

Test Report

Report Number:

F201335E1

Equipment under Test (EUT):

**GSM/UMTS/LTE Voice and Data Module
inside dedicated/specific host device "CloudBoxx 4G Worldwide"**

Applicant:

u-blox AG

Manufacturer:

u-blox AG



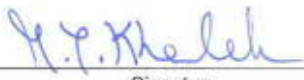
Deutsche
Akkreditierungsstelle
D-PL-17186-01-01
D-PL-17186-01-02
D-PL-17186-01-03

References

- [1] **ANSI C63.26: 2015** American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
- [2] **CFR 47 Part 2** Frequency allocations and radio treaty matters; General rules and regulations
- [3] **CFR 47 Part 22** Public mobile services, Subpart H – Cellular Radiotelephone service
- [4] **CFR 47 Part 24** Public mobile services, Subpart E – Broadband PCS
- [5] **CFR 47 Part 27** Miscellaneous wireless communications services
- [6] **RSS-Gen Issue 5** General Requirements for Compliance of Radio Apparatus
- [7] **RSS-130 Issue 2** Equipment Operating in the Frequency Bands 617-652 MHz, 663-698 MHz, 698-756 MHz and 777-787 MHz
- [8] **RSS-132 Issue 3** Cellular Telephone Systems Operating in the Bands 824-849 MHz and 869-894 MHz
- [9] **RSS 133 Issue 6, Amendment 1** 2 GHz Personal Communications Services
- [10] **RSS 139 Issue 3** Advanced Wireless Services (AWS) Equipment Operating in the Bands 1710-1780 MHz and 2110-2180 MHz

Test Result

The requirements of the tests performed as shown in the overview (clause 4) were fulfilled by the equipment under test. The complete test results are presented in the following.

Tested and written by:	Mohamed Yassine KHALEK Name	 Signature	30.10.2020 Date
Reviewed and approved by:	Manuel BASTERT Name	 Signature	30.10.2020 Date

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1 Identification

1.1 Applicant

Name:	u-blox AG
Address:	Zuercherstrasse 68 Thalwil 8800
Country:	Switzerland (Confederation Of)
Name for contact purposes:	Mr. Giulio Comar
Phone:	+41-44-722-7444
eMail address:	info@u-blox.com
Applicant represented during the test by the following person:	None

1.2 Manufacturer

Name:	u-blox AG
Address:	Zuercherstrasse 68 Thalwil 8800
Country:	Switzerland (Confederation Of)
Name for contact purposes:	Mr. Giulio Comar
Phone:	+41-44-722-7444
eMail address:	info@u-blox.com
Manufacturer represented during the test by the following person:	None

1.3 Test Laboratory

The tests were carried out by: **PHOENIX TESTLAB GmbH**
Königswinkel 10
32825 Blomberg
Germany

Accredited by Deutsche Akkreditierungsstelle GmbH (DAkKS) in compliance with DIN EN ISO/IEC 17025 under Reg. No. D-PL-17186-01-06 and D-PL-17186-01-05, FCC Test Firm Designation Number DE0004, FCC Test Firm Registration Number 469623, CAB Identifier DE0003 and ISED# 3469A.

1.4 EUT (Equipment under Test)

Type of equipment: *	GSM/UMTS/LTE Voice and Data Module
PMN: *	TOBY-R200
HVIN: *	TOBY-R200
HMN	CloudBoxx 4G Worldwide
Host manufacturer	INVERS GmbH
Order number: *	-
Serial number: *	-
FCC ID: *	XPY1EHM44NN
IC certification number: *	8595A-1EHM44NN
PCB identifier: *	-
Hardware version: *	-
Software version (FVIN): *	-

* Declared by the applicant

Note: PHOENIX TESTLAB GmbH does not take samples. The samples used for tests are provided exclusively by the applicant.

1.5 Technical Data of Equipment

General:

Power supply Host: *	DC					
Supply voltage Host: *	U _{nom} =	12 V	U _{min} =	7 V	U _{max} =	48 V
Temperature range: *	-40°C to +85°C					
Lowest / highest internal clock frequency: *	n.a.					

Cellular module:

Manufacturer:	U-blox AG					
Model name: *	TOBY-R200-82B					
Power supply module: *	by host					
Supply voltage module: *	U _{nom} =	n.a.	U _{min} =	n.a.	U _{max} =	n.a.
Serial Number: *	n.a.					
IMEI: *	352848082338480					
Supported bands: *	2G: 850, 900, 1800, 1900 3G Band support: 850, 900, 1900, 2100 4G Band support: 1, 2, 4, 5, 8, 12					
Max. output power: *	GSM 850/ E-GSM 900: Power Class 4 (33 dBm) / Power Class E2 (27 dBm) DCS 1800/ PCS 1900: Power Class 1 (30 dBm) / Power Class E2 (26 dBm) UMTS/HSDPA/HSUPA: Power Class 3 (24 dBm) LTE (23 dBm)					
Antenna type: *	External Adhesive Antenna					
Antenna name: *	Hirschmann Car Communication CGN 1890 LP/LC/P/FAKRA/3.0					
Antenna S/N	955-179-003 01/20/3460					
Antenna connector: *	FAKRA					
Antenna gain: *	0 dBi					

* Declared by the applicant

Ports / Connectors				
Identification	Connector		Length during test	Shielding (Yes / No)
	EUT	Ancillary		
Cellular antenna	FAKRA plug	Combined GPS/cellular antenna	~ 3 m	Yes
Host port	Customized 24 pin	Customized	~ 2 m	No

1.6 Dates

Date of receipt of test sample:	04.09.2020
Start of test:	07.09.2020
End of test:	07.10.2020

2 Operational States

The operation mode of the equipment under test during the emission tests was defined as follows:

PCS1900 GPRS data connection

- Downlink channel 661 (1960.0 MHz),
- Uplink channel 661 (1880.0 MHz),
- BS-Power -70 dBm; Mobile-Power 30 dBm; Packet switched, GPRS.

LTE band 4

- Downlink channel UARFCN 2175 (2132.5 MHz),
- Uplink channel UARFCN 20175 (1752.5 MHz),
- BS-Power -66.9 dBm; Mobile-Power 23 dBm; Mode PRBS9.

LTE band 5

- Downlink channel UARFCN 2525 (881.5 MHz),
- Uplink channel UARFCN 20525 (836.5 MHz),
- BS-Power -66.9 dBm; Mobile-Power 23 dBm; Mode PRBS9.

LTE band 12

- Downlink channel UARFCN 5035 (731.5 MHz),
- Uplink channel UARFCN 23035 (701.5 MHz),
- BS-Power -66.9 dBm; Mobile-Power 23 dBm; Mode PRBS9.

The system was set up as follows:



A GSM /LTE connection to the Host was established by using a Wideband Communication Tester (CMW500). The Host was connected wireless to the tester via a narrowband antenna and a test software "CloudBoxx_II_v2.5.5-99_FCC-Test" has been provided by the host manufacturer to allow the use of the external SIM slot for test purposes.

The Host equipment and its antenna were labelled as follows:



3 Additional Information

The host manufacturer INVERS GmbH integrates the already certified RF cellular module TOBY-R200 (FCC ID: XPY1EHM44NN / IC: 8595A-1EHM44NN) with a change in the RF trace layout design. Therefore, retesting of radiated spurious emissions has been requested to apply for a class 2 permissive change to add the trace design. The test report includes only worst-case test results for radiated emissions as ordered by the applicant.

4 Overview

Application	Frequency range [MHz]	FCC 47 CFR Part 22 [3], 24 [4], 27 [5] ISED RSSs 130 [7], 132 [8], 133 [9], 139 [10]	Status	Refer page
Radiated spurious emissions	30 – 18,000 (26,500 for DCS1900)	22.917 (a) (b) 24.238 (a) (b) 27.53 RSS130 §4.7.1 RSS132 §5.5 RSS133 §6.5 RSS 139 §6.6	Passed	14 et seq.

