

RF TEST REPORT



Report No.: FCC_IC_RF_SL18012901-ZBR-003_Co-Location_Rev1.0
Supersede Report No.: FCC_IC_RF_SL18012901-ZBR-003_Co-Location

Applicant	:	Zebra Technologies Corp.
Host Product Name	:	ZC100, ZC150, ZC300, ZC350
Module Model No.	:	T4NM-FDC0 WYSBHVXGXG
Test Standard	:	FCC 15.225, 15.247 RSS 247 Issue 2, 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 I28MD-FXLAN11AC
IC ID	:	3798B-ZCLFHF 3798B-FXLAN11AC
Dates of test	:	02/01/2018 – 02/08/2018
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 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:
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Laboratory Introduction

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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/RRR, 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

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1 Report Revision History

Report No.	Report Version	Description	Issue Date
FCC_IC_RF_SL18012901-ZBR-003_Co-Location	None	Original	02/12/2018
FCC_IC_RF_SL18012901-ZBR-003_Co-Location_Rev1.0	1.0	Update EUT info	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: ZC100, ZC150, ZC300, ZC350
Module(s) Model: T4NM-FDC0
 WYSBHVXGXG

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
Host Model No.	ZC100, 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 5 th , 2018
Equipment Class/ Category	DTS, 125 kHz, 13.56MHz
Clock Frequencies	N/A
Port/Connectors	RJ45

6.2 Radio Description

Specifications for Radio:

Bluetooth LE:

Radio Type	Bluetooth (Ver4.1)
Operating Frequency	2402MHz-2480MHz
Modulation	GFSK
Channel Spacing	2MHz
Antenna Type	Monopole Antenna
Antenna Gain	1 dBi
Antenna Connector Type	u.FL
Note	N/A

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:-134, 13.56MHz: -51
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

Radio Type	802.11b	802.11g	802.11n-20M	802.11n-40M
Operating Frequency	2412-2462MHz	2412-2462MHz	2412-2462MHz	2422-2452MHz
Modulation	DSSS (CCK, DQPSK, DBPSK)	OFDM-CCK (BPSK, QPSK, 16QAM, 64QAM)	OFDM (BPSK, QPSK, 16QAM, 64QAM)	OFDM (BPSK, QPSK, 16QAM, 64QAM)
Channel Spacing	5MHz	5MHz	5MHz	5MHz
Number of Channels	11	11	11	7
Antenna Type	Internal Omni PCB Antenna			
Antenna Gain (Peak)	2.4GHz: 3.66 dBi			
Antenna Connector Type	U.FL			
Note	2.4GHz and 5GHz Radio does not transmit simultaneously and 2.4GHz has higher power			

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
	IC	-		☒ N/A
AC Conducted Emissions Voltage	FCC	15.225(a)	ANSI C63.10 2013 RSS Gen. 8.8	☐ Pass
	IC	RSS Gen (7.2.2)		☒ N/A
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	☒ Pass ☐ N/A
	IC		IC	
Frequency Stability	FCC	-	FCC	☐ Pass
	IC	-	IC	☒ N/A
Occupied Bandwidth	FCC	-	FCC	☐ Pass
	IC	-	IC	☒ N/A
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

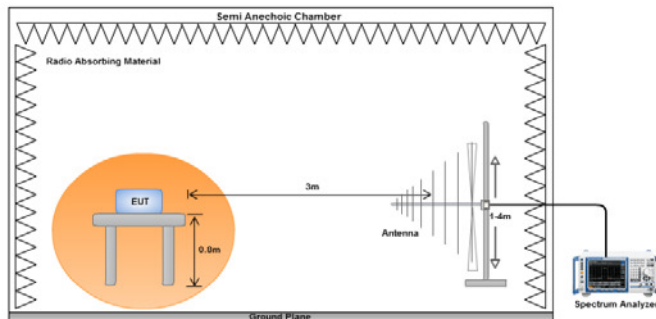
10.1 Antenna Requirement

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	N/A	
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)	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. <table><thead><tr><th>Frequency range (MHz)</th><th>Field Strength (uV/m)</th></tr></thead><tbody><tr><td>30 – 88</td><td>100</td></tr><tr><td>88 – 216</td><td>150</td></tr><tr><td>216 960</td><td>200</td></tr><tr><td>Above 960</td><td>500</td></tr></tbody></table>	Frequency range (MHz)	Field Strength (uV/m)	30 – 88	100	88 – 216	150	216 960	200	Above 960	500	☒
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 Temperature20.1°C Relative Humidity36% Atmospheric Pressure1026mbar										
Remark	-											
Result	☒ Pass ☐ Fail											

