RF GNSS TEST REPORT

Product Name : LTE Module
Model Name : EC25-E, EC25-E MINIPCIE

Prepared for:

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Report Number	**:**	UL32220170517RED011-1
Date of Report	**:**	05-19-2017
Date of Test	**:**	05-17-2017~05-18-2017

Notes：

The test results only relate to these samples which have been tested.
Partly using this report will not be admitted unless been allowed by Unilab.
Unilab is only responsible for the complete report with the reported stamp of Unilab.

Applicant:	Quectel Wireless Solutions Co. Ltd . Room 501, Building 13, No.99 Tianzhou Road, Xuhui District, Shanghai,China.
Manufacturer:	Quectel Wireless Solutions Co. Ltd . Room 501, Building 13, No.99 Tianzhou Road, Xuhui District, Shanghai,China.
Product Name:	LTE Module
Brand Name:	Quectel
Model Name:	EC25-E, EC25-E MINIPCIE
EUT Voltage:	Extreme Low: 3.3V Nominal: 4.0V Extreme High:4.6V
Date of Receipt:	05-17-2017
Date of Test	05-17-2017~05-18-2017
Test Standard:	Draft ETSI EN 303413 V1.1.0
Test Result:	Pass

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(Technical Engineer: Wayne Wu)

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(Senior Engineer: Forest Cao)

Approved by : Eva wang
(Supervisor: Eva Wang)

TABLE OF CONTENTS

1. GENERAL INFORMATION

1.1 EUT DESCRIPTION

Product Name:	LTE Module
Model Name:	EC25-E, EC25-E MINIPCIE
Hardware Version:	R2.0
Software Version:	EC25EFAR02A04M4G
RF Exposure Environment:	Uncontrolled
GPS	
Operation Frequency:	1575.42MHz
Type of Modulation:	BPSK
Glonass	
Operation Frequency:	1591MHz~1615MHz
Type of Modulation:	BPSK
Antenna Peak Gain:	4dBi
Type:	Connector

1.2 TEST UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the apparatus

Parameter	Uncertainty
Radio Frequency	3.5 x10^(-8)
Spurious emissions, conducted	2.94 dB
Spurious emissions, radiated	5.2dB
Temperature	0.9 ℃
Humidity	4.5%RH

2. TECHNIACL SUMMARY

2.1 SUMMARY OF STANDARDS AND TEST RESULTS

The EUT have been tested according to the applicable standards as referenced below:

Performed Item	Normative References	Test Performed
GUE adjacent frequency band selectivity performance	ETSI EN 303413 V1.1.0	P
Spurious emissions	ETSI EN 303413 V1.1.0	P

Note: P means pass,F means failure, N/A means not applicable.

2.2 TEST EQUIPMENT LIST

Equipment	Manufacturer	Model	Serial No.	Due Date	Cal interval
Spectrum Analyzer	Agilent	N9038A	MY51210142	11/04/2017	1 year
3m Chamber & Accessory Equipment	ETS-LINDGREN	FACT-3	CT-0000336	11/26/2017	3 years
Biconilog Antenna	Schwarzbeck	VULB 9160	3316	09/18/2017	2 years
VHF-UHF-Biconical Antenna	Schwarzbeck	VUBA9117	9117-263	09/18/2017	2 years
Horn Antenna	Schwarzbeck	BBHA9120D	942	09/18/2017	2 years
Horn Antenna	Schwarzbeck	BBHA9120D	9120D-943	09/18/2017	2 years
Microwave Preamplifier	EM Electronics	EM30180	3008A02425	02/25/2018	1 year

2.3 SUPPORT EQUIPMENT

Equipment	Model	Serial No.	Due Date	Cal interval
Multi-GNSS simulation system	NSS8000	BD062C962001	12/28/2017	1 year
Signal Generator	E4438C	MY49074290	04/16/2018	1 year

2.4 TEST FACILITY

All test facilities used to collect the test data are located at No.1350, Lianxi Rd. Pudong New District, Shanghai, China. The site and apparatus are constructed in conformance with the requirements of ANSI C63.4:2009, CISPR 16-1-1 and other equivalent standards. The laboratory is compliance with the requirements of the ISO/IEC/EN 17025.