5 Results

5.1 Method of measurement

The EUT is measured in the frequency range from 30 MHz to 26.5 GHz in a semi anechoic chamber with a metal ground plane, which has been validated to the requirements of ANSI C63.4. It is placed on a 3D-positioner to allow different positions at a distance of 3 meters from the receiving antenna. Both polarizations (vertical and horizontal) have been evaluated and the turn table has been turned to 360° to maximize the emissions. The receiving antenna is raised from 1 to 4 m.

The frequency range from 30 MHz to 18 GHz has been tested using the substitution method as described in [1], and the frequency range from 18 to 26.5 GHz has been tested using the field strength method [1]. The measured field strength using the field strength method is then converted to an ERP or EIRP [dBm] using the formula:

$E \text{ [dB}\mu\text{V/m]} = \text{EIRP [dBm]} - 20\log(d) + 104.8$ according to chapter 5.2.7 [1].

→ $\text{EIRP} = E - 95.25$ ($d = 3 \text{ m}$ measuring distance)

$\text{ERP [dBm]} = \text{EIRP} - 2.15 \text{ dB}$

Level (dBm) $\triangleq$ ERP (below 1GHz) or EIRP (above 1 GHz)

Procedure preliminary measurement:

The following procedure is used:

1. Set the measurement antenna to 1 m height.
2. Monitor the frequency range at vertical polarisation and a EUT azimuth of 0 °.
3. Rotate the EUT by 360° to maximize the detected signals.
4. Repeat 1) to 2) with the horizontal polarisation of the measuring antenna.
5. Increase the height of the antenna for 0.5 m and repeat steps 2 – 4 until the final height of 4 m is reached.
6. The highest values for each frequency will be saved by the software, including the antenna height, measurement antenna polarization and turntable azimuth for that value.

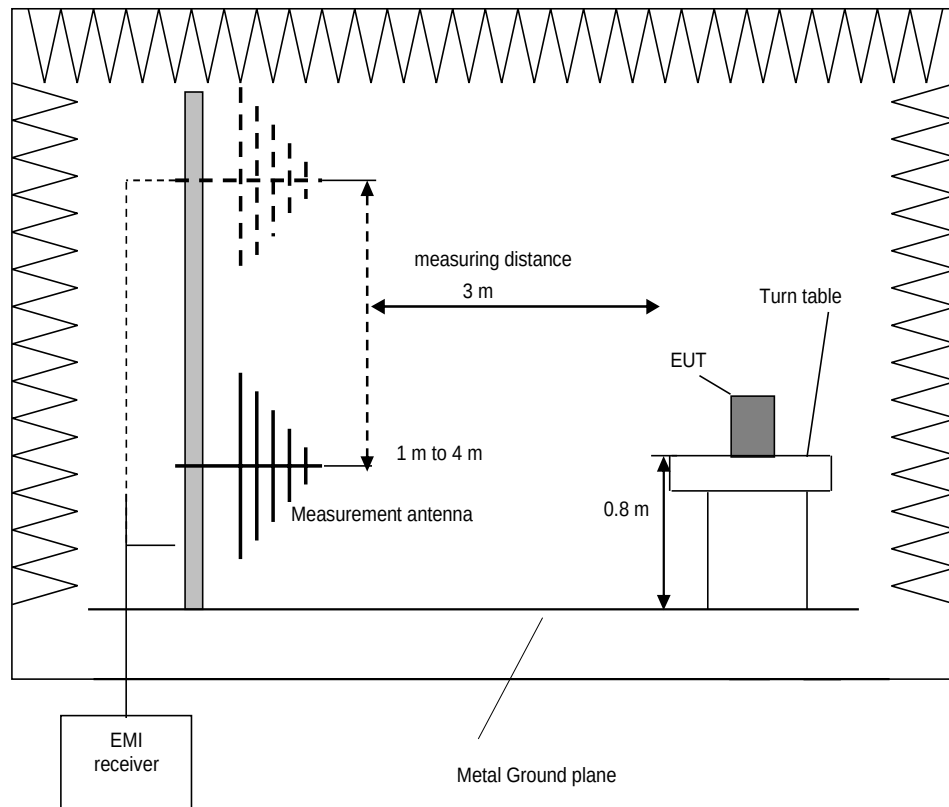
Procedure final measurement:

The following procedure is used:

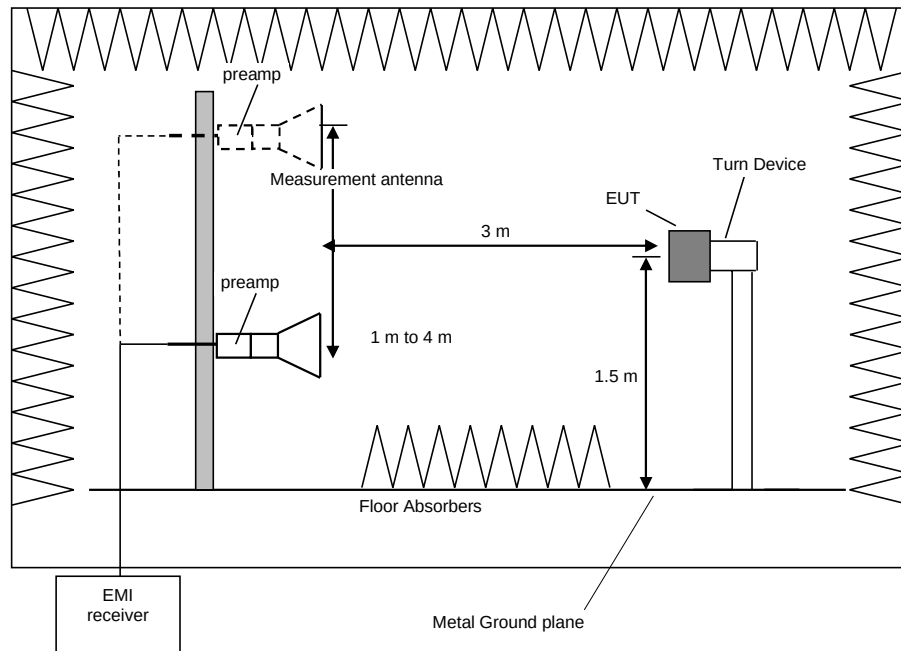
1. Select the highest frequency peaks to the limit for the final measurement.
2. The software will determine the exact peak frequencies by doing a partial scan with reduced RBW with +/- 10 times the RBW of the pre-scan of the selected peaks.
3. If the EUT is portable or ceiling mounted, find the worst case EUT position (x,y,z) for the final test.
4. The worst measurement antenna height is found by the measurement software by varying the measurement antenna height by +/- 0.5 m from the value obtained in the preliminary measurement, and to monitor the emission level.
5. The worst azimuth turntable position is found by varying the turntable azimuth by +/- 25° from the value obtained in the preliminary measurement, and to monitor the emission level.
6. The final measurement is performed at the worst-case antenna height and the worst-case turntable azimuth
7. Steps 2 – 6 will be repeated for each frequency peak selected in step 1.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
30 MHz to 1 GHz	100 kHz
1 GHz to 4 GHz	1 MHz
4 GHz to 12 GHz	1 MHz
12 GHz to 18 GHz	1 MHz
18 GHz to 25 / 26.5 GHz	1 MHz
26.5 GHz to 40 GHz	1 MHz



Test setup for measurements below 1 GHz



Test setup for measurements above 1 GHz

5.2 Radiated spurious emissions results:

Limit: 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 [3][4][5].

This results into a limit of -13 dBm for all power levels of the UE.

