RF TEST REPORT

SIEMIC
A Bureau Veritas Group Company

Report No.: FCC_ IC_RF_SL18101502-JPS-003_Cellular-Rev3.0
Supersede Report No.:

Applicant	Juniper Systems, Inc.
Product Name	Radio Module
Module Model	WP7603
Host Model	AG3
Test Standard	47CFR Part22; 47CFR Part27; 47CFR Part24 RSS-Gen Issue 4; RSS-130 Issue 1; RSS-132 Issue 3; RSS-133 Issue 6; RSS-139 Issue 3
Test Method	TIA-603-D: 2010
FCC ID	VSF27582
IC	7980A-27582
Date of test	10/19/2018-10/29/2018
Issue Date	02/20/2019
Test Result	Pass Fail
Equipment complied with the specification	[x]
Equipment did not comply with the specification	[ ]

Cipher	Chen Ge
Test Engineer	Engineering Reviewer

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Test result presented in this test report is applicable to the tested sample only

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

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A2LA ACCREDITED
TESTING CERT # 2742-01

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/RRA, NIST	EMI, EMS, RF , Telecom, Safety
Japan	VCCI, JATE, TELEC, RFT	EMI, RF/Wireless, Telecom
Mexico	NOM, COFETEL, Caniety	Safety, EMC , RF/Wireless, Telecom
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 & R&TTE Directive
Japan	MIC (RCB 208)	RF , Telecom
HongKong	OFTA (US002)	RF , Telecom

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1 Report Revision History

Report No.	Report Version	Description	Issue Date
FCC_ IC_RF_SL18101502-JPS-003_ Cellular	None	Original	10/30/2018
FCC_ IC_RF_SL18101502-JPS-003_ Cellular_Rev1.0	Rev1.0	Added reference test report no.	02/20/2019

2 Executive Summary

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

Company: Juniper Systems, Inc.
Product: Radio Module
Module Model: WP7603
Host Model: AG3

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	Juniper Systems, Inc.
Applicant Address	1132 1700 N, Logan, UT 84321
Manufacturer Name	Juniper Systems, Inc.
Manufacturer Address	1132 1700 N, Logan, UT 84321

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	Radio Module
Module Model	WP7603
Host Model	AG3
Trade Name	Juniper Systems, Inc.
Serial No.	AG3E107
Input Power	100-240VAC, 50-60Hz 0.5A
Power Adapter Manu/Model	PSAA20R-120L6
Date of EUT received	10/16/2018
Equipment Class/ Category	WCDMA/HSUPA/HSDPA, LTE
Port/Connectors	USB,Micro-USB, Serial
Antenna	FPC Antenna

6.2 Radio Description

Technology	Band	UL Freq. (Mhz)	DL Freq. (Mhz)
WCDMA/HSUPA/HSDPA	B2	1850 – 1910	1930 – 1990
	B4	1710 - 1755	2110 – 2155
	B5	824 - 849	869 – 894
LTE	B2	1850 – 1910	1930 – 1990
	B4	1710 – 1755	2110 – 2155
	B5	824 – 849	869 – 894
	B12	699 - 716	729 – 746

Table 5-1: WP7603 Antenna Gain Specifications

Device	Technology	Band	Frequency (MHz)	Maximum antenna gain (dBi)
AirPrime WP7603	LTE	2	1850–1910	6
		4	1710–1755	6
		5	824–849	6
		12	699–716	6
	UMTS	2	1850–1910	6
		4	1710–1755	6
		5	824–849	6

6.3 EUT test modes/configuration Description

Test mode

Final Test Mode		Note
Final_test_mode_1	Continuous transmission, single channel	LTE
Final_test_mode_2	Continuous transmission, single channel	WCDMA/HSUPA/HSDPA
Remark: N/A		

7 Supporting Equipment/Software and cabling Description

7.1 Supporting Equipment

Item	Supporting Equipment Description	Model	Serial Number	Manufacturer	Note
1	Laptop	LATITUDE E6530	N/A	Dell	-

7.2 Cabling Description

Name	Connection Start		Connection Stop		Length / shielding Info		Note
	From	I/O Port	To	I/O Port	Length (m)	Shielding	
USB	EUT	Micro USB	Laptop	USB	1	Unshielded	-
USB to Serial	EUT	Serial	Laptop	USB	1	Unshielded	-
USB to Ethernet	EUT	USB	Laptop	Ethernet	1	Unshielded	-

