

# TEST REPORT

For

## RFID Reader/Writer Unit

In conformity with

## FCC CFR 47 Part15 Subpart C

**Model : TR3X-SD01-24-CS141**

**FCC ID : MK4SD01-24-CS141**

**Report No. : WE211110BB2-13**

**Issue Date : April 7, 2022**

### Prepared for

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### Prepared by

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**History**

| Report No.     | Date             | Revisions                                       | Issued By |
|----------------|------------------|-------------------------------------------------|-----------|
| WE211110BB2-11 | January 28, 2022 | Initial Issue                                   | K. Onishi |
| WE211110BB2-12 | March 31, 2022   | Added test data (antenna port: 12ch, 24ch)      | K. Onishi |
| WE211110BB2-13 | April 7, 2022    | Added information of antenna port (Page. 7, 24) | K. Onishi |

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## 1 General information

### 1.1 Product information from applicant

|                               |                                                         |
|-------------------------------|---------------------------------------------------------|
| Test item                     | : RFID Reader/Writer Unit                               |
| Manufacturer                  | : TAKAYA Corporation                                    |
| Address                       | : 661-1, Ibara-cho, Ibara-city, Okayama, 715-8503 Japan |
| Model                         | : TR3X-SD01-24-CS141                                    |
| FCC ID                        | : MK4SD01-24-CS141                                      |
| Serial numbers                | : 21000010                                              |
| Hardware version              | : FT0300                                                |
| Software version              | : FT0300                                                |
| Transmitting Frequency        | : 13.56 MHz                                             |
| Type of Modulation            | : ASK 10%                                               |
| Operating temperature range   | : +5 to +50 degree C                                    |
| Receipt date of EUT           | : December 29, 2021                                     |
| Nominal power source voltages | : DC 24.0V                                              |
| Operating voltage range       | : DC 24.0V±10%                                          |

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

|                       |                                                   |
|-----------------------|---------------------------------------------------|
| Test specification(s) | : FCC CFR 47. Part 15 Subpart C (October 1, 2021) |
| Test method(s)        | : ANSI C63.10: 2013                               |
| Test(s) started       | : January 21, 2022                                |
| Test(s) completed     | : March 31, 2022                                  |

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

:   
Kazuyuki Onishi  
C&P Connectivity Wireless RF Operation RF/EMC Lab.

Reviewer

:   
Yoshihiko Taki  
Manager  
C&P Connectivity Wireless RF Operation RF/EMC Lab.

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### 1.3 Test facility

Address: 3-5-23, Kitayamata, Tsuzuki-ku, Yokohama, 224-0021, Japan  
TEL: +81-(0)50-3773-4513  
FAX: +81-(0)45-592-7506

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This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the US 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 ETSI TR 100 028-1 V1.4.1 (2001-12).

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

Conducted emission (150 kHz - 30 MHz):  $\pm 3.3$  dB  
Radiated emission (9 kHz - 30 MHz):  $\pm 5.6$  dB  
Radiated emission (30 MHz - 1000 MHz):  $\pm 5.1$  dB

### 1.5 Summary of test results

| Requirements                               | Section in FCC   | Section in this report | Results  |
|--------------------------------------------|------------------|------------------------|----------|
| Occupied bandwidth                         | 2.1049           | 2.1                    | -        |
| Radiated Emissions between 9 kHz to 30 MHz | 15.225 (a) - (d) | 2.2                    | Complied |
| Radiated Emissions between 30 to 1000 MHz  | 15.209           | 2.3                    | Complied |
| Carrier Frequency Stability                | 15.225 (e)       | 2.4                    | Complied |
| AC Power Line Conducted Emissions          | 15.207           | 2.5                    | Complied |

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## 1.6 Setup of equipment under test (EUT)

### 1.6.1 Test configuration of EUT

The test configuration of the EUT refers to following Tables.

Table: EUT

| No. | Equipment               | Model name         | S/N          | Note |
|-----|-------------------------|--------------------|--------------|------|
| A   | RFID Reader/Writer Unit | TR3X-SD01-24-CS141 | 21000010     | -    |
| B   | Antenna Unit 1          | TR3-CA065 (12)     | 21000253~264 | -    |
| C   | Antenna Unit 2          | TR3-CA065 (12)     | 21000265~276 | -    |

Table: Support equipment

| No. | Item            | Model Name | Manufacturer | S/N                      |
|-----|-----------------|------------|--------------|--------------------------|
| D   | PC              | PP22L      | DELL         | JX189 A00                |
| E   | AC adapter      | LA90PS0-00 | DELL         | CN-0DF266-71615-78V-B442 |
| F   | DC power supply | PMC35-2A   | KUKUSUI      | EF001839                 |
| G   | USB dongle      | BF07-1033R | pqi          | P077023200464            |

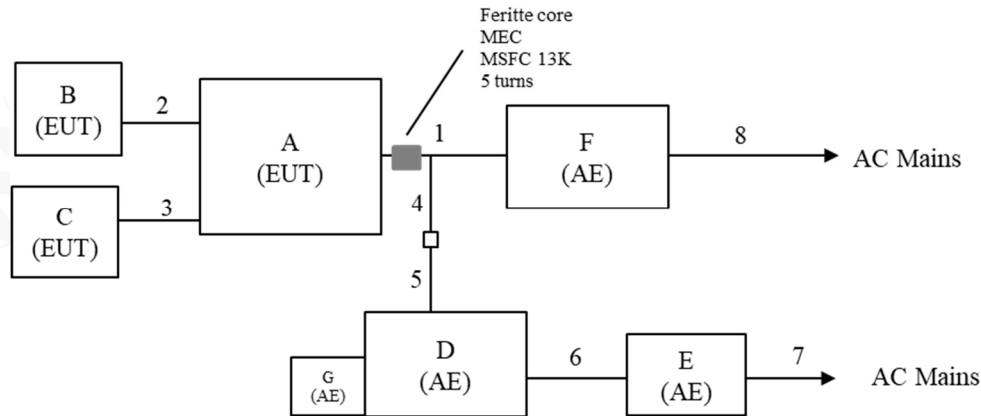
Table: Cable connected to the EUT

| No. | Cable Name                  | From | To | Length [m] | Shielded | Ferrite |
|-----|-----------------------------|------|----|------------|----------|---------|
| 1   | DC cable 1                  | A    | F  | 3.0        | No       | Yes     |
| 2   | Antenna cable 1 (12 cables) | A    | B  | 0.6        | No       | No      |
| 3   | Antenna cable 2 (12 cables) | A    | C  | 0.6        | No       | No      |
| 4   | Serial cable                | A    | D  | 3.2        | No       | Yes     |
| 5   | USB - Serial cable          | A    | D  | 0.2        | Yes      | No      |
| 6   | DC cable 2                  | D    | E  | 1.8        | No       | No      |
| 7   | AC cable 1                  | E    | AC | 0.9        | No       | No      |
| 8   | AC cable 2                  | F    | AC | 2.0        | No       | No      |

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## 1.6.2 Setup diagram of tested system:



## 1.6.3 Operating condition:

Software: TR3 R/W Mode Set Program 1.3.1.0  
Operating mode: 1. No modulation  
2. ISO 15693 ASK 10%  
Power setting: High power mode (100mW)  
Power mode: Continuous (TEST)

Note: This EUT has 24 antenna ports (3 switch circuit × 8 antennas), these antennas do not work with simultaneous transmission.

Test was performed to one antenna port of each switch circuit, which has highest field strength (Antenna port No. 1, 12, 24).

## 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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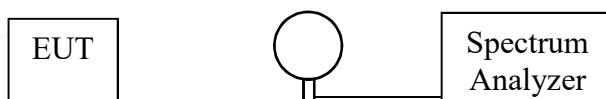
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## 2 Test procedure and test data

### 2.1 Occupied Bandwidth (99 %)

#### Test setup

Test setup is the following drawing. The antenna port of EUT was connected to the spectrum analyzer.



