



RADIO TEST REPORT

Test Report No.: 13720501H-F-R2

Customer	Sound Devices, LLC
Description of EUT	Digital Wireless Microphone Transmitter
Model Number of EUT	A20-MINI
FCC ID	22225-9295W
Test Regulation	FCC Part 15 Subpart C
Test Result	Complied (Refer to SECTION 3)
Issue Date	November 7, 2022
Remarks	-

Representative Test Engineer	Approved By
	
Nachi Konegawa Engineer	Tsubasa Takayama Leader
	
	
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- The information provided from the customer for this report is identified in Section 1.
- For test report(s) referred in this report, the latest version (including any revisions) is always referred.

REVISION HISTORY

Original Test Report No.: 13720501H-F

This report is a revised version of 13720501H-F-R1. 13720501H-F-R1 is replaced with this report.

Revision	Test Report No.	Date	Page Revised Contents												
- (Original)	13720501H-F	August 19, 2022	-												
1	13720501H-F-R1	September 16, 2022	SECTION 5: Transmitter unwanted emissions -Correction of below sentence. 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 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 accordance to KDB 206256 and ANSI C 63.26, and the test was made at the position that has the maximum noise. The confirm also includes compliance in the vertical axis (i.e. Y axis) as specified in EN 300422. A test data showing the highest emission levels as worst position are reported in this report.												
1	13720501H-F-R1	September 16, 2022	APPENDIX 3: Photographs of test setup -Addition of setup photo for Y/ Z Axis.												
2	13720501H-F-R2	November 7, 2022	SECTION 2: Equipment Under Test (EUT) -Correction of Antenna gain for Radio Specification (Radio microphone) 2.14 dBi → 2.66 dBi												
2	13720501H-F-R2	November 7, 2022	SECTION 4.2: Configuration and Peripherals -Correction of Antenna information for No B for Transmitter unwanted emissions test. <table border="1"><tr><td>B</td><td>Whip Antenna 548 MHz to 663 MHz</td><td>#2</td><td>-</td><td>Sound Devices, LLC</td><td>EUT</td></tr></table> → <table border="1"><tr><td>B</td><td>Antenna SMA Straight 548 MHz to 663 MHz</td><td>11225.000</td><td>-</td><td>Sound Devices, LLC</td><td>EUT</td></tr></table>	B	Whip Antenna 548 MHz to 663 MHz	#2	-	Sound Devices, LLC	EUT	B	Antenna SMA Straight 548 MHz to 663 MHz	11225.000	-	Sound Devices, LLC	EUT
B	Whip Antenna 548 MHz to 663 MHz	#2	-	Sound Devices, LLC	EUT										
B	Antenna SMA Straight 548 MHz to 663 MHz	11225.000	-	Sound Devices, LLC	EUT										
2	13720501H-F-R2	November 7, 2022	APPENDIX 1: Test Data (RF Output Power) -Correction of Antenna gain. 2.14 dBi → 2.66 dBi												

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Reference: Abbreviations (Including words undescribed in this report)

A2LA	The American Association for Laboratory Accreditation	ICES	Interference-Causing Equipment Standard
AC	Alternating Current	IEC	International Electrotechnical Commission
AFH	Adaptive Frequency Hopping	IEEE	Institute of Electrical and Electronics Engineers
AM	Amplitude Modulation	IF	Intermediate Frequency
Amp, AMP	Amplifier	ILAC	International Laboratory Accreditation Conference
ANSI	American National Standards Institute	ISED	Innovation, Science and Economic Development Canada
Ant, ANT	Antenna	ISO	International Organization for Standardization
AP	Access Point	JAB	Japan Accreditation Board
ASK	Amplitude Shift Keying	LAN	Local Area Network
Atten., ATT	Attenuator	LIMS	Laboratory Information Management System
AV	Average	MCS	Modulation and Coding Scheme
BPSK	Binary Phase-Shift Keying	MRA	Mutual Recognition Arrangement
BR	Bluetooth Basic Rate	N/A	Not Applicable
BT	Bluetooth	NIST	National Institute of Standards and Technology
BT LE	Bluetooth Low Energy	NS	No signal detect.
BW	BandWidth	NSA	Normalized Site Attenuation
Cal Int	Calibration Interval	NVLAP	National Voluntary Laboratory Accreditation Program
CCK	Complementary Code Keying	OBW	Occupied Band Width
Ch., CH	Channel	OFDM	Orthogonal Frequency Division Multiplexing
CISPR	Comite International Special des Perturbations Radioelectriques	P/M	Power meter
CW	Continuous Wave	PCB	Printed Circuit Board
DBPSK	Differential BPSK	PER	Packet Error Rate
DC	Direct Current	PHY	Physical Layer
D-factor	Distance factor	PK	Peak
DFS	Dynamic Frequency Selection	PN	Pseudo random Noise
DQPSK	Differential QPSK	PRBS	Pseudo-Random Bit Sequence
DSSS	Direct Sequence Spread Spectrum	PSD	Power Spectral Density
EDR	Enhanced Data Rate	QAM	Quadrature Amplitude Modulation
EIRP, e.i.r.p.	Equivalent Isotropically Radiated Power	QP	Quasi-Peak
EMC	ElectroMagnetic Compatibility	QPSK	Quadri-Phase Shift Keying
EMI	ElectroMagnetic Interference	RBW	Resolution Band Width
EN	European Norm	RDS	Radio Data System
ERP, e.r.p.	Effective Radiated Power	RE	Radio Equipment
EU	European Union	RF	Radio Frequency
EUT	Equipment Under Test	RMS	Root Mean Square
Fac.	Factor	RSS	Radio Standards Specifications
FCC	Federal Communications Commission	Rx	Receiving
FHSS	Frequency Hopping Spread Spectrum	SA, S/A	Spectrum Analyzer
FM	Frequency Modulation	SG	Signal Generator
Freq.	Frequency	SVSWR	Site-Voltage Standing Wave Ratio
FSK	Frequency Shift Keying	TR	Test Receiver
GFSK	Gaussian Frequency-Shift Keying	Tx	Transmitting
GNSS	Global Navigation Satellite System	VBW	Video BandWidth
GPS	Global Positioning System	Vert.	Vertical
Hori.	Horizontal	WLAN	Wireless LAN

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SECTION 1: Customer Information

Company Name	Sound Devices, LLC
Address	PO Box 576, E7556 State Rd 23 and 33, Reedsburg, WI, 53959, US
Telephone Number	+1 608 524 0625
Contact Person	Lee Stone of Audio Ltd (E-mail: lee.stone@audioltd.com)

The information provided from the customer is as follows;

- Customer, Description 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 and Test 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

Description	Digital Wireless Microphone Transmitter
Model Number	A20-MINI
Serial Number	Refer to SECTION 4.2
Condition	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	No Modification by the test lab
Receipt Date	May 14 and June 30, 2022 (for Antenna Terminal Conducted test) May 14, 2022 (for Radiated Emission test)
Test Date	June 2 to July 11, 2022

2.2 Product Description

General Specification

Rating	DC 3.7 V to 4.5 V
Operating temperature	-10 deg. C to 38 deg. C

Radio Specification (Radio microphone) *1)

Radio type	Transmitter
Modulation type	COFDM
Emission designator	200KG2E
Necessary bandwidth	200 kHz
Channel spacing	400 kHz
Frequency of operation	614.100 MHz to 615.900 MHz 657.100 MHz to 662.900 MHz
RF power	2 mW, 10 mW
Antenna gain	2.66 dBi

Radio Specification (Bluetooth Low Energy)

Equipment Type	Transceiver
Frequency of Operation	2402 MHz to 2480MHz
Type of Modulation	GFSK
Antenna Gain	1.8 dBi

*1) This test report applies for Radio microphone part (614.100 MHz to 615.900 MHz and 657.100 MHz to 662.900 MHz).

SECTION 3: Test Specification, Procedures & Results

3.1 Test Specification

Test Specification	FCC Part 15 Subpart C The latest version on the first day of the testing period
Title	FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators Section 15.236 Operation of wireless microphones in the bands 54-72 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz and 614-698 MHz.

* The EUT complies with FCC Part 15 Subpart B.

3.2 Procedures and Results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	ANSI C63.10-2013 6. Standard test methods	FCC: Section 15.207	N/A	N/A	*1)
RF Output Power	ANSI C63.10:2013 Clause 11.9.2.3	FCC: Section 15.236 (d) (1) (2)	See data.	Complied a)	Conducted
Emission Bandwidth (-20 dB Bandwidth)	ANSI C63.10:2013 Clause 6.9	FCC: Section 15.236 (f) (1) (2)	See data.	Complied b)	Conducted
Emission mask	EN 300 422-1 V1.4.2 Clause 8.3	FCC: Section 15.236 (g) KDB206256 IV (d)	See data.	Complied c)	Conducted
Transmitter unwanted emissions	EN 300 422-1 V1.4.2 Clause 8.4	FCC: Section 15.236 (g) KDB206256 IV (d)	0.9 dB 550.00 MHz, Horizontal	Complied d)	Radiated *2)
Transmitter frequency stability	ANSI C63.10:2013 Clause 6.8	FCC: Section 15.236 (f) (3)	See data.	Complied e)	Conducted

Note: UL Japan, Inc.'s EMI Work Procedures: Work Instructions-ULID-003591 and Work Instructions-ULID-003593.

*1) The test is not applicable since the EUT operates in RF mode only by battery and not by USB power supply.

*2) Based on KDB inquiry (Tracking Number: 505113), Transmitter unwanted emission test was conducted only Radiated.

- a) Refer to APPENDIX 1 (data of RF power output)
- b) Refer to APPENDIX 1 (data of Emission Bandwidth (-20 dB Bandwidth))
- c) Refer to APPENDIX 1 (data of Emission mask)
- d) Refer to APPENDIX 1 (data of Transmitter unwanted emissions)
- e) Refer to APPENDIX 1 (data of Transmitter frequency stability)

FCC Part 15.31 (e)

The test was performed with the New Battery and the stable voltage was supplied to the EUT during the tests.
Therefore, the EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

Not applicable according to 206256 D01 IV (f)

3.3 Addition to Standard

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

3.4 Uncertainty

Measurement uncertainty is not taken into account when stating conformity with a specified requirement.

Note: When margins obtained from test results are less than the measurement uncertainty, the test results may exceed the limit.

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

Spurious Emission (EUT height: 1.5 m) (Measurement Distance 3 m)	Uncertainty (+/-)
25 MHz to 200 MHz	5.6 dB
200 MHz to 1000 MHz	4.0 dB
1 GHz to 12.75 GHz	4.6 dB
Antenna terminal test	Uncertainty (+/-)
RF output power	1.3 dB
Emission Bandwidth (Span 1 MHz)	0.96 %
Emission mask	1.9 dB
Transmitter frequency stability	0.01541 ppm

3.5 Test Location

UL Japan, Inc. Ise EMC Lab.

*A2LA Certificate Number: 5107.02 / FCC Test Firm Registration Number: 884919

ISED Lab Company Number: 2973C / CAB identifier: JP0002

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 Japan

Telephone: +81-596-24-8999

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.10 shielded room	3.8 x 2.8 x 2.8	3.8 x 2.8	-	-
No.11 measurement room	4.0 x 3.4 x 2.5	N/A	-	-
No.12 measurement room	2.6 x 3.4 x 2.5	N/A	-	-
Large Chamber	16.9 x 22.1 x 10.17	16.9 x 22.1	-	10 m
Small Chamber	5.3 x 6.69 x 3.59	5.3 x 6.69	-	-

3.6 Test Data, Test Instruments, and Test Set Up

Refer to APPENDIX.

SECTION 4: Operation of EUT during testing

4.1 Operating Mode(s)

Mode	Remarks*
Transmitting (Tx), Power setting: 2 mW	Typ. 2 mW
Transmitting (Tx), Power setting: 10 mW	Typ. 10 mW
*Transmitting duty was 100 % on all tests.	
*Power of the EUT was set by the software as follows; Power settings: 2 mW, 10 mW Software: RealTerm: Serial Capture program 2.0.0.69 (Date: 2021.04.01 Storage location: Driven by connected PC)	
*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 except 2mW, 10mW settings.	

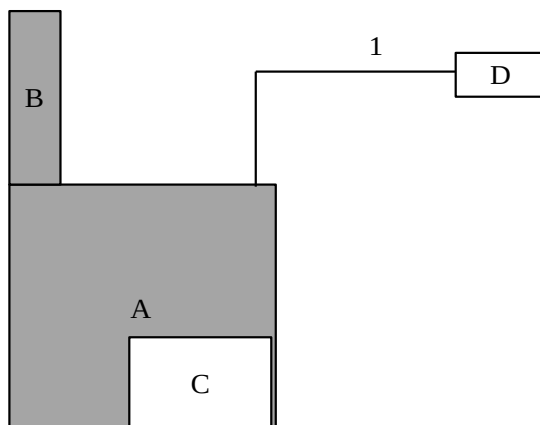
*The details of Operating mode(s)

The details of Operating mode(s)					
Test Item	Tested frequency		Power setting	Modulation	Remarks
RF power output	614.100 MHz	(Low)	2 mW, 10 mW,	Digital modulation (PN9 data packet)	-
	615.000 MHz	(Mid)			
	615.900 MHz	(High)			
	657.100 MHz	(Low)	2 mW, 10 mW,		
	660.000 MHz	(Mid)			
	662.900 MHz	(High)			
Emission Bandwidth	614.100 MHz	(Low)	10 mW	Digital modulation (PN9 data packet)	-
	615.000 MHz	(Mid)			
	615.900 MHz	(High)			
	657.100 MHz	(Low)	10 mW		
	660.000 MHz	(Mid)			
	662.900 MHz	(High)			
Emission Mask	614.100 MHz	(Low)	2 mW, 10 mW,	Digital modulation (PN9 data packet)	-
	615.000 MHz	(Mid)			
	615.900 MHz	(High)			
	657.100 MHz	(Low)	2 mW, 10 mW,		
	660.000 MHz	(Mid)			
	662.900 MHz	(High)			
Transmitter unwanted emissions	614.100 MHz	(Low)	10 mW	Digital modulation (PN9 data packet)	-
	615.000 MHz	(Mid)			
	615.900 MHz	(High)			
	657.100 MHz	(Low)	10 mW		
	660.000 MHz	(Mid)			
	662.900 MHz	(High)			
Transmitter frequency stability	615.000 MHz		10 mW	No modulation	*1)
	660.000 MHz		10 mW		

*1) There is no difference in frequency generating method on each frequency. Therefore the test was performed on Mid channel as a representative.