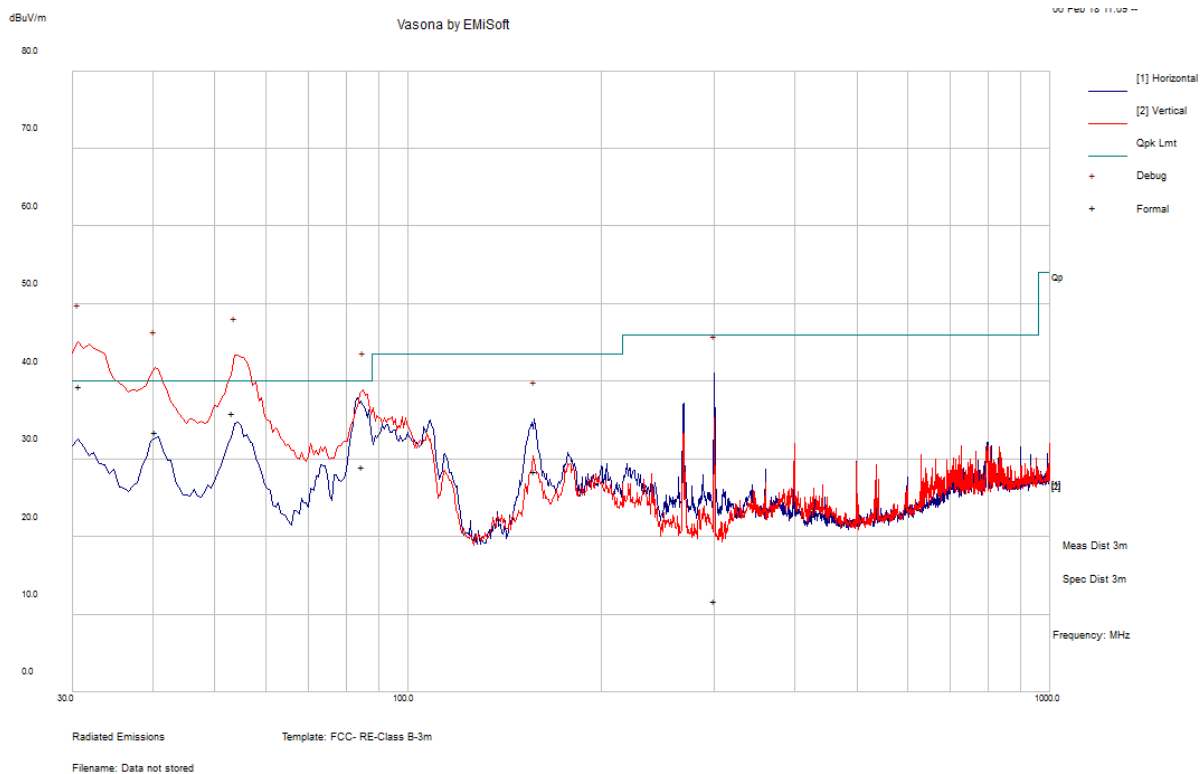
Test Data ☒ Yes (See below) ☐ N/A

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:	02/04/2018			
Remarks:	RFID and BT and 2.4GHz WLAN transmit simultaneously			

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

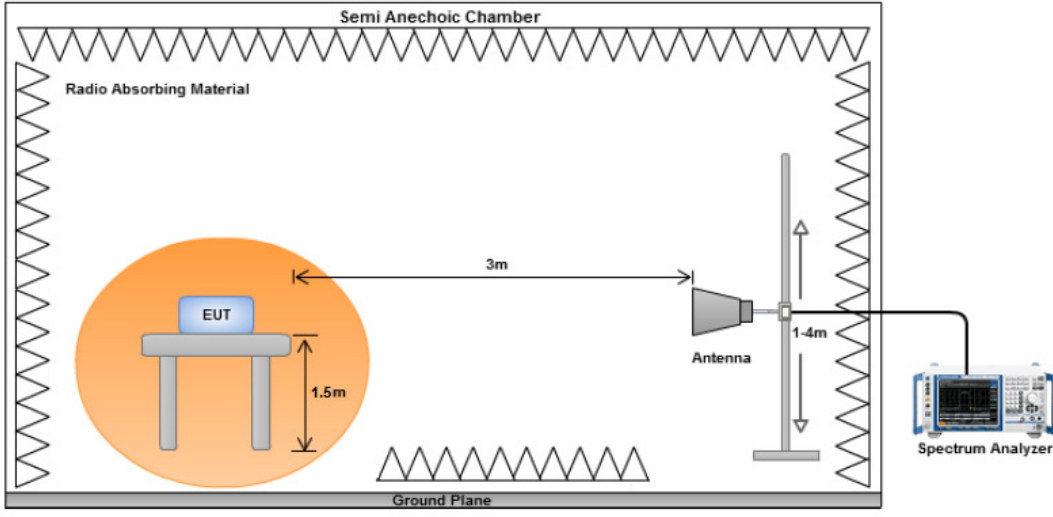


f=30MHz – 1000MHz Measurements

Frequency MHz	Raw dBuV/m	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
30.82	41.71	11.3	-13.66	39.35	Quasi Max	V	110	321	40	-0.65	Pass
53.40	51.7	11.61	-27.42	35.9	Quasi Max	V	100	128	40	-4.11	Pass
40.39	43.51	11.46	-21.47	33.49	Quasi Max	V	126	242	40	-6.51	Pass
84.95	45.12	11.86	-27.99	29	Quasi Max	V	177	152	40	-11	Pass
299.80	21.18	13.43	-22.82	11.8	Quasi Max	H	105	288	46	-34.2	Pass
157.48	39.63	12.39	-23.61	28.41	Quasi Max	H	221	9	43.5	-15.09	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	- The EUT was switched on and allowed to warm up to its normal operating condition. - 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: - Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen. - The EUT was then rotated to the direction that gave the maximum emission. - Finally, the antenna height was adjusted to the height that gave the maximum emission. - An average measurement was then made for that frequency point. - 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 BT and 2.4GHz WLAN transmit simultaneously			

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
4923.90	42.08	4.22	-0.95	45.35	Peak Max	H	138	349	74	-28.66	Pass
9455.43	38.76	5.71	0.25	44.71	Peak Max	V	235	51	74	-29.29	Pass
7766.86	38.83	5.23	-0.32	43.75	Peak Max	V	171	163	74	-30.25	Pass
4923.90	32.57	4.22	-0.95	35.83	Average Max	H	138	349	54	-18.17	Pass
9455.43	26.64	5.71	0.25	32.59	Average Max	V	235	51	54	-21.41	Pass
7766.86	26.46	5.23	-0.32	31.37	Average Max	V	171	163	54	-22.63	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 Conducted Measurement						
Spectrum Analyzer	N9030B	10SL0289	09/06/2017	1 Year	09/06/2018	☒

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