TEST REPORT

For

144/430MHz DUAL BAND TRANSCEIVER

In conformity with

FCC CFR 47 Part15 Subpart B (CSR)

Model : FTM-6000R

FCC ID : K6620795X40

Test Item : 144/430MHz DUAL BAND TRANSCEIVER

Report No. : WE210409BC1-12

Issue Date : 03 Jun. 2021

Prepared for

YAESU MUSEN CO., LTD.
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Prepared by

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History

Report No.	Date	Revisions	Issued By
WE210409BC1-11	24 May 2021	Initial Issue	T. Kato
WE201409BC1-12	03 Jun. 2021	Add the setup photo of RF conducted test (Sec 3.3)	T. Kato

1 General information

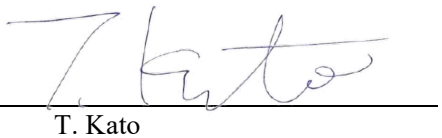
1.1 Product description from supplier

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-6000R
FCC ID	: K6620795X40
Serial number	: 12
Hardware version	: SPP2
Software version	: Ver. 79.34 (Main)
	: Ver. 70.18 (Panel)
Operating frequency range	: 108 - 983.295 MHz
Highest internal operating Freq.	: 941.94 MHz
Receipt date of EUT	: 14 May 2021
Nominal power source voltages	: DC 13.8 V

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	: 17 May 2021
Test(s) completed	: 18 May 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.)

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.

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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

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	(*2)	2.3
38 dB Rejection (cellular band)	15.121 (b)	- (*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-6000R	12
-	-	-	-	-

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

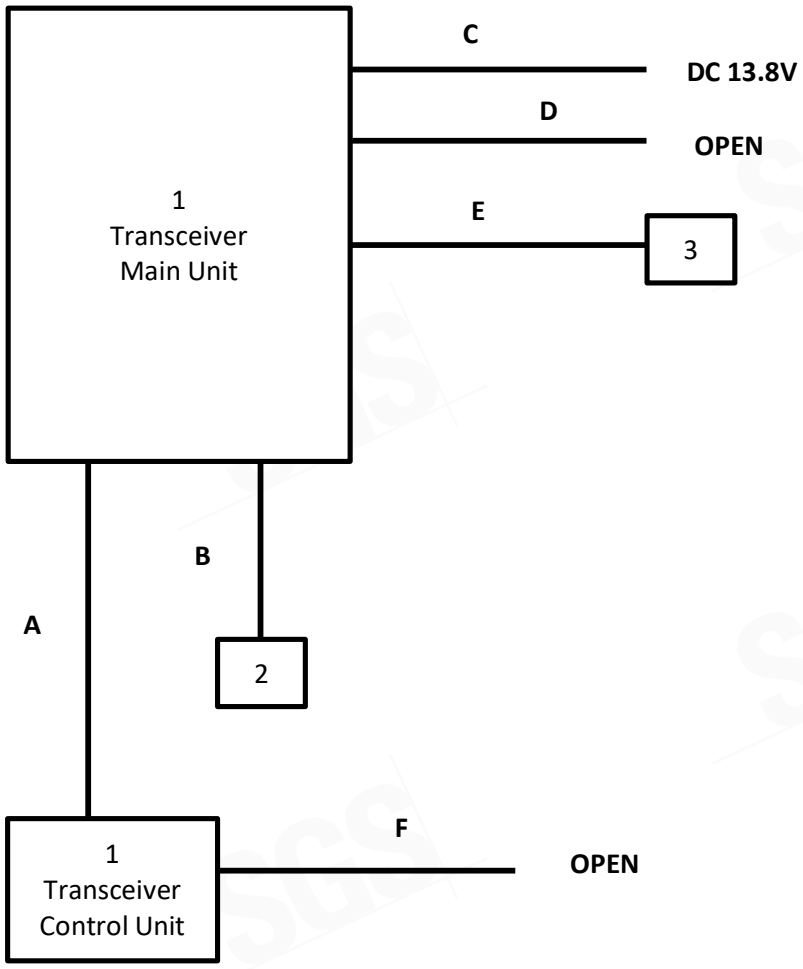
Connected cable(s)

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	USB Cable	1	OPEN	Yes	No	1.0

1.6.2 Operating condition:

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

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.