#### Test procedure

Spectrum analyzer is set as below according to ANSI C63.10 clause 6.9

- RBW: 1 to 5 % of OBW
- VBW > 3 x RBW
- Span: OBW x 1.5 to 5
- Trace: Max hold

#### Limitation

There are no limitations.

The measurement value is used for the emission designator.

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

|      |      |      |   |   |   |   |   |   |
|------|------|------|---|---|---|---|---|---|
| CL71 | LP05 | TR10 | - | - | - | - | - | - |
|------|------|------|---|---|---|---|---|---|

#### Test Date

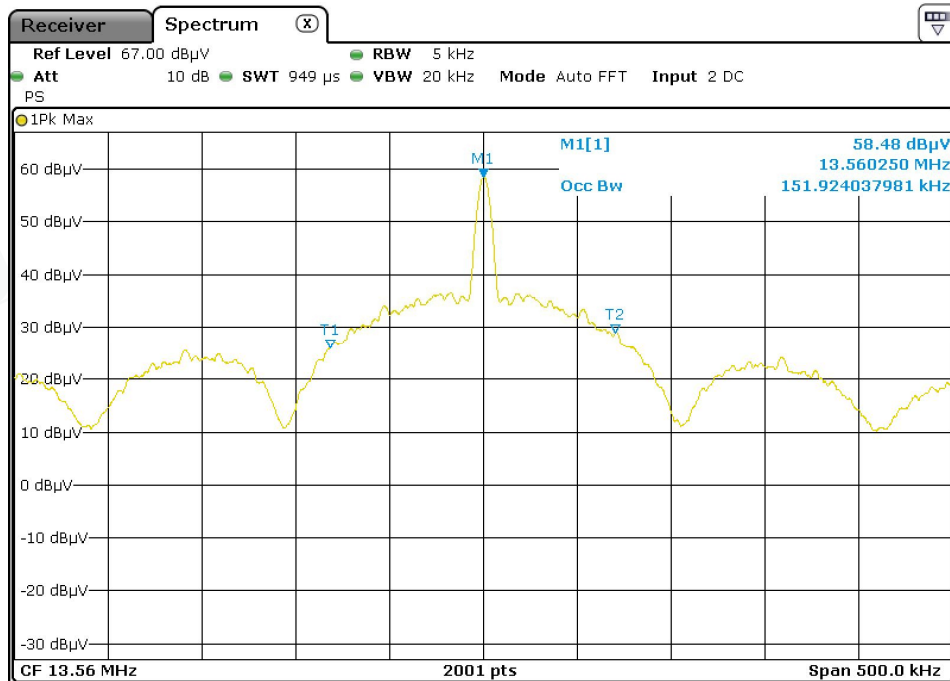
Tested Date: January 21, 2022      Temperature: 15 deg. C  
Humidity: 26 %      Atmos. Press: 1015 hPa

#### Test results

| Operating mode   | Antenna port | 99% Bandwidth<br>[kHz] |
|------------------|--------------|------------------------|
| ISO 15693 ASK10% | 1ch          | 151.924                |

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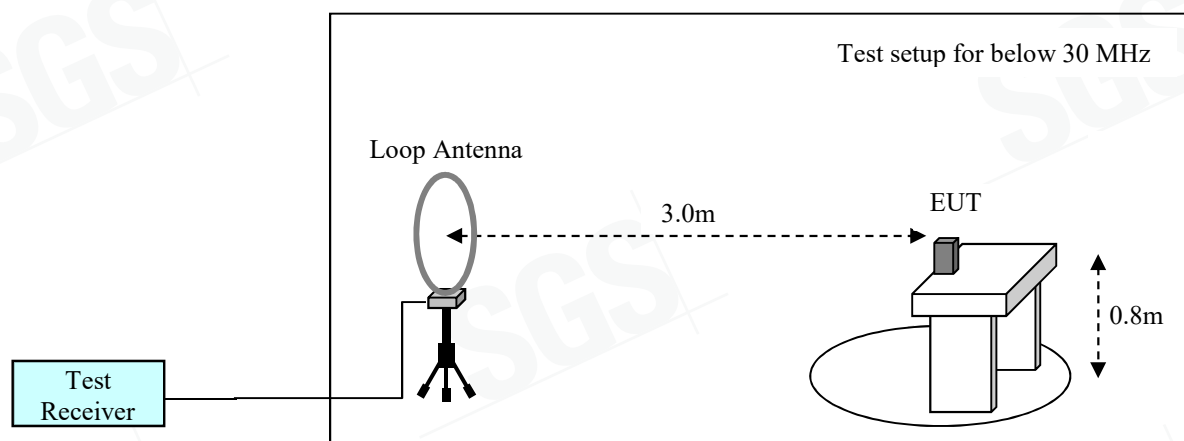
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## 2.2 Transmitter radiated spurious emissions between 9 kHz to 30 MHz

### Test setup

Test setup was implemented according to the method of ANSI C63.10 clause 6.4.



### Test procedure

Measurement procedures were implemented according to the method of ANSI C63.10: 2013 clauses 6.4.

The EUT is placed on a non-conducted table which is 0.8m 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.

In the frequency range of 9 kHz to 30 MHz, a calibrated loop antenna was positioned with its plane vertical at the distance 3m from the EUT with an extrapolation of corrected distance factor and rotated about its vertical axis for maximum response at each azimuth about the EUT. For certain applications, the loop antenna also needs to be positioned horizontally. The lowest height of the loop antenna shall be 1 m above the ground.

EUT is placed at three different orientations (X, Y and Z axis) in order to find the worst orientation.

The spectrum analyzer and receiver are set to the followings;

Below 30 MHz:

RBW=10 kHz, VBW= 30 kHz, final measurement is carried out with a receiver RBW of 9 kHz (QP)

## Applicable rule and limitation

### §15.205: Restricted bands of operation

| MHz                 | MHz                 | MHz             | GHz           |
|---------------------|---------------------|-----------------|---------------|
| 0.090 - 0.110       | 16.42 - 16.423      | 399.9 - 410     | 4.5 - 5.15    |
| 0.490 - 0.510       | 16.69475 - 16.69525 | 608 - 614       | 5.35 - 5.46   |
| 2.1735 - 2.1905     | 16.80425 - 16.80475 | 960 - 1240      | 7.25 - 7.75   |
| 4.125 - 4.128       | 25.5 - 25.67        | 1300 - 1427     | 8.025 - 8.5   |
| 4.17725 - 4.17775   | 37.5 - 38.25        | 1435 - 1626.5   | 9.0 - 9.2     |
| 4.20725 - 4.20775   | 73 - 74.6           | 1645.5 - 1646.5 | 9.3 - 9.5     |
| 6.215 - 6.218       | 74.8 - 75.2         | 1660 - 1710     | 10.6 - 12.7   |
| 6.26775 - 6.26825   | 108 - 121.94        | 1718.8 - 1722.2 | 13.25 - 13.4  |
| 6.31175 - 6.31225   | 123 - 138           | 2200 - 2300     | 14.47 - 14.5  |
| 8.291 - 8.294       | 149.9 - 150.05      | 2310 - 2390     | 15.35 - 16.2  |
| 8.362 - 8.366       | 156.52475 -         | 2483.5 - 2500   | 17.7 - 21.4   |
| 8.37625 - 8.38675   | 156.52525           | 2690 - 2900     | 22.01 - 23.12 |
| 8.41425 - 8.41475   | 156.7 - 156.9       | 3260 - 3267     | 23.6 - 24.0   |
| 12.29 - 12.293      | 162.0125 - 167.17   | 3332 - 3339     | 31.2 - 31.8   |
| 12.51975 - 12.52025 | 167.72 - 173.2      | 3345.8 - 3358   | 36.43 - 36.5  |
| 12.57675 - 12.57725 | 240 - 285           | 3600 - 4400     | (1)           |
|                     | 322 - 335.4         |                 |               |

### §15.209: General requirements

| Frequency (MHz) | Field Strength (uV/m) | Measurement Distance (m) |
|-----------------|-----------------------|--------------------------|
| 0.009 - 0.490   | 2400/F (kHz)          | 300                      |
| 0.490 - 1.705   | 24000/F (kHz)         | 30                       |
| 1.705 - 30.0    | 30                    | 30                       |

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

The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz.

