

# EMC TEST REPORT

**Product Name : LTE Module**

**Model No. : EC25-E, EC25-E MINIPCIE**

Prepared for:

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**Report Number : UL32220170517RED011-2**  
**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.

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**Manufacturer:** Quectel Wireless Solutions Co. Ltd .  
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Shanghai,China.

**Product Name:** LTE Module

**Brand Name:** Quectel

**Model Name:** EC25-E, EC25-E MINIPCIE

**Technical Data:** 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 301489-1 V2.2.0  
Draft ETSI EN 301489-19 V2.1.0

**Test Result:** PASS

**Performed Location :** Unilab (Shanghai) Co., Ltd.  
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## 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
<b>GPS</b>	
Operation Frequency:	1575.42MHz
Type of Modulation:	BPSK
<b>Glonass</b>	
Operation Frequency:	1591MHz~1615MHz
Type of Modulation:	BPSK
Antenna Peak Gain:	4dBi
Type:	Connector

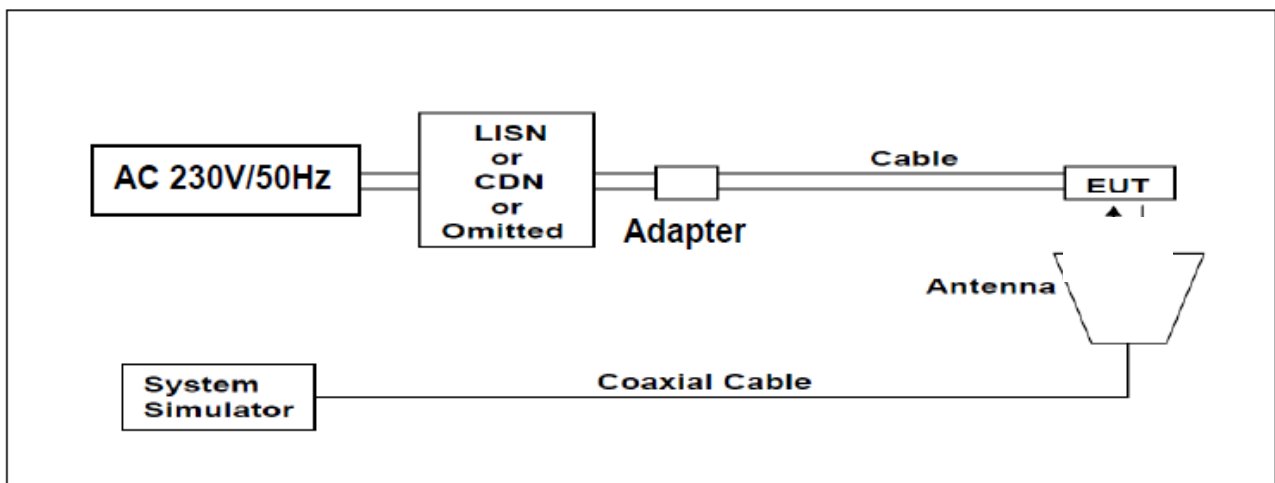
### 1.2 TEST MODE DESCRIPTION

Unilab has verified the construction and function in typical operation. All the test modes were carried out with the EUT in normal operation, which was shown in this test report is the worst test mode.

#### Final-Test Mode:

EMI	Mode 1: GPS Receive Mode 2: Glonass Receive
EMS	Mode 1: GPS Receive Mode 2: Glonass Receive

### 1.3 CONNECTION DIAGRAM OF TESTED SYSTEM



## 2. TECHNIACL SUMMARY

### 2.1 SUMMARY OF STANDARDS AND TEST RESULTS

Test items are been completed as follows(ETSI EN 301489-1):

