



RADIO TEST REPORT

Test Report No. : 13004393S-G-R3

Applicant : Murata Manufacturing Co., Ltd.
Type of Equipment : Communication Module
Model No. : Type1VY
FCC ID : VPYLB1VY
Test regulation : FCC Part 15 Subpart E: 2019
Section 15.407(DFS test only)
Test Result : Complied (Refer to SECTION 4.2)

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 13004393S-G-R2. 13004393S-G-R2 is replaced with this report.

Date of test : October 9, 2019

Representative test engineer: K. Noda
Kazuya Noda
Engineer
Consumer Technology Division

Approved by : T. Imamura
Toyokazu Imamura
Leader
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".

REVISION HISTORY

Original Test Report No.: 13004393S-G

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13004393S-G	December 2, 2019	-	-
1	13004393S-G-R1	December 9, 2019	13	Correction error: the ping data with ExPing → the transfer data with iperf-2.0.5 program, LDK102073 → LDK102087
			14	Update of 5.2: Addition of cables: No.11-14, Addition of equipment: No.J-K, Correction of No.F: Model No.: AIR-AP1262N-A-K9 → AIR- CAP3702E-A-K9 Serial No.: FTX1619E5EZ → FTX18227609 Remarks: LDK102073 → LDK102087
2	13004393S-G-R2	December 23, 2019	7	Addition: “Additional information of specification: ... except the mode of Config.5.”
			14	Addition: “[Master device information] This following remark is the information of companion device (master device). (not EUT information)”
3	13004393S-G-R3	January 7, 2020	p.8 p.8, 14	Added KDB document (KDB 905462 D03). Correction error (changed used band edge frequencies (5700 -> 5720 MHz).

Reference: Abbreviations (Including words undescribed in this report)

A2LA	The American Association for Laboratory Accreditation	NS	No signal detect.
AC	Alternating Current	NSA	Normalized Site Attenuation
AFH	Adaptive Frequency Hopping	NVLAP	National Voluntary Laboratory Accreditation Program
AM	Amplitude Modulation	OBW	Occupied Band Width
Amp, AMP	Amplifier	OFDM	Orthogonal Frequency Division Multiplexing
ANSI	American National Standards Institute	P/M	Power meter
Ant, ANT	Antenna	PCB	Printed Circuit Board
AP	Access Point	PER	Packet Error Rate
Atten., ATT	Attenuator	PHY	Physical Layer
AV	Average	PK	Peak
BPSK	Binary Phase-Shift Keying	PN	Pseudo random Noise
BR	Bluetooth Basic Rate	PRBS	Pseudo-Random Bit Sequence
BT	Bluetooth	PSD	Power Spectral Density
BT LE	Bluetooth Low Energy	QAM	Quadrature Amplitude Modulation
BW	BandWidth	QP	Quasi-Peak
Cal Int	Calibration Interval	QPSK	Quadri-Phase Shift Keying
CCK	Complementary Code Keying	RBW	Resolution Band Width
Ch., CH	Channel	RDS	Radio Data System
CISPR	Comite International Special des Perturbations Radioelectriques	RE	Radio Equipment
CW	Continuous Wave	RF	Radio Frequency
DBPSK	Differential BPSK	RMS	Root Mean Square
DC	Direct Current	RSS	Radio Standards Specifications
DFS	Dynamic Frequency Selection	Rx	Receiving
DQPSK	Differential QPSK	SA, S/A	Spectrum Analyzer
DSSS	Direct Sequence Spread Spectrum	SG	Signal Generator
EDR	Enhanced Data Rate	SVSWR	Site-Voltage Standing Wave Ratio
EIRP, e.i.r.p.	Equivalent Isotropically Radiated Power	TR	Test Receiver
EMC	ElectroMagnetic Compatibility	Tx	Transmitting
EMI	ElectroMagnetic Interference	VBW	Video BandWidth
EN	European Norm	Vert.	Vertical
ERP, e.r.p.	Effective Radiated Power	WLAN	Wireless LAN
EU	European Union		
EUT	Equipment Under Test		
Fac.	Factor		
FCC	Federal Communications Commission		
FHSS	Frequency Hopping Spread Spectrum		
FM	Frequency Modulation		
Freq.	Frequency		
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		
NIST	National Institute of Standards and Technology		

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

CONTENTS	PAGE
SECTION 1: Customer information	5
SECTION 2: Equipment under test (E.U.T.)	5
SECTION 3: Scope of Report	8
SECTION 4: Test specification, procedures & results	8
SECTION 5: Operation of E.U.T. during testing.....	14
SECTION 6: In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time	19
SECTION 7: In-Service Monitoring for Non-Occupancy Period	21
APPENDIX 1: Test instruments	23
APPENDIX 2: Photographs of test setup.....	24

SECTION 1: Customer information

Company Name : Murata Manufacturing Co., Ltd.
Address : 1-10-1 Higashikotari, Nagaokakyo-shi, Kyoto 617-8555 Japan
Telephone Number : +81-75-955-6736
Facsimile Number : +81-75-955-6634
Contact Person : Motoo Hayashi

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 : Communication Module
Model No. : Type1VY
Serial No. : Refer to SECTION 4.2
Rating : VDD_3P3, SWREG_IN, VDD_FEM:
Typ.: DC 3.3 V, Min.: DC 3.135 V, Max: DC 3.465 V
VDDIO_GPIO, VDDIO_AO:
Typ.: DC 3.3 V, Min.: DC 3.14 V, Max: DC 3.46 V
Receipt Date of Sample : August 25, 2019
(Information from test lab.)
Country of Mass-production : China, Japan
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: Type1VY (referred to as the EUT in this report) is a Communication Module.

