RADIO TEST REPORT

Test Report No. : 10636726H-G-R3

Applicant	:	**Panasonic Mobile Communications Development of Europe Ltd**
Type of Equipment	:	**Digital Camera**
Model No.	:	**DMC-CM1**
Test regulation	:	**FCC Part 15 Subpart C: 2015**
FCC ID	:	**UCE314062A**
Test Result	:	**Complied**

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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 10636726H-G-R2. 10636726H-G-R2 is replaced with this report.

Date of test: January 19 to March 4, 2015

Representative test engineer: K. Yamamoto
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http://www.ul.com/japan/jpn/pages/services/emc/about/mark1/index.jsp#nvlap

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REVISION HISTORY

Original Test Report No.: 10636726H-G

Revision	Test report No.	Date	Page revised	Contents
- (Original)	10636726H-G	February 20, 2015	-	-
1	10636726H-G-R1	March 5, 2015	P.1	Correction of test date
1	10636726H-G-R1	March 5, 2015	P.4	Correction of rating
1	10636726H-G-R1	March 5, 2015	P.6	Correction of FCC 15.31 (e) sentence
1	10636726H-G-R1	March 5, 2015	P.9	Correction of explanatory note for Frequency tolerance test
1	10636726H-G-R1	March 5, 2015	P.23	Correction of test data
2	10636726H-G-R2	March 9, 2015	P.13	Addition of explanatory note for Frequency tolerance test
3	10636726H-G-R3	March 10, 2015	P.13	Correction of explanatory note for Frequency tolerance test

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SECTION 1: Customer information

Company Name	:	Panasonic Mobile Communications Development of Europe Ltd
Address	:	Willoughby Road, Bracknell Berkshire RG12 8FP, UK
Telephone Number	:	+44 (0) 1344 706774
Facsimile Number	:	+44 (0) 1344 706796
Contact Person	:	Andrew James

SECTION 2: Equipment under test (E.U.T.)

2.1 Identification of E.U.T.

Type of Equipment	:	Digital Camera
Model No.	:	DMC-CM1
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	AC120V/60Hz (AC Adaptor) DC3.8V (Battery)
Receipt Date of Sample	:	January 7, 2015
Country of Mass-production	:	China
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

General Specification

Power Supply (radio part input) : Cellular PA: 3.0V-4.2V (Depend on Battery voltage)
Cellular other RF part: 1.3V, 1.8V, 2.05V, 2.7V (Regulated voltage)
WLAN 5GHz Front-end module: 3.0V-4.2V (Depend on Battery voltage)
WLAN/BT other RF part: 1.3V, 1.8V, 3.0V (Regulated voltage)

Clock frequency(ies) in the system : 2.26GHz (Max)
See below table for other clock frequencies

Frequency	Device
32.768kHz	MSM8974AB
32.768kHz (X'tal)	BUYD2206
27.0MHz	TC358764AXBG, XO2-256-64UCBGA, BUYD2206
48.0MHz (X'tal)	WCN3680
24.0MHz	MSM8974AB, Sub Camera
19.2MHz	WTR1625L, MSM8974AB
19.2MHz (X'tal)	PM8941
9.6MHz	WCD9320
72MHz	Main Camera
27.12MHz	NFC IC

Hardware / Software version : Rev. PR / QRCT Version 3.0.32.0

Radio Specification

	IEEE802.11b	**IEEE802.11g/n (20 M band)**	**IEEE802.11a/n/ac (20 M band)**	**IEEE802.11n/ac (40 M band)**	**IEEE802.11ac (80 M band)**
Frequency of operation	2412-2462MHz	2412-2462MHz	5180-5240MHz 5260-5320MHz 5500-5700MHz 5745-5825MHz	5190-5230MHz 5270-5310MHz 5510-5670MHz 5755-5795MHz	5210MHz 5290MHz 5530-5610MHz 5775MHz
Type of modulation	DSSS (CCK, DQPSK, DBPSK)	OFDM-CCK (64QAM, 16QAM, QPSK, BPSK)	OFDM (64QAM, 16QAM, QPSK, BPSK)		OFDM (64QAM, 16QAM, QPSK, BPSK, 256QAM)
Channel spacing	5MHz		20MHz	40MHz	80MHz
Antenna type	Monopole				
Antenna Connector type	Spring type				
Antenna Gain	2.4GHz: -5.40dBi W52: -3.0dBi, W53: -3.5dBi, W56: -1.5dBi, W58: -1.8dBi				

	Bluetooth Ver.4.0 with EDR function	**GSM**	**W-CDMA**	**LTE**
Frequency of operation	2402-2480MHz	[Up Link] GSM850: 824 – 849MHz PCS: 1850 – 1910MHz [Down Link] GSM850: 869 – 894MHz PCS: 1930 – 1990MHz	[Up Link] Band II: 1850 – 1910MHz Band IV: 1710 – 1755MHz Band V: 824 – 849MHz [Down Link] Band II: 1930 – 1990MHz Band IV: 2110 – 2155MHz Band V: 869 – 894MHz	[Up Link] Band II: 1850 – 1910MHz Band IV: 1710 – 1755MHz Band V: 824 – 849MHz Band VII: 2500 – 2570MHz Band X VII: 704 – 716MHz [Down Link] Band II: 1930 – 1990MHz Band IV: 2110 – 2155MHz Band V: 869 – 894MHz Band VII: 2620 – 2690MHz Band X VII: 734 – 746MHz
Type of modulation	BT: FHSS (GFSK, π/4-DQPSK, 8-DPSK) LE: GFSK	GMSK , 8PSK	QPSK	QPSK, 16QAM
Channel spacing	BT: 1MHz LE: 2MHz	200kHz	200kHz	100kHz
Antenna type	Monopole	Monopole	Main: Monopole Sub: Monopole	
Antenna Connector type	Spring type	Spring type	Main: Spring type Sub: Spring type	
Antenna Gain	-5.40dBi	GSM850: -0.9dBi PCS: 0.5dBi	Band II: 0.5dBi Band IV: 0.6dBi Band V: -0.9dBi	Band II: 0.5dBi Band IV: 0.6dBi Band V: -0.9dBi Band VII: -0.2dBi Band X VII: -1.5dBi

	NFC	**GPS/GLONASS**
Frequency of operation	13.56MHz	GPS: 1575.42MHz GLONASS: 1597.55-1605.89MHz
Type of modulation	ASK	GPS: BPSK GLONASS: BPSK
Channel spacing	-	GLONASS: 0.5625MHz
Antenna type	Loop	Monopole
Antenna Connector type	Spring type	Spring type
Antenna Gain	N/A	-2.9dBi

*This test report applies for NFC.

