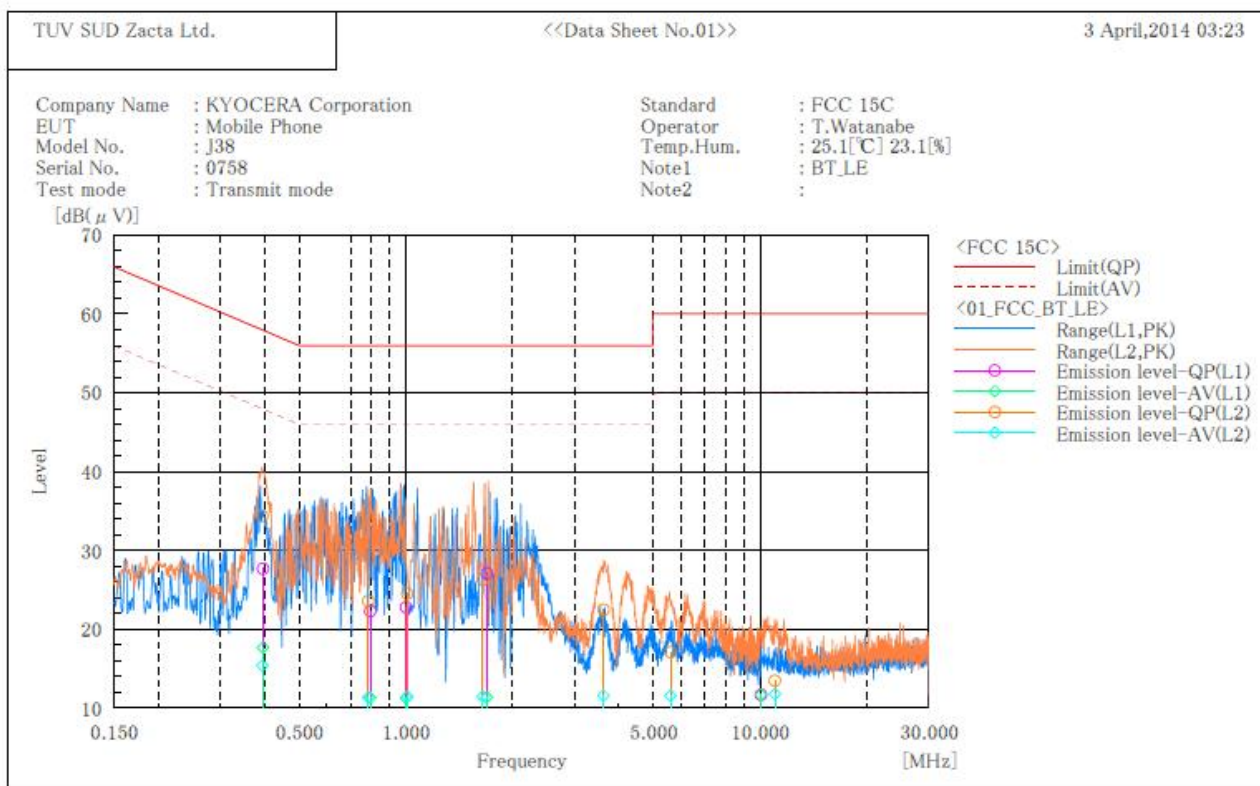
*: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.



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11.4 Test data

***** CONDUCTED EMISSION at MAINS PORT *****
 < 3m Semi-anechoic chamber >



Final Result

--- L1 Phase ---

| No. | Frequency [MHz] | Reading QP [dB(μV)] | Reading AV [dB(μV)] | c. f [dB] | Result QP [dB(μV)] | Result AV [dB(μV)] | Limit QP [dB(μV)] | Limit AV [dB(μV)] | Margin QP [dB] | Margin AV [dB] |
|-----|-----------------|---------------------|---------------------|-----------|--------------------|--------------------|-------------------|-------------------|----------------|----------------|
| 1 | 0.396 | 17.4 | 7.4 | 10.3 | 27.7 | 17.7 | 57.9 | 47.9 | 30.2 | 30.2 |
| 2 | 0.795 | 12.0 | 1.0 | 10.3 | 22.3 | 11.3 | 56.0 | 46.0 | 33.7 | 34.7 |
| 3 | 1.003 | 12.5 | 1.0 | 10.3 | 22.8 | 11.3 | 56.0 | 46.0 | 33.2 | 34.7 |
| 4 | 1.696 | 16.7 | 1.0 | 10.4 | 27.1 | 11.4 | 56.0 | 46.0 | 28.9 | 34.6 |
| 5 | 10.070 | 1.0 | 1.0 | 10.7 | 11.7 | 11.7 | 60.0 | 50.0 | 48.3 | 38.3 |

