# TEST REPORT

**KCTL Inc.**
65, Sinwon-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-31-285-0894 FAX: 82-505-299-8311
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**1. Client**

- Name : Samsung Electronics Co., Ltd.
- Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
- Date of Receipt : 2021-04-12

**2. Use of Report** : Certification

**3. Name of Product / Model** : Smart Wearable / SM-R895U (Alt. SM-R895F)

**4. Manufacturer / Country of Origin** : Samsung Electronics Co., Ltd. / Vietnam

**5. FCC ID (Model)** : A3LSMR895 (SM-R895U, SM-R895F)

**6. Date of Test** : 2021-04-28 to 2021-06-11

**7. Location of Test** : ■ Permanent Testing Lab ☐ On Site Testing
(Address:65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea)

**8. Test method used** : FCC Part 2
FCC Part 90 subpart S

**9. Test Result** : Refer to the test result in the test report

| | | |
|---|---|---|
| Affirmation | Tested by<br>Name : Minki Kim (Signature) | Technical Manager<br>Name : Seungyong Kim (Signature) |

2021-06-15

## KCTL Inc.

## REPORT REVISION HISTORY

| Date | Revision | Page No |
|---|---|---|
| 2021-06-15 | Originally issued | - |
| | | |
| | | |
| | | |
| | | |



## General remarks for test reports

**Statement concerning the uncertainty of the measurement systems used for the tests**

(may be required by the product standard or client)

☐ **Internal procedure used for type testing through which traceability of the measuring uncertainty has been established:**

**Procedure number, issue date and title:**

Calculations leading to the reported values are on file with the testing laboratory that conducted the testing.

☒ **Statement not required by the standard or client used for type testing**

# CONTENTS

## 1. General information

| | | |
|---|---|---|
| Client | : | Samsung Electronics Co., Ltd. |
| Address | : | 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea |
| Manufacturer | : | Samsung Electronics Co., Ltd. |
| Address | : | 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea |
| Laboratory | : | KCTL Inc. |
| Address | : | 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea |
| Accreditations | : | FCC Site Designation No: KR0040, FCC Site Registration No: 687132 |
| | | VCCI Registration No. : R-20080, G-20078, C-20059, T-20056 |
| | | CAB Identifier: KR0040 |
| | | ISED Number: 8035A |
| | | KOLAS No.: KT231 |

## 2. Device information

| | | |
|---|---|---|
| Equipment under test | : | Smart Wearable |
| Model | : | SM-R895U |
| Derivative model | : | SM-R895F |
| Modulation technique | : | Bluetooth(BDR/EDR)_GFSK, π/4DQPSK, 8DPSK |
| | | Bluetooth(BLE)_GFSK |
| | | WIFI(802.11a/b/g/n/ac)_DSSS, OFDM |
| | | LTE_QPSK, 16QAM |
| | | WCDMA_QPSK |
| Number of channels | : | Bluetooth(BDR/EDR)_79 ch / Bluetooth(BLE)_40 ch |
| | | 802.11b/g/n_HT20 : 13 ch |
| | | UNII-1: 4 ch (20 ㎒) |
| | | UNII-2A: 4 ch (20 ㎒) |
| | | UNII-2C: 12 ch (20 ㎒) |
| | | UNII-3: 5 ch (20 ㎒) |
| Power source | : | DC 3.88 Ⅴ |
| Antenna specification | : | LTE/WCDMA_PIFA (Housing metal) Antenna |
| | | WIFI/Bluetooth(BDR/EDR/BLE)_LDS Antenna |
| Antenna gain | : | WIFI/Bluetooth(BDR/EDR/BLE)_-7.70 ㏈i |
| | | UNII-1 : -4.10 ㏈i |
| | | UNII-2A : -2.30 ㏈i |
| | | UNII-2C : -5.20 ㏈i |
| | | UNII-3 : -10.60 ㏈i |
| Frequency range | : | Bluetooth(BDR/EDR/BLE)_2 402 ㎒ ~ 2 480 ㎒ |
| | | 2 412 ㎒ ~ 2 472 ㎒ (802.11b/g/n_HT20) |
| | | UNII-1: 5 180 ㎒ ~ 5 240 ㎒ (802.11a/n_HT20) |

| | | |
|---|---|---|
| | | UNII-2A: 5 260 ㎒ ~ 5 320 ㎒ (802.11a/n_HT20)<br>UNII-2C: 5 500 ㎒ ~ 5 720 ㎒ (802.11a/n_HT20)<br>UNII-3: 5 745 ㎒ ~ 5 825 ㎒ (802.11a/n_HT20)<br>LTE Band 2_1 850.7 ㎒ ~ 1 909.3 ㎒<br>LTE Band 4_1 710.7 ㎒ ~ 1 754.3 ㎒<br>LTE Band 5_824.7 ㎒ ~ 848.3 ㎒<br>LTE Band 12_699.7 ㎒ ~ 715.3 ㎒<br>LTE Band 13_779.5 ㎒ ~ 784.5 ㎒<br>LTE Band 25_1 850.7 ㎒ ~ 1 914.3 ㎒<br>LTE Band 26_824.7 ㎒ ~ 848.3 ㎒, 814.7 ㎒ ~ 823.3 ㎒<br>LTE Band 66_1 710.7 ㎒ ~ 1 779.3 ㎒<br>LTE Band 71_665.5 ㎒ ~ 695.5 ㎒<br>WCDMA 850_826.4 ㎒ ~ 846.6 ㎒<br>WCDMA 1700_1 712.4 ㎒ ~ 1 752.6 ㎒<br>WCDMA 1900_1 852.4 ㎒ ~ 1 907.6 ㎒ |
| Software version | : | SM-R895U_R895U.001, SM-R895F_R895F.001 |
| Hardware version | : | REV1.0 |
| Test device serial No. | : | Conducted(R3AR404G9WN, R3AR404FK3E)<br>Radiated(R3AR404CJKV, R3AR404CJPL, R3AR404CJTT, R3AR404CJNH) |
| Operation temperature | : | -30 ℃ ~ 50 ℃ |

**Note.**

1. Due to marketing purpose, derivative model SM-R895F will be filed for ISED approval and the test reports remain valid for Model SM-R895F ISED submission.
2. The product equality letter includes detailed information about the differences between basic and derivative model.

## 2.1. Frequency/channel operations

This device contains the following capabilities:
WiFi (802.11a/b/g/n), Bluetooth (BDR/EDR/BLE), LTE Band 2, LTE Band 4, LTE Band 5, LTE Band 12, LTE Band 13, LTE Band 25, LTE Band 26, LTE Band 66, LTE Band 71, WCDMA 850, WCDMA 1700, WCDMA 1900

**LTE Band 26**

| Ch. | Frequency (㎒) |
|---|---|
| 26697 | 814.7 |
| 26783 | 823.3 |

Table 2.3.1. 1.4M BW

| Ch. | Frequency (㎒) |
|---|---|
| 26705 | 815.5 |
| 26775 | 822.5 |

Table 2.3.2. 3M BW

| Ch. | Frequency (㎒) |
|---|---|
| 26715 | 816.5 |
| 26765 | 821.5 |

Table 2.3.3. 5M BW

| Ch. | Frequency (㎒) |
|---|---|
| 26740 | 819.0 |

Table 2.3.4. 10M BW

| Ch. | Frequency (㎒) |
|---|---|
| 26765 | 821.5 |

Table 2.3.5. 15M BW

# 3. Maximum ERP/EIRP power

**LTE Band 26 (Part 90) (FCC Model: SM-R895U, Alt. SM-R895F)**

| Mode | Tx frequency (㎒) | Emission designator | Conducted | |
|---|---|---|---|---|
| | | | Max. power (dBm) | Max. power (W) |
| LTE Band 26 | 814.7 ~ 823.3 | 1M10G7D | 23.57 | 0.228 |
| | | 1M11W7D | 22.63 | 0.183 |
| | 815.5 ~ 822.5 | 2M72G7D | 23.39 | 0.218 |
| | | 2M71W7D | 22.30 | 0.170 |
| | 816.5 ~ 821.5 | 4M55G7D | 23.36 | 0.217 |
| | | 4M56W7D | 22.29 | 0.169 |
| | 819.0 | 8M97G7D | 23.33 | 0.215 |
| | | 9M04W7D | 22.01 | 0.159 |
| | 821.5 | 13M5G7D | 23.31 | 0.214 |
| | | 13M5W7D | 22.32 | 0.171 |
| Straddle channel | 824.0 | 1M10G7D | 23.44 | 0.221 |
| | | 1M11W7D | 22.45 | 0.176 |
| | | 2M71G7D | 23.34 | 0.216 |
| | | 2M70W7D | 22.29 | 0.169 |
| | | 4M53G7D | 23.34 | 0.216 |
| | | 4M52W7D | 22.26 | 0.168 |
| | | 9M02G7D | 23.41 | 0.219 |
| | | 8M97W7D | 22.10 | 0.162 |
| | | 13M5G7D | 23.37 | 0.217 |
| | | 13M5W7D | 22.42 | 0.175 |

## 4. Summary of tests

| FCC Part section(s) | Parameter | Test Limit | Test Condition | Test results |
|---|---|---|---|---|
| 2.1046<br>90.635 | Conducted Output Power | < 100 Watts | Conducted | Pass |
| 2.1049 | Occupied Bandwidth<br>& 26 dB Bandwidth | N/A | | Pass |
| 2.1051<br>90.691(a) | Band Edge Emissions at Antenna Terminal | <43 + 10Log$_{10}$(P) dB,<br><50 10Log$_{10}$(P) dB at Band Edge and for all out-of-band emissions within 37.5kHz of Block Edge | | Pass |
| | Spurious Emissions at Antenna Terminal | | | Pass |
| 2.1055<br>90.213 | Frequency stability | < 2.5 ppm | | Pass |
| 22.913(a)(5) | Effective Radiated Power | < 7 Watts max. ERP | Radiated | Pass |
| 2.1053<br>90.691(a) | Radiated Spurious Emissions | <43 + 10Log$_{10}$(P) dB | | Pass |

**Notes:**

1. The test procedure(s) in this report were performed in accordance as following.
   - ANSI C63.26-2015
   - ANSI/TIA-603-E-2016
   - KDB 971168 D01 v03r01

## 4.1. Worst case orientation

1. All modes of operation were investigated and the worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations in the test data.
2. All final radiated testing was performed with the EUT in worst case orientation.
3. All the radiated tests have been performed two modes (with charger and without charger) and the mode with charger is the worst case mode.
4. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z. It was determined that **X** orientation was worst-case orientation. Therefore, all final radiated testing was performed with the EUT in **X** orientation.

| Test condition | LTE Band | Modulation | Bandwidth (MHz) | RB size | RB offset |
|---|---|---|---|---|---|
| Radiated | B26 (Part90) | QPSK | 1.4 | 1 | 0, 3, 5 |
| Conducted | | QPSK, 16QAM | 1.4, 3, 5, 10, 15 | 1 | 0, 5, 14, 24, 49, 74 |
| | | | | Full | 0 |

## 5. Measurement uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4-2014.

All measurement uncertainty values are shown with a coverage factor of $k$=2 to indicated a 95 % level of confidence. The measurement data shown herein meets of exceeds the $U_{CISPR}$ measurement uncertainty values specified in CISPR 16-4-2 and thus, can be compared directly to specified limits to determine compliance.

| Parameter | Expanded uncertainty (±) | |
|---|---|---|
| Conducted RF power | 0.9 dB | |
| Conducted spurious emissions | 1.6 dB | |
| Radiated spurious emissions | Below 1 000 ㎒ | 4.3 dB |
| | 1 000 ㎒ ~ 18 000 ㎒ | 3.8 dB |
| | Above 1 8000 ㎒ | 3.8 dB |

## 6. Measurement results explanation example

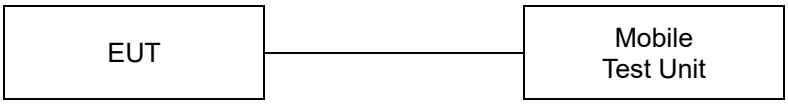
| Frequency (㎒) | Factor(㏈) | Frequency (㎒) | Factor(㏈) |
|---|---|---|---|
| 30 | 6.55 | 11 000 | 8.53 |
| 50 | 6.58 | 12 000 | 8.43 |
| 100 | 6.61 | 13 000 | 8.70 |
| 200 | 6.60 | 14 000 | 9.14 |
| 300 | 6.61 | 15 000 | 9.10 |
| 400 | 6.68 | 16 000 | 9.16 |
| 500 | 6.70 | 17 000 | 9.28 |
| 600 | 6.73 | 18 000 | 8.80 |
| 700 | 6.77 | 19 000 | 9.98 |
| 800 | 6.81 | 20 000 | 9.23 |
| 900 | 6.84 | 21 000 | 8.96 |
| 1 000 | 6.87 | 22 000 | 9.66 |
| 2 000 | 7.40 | 23 000 | 9.01 |
| 3 000 | 7.28 | 24 000 | 9.50 |
| 4 000 | 7.35 | 25 000 | 10.05 |
| 5 000 | 7.46 | 26 000 | 8.93 |
| 6 000 | 7.47 | 26 500 | 8.81 |
| 7 000 | 7.91 | 27 000 | 8.71 |
| 8 000 | 8.33 | 28 000 | 8.97 |
| 9 000 | 8.30 | 29 000 | 10.26 |
| 10 000 | 8.45 | 30 000 | 10.70 |

**Note.**
Offset(㏈) = RF cable loss(㏈) + Divider (㏈)

# 7. Test results

## 7.1. Conducted output power

**Test setup**




**Test procedure**

971168 D01 v03r01 – Section 5.2
ANSI C63.26-2015 – Section 5.2.4.2
CFR 47, - Section §2.1046

**Test settings**

When an average power meter is used to perform RF output power measurements, the fundamental condition that measurement be performed only over durations of active transmissions at maximum output power level applies. Thus, an average power meter can always be used to perform the measurement when the EUT can be configured to transmit continuously.

If the EUT cannot be configured to transmit continuously (i.e., burst duty cycle < 98%), then the following options can be implemented to facilitate measurement of the average power with an average power meter:

a) A gated average power meter can be used to perform the measurement if the gating parameters can be adjusted such that the power is measured only during active transmission bursts at maximum output power levels.
b) A conventional average power meter with no signal gating capability can also be used if the measured burst duty cycle is constant (i.e., duty cycle variations are less than or equal to ± 2%) by performing the measurement over the on/off burst cycles and then correcting (increasing) the measured level by a factor equal to [10log (1/duty cycle)]. See 5.2.4.3.4 for guidance with respect to measuring the transmitter duty cycle.

See item r) of 4.1 for more information regarding power meter functional requirements and limitations, and consult the instrumentation-specific application literature for proper set-up and use.

**Notes:**

Offset(㏈) = RF cable loss(㏈)

## Test results

| Test Band | Bandwidth (㎒) | Test mode | RB size | RB offset | MPR | Maximum power Frequency (㎒) | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Low | Middle | High |
| LTE Band 26 | 1.4 | QPSK | 1 | 0 | 0 | 23.54 | - | 23.44 |
| | | | 1 | 3 | 0 | 23.52 | - | 23.40 |
| | | | 1 | 5 | 0 | 23.57 | - | 23.52 |
| | | | 3 | 0 | 0 | 23.55 | - | 23.50 |
| | | | 3 | 1 | 0 | 23.53 | - | 23.46 |
| | | | 3 | 3 | 0 | 23.48 | - | 23.42 |
| | | | 6 | 0 | 1 | 22.50 | - | 22.43 |
| | | 16QAM | 1 | 0 | 1 | 22.22 | - | 22.11 |
| | | | 1 | 3 | 1 | 22.05 | - | 21.95 |
| | | | 1 | 5 | 1 | 22.32 | - | 22.17 |
| | | | 3 | 0 | 1 | 22.63 | - | 22.57 |
| | | | 3 | 1 | 1 | 22.57 | - | 22.49 |
| | | | 3 | 3 | 1 | 22.59 | - | 22.46 |
| | | | 6 | 0 | 2 | 21.55 | - | 21.43 |
| | 3 | QPSK | 1 | 0 | 0 | 23.24 | - | 23.39 |
| | | | 1 | 8 | 0 | 23.15 | - | 23.26 |
| | | | 1 | 14 | 0 | 23.21 | - | 23.30 |
| | | | 8 | 0 | 1 | 22.17 | - | 22.24 |
| | | | 8 | 4 | 1 | 22.17 | - | 22.26 |
| | | | 8 | 7 | 1 | 21.88 | - | 21.99 |
| | | | 15 | 0 | 1 | 22.16 | - | 22.25 |
| | | 16QAM | 1 | 0 | 1 | 22.19 | - | 22.30 |
| | | | 1 | 8 | 1 | 22.19 | - | 22.28 |
| | | | 1 | 14 | 1 | 22.19 | - | 22.29 |
| | | | 8 | 0 | 2 | 21.21 | - | 21.29 |
| | | | 8 | 4 | 2 | 21.35 | - | 21.42 |
| | | | 8 | 7 | 2 | 21.21 | - | 21.34 |
| | | | 15 | 0 | 2 | 21.23 | - | 21.35 |
| | 5 | QPSK | 1 | 0 | 0 | 23.26 | - | 23.31 |
| | | | 1 | 12 | 0 | 23.26 | - | 23.36 |
| | | | 1 | 24 | 0 | 23.25 | - | 23.31 |
| | | | 12 | 0 | 1 | 22.20 | - | 22.29 |
| | | | 12 | 7 | 1 | 22.15 | - | 22.24 |
| | | | 12 | 13 | 1 | 22.17 | - | 22.24 |
| | | | 25 | 0 | 1 | 22.17 | - | 22.27 |
| | | 16QAM | 1 | 0 | 1 | 22.19 | - | 22.29 |
| | | | 1 | 12 | 1 | 21.88 | - | 21.95 |
| | | | 1 | 24 | 1 | 22.16 | - | 22.24 |
| | | | 12 | 0 | 2 | 21.20 | - | 21.28 |
| | | | 12 | 7 | 2 | 21.22 | - | 21.32 |
| | | | 12 | 13 | 2 | 21.21 | - | 21.27 |
| | | | 25 | 0 | 2 | 21.20 | - | 21.26 |

| Test Band | Bandwidth (㎒) | Test mode | RB size | RB offset | MPR | Maximum power Frequency (㎒) | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Low | Middle | High |
| LTE Band 26 | 10 | QPSK | 1 | 0 | 0 | - | 23.33 | - |
| | | | 1 | 25 | 0 | - | 23.28 | - |
| | | | 1 | 49 | 0 | - | 23.18 | - |
| | | | 25 | 0 | 1 | - | 22.30 | - |
| | | | 25 | 12 | 1 | - | 22.23 | - |
| | | | 25 | 25 | 1 | - | 22.29 | - |
| | | | 50 | 0 | 1 | - | 22.26 | - |
| | | 16QAM | 1 | 0 | 1 | - | 22.01 | - |
| | | | 1 | 25 | 1 | - | 21.96 | - |
| | | | 1 | 49 | 1 | - | 21.96 | - |
| | | | 25 | 0 | 2 | - | 21.34 | - |
| | | | 25 | 12 | 2 | - | 21.34 | - |
| | | | 25 | 25 | 2 | - | 21.25 | - |
| | | | 50 | 0 | 2 | - | 21.33 | - |
| | 15 | QPSK | 1 | 0 | 0 | - | 23.31 | - |
| | | | 1 | 36 | 0 | - | 23.25 | - |
| | | | 1 | 74 | 0 | - | 23.13 | - |
| | | | 36 | 0 | 1 | - | 22.25 | - |
| | | | 36 | 18 | 1 | - | 22.20 | - |
| | | | 36 | 37 | 1 | - | 22.18 | - |
| | | | 75 | 0 | 1 | - | 22.21 | - |
| | | 16QAM | 1 | 0 | 1 | - | 22.32 | - |
| | | | 1 | 36 | 1 | - | 22.28 | - |
| | | | 1 | 74 | 1 | - | 22.18 | - |
| | | | 36 | 0 | 2 | - | 21.23 | - |
| | | | 36 | 18 | 2 | - | 21.20 | - |
| | | | 36 | 37 | 2 | - | 21.18 | - |
| | | | 75 | 0 | 2 | - | 21.24 | - |

