RF TEST REPORT

SIEMIC
A Bureau Veritas Group Company

Report No.: FCC_IC_RF_SL18012901-ZBR-003A3_Co-Location
Supersede Report No.:

Applicant	:	Zebra Technologies Corp.
Host Product Name	:	ZC150, ZC300, ZC350
Module Model No.	:	T4NM-FDC0 ZQ3BT
Test Standard	:	FCC 15.225, 15.247 RSS247 Issue 2, 2017 RSS-210 Issue 9: 2016
Test Method	:	FCC 15.225, 15.247 ANSI C63.10 2013 RSS Gen Issue 4 2014
FCC ID	:	I28MD-ZCLFHF I28-ZBRZQ3BT
IC ID	:	3798B-ZCLFHF 3798B-ZBRZQ3BT
Dates of test	:	02/01/2018 – 03/06/2018
Issue Date	:	03/06/2018
Test Result	:	☒ Pass ☐ Fail
Equipment complied with the specification		**[X]**
Equipment did not comply with the specification		**[ ]**

This Test Report is Issued Under the Authority of:	
Shuo	
Shuo Zhang	**Chen Ge**
RF Test Engineer	Engineer Reviewer
This test report may be reproduced in full only **Test result presented in this test report is applicable to the tested sample only**	

Issued By:
SIEMIC Laboratories
775 Montague Expressway, Milpitas, CA 95035

ilac-MRA
A2LA ACCREDITED
TESTING CERT # 2742-01

Laboratory Introduction

SIEMIC, headquartered in the heart of Silicon Valley, with superior facilities in US and Asia, is one of the leading independent testing and certification facilities providing customers with one-stop shop services for Compliance Testing and Global Certifications.

In addition to testing and certification, SIEMIC provides initial design reviews and compliance management throughout a project. Our extensive experience with China, Asia Pacific, North America, European, and International compliance requirements, assures the fastest, most cost effective way to attain regulatory compliance for the global markets.

Accreditations for Conformity Assessment

Country/Region	Accreditation Body	Scope
USA	FCC, A2LA	EMC, RF/Wireless, Telecom
Canada	IC, A2LA, NIST	EMC, RF/Wireless, Telecom
Taiwan	BSMI, NCC, NIST	EMC, RF, Telecom, Safety
Hong Kong	OFTA, NIST	RF/Wireless, Telecom
Australia	NATA, NIST	EMC, RF, Telecom, Safety
Korea	KCC/RRA, NIST	EMI, EMS, RF, Telecom, Safety
Japan	VCCI, JATE, TELEC, RFT	EMI, RF/Wireless, Telecom
Mexico	NOM, COFETEL, Caniety	EMC, RF/Wireless, Telecom, Safety
Europe	A2LA, NIST	EMC, RF, Telecom, Safety
Israel	MOC, NIST	EMC, RF, Telecom, Safety

Accreditations for Product Certifications

Country	Accreditation Body	Scope
USA	FCC TCB, NIST	EMC, RF, Telecom
Canada	IC FCB, NIST	EMC, RF, Telecom
Singapore	iDA, NIST	EMC, RF, Telecom
EU	NB	EMC & RED Directive
Japan	MIC (RCB 208)	RF, Telecom
Hong Kong	OFTA (US002)	RF, Telecom

