RADIO TEST REPORT

Test Report No. : 32AE0200-HO-02-A-R2

Applicant	:	**Panasonic Corporation Automotive Systems Company**
Type of Equipment	:	**SMART FOB**
Model No.	:	**HK1210A**
Test regulation	:	**FCC Part 15 Subpart C: 2011**
FCC ID	:	**ACJ932HK1210A**
Test Result	:	**Complied**

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with 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 report is a revised version of 32AE0200-HO-02-A-R1. 32AE0200-HO-02-A-R1 is replaced with this report.

Date of test: November 20 to December 20, 2011

Representative test engineer:
Motoya Imura
Engineer of WiSE Japan,
UL Verification Service

Approved by:
Shinya Watanabe
Leader of WiSE Japan,
UL Verification Service

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.
*As for the range of Accreditation in NVLAP, you may refer to the WEB address, http://www.ul.com/japan/jpn/pages/services/emc/about/mark1/index.jsp#nvlap

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SECTION 1: Customer information

Company Name	:	Panasonic Corporation Automotive Systems Company
Address	:	4261 Ikonobe-cho, Tsuzuki-ku, Yokohama city, Kanagawa-ken 224-8520, Japan
Telephone Number	:	+81-45-939-1665
Facsimile Number	:	+81-45-939-1917
Contact Person	:	Masahiro Yoshii

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

2.1 Identification of E.U.T.

Type of Equipment	:	SMART FOB
Model No.	:	HK1210A
Serial No.	:	Refer to Clause 4.2
Rating	:	DC 3V
Receipt Date of Sample	:	November 18, 2011
Country of Mass-production	:	China
Condition of EUT	:	Engineering 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

Clock frequency(ies) in the system	:	18.370366MHz

Radio Specification

[Transmitter part]

Radio Type	:	Transceiver
Frequency of Operation	:	313.85MHz
Modulation	:	FSK
Method of Frequency Generation	:	Crystal
Power Supply (radio part input)	:	DC 3.0V (CR2032)
Antenna type	:	Monopole Sheet-Metal Antenna
Antenna gain	:	-20dBi
Keyless operation power	:	+4dBm
Smart operation power	:	+7dBm

[Receiver part]

Frequency of Operation	:	125kHz
Modulation	:	ASK
Antenna type	:	Ferrite antenna (3 axes)

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification	:	FCC Part 15 Subpart C: 2011, final revised on July 8, 2011 and effective August 8, 2011
Title	:	FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators Section 15.231 Periodic operation in the band 40.66 - 40.70MHz and above 70MHz

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted emission	**FCC:** ANSI C63.4:2003 7. AC powerline conducted emission measurements	**FCC:** Section 15.207	N/A	N/A*1)	-
	IC: RSS-Gen 7.2.4	**IC:** RSS-Gen 7.2.4			
Automatically Deactivate	**FCC:** ANSI C63.4:2003 13. Measurement of intentional radiators	**FCC:** Section 15.231(a)(1)(2)	N/A	Complied	Radiated
	IC: -	**IC:** RSS-210 A1.1.1			
Electric Field Strength of Fundamental Emission	**FCC:** ANSI C63.4:2003 13. Measurement of intentional radiators	**FCC:** Section 15.231(b)	**Keyless operation** 1.0dB 313.816MHz Horizontal, PK with Duty factor **SMART operation** 0.3dB 313.816MHz, Horizontal, PK with Duty factor	Complied	Radiated
	IC: RSS-Gen 4.8	**IC:** RSS-210 A1.1.2			
Electric Field Strength of Spurious Emission	**FCC:** ANSI C63.4:2003 13. Measurement of intentional radiators	**FCC:** Section 15.205 Section 15.209 Section 15.231(b)	**Keyless operation** 6.2dB 2824.337MHz, Horizontal, PK with Duty factor **SMART operation** 4.3dB 2824.337MHz, Horizontal, PK with Duty factor	Complied	Radiated
	IC: RSS-Gen 4.9	**IC:** RSS-210 A1.1.2, 2.5.1 RSS-Gen 7.2.5			
-20dB Bandwidth	**FCC:** ANSI C63.4:2003 13. Measurement of intentional radiators	**FCC:** Section 15.231(c)	N/A	Complied	Radiated
	IC: -	**IC:** Reference data			
Receiver Spurious Emissions	**FCC:** ANSI C63.4:2003 12. Measurement of unintentional radiators other than ITE	**FCC:** Section 15.109(a) Section 15.209	21.8dB 36.740MHz Horizontal/Vertical	Complied	Radiated
	IC: RSS-Gen 4.10	**IC:** RSS-Gen 6 RSS-210 2.3			
Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422. *1) The test is not applicable since the EUT does not have AC Mains.					

FCC 15.31 (e)
This test was performed with the New Battery (DC 3.0V) and the constant voltage was supplied to the EUT during the tests. Therefore, the EUT complies with the requirement.

FCC Part 15.203 Antenna requirement
It is impossible for end users to replace the antenna, because the antenna is mounted inside of the EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203.

3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	**IC:** RSS-Gen 4.6.1	**IC:** RSS-Gen 4.6.1	N/A	Complied	Radiated

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)	**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	4.2dB	5.0dB	5.1dB	5.6dB	5.9dB	4.4dB	4.3dB
No.2	4.1dB	5.2dB	5.1dB	5.7dB	5.8dB	4.3dB	4.2dB
No.3	4.5dB	5.0dB	5.2dB	5.7dB	5.8dB	4.5dB	4.2dB
No.4	4.7dB	5.2dB	5.2dB	5.7dB	5.8dB	5.1dB	4.2dB

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

Radiated emission test(3m)
The data listed in this report meets the limits unless the uncertainty is taken into consideration.

3.5 Test Location

UL Japan, Inc. Head Office EMC Lab. *NVLAP Lab. code: 200572-0
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8116 Facsimile : +81 596 24 8124

	FCC Registration Number	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	313583	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	655103	2973C-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	148738	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	134570	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	4.75 x 5.4 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 4.5 x 2.8m	2.0 x 2.0m	-
No.10 measurement room	-	-	2.6 x 2.8 x 2.5m	2.4 x 2.4m	-
No.11 measurement room	-	-	3.1 x 3.4 x 3.0m	2.4 x 3.4m	-

* 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 Data of EMI, Test instruments, and Test set up.

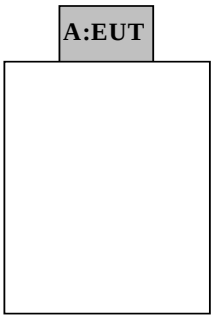
Refer to APPENDIX.

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

4.1 Operating Modes

Test Item*	Mode
Automatically Deactivate Duty Cycle	Normal use mode
Electric Field Strength of Fundamental Emission Electric Field Strength of Spurious Emission -20dB & 99% Occupied Bandwidth	Transmitting mode (Tx) *1)
Receiver Spurious Emission	Receiving 125kHz mode (Rx)
* The system was configured in typical fashion (as a customer would normally use it) for testing. *1) The software of this mode is the same as one of normal product, except that EUT continues to transmit when transmitter button is being pressed (For Normal use mode, EUT stops to transmit in a given time, even if transceiver button is being pressed.) End users cannot change the settings of the output power of the product.	

4.2 Configuration and peripherals



* Test data was taken under worse case conditions.

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	SMART FOB	HK1210A	6S-514 *1) 6S-515 *2)	Panasonic Corporation Automotive Systems Company	EUT

*1) Used for Normal use and Receiving 125kHz mode
*2) Used for Transmitting mode

SECTION 5: Radiated emission (Electric Field Strength of Fundamental and Spurious Emission)

Test Procedure and conditions

EUT was placed on a urethane platform of nominal size, 0.5m by 1.0m, raised 0.8m above the conducting ground plane. The EUT was set on the center of the tabletop.
Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna was varied in height above the conducting ground plane to obtain the maximum signal strength.
Photographs of the set up are shown in Appendix 3.

[Transmitting mode]

The Radiated Electric Field Strength has been measured on Semi anechoic chamber with a ground plane and at a distance of 3m.
The measuring antenna height was varied between 1 and 4m (frequency 9kHz – 30MHz: loop antenna was fixed height at 1.0m) and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.
The measurements were performed for both vertical and horizontal antenna polarization.
The radiated emission measurements were made with the following detector function of the test receiver/spectrum analyzer.

