RADIO TEST REPORT

Test Report No. : 13063555S-B-R2

Applicant	:	**PIONEER CORPORATION**
Type of Equipment	:	**RDS AV RECEIVER**
Model No.	:	**DMH-WC6600NEX**
FCC ID	:	**AJDK112**
Test regulation	:	**FCC Part 15 Subpart C: 2019** ***Bluetooth BDR/EDR part**
Test items	:	**Antenna Terminal Conducted Tests**
Test Result	:	**Complied (Refer to SECTION 3.2)**

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
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.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by the A2LA accreditation body.
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.
10. This report is a revised version of 13063555S-B-R1. 13063555S-B-R1 is replaced with this report.

Date of test: October 11, 2019

Representative test engineer: T. Kawakami
Takahiro Kawakami
Engineer
Consumer Technology Division

Approved by: K. Takeyama
Kazutaka Takeyama
Engineer
Consumer Technology Division

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.: 13063555S-B

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13063555S-B	January 16, 2020	-	-
1	13063555S-B-R1	February 4, 2020	P.1	Modification of the applicant from: PIONEER CORPORATIONRDS AV RECEIVER to: PIONEER CORPORATION
			P.1	Addition of Test items: Antenna Terminal Conducted Tests
			P.5	Modification of the company name from: PIONEER CORPORATIONRDS AV RECEIVER to: PIONEER CORPORATION
			P.6	Modification of product description from: is a RDS AV RECEIVER to: is an RDS AV RECEIVER
			P.6	Removed from Clock frequency (ies) in the system: "Bluetooth Wi-Fi module: 32.768 kHz"
			P.7	Modification of the reference test report number from: No.13063556M-A to: No.13063556M-A-R1
2	13063555S-B-R2	February 13, 2020	P.7	Modification of the carrier frequency separation results from: N/A to: Complied
			P.7	Modification of the reference test report number from: No.13063556M-A-R1 to: No.13063556M-A-R2

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Reference: Abbreviations (Including words undescribed in this report)

A2LA	The American Association for Laboratory Accreditation
AC	Alternating Current
AFH	Adaptive Frequency Hopping
AM	Amplitude Modulation
Amp, AMP	Amplifier
ANSI	American National Standards Institute
Ant, ANT	Antenna
AP	Access Point
ASK	Amplitude Shift Keying
Atten., ATT	Attenuator
AV	Average
BPSK	Binary Phase-Shift Keying
BR	Bluetooth Basic Rate
BT	Bluetooth
BT LE	Bluetooth Low Energy
BW	BandWidth
Cal Int	Calibration Interval
CCK	Complementary Code Keying
Ch., CH	Channel
CISPR	Comite International Special des Perturbations Radioelectriques
CW	Continuous Wave
DBPSK	Differential BPSK
DC	Direct Current
D-factor	Distance factor
DFS	Dynamic Frequency Selection
DQPSK	Differential QPSK
DSSS	Direct Sequence Spread Spectrum
EDR	Enhanced Data Rate
EIRP, e.i.r.p.	Equivalent Isotropically Radiated Power
EMC	ElectroMagnetic Compatibility
EMI	ElectroMagnetic Interference
EN	European Norm
ERP, e.r.p.	Effective Radiated Power
EU	European Union
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
LIMS	Laboratory Information Management System
MCS	Modulation and Coding Scheme
MRA	Mutual Recognition Arrangement
N/A	Not Applicable
NIST	National Institute of Standards and Technology
NS	No signal detect.
NSA	Normalized Site Attenuation
NVLAP	National Voluntary Laboratory Accreditation Program
OBW	Occupied Band Width
OFDM	Orthogonal Frequency Division Multiplexing
P/M	Power meter
PCB	Printed Circuit Board
PER	Packet Error Rate
PHY	Physical Layer
PK	Peak
PN	Pseudo random Noise
PRBS	Pseudo-Random Bit Sequence
PSD	Power Spectral Density
QAM	Quadrature Amplitude Modulation
QP	Quasi-Peak
QPSK	Quadri-Phase Shift Keying
RBW	Resolution Band Width
RDS	Radio Data System
RE	Radio Equipment
RF	Radio Frequency
RMS	Root Mean Square
RSS	Radio Standards Specifications
Rx	Receiving
SA, S/A	Spectrum Analyzer
SG	Signal Generator
SVSWR	Site-Voltage Standing Wave Ratio
TR	Test Receiver
Tx	Transmitting
VBW	Video BandWidth
Vert.	Vertical
WLAN	Wireless LAN

CONTENTS **PAGE**

SECTION 1: Customer information

Company Name	:	PIONEER CORPORATION
Address	:	25-1, Yamada, Kawagoe-shi, Saitama, 350-8555, JAPAN
Telephone Number	:	+81-49-228-7681
Facsimile Number	:	+81-49-228-6172
Contact Person	:	Shigeru Yoshida

The information provided from the customer is as follows;
- Applicant, Type of Equipment, Model No., 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 (E.U.T.)
- SECTION 4: Operation of E.U.T. 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 (E.U.T.)

2.1 Identification of E.U.T.

Type of Equipment	:	RDS AV RECEIVER
Model No.	:	DMH-WC6600NEX
Serial No.	:	Refer to SECTION 4.2
Rating	:	DC 14.4 V (DC 10.8 V to 15.1 V)
Receipt Date of Sample (Information from test lab.)	:	September 18, 2019
Country of Mass-production	:	Thailand
Condition of EUT	:	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT	:	No Modification by the test lab.

2.2 Product Description

Model: DMH-WC6600NEX (referred to as the EUT in this report) is an RDS AV RECEIVER.

General Specification

The clock frequencies used in the EUT:

Clock frequency(ies) in the system : DC-DC CONVERTER 1008 kHz / 700.5 kHz, 365.8 kHz / 413.9 kHz
FM/AM TUNER 55.467 MHz (VCO: 5.9904 GHz / 6.2208 GHz)
MAIN PROCESSER 24 MHz
SYSTEM MICRO COMPUTER 12.5 MHz
LCD BACK LIGHT 515.7 kHz / 476.6 kHz
LINE AMPLIFER 515.7 kHz / 476.6 kHz
CHIPS 26 MHz, 32.768 kHz, 10 MHz
HDMI RECEIVER 27 MHz
VIDEO DECORDER 32 MHz

Radio Specification

Radio Type	:	Transceiver	
Frequency of Operation	:	2.4 GHz:	2402 MHz - 2480 MHz (Bluetooth BDR/EDR, Bluetooth Low Energy)
			2412 MHz - 2462 MHz (IEEE 802.11b/g/n)
		5 GHz	5745 MHz (IEEE 802.11a/n-20)
			5755 MHz (IEEE 802.11n-40/ac-40)
			5775 MHz (IEEE 802.11ac-80)
Modulation	:	DSSS (IEEE 802.11b), OFDM (IEEE 802.11g/n/a/ac)	
		FHSS (Bluetooth BDR/EDR)	
		GFSK (Bluetooth Low Energy)	
Power Supply (inner)	:	DC 3.3 V/1.8 V	
Antenna type	:	Monopole Antenna	
Antenna Gain	:	2.4 GHz:	-14.5 dBi (Bluetooth BDR/EDR, Bluetooth Low Energy)
			-11.2 dBi (IEEE 802.11b/g/n)
		5 GHz:	-13.2 dBi
Operating Temperature	:	-10 deg. C to +60 deg. C	

GNSS

Radio Type	:	Receiver
Frequency of Operation	:	GPS: 1575.42 MHz
		GLONASS: 1598.025 MHz - 1605.375 MHz
		Galileo: 1575.42 MHz
Antenna type	:	External Antenna
Antenna Gain	:	2.0 dBi (Elevation Angle:90 deg.)
		-6.0 dBi (Elevation Angle:10 deg.)

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on July 19, 2019 and effective August 19, 2019 except 15.258

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

*The customer has declared that the EUT has complies with FCC Part 15 Subpart B as SDoC.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst Margin	Results	Remarks
Conducted Emission	**FCC:** ANSI C63.10-2013 6. Standard test methods	**FCC:** Section 15.207	N/A	N/A	- *1)
	ISED: RSS-Gen 8.8	**ISED:** RSS-Gen 8.8			
Carrier Frequency Separation	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section15.247(a)(1)	N/A See data.	Complied a)	Conducted
	ISED: -	**ISED:** RSS-247 5.1 (b)			
20dB Bandwidth	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section15.247(a)(1)		Complied b)	Conducted
	ISED: -	**ISED:** RSS-247 5.1 (a)			
Number of Hopping Frequency	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section15.247(a)(1)(iii)		Complied c)	Conducted
	ISED: -	**ISED:** RSS-247 5.1 (d)			
Dwell time	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section15.247(a)(1)(iii)		Complied d)	Conducted
	ISED: -	**ISED:** RSS-247 5.1 (d)			
Maximum Peak Output Power	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section15.247(a)(b)(1)		Complied e)	Conducted
	ISED: RSS-Gen 6.12	**ISED:** RSS-247 5.4 (b)			
Spurious Emission & Band Edge Compliance	**FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02	**FCC:** Section15.247(d)	See data.	Complied f)	Conducted/ Radiated (above 30 MHz) *2)
	ISED: RSS-Gen 6.13	**ISED:** RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10			

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 power ports.
*2) For the Radiated spurious emission test, refer to test report No.13063556M-A-R2.

a) Refer to APPENDIX 1 (data of Carrier Frequency Separation)
b) Refer to APPENDIX 1 (data of 20dB Bandwidth, 99%Occupied Bandwidth and Carrier Frequency Separation)
c) Refer to APPENDIX 1 (data of Number of Hopping Frequency)
d) Refer to APPENDIX 1 (data of Dwell time)
e) Refer to APPENDIX 1 (data of Maximum Peak Output Power)
f) 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)

This 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 this 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	RSS-Gen 6.7	**ISED:** -	N/A	- a)	Conducted
a) Refer to APPENDIX 1 (data of 6 dB Bandwidth and 99 % Occupied Bandwidth)					

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.
Shonan EMC Lab.

Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1 GHz (Average Detector)_SPM-06	0.98 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	1.75 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.89 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	1.12 dB
Power Measurement above 1 GHz (Average Detector)_SPM-13	1.06 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-13	1.24 dB
Spurious emission (Conducted) below 1GHz	0.9 dB
Spurious emission (Conducted) 1 GHz-3 GHz	0.9 dB
Spurious emission (Conducted) 3 GHz-18 GHz	2.9 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.6 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.0 dB
Bandwidth Measurement	0.07 %
Duty cycle and Time Measurement	0.262 %

3.5 Test Location

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Telephone: +81 463 50 6400, Facsimile: +81 463 50 6401
A2LA Certificate Number: 1266.03 (FCC Test Firm Registration Number: 626366, ISED Lab Company Number: 2973D)

Test site	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Semi-anechoic chamber	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.2 Semi-anechoic chamber	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber	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 E.U.T. during testing

4.1 Operating Mode(s)

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

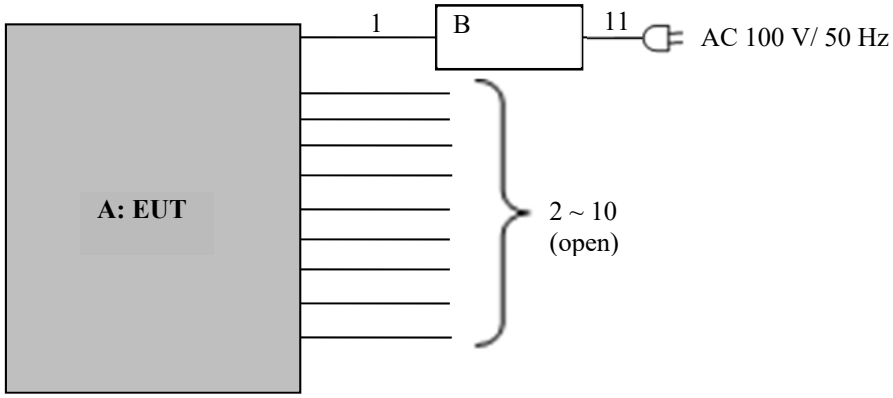
Details of Operating Mode(s)

Test Item	Mode	Tested frequency
Conducted Emission, Spurious Emission (Conducted/Radiated)	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
20dB 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

*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.

*EUT has the power settings by the software as follows;
Power settings: Fixed
Software: SoC：0.0601400
SYS：7.13
*This setting of software is the worst case.
Any conditions under the normal use do not exceed the condition of setting.
In addition, end users cannot change the settings of the output power of the product.

4.2 Configuration and peripherals



* 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	Remark
A	RDS AV RECEIVER	DMH-WC6600NEX	SGTM000034UC	Pioneer Corporation	EUT
B	DC Power Supply	PAN 35-10A	DE001677	Kikusui	-

List of cables used

No.	Name	Length (m)	eld		Remark
			Cable	Connector	
1	DC (+B, ACC, GND)	0.15 + 2.4	Unshielded	Unshielded	-
2	Speaker Front L	0.15	Unshielded	Unshielded	-
3	Speaker Front R	0.15	Unshielded	Unshielded	-
4	Speaker Rear L	0.15	Unshielded	Unshielded	-
5	Speaker Rear R	0.15	Unshielded	Unshielded	-
6	System Remote Control	0.15	Unshielded	Unshielded	-
7	ILL +	0.15	Unshielded	Unshielded	-
8	Reverse Gear Signal In	0.15	Unshielded	Unshielded	-
9	Parking Brake	2.0	Unshielded	Unshielded	-
10	Car Speed Signal In	0.15	Unshielded	Unshielded	-
11	AC	2.0	Unshielded	Unshielded	-

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
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)	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 = 10 kHz)

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

Report No.	13063555S-B-R2
Test place	Shonan EMC Lab. No.5 Semi Anechoic Chamber
Date	October 11, 2019
Temperature / Humidity	24 deg. C / 52 % RH
Engineer	Takahiro Kawakami
Mode	Tx

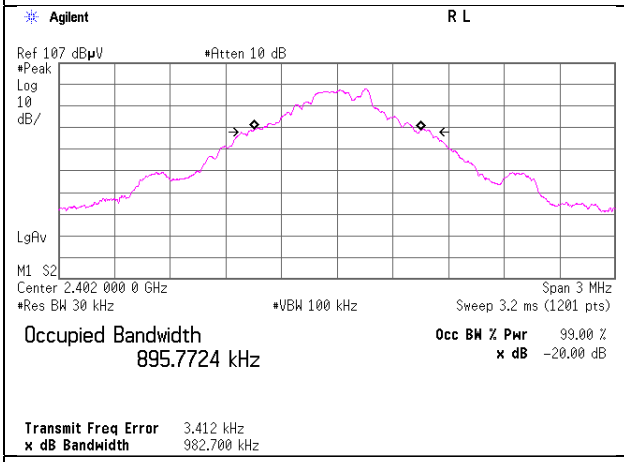
Mode	Freq. [MHz]	20dB Bandwidth [MHz]	99% Occupied Bandwidth [kHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
DH5	2402.0	0.983	895.772	1.000	>= 0.655
DH5	2441.0	1.019	896.900	1.000	>= 0.679
DH5	2480.0	1.016	897.037	1.000	>= 0.677
DH5	Hopping On	-	78603.9	-	-
3DH5	2402.0	1.322	1207.9	1.000	>= 0.881
3DH5	2441.0	1.321	1208.2	1.000	>= 0.881
3DH5	2480.0	1.323	1207.8	1.000	>= 0.882
3DH5	Hopping On	-	78701.0	-	-

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

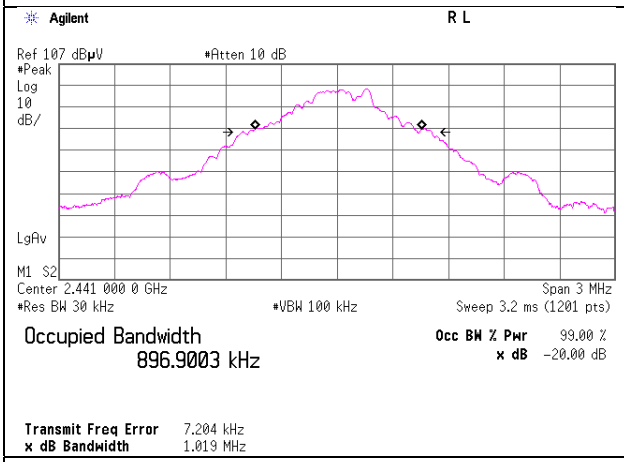
20dB Bandwidth and 99% Occupied Bandwidth

