

TEST REPORT

EUT Description	Integrated Device
Brand Name	CINTERION ELS81-US
Model Name	ELS81-US
FCC/IC ID	FCC ID: QIPELS81-US
Date of Test Start/End	2018-09-27 / 2018-10-05
Features	WWAN: UMTS: II,IV,V LTE:2,4,5,12 (see section 1)

Applicant	Gemalto M2M GmbH
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Reference Standards	FCC CFR Title 47 Part 2, 22, 24, 27 (see section 1)
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Test Report identification	180810-02.TR02
Revision Control	Rev. 01 This test report revision replaces any previous test report revision (see section 8)

The test results relate only to the samples tested.
The test report shall not be reproduced in full, without written approval of the laboratory.

Issued by _____ Reviewed by _____

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1. Standards, reference documents and applicable test methods

1. FCC 47 CFR part 2 - Subpart J - Equipment Authorization Procedures.
2. FCC 47 CFR part 22 - Subpart H - Cellular Radiotelephone Service.
3. FCC 47 CFR part 24 – Subpart E - Broadband PCS.
4. FCC 47 CFR part 27 – Subpart C - Technical Standards.
5. FCC 47 CFR part 27 – Subpart L - 1695-1710, 1710-1755 MHz, 1755-1780 MHz, 2110-2155 MHz, 2155-2180 MHz, 2180-2200 MHz Bands.
6. FCC OET KDB 971168 D01 v03r01 Measurement guidance for certification of licensed digital transmitters.
7. C63.26-2015 - IEEE/ANSI Standard for Compliance Testing of Transmitters Used in Licensed Radio Services.

2. General conditions, competences and guarantees

- ✓ Intel Corporation SAS Wireless RF Lab (Intel WRF Lab) is an ISO/IEC 17025:2005 testing laboratory accredited by the American Association for Laboratory Accreditation (A2LA) with the certificate number 3478.01.
- ✓ Intel Corporation SAS Wireless RF Lab (Intel WRF Lab) is an Accredited Test Firm recognized by the FCC, with Designation Number FR0011.
- ✓ Intel Corporation SAS Wireless RF Lab (Intel WRF Lab) is a registered Test site listed by the IC, with IC Assigned Code 1000Y.
- ✓ Intel WRF Lab only provides testing services and is committed to providing reliable, unbiased test results and interpretations.
- ✓ Intel WRF Lab is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.
- ✓ Intel WRF Lab has developed calibration and proficiency programs for its measurement equipment to ensure correlated and reliable results to its customers.
- ✓ This report is only referred to the item that has undergone the test.
- ✓ This report does not imply an approval of the product by the Certification Bodies or competent Authorities.

3. Environmental Conditions

- ✓ At the site where the measurements were performed the following limits were not exceeded during the tests:

Temperature	24°C ± 3°C
Humidity	50% ± 5%

4. Test samples

Sample	Control #	Description	Model	Serial #	Date of receipt	Note
#01	180810-01.S01	PC NUC	NUC7I7DNKE	BTDN825001AC	2018-08-20	PC
	171018-01.S06	RF Module US	ELS81-US	004401082442910	2018-07-31	Module
	171018-01.S01	Tekfun Antenna	W50-S-V4	-	2017-10-17	Antenna
	171018-01.S01	Tekfun Antenna	W50-S-V4	-	2017-10-17	Antenna

5. EUT Features

Brand Name	CINTERION ELS81-US
Model Name	ELS81-US
FCC/IC ID	FCC ID: QIPELS81-US
Software Version	NA
Driver Version	4.19.0.0
Prototype / Production	Production
Supported Radios	<p>GSM 850 (824.2 – 848.8 MHz) 1900 (1880 – 1909.8 MHz)</p> <p>WCDMA / HSPA+ FDD II (1850.0 – 1910.0 MHz) FDD IV (1710.0 – 1755.0 MHz) FDD V (824.0 – 849.0 MHz)</p> <p>LTE FDD Band 2 (1850.0 – 1910.0 MHz) Band 4 (1710.0 – 1755.0 MHz) Band 5 (824.0 – 849.0 MHz) Band 12 (699 MHz – 716 MHz)</p>
Antenna Information	According to the manufacturer, the integrated device used external antennas connected at the rear of the device. Main and div antennas are 90° apart and tilted 45° from the middle of the device giving form to a “V” shape

6. Remarks and comments

- As per applicant request. The Testing was performed in the highest order RAT supported by the device.

