

TEST REPORT

Test report no.: 1-7616/18-01-04



Testing laboratory

CTC advanced GmbH

Untertuerkheimer Strasse 6 – 10

66117 Saarbruecken / Germany

Phone: + 49 681 5 98 - 0

Fax: + 49 681 5 98 - 9075

Internet: <http://www.ctcadvanced.com>

e-mail: mail@ctcadvanced.com

Accredited Testing Laboratory:

The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)

The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-03

Applicant

Treon Oy

Visiokatu 3

FI-33720 Tampere / FINLAND

Phone: -/-

Contact: Rami Koskinen

e-mail: rami.koskinen@treon.fi

Phone: +358 5 03 08 25 98

Manufacturer

Treon Oy

Visiokatu 3

FI-33720 Tampere / FINLAND

Test standard/s

FCC - Title 47 CFR
Part 22

FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 22 - Public mobile services

FCC - Title 47 CFR
Part 24

FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 24 - Personal communications services

FCC - Title 47 CFR
Part 27

FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 27 - Miscellaneous wireless communications services

For further applied test standards please refer to section 3 of this test report.

Test Item

Kind of test item: IoT device

Model name: Treon Gateway

FCC ID: 2AR86GW11

IC: 24716-GW11

Frequency bands: LTE band 2; 4 & 5

Technology tested: LTE

Antenna: Integrated antenna

Power supply: 5 V DC / 115 V AC by mains adapter GTM96180-1807-2.0

Temperature range: 0°C to +50°C



This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

Test report authorized:



Andreas Luckenbill
Lab Manager
Radio Communications & EMC

Test performed:



Marco Bertolino
Lab Manager
Radio Communications & EMC

1 Table of contents

1	Table of contents	2
2	General information	3
2.1	Notes and disclaimer	3
2.2	Application details	3
2.3	Test laboratories sub-contracted	3
3	Test standard/s and references	4
4	Test environment.....	5
5	Test item.....	5
5.1	General description	5
5.2	Additional information	5
6	Description of the test setup.....	6
6.1	Shielded semi anechoic chamber.....	7
6.2	Shielded fully anechoic chamber	8
6.3	Radiated measurements > 18 GHz.....	9
7	Summary of measurement results LTE band 2.....	10
7.1	LTE Cat M1	10
7.2	LTE NB-IoT	10
7.3	Results LTE band 2 Cat M1	11
7.3.1	RF output power	11
7.3.2	Spurious emissions radiated.....	12
7.4	Results LTE band 2 NB-IoT	18
7.4.1	RF output power	18
7.4.2	Spurious emissions radiated.....	19
8	Summary of measurement results LTE band 4.....	25
8.1	LTE Cat M1	25
8.2	LTE NB-IoT	25
8.3	Results LTE – band 4 Cat M1	26
8.3.1	RF output power	26
8.3.2	Spurious emissions radiated.....	27
8.4	Results LTE – band 4 NB-IoT	33
8.4.1	RF output power	33
8.4.2	Spurious emissions radiated.....	34
9	Summary of measurement results LTE band 5.....	40
9.1	LTE Cat M1	40
9.2	LTE NB-IoT	40
9.3	Results LTE band 5 Cat M1	41
9.3.1	RF output power	41
9.3.2	Spurious emissions radiated.....	42
9.4	Results LTE band 5 NB-IoT	48
9.4.1	RF output power	48
9.4.2	Spurious emissions radiated.....	49
10	Observations	54
Annex A	Glossary.....	55
Annex B	Document history	56
Annex C	Accreditation Certificate	56

2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CTC advanced GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CTC advanced GmbH.

The testing service provided by CTC advanced GmbH has been rendered under the current "General Terms and Conditions for CTC advanced GmbH".

CTC advanced GmbH will not be liable for any loss or damage resulting from false, inaccurate, inappropriate or incomplete product information provided by the customer.

Under no circumstances does the CTC advanced GmbH test report include any endorsement or warranty regarding the functionality, quality or performance of any other product or service provided.

Under no circumstances does the CTC advanced GmbH test report include or imply any product or service warranties from CTC advanced GmbH, including, without limitation, any implied warranties of merchantability, fitness for purpose, or non-infringement, all of which are expressly disclaimed by CTC advanced GmbH.

All rights and remedies regarding vendor's products and services for which CTC advanced GmbH has prepared this test report shall be provided by the party offering such products or services and not by CTC advanced GmbH. In no case this test report can be considered as a Letter of Approval.

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

2.2 Application details

Date of receipt of order:	2018-11-26
Date of receipt of test item:	2019-01-28
Start of test:	2019-01-28
End of test:	2019-02-14
Person(s) present during the test:	-/-

2.3 Test laboratories sub-contracted

None

3 Test standard/s and references

Test standard	Date	Description
FCC - Title 47 CFR Part 22	-/-	FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 22 - Public mobile services
FCC - Title 47 CFR Part 24	-/-	FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 24 - Personal communications services
FCC - Title 47 CFR Part 27	-/-	FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 27 - Miscellaneous wireless communications services
RSS - 132 Issue 3	January 2013	Spectrum Management and Telecommunications - Radio Standards Specification - Cellular Telephone Systems Operating in the Bands 824-849 MHz and 869-894 MHz
RSS - 133 Issue 6	January 2018	Spectrum Management and Telecommunications - Radio Standards Specifications - 2 GHz Personal Communication Services
RSS - 139 Issue 3	July 2015	Spectrum Management and Telecommunications - Radio Standards Specification - Advanced Wireless Services (AWS) Equipment Operating in the Bands 1710-1755 MHz and 2110-2180 MHz

Guidance	Version	Description
ANSI C63.4-2014	-/-	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.26-2015	-/-	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
Power Meas License Digital Systems: KDB 971168 D01	v03r01	Measurement Guidance for Certification of Licensed Digital Transmitters

4 Test environment

Temperature	:	T_{nom} T_{max} T_{min}	+22 °C during room temperature tests No tests under extreme voltage conditions performed. No tests under extreme voltage conditions performed.
Relative humidity content	:		46 %
Barometric pressure	:		1017 hpa
Power supply	:	V_{nom} V_{max} V_{min}	5 V DC / 115 V AC by mains adapter GTM96180-1807-2.0 No tests under extreme voltage conditions performed. No tests under extreme voltage conditions performed.

5 Test item

5.1 General description

Kind of test item	:	IoT device
Type identification	:	Treon Gateway
HMN	:	-/-
PMN	:	Treon Gateway
HVIN	:	1111
FVIN	:	-/-
S/N serial number	:	Radiated unit: 00000000 407c097f
Hardware status	:	-/-
Software status	:	-/-
Firmware status	:	-/-
Frequency band	:	LTE band 2; 4 & 5
Type of radio transmission	:	modulated carrier; OFDM
Use of frequency spectrum	:	
Type of modulation	:	BPSK, QPSK, 16 – QAM
Antenna	:	Integrated antenna
Power supply	:	5 V DC / 115 V AC V by mains adapter GTM96180-1807-2.0
Temperature range	:	0°C to +50°C

5.2 Additional information

The content of the following annexes is defined in the QA. It may be that not all of the listed annexes are necessary for this report, thus some values in between may be missing.

Test setup and EUT photos are included in test report:

1-7616/18-01-02_AnnexA
 1-7616/18-01-02_AnnexB
 1-7616/18-01-02_AnnexD

6 Description of the test setup

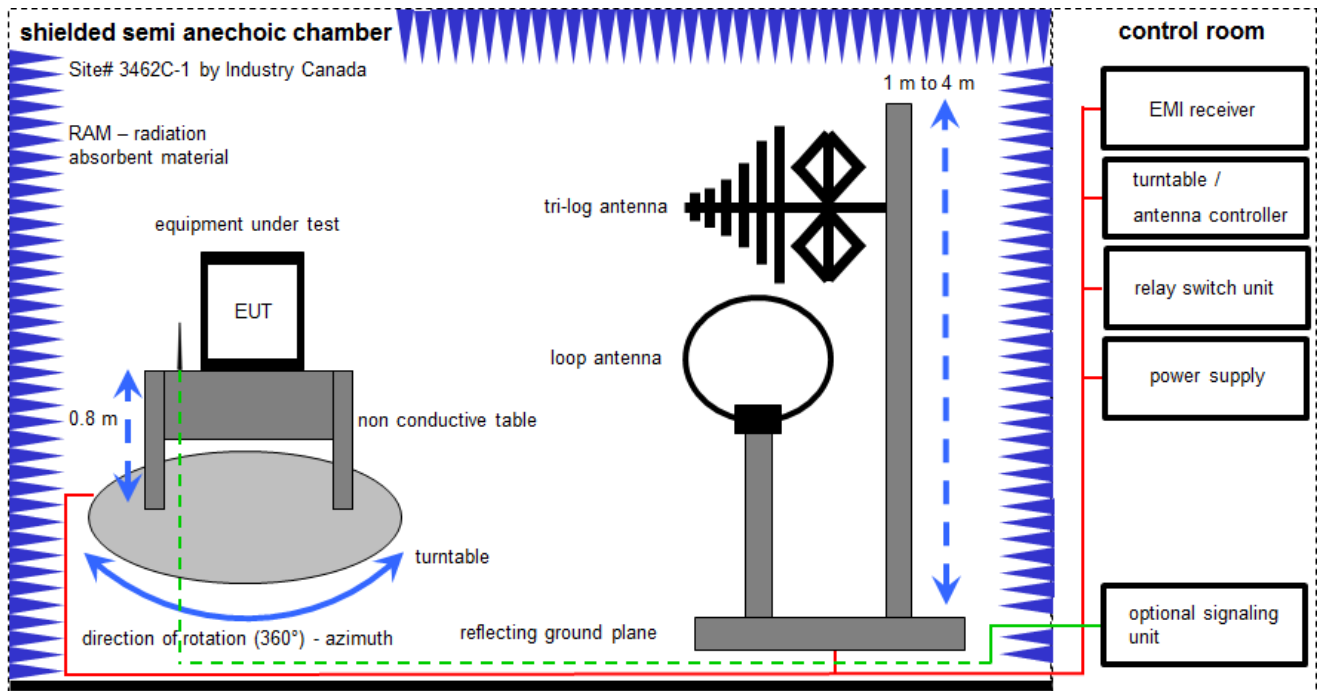
Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, RF generating and signaling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

Agenda: Kind of Calibration

k	calibration / calibrated	EK	limited calibration
ne	not required (k, ev, izw, zw not required)	zw	cyclical maintenance (external cyclical maintenance)
ev	periodic self verification	izw	internal cyclical maintenance
Ve	long-term stability recognized	g	blocked for accredited testing
vlk!	Attention: extended calibration interval		
NK!	Attention: not calibrated	*)	next calibration ordered / currently in progress

6.1 Shielded semi anechoic chamber



Measurement distance: tri-log antenna 10 meter; loop antenna 10 meter;
 EMC32 software version: 10.30.0

FS = UR + CL + AF

(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

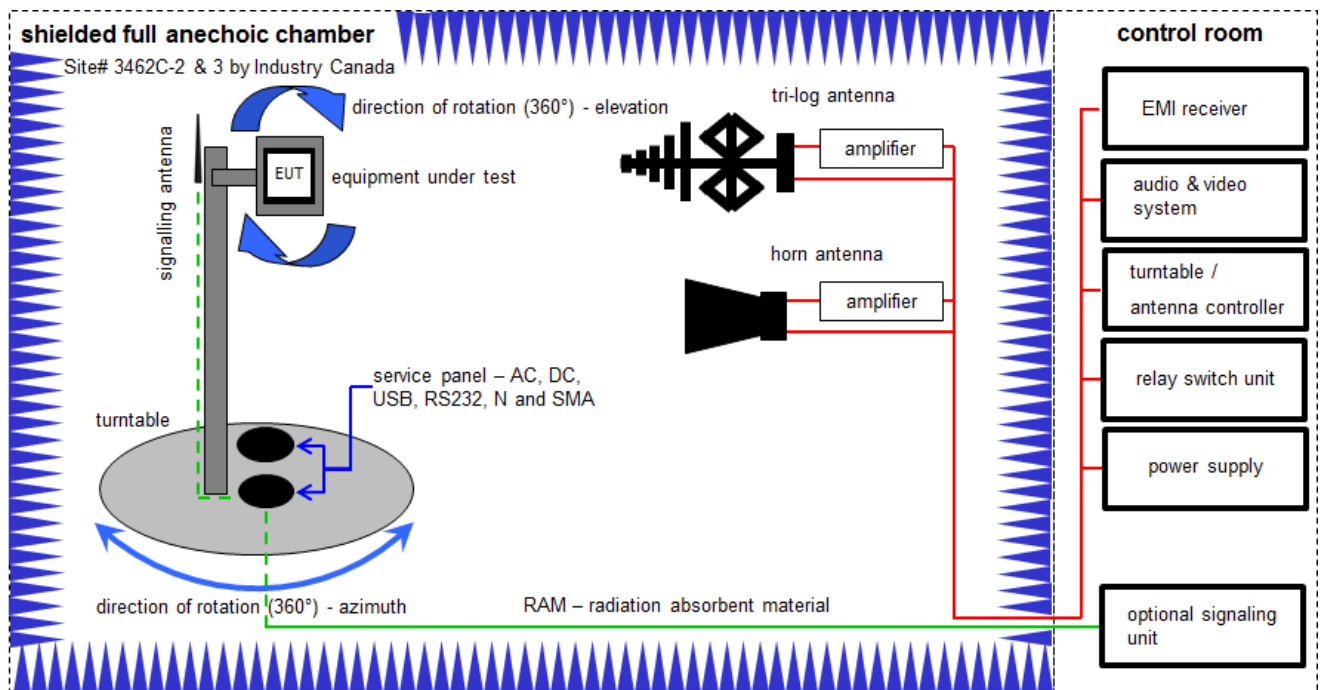
Example calculation:

FS [dBμV/m] = 12.35 [dBμV/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dBμV/m] (35.69 μV/m)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A, B	Switch-Unit	3488A	HP	2719A14505	300000368	ev	-/-	-/-
2	A, B	Meßkabine 1	HF-Absorberhalle	MWB AG 300023		300000551	ne	-/-	-/-
3	A, B	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	12.12.2018	11.12.2019
4	A, B	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	vKI!	15.01.2018	14.01.2020
5	A, B	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw	-/-	-/-
6	A, B	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw	-/-	-/-
7	A, B	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw	-/-	-/-
8	B	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck Mess - Elektronik	371	300003854	vKI!	24.11.2017	23.11.2020
9	A, B	Wideband Radio Communication Tester	CMW500	R&S	116854	300004625	k	18.12.2018	17.12.2020
10	A	Active Loop Antenna 9 kHz to 30 MHz	6502	EMCO	2210	300001015	vKI!	07.07.2017	06.07.2019

6.2 Shielded fully anechoic chamber



Measurement distance: tri-log antenna and horn antenna 3 meter

OP = AV + D - G + CA

(OP-radiated output power; AV-analyzer value; D-free field attenuation of measurement distance; G-antenna gain+amplifier gain; CA-loss signal path)

Example calculation:

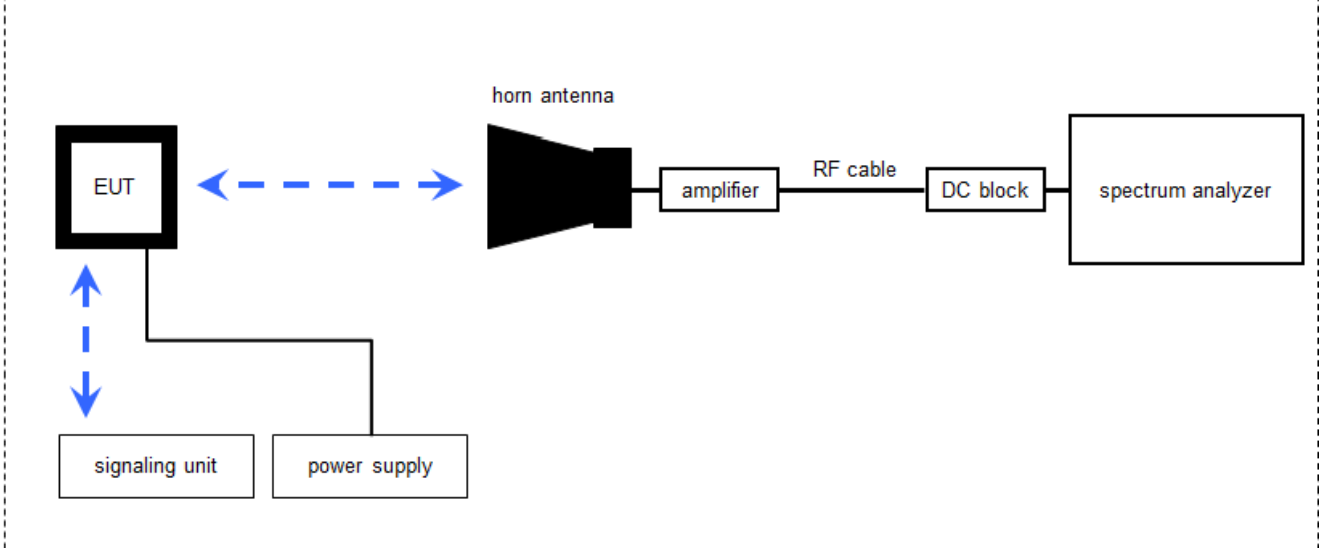
OP [dBm] = -65.0 [dBm] + 50 [dB] - 20 [dBi] + 5 [dB] = -30 [dBm] (1 µW)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A, C	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vKI!	07.07.2017	06.07.2019
2	C	Highpass Filter	WHK1.1/15G-10SS	Wainwright	37	400000148	ne	-/-	-/-
3	C	Band Reject Filter	WRCG1850/1910-1835/1925-40/8SS	Wainwright	23	400000149	ne	-/-	-/-
4	C	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	18	300003789	ne	-/-	-/-
5	C	Band Reject Filter	WRCG824/849-810/863-60/9SS	Wainwright	6	300003791	ne	-/-	-/-
6	C	Band Reject Filter	WRCG1710/1755-1690/1775-90/14SS	Wainwright	7	300003793	ne	-/-	-/-
7	B	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck Mess - Elektronik	318	300003696	vKI!	23.05.2017	22.05.2020
8	C	Broadband Amplifier 0.5-18 GHz	CBLU5184540	CERNEX	22051	300004483	ev	-/-	-/-
9	A, B, C	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000032	300004510	ne	-/-	-/-
10	A, B, C	Computer	Intel Core i3 3220/3.3 GHz, Prozessor	-/-	2V2403033A54 21	300004591	ne	-/-	-/-
11	A, B, C	NEXIO EMV-Software	BAT EMC V3.16.0.49	EMCO	-/-	300004682	ne	-/-	-/-
12	A, B, C	Anechoic chamber	-/-	TDK	-/-	300003726	ne	-/-	-/-
13	A, B, C	EMI Test Receiver 9kHz-26,5GHz	ESR26	R&S	101376	300005063	k	19.12.2018	18.12.2019
14	C	RF Amplifier	AFS4-00100800-28-20P-4-R	MITEQ	2008992	300005204	ne	-/-	-/-
15	C	RF-Amplifier	AMF-6F06001800-30-10P-R	NARDA-MITEQ Inc	2011571	300005240	ev	-/-	-/-
16	A, B, C	Wideband Radio Communication Tester	CMW500	R&S	166977	-/-	ne	-/-	-/-

6.3 Radiated measurements > 18 GHz

Radiated measurements > 18 GHz



Measurement distance: horn antenna 50 cm

$$OP = AV + D - G + CA$$

(OP-radiated output power; AV-analyzer value; D-free field attenuation of measurement distance; G-antenna gain+amplifier gain; CA-loss signal path)

Example calculation:

$$OP \text{ [dBm]} = -59.0 \text{ [dBm]} + 44.0 \text{ [dB]} - 20.0 \text{ [dBi]} + 5.0 \text{ [dB]} = -30 \text{ [dBm]} \text{ (1 } \mu\text{W)}$$

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Microwave System Amplifier, 0.5-26.5 GHz	83017A	HP	00419	300002268	ev	-/-	-/-
2	A	Std. Gain Horn Antenna 18.0-26.5 GHz	638	Narda	01096	300000486	vIKII	13.12.2017	12.12.2019
3	A	Signal Analyzer 40 GHz	FSV40	R&S	101042	300004517	k	17.12.2018	16.12.2019
4	A	RF-Cable	ST18/SMAm/SMAm/48	Huber & Suhner	Batch no. 600918	400001182	ev	-/-	-/-
5	A	RF-Cable	ST18/SMAm/SMAm/48	Huber & Suhner	Batch no. 127377	400001183	ev	-/-	-/-
6	A	Wideband Radio Communication Tester	CMW500	R&S	116854	300004625	k	18.12.2018	17.12.2020

7 Summary of measurement results LTE band 2

☒	No deviations from the technical specifications were ascertained
☐	There were deviations from the technical specifications ascertained
☒	This test report is only a partial test report. The content and verdict of the performed test cases are listed below.