Clock frequency(ies) in the system : 48 MHz

Radio Specification

Equipment type	:	Transceiver
Frequency of operation	:	2.4 GHz: 2402 MHz – 2480 MHz (Bluetooth BDR/EDR/Low Energy (LE)) 2412 MHz – 2462 MHz (IEEE 802.11b, 11g, 11n-20) U-NII-1: 5180 MHz – 5240 MHz (IEEE 802.11a, 11n-20, 11ac-20) 5190 MHz – 5230 MHz (IEEE 802.11n-40, 11ac-40) 5210 MHz (IEEE 802.11ac-80) U-NII-2A: 5260 MHz – 5320 MHz (IEEE 802.11a, 11n-20, 11ac-20) 5270 MHz – 5310 MHz (IEEE 802.11n-40, 11ac-40) 5290 MHz (IEEE 802.11ac-80) U-NII-2B: 5500 MHz – 5720 MHz (IEEE 802.11a, 11n-20, 11ac-20) 5510 MHz – 5710 MHz (IEEE 802.11n-40, 11ac-40) 5530 MHz – 5690 MHz (IEEE 802.11ac-80) U-NII-3: 5745 MHz – 5825 MHz (IEEE 802.11a, 11n-20, 11ac-20) 5755 MHz – 5795 MHz (IEEE 802.11n-40, 11ac-40) 5775 MHz (IEEE 802.11ac-80)
Bandwidth	:	20 MHz (IEEE 802.11a/b/g/n/ac), 40 MHz (IEEE 802.11n/ac), 80 MHz (IEEE 802.11ac), 79 MHz (Bluetooth BDR/EDR), 1 MHz (Bluetooth LE)
Channel spacing	:	5 MHz (Wi-Fi 2.4 GHz), 20 MHz/40 MHz/80 MHz (Wi-Fi 5 GHz), 1 MHz (Bluetooth BDR/EDR), 2 MHz (Bluetooth LE)
Type of modulation	:	DSSS (IEEE 802.11b), OFDM (IEEE 802.11a/g/n/ac), FHSS (Bluetooth BDR/EDR), GFSK (Bluetooth LE)
Antenna type	:	2.4 GHz: Monopole antenna/Slot antenna/Dual monopole antenna 5 GHz: Slot antenna/ Dual monopole antenna
Antenna connector type	:	Spring
Antenna gain	:	Chain-0: [2.4 GHz] Dual Monopole antenna: +0.93 dBi [5 GHz] Dual Monopole antenna: +1.04 dBi Chain-1: [2.4 GHz] Dual Monopole antenna: +0.93 dBi [2.4 GHz] Slot antenna: +1.97 dBi [2.4 GHz] Monopole antenna: +1.98 dBi [5 GHz] Dual Monopole antenna: +1.04 dBi [5 GHz] Slot antenna: +1.98 dBi
ITU code	:	F1D, G1D (Bluetooth BDR/EDR), F1D (Bluetooth LE) D1D, G1D (IEEE802.11b/g/n/a/ac)
Operation temperature range	:	-30 deg. C to +85 deg.C

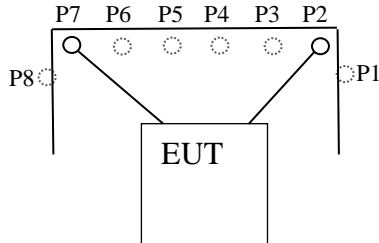
* The EUT has 2-type of jig for the measurement; PCB_A and PCB_B and the corresponding antenna is different. Refer to section 4.2 for details of the combination.

Additional information of specification:

serial no. A-**

The radio output port 0 of the radio circuit is configured with a path such as a chip resistor so that it can be connected only to the connector P2 on the jig board.

The wireless circuit port 1 of the wireless circuit is configured with a chip resistor and so on so that it can be connected only to connector P7 on the jig board.

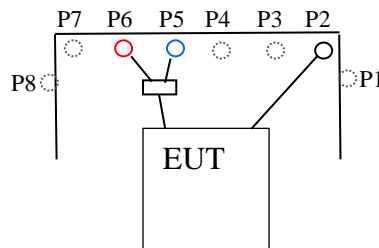


serial no. B-**

The radio output port 0 of the radio circuit is configured with a path such as a chip resistor so that it can be connected only to the connector P2 on the jig board.

The radio output port 1 of the radio circuit is configured with a path such as a chip resistor so that it can be connected to the jig board connector P5 and connector P6 via duplexer in the jig board.

(* P5 is for 2.4 GHz band signal only. P6 is for 5 GHz band signal only.)



Transmission pattern

		Config. 1	Config. 2	Config. 3	Config. 4	Config. 5
chain 0	Bluetooth	-	-	transmit	transmit	transmit
	WLAN 2.4 GHz	-	transmit	-	-	-
	WLAN 5 GHz	transmit	-	-	transmit	-
chain 1	WLAN 2.4 GHz	-	transmit	-	-	transmit
	WLAN 5 GHz	transmit	-	-	transmit	-

Bluetooth mode is only chain 0 output.

WLAN all mode is simultaneous transmission at chain 0 and chain 1 output except the mode of Config.5.

SECTION 3: Scope of Report

The EUT has the channels from 5180 MHz to 5320 MHz and 5500 MHz to 5720 MHz.
This report only covers DFS requirement subject to 5250 MHz to 5350 MHz and 5500 MHz to 5720 MHz bands,
as specified by the following referenced procedures.

