# TEST REPORT

## REPORT NUMBER: B18W50650-WWAN_Rev2

## ON

| | |
|---|---|
| **Type of Equipment:** | LTE CAT-M1(eMTC) and NB-IoT Module |
| **Model Name:** | SIM7000A |
| **Manufacturer:** | Shanghai SIMCom Wireless Solutions Limited. |

## ACCORDING TO

**FCC CFR Part 2, FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS;**

**PART 24, PERSONAL COMMUNICATIONS SERVICES;**

**PART 27,MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES.**

**Chongqing Academy of Information and Communications Technology**

***Month date, year***
*Jan, 02, 2019*

Signature

**Zhang Yan**
**Director**

**Note:**

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of Chongqing Academy of Information and Communications Technology.

**Report No.:B18W50650-WWAN_Rev2**

**Revision Version**

| Report Number | Revision | Date | Memo |
|---|---|---|---|
| B18W50650-WWAN | V1.0 | 2018-12-27 | -- |
| B18W50650-WWAN_Rev1 | V2.0 | 2018-12-30 | Revision of test report |
| B18W50650-WWAN_Rev2 | V3.0 | 2019-01-02 | Revision of test report |

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| | |
|---|---|
| **FCC ID:** | 2AJYU-SIM7000A |
| **Report Date:** | 2019-01-02 |
| **Test Firm Name:** | Chongqing Academy of Information and Communications Technology |
| **FCC Registration Number:** | CN1239 |

Statement

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported tests were carried out on a sample equipment to demonstrate limited compliance with FCC CFR 47 Parts 2, 24, 27，The sample tested was found to comply with the requirements defined in the applied rules.

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# 1 General Information

## 1.1 Notes

All reported tests were carried out on a sample equipment to demonstrate limited compliance with FCC CFR 47 Parts 2, 24, 27.

The test results of this test report relate exclusively to the item(s) tested as specified in section 2.

The following deviation from, additions to, or exclusions from the test specifications have been made. See Annex B.

**1.2 Testers**

| | |
|---|---|
| Name: | Bao Cheng |
| Position: | Engineer |
| Department: | Department of RF test |
| Date: | 2018-12-17 to 2019-01-02 |
| Signature: |  |

Editor of this test report:

| | |
|---|---|
| Name: | Chen Wen |
| Position: | Engineer |
| Department: | Department of RF test |
| Date: | 2019-01-02 |
| Signature: |  |

Technical responsibility for area of testing:

| | |
|---|---|
| Name: | Zhang Yan |
| Position: | Manager |
| Department: | Director of the laboratory |
| Date: | 2019-01-02 |
| Signature: |  |

### 1.3 Testing Laboratory information

1.3.1 Location

| | |
|---|---|
| Name: | Chongqing Academy of Information and Communications Technology |
| Address: | Building B, Technology Innovation Center, No.8, Yuma Road, Chayuan New Area, Nan'an District, Chongqing, People's Republic of China, 401336 |
| Tel: | +86-23-88069965 |
| Fax: | +86-23-88608777 |
| Email: | liqiao@caict.ac.cn |

1.3.2 Test location, where different from section 1.3.1

| | |
|---|---|
| Name: | ------ |
| Street: | ------ |
| City: | ------ |
| Country: | ------ |
| Telephone: | ------ |
| Fax: | ------ |
| Postcode: | ------ |

## 1.4 Details of applicant or manufacturer

1.4.1 Applicant

| | |
|---|---|
| Name: | Shanghai SIMCom Wireless Solutions Limited. |
| Address: | Bldg. B, SIM Technology Bldg.,No.633, Jinzhong Rd, Changning Dist., Shanghai, P.R.China, |
| Country: | China |
| Telephone: | -- |
| Fax: | -- |
| Contact: | Haisheng Zeng |
| Telephone: | -- |
| Email: | -- |

1.4.2 Manufacturer (if different from applicant in section 1.4.1)

| | |
|---|---|
| Name: | -- |
| Address: | -- |
| Country: | -- |
| Telephone: | -- |
| Fax: | -- |
| Contact: | -- |
| Telephone: | -- |
| Email: | -- |

# 2 Test Item

## 2.1 General Information

| | |
|---|---|
| Manufacturer: | Shanghai SIMCom Wireless Solutions Limited. |
| Type of Equipment: | LTE CAT-M1(eMTC) and NB-IoT Module |
| Model Name: | SIM7000A |
| Production Status: | Product |
| Hardware Version: | SIM7000A_V1.02 |
| Software Version: | SIM7000A R1529 |
| Normal Voltages | 3.80 V |
| High Voltages | 4.30 V |
| Low Voltages | 3.00 V |
| Receipt date of test item: | 2018-12-17 |

## 2.2 Outline of Equipment under Test

The SIM7000A, referred to as "EUT" hereafter, is a multi-Band wireless module operating on the LTE networks. The table below shows the supported Bands for the EUT.

| Technology | Band | UL Freq.(MHz) | DL Freq.(MHz) | Note |
|---|---|---|---|---|
| LTE | B2 | 1850 – 1910 | 1930 – 1990 | -- |
| | B4 | 1710 – 1755 | 2110 – 2155 | -- |
| | B12 | 699 – 716 | 729 – 746 | -- |
| | B13 | 777 - 787 | 746 - 756 | -- |

## 2.3 Modifications Incorporated in EUT

The EUT has not been modified from what is described by the brand name and unique type identification stated above.

## 2.4 Equipment Configuration

Equipment configuration list:

| Item | Generic Description | Manufacturer | Type | Serial No. | Remarks |
|---|---|---|---|---|---|
| A | Modules | Shanghai SIMCom Wireless Solutions Limited. | SIM7000A | 865235030045922 | None |
| B | Modules | Shanghai SIMCom Wireless Solutions Limited. | SIM7000A | 865235030049031 | None |

## 2.5 Other Information

--

## 3 Summary of Test Results

A brief summary of the tests carried out is shown as following.

| FCC Rules | Name of Test | Result |
|---|---|---|
| 2.1046<br>24.232(c), 27.50 | Conducted RF Power Output | Pass |
| 2.1049, 24.238(b) | Occupied Bandwidth | Pass |
| 2.1051, 2.1053<br>24.238, 27.53 | Conducted spurious emissions | Pass |
| 2.1051, 2.1053<br>24.238, 27.53 | Radiated Spurious Emission | Pass |
| 2.1051, 2.1053<br>24.238, 27.53 | Band Edge | Pass |
| 2.1055, 24.235<br>27.54 | Frequency Stability over Temperature Variation | Pass |
| 2.1055, 24.235<br>27.54 | Frequency Stability over Voltage Variation | Pass |
| 24.232, 27.50 | Peak to Average Ratio | Pass |
| 24.232(b) | ERP and EIRP | Pass |
| Note:-- | | |

## 4 Test Equipments and Ancillaries Used For Tests

The test equipments and ancillaries used are as follows.

| No. | Equipment | Model | SN | Manufacture | Cal. Due Date |
|---|---|---|---|---|---|
| 1 | EMI Test Receiver | ESU26 | 100367 | R&S | 2019-03-02 |
| 2 | Trilog super broad band test antenna | VULB 9163 | 9163-544 | R&S | 2019-11-24 |
| 3 | Double-Ridged Horn Antenna | HF907 | 100356 | R&S | 2019-06-22 |
| 4 | Fully-Anechoic Chamber | 11.8m×6.5 m×6.3m | -- | ETS | 2019-10-23 |
| 5 | Universal Radio Communication Tester | SP8315 | SP8315-1249 | StarPoint | 2019-03-02 |
| 6 | Signal Generator | SMU200A | 104517 | R&S | 2019-03-02 |
| 7 | Spectrum analyzer | FSQ 26 | 201137/026 | R&S | 2019-03-02 |
| 8 | DC Power Supply | N6705B | MY50000919 | Agilent | 2019-12-05 |
| 9 | Climate chamber | SH-241 | 92010759 | ESPEC | 2019-03-01 |

# 5 Test Results

## 5.1 Conducted RF Power Output

| | |
|---|---|
| **Specifications:** | FCC Part 2.1046, 24.232(c), 27.50 |
| **DUT Serial Number:** | 865235030045922 |
| **Test conditions:** | Ambient Temperature:15℃-35℃<br>Relative Humidity:30%-60%<br>Air pressure: 86-106kPa |
| **Test Results:** | Pass |

### Limit Level Construction:

**According to Part24.232(c)**, mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

**According to Part 27.50(c)**, portable stations (hand-held devices) in the 600 MHz uplink Band and the 698-746 MHz Band, and fixed and mobile stations in the 600 MHz uplink Band are limited to 3 watts ERP.

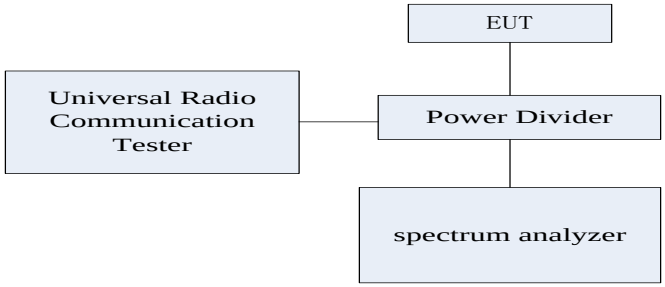
**According to Part 27.50(d)**, fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz Band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz Bands are limited to 1 watt EIRP.

**Measurement Uncertainty:**

| Item | Uncertainty |
|---|---|
| Expanded Uncertainty | 0.52 dB (k=2) |

### Test Setup:

During the test, the EUT was controlled via the Wireless Telecommunications Test Set to ensure max power transmission and proper modulation and measured by spectrum analyzer.




### Test Method:

1) The EUT was coupled to the spectrum analyzer and the Wireless Telecommunications Test Set through a power divider. The loss of the RF cables of the test system is calibrated to correct the readings.

2) For RMS power test, the spectrum analyzer was set to RMS Detector function and Maximum hold mode.

3) For Peak power test, the spectrum analyzer was set to Maxpeak Detector function and Maximum hold mode.

4) The resolution Bandwidth of the spectrum analyzer was comparable to the emission Bandwidth.

**Note:** Only worst case mode of in-band result is given below.

**5.1.1 NB-IoT Band 2**

| Maximum Average Conducted Power（dBm） | | | | | |
|---|---|---|---|---|---|
| Sub-carrier Spacing [kHz] | Modulation | $N_{tones}$ | Channel | | |
| | | | Low | Mid | High |
| 3.75 | BPSK | 1@0 | 22.95 | 23.23 | 23.10 |
| | | 1@47 | 23.08 | 23.25 | 23.18 |
| | QPSK | 1@0 | 23.20 | 23.14 | 23.15 |
| | | 1@47 | 23.10 | 23.25 | 23.11 |
| 15 | BPSK | 1@0 | 23.48 | 23.36 | 23.57 |
| | | 1@11 | 23.63 | 23.35 | 23.52 |
| | QPSK | 1@0 | 23.53 | 23.41 | 23.48 |
| | | 1@11 | 23.52 | 23.54 | 23.58 |
| | | 12@0 | 21.96 | 21.82 | 21.94 |

**5.1.2 NB-IoT Band 4**

| Maximum Average Conducted Power（dBm） | | | | | |
|---|---|---|---|---|---|
| Sub-carrier Spacing [kHz] | Modulation | $N_{tones}$ | Channel | | |
| | | | Low | Mid | High |
| 3.75 | BPSK | 1@0 | 23.26 | 23.43 | 23.57 |
| | | 1@47 | 23.30 | 23.50 | 23.62 |
| | QPSK | 1@0 | 23.37 | 23.51 | 23.61 |
| | | 1@47 | 23.35 | 23.50 | 23.60 |
| 15 | BPSK | 1@0 | 23.53 | 23.70 | 23.77 |
| | | 1@11 | 23.60 | 23.72 | 23.83 |
| | QPSK | 1@0 | 23.50 | 23.62 | 23.75 |
| | | 1@11 | 23.60 | 23.77 | 23.79 |
| | | 12@0 | 21.70 | 21.80 | 21.91 |

**5.1.3 NB-IoT Band 12**

| Maximum Average Conducted Power（dBm） | | | | | |
|---|---|---|---|---|---|
| Sub-carrier Spacing [kHz] | Modulation | $N_{tones}$ | Channel | | |
| | | | Low | Mid | High |
| 3.75 | BPSK | 1@0 | 23.50 | 23.26 | 23.27 |
| | | 1@47 | 23.57 | 23.31 | 23.21 |
| | QPSK | 1@0 | 23.60 | 23.25 | 23.27 |
| | | 1@47 | 23.55 | 23.26 | 23.19 |
| 15 | BPSK | 1@0 | 23.80 | 23.15 | 23.60 |
| | | 1@11 | 24.02 | 23.17 | 23.68 |
| | QPSK | 1@0 | 23.68 | 23.10 | 23.77 |
| | | 1@11 | 23.80 | 23.20 | 23.68 |
| | | 12@0 | 22.27 | 21.67 | 22.12 |

**5.1.4 NB-IoT Band 13**

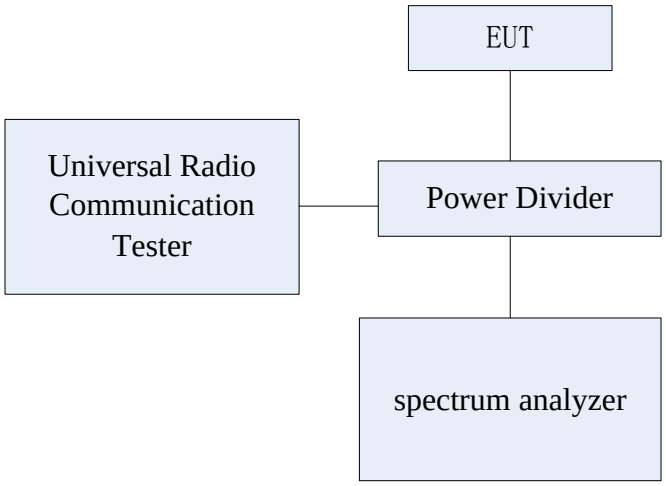
| Maximum Average Conducted Power（dBm） | | | | | |
|---|---|---|---|---|---|
| Sub-carrier Spacing [kHz] | Modulation | $N_{tones}$ | Channel | | |
| | | | Low | Mid | High |
| 3.75 | BPSK | 1@0 | 23.58 | 23.55 | 22.62 |
| | | 1@47 | 23.56 | 23.57 | 22.67 |
| | QPSK | 1@0 | 23.47 | 23.63 | 22.60 |
| | | 1@47 | 23.49 | 23.61 | 22.60 |
| 15 | BPSK | 1@0 | 23.81 | 23.84 | 23.95 |
| | | 1@11 | 23.96 | 23.87 | 23.93 |
| | QPSK | 1@0 | 23.90 | 23.78 | 23.80 |
| | | 1@11 | 23.96 | 23.81 | 23.87 |
| | | 12@0 | 22.30 | 22.19 | 22.35 |

## 5.2 Occupied Bandwidth

| | |
|---|---|
| **Specifications:** | FCC Part 2.1049, 24.238(b) |
| **DUT Serial Number:** | 865235030045922 |
| **Test conditions:** | Ambient Temperature:15℃-35℃<br>Relative Humidity:30%-60%<br>Air pressure: 86-106kPa |
| **Test Results:** | -- |

### Test Setup

During the test, the EUT was controlled via the Wireless Communications Test Set to ensure max power transmission and proper modulation and measured by spectrum analyzer.




**Measurement Uncertainty:**

| Item | Uncertainty |
|---|---|
| Expanded Uncertainty | 69 kHz (k=2) |

### Test Method

The 99% occupied Bandwidth was calculated from the spectrum analyzer. Markers in the spectrum analyzer were then placed between the calculated frequencies to show the calculated 99% power Band. The 26dB Bandwidth was also measured and recorded.

**Note:** For Occupied Bandwidth test, the EUT working in Sub-carrier Spacing 15 kHz, full tones mode is the worst case mode.

### 5.1.1 NB-IoT Band 2

**NB-IoT standalone Test frequencies for operating band 2**

| Frequency ID | $N_{UL}$ | $N_{tones}$ | Sub-carrier Spacing [kHz] | Occupied Bandwidth（99%）（kHz） | | Occupied Bandwidth（26dB）（kHz） | |
|---|---|---|---|---|---|---|---|
| | | | | QPSK | BPSK | QPSK | BPSK |
| Low Range | 18601 | 12@0 | 15 | 187.5 | 190.7 | 243.6 | 245.2 |
| Mid Range | 18900 | | | 187.5 | 190.7 | 242.0 | 245.2 |
| High Range | 19199 | | | 187.5 | 190.7 | 246.8 | 245.2 |

**NB-IoT in-band Test frequencies for operating band 2**

| Frequency ID | $N_{UL}$ | $N_{tones}$ | Sub-carrier Spacing [kHz] | Occupied Bandwidth（99%）（kHz） | | Occupied Bandwidth（26dB）（kHz） | |
|---|---|---|---|---|---|---|---|
| | | | | QPSK | BPSK | QPSK | BPSK |
| Low Range | 18601 | 12@0 | 15 | 187.5 | 189.1 | 240.4 | 245.2 |
| Mid Range | 18900 | | | 187.5 | 193.9 | 245.2 | 243.6 |
| High Range | 19199 | | | 187.5 | 189.1 | 243.6 | 243.6 |

**NB-IoT guard-band Test frequencies for operating band 2**

| Frequency ID | $N_{UL}$ | $N_{tones}$ | Sub-carrier Spacing [kHz] | Occupied Bandwidth（99%）（kHz） | | Occupied Bandwidth（26dB）（kHz） | |
|---|---|---|---|---|---|---|---|
| | | | | QPSK | BPSK | QPSK | BPSK |
| Low Range | 18601 | 12@0 | 15 | 187.5 | 195.5 | 246.8 | 243.6 |
| Mid Range | 18900 | | | 187.5 | 185.9 | 251.6 | 245.2 |
| High Range | 19199 | | | 185.9 | 190.7 | 245.2 | 245.2 |

### 5.1.2 NB-IoT Band 4

**NB-IoT standalone Test frequencies for operating band 4**

| Frequency ID | $N_{UL}$ | $N_{tones}$ | Sub-carrier Spacing [kHz] | Occupied Bandwidth（99%）（kHz） | | Occupied Bandwidth（26dB）（kHz） | |
|---|---|---|---|---|---|---|---|
| | | | | QPSK | BPSK | QPSK | BPSK |
| Low Range | 19951 | 12@0 | 15 | 185.9 | 192.3 | 243.3 | 254.8 |
| Mid Range | 20175 | | | 185.9 | 189.1 | 250.0 | 242.0 |
| High Range | 20399 | | | 184.30 | 192.3 | 243.6 | 248.4 |

**NB-IoT in-band Test frequencies for operating band 4**

| Frequency ID | $N_{UL}$ | $N_{tones}$ | Sub-carrier Spacing [kHz] | Occupied Bandwidth（99%）（kHz） | | Occupied Bandwidth（26dB）（kHz） | |
|---|---|---|---|---|---|---|---|
| | | | | QPSK | BPSK | QPSK | BPSK |
| Low Range | 19951 | 12@0 | 15 | 187.5 | 189.1 | 246.8 | 245.2 |
| Mid Range | 20175 | | | 184.3 | 193.9 | 240.4 | 243.6 |
| High Range | 20399 | | | 187.5 | 190.7 | 253.2 | 242.0 |

**NB-IoT guard-band Test frequencies for operating band 4**

| Frequency ID | $N_{UL}$ | $N_{tones}$ | Sub-carrier Spacing [kHz] | Occupied Bandwidth（99%）（kHz） | | Occupied Bandwidth（26dB）（kHz） | |
|---|---|---|---|---|---|---|---|
| | | | | QPSK | BPSK | QPSK | BPSK |
| Low Range | 19951 | 12@0 | 15 | 185.9 | 197.1 | 246.8 | 254.8 |
| Mid Range | 20175 | | | 185.9 | 193.9 | 248.4 | 246.8 |
| High Range | 20399 | | | 187.5 | 187.5 | 248.4 | 246.8 |

**5.1.3 NB-IoT Band 12**

**NB-IoT standalone Test frequencies for operating band 12**

| Frequency ID | $N_{UL}$ | $N_{tones}$ | Sub-carrier Spacing [kHz] | Occupied Bandwidth（99%）（kHz） | | Occupied Bandwidth（26dB）（kHz） | |
|---|---|---|---|---|---|---|---|
| | | | | QPSK | BPSK | QPSK | BPSK |
| Low Range | 23011 | 12@0 | 15 | 187.5 | 193.9 | 242.0 | 246.8 |
| Mid Range | 23095 | | | 189.1 | 187.5 | 248.4 | 243.6 |
| High Range | 23179 | | | 185.9 | 189.1 | 240.4 | 246.8 |

**NB-IoT in-band Test frequencies for operating band 12**

| Frequency ID | $N_{UL}$ | $N_{tones}$ | Sub-carrier Spacing [kHz] | Occupied Bandwidth（99%）（kHz） | | Occupied Bandwidth（26dB）（kHz） | |
|---|---|---|---|---|---|---|---|
| | | | | QPSK | BPSK | QPSK | BPSK |
| Low Range | 23011 | 12@0 | 15 | 187.5 | 189.1 | 245.2 | 243.6 |
| Mid Range | 23095 | | | 187.5 | 195.5 | 243.6 | 246.8 |
| High Range | 23179 | | | 187.5 | 192.3 | 245.2 | 245.2 |

**NB-IoT guard-band Test frequencies for operating band 12**

| Frequency ID | $N_{UL}$ | $N_{tones}$ | Sub-carrier Spacing [kHz] | Occupied Bandwidth（99%）（kHz） | | Occupied Bandwidth（26dB）（kHz） | |
|---|---|---|---|---|---|---|---|
| | | | | QPSK | BPSK | QPSK | BPSK |
| Low Range | 23011 | 12@0 | 15 | 187.5 | 190.7 | 245.2 | 246.8 |
| Mid Range | 23095 | | | 187.5 | 192.3 | 242.0 | 246.8 |
| High Range | 23179 | | | 187.5 | 192.3 | 253.2 | 246.8 |

**5.1.4 NB-IoT Band 13**

**NB-IoT standalone Test frequencies for operating band 13**

| Frequency ID | $N_{UL}$ | $N_{tones}$ | Sub-carrier Spacing [kHz] | Occupied Bandwidth（99%）（kHz） | | Occupied Bandwidth（26dB）（kHz） | |
|---|---|---|---|---|---|---|---|
| | | | | QPSK | BPSK | QPSK | BPSK |
| Low Range | 23181 | 12@0 | 15 | 185.9 | 193.9 | 243.6 | 248.4 |
| Mid Range | 23230 | | | 187.5 | 189.1 | 242.0 | 256.4 |
| High Range | 23279 | | | 189.1 | 190.7 | 248.4 | 243.6 |

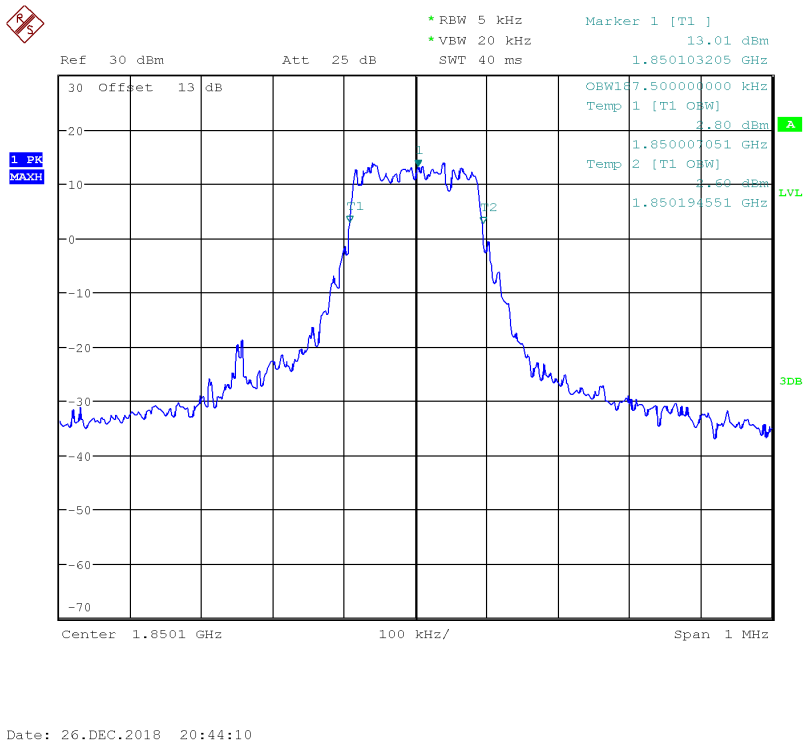
**NB-IoT in-band Test frequencies for operating band 13**

| Frequency ID | $N_{UL}$ | $N_{tones}$ | Sub-carrier Spacing [kHz] | Occupied Bandwidth（99%）（kHz） | | Occupied Bandwidth（26dB）（kHz） | |
|---|---|---|---|---|---|---|---|
| | | | | QPSK | BPSK | QPSK | BPSK |
| Low Range | 23181 | 12@0 | 15 | 187.5 | 192.3 | 253.2 | 243.6 |
| Mid Range | 23230 | | | 187.5 | 189.1 | 243.6 | 248.4 |
| High Range | 23279 | | | 187.5 | 192.3 | 250.0 | 246.8 |

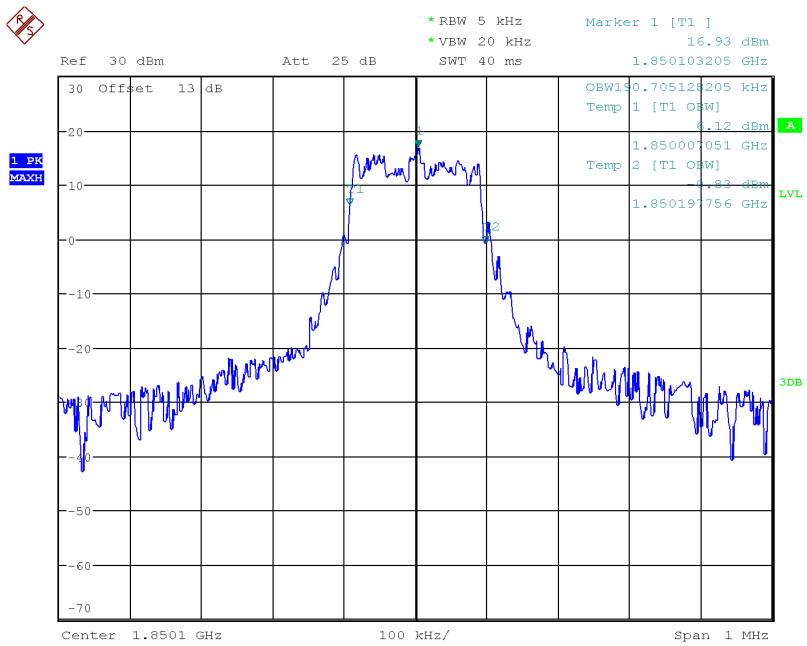
**NB-IoT guard-band Test frequencies for operating band 13**

| Frequency ID | $N_{UL}$ | $N_{tones}$ | Sub-carrier Spacing [kHz] | Occupied Bandwidth（99%）（kHz） | | Occupied Bandwidth（26dB）（kHz） | |
|---|---|---|---|---|---|---|---|
| | | | | QPSK | BPSK | QPSK | BPSK |
| Low Range | 23181 | 12@0 | 15 | 185.9 | 189.1 | 243.6 | 256.4 |
| Mid Range | 23230 | | | 184.3 | 189.1 | 250.0 | 246.8 |
| High Range | 23279 | | | 185.9 | 190.7 | 243.6 | 246.8 |

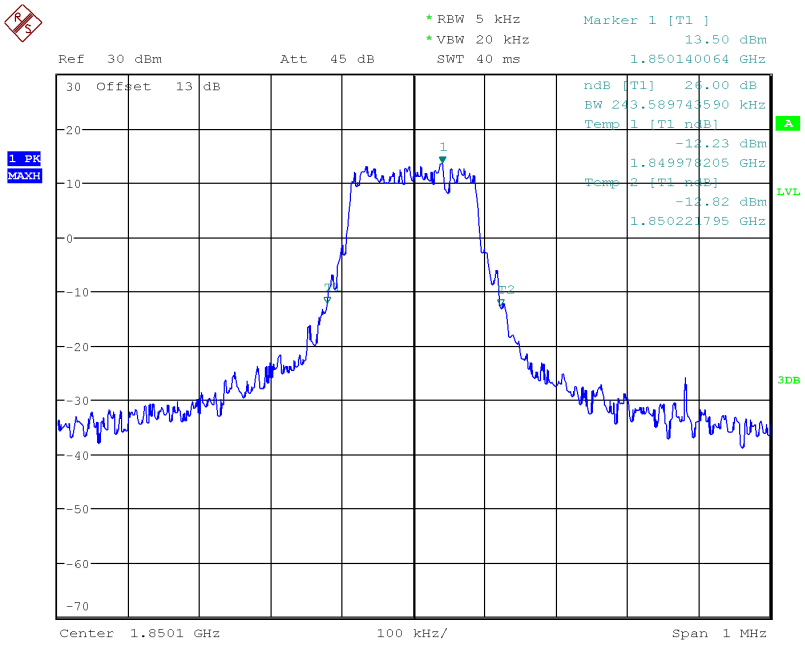
**Graphical results for Band2:**




NB-IoT standalone band 2 18601 QPSK(99%)

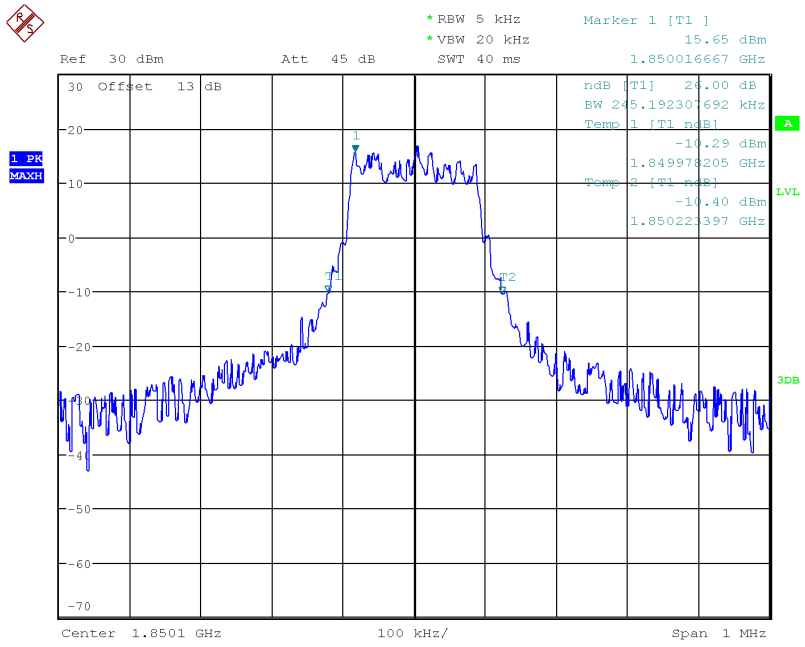



NB-IoT standalone band 2 18601 BPSK(99%)



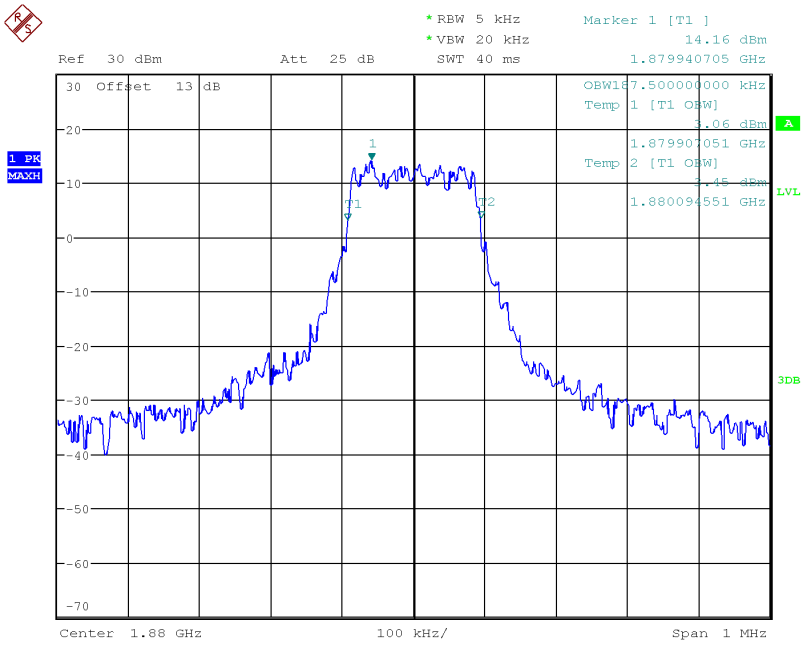

Date: 26.DEC.2018 20:44:41

NB-IoT standalone band 2 18601 QPSK(26dB)

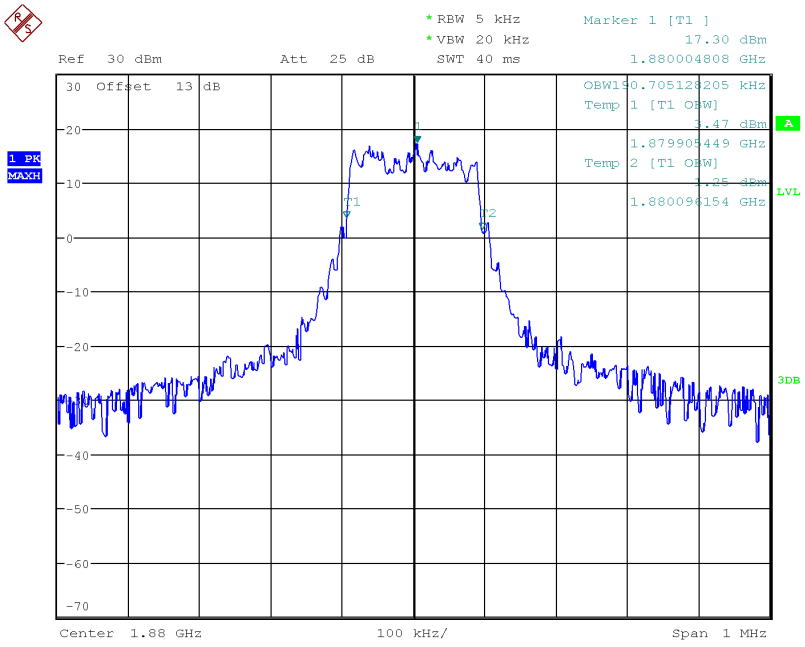



Date: 26.DEC.2018 20:45:16

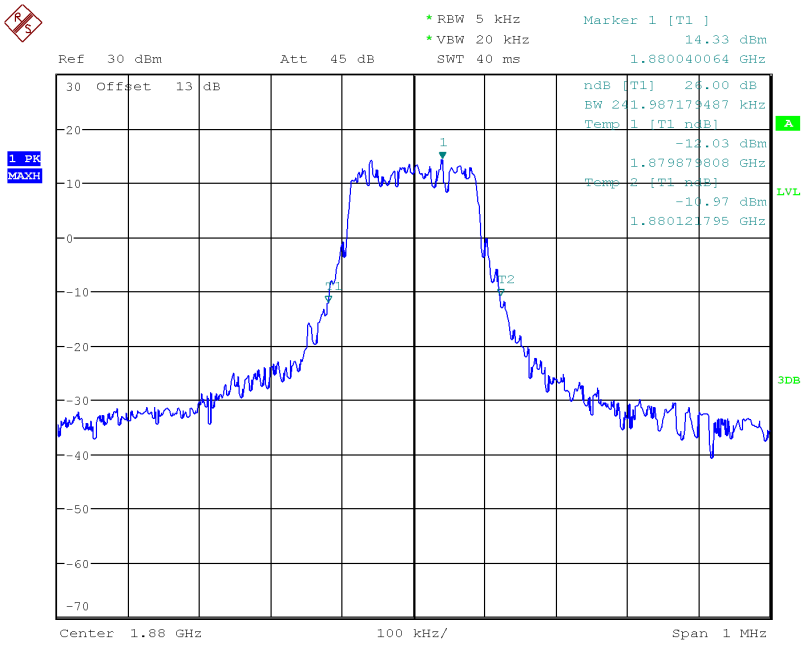
NB-IoT standalone band 2 18601 BPSK(26dB)




NB-IoT standalone band 2 18900 QPSK(99%)




NB-IoT standalone band 2 18900 BPSK(99%)

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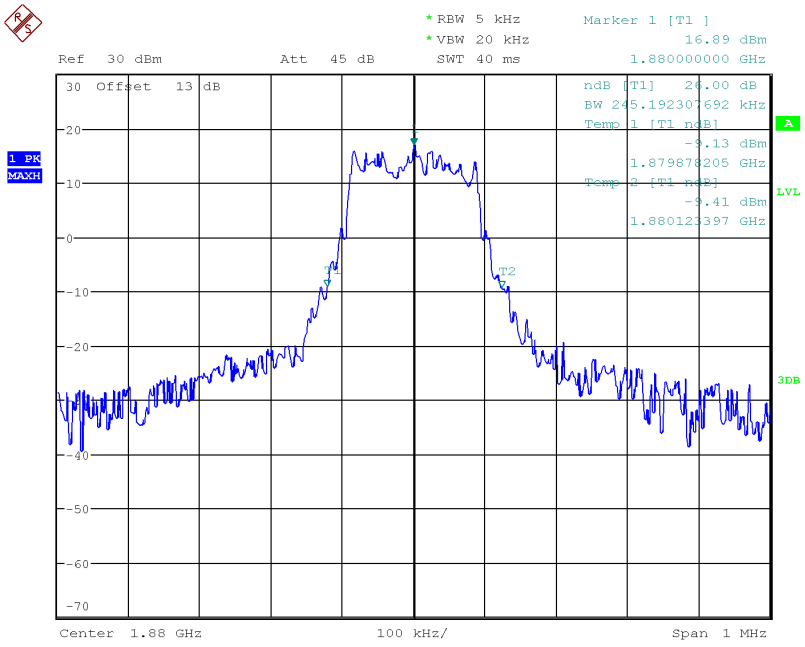


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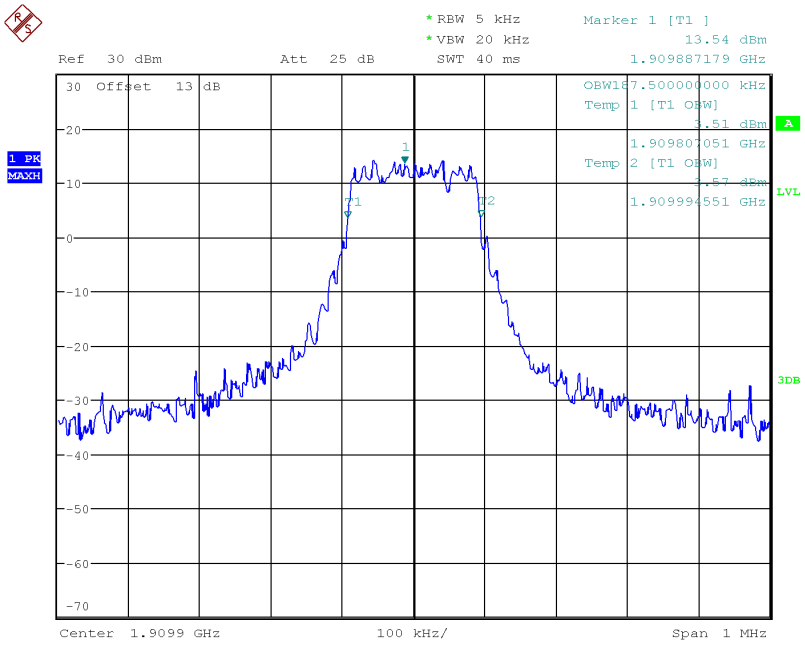
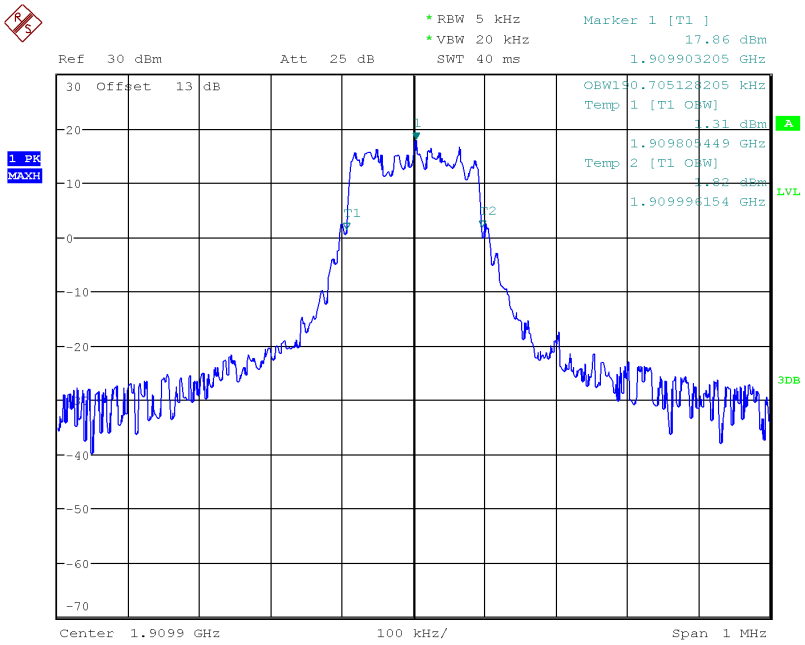



Date: 26.DEC.2018 20:50:22

NB-IoT standalone band 2 19199 QPSK(99%)




