RADIO TEST REPORT

Test Report No. 15430541S-B-R2

Customer	**AISIN CORPORATION**
Description of EUT	**UWB/NFC Module**
Model Number of EUT	**AD10**
FCC ID	**PENAD10**
Test Regulation	**FCC Part 15 Subpart F**
Test Result	**Complied**
Issue Date	**January 8, 2025**
Remarks	**UWB part(s)**

Representative Test Engineer	Approved By
K. Adachi	T. Imamura
Kenichi Adachi Engineer	Toyokazu Imamura Engineer

CERTIFICATE 1266.03

☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan, Inc.

☒ 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. 15430541S-B

This report is a revised version of 15430541S-B-R1. 15430541S-B-R1 is replaced with this report.

Revision	Test Report No.	Date	Revised Contents
- (Original)	15430541S-B	September 26, 2024	-
1	15430541S-B-R1	November 11, 2024	P5 Removed description of antenna gain disclaimer from the Radio Specification
			P14 Deleted unneeded and unused calculation formulas.
2	15430541S-B-R2	January 8, 2025	P9 Modified typo: “ERECTRICAL KEY” → “ELECTRICAL KEY”
			P14 Added descriptive sentence to Section 7: “The test was performed in the typical sequence cycle mode.”
			P15 Modified the frequency result of vertical: From “6144.390” to “6624.390”

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	AISIN CORPORATION
Address	2-1, Asahi-machi, Kariya, Aichi, 448-8650 JAPAN
Telephone Number	+81-90-6384-0539
Contact Person	Kyosuke Seike

The information provided by 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

SECTION 2: Equipment Under Test (EUT)

2.1 Identification of EUT

Description	UWB/NFC Module
Model Number	AD10
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	August 2, 2024
Test Date	August 5, 2024 to September 10, 2024

2.2 Product Description

General Specification

Rating	DC 7.1 V (DC 6.0 V to 8.2 V)
Operating temperature	-40 deg. C to +85 deg. C

Radio Specification

NFC

Equipment Type	Transceiver
Frequency of Operation	13.56 MHz
Type of Modulation	ASK (NFC-A)

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	3.58 dBi (max)

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	**FCC:** ANSI C63.10-2013 6. Standard test methods	**FCC:** Section 15.207 Section 15.505(a) Section 15.521(j)	-	N/A	*1)
	ISED: RSS-Gen 8.8	**ISED:** RSS-220 5.2.1(b)			
UWB Bandwidth	**FCC:** Section 15.503(a) ANSI C63.10: 2013 6 Standard test methods, 10 Procedures for measuring ultra-wideband devices	**FCC:** Section 15.503(d) Section 15.519 (b)	See data.	Complied	Radiated
	ISED: RSS-220 Annex 2	**ISED:** RSS-220 2, RSS-220 5.1			
Radiated emission	**FCC:** Section 15.503(a) ANSI C63.10: 2013 6 Standard test methods, 10 Procedures for measuring ultra-wideband devices	**FCC:** Section 15.209, Section 15.505, Section 15.519 (c) (d),Section 521(c)	0.5 dB 31948.801 MHz AV, Vertical (Transmitting ch9)	Complied	Radiated
	ISED: RSS-Gen 6.5 RSS-220 Annex 4	**ISED:** RSS-220 5.3.1(c)(d)(e)			
Peak level of the Emission	**FCC:** Section 15.521(e)(g) ANSI C63.10: 2013 6 Standard test methods, 10 Procedures for measuring ultra-wideband devices	**FCC:** Section 15.519 (e)	-	Complied	Radiated
	ISED: RSS-220 Annex 4	**ISED:** RSS-220 5.3.1(g)			
Transmitter timeout	**FCC:** Section 15.519(a)(1) ANSI C63.10: 2013 6 Standard test methods, 10 Procedures for measuring ultra-wideband devices	**FCC:** Section 15.519 (a)(1)	-	Complied	Conducted
	ISED: RSS-220 Annex 4	**ISED:** RSS-220 5.3.1(b)			
Note: UL Japan, Inc.'s EMI Work Procedures: Work Instructions-ULID-003591 and Work Instructions-ULID-003593. *1) This test not applicable since the EUT does not have AC Mains.					

FCC Part 15.31 (e)

The stable voltage was supplied by the end product which was required to have a power supply regulator. Therefore, the EUT complies with the requirement.

FCC Part 15.203 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.

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	3.2 dB
Radiated Emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.3 dB
	30 MHz-200 MHz	4.9 dB
	200 MHz-1 GHz	6.2 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	4.3 dB
200 MHz - 1000 MHz	3.5 dB
1 GHz - 13 GHz	4.1 dB

Substitution measurement (EUT height: 1.5 m, Distance: 1 m)	
Frequency range	Uncertainty (+/-)
1 GHz - 13 GHz	4.7 dB
13 GHz - 18 GHz	5.4 dB
18 GHz - 26.5 GHz	3.8 dB
26.5 GHz - 40 GHz	3.9 dB

Substitution measurement (EUT height: 1.5 m, Distance: 0.5 m)	
Frequency range	Uncertainty (+/-)
1 GHz - 13 GHz	4.7 dB
13 GHz - 18 GHz	5.3 dB
18 GHz - 26.5 GHz	3.8 dB
26.5 GHz - 40 GHz	3.8 dB

Substitution measurement (EUT height: 1.5 m, Distance: 0.3 m)	
Frequency range	Uncertainty (+/-)
1 GHz - 13 GHz	4.8 dB
13 GHz - 18 GHz	5.3 dB
18 GHz - 26.5 GHz	3.8 dB
26.5 GHz - 40 GHz	3.8 dB

Substitution measurement (EUT height: 1.5 m, Distance: 0.1 m)	
Frequency range	Uncertainty (+/-)
13 GHz - 18 GHz	5.6 dB
18 GHz - 26.5 GHz	4.2 dB
26.5 GHz - 40 GHz	4.2 dB

Antenna terminal test	Uncertainty (+/-)
Spurious Emission (Conducted) below 1 GHz	0.91 dB
Conducted Emissions Power Density Measurement 1 GHz-3 GHz	1.3 dB
Conducted Emissions Power Density Measurement 3 GHz-18 GHz	2.5 dB
Spurious Emission (Conducted) 18 GHz-26.5 GHz	2.8 dB
Spurious Emission (Conducted) 26.5 GHz-40 GHz	2.6 dB
Bandwidth Measurement	0.012 %
Duty Cycle and Time Measurement	0.27 %
Voltage	0.74 %

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 room	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Semi-anechoic chamber (SAC1)	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.2 Semi-anechoic chamber (SAC2)	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber (SAC3)	12.7 x 7.7 x 5.35	12.7 x 7.7	5 m
No.4 Semi-anechoic chamber (SAC4)	8.1 x 5.1 x 3.55	8.1 x 5.1	-
Wireless anechoic chamber 1 (WAC1)	9.5 x 6.0 x 5.4	9.5 x 6.0	3 m
Wireless anechoic chamber 2 (WAC2)	9.5 x 6.0 x 5.4	9.5 x 6.0	3 m
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	-	-
No.2 Measurement room	4.5 x 3.5 x 2.5	-	-
Wireless shielded room 1	3.0 x 4.5 x 2.7	3.0 x 4.5	-
Wireless shielded room 2	3.0 x 4.5 x 2.7	3.0 x 4.5	-

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)

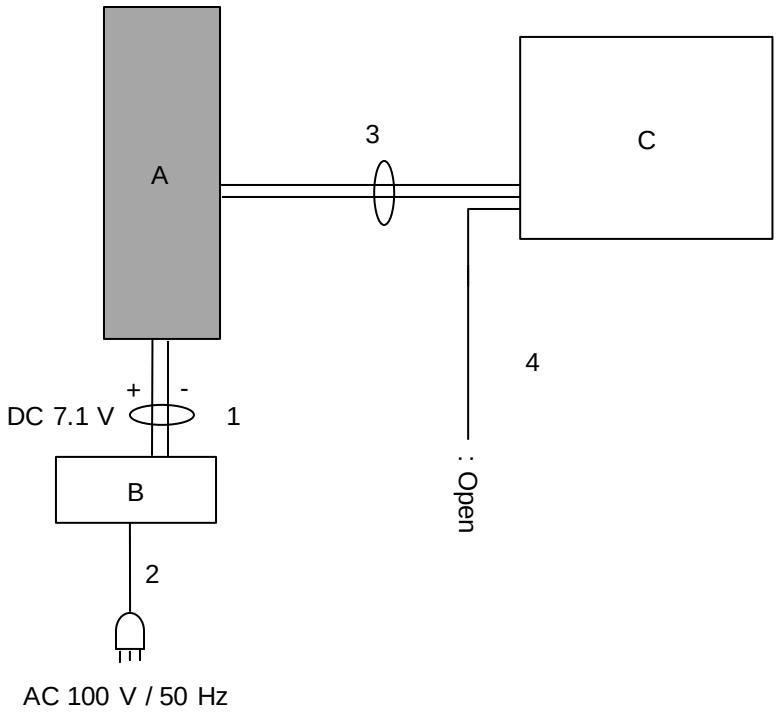
Test Item	Operating Mode	Tested frequency
Other than Transmitter timeout test	Transmitting (Tx) ch5 (6489.6 MHz), Transmitting (Tx) ch9 (7987.2 MHz)	6489.6 MHz, 7987.2 MHz
Transmitter timeout test	Normal transmitting (Tx) ch5 (6489.6 MHz), Normal transmitting (Tx) ch9 (7987.2 MHz)	6489.6 MHz, 7987.2 MHz

*Power of the EUT was set by the software as follows;
Power Setting: Normal Power : Fixed
Low Power : Fixed
Software: UWB: SOFTWARE, ELECTRICAL KEY, C Version: 00001

*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.

4.2 Configuration and Peripherals

[Other than Transmitter timeout test]



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

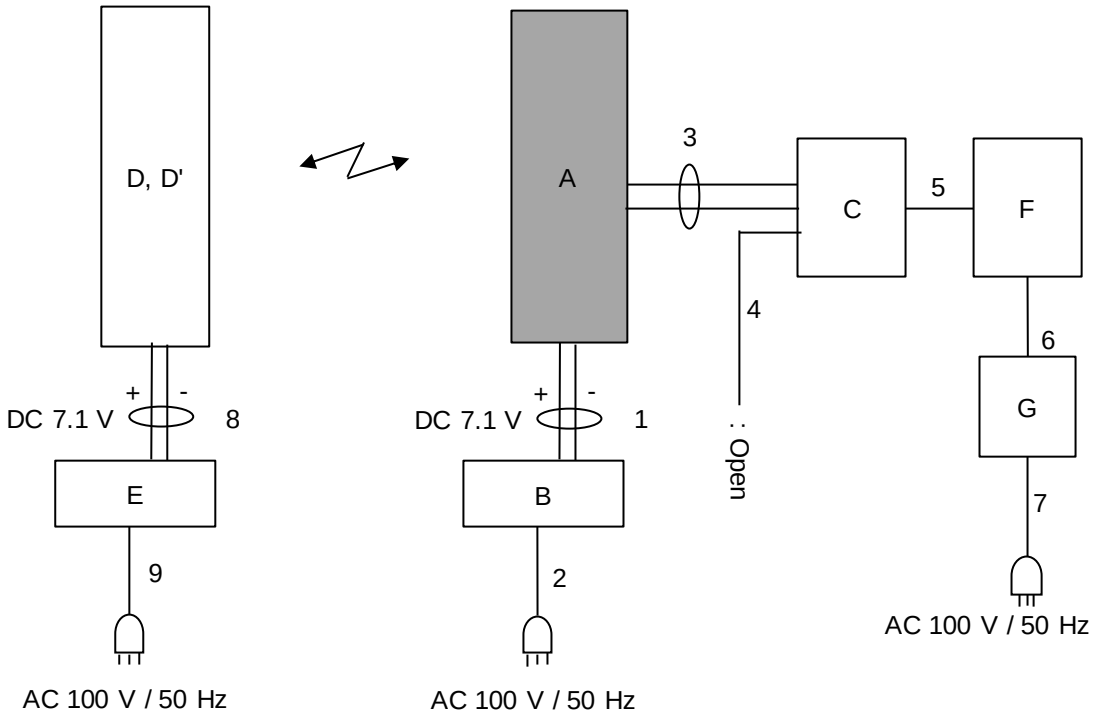
Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	UWB/NFC Module	AD10	SH1DU24111	AISIN	EUT
B	Power Supply (DC)	PAN35-10A	NA000955	KIKUSUI	-
C	MLT advan	5CF1L1	SER 6148	PRISM Co., Ltd	Control tool

List of cables used

No.	Cable	Length (m)	Shield-Cable	Shield-Connector	Remarks
1	DC	2.0	Unshielded	Unshielded	-
2	AC	2.0	Unshielded	Unshielded	-
3	Signal	2.0 + 0.4	Unshielded	Unshielded	-
4	Signal	0.4	Shielded	Shielded	-

[Transmitter timeout test]



Description of EUT and Support Equipment

No.	Item	Model number	Serial Number	Manufacturer	Remarks
A	UWB/NFC Module	AD10	SH1DU24111	AISIN	EUT
B	Power Supply (DC)	PAN35-10A	NA000955	KIKUSUI	-
C	MLT advan	5CF1L1	SER 6148	PRISM Co., Ltd	Control tool
D	UWB Module	AE10	SH1TU24151	AISIN	AE (for ch 5)
D'	UWB Module	AE10	SH1TU24161	AISIN	AE (for ch 9)
E	Power Supply (DC)	PAN35-10A	BP002287	Kikusui Electronics Corp.	-
F	Personal computer	A6SJKWDA231B	24017884E	Toshiba	-
G	AC adapter	PA517U-1ACA	G71C000MPC20 O109Q05WPWCC	Toshiba	-

List of Cables Used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC	2.0	Unshielded	Unshielded	-
2	AC	2.0	Unshielded	Unshielded	-
3	Signal	2.0 + 0.4	Unshielded	Unshielded	-
4	Signal	0.4	Unshielded	Unshielded	-
5	USB	1.0	Shielded	Shielded	-
6	DC	1.7	Unshielded	Unshielded	-
7	AC	0.5	Unshielded	Unshielded	-
8	DC	2.0	Unshielded	Unshielded	-
9	AC	2.0	Unshielded	Unshielded	-

SECTION 5: Radiated Emission

Test Procedure

[For below 30 MHz]
EUT was placed on a platform of nominal size, 0.5 m by 0.5 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, 0.5 m by 0.5 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.

