

AS/CA S042.1:2015
AS/CA S042.4:2015
ETSI EN 301 908-1 V11.1.1 (2016-07)
ETSI EN 301 908-13 V11.1.2 (2017-07)

TEST REPORT

For

Pycom Ltd

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Model: FiPy 1.0

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Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Shenzhen).

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Pycom Ltd's* product, model number: *FiPy 1.0* in this report is a *FiPy*, which was measured approximately: 55 mm (L) * 20 mm (W) *10 mm (H), rated with input voltage: DC 3.3V.

** All measurement and test data in this report was gathered from production sample serial number: 180305061. (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2018-03-05.*

Objective

According to 5.2 RF compatibility, network integrity and interoperability with the STS of AS/CA S042.4:2015, CE shall comply with the requirements of ETSI EN 301 908-1 V11.1.1 (2016-07), ETSI EN 301 908-13 V11.1.2 (2017-07), so all the test items were performed in according with ETSI EN 301 908-1 V11.1.1 (2016-07), ETSI EN 301 908-13 V11.1.2 (2017-07), please refer to the CE report RDG170313008-22K issued on 2017-05-31.

This report is prepared on behalf of *Pycom Ltd* in accordance with ETSI EN 301 908-1 V11.1.1 (2016-07), IMT cellular networks; ETSI EN 301 908-1 V11.1.1 (2016-07), Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU; Part 1: Introduction and common requirements; and ETSI EN 301 908-13 V11.1.2 (2017-07), IMT cellular networks; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU; Part 13: Evolved Universal Terrestrial Radio Access (E-UTRA) User Equipment (UE).

The objective is to determine the EUT compliance with ETSI EN 301 908-1 V11.1.1 (2016-07) and ETSI EN 301 908-13 V11.1.2 (2017-07).

Related Submittal(s)/Grant(s)

No related submittal(s).

Test Methodology

All measurements contained in this report were conducted with ETSI EN 301 908-1 V11.1.1 (2016-07) and ETSI EN 301 908-13 V11.1.2 (2017-07).

Measurement Uncertainty

According to the requirements of ETSI EN 301 908-1 and ETSI EN 301 908-13, F_{lab} (the value of the measurement uncertainty according to the requirements of ETSI TR 100 028) shall be, for each measurement, equal to or lower than the figure in the following table:

Item	Parameter	F_{lab}	Maximum allowable uncertainty
1	ERP 30MHz-180MHz	$\pm 3.62\text{dB}$	$\pm 6\text{ dB}$
2	ERP 180MHz-12750MHz	$\pm 2.6\text{ dB}$	$\pm 3\text{ dB}$
3	Transmitter maximum output power	$\pm 0.6\text{ dB}$	$\pm 0,7\text{ dB}$
4	Transmitter spectrum emissions mask	$\pm 1,5\text{ dB}$	$\pm 1,5\text{ dB}$
5	Transmitter spurious emissions $9\text{ kHz} < f \leq 4\text{ GHz}$	$\pm 2.5\text{ dB}^*$	$\pm 2,0\text{ dB}$
6	Transmitter spurious emissions $4\text{ GHz} < f \leq 12,75\text{ GHz}$	$\pm 2.5\text{ dB}$	$\pm 4,0\text{ dB}$
7	Transmitter Minimum output power	$\pm 0.6\text{ dB}$	$\pm 2,0\text{ dB}$
8	Receiver Adjacent Channel Selectivity (ACS)	$\pm 1.5\text{ dB}^*$	$\pm 1,1\text{ dB}$
9	Receiver Blocking characteristics $1\text{ MHz} < \text{finterferer} \leq 3\text{ GHz}$	$\pm 1.5\text{ dB}^*$	$\pm 1,3\text{ dB}$
10	Receiver Blocking characteristics $3\text{ GHz} < \text{finterferer} \leq 12,75\text{ GHz}$	$\pm 3.3\text{ dB}^*$	$\pm 3,2\text{ dB}$
11	Receiver spurious response $1\text{ MHz} < \text{finterferer} \leq 3\text{ GHz}$	$\pm 1.5\text{ dB}^*$	$\pm 1,3\text{ dB}$
12	Receiver spurious response $3\text{ GHz} < \text{finterferer} \leq 12,75\text{ GHz}$	$\pm 3.3\text{ dB}^*$	$\pm 3,2\text{ dB}$
13	Receiver intermodulation characteristics	$\pm 1.4\text{ dB}$	$\pm 1,4\text{ dB}$
14	Receiver spurious emissions $9\text{ kHz} < f \leq 4\text{ GHz}$	$\pm 2.5\text{ dB}^*$	$\pm 2,0\text{ dB}$
15	Receiver spurious emissions $4\text{ GHz} < f \leq 12,75\text{ GHz}$	$\pm 2.5\text{ dB}$	$\pm 4,0\text{ dB}$
16	Transmitter adjacent channel leakage power ratio	$\pm 0.8\text{ dB}$	$\pm 0,8\text{ dB}$

Note: * Test system of laboratory have a measurement uncertainty greater than that specified in harmonized standard, this equipment can still be used provided that an adjustment is made follows: any additional uncertainty in the test system over and above that specified in harmonized standard should be used to tighten the test requirements - making the test harder to pass (for some tests, e.g. receiver tests, this may require modification of stimulus signals). This procedure will ensure that a test system not compliant with harmonized standard does not increase the probability of passing a EUT that would otherwise have failed a test if a test system compliant with harmonized standard had been used.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing according to EN 301 908-1 and EN 301 908-13.

EUT Exercise Software

No exercise software.

Special Accessories

No special accessory.

Equipment Modifications

No modifications were made to the unit tested.

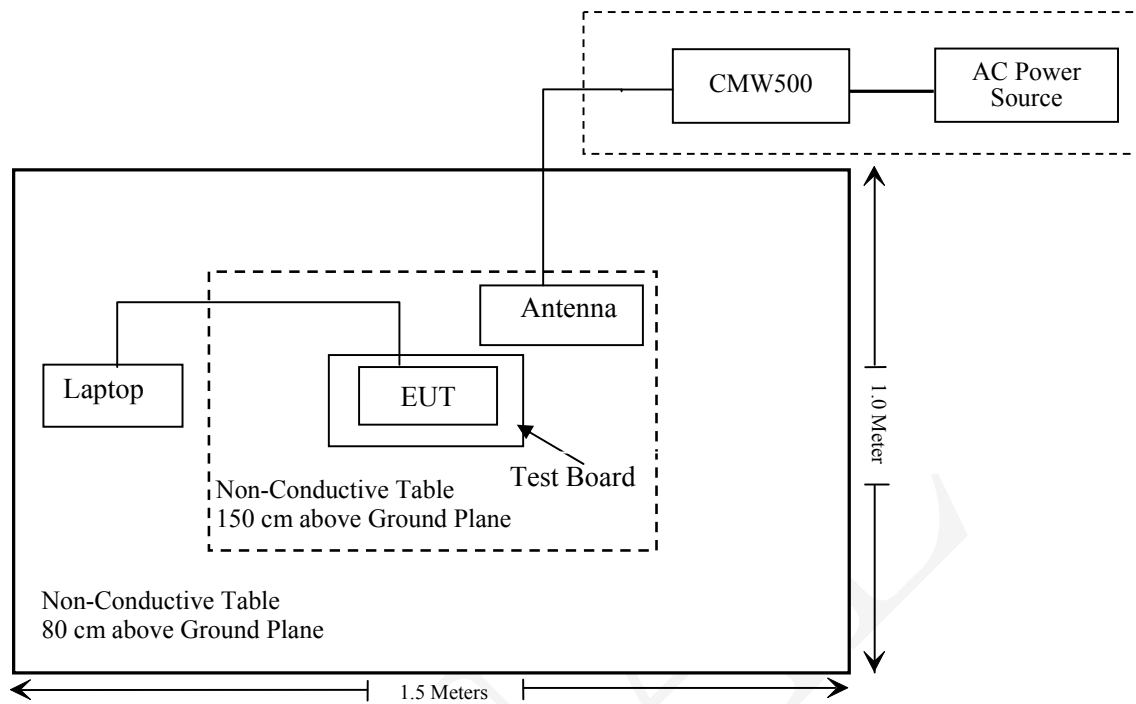
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
R&S	Wideband Radio Communication tester	CMW500	146520
DELL	Laptop	Compaq CQ45	N/A
Pycom Ltd	Expansion Board	/	1630001501

External I/O Cable

Cable Description	Length (m)	From Port	To
/	/	/	/

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

Rules	Description of Test	Result
AS/CA S042.1 2015	General	Not Applicable
ETSI EN 301 908-1, Section 4.2.2	Radiated emissions (UE)	Compliance
ETSI EN 301 908-1, Section 4.2.3	Radiated emissions (BS and repeater)	Not Applicable
ETSI EN 301 908-13, Section 4.2.4	Control and monitoring functions (UE)	Compliance
ETSI EN 301 908-13, Section 4.2.2	Transmitter maximum output power	Compliance
ETSI EN 301 908-13, Section 4.2.3	Transmitter spectrum emission mask	Compliance
ETSI EN 301 908-13, Section 4.2.4	Transmitter spurious emissions	Compliance
ETSI EN 301 908-13, Section 4.2.5	Transmitter minimum output power	Compliance
ETSI EN 301 908-13, Section 4.2.6	Receiver Adjacent Channel Selectivity (ACS)	Compliance
ETSI EN 301 908-13, Section 4.2.7	Receiver blocking characteristics	Compliance
ETSI EN 301 908-13, Section 4.2.8	Receiver spurious response	Compliance
ETSI EN 301 908-13, Section 4.2.9	Receiver intermodulation characteristics	Compliance
ETSI EN 301 908-13, Section 4.2.10	Receiver spurious emissions	Compliance
ETSI EN 301 908-13, Section 4.2.11	Transmitter Adjacent Channel Leakage power Ratio	Compliance
ETSI EN 301 908-13, Section 4.2.12	Receiver Reference Sensitivity Level	Compliance

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test					
Sunol Sciences	Horn Antenna	DRH-118	A052604	2017-12-22	2020-12-21
Sunol Sciences	Broadband Antenna	JB1	A040904-2	2017-12-17	2020-12-16
Rohde & Schwarz	Signal Analyzer	FSEM	845987/005	2018-04-24	2019-04-24
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2018-05-21	2019-05-21
HP	Amplifier	HP8447E	1937A01046	2018-05-21	2018-11-19
Anritsu	Signal Generator	68369B	004114	2017-12-24	2018-12-24
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2018-01-11	2019-01-11
COM POWER	Dipole Antenna	AD-100	041000	NCR	NCR
A.H. System	Horn Antenna	SAS-200/571	135	2015-08-18	2018-08-17
RF Conducted test					
R&S	SPECTRUM ANALYZER	FSU26	200120	2017-12-24	2018-12-24
ESPEC	Temperature & Humidity Chamber	EL-10KA	09107726	2017-12-21	2018-12-21
Long Wei	DC Power Supply	TPR-6420D	398363	NCR	NCR
R & S	Wideband Radio Communication Tester	CMW500	1201.002K50-146520-wh	2018-04-24	2019-04-24

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

AS/CA S042.1 2015 – GENERAL

Applicable Standard

According to AS/CA S042.1 2015, the equipment can call to the emergency service numbers 000 and 112.

FINAL

ETSI EN 301 908-1 V11.1.1 (2016-07) §4.2.2 – RADIATED EMISSIONS (UE)**Applicable Standard**

This test assesses the ability of radio communications equipment and ancillary equipment to limit unwanted emissions from the enclosure port.

This test is applicable to radio communications equipment and ancillary equipment.

This test shall be performed on the radio communications equipment and/or a representative configuration of the ancillary equipment.

