

RADIO TEST REPORT

Test Report No. 14872837S-A-R1

Customer	Sony Corporation, Japan & Sony Group Companies
Description of EUT	AV Receiver
Model Number of EUT	XAV-3600
FCC ID	AK8XAV3600
Test Regulation	FCC Part 15 Subpart C
Test Result	Complied
Issue Date	January 25, 2024
Remarks	-

Representative Test EngineerHiromasa Sato
Engineer**Approved By**Kazuya Noda
Leader

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".

Report Cover Page - Form-ULID-003532 (DCS:13-EM-F0429) Issue# 23.0

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REVISION HISTORY

Original Test Report No.: 14872837S-A

This report is a revised version of 14872837S-A. 14872837S-A is replaced with this report.

Revision	Test Report No.	Date	Page Revised Contents
- (Original)	14872837S-A	January 15, 2024	-
1	14872837S-A-R1	January 25, 2024	Sec.5 Correction of text From: "The test results and limit are rounded off to one decimal place, so some differences might be observed. To: "Test results are rounded off and limit are rounded down, so some differences might be observed."

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

CONTENTS	PAGE
SECTION 1: Customer Information	5
SECTION 2: Equipment Under Test (EUT).....	5
SECTION 3: Test Specification, Procedures & Results	7
SECTION 4: Operation of EUT during testing	10
SECTION 5: Radiated Spurious Emission.....	14
SECTION 6: Antenna Terminal Conducted Tests	16
APPENDIX 1: Test data	17
20dB Bandwidth, 99%Occupied Bandwidth and Carrier Frequency Separation	17
Number of Hopping Frequency.....	21
Dwell time	23
Maximum Peak Output Power	26
Average Output Power.....	27
Radiated Spurious Emission.....	29
Conducted Spurious Emission.....	40
Conducted Emission Band Edge compliance	46
APPENDIX 2: Test Instruments	48
APPENDIX 3: Photographs of test setup.....	50
Radiated Spurious Emission.....	50
Antenna Terminal Conducted Tests	51

SECTION 1: Customer Information

Company Name	Sony Corporation, Japan & Sony Group Companies
Address	700/402 Moo. 7, Amata City Chonburi Industrial Estate, Don Hua Roh, Muang Chonburi, Chonburi 20000, Thailand
Telephone Number	+66-38-214-900-17 Ext : 1932
Contact Person	Jumroen Phaoenchoke

The information provided from the customer is as follows;

- Customer, Description of EUT, Model Number of EUT, FCC ID on the cover and other relevant pages
- Operating/Test Mode(s) (Mode(s)) on all the relevant pages
- SECTION 1: Customer Information
- SECTION 2: Equipment Under Test (EUT) other than the Receipt Date and Test Date
- SECTION 4: Operation of EUT during testing

SECTION 2: Equipment Under Test (EUT)

2.1 Identification of EUT

Description	AV Receiver
Model Number	XAV-3600
Serial Number	Refer to SECTION 4.2
Condition	Engineering prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	No Modification by the test lab
Receipt Date	September 22, 2023
Test Date	September 27 to October 3, 2023

2.2 Product Description

General Specification

Rating	DC 12 V
Operating temperature	0 deg. C to 40 deg. C

Radio Specification

This report contains data provided by the customer which can impact the validity of results. UL Japan, Inc. is only responsible for the validity of results after the integration of the data provided by the customer. The data provided by the customer is marked "a)" in the table below.

Equipment Type	Transceiver
Frequency of Operation	2402 MHz to 2480 MHz
Type of Modulation	FHSS (GFSK, $\pi/4$ DQPSK, 8 DPSK)
Antenna Gain ^{a)}	-0.63 dBi (Peak), -4.86 dBi (Average)

FM/AM tuner specification

FM tuner specification:

Frequency of operation: 87.5 MHz to 107.9 MHz

AM tuner specification:

Frequency of operation: 530 kHz to 1710 kHz

2.3 Variant model(s)

Model	XAV-3600	XAV-1600	XAV-1600	Comparison
Trial No	SK-3240	SK-3240	SK-3240	
Destination	UC	E	IN	
Comparison model	Original	Similar	Similar	
Category name	AV Receiver	AV Receiver	AV Receiver	
Panel Design	Value(Global)	Value(Global)	Value(Global)	
Screen Size	6.75inch / 171 mm	6.75inch / 171 mm	6.75inch / 171 mm	Same
Touch Panel	Resistive + AG	Resistive + AG	Resistive + AG	Same
Tuner	Value(Global)	Value(Global)	Value(Global)	
FM:Tuning range(MHz)	87.5-107.9	87.5-107.9, 87.5-108.0	87.5-107.9, 87.5-108.0	Difference
AM:Tuning range(kHz)	530-1710	530-1710, 531-1602	530-1710, 531-1602	Difference
DAB	No	No	No	Same
Other features	Value(Global)	Value(Global)	Value(Global)	
Card Remote	No	No	No	Same
Card Remote name	No	No	No	Same
External microphone	Supplied	Supplied	Supplied	Same
Plate window (Printing)	XAV-3600	XAV-1600	XAV-1600	Difference
Label model number (Printing)	XAV-3600	XAV-1600	XAV-1600	Difference
USB	Yes (Rear x1)	Yes (Rear x1)	Yes (Rear x1)	Same
SiriusXM Ready	No	No	No	Same
HDMI IN	Yes	No	No	Difference
Rear View Camera Input	Yes	Yes	Yes	Same
WLAN (2.4 GHz)	No	No	No	Same
WLAN (5GHz)	No	No	No	Same

SECTION 3: Test Specification, Procedures & Results

3.1 Test Specification

Test Specification	FCC Part 15 Subpart C The latest version on the first day of the testing period
Title	FCC 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	*1)
Carrier Frequency Separation	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: -	FCC: Section15.247(a)(1) ISED: RSS-247 5.1 (b)	See data.	Complied	Conducted
20dB Bandwidth	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: -	FCC: Section15.247(a)(1) ISED: RSS-247 5.1 (a)		Complied	Conducted
Number of Hopping Frequency	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: -	FCC: Section15.247(a)(1)(iii) ISED: RSS-247 5.1 (d)		Complied	Conducted
Dwell time	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: -	FCC: Section15.247(a)(1)(iii) ISED: RSS-247 5.1 (d)		Complied	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: RSS-Gen 6.12	FCC: Section15.247(b)(1) ISED: RSS-247 5.4 (b)		Complied	Conducted
Spurious Emission & Band Edge Compliance	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: RSS-Gen 6.13	FCC: Section15.247(d) ISED: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	5.0 dB 490.932 MHz, QP, Hori. Mode: Tx, 3DH5 2441 MHz	Complied	Conducted/ Radiated (above 30 MHz) *2)
Note: UL Japan, Inc.'s EMI Work Procedures: Work Instructions-ULID-003591 and Work Instructions-ULID-003593. * In case any questions arise about test procedure, ANSI C63.10: 2013 is also referred. *1) The test is not applicable since the EUT does not have AC power ports. *2) Radiated test was selected over 30 MHz based on section 15.247(d).					

FCC Part 15.31 (e)

The EUT provides stable voltage constantly to the wireless transmitter 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.

3.3 Addition to Standard

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

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

3.4 Uncertainty

Measurement uncertainty is not taken into account when stating conformity with a specified requirement.
Note: When margins obtained from test results are less than the measurement uncertainty, the test results may exceed the limit.

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

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

Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1 GHz (Average Detector) SPM-06	1.3 dB
Power Measurement above 1 GHz (Peak Detector) SPM-06	2.1 dB
Power Measurement above 1 GHz (Average Detector) SPM-07	1.1 dB
Power Measurement above 1 GHz (Peak Detector) SPM-07	1.2 dB
Power Measurement above 1 GHz (Average Detector) SPM-13	1.1 dB
Power Measurement above 1 GHz (Peak Detector) SPM-13	1.4 dB
Spurious Emission (Conducted) below 1 GHz	0.84 dB
Conducted Emissions Power Density Measurement 1 GHz-3 GHz	0.86 dB
Conducted Emissions Power Density Measurement 3 GHz-18 GHz	2.4 dB
Spurious Emission (Conducted) 18 GHz-26.5 GHz	2.4 dB
Spurious Emission (Conducted) 26.5 GHz-40 GHz	2.2 dB
Bandwidth Measurement	0.012 %
Duty Cycle and Time Measurement	0.27 %
Temperature SCH-01	0.87 deg. C
Humidity SCH-01	3.5 %
Temperature SCH-02	2.0 deg .C
Humidity SCH-02	6.7 %
Voltage	0.92 %

3.5 Test Location

UL Japan, Inc. Shonan EMC Lab.

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

Telephone: +81-463-50-6400

A2LA Certificate Number: 1266.03

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

Test 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)

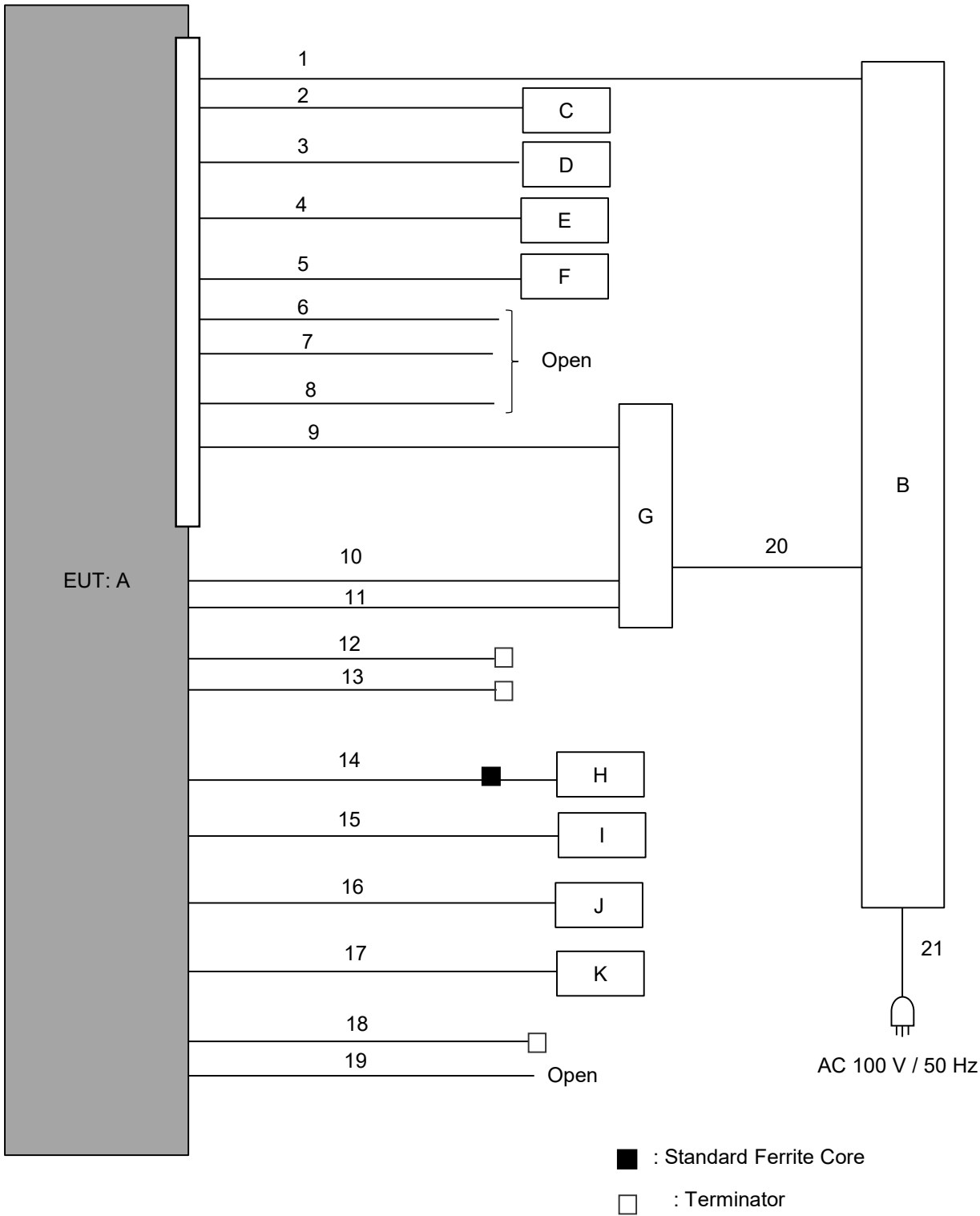
Mode	Remarks*
Bluetooth (BT)	BR / EDR, Payload: PRBS9
*EUT has the power settings by the software as follows; Power Setting: BDR: Ext=23, Int=39 EDR: Ext=73, Int=48 Software: CPU : 0100 MCU : 0200 DSP : 3750 OSD : 2010091935 Software: CSR BlueSuite BlueTest Version 2.5.8 (Date: 2017.10.30, Storage location: Driven by connected PC) *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.	

Details of Operating Mode(s)

Test Item	Mode	Hopping	Tested Frequency
Radiated Spurious Emission (Below 1 GHz)	Tx 3DH5 *1)	Off	2441 MHz
Radiated Spurious Emission (Above 1 GHz), Conducted Spurious Emission	Tx DH5 Tx 3DH5	Off	2402 MHz 2441 MHz 2480 MHz
Carrier Frequency Separation	Tx DH5 Tx 3DH5	On	2402 MHz 2441 MHz 2480 MHz
20dB Bandwidth	Tx DH5 Tx 3DH5	Off	2402 MHz 2441 MHz 2480 MHz
Number of Hopping Frequency	Tx DH5 Tx 3DH5	On	-
Dwell time	Tx DH1, DH3, DH5 Tx 3DH1, 3DH3, 3DH5	On	-
Maximum Peak Output Power	Tx DH5 Tx 2DH5 Tx 3DH5	Off	2402 MHz 2441 MHz 2480 MHz
Band Edge Compliance (Conducted)	Tx DH5 Tx 3DH5	On ----- Off	2402 MHz 2480 MHz
99% Occupied Bandwidth	Tx DH5 Tx 3DH5	On ----- Off	2402 MHz 2441 MHz 2480 MHz
*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) *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. *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. *1) Conducted emissions and Spurious emissions for frequencies below 1 GHz were limited to the channel that had the highest power during the antenna terminal test, as preliminary testing indicated that changing the operating frequency had no significant impact on the emissions in those frequency bands.			

