

Annex 1: Measurement diagrams to
TEST REPORT
 No.: 18-1-0039301T02a







According to:
FCC Regulations
 Part 27

for

Gemalto M2M GmbH

LTE Module Rel.13 CAT-M1 EMS31-V

FCC-ID: QIPEMS31-VR1

| Laboratory Accreditation and Listings | | |
|---|---|---|
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| accredited according to DIN EN ISO/IEC 17025 | | |
| <p>CETECOM GmbH</p> <p>Laboratory Radio Communications & Electromagnetic Compatibility Im Teelbruch 116 • 45219 Essen • Germany Registered in Essen, Germany, Reg. No.: HRB Essen 8984 Tel.: + 49 (0) 20 54 / 95 19-954 • Fax: + 49 (0) 20 54 / 95 19-964 E-mail: info@cetecom.com • Internet: www.cetecom.com</p> | | |
| Laboratory Accreditation and Listings | | |

1. Summary of test results

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2. Measurement diagrams LTE-mode

2.1. PAPR-Value (CCDF plots)

2.1.1. LTE Band 4

Worst-Case of maximum power value was tested against the CCDF method, for each possible bandwidth.

2.1.1.1. 5-MHz signal bandwidth

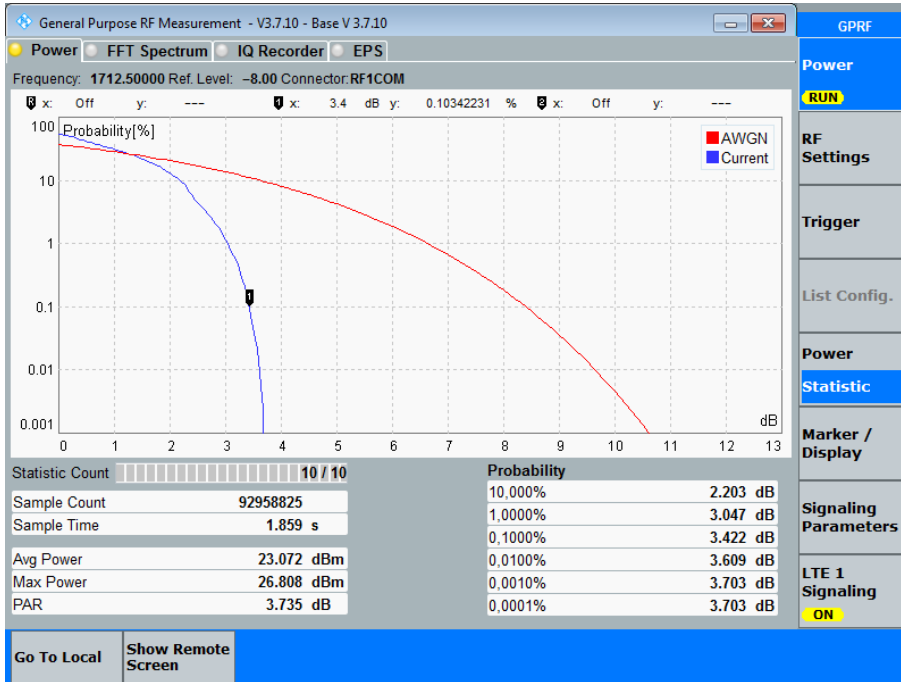


Diagram 1:
CCDF_Ch19975_1RBlow_BW_5_QPSK

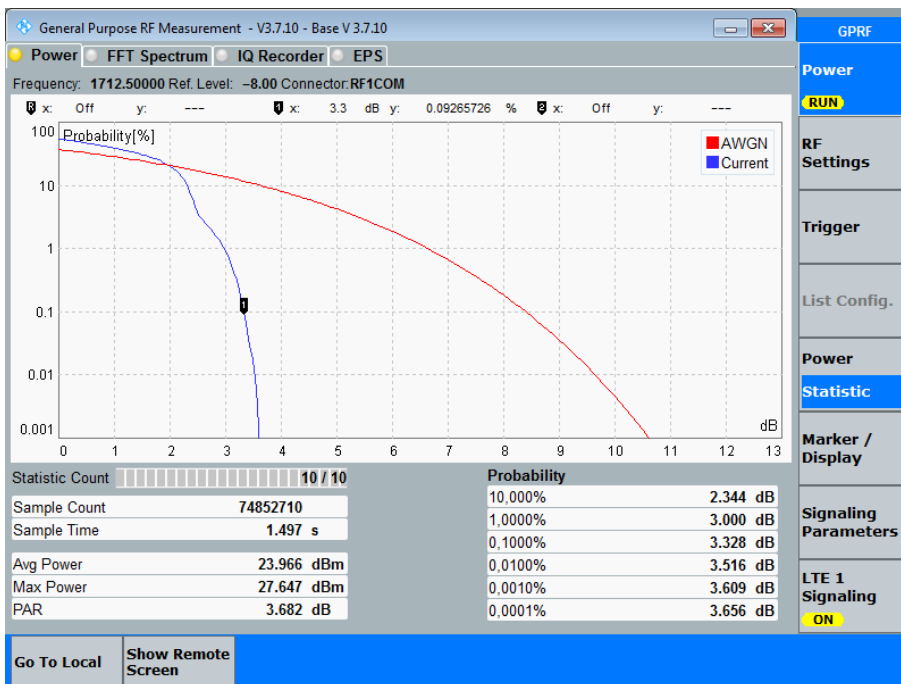


Diagram 2:
CCDF_Ch19975_1RBhigh_BW_5_16QAM

2.1.1.2. 10-MHz signal bandwidth

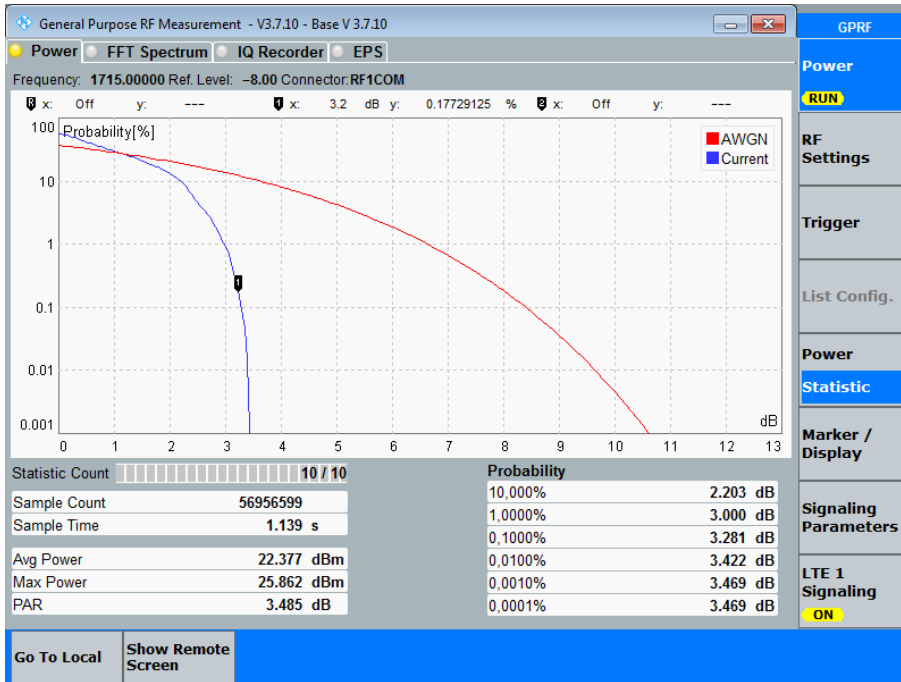


Diagram 3: CCDF_Ch20000_1RBlow_BW_10_QPSK

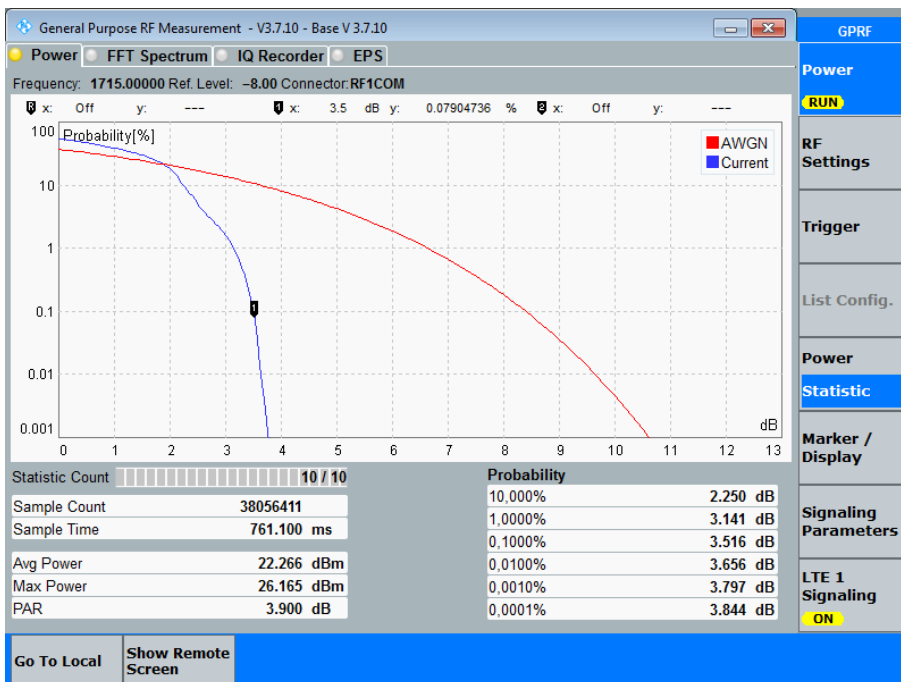


Diagram 4: CCDF_Ch2000_1RBlow_BW_10_16QAM

2.1.1.3. 15-MHz signal bandwidth

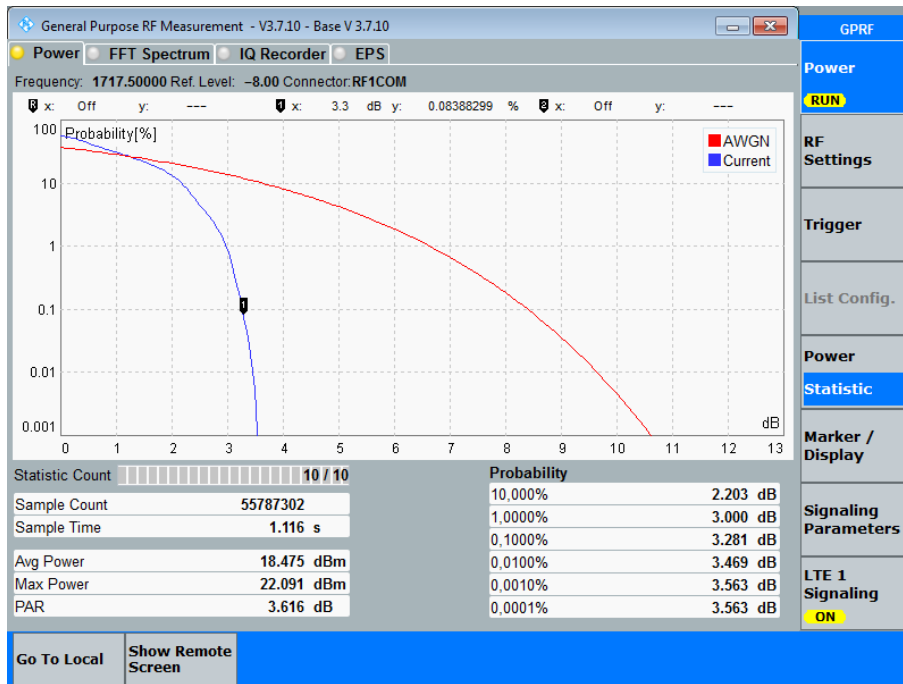


Diagram 5: CCDF_Ch20025_1RBlow_BW_15_QPSK

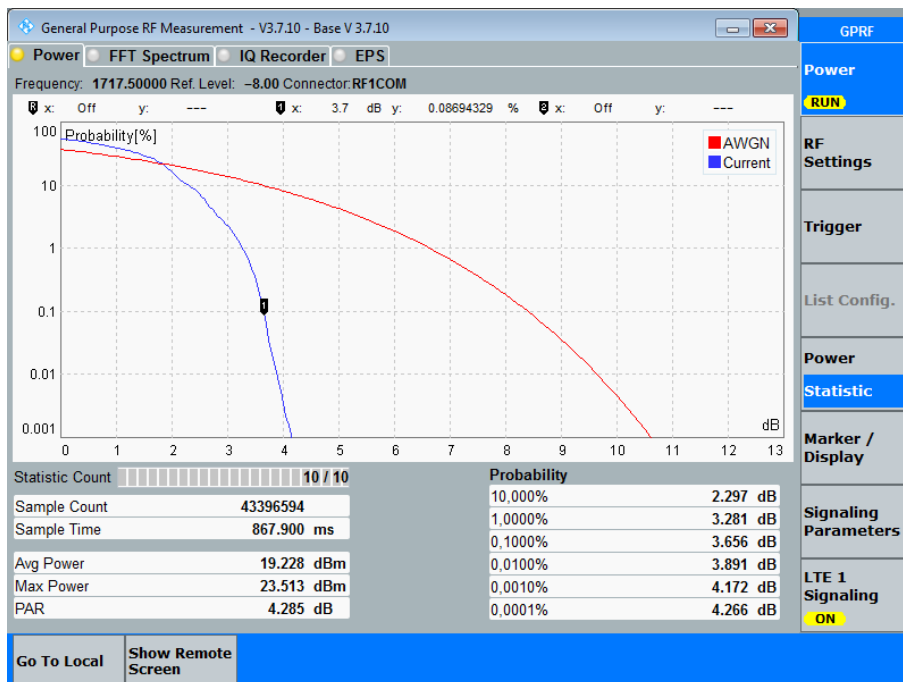


Diagram 6: CCDF_Ch20025_1RBlow_BW_15_16QAM

2.1.1.4. 20MHz signal bandwidth

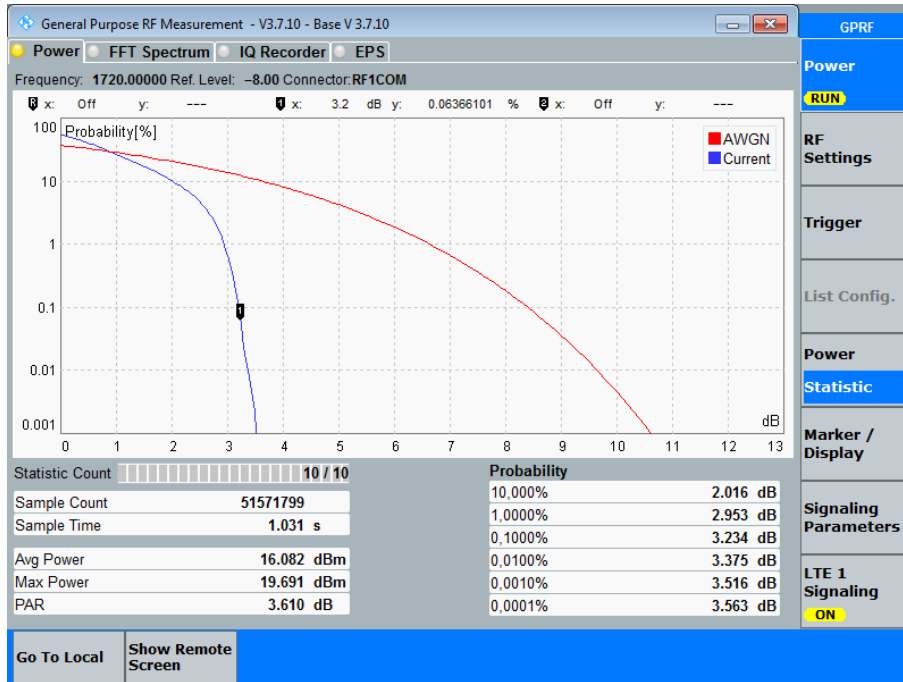


Diagram 7: CCDF_Ch20050_3RBs_BW_20_QPSK

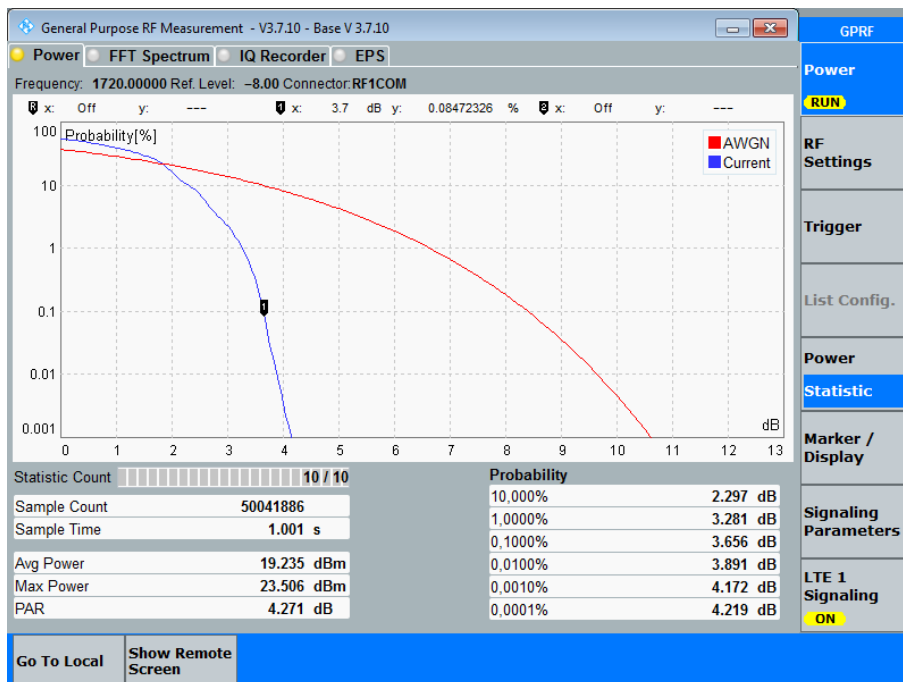


Diagram 8: CCDF_Ch20050_1RBlow_BW_20_16QAM

2.1.2. LTE Band 13

Worst-Case of each maximum Peak to Average power value was tested with the CCDF method