Limits

The frequency boundary and reference bandwidths for the detailed transitions of the limits between the requirements for out-of-band emissions and spurious emissions are based on Recommendations ITU-R SM.329-12 [1] and SM.1539-1 [i.6].

The requirements shown in table 4.2.2.2-1 are only applicable for frequencies in the spurious domain.

Table 4.2.2.2-1: Radiated spurious emissions requirements (UE)

Frequency	Minimum requirement (e.r.p.)/ reference bandwidth idle mode	Minimum requirement (e.r.p.)/ reference bandwidth traffic mode	Applicability
$30 \text{ MHz} \leq f < 1\,000 \text{ MHz}$	-57 dBm/100 kHz	-36 dBm/100 kHz	All
$1 \text{ GHz} \leq f < 12,75 \text{ GHz}$	-47 dBm/1 MHz	-30 dBm/1 MHz	All
$f_c - 2,5 \times 5 \text{ MHz} < f < f_c + 2,5 \times 5 \text{ MHz}$		Not defined	UTRA FDD, UTRA TDD, 3,84 Mcps option, cdma2000, spreading rate 3
$f_c - 2,5 \times BW_{\text{Channel}} \text{ MHz} < f < f_c + 2,5 \times BW_{\text{Channel}} \text{ MHz}$		Not defined	E-UTRA FDD, E-UTRA TDD, Mobile WiMAX™
$f_c - 2,5 \times 10 \text{ MHz} < f < f_c + 2,5 \times 10 \text{ MHz}$		Not defined	UTRA TDD, 7,68 Mcps option
$f_c - 4 \text{ MHz} < f < f_c + 4 \text{ MHz}$		Not defined	UTRA TDD, 1,28 Mcps option cdma2000, spreading rate 1

NOTE: f_c is the UE transmit centre frequency.

Test configurations

The equipment shall be tested under normal test conditions;

The test configuration shall be as close to normal intended use as possible;

If the equipment is part of a system, or can be connected to ancillary equipment, then it shall be acceptable to test the equipment while connected to the minimum configuration of ancillary equipment necessary to exercise the ports;

If the equipment has a large number of ports, then a sufficient number shall be selected to simulate actual operation conditions and to ensure that all the different types of termination are tested;

The test conditions, test configuration and mode of operation shall be recorded in the test report; ports which in normal operation are connected shall be connected to an ancillary equipment or to a representative piece of cable correctly terminated to simulate the input/output characteristics of the ancillary equipment, RF input/output ports shall be correctly terminated;

Ports that are not connected to cables during normal operation, e.g. service connectors, programming connectors; temporary connectors, etc. Shall not be connected to any cables for the purpose of this test. Where cables have to be connected to these ports, or interconnecting cables have to be extended in length in order to exercise the EUT, precautions shall be taken to ensure that the evaluation of the EUT is not affected by the addition or extension of these cables:

Emission tests shall be performed in two modes of operation:

With a communication link established (traffic mode); and

In the idle mode;

The traffic mode configuration which uses the UE maximum output power for testing shall be declared by the manufacturer.

Ancillary equipment shall be tested with it connected to a UE in which case compliance shall be demonstrated to the appropriate clauses of the present document.

Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	51 %
ATM Pressure:	101.0 kPa

The testing was performed by Jacob Kong on 2018-05-15.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to following data tables.

Traffic Mode

Frequency (MHz)	Receiver Reading (dBμV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	EN 301 908-1	
			Height (m)	Polar (H/V)	SG Level (dBm)	Cable Loss (dB)	Antenna Gain (dB)		Limit (dBm)	Margin (dB)
eMTC Band 3 QPSK										
386.20	34.75	209	2.4	H	-62.2	0.42	0	-62.62	-36	26.62
386.20	33.99	240	1.7	V	-63.0	0.26	0	-63.26	-36	27.26
3495.00	43.02	170	1.6	H	-57.4	1.50	12.00	-46.90	-30	16.90
3495.00	49.7	339	2.2	V	-51.4	1.50	12.00	-40.90	-30	10.90
5242.50	55.5	56	1.5	H	-43.1	1.60	12.10	-32.60	-30	2.60
5242.50	55.92	336	1.5	V	-42.2	1.60	12.10	-31.70	-30	1.70
6990.00	35.92	196	1.3	H	-60.2	1.90	11.20	-50.90	-30	20.90
6990.00	37.14	214	1.4	V	-59.1	1.90	11.20	-49.80	-30	19.80
eMTC Band 20 QPSK										
386.20	34.60	173	1.1	H	-62.4	0.42	0	-62.82	-36	26.82
386.20	33.43	109	1.0	V	-63.6	0.26	0	-63.86	-36	27.86
1694.00	52.44	321	2.4	H	-54.6	1.30	8.90	-47.00	-30	17.00
1694.00	61.45	106	2.5	V	-45.0	1.30	8.90	-37.40	-30	7.40
2541.00	51.54	329	1.6	H	-52.0	2.60	10.20	-44.40	-30	14.40
2541.00	58.1	305	1.5	V	-44.8	2.60	10.20	-37.20	-30	7.20
3388.00	34.88	42	2.5	H	-65.8	1.40	11.80	-55.40	-30	25.40
3388.00	38.42	117	1.2	V	-62.0	1.40	11.80	-51.60	-30	21.60
eMTC Band 28 QPSK										
386.20	34.48	180	1.8	H	-62.5	0.42	0	-62.92	-36	26.92
386.20	33.72	85	2.0	V	-63.3	0.26	0	-63.56	-36	27.56
1442.00	48.32	203	1.4	H	-59.5	1.60	7.90	-53.20	-30	23.20
1442.00	53.21	130	2.2	V	-54.9	1.60	7.90	-48.60	-30	18.60
2163.00	44.62	100	1.5	H	-59.0	1.30	9.80	-50.50	-30	20.50
2163.00	42.16	18	1.3	V	-62.1	1.30	9.80	-53.60	-30	23.60
2884.00	33.48	226	2.5	H	-70.2	1.70	10.70	-61.20	-30	31.20
2884.00	38.08	235	2.3	V	-65.7	1.70	10.70	-56.70	-30	26.70

Idle Mode

Frequency (MHz)	Receiver Reading (dBμV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	EN 301 908-1	
			Height (m)	Polar (H/V)	SG Level (dBm)	Cable Loss (dB)	Antenna Gain (dB)		Limit (dBm)	Margin (dB)
eMTC Band 3 QPSK										
386.20	31.72	213	2.1	H	-65.3	0.42	0	-65.72	-57	8.72
386.20	32.92	349	1.2	V	-64.1	0.26	0	-64.36	-57	7.36
3285.36	47.98	331	1.7	H	-58.4	1.50	11.70	-48.20	-47	1.20
3285.36	47.92	96	1.4	V	-58.5	1.50	11.70	-48.30	-47	1.30
eMTC Band 20 QPSK										
386.20	32.69	241	1.5	H	-64.3	0.42	0	-64.72	-57	7.72
386.20	32.39	40	2.1	V	-64.6	0.26	0	-64.86	-57	7.86
3285.36	47.81	282	2.0	H	-58.6	1.50	11.70	-48.40	-47	1.40
3285.36	48.12	352	1.6	V	-58.3	1.50	11.70	-48.10	-47	1.10
eMTC Band 28 QPSK										
386.20	31.86	9	1.2	H	-65.1	0.42	0	-65.52	-57	8.52
386.20	32.43	334	1.9	V	-64.6	0.26	0	-64.86	-57	7.86
3285.36	48.01	302	1.8	H	-58.4	1.50	11.70	-48.20	-47	1.20
3285.36	47.92	288	2.2	V	-58.5	1.50	11.70	-48.30	-47	1.30

- Note:** 1) Absolute Level = SG Level - Cable Loss + Antenna Gain
 2) Margin = Limit - Absolute Level
 3) The distance from observation point to the antenna is 150cm in Idle Mode.

ETSI EN 301 908-1 V11.1.1 (2016-07) §4.2.4 – CONTROL AND MONITORING FUNCTIONS (UE)

Applicable Standard

This requirement, together with other control and monitoring technical requirements identified in the table of cross references in the applicable part, verifies that the control and monitoring functions of the UE prevent it from transmitting in the absence of a valid network.

This test is applicable to radio communications equipment and ancillary equipment in the operating band defined in the applicable part of this multi-part harmonised standard.

This test shall be performed on the radio communications equipment and/or a representative configuration of the ancillary equipment.

Limits:

The maximum measured power during the duration of the test shall not exceed -30 dBm.

Test method

a) At the start of the test, the UE shall be switched off. The UE antenna connector shall be connected to a power measuring equipment, with the following characteristics:

The RF bandwidth shall exceed the total operating transmit frequency range of the UE for operation with an applicable part;

The response time of the power measuring equipment shall be such that the measured power has reached within 1 dB of its steady state value within 100 µs of a CW signal being applied;

It shall record the maximum power measured.

NOTE: The equipment may include a video low pass filter to minimize its response to transients or Gaussian noise peaks.

b) The UE shall be switched on for a period of approximately fifteen minutes, and then switched off.

c) The EUT shall remain switched off for a period of at least thirty seconds, and shall then be switched on for a period of approximately one minute.

d) The maximum power emitted from the UE throughout the duration of the test shall be recorded.

The results obtained shall be compared to the limits in clause 4.2.4.2 in order to prove compliance.

Test Data**Environmental Conditions**

Temperature:	23 °C
Relative Humidity:	50 %
ATM Pressure:	100.0 kPa

The testing was performed by Jacob Kong on 2018-05-15.

EUT operation mode: Transmitting

Test Result: Compliant.

No emission was detected.

ETSI EN 301 908-13 V11.1.2 (2017-07) §4.2.2 – TRANSMITTER MAXIMUM OUTPUT POWER

Applicable Standard

According to ETSI EN 301 908-13 V11.1.2 (2017-07) §4.2.2.1, Transmitter maximum output power for Single Carrier:

The following UE Power Classes define the maximum output power for any transmission bandwidth within the channel bandwidth. The period of measurement shall be at least one sub-frame (1 ms).

Limits

The UE maximum output power shall be within the shown value in table 4.2.2.1.2-1.

Table 4.2.2.1.2-1: UE power classes

E-UTRA Band	Power Class 3 (dBm)	Tolerance (dB)
1	23	±2,7
3	23	±2,7 (see note)
7	23	±2,7 (see note)
8	23	±2,7 (see note)
20	23	±2,7 (see note)
22	23	+3,0/-4,5
28	23	+2,7/-3,2
33	23	±2,7
34	23	±2,7
38	23	±2,7
40	23	±2,7
42	23	+3,0/-4,0
43	23	+3,0/-4,0
NOTE: For transmission bandwidths (ETSI TS 136 521-1 [1], clause 5) confined within F_{UL_low} and $F_{UL_low} + 4$ MHz or $F_{UL_high} - 4$ MHz and F_{UL_high} , the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1,5 dB (tolerance = +2,7/-4,2).		

NOTE 1: These requirements do not take into account the maximum power reductions allowed to the UE in subject to certain transmission conditions specified in ETSI TS 136 101 [3], clauses 6.2.3 and 6.2.4.

NOTE 2: The range of UE maximum output power for the various power classes are specified in ETSI TS 136 101 [3], clause 6.2.2. The values in table 4.2.2.1.2-1 correspond to the measurement limits taking into account the measurement uncertainty of measurement equipment (see clause 5.2).

Test Condition

Test environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; as specified in annex B.

Frequencies to be tested: low range, mid range, high range; as specified in TS 136 508 [2], clause 4.3.1.

Channel bandwidths to be tested: lowest, 5 MHz and highest channel bandwidth as defined in TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in TS 136 521-1 [1]:

Connect the SS to the UE antenna connectors.