CONTENTS

1 REPORT REVISION HISTORY 4

2 EXECUTIVE SUMMARY 5

3 CUSTOMER INFORMATION 5

4 TEST SITE INFORMATION 5

5 MODIFICATION 5

6 EUT INFORMATION 6

6.1 EUT Description 6

6.2 Radio Description 6

6.3 EUT test modes/configuration Description 7

7 SUPPORTING EQUIPMENT/SOFTWARE AND CABLING DESCRIPTION 8

7.1 Supporting Equipment 8

7.2 Cabling Description 8

7.3 Test Software Description 8

8 TEST SUMMARY 9

9 MEASUREMENT UNCERTAINTY 10

9.1 Radiated Emissions (30MHz to 1GHz) 10

9.2 Radiated Emissions (1GHz to 40GHz) 10

9.3 RF conducted measurement 11

10 MEASUREMENTS, EXAMINATION AND DERIVED RESULTS 12

10.1 Antenna Requirement 12

10.2 Radiated Measurements 13

10.2.1 Radiated Measurements 30MHz to 1GHz 13

10.2.2 Radiated Spurious Emissions between 1GHz-25GHz 15

ANNEX A. TEST INSTRUMENT 17

ANNEX A. SIEMIC ACCREDITATION 18

1 Report Revision History

Report No.	Report Version	Description	Issue Date
FCC_IC_RF_SL18012901-ZBR-003A3_Co-Location	None	Original	03/06/2018

2 Executive Summary

The purpose of this test program was to demonstrate compliance of following product

Company:	Zebra Technologies Corporation
Host Product:	ZC150, ZC300, ZC350
Module Model:	T4NM-FDC0 ZQ3BT

against the current Stipulated Standards. The specified model product stated above has demonstrated compliance with the Stipulated Standard listed on 1st page.

3 Customer information

Applicant Name	:	Zebra Technologies Corp.
Applicant Address	:	3 Overlook Point Lincolnshire, IL 60069, USA
Manufacturer Name	:	Zebra Technologies Corp.
Manufacturer Address	:	3 Overlook Point Lincolnshire, IL 60069, USA

4 Test site information

Lab performing tests	:	SIEMIC Laboratories
Lab Address	:	775 Montague Expressway, Milpitas, CA 95035
FCC Test Site No.	:	881796
IC Test Site No.	:	4842D-2
VCCI Test Site No.	:	A0133

5 Modification

Index	Item	Description	Note
-	-	-	-
-	-	-	-

6 EUT Information

6.1 EUT Description

Product Name	Color Card Printer
Model No.	ZC150, ZC300, ZC350
Trade Name	Zebra Technologies Corporation
Serial No.	C3J17390595
Input Power	100-240Vac, 2.8A, 50/60Hz
Power Adapter Manu/Model	N/A
Power Adapter SN	N/A
Date of EUT received	February 5th, 2018
Equipment Class/ Category	DTS, 125 kHz, 13.56MHz
Clock Frequencies	N/A
Port/Connectors	RJ45

6.2 Radio Description

Specifications for Radio:

Specs for Bluetooth

Radio Type	Bluetooth (Ver4.0+EDR)
Operating Frequency	2402MHz-2480MHz
Modulation	FHSS (BDR/EDR)
Channel Spacing	1MHz (BDR, EDR)
Antenna Type	Chip
Antenna Gain	1.69 dBi (for 2.4GHz)
Antenna Connector Type	U.FL connector

Specifications for Radio:

Radio Type	RFID
Operating Frequency	125KHz, 13.56MHz
Modulation	ASK (125KHz), ASK (13.56MHz)
Channel Spacing	None
Antenna Type	Loop Antenna
Antenna Gain(dBi)	125KHz:-134dBi, 13.56MHz: -51dBi
Antenna Connector Type	N/A

Channel List:

Type	Mode	Channel No.	Frequency (MHz)	Available (Y/N)
RFID	125KHz	1	0.125	Y
RFID	13.56MHz	1	13.56	Y

6.3 EUT test modes/configuration Description

Mode	Note
RF test	EUT is set to continuously transmit
Note: None	

Test Item	Operating mode	Tested antenna port
Antenna Requirement	N/A	-
Conducted Emissions Voltage	N/A	-
Radiated Spurious Emission	Continuous Transmit	-
Frequency Stability	N/A	-
Occupied Bandwidth	N/A	-
Note: -		

7 Supporting Equipment/Software and cabling Description

7.1 Supporting Equipment

Index	Supporting Equipment Description	Model	Serial No	Manu	Note
-	-	-	-	-	-

7.2 Cabling Description

Name	Connection Start		Connection Stop		Length / shielding Info		Note
	From	I/O Port	To	I/O Port	Length (m)	Shielding	
1	EUT	Connector	Computer	USB	5	-	-

