





# RADIO TEST REPORT

## Test Report No. 14727491S-J-R1

Customer	Murata Manufacturing Co., Ltd.
Description of EUT	Communication Module
Model Number of EUT	LBUA2ZZ2DK
FCC ID	VPYLB2DK
Test Regulation	FCC Part 15 Subpart F
Test Result	Complied
Issue Date	August 30, 2023
Remarks	UWB part(s)

<b>Representative Test Engineer</b>	<b>Approved By</b>
	
Hiromasa Sato Engineer	Toyokazu Imamura Leader
	
	
CERTIFICATE 1266.03	
<input type="checkbox"/> The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan, Inc.	
<input checked="" type="checkbox"/> There is no testing item of "Non-accreditation".	

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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. 14727491S-J**

This report is a revised version of 14727491S-J. 14727491S-J is replaced with this report.

Revision	Test Report No.	Date	Revised Contents
- (Original)	14727491S-J	August 9, 2023	-
1	14727491S-J-R1	August 30, 2023	P14, 36: Addition of pre-check results of the top and bottom surfaces P18: - Correction of the values in the table from “-42.75 dBm/MHz” to “-43.26 dBm/MHz” - Correction of the limit values in the table from “-75.30 dBm” to “-85.30 dBm” P20, 22 to 26: Addition of plot chart

**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	Murata Manufacturing Co., Ltd.
Address	1-10-1 Higashikotari, Nagaokakyo-shi, Kyoto 617-8555 Japan
Telephone Number	+81-75-955-6736
Contact Person	Motoo Hayashi

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	Communication Module
Model Number	LBUA2ZZ2DK
Serial Number	Refer to SECTION 4.2
Condition	Engineering prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	No Modification by the test lab
Receipt Date	November 15, 2022 (Sample for Transmitter timeout) April 17, 2023 (Other than above)
Test Date	December 15, 2022 to April 19 to 26, 2023

### **2.2 Product Description**

#### **General Specification**

Rating	DC 3.3 V
Operating temperature	-30 deg. C to +85 deg. C

#### **Radio Specification**

##### **Bluetooth (Low Energy)**

Equipment Type	Transceiver
Frequency of Operation	2402 MHz to 2480 MHz
Type of Modulation	GFSK
Antenna Gain	-4.8 dBi

##### **UWB**

Equipment Type	Transceiver
Frequency of Operation	6489.6 MHz (6240.0 MHz to 6739.2 MHz) (CH5), 7987.2 MHz (7737.6 MHz to 8236.8 MHz) (CH9)
Type of Modulation	BPM-BPSK
Antenna Gain	1.6 dBi (CH5), 4.0 dBi (CH9)
Device type of ETIS EN 302 065-2	LT1

## SECTION 3: Test specification, Procedures & Results

### 3.1 Test Specification

Test Specification	FCC Part 15 Subpart F The latest version on the first day of the testing period
Title	FCC 47 CFR Part 15 Radio Frequency Device Subpart F Ultra-Wideband Operation Section 15.207 Conducted limits Section 15.503 Definitions Section 15.505 Cross reference Section 15.519 Technical requirements for hand held UWB systems Section 15.521 Technical requirements applicable to all UWB devices

### 3.2 Procedures and Results

Item	Test Procedure	Specification	Worst Margin	Results	Remarks
Conducted Emission	<b>FCC:</b> ANSI C63.10-2013 6. Standard test methods  <b>ISED:</b> RSS-Gen 8.8	<b>FCC:</b> Section 15.207 Section 15.505(a) Section 15.521(j) <b>ISED:</b> RSS-220 5.2.1(b)	27.7 dB 0.40000 MHz, QP, L1 1) Mode: Tx ch 5 (6489.6 MHz) 2) Mode: Tx ch 9 (7987.2 MHz)	Complied	-
UWB Bandwidth	<b>FCC:</b> Section 15.503(a) ANSI C63.10: 2013 6 Standard test methods, 10 Procedures for measuring ultra-wideband devices <b>ISED:</b> RSS-220 Annex 2	<b>FCC:</b> Section 15.503(d) Section 15.519(b)  <b>ISED:</b> RSS-220 2, RSS-220 5.1	See data.	Complied	Radiated
Radiated emission	<b>FCC:</b> Section 15.503(a) ANSI C63.10: 2013 6 Standard test methods, 10 Procedures for measuring ultra-wideband devices <b>ISED:</b> RSS-Gen 6.5 RSS-220 Annex 4	<b>FCC:</b> Section 15.209, Section 15.505, Section 15.519(c) (d), Section 521(c) <b>ISED:</b> RSS-220 5.3.1(c)(d)(e)	1.13 dB 6401.610 MHz, Horizontal Mode: Tx ch 5 (6489.6 MHz)	Complied	Radiated
Peak level of the Emission	<b>FCC:</b> Section 15.521(e)(g) ANSI C63.10: 2013 6 Standard test methods, 10 Procedures for measuring ultra-wideband devices <b>ISED:</b> RSS-220 Annex 4	<b>FCC:</b> Section 15.519(e)  <b>ISED:</b> RSS-220 5.3.1(g)	-	Complied	Radiated
Transmitter timeout	<b>FCC:</b> Section 15.519(a)(1) ANSI C63.10: 2013 6 Standard test methods, 10 Procedures for measuring ultra-wideband devices <b>ISED:</b> RSS-220 Annex 4	<b>FCC:</b> Section 15.519(a)(1)  <b>ISED:</b> RSS-220 5.3.1(b)	-	Complied	Conducted

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

#### FCC Part 15.31 (e)

The stable voltage was provided to the EUT during the tests. Therefore, this EUT complies with the requirement.

#### FCC Part 15.203/212 Antenna requirement

It is impossible for end users to replace the antenna, because the antenna is mounted inside of the EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203/212.

### 3.3 Addition to Standard

Item	Test Procedure	Specification	Worst Margin	Results	Remarks
99% Occupied Bandwidth	ISED: RSS-Gen 6.7	ISED: -	N/A	-	Radiated

Other than above, 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  $k=2$ .

Item	Frequency range	Uncertainty (+/-)
Conducted Emission (AC Mains) LISN	150 kHz-30 MHz	3.1 dB
Radiated Emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.3 dB
	30 MHz-200 MHz	4.8 dB
	200 MHz-1 GHz	6.1 dB
	1 GHz-6 GHz	4.7 dB
	6 GHz-18 GHz	5.3 dB
	18 GHz-40 GHz	5.5 dB
Radiated emission (Measurement distance: 1 m)	1 GHz-18 GHz	5.6 dB
	18 GHz-40 GHz	5.8 dB

#### Radiated Emission (Substitution measurement)

Substitution measurement (EUT height: 1.5 m, Distance: 3 m)	
Frequency range	Uncertainty (+/-)
30 MHz - 200 MHz	4.7 dB
200 MHz - 1000 MHz	3.5 dB
1 GHz - 13 GHz	4.5 dB

Substitution measurement (EUT height: 1.5 m, Distance: 1 m)	
Frequency range	Uncertainty (+/-)
1 GHz - 13 GHz	5.0 dB
13 GHz - 18 GHz	5.5 dB
18 GHz - 26.5 GHz	4.0 dB
26.5 GHz - 40 GHz	4.0 dB

Substitution measurement (EUT height: 1.5 m, Distance: 0.5 m)	
Frequency range	Uncertainty (+/-)
1 GHz - 13 GHz	5.0 dB
13 GHz - 18 GHz	5.4 dB
18 GHz - 26.5 GHz	4.0 dB
26.5 GHz - 40 GHz	4.0 dB

Substitution measurement (EUT height: 1.5 m, Distance: 0.3 m)	
Frequency range	Uncertainty (+/-)
1 GHz - 13 GHz	5.2 dB
13 GHz - 18 GHz	5.4 dB
18 GHz - 26.5 GHz	4.0 dB
26.5 GHz - 40 GHz	4.0 dB

Substitution measurement (EUT height: 1.5 m, Distance: 0.1 m)	
Frequency range	Uncertainty (+/-)
13 GHz - 18 GHz	5.8 dB
18 GHz - 26.5 GHz	4.3 dB
26.5 GHz - 40 GHz	4.3 dB

Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1 GHz (Average Detector) SPM-06	1.3 dB
Power Measurement above 1 GHz (Peak Detector) SPM-06	2.1 dB
Power Measurement above 1 GHz (Average Detector) SPM-07	1.1 dB
Power Measurement above 1 GHz (Peak Detector) SPM-07	1.2 dB
Power Measurement above 1 GHz (Average Detector) SPM-13	1.1 dB
Power Measurement above 1 GHz (Peak Detector) SPM-13	1.4 dB
Spurious Emission (Conducted) below 1 GHz	0.8 dB
Conducted Emissions Power Density Measurement 1 GHz-3 GHz	0.9 dB
Conducted Emissions Power Density Measurement 3 GHz-18 GHz	2.4 dB
Spurious Emission (Conducted) 18 GHz-26.5 GHz	2.4 dB
Spurious Emission (Conducted) 26.5 GHz-40 GHz	2.2 dB
Bandwidth Measurement	0.012 %
Duty Cycle and Time Measurement	0.27 %
Temperature_SCH-01	0.87 deg. C
Humidity_SCH-01	3.5 %
Temperature_SCH-02	2.0 deg. C
Humidity_SCH-02	6.7 %
Voltage	0.92 %

### 3.5 Test Location

UL Japan, Inc. Shonan EMC Lab.

1-22-3, Megumigaoka, Hiratsuka-shi, Kanagawa-ken 259-1220 Japan

Telephone: +81-463-50-6400

A2LA Certificate Number: 1266.03

(FCC test firm registration number: 626366, ISED lab company number: 2973D / CAB identifier: JP0001)

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Semi-anechoic chamber	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.2 Semi-anechoic chamber	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5 m
No.4 Semi-anechoic chamber	-	8.1 x 5.1 x 3.55	8.1 x 5.1	-
No.1 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.2 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.3 Shielded room	-	6.3 x 4.7 x 2.7	6.3 x 4.7	-
No.4 Shielded room	-	4.4 x 4.7 x 2.7	4.4 x 4.7	-
No.5 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.6 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.8 Shielded room	-	3.45 x 5.5 x 2.4	3.45 x 5.5	-
No.1 Measurement room	-	2.55 x 4.1 x 2.5	-	-

### 3.6 Test Data, Test Instruments, and Test Set Up

Refer to APPENDIX.



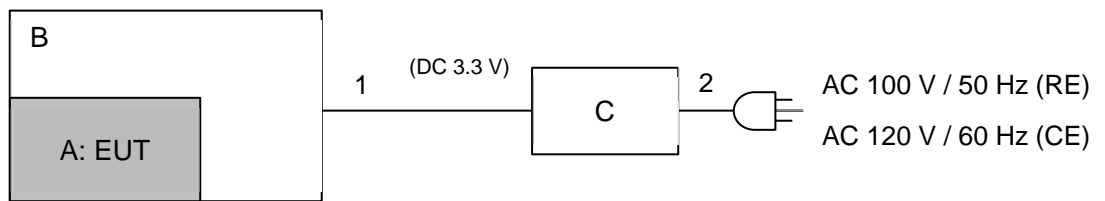
## SECTION 4: Operation of EUT during testing

### 4.1 Operating Mode(s)

Test Item	Operating Mode	Tested frequency
Other than Transmitter timeout test	Transmitting (Tx) ch 5 (6489.6 MHz), Transmitting (Tx) ch 9 (7987.2 MHz)	6489.6 MHz, 7987.2 MHz
Transmitter timeout test	Normal transmitting ch 5 (6489.6 MHz), Normal transmitting ch 9 (7987.2 MHz)	6489.6 MHz, 7987.2 MHz
<p>*Power of the EUT was set by the software as follows;            Power Setting: 0x28            Software: Test FW Version: 1            (Date: 2022.11.11, Storage location: EUT memory)</p> <p>*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.</p>		

### 4.2 Configuration and Peripherals

[other than Antenna Terminal Conducted test]



\*Test data was taken under worse case conditions.