7.3 Test Software Description

Test Item	Software	Description
RF Testing	QRCT	Set the EUT to transmit continuously in diferent test mode

8 Test Summary

Test Item	FCC Rules	ISEDC Standards	Pass / Fail
Conducted RF Power Output	2.1046, 22.913(a), 24.232, 27.50	RSS-130 4.4, RSS-132 5.4, RSS-133 6.4, RSS-139 6.5	☐ Pass ☒ N/A
Occupied Bandwidth	2.1049, 22.917(b), 24.238(b)	RSS-Gen 6.6	☐ Pass ☒ N/A
Conducted Spurious Emission	2.1051, 22.1053, 22.917, 24.238, 27.53	RSS-130 4.6, RSS-132 5.5, RSS-133 6.5, RSS-139 6.6	☐ Pass ☒ N/A
Spurious Emission	2.1051, 22.1053, 22.917, 24.238, 27.53	RSS-130 4.3, RSS-132 5.3, RSS-133 6.3, RSS-139 6.6	☒ Pass ☐ N/A
Band Edge	2.1051, 22.1053, 22.917, 24.238, 27.53	RSS-130 4.6, RSS-132 5.5, RSS-133 6.5, RSS-139 6.6	☐ Pass ☒ N/A
Peak to Average Ratio	24.232, 27.50	RSS-130 4.4	☐ Pass ☒ N/A
Frequency stability	2.1055, 22.355, 24.235, 27.54	RSS-130 4.3, RSS-132 5.3, RSS-133 6.3, RSS-139 6.4	☐ Pass ☒ N/A

Remark	1. All measurement uncertainties do not take into consideration for all presented test results. 2. 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. 3. All the RF testing refer to Sierra module, FCC ID:N7NWP76C, IC:2147-WP76C Test report no. FCC: B17W00381-FCC-RF IC: B17W00381-FCC-RF

9 Measurement Uncertainty

9.1 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**

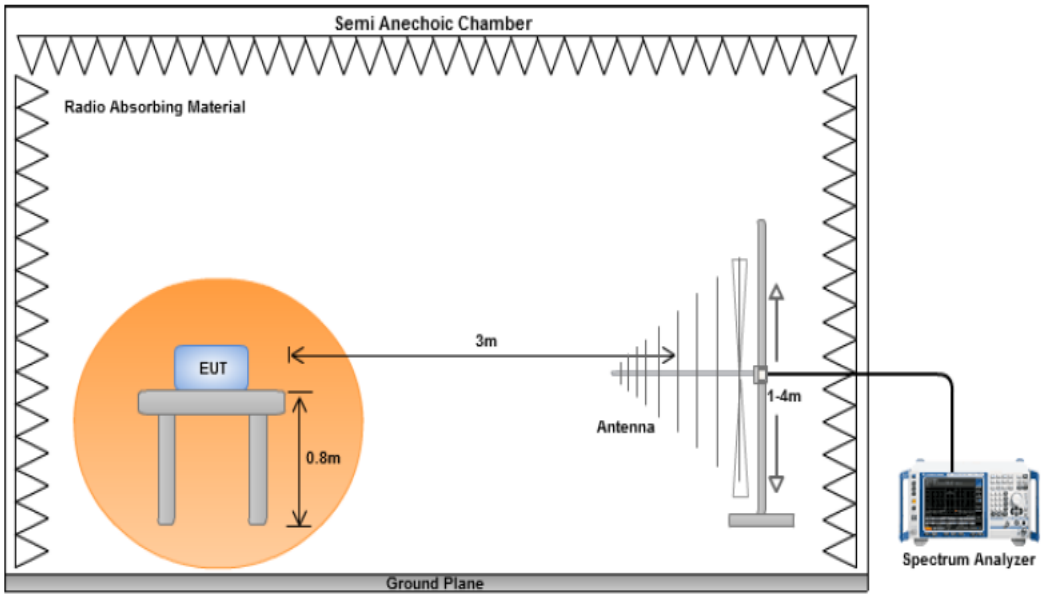
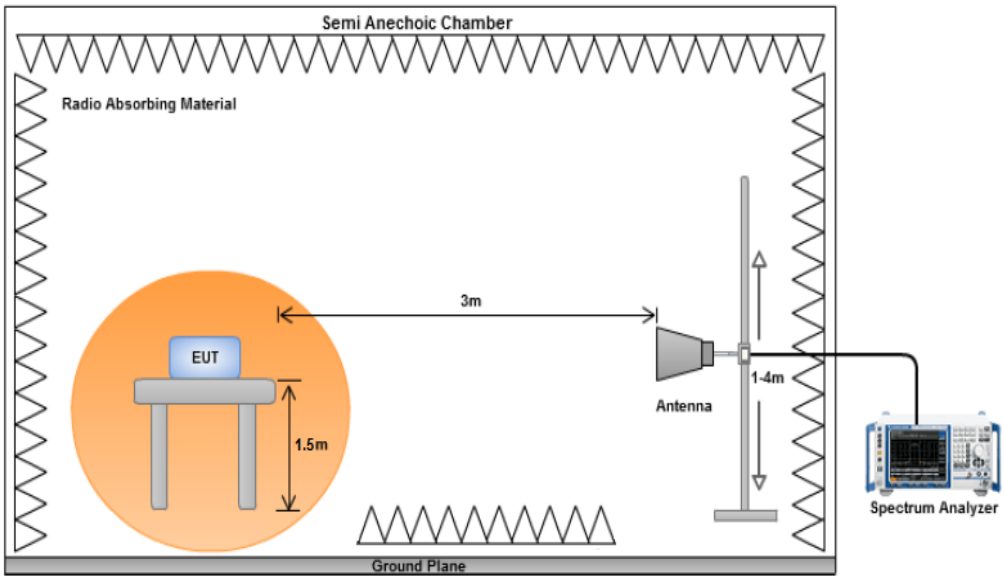
The total derived measurement uncertainty is +/- 8.47 dB.