7. LTE Test Verdicts summary

Band	FCC part	Test name	Verdict
LTE2	24.238	Radiated spurious emission	P
LTE4	27.53, 2.1053	Radiated spurious emission	P
LTE 5	22.917, 2.1053	Radiated spurious emission	P
LTE12	27.53 (g), 2.1053	Radiated spurious emission	P

P: Pass
F: Fail
NM: Not Measured
NA: Not Applicable

8. Document Revision History

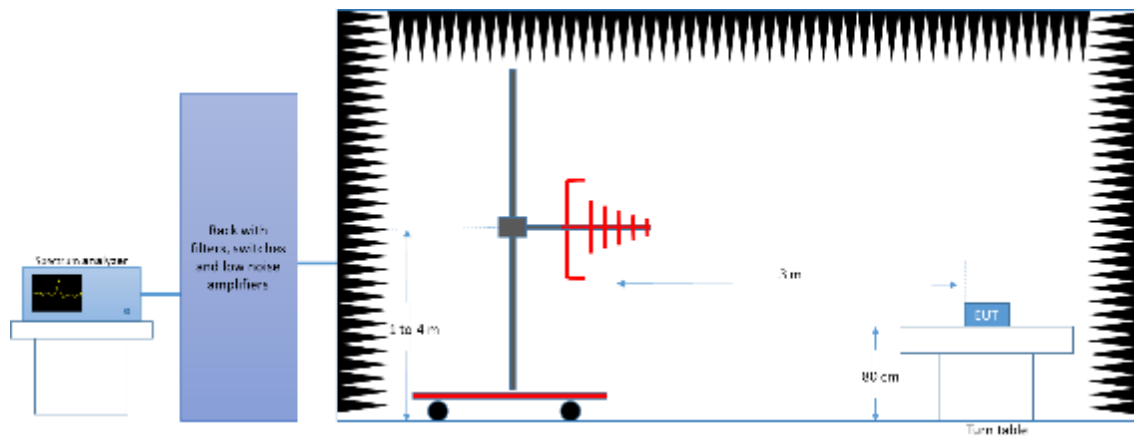
Revision #	Date	Modified by	Revision Details
Rev. 00	2018-10-01	F. Sauvan	First Issue
Rev. 01	2019-05-06	I. Kharrat	Applicant information update ISED recognition statement removed
Rev.02	2019-08-23	I. Kharrat	Applicant information update ISED recognition statement added

Annex A. Test & System Description

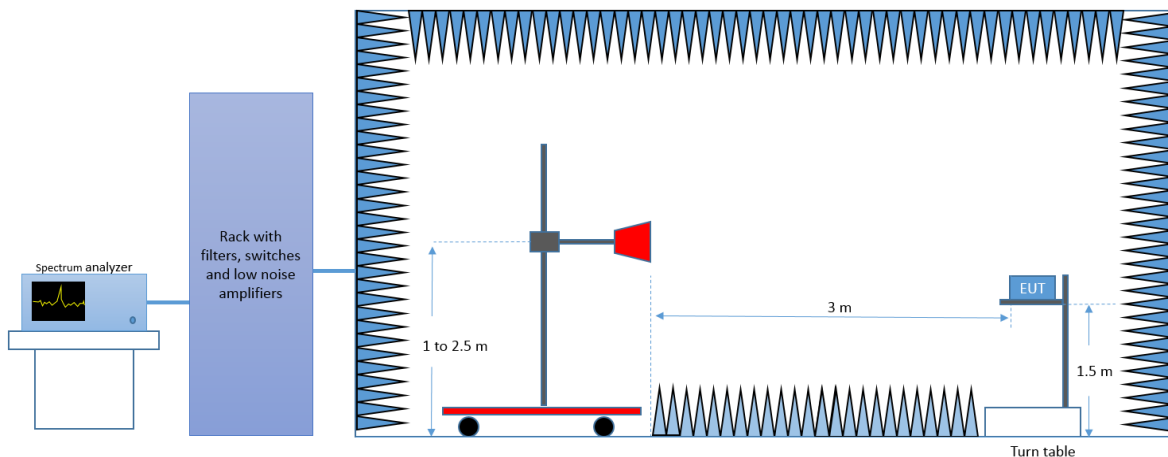
A.1 Measurement System

Measurements were performed using the following setups. A communication tester was used to establish a communication link with the EUT, and the communication tester parameters were set to get the maximum output power from the EUT.