SECTION 4: Test specification, procedures & results

4.1 Test Specification

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

Title : FCC 47CFR Part15 Radio Frequency Device Subpart E
Unlicensed National Information Infrastructure Devices
Section 15.407 General technical requirements

Test Specification : KDB 905462 D02 v02
Title : COMPLIANCE MEASUREMENT PROCEDURES FOR UNLICENSED
-NATIONAL INFORMATION INFRASTRUCTURE DEVICES
OPERATING IN THE 5250 - 5350 MHz AND 5470 - 5725 MHz BANDS
INCORPORATING DYNAMIC FREQUENCY SELECTION

Test Specification : KDB 905462 D03 v01r02
Title : U-NII CLIENT DEVICES WITHOUT RADAR DETECTION
CAPABILITY

4.2 Procedures and results

Table 2: Applicability of DFS Requirements

Requirement	Operating Mode	Test Procedures & Limits	Deviation	Results
	Client without Radar Detection			
U-NII Detection Bandwidth	Not required	FCC, KDB 905462 D02 Section 7.8.1	N/A	N/A
Initial Channel Availability Check Time	Not required	FCC15.407 (h)(2)	N/A	N/A
		FCC, KDB 905462 D02 Section 7.8.2.1		
		RSS-247 6.3		
Radar Burst at the Beginning of the Channel Availability Check Time	Not required	FCC15.407 (h)(2)	N/A	N/A
		FCC, KDB 905462 D02 Section 7.8.2.2		
		RSS-247 6.3		
Radar Burst at the End of the Channel Availability Check Time	Not required	FCC15.407 (h)(2)	N/A	N/A
		FCC, KDB 905462 D02 Section 7.8.2.3		
		RSS-247 6.3		
In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time	Yes	FCC15.407 (h)(2)	N/A	Complied a)
		FCC, KDB 905462 D02 Section 7.8.3		
		RSS-247 6.3		
In-Service Monitoring for Non-Occupancy period	Yes *	FCC15.407 (h)(2)	N/A	Complied b)
		FCC, KDB 905462 D02 Section 7.8.3		
		RSS-247 6.3		
Statistical Performance Check	Not required	FCC15.407 (h)(2)	N/A	N/A
		FCC, KDB 905462 D02 Section 7.8.4		
*Although this test was not required in FCC, KDB 905462 D02, it was performed as additional test.				
a) Refer to SECTION 6 (data of In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time)				
b) Refer to SECTION 7 (data of In-Service Monitoring for Non-Occupancy Period)				
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.				

Table 3: DFS Detection Thresholds for Master Devices and Client Devices With Radar

Maximum Transmit Power	Value (See Notes 1, 2 and 3)
E.I.R.P. \geq 200 milliwatt	-64 dBm
E.I.R.P. < 200 milliwatt and power spectral density < 10dBm/MHz	-62 dBm
E.I.R.P. < 200 milliwatt that do not meet the power spectral density requirement	-64 dBm
<p>Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna.</p> <p>Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response.</p> <p>Note 3: E.I.R.P. is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.</p>	

Table 4: DFS Response Requirement Values

Parameter	Value
Non-occupancy period	Minimum 30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds See Note 1
Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2
U-NII Detection Bandwidth	Minimum 100 % of the U-NII 99 % transmission power bandwidth See Note 3
<p>Note 1: The Channel Move Time and the Channel Closing Transmission Time should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst.</p> <p>Note 2: The Channel Closing Transmission Time is comprised of 200 milliseconds starting at the beginning of the Channel Move Time plus any additional intermittent control signals required to facilitate a Channel move (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signal will not count quiet periods in between transmissions.</p> <p>Note 3: During the U-NII Detection Bandwidth detection test, radar type 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.</p>	

Table 5 Short Pulse Radar Test Waveform

Radar Type	Pulse Width [μs]	PRI [μs]	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Number of Trials
0	1	1428	18	See Note 1	See Note 1
1	1	Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a	Roundup ((1 / 360) x ((19 x 10 ⁶) / PRI [micro sec.]))	60 %	30
		Test B: 15 unique PRI values randomly selected within the range of 518 - 3066 micro sec., with a minimum increment of 1 micro sec., excluding PRI values selected in Test A			
2	1 - 5	150 - 230	23 - 29	60 %	30
3	6 - 10	200 - 500	16 - 18	60 %	30
4	11 - 20	200 - 500	12 - 16	60 %	30
Aggregate (Rader Types 1-4)				80 %	120
Note 1: Short Pulse Radar Type 0 should be used for the detection bandwidth test, channel move time, and channel closing time tests.					

Table 5a Pulse Repetition Interval Values for Test A

Pulse Repetition Frequency Number	Pulse Repetition Frequency (Pulses Per Second)	Pulse Repetition Interval (Micro seconds)
1	1930.5	518
2	1858.7	538
3	1792.1	558
4	1730.1	578
5	1672.2	598
6	1618.1	618
7	1567.4	638
8	1519.8	658
9	1474.9	678
10	1432.7	698
11	1392.8	718
12	1355	738
13	1319.3	758
14	1285.3	778
15	1253.1	798
16	1222.5	818
17	1193.3	838
18	1165.6	858
19	1139	878
20	1113.6	898
21	1089.3	918
22	1066.1	938
23	326.2	3066

Table 6 Long Pulse Radar Test Waveform

Radar Type	Pulse Width [μs]	Chip Width [MHz]	PRI [μs]	Number of Pulses per <i>Burst</i>	Number of <i>Burst</i>	Minimum Percentage of Successful Detection	Minimum Number of Trials
5	50 - 100	5 - 20	1000 - 2000	1 - 3	8 - 20	80 %	30

Table 7 Frequency Hopping Radar Test Waveform

Radar Type	Pulse Width [μs]	PRI [μs]	Pulse per Hop [kHz]	Hopping Rate [kHz]	Hopping Sequence Length [ms]	Minimum Percentage of Successful Detection	Minimum Number of Trials
6	1	333	9	0.333	300	70 %	30

4.3 Test Location

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
A2LA Certificate Number: 1266.03
FCC Test Firm Registration Number: 626366

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Semi-anechoic chamber	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.2 Semi-anechoic chamber	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5 m
No.4 Semi-anechoic chamber	-	8.1 x 5.1 x 3.55	8.1 x 5.1	-
No.1 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.2 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.3 Shielded room	-	6.3 x 4.7 x 2.7	6.3 x 4.7	-
No.4 Shielded room	-	4.4 x 4.7 x 2.7	4.4 x 4.7	-
No.5 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.6 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.8 shielded room	-	3.45 x 5.5 x 2.4	3.45 x 5.5	-
No.1 Measurement room	-	2.55 x 4.1 x 2.5	-	-

4.4 Uncertainty

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

Time Measurement uncertainty for this test was: (\pm) 0.012 %

4.5 Test set up, Data of DFS test, and Test instruments of DFS

Refer to APPENDIX.