Phenomenon	Application	Equipment test requirement		
		fixed use	vehicular use	portable use
Radiated emission	enclosure of ancillary equipment	applicable for stand alone testing	applicable for stand alone testing	applicable for stand alone testing
Conducted emission	DC power input/output port	applicable	applicable	not applicable
	AC mains input/output port	applicable	not applicable	not applicable
	Telecommunication port	applicable	not applicable	not applicable
harmonic current emissions	AC mains input port	applicable	not applicable	not applicable
Voltage fluctuations and flicker	AC mains input port	applicable	not applicable	not applicable
RF electromagnetic Field (80 MHz to 6000 MHz)	enclosure	applicable	applicable	applicable
Electrostatic discharge	enclosure	applicable	not applicable	applicable
fast transients common mode	signal, Telecommunication and control ports,	applicable	not applicable	not applicable
	DC and AC power ports	applicable	not applicable	not applicable
RF common mode 0,15 MHz to 80 MHz	Signal telecommunication and control ports	applicable	applicable	not applicable
	DC and AC power ports	applicable	applicable	not applicable
transients and surges	DC power input ports	not applicable	applicable	not applicab
voltage dips and interruptions	AC mains power input ports	applicable	not applicable	not applicable
surges, line to line and line to ground	AC mains power input ports, telecommunication ports	applicable	not applicable	not applicable

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

<b>EMISSION (ETSI EN 301489-1)</b>		
<b>Test Item</b>	<b>Standard</b>	<b>Result</b>
Radiated disturbance	ETSI EN 301489-1 & EN 55032	N/A
Conducted disturbance	ETSI EN 301489-1 & EN 55032	N/A
Harmonic current emission	ETSI EN 301489-1 & EN 61000-3-2	N/A
Voltage fluctuations and flicker	ETSI EN 301489-1 & EN 61000-3-3	N/A

<b>IMMUNITY (ETSI EN 301489-1 &amp; ETSI EN 301489-19)</b>		
<b>Test Item</b>	<b>Standard</b>	<b>Result</b>
Radio-frequency electromagnetic field Immunity	ETSI EN 301489-1 & ETSI EN 301489-19 & EN 61000-4-3	P
Electrostatic discharge (ESD)	ETSI EN 301489-1 & ETSI EN 301489-19 & EN 61000-4-2	P
Electrical fast transients (EFT)	ETSI EN 301489-1 & ETSI EN 301489-19 & EN 61000-4-4	N/A
Radio-frequency common mode	ETSI EN 301489-1 & ETSI EN 301489-19 & EN 61000-4-6	N/A
Transients and surges	ETSI EN 301489-1 & ETSI EN 301489-19 & ISO 7637-2	N/A
Voltage dips and interruptions	ETSI EN 301489-1 & ETSI EN 301489-19 & EN 61000-4-11	N/A
Surges	ETSI EN 301489-1 & ETSI EN 301489-19 & EN 61000-4-5	N/A

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

## 2.2 TEST UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

<b>Test item</b>	<b>Value (dB)</b>
Conducted disturbance	3.4
Radiated disturbance	4.2

## 2.3 TEST EQUIPMENT LIST

Equipment	Manufacturer	Model	Serial No.	Due Date	Cal interval
Receiver	Agilent	N9038A	MY51210142	01/11/2017	1 year
LISN	SCHWARZBECK	NNBM8124-200	1035	25/07/2017	1 year
3m Chamber & Accessory Equipment	ETS-LINDGREN	FACT-3	CT-0000336	26/11/2017	3 years
Biconilog Antenna	SCHWARZBECK	VULB 9160	3316	08/09/2018	2 years
Horn Antenna	SCHWARZBECK	BBHA9120D	942	08/09/2018	2 years
Microwave Preamplifier	EM Electronics	EM30180	3008A02425	07/06/2017	1 year
Power Meter	R&S	NRP2	104626	20/08/2017	1 year
Signal generator	R&S	SMB100A	178486	20/08/2017	1 year
Power Amplifier	BONN	BLWA0810-160/100D	139273B	07/06/2017	1 year
VHF/UHF EMS Antenna	SCHWARZBECK	STLP9128D	033	26/04/2019	2 years
Conducted Immunity Test System	FRANKONIA	CIT-10/75	126B1137	26/05/2018	1 year
Attenuator	FRANKONIA	75-A-FFN-06	1010	08/06/2017	1 year
CDN	FRANKONIA	CDN M2+M3	A3011136	24/06/2017	1 year
ISO7637 test system	TESEQ	NSG5500-2/5602	2492/2097	03/03/2018	1 year

## 2.4 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

## 2.5 TEST FACILITY

The site and apparatus are constructed in conformance with the requirements of ANSI C63.4, CISPR 16-1-1 and other equivalent standards. The laboratory is compliance with the requirements of the ISO/IEC/EN 17025.