4.2 Configuration and Peripherals

【Transmitter unwanted emissions test】



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

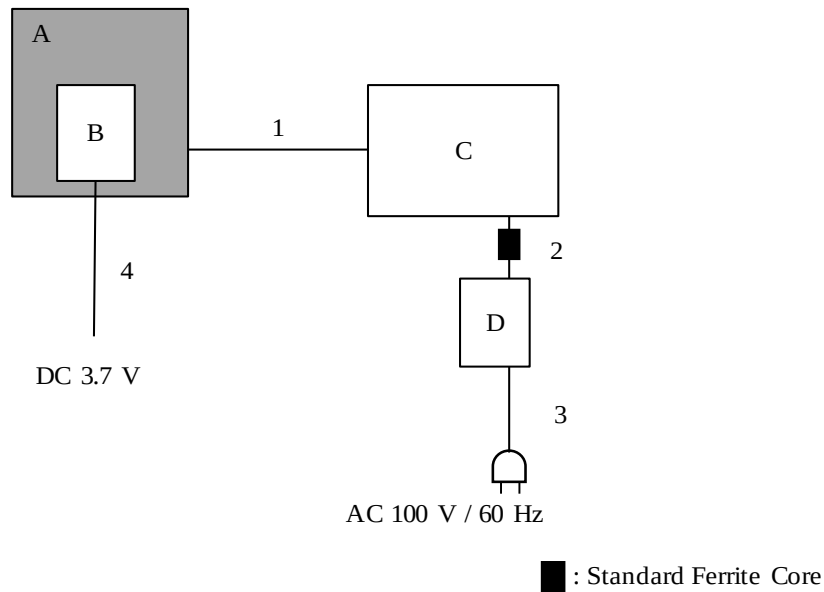
Description of EUT and Support Equipment

No.	Item	Model number	Serial Number	Manufacturer	Remarks
A	Digital Wireless Microphone Transmitter	A20-MINI	GF9922068002	Sound Devices, LLC	EUT
B	Antenna SMA Straight 548 MHz to 663 MHz	11225.000	-	Sound Devices, LLC	EUT
C	Battery	NP-BX1	3852248	DuraPro	-
D	Lavalier Microphone Black	VT 506	-	Voice Technologies	-

List of Cables Used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Signal Cable	1.5	Unshielded	Unshielded	-

【Antenna Terminal Conducted test】



* 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	Digital Wireless Microphone Transmitter	A20-MINI	GF9922068004	Sound Devices, LLC	EUT
B	Battery	NP-BX1	3852248	DuraPro	-
C	Laptop PC	X1 Carbon	R9-OH8TU 15/9	LENOVO	-
D	AC Adapter	ADLX45NCC2A	8SSA10E75794C1SG 59R0GHF	LENOVO	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB Cable	1.3	Shielded	Shielded	-
2	DC Cable	1.0	Unshielded	Unshielded	-
3	AC Cable	1.0	Unshielded	Unshielded	-
4	DC Cable	0.8	Unshielded	Unshielded	-

SECTION 5: Transmitter unwanted emissions

Test Procedure

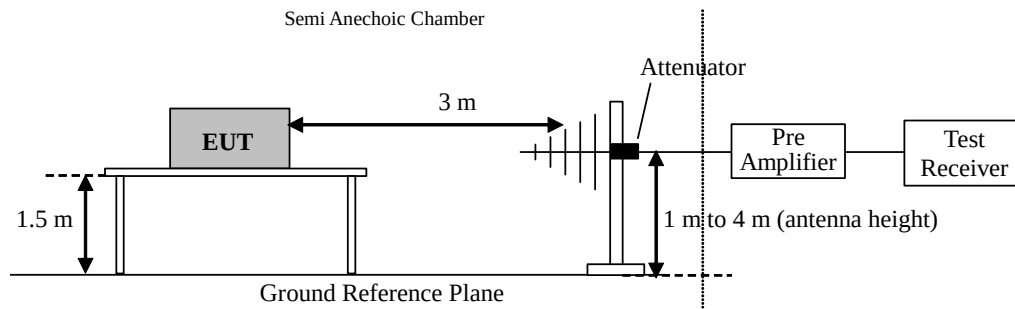
- 1) EUT was placed on a platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane. Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The Radiated Electric Field Strength has been measured in semi anechoic chamber at a 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 (2.15 dBi) 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

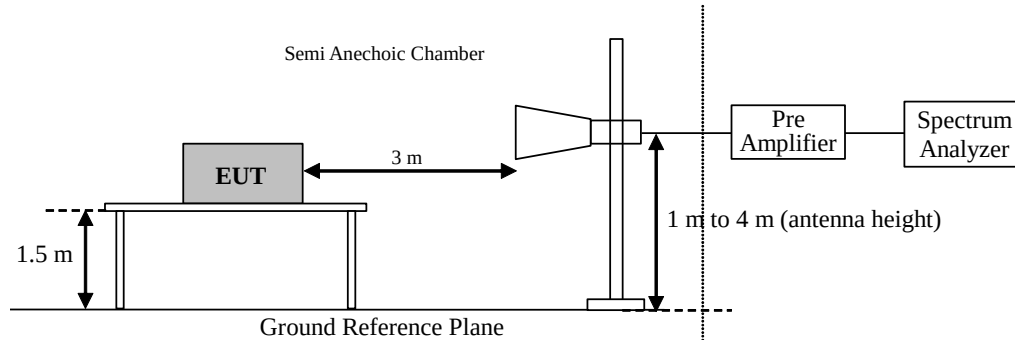
Frequency	25 MHz to 30 MHz	30 MHz to 1 GHz	Above 1 GHz
Instrument used	Test Receiver		Spectrum Analyzer
Detector	QP		RMS Average
IF Bandwidth	BW: 9 kHz	BW: 120 kHz	RBW: 1 MHz VBW: 3 MHz
Test Distance	3 m		

Figure 1: Test Setup

[25 MHz to 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 accordance to KDB 206256 and ANSI C 63.10, and the test was made at the position that has the maximum noise.

The confirm also includes compliance in the vertical axis (i.e. Y axis) as specified in EN 300422.

A test data showing the highest emission levels as worst position are reported in this report.

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

Measurement range : 25 MHz to 7 GHz

Test data : APPENDIX

Test result : Pass

***Test was performed with 10th harmonics of fundamental.**

SECTION 6: Antenna Terminal Conducted 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 Output Power	-	-	-	Auto	Average	-	Power Meter (Sensor: 50 MHz BW)
Emission Bandwidth	2 times to 5 times of occupied bandwidth	1 to 5% of Occupied bandwidth	Three times of RBW	Auto	Peak *1)	Max Hold *1)	Spectrum Analyzer
*1) The measurement was performed with Peak and Max Hold							

[Side band spectrum measurement (Emission mask)]

The EUT was modulated with PN9 audio data packet.

The spectrum mask was measured in accordance with section 8.3.2 of EN 300 422-1.

The measurements were made under normal condition.

[Transmitter 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

APPENDIX 1: Test Data

RF Output Power

Test place Ise EMC Lab. No.8 Measurement Room
Date June 2, 2022
Temperature / Humidity 23 deg. C / 63 % RH
Engineer Keiya Ido
Mode Tx

Power Setting	Channel	Freq.	Reading Average	Cable Loss	Atten. Loss	Ant Gain	Result [EIRP]		Limit [EIRP]	Margin	Remarks
		[MHz]	[dBm]	[dB]	[dB]	[dB]	[dBm]	[mW]	[mW]	[dB]	
2 mW	Low ch	657.100	-7.59	0.23	9.91	2.66	5.21	3.32	250	18.77	
	Mid ch	660.000	-7.57	0.23	9.91	2.66	5.23	3.33	250	18.75	
	High ch	662.900	-7.56	0.23	9.91	2.66	5.24	3.34	250	18.74	
10 mW	Low ch	657.100	-1.03	0.23	9.91	2.66	11.77	15.03	250	12.21	
	Mid ch	660.000	-0.93	0.23	9.91	2.66	11.87	15.38	250	12.11	
	High ch	662.900	-0.96	0.23	9.91	2.66	11.84	15.28	250	12.14	

Calculation formula:

Result = Reading + Cable Loss + Atten. Loss + Ant Gain

Power Setting	Channel	Freq.	Reading Average	Cable Loss	Atten. Loss	Ant Gain	Result [EIRP]		Limit [EIRP]	Margin	Remarks
		[MHz]	[dBm]	[dB]	[dB]	[dB]	[dBm]	[mW]	[mW]	[dB]	
2 mW	Low ch	614.100	-7.52	0.22	9.91	2.66	5.27	3.37	20	7.74	
	Mid ch	615.000	-7.51	0.22	9.91	2.66	5.28	3.37	20	7.73	
	High ch	615.900	-7.66	0.22	9.91	2.66	5.13	3.26	20	7.88	
10 mW	Low ch	614.100	-1.24	0.22	9.91	2.66	11.55	14.29	20	1.46	
	Mid ch	615.000	-1.25	0.22	9.91	2.66	11.54	14.26	20	1.47	
	High ch	615.900	-1.28	0.22	9.91	2.66	11.51	14.16	20	1.50	

Calculation formula:

Result = Reading + Cable Loss + Atten. Loss + Ant Gain

Emission Bandwidth

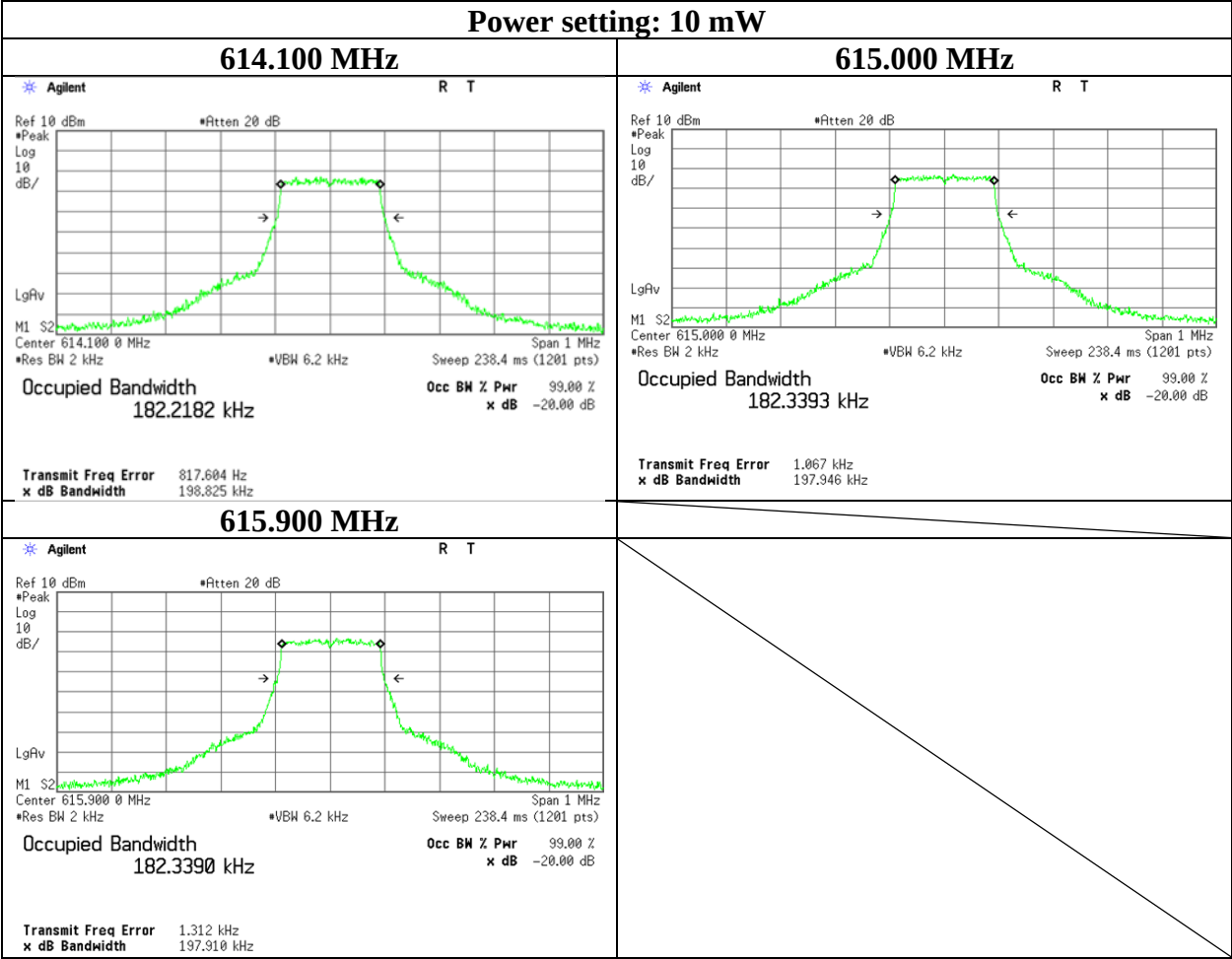
Test place	Ise EMC Lab. No.2 Measurement Room
Date	June 17, 2022
Temperature/ Humidity	22 deg. C / 57 % RH
Engineer	Keiya Ido
Mode	Tx

Power Setting	Channel	Freq. [MHz]	"-20 dB Bandwidth [kHz]	Limit [kHz]	Margin [kHz]
10 mW	Low	614.100	198.8250	200	1.1750
	Mid	615.000	197.9460	200	2.0540
	High	615.900	197.9100	200	2.0900

Power Setting	Channel	Freq. [MHz]	"- 20 dB Bandwidth [kHz]	Limit [kHz]	Margin [kHz]
10 mW	Low	657.100	196.4430	200	3.5570
	Mid	660.000	196.6170	200	3.3830
	High	662.900	198.3540	200	1.6460