Test Antennas are used as below;

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

	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
Detector Type	Peak	Peak	Peak	Peak	Peak	Peak and Peak with Duty factor
IF Bandwidth	200Hz	200Hz	9kHz	9kHz	120kHz	PK: S/A:RBW 1MHz, VBW:3MHz

*For the test below 30MHz, the noise was not detected when it was confirmed with PK detect.

- The carrier level (or, noise levels) was (or were) measured at each position of all three axes X, Y and Z, and the position that has the maximum noise was determined.
Noise levels of all the frequencies were measured at the position.
This EUT has two modes which mechanical key is inserted or not. The worst case was confirmed with and without mechanical key, as a result, the test without mechanical key was the worst case. Therefore the testwithout mechanical key was performed only.

*The result is rounded off to the second decimal place, so some differences might be observed.

Measurement range : 9kHz-3.2GHz
Test data : APPENDIX
Test result : Pass

[Receiving mode]
The Radiated Electric Field Strength has been measured on a semi anechoic chamber with a ground plane and at a distance of 3m.

Frequency : From 9kHz to 30MHz at distance 3m
The EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.
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 1000MHz at distance 3m
The measuring antenna height was varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.
The measurements were performed for both vertical and horizontal antenna polarization.
The radiated emission measurements were made with the following detector function of the test receiver/spectrum analyzer.

	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
Detector Type	PK/AV	QP	PK/AV	QP	QP
IF Bandwidth	200Hz	200Hz	9kHz	9kHz	120kHz

The worst case in receiving mode was confirmed with and without mechanical key, as a result, no difference was seen. Therefore the test with mechanical key was performed only.

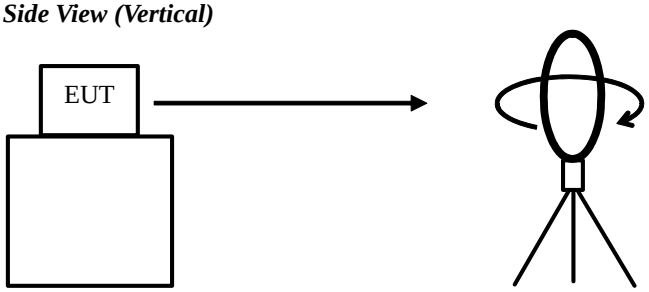
* Part 15 Section 15.31 (f)(2) (9kHz-30MHz)
[Limit at 3m]=[Limit at 300m]-40 x log (3[m]/300[m])
[Limit at 3m]=[Limit at 30m]-40 x log (3[m]/30[m])

*The result is rounded off to the one decimal place, so some differences might be observed.

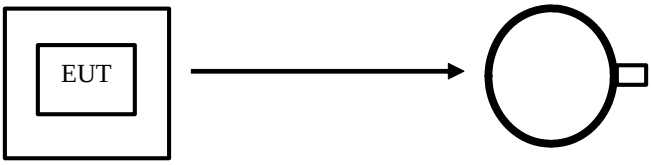
Measurement range : 9kHz-1000MHz
Test data : APPENDIX
Test result : Pass

Figure 1: Direction of the Loop Antenna

Side View (Vertical)

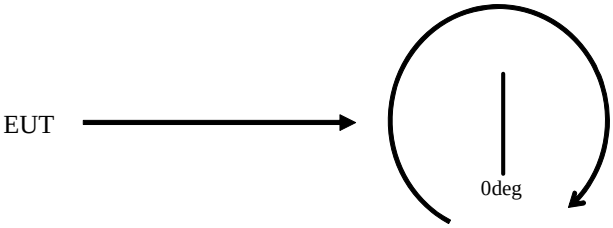


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



Front side: 0 deg.
Forward direction: clockwise

SECTION 6: Automatically deactivate

Test Procedure

The measurement was performed with Electric field strength using a spectrum analyzer.

Test data : APPENDIX
Test result : Pass

SECTION 7: -20dB and 99% Occupied Bandwidth

Test Procedure

The measurement was performed in the antenna height to gain the maximum of Electric field strength.

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
20dB Bandwidth	500kHz	10kHz	30kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth	Enough width to display 20dB Bandwidth	1 % of Span	Three times of RBW	Auto	Peak *1)	Max Hold *1)	Spectrum Analyzer
*1) The measurement was performed with Peak detector, Max Hold since the duty cycle was not 100%.							

Test data : APPENDIX
Test result : Pass

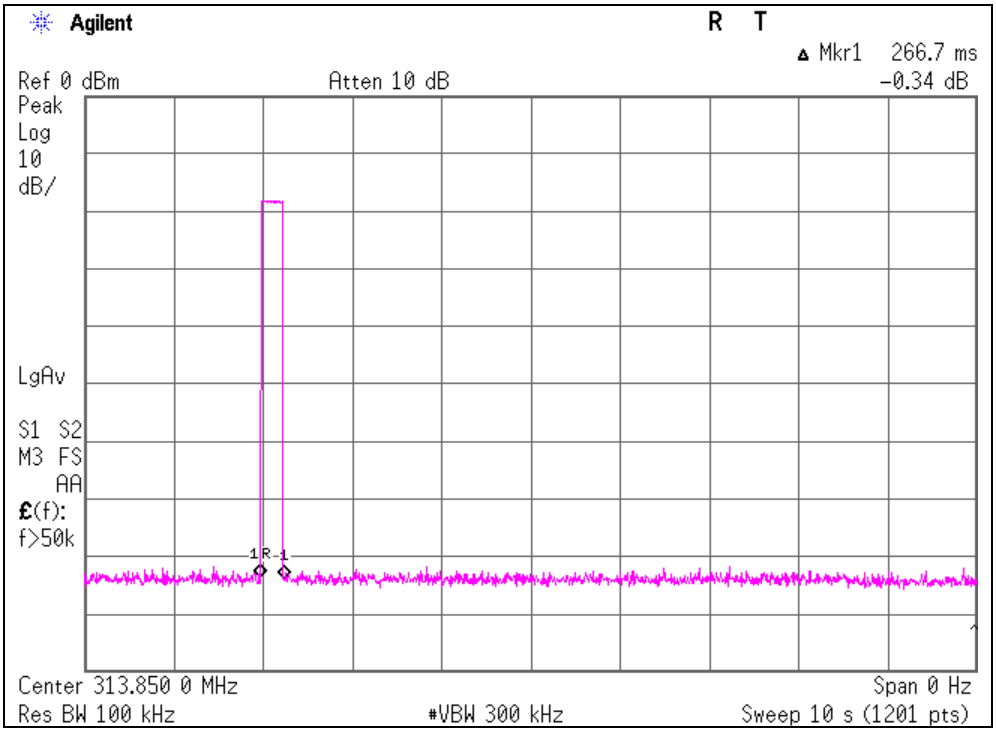
APPENDIX 1: Data of EMI test

Automatically deactivate

(Keyless operation)

Test place	Head Office EMC Lab. No.4 Semi Anechoic Chamber
Report No.	32AE0200-HO-02
Date	11/20/2011
Temperature/ Humidity	23 deg.C/ 57% RH
Engineer	Motoya Imura
Mode	Normal use mode

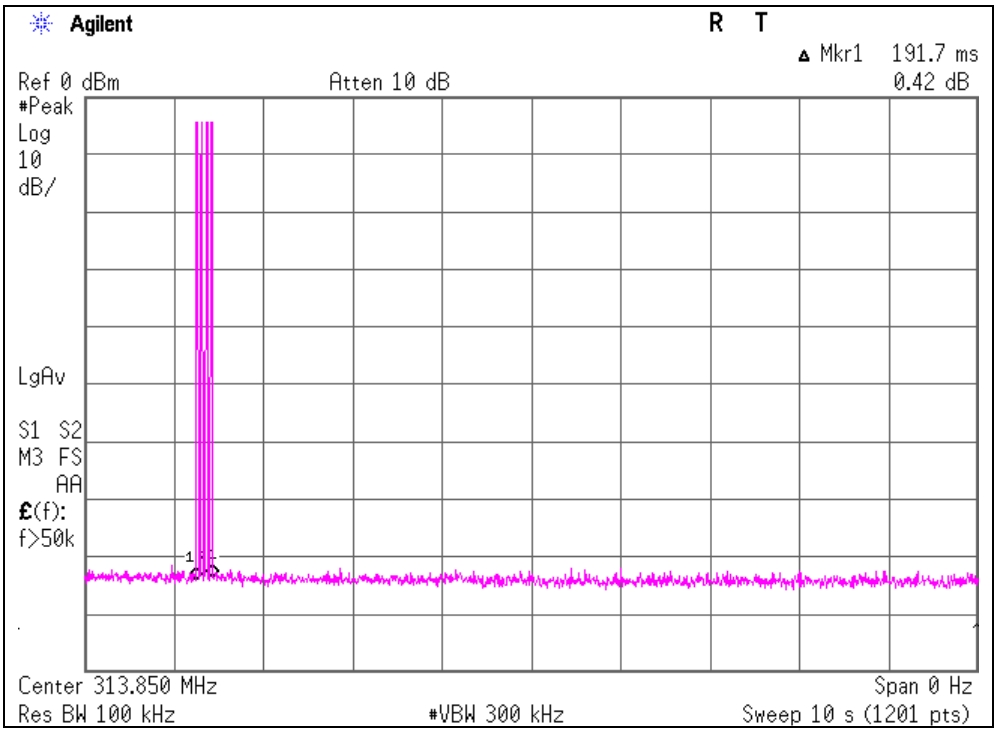
Time of Transmitting [sec]	Limit [sec]	Result
0.267	5.00	Pass