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 place 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 [μV/m]	Measurement Distance [m]	Field Strength [dBμV/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				

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] – Gain [dB]
Result [dBµV/m] = Reading [dBµV] + Correction Factor [dB/m]

Test Data

Operating mode: Rx 108.000 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	498.150	31.2	17.9	8.2	29.5	27.8	46.0	18.2	Hori.
2	830.250	32.5	22.3	9.0	30.4	33.4	46.0	12.6	Hori.
3	830.250	31.2	22.3	9.0	30.4	32.1	46.0	13.9	Vert.
4	960.000	21.0	25.2	9.3	30.2	25.3	46.0	20.7	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	4649.401	45.1	37.9	3.7	48.8	41.6	73.9	53.9	25.1	12.3	Hori.
2	3154.950	46.6	38.1	0.5	47.1	38.6	73.9	53.9	26.8	15.3	Vert.
3	3487.051	46.1	37.5	0.8	46.9	38.3	73.9	53.9	27.0	15.6	Vert.
4	4649.401	46.3	39.3	3.7	50.0	43.0	73.9	53.9	23.9	10.9	Vert.

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	41.2	17.8	8.2	29.5	37.7	46.0	8.3	Hori.
2	991.880	36.4	24.3	9.4	30.1	40.0	53.9	13.9	Hori.
3	495.940	37.6	17.8	8.2	29.5	34.1	46.0	11.9	Vert.
4	960.000	21.0	25.2	9.3	30.2	25.3	46.0	20.7	Vert.
5	991.880	33.7	24.3	9.4	30.1	37.3	53.9	16.6	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	1487.820	52.7	48.9	-6.6	46.1	42.3	73.9	53.9	27.8	11.6	Hori.
2	1487.820	49.5	43.3	-6.6	42.9	36.7	73.9	53.9	31.0	17.2	Vert.
3	3471.580	49.1	43.9	0.8	49.9	44.7	73.9	53.9	24.0	9.2	Vert.
4	3967.521	45.1	36.8	2.5	47.6	39.3	73.9	53.9	26.3	14.6	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	39.9	23.6	9.2	30.3	42.4	46.0	3.6	Hori.
2	925.240	41.2	23.6	9.2	30.3	43.7	46.0	2.3	Vert.
3	960.000	21.0	25.2	9.3	30.2	25.3	46.0	20.7	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	1850.480	51.0	46.9	-5.7	45.3	41.2	73.9	53.9	28.6	12.7	Hori.
2	3700.960	51.8	48.4	1.0	52.8	49.4	73.9	53.9	21.1	4.5	Hori.
3	4626.201	45.1	37.4	3.6	48.7	41.0	73.9	53.9	25.2	12.9	Hori.
4	1850.480	50.3	45.5	-5.7	44.6	39.8	73.9	53.9	29.3	14.1	Vert.
5	3700.960	53.8	51.3	1.0	54.8	52.3	73.9	53.9	19.1	1.6	Vert.
6	4626.201	45.4	37.0	3.6	49.0	40.6	73.9	53.9	24.9	13.3	Vert.

[Test condition]

