



RADIO TEST REPORT

Test Report No. : 13540266H

Applicant : THAMWAY CO., LTD
Type of EUT : HF Linear Amplifier
Model Number of EUT : DXV600L
FCC ID : 2ANNYDXV600L01
Test regulation : FCC Part 97: 2017
Test Result : Complied (Refer to SECTION 3.2)

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by the A2LA accreditation body.
6. This test report covers Radio technical requirements.
It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
9. The information provided from the customer for this report is identified in Section 1.

Date of test: December 8, 2020

Representative test engineer:

T. Nakagawa
Tomohisa Nakagawa
Engineer
Consumer Technology Division

Approved by:

T. Shimada
Takumi Shimada
Engineer
Consumer Technology Division



CERTIFICATE 5107.02

- ☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.
☒ There is no testing item of "Non-accreditation".

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REVISION HISTORY

Original Test Report No.: 13540266H

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13540266H	December 24, 2020	-	-

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SECTION 1: Customer information

Company Name	:	THAMWAY CO., LTD
Address	:	3-9-2 Imaizumi, Fuji Shizuoka, 417-0001, Japan
Telephone Number	:	+81-545-53-8965
Facsimile Number	:	+81-545-53-8978
Contact Person	:	Junichi Ohashi

The information provided from the customer is as follows;

- Applicant, Type of EUT, Model Number of EUT, FCC ID on the cover and other relevant pages
- Operating/Test Mode(s) (Mode(s)) on all the relevant pages
- SECTION 1: Customer information
- SECTION 2: Equipment under test (EUT) other than the Receipt Date
- SECTION 4: Operation of EUT during testing

* The laboratory is exempted from liability of any test results affected from the above information in SECTION 2 and 4.

SECTION 2: Equipment under test (EUT)

2.1 Identification of EUT

Type	:	HF Linear Amplifier
Model Number	:	DXV600L
Serial Number	:	Refer to Section 4, Clause 4.2
Rating	:	AC 100 V to 120 V, 60 Hz
Receipt Date	:	December 7, 2020
Country of Mass-production	:	Japan
Condition	:	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	:	No Modification by the test lab

2.2 Product Description

Model: DXV600L (referred to as the EUT in this report) is a HF Linear Amplifier.

Radio Specification

Radio Type	:	External RF power amplifier
Frequency of Operation /	:	1800 kHz - 2000 kHz, 600 W
Specific operating power level	:	3500 kHz - 4000 kHz, 600 W
	:	7000 kHz - 7300 kHz, 600 W
	:	10100 kHz - 10150 kHz, 450 W
	:	14000 kHz - 14350 kHz, 400 W
	:	18068 kHz - 18168 kHz, 400 W
	:	21000 kHz - 21450 kHz, 300 W
Types of emission	:	A3E (AM), J3E (SSB), A1A (CW), F1B (RTTY)
Power Supply (radio part input)	:	AC 120 V, 7 A
Clock frequency (Maximum)	:	N/A, The EUT does not have a microcomputer part.

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 97: 2017

Title : FCC 47CFR Part 97 AMATEUR RADIO SERVICE

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Spurious Emission	[FCC] Section 2.1051	[FCC] Section 97.317 (a) (1) Section 97.307 (d)	See data.	Complied a)	Conducted
RF Power Gain	[ANSI/TIA-603-E-2016] Section 2.2.1	[FCC] Section 97.317 (a) (2) Section 97.317 (a) (3)	See data.	Complied b)	Conducted

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420.

*These tests were also referred to ANSI/TIA-603-E-2016 "Land Mobile FM or PM Communications Equipment Measurement and Performance Standards".

a) Refer to APPENDIX 1 (Spurious Emission)

b) Refer to APPENDIX 1 (RF Power Gain)

Symbols:

Complied The data of this test item has enough margin, more than the measurement uncertainty.

Complied# The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.

3.3 Addition to standard

No addition, exclusion nor deviation has been made from the standard.

3.4 Uncertainty

EMI

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor $k=2$.

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Antenna Terminal test

Test Item	Uncertainty (+/-)
RF output power	1.4 dB
Conducted Spurious Emission	2.6 dB

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3.5 Test Location

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*A2LA Certificate Number: 5107.02 / FCC Test Firm Registration Number: 199967 / ISED Lab Company Number: 2973C

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Test site	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.5 measurement room	6.4 x 6.4 x 3.0	6.4 x 6.4	-	-
No.6 shielded room	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	3.1 x 5.0 x 2.7	3.1 x 5.0	-	-
No.9 measurement room	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.11 measurement room	6.2 x 4.7 x 3.0	4.8 x 4.6	-	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0 m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

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SECTION 4: Operation of E.U.T. during testing

4.1 Operating Mode(s)

Mode	Remarks
Transmitting (Tx)	Transmitting duty was 100 % on all tests.
Standby	-
To operate EUT at its specific operating power level, following settings were applied. - The exciter RF output power was applied to the EUT input port, and increased the exciter output level until the EUT satisfies the rated RF power level. - The ALC (Auto Level Control) function was not used to avoid power reduction.	

*The details of Operating mode(s)

Test Item	Operating Mode	Tested frequency	Remarks
Spurious Emission	Tx, AMP switch: ON (Tx, AMP ON) Tx, AMP switch: OFF (Tx, AMP OFF)	1900 kHz 3750 kHz 7150 kHz 10125 kHz 14175 kHz 18118 kHz 21225 kHz	-
	Standby, AMP switch: OFF (Standby)	-	-
RF Power Gain	Tx, AMP ON Tx, AMP OFF	1900 kHz 3750 kHz 7150 kHz 10125 kHz 14175 kHz 18118 kHz 21225 kHz 26000 kHz 27000 kHz 28000 kHz	-
These tests were performed on the center frequency of each operation band, according to the Section 2.1060 (b) except for the frequency range 26 MHz to 28 MHz.			

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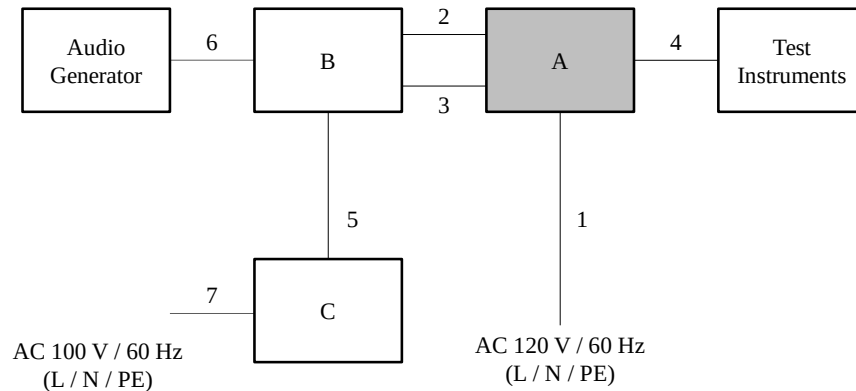
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4.2 Configuration and peripherals



* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	HF Linear Amplifier	DXV600L	20P0069	THAMWAY CO., LTD	EUT
B	Exciter	IC-756PROIII	3101412	Icom Inc.	*1)
C	DC Power Supply	-	-	-	-

*1) The exciter was used for all tests except for the frequency range 26 MHz - 28 MHz, because it does not work on this frequency range. When testing on frequency range 26 MHz - 28 MHz, a combination of a signal generator and an amplifier was used as an exciter.