Automatically deactivate
(SMART operation)

Test place	Head Office EMC Lab. No.4 Semi Anechoic Chamber
Report No.	32AE0200-HO-02
Date	12/08/2011
Temperature/ Humidity	23 deg.C/ 42% RH
Engineer	Motoya Imura
Mode	Normal use mode

Time of Transmitting [sec]	Limit [sec]	Result
0.192	5.00	Pass



Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission)

(Keyless operation)

Test place	Head Office EMC Lab. No.4 Semi Anechoic Chamber
Report No.	32AE0200-HO-02
Date	11/20/2011
Temperature/ Humidity	23 deg.C/ 57% RH
Engineer	Motoya Imura
Mode	Transmitting mode

QP or PK

Frequency	Detector	Reading [dBuV]		Ant Factor	Loss	Gain	Duty Factor	Result [dBuV/m]		Limit	Margin [dB]		Remark Inside or Outside
[MHz]		Hor	Ver	[dB/m]	[dB]	[dB]	[dB]	Hor	Ver	[dBuV/m]	Hor	Ver	of Restricted Bands
313.816	PK	85.8	81.4	16.4	9.8	32.1	-	79.9	75.5	95.5	15.6	20.0	Carrier
627.632	PK	32.7	35.2	20.7	11.7	32.2	-	32.9	35.4	75.5	42.6	40.1	Outside
941.449	PK	33.0	31.7	25.3	13.2	31.1	-	40.4	39.1	75.5	35.1	36.4	Outside
1255.400	PK	43.2	43.2	24.6	1.8	34.0	-	35.6	35.6	75.5	39.9	39.9	Outside
1569.250	PK	44.1	44.0	25.4	2.0	33.3	-	38.2	38.1	73.9	35.7	35.8	Inside
1883.100	PK	43.2	42.2	26.0	2.2	32.6	-	38.8	37.8	75.5	36.7	37.7	Outside
2196.950	PK	45.4	45.2	27.2	2.4	32.3	-	42.7	42.5	75.5	32.8	33.0	Outside
2510.587	PK	51.9	51.0	28.6	2.6	32.2	-	50.9	50.0	75.5	24.6	25.5	Outside
2824.337	PK	53.8	52.0	28.6	2.7	32.0	-	53.1	51.3	73.9	20.8	22.6	Inside
3138.106	PK	53.6	54.0	28.7	2.9	31.9	-	53.3	53.7	75.5	22.2	21.8	Outside

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

PK with Duty factor

Frequency	Detector	Reading [dBuV]		Ant Factor	Loss	Gain	Duty Factor	Result [dBuV/m]		Limit	Margin [dB]		Remark
[MHz]		Hor	Ver	[dB/m]	[dB]	[dB]	[dB]	Hor	Ver	[dBuV/m]	Hor	Ver	
313.816	PK	85.8	81.4	16.4	9.8	32.1	-5.4	74.5	70.1	75.5	1.0	5.4	Carrier
627.632	PK	32.7	35.2	20.7	11.7	32.2	-5.4	27.5	30.0	55.5	28.0	25.5	Outside
941.449	PK	33.0	31.7	25.3	13.2	31.1	-5.4	35.0	33.7	55.5	20.5	21.8	Outside
1255.400	PK	43.2	43.2	24.6	1.8	34.0	-5.4	30.2	30.2	55.5	25.3	25.3	Outside
1569.250	PK	44.1	44.0	25.4	2.0	33.3	-5.4	32.8	32.7	53.9	21.1	21.2	Inside
1883.100	PK	43.2	42.2	26.0	2.2	32.6	-5.4	33.4	32.4	55.5	22.1	23.1	Outside
2196.950	PK	45.4	45.2	27.2	2.4	32.3	-5.4	37.3	37.1	55.5	18.2	18.4	Outside
2510.587	PK	51.9	51.0	28.6	2.6	32.2	-5.4	45.5	44.6	55.5	10.0	10.9	Outside
2824.337	PK	53.8	52.0	28.6	2.7	32.0	-5.4	47.7	45.9	53.9	6.2	8.0	Inside
3138.106	PK	53.6	54.0	28.7	2.9	31.9	-5.4	47.9	48.3	55.5	7.6	7.2	Outside

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amprifier) + Duty factor (Refer to Duty factor data sheet)

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

* The test above 1GHz was performed with PK detect. Average emission measurements were calculated with PK detect and Duty cycle factor.
* Duty Factor was calculated with the assumption of the worst condition in 100msec.
* The noise measured with PK detect was pulse emission.

Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission)

(SMART operation)

Test place	Head Office EMC Lab. No.4 Semi Anechoic Chamber
Report No.	32AE0200-HO-02
Date	11/20/2011
Temperature/ Humidity	23 deg.C/ 57% RH
Engineer	Motoya Imura
Mode	Transmitting mode

QP or PK

Frequency	Detector	Reading [dBuV]		Ant Factor	Loss	Gain	Duty Factor	Result [dBuV/m]		Limit	Margin [dB]		Remark Inside or Outside
[MHz]		Hor	Ver	[dB/m]	[dB]	[dB]	[dB]	Hor	Ver	[dBuV/m]	Hor	Ver	of Restricted Bands
313.816	PK	86.9	82.9	16.4	9.8	32.1	-	81.0	77.0	95.5	14.5	18.5	Carrier
627.632	PK	38.1	38.8	20.7	11.7	32.2	-	38.3	39.0	75.5	37.2	36.5	Outside
941.449	PK	34.0	33.1	25.3	13.2	31.1	-	41.4	40.5	75.5	34.1	35.0	Outside
1255.400	PK	43.3	46.7	24.6	1.8	34.0	-	35.7	39.1	75.5	39.8	36.4	Outside
1569.250	PK	44.2	44.2	25.4	2.0	33.3	-	38.3	38.3	73.9	35.6	35.6	Inside
1883.100	PK	43.2	42.0	26.0	2.2	32.6	-	38.8	37.6	75.5	36.7	37.9	Outside
2196.950	PK	47.7	47.1	27.2	2.4	32.3	-	45.0	44.4	75.5	30.5	31.1	Outside
2510.587	PK	55.7	54.1	28.6	2.6	32.2	-	54.7	53.1	75.5	20.8	22.4	Outside
2824.337	PK	56.1	55.3	28.6	2.7	32.0	-	55.4	54.6	73.9	18.5	19.3	Inside
3138.106	PK	56.8	57.1	28.7	2.9	31.9	-	56.5	56.8	75.5	19.0	18.7	Outside

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

PK with Duty factor

Frequency	Detector	Reading [dBuV]		Ant Factor	Loss	Gain	Duty Factor	Result [dBuV/m]		Limit	Margin [dB]		Remark
[MHz]		Hor	Ver	[dB/m]	[dB]	[dB]	[dB]	Hor	Ver	[dBuV/m]	Hor	Ver	
313.816	PK	86.9	82.9	16.4	9.8	32.1	-5.8	75.2	71.2	75.5	0.3	4.3	Carrier
627.632	PK	38.1	38.8	20.7	11.7	32.2	-5.8	32.5	33.2	55.5	23.0	22.3	Outside
941.449	PK	34.0	33.1	25.3	13.2	31.1	-5.8	35.6	34.7	55.5	19.9	20.8	Outside
1255.400	PK	43.3	46.7	24.6	1.8	34.0	-5.8	29.9	33.3	55.5	25.6	22.2	Outside
1569.250	PK	44.2	44.2	25.4	2.0	33.3	-5.8	32.5	32.5	53.9	21.4	21.4	Inside
1883.100	PK	43.2	42.0	26.0	2.2	32.6	-5.8	33.0	31.8	55.5	22.5	23.7	Outside
2196.950	PK	47.7	47.1	27.2	2.4	32.3	-5.8	39.2	38.6	55.5	16.3	16.9	Outside
2510.587	PK	55.7	54.1	28.6	2.6	32.2	-5.8	48.9	47.3	55.5	6.6	8.2	Outside
2824.337	PK	56.1	55.3	28.6	2.7	32.0	-5.8	49.6	48.8	53.9	4.3	5.1	Inside
3138.106	PK	56.8	57.1	28.7	2.9	31.9	-5.8	50.7	51.0	55.5	4.8	4.5	Outside

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amprifier) + Duty factor (Refer to Duty factor data sheet)

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

* The test above 1GHz was performed with PK detect. Average emission measurements were calculated with PK detect and Duty cycle factor.
* The noise measured with PK detect was pulse emission.