2.5 TEST SETUP CONFIGURATION

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

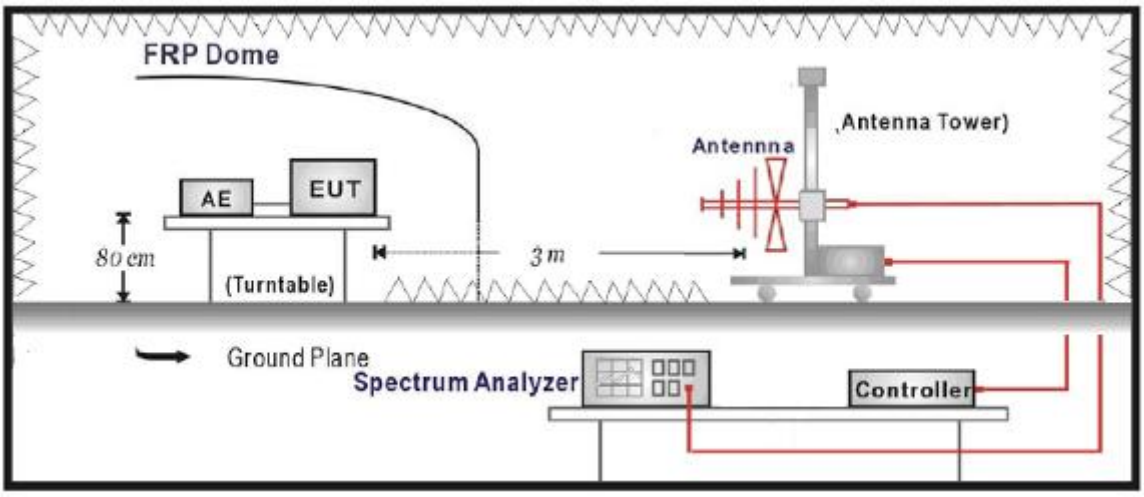
Notes:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. All the tests were carried out with the EUT in normal operation. Which was shown in the test report is the worst test mode.
3. Grounding was established in accordance with the manufacturer’s requirements and conditions for the intended use.

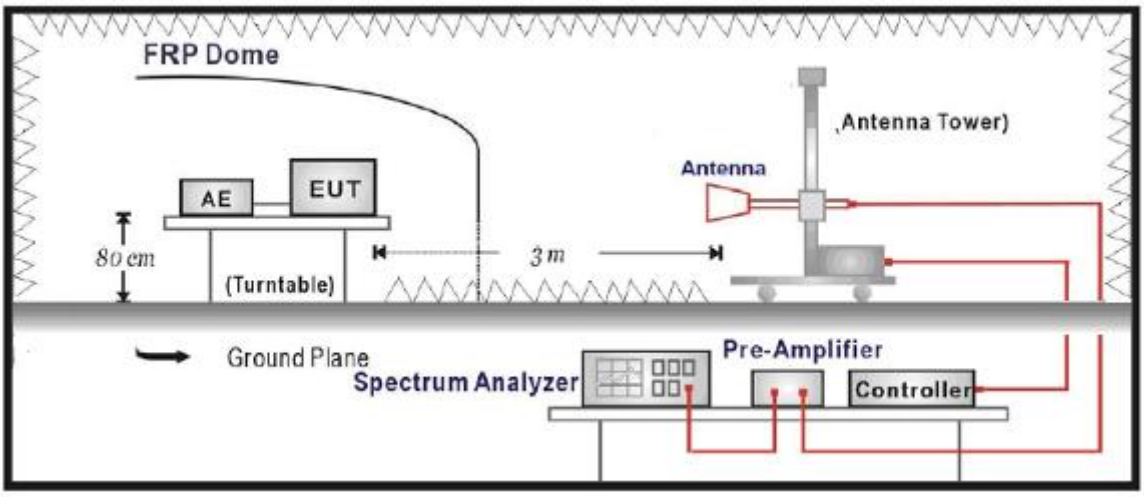
3. RECEIVER SPURIOUS EMISSIONS

3.1 TEST SETUP

Radiated Spurious Measurement: below 1GHz:



Radiated Spurious Measurement: above 1GHz:



3.2 LIMITS

The spurious emissions of the GUE shall not exceed the values given in table 4-5.
In case of a GUE with an external antenna connector, these limits apply to emissions at the antenna port (conducted).For emissions radiated by the cabinet or for emissions radiated by a GUE with an integral antenna (without an antenna connector), these limits are e.r.p. for emissions up to 1 GHz and e.i.r.p. for emissions above 1 GHz.