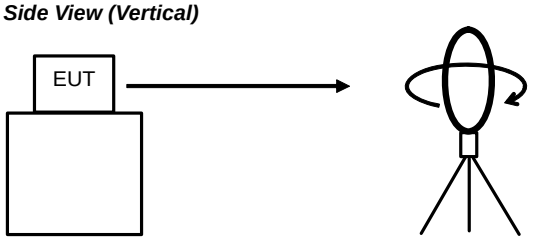
UWB emissions and other emissions:
1) The height of the measuring antenna varied between 1 m and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.
The measurements were performed for both vertical and horizontal antenna polarization with the 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.

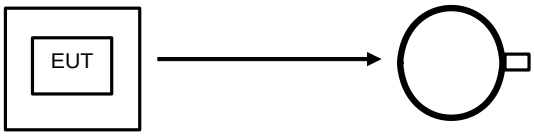
3) Equivalent isotropic radiated power was calculated by subtracting the cable loss and the attenuator loss connected between the signal generator and the substitution antenna from the output power of the signal generator recorded in 2).
For the usage of the antenna (horn antenna) for the substitution antenna, the equivalent isotropic radiated power was calculated by compensating the finite substitution antenna.

Figure 1: Direction of the Loop Antenna

Side View (Vertical)

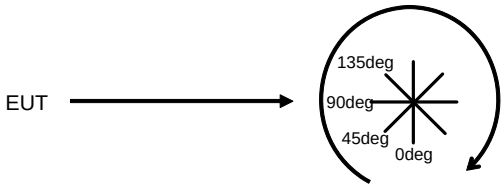


Top View (Horizontal)



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.

Radiated Emission Test was performed in the highest mode of Power.

- 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 2	2 to 10.6	10.6 to 18	18 to 40
Horizontal	X	X	X	X	X	X	Z
Vertical	X	X	X	X	Z	Z	Z

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 6: 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 or 10 MHz	3 MHz or 40 MHz	Auto	Peak	Max Hold	Spectrum Analyzer

Test data : APPENDIX
Test result : Pass

SECTION 7: Transmitter timeout

Test Procedure
The test was made with spectrum analyzer.

The test was performed in the typical sequence cycle mode.

Test Data : APPENDIX
Test Result : Pass

APPENDIX 1: Test Data

Radiated emission

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	15430541S-B-R2
Date	August 5, 2024
Temperature / Humidity	21 deg. C / 50 % RH
Engineer	Yuta Shiba
Mode	Transmitting ch5 (Normal Power)

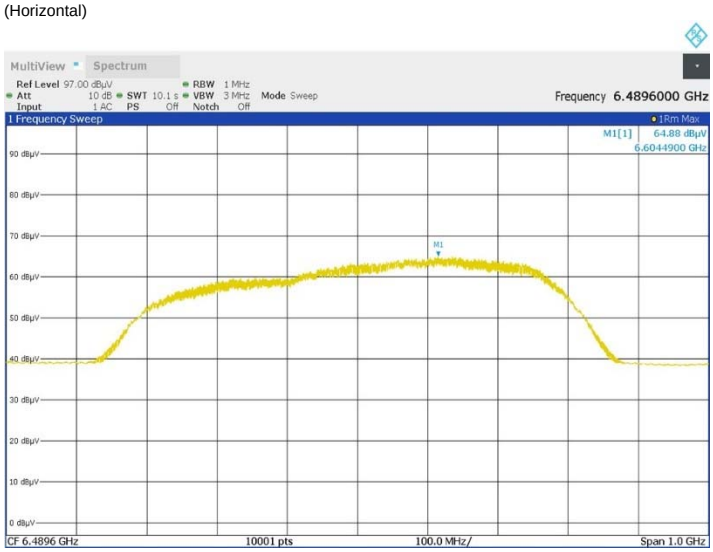
(UWB emission, RBW 1 MHz)

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

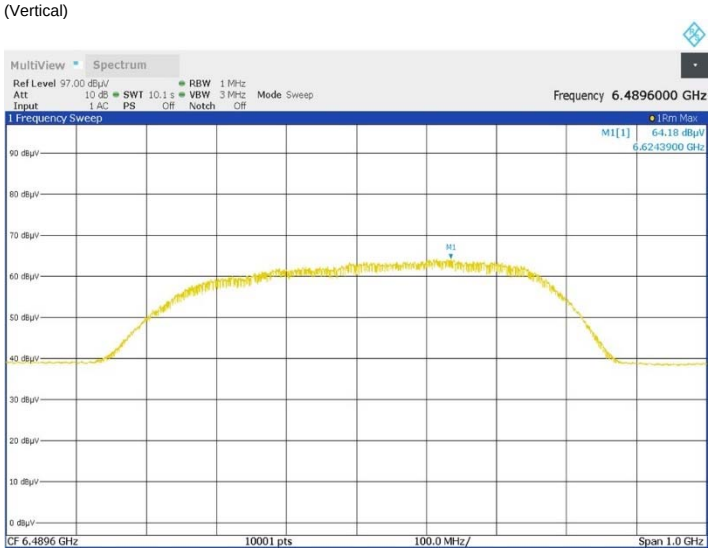
Band	Pol.	Frequency [MHz]	SA Reading [dBuV/MHz]	SG level [dBm]	Tx Ant.Gain [dBi]	Tx Loss [dB]	-	EIRP Result [dBm/MHz]	EIRP Limit [dBm/MHz]	Margin [dB]	Remarks	Height [cm]	Angle [deg.]
3.1 GHz - 10.6 GHz	Hor.	6604.490	64.88	-46.37	10.58	10.35	-	-46.14	-41.30	4.84	carrier	148	179
3.1 GHz - 10.6 GHz	Ver.	6624.390	64.18	-47.33	10.67	10.37	-	-47.03	-41.30	5.73	carrier	149	357

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

(Horizontal)



(Vertical)



* For RF Exposure evaluation
Maximum RMS power measured: -46.14 dBm/MHz (refer to upper table value), 10 ^ (-46.14 [dBm/MHz] / 10) = 0.00002432 mW/MHz
The bandwidth of this equipment was 608.798 MHz (99 % occupied bandwidth, refer to the data of bandwidth sheet)
Total RMS output power was 0.01480597 mW = 0.00002432 mW/MHz x 608.798 MHz
* There were no detect UWB emissions in the range that below 5000 MHz.

Radiated emission

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	15430541S-B-R2
Date	September 2, 2024
Temperature / Humidity	25 deg. C / 41 % RH
Engineer	Kenichi Adachi
Mode	Transmitting ch5 (Low Power)

(UWB emission, RBW 1 MHz)

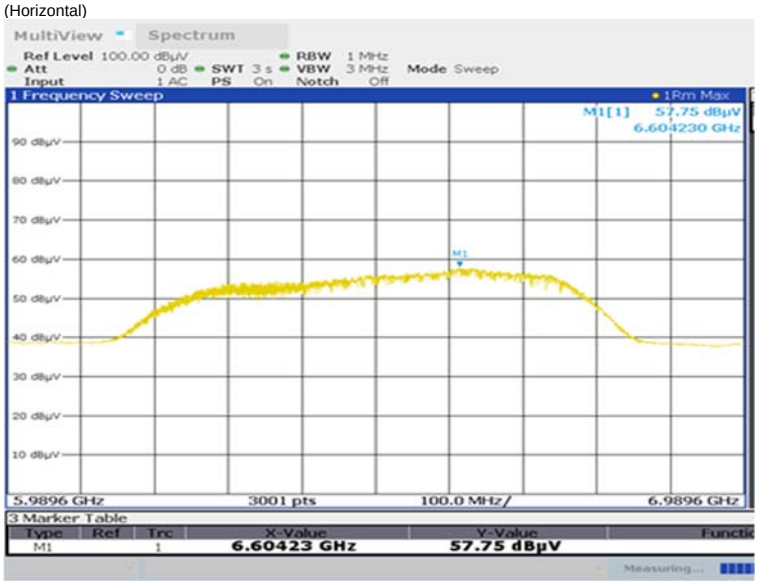
(*SA: Spectrum analyzer, SG: Signal generator, Ant.: substitution antenna)

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.	6604.230	57.75	-52.64	10.58	10.35	-	-52.41	-41.30	11.11	carrier	151	176
3.1 GHz - 10.6 GHz	Ver.	6603.900	57.36	-52.95	10.58	10.35	-	-52.72	-41.30	11.42	carrier	153	273

Sample Calculation :

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

(Horizontal)



(Vertical)

* For RF Exposure evaluation

Maximum RMS power measured: -52.41 dBm/MHz (refer to upper table value) / 10 ^(-52.41 [dBm/MHz]/ 10) = 0.00000574 mW/MHz

The bandwidth of this equipment was 608.798 MHz (99 % occupied bandwidth, refer to the data of bandwidth sheet)

Total RMS output power was 0.0034945 mW = 0.00000574 mW/MHz x 608.798 MHz

* There were no detect UWB emissions in the range that below 5000 MHz.

Radiated emission

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	15430541S-B-R2
Date	August 5, 2024
Temperature / Humidity	18 deg. C / 54 % RH
Engineer	Takayuki Kobayashi
Mode	Transmitting ch9 (Normal Power)

(UWB emission, RBW 1 MHz)

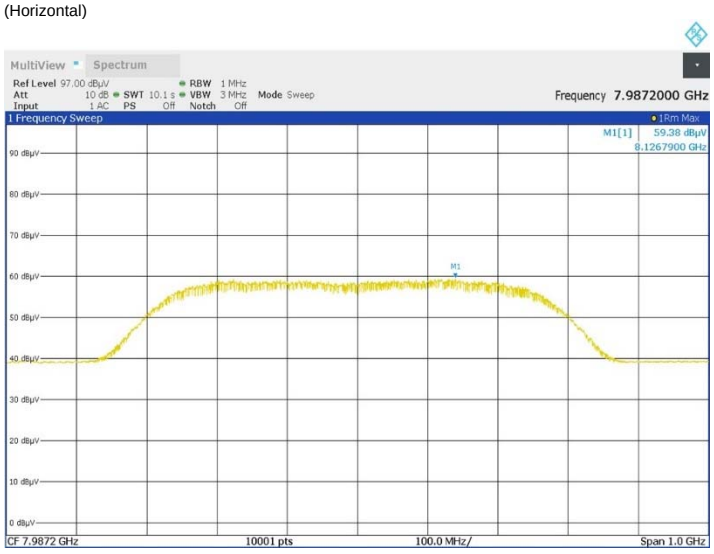
(*SA: Spectrum analyzer, SG: Signal generator, Ant.: substitution antenna)

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.	8126.790	59.38	-52.01	13.11	11.44	-	-50.34	-41.30	9.04	carrier	146	175
3.1 GHz - 10.6 GHz	Ver.	8059.890	61.86	-49.12	13.01	11.39	-	-47.50	-41.30	6.20	carrier	150	27

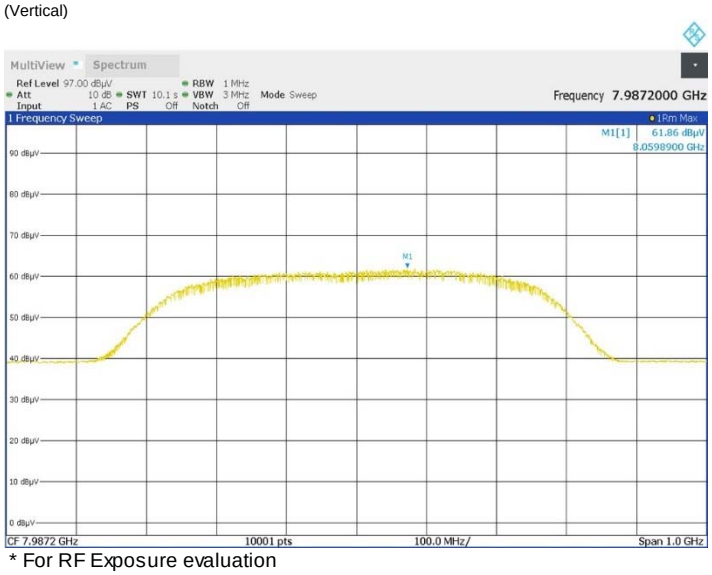
Sample Calculation :

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

(Horizontal)



(Vertical)



* For RF Exposure evaluation

Maximum RMS power measured: -47.5 dBm/MHz (refer to upper table value), 10 ^ (-47.5 [dBm/MHz] / 10) = 0.00001778 mW/MHz

The bandwidth of this equipment was 628.699 MHz (99 % occupied bandwidth, refer to the data of bandwidth sheet)

Total RMS output power was 0.01117827 mW = 0.00001778 mW/MHz x 628.699 MHz

* There were no detect UWB emissions in the range that below 5000 MHz.