10 Measurements, Examination and Derived Results

10.1 Radiated Spurious Emission

Requirement(s):

Spec	Requirement	Applicable
2.1051, 22.1053, 22.917, 24.238, 27.53	According to Part 22.917 (a), i.e., Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB. According to Part 24.238 (a), i.e., Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB, so the limit level is: P(dBm)– (43 + 10 log(P)) dB= -13dBm. According to Part 27.53(h): Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 log10(P) dB. According to Part 27.53(g): For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.	☒
RSS-130 4.3, RSS-132 5.3, RSS-133 6.3, RSS-139 6.6	According to RSS-130 4.6: The power of any unwanted emissions in any 100 kHz bandwidth on any frequency outside the frequency range(s) within which the equipment is designed to operate shall be attenuated below the transmitter power, P (dBW), by at least 43 + 10 log10 p (watts), dB. However, in the 100 kHz band immediately outside the equipment's operating frequency range, a resolution bandwidth of 30 kHz may be employed. In addition to the limit outlined above, equipment operating in the frequency bands 746-756 MHz and 777-787 MHz shall also comply with the following restrictions: The power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power, P (dBW), by at least: (i) 76 + 10 log10 p(watts), dB, for base and fixed equipment, and (ii) 65 + 10 log10 p(watts), dB, for mobile and portable equipment According to RSS-132 5.5: Mobile and base station equipment shall comply with the limits in (i) and (ii) below. (i) In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p (watts). (ii) After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p (watts). If the measurement is performed According to RSS-133 6.5: Equipment shall comply with the limits in (i) and (ii) below. (i) In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p(watts). (ii) After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p(watts). If the	☒

	measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required. According to RSS-139 6.6: (i) In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least 43 + 10 log10 p (watts) dB. (ii) After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least 43 + 10 log10 p (watts) dB.	
Test Setup Below 1GHz		
Test Setup Above 1GHz		
Test Procedure	Substitution method: 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. Remove the transmitter and replace it with a substitution antenna (the antenna should be half-wavelength for each frequency involved). The center of the substitution antenna should be approximately at the same location as the center of the transmitter. 4. Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a nonradiating cable. With the antennas at both ends horizontally polarized, and with the signal generator tuned to a particular spurious frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained. 5. Steps 4 were repeated for the next frequency point, until all selected frequency points were measured.			
Test Date	10/19/2018-10/29/2018	Environmental condition	Temperature Relative Humidity Atmospheric Pressure	23°C 48% 1008mbar
Remark	The EUT was scanned up to 25GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case. Limit calculation: Emission limit = PdBm – [43+ 10 log (PW)] = 10log(1000 x PW) - 43 - 10log(PW) = 30 dBm - 43 = -13 dBm All different modulation and bandwidth configuration has been verified and only the test data of worst case with QPSK modulation and greatest bandwidth was presented in this report.			
Result	☒ Pass ☐ Fail			

Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by *Cipher* at *10m chamber*.

