RADIO TEST REPORT

Test Report No. : 11415417H-A-R1

Applicant	:	**Panasonic Corporation of North America**
Type of Equipment	:	**DECT module**
Model No.	:	**FV-LKVK1**
FCC ID	:	**ACJ96NFV-LKVK1**
Test regulation	:	**FCC Part 15 Subpart D: 2016**
Test Result	:	**Complied**

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 above regulation.
4. The test results in this 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 NVLAP, NIST, or any agency of the Federal Government.
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. This report is a revised version of 11415417H-A. 11415417H-A is replaced with this report.

Date of test: August 18 to September 1, 2016

Representative test engineer:
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Approved by:
Takayuki Shimada
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Consumer Technology Division

NVLAP TESTING
NVLAP LAB CODE: 200572-0

This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.
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REVISION HISTORY

Original Test Report No.: 11415417H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	11415417H-A	September 28, 2016	-	-
1	11415417H-A-R1	October 24, 2016	P 12	Correction of font.
1	11415417H-A-R1	October 24, 2016	P 17	Correction of Configuration and peripherals.
1	11415417H-A-R1	October 24, 2016	P 8, P 9, P18	Correction of typo.
1	11415417H-A-R1	October 24, 2016	P 10, P 22, P 35	Correction of sentence.
1	11415417H-A-R1	October 24, 2016	P 30 - P 33	Correction of dBuV/m.

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SECTION 1: Symbols and Abbreviations

Following symbols and abbreviations are used in this test report.

EUT	equipment under test
SA	spectrum analyzer
SG	signal generator
PK	peak
AV	average
Tx	transmit
Rx	receive
DECT	Digital Enhanced Cordless Telecommunications
BW	band width
RBW	resolution band width
VBW	video band width
LIC	Least Interfered Channel
N/A	Not applicable
TDMA	Time Division Multiple Access
FDMA	Frequency Division Multiple Access
Ch	channel

Icon (if any)"☒" is "applicable" , "☐" is "not applicable"

SECTION 2: Applicant information

Company Name	Panasonic Corporation of North America
Address	Two Riverfront Plaza,9th Floor,Newark,NJ07102-5490
Telephone Number	+201-348-7760
Facsimile Number	+201-348-7760
Contact Person	Ben Botros

SECTION 3: EUT

3.1. Identification of EUT

Type of Equipment	DECT module
Model No.	FV-LKVK1
Serial No.	Refer to SECTION 5:, Clause 5.3
Host Rating	☐AC Voltage V Frequency ☐60Hz ☐From 50Hz to 60Hz ☒DC Voltage 5 V (4.75 V~ 5.25 V)
Country of Manufacture	China
Receipt Date of Sample	August 17, 2016
Condition of EUT	☐Production model ☒Production prototype ☐Engineering prototype
	☒(Not for Sale: This sample is equivalent to mass-produced items.) ☐(Not for Sale: This sample is not mass-produced items.)
Modification of EUT	No Modification by the test lab

3.2 Product Description

Model: FV-LKVK1 (referred to as the EUT in this report) is a DECT module.

3.3 General Specification

Clock Frequency(ies) in the system	CPU 104 MHz, X'tal: 13.824 MHz

3.4 Radio Specification

☒DECT

Equipment Type	Transceiver		
Frequency of Operation	☒1921.536 - 1928.448 MHz		
Type of Modulation	☒GFSK		
Number of Channel	☒60(5 x 12)		
Number of RF Channel	☒5		
Access type	☒TDMA	☐FDMA	
Device type	☐responding device	☒initiating device	
Antenna Gain	☒(0.3)dBi		
Antenna Type	☐PCB Pattern ☐Dipole ☐Inverted F ☒Other(Wired monopole Antenna)		
Antenna configuration	number of antenna(s):	Tx:1	Rx:1

SECTION 4: Test specification, procedures & results

4.1 Test specification

Test Specification	FCC Part 15 Subpart D FCC part 15 final revised on April 6, 2016.
Title	FCC 47CFR Part15 Radio Frequency Device Subpart D Unlicensed Personal Communications Service Devices

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

4.2 Test Procedures

Item	Test Procedure
Conducted Emission	FCC: ANSI C63.4:2014
	IC: RSS-Gen
Peak transmit power	FCC: ANSI C63.17:2013
	IC: RSS-213
Emission Bandwidth	FCC: ANSI C63.17:2013
Occupied Bandwidth	IC: RSS-213
Power Spectrum Density	FCC: ANSI C63.17:2013
	IC: RSS-213
In-band unwanted emissions	FCC: ANSI C63.17:2013
	IC: RSS-213
Out-of-band emissions	FCC: ANSI C63.17:2013
	IC: RSS-213
Carrier frequency stability	FCC: ANSI C63.17:2013
	IC: RSS-213
Frame repetition stability	FCC: ANSI C63.17:2013
	IC: RSS-213
Frame period and jitter	FCC: ANSI C63.17:2013
	IC: RSS-213
Monitoring Threshold Least interfered channel	FCC: ANSI C63.17:2013
	IC: RSS-213
Threshold and LIC monitoring bandwidth	FCC: ANSI C63.17:2013
	IC: RSS-213
Reaction time and monitoring interval	FCC: ANSI C63.17:2013
	IC: RSS-213
Timing for EUTs using control and Signaling channel-type transmissions	FCC: ANSI C63.17:2013
	IC: RSS-213
Timing for EUTs using communications channel-type transmissions	FCC: ANSI C63.17:2013
	IC: RSS-213
Duplex connections	FCC: ANSI C63.17:2013
	IC: RSS-213
Alternative monitoring interval	FCC: ANSI C63.17:2013
	IC: RSS-213
Spurious Emissions	FCC: ANSI C63.4:2014
	IC: RSS-Gen
Note1: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422. Note2: In case any questions arise about test procedure, ANSI C63.4: 2014 or C63.17: 2013 is also referred.	

4.3 Test Results

Item	Specification	Worst Margin	Results	Remarks
Conducted Emission	FCC: Section 15.207 (Section 15.315) IC: RSS-Gen 7.2.4	[QP] 26.3 dB 24.95570 MHz, L [AV] 16.7 dB 24.95570 MHz, L	☐N/A ☒Complied	-
Peak transmit power	FCC: Section 15.319(c)(e) IC: RSS-213 5.6	See data	☐N/A ☒Complied	-
Emission Bandwidth	FCC: Section 323(a)	See data	☐N/A ☒Complied	-
Occupied Bandwidth	IC: RSS-213 5.5 : RSS-Gen 6.6	See data	☐N/A ☒Complied	Note1
Power Spectrum Density	FCC: Section 15.319(d) IC: RSS-213 5.7	See data	☐N/A ☒Complied	-
Out-of-band emissions	FCC: Section15.323(d) IC: RSS-213 5.8.1	See data	☐N/A ☒Complied	-
In-band unwanted emissions	FCC: Section15.323(d) IC: RSS-213 5.8.2	See data	☐N/A ☒Complied	-
Carrier frequency stability	FCC: Section15.323(f) IC: RSS-213 5.3	See data	☐N/A ☒Complied	-
Frame repetition stability	FCC: Section15.323(e) IC: RSS-213 5.2(13)	See data	☐N/A ☒Complied	-
Frame period and jitter	FCC: Section15.323(e) IC: RSS-213 5.2(13)	See data	☐N/A ☒Complied	-
Monitoring Threshold Least interfered channel	FCC: Section15.323(c)(2)(5)(9) IC: RSS-213 5.2(2)(5)(9)	See data	☐N/A ☒Complied	-
Threshold and LIC monitoring bandwidth	FCC: Section15.323(c)(7) IC: RSS-213 5.2(7)	-	☒N/A ☐Complied	Note2
Reaction time and monitoring interval	FCC: Section15.323(c)(7) IC: RSS-213 5.2(7)	-	☐N/A ☒Complied	-
Timing for EUTs using control and Signaling channel-type transmissions	FCC: Section15.323(c)(4)(6) IC: RSS-213 5.2(4)(6)	-	☒N/A ☐Complied	Note3
Timing for EUTs using communications channel-type transmissions	FCC: Section15.323(c)(3)(4) IC: RSS-213 5.2(3)(4)	-	☐N/A ☒Complied	-
Duplex connections	FCC: Section15.323(c)(10) IC: RSS-213 5.2(10)	-	☐N/A ☒Complied	-
Alternative monitoring interval	FCC: Section15.323(c)(11)(12) IC: RSS-213 5.2(11)(12)	-	☒N/A ☐Complied	Note4
Spurious Emissions	FCC: Section15.319(g), 15.109(a),15.209(a) IC:RSS-GEN 8.9	-	☒N/A ☐Complied	Note5

4.3 Test Results(Cont.)

Note1: reference data
Note2: This test is not applicable because the manufacture declares that the tested EUT uses the same receiver for monitoring and communication.
Note3: This test is not applicable because EUT does not transmit unacknowledged control and signaling information.
Note4: This test is not applicable because EUT does not implement this provision.
Note5: This test is not applicable since EUT is in accordance with ANSI C63.17/ 6.1.6.2/ c).

4.4 FCC Part 15.31 (e) / IC Supplied Voltage Information

☐This EUT complies with the requirement.

Because:

☐The test was performed with the New Battery (DC**V) and the stable voltage was supplied to the EUT during the tests.

☐The EUT provides stable voltage (DC**V) constantly to RF Module regardless of input voltage.

☒The EUT provides stable voltage (DC 3.3 V) constantly to RF Part regardless of input voltage.

☐The EUT is a battery-operated device and test was performed with the full-charged battery.

☐The RF Module has its own regulator. The RF Module is constantly provided voltage (DC**V) through the regulator regardless of input voltage.

☐The EUT provides stable voltage (DC**V) 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,

4.5 FCC Part 15.203/15.317 Antenna requirement / IC Antenna Information

☒This equipment complies with the antenna requirement.

Because:

☒It is impossible for end users to replace the antenna, because the antenna is mounted inside of the EUT.

☐The EUT has an external antenna connector, but it is installed by the professionals.

☐The EUT has a unique coupling/antenna connector (connector type :)

☐The antenna is not removable from the EUT

☐It is impossible for end users to replace the antenna, because the antenna is mounted inside of the vehicle.

4.6 Addition to standard

☒No addition, exclusion nor deviation has been made from the standard.

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

4.7 Uncertainty

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

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Antenna terminal test Uncertainty (+/-)			
Peak transmit power / Power Spectrum Density / In-band unwanted emissions / Out-of-band emissions			
Below 1 GHz	1 GHz -3 GHz	3 GHz -18 GHz	18 GHz -26.5 GHz
1.4 dB	1.7 dB	2.8 dB	2.8 dB

Frequency range	Conducted emission using AMN(LISN) (+/-)
0.15 – 30MHz	3.0 dB
Carrier frequnecy stability (+/-)	
0.58 ppm	
Frame repetition stability (+/-)	
1.00 ppm	
Frame period and jitter (+/-)	
21.02 ps	

Conducted Emission test
☒The data listed in this test report has enough margin, more than the site margin.
☐The data listed in this report meets the limits unless the uncertainty is taken into consideration.

4.8 Test Location

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	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms
No.1 semi-anechoic chamber	2973C-1	19.2 x 11.2 x 7.7m	7.0 x 6.0m	No.1 Power source room
No.2 semi-anechoic chamber	2973C-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	2973C-3	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.3 Preparation room
No.3 shielded room	-	4.0 x 6.0 x 2.7m	N/A	-
No.4 semi-anechoic chamber	2973C-4	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.4 Preparation room
No.4 shielded room	-	4.0 x 6.0 x 2.7m	N/A	-
No.5 semi-anechoic chamber	-	6.0 x 6.0 x 3.9m	6.0 x 6.0m	-
No.6 shielded room	-	4.0 x 4.5 x 2.7m	4.0 x 4.5 m	-
No.6 measurement room	-	4.75 x 5.4 x 3.0m	4.75 x 4.15 m	-
No.7 shielded room	-	4.7 x 7.5 x 2.7m	4.7 x 7.5m	-
No.8 measurement room	-	3.1 x 5.0 x 2.7m	N/A	-
No.9 measurement room	-	8.0 x 4.6 x 2.8m	2.4 x 2.4m	-
No.11 measurement room	-	6.2 x 4.7 x 3.0m	4.8 x 4.6m	-

4.9 Test data, Test instruments, and Test set up

Refer to APPENDIX.

