RADIO TEST REPORT

Test Report No.: 12217076S-A-R2

Applicant	**:**	**Alpine Electronics, Inc.**
Type of Equipment	**:**	**Display Unit**
Model No.	**:**	**GABI02**
FCC ID	**:**	**A269ZUA156**
Test regulation	**:**	**FCC Part15 Subpart C: 2018**
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 the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
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6. This test report covers EMC technical requirements. It does not cover administrative issues such as Manual or non-EMC test related Requirements.(if applicable)
7. The all test items in this test report are conducted by UL Japan, Inc. Shonan EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
9. This report is a revised version of 12217076S-A-R1. 12217076S-A-R1 is replaced with this report.

Date of test: April 5 to 27, 2018

Representative test engineer:

Shiro Kobayashi
Engineer
Consumer Technology Division

Approved by :

Hikaru Shirasawa
Engineer
Consumer Technology Division

☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.
☒ There is no testing item of "Non-accreditation".

RTL02610

REVISION HISTORY

Original Test Report No.: 12217076S-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	12217076S-A	May 22, 2018	-	-
1	12217076S-A-R1	June 5, 2018	4 5	Correction of General Specification Correction of FCC Part 15.31 (e)
2	12217076S-A-R2	July 5, 2018	6	Correction of Addition to standard

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SECTION 1: Customer information

Company Name	:	ALPINE Electronics, Inc.
Address	:	20-1 Yoshima-Industrial Park, Iwaki, Fukushima 970-1192, Japan
Telephone Number	:	+81-246-36-4111
Facsimile Number	:	+81-246-36-6898
Contact Person	:	Mitsuru Yoshida

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

2.1 Identification of E.U.T.

Type of Equipment	:	Display Unit
Model No.	:	GABI02
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 13.5 V
Receipt Date of Sample	:	March 16, 2018
Country of Mass-production	:	China, Mexico
Condition of EUT	:	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT	:	No Modification by the test lab

2.2 Product description

Model: GABI02 (referred to as the EUT in this report) is a Display Unit.

General Specification

Clock frequency(ies) in the system	:	Ucom: 16 MHz/ NFC: 13.56 MHz/ Xta: 27.12 MHz

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	13.56 MHz
Modulation	:	ASK
Antenna type	:	Loop
Operating Temperature	:	-40 deg.C to +85 deg C.

SECTION 3: Test specification, procedures & results

3.1 Test specification

Test specification : FCC Part 15 Subpart C
FCC Part 15 final revised on November 14, 2016 and effective December 14, 2016

Title : FCC 47 CFR Part 15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.209 Radiated emission limits, general requirements
Section 15.215 Additional provisions to the general radiated emission limitations.
Section 15.225 Operation within the bands 13.110 - 14.010 MHz.

* The revision on March 12, 2018, does not affect the test specification applied to the EUT.

3.2 Procedures & Results

Item	Test Procedure	Specification	Remarks	Deviation	Worst Margin	Results
Conducted emission	ANSI C63.10:2013 6 Standard test methods <IC>RSS-Gen 8.8	FCC 15.207 <IC> RSS-Gen 8.8	-	N/A *1)	-	-
Electric field strength of Fundamental emission	ANSI C63.10:2013 6 Standard test methods <IC>RSS-Gen 6.4, 6.12	FCC 15.225 (a) <IC> RSS-210 B.6	Radiated	N/A	69.0 dB (Vertical)	Complied
Electric field strength of Spurious emission (within the 13.110-14.010 MHz band)	ANSI C63.10:2013 6 Standard test methods <IC>RSS-Gen 6.4, 6.13	FCC 15.225 (b)(c) <IC> RSS-210 B.6	Radiated	N/A	45.5 dB (13.110 MHz & 14.010 MHz, Horizontal & Vertical)	Complied
Electric field strength of Spurious emission (outside of the 13.110-14.010 MHz band)	ANSI C63.10:2013 6 Standard test methods <IC>RSS-Gen 6.4, 6.13	FCC 15.209 FCC 15.225 (d) <IC> RSS-210 B.6	Radiated	N/A	1.7 dB (40.68 MHz, Vertical)	Complied
20dB bandwidth	ANSI C63.10:2013 6 Standard test methods <IC> -	FCC 15.215 (c) <IC> -	Radiated	N/A	-	Complied
Frequency tolerance	ANSI C63.10:2013 6 Standard test methods <IC> RSS-Gen 6.11, 8.11	FCC 15.225 (e) <IC> RSS-210 B.6	Radiated	N/A	-	Complied
Note: UL Japan's Work Procedures No. 13-EM-W0420 and 13-EM-W0422 *1) The test is not applicable since the EUT has no AC mains.						

FCC Part 15.31 (e)

This EUT provides stable voltage constantly to RF part regardless of input voltage. Instead of a new battery, DC power supply was used for the test. That does not affect the test result. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

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

3.3 Addition to standard

Item	Test Procedure	Specification	Remarks	Worst Margin	Results
Occupied Bandwidth (99 %)	ANSI C63.10:2013 6.Standard test methods RSS-Gen 6.6	RSS-Gen 4.6.1	Radiated	-	-
Note: UL Japan's EMI Work Procedures No.13-EM-W0420 and 13-EM-W0422.					

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

3.4 Uncertainty

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

Shonan EMC Lab.