Table 4-5: Spurious emission limits

Frequency range	Maximum power	Bandwidth
30 MHz to 1 GHz	-57 dBm	100 kHz
1 GHz to 8,3 GHz	-47 dBm	1 MHz

3.3 TEST PROCEDURE

Refer to ETSI EN 303 413 V1.1.0 Clause 5.5.2.

3.4 TEST RESULT

Test mode ：GPS Receiver

Frequency (MHz)	Polarization (H/V)	Measure Level (dBm)	Limit (dBm)	Over Limit (dB)	Detector
61.8	H	-70.42	-57	-13.42	Peak
135.1	V	-71.11	-57	-14.11	Peak
306.7	H	-66.33	-57	-9.33	Peak
344.3	V	-66.52	-57	-9.52	Peak
666.7	H	-64.15	-57	-7.15	Peak
802.3	V	-65.45	-57	-8.45	Peak
1568.5	H	-58.33	-47	-11.33	Peak
1752.6	V	-58.78	-47	-11.78	Peak
3611.9	H	-59.25	-47	-12.25	Peak
4052.4	V	-59.99	-47	-12.99	Peak
4387.8	H	-59.21	-47	-12.21	Peak
5755.9	V	-60.15	-47	-13.15	Peak

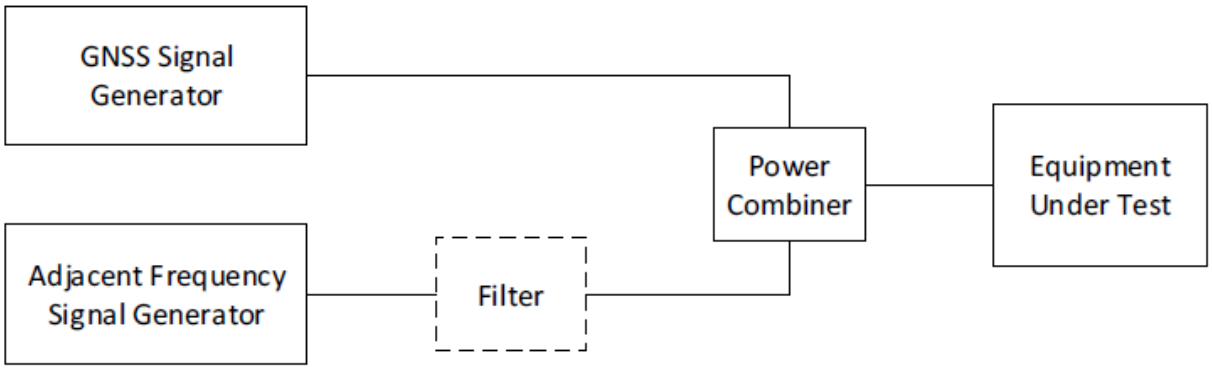
Test mode ：Glonass Receive

Frequency (MHz)	Polarization (H/V)	Measure Level (dBm)	Limit (dBm)	Over Limit (dB)	Detector
47.8	H	-70.25	-57	-13.25	Peak
143.6	V	-63.35	-57	-6.35	Peak
255.8	H	-64.78	-57	-7.78	Peak
303.4	V	-63.25	-57	-6.25	Peak
557.9	H	-66.88	-57	-9.88	Peak
833.4	V	-61.32	-57	-4.32	Peak
1400.2	H	-55.68	-47	-8.68	Peak
1845.6	V	-58.63	-47	-11.63	Peak
3333.3	H	-62.34	-47	-15.34	Peak
4589.6	V	-65.34	-47	-18.34	Peak
4801.4	H	-58.96	-47	-11.69	Peak
5893.6	V	-60.21	-47	-13.21	Peak

