

# TEST REPORT

For

## HF Transceiver

In conformity with

### FCC CFR 47 Part15 Subpart B (ITE)

**Model : FT-410**

**FCC ID : K6620621X50**

**Test Item : HF Transceiver**

**Report No. : ERY1505P21R1**

**Issue Date : 21 May. 2015**

**Prepared for**

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**Prepared by**

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SGS RF Technologies Inc. is managed to ISO17025 and has the necessary knowledge and test facilities for testing according to the referenced standards. The test results in this report apply only to the sample tested.

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## **History**

| Report No.   | Date         | Revisions                                  | Issued By |
|--------------|--------------|--------------------------------------------|-----------|
| ERY1505P08R1 | 08 May. 2015 | Initial Issue                              | T.Kato    |
| ERY1505P21R1 | 21 May. 2015 | Revise the year of ANSI standard (Sec 1.2) | T.Kato    |

## 1 General information

### 1.1 Product description

Test item : HF Transceiver  
Manufacturer : YAESU MUSEN CO., LTD.  
Address : 43 Utsuroda, Morijuku, Sukagawa-shi, Fukushima-ken 962-0001 JAPAN  
Model : FT-410  
FCC ID : K6620621X50  
Serial number : 5F000015  
Hardware version : SPP01.02  
Software version : SPP01  
Highest internal operating Freq. : 368.64 MHz  
Receipt date of EUT : 17 Apr. 2015  
Nominal power source voltages : DC 13.8 V (This is supplied AC/DC power supply)

### 1.2 Test(s) performed/ Summary of test result

Test specification(s) : FCC CFR 47 Part 15 Subpart B (01 Oct. 2014)  
Test method(s) : ANSI C63.4: 2009  
Test(s) started : 01 May. 2015  
Test(s) completed : 07 May. 2015  
Purpose of test(s) : Certification as the peripheral of class B personal computer  
  
Summary of test result : Complied

Note: The above judgment is only based on the measurement data and it does not include the measurement uncertainty. Accordingly, the statement below is applied to the test result.  
The EUT complies with the limit required in the standard in case that the margin is not less than the measurement uncertainty in the Laboratory.  
Compliance of the EUT is more probable than non-compliance is case that the margin is less than the measurement uncertainty in the Laboratory.

Test engineer

:   
T. Kato  
EMC testing Department

Reviewer

:   
K. Onishi  
Manager  
EMC testing Department

### 1.3 Test facility

The Federal Communications Commission has reviewed the technical characteristics of the test facilities at SGS RF Technologies Inc., located in 472, Nippa-cho, Kohoku-ku, Yokohama, 223-0057, Japan, and has found these test facilities to be in compliance with the requirements of 47 CFR Part 15, section 2.948, per October 1, 2014.

The description of the test facilities has been filed under registration number 319924 at the Office of the Federal Communications Commission. The facility has been added to the list of laboratories performing these test services for the public on a fee basis.

The list of all public test facilities is available on the Internet at <http://www.fcc.gov>.

Registered by Industry Canada (IC): The registered facility number is as follows;

Test site No. 1 (Semi-Anechoic chamber 3m): 6974A-1

Accredited by **National Voluntary Laboratory Accreditation Program (NVLAP)** for the emission tests stated in the scope of the certificate under Certificate Number 200780-0

This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

### 1.4 Measurement uncertainty

The treatment of uncertainty is based on the general matters on the definition of uncertainty in “Guide to the expression of uncertainty in measurement (GUM)” published by ISO. The Lab’s uncertainty is determined by referring UKAS Publication LAB34: 2002 “The Expression of Uncertainty in EMC Testing” and CISPR16-4-2: 2011 “Uncertainty in EMC Measurements”.