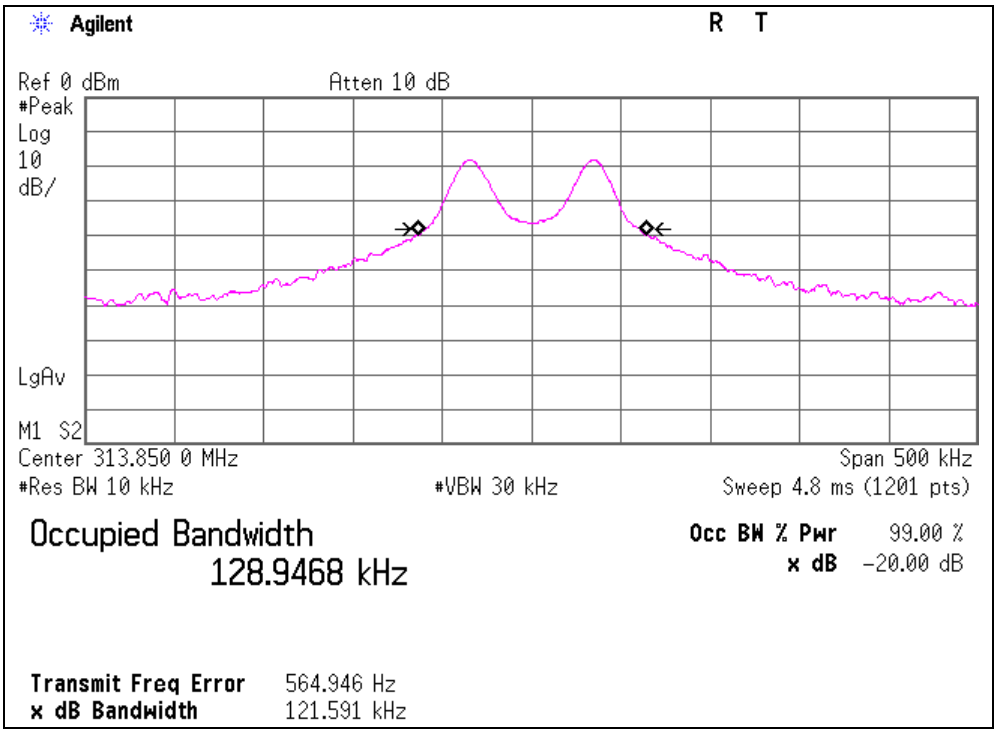
-20dB Occupied Bandwidth

(Keyless operation)

Test place	Head Office EMC Lab. No.4 Semi Anechoic Chamber
Report No.	32AE0200-HO-02
Date	11/20/2011
Temperature/ Humidity	23 deg.C/ 57% RH
Engineer	Motoya Imura
Mode	Transmitting mode

Bandwidth Limit : Fundamental Frequency **313.85** MHz x 0.25% = 784.63 kHz

-20dB Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
121.59	784.63	Pass



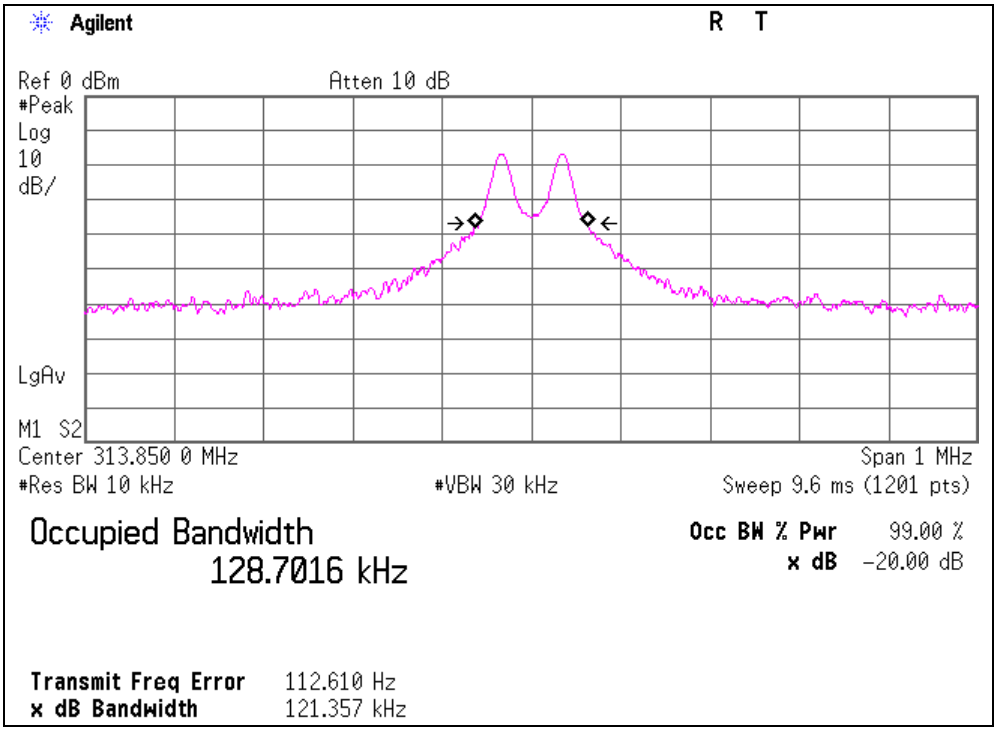
99% Occupied Bandwidth

(Keyless operation)

Test place	Head Office EMC Lab. No.4 Semi Anechoic Chamber
Report No.	32AE0200-HO-02
Date	11/20/2011
Temperature/ Humidity	23 deg.C/ 57% RH
Engineer	Motoya Imura
Mode	Transmitting mode

Bandwidth Limit : Fundamental Frequency **313.85** MHz x 0.25% = 784.63 kHz

99% Occupied Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
128.70	784.63	Pass



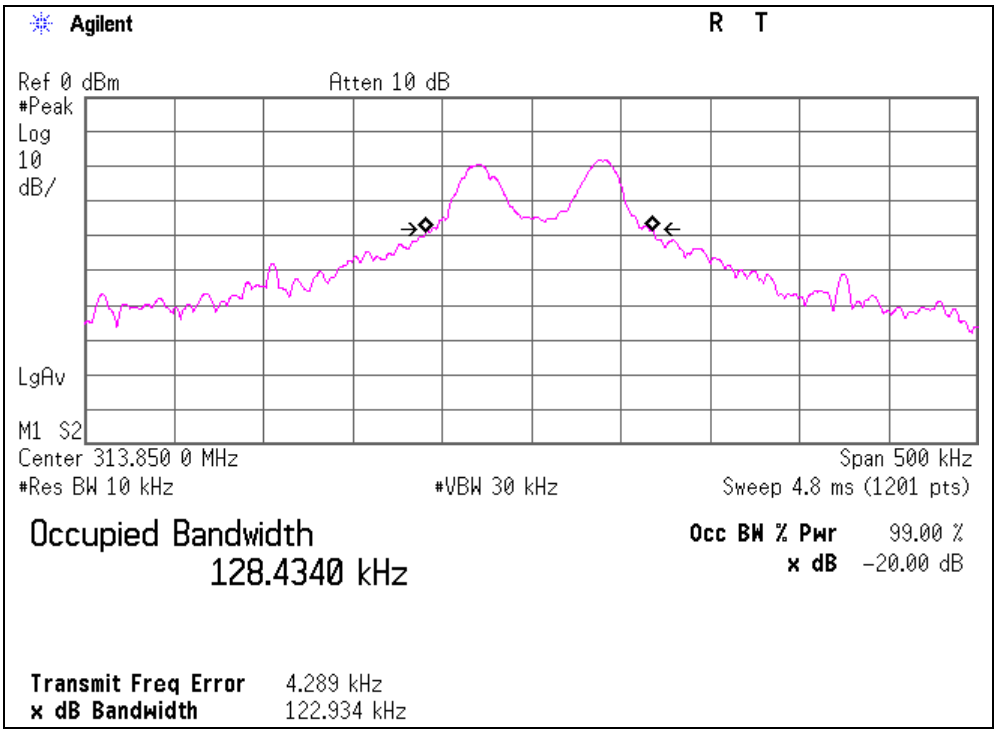
-20dB Occupied Bandwidth

(SMART operation)