TC identifier	Description	verdict	date	Remark
RF-Testing	CFR Part 24 RSS 133	See table	2019-03-06	Delta tests according to manufacturer demand!

7.1 LTE Cat M1

Test Case	temperature conditions	power source voltages	C	NC	NA	NP	Remark
RF Output Power	Nominal	Nominal	☒	☐	☐	☐	Radiated tests only
Frequency Stability	Extreme	Extreme	☐	☐	☐	☒	-/-
Spurious Emissions Radiated	Nominal	Nominal	☒	☐	☐	☐	-/-
Spurious Emissions Conducted	Nominal	Nominal	☐	☐	☐	☒	-/-
Block Edge Compliance	Nominal	Nominal	☐	☐	☐	☒	-/-
Occupied Bandwidth	Nominal	Nominal	☐	☐	☐	☒	-/-

7.2 LTE NB-IoT

Test Case	temperature conditions	power source voltages	C	NC	NA	NP	Remark
RF Output Power	Nominal	Nominal	☒	☐	☐	☐	Radiated tests only
Frequency Stability	Extreme	Extreme	☐	☐	☐	☒	-/-
Spurious Emissions Radiated	Nominal	Nominal	☒	☐	☐	☐	-/-
Spurious Emissions Conducted	Nominal	Nominal	☐	☐	☐	☒	-/-
Block Edge Compliance	Nominal	Nominal	☐	☐	☐	☒	-/-
Occupied Bandwidth	Nominal	Nominal	☐	☐	☐	☒	-/-

Notes:

C	Compliant	NC	Not compliant	NA	Not applicable	NP	Not performed
----------	-----------	-----------	---------------	-----------	----------------	-----------	---------------

7.3 Results LTE band 2 Cat M1

The EUT was set to transmit the maximum power.

7.3.1 RF output power

Description:

This paragraph contains average power, peak output power and EIRP measurements for the mobile station. In all cases, the peak output power is within the required mask (this mask is specified in the JTC standards, TIA PN3389 Vol. 1 Chap 7, and is no FCC requirement).

Measurement:

The mobile was set up for the maximum output power with pseudo random data modulation.

To determine the Peak-To-Average Power Ratio (PAPR) the measurement was performed with the Power Complementary Cumulative Distribution Function (CCDF).

Measurement parameters	
Detector:	Peak and RMS (Power in Burst)
Sweep time:	Auto
Video bandwidth:	Depends on Channel Bandwidth
Resolution bandwidth:	Depends on Channel Bandwidth
Span:	Zero Span
Trace-Mode:	Max Hold
Test setup:	Chapter 6.2 A

Limits:

FCC	IC
CFR Part 24.232 CFR Part 2.1046	RSS 133, Issue 5, Section 6.4
Nominal Peak Output Power	
+33.00 dBm	
In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.	

Results:

Output Power (radiated)		
Frequency (MHz)	Average Output Power (dBm) QPSK	Average Output Power (dBm) 16-QAM
1850.7	25.1	24.1
1880.0	26.1	26.0
1909.3	24.7	23.9
Measurement uncertainty: ± 3.0 dB		

7.3.2 Spurious emissions radiated

Description:

Investigation of the spectrum from 9 kHz to 20 GHz.

Measurement:

Measurement parameters	
Detector:	Peak
Sweep time:	2 sec.
Video bandwidth:	Below 1 GHz: 100 kHz Above 1 GHz: 1 MHz
Resolution bandwidth:	Below 1 GHz: 100 kHz Above 1 GHz: 1 MHz
Span:	100 MHz Steps
Trace-Mode:	Max Hold
Test setup:	Chapter 6.1 A & B; 6.2 C & 6.3 A

Limits:

FCC	IC
CFR Part 24.238 CFR Part 2.1053	RSS 133
Spurious Emissions Radiated	
Attenuation $\geq 43 + 10\log(P)$ (P, Power in Watts)	
-13 dBm	

Results:

Radiated emissions measurements were made only at the center carrier frequency of the LTE band II (1880 MHz). It was decided that measurements at this carrier frequency would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the LTE band II into any of the other blocks. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

The final open field radiated levels are presented on the next pages.
 All measurements were done in horizontal and vertical polarization; the plots show the worst case.
 The plots show only the middle channel. If spurious were detected, the lowest and highest channel were checked too. The found values are stated in the table below.

As can be seen from this data, the emissions from the test item were within the specification limit.

QPSK

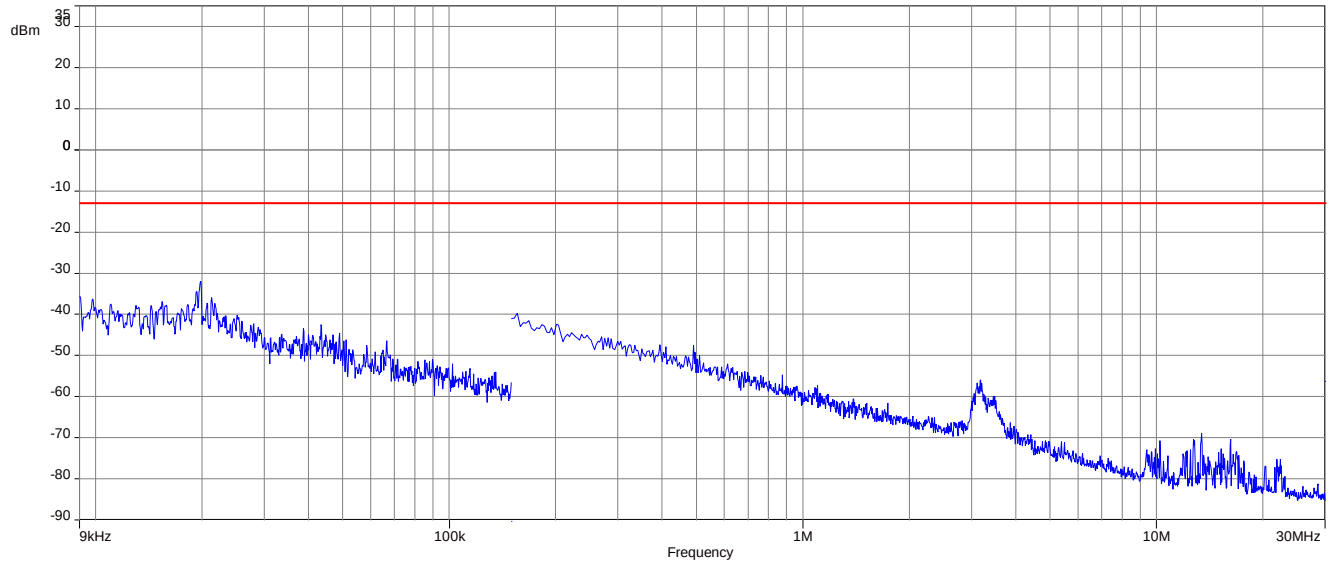
Spurious emission level (dBm)					
Lowest channel		Middle channel		Highest channel	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
All detected emissions are more than 20 dB below the limit.		All detected emissions are more than 20 dB below the limit.		All detected emissions are more than 20 dB below the limit.	
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
Measurement uncertainty			± 3dB		

16-QAM

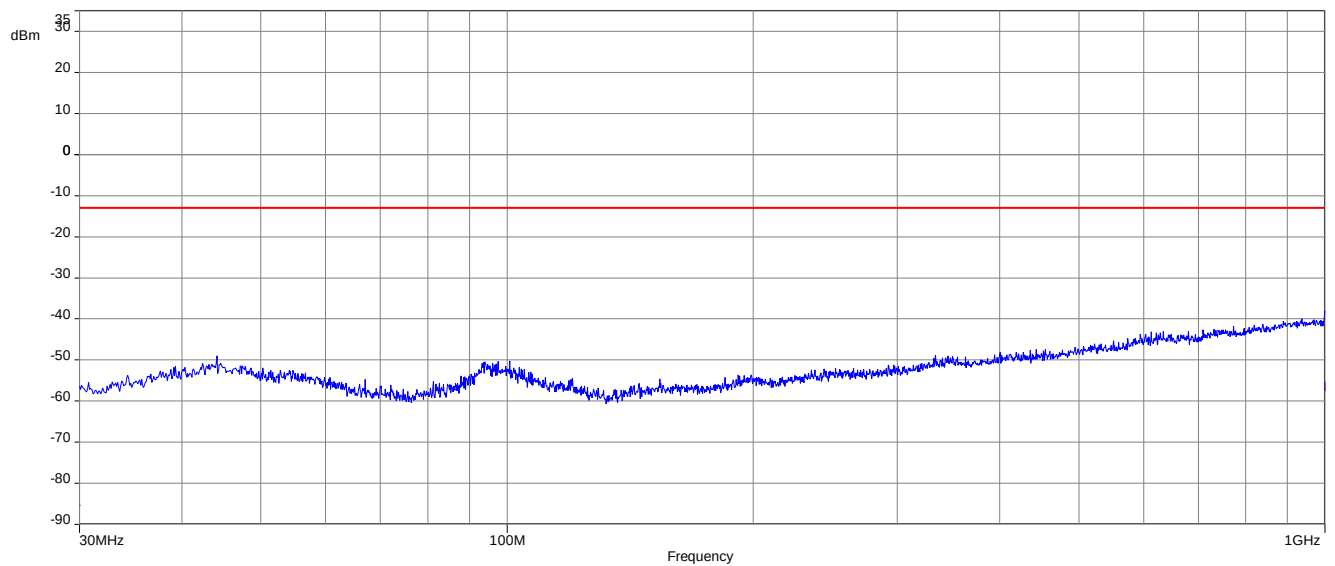
Spurious emission level (dBm)					
Lowest channel		Middle channel		Highest channel	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
All detected emissions are more than 20 dB below the limit.		All detected emissions are more than 20 dB below the limit.		All detected emissions are more than 20 dB below the limit.	
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
Measurement uncertainty			± 3dB		