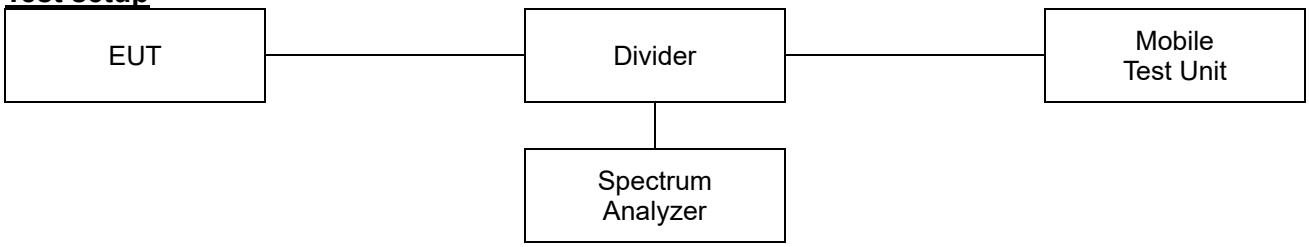
## Straddle channel

| Test Band | Bandwidth (㎒) | Test mode | RB size | RB offset | MPR | Maximum power |
|---|---|---|---|---|---|---|
| LTE Band 26 | 1.4 | QPSK | 1 | 0 | 0 | 23.39 |
| | | | 1 | 3 | 0 | 23.33 |
| | | | 1 | 5 | 0 | 23.41 |
| | | | 3 | 0 | 0 | 23.44 |
| | | | 3 | 1 | 0 | 23.34 |
| | | | 3 | 3 | 0 | 23.28 |
| | | | 6 | 0 | 1 | 22.28 |
| | | 16QAM | 1 | 0 | 1 | 21.98 |
| | | | 1 | 3 | 1 | 21.87 |
| | | | 1 | 5 | 1 | 22.04 |
| | | | 3 | 0 | 1 | 22.45 |
| | | | 3 | 1 | 1 | 22.38 |
| | | | 3 | 3 | 1 | 22.41 |
| | | | 6 | 0 | 2 | 21.34 |
| | 3 | QPSK | 1 | 0 | 0 | 23.34 |
| | | | 1 | 8 | 0 | 23.20 |
| | | | 1 | 14 | 0 | 23.34 |
| | | | 8 | 0 | 1 | 22.25 |
| | | | 8 | 4 | 1 | 22.27 |
| | | | 8 | 7 | 1 | 21.98 |
| | | | 15 | 0 | 1 | 22.28 |
| | | 16QAM | 1 | 0 | 1 | 22.29 |
| | | | 1 | 8 | 1 | 22.25 |
| | | | 1 | 14 | 1 | 22.26 |
| | | | 8 | 0 | 2 | 21.36 |
| | | | 8 | 4 | 2 | 21.47 |
| | | | 8 | 7 | 2 | 21.30 |
| | | | 15 | 0 | 2 | 21.38 |
| | 5 | QPSK | 1 | 0 | 0 | 23.33 |
| | | | 1 | 12 | 0 | 23.31 |
| | | | 1 | 24 | 0 | 23.34 |
| | | | 12 | 0 | 1 | 22.28 |
| | | | 12 | 7 | 1 | 22.21 |
| | | | 12 | 13 | 1 | 22.25 |
| | | | 25 | 0 | 1 | 22.22 |
| | | 16QAM | 1 | 0 | 1 | 22.26 |
| | | | 1 | 12 | 1 | 21.93 |
| | | | 1 | 24 | 1 | 22.23 |
| | | | 12 | 0 | 2 | 21.25 |
| | | | 12 | 7 | 2 | 21.32 |
| | | | 12 | 13 | 2 | 21.31 |
| | | | 25 | 0 | 2 | 21.29 |

| Test Band | Bandwidth (㎒) | Test mode | RB size | RB offset | MPR | Maximum power |
|---|---|---|---|---|---|---|
| LTE Band 26 | 10 | QPSK | 1 | 0 | 0 | 23.41 |
| | | | 1 | 25 | 0 | 23.36 |
| | | | 1 | 49 | 0 | 23.25 |
| | | | 25 | 0 | 1 | 22.38 |
| | | | 25 | 12 | 1 | 22.28 |
| | | | 25 | 25 | 1 | 22.38 |
| | | | 50 | 0 | 1 | 22.33 |
| | | 16QAM | 1 | 0 | 1 | 22.10 |
| | | | 1 | 25 | 1 | 22.01 |
| | | | 1 | 49 | 1 | 22.04 |
| | | | 25 | 0 | 2 | 21.43 |
| | | | 25 | 12 | 2 | 21.43 |
| | | | 25 | 25 | 2 | 21.30 |
| | | | 50 | 0 | 2 | 21.39 |
| LTE Band 26 | 15 | QPSK | 1 | 0 | 0 | 23.37 |
| | | | 1 | 36 | 0 | 23.29 |
| | | | 1 | 74 | 0 | 23.26 |
| | | | 36 | 0 | 1 | 22.38 |
| | | | 36 | 18 | 1 | 22.27 |
| | | | 36 | 37 | 1 | 22.32 |
| | | | 75 | 0 | 1 | 22.30 |
| | | 16QAM | 1 | 0 | 1 | 22.42 |
| | | | 1 | 36 | 1 | 22.39 |
| | | | 1 | 74 | 1 | 22.30 |
| | | | 36 | 0 | 2 | 21.36 |
| | | | 36 | 18 | 2 | 21.29 |
| | | | 36 | 37 | 2 | 21.23 |
| | | | 75 | 0 | 2 | 21.35 |

## 7.2. 99% Occupied Bandwidth & 26 dB Bandwidth

**Test setup**




**Limit**

According to §2.1049 ,the occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured.

**Test procedure**

971168 D01 v03r01 – Section 4.2 and 4.3
ANSI C63.26-2015 – Section 5.4.3 and 5.4.4

**Test settings**

### ◆ 26dB Bandwidth

c) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be wide enough to see sufficient roll off of the signal to make the measurement.

d) The nominal RBW shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set ≥ 3 × RBW.

e) Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation.
See guidance provided in 4.2.3.

d) The dynamic range of the spectrum analyzer at the selected RBW shall be more than 10 dB below the target "−X dB" requirement, i.e., if the requirement calls for measuring the −26 dB OBW, the spectrum analyzer noise floor at the selected RBW shall be at least 36 dB below the reference level.

e) Set spectrum analyzer detection mode to peak, and the trace mode to max hold.

f) Determine the reference value by either of the following:
   1) Set the EUT to transmit a modulated signal. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value).
   2) Set the EUT to transmit an unmodulated carrier. Set the spectrum analyzer marker to the level of the carrier.

g) Determine the "−X dB amplitude" as equal to (Reference Value − X). Alternatively, this calculation can be performed on the spectrum analyzer using the delta-marker measurement function.

h) If the reference value was determined using an unmodulated carrier, turn the EUT modulation on, then either clear the existing trace or start a new trace on the spectrum analyzer and allow the new trace to stabilize. Otherwise the trace from step f) shall be used for step i).

i) Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display such that each marker is at or slightly below the "−X dB amplitude" determined in step f). If a marker is below this "−X dB amplitude" value it should be as close as possible to this value. The OBW is the positive frequency difference between the two markers.

j) The spectral envelope can cross the "−X dB amplitude" at multiple points. The lowest or highest frequency shall be selected as the frequencies that are the farthest away from the center frequency at which the spectral envelope crosses the "−X dB amplitude."

j) The OBW shall be reported by providing plot(s) of the measuring instrument display, to include markers depicting the relevant frequency and amplitude information (e.g., marker table). The frequency and amplitude axis and scale shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

## ◆ 99% Occupied Bandwidth

a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (typically a span of 1.5 × OBW is sufficient).

b) The nominal IF filter 3 dB bandwidth (RBW) shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set ≥ 3 × RBW.

c) Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.

d) Set the detection mode to peak, and the trace mode to max-hold.

e) If the instrument does not have a 99% OBW function, recover the trace data points and sum directly in linear power terms. Place the recovered amplitude data points, beginning at the lowest frequency, in a running sum until 0.5% of the total is reached. Record that frequency as the lower OBW frequency. Repeat the process until 99.5% of the total is reached and record that frequency as the upper OBW frequency. The 99% power OBW can be determined by computing the difference these two frequencies.

f) The OBW shall be reported and plot(s) of the measuring instrument display shall be provided with the test report. The frequency and amplitude axis and scale shall be clearly labeled. Tabular data can be reported in addition to the plot(s).

**Notes:**

1. The EUT was setup to maximum output power as its lowest and highest channel with all bandwidth, Modulation.

## Test results

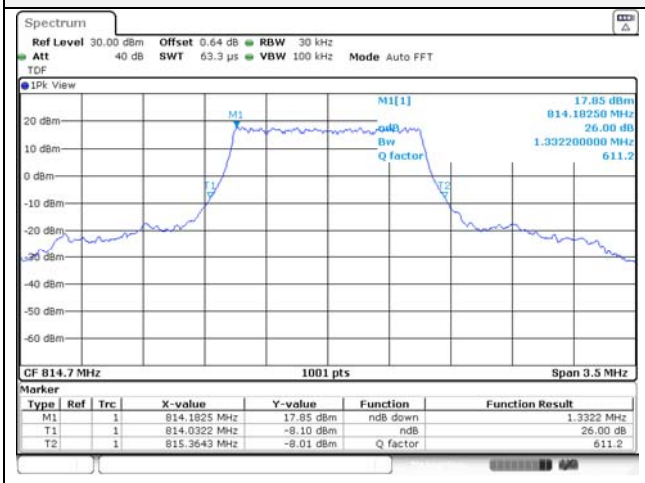
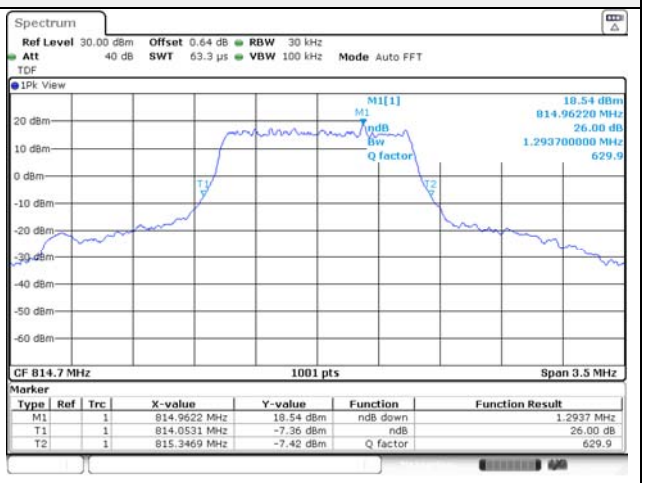
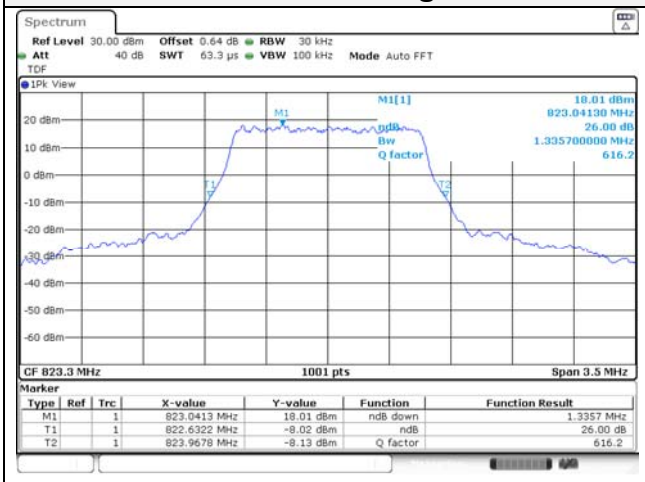
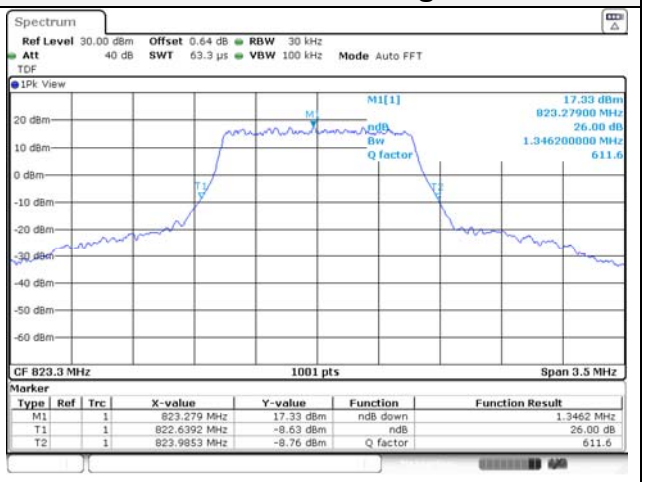
| Test Band | Bandwidth (㎒) | Frequency (㎒) | Test mode | 26㏈ bandwidth (㎒) | 99 % bandwidth (㎒) |
|---|---|---|---|---|---|
| LTE Band 26 | 1.4 | 814.7 | QPSK | 1.332 | 1.094 |
| | | | 16QAM | 1.294 | 1.091 |
| | | 823.3 | QPSK | 1.336 | 1.101 |
| | | | 16QAM | 1.346 | 1.108 |
| | 3 | 815.5 | QPSK | 3.139 | 2.720 |
| | | | 16QAM | 3.064 | 2.705 |
| | | 822.5 | QPSK | 3.102 | 2.705 |
| | | | 16QAM | 3.064 | 2.705 |
| | 5 | 816.5 | QPSK | 5.445 | 4.545 |
| | | | 16QAM | 5.507 | 4.558 |
| | | 821.5 | QPSK | 5.320 | 4.520 |
| | | | 16QAM | 5.320 | 4.533 |
| | 10 | 819.0 | QPSK | 10.165 | 8.966 |
| | | | 16QAM | 10.240 | 9.041 |
| | 15 | 821.5 | QPSK | 15.397 | 13.524 |
| | | | 16QAM | 15.022 | 13.487 |

## Straddle channel

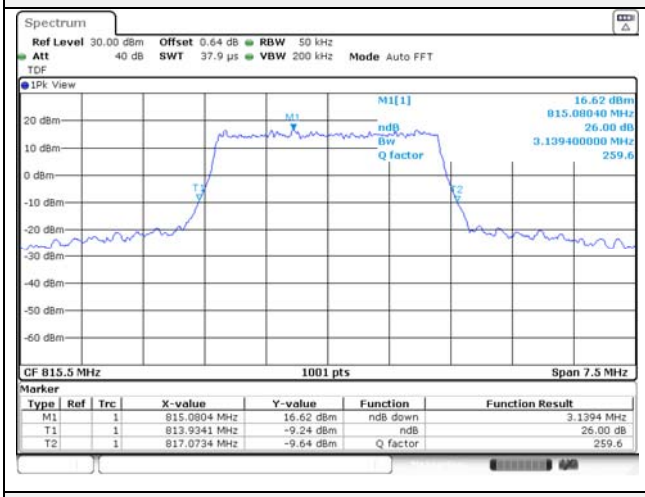
| Test Band | Bandwidth (㎒) | Frequency (㎒) | Test mode | 26㏈ bandwidth (㎒) | 99 % bandwidth (㎒) |
|---|---|---|---|---|---|
| LTE Band 26 | 1.4 | 824 | QPSK | 1.336 | 1.098 |
| | | | 16QAM | 1.339 | 1.108 |
| | 3 | 824 | QPSK | 3.079 | 2.705 |
| | | | 16QAM | 3.109 | 2.697 |
| | 5 | 824 | QPSK | 5.432 | 4.533 |
| | | | 16QAM | 5.407 | 4.520 |
| | 10 | 824 | QPSK | 9.990 | 9.016 |
| | | | 16QAM | 10.065 | 8.966 |
| | 15 | 824 | QPSK | 15.247 | 13.487 |
| | | | 16QAM | 14.948 | 13.524 |

## 26dB Bandwidth

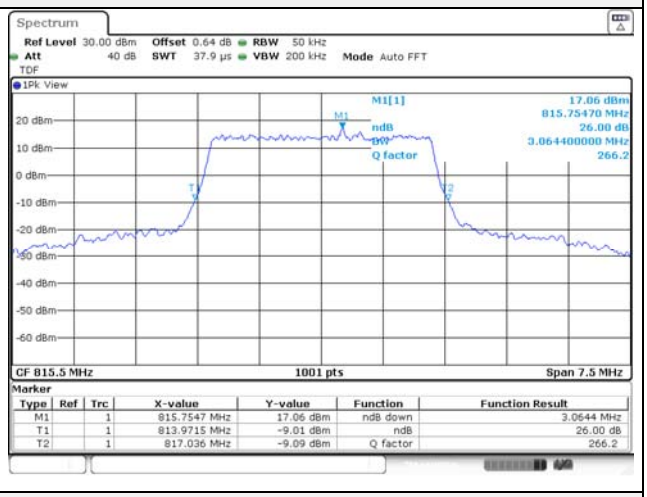
### Test mode: LTE Band 26

| 1.4M BW QPSK Low ch. | 1.4M BW 16QAM Low ch. |
|---|---|
|  |  |
| **1.4M BW QPSK High ch.** | **1.4M BW 16QAM High ch.** |
|  |  |

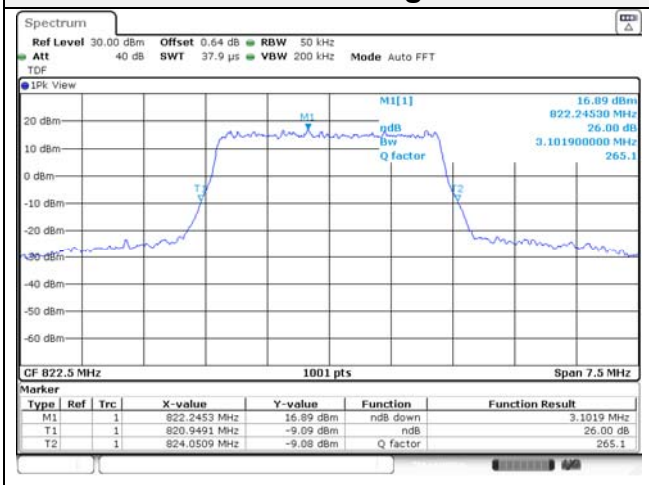
### 3M BW QPSK Low ch.



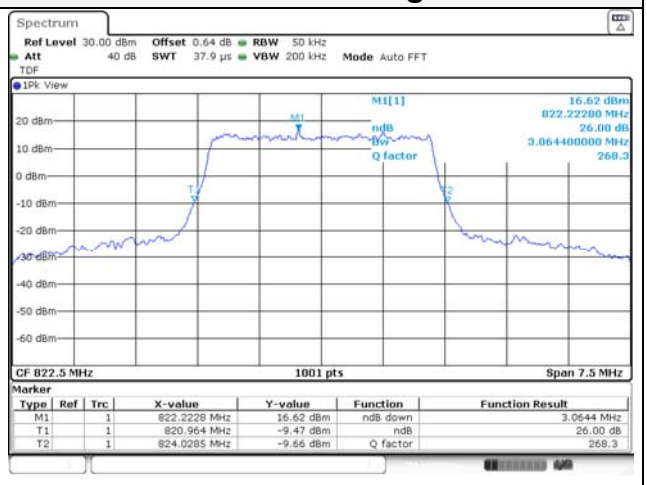

### 3M BW 16QAM Low ch.



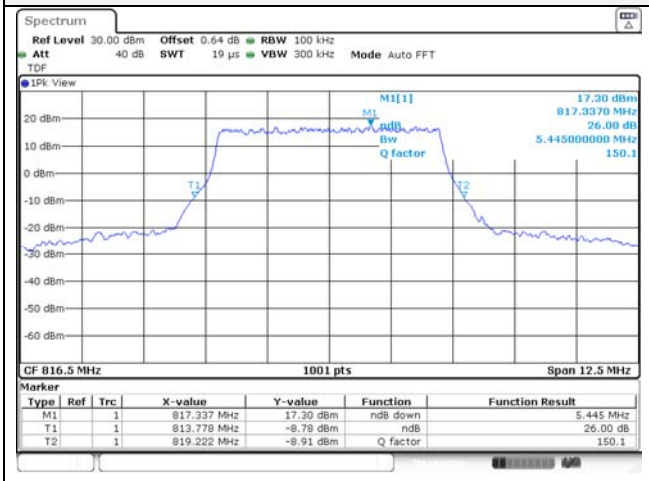

### 3M BW QPSK High ch.



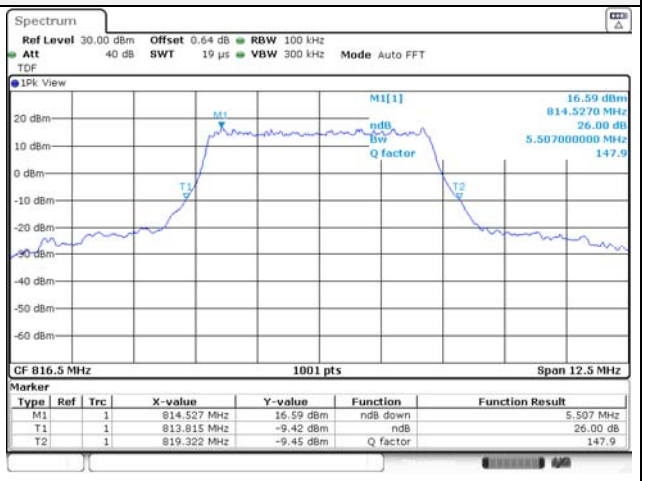

### 3M BW 16QAM High ch.



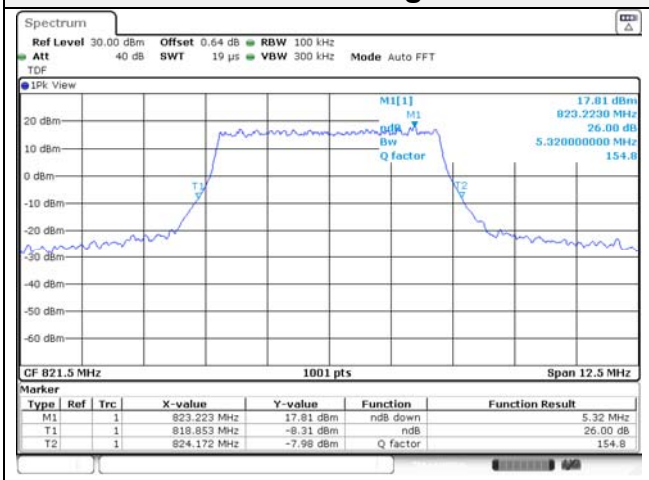
### 5M BW QPSK Low ch.