SECTION 5: Operation of EUT. During testing

5.1 Tested Mode(s)

Mode	Rate	Channel	Antenna port
☒Continuous transmitting	1.152Mbps	Lch / Mch / Hch	-
☒Communication	1.152Mbps	Mch	-
☒Loop Back	1.152Mbps	Lch / Mch / Hch	-
☐Speech mode	-	-	-
☐Charging mode	-	-	-

Item	Mode	Channel
Conducted Emission	Continuous transmitting	Lch / Mch / Hch
Peak transmit power	Continuous transmitting	Lch / Mch / Hch
Emission Bandwidth	Loop Back	Lch / Mch / Hch
Occupied Bandwidth	Loop Back	Lch / Mch / Hch
Power Spectrum Density	Continuous transmitting	Lch / Mch / Hch
Out-of-band emissions	Continuous transmitting	Lch / Hch
In-band unwanted emissions	Continuous transmitting	Lch / Mch / Hch
Carrier frequency stability	Loop Back	Mch
Frame repetition stability	Continuous transmitting	Mch
Frame period and jitter	Continuous transmitting	Mch
Monitoring Threshold Least interfered channel	Communication	Mch
Reaction time and monitoring interval	Communication	Mch
Timing for EUTs using communications channel-type transmissions	Communication	Mch
Duplex connections	Communication	Mch

Ch explanation

Lowest ch (Lch)	☒1921.536MHz
Midest ch (Mch)	☒1924.992MHz
Highest ch (Hch)	☒1928.448MHz

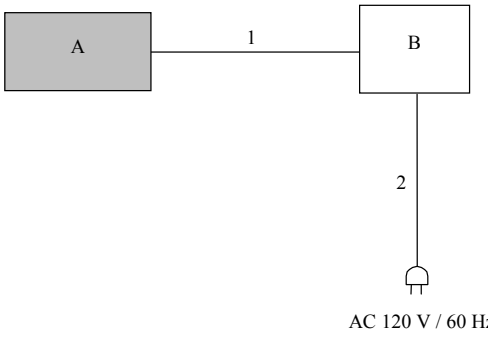
5.2 settings of software

Power of the EUT was set by the software as follows;

Power settings	Same as product
Software	JLBDS1 71.04
Note1: 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.	

5.3 Configuration and peripherals

Conducted Emission / Peak transmit power / Emission Bandwidth / Occupied Bandwidth / Power Spectrum Density / Carrier frequency stability / Out-of-band emissions / In-band unwanted emissions / Frame repetition stability / Frame period and jitter tests only



Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	DECT module	FV-LKVK1	No.1 *1) No.2 *2)	Panasonic Ecology Systems Co., Ltd.	EUT
B	DC Power Supply	PW18-1.3AT	08016530	KENWOOD TMI	-

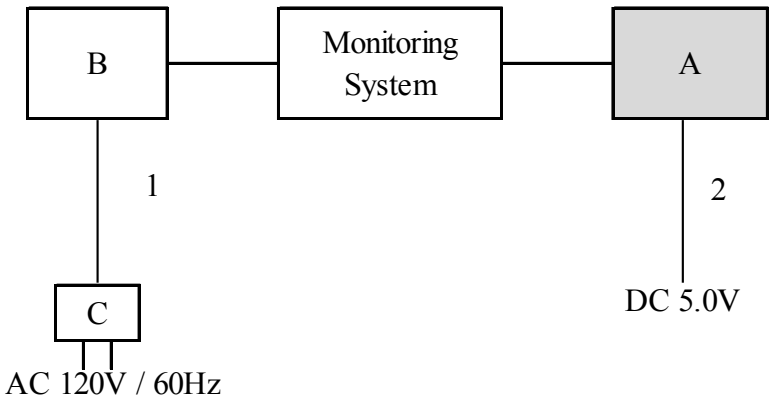
*1) Used for all tests except for Conducted Emission test.
*2) Used for Conducted Emission test.

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	0.15	Unshielded	Unshielded	-
2	AC Cable	1.80	Unshielded	Unshielded	-

5.3 Configuration and peripherals (cont.)

Monitoring Threshold Least interfered channel / Reaction time and monitoring interval / Timing for EUTs using communications channel-type transmissions / Duplex connections tests only



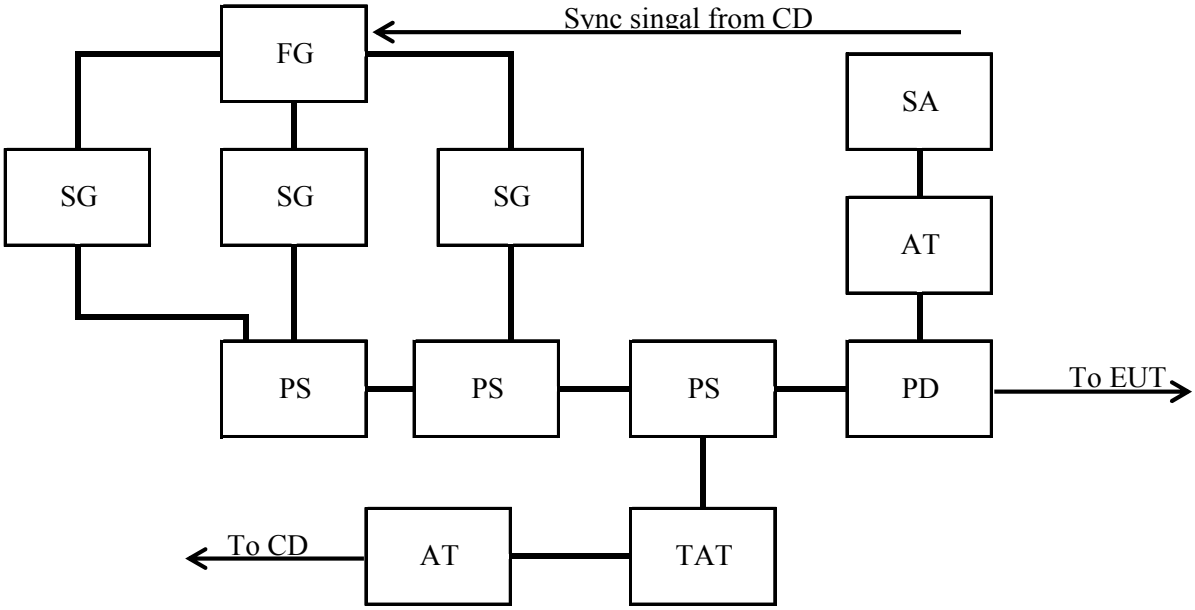
Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	DECT module	FV-LKVK1	No.1	Panasonic	EUT
B	Base unit	KX-HNB600	5GBQA005636	Panasonic	Companion device
C	AC Adaptor	PNLV236	FL09FF4	Panasonic	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	2.00	Unshielded	Unshielded	-
2	DC Cable	1.00	Unshielded	Unshielded	-

Monitoring system



FG: Function generator
SG:Signal generator
PS:Power spliter
PD:Power divider
AT:Attenuator
TAT:Tunable attenator
SA:Spectrum analyzer
CD:Companion Device

SECTION 6: Conducted Emission

Test Procedure and conditions

EUT was placed on the table raised 0.8m above the conducting ground plane.
The rear of tabletop was located 40cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80cm from a Line Impedance Stabilization Network (LISN)/ Artificial mains Network (AMN) and excess AC cable was bundled in center.

☒ For the tests on EUT with other peripherals (as a whole system)
I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30cm to 40cm long and were hanged at a 40cm height to the ground plane. All unused 50ohm connectors of the LISN (AMN) were resistivity terminated in 50ohm when not connected to the measuring equipment.

☐ For the tests on EUT itself (as a standalone equipment)
Each EUT current-carrying power lead, except the ground (safety) lead, was individually connected through a LISN / (AMN) to the input power source.
☐ All unused 50ohm connectors of the LISN (AMN) were resistivity terminated in 50ohm when not connected to the measuring equipment.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber. The EUT was connected to a LISN (AMN).
An overview sweep with peak detection has been performed.

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

Detector	QP and CISPR AV
Measurement range	0.15-30MHz
Test data	APPENDIX
Test result	Pass

Used Table specification

Material	☒Urethane	☐Wooden	☐Other( )
Table size	☐1.0 m* 1.5m	☒0.5m*1.0m	☐( )m*( )m

Used vertical conducting plane

Plane size	☒2.0 m * 2.0 m	☐2.0m * 2.5 m	☐( )m*( )m

SECTION 7: Antenna Terminal Conducted Tests (Used Instrument / Test Condition)

In below measurement, if cable and Attenuator are 0.0dB, there are no used.

Peak transmit power

Used instrument	Spectrum Analyzer
RBW	≥ Emission bandwidth
VBW	≥ RBW
Span	Zero
Center frequency	Nominal center frequency of transmit carrier
Amplitude scale	Log
Detection	PK
Trigger	Video
Sweep rate	Sufficiently rapid to permit the transmit pulse to be resolved accurately
Limit = 100uW × SQRT(B) Note: B is the measured Emission Bandwidth or Occupied Bandwidth in Hz. If antenna gain exceeds 3dBi , limit is reduced by the amount in decibels.	
CALCULATIONS ☒Result [dBm] = Reading [dBm]+ Cable Loss (including the cable(s) customer supplied) [dB] + Attenuator Loss [dB] ☐Result [dBm] = Reading [dBm]+ Cable Loss [dB] + Attenuator Loss [dB]	

Emission bandwidth/ Occupied Bandwidth

Used instrument	Spectrum Analyzer
RBW	Approximately 1% of the emission bandwidth (a rough estimate may be obtained from peak power level measurement, or use manufacturer's declared value)
VBW	≥ 3 × the RBW
Center frequency	Nominal center frequency of channel
Span	2 × the expected emission bandwidth
Amplitude scale	Log
Detection	Peak detection with maximum hold enabled
Sweep time	Coupled to frequency span and RBW

Power Spectrum Density

Used instrument	Spectrum Analyzer
RBW	3 kHz
VBW	≥ 3 × the RBW
Span	Zero span at frequency with the maximum level (frequency determined in Emission bandwidth if the same type of signal (continuous versus burst) was used in Emission bandwidth)
Center frequency	Spectral peak as determined in Emission bandwidth
Amplitude scale	Log power
Detection	Sample detection and averaged for a minimum of 100 sweeps
Trigger	External or internal
CALCULATIONS ☒Result [dBm] = Reading [dBm]+ Cable Loss (including the cable(s) customer supplied) [dB] + Attenuator Loss [dB] ☐Result [dBm] = Reading [dBm]+ Cable Loss [dB] + Attenuator Loss [dB]	

Out-of-band emissions

Used instrument	Spectrum Analyzer
RBW	Approximately 1% of the emission bandwidth (B)
VBW	≥ 3 × the RBW
Sweep time	The sweep time shall be sufficiently slow that the swept frequency rate shall not exceed one RBW per three transmit bursts.
Number of sweeps	Sufficient to stabilize the trace
Amplitude scale	Log
Center frequency	Spectral peak as determined in Emission bandwidth
CALCULATIONS ☒Result [dBm] = Reading [dBm]+ Cable Loss (including the cable(s) customer supplied) [dB] + Attenuator Loss [dB] ☐Result [dBm] = Reading [dBm]+ Cable Loss [dB] + Attenuator Loss [dB]	
Limit f ≤ 1.25MHz outside UPCS band : ≤ -9.5dBm 1.25MHz ≤ f ≤ 2.5MHz outside UPCS band : ≤ -29.5dBm f ≥ 2.5MHz outside UPCS band : ≤ -39.5dBm	

In-band unwanted emissions

Used instrument	Spectrum Analyzer
RBW	Approximately 1% of the emission bandwidth (B)
VBW	≥ 3 × the RBW
Sweep time	The sweep time shall be sufficiently slow that the swept frequency rate shall not exceed one RBW per three transmit bursts.
Number of sweeps	Sufficient to stabilize the trace
Amplitude scale	Log
Span	Approximately equal to 3.5 B × 2
Center frequency	Spectral peak as determined in Emission bandwidth
CALCULATIONS ☒Offset [dB] = Cable Loss (including the cable(s) customer supplied) [dB] + Attenuator Loss [dB] ☐Offset [dB] = Cable Loss [dB] + Attenuator Loss [dB]	
Limit B < f ≤ 2B : at least 30dB below max permitted peak power 2B < f ≤ 3B : at least 50dB below max permitted peak power 3B < f ≤ UPCS Band Edge: at least 60dB below max permitted peak power Note: B is the measured Emission Bandwidth or Occupied Bandwidth in Hz	

Carrier-frequency stability

Used instrument	DECT tester
Center frequency	Nominal carrier center frequency
Recording speed	at least once every second
Number of measurements	3000 readings
CALCULATIONS Over Time at Nominal Temperature Deviation [ppm] = ((Max or Min Frequency Offset.[Hz] – Average Mean Frequency Offset [Hz]) / Average Mean Carrier Frequency[Hz]) × 10^6 Over Voltage or Temperature Deviation [ppm] = ((MCF [Normal Temperature] –MCF [Over Voltage or Temperature]) / MCF [Over Voltage or Temperature])) × 10^6 MCF: Mean Carrier Frequency[Hz] Average Mean Carrier Frequency is calculated from 3000 readings.	
Note: This measurement is measured using the function of the frequency offset counter of the DECT tester.	