Radiated Emission Test Results for WCDMA

Test specification	below 1GHz		Result	Pass
Environmental Conditions:	Temp (°C):	24		
	Humidity (%)	39		
	Atmospheric (mbar):	1012		
Mains Power:	120VAC			
Tested by:	Cipher			
Test Date:	10/19/2018-10/29/2018			
Remarks:	WCDMA Band5-HSUPA Mid-Channel			

Frequency MHz	SG Level dBm	Cable Loss dB	Antenna Gain dBd	Substituted Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass /Fail
750.05	-49.23	0.29	0	-49.52	RMS Max	H	109	27	-13	-36.52	Pass
454.18	-50.19	0.21	0	-50.40	RMS Max	V	178	29	-13	-37.4	Pass
456.81	-51.84	0.21	0	-52.05	RMS Max	V	100	228	-13	-39.05	Pass
444.73	-50.38	0.21	0	-50.59	RMS Max	V	170	302	-13	-37.59	Pass
448.66	-51.86	0.21	0	-52.07	RMS Max	V	196	269	-13	-39.07	Pass
463.42	-51.86	0.21	0	-52.07	RMS Max	V	154	260	-13	-39.07	Pass

Note: Dipole antenna was used for substitution method. Both horizontal and vertical polarities were investigated. The results above show only the worst case.

Radiated Emission Test Results for LTE

Test specification	below 1GHz		Result	Pass
Environmental Conditions:	Temp (°C):	24		
	Humidity (%)	39		
	Atmospheric (mbar):	1012		
Mains Power:	120VAC			
Tested by:	Cipher			
Test Date:	10/19/2018-10/29/2018			
Remarks:	LTE band5-Low CH-3MHz BW, QPSK			

Frequency MHz	SG Level dBm	Cable Loss dB	Antenna Gain dBd	Substituted Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass /Fail
745	-61.08	0.29	0	-61.37	RMS Max	V	163	242	-13	-48.37	Pass
745	-64.12	0.29	0	-64.41	RMS Max	H	183	146	-13	-51.41	Pass
620	-62.95	0.31	0	-63.26	RMS Max	V	149	253	-13	-50.26	Pass
620	-65.22	0.31	0	-65.53	RMS Max	H	186	106	-13	-52.53	Pass
750	-64.06	0.33	0	-64.39	RMS Max	V	132	248	-13	-51.39	Pass
750	-65.15	0.33	0	-65.48	RMS Max	H	153	165	-13	-52.48	Pass

Note: Dipole antenna was used for substitution method. Both horizontal and vertical polarities were investigated. The results above show only the worst case.

Radiated Emission Test Results (Above 1GHz)

WCDMA band 2 Low Channel

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
3720	-58.75	219	174	V	3720	-54.93	10.21	1.95	-46.67	-13	-33.67
3720	-60.99	243	179	H	3720	-57.17	10.21	1.95	-48.91	-13	-35.91
7951	-61.63	10	152	V	7951	-55.9	10.79	2.55	-47.66	-13	-34.66
7951	-58.79	79	173	H	7951	-53.06	10.79	2.55	-44.82	-13	-31.82

WCDMA band 2 Mid Channel

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
3760	-61.17	50	193	V	3760	-57.29	9.98	1.95	-49.26	-13	-36.26
3760	-60.63	325	207	H	3760	-56.75	9.98	1.95	-48.72	-13	-35.72
7404	-61.46	53	165	V	7404	-55.51	10.56	2.56	-47.51	-13	-34.51
7404	-60.92	300	200	H	7404	-54.97	10.56	2.56	-46.97	-13	-33.97