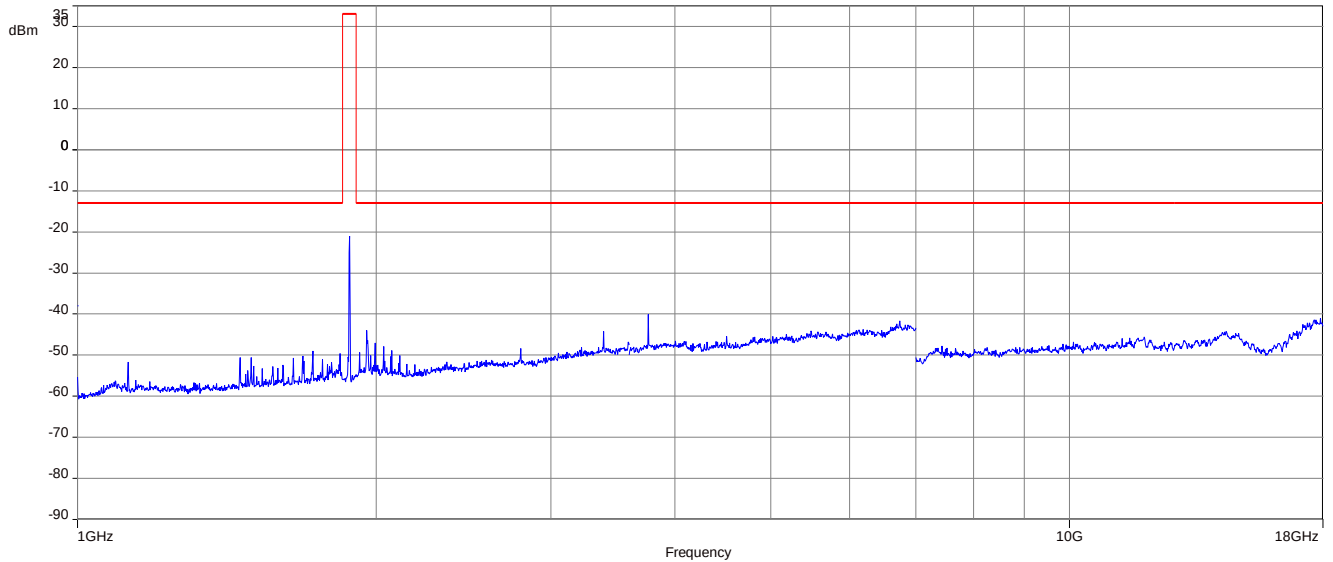
QPSK

Plot 1: Middle channel, 9 kHz to 30 MHz

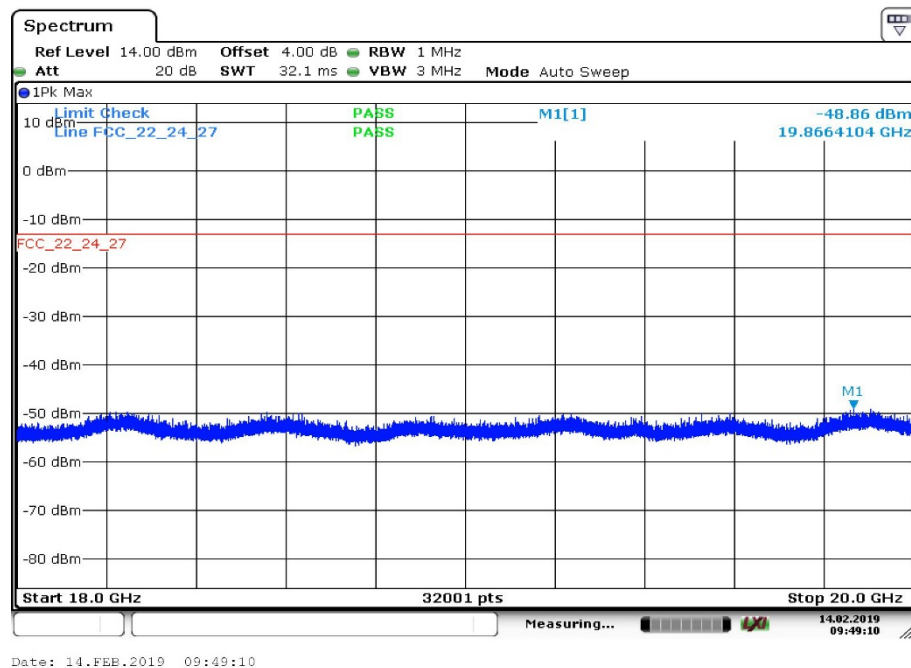


Plot 2: Middle channel, 30 MHz to 1 GHz



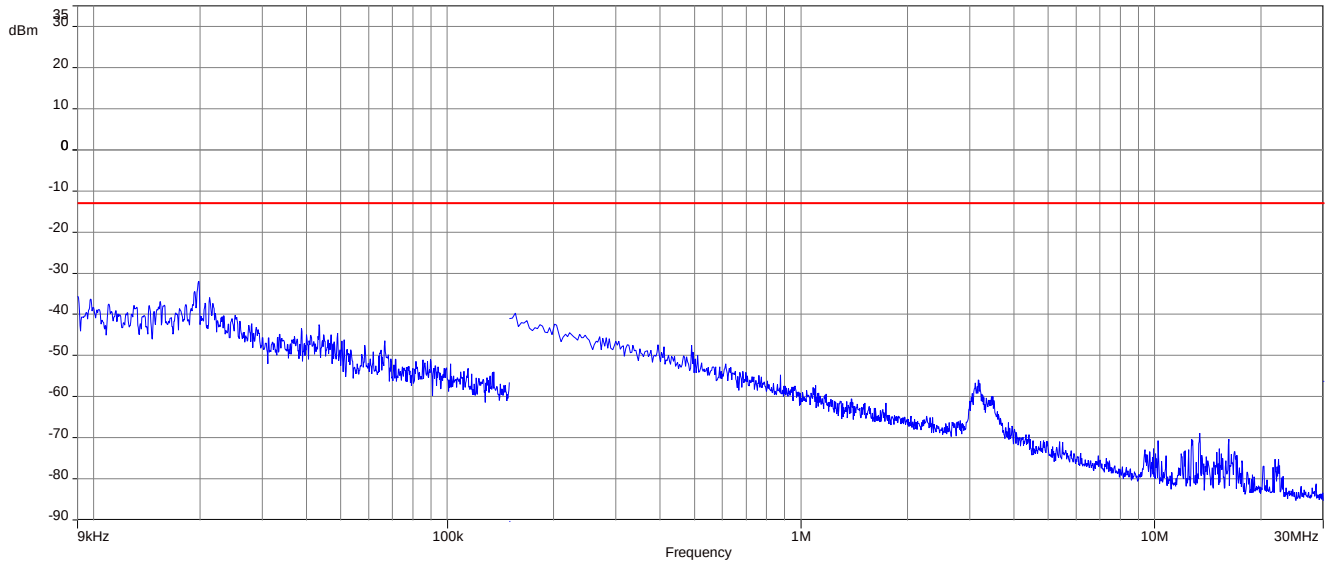
Plot 3: Middle channel, 1 GHz – 18 GHz

Carrier notched with 1.9 GHz rejection filter

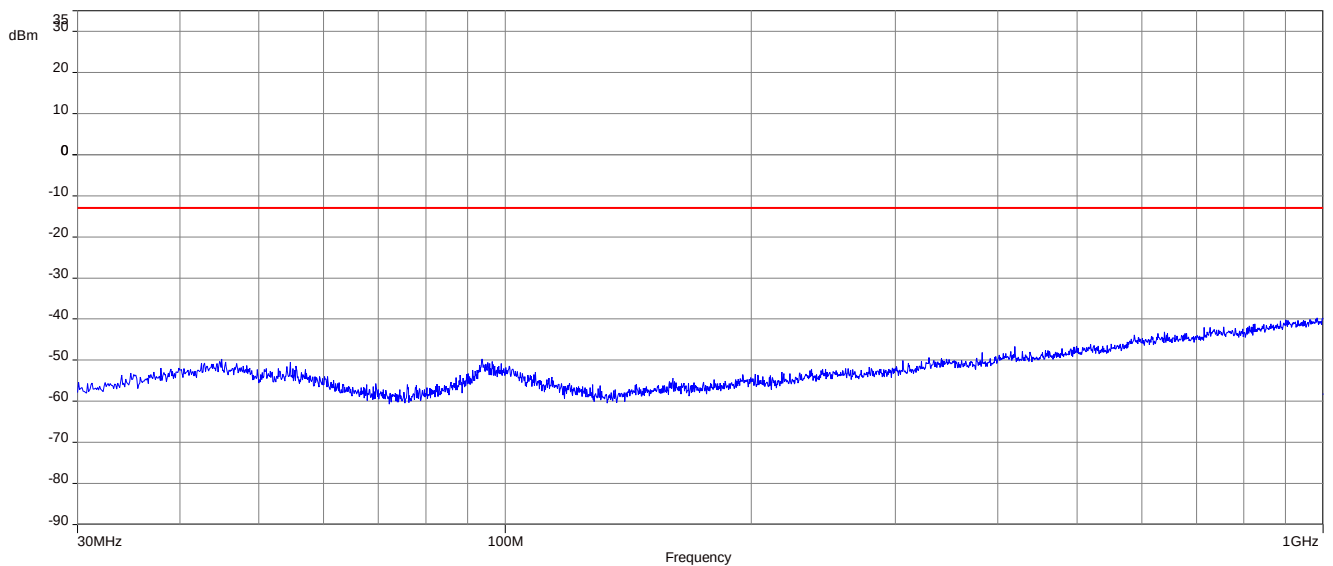
Plot 4: Middle channel, 18 GHz – 20 GHz

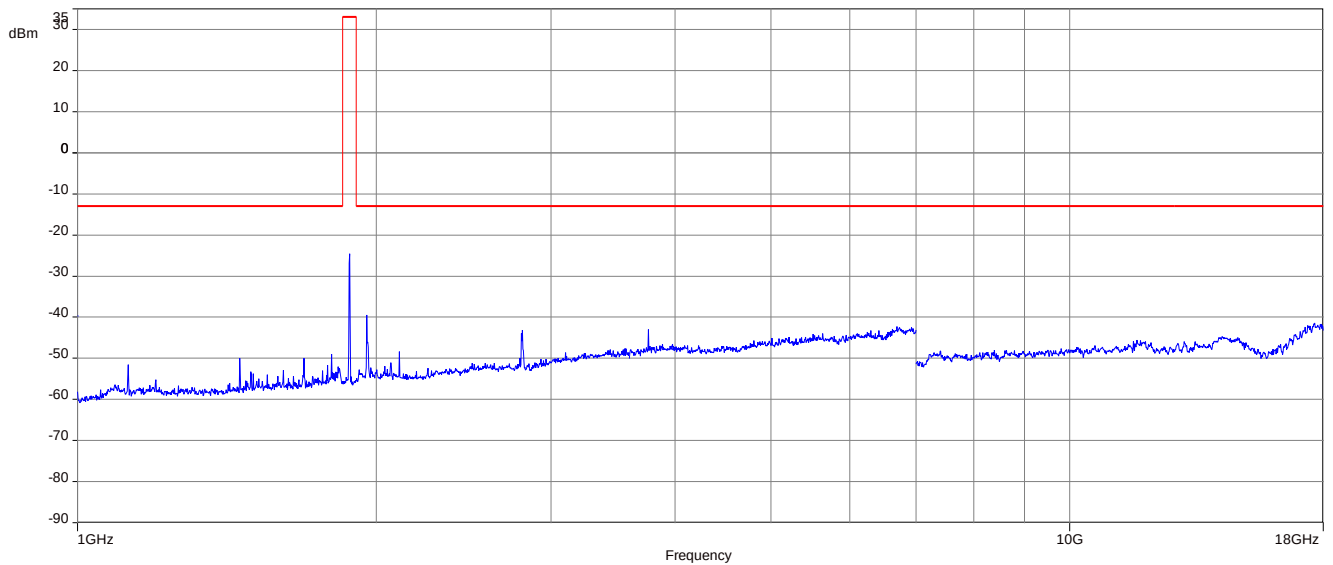
16-QAM:

Plot 1: Middle channel, 9 kHz to 30 MHz

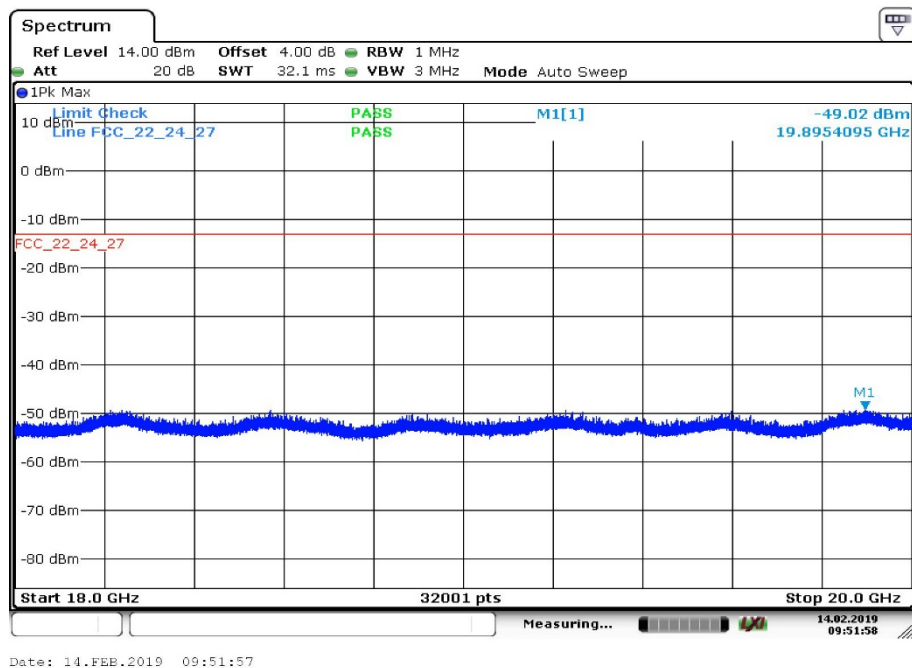


Plot 2: Middle channel, 30 MHz to 1 GHz



Plot 3: Middle channel, 1 GHz – 18 GHz

Carrier notched with 1.9 GHz rejection filter

Plot 4: Middle channel, 18 GHz – 20 GHz

7.4 Results LTE band 2 NB-IoT

The EUT was set to transmit the maximum power.

7.4.1 RF output power

Description:

This paragraph contains average power, peak output power and EIRP measurements for the mobile station. In all cases, the peak output power is within the required mask (this mask is specified in the JTC standards, TIA PN3389 Vol. 1 Chap 7, and is no FCC requirement).

Measurement:

The mobile was set up for the maximum output power with pseudo random data modulation.

To determine the Peak-To-Average Power Ratio (PAPR) the measurement was performed with the Power Complementary Cumulative Distribution Function (CCDF).

Measurement parameters	
Detector:	Peak and RMS (Power in Burst)
Sweep time:	Auto
Video bandwidth:	Depends on Channel Bandwidth
Resolution bandwidth:	Depends on Channel Bandwidth
Span:	Zero Span
Trace-Mode:	Max Hold
Test setup:	Chapter 6.2 A

Limits:

FCC	IC
CFR Part 24.232 CFR Part 2.1046	RSS 133, Issue 5, Section 6.4
Nominal Peak Output Power	
+33.00 dBm	
In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.	

Results:

Output Power (radiated)		
Frequency (MHz)	Average Output Power (dBm) BPSK	Average Output Power (dBm) QPSK
1850.7	25.2	26.0
1880.0	26.1	27.3
1909.3	23.8	21.9
Measurement uncertainty: ± 3.0 dB		

7.4.2 Spurious emissions radiated

Description:

Investigation of the spectrum from 9 kHz to 20 GHz.

Measurement:

Measurement parameters	
Detector:	Peak
Sweep time:	2 sec.
Video bandwidth:	Below 1 GHz: 100 kHz Above 1 GHz: 1 MHz
Resolution bandwidth:	Below 1 GHz: 100 kHz Above 1 GHz: 1 MHz
Span:	100 MHz Steps
Trace -Mode:	Max Hold
Test setup:	Chapter 6.1 A & B; 6.2 C & 6.3 A

Limits:

FCC	IC
CFR Part 24.238 CFR Part 2.1053	RSS 133
Spurious Emissions Radiated	
Attenuation $\geq 43 + 10\log(P)$ (P, Power in Watts)	
-13 dBm	

Results:

Radiated emissions measurements were made only at the center carrier frequency of the LTE band II (1880 MHz). It was decided that measurements at this carrier frequency would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the LTE band II into any of the other blocks. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

The final open field radiated levels are presented on the next pages.
 All measurements were done in horizontal and vertical polarization; the plots show the worst case.
 The plots show only the middle channel. If spurious were detected, the lowest and highest channel were checked too. The found values are stated in the table below.

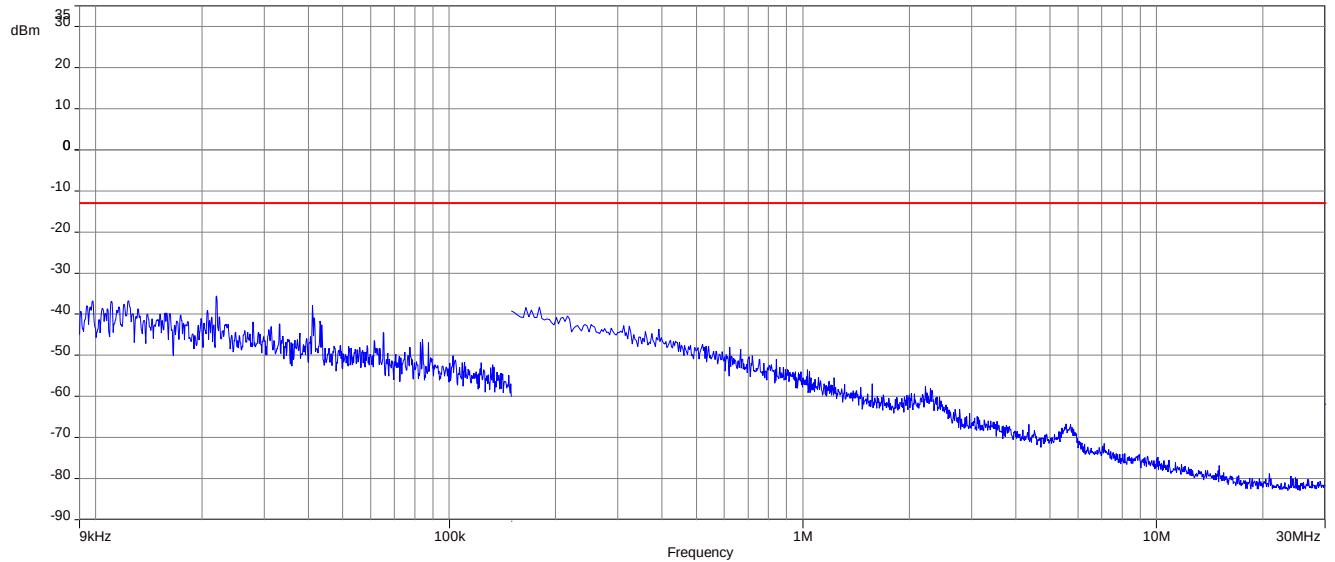
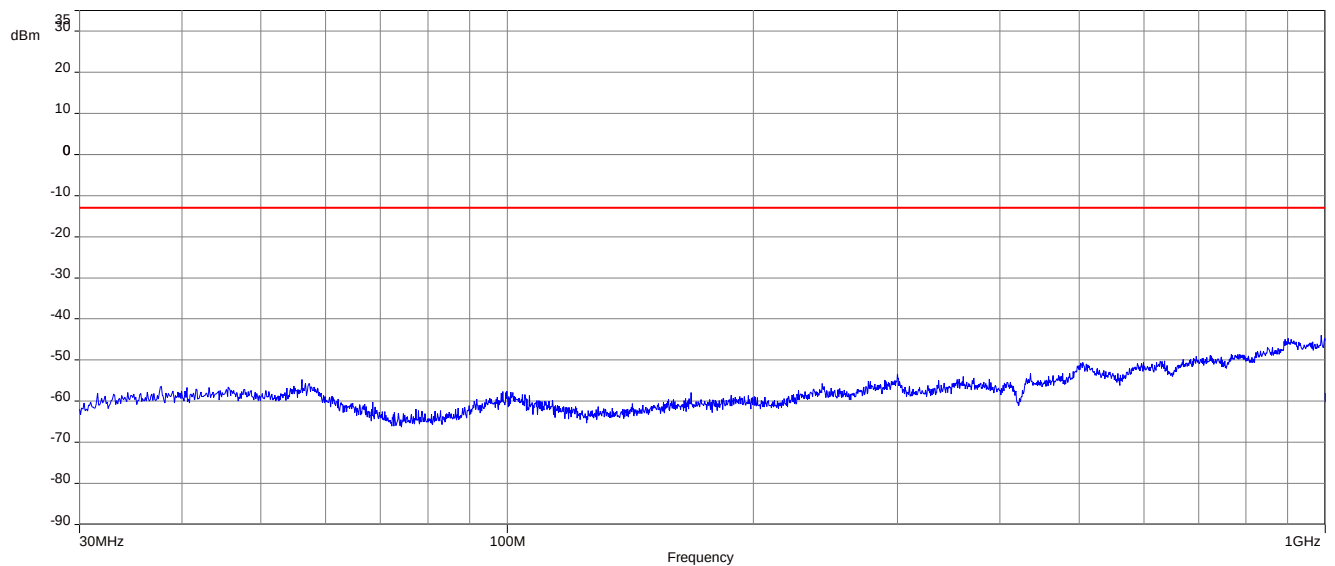
As can be seen from this data, the emissions from the test item were within the specification limit.

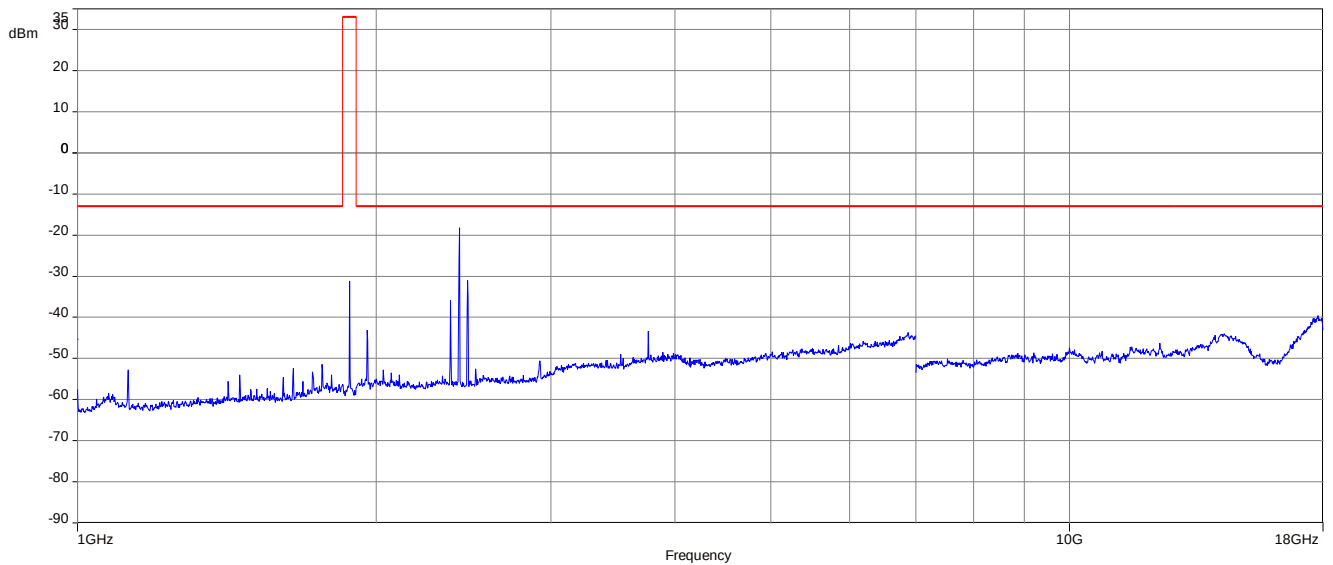
BPSK

Spurious emission level (dBm)					
Lowest channel		Middle channel		Highest channel	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
All detected emissions are more than 20 dB below the limit.		All detected emissions are more than 20 dB below the limit.		All detected emissions are more than 20 dB below the limit.	
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
Measurement uncertainty			± 3dB		

