



# **RADIO TEST REPORT**

**Test Report No. : 13977035S-B**

**Applicant** : ALPS ALPINE CO., LTD.  
**Type of EUT** : Head unit  
**Model Number of EUT** : AH00ICB  
**FCC ID** : A269ZUA165  
**Test regulation** : FCC Part 15 Subpart C: 2021  
\* Bluetooth BR/EDR part  
**Test item** : Antenna Terminal Conducted Tests  
**Test Result** : Complied (Refer to SECTION 3)

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

**Date of test:** October 25 to November 15, 2021

**Representative test engineer:**

*T. Kawakami*

Takahiro Kawakami  
Engineer

**Approved by:**

*K. Noda*

Kazuya Noda  
Leader



CERTIFICATE 1266.03

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

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## **REVISION HISTORY**

**Original Test Report No.: 13977035S-B**

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13977035S-B	January 31, 2022	-	-

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## Reference: Abbreviations (Including words undescribed in this report)

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

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<b>CONTENTS</b>	<b>PAGE</b>
<b>SECTION 1: Customer information.....</b>	<b>5</b>
<b>SECTION 2: Equipment under test (EUT).....</b>	<b>5</b>
<b>SECTION 3: Test specification, procedures &amp; results.....</b>	<b>7</b>
<b>SECTION 4: Operation of EUT during testing .....</b>	<b>10</b>
<b>SECTION 5: Antenna Terminal Conducted Tests.....</b>	<b>13</b>
<b>APPENDIX 1: Test data .....</b>	<b>14</b>
20dB Bandwidth, 99% Occupied Bandwidth and Carrier Frequency Separation .....	14
Number of Hopping Frequency .....	18
Dwell time.....	20
Maximum Peak Output Power .....	23
Burst Rate Confirmation .....	24
Conducted Spurious Emission .....	25
Conducted Emission Band Edge compliance .....	31
<b>APPENDIX 2: Test instruments .....</b>	<b>33</b>
<b>APPENDIX 3: Photographs of test setup .....</b>	<b>34</b>
Antenna Terminal Conducted Tests.....	34

## **SECTION 1: Customer information**

Company Name : ALPS ALPINE CO., LTD.  
Address : 20-1 Yoshima Industrial park, Iwaki, Fukushima, Japan 970-1192  
Telephone Number : +81-246-36-4111  
Contact Person : Kenji Nagase

The information provided from the customer is as follows;

- Applicant, Type of EUT, Model Number of EUT, FCC ID on the cover and other relevant pages
  - Operating/Test Mode(s) (Mode(s)) on all the relevant pages
  - SECTION 1: Customer information
  - SECTION 2: Equipment under test (EUT) other than the Receipt Date
  - SECTION 4: Operation of EUT during testing
- \* The laboratory is exempted from liability of any test results affected from the above information in SECTION 2 and 4.

## **SECTION 2: Equipment under test (EUT)**

### **2.1 Identification of EUT**

Type : Head unit  
Model Number : AH00ICB  
Serial Number : Refer to SECTION 4.2  
Receipt Date : October 18, 2021  
Condition : Engineering prototype  
(Not for Sale: This sample is equivalent to mass-produced items.)  
Modification : No Modification by the test lab.

### **2.2 Product Description**

Model: AH00ICB (referred to as the EUT in this report) is a Head unit.

The EUT has following similar model:

Model Name	Details
AH00ICB (EUT)	External amplifier model
AH00ICB 1	Internal amplifier model

## **General Specification**

Rating : DC 13.2 V  
Operating Temperature : -30 deg. C - +70 deg. C

## **Radio Specification**

### **Bluetooth**

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2480 MHz
Antenna type	:	Planar Inverted-F Antenna
Modulation	:	FHSS (GFSK, $\pi/4$ -DQPSK, 8DPSK)
Antenna Gain	:	-0.2 dBi

### **Bluetooth Low Energy**

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2480 MHz
Antenna type	:	Planar Inverted-F Antenna
Modulation	:	GFSK
Antenna Gain	:	-0.2 dBi

### **WLAN 2.4 GHz (IEEE802.11b/g/n-20)**

Radio Type	:	Transceiver
Frequency of Operation	:	2412 MHz - 2462 MHz
Antenna type	:	Planar Inverted-F Antenna
Modulation	:	DSSS (CCK, DQPSK, DBPSK) OFDM (64QAM, 16QAM, QPSK, BPSK)
Antenna Gain	:	-0.2 dBi

### **WLAN 5 GHz (IEEE802.11a/n-20/n-40/ac-20/ac-40/ac-80)**

Radio Type	:	Transceiver
Frequency of Operation	:	5180 MHz - 5825 MHz
Antenna type	:	Planar Inverted-F Antenna
Modulation	:	OFDM (256QAM, 64QAM, 16QAM, QPSK, BPSK)
Antenna Gain	:	+2.71 dBi (Chain1) +2.71 dBi (Chain2)

## SECTION 3: Test specification, procedures & results

### 3.1 Test Specification

Test Specification : FCC Part 15 Subpart C  
FCC Part 15 final revised on May 3, 2021 and effective July 2, 2021

Title : FCC 47 CFR Part 15 Radio Frequency Device Subpart C Intentional Radiators  
Section 15.207 Conducted limits  
Section 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz,  
and 5725-5850 MHz

\* Also the EUT complies with FCC Part 15 Subpart B.

### 3.2 Procedures and results

Item	Test Procedure	Specification	Worst Margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods ----- ISED: RSS-Gen 8.8	FCC: Section 15.207 ----- ISED: RSS-Gen 8.8	N/A	N/A	*1)
Carrier Frequency Separation	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: -	FCC: Section 15.247(a)(1) ----- ISED: RSS-247 5.1 (b)	See data.	Complied a)	Conducted
20 dB Bandwidth	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: -	FCC: Section 15.247(a)(1) ----- ISED: RSS-247 5.1 (a)		Complied a)	Conducted
Number of Hopping Frequency	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: -	FCC: Section 15.247(a)(1)(iii) ----- ISED: RSS-247 5.1 (d)		Complied b)	Conducted
Dwell time	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: -	FCC: Section 15.247(a)(1)(iii) ----- ISED: RSS-247 5.1 (d)		Complied c)	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: RSS-Gen 6.12	FCC: Section 15.247(a)(b)(1) ----- ISED: RSS-247 5.4 (b)		Complied d)	Conducted
Spurious Emission & Band Edge Compliance	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: RSS-Gen 6.13	FCC: Section 15.247(d) ----- ISED: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	See data.	Complied e)	Conducted

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.

\*1) The test is not applicable since the EUT does not have AC Mains.

a) Refer to APPENDIX 1 (data of 20 dB Bandwidth, 99 % Occupied Bandwidth and Carrier Frequency Separation)

b) Refer to APPENDIX 1 (data of Number of Hopping Frequency)

c) Refer to APPENDIX 1 (data of Dwell time)

d) Refer to APPENDIX 1 (data of Maximum Peak Output Power)

e) Refer to APPENDIX 1 (data of Conducted Spurious Emission)

Symbols:

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

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

\* In case any questions arise about test procedure, ANSI C63.10: 2013 is also referred.

#### **FCC Part 15.31 (e)**

The EUT provides stable voltage constantly to the RF Part regardless of input voltage. Instead of a new battery, DC power supply was used for the test. That does not affect the test result, 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.

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### 3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99 % Occupied Bandwidth	ISED: RSS-Gen 6.7	ISED: -	N/A	Complied a)	Conducted

a) Refer to APPENDIX 1 (data of 20dB Bandwidth, 99%Occupied Bandwidth and Carrier Frequency Separation)

Other than above, no addition, exclusion nor deviation has been made from the standard.

### 3.4 Uncertainty

There is no applicable rule of uncertainty in this applied standard. Therefore, the results are derived depending on whether or not laboratory uncertainty is applied.

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

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Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1 GHz (Average Detector)_SPM-06	1.2 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	2.0 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	1.2 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	1.3 dB
Power Measurement above 1 GHz (Average Detector)_SPM-13	1.3 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-13	1.3 dB
Spurious emission (Conducted) below 1 GHz	0.93 dB
Spurious emission (Conducted) 1 GHz-3 GHz	0.92 dB
Spurious emission (Conducted) 3 GHz-18 GHz	2.3 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.3 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.3 dB
Bandwidth Measurement	0.012 %
Duty cycle and Time Measurement	0.27 %
Temperature_SCH-01	0.93 deg.C.
Humidity_SCH-01	4.1 %
Temperature_SCH-02	2.0 deg.C.
Humidity_SCH-02	6.6 %
Voltage	0.97 %

### 3.5 Test Location

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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

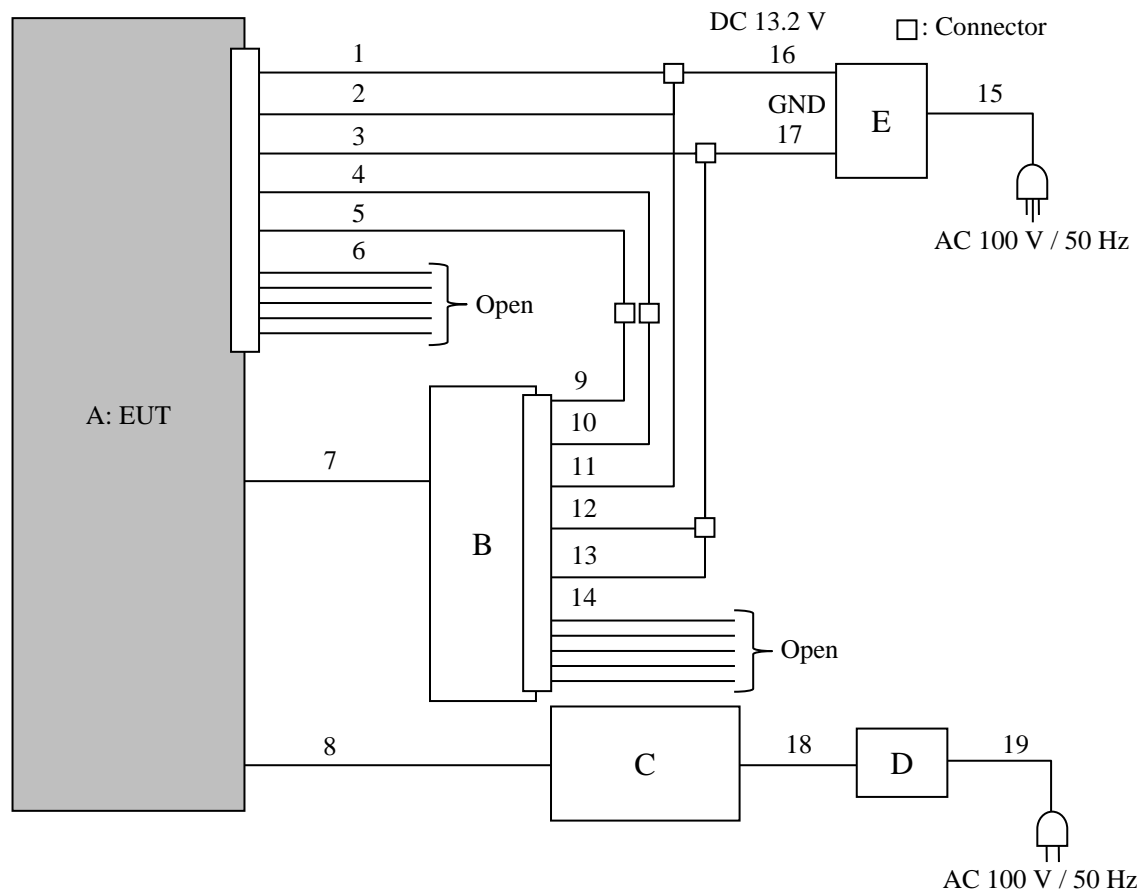
### 4.1 Operating Mode(s)