The uncertainty of the measurement result in the level of confidence of approximately 95% ( $k=2$ ) is as follows;

Conducted emission:  $\pm 3.4$  dB (150 kHz - 30 MHz)

Radiated emission (9 kHz - 30 MHz):  $\pm 3.3$  dB

Radiated emission (30 MHz - 200 MHz):  $\pm 5.0$  dB

Radiated emission (200 MHz - 1000 MHz):  $\pm 6.2$  dB

Radiated emission (1 GHz - 6 GHz):  $\pm 4.7$  dB

## 1.5 Summary of test results

| Requirement                             | Section in specification | Result   | Section in this report |
|-----------------------------------------|--------------------------|----------|------------------------|
| Radiated emissions (30 to 2000 MHz) (*) | 15.109                   | Complied | 2.1                    |
| AC power line conducted emissions       | 15.107                   | Complied | 2.2                    |

(\*) The highest internal operating frequency is 368.64 MHz

## 1.6 Setup of equipment under test (EUT)

### 1.6.1 Test configuration of EUT

#### Equipment(s) under test

| No. | Item           | Manufacture           | Model No. | Serial No. |
|-----|----------------|-----------------------|-----------|------------|
| A   | HF Transceiver | YAESU MUSEN CO., LTD. | FT-410    | 5F000015   |
| -   | -              | -                     | -         | -          |

#### Support Equipment(s)

| No. | Item               | Manufacture           | Model No.      | Serial No.      |
|-----|--------------------|-----------------------|----------------|-----------------|
| B   | DC Power Supply    | YAESU MUSEN CO., LTD. | FP-1030A       | 1412167017      |
| C   | Hand Microphone    | YAESU MUSEN CO., LTD. | MH-31B8J       | 5F000015        |
| D   | Headphone          | YAESU MUSEN CO., LTD. | YH-77STA       | YTS03           |
| E   | External Speaker   | YAESU MUSEN CO., LTD. | MLS-100        | 064             |
| F   | USB Interface Unit | YAESU MUSEN CO., LTD. | SCU-17         | 17              |
| G   | PC                 | Panasonic             | CF-W8GWYAJP    | 9GKSA91771      |
| H   | LAN Hub            | NEC                   | PA-WR8700N-HP  | 87N1111286973B0 |
| I   | AC adaptor for Hub | NEC                   | AL1-002292-002 | -               |

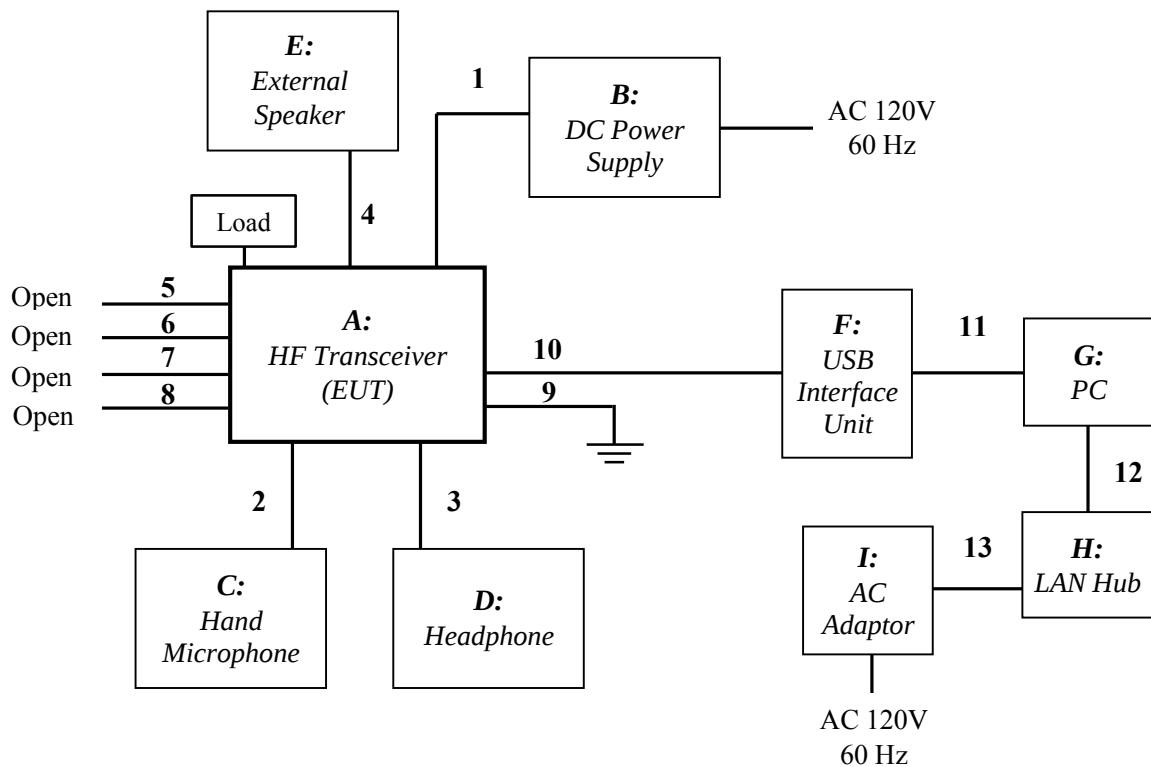
#### Connected cable(s)

