



RADIO TEST REPORT

Test Report No. 14648829M-E

Customer	ALPS ALPINE CO., LTD.
Description of EUT	Display Control Unit
Model Number of EUT	IDCM
FCC ID	A269ZUA167
Test Regulation	FCC Part 15 Subpart C
Test Result	Complied (Refer to SECTION 3)
Issue Date	February 28, 2023
Remarks	-

Representative Test Engineer

Hiromitsu Tanabe
Engineer

Approved By

Kazuhiro Ando
Engineer



CERTIFICATE 1266.01

- 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# 21.0

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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.: 14648829M-E

Revision	Test Report No.	Date	Page Revised Contents
- (Original)	14648829M-E	February 28, 2023	-

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	6
SECTION 4: Operation of EUT during testing.....	9
SECTION 5: Radiated Spurious Emission	12
SECTION 6: Antenna Terminal Conducted Tests.....	14
APPENDIX 1: Test data	15
20dB Bandwidth, 99%Occupied Bandwidth and Carrier Frequency Separation	15
Number of Hopping Frequency	19
Dwell time.....	21
Maximum Peak Output Power.....	24
Average Output Power.....	25
Radiated Spurious Emission	27
Conducted Spurious Emission	38
Conducted Emission Band Edge compliance	44
APPENDIX 2: Test Instruments	46
APPENDIX 3: Photographs of test setup.....	47
Radiated Spurious Emission	47
Antenna Terminal Conducted Tests.....	49

SECTION 1: Customer Information

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

The information provided from the customer is as follows;

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

* The laboratory is exempted from liability of any test results affected from the above information in SECTION 2 and 4.

SECTION 2: Equipment Under Test (EUT)

2.1 Identification of EUT

Description	Display Control Unit
Model Number	IDCM
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	April 18, 2022
Test Date	April 19, 2022 to January 16, 2023

2.2 Product Description

General Specification

Rating	DC 13.5 V Typ. (DC 9 V to DC 16 V)
Operating temperature	-40 deg. C to +85 deg. C

Radio Specification

Bluetooth (BR / EDR)

Equipment Type	Transceiver
Frequency of Operation	2402 MHz to 2480 MHz
Type of Modulation	FHSS (GFSK, $\pi/4$ DQPSK, 8 DPSK)
Antenna Gain	5.2 dBi

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 a)	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 a)	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 b)	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 c)	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: RSS-Gen 6.12	FCC: Section15.247(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: Section15.247(d) ----- ISED: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	8.7 dB 2597.000 MHz, AV, Horizontal	Complied e) / f)	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 Mains. *2) Radiated test was selected over 30 MHz based on section 15.247(d). a) Refer to APPENDIX 1 (data of 20dB 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) f) Refer to APPENDIX 1 (data of Radiated Spurious Emission)					

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 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	- 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

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 $k=2$.

Radiated emission

Measurement distance	Frequency range	Required Uncertainty (+/-)	Calculate Uncertainty (+/-)
3 m	9 kHz to 30 MHz	Not Defined	2.9 dB
	30 MHz to 200 MHz	6.3 dB	6.2 dB
	200 MHz to 1000 MHz		6.3 dB
	1 GHz to 6 GHz	5.2 dB	5.0 dB
	6 GHz to 18 GHz	5.5 dB	5.4 dB
	18 GHz to 40 GHz	Not Defined	5.5 dB
1 m	1 GHz to 18 GHz	Not Defined	5.4 dB
	18 GHz to 40 GHz		5.6 dB
0.5m	26.5 GHz to 40 GHz	Not Defined	5.9 dB

Antenna Terminal test

Test Item	Required Uncertainty (+/-)	Calculate Uncertainty (+/-)
20 dB Bandwidth / 99 % Occupied Bandwidth	Not Defined	1.6 %
Maximum Peak Output Power	0.75 dB	0.73 dB
Carrier Frequency Separation	Not Defined	2.1×10^{-7}
Dwell time / Burst Rate	Not Defined	0.256 %
Conducted Spurious Emission (below 6 GHz)	4 dB	2.2 dB
Conducted Spurious Emission (6 GHz to 18 GHz)		2.2 dB
Conducted Spurious Emission (18 GHz to 26.5 GHz)		2.4 dB
Conducted Spurious Emission (26.5 GHz to 40 GHz)		2.7 dB

3.5 Test Location

UL Japan, Inc. Kashima EMC Lab.
1614 Mushihata, Katori-shi, Chiba-ken, 289-0341 Japan
Telephone: +81 478 88 6500
A2LA Certificate Number: 1266.01 / FCC Test Firm Registration Number: 910230
ISED Lab Company Number: 4659A / CAB identifier: JP0006

Test site	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Open site	6.0 x 5.5 x 2.5	20 x 40	10 m
No.5 Open site	8.6 x 7.1 x 2.4	18 x 23	10 m
No.1 Shielded room	5.4 x 4.5 x 2.3	-	-
No.5 Shielded Room	4.2 x 3.1 x 2.5	-	-
No.9 Shielded Room	6.1 x 3.6 x 2.8	-	-
No.6 Semi-anechoic Chamber	8.5 x 5.5 x 5.2	-	3 m
No.10 Semi-anechoic Chamber	18.4 x 9.9 x 7.7	-	10 m
No.11 Semi-anechoic Chamber	9.0 x 6.5 x 5.2	-	3 m
No.1 Measurement room	5.0 x 3.7 x 2.6	-	-
No.2 Measurement room	4.3 x 4.4 x 2.7	-	-
No.3 Measurement room	4.5 x 5.3 x 2.7	-	-

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)