Date: 26.DEC.2018 20:51:53

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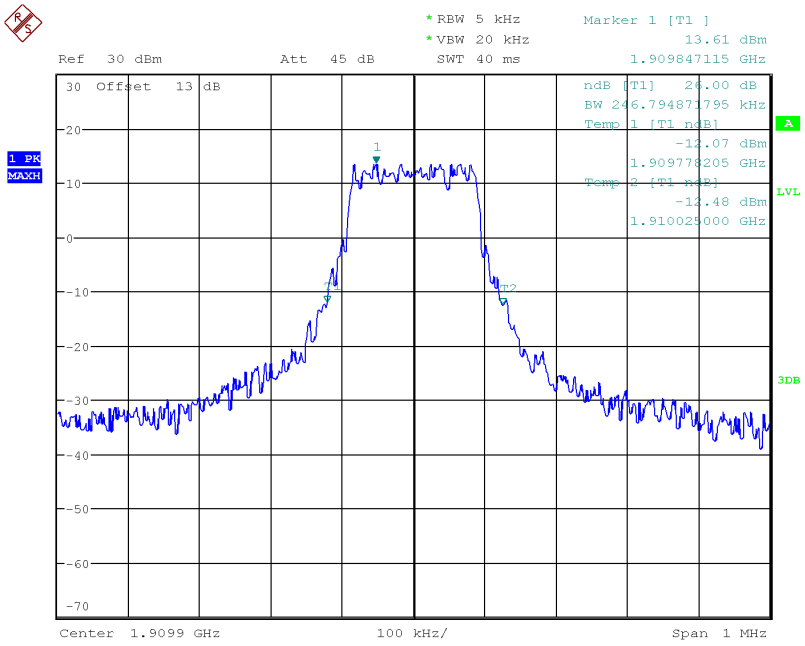
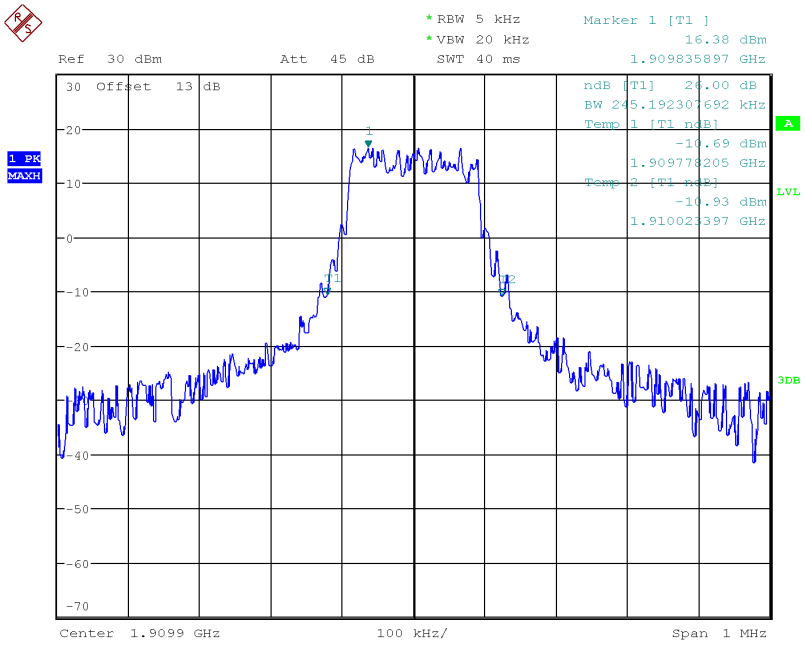



NB-IoT standalone band 2 19199 QPSK(26dB)

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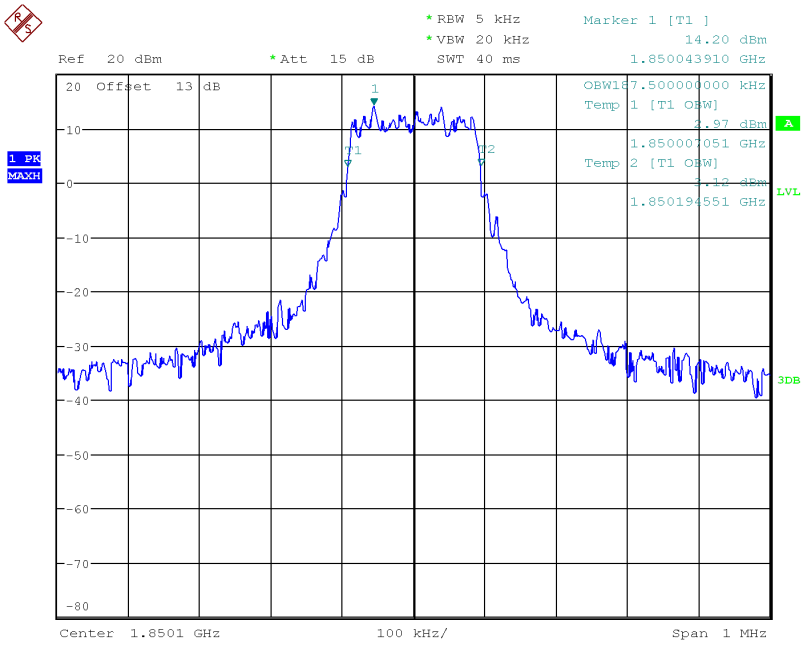
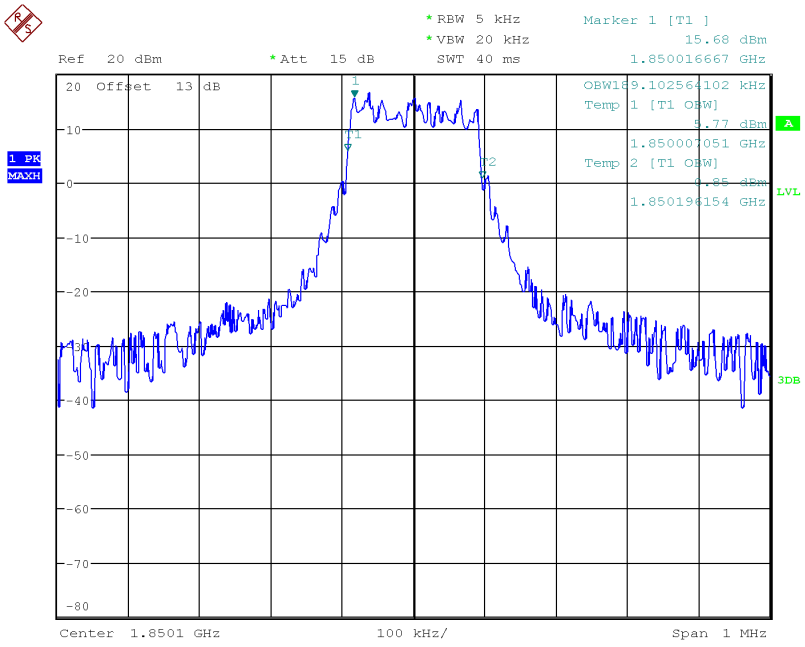
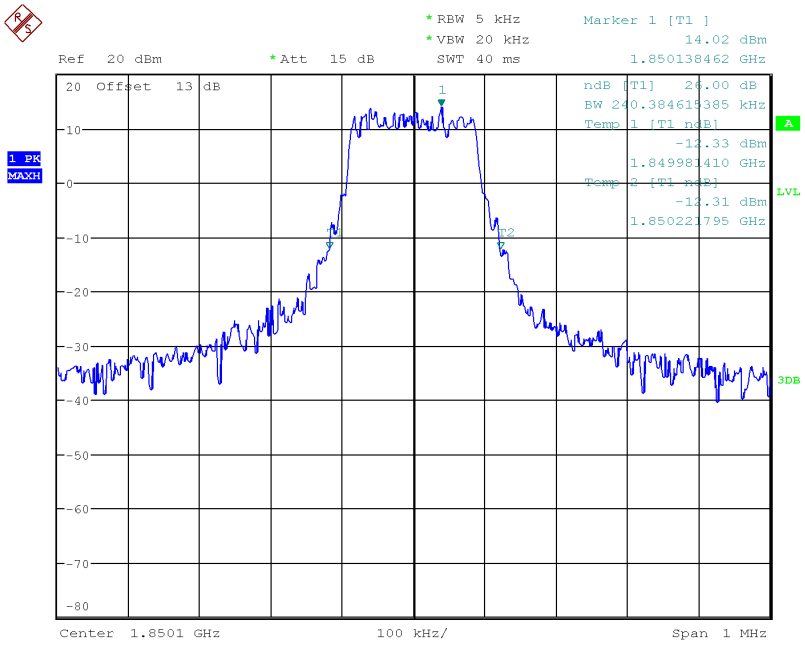



NB-IoT In-band band 2 18601 QPSK(99%)




NB-IoT In-band band 2 18601 BPSK(99%)

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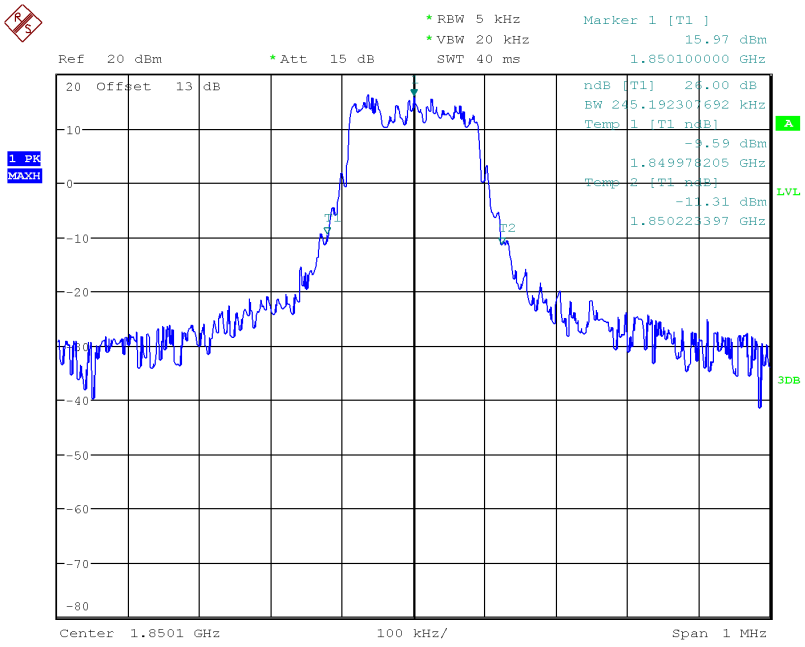


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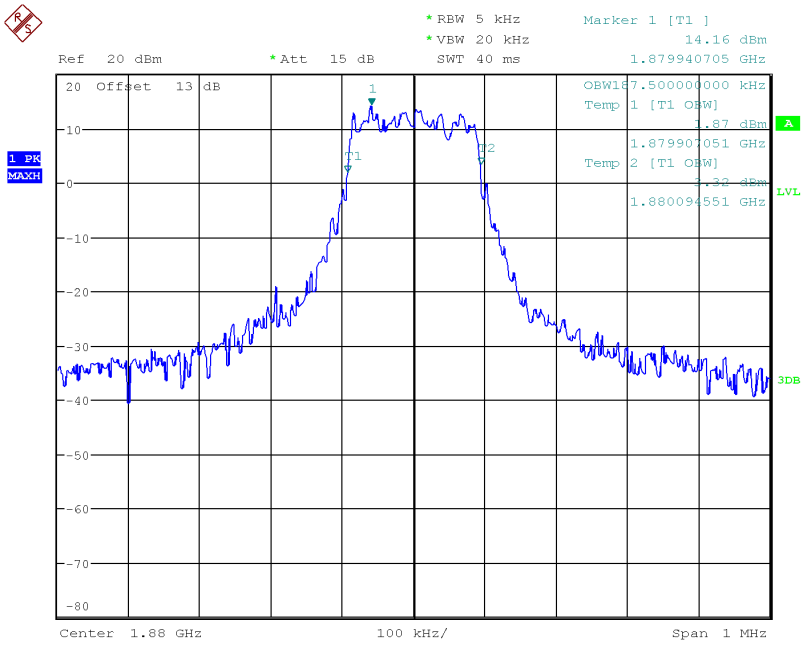


Date: 26.DEC.2018 20:57:35

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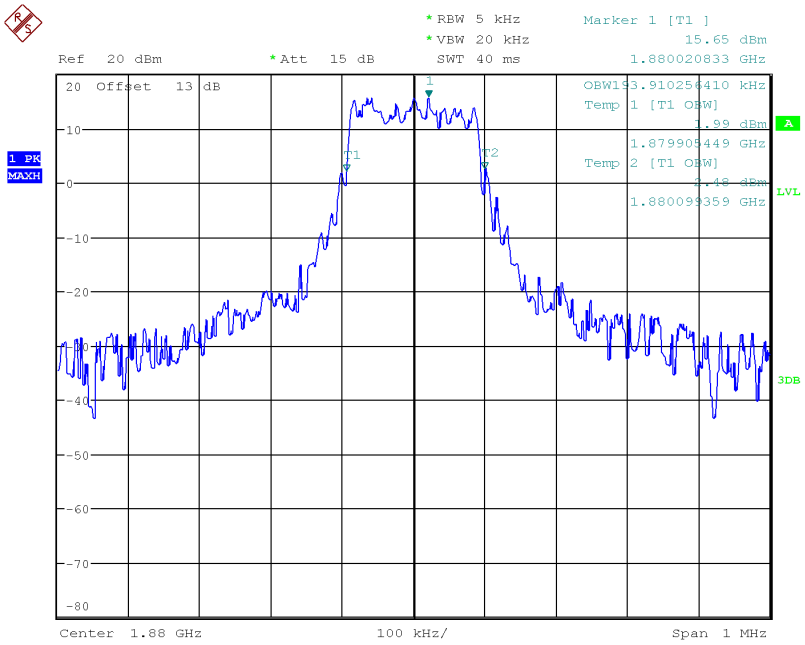


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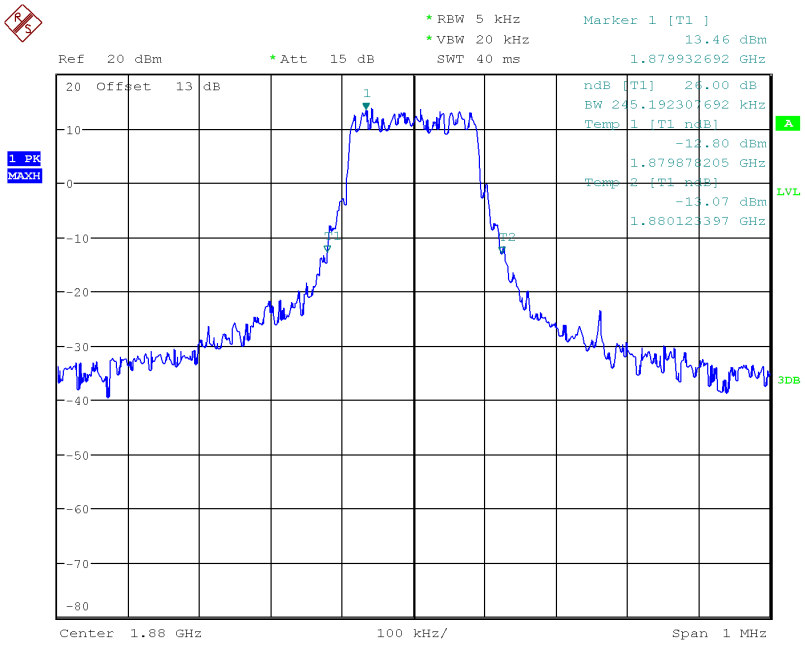
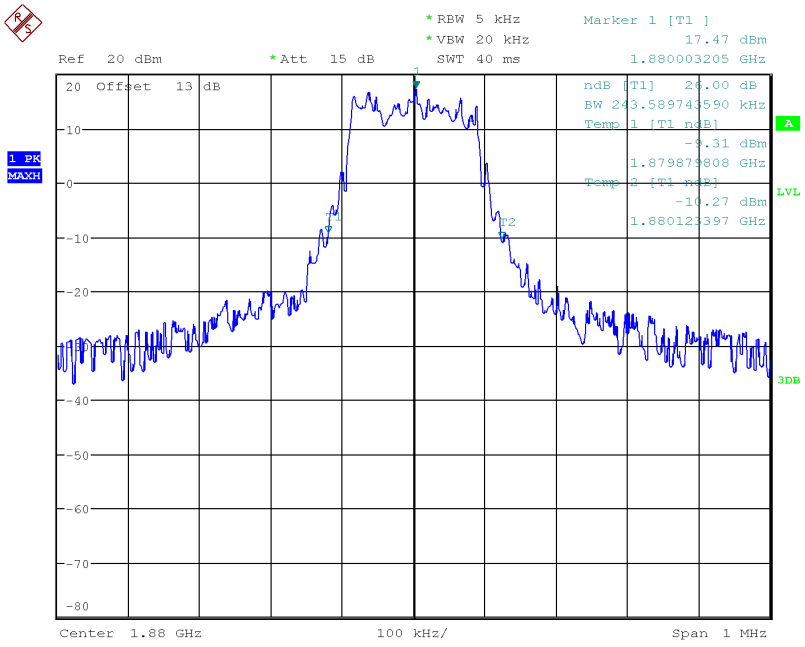
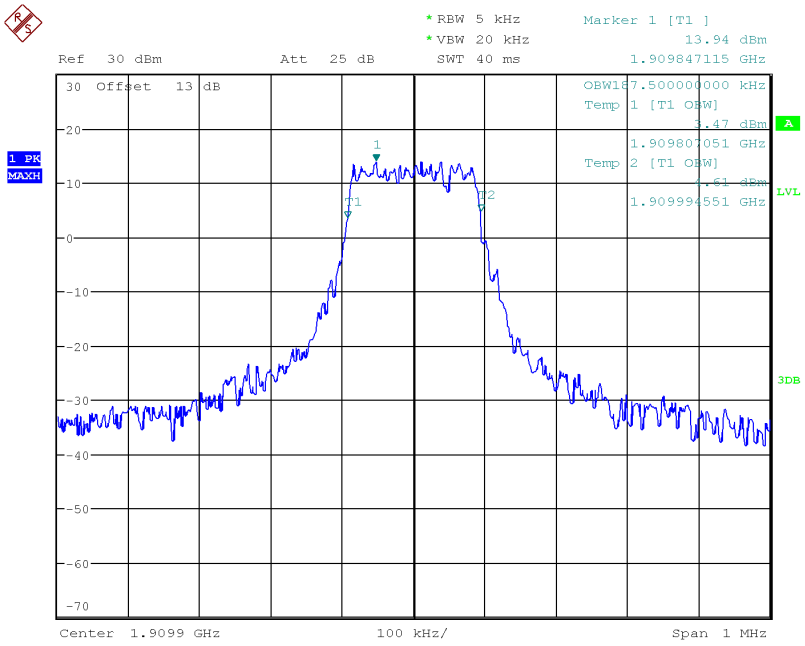


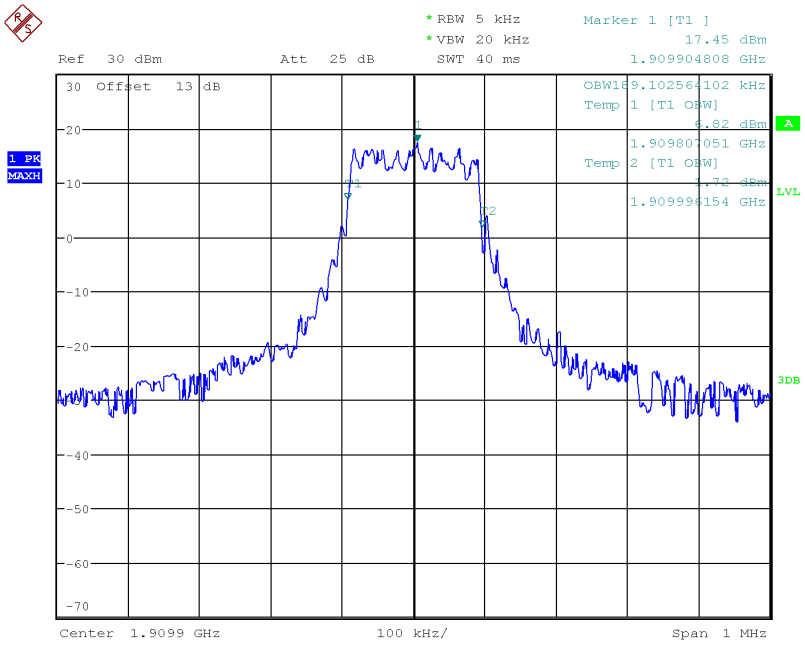

NB-IoT In-band band 2 18900 QPSK(26dB)




NB-IoT In-band band 2 18900 BPSK(26dB)




NB-IoT In-band band 2 19199 QPSK(99%)

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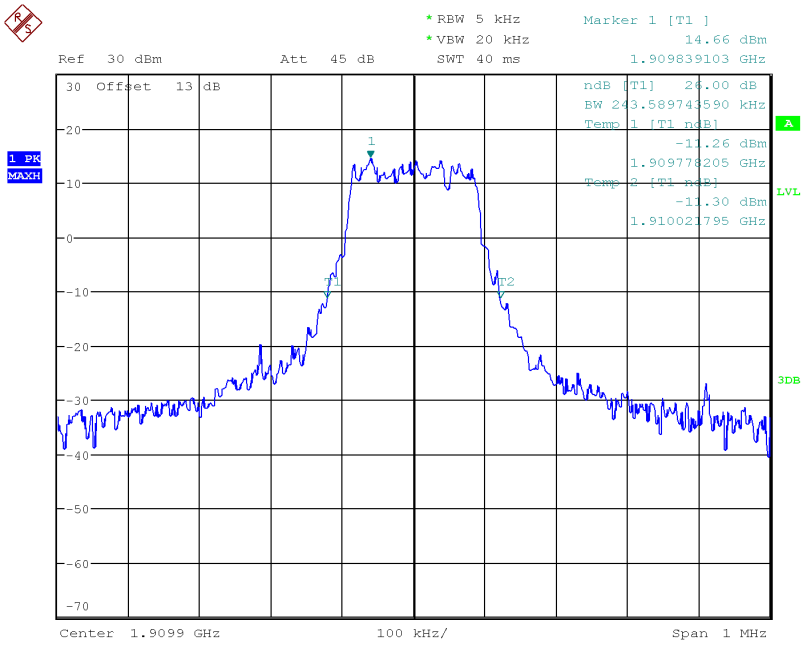


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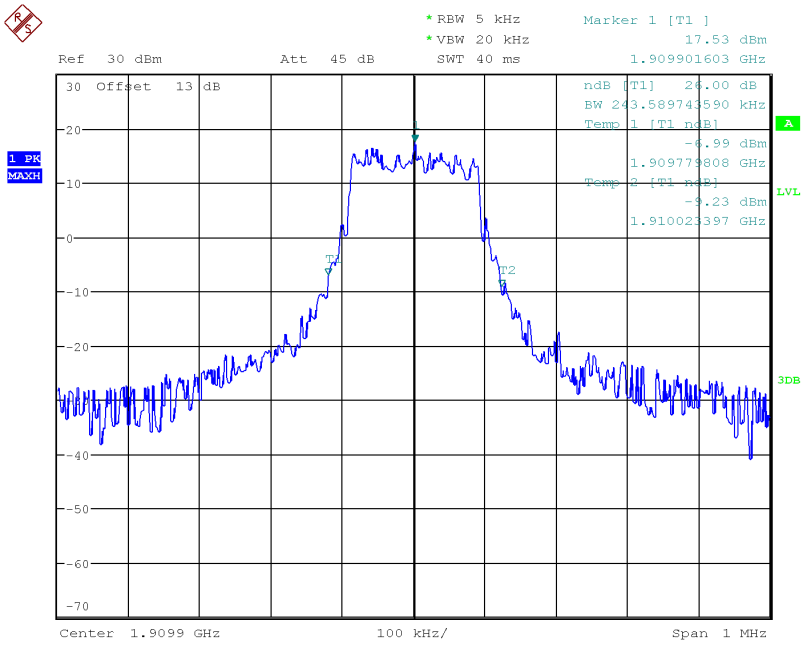
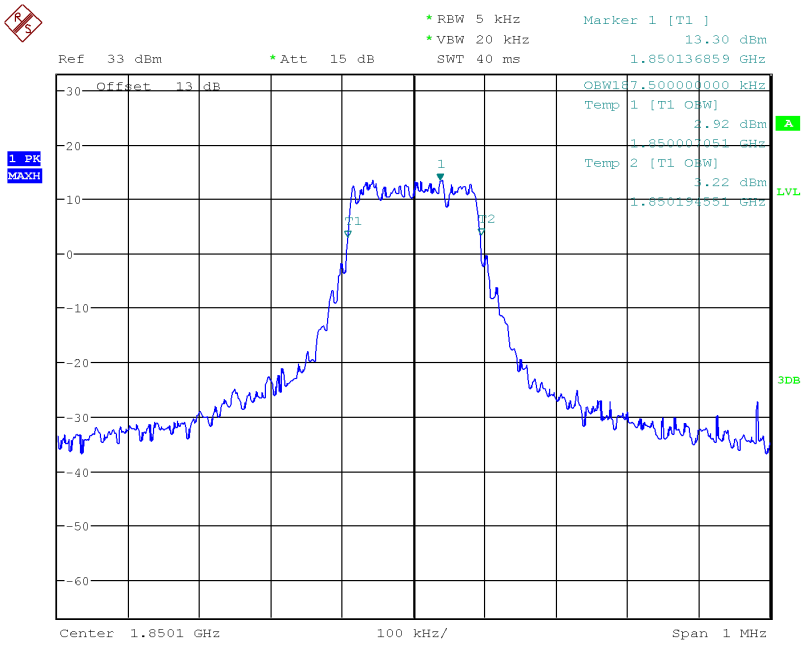
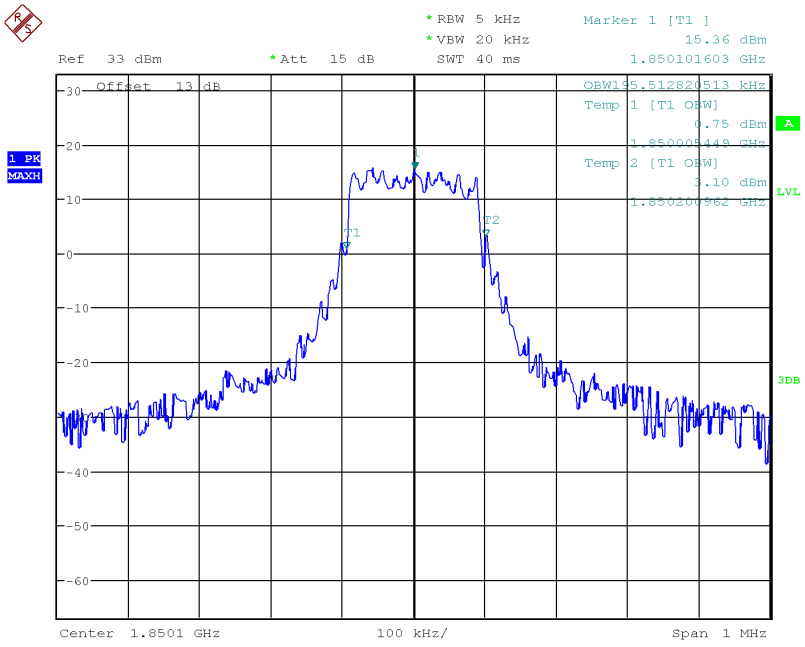



NB-IoT In-band band 2 19199 BPSK(26dB)




NB-IoT Guard-band band 2 18601 QPSK(99%)

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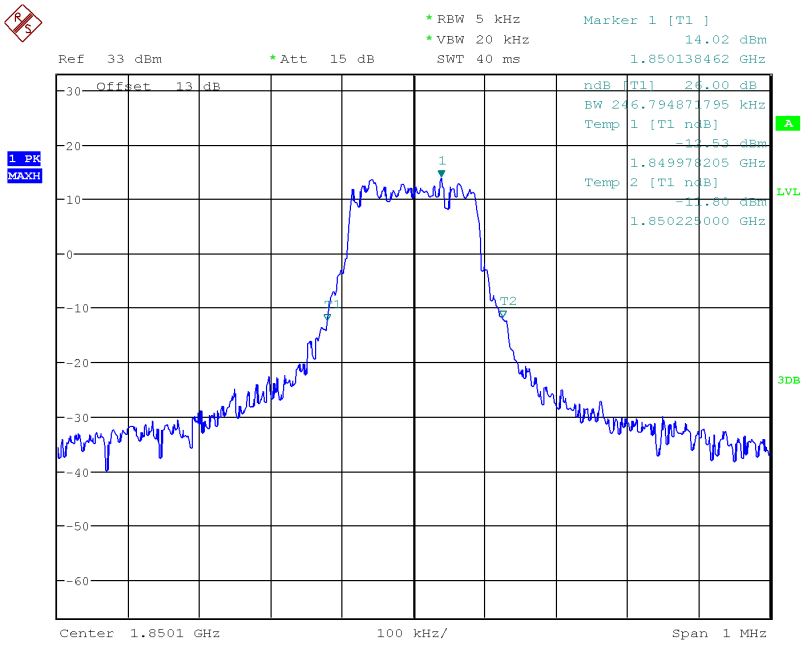


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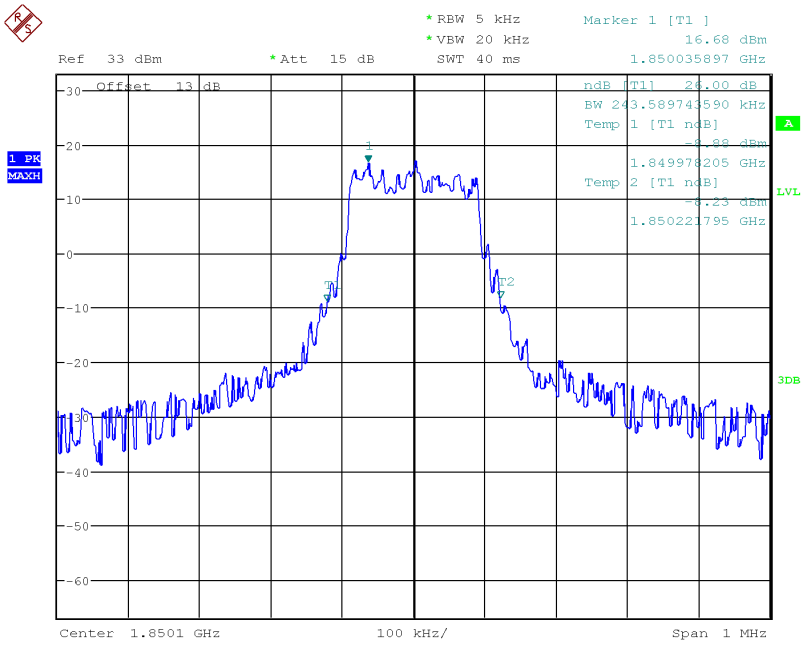


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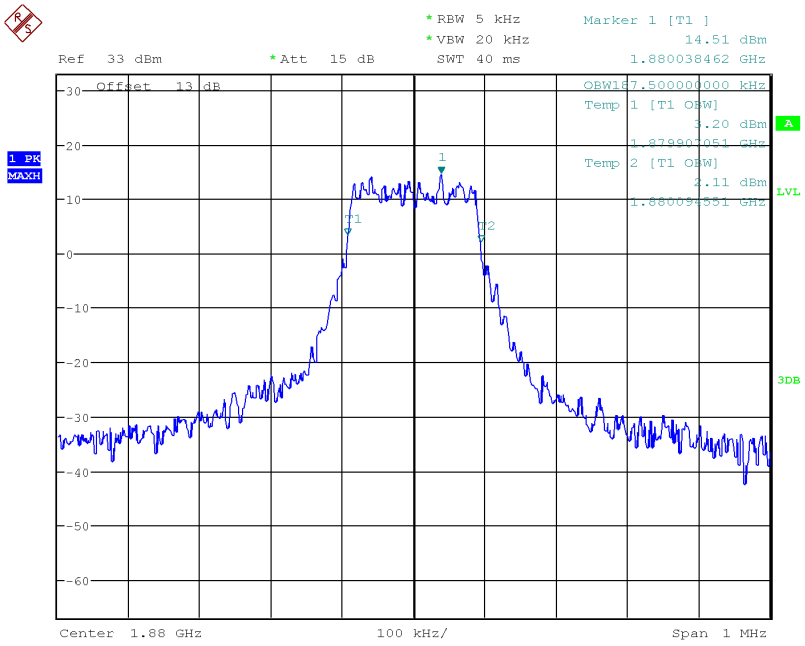
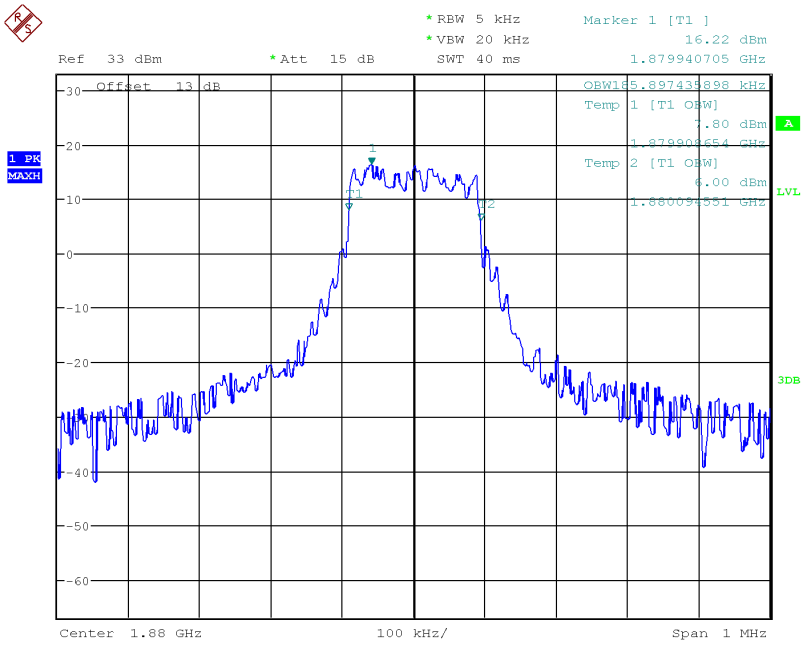



NB-IoT Guard-band band 2 18900 QPSK(99%)

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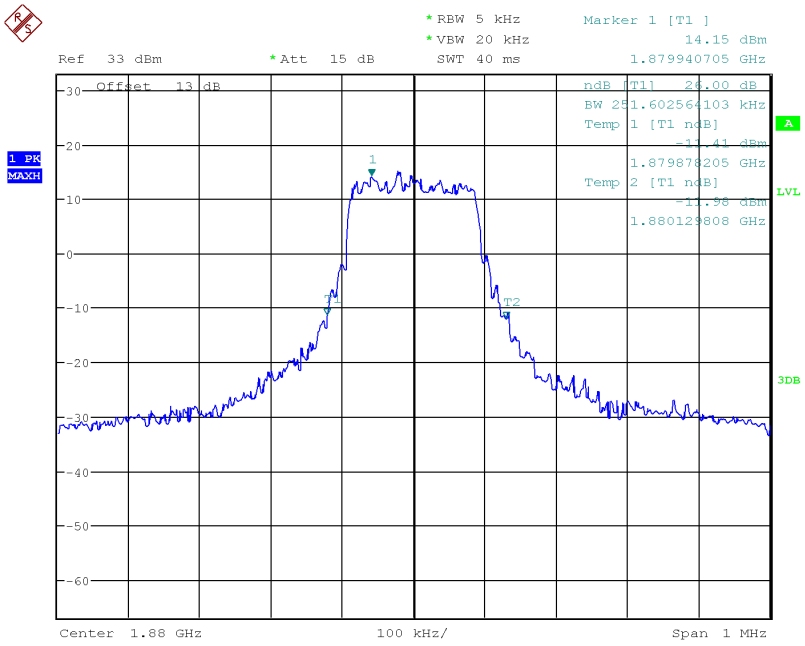


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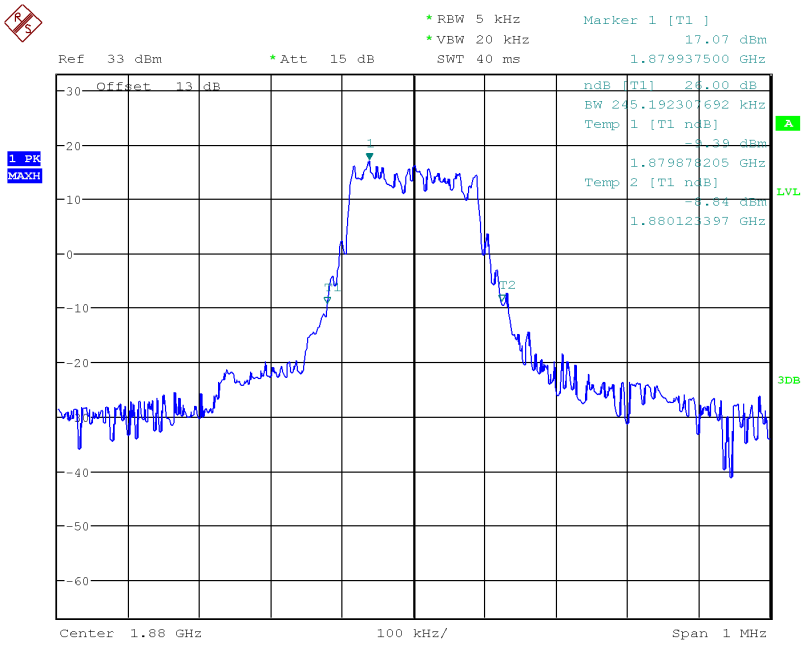
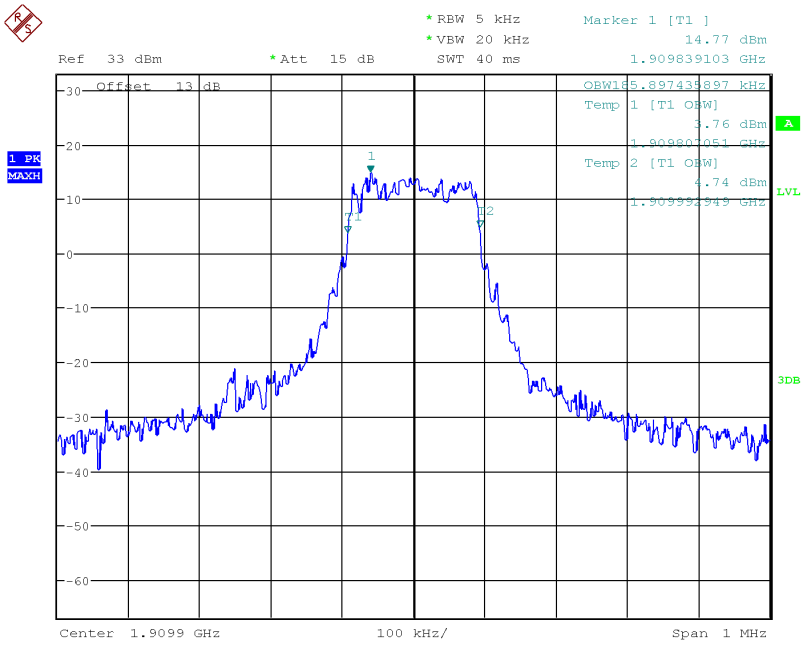
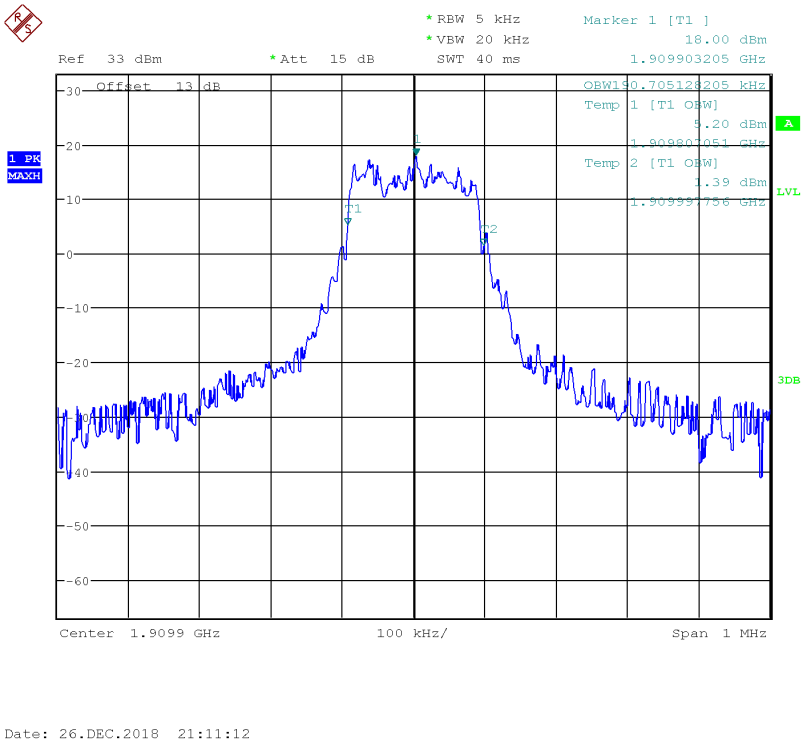



NB-IoT Guard-band band 2 18900 BPSK(26dB)




NB-IoT Guard-band band 2 19199 QPSK(99%)