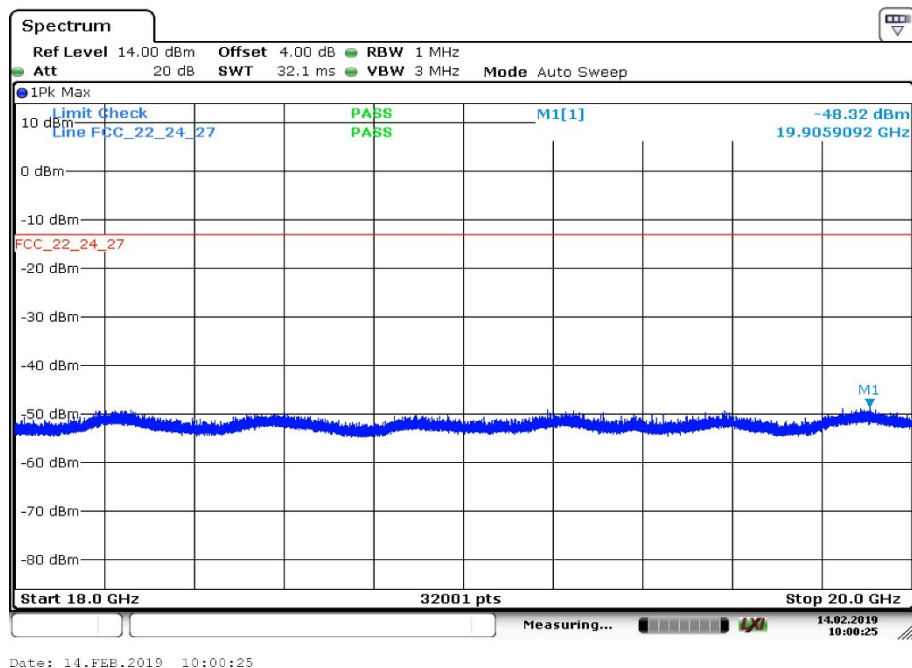
QPSK

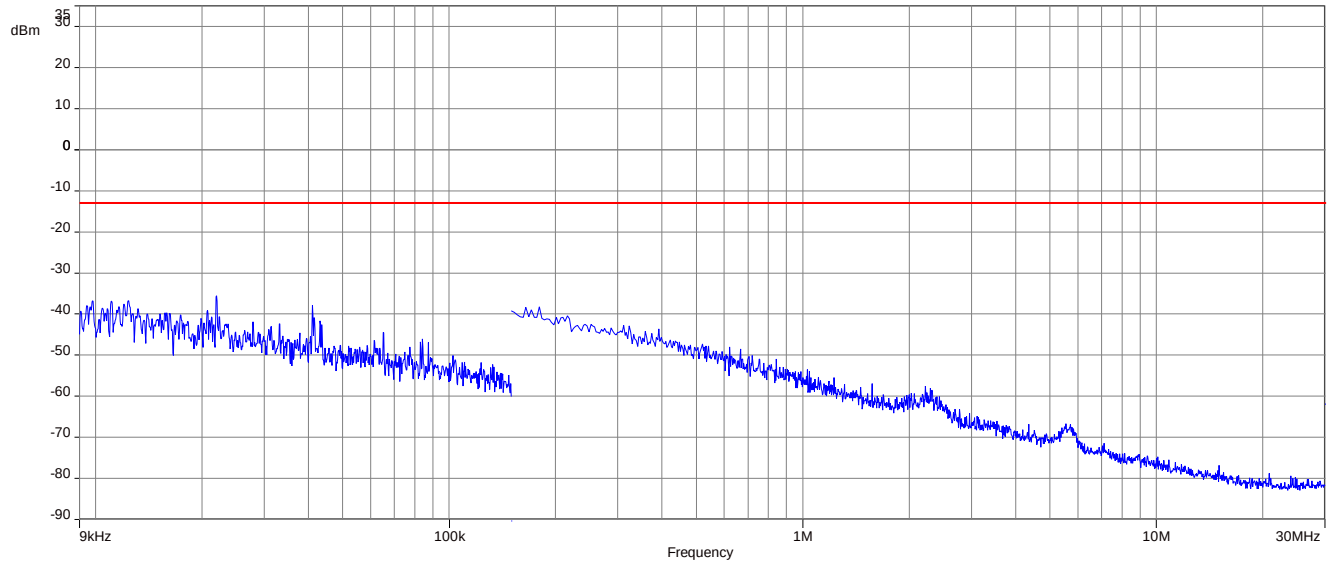
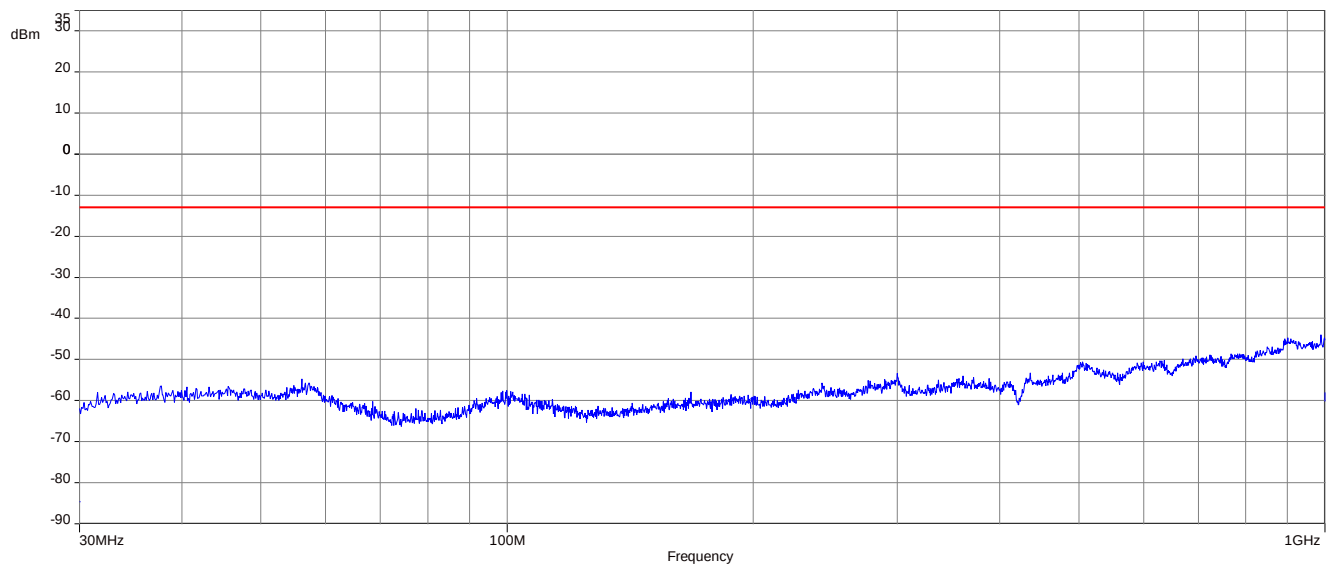
Spurious emission level (dBm)					
Lowest channel		Middle channel		Highest channel	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
All detected emissions are more than 20 dB below the limit.		All detected emissions are more than 20 dB below the limit.		All detected emissions are more than 20 dB below the limit.	
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
Measurement uncertainty			± 3dB		

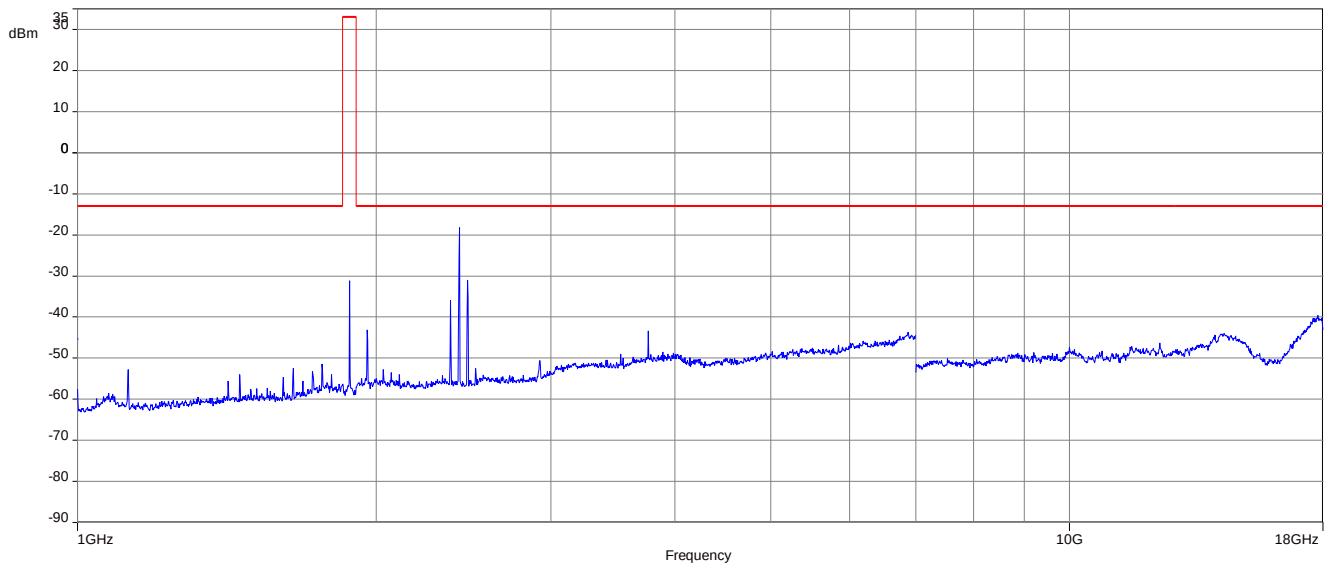
BPSK**Plot 1:** Middle channel, 9 kHz to 30 MHz**Plot 2:** Middle channel, 30 MHz to 1 GHz

Plot 3: Middle channel, 1 GHz – 18 GHz

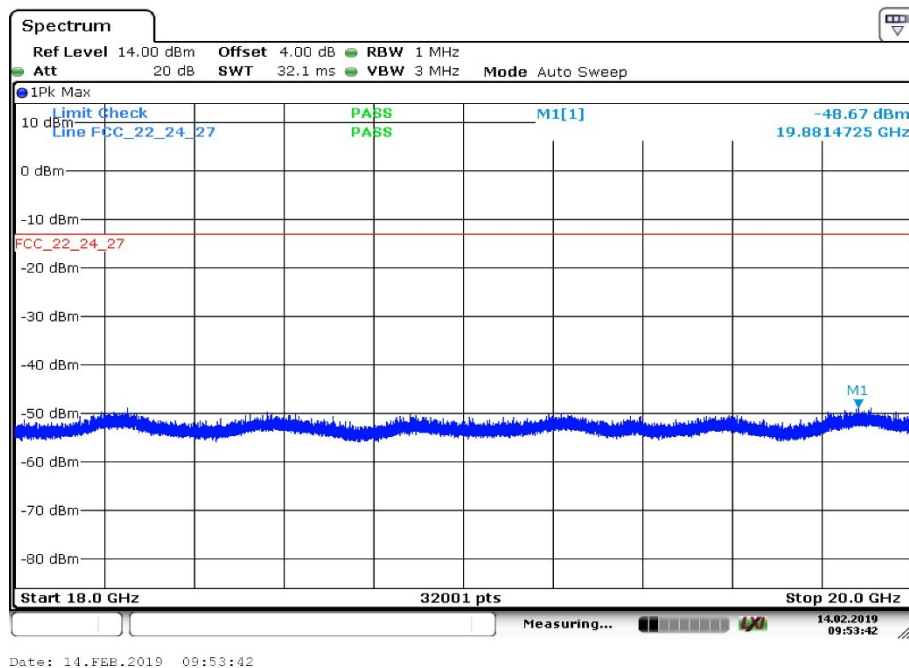
Carrier notched with 1.9 GHz rejection filter. The emissions on the right side of the carrier are a part of the signaling unit. (Downlink).

Plot 4: Middle channel, 18 GHz – 20 GHz

QPSK**Plot 1:** Middle channel, 9 kHz to 30 MHz**Plot 2:** Middle channel, 30 MHz to 1 GHz

Plot 3: Middle channel, 1 GHz – 18 GHz

Carrier notched with 1.9 GHz rejection filter. The emissions on the right side of the carrier are a part of the signaling unit. (Downlink).

Plot 4: Middle channel, 18 GHz – 20 GHz

8 Summary of measurement results LTE band 4

☒	No deviations from the technical specifications were ascertained
☐	There were deviations from the technical specifications ascertained
☒	This test report is only a partial test report. The content and verdict of the performed test cases are listed below.

TC identifier	Description	verdict	date	Remark
RF-Testing	CFR Part 27 RSS 139	See table	2019-03-06	Delta tests according to manufacturer demand!

8.1 LTE Cat M1

Test Case	temperature conditions	power source voltages	C	NC	NA	NP	Remark
RF Output Power	Nominal	Nominal	☒	☐	☐	☐	Radiated tests only
Frequency Stability	Extreme	Extreme	☐	☐	☐	☒	-/-
Spurious Emissions Radiated	Nominal	Nominal	☒	☐	☐	☐	-/-
Spurious Emissions Conducted	Nominal	Nominal	☐	☐	☐	☒	-/-
Block Edge Compliance	Nominal	Nominal	☐	☐	☐	☒	-/-
Occupied Bandwidth	Nominal	Nominal	☐	☐	☐	☒	-/-

8.2 LTE NB-IoT

Test Case	temperature conditions	power source voltages	C	NC	NA	NP	Remark
RF Output Power	Nominal	Nominal	☒	☐	☐	☐	Radiated tests only
Frequency Stability	Extreme	Extreme	☐	☐	☐	☒	-/-
Spurious Emissions Radiated	Nominal	Nominal	☒	☐	☐	☐	-/-
Spurious Emissions Conducted	Nominal	Nominal	☐	☐	☐	☒	-/-
Block Edge Compliance	Nominal	Nominal	☐	☐	☐	☒	-/-
Occupied Bandwidth	Nominal	Nominal	☐	☐	☐	☒	-/-

Notes:

C	Compliant	NC	Not compliant	NA	Not applicable	NP	Not performed
----------	-----------	-----------	---------------	-----------	----------------	-----------	---------------

8.3 Results LTE – band 4 Cat M1

The EUT was set to transmit the maximum power.

8.3.1 RF output power

Description:

This paragraph contains average power, peak output power and EIRP measurements for the mobile station. In all cases, the peak output power is within the required mask (this mask is specified in the JTC standards, TIA PN3389 Vol. 1 Chap 7, and is no FCC requirement).

Measurement:

The mobile was set up for the maximum output power with pseudo random data modulation.

To determine the Peak-To-Average Power Ratio (PAPR) the measurement was performed with the Power Complementary Cumulative Distribution Function (CCDF).

Measurement parameters	
Detector:	Peak and RMS (Power in Burst)
Sweep time:	Auto
Video bandwidth:	Depends on Channel Bandwidth
Resolution bandwidth:	Depends on Channel Bandwidth
Span:	Zero Span
Trace-Mode:	Max Hold
Test setup:	Chapter 6.2 A

Limits:

FCC	IC
Average E.I.R.P. Output Power	
+30.00 dBm In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.	

Results:

Output Power (radiated)		
Frequency (MHz)	Average Output Power (dBm) QPSK	Average Output Power (dBm) 16-QAM
1710.7	24.0	23.9
1732.5	23.6	23.5
1754.3	25.1	24.8
Measurement uncertainty: ± 3.0 dB		

8.3.2 Spurious emissions radiated

Description:

Investigation of the spectrum from 9 kHz to 18 GHz.

Measurement:

Measurement parameters	
Detector:	Peak
Sweep time:	2 sec.
Video bandwidth:	Below 1 GHz: 100 kHz Above 1 GHz: 1 MHz
Resolution bandwidth:	Below 1 GHz: 100 kHz Above 1 GHz: 1 MHz
Span:	100 MHz Steps
Trace-Mode:	Max Hold
Test setup:	Chapter 6.1 A & B; 6.2 C

Limits:

FCC	IC
Spurious Emissions Radiated	
Attenuation $\geq 43 + 10\log(P)$ (P, Power in Watts)	
-13 dBm	

Results:

Radiated emissions measurements were made only at the upper, center, and lower carrier frequencies of the LTE band 4 (1712.5 MHz, 1732.5 MHz and 1752.5 MHz). It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the LTE band 4 into any of the other blocks. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

The final open field radiated levels are presented on the next pages.
 All measurements were done in horizontal and vertical polarization; the plots show the worst case.
 The plots show only the middle channel with 10 MHz bandwidth and full resource blocks. If spurious were detected, the lowest and highest channel and all supported channel bandwidths were checked, too.