| No. | Item                    | Identification (Manu.etc.) | Cable Shielded | Ferrite Core | Length [m] |
|-----|-------------------------|----------------------------|----------------|--------------|------------|
| 1   | DC Power cable          | YAESU MUSEN CO., LTD.      | No             | No           | 2.0        |
| 2   | Mic. cable              | YAESU MUSEN CO., LTD.      | No             | No           | 0.6        |
| 3   | Headphones cable        | YAESU MUSEN CO., LTD.      | No             | No           | 1.8        |
| 4   | EXT SPKR cable          | YAESU MUSEN CO., LTD.      | No             | No           | 1.8        |
| 5   | TUNER cable             | YAESU MUSEN CO., LTD.      | No             | No           | 1.1        |
| 6   | LINER cable             | YAESU MUSEN CO., LTD.      | No             | No           | 1.2        |
| 7   | DATA cable              | YAESU MUSEN CO., LTD.      | No             | No           | 1.6        |
| 8   | KEY cable               | YAESU MUSEN CO., LTD.      | No             | No           | 0.5        |
| 9   | GND cable               | YAESU MUSEN CO., LTD.      | No             | No           | 2.0        |
| 10  | CAT cable               | SANWA SUPPLY INC.          | No             | No           | 1.5        |
| 11  | USB cable               | YAESU MUSEN CO., LTD.      | Yes            | No           | 2.0        |
| 12  | LAN Cable               | -                          | No             | No           | 2.0        |
| 13  | DC cable for AC adaptor | NEC                        | No             | No           | 1.3        |

### 1.6.2 Operating condition:

ITE mode: The EUT is connected to PC using CAT cable.

### 1.6.3 Setup diagram of tested system



Note: The signal cable 5 to 8 were connected to no AE by a request from the manufacturer. 50 ohm terminals were connected to the antenna terminals.

## 1.7 Equipment modifications

No modifications have been made to the equipment in order to achieve compliance with the applicable standards described in clause 1.2.