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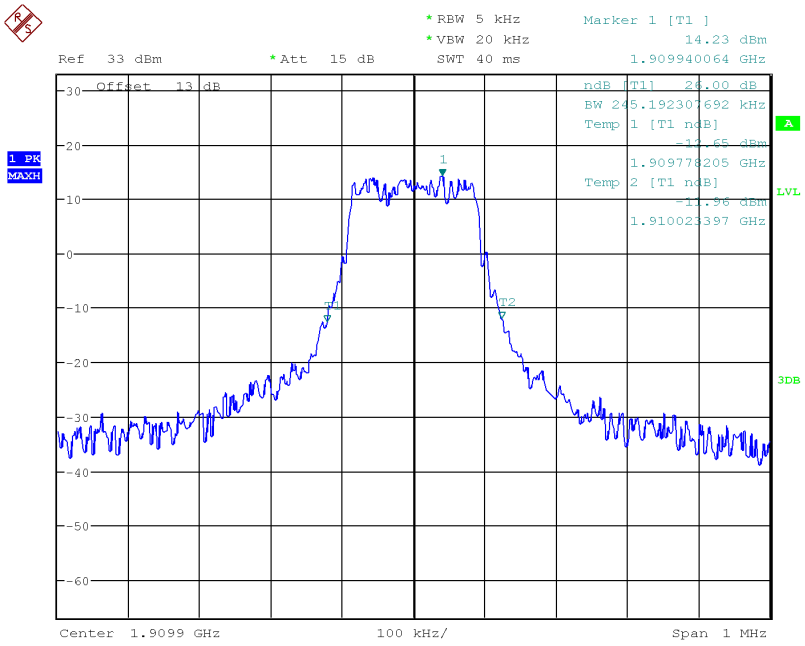
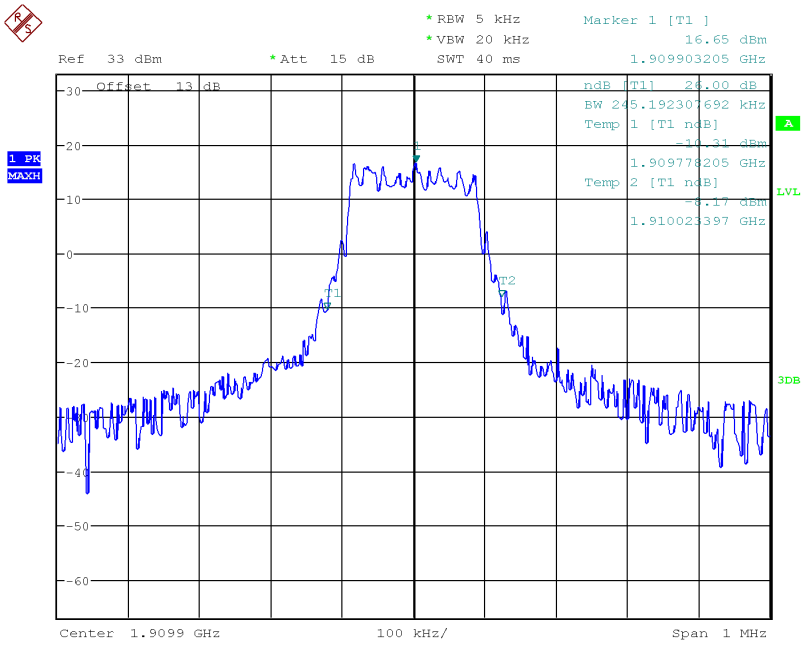
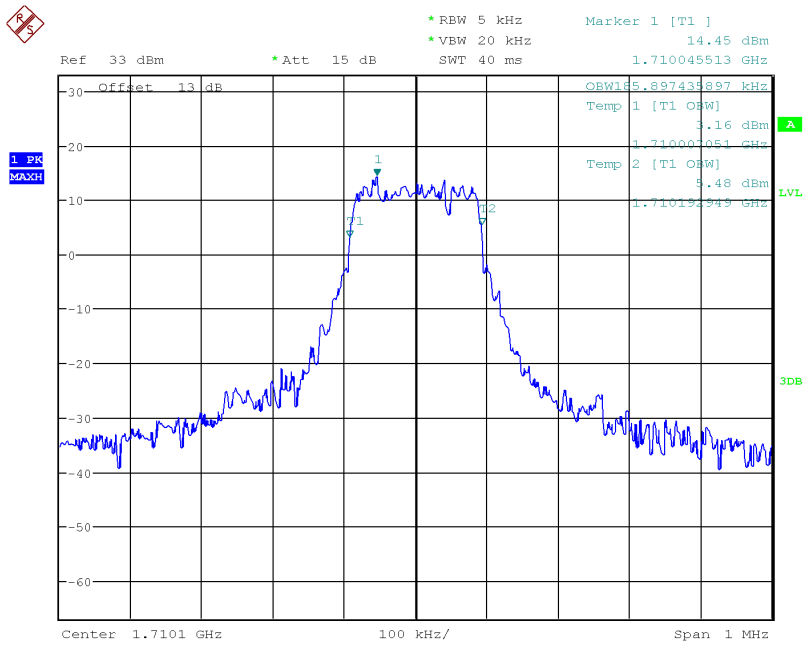



NB-IoT Guard-band band 2 19199 QPSK(26dB)

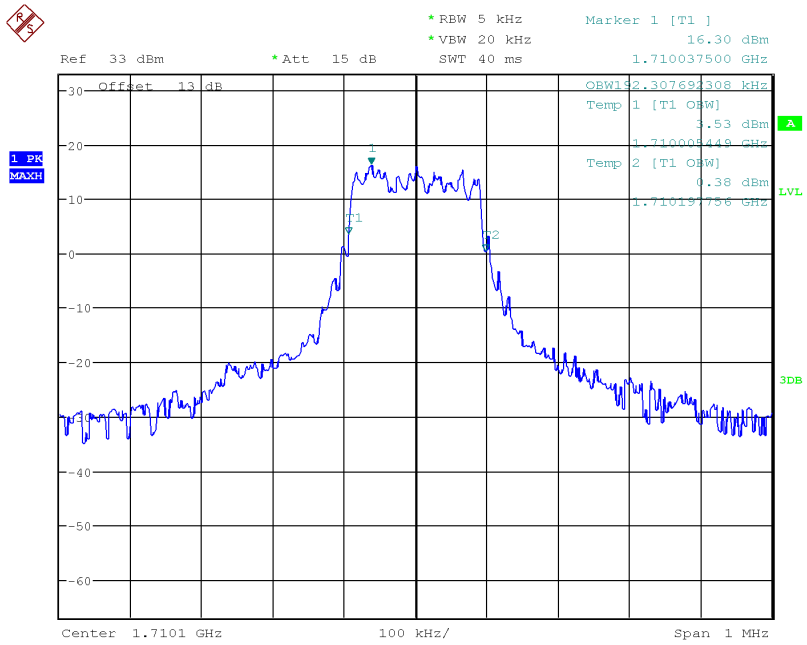



NB-IoT Guard-band band 2 19199 BPSK(26dB)

## Graphical results for Band4:




NB-IoT standalone band 4 19951 QPSK(99%)

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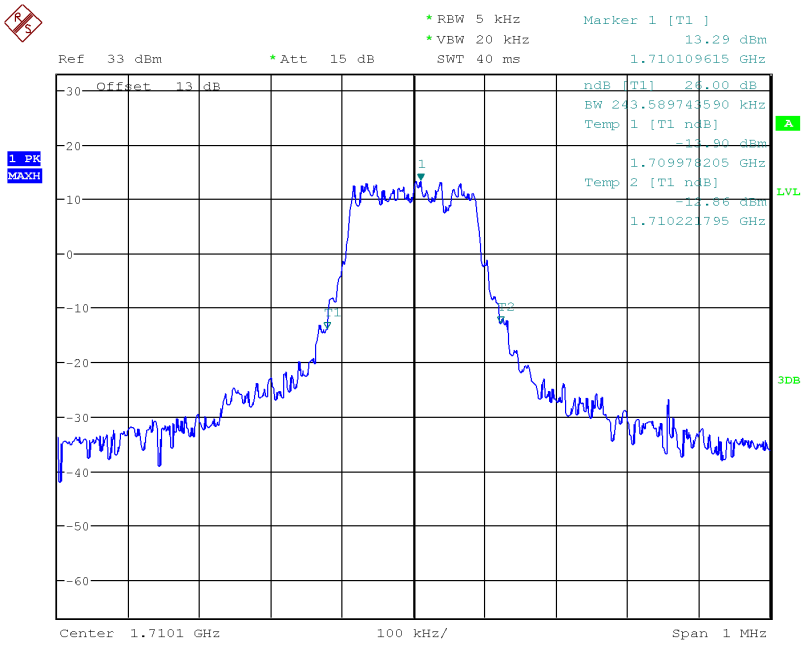
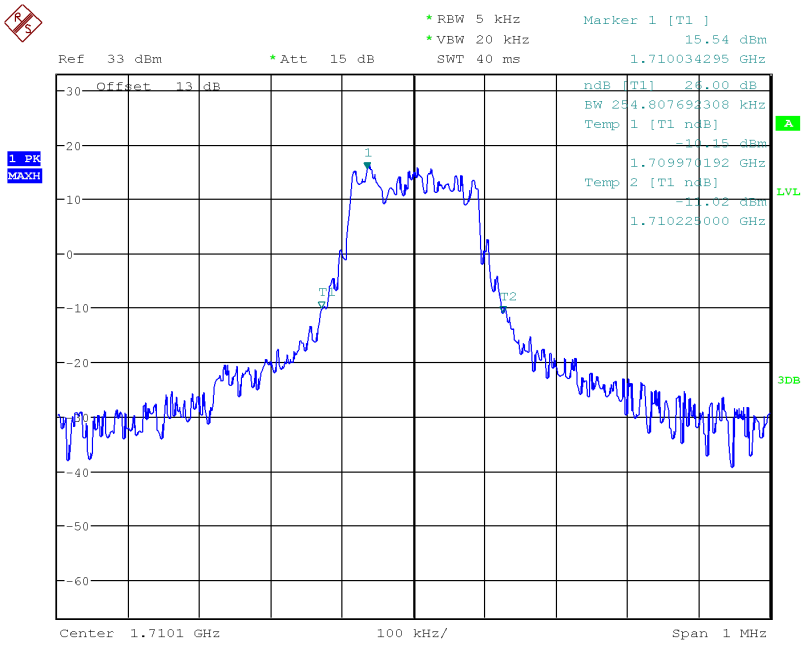
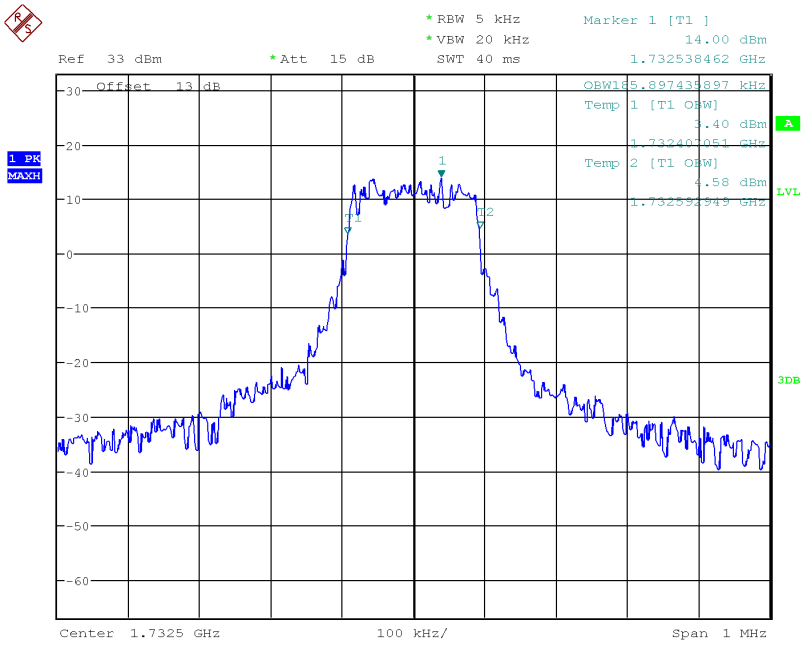


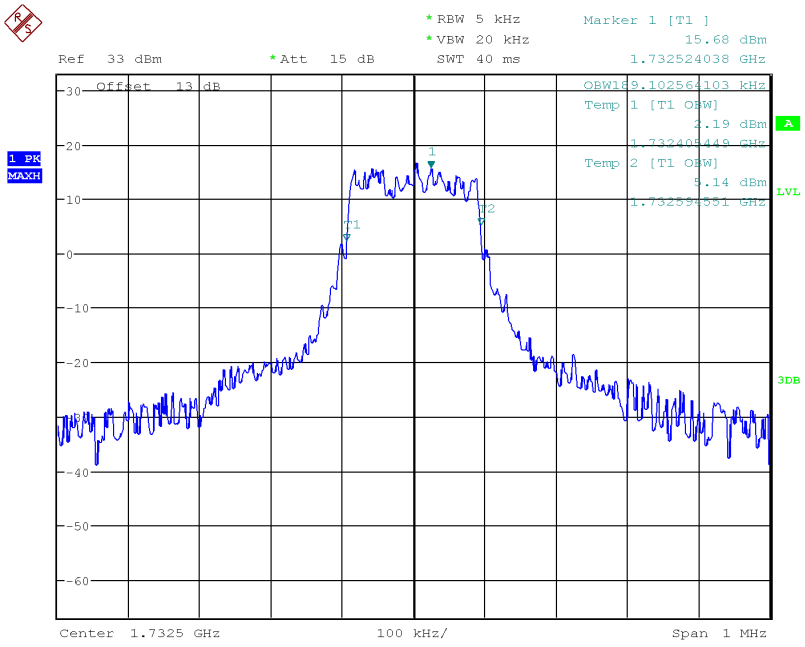

NB-IoT standalone band 4 19951 QPSK(26dB)



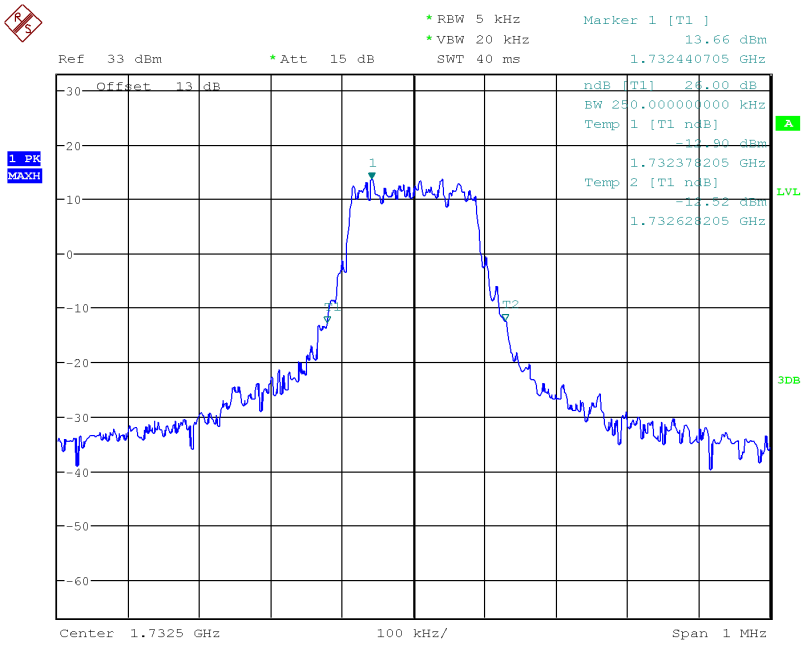

NB-IoT standalone band 4 19951 BPSK(26dB)



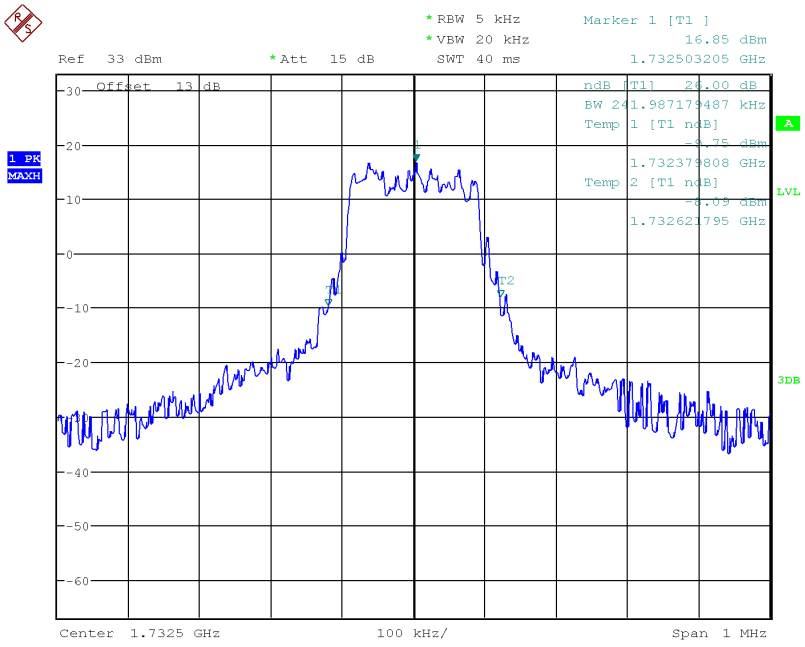

NB-IoT standalone band 4 20175 QPSK(99%)



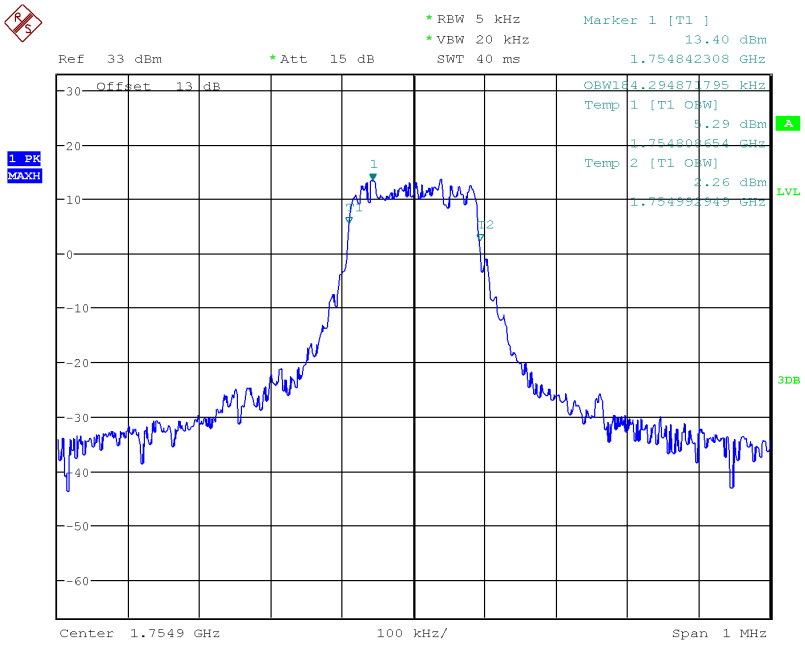

NB-IoT standalone band 4 20175 BPSK(99%)



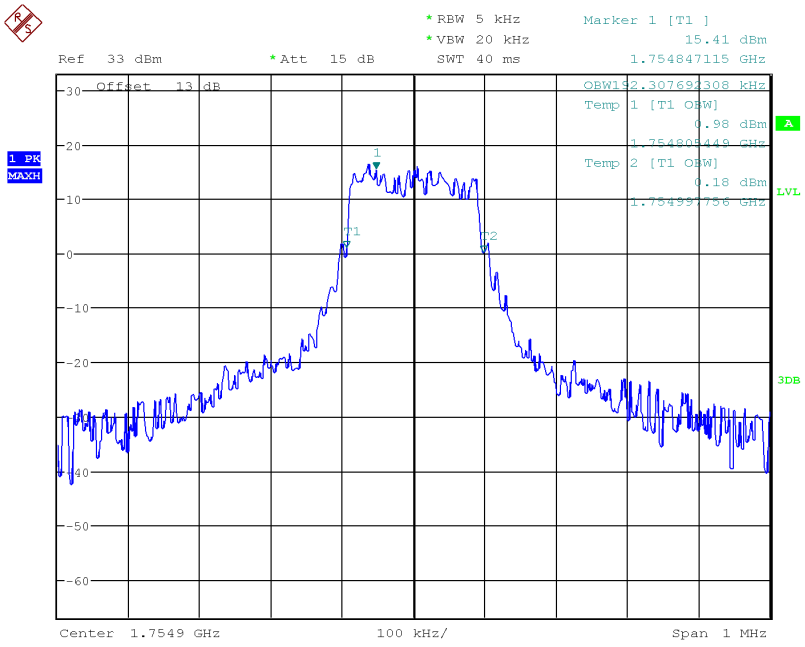

NB-IoT standalone band 4 20175 QPSK(26dB)



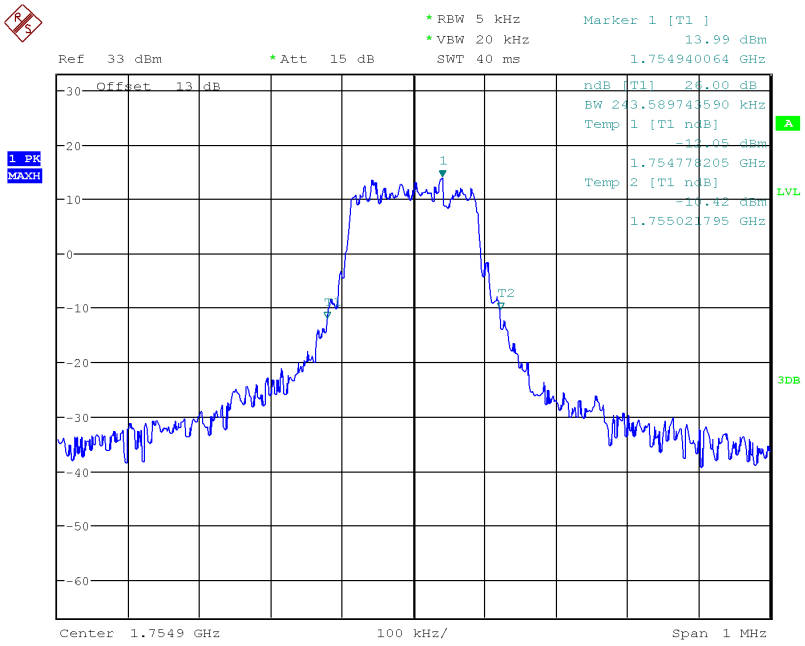

NB-IoT standalone band 4 20175 BPSK(26dB)



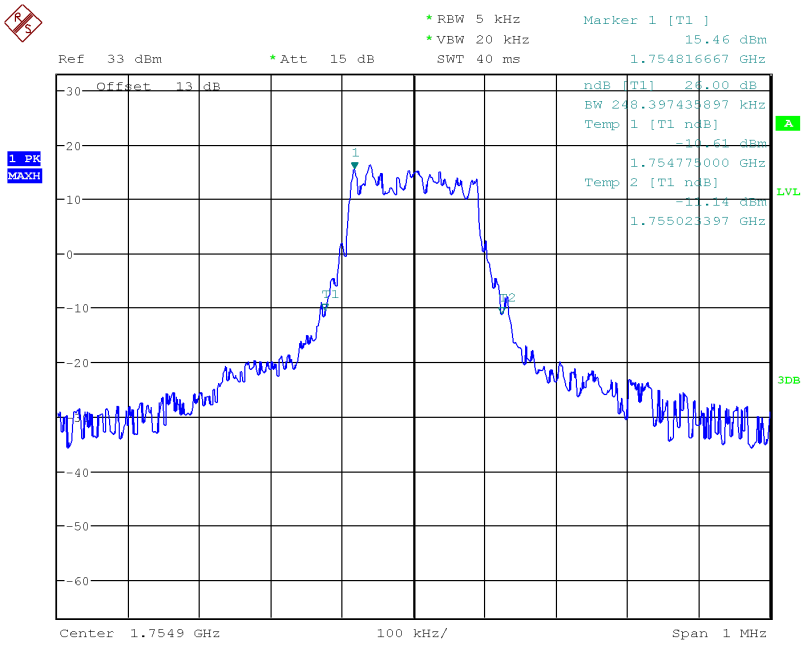

NB-IoT standalone band 4 20399 QPSK(99%)



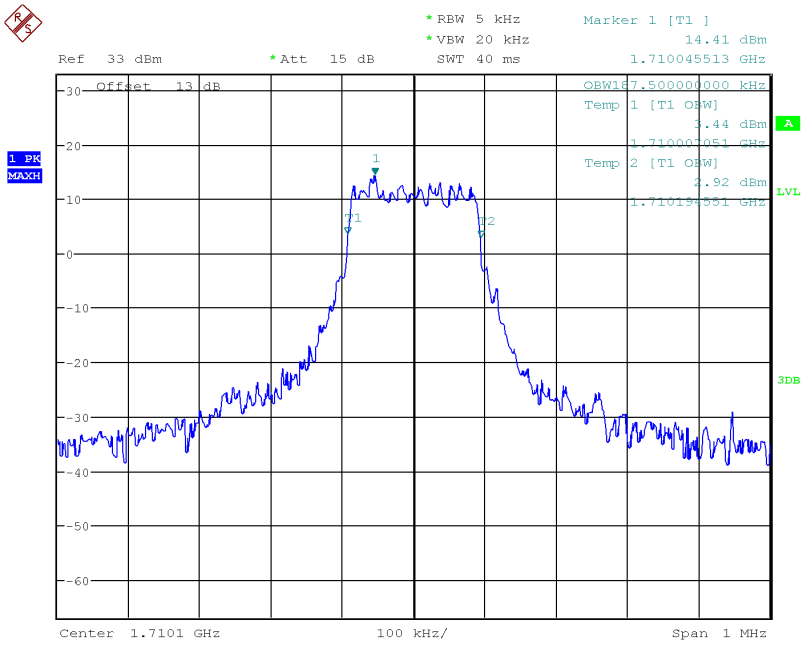

NB-IoT standalone band 4 20399 BPSK(99%)



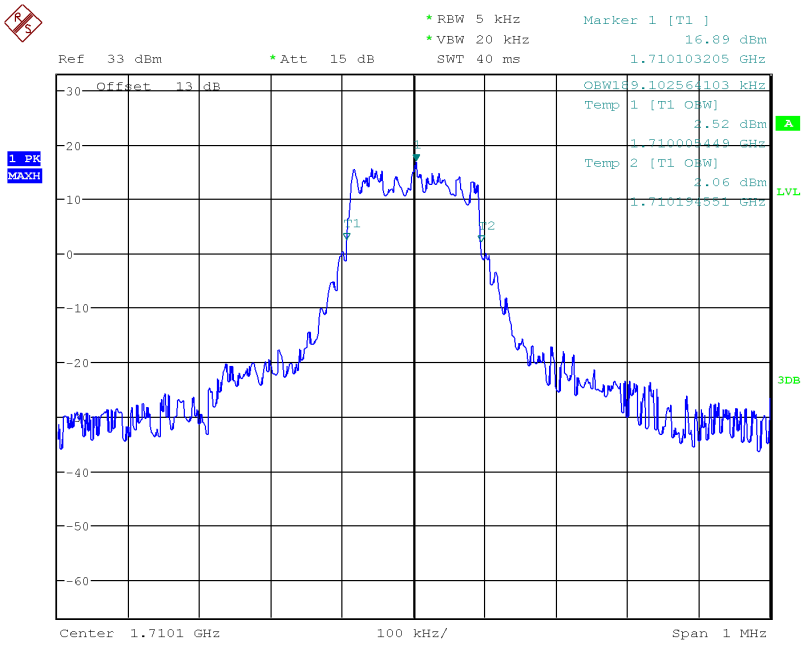

NB-IoT standalone band 4 20399 QPSK(26dB)



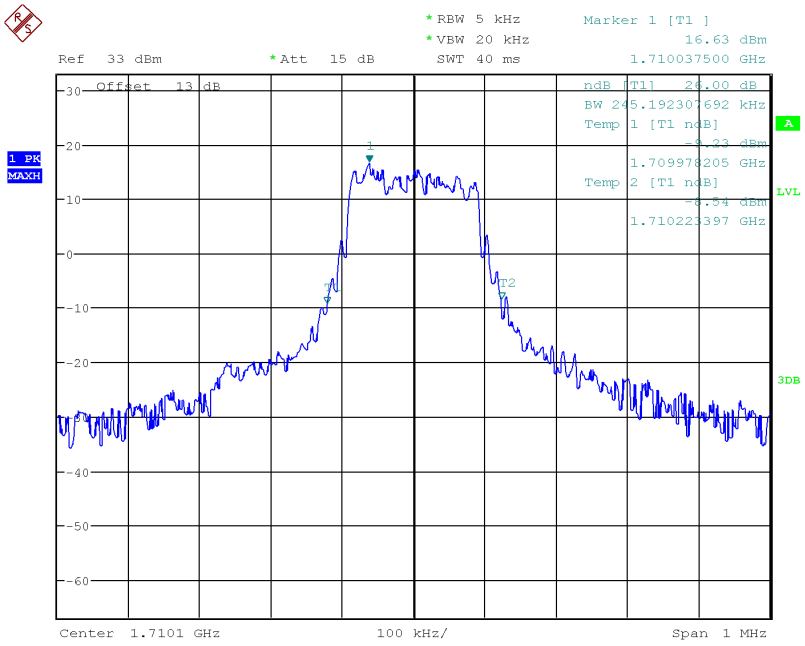

NB-IoT standalone band 4 20399 BPSK(26dB)



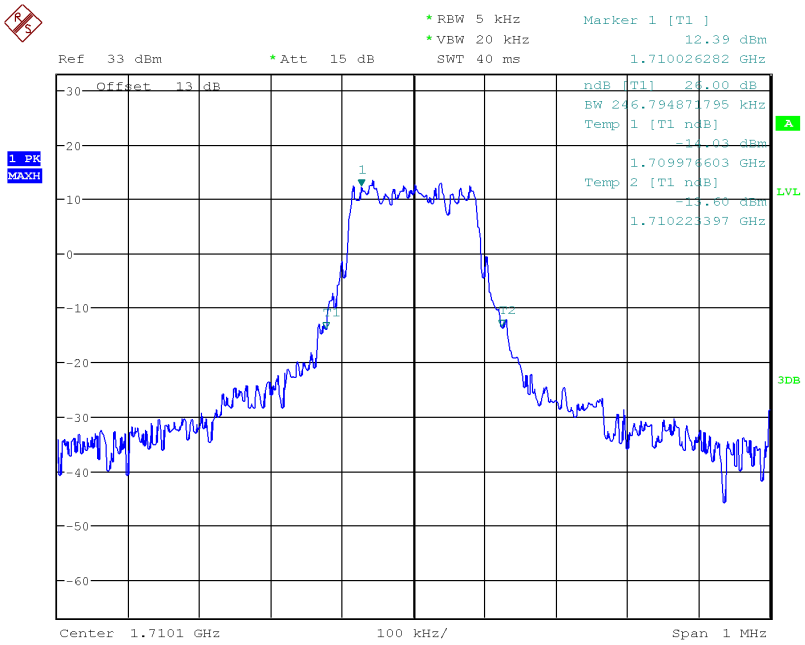

NB-IoT In-band band 4 19951 QPSK(99%)



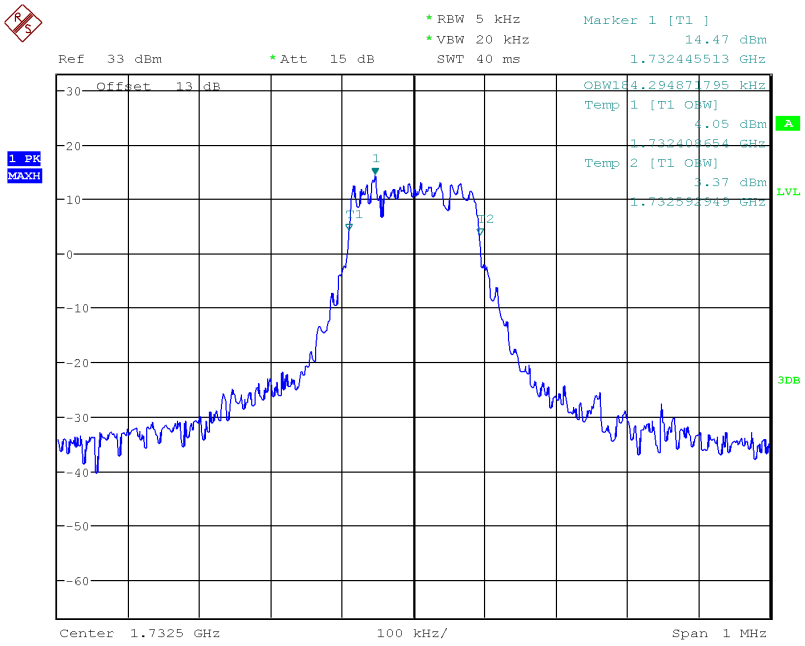

NB-IoT In-band band 4 19951 BPSK(99%)



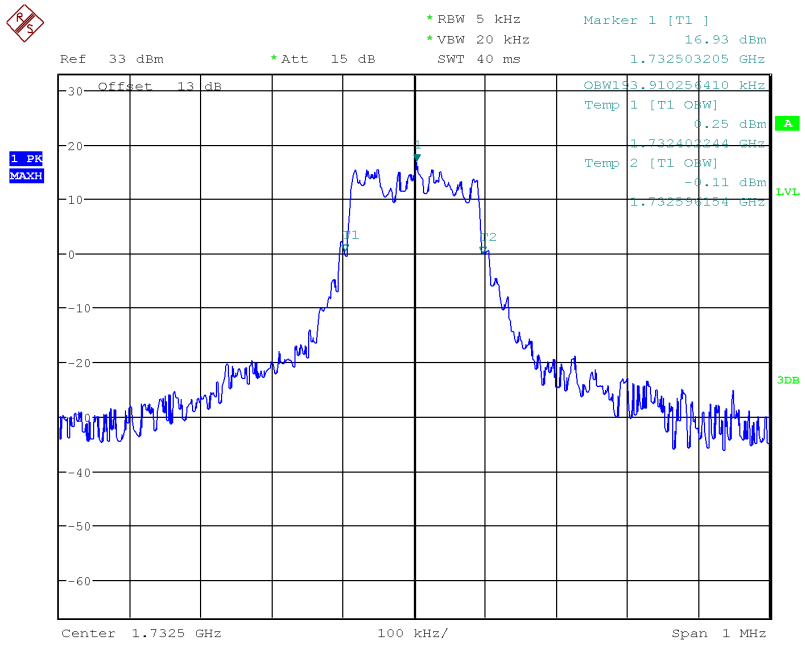

NB-IoT In-band band 4 19951 QPSK(26dB)



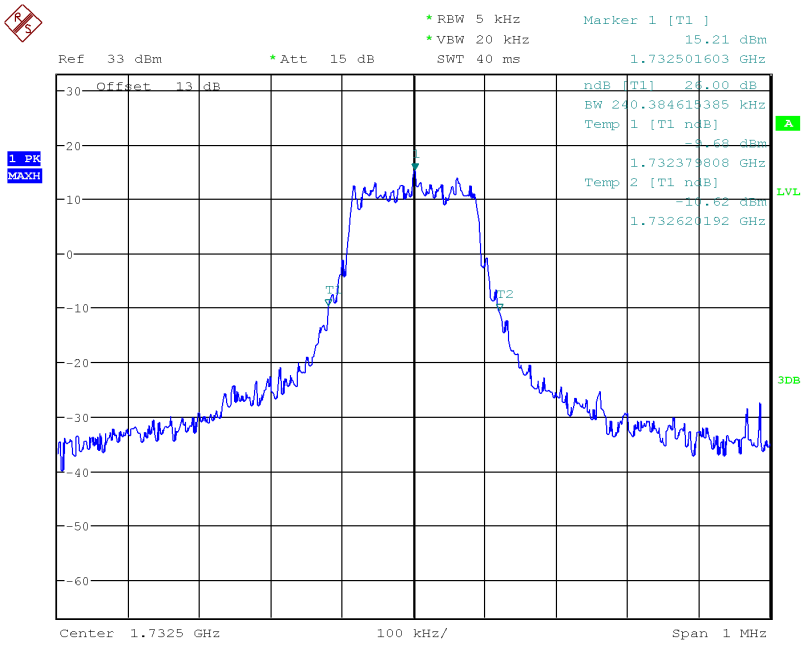

NB-IoT In-band band 4 19951 BPSK(26dB)




NB-IoT In-band band 4 20175 QPSK(99%)




NB-IoT In-band band 4 20175 BPSK(99%)

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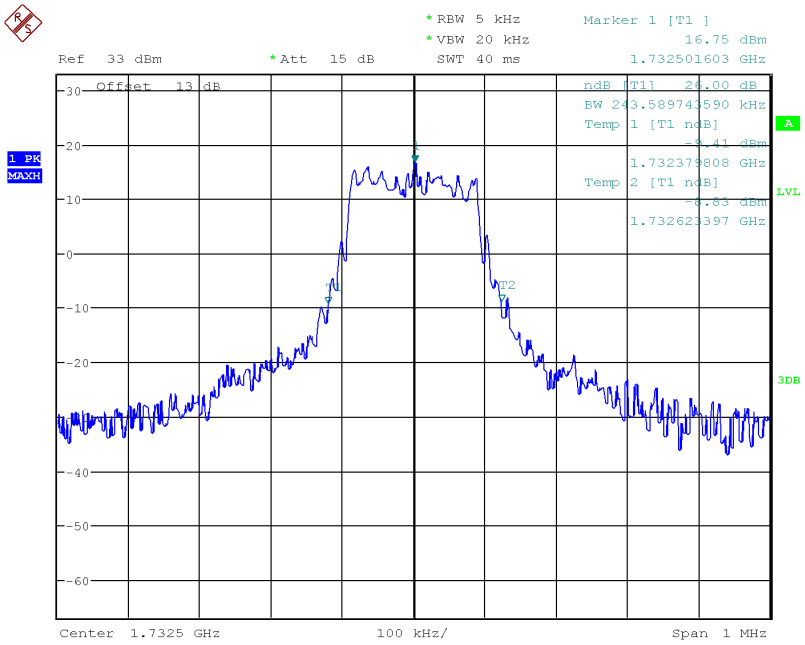


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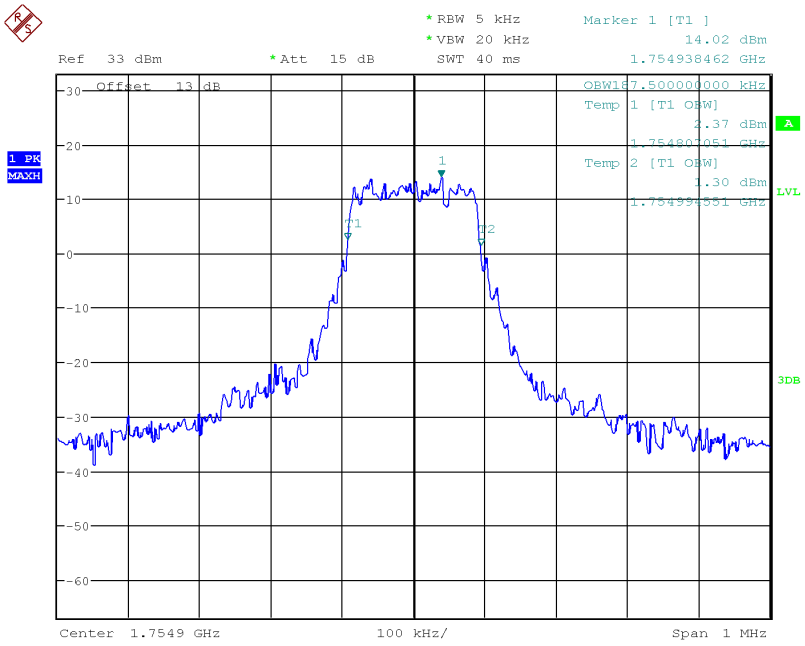
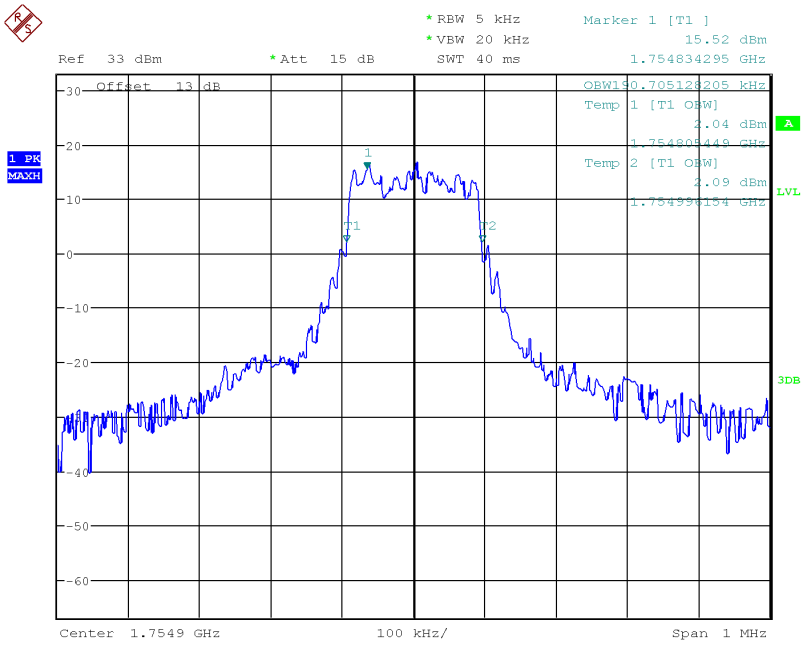
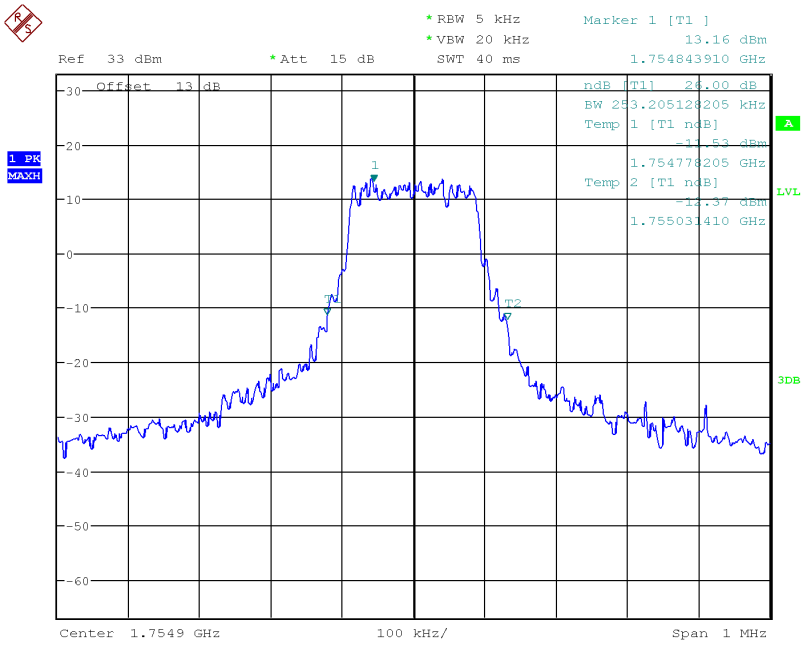


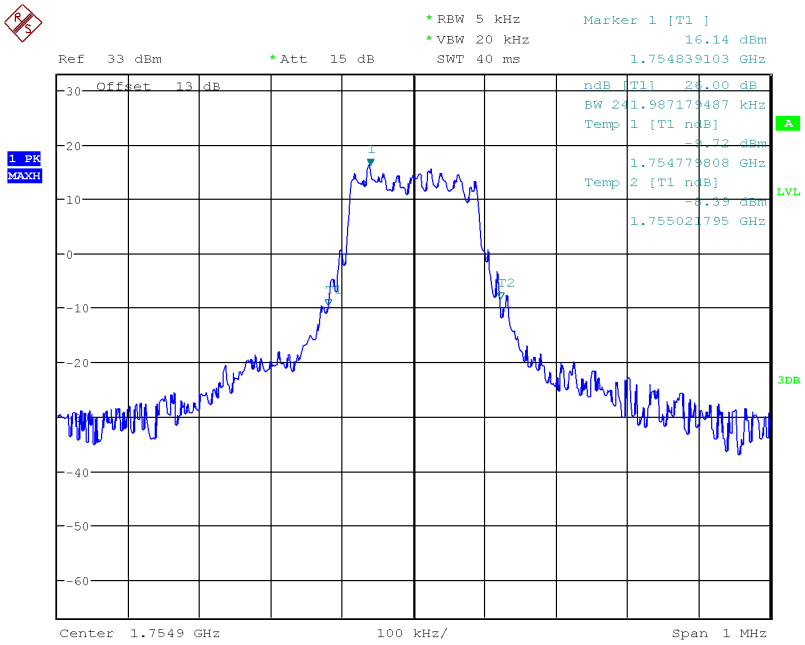

NB-IoT In-band band 4 20399 QPSK(99%)