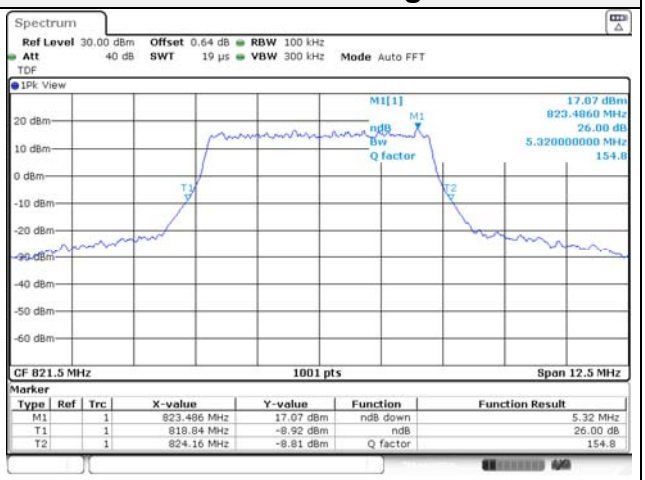

### 5M BW 16QAM Low ch.



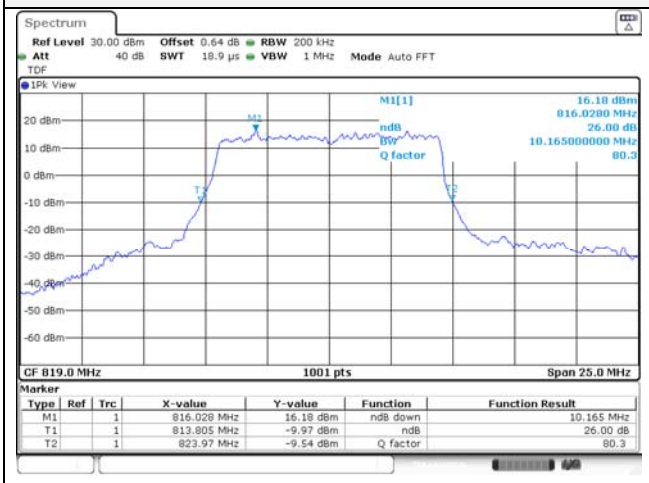

### 5M BW QPSK High ch.



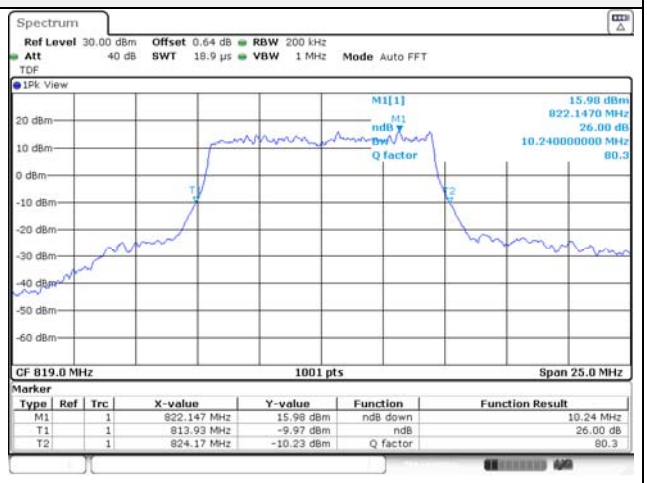

### 5M BW 16QAM High ch.



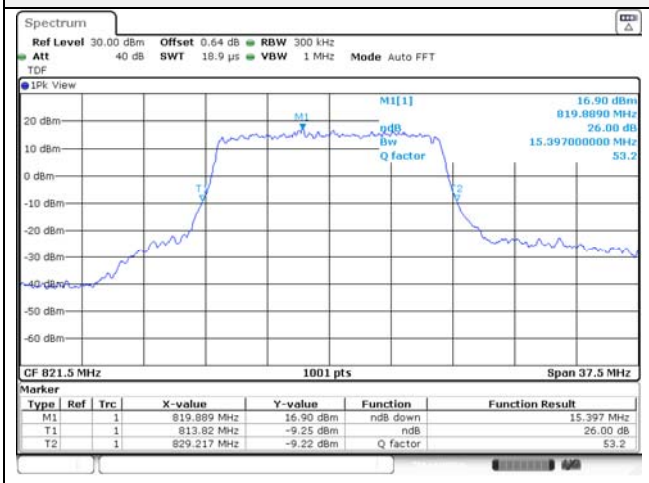
## 10M BW QPSK Mid ch.



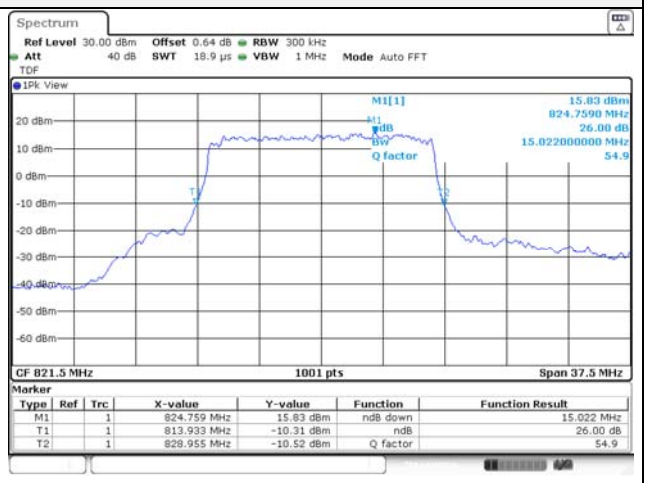

## 10M BW 16QAM Mid ch.




## 15M BW QPSK Mid ch.

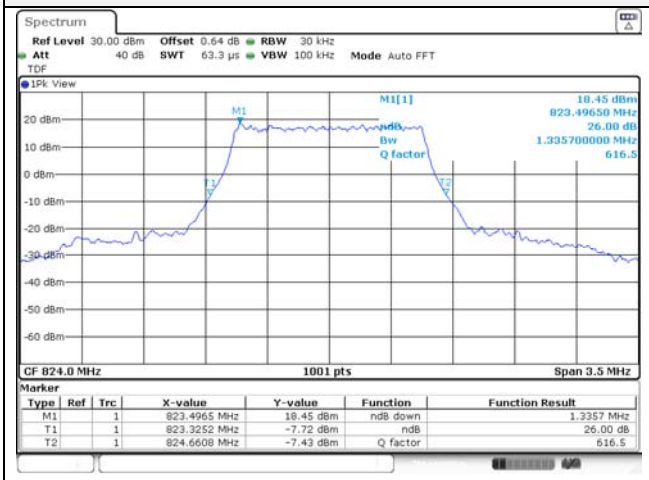



## 15M BW 16QAM Mid ch.

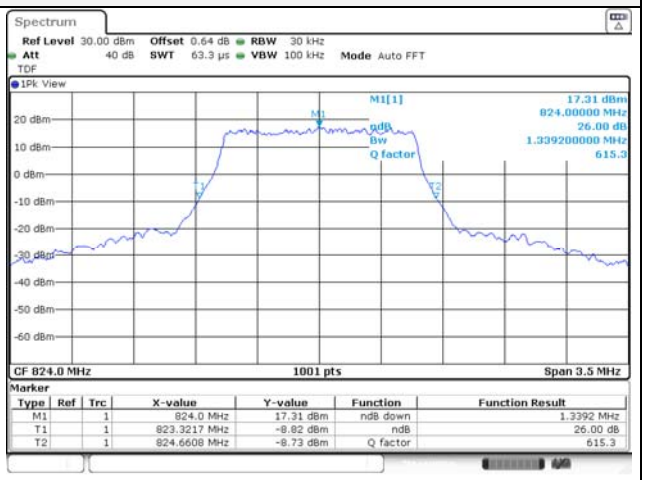


## Straddle channel

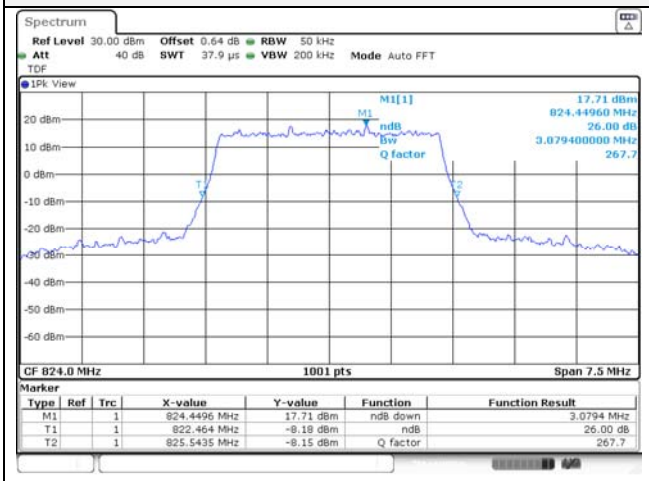
### 1.4M BW QPSK



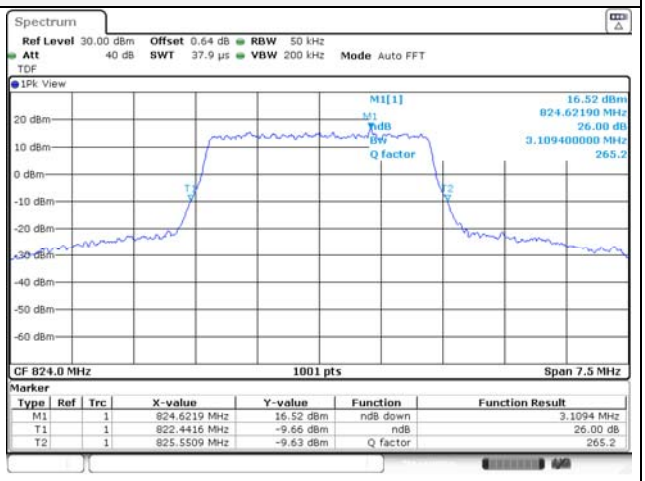

### 1.4M BW 16QAM



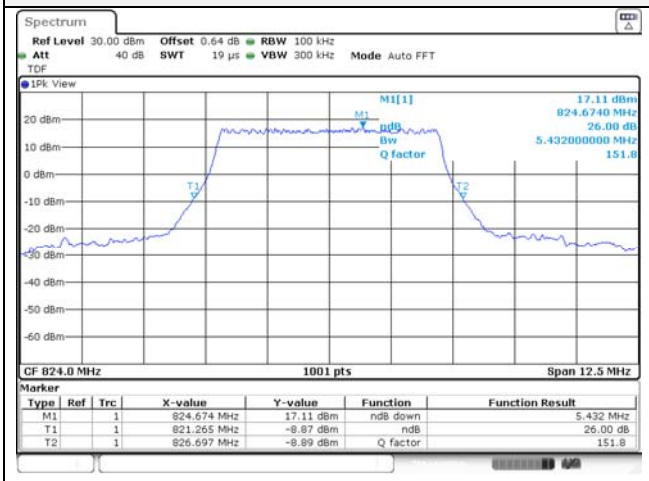

### 3M BW QPSK



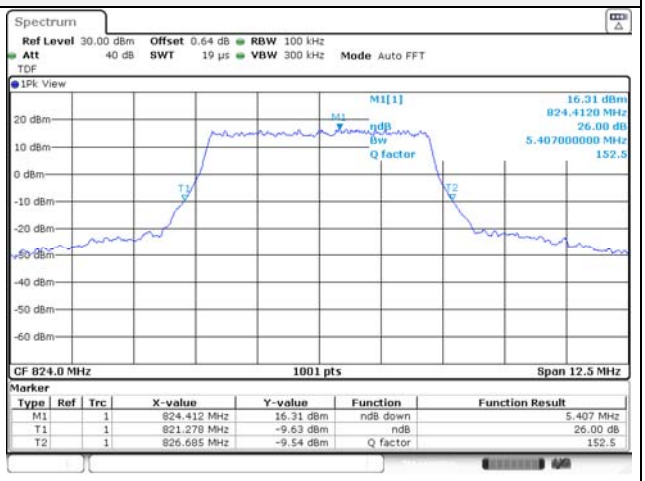

### 3M BW 16QAM



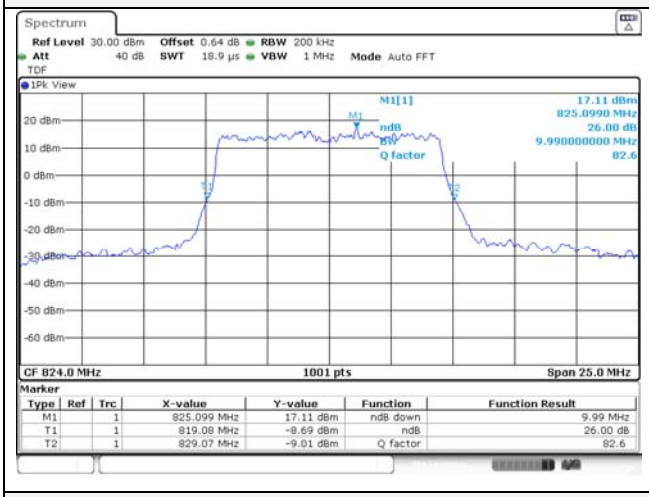

### 5M BW QPSK



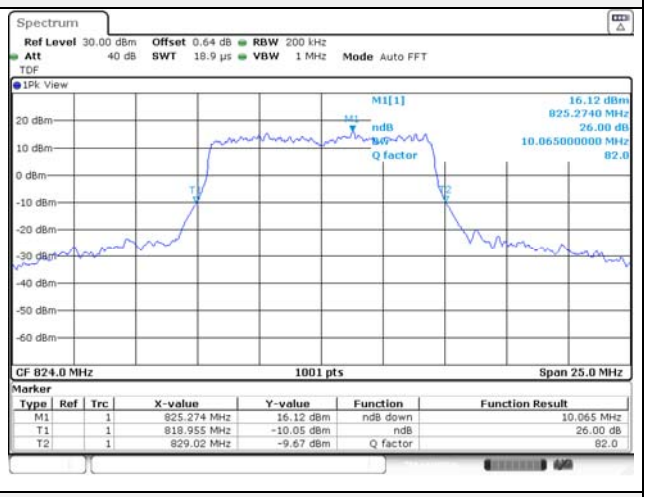

### 5M BW 16QAM



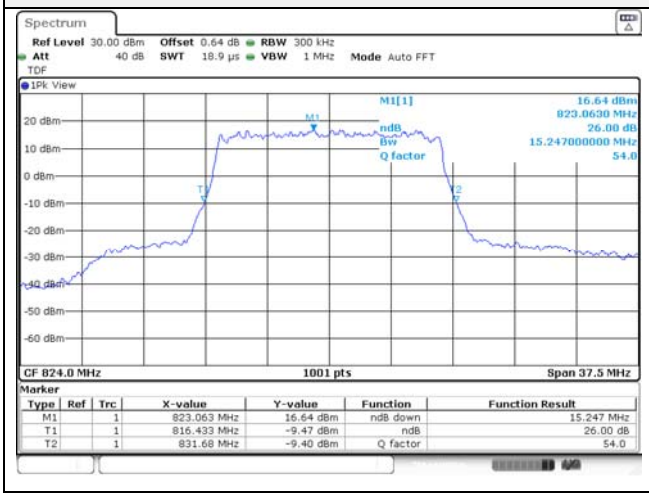
### 10M BW QPSK



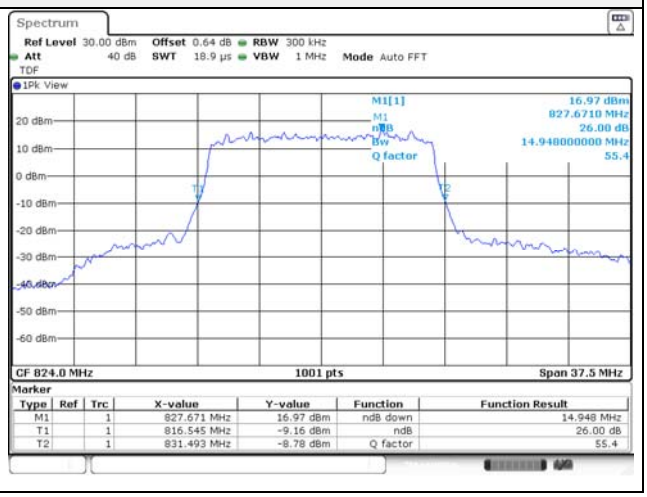

### 10M BW 16QAM




### 15M BW QPSK

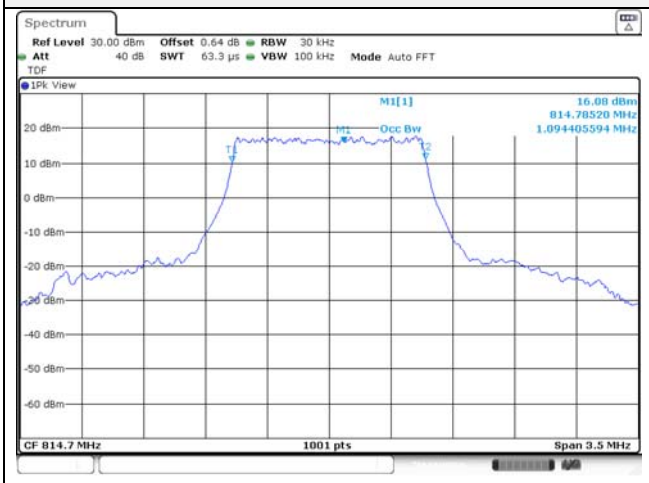
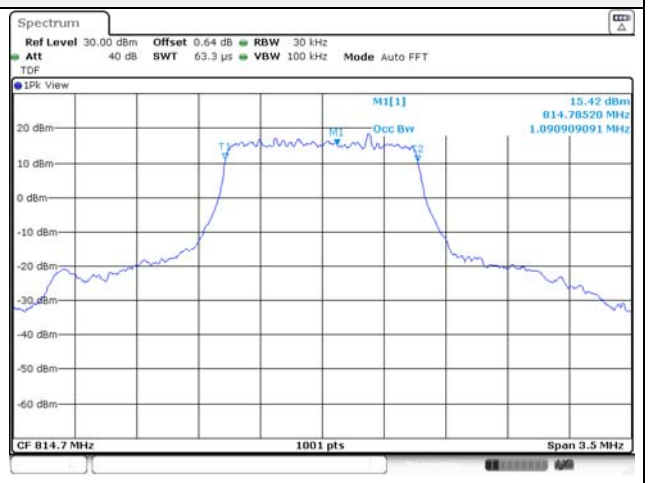
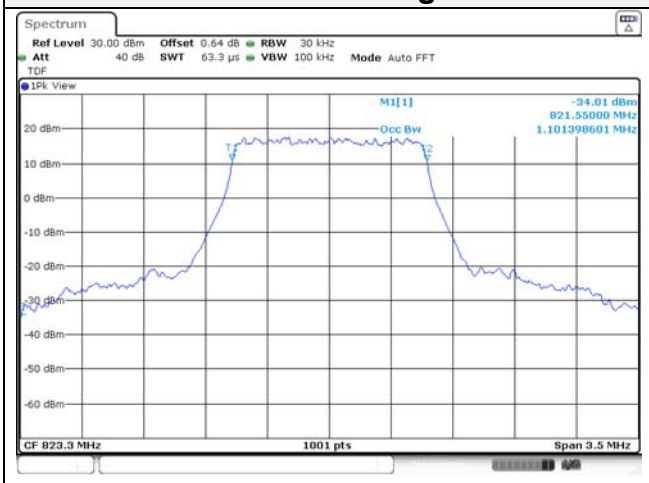
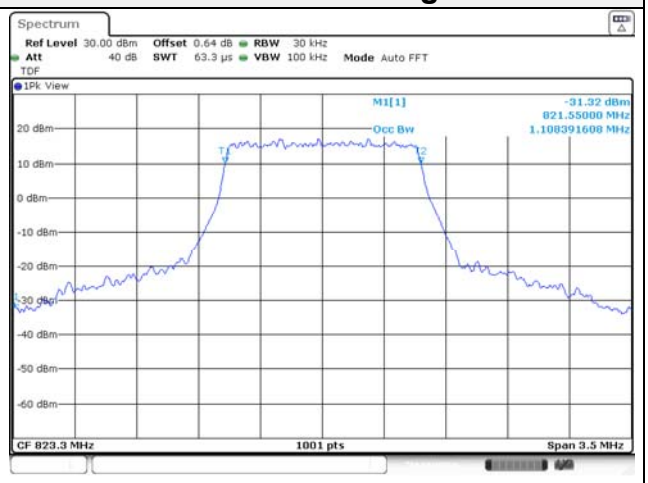


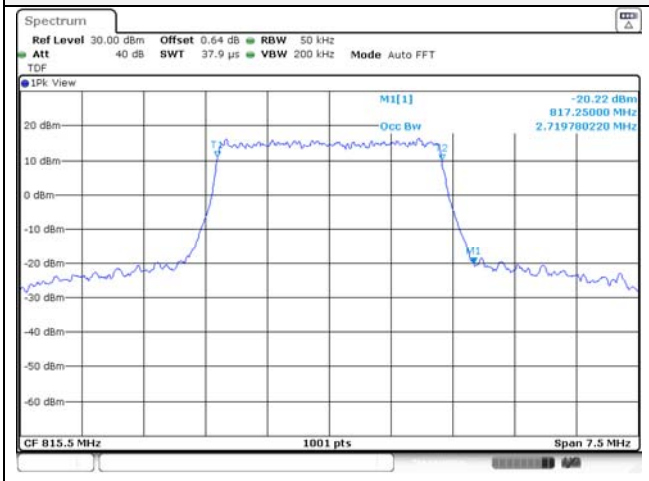
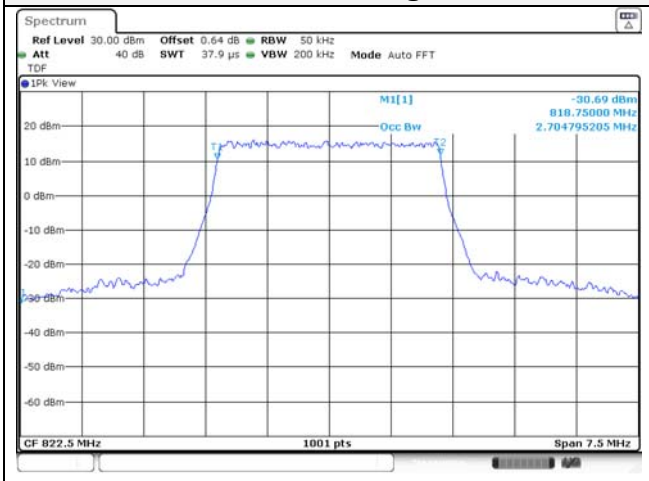
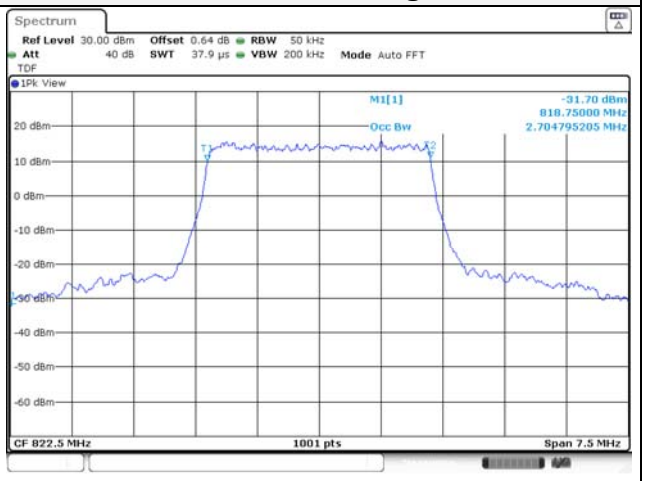