The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.

The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1].

Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

Test Procedure

According to ETSI EN 301 908-13 V11.1.2 (2017-07) §5.3.1.

Test Data

Environmental Conditions

Temperature:	25°C
Relative Humidity:	51 %
ATM Pressure:	101.0 kPa

The testing was performed by Jacob Kong on 2018-05-15.

EUT operation mode: Transmitting

Test Result: Compliant, the worst case, please refer to following table.

Test Band	Test Bandwidth	Test Channel	Test RB	NB Index	Test Condition			Limits
					N.T.	H.T.	L.T.	dBm
E-UTRA Band 3	20MHz	Low	RB1#0	0	22.58	22.01	22.53	23+2/-2
			RB6#0	0	22.62	22.50	22.92	23+2/-2
		Middle	RB1#0	0	22.17	21.71	22.34	23+2/-2
			RB6#0	0	22.16	22.14	22.64	23+2/-2
		High	RB1#5	15	22.62	22.55	22.50	23+2/-2
			RB6#0	15	22.55	22.30	22.76	23+2/-2
E-UTRA Band20	20MHz	Low	RB1#0	0	22.48	22.23	22.88	23+2/-2
			RB6#0	0	22.36	21.76	22.04	23+2/-2
		Middle	RB1#0	0	22.31	21.99	22.74	23+2/-2
			RB6#0	0	22.34	21.67	22.56	23+2/-2
		High	RB1#5	15	22.01	21.19	22.13	23+2/-2
			RB6#0	15	21.92	21.99	21.91	23+2/-2
E-UTRA Band 28	20MHz	Low	RB1#0	0	21.99	22.22	22.13	23+2/-2
			RB6#0	0	22.02	21.81	21.98	23+2/-2
		Middle	RB1#0	0	21.90	22.18	21.97	23+2/-2
			RB6#0	0	21.89	21.17	21.84	23+2/-2
		High	RB1#5	15	22.19	21.91	22.16	23+2/-2
			RB6#0	15	22.03	22.29	22.08	23+2/-2

Note:

L.T.: Low Temperature -20°C
 N.T.: Normal Temperature +25°C
 H.T.: High Temperature +55°C
 Nominal Voltage 3.3 V_{DC}
 The EUT power by PCB Board.

ETSI EN 301 908-13 V11.1.2 (2017-07) §4.2.3 – TRANSMITTER SPECTRUM EMISSION MASK

Applicable Standard

According to ETSI EN 301 908-13 V11.1.2 (2017-07) §4.2.3.1, Transmitter spectrum emission mask for Single Carrier:

The spectrum emission mask of the UE applies to frequencies (Δf_{OOB}) starting from the \pm edge of the assigned E-UTRA channel bandwidth

Limit:

The power of any UE emission shall fulfil requirements in tables from 4.2.3.1.2-1 to 4.2.3.1.2-3.

Table 4.2.3.1.2-1: General E-UTRA spectrum emission mask, E UTRA bands ≤ 3 GHz

Δf_{OOB} (MHz)	1,4 MHz	3,0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Measurement bandwidth
0 to 1	-8,5	-11,5	-13,5	-16,5	-18,5	-19,5	30 kHz
1 to 2,5	-8,5	-8,5	-8,5	-8,5	-8,5	-8,5	1 MHz
2,5 to 2,8	-23,5	-8,5	-8,5	-8,5	-8,5	-8,5	1 MHz
2,8 to 5		-8,5	-8,5	-8,5	-8,5	-8,5	1 MHz
5 to 6		-23,5	-11,5	-11,5	-11,5	-11,5	1 MHz
6 to 10			-23,5	-11,5	-11,5	-11,5	1 MHz
10 to 15				-23,5	-11,5	-11,5	1 MHz
15 to 20					-23,5	-11,5	1 MHz
20 to 25						-23,5	1 MHz

NOTE 1: The first and last measurement position with a 30 kHz filter is at Δf_{OOB} equals to 0,015 MHz and 0,985 MHz.
 NOTE 2: The first and last measurement position with a 1 MHz filter for 1 MHz - 2,5 MHz offset range is at Δf_{OOB} equals to 1,5 MHz and 2,0 MHz. Similarly for other Δf_{OOB} ranges.
 NOTE 3: The measurements shall be performed above the upper edge of the channel and below the lower edge of the channel.
 NOTE 4: For the 2,5 MHz - 2,8 MHz offset range with 1,4 MHz channel bandwidth, the measurement position is at Δf_{OOB} equals to 3 MHz.

Table 4.2.3.1.2-2: General E-UTRA spectrum emission mask, 3 GHz < E-UTRA bands $\leq 4,2$ GHz

Δf_{OOB} (MHz)	Spectrum emission limit (dBm)/Channel bandwidth						Measurement bandwidth
	1,4 MHz	3,0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
0 to 1	-8,2	-11,2	-13,2	-16,2	-18,2	-19,2	30 kHz
1 to 2,5	-8,2	-8,2	-8,2	-8,2	-8,2	-8,2	1 MHz
2,5 to 2,8	-23,2						1 MHz
2,8 to 5							1 MHz
5 to 6		-23,2	-11,2	-11,2	-11,2	-11,2	1 MHz
6 to 10			-23,2	-23,2	-23,2	-23,2	1 MHz
10 to 15							1 MHz
15 to 20							1 MHz
20 to 25						-23,2	1 MHz

NOTE 1: The first and last measurement position with a 30 kHz filter is at Δf_{OOB} equals to 0,015 MHz and 0,985 MHz.
 NOTE 2: At the boundary of spectrum emission limit, the first and last measurement position with a 1 MHz filter is the inside of +0,5 MHz and -0,5 MHz, respectively.
 NOTE 3: The measurements shall be performed above the upper edge of the channel and below the lower edge of the channel.
 NOTE 4: For the 2,5-2,8 MHz offset range with 1,4 MHz channel bandwidth, the measurement position is at Δf_{OOB} equals to 3 MHz.

Table 4.2.3.1.2-3: Additional spectrum emission mask (network signalled value "NS_01")

E-UTRA band	Frequency range	Channel Bandwidth	Spectrum emission limit (dBm)	Measurement Bandwidth
20	$863 \text{ MHz} \leq f \leq 867 \text{ MHz}$	10 MHz (note 2)	-11,5	1 MHz
	$867 \text{ MHz} \leq f \leq 870 \text{ MHz}$	10 MHz (note 2)	-14,5	1 MHz
NOTE 1: At the boundary of spectrum emission limit, the first and last measurement position with a 1 MHz filter is the inside of +0,5 MHz and -0,5 MHz, respectively.				
NOTE 2: The conformance shall be assessed at test frequency 857 MHz with 50 RB allocation.				

NOTE: The values in table 4.2.3.1.2-3 are for conformance testing and can therefore be considered as worst case values. For coexistence studies different values can be used, because effects such as partial spectrum allocation or hand/head attenuation may result in lower OOB emissions during typical LTE UE usage (see [i.11]).

Test Condition

Test environment: normal, as specified in annex B.

Frequencies to be tested: low range, mid range and high range; as specified in ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidths to be tested: lowest, 5 MHz, 10 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

Connect the SS to the UE antenna connectors.

The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.

The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1].

Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

Test Procedure

According to ETSI EN 301 908-13 V11.1.2 (2017-07) §5.3.2.

Test Data**Environmental Conditions**

Temperature:	25 °C
Relative Humidity:	51 %
ATM Pressure:	101.0 kPa

The testing was performed by Jacob Kong on 2018-03-15.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the plots in the appendix A.

ETSI EN 301 908-13 V11.1.2 (2017-07) §4.2.4 – TRANSMITTER SPURIOUS EMISSIONS

Applicable Standard

According to ETSI EN 301 908-13 V11.1.2 (2017-07) §4.2.4.1, Transmitter spurious emissions for Single Carrier:

Spurious emissions are emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions. The spurious emission limits are specified in terms of general requirements in line with Recommendation ITU-R SM.329-12 [i.4] and E-UTRA operating band requirement to address UE co-existence.

To improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

Limits

The spurious emission limits in table 4.2.4.1.2-2 apply for the frequency ranges that are more than Δf_{OOB} (MHz) from the edge of the channel bandwidth shown in table 4.2.4.1.2-1.

The measured average power of spurious emission for general requirements shall not exceed the described values in table 4.2.4.1.2-2.

The measured average power of spurious emission for E-UTRA operating band specific requirements to protected bands shall not exceed the described values in tables 4.2.4.1.2-3 and 4.2.4.1.2-6.

Table 4.2.4.1.2-1: Δf_{OOB} boundary between E-UTRA channel and spurious emission domain

Channel bandwidth	1,4 MHz	3,0 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Δf_{OOB} (MHz)	2,8	6	10	15	20	25

Table 4.2.4.1.2-2: General spurious emissions limits

Frequency range	Maximum level	Measurement bandwidth	Comment
$9 \text{ kHz} \leq f < 150 \text{ kHz}$	-36 dBm	1 kHz	
$150 \text{ kHz} \leq f < 30 \text{ MHz}$	-36 dBm	10 kHz	
$30 \text{ MHz} \leq f < 1\,000 \text{ MHz}$	-36 dBm	100 kHz	
$1 \text{ GHz} \leq f < 12,75 \text{ GHz}$	-30 dBm	1 MHz	
$12,75 \text{ GHz} \leq f < 5^{\text{th}}$ harmonic of the upper frequency edge of the UL operating band in GHz	-30 dBm	1 MHz	See note
NOTE: Shall apply for Band 22, 42 and Band 43.			

NOTE 1: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band. The additional requirements in table 4.2.4.1.2-3 apply for the frequency ranges that are more and less than Δf_{OOB} (MHz) from the edge of the channel bandwidth shown in table 4.2.4.1.2-1.

Table 4.2.4.1.2-3: Spurious emission band UE co-existence limits (network signalled value "NS_01")