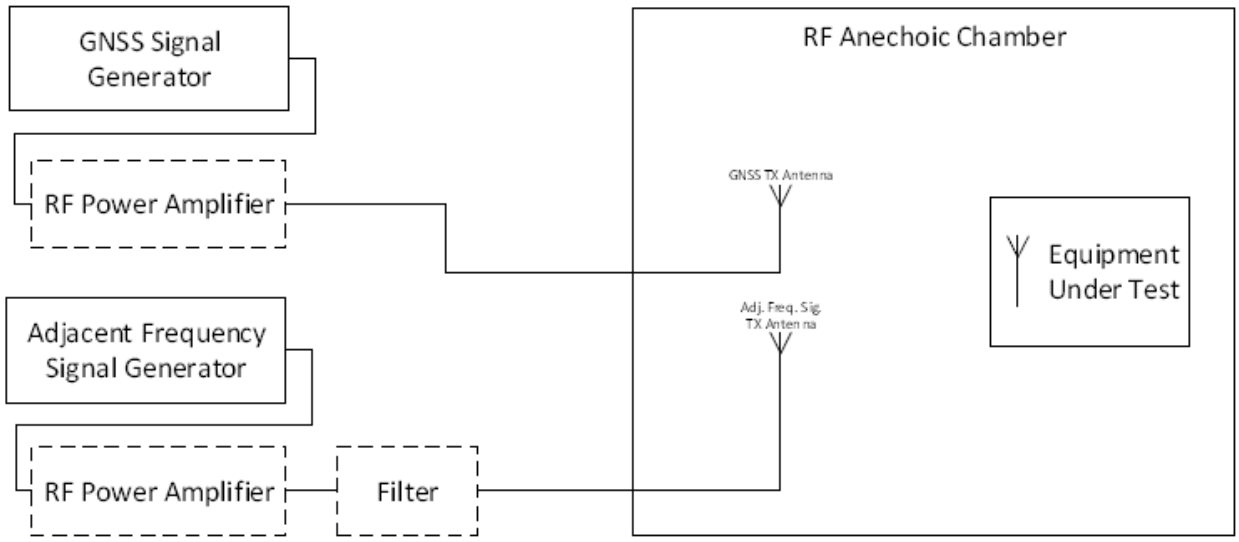
4. GUE ADJACENT FREQUENCY BAND SELECTIVITY PERFORMANCE

4.1 TEST SETUP

Conducted measurement setup for EUT adjacent frequency band selectivity:



Radiated measurement setup for EUT adjacent frequency band selectivity:



4.2 SPECIFICATIONS

The C/N0 metric reported by the GUE for all GNSS and GNSS signals given in table 4-1 and supported by the GUE shall not degrade by more than the value given in equation 4-1 when an adjacent frequency signal is applied. The adjacent frequency signal is defined in table 4-4, with the frequencies and power levels defined in table 4-2 and/or in table 4-3 depending on the RNSS bands supported by the GUE.

Equation 4-1: Maximum degradation in C/N0

$$\Delta\, C/N_0 \leq 1 \text{ dB}$$

Table 4-1: GNSS, GNSS signals and RNSS frequency bands

GNSS	GNSS Signal Designations	RNSS Frequency Band (MHz)
BDS	B1I	1 559 to 1 610
Galileo	E1	1 559 to 1 610
	E5a	1 164 to 1 215
	E5b	1 164 to 1 215
	E6	1 215 to 1 300
GLONASS	G1	1 559 to 1 610
	G2	1 215 to 1 300
GPS	L1	1 559 to 1 610
	L2	1 215 to 1 300
	L5	1 164 to 1 215
SBAS	L1	1 559 to 1 610
	L5	1 164 to 1 215

Table 4-2: Frequency bands, adjacent frequency signal test point centre frequencies and power levels for the 1 559 MHz to 1 610 MHz RNSS band

Frequency band (MHz)	Test point centre frequency (MHz)	Adjacent frequency signal power level (dBm)	Comments
1 518 to 1 525	1 524	-65	MSS (space-to-Earth) band
1 525 to 1 549	1 548	-95	MSS (space-to-Earth) band
1 549 to 1 559	1 554	-105	MSS (space-to-Earth) band
1 559 to 1 610	GUE RNSS band under test		
1 610 to 1 626	1 615	-105	MSS (Earth-to-space) band
1 626 to 1 640	1 627	-85	MSS (Earth-to-space) band

Table 4-3: Frequency bands, adjacent frequency signal test point centre frequencies and power levels for the 1 164 MHz to 1 300 MHz RNSS band

Frequency band (MHz)	Test point centre frequency (MHz)	Adjacent frequency signal power level (dBm)	Comments
960 to 1 164	1 154	-75	AM(R)S, ARNS band
1 164 to 1 215	GUE RNSS band under test		
1 215 to 1 260	GUE RNSS band under test		
1 260 to 1 300	GUE RNSS band under test		
1 300 to 1 350	1 310	-85	Radiolocation, ARNS, RNSS (Earth-to-space) band