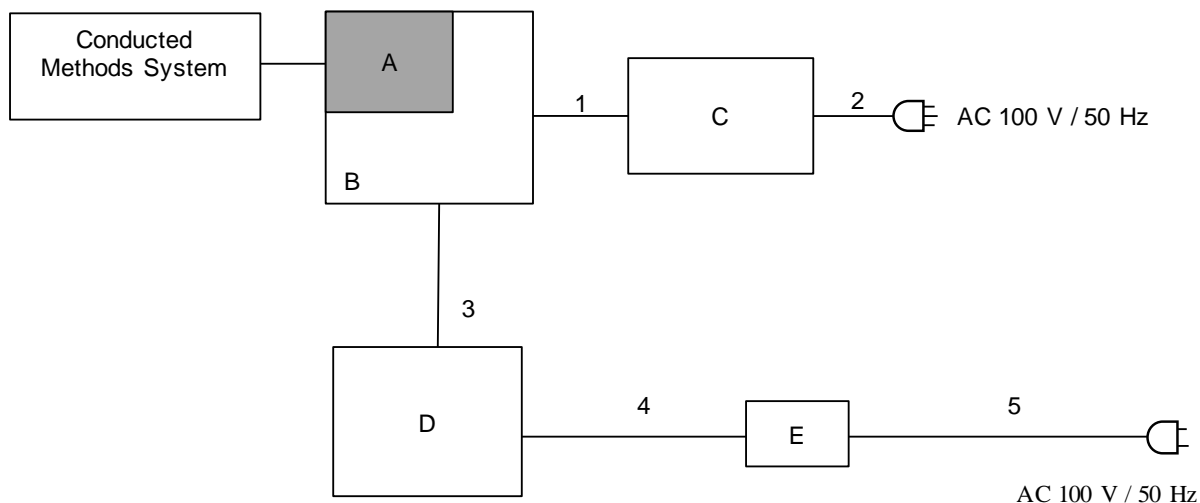
#### Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Communication Module	LBUA2ZZ2DK	UWB No.1	Murata Manufacturing Co., Ltd.	EUT
B	Jig Board	-	-	Murata Manufacturing Co., Ltd.	-
C	Power Supply (DC)	PAN60-10A	NL002383	KIKUSUI	-

#### List of cables used

No.	Cable	Length (m)	Shield-Cable	Shield-Connector	Remarks
1	DC	2.0	Unshielded	Unshielded	-
2	AC	2.8	Unshielded	Unshielded	-

[Antenna Terminal Conducted test]



**Description of EUT and Support Equipment**

No.	Item	Model number	Serial Number	Manufacturer	Remarks
A	Communication Module	LBUA2ZZ2DK	No.3	Murata Manufacturing Co., Ltd.	EUT
B	Jig Board	-	-	Murata Manufacturing Co., Ltd.	-
C	Power Supply (DC)	PAN60-10A	NL002383	KIKUSUI	-
D	Laptop Computer	ThinkPad E14 Gen2	PF397TS8	LENOVO	-
E	AC Adapter	ADLX65YCC2D	8SSA10R16922C2TJ19M0AZJ	LENOVO	-

**List of Cables Used**

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC	2.0	Unshielded	Unshielded	-
2	AC	2.5	Unshielded	Unshielded	-
3	USB	1.0	Shielded	Shielded	-
4	DC	1.7	Unshielded	Unshielded	-
5	AC	0.8	Unshielded	Unshielded	-

## **SECTION 5: Conducted Emission**

### **Test Procedure and Conditions**

EUT was placed on a platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane. The table is made of expanded polystyrol and expanded polypropylene and the tabletop is covered with polycarbonate. That has very low permittivity.

The rear of tabletop was located 40cm to the vertical conducting plane. The rear of EUT, including peripherals was aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80cm from a Line Impedance Stabilization Network (LISN) / Artificial mains Network (AMN) and excess AC cable was bundled in center.

Each EUT current-carrying power lead, except the ground (safety) lead, was individually connected through a LISN / (AMN) to the input power source.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Shielded room.

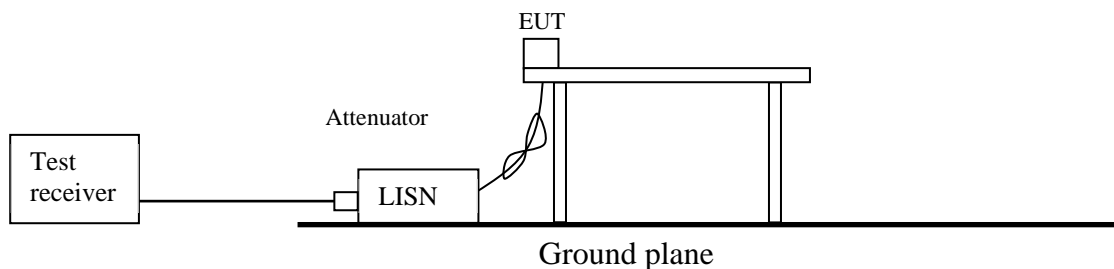
The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

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

<b>Detector</b>	<b>: QP and CISPR Average</b>
<b>Measurement Range</b>	<b>: 0.15 MHz to 30 MHz</b>
<b>Test Data</b>	<b>: APPENDIX</b>
<b>Test Result</b>	<b>: Pass</b>

**Figure 1: Test Setup**



## **SECTION 6: Radiated Emission**

### **Test Procedure**

[For below 30 MHz]

EUT was placed on a platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane. The table is made of expanded polystyrol and expanded polypropylene and the tabletop is covered with polycarbonate. That has very low permittivity.

The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity. The measurements were performed for vertical polarization (antenna angle: 0 deg., 45 deg., 90 deg., and 135 deg.) and horizontal polarization.

\*Refer to Figure 1 about Direction of the Loop Antenna.

[For 30 MHz to 960 MHz]

EUT was placed on a platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane. The table is made of expanded polystyrol and expanded polypropylene and the table top is covered with polycarbonate. That has very low permittivity.

[For 960 MHz to 1000 MHz]

EUT was placed on a urethane platform of nominal size, 0.15 m by 0.05 m, raised 1.5 m above the conducting ground plane.

[For above 1000 MHz]

EUT was placed on a urethane platform of nominal size, 0.15 m by 0.05 m, raised 1.5 m above the conducting ground plane.

UWB emissions and other emissions:

1) The height of the measuring antenna varied between 1 m and 4 m and EUT 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 with the Test Receiver, or the Spectrum Analyzer.

The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear mode).

The test was made with the detector (RBW/VBW) in the following table.

When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

(UWB emissions only) (refer to ANSI C63.10 (reference ANSI C63.26))

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.

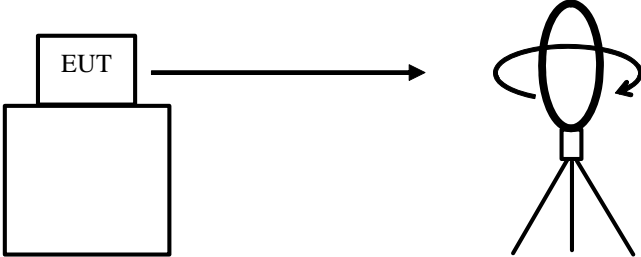
Its Output power of Signal Generator was recorded.

3) Equivalent isotropic 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).

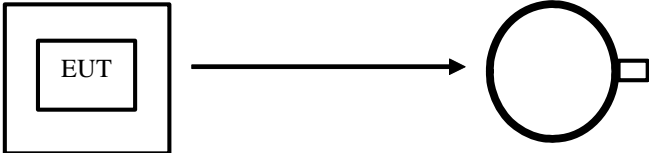
For the usage of the antenna (horn antenna) for the substitution antenna, the equivalent isotropic radiated power was calculated by compensating the finite substitution antenna.

Figure 1: Direction of the Loop Antenna

Side View (Vertical)

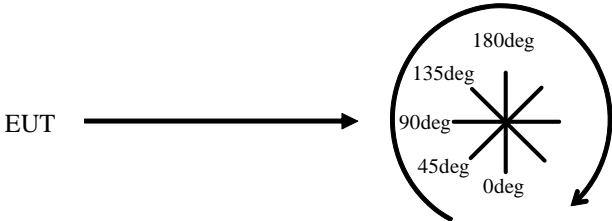


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



Front side: 0 deg.  
Forward direction: clockwise

**Test Antennas are used as below;**

Frequency	Below 30 MHz	30 MHz to 200 MHz	200 MHz to 1 GHz	Above 1 GHz
Antenna Type	Loop	Biconical	Logperiodic	Horn

Frequency	Below 30 MHz	30 to 960 MHz	Above 960 MHz	
Instrument used	Test Receiver	Test Receiver	Spectrum Analyzer	
Detector	Quasi-Peak	Quasi-Peak	Peak	RMS (AV) *2)
IF Bandwidth	BW 9 kHz	BW 120 kHz	UWB spurious emission: RBW: 1 MHz, VBW: 3 MHz Carrier emission: RBW: 50 MHz, VBW: 80 MHz	UWB spurious emission: RBW: 1 MHz, VBW: 3 MHz GPS band emission: RBW: 1 kHz, VBW: 3 kHz
Test Distance	3 m	3 m	3.0 m (960 MHz to 1 GHz) 0.5 m (1 GHz to 10.6 GHz) *1) 0.3 m (10.6 GHz to 18 GHz) *1) 0.1 m (above 18 GHz) *1)	

\*1) For section 10.3.2 of ANSI C63.10: 2013. This measurement was performed at less than 3 m due to the small radiation emission of EUT. In addition, this measurement was performed by the substitution measurement.

Since there are frequencies that are the distance of the near field condition with respect to the measurement distance, we have verified the measurement results in the near field condition and the far field condition and confirmed that there was no difference in the test results.

\*2) For section 10.3.7 of ANSI C63.10: 2013. This measurement was set the sweep time so that there is no more than a 1 ms integration period over each measurement bin.

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

Polarity	Frequency [GHz]						
	Below 0.030	0.030 to 0.96	0.96 to 1	1 to 4.8	4.8 to 10.6	10.6 to 18	18 to 40
Horizontal	X, Bottom	X, Bottom	X, Bottom	X, Bottom	X, Bottom	X, Bottom	Y, Bottom
Vertical	X, Bottom	X, Bottom	X, Bottom	X, Bottom	Y, Bottom	X, Bottom	X, Bottom

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

**Measurement range** : 9 kHz to 40 GHz  
**Test data** : APPENDIX  
**Test result** : Pass

**SECTION 7: UWB bandwidth and 99 % occupied bandwidth**

**Test Procedure**

The tests were made with below setting by a radiated electric field in semi-anechoic chamber.