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification	:	FCC Part 15 Subpart C: 2015, final revised on January 21, 2015
Title	:	FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators Section 15.207 Conducted limits Section 15.225 : Operation within the band 13.110-14.010MHz

* The revision on January 21, 2015 does not affect the test specification applied to the EUT.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted emission	ANSI C63.4:2009 7. AC powerline conducted emission measurements	Section 15.207	[QP] 29.4dB 0.54752MHz, L [AV] 25.0dB 0.54752MHz, N	Complied	-
	<IC>RSS-Gen 8.8	<IC>RSS-Gen 8.8			
Electric Field Strength of Fundamental Emission	ANSI C63.4:2009 13. Measurement of intentional radiators	Section 15.225(a)	68.1dB, 13.56000MHz, QP, 0deg.	Complied	Radiated
	<IC> RSS-Gen 6.4, 6.12	<IC>RSS-210 A2.6			
Spectrum Mask	ANSI C63.4:2009 13. Measurement of intentional radiators	Section 15.225(b)(c)	45.4dB, 13.11000MHz, QP, 0deg.	Complied	Radiated
	<IC>RSS-Gen 6.4, 6.13	<IC> RSS-210 A2.6			
20dB Bandwidth	ANSI C63.4:2009 13. Measurement of intentional radiators	Section15.215(c)	See data	Complied	Radiated
	<IC> -	<IC> -			
Electric Field Strength of Spurious Emission	ANSI C63.4:2009 13. Measurement of intentional radiators	Section15.209, Section 15.225 (d)	1.3dB 203.400MHz, Horizontal, QP	Complied	Radiated
	<IC>RSS-Gen 6.4, 6.13	<IC>RSS-210 A2.6			
Frequency Tolerance	ANSI C63.4:2009 13. Measurement of intentional radiators	Section15.225(e)	See data	Complied	Radiated
	<IC>RSS-Gen 6.11, 8.11	<IC> RSS-210 A2.6			
Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422					

FCC 15.31 (e)
The EUT is a battery-operated device and test was performed with the full-charged battery.
During the test, the battery was charged from AC Adaptor.
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

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	99% Occupied Band Width	RSS-Gen 6.6	-	Radiated	N/A	N/A	N/A

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

3.4 Uncertainty

EMI

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

Test room (semi-anechoic chamber)	Conducted emission (±dB)
	150kHz-30MHz
No.1	3.5dB
No.2	3.5dB
No.3	3.6dB
No.4	3.5dB

Test room (semi-anechoic chamber)	Radiated emission						
	(3m*)(±dB)				(1m*)(±dB)		(0.5m*)(±dB)
	9kHz -30MHz	30MHz -300MHz	300MHz -1GHz	1GHz -10GHz	10GHz -18GHz	18GHz -26.5GHz	26.5GHz -40GHz
No.1	4.0dB	5.1dB	5.0dB	5.1dB	6.0dB	4.9dB	4.3dB
No.2	3.9dB	5.2dB	5.0dB	4.9dB	5.9dB	4.7dB	4.2dB
No.3	4.3dB	5.1dB	5.2dB	5.2dB	6.0dB	4.8dB	4.2dB
No.4	4.6dB	5.2dB	5.0dB	5.2dB	6.0dB	5.7dB	4.2dB

*3m/1m/0.5m = Measurement distance

Frequency counter (±)	
Normal condition	Extreme condition
7×10^{-6}	9×10^{-6}

Conducted emission test

The data listed in this test report has enough margin, more than the site margin.

Radiated emission test (3m)

The data listed in this report meets the limits unless the uncertainty is taken into consideration.

3.5 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	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

3.6 Test set up, Data of EMI, and Test instruments

Refer to APPENDIX.

SECTION 4: Operation of E.U.T. during testing

4.1 Operating Modes

The mode is used :

Mode	Remarks*
Transmitting mode (Tx)	The EUT Transmits and Receives at the same time and there is no receiving mode.
The EUT was operated in a manner similar to typical use during the tests. The EUT Transmits and Receives at the same time and there is no receiving mode.	

Test Item	Operating mode*
Conducted emission	Tx Mod on,with Tag (FeliCa)
Electric Field Strength of Fundamental Emission	Tx Mod on,with Tag (Type A, Type B, FeliCa) Tx Mod on,without Tag
Spectrum Mask	Tx Mod on,with Tag (Type A, Type B, FeliCa) Tx Mod on,without Tag
20dB Bandwidth	Tx Mod on,with Tag (FeliCa)
99% Occupied Bandwidth	Tx Mod on,with Tag (FeliCa)
Electric Field Strength of Spurious Emission	Tx Mod on,with Tag (FeliCa)
Frequency Tolerance	Tx Mod on

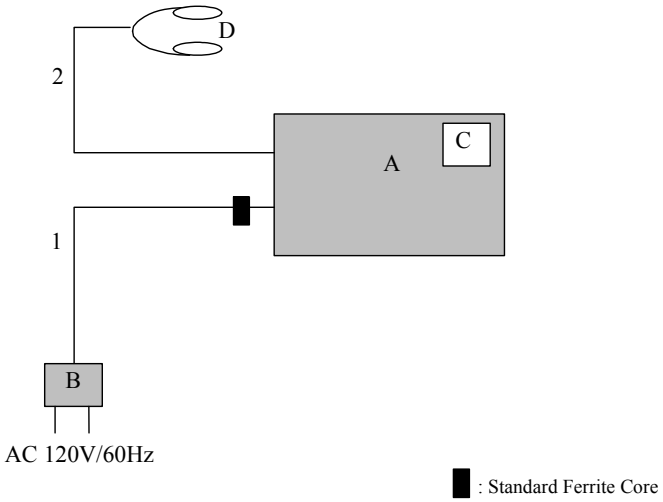
* After the comparison of the test data between with Tag and without Tag, the tests were performed with the worst case.