Emission Bandwidth

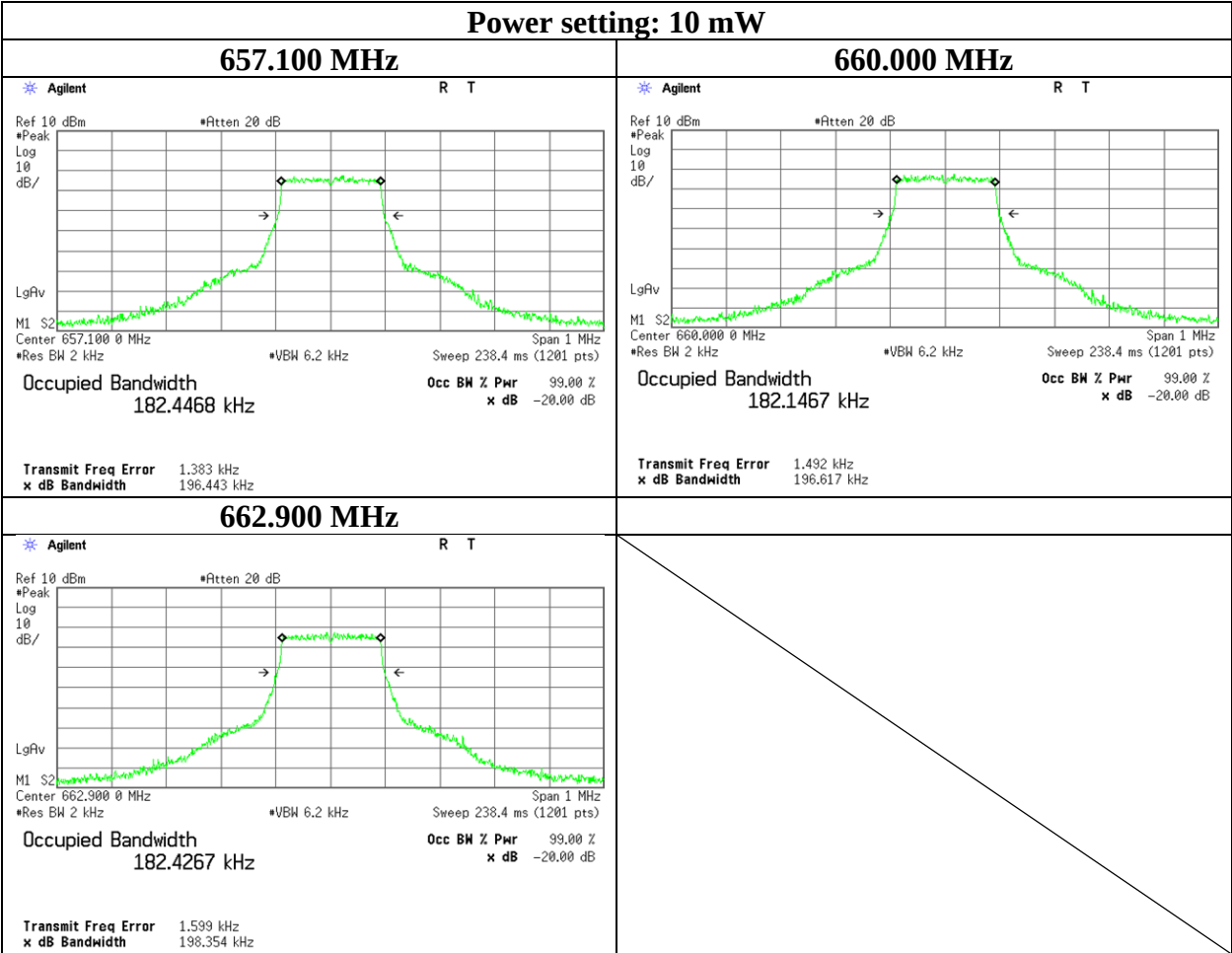
Test place	Ise EMC Lab. No.2 Measurement Room
Date	June 17, 2022
Temperature/ Humidity	22 deg. C / 57 % RH
Engineer	Keiya Ido
Mode	Tx (614.100 MHz to 615.900 MHz)



Emission Bandwidth

Test place
Date
Temperature/ Humidity
Engineer
Mode

Ise EMC Lab. No.8 Measurement Room
June 2, 2022
23 deg. C / 63 % RH
Keiya Ido
Tx (657.100 MHz to 662.900 MHz)



Emission Mask

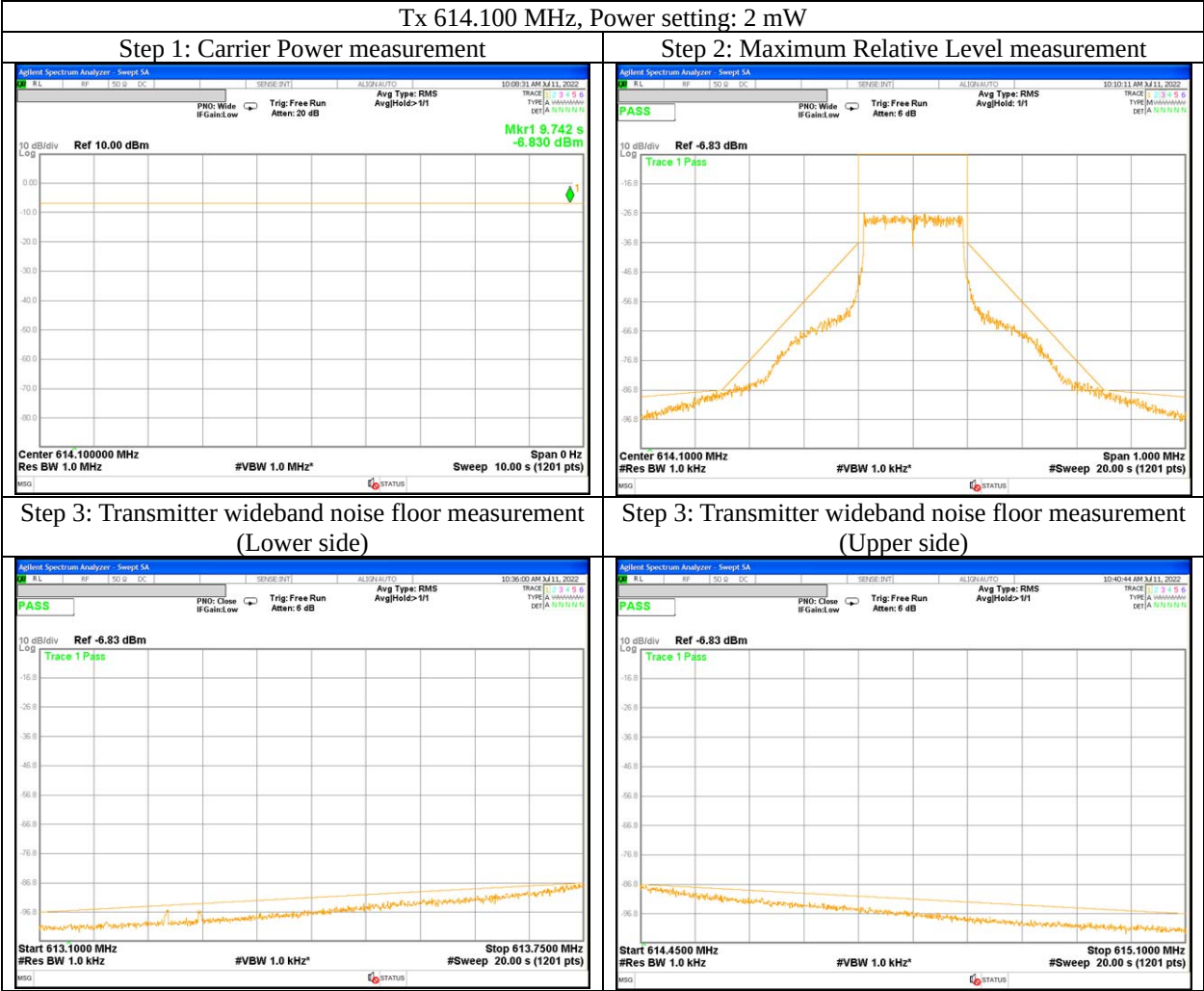
Test placeIse EMC Lab. No.8 Measurement Room

DateJuly 11, 2022

Temperature/ Humidity23 deg. C / 55 % RH

EngineerNachi Konegawa

ModeTx 614.100 MHz, 2 mW



Emission Mask

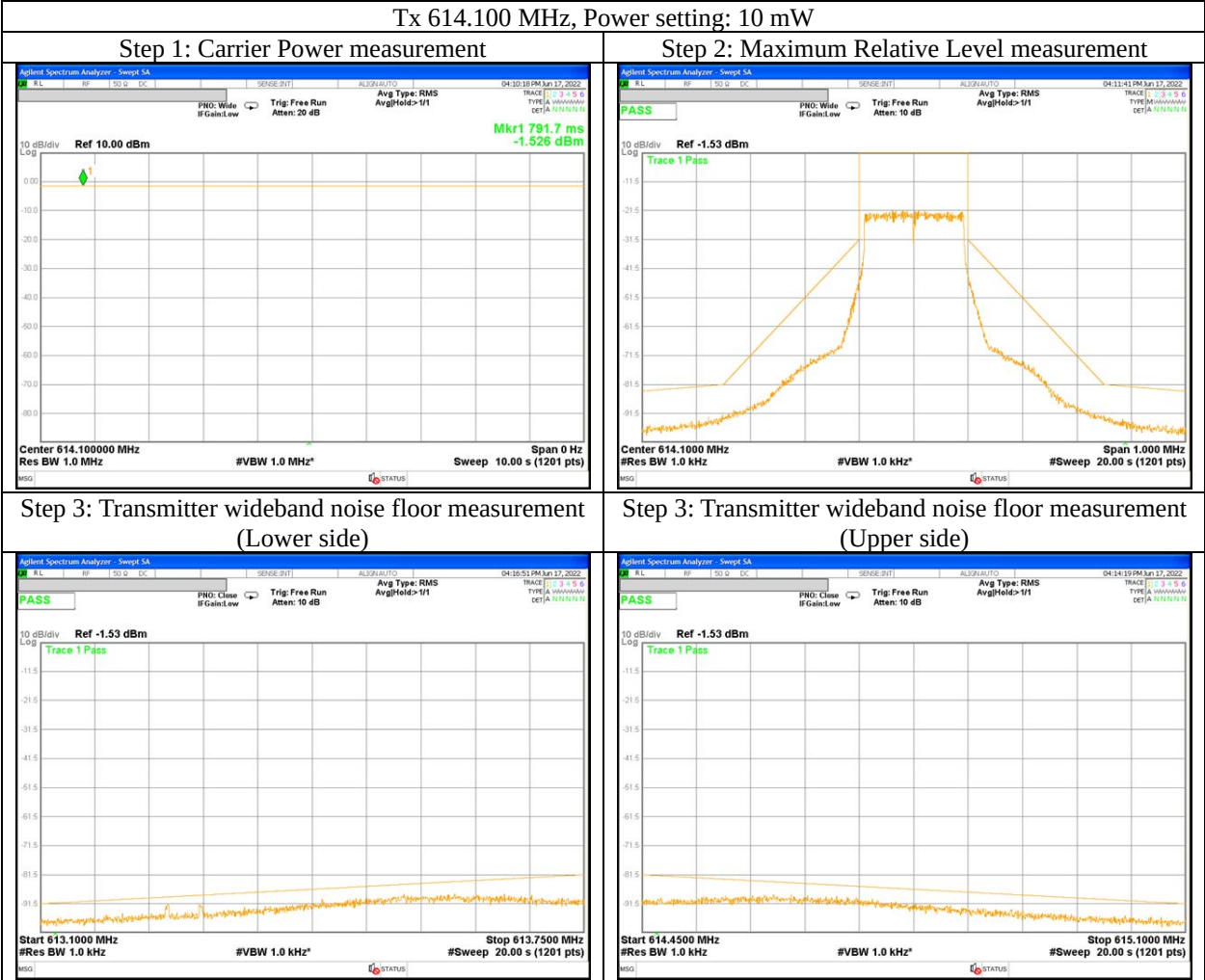
Test placeIse EMC Lab. No.2 Measurement Room