2.1.2.1. 5-MHz signal bandwidth

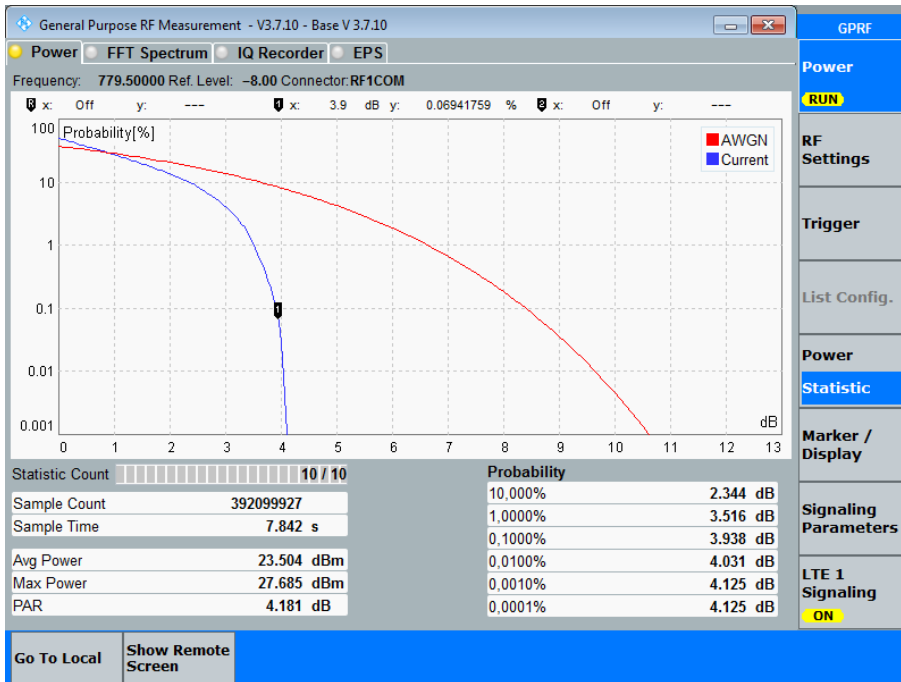


Diagram 9: CCDF_Ch23205_50%RBs_BW_5_QPSK



Diagram 10: CCDF_Ch23255_1RBhigh_BW_5_16QAM

2.1.2.2. 10MHz signal bandwidth

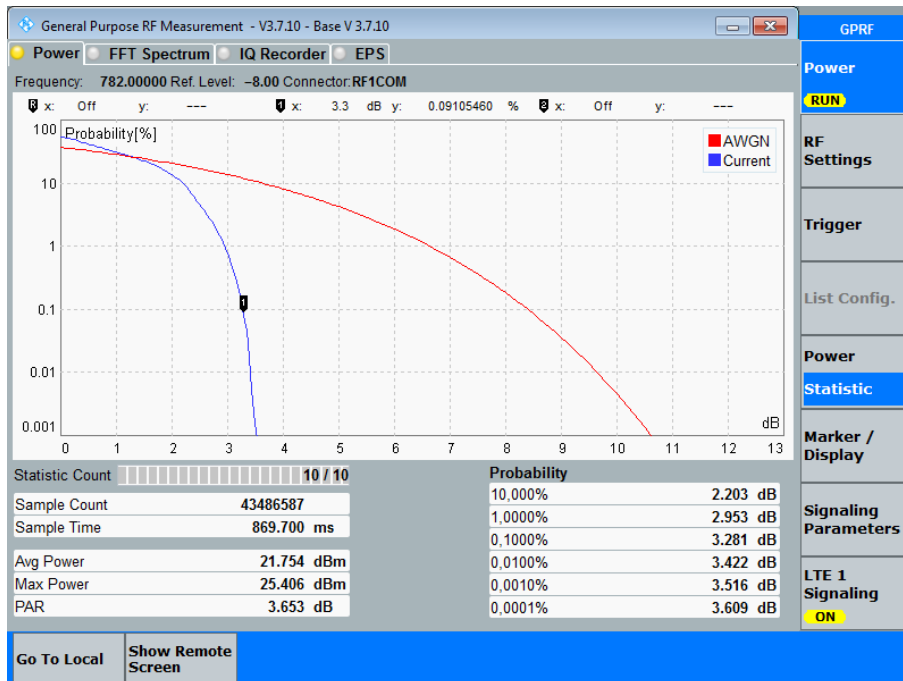


Diagram 11: CCDF_Ch23230_1RBlow_BW_10_QPSK

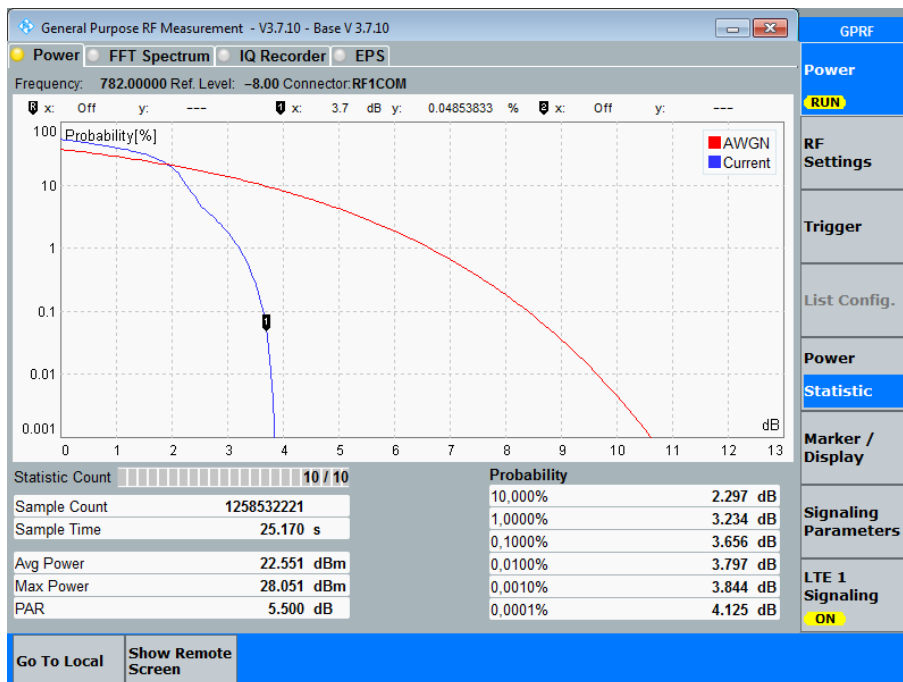


Diagram 12: CCDF_Ch23230_1RBlow_BW_10_16QAM

2.2. Spurious emissions radiated (LTE Band 4)

2.2.1. Magnetic field strength radiated (LTE Band 4)

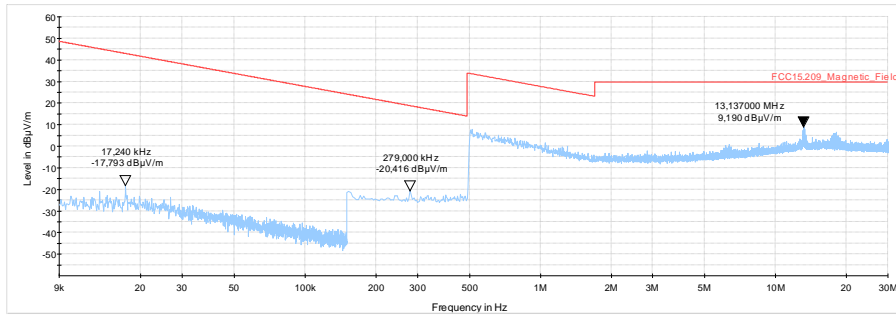


Diagram 13: 2.02a_MgF_LTE_Bd4_Ch20000_1RBlow_1NB_16QAM_laying

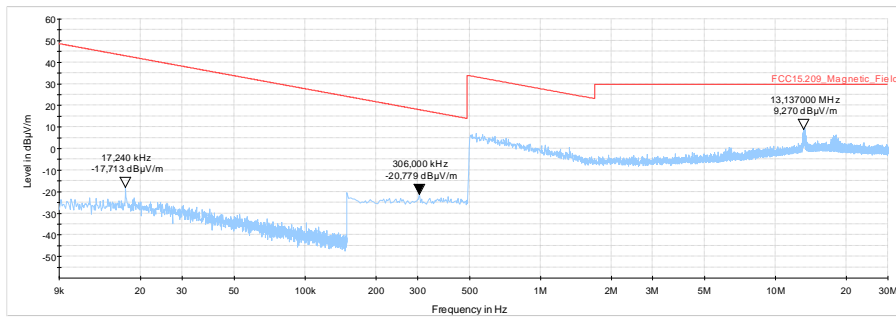


Diagram 14: 2.02b_MgF_LTE_Bd4_Ch20000_1RBlow_1NB_16QAM_standing

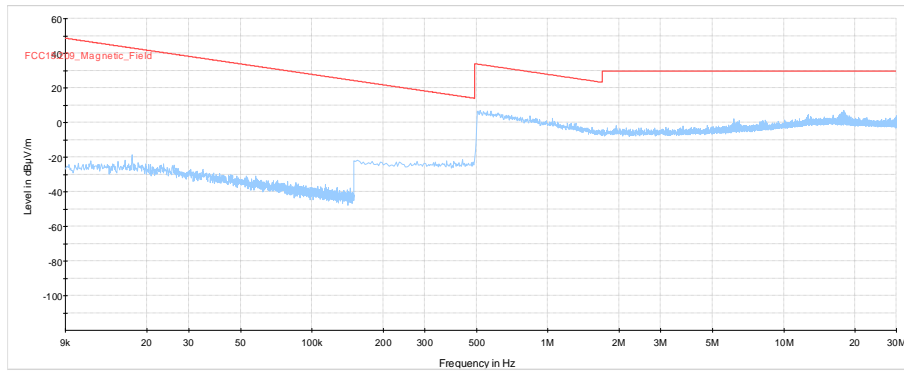


Diagram 15: 2.03b_MgF_LTE_Bd4_Ch20175_BW5MHz_1RBlow_1NB_16QAM_standing

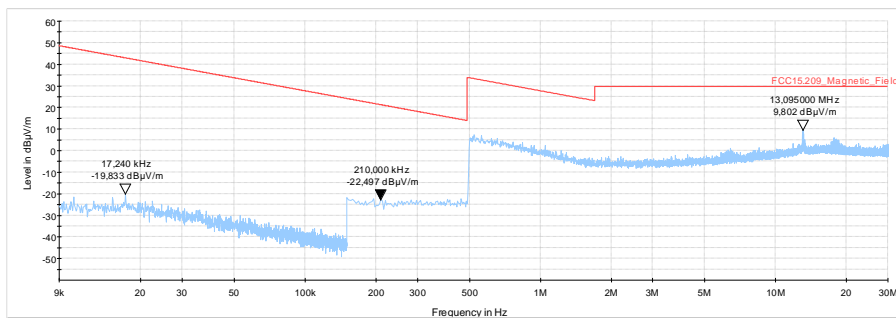
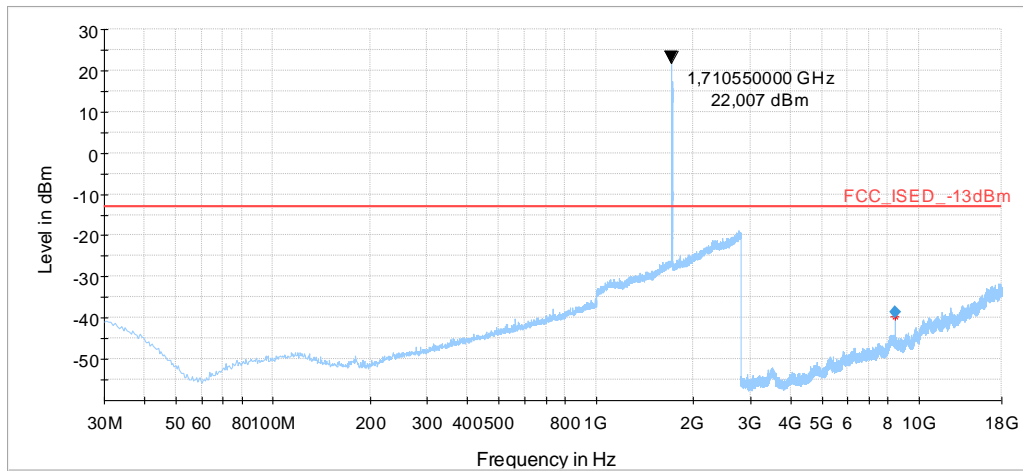
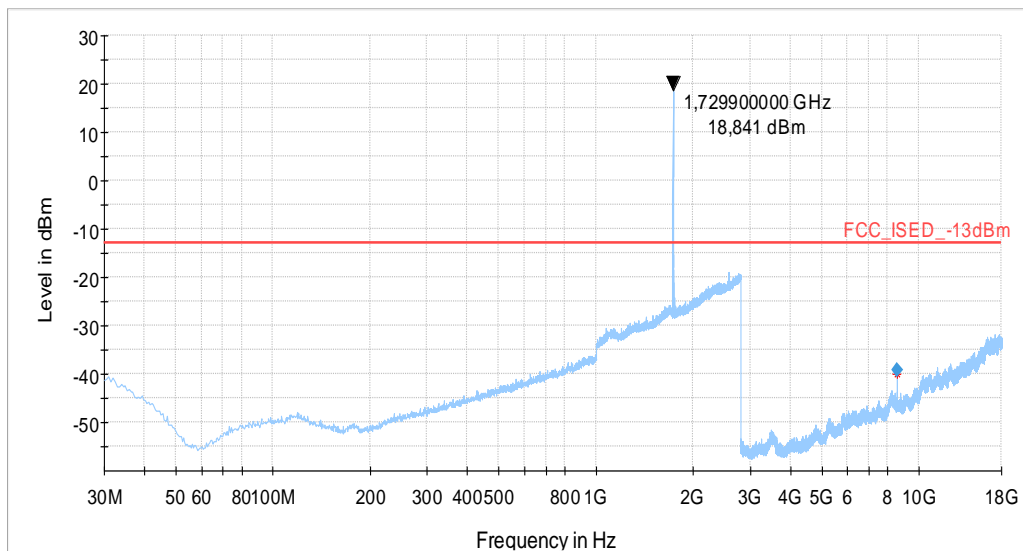


Diagram 16: 2.04b_MgF_LTE_Bd4_Ch20300_BW20MHz_1RBlow_1NB_QPSK_standing

2.2.2. Emissions above 30MHz (LTE Band 4)**Diagram 17: 8.401_RSE-Ch20000_BW10_1RBlow_1NB_16QAM****Diagram 18: 8.402_RSE-Ch20175_BW5_1RBlow_1NB_16QAM**