### §15.225: Operation within the band 13.110 - 14.010 MHz

| Frequency (MHz) | Field strength @30m (uV/m) | Field strength @30m (dBuV/m) | Field strength @3m (dBuV/m) |
|-----------------|----------------------------|------------------------------|-----------------------------|
| 13.110 - 13.410 | 106                        | 40.5                         | 61.8                        |
| 13.410 - 13.553 | 334                        | 50.5                         | 71.8                        |
| 13.553 - 13.567 | 15,848                     | 84.0                         | 105.3                       |
| 13.567 - 13.710 | 334                        | 50.5                         | 71.8                        |
| 13.710 - 14.010 | 106                        | 40.5                         | 61.8                        |

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Extrapolation factor of 3m test distance (ANSI C63.10-2013 6.4.4)

| Frequency [MHz] | D ( $\lambda/2\pi$ ) [m] | D (Limit) [m] | Extrapolation Factor |
|-----------------|--------------------------|---------------|----------------------|
| 0.009           | 5305.16                  | 300           | 80.00                |
| 0.159           | 300.29                   | 300           | 80.00                |
| 0.160           | 298.42                   | 300           | 79.95                |
| 0.490           | 97.44                    | 300           | 70.23                |
| 0.490           | 97.44                    | 30            | 40.00                |
| 1.591           | 30.01                    | 30            | 40.00                |
| 1.592           | 29.99                    | 30            | 40.00                |
| 10.000          | 4.77                     | 30            | 24.04                |
| 13.560          | 3.52                     | 30            | 21.39                |
| 15.910          | 3.00                     | 30            | 20.00                |
| 30.000          | 1.59                     | 30            | 20.00                |

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

|      |      |      |      |   |   |   |   |   |
|------|------|------|------|---|---|---|---|---|
| AC01 | CL71 | LP05 | TR10 | - | - | - | - | - |
|------|------|------|------|---|---|---|---|---|

Test software used

EMI1 Ver. 6.1

Calculation method

The Correction Factor and Result are calculated as followings.

Correction Factor [dB/m] = Ant. Factor [dB/m] + Loss [dB]

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

Test results - Complied with requirement.

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## Test Data

§15.225 (a), (b), (c): Fundamental emission

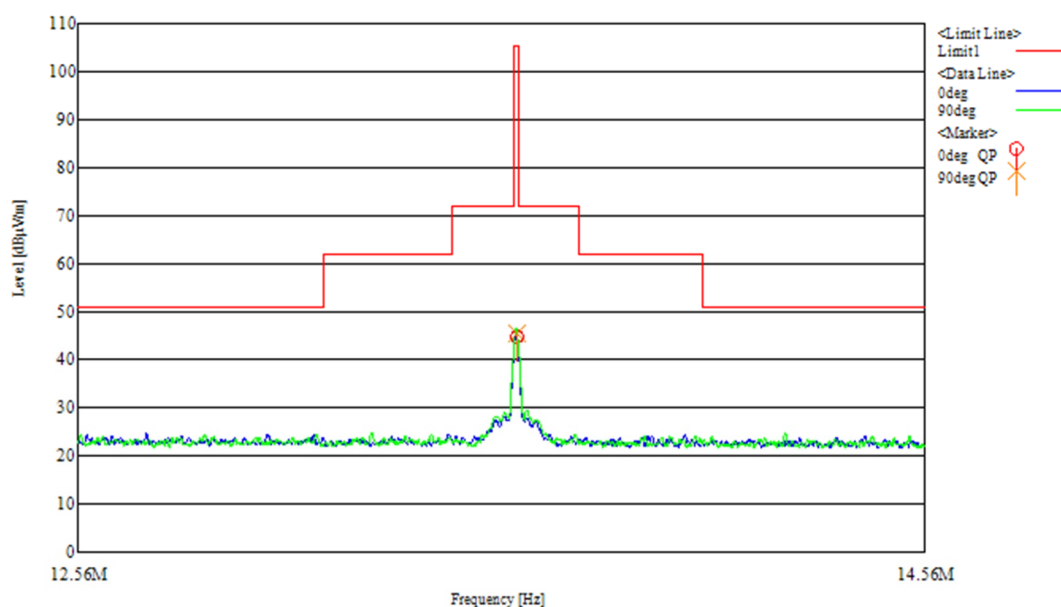
Operating mode: ISO 15693 ASK 10%

EUT condition: Y-plane (Maximum position)

Measurement distance: 3 m

| No. | Frequency [MHz] | Reading [dBuV] | Detector | Corr. Factor [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Ant   |
|-----|-----------------|----------------|----------|-------------------|-----------------|----------------|-------------|-------|
| 1   | 13.56017        | 34.9           | QP       | 9.6               | 44.5            | 105.3          | 60.8        | 0deg  |
| 2   | 13.56014        | 35.7           | QP       | 9.6               | 45.3            | 105.3          | 60.0        | 90deg |

## Graphical express of test result



Tested Date: January 21, 2022  
Humidity: 26 %

Temperature: 15 deg. C  
Atmos. Press: 1015 hPa

## Field strength of each antenna [dBuV/m]

|     |      |      |      |      |      |
|-----|------|------|------|------|------|
| 1ch | 45.3 | 9ch  | 43.3 | 17ch | 42.8 |
| 2ch | 43.8 | 10ch | 43.4 | 18ch | 42.7 |
| 3ch | 43.6 | 11ch | 43.5 | 19ch | 42.9 |
| 4ch | 43.7 | 12ch | 44.5 | 20ch | 43.2 |
| 5ch | 43.6 | 13ch | 43.3 | 21ch | 43.1 |
| 6ch | 43.3 | 14ch | 42.9 | 22ch | 43.1 |
| 7ch | 43.3 | 15ch | 42.5 | 23ch | 43.3 |
| 8ch | 43.4 | 16ch | 42.5 | 24ch | 43.8 |

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## §15.225 (d): Harmonics and spurious emission between 9 kHz to 30MHz

Operating mode: ISO 15693 ASK 10%

Antenna port: 1ch

Measurement distance: 3 m

## [X-plane]

| No.      | Frequency [MHz] | Reading [dBμV] | Factor [dB/m] | Loss [dB]  | Result [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Ant.         |
|----------|-----------------|----------------|---------------|------------|-----------------|----------------|-------------|--------------|
| 1        | 0.59005         | 37.7           | 10.7          | 0.1        | 48.5            | 72.2           | 23.7        | 0deg         |
| 2        | 0.88225         | 25.8           | 10.7          | 0.1        | 36.6            | 68.7           | 32.1        | 0deg         |
| 3        | 1.18035         | 30.1           | 10.6          | 0.1        | 40.8            | 66.1           | 25.3        | 0deg         |
| 4        | 0.59003         | 38.4           | 10.7          | 0.1        | 49.2            | 72.2           | 23.0        | 90deg        |
| <b>5</b> | <b>0.88225</b>  | <b>35.2</b>    | <b>10.7</b>   | <b>0.1</b> | <b>46.0</b>     | <b>68.7</b>    | <b>22.7</b> | <b>90deg</b> |
| 6        | 1.18018         | 30.6           | 10.6          | 0.1        | 41.3            | 66.1           | 24.8        | 90deg        |