Frame-repetition stability

Used instrument	Modulation Domain Analyzer
Center frequency	Nominal carrier center frequency
Frequency span	Span large enough so that the full waveform is greater than 50% but less than 100% of the display scale
Record the number of times	1000/X (where X is the measurement interval in units of frame period)
CALCULATIONS Frame Repetition Stability [ppm] = 3 ×(Standard Deviation[Hz] / Mean[Hz]) × 10^6	

Frame period and jitter

Used instrument	Modulation Domain Analyzer
Record the number of times	More 100 000 frames total accumulated
CALCULATIONS Max Jitter [us] = (1 / (Frame period[Hz] + PK-PK[Hz] / 2)) – (1 / Frame period[Hz]) 3 × Standard Deviation of Jitter [us] = 3 × (1 / (Frame period[Hz] + Standard Deviation[Hz]) – 1 / Frame Period[Hz]) × 10^6	

Monitoring Threshold Least interfered channel

Used instrument	Spectrum Analyzer
Limit Monitoring Limit Threshold (T_L) [dBm] = -174+10 × log(B) +M_L + P_{max} – P_{EUT} M_L: 30dB LIC may only be used by systems with more than 20 duplex system access channels. System with less than 20 duplex system access channels are not allowed to transmit when interferer level is above T_L. Note: B is the measured Emission Bandwidth or Occupied Bandwidth in Hz : P_{EUT} is the measured Peak transmit power [dBm]. : P_{max} is 100uW × SQRT(B). If antenna gain exceeds 3dBi , P_{max} is reduced by the amount in decibels.	

Timing for EUTs using communications channel-type transmissions

Used instrument	Spectrum Analyzer
Limit Initial transmission without acknowledgements : 1 [sec] Transmission time after loss of acknowledgements : 30 [sec] Transmission duration on same time and frequency window : 28800 [sec]	

APPENDIX 1: Test data

Conducted emission

DATA OF CONDUCTED EMISSION TEST

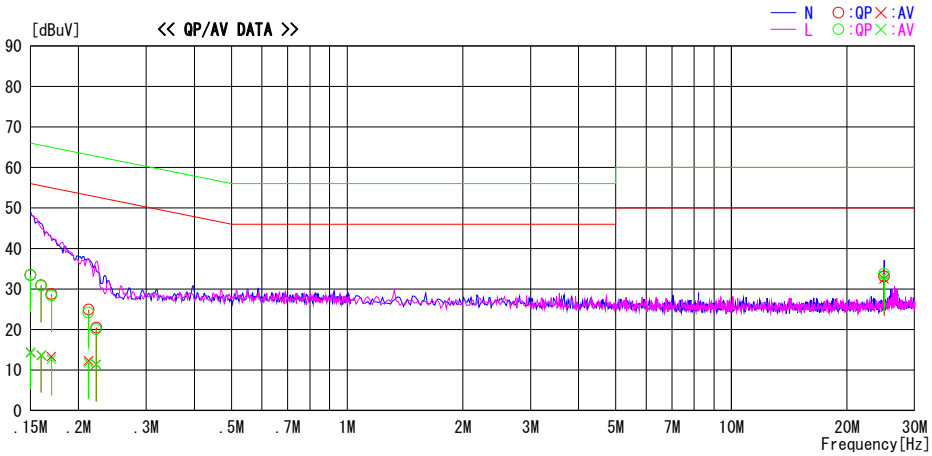
UL Japan, Inc. Ise EMC Lab. No.2 Semi Anechoic Chamber
Date : 2016/09/01

Report No. : 11415417H

Temp./Humi. : 22deg. C / 52% RH
Engineer : Koji Yamamoto

Mode / Remarks : Continuous Transmitting 1924.992MHz

LIMIT : FCC15.207 QP
FCC15.207 AV



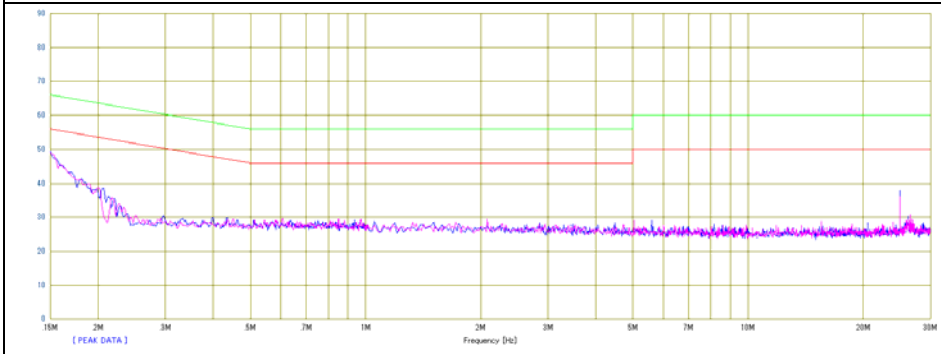
Frequency	Reading Level		Corr.	Results		Limit		Margin		Phase	Comment
	QP	AV	Factor	QP	AV	QP	AV	QP	AV		
[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
0.15000	20.3	1.1	13.2	33.5	14.3	66.0	56.0	32.5	41.7	N	
0.16000	17.7	0.4	13.2	30.9	13.6	65.5	55.5	34.6	41.9	N	
0.17000	15.5	0.1	13.2	28.7	13.3	65.0	55.0	36.3	41.7	N	
0.21235	11.7	-0.9	13.2	24.9	12.3	63.1	53.1	38.2	40.8	N	
0.22250	7.3	-1.8	13.2	20.5	11.4	62.7	52.7	42.2	41.3	N	
24.95566	17.9	17.3	15.2	33.1	32.5	60.0	50.0	26.9	17.5	N	
0.15000	20.2	1.2	13.2	33.4	14.4	66.0	56.0	32.6	41.6	L	
0.16000	17.6	0.5	13.2	30.8	13.7	65.5	55.5	34.7	41.8	L	
0.17000	15.2	-0.5	13.2	28.4	12.7	65.0	55.0	36.6	42.3	L	
0.21185	11.0	-1.3	13.2	24.2	11.9	63.1	53.1	38.9	41.2	L	
0.22231	6.9	-1.8	13.2	20.1	11.4	62.7	52.7	42.6	41.3	L	
24.95570	18.5	18.1	15.2	33.7	33.3	60.0	50.0	26.3	16.7	L	

CHART : WITH FACTOR, Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + ATTEN + CABLE)
Except for the above table : adequate margin data below the limits.

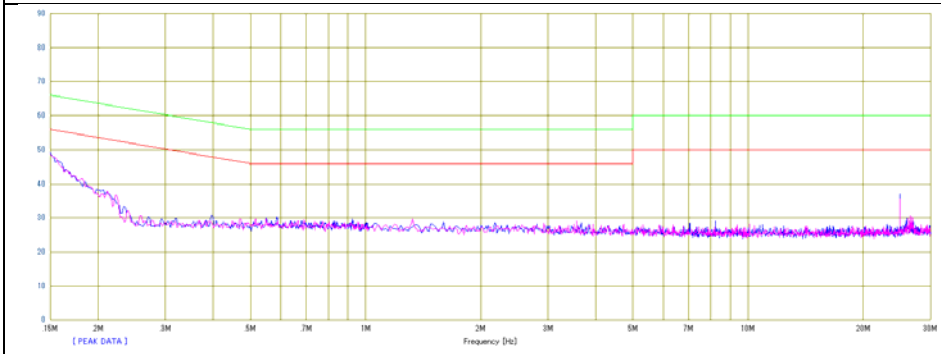
Conducted emissions

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11415417H
Date	September 1, 2016
Temperature / Humidity	22deg. C / 52% RH
Engineer	Koji Yamamoto
Mode	Continuous transmitting

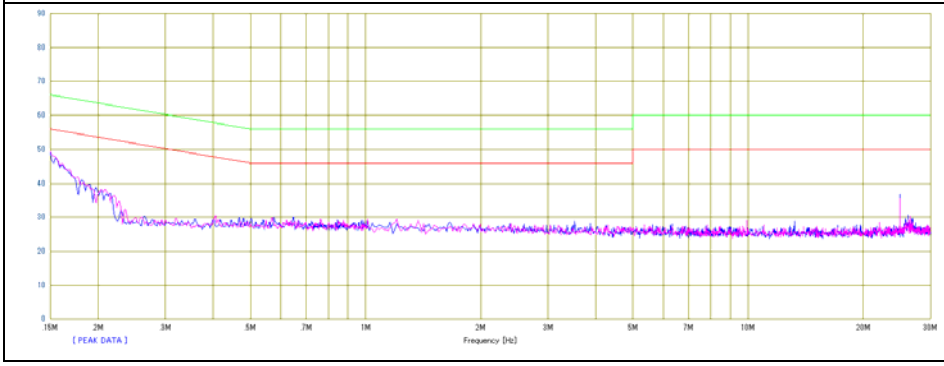
1921.536 MHz



1924.992 MHz



1928.448 MHz



Y scale [dBuV] Chart N L

Peak transmit power/ Emission bandwidth/ Occupied Bandwidth

Test place	Ise EMC Lab.	
Measurement Room	No.11 measurement room	
Date	08/18/2016	
Temperature / Humidity	24deg. C / 36% RH	
Engineer	Takumi Shimada	
Mode	Continuous transmitting/ Loop Back	

Peak transmit power

Frequency	Reading	Cable Loss	Atten.	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
1921.536	-2.49	1.52	19.85	18.88	77.26	21.84	153	2.96
1924.992	-2.47	1.52	19.85	18.90	77.63	21.84	153	2.94
1928.448	-2.47	1.52	19.85	18.90	77.65	21.84	153	2.94

Emission bandwidth

Frequency	BW	Limit [MHz]		Result
[MHz]	[MHz]	Lower	Upper	
1921.536	2.331	0.05	2.5	Pass
1924.992	2.333	0.05	2.5	Pass
1928.448	2.330	0.05	2.5	Pass

Occupied Bandwidth **(Reference data)**

Frequency	BW	Limit [MHz]		Result
[MHz]	[MHz]	Lower	Upper	
1921.536	1.227	0.05	2.5	Pass
1924.992	1.230	0.05	2.5	Pass
1928.448	1.230	0.05	2.5	Pass