SECTION 5: Operation of E.U.T. during testing

5.1 Operating Modes

The EUT, which is a Client Device without Radar detection capability, operates over the 5260 MHz - 5320 MHz and 5500 MHz - 5720 MHz.

The EUT uses one transmitter connected to a 50 ohm coaxial antenna ports. The antenna port is connected to the test system.

WLAN traffic is generated by streaming the transfer data with iperf-2.0.5 program from the Master to the Client. (Channel loading was over 17 %)

The EUT utilizes the 802.11a, 802.11n and 802.11ac architecture, with a nominal channel bandwidth. The EUT had used IEEE 802.11ac VHT80 (widest mode).

The FCC ID for the Master Device used with EUT for DFS testing is LDK102087.

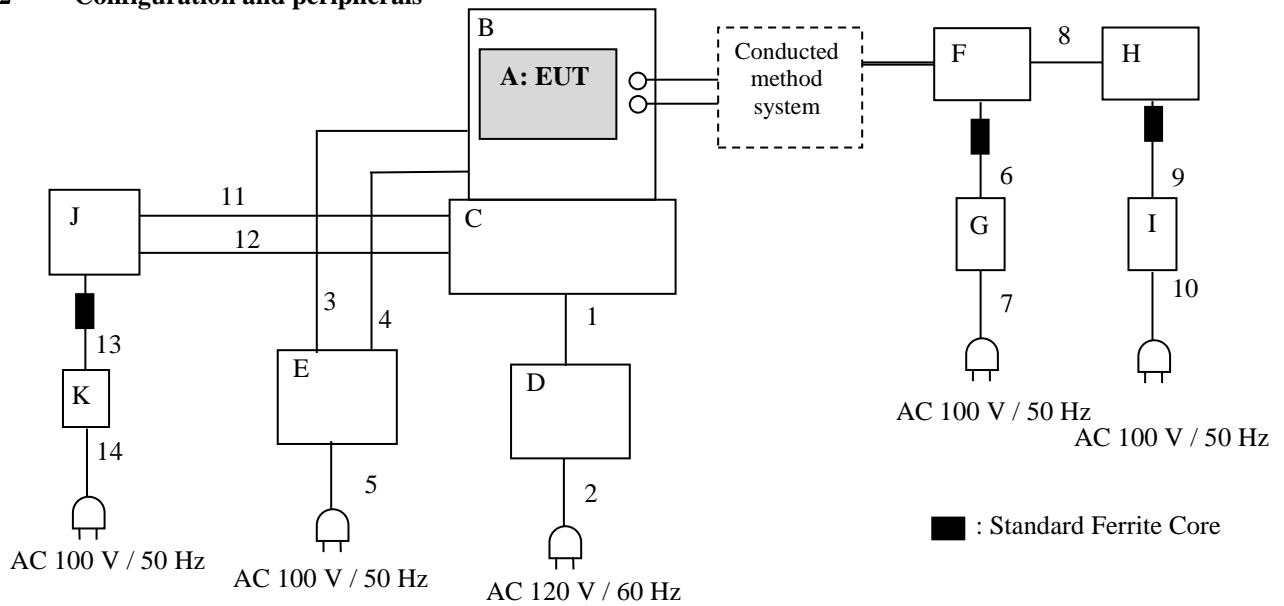
[Master device information]

This following remark is the information of companion device (master device). (not EUT information)

The rated output power of the Master unit is > 200 mW (23 dBm). Therefore the required interference threshold level is -64 dBm. After correction for antenna gain and procedural adjustments, the required conducted threshold at the antenna port is $-64 + 1 + 4 = -59$ dBm (threshold level + additional 1 dB + antenna gain *1)).

*1) Minimum antenna gain of Master Device (FCC ID: LDK102087, ISED No.: 2461B-102087)

5.2 Configuration and peripherals



Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Communication Module	Type1VY	A-7	Murata Manufacturing Co., Ltd.	EUT
B	Jig board	P2ML7925	A-7	Murata Manufacturing Co., Ltd.	-
C	Platform	iMX8	00-04-9F-05-A7-7B	NXP Semiconductors	-
D	AC Adapter	EA10682N-120	-	EDACPOWER ELEC.	-
E	DC power supply	PW16-5ADP	18026330	TEXIO	-
F	Wireless LAN access point (Master Device)	AIR-CAP3702E-A-K9	FTX18227609	Cisco Systems	FCC ID: LDK102087
G	AC Adapter	AA25480L	ALD02510FEW	Cisco Systems	-
H	Notebook Computer	DELL Vostro V1510	29090510205	Dell	-
I	AC Adapter	LA65NS1-00	71615-93B-385D	Dell	-
J	Notebook Computer	Type7666-77J	LV-B8PVT 08/05	Lenovo	-
K	AC Adapter	42T4422	11S42T4422Z1ZF3D9BV4XN	Lenovo	-

List of cables used

No.	Cable Name	Length (m)	Shield	
			Cable	Connector
1	DC	1.2	Unshielded	Unshielded
2	AC	1.5	Unshielded	Unshielded
3	DC	0.7	Unshielded	Unshielded
4	DC	0.7	Unshielded	Unshielded
5	AC	2.0	Unshielded	Unshielded
6	Access Point DC Power	1.8	Unshielded	Unshielded
7	Access Point AC Power	2.0	Unshielded	Unshielded
8	LAN	3.0	Unshielded	Unshielded
9	DELL PC DC Power	1.8	Unshielded	

5.3 Test and Measurement System

SYSTEM OVERVIEW

The measurement system is based on a conducted test method.