5.2.1 Radiated spurious emissions PCS1900

Ambient temperature:	20 °C
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Relative humidity:	42%
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Measurement at uplink channel 661 (uplink channel notched):

Spurious emissions level		
f (MHz)	Level (dBm)	Limit (dBm)
1880.0	Uplink channel, no spurious	
1960.0	Downlink channel, no spurious	
26238.5	-46.5* (Noise floor)	-13
Measurement uncertainty: +2.2 dB / -3.6 dB		

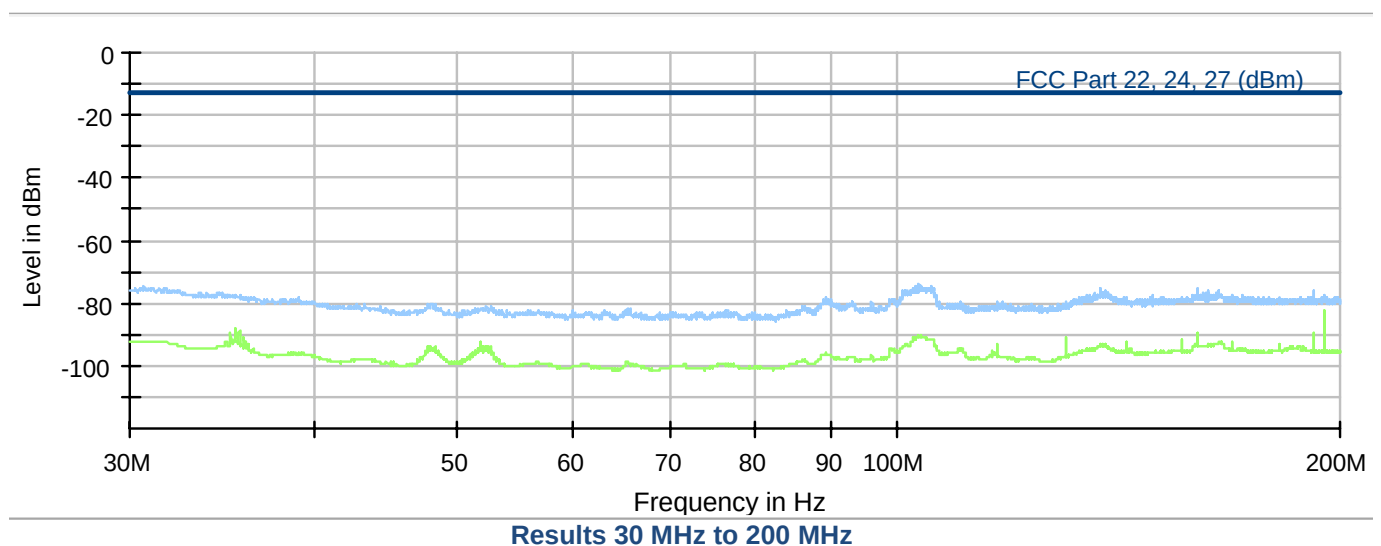
*calculated according to conversion formula in page 13.

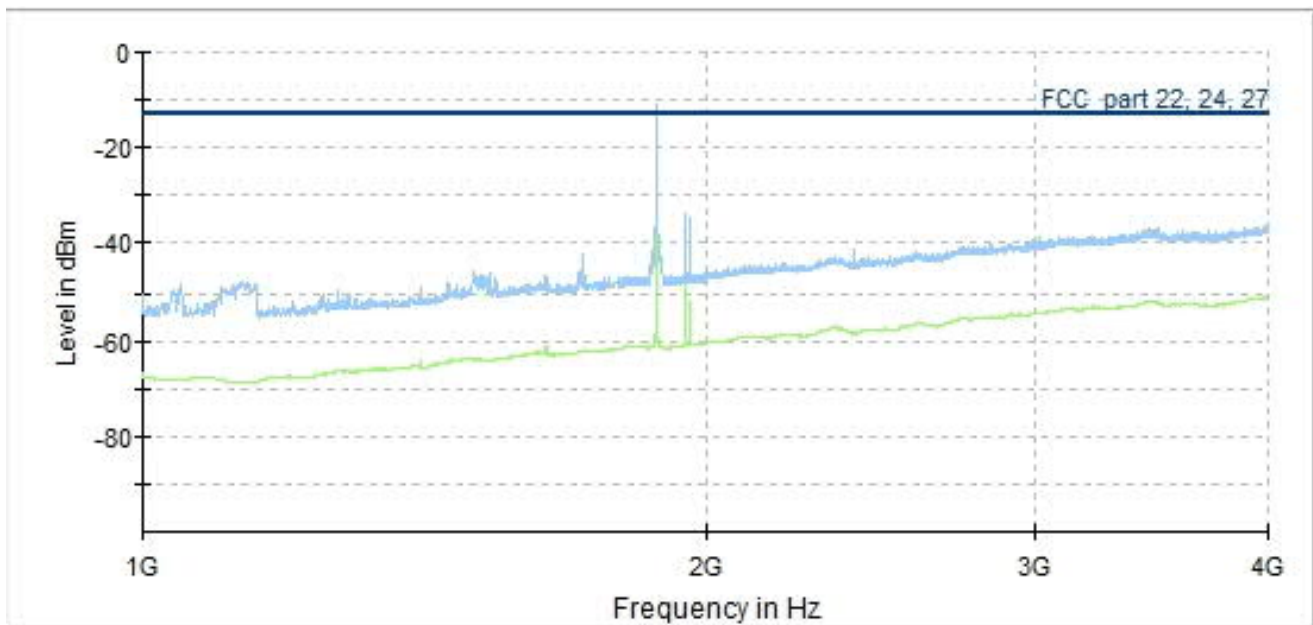
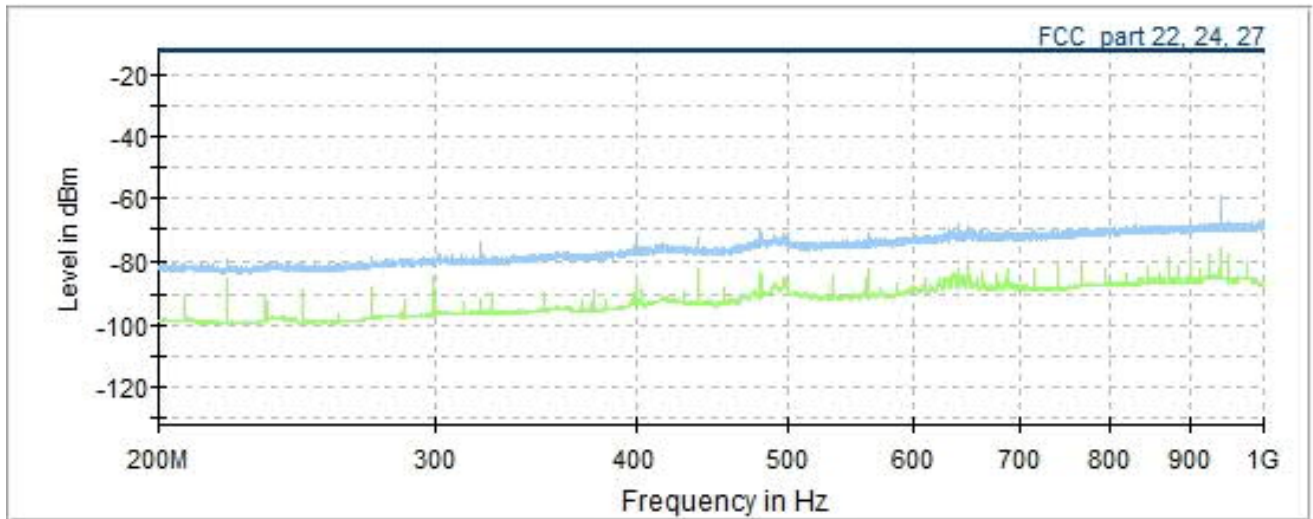
Limit: The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log (P)$ dB [3][4][5].