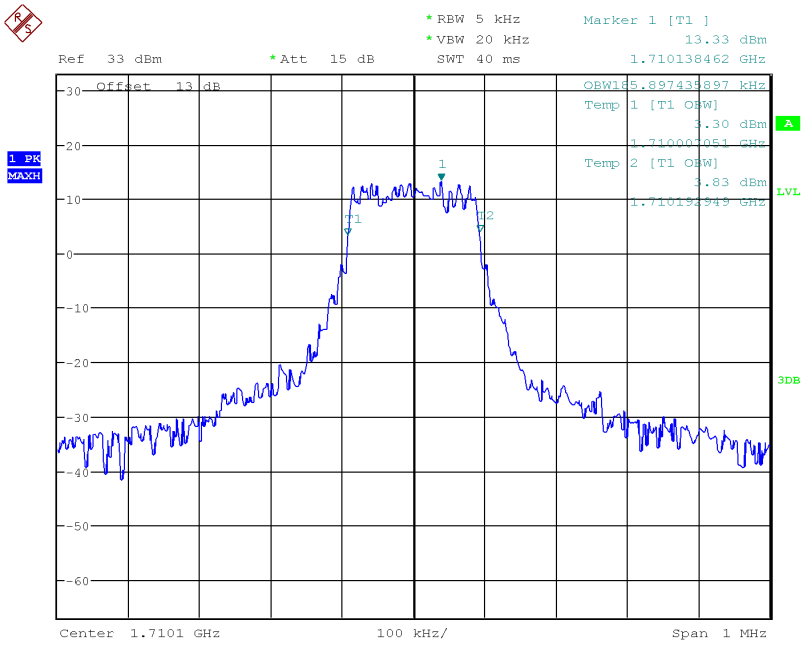

NB-IoT In-band band 4 20399 BPSK(99%)



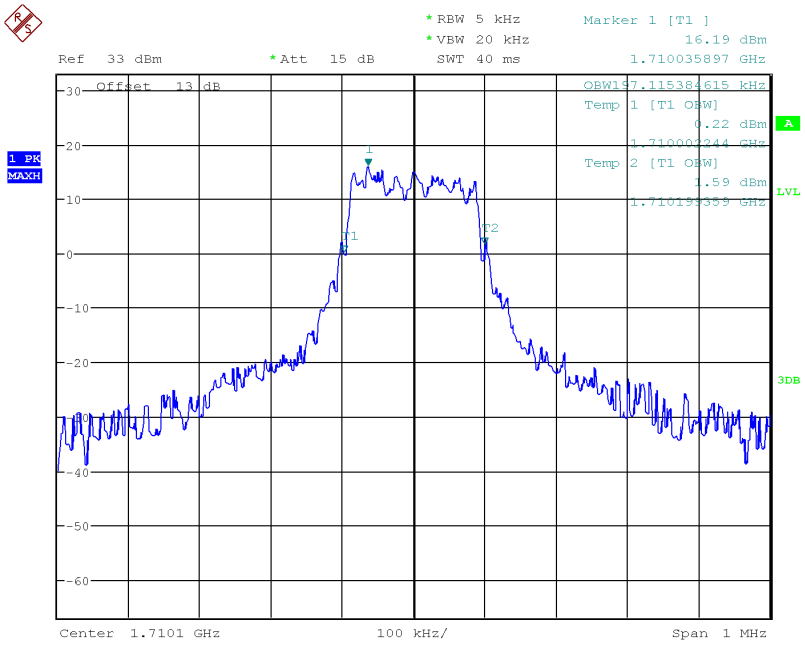

NB-IoT In-band band 4 20399 QPSK(26dB)



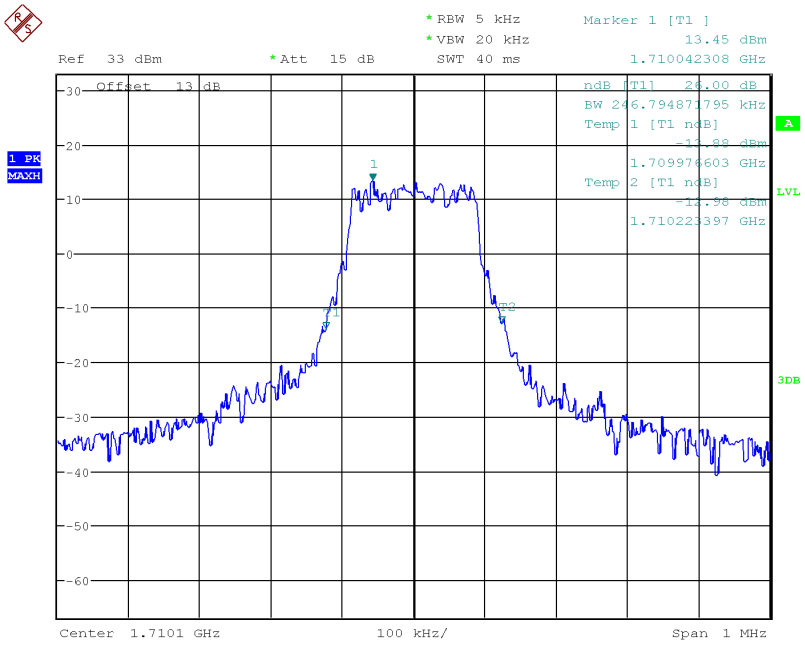

NB-IoT In-band band 4 20399 BPSK(26dB)




NB-IoT Guard-band band 4 19951 QPSK(99%)




NB-IoT Guard-band band 4 19951 BPSK(99%)

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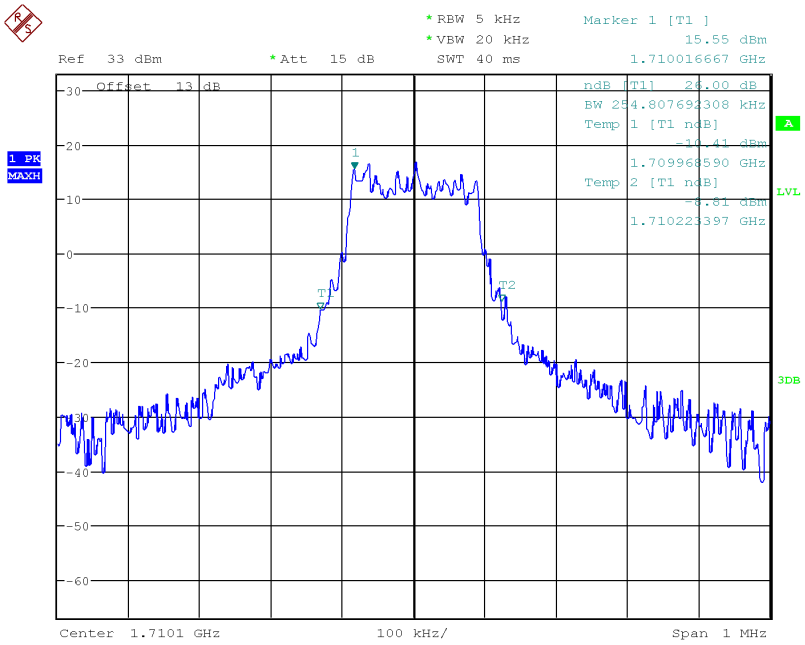


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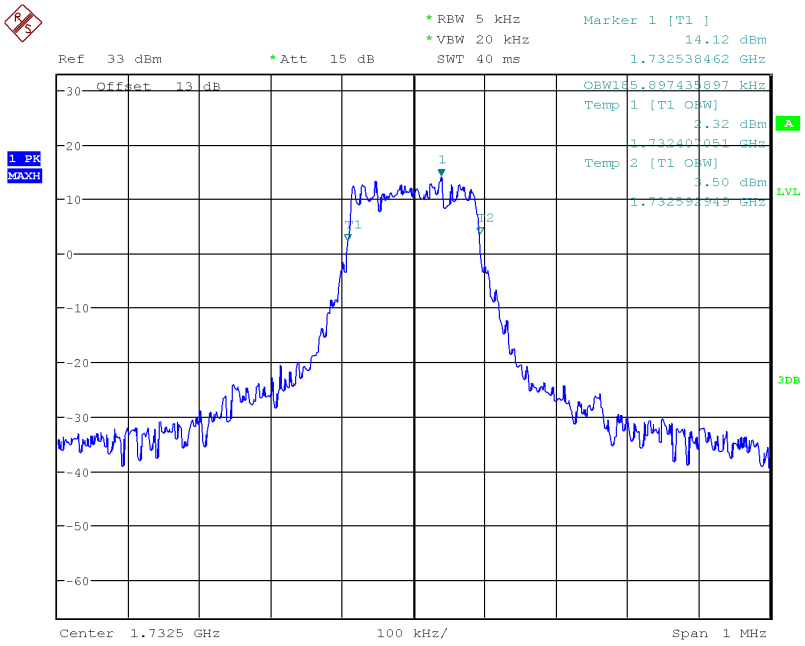
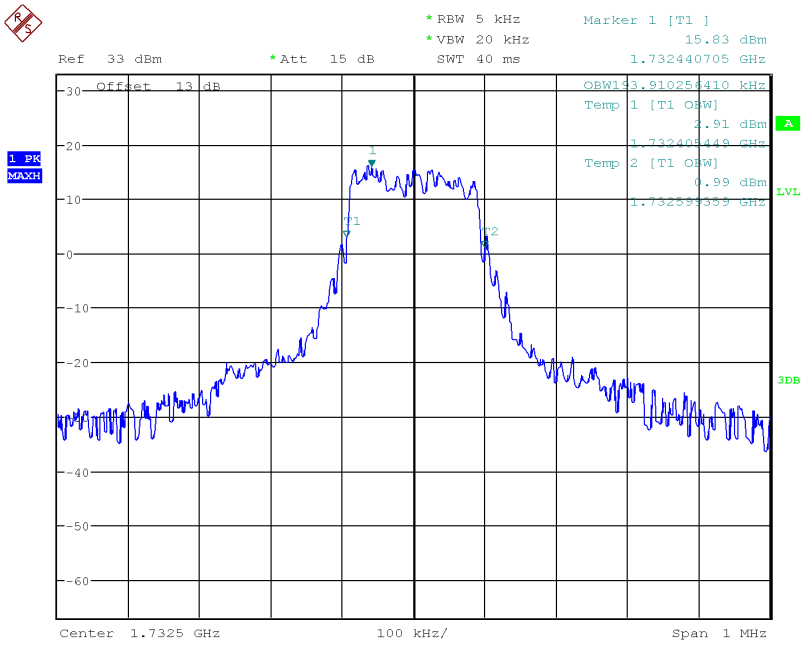



NB-IoT Guard-band band 4 20175 QPSK(99%)

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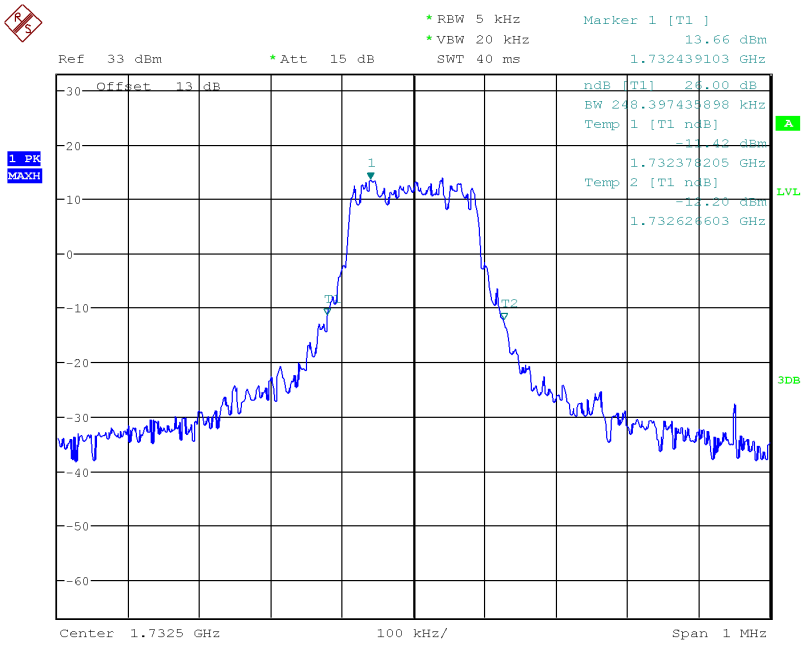
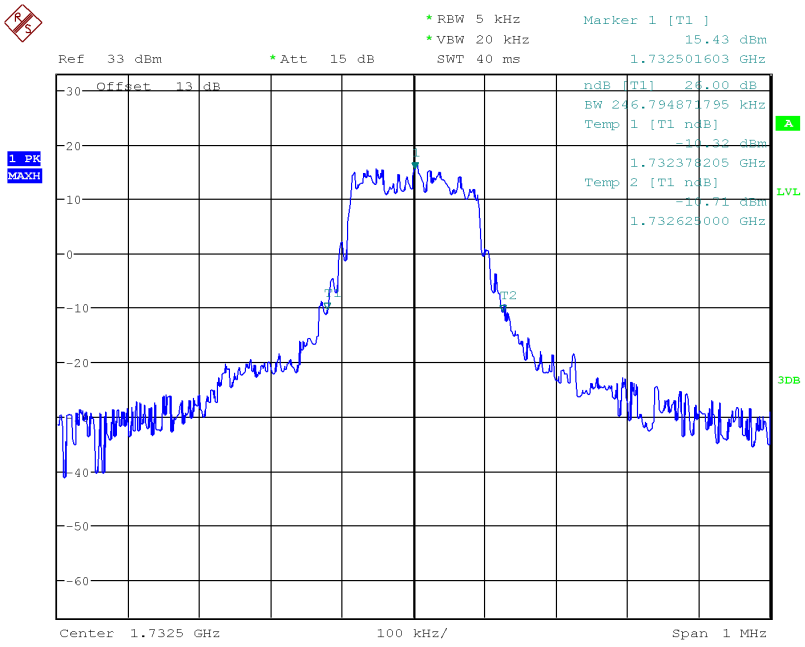
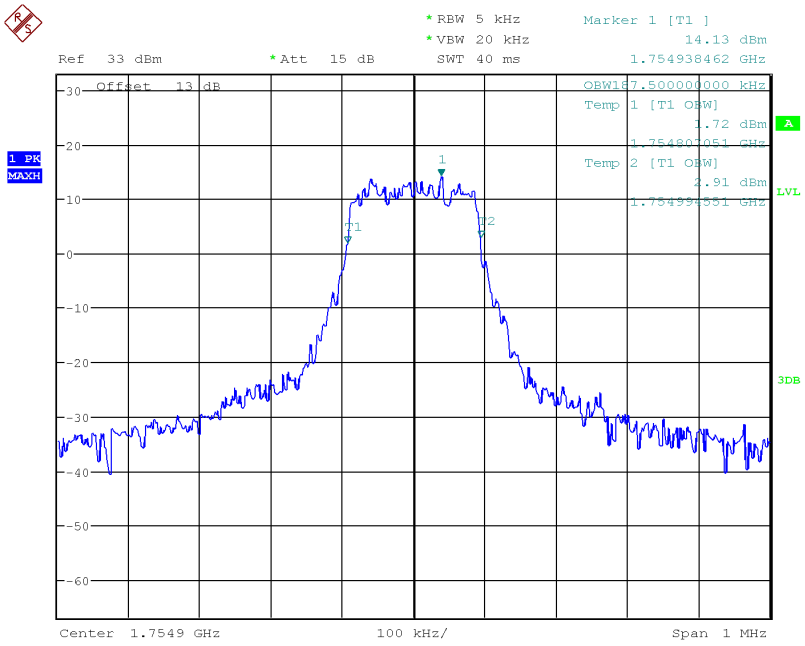


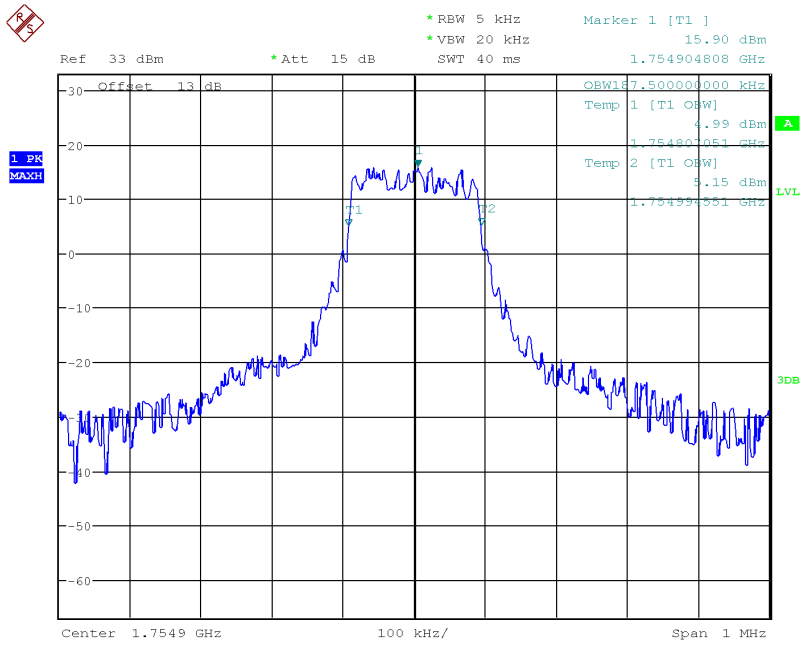

NB-IoT Guard-band band 4 20175 QPSK(26dB)



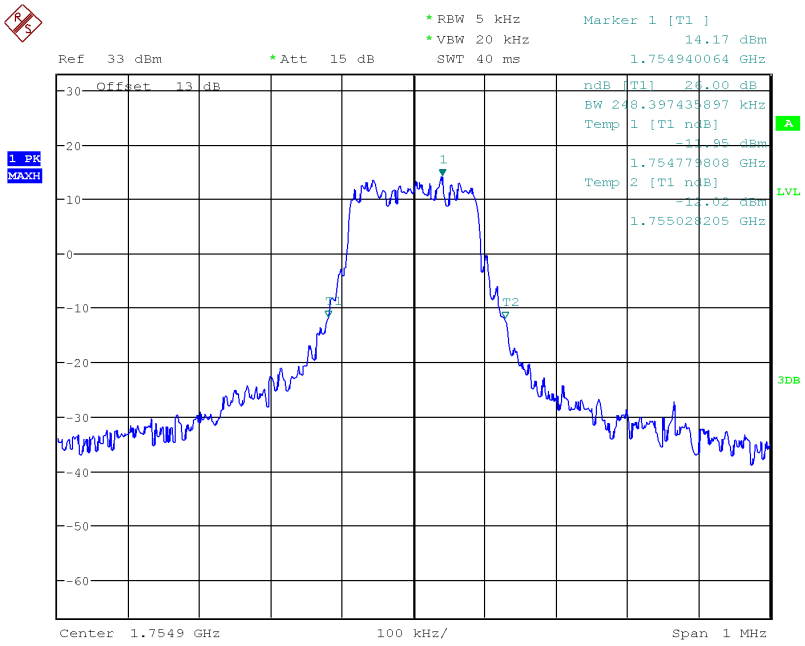

NB-IoT Guard-band band 4 20175 BPSK(26dB)



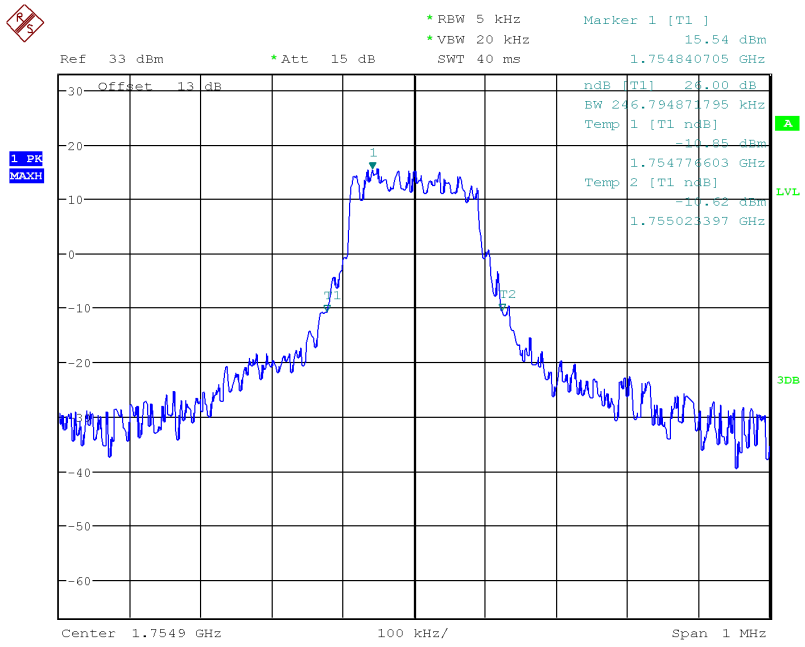

NB-IoT Guard-band band 4 20399 QPSK(99%)




NB-IoT Guard-band band 4 20399 BPSK(99%)

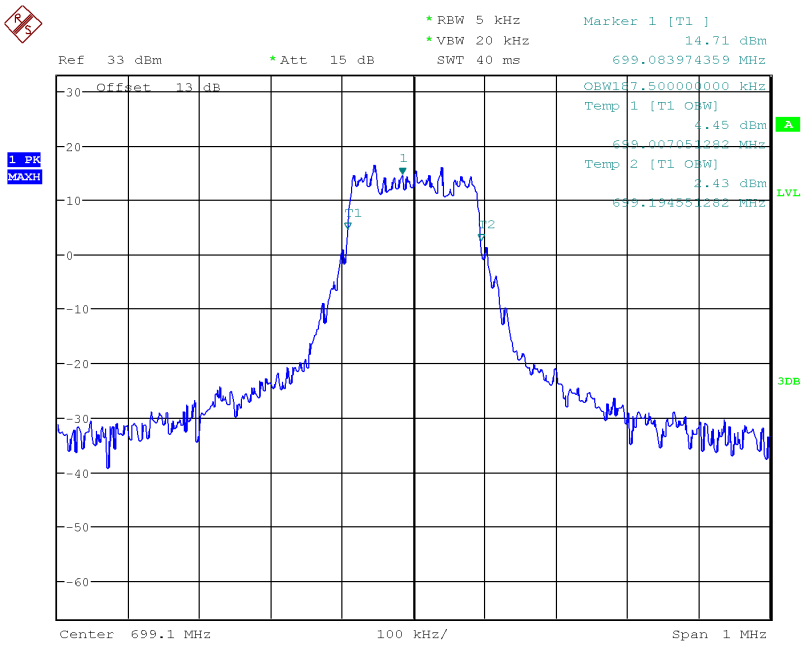



NB-IoT Guard-band band 4 20399 QPSK(26dB)

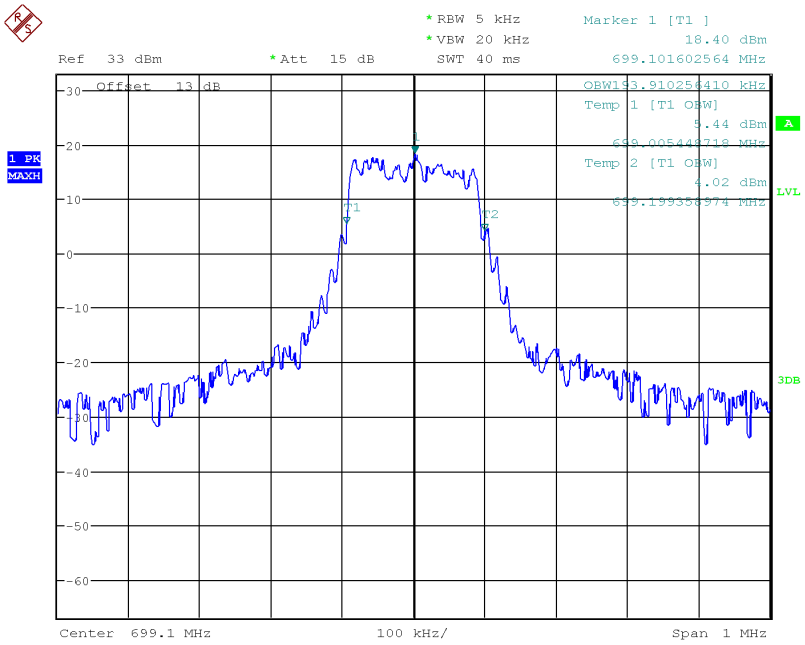



NB-IoT Guard-band band 4 20399 BPSK(26dB)

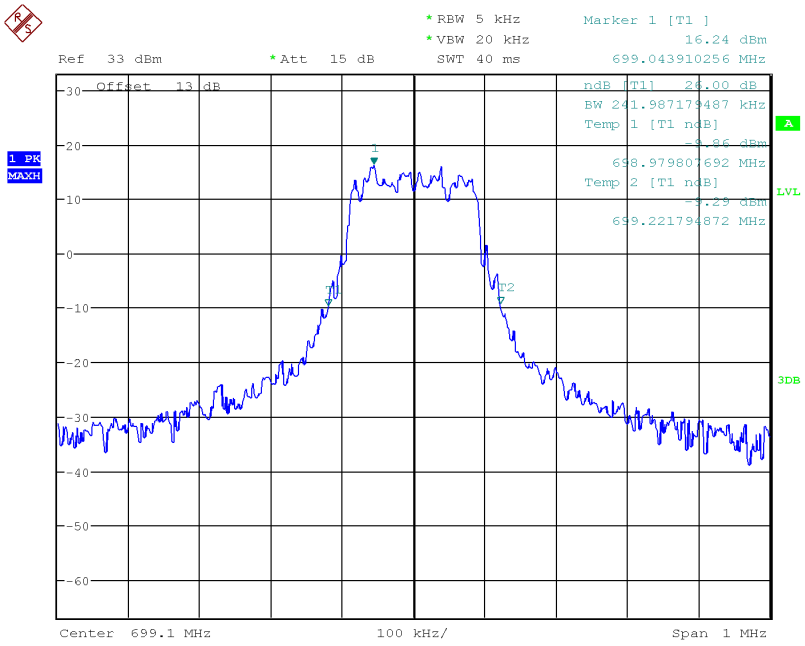
**Graphical results for Band12:**



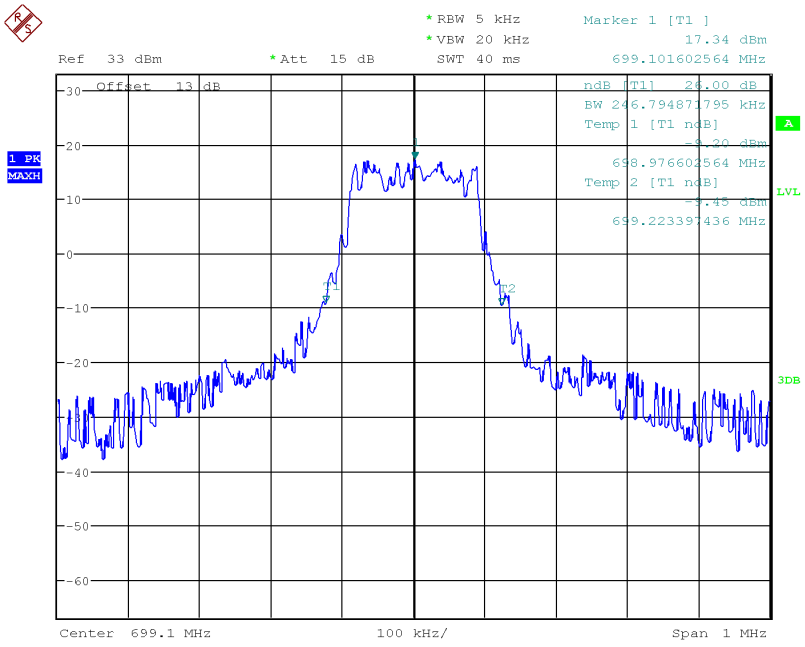

NB-IoT standalone band 12 23011 QPSK(99%)



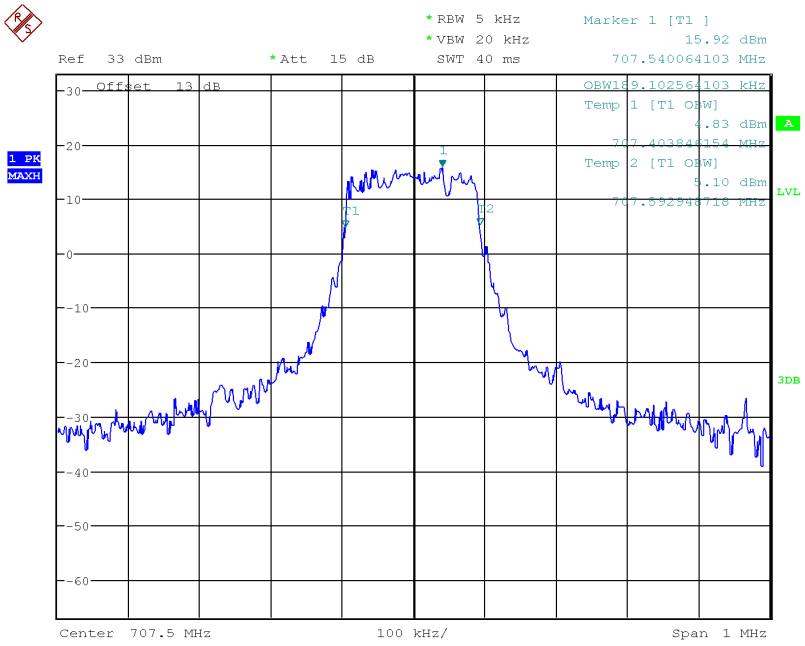

NB-IoT standalone band 12 23011 BPSK(99%)



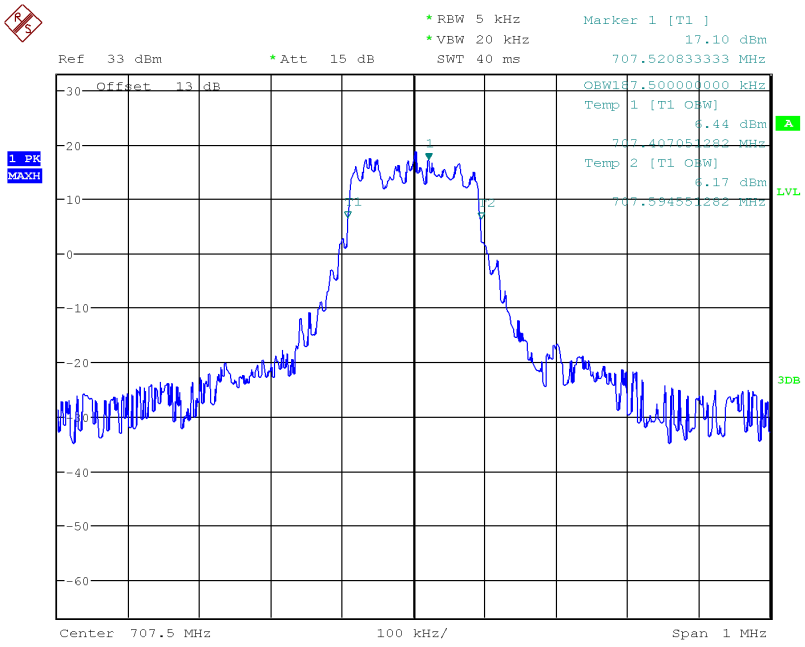

NB-IoT standalone band 12 23011 QPSK(26dB)



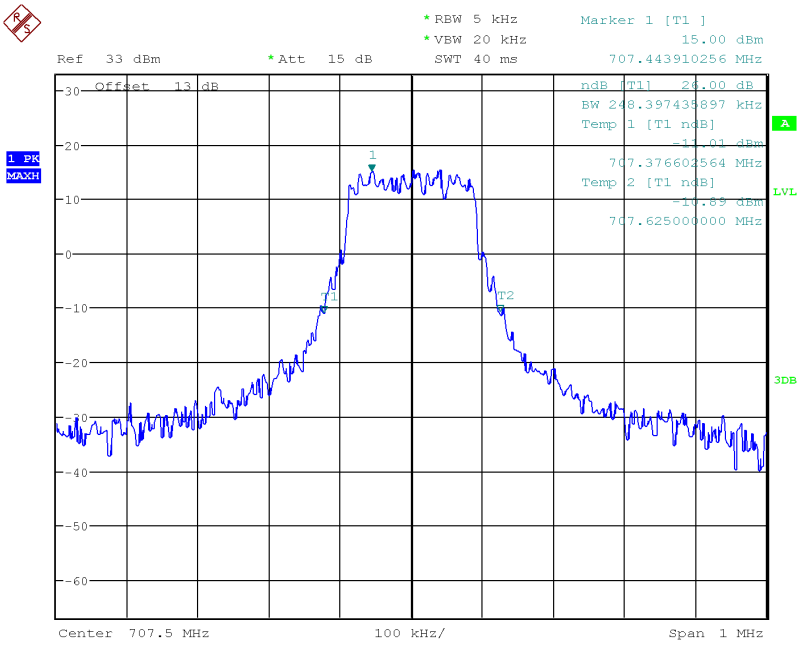

NB-IoT standalone band 12 23011 BPSK(26dB)



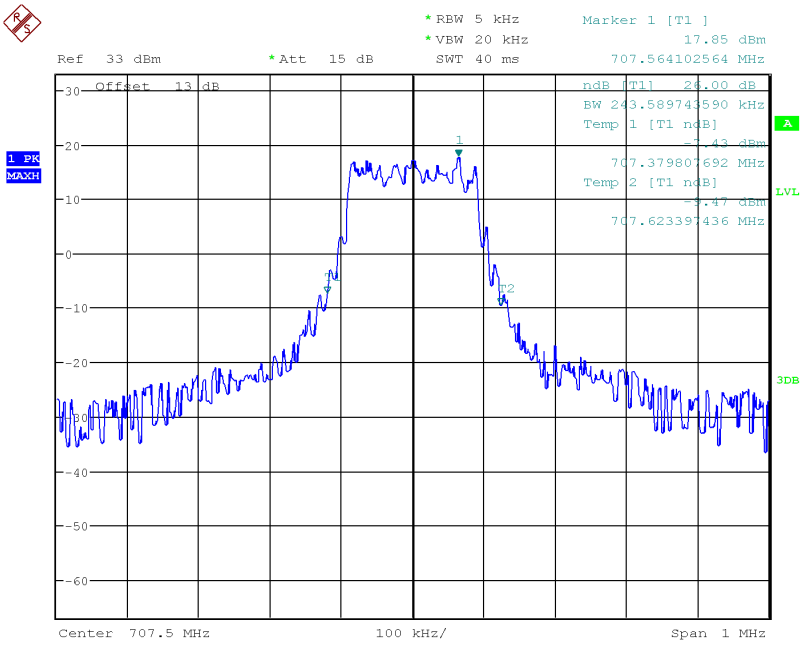

NB-IoT standalone band 12 23095 QPSK(99%)



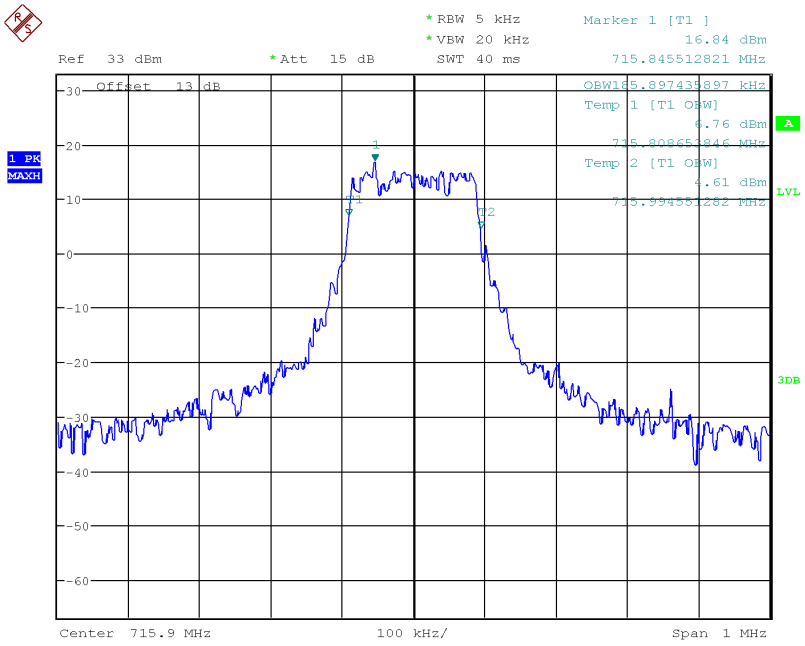

NB-IoT standalone band 12 23095 BPSK(99%)



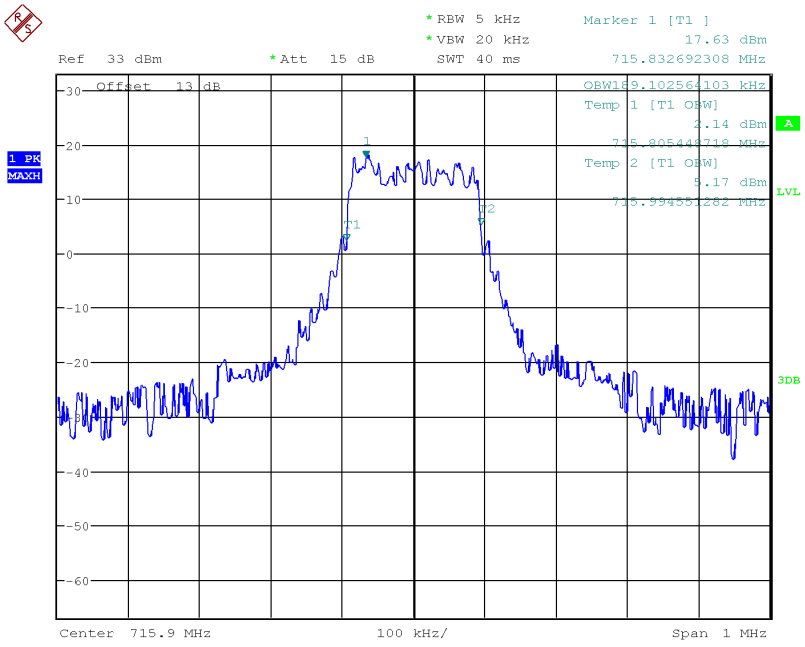

NB-IoT standalone band 12 23095 QPSK(26dB)



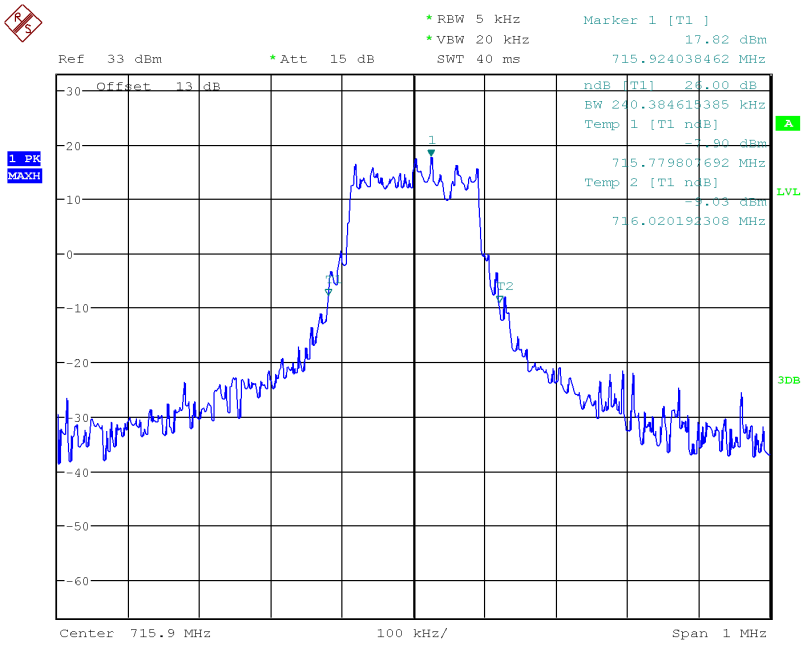

NB-IoT standalone band 12 23095 BPSK(26dB)




NB-IoT standalone band 12 23179 QPSK(99%)




NB-IoT standalone band 12 23179 BPSK(99%)