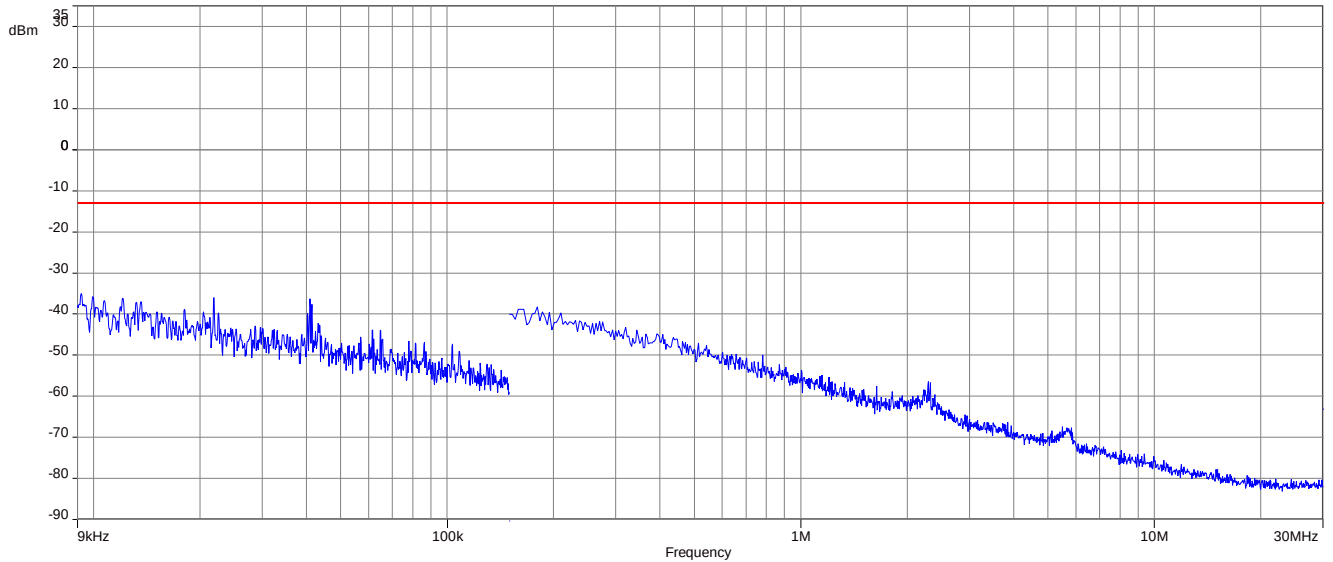
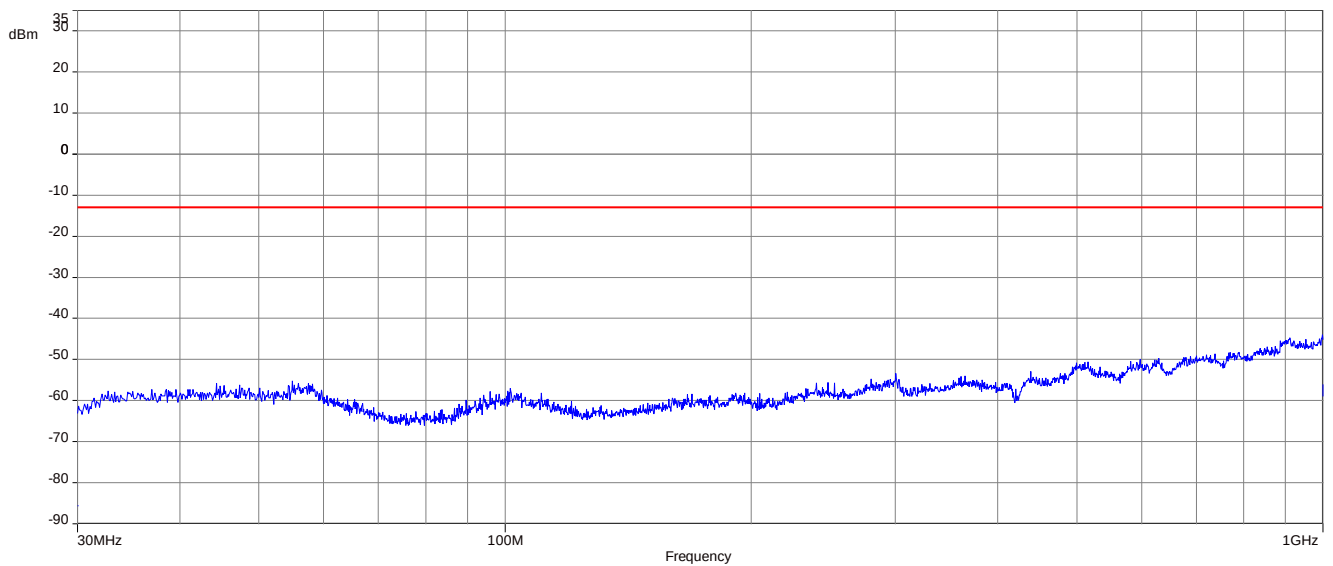
As can be seen from this data, the emissions from the test item were within the specification limit.

QPSK

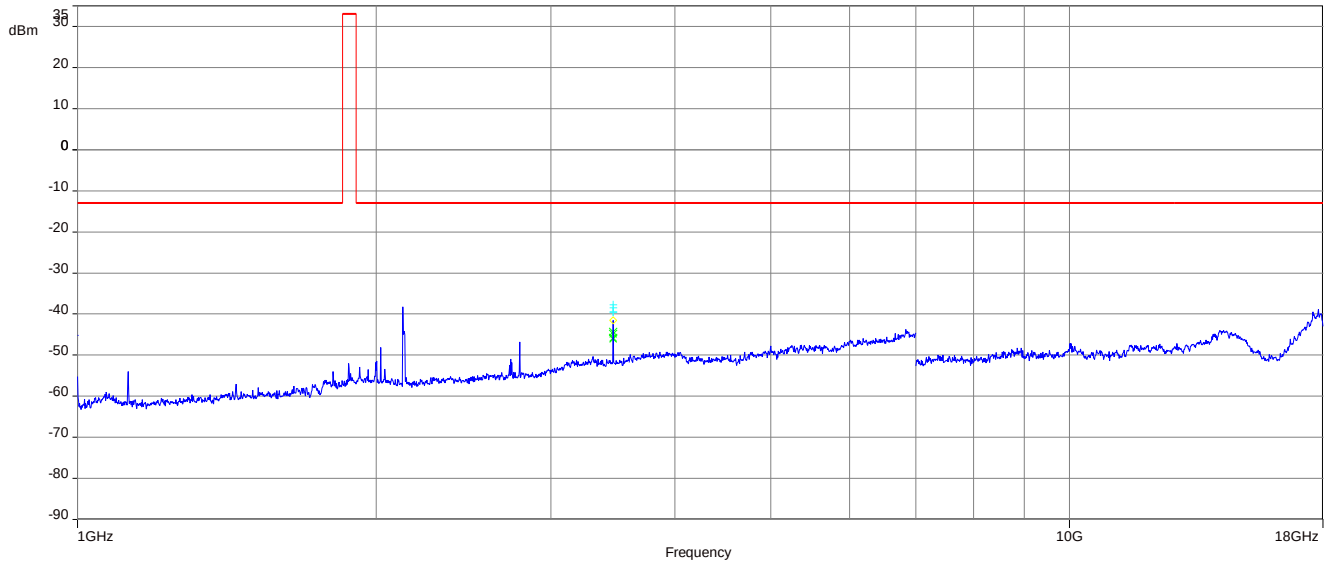
Spurious emission level (dBm)					
Lowest channel		Middle channel		Highest channel	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
All detected emissions are more than 20 dB below the limit.		All detected emissions are more than 20 dB below the limit.		All detected emissions are more than 20 dB below the limit.	
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
Measurement uncertainty			± 3dB		

16-QAM

Spurious emission level (dBm)					
Lowest channel		Middle channel		Highest channel	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
All detected emissions are more than 20 dB below the limit.		All detected emissions are more than 20 dB below the limit.		All detected emissions are more than 20 dB below the limit.	
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
Measurement uncertainty			± 3dB		

QPSK:**Plot 1:** Middle channel, 9 kHz to 30 MHz**Plot 2:** Middle channel, 30 MHz to 1 GHz

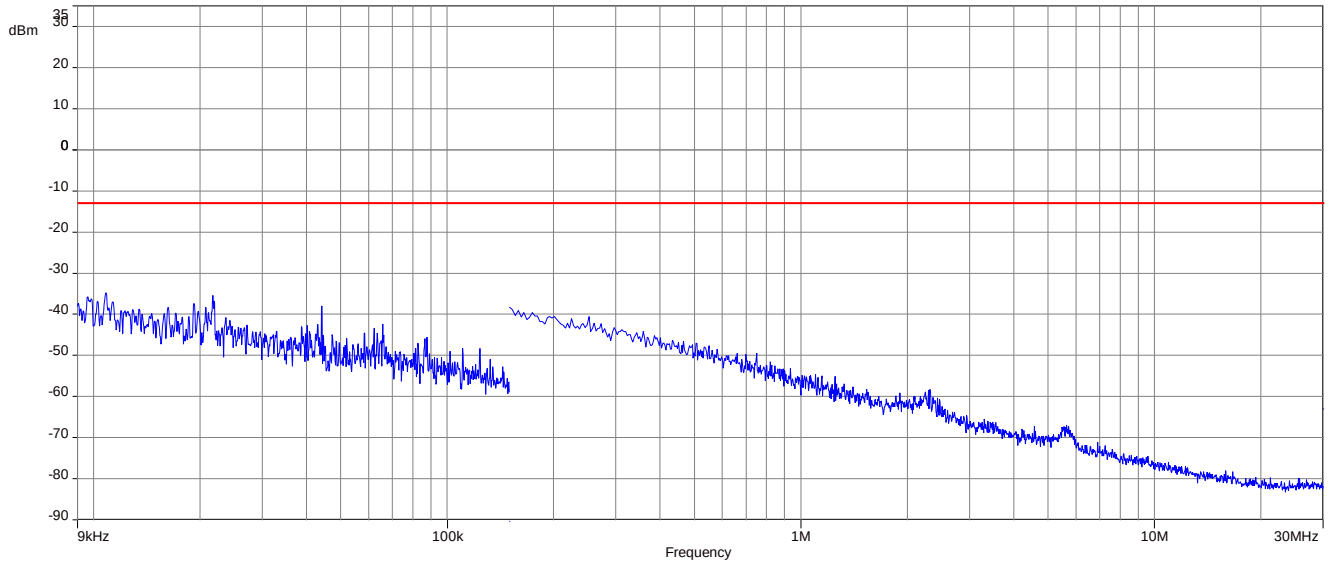
Plot 3: Middle channel, 1 GHz – 18 GHz



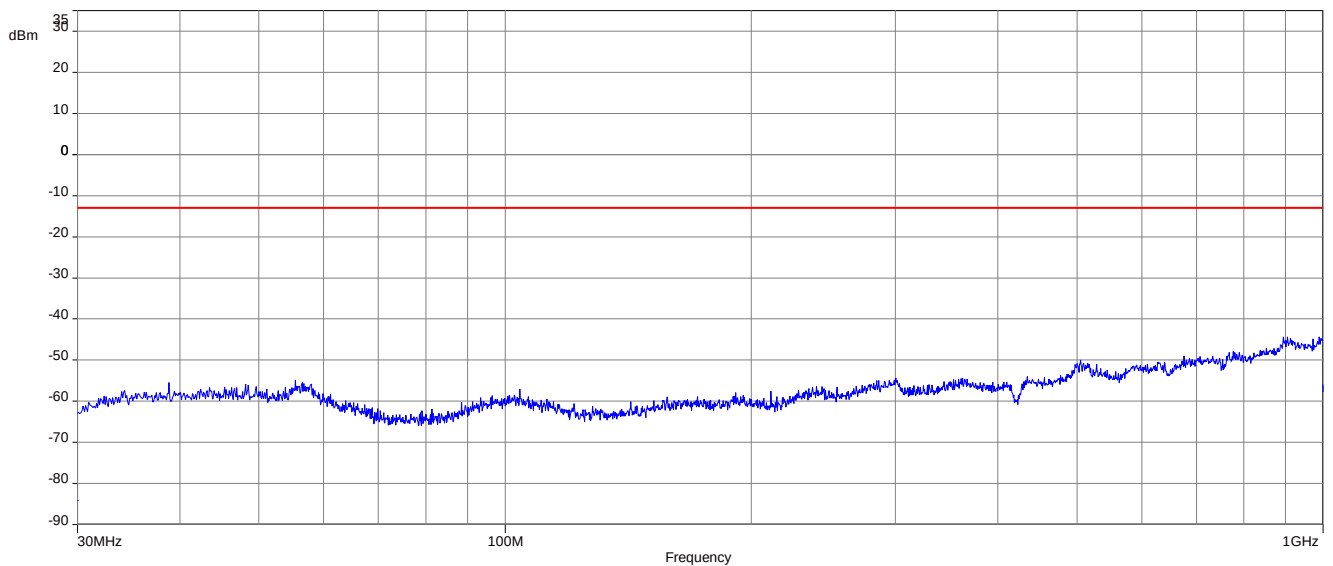
Carrier notched with 1.7 GHz rejection filter

16-QAM:

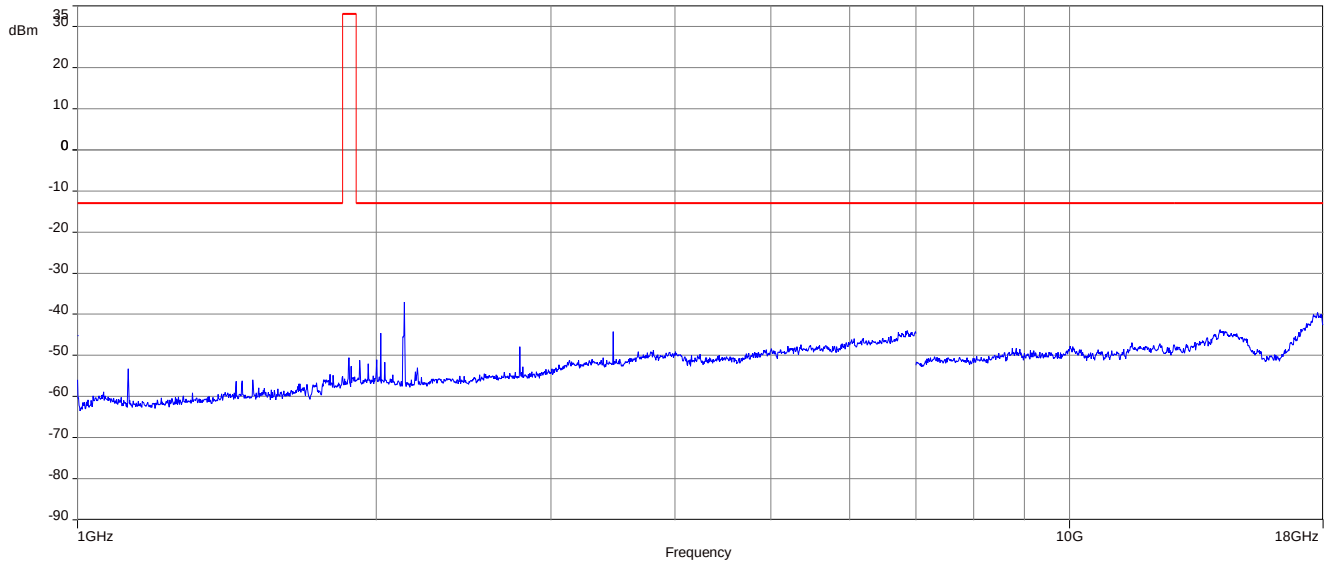
Plot 1: Middle channel, 9 kHz to 30 MHz



Plot 2: Middle channel, 30 MHz to 1 GHz



Plot 3: Middle channel, 1 GHz – 18 GHz



Carrier notched with 1.7 GHz rejection filter

8.4 Results LTE – band 4 NB-IoT

The EUT was set to transmit the maximum power.

8.4.1 RF output power

Description:

This paragraph contains average power, peak output power and EIRP measurements for the mobile station. In all cases, the peak output power is within the required mask (this mask is specified in the JTC standards, TIA PN3389 Vol. 1 Chap 7, and is no FCC requirement).

Measurement:

The mobile was set up for the maximum output power with pseudo random data modulation.

To determine the Peak-To-Average Power Ratio (PAPR) the measurement was performed with the Power Complementary Cumulative Distribution Function (CCDF).

Measurement parameters	
Detector:	Peak and RMS (Power in Burst)
Sweep time:	Auto
Video bandwidth:	Depends on Channel Bandwidth
Resolution bandwidth:	Depends on Channel Bandwidth
Span:	Zero Span
Trace-Mode:	Max Hold
Test setup:	Chapter 6.2 A

Limits:

FCC	IC
Average E.I.R.P. Output Power	
+30.00 dBm In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.	

Results:

Output Power (radiated)		
Frequency (MHz)	Average Output Power (dBm) BPSK	Average Output Power (dBm) QPSK
1710.7	26.0	25.9
1732.5	25.5	23.4
1754.3	25.6	23.6
Measurement uncertainty: ± 3.0 dB		

8.4.2 Spurious emissions radiated

Description:

Investigation of the spectrum from 9 kHz to 20 GHz.

Measurement:

Measurement parameters	
Detector:	Peak
Sweep time:	2 sec.
Video bandwidth:	Below 1 GHz: 100 kHz Above 1 GHz: 1 MHz
Resolution bandwidth:	Below 1 GHz: 100 kHz Above 1 GHz: 1 MHz
Span:	100 MHz Steps
Trace-Mode:	Max Hold
Test setup:	Chapter 6.1 A & B; 6.2 C

Limits:

FCC	IC
Spurious Emissions Radiated	
Attenuation $\geq 43 + 10\log(P)$ (P, Power in Watts)	
-13 dBm	

Results:

Radiated emissions measurements were made only at the upper, center, and lower carrier frequencies of the LTE band 4 (1712.5 MHz, 1732.5 MHz and 1752.5 MHz). It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the LTE band 4 into any of the other blocks. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

The final open field radiated levels are presented on the next pages.
 All measurements were done in horizontal and vertical polarization; the plots show the worst case.
 The plots show only the middle channel with 10 MHz bandwidth and full resource blocks. If spurious were detected, the lowest and highest channel and all supported channel bandwidths were checked, too.

As can be seen from this data, the emissions from the test item were within the specification limit.