7.3 Test Software Description

Test Item	Software	Description
RF Testing	Tera Term	Set the EUT to transmit continuously
-	-	-

8 Test Summary

Test Item	Test standard		Test Method/Procedure	Pass / Fail
Antenna Requirement	FCC	15.203	ANSI C63.10 – 2013 558074 D01 DTS Meas. Guidance v03r02	☐ Pass ☒ N/A
	IC	-		
AC Conducted Emissions Voltage	FCC	15.225(a)	ANSI C63.10 2013 RSS Gen. 8.8	☐ Pass ☒ N/A
	IC	RSS Gen (7.2.2)		
Remark	1. Device is battery operated. Conducted Emission test is not required			

Test Item	Test standard		Test Method/Procedure		Pass / Fail
Radiated Spurious Emission	FCC	-	FCC	RSS Gen 7.1	☒ Pass ☐ N/A
	IC		IC		
Frequency Stability	FCC	-	FCC	-	☐ Pass ☒ N/A
	IC	-	IC	-	
Occupied Bandwidth	FCC	-	FCC	-	☐ Pass ☒ N/A
	IC	-	IC	-	
Remark	2. All measurement uncertainties are not taken into consideration for all presented test result. 3. The applicant shall ensure frequency stability by showing that an emission is maintained within the band of operation under all normal operating conditions as specified in the user's manual. 4. Only Radiated Spurious Emission for colocation has been tested for this report				

9 Measurement Uncertainty

9.1 Radiated Emissions (30MHz to 1GHz)

The test is to measure the radiated emissions of the EUT.

Some error sources that can contribute to the total uncertainty:
- Uncertainty of the receiver
- Uncertainty of the antenna
- Uncertainty of cables
- Uncertainty due to the mismatches
- NSA Calibration
- Etc., details see the below table

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Receiver Reading	0.12	Rectangular	1.732	1	0.069284
Cable Insertion Loss	0.21	Normal	2	1	0.105
Filter Insertion Loss	0.25	Normal	2	1	0.125
Antenna Factor	0.65	Normal	2	1	0.325
Receiver CW accuracy	0.5	Rectangular	1.732	1	0.2886836
Pulse Amplitude Response	1.5	Rectangular	1.732	1	0.86605081
PRF Response	1.5	Rectangular	1.732	1	0.86605081
Mismatch Filter - Receiver	0.25	U-Shape	1.414	1	0.1768033
NSA Calibration	4.0	U-Shape	1.414	1	2.8288543
Combined Standard Uncertainty					3.0059131
Expanded Uncertainty (K=2)					**6.0118262**

The total derived measurement uncertainty is +/- 6.00 dB.

9.2 Radiated Emissions (1GHz to 40GHz)

The test is to measure the radiated emissions of the EUT.

Some error sources that can contribute to the total uncertainty:
- Uncertainty of the receiver
- Uncertainty of the antenna
- Uncertainty of cables
- Uncertainty due to the mismatches
- VSWR Calibration
- Etc., details see the below table

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Receiver Reading	0.12	Rectangular	1.732	1	0.0692840
Cable Insertion Loss	0.21	Normal	2	1	0.1050000
Filter Insertion Loss	0.25	Normal	2	1	0.1250000
Antenna Factor	0.65	Normal	2	1	0.3250000
Receiver CW accuracy	0.5	Rectangular	1.732	1	0.2886836
Pulse Amplitude Response	1.5	Rectangular	1.732	1	0.8660508
PRF Response	1.5	Rectangular	1.732	1	0.8660508
Mismatch Filter - Receiver	0.25	U-Shape	1.414	1	0.1768033
VSWR Calibration	2.0	U-Shape	1.414	1	1.4144272
Combined Standard Uncertainty					4.2363
Expanded Uncertainty (K=2)					**8.4726**

The total derived measurement uncertainty is +/- 8.47 dB.