Item	Frequency range	Uncertainty (+/-)				
		No. 1 SAC / SR	No. 2 SAC / SR	No. 3 SAC / SR	No. 4 SAC / SR	No. 5,6,8 SR
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.2 dB	3.2 dB	3.3 dB	-	-
	30 MHz-200 MHz	4.9 dB	4.8 dB	4.9 dB	-	-
	200 MHz-1 GHz	6.1 dB	6.1 dB	6.1 dB	-	-
	1 GHz-6 GHz	4.7 dB	4.7 dB	4.7 dB	-	-
	6 GHz-18 GHz	5.3 dB	5.3 dB	5.3 dB	-	-
	18 GHz-40 GHz	5.6 dB	5.6 dB	5.6 dB	-	-
Radiated emission (Measurement distance: 1 m)	1 GHz-18 GHz	5.6 dB	5.6 dB	5.6 dB	-	-
	18 GHz-40 GHz	5.9 dB	5.9 dB	5.9 dB	-	-

SAC=Semi-Anechoic Chamber
SR= Shielded Room is applied besides radiated emission

Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1 GHz (Average Detector)_SPM-06	0.48 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	0.66 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.47 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	0.64 dB
Spurious emission (Conducted) below 1GHz	1.8 dB
Spurious emission (Conducted) 1 GHz-3 GHz	1.7 dB
Spurious emission (Conducted) 3 GHz-18 GHz	2.5 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.5 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.7 dB
Bandwidth Measurement	1.01 %
Duty cycle and Time Measurement	0.012 %

Radiated emission test

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

3.5 Test location

UL Japan, Inc. Shonan EMC Lab.
1-22-3, Megumigaoka, Hiratsuka-shi, Kanagawa-ken 259-1220 JAPAN
Telephone number : +81 463 50 6400
Facsimile number : +81 463 50 6401
JAB Accreditation No. : RTL02610
FCC Test Firm Registration Number: 839876

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

3.6 Test setup, Data of EMI & Test instruments

Refer to APPENDIX.

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

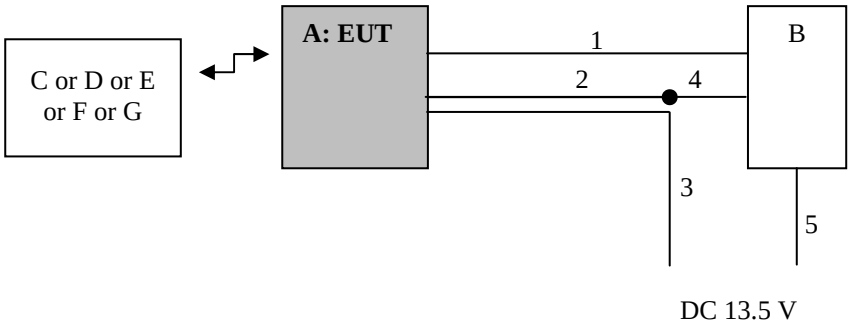
4.1 Operating modes

The EUT exercise program used during testing was designed to exercise the various system components in a manner similar to typical use.
Test sequence is used: Transmitting (13.56 MHz)

Power settings	Fixed
Firmware Version	Ver.0900

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

4.2 Configuration and peripherals



* Test data was taken under worse case conditions.

Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Display Unit	GABI02	2	Alpine Electronics, Inc.	EUT
B	CAN BOX	-	-	Alpine Electronics, Inc.	-
C	Tag	NFC Forum Type1	-	-	-
D	Tag	NFC Forum Type2	TS-C1-E52351	-	-
E	Tag	NFC Forum Type3	TS-C1-E83624	-	-
F	Tag	NFC Forum Type4	-	AdvanIDe	-
G	Tag	ISO15693 Tag	-	NXP	-

List of cables used

No.	Cable	Length (m)	Shield-Cable	Shield-Connector	Remarks
1	Signal	5.1	Unshielded	Unshielded	-
2	Signal	5.1	Unshielded	Unshielded	-
3	DC	5.1	Unshielded	Unshielded	-
4	Signal	0.45	Unshielded	Unshielded	-
5	DC	0.3	Unshielded	Unshielded	-

SECTION 5: Radiated emission

5.1 Operating environment

Test place : See test data (APPENDIX 1)
Temperature : See test data (APPENDIX 1)
Humidity : See test data (APPENDIX 1)

5.2 Test configuration

EUT was placed on a platform of nominal size, 1.0 m by 1.5 m, raised 80 cm above the conducting ground plane. That has very low permittivity.
Photographs of the set up are shown in APPENDIX 3.

5.3 Test procedure

The Radiated Electric Field Strength intensity has been measured on a semi-anechoic chamber with a ground plane at a distance of 3 m.
Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30 m open are 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 414788. 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 Radiated Electric Field Strength intensity has been measured with a ground plane and at a distance of 3 m.

Frequency: From 9 kHz to 30 MHz at distance 3 m (Refer to Figure 2)
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: 0 deg., 45 deg., 90 deg. and 135 deg.) and horizontal polarization. Drawing of the antenna direction is shown in Figure 1.

Frequency: From 30 MHz to 1 GHz at distance 3 m (Refer to Figure 2).
The measuring antenna height was varied between 1 and 4 m 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.

Measurements were performed with QP, PK, and AV detector.
The radiated emission measurements were made with the following detector function of the test receiver.