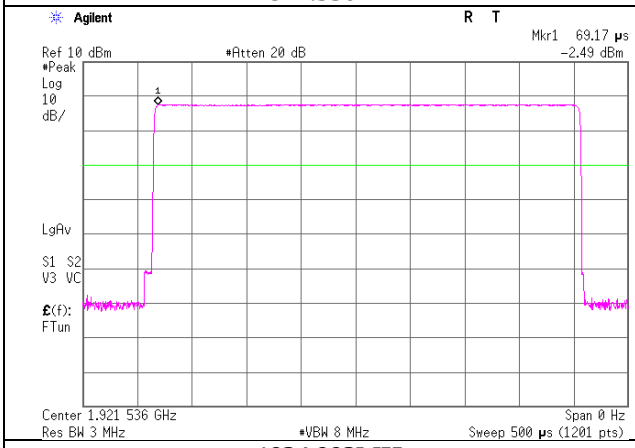
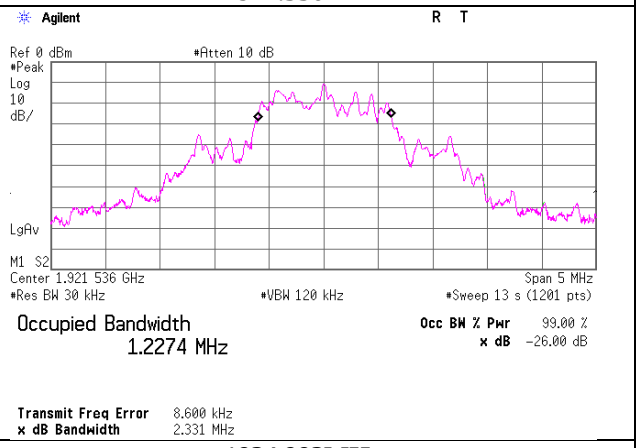
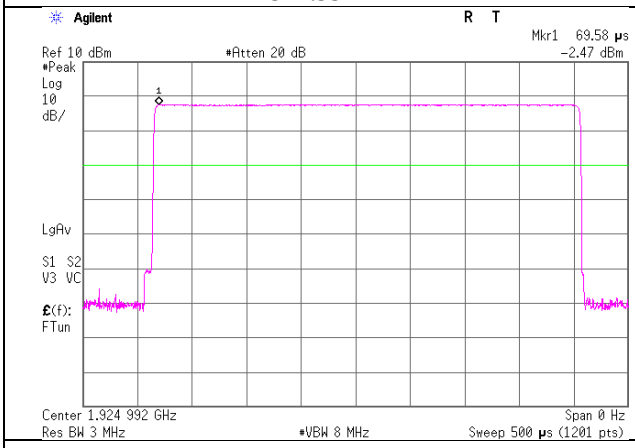
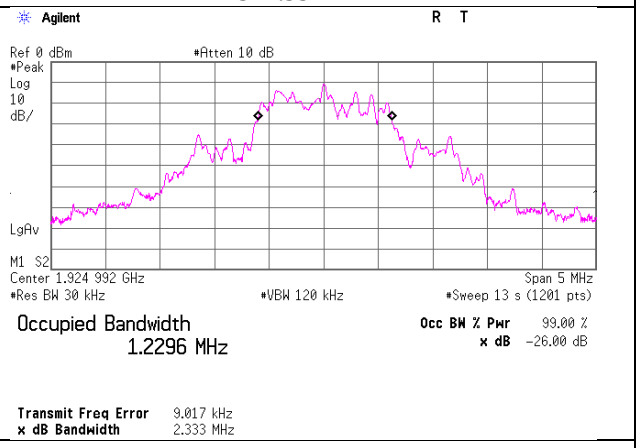
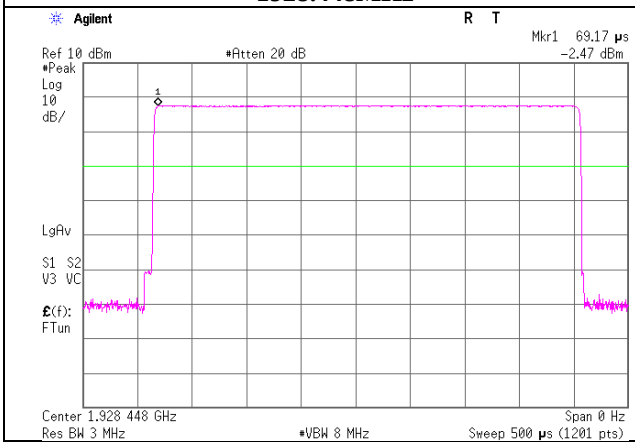
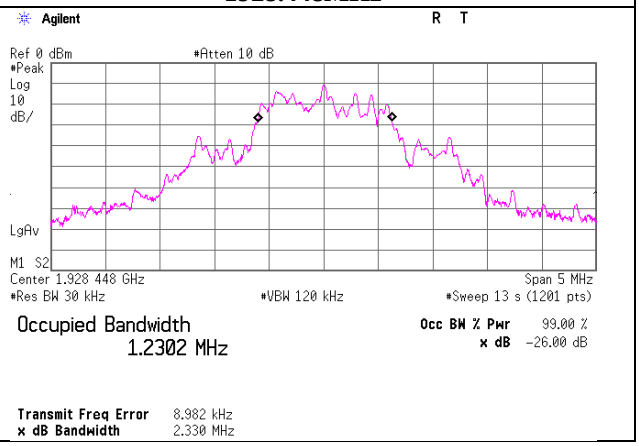
Average Output Power(Reference data for RF Exposure)

Test place	Ise EMC Lab.	
Measurement Room	No.11 measurement room	
Date	08/18/2016	
Temperature / Humidity	24deg. C / 36% RH	
Engineer	Takumi Shimada	
Mode	Continuous transmitting/ Loop Back	

Average Output Power(Reference data for RF Exposure)

Frequency	Reading	Cable Loss	Atten.	Result (Time average)	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]
1921.536	-15.47	1.52	19.85	5.90	3.89
1924.992	-15.46	1.52	19.85	5.91	3.90
1928.448	-15.46	1.52	19.85	5.91	3.90

Peak transmit power / Emission bandwidth / Occupied Bandwidth

Peak transmit power	Emission bandwidth / Occupied Bandwidth
1921.536MHz	**1921.536MHz**
	
1924.992MHz	**1924.992MHz**
	
1928.448MHz	**1928.448MHz**
	

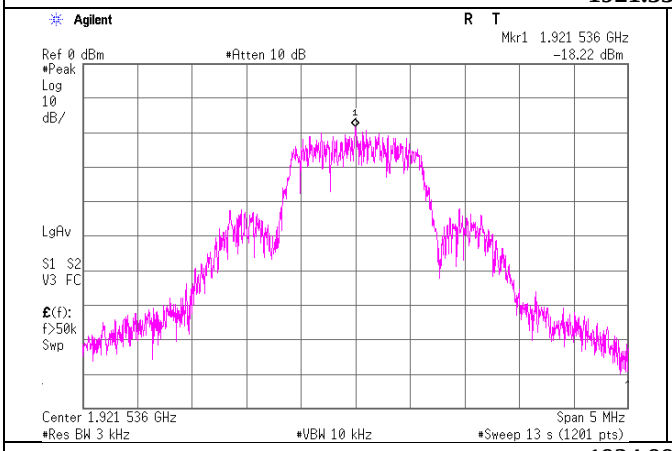
Power Spectrum Density

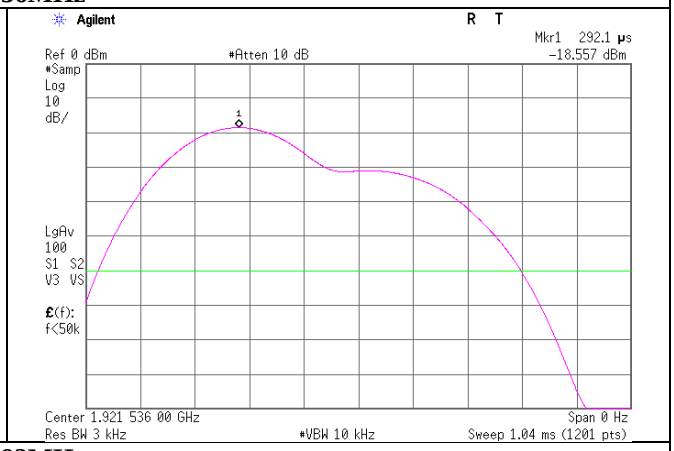
Test place	Ise EMC Lab.		
Measurement Room	No.11 measurement room		
Date	08/18/2016		
Temperature / Humidity	24deg. C / 36% RH		
Engineer	Takumi Shimada		
Mode	Continuous transmitting		

Frequency	Reading	Cable Loss	Atten.	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
1921.536	-18.56	1.52	19.85	2.81	1.91	4.77	3.00	1.96
1924.992	-19.02	1.52	19.85	2.35	1.72	4.77	3.00	2.42
1928.448	-18.58	1.52	19.85	2.79	1.90	4.77	3.00	1.98