Justification: The system was configured in typical fashion (as a user would normally use it) for testing.

Frequency Tolerance:

Temperature : -20deg. C to +50deg. C Step 10deg. C
Voltage : DC 3.8V (Full-charged battery with AC Adaptor)
*AC Adaptor and USB input voltage were used for battery charge only.

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

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Digital Camera	DMC-CM1	004401221415652 *1) 004401221415512 *2)	Panasonic	EUT
B	AC Adaptor	VSK0825	k4000106PH	Panasonic	EUT
C	Micro SD Card	02GUECA-MB	-	Panasonic	-
D	Earphone	-	-	Panasonic	-

*1) Used for Conducted emission (Antenna termination) test only
*2) Used for all tests except for Conducted emission (Antenna termination)

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	1.2	Unshielded	Unshielded	-
2	Earphone Cable	1.2	Unshielded	Unshielded	-

SECTION 5: Conducted emission

5.1 Operating environment

Test place : No.4 semi anechoic chamber
Temperature : See data
Humidity : See data

5.2 Test configuration

EUT was placed on a urethane platform of nominal size, 1.0m by 1.5m, raised 0.8m above the conducting ground plane. The rear of tabletop was located 40cm to the vertical conducting plane. The rear of EUT and its peripherals was 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 LISN/AMN and excess AC cable was bundled in center. 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. Each EUT current-carrying power lead, except the ground (safety) lead, was individually connected through a LISN/ an AMN to the input power source. All unused 50ohm connectors of the LISN/ AMN were resistively terminated in 50ohm when not connected to the measuring equipment.
The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT on a horizontal conducting plane 4.0 x 4.0m and a vertical conducting plane 2.0 x 2.0m in a semi Anechoic Chamber.
Photographs of the set up are shown in Appendix 3.

5.3 Test conditions

Frequency range : 0.15MHz-30MHz
EUT position : Table top
EUT operation mode : See Clause 4.1

5.4 Test procedure

The AC Mains Terminal Continuous disturbance Voltage had been measured with the EUT in the semi Anechoic Chamber.
The EUT was connected to a Line Impedance Stabilization Network (LISN)/ Artificial Mains Network (AMN).
An overview sweep with peak detection has been performed.
The measurements had been performed with a quasi-peak detector and if required, with an average detector.
The conducted emission measurements were made with the following detector function of the test receiver.
Detector Type : QP and CISPR AV
IF Bandwidth : 9kHz

5.5 Test result

Summary of the test results : Pass

SECTION 6: Radiated emission (Fundamental , Spurious Emission and Spectrum Mask)

Test Procedure

EUT was placed on a urethane platform of nominal size, 1.0m by 1.5m, raised 0.8m above the conducting ground plane.
The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

Frequency : From 9kHz to 30MHz
The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.
The measurements were performed for vertical polarization (antenna angle: 0deg.) and horizontal polarization.
*Refer to Figure 1 about Direction of the Loop Antenna.

Frequency : From 30MHz to 1GHz
The measuring antenna height varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.
The measurements were performed for both vertical and horizontal antenna polarization.

The test was made with the detector (RBW/VBW) in the following table.
When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

Test Antennas are used as below;

Frequency	Below 30MHz	30MHz to 300MHz	300MHz to 1GHz	Above 1GHz
Antenna Type	Loop	Biconical	Logperiodic	Horn

Frequency	From 9kHz to 90kHz and From 110kHz to 150kHz	From 90kHz to 110kHz	From 150kHz to 490kHz	From 490kHz to 30MHz	From 30MHz to 1GHz	Above 1GHz	
Instrument used	Test Receiver					Spectrum Analyzer	
Detector	PK/AV	QP	PK/AV	QP	QP	PK	AV
IF Bandwidth	200Hz	200Hz	9kHz	9kHz	120kHz	RBW: 1MHz VBW: 3MHz	RBW: 1MHz VBW: 10Hz
Test Distance	3m *1)	3m *1)	3m *1)	3m *2)	3m	3m	3m

*1) Distance Factor: 40 x log (3m/300m) = -80dB
*2) Distance Factor: 40 x log (3m/30m) = -40dB

Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open field test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 937606.

These tests were performed in semi anechoic chamber. Therefore the measured level of emissions may be higher than if measurements were made without a ground plane.
However test results were confirmed to pass against standard limit.

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

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

Measurement range : 9kHz-1GHz
Test data : APPENDIX 1
Test result : Pass

SECTION 7: Other test

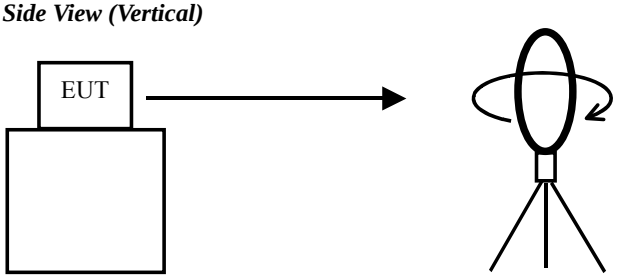
Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
20dB Bandwidth	100kHz	1kHz	3kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth	Enough width to display 20dB Bandwidth	1 to 3% of Span	Three times of RBW	Auto	Peak	Max Hold *1)	Spectrum Analyzer
Frequency Tolerance *2)	-	-	-	-	-	-	Frequency counter

*1) The measurement was performed with Max Hold since the duty cycle was not 100%.
*2) The power supply set to 100 % nominal setting, raise EUT operating temperature to 50 deg. C.
Record the frequency of the EUT transmission.
Repeat measurements at each 10 deg. C decrement to –20 deg. C.
The EUT is a battery-operated device and test was performed with the full-charged battery.