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	AC Cable	3.0	Unshielded	Unshielded	-
2	RF Coaxial Cable	2.3	Shielded	Shielded	-
3	Tx Control Cable	1.5	Shielded	Shielded	-
4	RF Coaxial Cable	0.5	Shielded	Shielded	-
5	DC Cable	0.6	Unshielded	Unshielded	-
6	Signal Cable	1.5	Shielded	Shielded	-
7	AC Cable	3.0	Unshielded	Unshielded	-

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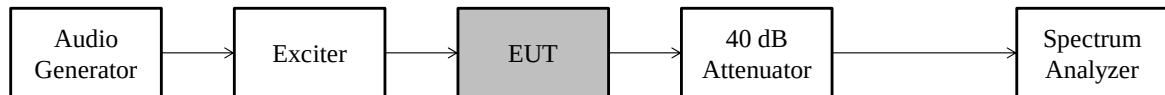
Facsimile : +81 596 24 8124

SECTION 5: Spurious Emission

Test Procedure

The test was performed with connection below.

Test Setup



[Spectrum analyzer settings]

Frequency	9 kHz - 150 kHz	150 kHz - 30 MHz	30 MHz - 1000 MHz
RBW	200 Hz	10 kHz	100 kHz
VBW	620 Hz	30 kHz	300 kHz
Detector	Peak	Peak	Peak
Trace mode	Max hold	Max hold	Max hold

Peak detector and Max hold were applied as Worst-case measurement.

[Exciter settings]

Modulation	Single sideband, J3E (A3J)
Input signal	Two tone signals, 400 Hz and 1800 Hz sine wave
Input level	Necessary to produce rated peak envelope power

These settings were according to the Section 2.1051 (2.1049). This modulation is the worst case in actual operation.

In addition, intermodulation distortions were measured for the purpose of reference. These plots show that EUT does not cause splatter interference outside the necessary bandwidth. (Section 97.307 (a) and (b))

The test results are rounded off to two decimals place, so some differences might be observed.

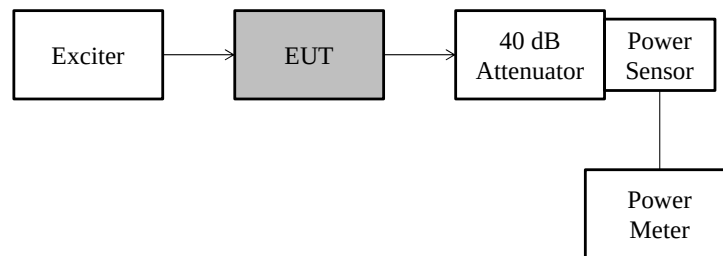
Measurement range : 9 kHz - 10th harmonic of the highest fundamental frequency
Test data : APPENDIX
Test result : Pass

SECTION 6: RF Power Gain

Test Procedure

The test was performed with connection below.

Test Setup



Instrument used: Power Meter (P/M)

[Exciter settings]

Modulation	None, Continuous Wave, A1A
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This setting is the most appropriate setting to test the RF Power Gain.

The test results are rounded off to two decimals place, so some differences might be observed.

Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

Spurious Emission

Test place Ise EMC Lab. No.6 Measurement Room
Report No. 13540266H
Date December 8, 2020
Temperature / Humidity 24 deg. C / 27 % RH
Engineer Tomohisa Nakagawa
Mode Tx, AMP ON

Tx Freq. [kHz]	Reading		Loss		Level [dBm]	Result [dBc]	Limit [dBc]	Margin [dB]
	Freq. [MHz]	Level [dBm]	Cable 1 [dB]	Atten. [dB]				
1900	1.9022	18.616	0.03	40.31	58.97	Carrier	-	-
	0.0450	-62.651	0.00	40.31	-22.33	81.30	43	38.30
	2.3589	-45.488	0.03	40.31	-5.14	64.10	43	21.10
	3.8036	-47.047	0.04	40.31	-6.68	65.64	43	22.64
	5.7051	-47.529	0.05	40.31	-7.15	66.12	43	23.12
	20.9137	-56.407	0.10	40.31	-15.96	74.92	43	31.92
	26.6150	-57.004	0.11	40.31	-16.54	75.51	43	32.51
3750	3.7499	19.033	0.04	40.31	59.40	Carrier	-	-
	0.0126	-66.510	0.00	40.30	-26.21	85.61	43	42.61
	4.2066	-46.530	0.04	40.31	-6.16	65.56	43	22.56
	7.5021	-38.744	0.06	40.31	1.65	57.76	43	14.76
	11.2572	-41.361	0.07	40.31	-0.95	60.35	43	17.35
	15.0034	-60.729	0.08	40.31	-20.31	79.71	43	36.71
	22.5077	-41.831	0.10	40.31	-1.38	60.78	43	17.78
7150	45.0160	-46.259	0.15	40.31	-5.74	65.14	43	22.14
	7.1528	19.438	0.05	40.31	59.82	Carrier	-	-
	0.0182	-72.488	0.00	40.30	-32.19	92.01	43	49.01
	14.3049	-42.931	0.08	40.31	-2.51	62.33	43	19.33
	21.4539	-58.192	0.10	40.31	-17.74	77.56	43	34.56
	28.6060	-45.327	0.11	40.31	-4.87	64.69	43	21.69
	42.9150	-45.887	0.14	40.31	-5.39	65.21	43	22.21
10125	10.1259	17.788	0.07	40.31	58.20	Carrier	-	-
	0.0182	-72.857	0.00	40.30	-32.56	90.76	43	47.76
	20.2510	-48.442	0.09	40.31	-8.00	66.20	43	23.20
	30.3840	-43.674	0.12	40.31	-3.19	61.39	43	18.39
	40.5120	-44.579	0.14	40.31	-4.08	62.28	43	19.28
	60.7680	-47.013	0.17	40.30	-6.47	64.67	43	21.67
	91.1520	-50.216	0.22	40.28	-9.64	67.83	43	24.83
14175	131.652	-49.247	0.27	40.25	-8.63	66.83	43	23.83
	14.1765	18.094	0.08	40.31	58.51	Carrier	-	-
	0.0294	-73.051	0.00	40.30	-32.75	91.27	43	48.27
	14.6332	-39.998	0.08	40.31	0.42	58.09	43	15.09
	28.3523	-37.986	0.11	40.31	2.47	56.04	43	13.04
	42.528	-49.493	0.14	40.31	-8.99	67.51	43	24.51
	56.712	-45.151	0.17	40.30	-4.62	63.14	43	20.14
18118	85.056	-41.342	0.21	40.28	-0.77	59.29	43	16.29
	18.1197	17.371	0.09	40.31	57.81	Carrier	-	-
	0.1436	-72.762	0.01	40.31	-32.43	90.24	43	47.24
	36.256	-42.365	0.13	40.31	-1.88	59.69	43	16.69
	72.483	-47.683	0.19	40.30	-7.12	64.93	43	21.93
	108.710	-45.922	0.24	40.27	-5.32	63.13	43	20.13
	21.2271	17.110	0.10	40.31	57.56	Carrier	-	-
21225	0.0196	-71.954	0.00	40.30	-31.65	89.21	43	46.21
	42.452	-38.252	0.14	40.31	2.25	55.31	43	12.31
	84.912	-40.276	0.21	40.28	0.29	57.27	43	14.27