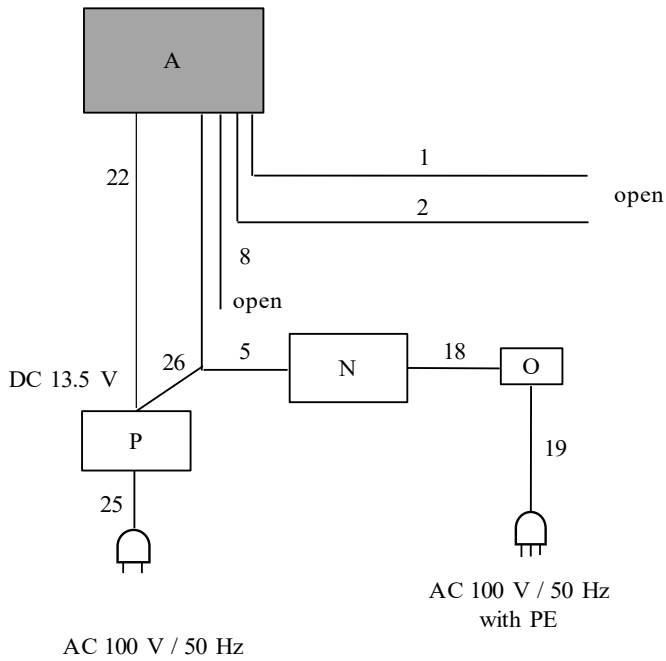
Mode	Remarks*
Bluetooth (BT)	BR / EDR, Payload: PRBS9
<p>*EUT has the power settings by the software as follows; Power Setting: 0 dBm Software: CSR BlueSuite BlueTest 3 Version 2.5.0.93 (Date: 2022.4.19, Storage location: Driven by connected PC)</p> <p>*This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.</p>	

Details of Operating Mode(s)

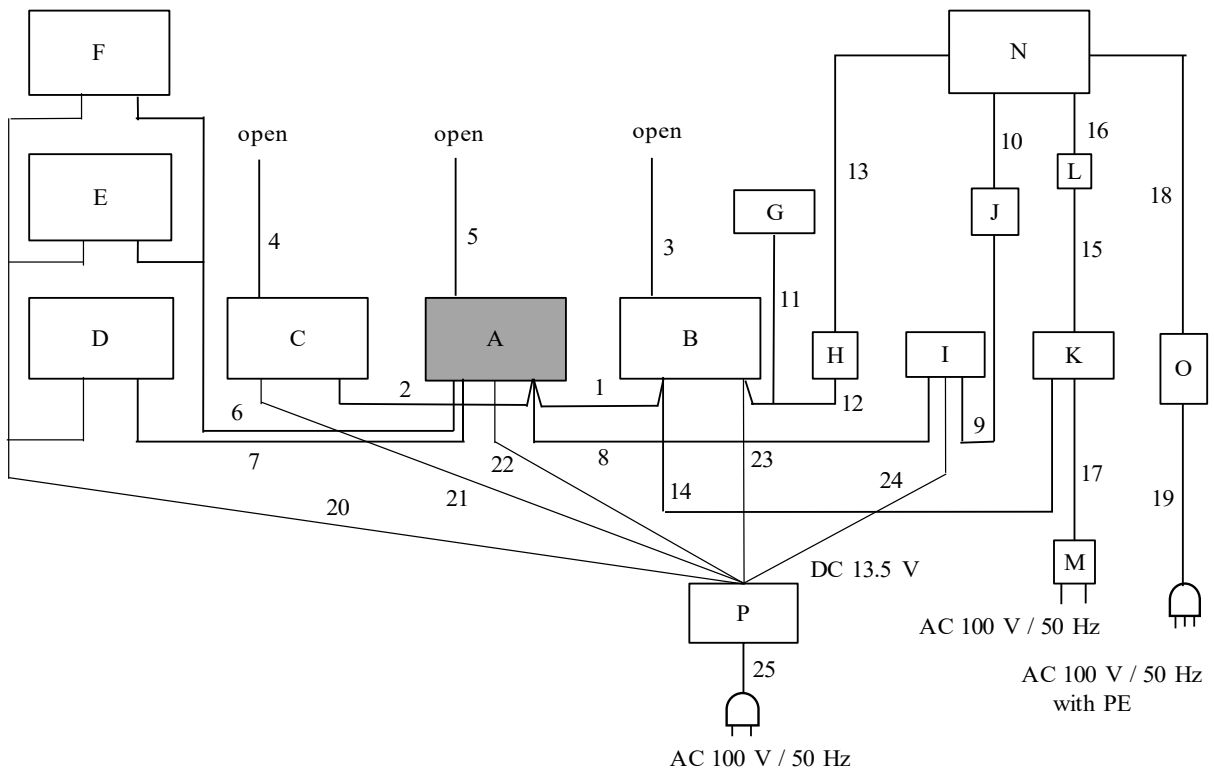
Test Item	Mode	Hopping	Tested Frequency
Radiated Spurious Emission, Conducted Spurious Emission	Tx DH5 Tx 3DH5	Off	2402 MHz 2441 MHz 2480 MHz
Carrier Frequency Separation	Tx DH5 Tx 3DH5	On	2402 MHz 2441 MHz 2480 MHz
20dB Bandwidth	Tx DH5 Tx 3DH5	Off	2402 MHz 2441 MHz 2480 MHz
Number of Hopping Frequency	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
<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). *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.</p>			

