

# TEST REPORT

For

## 144/430MHz DUAL BAND TRANSCEIVER

In conformity with

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

**Model : FTM-200DR**

**FCC ID : K6620615X40**

**Test Item : 144/430MHz DUAL BAND TRANSCEIVER**

**Report No. : WE210514BC1-11**

**Issue Date : 10 Jun. 2021**

**Prepared for**

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## History

| Report No.     | Date         | Revisions     | Issued By |
|----------------|--------------|---------------|-----------|
| WE210514BC1-11 | 10 Jun. 2021 | Initial Issue | T. Kato   |
|                |              |               |           |

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## 1 General information

### 1.1 Product description from supplier

|                                  |                                                                     |
|----------------------------------|---------------------------------------------------------------------|
| Test item                        | : 144/430MHz DUAL BAND TRANSCEIVER                                  |
| Manufacturer                     | : YAESU MUSEN CO., LTD.                                             |
| Address                          | : 43 Utsuroda, Morijuku, Sukagawa-shi, Fukushima-ken 962-0001 JAPAN |
| Model                            | : FTM-200DR                                                         |
| FCC ID                           | : K6620615X40                                                       |
| Serial number                    | : 15                                                                |
| Hardware version                 | : SPP                                                               |
| Software version                 | : 0.06 (Main), 70.04 (Sub), 7.11 (DSP)                              |
| Operating frequency range        | : 108 - 983.295 MHz                                                 |
| Highest internal operating Freq. | : 941.94 MHz                                                        |
| Receipt date of EUT              | : 26 May 2021                                                       |
| Nominal power source voltages    | : DC 13.8 V                                                         |

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

Test specification(s) : FCC CFR 47 Part 15 Subpart B  
Test method(s) : ANSI C63.4: 2014  
Test(s) started : 26 May 2021  
Test(s) completed : 02 Jun. 2021  
Purpose of test(s) : Certification as the scanning receiver

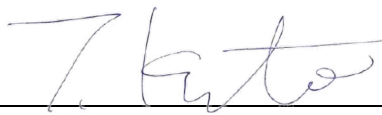
Summary of test result : Complied

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  
(Test Engineer, RF/EMC Testing Lab.)

Reviewer

:   
K. Onishi  
(Testing Leader, RF/EMC Testing Lab.)

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### 1.3 Test facility

The Federal Communications Commission has reviewed the technical characteristics of the test facilities at SGS Japan Inc., located in 3-5-23, Kitayamata, Tsuzuki-ku, Yokohama, 224-0021, Japan, and has found these test facilities to be in compliance with the requirements of 47 CFR Part 15, section 2.948.

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 Innovation, Science and Economic Development Canada (ISED):  
The registered CAB identifier is JP0009.

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 U.S. 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;

|                                          |            |
|------------------------------------------|------------|
| AC conducted emission (150 kHz - 30 MHz) | : ± 3.3 dB |
| RF conducted emission (30 MHz - 6 GHz)   | : ± 1.0 dB |
| Radiated emission (30 MHz - 1000 MHz)    | : ± 6.0 dB |
| Radiated emission (1 GHz - 6 GHz)        | : ± 4.0 dB |

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## 1.5 Summary of test results

| Requirement                              | Section in specification | Result   | Section in this report |
|------------------------------------------|--------------------------|----------|------------------------|
| Radiated emissions (30 to 5000 MHz) (*1) | 15.109                   | Complied | 2.1                    |
| Conducted emission for receiver          | 15.111                   | Complied | 2.2                    |
| AC power line conducted emissions        | 15.107                   | N/A (*2) | 2.3                    |
| 38 dB Rejection (cellular band)          | 15.121 (b)               | N/A (*3) | -                      |

(\*1) The highest internal operating frequency is 941.94 MHz

(\*2) The EUT is powered by the car battery.

(\*3) This item was not tested in this report.