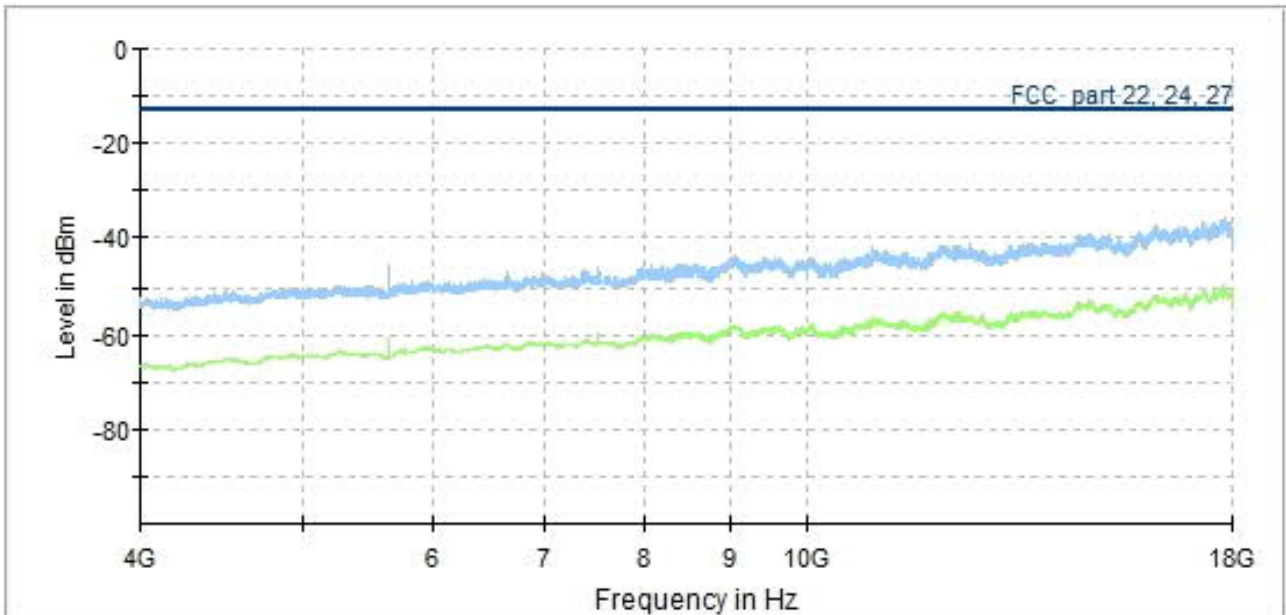
This results into a limit of -13 dBm for all power levels of the UE.

All emissions show more than 20 dB margin to the limit. Therefore, no final measurement has been performed.

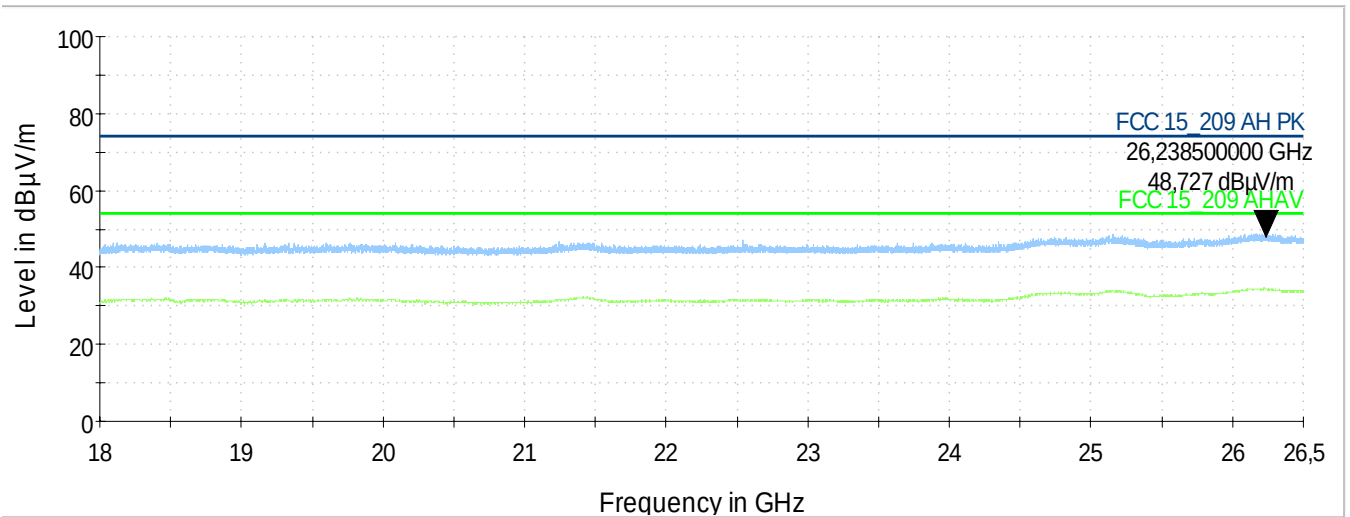
Test equipment (please refer to chapter 6 for details)
1 – 14, 16, 18 – 27







Results 4 to 18 GHz



Results 18 to 26.5 GHz

5.2.2 Radiated spurious emissions LTE Band 4

Ambient temperature	22 °C	Relative humidity	40 %
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Measurement at uplink channel 20175 (uplink channel notched):

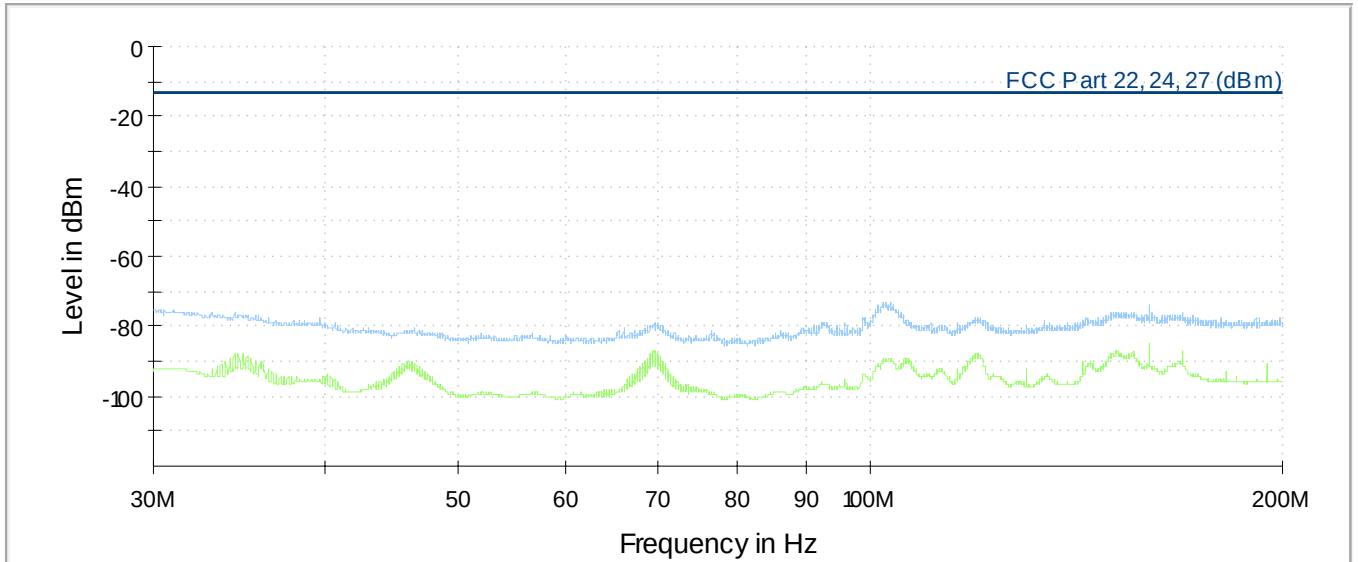
Spurious emissions level		
f (MHz)	Level (dBm)	Limit (dBm)
1752.5	Uplink channel, no spurious	
2132.5	Downlink channel, no spurious	
Measurement uncertainty: +2.2 dB / -3.6 dB		

Limit: 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 [3][4][5].