4.2 Configuration and Peripherals

Antenna Terminal Conducted



Radiated Emission



* 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	Display Control Unit	IDCM	L122075ZAB10007Q *1) L122075ZAB10008Q *2)	ALPS ALPINE CO., LTD.	EUT
B	Display Control Unit	CSM	L122076ZAC10001Q	ALPS ALPINE CO., LTD.	-
C	Display Control Unit	IDCM-S	-	ALPS ALPINE CO., LTD.	-
D	Display Unit	DJ126NA-01B	0104	ALPS ALPINE CO., LTD.	-
E	Display Unit	DJ126NA-01B	0096	ALPS ALPINE CO., LTD.	-
F	Display Unit	DJ126NA-01B	0098	ALPS ALPINE CO., LTD.	-
G	Dummy Load	-	-	PIGEON	4Ω x4
H	USB - CAN Interface	IPEH-002022-265589	-	PEAK System	-
I	Media Converter Board	RTL9010AA	C018060309	REALTEK	-
J	LAN Adapter	LUA4-U3-AGTE-NBK	20524703209453	BUFFALO	-
K	A2B Board	EVAL-AD2428WD2DZ	-	Analog Device	-
L	A2B Board	EVAL-ADUSB2Z	2018092132519	Analog Device	-
M	AC Adapter	SMI18-12	-	CUI Inc.	-
N	Laptop PC	Vostro 3590	2474696559	Dell	-
O	AC Adapter	HA45NM140	CN-00285K-CH200-03H-0MGU-A07	Dell	-
P	DC Power Supply	GSV3000	1708192899	DIAMOND ANTENNA	-

*1) Used for Antenna Terminal conducted test

*2) Used for Conducted Emission test and Radiated Emission test

List of Cables Used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	A2B BUS Cable	2.50	Unshielded	Unshielded	-
2	A2B BUS Cable	2.50	Unshielded	Unshielded	-
3	A2B BUS Cable	1.00	Unshielded	Unshielded	-
4	A2B BUS Cable	1.00	Unshielded	Unshielded	-
5	BT UART Cable	1.00	Unshielded	Unshielded	-
6	LVDS Cable	4.50	Shielded	Shielded	-
7	LVDS Cable	4.80	Shielded	Shielded	-
8	Ethernet Cable	1.50	Unshielded	Unshielded	-
9	LAN Cable	0.30	Unshielded	Unshielded	-
10	USB Cable	0.15	Shielded	Shielded	-
11	Speaker Cable	1.60	Unshielded	Unshielded	-
12	CAN BUS Cable	1.85	Unshielded	Unshielded	-
13	USB Cable	0.25	Shielded	Shielded	-
14	A2B BUS Cable	1.50	Unshielded	Unshielded	-
15	Signal Cable	0.15	Unshielded	Unshielded	-
16	USB Cable	3.00	Shielded	Shielded	-
17	DC Cable	1.50	Unshielded	Unshielded	-
18	DC Cable	1.80	Unshielded	Unshielded	-
19	AC Cable	0.90	Unshielded	Unshielded	-
20	DC Cable	2.40	Unshielded	Unshielded	-
21	DC Cable	3.10	Unshielded	Unshielded	-
22	DC Cable	3.10	Unshielded	Unshielded	-
23	DC Cable	4.60	Unshielded	Unshielded	-
24	DC Cable	1.90	Unshielded	Unshielded	-
25	AC Cable	1.80	Unshielded	Unshielded	-
26	GND Cable	1.50	Unshielded	Unshielded	-

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 1.5 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.

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.

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 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	Below 1 GHz	Above 1 GHz
Antenna Type	Hybrid	Horn

In any 100 kHz bandwidth outside the restricted band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.

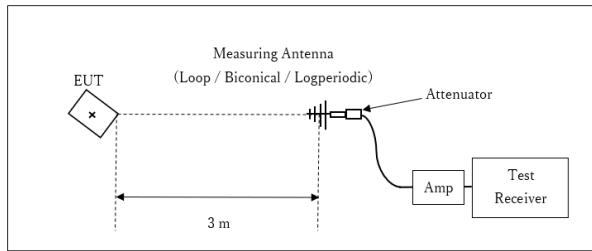
20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9 (ISED) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (ISED).

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

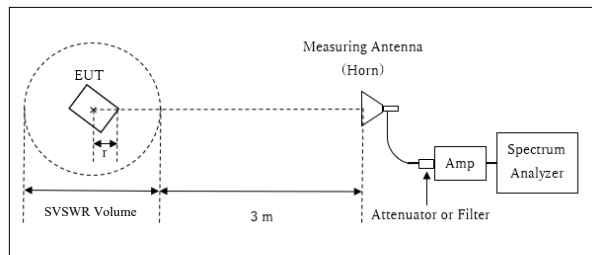
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz to 10 GHz

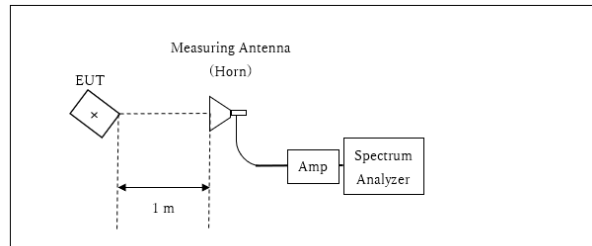


r : Radius of an outer periphery of EUT
× : Center of turn table

Distance Factor: $20 \times \log(4.38 \text{ m} / 3.0 \text{ m}) = 3.29 \text{ dB}$
* Test Distance: $(3 + \text{SVSWR Volume} / 2) - r = 4.38 \text{ m}$

SVSWR Volume : 3.0 m
(SVSWR Volume has been calibrated based on CISPR 16-1-4.)
 $r = 0.12 \text{ m}$

10 GHz to 26.5 GHz



× : Center of turn table

Distance Factor: $20 \times \log(1.0 \text{ m} / 3.0 \text{ m}) = -9.5 \text{ dB}$
*Test Distance: 1 m

The test was made on EUT as tabletop equipment since it was ceiling-mounted device.