Day 1

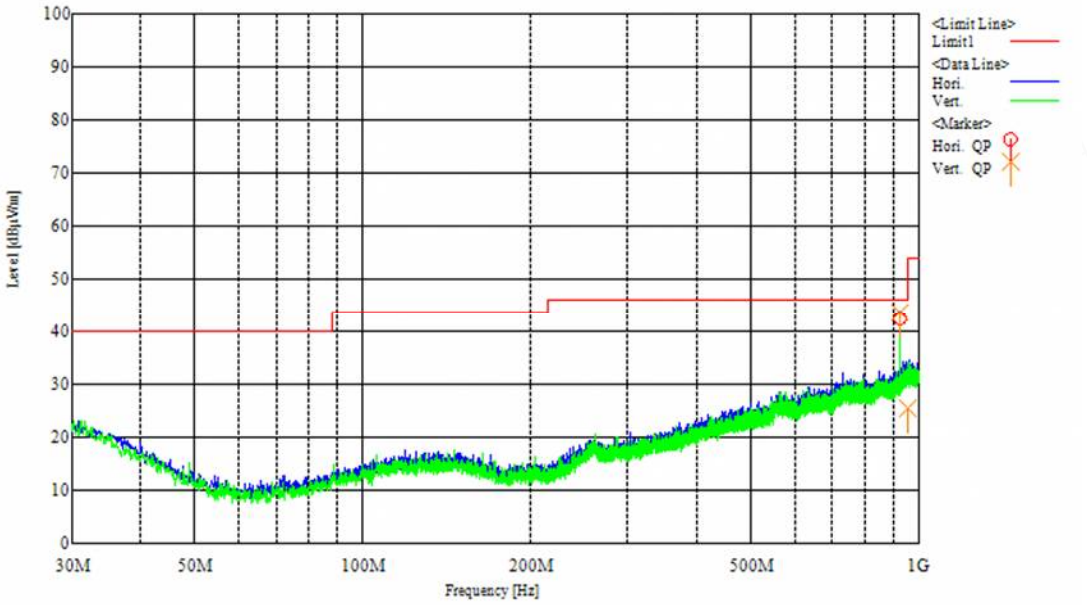
Tested Date: 17 May 2021 Temperature: 18 degC
Humidity: 68 % Atmos. Press: 1001 hPa

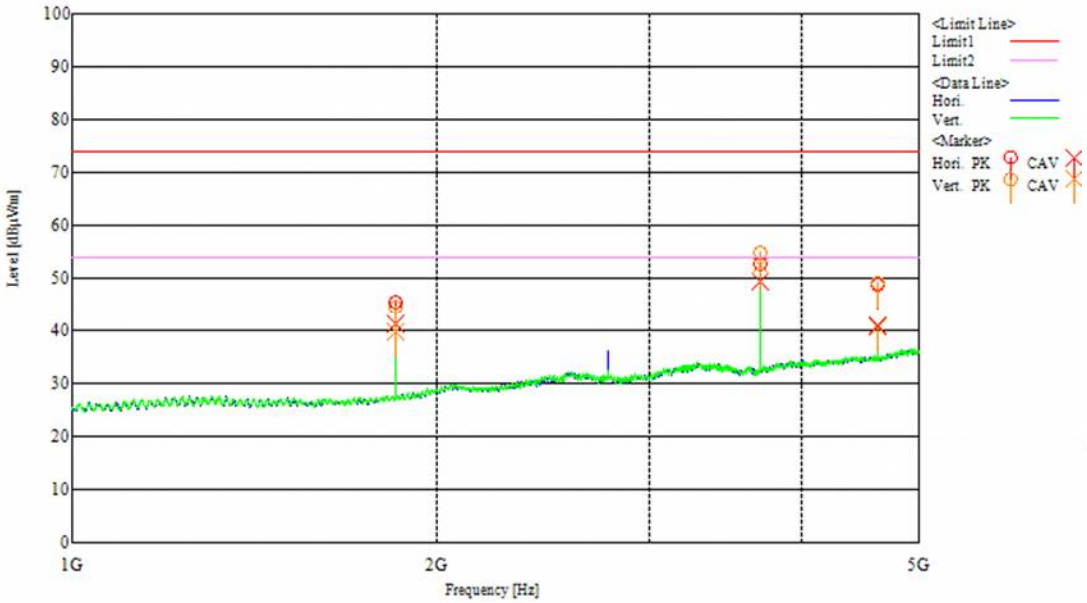
Day 2

Tested Date: 18 May 2021 Temperature: 20 degC
Humidity: 69 % Atmos. Press: 1004 hPa

[Chart (Worst)]

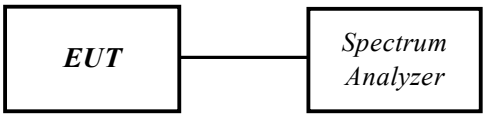
Operating condition: Rx 983.290 MHz





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]