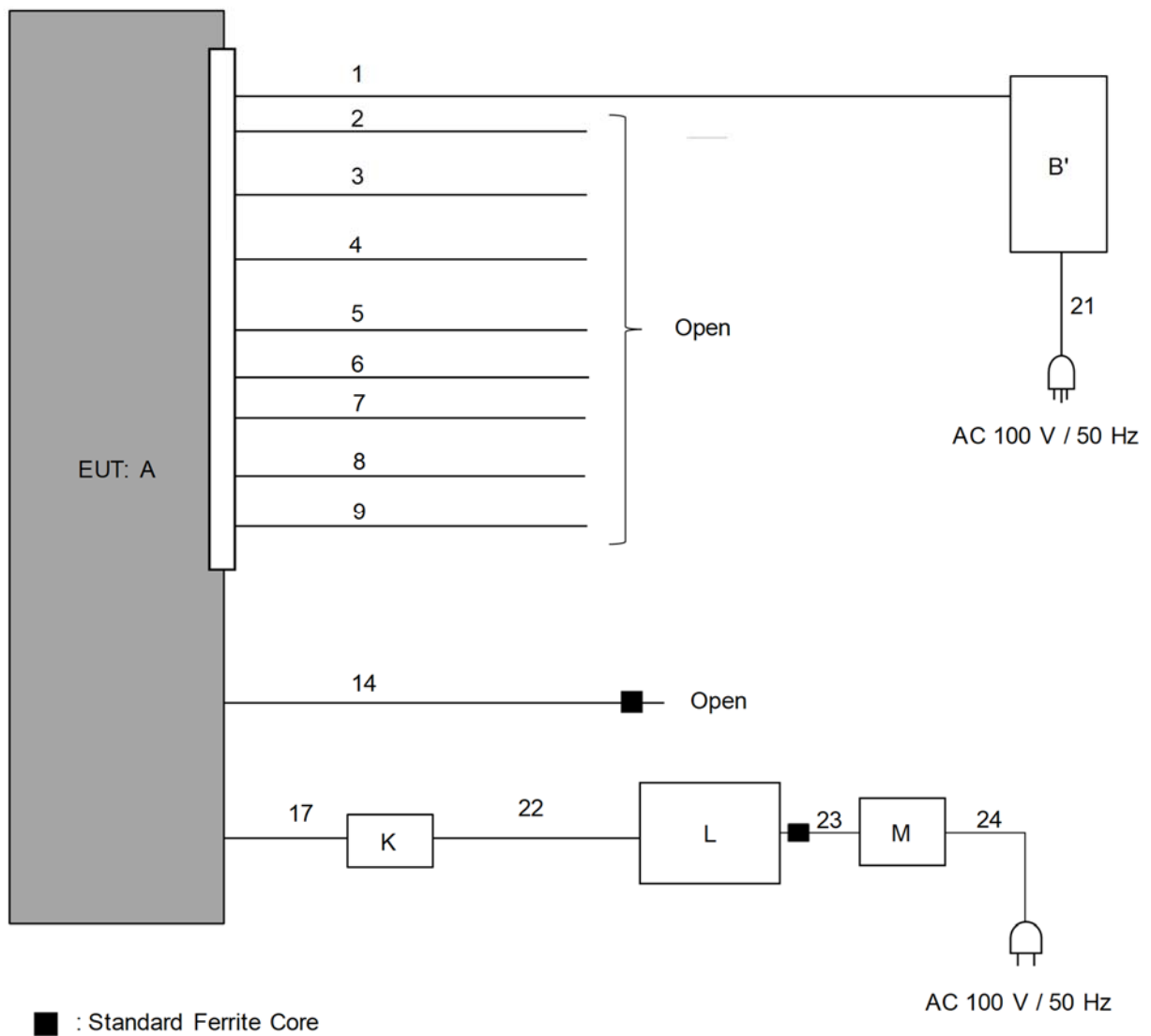
4.2 Configuration and Peripherals

<For Radiated Emission test>



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

<For Antenna Terminal Conducted test >



Description of EUT and Support Equipment

No.	Item	Model number	Serial Number	Manufacturer	Remarks
A	AV Receiver	XAV-3600	0000002 *1) 0000001 *2)	SONY	EUT
B	Power Supply(DC)	PAN35-10A	DE001677	KIKUSUI	-
B'		PAN60-10A	NL002383	KIKUSUI	-
C	Speaker	LV-002	S11014200775	L&V	-
D	Speaker	LV-002	S11014200775	L&V	-
E	Speaker	LV-002	S11014200773	L&V	-
F	Speaker	LV-002	S11014200773	L&V	-
G	Amplifier	XM-GS4	0000052	SONY	-
H	USB	USB Memory	USM16GU	SONY	-
I	Microphone	-	-	SONY	-
J	Wired Remote Controller	RM-X4S	-	SONY	-
K	Jig Board	-	-	-	*3)
L	Laptop Computer	7666-77J	LV-B8PZ8 08/05	Lenovo	-
M	AC Adapter	92P1213	11S92P1213Z1ZDD Z92C2WU	Lenovo	-

*1) Used for Radiated Emission test.

*2) Used for Antenna Terminal Conducted test.

*3) This support equipment is for testing and is not included with products.

List of Cables Used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC	0.15+0.05+3.3	Unshielded	Unshielded	-
2	Speaker	0.15+2.8	Unshielded	Unshielded	-
3	Speaker	0.15+2.8	Unshielded	Unshielded	-
4	Speaker	0.15+2.8	Unshielded	Unshielded	-
5	Speaker	0.15+2.8	Unshielded	Unshielded	-
6	ILL	0.15+1.0	Unshielded	Unshielded	-
7	REVERSE IN	0.15+1.0	Unshielded	Unshielded	-
8	Parking Brake	2.0	Unshielded	Unshielded	-
9	REM OUT	0.15+0.3+1.0	Unshielded	Unshielded	-
10	AUDIO OUT1	1.2	Shielded	Shielded	-
11	AUDIO OUT2	1.4	Shielded	Shielded	-
12	REAR CAMERA IN	2.0	Shielded	Shielded	-
13	SUB OUT	1.5	Shielded	Shielded	-
14	USB	1.5	Shielded	Shielded	-
15	Microphone	3.5	Shielded	Shielded	-
16	Wired Remote Controller	1.9	Shielded	Shielded	-
17	Signal	0.1	Unshielded	Unshielded	*4)
18	AM/FM Antenna	2.0	Shielded	Shielded	-
19	HDMI	2.0	Shielded	Shielded	-
20	DC	1.4	Unshielded	Unshielded	-
21	AC	2.0	Unshielded	Unshielded	-
22	USB	1.8	Shielded	Shielded	-
23	DC	1.8	Unshielded	Unshielded	-
24	AC	0.9	Unshielded	Unshielded	-

*4) This cable is for testing and is not included with products.

SECTION 5: Radiated Spurious Emission

Test Procedure

[For below 1 GHz]

EUT was placed on a urethane platform of nominal size, 1.0 m by 2.0 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane. Test antenna was aimed at the EUT for receiving the maximum signal and always kept within the illumination area of the 3 dB beamwidth of the antenna.

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.

Test Antennas are used as below;

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

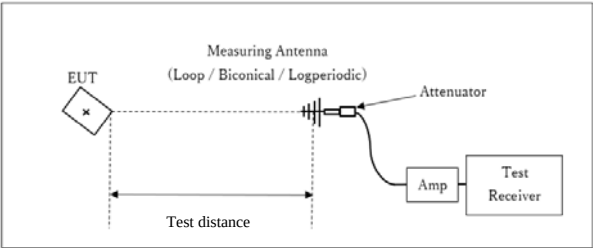
20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9 (ISED) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (ISED).

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV *1)	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	RBW: 1 MHz VBW: 1/T (T: burst length, refer to Burst rate confirmation sheet) Detector: Peak	RBW: 100 kHz VBW: 300 kHz

*1) Average Power Measurement was performed based on KDB 558074 D01 15.247 Meas Guidance v05r02.

Figure 2: Test Setup

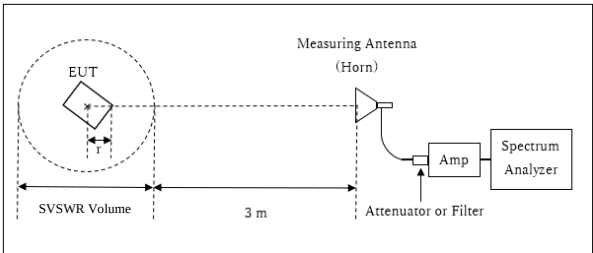
Below 1 GHz



x : Center of turn table

Test Distance: 3 m

1 GHz to 10 GHz

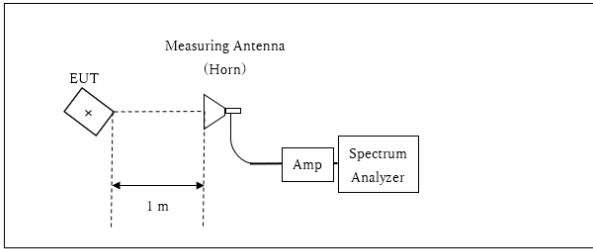


r : Radius of an outer periphery of EUT
x : Center of turn table

Distance Factor: $20 \times \log (3.89 \text{ m} / 3.0 \text{ m}) = 2.26 \text{ dB}$
* Test Distance: $(3 + \text{SVSWR Volume} / 2) - r = 3.89 \text{ m}$

SVSWR Volume : 2.0 m
(SVSWR Volume has been calibrated based on CISPR 16-1-4.)
 $r = 0.11 \text{ m}$

10 GHz to 26.5 GHz



x : Center of turn table

Distance Factor: $20 \times \log (1.0 \text{ m} / 3.0 \text{ m}) = -9.54 \text{ dB}$
*Test Distance: 1 m

- The carrier level and noise levels were confirmed at each position of 0 deg and 30 deg of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

Antenna polarization	Carrier	Spurious (30 MHz - 1 GHz)	Spurious (1 GHz - 2.8 GHz)	Spurious (2.8 GHz - 10 GHz)	Spurious (10 GHz - 18 GHz)	Spurious (18 GHz - 26.5 GHz)
Horizontal	30 deg.	30 deg.	30 deg.	30 deg.	0 deg.	0 deg.
Vertical	30 deg.	30 deg.	30 deg.	30 deg.	0 deg.	0 deg.

Test results are rounded off and limit are rounded down, so some differences might be observed.

Measurement Range : 30 MHz to 26.5 GHz
Test Data : APPENDIX
Test Result : Pass

SECTION 6: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument Used
20dB 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	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 30MHz, RBW was narrowed to separate the noise contents.

Then, wide-band noise near the limit was checked separately, however the noise was low enough 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

APPENDIX 1: Test data

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

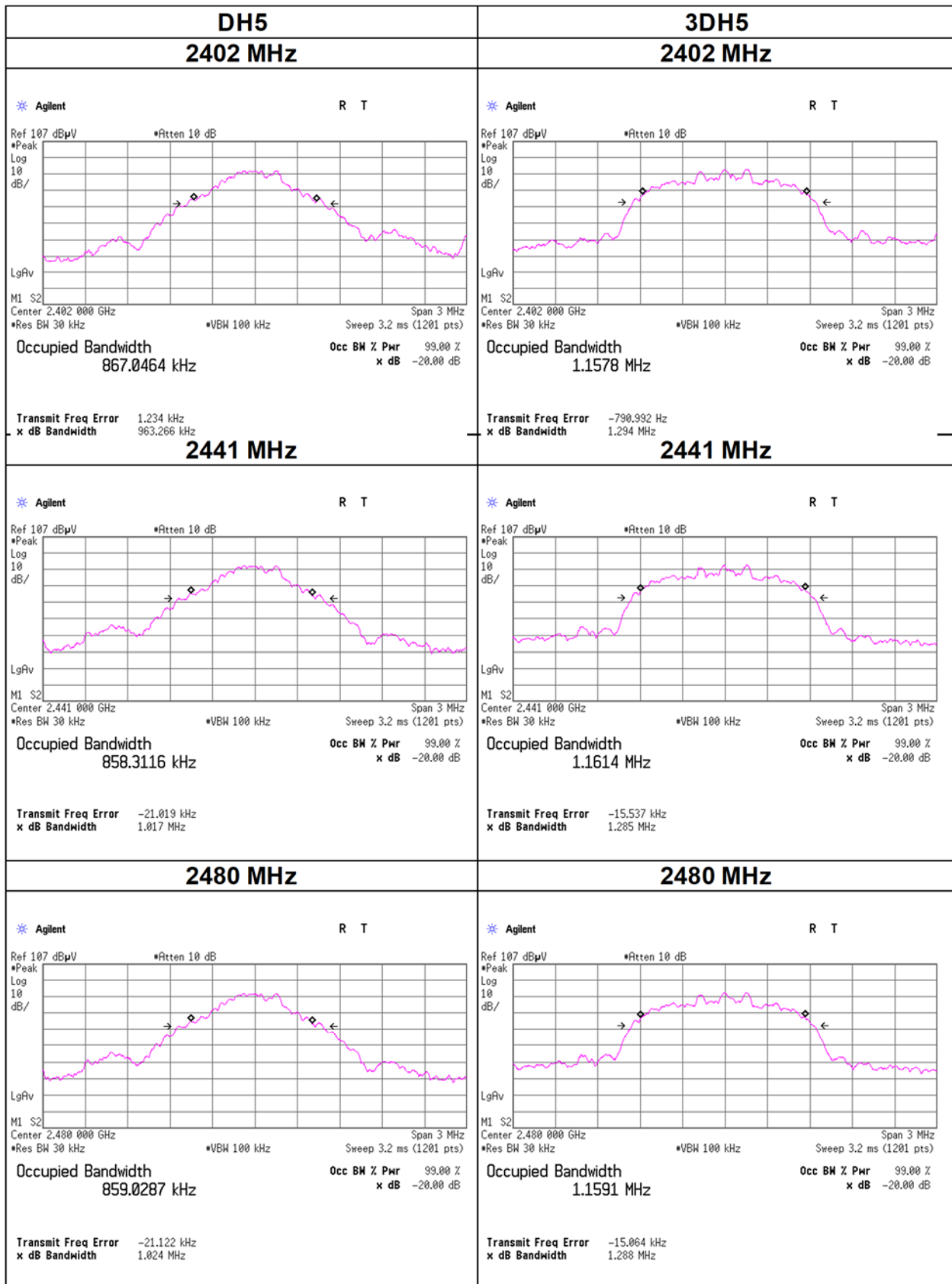
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	October 3, 2023
Temperature / Humidity	25 deg. C / 41 % RH
Engineer	Hiromasa Sato
Mode	Tx, Hopping Off, Tx, Hopping On

Mode	Freq. [MHz]	20 dB Bandwidth [MHz]	99 % Occupied Bandwidth [kHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
DH5	2402.0	0.963	867.0	1.000	≥ 0.642
DH5	2441.0	1.017	858.3	1.000	≥ 0.678
DH5	2480.0	1.024	859.0	1.000	≥ 0.683
DH5	Hopping On	-	78602.7	-	-
3DH5	2402.0	1.294	1157.8	1.000	≥ 0.863
3DH5	2441.0	1.285	1161.4	1.000	≥ 0.857
3DH5	2480.0	1.288	1159.1	1.000	≥ 0.859
3DH5	Hopping On	-	78738.2	-	-

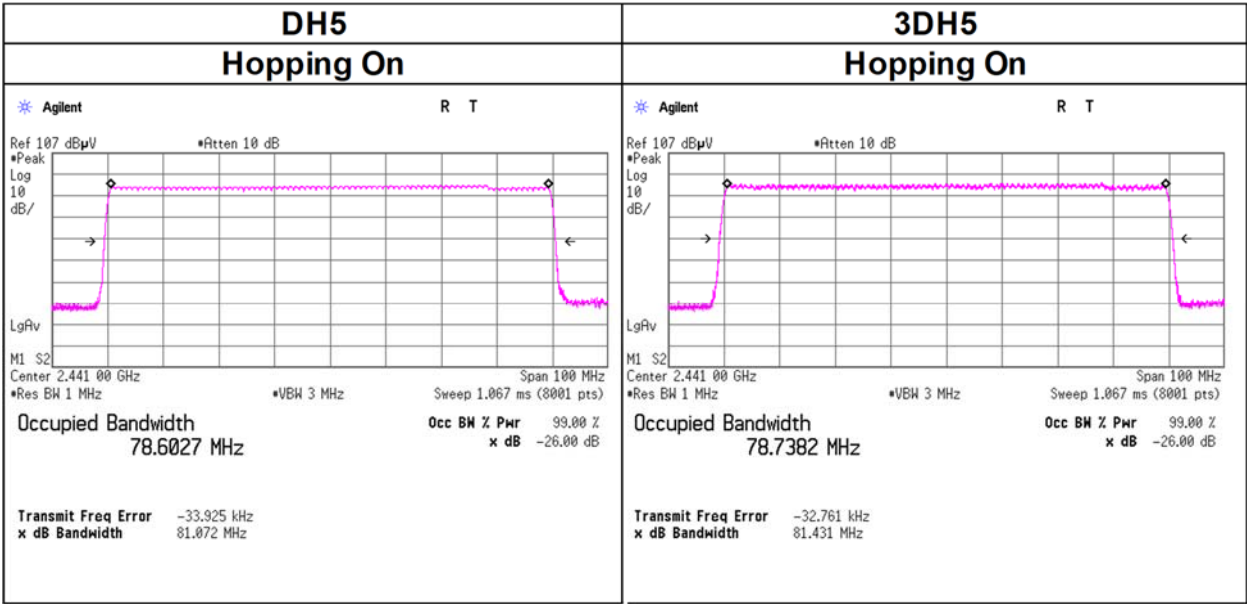
Limit: Two-thirds of 20 dB Bandwidth or 25 kHz (whichever is greater).