Bluetooth (BT): Transmitting (Tx), Payload: PRBS9

Details of Operating Mode(s)

Test Item	Mode	Tested frequency
Conducted Emission, Spurious Emission (Conducted)	Tx (Hopping Off) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Carrier Frequency Separation	Tx (Hopping On) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
20 dB Bandwidth	Tx (Hopping Off) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Number of Hopping Frequency	Tx (Hopping On) DH5, 3DH5	-
Dwell time	Tx (Hopping On), -DH1, DH3, DH5 -3DH1, 3DH3, 3DH5	-
Maximum Peak Output Power	Tx (Hopping Off) DH5, 2DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Band Edge Compliance (Conducted)	Tx DH5, 3DH5 -Hopping On -Hopping Off	2402 MHz 2480 MHz
99 % Occupied Bandwidth	Tx DH5, 3DH5 -Hopping On -Hopping Off	2402 MHz 2441 MHz 2480 MHz
<p>*As a result of preliminary test, the formal test was performed with the above modes, which had the maximum payload length (except Dwell time test)</p> <p>*2DH mode (2Mb/s EDR: pi/4DQPSK) was excluded for other tests than power measurement by using 3DH mode (3 Mb/s EDR: 8DPSK) as a representative.</p> <p>* It is considered that the non-tested packet type (e.g. inquiry) can be omitted as it is complied with above all the test items based on Bluetooth Core specification.</p> <p>*EUT has the power settings by the software as follows;</p> <p>Power settings: 8 (setting value)</p> <p>Software: QRCT (Qualcomm Radio Control Toolkit) v4.0.00195.0 (Date: 2021.10.18, Storage location: Driven by connected PC)</p> <p>*This setting of software is the worst case.</p> <p>Any conditions under the normal use do not exceed the condition of setting.</p> <p>In addition, end users cannot change the settings of the output power of the product.</p>		

## 4.2 Configuration and peripherals



#### Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remark
A	Head unit	AH00ICB	73	ALPS ALPINE	EUT
B	Display	QH00159A	114	ALPS ALPINE	-
C	Laptop Computer	7666-77J	LV-B8R1X 08/05	Lenovo	-
D	AC Adapter	42T4422	11S92P1154Z1DXF1DBF DN	Lenovo	-
E	Power Supply (DC)	PW16-5ADP	19100034	TEXIO	-

#### List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	+B	2.2	Unshielded	Unshielded	-
2	ACC	2.2	Unshielded	Unshielded	-
3	GND	2.2	Unshielded	Unshielded	-
4	BCAN H	2.2	Unshielded	Unshielded	-
5	BCAN L	2.2	Unshielded	Unshielded	-
6	Signal	2.2	Unshielded	Unshielded	-
7	GVIF	2.4	Shielded	Shielded	-
8	USB	2.2 + 1.0	Shielded	Shielded	-
9	BCAN L	0.6	Unshielded	Unshielded	-
10	BCAN H	0.6	Unshielded	Unshielded	-
11	+B	0.6	Unshielded	Unshielded	-
12	GND	0.6	Unshielded	Unshielded	-
13	DISP CONT	0.6	Unshielded	Unshielded	-
14	Signal	0.6	Unshielded	Unshielded	-
15	AC	2.0	Unshielded	Unshielded	-
16	DC+	2.0	Unshielded	Unshielded	-
17	DC-	2.0	Unshielded	Unshielded	-
18	DC	1.8	Unshielded	Unshielded	-
19	AC	0.9	Unshielded	Unshielded	-

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## SECTION 5: Antenna Terminal Conducted Tests

### Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
20 dB Bandwidth	3 MHz	30 kHz	100 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99 % Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak Average *2)	-	Power Meter (Sensor: 160 MHz BW)
Carrier Frequency Separation	3 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Number of Hopping Frequency	30 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Dwell Time	Zero Span	100 kHz, 1 MHz	300 kHz, 3 MHz	As necessary capture the entire dwell time per hopping channel	Peak	Clear Write	Spectrum Analyzer
Conducted Spurious Emission *3) *4)	9 kHz to 150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150 kHz to 30 MHz	10 kHz	30 kHz				
	30 MHz to 25 GHz	100 kHz	300 kHz				
Conducted Spurious Emission Band Edge compliance	10 MHz or 13 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer

\*1) Peak hold was applied as Worst-case measurement.

\*2) Reference data

\*3) In the frequency range below 30 MHz, RBW was narrowed to separate the noise contents.

Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.

(9 kHz -150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 10 kHz)

\*4) The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377 Ohms. For example, the measurement at frequency 9 kHz resulted in a level of 45.5 dBuV/m, which is equivalent to  $45.5 - 51.5 = -6.0$  dBuA/m, which has the same margin, 3 dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.

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

The equipment and cables were not used for factor 0 dB of the data sheets.

**Test data** : APPENDIX

**Test result** : Pass

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## **APPENDIX 1: Test data**

### **20 dB Bandwidth, 99 % Occupied Bandwidth and Carrier Frequency Separation**

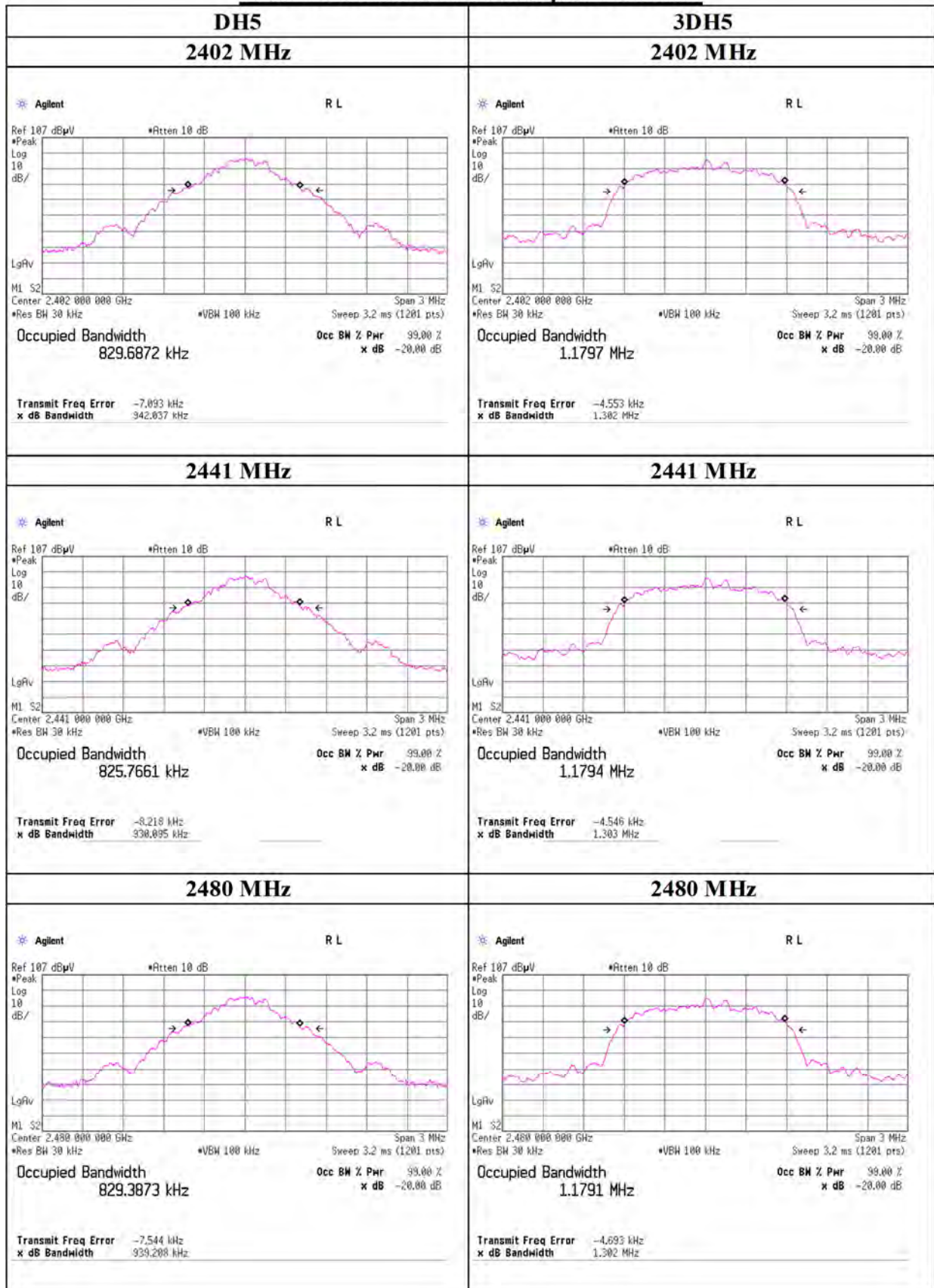
Report No.	13977035S-B
Test place	Shonan EMC Lab.
	No.1 Measurement Room    No.5 Shielded Room
Date	October 25, 2021    November 9, 2021
Temperature / Humidity	23 deg. C / 41 % RH    24 deg. C / 42 % RH
Engineer	Kenichi Adachi    Miku Ikudome
Mode	Tx, Hopping Off, Tx, Hopping On

Mode	Freq. [MHz]	20 dB Bandwidth [MHz]	99 % Occupied Bandwidth [kHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
DH5	2402.0	0.942	829.7	1.000	$\geq 0.628$
DH5	2441.0	0.930	825.8	1.000	$\geq 0.620$
DH5	2480.0	0.939	829.4	1.000	$\geq 0.626$
DH5	Hopping On	-	78536.3	-	-
3DH5	2402.0	1.302	1179.7	1.000	$\geq 0.868$
3DH5	2441.0	1.303	1179.4	1.000	$\geq 0.869$
3DH5	2480.0	1.302	1179.1	1.000	$\geq 0.868$
3DH5	Hopping On	-	78692.8	-	-

Limit: Two-thirds of 20 dB Bandwidth or 25 kHz (whichever is greater).