The test results and limit are rounded off to one decimal place, 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
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	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 not detected as shown in the chart. (9 kHz -150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 9.1 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

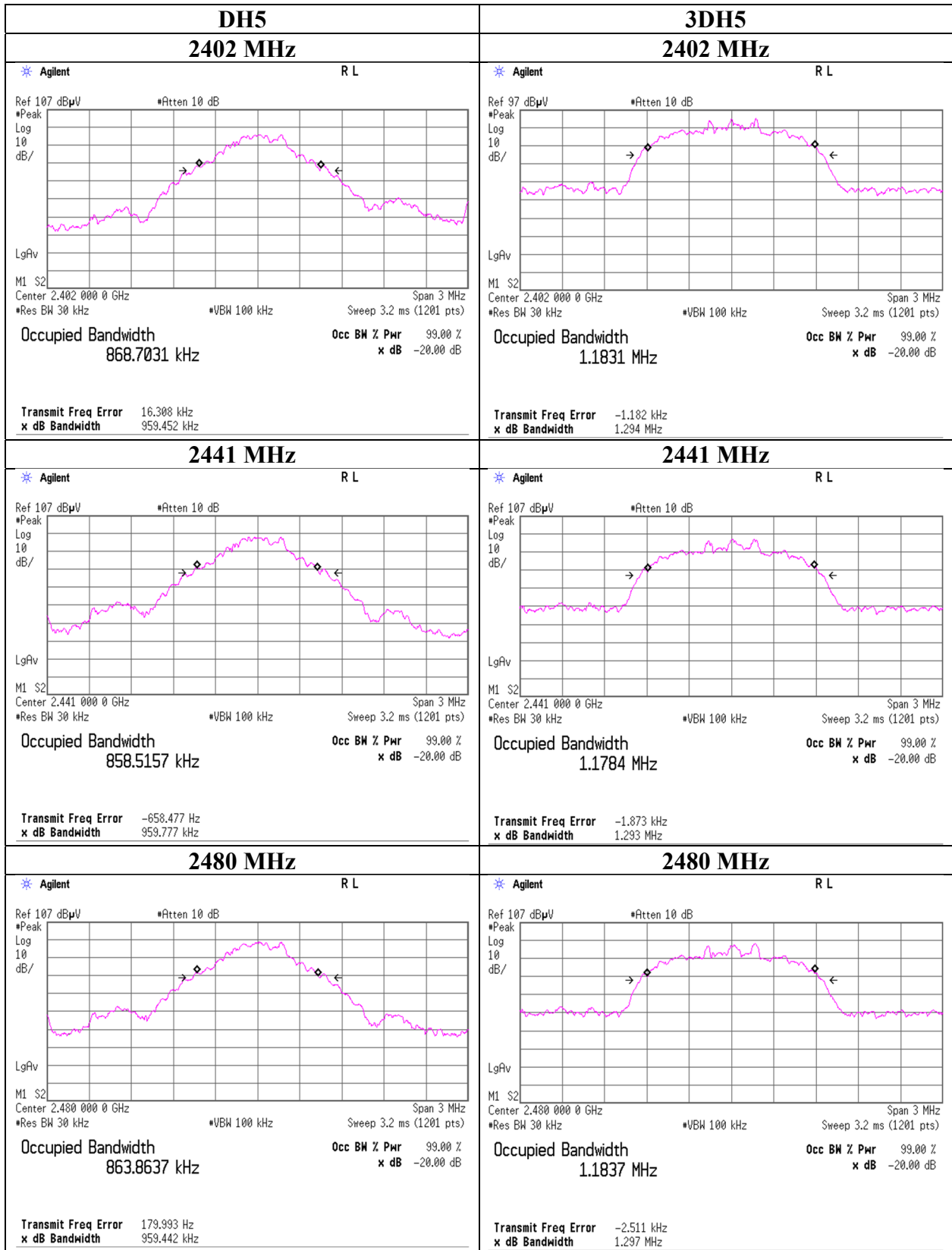
20dB Bandwidth, 99%Occupied Bandwidth and Carrier Frequency Separation

Test place	Kashima EMC Lab. No.2 Measurement Room	
Date	April 19, 2022	April 21, 2022
Temperature / Humidity	20 deg. C / 55 % RH	20 deg. C / 54 % RH
Engineer	Hiromitsu Tanabe	Hiromitsu Tanabe
Mode	Tx, Hopping Off, Tx, Hopping On	

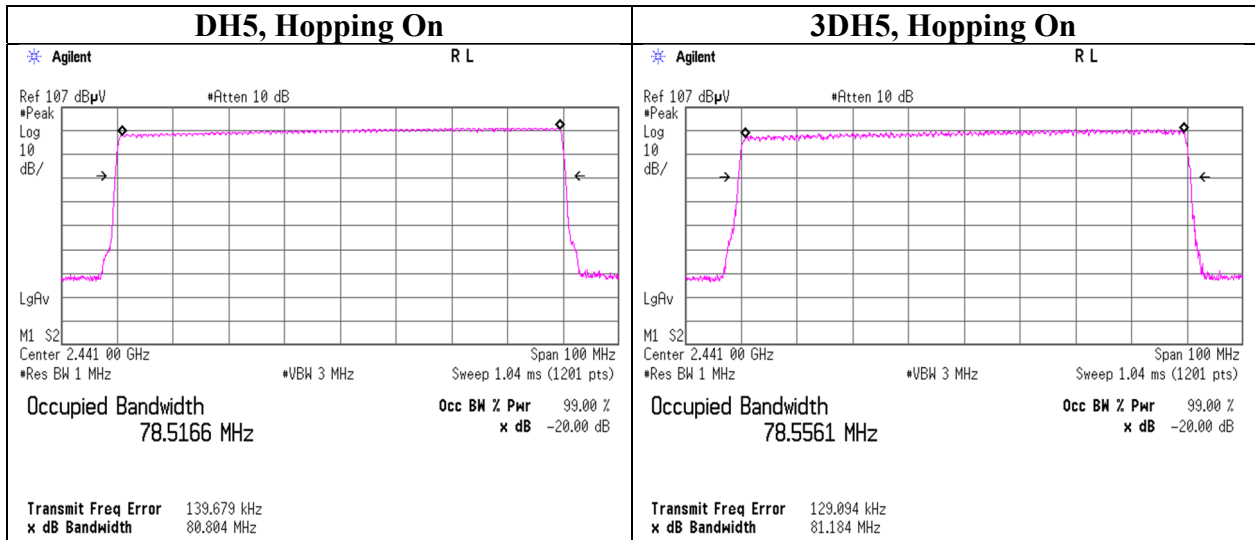
Mode	Freq. [MHz]	20 dB Bandwidth [MHz]	99 % Occupied Bandwidth [kHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
DH5	2402.0	0.959	868.703	1.000	>= 0.640
DH5	2441.0	0.960	858.516	1.000	>= 0.640
DH5	2480.0	0.959	863.864	1.000	>= 0.640
DH5	Hopping On	-	78516.6	-	-
3DH5	2402.0	1.294	1183.098	1.000	>= 0.863
3DH5	2441.0	1.293	1178.418	1.000	>= 0.862
3DH5	2480.0	1.297	1183.650	1.000	>= 0.864
3DH5	Hopping On	-	78556.1	-	-