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
UWB Bandwidth, 99 % Occupied Bandwidth	1 GHz	1 MHz	3 MHz	Auto	Peak	Max Hold	Spectrum Analyzer

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

**SECTION 8: Transmitter timeout**

**Test Procedure**

The test was made with spectrum analyzer.

**Test Data** : APPENDIX  
**Test Result** : Pass

**APPENDIX 1: Test Data**

**Conducted Emission**

**DATA OF CONDUCTED EMISSION TEST**

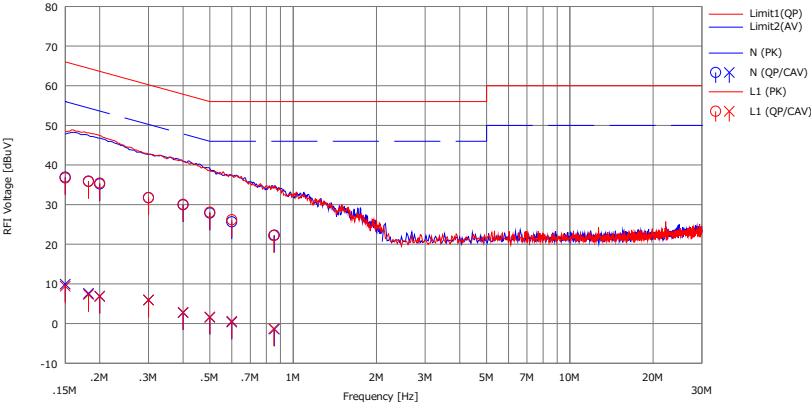
UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room  
Date : 2023/04/26

Mode : Tx ch 5 (6489.6 MHz)  
Power : DC 3.3 V  
Temp./Humi. : 24 deg.C / 30 %RH

Remarks : DC Power Supply : AC 120 V / 60 Hz

Limit : FCC\_Part 15 Subpart C(15.207)

Engineer : Kouki Yamada



No.	Freq. [MHz]	Reading		C.Fac. [dB]	Results		Limit		Margin		Phase	Comment
		(QP) [dBuV]	(CAV) [dBuV]		(QP) [dBuV]	(CAV) [dBuV]	(QP) [dBuV]	(AV) [dBuV]	(QP) [dB]	(AV) [dB]		
1	0.15000	24.50	-2.50	12.42	36.92	9.92	66.00	56.00	29.0	46.0	N	
2	0.18212	23.50	-4.80	12.42	35.92	7.62	64.39	54.39	28.4	46.7	N	
3	0.20000	22.80	-5.50	12.42	35.22	6.92	63.61	53.61	28.3	46.6	N	
4	0.30000	19.30	-6.50	12.45	31.75	5.95	60.24	50.24	28.4	44.2	N	
5	0.40000	17.50	-9.70	12.45	29.95	2.75	57.85	47.85	27.9	45.1	N	
6	0.50000	15.40	-10.90	12.46	27.86	1.56	56.00	46.00	28.1	44.4	N	
7	0.60000	13.20	-12.10	12.47	25.67	0.37	56.00	46.00	30.3	45.6	N	
8	0.85229	9.80	-13.90	12.49	22.29	-1.41	56.00	46.00	33.7	47.4	N	
9	0.15000	24.30	-3.00	12.43	36.73	9.43	66.00	56.00	29.2	46.5	L1	
10	0.18222	23.40	-5.10	12.42	35.82	7.32	64.38	54.38	28.5	47.0	L1	
11	0.20000	23.00	-5.60	12.43	35.43	6.83	63.61	53.61	28.1	46.7	L1	
12	0.30000	19.30	-6.50	12.44	31.74	5.94	60.24	50.24	28.5	44.3	L1	
13	0.40000	17.60	-9.60	12.46	30.06	2.86	57.85	47.85	27.7	44.9	L1	
14	0.50000	15.60	-10.80	12.47	28.07	1.67	56.00	46.00	27.9	44.3	L1	
15	0.60000	13.70	-11.90	12.49	26.19	0.59	56.00	46.00	29.8	45.4	L1	
16	0.85130	9.70	-13.80	12.49	22.19	-1.31	56.00	46.00	33.8	47.3	L1	

Calculation: Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN)+Cable+ATT)[dB]  
LISN(AMN):SLS-05

## Conducted Emission

### DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room  
Date : 2023/04/26

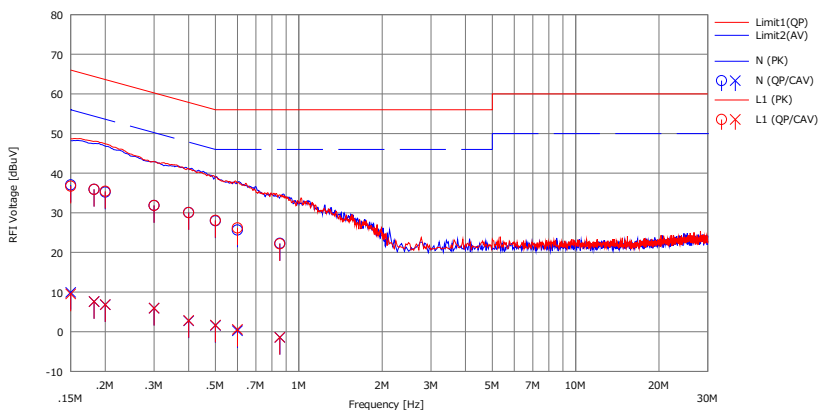
Mode : Tx ch 9 (7987.2 MHz)

Power : DC 3.3 V  
Temp./Humi. : 24 deg.C / 30 %RH

Remarks : DC Power Supply : AC 120 V / 60 Hz

Limit : FCC\_Part 15 Subpart C(15.207)

Engineer : Kouki Yamada



No.	Freq. [MHz]	Reading			C.Fac	Results		Limit		Margin		Phase	Comment
		(QP) [dBuV]	(CAV) [dBuV]	[dB]		(QP) [dBuV]	(CAV) [dBuV]	(QP) [dBuV]	(AV) [dBuV]	(QP) [dB]	(AV) [dB]		
1	0.15000	24.60	-2.50	12.42	37.02	9.92	66.00	56.00	28.9	46.0	N		
2	0.18232	23.50	-4.80	12.42	35.92	7.62	64.38	54.38	28.4	46.7	N		
3	0.20000	22.80	-5.60	12.42	35.22	6.82	63.61	53.61	28.3	46.7	N		
4	0.30000	19.40	-6.50	12.45	31.85	5.95	60.24	50.24	28.3	44.2	N		
5	0.40000	17.60	-9.70	12.45	30.05	2.75	57.85	47.85	27.8	45.1	N		
6	0.50000	15.50	-10.90	12.46	27.96	1.56	56.00	46.00	28.0	44.4	N		
7	0.60000	13.20	-12.20	12.47	25.67	0.27	56.00	46.00	30.3	45.7	N		
8	0.85437	9.80	-13.90	12.49	22.29	-1.41	56.00	46.00	33.7	47.4	N		
9	0.15000	24.30	-2.90	12.43	36.73	9.53	66.00	56.00	29.2	46.4	L1		
10	0.18215	23.50	-4.80	12.42	35.92	7.62	64.39	54.39	28.4	46.7	L1		
11	0.20000	23.00	-5.60	12.43	35.43	6.83	63.61	53.61	28.1	46.7	L1		
12	0.30000	19.40	-6.50	12.44	31.84	5.94	60.24	50.24	28.4	44.3	L1		
13	0.40000	17.60	-9.60	12.46	30.06	2.86	57.85	47.85	27.7	44.9	L1		
14	0.50000	15.60	-10.80	12.47	28.07	1.67	56.00	46.00	27.9	44.3	L1		
15	0.60000	13.70	-11.90	12.49	26.19	0.59	56.00	46.00	29.8	45.4	L1		
16	0.85336	9.70	-13.90	12.49	22.19	-1.41	56.00	46.00	33.8	47.4	L1		

Calculation: Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN)+Cable+ATT)[dB]  
LISN(AMN):SLS-05



**Radiated emission**

Test place Shonan EMC Lab. No.3 Semi Anechoic Chamber  
 Report No. 14727491S-J-R1  
 Date April 19, 2023  
 Temperature / Humidity 22 deg. C / 45 % RH  
 Engineer Hiromasa Sato  
 Mode Transmitting CH 5

(UWB emission, RBW 1 MHz)

(\*SA: Spectrum analyzer, SG: Signal generator, Ant.: substitution antenna)

Band	Pol.	Frequency [MHz]	SA Reading [dBuV/MHz]	SG level [dBm]	Tx Ant.Gain [dBi]	Tx Loss [dB]	-	EIRP Result [dBm/MHz]	EIRP Limit [dBm/MHz]	Margin [dB]	Remarks	Height [cm]	Angle [deg.]
3.1 GHz - 10.6 GHz	Hor.	6401.610	68.26	-42.91	10.51	10.03	-	-42.43	-41.30	1.13	carrier	151	208
3.1 GHz - 10.6 GHz	Ver.	6390.810	67.23	-43.79	10.53	10.02	-	-43.28	-41.30	1.98	carrier	149	215

Sample Calculation :

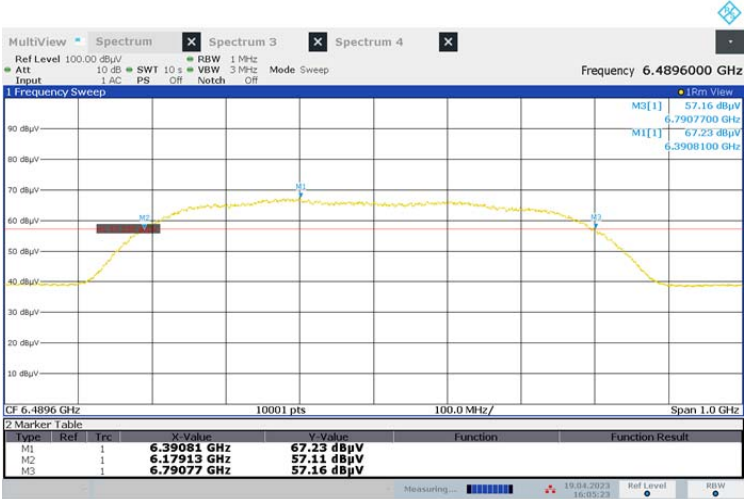
EIRP Result [dBm/MHz] = SG level [dBm] + Tx Ant.Gain [dBi] - Tx Loss [dB]

(Horizontal)



15:52:40 19.04.2023

(Vertical)



16:05:24 19.04.2023

\* For RF Exposure evaluation

Maximum RMS power measured: -42.43 dBm/MHz (refer to upper table value) / 10 ^ ( -42.43 [dBm/MHz]/ 10 ) = 0.00005715 mW/MHz

The bandwidth of this equipment was 616.231 MHz (99 % occupied bandwidth, refer to the data of bandwidth sheet)

Total RMS output power was 0.0352176 mW = 0.00005715 mW/MHz x 616.231 MHz

**Radiated emission**

Test place                   Shonan EMC Lab. No.3 Semi Anechoic Chamber  
Report No.                   14727491S-J-R1  
Date                         April 19, 2023  
Temperature / Humidity    22 deg. C / 45 % RH  
Engineer                    Hiromasa Sato  
Mode                         Transmitting CH 9

(UWB emission, RBW 1 MHz)

(\*SA: Spectrum analyzer, SG: Signal generator, Ant.: substitution antenna)