No limit applies to 20 dB Bandwidth.

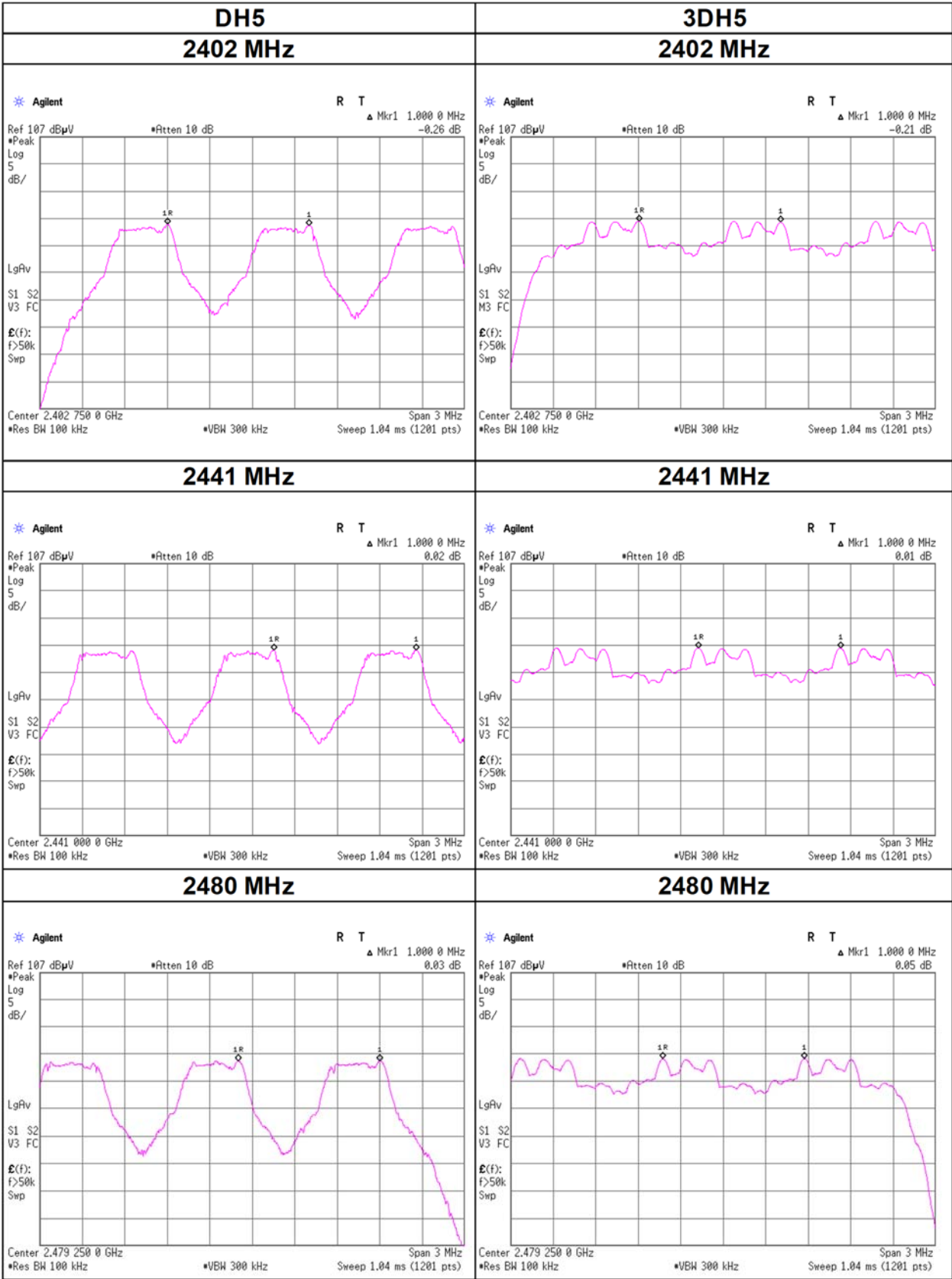
20dB Bandwidth and 99% Occupied Bandwidth



20dB Bandwidth and 99% Occupied Bandwidth



Carrier Frequency Separation



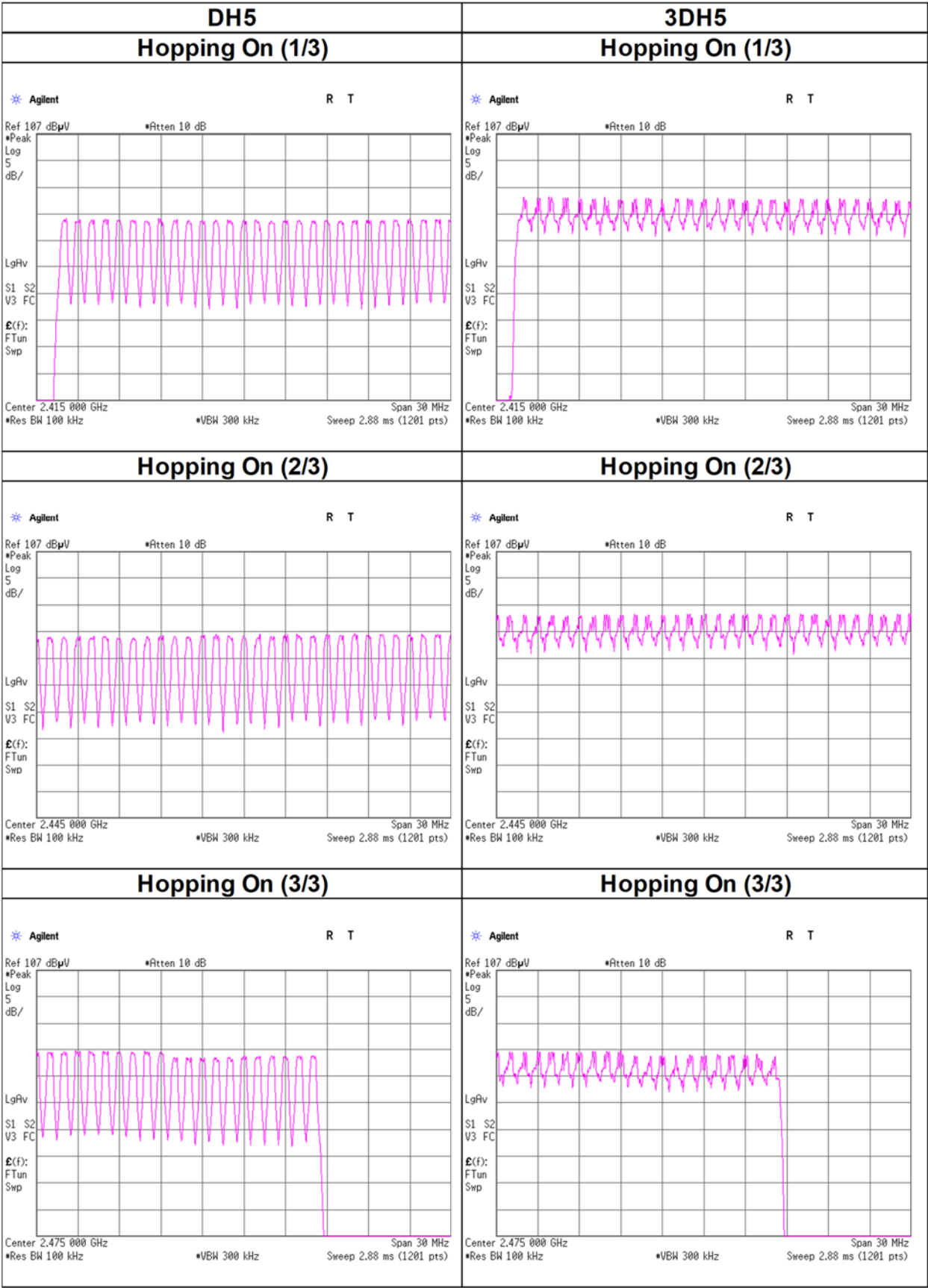
Number of Hopping Frequency

Test place	Shonan EMC Lab. No.5 Shielded Room
Date	October 3, 2023
Temperature / Humidity	25 deg. C / 41 % RH
Engineer	Hiromasa Sato
Mode	Tx, Hopping On

Mode	Number of channel [channels]	Limit [channels]
DH5	79	>= 15
3DH5	79	>= 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



Dwell time

Test place Shonan EMC Lab. No.5 Shielded Room
Date October 3, 2023
Temperature / Humidity 25 deg. C / 41 % RH
Engineer Hiromasa Sato
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	50.4 times / 5 s x 31.6 s = 319 times	0.414	132	400
DH3	25.0 times / 5 s x 31.6 s = 158 times	1.667	263	400
DH5	17.0 times / 5 s x 31.6 s = 108 times	2.917	315	400
3DH1	50.4 times / 5 s x 31.6 s = 319 times	0.431	137	400
3DH3	25.0 times / 5 s x 31.6 s = 158 times	1.678	265	400
3DH5	17.0 times / 5 s x 31.6 s = 108 times	2.931	317	400

Sample Calculation

Result = Number of transmission x Length of transmission

*Average data of 5 tests.

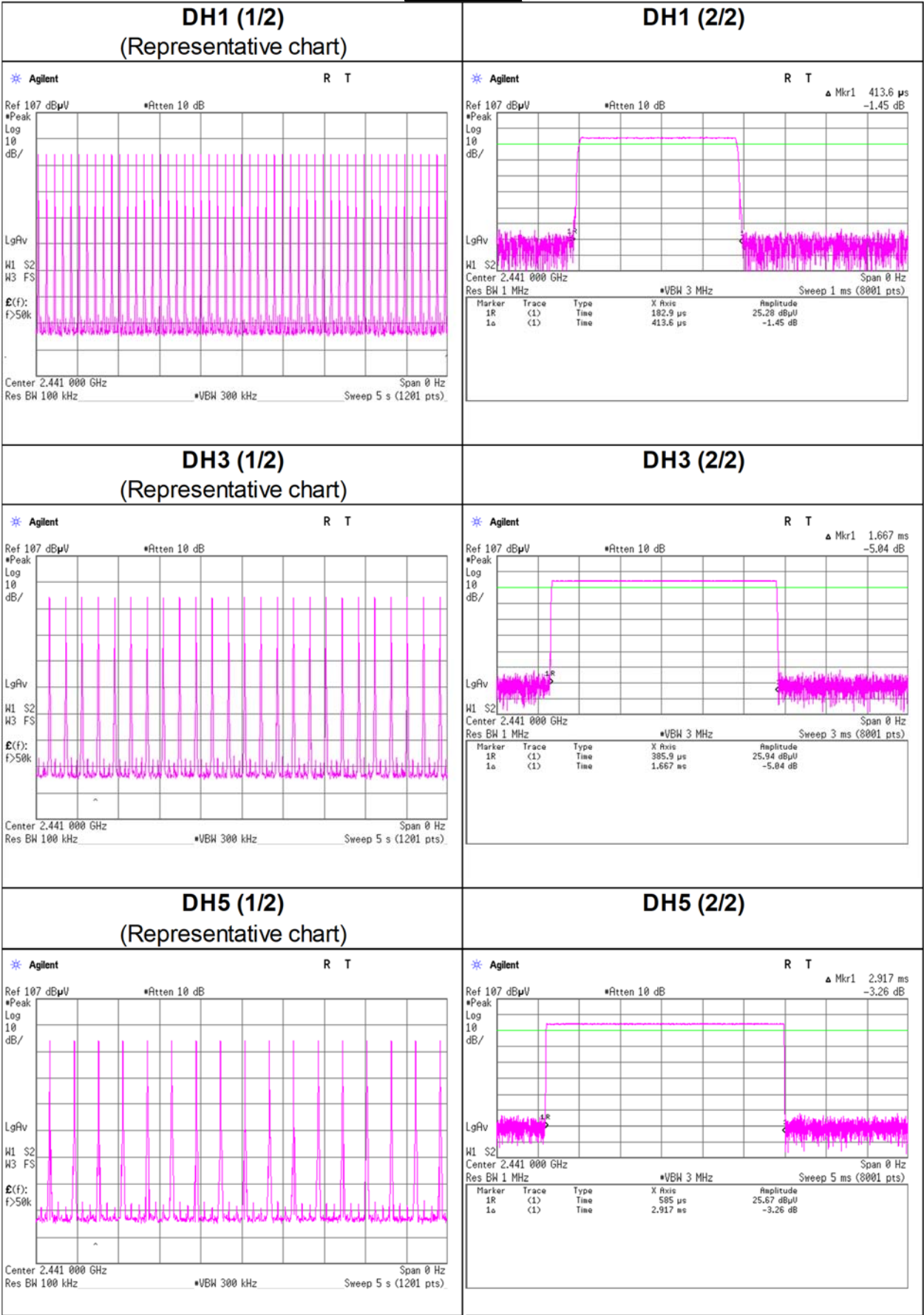
Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
DH1	51	51	50	50	50	50.4
DH3	25	25	25	25	25	25
DH5	17	17	17	17	17	17
3DH1	51	51	50	50	50	50.4
3DH3	25	25	25	25	25	25
3DH5	17	17	17	17	17	17

Sample Calculation

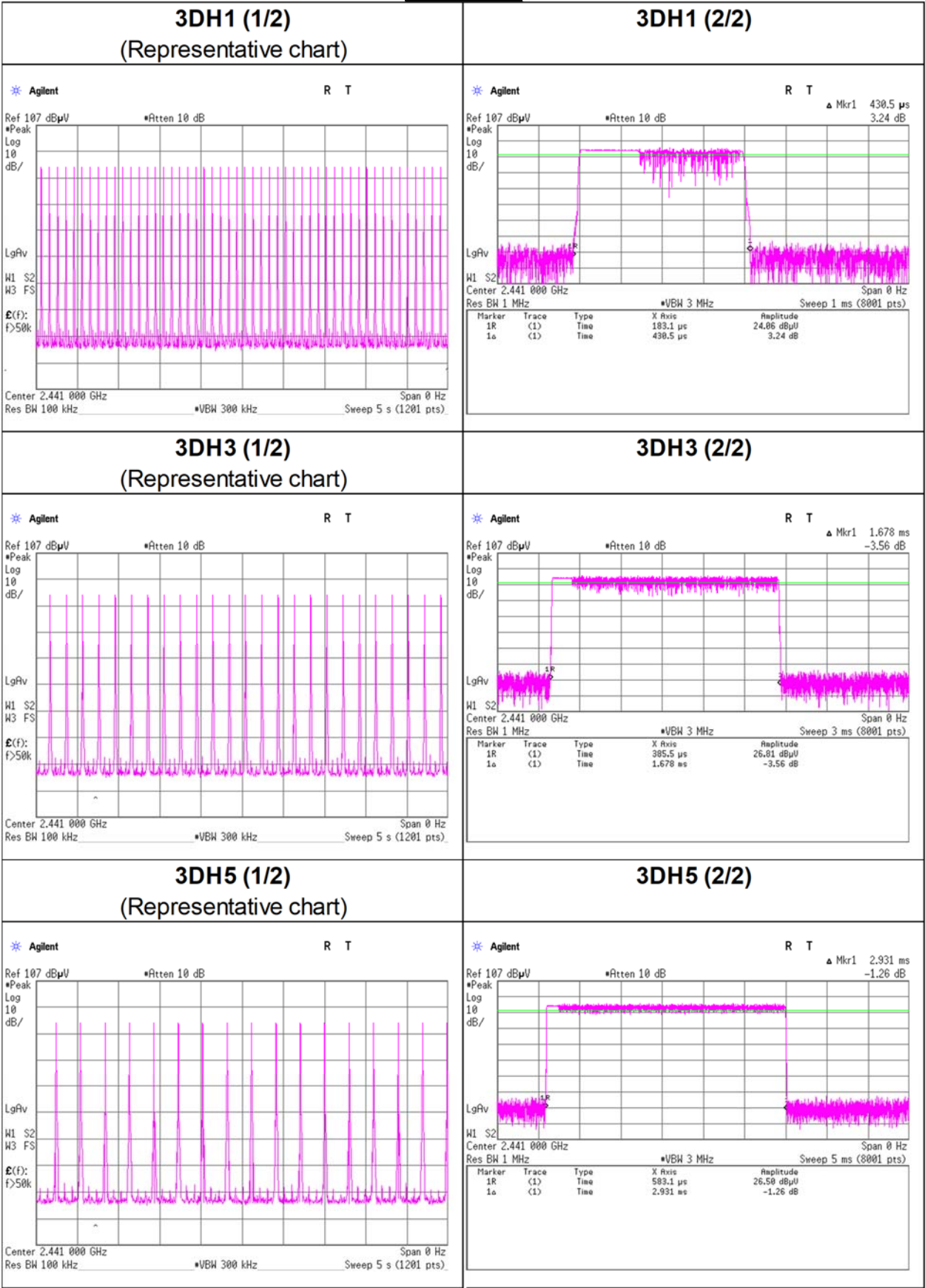
Average = Summation (Sampling 1 to 5) / 5