9.3 RF conducted measurement

The test is to measure the RF output power from the EUT.

Some error sources that can contribute to the total uncertainty:

- Uncertainty of the Reference Level Uncertainty
- Uncertainty of variable attenuators
- Uncertainty of cables
- Uncertainty due to the mismatches

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Reference Level	0.12	Rectangular	1.732	1	0.069284
Cable Insertion Loss	0.21	Normal	2	1	0.105
Attenuator	0.25	Normal	2	1	0.125
Mismatch	0.25	U-Shape	1.414	1	0.1768033
Combined Standard Uncertainty					0.476087
Expanded Uncertainty (K=2)					**0.952174**

The total derived measurement uncertainty is +/- 0.95 dB.

10 Measurements, examination and derived results

10.1 Antenna Requirement

Spec	Requirement	Applicable
§15.203	An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. Antenna requirement must meet at least one of the following: a) Antenna must be permanently attached to the device. b) The antenna must use a unique type of connector to attach to the device. c) Device must be professionally installed. The installer shall be responsible for ensuring that the correct antenna is employed by the device.	☒
Remark	Antenna arrangement which was permanently attached and the antenna gain is 1.69 dBi.	
Result	☒ PASS ☐ FAIL	

10.2 Radiated Measurements

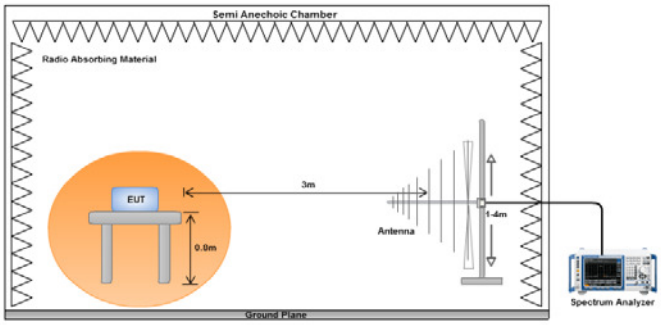
10.2.1 Radiated Measurements 30MHz to 1GHz

Requirement(s):

Spec	Requirement	Applicable
47 CFR §15.225 RSS-210 (B.6) RSS-247	Operation within the band 13.110–14.010 MHz: (a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters. (b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters. (c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters. (d) The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in §15.209.	☒

Frequency range (MHz)	Field Strength (uV/m)
30 – 88	100
88 – 216	150
216 960	200
Above 960	500

Test Setup



Procedure

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
   a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
   b. The EUT was then rotated to the direction that gave the maximum emission.
   c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
3. A Quasi-peak measurement was then made for that frequency point.
4. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.

Test Date	02/01/2018 – 02/08/2018	Environmental conditions	Temperature	20.1°C
			Relative Humidity	36%
			Atmospheric Pressure	1026mbar
Remark	-			
Result	☒ Pass ☐ Fail			

