RADIO TEST REPORT

Test Report No. : 12244307H-A

Applicant	:	**Sony Corporation**
Type of Equipment	:	**UHF Synthesized Transmitter**
Model No.	:	**UTX-B03**
FCC ID	:	**AK8UTXB03**
Test regulation	:	**FCC Part 74: 2018**
Test Result	:	**Complied**

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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 above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
6. The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.
7. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Date of test: May 24 to June 23, 2018

Representative test engineer:
K. Yamamoto
Koji Yamamoto
Engineer
Consumer Technology Division

Approved by:
T. Takayama
Tsubasa Takayama
Leader
Consumer Technology Division

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☒ There is no testing item of "Non-accreditation".

REVISION HISTORY

Original Test Report No.: 12244307H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	12244307H-A	August 24, 2018	-	-

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SECTION 1: Customer information

Company Name	:	Sony Global Manufacturing & Operations Corporation
Address	:	8-4 Shiomi Kisarazu-shi, Chiba, 292-0834 Japan
Telephone Number	:	+81-438-37-4704
Contact Person	:	Youhei Hisano

*Remarks
Sony Global Manufacturing & Operations Corporation (Subsidiary Company Name) is on behalf of the applicant: Sony Corporation.

SECTION 2: Equipment under test (E.U.T.)

2.1 Identification of E.U.T.

Type of Equipment	:	UHF Synthesized Transmitter
Model No.	:	UTX-B03
Serial No.	:	Refer to 4.2 in this report.
Rating	:	DC 3V (Battery), DC 5V (USB)
Receipt Date of Sample	:	May 23, 2018
Country of Manufacture	:	Korea
Condition of EUT	:	Engineering prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT	:	No Modification by the test lab

2.2 Product Description

Model No: UTX-B03 (referred to as the EUT in this report) is the UHF SYNTHESIZED TRANSMITTER.

Radio Specification

Radio type	:	Transmitter
Modulation type	:	Frequency modulation
Emission designator	:	116KF3E
Necessary bandwidth	:	116 kHz = 2M + 2D where M: Maximum modulation frequency = 18 kHz D: Peak deviation = 40 kHz
Channel spacing	:	125 kHz
Frequency of operation	:	470.125 MHz - 607.875 MHz (14) 470.125 MHz - 541.875 MHz (25) 536.125 MHz - 607.875 MHz
Clock frequency(ies)	:	PLL: 19.2 MHz (TCXO)
RF power	:	High: 30 mW, Low: 5 mW
Antenna type	:	1/4 Lambda Monopole antenna (whip type)
Antenna gain	:	2.14 dBi
Power Supply (radio part input)	:	DC 3.3 V, DC 5.5 V
AF Specification	:	40 Hz - 18000 Hz, Maximum input: -24 dBV (MIC level, ATT 0 dB)

Variant model

This model has a variant model: UTX-B03HR.
The difference of them is that only micro input terminal (Change of HIROSE connector from BMP connector).

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 74: 2018

Title : FCC 47CFR Part74
EXPERIMENTAL RADIO, AUXILIARY, SPECIAL BROADCAST AND OTHER PROGRAM DISTRIBUTIONAL SERVICES

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
RF power output	FCC: Section 2.1046 IC: RSS-Gen Section 6.12 RSS-210 A1 Section 5.1	FCC: Section 74.861 (e) (1) IC: RSS-210 G 3.1	See data.	Complied	Conducted
Modulation Characteristics	FCC: Section 2.1047 IC: RSS-210 A1 Section 5.3	FCC: Section 74.861 (e) (3) IC: RSS-210 G 3.5	See data.	Complied	Conducted
Occupied Bandwidth	FCC: Section 2.1049 IC: RSS-Gen Section 6.6	FCC: Section 74.861 (e) (5) IC: RSS-210 G 3.2	See data.	Complied	Conducted
Spurious emissions at antenna terminals	EN 300 422-1 V 1.4.2 Clause 8.4	FCC: Section 74.861 (e) (6) IC: RSS-210 G 3.4	See data.	Complied	Conducted
Necessary bandwidth	EN 300 422-1 V 1.4.2 Clause 8.3	FCC: Section 74.861 (e) (7) IC: RSS-210 G 3.4	See data.	Complied	Conducted
Field strength of spurious radiation	EN 300 422-1 V 1.4.2 Clause 8.4	FCC: Section 74.861 (e) (7) IC: RSS-210 G 3.4	21.1 dB 1215.750 MHz, Vertical	Complied	Radiated
Frequency stability	FCC: Section 2.1055 IC: RSS-Gen Section 6.11	FCC: Section 74.861 (e) (4) IC: RSS-210 G 3.3	See data.	Complied	Conducted
Note: UL Japan, Inc.'s EMI Work Procedure No. 13-EM-W0420. This EUT does not have receiving part. Therefore Receiver Spurious Emission test was not performed.					

* In case any questions arise about test procedure, KDB 206256 D01 Wireless Microphones v02 is also referred.

Supplied Voltage Information
This EUT provides stable voltage constantly to RF Module regardless of input voltage.

Antenna Information
The antenna is not removable from the EUT.

3.3 Addition to standard

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

3.4 Uncertainty

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

Ise EMC Lab.

Spurious Emission (EUT height: 1.5m)	dB
Mesurment Distance 3m	
･25 MHz - 200 MHz	5.6
･200 MHz - 1000 MHz	4.0
･1 GHz - 12.75 GHz	4.6

Antenna terminal test	Uncertainty (+/-)
RF output power	1.3 dB
Occupied bandwidth	
Span 1 MHz	0.96%
Emission mask	1.9 dB
Frequency stability	0.0154 ppm
Spurious emissions at antenna terminals	2.3 dB

Radiated emission test (3 m)
The data listed in this test report has enough margin, more than the site margin.

3.5 Test Location

UL Japan, Inc. Ise EMC Lab.
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone: +81 596 24 8999, Facsimile: +81 596 24 8124
NVLAP Lab. code: 200572-0 / FCC Test Firm Registration Number: 199967

Test site	IC Registration Number	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	2973C-1	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	2973C-2	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	2973C-3	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	2973C-4	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.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	N/A	-	-
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 m 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 Data of Radio, Test instruments, and Test set up

Refer to APPENDIX.

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

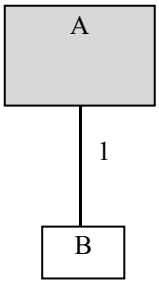
4.1 Operating Mode(s)

Mode	Remarks
Transmitting (Tx), Low power	Typ. 5 mW
Transmitting (Tx), High power	Typ. 30 mW
*Transmitting duty was 100% on all tests.	
*Power of the EUT was set by the software as follows; Power settings: Low (5 mW), High (30 mW) Software: Version T.011 *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product without High or Low settings.	

*The details of Operating mode(s)

Test Item	Tested frequency	Power setting	Modulation	Remarks
RF power output	470.125 MHz (Low) 539.000 MHz (Mid) 607.875 MHz (High)	Low power High power	None (No modulation)	
Modulation Characteristics	539.000 MHz (Mid)	Low power High power	See data.	*1)
Occupied Bandwidth	470.125 MHz (Low) 539.000 MHz (Mid) 607.875 MHz (High)	Low power High power	-26.1 dBV, 2500 Hz, Sine wave	*2)
Spurious emissions at antenna terminals	470.125 MHz (Low) 539.000 MHz (Mid) 607.875 MHz (High)	High power	-26.1 dBV, 2500 Hz, Sine wave	*2)
Necessary bandwidth	470.125 MHz (Low) 539.000 MHz (Mid) 607.875 MHz (High)	Low power High power	See data.	
Field strength of spurious radiation	470.125 MHz (Low) 539.000 MHz (Mid) 607.875 MHz (High)	High power	None (No modulation)	
Frequency stability	539.000 MHz (Mid)	High power	None (No modulation)	*3)
*1) There is no difference in audio part on each channel. Therefore the test was performed on Mid channel as a representative. *2) When modulated by a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation. *3) There is no difference in frequency generating method on each channel. Therefore the test was performed on Mid channel as a representative.				

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	UHF Synthesized Transmitter	UTX-B03	UC14 (Low / Mid Channel) UC25 (High Channel)	Sony Corporation	EUT
B	Lavalier Microphone	-	-	Sony Corporation	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Microphone Cable	1.2	Shielded	Shielded	-

SECTION 5: Field strength of spurious radiation

Test Procedure

1) EUT was placed on a platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane. Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The Radiated Electric Field Strength has been measured in semi anechoic chamber at a distance of 3 m. The measuring antenna height was varied between 1 to 4 m and the turn table was rotated a full revolution in order to obtain the maximum value of the electric field strength.
The measurements were performed for both vertical and horizontal antenna polarization.

2) Exchanged the EUT to the Substitution Antenna, the measurement was set for the same height 1.5 m as the EUT. The frequency below 1 GHz of the Substitution Antenna was used the Half wave dipole Antenna, which was tuned the measured frequency in 1).
The frequency above 1 GHz of the Substitution Antenna was used Horn Antenna.
The Substitution Antenna was connected to the Signal Generator, and the polarized electromagnetic radiation of the Substitution Antenna was matched with the one of the measuring Antenna, which was set with the Signal Generator to the measured frequency in 1). Then, we set with the Output power (CW) of the Signal Generator where the measuring electromagnetic field strength is equal to the measured value in 1) by means of varying the measuring antenna height between 1 to 4 m to obtain maximum receiving level.
Its Output power of Signal Generator was recorded.

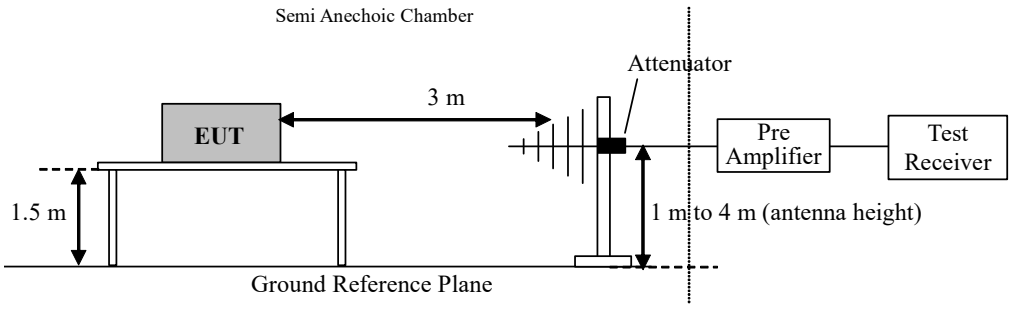
3) Effective radiated power was calculated by subtracting the cable loss and the attenuator loss connected between the Signal Generator and the Substitution Antenna from the Output power of the Signal Generator recorded in 2).
For the usage of the Antenna (Horn Antenna) except for the Half wave dipole Antenna (2.15dBi) for the Substitution Antenna, the Effective radiated power was calculated by compensating the finite difference in the Antenna gain of the Half wave dipole Antenna, and Substitution Antenna.