DateJune 17, 2022

Temperature/ Humidity22 deg. C / 57 % RH

EngineerKeiya Ido

ModeTx 614.100 MHz, 10 mW



Emission Mask

Test place

Date

Temperature/ Humidity

Engineer

Mode

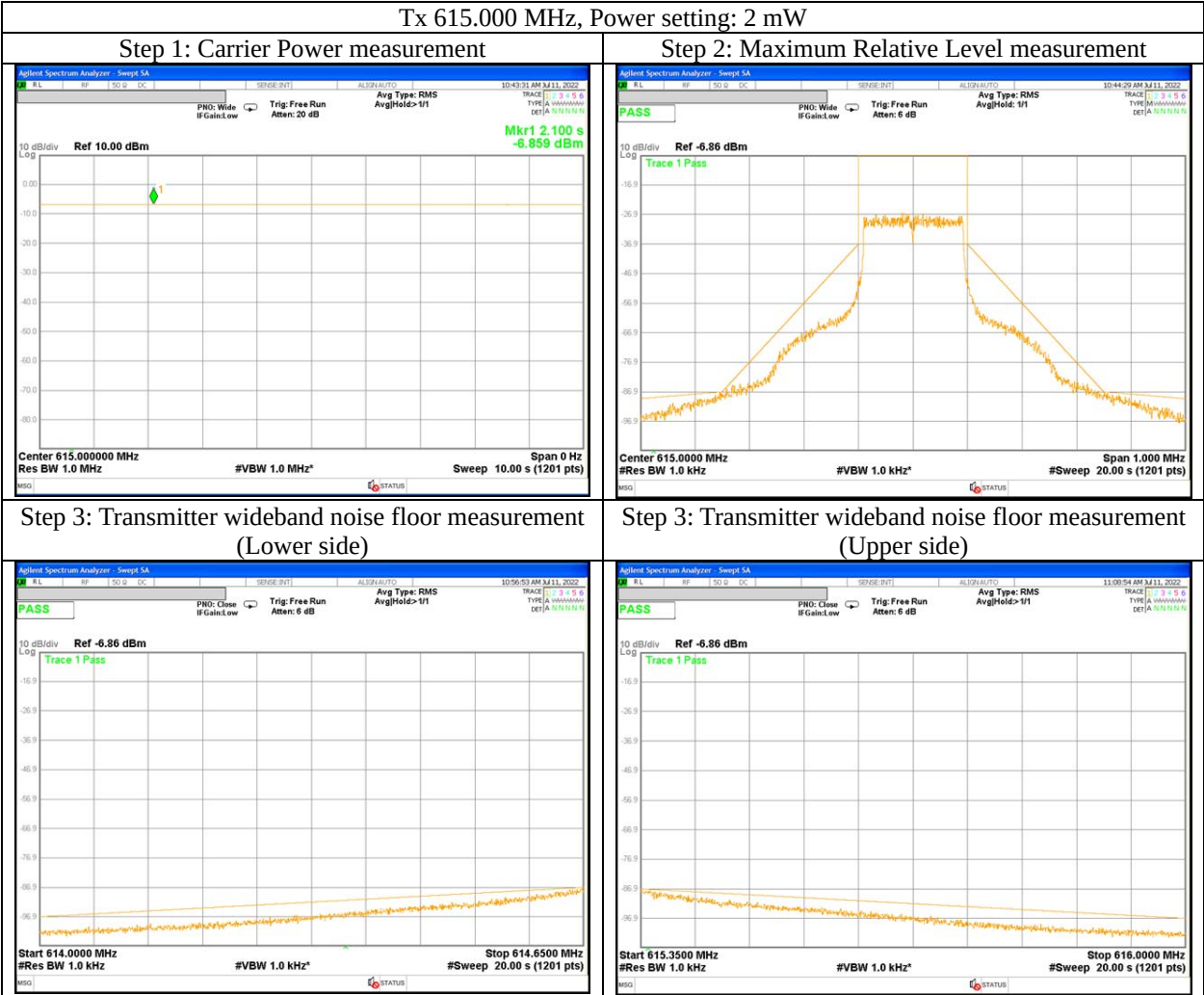
Ise EMC Lab. No.8 Measurement Room

July 11, 2022

23 deg. C / 55 % RH

Nachi Konegawa

Tx 615.000 MHz, 2 mW



Emission Mask

Test place

Date

Temperature/ Humidity

Engineer

Mode

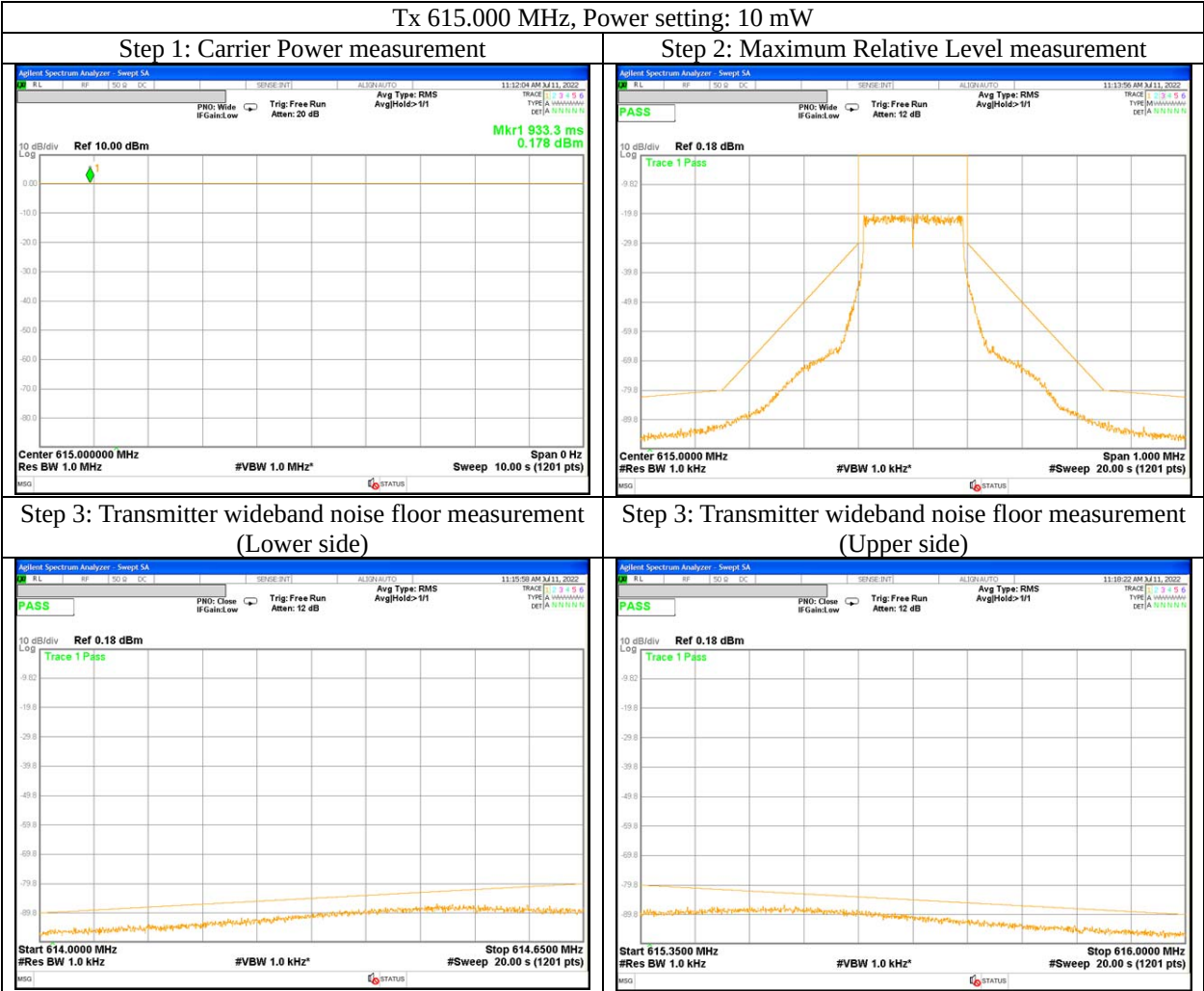
Ise EMC Lab. No.8 Measurement Room

July 11, 2022

23 deg. C / 55 % RH

Nachi Konegawa

Tx 615.000 MHz, 10 mW



Emission Mask

Test place

Date

Temperature/ Humidity

Engineer

Mode

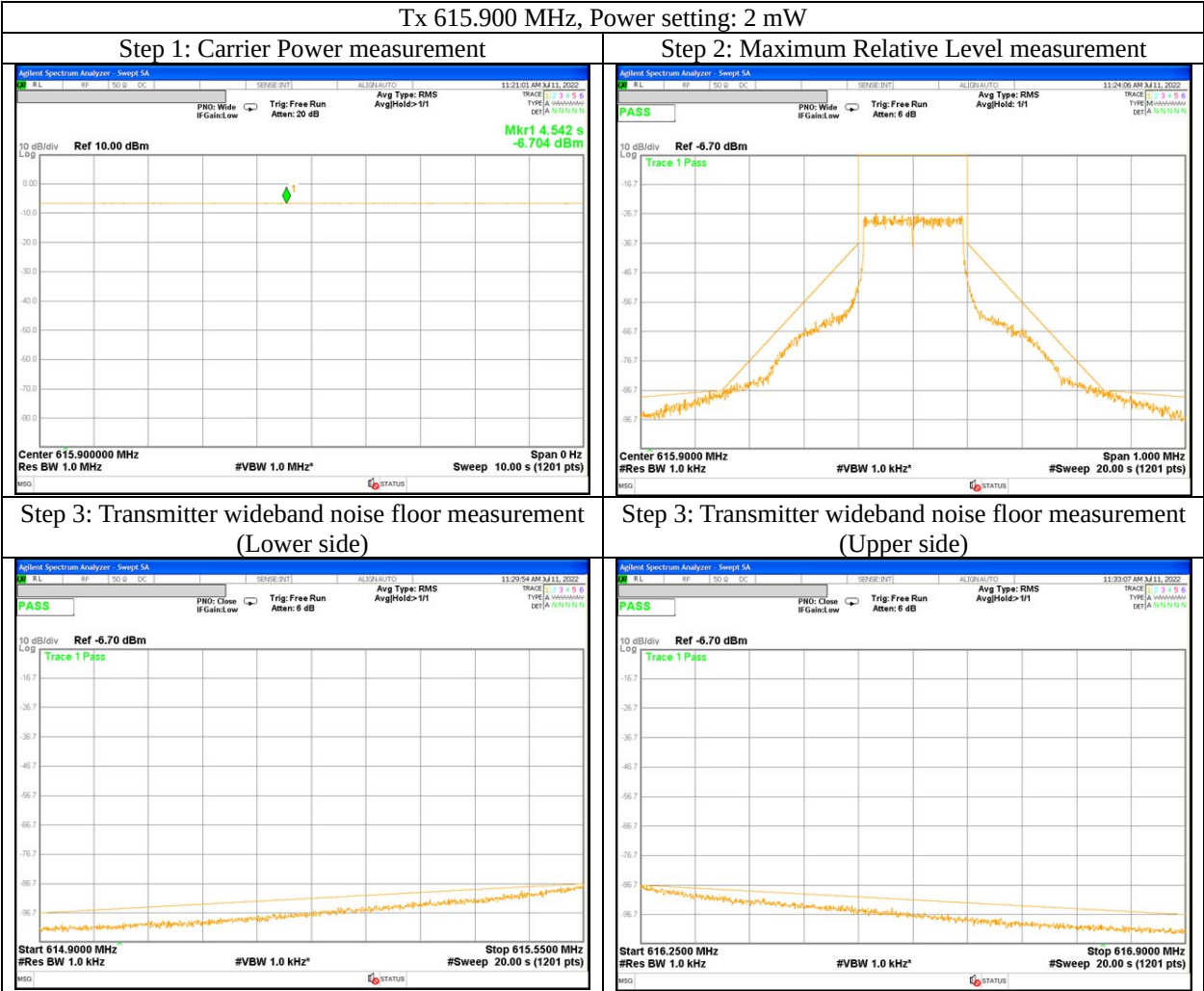
Ise EMC Lab. No.8 Measurement Room

July 11, 2022

23 deg. C / 55 % RH

Nachi Konegawa

Tx 615.900 MHz, 2 mW



Emission Mask

Test place

Date

Temperature/ Humidity

Engineer

Mode

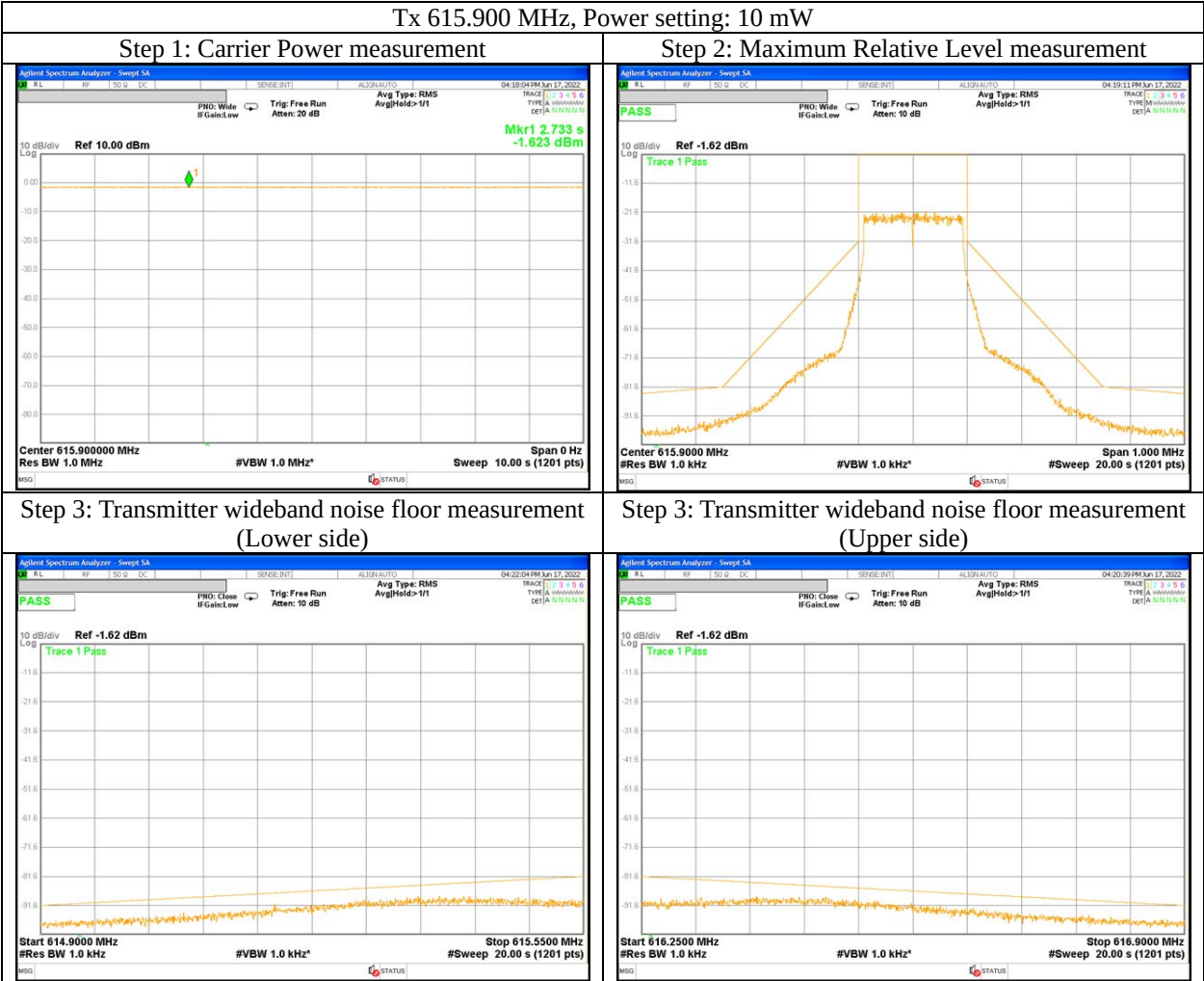
Ise EMC Lab. No.2 Measurement Room

June 17, 2022