Limit: Two-thirds of 20 dB Bandwidth or 25 kHz (whichever is greater).
No limit applies to 20 dB Bandwidth.

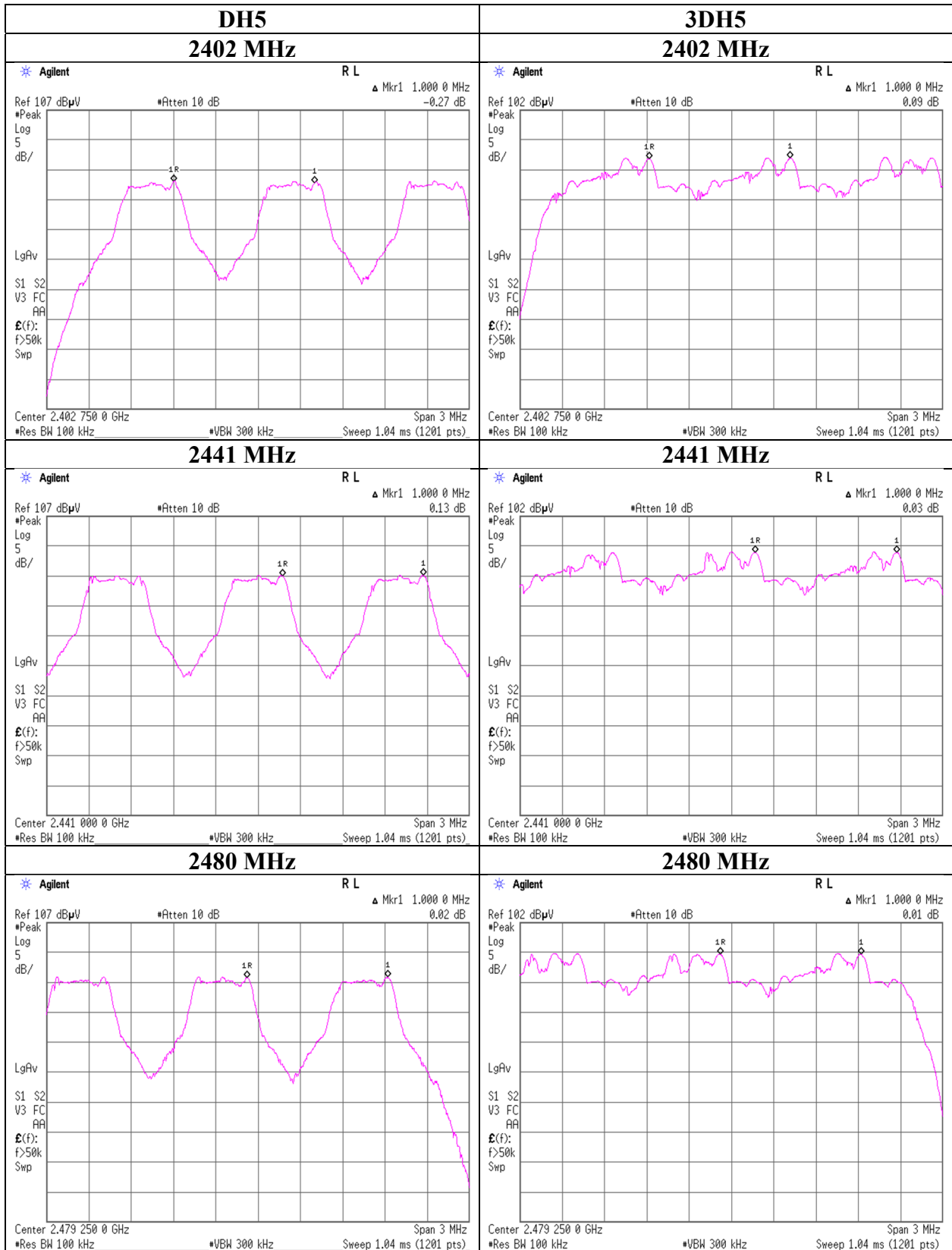
20dB Bandwidth and 99% Occupied Bandwidth