Radiated emission

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	15430541S-B-R2
Date	September 2, 2024
Temperature / Humidity	25 deg. C / 41 % RH
Engineer	Kenichi Adachi
Mode	Transmitting ch9 (Low Power)

(UWB emission, RBW 1 MHz)

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

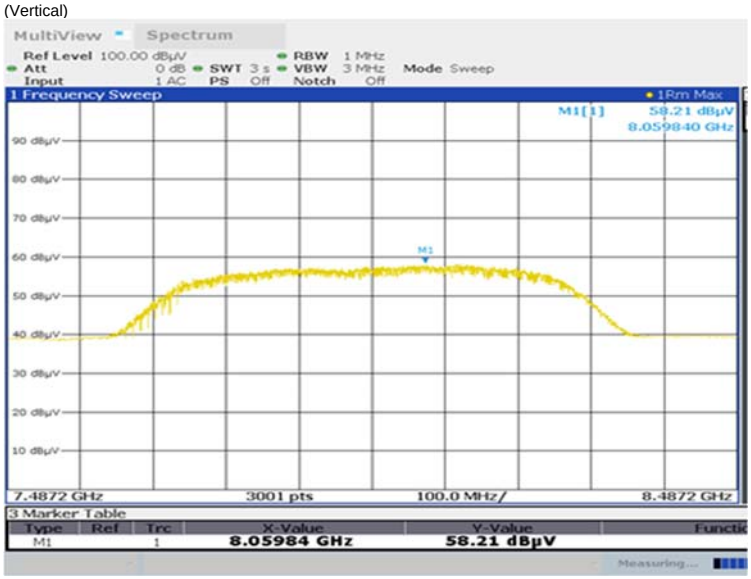
Band	Pol.	Frequency [MHz]	SA Reading [dBuV/MHz]	SG level [dBm]	Tx Ant.Gain [dBi]	Tx Loss [dB]	-	EIRP Result [dBm/MHz]	EIRP Limit [dBm/MHz]	Margin [dB]	Remarks	Height [cm]	Angle [deg.]
3.1 GHz - 10.6 GHz	Hor.	7810.590	57.30	-52.75	12.56	11.22	-	-51.41	-41.30	10.11	carrier	153	178
3.1 GHz - 10.6 GHz	Ver.	8059.840	58.21	-52.54	13.01	11.39	-	-50.92	-41.30	9.62	carrier	151	35

Sample Calculation :

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

(Horizontal)

(Vertical)



* For RF Exposure evaluation

Maximum RMS power measured: -50.92 dBm/MHz (refer to upper table value) / 10 ^ (-50.92 [dBm/MHz]/ 10) = 0.00000809 mW/MHz

The bandwidth of this equipment was 628.699 MHz (99 % occupied bandwidth, refer to the data of bandwidth sheet)

Total RMS output power was 0.00508617 mW = 0.00000809 mW/MHz x 628.699 MHz

* There were no detect UWB emissions in the range that below 5000 MHz.

Radiated emission

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber			
Report No.	15430541S-B-R2			
Date	August 9, 2024	August 6, 2024	August 6, 2024	August 7, 2024
Temperature / Humidity	24 deg. C / 40 % RH	20 deg. C / 45 % RH	23 deg. C / 46 % RH	21 deg. C / 48 % RH
Engineer	Yuta Shiba (9 kHz to 1000 MHz)	Takayuki Kobayashi (1 GHz to 2 GHz)	Kouki Yamada (2 GHz to 10.6 GHz)	Takayuki Kobayashi (10.6 GHz to 18 GHz)
Mode	Transmitting ch5 (Normal Power)			

(UWB emission except carrier emission)

9 kHz - 18 GHz

No.	Freq.	Reading (PK)	SG Level	TX Ant.Gain	TX Loss	ERP		Margin	Pola.	Height	Angle	TX Ant.Type	Comment
						Result	Limit						
	[MHz]	[dBuV]	[dBm]	[dBi]	[dB]	[dBm]	[dBm]	[dB]		[cm]	[deg]		
1	12979.200	47.27	-65.64	13.52	14.62	-66.74	-61.30	5.4	Hori.	146	279	Horn	RMS
2	12979.200	47.04	-65.91	13.52	14.62	-67.01	-61.30	5.7	Vert.	144	233	Horn	RMS

Calculation:Result [dBm] = SG level [dBm] + Tx Ant Gain [dBi] - Tx Loss (Cable)[dB]
Tx Antenna: Horn(1 GHz-40 GHz) / Rx-Antenna: Horn(1 GHz-40 GHz)

* For RBW less than 960 MHz was set according to FCC 15.209, Above 960 MHz was set to 1 MHz .
(* There were no detect UWB emissions in the range that below 960 MHz)

Radiated emission

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber	
Report No.	15430541S-B-R2	
Date	August 8, 2024	August 8, 2024
Temperature / Humidity	24 deg. C / 40 % RH	19 deg. C / 52 % RH
Engineer	Yuta Shiba (18 GHz to 26.5 GHz)	Takayuki Kobayashi (26.5 GHz to 40 GHz)
Mode	Transmitting ch5 (Normal Power)	

18 GHz – 26.5 GHz

No.	Freq.	Reading (PK)	SG Level	TX Ant.Gain	TX Loss	ERP Result	ERP Limit	Margin	Pola.	Height	Angle	TX Ant.Type	Comment
	[MHz]	[dBuV]	[dBm]	[dBi]	[dB]	[dBm]	[dBm]	[dB]		[cm]	[deg]		
1	19468.801	31.47	-87.47	10.47	18.24	-95.24	-61.30	33.9	Hori.	150	0	Horn	RMS,Floor noise
2	25958.400	45.03	-59.10	12.47	21.08	-67.71	-61.30	6.4	Hori.	150	73	Horn	RMS
3	19468.801	31.44	-86.65	10.47	18.24	-94.42	-61.30	33.1	Vert.	150	0	Horn	RMS,Floor noise
4	25958.400	41.50	-61.28	12.47	21.08	-69.89	-61.30	8.5	Vert.	153	349	Horn	RMS

Calculation:Result [dBm] = SG level [dBm] + Tx Ant Gain [dBi] - Tx Loss (Cable)[dB]
Tx Antenna: Horn(1 GHz-40 GHz) / Rx-Antenna: Horn(1 GHz-40 GHz)

26.5 GHz – 40 GHz

No.	Freq.	Reading (PK)	SG Level	TX Ant.Gain	TX Loss	ERP Result	ERP Limit	Margin	Pola.	Height	Angle	TX Ant.Type	Comment
	[MHz]	[dBuV]	[dBm]	[dBi]	[dB]	[dBm]	[dBm]	[dB]		[cm]	[deg]		
1	32448.000	46.77	-72.90	12.53	24.18	-84.55	-61.30	23.2	Hori.	150	0	Horn	RMS, FloorNoise
2	38937.602	48.24	-66.40	15.57	26.88	-77.71	-61.30	16.4	Hori.	150	0	Horn	RMS, FloorNoise
3	32448.000	46.92	-72.90	12.53	24.18	-84.55	-61.30	23.2	Vert.	150	0	Horn	RMS, FloorNoise
4	38937.602	49.93	-63.40	15.57	26.88	-74.71	-61.30	13.4	Vert.	100	0	Horn	RMS, FloorNoise

Calculation:Result [dBm] = SG level [dBm] + Tx Ant Gain [dBi] - Tx Loss (Cable)[dB]
Tx Antenna: Horn(1 GHz-40 GHz) / Rx-Antenna: Horn(1 GHz-40 GHz)

Radiated emission

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	15430541S-B-R2
Date	August 9, 2024
Temperature / Humidity	24 deg. C / 40 % RH
Engineer	Yuta Shiba
Mode	Transmitting ch5 (Normal Power)

(Other emission)

No.	Freq.	Reading (QP)	Ant.Fac	Loss	Gain	Result (QP)	Limit (QP)	Margin (QP)	Pola.	Height	Angle	Ant. Type	Comment
	[MHz]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[H/V]	[cm]	[deg]		
1	98.322	27.30	9.83	7.26	32.12	12.27	43.50	31.2	Hori.	317	1	BC	
2	186.781	20.70	16.20	7.69	32.03	12.56	43.50	30.9	Hori.	300	0	BC	
3	558.894	20.50	17.81	9.64	31.92	16.03	46.00	29.9	Hori.	100	359	LP	
4	641.213	20.10	19.39	9.95	31.86	17.58	46.00	28.4	Hori.	100	245	LP	
5	91.755	29.70	8.53	7.38	32.12	13.49	43.50	30.0	Vert.	100	76	BC	
6	98.328	27.40	9.84	7.26	32.12	12.38	43.50	31.1	Vert.	100	11	BC	
7	191.188	20.50	16.34	7.70	32.03	12.51	43.50	30.9	Vert.	100	0	BC	
8	869.200	21.70	22.14	10.78	31.15	23.47	46.00	22.5	Vert.	100	359	LP	

Calculation Result [dBuV/m] = Reading [dBuV/m] + Ant.Fac [dB/m] + Loss (Cable + ATT + ΔAF)[dB] - Gain (AMP)[dB]
Ant.Type = BC: Biconical antenna, LP: Logperiodic antenna, **SH*: Horn antenna

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

Radiated emission

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber			
Report No.	15430541S-B-R2			
Date	August 9, 2024	August 6, 2024	August 6, 2024	August 7, 2024
Temperature / Humidity	24 deg. C / 40 % RH	20 deg. C / 45 % RH	23 deg. C / 46 % RH	21 deg. C / 48 % RH
Engineer	Yuta Shiba (9 kHz to 1000 MHz)	Takayuki Kobayashi (1 GHz to 2 GHz)	Kouki Yamada (2 GHz to 10.6 GHz)	Takayuki Kobayashi (10.6 GHz to 18 GHz)
Mode	Transmitting ch9 (Normal Power)			

(UWB emission except carrier emission)

9 kHz - 18 GHz

No.	Freq. [MHz]	Reading (PK) [dBuV]	SG Level [dBm]	TX Ant.Gain [dBi]	TX Loss [dB]	ERP Result [dBm]	ERP Limit [dBm]	Margin [dB]	Pola.	Height [cm]	Angle [deg]	TX Ant.Type	Comment
1	15974.400	46.10	-65.59	13.80	16.21	-68.00	-61.30	6.7	Hori.	153	283	Horn	RMS
2	15974.400	45.99	-66.10	13.80	16.21	-68.51	-61.30	7.2	Vert.	149	155	Horn	RMS

Calculation:Result [dBm] = SG level [dBm] + Tx Ant Gain [dBi] - Tx Loss (Cable)[dB]
Tx Antenna: Horn(1 GHz-40 GHz) / Rx-Antenna: Horn(1 GHz-40 GHz)

* For RBW less than 960 MHz was set according to FCC 15.209, Above 960 MHz was set to 1 MHz .
(* There were no detect UWB emissions in the range that below 960 MHz)

Radiated emission

Test place	Shonan EMC Lab. No.5 Semi Anechoic Chamber	
Report No.	15430541S-B-R2	
Date	August 8, 2024	August 8, 2024
Temperature / Humidity	24 deg. C / 40 % RH	19 deg. C / 52 % RH
Engineer	Yuta Shiba (18 GHz to 26.5 GHz)	Takayuki Kobayashi (26.5 GHz to 40 GHz)
Mode	Transmitting ch9 (Normal Power)	

18 GHz – 26.5 GHz

No.	Freq.	Reading (PK)	SG Level	TX Ant.Gain	TX Loss	ERP		Margin	Pola.	Height	Angle	TX Ant.Type	Comment
						Result	Limit						
	[MHz]	[dBuV]	[dBm]	[dBi]	[dB]	[dBm]	[dBm]	[dB]		[cm]	[deg]		
1	23961.600	31.00	-86.07	12.57	20.20	-93.70	-61.30	32.4	Hori.	150	0	Horn	RMS,Floor noise
2	23961.600	30.85	-84.29	12.57	20.20	-91.92	-61.30	30.6	Vert.	150	0	Horn	RMS,Floor noise

Calculation:Result [dBm] = SG level [dBm] + Tx Ant Gain [dBi] - Tx Loss (Cable)[dB]
Tx Antenna: Horn(1 GHz-40 GHz) / Rx-Antenna: Horn(1 GHz-40 GHz)

26.5 GHz – 40 GHz

No.	Freq.	Reading (PK)	SG Level	TX Ant.Gain	TX Loss	ERP		Margin	Pola.	Height	Angle	TX Ant.Type	Comment
						Result	Limit						
	[MHz]	[dBuV]	[dBm]	[dBi]	[dB]	[dBm]	[dBm]	[dB]		[cm]	[deg]		
1	31948.801	58.78	-51.30	13.01	23.61	-61.90	-61.30	0.6	Hori.	152	34	Horn	RMS
2	31985.000	57.54	-52.10	12.99	23.63	-62.74	-61.30	1.4	Hori.	153	35	Horn	RMS
3	39936.000	47.33	-68.60	14.02	26.88	-81.46	-61.30	20.1	Hori.	150	0	Horn	RMS, FloorNoise
4	31948.801	56.70	-51.20	13.01	23.61	-61.80	-61.30	0.5	Vert.	153	322	Horn	RMS
5	31985.000	55.57	-52.60	12.99	23.63	-63.24	-61.30	1.9	Vert.	152	320	Horn	RMS
6	39936.000	47.86	-66.10	14.02	26.88	-78.96	-61.30	17.6	Vert.	150	0	Horn	RMS, FloorNoise

Calculation:Result [dBm] = SG level [dBm] + Tx Ant Gain [dBi] - Tx Loss (Cable)[dB]
Tx Antenna: Horn(1 GHz-40 GHz) / Rx-Antenna: Horn(1 GHz-40 GHz)

Radiated emission

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	15430541S-B-R2
Date	August 9, 2024
Temperature / Humidity	24 deg. C / 40 % RH
Engineer	Yuta Shiba
Mode	Transmitting ch9 (Normal Power)

(Other emission)