Sample calculation: Level = Level Reading + Cable 1 Loss + Attenuator Loss + Cable 2 Loss
Result = Carrier Level - Spurious Level

Limit: Section 97.317 (a) (1), 97.307 (d)

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Spurious Emission

Test place Ise EMC Lab. No.6 Measurement Room
Report No. 13540266H
Date December 8, 2020
Temperature / Humidity 24 deg. C / 27 % RH
Engineer Tomohisa Nakagawa
Mode Standby AMP Off

Mode	Reading		Cable 1 [dB]	Loss		Level [dBm]
	Freq. [MHz]	Level [dBm]		Atten. [dB]	Cable 2 [dB]	
Standby	0.1363	-91.77	0.01	40.31	0.01	-51.44
	0.1590	-81.37	0.01	40.31	0.01	-41.04
	217.440	-79.97	0.37	40.16	0.13	-39.31

Sample calculation:

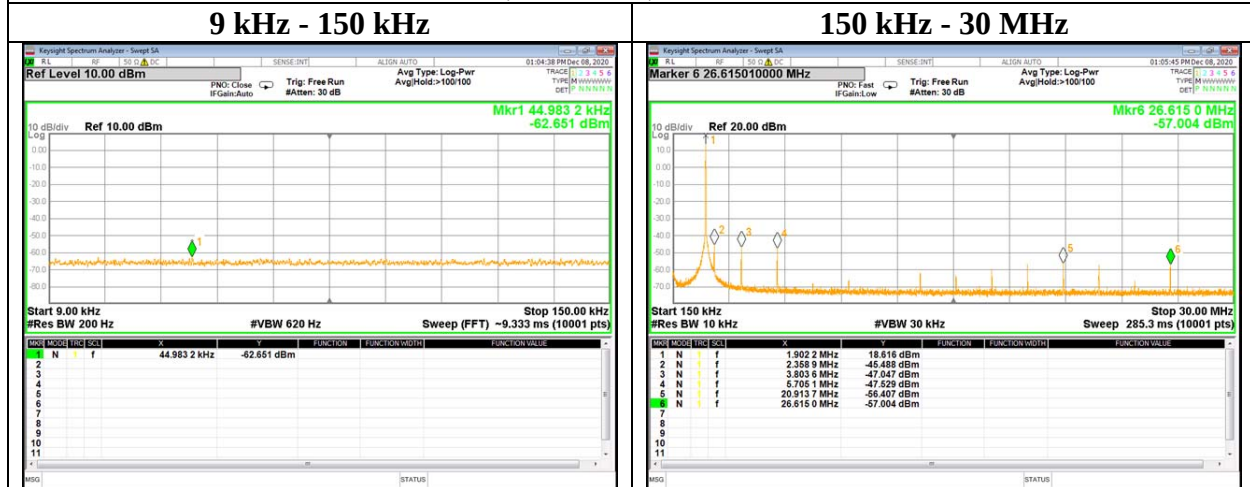
$$\text{Level} = \text{Level Reading} + \text{Cable 1 Loss} + \text{Attenuator Loss} + \text{Cable 2 Loss}$$

Requirement Section 97.317 (a) (1), 97.307 (d)

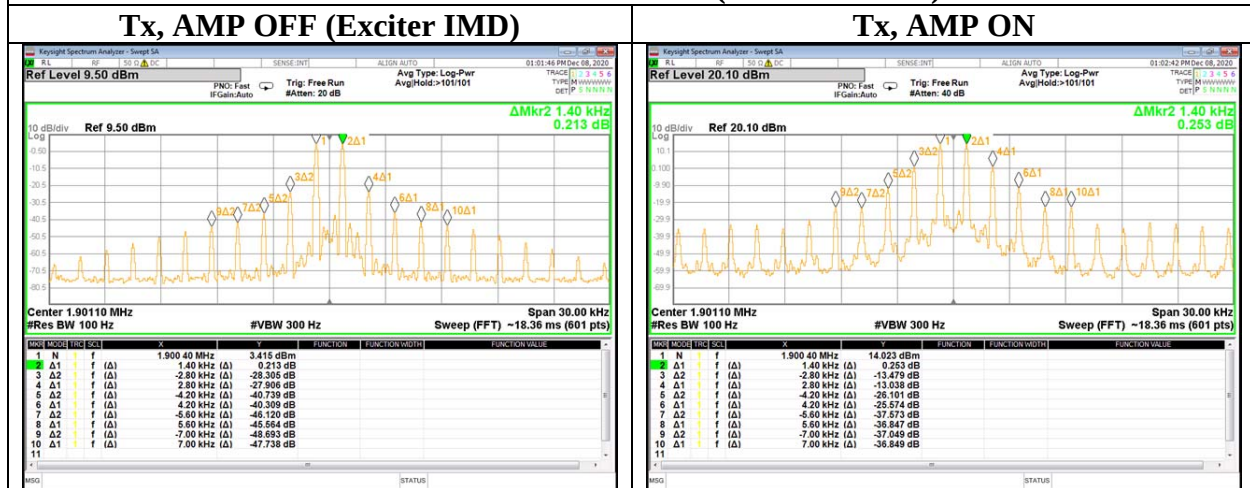
Limit: Not applicable

Spurious Emission

Tx, AMP ON, 1900 kHz



Intermodulation Distortions (Reference data)



The analyzer reference level was set to the 6 dB above the peak marker.