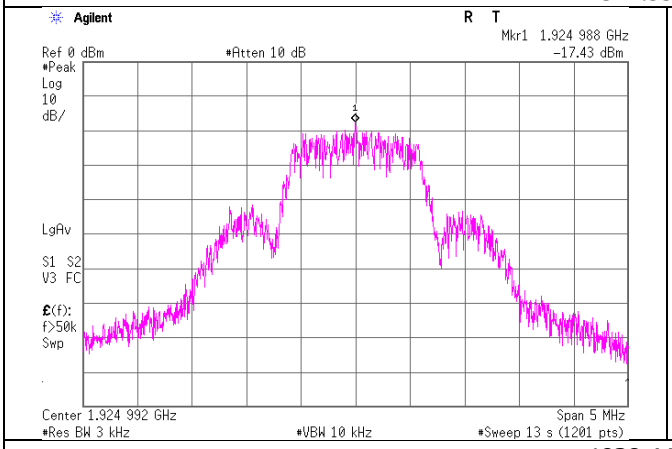
Power Spectrum Density

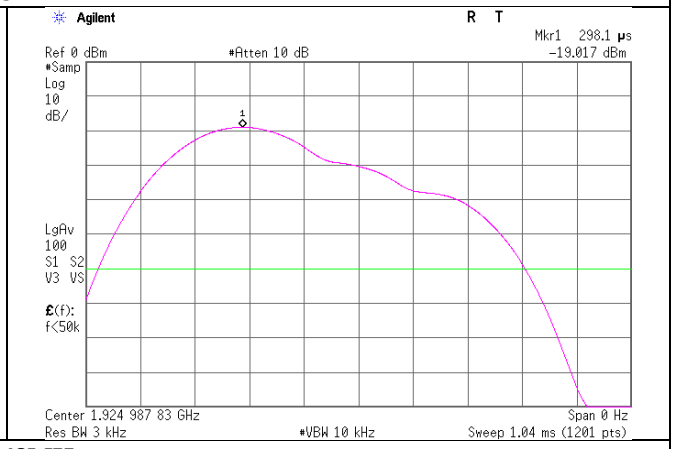
1921.536MHz



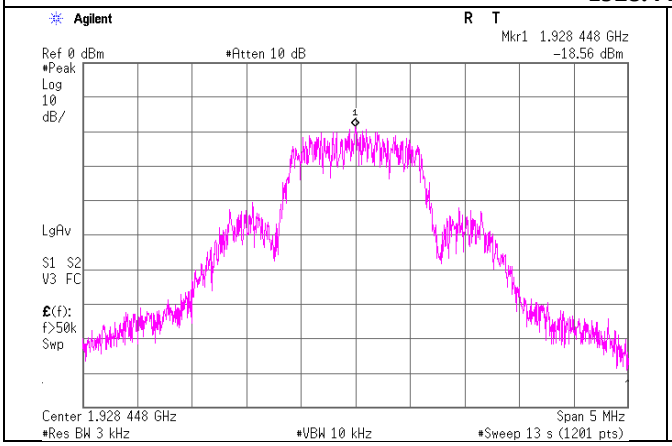


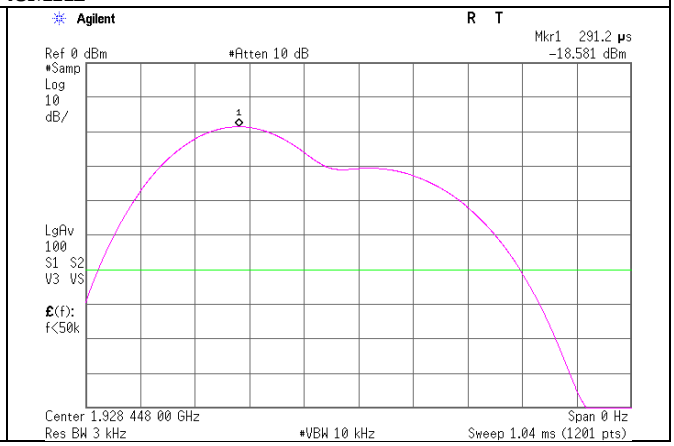
1924.992MHz





1928.448MHz

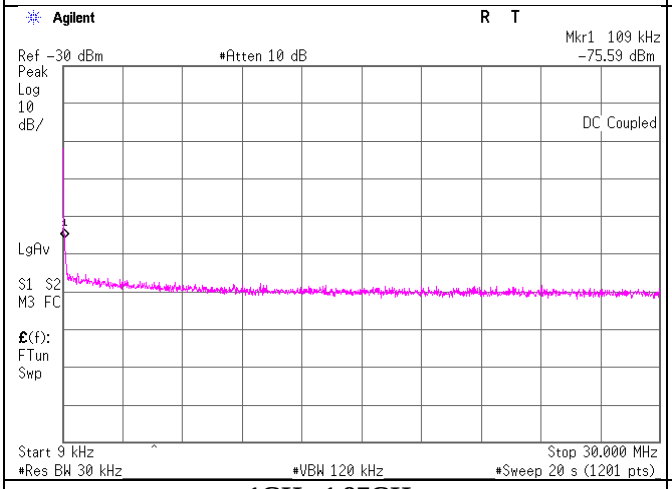




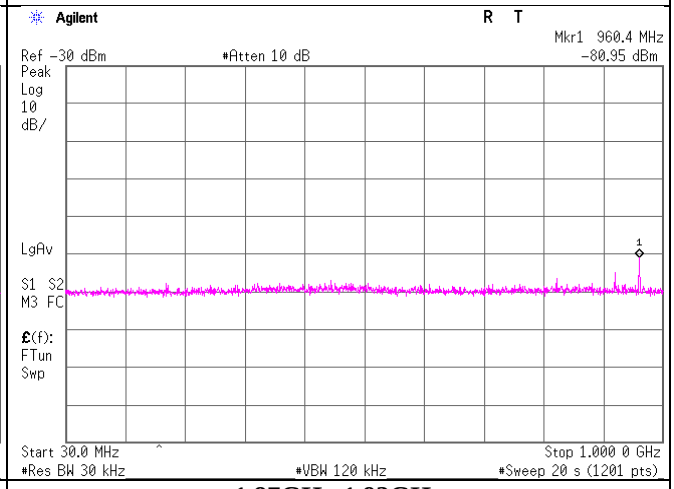
Out-of-band emissions

Test place	Ise EMC Lab.		
Measurement Room	No.11 measurement room		
Date	08/18/2016		
Temperature / Humidity	24deg. C / 36% RH		
Engineer	Takumi Shimada		
Mode	Continuous transmitting		
Frequency	1921.536MHz		

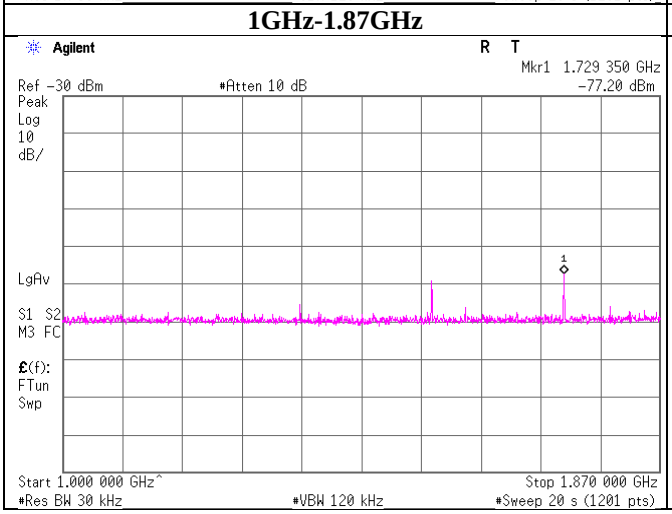
9kHz-30MHz



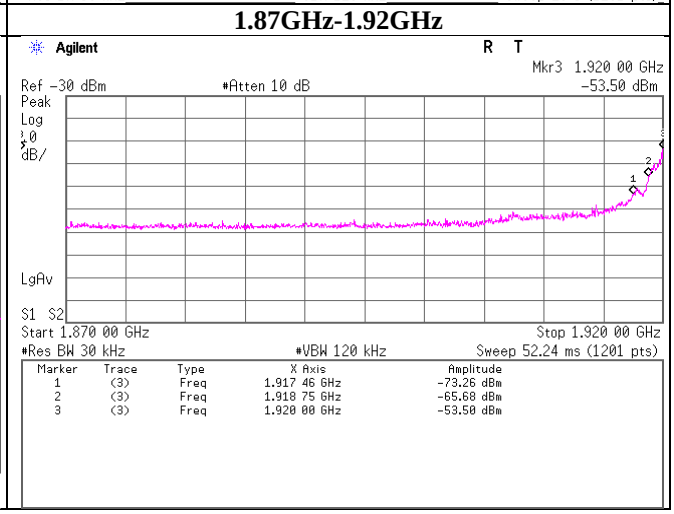
30MHz-1GHz



1GHz-1.87GHz



1.87GHz-1.92GHz

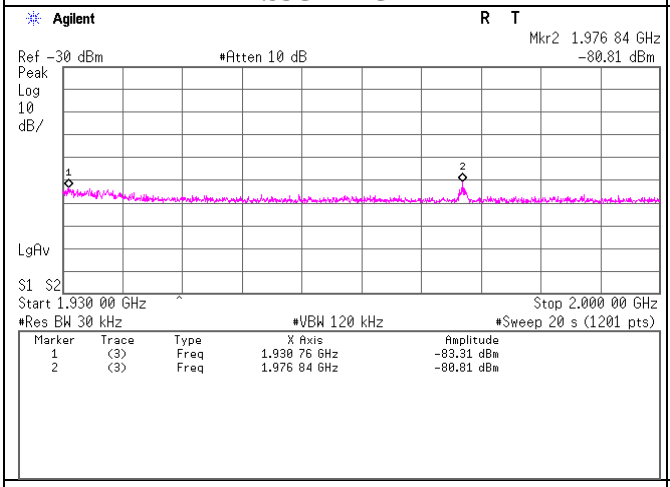


Frequency [MHz]	Reading [dBm]	Cable Loss [dB]	Attenator [dB]	Result [dBm]	Limit [dBm]	Margin [dB]	Remark
0.11	-75.6	0.01	9.8	-65.8	-39.5	26.3	
960.40	-81.0	0.59	9.9	-70.5	-39.5	31.0	
1729.35	-77.2	1.47	19.8	-55.9	-39.5	16.4	
1917.46	-73.3	1.52	19.9	-51.9	-39.5	12.4	
1918.75	-65.7	1.52	19.9	-44.3	-29.5	14.8	
1920.00	-53.5	1.52	19.9	-32.1	-9.5	22.6	

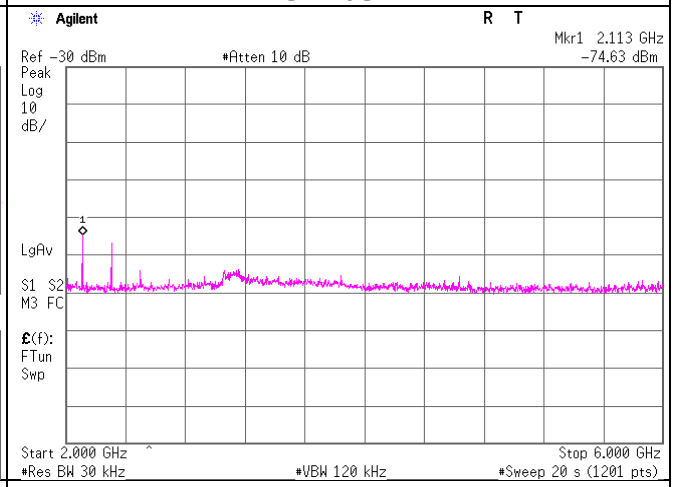
UL Japan, Inc.
Ise EMC Lab.
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8999
Facsimile : +81 596 24 8124

Out-of-band emissions

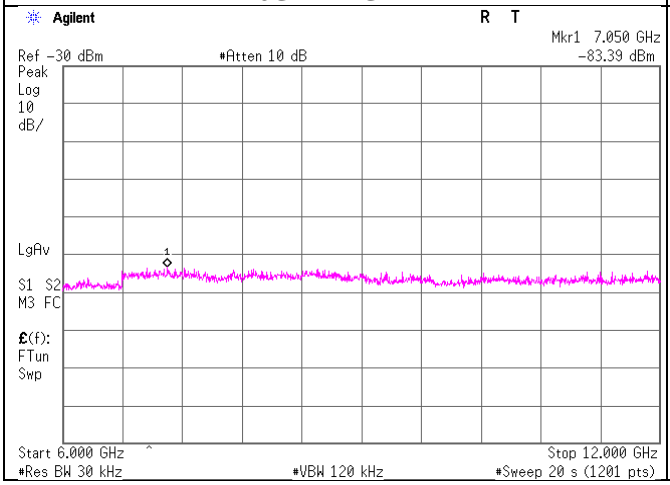
1.93GHz-2GHz



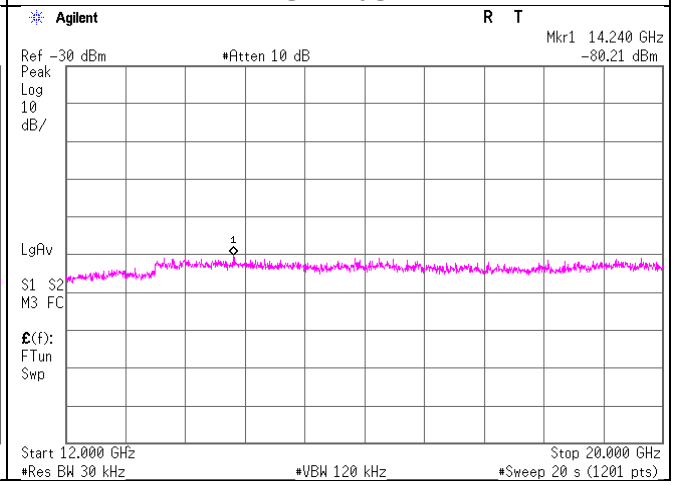
2GHz-6GHz



6GHz-12GHz



12GHz-20GHz

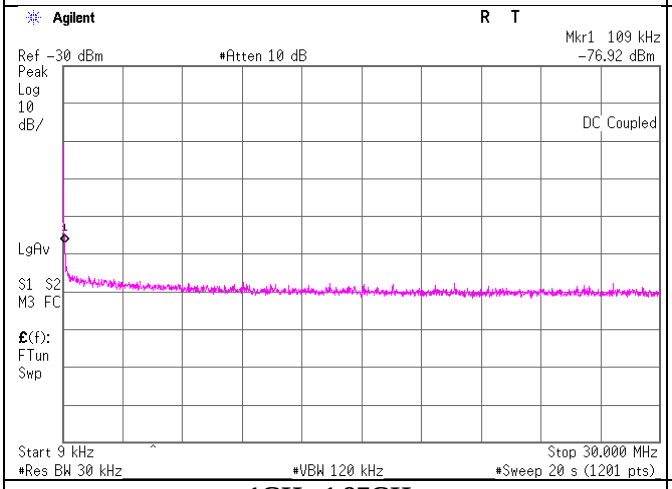


Frequency [MHz]	Reading [dBm]	Cable Loss [dB]	Attenator [dB]	Result [dBm]	Limit [dBm]	Margin [dB]	Remark
1930.76	-83.3	1.52	19.9	-61.9	-9.5	52.4	
1976.84	-80.8	1.53	19.9	-59.4	-39.5	19.9	
2113.00	-74.6	1.60	19.9	-53.2	-39.5	13.7	
7050.00	-83.4	3.54	20.1	-59.7	-39.5	20.2	
14240.00	-80.2	5.65	20.4	-54.2	-39.5	14.7	