E-UTRA Band	Spurious emission					
	Protected band	Frequency range (MHz)		Maximum Level (dBm)	MBW (MHz)	Comment
1	E-UTRA Band 1, 7, 8, 20, 22, 28, 32, 38, 40, 42, 43	F _{DL_low}	-	F _{DL_high}	-50	
	E-UTRA Band 3, 34	F _{DL_low}	-	F _{DL_high}	-50	Note 3
	Frequency range	1 900	-	1 915	-15,5	Notes 3, 8
	Frequency range	1 915	-	1 920	+1,6	Notes 3, 8
3	E-UTRA Band 1, 7, 8, 20, 28, 32, 33, 34, 38, 43	F _{DL_low}	-	F _{DL_high}	-50	
	E-UTRA Band 3	F _{DL_low}	-	F _{DL_high}	-50	Note 3
	E-UTRA Band 22, 42	F _{DL_low}	-	F _{DL_high}	-50	Note 2
7	E-UTRA Band 1, 3, 7, 8, 20, 22, 28, 32, 33, 34, 40, 42, 43	F _{DL_low}	-	F _{DL_high}	-50	
	Frequency range	2 570	-	2 575	+1,6	Notes 3, 4
	Frequency range	2 575	-	2 595	-15,5	Notes 3, 4
	Frequency range	2 595	-	2 620	-40	Notes 3, 4
8	E-UTRA Band 1, 20, 28, 32, 33, 34, 38, 40	F _{DL_low}	-	F _{DL_high}	-50	
	E-UTRA band 3	F _{DL_low}	-	F _{DL_high}	-50	Note 2
	E-UTRA band 7	F _{DL_low}	-	F _{DL_high}	-50	Note 2
	E-UTRA Band 8	F _{DL_low}	-	F _{DL_high}	-50	Note 3
	E-UTRA Band 22, 42, 43	F _{DL_low}	-	F _{DL_high}	-50	Note 2
20	E-UTRA Band 1, 3, 7, 8, 22, 32, 33, 34, 40, 43	F _{DL_low}	-	F _{DL_high}	-50	
	E-UTRA Band 20	F _{DL_low}	-	F _{DL_high}	-50	Note 3
	E-UTRA Band 38, 42	F _{DL_low}	-	F _{DL_high}	-50	Note 2
	Frequency range	758	-	788	-50	
22	E-UTRA Band 1, 3, 7, 8, 20, 28, 32, 33, 34, 38, 40, 43	F _{DL_low}	-	F _{DL_high}	-50	
	Frequency range	3 510	-	3 525	-40	Note 3
	Frequency range	3 525	-	3 590	-50	
28	E-UTRA Band 3, 7, 8, 20, 32, 34, 38	F _{DL_low}	-	F _{DL_high}	-50	
	E-UTRA Band 1, 22, 42, 43	F _{DL_low}	-	F _{DL_high}	-50	Note 2
	E-UTRA Band 1	F _{DL_low}	-	F _{DL_high}	-50	Note 6
	Frequency range	758	-	773	-32	Note 3
	Frequency range	773	-	803	-50	
	Frequency range	470	-	694	-42	Notes 3, 7
33	E-UTRA Band 1, 7, 8, 20, 22, 28, 32, 34, 38, 40, 42, 43	F _{DL_low}	-	F _{DL_high}	-50	
	E-UTRA Band 3	F _{DL_low}	-	F _{DL_high}	-50	Note 3
34	E-UTRA Band 1, 3, 7, 8, 20, 22, 28, 32, 33, 38, 40, 42, 43	F _{DL_low}	-	F _{DL_high}	-50	
38	E-UTRA Band 1, 3, 8, 20, 22, 28, 32, 33, 34, 40, 42, 43	F _{DL_low}	-	F _{DL_high}	-50	
	Frequency range	2 620	-	2 645	-15,5	Notes 3, 5
	Frequency range	2 645	-	2 690	-40	Notes 3, 5
40	E-UTRA Band 1, 3, 7, 8, 20, 22, 28, 32, 33, 34, 38, 42, 43	F _{DL_low}	-	F _{DL_high}	-50	

E-UTRA Band	Spurious emission					Comment
	Protected band	Frequency range (MHz)		Maximum Level (dBm)	MBW (MHz)	
42	E-UTRA Band 1, 3, 7, 8, 20, 28, 32, 33, 34, 38, 40	F_{DL_low}	-	F_{DL_high}	-50	1
43	E-UTRA Band 1, 3, 7, 8, 20, 22, 28, 32, 33, 34, 38, 40	F_{DL_low}	-	F_{DL_high}	-50	1
NOTE 1: F_{DL_low} and F_{DL_high} refer to each frequency range of the protected E-UTRA band.						
NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in table 4.2.4.1.2-2 are permitted for each assigned E-UTRA carrier used in the measurement due to 2 nd , 3 rd or 4 th harmonic spurious emissions. Due to spreading of the harmonic emission the exception shall be allowed for the first 1 MHz frequency range immediately outside the harmonic emission on both sides of the harmonic emission. This results in an overall exception interval centred at the harmonic emission of $(2 \text{ MHz} + N \times L_{CRB} \times 180 \text{ kHz})$, where N is 2, 3, 4 for the 2 nd , 3 rd or 4 th harmonic respectively. The exception is allowed if the measurement bandwidth (MBW) totally or partially overlaps the overall exception interval.						
NOTE 3: These requirements shall also apply for the frequency ranges that are less than Δf_{OOB} (MHz) in table 4.2.4.1.2-1 from the edge of the channel bandwidth.						
NOTE 4: This requirement shall be applicable for any channel bandwidths within the range 2 500 - 2 570 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 2 560,5 - 2 562,5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 2 552 - 2 560 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB.						
NOTE 5: This requirement shall be applicable for any channel bandwidths within the range 2 570 - 2 615 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 2 605,5 - 2 607,5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 2 597 - 2 605 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB. For carriers with channel bandwidth overlapping the frequency range 2 615 - 2 620 MHz the requirement shall apply with the maximum output power configured to +19 dBm.						
NOTE 6: As exceptions, measurements with a level up to the applicable requirement of -36 dBm/MHz is permitted for each assigned E-UTRA carrier used in the measurement due to 3 rd harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see figure 5.4.2-1 in ETSI TS 136 521-1 [1]) for which the 3 rd harmonic totally or partially overlaps the measurement bandwidth (MBW).						
NOTE 7: This requirement shall be applicable in the case of a 10 MHz E-UTRA carrier confined within 703 MHz and 733 MHz, otherwise the requirement of -25 dBm with a measurement bandwidth of 8 MHz applies.						
NOTE 8: This requirement shall be applicable for any channel bandwidths within the range 1 920 - 1 980 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 1 927,5 - 1 929,5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 1 930 - 1 938 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB.						

NOTE 2: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

Table 4.2.4.1.2-4: Additional spurious emissions limits (network signalled value "NS_01")

E-UTRA band	Protected Frequency range	Maximum Level (dBm)	MBW (MHz)
20	$470 \text{ MHz} \leq f \leq 790 \text{ MHz}$	-65	8 MHz
NOTE: The conformance shall be assessed using the measurement position placed at the following centre frequencies: 474 MHz, 586 MHz, 690 MHz, 754 MHz, 770 MHz and 786 MHz.			

Table 4.2.4.1.2-5: Additional spurious emissions limits (network signalled value "NS_22")

E-UTRA band	Protected Frequency range (MHz)	Channel bandwidth/ Maximum Level (dBm)	MBW (MHz)
		5, 10, 15, 20 MHz	
42, 43	3 400 ≤ f ≤ 3 800	-23 (note 1)	5 MHz
		-40 (note 2)	1 MHz
NOTE 1: This requirement shall apply within an offset between 5 MHz and 25 MHz from the lower and from the upper edge of the channel bandwidth.			
NOTE 2: This requirement shall apply from 3 400 MHz up to 25 MHz below the lower E-UTRA channel edge and from 25 MHz above the upper E-UTRA channel edge up to 3 800 MHz.			

Table 4.2.4.1.2-6: Additional spurious emissions limits (network signalled value "NS_23")

E-UTRA band	Protected Frequency range (MHz)	Channel bandwidth/ Maximum Level (dBm)	MBW (MHz)
		5, 10, 15, 20 MHz	
42, 43	3 400 ≤ f ≤ 3 800	-23 (note 1)	5 MHz
		-40 (note 2)	1 MHz
NOTE 1: This requirement shall apply within an offset between 5 MHz and 25 MHz from the lower and from the upper edge of the channel bandwidth.			
NOTE 2: This requirement shall apply from 3 400 MHz up to 25 MHz below the lower E-UTRA channel edge and from 25 MHz above the upper E-UTRA channel edge up to 3 800 MHz.			
NOTE 3: F _{offset_NS_23} is: 0 MHz for 5 MHz channel BW, 5 MHz for 10 MHz channel BW, 9 MHz for 15 MHz channel BW and 12 MHz for 20 MHz channel BW.			

Test Condition

Test Environment: normal, as specified in annex B.

Frequencies to be tested: low range, mid range, high range; see ETSI TS 136 508 [2].

Channel bandwidth to be tested: lowest, 5 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [2].

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

Connect the SS to the UE antenna connectors.

The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.

The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1].

Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

Test Procedure

SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 6.6.3.1.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

Send continuously Up power control commands in the uplink scheduling information to the UE until the UE transmits at PUMAX level.

For each applicable requirement in tables from 4.2.4.1.2-2 to 4.2.4.1.2-6; measure the power of the transmitted signal with a measurement filter of bandwidths. The center frequency of the filter shall be stepped in contiguous steps according to the tables. The measured power shall be verified for each step. The measurement period shall capture the active time slots.

Repeat for applicable test frequencies, channel bandwidths and operating bands.

Details of the test method can be found in ETSI TS 136 521-1 [1], clauses 6.6.3.1, 6.6.3.2 and 6.6.3.3.

Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	51 %
ATM Pressure:	101.0 kPa

The testing was performed by Jacob Kong from 2018-03-14 to 2018-05-15.

EUT operation mode: Transmitting

Test Result: Compliant. The worst case is middle channel and the testing data please refer to plot in the appendix B.

ETSI EN 301 908-13 V11.1.2 (2017-07) §4.2.5 – TRANSMITTER MINIMUM OUTPUT POWER

Applicable Standard

According to ETSI EN 301 908-13 V11.1.2 (2017-07) §4.2.5.1, Transmitter minimum output power for Single Carrier:

The minimum controlled output power of the UE is defined as the broadband transmit power of the UE, i.e. the power in the channel bandwidth for all transmit bandwidth configurations (resource blocks), when the power is set to a minimum value.

Limits

The minimum output power measured shall not exceed the values specified in table 4.2.5.1.2-1.

Table 4.2.5.1.2-1: Minimum output power

	Channel bandwidth/minimum output power/measurement bandwidth					
	1,4 MHz	3,0 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Minimum output power	For carrier frequency $f \leq 3,0$ GHz: ≤ -39 dBm For carrier frequency $3,0$ GHz $< f \leq 4,2$ GHz: $\leq -38,7$ dBm					
Measurement bandwidth	1,08 MHz	2,7 MHz	4,5 MHz	9,0 MHz	13,5 MHz	18 MHz

Test Condition

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on E-UTRA operating bands specified in table 5.4.2.1-1. All of these configurations shall be tested with applicable test parameters for each channel bandwidth, and are shown in table 6.3.2.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annexes A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.3.2.4.1-1: Test Configuration Table

Initial Conditions				
Test Environment as specified in TS 36.508[7] subclause 4.1		Normal, TL/VL, TL/VH, TH/VL, TH/VH		
Test Frequencies as specified in TS36.508 [7] subclause 4.3.1		Low range, Mid range, High range		
Test Channel Bandwidths as specified in TS 36.508 [7] subclause 4.3.1		Lowest, 5MHz, Highest		
Test Parameters for Channel Bandwidths				
	Downlink Configuration	Uplink Configuration		
Ch BW	N/A for min output power test	Mod'n	RB allocation	
			FDD	TDD
1.4MHz		QPSK	6	6
3MHz		QPSK	15	15
5MHz		QPSK	25	25
10MHz		QPSK	50	50
15MHz		QPSK	75	75
20MHz		QPSK	100	100
Note 1: Test Channel Bandwidths are checked separately for each E-UTRA band, the applicable channel bandwidths are specified in Table 5.4.2.1-1.				

Test Environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; as specified in annex B.

Frequencies to be tested: low range, mid range and high range; see ETSI TS 136 508 [2].

Channel bandwidths to be tested: lowest, 5 MHz and highest channel bandwidth, as specified in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

Connect the SS to the UE antenna connectors.

The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.

The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1].

Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

Test Procedure

SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 6.3.2.1.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

Send continuous uplink power control "down" commands in the uplink scheduling information to the UE to ensure that the UE transmits at its minimum output power.

Measure the mean power of the UE in the associated measurement bandwidth specified in table 4.5.2.1-1 for the specific channel bandwidth under test. The period of measurement shall be the continuous duration of one sub-frame (1 ms). For TDD slots with transient periods are not under test.

Repeat for applicable test frequencies, channel bandwidths, operating bands and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.3.2.

Test Data**Environmental Conditions**

Temperature:	25 °C
Relative Humidity:	51 %
ATM Pressure:	101.0 kPa

The testing was performed by Jacob Kong on 2018-05-15.