WCDMA band 2 High Channel

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
3800	-62.43	150	166	V	3800	-58.48	9.76	1.95	-50.67	-13	-37.67
3800	-61.98	354	188	H	3800	-58.03	9.76	1.95	-50.22	-13	-37.22
7859	-59.42	216	203	V	7859	-53.66	10.93	2.52	-45.25	-13	-32.25
7859	-60	308	202	H	7859	-54.24	10.93	2.52	-45.83	-13	-32.83

WCDMA band 4 Low Channel

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
3440	-62.1	341	192	V	3440	-58.41	9.69	1.7	-50.42	-13	-37.42
3440	-60.77	18	205	H	3440	-57.08	9.69	1.7	-49.09	-13	-36.09
7558	-58.59	43	184	V	7558	-52.75	10.88	2.44	-44.31	-13	-31.31
7558	-59.82	125	166	H	7558	-53.98	10.88	2.44	-45.54	-13	-32.54

WCDMA band 4 Mid Channel

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
3465	-65.66	200	183	V	3465	-61.92	9.79	1.72	-53.85	-13	-40.85
3465	-62.67	82	219	H	3465	-58.93	9.79	1.72	-50.86	-13	-37.86
7837	-58.69	237	193	V	7837	-52.93	10.96	2.52	-44.49	-13	-31.49
7837	-61.43	347	163	H	7837	-55.67	10.96	2.52	-47.23	-13	-34.23

WCDMA band 4 High Channel

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
3490	-60.03	331	172	V	3490	-56.24	9.88	1.73	-48.09	-13	-35.09
3490	-60.3	10	212	H	3490	-56.51	9.88	1.73	-48.36	-13	-35.36
7516	-58.52	129	208	V	7516	-52.67	10.74	2.43	-44.36	-13	-31.36
7516	-62.3	299	168	H	7516	-56.45	10.74	2.43	-48.14	-13	-35.14

WCDMA band 5 Low Channel

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
1658	-68.45	296	213	V	1658	-64.19	9.32	1.28	-56.15	-13	-43.15
1658	-69.05	151	155	H	1658	-64.79	9.32	1.28	-56.75	-13	-43.75
7094	-58.95	262	166	V	7094	-53.03	10.42	2.89	-45.5	-13	-32.5
7094	-58.25	305	217	H	7094	-52.33	10.42	2.89	-44.8	-13	-31.8

WCDMA band 5 Mid Channel

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
1673	-65.41	359	150	V	1673	-61.27	9.29	1.29	-53.27	-13	-40.27
1673	-67.03	95	164	H	1673	-62.89	9.29	1.29	-54.89	-13	-41.89
7339	-60.31	349	165	V	7339	-54.23	10.47	2.82	-46.58	-13	-33.58
7339	-57.68	74	185	H	7339	-51.6	10.47	2.82	-43.95	-13	-30.95

WCDMA band 5 High Channel

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
1688	-67.39	267	186	V	1688	-63.3	9.26	1.3	-55.34	-13	-42.34
1688	-67.6	58	179	H	1688	-63.51	9.26	1.3	-55.55	-13	-42.55
7706	-59.92	261	174	V	7706	-54.12	11.06	2.48	-45.54	-13	-32.54
7706	-62.3	7	193	H	7706	-56.5	11.06	2.48	-47.92	-13	-34.92

LTE band 2 Low Channel, 20MHz BW, QPSK

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
3720	-62.82	230	152	V	3720	-59	10.21	1.95	-50.74	-13	-37.74
3720	-60.4	355	216	H	3720	-56.58	10.21	1.95	-48.32	-13	-35.32
7264	-61.19	342	164	V	7264	-55.09	10.37	2.95	-47.67	-13	-34.67
7264	-62.57	254	183	H	7264	-56.47	10.37	2.95	-49.05	-13	-36.05

LTE band 2 Mid Channel, 20MHz BW, QPSK

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
3760	-59.25	179	200	V	3760	-55.37	9.98	1.95	-47.34	-13	-34.34
3760	-63.42	327	190	H	3760	-59.54	9.98	1.95	-51.51	-13	-38.51
7474	-59.49	164	202	V	7474	-53.63	10.65	2.42	-45.4	-13	-32.4
7474	-61.62	336	156	H	7474	-55.76	10.65	2.42	-47.53	-13	-34.53