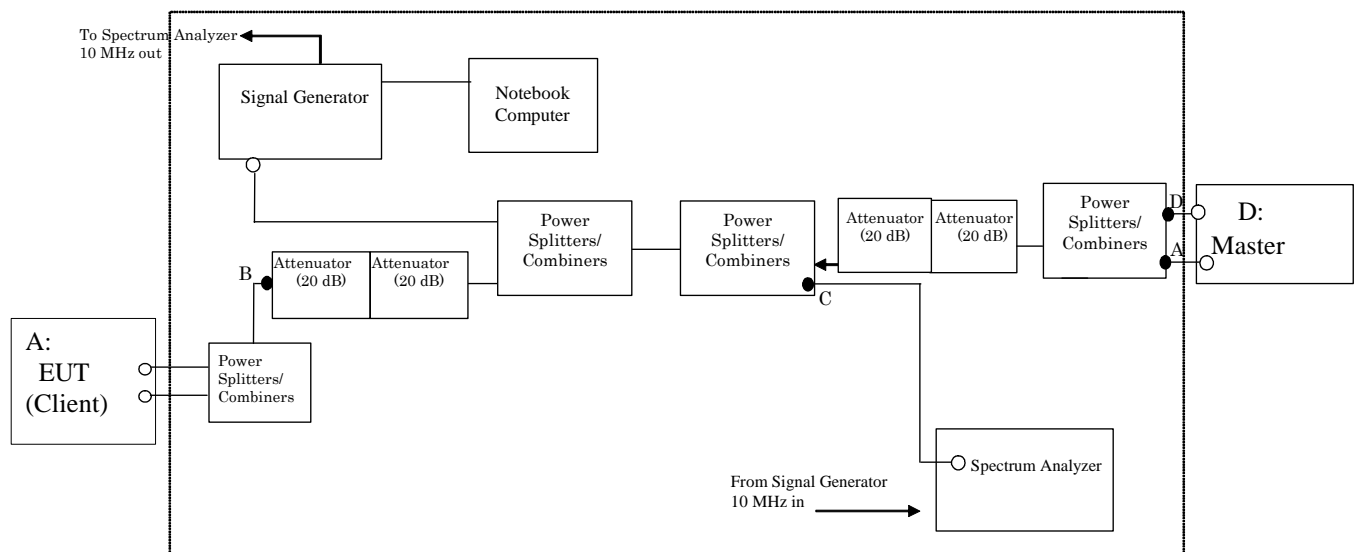
The software selects waveform parameters from within the bounds of the signal type on a random basis using uniform distribution. The short pulse types 2, 3, and 4, the long pulse type 5, and the frequency hopping type 6 parameters are randomized at run-time.

The signal monitoring equipment consists of a spectrum analyzer with the capacity to display 8001 bins on the horizontal axis. A time-domain resolution of 2 ms/bin is achievable with a 16 seconds sweep time, meeting the 10 seconds short pulse reporting criteria. The aggregate ON time is calculated by multiplying the number of bins above a threshold during a particular observation period by the dwell time per bin, with the analyzer set to peak detection. A time-domain resolution of 3 ms/bin is achievable with a 24 seconds sweep time, meeting the 22 seconds long pulse reporting criteria and allowing a minimum of 10 seconds after the end of the long pulse waveform.

FREQUENCY HOPPING RADAR WAVEFORM GENERATING SUBSYSTEM

The first 100 frequencies are selected out of the hopping sequence of the randomized 475 hop frequencies. Only a *Burst* that has the frequency falling within the receiver bandwidth of the tested U-NII device is selected among those frequencies. (Frequency-domain simulation). The radar waveform generated at the start time of the selected *Burst* (Time-domain simulation) is download to the Signal Generator. If all of the randomly selected 100 frequencies do not fall within the receiver bandwidth of the U-NII device, the radar waveform is not used for the test.

CONDUCTED METHODS SYSTEM BLOCK DIAGRAM



MEASUREMENT SYSTEM FREQUENCY REFERENCE

Lock the signal generator and the spectrum analyzer to the same reference sources as follows: Connect the 10 MHz OUT on the signal generator to the 10 MHz IN on the spectrum analyzer and set the spectrum analyzer 10 MHz In to On.

SYSTEM CALIBRATION

Step 1: Set the system as shown in Figure 3 of KDB 905462 D02.

Step 2: Adjust each attenuator to fulfill the following three conditions:

- WLAN can be communicated, and
- Rader detection threshold level is bigger than Client Device traffic level on the spectrum analyzer, and
- Master Device traffic level is not displayed on the spectrum analyzer.

Step 3: Terminate 50 ohm at B, C and D points, and connect the spectrum analyzer to the point A.

(See the figure on Section 5.3)

At the point A, adjust the signal generator and spectrum analyzer to the center frequency of the channel to be measured. Download the applicable radar waveforms to the signal generator. Select the radar waveform, trigger a burst manually and measure the amplitude on the spectrum analyzer. Readjust the amplitude of the signal generator as required so that the peak level of the waveform is at a displayed level equal to the required or desired interference detection threshold. Separate signal generator amplitude settings are determined as required for each radar type.