Band	Pol.	Frequency [MHz]	SA Reading [dBuV/MHz]	SG level [dBm]	Tx Ant.Gain [dBi]	Tx Loss [dB]	-	EIRP Result [dBm/MHz]	EIRP Limit [dBm/MHz]	Margin [dB]	Remarks	Height [cm]	Angle [deg.]
3.1 GHz - 10.6 GHz	Hor.	8051.290	67.87	-44.89	12.90	11.27	-	-43.26	-41.30	1.96	carrier	148	33
3.1 GHz - 10.6 GHz	Ver.	8051.390	67.14	-45.16	12.90	11.27	-	-43.53	-41.30	2.23	carrier	144	91

Sample Calculation :

EIRP Result [dBm/MHz] = SG level [dBm] + Tx Ant.Gain [dBi] - Tx Loss [dB]

(Horizontal)



17:22:45 19.04.2023

(Vertical)



17:32:48 19.04.2023

\* For RF Exposure evaluation  
Maximum RMS power measured: -43.26 dBm/MHz (refer to upper table value) / 10 ^ ( -43.26 [dBm/MHz]/ 10 ) = 0.00004721 W/MHz  
The bandwidth of this equipment was 612.664 MHz (99 % occupied bandwidth, refer to the data of bandwidth sheet)  
Total RMS output power was 0.02892387 mW = 0.00004721 mW/MHz x 612.664 MHz

### Radiated emission

Test place           Shonan EMC Lab. No.3 Semi Anechoic Chamber  
 Report No.         14727491S-J-R1  
 Date                April 19, 2023                   April 21, 2023                   April 22, 2023                   April 20, 2023  
 Temperature /     22 deg. C / 45 % RH         23 deg. C / 35 % RH         24 deg. C / 41 % RH         23 deg. C / 42 % RH  
 Humidity  
 Engineer           Yohsuke Matsuzawa           Yohsuke Matsuzawa           Yosuke Murakami           Yasumasa Owaki  
                       (9 kHz - 1000 MHz)           (1 GHz - 10.6 GHz)           (10.6 GHz - 18 GHz)         (18 GHz - 40 GHz)  
 Mode               Transmitting CH 5

(UWB emission, For RBW less than 960 MHz was set according to FCC 15.209, Above 960 MHz was set to 1 MHz)

#### 9 kHz - 18 GHz

No.	Freq. [MHz]	Reading (AV) [dBuV]	SG Level [dBm]	TX Ant.Gain [dB]	TX Loss [dB]	ERP		Margin [dB]	Pola.	Height [cm]	Angle [deg]	TX Ant.Type	Comment
						Result [dBm]	Limit [dBm]						
1	12979.200	38.03	-80.71	13.25	14.58	-82.04	-61.30	20.7	Hori.	153	313	Horn	RMS
2	12979.200	37.92	-80.76	13.25	14.58	-82.09	-61.30	20.7	Vert.	149	79	Horn	RMS

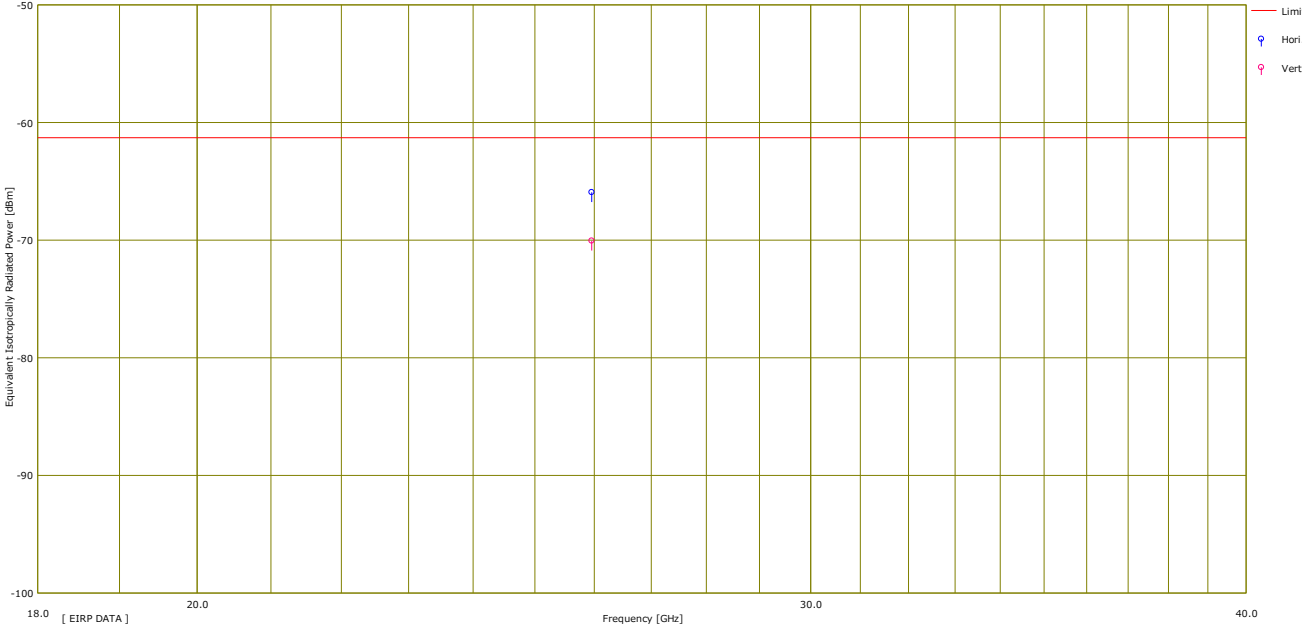
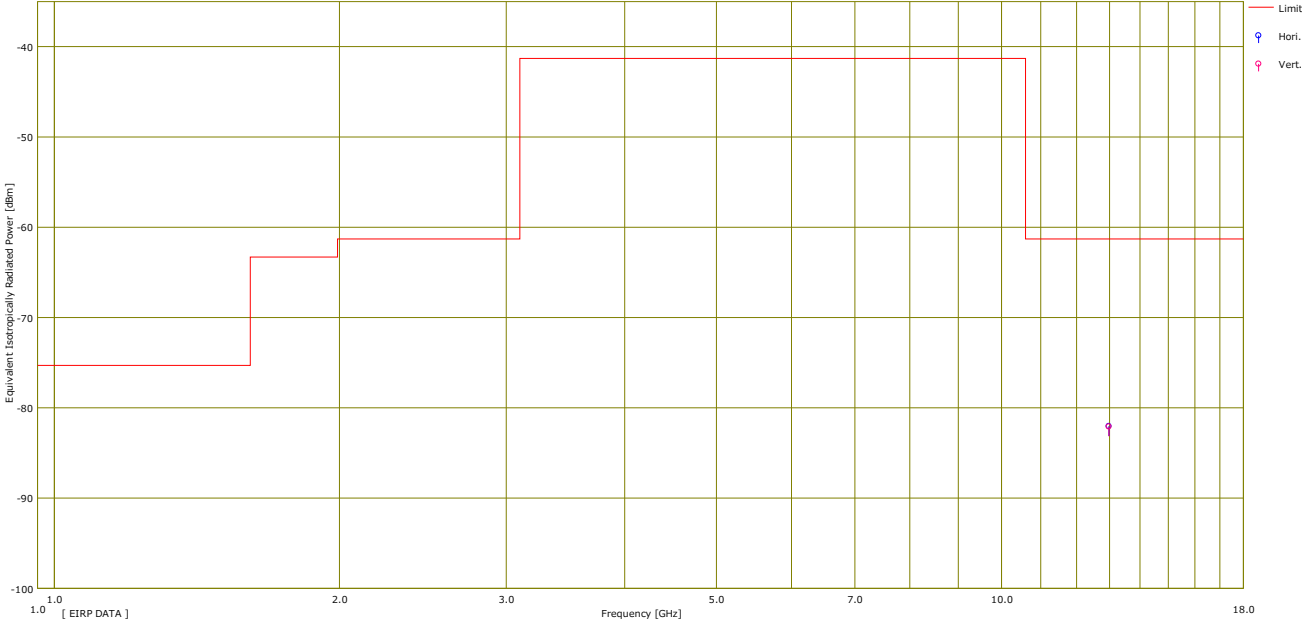
#### 18 GHz - 40 GHz

No.	Freq. [MHz]	Reading (PK) [dBuV]	SG Level [dBm]	TX Ant.Gain [dB]	TX Loss [dB]	ERP		Margin [dB]	Pola.	Height [cm]	Angle [deg]	TX Ant.Type	Comment
						Result [dBm]	Limit [dBm]						
1	25958.400	46.54	-56.54	11.60	21.00	-65.94	-61.30	4.6	Hori.	154	213	Horn	RMS
2	25958.400	42.92	-60.66	11.60	21.00	-70.06	-61.30	8.7	Vert.	149	312	Horn	RMS

**Radiated emission**

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber			
Report No.	14727491S-J-R1			
Date	April 19, 2023	April 21, 2023	April 22, 2023	April 20, 2023
Temperature / Humidity	22 deg. C / 45 % RH	23 deg. C / 35 % RH	24 deg. C / 41 % RH	23 deg. C / 42 % RH
Engineer	Yohsuke Matsuzawa (9 kHz - 1000 MHz)	Yohsuke Matsuzawa (1 GHz - 10.6 GHz)	Yosuke Murakami (10.6 GHz - 18 GHz)	Yasumasa Owaki (18 GHz - 40 GHz)
Mode	Transmitting CH 5			

(UWB emission, For RBW less than 960 MHz was set according to FCC 15.209, Above 960 MHz was set to 1 MHz)



**Radiated emission**

Test place Shonan EMC Lab. No.3 Semi Anechoic Chamber  
 Report No. 14727491S-J-R1  
 Date April 19, 2023 April 21, 2023 April 22, 2023 April 20, 2023  
 Temperature / Humidity 22 deg. C / 45 % RH 23 deg. C / 35 % RH 24 deg. C / 41 % RH 23 deg. C / 42 % RH  
 Engineer Yohsuke Matsuzawa Yohsuke Matsuzawa Yosuke Murakami Yasumasa Owaki  
 (9 kHz - 1000 MHz) (1 GHz - 10.6 GHz) (10.6 GHz - 18 GHz) (18 GHz - 40 GHz)  
 Mode Transmitting CH 9

(UWB emission, For RBW less than 960 MHz was set according to FCC 15.209, Above 960 MHz was set to 1 MHz)

**9 kHz - 18 GHz**

No.	Freq. [MHz]	Reading (AV) [dBuV]	SG Level [dBm]	TX Ant.Gain [dBi]	TX Loss [dB]	ERP		Margin [dB]	Pola.	Height [cm]	Angle [deg]	TX Ant.Type	Comment
						Result [dBm]	Limit [dBm]						
1	15974.400	37.87	-74.54	13.57	16.16	-77.13	-61.30	15.8	Hori.	153	322	Horn	RMS
2	15974.400	37.21	-75.13	13.57	16.16	-77.72	-61.30	16.4	Vert.	149	324	Horn	RMS