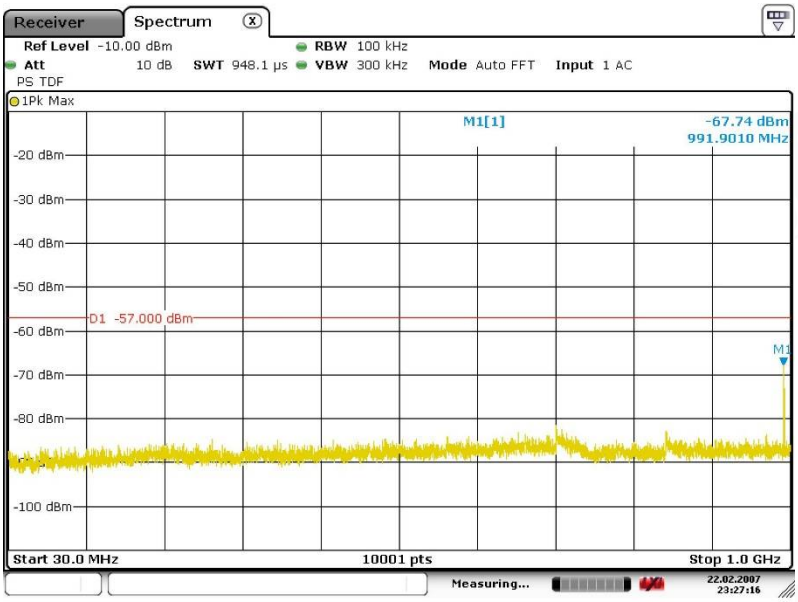
Operating freq. [MHz]	Frequency range 30 - 1000 MHz		Frequency range 1000 - 5000 MHz	
	Freq. [MHz]	Level [dBm]	Freq. [MHz]	Level [dBm]
108.000	830.218	-79.8	4649.440	-75.4
553.990	991.901	-67.7	4959.800	-74.2
983.290	925.269	-69.3	4626.240	-75.1

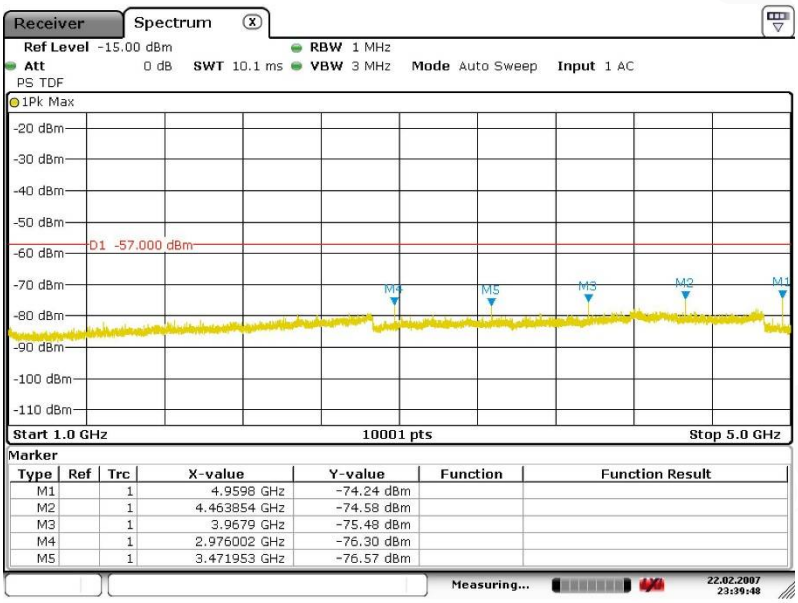
[Test condition]

Tested Date: 18 May 2021 Temperature: 20 degC
Humidity: 69 % Atmos. Press: 1004 hPa

[Chart]

Operating mode: Rx 553.990 MHz (Worst)





Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	4.9598 GHz	-74.24 dBm		
M2		1	4.463854 GHz	-74.58 dBm		
M3		1	3.9679 GHz	-75.48 dBm		
M4		1	2.976002 GHz	-76.30 dBm		
M5		1	3.471953 GHz	-76.57 dBm		

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 grater than average limitation the average detection measurements were performed.

Applicable rule and limitation

§15.107 (b) AC power line conducted limits

Frequency of Emission [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.*

Test Data

[Emission level]

Operating mode: -

	Freq. [MHz]	Reading QP [dBµV]	Reading Ave [dBµV]	Factor [dB]	Result QP [dBµV]	Result Ave [dBµV]	Limit QP [dBµV]	Limit Ave [dBµV]	Margin QP [dB]	Margin Ave [dB]	Line

[Chart]

Operating mode: -

[Test condition]

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

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
BA10	Bilogical 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 (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.