## [Y-plane]

| No. | Frequency [MHz] | Reading [dBμV] | Factor [dB/m] | Loss [dB] | Result [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Ant.  |
|-----|-----------------|----------------|---------------|-----------|-----------------|----------------|-------------|-------|
| 1   | 0.59011         | 37.5           | 10.7          | 0.1       | 48.3            | 72.2           | 23.9        | 0deg  |
| 2   | 0.88515         | 26.0           | 10.7          | 0.1       | 36.8            | 68.7           | 31.9        | 0deg  |
| 3   | 1.18013         | 29.9           | 10.6          | 0.1       | 40.6            | 66.1           | 25.5        | 0deg  |
| 4   | 0.59018         | 38.2           | 10.7          | 0.1       | 49.0            | 72.2           | 23.2        | 90deg |
| 5   | 0.88225         | 26.1           | 10.7          | 0.1       | 36.9            | 68.7           | 31.8        | 90deg |
| 6   | 1.18030         | 30.6           | 10.6          | 0.1       | 41.3            | 66.1           | 24.8        | 90deg |

## [Z-plane]

| No. | Frequency [MHz] | Reading [dBμV] | Factor [dB/m] | Loss [dB] | Result [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Ant.  |
|-----|-----------------|----------------|---------------|-----------|-----------------|----------------|-------------|-------|
| 1   | 0.59018         | 37.7           | 10.7          | 0.1       | 48.5            | 72.2           | 23.7        | 0deg  |
| 2   | 0.88225         | 25.7           | 10.7          | 0.1       | 36.5            | 68.7           | 32.2        | 0deg  |
| 3   | 1.18035         | 30.0           | 10.6          | 0.1       | 40.7            | 66.1           | 25.4        | 0deg  |
| 4   | 0.59004         | 38.4           | 10.7          | 0.1       | 49.2            | 72.2           | 23.0        | 90deg |
| 5   | 0.88565         | 26.3           | 10.7          | 0.1       | 37.1            | 68.7           | 31.6        | 90deg |
| 6   | 1.18015         | 30.6           | 10.6          | 0.1       | 41.3            | 66.1           | 24.8        | 90deg |

Tested Date: January 21, 2022  
Humidity: 26 %Temperature: 15 deg. C  
Atmos. Press: 1015 hPa

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Operating mode: ISO 15693 ASK 10%

Antenna port: 12ch

Measurement distance: 3 m

[X-plane]

| No. | Frequency<br>[MHz] | Reading<br>[dBμV] | Factor<br>[dB/m] | Loss<br>[dB] | Result<br>[dBμV/m] | Limit<br>[dBμV/m] | Margin<br>[dB] | Ant. |
|-----|--------------------|-------------------|------------------|--------------|--------------------|-------------------|----------------|------|
| -   | -                  | -                 | -                | -            | -                  | -                 | -              | -    |
| -   | -                  | -                 | -                | -            | -                  | -                 | -              | -    |

There are no spurious emissions greater than noise floor or 20dB below the limit.

[Y-plane]

| No. | Frequency<br>[MHz] | Reading<br>[dBμV] | Factor<br>[dB/m] | Loss<br>[dB] | Result<br>[dBμV/m] | Limit<br>[dBμV/m] | Margin<br>[dB] | Ant. |
|-----|--------------------|-------------------|------------------|--------------|--------------------|-------------------|----------------|------|
| -   | -                  | -                 | -                | -            | -                  | -                 | -              | -    |
| -   | -                  | -                 | -                | -            | -                  | -                 | -              | -    |

There are no spurious emissions greater than noise floor or 20dB below the limit.

[Z-plane]

| No. | Frequency<br>[MHz] | Reading<br>[dBμV] | Factor<br>[dB/m] | Loss<br>[dB] | Result<br>[dBμV/m] | Limit<br>[dBμV/m] | Margin<br>[dB] | Ant. |
|-----|--------------------|-------------------|------------------|--------------|--------------------|-------------------|----------------|------|
| -   | -                  | -                 | -                | -            | -                  | -                 | -              | -    |
| -   | -                  | -                 | -                | -            | -                  | -                 | -              | -    |

There are no spurious emissions greater than noise floor or 20dB below the limit.

Tested Date: March 31, 2022  
Humidity: 53 %

Temperature: 20 deg. C  
Atmos. Press: 1009 hPa

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Operating mode: ISO 15693 ASK 10%

Antenna port: 24ch

Measurement distance: 3 m

[X-plane]

| No. | Frequency<br>[MHz] | Reading<br>[dBμV] | Factor<br>[dB/m] | Loss<br>[dB] | Result<br>[dBμV/m] | Limit<br>[dBμV/m] | Margin<br>[dB] | Ant. |
|-----|--------------------|-------------------|------------------|--------------|--------------------|-------------------|----------------|------|
| -   | -                  | -                 | -                | -            | -                  | -                 | -              | -    |
| -   | -                  | -                 | -                | -            | -                  | -                 | -              | -    |

There are no spurious emissions greater than noise floor or 20dB below the limit.

[Y-plane]

| No. | Frequency<br>[MHz] | Reading<br>[dBμV] | Factor<br>[dB/m] | Loss<br>[dB] | Result<br>[dBμV/m] | Limit<br>[dBμV/m] | Margin<br>[dB] | Ant. |
|-----|--------------------|-------------------|------------------|--------------|--------------------|-------------------|----------------|------|
| -   | -                  | -                 | -                | -            | -                  | -                 | -              | -    |
| -   | -                  | -                 | -                | -            | -                  | -                 | -              | -    |

There are no spurious emissions greater than noise floor or 20dB below the limit.

[Z-plane]

| No. | Frequency<br>[MHz] | Reading<br>[dBμV] | Factor<br>[dB/m] | Loss<br>[dB] | Result<br>[dBμV/m] | Limit<br>[dBμV/m] | Margin<br>[dB] | Ant. |
|-----|--------------------|-------------------|------------------|--------------|--------------------|-------------------|----------------|------|
| -   | -                  | -                 | -                | -            | -                  | -                 | -              | -    |
| -   | -                  | -                 | -                | -            | -                  | -                 | -              | -    |

There are no spurious emissions greater than noise floor or 20dB below the limit.

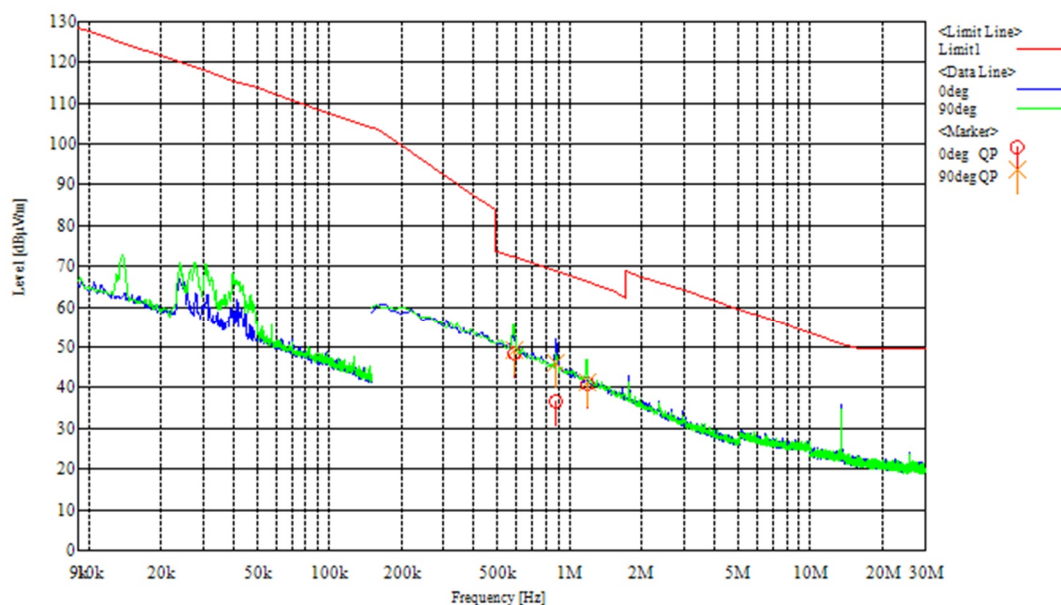
Tested Date: March 31, 2022  
Humidity: 53 %