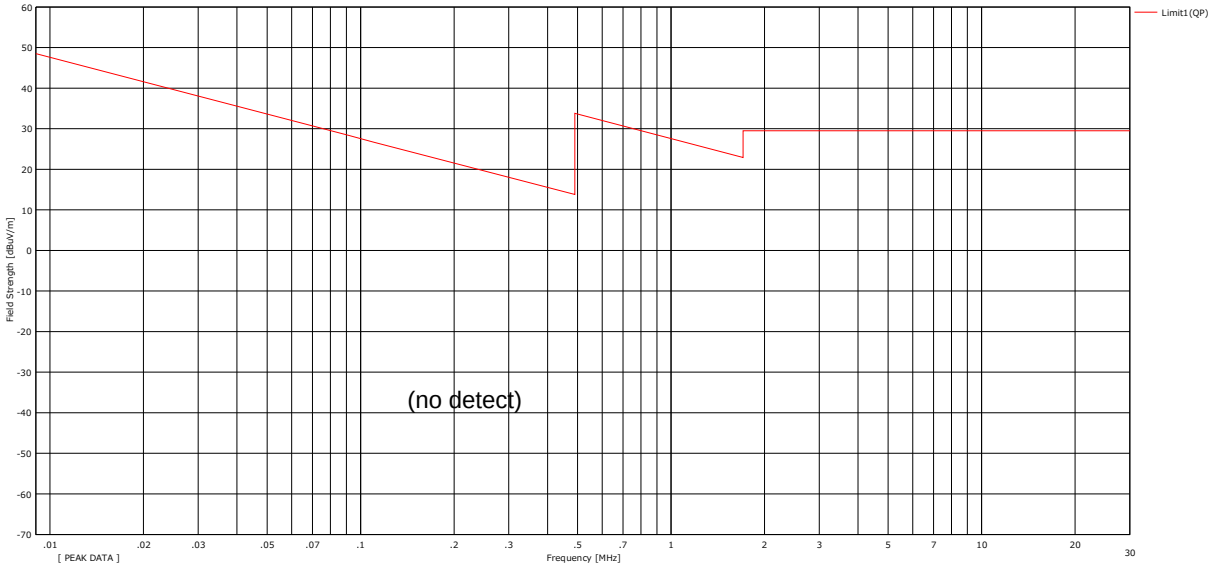
No.	Freq.	Reading <QP>	Ant.Fac	Loss	Gain	Result <QP>	Limit <QP>	Margin <QP>	Pola.	Height	Angle	Ant. Type	Comment
	[MHz]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[H/V]	[cm]	[deg]		
1	98.330	28.20	9.84	7.26	32.12	13.18	43.50	30.3	Hori.	120	170	BC	
2	308.001	21.10	12.75	8.51	31.93	10.43	46.00	35.5	Hori.	150	0	LP	
3	702.206	20.30	19.80	10.20	31.81	18.49	46.00	27.5	Hori.	100	1	LP	
4	31.220	21.80	18.14	6.35	32.16	14.13	40.00	25.8	Vert.	100	359	BC	
5	91.763	29.70	8.53	7.38	32.12	13.49	43.50	30.0	Vert.	100	333	BC	
6	98.318	26.50	9.83	7.26	32.12	11.47	43.50	32.0	Vert.	100	351	BC	
7	648.010	20.10	19.51	9.98	31.86	17.73	46.00	28.2	Vert.	150	359	LP	
8	750.809	19.80	20.44	10.38	31.67	18.95	46.00	27.0	Vert.	150	50	LP	

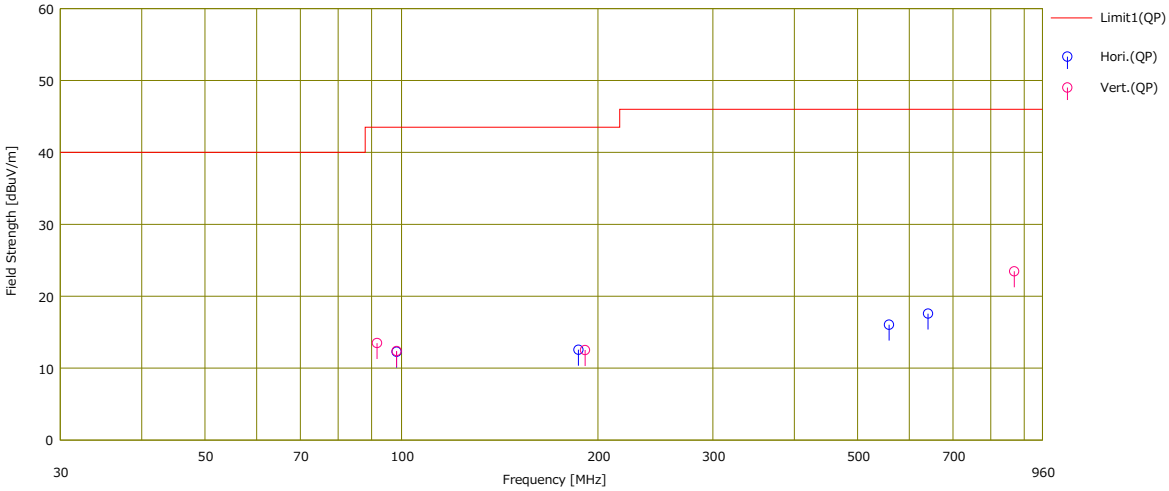
Calculation Result [dBuV/m] = Reading [dBuV/m] + Ant.Fac [dB/m] + Loss (Cable + ATT + ΔAF)[dB] - Gain (AMP)[dB]
Ant.Type = BC: Biconical antenna, LP: Logperiodic antenna, **SH*: Horn antenna

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

Radiated emission
(Plot data)

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	15430541S-B-R2
Date	August 9, 2024
Temperature / Humidity	24 deg. C / 40 % RH
Engineer	Yuta Shiba
	(9 kHz to 1000 MHz)
Mode	Transmitting ch5 (Normal Power)

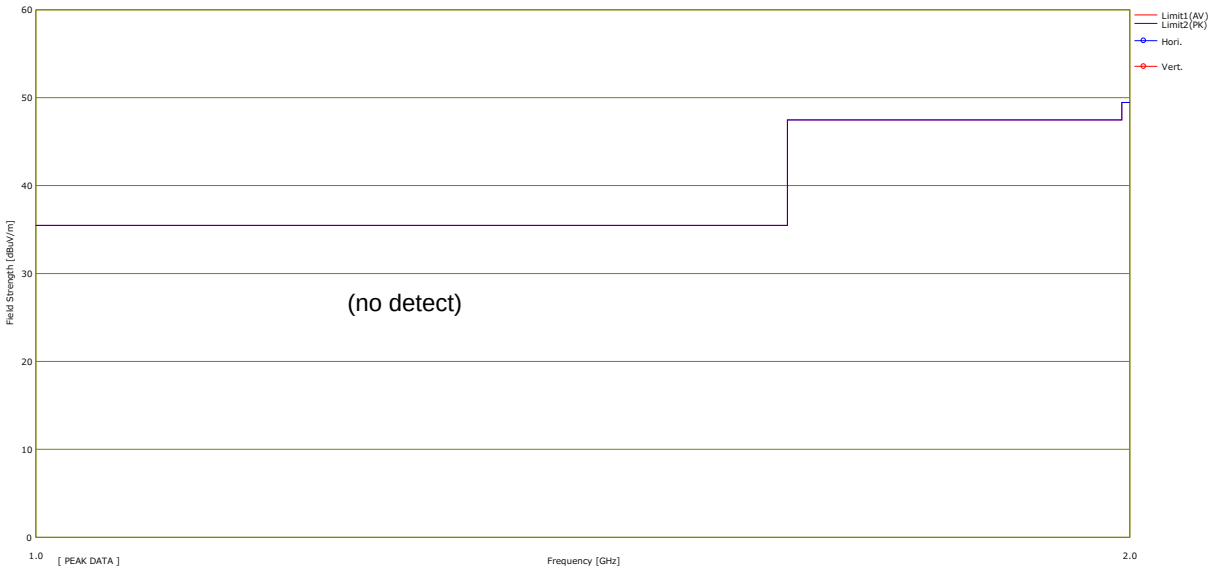


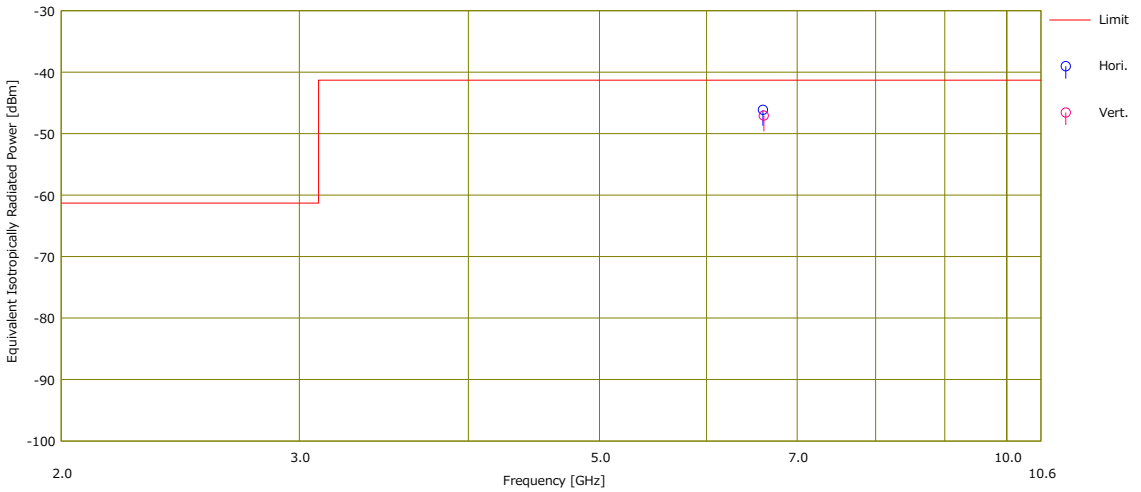


Calculation:Result[dBm]=SG level[dB]+Tx Ant Gain[dBi]-Tx Loss (Cable+ATT)[dB]
Ant.Type=BC:Biconical Antenna LP:Logperiodic Antenna **SH*: Horn Antenna

Radiated emission
(Plot data)

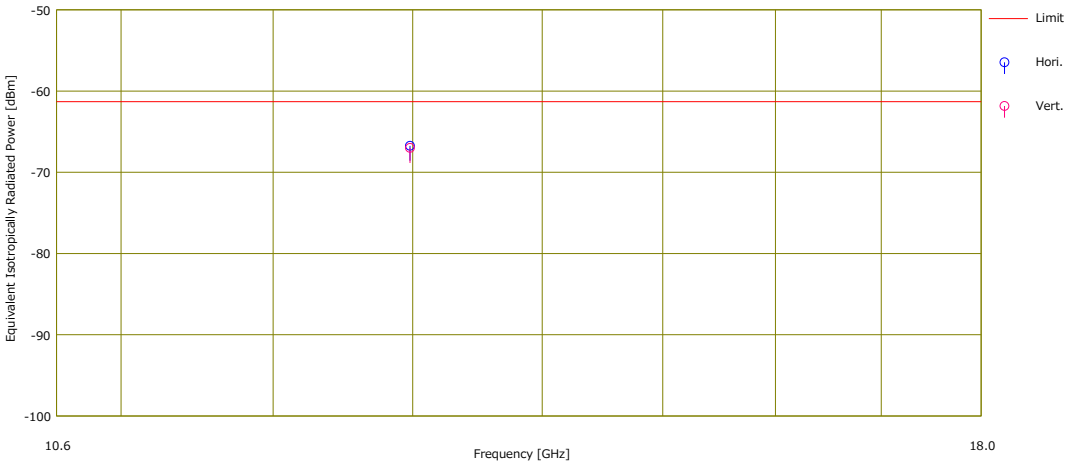
Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber	
Report No.	15430541S-B-R2	
Date	August 6, 2024	August 6, 2024
Temperature / Humidity	20 deg. C / 45 % RH	23 deg. C / 46 % RH
Engineer	Takayuki Kobayashi (1 GHz to 2 GHz)	Kouki Yamada (2 GHz to 10.6 GHz)
Mode	Transmitting ch5 (Normal Power)	

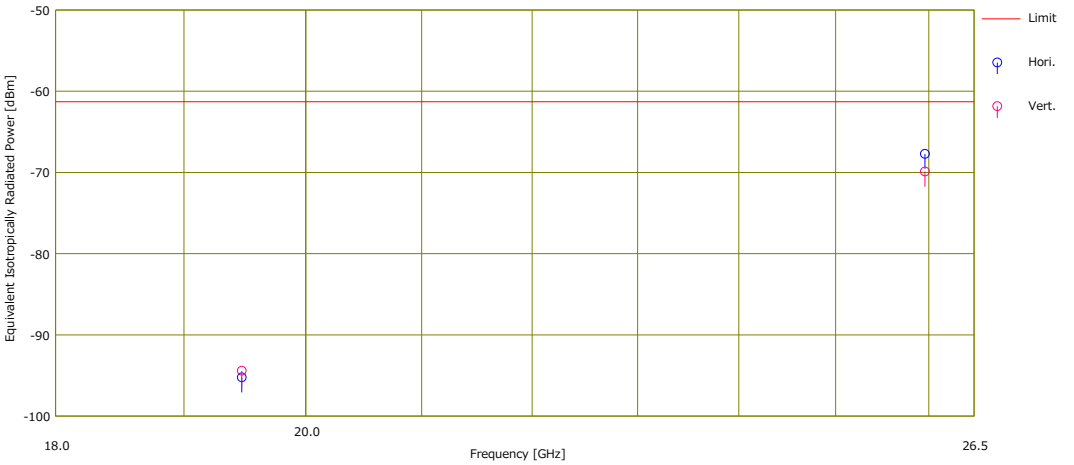


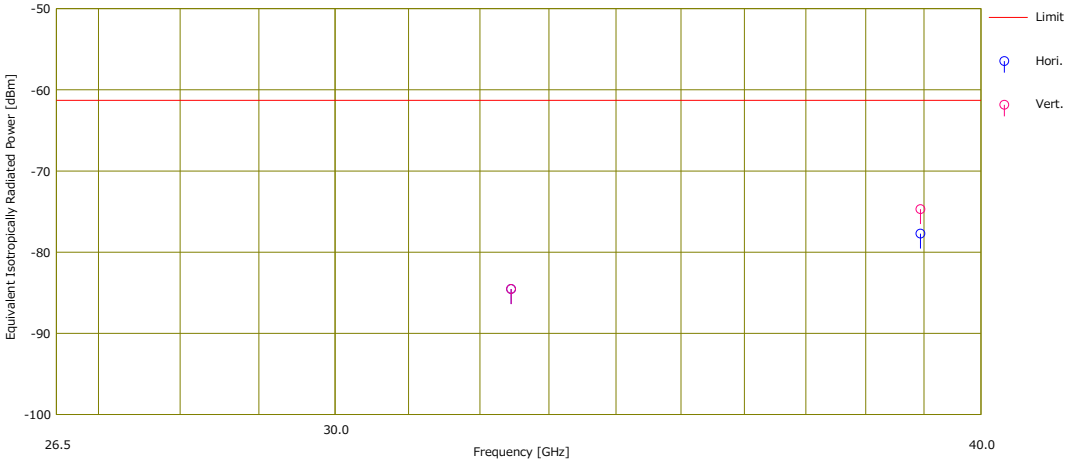


Radiated emission
(Plot data)