Frequency	25 MHz to 200 MHz	200 MHz to 1 GHz	Above 1 GHz
Antenna Type	Biconical	Logperiodic	Horn

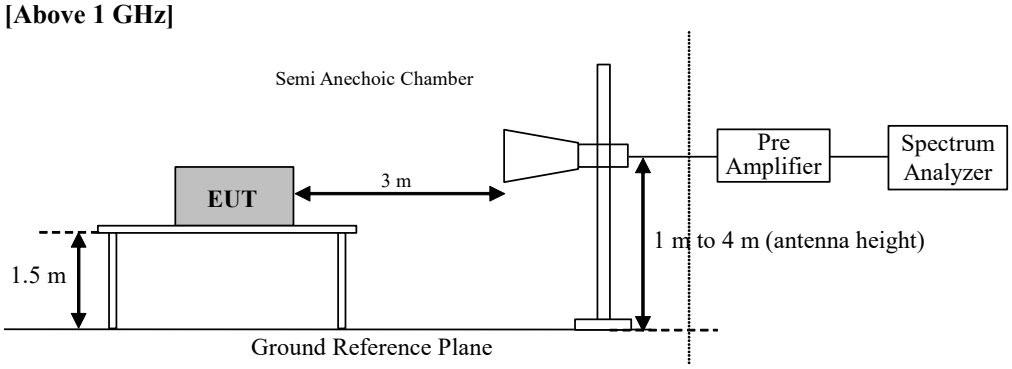
Frequency	25 MHz to 30 MHz	30 MHz to 1 GHz	Above 1 GHz
Instrument used	Spectrum Analyzer		
Detector	RMS Average		
IF Bandwidth	RBW: 10 kHz VBW: 30 kHz	RBW: 100 kHz VBW: 300 kHz	RBW: 1 MHz VBW: 3 MHz
Test Distance	3 m		

Figure 1: Test Setup

[25 MHz - 1 GHz]



[Above 1 GHz]



- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

The test results and limit are rounded off to one decimal place, so some differences might be observed.

Measurement range : **25 MHz - 7 GHz**
Test data : **APPENDIX**
Test result : **Pass**

SECTION 6: Modulation Characteristics

Deviation versus Audio input level and Audio Frequency

Test Procedure

The frequency deviations were measured when input level and frequency were varied. It was measured with Radio communication Service Monitor.

Audio input level	-80 dBV to -20 dBV, 5 dB step
Audio frequency	40 Hz, 100 Hz, 300 Hz, 500 Hz, 700 Hz, 1 kHz, 3 kHz, 5 kHz, 7 kHz, 10 kHz, 15 kHz, 18 kHz

Audio Frequency Response

Test Procedure

The audio input level was measured when frequency deviation indicates 50% modulation which measured with Radio communication Service Monitor.

Audio frequency	40 Hz, 70 Hz, 100 Hz, 300 Hz, 500 Hz, 700 Hz, 1 kHz, 3 kHz, 5 kHz, 7 kHz, 10 kHz, 15 kHz, 18 kHz

The test results and limit are rounded off to one decimal place, so some differences might be observed.

Test data : **APPENDIX**
Test result : **Pass**

SECTION 7: Antenna terminal tests

Test Procedure

The tests were made with below setting connected to the antenna port.

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
RF power output	-	-	-	Auto	Average	-	Power Meter (Sensor: 50MHz BW)
Occupied Bandwidth	Enough width to display emission skirts	1 to 5% of Anticipated OBW	Three times of RBW	Auto	Peak *1)	Max Hold *1)	Spectrum Analyzer
Spurious emissions at antenna terminals	9 kHz -150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer *2)
	150 kHz - 30 MHz	10 kHz	30 kHz				
	30 MHz - 1 GHz	100 kHz	300 kHz				
	Above 1 GHz	1 MHz	3 MHz				
Frequency stability	-	-	-	-	-	-	Frequency Counter

*1) The measurement was performed with Peak and Max Hold since the modulation method was FM.
*2) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents. Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.

[Frequency stability]
The power supply set to 100 % nominal setting, raise EUT operating temperature to 50 deg. C.
Record the frequency of the EUT.
Repeat measurements at each 10 deg. C decrement to -30 deg. C.

EUT power supply was varied between 85 % and 115 % of nominal and the frequency of the EUT was recorded when temperature is 20 deg. C. The additional test was performed at battery end point voltage.

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

Test data : APPENDIX
Test result : Pass

SECTION 8: Necessary bandwidth

Test procedure
In accordance with section 8.3 of ETSI EN 300 422-1, a weighted noise source through a weighting filter based on ITU-R Recommendation BS.559-2 was applied to the audio input of transmitter.
The transmitter RF output spectrums were measured at each channel using a receiving antenna and a spectrum analyzer with settings specified in the section 8.3.1 of ETSI EN 300 422-1.The input level of both white noise and filter to EUT was -12 dBV according to the following result.

	lim-8dB	lim	lim+12dB	Difference of Demodulation level lim-8dB and lim+12dB	White noise +Filter input level
EUT input level	-32 dBV	-24 dBV	-12 dBV		-12 dBV
Demodulation level	-37.21 dBV	-	-27.84 dBV	9.37 dB < 10 dB	
"lim" means "audio limiting threshold" declared by manufacturer.					

Test data **APPENDIX.**
Test result **Pass**

APPENDIX 1: Data of EMI test

RF power output

Report No.	12244307H
Test place	Ise EMC Lab. No.7 Shielded Room
Date	May 24, 2018
Temperature/ Humidity	23 deg. C / 55 % RH
Engineer	Ken Fujita
Mode	Tx

Power Setting	Channel	Freq. [MHz]	Reading Average [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result Average [dBm]	Result Average [mW]	Limit [mW]	Margin [dB]	Remarks
Low	Low	470.125	-3.40	0.00	9.89	6.49	4.457	250	17.49	
	Mid	539.000	-3.30	0.00	9.89	6.59	4.560	250	17.39	
	High	607.875	-3.28	0.00	9.90	6.62	4.592	250	17.36	
High	Low	470.125	4.23	0.00	9.89	14.12	25.8	250	9.86	
	Mid	539.000	4.40	0.00	9.89	14.29	26.9	250	9.69	
	High	607.875	4.19	0.00	9.90	14.09	25.6	250	9.89	

Calculation formula:

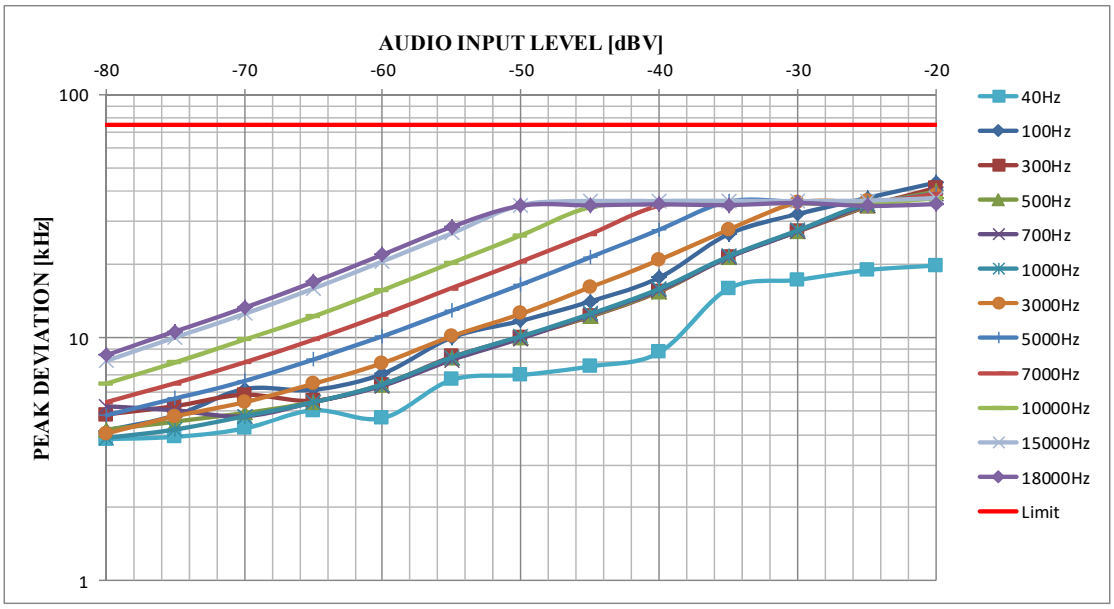
Result = Reading + Cable Loss + Atten. Loss

Cable or Atten. Loss were not used for factor 0.00 dB of the above table.

Modulation Characteristics
[Deviation versus Audio input level and Audio Frequency]

Report No.	12244307H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	June 5, 2018
Temperature / Humidity	20 deg. C / 45 % RH
Engineer	Koji Yamamoto
Mode	Tx 539.000 MHz (RF Power: Low)