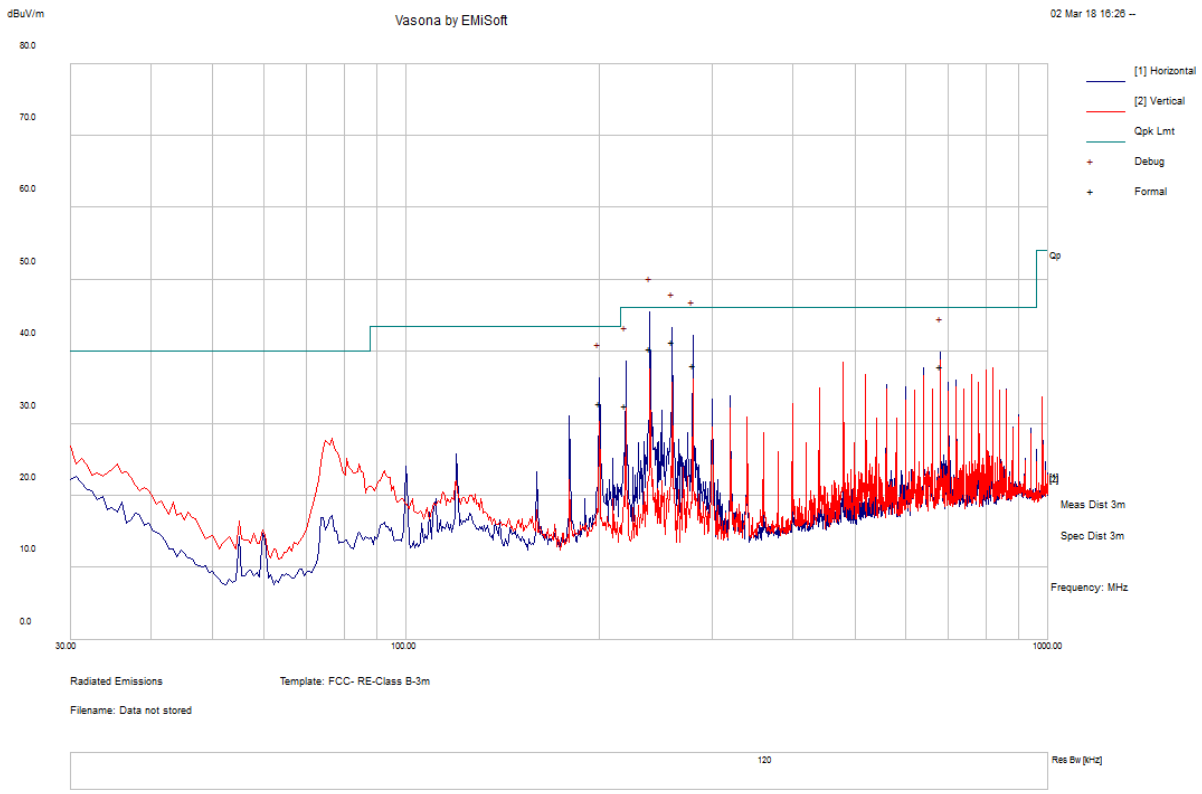
Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Shuo Zhang at 10-meter chamber.

Test specification:	Radiated Emissions			
Mains Power:	120VAC, 60Hz		Result:	☒ Pass ☐ Fail
Tested by:	Shuo Zhang			
Test Date:	03/02/2018			
Remarks:	RFID and Bluetooth transmit simultaneously			