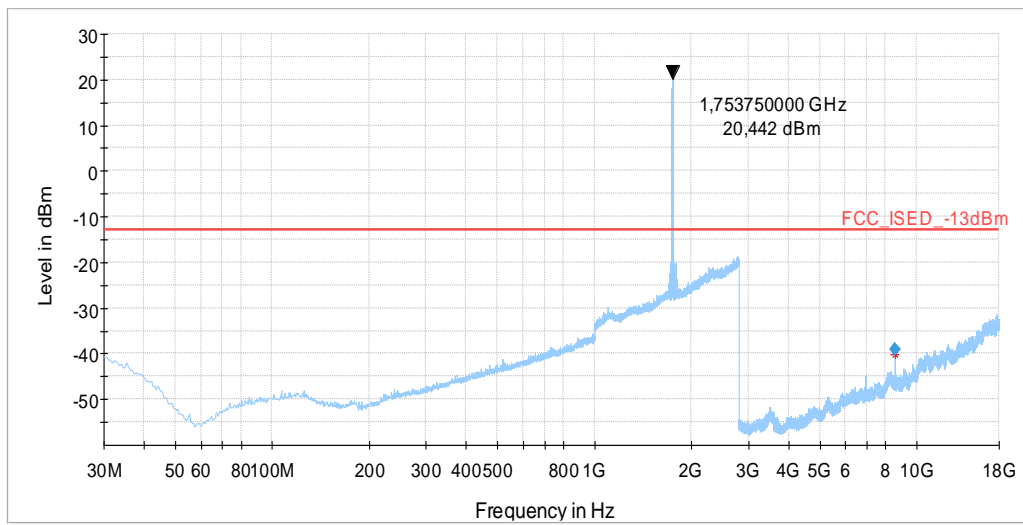


Diagram 19: 8.403_RSE_Ch20300_BW20_1RBlow_1NB_QPSK

2.3. Spurious emissions radiated (LTE Band 13)

2.3.1. Magnetic field strength radiated (LTE Band 13)

2.3.1.1. High Channel 23255

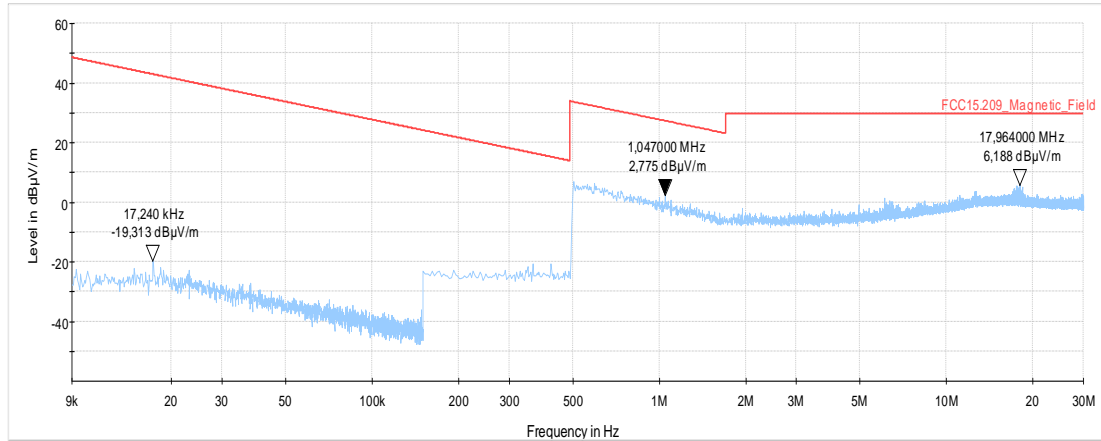


Diagram 20: 2.01a_MgF_LTE_Bd13_Ch23255_1RBhigh_4NB_16QAM_laying

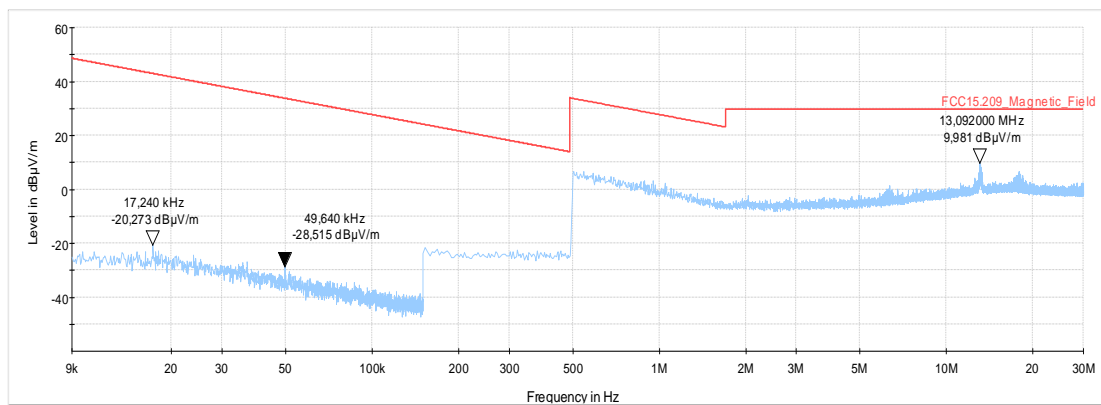


Diagram 21: 2.01b_MgF_LTE_Bd13_Ch23255_1RBhigh_4NB_16QAM_standing

2.3.1.2. Low Channel 23205

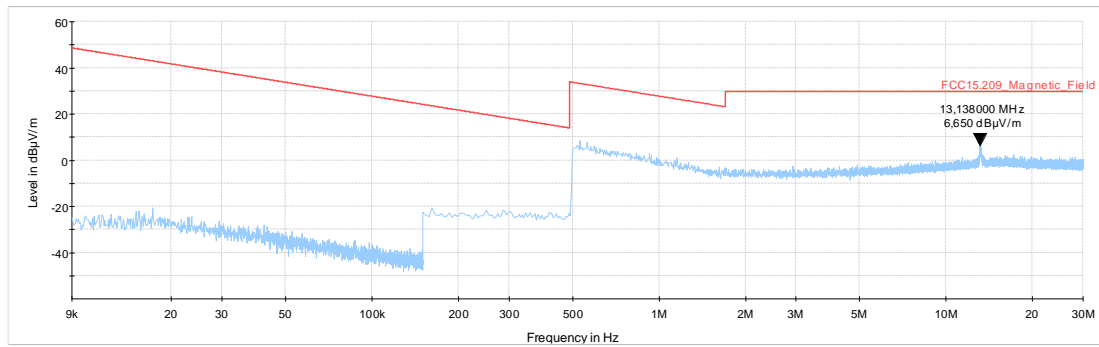


Diagram 22: 2.05a_MgF_LTE_Bd13_Ch23205_BW5MHz_1RBlow_0NB_16QAM_laying

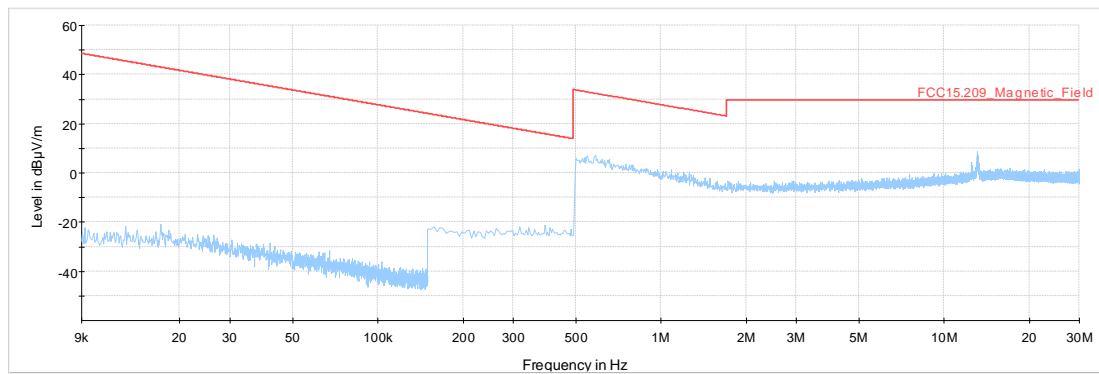


Diagram 23: 2.05b_MgF_LTE_Bd13_Ch23205_BW5MHz_1RBlow_0NB_16QAM_standing

2.3.1.3. Middle Channel 23230

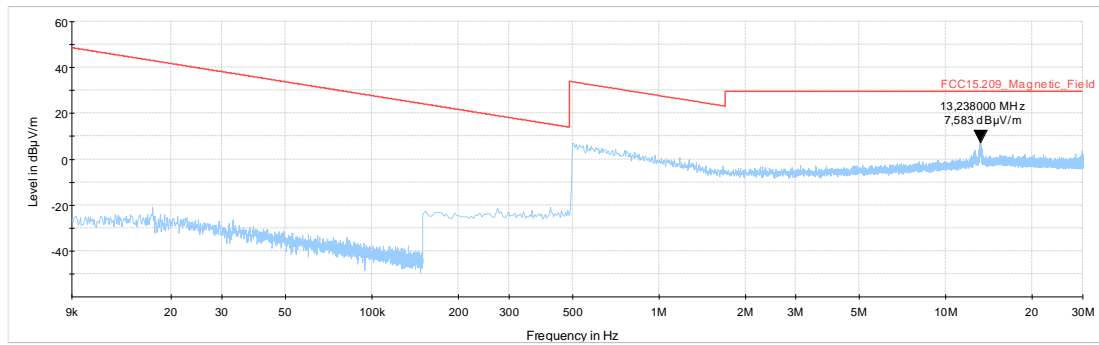


Diagram 24: 2.06a_MgF_LTE_Bd13_Ch23230_BW5MHz_1RBhigh_3NB_16QAM_laying

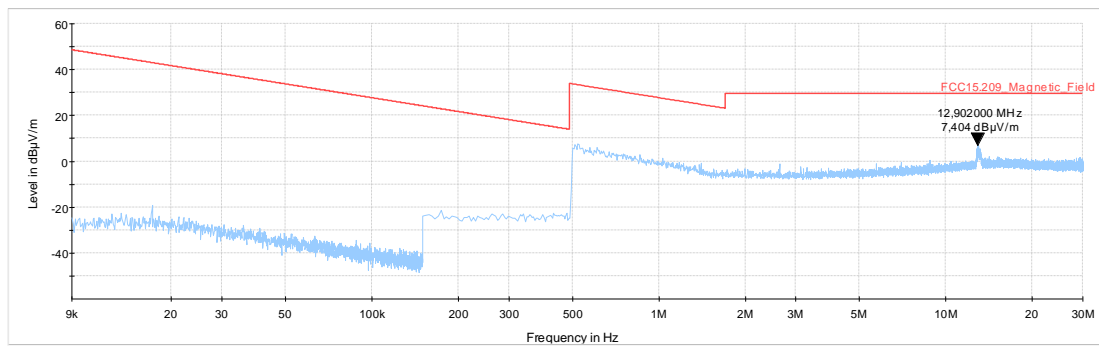


Diagram 25: 2.06b_MgF_LTE_Bd13_Ch23230_BW5MHz_1RBhigh_3NB_16QAM_standing

2.3.2. Emissions above 30MHz (LTE Band 13)

2.3.2.1. General requirement

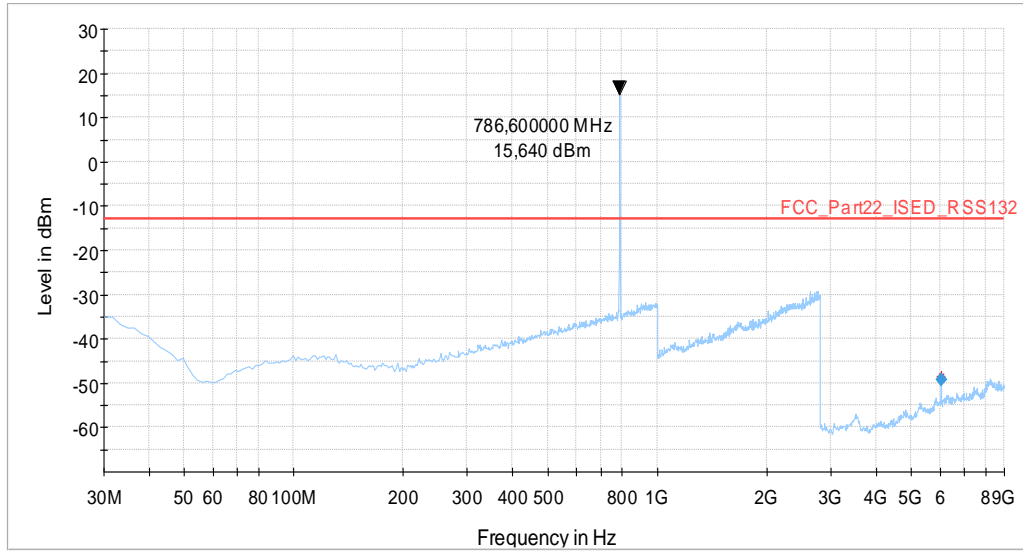


Diagram 26: 8.1301_RSE_Ch23255_BW5_1RBhigh_4NB_16QAM