No limit applies to 20 dB Bandwidth.

### 20 dB Bandwidth & 99 % Occupied Bandwidth



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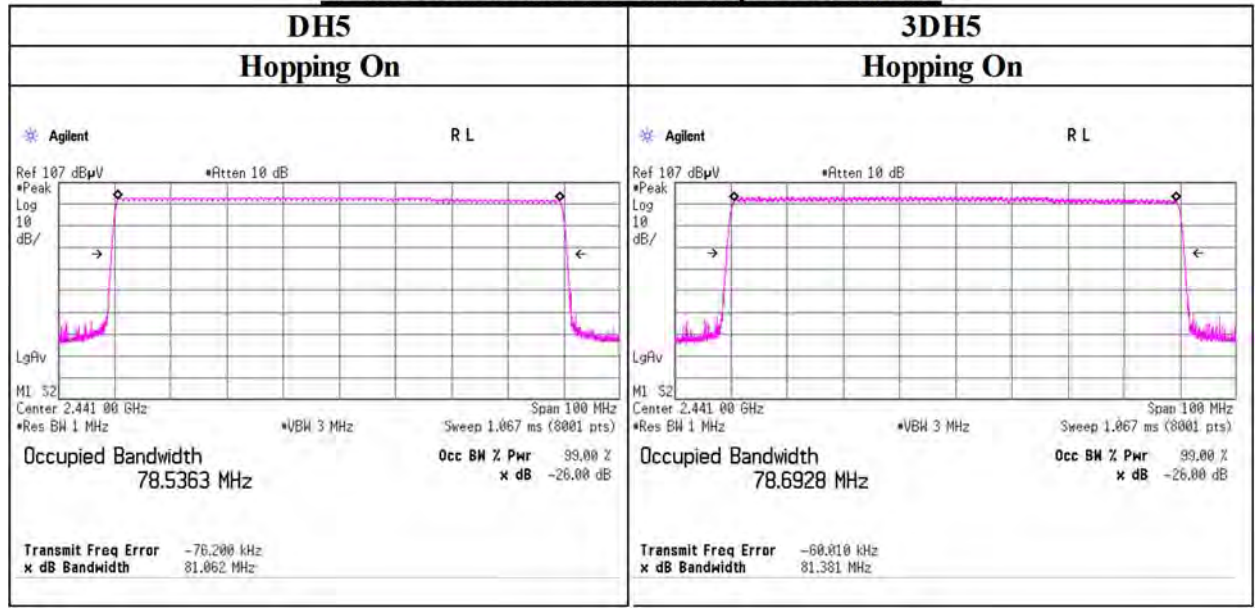
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### 20 dB Bandwidth & 99 % Occupied Bandwidth



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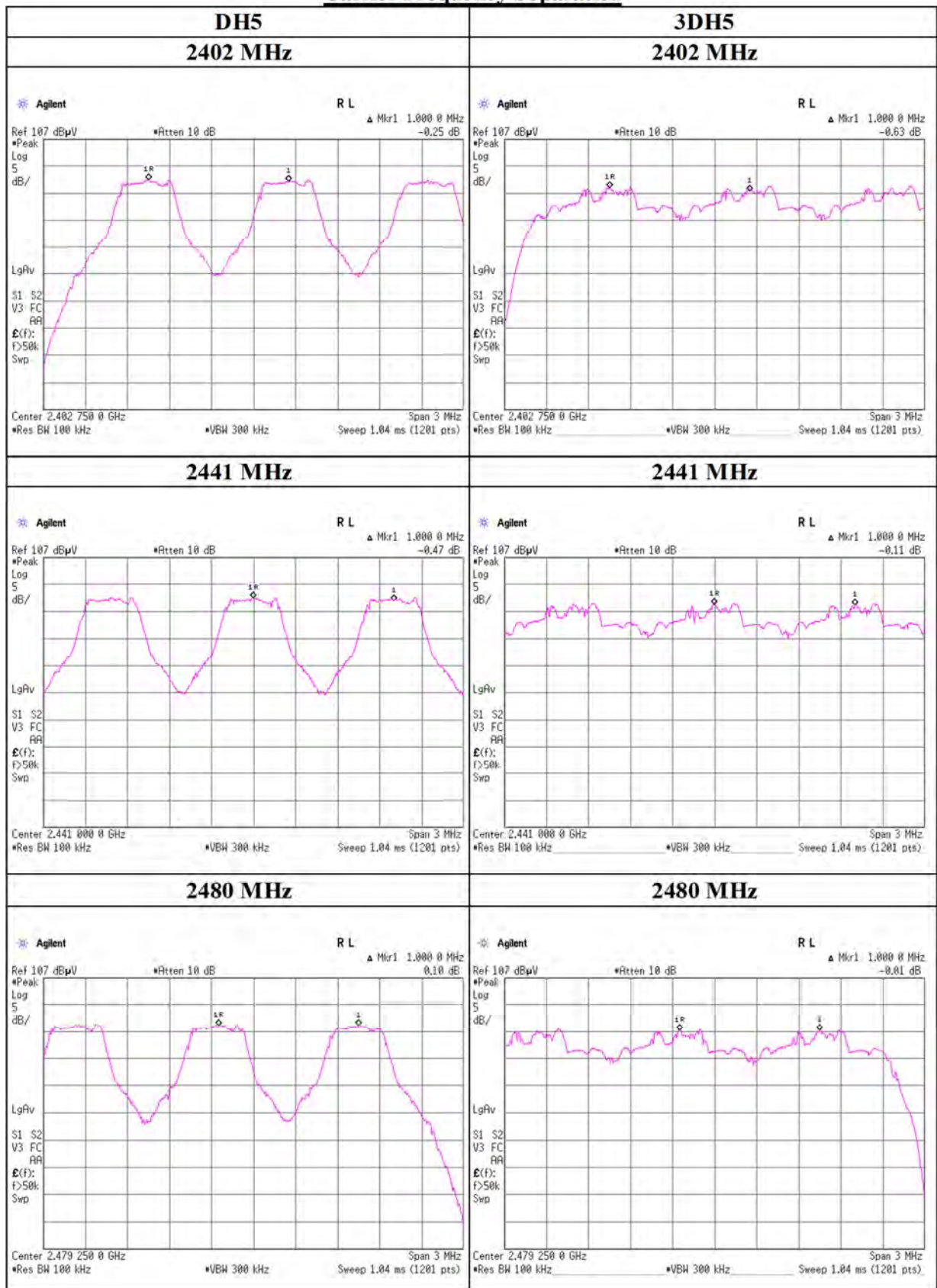
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### Carrier Frequency Separation



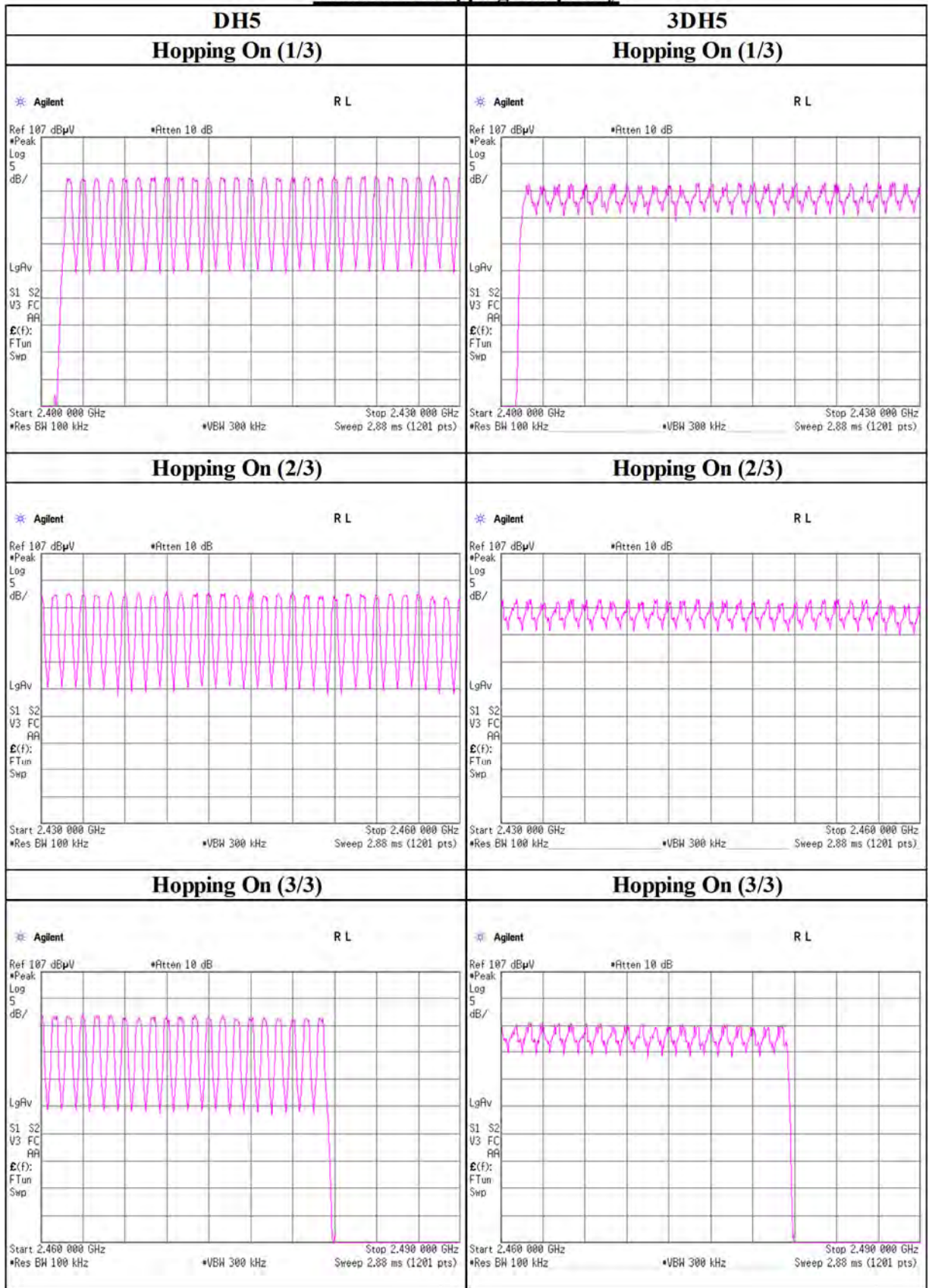
### **Number of Hopping Frequency**

Report No. 13977035S-B  
Test place Shonan EMC Lab. No.5 Shielded Room  
Date November 9, 2021  
Temperature / Humidity 24 deg. C / 42 % RH  
Engineer Miku Ikudome  
Mode Tx, Hopping On

Mode	Number of channel [channels]	Limit [channels]
DH5	79	$\geq 15$
3DH5	79	$\geq 15$

Test was not performed at AFH mode whose number of hopping channel is 20 channels because this Bluetooth radio is in compliance of Bluetooth Specification.