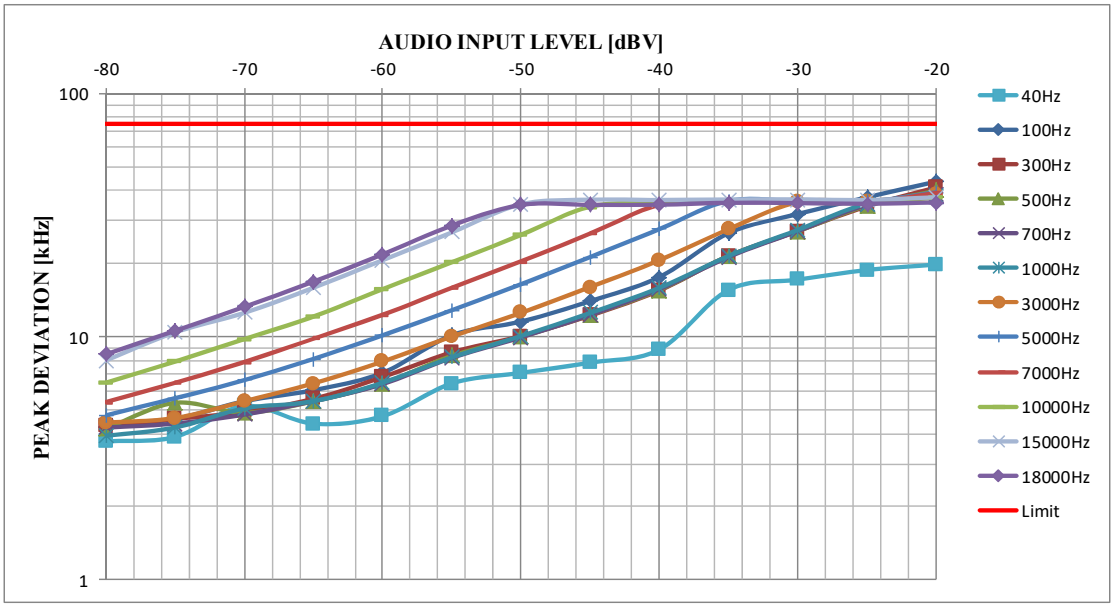
AF Level	AF Frequency [Hz] / Peak Deviation [kHz]												Limit
[dBV]	40	100	300	500	700	1000	3000	5000	7000	10000	15000	18000	[kHz]
-80	3.832	4.152	4.830	4.192	5.230	3.872	4.032	4.790	5.429	6.467	8.024	8.463	75
-75	3.912	4.790	5.230	4.511	5.030	4.192	4.751	5.629	6.507	7.904	10.020	10.619	75
-70	4.232	6.148	5.828	4.910	4.751	4.751	5.429	6.627	7.904	9.820	12.535	13.253	75
-65	5.030	6.108	5.509	5.429	5.429	5.429	6.467	8.144	9.820	12.216	15.888	16.966	75
-60	4.671	7.106	6.427	6.427	6.347	6.427	7.864	10.140	12.415	15.689	20.639	21.916	75
-55	6.707	10.020	8.343	8.224	8.104	8.303	10.140	12.934	16.008	20.319	26.866	28.583	75
-50	7.026	11.737	10.060	10.060	9.940	10.140	12.535	16.527	20.559	26.347	35.090	34.890	75
-45	7.625	14.092	12.216	12.295	12.415	12.535	16.128	21.397	26.667	34.371	36.452	35.010	75
-40	8.703	17.685	15.489	15.569	15.689	15.888	20.878	27.824	34.890	35.649	36.487	35.329	75
-35	15.928	26.667	21.477	21.477	21.397	21.597	27.824	36.287	35.968	35.848	36.565	35.090	75
-30	17.285	32.255	27.305	27.385	27.385	27.625	35.848	36.168	35.848	35.728	36.487	35.812	75
-25	18.962	37.525	34.571	34.810	35.010	35.409	36.287	35.968	35.728	35.649	36.621	34.816	75
-20	19.800	43.433	41.317	39.960	38.802	38.084	38.363	39.122	39.002	37.445	37.525	35.409	75



Modulation Characteristics
[Deviation versus Audio input level and Audio Frequency]

Report No.	12244307H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	June 5, 2018
Temperature / Humidity	20 deg. C / 45 % RH
Engineer	Koji Yamamoto
Mode	Tx 539.000 MHz (RF Power: High)

AF Level	AF Frequency [Hz] / Peak Deviation [kHz]												Limit
[dBV]	40	100	300	500	700	1000	3000	5000	7000	10000	15000	18000	[kHz]
-80	3.713	4.271	4.311	4.192	4.232	3.912	4.431	4.751	5.389	6.467	7.984	8.463	75
-75	3.872	4.591	4.591	5.349	4.391	4.232	4.631	5.589	6.467	7.904	10.419	10.579	75
-70	5.190	5.429	4.910	4.870	4.790	5.070	5.429	6.627	7.864	9.780	12.535	13.253	75
-65	4.391	6.028	5.549	5.429	5.429	5.429	6.427	8.104	9.820	12.096	15.888	16.846	75
-60	4.711	7.106	6.826	6.427	6.387	6.467	7.904	10.140	12.295	15.689	20.639	21.796	75
-55	6.427	10.140	8.623	8.343	8.184	8.224	10.020	12.854	15.888	20.239	26.866	28.663	75
-50	7.106	11.537	10.060	9.980	9.940	10.060	12.535	16.447	20.439	26.227	35.010	34.816	75
-45	7.824	14.012	12.216	12.295	12.295	12.535	16.008	21.277	26.547	34.251	36.567	34.829	75
-40	8.862	17.605	15.489	15.569	15.689	15.888	20.639	27.705	34.810	35.529	36.483	34.890	75
-35	15.569	26.667	21.477	21.477	21.277	21.477	27.705	36.168	35.968	35.848	36.692	35.531	75
-30	17.166	31.936	27.186	27.186	27.186	27.505	35.728	36.048	35.728	35.649	36.687	35.409	75
-25	18.802	37.445	34.371	34.571	34.810	35.209	36.168	35.968	35.649	35.529	36.486	35.209	75
-20	19.800	43.433	41.118	39.840	38.603	37.844	38.283	39.241	39.002	37.325	37.445	35.645	75

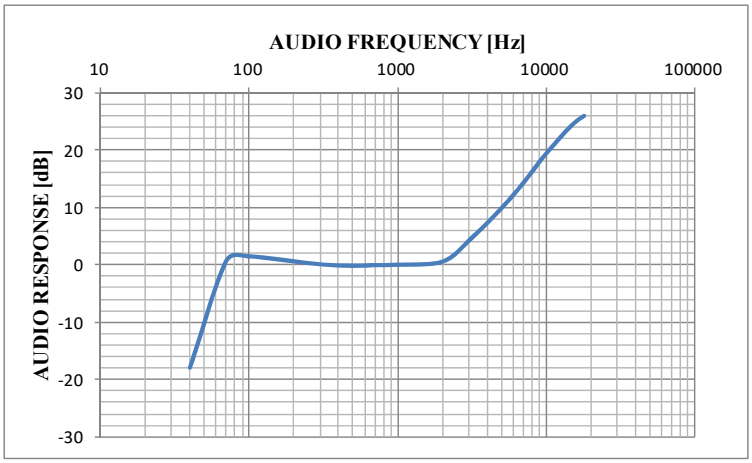


Modulation Characteristics
[Audio Frequency Response]

Report No.	12244307H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	June 5, 2018
Temperature / Humidity	20 deg. C / 45 % RH
Engineer	Koji Yamamoto
Mode	Tx 539.000 MHz

[Power Setting: High]

AF Frequency [Hz]	AF Level [mV]	AF Response [dB]
40	122.00	-17.93
70	14.45	0.60
100	13.08	1.47
300	15.37	0.07
500	15.75	-0.14
700	15.61	-0.07
1000	15.49	0.00
2000	14.56	0.54
3000	9.63	4.13
5000	4.98	9.86
7000	3.01	14.23
10000	1.66	19.40
15000	0.93	24.43
18000	0.78	25.96

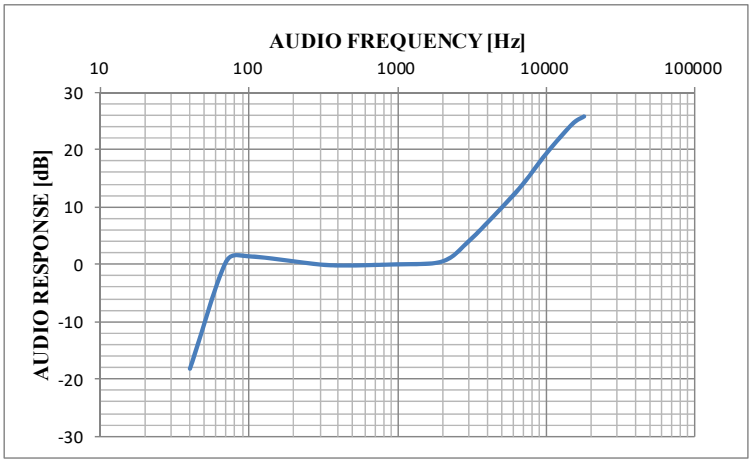


Calculation formula:

AF Response = 20 * log (AF Level of 1 kHz / AF Level)

[Power Setting: Low]

AF Frequency [Hz]	AF Level [mV]	AF Response [dB]
40	125.00	-18.20
70	14.62	0.44
100	13.11	1.39
300	15.43	-0.03
500	15.73	-0.20
700	15.56	-0.10
1000	15.38	0.00
2000	14.51	0.51
3000	9.72	3.99
5000	4.95	9.85
7000	3.06	14.02
10000	1.67	19.28
15000	0.92	24.46
18000	0.79	25.79



Calculation formula:

AF Response = 20 * log (AF Level of 1 kHz / AF Level)

Occupied Bandwidth

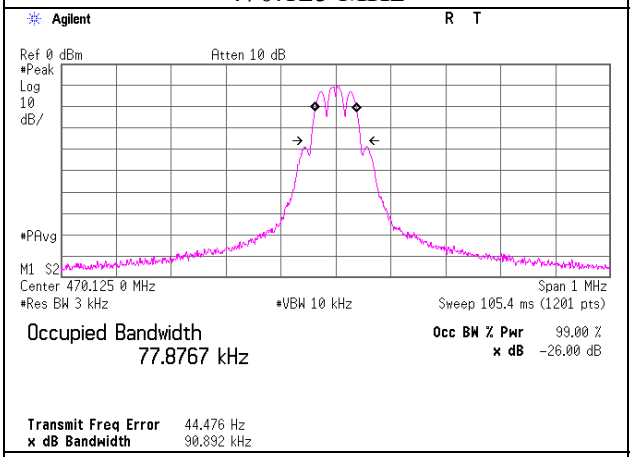
Report No.	12244307H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	June 4, 2018
Temperature / Humidity	21 deg. C / 43 % RH
Engineer	Koji Yamamoto
Mode	Tx

Power Setting	Channel	Freq. [MHz]	99% Occupied Bandwidth [kHz]	Limit [kHz]	Margin [dB]
Low Power	Low	470.125	77.8767	200	122.1233
	Mid	539.000	88.7082	200	111.2918
	High	607.875	86.3674	200	113.6326
High Power	Low	470.125	77.9637	200	122.0363
	Mid	539.000	88.6146	200	111.3854
	High	607.875	86.4190	200	113.5810