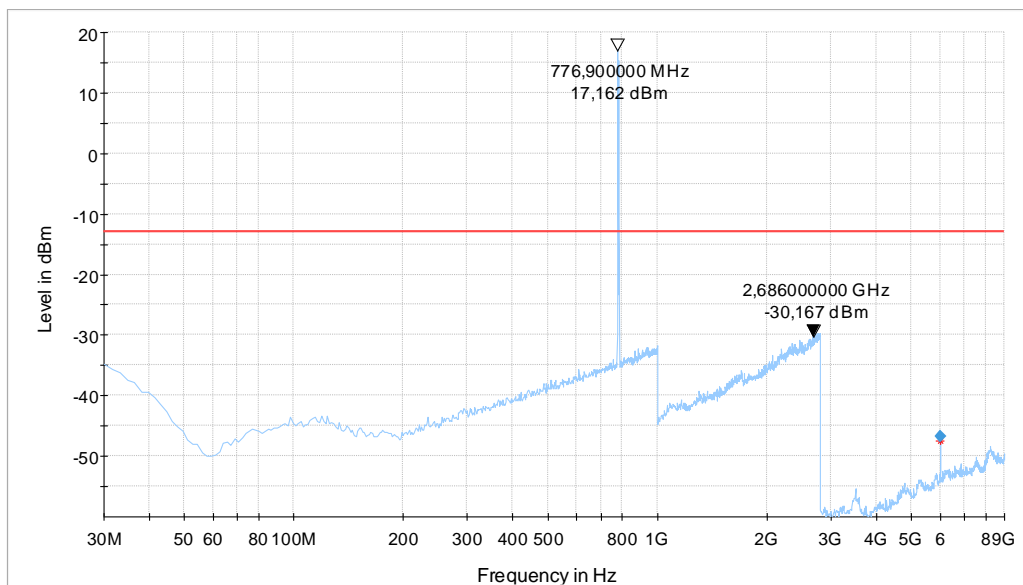


Diagram 27: 8.1303_RSE_Ch23205_BW5_1RBlow_0NB_16QAM

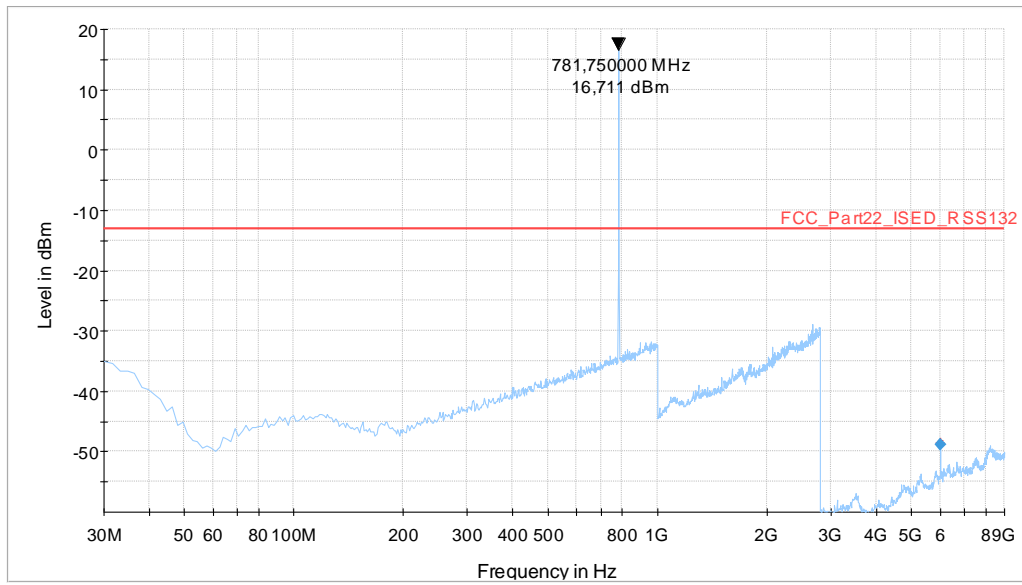
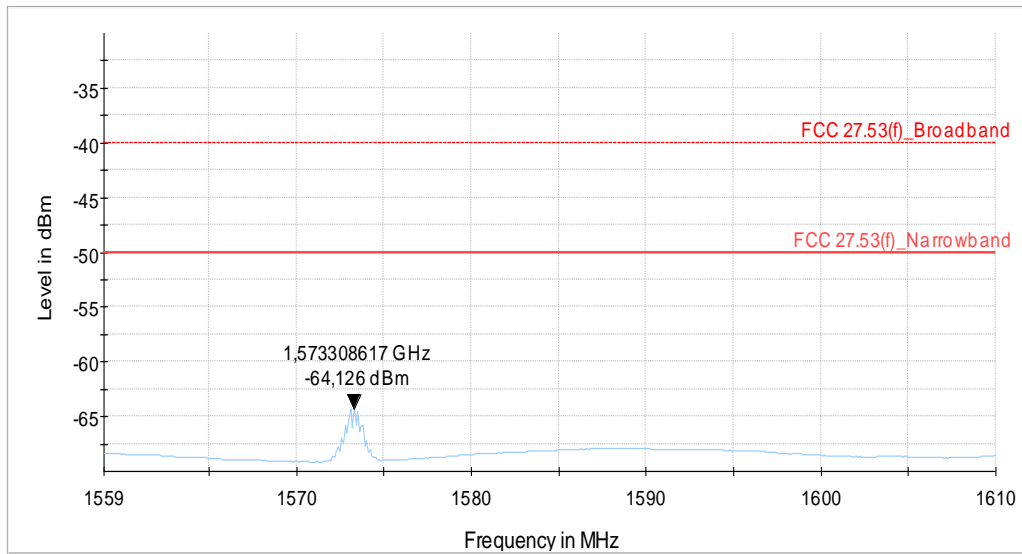
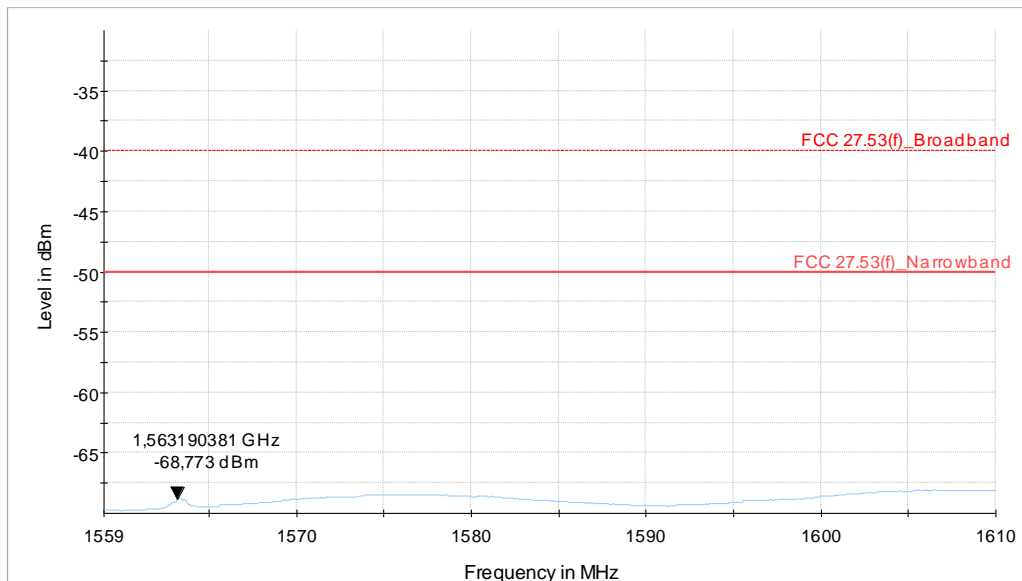
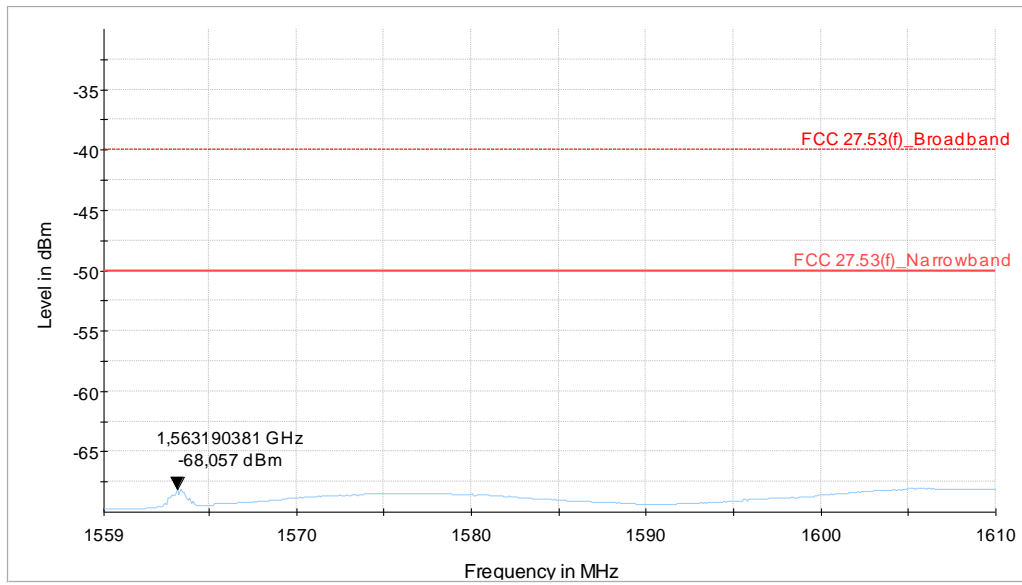


Diagram 28: 8.1305_RSE_Ch23230_BW5_1RBhigh_3NB_16QAM

2.3.2.2. Special requirement §27.53(f)**Diagram 29: 8.1302_RSE_Ch23255_BW5_1RBhigh_4NB_16QAM_GPS_protection****Diagram 30: 8.1304_RSE_Ch23205_BW5_1RBlow_0NB_16QAM_GPS_protection**

**Diagram 31: 8.1306_RSE_Ch23230_BW5_1RBlow_3NB_16QAM_GPS_protection**

2.4. Radiated emissions – band-edge (LTE Band 4)

2.4.1. Low Band-Edge

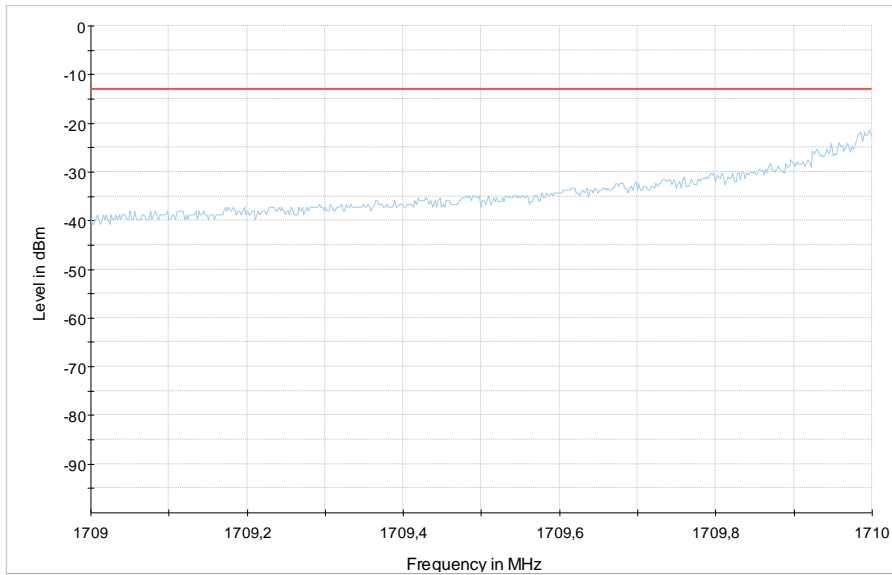


Diagram 1: 9.405a_BE_low_Ch_19975_BW5_1RBlow_1NB_QPSK

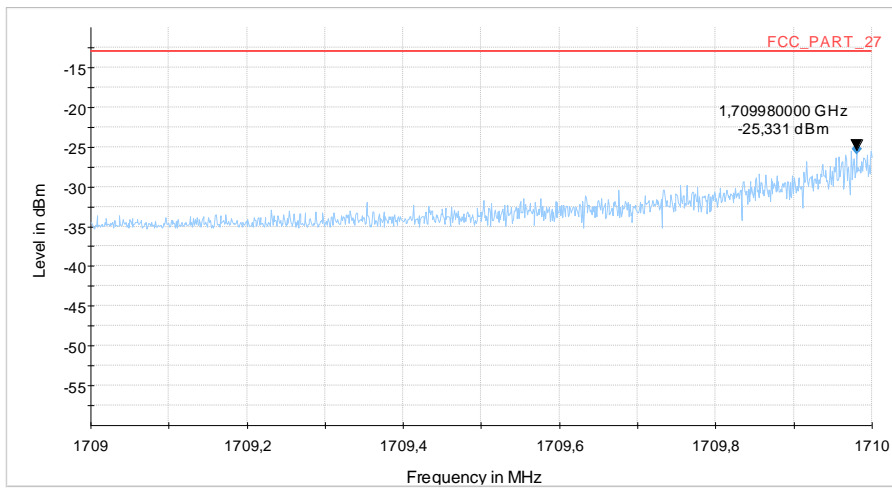


Diagram 2: 9.405b_BE_low_Ch_19975_BW5_1RBlow_1NB_10TBS_16-QAM

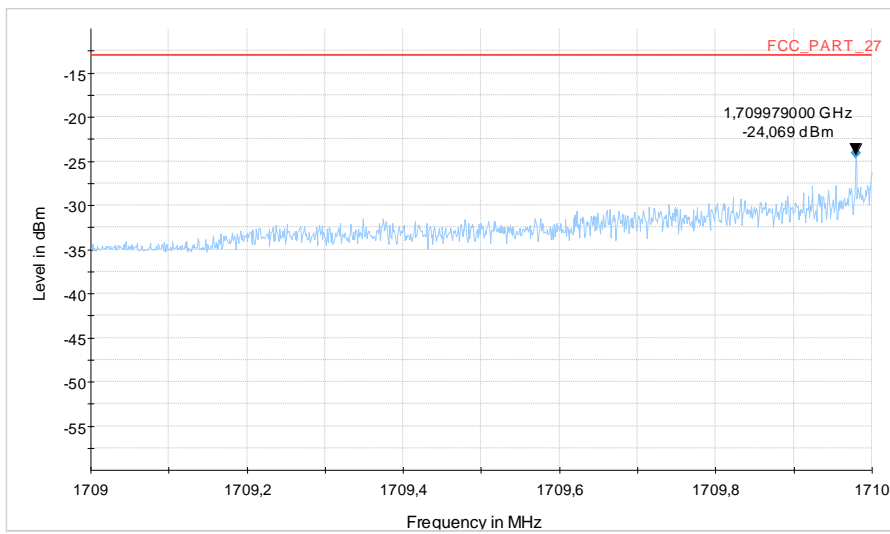


Diagram 3: 9.406a_BE_low_Ch_19975_BW5_6RBlow_1NB_6TBS_QPSK

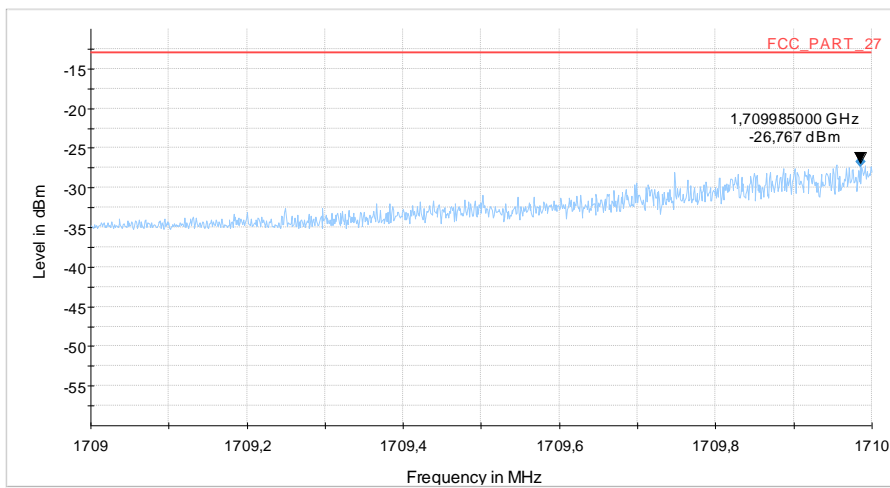
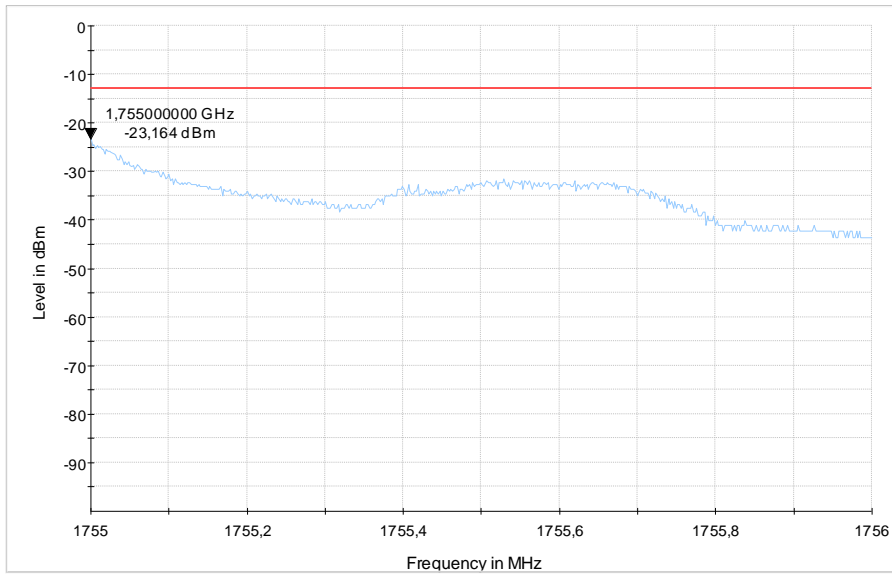
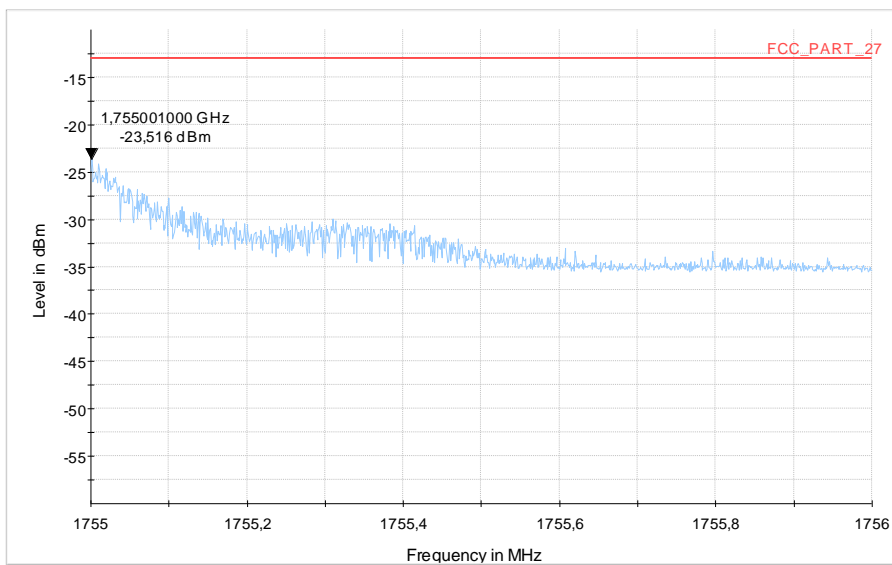
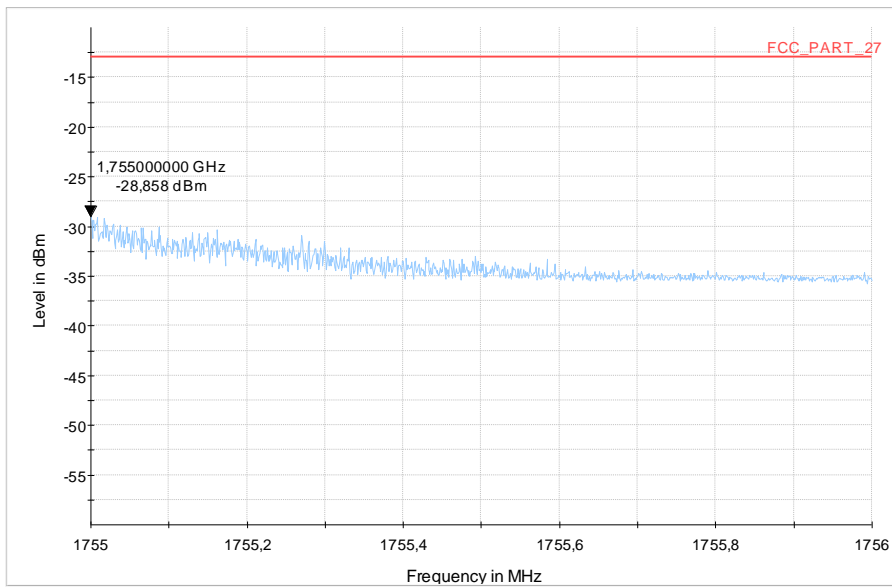
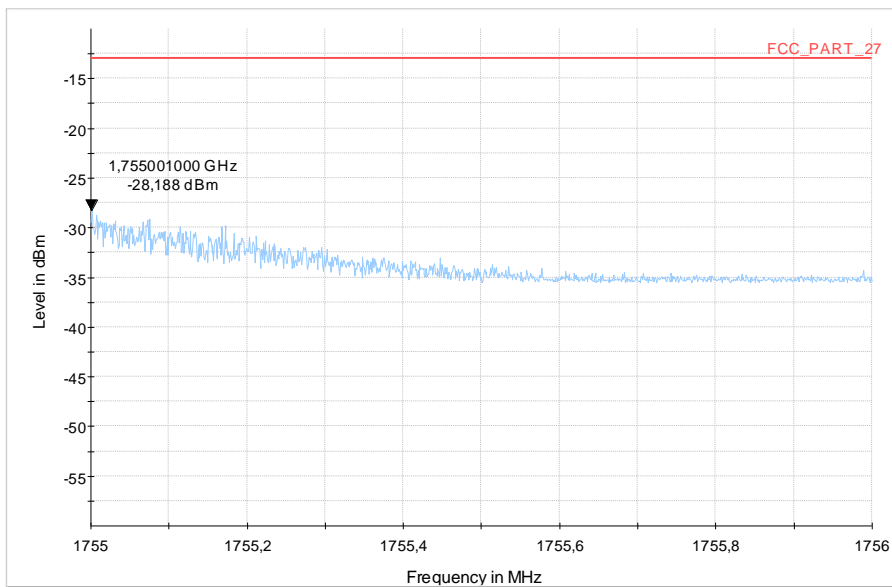