### Number of Hopping Frequency



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## Dwell time

Report No.	13977035S-B
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	November 9, 2021
Temperature / Humidity	24 deg. C / 42 % RH
Engineer	Miku Ikudome
Mode	Tx, Hopping On

Mode	Number of transmission in a 31.6 (79 Hopping x 0.4)			Length of transmission [ms]	Result [ms]	Limit [ms]
DH1	50.2 times /	5 s x	31.6 s = 318 times	0.407	129	400
DH3	26.4 times /	5 s x	31.6 s = 167 times	1.672	279	400
DH5	21.4 times /	5 s x	31.6 s = 136 times	2.918	397	400
3DH1	49.6 times /	5 s x	31.6 s = 314 times	0.411	129	400
3DH3	26.6 times /	5 s x	31.6 s = 169 times	1.669	282	400
3DH5	21.4 times /	5 s x	31.6 s = 136 times	2.924	398	400

Sample Calculation

Result = Number of transmission x Length of transmission

\*Average data of 5 tests.

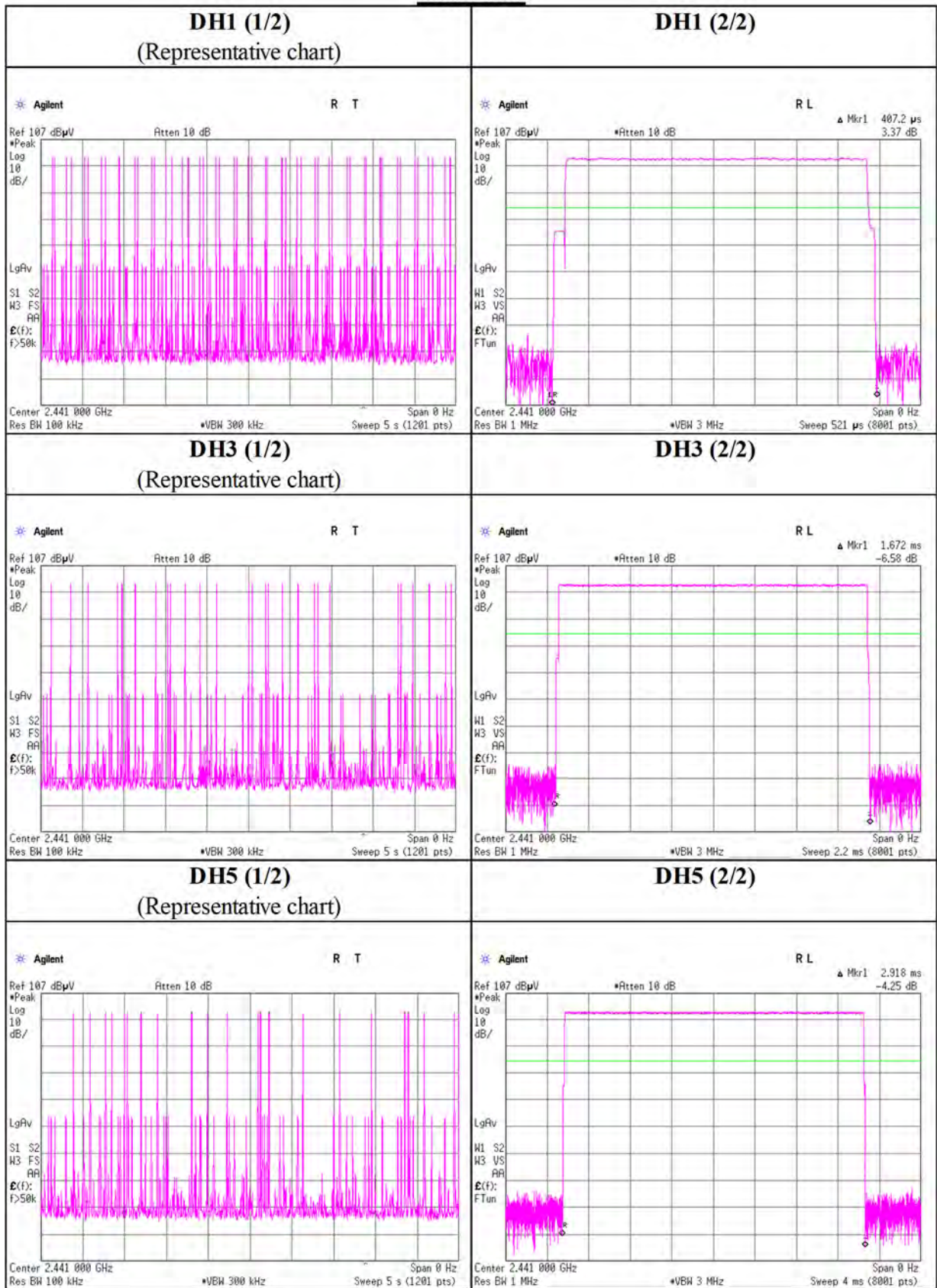
Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
DH1	50	52	51	48	50	50.2
DH3	27	26	28	25	26	26.4
DH5	22	22	22	21	20	21.4
3DH1	50	49	48	50	51	49.6
3DH3	25	26	28	28	26	26.6
3DH5	22	23	22	19	21	21.4

Sample Calculation

Average = Summation (Sampling 1 to 5) / 5

This device complies with the Bluetooth protocol for FHSS operation, employing a pseudo random channel selection and hopping rate to ensure that the occupancy time in  $N \times 0.4$  s, where  $N$  is the number of channels being used in the hopping sequence ( $20 \leq N \leq 79$ ), is always less than 0.4 s regardless of packet size. This is confirmed in the test report for  $N = 79$ .

### Dwell time



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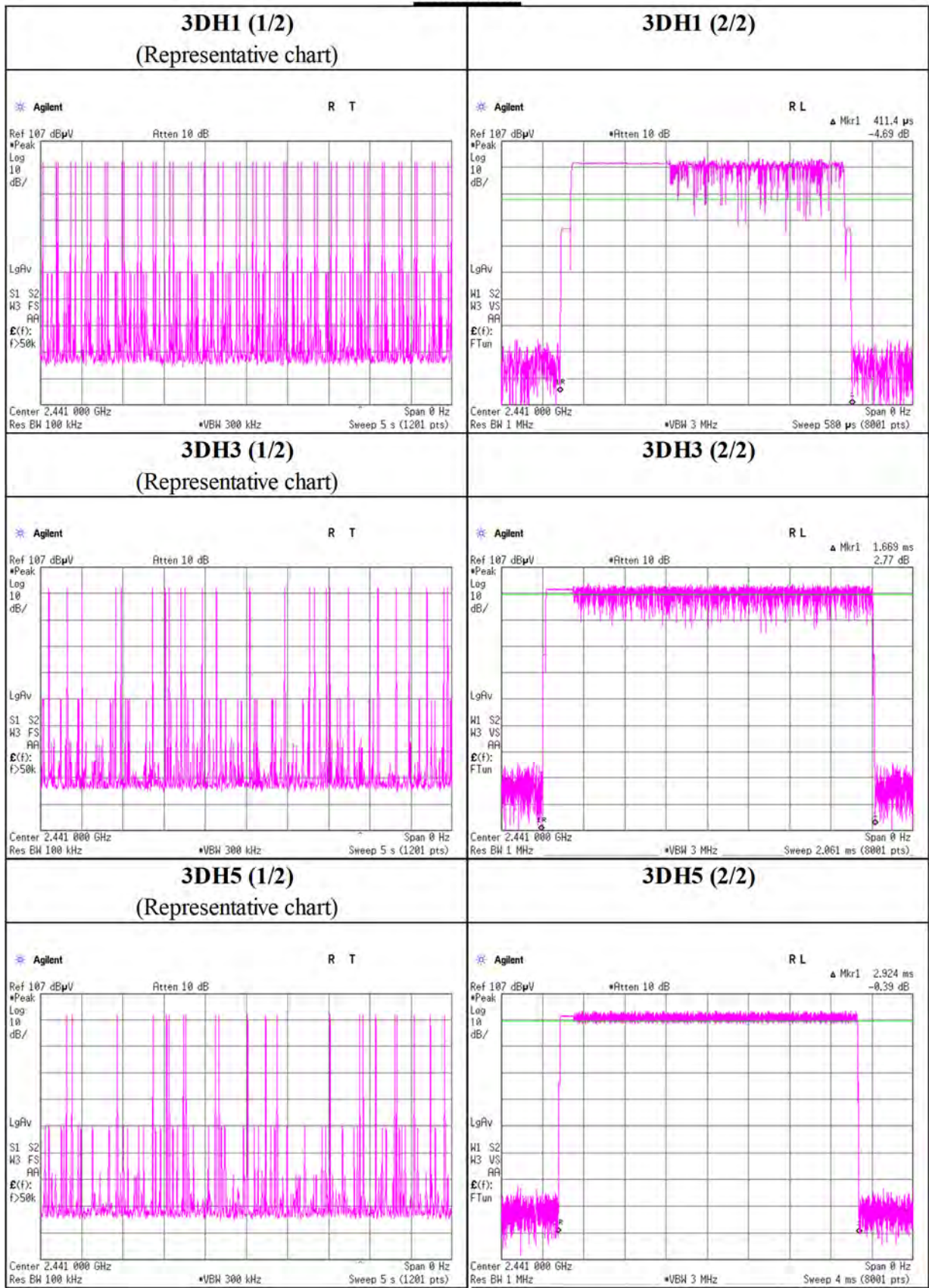
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### Dwell time



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## Maximum Peak Output Power

Report No. 13977035S-B  
Test place Shonan EMC Lab. No.1 Measurement Room  
Date October 25, 2021  
Temperature / Humidity 23 deg. C / 41 % RH  
Engineer Kenichi Adachi  
Mode Tx, Hopping Off

### Maximum peak output power

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Conducted Power					e.i.r.p. for RSS-247					
					Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
					[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
DH5	2402	-11.08	1.70	9.64	0.26	1.06	20.97	125	20.71	-0.20	0.06	1.01	36.02	4000	35.96
DH5	2441	-10.62	1.72	9.64	0.74	1.19	20.97	125	20.23	-0.20	0.54	1.13	36.02	4000	35.48
DH5	2480	-11.56	1.73	9.64	-0.19	0.96	20.97	125	21.16	-0.20	-0.39	0.91	36.02	4000	36.41
2DH5	2402	-10.61	1.70	9.64	0.73	1.18	20.97	125	20.24	-0.20	0.53	1.13	36.02	4000	35.49
2DH5	2441	-10.13	1.72	9.64	1.23	1.33	20.97	125	19.74	-0.20	1.03	1.27	36.02	4000	34.99
2DH5	2480	-11.12	1.73	9.64	0.25	1.06	20.97	125	20.72	-0.20	0.05	1.01	36.02	4000	35.97
3DH5	2402	-10.05	1.70	9.64	1.29	1.35	20.97	125	19.68	-0.20	1.09	1.29	36.02	4000	34.93
3DH5	2441	-9.58	1.72	9.64	1.78	1.51	20.97	125	19.19	-0.20	1.58	1.44	36.02	4000	34.44
3DH5	2480	-10.51	1.73	9.64	0.86	1.22	20.97	125	20.11	-0.20	0.66	1.16	36.02	4000	35.36

Sample Calculation:

Result = Reading + Cable Loss + Attenuator Loss

e.i.r.p. Result = Conducted Power Result + Antenna Gain

\*The equipment and cables were not used for factor 0 dB of the data sheets.