BPSK

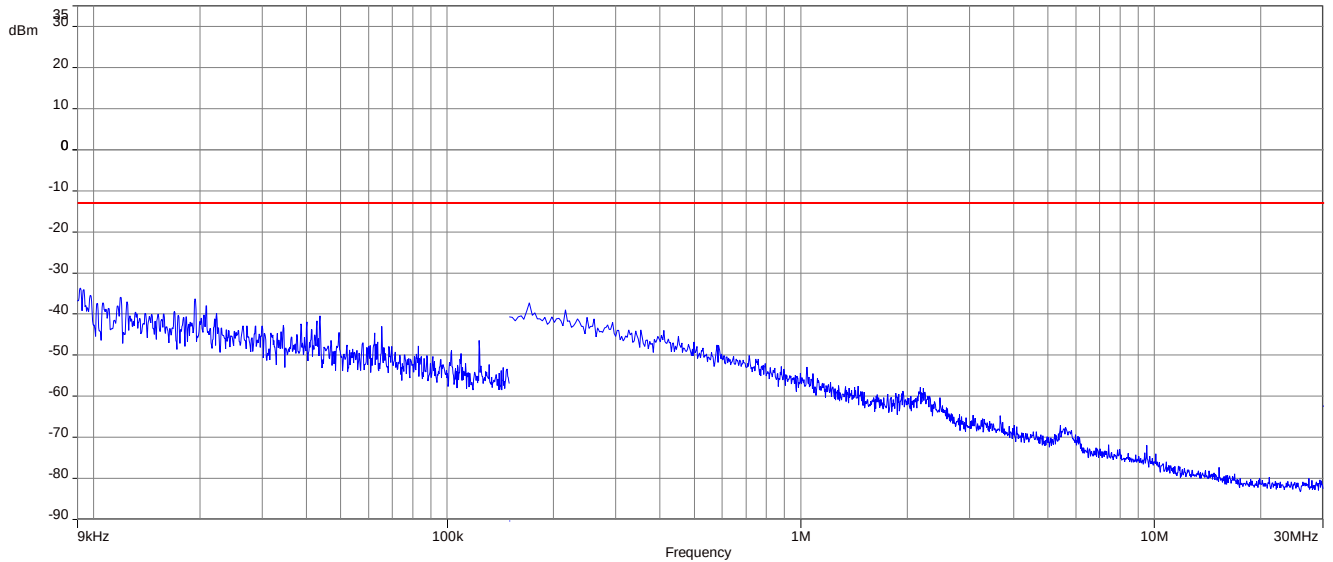
Spurious emission level (dBm)					
Lowest channel		Middle channel		Highest channel	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
All detected emissions are more than 20 dB below the limit.		All detected emissions are more than 20 dB below the limit.		All detected emissions are more than 20 dB below the limit.	
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
Measurement uncertainty			± 3dB		

QPSK

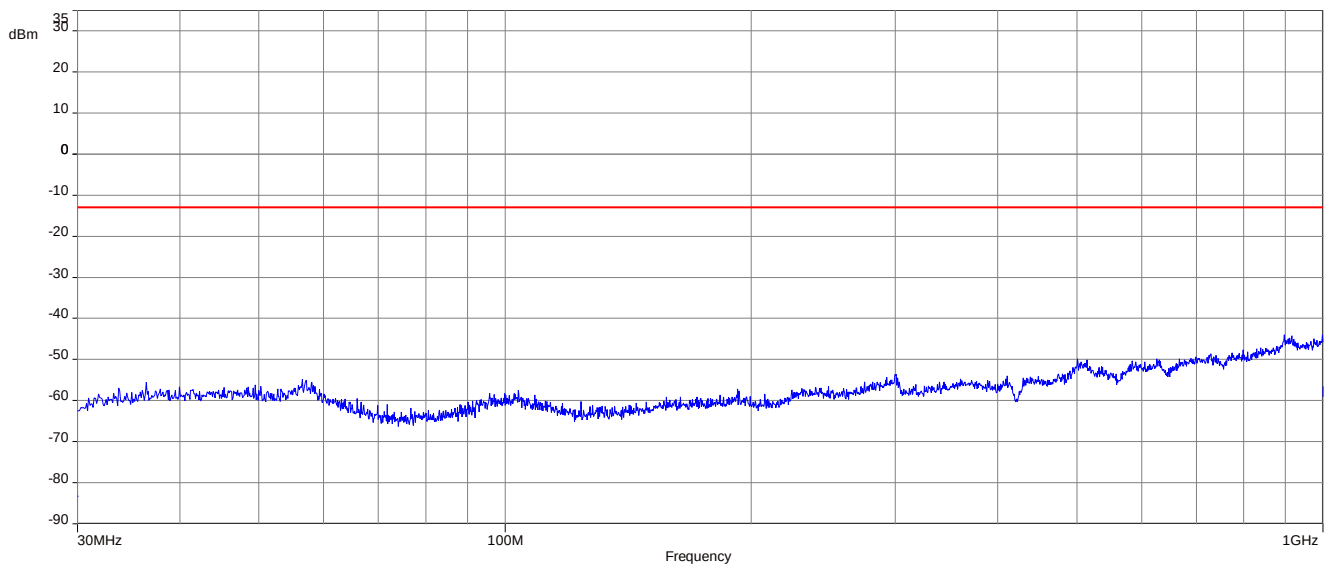
Spurious emission level (dBm)					
Lowest channel		Middle channel		Highest channel	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
All detected emissions are more than 20 dB below the limit.		All detected emissions are more than 20 dB below the limit.		All detected emissions are more than 20 dB below the limit.	
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
Measurement uncertainty			± 3dB		

BPSK:

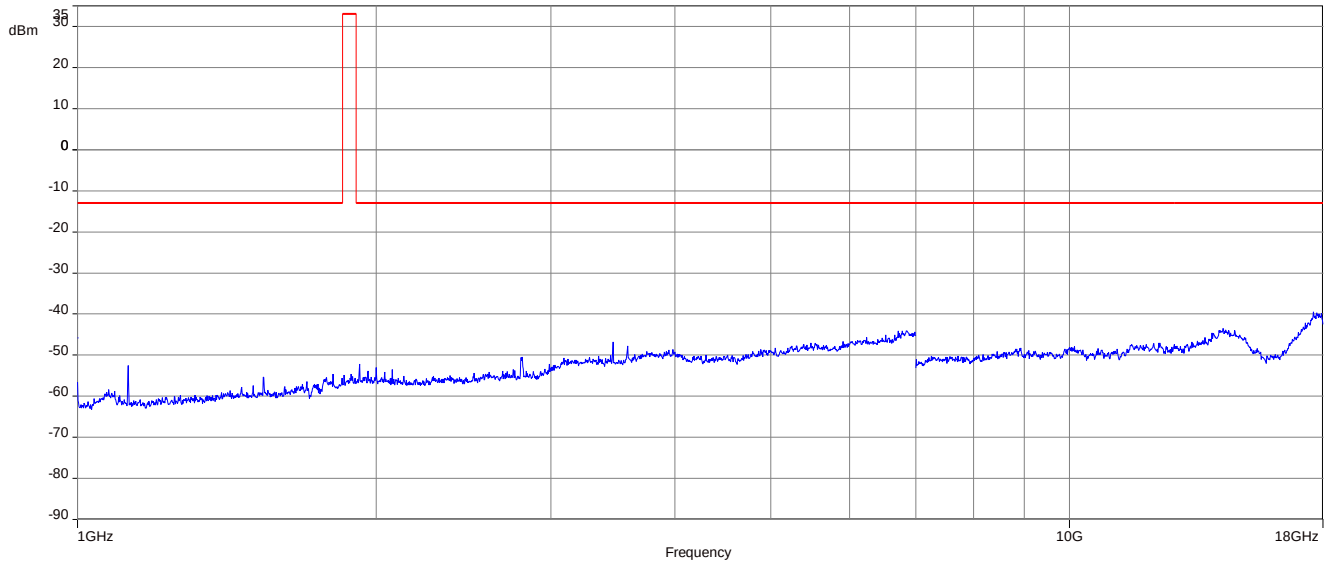
Plot 1: Middle channel, 9 kHz to 30 MHz



Plot 2: Middle channel, 30 MHz to 1 GHz



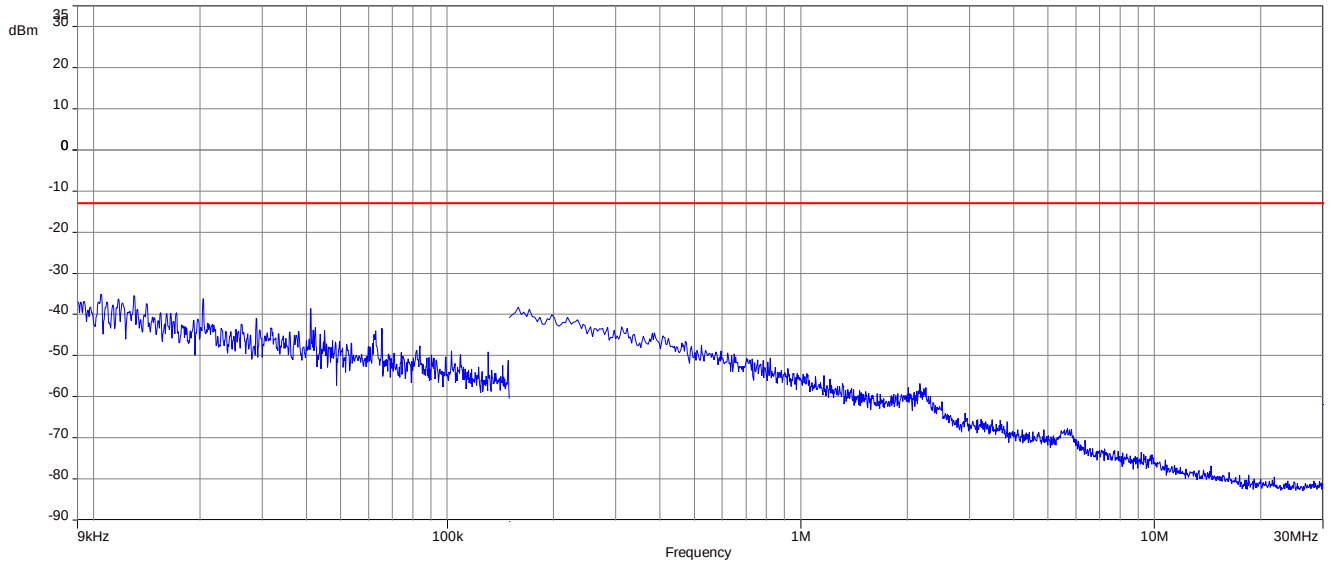
Plot 3: Middle channel, 1 GHz – 18 GHz



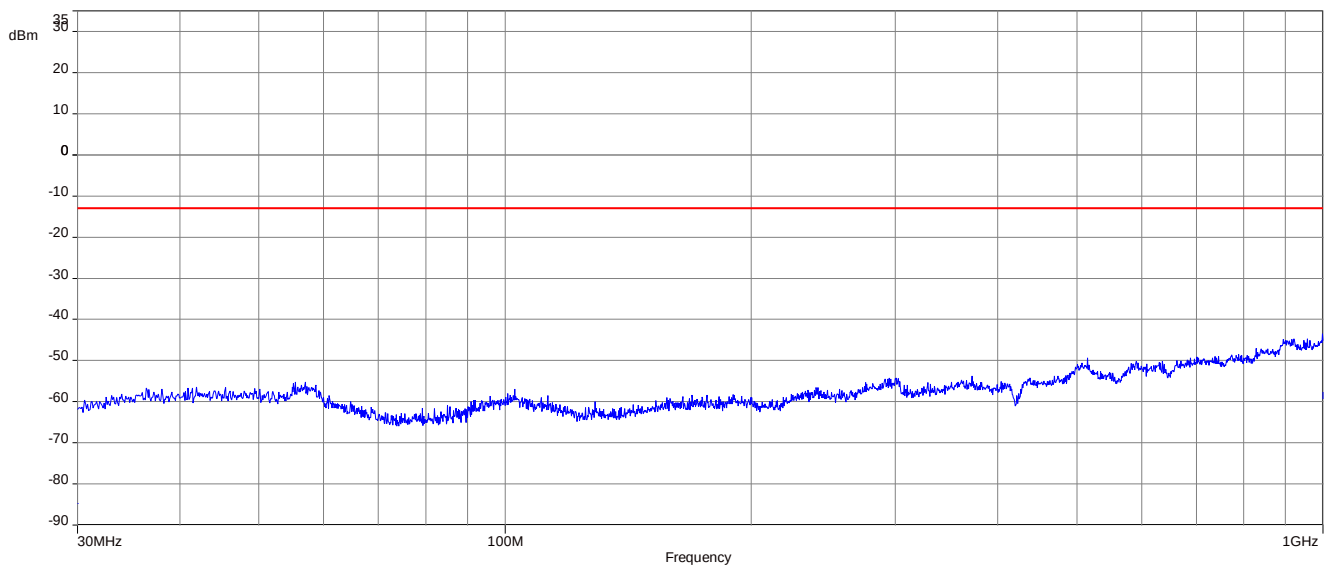
Carrier notched with 1.7 GHz rejection filter

QPSK:

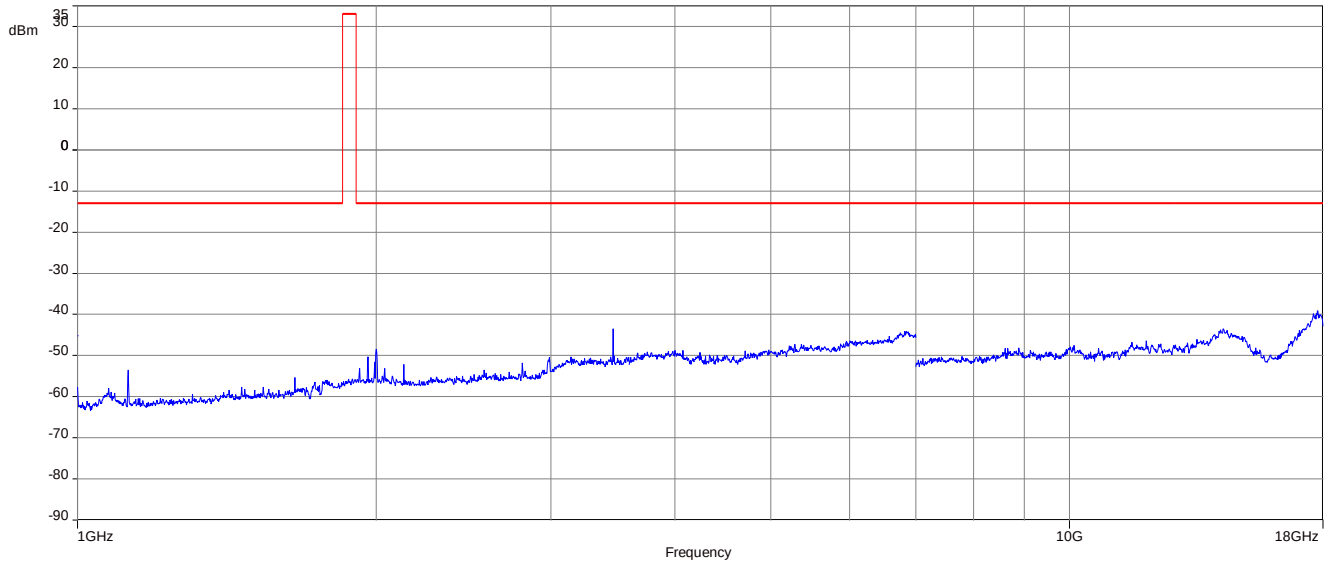
Plot 1: Middle channel, 9 kHz to 30 MHz



Plot 2: Middle channel, 30 MHz to 1 GHz



Plot 3: Middle channel, 1 GHz – 18 GHz



Carrier notched with 1.7 GHz rejection filter

9 Summary of measurement results LTE band 5

☒	No deviations from the technical specifications were ascertained
☐	There were deviations from the technical specifications ascertained
☒	This test report is only a partial test report. The content and verdict of the performed test cases are listed below.

TC identifier	Description	verdict	date	Remark
RF-Testing	CFR Part 22 RSS 132	See table	2019-03-06	Delta tests according customer demand!

9.1 LTE Cat M1

Test Case	temperature conditions	power source voltages	C	NC	NA	NP	Remark
RF Output Power	Nominal	Nominal	☒	☐	☐	☐	Radiated tests only
Frequency Stability	Extreme	Extreme	☐	☐	☐	☒	-/-
Spurious Emissions Radiated	Nominal	Nominal	☒	☐	☐	☐	-/-
Spurious Emissions Conducted	Nominal	Nominal	☐	☐	☐	☒	-/-
Block Edge Compliance	Nominal	Nominal	☐	☐	☐	☒	-/-
Occupied Bandwidth	Nominal	Nominal	☐	☐	☐	☒	-/-

9.2 LTE NB-IoT

Test Case	temperature conditions	power source voltages	C	NC	NA	NP	Remark
RF Output Power	Nominal	Nominal	☒	☐	☐	☐	Radiated tests only
Frequency Stability	Extreme	Extreme	☐	☐	☐	☒	-/-
Spurious Emissions Radiated	Nominal	Nominal	☒	☐	☐	☐	-/-
Spurious Emissions Conducted	Nominal	Nominal	☐	☐	☐	☒	-/-
Block Edge Compliance	Nominal	Nominal	☐	☐	☐	☒	-/-
Occupied Bandwidth	Nominal	Nominal	☐	☐	☐	☒	-/-

Notes:

C	Compliant	NC	Not compliant	NA	Not applicable	NP	Not performed
----------	-----------	-----------	---------------	-----------	----------------	-----------	---------------

9.3 Results LTE band 5 Cat M1

The EUT was set to transmit the maximum power.

9.3.1 RF output power

Description:

This paragraph contains conducted average power, ERP and Peak-to-Average Power Ratio measurements for the mobile station.

Measurement:

The mobile was set up for the maximum output power with pseudo random data modulation.

To determine the Peak-To-Average Power Ratio (PAPR) the measurement was performed with the Power Complementary Cumulative Distribution Function (CCDF).

Measurement parameters	
Detector:	Peak and RMS (Power in Burst)
Sweep time:	Auto
Video bandwidth:	Depends on Channel Bandwidth
Resolution bandwidth:	Depends on Channel Bandwidth
Span:	Zero Span
Trace-Mode:	Max Hold
Test setup:	Chapter 6.1 B

Limits:

FCC	IC
CFR Part 22.913 CFR Part 2.1046	RSS 132
Nominal Peak Output Power	
+38.45 dBm In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.	

Results:

Output Power (radiated)		
Frequency (MHz)	Average Output Power (dBm) QPSK	Average Output Power (dBm) 16-QAM
824.7	16.4	14.6
836.5	17.4	16.7
848.3	17.1	15.4
Measurement uncertainty: ± 3.0 dB		

9.3.2 Spurious emissions radiated

Description:

Investigation of the spectrum from 9 kHz to 9 GHz.

Measurement:

Measurement parameters	
Detector:	Peak
Sweep time:	2 sec.
Video bandwidth:	300 kHz
Resolution bandwidth:	100 kHz
Span:	100 MHz Steps
Trace-Mode:	Max Hold
Test setup:	Chapter 6.1 A & B; 6.2 C

Limits:

FCC	IC
CFR Part 22.917 CFR Part 2.1053	RSS 132
Spurious Emissions Radiated	
Attenuation $\geq 43 + 10\log(P)$ (P, Power in Watts)	
-13 dBm	

Results:

Radiated emissions measurements were made only at the center carrier frequency of the LTE band 5 (836.5 MHz). It was decided that measurements at this carrier frequency would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the LTE band V into any of the other blocks. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

The final open field radiated levels are presented on the next pages.
 All measurements were done in horizontal and vertical polarization; the plots show the worst case.
 The plots show only the middle channel. If spurious were detected, the lowest and highest channel were checked too. The found values are stated in the table below.