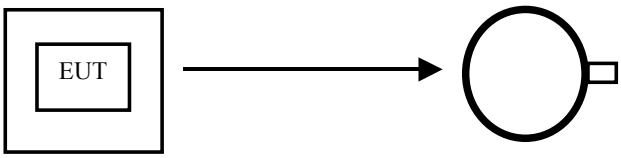
Test data : APPENDIX
Test result : Pass

Figure 1: Direction of the Loop Antenna

Side View (Vertical)

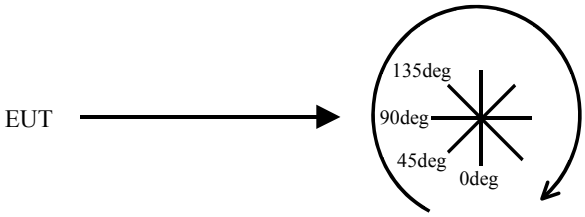


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



Front side: 0 deg.
Forward direction: clockwise

APPENDIX 1: Data of EMI test

Conducted emission

DATA OF CONDUCTED EMISSION TEST

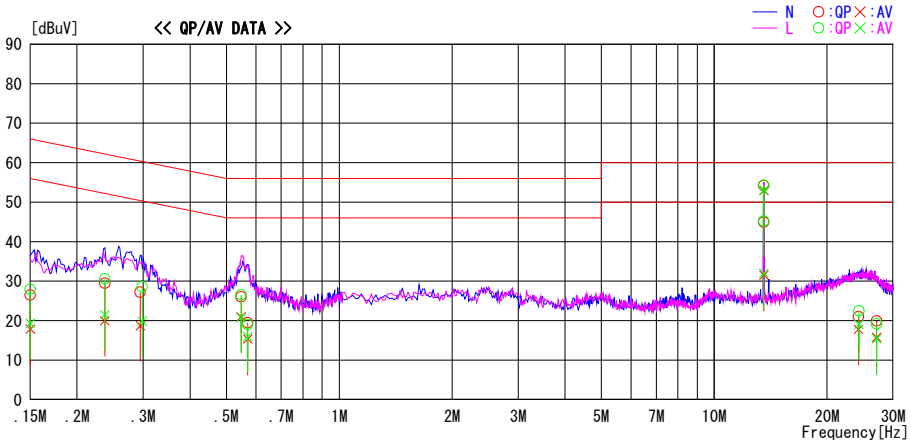
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2015/01/20

Report No. : 10636726H

Temp./Humi. : 23deg. C / 35% RH
Engineer : Koji Yamamoto

Mode / Remarks : Tx 13.56MHz Felica

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	13.1	4.5	13.4	26.5	17.9	66.0	56.0	39.5	38.1	N	
0.15000	14.5	5.9	13.4	27.9	19.3	66.0	56.0	38.1	36.7	L	
0.23717	16.1	6.6	13.4	29.5	20.0	62.2	52.2	32.7	32.2	N	
0.23717	17.2	8.1	13.4	30.6	21.5	62.2	52.2	31.6	30.7	L	
0.29471	13.8	5.3	13.4	27.2	18.7	60.4	50.4	33.2	31.7	N	
0.29820	15.2	6.5	13.4	28.6	19.9	60.3	50.3	31.7	30.4	L	
0.54752	12.5	7.5	13.5	26.0	21.0	56.0	46.0	30.0	25.0	N	
0.54752	13.1	7.3	13.5	26.6	20.8	56.0	46.0	29.4	25.2	L	
0.57018	6.0	1.8	13.5	19.5	15.3	56.0	46.0	36.5	30.7	N	
0.57018	5.5	2.5	13.5	19.0	16.0	56.0	46.0	37.0	30.0	L	
13.56000	38.8	37.6	15.4	54.2	53.0	60.0	50.0	-	-	N	
13.56000	29.5	16.1	15.4	44.9	31.5	60.0	50.0	-	-	N	Without Tag
13.56000	38.9	37.7	15.4	54.3	53.1	60.0	50.0	-	-	L	
13.56000	29.8	16.7	15.4	45.2	32.1	60.0	50.0	-	-	L	Without Tag
24.25415	3.8	0.6	17.2	21.0	17.8	60.0	50.0	39.0	32.2	N	
24.29433	5.3	1.9	17.2	22.5	19.1	60.0	50.0	37.5	30.9	L	
27.12000	1.5	-2.3	17.7	19.2	15.4	60.0	50.0	40.8	34.6	L	
27.12000	2.2	-1.9	17.7	19.9	15.8	60.0	50.0	40.1	34.2	N	

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.

*The test result is rounded off to one or two decimal places, so some differences might be observed.

Conducted emission
(Antenna Termination)

DATA OF CONDUCTED EMISSION TEST

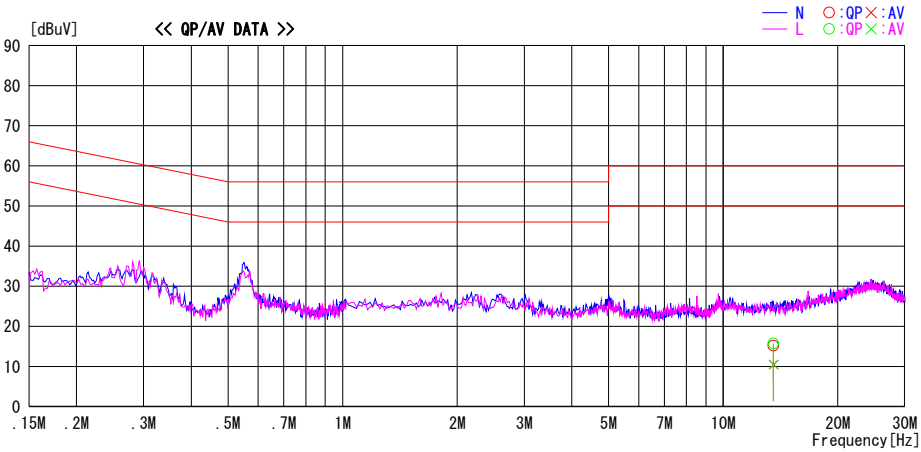
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2015/02/02

Report No. : 10636726H

Temp./Humi. : 23deg. C / 31% RH
Engineer : Shinya Watanabe

Mode / Remarks : Tx 13.56MHz FeliCa / Termiated

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]		
13.56000	0.0	-4.7	15.2	15.2	10.5	60.0	50.0	44.8	39.5	N	
13.56000	0.5	-4.7	15.2	15.7	10.5	60.0	50.0	44.3	39.5	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.

*The test result is rounded off to one or two decimal places, so some differences might be observed.