DH5

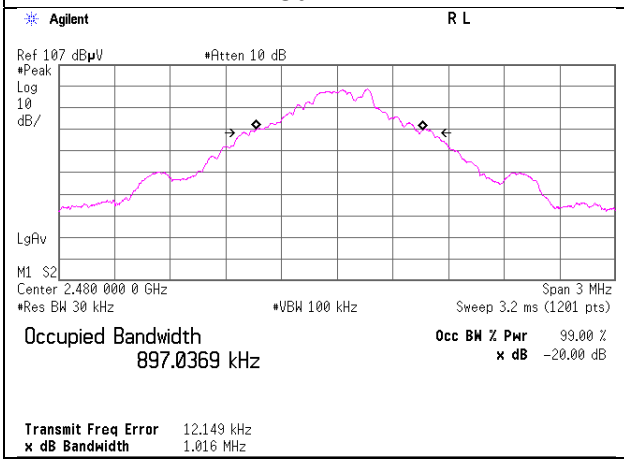
2402 MHz



2441 MHz

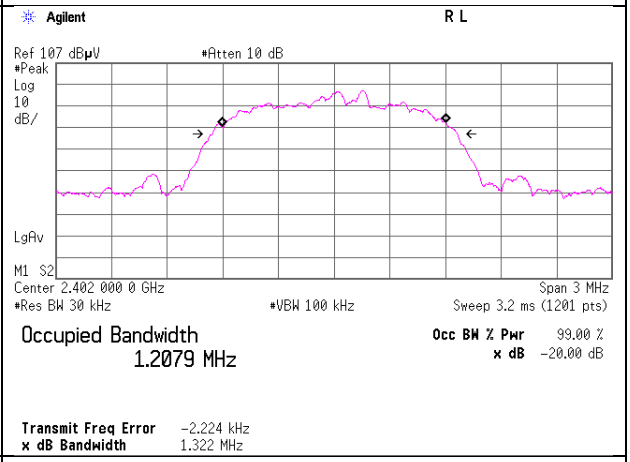


2480 MHz

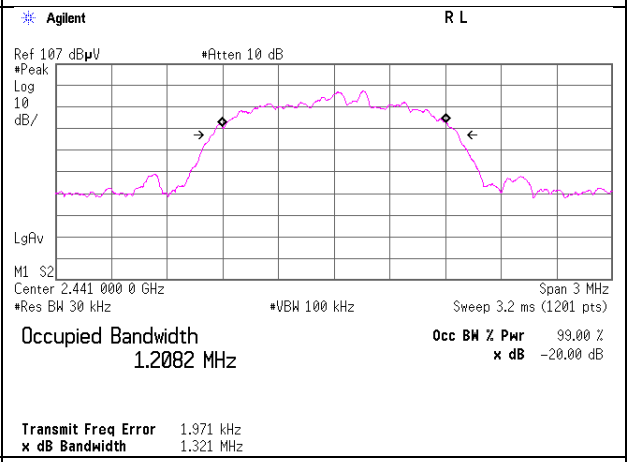


3DH5

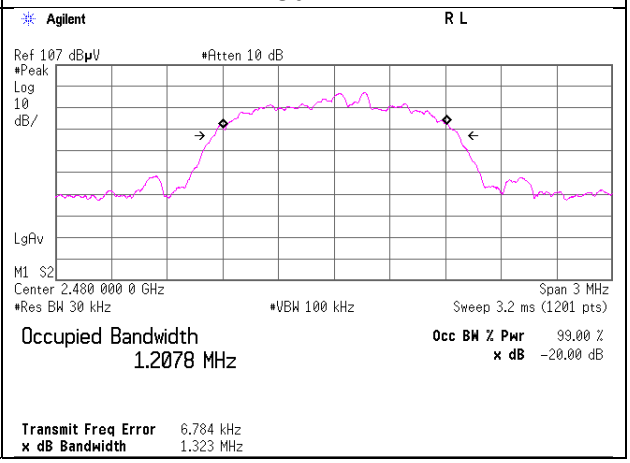
2402 MHz



2441 MHz

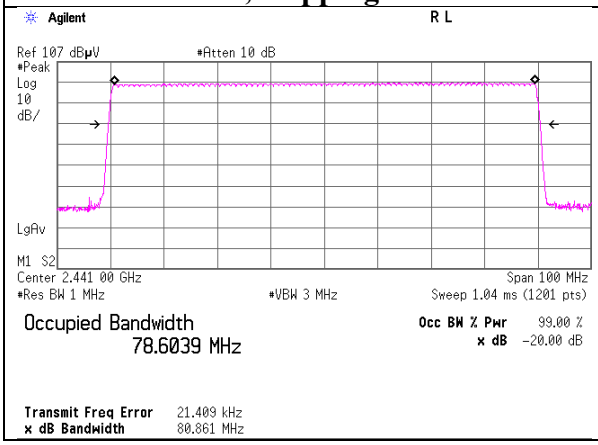


2480 MHz

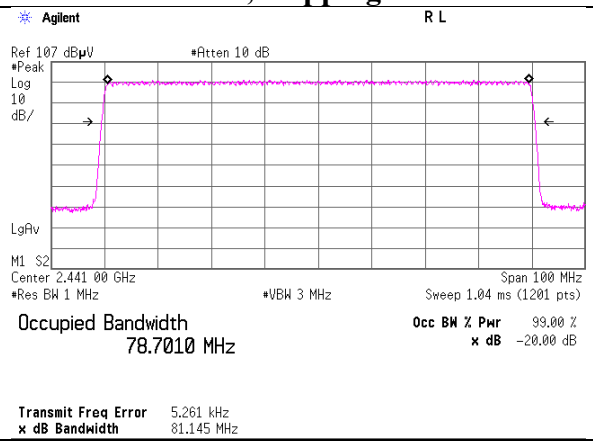


20dB Bandwidth and 99% Occupied Bandwidth

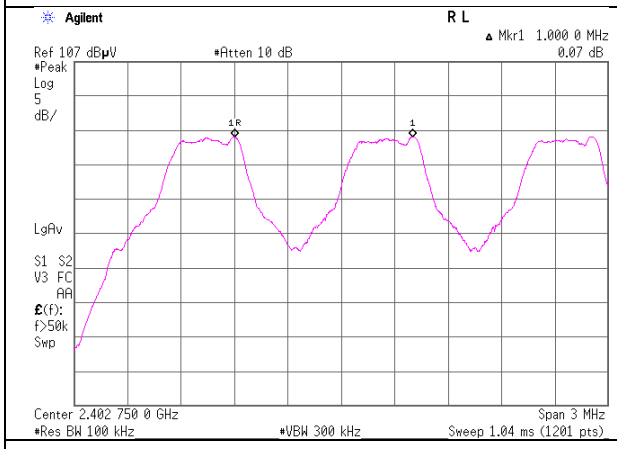
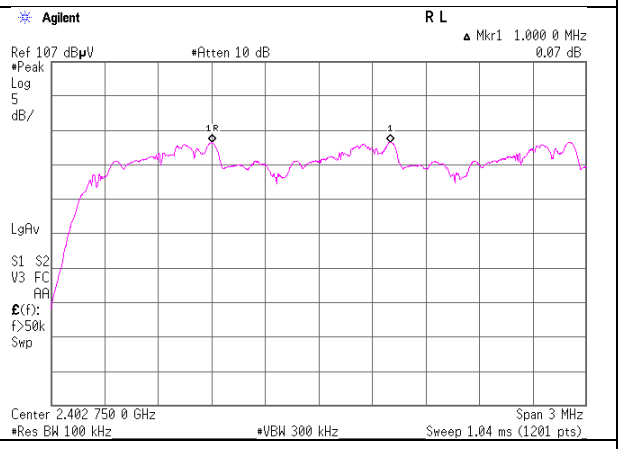
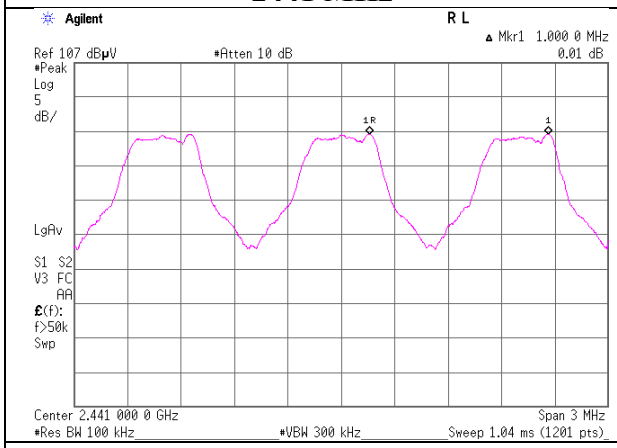
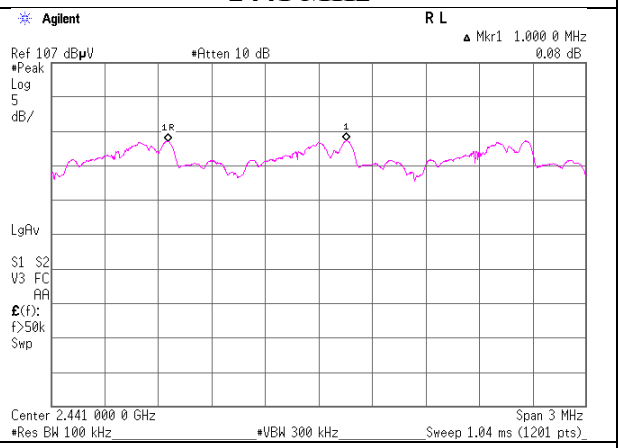
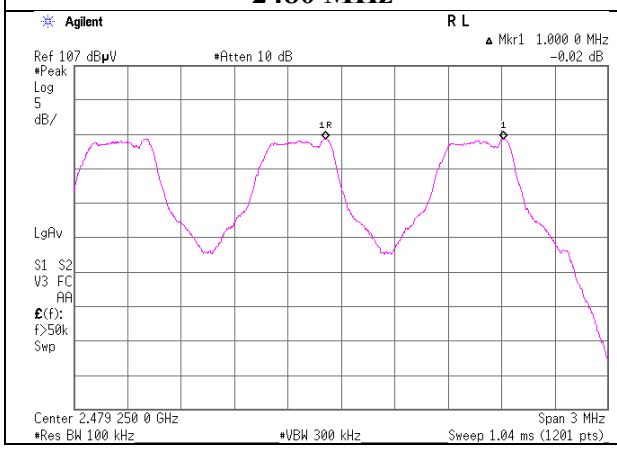
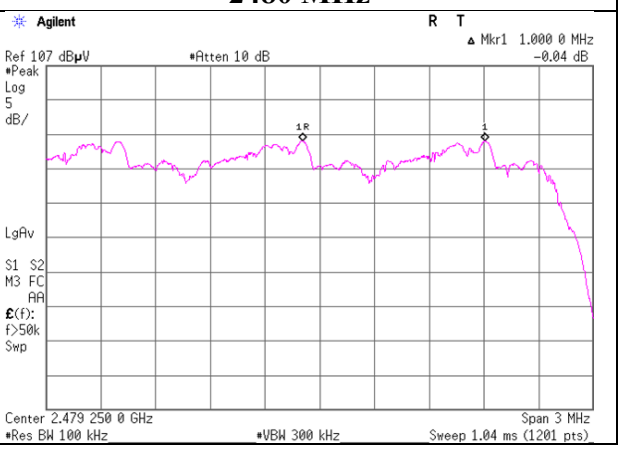
DH5, Hopping On



3DH5, Hopping On



Carrier Frequency Separation

DH5	3DH5
2402 MHz	2402 MHz
	
2441 MHz	2441 MHz
	
2480 MHz	2480 MHz
	

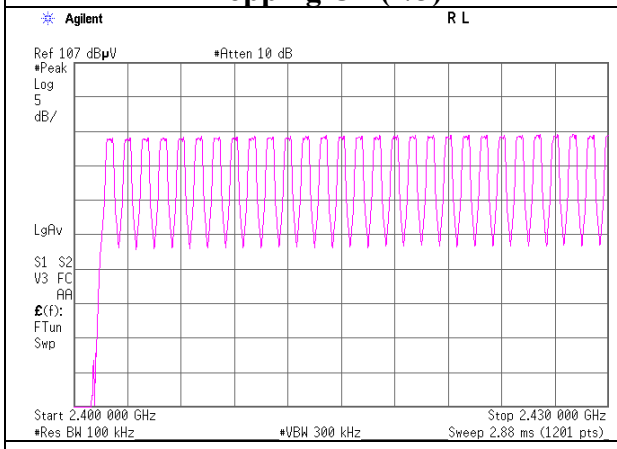
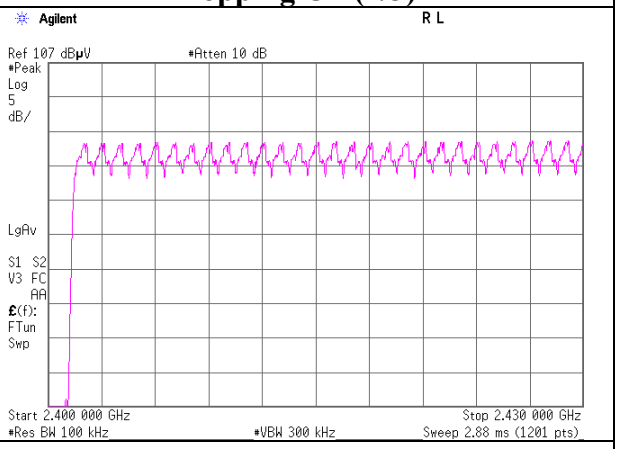
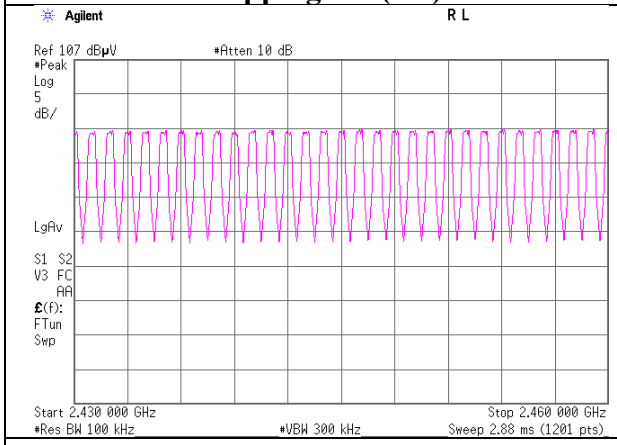
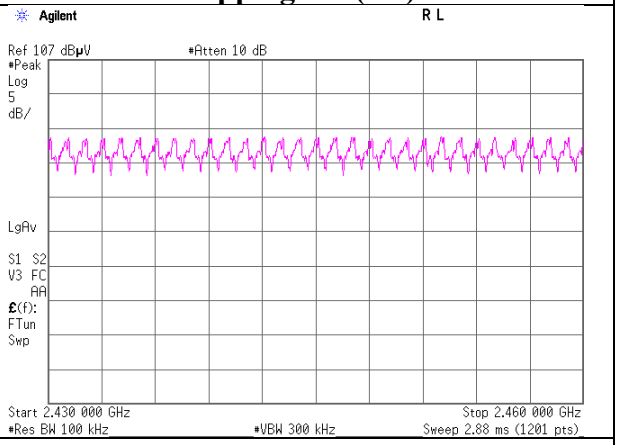
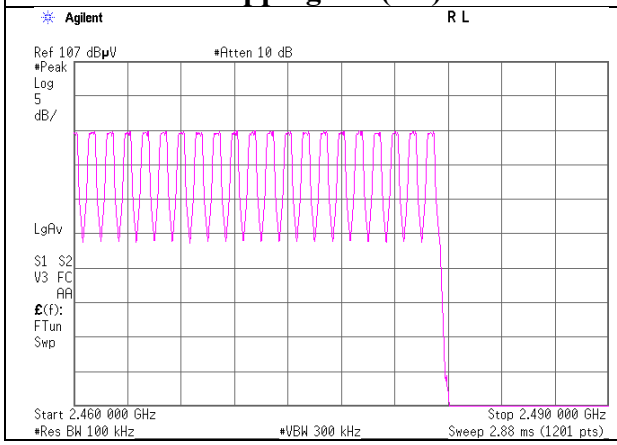
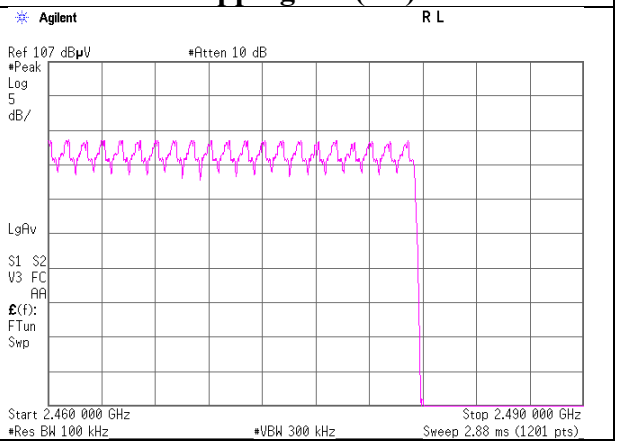
Number of Hopping Frequency