f=30MHz – 1000MHz plot and 3-meter distance

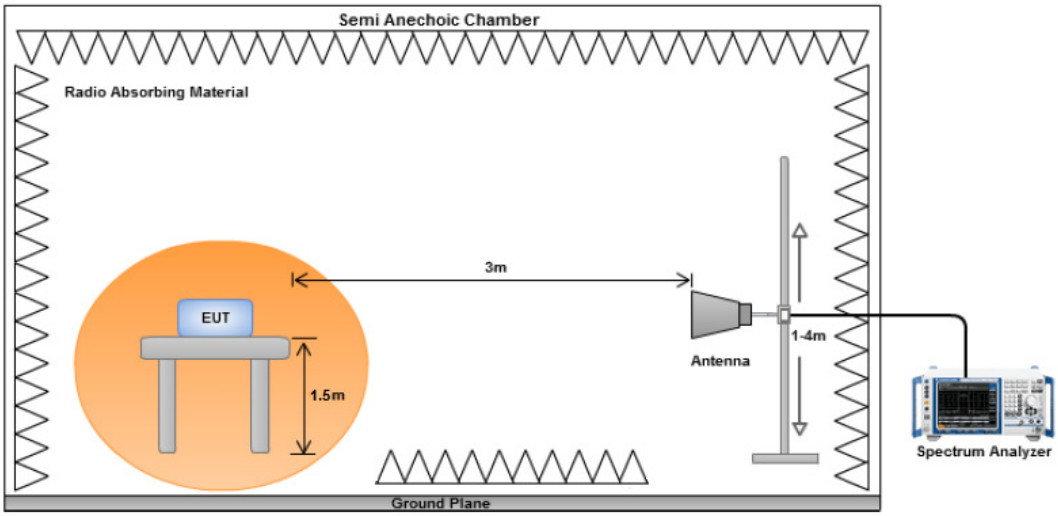


f=30MHz – 1000MHz Measurements

Frequency MHz	Raw dBµV/m	Cable Loss	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
239.99	55.53	10	-25.09	40.44	Quasi Max	H	111	270	46	-5.56	Pass
260.00	55.81	10	-24.49	41.32	Quasi Max	H	100	105	46	-4.68	Pass
280.02	51.16	10	-23.04	38.12	Quasi Max	H	102	271	46	-7.88	Pass
679.96	44.6	10	-16.58	38.02	Quasi Max	H	104	146	46	-7.98	Pass
199.96	47	10	-24.2	32.79	Quasi Max	H	118	105	43.5	-10.71	Pass
219.97	48.17	10	-25.63	32.54	Quasi Max	H	119	88	46	-13.46	Pass

10.2.2 Radiated Spurious Emissions between 1GHz-25GHz

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR§15.247(d), RSS210(A8.5)	a)	For non-restricted band, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB or 30dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, determined by the measurement method on output power to be used. Attenuation below the general limits specified in § 15.209(a) is not required ☐ 20 dB down ☒ 30 dB down	☒
	b)	or restricted band, emission must also comply with the radiated emission limits specified in 15.209	☐
Test Setup			
Procedure	1. The EUT was switched on and allowed to warm up to its normal operating condition. 2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner: a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen. b. The EUT was then rotated to the direction that gave the maximum emission. c. Finally, the antenna height was adjusted to the height that gave the maximum emission. 3. An average measurement was then made for that frequency point. 4. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.		
Remark	The EUT was scanned up to 40GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case.		
Result	☒ Pass		

Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☐ Yes (See below) ☒ N/A

Test was done by Shuo Zhang at 10-meter chamber.

Test specification:	Radiated Emissions			
Mains Power:	120VAC, 60Hz		Result:	☒ Pass ☐ Fail
Tested by:	Shuo Zhang			
Test Date:	02/05/2018			
Remarks:	RFID and Bluetooth transmit simultaneously			

Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	AF (dB)	Level (dBuV/m)	Measurement Type	Pol (V/H)	Hgt (cm)	Azt (Deg)	Limit (dBuV/m)	Margin (dB)	Pass /Fail
1683.49	68.02	2.92	-14.13	56.82	Peak Max	H	184	40	74	-17.19	Pass
17983.90	38.19	9.15	8.17	55.5	Peak Max	V	291	136	74	-18.5	Pass
4804.37	39.85	4.71	-4.97	39.58	Peak Max	H	225	88	74	-34.42	Pass
1683.49	48.03	2.92	-14.13	36.82	Average Max	H	184	40	54	-17.18	Pass
17983.90	26.11	9.15	8.17	43.43	Average Max	V	291	136	54	-10.57	Pass
4804.37	27.89	4.71	-4.97	27.63	Average Max	H	225	88	54	-26.37	Pass

Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Cycle	Cal Due	In use
Radiated Emissions						
Spectrum Analyzer	N9030B	10SL0289	09/06/2017	1 Year	09/06/2018	☑
ETS-Lingren Loop Antenna	6512	00049120	07/14/2017	1 Year	07/14/2018	☑
Bi-Log antenna (30MHz~2GHz)	JB1	A030702	07/13/2017	1 Year	07/13/2018	☑
Horn Antenna (1-26.5GHz)	3115	10SL0059	11/09/017	1 Year	11/09/2018	☑
RF Pre-Amplifier (9kHz - 6.5GHz)	LPA-6-30	11170602	2/9/2017	1 Year	2/9/2018	☑
Pre-Amplifier (1 - 26.5GHz)	8449B	3008A00715	8/16/2017	1 Year	8/16/2018	☑