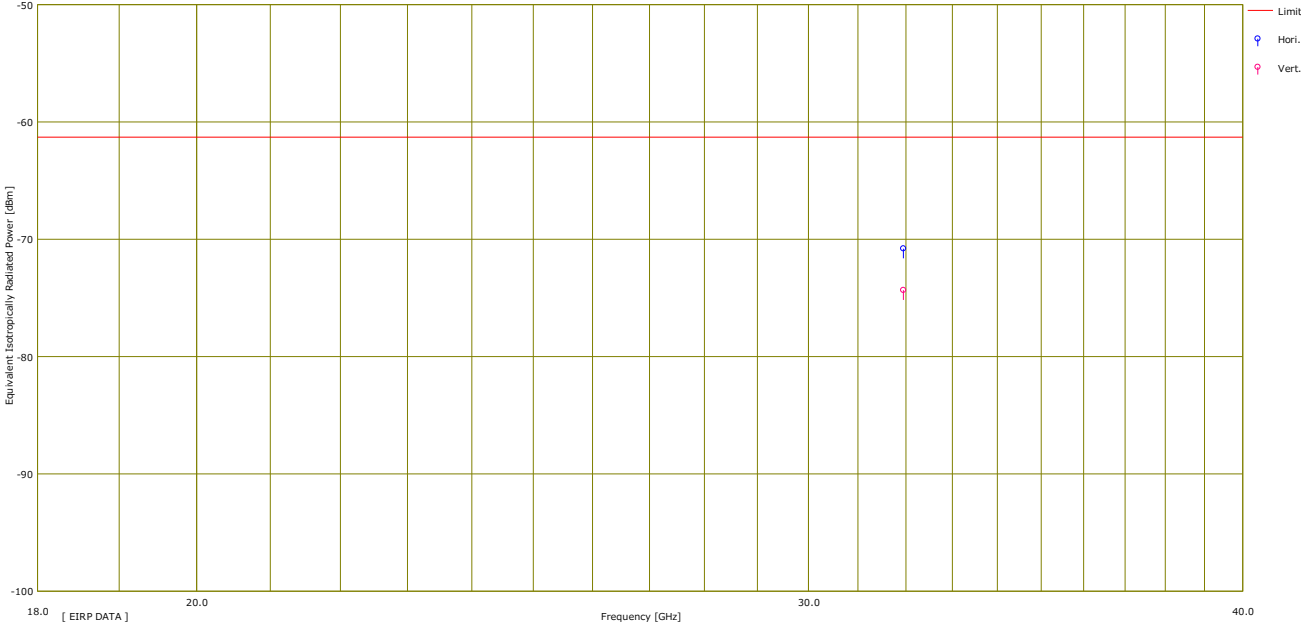
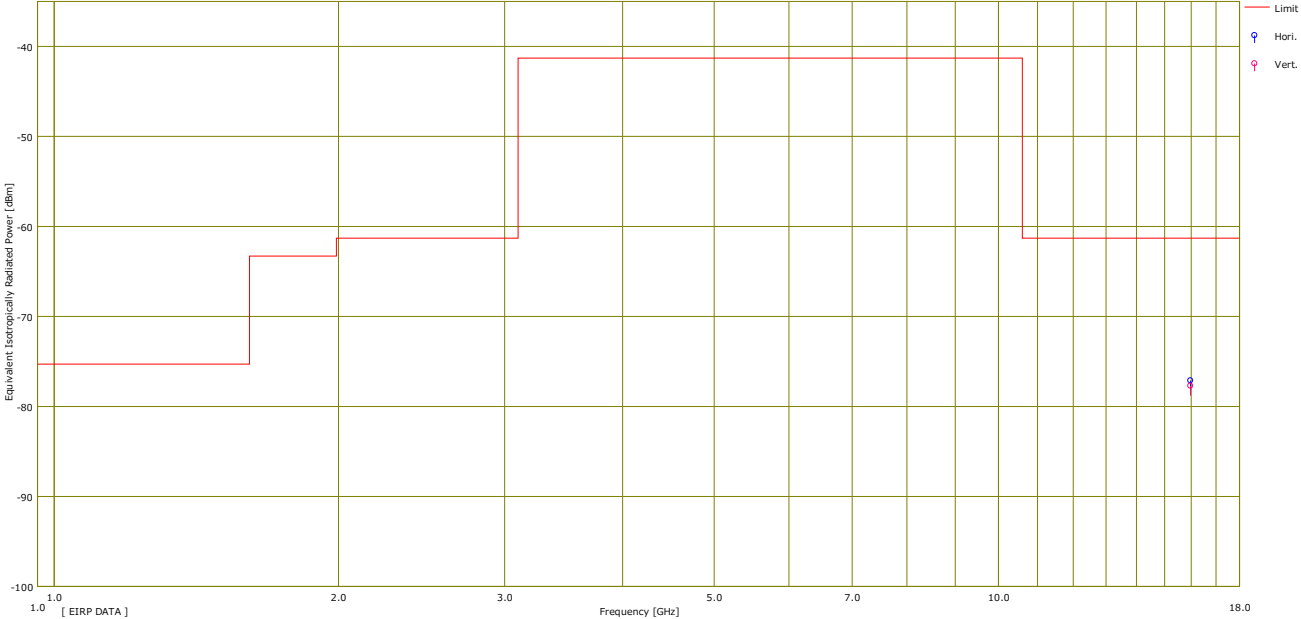
**18 GHz - 40 GHz**

No.	Freq. [MHz]	Reading (PK) [dBuV]	SG Level [dBm]	TX Ant.Gain [dBi]	TX Loss [dB]	ERP		Margin [dB]	Pola.	Height [cm]	Angle [deg]	TX Ant.Type	Comment
						Result [dBm]	Limit [dBm]						
1	31948.801	55.55	-59.58	12.34	23.56	-70.80	-61.30	9.5	Hori.	153	230	Horn	RMS
2	31948.801	54.07	-63.12	12.34	23.56	-74.34	-61.30	13.0	Vert.	150	161	Horn	RMS

**Radiated emission**

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber			
Report No.	14727491S-J-R1			
Date	April 19, 2023	April 21, 2023	April 22, 2023	April 20, 2023
Temperature / Humidity	22 deg. C / 45 % RH	23 deg. C / 35 % RH	24 deg. C / 41 % RH	23 deg. C / 42 % RH
Engineer	Yohsuke Matsuzawa (9 kHz - 1000 MHz)	Yohsuke Matsuzawa (1 GHz - 10.6 GHz)	Yosuke Murakami (10.6 GHz - 18 GHz)	Yasumasa Owaki (18 GHz - 40 GHz)
Mode	Transmitting CH 9			

(UWB emission, For RBW less than 960 MHz was set according to FCC 15.209, Above 960 MHz was set to 1 MHz)

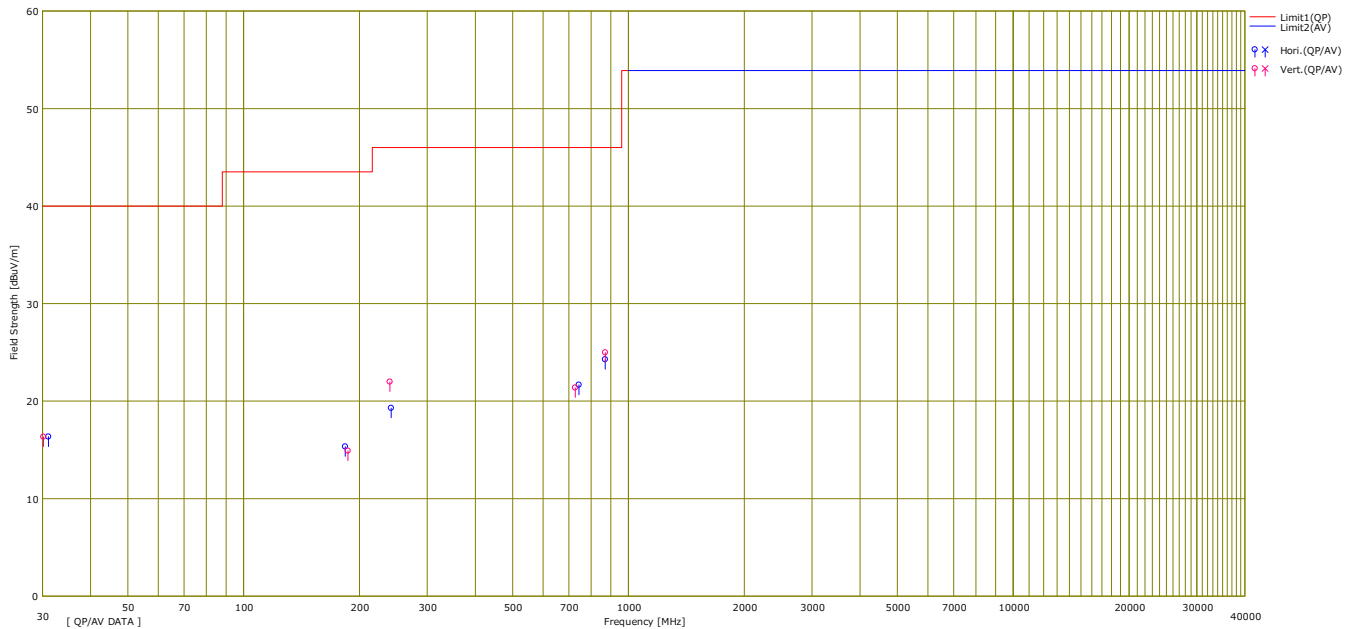


### Radiated emission

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	14727491S-J-R1
Date	April 19, 2023
Temperature / Humidity	22 deg. C / 45 % RH
Engineer	Yohsuke Matsuzawa
Mode	Transmitting CH 5

(Other emission) (\* There were no detect other emissions in the range that below 30 MHz and above 960 MHz)

No.	Freq. [MHz]	Reading	Ant.Fac [dB/m]	Loss	Gain	Result	Limit	Margin	Pola.	Height [cm]	Angle [deg]	Ant. Type	Comment
		<QP> [dBuV]				<QP> [dBuV/m]	<QP> [dB]	[H/V]					
1	31.093	23.60	18.34	6.60	32.20	16.34	40.00	23.6	Hori.	162	121	BC	
2	183.719	23.10	16.41	7.90	32.08	15.33	43.50	28.1	Hori.	199	218	BC	
3	241.760	25.70	17.34	8.27	32.02	19.29	46.00	26.7	Hori.	267	75	BC	
4	743.612	22.80	20.19	10.44	31.77	21.66	46.00	24.3	Hori.	145	198	LP	
5	870.148	22.60	22.04	10.87	31.24	24.27	46.00	21.7	Hori.	153	231	LP	
6	30.178	23.30	18.64	6.59	32.20	16.33	40.00	23.6	Vert.	100	195	BC	
7	186.714	22.60	16.46	7.92	32.08	14.90	43.50	28.6	Vert.	100	215	BC	
8	240.000	28.50	17.24	8.26	32.02	21.98	46.00	24.0	Vert.	100	368	BC	
9	727.154	22.30	20.49	10.39	31.81	21.37	46.00	24.6	Vert.	100	278	LP	
10	870.589	23.30	22.05	10.87	31.24	24.98	46.00	21.0	Vert.	100	165	LP	