20dB Bandwidth and 99% Occupied Bandwidth



Carrier Frequency Separation



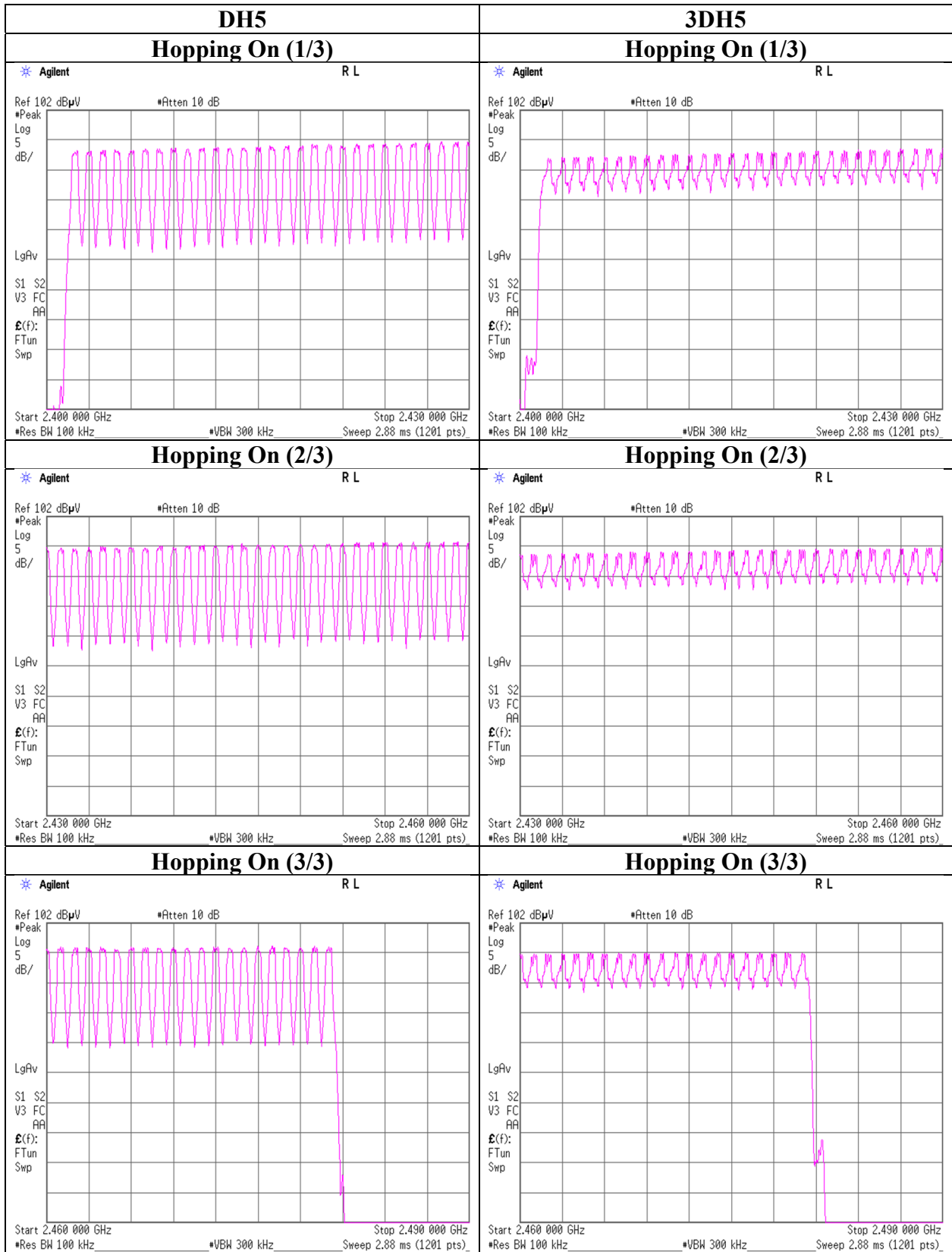
Number of Hopping Frequency

Test place Kashima EMC Lab. No.2 Measurement Room
Date April 21, 2022
Temperature / Humidity 20 deg. C / 54 % RH
Engineer Hiromitsu Tanabe
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	Kashima EMC Lab. No.2 Measurement Room
Date	April 21, 2022
Temperature / Humidity	20 deg. C / 54 % RH
Engineer	Hiromitsu Tanabe
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	51.0 times / 5 s x 31.6 s = 323 times	0.423	137	400
DH3	26.0 times / 5 s x 31.6 s = 165 times	1.679	277	400
DH5	17.0 times / 5 s x 31.6 s = 108 times	2.929	316	400
3DH1	51.0 times / 5 s x 31.6 s = 323 times	0.445	144	400
3DH3	26.0 times / 5 s x 31.6 s = 165 times	1.690	279	400
3DH5	17.0 times / 5 s x 31.6 s = 108 times	2.945	318	400

Sample Calculation

Result = Number of transmission x Length of transmission

*Average data of 5 tests.