Fundamental emission and Spectrum Mask

DATA OF RADIATED EMISSION TEST

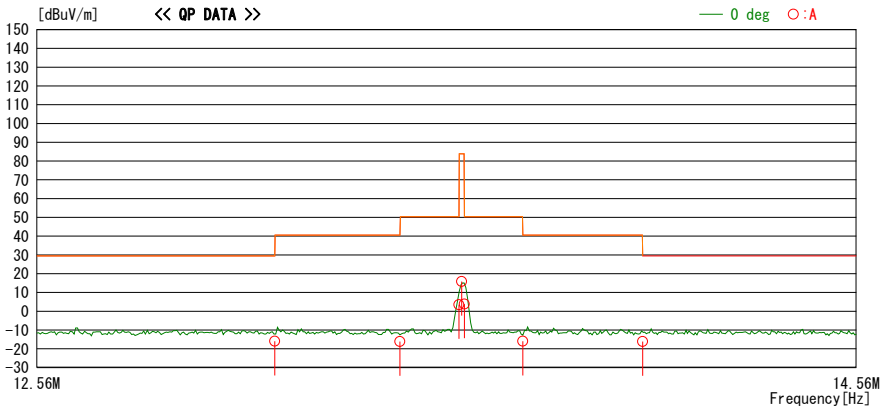
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2015/01/19

Report No. : 10636726H

Temp. / Humi. : 25deg. C / 41% RH
Engineer : Koji Yamamoto

Mode / Remarks : Tx 13.56MHz Felica Worst-axis:Y-axis

LIMIT : FCC15_225_PKQP, 9-90kHz:PK, 110-490kHz:PK, other:QP
FCC15_225_AVQP, 9-90kHz:AV, 110-490kHz:AV, other:QP



Freq. [MHz]	Reading [dBuV]	DET	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Antenna [deg]		Table [deg]	Comment
13.11000	29.8	QP	19.5	-33.2	32.1	-16.0	29.5	45.5	0	A	359	
13.41000	29.8	QP	19.4	-33.2	32.1	-16.1	40.5	56.6	0	A	359	
13.55300	49.4	QP	19.4	-33.2	32.1	3.5	50.4	46.9	0	A	359	
13.56000	61.7	QP	19.4	-33.2	32.1	15.8	83.9	68.1	0	A	359	
13.56700	49.8	QP	19.4	-33.2	32.1	3.9	50.4	46.5	0	A	359	
13.71000	30.0	QP	19.4	-33.2	32.1	-15.9	40.5	56.4	0	A	359	
14.01000	29.8	QP	19.3	-33.2	32.1	-16.2	29.5	45.7	0	A	359	

CHART: WITH FACTOR , ANT TYPE: LOOP Except for the data below : adequate margin data below the limits.
CALCULATION : RESULT = READING + ANT FACTOR + LOSS(CABLE + ATTEN + D.FACTOR) - GAIN(AMP)

Result of the fundamental emission at 3m without Distance factor

QP

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	13.56000	QP	61.7	19.4	6.8	32.1	-	55.8	-	-	Fundamental

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amprifier)

Fundamental emission and Spectrum Mask

DATA OF RADIATED EMISSION TEST

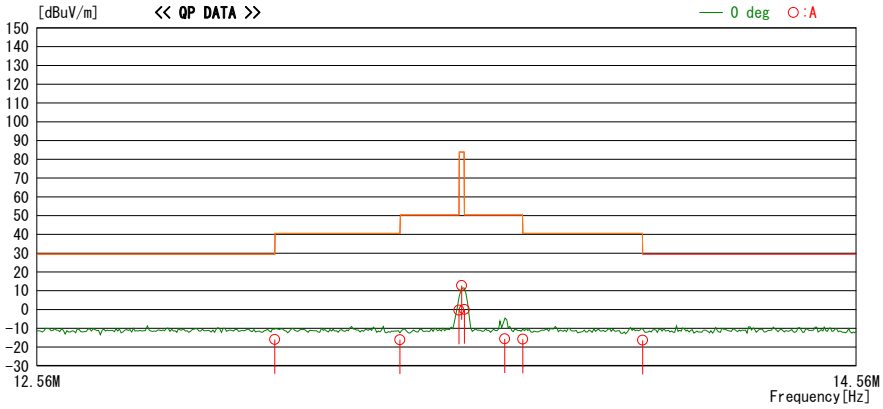
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2015/01/19

Report No. : 10636726H

Temp./ Humi. : 25deg. C / 41% RH
Engineer : Koji Yamamoto

Mode / Remarks : Tx 13.56MHz Type A Worst-axis:Y-axis

LIMIT : FCC15_225_PKQP, 9-90kHz:PK, 110-490kHz:PK, other:QP
FCC15_225_AVQP, 9-90kHz:AV, 110-490kHz:AV, other:QP



Freq. [MHz]	Reading [dBuV]	DET	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Antenna [deg]		Table [deg]	Comment
13.11000	29.8	QP	19.5	-33.2	32.1	-16.0	29.5	45.5	0	A	359	
13.41000	29.8	QP	19.4	-33.2	32.1	-16.1	40.5	56.6	0	A	359	
13.55300	45.6	QP	19.4	-33.2	32.1	-0.3	50.4	50.7	0	A	359	
13.56000	58.6	QP	19.4	-33.2	32.1	12.7	83.9	71.2	0	A	359	
13.56700	45.9	QP	19.4	-33.2	32.1	0.0	50.4	50.4	0	A	359	
13.66576	30.3	QP	19.4	-33.2	32.1	-15.6	50.4	66.0	0	A	359	
13.71000	30.1	QP	19.4	-33.2	32.1	-15.8	40.5	56.3	0	A	359	
14.01000	29.7	QP	19.3	-33.2	32.1	-16.3	29.5	45.8	0	A	359	

CHART: WITH FACTOR , ANT TYPE: LOOP Except for the data below : adequate margin data below the limits.
CALCULATION : RESULT = READING + ANT FACTOR + LOSS(CABLE + ATTEN + D.FACTOR) - GAIN(AMP)

Result of the fundamental emission at 3m without Distance factor

QP

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	13.56000	QP	58.6	19.4	6.8	32.1	-	52.7	-	-	Fundamental

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amprifier)

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Fundamental emission and Spectrum Mask