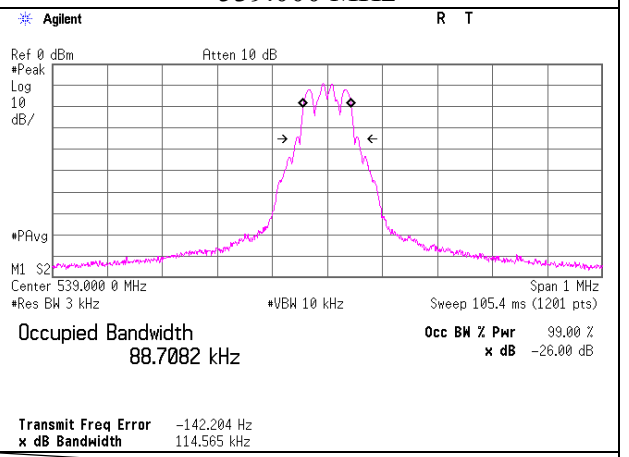
Occupied Bandwidth

Report No.	12244307H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	June 4, 2018
Temperature / Humidity	21 deg. C / 43 % RH
Engineer	Koji Yamamoto
Mode	Tx (RF Power: Low)

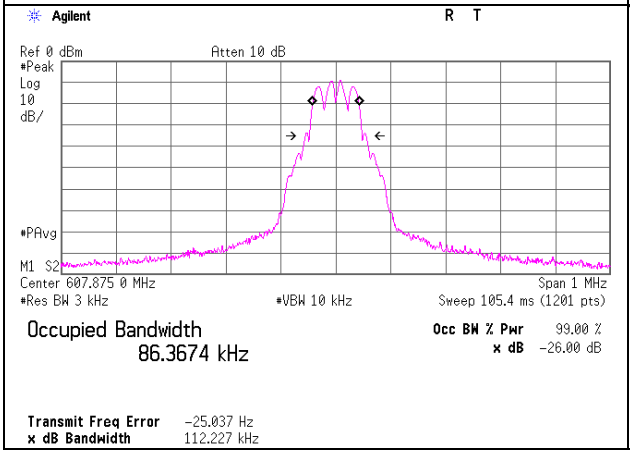
470.125 MHz



539.000 MHz



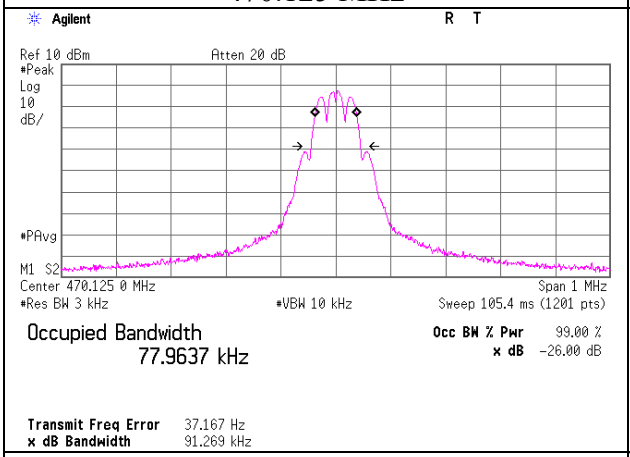
607.875 MHz



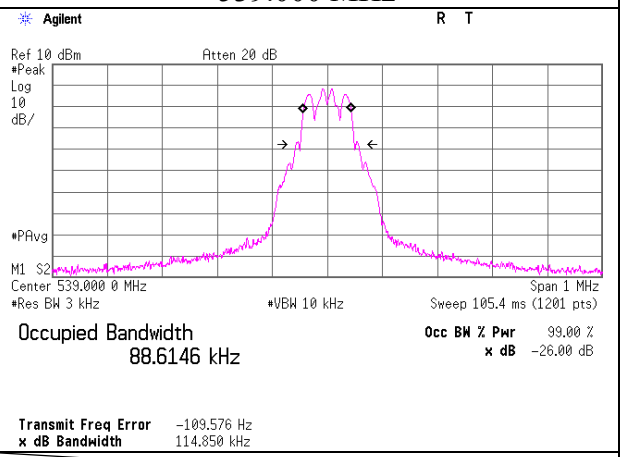
Occupied Bandwidth

Report No.	12244307H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	June 4, 2018
Temperature / Humidity	21 deg. C / 43 % RH
Engineer	Koji Yamamoto
Mode	Tx (RF Power: High)

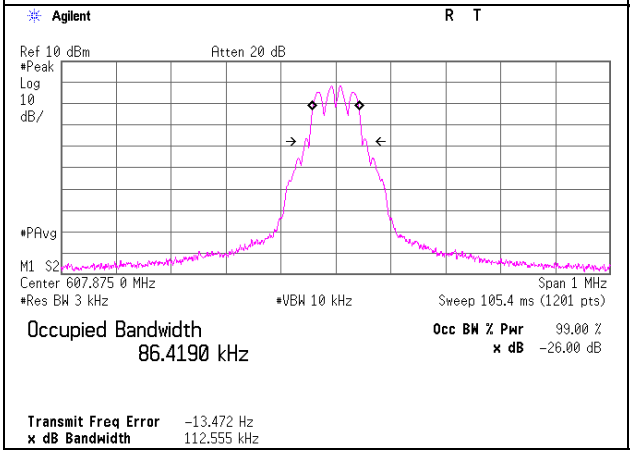
470.125 MHz



539.000 MHz



607.875 MHz



Spurious emissions at antenna terminals

Report No.	12244307H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	June 4, 2018
Temperature / Humidity	21 deg. C / 47 % RH
Engineer	Koji Yamamoto
Mode	Tx (RF Power: High)

Channel	Tested Freq. [MHz]	Reading Freq. [MHz]	Reading Level [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
Low	470.125	0.011	-100.65	0.01	9.83	-90.81	-30	60.81
		0.200	-89.09	0.01	9.83	-79.25	-30	49.25
		940.200	-69.72	0.30	9.91	-59.51	-30	29.51
		3317.000	-59.42	1.07	10.03	-48.32	-30	18.32
Mid	539.000	0.013	-100.51	0.01	9.83	-90.67	-30	60.67
		0.374	-89.57	0.01	9.83	-79.73	-30	49.73
		1078.000	-62.07	0.62	10.02	-51.43	-30	21.43
		3238.750	-59.58	1.07	10.05	-48.46	-30	18.46
High	607.875	0.010	-99.81	0.01	9.83	-89.97	-30	59.97
		0.498	-89.58	0.01	9.83	-79.74	-30	49.74
		1216.000	-62.76	0.66	10.03	-52.07	-30	22.07
		3081.000	-60.35	1.02	10.05	-49.28	-30	19.28

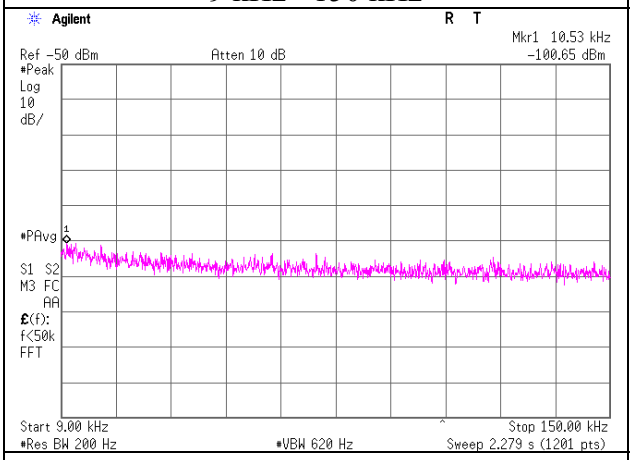
Calculation formula:

Result = Reading + Cable Loss + Attenuator Loss

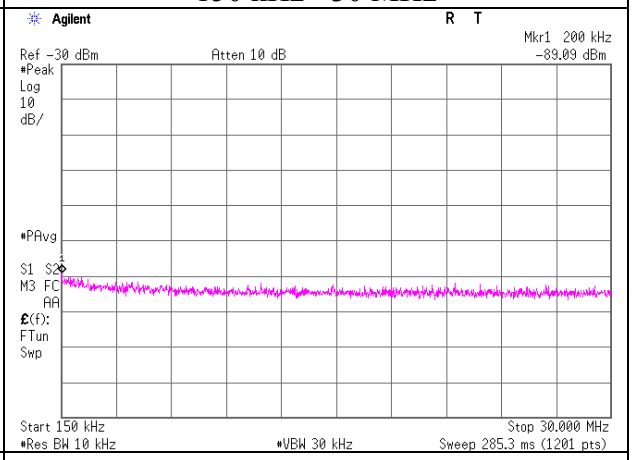
Spurious emissions at antenna terminals

Report No.	12244307H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	June 4, 2018
Temperature / Humidity	21 deg. C / 47 % RH
Engineer	Koji Yamamoto
Mode	Tx 470.125 MHz (RF Power: High)