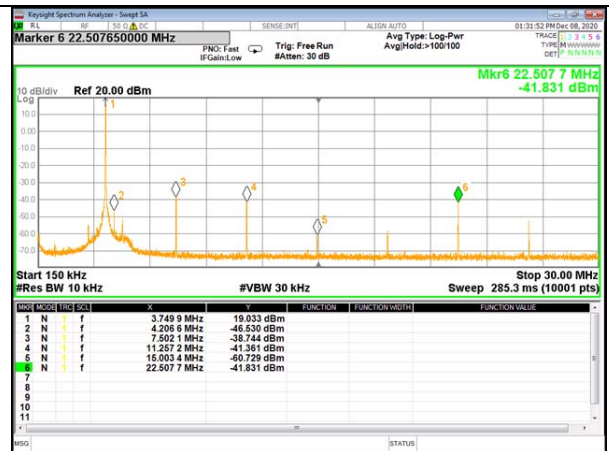
Spurious Emission

Tx, AMP ON, 3750 kHz

9 kHz - 150 kHz



150 kHz - 30 MHz

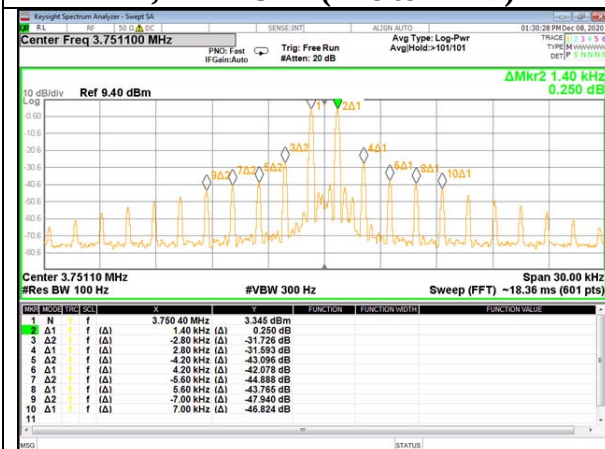


30 MHz - 50 MHz

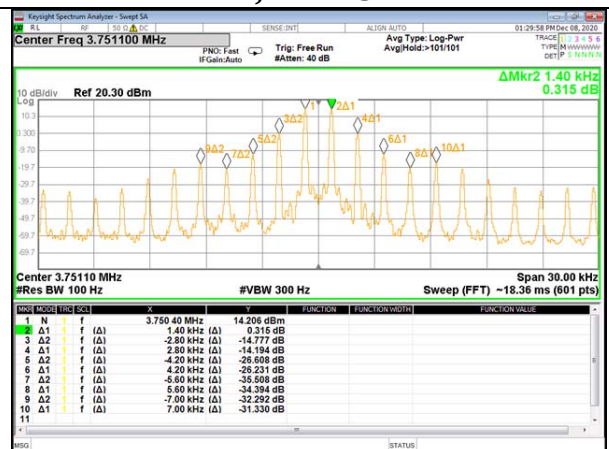


Intermodulation Distortions (Reference data)

Tx, AMP OFF (Exciter IMD)



Tx, AMP ON



The analyzer reference level was set to the 6 dB above the peak marker.

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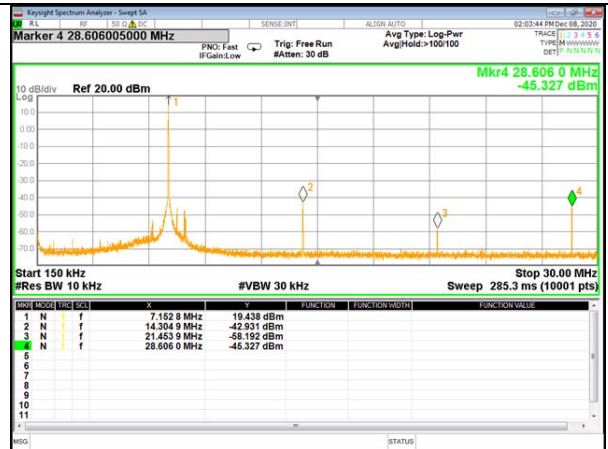
Spurious Emission

Tx, AMP ON, 7150 kHz

9 kHz - 150 kHz



150 kHz - 30 MHz

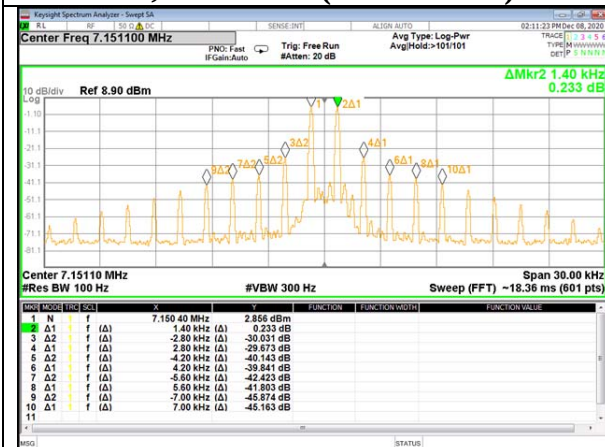


30 MHz - 100 MHz

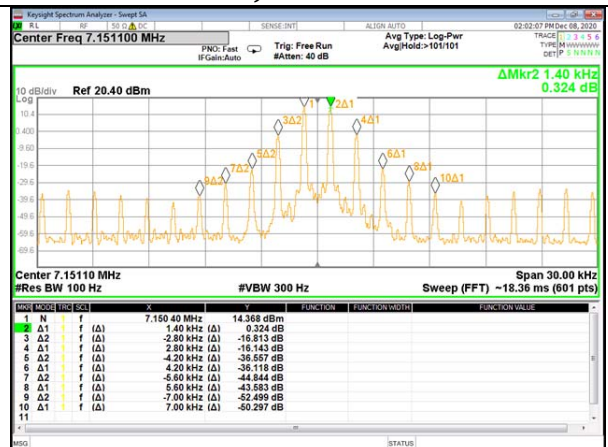


Intermodulation Distortions (Reference data)

Tx, AMP OFF (Exciter IMD)



Tx, AMP ON



The analyzer reference level was set to the 6 dB above the peak marker.