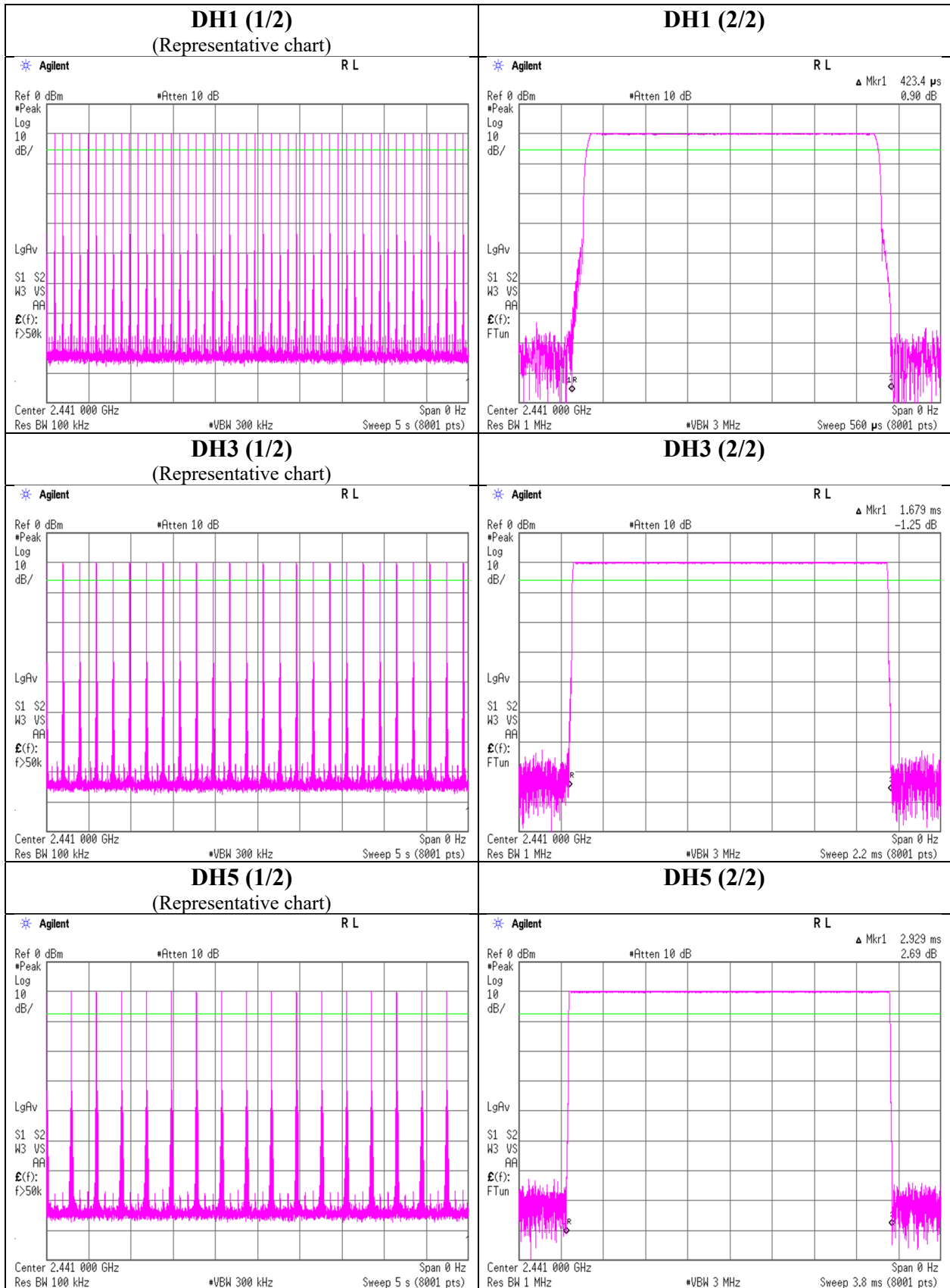
Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
DH1	51	51	51	51	51	51
DH3	26	26	26	26	26	26
DH5	17	17	17	17	17	17
3DH1	51	51	51	51	51	51
3DH3	26	26	26	26	26	26
3DH5	17	17	17	17	17	17

Sample Calculation

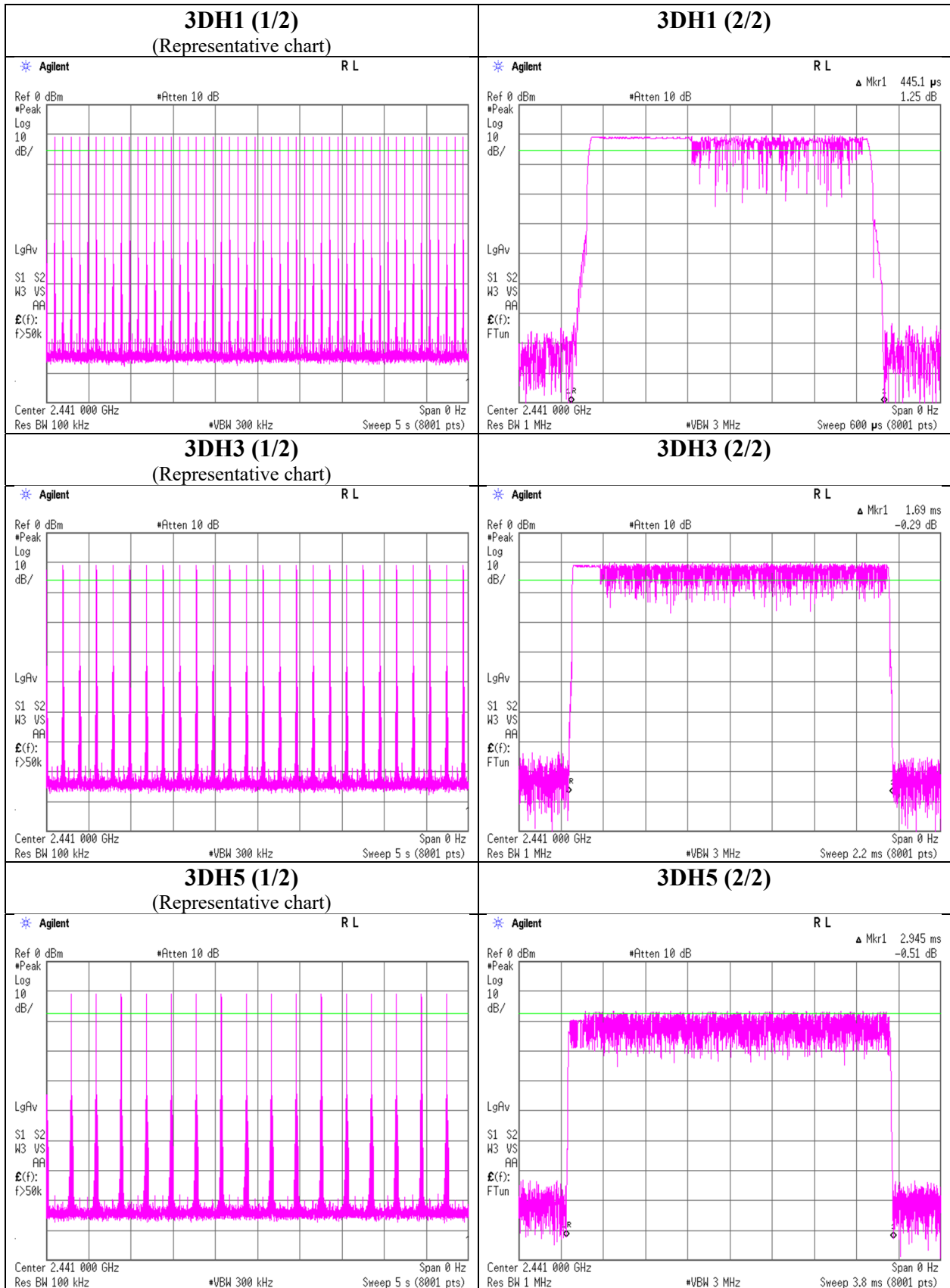
Average = Summation (Sampling 1 to 5) / 5