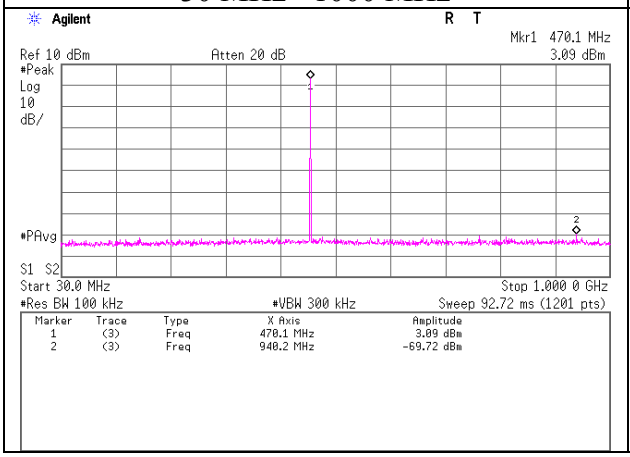
9 kHz - 150 kHz



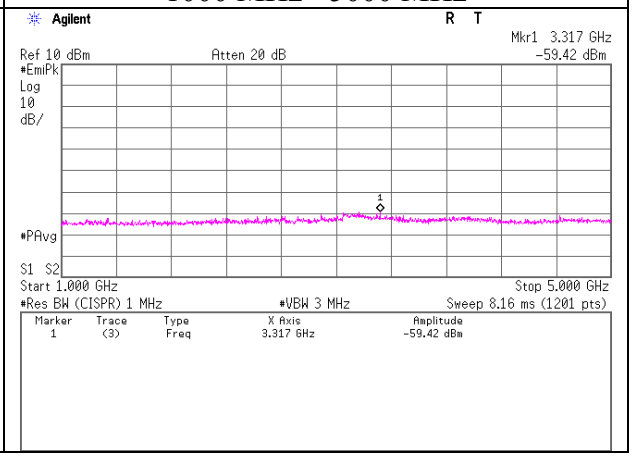
150 kHz - 30 MHz



30 MHz - 1000 MHz



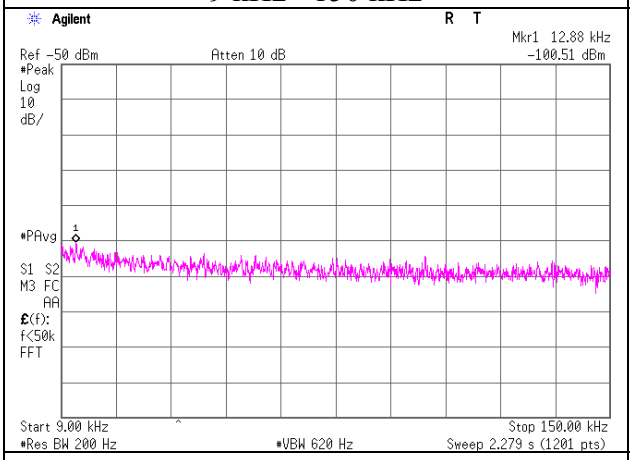
1000 MHz - 5000 MHz



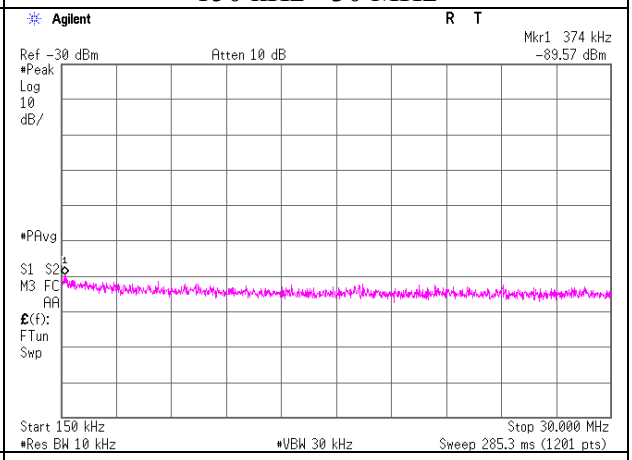
Spurious emissions at antenna terminals

Report No.	12244307H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	June 4, 2018
Temperature / Humidity	21 deg. C / 47 % RH
Engineer	Koji Yamamoto
Mode	Tx 539.000 MHz (RF Power: High)

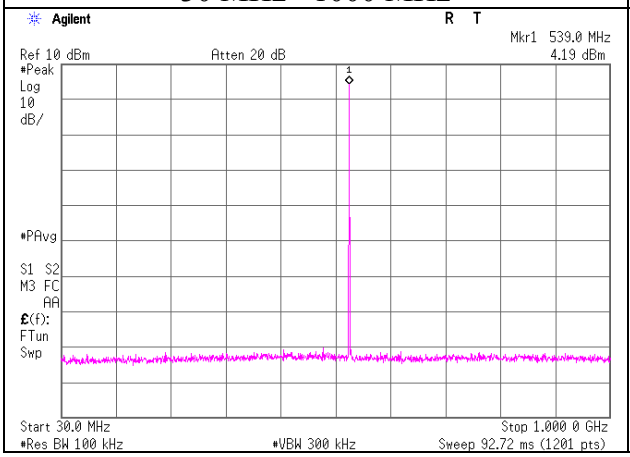
9 kHz - 150 kHz



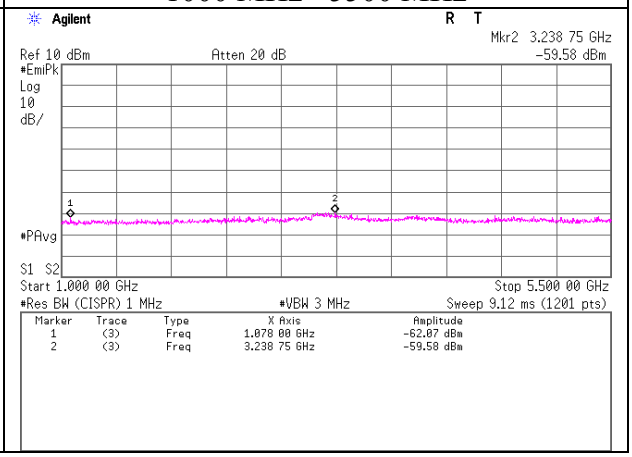
150 kHz - 30 MHz



30 MHz - 1000 MHz



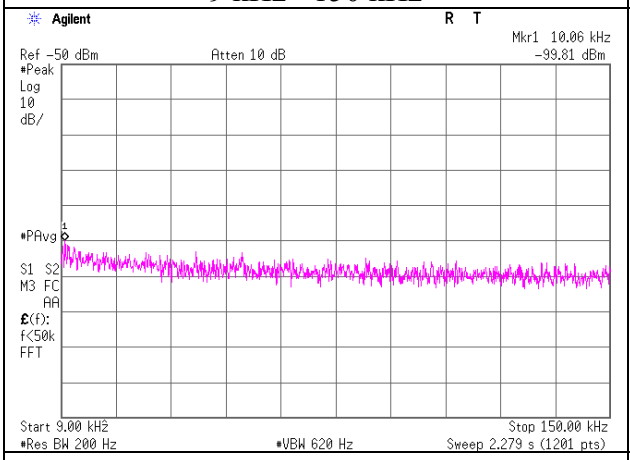
1000 MHz - 5500 MHz



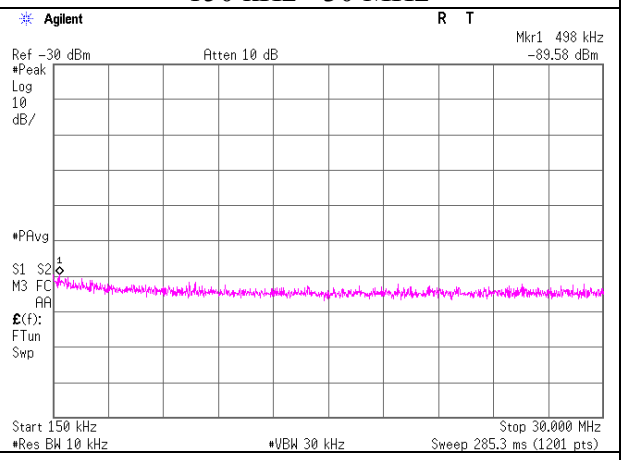
Spurious emissions at antenna terminals

Report No.	12244307H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	June 4, 2018
Temperature / Humidity	21 deg. C / 47 % RH
Engineer	Koji Yamamoto
Mode	Tx 607.875 MHz (RF Power: High)

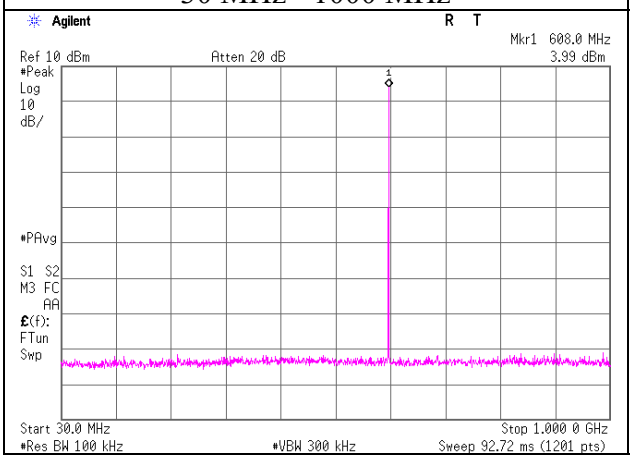
9 kHz - 150 kHz



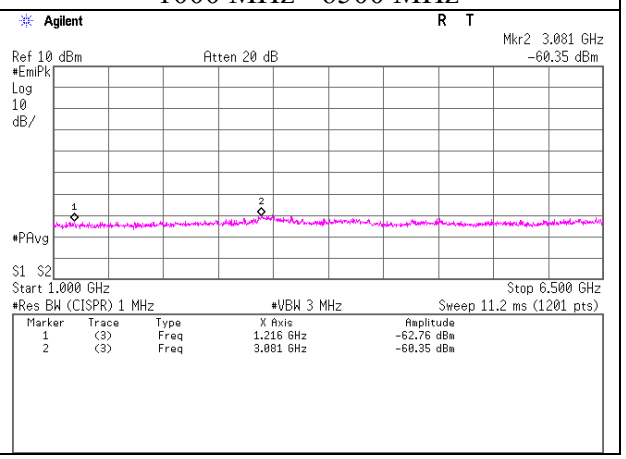
150 kHz - 30 MHz



30 MHz - 1000 MHz



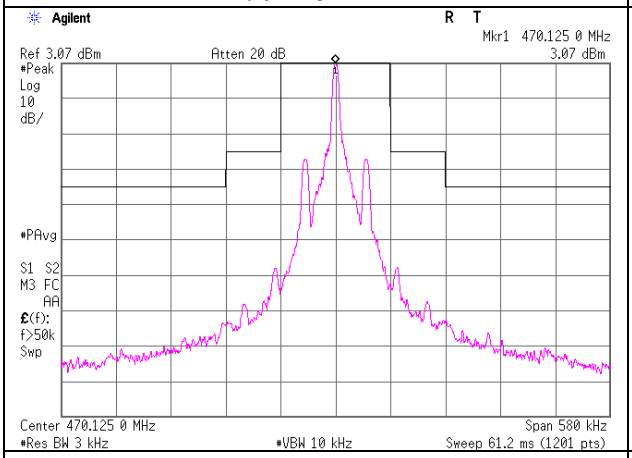
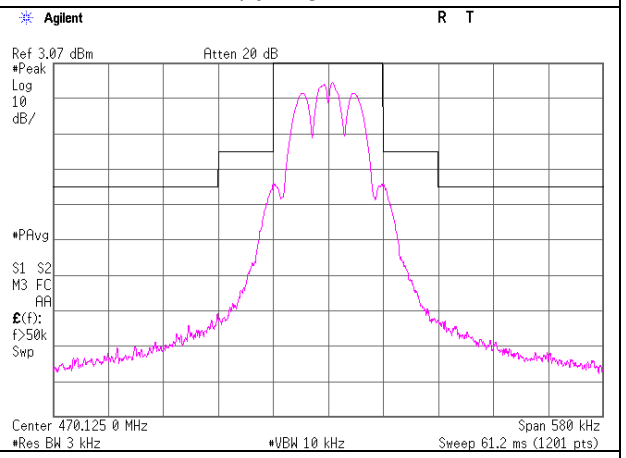
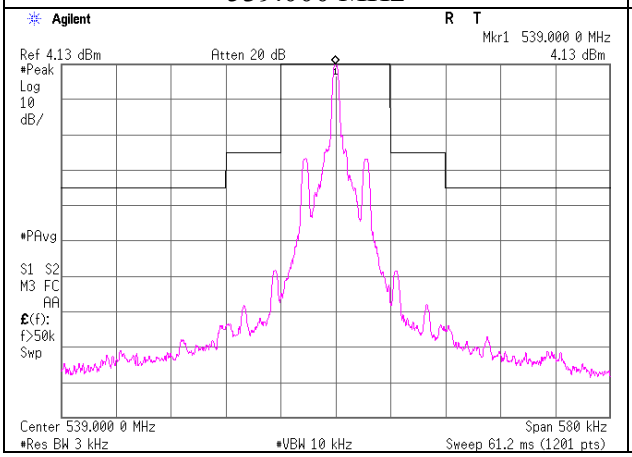
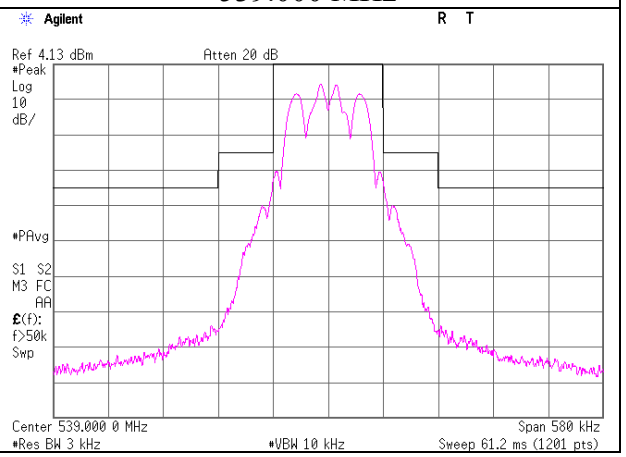
1000 MHz - 6500 MHz