## 2.6 IMMUNITY PERFORMANCE CRITERIA

### General Requirements (ETSI EN 301489-1):

The performance criteria are used to take a decision on whether a radio equipment passes or fails immunity tests. For the purpose of the present document four categories of performance criteria apply:

- Performance criteria for continuous phenomena applied to transmitters and receivers;
- Performance criteria for transient phenomena applied to transmitters and receivers;
- Performance criteria for equipment which does not provide a continuous communication link;
- Performance criteria for ancillary equipment tested on a stand alone basis.

Normally, the performance criteria depend on the type of radio equipment. Thus, the present document only contains general performance criteria commonly used for the assessment of radio equipment. More specific and product-related performance criteria for a dedicated type of radio equipment may be found in the part of EN 301 489 series [i.13] dealing with the particular type of radio equipment.

### **(1) Performance criteria for continuous phenomena applied to transmitters and receivers**

If no further details are given in the relevant part of EN 301 489 series [i.13] dealing with the particular type of radio equipment, the following general performance criteria for continuous phenomena shall apply. During and after the test, the apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer when the apparatus is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance. During the test the EUT shall not unintentionally transmit or change its actual operating state and stored data. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be deduced from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

### **(2) Performance criteria for transient phenomena applied to transmitters and receivers**

If no further details are given in the relevant part of EN 301 489 series [i.13] dealing with the particular type of radio equipment, the following general performance criteria for transient phenomena shall apply. After the test, the apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer, when the apparatus is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance. During the EMC exposure to an electromagnetic phenomenon, a degradation of performance is, however, allowed. No change of the actual mode of operation (e.g. unintended transmission) or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be deduced from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

### **(3) Performance criteria for equipment which does not provide a continuous communication link**

For radio equipment which does not provide a continuous communication link, the performance criteria described in clauses 6.1 and 6.2 are not appropriate, then the manufacturer shall declare, for inclusion in the test report, his own specification for an acceptable level of performance or degradation of performance during and/or after the immunity tests. The performance specification shall be included in the product description and documentation. The related specifications set out in clause 5.3 have also to be taken into account. The performance criteria specified by the manufacturer shall give the same degree of immunity protection as called for in clauses 6.1 and 6.2.

### **(4) Performance criteria for ancillary equipment tested on a stand alone basis**

If ancillary equipment is intended to be tested on a stand alone basis, the performance criteria described in clauses 6.1 and 6.2 are not appropriate, then the manufacturer shall declare, for inclusion in the test report, his own specification for an acceptable level of performance or degradation of performance during and/or after the immunity tests. The performance specification shall be included in the product description and documentation. The related specifications set out in clause 5.3 have also to be taken into account. The performance criteria specified by the manufacturer shall give the same degree of immunity protection as called for in clauses 6.1 and 6.2.

### **General Requirements (ETSI EN 301 489-19):**

If the EUT is of a non specialized nature or the EUT is combined with an ancillary equipment, the test modulation, test arrangements, etc. as required in clause 4 shall apply.

The EUT, for all immunity tests according to the present document, except the spot frequency test of the immunity test with radiated RF electromagnetic fields (see ETSI EN 301 489-1 [1], clause 9.2), shall be assessed for:

- the storage of messages in the memory of the EUT at the start of the test;
- unintentional responses of the EUT during the test;
- the maintenance of the EUT memory assessed at the conclusion of the test;
- the ability to receive and store messages at the conclusion of the test.



For the spot frequency test of the immunity test with radiated RF electromagnetic fields (see ETSI EN 301 489-1 [1], clause 9.2) the EUT shall be assessed by monitoring the accuracy of the call received alert signal.

**(1) Performance criteria for Continuous phenomena applied to ROMES and ROGNSS receivers**

For the EUT, excluding spot frequency tests as part of the immunity test with radiated RF electromagnetic fields (see ETSI EN 301 489-1 [1], clause 9.2):

- the general performance criteria set out in clause 6.1;
- during the test no false calls shall occur;
- at the conclusion of the test comprising the series of individual exposures the EUT shall operate as intended with no loss of functions or stored data (messages), as declared by the manufacturer.