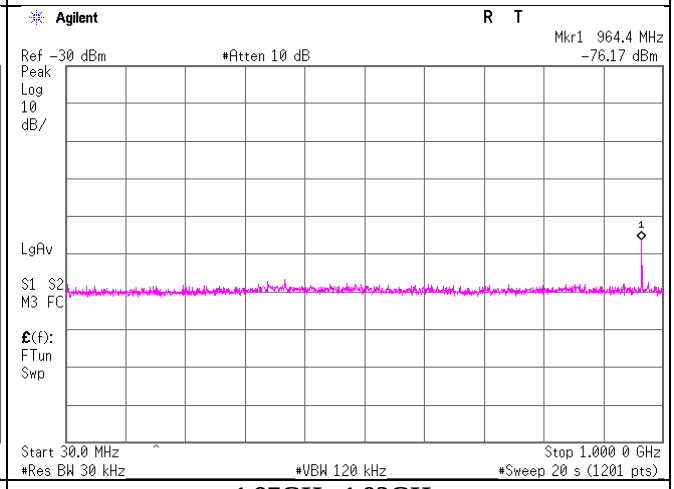
Out-of-band emissions

Test place	Ise EMC Lab.		
Measurement Room	No.11 measurement room		
Date	08/18/2016		
Temperature / Humidity	24deg. C / 36% RH		
Engineer	Takumi Shimada		
Mode	Continuous transmitting		
Frequency	1928.448MHz		

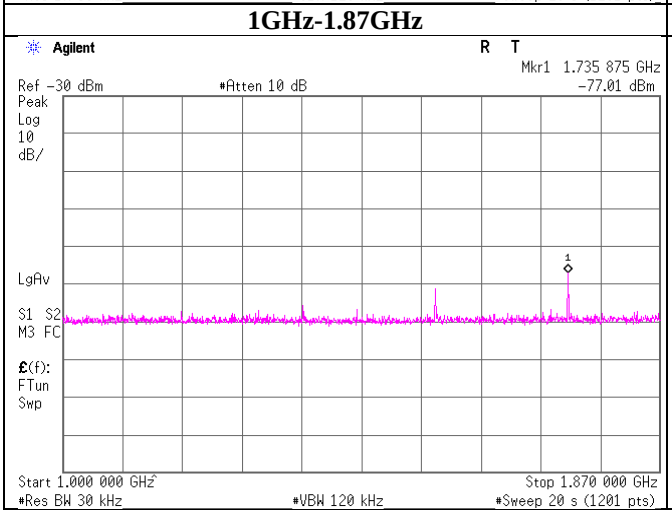
9kHz-30MHz



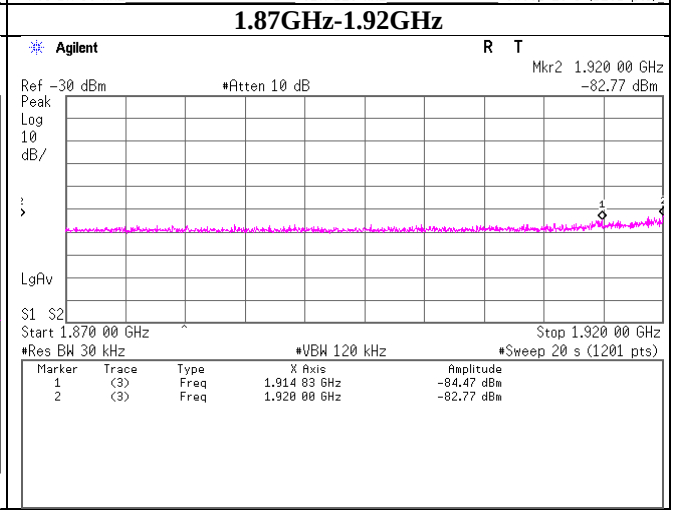
30MHz-1GHz



1GHz-1.87GHz



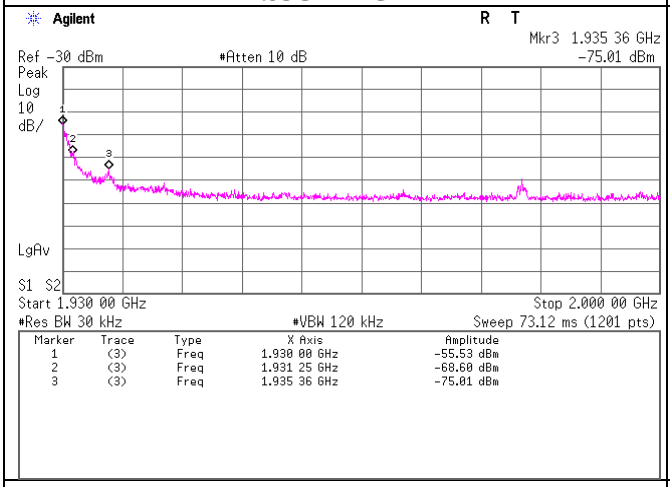
1.87GHz-1.92GHz



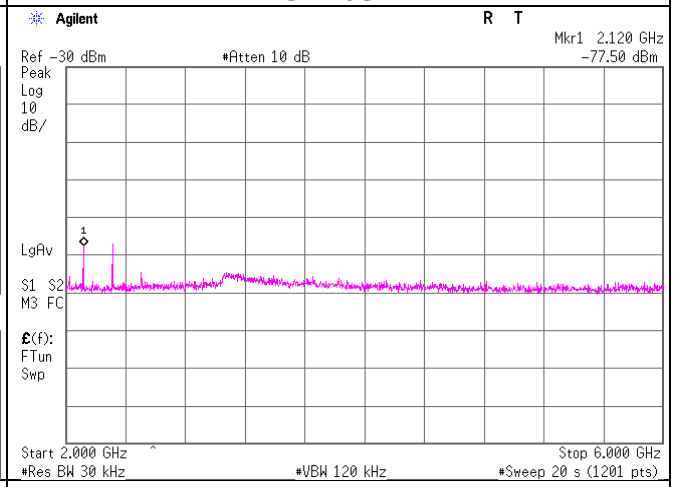
Frequency [MHz]	Reading [dBm]	Cable Loss [dB]	Attenator [dB]	Result [dBm]	Limit [dBm]	Margin [dB]	Remark
0.11	-76.9	0.01	9.8	-67.1	-39.5	27.6	
964.40	-76.2	0.60	9.9	-65.7	-39.5	26.2	
1735.88	-77.0	1.47	19.8	-55.7	-39.5	16.2	
1914.83	-84.5	1.52	19.9	-63.1	-39.5	23.6	
1920.00	-82.8	1.52	19.9	-61.4	-9.5	51.9	

Out-of-band emissions

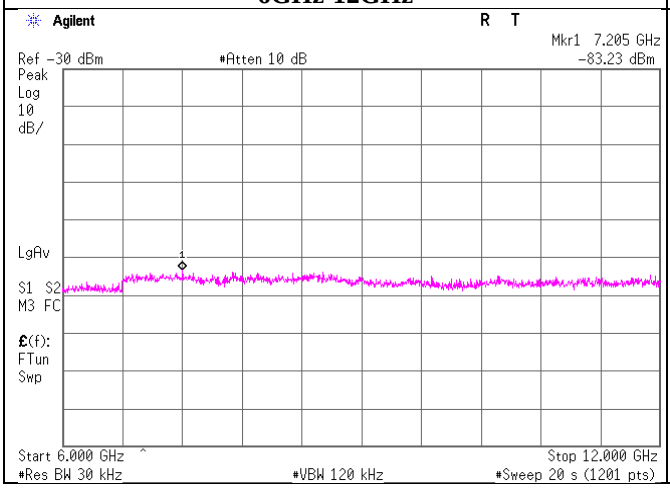
1.93GHz-2GHz



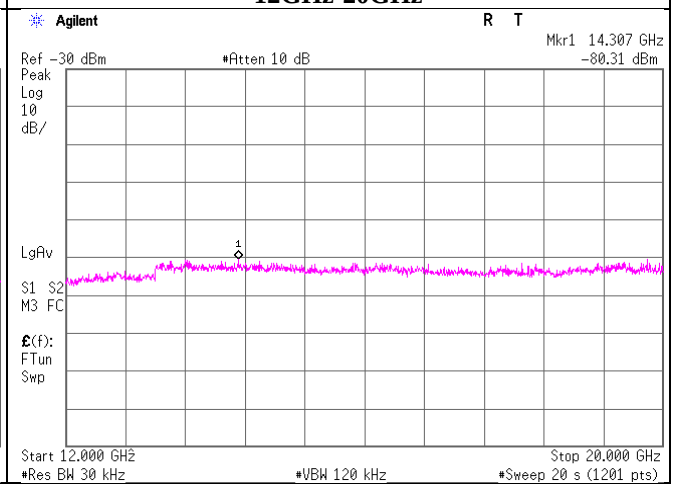
2GHz-6GHz



6GHz-12GHz



12GHz-20GHz

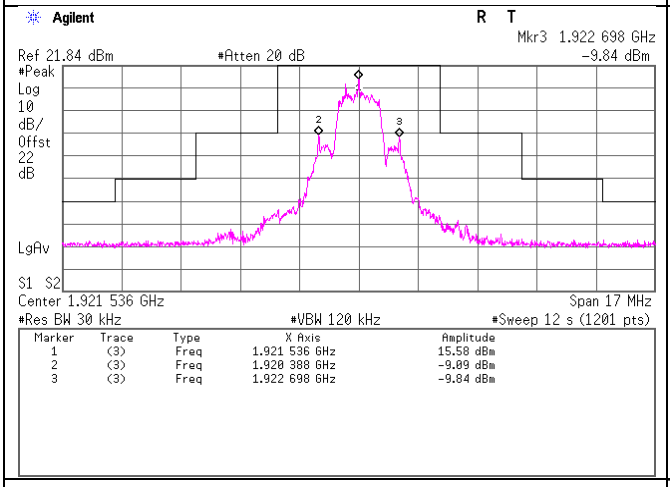


Frequency [MHz]	Reading [dBm]	Cable Loss [dB]	Attenator [dB]	Result [dBm]	Limit [dBm]	Margin [dB]	Remark
1930.00	-55.5	1.52	19.9	-34.2	-9.5	24.7	
1931.25	-68.6	1.52	19.9	-47.2	-29.5	17.7	
1935.36	-75.0	1.52	19.9	-53.6	-39.5	14.1	
2120.00	-77.5	1.60	19.9	-56.1	-39.5	16.6	
7205.00	-83.2	3.63	20.1	-59.5	-39.5	20.0	
14307.00	-80.3	5.90	20.4	-54.0	-39.5	14.5	

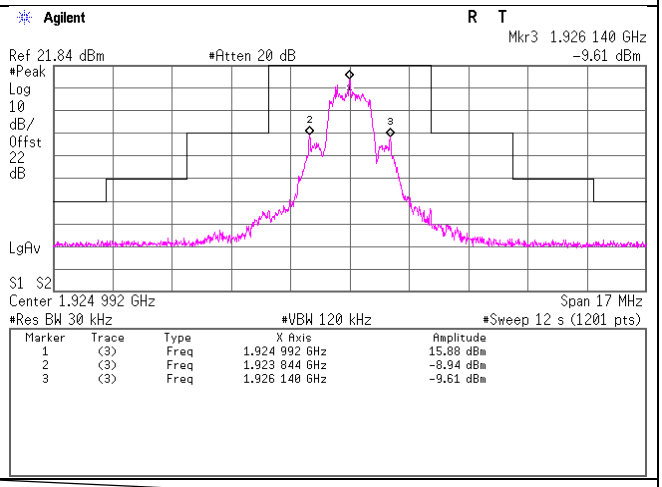
In-band unwanted emissions

Test place	Ise EMC Lab.		
Measurement Room	No.11 measurement room		
Date	08/18/2016		
Temperature / Humidity	24deg. C / 36% RH		
Engineer	Takumi Shimada		
Mode	Continuous transmitting		