### 15M BW 16QAM

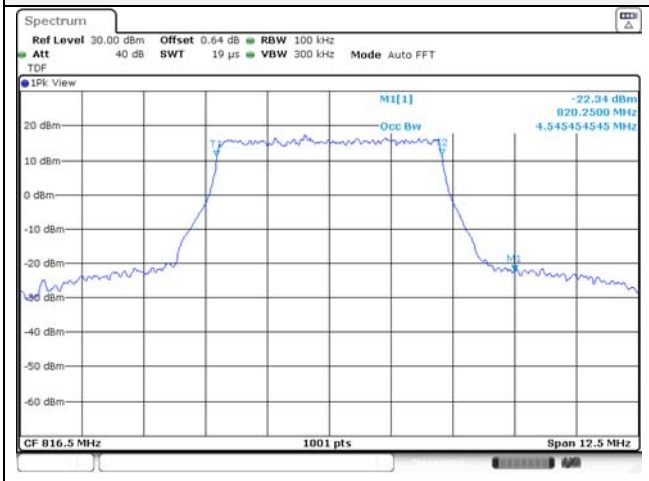
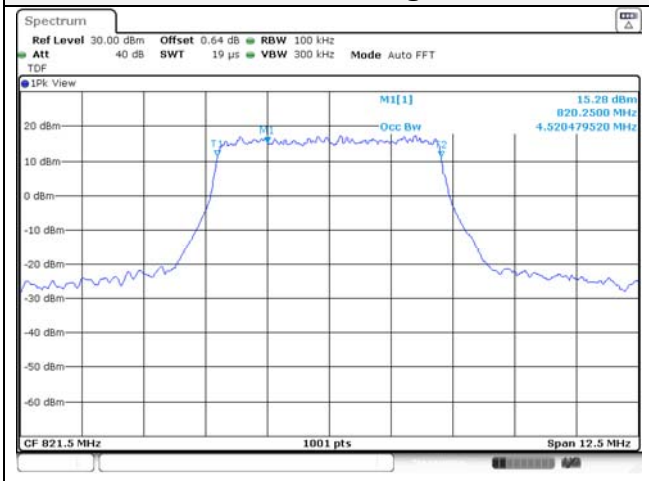


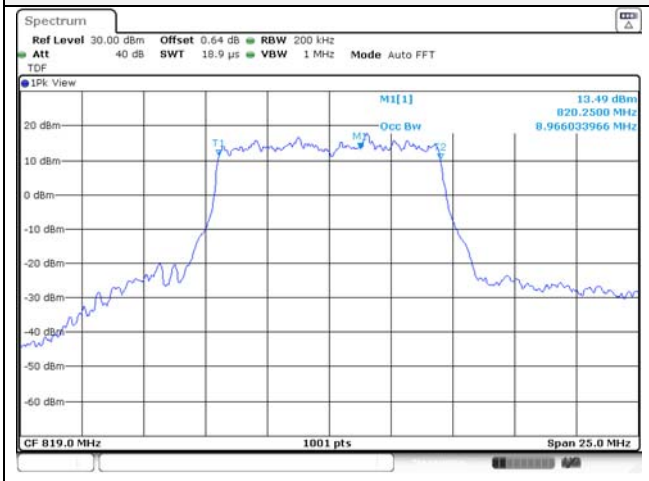
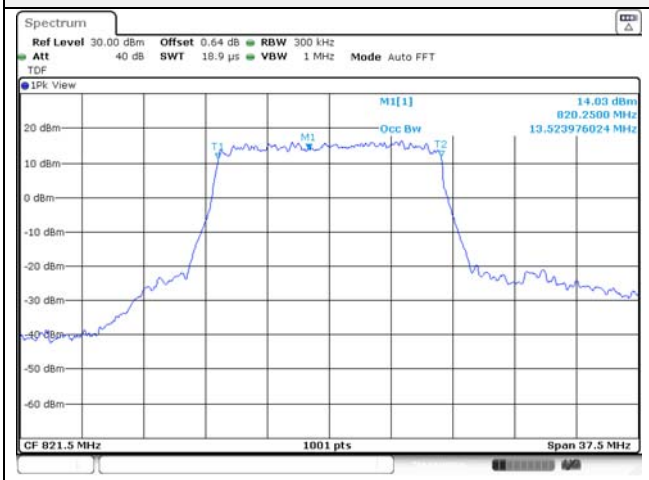
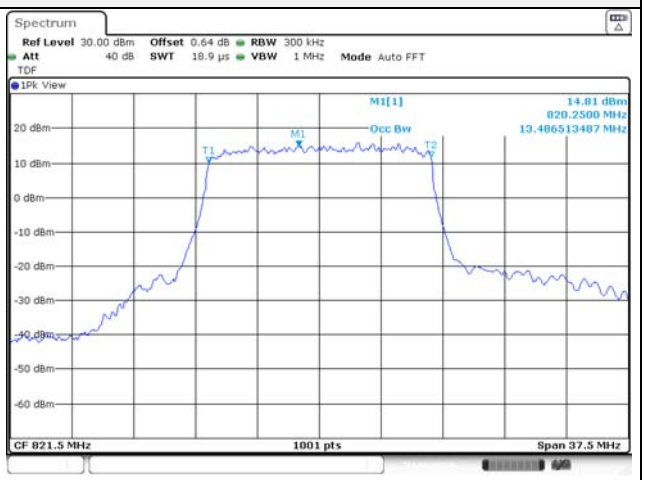
## 99% Occupied Bandwidth

### Test mode: LTE Band 26

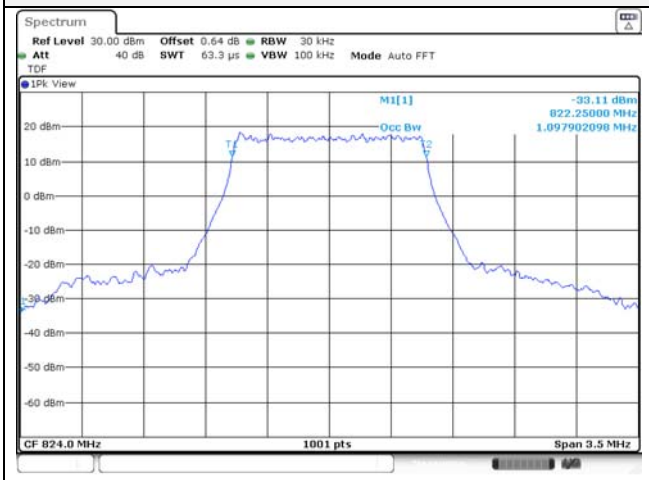
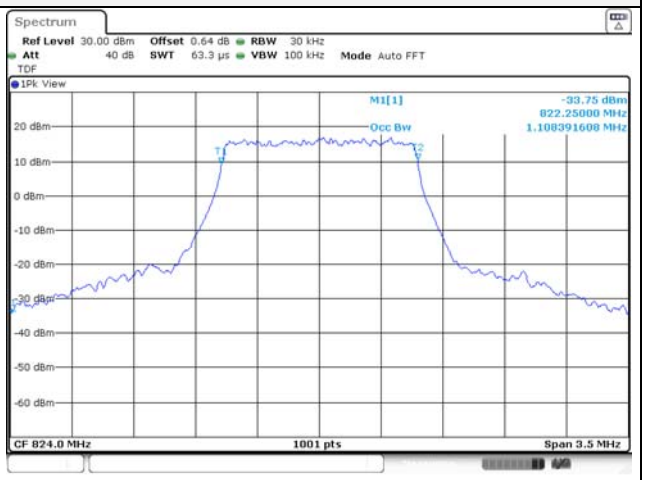
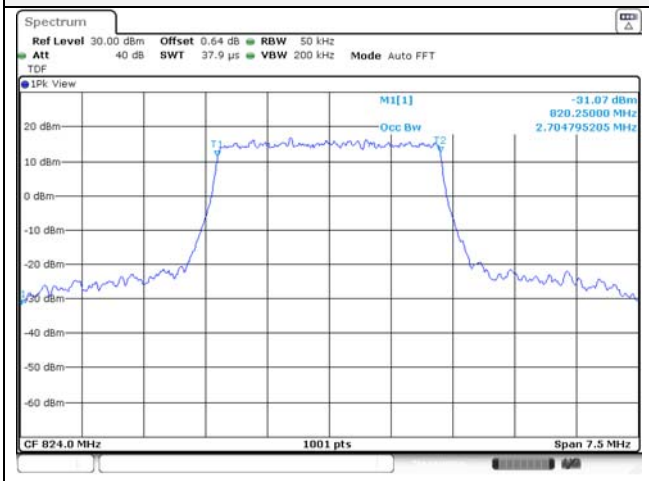
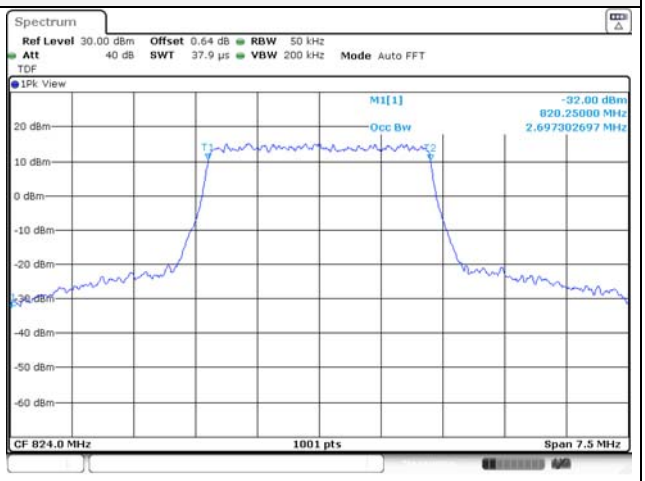
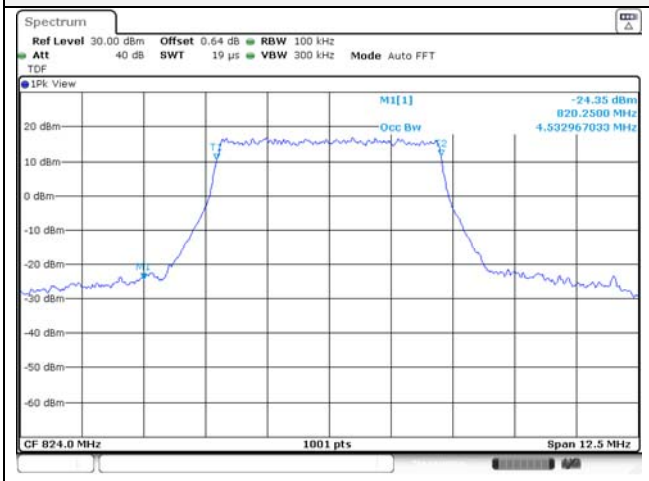
| 1.4M BW QPSK Low ch. | 1.4M BW 16QAM Low ch. |
|---|---|
|  |  |
| **1.4M BW QPSK High ch.** | **1.4M BW 16QAM High ch.** |
|  |  |

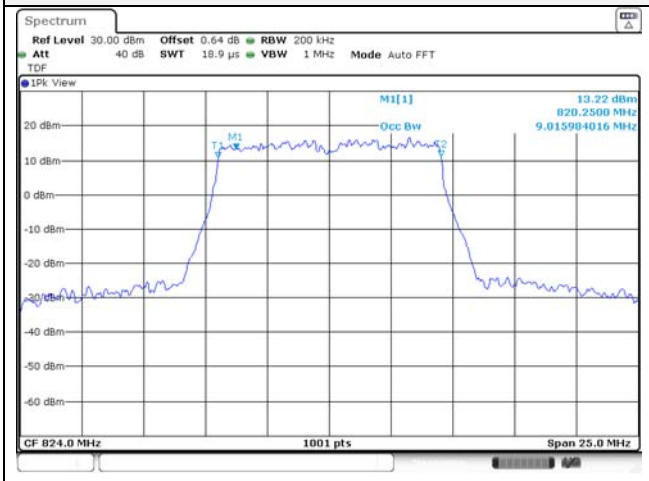
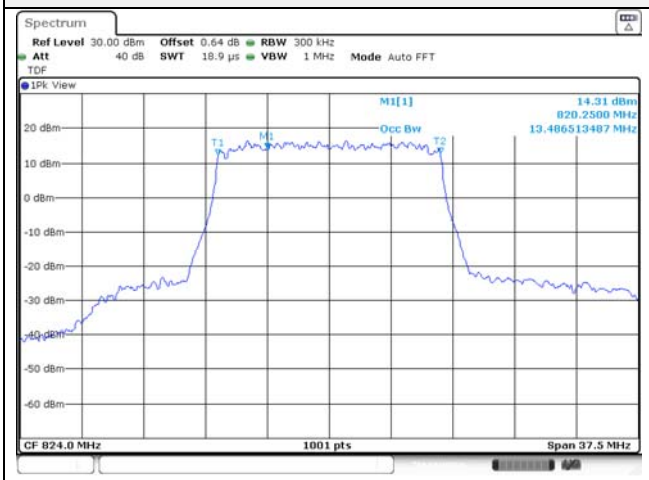
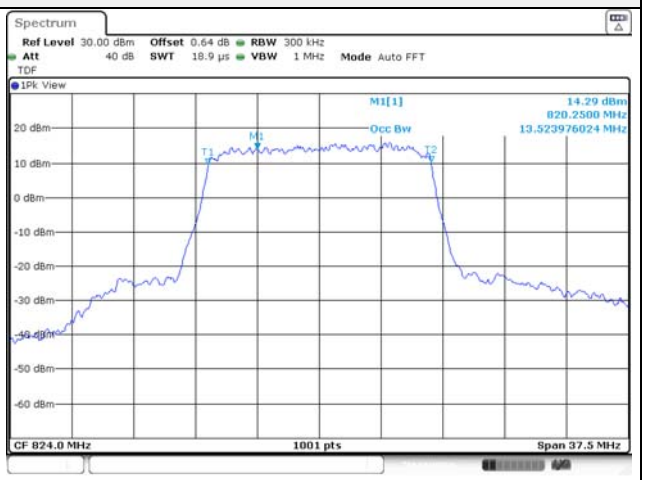
| 3M BW QPSK Low ch. | 3M BW 16QAM Low ch. |
|---|---|
|  |  |
| **3M BW QPSK High ch.** | **3M BW 16QAM High ch.** |
|  |  |

| 5M BW QPSK Low ch. | 5M BW 16QAM Low ch. |
|---|---|
|  |  |
| **5M BW QPSK High ch.** | **5M BW 16QAM High ch.** |
|  |  |

| 10M BW QPSK Mid ch. | 10M BW 16QAM Mid ch. |
|---|---|
|  |  |
| **15M BW QPSK Mid ch.** | **15M BW 16QAM Mid ch.** |
|  |  |

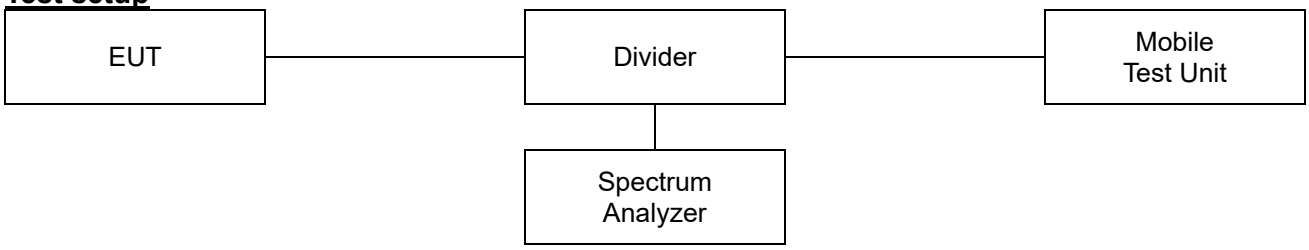
## Straddle channel

| 1.4M BW QPSK | 1.4M BW 16QAM |
|---|---|
|  |  |
| **3M BW QPSK** | **3M BW 16QAM** |
|  |  |
| **5M BW QPSK** | **5M BW 16QAM** |
|  |  |

| 10M BW QPSK | 10M BW 16QAM |
|---|---|
|  |  |
| **15M BW QPSK** | **15M BW 16QAM** |
|  |  |

## 7.3. Spurious Emissions at Antenna Terminal

**Test setup**




**Limit**

According to §90.691(a), Out-of-band emission requirement shall apply only to the “outer” channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(1) For any frequency removed from the EA licensee’s frequency block by up to and including 37.5 ㎑, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 $Log_{10}$(f/6.1) decibels or 50 + 10$Log_{10}$(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz where f is greater than 12.5 ㎑.

(2) For any frequency removed from the EA licensee’s frequency block greater than 37.5 ㎑, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + 10$Log_{10}$(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 ㎑.

**Test procedure**

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**Test settings**

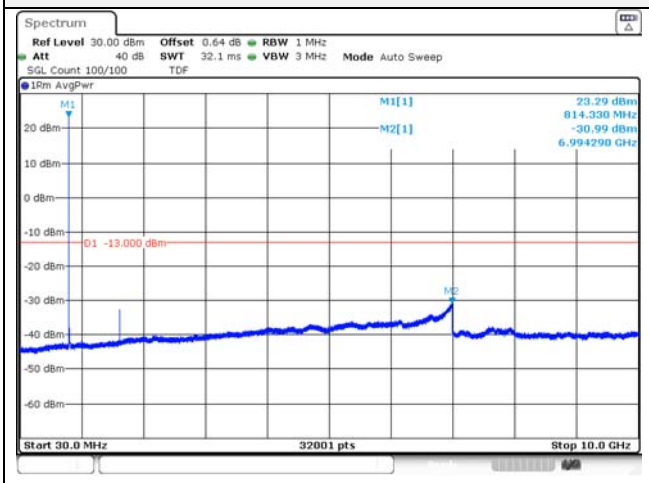
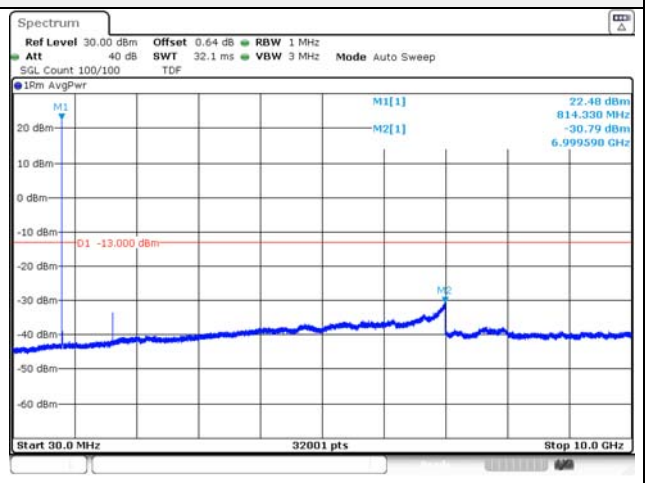
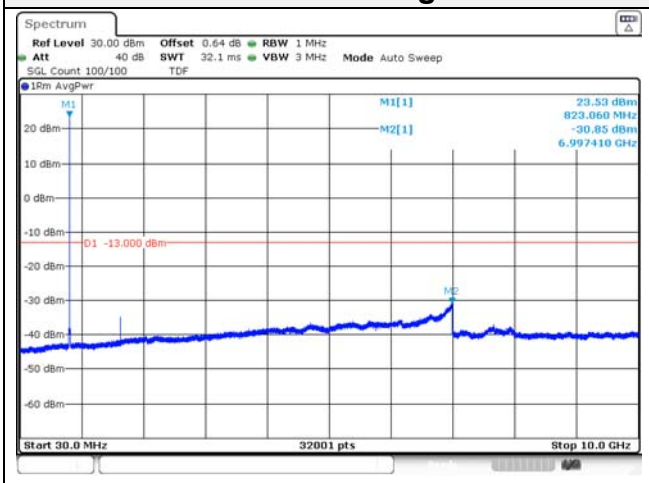
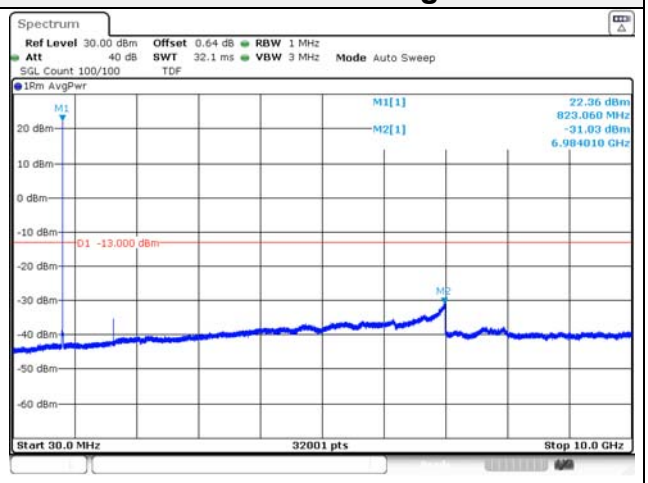
1) Start frequency was set to 30 ㎒ and stop frequency was set to at least 10th the fundamental frequency.
2) Detector = RMS
3) Sweep time = auto couple.
4) Trace mode = trace average
5) Allow trace to fully stabilize.
6) Please see test notes below RBW and VBW settings.