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber		
Report No.	15430541S-B-R2		
Date	August 7, 2024	August 8, 2024	August 8, 2024
Temperature / Humidity	21 deg. C / 48 % RH	24 deg. C / 40 % RH	19 deg. C / 52 % RH
Engineer	Takayuki Kobayashi (10.6 GHz to 18 GHz)	Yuta Shiba (18 GHz to 26.5 GHz)	Takayuki Kobayashi (26.5 GHz to 40 GHz)
Mode	Transmitting ch5 (Normal Power)		

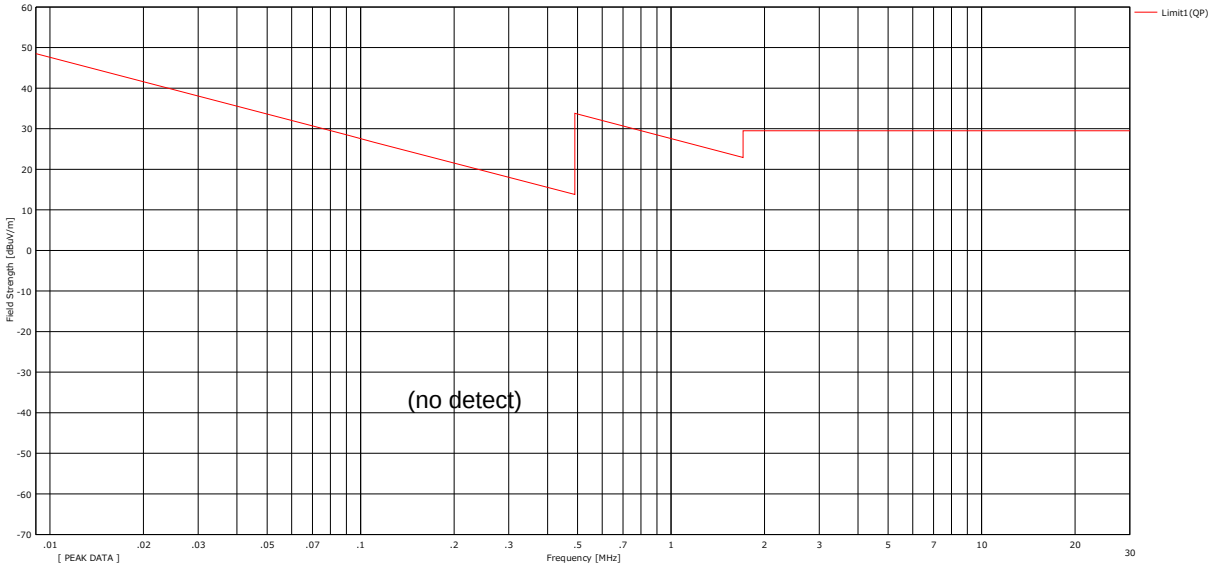


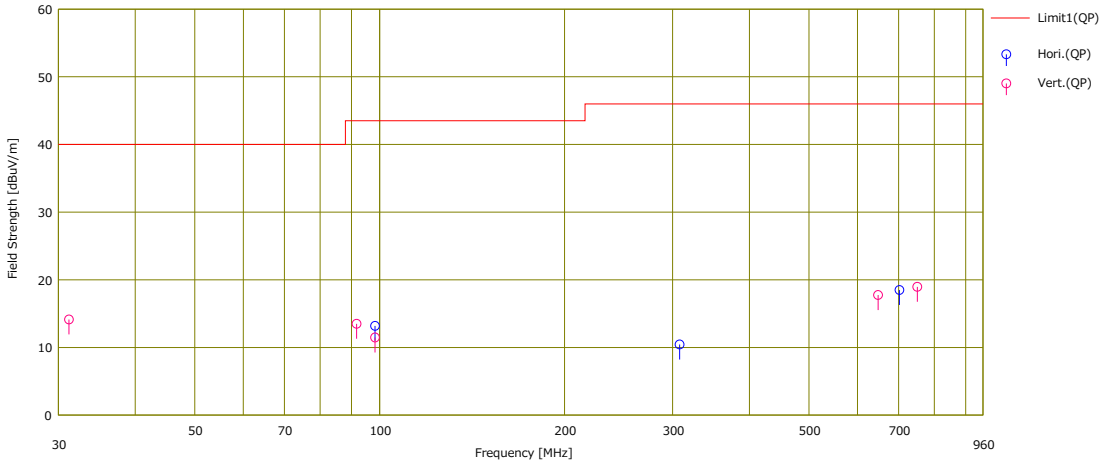




Radiated emission
(Plot data)

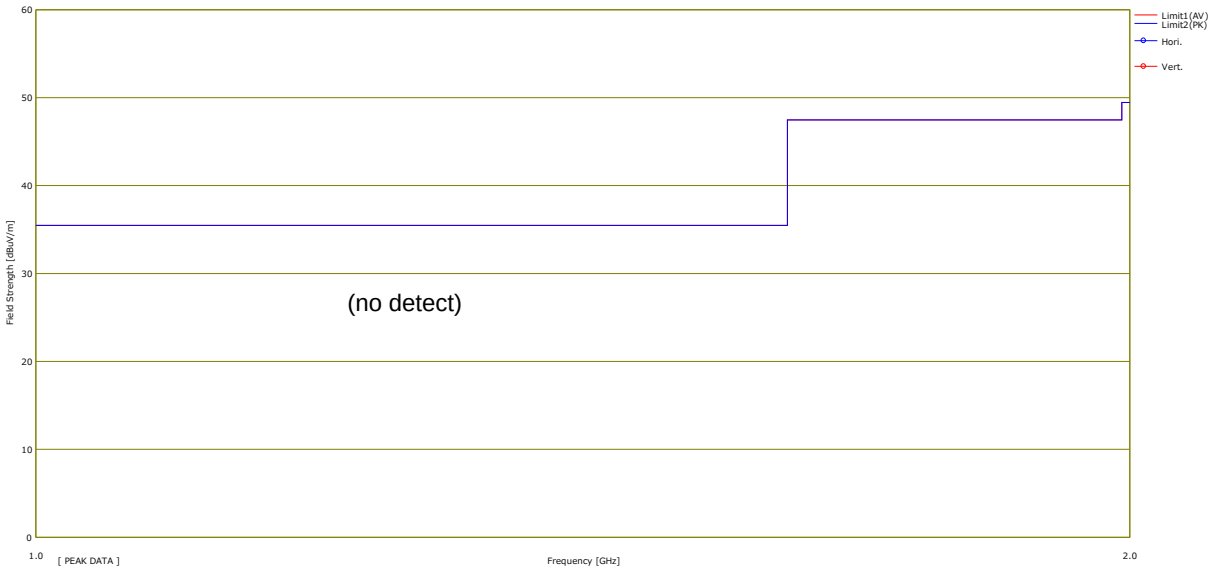
Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	15430541S-B-R2
Date	August 9, 2024
Temperature / Humidity	24 deg. C / 40 % RH
Engineer	Yuta Shiba
	(9 kHz to 1000 MHz)
Mode	Transmitting ch9 (Normal Power)

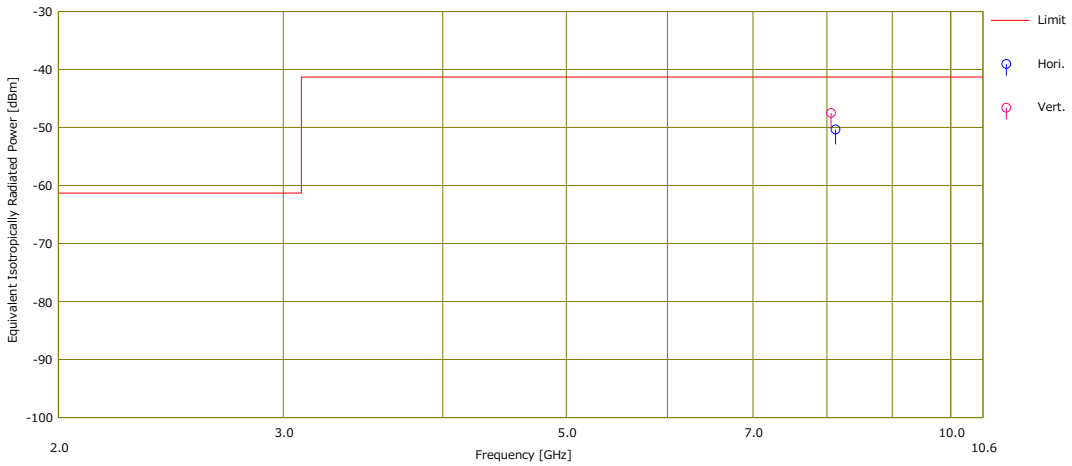




Radiated emission
(Plot data)

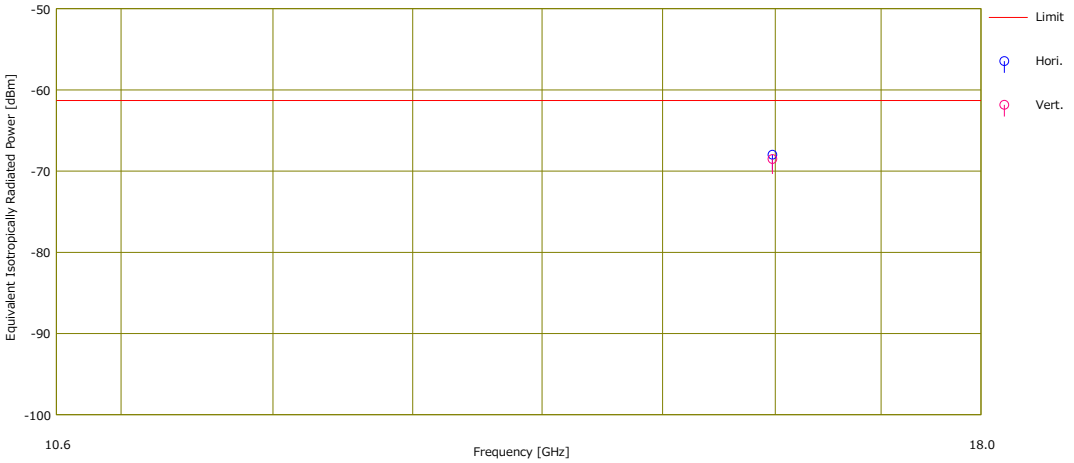
Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber	
Report No.	15430541S-B-R2	
Date	August 6, 2024	August 6, 2024
Temperature / Humidity	20 deg. C / 45 % RH	23 deg. C / 46 % RH
Engineer	Takayuki Kobayashi (1 GHz to 2 GHz)	Kouki Yamada (2 GHz to 10.6 GHz)
Mode	Transmitting ch9 (Normal Power)	

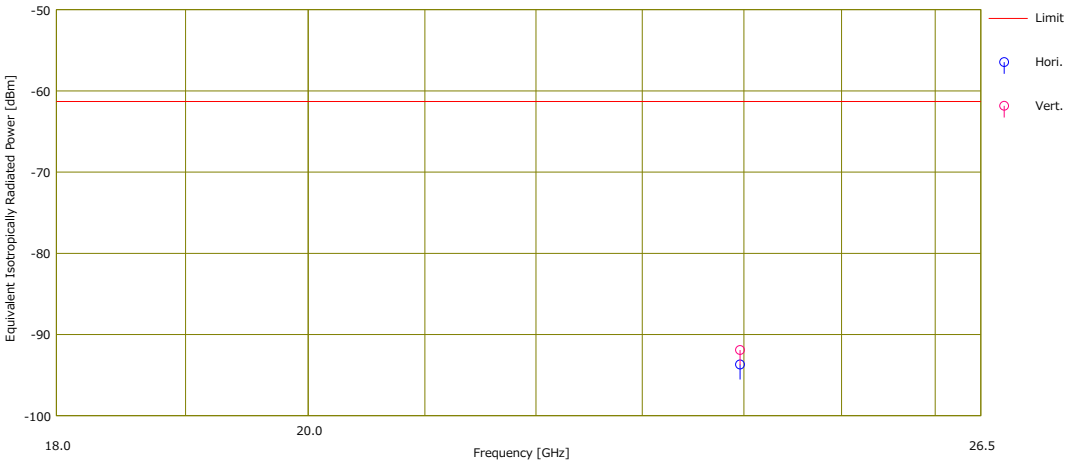


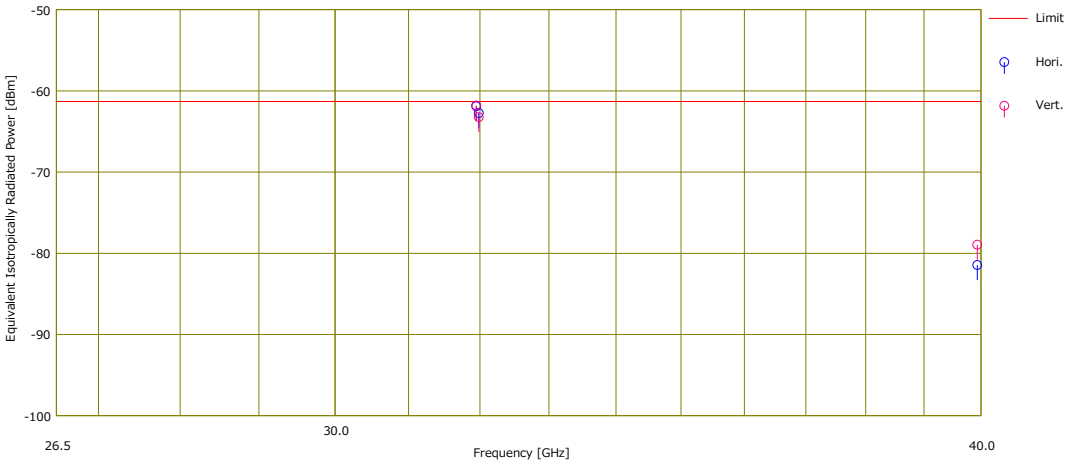


Radiated emission
(Plot data)