## 1.8 Deviation from the standard

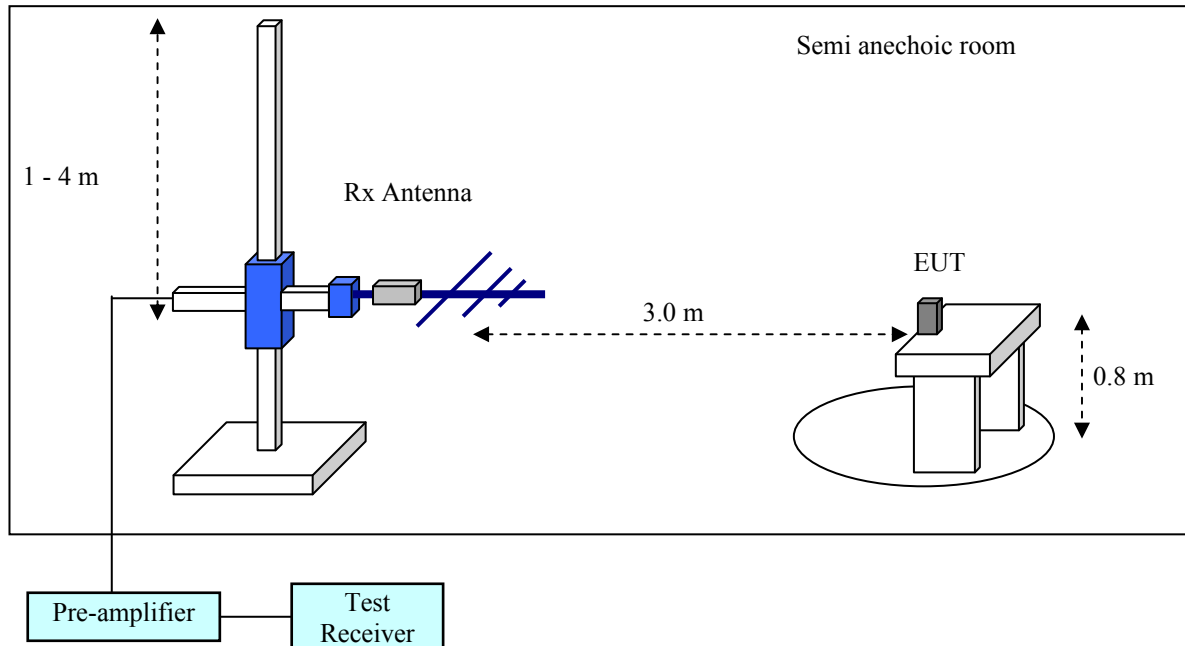
No deviations from the standards described in clause 1.2.

## 2 Test procedure and test data

### 2.1 Radiated emissions

#### Test setup

Test setup was implemented according to the method of ANSI C63.4 clause 6 “General requirements for EUT equipment arrangements and operation”, clause 8.2 and Annex H.3 “Radiated emission measurements setup”.



#### Test procedure

Measurement procedures were implemented according to the method of ANSI C63.4 clauses 8.2.

The EUT is placed on a non-conducted table which is 0.8 m high from a ground plane and the measurement antenna to EUT distance is 3 meters. The turn table is rotated for 360 degrees to determine the maximum emission level.

The antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

The spectrum analyzer and receiver are set to the followings;

RBW=100 kHz (up to 1000 MHz) or 1 MHz (above 1000 MHz) ,

VBW= 300 kHz (up to 1000 MHz) or 3 MHz (above 1000 MHz)

Final measurement is carried out with a receiver RBW of 120 kHz (up to 1000 MHz), or 1 MHz (above 1000 MHz).

#### Applicable rule and limitation

FCC 15.109 Radiated emissions limits

| Frequency [MHz] | Field Strength [ $\mu\text{V/m}$ ] | Measurement Distance [m] | Field Strength [dB $\mu\text{V/m}$ ] |
|-----------------|------------------------------------|--------------------------|--------------------------------------|
| 30 – 88         | 100                                | 3                        | 40.0                                 |
| 88 – 216        | 150                                | 3                        | 43.5                                 |
| 216 – 960       | 200                                | 3                        | 46.0                                 |
| Above 960       | 500                                | 3                        | 53.9                                 |

In the emission table above, the tighter limit applies at the band edges.

The emission limits shown in the above table are based on measurements employing a QP detector (up to 1000 MHz) or AVE/PEAK detector (above 1000 MHz).