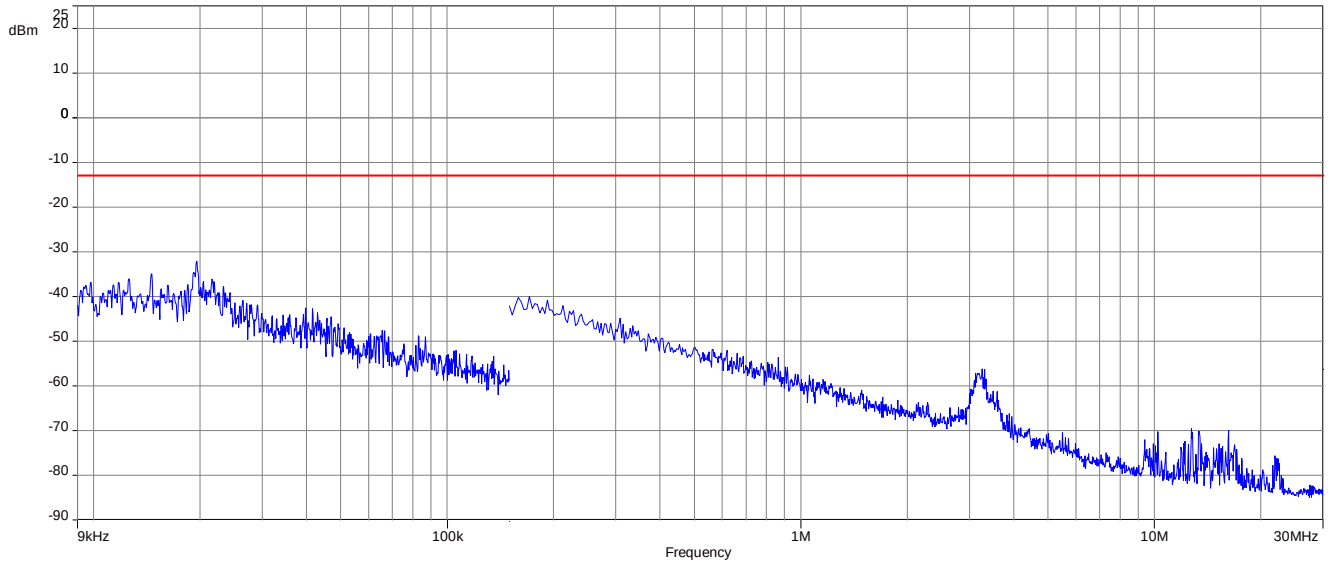
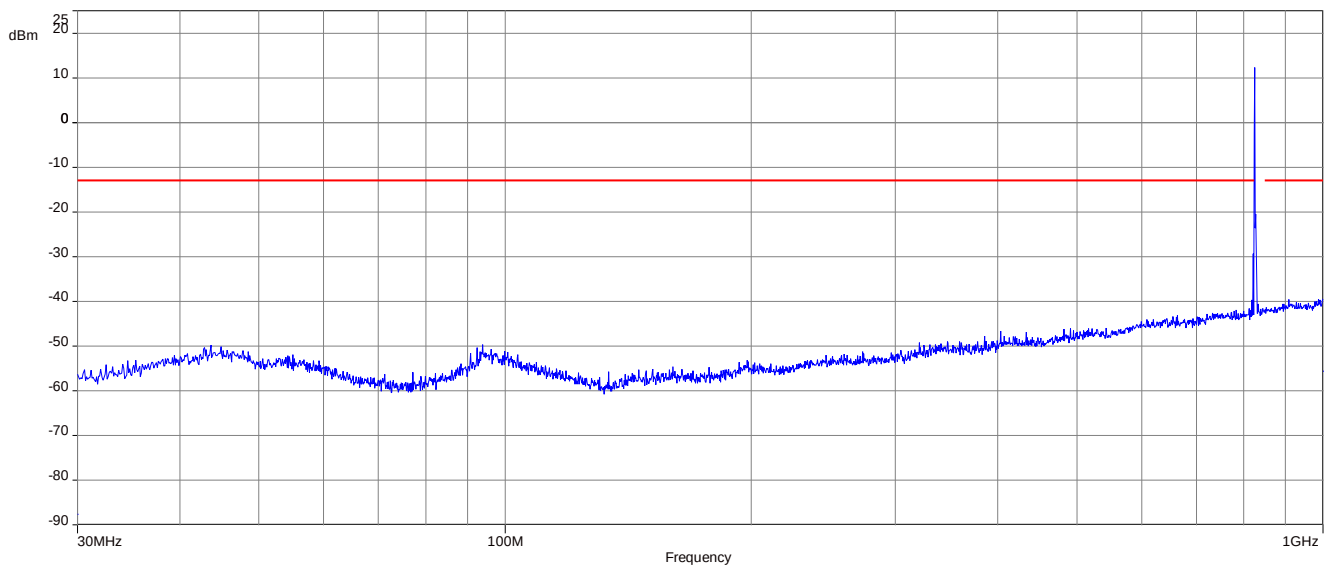
As can be seen from this data, the emissions from the test item were within the specification limit.

QPSK

Spurious emission level (dBm)					
Lowest channel		Middle channel		Highest channel	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
All detected emissions are more than 20 dB below the limit.		All detected emissions are more than 20 dB below the limit.		All detected emissions are more than 20 dB below the limit.	
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
Measurement uncertainty			± 3dB		

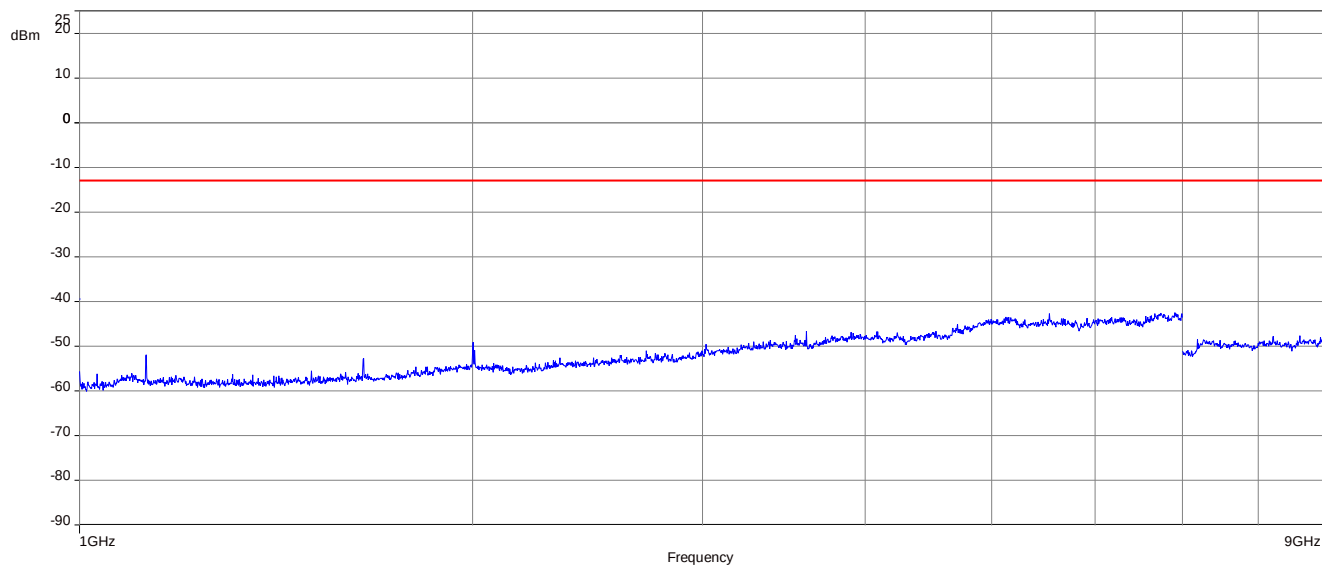
16-QAM

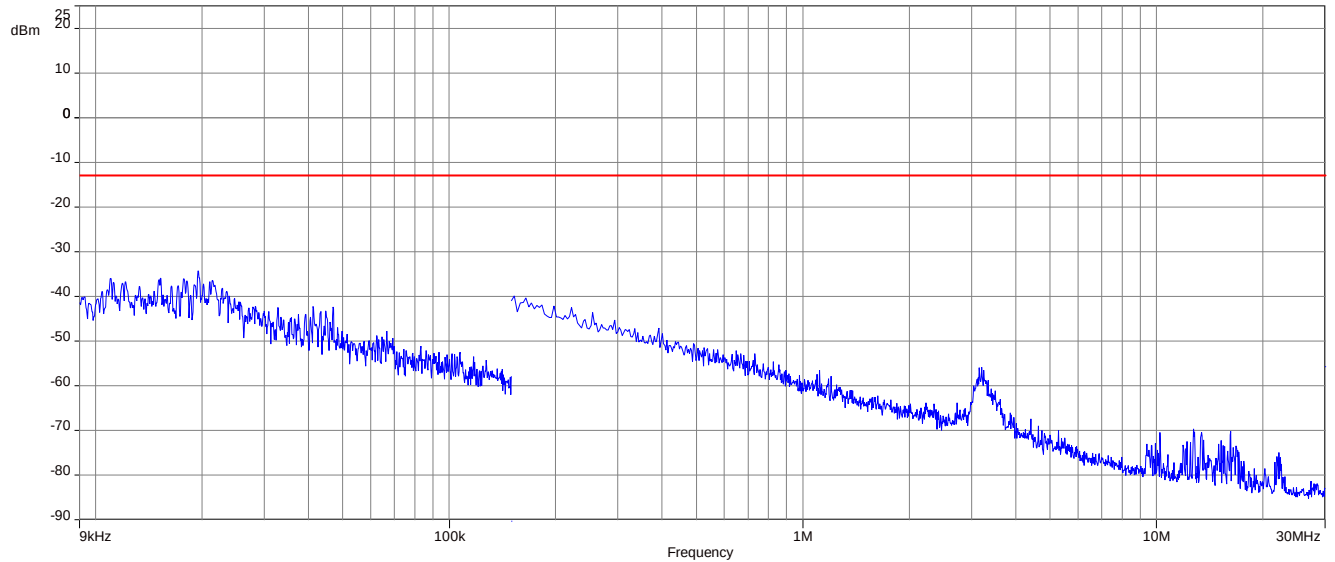
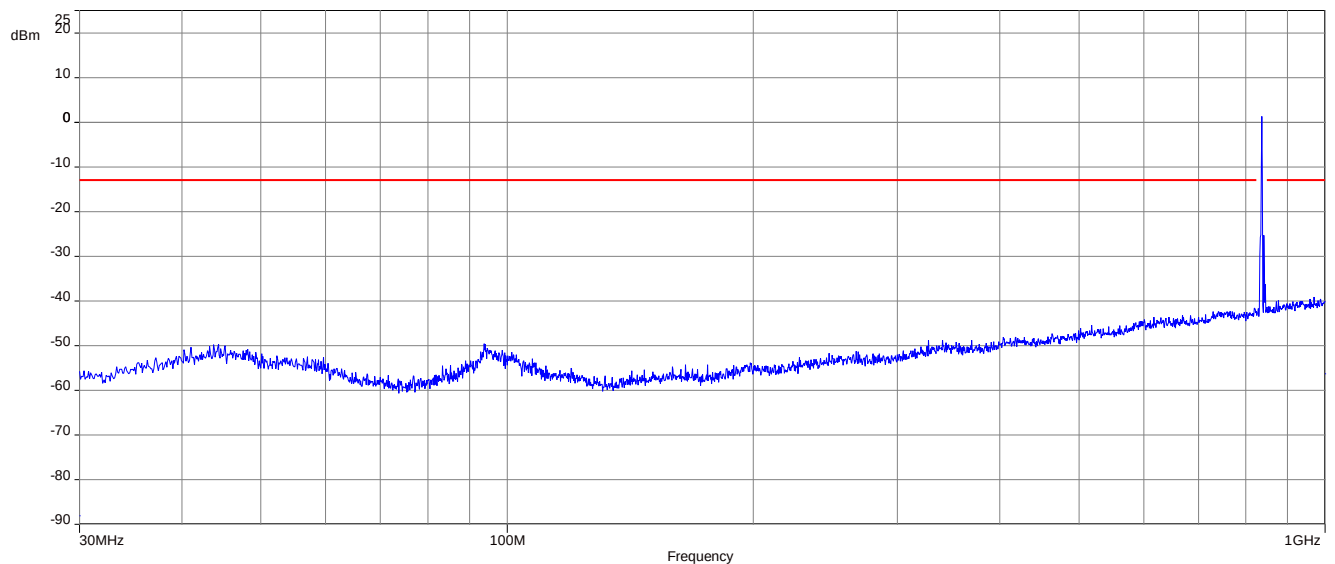
Spurious emission level (dBm)					
Lowest channel		Middle channel		Highest channel	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
All detected emissions are more than 20 dB below the limit.		All detected emissions are more than 20 dB below the limit.		All detected emissions are more than 20 dB below the limit.	
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
Measurement uncertainty			± 3dB		

QPSK:**Plot 1:** Middle channel, 9 kHz to 30 MHz**Plot 2:** Middle channel, 30 MHz to 1 GHz

Carrier notched with 800 MHz rejection filter

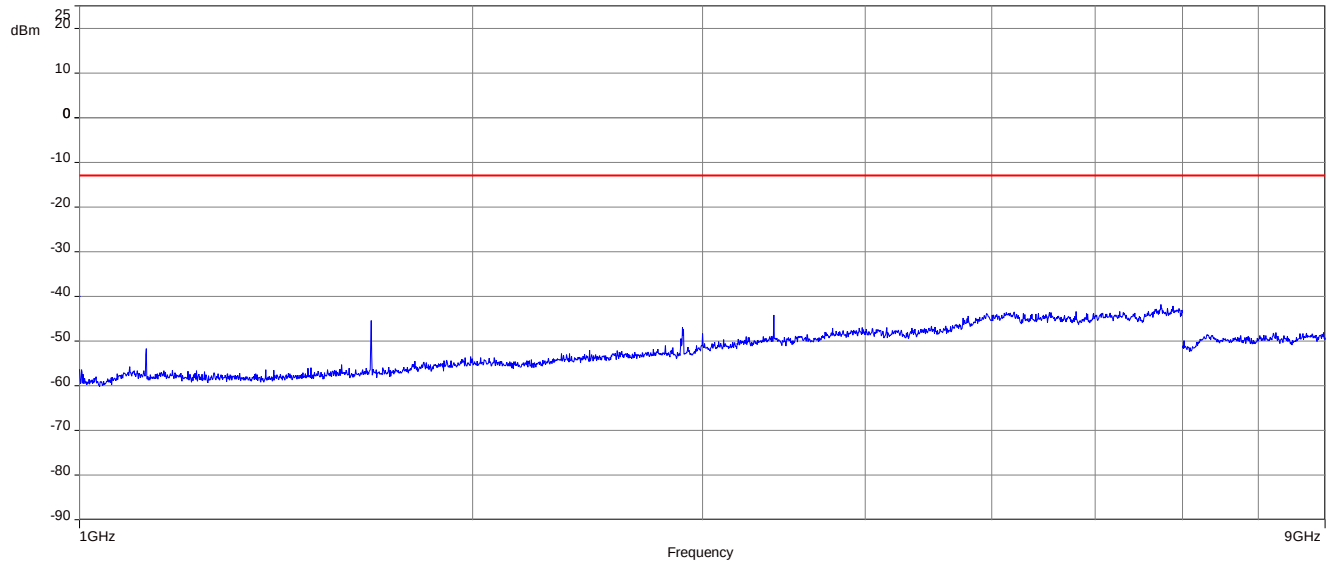
Plot 3: Middle channel, 1 GHz – 9 GHz



16-QAM:**Plot 1:** Middle channel, 9 kHz to 30 MHz**Plot 2:** Middle channel, 30 MHz to 1 GHz

Carrier notched with 800 MHz rejection filter

Plot 3: Middle channel, 1 GHz – 9 GHz



9.4 Results LTE band 5 NB-IoT

The EUT was set to transmit the maximum power.

9.4.1 RF output power

Description:

This paragraph contains conducted average power, ERP and Peak-to-Average Power Ratio measurements for the mobile station.

Measurement:

The mobile was set up for the maximum output power with pseudo random data modulation.

To determine the Peak-To-Average Power Ratio (PAPR) the measurement was performed with the Power Complementary Cumulative Distribution Function (CCDF).

Measurement parameters	
Detector:	Peak and RMS (Power in Burst)
Sweep time:	Auto
Video bandwidth:	Depends on Channel Bandwidth
Resolution bandwidth:	Depends on Channel Bandwidth
Span:	Zero Span
Trace-Mode:	Max Hold
Test setup:	Chapter 6.1 B

Limits:

FCC	IC
CFR Part 22.913 CFR Part 2.1046	RSS 132
Nominal Peak Output Power	
+38.45 dBm	
In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.	

Results:

Output Power (radiated)		
Frequency (MHz)	Average Output Power (dBm) BPSK	Average Output Power (dBm) QPSK
824.7	18.8	19.5
836.5	20.2	20.6
848.3	18.3	19.0
Measurement uncertainty: ± 3.0 dB		

9.4.2 Spurious emissions radiated

Description:

Investigation of the spectrum from 9 kHz to 9 GHz.

Measurement:

Measurement parameters	
Detector:	Peak
Sweep time:	2 sec.
Video bandwidth:	300 kHz
Resolution bandwidth:	100 kHz
Span:	100 MHz Steps
Trace-Mode:	Max Hold
Test setup:	Chapter 6.1 A & B; 6.2 C

Limits:

FCC	IC
CFR Part 22.917 CFR Part 2.1053	RSS 132
Spurious Emissions Radiated	
Attenuation $\geq 43 + 10\log(P)$ (P, Power in Watts)	
-13 dBm	

Results:

Radiated emissions measurements were made only at the center carrier frequency of the LTE band V (836.5 MHz). It was decided that measurements at this carrier frequency would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the LTE band V into any of the other blocks. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

The final open field radiated levels are presented on the next pages.
 All measurements were done in horizontal and vertical polarization; the plots show the worst case.
 The plots show only the middle channel. If spurious were detected, the lowest and highest channel were checked too. The found values are stated in the table below.