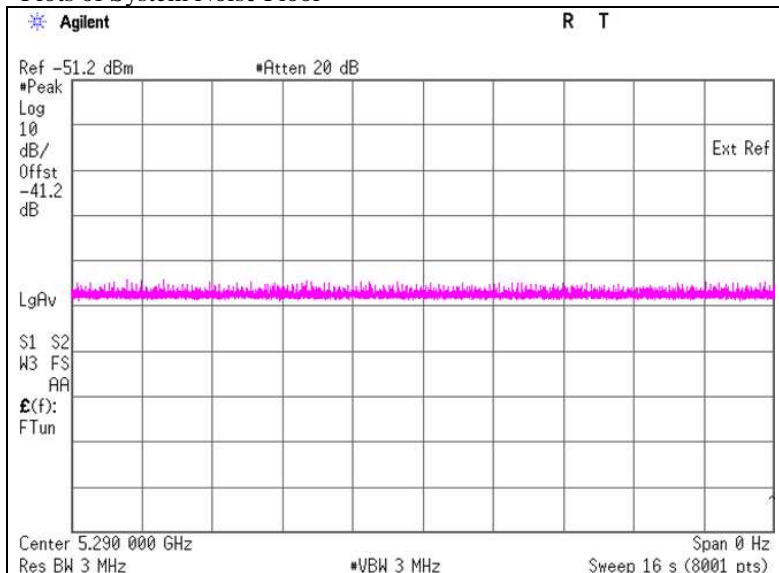
Step 4: Without changing any of the instrument settings, restore the system setting to Step 2 and adjust the Reference Level Offset of the spectrum analyzer to the level at Step 3.

By taking the above steps 1 to 4, the spectrum analyzer displays the level of the signal generator as received at the antenna ports of the Master Device.

See Clause 5.4 for Plots of Noise, Rader Waveforms, and WLAN signals.

5.4 Plots of Noise, Rader Waveforms, and WLAN signals

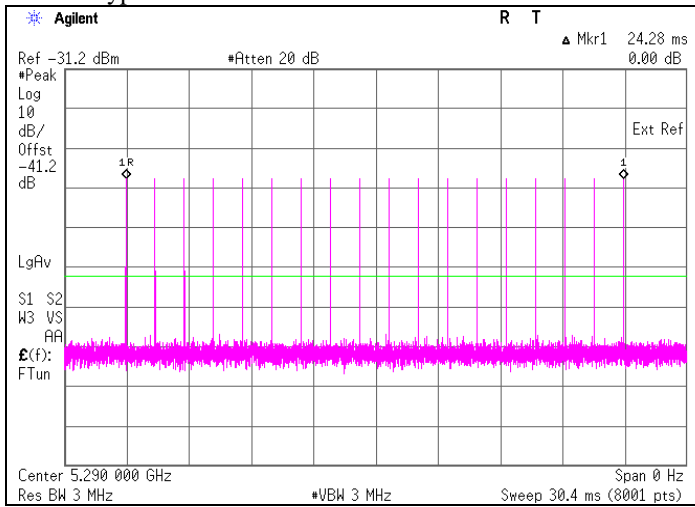
Plots of System Noise Floor



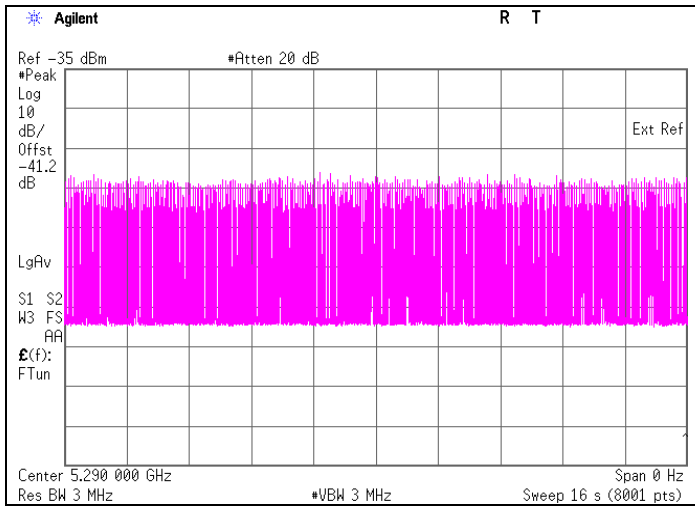
It was confirmed that the EUT did not transmit before having received appropriate control signals from a Master Device.

Plots of Radar Waveforms

Rader Type 0



Plots of WLAN Traffic



SECTION 6: In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time

6.1 Operating environment

Test place : No.3 Shielded room
Temperature : 23 deg.C
Humidity : 50 %RH

6.2 Test Procedure

Transfer files from the Master Device to the Client Device on the tested channel during the entire period of the test. The Radar Waveform generator sends a Burst of pulses for one of the Short Pulse Radar Types 0 at levels defined, on the Operating Channel. An additional 1 dB is added to the radar test signal to ensure it is at or above the DFS Detection Threshold, accounting for equipment variations/errors. Observe the transmissions of the EUT at the end of the radar Burst on the Operating Channel for duration greater than 10 seconds.