	9 kHz to 90 kHz & 110 kHz to 150 kHz	90 kHz to 110 kHz	150 kHz to 490 kHz	490 kHz to 30 MHz	30 MHz to 1 GHz
Detector Type	PK/AV	QP	PK/AV	QP	QP
IF Bandwidth	200 Hz	200 Hz	10 kHz	9 kHz	120 kHz
Distance factor *1)	-80 dB	-80 dB	-80 dB	-40 dB	-
Measuring antenna	Loop antenna				Biconical (30 MHz - 199.99 MHz) Logperiodic (200 MHz - 1 GHz)

*1) FCC 15.31 (f)(2) (9 kHz-30 MHz)
Distance Factor: 40 x log (3 m / 300 m) = -80 dB
Distance Factor: 40 x log (3 m / 30 m) = -40 dB

The EUT was set at 56.7 degree (on the condition that the horizontal plane is set to 0 deg.) as normal position according to the EUT's specification.

Figure 1. Direction of the Loop Antenna

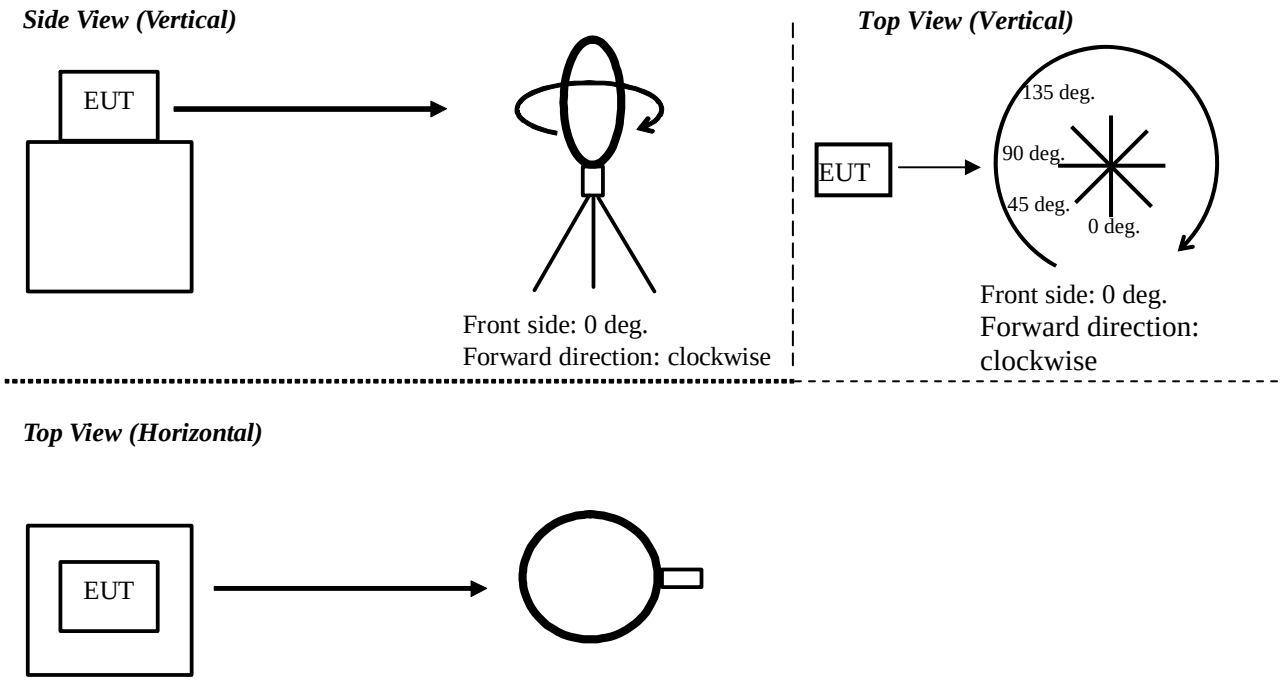
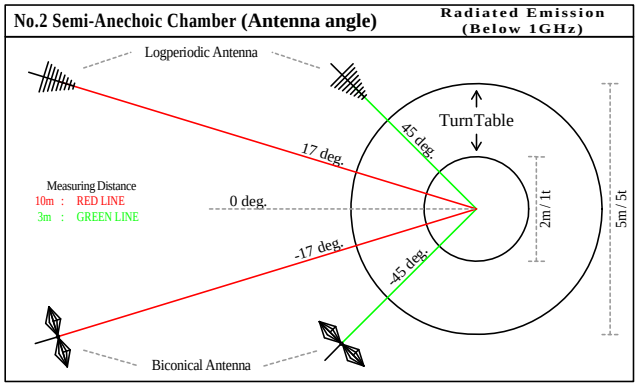


Figure 2. Antenna angle



5.4 Results

Summary of the test results : Pass

Refer to APPENDIX 1

SECTION 6: 20 dB bandwidth & Occupied bandwidth (99 %)

Test procedure

The test was measured with a spectrum analyzer using a test fixture.

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
20 dB Bandwidth	2 to 5 times of OBW	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
99 % Occupied Bandwidth	Enough width to display measured Bandwidth	1 to 5 % of Span	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer

Summary of the test results: Pass
Refer to APPENDIX 1

SECTION 7: Frequency Tolerance

Test procedure
The test was measured with a frequency counter using a test fixture.
The temperature test was started after the temperature stabilization time of 30 minutes.
The test was begun from 50 deg.C and the temperature was lowered each 10 deg.C.