Test place	Head Office EMC Lab. No.4 Semi Anechoic Chamber
Report No.	32AE0200-HO-02
Date	12/08/2011
Temperature/ Humidity	23 deg.C/ 42% RH
Engineer	Motoya Imura
Mode	Transmitting mode

Bandwidth Limit : Fundamental Frequency **313.85** MHz x 0.25% = 784.63 kHz

-20dB Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
122.93	784.63	Pass



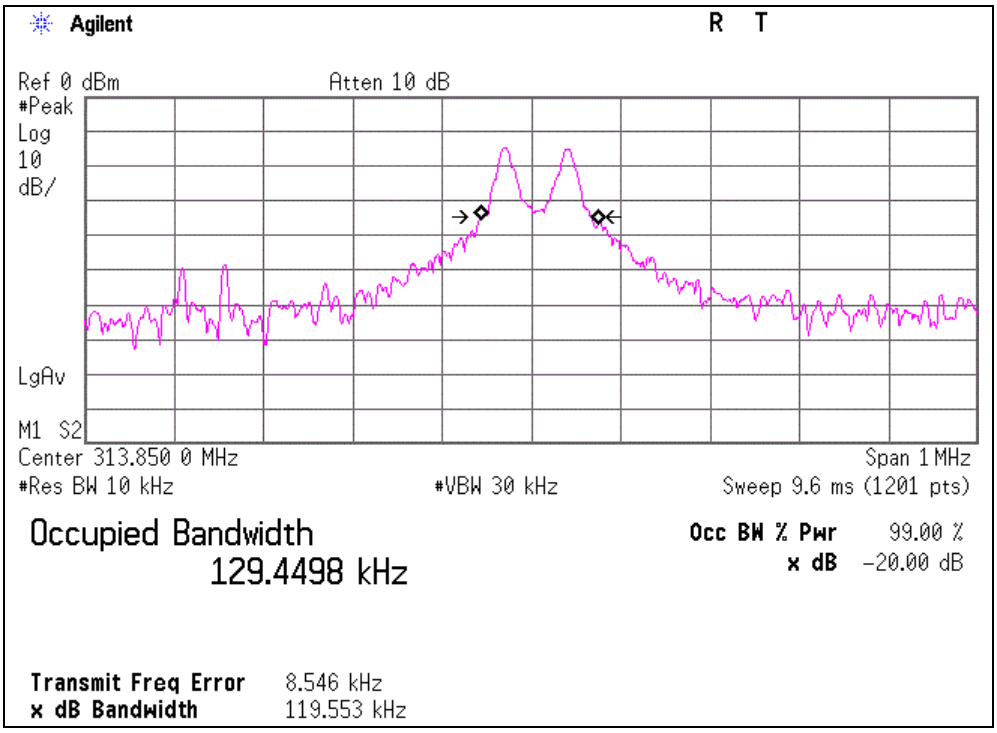
99% Occupied Bandwidth

(SMART operation)

Test place	Head Office EMC Lab. No.4 Semi Anechoic Chamber
Report No.	32AE0200-HO-02
Date	12/08/2011
Temperature/ Humidity	23 deg.C/ 42% RH
Engineer	Motoya Imura
Mode	Transmitting mode

Bandwidth Limit : Fundamental Frequency **313.85** MHz x 0.25% = 784.63 kHz

99% Occupied Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
129.45	784.63	Pass



Duty Cycle

(Keyless operation_1/3)

Test place	Head Office EMC Lab. No.4 Semi Anechoic Chamber
Report No.	32AE0200-HO-02
Date	11/20/2011
Temperature/ Humidity	23 deg.C/ 57% RH
Engineer	Motoya Imura
Mode	Transmitting mode

Type	Times	ON time(One pulse) [ms]	ON time(in 50ms) [ms]	ON time(in 100ms) [ms]
A	1	0.790	0.7896	1.5792
B	77	0.270	20.7592	41.5184
C	10	0.538	5.376	10.752

*1)ON time(in 100ms) = Times * ON time(One pulse)
*2)The train of pulses was exceeding 100msec, and that sampled 100msec was the worst case against the pulse train.
*3) The worst Duty cycle was determined to be the actual measurement value based on the comparison between the theoretical value 50% (-6dB) and the actual measured one.
Therefore, the final result was Duty cycle -5.4dB.

(Total)

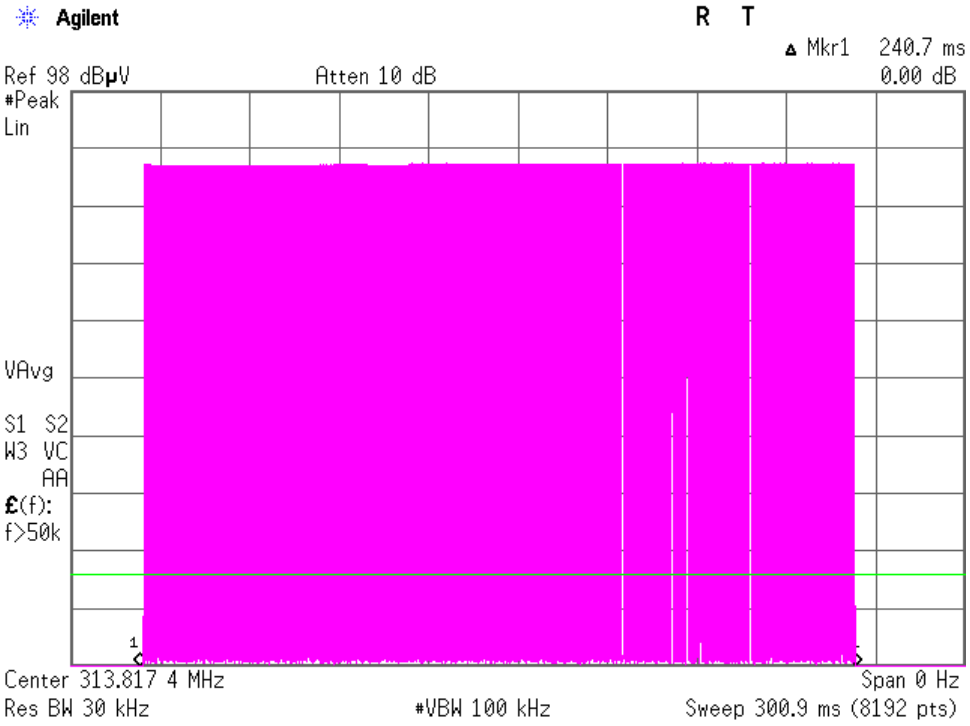
ON time [ms]	Cycle [ms]	Duty (On time/Cycle)	Duty [dB]
53.85	100.00	0.54	-5.4

*4)ON time = Type A's ON time (in 100ms) + Type B's ON time (in 100ms) + Type C' ON time (in 100ms)
*5)Duty = $20\log_{10}$(ON time/Cycle)