Radiated Setup 30MHz- 1GHz



Radiated Setup Frequency range 1 GHz to 18 GHz



A.2 Test Equipment List

A.2.1 Radiated Setup #1

ID#	Device	Type/Model	Serial #	Manufacturer	Cal. Date	Cal. Due Date
0420	Spectrum analyzer	FSV40	101556	Rohde & Schwarz	2018-05-17	2020-05-17
0137	BiConiLog antenna 26 MHz – 6 GHz	3142E	00156946	ETS Lindgren	2017-12-19	2019-12-19
0135	Semi Anechoic chamber	FACT 3	5720	ETS Lindgren	2018-04-18	2020-04-18
0329	Measurement Software	EMC32	100401	Rohde & Schwarz	N/A	N/A
0210	Communication tester	CMW500	147712	Rohde & Schwarz	N/A	N/A

A.2.2 Radiated Setup #2

ID#	Device	Type/Model	Serial #	Manufacturer	Cal. Date	Cal. Due Date
0133	Spectrum analyzer	FSV40	101358	Rohde & Schwarz	2018-04-11	2020-04-11
0138	Horn antenna 1 GHz – 18 GHz	3117	00152266	ETS Lindgren	2018-03-29	2020-03-29
0337	Full Anechoic chamber	RFD_FA_100	5996	ETS Lindgren	2018-04-30	2020-04-30
0530	Measurement Software	EMC32	100623	Rohde & Schwarz	N/A	N/A
0311	Communication tester	CMW500	152720	Rohde & Schwarz	2018-04-16	2020-04-16

A.3 Measurement Uncertainty Evaluation

The system uncertainty evaluation is shown in the below table:

Measurement type	Uncertainty [\pm dB]
Radiated test < 1GHz	± 3.8
Radiated test 1GHz - 18 GHz	± 4.7

A.4 Conducted power

The tests were performed using the following conducted powers at the antenna terminal.

Band	Channel#	Frequency (MHz)	Conducted power (dBm)
WCDMA II	9262	1852.4	23.05
	9400	1880	22.98
	9538	1907.6	23.25
WCDMA IV	4132	826.4	23.08
	4183	836.6	22.99
	4233	846.6	22.91
WCDMA V	1312	1712.4	23.15
	1413	1732.6	23.32
	1513	1752.6	23.30
LTE 2	18650	1711.58	22.60
	18900	1732.5	22.41
	19150	1753.42	22.25
LTE 4	20000	1711.58	22.80
	20175	1732.5	22.41
	20350	1753.42	22.37
LTE 5	20450	829	23.09
	20525	836.5	22.77
	20600	844	22.64
LTE 12	23035	699.97	23.06
	23095	707.41	22.86
	23155	715.03	22.83

Annex B. Test Results

B.1 Radiated spurious emission

B.1.1 Standard references

BAND	FCC part	Limits
LTE 2	2. 1051, 24.238	The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB
LTE 4	2. 1051, 27.53	The power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ dB
LTE 5	2. 1051, 22.917	The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB
LTE 12	2.1051, 27.53 (g)	The power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ dB

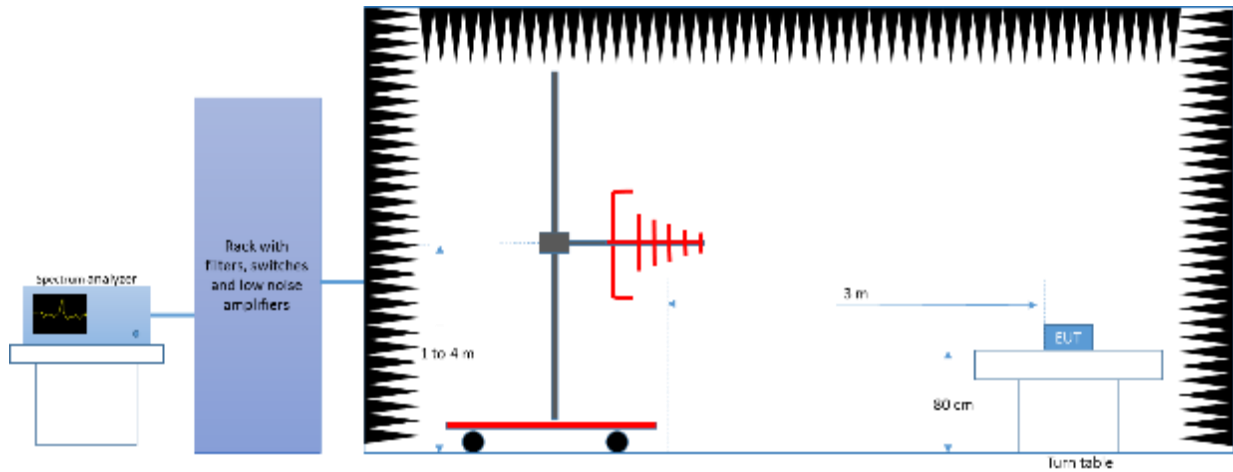
B.1.2 Test procedure

The setup below was used to measure the radiated spurious emissions. The test was done following the FCC OET KDB 971168 D01 v03r01.