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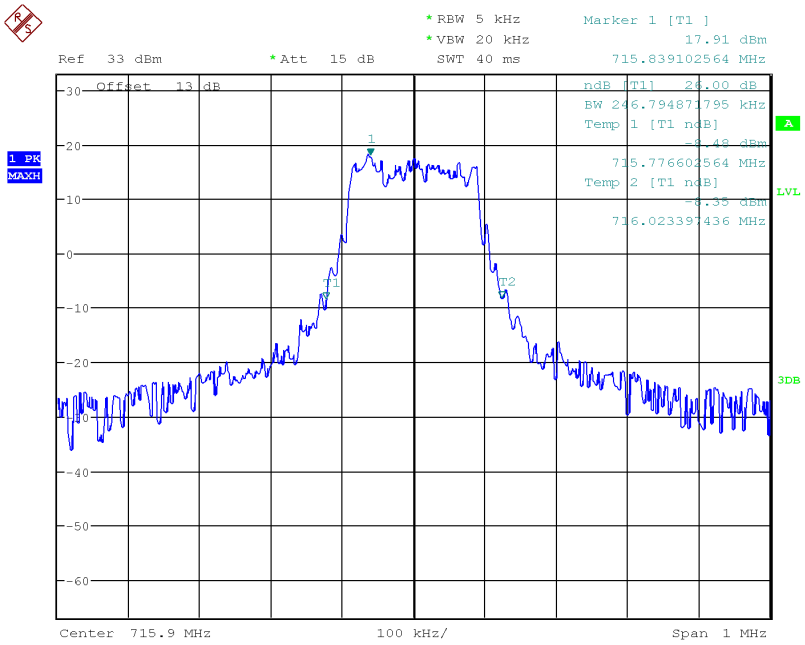
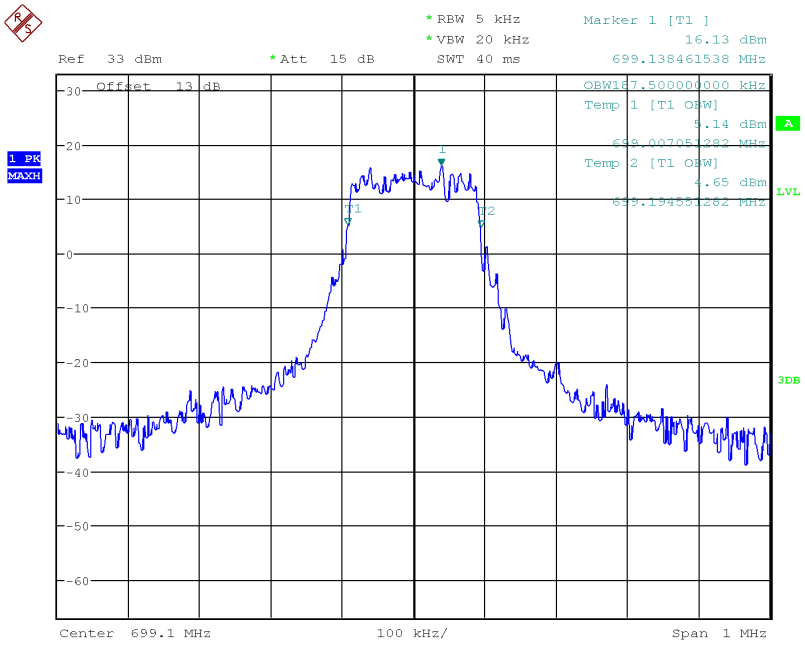
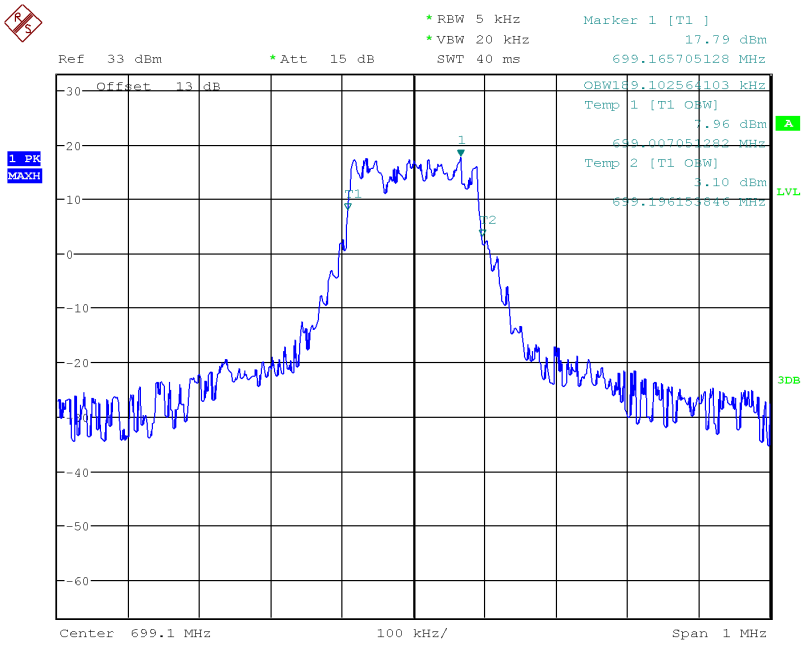


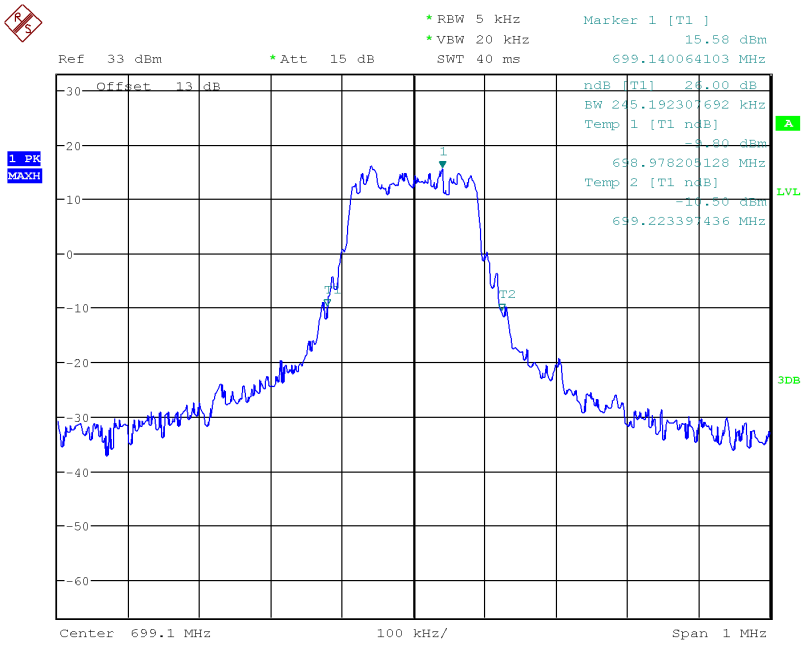

NB-IoT standalone band 12 23179 BPSK(26dB)



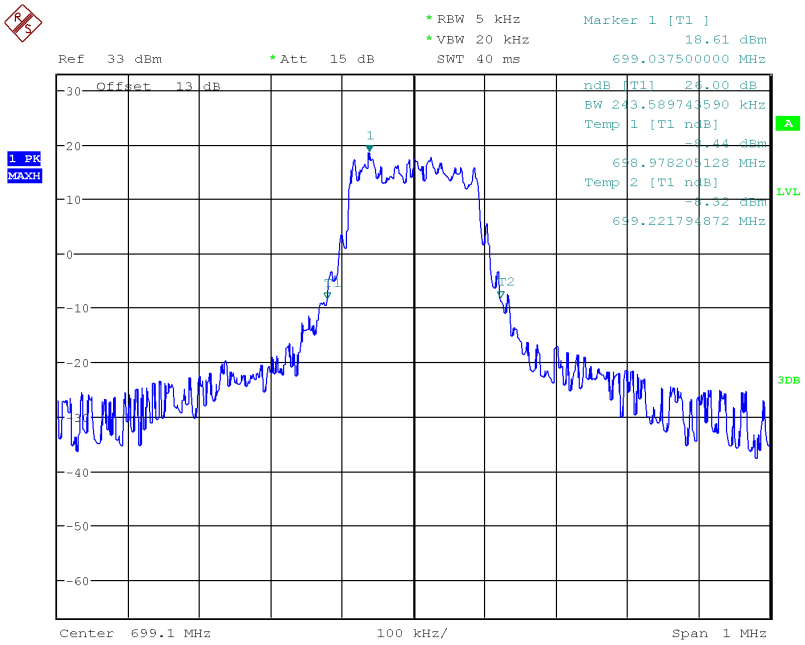

NB-IoT In-band band 12 23011 QPSK(99%)



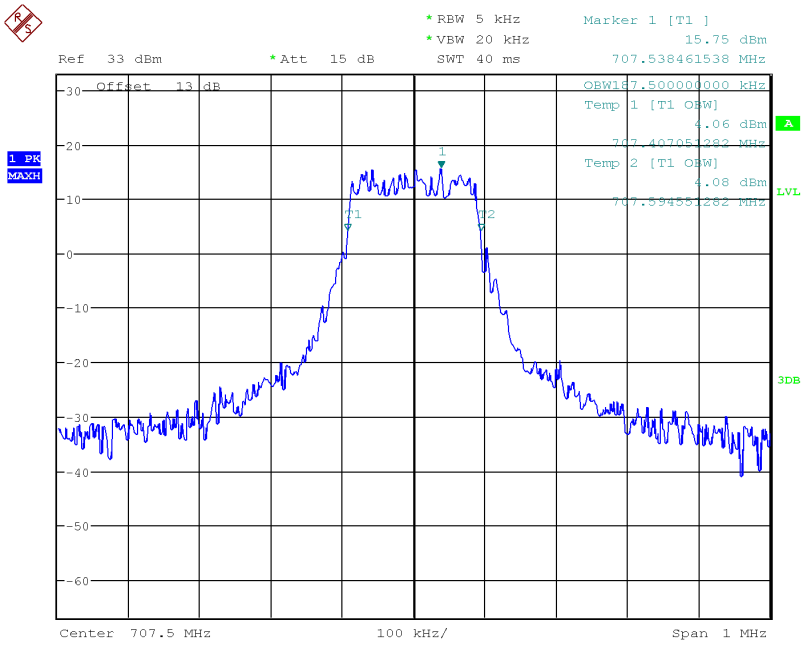

NB-IoT In-band band 12 23011 BPSK(99%)



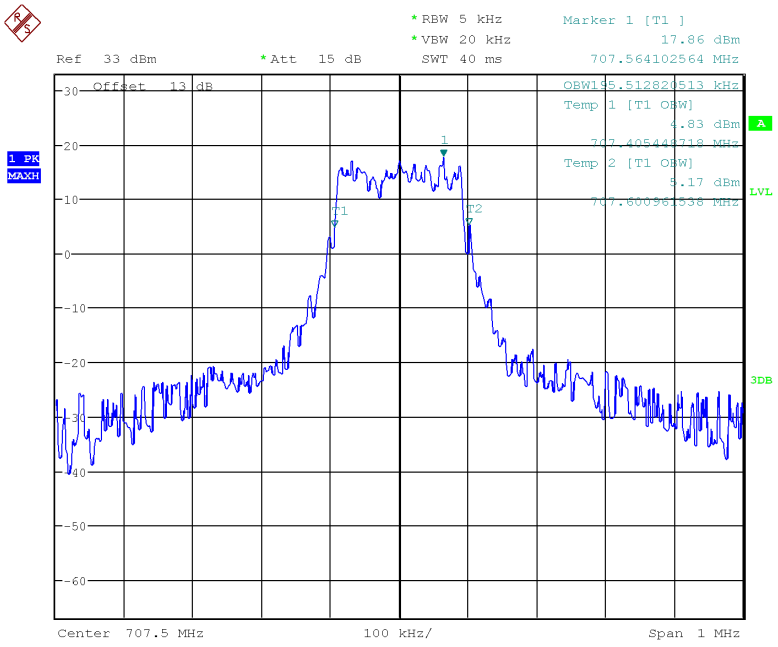

NB-IoT In-band band 12 23011 QPSK(26dB)



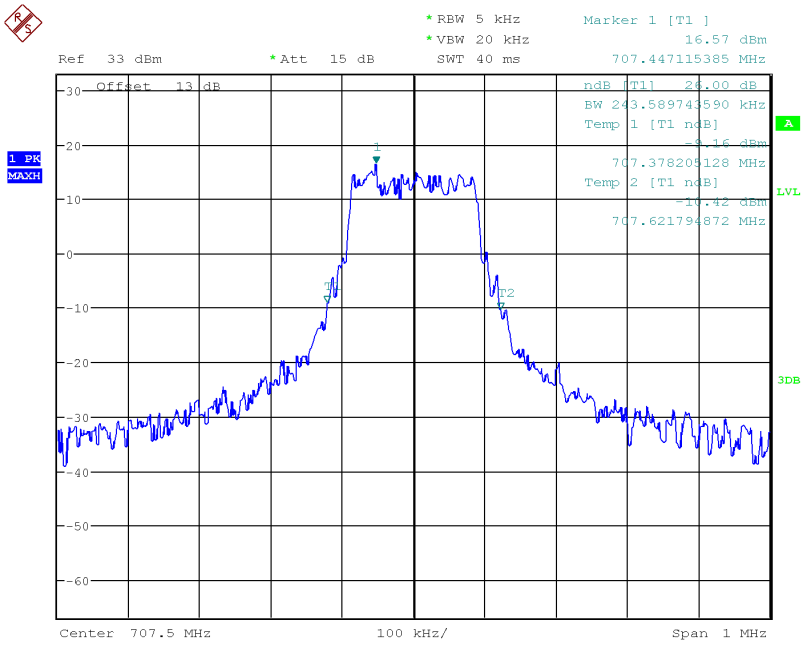

NB-IoT In-band band 12 23011 BPSK(26dB)



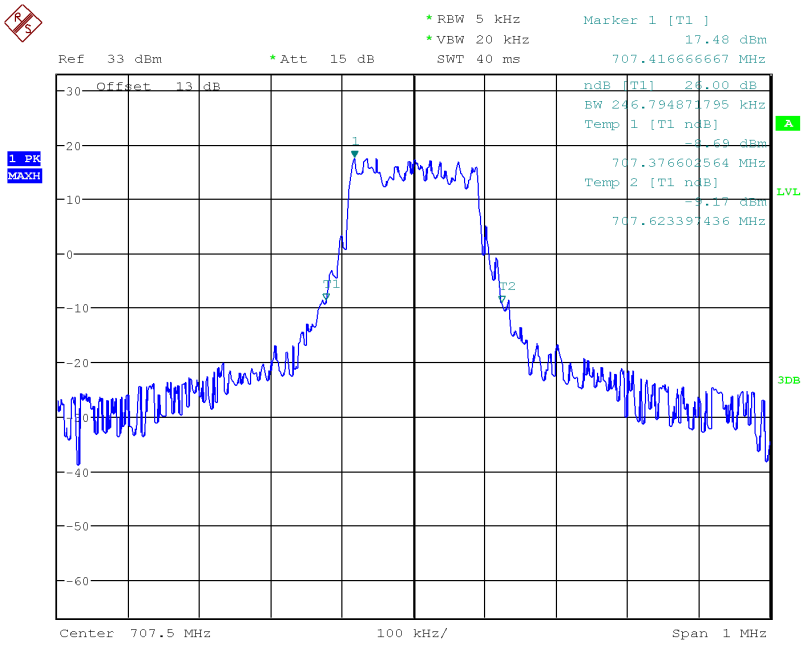

NB-IoT In-band band 12 23095 QPSK(99%)



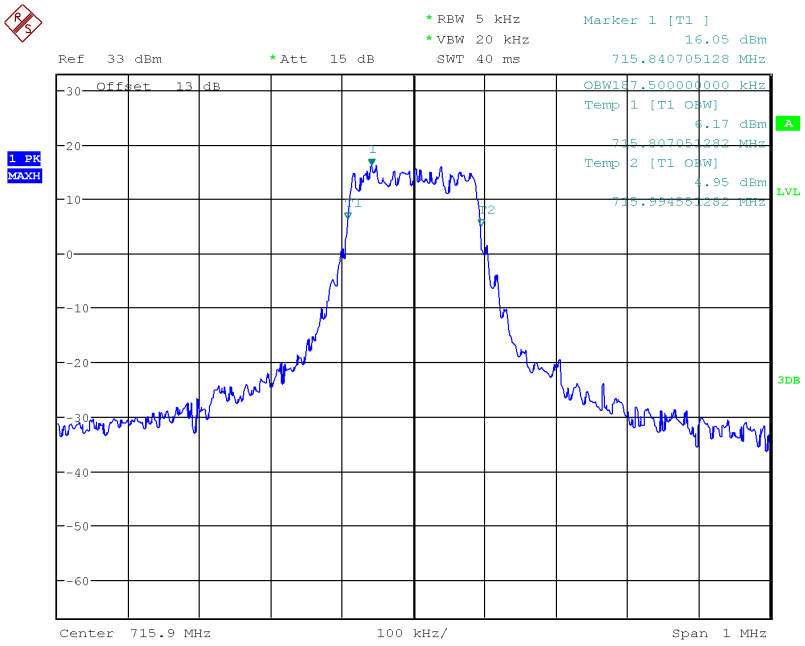

NB-IoT In-band band 12 23095 BPSK(99%)



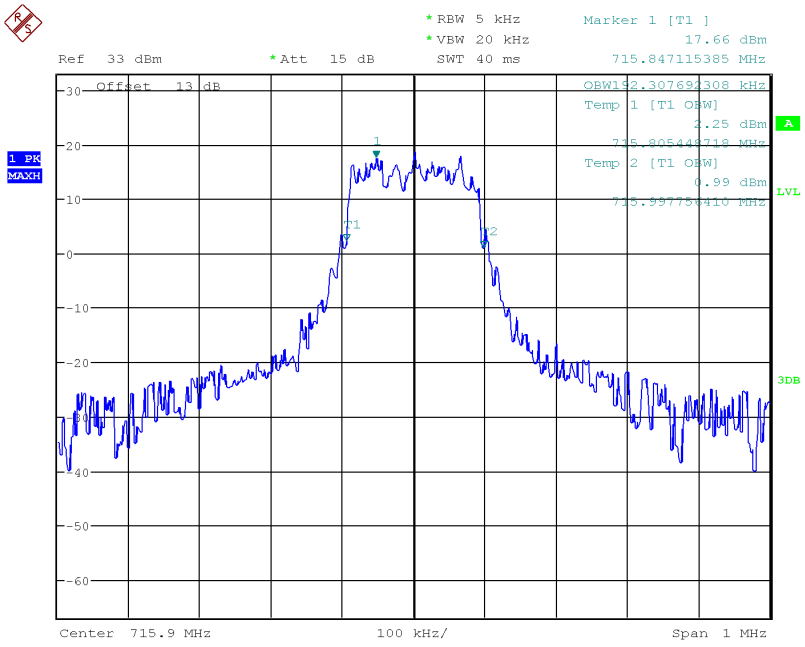

NB-IoT In-band band 12 23095 QPSK(26dB)



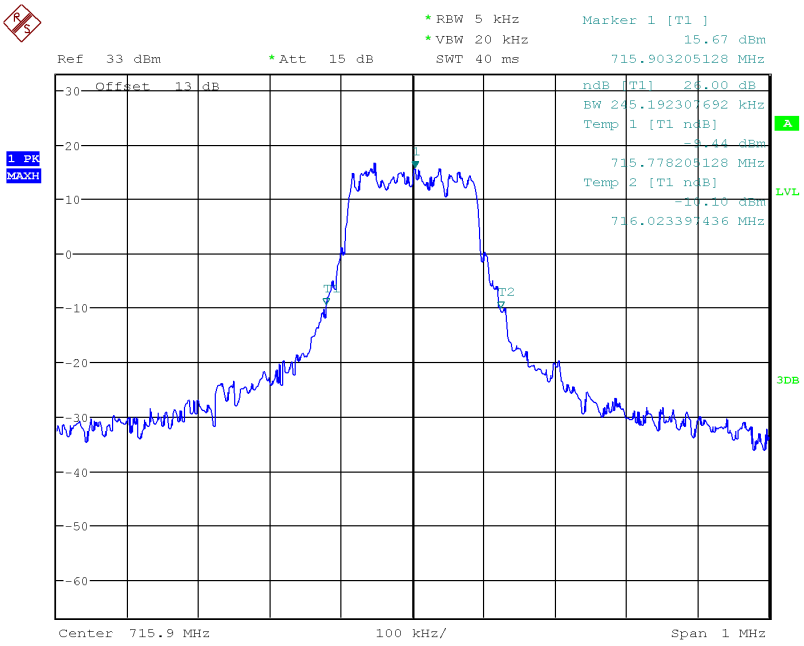

NB-IoT In-band band 12 23095 BPSK(26dB)



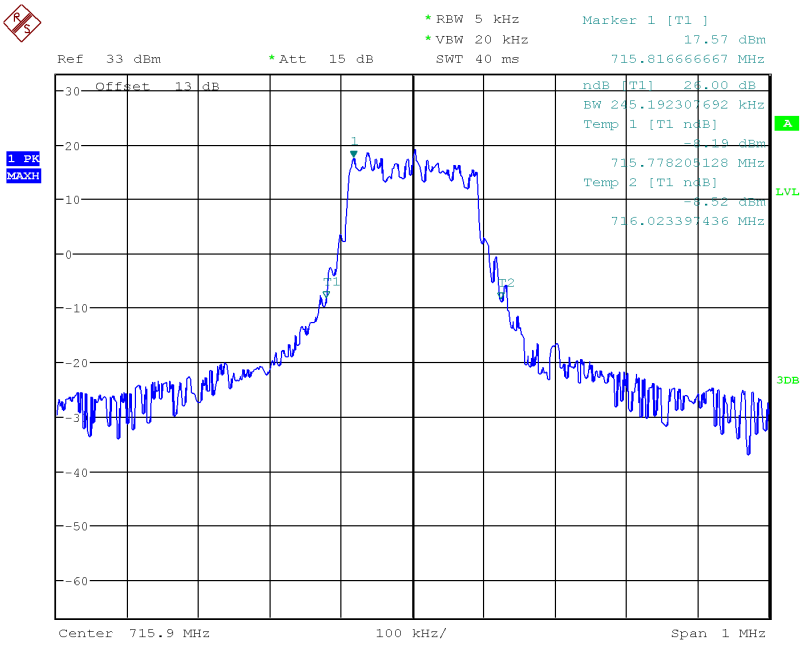

NB-IoT In-band band 12 23179 QPSK(99%)



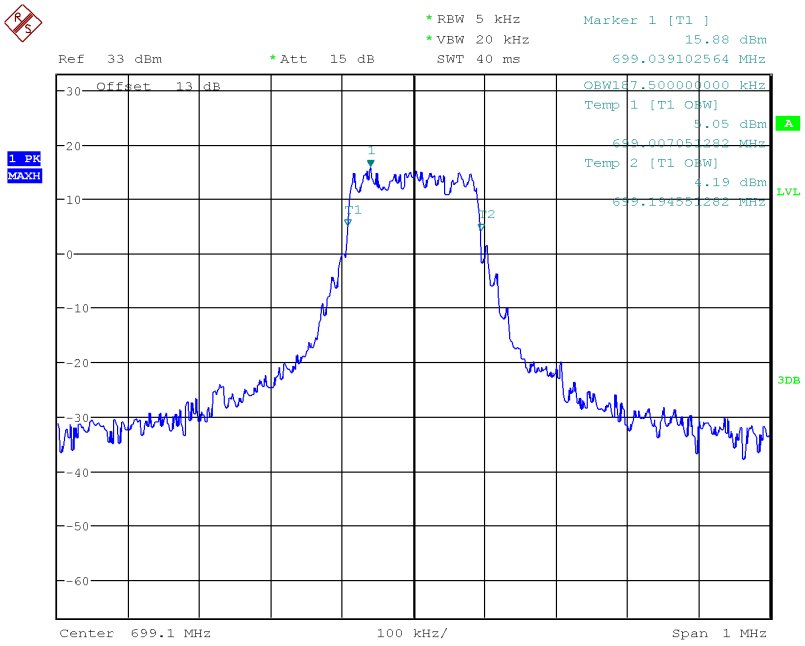

NB-IoT In-band band 12 23179 BPSK(99%)



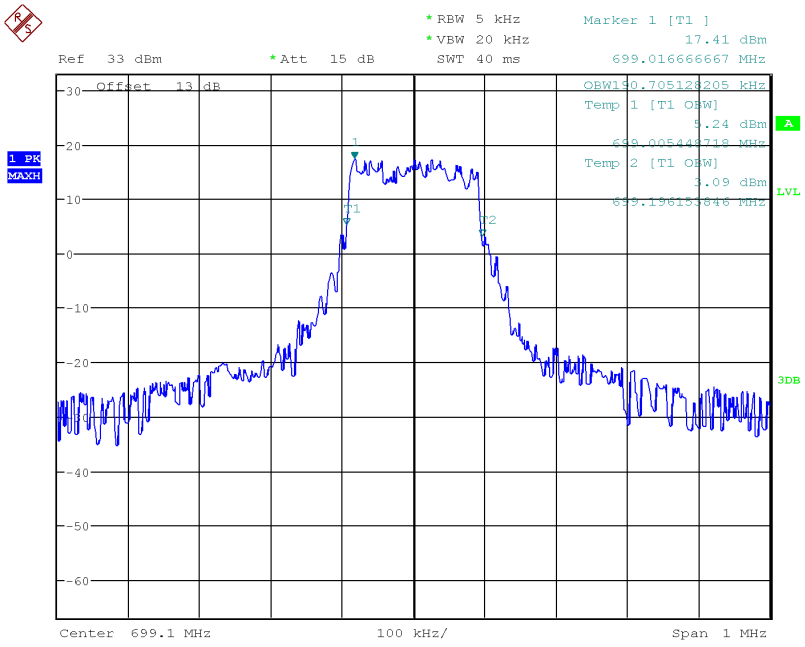

NB-IoT In-band band 12 23179 QPSK(26dB)




NB-IoT In-band band 12 23179 BPSK(26dB)




NB-IoT Guard-band band 12 23011 QPSK(99%)

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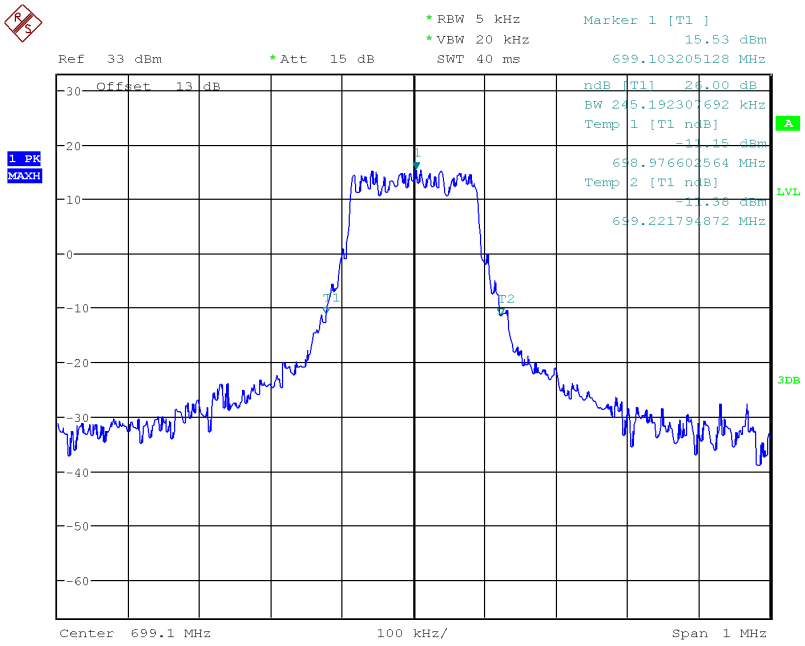


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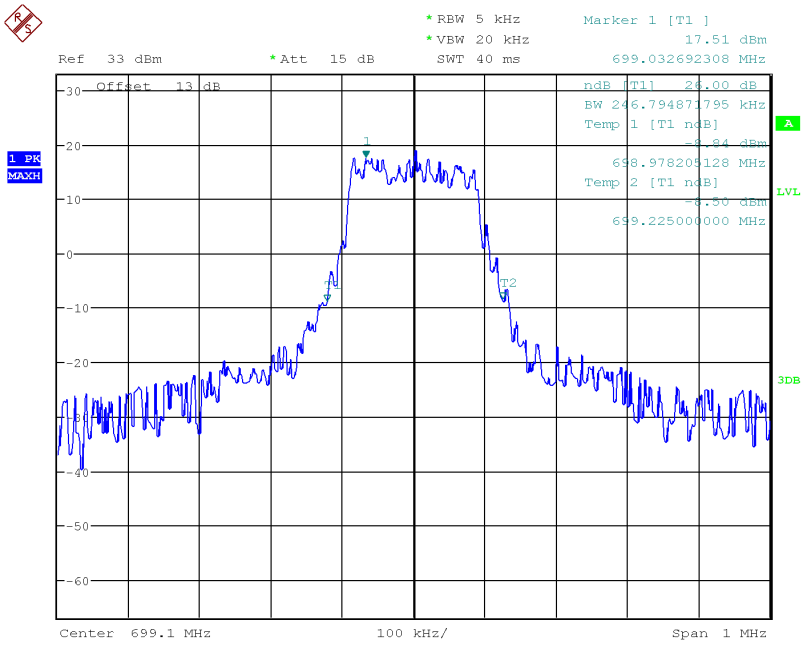
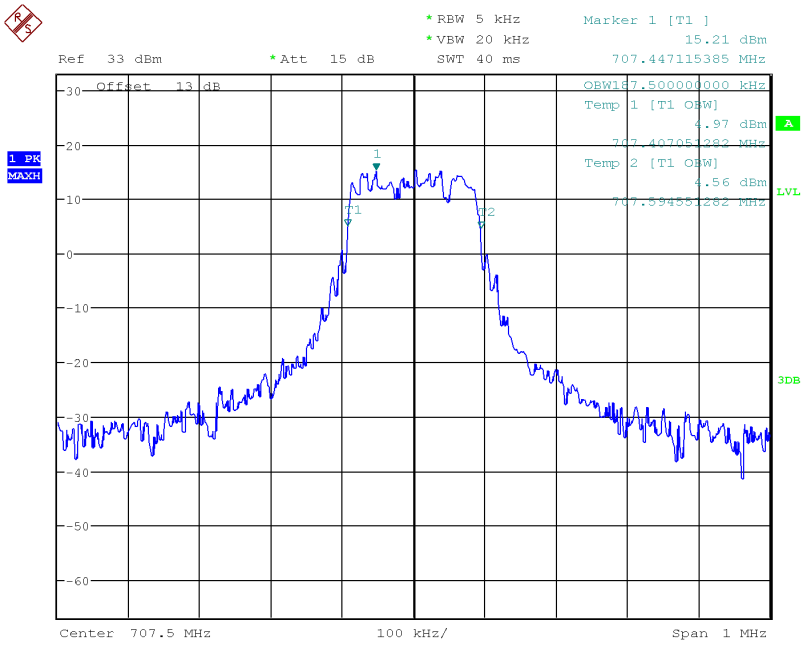
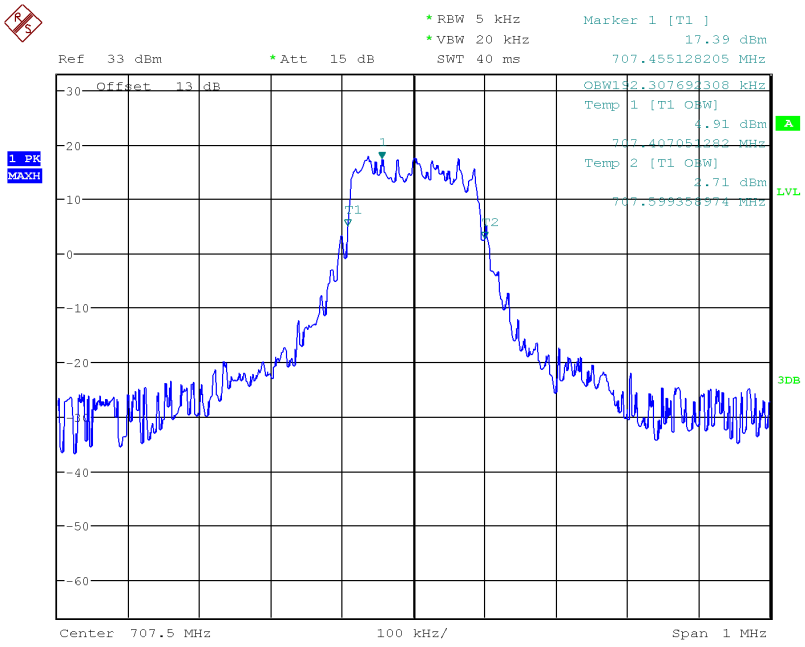



NB-IoT Guard-band band 12 23011 BPSK(26dB)




NB-IoT Guard-band band 12 23095 QPSK(99%)

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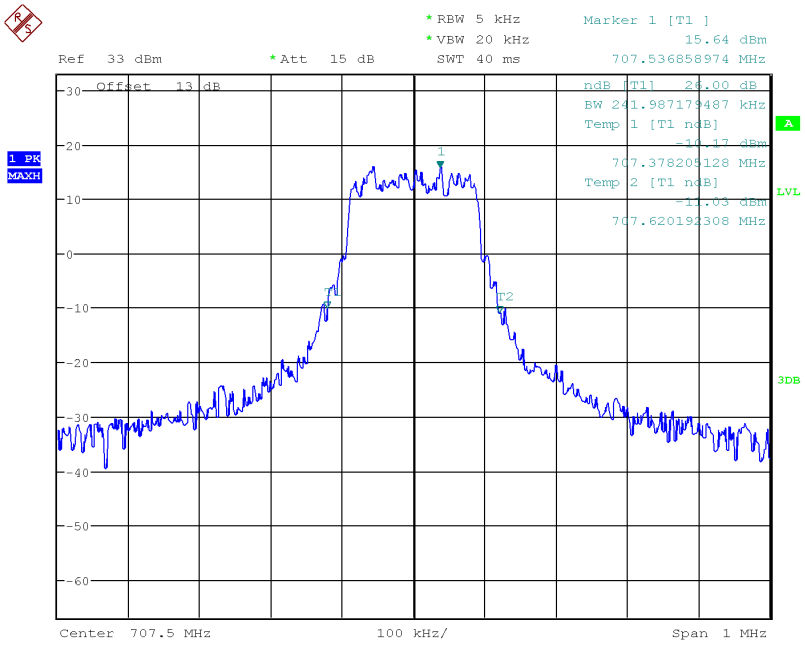
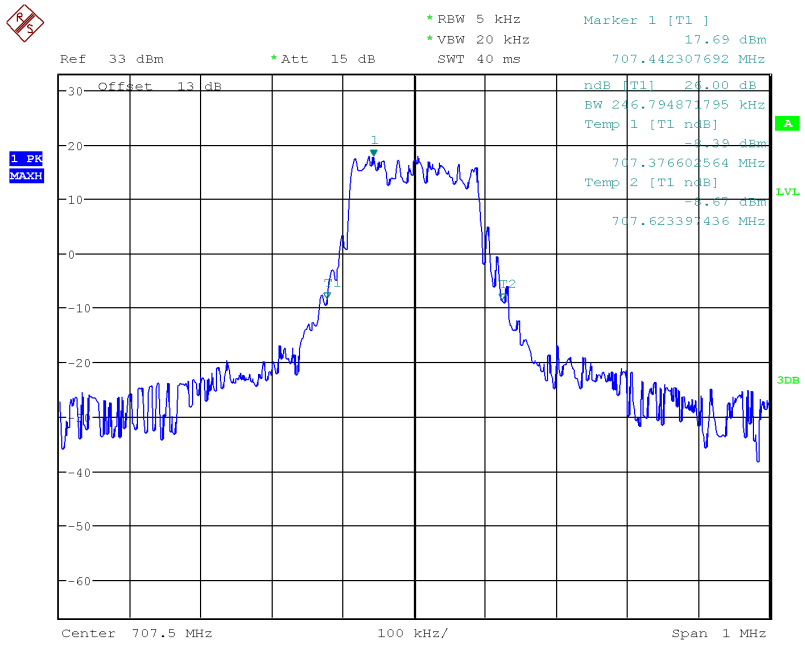
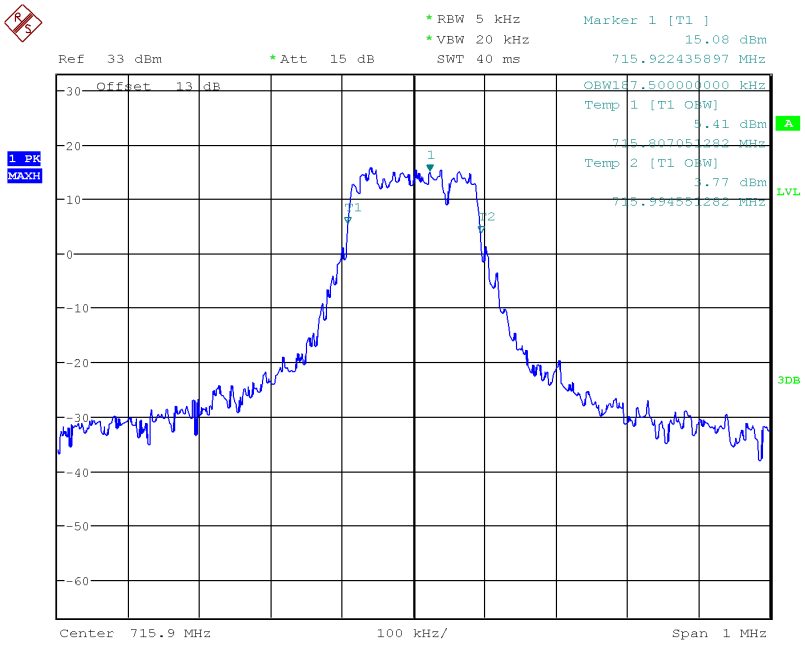



NB-IoT Guard-band band 12 23095 QPSK(26dB)

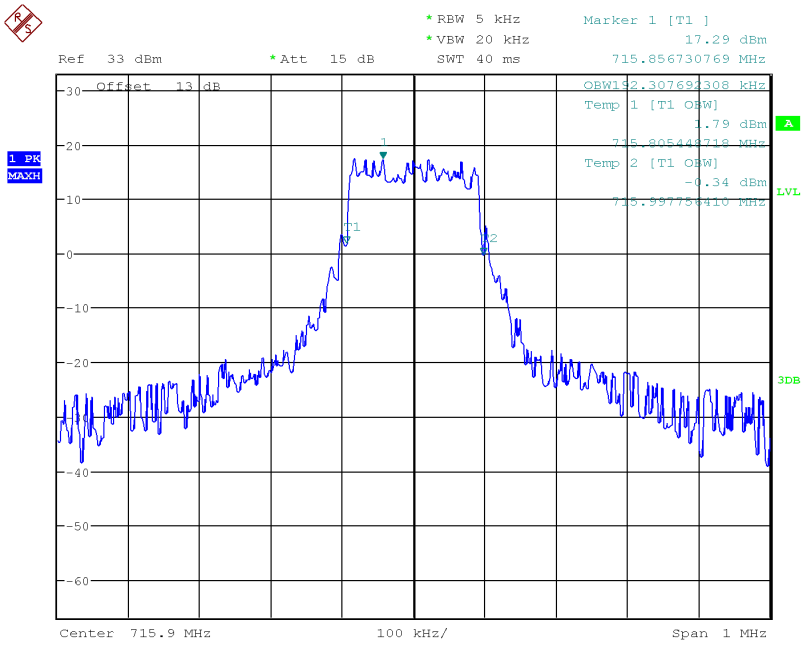



NB-IoT Guard-band band 12 23095 BPSK(26dB)



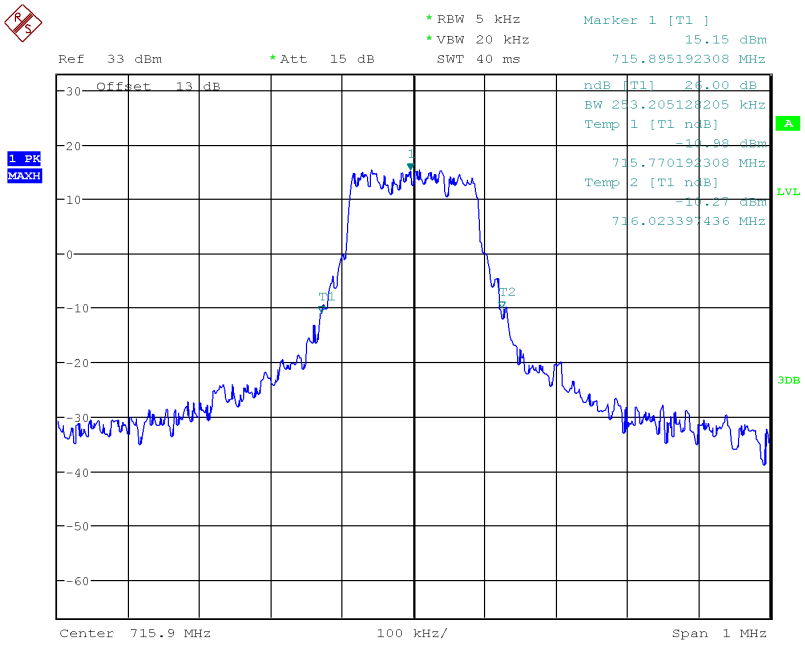

Date: 26.DEC.2018 22:07:57

NB-IoT Guard-band band 12 23179 QPSK(99%)

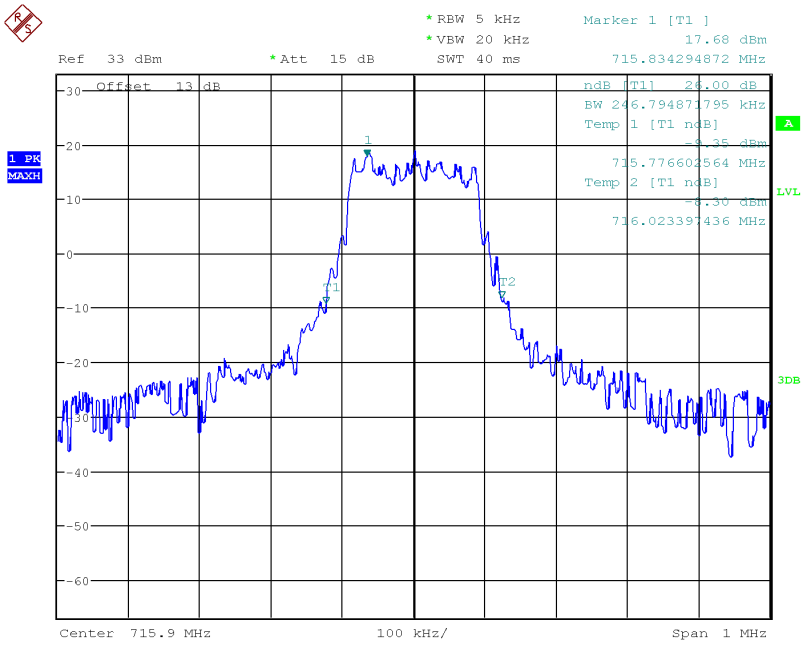



Date: 26.DEC.2018 22:06:15

NB-IoT Guard-band band 12 23179 BPSK(99%)

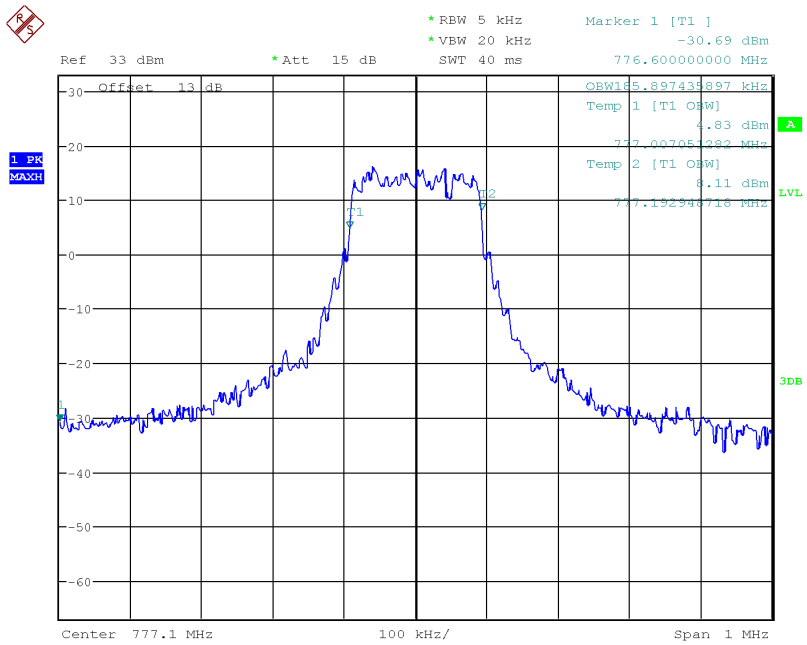



NB-IoT Guard-band band 12 23179 QPSK(26dB)