For the spot frequency test as part of the immunity test with radiated RF electromagnetic fields (see ETSI EN 301 489-1 [1], clause 9.2) the EUT shall be assessed by monitoring the accuracy of the call received alert signal.

**(2) Performance criteria for Transient phenomena applied to ROMES and ROGNSS receivers**

For the EUT:

- the general performance criteria set out in clause 6.1;
- during the test no false calls shall occur;
- at the conclusion of the test comprising the series of individual exposures, the EUT shall operate as intended with no loss of function and/or stored data (messages), as declared by the manufacturer.

**(3) Performance criteria for equipment which does not provide a continuous communication link**

The provision of ETSI EN 301 489-1 [1], clause 6.3 shall apply with the following modifications.

For EUTs of a specialized nature and/or ancillary equipment tested on a stand alone basis the manufacturer shall define the method of test to determine the acceptable level of performance or degradation of performance during and/or after the test. Under these circumstances the manufacturer will also provide the following information:

- the primary functions of the equipment to be tested during and after EMC stress;
- the intended functions of the EUT which shall be in accordance with the documentation accompanying the equipment;
- the pass/failure criteria for the equipment;
- the method of observing a degradation of performance of the equipment.

The assessment of the performance or the degradation of performance which shall be carried out during and/or at the conclusion of the tests, shall be simple, but at the same time give adequate proof that the primary functions of the equipment are operational.

The following special conditions set out in table 2, relate to the immunity test methods and performance criteria used in ETSI EN 301 489-1 [1], clause 9.

**Special conditions for EMC immunity tests**

Reference to clauses in EN 301 489-1 [1]	Special product-related conditions, additional to or modifying the test conditions in EN 301 489-1 [1], clause 9
9.1 Test configuration; Test methods and levels for immunity tests	The message memory shall be loaded with recognizable messages. The EUT shall operate in stand-by mode of operation, except for the spot frequency test as part of the immunity test with radiated RF electromagnetic fields (see ETSI EN 301 489-1 [1], clause 9.2) where repetitive calls shall be coupled to the input of the receiver. • for the immunity tests of ancillary equipment, without a separate pass/fail criteria, an EUT coupled to the ancillary equipment shall be used to judge whether the ancillary equipment passes or fails.
9.2.2 Test method; Radio frequency electromagnetic field	<b>Spot frequency test:</b> A spot frequency test shall additionally be performed at: • 80 MHz; • 104 MHz; • 136 MHz; • 165 MHz; • 200 MHz; • 260 MHz; • 330 MHz; • 430 MHz; • 560 MHz; • 715 MHz $\pm$ 1 MHz; • a spot frequency test shall be performed at 920 MHz $\pm$ 1 MHz using a test level of 3 V/m (measured unmodulated) 100 % modulated by 200 Hz pulses of equal mark to space ratio.

## 2.7 TEST SETUP CONFIGURATION

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

**Notes:**

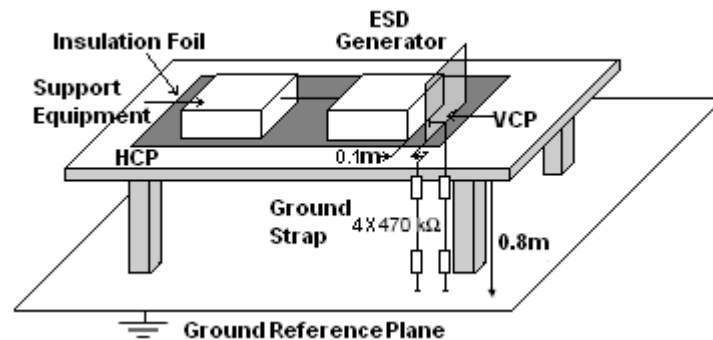
1. All the equipment and cables was placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

### 3. ELECTROMAGNETIC DISCHARGE(ESD)

#### 3.1 TEST SPECIFICATION

<b>Basic Standard</b>	: EN 61000-4-2
<b>Test Port</b>	: Enclosure port
<b>Discharge Impedance</b>	: 330 ohm / 150 pF
<b>Discharge Mode</b>	: Single Discharge
<b>Discharge Period</b>	: one second between each discharge

#### 3.2 TEST SETUP



#### 3.3 TEST PROCEDURE

The test applied a non-conductive surface and a horizontal coupling plane on a wooden table, 0.8 m high, standing on the reference ground plane, which is a 3 m x 4 m metallic sheet with 1.5 mm thickness. This reference ground plane projected beyond the EUT by at least 0.5 m on all sides and the minimum distance between the EUT and all other conductive structure, except the ground plane beneath the EUT, was more than 1.0 m.