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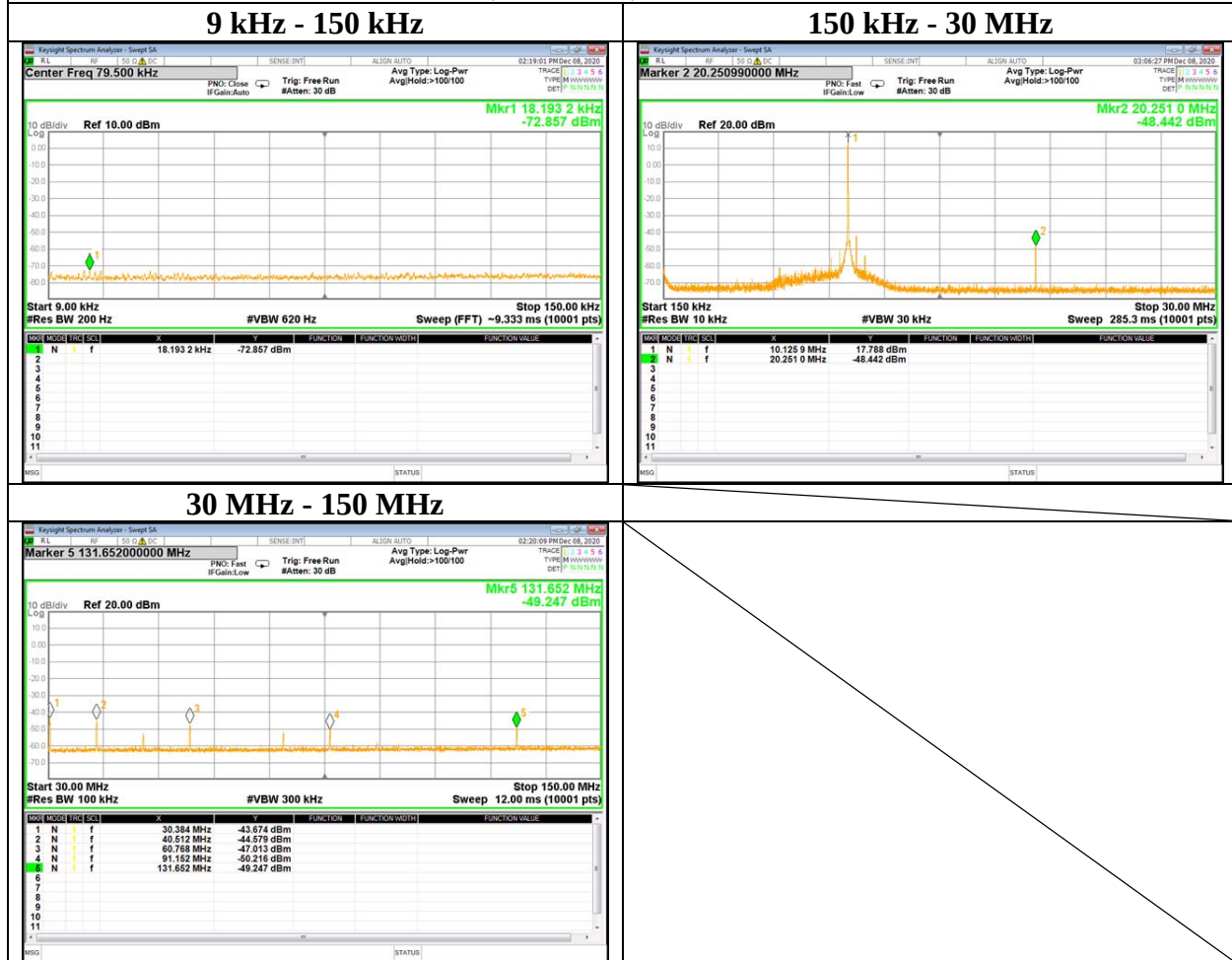
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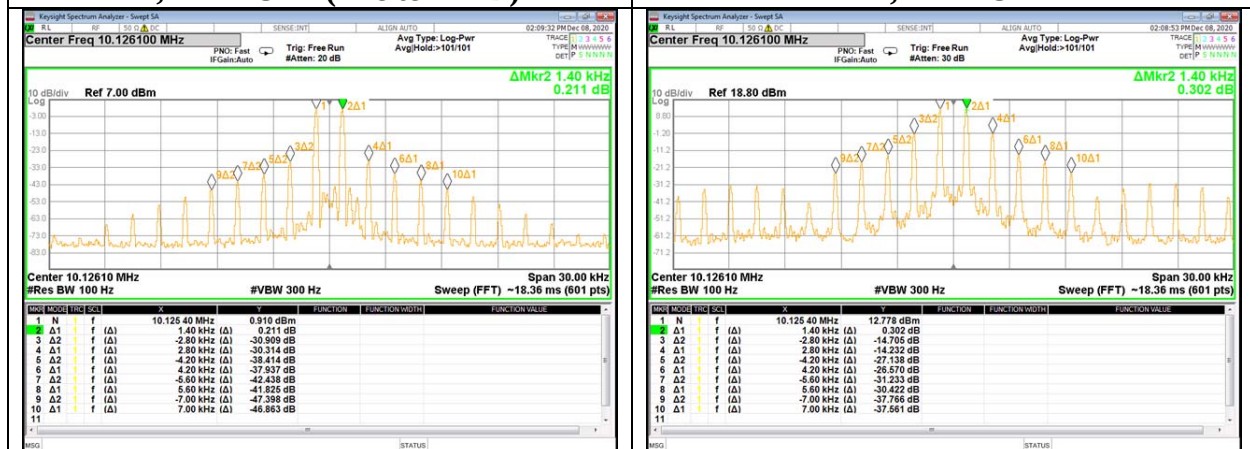
Spurious Emission

Tx, AMP ON, 10125 kHz



Intermodulation Distortions (Reference data)

Tx, AMP OFF (Exciter IMD)



The analyzer reference level was set to the 6 dB above the peak marker.