Report No.	13063555S-B-R2
Test place	Shonan EMC Lab. No.5 Semi Anechoic Chamber
Date	October 11, 2019
Temperature / Humidity	24 deg. C / 52 % RH
Engineer	Takahiro Kawakami
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

DH5	3DH5
Hopping On (1/3)	**Hopping On (1/3)**
	
Hopping On (2/3)	**Hopping On (2/3)**
	
Hopping On (3/3)	**Hopping On (3/3)**
	

Dwell time

Report No.	13063555S-B-R2
Test place	Shonan EMC Lab. No.5 Semi Anechoic Chamber
Date	October 11, 2019
Temperature / Humidity	24 deg. C / 52 % RH
Engineer	Takahiro Kawakami
Mode	Tx, Hopping On

Mode	Number of transmission in a 31.6(79 Hopping x 0.4) / 12.8 (32 Hopping x 0.4) second period	Length of transmission [msec]	Result [msec]	Limit [msec]
DH1	50.4 times / 5 sec. x 31.6 sec. = 319 times	0.422	135	400
DH3	25.8 times / 5 sec. x 31.6 sec. = 164 times	1.678	275	400
DH5	18.8 times / 5 sec. x 31.6 sec. = 119 times	2.926	348	400
3DH1	48.8 times / 5 sec. x 31.6 sec. = 309 times	0.427	132	400
3DH3	24.0 times / 5 sec. x 31.6 sec. = 152 times	1.679	255	400
3DH5	18.6 times / 5 sec. x 31.6 sec. = 118 times	2.931	346	400

Sample Calculation
Result = Number of transmission x Length of transmission

*Average data of 5 tests.(except Inquiry)

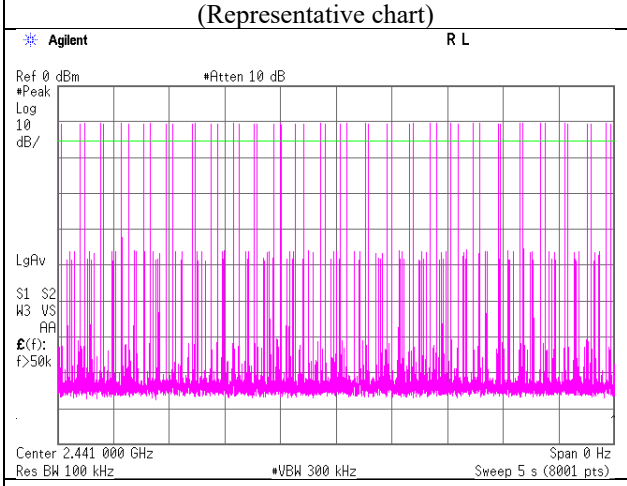
Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
DH1	51	51	50	51	49	50.4
DH3	27	25	25	29	23	25.8
DH5	17	19	20	18	20	18.8
3DH1	47	50	50	49	48	48.8
3DH3	23	22	25	26	24	24
3DH5	20	17	17	20	19	18.6

Sample Calculation
Average = Summation (Sampling 1 to 5) / 5

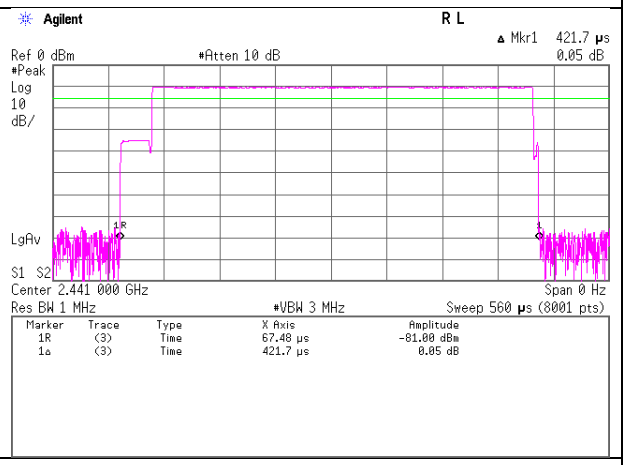
This device complies with the Bluetooth protocol for FHSS operation, employing a pseudo random channel selection and hopping rate to ensure that the occupancy time in N x 0.4s, where N is the number of channels being used in the hopping sequence ($20 \leq N \leq 79$), is always less than 0.4s regardless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

Dwell time

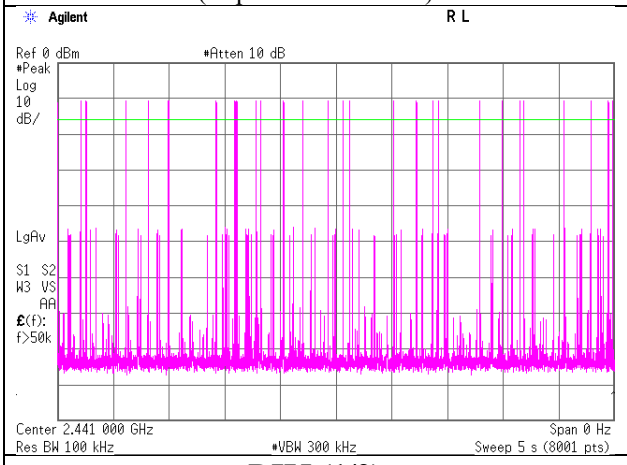
DH1 (1/2)
(Representative chart)



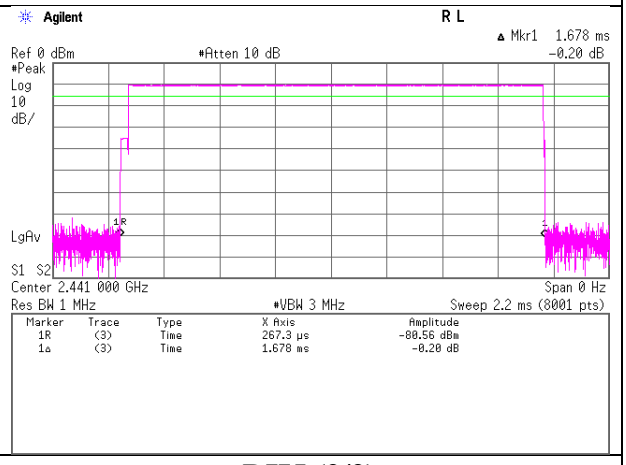
DH1 (2/2)



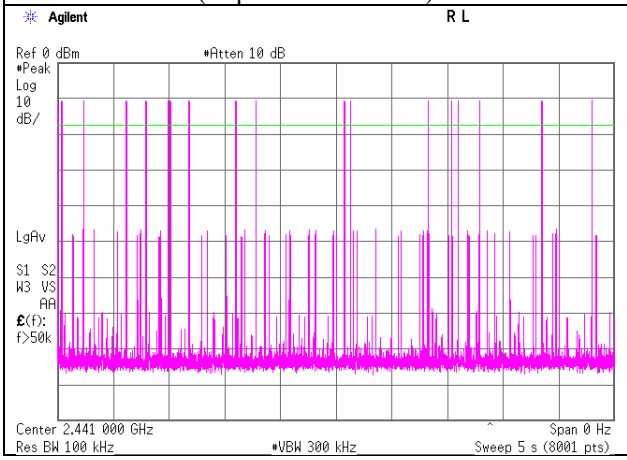
DH3 (1/2)
(Representative chart)



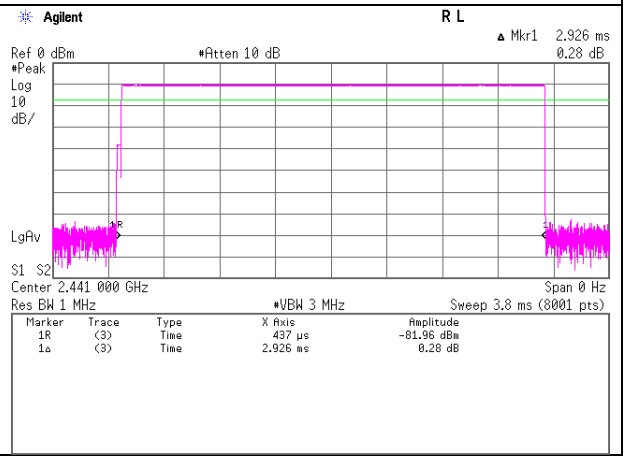
DH3 (2/2)



DH5 (1/2)
(Representative chart)

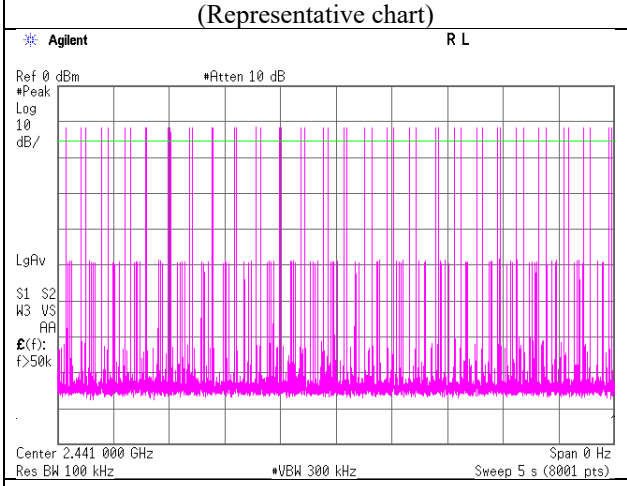


DH5 (2/2)