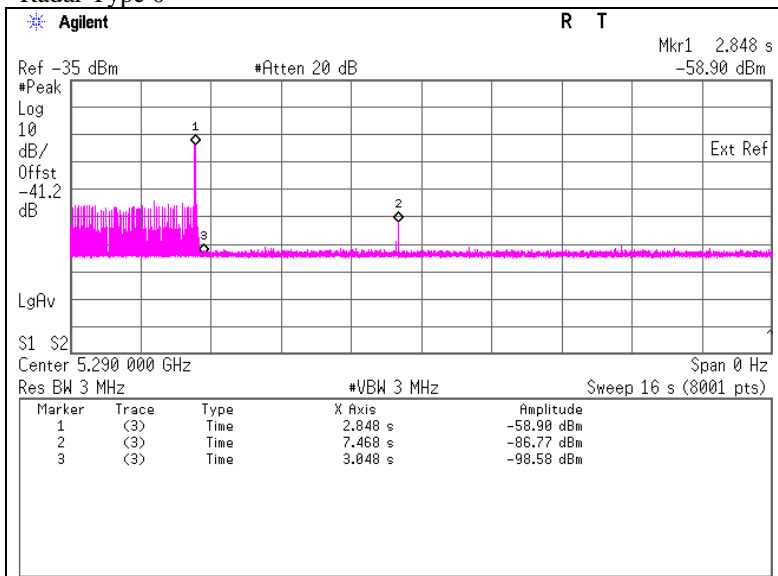
6.3 Test data

Test Item	Unit	Measurement Time	Limit	Results
Channel Move Time *1)	[s]	4.620	10.000	Pass
Channel Closing Transmission Time *2)	[ms]	4	60	Pass

*1) Channel Move Time is calculated as follows:
(Channel Move Time) = (End of Transmission) - (End of Burst)

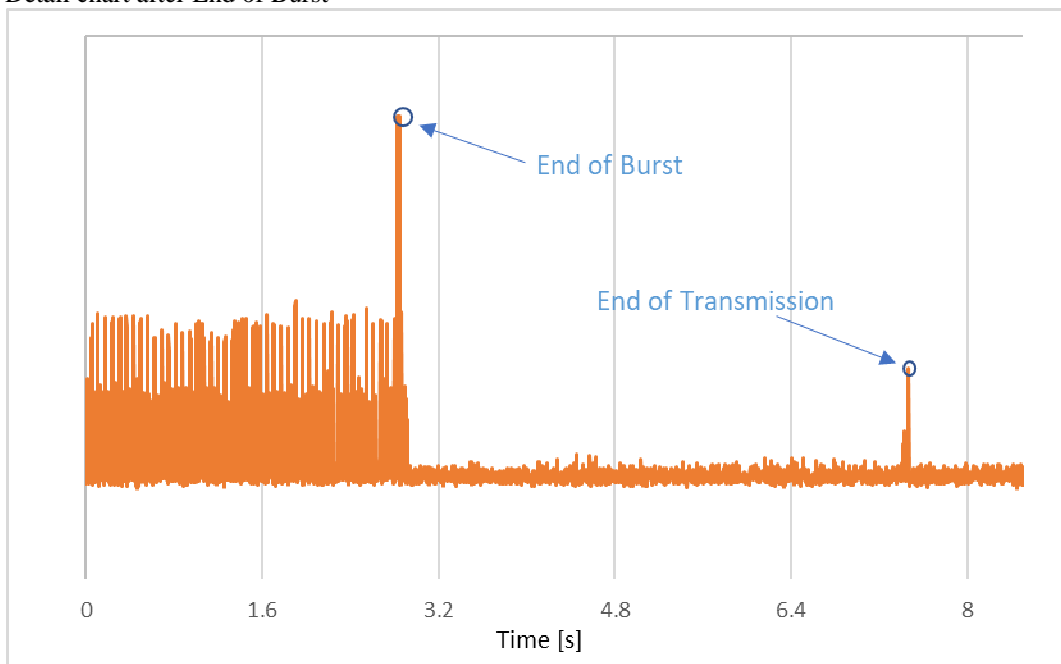
*2) Channel Closing Transmission Time is calculated from (End of Burst + 200 ms) to (End of Burst + 10 s)
(Channel Closing Transmission Time) = (Number of analyzer bins showing transmission) x (dwell time per bin)
= 2 x 2 [ms]

Radar Type 0



Marker 1: - End of Burst : 2.848 s
Marker 2: - End of Transmission : 7.468 s
Marker 3: - End of Burst + 200 ms : 3.048s

Detail chart after End of Burst



6.4 Test result

Test result: Pass

Date : October 9, 2019

Test engineer : Kazuya Noda

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

SECTION 7: In-Service Monitoring for Non-Occupancy Period

7.1 Operating environment

Test place : No.3 Shielded room
Temperature : 23 deg.C
Humidity : 50 %RH

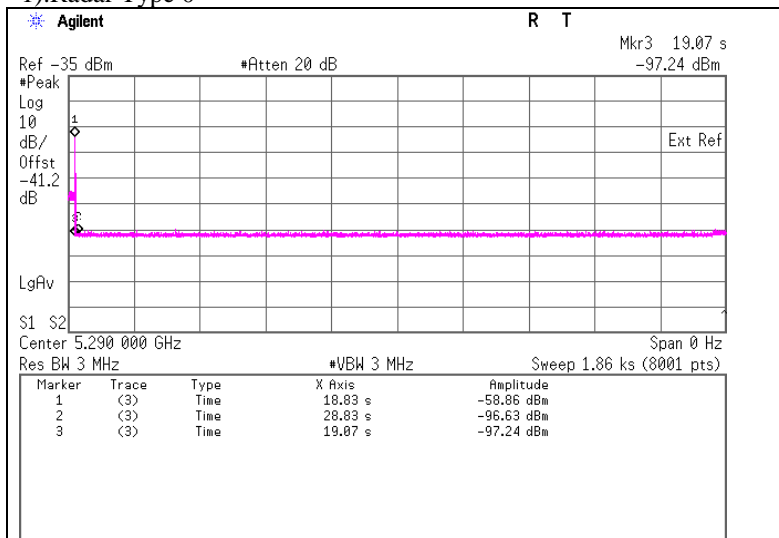
7.2 Test Procedure

The following two tests are performed:

- 1). Transfer files from the Master Device to the Client Device on the tested channel during the entire period of the test. The Radar Waveform generator sends a Burst of pulses for one of the Radar Types 0 at levels defined on the Operating Channel. An additional 1 dB is added to the radar test signal to ensure it is at or above the DFS Detection Threshold, accounting for equipment variations/errors. Observe the transmissions of the EUT after the Channel Move Time on the Operating Channel for duration greater than 30 minutes.
- 2). Transfer files from the Master Device to the Client Device on the tested channel during the entire period of the test. Observe the transmissions of the EUT on the Operating Channel for duration greater than 30 minutes after the Master Device is shut off.