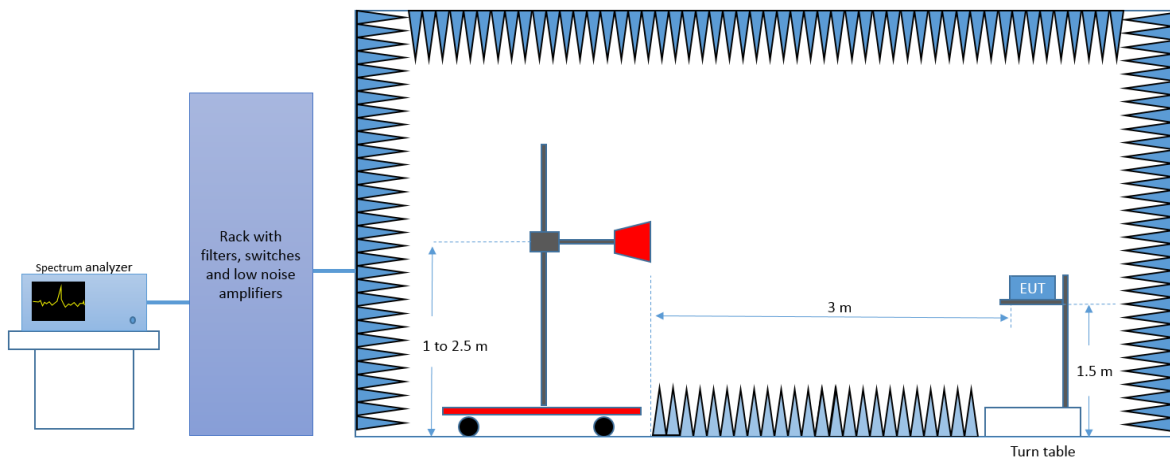
Depending of the frequency range and bands being tested, different antennas and filters were used.

The final measurement is done by varying the antenna height from 1 to 4 meters, the EUT azimuth over 360° and for both Vertical and Horizontal polarizations.

Radiated Setup 30MHz- 1GHz



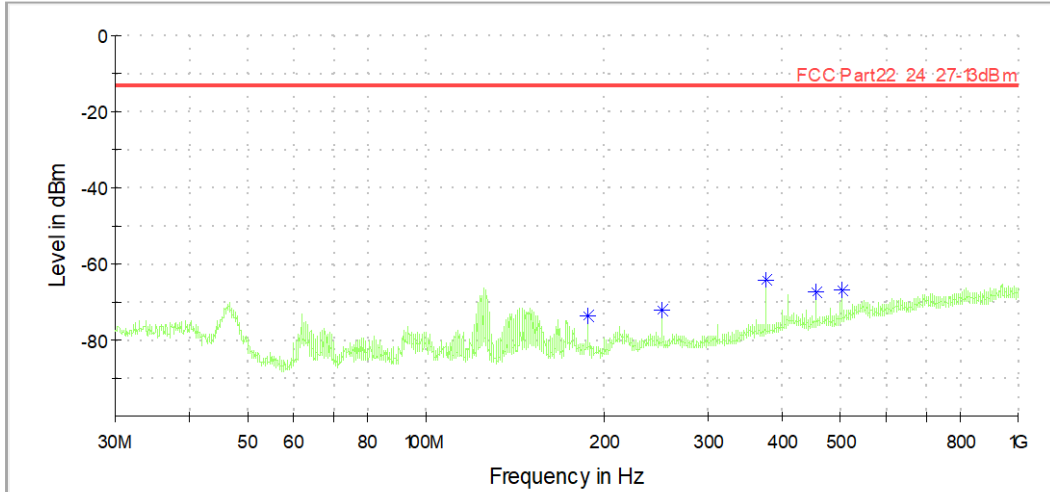
Radiated Setup Frequency range 1 GHz to 18 GHz



B.1.3 Test Results

LTE 2

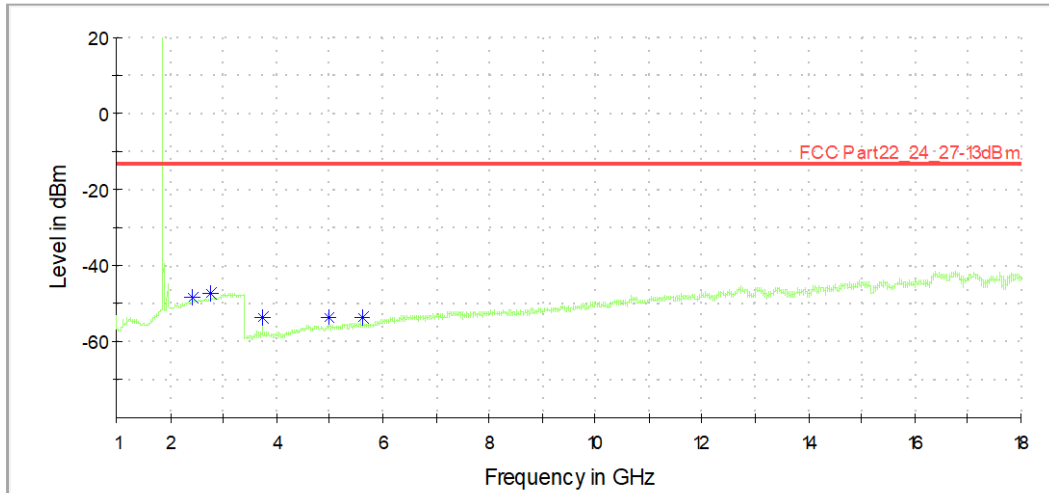
**30MHz to 1GHz - Radiated Spurious
LTE 2 - QPSK - Mid channel 18900**