--- L2 Phase ---

| No. | Frequency [MHz] | Reading QP [dB(μV)] | Reading AV [dB(μV)] | c. f [dB] | Result QP [dB(μV)] | Result AV [dB(μV)] | Limit QP [dB(μV)] | Limit AV [dB(μV)] | Margin QP [dB] | Margin AV [dB] |
|-----|-----------------|---------------------|---------------------|-----------|--------------------|--------------------|-------------------|-------------------|----------------|----------------|
| 1 | 0.394 | 24.0 | 5.0 | 10.4 | 34.4 | 15.4 | 58.0 | 48.0 | 23.6 | 32.6 |
| 2 | 0.785 | 13.2 | 1.0 | 10.4 | 23.6 | 11.4 | 56.0 | 46.0 | 32.4 | 34.6 |
| 3 | 1.011 | 14.1 | 1.1 | 10.4 | 24.5 | 11.5 | 56.0 | 46.0 | 31.5 | 34.5 |
| 4 | 1.651 | 15.9 | 1.1 | 10.4 | 26.3 | 11.5 | 56.0 | 46.0 | 29.7 | 34.5 |
| 5 | 3.621 | 12.0 | 1.1 | 10.5 | 22.5 | 11.6 | 56.0 | 46.0 | 33.5 | 34.4 |
| 6 | 5.595 | 6.5 | 1.0 | 10.6 | 17.1 | 11.6 | 60.0 | 50.0 | 42.9 | 38.4 |
| 7 | 11.024 | 2.7 | 1.0 | 10.8 | 13.5 | 11.8 | 60.0 | 50.0 | 46.5 | 38.2 |



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12. Antenna requirement

According to FCC section 15.203, 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 antenna is a special antenna mounted inside of the EUT. Therefore, the EUT complies with the antenna requirement of FCC section 15.203.



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13. Uncertainty of measurement

Expanded uncertainties stated are calculated with a coverage Factor $k=2$.

Please note that these results are not taken into account when determining compliance or non-compliance with test result.

| Test item | Measurement uncertainty |
|-------------------------------------|--------------------------------|
| Conducted emission at mains port | $\pm 3.0\text{dB}$ |
| Radiated emission (9kHz – 30MHz) | $\pm 4.4\text{dB}$ |
| Radiated emission (30MHz – 1000MHz) | $\pm 4.5\text{dB}$ |
| Radiated emission (1000MHz – 26GHz) | $\pm 3.9\text{dB}$ |



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14. Laboratory description

1. Location:

TÜV SÜD Zacta Ltd. Yonezawa Testing Center
 4149-7 Hachimanpara 5-chome Yonezawa-shi Yamagata 992-1128 Japan
 Phone: +81-238-28-2880 Fax: +81-238-28-2888

2. Facility filing information:

1) NVLAP accreditation: NVLAP Lab. code: 200306-0

2) VLAC accreditation: Lab. code: VLAC-013

| Site name | Radiated emission | Conducted emission for mains port | Conducted emission for telecom port | Radiated emission (CMAD) | Expiry Date |
|--------------------------------|-------------------|-----------------------------------|-------------------------------------|--------------------------|--------------|
| 3m Semi-anechoic chamber | VLAC-013 | VLAC-013 | VLAC-013 | - | Jul. 3, 2015 |
| 10m Semi-anechoic chamber No.1 | | | | VLAC-013 | |
| 10m Semi-anechoic chamber No.2 | | | | VLAC-013 | |
| Shielded room No.1 | - | VLAC-013 | - | - | |

3) FCC filing:

| Site name | Registration Number | Expiry Date |
|--------------------------------|---------------------|---------------|
| Site 3 | 91065 | Oct.31, 2014 |
| 3m Semi-anechoic chamber | 540072 | Feb. 20, 2017 |
| 10m Semi-anechoic chamber No.1 | | |
| 10m Semi-anechoic chamber No.2 | | |
| Shielded room No.1 | | |