All comparison were carried out on same frequency and measurement factors.

Test was not performed at AFH mode, because the decrease of number of channel (min: 20 ch) at AFH mode does not influence on the output power and bandwidth of the EUT.  
As this device had AFH mode and frequency separation could not meet the requirement of over 20 dB BW without 2/3 relaxation, 125 mW power limit was applied to it.

### Average power (Reference data for RF Exposure)

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
					[dBm]	[mW]		[dBm]	[mW]
					[dBm]	[mW]	[dB]	[dBm]	[mW]
DH5	2402	-12.68	1.70	9.64	-1.34	0.73	1.10	-0.24	0.95
DH5	2441	-12.21	1.72	9.64	-0.85	0.82	1.10	0.25	1.06
DH5	2480	-13.23	1.73	9.64	-1.86	0.65	1.10	-0.76	0.84
2DH5	2402	-14.15	1.70	9.64	-2.81	0.52	1.10	-1.71	0.67
2DH5	2441	-13.65	1.72	9.64	-2.29	0.59	1.10	-1.19	0.76
2DH5	2480	-14.67	1.73	9.64	-3.30	0.47	1.10	-2.20	0.60
3DH5	2402	-14.15	1.70	9.64	-2.81	0.52	1.10	-1.71	0.67
3DH5	2441	-13.65	1.72	9.64	-2.29	0.59	1.10	-1.19	0.76
3DH5	2480	-14.67	1.73	9.64	-3.30	0.47	1.10	-2.20	0.60

Sample Calculation:

Result (Time average) = Reading + Cable Loss + Attenuator Loss

Result (Burst power average) = Result (Time average) + Duty factor

\*The equipment and cables were not used for factor 0 dB of the data sheets.

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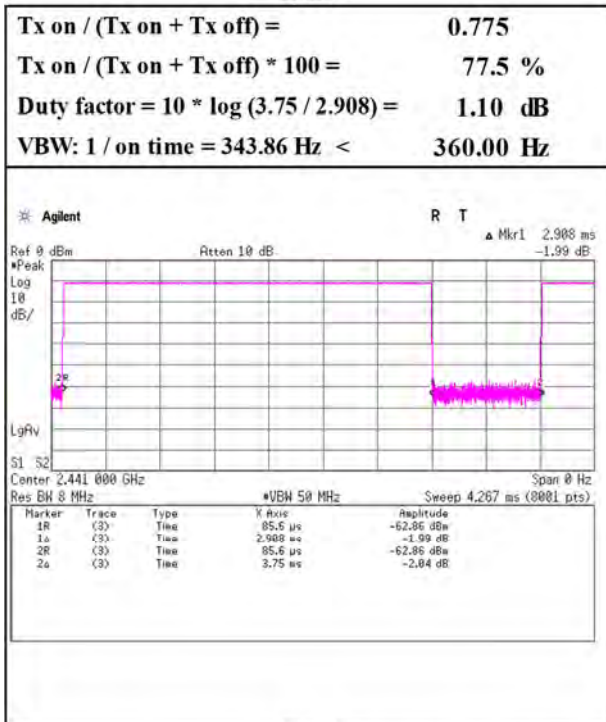
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

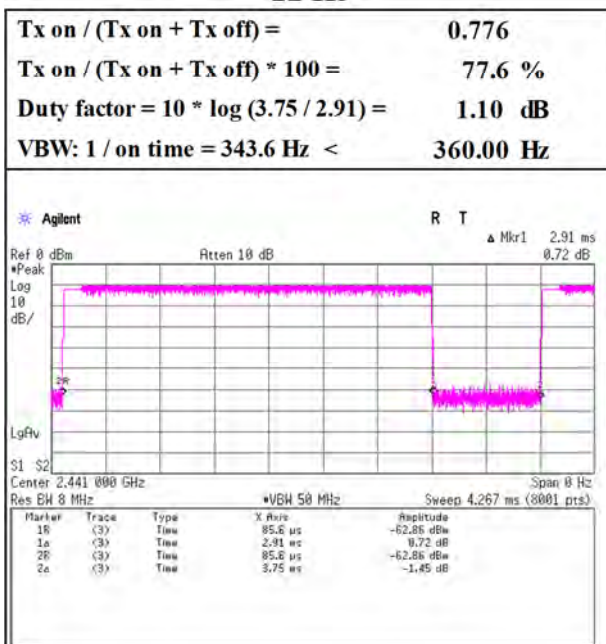
## Burst Rate Confirmation

Report No. 13977035S-B  
Test place Shonan EMC Lab. No.1 Measurement Room  
Date October 25, 2021  
Temperature / Humidity 23 deg. C / 41 % RH  
Engineer Kenichi Adachi  
Mode Tx, Hopping Off

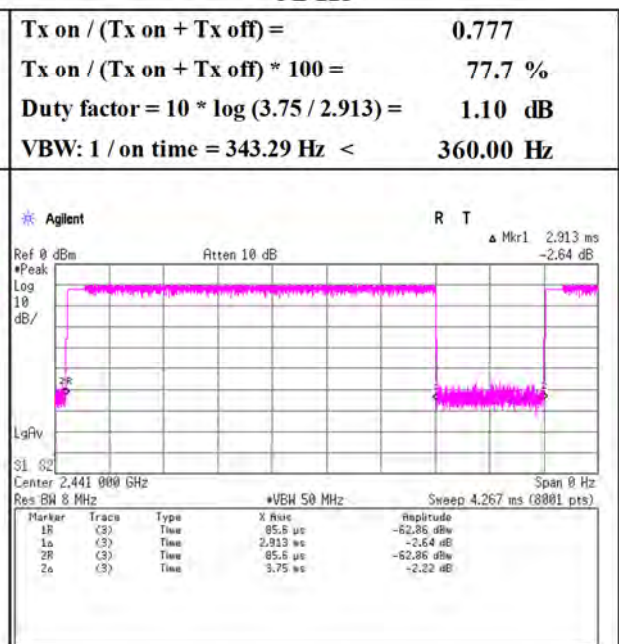
### DH5



### 2DH5



### 3DH5



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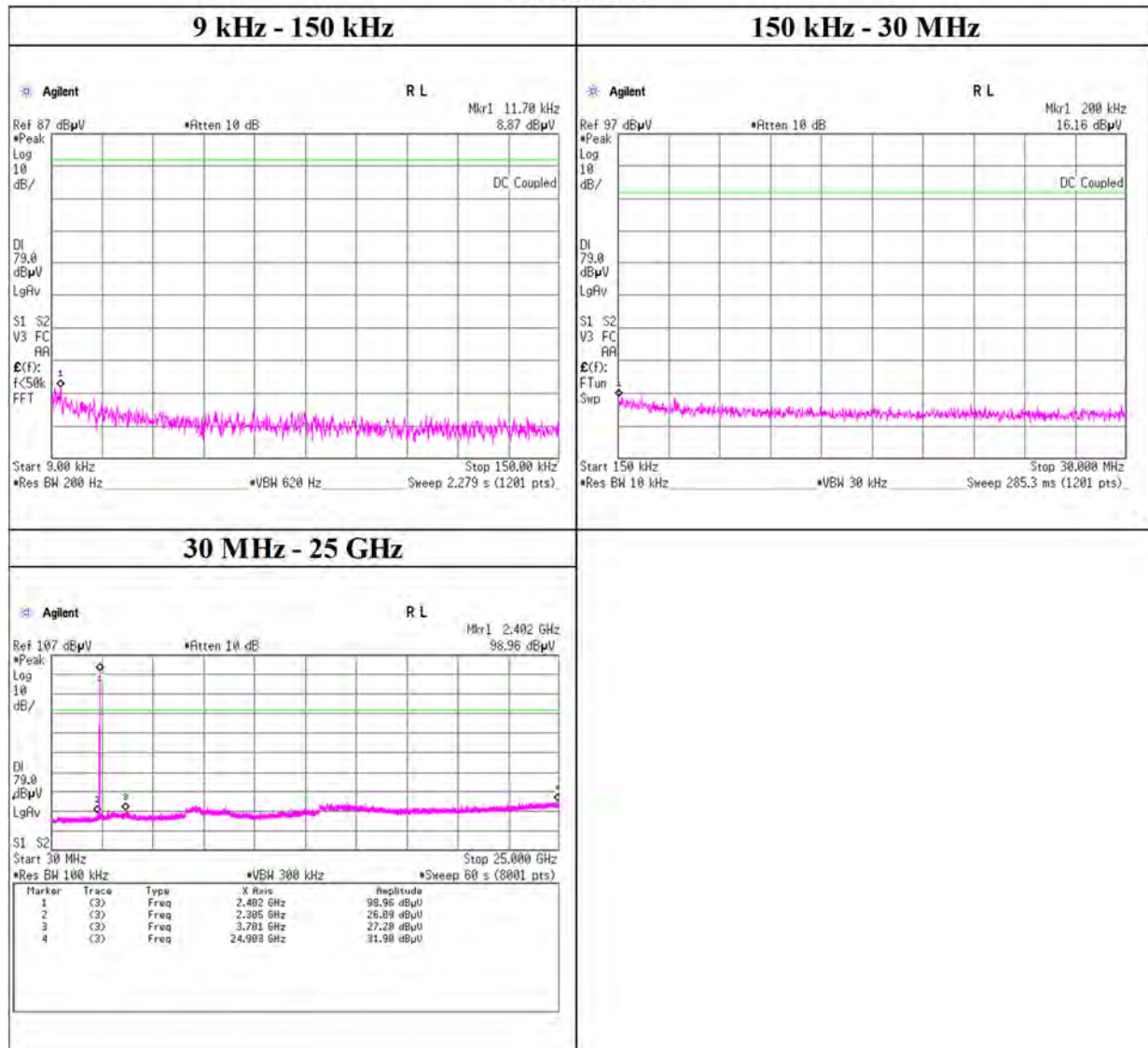
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

## Conducted Spurious Emission

Report No.	13977035S-B
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	November 15, 2021
Temperature / Humidity	21 deg. C / 30 % RH
Engineer	Takahiro Kawakami
Mode	Tx, Hopping Off, DH5