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



Dwell time



Maximum Peak Output Power

Test place Shonan EMC Lab. No.1 Shielded Room
Date September 27, 2023
Temperature / Humidity 24 deg. C / 48 % RH
Engineer Ken Fujita
Mode Tx, Hopping Off

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	-15.09	2.02	10.04	-3.03	0.50	20.97	125	24.00	-0.63	-3.66	0.43	36.02	4000	39.68
DH5	2441	-14.72	2.04	10.04	-2.64	0.54	20.97	125	23.61	-0.63	-3.27	0.47	36.02	4000	39.29
DH5	2480	-15.02	2.05	10.04	-2.93	0.51	20.97	125	23.90	-0.63	-3.56	0.44	36.02	4000	39.58
2DH5	2402	-13.89	2.02	10.04	-1.83	0.66	20.97	125	22.80	-0.63	-2.46	0.57	36.02	4000	38.48
2DH5	2441	-14.08	2.04	10.04	-2.00	0.63	20.97	125	22.97	-0.63	-2.63	0.55	36.02	4000	38.65
2DH5	2480	-14.20	2.05	10.04	-2.11	0.62	20.97	125	23.08	-0.63	-2.74	0.53	36.02	4000	38.76
3DH5	2402	-13.53	2.02	10.04	-1.47	0.71	20.97	125	22.44	-0.63	-2.10	0.62	36.02	4000	38.12
3DH5	2441	-13.52	2.04	10.04	-1.44	0.72	20.97	125	22.41	-0.63	-2.07	0.62	36.02	4000	38.09
3DH5	2480	-13.65	2.05	10.04	-1.56	0.70	20.97	125	22.53	-0.63	-2.19	0.60	36.02	4000	38.21

Sample Calculation:

Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

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

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 Output Power
(Reference data for RF Exposure)

Test place	Shonan EMC Lab. No.1 Shielded Room
Date	September 27, 2023
Temperature / Humidity	24 deg. C / 48 % RH
Engineer	Ken Fijita
Mode	Tx, Hopping Off

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]
DH5	2402	-17.37	2.02	10.04	-5.31	0.29	1.09	-4.22	0.38
DH5	2441	-17.01	2.04	10.04	-4.93	0.32	1.09	-3.84	0.41
DH5	2480	-17.53	2.05	10.04	-5.44	0.29	1.09	-4.35	0.37
2DH5	2402	-17.97	2.02	10.04	-5.91	0.26	1.07	-4.84	0.33
2DH5	2441	-18.02	2.04	10.04	-5.94	0.25	1.07	-4.87	0.33
2DH5	2480	-18.32	2.05	10.04	-6.23	0.24	1.07	-5.16	0.30
3DH5	2402	-17.99	2.02	10.04	-5.93	0.26	1.07	-4.86	0.33
3DH5	2441	-18.21	2.04	10.04	-6.13	0.24	1.07	-5.06	0.31
3DH5	2480	-18.33	2.05	10.04	-6.24	0.24	1.07	-5.17	0.30

Sample Calculation:

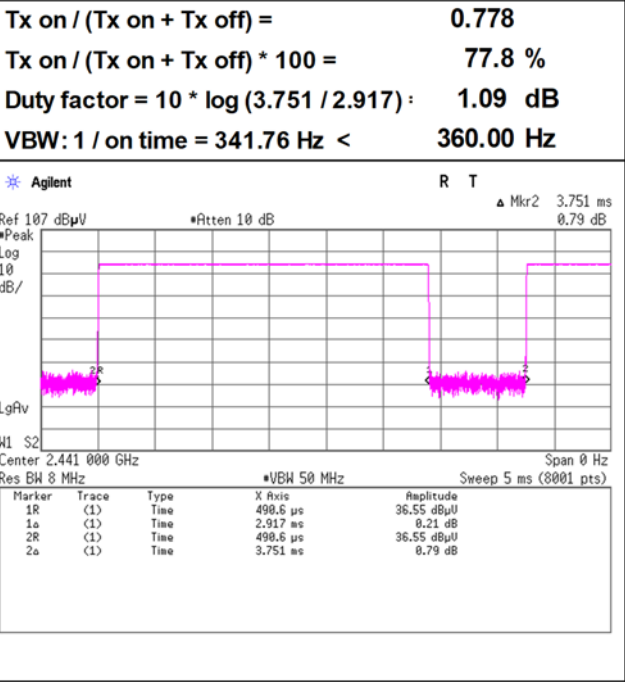
Result (Time average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

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

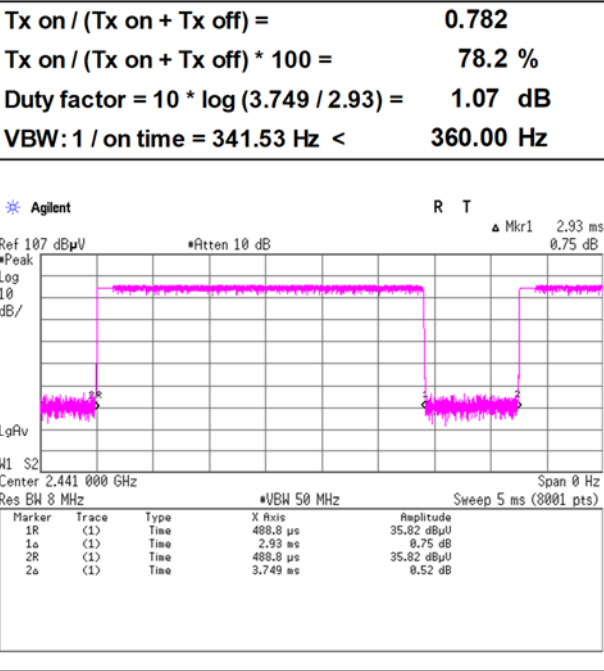
Burst Rate Confirmation

Test place	Shonan EMC Lab. No.5 Shielded Room
Date	October 3, 2023
Temperature / Humidity	25 deg. C / 41 % RH
Engineer	Hiromasa Sato
Mode	Tx, Hopping Off

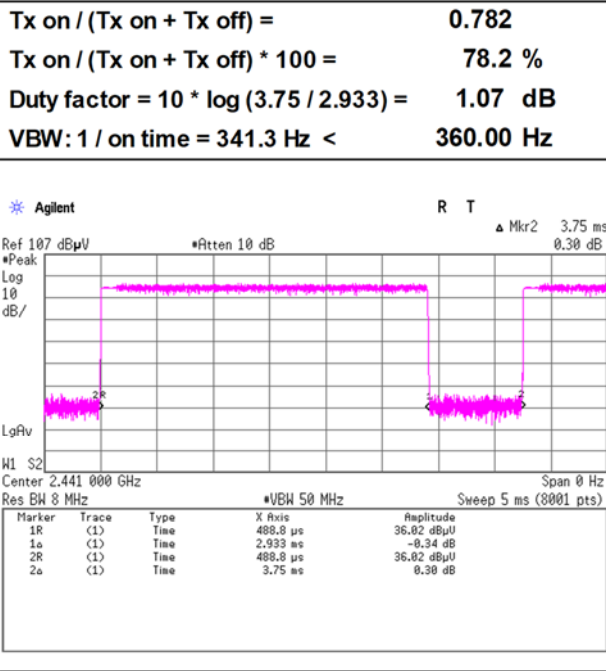
DH5



2DH5



3DH5



Radiated Spurious Emission

Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	SAC1	SAC2
Date	September 28, 2023	September 27, 2023
Temperature / Humidity	22 deg.C, 48 %RH	23 deg.C, 54 %RH
Engineer	Kouki Yamada	Ken Fujita
	(1 GHz -10 GHz)	(10 GHz -26.5 GHz)
Mode	Tx, Hopping Off, DH5 2402 MHz	

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2390.000	PK	45.75	27.77	15.12	39.49	2.26	51.41	73.9	22.4	326	280	-
Hori.	4804.000	PK	48.29	31.06	8.15	39.62	2.26	50.14	73.9	23.7	107	186	-
Hori.	7206.000	PK	46.01	36.74	9.82	39.36	2.26	55.47	73.9	18.4	150	0	-
Hori.	2390.000	AV	33.69	27.77	15.12	39.49	2.26	39.35	53.9	14.5	326	280	VBW:360 Hz
Hori.	4804.000	AV	38.34	31.06	8.15	39.62	2.26	40.19	53.9	13.7	107	186	VBW:360 Hz
Hori.	7206.000	AV	33.89	36.74	9.82	39.36	2.26	43.35	53.9	10.5	150	0	floor noise
Vert.	2390.000	PK	45.54	27.77	15.12	39.49	2.26	51.20	73.9	22.7	111	2	-
Vert.	4804.000	PK	48.75	31.06	8.15	39.62	2.26	50.60	73.9	23.3	102	223	-
Vert.	7206.000	PK	45.78	36.74	9.82	39.36	2.26	55.24	73.9	18.6	150	0	-
Vert.	2390.000	AV	33.86	27.77	15.12	39.49	2.26	39.52	53.9	14.3	111	2	VBW:360 Hz
Vert.	4804.000	AV	38.07	31.06	8.15	39.62	2.26	39.92	53.9	13.9	102	223	VBW:360 Hz
Vert.	7206.000	AV	33.94	36.74	9.82	39.36	2.26	43.40	53.9	10.5	150	0	floor noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log (3.89 m / 3.0 m) = 2.26 dB

10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

*These results have sufficient margin without taking account Duty cycle correction factor.

20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	83.27	27.76	15.14	39.49	2.26	88.94	-	-	Carrier
Hori.	2400.000	PK	39.42	27.76	15.14	39.49	2.26	45.09	68.9	23.8	-
Vert.	2402.000	PK	85.93	27.76	15.14	39.49	2.26	91.60	-	-	Carrier
Vert.	2400.000	PK	39.30	27.76	15.14	39.49	2.26	44.97	71.6	26.6	-

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

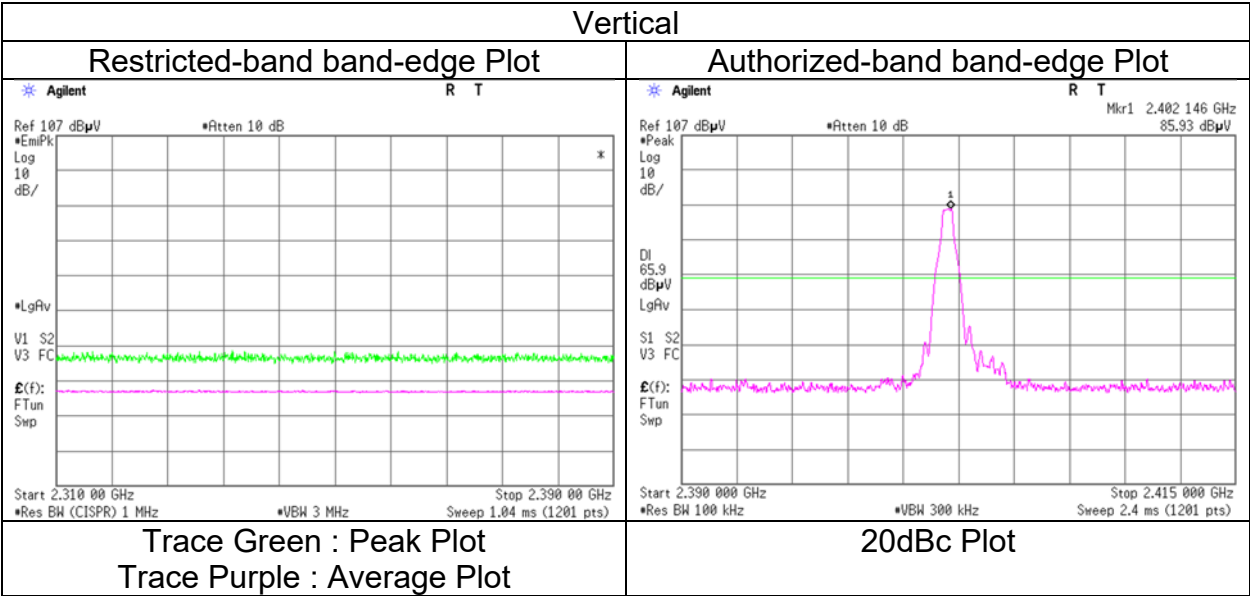
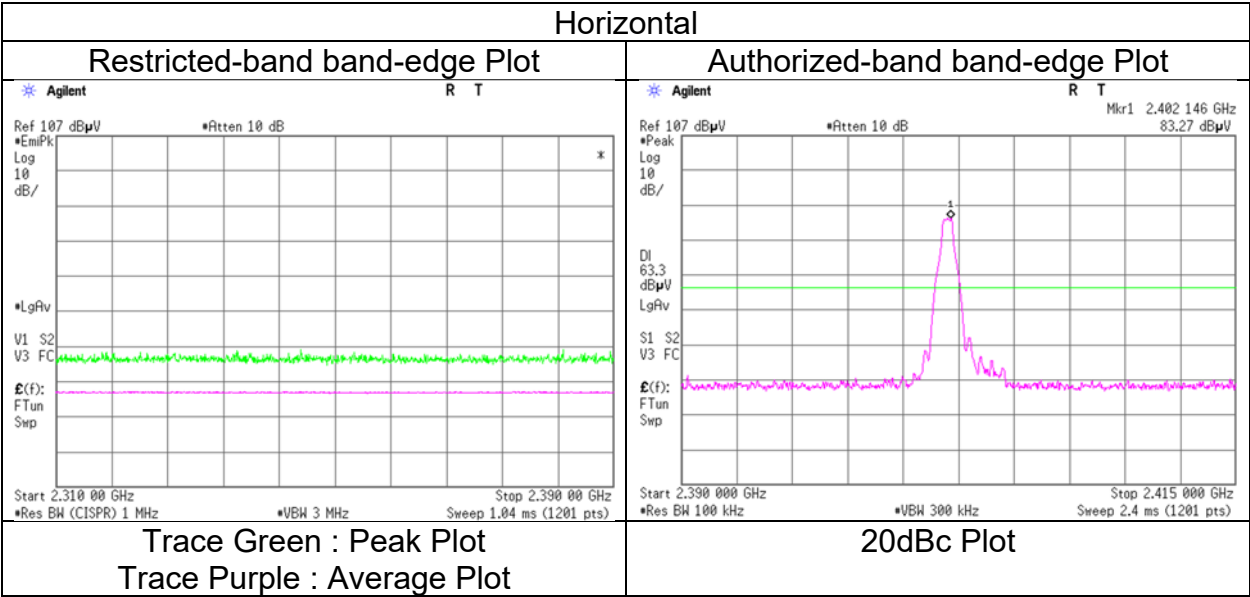
Distance factor : 1 GHz - 10 GHz : 20log (3.89 m / 3.0 m) = 2.26 dB

10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

*These results have sufficient margin without taking account Duty cycle correction factor.

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Shonan EMC Lab.
Semi Anechoic Chamber	SAC1
Date	September 28, 2023
Temperature / Humidity	22 deg.C, 48 %RH
Engineer	Kouki Yamada
Mode	Tx, Hopping Off, DH5 2402 MHz



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge and authorized band edge were shown in tabular data.