ESD shall be applied only to those points and surfaces of the EUT which are expected to be touched during usual operation, including user access, as specified in the user manual.

The discharges shall be applied in the following:

A. Contact discharge (Tests shall be performed at a maximum repetition rate of one discharge per second.):

a. Direct discharge:

The tip of the discharge electrode should touch the EUT, before the discharge switch was operated. The EUT shall be exposed to at least 200 discharges, 100 each at negative and positive polarity, at a minimum of four test points (a minimum of 50 discharges at each point). One of the test points shall be subjected to at least 50 indirect discharges (contact) to the center of the front edge of the horizontal coupling plane. If no direct contact test points are available, then at least 200 indirect discharges shall be applied in the indirect mode (use of the Vertical Coupling Plane)

b. Indirect discharge:

b1. Horizontal Coupling Plane (HCP): More than 50 single discharges were applied at the front edge of each HCP opposite the center point of the EUT and 0.1m from vertically the front of the EUT. Discharge to the HCP was made horizontal to the edge of the HCP.

b2. Vertical Coupling Plane (VCP): More than 50 single discharges were applied to the center of one vertical edge of the coupling plane. The coupling plane, of dimensions 0.5 m x 0.5 m, was placed parallel to, and positioned at a distance of 0. m from the EUT. Discharges

were applied to the coupling plane, with this plane in sufficient different positions that all sides of the EUT were completely illuminated.

#### B. Air discharge at slots and apertures, and insulating surfaces:

On those parts of the EUT where it is not possible to perform contact discharge testing, the equipment should be investigated to identify user accessible points where breakdown may occur. Such points are tested using the air discharge method. The round discharge tip of the discharge electrode was approached as fast as possible to touch the EUT. After each discharge, the ESD simulator (discharge electrode) was removed from the EUT. The simulator was then re-triggered for a new single discharge and applies more than 10 times on each reselected point. This procedure was repeated until the air discharge completed.

### 3.4 RESULTS & PERFORMANCE

#### Discharge point :



**EUT** : LTE Module **M/N** : EC25-E, EC25-E  
**Power** : DC 4.0V **Temperature** : 20℃  
**Mode** : Mode 1&2 **Humidity** : 56%

Contact discharge					
Test location	Test level (±kV)	Minimum number of discharge per polarity (each location)	Required Criterion	Performance Criterion	Result
1	2,4	10	TT/TR	TT/TR	Pass

Contact discharge (HCP)					
Test location	Test level (±kV)	Minimum number of discharge per polarity (each location)	Required Criterion	Performance Criterion	Result
Front	2,4	25	TT/TR	TT/TR	Pass
Rear	2,4	25	TT/TR	TT/TR	Pass
Left	2,4	25	TT/TR	TT/TR	Pass
Right	2,4	25	TT/TR	TT/TR	Pass
Contact discharge (VCP)					
Test location	Test level (±kV)	Minimum number of discharge per polarity (each location)	Required Level	Performance Criterion	Result
Front	2,4	25	TT/TR	TT/TR	Pass
Rear	2,4	25	TT/TR	TT/TR	Pass
Left	2,4	25	TT/TR	TT/TR	Pass
Right	2,4	25	TT/TR	TT/TR	Pass

### 3.5 ADDITIONAL RESULT INFORMATION

No observable change for EUT during the test and after test, and the following Performance criteria be conformed:

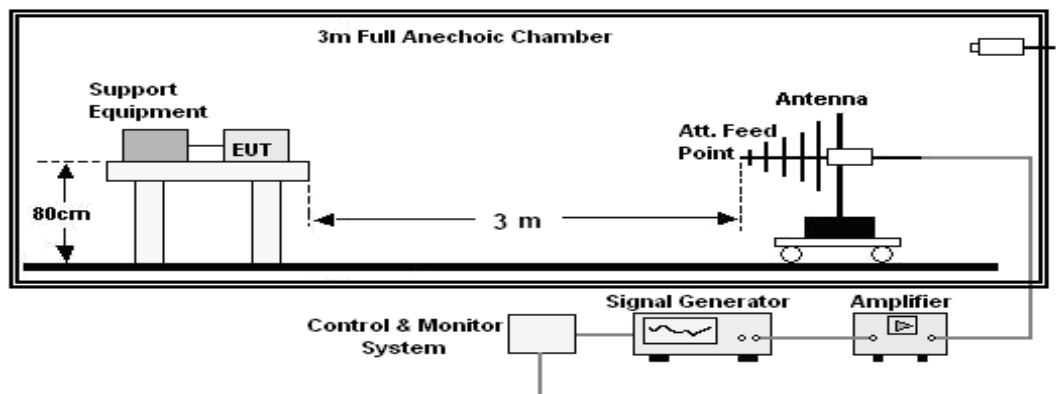
- The EUT operate with no user noticeable loss of the communication link each exposure.
- The total test comprising the series of individual exposures, and operate as intended with no loss of user control functions or stored data, as declared by the manufacturer, and the communication link have been maintained
- The transmitter shall not unintentionally operate at the idle mode.

## 4. RF ELECTROMAGNETIC FIELD IMMUNITY

### 4.1 TEST SPECIFICATION

<b>Basic Standard</b>	: EN 61000-4-3
<b>Frequency Range</b>	: 80MHz-6000MHz
<b>Step Size</b>	: 10%
<b>Modulation</b>	: 1kHz, 80% AM
<b>Dwell Time</b>	: 1 second
<b>Polarization</b>	: Horizontal & Vertical

### 4.2 TEST SETUP



### 4.3 TEST PROCEDURE

- The EUT and support equipment were placed on the non-conductive table 0.8m above the ground plane at a fully-anechoic chamber. The transmit antenna was located at a distance of 3 meters from the EUT and support equipment.
- The frequency range is swept from 80MHz to 6000MHz, with the signal 80% amplitude modulated with a 1 kHz sine wave. The rate of sweep did not exceed  $1.5 \times 10^{-3}$  decade/s. Where the frequency range is swept incrementally, the step size was 1%. The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond.
- The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each side. A CCD camera was put inside the chamber and through its display to monitor the operational situation of the EUT to judge the EUT performance criterion during test.

#### 4.4 RESULTS & PERFORMANCE

<b>EUT</b>	: LTE Module	<b>M/N</b>	: EC25-E, EC25-E MINIPCIE
<b>Power</b>	: DC 4.0V	<b>Temperature</b>	: 20℃
<b>Mode</b>	: Mode 1&2	<b>Humidity</b>	: 56%

Frequency (MHz)	EUT Position	Antenna Polarization	Field Strength (V/m)	EUT Performance	Result
80 – 6000	Front	Horizontal	3	CT/CR	PASS
80 – 6000	Front	Vertical	3	CT/CR	PASS
80 – 6000	Rear	Horizontal	3	CT/CR	PASS
80 – 6000	Rear	Vertical	3	CT/CR	PASS
80 – 6000	Left	Horizontal	3	CT/CR	PASS
80 – 6000	Left	Vertical	3	CT/CR	PASS
80 – 6000	Right	Horizontal	3	CT/CR	PASS
80 – 6000	Right	Vertical	3	CT/CR	PASS
80 – 6000	Floor	Horizontal	3	CT/CR	PASS
80 – 6000	Floor	Vertical	3	CT/CR	PASS
80 – 6000	Top	Horizontal	3	CT/CR	PASS
80 – 6000	Top	Vertical	3	CT/CR	PASS

#### 4.5 ADDITIONAL RESULT INFORMATION

No observable change for EUT during the test and after test.

## **APPENDIX 1    PHOTOGRAPHS OF TEST SETUP**

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

## **APPENDIX 2    PHOTOGRAPHS OF EUT**

Please refer to the file named “EUT Photos”.

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