— RMS measurements
 — Limit FCC

Frequency MHz	RMS dBm	Limit dBm	Margin dB
187.5	-73.5	-13.0	60.5
250.0	-72.0	-13.0	59.0
375.0	-64.2	-13.0	51.2
456.0	-67.2	-13.0	54.2
504.0	-66.8	-13.0	53.8

**1GHz to 18GHz - Radiated Spurious
LTE 2 - QPSK - Mid channel 18900**



— RMS measurements — Limit FCC

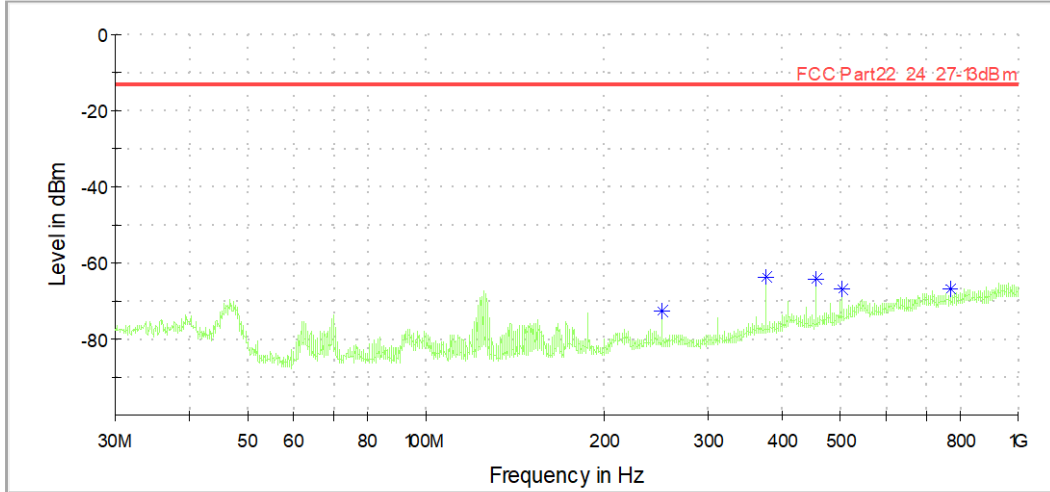
Frequency	RMS	Limit	Margin
MHz	dBm	dBm	dB
2440.5	-48.6	-13.0	35.6
2774.5	-47.1	-13.0	34.1
3760.0	-53.6	-13.0	40.6
4981.8	-53.5	-13.0	40.5
5640.2	-53.9	-13.0	40.9

Note1: the peak showed above the limit is the fundamental emission

Note2: the peak at 1960MHz corresponds to the downlink frequency

LTE 4

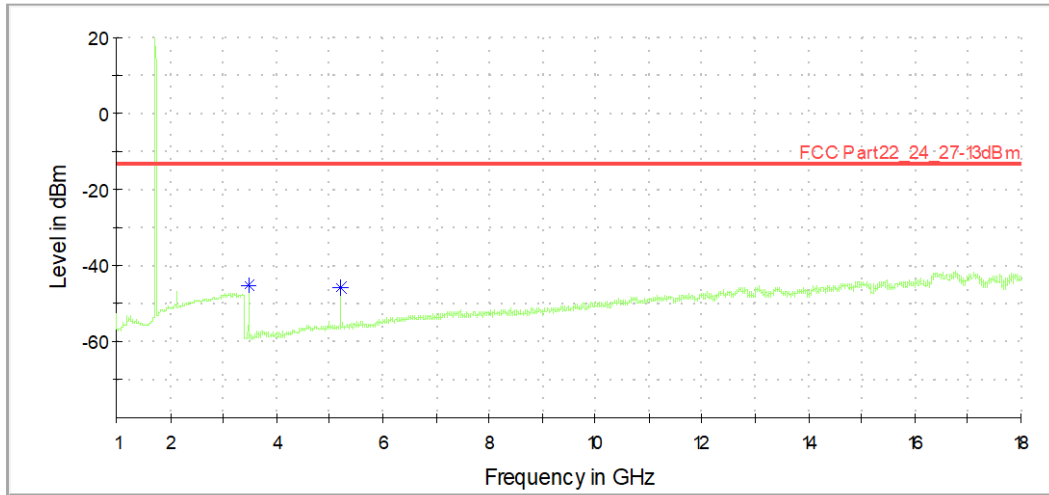
**30MHz to 1GHz - Radiated Spurious
LTE 4 - QPSK - Mid channel 20175**