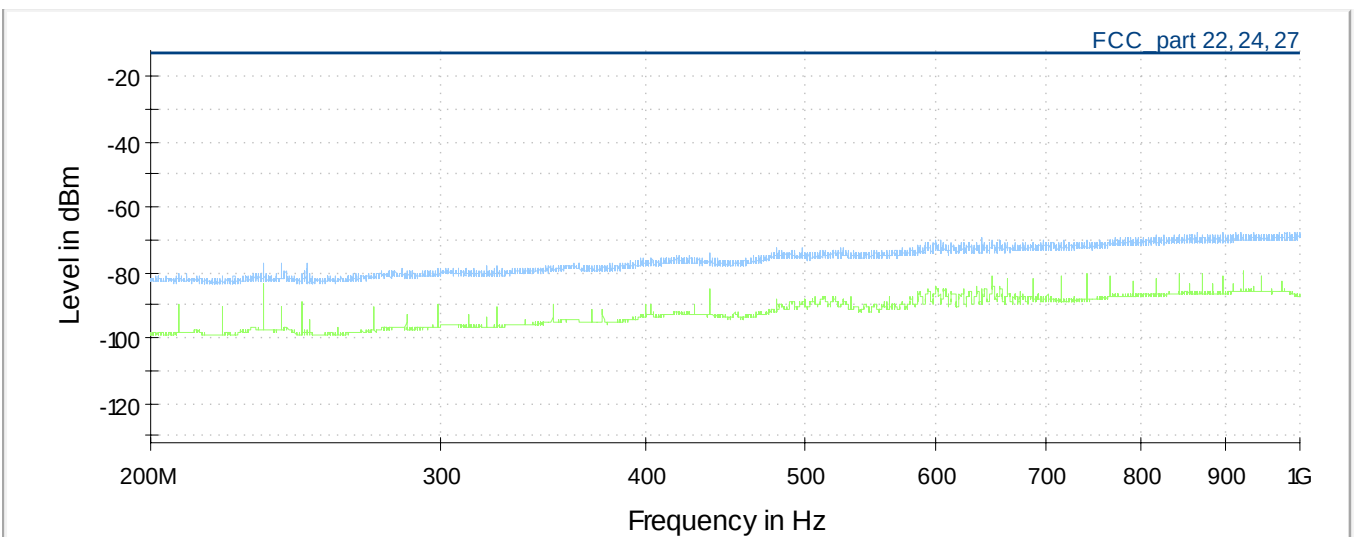
This results into a limit of -13 dBm for all power levels of the UE.

All emissions show more than 20 dB margin to the limit. Therefore, no final measurement has been performed.

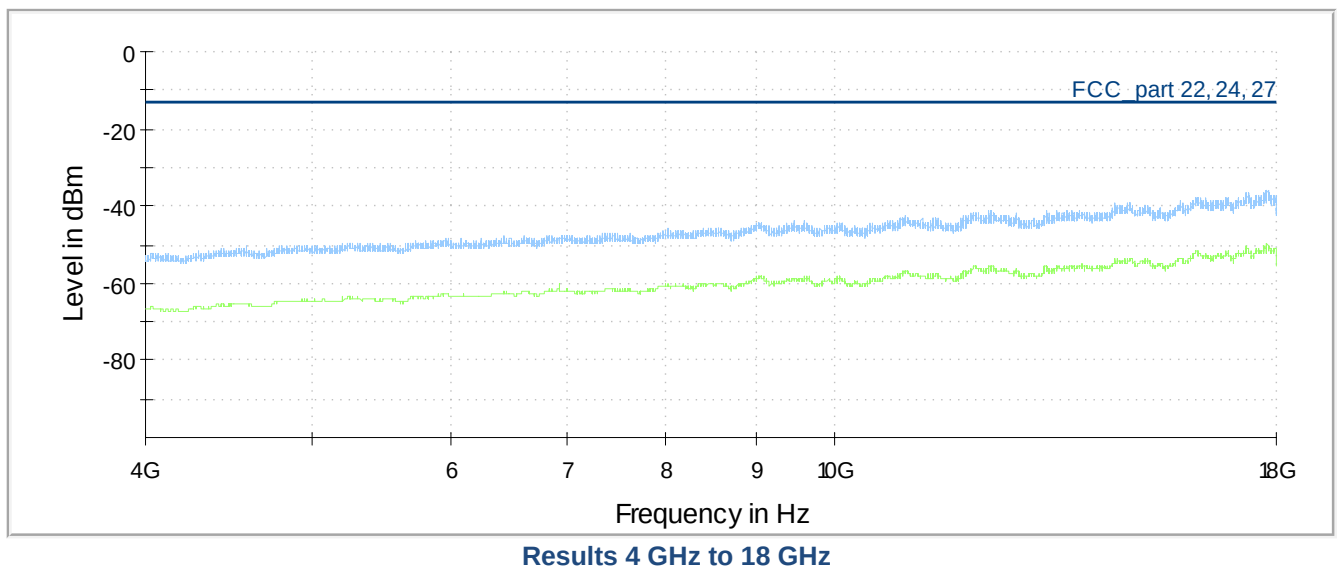
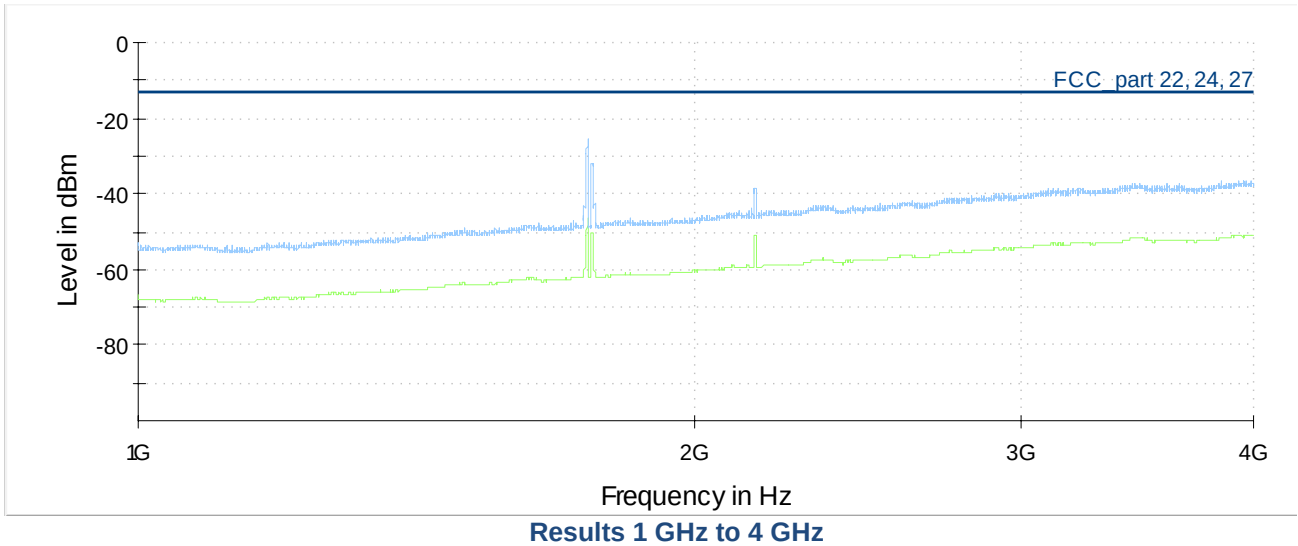
Test equipment (please refer to chapter 6 for details)
1 – 14, 17 – 27



Results 30 MHz to 200 MHz



Results 200 MHz to 1 GHz



5.2.3 Radiated spurious emissions LTE Band 5

Ambient temperature	22 °C	Relative humidity	42 %
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Measurement at uplink channel 20525 (uplink channel notched):