Diagram 4: 9.406b_BE_low_Ch_19975_BW5_5RBlow_1NB_10TBS_16-QAM

2.4.2. High Band-Edge**Diagram 5: 9.417a_BE_high_Ch_20375_BW5_1RBhigh_4NB_QPSK****Diagram 6: 9.417b_BE_high_Ch_20375_BW5_1RBhigh_4NB_10TBS_16-QAM**

**Diagram 7: 9.418a_BE_high_Ch_20375_BW5_6RBhigh_4NB_6TBS_QPSK****Diagram 8: 9.418b_BE_high_Ch_20375_BW5_5RBhigh_4NB_10TBS_16-QAM**

2.5. Radiated emissions – band-edge (LTE Band 13)

2.5.1. Low Band-Edge 5MHz signal BW

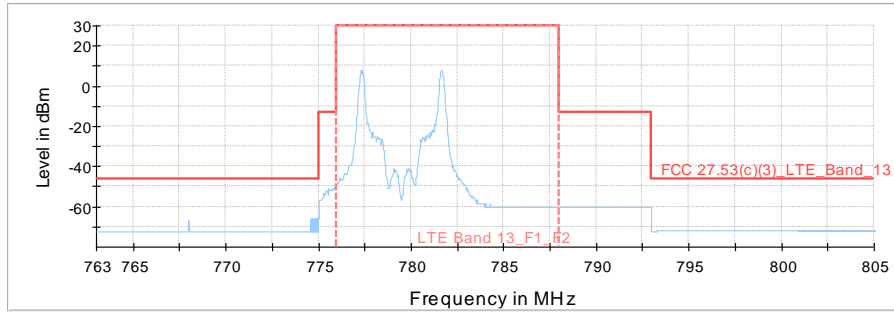


Diagram 9: 9.131a_CH23205_BW5MHz_RB1_QPSK_NB1_TBS6

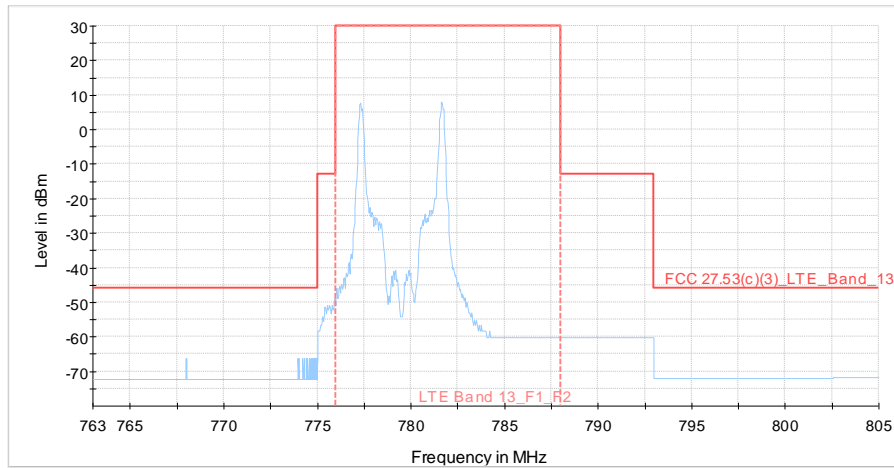


Diagram 10: 9.131b_CH23205_BW5MHz_RB1_16QAM_NB1_TBS10

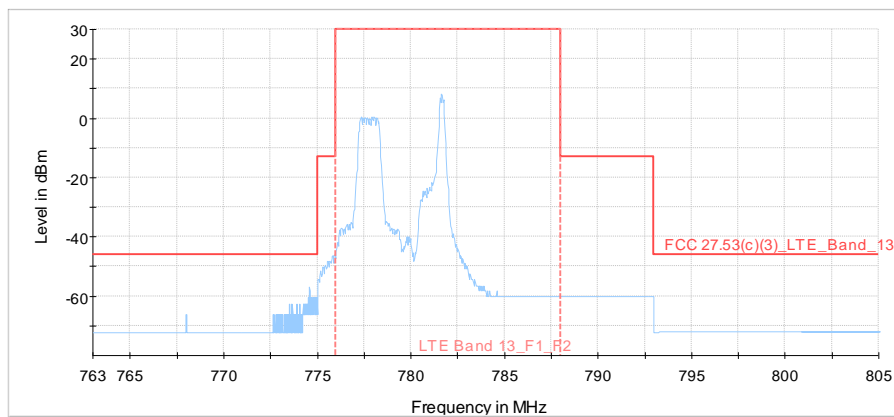
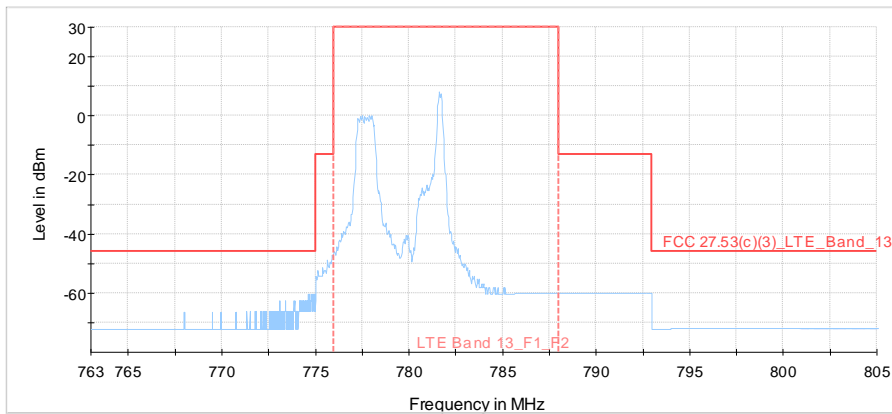
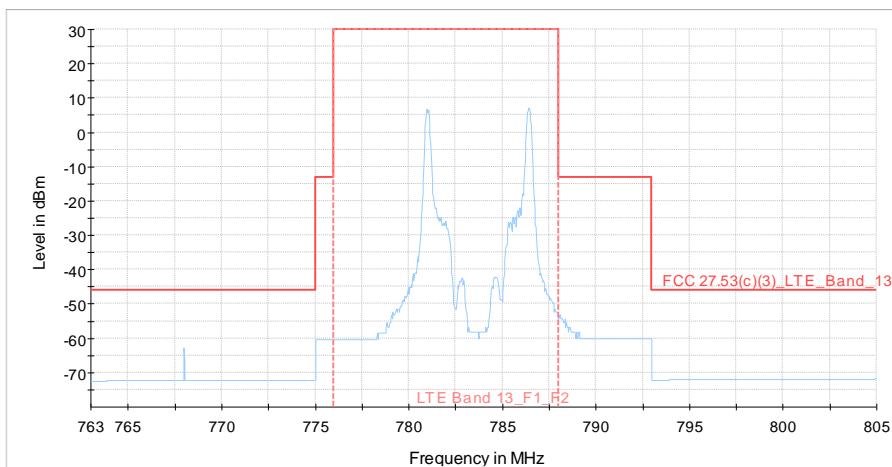
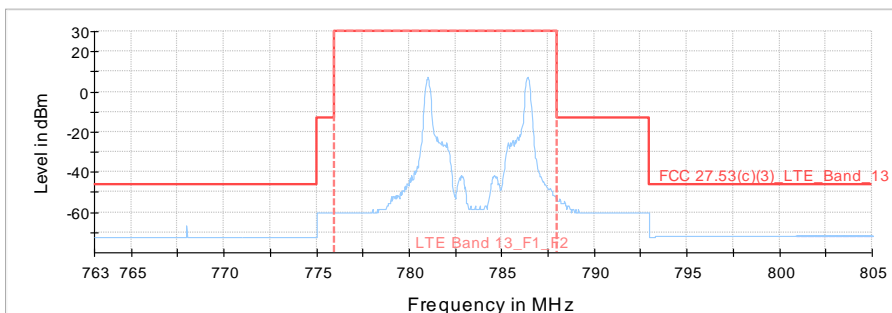
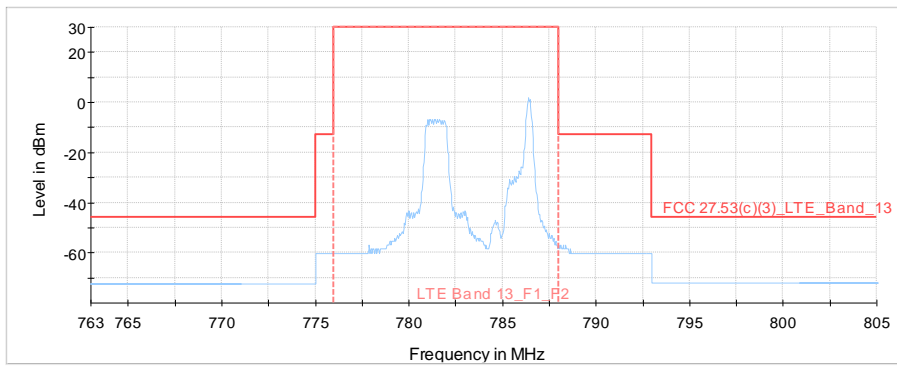
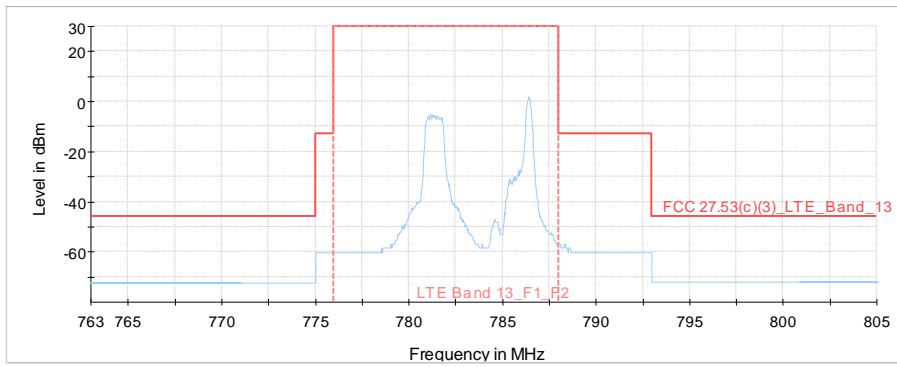
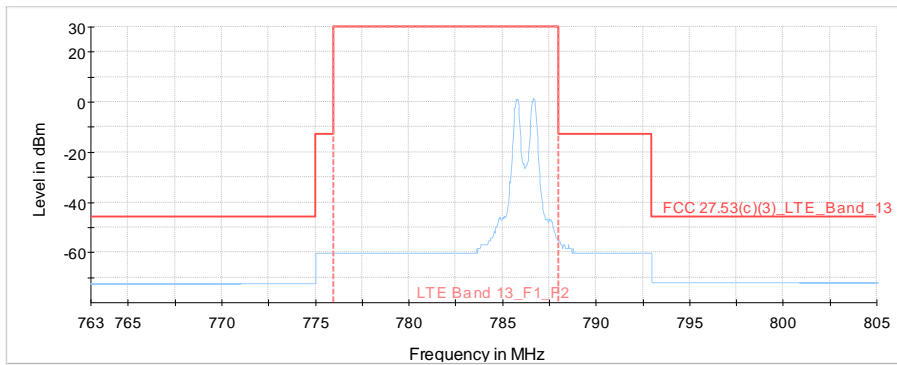
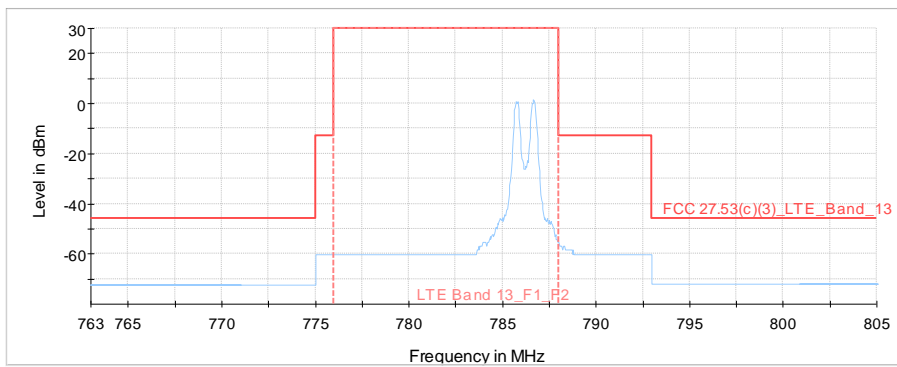
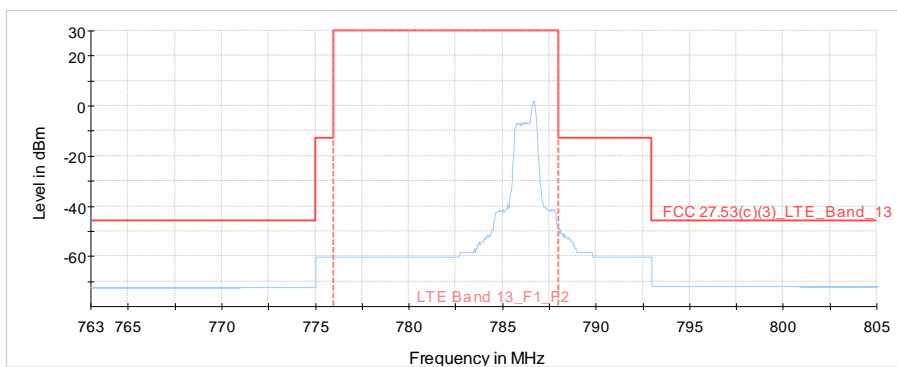
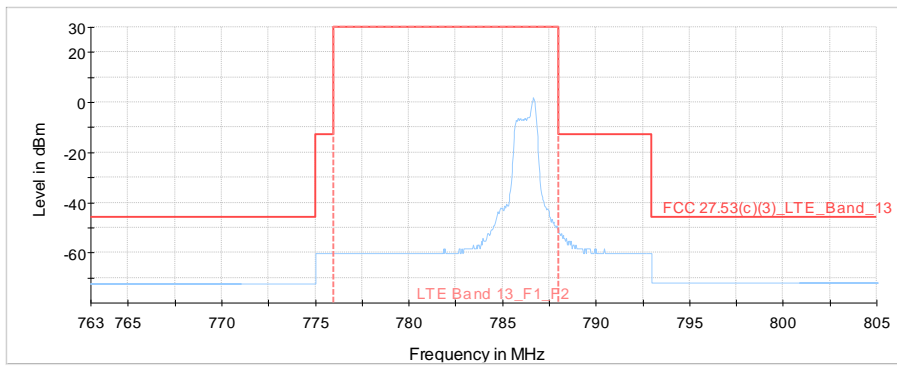


Diagram 11: 9.132a_CH23205_BW5MHz_RB6_QPSK_NB1_TBS6

**Diagram 12: 9.132b_CH23205_BW5MHz_RB5_16QAM_NB1_TBS10****2.5.2. Low/High Band-Edge 10MHz Signal-BW****Diagram 13: 9.133a_CH23230_BW10MHz_RB1_QPSK_NB4_TBS6****Diagram 14: 9.133b_CH23230_BW10MHz_RB1_16QAM_NB4_TBS10**