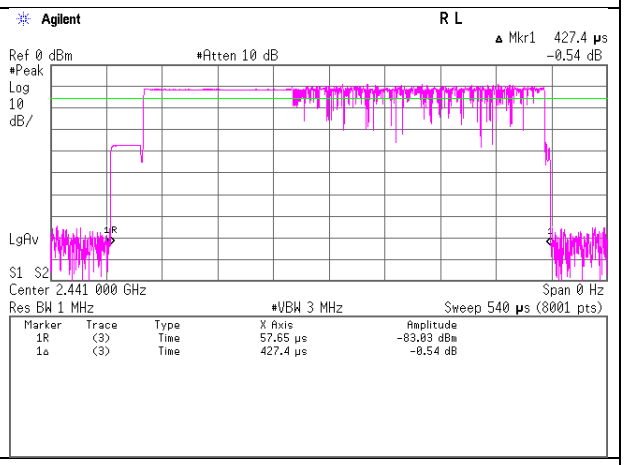


Dwell time

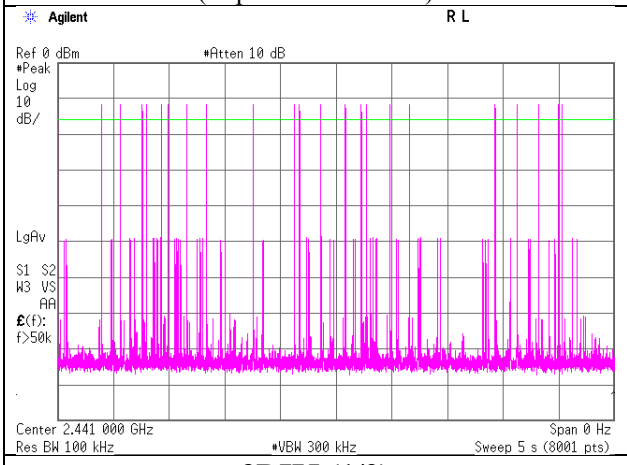
3DH1 (1/2)
(Representative chart)



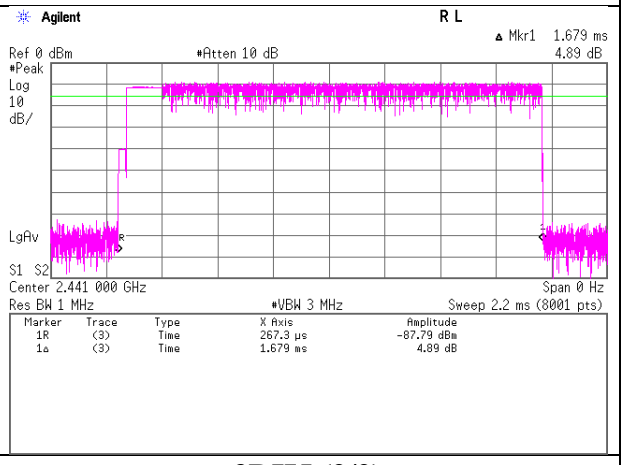
3DH1 (2/2)



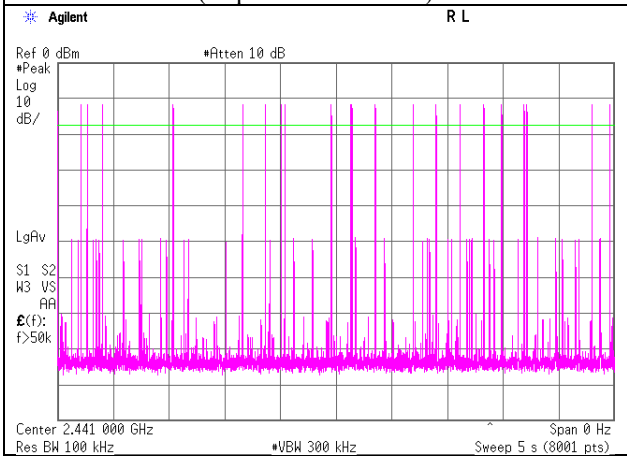
3DH3 (1/2)
(Representative chart)



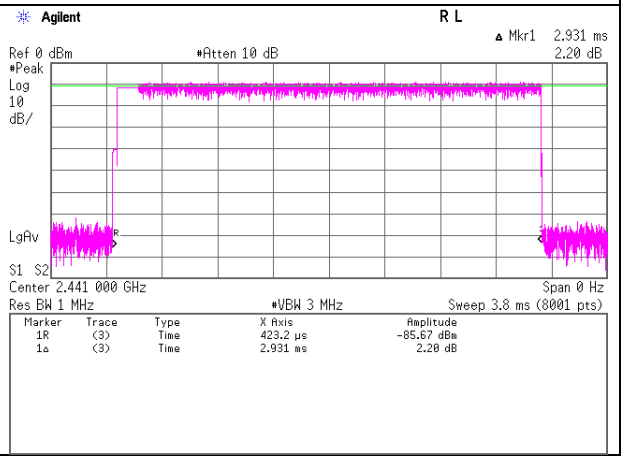
3DH3 (2/2)



3DH5 (1/2)
(Representative chart)



3DH5 (2/2)



Maximum Peak Output Power

Report No.	13063555S-B-R2
Test place	Shonan EMC Lab. No.5 Semi Anechoic Chamber
Date	October 11, 2019
Temperature / Humidity	24 deg. C / 52 % RH
Engineer	Takahiro Kawakami
Mode	Tx, Hopping Off

					Conducted Power					e.i.r.p. for RSS-247					
Mode	Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
DH5	2402.0	-10.67	1.23	9.82	0.38	1.09	20.96	125	20.58	-14.50	-14.12	0.04	36.02	4000	50.14
DH5	2441.0	-9.98	1.24	9.82	1.08	1.28	20.96	125	19.88	-14.50	-13.42	0.05	36.02	4000	49.44
DH5	2480.0	-9.83	1.24	9.82	1.23	1.33	20.96	125	19.73	-14.50	-13.27	0.05	36.02	4000	49.29
2DH5	2402.0	-8.78	1.23	9.82	2.27	1.69	20.96	125	18.69	-14.50	-12.23	0.06	36.02	4000	48.25
2DH5	2441.0	-8.48	1.24	9.82	2.58	1.81	20.96	125	18.38	-14.50	-11.92	0.06	36.02	4000	47.94
2DH5	2480.0	-8.62	1.24	9.82	2.44	1.75	20.96	125	18.52	-14.50	-12.06	0.06	36.02	4000	48.08
3DH5	2402.0	-8.76	1.23	9.82	2.29	1.69	20.96	125	18.67	-14.50	-12.21	0.06	36.02	4000	48.23
3DH5	2441.0	-8.40	1.24	9.82	2.66	1.85	20.96	125	18.30	-14.50	-11.84	0.07	36.02	4000	47.86
3DH5	2480.0	-8.40	1.24	9.82	2.66	1.85	20.96	125	18.30	-14.50	-11.84	0.07	36.02	4000	47.86

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: 20ch) at AFH mode does not influence on the output power and bandwidth of the EUT.
However, the limit level 125mW of AFH mode was used for the test.

Average Output Power
(Reference data for RF Exposure)

Report No.	13063555S-B-R2
Test place	Shonan EMC Lab. No.5 Semi Anechoic Chamber
Date	October 11, 2019
Temperature / Humidity	24 deg. C / 52 % RH
Engineer	Takahiro Kawakami
Mode	Tx, Hopping Off

Mode	Freq.	Reading	Cable Loss	Atten. Loss	Result (Time average)		Duty factor	Result (Burst power average)	
	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dB]	[dBm]	[mW]
DH5	2402.0	-12.36	1.23	9.82	-1.31	0.74	1.08	-0.23	0.95
DH5	2441.0	-11.63	1.24	9.82	-0.57	0.88	1.08	0.51	1.12
DH5	2480.0	-11.49	1.24	9.82	-0.43	0.91	1.08	0.65	1.16
2DH5	2402.0	-12.74	1.23	9.82	-1.69	0.68	1.07	-0.62	0.87
2DH5	2441.0	-12.38	1.24	9.82	-1.32	0.74	1.07	-0.25	0.94
2DH5	2480.0	-12.57	1.24	9.82	-1.51	0.71	1.07	-0.44	0.90
3DH5	2402.0	-12.92	1.23	9.82	-1.87	0.65	1.07	-0.80	0.83
3DH5	2441.0	-12.46	1.24	9.82	-1.40	0.72	1.07	-0.33	0.93
3DH5	2480.0	-12.50	1.24	9.82	-1.44	0.72	1.07	-0.37	0.92

Sample Calculation:
Result (Time average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss
Result (Burst power average) = Time average + Duty factor

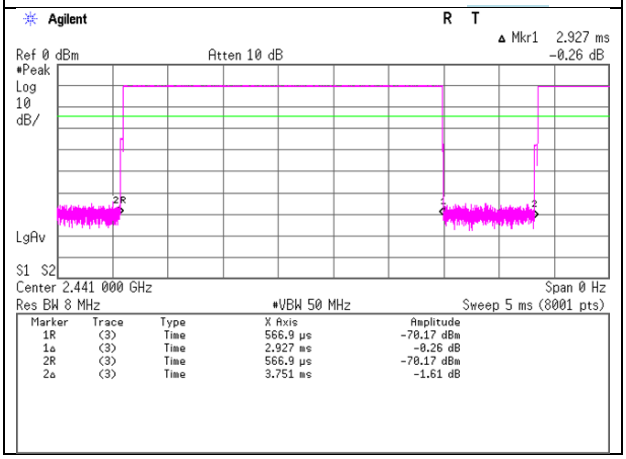
*The equipment and cables were not used for factor 0 dB of the data sheets.