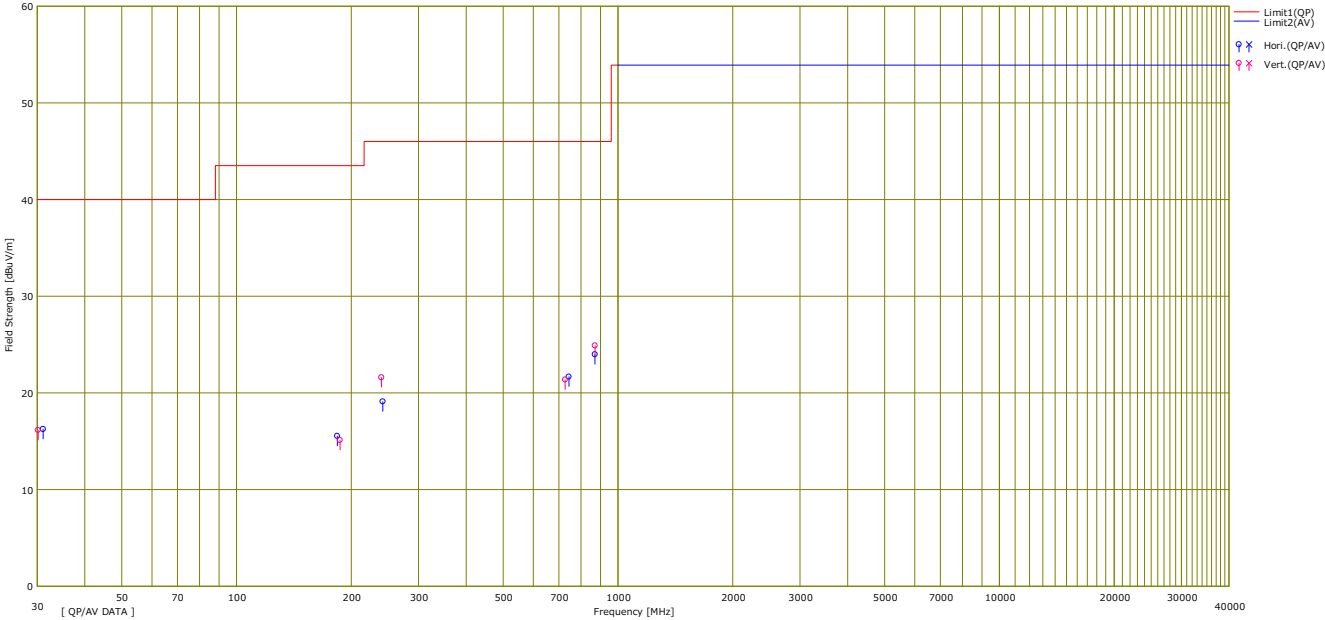


**Radiated emission**

Test place Shonan EMC Lab. No.3 Semi Anechoic Chamber  
 Report No. 14727491S-J-R1  
 Date April 19, 2023  
 Temperature / Humidity 22 deg. C / 45 % RH  
 Engineer Yohsuke Matsuzawa  
 Mode Transmitting CH 9

(Other emission) (\* There were no detect other emissions in the range that below 30 MHz and above 960 MHz.)

No.	Freq. [MHz]	Reading	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result	Limit	Margn	Pola [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
		<QP> [dBuV]				<QP> [dBuV/m]	<QP> [dB]						
1	31.113	23.50	18.33	6.60	32.20	16.23	40.00	23.7	Hori.	161	122	BC	
2	183.731	23.30	16.41	7.90	32.08	15.53	43.50	27.9	Hori.	201	215	BC	
3	241.851	25.50	17.34	8.27	32.02	19.09	46.00	26.9	Hori.	263	80	BC	
4	743.661	22.80	20.19	10.44	31.77	21.66	46.00	24.3	Hori.	155	200	LP	
5	870.353	22.30	22.04	10.87	31.24	23.97	46.00	22.0	Hori.	155	233	LP	
6	30.187	23.10	18.64	6.59	32.20	16.13	40.00	23.8	Vert.	100	191	BC	
7	186.738	22.80	16.46	7.92	32.08	15.10	43.50	28.4	Vert.	100	221	BC	
8	240.000	28.10	17.24	8.26	32.02	21.58	46.00	24.4	Vert.	100	358	BC	
9	727.255	22.30	20.48	10.39	31.81	21.36	46.00	24.6	Vert.	100	300	LP	
10	870.601	23.20	22.05	10.87	31.24	24.88	46.00	21.1	Vert.	100	173	LP	





### Radiated emission (GPS band)

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	14727491S-J-R1
Date	April 21, 2023
Temperature / Humidity	23 deg. C / 35 % RH
Engineer	Yohsuke Matsuzawa
Mode	Transmitting CH 5

(GPS bands emission)

No.	Freq. [MHz]	Reading (AV) [dBuV]	SG Level [dBm]	TX Ant.Gain [dBi]	TX Loss [dB]	ERP		Margin [dB]	Pola.	Height [cm]	Angle [deg]	TX Ant.Type	Comment
						Result [dBm]	Limit [dBm]						
1	1202.000	17.53	-135.00	6.30	4.30	-133.00	-85.30	47.7	Hori.	150	0	Horn	RBW: 1 kHz (Noise floor level)
2	1584.500	17.83	-135.00	9.00	4.96	-130.96	-85.30	45.6	Hori.	150	0	Horn	RBW: 1 kHz (Noise floor level)
3	1202.000	17.36	-135.00	6.30	4.30	-133.00	-85.30	47.7	Vert.	150	0	Horn	RBW: 1 kHz (Noise floor level)
4	1584.500	17.77	-135.00	9.00	4.96	-130.96	-85.30	45.6	Vert.	150	0	Horn	RBW: 1 kHz (Noise floor level)



### Radiated emission (GPS band)

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	14727491S-J-R1
Date	April 21, 2023
Temperature / Humidity	23 deg. C / 35 % RH
Engineer	Yohsuke Matsuzawa
Mode	Transmitting CH 9

(GPS bands emission)

No.	Freq. [MHz]	Reading	SG Level [dBm]	TX Ant.Gain [dBi]	TX Loss [dB]	ERP		Margin [dB]	Pola.	Height [cm]	Angle [deg]	TX Ant.Type	Comment
		<AV> [dBuV]				Result [dBm]	Limit [dBm]						
1	1202.000	17.55	-135.00	6.30	4.24	-132.94	-85.30	47.6	Hori.	150	0	Horn	RBW: 1 kHz (Noise floor level)
2	1584.500	17.73	-135.00	9.00	4.88	-130.88	-85.30	45.5	Hori.	150	0	Horn	RBW: 1 kHz (Noise floor level)
3	1202.000	17.46	-135.00	6.30	4.24	-132.94	-85.30	47.6	Vert.	150	0	Horn	RBW: 1 kHz (Noise floor level)
4	1584.500	17.68	-135.00	9.00	4.88	-130.88	-85.30	45.5	Vert.	150	0	Horn	RBW: 1 kHz (Noise floor level)



**Peak level of the emission**

Test place Shonan EMC Lab. No.3 Semi Anechoic Chamber  
 Report No. 14727491S-J-R1  
 Date April 19, 2023  
 Temperature / Humidity 22 deg. C / 45 % RH  
 Engineer Hiromasa Sato  
 Mode Transmitting CH 5

(Peak level of the emission)

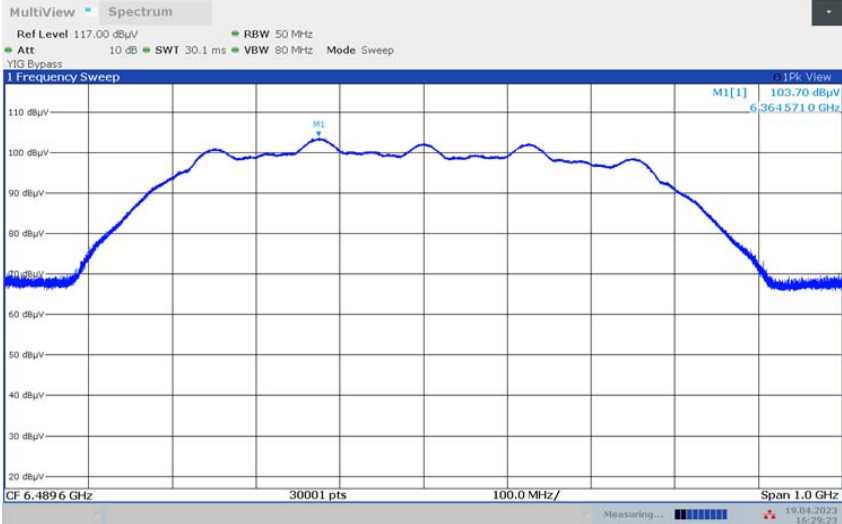
(\*SA: Spectrum analyzer, SG: Signal generator, Ant.: substitution antenna)

Band	Pol.	Frequency [MHz]	SA Reading [dBuV/50 MHz]	SG level [dBm]	Tx Ant.Gain [dBi]	Tx Loss [dB]	RBW converted factor [dB]	EIRP Result [dBm/50 MHz]	EIRP Limit [dBm/50 MHz]	Margin [dB]	Remarks	Height [cm]	Angle [deg.]
3.1 GHz - 10.6 GHz	Hor.	6364.571	103.70	-7.58	10.61	10.00	0.29	-6.68	0.00	6.68	carrier	151	208
3.1 GHz - 10.6 GHz	Ver.	6365.037	102.41	-8.04	10.60	10.00	0.29	-7.15	0.00	7.15	carrier	149	215

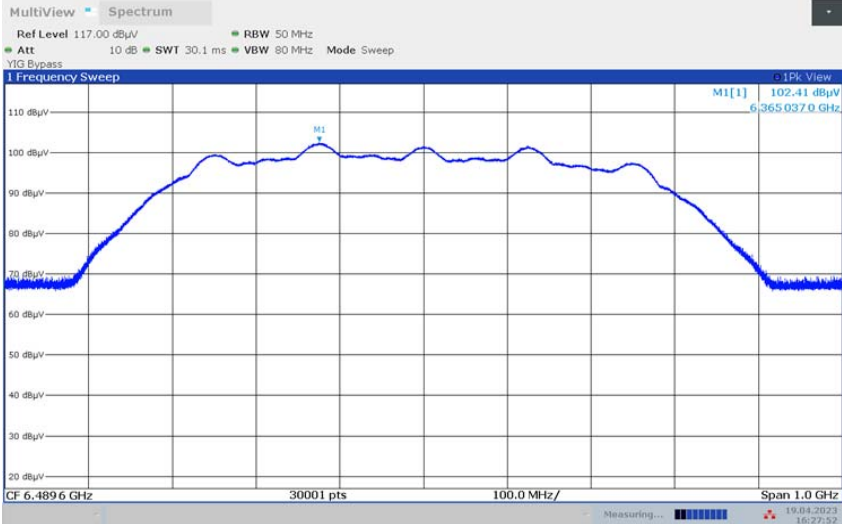
Sample Calculation :

EIRP Result [dBm/MHz] = SG level [dBm] + Tx Ant.Gain [dBi] - Tx Loss [dB] + RBW converted factor [dB]  
 RBW converted factor [dB] = 20 x log ( 50 / (3 dB measured bandwidth = 48.3384 [MHz] ) )

(Horizontal)



(Vertical)



\* For RSP-100 Annex B  
 Maximum peak power measured: -6.68 dBm/50 MHz (refer to upper table value) / 10 ^ ( -6.68 [dBm/50 MHz]/ 10 ) = 0.214783 mW/50 MHz  
 The bandwidth of this equipment was 616.231 MHz (99 % occupied bandwidth, refer to the data of bandwidth sheet)  
 Total peak output power was 2.647119 mW = 0.214783 [mW/50 MHz] x 616.231 [MHz] / 50 [MHz]

### Peak level of the emission

Test place Shonan EMC Lab. No.3 Semi Anechoic Chamber  
Report No. 14727491S-J-R1  
Date April 19, 2023  
Temperature / Humidity 22 deg. C / 45 % RH  
Engineer Hiromasa Sato  
Mode Transmitting CH 9