**Diagram 15: 9.134a_CH23230_BW10MHz_RB6_QPSK_NB4_TBS6****Diagram 16: 9.134b_CH23230_BW10MHz_RB5_16QAM_NB4_TBS10**

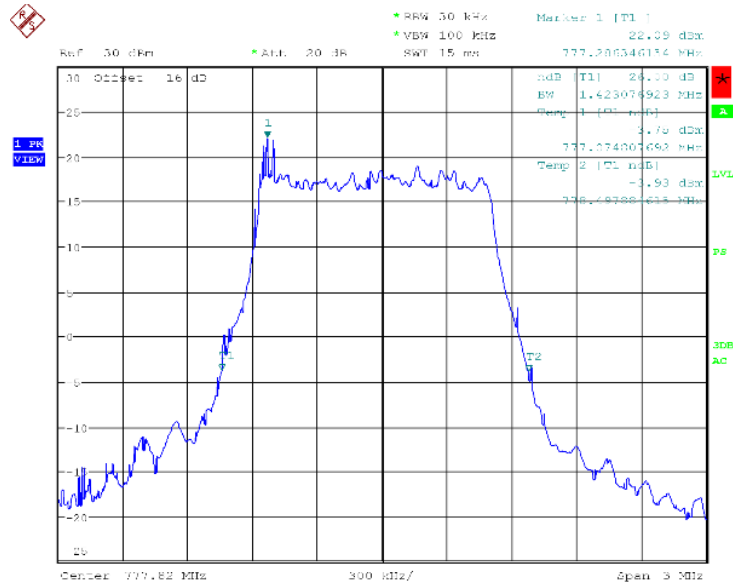
2.5.3. High Band-Edge – 5MHz Signal BW**Diagram 17: 9.135a_CH23255_BW5MHz_RB1_QPSK_NB4_TBS6****Diagram 18: 9.135b_CH23255_BW5MHz_RB1_16QAM_NB4_TBS10****Diagram 19: 9.136a_CH23255_BW5MHz_RB6_QPSK_NB4_TBS6**

**Diagram 20: 9.136b_CH23255_BW5MHz_RB5_16QAM_NB4_TBS10**

2.6. 26dBc Emission bandwidth

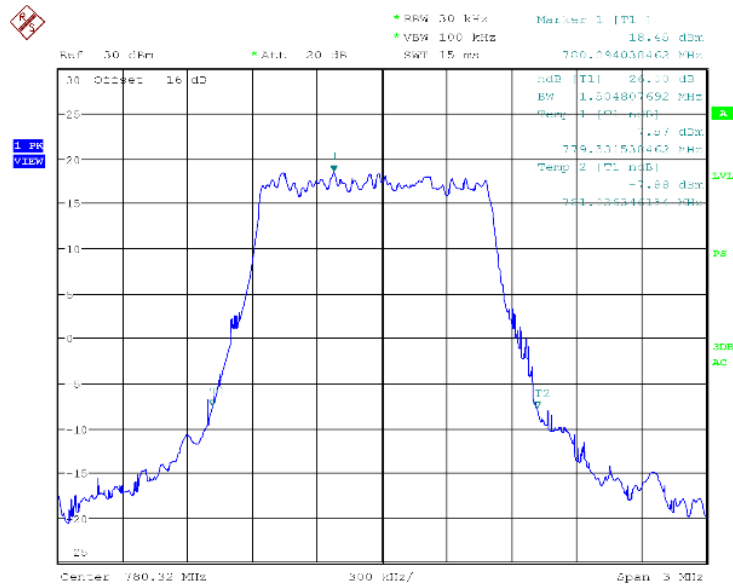
2.6.1. LTE Band 13

2.6.1.1. BW = 5MHz



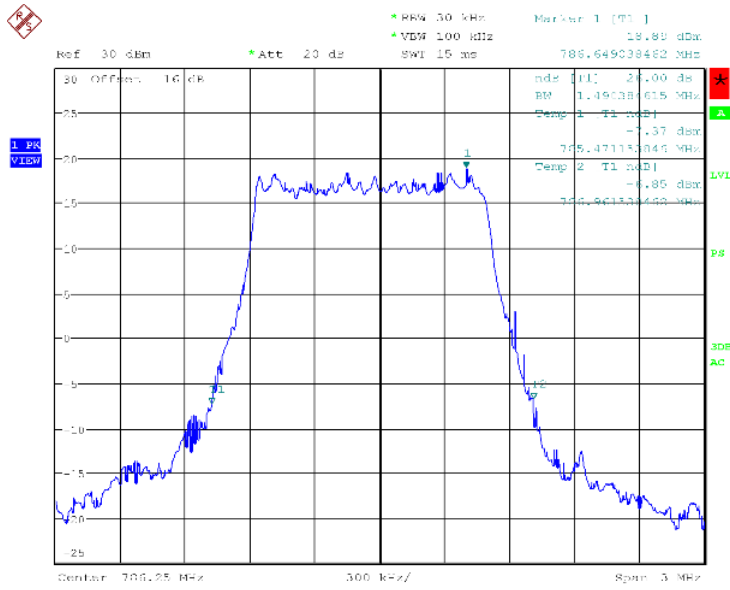
Date: 6.MAR.2018 16:44:53

Diagram 21: 34.1301_EBW_Ch23205low_6RBs_QPSK



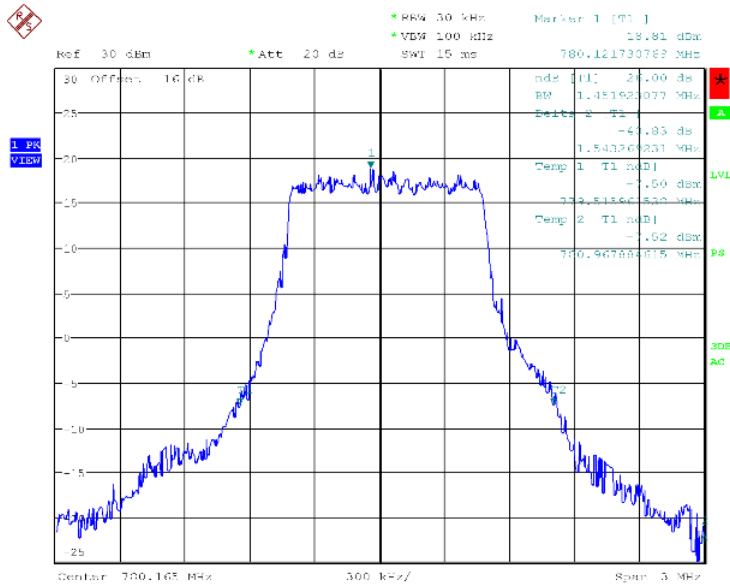
Date: 7.MAR.2018 13:10:14

Diagram 22: 34.1302_EBW_Ch23230mid_6RBs_low_QPSK



Date: 8.MAR.2018 17:01:48

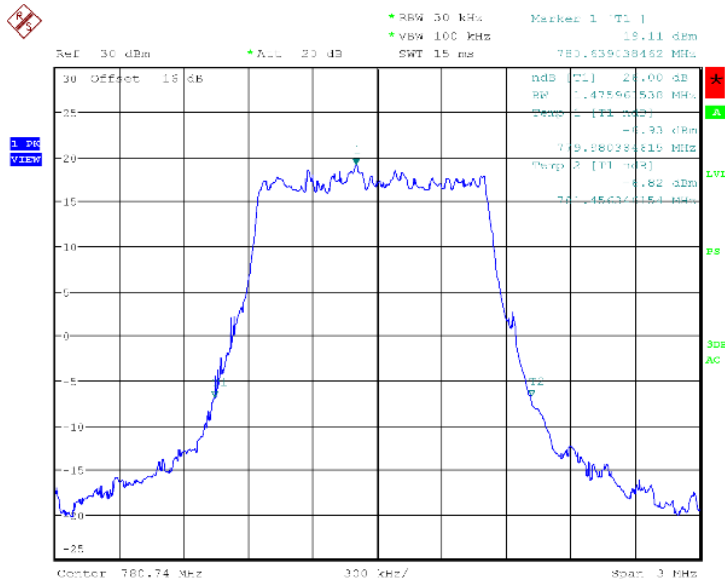
Diagram 23: 34.1303_EBW_Ch23255high_6RBs_high_QPSK



Date: 8.MAR.2018 17:22:27

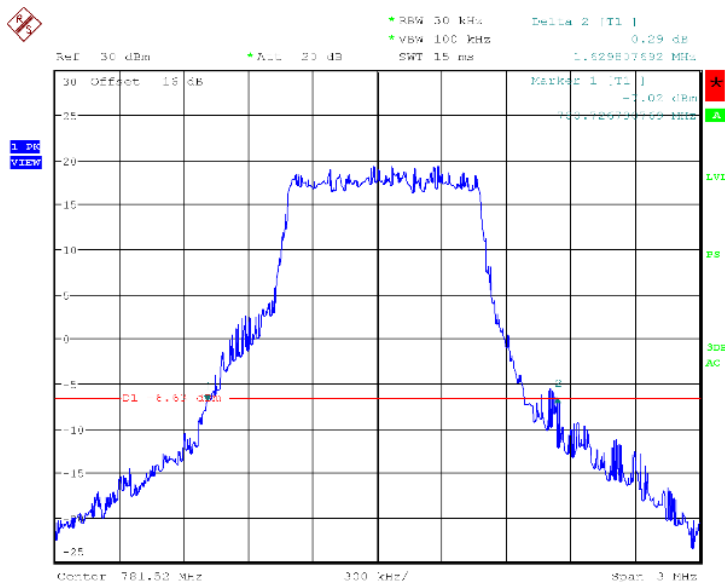
Diagram 24: 34.1306_EBW_Ch23230mid_BW5_5RBs_NB0_16QAM

2.6.1.2. BW = 10MHz



Date: 6.MAR.2018 17:06:51

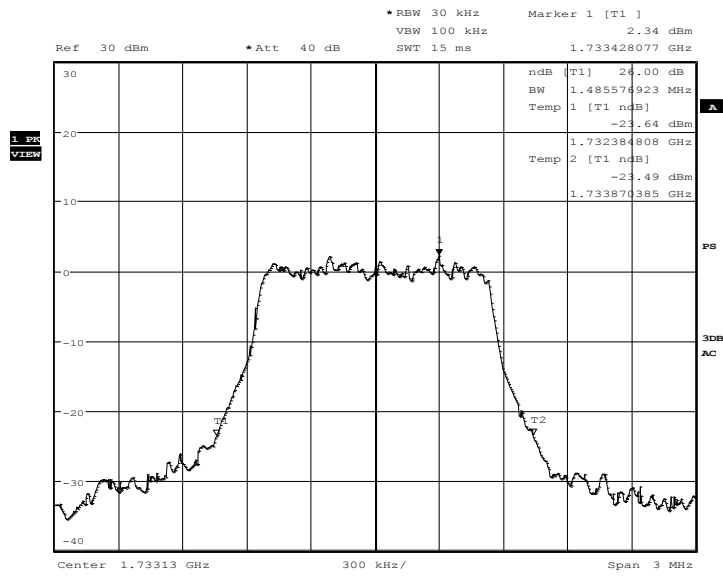
Diagram 27: 34.1304_EBW_Ch23230mid_BW10_6RBs_low_QPSK



Date: 6.MAR.2018 17:13:53

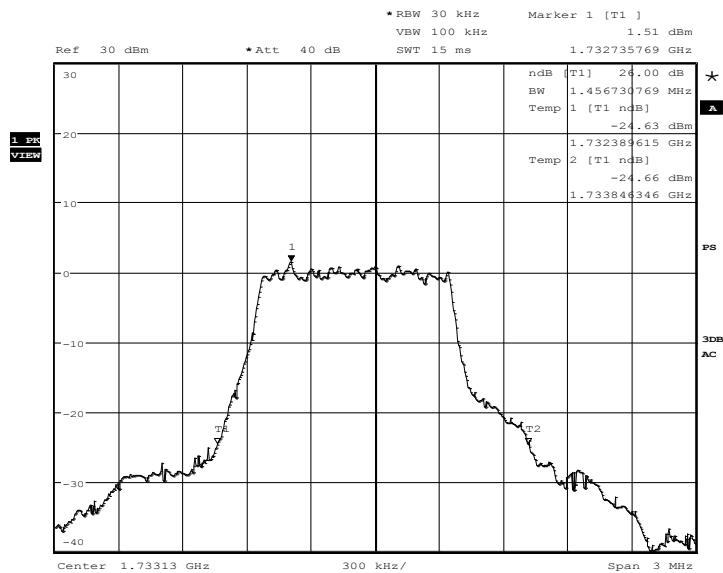
Diagram 28: 34.1305_EBW_Ch23230mid_BW10_5RBs_low_16QAM