DATA OF RADIATED EMISSION TEST

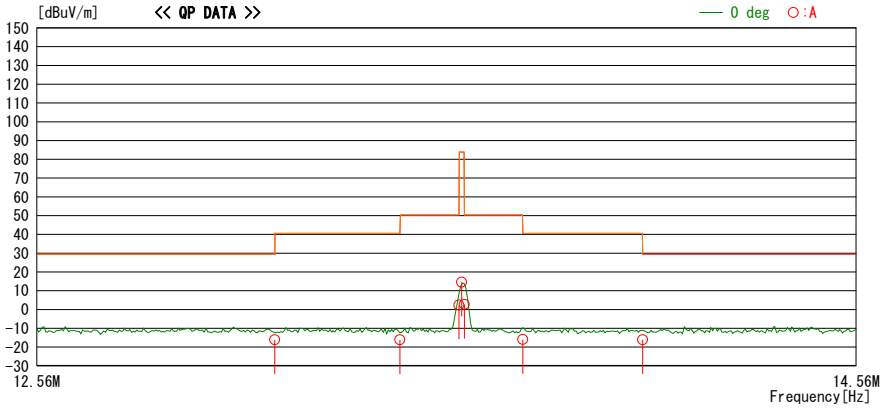
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2015/01/19

Report No. : 10636726H

Temp./ Humi. : 25deg. C / 41% RH
Engineer : Koji Yamamoto

Mode / Remarks : Tx 13.56MHz Type B Worst-axis:Y-axis

LIMIT : FCC15_225_PKQP, 9-90kHz:PK, 110-490kHz:PK, other:QP
FCC15_225_AVQP, 9-90kHz:AV, 110-490kHz:AV, other:QP



Freq. [MHz]	Reading [dBuV]	DET	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Antenna [deg]		Table [deg]	Comment
13.11000	29.7	QP	19.5	-33.2	32.1	-16.1	29.5	45.6	0	A	359	
13.41000	29.8	QP	19.4	-33.2	32.1	-16.1	40.5	56.6	0	A	359	
13.55300	48.2	QP	19.4	-33.2	32.1	2.3	50.4	48.1	0	A	359	
13.56000	60.5	QP	19.4	-33.2	32.1	14.6	83.9	69.3	0	A	359	
13.56700	48.6	QP	19.4	-33.2	32.1	2.7	50.4	47.7	0	A	359	
13.71000	29.9	QP	19.4	-33.2	32.1	-16.0	40.5	56.5	0	A	359	
14.01000	29.8	QP	19.3	-33.2	32.1	-16.2	29.5	45.7	0	A	359	

CHART: WITH FACTOR , ANT TYPE: LOOP Except for the data below : adequate margin data below the limits.
CALCULATION : RESULT = READING + ANT FACTOR + LOSS(CABLE + ATTEN + D.FACTOR) - GAIN(AMP)

Result of the fundamental emission at 3m without Distance factor

QP

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	13.56000	QP	60.5	19.4	6.8	32.1	-	54.6	-	-	Fundamental

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amprifier)

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Fundamental emission and Spectrum Mask

DATA OF RADIATED EMISSION TEST

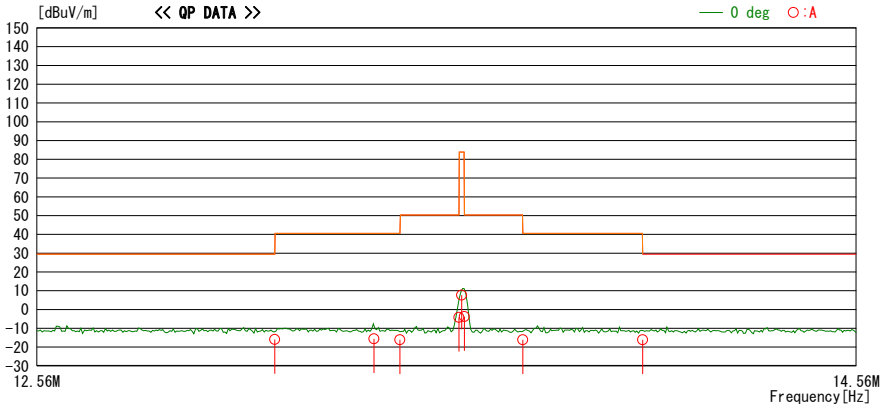
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2015/01/19

Report No. : 10636726H

Temp./ Humi. : 25deg. C / 41% RH
Engineer : Koji Yamamoto

Mode / Remarks : Tx 13.56MHz wihtout Tag Worst-axis:Y-axis

LIMIT : FCC15_225_PKQP, 9-90kHz:PK, 110-490kHz:PK, other:QP
FCC15_225_AVQP, 9-90kHz:AV, 110-490kHz:AV, other:QP



Freq. [MHz]	Reading [dBuV]	DET	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Antenna [deg]		Table [deg]	Comment
13.11000	29.9	QP	19.5	-33.2	32.1	-15.9	29.5	45.4	0	A	359	
13.41000	29.8	QP	19.4	-33.2	32.1	-16.1	40.5	56.6	0	A	358	
13.34760	30.3	QP	19.4	-33.2	32.1	-15.6	40.5	56.1	0	A	359	
13.55300	41.7	QP	19.4	-33.2	32.1	-4.2	50.4	54.6	0	A	359	
13.56000	53.6	QP	19.4	-33.2	32.1	7.7	83.9	76.2	0	A	359	
13.56700	42.1	QP	19.4	-33.2	32.1	-3.8	50.4	54.2	0	A	359	
13.71000	29.8	QP	19.4	-33.2	32.1	-16.1	40.5	56.6	0	A	359	
14.01000	29.8	QP	19.3	-33.2	32.1	-16.2	29.5	45.7	0	A	359	

CHART: WITH FACTOR , ANT TYPE: LOOP Except for the data below : adequate margin data below the limits.
CALCULATION : RESULT = READING + ANT FACTOR + LOSS(CABLE + ATTEN + D.FACTOR) - GAIN(AMP)

Result of the fundamental emission at 3m without Distance factor

QP

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0	13.56000	QP	53.6	19.4	6.8	32.1	-	47.7	-	-	Fundamental

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amprifier)