## Test results - Complied with requirement

### Test equipment used (refer to List of utilized test equipment)

|      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|
| AC01 | TR06 | CL11 | PR15 | BA10 | CL29 | CL30 |
| PR12 | DH01 |      |      |      |      |      |

### Test software used

EMI Ver. 5.6

### Calculation method

The Correction Factor and Result are calculated as followings.

$$\text{Correction Factor [dB/m]} = \text{Ant. Factor [dB/m]} + \text{Loss [dB]} - \text{Gain [dB]}$$

$$\text{Result [dB}\mu\text{V/m]} = \text{Reasding [dB}\mu\text{V]} + \text{Correction Factor [dB/m]}$$

### Test Data

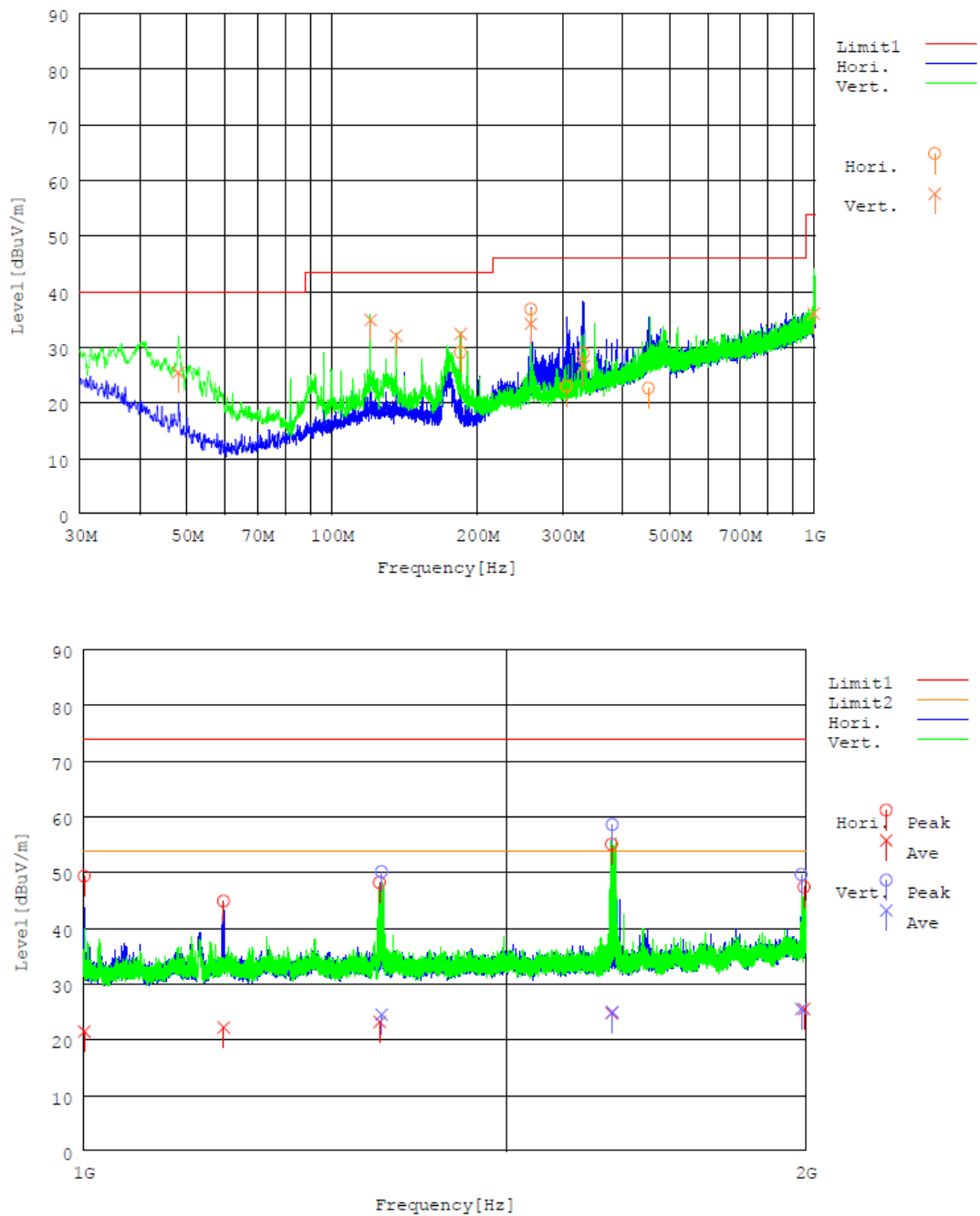
Range: 30 - 1000 MHz

| No. | Frequency [MHz] | Reading [dB $\mu$ V] | Factor [dB/m] | Loss [dB] | Gain [dB] | Result [dB $\mu$ V/m] | Limit [dB $\mu$ V/m] | Margin [dB] | Ant.  |
|-----|-----------------|----------------------|---------------|-----------|-----------|-----------------------|----------------------|-------------|-------|
| 1   | 184.318         | 41.6                 | 9.0           | 8.4       | 30.0      | 29.0                  | 43.5                 | 14.5        | Hori. |
| 2   | 258.045         | 45.2                 | 12.7          | 8.9       | 29.9      | 36.9                  | 46.0                 | 9.1         | Hori. |
| 3   | 306.352         | 30.1                 | 13.6          | 9.2       | 29.9      | 23.0                  | 46.0                 | 23.0        | Hori. |
| 4   | 331.772         | 35.1                 | 14.3          | 9.4       | 29.9      | 28.9                  | 46.0                 | 17.1        | Hori. |
| 5   | 452.446         | 25.0                 | 17.2          | 10.1      | 29.7      | 22.6                  | 46.0                 | 23.4        | Hori. |
| 6   | 47.937          | 39.0                 | 9.5           | 7.1       | 30.2      | 25.4                  | 40.0                 | 14.6        | Vert. |
| 7   | 120.045         | 45.5                 | 11.6          | 7.9       | 30.1      | 34.9                  | 43.5                 | 8.6         | Vert. |
| 8   | 135.749         | 42.4                 | 11.7          | 8.0       | 30.0      | 32.1                  | 43.5                 | 11.4        | Vert. |
| 9   | 184.318         | 45.0                 | 9.0           | 8.4       | 30.0      | 32.4                  | 43.5                 | 11.1        | Vert. |
| 10  | 258.044         | 42.5                 | 12.7          | 8.9       | 29.9      | 34.2                  | 46.0                 | 11.8        | Vert. |
| 11  | 331.772         | 32.8                 | 14.3          | 9.4       | 29.9      | 26.6                  | 46.0                 | 19.4        | Vert. |