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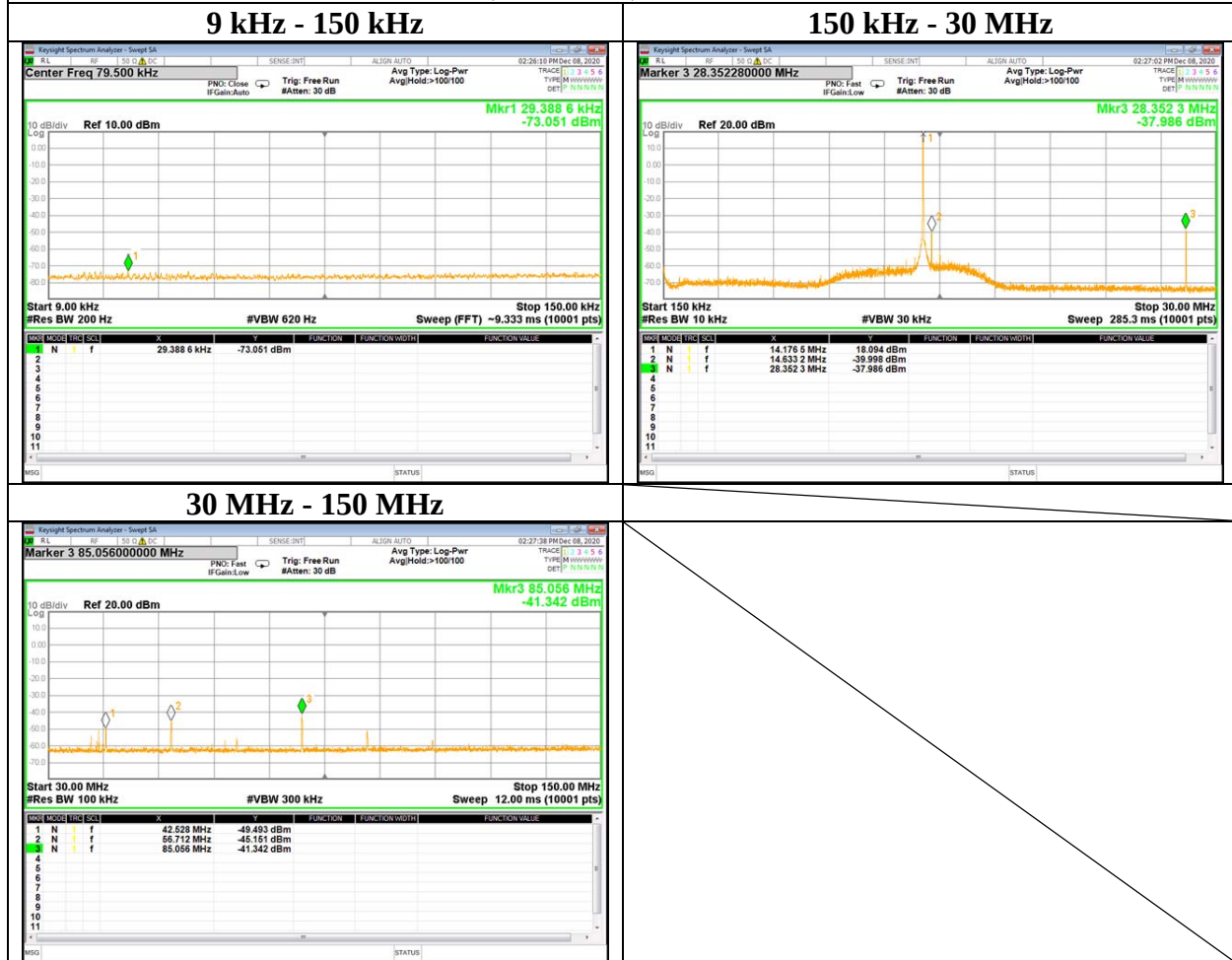
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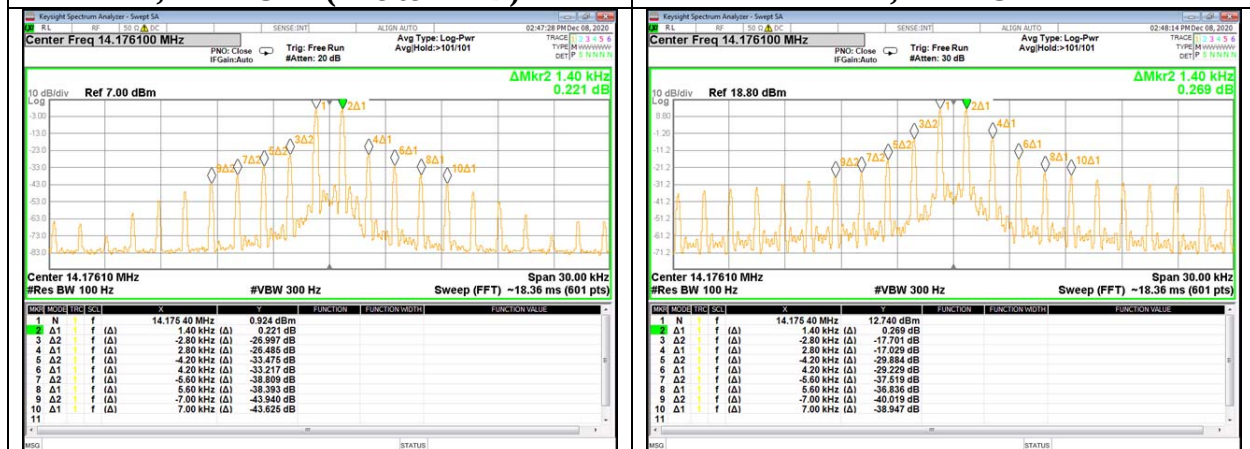
Spurious Emission

Tx, AMP ON, 14175 kHz



Intermodulation Distortions (Reference data)

Tx, AMP OFF (Exciter IMD)



The analyzer reference level was set to the 6 dB above the peak marker.

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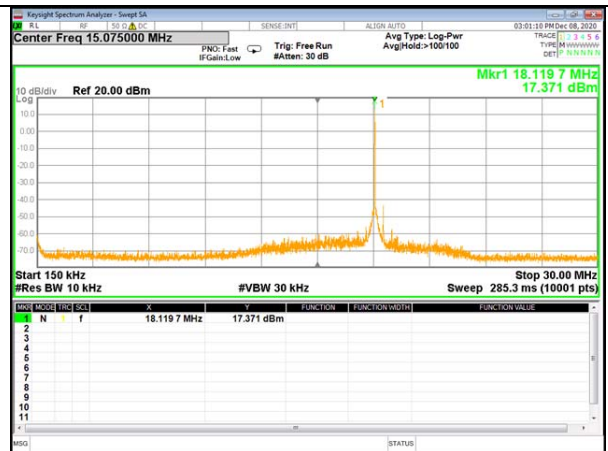
Spurious Emission