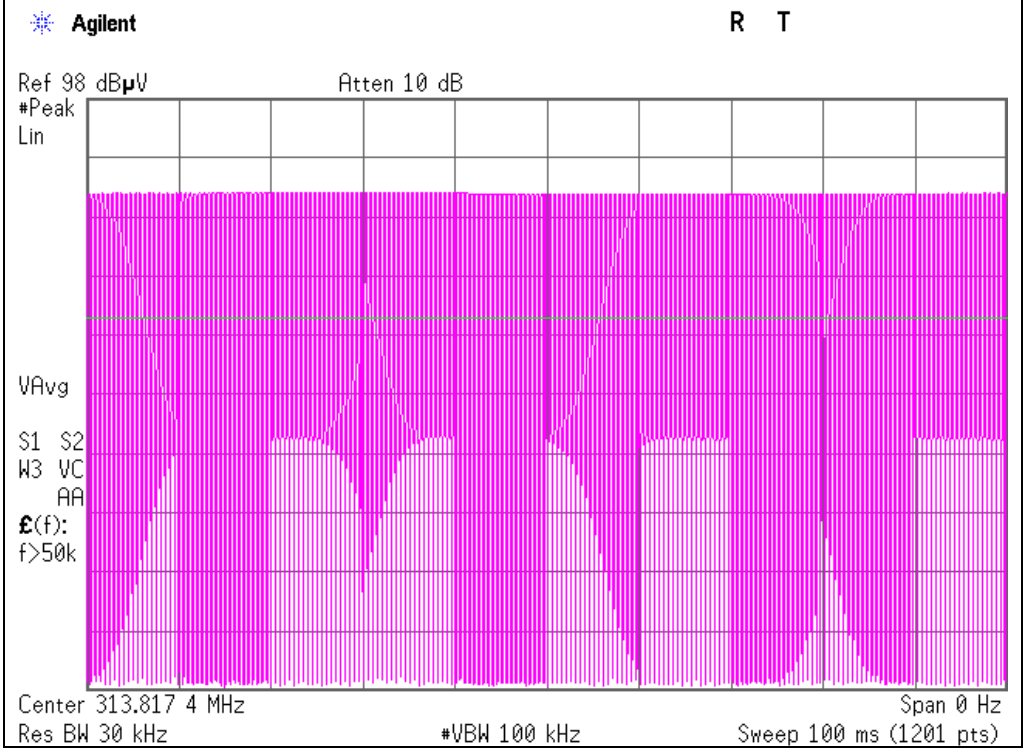
Duty Cycle

(Keyless operation_2/3)

300msec

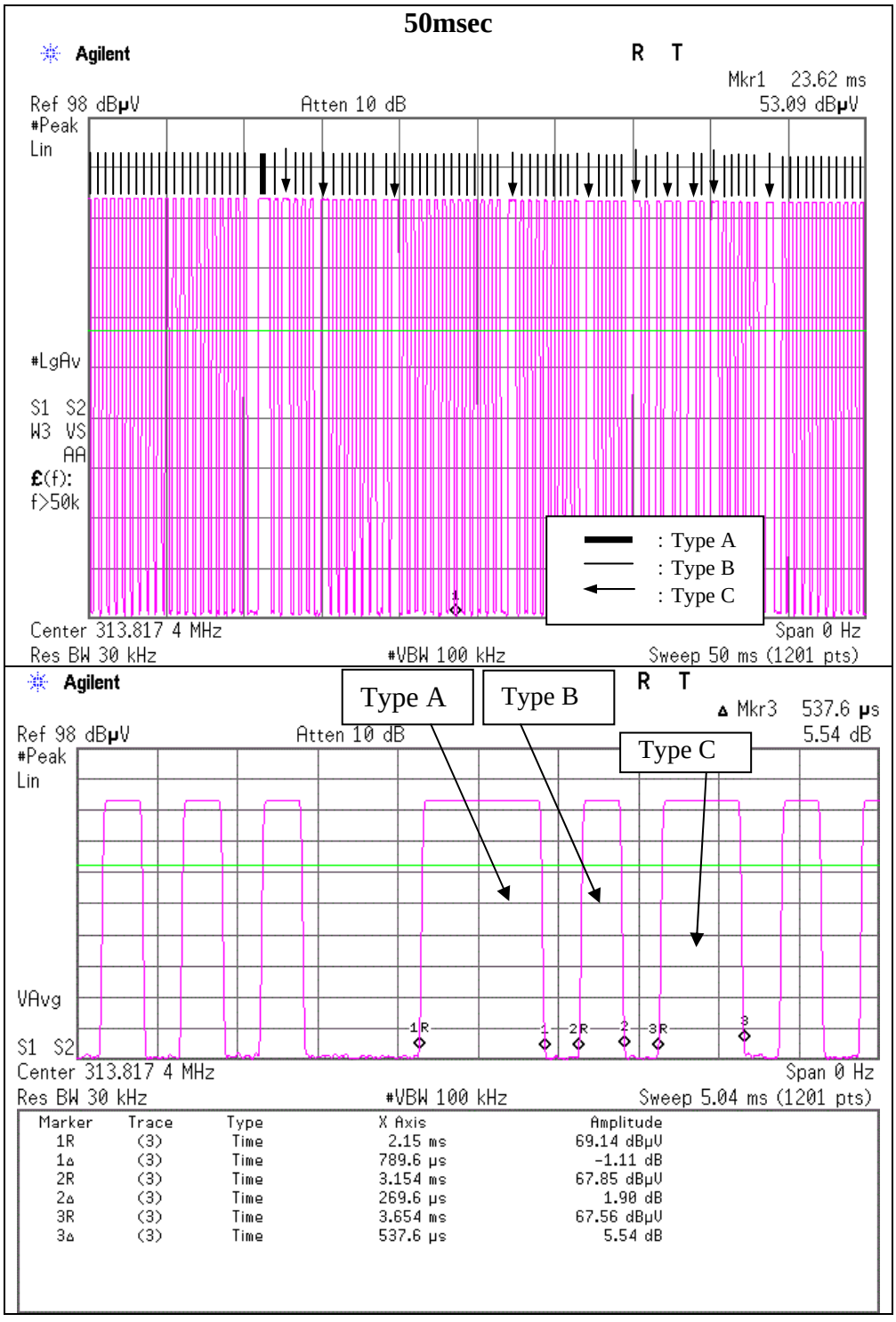


100msec



Duty Cycle

(Keyless operation_3/3)



Marker	Trace	Type	X Axis	Amplitude
1R	(3)	Time	2.15 ms	69.14 dBµV
1Δ	(3)	Time	789.6 µs	-1.11 dB
2R	(3)	Time	3.154 ms	67.85 dBµV
2Δ	(3)	Time	269.6 µs	1.90 dB
3R	(3)	Time	3.654 ms	67.56 dBµV
3Δ	(3)	Time	537.6 µs	5.54 dB

Duty Cycle
(SMART operation_1/4)

Test place	Head Office EMC Lab. No.4 Semi Anechoic Chamber
Report No.	32AE0200-HO-02
Date	12/20/2011
Temperature/ Humidity	24 deg.C/ 45% RH
Engineer	Motoya Imura
Mode	Transmitting mode

Type	Times	ON time(One pulse) [ms]	ON time(in 1Period) [ms]
A	1	0.197	0.1972
B	15	0.131	1.9635
C	72	0.073	5.2632

*1)ON time(in 1Period) = Times * ON time(One pulse)

*2) The worst Duty cycle was determined to be the actual measurement value based on the comparison between the theoretical value 50% (-6dB) and the actual measured one.
Therefore, the final result was Duty cycle -5.8dB.

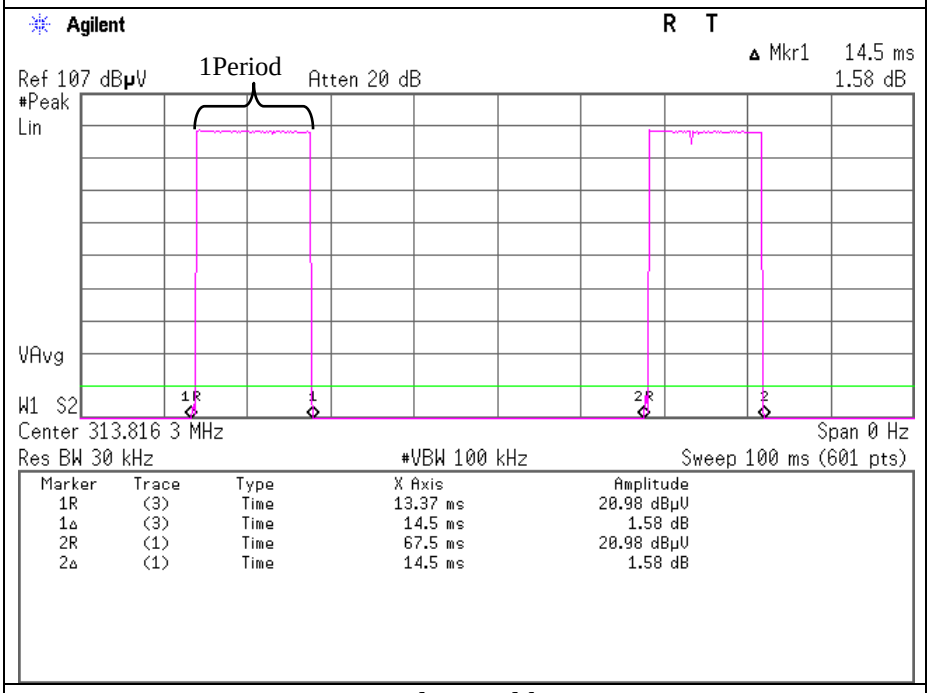
(Total)