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Spurious emission

DATA OF RADIATED EMISSION TEST

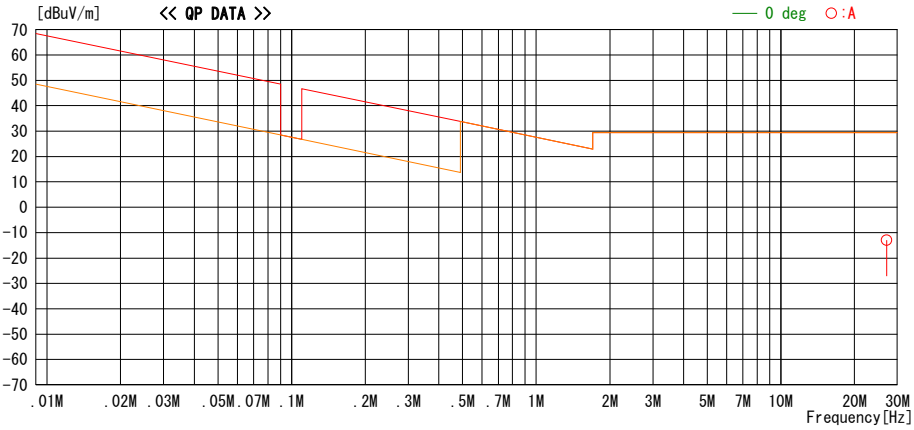
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2015/01/19

Report No. : 10636726H

Temp./ Humi. : 25deg. C / 41% RH
Engineer : Koji Yamamoto

Mode / Remarks : Tx 13.56MHz Felica Worst-axis:Y-axis

LIMIT : FCC15.209(a), 9-90kHz:PK, 110-490kHz:PK, other:QP
FCC15.209(a), 9-90kHz:AV, 110-490kHz:AV, other:QP



Freq. [MHz]	Reading [dBuV]	DET	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Antenna [deg]		Table [deg]	Comment
27.12000	32.3	QP	19.7	-32.9	32.1	-13.0	29.5	42.5	0	A	358	

CHART: WITH FACTOR , ANT TYPE: LOOP Except for the data below : adequate margin data below the limits.
CALCULATION : RESULT = READING + ANT FACTOR + LOSS(CABLE + ATTEN + D.FACTOR) - GAIN(AMP)

Spurious emission

DATA OF RADIATED EMISSION TEST

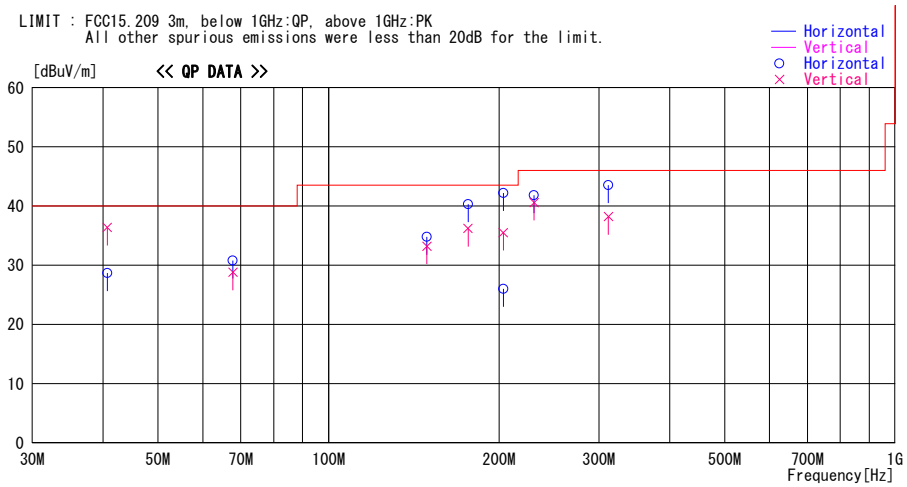
UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2015/01/20

Report No. : 10636726H

Temp./Humi. : 23deg. C / 35% RH
Engineer : Koji Yamamoto

Mode / Remarks : Tx 13.56MHz Felica Worst-Axis (Hori:X / Vert:X)

LIMIT : FCC15.209 3m, below 1GHz:QP, above 1GHz:PK
All other spurious emissions were less than 20dB for the limit.



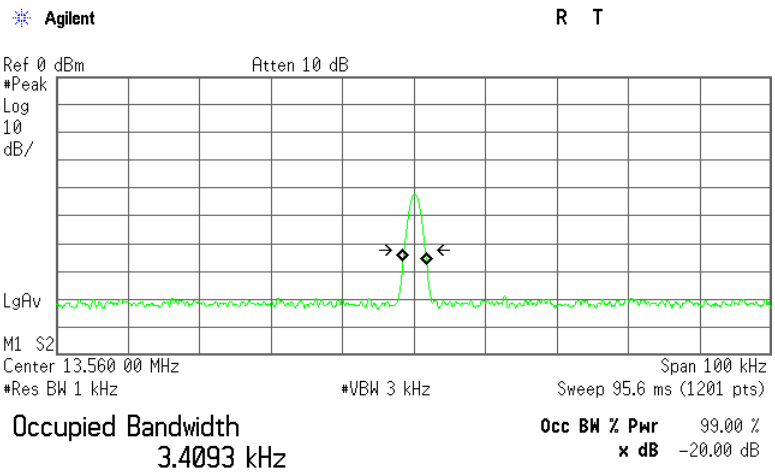
Frequency	Reading	DET	Antenna Factor	Loss& Gain	Level	Angle	Height	Polar.	Limit	Margin	Comment
[MHz]	[dBuV]		[dB/m]	[dB]	[dBuV/m]	[Deg]	[cm]		[dBuV/m]	[dB]	
40.680	39.5	QP	14.0	-24.8	28.7	302	300	Hori.	40.0	11.3	
40.680	47.2	QP	14.0	-24.8	36.4	0	100	Vert.	40.0	3.6	
67.800	48.6	QP	6.6	-24.4	30.8	281	223	Hori.	40.0	9.2	
67.800	46.6	QP	6.6	-24.4	28.8	121	100	Vert.	40.0	11.2	
149.160	43.2	QP	14.9	-23.3	34.8	184	340	Hori.	43.5	8.7	
149.160	41.6	QP	14.9	-23.3	33.2	109	100	Vert.	43.5	10.3	
176.280	47.4	QP	16.0	-23.1	40.3	106	268	Hori.	43.5	3.2	
176.280	43.3	QP	16.0	-23.1	36.2	293	100	Vert.	43.5	7.3	
203.400	48.3	QP	16.7	-22.8	42.2	1	197	Hori.	43.5	1.3	
203.400	41.6	QP	16.7	-22.8	35.5	155	100	Vert.	43.5	8.0	
203.400	32.1	QP	16.7	-22.8	26.0	1	197	Hori.	43.5	17.5	Without Tag
230.520	47.3	QP	17.0	-22.5	41.8	166	300	Hori.	46.0	4.2	
230.520	46.1	QP	17.0	-22.5	40.6	266	100	Vert.	46.0	5.4	
311.880	48.1	QP	17.3	-21.9	43.5	145	100	Hori.	46.0	2.5	
311.880	42.8	QP	17.3	-21.9	38.2	18	100	Vert.	46.0	7.8	