## 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. |
|-----|----------------------------------|-----------------------|-----------|------------|
| 1   | 144/430MHz DUAL BAND TRANSCEIVER | YAESU MUSEN CO., LTD. | FTM-200DR | 15         |
| -   | -                                | -                     | -         | -          |

#### Support Equipment(s)

| No. | Item             | Manufacture           | Model No. | Serial No. |
|-----|------------------|-----------------------|-----------|------------|
| 2   | DTMF Microphone  | YAESU MUSEN CO., LTD. | SSM-85D   | SPP2       |
| 3   | External Speaker | YAESU MUSEN CO., LTD. | MLS-100   | 1D064      |

#### Connected cable(s)

| No. | Item           | From | To   | Cable Shielded | Ferrite Core | Length [m] |
|-----|----------------|------|------|----------------|--------------|------------|
| A   | Control Cable  | 1    | 1    | No             | No           | 3.0        |
| B   | Mic. Cable     | 1    | 2    | No             | No           | 0.5        |
| C   | DC Power Cable | 1    | DC   | No             | No           | 2.8        |
| D   | Data Cable     | 1    | OPEN | Yes            | No           | 1.1        |
| E   | Speaker Cable  | 1    | 3    | No             | No           | 1.8        |
| F   | EXTGPS Cable   | 1    | OPEN | Yes            | No           | 1.0        |

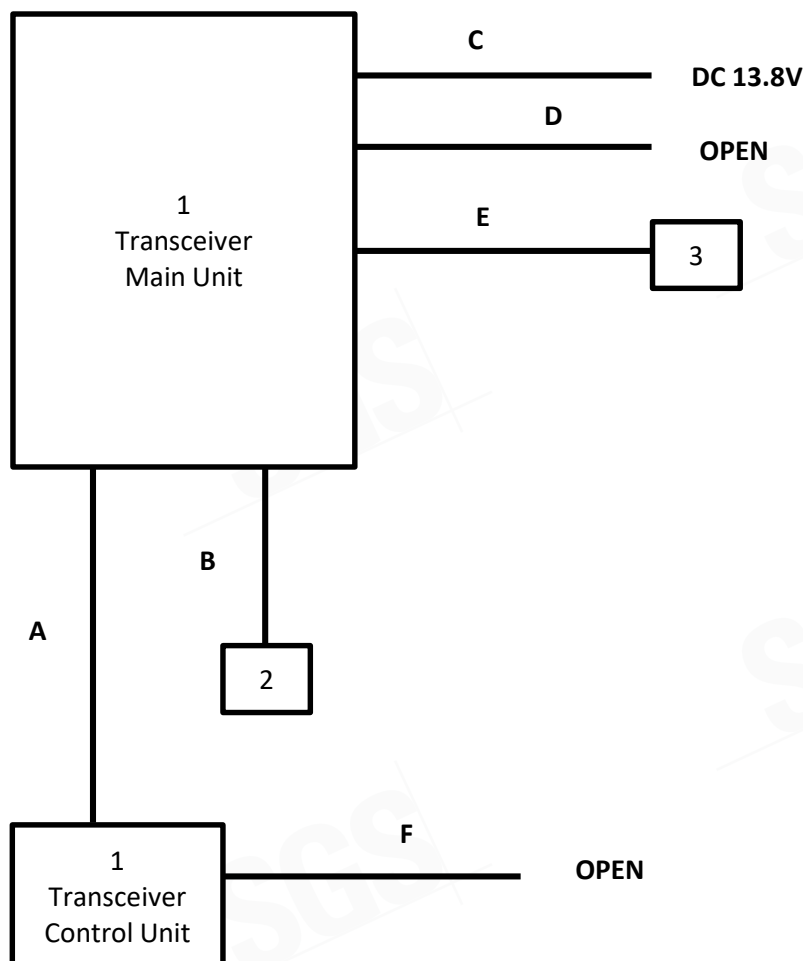
### 1.6.2 Operating condition:

- Rx 108.000 MHz
- Rx 553.990 MHz
- Rx 983.290 MHz

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### 1.6.3 Setup diagram of tested system



## 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.

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## 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 height 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 [ $\text{dB}\mu\text{V/m}$ ] |
|-----------------|------------------------------------|--------------------------|---------------------------------------------|
| 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)

|      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|
| AC11 | TR10 | CL71 | PR15 | BA10 | CL80 | CL35 |
| CL36 | PR16 | DH07 |      |      |      |      |

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**Test software used**

EMI1 Ver. 6.1

**Calculation method**

The Correction Factor and Result are calculated as followings.

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

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

**Test Data**Operating mode: Rx 108.000 MHz

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   | 830.250         | 39.1                 | 22.3          | 9.0       | 30.4      | 40.0                  | 46.0                 | 6.0         | Hori. |
| 2   | 30.194          | 28.4                 | 19.0          | 6.3       | 30.3      | 23.4                  | 40.0                 | 16.6        | Vert. |
| 3   | 31.194          | 29.5                 | 18.4          | 6.3       | 30.3      | 23.9                  | 40.0                 | 16.1        | Vert. |
| 4   | 33.201          | 27.7                 | 17.4          | 6.3       | 30.3      | 21.1                  | 40.0                 | 18.9        | Vert. |
| 5   | 830.250         | 37.1                 | 22.3          | 9.0       | 30.4      | 38.0                  | 46.0                 | 8.0         | Vert. |
| 6   | 960.000         | 21.1                 | 25.2          | 9.3       | 30.2      | 25.4                  | 46.0                 | 20.6        | Vert. |

All other emissions were under noise floor.

Range: 1000 - 5000 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   | 3819.152        | 45.8                    | 38.1                     | 1.9             | 47.7                     | 40.0                      | 73.9                    | 53.9                     | 26.2           | 13.9            | Hori. |
| 2   | 4649.402        | 45.0                    | 36.7                     | 3.7             | 48.7                     | 40.4                      | 73.9                    | 53.9                     | 25.2           | 13.5            | Hori. |
| 3   | 3154.951        | 47.7                    | 41.1                     | 0.5             | 48.2                     | 41.6                      | 73.9                    | 53.9                     | 25.7           | 12.3            | Vert. |
| 4   | 3487.052        | 47.6                    | 41.3                     | 0.8             | 48.4                     | 42.1                      | 73.9                    | 53.9                     | 25.5           | 11.8            | Vert. |
| 5   | 3819.152        | 49.5                    | 44.6                     | 1.9             | 51.4                     | 46.5                      | 73.9                    | 53.9                     | 22.5           | 7.4             | Vert. |
| 6   | 4649.402        | 45.9                    | 38.5                     | 3.7             | 49.6                     | 42.2                      | 73.9                    | 53.9                     | 24.3           | 11.7            | Vert. |

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Operating mode: Rx 553.990 MHz

Range: 30 - 1000 MHz

| No. | Frequency [MHz] | Reading [dBμV] | Factor [dB/m] | Loss [dB] | Gain [dB] | Result [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Ant.  |
|-----|-----------------|----------------|---------------|-----------|-----------|-----------------|----------------|-------------|-------|
| 1   | 495.940         | 29.4           | 17.8          | 8.2       | 29.5      | 25.9            | 46.0           | 20.1        | Hori. |
| 2   | 30.194          | 28.3           | 19.0          | 6.3       | 30.3      | 23.3            | 40.0           | 16.7        | Vert. |
| 3   | 31.188          | 29.4           | 18.4          | 6.3       | 30.3      | 23.8            | 40.0           | 16.2        | Vert. |
| 4   | 33.218          | 27.5           | 17.4          | 6.3       | 30.3      | 20.9            | 40.0           | 19.1        | Vert. |
| 5   | 960.000         | 20.9           | 25.2          | 9.3       | 30.2      | 25.2            | 46.0           | 20.8        | Vert. |

All other emissions were under noise floor.