Temperature: 20 deg. C  
Atmos. Press: 1009 hPa

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## Graphical express of test result (Antenna port: 1ch, X-plane)



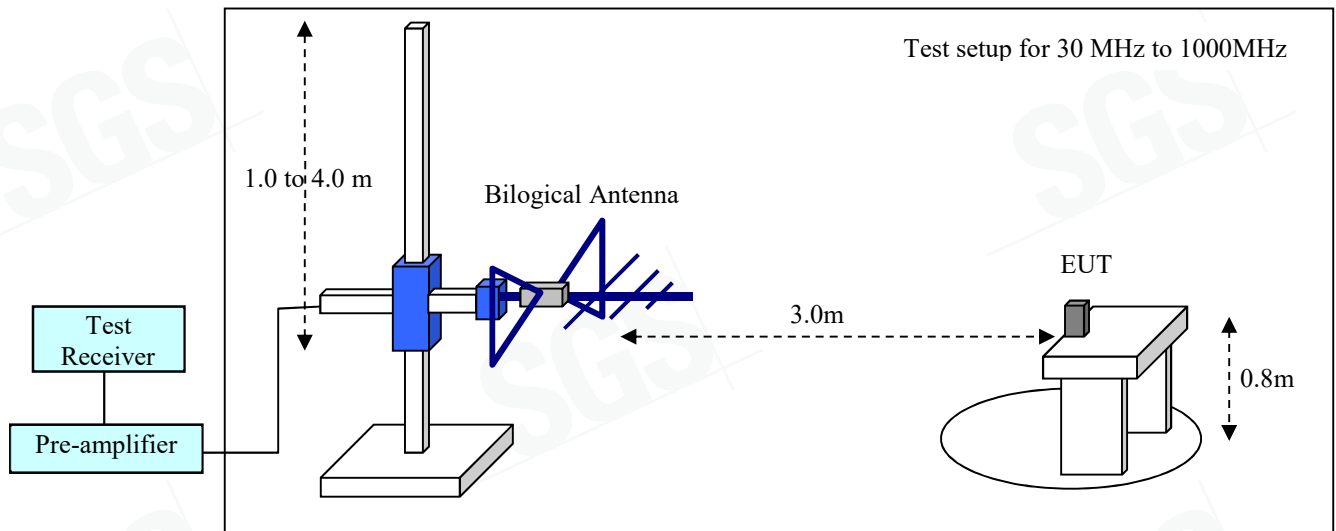
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## 2.3 Transmitter radiated spurious emissions between 30MHz to 1000MHz

### Test setup

Test setup was implemented according to the method of ANSI C63.10 clause 6.



### Test procedure

Measurement procedures were implemented according to the method of ANSI C63.10: 2013 clauses 6.5.

Exploratory radiated measurements were performed at the measurement distance of 3 meters using broadband antennas and a spectrum analyzer. The EUT was set up in its typical configuration and arrangement, and operated in its various modes.

For each mode of operation required to be tested, the frequency spectrum were monitored. Variations in antenna height between 1 and 4 m, antenna polarization, EUT azimuth, and cable or wire placement (each variable within bounds specified elsewhere) were explored to produce the emission that has the highest amplitude relative to the limit. Based on the exploratory measurement results, the one EUT, cable and wire arrangement, and mode of operation that produces the emission that has the highest amplitude relative to the limit is selected for the final measurement. This investigation was performed with the EUT rotated 360°, the antenna height scanned between 1m and 4m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. EUT was placed at three different orientations (X, Y and Z axis) in order to find the worst orientation.

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## Applicable rule and limitation

### §15.209: General requirements

Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Frequency<br>[MHz] | Field Strength<br>[ $\mu\text{V/m}$ ] | Measurement<br>Distance [m] | Field Strength<br>[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 level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission.

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector.

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

|      |      |      |      |      |   |   |   |   |
|------|------|------|------|------|---|---|---|---|
| AC01 | BA10 | CL71 | PR15 | TR10 | - | - | - | - |
|------|------|------|------|------|---|---|---|---|

### Test software used

EMI1 Ver. 6.1

### Calculation method

The Correction Factors 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 results - Complied with requirement.

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## Test Data

Operating mode: ISO 15693 ASK 10%

Antenna port: 1ch

Measurement distance: 3 m

## [X-plane]

| No. | Frequency [MHz] | Reading [dBμV] | Factor [dB/m] | Loss [dB] | Gain [dB] | Result [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Ant.  |
|-----|-----------------|----------------|---------------|-----------|-----------|-----------------|----------------|-------------|-------|
| 1   | 54.094          | 45.0           | 6.4           | 6.5       | 30.2      | 27.7            | 40.0           | 12.3        | Vert. |
| 2   | 83.487          | 42.7           | 8.1           | 6.7       | 30.1      | 27.4            | 40.0           | 12.6        | Vert. |
| 3   | 124.652         | 42.0           | 11.8          | 6.9       | 30.1      | 30.6            | 43.5           | 12.9        | Vert. |
| 4   | 172.929         | 45.7           | 9.5           | 7.1       | 30.0      | 32.3            | 43.5           | 11.2        | Vert. |
| 5   | 180.075         | 47.5           | 9.0           | 7.1       | 30.0      | 33.6            | 43.5           | 9.9         | Vert. |
| 6   | 664.905         | 30.0           | 20.4          | 8.7       | 29.7      | 29.4            | 46.0           | 16.6        | Vert. |

## [Y-plane]

| No. | Frequency [MHz] | Reading [dBμV] | Factor [dB/m] | Loss [dB] | Gain [dB] | Result [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Ant.  |
|-----|-----------------|----------------|---------------|-----------|-----------|-----------------|----------------|-------------|-------|
| 1   | 124.226         | 42.3           | 11.8          | 6.9       | 30.1      | 30.9            | 43.5           | 12.6        | Vert. |
| 2   | 166.987         | 44.1           | 9.9           | 7.1       | 30.0      | 31.1            | 43.5           | 12.4        | Vert. |
| 3   | 173.032         | 46.0           | 9.5           | 7.1       | 30.0      | 32.6            | 43.5           | 10.9        | Vert. |
| 4   | 178.899         | 48.2           | 9.1           | 7.1       | 30.0      | 34.4            | 43.5           | 9.1         | Vert. |
| 5   | 664.783         | 29.9           | 20.4          | 8.7       | 29.7      | 29.3            | 46.0           | 16.7        | Vert. |
| 6   | 797.654         | 27.3           | 22.0          | 9.0       | 30.3      | 28.0            | 46.0           | 18.0        | Vert. |