EUT operation mode: Transmitting (Worst case)

Test Band	Test Bandwidth	Test RB	NB Index	Test Channel	Test Condition (dBm)			Limits ≤ -39 (dBm)
					N.T.	H.T.	L.T.	
E-UTRA Band 3	5MHz	RB6	0	L	-42.69	-42.59	-42.53	
			0	M	-43.13	-42.67	-43.00	
			0	H	-43.51	-43.54	-43.79	
E-UTRA Band 20	5MHz	RB6	0	L	-46.32	-46.41	-45.97	
			0	M	-45.98	-46.65	-45.98	
			0	H	-46.10	-46.44	-46.18	
E-UTRA Band28	5MHz	RB6	0	L	-45.67	-45.30	-45.53	
			0	M	-45.75	-45.66	-45.70	
			0	H	-45.40	-45.88	-45.26	

ETSI EN 301 908-13 V11.1.2 (2017-07) §4.2.6 – RECEIVER ADJACENT CHANNEL SELECTIVITY (ACS)

Applicable Standard

According to ETSI EN 301 908-13 V11.1.2 (2017-07) §4.2.6,

Adjacent Channel Selectivity (ACS) is a measure of a receiver's ability to receive an E-UTRA signal at its assigned channel frequency in the presence of an adjacent channel signal at a given frequency offset from the centre frequency of the assigned channel. ACS is the ratio of the receive filter attenuation on the assigned channel frequency to the receive filter attenuation on the adjacent channel(s).

Limits

The throughput R_{av} shall be $\geq 95\%$ of the maximum throughput of the reference measurement channels as specified in ETSI TS 136 521-1 [1] under the conditions specified in table 4.2.6.1.2-2 and also under the conditions specified in table 4.2.6.1.2-3.

Table 4.2.6.1.2-1: Adjacent channel selectivity

Rx Parameter	Units	Channel bandwidth					
		1,4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
ACS	dB	33,0	33,0	33,0	33,0	30	27

Table 4.2.6.1.2-2: Test parameters for Adjacent channel selectivity, Case 1

Rx Parameter	Units	Channel bandwidth					
		1,4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in Transmission Bandwidth Configuration	dBm	REFSENS + 14 dB					
$P_{\text{Interferer}}$	dBm	REFSENS +45,5 dB	REFSENS +45,5 dB	REFSENS +45,5 dB	REFSENS +45,5 dB	REFSENS +42,5 dB	REFSENS +39,5 dB
$BW_{\text{Interferer}}$	MHz	1,4	3	5	5	5	5
$F_{\text{Interferer}}$ (offset)	MHz	1,4025	3,0075	5,0025	7,5075	10,0125	12,5025
NOTE 1: The transmitter shall be set to 4 dB below $P_{\text{CMAX_L}}$ or $P_{\text{CMAX_L_CA}}$ as defined in clause 6.2.5 in ETSI TS 136 101 [3].							
NOTE 2: The interferer shall consist of the Reference measurement channel specified in clause A.3.2 of ETSI TS 136 521-1 [1] with set-up according to clause C.3.1 of ETSI TS 136 521-1 [1].							
NOTE 3: REFSENS as defined in ETSI TS 136 521-1 [1].							

Table 4.2.6.1.2-3: Test parameters for Adjacent channel selectivity, Case 2

Rx Parameter	Units	Channel bandwidth					
		1,4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in Transmission Bandwidth Configuration	dBm	-56,5	-56,5	-56,5	-56,5	-53,5	-50,5
$P_{\text{Interferer}}$	dBm	-25					
$BW_{\text{Interferer}}$	MHz	1,4	3	5	5	5	5
$F_{\text{Interferer}}$ (offset)	MHz	1,4025	3,0075	5,0025	7,5075	10,0125	12,5025
NOTE 1: The transmitter shall be set to 24 dB below $P_{\text{CMAX_L}}$ or $P_{\text{CMAX_L_CA}}$ as defined in clause 6.2.5 in ETSI TS 136 101 [3].							
NOTE 2: The interferer shall consist of the Reference measurement channel specified in clause A.3.2 of ETSI TS 136 521-1 [1] with set-up according to clause C.3.1 of ETSI TS 136 521-1 [1].							

Test Condition

Test Environment: normal, as specified in annex B.

Frequencies to be tested: mid range see ETSI TS 136 508 [2].

Channel bandwidth to be tested: lowest, 5 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

Connect the SS and interfering source to the UE antenna connectors.

The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.

The UL and DL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], table 7.5.4.1-1.

Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

Test Procedure

SS transmits PDSCH via PDCCH DCI format 1A for C_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.5.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 7.5.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

Set the Downlink signal level to the value as defined in table 4.2.6.1.2-2 (Case 1). Send Uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in table 4.2.6.1.2-2 (Case 1) for carrier frequency $f \leq 3,0$ GHz or within +0, -4,0 dB of the target level for carrier frequency $3,0 \text{ GHz} < f \leq 4,2 \text{ GHz}$, for at least the duration of the Throughput measurement (obtain correct UE output power as specified in ETSI TS 136 521-1 [1]).

Set the Interferer signal level to the value as defined in table 4.2.6.1.2-2 (Case 1) and frequency below the wanted signal, using a modulated interferer as defined in ETSI TS 136 521-1 [1], annex C.

Measure the average throughput for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [1].

Set the Downlink signal level to the value as defined in table 4.2.6.1.2-3 (Case 2). Send Uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in table 4.2.6.1.2-3 (Case 2) for carrier frequency $f \leq 3,0$ GHz or within +0, -4,0 dB of the target level for carrier frequency $3,0 \text{ GHz} < f \leq 4,2 \text{ GHz}$, for at least the duration of the throughput measurement (obtain correct UE output power as specified in ETSI TS 136 521-1 [1]).

Set the Interferer signal level to the value as defined in table 4.2.6.1.2-3 (Case 2) and frequency below the wanted signal, using a modulated interferer as defined in ETSI TS 136 521-1 [1], annex C.

Measure the average throughput for a duration sufficient to achieve statistical significance according to ETSI TS 136 521-1 [1], annex G.

Repeat for applicable channel bandwidths in both Case 1 and Case 2.

Repeat for applicable test frequencies, channel bandwidths and operating bands.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.5.

Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	51 %
ATM Pressure:	101.0 kPa

The testing was performed by Jacob Kong on 2018-05-15..

EUT operation mode: Receiving. (Worst case)

Test Result: Compliant. Please refer the following table.

Test Band	Test Bandwidth	Test RB	Test Channel	Throughput (%)				Limits (%)
				Case 1		Case 2		
				F-F _{offset}	F+F _{offset}	F-F _{offset}	F+F _{offset}	
Band 3	5 MHz	RB4#0	M	99.83	99.62	99.84	99.22	≥95
Band 20	5 MHz	RB4#0	M	99.49	99.40	99.66	99.37	
Band 28	5 MHz	RB4#0	M	99.37	99.19	99.84	99.88	

ETSI EN 301 908-13 V11.1.2 (2017-07) §4.2.7 – RECEIVER BLOCKING CHARACTERISTICS

Applicable Standard

According to ETSI EN 301 908-13 V11.1.2 (2017-07) §4.2.7:

The blocking characteristic is a measure of the receiver's ability to receive a wanted signal at its assigned channel frequency in the presence of an unwanted interferer on frequencies other than those of the spurious response or the adjacent channels, without this unwanted input signal causing a degradation of the performance of the receiver beyond a specified limit. The blocking performance shall apply at all frequencies except those at which a spurious response occur.

Limit:

With parameters specified in tables 4.2.7.1.2-1 and 4.2.7.1.2-2, the throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in ETSI TS 136 521-1 [1].

With parameters specified in tables 4.2.7.1.2-3 and 4.2.7.1.2-4, the throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in ETSI TS 136 521-1 [1], except for the spurious response frequencies.

For table 4.2.7.1.2-4 in frequency range 1, 2 and 3, up to $\max(24, 6 \lfloor N_{RB} / 6 \rfloor)$ exceptions are allowed for spurious response frequencies in each assigned frequency channel when measured using a 1 MHz step size, where is the number of resource blocks in the downlink transmission bandwidth configuration. For these exceptions the requirements of clause 4.2.8.1 Spurious response are applicable.

With parameters specified in table 4.2.7.1.2-5, the throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in ETSI TS 136 521-1 [1].

Table 4.2.7.1.2-1: In-band blocking parameters

Rx Parameter	Units	Channel bandwidth					
		1,4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in Transmission Bandwidth Configuration	dBm	REFSENS + channel bandwidth specific value below					
		6	6	6	6	7	9
BW _{interferer}	MHz	1,4	3	5	5	5	5
F _{offset, case 1}	MHz	2,1125	4,5075	7,5125	7,5025	7,5075	7,5125
F _{offset, case 2}	MHz	3,5075	7,5075	12,5075	12,5125	12,5025	12,5075
NOTE 1: The transmitter shall be set to 4 dB below P _{C_{MAX}L} at the minimum uplink configuration specified in ETSI TS 136 101 [3] (table 7.3.1-2 with P _{C_{MAX}L} as defined in clause 6.2.5).							
NOTE 2: The interferer shall consist of the Reference measurement channel specified in clause A.3.2 of ETSI TS 136 521-1 [1] with a set-up according to clause C.3.1 of ETSI TS 136 521-1 [1].							
NOTE 3: REFSENS as defined in ETSI TS 136 521-1 [1].							

Table 4.2.7.1.2-2: In-band blocking

E-UTRA band	Parameter	Units	Case 1	Case 2
	$P_{\text{Interferer}}$	dBm	-56	-44
	$F_{\text{Interferer}}$ (Offset)	MHz	$= -BW/2 - F_{\text{offset, case 1}}$ and $= +BW/2 + F_{\text{offset, case 1}}$	$\leq -BW/2 - F_{\text{offset, case 2}}$ and $\geq +BW/2 + F_{\text{offset, case 2}}$
1, 3, 7, 8, 20, 22, 28, 33, 34, 38, 40, 42, 43	$F_{\text{Interferer}}$	MHz	(note 2)	$F_{\text{DL_low}} - 15$ to $F_{\text{DL_high}} + 15$

NOTE 1: For certain bands, the unwanted modulated interfering signal may not fall inside the UE receive band, but within the first 15 MHz below or above the UE receive band.

NOTE 2: For each carrier frequency the requirement is valid for two frequencies:
a) the carrier frequency $-BW/2 - F_{\text{offset, case 1}}$; and
b) the carrier frequency $+BW/2 + F_{\text{offset, case 1}}$.

NOTE 3: $F_{\text{Interferer}}$ range values for unwanted modulated interfering signal are interferer center frequencies.

Table 4.2.7.1.2-3: Out-of-band blocking parameters

Rx Parameter	Units	Channel bandwidth					
		1,4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in Transmission Bandwidth Configuration	dBm	REFSENS + channel bandwidth specific value below					
		6	6	6	6	7	9

NOTE 1: The transmitter shall be set to 4 dB below $P_{\text{CMAX_L}}$ at the minimum uplink configuration specified in ETSI TS 136 101 [3] (table 7.3.1-2 with $P_{\text{CMAX_L}}$ as defined in clause 6.2.5).

NOTE 2: Reference measurement channel is clause A.3.2 of ETSI TS 136 521-1 [1].

NOTE 3: REFSENS as defined in ETSI TS 136 521-1 [1].

Table 4.2.7.1.2-4: Out-of-band blocking

E-UTRA band	Parameter	Units	Frequency		
			Range 1	Range 2	Range 3
	$P_{\text{Interferer}}$	dBm	-44	-30	-15
1, 3, 7, 8, 20, 22, 28, 33, 34, 38, 40, 42 (NOTE 2), 43 (NOTE 2)	$F_{\text{Interferer}}$ (CW)	MHz	$F_{\text{DL_low}} - 15$ to $F_{\text{DL_low}} - 60$	$F_{\text{DL_low}} - 60$ to $F_{\text{DL_low}} - 85$	$F_{\text{DL_low}} - 85$ to 1 MHz
			$F_{\text{DL_high}} + 15$ to $F_{\text{DL_high}} + 60$	$F_{\text{DL_high}} + 60$ to $F_{\text{DL_high}} + 85$	$F_{\text{DL_high}} + 85$ to +12 750 MHz

NOTE 1: Range 3 shall be tested only with the highest channel bandwidth.