| 12  | 995.144         | 29.4                 | 24.3          | 12.5      | 30.1      | 36.1                  | 53.9                 | 17.8        | Vert. |

Range: 1000 - 2000 MHz

| No. | Frequency [MHz] | Reading PK [dB $\mu$ V] | Reading AVE [dB $\mu$ V] | C.Factor [dB/m] | Result PK [dB $\mu$ V/m] | Result AVE [dB $\mu$ V/m] | Limit PK [dB $\mu$ V/m] | Limit AVE [dB $\mu$ V/m] | Margin PK [dB] | Margin AVE [dB] | Ant.  |
|-----|-----------------|-------------------------|--------------------------|-----------------|--------------------------|---------------------------|-------------------------|--------------------------|----------------|-----------------|-------|
| 1   | 1000.500        | 61.1                    | 33.3                     | -11.8           | 49.3                     | 21.5                      | 73.9                    | 53.9                     | 24.6           | 32.4            | Hori. |
| 2   | 1143.493        | 55.6                    | 32.9                     | -10.7           | 44.9                     | 22.2                      | 73.9                    | 53.9                     | 29.0           | 31.7            | Hori. |
| 3   | 1327.884        | 58.2                    | 33.2                     | -10.0           | 48.2                     | 23.2                      | 73.9                    | 53.9                     | 25.7           | 30.7            | Hori. |
| 4   | 1659.267        | 63.7                    | 33.4                     | -8.6            | 55.1                     | 24.8                      | 73.9                    | 53.9                     | 18.8           | 29.1            | Hori. |
| 5   | 1996.050        | 52.3                    | 30.4                     | -4.9            | 47.4                     | 25.5                      | 73.9                    | 53.9                     | 26.5           | 28.4            | Hori. |
| 6   | 1330.583        | 60.0                    | 34.4                     | -9.9            | 50.1                     | 24.5                      | 73.9                    | 53.9                     | 23.8           | 29.4            | Vert. |
| 7   | 1660.467        | 67.1                    | 33.4                     | -8.5            | 58.6                     | 24.9                      | 73.9                    | 53.9                     | 15.3           | 29.0            | Vert. |
| 8   | 1990.950        | 54.6                    | 30.5                     | -5.0            | 49.6                     | 25.5                      | 73.9                    | 53.9                     | 24.3           | 28.4            | Vert. |