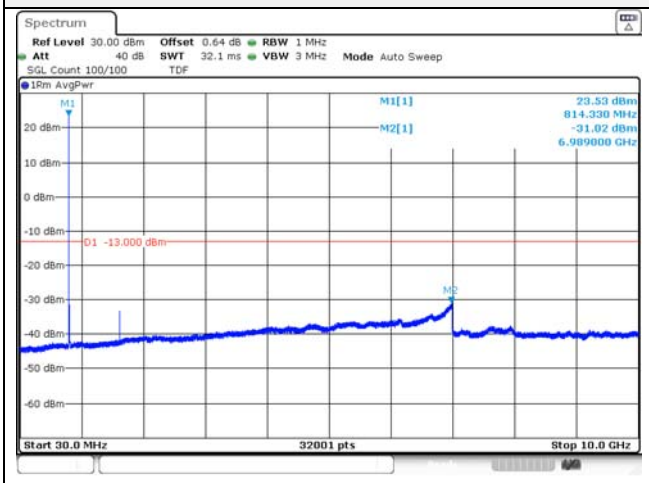
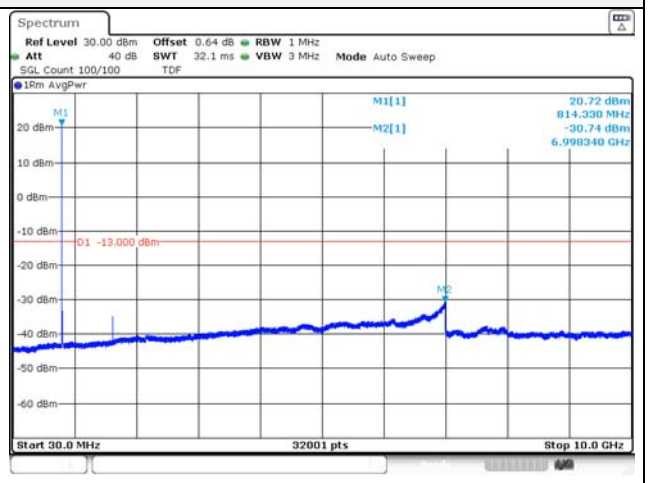
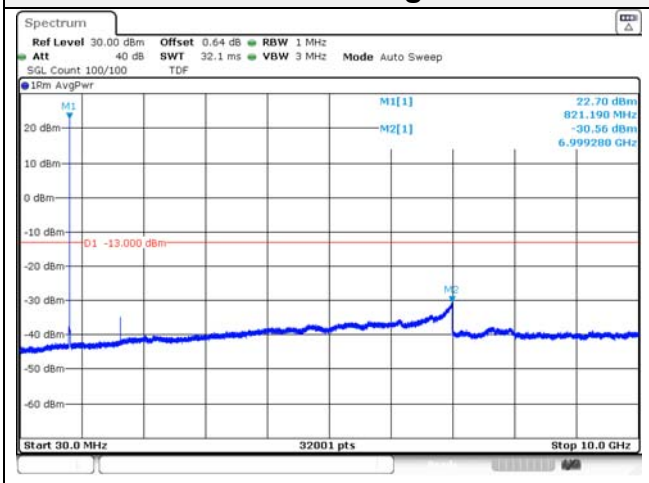
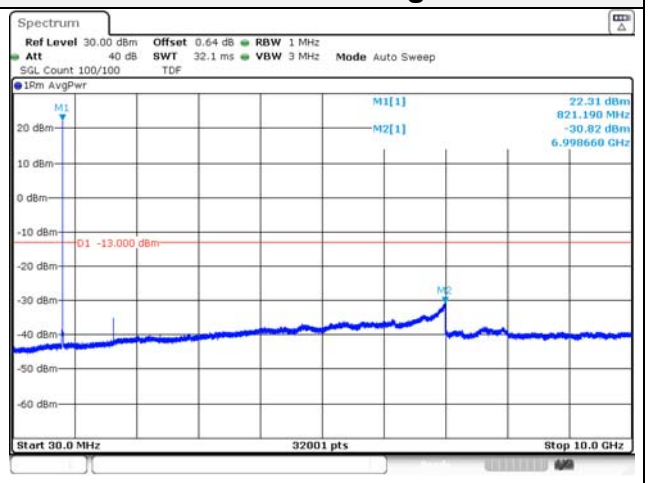
**Notes:**

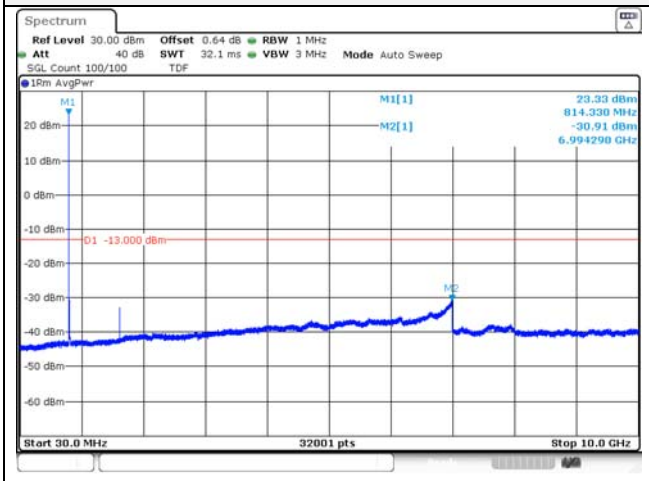
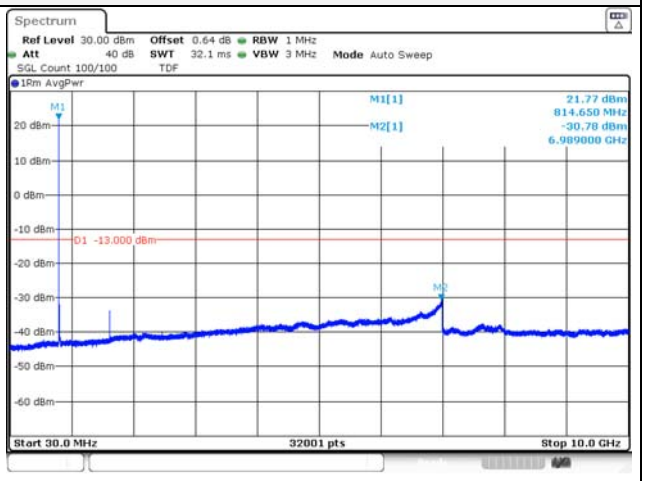
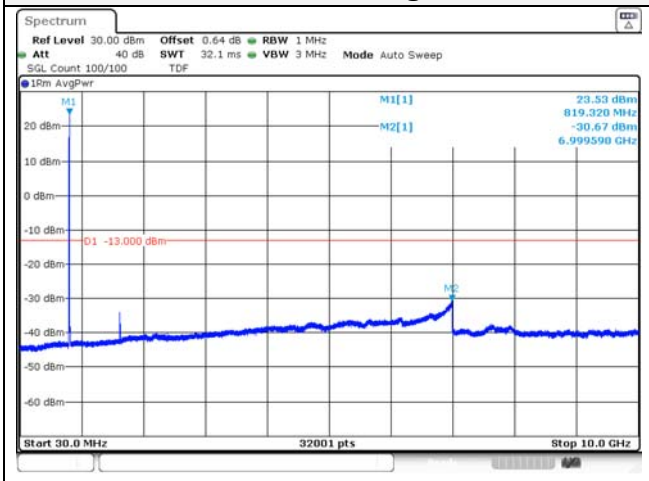
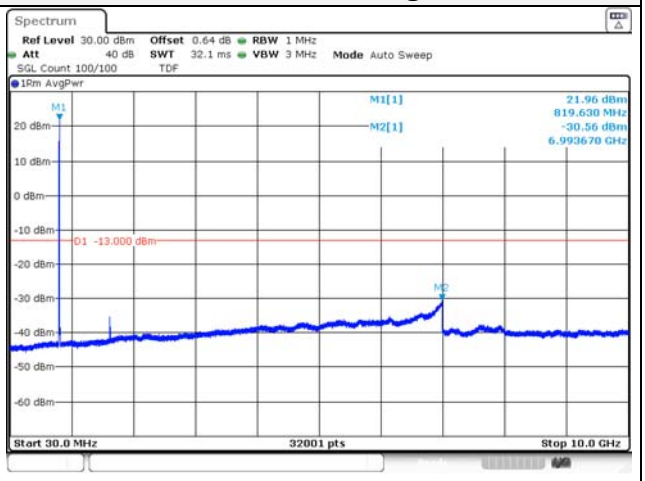
1. Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 100 ㎑ or greater for frequencies less than 1 ㎓ and 1 ㎒ or greater for frequencies greater than 1 ㎓.
   The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 ㏈ below the transmitter power.

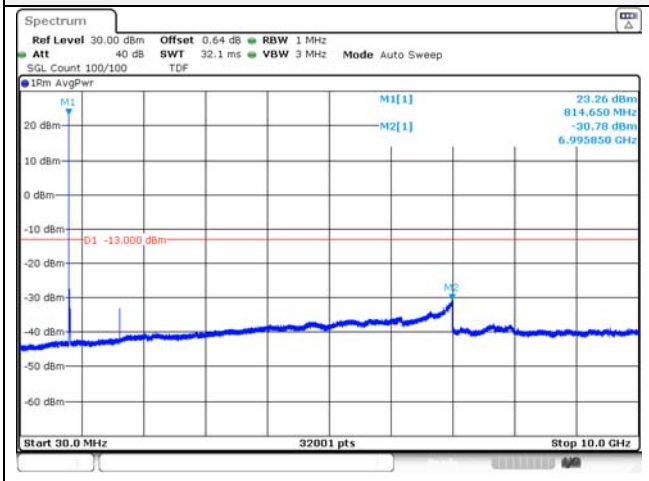
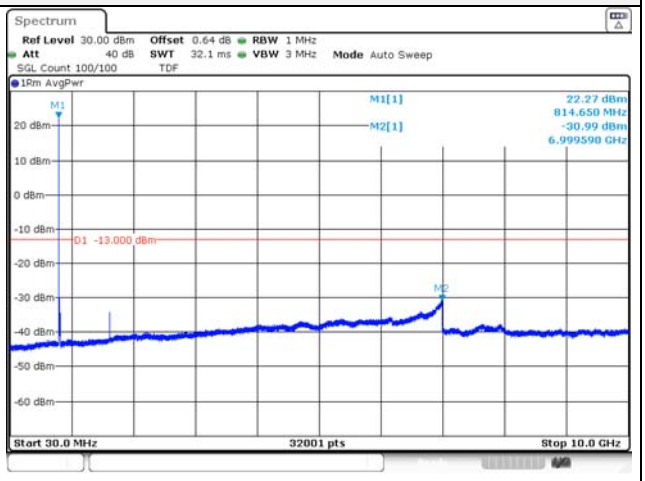
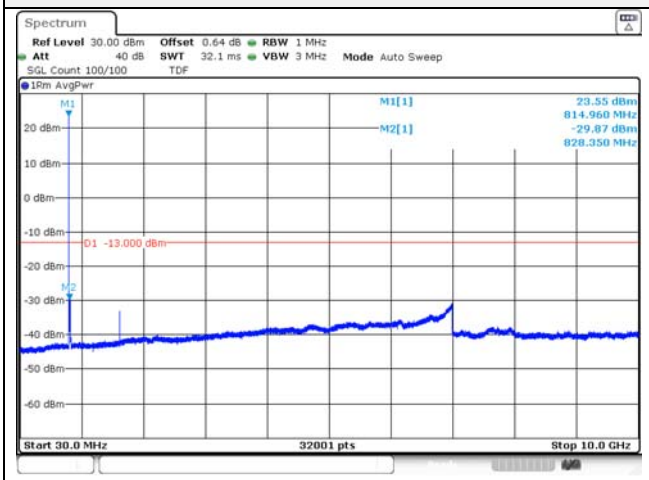
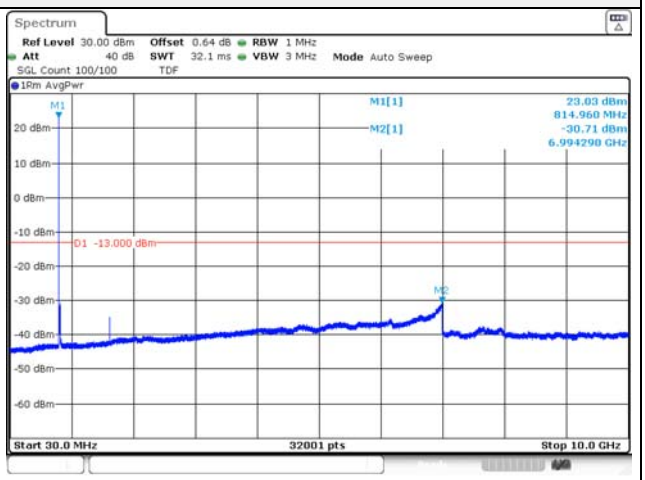
## Test results

### Test mode: LTE Band 26

| 1.4M BW QPSK Low ch. | 1.4M BW 16QAM Low ch. |
|---|---|
|  |  |
| **1.4M BW QPSK High ch.** | **1.4M BW 16QAM High ch.** |
|  |  |

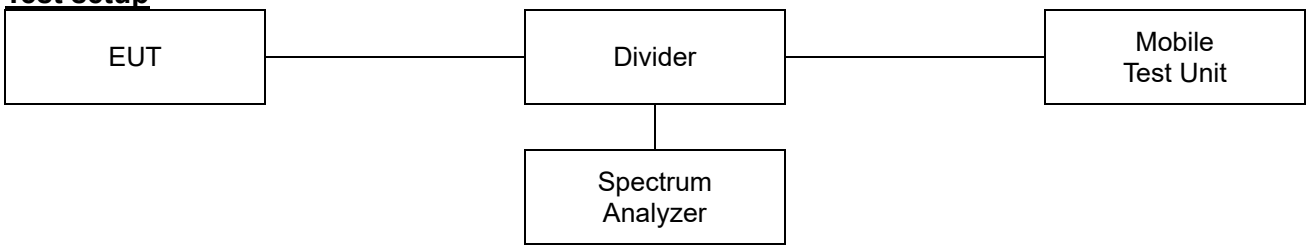
| 3M BW QPSK Low ch. | 3M BW 16QAM Low ch. |
|---|---|
|  |  |
| **3M BW QPSK High ch.** | **3M BW 16QAM High ch.** |
|  |  |

| 5M BW QPSK Low ch. | 5M BW 16QAM Low ch. |
|---|---|
|  |  |
| **5M BW QPSK High ch.** | **5M BW 16QAM High ch.** |
|  |  |

| 10M BW QPSK Mid ch. | 10M BW 16QAM Mid ch. |
|---|---|
|  |  |
| **15M BW QPSK Mid ch.** | **15M BW 16QAM Mid ch.** |
|  |  |

## 7.4. Band Edge Emissions at Antenna Terminal

**Test setup**




**Limit**

According to §90.691(a), Out-of-band emission requirement shall apply only to the “outer” channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(1) For any frequency removed from the EA licensee’s frequency block by up to and including 37.5 ㎑, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 $Log_{10}(f/6.1)$ decibels or 50 + $10Log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz where f is greater than 12.5 ㎑.

(2) For any frequency removed from the EA licensee’s frequency block greater than 37.5 ㎑, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + $10Log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 ㎑.

**Test procedure**

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**Test settings**

1) Start frequency was set to 30 ㎒ and stop frequency was set to at least 10th the fundamental frequency.
2) Span was set large enough so as to capture all out of band emissions near the band edge.
3) Set the RBW > 1% of the emission bandwidth.
4) Set the VBW ≥ 3 x RBW.
5) Set the number of sweep points ≥ 2 x Span/RBW
6) Detector = RMS
7) Trace mode = trace average
8) Sweep time should be auto for peak detection. For RMS detection the sweep time should be set as follows:
    a) If the device can be configured to transmit continuously (duty cycle ≥ 98%), set the (sweep time) > (number of points in sweep) x (symbol period) (e.g., by a factor of 10 x symbol period x number of points) Increasing the sweep time (i.e., slowing the sweep speed) will allow for averaging over multiple symbols.
    b) If the device cannot transmit continuously (duty cycle < 98%), a gated sweep shall be used when possible (i.e., gate triggered such that the analyzer only

sweeps when the device is transmitting at full power), set the sweep time > (number of points in sweep) x (symbol period) but the sweep time shall always be maintained at a value that is less than or equal to the minimum transmission time

c) If the device cannot be configured to transmit continuously (duty cycle > 98%), and a free-running sweep must be used, set the sweep time so that the averaging is performed over multiple on/off cycles by setting the sweep time > (number of points in sweep) × (transmitter period) (i.e., the transmit on-time + the off-time). The spectrum analyzer readings shall subsequently be corrected by [10 log (1/duty cycle)]. This assumes that the transmission period and duty cycle is relatively constant (duty cycle variation ≤ ±2%).

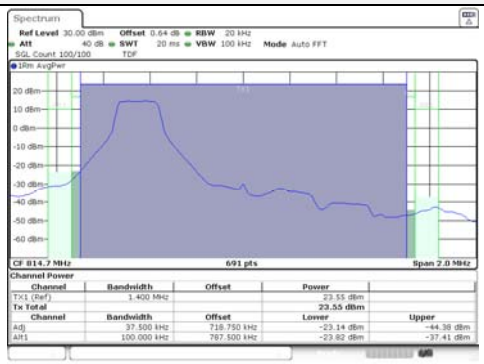
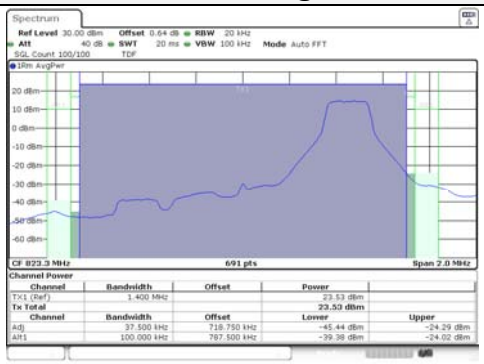
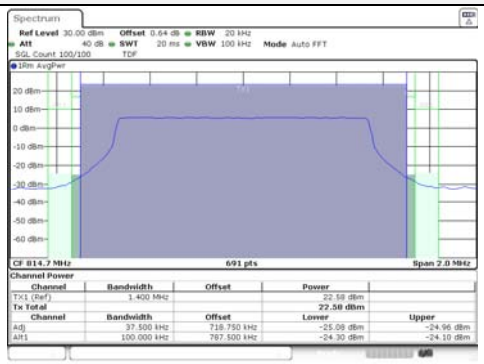
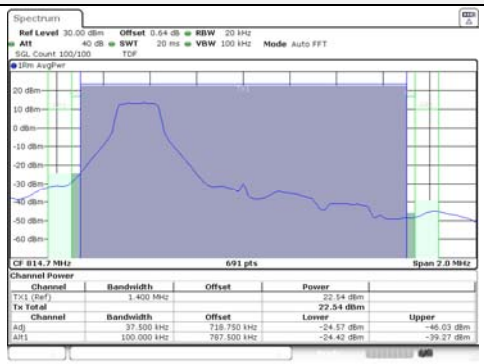
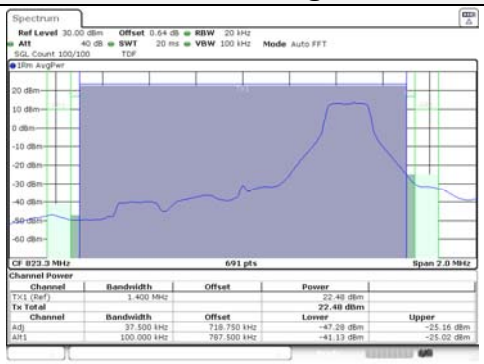
d) If the device cannot be configured to transmit continuously and a free-running sweep must be used, and if the transmissions exhibit a non-constant duty cycle (duty cycle variations > ±2%), set the sweep time so that the averaging is performed over the on-period by setting the sweep time > (symbol period) × (number of points), while also maintaining the sweep time < (transmitter on-time). The trace mode shall be set to max hold, since not every display point will be averaged only over just the on-time. Thus, multiple sweeps (e.g., 100) in maximum hold art necessary to ensure that the maximum power is measured.

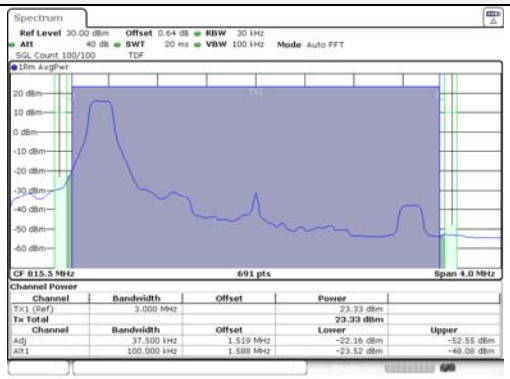
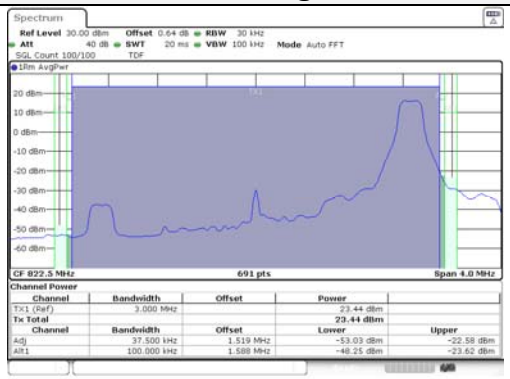
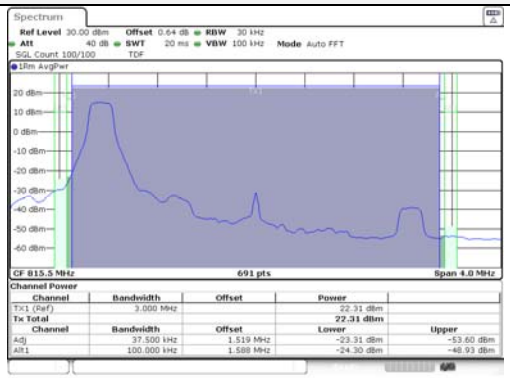
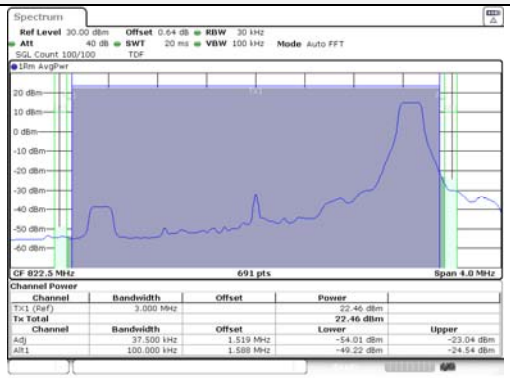
9) Allow trace to fully stabilize.