Spurious emissions at antenna terminals

[Side band Spectrum]

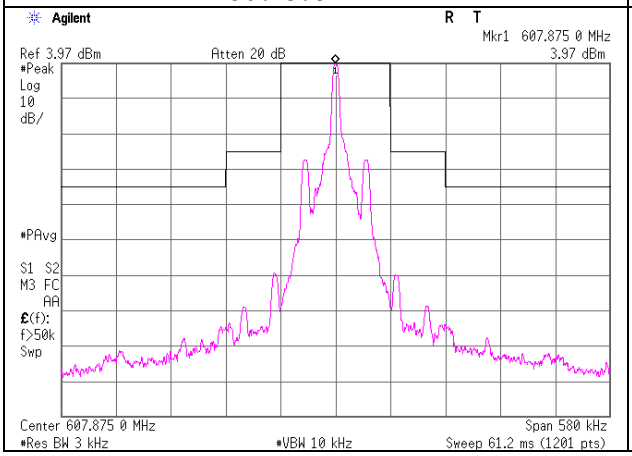
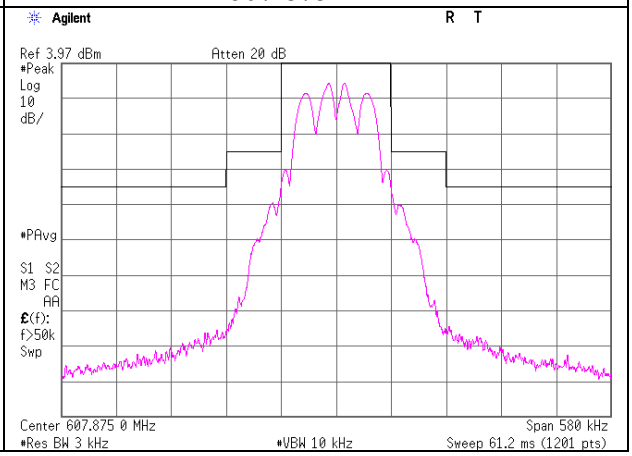
Report No.	12244307H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	June 4, 2018
Temperature / Humidity	21 deg. C / 47 % RH
Engineer	Koji Yamamoto
Mode	Tx (RF Power: High)

Reference	Result
470.125 MHz	470.125 MHz
	
539.000 MHz	539.000 MHz
	

Spurious emissions at antenna terminals

[Side band Spectrum]

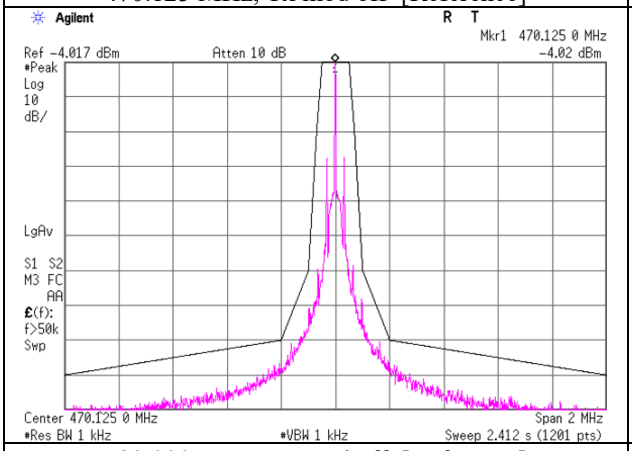
Report No.	12244307H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	June 4, 2018
Temperature / Humidity	23 deg. C / 51 % RH
Engineer	Koji Yamamoto
Mode	Tx (RF Power: High)

Reference	Result
607.875 MHz	607.875 MHz
	

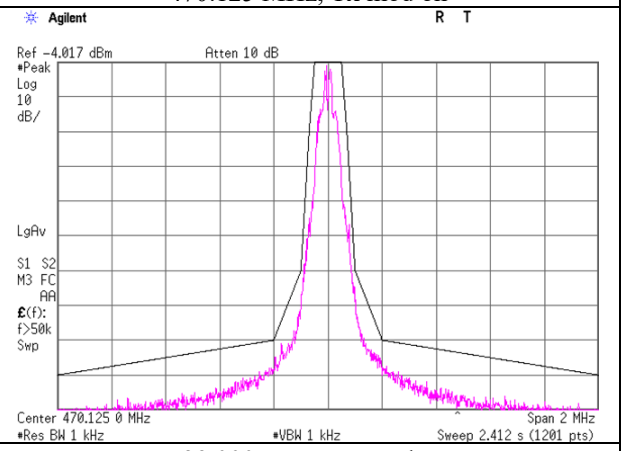
Necessary bandwidth

Report No.	12244307H
Test place	Ise EMC Lab. No.7 Shielded Room
Date	May 24, 2018
Temperature/ Humidity	22 deg. C / 42 % RH
Engineer	Ken Fujita
Mode	Transmitting mode (RF Power: Low)

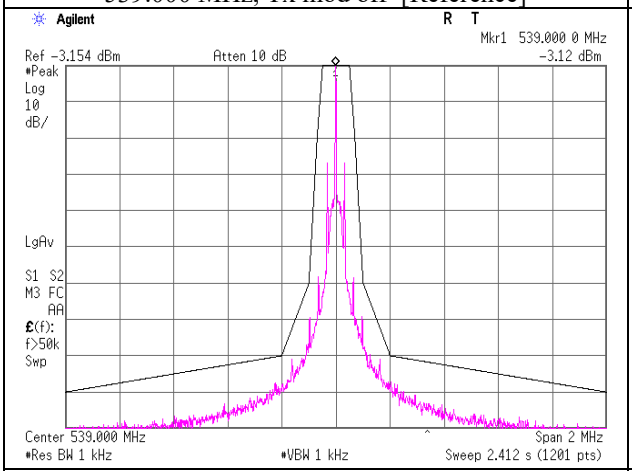
470.125 MHz, Tx mod off [Reference]



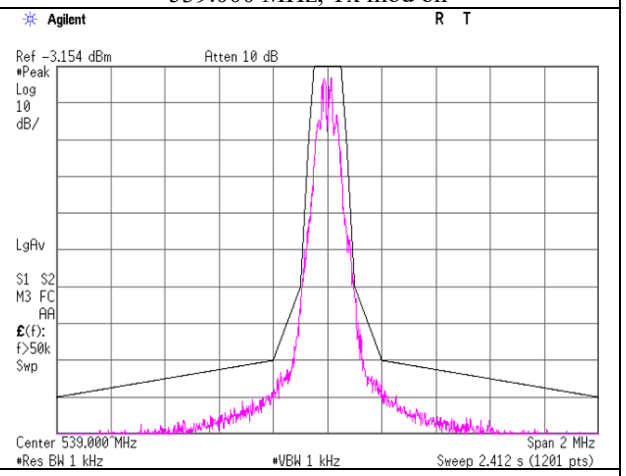
470.125 MHz, Tx mod on



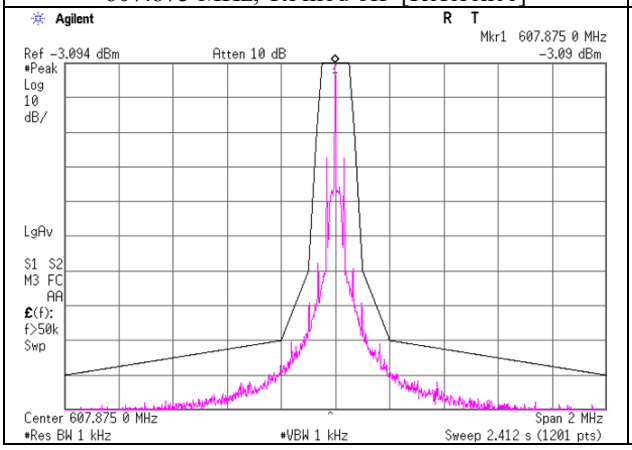
539.000 MHz, Tx mod off [Reference]