22 deg. C / 57 % RH

Keiya Ido

Tx 615.900 MHz, 10 mW



Emission Mask

Test place

Date

Temperature/ Humidity

Engineer

Mode

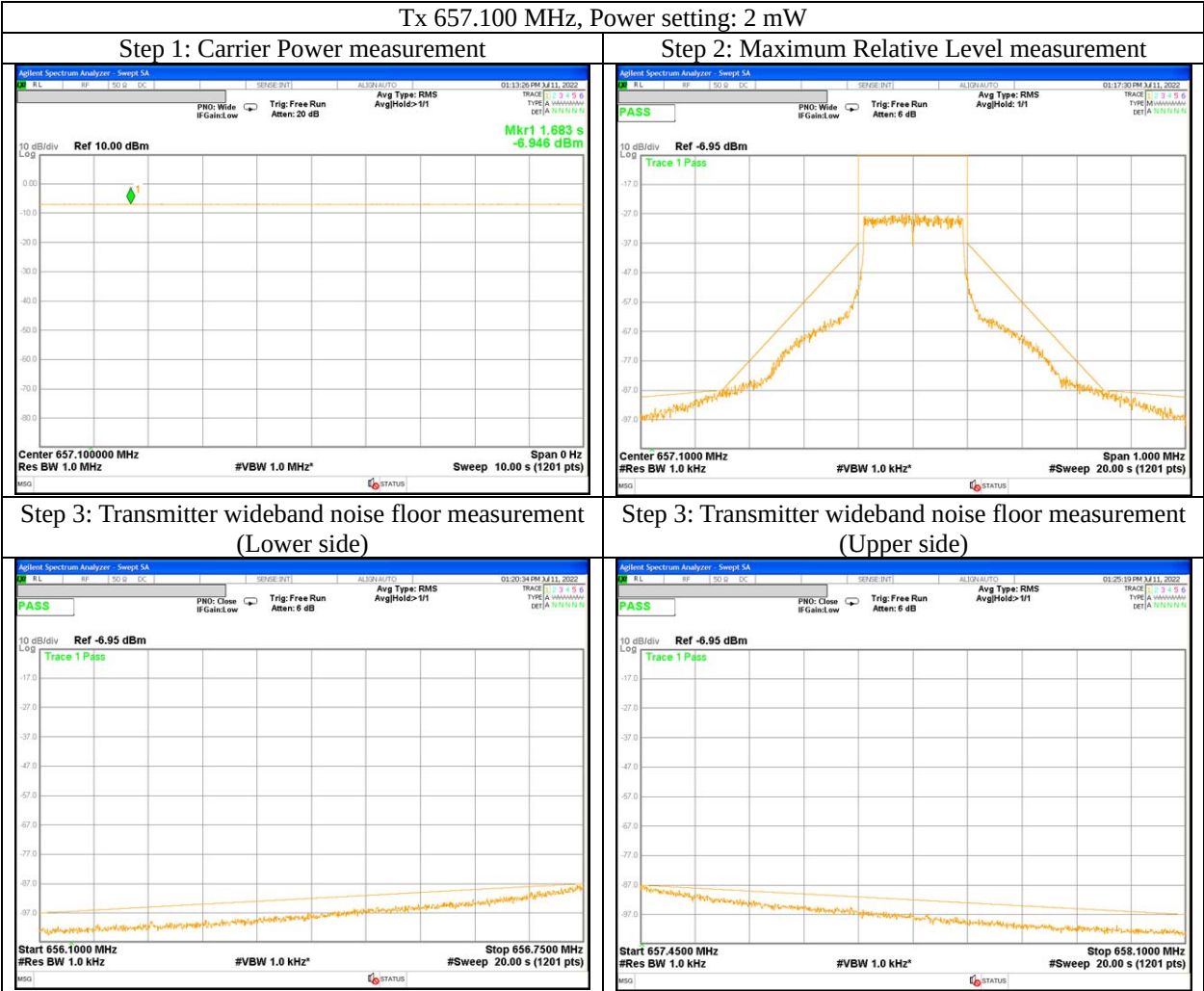
Ise EMC Lab. No.8 Measurement Room

July 11, 2022

23 deg. C / 55 % RH

Nachi Konegawa

Tx 657.100 MHz, 2 mW



Emission Mask

Test place

Date

Temperature/ Humidity

Engineer

Mode

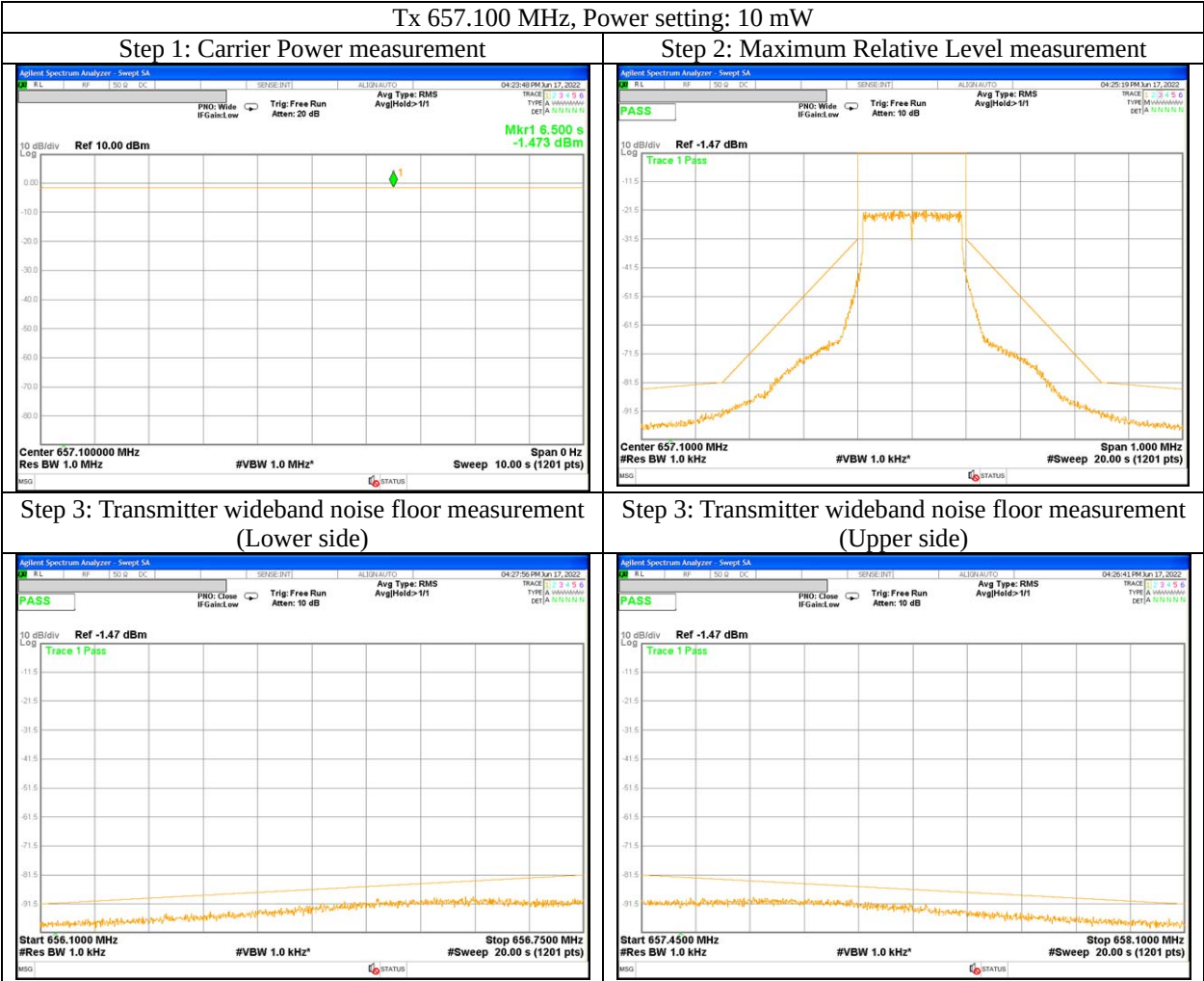
Ise EMC Lab. No.2 Measurement Room

June 17, 2022

22 deg. C / 57 % RH

Keiya Ido

Tx 657.100 MHz, 10 mW



Emission Mask

Test place

Date

Temperature/ Humidity

Engineer

Mode

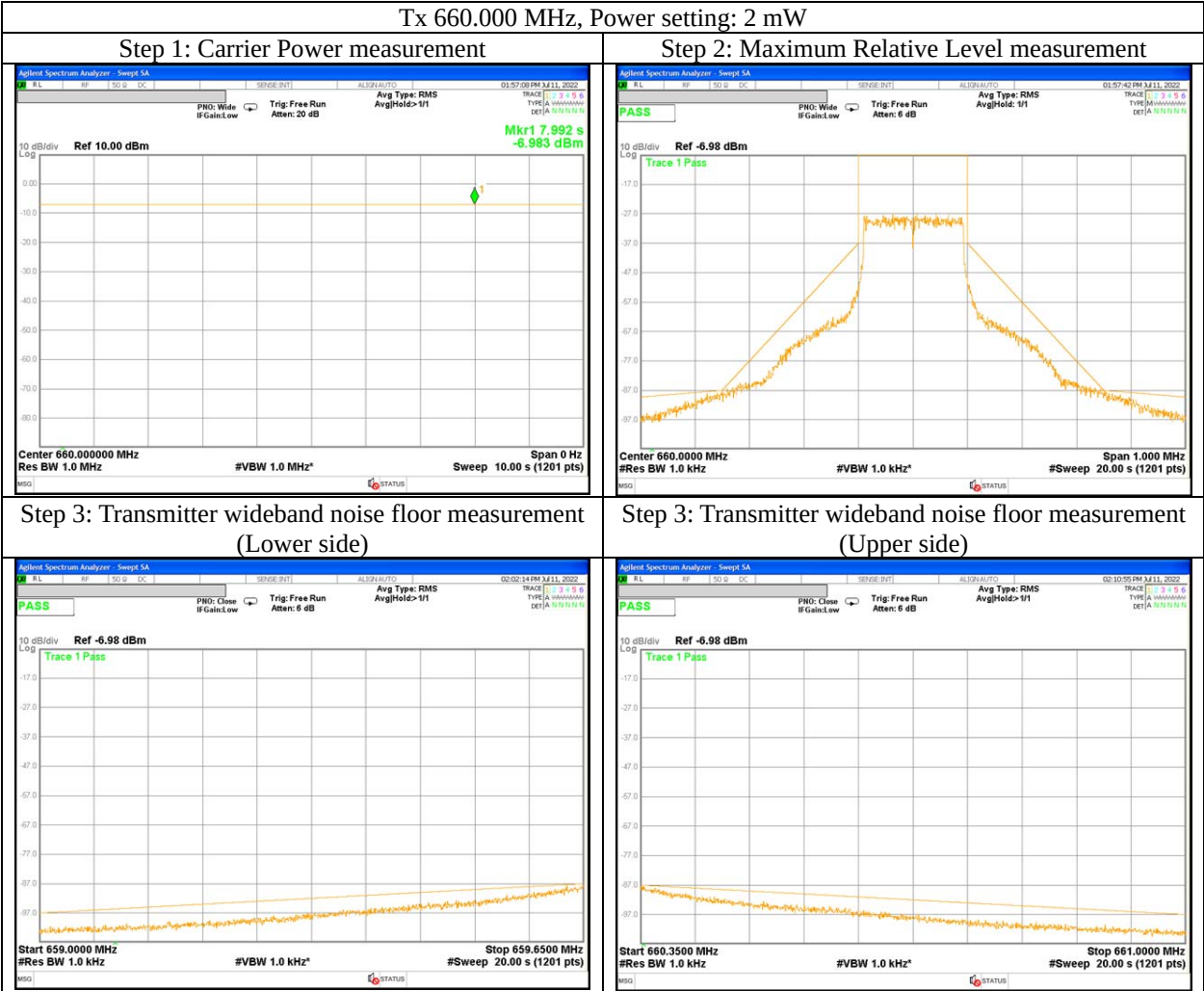
Ise EMC Lab. No.8 Measurement Room

July 11, 2022

23 deg. C / 55 % RH

Nachi Konegawa

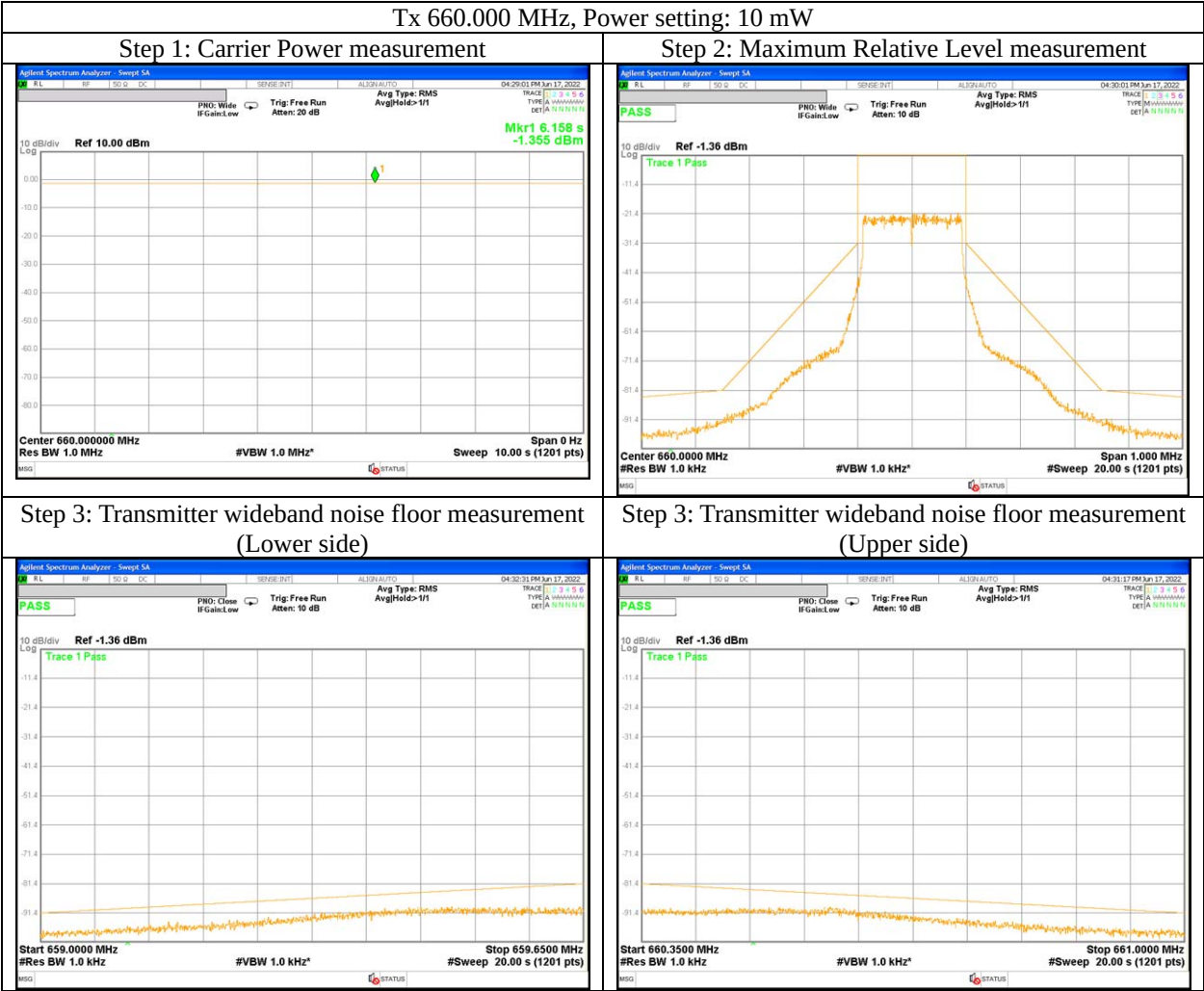
Tx 660.000 MHz, 2 mW



Emission Mask

Test place
Date
Temperature/ Humidity
Engineer
Mode

Ise EMC Lab. No.2 Measurement Room
June 17, 2022
22 deg. C / 57 % RH
Keiya Ido
Tx 660.000 MHz, 10 mW