Range: 1000 - 5000 MHz

| No. | Frequency [MHz] | Reading PK [dBμV] | Reading AVE [dBμV] | C.Factor [dB/m] | Result PK [dBμV/m] | Result AVE [dBμV/m] | Limit PK [dBμV/m] | Limit AVE [dBμV/m] | Margin PK [dB] | Margin AVE [dB] | Ant.  |
|-----|-----------------|-------------------|--------------------|-----------------|--------------------|---------------------|-------------------|--------------------|----------------|-----------------|-------|
| 1   | 4959.402        | 43.5              | 33.6               | 5.5             | 49.0               | 39.1                | 73.9              | 53.9               | 24.9           | 14.8            | Hori. |
| 2   | 3471.582        | 45.0              | 35.3               | 0.8             | 45.8               | 36.1                | 73.9              | 53.9               | 28.1           | 17.8            | Vert. |
| 3   | 4959.402        | 44.3              | 35.8               | 5.5             | 49.8               | 41.3                | 73.9              | 53.9               | 24.1           | 12.6            | Vert. |

Operating mode: Rx 983.290 MHz

Range: 30 - 1000 MHz

| No. | Frequency [MHz] | Reading [dBμV] | Factor [dB/m] | Loss [dB] | Gain [dB] | Result [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Ant.  |
|-----|-----------------|----------------|---------------|-----------|-----------|-----------------|----------------|-------------|-------|
| 1   | 925.240         | 30.5           | 23.6          | 9.2       | 30.3      | 33.0            | 46.0           | 13.0        | Hori. |
| 2   | 31.261          | 29.4           | 18.4          | 6.3       | 30.3      | 23.8            | 40.0           | 16.2        | Vert. |
| 3   | 925.240         | 30.5           | 23.6          | 9.2       | 30.3      | 33.0            | 46.0           | 13.0        | Vert. |
| 4   | 959.846         | 20.9           | 25.2          | 9.3       | 30.2      | 25.2            | 46.0           | 20.8        | Vert. |

All other emissions were under noise floor.