— RMS measurements — Limit FCC

Frequency	RMS	Limit	Margin
MHz	dBm	dBm	dB
250.0	-72.5	-13.0	59.5
375.0	-63.9	-13.0	50.9
456.0	-64.3	-13.0	51.3
504.0	-66.9	-13.0	53.9
770.1	-66.7	-13.0	53.7

**1GHz to 18GHz - Radiated Spurious
LTE 4 - QPSK - Mid channel 20175**



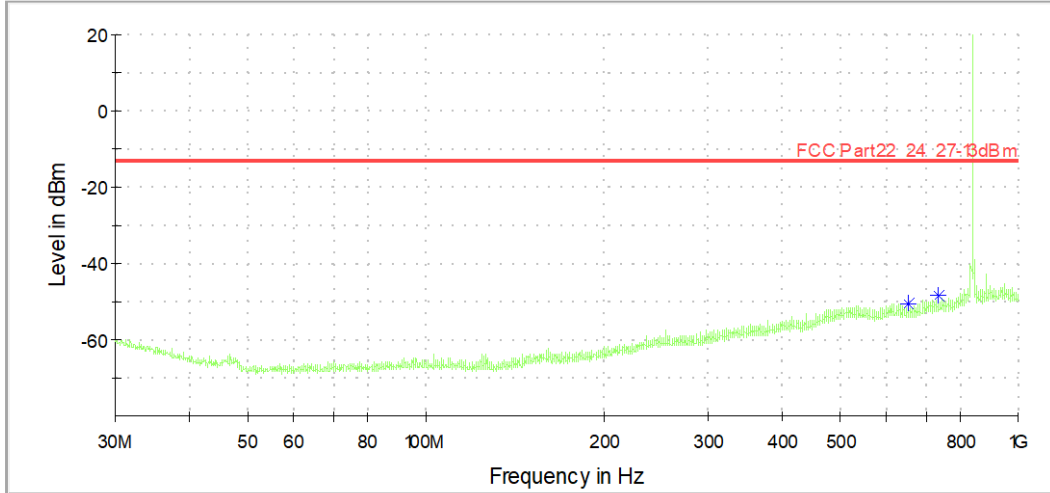
— RMS measurements — Limit FCC

Frequency	RMS	Limit	Margin
MHz	dBm	dBm	dB
3464.8	-45.2	-13.0	32.2
5197.6	-45.7	-13.0	32.7

Note1: the peak showed above the limit is the fundamental emission
 Note2: the peak at 2132.5MHz corresponds to the downlink frequency

LTE 5

**30MHz to 1GHz - Radiated Spurious
LTE 5 - QPSK - Mid channel 20525**

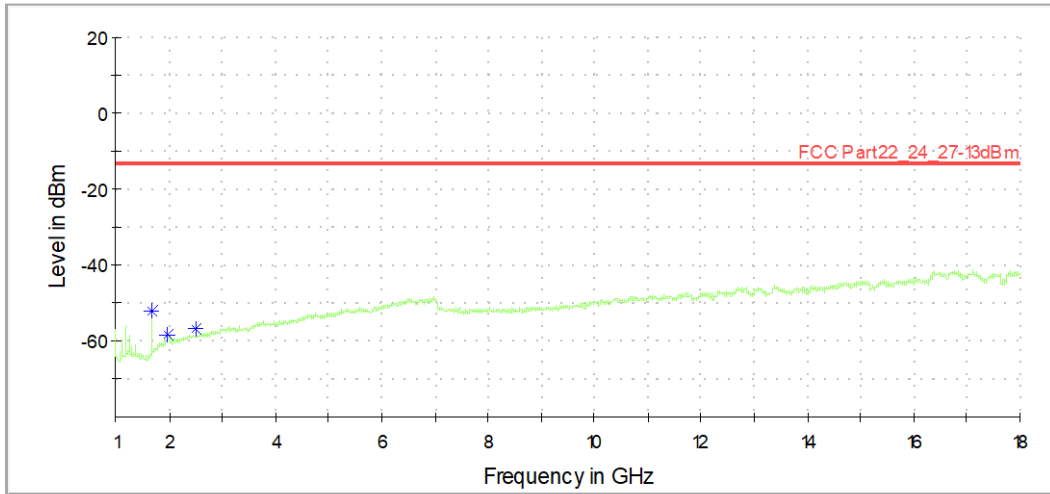


— RMS measurements — Limit FCC

Frequency MHz	RMS dBm	Limit dBm	Margin dB
651.0	-50.5	-13.0	37.5
735.2	-48.6	-13.0	35.6