Table 4-4: Adjacent frequency signal

Parameter	Value	Comments
Frequency	See table 4-2 and table 4-3	
Power level	See table 4-2 and table 4-3	
Bandwidth	1 MHz	See clause B.1 for details
Format	AWGN	

4.3 TEST PROCEDURE

Test method for GUE utilizing the 1 559 MHz to 1 610 MHz RNSS band:

1 Configure the GNSS signal generator to simulate those GNSS and GNSS signals from table 4-1 declared as supported by the GUE, with power levels and other details as specified in clause B.2.
2 With the adjacent frequency signal switched off, the EUT shall be given sufficient time to acquire all simulated satellites from the declared GNSS system(s).
3 Record the baseline C/N0 value(s) reported by the EUT. Sufficient filtering shall be used to obtain a stable value. C/N0 may be averaged across all the satellites in view for each GNSS constellation. However, C/N0 shall not be averaged across satellite signals in different GNSS constellations. For a multi-GNSS EUT, there shall be a separate C/N0 value recorded for each GNSS constellation and each GNSS signal supported.
4 The adjacent frequency signal generator shall be configured to generate the signal defined in table 4-4, at the first test point centre frequency and signal power level as specified in table 4-2.
5 The adjacent frequency signal shall be switched on, and the EUT's C/N0 value(s) recorded as in step 3) to measure the degradation with respect to the baseline value(s) recorded in step 3.
6 Test point Pass/Fail Criteria: If the C/N0 degradation from step 5) does not exceed the value in equation 4-1, then this test point is set to "pass". If the C/N0 degradation exceeds the value in equation 4-1, then this test point is set to "fail." For a multi-GNSS and multi-signal EUT, there shall be a separate pass/fail determination for each GNSS and for each GNSS signal supported. If the C/N0 degradation exceeds the value in equation 4-1 for any supported GNSS or supported GNSS signal, then this test point is set to "fail".
7 Step 1 through step 6 shall be repeated for all test point centre frequencies (and associated signal power level) specified in table 4-2.

If the EUT passes the C/N0 degradation test for all test points for all GNSS constellations and all GNSS signals declared as supported from table 4-1, the EUT shall be deemed to "pass". If the C/N0 degradation test fails for any GNSS constellation or GNSS signal at any of the test points, the EUT shall be deemed to "fail".

Test method for GUE utilizing the 1 164 MHz to 1 300 MHz RNSS band:

For a GUE also utilizing the RNSS bands in the 1 164 MHz to 1 300 MHz range, the test method in clause 5.4.3 (step 1) through step 7), inclusive), shall be repeated using the adjacent frequency test point centre frequencies and associated signal power levels specified in table 4-3.

If the EUT passes the C/N0 degradation tests as defined in both clause 5.4.3 and clause 5.4.4, the EUT shall be deemed to "pass". If the C/N0 degradation test fails tests as defined in either or both of clause 5.4.3 or clause 5.4.4, the EUT shall be deemed to "fail".

4.4 TEST RESULT

Test point centre frequency (MHz)	Adjacent frequency signal power level (dBm)	C/N_0 (dB)		$\Delta C/N_0$ (dB)	Limit(dB)	Result
		Without interference	With interference			
GPS mode						
1524	-65	48.8	48.8	0.00	$\Delta C/N_0 \leq 1$	PASS
1548	-95	48.8	48.7	0.01	$\Delta C/N_0 \leq 1$	PASS
1554	-105	48.8	48.8	0.00	$\Delta C/N_0 \leq 1$	PASS
1615	-105	48.8	48.7	0.01	$\Delta C/N_0 \leq 1$	PASS
1627	-85	48.8	48.8	0.00	$\Delta C/N_0 \leq 1$	PASS
Glonass mode						
1524	-65	46.7	46.7	0.00	$\Delta C/N_0 \leq 1$	PASS
1548	-95	46.7	46.7	0.00	$\Delta C/N_0 \leq 1$	PASS
1554	-105	46.7	46.6	0.01	$\Delta C/N_0 \leq 1$	PASS
1615	-105	46.7	46.7	0.00	$\Delta C/N_0 \leq 1$	PASS
1627	-85	46.7	46.7	0.00	$\Delta C/N_0 \leq 1$	PASS

APPENDIX 1 PHOTOGRAPHS OF TEST SETUP

Please refer to the file named “RF Test Setup Photos”.

APPENDIX 2 PHOTOGRAPHS OF EUT

Please refer to the file named “EUT Photos”.

----End of the report----