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 Kashima EMC Lab. No.2 Measurement Room
Date April 19, 2022
Temperature / Humidity 20 deg. C / 55 % RH
Engineer Hiromitsu Tanabe
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	2402.0	-11.16	1.27	9.89	0.00	1.00	20.96	125	20.96	5.2	5.20	3.31	36.02	4000	30.82
DH5	2441.0	-9.27	1.28	9.89	1.90	1.55	20.96	125	19.06	5.2	7.10	5.13	36.02	4000	28.92
DH5	2480.0	-8.59	1.30	9.89	2.60	1.82	20.96	125	18.36	5.2	7.80	6.03	36.02	4000	28.22
2DH5	2402.0	-11.52	1.27	9.89	-0.36	0.92	20.96	125	21.32	5.2	4.84	3.05	36.02	4000	31.18
2DH5	2441.0	-9.58	1.28	9.89	1.59	1.44	20.96	125	19.37	5.2	6.79	4.78	36.02	4000	29.23
2DH5	2480.0	-8.88	1.30	9.89	2.31	1.70	20.96	125	18.65	5.2	7.51	5.64	36.02	4000	28.51
3DH5	2402.0	-11.16	1.27	9.89	0.00	1.00	20.96	125	20.96	5.2	5.20	3.31	36.02	4000	30.82
3DH5	2441.0	-9.27	1.28	9.89	1.90	1.55	20.96	125	19.06	5.2	7.10	5.13	36.02	4000	28.92
3DH5	2480.0	-8.59	1.30	9.89	2.60	1.82	20.96	125	18.36	5.2	7.80	6.03	36.02	4000	28.22

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.

However, the limit level 125 mW of AFH mode was used for the test.

Average Output Power
(Reference data for RF Exposure)

Test place	Kashima EMC Lab. No.2 Measurement Room
Date	April 19, 2022
Temperature / Humidity	20 deg. C / 55 % RH
Engineer	Hiromitsu Tanabe
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	2402.0	-13.01	1.27	9.89	-1.85	0.65	1.08	-0.77	0.84
DH5	2441.0	-10.90	1.28	9.89	0.27	1.06	1.08	1.35	1.36
DH5	2480.0	-10.17	1.30	9.89	1.02	1.26	1.08	2.10	1.62
2DH5	2402.0	-15.14	1.27	9.89	-3.98	0.40	1.06	-2.92	0.51
2DH5	2441.0	-12.97	1.28	9.89	-1.80	0.66	1.06	-0.74	0.84
2DH5	2480.0	-12.19	1.30	9.89	-1.00	0.79	1.06	0.06	1.01
3DH5	2402.0	-15.16	1.27	9.89	-4.00	0.40	1.06	-2.94	0.51
3DH5	2441.0	-12.98	1.28	9.89	-1.81	0.66	1.06	-0.75	0.84
3DH5	2480.0	-12.19	1.30	9.89	-1.00	0.79	1.06	0.06	1.01

Sample Calculation:

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

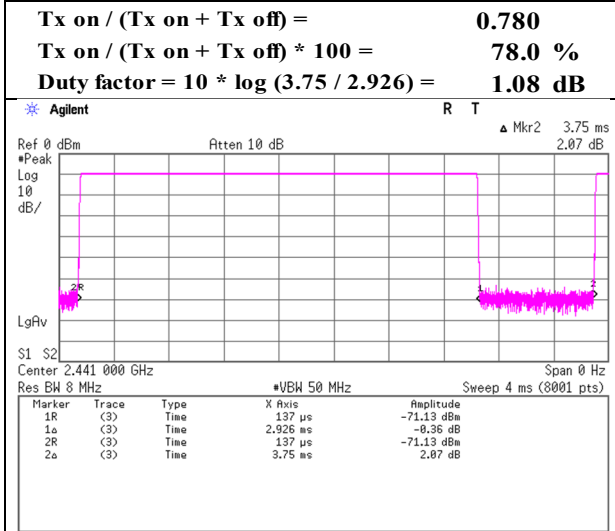
Result (Burst power average) = Time average + Duty factor

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

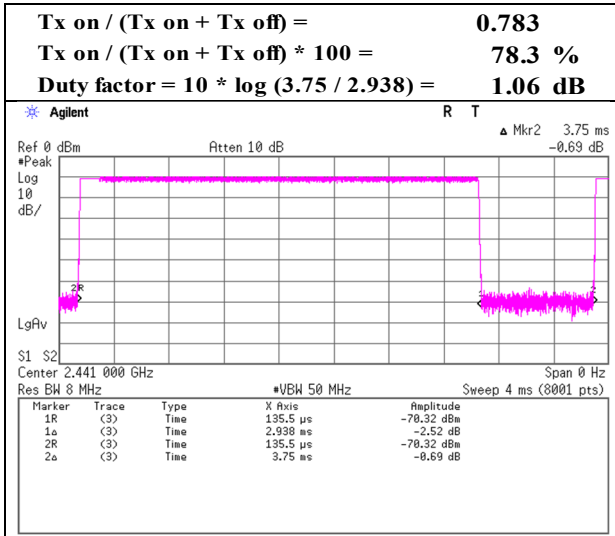
Burst Rate Confirmation

Test place	Kashima EMC Lab. No.2 Measurement Room
Date	April 19, 2022
Temperature / Humidity	20 deg. C / 55 % RH
Engineer	Hiromitsu Tanabe
Mode	Tx, Hopping Off

DH5



2DH5



3DH5