## [Z-plane]

| No. | Frequency [MHz] | Reading [dBμV] | Factor [dB/m] | Loss [dB] | Gain [dB] | Result [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Ant.  |
|-----|-----------------|----------------|---------------|-----------|-----------|-----------------|----------------|-------------|-------|
| 1   | 271.203         | 31.8           | 12.5          | 7.5       | 29.9      | 21.9            | 46.0           | 24.1        | Hori. |
| 2   | 54.094          | 45.7           | 6.4           | 6.5       | 30.2      | 28.4            | 40.0           | 11.6        | Vert. |
| 3   | 84.733          | 43.6           | 8.1           | 6.7       | 30.1      | 28.3            | 40.0           | 11.7        | Vert. |
| 4   | 119.998         | 47.9           | 11.7          | 6.9       | 30.1      | 36.4            | 43.5           | 7.1         | Vert. |
| 5   | 180.190         | 42.7           | 9.0           | 7.1       | 30.0      | 28.8            | 43.5           | 14.7        | Vert. |
| 6   | 664.779         | 27.0           | 20.4          | 8.7       | 29.7      | 26.4            | 46.0           | 19.6        | Vert. |

Tested Date: January 21, 2022  
Humidity: 26 %Temperature: 15 deg. C  
Atmos. Press: 1015 hPa

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Operating mode: ISO 15693 ASK 10%

Antenna port: 12ch

Measurement distance: 3 m

## [X-plane]

| No. | Frequency [MHz] | Reading [dBμV] | Factor [dB/m] | Loss [dB] | Gain [dB] | Result [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Ant.  |
|-----|-----------------|----------------|---------------|-----------|-----------|-----------------|----------------|-------------|-------|
| 1   | 132.087         | 38.2           | 11.8          | 6.9       | 30.0      | 26.9            | 43.5           | 16.6        | Hori. |
| 2   | 81.227          | 45.8           | 7.7           | 6.7       | 30.1      | 30.1            | 40.0           | 9.9         | Vert. |
| 3   | 148.172         | 42.3           | 11.2          | 7.0       | 30.0      | 30.5            | 43.5           | 13.0        | Vert. |
| 4   | 152.876         | 43.4           | 10.9          | 7.0       | 30.0      | 31.3            | 43.5           | 12.2        | Vert. |
| 5   | 169.278         | 47.1           | 9.7           | 7.1       | 30.0      | 33.9            | 43.5           | 9.6         | Vert. |
| 6   | 338.678         | 39.3           | 14.1          | 7.8       | 29.9      | 31.3            | 46.0           | 14.7        | Vert. |

## [Y-plane]

| No. | Frequency [MHz] | Reading [dBμV] | Factor [dB/m] | Loss [dB] | Gain [dB] | Result [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Ant.  |
|-----|-----------------|----------------|---------------|-----------|-----------|-----------------|----------------|-------------|-------|
| 1   | 131.995         | 42.6           | 11.8          | 6.9       | 30.0      | 31.3            | 43.5           | 12.2        | Hori. |
| 2   | 81.167          | 42.6           | 7.7           | 6.7       | 30.1      | 26.9            | 40.0           | 13.1        | Vert. |
| 3   | 152.875         | 42.8           | 10.9          | 7.0       | 30.0      | 30.7            | 43.5           | 12.8        | Vert. |
| 4   | 167.981         | 48.4           | 9.9           | 7.1       | 30.0      | 35.4            | 43.5           | 8.1         | Vert. |
| 5   | 338.678         | 39.6           | 14.1          | 7.8       | 29.9      | 31.6            | 46.0           | 14.4        | Vert. |
| 6   | 431.988         | 34.7           | 16.7          | 8.0       | 29.7      | 29.7            | 46.0           | 16.3        | Vert. |

## [Z-plane]

| No. | Frequency [MHz] | Reading [dBμV] | Factor [dB/m] | Loss [dB] | Gain [dB] | Result [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Ant.  |
|-----|-----------------|----------------|---------------|-----------|-----------|-----------------|----------------|-------------|-------|
| 1   | 131.997         | 38.6           | 11.8          | 6.9       | 30.0      | 27.3            | 43.5           | 16.2        | Hori. |
| 2   | 79.962          | 44.2           | 7.6           | 6.7       | 30.2      | 28.3            | 40.0           | 11.7        | Vert. |
| 3   | 148.172         | 41.7           | 11.2          | 7.0       | 30.0      | 29.9            | 43.5           | 13.6        | Vert. |
| 4   | 152.876         | 42.2           | 10.9          | 7.0       | 30.0      | 30.1            | 43.5           | 13.4        | Vert. |
| 5   | 166.987         | 47.7           | 9.9           | 7.1       | 30.0      | 34.7            | 43.5           | 8.8         | Vert. |
| 6   | 664.434         | 29.8           | 20.4          | 8.6       | 29.7      | 29.1            | 46.0           | 16.9        | Vert. |

Tested Date: March 30, 2022  
Humidity: 47 %Temperature: 22 deg. C  
Atmos. Press: 1019 hPa

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Operating mode: ISO 15693 ASK 10%

Antenna port: 24ch

Measurement distance: 3 m

## [X-plane]

| No. | Frequency [MHz] | Reading [dBμV] | Factor [dB/m] | Loss [dB] | Gain [dB] | Result [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Ant.  |
|-----|-----------------|----------------|---------------|-----------|-----------|-----------------|----------------|-------------|-------|
| 1   | 271.203         | 46.5           | 12.5          | 7.5       | 29.9      | 36.6            | 46.0           | 9.4         | Hori. |
| 2   | 284.763         | 42.5           | 12.7          | 7.6       | 29.9      | 32.9            | 46.0           | 13.1        | Hori. |
| 3   | 54.094          | 47.4           | 6.4           | 6.5       | 30.2      | 30.1            | 40.0           | 9.9         | Vert. |
| 4   | 81.228          | 45.8           | 7.7           | 6.7       | 30.1      | 30.1            | 40.0           | 9.9         | Vert. |
| 5   | 168.234         | 39.7           | 9.8           | 7.1       | 30.0      | 26.6            | 43.5           | 16.9        | Vert. |
| 6   | 178.706         | 44.8           | 9.1           | 7.1       | 30.0      | 31.0            | 43.5           | 12.5        | Vert. |

## [Y-plane]

| No. | Frequency [MHz] | Reading [dBμV] | Factor [dB/m] | Loss [dB] | Gain [dB] | Result [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Ant.  |
|-----|-----------------|----------------|---------------|-----------|-----------|-----------------|----------------|-------------|-------|
| 1   | 131.989         | 42.5           | 11.8          | 6.9       | 30.0      | 31.2            | 43.5           | 12.3        | Hori. |
| 2   | 271.203         | 44.7           | 12.5          | 7.5       | 29.9      | 34.8            | 46.0           | 11.2        | Hori. |
| 3   | 79.990          | 44.0           | 7.6           | 6.7       | 30.2      | 28.1            | 40.0           | 11.9        | Vert. |
| 4   | 168.011         | 48.6           | 9.9           | 7.1       | 30.0      | 35.6            | 43.5           | 7.9         | Vert. |
| 5   | 181.151         | 44.5           | 8.9           | 7.1       | 30.0      | 30.5            | 43.5           | 13.0        | Vert. |
| 6   | 271.221         | 39.8           | 12.5          | 7.5       | 29.9      | 29.9            | 46.0           | 16.1        | Vert. |