Emission Mask

Test place

Date

Temperature/ Humidity

Engineer

Mode

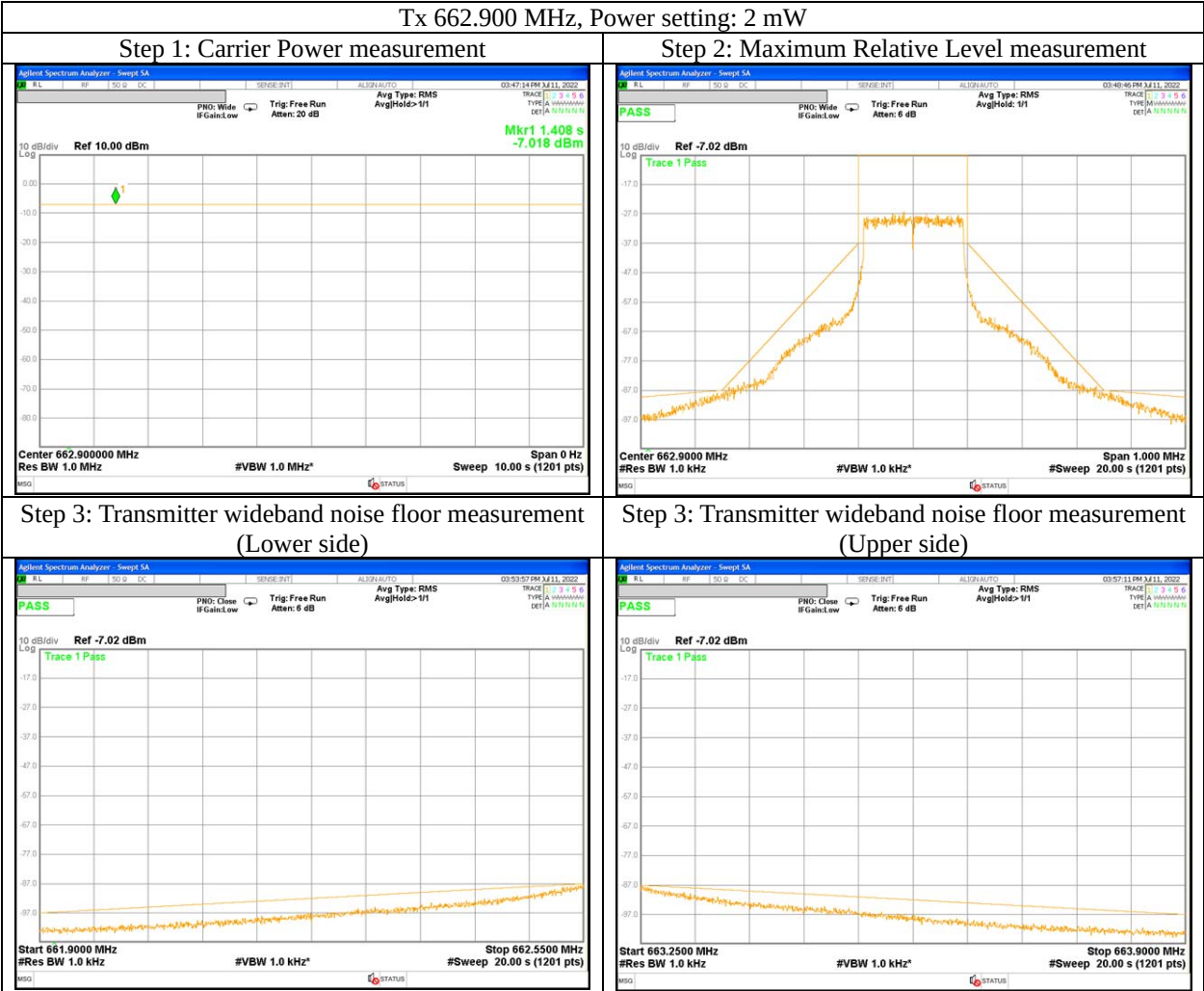
Ise EMC Lab. No.8 Measurement Room

July 11, 2022

23 deg. C / 55 % RH

Nachi Konegawa

Tx 662.900 MHz, 2 mW



Emission Mask

Test place

Date

Temperature/ Humidity

Engineer

Mode

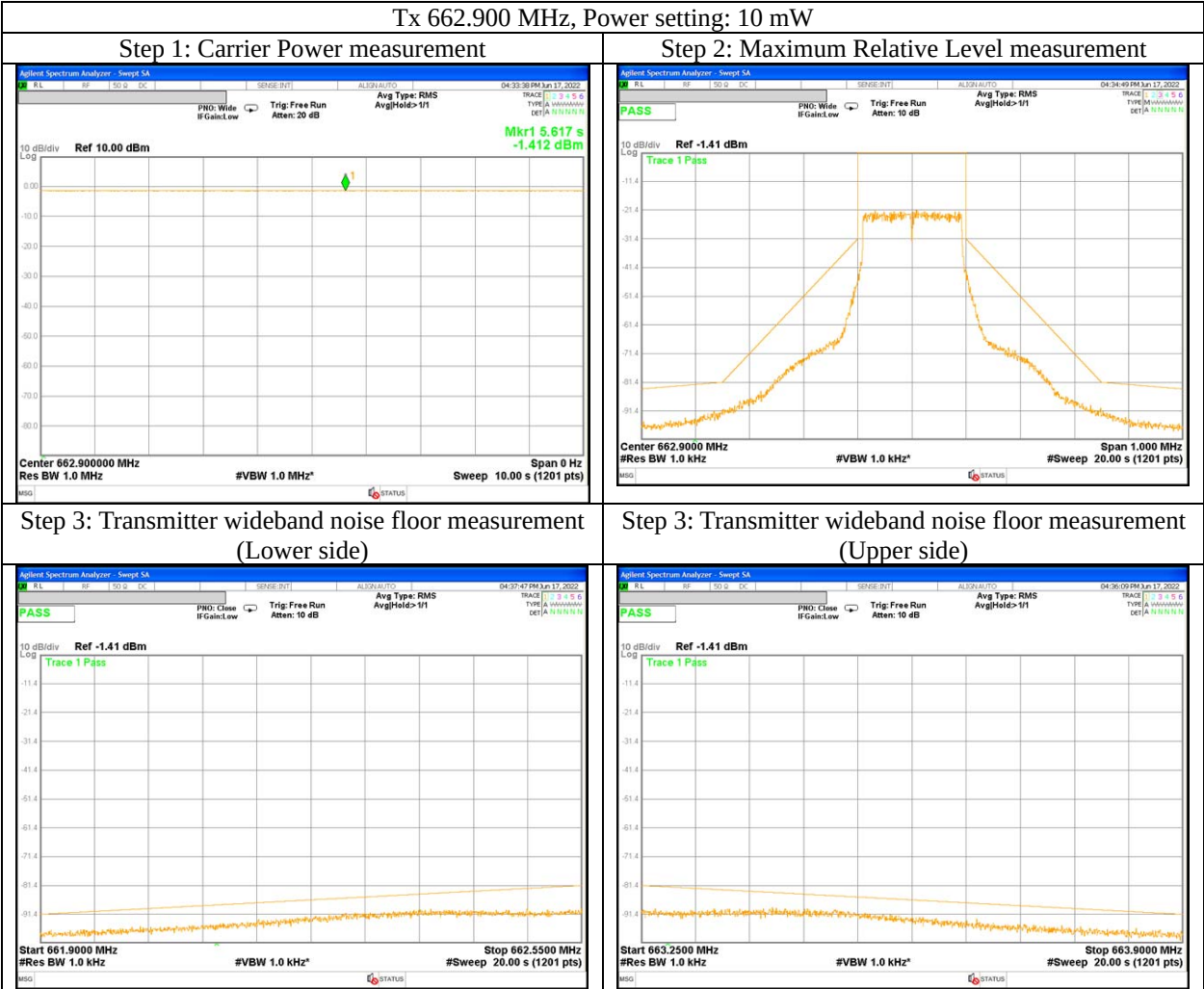
Ise EMC Lab. No.2 Measurement Room

June 17, 2022

22 deg. C / 57 % RH

Keiya Ido

Tx 662.900 MHz, 10 mW



Transmitter unwanted emissions

Test place	Ise EMC Lab.	No.2
Semi Anechoic Chamber	No.2	No.2
Date	June 13, 2022	June 20, 2022
Temperature / Humidity	23 deg. C / 49% RH	22 deg. C / 61 % RH
Engineer	Hiroyuki Furutaka	Nachi Konegawa
	(Below 1 GHz)	(Above 1 GHz)
Mode	Tx 614.100 MHz, 10 mW	

Frequency	Rx SA/TR		Tx SG		Tx	Tx	Result		Limit	Margin		Horizontal		Vertical		Remarks
	Reading [dBuV]		Reading [dBm]		Cable Loss [dB]	Ant. Gain [dBi]	(ERP) [dBm]		(ERP) [dBm]	[dB]	Rx Ant. Height [cm]	Turn Table [deg.]	Rx Ant. Height [cm]	Turn Table [deg.]		
	Hori.	Vert.	Hori.	Vert.			Hori.	Vert.								
[MHz]																
500.00	36.6	34.7	-45.1	-44.9	4.6	-8.2	-60.0	-59.8	-54.0	6.0	5.8	150	68	102	95	
550.00	38.9	32.0	-41.5	-47.9	4.8	-8.1	-56.5	-62.9	-54.0	2.5	8.9	159	274	100	41	
650.00	35.2	31.6	-43.4	-46.1	5.2	-7.8	-58.6	-61.3	-54.0	4.6	7.3	159	274	100	123	
1228.20	53.4	52.7	-53.8	-55.1	2.7	6.8	-51.7	-53.1	-30.0	21.7	23.1	139	167	144	172	
1842.30	51.2	52.1	-61.3	-60.9	3.3	10.1	-56.6	-56.2	-30.0	26.6	26.2	144	326	160	39	
2456.40	48.3	46.8	-64.4	-69.0	3.8	10.3	-60.0	-64.6	-30.0	30.0	34.6	104	15	113	346	
3070.50	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	-
3684.60	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	-
4298.70	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	-
4912.80	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	-
5526.90	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	-
6141.00	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	-

Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - 2.15

Rx-ANTENNA : Biconical Antenna(25 MHz - 200 MHz), Logperiodic Antenna(200 MHz - 1000 MHz), Horn Antenna(1 GHz - the tenth harmonic)

Tx-ANTENNA : 120 MHz tuned Dipole Antenna(30 MHz - 120 MHz), Dipole Antenna(120 MHz - 1000 MHz), Horn Antenna(1 GHz - the tenth harmonic)

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.

Transmitter unwanted emissions

Test place	Ise EMC Lab.	No.2
Semi Anechoic Chamber	No.2	No.2
Date	June 14, 2022	June 20, 2022
Temperature / Humidity	23 deg. C / 50 % RH	22 deg. C / 61 % RH
Engineer	Hiroki Numata	Nachi Konegawa
	(Below 1 GHz)	(Above 1 GHz)
Mode	Tx 615.000 MHz, 10 mW	

Frequency	Rx SA/TR		Tx SG		Tx Cable Loss [dB]	Tx Ant. Gain [dBi]	Result		Limit (ERP) [dBm]	Margin		Horizontal		Vertical		Remarks
	Reading [dBuV]		Reading [dBm]				(ERP) [dBm]	(ERP) [dBm]		[dB]	Rx Ant. Height [cm]	Turn Table [deg.]	Rx Ant. Height [cm]	Turn Table [deg.]		
	Hori.	Vert.	Hori.	Vert.											Hori.	
500.00	38.7	34.2	-43.0	-45.4	4.6	-8.2	-57.8	-60.2	-54.0	3.8	6.2	104	93	128	252	
550.00	39.8	33.7	-40.6	-46.2	4.8	-8.1	-55.6	-61.2	-54.0	1.6	7.2	150	90	121	131	
650.00	36.2	31.0	-42.4	-46.7	5.2	-7.8	-57.6	-61.9	-54.0	3.6	7.9	126	64	185	3	
1230.00	53.0	48.8	-54.2	-59.1	2.7	6.8	-52.2	-57.0	-30.0	22.2	27.0	133	62	100	264	
1845.00	57.0	55.9	-55.5	-59.5	3.3	10.1	-50.8	-54.8	-30.0	20.8	24.8	104	284	117	20	
2460.00	48.3	47.0	-64.4	-68.8	3.8	10.3	-60.1	-64.4	-30.0	30.1	34.4	104	17	112	340	
3075.00	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
3690.00	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
4305.00	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
4920.00	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
5535.00	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
6150.00	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	

Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - 2.15

Rx-ANTENNA : Biconical Antenna(25 MHz - 200 MHz), Logperiodic Antenna(200 MHz - 1000 MHz), Horn Antenna(1 GHz - the tenth harmonic)

Tx-ANTENNA : 120 MHz tuned Dipole Antenna(30 MHz - 120 MHz), Dipole Antenna(120 MHz - 1000 MHz), Horn Antenna(1 GHz - the tenth harmonic)

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.

Transmitter unwanted emissions

Test place	Ise EMC Lab.	No.2
Semi Anechoic Chamber	No.2	No.2
Date	June 14, 2022	June 20, 2022
Temperature / Humidity	23 deg. C / 50 % RH	22 deg. C / 61 % RH
Engineer	Hiroki Numata	Nachi Konegawa
	(Below 1 GHz)	(Above 1 GHz)
Mode	Tx 615.900 MHz, 10 mW	

Frequency [MHz]	Rx SA/TR Reading [dBuV]		Tx SG Reading [dBm]		Tx Cable Loss [dB]	Tx Ant. Gain [dBi]	Result (ERP) [dBm]		Limit (ERP) [dBm]	Margin [dB]		Horizontal		Vertical		Remarks
	Hori.	Vert.	Hori.	Vert.			Hori.	Vert.		Hori.	Vert.	Rx Ant. Height [cm]	Turn Table [deg.]	Rx Ant. Height [cm]	Turn Table [deg.]	
500.00	35.8	33.9	-45.9	-45.7	4.6	-8.2	-60.8	-60.5	-54.0	6.8	6.5	172	317	137	194	
550.00	39.9	36.7	-40.5	-43.2	4.8	-8.1	-55.5	-58.2	-54.0	1.5	4.2	145	302	117	127	
650.00	36.5	31.7	-42.1	-46.0	5.2	-7.8	-57.3	-61.2	-54.0	3.3	7.2	118	286	100	65	
1231.80	54.6	53.4	-52.6	-54.5	2.7	6.8	-50.5	-52.4	-30.0	20.5	22.4	102	0	120	22	
1847.70	52.5	51.2	-60.0	-61.8	3.3	10.1	-55.3	-57.1	-30.0	25.3	27.1	106	266	110	161	
2463.60	48.8	47.5	-63.9	-68.3	3.8	10.3	-59.5	-63.9	-30.0	29.5	33.9	105	345	111	343	
3079.50	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
3695.40	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
4311.30	NS	NS	-	-	-	-	-	-	-30.0	NS	NS	-	-	-	-	
4927.20	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
5543.10	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
6159.00	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	

Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - 2.15

Rx-ANTENNA : Biconical Antenna(25 MHz - 200 MHz), Logperiodic Antenna(200 MHz - 1000 MHz), Horn Antenna(1 GHz - the tenth harmonic)

Tx-ANTENNA : 120 MHz tuned Dipole Antenna(30 MHz - 120 MHz), Dipole Antenna(120 MHz - 1000 MHz), Horn Antenna(1 GHz - the tenth harmonic)

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.