### 2402 MHz



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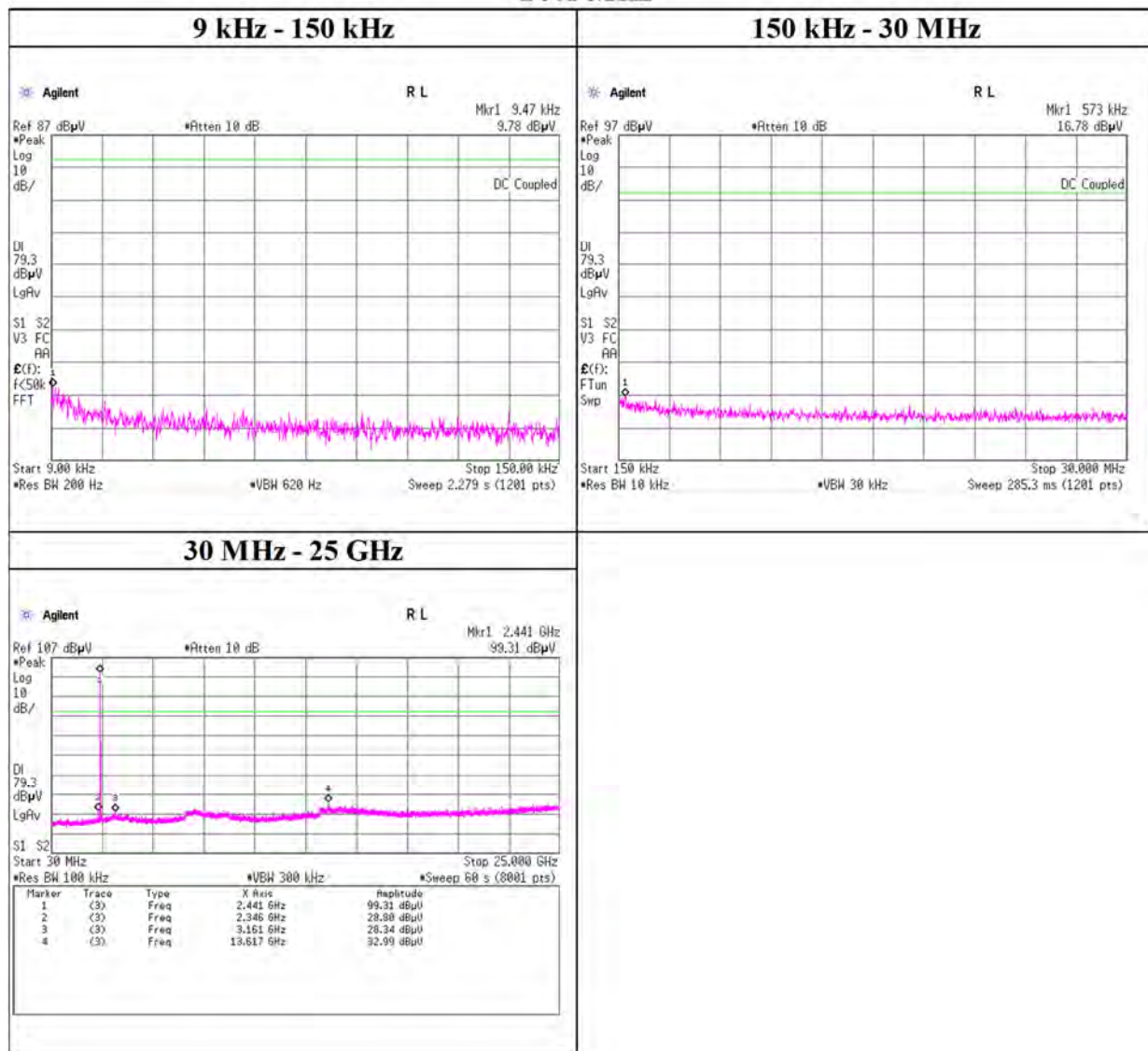
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## Conducted Spurious Emission

Report No.	13977035S-B
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	November 15, 2021
Temperature / Humidity	21 deg. C / 30 % RH
Engineer	Takahiro Kawakami
Mode	Tx, Hopping Off, DH5

### 2441 MHz



**UL Japan, Inc.**

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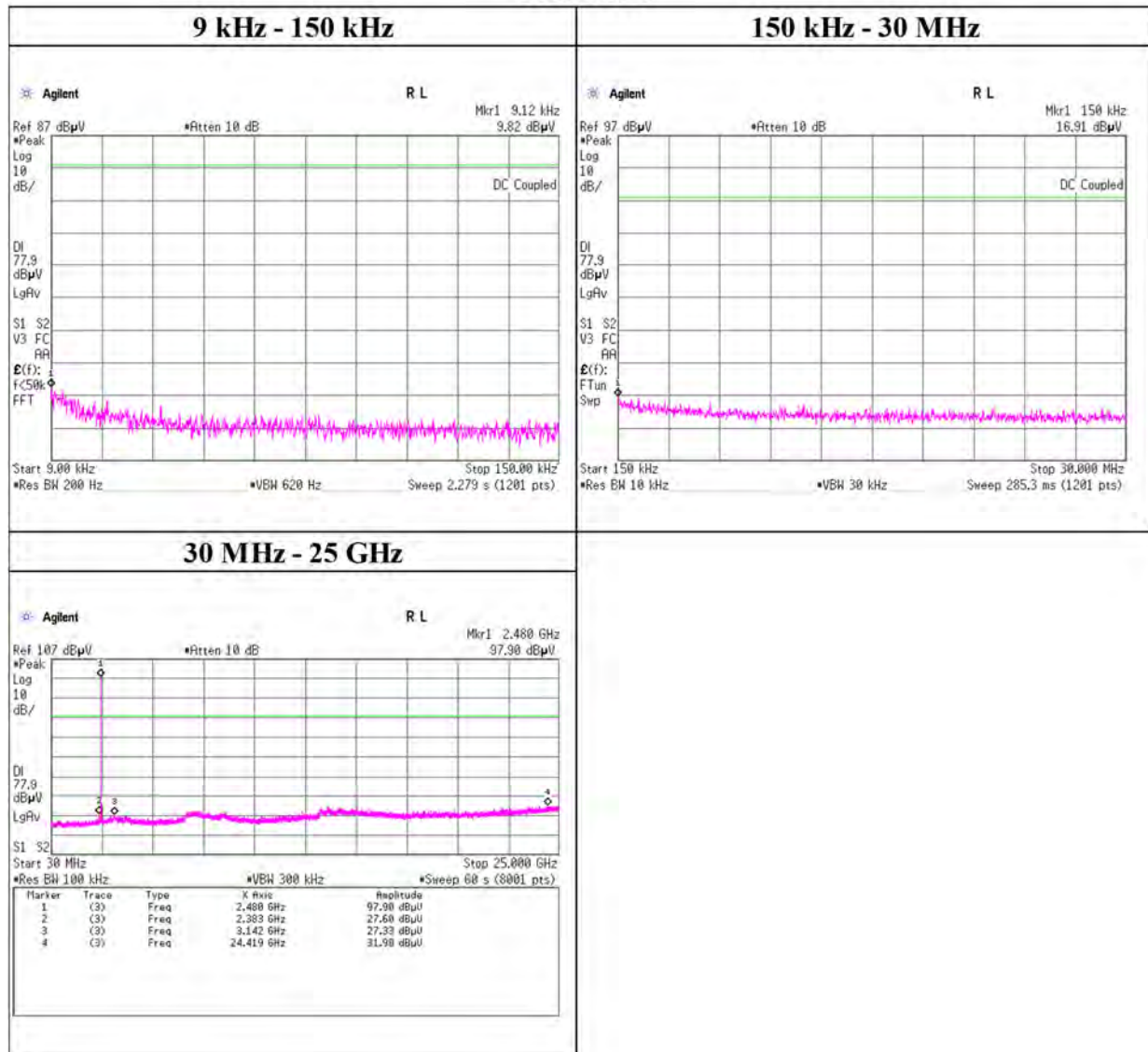
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

## Conducted Spurious Emission

Report No. 13977035S-B  
Test place Shonan EMC Lab. No.5 Shielded Room  
Date November 15, 2021  
Temperature / Humidity 21 deg. C / 30 % RH  
Engineer Takahiro Kawakami  
Mode Tx, Hopping Off, DH5

### 2480 MHz



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Shonan EMC Lab.

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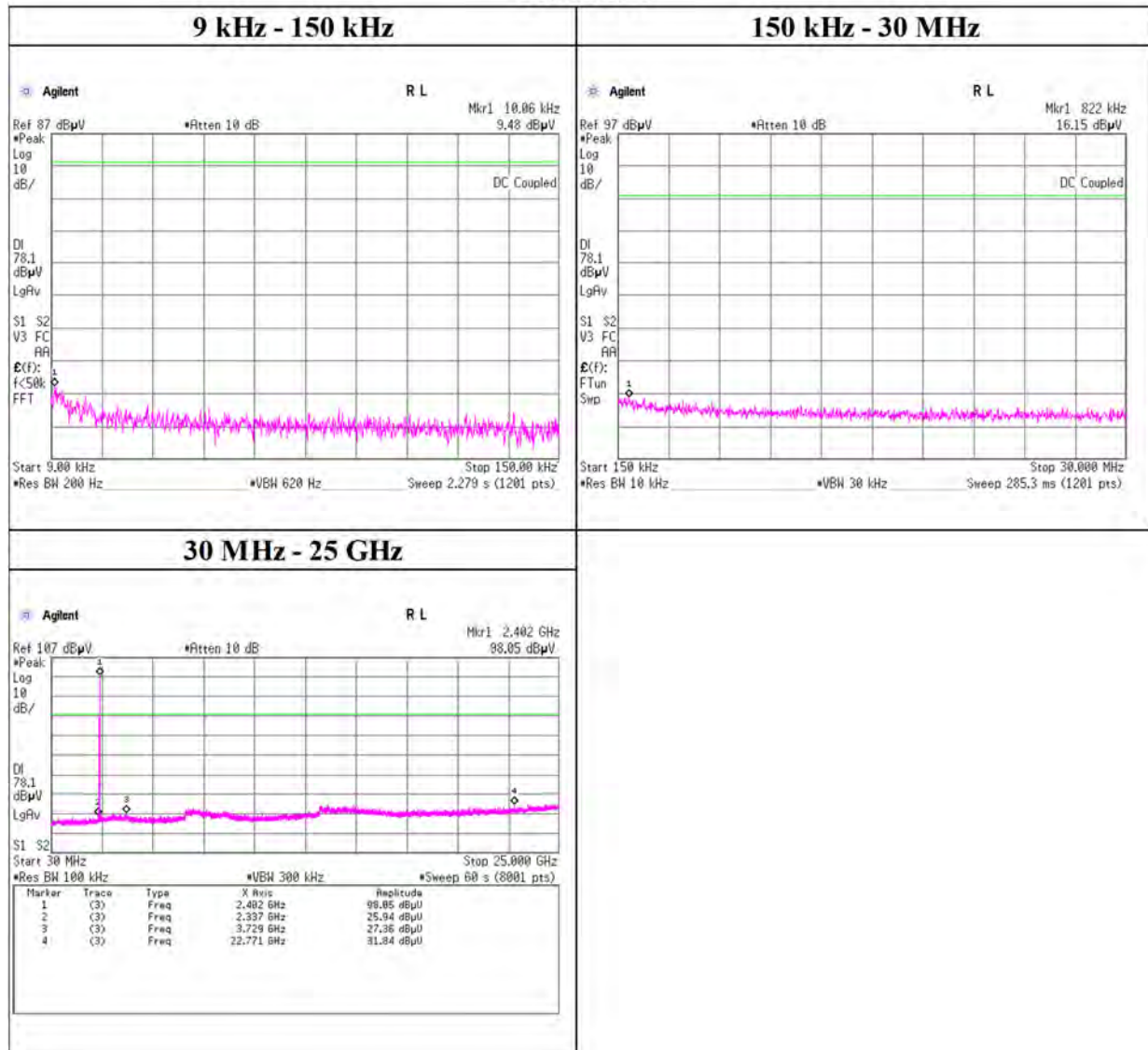
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