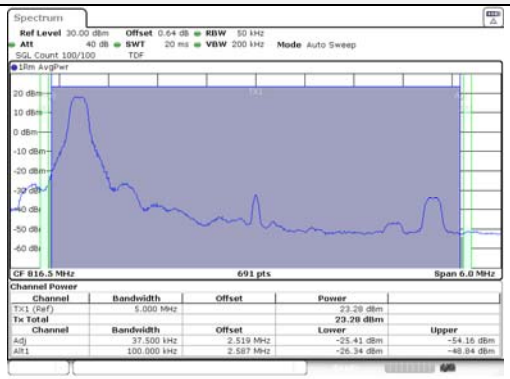
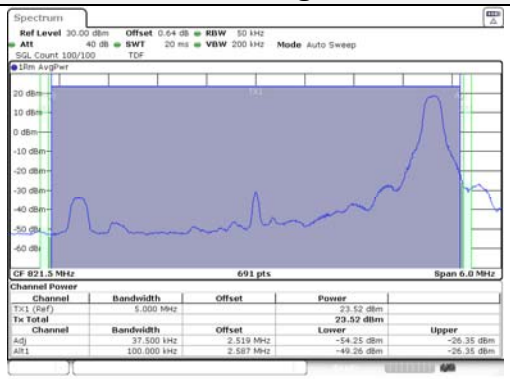
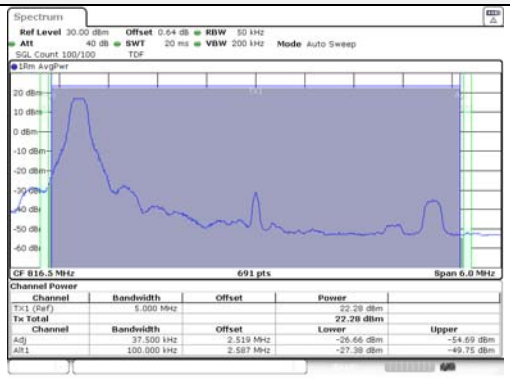
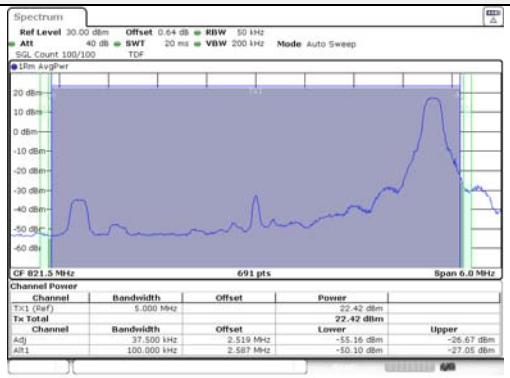
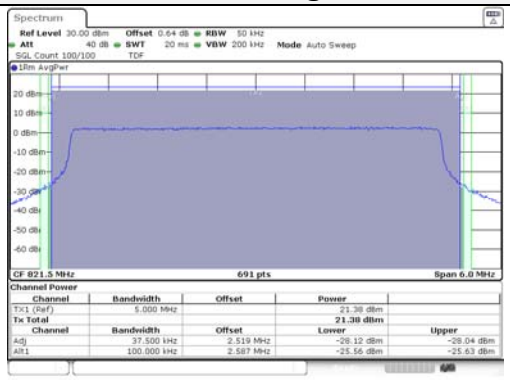
**Notes:**

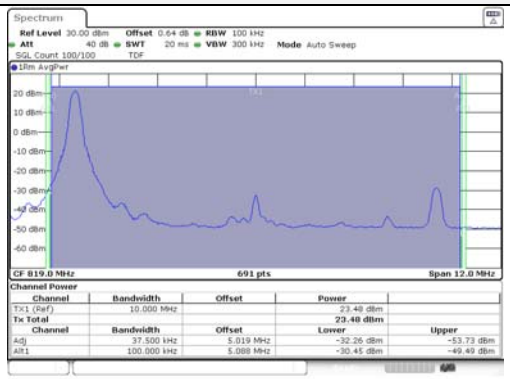
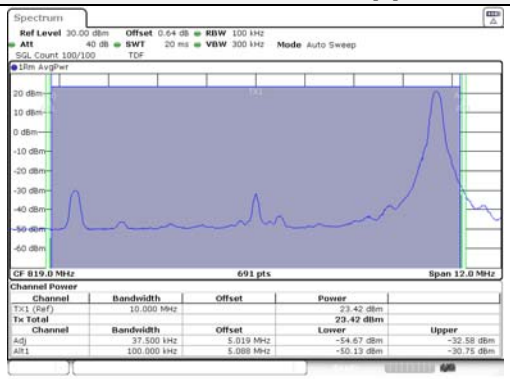
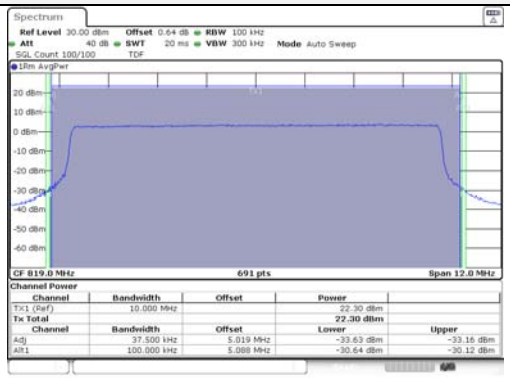
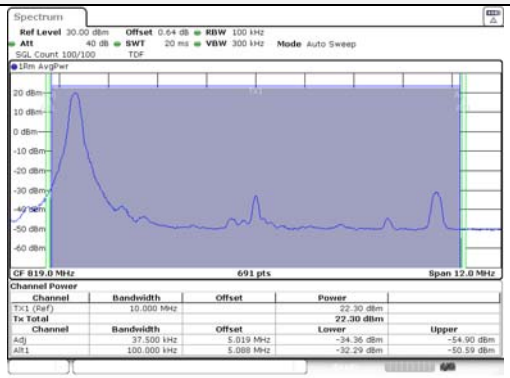
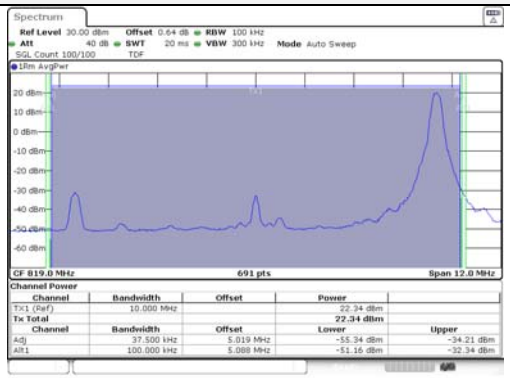
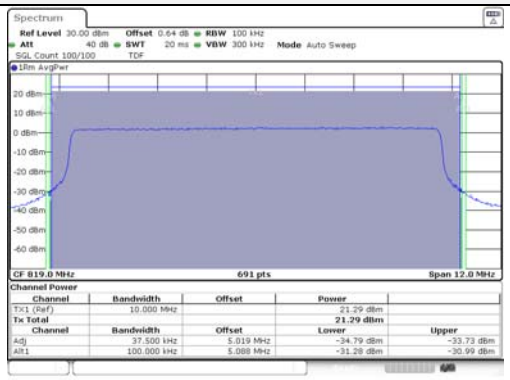
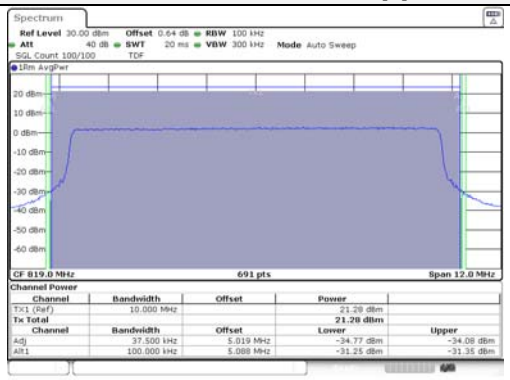
1. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 ㎒ or greater. however in the 1 ㎒ bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 ㏈ below the transmitter power.
2. The EUT was setup to maximum output power as its lowest and highest channel with all bandwidth, modulation and RB configurations.

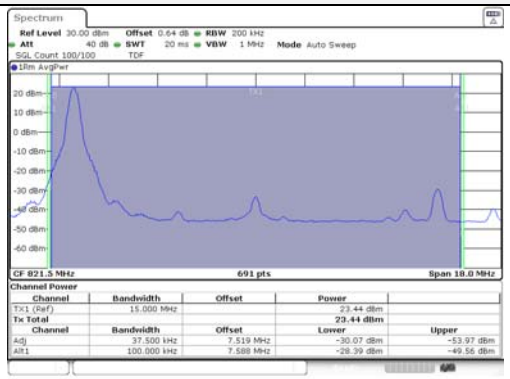
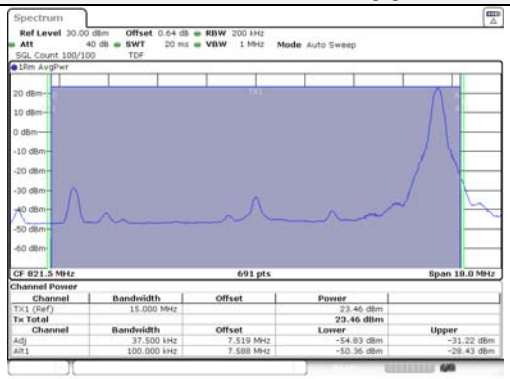
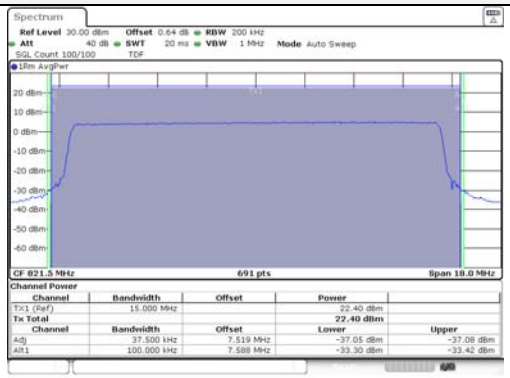
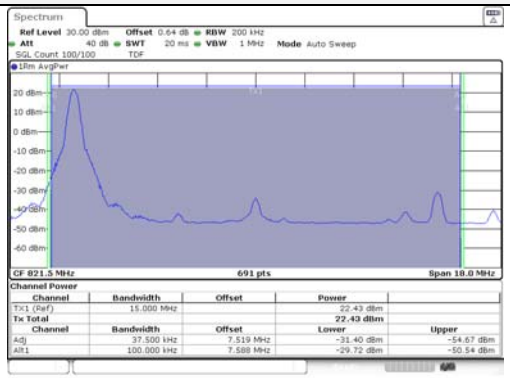
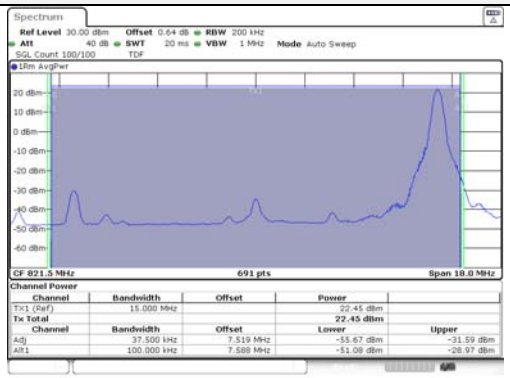
## Test results
## Test mode: LTE Band 26

| 1.4M BW QPSK Low ch. 1RB | 1.4M BW QPSK High ch. 1RB |
|---|---|
|  |  |
| **1.4M BW QPSK Low ch. FRB** | **1.4M BW QPSK High ch. FRB** |
|  |  |
| **1.4M BW 16QAM Low ch. 1RB** | **1.4M BW 16QAM High ch. 1RB** |
|  |  |
| **1.4M BW 16QAM Low ch. FRB** | **1.4M BW 16QAM High ch. FRB** |
|  |  |

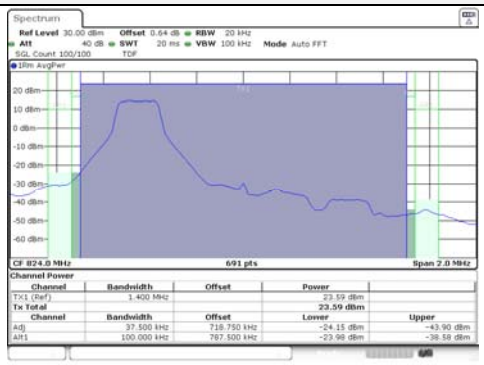
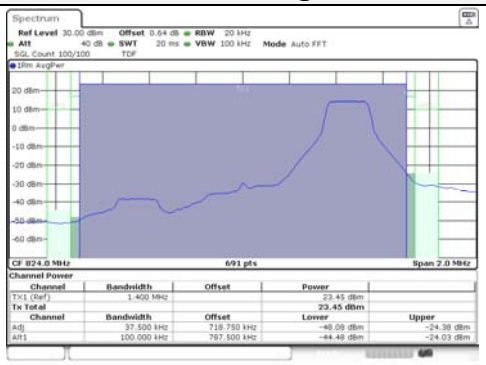
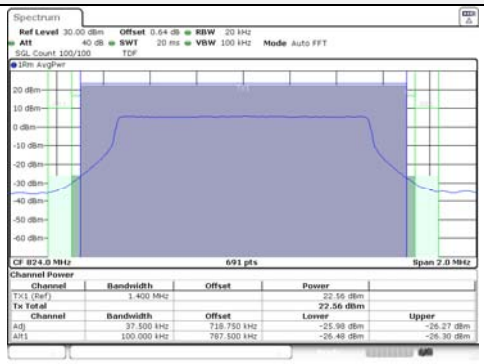
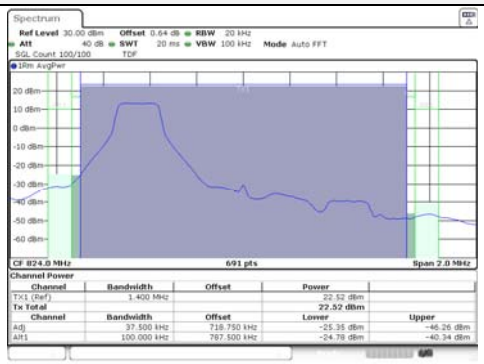
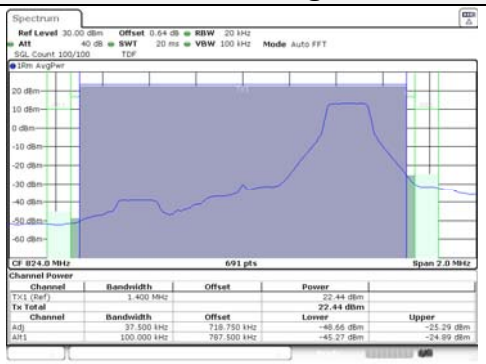
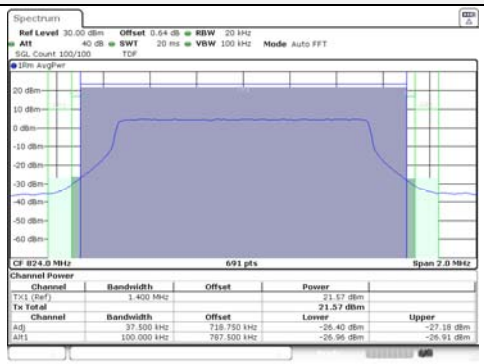
| 3M BW QPSK Low ch. 1RB | 3M BW QPSK High ch. 1RB |
|---|---|
|  |  |
| **3M BW QPSK Low ch. FRB** | **3M BW QPSK High ch. FRB** |
|  |  |
| **3M BW 16QAM Low ch. 1RB** | **3M BW 16QAM High ch. 1RB** |
|  |  |
| **3M BW 16QAM Low ch. FRB** | **3M BW 16QAM High ch. FRB** |
|  |  |

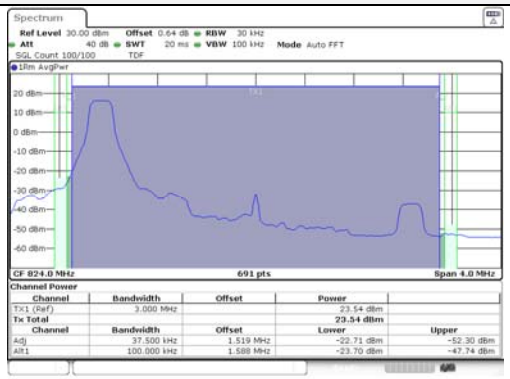
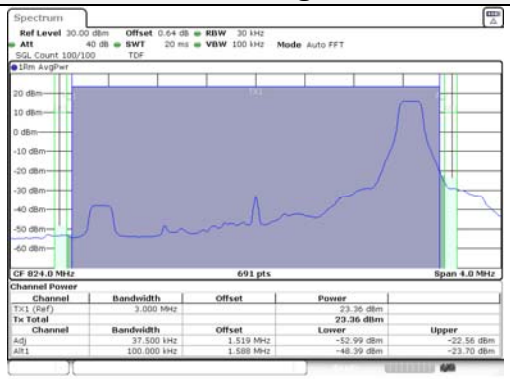
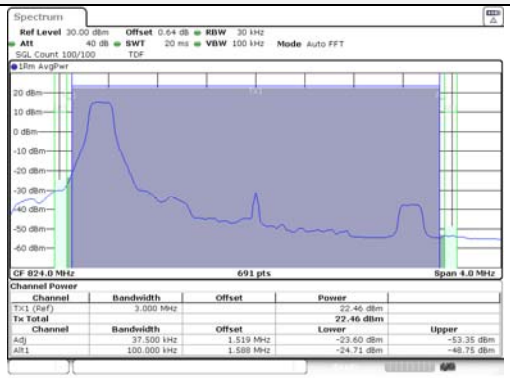
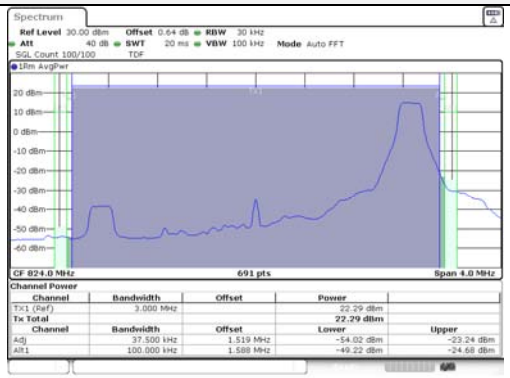
| 5M BW QPSK Low ch. 1RB | 5M BW QPSK High ch. 1RB |
|---|---|
|  |  |
| **5M BW QPSK Low ch. FRB** | **5M BW QPSK High ch. FRB** |
|  |  |
| **5M BW 16QAM Low ch. 1RB** | **5M BW 16QAM High ch. 1RB** |
|  |  |
| **5M BW 16QAM Low ch. FRB** | **5M BW 16QAM High ch. FRB** |
|  |  |