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber		
Report No.	15430541S-B-R2		
Date	August 7, 2024	August 8, 2024	August 8, 2024
Temperature / Humidity	21 deg. C / 48 % RH	24 deg. C / 40 % RH	19 deg. C / 52 % RH
Engineer	Takayuki Kobayashi (10.6 GHz to 18 GHz)	Yuta Shiba (18 GHz to 26.5 GHz)	Takayuki Kobayashi (26.5 GHz to 40 GHz)
Mode	Transmitting ch9 (Normal Power)		



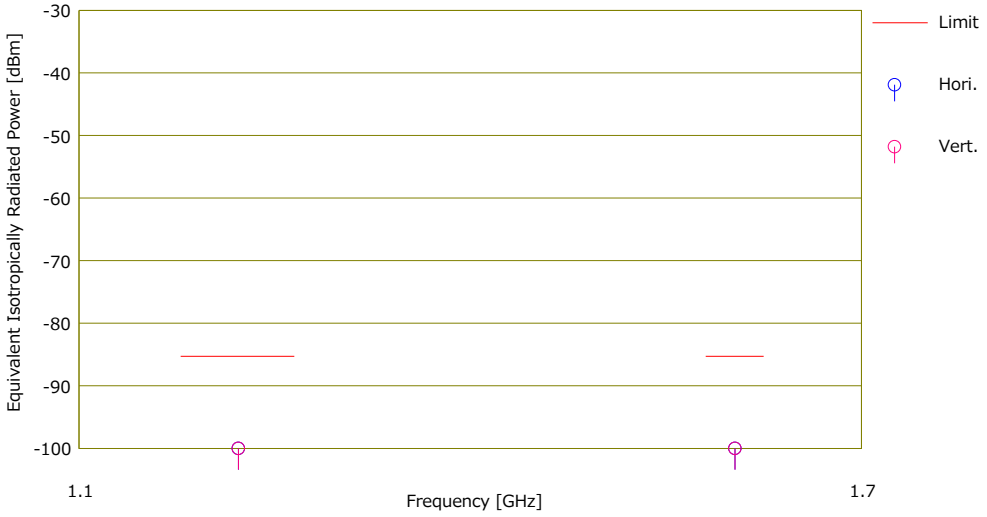




Radiated emission (GPS band)

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	15430541S-B-R2
Date	August 6, 2024
Temperature / Humidity	20 deg. C / 54 % RH
Engineer	Takayuki Kobayashi
Mode	Transmitting ch5 (Normal Power)

(GPS bands emission)



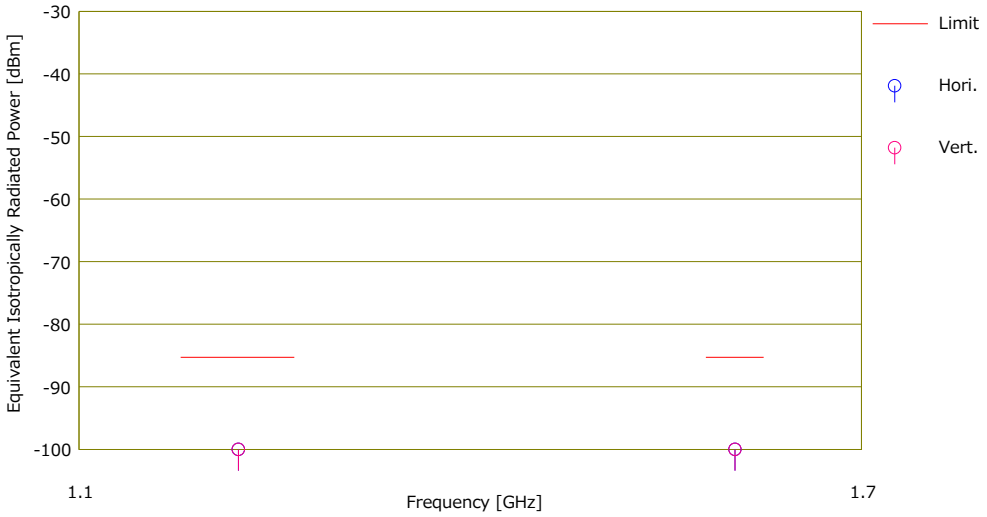
No.	Freq.	Reading <PK>	SG Level	TX Ant.Gain	TX Loss	ERP Result	ERP Limit	Margin	Pola.	Height	Angle	TX Ant.Type	Comment
	[MHz]	[dBuV]	[dBm]	[dBi]	[dB]	[dBm]	[dBm]	[dB]		[cm]	[deg]		
1	1202.000	18.08	-105.00	7.17	4.27	-102.10	-85.30	16.8	Hori.	150	0	Horn	RMS,RBW:1 KHz, FloorNoise
2	1584.500	18.16	-105.00	9.61	4.94	-100.33	-85.30	15.0	Hori.	150	0	Horn	RMS,RBW:1 KHz, FloorNoise
3	1202.000	18.81	-105.00	7.17	4.27	-102.10	-85.30	16.8	Vert.	150	0	Horn	RMS,RBW:1 KHz, FloorNoise
4	1584.500	18.23	-105.00	9.61	4.94	-100.33	-85.30	15.0	Vert.	150	0	Horn	RMS,RBW:1 KHz, FloorNoise

Calculation:Result [dBm] = SG level [dBm] + Tx Ant Gain [dBi] - Tx Loss (Cable)[dB]
Tx Antenna: Horn(1 GHz-40 GHz) / Rx-Antenna: Horn(1 GHz-40 GHz)

Radiated emission (GPS band)

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	15430541S-B-R2
Date	August 6, 2024
Temperature / Humidity	20 deg. C / 54 % RH
Engineer	Takayuki Kobayashi
Mode	Transmitting ch9 (Normal Power)

(GPS bands emission)



No.	Freq. [MHz]	Reading (PK) [dBuV]	SG Level [dBm]	TX Ant.Gain [dBi]	TX Loss [dB]	ERP Result [dBm]	ERP Limit [dBm]	Margin [dB]	Pola.	Height [cm]	Angle [deg]	TX Ant.Type	Comment
1	1202.000	18.67	-105.00	7.17	4.27	-102.10	-85.30	16.8	Hori.	150	0	Horn	RMS,RBW:1 KHz, FloorNoise
2	1584.500	18.38	-105.00	9.61	4.94	-100.33	-85.30	15.0	Hori.	150	0	Horn	RMS,RBW:1 KHz, FloorNoise
3	1202.000	18.18	-105.00	7.17	4.27	-102.10	-85.30	16.8	Vert.	150	0	Horn	RMS,RBW:1 KHz, FloorNoise
4	1584.500	18.53	-105.00	9.61	4.94	-100.33	-85.30	15.0	Vert.	150	0	Horn	RMS,RBW:1 KHz, FloorNoise

Calculation:Result [dBm] = SG level [dBm] + Tx Ant Gain [dBi] - Tx Loss (Cable)[dB]
Tx Antenna: Horn(1 GHz-40 GHz) / Rx-Antenna: Horn(1 GHz-40 GHz)

Peak level of the emission

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	15430541S-B-R2
Date	August 5, 2024
Temperature / Humidity	21 deg. C / 50 % RH
Engineer	Yuta Shiba
Mode	Transmitting ch5 (Normal Power)

(Peak level of the emission)

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

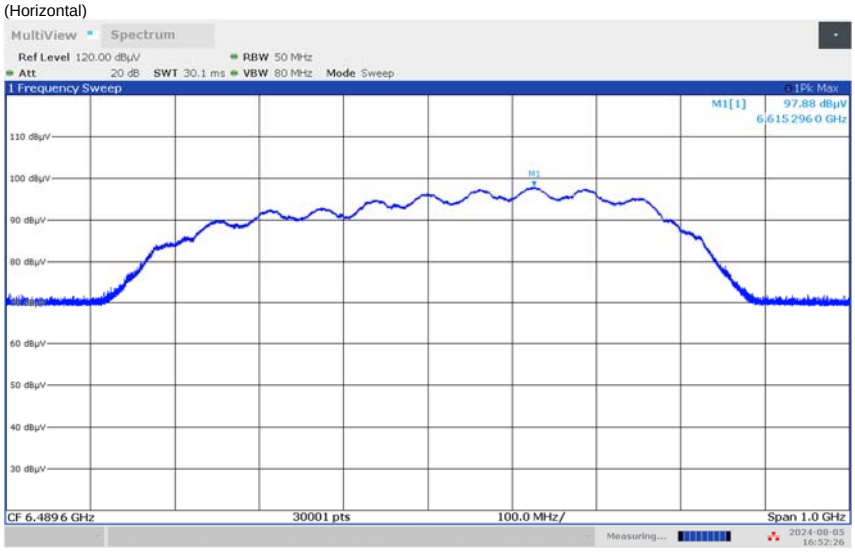
Band	Pol.	Frequency [MHz]	SA Reading [dBuV/50 MHz]	SG level [dBm]	Tx Ant.Gain [dBi]	Tx Loss [dB]	RBW converted factor [dB]	EIRP Result [dBm/50 MHz]	EIRP Limit [dBm/50 MHz]	Margin [dB]	Remarks	Height [cm]	Angle [deg.]
3.1 GHz - 10.6 GHz	Hor.	6615.296	97.88	-12.93	10.63	10.36	0.50	-12.16	0.00	12.16	carrier	148	179
3.1 GHz - 10.6 GHz	Ver.	6615.596	97.07	-13.74	10.63	10.36	0.50	-12.97	0.00	12.97	carrier	149	357

Sample Calculation :

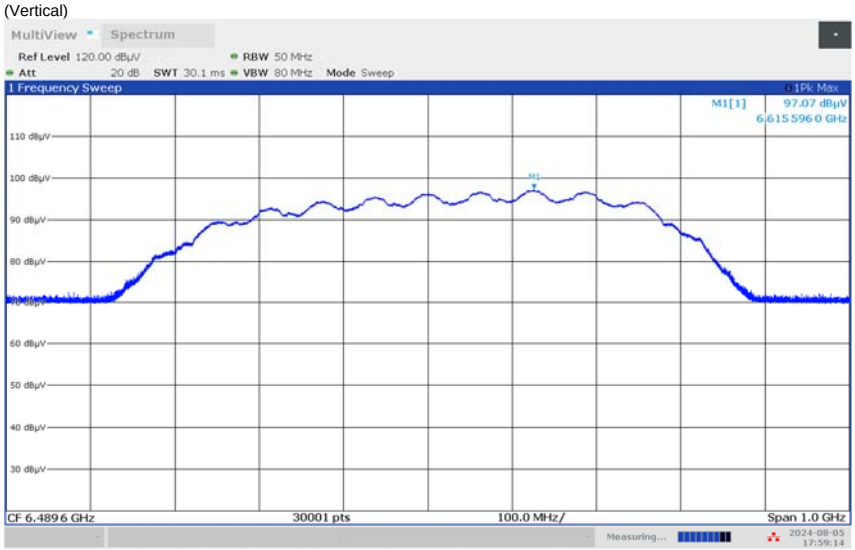
EIRP Result [dBm/MHz] = SG level [dBm] + Tx Ant.Gain [dBi] - Tx Loss [dB] + RBW converted factor [dB]

RBW converted factor [dB] = 20 x log (50 / (3 dB measured bandwidth = 47.1834 [MHz]))

(Horizontal)



(Vertical)



* For RSP-100 Annex B

Maximum peak power measured: -12.16 dBm/50 MHz (refer to upper table value) / 10 ^ (-12.16 [dBm/50 MHz]/ 10) = 0.0608135 mW/50 MHz

The bandwidth of this equipment was 608.798 MHz (99 % occupied bandwidth, refer to the data of bandwidth sheet)

Total peak output power was 0.74046274 mW = 0.0608135 [mW/50 MHz] x 608.798 [MHz] / 50 [MHz]

Peak level of the emission

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	15430541S-B-R2
Date	September 10, 2024
Temperature / Humidity	24 deg. C / 49 % RH
Engineer	Hiromasa Sato
Mode	Transmitting ch5 (Low Power)

(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.	6615.929	92.03	-19.08	10.63	10.36	0.50	-18.31	0.00	18.31	carrier	151	176
3.1 GHz - 10.6 GHz	Ver.	6614.396	90.01	-17.80	10.62	10.36	0.50	-17.04	0.00	17.04	carrier	153	273