Summary of the test results: Pass
Refer to APPENDIX 1

APPENDIX 1: Data of Radio tests

Data of Electric field strength of Fundamental emission and Spurious emission within the band: FCC15.225(a)(b)(c)

UL Japan, Inc.
Shonan EMC Lab., No.2 Semi Anechoic Chamber

Company:	Alpine Electronics, Inc.	Regulation:	FCC Part15 Subpart C 15.225
Equipment:	Display Unit	Test Distance:	3 m
Model:	GABI02	Date:	April 5, 2018
Sample No.:	2	Temperature:	22 deg.C
Power:	DC 13.5 V	Humidity:	43 %RH
Mode:	Transmitting 13.56 MHz	ENGINEER:	Takahiro Suzuki

Remarks: : NFC Forum Type 2, with Tag , Vertical polarization (antenna angle) of the worst case: 0 deg

Fundamental emission

No.	FREQ	Test Receiver Reading		Antenna Factor	Loss	AMP GAIN	Distance factor	RESULT		LIMIT (30 m)	MARGIN	
		Hor	Ver					Hor	Ver		Hor	Ver
	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]
1	13.560	54.3	61.1	19.1	6.7	31.9	-40.0	8.1	14.9	83.9	75.8	69.0

Calculation:Result[dBuV/m]=Reading[dBuV]+Ant.Fac[dB/m]+Loss(Cable+ATT)[dB]-Gain(AMP)[dB]+Distance factor[dB]

Distance factor: 40 x log (3 m/30 m) = -40 dB

Limits (30 m)

・13.553 MHz to 13.56 7MHz : 83.9 dBuV/m (FCC 15.225(a))

Spurious emission within the band

No.	FREQ	Test Receiver Reading		Antenna Factor	Loss	AMP GAIN	Distance factor	RESULT		LIMIT (30m)	MARGIN	
		Hor	Ver					Hor	Ver		Hor	Ver
	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]
1	13.110	30.1	30.1	19.2	6.6	31.9	-40.0	-16.0	-16.0	29.5	45.5	45.5
2	13.349	32.0	35.2	19.2	6.7	31.9	-40.0	-14.1	-10.9	40.5	54.6	51.4
3	13.410	30.1	30.6	19.2	6.7	31.9	-40.0	-16.0	-15.5	40.5	56.5	56.0
4	13.456	30.7	32.7	19.1	6.7	31.9	-40.0	-15.4	-13.4	50.4	65.8	63.8
5	13.553	39.5	44.3	19.1	6.7	31.9	-40.0	-6.6	-1.8	50.4	57.0	52.2
6	13.567	42.3	47.2	19.1	6.7	31.9	-40.0	-3.9	1.1	50.4	54.3	49.3
7	13.668	30.8	33.1	19.1	6.7	31.9	-40.0	-15.3	-13.1	50.4	65.7	63.5
8	13.710	30.3	30.8	19.1	6.7	31.9	-40.0	-15.8	-15.3	40.5	56.3	55.8
9	13.772	32.9	36.0	19.1	6.7	31.9	-40.0	-13.3	-10.1	40.5	53.8	50.6
10	14.010	30.2	30.2	19.1	6.7	31.9	-40.0	-16.0	-16.0	29.5	45.5	45.5

Calculation:Result[dBuV/m]=Reading[dBuV]+Ant.Fac[dB/m]+Loss(Cable+ATT)[dB]-Gain(AMP)[dB]+Distance factor[dB]

Outside filed strength frequencies

・Fc±7 kHz:13.553 MHz to 13.567 MHz

・Fc±150 kHz:13.410 MHz to 13.710 MHz

・Fc±450 kHz:13.110 MHz to 14.010 MHz

Fc = 13.56 MHz

Limits (30 m)

・13.410 MHz to 13.553 MHz and 13.567 MHz to 13.710 MHz : 50.4 dBuV/m (FCC 15.225(b))

・13.110MHz to 13.410MHz and 13.710MHz to 14.010MHz : 40.5dBuV/m (FCC 15.225(c))

・Below 13.110 MHz and Above 14.010 MHz : 29.5 dBuV/m (FCC 15.225(d)and FCC 15.209)

Radiated Emission

UL Japan, Inc.
Shonan EMC Lab. No.2 Semi Anechoic Chamber

Company:	Alpine Electronics, Inc.	Regulation:	FCC Part15 Subpart C 15.225
Equipment:	Display Unit	Test Distance:	3 m
Model:	GABI02	Date:	April 5, 2018
Sample No.:	2	Temperature:	22 deg.C
Power:	DC 13.5 V	Humidity:	43 %RH
Mode:	Transmitting 13.56 MHz	ENGINEER:	Takahiro Suzuki

EUT axis: Below 30 MHz, NFC Forum Type 2, with Tag , Vertical polarization (antenna angle) of the worst case: 0 deg
Above 30 MHz, NFC Forum Type 2, with Tag

Remarks:

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	27.12	QP	29.7	18.6	7.0	31.9	-40.0	-16.6	29.5	46.1	-	200	* Limit: 30m
Hori.	40.68	QP	41.1	14.1	7.1	31.9	0.0	30.3	40.0	9.7	235	121	
Hori.	187.94	QP	41.0	16.2	8.8	31.8	0.0	34.2	43.5	9.3	184	283	
Hori.	244.08	QP	45.3	11.5	6.0	31.7	0.0	31.1	46.0	14.9	129	132	
Hori.	257.64	QP	45.2	11.8	6.1	31.7	0.0	31.4	46.0	14.6	141	120	
Hori.	707.01	QP	38.8	19.7	8.8	31.6	0.0	35.7	46.0	10.3	132	41	
Vert.	27.12	QP	30.0	18.6	7.0	31.8	-40.0	-16.3	29.5	45.8	-	66	* Limit: 30m
Vert.	40.68	QP	49.0	14.1	7.1	31.9	0.0	38.3	40.0	**1.7**	100	56	
Vert.	67.80	QP	44.3	6.6	7.2	31.9	0.0	26.2	40.0	13.8	100	58	
Vert.	494.90	QP	41.1	17.4	7.7	31.6	0.0	34.6	46.0	11.4	100	38	
Vert.	989.81	QP	37.9	22.3	10.1	30.2	0.0	40.1	53.9	13.9	168	192	