4) Industry Canada Oats site filing:

| Site name | Sites on file: Oats 3m/10m | Expiry Date |
|--------------------------------|----------------------------|---------------|
| Site 3 | 4224A-3 | Jan. 23, 2015 |
| 3m Semi-anechoic chamber | 4224A-4 | |
| 10m Semi-anechoic chamber No.1 | 4224A-5 | |
| 10m Semi-anechoic chamber No.2 | 4224A-6 | Jan. 15, 2017 |

5) VCCI site filing:

| Site name | Radiated emission | Conducted emission for mains port | Conducted emission for telecom port | Expiry Date |
|--------------------------------|-------------------|-----------------------------------|-------------------------------------|---|
| Site 3 | R-138 | C-134 | T-1222 | Nov. 16, 2014 Nov. 28, 2014* (*:Telecom port) |
| 3m Semi-anechoic chamber | A-0166 | A-0166 | A-0166 | Jul. 3, 2015 |
| 10m Semi-anechoic chamber No.1 | | | | |
| 10m Semi-anechoic chamber No.2 | | | | |
| Shielded room No.1 | - | A-0166 | | |

6) TÜV SÜD PS authorization:

Authorized as an EMC test laboratory

7) TÜV Rheinland authorization:

Authorized as an EMC test laboratory

Appendix A. Test equipment

Antenna port conducted test

| Equipment | Company | Model No. | Serial No. | Cal. due | Cal. date |
|-------------------|----------------------|-----------|------------|-----------|---------------|
| Spectrum analyzer | Agilent Technologies | E4440A | US4432655 | May 2014 | May 14, 2013 |
| Microwave cable | RS | YH_13S5 | N/A (S403) | May 2014 | May 10, 2013 |
| Attenuator | Weinschel | 56-10 | J4180 | Nov. 2014 | Nov. 12, 2013 |