Note1: the peak showed above the limit is the fundamental emission
 Note2: the peak at 881.5MHz corresponds to the downlink frequency

**1GHz to 18GHz - Radiated Spurious
LTE 5 - QPSK - Mid channel 20525**

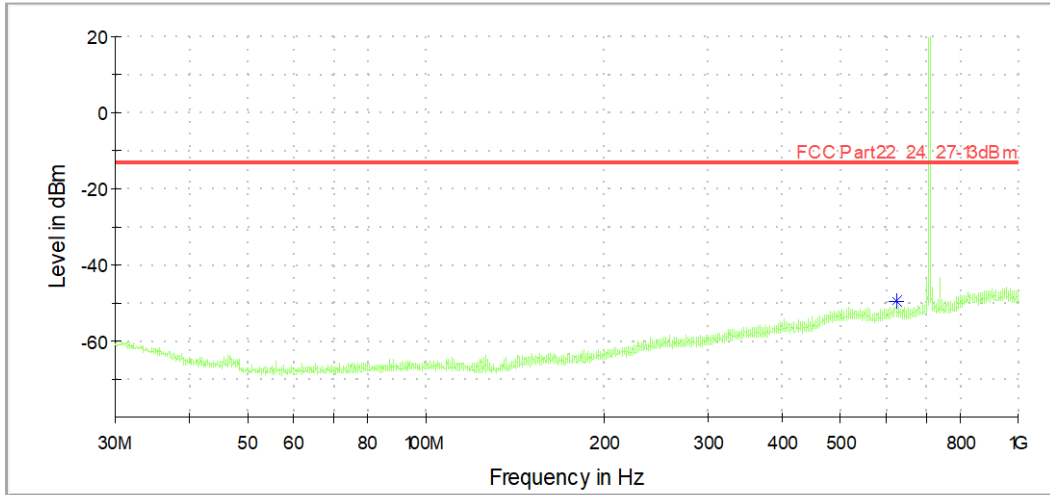


— RMS measurements — Limit FCC

Frequency	RMS	Limit	Margin
MHz	dBm	dBm	dB
1673.0	-52.2	-13.0	39.2
1995.0	-58.3	-13.0	45.3
2509.5	-56.6	-13.0	43.6

LTE 12

**30MHz to 1GHz - Radiated Spurious
LTE 12 - QPSK - Mid channel 23095**

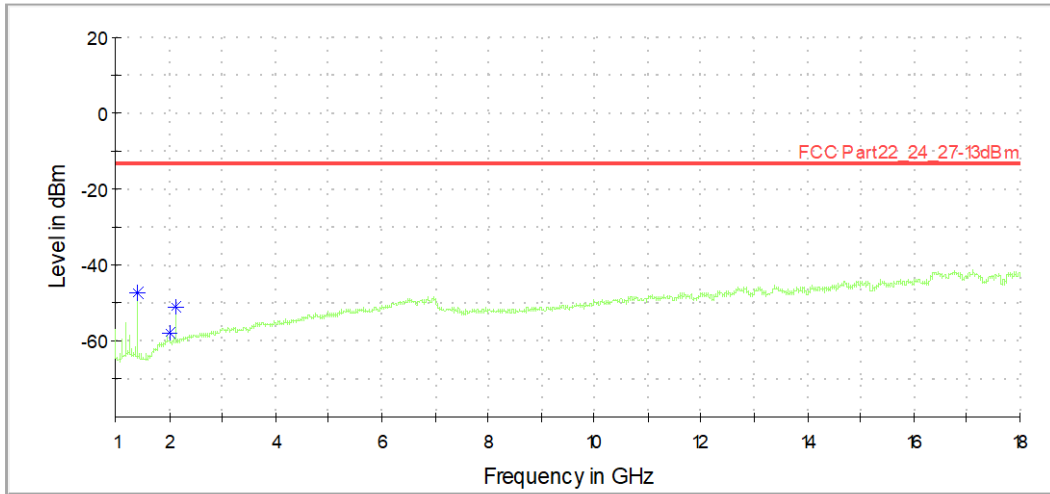


— RMS measurements — Limit FCC

Frequency	RMS	Limit	Margin
MHz	dBm	dBm	dB
622.8	-49.7	-13.0	36.7

Note1: the peak showed above the limit is the fundamental emission
 Note2: the peak at 737.5MHz corresponds to the downlink frequency