[Chart]



[Test condition]

Tested Date: 01 May. 2015  
Humidity: 57 %

Temperature: 21 degC  
Atmos. Press: 1017 hPa

## 2.2 AC power line conducted emissions

### Test setup

Test setup was implemented according to the method of ANSI C63.4 clause 6 “General requirements for EUT equipment arrangements and operation” and Annex H.1 “AC power line conducted emission measurements setup”.

### Test procedure

Measurement procedures were implemented according to the method of ANSI C63.4 clauses 7, clause 13.1.3 and Annex H.2 “AC power line conducted emission measurements”.

Exploratory measurements were used the spectrum analyzer to identify the frequency of the emission that has the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable positions, and with a typical system equipment configuration and arrangement.

Final ac power line conducted emission measurements were performed based on the exploratory tests.

The EUT cable configuration and arrangement and mode of operation that produced the emission with the highest amplitude relative to the limit are selected for the final measurement.

When the measurement value is greater than average limitation the average detection measurements were performed.

### Applicable rule and limitation

§15.107 (b) AC power line conducted limits

| Frequency of Emission<br>[MHz] | Conducted emissions Limit [dBμV] |            |
|--------------------------------|----------------------------------|------------|
|                                | 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. The lower limit applies at the band edges.

### Test equipment used (refer to List of utilized test equipment)

|      |      |      |
|------|------|------|
| TR06 | LN05 | CL18 |
|------|------|------|

### Test software used

EMI Ver. 5.6

### Calculation method

The Correction Factor and Result are calculated as followings.

Correction Factor [dB] = ISN Factor [dB] + Loss [dB]

Result [dBμV] = Reading [dBμV] + Correction Factor [dB]

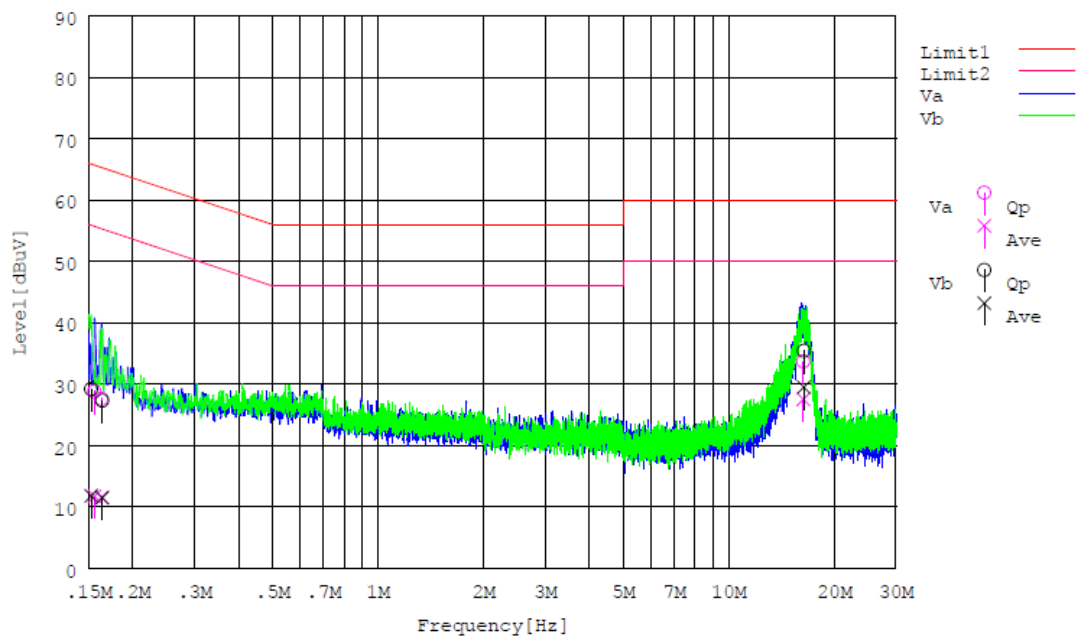
### Test results - Complied with requirement