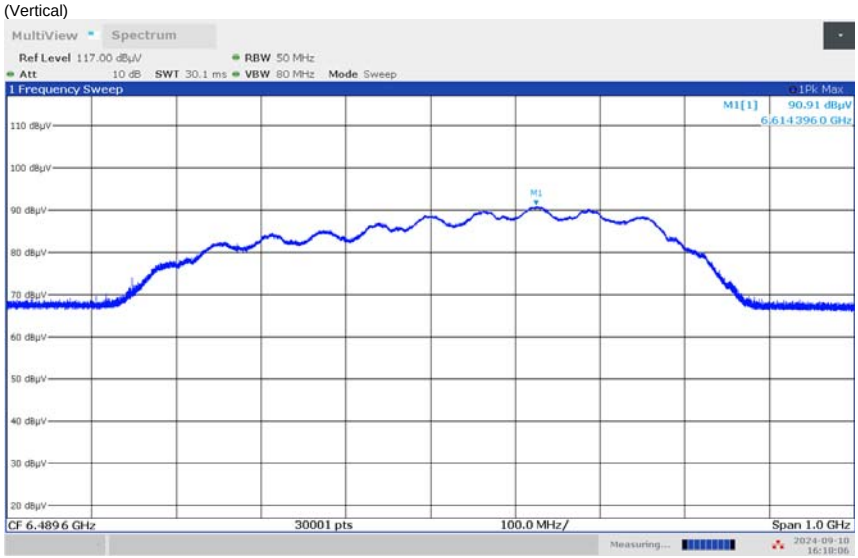
Sample Calculation :

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 = 47.1834 [MHz]))

(Horizontal)

(Vertical)



* For RSP-100 Annex B

Maximum peak power measured: -17.04 dBm/50 MHz (refer to upper table value) / 10 ^ (-17.04 [dBm/50 MHz]/ 10) = 0.0197697 mW/50 MHz

The bandwidth of this equipment was 608.798 MHz (99 % occupied bandwidth, refer to the data of bandwidth sheet)

Total peak output power was 0.24071508 mW = 0.0197697 [mW/50 MHz] x 608.798 [MHz] / 50 [MHz]

Peak level of the emission

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	15430541S-B-R2
Date	August 5, 2024
Temperature / Humidity	18 deg. C / 54 % RH
Engineer	Takayuki Kobayashi
Mode	Transmitting ch9 (Normal Power)

(Peak level of the emission)

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

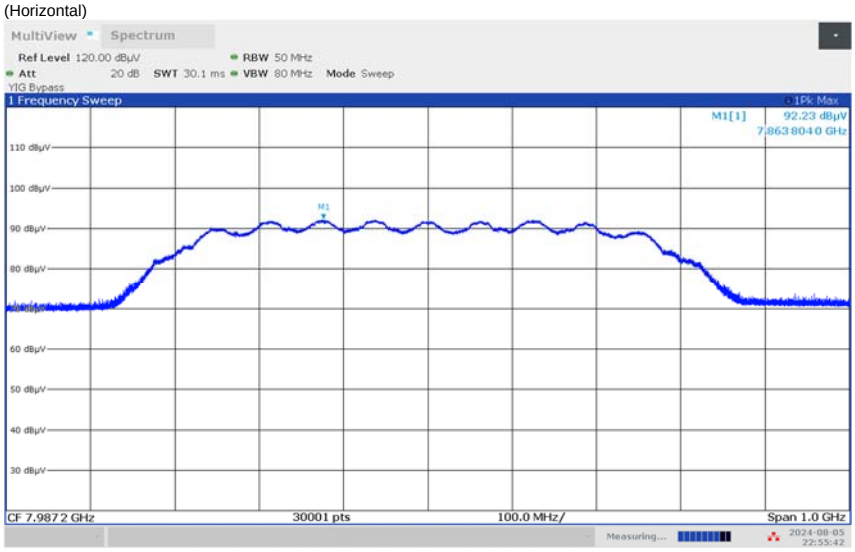
Band	Pol.	Frequency [MHz]	SA Reading [dBuV/50 MHz]	SG level [dBm]	Tx Ant.Gain [dBi]	Tx Loss [dB]	RBW converted factor [dB]	EIRP Result [dBm/50 MHz]	EIRP Limit [dBm/50 MHz]	Margin [dB]	Remarks	Height [cm]	Angle [deg.]
3.1 GHz - 10.6 GHz	Hor.	7863.804	92.23	-18.44	12.71	11.26	0.50	-16.49	0.00	16.49	carrier	146	175
3.1 GHz - 10.6 GHz	Ver.	8049.798	94.37	-14.52	12.97	11.39	0.50	-12.44	0.00	12.44	carrier	150	27

Sample Calculation :

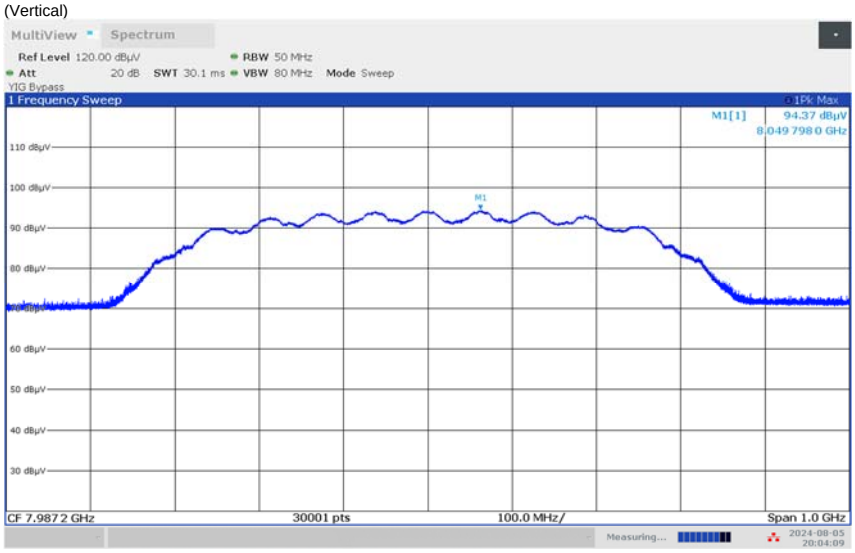
EIRP Result [dBm/MHz] = SG level [dBm] + Tx Ant.Gain [dBi] - Tx Loss [dB] + RBW converted factor [dB]

RBW converted factor [dB] = 20 x log (50 / (3 dB measured bandwidth = 47.1834 [MHz]))

(Horizontal)



(Vertical)



* For RSP-100 Annex B

Maximum peak power measured: -12.44 dBm/50 MHz (refer to upper table value) / 10 ^ (-12.44 [dBm/50 MHz]/ 10) = 0.05701643 mW/50 MHz

The bandwidth of this equipment was 628.699 MHz (99 % occupied bandwidth, refer to the data of bandwidth sheet)

Total peak output power was 0.71692345 mW = 0.05701643 [mW/50 MHz] x 628.699 [MHz] / 50 [MHz]

Peak level of the emission

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	15430541S-B-R2
Date	September 10, 2024
Temperature / Humidity	24 deg. C / 49 % RH
Engineer	Hiromasa Sato
Mode	Transmitting ch9 (Low Power)

(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.	7856.504	91.76	-18.54	11.69	11.25	0.50	-17.60	0.00	17.60	carrier	153	178
3.1 GHz - 10.6 GHz	Ver.	8051.231	91.47	-18.80	11.39	11.39	0.50	-18.30	0.00	18.30	carrier	151	35

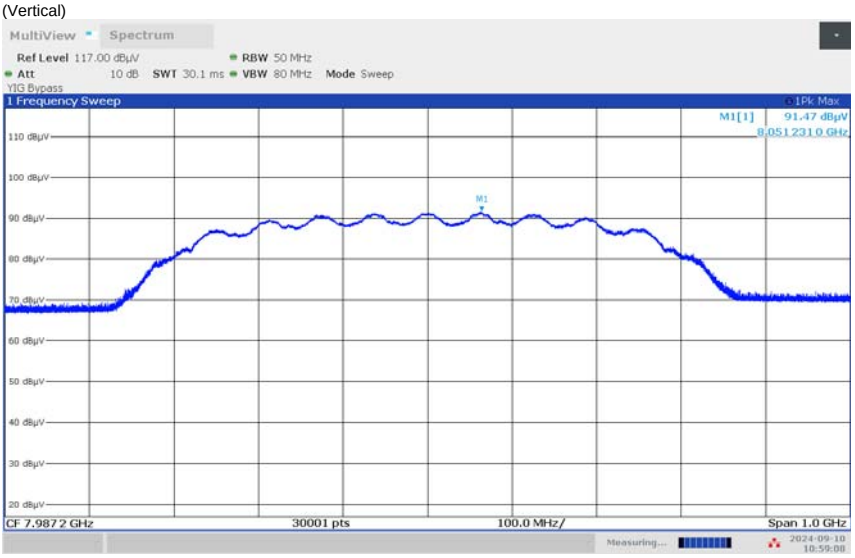
Sample Calculation :

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 = 47.1834 [MHz]))

(Horizontal)

(Vertical)



* For RSP-100 Annex B

Maximum peak power measured: -17.6 dBm/50 MHz (refer to upper table value) / 10 ^ (-17.6 [dBm/50 MHz]/ 10) = 0.01737801 mW/50 MHz

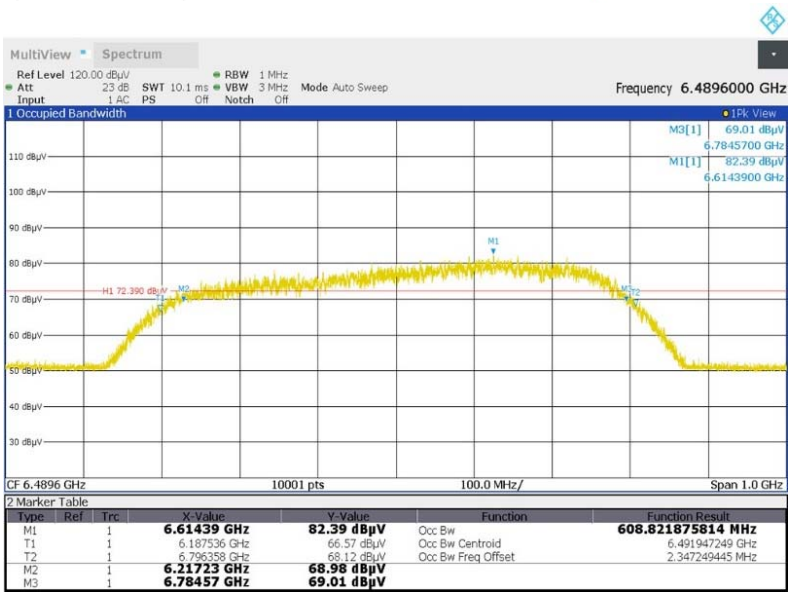
The bandwidth of this equipment was 628.699 MHz (99 % occupied bandwidth, refer to the data of bandwidth sheet)

Total peak output power was 0.21851075 mW = 0.01737801 [mW/50 MHz] x 628.699 [MHz] / 50 [MHz]

UWB Bandwidth

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	15430541S-B-R2
Date	August 5, 2024
Temperature / Humidity	21 deg. C / 50 % RH
Engineer	Yuta Shiba
Mode	Transmitting ch5 (Normal Power)
10 dB Bandwidth:	**567.340 MHz (Limit: >= 500 MHz)**
Center Frequency	**6500.900 MHz (= (fH + fL) / 2)**

(worst: horizontal)



Start Frequency: 5989.600 **MHz** **f L:** 6217.230 **MHz**

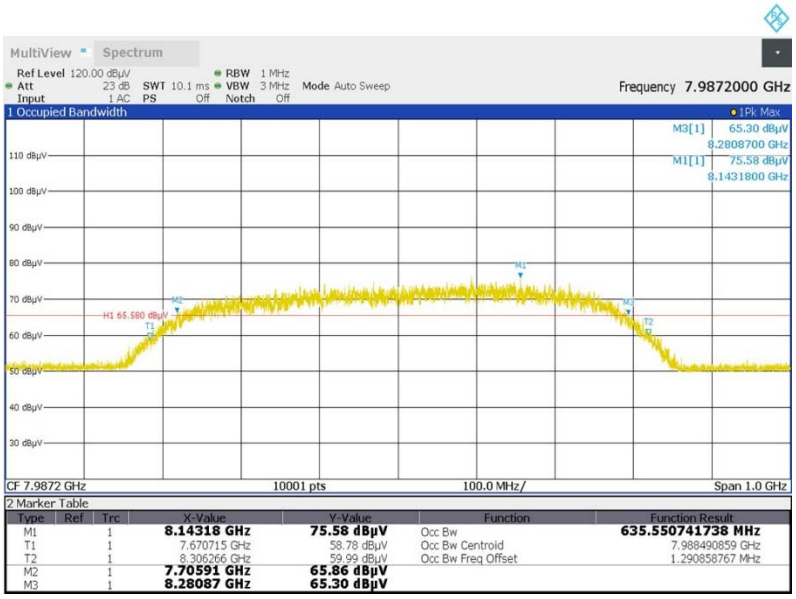
Stop Frequency: 6989.600 **MHz** **f H:** 6784.570 **MHz**

99 % Occupied Bandwidth: 608.798 MHz

UWB Bandwidth

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	15430541S-B-R2
Date	August 5, 2024
Temperature / Humidity	18 deg. C / 54 % RH
Engineer	Takayuki Kobayashi
Mode	Transmitting ch9 (Normal Power)
10 dB Bandwidth:	**574.960 MHz (Limit: >= 500 MHz)**
Center Frequency	**7993.390 MHz (= (fH + fL) / 2)**

(worst: vertical)