Transmitter unwanted emissions

Test place	Ise EMC Lab.	No.2
Semi Anechoic Chamber	No.2	No.2
Date	June 15, 2022	June 21, 2022
Temperature / Humidity	24 deg. C / 52 % RH	25 deg. C / 68 % RH
Engineer	Hiroyuki Furutaka (25 MHz to 1000 MHz)	Sayaka Hara (Above 1 GHz)
Mode	Tx 657.100 MHz, 10 mW	

Frequency [MHz]	Rx SA/TR		Tx SG		Tx Cable Loss [dB]	Tx Ant. Gain [dBi]	Result		Limit (ERP) [dBm]	Margin		Horizontal		Vertical		Remarks		
	Reading [dBuV]		Reading [dBm]				(ERP) [dBm]			(ERP) [dBm]		[dB]		Rx Ant. Height [cm]	Turn Table [deg.]		Rx Ant. Height [cm]	Turn Table [deg.]
	Hori.	Vert.	Hori.	Vert.			Hori.	Vert.		Hori.	Vert.	Hori.	Vert.					
500.00	38.0	32.0	-42.8	-48.3	4.6	-8.2	-57.7	-63.2	-54.0	3.7	9.2	169	301	185	323			
550.00	36.8	30.1	-43.3	-50.3	4.8	-8.1	-58.3	-65.3	-54.0	4.3	11.3	159	105	111	258			
614.16	37.3	32.0	-40.5	-45.1	5.1	-8.0	-55.7	-60.3	-54.0	1.7	6.3	128	278	100	207			
1314.20	52.9	51.0	-54.5	-56.9	2.8	7.1	-52.3	-54.8	-30.0	22.3	24.8	122	110	138	263			
1971.30	51.5	50.4	-61.3	-64.0	3.4	10.1	-56.7	-59.4	-30.0	26.7	29.4	140	210	124	130			
2628.40	48.2	NS	-63.0	-	3.9	10.7	-58.4	-	-30.0	28.4	-	144	61	-	-			
3285.50	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-			
3942.60	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-			
4599.70	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-			
5256.80	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-			
5913.90	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-			
6571.00	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-			

Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - 2.15

Rx-ANTENNA : Biconical Antenna(25 MHz - 200 MHz), Logperiodic Antenna(200 MHz - 1000 MHz), Horn Antenna(1 GHz - the tenth harmonic)

Tx-ANTENNA : 120 MHz tuned Dipole Antenna(30 MHz - 120 MHz), Dipole Antenna(120 MHz - 1000 MHz), Horn Antenna(1 GHz - the tenth harmonic)

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.

Transmitter unwanted emissions

Test place	Ise EMC Lab.	No.2
Semi Anechoic Chamber	No.2	No.2
Date	June 15, 2022	June 21, 2022
Temperature / Humidity	24 deg. C / 52 % RH	25 deg. C / 68 % RH
Engineer	Hiroyuki Furutaka	Sayaka Hara
	(25 MHz to 1000 MHz)	(Above 1 GHz)
Mode	Tx 660.000 MHz, 10 mW	

Frequency	Rx SA/TR		Tx SG		Tx	Tx	Result		Limit	Margin		Horizontal		Vertical		Remarks
	Reading [dBuV]		Reading [dBm]		Cable Loss [dB]	Ant. Gain [dBi]	(ERP) [dBm]			(ERP) [dBm]	[dB]	Rx Ant. Height [cm]	Turn Table [deg.]	Rx Ant. Height [cm]	Turn Table [deg.]	
	Hori.	Vert.	Hori.	Vert.			Hori.	Vert.								
500.00	36.6	33.9	-44.2	-46.4	4.6	-8.2	-59.1	-61.3	-54.0	5.1	7.3	100	324	114	291	
550.00	36.7	31.9	-43.4	-48.5	4.8	-8.1	-58.4	-63.5	-54.0	4.4	9.5	158	280	117	205	
614.16	36.5	32.3	-41.3	-44.8	5.1	-8.0	-56.5	-60.0	-54.0	2.5	6.0	134	297	100	206	
1320.00	51.9	49.8	-55.4	-58.1	2.8	7.2	-53.2	-55.9	-30.0	23.2	25.9	126	277	153	138	
1980.00	54.7	49.8	-58.1	-64.6	3.4	10.1	-53.5	-60.0	-30.0	23.5	30.0	117	229	164	120	
2640.00	52.0	NS	-59.2	-	3.9	10.7	-54.6	-	-30.0	24.6	-	115	255	-	-	
3300.00	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
3960.00	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
4620.00	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
5280.00	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
5940.00	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
6600.00	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	

Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - 2.15

Rx-ANTENNA : Biconical Antenna(25 MHz - 200 MHz), Logperiodic Antenna(200 MHz - 1000 MHz), Horn Antenna(1 GHz - the tenth harmonic)

Tx-ANTENNA : 120 MHz tuned Dipole Antenna(30 MHz - 120 MHz), Dipole Antenna(120 MHz - 1000 MHz), Horn Antenna(1 GHz - the tenth harmonic)

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.

Transmitter unwanted emissions

Test place	Ise EMC Lab.	No.2
Semi Anechoic Chamber	No.2	No.2
Date	June 15, 2022	June 21, 2022
Temperature / Humidity	24 deg. C / 52 % RH	25 deg. C / 68 % RH
Engineer	Hiroyuki Furutaka	Sayaka Hara
	(25 MHz to 1000 MHz)	(Above 1 GHz)
Mode	Tx 662.900 MHz, 10 mW	

Frequency [MHz]	Rx SA/TR		Tx SG		Tx Cable Loss [dB]	Tx Ant. Gain [dBi]	Result (ERP) [dBm]		Limit (ERP) [dBm]	Margin [dB]		Horizontal		Vertical		Remarks
	Reading [dBuV]		Reading [dBm]							Rx Ant. Height [cm]	Turn Table [deg.]	Rx Ant. Height [cm]	Turn Table [deg.]			
	Hori.	Vert.	Hori.	Vert.			Hori.	Vert.								
500.00	36.7	33.8	-44.1	-46.5	4.6	-8.2	-59.0	-61.4	-54.0	5.0	7.4	112	271	123	274	
550.00	32.4	24.3	-47.7	-56.1	4.8	-8.1	-62.7	-71.1	-54.0	8.7	17.1	158	267	107	246	
614.16	35.3	31.0	-42.5	-46.1	5.1	-8.0	-57.7	-61.3	-54.0	3.7	7.3	127	279	106	204	
1325.80	50.9	49.9	-56.5	-58.0	2.8	7.2	-54.3	-55.8	-30.0	24.3	25.8	122	275	156	133	
1988.70	51.9	49.3	-61.0	-65.1	3.4	10.1	-56.4	-60.6	-30.0	26.4	30.6	139	213	141	161	
2651.60	48.2	NS	-63.0	-	3.9	10.7	-58.3	-	-30.0	28.3	-	141	54	-	-	
3314.50	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
3977.40	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
4640.30	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
5303.20	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
5966.10	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
6629.00	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	

Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - 2.15

Rx-ANTENNA : Biconical Antenna(25 MHz - 200 MHz), Logperiodic Antenna(200 MHz - 1000 MHz), Horn Antenna(1 GHz - the tenth harmonic)

Tx-ANTENNA : 120 MHz tuned Dipole Antenna(30 MHz - 120 MHz), Dipole Antenna(120 MHz - 1000 MHz), Horn Antenna(1 GHz - the tenth harmonic)

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.

Transmitter frequency stability

Test place Ise EMC Lab. No.6 Measurement Room
Date June 19, 2022
Temperature / Humidity 22 deg. C / 55 % RH
Engineer Nachi Konegawa
Mode Tx 615.000 MHz 10 mW

Varying Temperature

Test condition		Tested frequency [MHz]	Frequency error [MHz]	Result		Limit [+/- ppm]	Remarks
Temp. [deg. C]	Voltage [V]			[%]	[ppm]		
55	3.70	615.000	0.001334	0.00022	2.17	50	
50	3.70	615.000	0.001937	0.00031	3.15	50	
40	3.70	615.000	0.001135	0.00018	1.85	50	
30	3.70	615.000	0.001063	0.00017	1.73	50	
20	3.70	615.000	0.000817	0.00013	1.33	50	
10	3.70	615.000	0.001419	0.00023	2.31	50	
0	3.70	615.000	0.001588	0.00026	2.58	50	
-10	3.70	615.000	0.002653	0.00043	4.31	50	
-20	3.70	615.000	0.003285	0.00053	5.34	50	

Result [%] = Frequency error / Tested frequency * 100

Limit (+/-): 0.005 (+/- 50ppm)

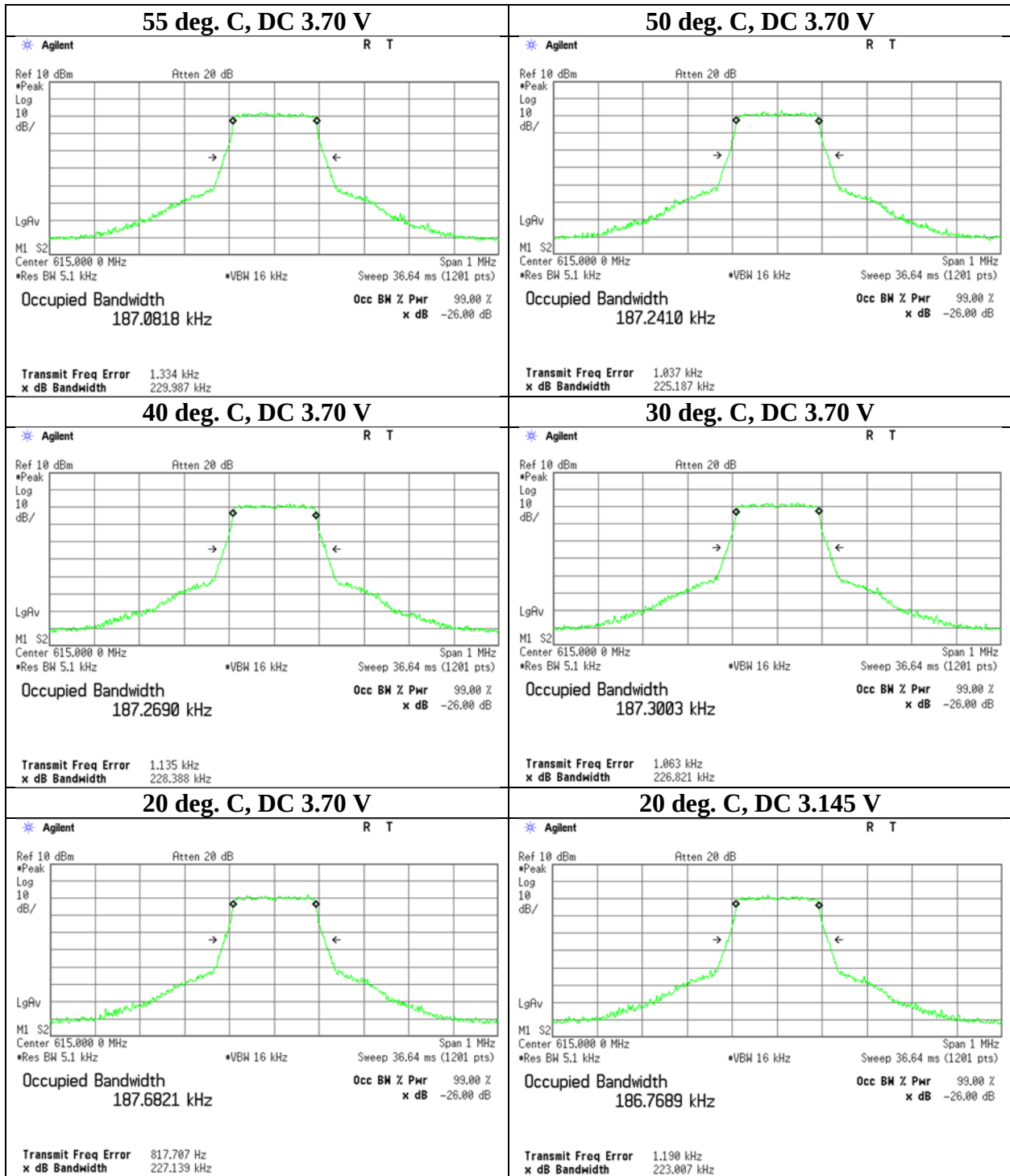
Varying Supply Voltage

Test condition		Tested frequency [MHz]	Frequency error [MHz]	Result		Limit [+/- ppm]	Remarks
Temp. [deg. C]	Voltage [V]			[%]	[ppm]		
20	3.70	615.000	0.000817	0.00013	1.33	50	Nominal
20	3.15	615.000	0.001190	0.00019	1.93	50	Norminal (-15%) Minimum operating Voltage
20	4.26	615.000	0.000854	0.00014	1.39	50	Norminal (+15%)
20	4.80	615.000	0.001014	0.00016	1.65	50	Maximum operating Voltage

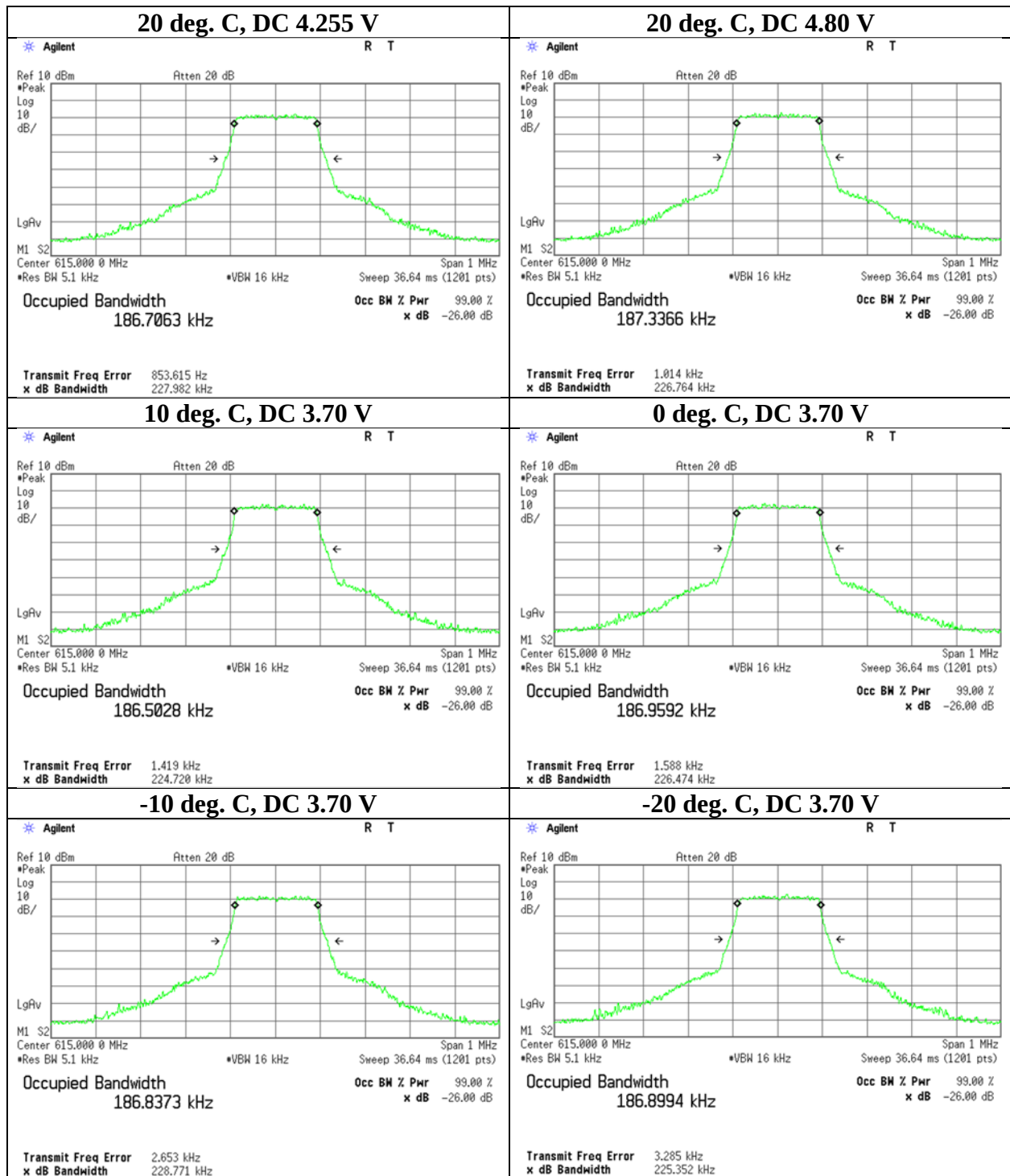
Result [%] = Frequency error / Tested frequency * 100