Result = Reading + Ant Factor + Loss (Cable+ATT+ΔAF(above 30 MHz)) - Gain(Amprifier) + Distance factor(below 30 MHz)
* Other frequency noises omitted in this report were not seen or have enough margin (more than 20 dB).
* Carrier level (Result at 3 m): Hor= 48.1 dBuV/m, Ver= 54.9 dBuV/m

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Radiated Emission (Worst mode plot)

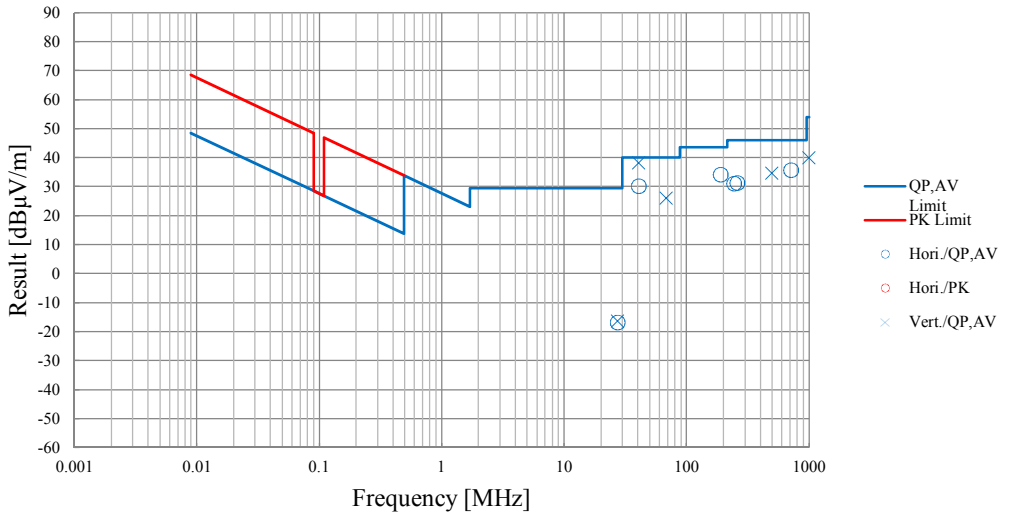
UL Japan, Inc.
Shonan EMC Lab. No.2 Semi Anechoic Chamber

Company:	Alpine Electronics, Inc	Regulation:	FCC Part15 Subpart C 15.225
Equipment:	Display Unit	Test Distance:	3 m
Model:	GABI02	Date:	April 5, 2018
Sample No.:	2	Temperature:	22 deg.C
Power:	DC 13.5 V	Humidity:	43 %RH
Mode:	Transmitting 13.56 MHz	ENGINEER:	Takahiro Suzuki

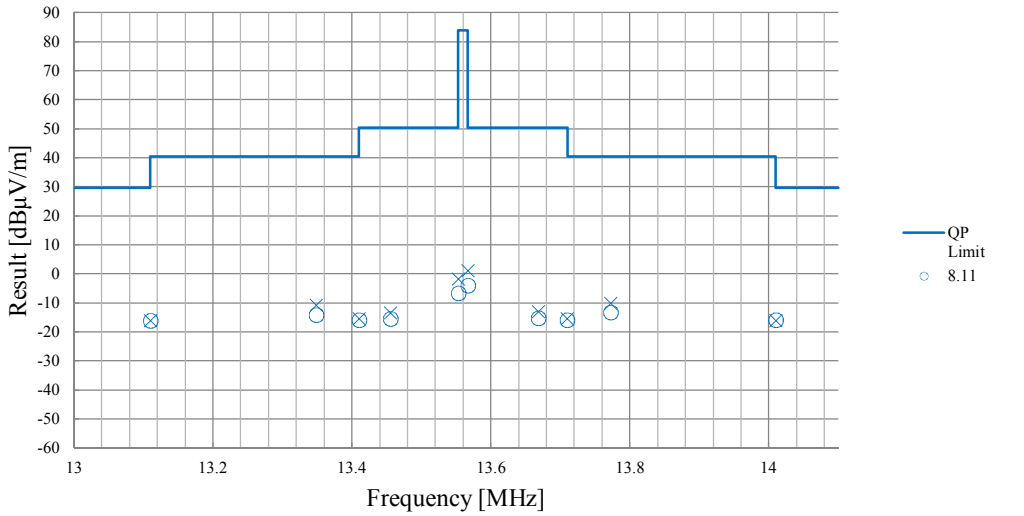
EUT axis: Below 30 MHz, NFC Forum Type 2, with Tag , Vertical polarization (antenna angle) of the worst case: 0 deg
Above 30 MHz, NFC Forum Type 2, with Tag

Remarks: These plots data contains sufficient number to show the trend of characteristic features for EUT.