Annex A. SIEMIC Accreditation

Accreditations	Document	Scope / Remark
ISO 17025 (A2LA)		Please see the documents for the detailed scope
ISO Guide 65 (A2LA)		Please see the documents for the detailed scope
TCB Designation		A1, A2, A3, A4, B1, B2, B3, B4, C
FCC DoC Accreditation		FCC Declaration of Conformity Accreditation
FCC Site Registration		3 meter site
FCC Site Registration		10 meter site
IC Site Registration		3 meter site
IC Site Registration		10 meter site
EU NB		**Radio Equipment: EN45011:** EN ISO/IEC 17065
		Electromagnetic Compatibility: EN45011 – EN ISO/IEC 17065
Singapore iDA CB(Certification Body)		Phase I, Phase II
Vietnam MIC CAB Accreditation		Please see the document for the detailed scope
Hong Kong OFCA		**(Phase II)** OFCA Foreign Certification Body for Radio and Telecom
		(Phase I) Conformity Assessment Body for Radio and Telecom
Industry Canada CAB		**Radio:** Scope A – All Radio Standard Specification in Category I
		Telecom: CS-03 Part I, II, V, VI, VII, VIII

Japan Recognized Certification Body Designation		**Radio**: A1. Terminal equipment for purpose of calling **Telecom**: B1. Specified radio equipment specified in Article 38-2, Paragraph 1, Item 1 of the Radio Law
Korea CAB Accreditation		**EMI:** KCC Notice 2008-39, RRL Notice 2008-3: CA Procedures for EMI KN22: Test Method for EMI **EMS:** KCC Notice 2008-38, RRL Notice 2008-4: CA Procedures for EMS KN24, KN61000-4-2, -4-3, -4-4, -4-5, -4-6, -4-8, -4-11: Test Method for EMS
		Radio: RRL Notice 2008-26, RRL Notice 2008-2, RRL Notice 2008-10, RRL Notice 2007-49, RRL Notice 2007-20, RRL Notice 2007-21, RRL Notice 2007-80, RRL Notice 2004-68
		Telecom: President Notice 20664, RRL Notice 2007-30, RRL Notice 2008-7 with attachments 1, 3, 5, 6; President Notice 20664, RRL Notice 2008-7 with attachment 4
Taiwan NCC CAB Recognition		LP0002, PSTN01, ADSL01, ID0002, IS6100, CNS14336, PLMN07, PLMN01, PLMN08
Taiwan BSMI CAB Recognition		CNS 13438
Japan VCCI		R-3083: Radiation 3 meter site C-3421: Main Ports Conducted Interference Measurement T-1597: Telecommunication Ports Conducted Interference Measurement
Australia CAB Recognition		**EMC:** AS/NZS CISPR 11, AS/NZS CISPR 14.1, AS/NZS CISPR22, AS/NZS 61000.6.3, AS/NZS 61000.6.4
		Radiocommunications: AS/NZS 4281, AS/NZS 4268, AS/NZS 4280.1, AS/NZS 4280.2, AS/NZS 4295, AS/NZS 4582, AS/NZS 4583, AS/NZS 4769.1, AS/NZS 4769.2, AS/NZS 4770, AS/NZS 4771
		Telecommunications: AS/ACIF S002:05, AS/ACIF S003:06, AS/ACIF S004:06 AS/ACIF S006:01, AS/ACIF S016:01, AS/ACIF S031:01, AS/ACIF S038:01, AS/ACIF S040:01, AS/ACIF S041:05, AS/ACIF S043.2:06, AS/ACIF S60950.1
Australia NATA Recognition		AS/ACIF S002, AS/ACIF S003, AS/ACIF S004, AS/ACIF S006, AS/ACIF S016,AS/ACIF S031, AS/ACIF S038, AS/ACIF S040, AS/ACIF S041, AS/ACIF S043.2