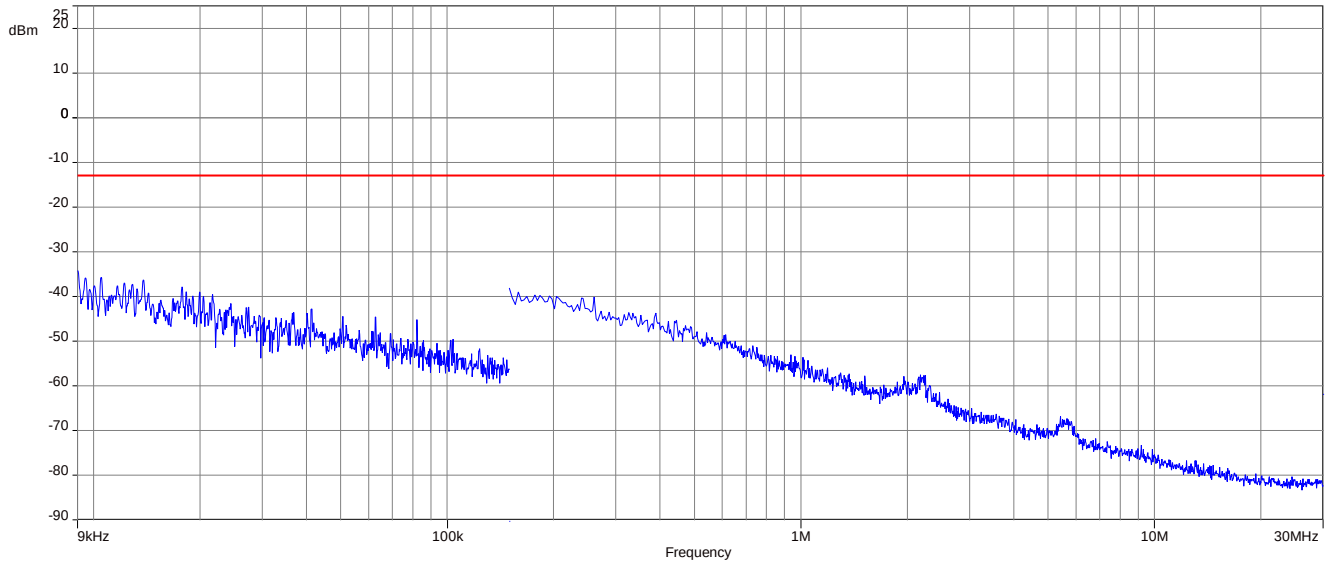
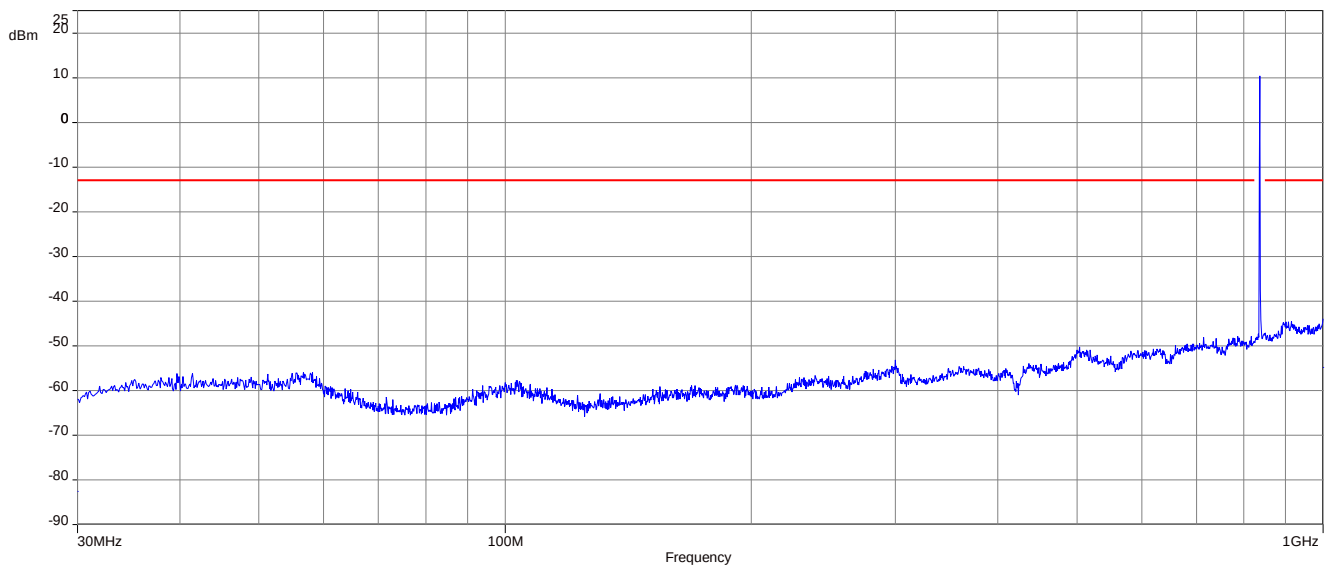
As can be seen from this data, the emissions from the test item were within the specification limit.

BPSK:

Spurious emission level (dBm)					
Lowest channel		Middle channel		Highest channel	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
All detected emissions are more than 20 dB below the limit.		All detected emissions are more than 20 dB below the limit.		All detected emissions are more than 20 dB below the limit.	
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
Measurement uncertainty			± 3dB		

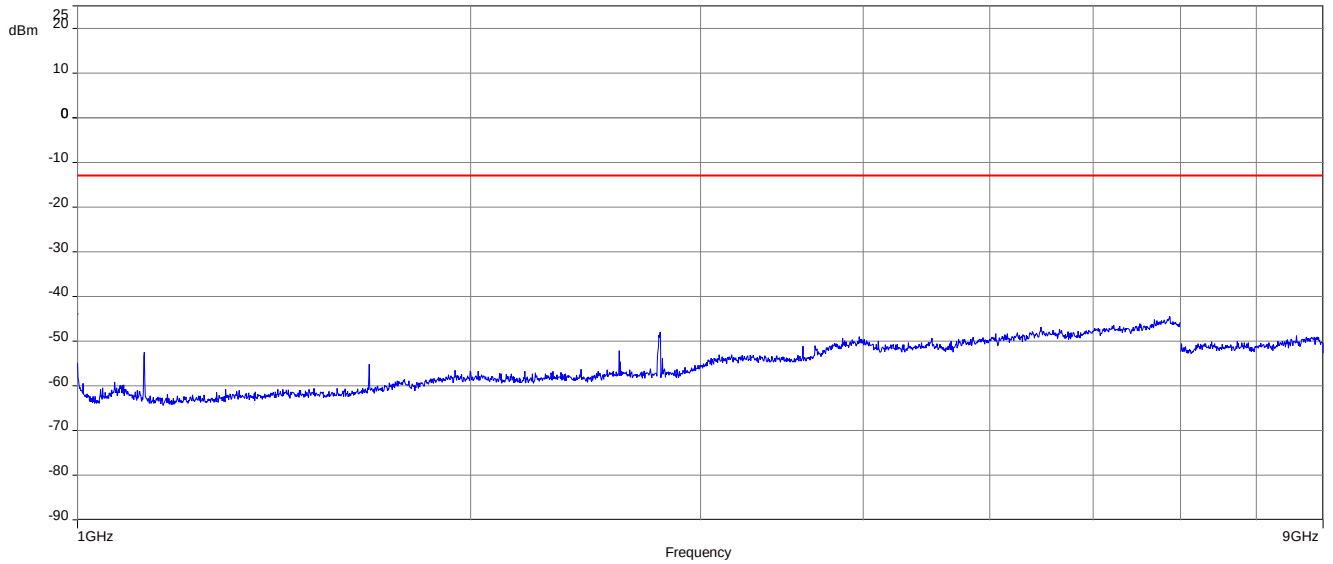
QPSK

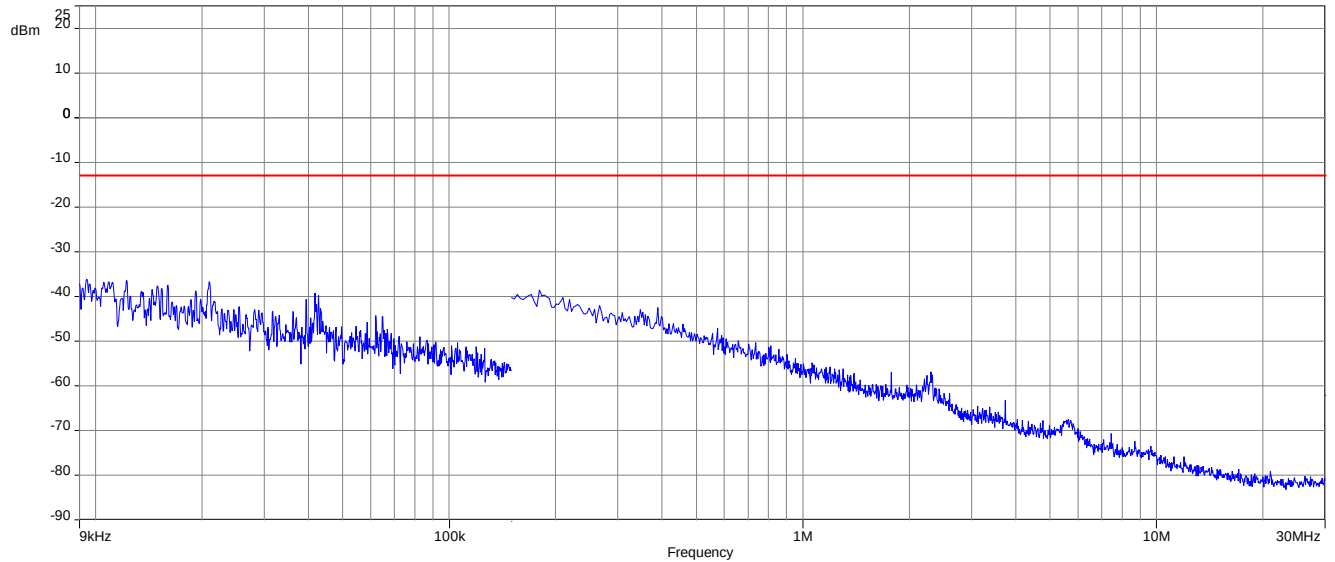
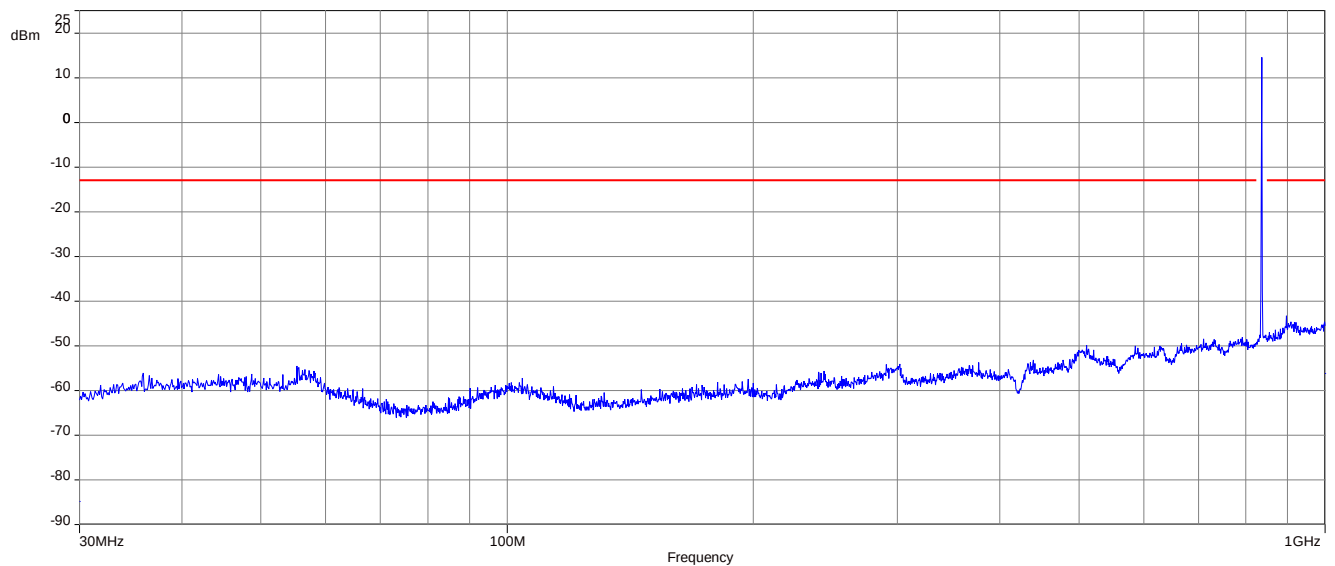
Spurious emission level (dBm)					
Lowest channel		Middle channel		Highest channel	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
All detected emissions are more than 20 dB below the limit.		All detected emissions are more than 20 dB below the limit.		All detected emissions are more than 20 dB below the limit.	
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-
Measurement uncertainty			± 3dB		

BPSK:**Plot 1:** Middle channel, 9 kHz to 30 MHz**Plot 2:** Middle channel, 30 MHz to 1 GHz

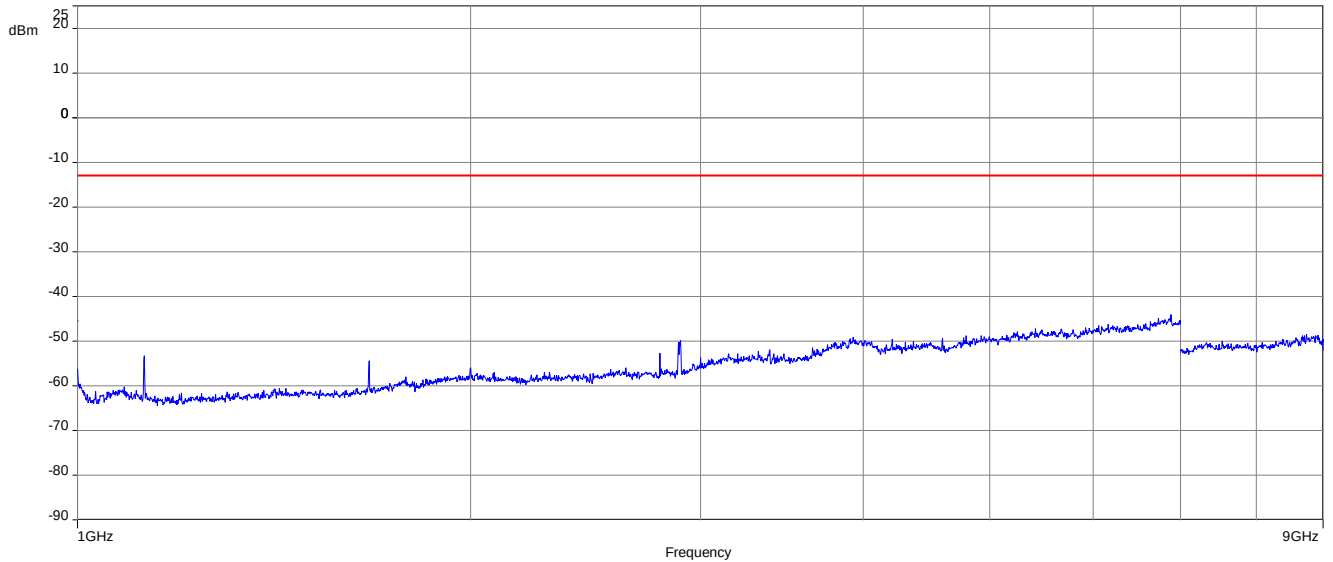
Carrier notched with 800 MHz rejection filter

Plot 3: Middle channel, 1 GHz – 9 GHz



QPSK:**Plot 1:** Middle channel, 9 kHz to 30 MHz**Plot 2:** Middle channel, 30 MHz to 1 GHz

Carrier notched with 800 MHz rejection filter

Plot 3: Middle channel, 1 GHz – 9 GHz

10 Observations

No observations except those reported with the single test cases have been made.

Annex A Glossary

EUT	Equipment under test
DUT	Device under test
UUT	Unit under test
GUE	GNSS User Equipment
ETSI	European Telecommunications Standards Institute
EN	European Standard
FCC	Federal Communications Commission
FCC ID	Company Identifier at FCC
IC	Industry Canada
PMN	Product marketing name
HMN	Host marketing name
HVIN	Hardware version identification number
FVIN	Firmware version identification number
EMC	Electromagnetic Compatibility
HW	Hardware
SW	Software
Inv. No.	Inventory number
S/N or SN	Serial number
C	Compliant
NC	Not compliant
NA	Not applicable
NP	Not performed
PP	Positive peak
QP	Quasi peak
AVG	Average
OC	Operating channel
OCW	Operating channel bandwidth
OBW	Occupied bandwidth
OOB	Out of band
DFS	Dynamic frequency selection
CAC	Channel availability check
OP	Occupancy period
NOP	Non occupancy period
DC	Duty cycle
PER	Packet error rate
CW	Clean wave
MC	Modulated carrier
WLAN	Wireless local area network
RLAN	Radio local area network
DSSS	Dynamic sequence spread spectrum
OFDM	Orthogonal frequency division multiplexing
FHSS	Frequency hopping spread spectrum
GNSS	Global Navigation Satellite System
C/N₀	Carrier to noise-density ratio, expressed in dB-Hz

Annex B Document history

Version	Applied changes	Date of release
-/-	Initial release	2019-03-06

Annex C Accreditation Certificate

first page	last page
 Deutsche Akkreditierungsstelle GmbH Entrusted according to Section 8 subsection 1 AkkStelleG in connection with Section 1 subsection 1 AkkStelleGBV Signatory to the Multilateral Agreements of EA, ILAC and IAF for Mutual Recognition Accreditation  The Deutsche Akkreditierungsstelle GmbH attests that the testing laboratory CTC advanced GmbH Untertürkheimer Straße 6-10, 66117 Saarbrücken is competent under the terms of DIN EN ISO/IEC 17025:2005 to carry out tests in the following fields: Telecommunication The accreditation certificate shall only apply in connection with the notice of accreditation of 02.06.2017 with the accreditation number D-PL-12076-01 and is valid until 21.04.2021. It comprises the cover sheet, the reverse side of the cover sheet and the following annex with a total of 43 pages. Registration number of the certificate: D-PL-12076-01-03 Frankfurt, 02.06.2017  Dep. Dir. (FH) Ralf Böker Head of Division See notes overleaf.	Deutsche Akkreditierungsstelle GmbH Office Berlin Spittelmarkt 10 10117 Berlin Office Frankfurt am Main Europa-Allee 52 60327 Frankfurt am Main Office Braunschweig Bundesallee 100 38116 Braunschweig The publication of extracts of the accreditation certificate is subject to the prior written approval by Deutsche Akkreditierungsstelle GmbH (DAKKS). Exempted is the unchanged form of separate disseminations of the cover sheet by the conformity assessment body mentioned overleaf. No impression shall be made that the accreditation also extends to fields beyond the scope of accreditation attested by DAKKS. The accreditation was granted pursuant to the Act on the Accreditation Body (AkkStelleG) of 31 July 2009 (Federal Law Gazette I p. 2625) and the Regulation (EC) No 765/2008 of the European Parliament and of the Council of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products (Official Journal of the European Union L 218 of 9 July 2008, p. 30). DAKKS is a signatory to the Multilateral Agreements for Mutual Recognition of the European co-operation for Accreditation (EA), International Accreditation Forum (IAF) and International Laboratory Accreditation Cooperation (ILAC). The signatories to these agreements recognise each other's accreditations. The up-to-date state of membership can be retrieved from the following websites: EA: www.european-accreditation.org ILAC: www.ilac.org IAF: www.iaf.nu

Note: The current certificate annex is published on the website (link see below) of the Accreditation Body DAKKS or may be received by CTC advanced GmbH on request

<https://www.dakks.de/as/ast/d/D-PL-12076-01-03.pdf>

END OF TEST REPORT