Burst Rate Confirmation

Report No.	13063555S-B-R2
Test place	Shonan EMC Lab. No.5 Semi Anechoic Chamber
Date	October 11, 2019
Temperature / Humidity	24 deg. C / 52 % RH
Engineer	Takahiro Kawakami
Mode	Tx, Hopping Off

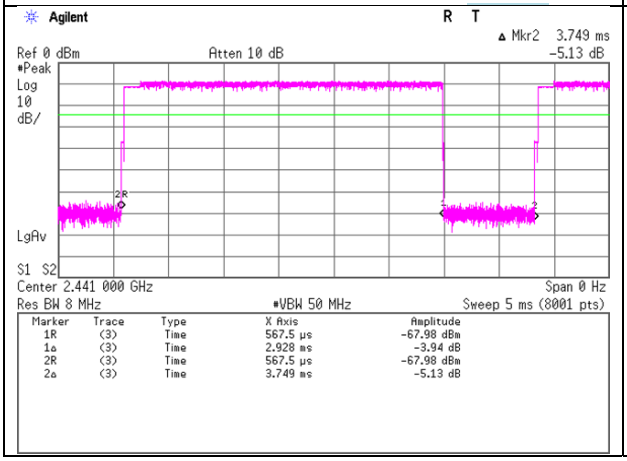
DH5

Tx on / (Tx on + Tx off) =	0.780
Tx on / (Tx on + Tx off) * 100 =	78.0 %
Duty factor = 10 * log (3.751 / 2.927) =	1.08 dB
VBW = 1 / Tx on = 342 Hz	360 Hz



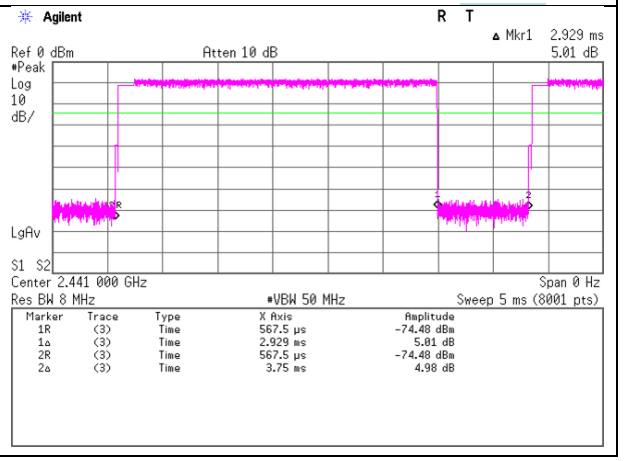
2DH5

Tx on / (Tx on + Tx off) =	0.781
Tx on / (Tx on + Tx off) * 100 =	78.1 %
Duty factor = 10 * log (3.749 / 2.928) =	1.07 dB
VBW = 1 / Tx on = 342 Hz	360 Hz



3DH5

Tx on / (Tx on + Tx off) =	0.781
Tx on / (Tx on + Tx off) * 100 =	78.1 %
Duty factor = 10 * log (3.75 / 2.929) =	1.07 dB
VBW = 1 / Tx on = 341 Hz	360 Hz



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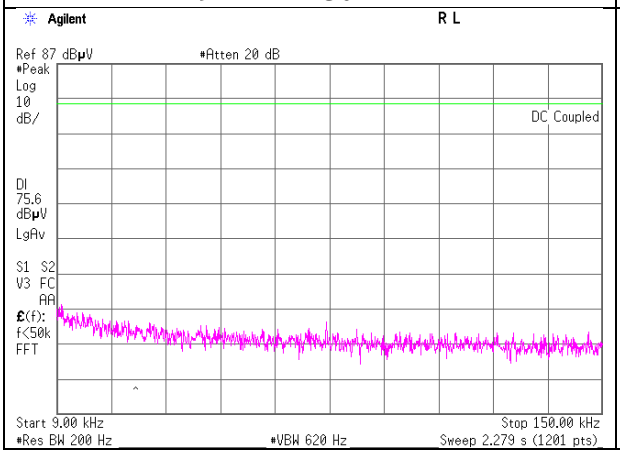
Conducted Spurious Emission

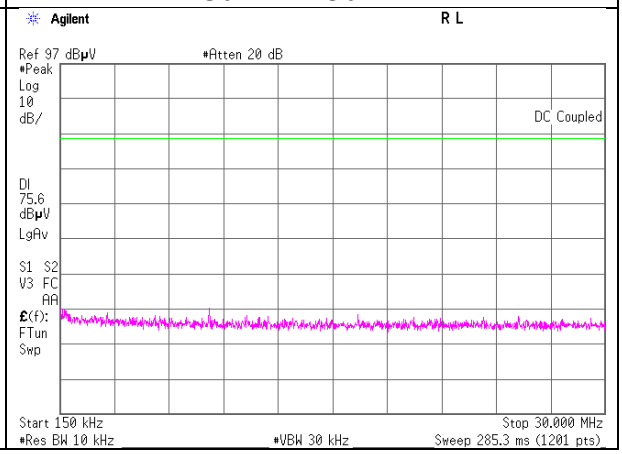
Report No.	13063555S-B-R2
Test place	Shonan EMC Lab. No.5 Semi Anechoic Chamber
Date	October 11, 2019
Temperature / Humidity	24 deg. C / 52 % RH
Engineer	Takahiro Kawakami
Mode	Tx, Hopping Off, DH5

2402 MHz

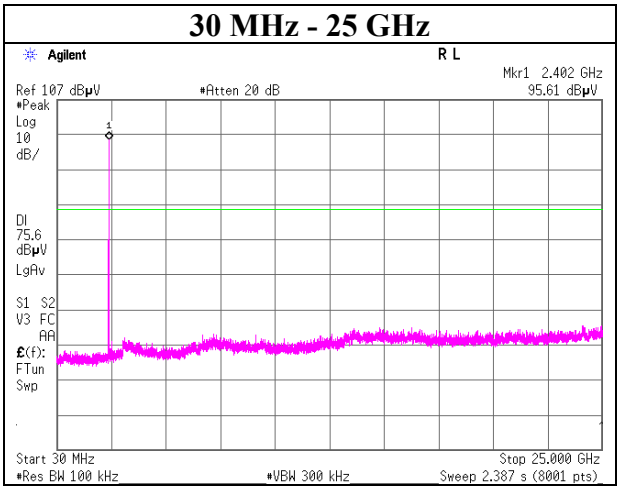
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 25 GHz

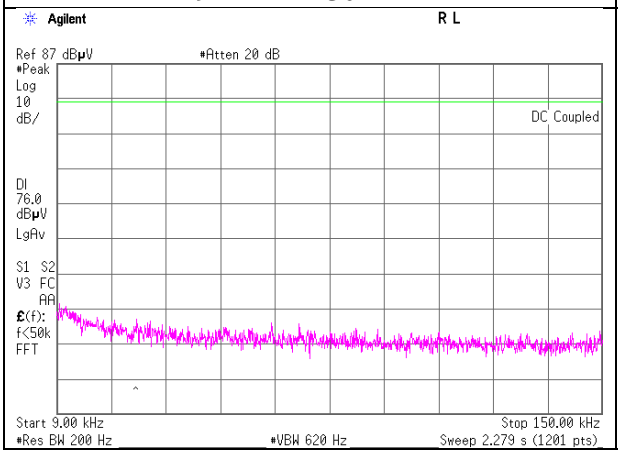


Conducted Spurious Emission

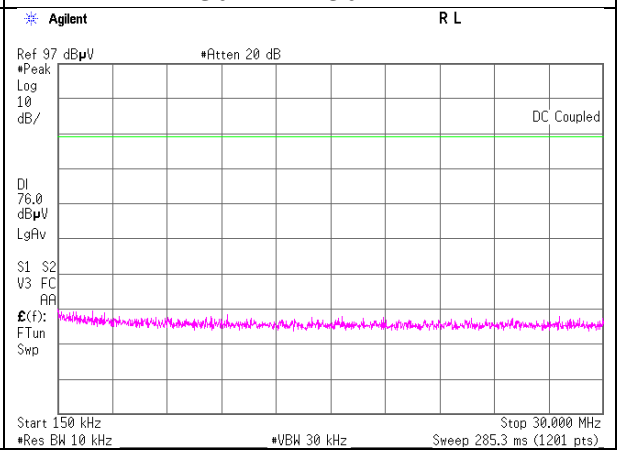
Report No.	13063555S-B-R2
Test place	Shonan EMC Lab. No.5 Semi Anechoic Chamber
Date	October 11, 2019
Temperature / Humidity	24 deg. C / 52 % RH
Engineer	Takahiro Kawakami
Mode	Tx, Hopping Off, DH5

2441 MHz

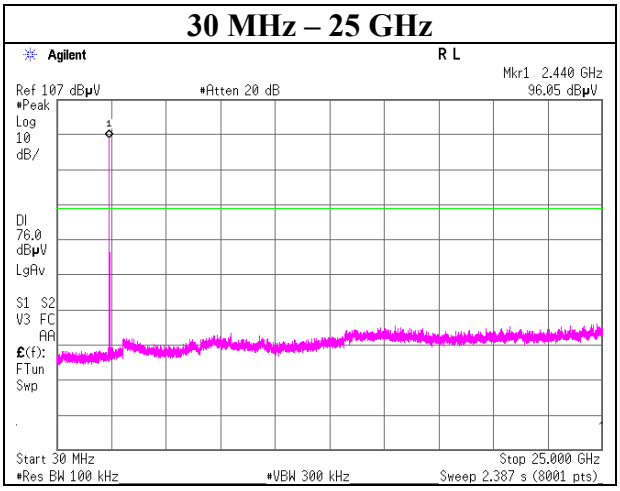
9 kHz – 150 kHz



150 kHz – 30 MHz



30 MHz – 25 GHz

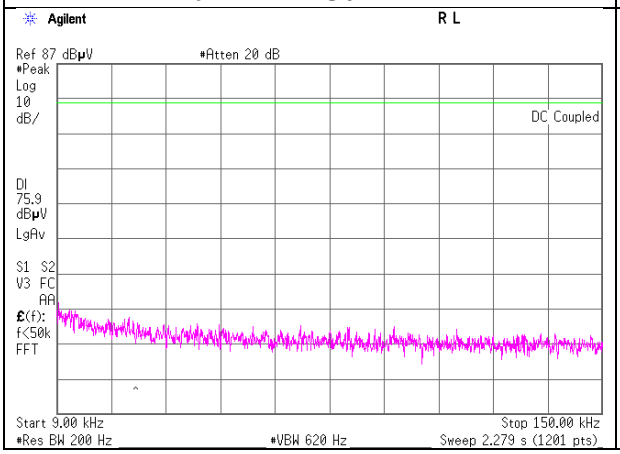


Conducted Spurious Emission

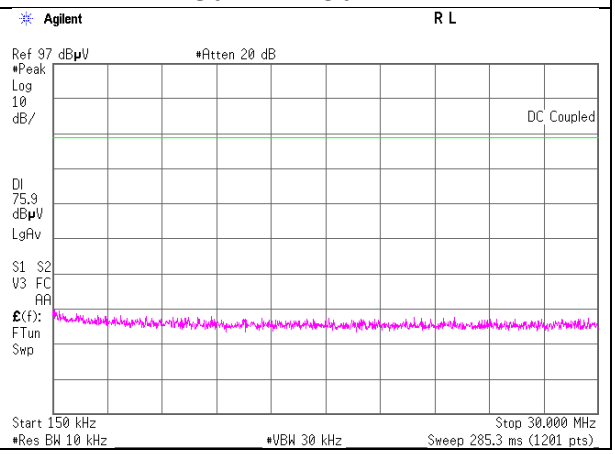
Report No.	13063555S-B-R2
Test place	Shonan EMC Lab. No.5 Semi Anechoic Chamber
Date	October 11, 2019
Temperature / Humidity	24 deg. C / 52 % RH
Engineer	Takahiro Kawakami
Mode	Tx, Hopping Off, DH5