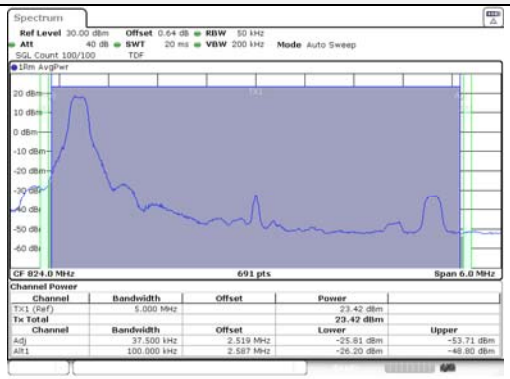
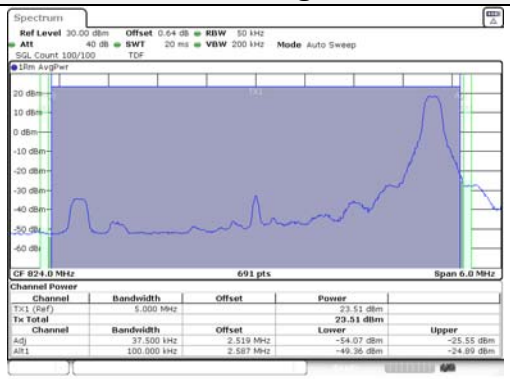
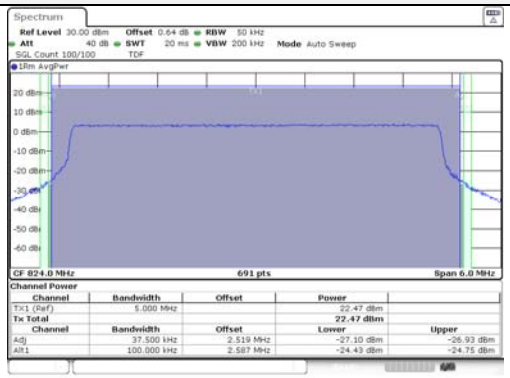
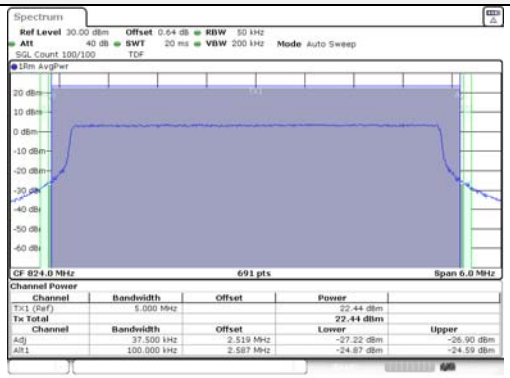
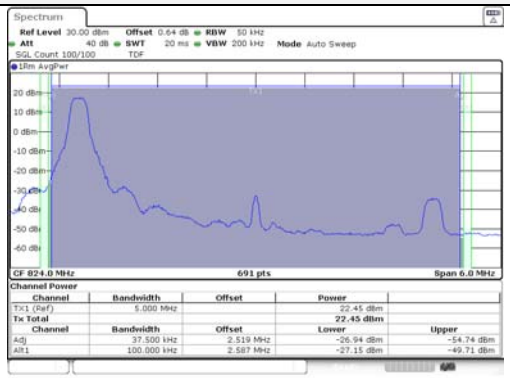
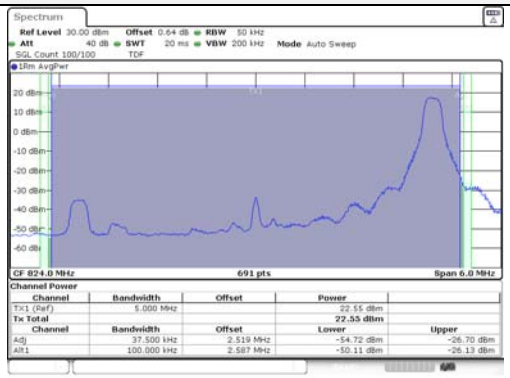
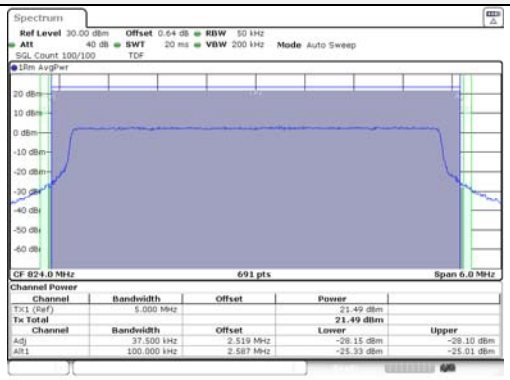
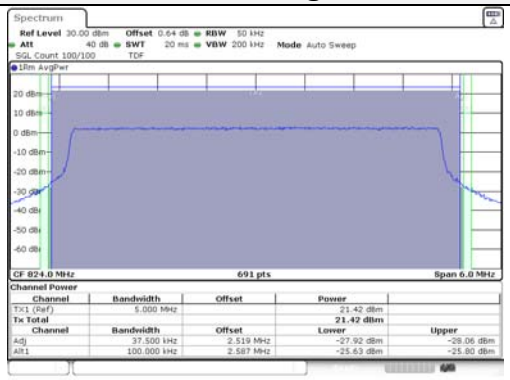
| 10M BW QPSK Mid ch. Lower 1RB | 10M BW QPSK Mid ch. Upper 1RB |
|---|---|
|  |  |
| **10M BW QPSK Mid ch. Lower FRB** | **10M BW QPSK Mid ch. Upper FRB** |
|  |  |
| **10M BW 16QAM Mid ch. Lower 1RB** | **10M BW 16QAM Mid ch. Upper 1RB** |
|  |  |
| **10M BW 16QAM Mid ch. Lower FRB** | **10M BW 16QAM Mid ch. Upper FRB** |
|  |  |

| 15M BW QPSK Mid ch. Lower 1RB | 15M BW QPSK Mid ch. Upper 1RB |
|---|---|
|  |  |
| **15M BW QPSK Mid ch. Lower FRB** | **15M BW QPSK Mid ch. Upper FRB** |
|  |  |
| **15M BW 16QAM Mid ch. Lower 1RB** | **15M BW 16QAM Mid ch. Upper 1RB** |
|  |  |
| **15M BW 16QAM Mid ch. Lower FRB** | **15M BW 16QAM Mid ch. Upper FRB** |
|  |  |

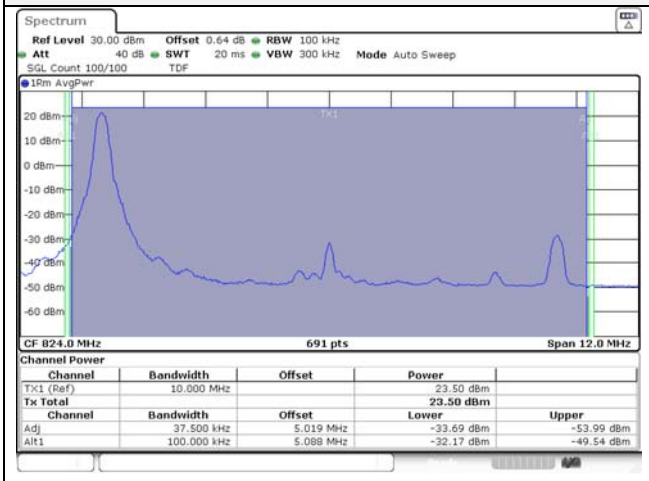
## Straddle channel

| 1.4M BW QPSK Low ch. 1RB | 1.4M BW QPSK High ch. 1RB |
|---|---|
|  |  |
| **1.4M BW QPSK Low ch. FRB** | **1.4M BW QPSK High ch. FRB** |
|  |  |
| **1.4M BW 16QAM Low ch. 1RB** | **1.4M BW 16QAM High ch. 1RB** |
|  |  |
| **1.4M BW 16QAM Low ch. FRB** | **1.4M BW 16QAM High ch. FRB** |
|  |  |

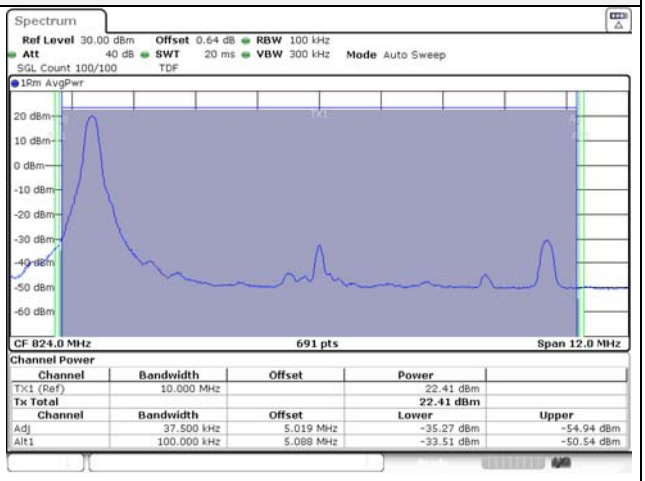
| 3M BW QPSK Low ch. 1RB | 3M BW QPSK High ch. 1RB |
|---|---|
|  |  |
| **3M BW QPSK Low ch. FRB** | **3M BW QPSK High ch. FRB** |
|  |  |
| **3M BW 16QAM Low ch. 1RB** | **3M BW 16QAM High ch. 1RB** |
|  |  |
| **3M BW 16QAM Low ch. FRB** | **3M BW 16QAM High ch. FRB** |
|  |  |

| 5M BW QPSK Low ch. 1RB | 5M BW QPSK High ch. 1RB |
|---|---|
|  |  |
| **5M BW QPSK Low ch. FRB** | **5M BW QPSK High ch. FRB** |
|  |  |
| **5M BW 16QAM Low ch. 1RB** | **5M BW 16QAM High ch. 1RB** |
|  |  |
| **5M BW 16QAM Low ch. FRB** | **5M BW 16QAM High ch. FRB** |
|  |  |

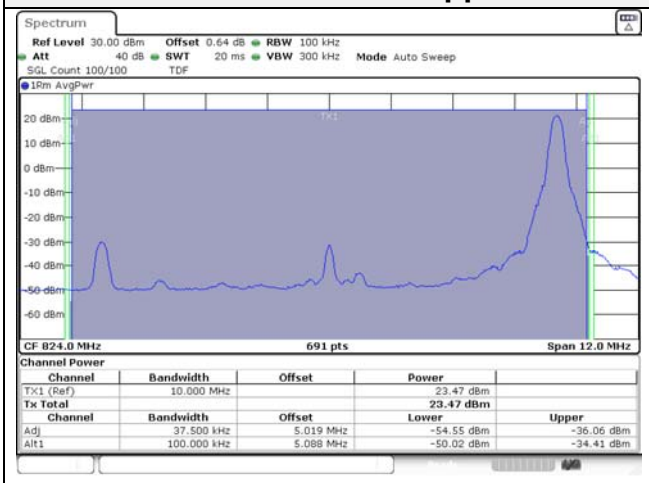
## 10M BW QPSK Mid ch. Lower 1RB



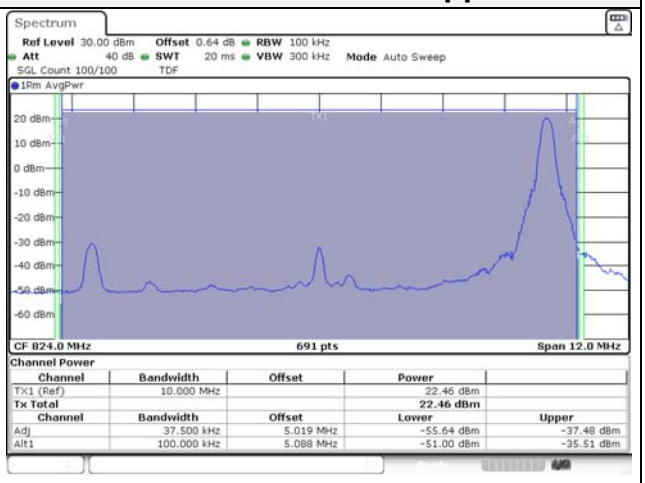

## 10M BW 16QAM Mid ch. Lower 1RB



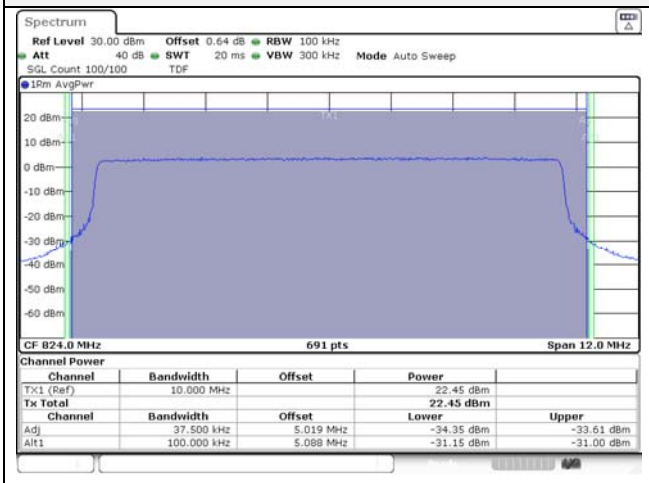

## 10M BW QPSK Mid ch. Upper 1RB



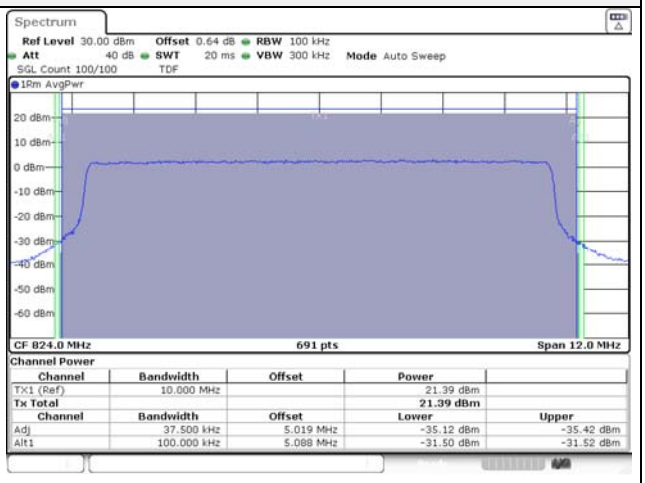

## 10M BW 16QAM Mid ch. Upper 1RB



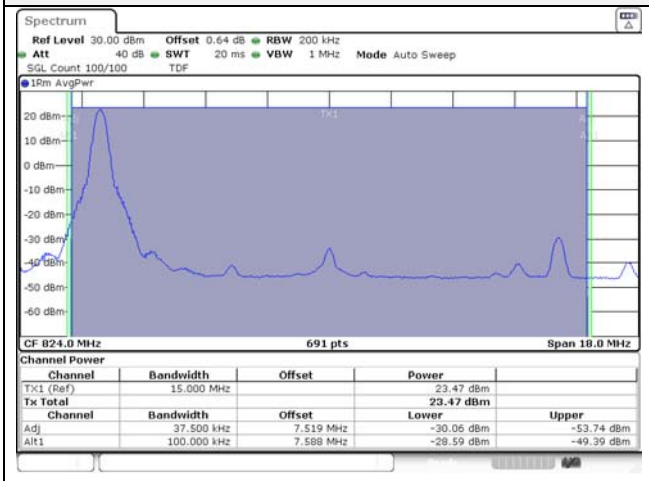

## 10M BW QPSK Mid ch. FRB



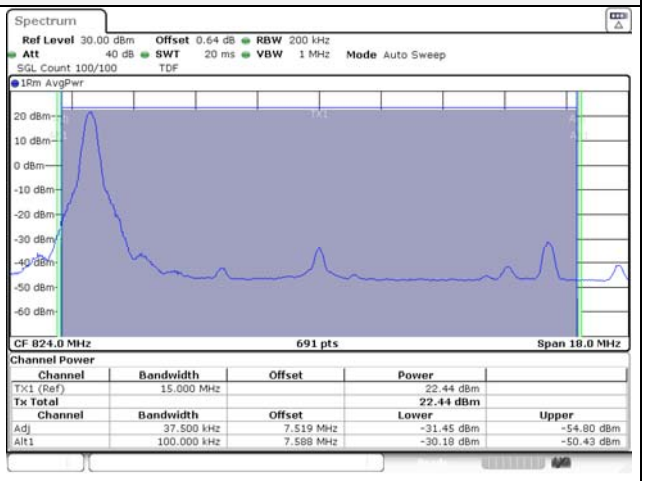

## 10M BW 16QAM Mid ch. FRB



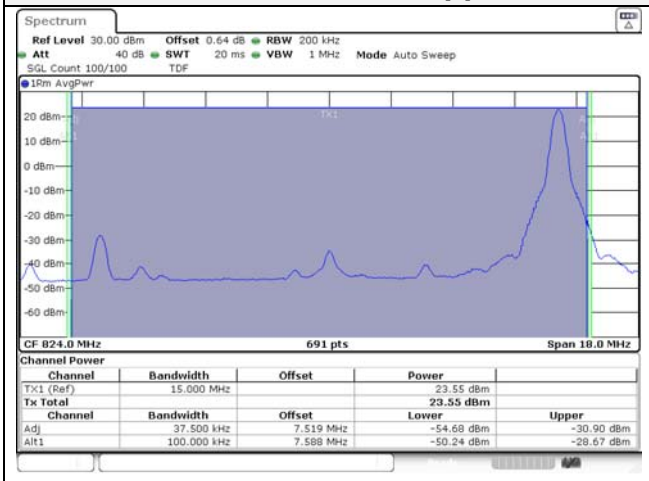
### 15M BW QPSK Mid ch. Lower 1RB



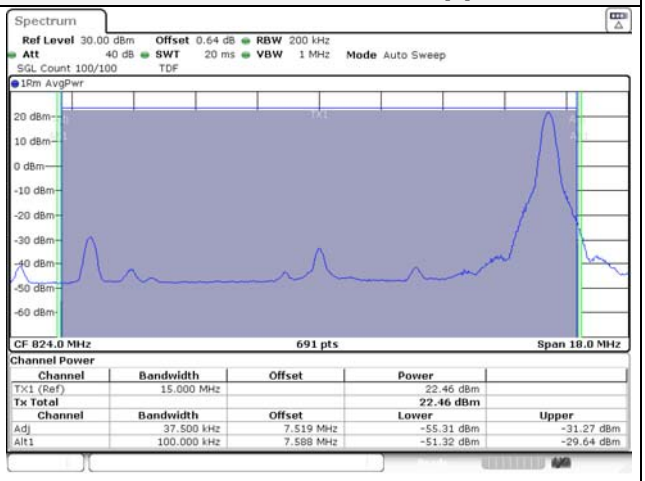

### 15M BW 16QAM Mid ch. Lower 1RB




### 15M BW QPSK Mid ch. Upper 1RB

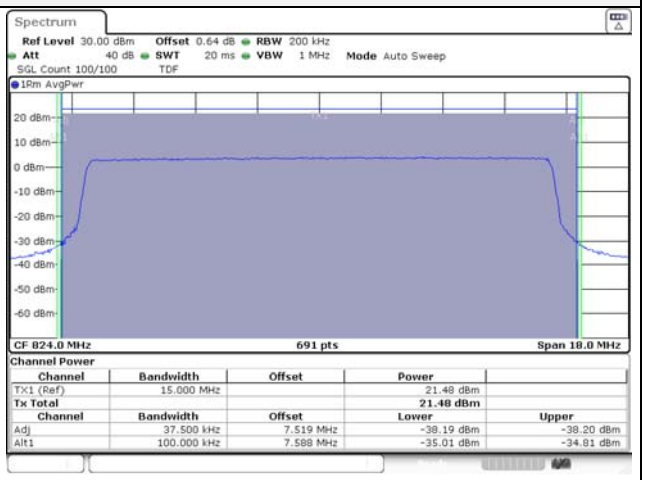



### 15M BW 16QAM Mid ch. Upper 1RB



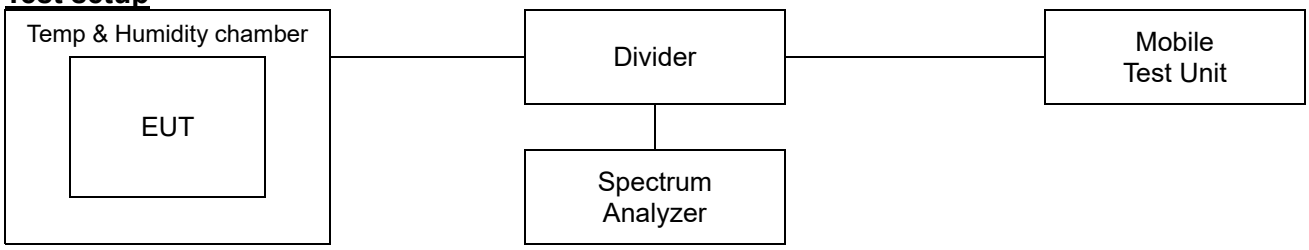

### 15M BW QPSK Mid ch. FRB


### 15M BW 16QAM Mid ch. FRB



## 7.5. Frequency stability

**Test setup**




**Limit**

**According to §2.1055(a),**

The frequency stability shall be measured with variation of ambient temperature as follows:

1) From -30° to + 50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.
2) From -20° to + 50° centigrade for equipment to be licensed for use in the maritime services under part 80 of this chapter, except for class A, B, and S emergency position indicating radiobeacons (EPIRBS), and equipment to be licensed for use above 952 ㎒ at operational fixed stations in all services, stations in the local television transmission service and point-to-point microwave radio service under part 21 of this chapter, equipment licensed for use aboard aircraft in the aviation services under part 87 of this chapter, and equipment authorized for use in the family radio service under part 95 of this chapter.
3) From 0° to + 50° centigrade for equipment to be licensed for use in the radio broadcast Services under part 73 of this chapter.

**According to §2.1055(d),**

The frequency stability shall be measured with variation of primary supply Voltage as follows:

1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.
2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating and point which shall be specified by the manufacturer.
3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

**According to §90.213**

For mobile devices operating in the 809 to 824 ㎒ band at a power level 2 Watts or less, the limit specified in Table is ±2.5 ppm.

**Test procedure**

ANSI 63.26-2015 – Section 5.6

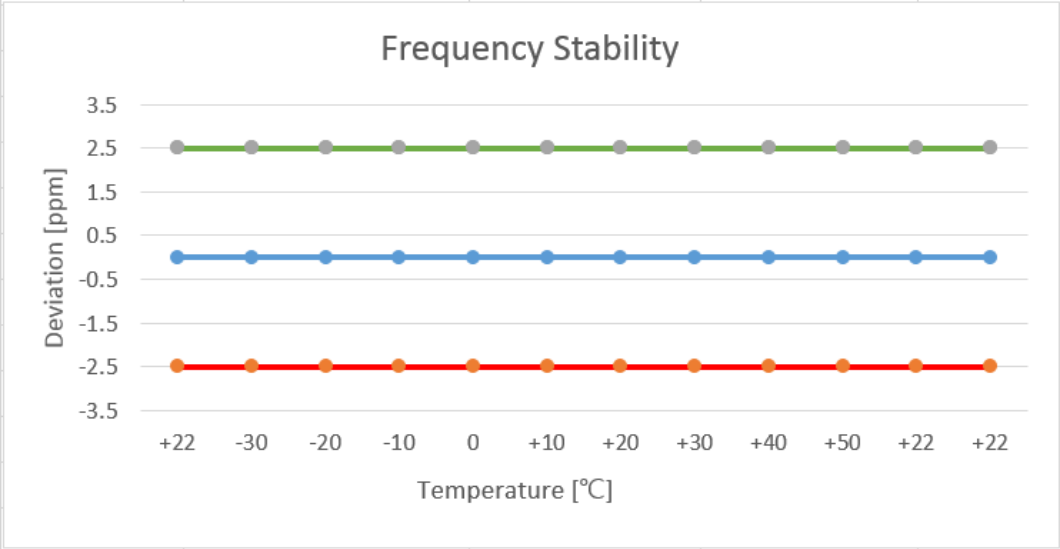
**Test settings**

1) The carrier frequency of the transmitter is measured at room temperature. (20°C to provide a reference)
2) The equipment is turned on in a “standby” condition for one minute before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3) Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each Temperature level.