ON time [ms]	Cycle [ms]	Duty (On time/Cycle)	Duty [dB]
7.42	14.50	0.51	-5.8

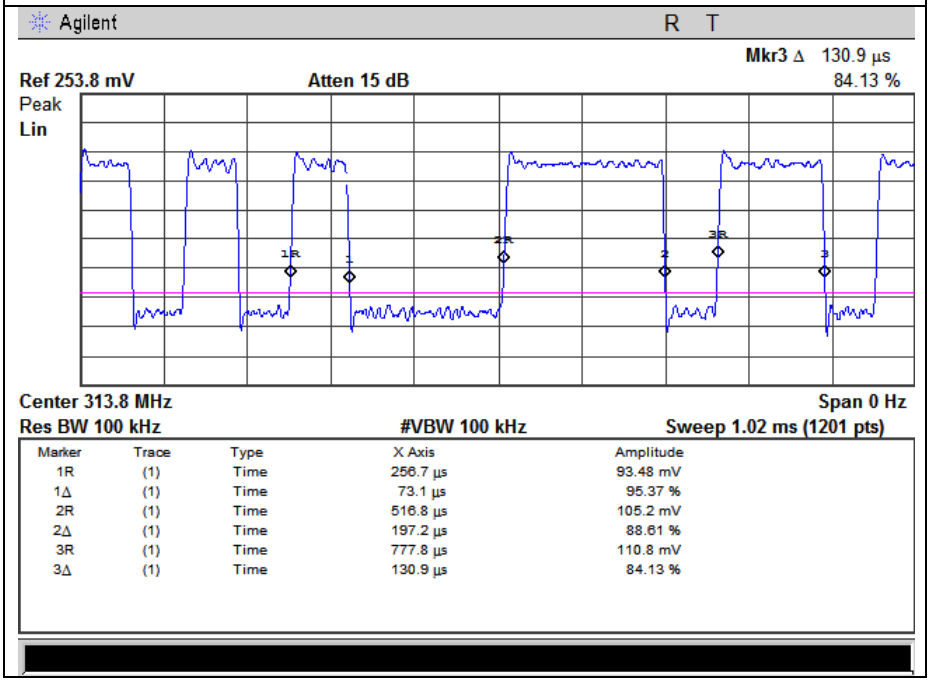
*3)ON time = Type A's ON time (in 1Period) + Type B's ON time (in 1Period) + Type C' ON time (in 1Period)
*4)Duty = $20\log_{10}$(ON time/Cycle)
*5) 1 period is 14.50msec. (See page 24)

Duty Cycle
(SMART operation_2/4)

Pulse- Period



Pulse-Width



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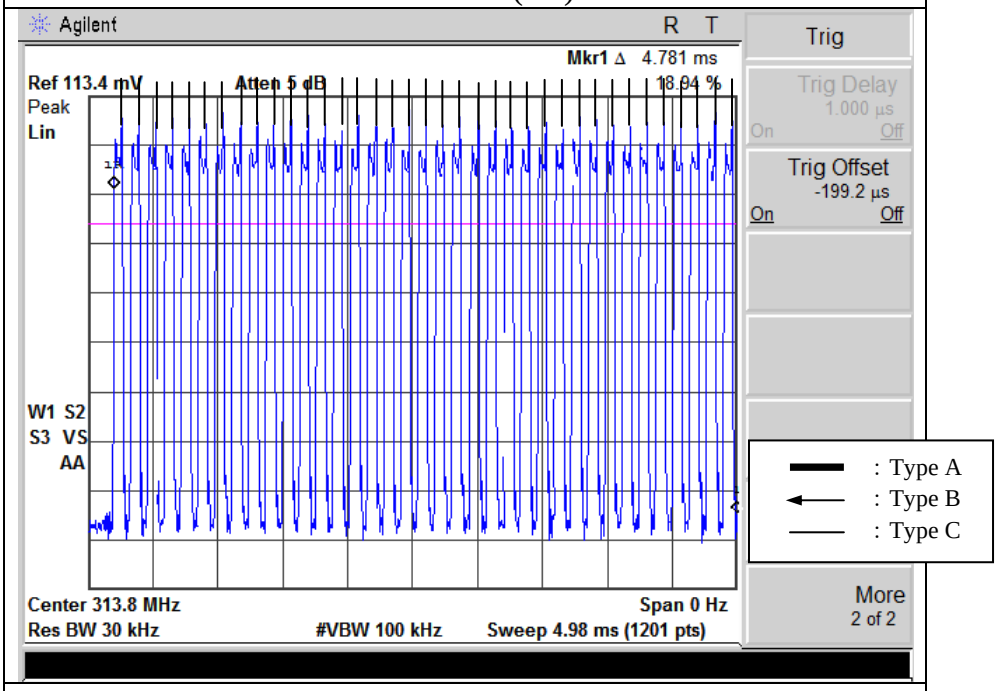
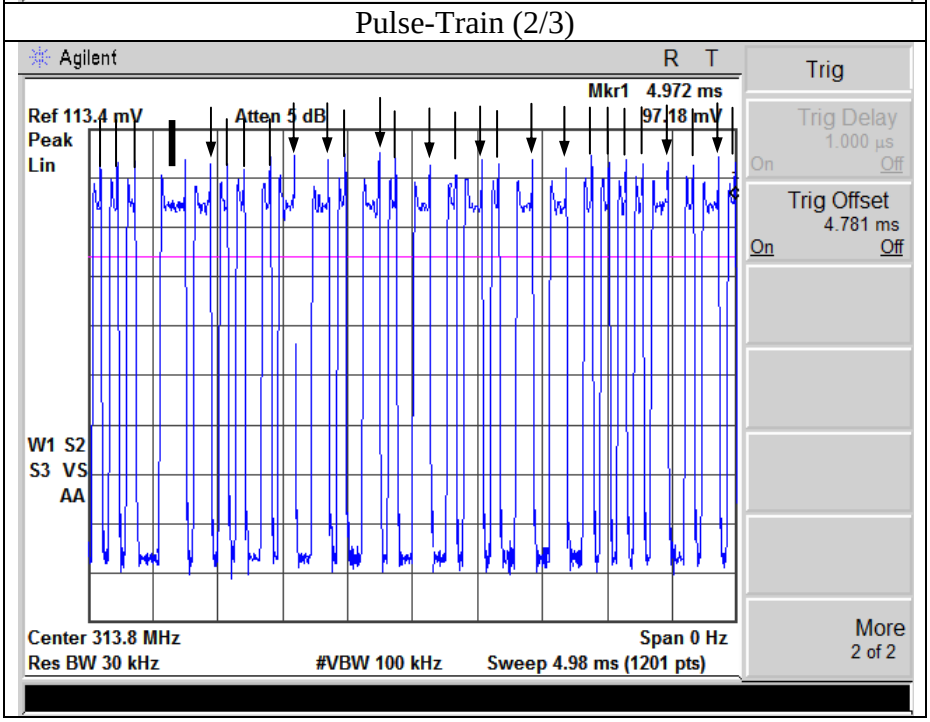
Duty Cycle

(SMART operation_3/4)

Pulse-Train (1/3)