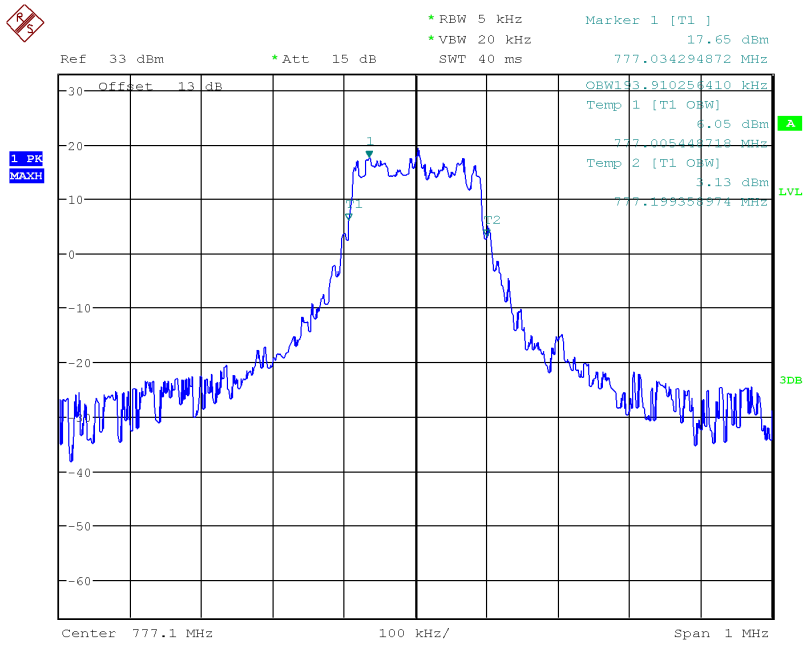



NB-IoT Guard-band band 12 23179 BPSK(26dB)

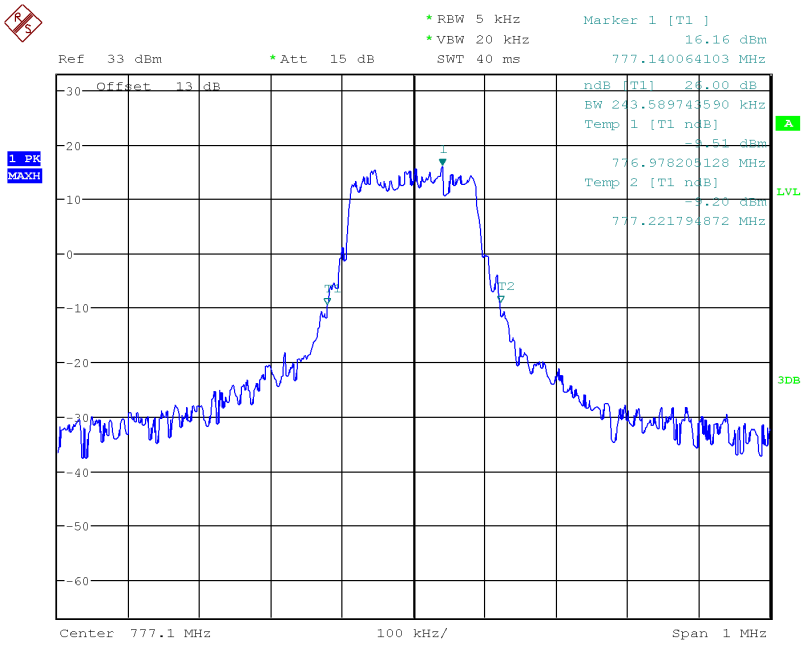
**Graphical results for Band13:**



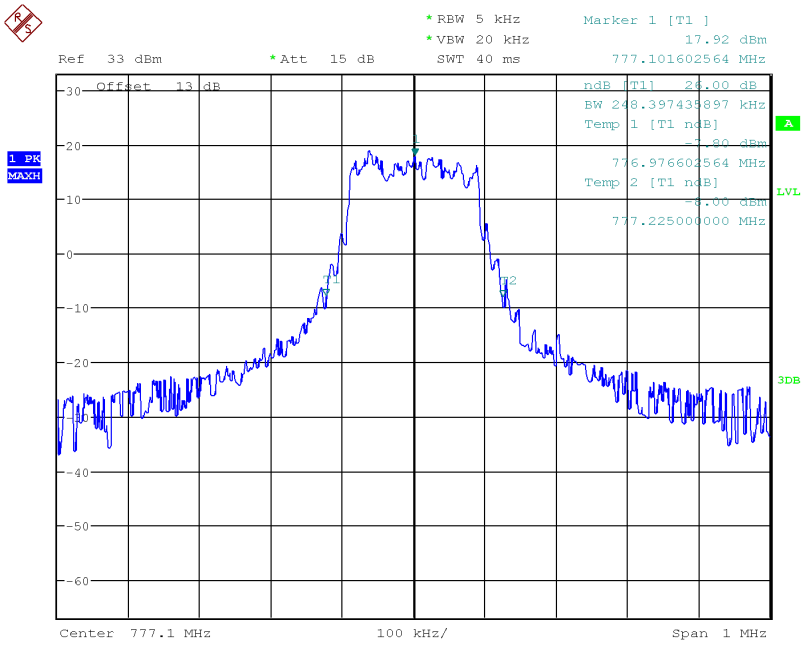

NB-IoT standalone band 13 23181 QPSK(99%)



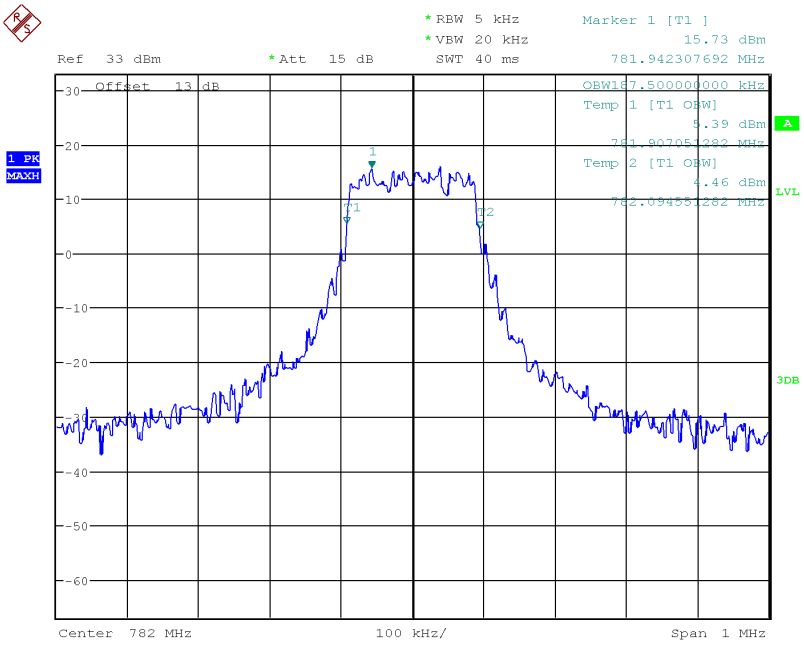

NB-IoT standalone band 13 23181 BPSK(99%)



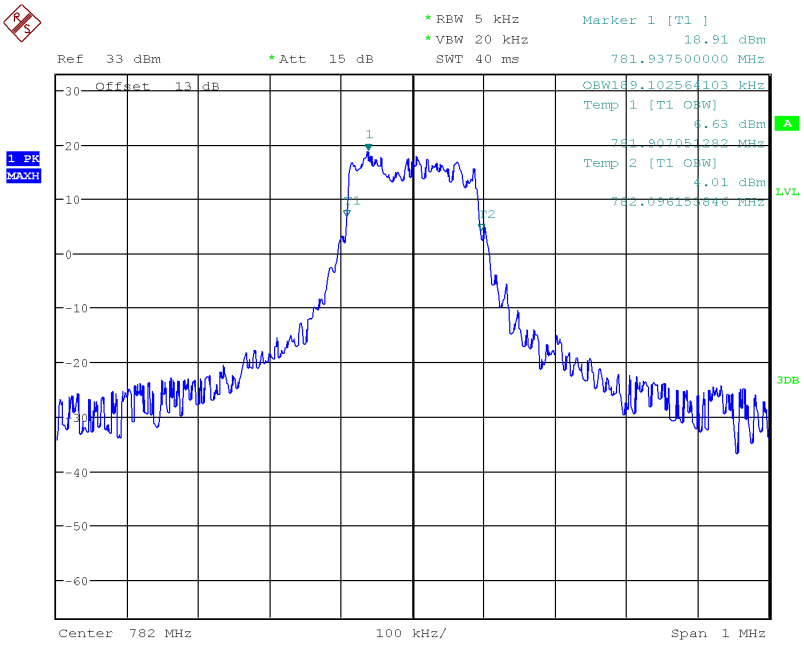

NB-IoT standalone band 13 23181 QPSK(26dB)



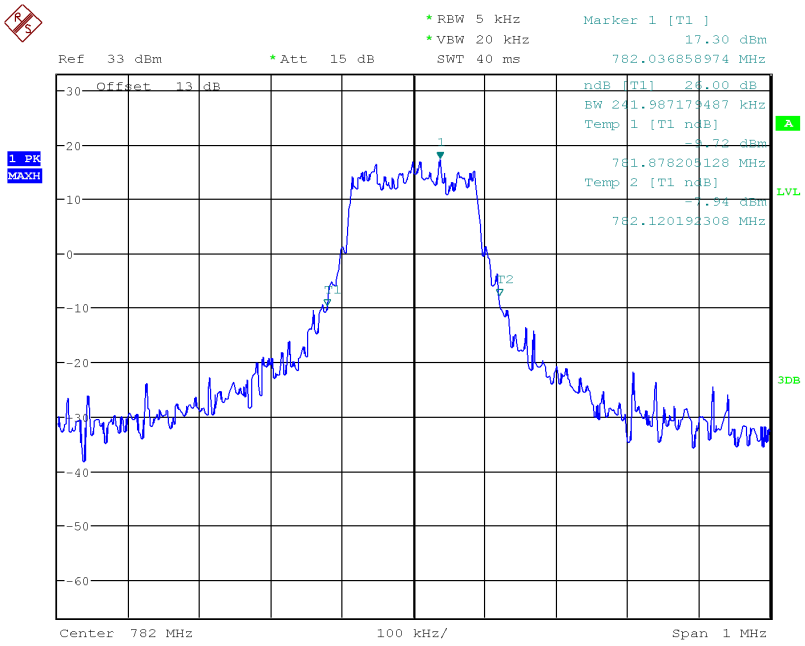

NB-IoT standalone band 13 23181 BPSK(26dB)



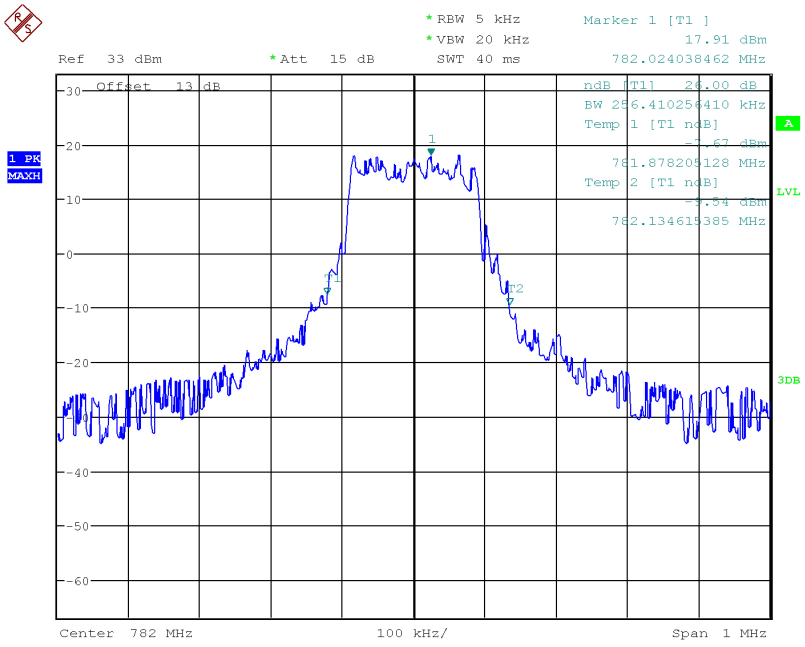

NB-IoT standalone band 13 23230 QPSK(99%)



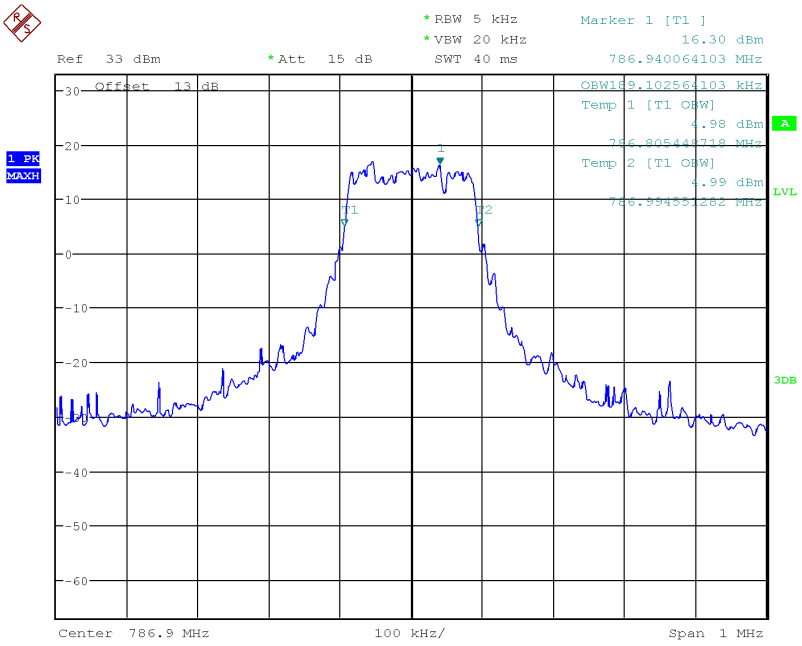

NB-IoT standalone band 13 23230 BPSK(99%)



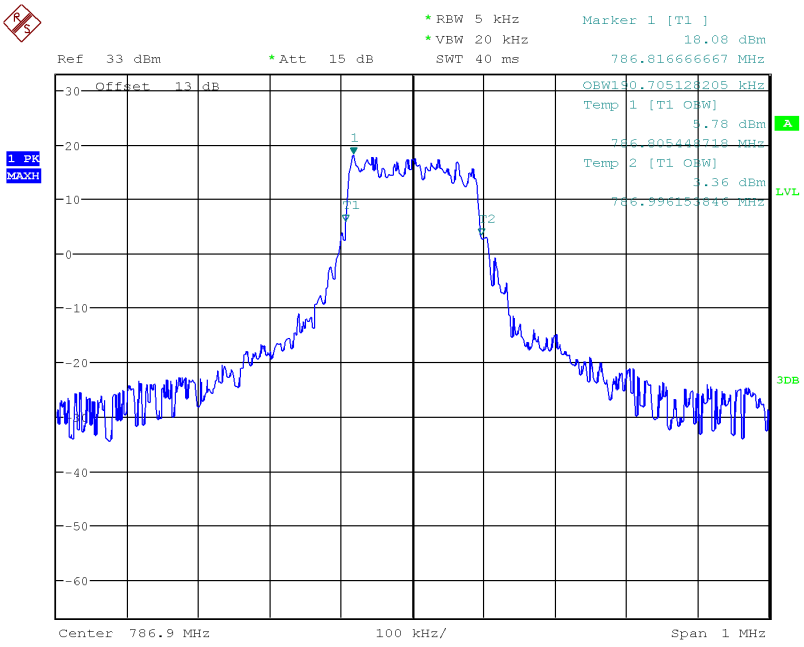

NB-IoT standalone band 13 23230 QPSK(26dB)




NB-IoT standalone band 13 23230 BPSK(26dB)




NB-IoT standalone band 13 23279 QPSK(99%)

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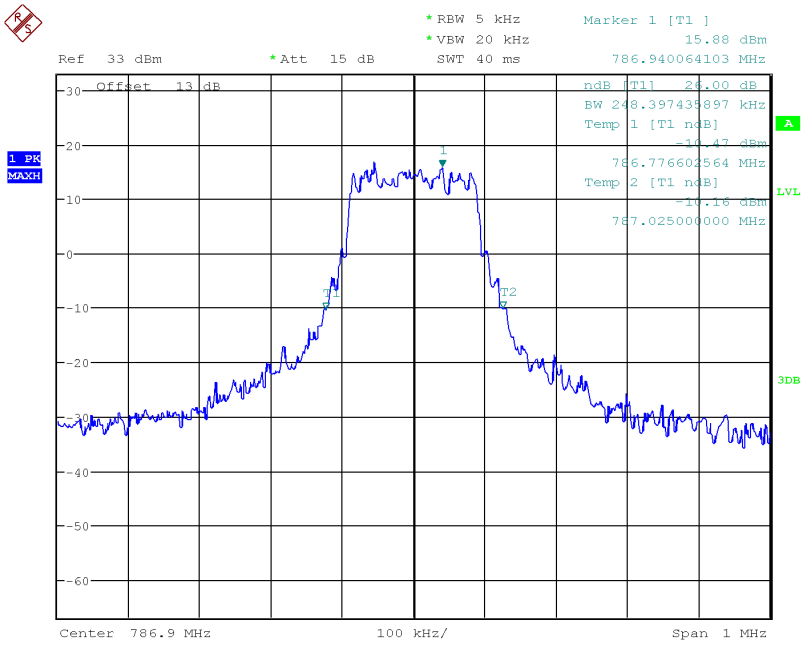
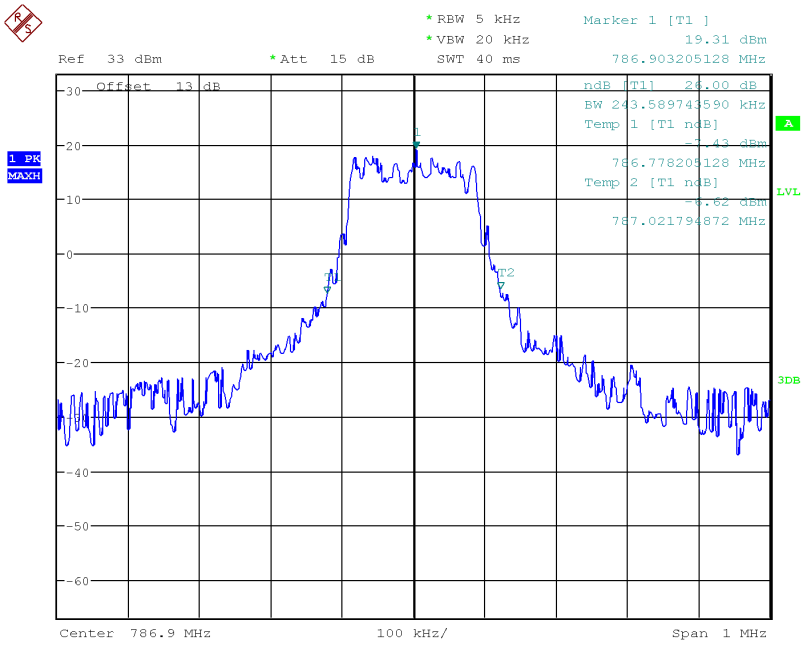
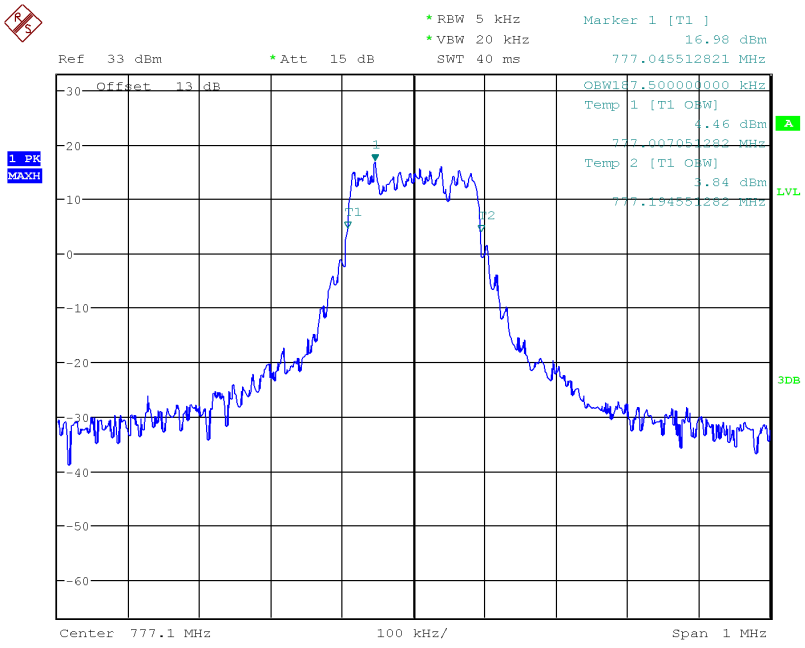


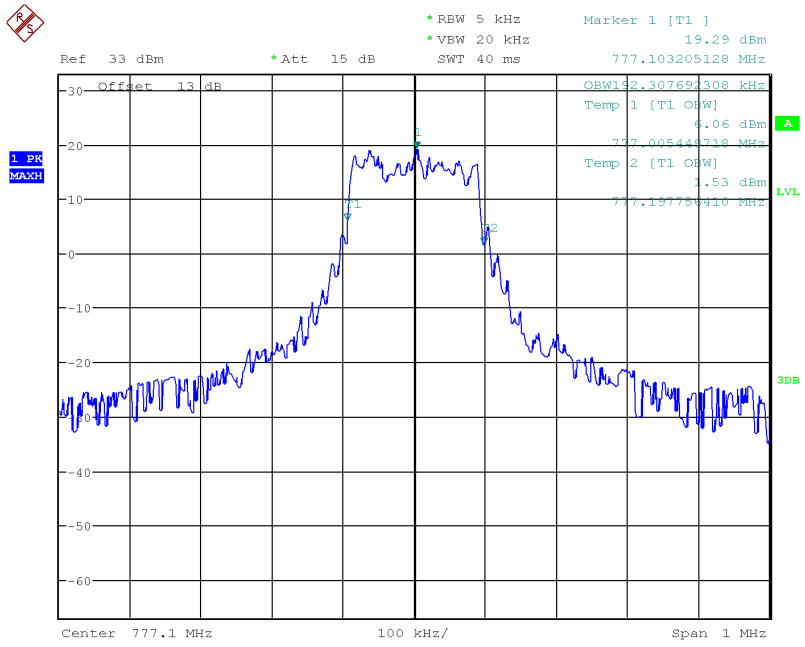

NB-IoT standalone band 13 23279 QPSK(26dB)




NB-IoT standalone band 13 23279 BPSK(26dB)




NB-IoT In-band band 13 23181 QPSK(99%)

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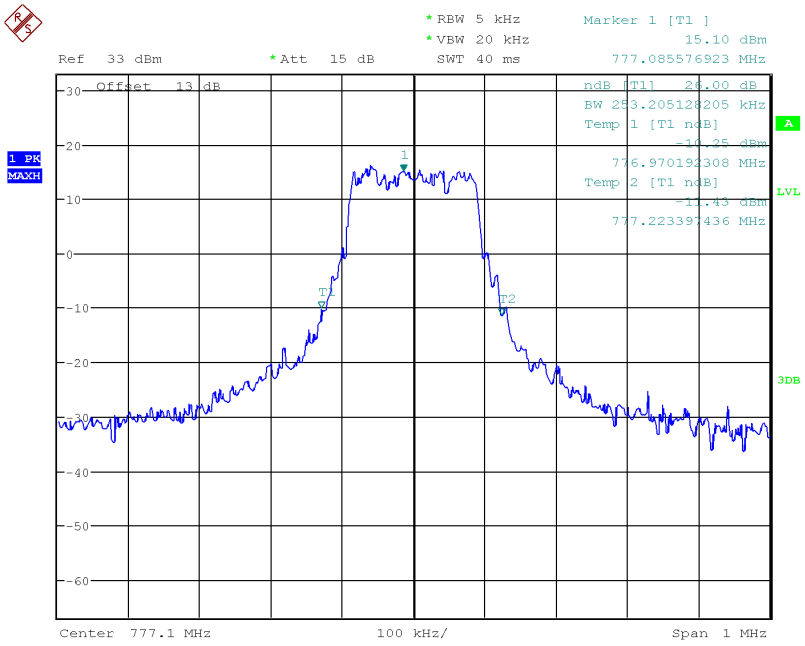


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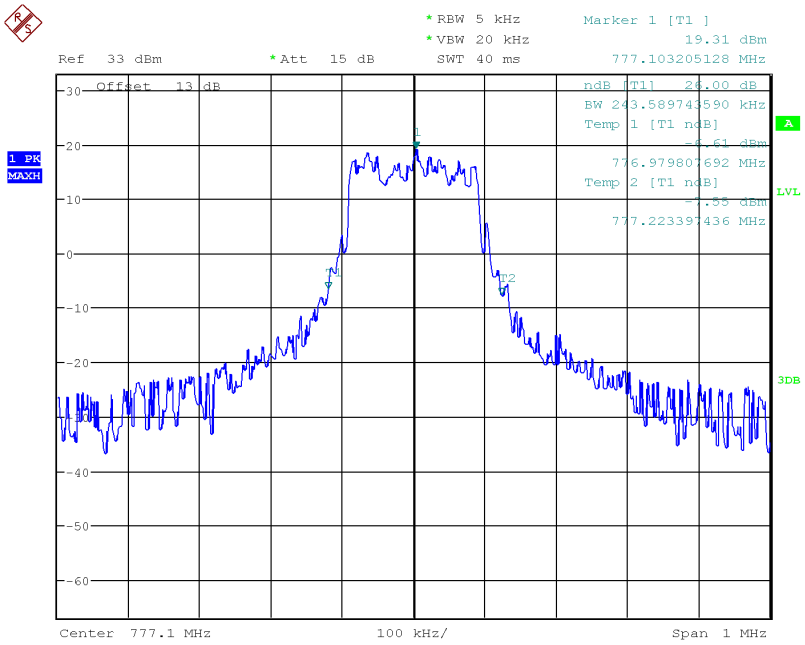


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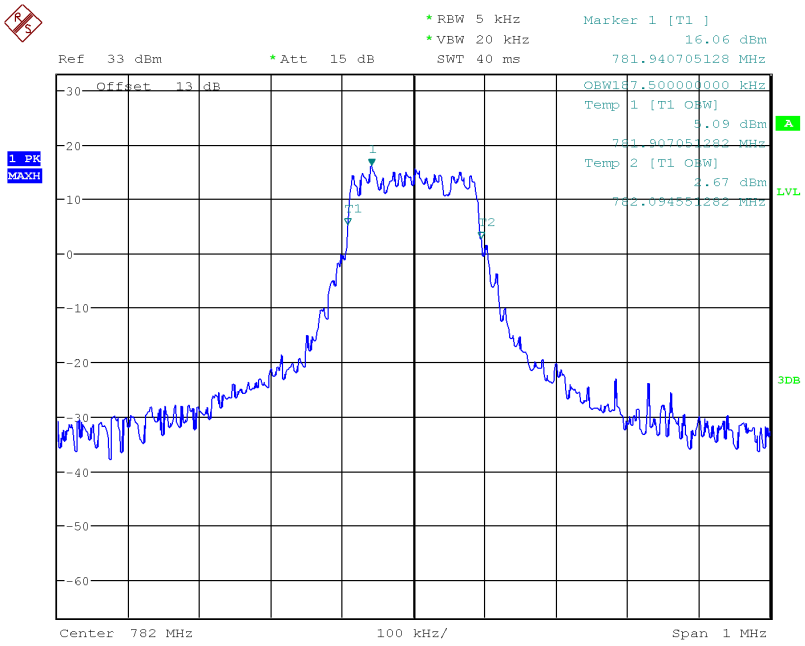
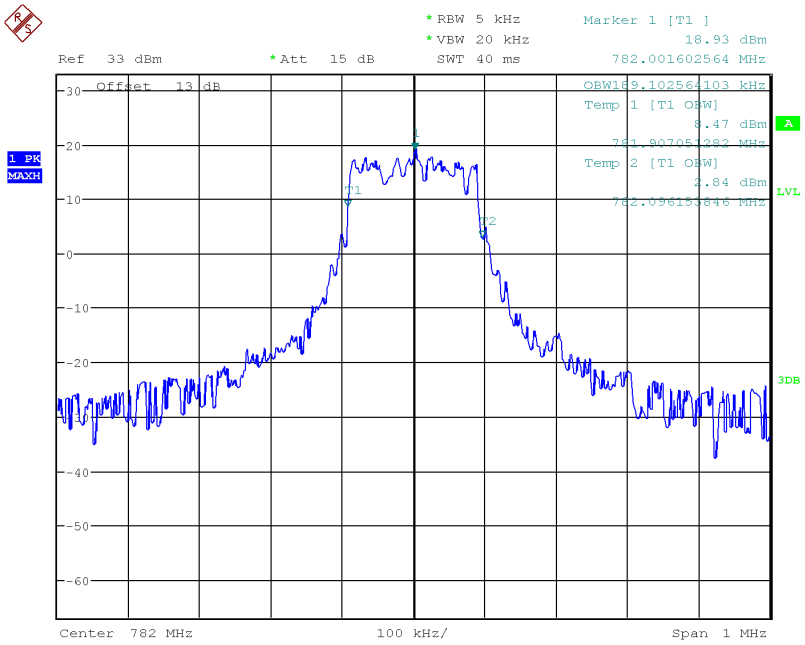



NB-IoT In-band band 13 23230 QPSK(99%)

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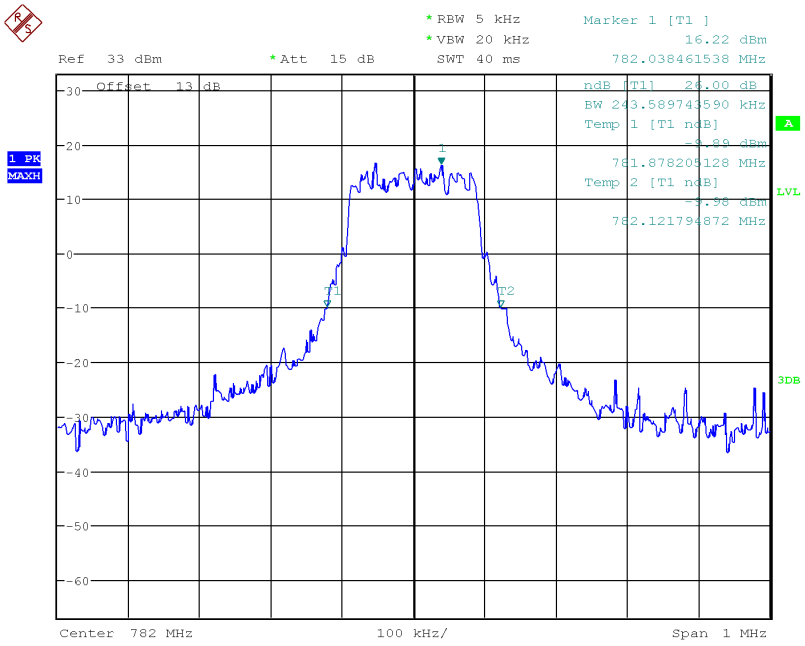


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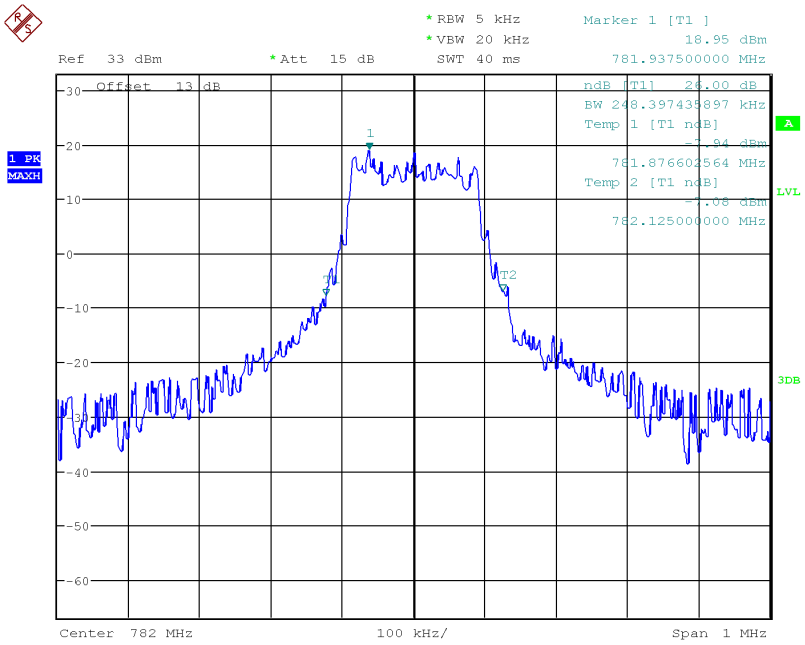
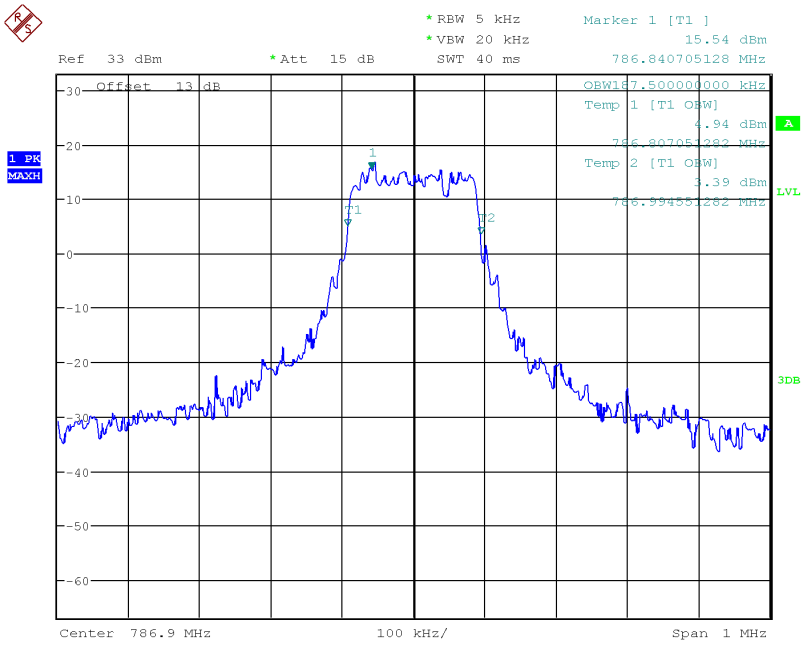
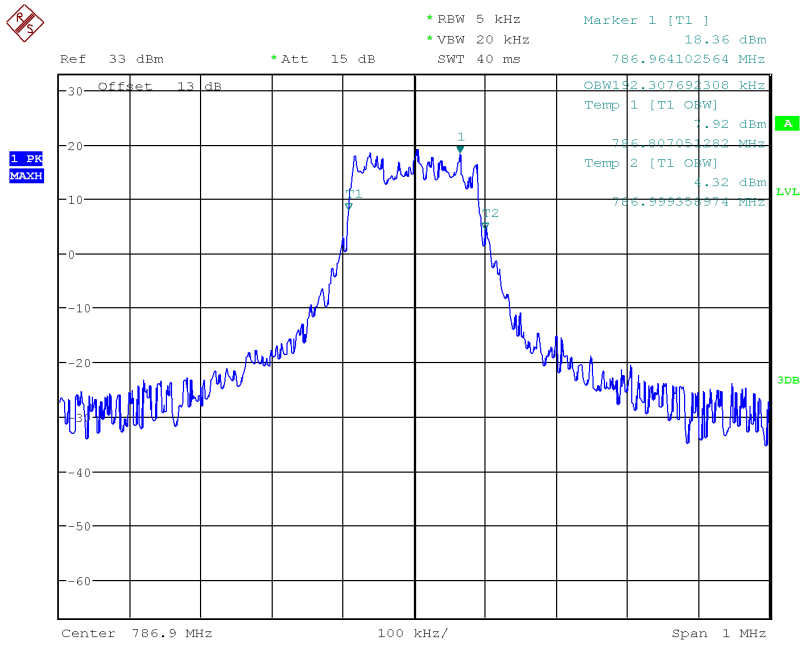


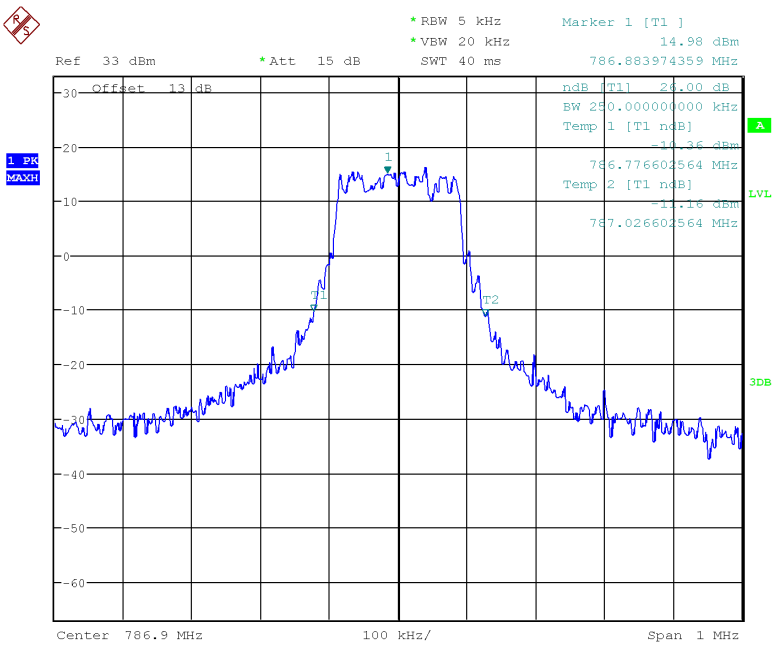

NB-IoT In-band band 13 23230 BPSK(26dB)



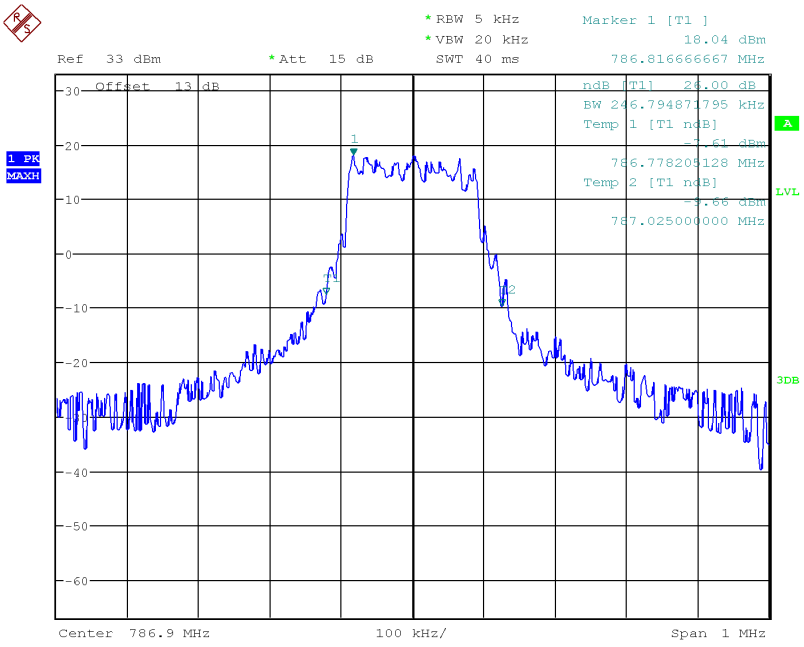

NB-IoT In-band band 13 23279 QPSK(99%)



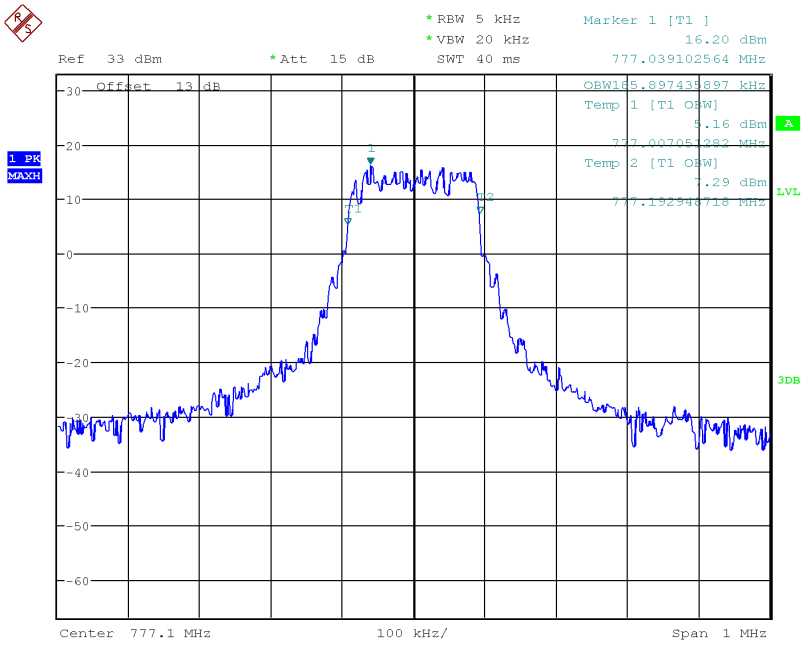

NB-IoT In-band band 13 23279 BPSK(99%)



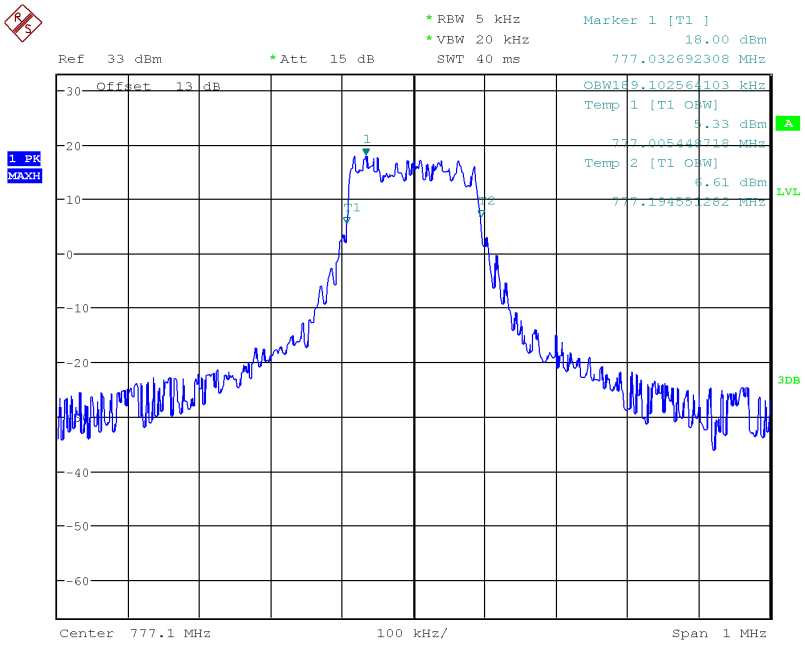

NB-IoT In-band band 13 23279 QPSK(26dB)