Radiated emission

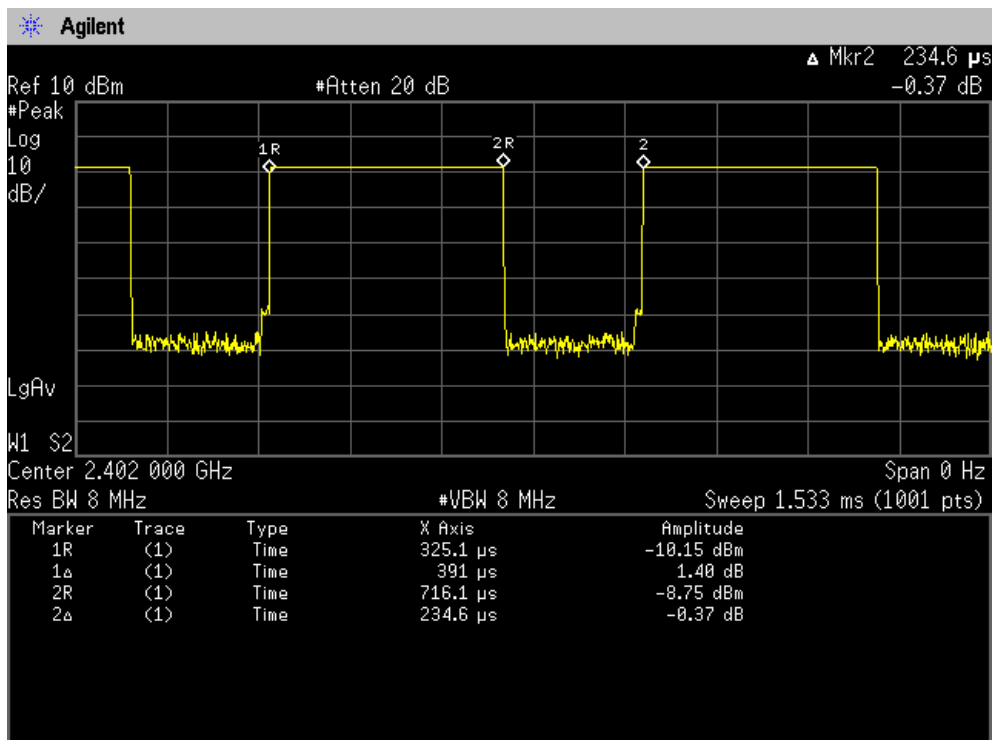
| Equipment | Company | Model No. | Serial No. | Cal. Due | Cal. Date |
|-----------------------------|----------------------|------------------|------------------|-----------|---------------|
| EMI Receiver | ROHDE&SCHWARZ | ECSI | 100451 | Nov. 2014 | Nov. 16, 2013 |
| Preamplifier | ANRITSU | MH648A | M96057 | Jun. 2014 | Jun. 12, 2013 |
| Loop antenna | ROHDE&SCHWARZ | HFH2-Z2 | 892246/010 | Oct. 2014 | Oct. 5, 2013 |
| Biconical Antenna | Schwarzbeck | VHA9103/BBA9106 | 2155 | May 2014 | May 1, 2013 |
| Log periodic Antenna | Schwarzbeck | UHALP9108A | 0560 | May 2014 | May 1, 2013 |
| Attenuator | TME | CFA-01NPJ-6 | N/A (S275) | Jun. 2014 | Jun. 6, 2013 |
| Attenuator | TME | CFA-01NPJ-3 | N/A (S272) | Jun. 2014 | Jun. 6, 2013 |
| Spectrum analyzer | Agilent Technologies | E4440A | US4432655 | May 2014 | May 14, 2013 |
| Preamplifier | Agilent Technologies | 8449B | 3008A1008 | Dec. 2014 | Dec. 9, 2013 |
| Double ridged guide antenna | EMCO | 3115 | 5205 | Dec. 2014 | Dec. 10, 2013 |
| Attenuator | AEROFLEX | 40A-03 | 081217-20 | Feb. 2015 | Feb. 23, 2014 |
| Broad-Band Horn Antenna | Schwarzbeck | BBHA9170 | BBHA9170189 | May 2015 | May 2, 2013 |
| Preamplifier | TSJ | MLA-1840-B03-35 | 1240332 | May 2015 | May 2, 2013 |
| Microwave cable | SUHNER | SUCOFLEX104/9m | 346316/4 | Oct. 2014 | Oct. 6, 2013 |
| | | SUCOFLEX104/1m | 322084/4 | Oct. 2014 | Oct. 6, 2013 |
| | | SUCOFLEX104/1.5m | 317226/4 | Oct. 2014 | Oct. 6, 2013 |
| | | SUCOFLEX104/7m | 41625/6 | Oct. 2014 | Oct. 6, 2013 |
| PC | DELL | DIMENSION E521 | 75465BX | N/A | N/A |
| Software | TOYO Corporation | EP5/RE-AJ | 0611193/V5.3.61 | N/A | N/A |
| 3m Semi-anechoic chamber | TOKIN | N/A | N/A (9002-NSA) | May 2014 | May 19, 2013 |
| 3m Semi-anechoic chamber | TOKIN | N/A | N/A (9002-SVSWR) | May 2014 | May 19, 2013 |

Conducted emission at mains port

| Equipment | Company | Model No. | Serial No. | Cal. due | Cal. date |
|--|---------------------------------|-------------|------------|-----------|---------------|
| EMI Receiver | ROHDE&SCHWARZ | ECSI | 100451 | Nov. 2014 | Nov. 16, 2013 |
| Attenuator | HUBER+SUHNER | 6810.01.A | N/A (S411) | Feb. 2015 | Feb. 28, 2014 |
| Line impedance stabilization network for EUT | Kyoritsu Electrical Works, Ltd. | KNW-407F | 8-2003-1 | Jul. 2014 | Jul. 1, 2013 |
| Coaxial cable | FUJIKURA | 5D-2W/4m | N/A (S350) | Feb. 2015 | Feb. 5, 2014 |
| Coaxial cable | FUJIKURA | 5D-2W/1m | N/A (S193) | Feb. 2015 | Feb. 5, 2014 |
| Coaxial cable | SUHNER | RG214/U/10m | N/A (S194) | Feb. 2015 | Feb. 5, 2014 |
| PC | DELL | DIMENSION | 75465BX | N/A | N/A |

Appendix B. Duty Cycle

[Plot & Calculation]



$$\text{Duty Cycle} = T_{\text{on}} / (T_{\text{on}} + T_{\text{off}}) = 391[\mu\text{s}] / (391[\mu\text{s}] + 234.6[\mu\text{s}]) = 62.5\%$$