2.6.2. LTE Band 4



Date: 6.FEB.2018 15:33:14

Diagram 29: 34.01_EBW_Ch20175_QPSK_6RBs_3NB_TBS_6

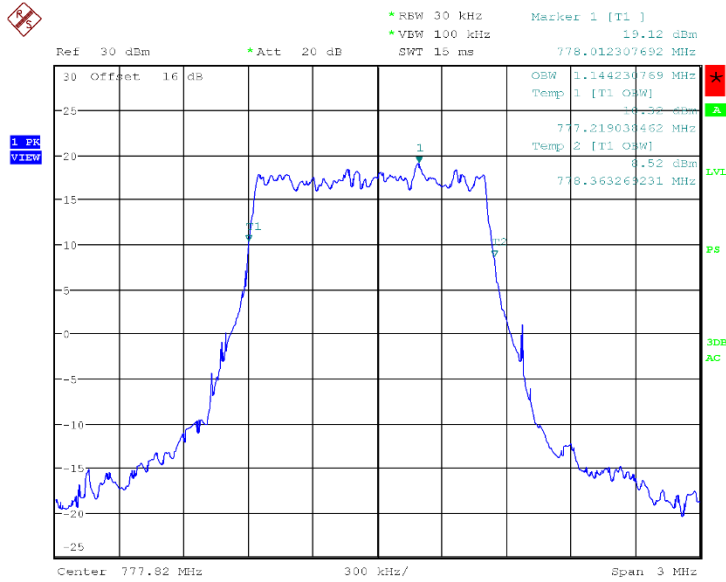


Date: 6.FEB.2018 15:27:22

Diagram 30: 34.02_EBW_Ch20175_16QAM_5RBs_3NB_TBS_10

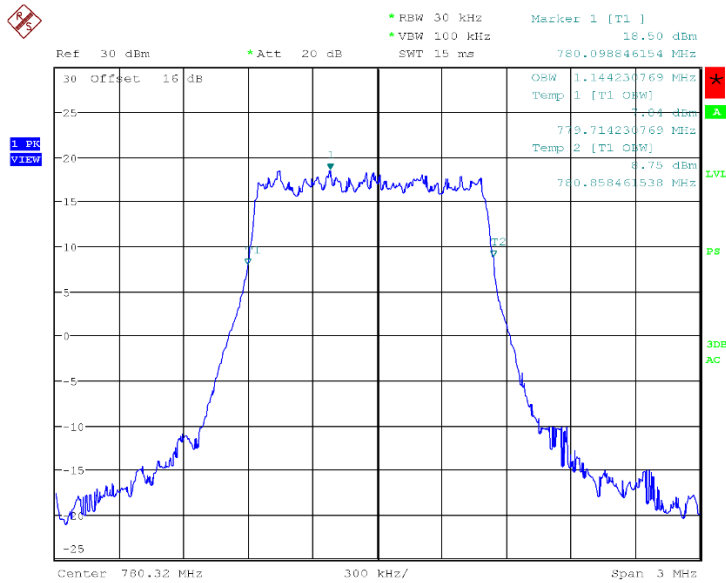
2.7. 99% Occupied bandwidth

2.7.1. LTE Band 13 (5MHz nominal signal bandwidth)



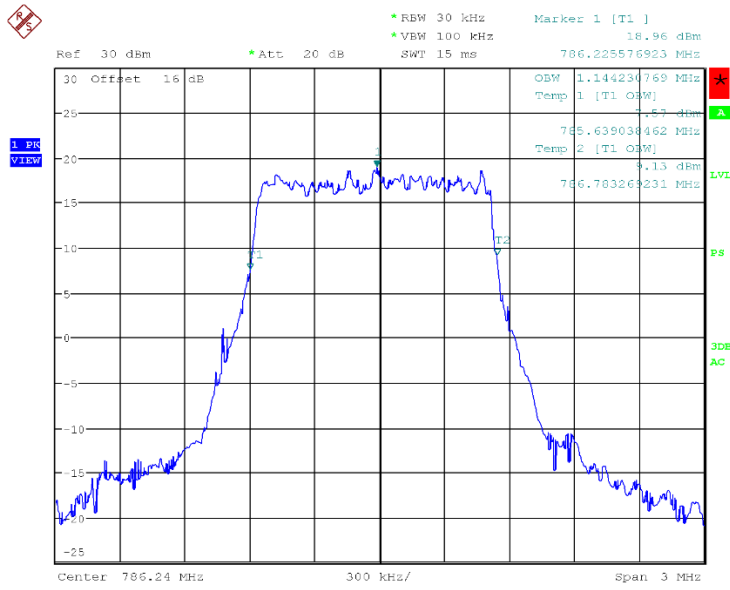
Date: 7.MAR.2018 12:34:04

Diagram 31: 35.1301_OBW_Ch23205low_6RBs_low_QPSK



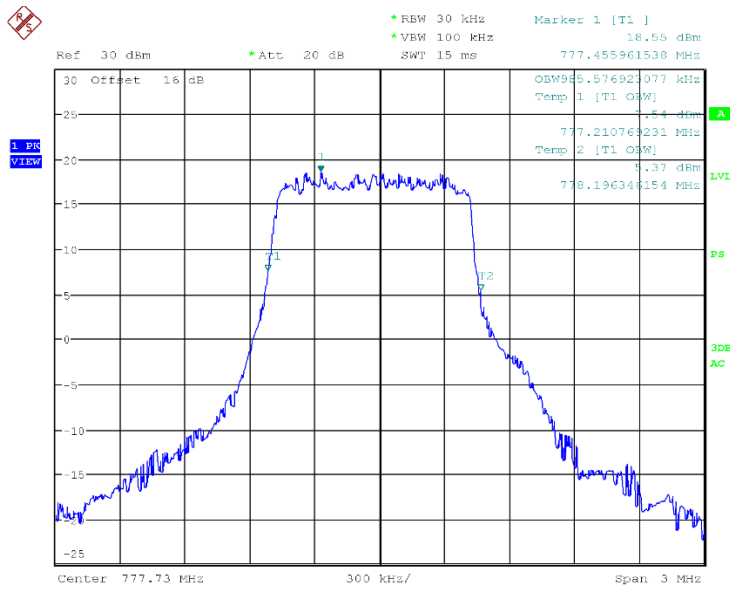
Date: 7.MAR.2018 13:01:17

Diagram 32: 35.1302_OBW_Ch23230mid_6RBs_low_QPSK



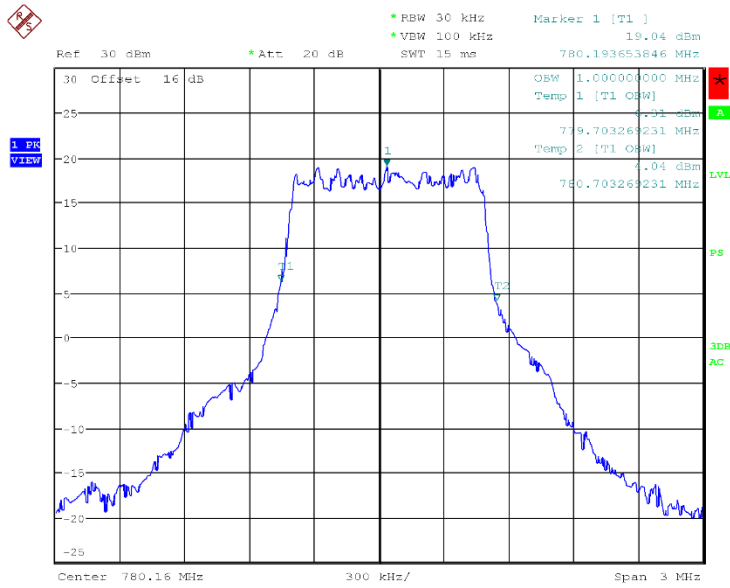
Date: 7.MAR.2018 12:28:13

Diagram 33: 35.1303_OBW_Ch23255high_6RBs_high_QPSK



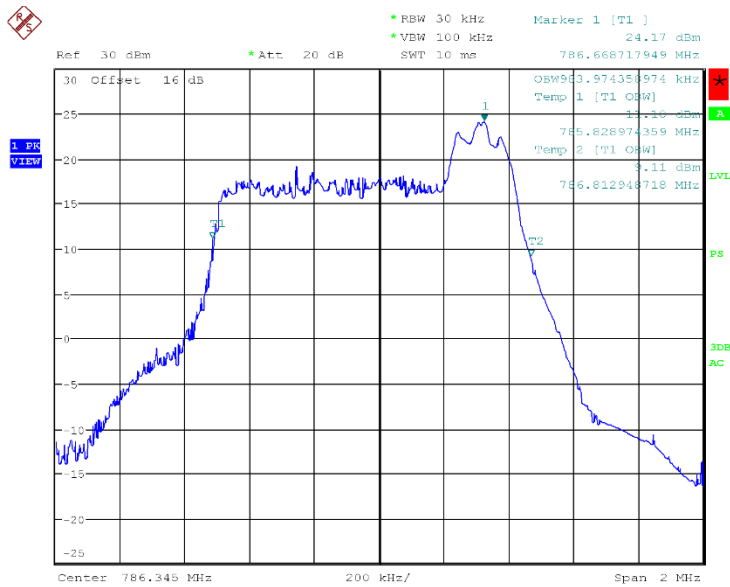
Date: 7.MAR.2018 08:59:28

Diagram 34: 35.1307_OBW_Ch23205low_BW5_5RBs_NB0_16QAM



Date: 7.MAR.2018 09:15:18

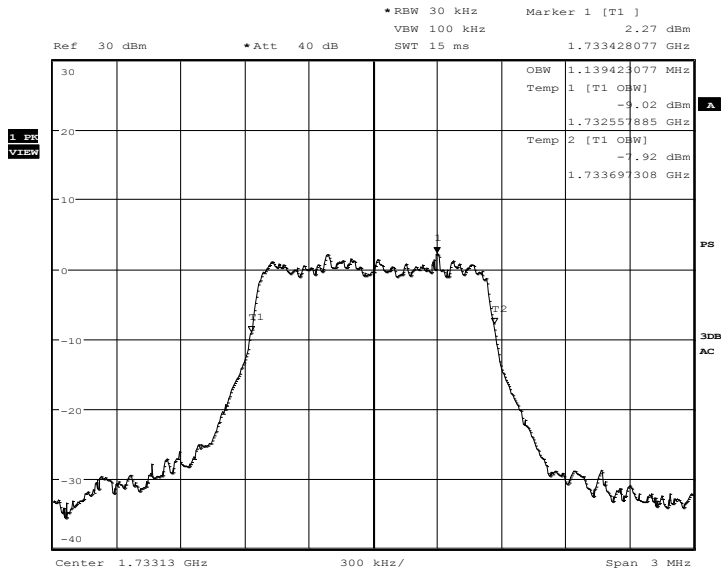
Diagram 35: 35.1306_OBW_Ch23230mid_BW5_5RBs_NB0_16QAM



Date: 7.MAR.2018 11:05:40

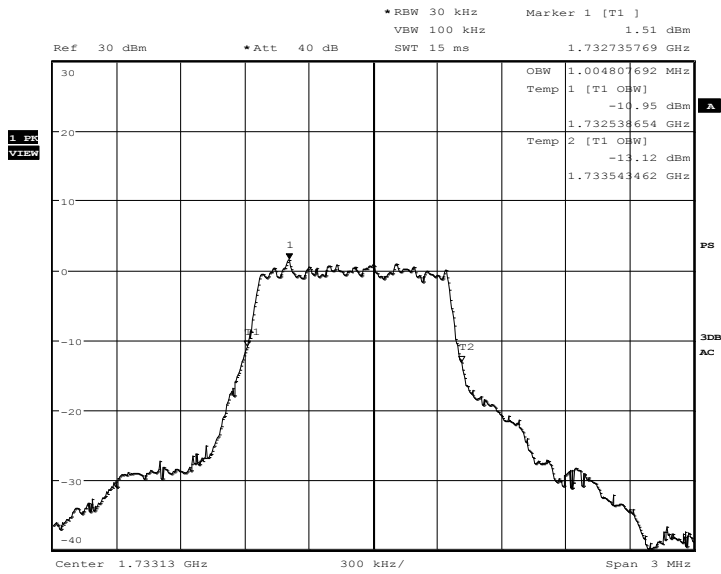
Diagram 36: 35.1308_OBW_Ch23255high_BW5_5RBs_NB3_16QAM

2.7.3. LTE Band 4



Date: 6.FEB.2018 15:14:52

Diagram 39: 35.01_OBW_Ch20175_QPSK_6RBs_3NB_TBS_6



Date: 6.FEB.2018 15:20:39

Diagram 40: 35.02_OBW_Ch20175_16QAM_5RBs_3NB_TBS_10

2.8. Spurious emissions conducted (LTE Band 4)

2.8.1. Channel Low

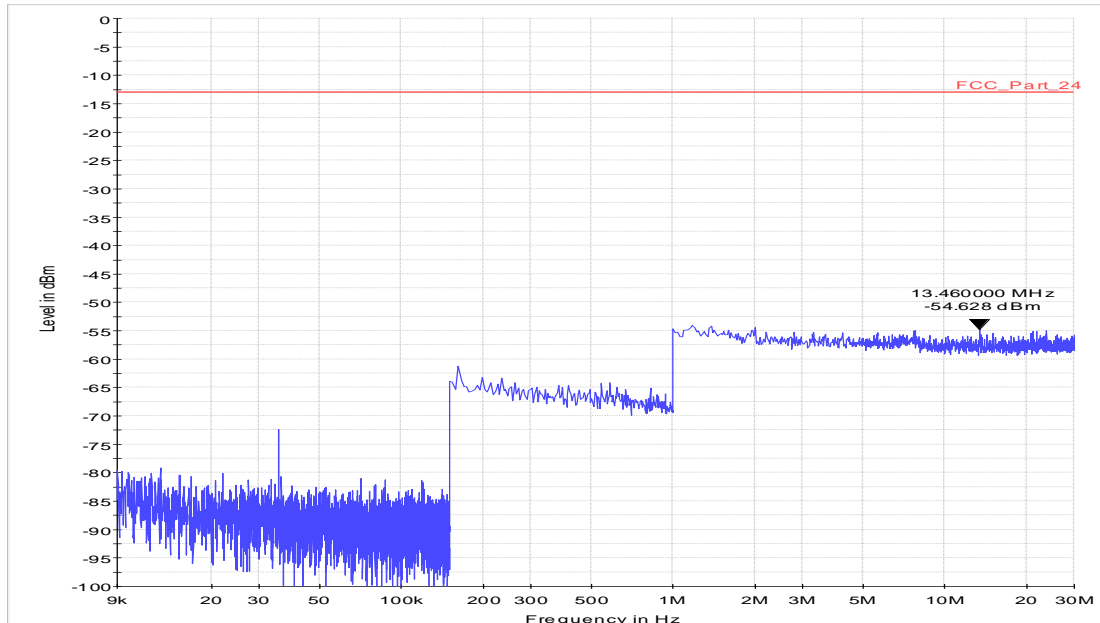


Diagram 32: 36.40b_RSE_C_Ch20000_BW_10_1RB_low_16QAM_1NB_Sweep1

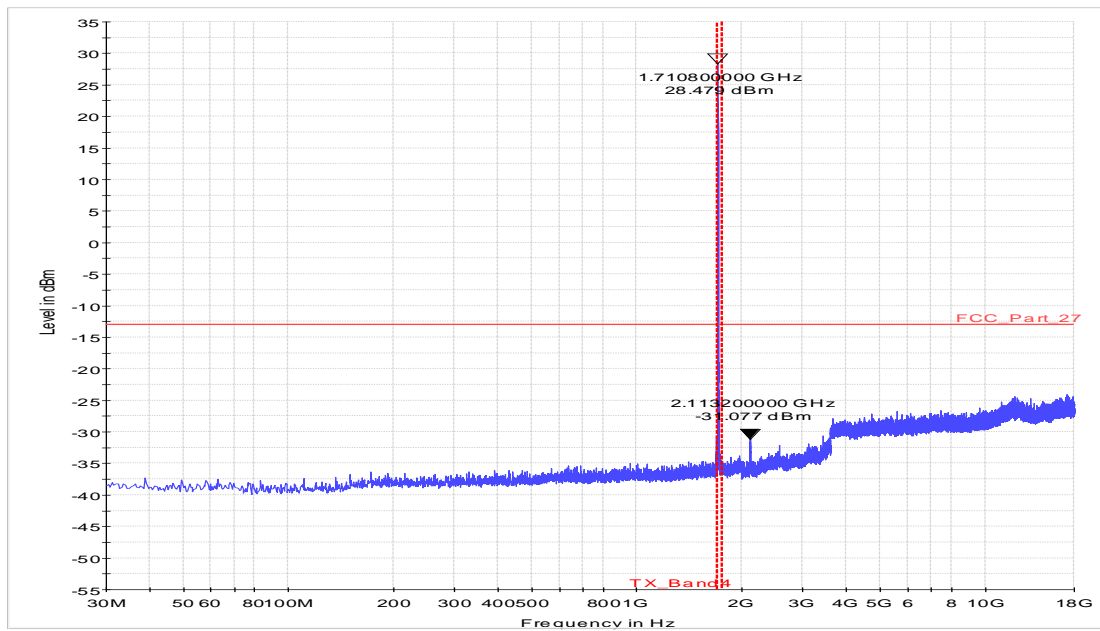


Diagram 33: 36.41b_RSE_C_Ch20000_BW_10_1RB_low_16QAM_1NB_Sweep2

Downlink channel on 2113.2MHz visible from base signalling station-> not relevant for results

2.8.2. Channel Mid

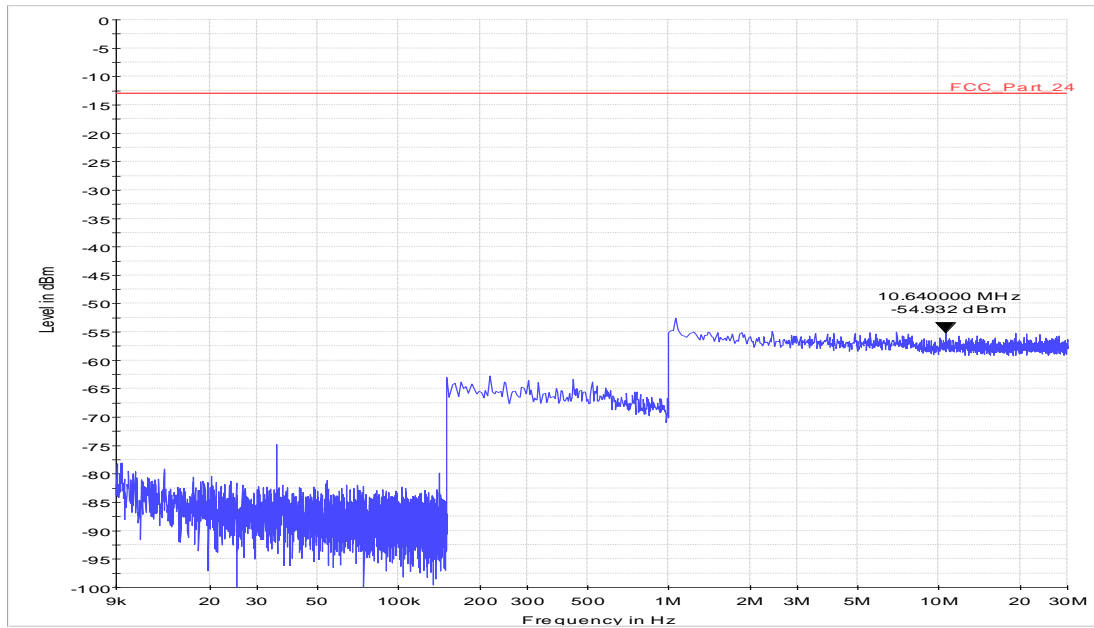


Diagram 34: 36.42b_RSE_C_Ch20175_BW_5_1RB_low_16QAM_1NB_Sweep1

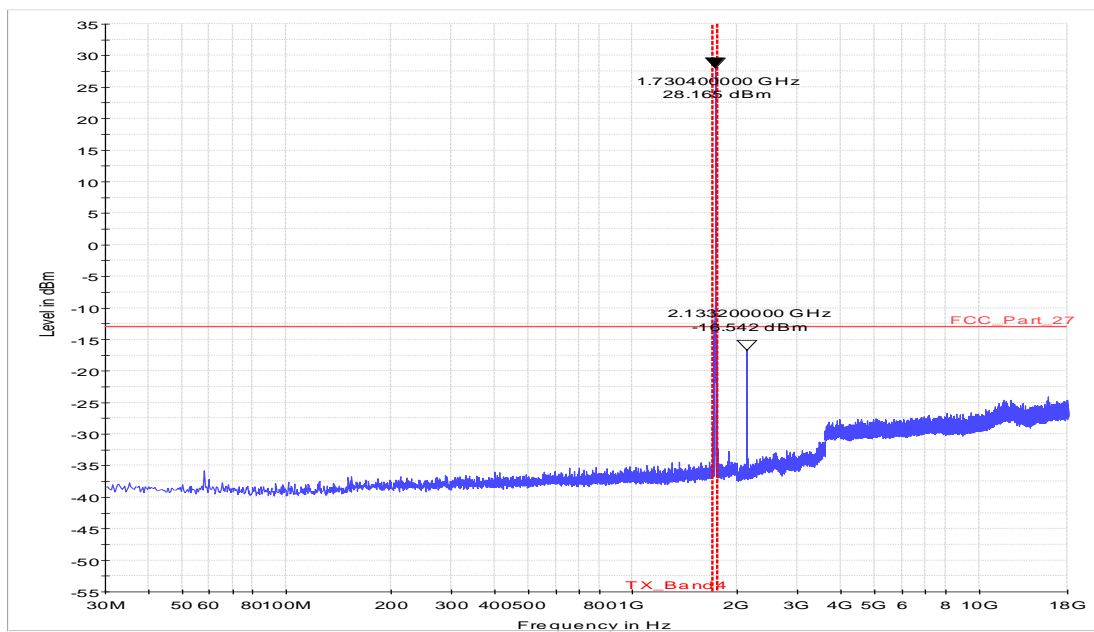


Diagram 35: 36.43b_RSE_C_Ch20175_BW_5_1RB_low_16QAM_1NB_Sweep2

Downlink channel on 2133.2MHz visible from base signalling station-> not relevant for results