Spurious emission plot



Within band plot



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Data of Frequency Tolerance

UL Japan, Inc.
Shonan EMC Lab. No.5 Shielded room

Company	Alpine Electronics, Inc.		
Equipment	Display Unit	Regulation	FCC Part15 Subpart C 15.225 (e)
Model	GABI02	Date	April 27, 2018
Serial No.	2	Temperature	23 deg.C
Power	DC 13.5 V	Humidity	41 %RH
Mode	Transmitting 13.56 MHz	ENGINEER	Shiro Kobayashi

Temperature Variation: -20 deg.C

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency tolerance (%)	Limit (%)
startup	13.56	13.560376	0.000376	0.00277	0.010
after 2 minutes	13.56	13.560379	0.000379	0.00279	0.010
after 5 minutes	13.56	13.560380	0.000380	0.00280	0.010
after 10 minutes	13.56	13.560378	0.000378	0.00279	0.010

Temperature Variation: -10 deg.C

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency tolerance (%)	Limit (%)
startup	13.56	13.560427	0.000427	0.00315	0.010
after 2 minutes	13.56	13.560426	0.000426	0.00314	0.010
after 5 minutes	13.56	13.560424	0.000424	0.00313	0.010
after 10 minutes	13.56	13.560423	0.000423	0.00312	0.010

Temperature Variation: 0 deg.C

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency tolerance (%)	Limit (%)
startup	13.56	13.560433	0.000433	0.00319	0.010
after 2 minutes	13.56	13.560434	0.000434	0.00320	0.010
after 5 minutes	13.56	13.560434	0.000434	0.00320	0.010
after 10 minutes	13.56	13.560435	0.000435	0.00321	0.010

Temperature Variation: 10 deg.C

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency tolerance (%)	Limit (%)
startup	13.56	13.560426	0.000426	0.00314	0.010
after 2 minutes	13.56	13.560426	0.000426	0.00314	0.010
after 5 minutes	13.56	13.560425	0.000425	0.00313	0.010
after 10 minutes	13.56	13.560426	0.000426	0.00314	0.010

Temperature Variation: 20 deg.C

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency tolerance (%)	Limit (%)
startup	13.56	13.560398	0.000398	0.00294	0.010
after 2 minutes	13.56	13.560401	0.000401	0.00296	0.010
after 5 minutes	13.56	13.560403	0.000403	0.00297	0.010
after 10 minutes	13.56	13.560404	0.000404	0.00298	0.010

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Data of Frequency Tolerance

Temperature Variation: 30 deg.C

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency tolerance (%)	Limit (%)
startup	13.56	13.560376	0.000376	0.00277	0.010
after 2 minutes	13.56	13.560377	0.000377	0.00278	0.010
after 5 minutes	13.56	13.560377	0.000377	0.00278	0.010
after 10 minutes	13.56	13.560377	0.000377	0.00278	0.010

Temperature Variation: 40 deg.C

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency tolerance (%)	Limit (%)
startup	13.56	13.560362	0.000362	0.00267	0.010
after 2 minutes	13.56	13.560360	0.000360	0.00265	0.010
after 5 minutes	13.56	13.560359	0.000359	0.00265	0.010
after 10 minutes	13.56	13.560359	0.000359	0.00265	0.010

Temperature Variation: 50 deg.C

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency tolerance (%)	Limit (%)
startup	13.56	13.560345	0.000345	0.00254	0.010
after 2 minutes	13.56	13.560345	0.000345	0.00254	0.010
after 5 minutes	13.56	13.560345	0.000345	0.00254	0.010
after 10 minutes	13.56	13.560344	0.000344	0.00254	0.010

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Data of Frequency Tolerance

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Company	Alpine Electronics, Inc.		
Equipment	Display Unit	Regulation	FCC Part15 Subpart C 15.225 (e)
Model	GABI02	Date	April 27, 2018
Serial No.	2	Temperature	23 deg.C
Power	DC 13.5 V	Humidity	41 %RH
Mode	Transmitting 13.56 MHz	ENGINEER	Shiro Kobayashi

Voltage Variation: DC 11.475 V
Temperature Variation: 20 deg.C

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency tolerance (%)	Limit (%)
startup	13.56	13.560404	0.000404	0.00298	0.010
after 2 minutes	13.56	13.560405	0.000405	0.00299	0.010
after 5 minutes	13.56	13.560405	0.000405	0.00299	0.010
after 10 minutes	13.56	13.560405	0.000405	0.00299	0.010

Voltage Variation: DC 15.525 V
Temperature Variation: 20 deg.C

Test Conditions	Original Frequency (MHz)	Measure Frequency (MHz)	Frequency Error (MHz)	Frequency tolerance (%)	Limit (%)
startup	13.56	13.560406	0.000406	0.00299	0.010
after 2 minutes	13.56	13.560407	0.000407	0.00300	0.010
after 5 minutes	13.56	13.560406	0.000406	0.00299	0.010
after 10 minutes	13.56	13.560407	0.000407	0.00300	0.010

20 dB bandwidth & 99 % Occupied bandwidth: FCC 15.215 / RSS-Gen

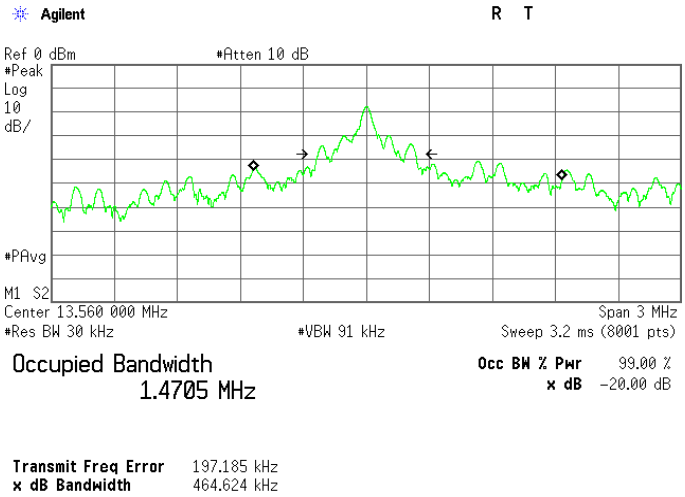
UL Japan, Inc.
Shonan EMC Lab. No.5 Shielded Room