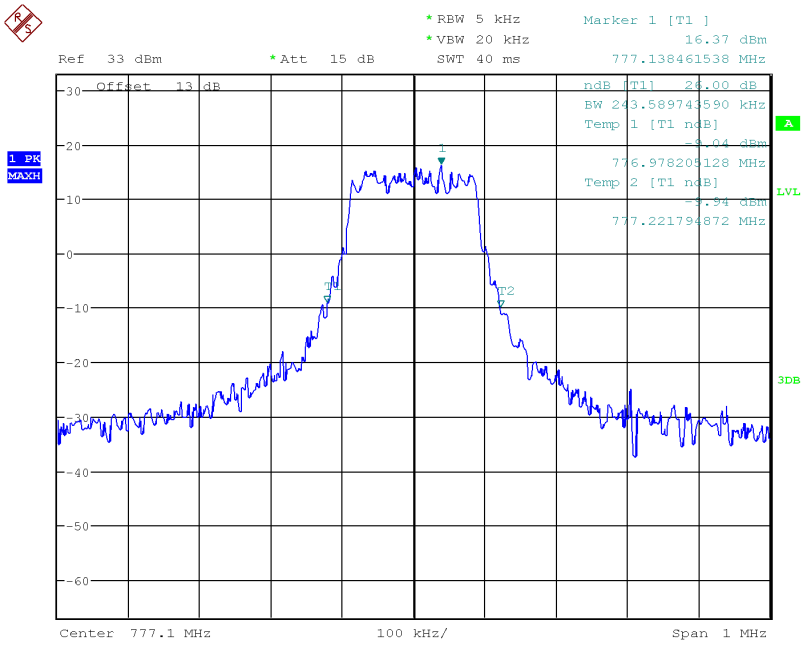

NB-IoT In-band band 13 23279 BPSK(26dB)



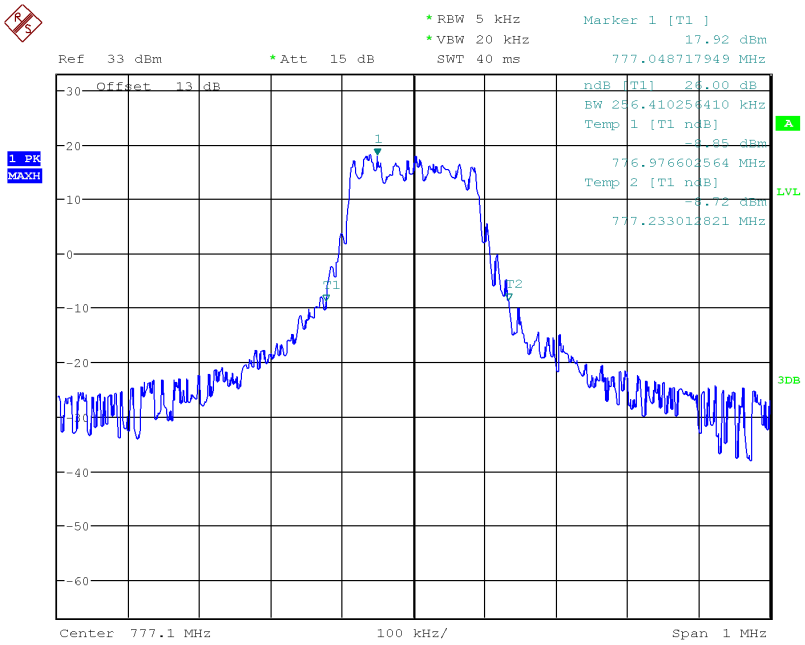

NB-IoT Guard-band band 13 23181 QPSK(99%)



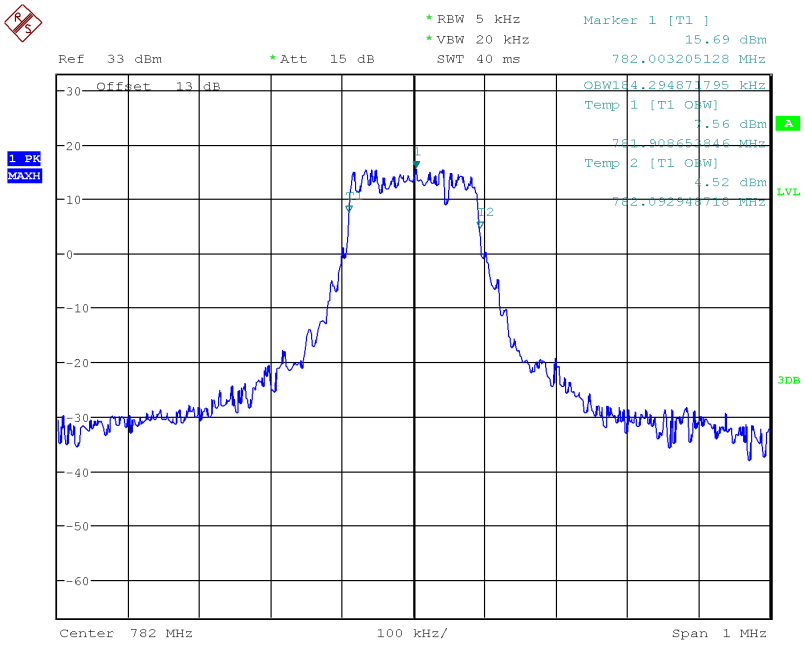

NB-IoT Guard-band band 13 23181 BPSK(99%)




NB-IoT Guard-band band 13 23181 QPSK(26dB)




NB-IoT Guard-band band 13 23181 BPSK(26dB)

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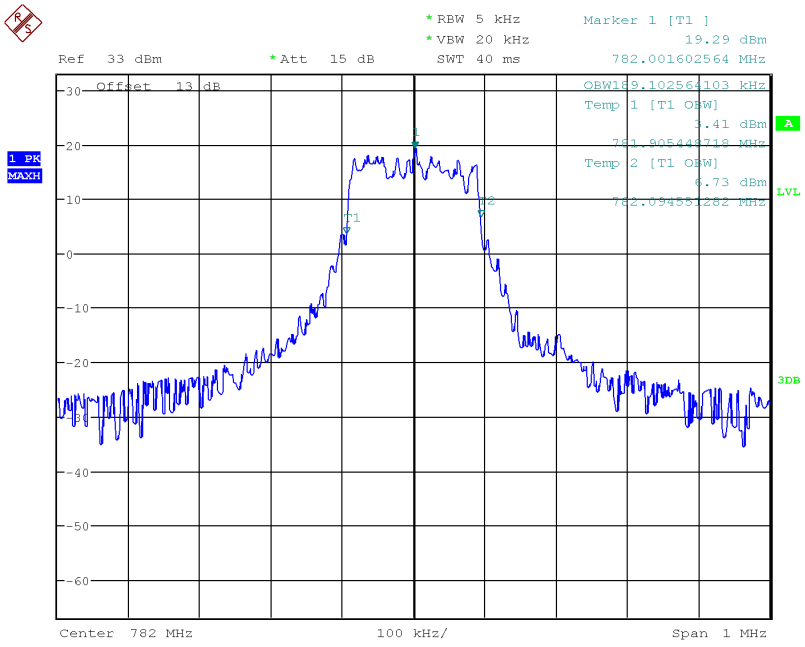


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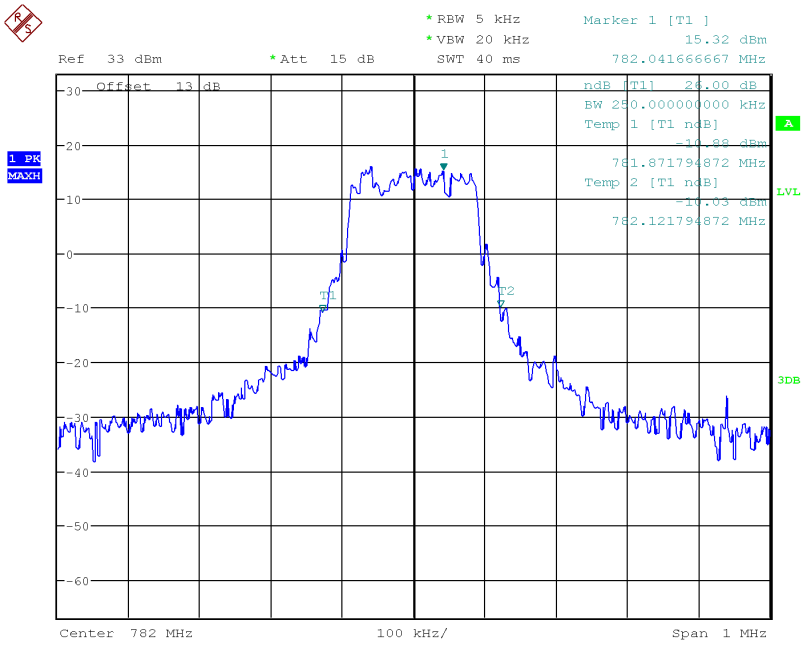
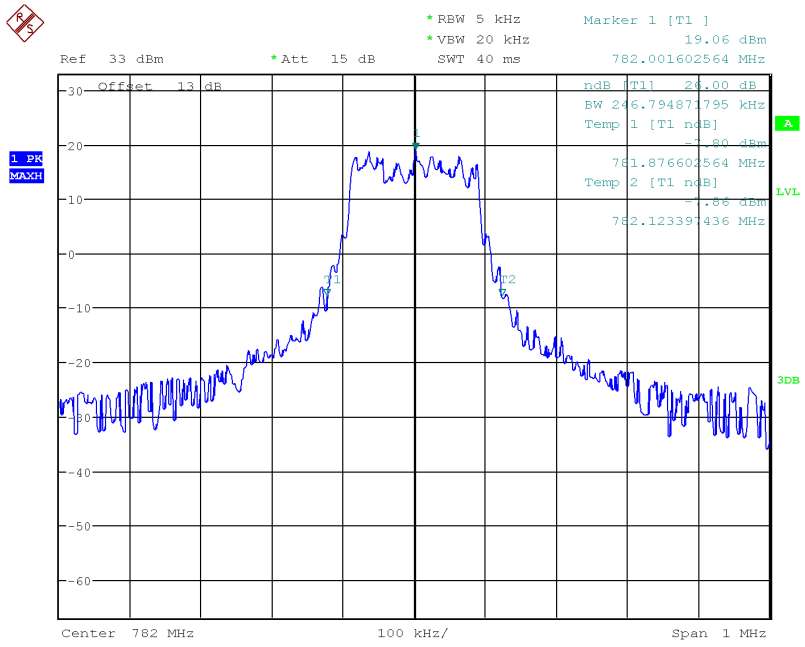
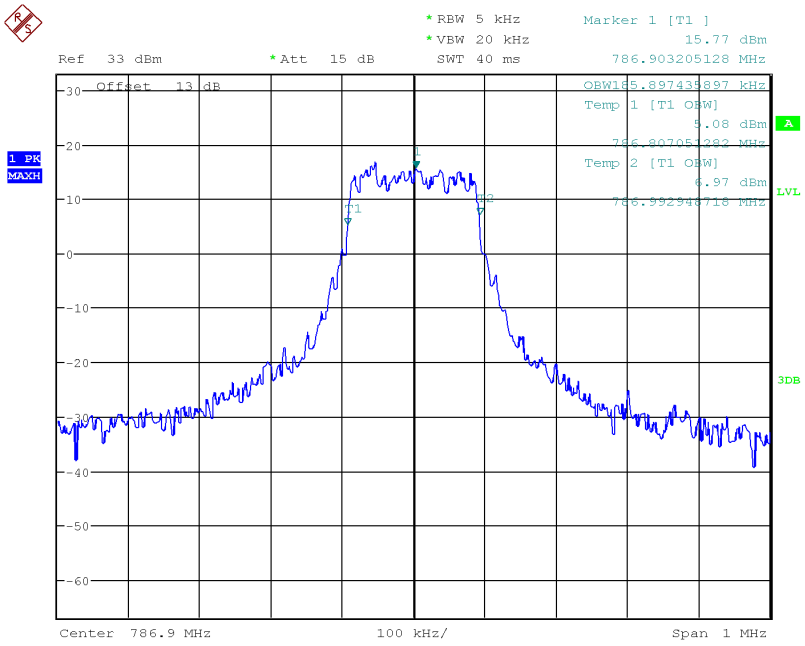


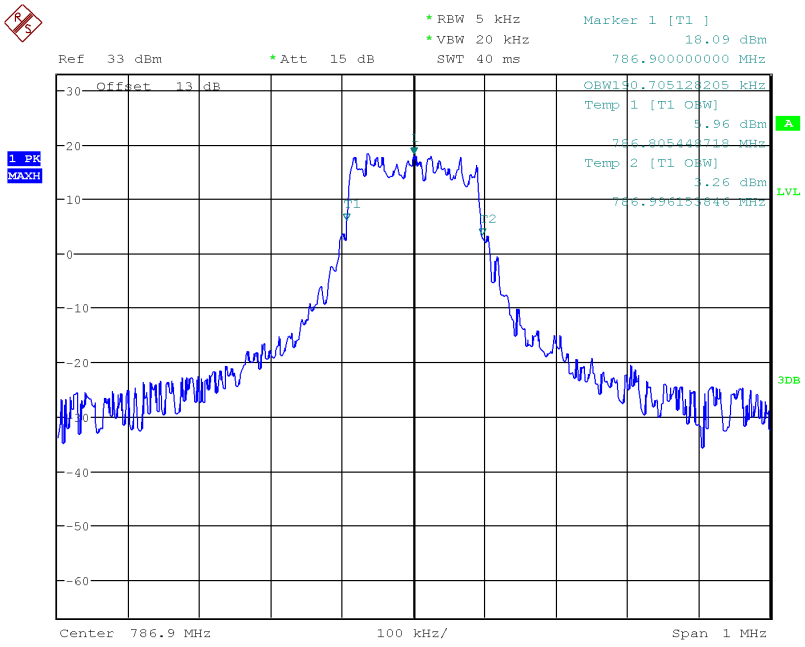

NB-IoT Guard-band band 13 23230 QPSK(26dB)



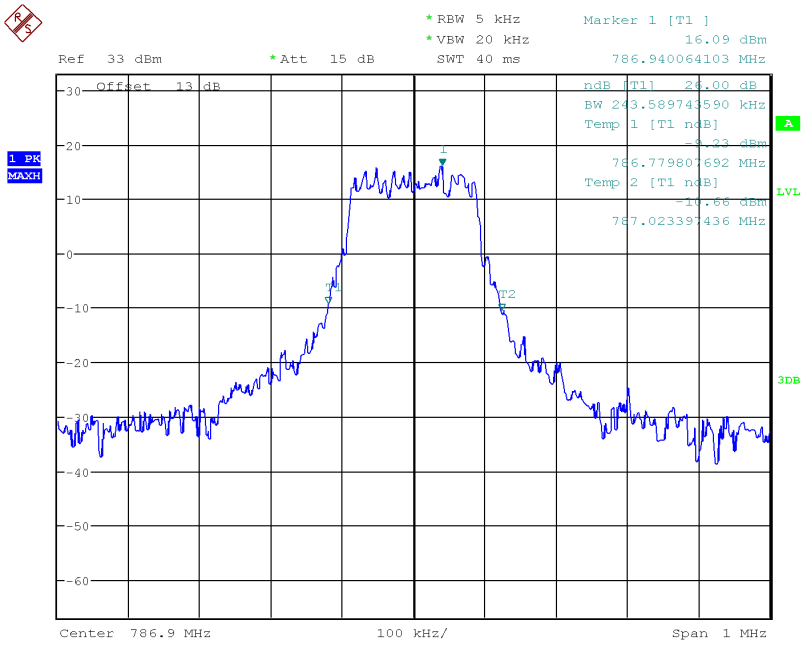

NB-IoT Guard-band band 13 23230 BPSK(26dB)



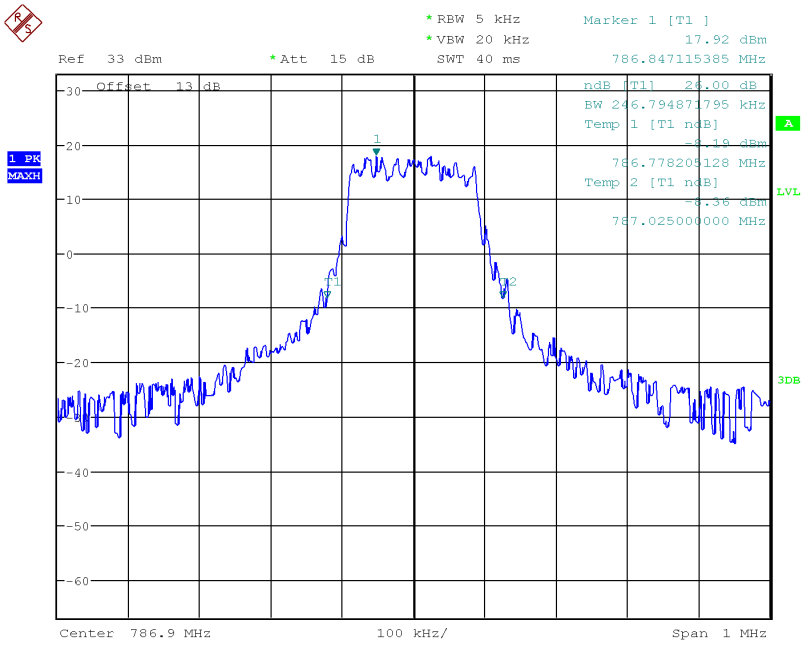

NB-IoT Guard-band band 13 23279 QPSK(99%)




NB-IoT Guard-band band 13 23279 BPSK(99%)




NB-IoT Guard-band band 13 23279 QPSK(26dB)




NB-IoT Guard-band band 13 23279 BPSK(26dB)

## 5.3 Conducted Spurious Emission

| | |
|---|---|
| **Specifications:** | FCC Part 2.1051, 24.238, 2.1053, 27.53 |
| **DUT Serial Number:** | 865235030045922 |
| **Test conditions:** | Ambient Temperature:15℃-35℃<br>Relative Humidity:30%-60%<br>Air pressure: 86-106kPa |
| **Test Results:** | -- |

### Limit Level Construction:

**According to Part 24.238 (a)**, i.e., Out of Band emissions. 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, so the limit level is: P(dBm)– (43 + 10 log(P)) dB= -13dBm.

**According to Part 27.53(h):**

Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 Bands, 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 log10(P) dB.

**According to Part 27.53(g):**

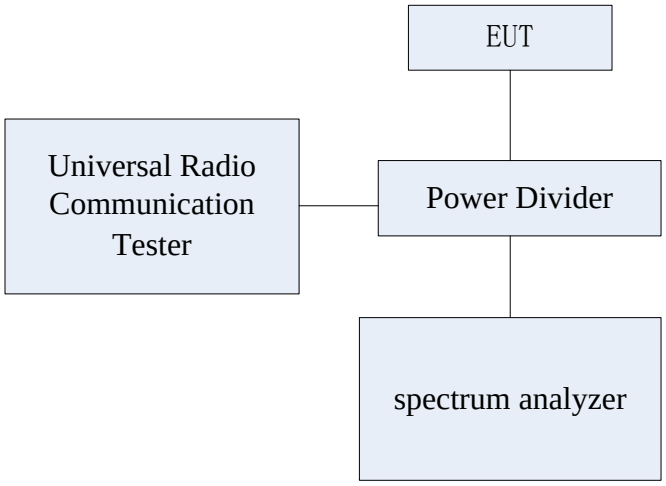
For operations in the 600 MHz Band and the 698-746 MHz Band, the power of any emission outside a licensee's frequency Band(s) of operation shall be attenuated below the transmitter power (P) within the licensed Band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution Bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz Bands immediately outside and adjacent to a licensee's frequency block, a resolution Bandwidth of at least 30 kHz may be employed.

**Measurement Uncertainty:**

| Item | Uncertainty | |
|---|---|---|
| Expanded Uncertainty | 9kHz < f≤4GHz | 0.71 dB (k=2) |
| | 4GHz≤f < 12.75GHz | 0.74 dB (k=2) |
| | 12.75GHz≤f < 26GHz | 2.70 dB (k=2) |

**Test Setup:**

During the test, the EUT was controlled via the Wireless Communications Test Set to ensure max power transmission and proper modulation and measured by spectrum analyzer.

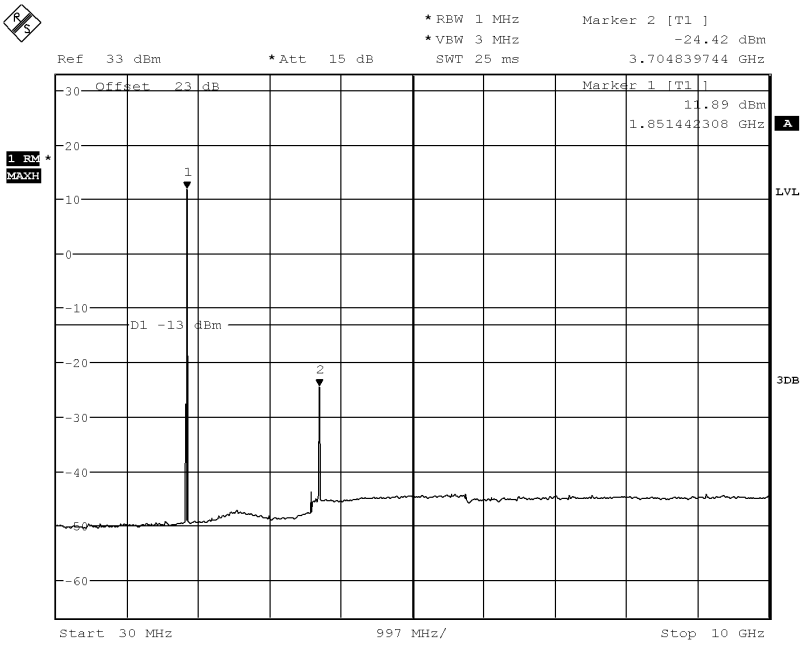



**Test Method:**

The measurement was performed accordance with section 2.2.13 of ANSI/TIA-603-E-2016: Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.
The measurement was performed accordance with section 2.2.13 of ANSI/TIA-603-E-2016: Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.
The RF output of the transmitter was connected to a spectrum analyzer through a calibrated coaxial cable. Sufficient scans were taken to show the out-of-Band emissions, if any, up to 10th harmonic. The EUT was scanned for spurious emissions from 30MHz to 20GHz with sufficient Bandwidth and video resolution. The spectrum analyzer was set to Maximum hold mode to ensure that the worst-case emissions were captured.

**Note:** Only worst case mode of in-band result is given below.

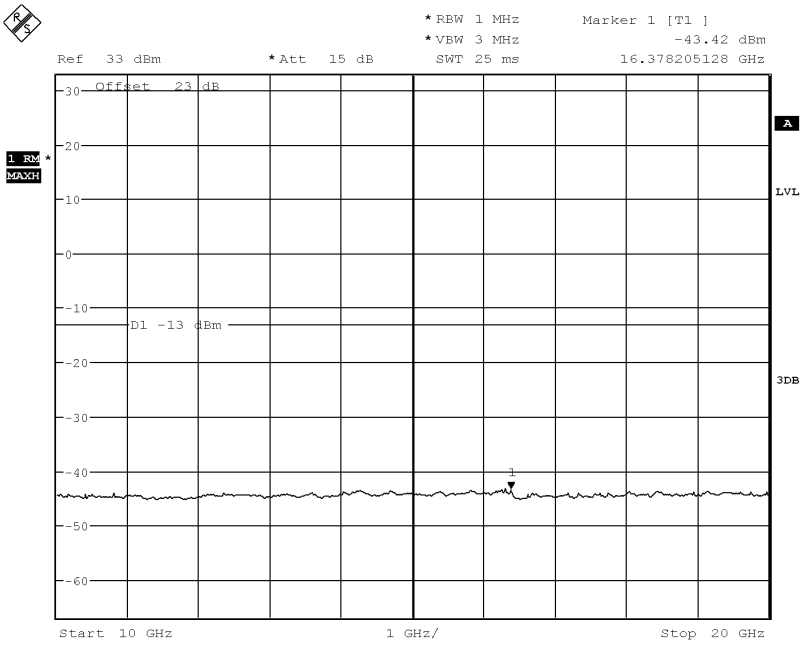
### 5.3.1 NB-IoT Band 2




Date: 28.DEC.2018 22:11:10

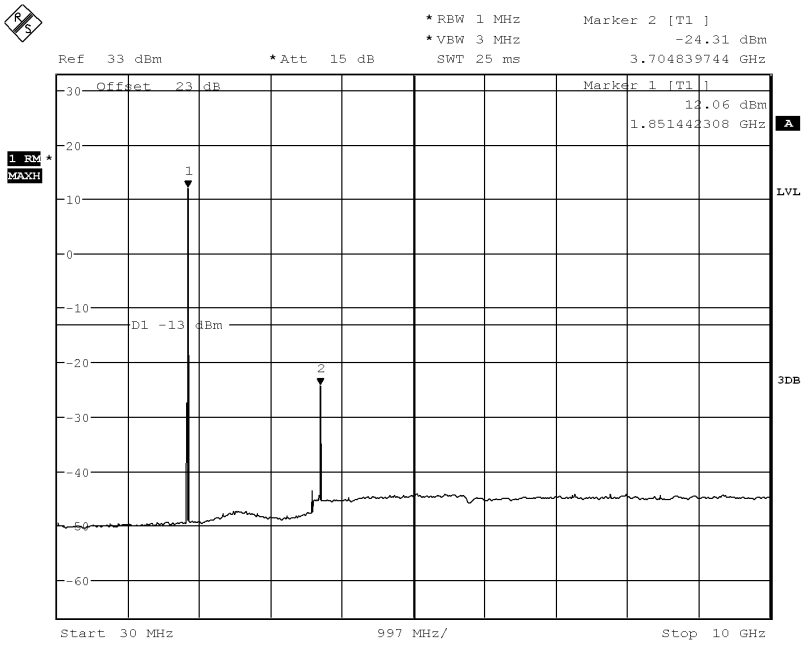
30MHz to 10GHz, Low Channel, Subcarrier (3.75kHz), QPSK, 1@0

Note: The strong emission shown in each case is the carrier signal.



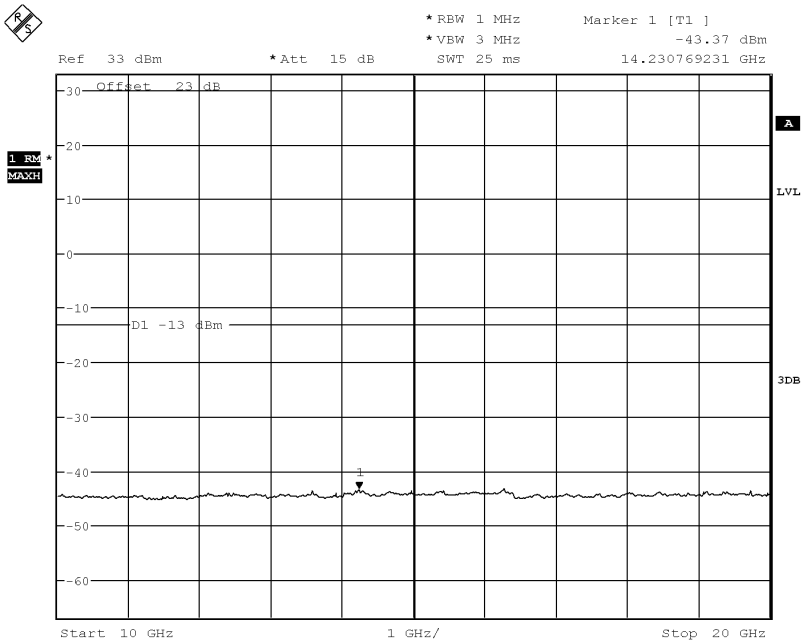

Date: 28.DEC.2018 22:11:44

10GHz to 20GHz, Low Channel, Subcarrier (3.75kHz), QPSK, 1@0

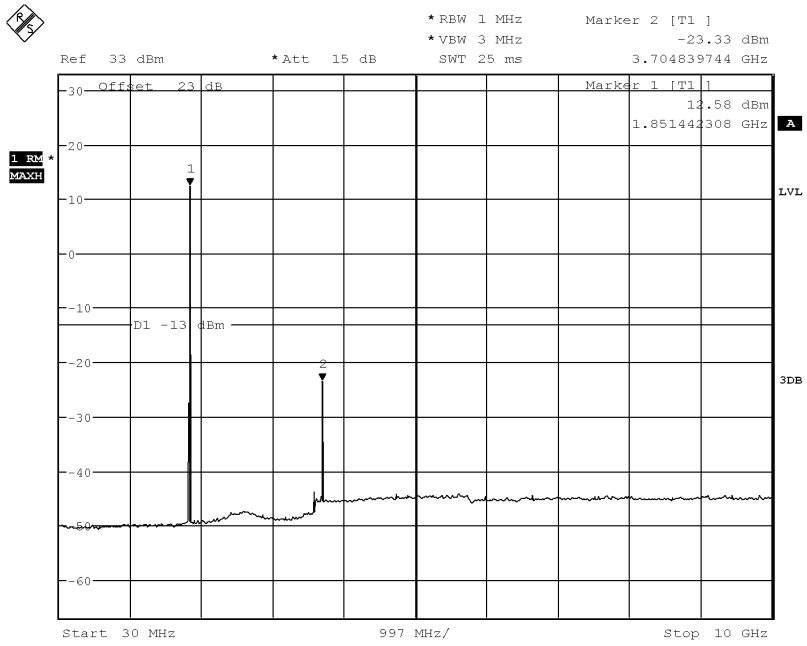



30MHz to 10GHz, Low Channel, Subcarrier (3.75kHz), BPSK, 1@0

Note: The strong emission shown in each case is the carrier signal.

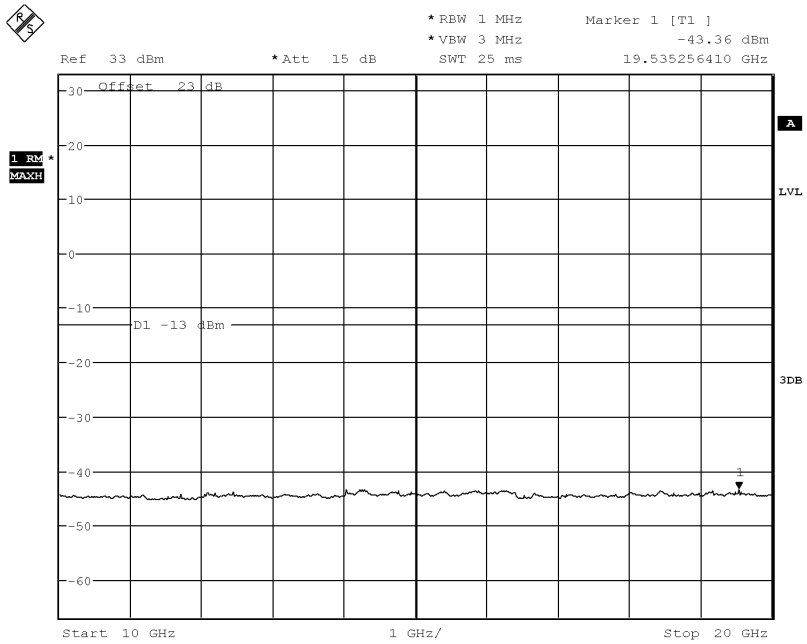



10GHz to 20GHz, Low Channel, Subcarrier (3.75kHz), BPSK, 1@0

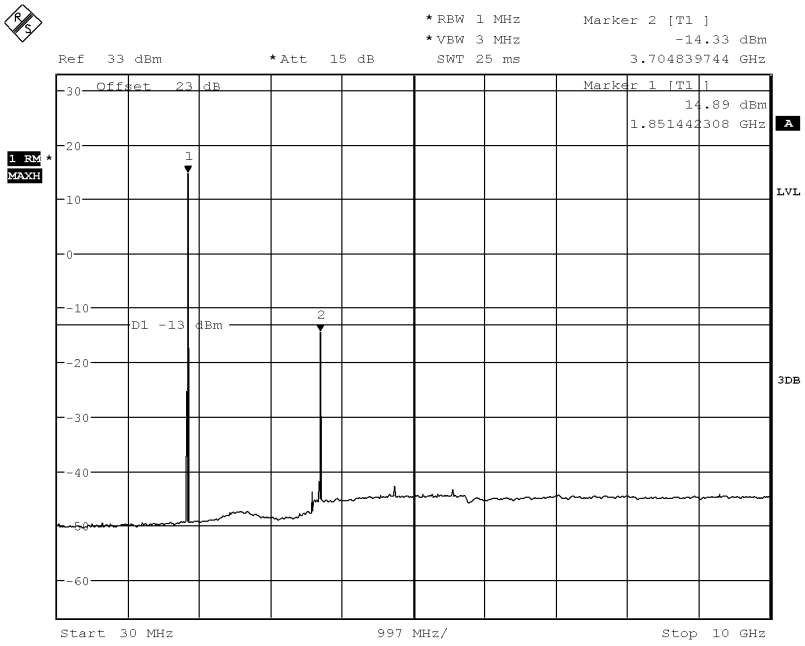



30MHz to 10GHz, Low Channel, Subcarrier (15kHz), QPSK, 1@0

Note: The strong emission shown in each case is the carrier signal.

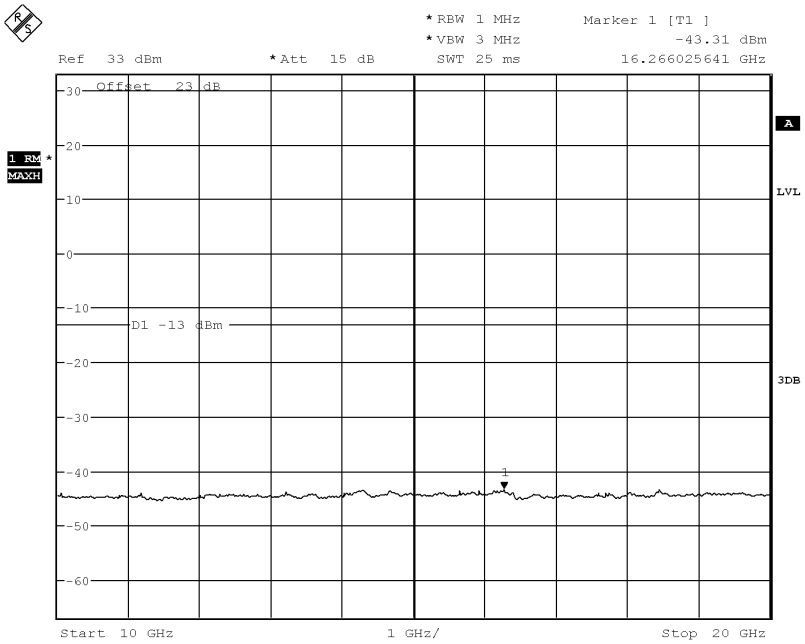



10GHz to 20GHz, Low Channel, Subcarrier (15kHz), QPSK, 1@0

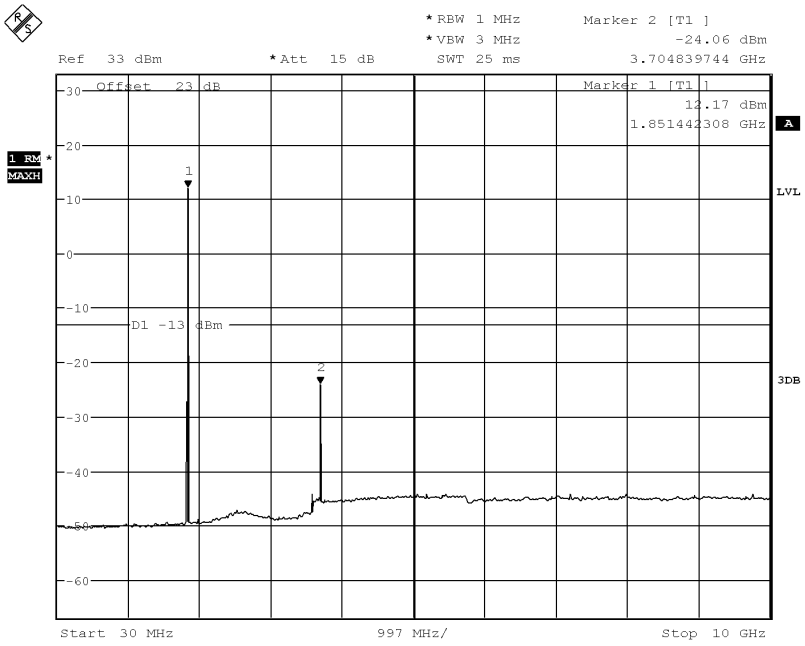



30MHz to 10GHz, Low Channel, Subcarrier (15kHz), QPSK, 12@0

Note: The strong emission shown in each case is the carrier signal.



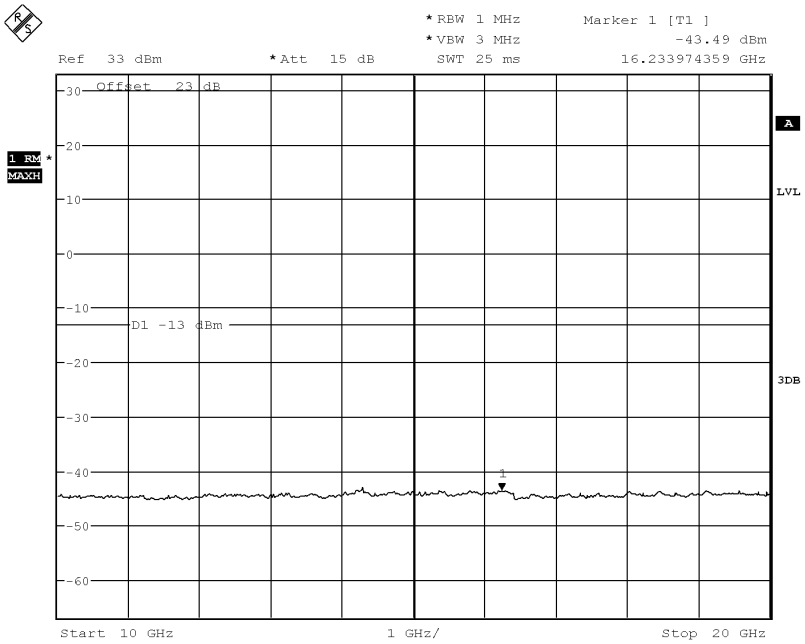

10GHz to 20GHz, Low Channel, Subcarrier (15kHz), QPSK, 12@0




Date: 28.DEC.2018 22:15:40

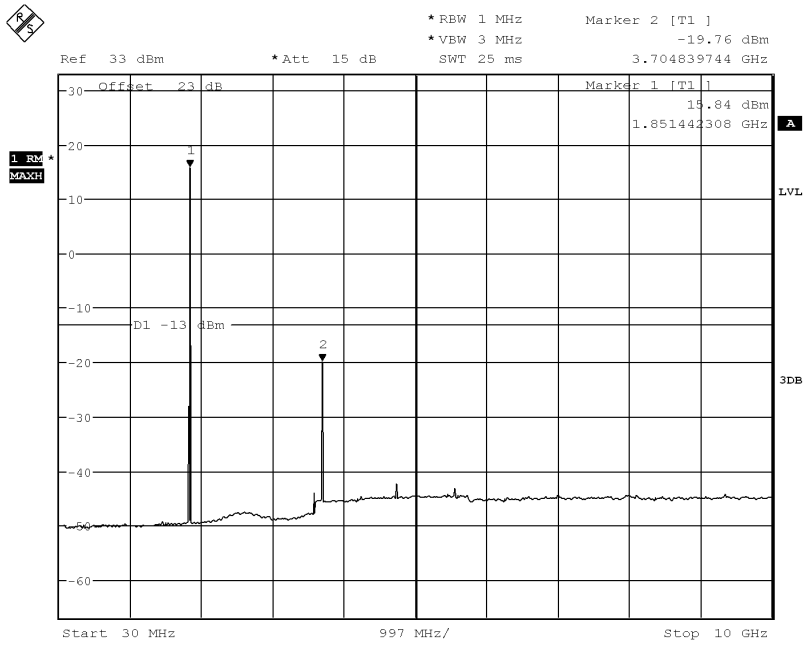
30MHz to 10GHz, Low Channel, Subcarrier (15kHz), BPSK, 1@0

Note: The strong emission shown in each case is the carrier signal.



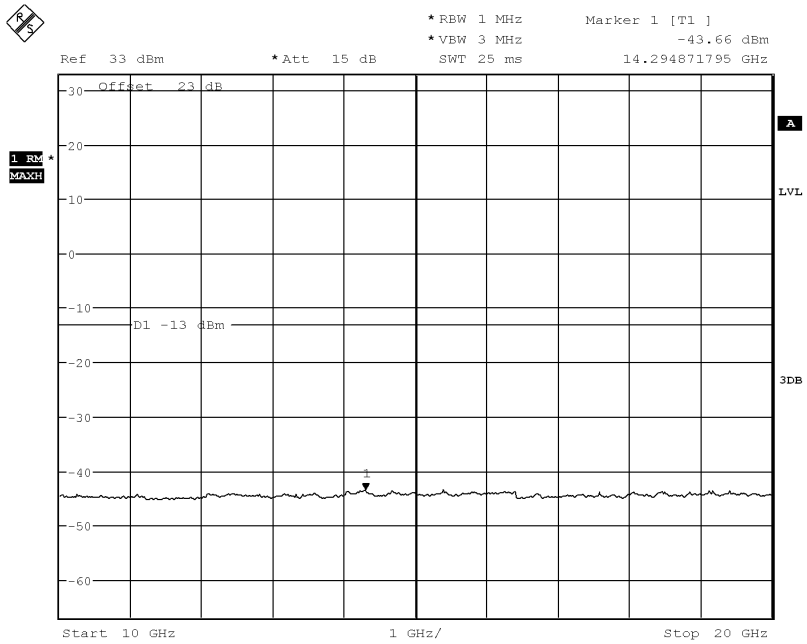

Date: 28.DEC.2018 22:12:56

10GHz to 20GHz, Low Channel, Subcarrier (15kHz), BPSK, 1@0

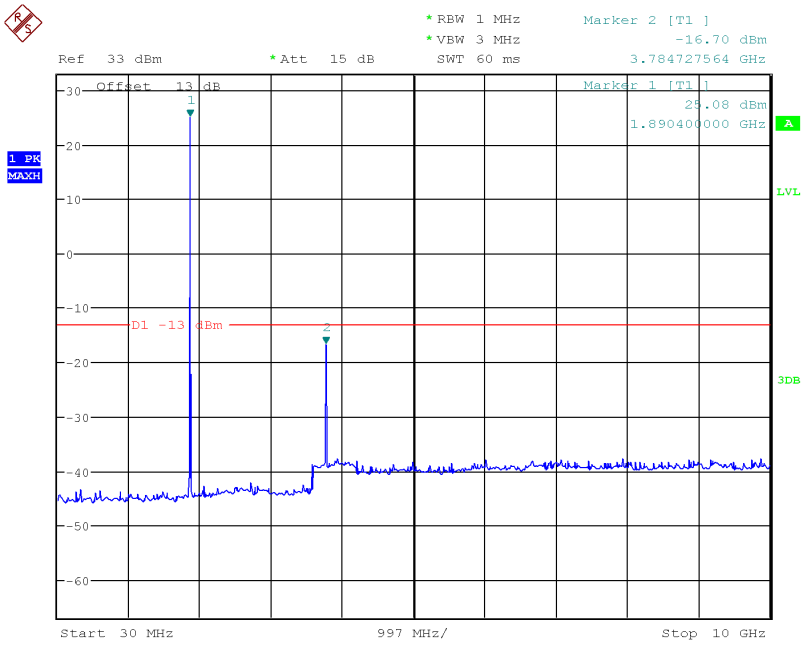



30MHz to 10GHz, Low Channel, Subcarrier (15kHz), BPSK, 12@0

Note: The strong emission shown in each case is the carrier signal.