(Peak level of the emission)

(\*SA: Spectrum analyzer, SG: Signal generator, Ant.: substitution antenna)

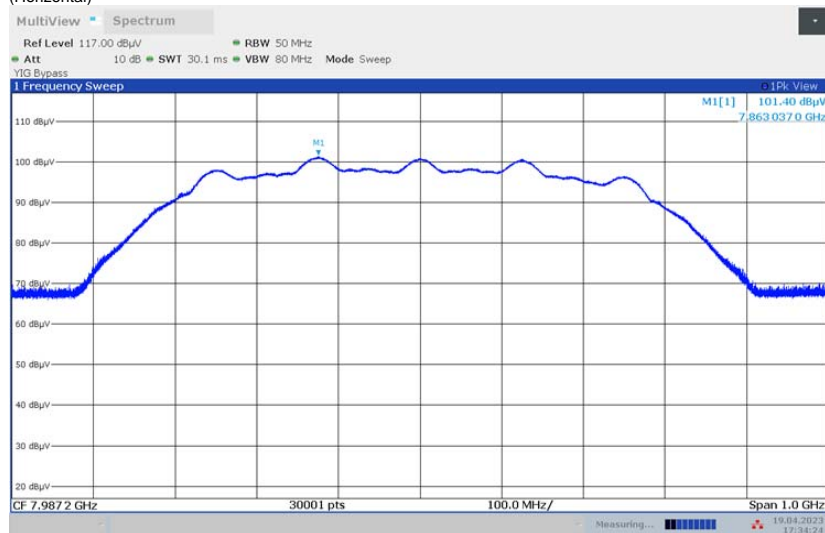
Band	Pol.	Frequency [MHz]	SA Reading [dBuV/50 MHz]	SG level [dBm]	Tx Ant.Gain [dBi]	Tx Loss [dB]	RBW converted factor [dB]	EIRP Result [dBm/50 MHz]	EIRP Limit [dBm/50 MHz]	Margin [dB]	Remarks	Height [cm]	Angle [deg.]
3.1 GHz - 10.6 GHz	Hor.	7863.037	101.40	-10.15	12.52	11.14	0.29	-8.48	0.00	8.48	carrier	148	33
3.1 GHz - 10.6 GHz	Ver.	7863.504	100.65	-11.26	12.52	11.14	0.29	-9.59	0.00	9.59	carrier	144	91

Sample Calculation :

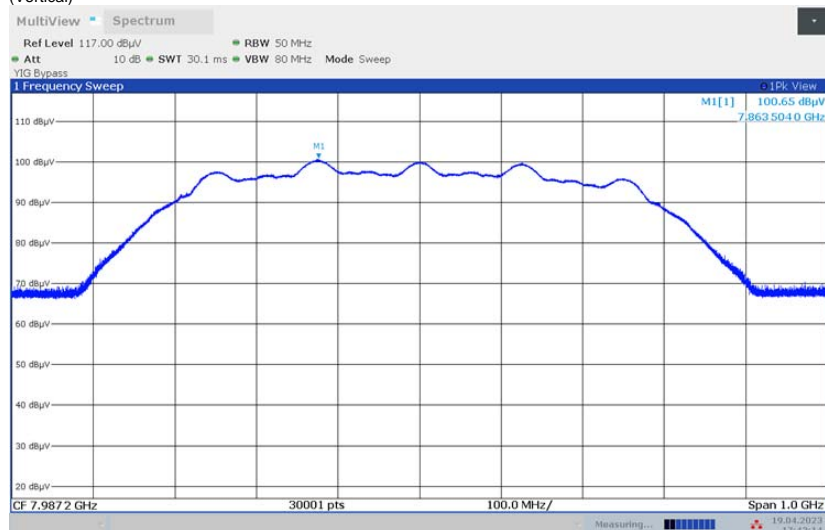
EIRP Result [dBm/MHz] = SG level [dBm] + Tx Ant.Gain [dBi] - Tx Loss [dB] + RBW converted factor [dB]

RBW converted factor [dB] =  $20 \times \log ( 50 / (3 \text{ dB measured bandwidth} = 48.3384 \text{ [MHz]} ) )$

(Horizontal)



(Vertical)



\* For RSP-100 Annex B

Maximum peak power measured:  $-8.48 \text{ dBm/50 MHz (refer to upper table value)} / 10 \wedge (-8.48 \text{ [dBm/50 MHz]} / 10) = 0.141906 \text{ mW/50 MHz}$

The bandwidth of this equipment was 612.664 MHz (99 % occupied bandwidth, refer to the data of bandwidth sheet)

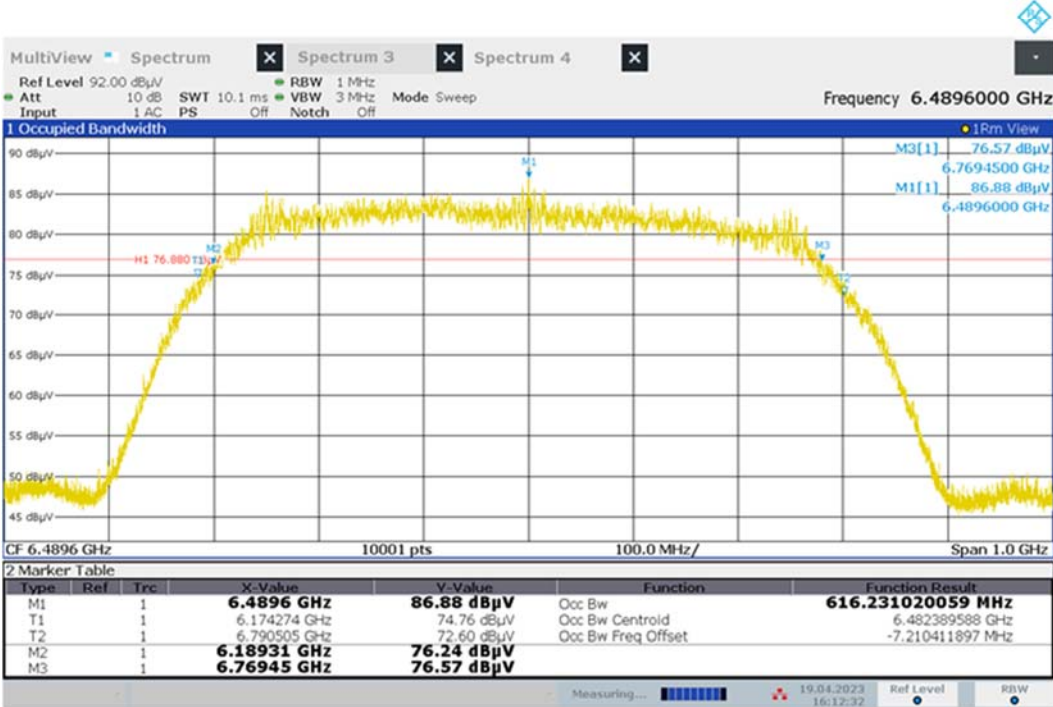
Total peak output power was  $1.738814 \text{ mW} = 0.141906 \text{ [mW/50 MHz]} \times 612.664 \text{ [MHz]} / 50 \text{ [MHz]}$

**UWB Bandwidth**

Test place                      Shonan EMC Lab. No.3 Semi Anechoic Chamber  
 Report No.                      14727491S-J-R1  
 Date                              April 19, 2023  
 Temperature / Humidity      22 deg. C / 45 % RH  
 Engineer                        Hiromasa Sato  
 Mode                              Transmitting CH 5

**10 dB Bandwidth:**                      **580.140 MHz (Limit: >= 500 MHz)**  
**99 % Occupied Bandwidth:**        **616.231 MHz**  
**Center Frequency**                      **6479.380 MHz ( = ( fH + fL ) / 2 )**

(worst: Horizontal)



16:12:33 19.04.2023

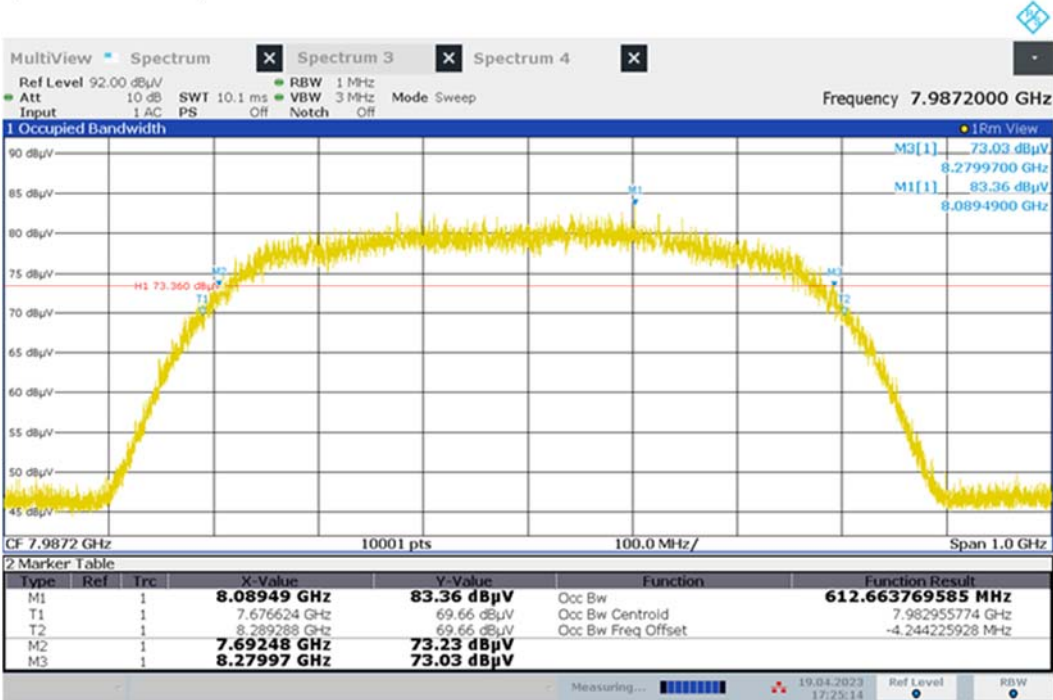
**Start Frequency:**                      5989.600 MHz                              **f L:**                      6189.310 MHz  
**Stop Frequency:**                      6989.600 MHz                              **f H:**                      6769.450 MHz

**UWB Bandwidth**

Test place: Shonan EMC Lab. No.3 Semi Anechoic Chamber  
 Report No.: 14727491S-J-R1  
 Date: April 19, 2023  
 Temperature / Humidity: 22 deg. C / 45 % RH  
 Engineer: Hiromasa Sato  
 Mode: Transmitting CH 9

**10 dB Bandwidth:** 587.490 MHz (Limit: >= 500 MHz)  
**99 % Occupied Bandwidth:** 612.664 MHz  
**Center Frequency** 7986.225 MHz ( = ( fH + fL ) / 2 )

(worst: Horizontal)