**Test results**

Test mode : LTE Band 26
Frequency (㎐) : 823 300 000
Channel : 26783
Deviation limit(FCC) : ±0.00025% or 2.5ppm

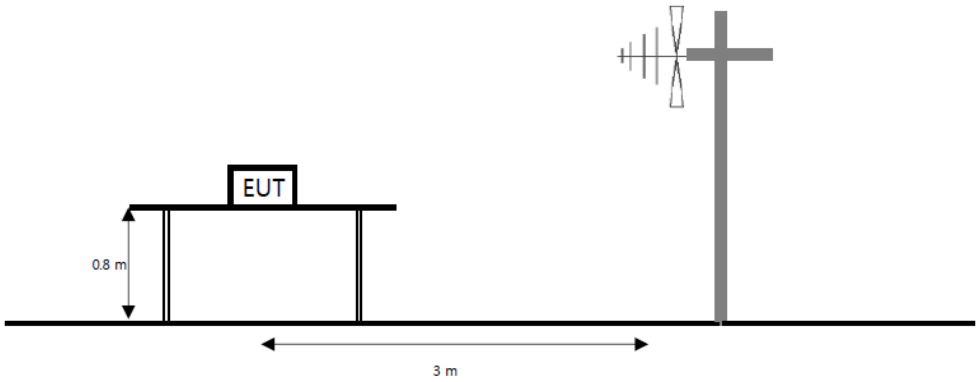
| Voltage (%) | Power (V) | Temp. (°C) | Frequency (㎐) | Frequency error (㎐) | Deviation | |
|---|---|---|---|---|---|---|
| | | | | | (ppm) | (%) |
| 100% | 3.88 | +22(Ref) | 823,299,997 | -3.19 | 0.0 | 0.000000 |
| | | -30 | 823,299,997 | -2.77 | 0.0 | 0.000000 |
| | | -20 | 823,299,998 | -2.50 | 0.0 | 0.000000 |
| | | -10 | 823,299,997 | -3.13 | 0.0 | 0.000000 |
| | | 0 | 823,299,997 | -2.69 | 0.0 | 0.000000 |
| | | +10 | 823,299,997 | -3.11 | 0.0 | 0.000000 |
| | | +20 | 823,299,997 | -2.68 | 0.0 | 0.000000 |
| | | +30 | 823,299,998 | -2.47 | 0.0 | 0.000000 |
| | | +40 | 823,299,997 | -3.01 | 0.0 | 0.000000 |
| | | +50 | 823,299,997 | -3.01 | 0.0 | 0.000000 |
| 115% | 4.46 | +22(Ref) | 823,299,998 | -2.43 | 0.0 | 0.000000 |
| End point | 3.40 | +22(Ref) | 823,299,997 | -3.19 | 0.0 | 0.000000 |



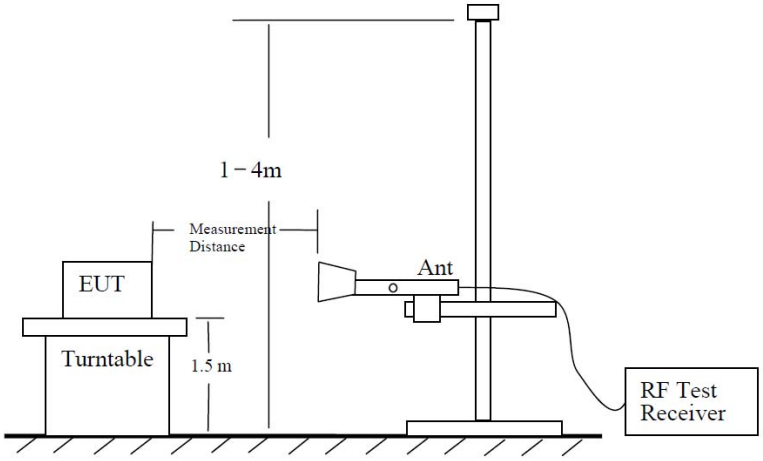
## 7.6. Radiated Power (ERP/EIRP)

**Test setup**

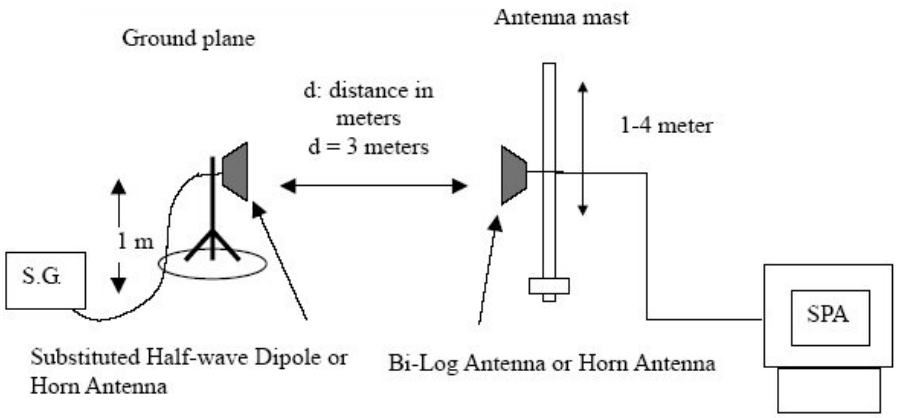
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ emissions.




The diagram below shows the test setup that is utilized to make the measurements for emission from 1 ㎓ to the tenth harmonic of the highest fundamental frequency or to 40 ㎓ emissions, whichever is lower.




The diagram below shows the test setup for substituted method.



**Limit**

According to §90.635(b), the maximum output power of the transmitter for mobile stations is 100 watts(20 dBw).

**Test procedure**

971168 D01 v03r01 - Section 5.2 and 5.8
ANSI 63.26-2015 – Section 5.2
ANSI/TIA-603-E-2016 - Section 2.2.17

**Test settings**

1) RBW = 1 % to 5 % of the OBW.
2) VBW ≥ 3 × RBW.
3) SPAN = 2 × to 3 × the OBW.
4) Number of measurement points in sweep ≥ 2 × span / RBW.
5) Sweep time :
   1) Auto couple, or
   2) ≥ [10 × (number of points in sweep) × (transmission period)] for single sweep (automation-compatible) measurement. Transmission period is the on and off time of the transmitter.
6) Detector = RMS
7) If the EUT can be configured to transmit continuously, then set the trigger to free run.
8) If the EUT cannot be configured to transmit continuously, then use a sweep trigger with the level set to enable triggering only on full power bursts and configure the EUT to transmit at full power for the entire duration of each sweep. Verify that the sweep time is less than or equal to the transmission burst duration. Time gating can also be used under similar constraints (i.e., configured such that measurement data is collected only during active full -power transmissions).
9) Trace mode = trace averaging (RMS) over 100 sweeps.
10) Compute the power by integrating the spectrum across the OBW of the signal using the instrument's band or channel power measurement function, with the band/channel limits set equal to the OBW band edges. If the instrument does not have a band or channel power function, then sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.
11) Allow trace to fully stabilize.

**Notes:**

1. On a test site, the EUT shall be placed at 80 cm or 1.5 m height on a turn table, and in the position close to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3 m from EUT to Correspond to the fundamental frequency of the transmitter.
3. The turntable is rotated through 360°, and the receiving antenna scans in order to determine the Level of the maximized emission.
4. The test antenna shall be raised and lowered again through the specified range of height until the maximum signal level is detected by the measuring receiver.
5. The maximum signal level detected by the measuring receiver shall be noted.
6. The EUT was replaced by half-wave dipole (1 ㎓ below) or horn antenna (1 ㎓ above) connected to a signal generator.
   The power is calculated by the following formula;
   Pd(㏈m) = Pg(㏈m) – Cable loss (㏈) + Antenna gain (㏈)
   Note. Pd is the dipole equivalent power and Pg is the generator output power into the substitution antenna.
7. The test antenna shall be raised and lowered through the specified range of height to ensure that The maximum signal is received.
8. The input signal to the substitution antenna shall be adjusted to the level that produces a level Detected by the measuring corrected for the change of input attenuator setting of the measuring Receiver.
9. The input level to the substitution antenna shall be recorded as power level in ㏈m, corrected for Any change of input attenuator setting of the measuring receiver.
10. The measurement shall be repeated with the test antenna and the substitution antenna Orientated for horizontal polarization.

## Test results

### Test mode: LTE Band 26

| Bandwidth | Modulation | Frequency | Pol. | Antenna Gain | C.L | Substitute Level | ERP | |
|---|---|---|---|---|---|---|---|---|
| | | [㎒] | [V/H] | [dBd] | [dB] | [dBm] | [dBm] | [W] |
| 1.4 M | QPSK | 814.7 | H | -2.29 | 5.23 | 19.37 | 11.85 | 0.015 |
| | | 823.3 | H | -2.12 | 5.27 | 19.48 | 12.09 | 0.016 |
| | 16QAM | 814.7 | H | -2.29 | 5.23 | 18.03 | 10.51 | 0.011 |
| | | 823.3 | H | -2.12 | 5.27 | 18.34 | 10.95 | 0.012 |
| 3 M | QPSK | 815.5 | H | -2.32 | 5.24 | 19.39 | 11.83 | 0.015 |
| | | 822.5 | H | -2.20 | 5.25 | 18.71 | 11.26 | 0.013 |
| | 16QAM | 815.5 | H | -2.32 | 5.24 | 18.18 | 10.62 | 0.012 |
| | | 822.5 | H | -2.20 | 5.25 | 17.94 | 10.49 | 0.011 |
| 5 M | QPSK | 816.5 | H | -2.35 | 5.23 | 19.27 | 11.69 | 0.015 |
| | | 821.5 | H | -2.30 | 5.25 | 18.94 | 11.39 | 0.014 |
| | 16QAM | 816.5 | H | -2.35 | 5.23 | 18.48 | 10.90 | 0.012 |
| | | 821.5 | H | -2.30 | 5.25 | 17.75 | 10.20 | 0.010 |
| 10 M | QPSK | 819.0 | H | -2.42 | 5.24 | 19.38 | 11.72 | 0.015 |
| | 16QAM | 819.0 | H | -2.42 | 5.24 | 18.57 | 10.91 | 0.012 |
| 15 M | QPSK | 821.5 | H | -2.30 | 5.25 | 19.46 | 11.91 | 0.016 |
| | 16QAM | 821.5 | H | -2.30 | 5.24 | 18.07 | 10.53 | 0.011 |

### Straddle channel

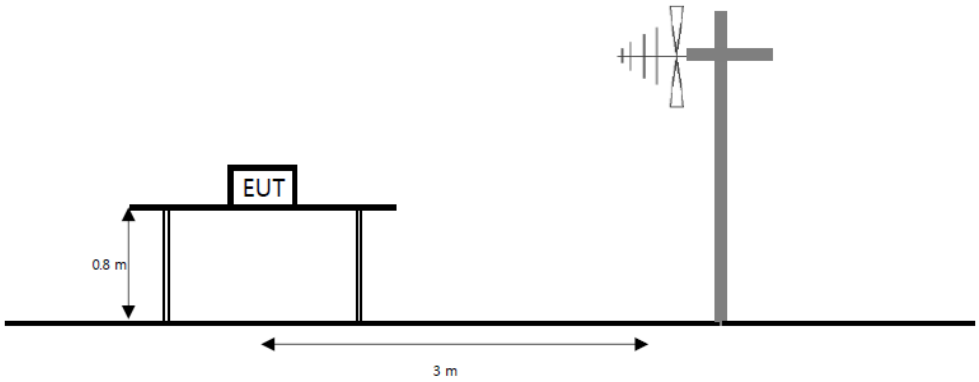
| Bandwidth | Modulation | Frequency | Pol. | Antenna Gain | C.L | Substitute Level | ERP | |
|---|---|---|---|---|---|---|---|---|
| | | [㎒] | [V/H] | [dBd] | [dB] | [dBm] | [dBm] | [W] |
| 1.4 M | QPSK | 824 | H | -2.05 | 5.28 | 19.33 | 12.00 | 0.016 |
| | 16QAM | | H | -2.05 | 5.28 | 18.14 | 10.81 | 0.012 |
| 3 M | QPSK | | H | -2.05 | 5.28 | 18.78 | 11.45 | 0.014 |
| | 16QAM | | H | -2.05 | 5.28 | 17.67 | 10.34 | 0.011 |
| 5 M | QPSK | | H | -2.05 | 5.28 | 18.95 | 11.62 | 0.015 |
| | 16QAM | | H | -2.05 | 5.28 | 17.76 | 10.43 | 0.011 |
| 10 M | QPSK | | H | -2.05 | 5.28 | 19.04 | 11.71 | 0.015 |
| | 16QAM | | H | -2.05 | 5.28 | 17.88 | 10.55 | 0.011 |
| 15 M | QPSK | | H | -2.05 | 5.28 | 19.26 | 11.93 | 0.016 |
| | 16QAM | | H | -2.05 | 5.28 | 18.36 | 11.03 | 0.013 |

Note.
1. E.R.P & E.I.R.P(dBm) = Substitute Level(dB) + Antenna gain(dBd&dBi) - C.L(Cable loss) (dB)

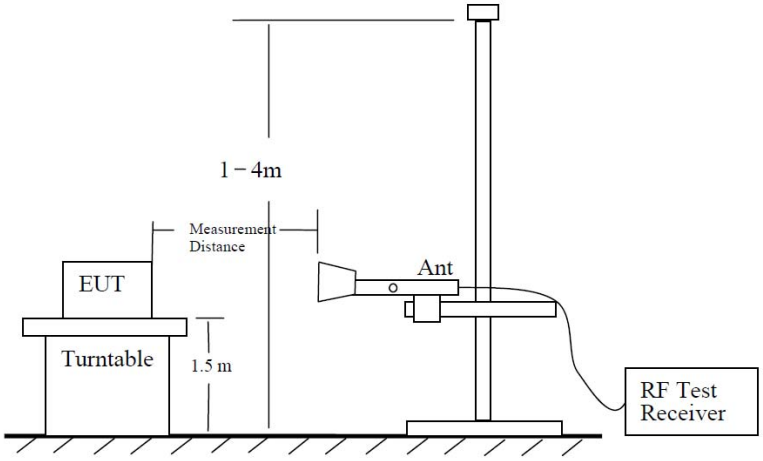
## 7.7. Radiated Spurious Emissions

**Test setup**

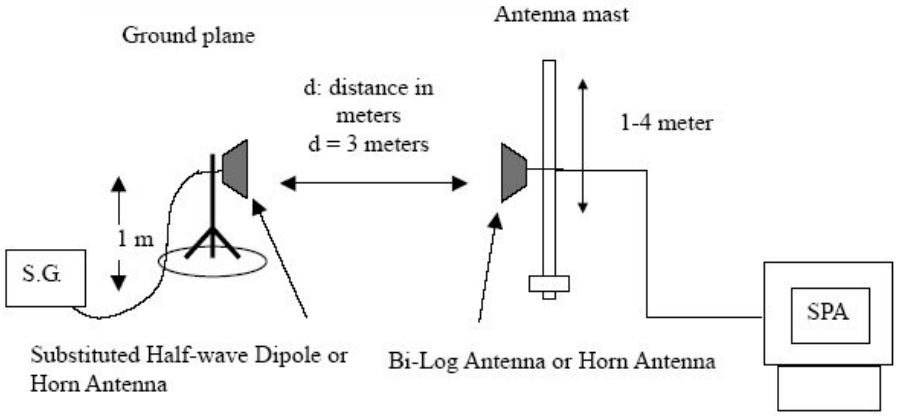
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ emissions.




The diagram below shows the test setup that is utilized to make the measurements for emission from 1 ㎓ to the tenth harmonic of the highest fundamental frequency or to 40 ㎓ emissions, whichever is lower.




The diagram below shows the test setup for substituted method.



**Limit**

According to §90.691(a), Out-of-band emission requirement shall apply only to the “outer” channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(1) For any frequency removed from the EA licensee’s frequency block by up to and including 37.5 ㎑, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 $Log_{10}(f/6.1)$ decibels or 50 + $10Log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz where f is greater than 12.5 ㎑.

(2) For any frequency removed from the EA licensee’s frequency block greater than 37.5 ㎑, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + $10Log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 ㎑.

**Test procedure**

971168 D01 v03r01 - Section 6.2
ANSI 63.26-2015 – Section 5.5
ANSI/TIA-603-E-2016 - Section 2.2.12

**Test settings**

1) RBW = 1 ㎑ for below 1 ㎓ and 1 ㎒ for above 1 ㎓.
2) VBW ≥ 3 × RBW.
3) Detector = RMS
4) Trace mode = Max hold
5) Sweep time = Auto couple
6) Number of sweep points ≥ 2 × span / RBW
7) Allow trace to fully stabilize.

**Notes:**

1. On a test site, the EUT shall be placed at 80 cm or 1.5 m height on a turn table, and in the position close to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3 m from EUT to correspond to the fundamental frequency of the transmitter.
3. The turntable is rotated through 360°, and the receiving antenna scans in order to determine the level of the maximized emission.
4. The test antenna shall be raised and lowered again through the specified range of height until the maximum signal level is detected by the measuring receiver.
5. The maximum signal level detected by the measuring receiver shall be noted.
6. The EUT was replaced by half-wave dipole (1 ㎓ below) or horn antenna (1 ㎓ above) connected to a signal generator.
7. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
8. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring corrected for the change of input attenuator setting of the measuring receiver.
9. The input level to the substitution antenna shall be recorded as power level in ㏈m, corrected for any change of input attenuator setting of the measuring receiver.
10. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.

**Test results (Above 1 000 ㎒)**

Test mode : LTE Band 26
Frequency(㎒) : 814.7
Channel : 26697
Bandwidth(㎒) : 1.4

| Mode | Frequency | Pol. | Antenna Gain | Cable loss | Substitute Level | Level | Limit | Margin |
|---|---|---|---|---|---|---|---|---|
| | [㎒] | [V/H] | [dBi] | [dB] | [dBm] | [dBm] | [dBm] | [dB] |
| QPSK | 1 630.19 | H | 5.99 | 7.45 | -43.04 | -44.50 | -13.00 | 31.50 |
| | 2 445.41 | H | 6.08 | 8.93 | -48.15 | -51.00 | -13.00 | 38.00 |
| | 3 261.86 | H | 7.63 | 10.47 | -53.56 | -56.40 | -13.00 | 43.40 |
| | 4 077.08 | V | 8.85 | 11.75 | -51.40 | -54.30 | -13.00 | 41.30 |

Test mode : LTE Band 26
Frequency(㎒) : 823.3
Channel : 26783
Bandwidth(㎒) : 1.4

| Mode | Frequency | Pol. | Antenna Gain | Cable loss | Substitute Level | Level | Limit | Margin |
|---|---|---|---|---|---|---|---|---|
| | [㎒] | [V/H] | [dBi] | [dB] | [dBm] | [dBm] | [dBm] | [dB] |
| QPSK | 1 645.78 | H | 5.95 | 7.47 | -42.18 | -43.70 | -13.00 | 30.70 |
| | 2 468.79 | H | 6.13 | 8.98 | -46.55 | -49.40 | -13.00 | 36.40 |
| | 3 290.17 | H | 7.71 | 10.52 | -52.69 | -55.50 | -13.00 | 42.50 |
| | 4 114.01 | V | 8.83 | 11.93 | -47.60 | -50.70 | -13.00 | 37.70 |

Test mode : LTE Band 26
Frequency(㎒) : 824
Channel : 26790
Bandwidth(㎒) : 1.4

| Mode | Frequency | Pol. | Antenna Gain | Cable loss | Substitute Level | Level | Limit | Margin |
|---|---|---|---|---|---|---|---|---|
| | [㎒] | [V/H] | [dBi] | [dB] | [dBm] | [dBm] | [dBm] | [dB] |
| QPSK | 1 647.01 | H | 5.95 | 7.47 | -41.68 | -43.20 | -13.00 | 30.20 |
| | 2 470.85 | H | 6.14 | 8.98 | -47.36 | -50.20 | -13.00 | 37.20 |
| | 3 293.04 | V | 7.72 | 10.52 | -52.30 | -55.10 | -13.00 | 42.10 |
| | 4 117.70 | V | 8.83 | 11.94 | -45.79 | -48.90 | -13.00 | 35.90 |

Note.
1. E.R.P & E.I.R.P(㏈m) = Substitute Level(㏈) + Antenna gain(㏈d&㏈i) - C.L(Cable loss) (㏈)

## 8. Measurement equipment

| Equipment Name | Manufacturer | Model No. | Serial No. | Next Cal. Date |
|---|---|---|---|---|
| Biconical VHF-UHF Broadband Antenna | SCHWARZBECK | VUBA9117 | 275 | 22.04.09 |
| Bilog Antenna | ETS.LINDGREN | 3143B | 00228420 | 21.09.30 |
| Horn Antenna | ETS.lindgren | 3117 | 161225 | 22.05.11* |
| Horn Antenna | ETS.LINDGREN | 3117 | 00227509 | 21.09.23 |
| Horn Antenna | ETS.lindgren | 3116 | 00086632 | 22.01.29 |
| Horn Antenna | ETS.lindgren | 3116 | 00086635 | 22.05.17* |
| High pass Filter | Wainwright Instruments GmbH | WHKX12-2805-3000-18000-40SS | 32 | 21.08.20 |
| High pass Filter | Wainwright Instruments GmbH | WHKX10-900-1000-15000-40SS | 11 | 21.08.20 |
| Broadband Amplifier | SONOMA INSTRUMENT | 310N | 186280 | 22.04.01 |
| Amplifier | L-3 Narda-MITEQ | AFS5-00101800-25-S-5 | 2054571 | 21.08.28 |
| Amplifier | L-3 Narda-MITEQ | JS44-18004000-33-8P | 2000996 | 22.01.21 |
| Spectrum Analyzer | KEYSIGHT | N9040B | US55230151 | 21.07.29 |
| Widebnad Radio Communication Tester | R&S | CMW500 | 141780 | 22.04.01 |
| Spectrum Analyzer | R&S | FSV40 | 100988 | 21.12.23 |
| Spectrum Analyzer | R&S | FSV30 | 100807 | 21.07.29 |
| Power Divider | Aeroflex/ Weinschel,Inc | 1580-1 | PE430 | 21.07.29 |
| Vector Signal Generator | R&S | SMBV100A | 257566 | 21.07.13 |
| Signal Generator | R&S | SMB100A | 176206 | 22.01.20 |
| Antenna Stand | innco systems GmbH | AS1500-EP-10kg | N/A | N/A |
| Antenna Stand | innco systems GmbH | AS1500-EP-10kg | N/A | N/A |
| Turn Device | innco systems GmbH | DE3700-RH | N/A | N/A |

* Tests related to this equipment were progressed after the calibration was completed.

**End of test report**