LTE band 2 High Channel, 20MHz BW, QPSK

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
3800	-60.76	176	206	V	3800	-56.81	9.76	1.95	-49	-13	-36
3800	-63.07	197	160	H	3800	-59.12	9.76	1.95	-51.31	-13	-38.31
7828	-59.56	195	177	V	7828	-53.79	10.97	2.51	-45.33	-13	-32.33
7828	-61.27	61	156	H	7828	-55.5	10.97	2.51	-47.04	-13	-34.04

LTE band 2 Low Channel, 20MHz BW, 16QAM

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
3720	-62.61	122	183	V	3720	-58.79	10.21	1.95	-50.53	-13	-37.53
3720	-58.95	285	163	H	3720	-55.13	10.21	1.95	-46.87	-13	-33.87
7208	-60.82	197	214	V	7208	-54.78	10.32	2.93	-47.39	-13	-34.39
7208	-62.15	308	210	H	7208	-56.11	10.32	2.93	-48.72	-13	-35.72

LTE band 2 Mid Channel, 20MHz BW, 16QAM

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
3760	-60.86	260	169	V	3760	-56.98	9.98	1.95	-48.95	-13	-35.95
3760	-60.16	112	171	H	3760	-56.28	9.98	1.95	-48.25	-13	-35.25
7129	-61.75	72	178	V	7129	-55.79	10.39	2.9	-48.3	-13	-35.3
7129	-62.84	162	182	H	7129	-56.88	10.39	2.9	-49.39	-13	-36.39

LTE band 2 High Channel, 20MHz BW, 16QAM

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
3800	-61.84	192	164	V	3800	-57.89	9.76	1.95	-50.08	-13	-37.08
3800	-63.02	4	172	H	3800	-59.07	9.76	1.95	-51.26	-13	-38.26
7384	-62.56	52	198	V	7384	-56.57	10.54	2.64	-48.67	-13	-35.67
7384	-58.41	54	157	H	7384	-52.42	10.54	2.64	-44.52	-13	-31.52

LTE band 4 Low Channel, 20MHz BW, QPSK

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
3440	-61.15	22	192	V	3440	-57.46	9.69	1.7	-49.47	-13	-36.47
3440	-64.03	153	219	H	3440	-60.34	9.69	1.7	-52.35	-13	-39.35
7189	-61.26	188	202	V	7189	-55.24	10.32	2.92	-47.84	-13	-34.84
7189	-58	61	157	H	7189	-51.98	10.32	2.92	-44.58	-13	-31.58

LTE band 4 Mid Channel, 20MHz BW, QPSK

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
3465	-63.25	314	177	V	3465	-59.51	9.79	1.72	-51.44	-13	-38.44
3465	-63.51	312	166	H	3465	-59.77	9.79	1.72	-51.7	-13	-38.7
7995	-59.51	120	157	V	7995	-53.79	10.71	2.56	-45.64	-13	-32.64
7995	-62.07	31	185	H	7995	-56.35	10.71	2.56	-48.2	-13	-35.2

LTE band 4 High Channel, 20MHz BW, QPSK

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
3490	-62.47	261	162	V	3490	-58.68	9.88	1.73	-50.53	-13	-37.53
3490	-63.72	82	157	H	3490	-59.93	9.88	1.73	-51.78	-13	-38.78
7115	-58.53	299	204	V	7115	-52.59	10.4	2.9	-45.09	-13	-32.09
7115	-58.17	344	194	H	7115	-52.23	10.4	2.9	-44.73	-13	-31.73

LTE band 4 Low Channel, 20MHz BW, 16QAM

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
3440	-63.83	116	152	V	3440	-60.14	9.69	1.7	-52.15	-13	-39.15
3440	-61.95	149	209	H	3440	-58.26	9.69	1.7	-50.27	-13	-37.27
7561	-61.38	47	209	V	7561	-55.54	10.89	2.44	-47.09	-13	-34.09
7561	-61.05	19	166	H	7561	-55.21	10.89	2.44	-46.76	-13	-33.76

LTE band 4 Mid Channel, 20MHz BW, 16QAM

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
3465	-64.21	69	179	V	3465	-60.47	9.79	1.72	-52.4	-13	-39.4
3465	-62.34	106	184	H	3465	-58.6	9.79	1.72	-50.53	-13	-37.53
7714	-61.71	318	162	V	7714	-55.91	11.05	2.48	-47.34	-13	-34.34
7714	-61.56	118	216	H	7714	-55.76	11.05	2.48	-47.19	-13	-34.19