Company:	Alpine Electronics, Inc.	Regulation:	FCC Part15 Subpart C 15.215
Equipment:	Display Unit		
Model:	GABI02	Date:	April 27, 2018
Sample No.:	2	Temperature:	23 deg.C
Power:	DC 13.5 V	Humidity:	41 %RH
Mode:	Transmitting 13.56 MHz	ENGINEER:	Shiro Kobayashi

Tag: Type 1

20 dB Bandwidth: 464.624 kHz

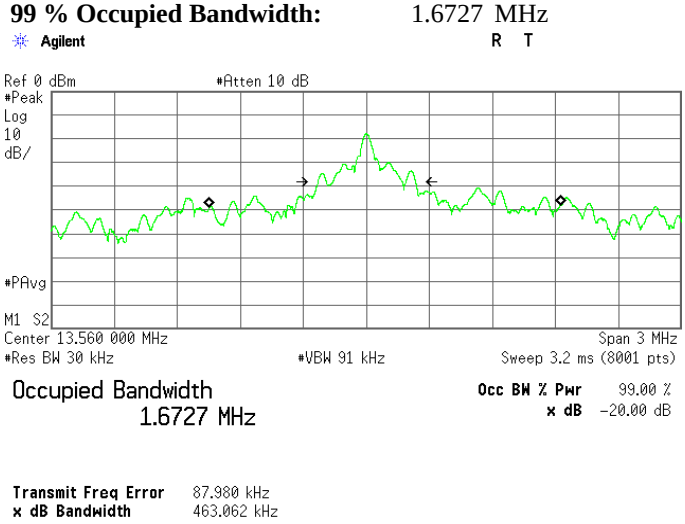
99 % Occupied Bandwidth: 1.4705 MHz



Tag: Type 2

20 dB Bandwidth: 463.062 kHz

99 % Occupied Bandwidth: 1.6727 MHz



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20 dB bandwidth & 99 % Occupied bandwidth: FCC 15.215 / RSS-Gen

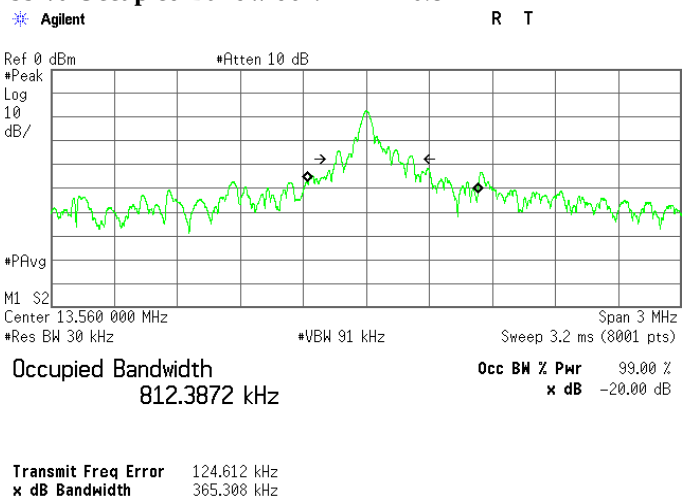
UL Japan, Inc.
Shonan EMC Lab. No.5 Shielded Room

Company:	Alpine Electronics, Inc.	Regulation:	FCC Part15 Subpart C 15.215
Equipment:	Display Unit		
Model:	GABI02	Date:	April 27, 2018
Sample No.:	2	Temperature:	23 deg.C
Power:	DC 13.5 V	Humidity:	41 %RH
Mode:	Transmitting 13.56 MHz	ENGINEER:	Shiro Kobayashi

Tag: Type 3

20 dB Bandwidth: 365.308 kHz

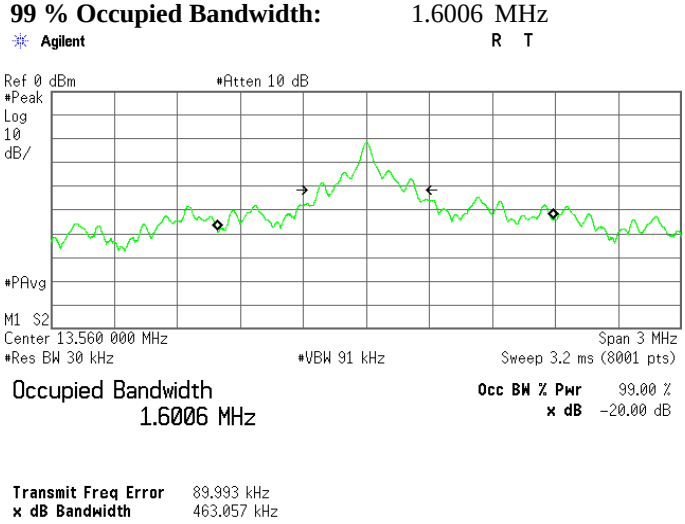
99 % Occupied Bandwidth: 0.8124 MHz



Tag: Type 4

20 dB Bandwidth: 463.057 kHz

99 % Occupied Bandwidth: 1.6006 MHz



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20 dB bandwidth & 99 % Occupied bandwidth: FCC 15.215 / RSS-Gen