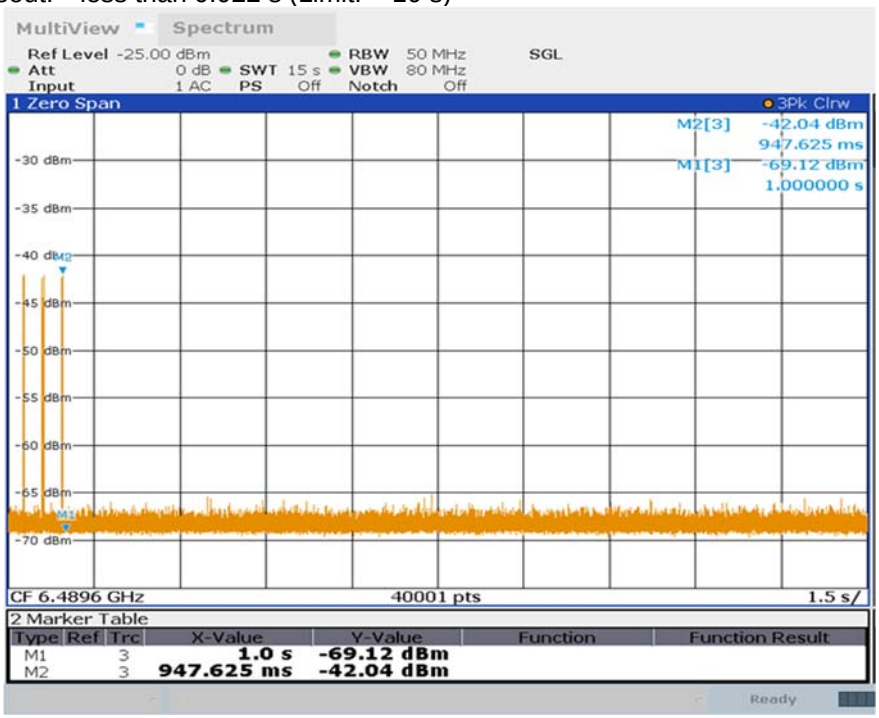
Start Frequency:	7487.200	**MHz**	**f L:**	7705.910	**MHz**
Stop Frequency:	8487.200	**MHz**	**f H:**	8280.870	**MHz**

99 % Occupied Bandwidth: 628.699 MHz

Transmitter timeout

Test place	Shonan EMC Lab. No.3 Shielded Room
Date	August 22, 2024
Temperature / Humidity	26 deg. C / 37 % RH
Engineer	Kenichi Adachi
Mode	Normal Tx ch5 (Normal Power)

Transmitter timeout: less than 0.022 s (Limit: < 10 s)

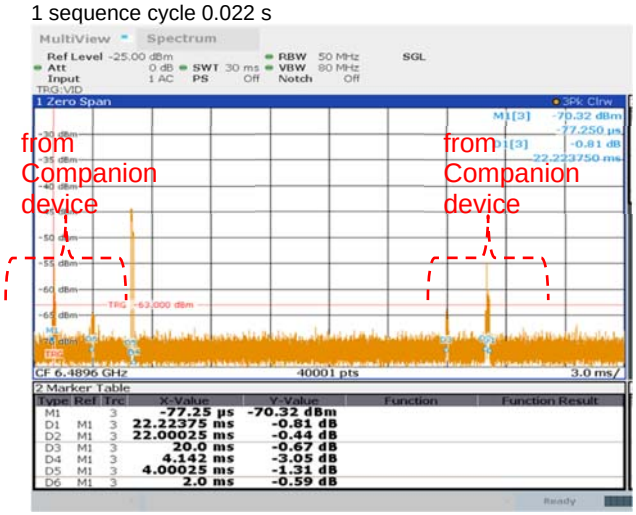


M1: power off of companion device
M2: end of EUT's transmission

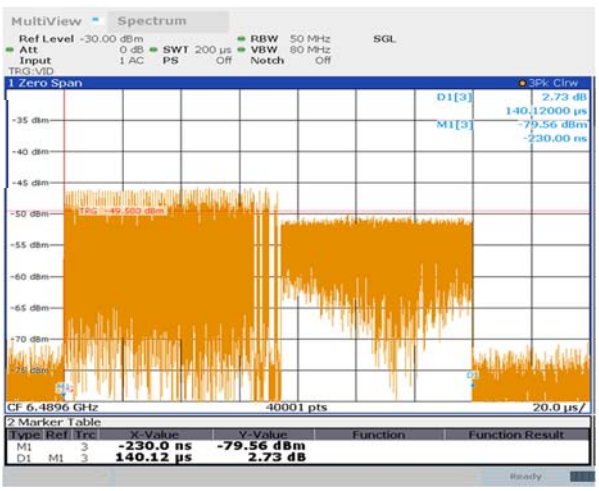
* Although no transmission signal was seen after the companion device was turned off, the transmitter timeout result was assumed to be the time for one sequence transmission, assuming that the time for one sequence transmission that EUT may transmit.

(reference data)

1 sequence cycle 0.022 s



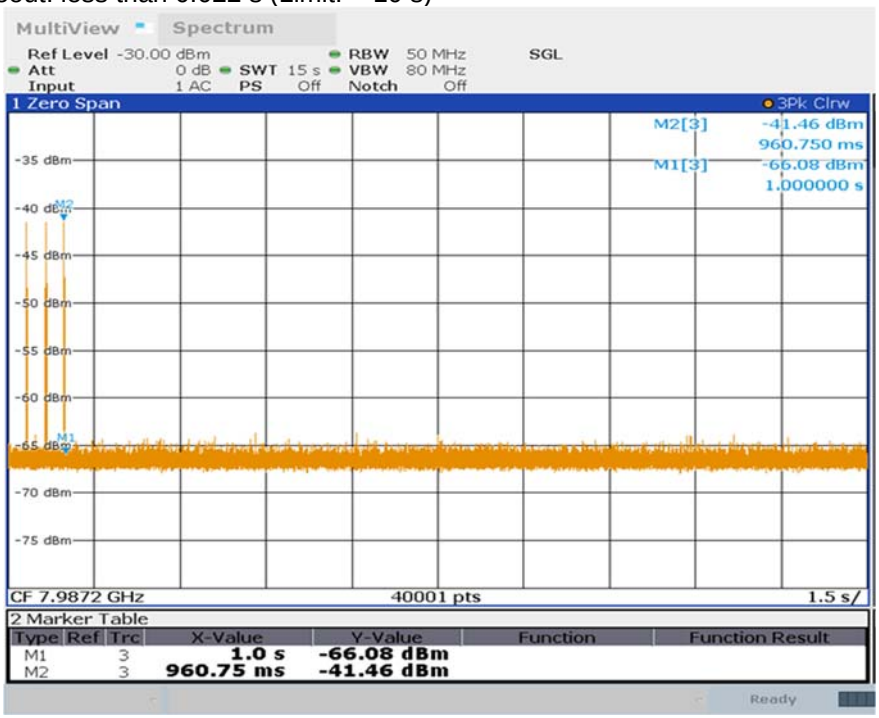
1 burst 140.12 us



Transmitter timeout

Test place	Shonan EMC Lab. No.3 Shielded Room
Date	August 22, 2024
Temperature / Humidity	26 deg. C / 37 % RH
Engineer	Kenichi Adachi
Mode	Normal Tx ch9 (Normal Power)

Transmitter timeout: less than 0.022 s (Limit: < 10 s)

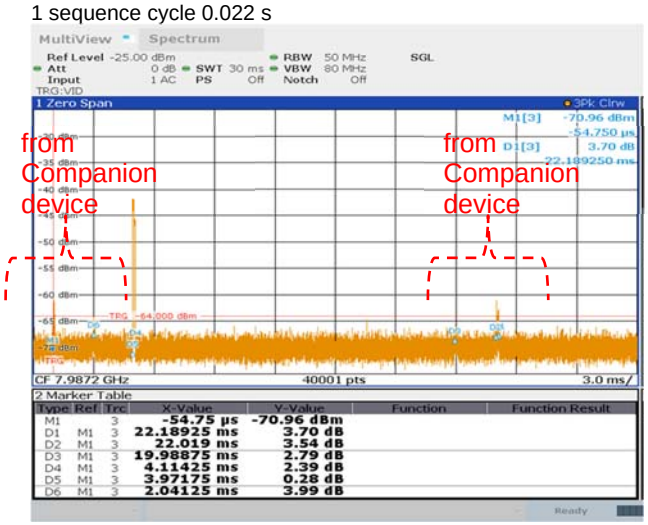


M1: power off of companion device
M2: end of EUT's transmission

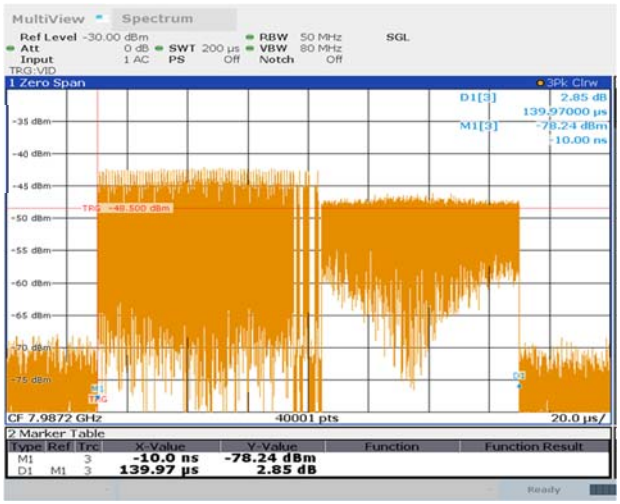
* Although no transmission signal was seen after the companion device was turned off, the transmitter timeout result was assumed to be the time for one sequence transmission, assuming that the time for one sequence transmission that EUT may transmit.

(reference data)

1 sequence cycle 0.022 s



1 burst 139.97 us



APPENDIX 2: Test instruments

Test Instruments (1/2)

Test Name	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Interval (Month)
RE	145005	Pre Amplifier	Toyo Corporation	TPA0118-36	2046104	2024/02/16	12
RE	145007	Pre Amplifier	Toyo Corporation	HAP18-26W	19	2024/03/05	12
RE	145023	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	BBA9106	91032666	2024/05/10	12
RE	145126	Pre Amplifier	SONOMA	310N	290213	2024/02/07	12
RE	145129	Pre Amplifier	Toyo Corporation	HAP26-40W	B3208602403-176	2024/05/09	12
RE	145171	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/NS4906	-/0901-271(RF Selector)	2024/04/01	12
RE	145176	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	2023/08/23 *1)	12
RE	145383	Horn Antenna	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	9120D-725	2024/03/04	12
RE	145501	Horn Antenna	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	9120D-739	2024/03/20	12
RE	145512	Horn Antenna	ETS-Lindgren	3160-09	00094868	2024/06/20	12
RE	145514	Horn Antenna	ETS-Lindgren	3160-10	00092383	2024/06/20	12
RE	145529	Logperiodic Antenna	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	196	2024/05/10	12
RE	145536	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100218	2024/04/10	12
RE	145565	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	2024/04/03	12
RE	145566	Semi-Anechoic Chamber	TDK	SAEC-03(SVSWR)	3	2024/05/23	12
RE	145568	Semi Anechoic Chamber(ME)	TDK	Semi Anechoic Chamber 3m/10m	1, 2, 3	2022/12/24	24
RE	146226	Signal Generator	Keysight Technologies Inc	E8257D-540	MY48051404	2024/01/10	12
RE	146432	Tape Measure	TAJIMA	GL19-55	-	-	-
RE	167096	Attenuator	JFW	50HF-006N	-	2024/02/13	12
RE	170932	EMI Software	TSJ (Techno Science Japan)	TEPTO-DV3(RE,CE,ME,PE)	Ver 3.1.0546	-	-
RE	179108	Coaxial Cable	Junkosha	MWX241-03000KMSKMS/B	1901Q033-R	2024/04/09	12
RE	179540	Coaxial Cable	Huber+Suhner	SUCOFLEX 102	802815/2	2024/03/05	12
RE	194601	Coaxial Cable	Fjikura	5D-2W	-	2023/12/08	12
RE	194684	Horn Antenna	Schwarzbeck Mess-Elektronik OHG	BBHA 9120 C	695	2024/03/11	12
RE	200010	Coaxial Cable	Huber+Suhner	SUCOFLEX 104	575618/4	2024/06/05	12
RE	202959	Highpass Filter	Micro-Tronics	HPM50107	G077	2023/10/11	12
RE	206229	Bandpass Filter	Micro-Tronics	BPC50411	086	2024/03/05	12
RE	221966	Coaxial Cable	Huber+Suhner	SUCOFLEX 102	2000703/2	2024/06/05	12
RE	221967	Coaxial Cable	Junkosha	J12J103275-00	JUN-29-22-038	2024/06/05	12
RE	235269	Spectrum Analyzer	Rohde & Schwarz	FSW43	102488	2023/12/18	12
RE	243217	Coaxial Cable	Hayashi-Repic co., Ltd.	SMS13-13A26-NMS13-9.0m	49306-01-04	2023/12/20	12
RE	248302	Attenuator	JFW	50HFFA-006-2/18N	-	2024/05/06	12

Test Instruments (2/2)

Test Name	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Interval (Month)
RE	146210	Digital Hitester	HIOKI E.E. CORPORATION	3805-50	80997823	2023/09/25	12
RE	156380	Coaxial Cable	Huber+Suhner	SUCOFLEX_104_E	SN MY 13406/4E	2024/05/09	12
RE	191840	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	-	2024/08/12	12
RE	194685	Horn Antenna	Schwarzbeck Mess-Elektronik OHG	BBHA 9120 C	711	2024/03/20	12
RE	213530	Test Receiver	Rohde & Schwarz	ESW44	103068	2024/02/22	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:

RE: Radiated Emission test