Tx, AMP ON, 18118 kHz

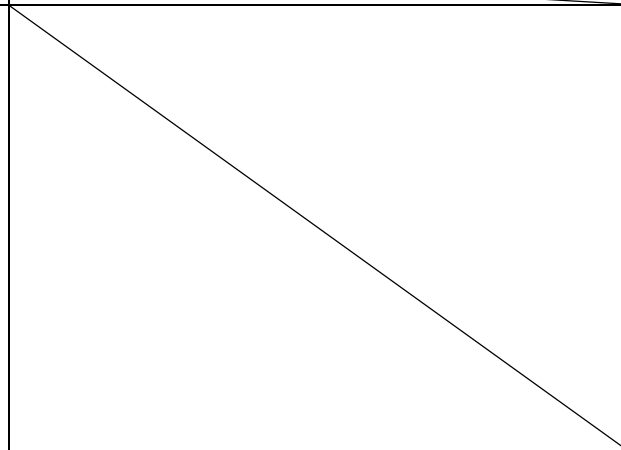
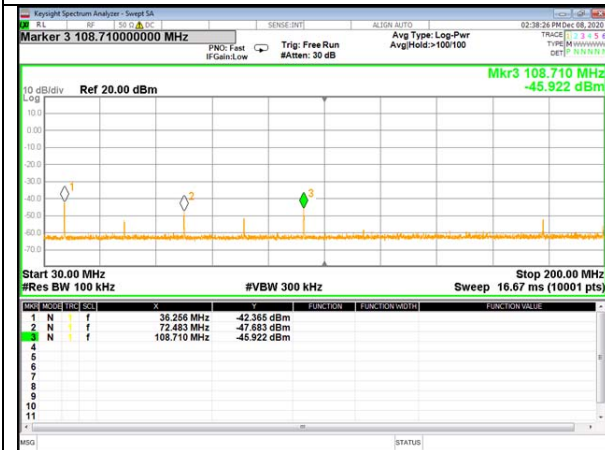
9 kHz - 150 kHz



150 kHz - 30 MHz

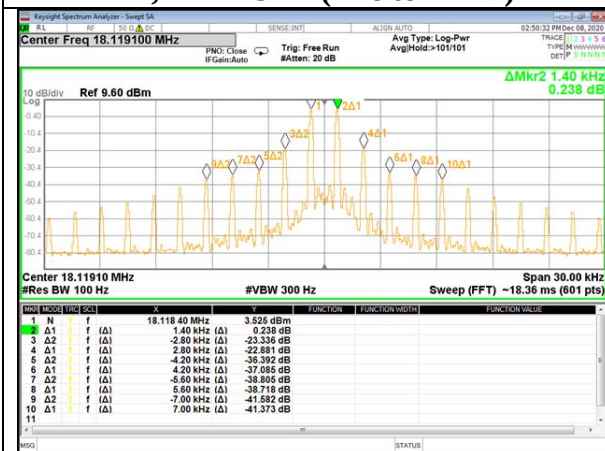


30 MHz - 200 MHz

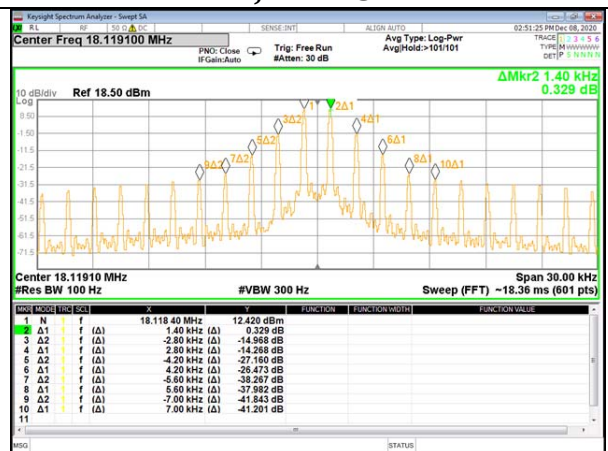


Intermodulation Distortions (Reference data)

Tx, AMP OFF (Exciter IMD)



Tx, AMP ON



The analyzer reference level was set to the 6 dB above the peak marker.

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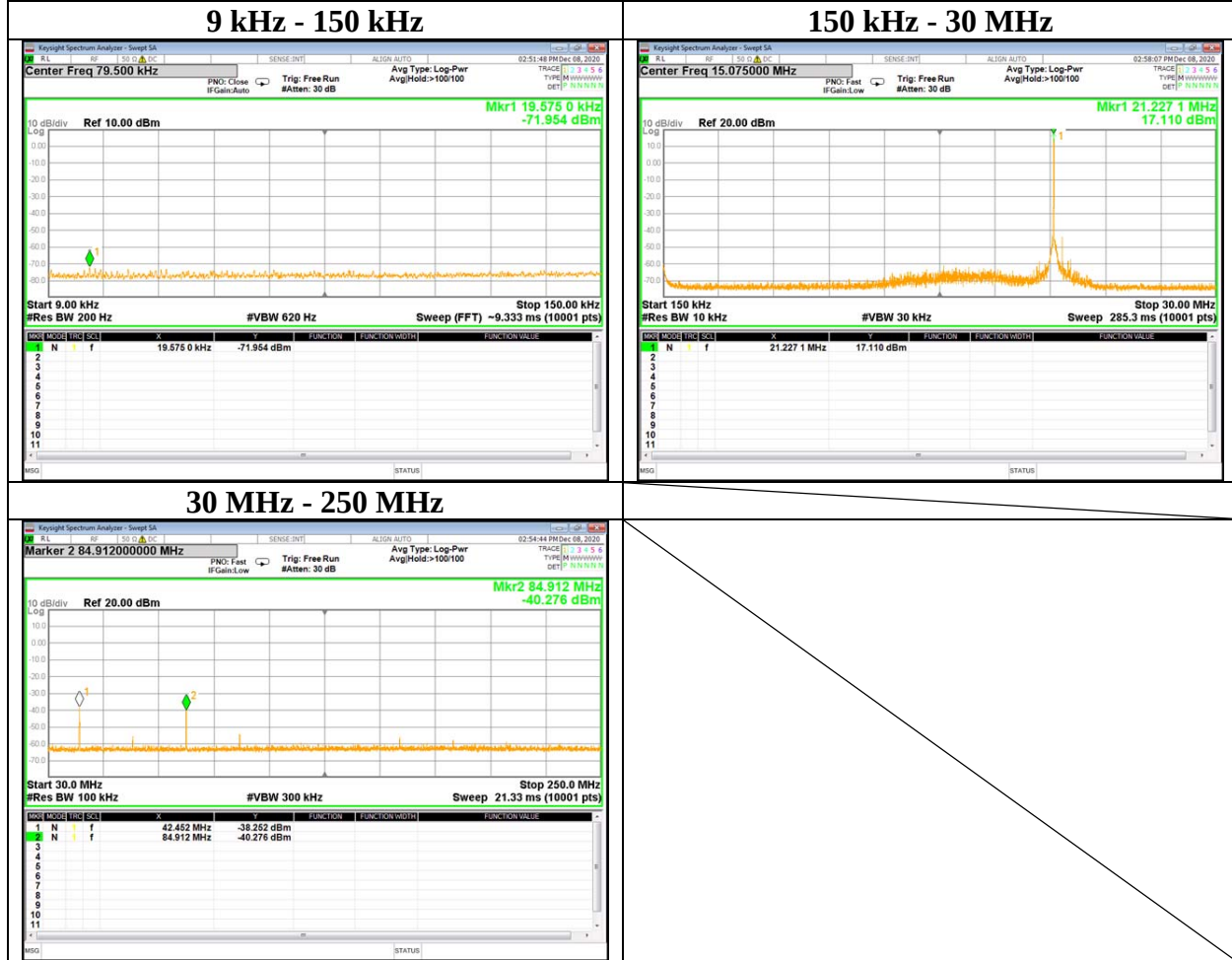
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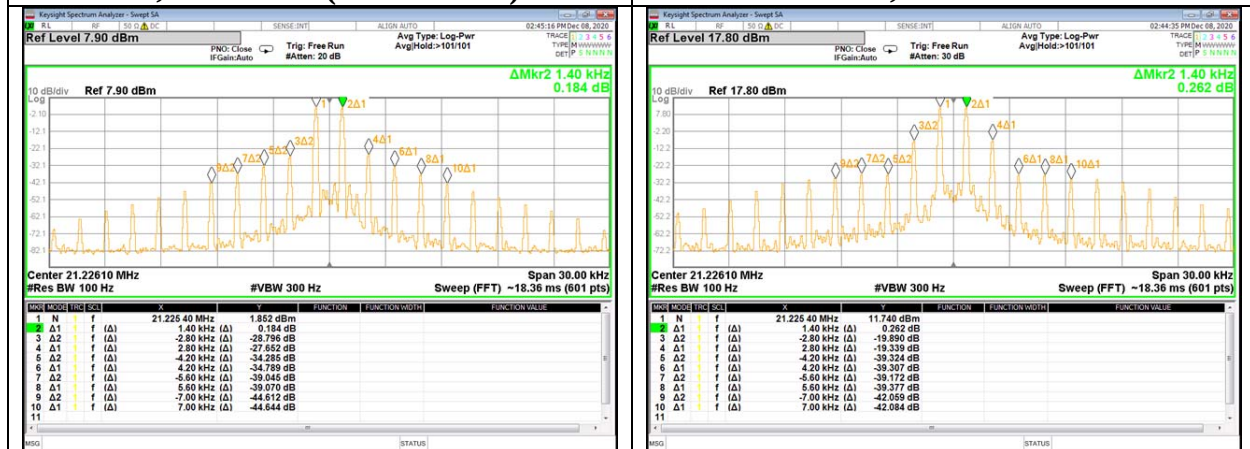
Spurious Emission