Range: 1000 - 5000 MHz

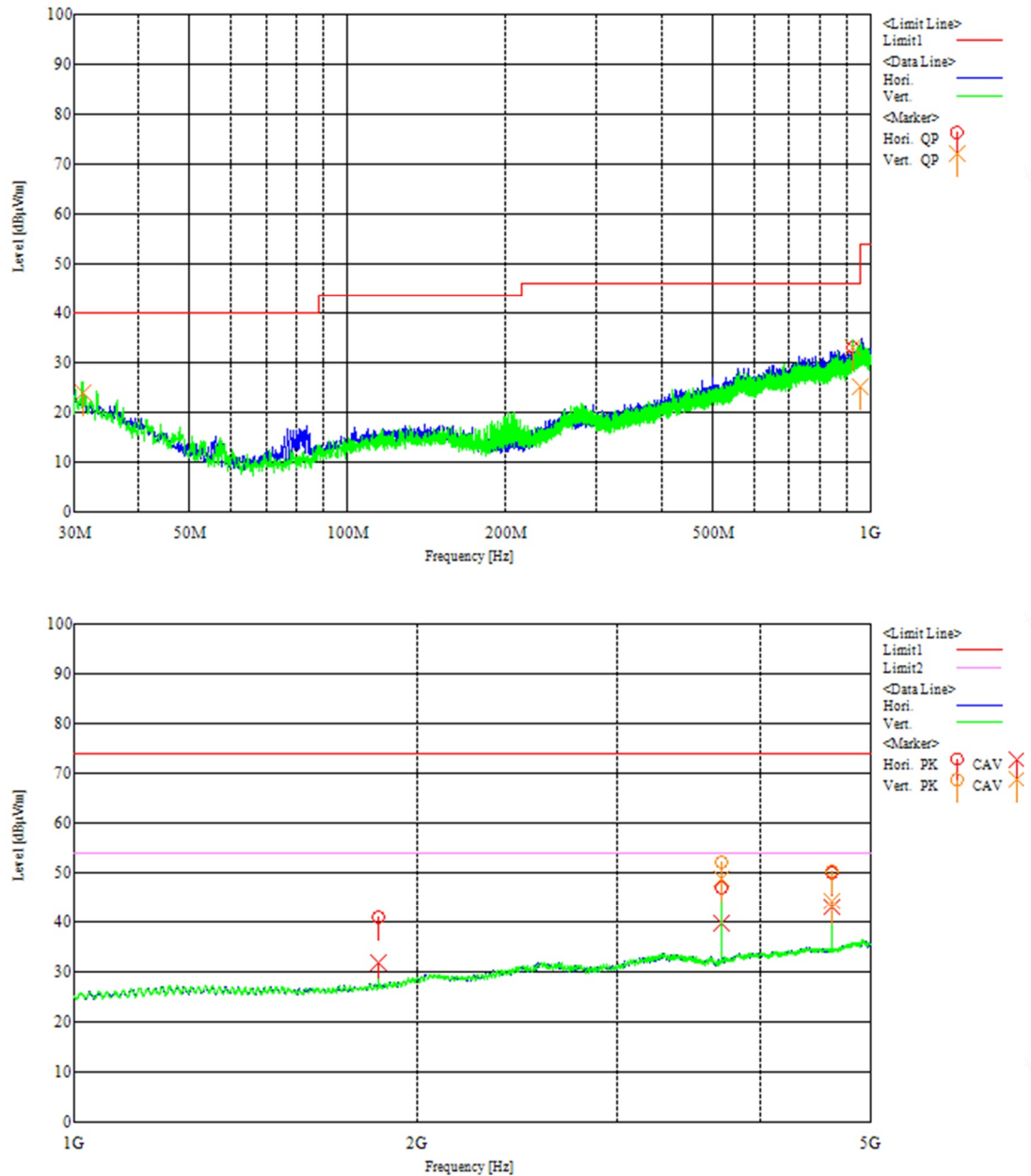
| No. | Frequency [MHz] | Reading PK [dBμV] | Reading AVE [dBμV] | C.Factor [dB/m] | Result PK [dBμV/m] | Result AVE [dBμV/m] | Limit PK [dBμV/m] | Limit AVE [dBμV/m] | Margin PK [dB] | Margin AVE [dB] | Ant.  |
|-----|-----------------|-------------------|--------------------|-----------------|--------------------|---------------------|-------------------|--------------------|----------------|-----------------|-------|
| 1   | 1850.482        | 46.5              | 37.6               | -5.7            | 40.8               | 31.9                | 73.9              | 53.9               | 33.1           | 22.0            | Hori. |
| 2   | 3700.961        | 46.0              | 38.8               | 1.0             | 47.0               | 39.8                | 73.9              | 53.9               | 26.9           | 14.1            | Hori. |
| 3   | 4626.199        | 46.5              | 39.5               | 3.6             | 50.1               | 43.1                | 73.9              | 53.9               | 23.8           | 10.8            | Hori. |
| 4   | 3700.962        | 51.1              | 47.8               | 1.0             | 52.1               | 48.8                | 73.9              | 53.9               | 21.8           | 5.1             | Vert. |
| 5   | 4626.202        | 46.8              | 40.7               | 3.6             | 50.4               | 44.3                | 73.9              | 53.9               | 23.5           | 9.6             | Vert. |

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[Chart (Worst)]

Operating condition: Rx 983.290 MHz



[Test condition]

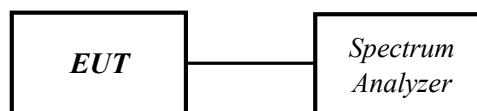
Tested Date: 26 May 2021  
Humidity: 49 %Temperature: 21 degC  
Atmos. Press: 1005 hPa