## Conducted Spurious Emission

Report No.	13977035S-B
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	November 15, 2021
Temperature / Humidity	21 deg. C / 30 % RH
Engineer	Takahiro Kawakami
Mode	Tx, Hopping Off, 3DH5

### 2402 MHz



**UL Japan, Inc.**

**Shonan EMC Lab.**

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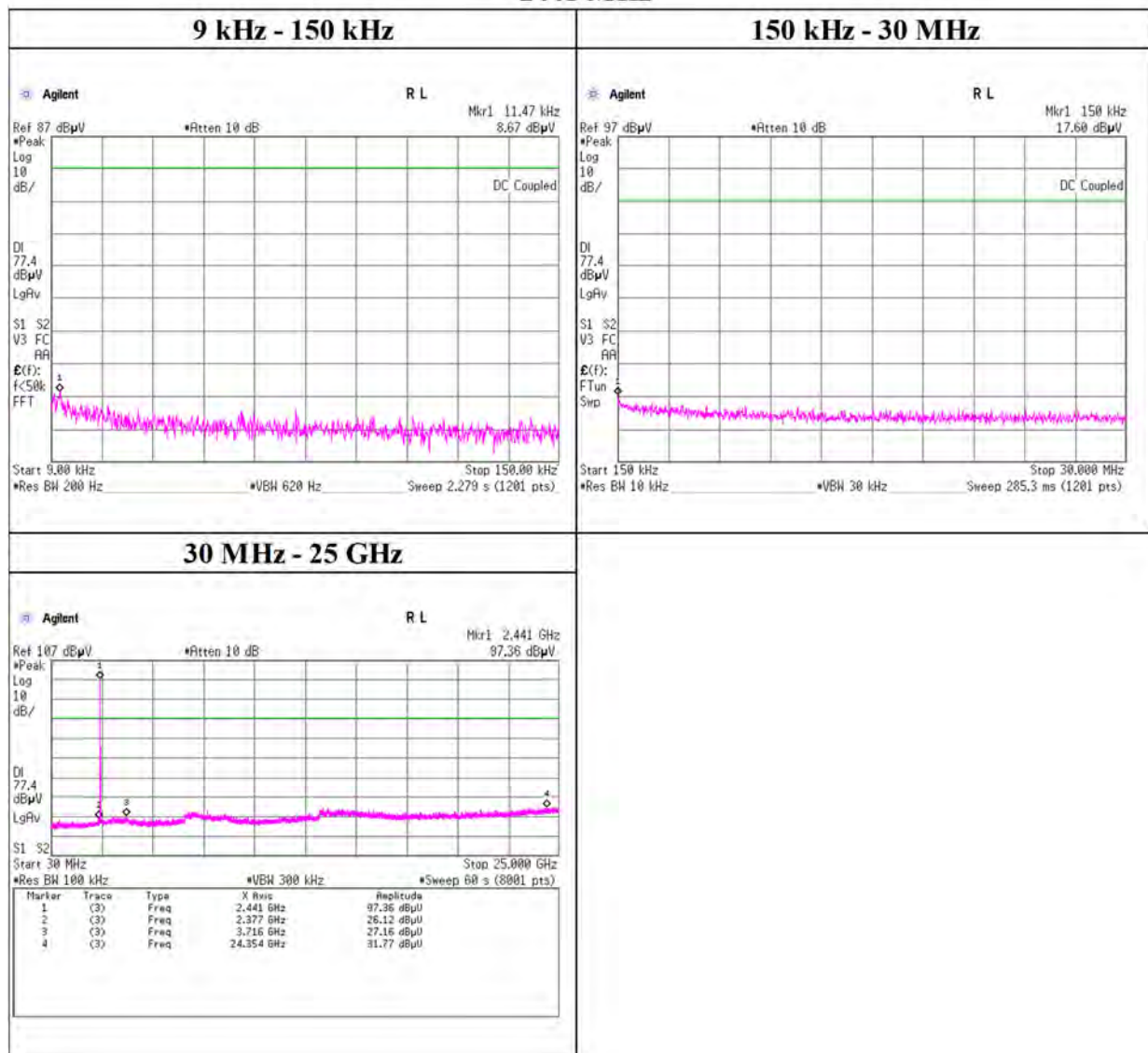
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

## Conducted Spurious Emission

Report No.	13977035S-B
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	November 15, 2021
Temperature / Humidity	21 deg. C / 30 % RH
Engineer	Takahiro Kawakami
Mode	Tx, Hopping Off, 3DH5

### 2441 MHz



**UL Japan, Inc.**

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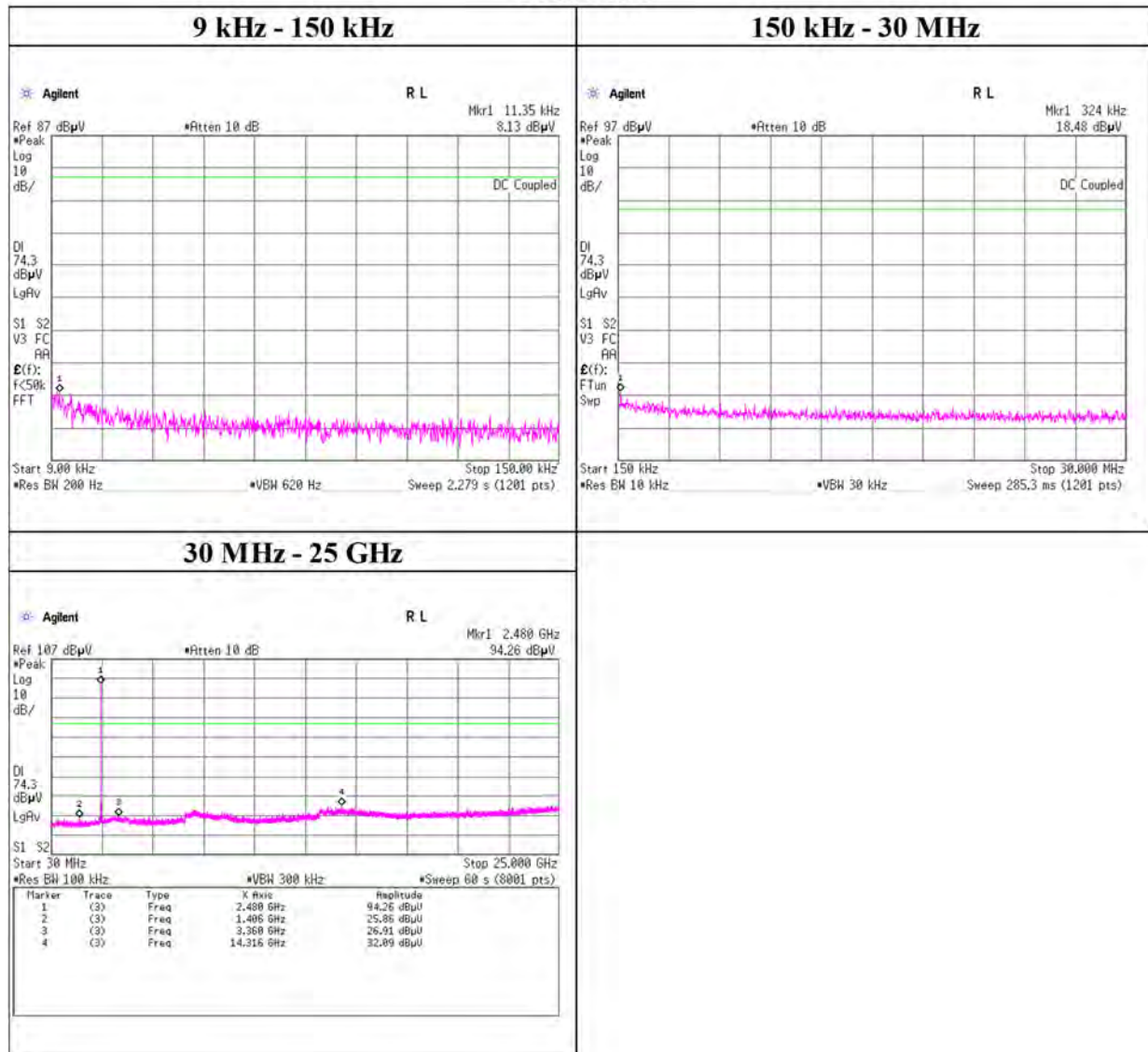
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

## Conducted Spurious Emission

Report No.	13977035S-B
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	November 15, 2021
Temperature / Humidity	21 deg. C / 30 % RH
Engineer	Takahiro Kawakami
Mode	Tx, Hopping Off, 3DH5