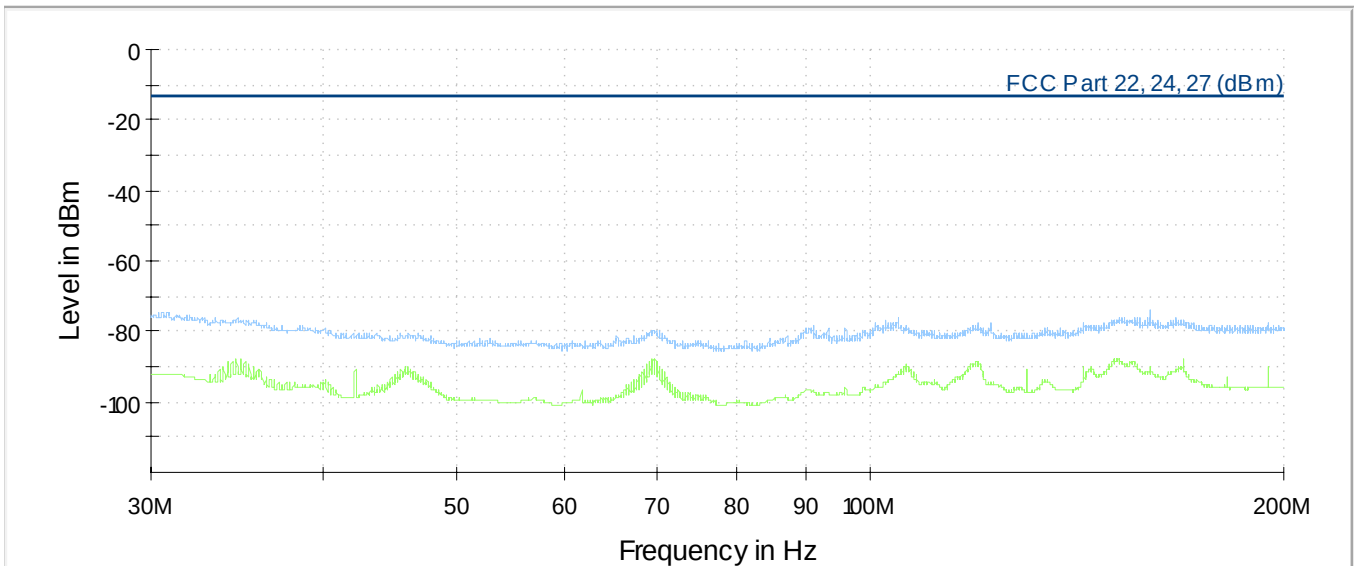
Spurious emissions level		
f (MHz)	Level (dBm)	Limit (dBm)
836.5	Uplink channel, no spurious	
881.5	Downlink channel, no spurious	
1673.0	-33.7	-13
Measurement uncertainty: +2.2 dB / -3.6 dB		

Limit: 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 [3][4][5].

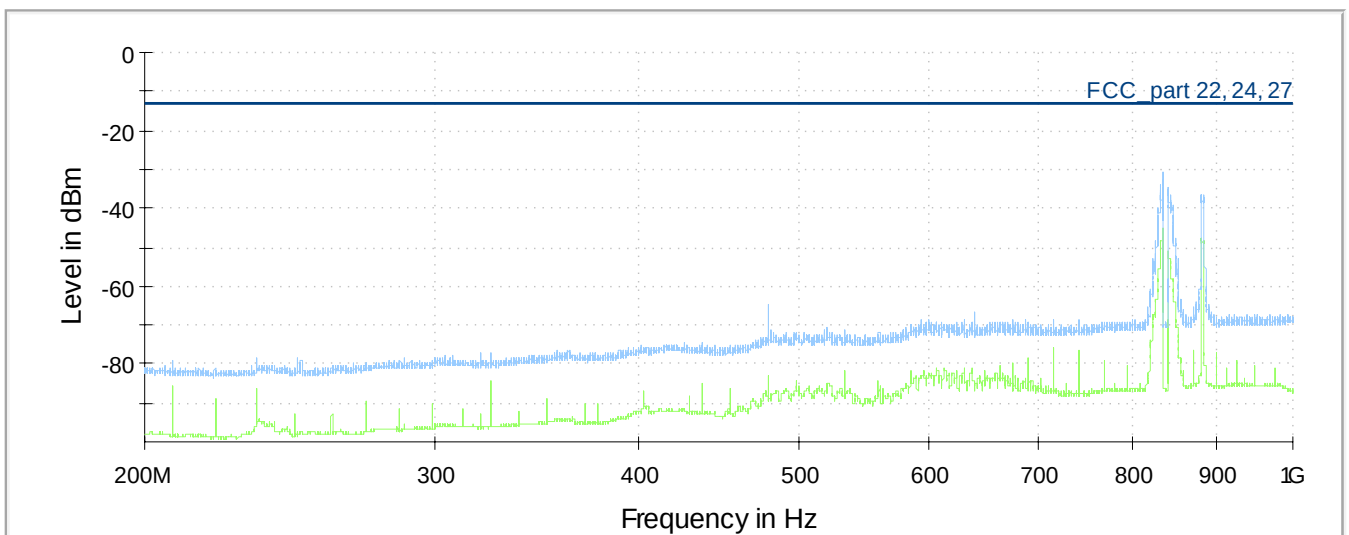
This results into a limit of -13 dBm for all power levels of the UE.

All emissions show more than 20 dB margin to the limit. Therefore, no final measurement has been performed.

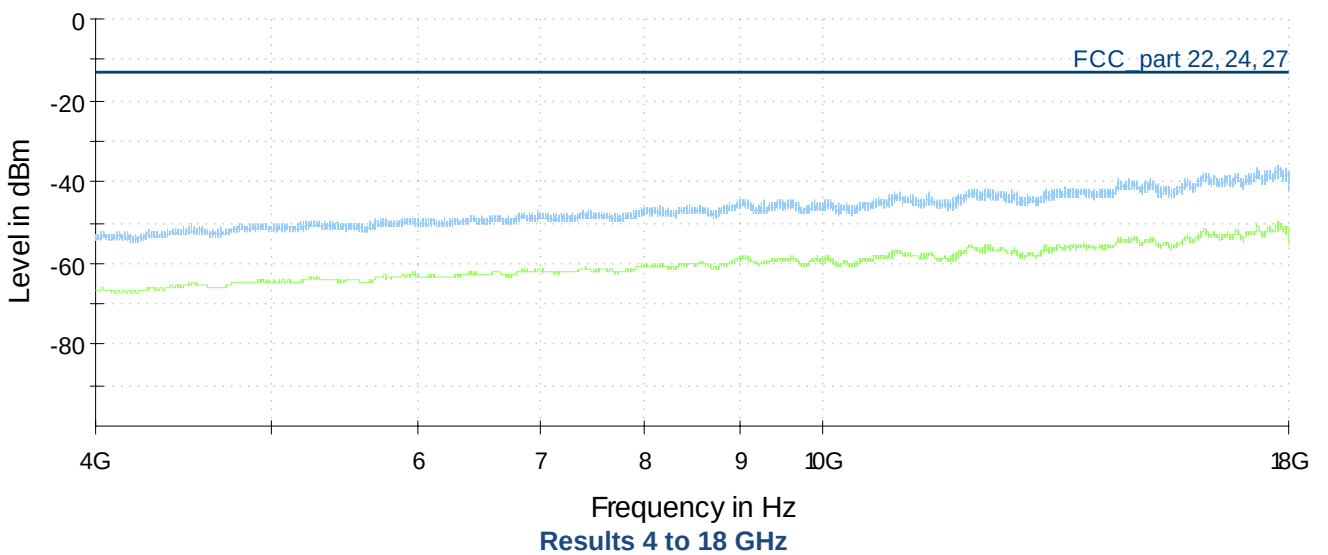
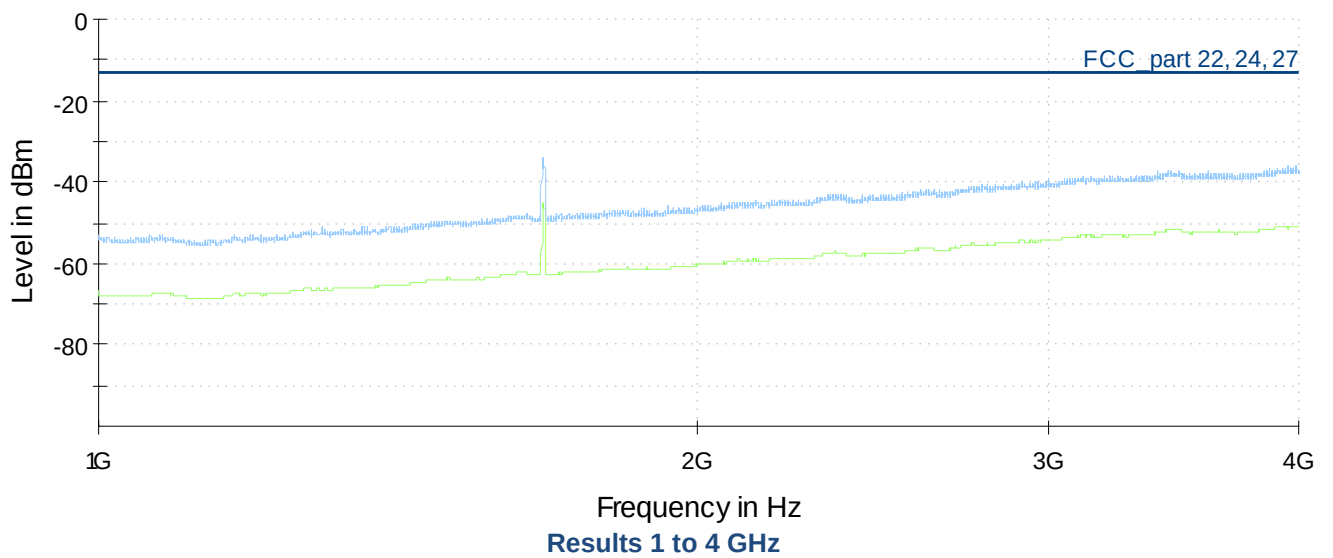
Test equipment (please refer to chapter 6 for details)
1 – 15, 18 – 27