Tx, AMP ON, 21225 kHz



Intermodulation Distortions (Reference data)

Tx, AMP OFF (Exciter IMD)



The analyzer reference level was set to the 6 dB above the peak marker.

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Spurious Emission

Standby

9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 250 MHz



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RF Power Gain

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	13540266H
Date	December 8, 2020
Temperature / Humidity	24 deg. C / 27 % RH
Engineer	Tomohisa Nakagawa
Mode	Tx, AMP ON/OFF

Operation Band

Tested Freq. [kHz]	Power Meter Reading		Result [dB]	Gain		Loss		Output Power		Specific power level [W]
	AMP OFF [dBm]	AMP ON [dBm]		Limit [dB]	Margin [dB]	Cable [dB]	Atten. [dB]	[dBm]	[W]	
1900	3.77	17.50	13.73	15	1.27	0.01	40.31	57.82	605.3	600
3750	4.33	17.53	13.20	15	1.80	0.02	40.31	57.86	610.9	600
7150	3.87	17.52	13.65	15	1.35	0.02	40.31	57.85	609.5	600
10125	2.07	16.24	14.17	15	0.83	0.03	40.31	56.58	455.0	450
14175	2.93	15.70	12.77	15	2.23	0.03	40.31	56.04	401.8	400
18118	4.29	15.70	11.41	15	3.59	0.04	40.31	56.05	402.7	400
21225	2.35	14.50	12.15	15	2.85	0.04	40.31	54.85	305.5	300

Sample calculation: Gain Result = P/M Reading "AMP ON" - P/M Reading "AMP OFF"

Output Power = P/M Reading "AMP ON" + Cable Loss + Attenuator Loss

Limit: Section 97.317 (a) (2)

Prohibited Band

Tested Freq. [kHz]	Power Meter Reading		Result [dB]	Gain	
	AMP OFF [dBm]	AMP ON [dBm]		Limit [dB]	Margin [dB]
26000	-27.78	-67.80	-40.02	0	40.02
27000	-27.79	-68.90	-41.11	0	41.11
28000	-27.80	-65.70	-37.90	0	37.90

Sample calculation: Gain Result = P/M Reading "AMP ON" - P/M Reading "AMP OFF"

Limit: Section 97.317 (a) (3)

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APPENDIX 2: Test instruments

Test equipment

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
AT	MOS-14	141561	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	1401	2020/01/07	12
AT	MMM-12	141547	DIGITAL HiTESTER	Hioki	3805	60500120	2020/02/03	12
AT	MJM-24	142225	Measure	ASKUL	-	-	-	-
AT	MSG-02	141905	Signal Generator	Rohde & Schwarz	SML03	100332	2020/09/23	12
AT	MRENT-146	185691	Spectrum Analyzer	Keysight Technologies Inc	N9020A	MY55400351	2020/09/23	12
AT	MPM-10	141807	Dual Power Meter	Hewlett Packard	E4419A (=EPM-442A)	GB37170359	2020/07/08	12
AT	MPSE-14	141827	Power Sensor	Hewlett Packard	ECP-E18A (=E4412A)	US37181064	2020/07/08	12
AT	MPM-15	141811	Power Meter	Keysight Technologies Inc	N1914A	MY53060017	2020/06/10	12
AT	MPSE-21	141834	Power sensor	Keysight Technologies Inc	N8482H	MY52460010	2020/06/10	12
AT	MCC-64	141327	Coaxial Cable	UL Japan	-	-	2020/02/04	12
AT	MCC-38	141395	Coaxial Cable	UL Japan	-	-	2020/11/17	12
AT	CAT40-04	158263	RF Device, Passive, Attenuator	All	All	DT991	2020/08/31	12
AT	MFG-04	141500	Function Generator	Keysight Technologies Inc	33612A	MY53400159	2020/01/14	12
AT	MCC-128	141221	Coaxial Cable	Suhner	NRG180	-	2020/08/20	12

***Hyphens for Last Calibration Date and Cal Int (month) are instruments that Calibration is not required (e.g. software), or instruments checked in advance before use.**

The expiration date of the calibration is the end of the expired month.

As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

Test Item: AT: Antenna Terminal Conducted test

UL Japan, Inc.

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