NOTE 2: The power level of the interferer ($P_{\text{Interferer}}$) for Range 3 shall be modified to -20 dBm for $F_{\text{Interferer}} > 2\,800$ MHz and $F_{\text{Interferer}} < 4\,400$ MHz.

Table 4.2.7.1.2-5: Narrow-band blocking

Parameter	Units	Channel Bandwidth					
		1,4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
P_w	dBm	P_{REFSENS} + channel-bandwidth specific value below					
		22	18	16	13	14	16
P_{uw} (CW)	dBm	-55	-55	-55	-55	-55	-55
F_{uw} (offset for $\Delta f = 15$ kHz)	MHz	0,9075	1,7025	2,7075	5,2125	7,7025	10,2075

NOTE 1: The transmitter shall be set a 4 dB below $P_{\text{CMAX_L}}$ at the minimum uplink configuration specified in ETSI TS 136 101 [3] (table 7.3.1-2 with $P_{\text{CMAX_L}}$ as defined in clause 6.2.5).

NOTE 2: Reference measurement channel is in clause A.3.2 of ETSI TS 136 521-1 [1].

NOTE 3: REFSENS as defined in ETSI TS 136 521-1 [1].

Test Condition

Test Environment: normal, as specified in annex B.

For In-band blocking, the frequencies to be tested are mid range as defined in ETSI TS 136 508 [2].

For out-of-band blocking, the frequency to be tested is low or high range as defined in ETSI TS 136 508 [2].

For Narrow-band blocking, the frequencies to be tested are mid range as defined in ETSI TS 136 508 [2].

Channel bandwidth to be tested: lowest, 5 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [2], clause 4.3.1. Range 3 of out-of-band blocking is tested only with highest bandwidth.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

Connect the SS to the UE antenna connectors.

The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.1 and uplink signals according to clauses H.1 and H.3.0.

The UL and DL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], table 7.6.2.4.1-1.

Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

Test Procedure

According to ETSI EN 301 908-13 V11.1.2 (2017-07) §5.3.6.

Test Data**Environmental Conditions**

Temperature:	25 °C
Relative Humidity:	51 %
ATM Pressure:	101.0 kPa

The testing was performed by Jacob Kong on 2018-05-15.

EUT operation mode: Receiving. (Worst case)

Test Result: Compliance.

In-Band Blocking:

Test Band	Test Bandwidth	Test Channel	Test RB	Case	Interfering Signals Frequency	Throughput (%)	Limits (%)
Band 3	5MHz	M	RB4#0	1	Low	98.75	≥95
					High	98.55	
				2	Low	98.68	
					High	98.52	
Band 20	5MHz	M	RB4#0	1	Low	98.17	
					High	98.17	
				2	Low	98.39	
					High	98.88	
Band28	5MHz	M	RB4#0	1	Low	98.69	
					High	98.75	
				2	Low	98.55	
					High	98.68	

Out-Band Blocking:

Test Band	Test Bandwidth	Test Channel	Test RB	Frequency Range	Worst Throughput (%)			Limits (%)
					Range 1	Range 2	Range 3	
Band 3	5MHz	H	RB4#0	Flow	98.59	98.43	99.10	≥95
				Fhigh	98.81	98.33	99.11	
Band 20	5MHz	H	RB4#0	Flow	98.64	98.74	99.20	
				Fhigh	98.57	98.46	98.82	
Band 28	5MHz	H	RB4#0	Flow	98.49	98.42	99.42	
				Fhigh	98.44	98.86	99.25	

Narrow band blocking:

Test Band	Test Bandwidth	Test Channel	Test RB	Throughput (%)	Limits (%)
Band 3	5M	M	RB4#0	98.20	≥95
Band 20	5M	M	RB4#0	98.41	
Band 28	5M	M	RB4#0	98.65	

ETSI EN 301 908-13 V11.1.2 (2017-07) §4.2.8 – RECEIVER SPURIOUS RESPONSE

Applicable Standard

According to ETSI EN 301 908-13 V11.1.2 (2017-07) §4.2.8:

Spurious response is a measure of the receiver's ability to receive a wanted signal on its assigned channel frequency without exceeding a given degradation due to the presence of an unwanted CW interfering signal at any other frequency at which a response is obtained i.e. for which the out-of-band blocking limit as specified in table 4.2.7.1.2-4 is not met.

Limits

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in ETSI TS 136 521-1 [1] with parameters specified in tables 4.2.8.1.2-1 and 4.2.8.1.2-2.

Table 4.2.8.1.2-1: Spurious response parameters

Rx Parameter	Units	Channel bandwidth					
		1,4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in Transmission Bandwidth Configuration	dBm	REFSENS + channel bandwidth specific value below					
		6	6	6	6	7	9
NOTE 1: The transmitter shall be set to 4 dB below $P_{\text{CMAX_L}}$ at the minimum uplink configuration specified in ETSI TS 136 101 [3] (table 7.3.1-2 with $P_{\text{CMAX_L}}$ as defined in clause 6.2.5).							
NOTE 2: Reference measurement channel is clause A.3.2 of ETSI TS 136 521-1 [1].							
NOTE 3: REFSENS as defined in ETSI TS 136 521-1 [1].							

Table 4.2.8.1.2-2: Spurious Response

Parameter	Units	Level
$P_{\text{Interferer}}$ (CW)	dBm	-44
$F_{\text{Interferer}}$	MHz	Spurious response frequencies

Test Condition

The initial conditions shall be the same as for those in out-of-band blocking in clause 5.3.6.1.1 in order to test spurious responses obtained in clause 5.3.6.1.2 under the same conditions.

Test Procedure

SS transmits PDSCH via PDCCH DCI format 1A for C_{RNTI} to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.6.2.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_{RNTI} to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 7.6.2.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

Set the parameters of the CW signal generator for an interfering signal according to table 4.2.8.1.2-2. The spurious frequencies are taken from step 5) records in clause 5.3.6.1.1.2.

Set the downlink signal level according to the table 4.2.8.1.2-1. Send uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in table 4.2.8.1.2-1 for carrier frequency $f \leq 3,0$ GHz or within +0, -4,0 dB of the target level for carrier frequency $3,0 \text{ GHz} < f \leq 4,2 \text{ GHz}$, for at least the duration of the throughput measurement as specified in ETSI TS 136 521-1 [1].

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.7.

Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	51 %
ATM Pressure:	101.0 kPa

The testing was performed by Jacob Kong on 2018-05-15.

EUT operation mode: Receiving. (Worst case)

Test Result: Compliant.

Test Band	Test Bandwidth	Test Channel	Test RB	Throughput (%)	Limit (%)
Band 3	5MHz	L	RB4#0	98.35	≥95
		M	RB4#0	99.14	
		H	RB4#0	98.85	
Band 20	5MHz	L	RB4#0	98.80	
		M	RB4#0	98.34	
		H	RB4#0	98.94	
Band 28	5MHz	L	RB4#0	98.97	
		M	RB4#0	98.92	
		H	RB4#0	98.58	

ETSI EN 301 908-13 V11.1.2 (2017-07) §4.2.9 – RECEIVER INTERMODULATION CHARACTERISTICS

Applicable Standard

According to ETSI EN 301 908-13 V11.1.2 (2017-07) §4.2.9,

Intermodulation response rejection is a measure of the capability of the receiver to receive a wanted signal on its assigned channel frequency in the presence of two or more interfering signals which have a specific frequency relationship to the wanted signal.

Limits

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in ETSI TS 136 521-1 [1] with parameters specified in table 4.2.9.1.2-1 for the specified wanted signal mean power in the presence of two interfering signals.

Table 4.2.9.1.2-1: Test parameters for Wide band intermodulation

Rx Parameter	Units	Channel bandwidth					
		1,4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in Transmission Bandwidth Configuration	dBm	REFSENS + channel bandwidth specific value below					
		12	8	6	6	7	9
P _{Interferer 1 (CW)}	dBm	-46					
P _{Interferer 2 (Modulated)}	dBm	-46					
BW _{Interferer 2}		1,4	3	5			
F _{Interferer 1 (Offset)}	MHz	-BW/2 - 2,1 / +BW/2 + 2,1	-BW/2 - 4,5 / +BW/2 + 4,5	-BW/2 - 7,5 / +BW/2 + 7,5			
F _{Interferer 2 (Offset)}	MHz	2 × F _{Interferer 1}					
NOTE 1: The transmitter shall be set to 4 dB below P _{CMAX_L} at the minimum uplink configuration specified in ETSI TS 136 101 [3] (table 7.3.1-2 with P _{CMAX_L} as defined in clause 6.2.5).							
NOTE 2: Reference measurement channel is clause A.3.2 of ETSI TS 136 521-1 [1].							
NOTE 3: The modulated interferer shall consist of the Reference measurement channel specified in clause A.3.2 of ETSI TS 136 521-1 [1] with set-up according to clause C.3.1 of ETSI TS 136 521-1 [1]. The interfering modulated signal is 5 MHz E-UTRA signal as described in annex C of ETSI TS 136 521-1 [1] for channel bandwidth ≥ 5 MHz.							
NOTE 4: REFSENS as defined in ETSI TS 136 521-1 [1].							

Test Condition

Test Environment: normal, as specified in annex B.

Frequencies to be tested: mid range; see ETSI TS 136 508 [2].

Channel bandwidths to be tested: lowest, 5 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

Connect the SS and interfering sources to the UE antenna connectors.

The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1, C.3.1 and uplink signals according to clauses H.1 and H.3.1.

The UL and DL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], table 7.8.4.1-1.

Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

Test Procedure

SS transmits PDSCH via PDCCH DCI format 1A for C_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.8.1.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 7.8.1.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

Set the Downlink signal level to the value as defined in table 4.2.9.1.2-1. Send uplink power control commands to the UE (less or equal to 1 dB step size should be used), to ensure that the UE output power is within +0, -3,4 dB of the target level in table 4.2.9.1.2-1 for carrier frequency $f \leq 3,0$ GHz or within +0, -4,0 dB of the target level for carrier frequency $3,0 \text{ GHz} < f \leq 4,2 \text{ GHz}$, for at least the duration of the throughput measurement as specified in ETSI TS 136 521-1 [1].

Set the Interfering signal levels to the values as defined in table 4.2.9.1.2-1, using a modulated interferer bandwidth as defined in annex C of ETSI TS 136 521-1 [1].

Measure the average throughput for a duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [1].

Repeat for applicable test frequencies, channel bandwidths and operating bands.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.8.

Test Data**Environmental Conditions**

Temperature:	25 °C
Relative Humidity:	51 %
ATM Pressure:	101.0 kPa

The testing was performed by Jacob Kong on 2018-05-15.

EUT operation mode: Receiving. (Worst case)

Test Result: Compliant.

Test Band	Test Bandwidth	Test RB	Test Channel	Throughput (%)		Limits (%)
				Low Interfering	High Interfering	
Band 3	5MHz	RB4#0	M	98.69	98.51	≥95
Band 20	5MHz	RB4#0	M	98.34	98.22	
Band 28	5MHz	RB4#0	M	98.19	98.86	

ETSI EN 301 908-13 V11.1.2 (2017-07) §4.2.10 – RECEIVER SPURIOUS EMISSIONS

Applicable Standard

The spurious emissions power is the power of emissions generated or amplified in a receiver that appear at the UE antenna connector.