### 2480 MHz



**UL Japan, Inc.**

**Shonan EMC Lab.**

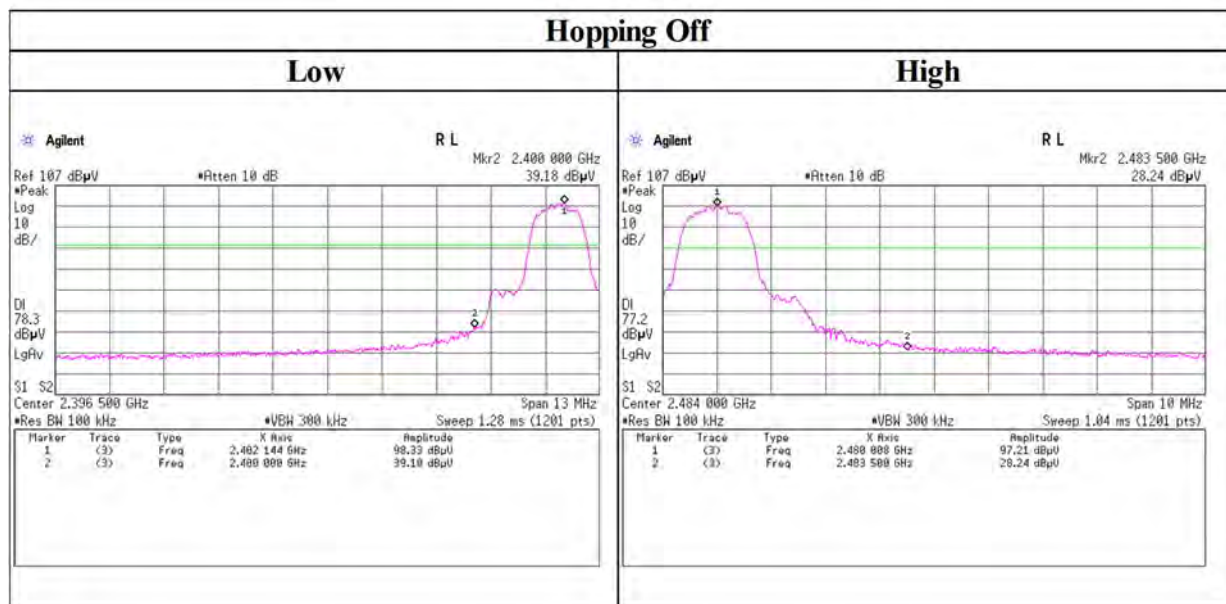
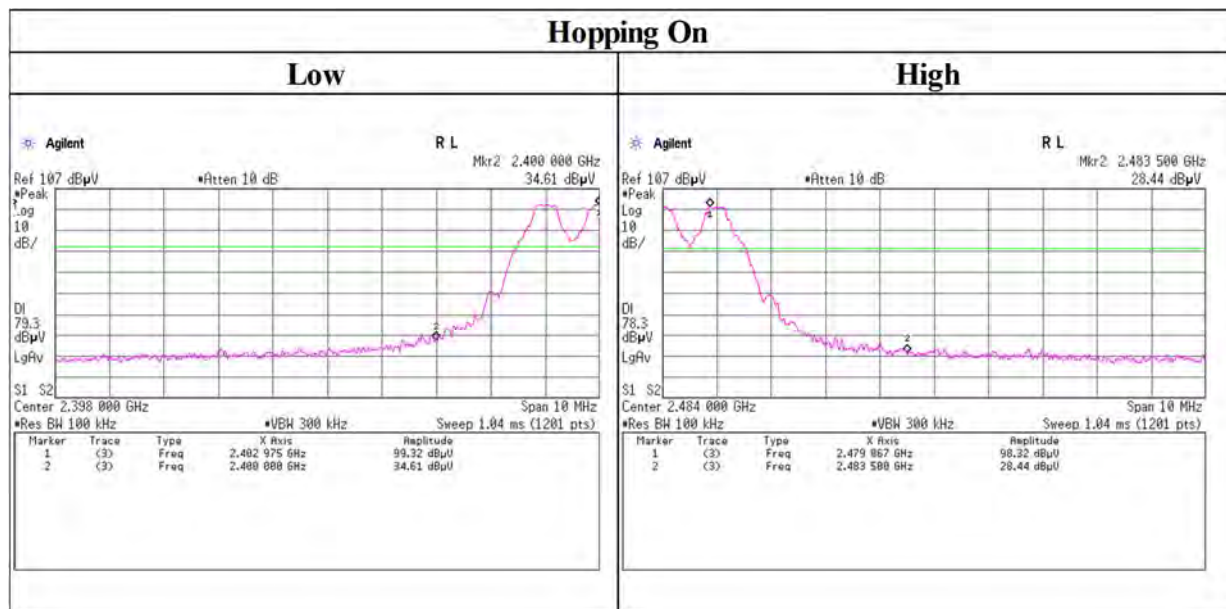
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

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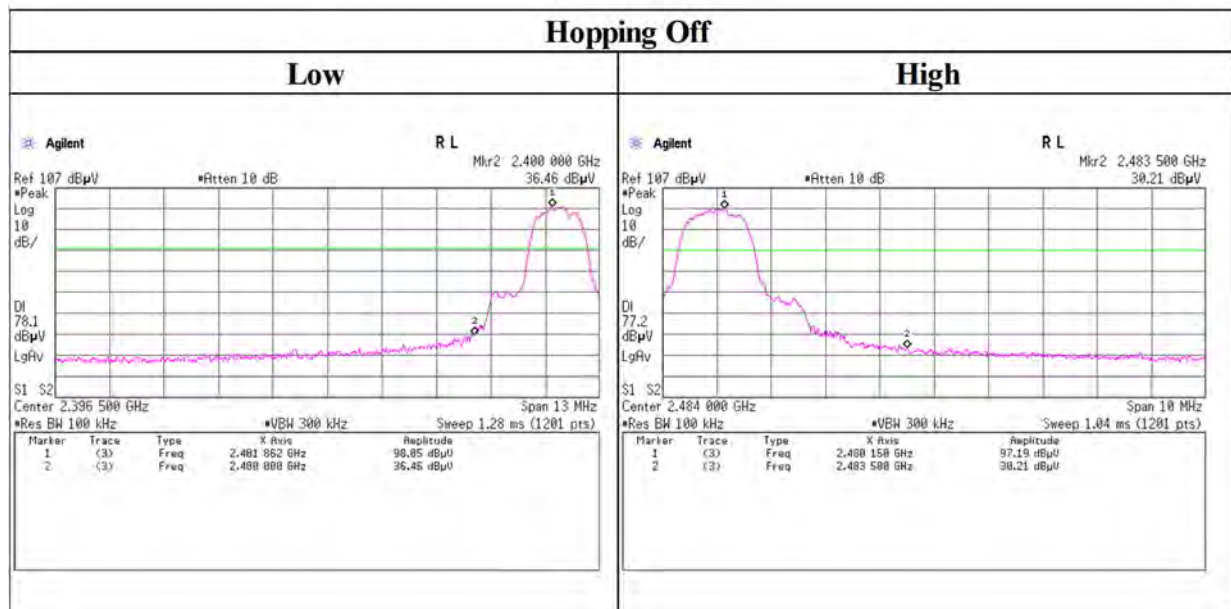
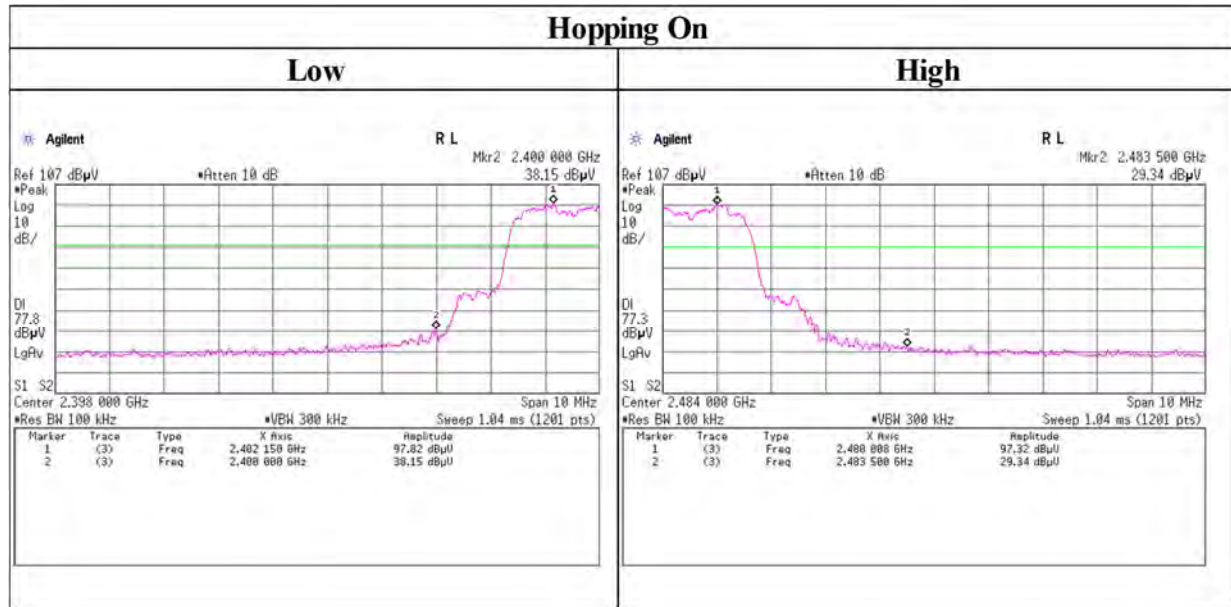
## Conducted Emission Band Edge compliance

Report No. 13977035S-B  
Test place Shonan EMC Lab. No.5 Shielded Room  
Date November 15, 2021  
Temperature / Humidity 21 deg. C / 30 % RH  
Engineer Takahiro Kawakami  
Mode Tx DH5



## Conducted Emission Band Edge compliance

Report No.	13977035S-B
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	November 15, 2021
Temperature / Humidity	21 deg. C / 30 % RH
Engineer	Takahiro Kawakami
Mode	Tx 3DH5



## **APPENDIX 2: Test instruments**

### **Test equipment**

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
AT	KTS-08	145095	Digital Tester	SANWA	PC500	7019224	2021/04/26	12
AT	SAT10-09	145132	Attenuator	Weinschel Corp.	54A-10	W5692	2021/10/05	12
AT	SCC-G14	145175	Coaxial Cable	Suhner	SUCOFLEX 102	31600/2	2020/12/21	12
AT	SCC-H22	197396	Microwave cable	RS Pro	R-132G7210 100CO	-	2021/04/08	12
AT	SCC-H23	199603	Microwave cable	RS Pro	R-132G7210 100CO	-	2021/06/14	12
AT	SOS-27	191845	Humidity Indicator	CUSTOM. Inc	CTH-201	-	2021/08/02	12
AT	SOS-28	191846	Humidity Indicator	CUSTOM. Inc	CTH-201	-	2021/08/02	12
AT	SPM-06	146267	Power Meter	Anritsu Corporation	ML2495A	850009	2021/05/25	12
AT	SPSS-03	146309	Power sensor	Anritsu Corporation	MA2411B	917063	2021/05/25	12
AT	SRENT-09	150461	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46186392	2021/02/22	12
AT	SRENT-15	160899	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46185516	2021/01/26	12
AT	STM-G7	171614	Terminator	Weinschel - API Technologies Corp	M1459A	88995	2021/05/17	12
AT	STS-05	146212	Digital Hitester	HIOKI E.E. CORPORATION	3805-50	80997828	2021/09/14	12

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

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

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

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

Test item: AT: Antenna Terminal Conducted Tests