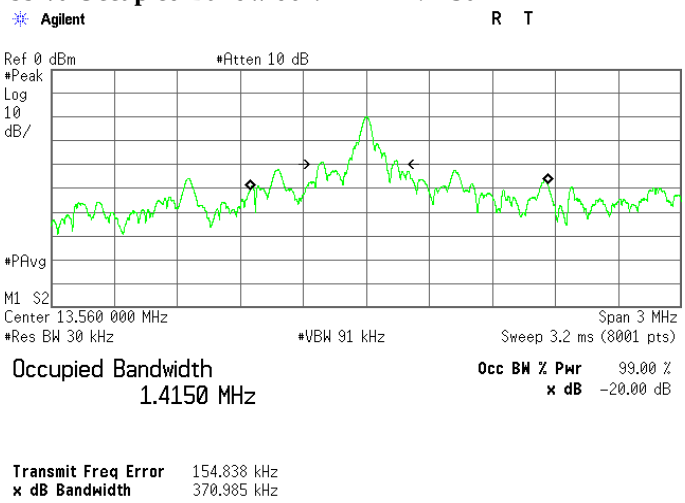
UL Japan, Inc.
Shonan EMC Lab. No.5 Shielded Room

Company:	Alpine Electronics, Inc.	Regulation:	FCC Part15 Subpart C 15.215
Equipment:	Display Unit		
Model:	GABI02	Date:	April 27, 2018
Sample No.:	2	Temperature:	23 deg.C
Power:	DC 13.5 V	Humidity:	41 %RH
Mode:	Transmitting 13.56 MHz	ENGINEER:	Shiro Kobayashi

Tag: SO 15693

20 dB Bandwidth: 370.985 kHz

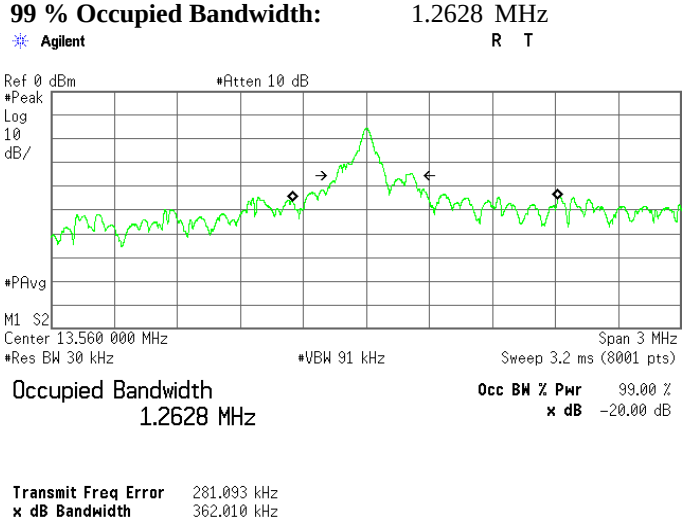
99 % Occupied Bandwidth: 1.4150 MHz



without Tag

20 dB Bandwidth: 362.010 kHz

99 % Occupied Bandwidth: 1.2628 MHz



APPENDIX 3
Test Instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SAF-02	Pre Amplifier	SONOMA	310N	290212	RE	2018/02/16 * 12
SAT6-02	Attenuator	JFW	50HF-006N	-	RE	2018/02/16 * 12
SAT3-11	Attenuator	JFW	50HF-003N	-	RE	2018/02/22 * 12
SBA-02	Biconical Antenna	Schwarzbeck	BBA9106	91032665	RE	2017/11/23 * 12
SCC-B1/B3/B5/B7/B8/B13/SRSE-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-270(RF Selector)	RE	2018/04/07 * 12
SCC-B2/B4/B6/B7/B8/B13/SRSE-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-270(RF Selector)	RE	2018/04/07 * 12
SLA-06	Logperiodic Antenna	Schwarzbeck	VUSLP9111B	195	RE	2018/01/30 * 12
SOS-03	Humidity Indicator	A&D	AD-5681	4063325	RE	2017/10/30 * 12
STR-07	Test Receiver	Rohde & Schwarz	ESU26	100484	RE	2017/09/26 * 12
SJM-09	Measure	PROMART	SEN1935	-	RE	-
SAEC-02(NSA)	Semi-Anechoic Chamber	TDK	SAEC-02(NSA)	2	RE	2017/06/08 * 12
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE,RFI,MF)	-	RE	-
STS-02	Digital Hitester	Hioki	3805-50	080997819	RE	2018/03/08 * 12
SLP-02	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100218	RE	2017/10/16 * 12
SAT6-12	Attenuator	HIROSE ELECTRIC CO.,LTD.	AT-406(40)	-	RE	2017/08/24 * 12
SSCA-01	Search coil	LANGER	RF-R 400-1	02-0634	FT, BW	Pre Check
SSA-03	Spectrum Analyzer	Agilent	E4448A	MY48250152	BW	2017/08/20 * 12
SFC-01	Microwave Counter	Agilent	53151A	US40511493	FT	2017/06/20 * 12
SCH-01	Temperature and Humidity Chamber	Espec	PL-1KT	14020837	FT, BW	2018/04/11 * 12
KTS-07	Digital Tester	SANWA	PC500	7019232	FT, BW	2017/10/11 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	FT, BW	2017/12/21 * 12

The expiration date of the calibration is the end of the expired month .
As for some calibrations performed after the tested dates , those test equipment have been controlled by means of an unbroken chains of calibrations .

All equipment is calibrated with valid calibrations . Each measurement data is traceable to the national or international standards.
Test Item :
RE: Radiated emission,
FT: Frequency Tolerance
BW: Bandwidth