2480 MHz

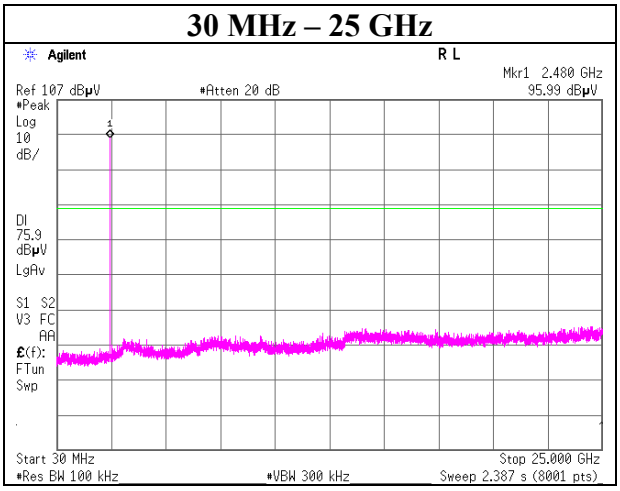
9 kHz – 150 kHz



150 kHz – 30 MHz



30 MHz – 25 GHz



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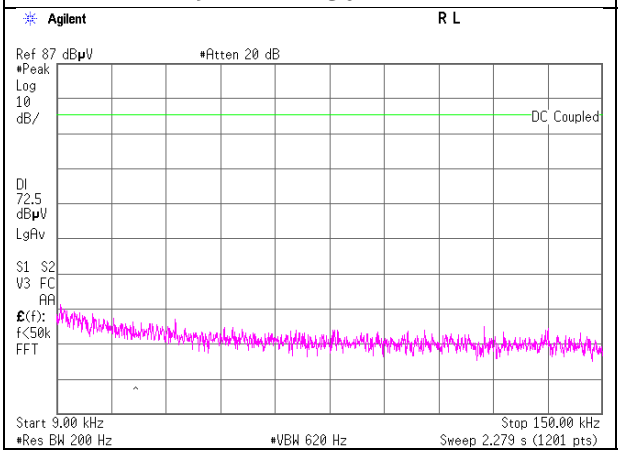
Conducted Spurious Emission

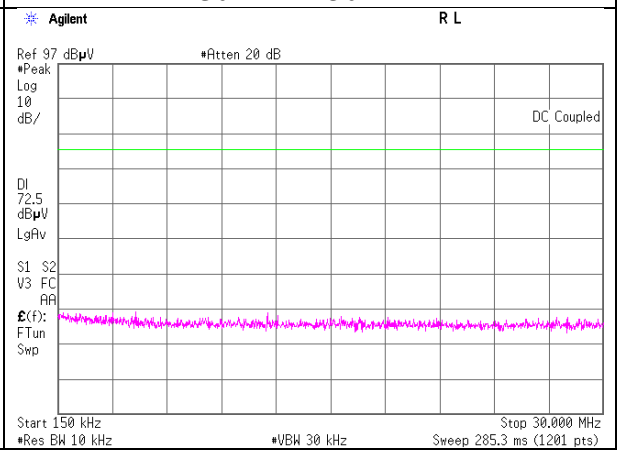
Report No.	13063555S-B-R2
Test place	Shonan EMC Lab. No.5 Semi Anechoic Chamber
Date	October 11, 2019
Temperature / Humidity	24 deg. C / 52 % RH
Engineer	Takahiro Kawakami
Mode	Tx, Hopping Off, 3DH5

2402 MHz

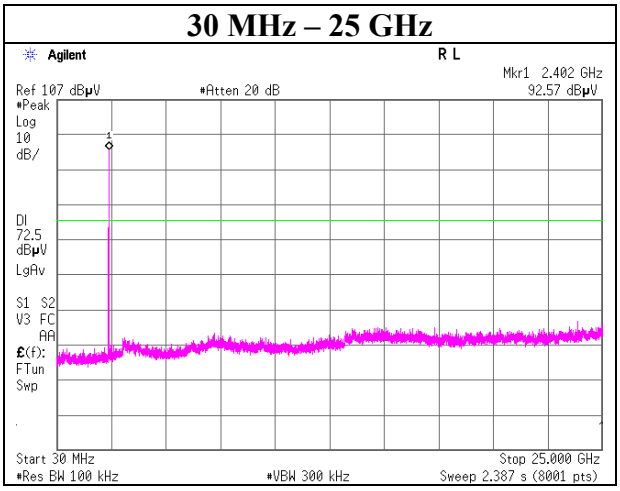
9 kHz – 150 kHz



150 kHz – 30 MHz



30 MHz – 25 GHz



UL Japan, Inc.
Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN
Telephone : +81 463 50 6400
Facsimile : +81 463 50 6401

Conducted Spurious Emission

Report No.	13063555S-B-R2
Test place	Shonan EMC Lab. No.5 Semi Anechoic Chamber
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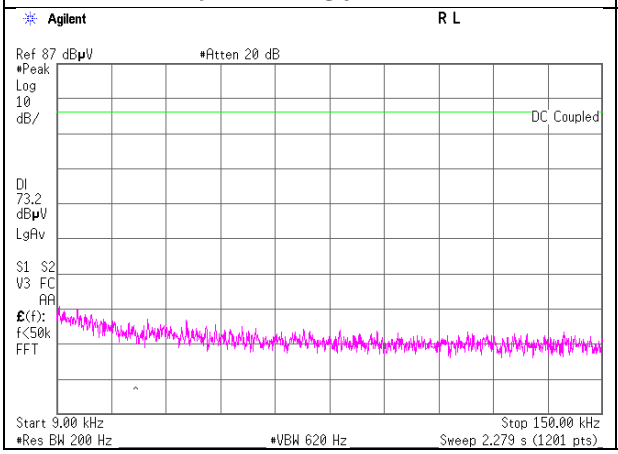
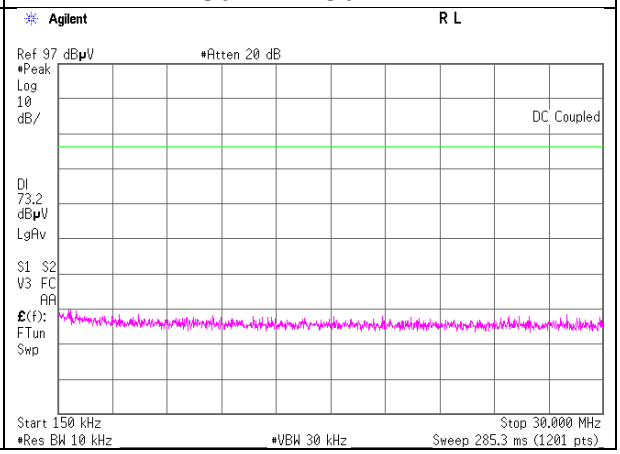
Temperature / Humidity	24 deg. C / 52 % RH
Engineer	Takahiro Kawakami
Mode	Tx, Hopping Off, 3DH5

2441 MHz

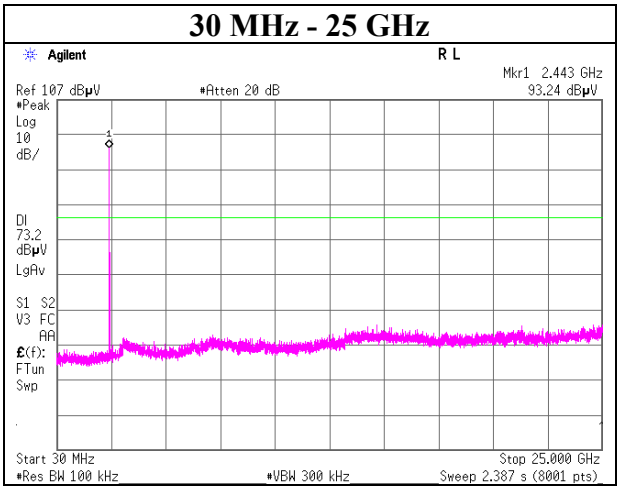
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 25 GHz



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Conducted Spurious Emission

Report No.	13063555S-B-R2
Test place	Shonan EMC Lab. No.5 Semi Anechoic Chamber
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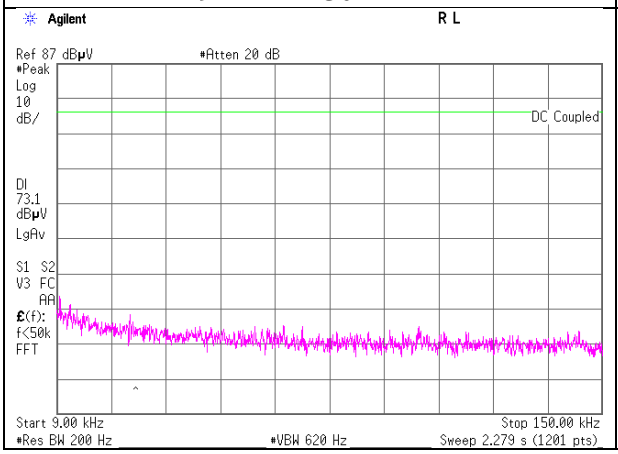
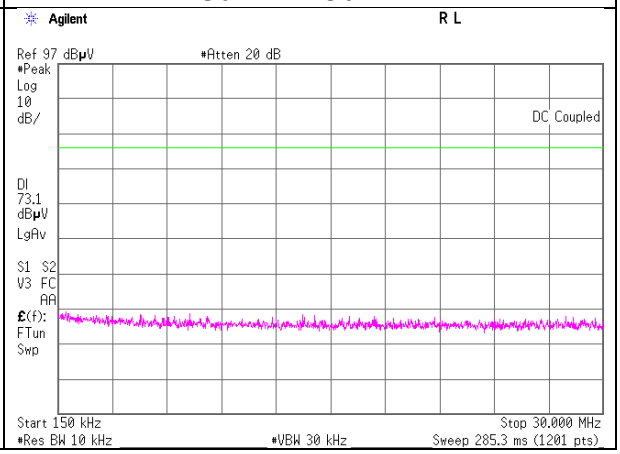
Temperature / Humidity	24 deg. C / 52 % RH
Engineer	Takahiro Kawakami
Mode	Tx, Hopping Off, 3DH5