Results 30 MHz to 200 MHz



Results 200 MHz to 1 GHz



5.2.4 Radiated spurious emissions LTE Band 12

Ambient temperature	22 °C	Relative humidity	42 %
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Measurement at uplink channel 23035 (uplink channel notched):

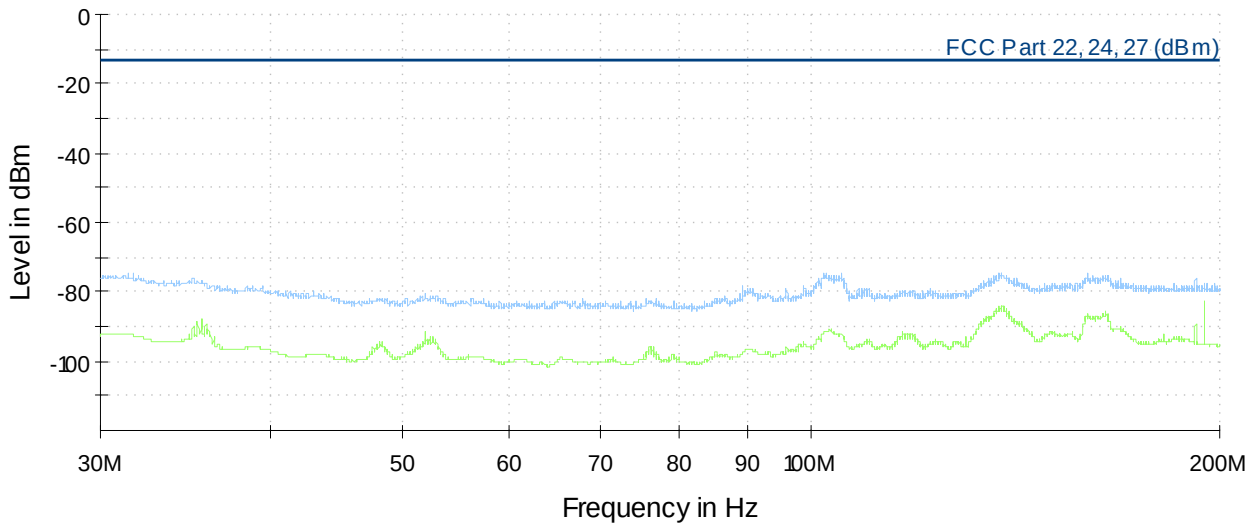
Spurious emissions level		
f (MHz)	Level (dBm)	Limit (dBm)
701.5	Uplink channel, no spurious	
731.5	Downlink channel, no spurious	
1400.3	-29.6	-13
Measurement uncertainty: +2.2 dB / -3.6 dB		

Limit: 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 [3][4][5].

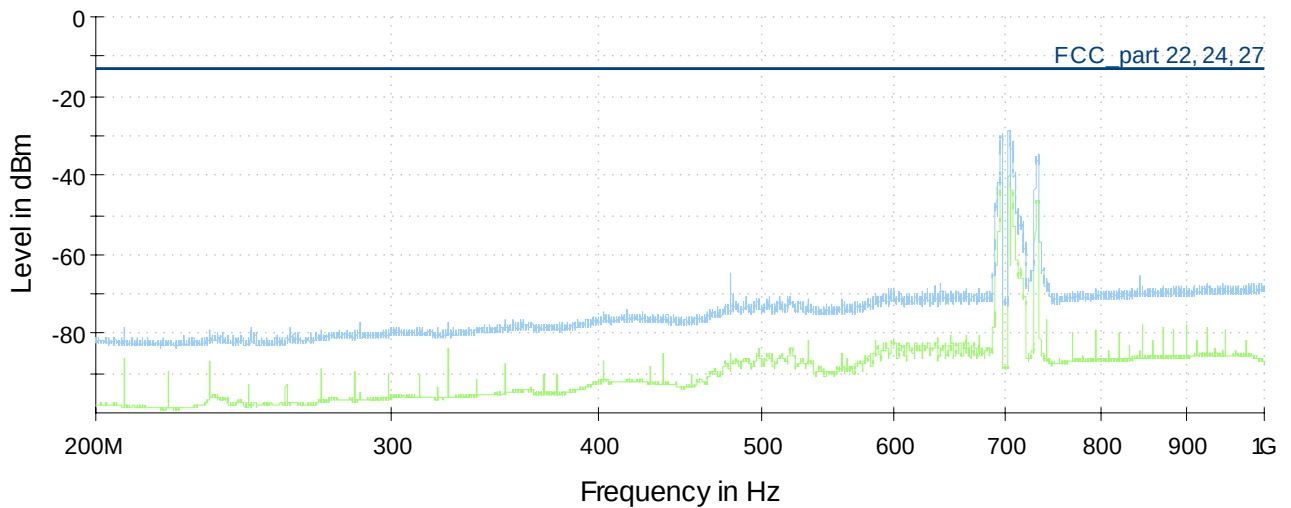
This results into a limit of -13 dBm for all power levels of the UE.

All emissions show more than 20 dB margin to the limit. Therefore, no final measurement has been performed.