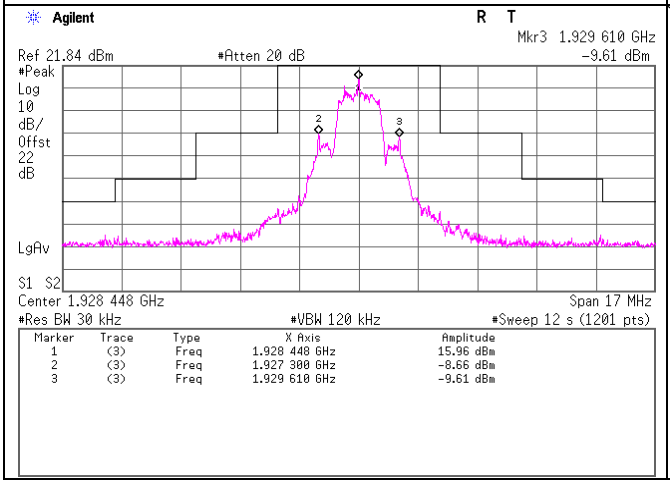
1921.536MHz



1924.992MHz



1928.448MHz



Carrier-frequency stability

Test place	Ise EMC Lab.		
Measurement Room	No.11 measurement room		
Date	08/19/2016		
Temperature / Humidity	25deg. C / 40% RH		
Engineer	Takumi Shimada		
Mode	Loop Back		

Carrier Frequency Stability over Time

Average Mean Carrier Frequency [MHz]	Max Frequency Offset [kHz]	Min Frequency Offset [kHz]	Average Mean Frequency Offset [kHz]	Max Deviation [ppm]	Min Deviation [ppm]	Limit [ppm]	Result
1925.000890	25.8	-5.3	8.9	8.8	-7.4	±10	Pass

Carrier Frequency Stability over Power Supply Voltage at Nominal Temperature

Voltage	Mean Carrier Frequency [MHz]	Difference [kHz]	Deviation [ppm]	Limit [ppm]	Result
85% of Vnom	1924.999098	-1.8	-0.9	±10	Pass
115% of Vnom	1925.000052	-0.8	-0.4	±10	Pass

Carrier Frequency Stability over Temerature **Carrier Frequency Stability over Temerature**

Temperature	Mean Carrier Frequency [MHz]	Difference [kHz]	Deviation [ppm]	Limit [ppm]	Result
T = -20deg.C	1924.999371	-1.5	-0.8	±10	Pass
T = +50deg.C	1924.999171	-1.7	-0.9	±10	Pass

Frame-repetition stability / Frame period and jitter

Test place	Ise EMC Lab.		
Measurement Room	No.11 measurement room		
Date	08/18/2016		
Temperature / Humidity	24deg. C / 36% RH		
Engineer	Takumi Shimada		
Mode	Continuous transmitting		

Frame-repetition stability

Carrier Frequency [MHz]	Mean [Hz]	Standard Deviation [Hz]	Frame Repetition Stability [ppm]	Limit [ppm]	Result
1924.992	100.00001	0.000002	0.057	±10	Pass

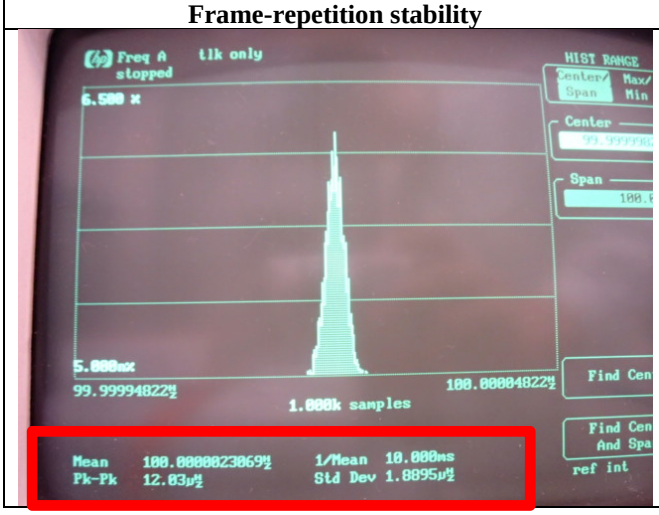
Frame Period and Jitter

Carrier Frequency [MHz]	Frame Period [ms]	Limit [ms]	Result
1924.992	10.000	10 or 20	Pass

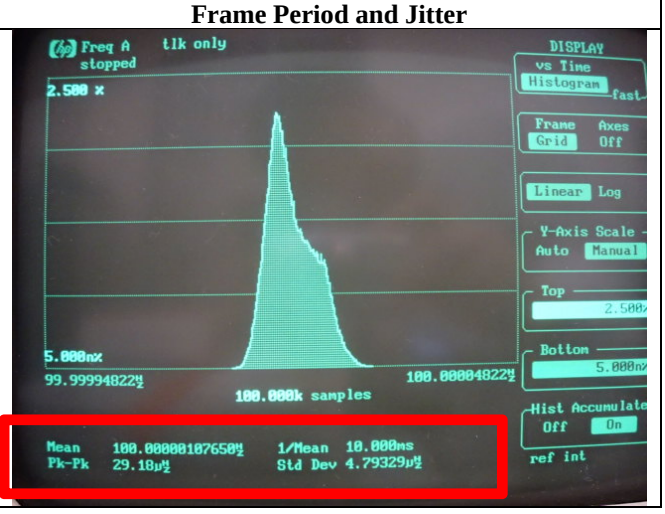
Carrier Frequency [MHz]	Max Jitter [us]	Limit [us]	Result
1924.992	-0.001	±25	Pass

Carrier Frequency [MHz]	3 × Standard Deviation of Jitter [us]	Limit [us]	Result
1924.992	-0.001	±12.5	Pass

Frame-repetition stability



Frame Period and Jitter



Monitoring Threshold Least interfered channel

Test place	Ise EMC Lab.		
Measurement Room	No.11 measurement room		
Date	08/26/2016		
Temperature / Humidity	24deg. C / 57% RH		
Engineer	Takumi Shimada		
Mode	Communication		

Monitoring Threshold Limit

	FCC 15.323 [dBm]	RSS-213 [dBm]
T_L	-77.4	-81.6

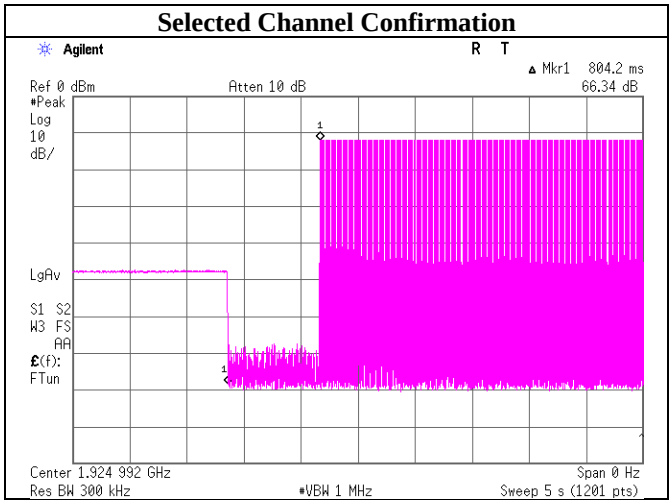
LIC Procedure Test

	Observation	Verdict
f_1 at $T_L + U_M$ + 7dB, f_2 at $T_L + U_M$	Transmission always on f_2	Pass
f_1 at $T_L + U_M$, f_2 at $T_L + U_M$ + 7dB	Transmission always on f_1	Pass
f_1 at $T_L + U_M$ + 1dB, f_2 at $T_L + U_M$ - 6dB	Transmission always on f_2	Pass
f_1 at $T_L + U_M$ - 6dB, f_2 at $T_L + U_M$ + 1dB	Transmission always on f_1	Pass

Selected Channel Confirmation

	Observation	Verdict
Shall not transmit on f_1	EUT transmits on f_2	Pass
Shall not transmit on f_2	EUT transmits on f_1	Pass

(Note1):Limit is $T_L + U_M$ U_M : 6dB
(Note2):f_1 is 1924.992MHz.f_2 is 1928.448MHz.



Selected Channel Confirmation, Connection 804.2 msec after interferer removed.

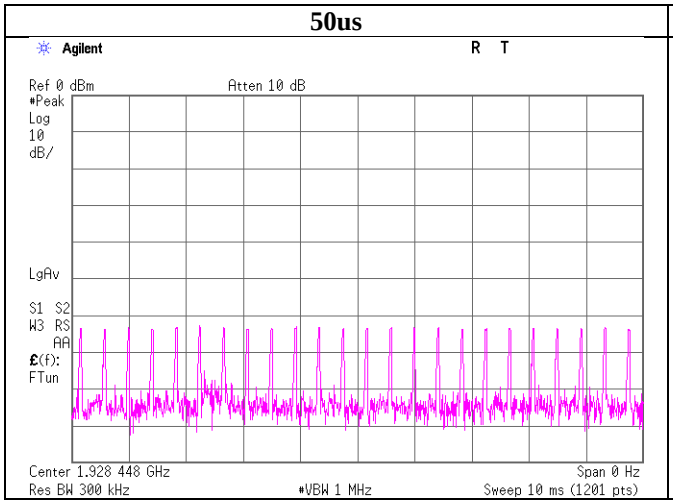
Reaction time and monitoring interval

Test place	Ise EMC Lab.		
Measurement Room	No.11 measurement room		
Date	08/26/2016		
Temperature / Humidity	24deg. C / 57% RH		
Engineer	Takumi Shimada		
Mode	Communication		

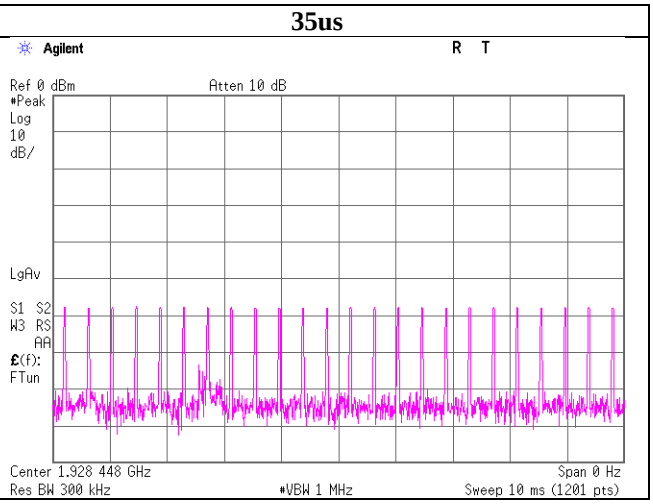
Pulse Width	Observation	Verdict
> largest of 50us and 50 × SQRT(1.25/B)	Transmission on f_1	Pass
> largest of 35us and 35×SQRT(1.25/B), and with interference level raised 6dB	Transmission on f_1	Pass

(Note1) If B is larger than 1.25MHz , the test is performed with pulse lengths of 50us and 35us.
B is the measured Emission Bandwidth or Occupied Bandwidth in MHz.
(Note2):f_1 is 1924.992MHz.f_2 is 1928.448MHz.