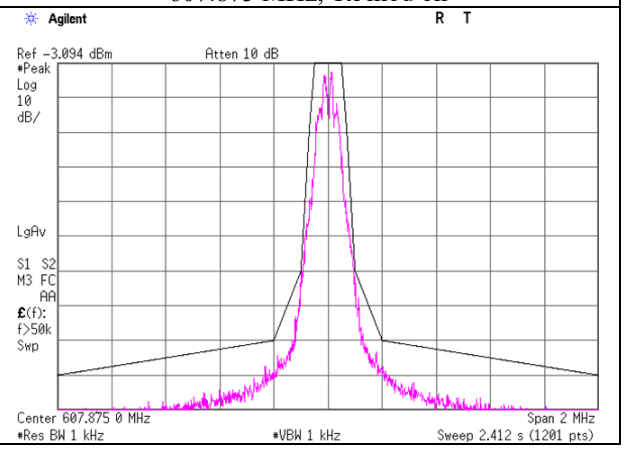
539.000 MHz, Tx mod on



607.875 MHz, Tx mod off [Reference]



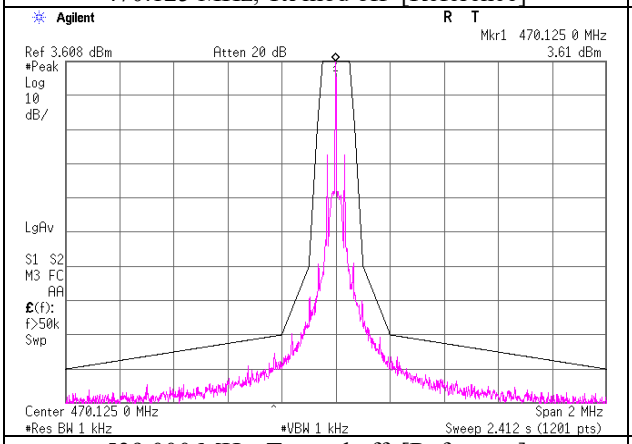
607.875 MHz, Tx mod on



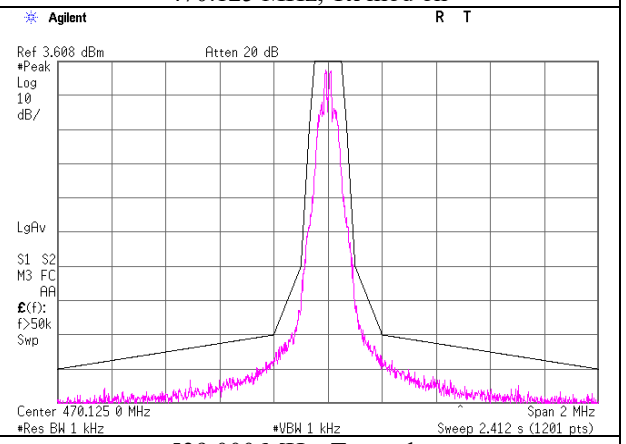
Necessary bandwidth

Report No.	12244307H
Test place	Ise EMC Lab. No.7 Shielded Room
Date	May 24, 2018
Temperature/ Humidity	22 deg. C / 42 % RH
Engineer	Ken Fujita
Mode	Transmitting mode (RF Power: High)

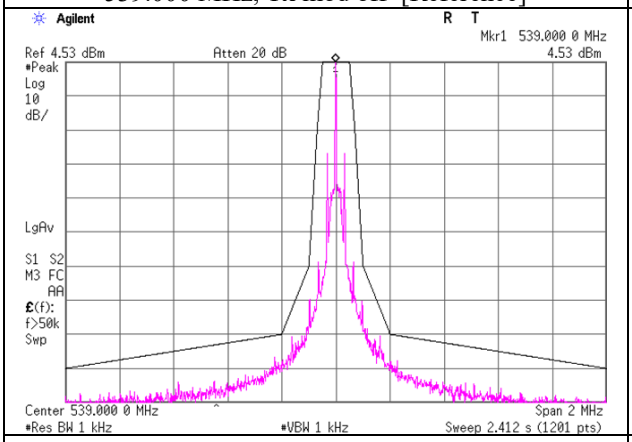
470.125 MHz, Tx mod off [Reference]



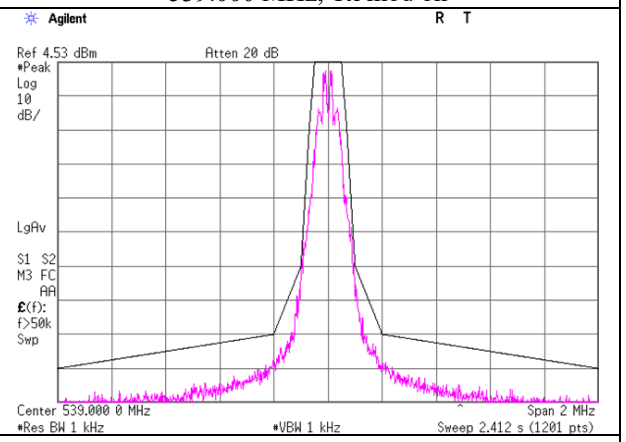
470.125 MHz, Tx mod on



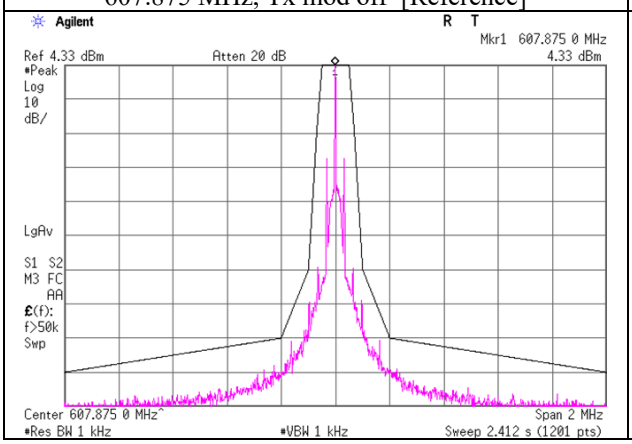
539.000 MHz, Tx mod off [Reference]



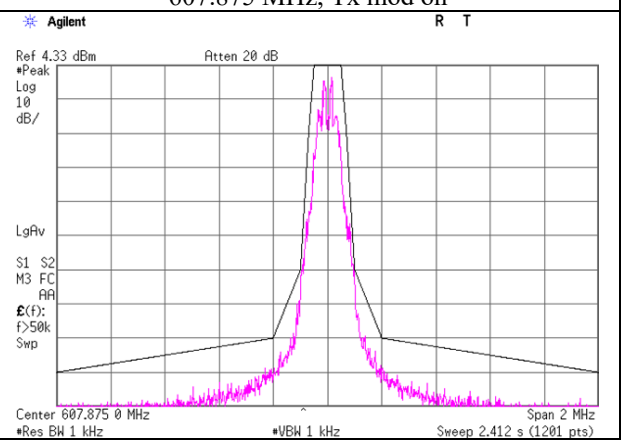
539.000 MHz, Tx mod on



607.875 MHz, Tx mod off [Reference]



607.875 MHz, Tx mod on



Field strength of spurious radiation

Report No.	12244307H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.2	No.4
Date	June 22, 2018	June 23, 2018
Temperature / Humidity	24 deg. C / 50 % RH	23 deg. C / 60 % RH
Engineer	Shuichi Ohyama (Below 1 GHz)	Junki Nagatomi (Above 1 GHz)
Mode	Tx 470.125 MHz	

[Power setting: High]

Frequency	Rx SA/TR Reading [dBuV]		Tx SG Reading [dBm]		Tx Cable Loss	Tx Ant. Gain	Tx Ant. Atten. Loss	Result (ERP) [dBm]		Limit (ERP) [dBm]	Margin [dB]		Horizontal		Vertical		Remarks
[MHz]	HOR	VER	HOR	VER	[dB]	[dBi]	[dB]	HOR	VER		HOR	VER	Rx Ant. Height [cm]	Turn Table [deg.]	Rx Ant. Height [cm]	Turn Table [deg.]	
940.250	NS	NS	-	-	-	-	-	-	-	-36.0	-	-	-	-	-	-	
1410.375	46.6	44.0	-58.7	-62.2	3.2	7.2	0.0	-56.8	-60.3	-30.0	26.8	30.3	108	169	148	95	
1880.500	39.3	39.5	-67.5	-67.1	3.7	9.7	0.0	-63.6	-63.2	-30.0	33.6	33.2	158	180	193	147	
2350.625	35.6	34.0	-68.0	-68.2	4.2	10.7	0.0	-63.6	-63.8	-30.0	33.6	33.8	124	126	131	9	
2820.750	41.9	41.9	-60.2	-60.3	4.6	11.2	0.0	-55.7	-55.8	-30.0	25.7	25.8	105	180	179	192	
3290.875	34.8	34.2	-69.4	-68.1	4.9	11.8	0.0	-64.7	-63.4	-30.0	34.7	33.4	170	39	125	337	
3761.000	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
4231.125	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
4701.250	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	

Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - Tx Antenna Attenuator Loss -2.15
Rx-ANTENNA : Biconical Antenna (25 M - 200 MHz), Logperiodic Antenna (200 M - 1000 MHz), Horn Antenna (1 G - 7 GHz)
Tx-ANTENNA : 120 MHz tuned Dipole Antenna (25 M - 120 MHz), Dipole Antenna (120 M - 1000 MHz), Horn Antenna (1 G - 7 GHz)
Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).
NS : No signal detect.
Detector : 25 MHz to 30 MHz: Spectrum Analyzer RMS Average (RBW: 10 kHz / VBW: 30 kHz)
30 MHz to 1 GHz: Spectrum Analyzer RMS Average (RBW: 100 kHz / VBW: 300 kHz)
Above 1 GHz: Spectrum Analyzer RMS Average (RBW: 1 MHz / VBW: 3 MHz)
*Emissions were investigated up to the 10th harmonic of the fundamental.

Field strength of spurious radiation

Report No.	12244307H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.2	No.4
Date	June 22, 2018	June 23, 2018
Temperature / Humidity	24 deg. C / 50 % RH	23 deg. C / 60 % RH
Engineer	Shuichi Ohyama (Below 1 GHz)	Junki Nagatomi (Above 1 GHz)
Mode	Tx 539.000 MHz	

[Power setting: High]

Frequency	Rx SA/TR Reading [dBuV]		Tx SG Reading [dBm]		Tx Cable Loss	Tx Ant. Gain	Tx Ant. Atten. Loss	Result (ERP) [dBm]		Limit (ERP) [dBm]	Margin [dB]		Horizontal		Vertical		Remarks
													Rx Ant. Height	Turn Table	Rx Ant. Height	Turn Table	
[MHz]	HOR	VER	HOR	VER	[dB]	[dBi]	[dB]	HOR	VER		HOR	VER	[cm]	[deg.]	[cm]	[deg.]	
1078.000	48.8	48.3	-58.6	-60.9	2.8	5.5	0.0	-58.1	-60.4	-30.0	28.1	30.4	150	48	150	37	
1617.000	42.9	46.6	-64.1	-60.6	3.4	8.3	0.0	-61.4	-57.9	-30.0	31.4	27.9	114	180	156	41	
2156.000	35.5	43.2	-68.0	-59.3	4.0	10.5	0.0	-63.6	-54.9	-30.0	33.6	24.9	139	74	211	195	
2695.000	42.5	40.4	-60.9	-61.8	4.5	11.1	0.0	-56.5	-57.4	-30.0	26.5	27.4	134	340	207	3	
3234.000	39.6	39.8	-61.8	-62.4	4.9	11.7	0.0	-57.1	-57.7	-30.0	27.1	27.7	172	74	163	0	
3773.000	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
4312.000	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
4851.000	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
5390.000	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	

Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - Tx Antenna Attenuator Loss -2.15
Rx-ANTENNA : Biconical Antenna (25 M - 200 MHz), Logperiodic Antenna (200 M - 1000 MHz), Horn Antenna (1 G - 7 GHz)
Tx-ANTENNA : 120 MHz tuned Dipole Antenna (25 M - 120 MHz), Dipole Antenna (120 M - 1000 MHz), Horn Antenna (1 G - 7 GHz)
Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).
NS : No signal detect.
Detector : 25 MHz to 30 MHz: Spectrum Analyzer RMS Average (RBW: 10 kHz / VBW: 30 kHz)
30 MHz to 1 GHz: Spectrum Analyzer RMS Average (RBW: 100 kHz / VBW: 300 kHz)
Above 1 GHz: Spectrum Analyzer RMS Average (RBW: 1 MHz / VBW: 3 MHz)
*Emissions were investigated up to the 10th harmonic of the fundamental.