## [Z-plane]

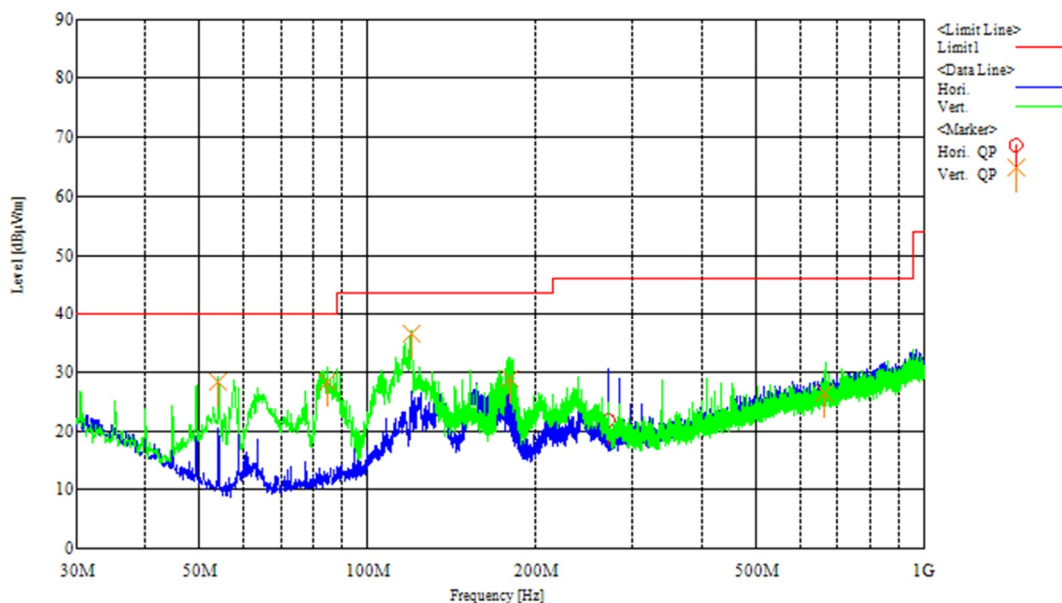
| No. | Frequency [MHz] | Reading [dBμV] | Factor [dB/m] | Loss [dB] | Gain [dB] | Result [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Ant.  |
|-----|-----------------|----------------|---------------|-----------|-----------|-----------------|----------------|-------------|-------|
| 1   | 271.200         | 43.9           | 12.5          | 7.5       | 29.9      | 34.0            | 46.0           | 12.0        | Hori. |
| 2   | 81.114          | 42.6           | 7.7           | 6.7       | 30.1      | 26.9            | 40.0           | 13.1        | Vert. |
| 3   | 119.949         | 38.9           | 11.7          | 6.9       | 30.1      | 27.4            | 43.5           | 16.1        | Vert. |
| 4   | 168.224         | 47.5           | 9.8           | 7.1       | 30.0      | 34.4            | 43.5           | 9.1         | Vert. |
| 5   | 271.203         | 40.0           | 12.5          | 7.5       | 29.9      | 30.1            | 46.0           | 15.9        | Vert. |
| 6   | 528.845         | 33.9           | 18.9          | 8.2       | 29.5      | 31.5            | 46.0           | 14.5        | Vert. |

Tested Date: March 30, 2022  
Humidity: 47 %Temperature: 22 deg. C  
Atmos. Press: 1019 hPa

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## Graphical express of test result (Antenna port: 1ch, Z-plane)



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## 2.4 Frequency stability

### Test setup

Test setup was implemented according to the method of ANSI C63.10: 2013 clauses 6.8 “Frequency stability tests”.

### Test procedure

Measurement procedures were implemented according to the test method of ANSI C63.10: 2013 clause 6.8.1.

Place the de-energized EUT in the temperature test chamber. Supply the EUT with nominal ac voltage, or install a new or fully charged battery in the EUT. An antenna was connected to the antenna output connector of the EUT if possible.

The frequency counter was connected to the measurement antenna with a suitable length of coaxial cable.

The environmental chamber set to the highest temperature specified in applicable regulation.

Allow sufficient time (approximately 30 minutes) for the temperature of the chamber to stabilize.

Turn the EUT on and measure the EUT operating frequency at startup, and two, five, and ten minutes after startup.

The measurements were performed that the temperature chamber set to reduce the lowest temperature specified in applicable regulation.

### Applicable rule and limitation

§15.225 (e): Frequency tolerance

| Test items             | Variation ranges      |                   | Limit    |
|------------------------|-----------------------|-------------------|----------|
| Temperature variations | +5 to +50 degrees C * | 24.0 +/-10% VDC * | +/-0.01% |

Note1: The above operating range is declared by manufacturer.

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

|      |   |   |   |   |   |   |   |   |
|------|---|---|---|---|---|---|---|---|
| TR09 | - | - | - | - | - | - | - | - |
|------|---|---|---|---|---|---|---|---|

### Test results - Complied with requirement.

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**Test Data**

Operating mode: No modulation

Antenna port: 1ch

| Temp.<br>(Degrees) | Voltages<br>(V) | Measured Frequency (MHz) |            |            |            | Worst<br>Deviation<br>(%) | Limit<br>(%) |
|--------------------|-----------------|--------------------------|------------|------------|------------|---------------------------|--------------|
|                    |                 | Start-up                 | 2 min.     | 5 min.     | 10 min.    |                           |              |
| 5                  | 24.0            | 13.5601774               | 13.5601755 | 13.5601741 | 13.5601735 | +0.0013                   | +/-0.01      |
| 10                 | 24.0            | 13.5601745               | 13.5601688 | 13.5601672 | 13.5601666 | +0.0013                   | +/-0.01      |
| 20                 | 26.4            | 13.5601626               | 13.5601482 | 13.5601463 | 13.5601452 | +0.0012                   | +/-0.01      |
|                    | 24.0            | 13.5601556               | 13.5601483 | 13.5601459 | 13.5601452 | +0.0011                   | +/-0.01      |
|                    | 21.6            | 13.5601622               | 13.5601480 | 13.5601462 | 13.5601452 | +0.0012                   | +/-0.01      |
| 30                 | 24.0            | 13.5601396               | 13.5601246 | 13.5601217 | 13.5601209 | +0.0010                   | +/-0.01      |
| 40                 | 24.0            | 13.5601155               | 13.5601041 | 13.5601021 | 13.5601014 | +0.0009                   | +/-0.01      |
| 50                 | 24.0            | 13.5600948               | 13.5600939 | 13.5600938 | 13.5600938 | +0.0007                   | +/-0.01      |

Tested Date: January 26, 2022  
Humidity: 25 %Temperature: 18 deg. C  
Atmos. Press: 1010 hPa

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## 2.5 AC power line conducted emissions

### Test setup

Test setup was implemented according to the method of ANSI C63.10: 2013 clause 6.2.

### Test procedure

Measurement procedures were implemented according to the method of ANSI C63.10: 2013 clauses 6.2 “Standard test method for ac power line conducted emissions from unlicensed wireless devices”.

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

§15.207 (a): 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)

|      |      |      |   |  |  |   |   |   |
|------|------|------|---|--|--|---|---|---|
| CL72 | LN13 | TR09 | - |  |  | - | - | - |
|------|------|------|---|--|--|---|---|---|

### Test software used

EMI 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 - Complied with requirement.