Radiated Spurious Emission

Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	SAC1	SAC2
Date	September 28, 2023	September 27, 2023
Temperature / Humidity	22 deg.C, 48 %RH	23 deg.C, 54 %RH
Engineer	Kouki Yamada	Ken Fujita
	(1 GHz -10 GHz)	(10 GHz -26.5 GHz)
Mode	Tx, Hopping Off, DH5 2441 MHz	

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	4882.000	PK	49.23	31.09	8.19	39.64	2.26	51.13	73.9	22.7	101	182	-
Hori.	7323.000	PK	46.76	36.82	9.91	39.36	2.26	56.39	73.9	17.5	150	0	-
Hori.	4882.000	AV	37.52	31.09	8.19	39.64	2.26	39.42	53.9	14.4	101	182	VBW:360 Hz
Hori.	7323.000	AV	36.21	36.82	9.91	39.36	2.26	45.84	53.9	8.0	150	0	Floor noise
Vert.	4882.000	PK	48.57	31.09	8.19	39.64	2.26	50.47	73.9	23.4	165	220	-
Vert.	7323.000	PK	47.27	36.82	9.91	39.36	2.26	56.90	73.9	17.0	150	0	-
Vert.	4882.000	AV	38.16	31.09	8.19	39.64	2.26	40.06	53.9	13.8	165	220	VBW:360 Hz
Vert.	7323.000	AV	35.28	36.82	9.91	39.36	2.26	44.91	53.9	8.9	150	0	Floor noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(3.89\text{ m} / 3.0\text{ m}) = 2.26\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

*These results have sufficient margin without taking account Duty cycle correction factor.

Radiated Spurious Emission

Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	SAC1	SAC2
Date	September 28, 2023	September 27, 2023
Temperature / Humidity	22 deg.C, 48 %RH	23 deg.C, 54 %RH
Engineer	Kouki Yamada	Ken Fujita
	(1 GHz -10 GHz)	(10 GHz -26.5 GHz)
Mode	Tx, Hopping Off, DH5 2480 MHz	

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2483.500	PK	45.42	27.65	15.23	39.53	2.26	51.03	73.9	22.8	326	271	-
Hori.	4960.000	PK	46.45	31.30	8.24	39.66	2.26	48.59	73.9	25.3	105	195	-
Hori.	7440.000	PK	46.18	36.95	10.01	39.36	2.26	56.04	73.9	17.8	150	0	-
Hori.	2483.500	AV	33.84	27.65	15.23	39.53	2.26	39.45	53.9	14.4	326	271	VBW:360 Hz
Hori.	4960.000	AV	35.83	31.30	8.24	39.66	2.26	37.97	53.9	15.9	105	195	VBW:360 Hz
Hori.	7440.000	AV	33.78	36.95	10.01	39.36	2.26	43.64	53.9	10.2	150	0	Floor noise
Vert.	2483.500	PK	46.14	27.65	15.23	39.53	2.26	51.75	73.9	22.1	129	3	-
Vert.	4960.000	PK	46.86	31.30	8.24	39.66	2.26	49.00	73.9	24.9	105	226	-
Vert.	7440.000	PK	46.36	36.95	10.01	39.36	2.26	56.22	73.9	17.6	150	0	-
Vert.	2483.500	AV	33.78	27.65	15.23	39.53	2.26	39.39	53.9	14.5	129	3	VBW:360 Hz
Vert.	4960.000	AV	35.01	31.30	8.24	39.66	2.26	37.15	53.9	16.7	105	226	VBW:360 Hz
Vert.	7440.000	AV	33.87	36.95	10.01	39.36	2.26	43.73	53.9	10.1	150	0	Floor noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(3.89\text{ m} / 3.0\text{ m}) = 2.26\text{ dB}$

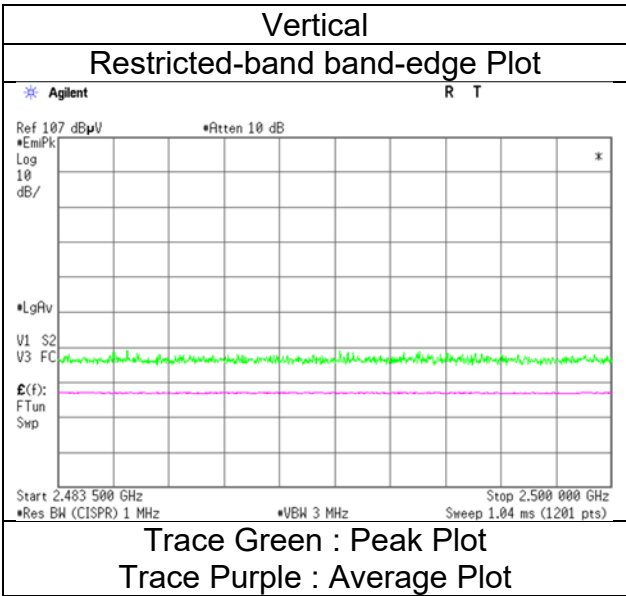
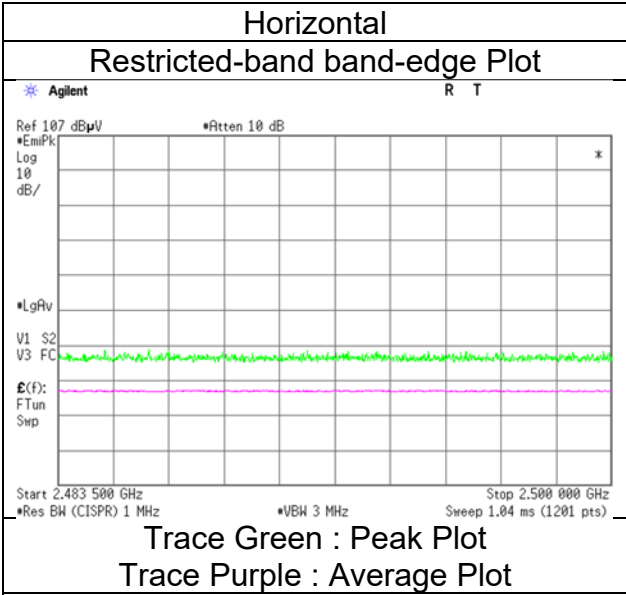
10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

*These results have sufficient margin without taking account Duty cycle correction factor.

Radiated Spurious Emission
(Reference Plot for bandto edge)

Test place
Semi Anechoic Chamber
Date
Temperature / Humidity
Engineer
Mode

Shonan EMC Lab.
SAC1
September 28, 2023
22 deg.C, 48 %RH
Kouki Yamada
Tx, Hopping Off, DH5 2480 MHz



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	SAC1	SAC2
Date	September 28, 2023	September 27, 2023
Temperature / Humidity	22 deg.C, 48 %RH	23 deg.C, 54 %RH
Engineer	Kouki Yamada	Ken Fujita
	(1 GHz -10 GHz)	(10 GHz -26.5 GHz)
Mode	Tx, Hopping Off, 3DH5 2402 MHz	

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2390.000	PK	45.92	27.77	15.12	39.49	2.26	51.58	73.9	22.3	285	239	-
Hori.	4804.000	PK	49.20	31.06	8.15	39.62	2.26	51.05	73.9	22.8	107	122	-
Hori.	7206.000	PK	46.65	36.74	9.82	39.36	2.26	56.11	73.9	17.7	150	0	-
Hori.	2390.000	AV	33.67	27.77	15.12	39.49	2.26	39.33	53.9	14.5	285	239	VBW:360 Hz
Hori.	4804.000	AV	41.09	31.06	8.15	39.62	2.26	42.94	53.9	10.9	107	122	VBW:360 Hz
Hori.	7206.000	AV	33.94	36.74	9.82	39.36	2.26	43.40	53.9	10.5	150	0	Floor noise
Vert.	2390.000	PK	45.31	27.77	15.12	39.49	2.26	50.97	73.9	22.9	105	1	-
Vert.	4804.000	PK	49.26	31.06	8.15	39.62	2.26	51.11	73.9	22.7	105	224	-
Vert.	7206.000	PK	46.29	36.74	9.82	39.36	2.26	55.75	73.9	18.1	150	0	-
Vert.	2390.000	AV	33.78	27.77	15.12	39.49	2.26	39.44	53.9	14.4	105	1	VBW:360 Hz
Vert.	4804.000	AV	40.50	31.06	8.15	39.62	2.26	42.35	53.9	11.5	105	224	VBW:360 Hz
Vert.	7206.000	AV	34.01	36.74	9.82	39.36	2.26	43.47	53.9	10.4	150	0	Floor noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log (3.89 m / 3.0 m) = 2.26 dB

10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

*These results have sufficient margin without taking account Duty cycle correction factor.

20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	86.30	27.76	15.14	39.49	2.26	91.97	-	-	Carrier
Hori.	2400.000	PK	38.12	27.76	15.14	39.49	2.26	43.79	71.9	28.1	-
Vert.	2402.000	PK	91.82	27.76	15.14	39.49	2.26	97.49	-	-	Carrier
Vert.	2400.000	PK	42.41	27.76	15.14	39.49	2.26	48.08	77.4	29.3	-

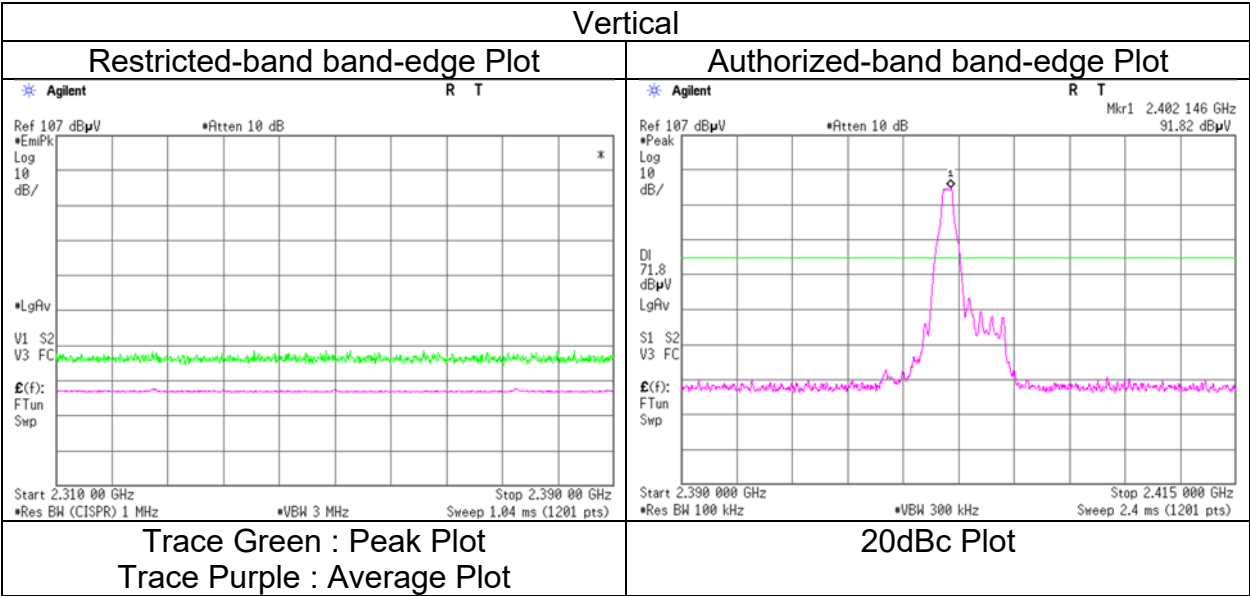
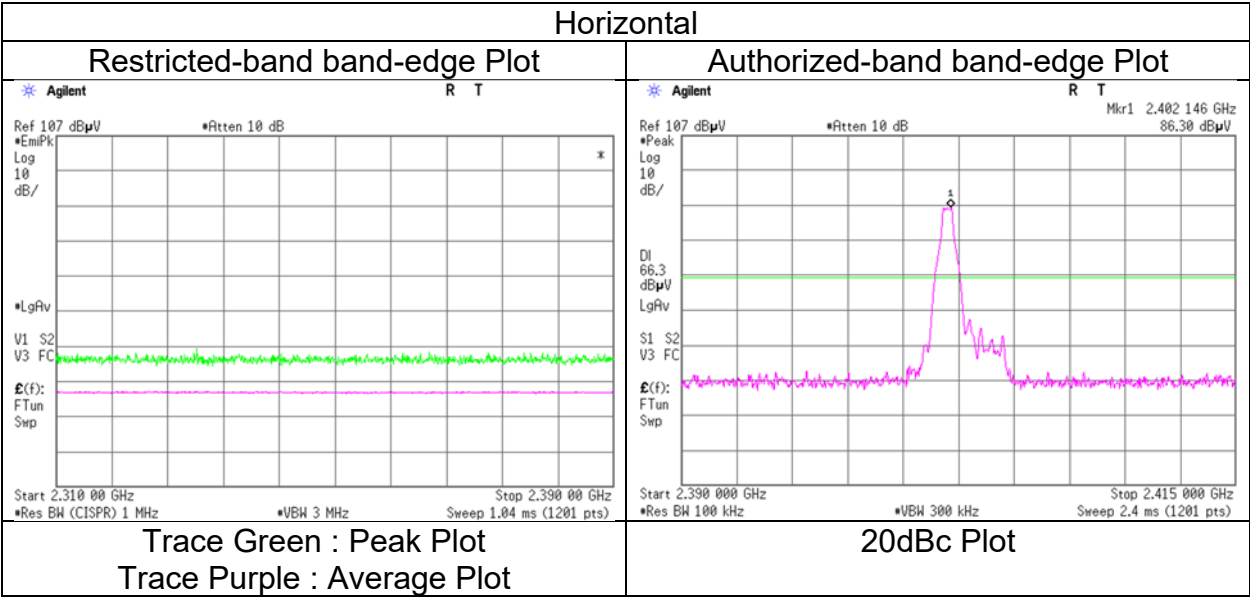
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log (3.89 m / 3.0 m) = 2.26 dB

10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Shonan EMC Lab.
Semi Anechoic Chamber	SAC1
Date	September 28, 2023
Temperature / Humidity	22 deg.C, 48 %RH
Engineer	Kouki Yamada
Mode	Tx, Hopping Off, 3DH5 2402 MHz



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge and authorized band edge were shown in tabular data.

Radiated Spurious Emission

Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	SAC1	SAC1	SAC2
Date	September 29, 2023	September 28, 2023	September 27, 2023
Temperature / Humidity	23 deg.C, 53 %RH	22 deg.C, 48 %RH	23 deg.C, 54 %RH
Engineer	Kouki Yamada	Kouki Yamada	Ken Fujita
	(30 MHz -1 GHz)	(1 GHz -10 GHz)	(10 GHz -26.5 GHz)
Mode	Tx, Hopping Off, 3DH5 2441 MHz		

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	129.507	QP	36.00	13.91	8.37	31.79	0.00	26.49	43.5	17.0	238	120	-
Hori.	423.219	QP	42.80	15.89	7.39	31.81	0.00	34.27	46.0	11.7	100	345	-
Hori.	457.075	QP	42.60	16.99	7.60	31.84	0.00	35.35	46.0	10.6	100	285	-
Hori.	480.006	QP	43.00	17.26	7.73	31.84	0.00	36.15	46.0	9.8	100	98	-
Hori.	490.932	QP	47.60	17.36	7.79	31.84	0.00	40.91	46.0	5.0	100	110	-
Hori.	494.998	QP	39.40	17.39	7.81	31.84	0.00	32.76	46.0	13.2	100	92	-
Hori.	959.991	QP	34.70	23.40	10.21	30.88	0.00	37.43	46.0	8.5	173	154	-
Hori.	4882.000	PK	48.07	31.09	8.19	39.64	2.26	49.97	73.9	23.9	101	182	-
Hori.	7323.000	PK	46.00	36.82	9.91	39.36	2.26	55.63	73.9	18.2	150	0	-
Hori.	4882.000	AV	37.83	31.09	8.19	39.64	2.26	39.73	53.9	14.1	101	182	VBW:360 Hz
Hori.	7323.000	AV	33.75	36.82	9.91	39.36	2.26	43.38	53.9	10.5	150	0	Floor noise
Vert.	33.872	QP	35.80	17.05	7.12	31.83	0.00	28.14	40.0	11.8	100	195	-
Vert.	38.768	QP	33.60	15.31	7.23	31.83	0.00	24.31	40.0	15.6	100	357	-
Vert.	490.933	QP	40.70	17.36	7.79	31.84	0.00	34.01	46.0	11.9	100	89	-
Vert.	524.811	QP	38.90	17.87	7.99	31.90	0.00	32.86	46.0	13.1	126	112	-
Vert.	959.999	QP	31.00	23.40	10.21	30.88	0.00	33.73	46.0	12.2	145	173	-
Vert.	4882.000	PK	47.65	31.09	8.19	39.64	2.26	49.55	73.9	24.3	104	218	-
Vert.	7323.000	PK	45.84	36.82	9.91	39.36	2.26	55.47	73.9	18.4	150	0	-
Vert.	4882.000	AV	37.06	31.09	8.19	39.64	2.26	38.96	53.9	14.9	104	218	VBW:360 Hz
Vert.	7323.000	AV	33.71	36.82	9.91	39.36	2.26	43.34	53.9	10.5	150	0	Floor noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log (3.89 m / 3.0 m) = 2.26 dB

10 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

*These results have sufficient margin without taking account Duty cycle correction factor.