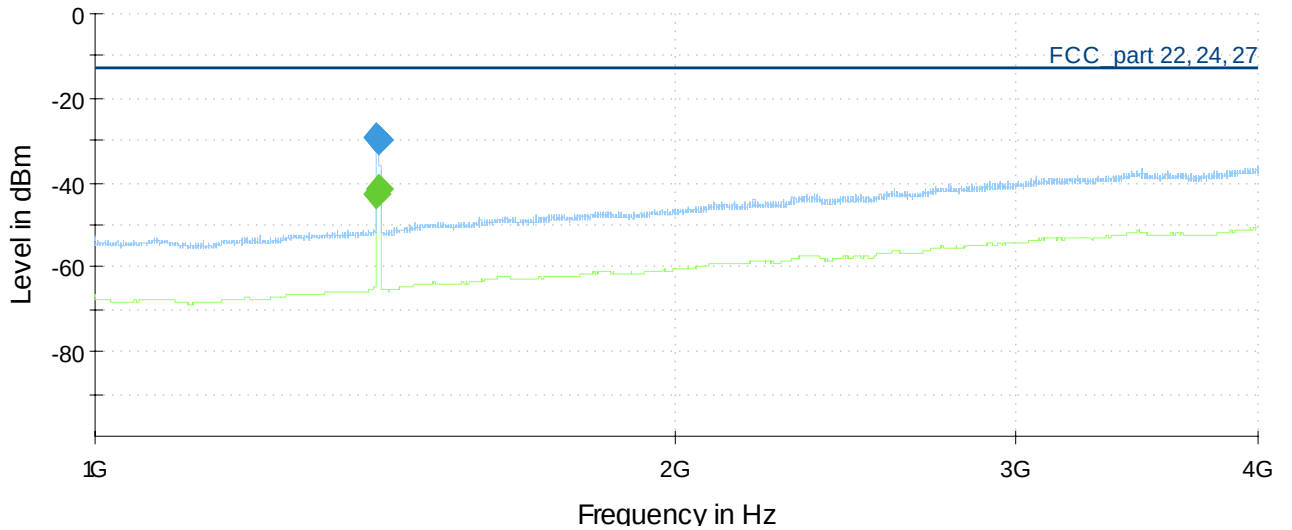
Test equipment (please refer to chapter 6 for details)
1 – 15, 18 – 27



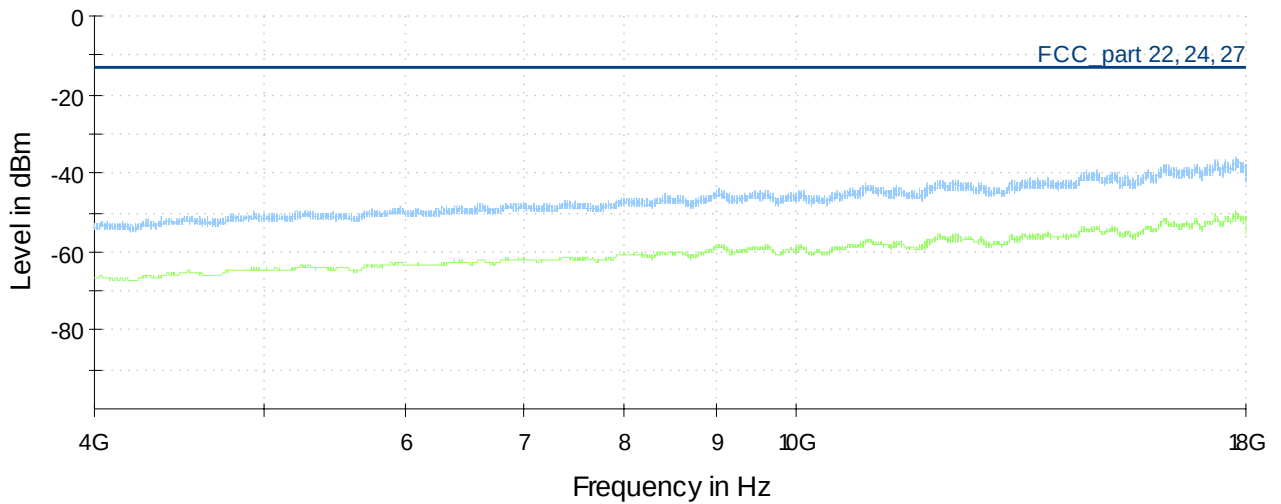
Results 30 MHz to 200 MHz



Results 200 MHz to 1 GHz



Results 1 to 4 GHz



Results 4 to 18 GHz

6 Test Equipment used for Tests

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal Due
1	Log Per Antenna	VUSLP 9111B	Schwarzbeck	464	483279	Calibration not necessary	
2	Software	EMC32	Rohde & Schwarz	100970	482972	Calibration not necessary	
3	RF Switch Matrix	OSP220	Rohde & Schwarz		482976	Calibration not necessary	
4	Turntable	TT3.0-3t	Maturo	825/2612/.01	483224	Calibration not necessary	
5	Antenna support	BAM 4.5-P-10kg	Maturo	222/2612.01	483225	Calibration not necessary	
6	Controller	NCD	Maturo	474/2612.01	483226	Calibration not necessary	
7	Anechoic chamber M276	SAC5-2	Albatross Projects	C62128-A540-A138-10-0006	483227	Calibration not necessary	
8	EMI Test receiver ESW	ESW44	Rohde & Schwarz	101828	482979	12.04.2019	04.2021
9	Log Per Antenna	HL050	Rohde & Schwarz	4062.4063.02-100908	482977	13.08.2019	08.2022
10	Highpass Filter	WHKX4.0/18G-8SS	Wainwright Instruments	1	480587	Calibration not necessary	
11	Highpass Filter	WHKX12-935-1000-15000-40ST	Wainwright Instruments	1	482908	Calibration not necessary	
12	standard gain horn antenna	20240-20	Flann Microwave	411	480297	Calibration not necessary	
13	Preamplifier 18 GHz - 26 GHz	JS4-18002600-20-5A	MITEQ Hauppauge N.Y.	658697	480342	17.02.2020	02.2022
14	Wideband Radio Communication Tester	CMW500	Rohde & Schwarz	167339	483023	15.04.2019	04.2021
15	Tuneable Notch Filter	WRCA800/960-0.2/40-6EEK	Wainwright Instruments	15	480414	Calibration not necessary	
16	Tuneable Notch Filter	WRCD1700/2000-0.2/40-10EEK	Wainwright Instruments	14	480415	Calibration not necessary	
17	Tunable Band Reject Filter	WTRCD10-1700-1900-5-13-60EEK	Wainwright Instruments GmbH	-	482011	Calibration not necessary	
18	Preamplifier	LNA-30-00101800-25-10P	Narda-Miteq	2110917	482967	Calibration not necessary	
19	Cable	C417	H+S	-	-	Calibration not necessary	
20	Cable	C416	H+S	-	-	Calibration not necessary	
21	Cable	C416.1	H+S	-	-	Calibration not necessary	
22	Cable	C419	H+S	-	-	Calibration not necessary	
23	Biconical antenna	VHA 9103B + VHBB 9124	Schwarzbeck	768	483278	Calibration not necessary	
24	Precision dipole	HZ-13	Rohde & Schwarz	831782/02	480062	Calibration not necessary	
25	Precision dipole	HZ-12	Rohde & Schwarz	831781/02	480061	Calibration not necessary	
26	Signal Generator	SMB100B	Rohde & Schwarz	101314	482975	26.02.2020	02.2021
27	Signal generator	SMHU 58	Rohde & Schwarz	844170/017	480266	14.02.2020	02.2022

7 Test site Validation

Test equipment	PM. No.	Frequency range	Type of validation	According to	Val. Date	Val Due
Semi anechoic chamber M276	483227	30 – 1000 MHz	NSA	ANSI C63.4a-2017	19.09.2019	18.09.2021
Semi anechoic chamber M276	483227	1 -18 GHz	SVSWR	CISPR 16-1-4 + Cor1:2010 + A1:2012 +A2:2017	01.10.2019	30.09.2021

8 Report History

Report Number	Date	Comment
F201335E1	30.10.2020	Initial Test Report
-	-	-
-	-	-

9 List of Annexes

Annex A	Test Setup Photos	5 pages
Annex B	EUT external Photos	3 pages