LTE band 4 High Channel, 20MHz BW, 16QAM

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
3490	-64.55	125	190	V	3490	-60.76	9.88	1.73	-52.61	-13	-39.61
3490	-64.16	120	171	H	3490	-60.37	9.88	1.73	-52.22	-13	-39.22
7522	-61.18	242	199	V	7522	-55.33	10.76	2.43	-47	-13	-34
7522	-62.53	28	183	H	7522	-56.68	10.76	2.43	-48.35	-13	-35.35

LTE band 5 Low Channel, 10MHz BW, QPSK

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
1658	-66.13	287	193	V	1658	-61.87	9.32	1.28	-53.83	-13	-40.83
1658	-66.24	214	153	H	1658	-61.98	9.32	1.28	-53.94	-13	-40.94
7075	-62.06	298	162	V	7075	-56.16	10.42	2.89	-48.63	-13	-35.63
7075	-61.83	151	156	H	7075	-55.93	10.42	2.89	-48.4	-13	-35.4

LTE band 5 Mid Channel, 10MHz BW, QPSK

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
1673	-65.41	34	207	V	1673	-61.27	9.29	1.29	-53.27	-13	-40.27
1673	-69.08	188	178	H	1673	-64.94	9.29	1.29	-56.94	-13	-43.94
7352	-60.87	63	163	V	7352	-54.82	10.49	2.77	-47.1	-13	-34.1
7352	-59.3	124	214	H	7352	-53.25	10.49	2.77	-45.53	-13	-32.53

LTE band 5 High Channel, 10MHz BW, QPSK

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
1688	-67.13	155	193	V	1688	-63.04	9.26	1.3	-55.08	-13	-42.08
1688	-65.71	78	192	H	1688	-61.62	9.26	1.3	-53.66	-13	-40.66
7240	-59.99	350	181	V	7240	-53.91	10.35	2.94	-46.5	-13	-33.5
7240	-59.64	31	179	H	7240	-53.56	10.35	2.94	-46.15	-13	-33.15

LTE band 5 Low Channel, 10MHz BW, 16QAM

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
1658	-66.06	226	212	V	1658	-61.8	9.32	1.28	-53.76	-13	-40.76
1658	-68.38	142	211	H	1658	-64.12	9.32	1.28	-56.08	-13	-43.08
7347	-58.83	160	214	V	7347	-52.77	10.48	2.79	-45.08	-13	-32.08
7347	-59.69	170	163	H	7347	-53.63	10.48	2.79	-45.94	-13	-32.94

LTE band 5 Mid Channel, 10MHz BW, 16QAM

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
1673	-66.21	222	213	V	1673	-62.07	9.29	1.29	-54.07	-13	-41.07
1673	-65.16	325	150	H	1673	-61.02	9.29	1.29	-53.02	-13	-40.02
7529	-61.33	139	174	V	7529	-55.48	10.78	2.43	-47.13	-13	-34.13
7529	-61.52	78	219	H	7529	-55.67	10.78	2.43	-47.32	-13	-34.32

LTE band 5 High Channel, 10MHz BW, 16QAM

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
1688	-68.74	286	185	V	1688	-64.65	9.26	1.3	-56.69	-13	-43.69
1688	-66.09	128	186	H	1688	-62	9.26	1.3	-54.04	-13	-41.04
7987	-57.29	266	195	V	7987	-51.57	10.72	2.56	-43.41	-13	-30.41
7987	-58.34	278	189	H	7987	-52.62	10.72	2.56	-44.46	-13	-31.46

LTE band 12 Low Channel, 10MHz BW, QPSK

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
2112	-65.25	62	169	V	2112	-60.81	9.32	1.41	-52.9	-13	-39.9
2112	-66.14	356	171	H	2112	-61.7	9.32	1.41	-53.79	-13	-40.79
7960	-61.51	22	175	V	7960	-55.78	10.77	2.55	-47.56	-13	-34.56
7960	-58.92	10	156	H	7960	-53.19	10.77	2.55	-44.97	-13	-31.97