Radiated Spurious Emission

Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	SAC1	SAC2
Date	September 28, 2023	September 27, 2023
Temperature / Humidity	22 deg.C, 48 %RH	23 deg.C, 54 %RH
Engineer	Kouki Yamada	Ken Fujita
	(1 GHz -10 GHz)	(10 GHz -26.5 GHz)
Mode	Tx, Hopping Off, 3DH5 2480 MHz	

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2483.500	PK	45.37	27.65	15.23	39.53	2.26	50.98	73.9	22.9	342	271	-
Hori.	4960.000	PK	47.02	31.30	8.24	39.66	2.26	49.16	73.9	24.7	105	195	-
Hori.	7440.000	PK	46.29	36.95	10.01	39.36	2.26	56.15	73.9	17.7	150	0	-
Hori.	2483.500	AV	33.75	27.65	15.23	39.53	2.26	39.36	53.9	14.5	342	271	VBW:360 Hz
Hori.	4960.000	AV	38.07	31.30	8.24	39.66	2.26	40.21	53.9	13.6	105	195	VBW:360 Hz
Hori.	7440.000	AV	33.69	36.95	10.01	39.36	2.26	43.55	53.9	10.3	150	0	Floor noise
Vert.	2483.500	PK	46.24	27.65	15.23	39.53	2.26	51.85	73.9	22.0	148	1	-
Vert.	4960.000	PK	48.63	31.30	8.24	39.66	2.26	50.77	73.9	23.1	164	214	-
Vert.	7440.000	PK	47.36	36.95	10.01	39.36	2.26	57.22	73.9	16.6	150	0	-
Vert.	2483.500	AV	34.11	27.65	15.23	39.53	2.26	39.72	53.9	14.1	148	1	VBW:360 Hz
Vert.	4960.000	AV	38.51	31.30	8.24	39.66	2.26	40.65	53.9	13.2	164	214	VBW:360 Hz
Vert.	7440.000	AV	35.88	36.95	10.01	39.36	2.26	45.74	53.9	8.1	150	0	Floor noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

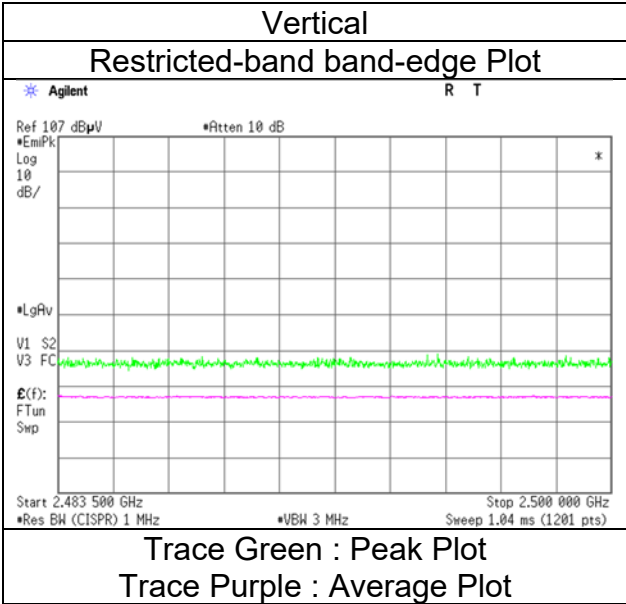
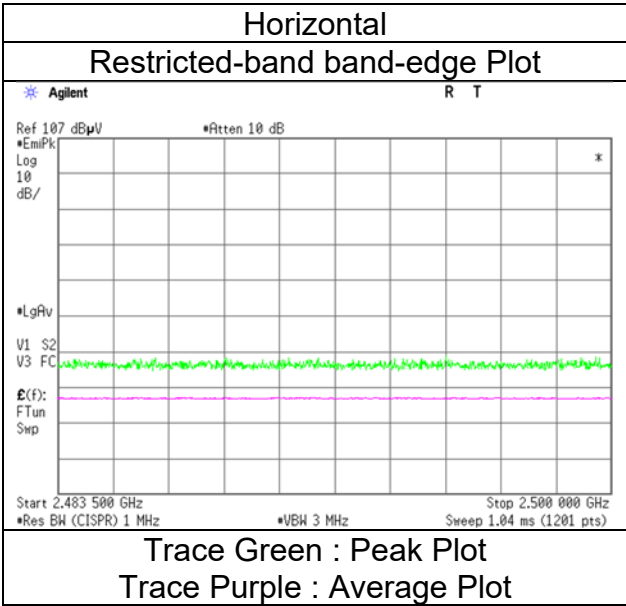
Distance factor : 1 GHz - 10 GHz : $20\log(3.89\text{ m} / 3.0\text{ m}) = 2.26\text{ dB}$

10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

*These results have sufficient margin without taking account Duty cycle correction factor.

Radiated Spurious Emission
(Reference Plot for band-edge)

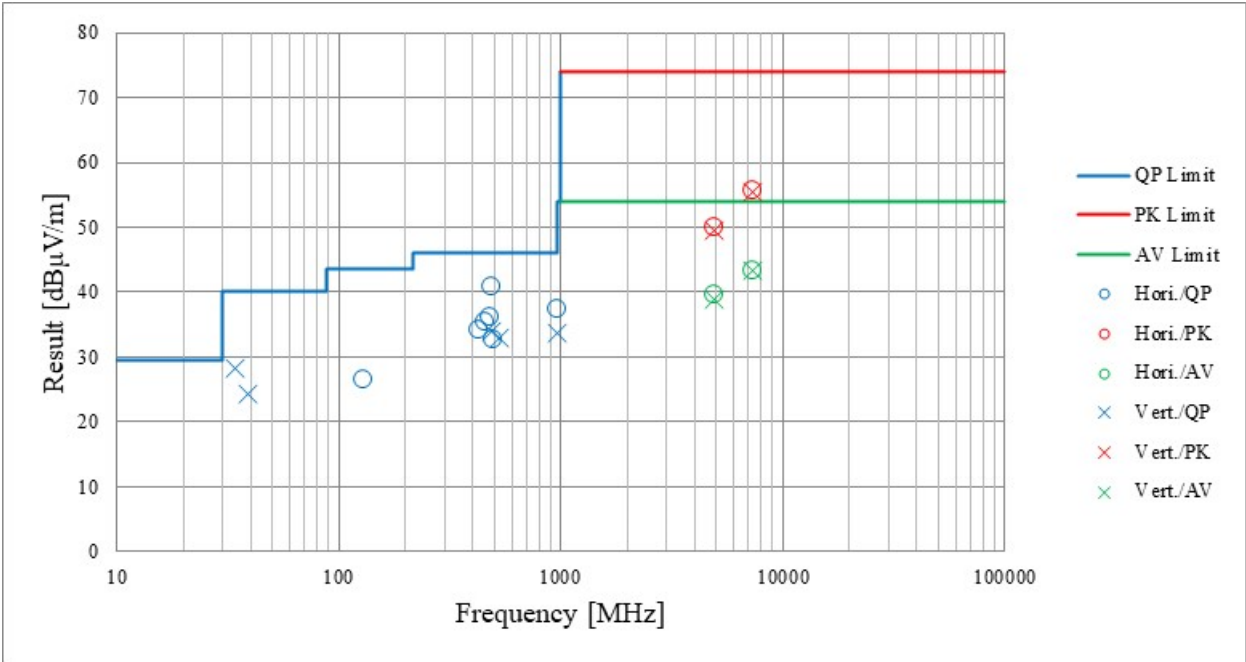
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	SAC1
Date	September 28, 2023
Temperature / Humidity	22 deg.C, 48 %RH
Engineer	Kouki Yamada
Mode	Tx, Hopping Off, 3DH5 2480 MHz



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission
(Plot data, Worst case mode for Maximum Peak Output Power)

Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	SAC1	SAC1	SAC2
Date	September 29, 2023	September 28, 2023	September 27, 2023
Temperature / Humidity	23 deg.C, 53 %RH	22 deg.C, 48 %RH	23 deg.C, 54 %RH
Engineer	Kouki Yamada	Kouki Yamada	Ken Fujita
	(30 MHz -1 GHz)	(1 GHz -10 GHz)	(10 GHz -26.5 GHz)
Mode	Tx, Hopping Off, 3DH5 2441 MHz		

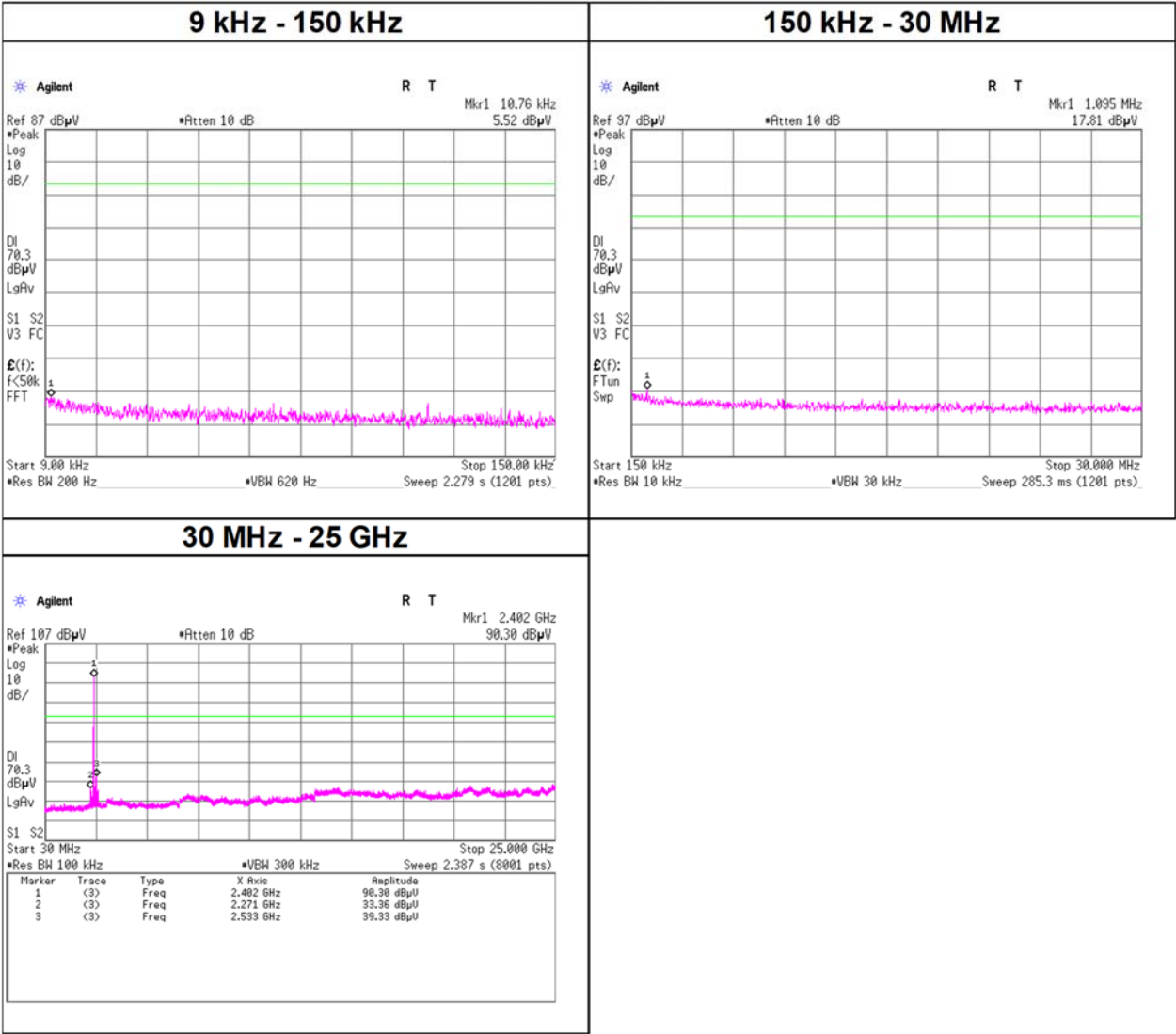


*These plots data contain sufficient number to show the trend of characteristic features for EUT.

Conducted Spurious Emission

Test place Shonan EMC Lab. No.5 Shielded Room
Date October 3, 2023
Temperature / Humidity 25 deg. C / 41 % RH
Engineer Hiromasa Sato
Mode Tx, Hopping Off, DH5

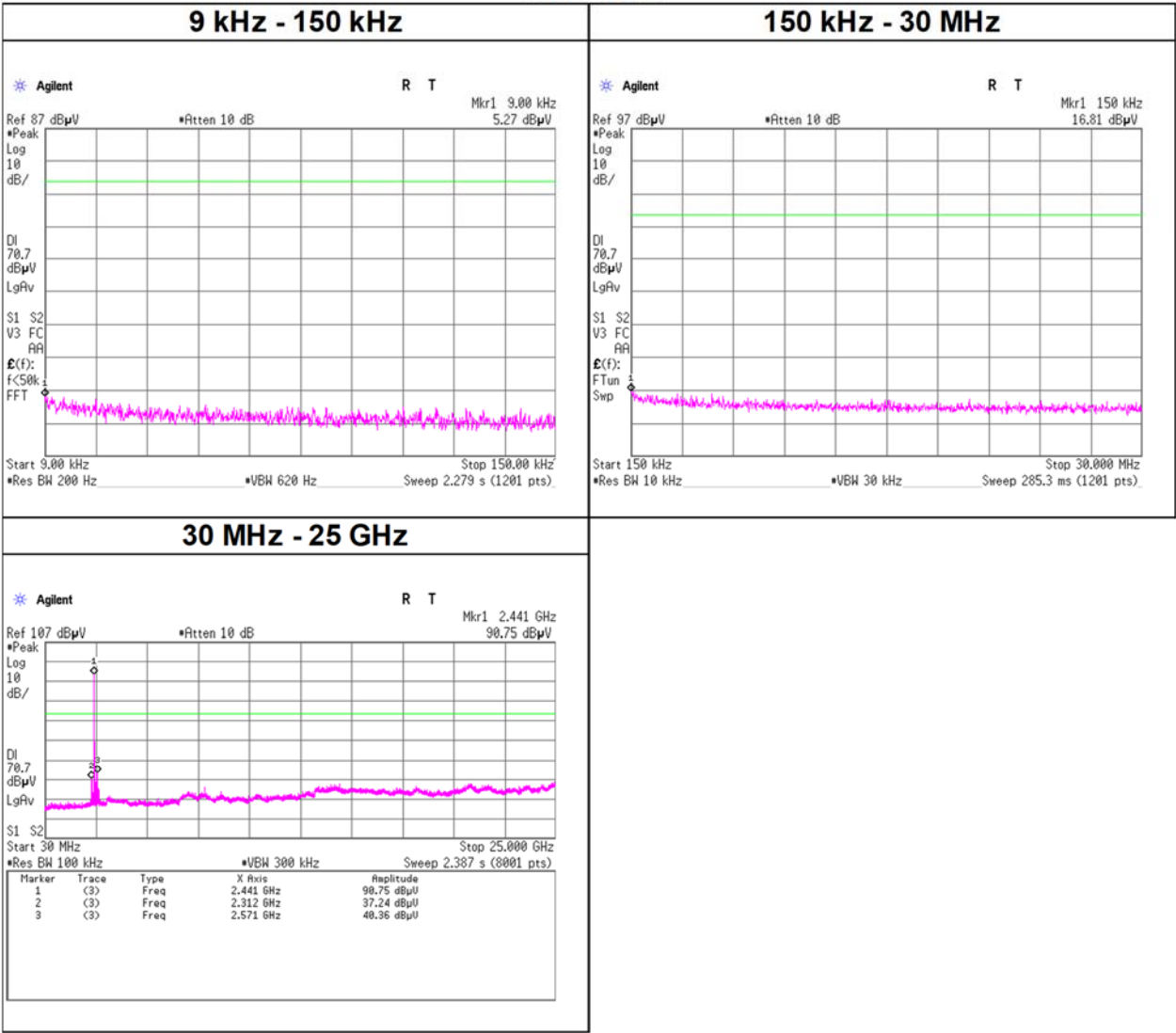
2402 MHz



Conducted Spurious Emission

Test place Shonan EMC Lab. No.5 Shielded Room
Date October 3, 2023
Temperature / Humidity 25 deg. C / 41 % RH
Engineer Hiromasa Sato
Mode Tx, Hopping Off, DH5