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## 2.2 Conducted emissions for receiver

### Test setup



### Applicable rule and limitation

§15.111 (b) Antenna power conducted limit : 2 nW (= -57 dBm)

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

|      |      |  |
|------|------|--|
| TR10 | CL31 |  |
|------|------|--|

### Test results - Complied with requirement

### Test Data

[The maximum spurious level]

| Operating freq.<br>[MHz] | Frequency range<br>30 - 1000 MHz |                | Frequency range<br>1000 - 5000 MHz |                |
|--------------------------|----------------------------------|----------------|------------------------------------|----------------|
|                          | Freq.<br>[MHz]                   | Level<br>[dBm] | Freq.<br>[MHz]                     | Level<br>[dBm] |
| 108.000                  | Note                             | Note           | Note                               | Note           |
| 553.990                  | Note                             | Note           | Note                               | Note           |
| 983.290                  | 925.269                          | -78.3          | Note                               | Note           |

Note: No emission above noise floor was found.

[Test condition]

Tested Date: 02 Jun. 2021  
Humidity: 65 %

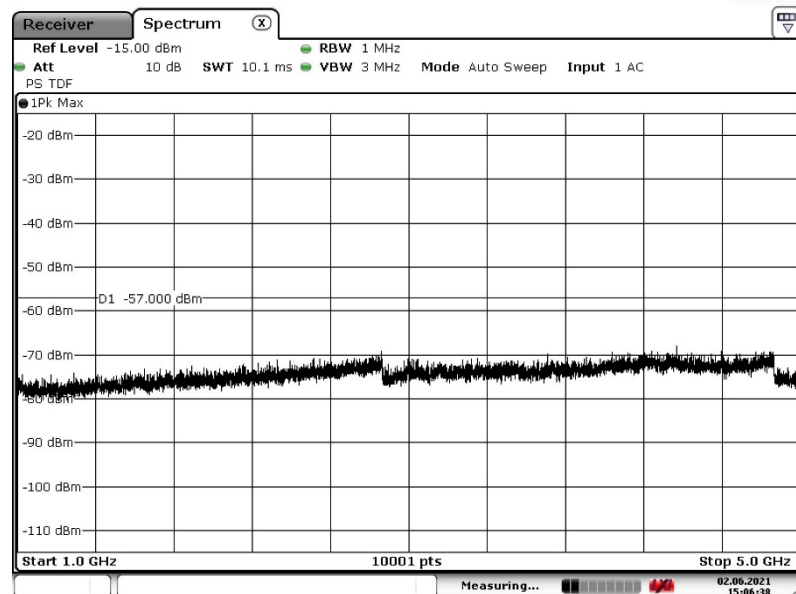
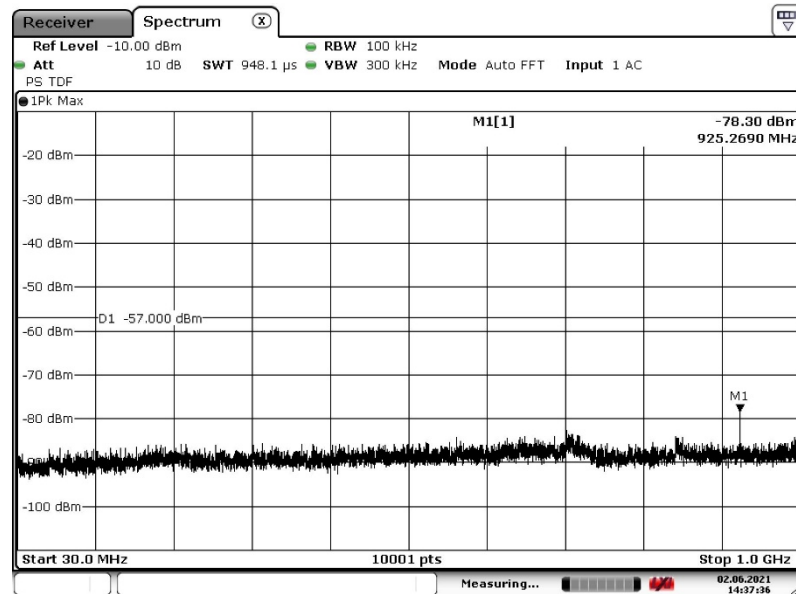
Temperature: 21 degC  
Atmos. Press: 1014 hPa