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## Test Data

Operating mode: ISO 15693 ASK 10%

Antenna port: 1ch

| No. | Frequency [MHz] | Reading   |           | C.F. [dB] | Result    |           | Limit     |           | Margin  |         | PHASE |
|-----|-----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|---------|---------|-------|
|     |                 | QP [dBuV] | AV [dBuV] |           | QP [dBuV] | AV [dBuV] | QP [dBuV] | AV [dBuV] | QP [dB] | AV [dB] |       |
| 1   | 7.05578         | 27.5      | 26.1      | 10.2      | 37.7      | 36.3      | 60.0      | 50.0      | 22.3    | 13.7    | Va    |
| 2   | 13.56018        | 35.2      | 35.2      | 10.3      | 45.5      | 45.5      | 60.0      | 50.0      | 14.5    | 4.5     | Va    |
| 3   | 25.87133        | 26.4      | 26.1      | 10.5      | 36.9      | 36.6      | 60.0      | 50.0      | 23.1    | 13.4    | Va    |
| 4   | 7.05586         | 27.2      | 25.6      | 10.2      | 37.4      | 35.8      | 60.0      | 50.0      | 22.6    | 14.2    | Vb    |
| 5   | 13.56018        | 32.5      | 32.6      | 10.3      | 42.8      | 42.9      | 60.0      | 50.0      | 17.2    | 7.1     | Vb    |
| 6   | 25.87133        | 27.0      | 26.7      | 10.5      | 37.5      | 37.2      | 60.0      | 50.0      | 22.5    | 12.8    | Vb    |

Tested Date: January 18, 2022  
Humidity: 36 %

Temperature: 25 deg. C  
Atmos. Press: 1006 hPa

Antenna port: 12ch

| No. | Frequency [MHz] | Reading   |           | C.F. [dB] | Result    |           | Limit     |           | Margin  |         | PHASE |
|-----|-----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|---------|---------|-------|
|     |                 | QP [dBuV] | AV [dBuV] |           | QP [dBuV] | AV [dBuV] | QP [dBuV] | AV [dBuV] | QP [dB] | AV [dB] |       |
| 1   | 0.15493         | 24.1      | 6.4       | 10.2      | 34.3      | 16.6      | 65.7      | 55.7      | 31.4    | 39.1    | Va    |
| 2   | 0.18449         | 20.8      | 4.4       | 10.2      | 31.0      | 14.6      | 64.3      | 54.3      | 33.3    | 39.7    | Va    |
| 3   | 7.05578         | 27.2      | 25.7      | 10.2      | 37.4      | 35.9      | 60.0      | 50.0      | 22.6    | 14.1    | Va    |
| 4   | 11.75971        | 26.9      | 26.5      | 10.3      | 37.2      | 36.8      | 60.0      | 50.0      | 22.8    | 13.2    | Va    |
| 5   | 25.87129        | 24.9      | 24.8      | 10.5      | 35.4      | 35.3      | 60.0      | 50.0      | 24.6    | 14.7    | Va    |
| 6   | 25.87123        | 27.2      | 27.2      | 10.5      | 37.7      | 37.7      | 60.0      | 50.0      | 22.3    | 12.3    | Vb    |

Tested Date: March 30, 2022  
Humidity: 47 %

Temperature: 22 deg. C  
Atmos. Press: 1019 hPa

Antenna port: 24ch

| No. | Frequency [MHz] | Reading   |           | C.F. [dB] | Result    |           | Limit     |           | Margin  |         | PHASE |
|-----|-----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|---------|---------|-------|
|     |                 | QP [dBuV] | AV [dBuV] |           | QP [dBuV] | AV [dBuV] | QP [dBuV] | AV [dBuV] | QP [dB] | AV [dB] |       |
| 1   | 0.20913         | 20.5      | 3.6       | 10.2      | 30.7      | 13.8      | 63.2      | 53.2      | 32.5    | 39.4    | Va    |
| 2   | 7.05576         | 26.9      | 25.4      | 10.2      | 37.1      | 35.6      | 60.0      | 50.0      | 22.9    | 14.4    | Va    |
| 3   | 13.56015        | 36.1      | 35.8      | 10.3      | 46.4      | 46.1      | 60.0      | 50.0      | 13.6    | 3.9     | Va    |
| 4   | 0.18449         | 21.6      | 7.9       | 10.2      | 31.8      | 18.1      | 64.3      | 54.3      | 32.5    | 36.2    | Vb    |
| 5   | 7.05569         | 26.6      | 24.9      | 10.2      | 36.8      | 35.1      | 60.0      | 50.0      | 23.2    | 14.9    | Vb    |
| 6   | 13.56020        | 32.9      | 32.7      | 10.3      | 43.2      | 43.0      | 60.0      | 50.0      | 16.8    | 7.0     | Vb    |

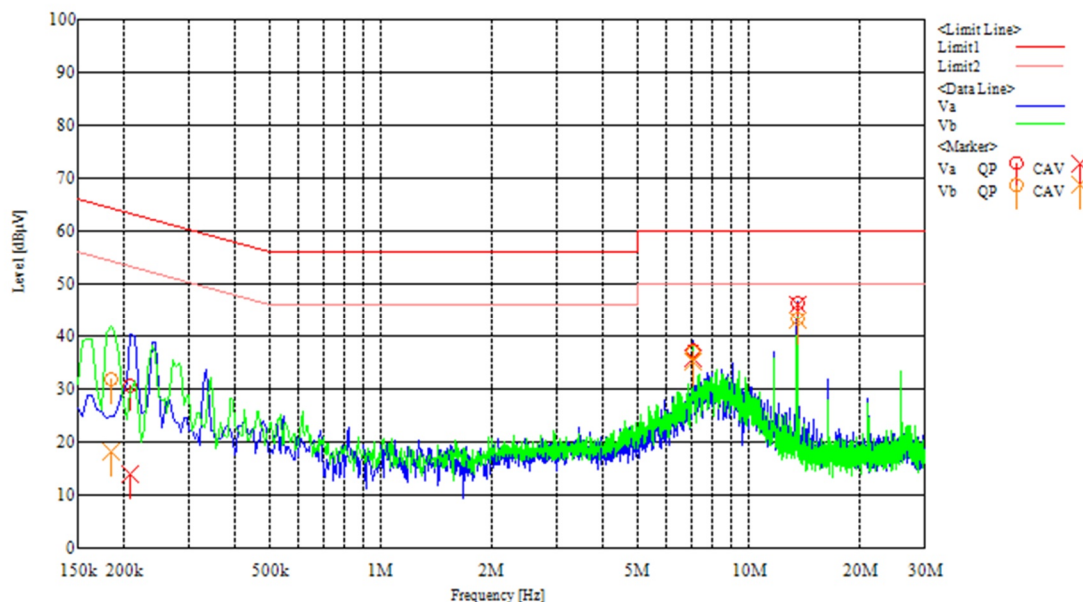
Tested Date: March 30, 2022  
Humidity: 47 %

Temperature: 22 deg. C  
Atmos. Press: 1019 hPa

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## Graphical express of test result (Antenna port: 24ch)



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

| RFT ID No. | Kind of Equipment and Precision   | Manufacturer    | Model No. | Serial Number | Calibration Date | Calibrated until |
|------------|-----------------------------------|-----------------|-----------|---------------|------------------|------------------|
| AC11(EM)   | Anechoic Chamber                  | TDK             | -         | -             | 2021/08/10       | 2022/08/31       |
| BA10       | Biological Antenna                | TESEQ           | CBL6111D  | 32342         | 2021/06/15       | 2022/06/30       |
| CL71       | RF Cable for RE                   | RFT             | -         | -             | 2022/01/14       | 2023/01/31       |
| CL72       | RF Cable for CE                   | RFT             | -         | -             | 2022/01/11       | 2023/01/31       |
| LN13       | LISN                              | Kyoritsu        | KNW-407F  | 8-2003-3      | 2021/08/02       | 2022/08/31       |
| LP05       | Loop Antenna                      | ETS-Lindgren    | 6502      | 00143302      | 2021/03/09       | 2022/03/31       |
| PR15       | Pre. Amplifier                    | Anritsu         | MH648A    | 6201156141    | 2021/06/15       | 2022/06/30       |
| TC01       | Temperature Chamber               | ESPEC           | SH-641    | 92000964      | 2021/12/10       | 2022/12/31       |
| TR09       | Test Receiver<br>(F/W : 4.43 SP3) | Rohde & Schwarz | ESU8      | 100386        | 2021/07/08       | 2022/07/31       |
| TR10       | Test Receiver<br>(F/W : 2.26)     | Rohde & Schwarz | ESR26     | 101313        | 2021/03/22       | 2022/03/31       |

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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