Limits

The measured spurious emissions derived in clause 5.3.9 shall not exceed the maximum level specified in table 4.2.10.1.2-1.

Table 4.2.10.1.2-1: General receiver spurious emission requirements

Frequency Band	Measurement bandwidth	Maximum level	Note
$30 \text{ MHz} \leq f < 1 \text{ GHz}$	100 kHz	-57 dBm	
$1 \text{ GHz} \leq f \leq 12,75 \text{ GHz}$	1 MHz	-47 dBm	
$12,75 \text{ GHz} \leq f \leq 5^{\text{th}}$ harmonic of the upper frequency edge of the DL operating band in GHz	1 MHz	-47 dBm	Note 1
NOTE 1: Shall apply only for Band 22, 42 and Band 43.			
NOTE 2: Unused PDCCH resources are padded with resource element groups with power level given by PDCCH_RA/RB as defined in ETSI TS 136 101 [3], clause C.3.1.			

Test Condition

Test Environment: normal, as specified in annex B.

Frequencies to be tested: low range, mid range and high range; as specified in ETSI TS 136 508 [2], clause 4.3.1.

Channel bandwidth to be tested: highest channel bandwidth as defined in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

Connect a spectrum analyzer (or other suitable test equipment) to the UE antenna connectors.

The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.1.

The DL Reference Measurement channels are set according to ETSI TS 136 521-1 [1].

Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

Test Procedure

- 1) Sweep the spectrum analyser (or other suitable test equipment) over a frequency range from 30 MHz to 12,75 GHz and measure the average power of the spurious emissions.
- 2) Repeat step 1) for all E-UTRA Rx antennas of the UE.
- 3) Repeat for applicable test frequencies, channel bandwidths and operating bands.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.9.

Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	51 %
ATM Pressure:	101.0 kPa

The testing was performed by Jacob Kong on 2018-03-14

EUT operation mode: Receiving. (Worst case)

Test Result: Compliant. Please refer to the plots in appendix C.

ETSI EN 301 908-13 V11.1.2 (2017-07) §4.2.11 – TRANSMITTER ADJACENT CHANNEL LEAKAGE POWER RATIO

Applicable Standard

According to ETSI EN 301 908-13 V11.1.2 (2017-07) §4.2.11.1,

Adjacent Channel Leakage power Ratio (ACLR) is the ratio of the filtered mean power centred on the assigned channel frequency to the filtered mean power centred on an adjacent channel frequency.

Limits

If the measured adjacent channel power is greater than -50 dBm then the measured E-UTRA_{ACLR} shall be higher than the limits in table 4.2.11.1.2-1.

Table 4.2.11.1.2-1: E-UTRA UE ACLR

	Channel bandwidth/E-UTRA _{ACLR1} /measurement bandwidth					
	1,4 MHz	3,0 MHz	5 MHz	10 MHz	15 MHz	20 MHz
E-UTRA _{ACLR1}	29,2 dB	29,2 dB	29,2 dB	29,2 dB	29,2 dB	29,2 dB
E-UTRA channel Measurement bandwidth	1,08 MHz	2,7 MHz	4,5 MHz	9,0 MHz	13,5 MHz	18 MHz
UE channel	+1,4 MHz or -1,4 MHz	+3 MHz or -3 MHz	+5 MHz or -5 MHz	+10 MHz or -10 MHz	+15 MHz or -15 MHz	+20 MHz or -20 MHz

If the measured UTRA channel power is greater than -50 dBm then the measured UTRA_{ACLR1}, UTRA_{ACLR2} shall be higher than the limits in table 4.2.11.2-2.

Table 4.2.11.2-2: UTRA UE ACLR

	Channel bandwidth/UTRA _{ACLR1/2} /measurement bandwidth					
	1,4 MHz	3,0 MHz	5 MHz	10 MHz	15 MHz	20 MHz
UTRA _{ACLR1}	32,2 dB	32,2 dB	32,2 dB	32,2 dB	32,2 dB	32,2 dB
Adjacent channel centre frequency offset (in MHz)	0,7 + BW _{UTRA} /2 / -0,7 - BW _{UTRA} /2	1,5 + BW _{UTRA} /2 / -1,5 - BW _{UTRA} /2	2,5 + BW _{UTRA} /2 / -2,5 - BW _{UTRA} /2	5 + BW _{UTRA} /2 / -5 - BW _{UTRA} /2	7,5 + BW _{UTRA} /2 / -7,5 - BW _{UTRA} /2	10 + BW _{UTRA} /2 / -10 - BW _{UTRA} /2
UTRA _{ACLR2}	-	-	35,2 dB	35,2 dB	35,2 dB	35,2 dB
Adjacent channel centre frequency offset (in MHz)	-	-	2,5 + 3 × BW _{UTRA} /2 / -2,5 - 3 × BW _{UTRA} /2	5 + 3 × BW _{UTRA} /2 / -5 - 3 × BW _{UTRA} /2	7,5 + 3 × BW _{UTRA} /2 / -7,5 - 3 × BW _{UTRA} /2	10 + 3 × BW _{UTRA} /2 / -10 - 3 × BW _{UTRA} /2
E-UTRA channel Measurement bandwidth	1,08 MHz	2,7 MHz	4,5 MHz	9,0 MHz	13,5 MHz	18 MHz
UTRA 5 MHz channel Measurement bandwidth (see note 1)	3,84 MHz	3,84 MHz	3,84 MHz	3,84 MHz	3,84 MHz	3,84 MHz
UTRA 1,6 MHz channel measurement bandwidth (see note 2)	1,28 MHz	1,28 MHz	1,28 MHz	1,28 MHz	1,28 MHz	1,28 MHz

NOTE 1: Shall apply for E-UTRA FDD co-existence with UTRA FDD in paired spectrum.
NOTE 2: Shall apply for E-UTRA TDD co-existence with UTRA TDD in unpaired spectrum.
NOTE 3: BW_{UTRA} for UTRA FDD shall be 5 MHz and for UTRA TDD shall be 1,6 MHz.

Test Condition

Test Environment: normal, TL/VL, TL/VH, TH/VL and TH/VH, as specified in annex B.

Frequencies to be tested: low range, mid range and high range; see ETSI TS 136 508 [2].

Channel bandwidth to be tested: lowest, 5 MHz, 10 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

Connect the SS to the UE to the UE antenna connectors.

The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.0.

The UL Reference Measurement channels are set according to ETSI TS 136 521-1 [1].

Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

Test Procedure

SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 6.6.2.3.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

Send continuous uplink power control "up" commands in the uplink scheduling information to the UE to ensure that the UE transmits at P_{UMAX} level.

Measure the mean power of the UE in the channel bandwidth of the radio access mode according to the testconfiguration, which shall meet the requirements described in tables 4.2.11.1.2-1 and 4.2.11.1.2-2. The periodof the measurement shall be at least the continuous duration of one sub-frame (1 ms). For TDD slots with transient periods are not under test.

Measure the filtered mean power for E-UTRA.

Measure the filtered mean power of the first E-UTRA adjacent channel.

Measure the RRC filtered mean power of the first and the second UTRA adjacent channel.

Calculate the ratio of the power between the values measured in step 4) over step 5) for E-UTRA_{ACLR}.

Calculated the ratio of the power between the values measured in step 4) over step 6) for UTRA_{ACLR1}, UTRA_{ACLR2}.

Repeat for applicable test frequencies, channel bandwidths, operating bands and environmental conditions.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 6.6.2.3.

Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	51 %
ATM Pressure:	101.0 kPa

The testing was performed by Jacob Kong on 2018-03-15.

EUT operation mode: Transmitting. (Worst case)

Test Result: Compliance. Please refer to the plots in in appendix D.

ETSI EN 301 908-13 V11.1.2 (2017-07) §4.2.12 –RECEIVER REFERENCE SENSITIVITY LEVEL

Applicable Standard

According to ETSI EN 301 908-2 V11.1.1 (2016-07) §4.2.13, Reference sensitivity measures the UE's ability to receive data with a given average throughput for a specified reference measurement channel, under conditions of low signal level, ideal propagation and no added noise.

A UE unable to meet the throughput requirement under these conditions will decrease the effective coverage area of an e-NodeB.

Limits

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in ETSI TS 136 521-1 [1], clauses A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in ETSI TS 136 521-1 [1], clauses A.5.1.1/A.5.2.1) with parameters specified in table 4.2.12.1.2-1 and table 7.3.3-2.

Table 4.2.12.1.2-1: Reference sensitivity QPSK P_{REFSENS}

E-UTRA Band	Channel bandwidth						Duplex Mode
	1,4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	
1	-	-	-99,3	-96,3	-94,5	-93,3	FDD
3	-101,0	-98,0	-96,3	-93,3	-91,5	-90,3	FDD
7	-	-	-97,3	-94,3	-92,5	-91,3	FDD
8	-101,5	-98,5	-96,3	-93,3	-	-	FDD
20	-	-	-96,3	-93,3	-90,5	-89,3	FDD
22	-	-	-96,0	-93,0	-91,2	-90,0	FDD
28	-	-99,5	-97,8	-94,8	-93,0	-90,3	FDD
33	-	-	-99,3	-96,3	-94,5	-93,3	TDD
34	-	-	-99,3	-96,3	-94,5	-	TDD
38	-	-	-99,3	-96,3	-94,5	-93,3	TDD
40	-	-	-99,3	-96,3	-94,5	-93,3	TDD
42	-	-	-98,0	-95,0	-93,2	-92,0	TDD
43	-	-	-98,0	-95,0	-93,2	-92,0	TDD

NOTE 1: The transmitter shall be set to maximum output power level (ETSI TS 136 521-1 [1], table 7.3.5-2).

NOTE 2: The reference measurement channel is specified in ETSI TS 136 521-1 [1], clause A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in ETSI TS 136 521-1 [1], clauses A.5.1.1/A.5.2.1.

NOTE 3: The signal power is specified per port.

The reference receive sensitivity (REFSENS) requirement specified in table 4.2.12.1.2-1 shall be met for an uplink transmission bandwidth less than or equal to that specified in ETSI TS 136 521-1 [1], table 7.3.5-2.

Test Condition

Test Environment: normal, TL/VL, TL/VH, TH/VL, TH/VH; as specified in annex B.

Frequencies to be tested: low range, mid range and high range; see ETSI TS 136 508 [2].

Channel bandwidth to be tested: lowest, 5 MHz and highest channel bandwidth as defined in ETSI TS 136 508 [2], clause 4.3.1.

Uplink/Downlink configurations: as specified in ETSI TS 136 521-1 [1]:

Connect the SS to the UE to the UE antenna connectors.

The parameter settings for the cell are set up according to ETSI TS 136 508 [2], clause 4.4.3.

Downlink signals are initially set up according to ETSI TS 136 521-1 [1], clauses C.0, C.1 and C.3.0 and uplink signals according to clauses H.1 and H.3.1.

The UL and DL Reference Measurement channels are set according to ETSI TS 136 521-1 [1], table 7.3.4.1-1.

Propagation conditions are set according to ETSI TS 136 521-1 [1], clause B.0.

Ensure the UE is in State 3A-RF according to ETSI TS 136 508 [2], clause 5.2A.2.

NOTE: When reference is made to test set up, call set up and test mode, guidance on the applicability of these can be found in ETSI TS 136 521-1 [1], ETSI TS 136 508 [2] and ETSI TS 136 509 [i.10] respectively.

Test Procedure

SS transmits PDSCH via PDCCH DCI format 1A for C_RNTI to transmit the DL RMC according to ETSI TS 136 521-1 [1], table 7.3.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0 for C_RNTI to schedule the UL RMC according to ETSI TS 136 521-1 [1], table 7.3.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

Set the Downlink signal level to the appropriate REFSENS value defined in table 4.2.12.1.2-1. Send Continuously uplink power control "up" commands in the uplink scheduling information to the UE to ensure the UE transmits PUMAX level for at least the duration of the Throughput measurement. (Obtain correct UE output power as specified in ETSI TS 136 521-1 [1]).