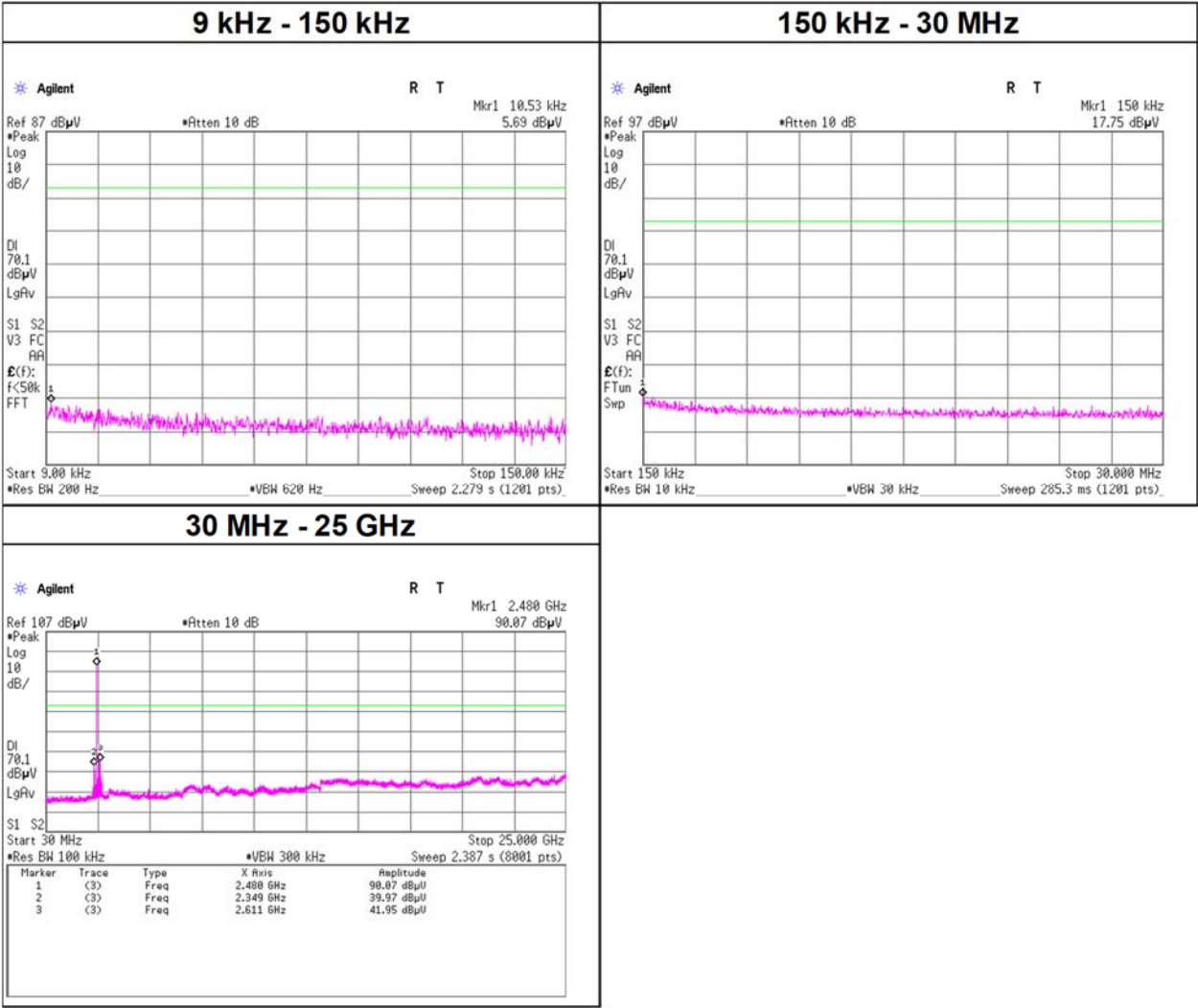
2441 MHz



Conducted Spurious Emission

Test place Shonan EMC Lab. No.5 Shielded Room
Date October 3, 2023
Temperature / Humidity 25 deg. C / 41 % RH
Engineer Hiromasa Sato
Mode Tx, Hopping Off, DH5

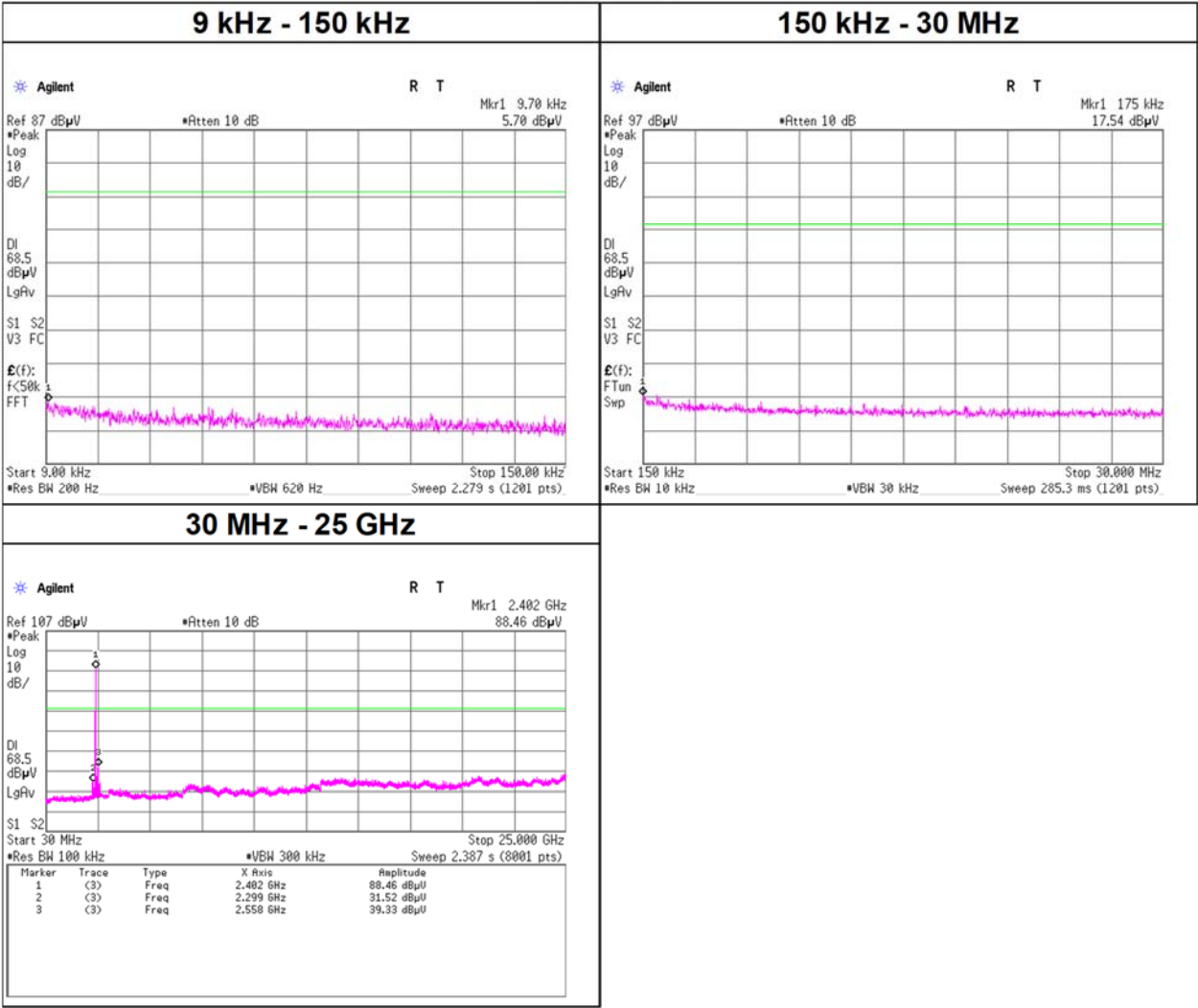
2480 MHz



Conducted Spurious Emission

Test place Shonan EMC Lab. No.5 Shielded Room
Date October 3, 2023
Temperature / Humidity 25 deg. C / 41 % RH
Engineer Hiromasa Sato
Mode Tx, Hopping Off, 3DH5

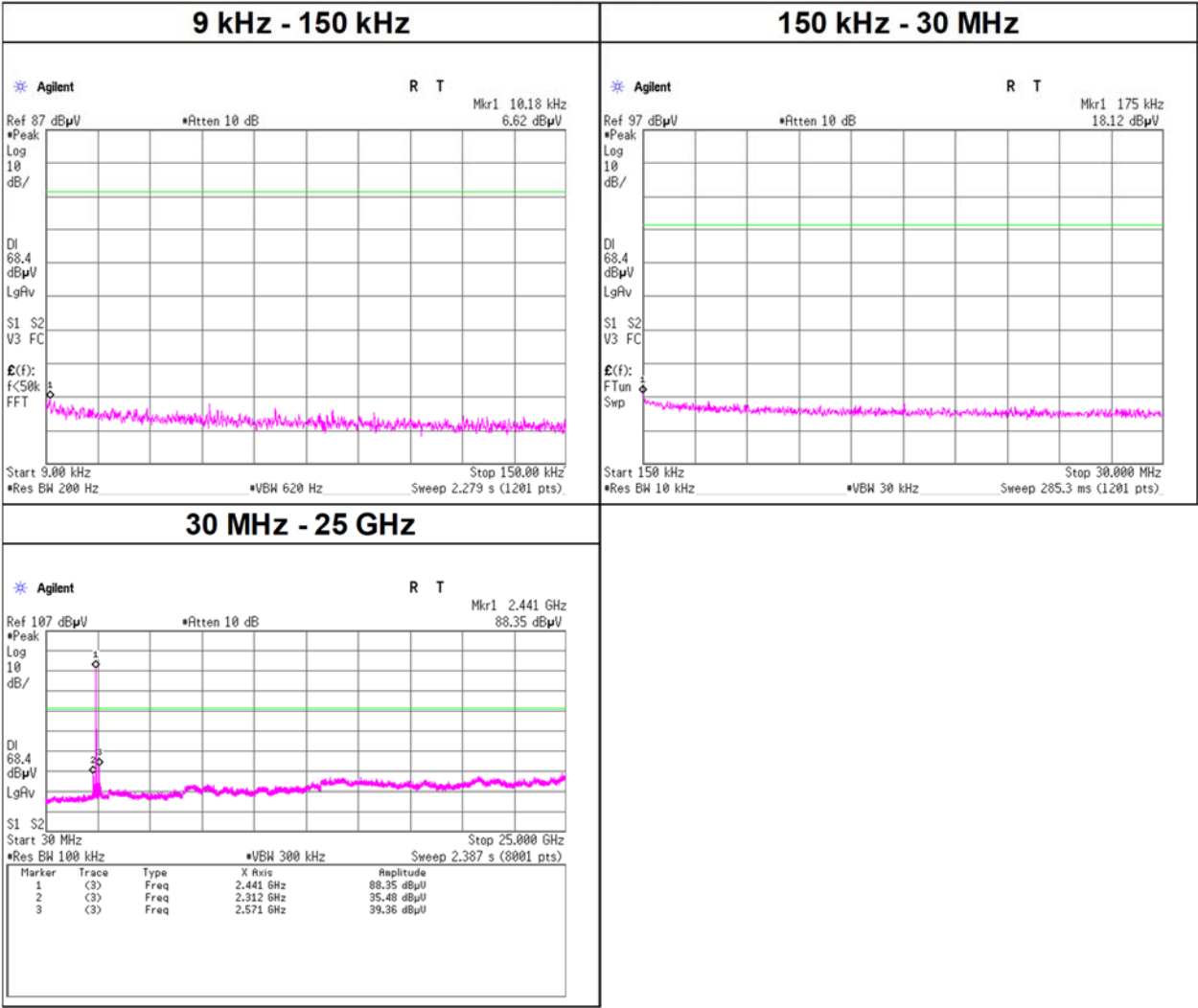
2402 MHz



Conducted Spurious Emission

Test place Shonan EMC Lab. No.5 Shielded Room
Date October 3, 2023
Temperature / Humidity 25 deg. C / 41 % RH
Engineer Hiromasa Sato
Mode Tx, Hopping Off, 3DH5