7.3 Test data

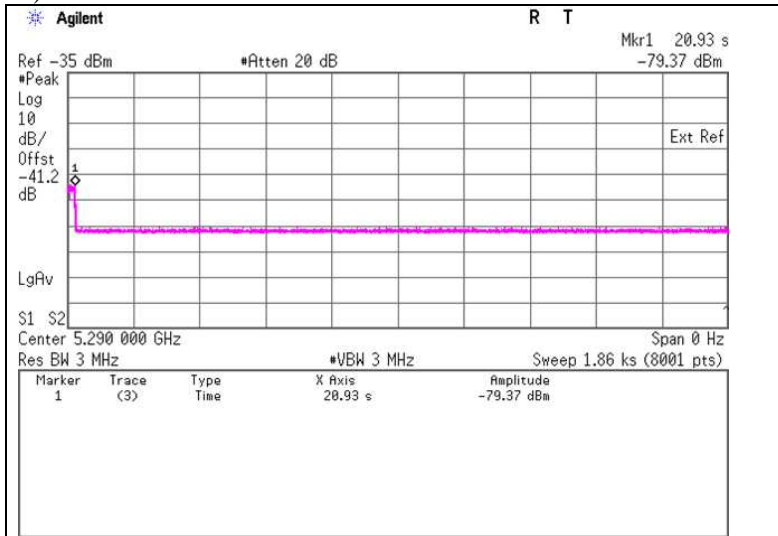
1).Radar Type 0



Marker 1 : End of Burst : 18.83 s
Marker 2 : End of Burst + 10 s : 28.83 s

* Measurement non-occupancy period: 30.52 minutes or more (1860 [s] – 28.83 [s] = 1831.17 [s] = 30.52 [minutes])

2).Master is shut off



Marker 1 : End of Burst : 20.93 s

* Measurement non-occupancy period: 30.65 minutes or more (1860 [s]- 20.93 [s] = 1839.07 [s] = 30.65 [minutes])

7.4 Test result

Test result: Pass

Date : October 9, 2019

Test engineer : Kazuya Noda

APPENDIX 1: Test instruments

Test Equipment

Local ID	Test Name	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Calibration Interval (Month)
SAT20-06	DFS	145146	Attenuator	Weinschel Corp.	54A-20	31506	2019/4/16	2020/4/30	12
SAT20-07	DFS	145155	Attenuator	Weinschel Corp.	54A-20	31484	2019/4/16	2020/4/30	12
SAT20-12	DFS	160495	Attenuator	Weinschel Corp.	54A-20	86752	2018/12/6	2019/12/30	12
SAT20-13	DFS	160496	Attenuator	Weinschel Corp.	54A-20	87636	2018/12/6	2019/12/30	12
SCC-G12	DFS	145040	Coaxial Cable	Suhner	SUCOFLEX 102	30790/2	2019/3/27	2020/3/31	12
SCC-G13	DFS	145166	Coaxial Cable	Suhner	SUCOFLEX 102	31599/2	2018/12/25	2019/12/31	12
SCC-G24	DFS	145181	Coaxial Cable	Suhner	141PE	-	2019/7/4	2020/7/31	12
SCC-G25	DFS	145182	Coaxial Cable	Suhner	141PE	-	2019/7/4	2020/7/31	12
SCC-G26	DFS	145041	Coaxial Cable	Suhner	141PE	-	2019/7/4	2020/7/31	12
SCC-H14	DFS	144995	Microwave cable	RS Pro	R-132G7210 100CO	-	2019/4/16	2020/4/30	12
SCC-H15	DFS	144996	Microwave cable	RS Pro	R-132G7210 100CO	-	2019/4/16	2020/4/30	12
SOS-06	DFS	146294	Humidity Indicator	A&D	AD-5681	4062118	2018/12/5	2019/12/31	12
SPD-01	DFS	146261	Power Divider	AGILENT	11636B	56998	2019/4/16	2020/4/30	12
SPSC-02	DFS	146252	Power Splitters/Combiners	Mini-Circuits	ZFSC-2-10G+	-	2019/4/16	2020/4/30	12
SPSC-03	DFS	146253	Power Splitters/Combiners	Mini-Circuits	ZFSC-2-10G+	-	2019/4/16	2020/4/30	12
SPSC-08	DFS	146277	Power Splitters/Combiners	Mini-Circuits	ZFSC-2-10G+	-	2019/7/5	2020/7/31	12
SSA-03	DFS	145801	Spectrum Analyzer	AGILENT	E4448A	MY482501 52	2019/8/8	2020/8/31	12
SSG-01	DFS	145804	Signal Generator	AGILENT	E4438C	MY472715 84	2019/4/23	2020/4/30	12
STS-03	DFS	146210	Digital Hitester	HIOKI	3805-50	80997823	2019/10/1	2020/10/31	12
COTS-SDFS-01	DFS	144863	Signal Studio Software for DFS	AGILENT	N7620A-101	5010-7739	-	-	-

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:

DFS: Dynamic Frequency Selection

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