LTE band 12 Mid Channel, 10MHz BW, QPSK

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
2122.5	-65.48	45	195	V	2122.5	-61.03	9.34	1.41	-53.1	-13	-40.1
2122.5	-66.55	353	205	H	2122.5	-62.1	9.34	1.41	-54.17	-13	-41.17
7082	-59.24	252	173	V	7082	-53.33	10.42	2.89	-45.8	-13	-32.8
7082	-59.87	350	218	H	7082	-53.96	10.42	2.89	-46.43	-13	-33.43

LTE band 12 High Channel, 10MHz BW, QPSK

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
2133	-65.12	323	179	V	2133	-60.66	9.36	1.41	-52.71	-13	-39.71
2133	-67.44	7	211	H	2133	-62.98	9.36	1.41	-55.03	-13	-42.03
7244	-59.57	265	153	V	7244	-53.49	10.35	2.94	-46.08	-13	-33.08
7244	-59.83	307	154	H	7244	-53.75	10.35	2.94	-46.34	-13	-33.34

LTE band 12 Low Channel, 10MHz BW, 16QAM

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
2112	-65.84	296	206	V	2112	-61.4	9.32	1.41	-53.49	-13	-40.49
2112	-67.15	98	184	H	2112	-62.71	9.32	1.41	-54.8	-13	-41.8
7317	-60.82	197	170	V	7317	-54.69	10.44	2.91	-47.16	-13	-34.16
7317	-60.93	47	201	H	7317	-54.8	10.44	2.91	-47.27	-13	-34.27

LTE band 12 Mid Channel, 10MHz BW, 16QAM

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
2122.5	-66.51	100	174	V	2122.5	-62.06	9.34	1.41	-54.13	-13	-41.13
2122.5	-66.35	29	201	H	2122.5	-61.9	9.34	1.41	-53.97	-13	-40.97
7702	-59.1	211	166	V	7702	-53.3	11.06	2.48	-44.72	-13	-31.72
7702	-60.62	167	206	H	7702	-54.82	11.06	2.48	-46.24	-13	-33.24

LTE band 12 High Channel, 10MHz BW, 16QAM

Frequency MHz	Raw dBm	Azt Deg	Hgt cm	Pol	Frequency MHz	Level dBm	Ant Gain dBi	Cable Loss	Absolute Level dBm	Limit dBm	Margin dB
2133	-66.95	112	217	V	2133	-62.49	9.36	1.41	-54.54	-13	-41.54
2133	-64.25	71	184	H	2133	-59.79	9.36	1.41	-51.84	-13	-38.84
7878	-61.53	169	189	V	7878	-55.78	10.91	2.53	-47.4	-13	-34.4
7878	-61.53	90	173	H	7878	-55.78	10.91	2.53	-47.4	-13	-34.4

Note: Both horizontal and vertical polarities were investigated. The results above show only the worst case.

Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Cycle	Cal Due	In use
Radiated Emissions						
EMI Test Receiver	ESIB 40	100179	06/03/2018	1 Year	06/03/2019	☑
Bi-Log antenna (30MHz~2GHz)	JB1	A030702	08/15/2018	1 Year	08/15/2019	☑
Horn Antenna (1-18GHz)	3115	10SL0059	08/25/2018	1 Year	08/25/2019	☑
Horn Antenna (18-40 GHz)	AH-840	101013	08/28/2018	1 Year	08/28/2019	☑
Tuned Dipole Antenna Set	AD-100	40133:40149	10/02/2018	1 Year	10/01/2019	☑
Pre-Amplifier	LPA-6-30	11140711	02/08/2018	1 Year	02/10/2019	☑
Pre-Amplifier (1-26.5GHz)	8449B	3008A00715	05/30/2018	1 Year	05/30/2019	☑
Agilent Signal Generator	MXG N5182A	MY47071065	04/06/2018	1 Year	04/06/2019	☑

Annex B. 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 & Telecommunications Terminal Equipment:** EN45001 – EN ISO/IEC 17025
		Electromagnetic Compatibility: EN45001 – EN ISO/IEC 17025
Singapore iDA CB(Certification Body)		Phase I, Phase II
Vietnam MIC CAB Accreditation		Please see the document for the detailed scope
HongKong 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 Measuremet
Australia CAB Regocnition		**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