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[Chart]

Operating mode: Rx 983.290 MHz (Worst)



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## 2.3 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)

|   |   |   |   |
|---|---|---|---|
| - | - | - | - |
|---|---|---|---|

### Test software used

EMI1 Ver. 6.1

### 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 - *This tem was not tested.*

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**Test Data**

[Emission level]

*Operating mode: -*

|  | Freq.<br>[MHz] | Reading<br>QP<br>[dBμV] | Reading<br>Ave<br>[dBμV] | Factor<br>[dB] | Result<br>QP<br>[dBμV] | Result<br>Ave<br>[dBμV] | Limit<br>QP<br>[dBμV] | Limit<br>Ave<br>[dBμV] | Margin<br>QP<br>[dB] | Margin<br>Ave<br>[dB] | Line |
|--|----------------|-------------------------|--------------------------|----------------|------------------------|-------------------------|-----------------------|------------------------|----------------------|-----------------------|------|
|  |                |                         |                          |                |                        |                         |                       |                        |                      |                       |      |
|  |                |                         |                          |                |                        |                         |                       |                        |                      |                       |      |

[Chart]

*Operating mode: -*

[Test condition]

Tested Date: -  
Humidity: - %Temperature: - degC  
Atmos. Press: - hPa

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#### 4 List of utilized test equipment / calibration

| ID No.   | Kind of Equipment             | Manufacturer         | Model No.     | Serial Number | Cal. Date | Cal. until |
|----------|-------------------------------|----------------------|---------------|---------------|-----------|------------|
| AC11(EM) | Anechoic Chamber              | TDK                  | -             | -             | 2020/8/11 | 2021/8/31  |
| AC11(EG) | Anechoic Chamber              | TDK                  | -             | -             | 2020/8/1  | 2021/8/31  |
| BA 10    | Biological Antenna            | TESEQ                | CBL6111D      | 32342         | 2020/6/24 | 2021/6/30  |
| CL35     | RF Cable 2 m                  | Junkosha             | MWX221        | 1502S020      | 2021/3/9  | 2022/3/31  |
| CL36     | RF Cable 2 m                  | Junkosha             | MWX221        | 1502S021      | 2021/3/9  | 2022/3/31  |
| CL80     | RF Cable 8 m                  | HUBER&SUHNER         | SUCOFLEX104PE | MY3792/4PE    | 2021/3/10 | 2022/3/31  |
| CL71     | RF Cable for RE               | RFT                  | -             | -             | 2021/1/18 | 2022/1/31  |
| DH07     | DRG Horn Antenna              | A.H. Systems         | SAS-571       | 1939          | 2021/2/27 | 2023/2/28  |
| PR15     | Pre. Amplifier                | Anritsu              | MH648A        | 6201156141    | 2020/6/25 | 2021/6/30  |
| PR16     | Pre. Amplifier (1-26G)        | Agilent Technologies | 8449B         | 3008A01538    | 2021/3/9  | 2022/3/31  |
| TR10     | Test Receiver<br>(F/W : 2.26) | Rohde & Schwarz      | ESR26         | 101313        | 2021/3/22 | 2022/3/31  |
| CL31     | RF Cable 1 m                  | Junkosha             | MWX221        | 1303S118      | 2021/1/27 | 2022/1/31  |

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.

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