## Test Data

[Emission level]

| No. | Frequency [MHz] | Reading   |           | C.F. [dB] | Result    |           | Limit     |           | Phase | Pass/Fail |
|-----|-----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-------|-----------|
|     |                 | QP [dBμV] | AV [dBμV] |           | QP [dBμV] | AV [dBμV] | QP [dBμV] | AV [dBμV] |       |           |
| 1   | 0.15555         | 18.5      | 1.4       | 10.3      | 28.8      | 11.7      | 65.7      | 55.7      | Va    | Pass      |
| 2   | 0.16295         | 17.3      | 1.2       | 10.3      | 27.6      | 11.5      | 65.3      | 55.3      | Va    | Pass      |
| 3   | 16.30994        | 23.3      | 17.1      | 10.4      | 33.7      | 27.5      | 60.0      | 50.0      | Va    | Pass      |
| 4   | 0.15222         | 18.9      | 1.5       | 10.3      | 29.2      | 11.8      | 65.9      | 55.9      | Vb    | Pass      |
| 5   | 0.16369         | 17.0      | 1.2       | 10.3      | 27.3      | 11.5      | 65.3      | 55.3      | Vb    | Pass      |
| 6   | 16.36713        | 25.0      | 19.1      | 10.4      | 35.4      | 29.5      | 60.0      | 50.0      | Vb    | Pass      |

[Chart]



[Test condition]

Tested Date: 07 May. 2015  
Humidity: 52 %

Temperature: 21 degC  
Atmos. Press: 1013 hPa

## 4 List of utilized test equipment / calibration

| RFT ID No. | Kind of Equipment and Precision   | Manufacturer         | Model No.     | Serial Number | Calibration Date | Calibrated until |
|------------|-----------------------------------|----------------------|---------------|---------------|------------------|------------------|
| AC01(EM)   | Anechoic Chamber (1st test room)  | JSE                  | 203397C       | -             | 2015/4/18        | 2016/4/30        |
| AC01(EG)   | Anechoic Chamber (1st test room)  | JSE                  | 203397C       | -             | 2014/11/24       | 2015/11/30       |
| BA10       | Biological Antenna                | TESEQ                | CBL6111D      | 32342         | 2014/6/9         | 2015/6/30        |
| CL11       | RF Cable for RE                   | RFT                  | -             | -             | 2015/3/13        | 2016/3/31        |
| CL18       | RF Cable for CE                   | RFT                  | -             | -             | 2015/5/1         | 2016/5/31        |
| CL29       | RF Cable 2 m                      | SUHNER               | SUCOFLEX104PE | 94709         | 2015/1/26        | 2016/1/31        |
| CL30       | RF Cable 5 m                      | SUHNER               | SUCOFLEX104PE | MY3599        | 2014/8/28        | 2015/8/31        |
| DH01       | DRG Horn Antenna                  | A.H. Systems         | SAS-571       | 785           | 2014/1/21        | 2016/1/31        |
| LN05       | LISN                              | Kyoritsu             | KNW-407F      | 8-1773-2      | 2014/5/22        | 2015/5/31        |
| PR12       | Pre. Amplifier (1-26G)            | Agilent Technologies | 8449B         | 3008A02513    | 2015/1/26        | 2016/1/31        |
| PR15       | Pre. Amplifier                    | Anritsu              | MH648A        | 6201156141    | 2014/6/10        | 2015/6/30        |
| TR06       | Test Receiver<br>(E/W : 3.93 SP2) | Rohde & Schwarz      | ESU26         | 100002        | 2014/9/5         | 2015/9/30        |

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.