**1GHz to 18GHz - Radiated Spurious
LTE 12 - QPSK - Mid channel 23095**

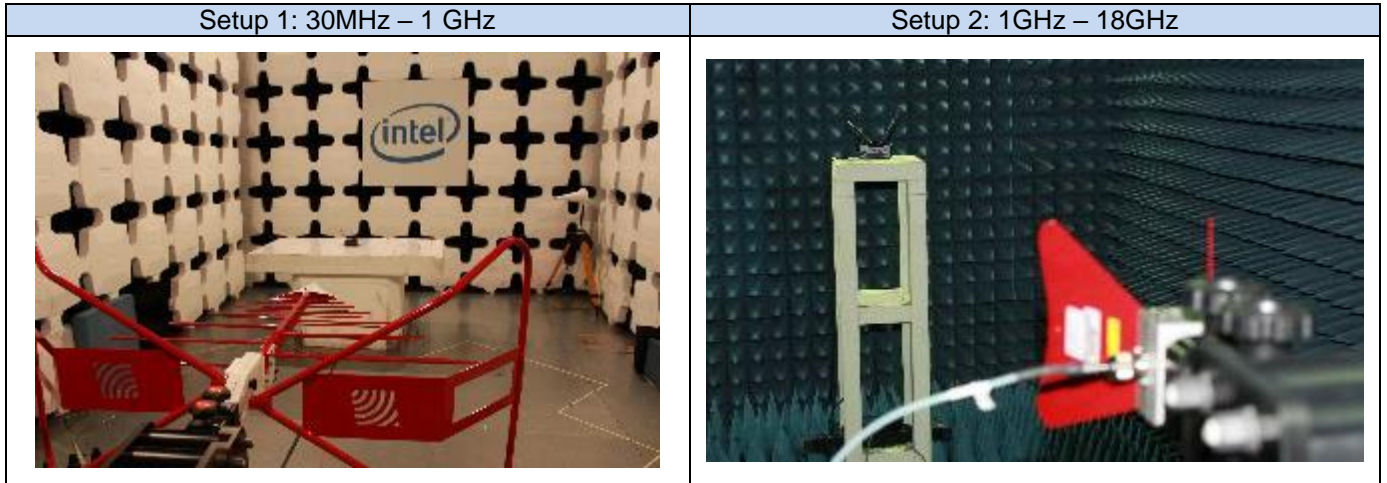


— RMS measurements — Limit FCC

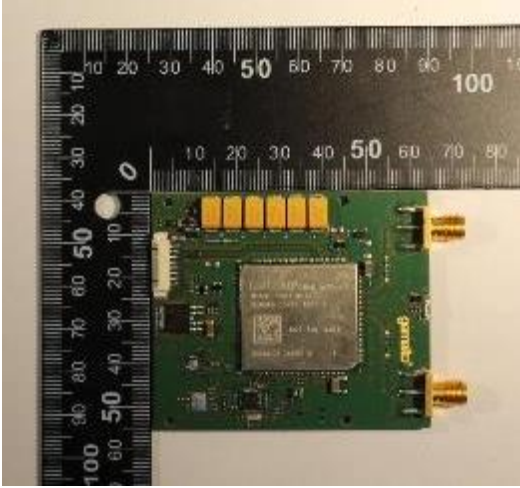
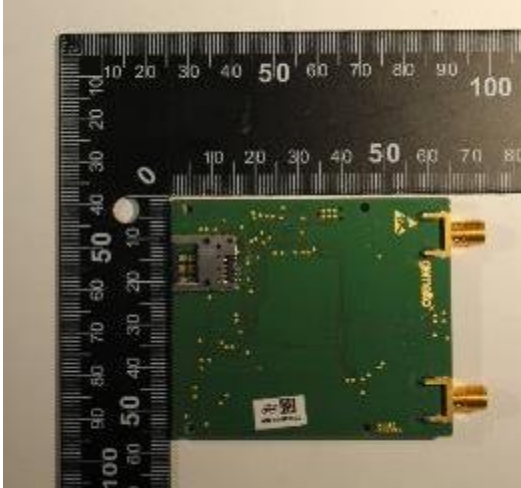

Frequency	RMS	Limit	Margin
MHz	dBm	dBm	dB
1415.0	-47.1	-13.0	34.1
1997.5	-58.0	-13.0	45.0
2122.5	-51.3	-13.0	38.3

Annex C. Photographs

C.1 Radiated Test Setup



C.2 Test Sample

Sample #01	
<p>Module - Top</p> 	<p>Module - Bottom</p> 
<p>NUC</p> 	<p>Antennas</p> 