Measure the average throughput for duration sufficient to achieve statistical significance according to clause G.2 of ETSI TS 136 521-1 [1].

Repeat for applicable test frequencies, channel bandwidths and operating bands.

Details of the test method can be found in ETSI TS 136 521-1 [1], clause 7.3.

Test Data**Environmental Conditions**

Temperature:	25 °C
Relative Humidity:	51 %
ATM Pressure:	101.0 kPa

The testing was performed by Jacob Kong on 2018-05-15.

EUT operation mode: Receiving. (Worst case)

Test Result: Compliance. Please refer to following data table.

Test Band	Test Bandwidth	Test RB	Test Channel	Throughput (%)			Limits (%)
				Test Condition			
				N.T.	H.T.	L.T.	
E-UTRA Band3	5MHz	RB4#0	L	98.47	98.97	98.59	≥95
			M	98.40	98.58	98.53	
			H	98.39	98.57	98.76	
E-UTRA Band 20	5MHz	RB4#0	L	98.22	98.70	98.70	
			M	98.65	98.42	98.51	
			H	98.47	98.74	98.20	
E-UTRA Band 28	5MHz	RB4#0	L	98.25	98.76	98.52	
			M	98.54	98.51	98.24	
			H	98.62	98.64	98.85	

EXHIBIT A - PRODUCT LABELING

Proposed Label Format



Specifications: The label must be legibly and durably applied on the external surface of the product. The compliance mark must be no smaller than 3mm in diameter and the supplier identification characters must be no less than 1mm in height

Proposed Label Location on EUT

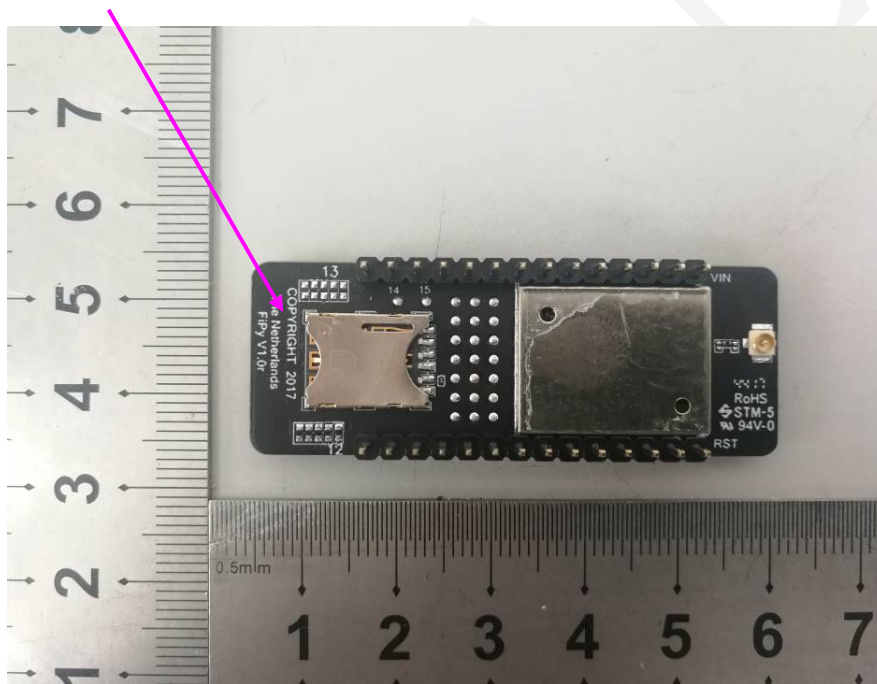
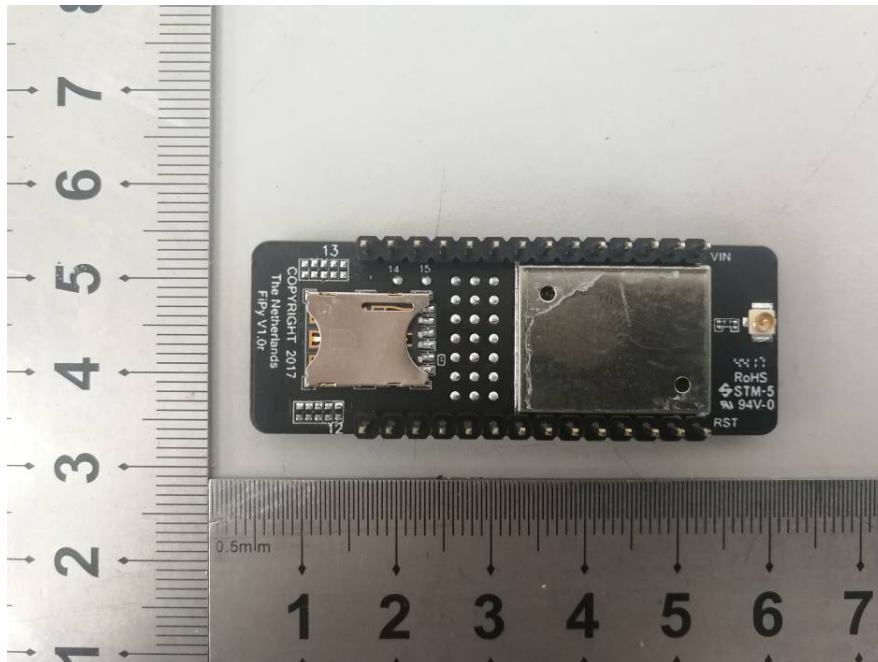


EXHIBIT B - EUT PHOTOGRAPHS

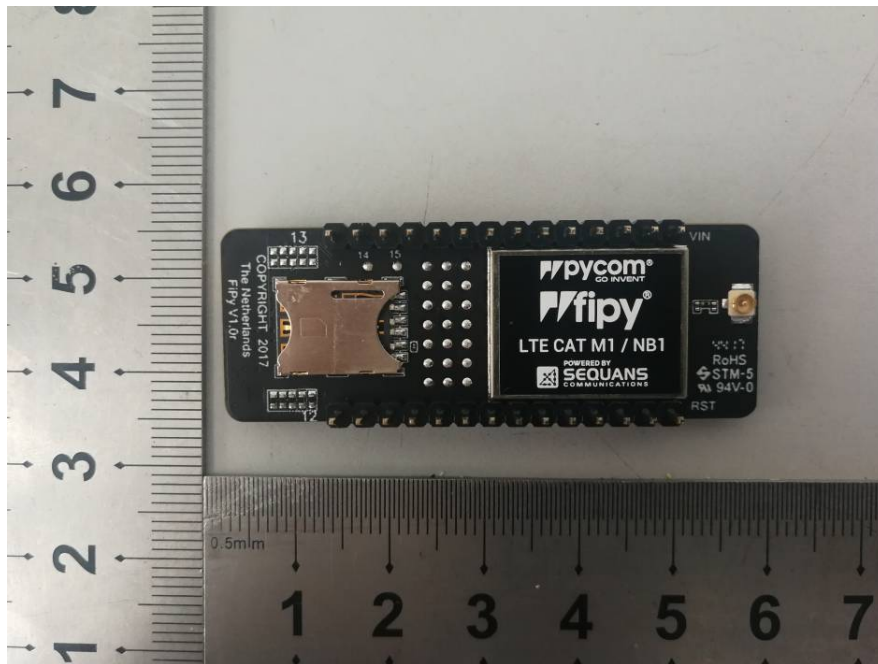
EUT – Top View



EUT –Bottom View 1



EUT – Shielding off View



EUT – Bottom View 2

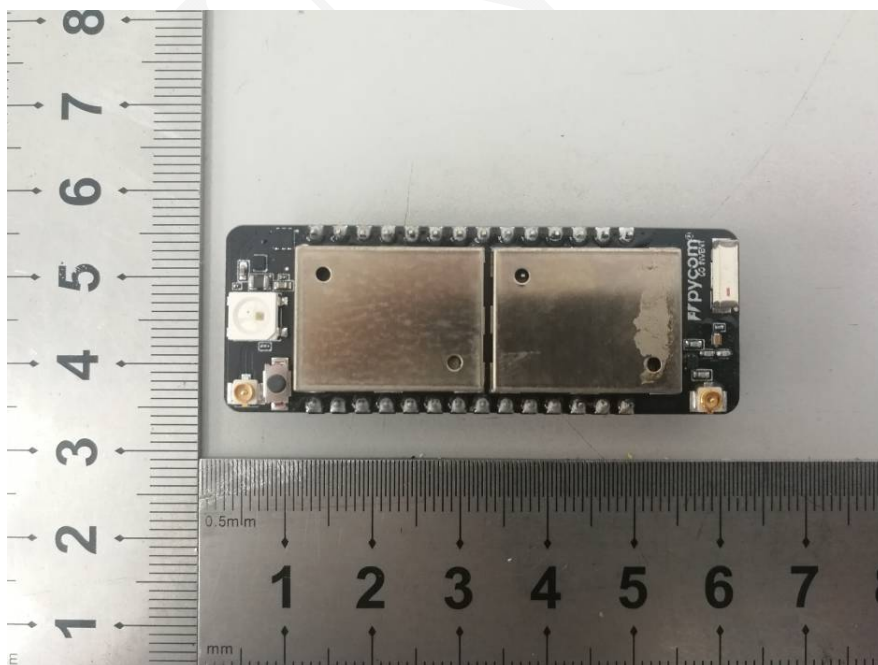
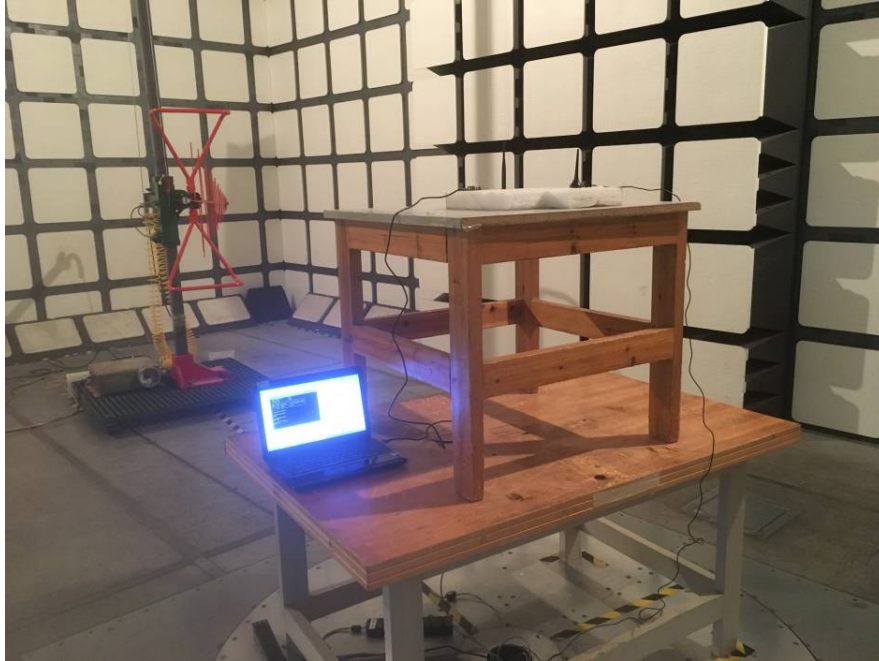


EXHIBIT C - TEST SETUP PHOTOGRAPHS

Radiated Spurious Emissions Test View (Below 1GHz)



Radiated Spurious Emissions Test View (Above 1GHz)



******* END OF REPORT *******