Field strength of spurious radiation

Report No.	12244307H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.2	No.4
Date	June 22, 2018	June 23, 2018
Temperature / Humidity	24 deg. C / 50 % RH	23 deg. C / 60 % RH
Engineer	Shuichi Ohyama (Below 1 GHz)	Junki Nagatomi (Above 1 GHz)
Mode	Tx 607.875 MHz	

[Power setting: High]

Frequency	Rx SA/TR Reading [dBuV]		Tx SG Reading [dBm]		Tx Cable Loss	Tx Ant. Gain	Tx Ant. Atten. Loss	Result (ERP) [dBm]		Limit (ERP) [dBm]	Margin [dB]		Horizontal		Vertical		Remarks
													Rx Ant. Height	Turn Table	Rx Ant. Height	Turn Table	
[MHz]	HOR	VER	HOR	VER	[dB]	[dBi]	[dB]	HOR	VER		HOR	VER	[cm]	[deg.]	[cm]	[deg.]	
1215.750	51.5	54.8	-54.7	-52.2	3.0	6.2	0.0	-53.6	-51.1	-30.0	23.6	21.1	155	201	140	60	
1823.625	50.0	50.4	-55.5	-55.8	3.6	9.5	0.0	-51.8	-52.1	-30.0	21.8	22.1	100	192	175	183	
2431.500	43.0	41.7	-61.1	-61.2	4.3	10.8	0.0	-56.8	-56.9	-30.0	26.8	26.9	106	95	148	108	
3039.375	42.2	39.9	-59.7	-63.7	4.7	11.5	0.0	-55.1	-59.1	-30.0	25.1	29.1	130	57	187	0	
3647.250	39.0	35.8	-62.4	-65.3	5.2	12.1	0.0	-57.7	-60.6	-30.0	27.7	30.6	109	292	187	173	
4255.125	36.8	37.8	-63.1	-64.2	5.6	12.3	0.0	-58.6	-59.7	-30.0	28.6	29.7	100	31	178	0	
4863.000	38.6	38.7	-58.0	-58.4	6.1	12.8	0.0	-53.4	-53.8	-30.0	23.4	23.8	133	344	178	0	
5470.875	35.5	35.1	-60.5	-61.6	6.5	13.1	0.0	-56.0	-57.1	-30.0	26.0	27.1	171	313	130	7	
6078.750	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	

Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - Tx Antenna Attenuator Loss -2.15
Rx-ANTENNA : Biconical Antenna (25 M - 200 MHz), Logperiodic Antenna (200 M - 1000 MHz), Horn Antenna (1 G - 7 GHz)
Tx-ANTENNA : 120 MHz tuned Dipole Antenna (25 M - 120 MHz), Dipole Antenna (120 M - 1000 MHz), Horn Antenna (1 G - 7 GHz)
Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).
NS : No signal detect.
Detector : 25 MHz to 30 MHz: Spectrum Analyzer RMS Average (RBW: 10 kHz / VBW: 30 kHz)
30 MHz to 1 GHz: Spectrum Analyzer RMS Average (RBW: 100 kHz / VBW: 300 kHz)
Above 1 GHz: Spectrum Analyzer RMS Average (RBW: 1 MHz / VBW: 3 MHz)
*Emissions were investigated up to the 10th harmonic of the fundamental.

Frequency stability

Report No.	12244307H
Test place	Ise EMC Lab. No.7 Shielded Room
Date	May 24, 2018
Temperature/ Humidity	23 deg. C / 55 % RH
Engineer	Ken Fujita
Mode	Tx 539.000 MHz

Varying Temperature

Test condition		Tested	Measured	Frequency	Result	Limit	Remarks
Temp.	Voltage	frequency	frequency	error			
[deg. C]	[V]	[MHz]	[MHz]	[MHz]	[%]	[+/- %]	
50	3.00	539.000	538.999533	-0.000467	-0.00009	0.005	
40	3.00	539.000	538.999540	-0.000460	-0.00009	0.005	
30	3.00	539.000	538.999840	-0.000160	-0.00003	0.005	
20	3.00	539.000	538.999841	-0.000159	-0.00003	0.005	
10	3.00	539.000	538.999842	-0.000158	-0.00003	0.005	
0	3.00	539.000	538.999856	-0.000144	-0.00003	0.005	
-10	3.00	539.000	538.999863	-0.000137	-0.00003	0.005	
-20	3.00	539.000	538.999879	-0.000121	-0.00002	0.005	
-30	3.00	539.000	538.999901	-0.000099	-0.00002	0.005	

Calculation formula: Frequency error = Measured frequency - Tested frequency
Result [%] = Frequency error / Tested frequency * 100

Varying Supply Voltage

Test condition		Tested	Measured	Frequency	Result	Limit	Remarks
Temp.	Voltage	frequency	frequency	error			
[deg. C]	[V]	[MHz]	[MHz]	[MHz]	[%]	[+/- %]	
20	5.00	539.000	538.999841	-0.000159	-0.00003	0.005	USB Power (nominal)
20	4.25	539.000	538.999853	-0.000147	-0.00003	0.005	USB Power (-15 %)
20	5.75	539.000	538.999855	-0.000145	-0.00003	0.005	USB Power (+15 %)
20	3.45	539.000	538.999841	-0.000159	-0.00003	0.005	Battery Power
20	2.00	539.000	538.999859	-0.000141	-0.00003	0.005	Battery End Point

Calculation formula: Frequency error = Measured frequency - Tested frequency
Result [%] = Frequency error / Tested frequency * 100

APPENDIX 2: Test instruments

Test Instruments

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Cal Int
RE	141203	Attenuator(6dB)	Weinschel Corp	2	BK7970	11/14/2017	11/30/2018	12
RE	141514	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	1611	09/14/2017	09/30/2018	12
RE	141317	Coaxial Cable	Fujikura/Agilent	-	-	02/23/2018	02/28/2019	12
RE	141152	EMI measurement program	TSJ	TEPTO-DV	-	-	-	-
RE	141265	Logperiodic Antenna (200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-190	05/31/2018	05/31/2019	12
RE	142182	Measure	KOMELON	KMC-36	-	-	-	-
RE	141578	Pre Amplifier	AGILENT	8447D	2944A10845	09/27/2017	09/30/2018	12
RE	141556	Thermo-Hygrometer	CUSTOM	CTH-201	0003	12/21/2017	12/31/2018	12
RE	141395	Coaxial Cable	UL Japan	-	-	12/15/2017	12/31/2018	12
RE	141369	Band Pass Filter	M-City	BPF0950-01	UL0002	02/28/2018	02/28/2019	12
RE	141508	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	09/14/2017	09/30/2018	12
RE	142227	Measure	KOMELON	KMC-36	-	-	-	-
RE	141581	MicroWave System Amplifier	AGILENT	83017A	650	10/06/2017	10/31/2018	12
RE	141412	Microwave Cable	Junkosha	MWX221	1305S002R(1m) / 1405S146(5m)	06/14/2018	06/30/2019	12
RE	141562	Thermo-Hygrometer	CUSTOM	CTH-180	1501	01/24/2018	01/31/2019	12
RE	141900	Spectrum Analyzer	AGILENT	E4440A	MY46185823	11/16/2017	11/30/2018	12
RE	142004	AC2_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	8/31/2017	08/31/2018	12
RE	141884	Spectrum Analyzer	AGILENT	E4448A	MY44020357	11/07/2017	11/30/2018	12
RE	142011	AC4_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	10/30/2017	10/31/2018	12
RE	141297	High Pass Filter (1.1-10GHz)	TOKYO KEIKI	TF219CD1	1001	01/18/2018	01/31/2019	12
RE	141896	Signal Generator	Rohde & Schwarz	SMR40	100137	06/07/2018	06/30/2019	12
RE	141409	Microwave Cable (1-30GHz)	Huber+Suhner	SF103/ 11PC3.5-31/ 11PC3.5-31/ 8.0m	54308/3	01/16/2018	01/31/2019	12
RE	141424	Biconical Antenna	Schwarzbeck	BBA9106	1915	10/02/2017	10/31/2018	12
AT	142764	Radiocomunication Service Monitor	Rohde & Schwarz	CMS54	829000/009	9/5/2017	9/30/2018	12
AT	89845	Audio Analyzer	AUDIO PRECISION	APx525	APX2-270709	11/20/2017	11/30/2018	12
AT	141898	Signal Genelator	KEYSIGHT	N5182B	MY56200177	11/22/2017	11/30/2018	12
AT	141901	Spectrum Analyzer	AGILENT	E4440A	MY48250080	10/18/2017	10/31/2018	12
AT	141360	DIGIITAL HiTESTER	HIOKI	3805	70900532	1/15/2018	1/31/2019	12
AT	141840	Power sensor	ANRITSU	MA2411B	11737	10/13/2017	10/31/2018	12
AT	141572	Thermo-Hygrometer	CUSTOM	CTH-201	3401	1/24/2018	1/31/2019	12
AT	141814	Power Meter	DARE!! Instruments	RPR3006W	14I00048SNO082	11/2/2017	11/30/2018	12
AT	141156	Attenuator(10dB)	Weinschel Corp	2	BL1173	11/14/2017	11/30/2018	12
AT	90070	Software	AUDIO PRECISION	APx500 4.1	-	-	-	-
AT	142178	Measure	PROMART	SEN1635	-	-	-	-

***Hyphens for Last Calibration Date, Calibration Due 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.
All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

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

Test Item: RE: Radiated Emission
AT: Antenna Terminal Conducted test