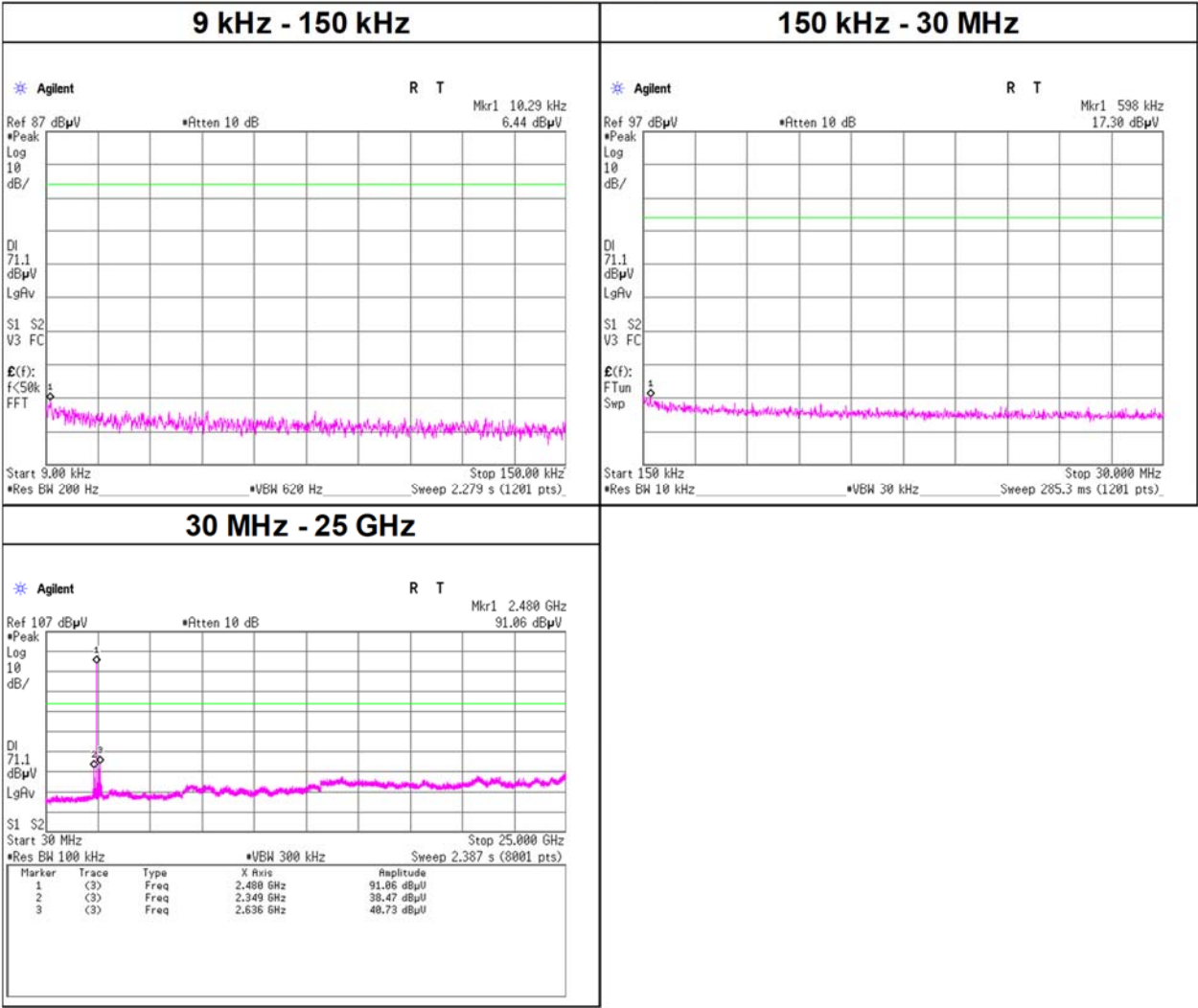
2441 MHz



Conducted Spurious Emission

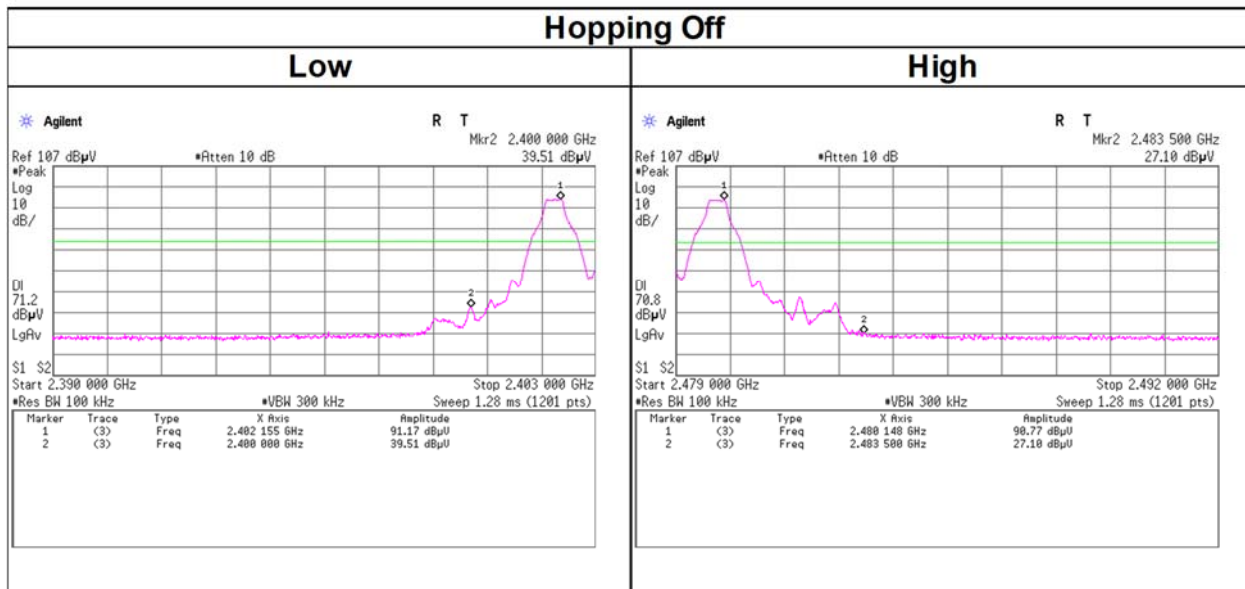
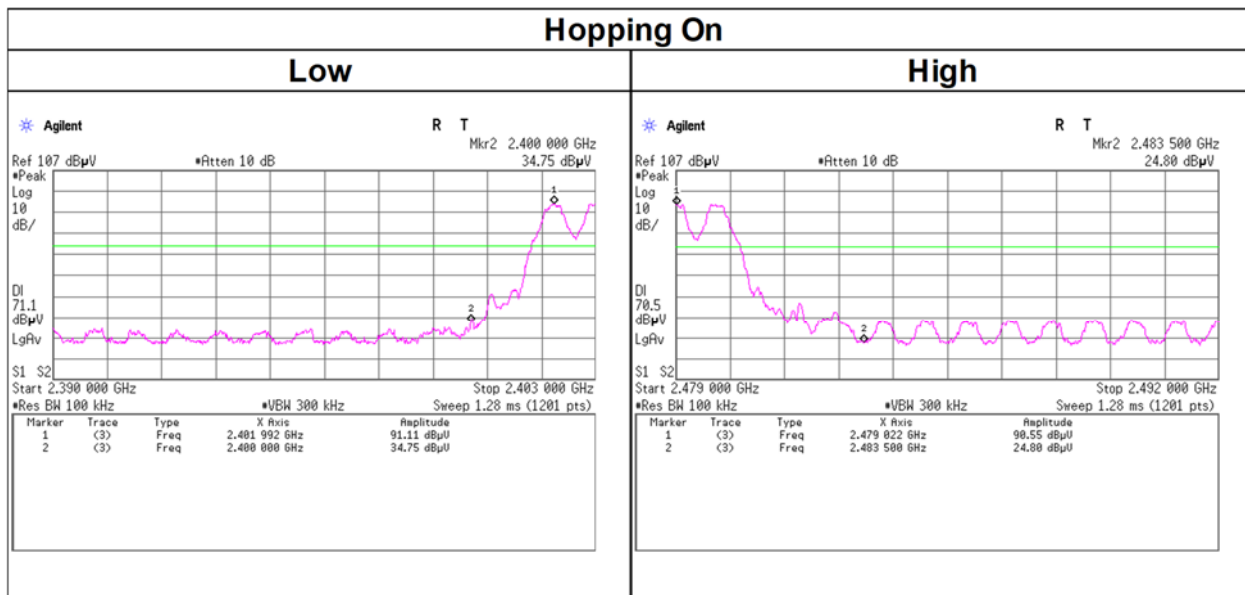
Test place Shonan EMC Lab. No.5 Shielded Room
Date October 3, 2023
Temperature / Humidity 25 deg. C / 41 % RH
Engineer Hiromasa Sato
Mode Tx, Hopping Off, 3DH5

2480 MHz



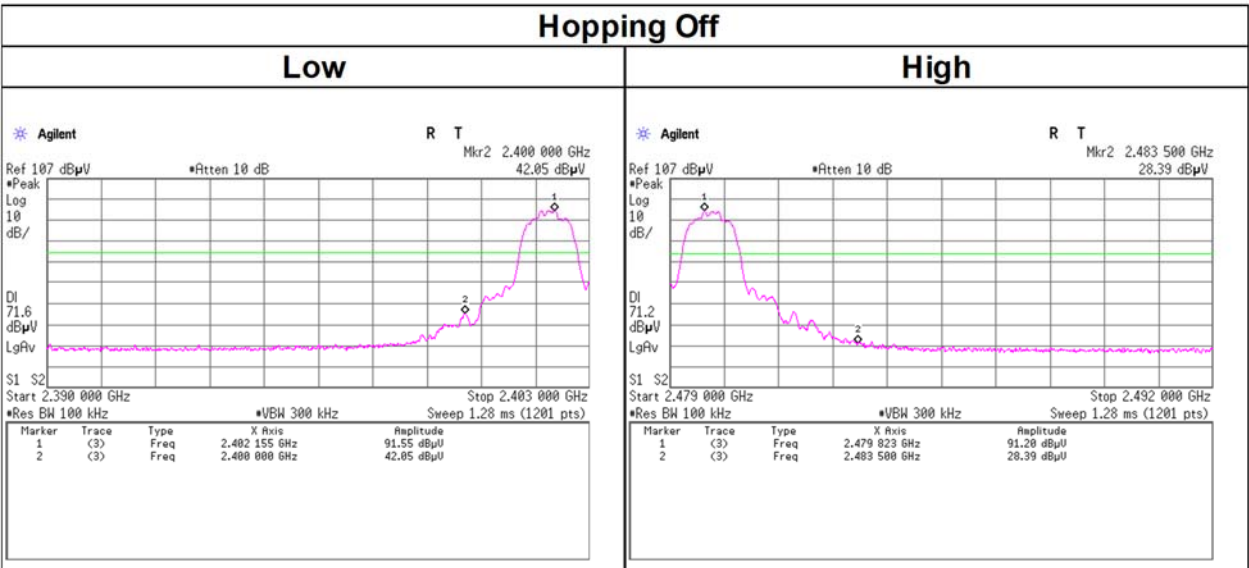
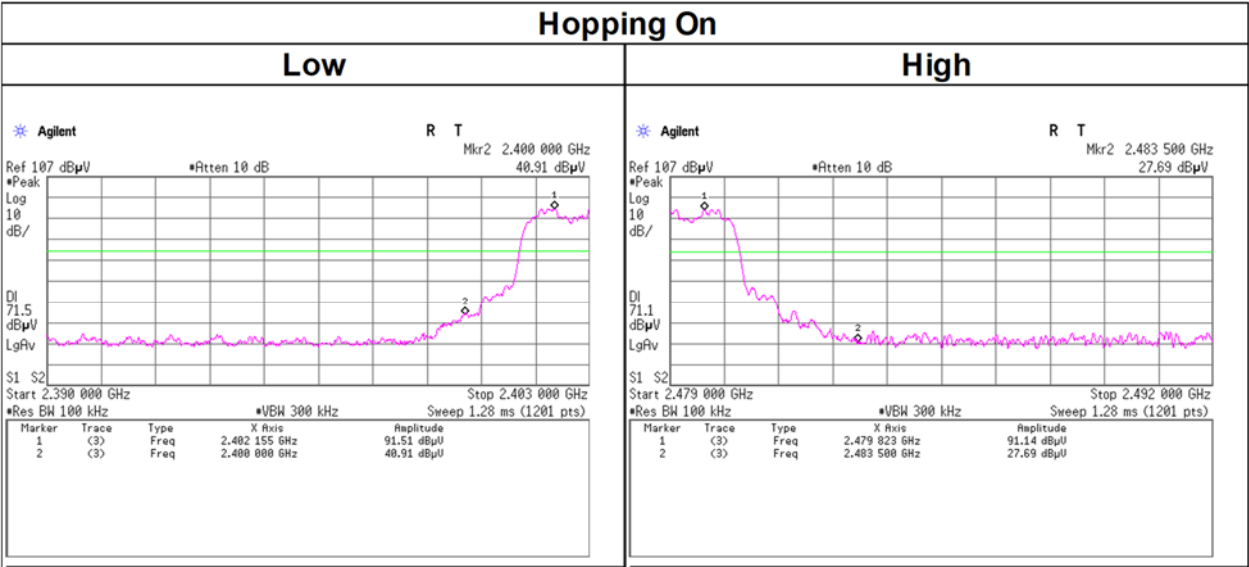
Conducted Emission Band Edge compliance

Test place Shonan EMC Lab. No.5 Shielded Room
Date October 3, 2023
Temperature / Humidity 25 deg. C / 41 % RH
Engineer Hiromasa Sato
Mode Tx DH5



Conducted Emission Band Edge compliance

Test place Shonan EMC Lab. No.5 Shielded Room
Date October 3, 2023
Temperature / Humidity 25 deg. C / 41 % RH
Engineer Hiromasa Sato
Mode Tx 3DH5



APPENDIX 2: Test Instruments

Test Equipment(1/2)

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
AT	151609	Attenuator	Weinschel Corp.	54A-10	81601	2023/03/02	12
AT	204926	Attenuator	Weinschel Corp.	54A-10	109971	2023/02/10	12
AT	145175	Coaxial Cable	Suhner	SUCOFLEX 102	31600/2	2022/12/01	12
AT	196947	Coaxial Cable	Huber+Suhner	SUCOFLEX 102	803478/2	2023/03/02	12
AT	191839	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	-	2023/08/01	12
AT	191845	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	-	2023/08/07	12
AT	146247	Power Meter	Keysight Technologies Inc	8990B	MY51000272	2023/05/29	12
AT	146310	Power sensor	Keysight Technologies Inc	N1923A	MY5326009	2023/05/29	12
AT	145800	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY48250106	2023/03/01	12
AT	146212	Digital Hitester	HIOKI E.E. CORPORATION	3805-50	80997828	2023/09/25	12
AT,RE	145793	Digital Hitester	HIOKI E.E. CORPORATION	3805-50	80997819	2023/05/26	12
RE	170932	EMI Software	TSJ (Techno Science Japan)	TEPTO-DV3(RE,CE,ME,PE)	-	-	-
RE	144892	Attenuator	Keysight Technologies Inc	8490D 010	6036	2022/10/20	12
RE	144899	Attenuator	Inmet	18N-6dB	-	2022/12/16	12
RE	145597	Semi-Anechoic Chamber	TDK	SAEC-01(NSA)	1	2023/04/04	12
RE	145561	Semi-Anechoic Chamber	TDK	SAEC-01(SVSWR)	1	2023/05/16	12
RE	145563	Semi-Anechoic Chamber	TDK	SAEC-02(NSA)	2	2023/03/28	12
RE	145003	Pre Amplifier	SONOMA	310N	290211	2023/02/09	12
RE	145127	Pre Amplifier	Toyo Corporation	TPA0118-36	2072554	2023/05/11	12
RE	145128	Pre Amplifier	Toyo Corporation	TPA0118-36	1440490	2023/05/19	12
RE	145007	Pre Amplifier	Toyo Corporation	HAP18-26W	19	2023/03/03	12
RE	144959	Attenuator	JFW	50HF-003N	-	2023/08/22	12
RE	145161	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	BBA9106	91032664	2023/04/12	12
RE	144967	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/NS4906	-/0901-269(RF Selector)	2023/04/18	12
RE	144968	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/NS4906	-/0901-269(RF Selector)	2023/04/18	12
RE	145039	Coaxial Cable	Junkosha	J12J102207-00	APR-30-15-037	2023/01/12	12
RE	145176	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	2023/08/23	12

Test Equipment(2/2)

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	178573	Coaxial Cable	Huber+Suhner	SUCOFLEX_104_E	MY13407/4E	2023/03/02	12
RE	179540	Coaxial Cable	Huber+Suhner	SUCOFLEX 102	802815/2	2023/03/03	12
RE	196985	Coaxial Cable	Huber+Suhner	SUCOFLEX 102	803650/2	2023/03/02	12
RE	200010	Coaxial Cable	Huber+Suhner	SUCOFLEX 104	575618/4	2023/06/06	12
RE	236869	Coaxial Cable	Huber+Suhner	SUCOFLEX 104	200084/4A	2023/06/06	12
RE	145301	Highpass Filter	Micro-Tronics	HPM50111	51	2022/10/20	12
RE	145383	Horn Antenna	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	9120D-725	2023/03/01	12
RE	145512	Horn Antenna	ETS-Lindgren	3160-09	00094868	2023/06/12	12
RE	194684	Horn Antenna	Schwarzbeck Mess-Elektronik OHG	BBHA 9120 C	695	2023/03/09	12
RE	207277	Measuring	ASKUL	-	-	-	-
RE	207279	Tape Measure	ASKUL	-	-	-	-
RE	236416	Logperiodic Antenna	Schwarzbeck Mess-Elektronik OHG	VULP 9118 B	00974	2023/07/11	12
RE	191837	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	-	2023/08/03	12
RE	191838	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	-	2023/08/03	12
RE	150461	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46186392	2023/05/02	12
RE	145790	Test Receiver	Rohde & Schwarz	ESU40	100093	2023/04/22	12
RE	213530	Test Receiver	Rohde & Schwarz	ESW44	103068	2023/01/12	12
RE	145792	Digital Hitester	HIOKI E.E. CORPORATION	3805-50	80997812	2023/09/25	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 test

RE: Radiated Emission