Limit (+/-): 0.005 (+/- 50ppm)

Transmitter frequency stability



Transmitter frequency stability



Transmitter frequency stability

Test place Ise EMC Lab. No.6 Measurement Room
Date June 19, 2022
Temperature / Humidity 22 deg. C / 55 % RH
Engineer Nachi Konegawa
Mode Tx 660.000 MHz 10 mW

Varying Temperature

Test condition		Tested frequency [MHz]	Frequency error [MHz]	Result		Limit [+/- ppm]	Remarks
Temp. [deg. C]	Voltage [V]			[%]	[ppm]		
55	3.70	660.000	0.001930	0.00029	2.92	50	
50	3.70	660.000	0.001745	0.00026	2.64	50	
40	3.70	660.000	0.001725	0.00026	2.61	50	
30	3.70	660.000	0.001506	0.00023	2.28	50	
20	3.70	660.000	0.001783	0.00027	2.70	50	
10	3.70	660.000	0.002052	0.00031	3.11	50	
0	3.70	660.000	0.002322	0.00035	3.52	50	
-10	3.70	660.000	0.003123	0.00047	4.73	50	
-20	3.70	660.000	0.003962	0.00060	6.00	50	

Result [%] = Frequency error / Tested frequency * 100

Limit (+/-): 0.005 (+/- 50ppm)

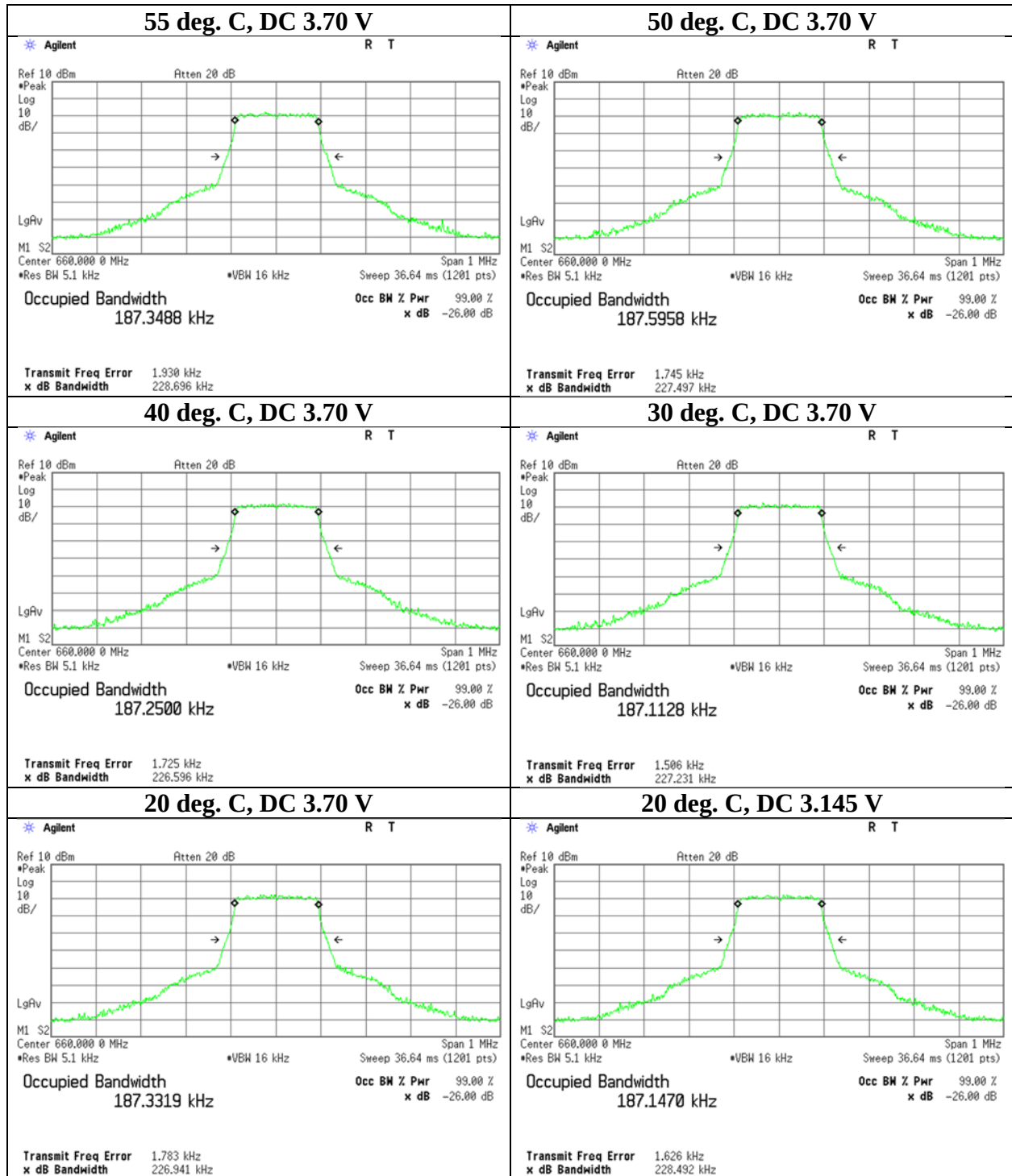
Varying Supply Voltage

Test condition		Tested frequency [MHz]	Frequency error [MHz]	Result		Limit [+/- ppm]	Remarks
Temp. [deg. C]	Voltage [V]			[%]	[ppm]		
20	3.70	660.000	0.001783	0.00027	2.70	50	Nominal
20	3.15	660.000	0.001626	0.00025	2.46	50	Norminal (-15%) Minimum operating Voltage
20	4.26	660.000	0.001423	0.00022	2.16	50	Norminal (+15%)
20	4.80	660.000	0.001568	0.00024	2.38	50	Maximum operating Voltage

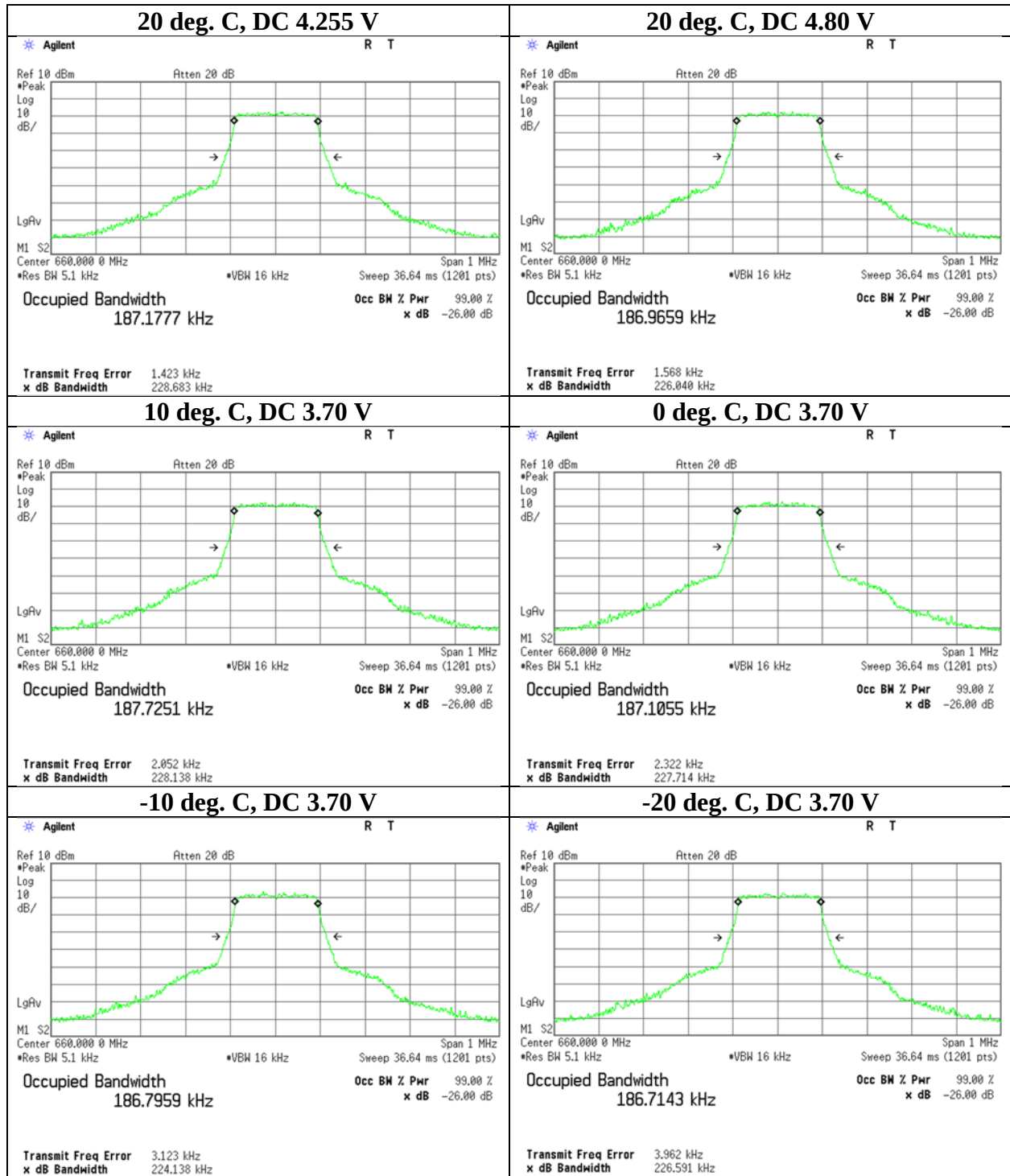
Result [%] = Frequency error / Tested frequency * 100

Limit (+/-): 0.005 (+/- 50ppm)

Transmitter frequency stability



Transmitter frequency stability



PPENDIX 2: Test Instruments

Test Equipment (1/2)

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	COTS-MEMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	MAEC-02	142004	AC2_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	05/30/2022	24
RE	MAT-10	141156	Attenuator(10dB)	Weinschel Corp	2	BL1173	11/09/2021	12
RE	MAT-112	220646	Attenuator	Huber+Suhner	6806_N-50-1	-	06/07/2022	12
RE	MBA-05	141425	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	VHA9103+BBA9106	VHA 91031302	08/28/2021	12
RE	MBA-08	141427	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	VHA9103B+BBA9106	08031	07/10/2021	12
RE	MCC-12	141317	Coaxial Cable	UL Japan	-	-	09/06/2021	12
RE	MCC-125	141219	Coaxial Cable	UL Japan	-	-	07/09/2022	12
RE	MCC-216	141392	Microwave Cable	Junkosha	MWX221	1604S253(1 m) / 537073/126E (5 m)	-	-
RE	MCC-258	214065	Microwave cable	Huber+Suhner	SF-126E/11PC35/ 11PC35/10000	550489/126E	01/18/2022	12
RE	MDA-03	141454	Dipole Antenna	Schwarzbeck Mess-Elektronik OHG	UHAP	991	12/02/2021	12
RE	MHA-06	141512	Horn Antenna 1-18GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	254	10/21/2021	12
RE	MHA-21	141508	Horn Antenna 1-18GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	557	05/20/2022	12
RE	MHF-27	141297	High Pass Filter (1.1-10GHz)	TOKYO KEIKI	TF219CD1	1001	01/23/2022	12
RE	MJM-27	142228	Measure	KOMELON	KMC-36	-	-	-
RE	MLA-21	141265	Logperiodic Antenna (200-1000MHz)	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	9111B-190	07/10/2021	12
RE	MMM-01	141542	Digital Tester	Fluke Corporation	FLUKE 26-3	78030611	08/10/2021	12
RE	MOS-41	192300	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0013	12/19/2021	12
RE	MPA-10	141579	Pre Amplifier	Keysight Technologies Inc	8449B	3008A02142	02/22/2022	12
RE	MPA-24	141594	Pre Amplifier	Keysight Technologies Inc	8447D	2944A10150	02/25/2022	12
RE	MSA-10	141899	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY46180655	02/18/2022	12
RE	MSG-20	158264	Signal Generator	Keysight Technologies Inc	N5182A	MY50142539	09/15/2021	12
RE	YTSSG03	141967	Signal Generator	Rohde & Schwarz	SMT02	51400043	08/18/2021	12
AT	MAT-10	141156	Attenuator(10dB)	Weinschel Corp	2	BL1173	11/09/2021	12
AT	MAT-26	141244	Attenuator(10dB)	Weinschel - API Technologies Corp	WA8-10-34	A198	02/25/2022	12
AT	MAT-58	141334	Attenuator(10dB)	Suhner	6810.19.A	-	12/08/2021	12
AT	MCC-138	141410	Microwave cable	Huber+Suhner	SUCOFLEX 102	37953/2	09/30/2021	12
AT	MCC-38	141395	Coaxial Cable	UL Japan	-	-	11/19/2021	12
AT	MCC-64	141327	Coaxial Cable	UL Japan	-	-	02/28/2022	12
AT	MCH-04	141429	Temperature and Humidity Chamber	Espec	PL-2KP	14015723	08/05/2021	12
AT	MMM-01	141542	Digital Tester	Fluke Corporation	FLUKE 26-3	78030611	08/10/2021	12
AT	MMM-17	141557	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	70900530	01/16/2022	12

Test Equipment (2/2)

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
AT	MMM-18	141558	Digital Tester (TRUE RMS MULTIMETER)	Fluke Corporation	115	17930030	05/17/2022	12
AT	MOS-14	141561	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	1401	01/10/2022	12
AT	MOS-28	141567	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0008	01/10/2022	12
AT	MOS-41	192300	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0013	12/19/2021	12
AT	MPM-13	141810	Power Meter	Anritsu Corporation	ML2495A	824014	12/22/2021	12
AT	MPSE-18	141832	Power sensor	Anritsu Corporation	MA2411B	738174	12/22/2021	12
AT	MSA-14	141901	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY48250080	01/10/2022	12
AT	MSA-16	141903	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46186390	01/07/2022	12
AT	MSA-17	141904	Spectrum Analyzer	Keysight Technologies Inc	N9030A	US51350215	09/30/2021	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: RE: Radiated Emission (Transmitter unwanted emissions)
AT: Antenna Terminal Conducted