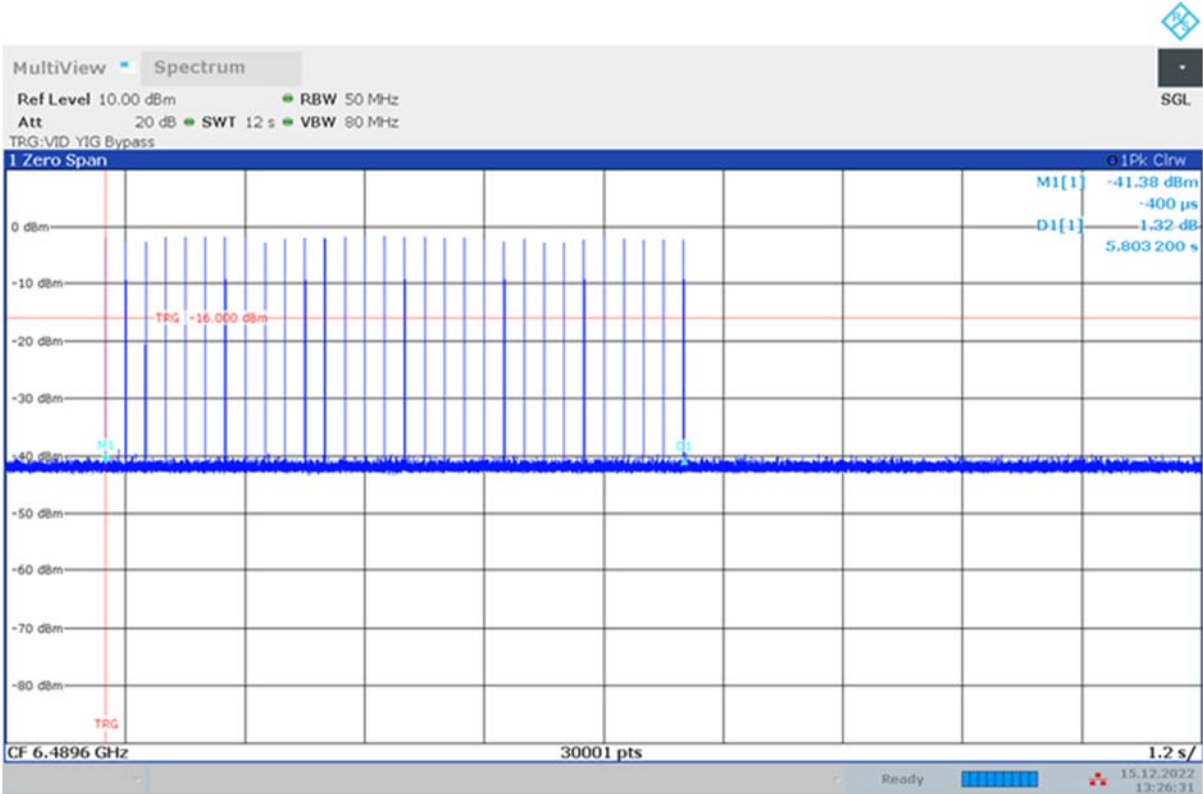
17:25:15 19.04.2023

**Start Frequency:** 7487.200 MHz      **fL:** 7692.480 MHz  
**Stop Frequency:** 8487.200 MHz      **fH:** 8279.970 MHz

### Transmitter timeout

Test place                   Shonan EMC Lab. No.5 Shielded room  
Date                         December 15, 2022  
Temperature / Humidity    21 deg. C / 30 % RH  
Engineer                  Takahiro Kawakami  
Mode                        Normal Tx ch 5

Transmitter Timeout:       5.803 s (Limit: <10 s)

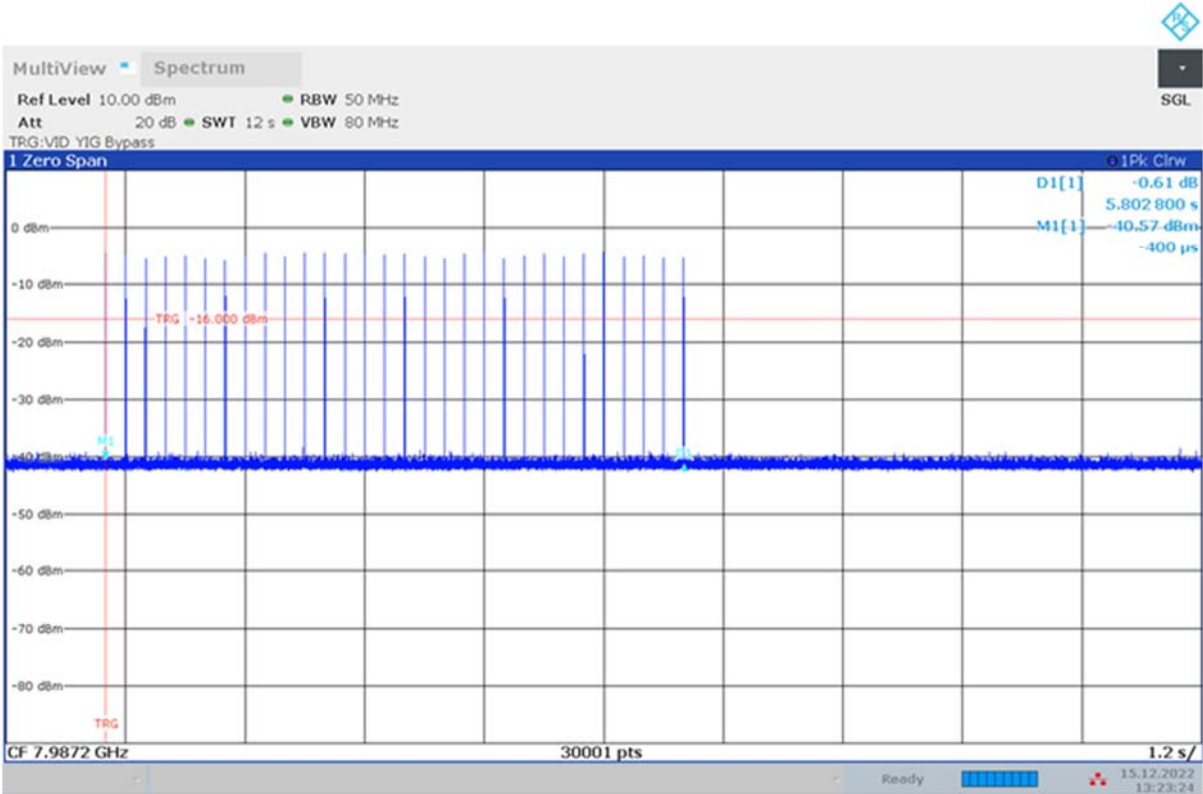


13:26:32 15.12.2022

### Transmitter timeout

Test place                   Shonan EMC Lab. No.5 Shielded room  
Date                         December 15, 2022  
Temperature / Humidity    21 deg. C / 30 % RH  
Engineer                   Takahiro Kawakami  
Mode                        Normal Tx ch 9

Transmitter Timeout:       5.802 s (Limit: <10 s)



13:23:25 15.12.2022



## APPENDIX 2: Test instruments

### Test Instruments (1/2)

Test Name	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Interval (Month)
AT	SAT10-15	160493	Attenuator	Weinschel Corp.	54A-10	83406	2022/12/01	12
AT	SCC-G60	196941	Coaxial Cable	Huber+Suhner	SUCOFLEX 102	803093/2	2022/03/01	12 *1)
AT	SOS-27	191845	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	-	2022/08/08	12
AT	SSA-03	145801	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY48250152	2022/08/04	12
AT	STS-05	146212	Digital Hitester	HIOKI E.E. CORPORATION	3805-50	80997828	2022/09/20	12
CE,RE	KJM-02	146432	Measure	TAJIMA	GL19-55	-	-	-
CE,RE	STR-09	213530	Test Receiver	Rohde & Schwarz	ESW44	103068	2023/01/12	12
CE,RE	STS-03	146210	Digital Hitester	HIOKI E.E. CORPORATION	3805-50	80997823	2022/09/20	12
AT,RE	SRENT-23	206472	Spectrum Analyzer	Rohde & Schwarz	FSW43	104056	2022/04/11	12
RE	KHA-02	144941	Horn Antenna	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	230	2022/05/09	12
RE	SAEC-03(NSA)	145565	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	2023/04/05	12
RE	SAF-03	145126	Pre Amplifier	SONOMA	310N	290213	2023/02/09	12
RE	SAF-06	145005	Pre Amplifier	Toyo Corporation	TPA0118-36	1440491	2023/02/02	12
RE	SAF-08	145007	Pre Amplifier	Toyo Corporation	HAP18-26W	19	2023/03/03	12
RE	SAF-10	145129	Pre Amplifier	Toyo Corporation	HAP26-40W	10	2023/03/03	12
RE	SAT10-05	145136	Attenuator	Keysight Technologies Inc	8493C-010	74864	2022/10/20	12
RE	SAT6-13	167094	Attenuator	JFW	50HF-006N	-	2023/02/09	12
RE	SCC-C1/C2/C3/C4/C5/C10/SRSE-03	145171	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/N S4906	-/0901-271(RF Selector)	2023/04/18	12
RE	SCC-G15	145176	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	2023/03/03	12
RE	SCC-G43	156380	Coaxial Cable	Huber+Suhner	SUCOFLEX_104_E	SN MY 13406/4E	2022/05/20	12
RE	SCC-G44	168300	Coaxial Cable	Huber+Suhner	SUCOFLEX 104	800375/4A	2022/11/10	12
RE	SCC-G57	179540	Coaxial Cable	Huber+Suhner	SUCOFLEX 102	802815/2	2023/03/03	12
RE	SCC-G58	183047	Coaxial Cable	Huber+Suhner	SUCOFLEX 104	800287/4A	-	-
RE	SCC-G70	200010	Coaxial Cable	Huber+Suhner	SUCOFLEX 104	575618/4	2022/07/22	12
RE	SCC-G71	221966	Coaxial Cable	Huber+Suhner	SUCOFLEX 102	2000703/2	2022/07/28	12
RE	SCC-M1	194601	Coaxial Cable	Fijikura	5D-2W	-	2022/12/16	12

**Test Instruments (2/2)**

Test Name	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Interval (Month)
RE	SHA-03	145501	Horn Antenna	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	9120D-739	2023/03/27	12
RE	SHA-04	145512	Horn Antenna	ETS-Lindgren	3160-09	00094868	2022/06/06	12
RE	SHA-06	145514	Horn Antenna	ETS-Lindgren	3160-10	00092383	2022/06/06	12
RE	SHA-07	145515	Horn Antenna	ETS-Lindgren (Cedar Park, Texas)	3116	108256	2022/05/09	12
RE	SHA-09	194684	Horn Antenna	Schwarzbeck Mess-Elektronik OHG	BBHA 9120 C	695	2023/03/09	12
RE	SHA-10	194685	Horn Antenna	Schwarzbeck Mess-Elektronik OHG	BBHA 9120 C	711	2023/03/27	12
RE	SLA-01	145531	Logperiodic Antenna	Schwarzbeck Mess-Elektronik OHG	UHALP9108A	UHALP 9108-A 0888	2022/06/11	12
RE	SLP-02	145536	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100218	2023/04/10	12
RE	SOS-23	191840	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	-	2022/08/08	12
RE	SRENT-23	206472	Spectrum Analyzer	Rohde & Schwarz	FSW43	104056	2022/04/11	12
RE	SSG-02	146226	Signal Generator	Keysight Technologies Inc	E8257D-540	MY48051404	2023/01/18	12

**\*1) This test equipment was used for the tests before the expiration date of the calibration.**

**\*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: CE: Conducted Emission test  
RE: Radiated Emission test  
AT: Antenna Terminal Conducted test**