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE + ATTEN - GAIN(AMP))

20dB Bandwidth and 99% Occupied Bandwidth

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No.	10636726H
Date	01/19/2015
Temperature/ Humidity	25 deg. C / 41% RH
Engineer	Koji Yamamoto
Mode	Tx Mod on with Tag (Felica)

FREQ [MHz]	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	2.99	3.41



Frequency Tolerance

Test place	Ise EMC Lab. No.11 measurement room	
Report No.	10636726H	
Date	02/03/2015	03/04/2015
Temperature/ Humidity	27 deg. C / 20% RH	25 deg. C / 35% RH
Engineer	Tomoki Matsui	Tomoki Matsui
Mode	Tx Mod on	

Test condition Temp. [deg. C]	Tested timing	Measured frequency [MHz]	Frequency error [MHz]	Result [%]	Result [ppm]	Limit [+/- %]
50	Power on	13.559409	-0.000591	-0.00436	-43.6	0.01
	+ 2 min.	13.559808	-0.000192	-0.00141	-14.1	0.01
	+ 5 min.	13.559809	-0.000191	-0.00141	-14.1	0.01
	+ 10 min.	13.559050	-0.000950	-0.00701	-70.1	0.01
40	Power on	13.559665	-0.000335	-0.00247	-24.7	0.01
	+ 2 min.	13.559566	-0.000434	-0.00320	-32.0	0.01
	+ 5 min.	13.559878	-0.000122	-0.00090	-9.0	0.01
	+ 10 min.	13.559747	-0.000253	-0.00186	-18.6	0.01
30	Power on	13.559113	-0.000887	-0.00654	-65.4	0.01
	+ 2 min.	13.559774	-0.000226	-0.00167	-16.7	0.01
	+ 5 min.	13.559361	-0.000639	-0.00471	-47.1	0.01
	+ 10 min.	13.559824	-0.000176	-0.00130	-13.0	0.01
20	Power on	13.559835	-0.000165	-0.00122	-12.2	0.01
	+ 2 min.	13.558896	-0.001104	-0.00815	-81.5	0.01
	+ 5 min.	13.559826	-0.000174	-0.00129	-12.9	0.01
	+ 10 min.	13.559835	-0.000165	-0.00122	-12.2	0.01
10	Power on	13.559668	-0.000332	-0.00245	-24.5	0.01
	+ 2 min.	13.559439	-0.000561	-0.00414	-41.4	0.01
	+ 5 min.	13.559616	-0.000384	-0.00283	-28.3	0.01
	+ 10 min.	13.559768	-0.000232	-0.00171	-17.1	0.01
0	Power on	13.559828	-0.000172	-0.00127	-12.7	0.01
	+ 2 min.	13.559424	-0.000576	-0.00425	-42.5	0.01
	+ 5 min.	13.559348	-0.000652	-0.00481	-48.1	0.01
	+ 10 min.	13.559157	-0.000843	-0.00621	-62.1	0.01
-10	Power on	13.559817	-0.000183	-0.00135	-13.5	0.01
	+ 2 min.	13.559788	-0.000212	-0.00156	-15.6	0.01
	+ 5 min.	13.559637	-0.000363	-0.00268	-26.8	0.01
	+ 10 min.	13.559749	-0.000251	-0.00185	-18.5	0.01
-20	Power on	13.560145	0.000145	0.00107	10.7	0.01
	+ 2 min.	13.560337	0.000337	0.00249	24.9	0.01
	+ 5 min.	13.560338	0.000338	0.00250	25.0	0.01
	+ 10 min.	13.559895	-0.000105	-0.00077	-7.7	0.01

Calculation formula Frequency error = Measured frequency - Tested frequency
Result [%] = Frequency error / Tested frequency * 100

APPENDIX 2: Test instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-04	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE/CE	2014/02/28 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	1501	RE/CE	2015/01/13 * 12
MJM-23	Measure	ASKUL	-	-	RE/CE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE/CE	-
MTR-01	Test Receiver	Rohde & Schwarz	ESI40	100084	RE/CE	2014/11/10 * 12
MLPA-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	RE	2014/10/04 * 12
MCC-113	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/SFM141(5m)/421-010(1m)/sucoform141-PE(1m)/RFM-E121(Switcher)	-/04178	RE/CE	2014/07/15 * 12
MCC-143	Coaxial Cable	UL Japan	-	-	RE	2014/07/28 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2014/03/14 * 12
MAT-68	Attenuator	Anritsu	MP721B	6200961025	RE	2014/11/11 * 12
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	RE	2014/04/08 * 12
MLS-23	LISN(AMN)	Schwarzbeck	NSLK8127	8127-729	CE(EUT)	2014/07/10 * 12
MAT-67	Attenuator	JFW Industries, Inc.	50FP-013H2 N	-	CE	2015/01/29 * 12
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE	2014/02/20 * 12
MCH-06	Temperature and Humidity Chamber	Tabai Espec	PL-1KT	14007630	RE	2014/04/23 * 12
MCC-38	Coaxial Cable	UL Japan	-	-	RE	2014/12/02 * 12
MOS-19	Thermo-Hygrometer	Custom	CTH-201	0001	RE	2014/12/22 * 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
RE: Radiated Emission