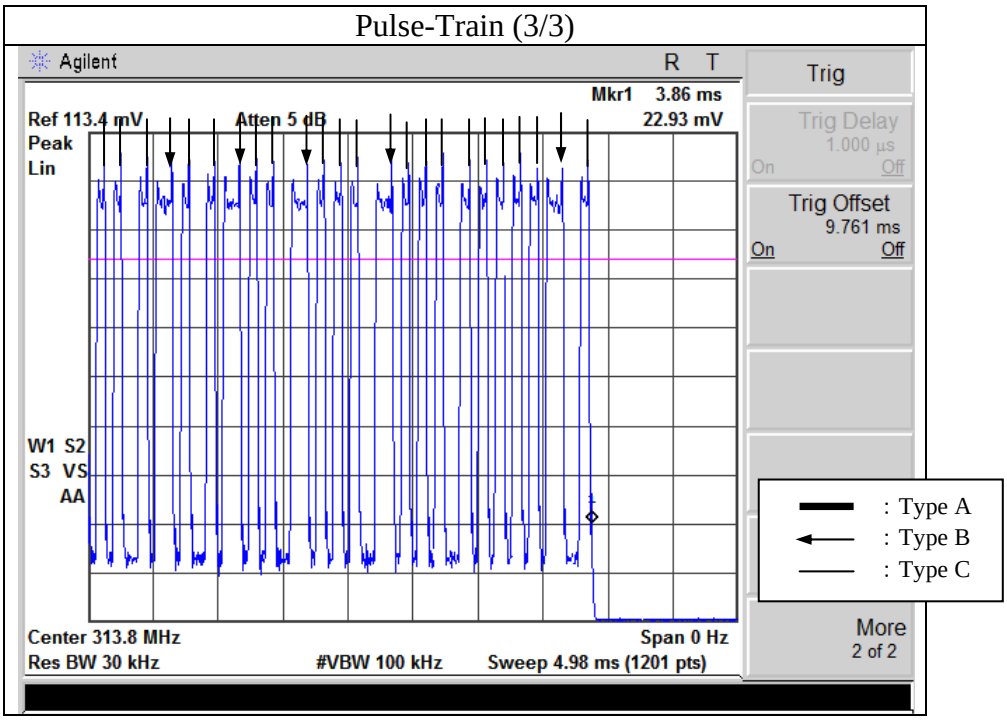
Pulse-Train (2/3)



Duty Cycle

(SMART operation_4/4)

Pulse-Train (3/3)



Receiver Spurious Emission

DATA OF RADIATED EMISSION TEST

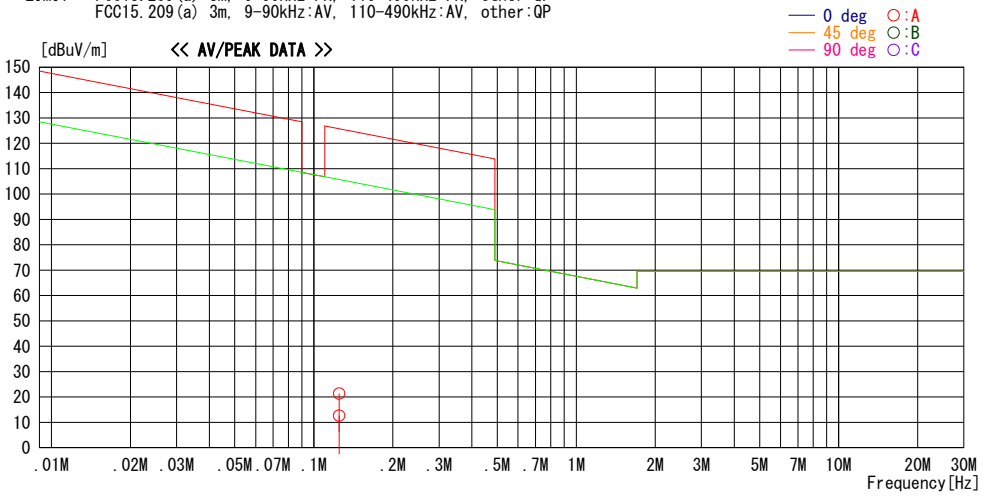
UL Japan, Inc. Head Office EMC Lab. No.4 Semi Anechoic Chamber
Date : 2011/11/20

Report No. : 32AE0200-HO-02

Temp. / Humi. : 23 deg. C / 57% RH
Engineer : Motoya Imura

Mode / Remarks : Rx 125kHz

LIMIT : FCC15.209(a) 3m, 9-90kHz:PK, 110-490kHz:PK, other:QP
FCC15.209(a) 3m, 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
0.12500	27.8	PEAK	19.9	5.9	32.2	21.4	125.7	104.3	0	A	0	NS
0.12500	19.0	AV	19.9	5.9	32.2	12.6	105.7	93.1	0	A	0	NS

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.) - GAIN(AMP.)

*NS: No signal detected.

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Receiver Spurious Emission

DATA OF RADIATED EMISSION TEST

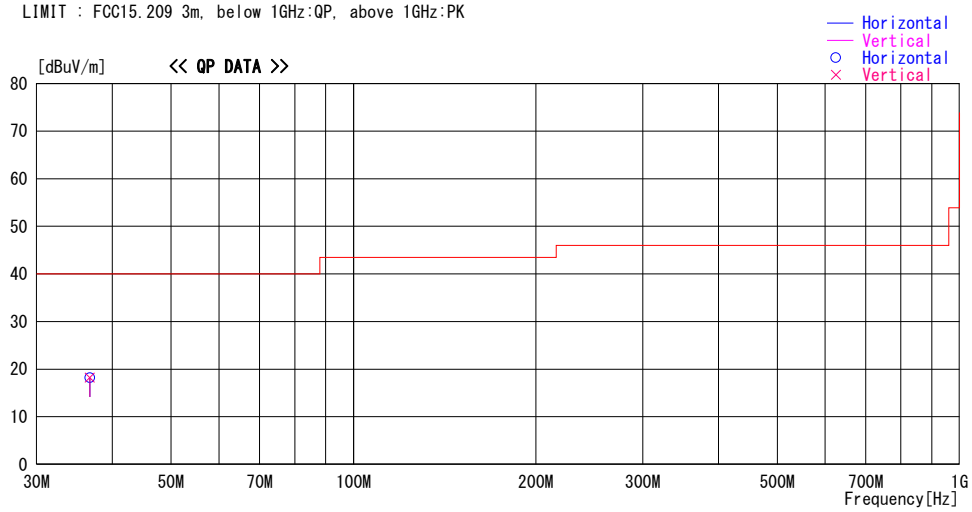
UL Japan, Inc. Head Office EMC Lab. No.4 Semi Anechoic Chamber
Date : 2011/11/20

Report No. : 32AE0200-HO-02

Temp./Humi. : 23deg. C / 57% RH
Engineer : Motoya Imura

Mode / Remarks : Rx 125kHz , WorstAxis(Hor:X,Ver:Y)

LIMIT : FCC15.209 3m, below 1GHz:QP, above 1GHz:PK



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]	
36.740	27.1	QP	16.2	-25.1	18.2	0	100	Vert.	40.0	21.8	NS
36.740	27.1	QP	16.2	-25.1	18.2	0	100	Hori.	40.0	21.8	NS

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

*NS: No signal detected.

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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	2011/03/01 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	-	RE	2011/02/23 * 12
MJM-07	Measure	PROMART	SEN1955	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-05	Spectrum Analyzer	Advantest	R3273	160400285	RE	2010/11/18 * 12
MTR-07	Test Receiver	Rohde & Schwarz	ESCI	100635	RE	2011/10/19 * 12
MLPA-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	RE	2011/10/19 * 12
MCC-113	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/SFM141(5m)/ 421-010(1m)/sucoform141-PE(1m)/RFM-E121(Switcher)	-/04178	RE	2011/07/04 * 12
MCC-31	Coaxial cable	UL Japan	-	-	RE	2011/07/28 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2011/03/04 * 12
MAT-51	Attenuator(6dB)	Weinschel	2	AS3557	RE	2011/01/14 * 12
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE	2011/08/17 * 12
MLA-08	Logperiodic Antenna	Schwarzbeck	UKLP9140-A	N/A	RE	2011/08/17 * 12
MCC-50	Coaxial Cable	UL Japan	-	-	RE	2011/03/25 * 12
MHA-21	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	RE	2011/08/11 * 12
MCC-56	Microwave Cable	Suhner	SUCOFLEX104	270875/4(1m) / 284655(5m)	RE	2011/03/02 * 12
MPA-12	MicroWave System Amplifier	Agilent	83017A	MY39500780	RE	2011/03/10 * 12
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	RE	2011/11/23 * 12
MSA-06	Spectrum Analyzer	Agilent	E4407B	MY45107638	RE	2011/04/15 * 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:
RE: Radiated emission, 99% Occupied Bandwidth, -20dB bandwidth , Automatically deactivate and Duty cycle tests