50us



35us



Timing for EUTs using communications channel-type transmissions

Test place	Ise EMC Lab.		
Measurement Room	No.11 measurement room		
Date	08/26/2016		
Temperature / Humidity	24deg. C / 57% RH		
Engineer	Takumi Shimada		
Mode	Communication		

Acknowledgements

No		Observation	Verdict
1	Initial transmission without acknowledgements	0sec	Pass
2	Transmission time after loss of acknowledgements	1.438sec	Pass

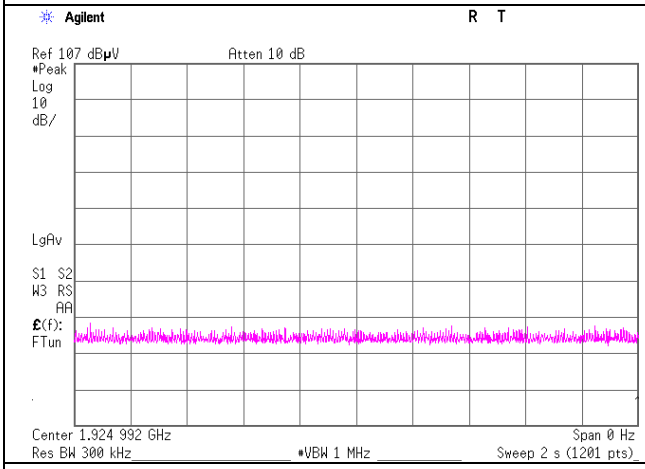
Note

Transmission Duration

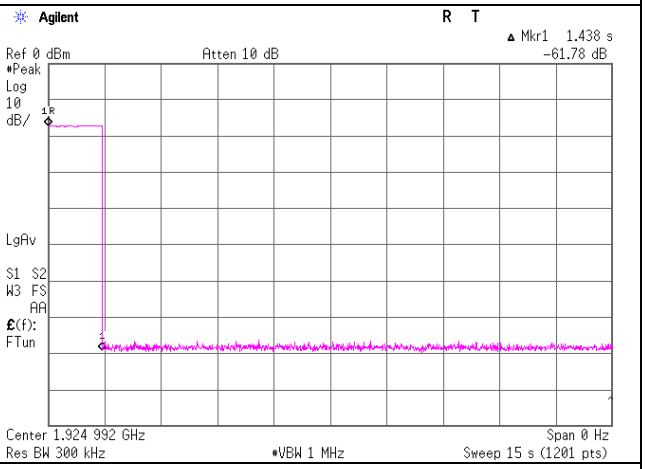
No		Observation	Verdict
3	Transmission duration on same time and frequency window	3055sec	Pass

Note

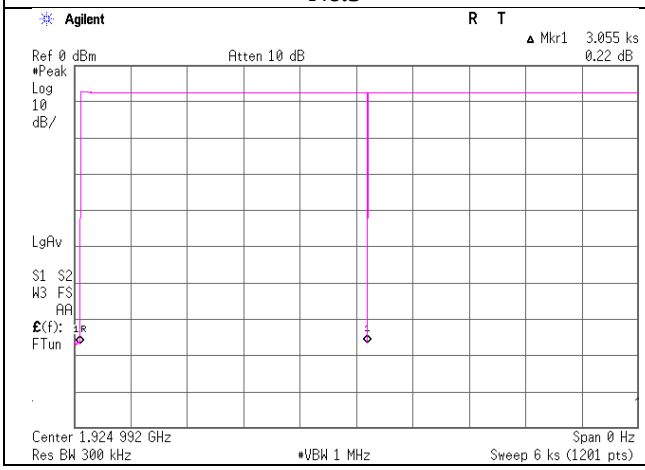
No.1



No.2



No.3



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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8999
Facsimile : +81 596 24 8124

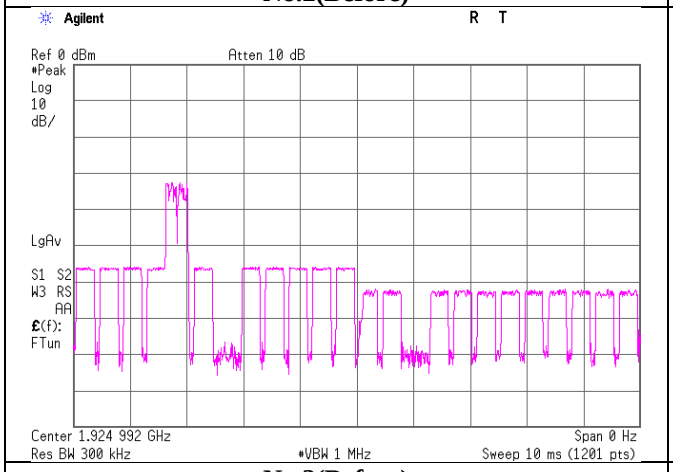
Duplex connections

Test place	Ise EMC Lab.		
Measurement Room	No.11 measurement room		
Date	08/26/2016		
Temperature / Humidity	24deg. C / 57% RH		
Engineer	Takumi Shimada		
Mode	Communication		

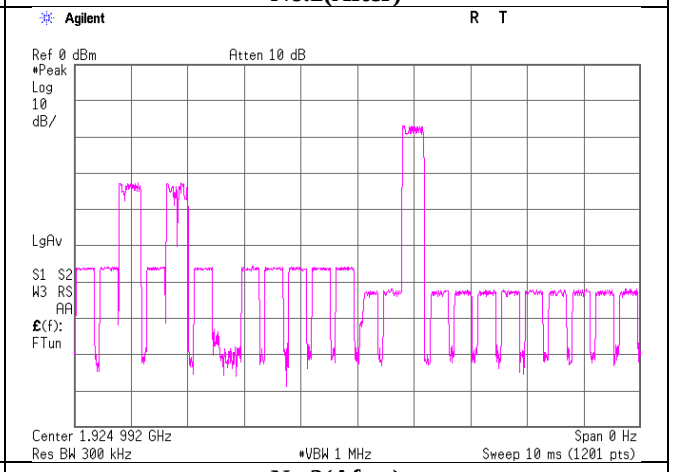
No		Observation	Verdict
1	EUT is restricted to a single carrier f1 for TDMA systems	EUT can transmit	Pass
2	Transmission on interference-free receive time/spectrum window	EUT transmits on interference free receive slot	Pass
3	Transmission on interference-free transmit time/spectrum window	EUT transmits on interference free transmit slot	Pass

Note

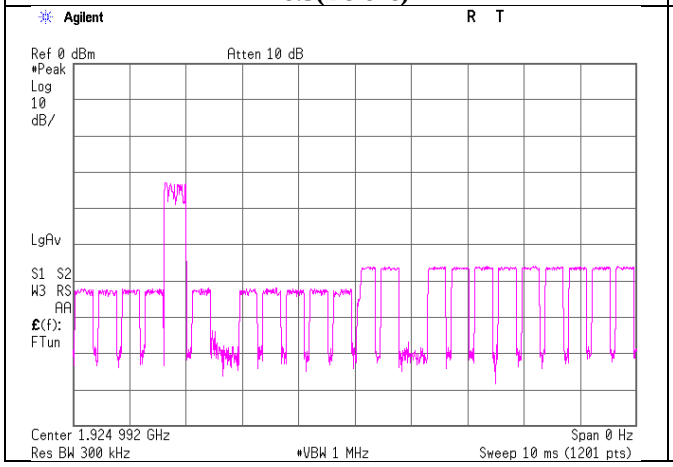
No.2(Before)



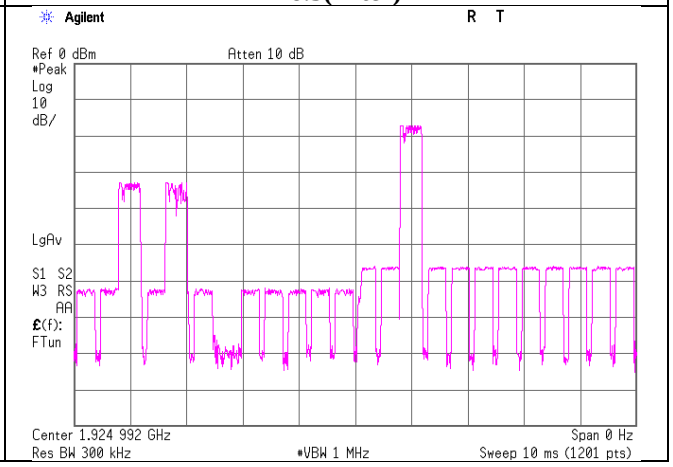
No.2(After)



No.3(Before)



No.3(After)



APPENDIX 2: Test instruments

EMI Test Instruments

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MRENT-130	Spectrum Analyzer	Agilent	E4440A	MY46187750	AT	2016/06/03 * 12
MMDA-01	Modulation Domain Analyzer	HP	53310A	3121A00942	AT	2015/03/18 * 24
MURC-07	Digital Radiocommunication tester	Rohde & Schwarz	CMD60	840966/001	AT	2016/03/01 * 12
MAT-10	Attenuator(10dB)	Weinschel Corp	2	BL1173	AT	2015/11/10 * 12
MCC-38	Coaxial Cable	UL Japan	-	-	AT	2015/12/07 * 12
MAT-86	Attenuator	Weinschel Associates	WA56-20	56200213	AT	2016/06/09 * 12
MCC-66	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	28636/2	AT	2016/04/18 * 12
MPM-09	Power Meter	Anritsu	ML2495A	6K00003348	AT	2015/10/19 * 12
MPSE-12	Power sensor	Anritsu	MA2411B	011598	AT	2015/10/19 * 12
MCH-05	Temperature and Humidity Chamber	Tabai Espec	PL-1KP	14019569	AT	2016/04/18 * 12
MOS-19	Thermo-Hygrometer	Custom	CTH-201	0001	AT	2015/12/08 * 12
MPD-01	PowerDivider DC to 26.5GHz	Agilent	11636B	52258	AT	2016/03/23 * 12
MDT-01	Detector	Agilent	8473C	1822A00789	AT	Pre Check
MCC-182	Microwave Cable	Junkosha	MMX221-00500D MSDMS	1502S309	AT	Pre Check
EST-48	Signal Generator	Agilent	E4438C	MY45090353	AT	2015/12/30 * 12
MSG-06	Signal Generator	Rohde & Schwarz	SML03	102251	AT	2016/06/14 * 12
MRENT-117	Signal Generator	Agilent	N5182B	MY51350370	AT	2016/04/07 * 12
MAT-63	Programmable Attenuator	Anritsu	MN63A	6200280022	AT	2016/07/05 * 12
MFG-04	Function Generator	Agilent	33612A	MY53400159	AT	2016/01/14 * 12
MPD-03	Power Divider DC-12.4GHz	SUHNER	4901.19.A	-	AT	2016/05/17 * 12
MPD-04	Power Divider DC-12.4GHz	SUHNER	4901.19.A	-	AT	2016/05/20 * 12
MPSC-04	Power Splitters/Combiners	Mini-Circuit	ZFSC-2-10G	0326	AT	2015/09/18 * 12
MAT-88	Attenuator	Weinschel Associates	WA56-10	56100304	AT	2016/06/15 * 12
MCC-183	Microwave Cable	Junkosha	MMX221-00500D MSDMS	1502S310	AT	Pre Check
MCC-184	Microwave Cable	Junkosha	MMX221-00500D MSDMS	1502S311	AT	Pre Check
MCC-185	Microwave Cable	Junkosha	MMX221-00500D MSDMS	1502S312	AT	Pre Check
MCC-189	Microwave Cable	Junkosha	MWX-221-02000D MSDMS	1507S108	AT	Pre Check
MCC-191	Microwave Cable	Junkosha	MWX-221-02000D MSDMS	1507S110	AT	Pre Check
MCC-192	Microwave Cable	Junkosha	MWX-221-02000D MSDMS	1507S111	AT	Pre Check
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	CE	2016/08/02 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	CE	2016/01/21 * 12
MJM-14	Measure	KOMELON	KMC-36	-	CE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	CE	-
MSA-14	Spectrum Analyzer	Agilent	E4440A	MY48250080	CE	2015/10/07 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	CE	2015/10/11 * 12
MLS-23	LISN(AMN)	Schwarzbeck	NSLK8127	8127-729	CE(EUT)	2016/07/07 * 12
MCC-13	Coaxial Cable	Fujikura	3D-2W(12m)/5D-2W(5m)/5D-2W(0.8m)/5D-2W(1m)	-	CE	2016/02/08 * 12
MAT-65	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2016/01/14 * 12
MMM-01	Digital Tester	Fluke	FLUKE 26-3	78030611	CE	2016/08/23 * 12

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: **CE: Conducted Emission test**
AT: Antenna Terminal Conducted test