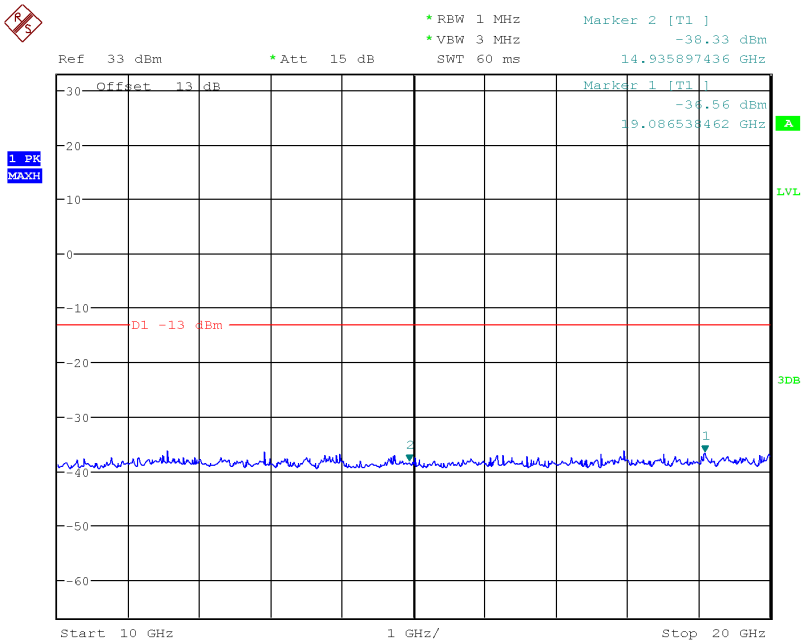



10GHz to 20GHz, Low Channel, Subcarrier (15kHz), BPSK, 12@0

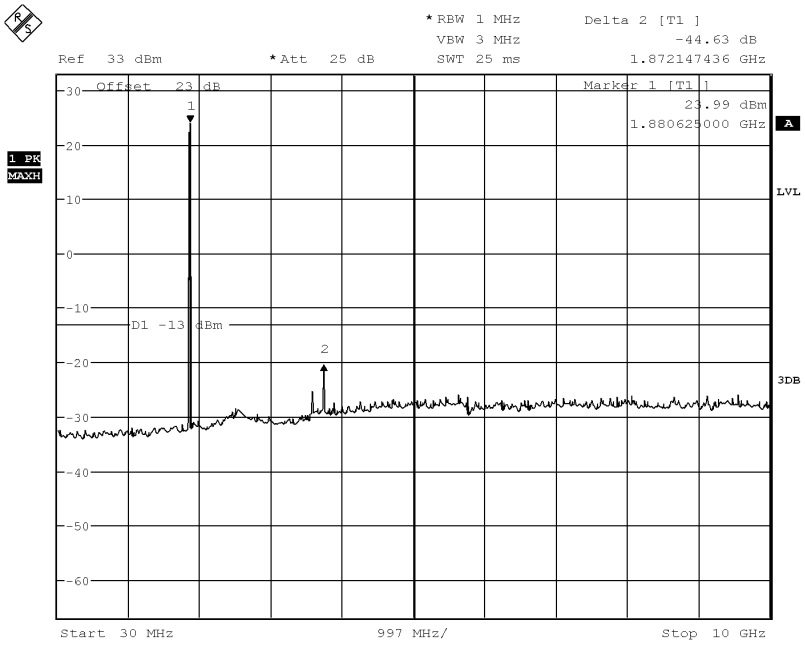



30MHz to 10GHz, Mid Channel, Subcarrier (3.75kHz), QPSK, 1@0

Note: The strong emission shown in each case is the carrier signal.

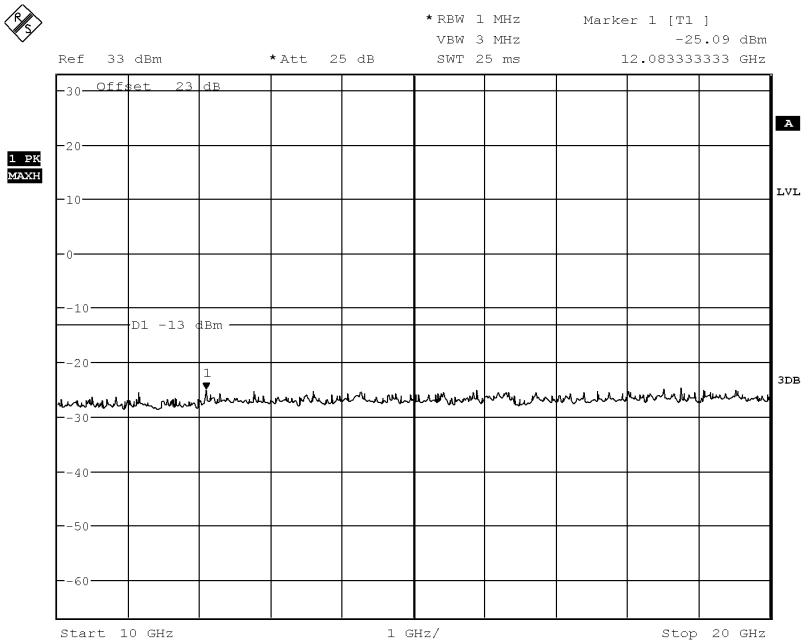



10GHz to 20GHz, Mid Channel, Subcarrier (3.75kHz), QPSK, 1@0

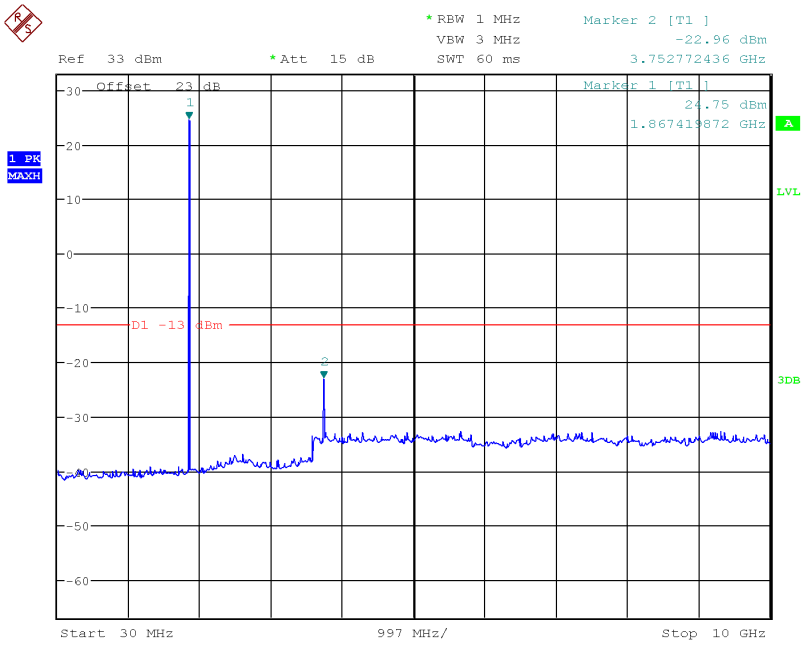



30MHz to 10GHz, Mid Channel, Subcarrier (3.75kHz), BPSK, 1@0

Note: The strong emission shown in each case is the carrier signal.

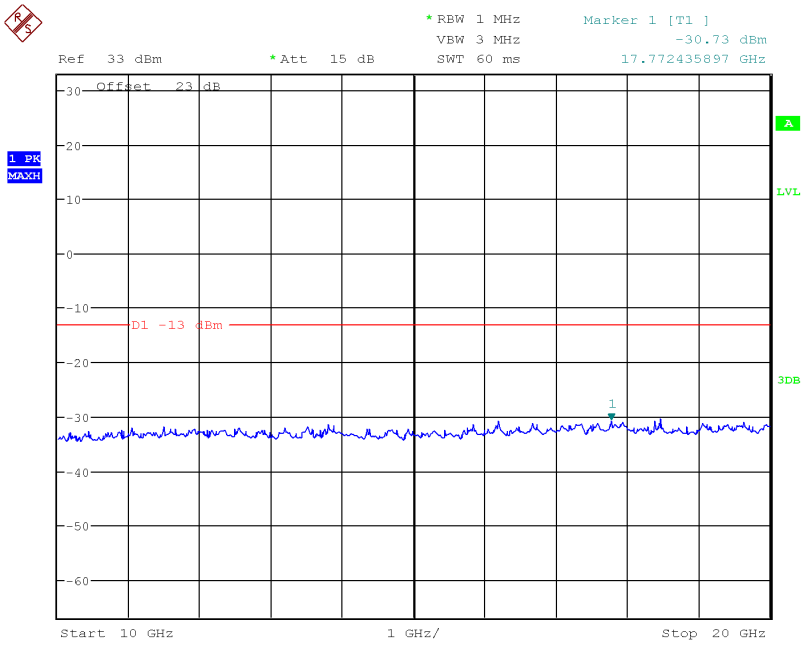



10GHz to 20GHz, Mid Channel, Subcarrier (3.75kHz), BPSK, 1@0

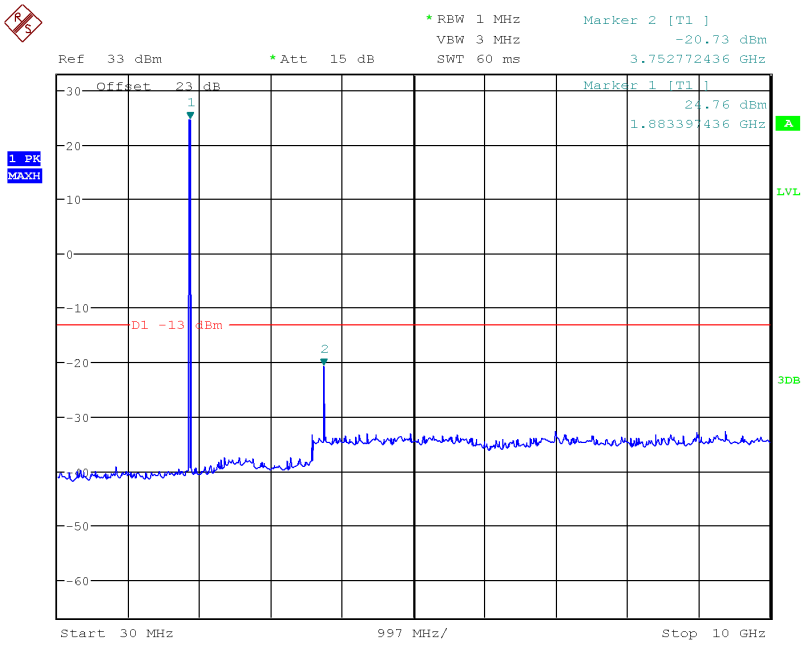



30MHz to 10GHz, Mid Channel, Subcarrier (15kHz), QPSK, 1@0

Note: The strong emission shown in each case is the carrier signal.

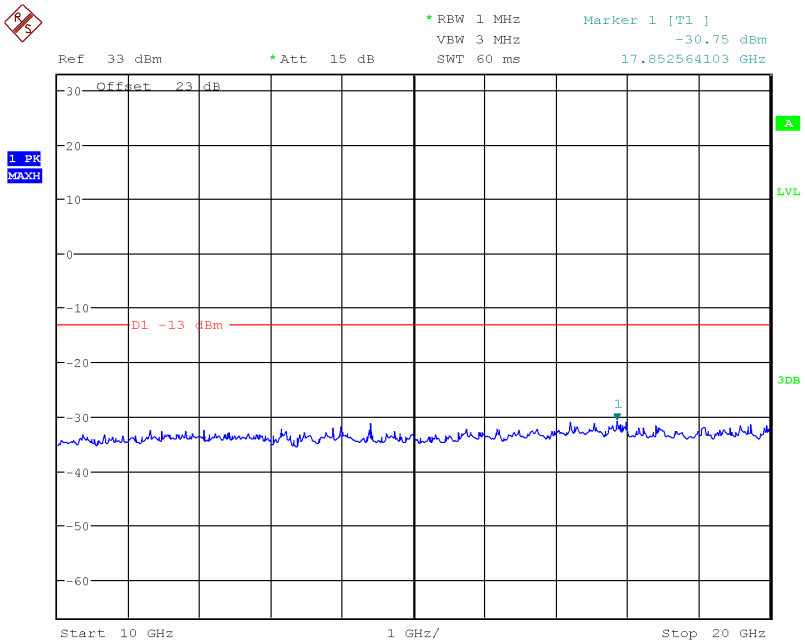



10GHz to 20GHz, Mid Channel, Subcarrier (15kHz), QPSK, 1@0

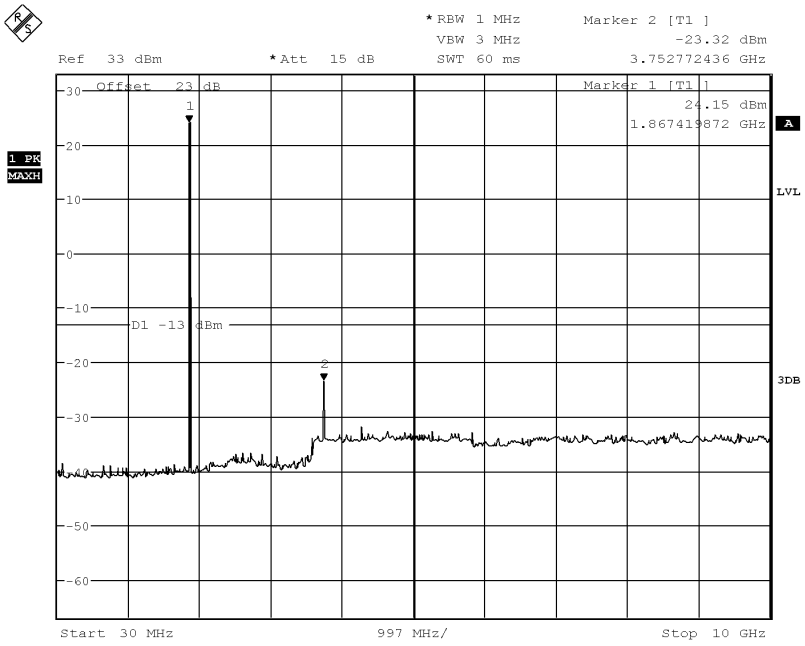



30MHz to 10GHz, Mid Channel, Subcarrier (15kHz), QPSK, 12@0

Note: The strong emission shown in each case is the carrier signal.

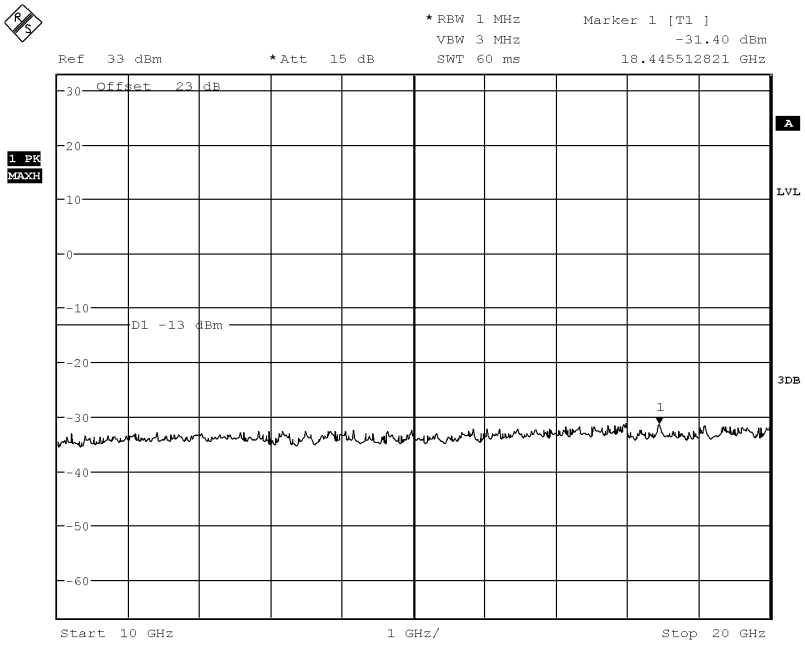



10GHz to 20GHz, Mid Channel, Subcarrier (15kHz), QPSK, 12@0

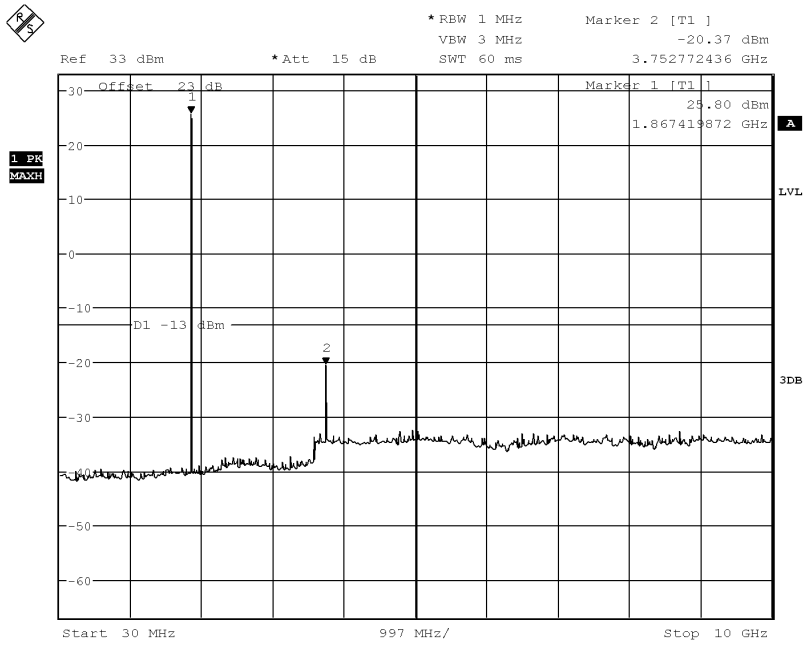



30MHz to 10GHz, Mid Channel, Subcarrier (15kHz), BPSK, 1@0

Note: The strong emission shown in each case is the carrier signal.

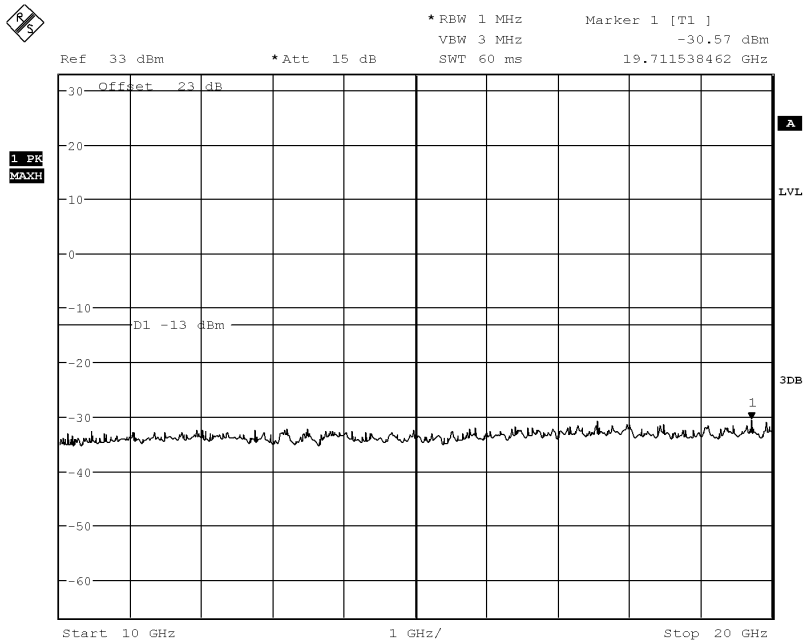



10GHz to 20GHz, Mid Channel, Subcarrier (15kHz), BPSK, 1@0

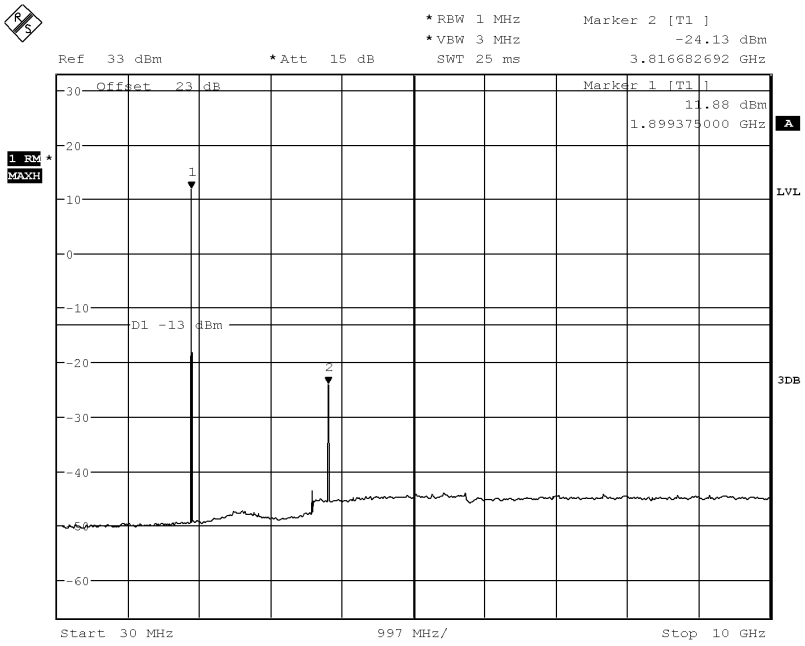



30MHz to 10GHz, Mid Channel, Subcarrier (15kHz), BPSK, 12@0

Note: The strong emission shown in each case is the carrier signal.

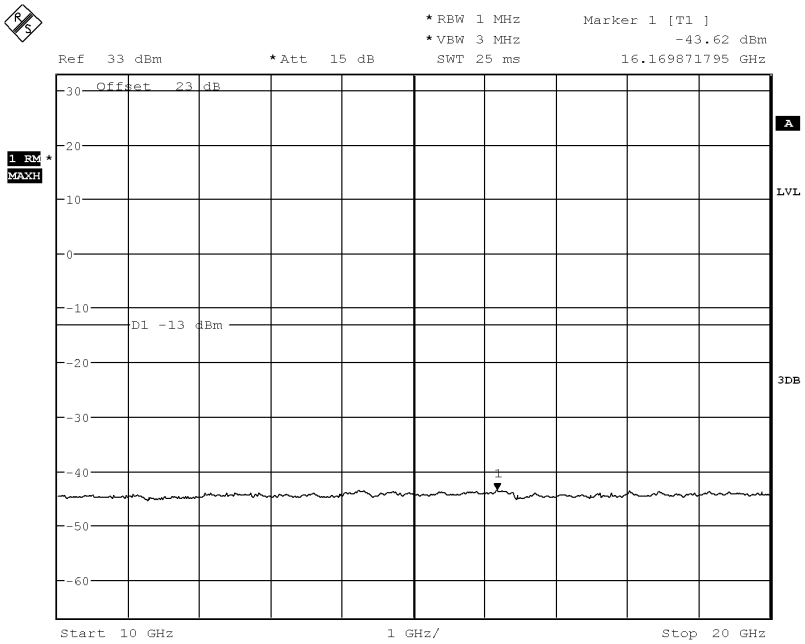



10GHz to 20GHz, Mid Channel, Subcarrier (15kHz), BPSK, 12@0

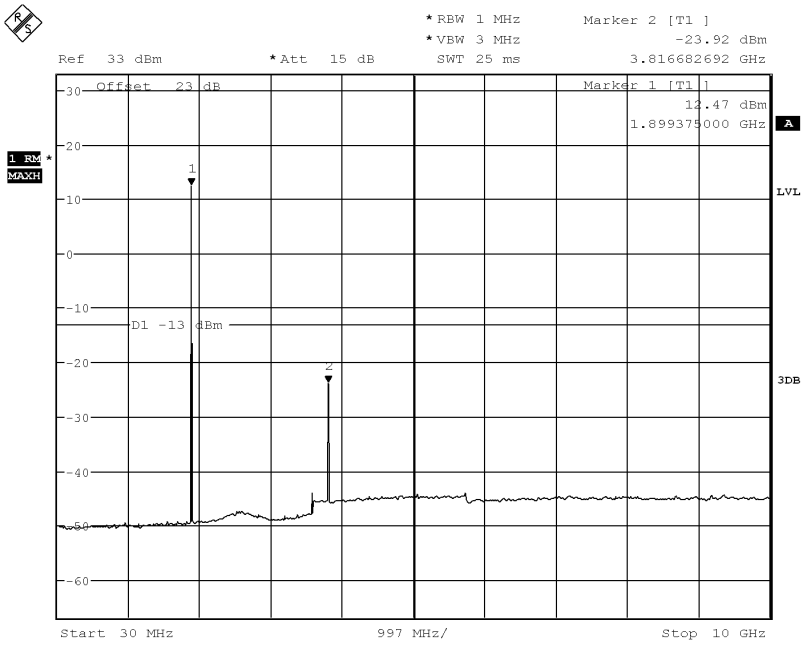



30MHz to 10GHz, High Channel, Subcarrier (3.75kHz), QPSK, 1@0

Note: The strong emission shown in each case is the carrier signal.

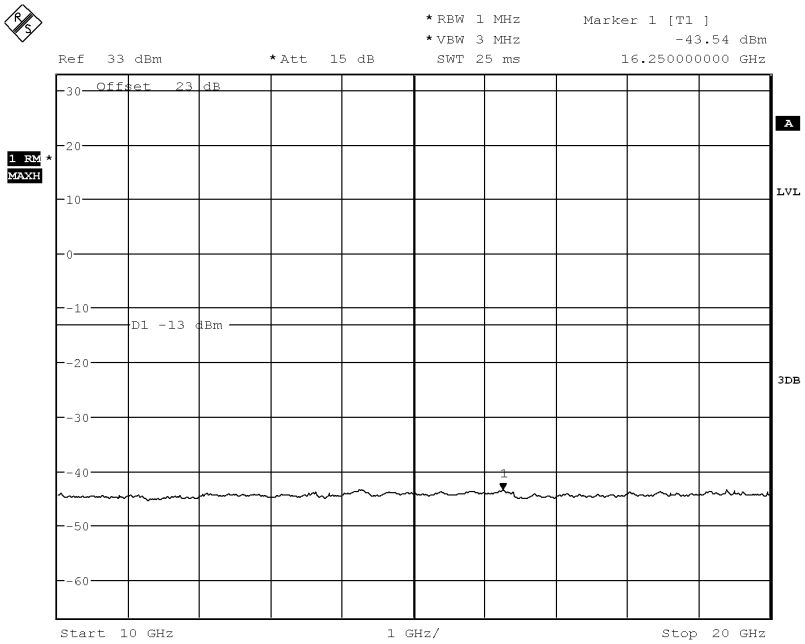



10GHz to 20GHz, High Channel, Subcarrier (3.75kHz), QPSK, 1@0

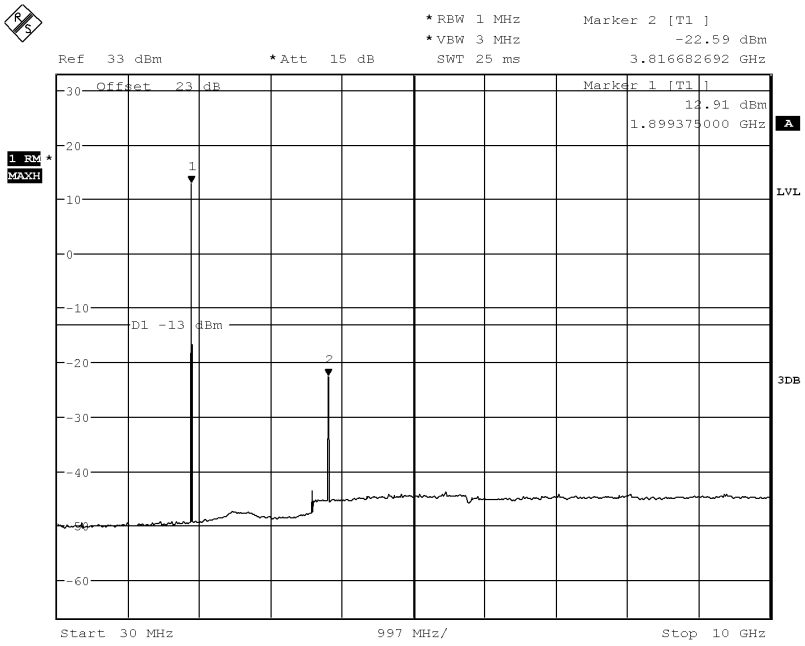



30MHz to 10GHz, High Channel, Subcarrier (3.75kHz), BPSK, 1@0

Note: The strong emission shown in each case is the carrier signal.

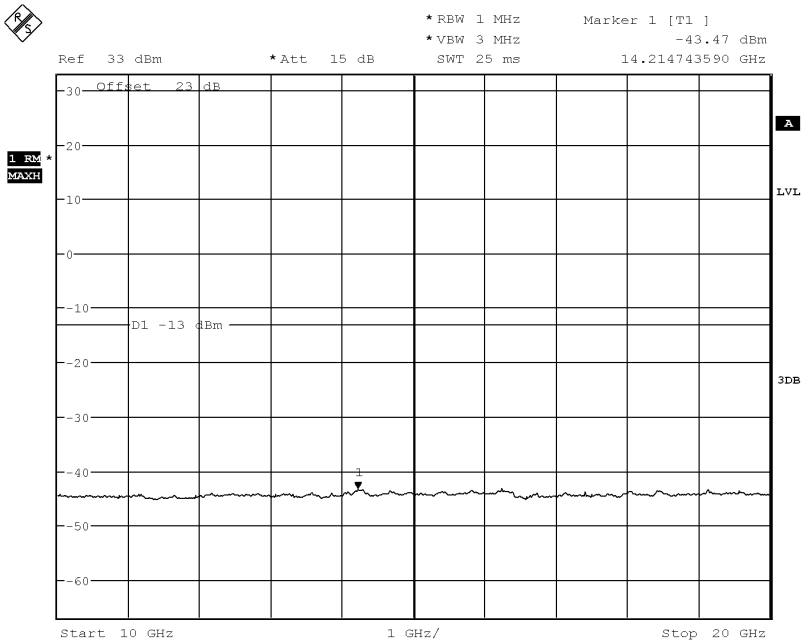



10GHz to 20GHz, High Channel, Subcarrier (3.75kHz), BPSK, 1@0

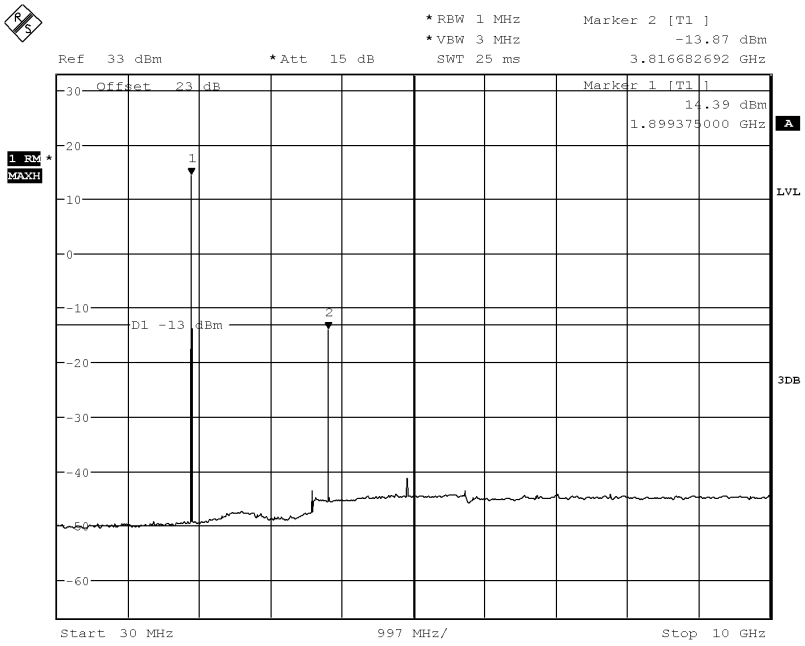



30MHz to 10GHz, High Channel, Subcarrier (15kHz), QPSK, 1@0

Note: The strong emission shown in each case is the carrier signal.

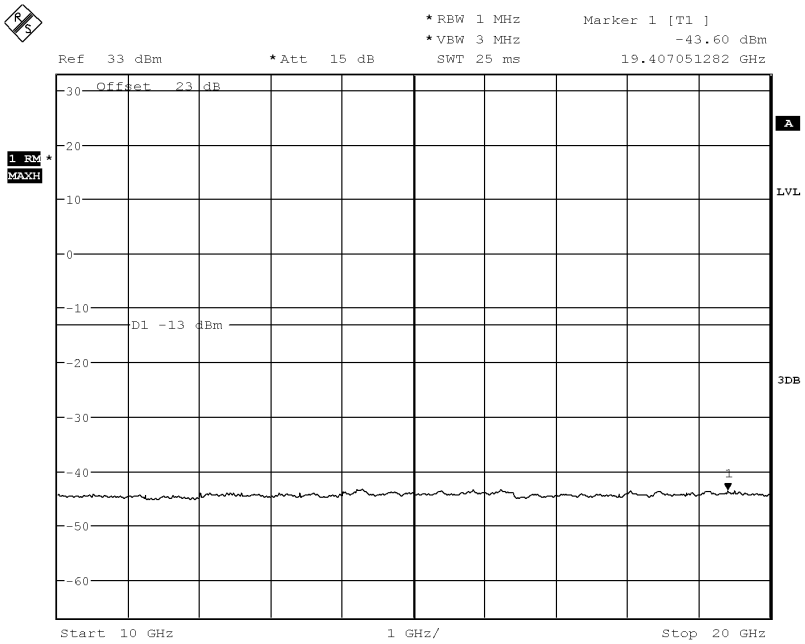



10GHz to 20GHz, High Channel, Subcarrier (15kHz), QPSK, 1@0

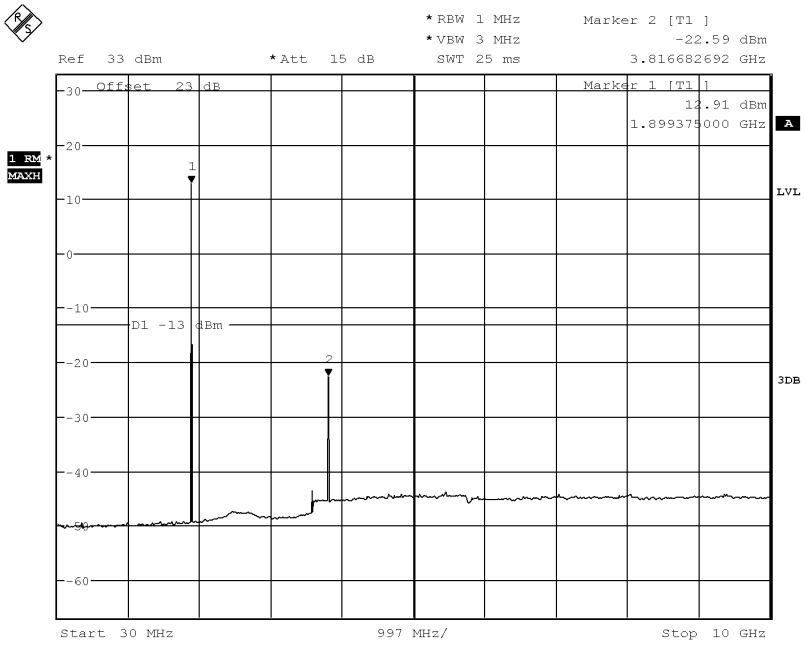



30MHz to 10GHz, High Channel, Subcarrier (15kHz), QPSK, 12@0

Note: The strong emission shown in each case is the carrier signal.

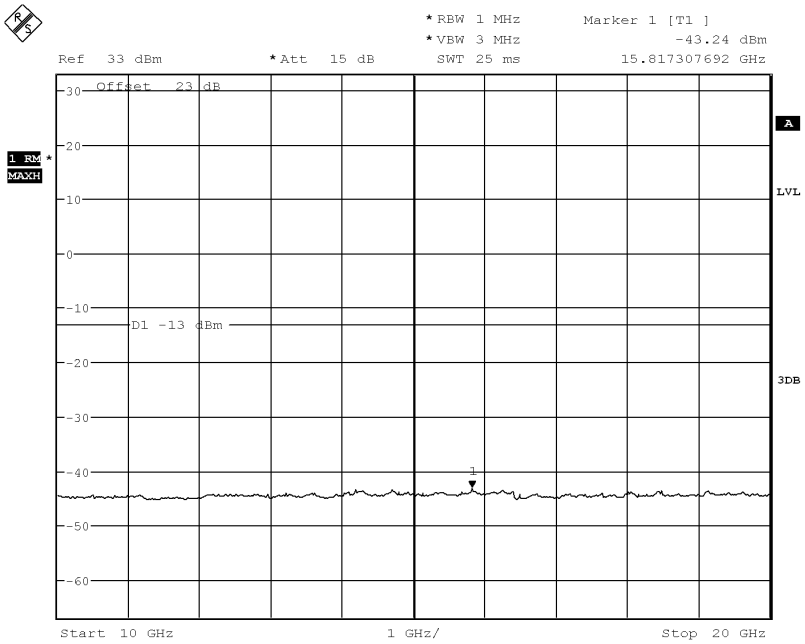



10GHz to 20GHz, High Channel, Subcarrier (15kHz), QPSK, 12@0

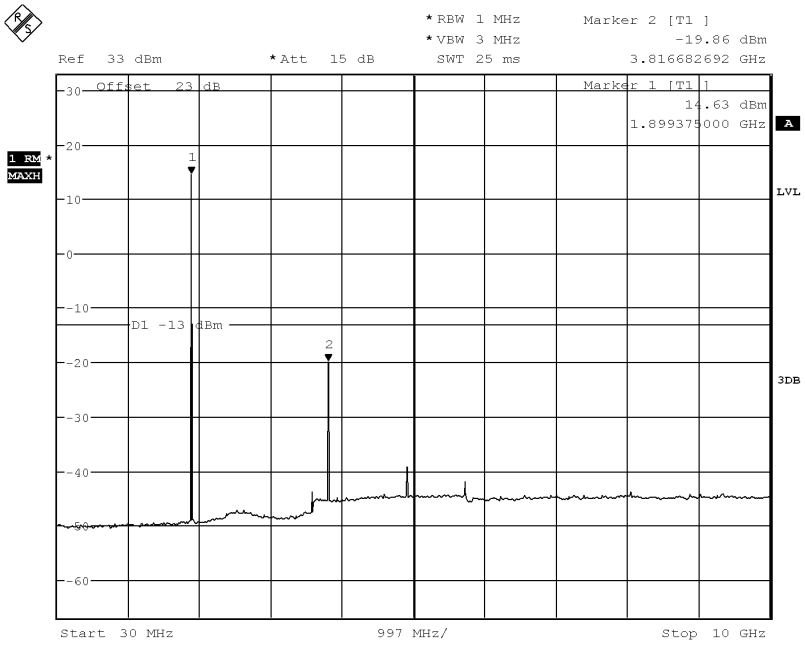



30MHz to 10GHz, High Channel, Subcarrier (15kHz), BPSK, 1@0

Note: The strong emission shown in each case is the carrier signal.

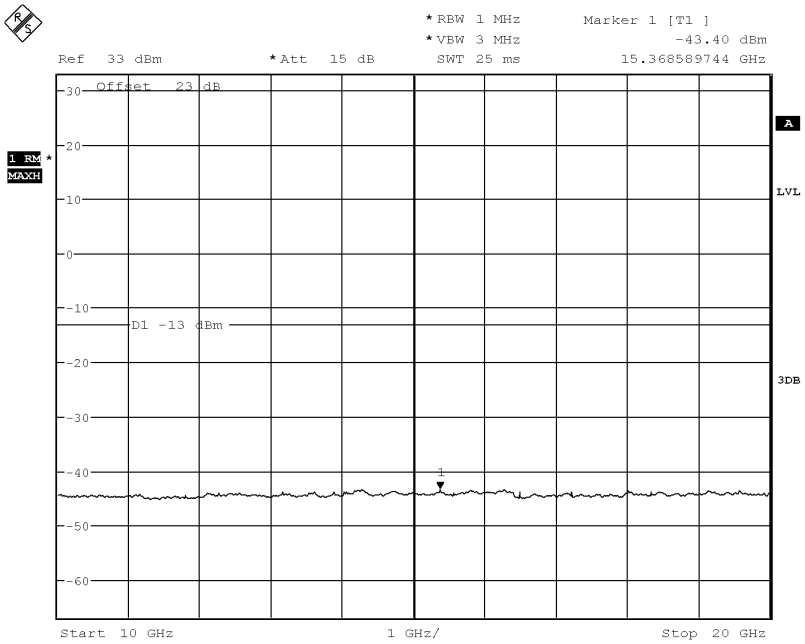



10GHz to 20GHz, High Channel, Subcarrier (15kHz), BPSK, 1@0




30MHz to 10GHz, High Channel, Subcarrier (15kHz), BPSK, 12@0

Note: The strong emission shown in each case is the carrier signal.




10GHz to 20GHz, High Channel, Subcarrier (15kHz), BPSK, 12@0