2480 MHz

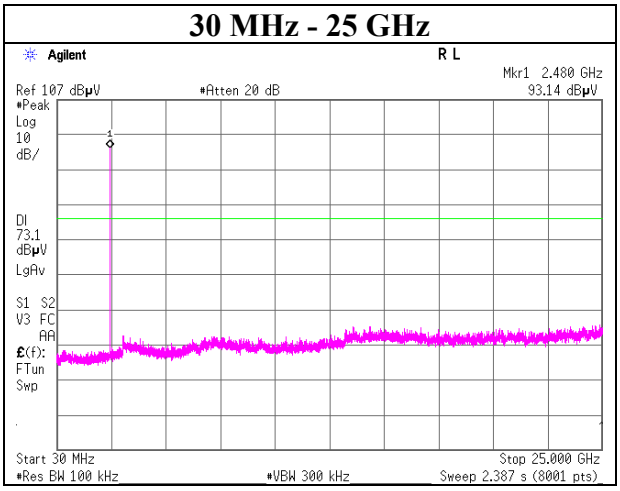
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 25 GHz



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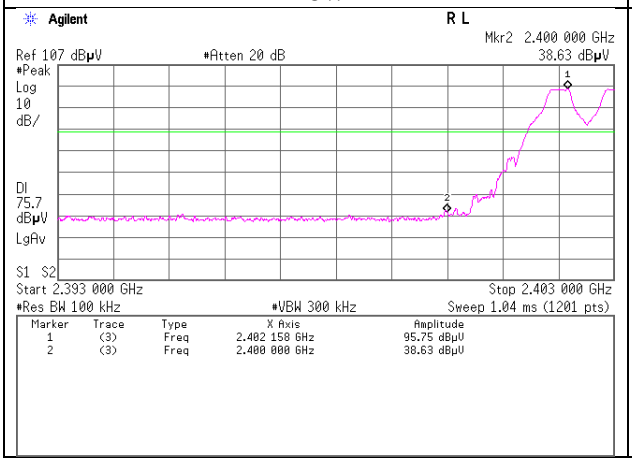
Conducted Emission Band Edge compliance

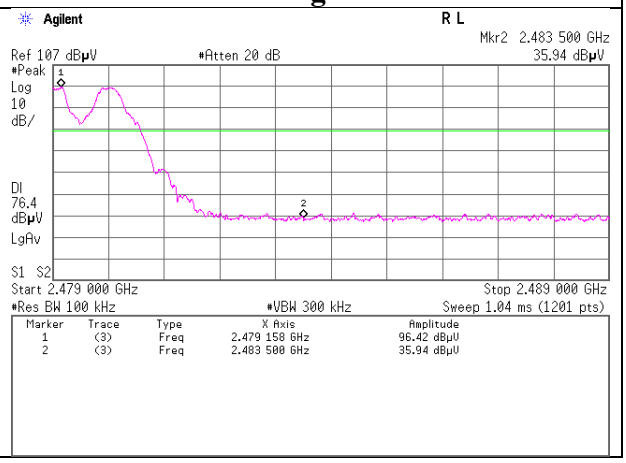
Report No.	13063555S-B-R2
Test place	Shonan EMC Lab. No.5 Semi Anechoic Chamber
Date	October 11, 2019
Temperature / Humidity	24 deg. C / 52 % RH
Engineer	Takahiro Kawakami
Mode	Tx DH5

Hopping On

Low

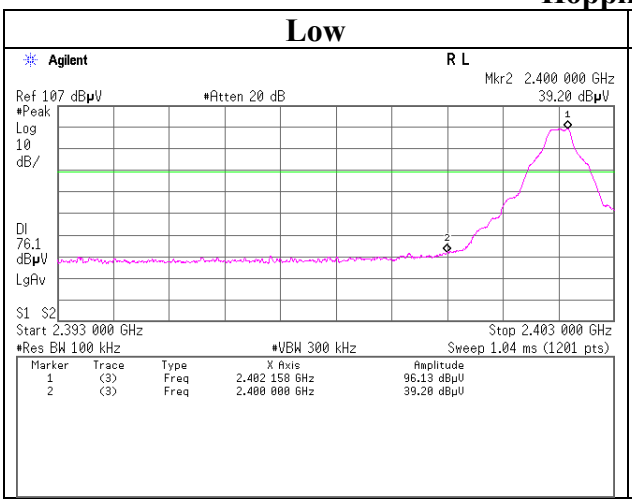


High

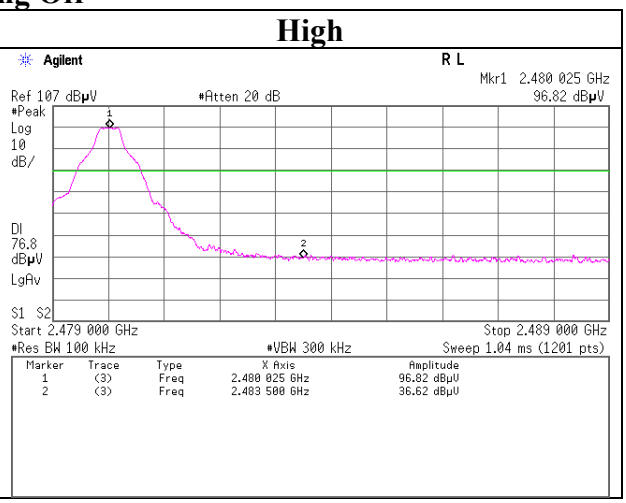


Hopping Off

Low



High



Conducted Emission Band Edge compliance

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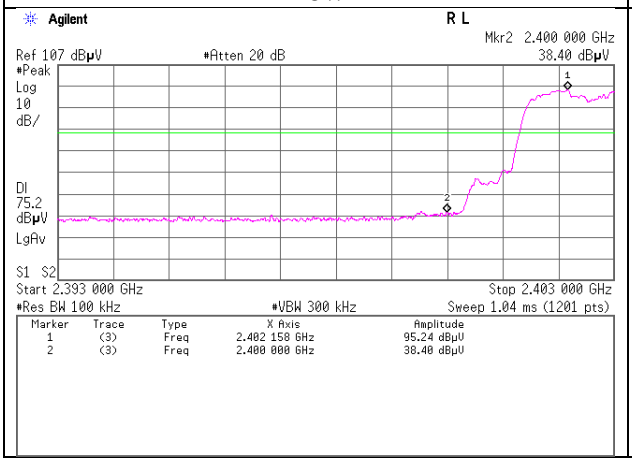
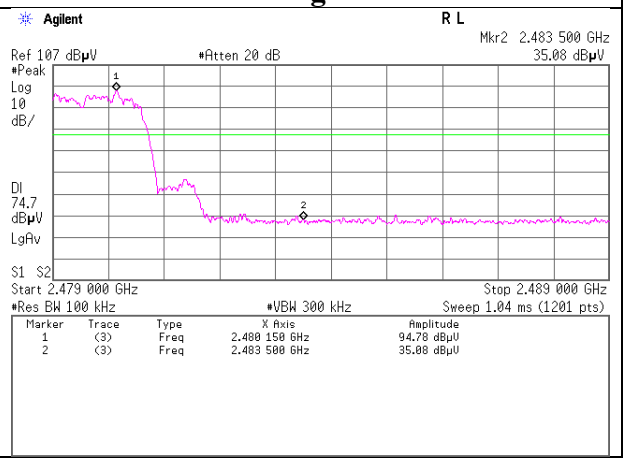
Test place	Shonan EMC Lab. No.5 Semi Anechoic Chamber
Date	October 11, 2019
Temperature / Humidity	24 deg. C / 52 % RH
Engineer	Takahiro Kawakami
Mode	Tx 3DH5

Hopping On

Low

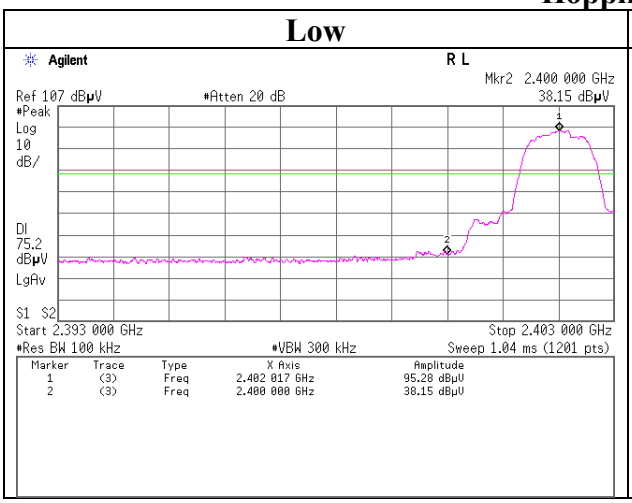


High

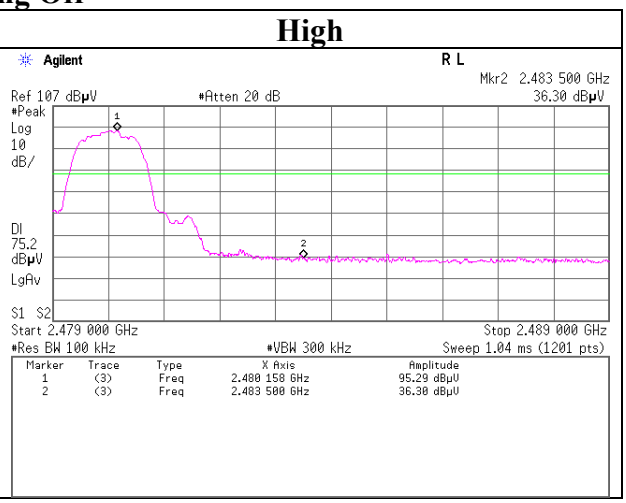


Hopping Off

Low



High



APPENDIX 2: Test instruments

Test Instruments

Local ID	Test Name	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Calibration Interval (Month)
KTS-08	AT	145095	Digital Tester	SANWA	PC500	7019224	2019/4/2	2020/4/30	12
SAT10-14	AT	154591	Attenuator	Weinschel Corp.	54A-10	81595	2019/4/16	2020/4/30	12
SCC-G39	AT	151616	Coaxial Cable	Junkosha	MWX241-01000KMSKMS/B	1612Q037	2018/12/25	2019/12/31	12
SOS-13	AT	146321	Humidity Indicator	CUSTOM	CTH-202	Q.C.17	2018/12/5	2019/12/31	12
SPM-13	AT	169910	Power Meter	EMC Instruments Corporation	8990B	MY51000448	2019/3/6	2020/3/31	12
SPSS-06	AT	169911	Power sensor	EMC Instruments Corporation	N1923A	MY57270004	2019/3/6	2020/3/31	12
SRENT-09	AT	150461	Spectrum Analyzer	AGILENT (KEYSIGHT)	E4440A	MY46186392	2019/1/3	2020/1/31	12
SSA-03	AT	145801	Spectrum Analyzer	AGILENT	E4448A	MY48250152	2019/8/8	2020/8/31	12
STM-G8	AT	171615	Terminator	Weinschel - API Technologies Corp	M1459A	88997	2019/7/4	2020/7/31	12

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

The expiration date of the calibration is the end of the expired month.
All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

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

Test item: AT: Antenna Terminal Conducted test