2.8.3. Channel High

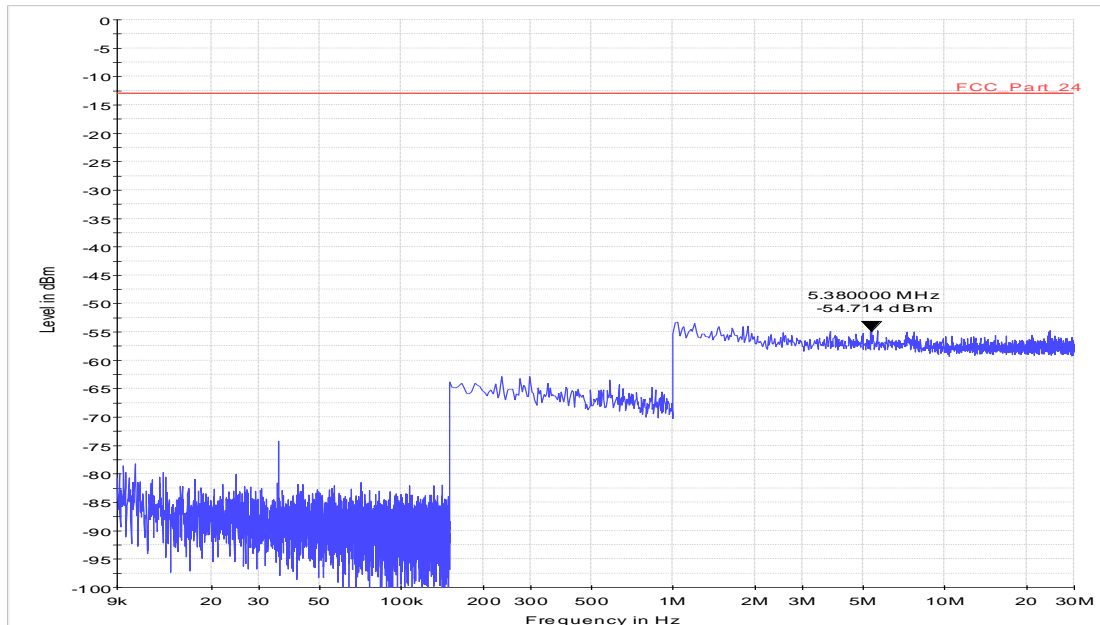


Diagram 36: 36.44a_RSE_C_Ch20300_BW_20_1RB_low_QPSK_1NB_Sweep1

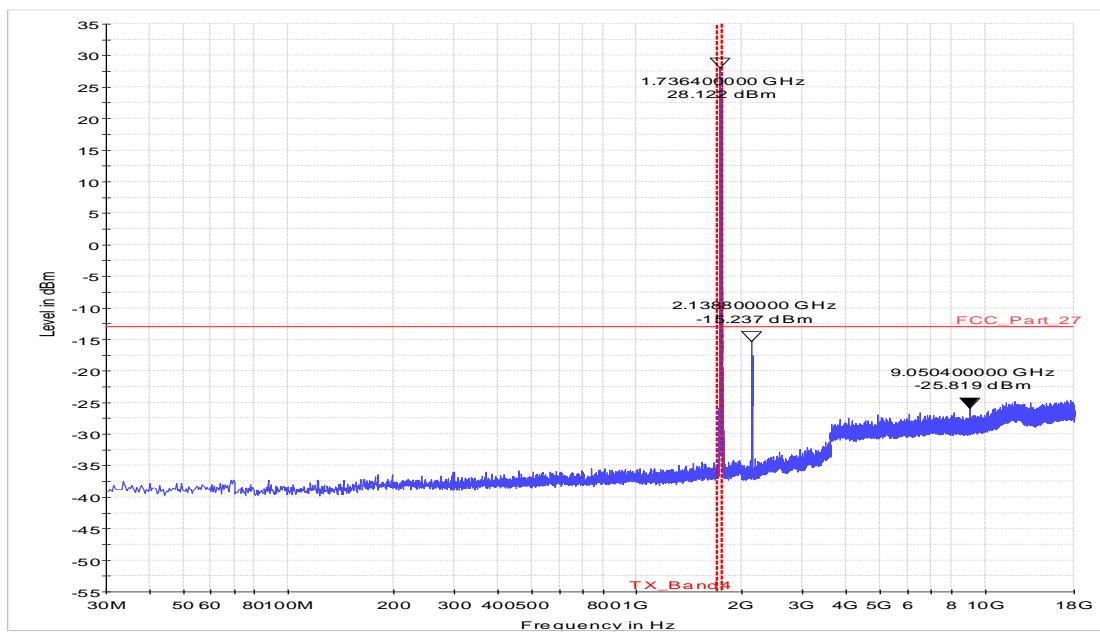


Diagram 37: 36.45a_RSE_C_Ch20300_BW_20_1RB_low_QPSK_1NB_Sweep2

Downlink channel on 2138.8MHz visible from base signalling station-> not relevant for results

2.9. Spurious emissions conducted (LTE Band 13)

2.9.1. Channel Low 16-QAM

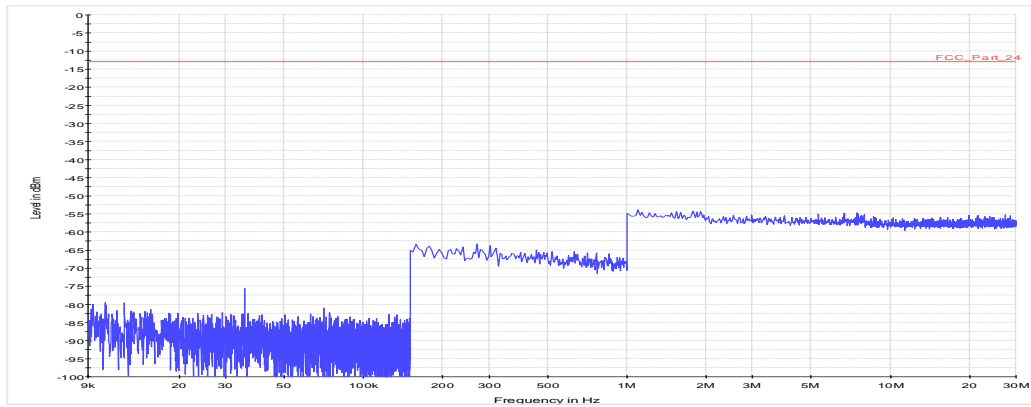


Diagram 38: 50.1301_CSE_Ch23205_1RBlow_0NB_16QAM_Sweep1

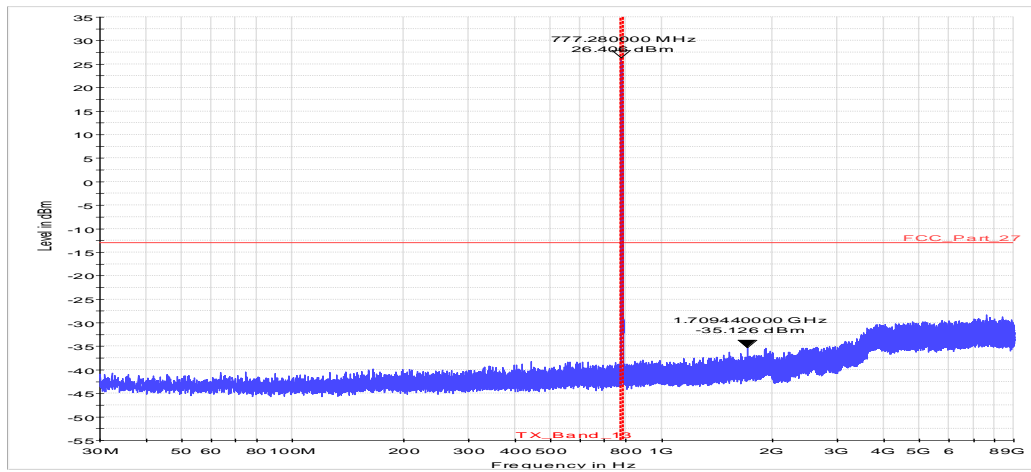


Diagram 39: 50.1302_CSE_Ch23205_1RBlow_0NB_16QAM_Sweep2

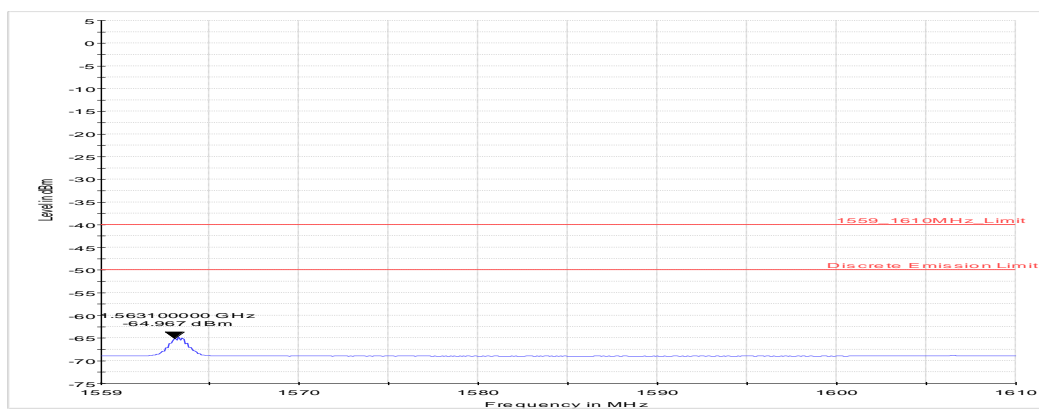


Diagram 40: 50.1306_CSE_Ch23205_1RBlow_16QAM_GPS-Protection

2.9.2. Channel Low QPSK

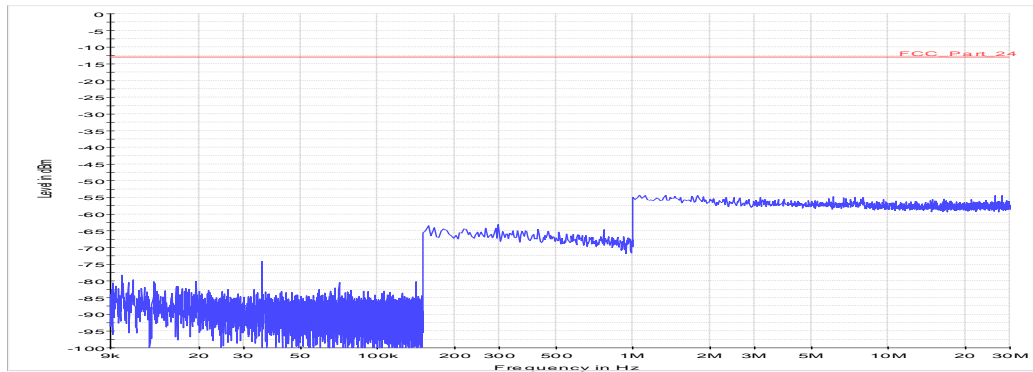


Diagram 41: 50.1303_CSE_Ch23205_1RBlow_QPSK_Sweep1

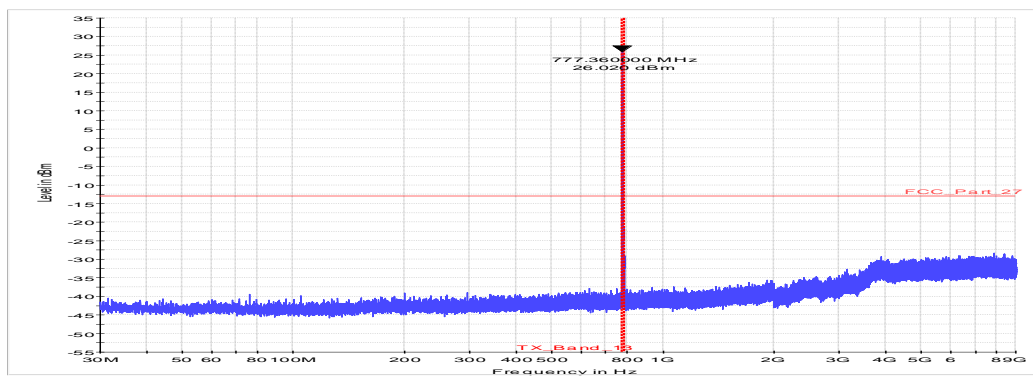


Diagram 42: 50.1304_CSE_Ch23205_1RBlow_QPSK_Sweep2

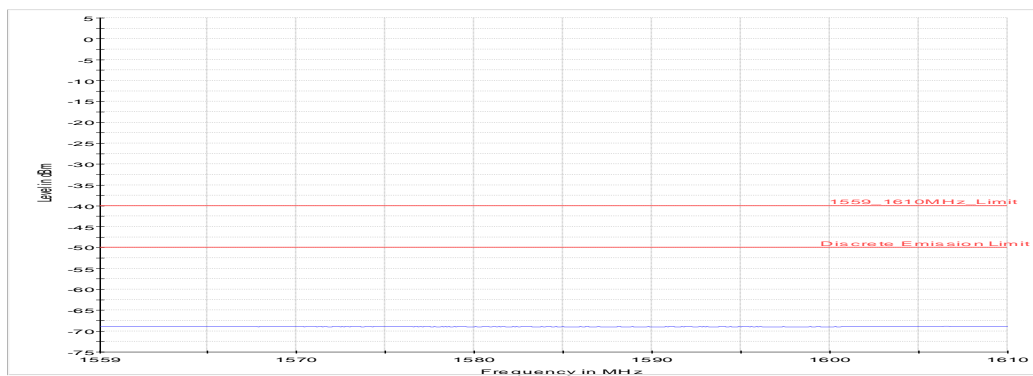


Diagram 43: 50.1305_CSE_Ch23205_1RBlow_QPSK_GPS-Protection

2.9.3. Channel Middle 16-QAM

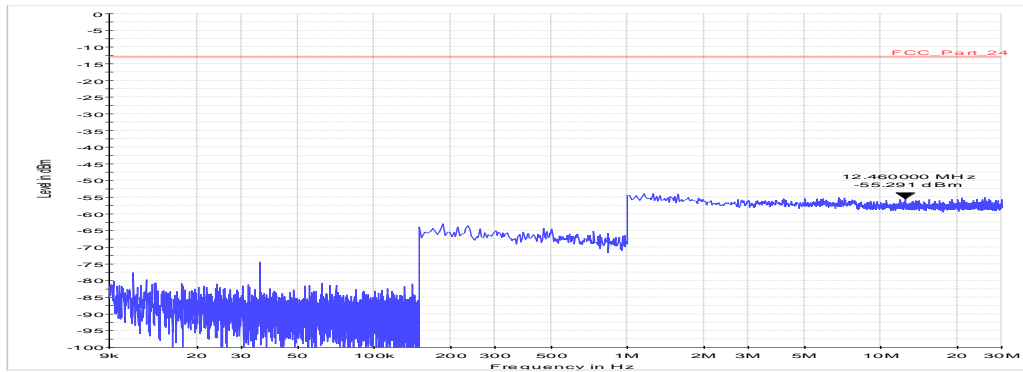


Diagram 44: 50.1310_CSE_Ch23230_1RBhigh_3NB_16QAM_Sweep1

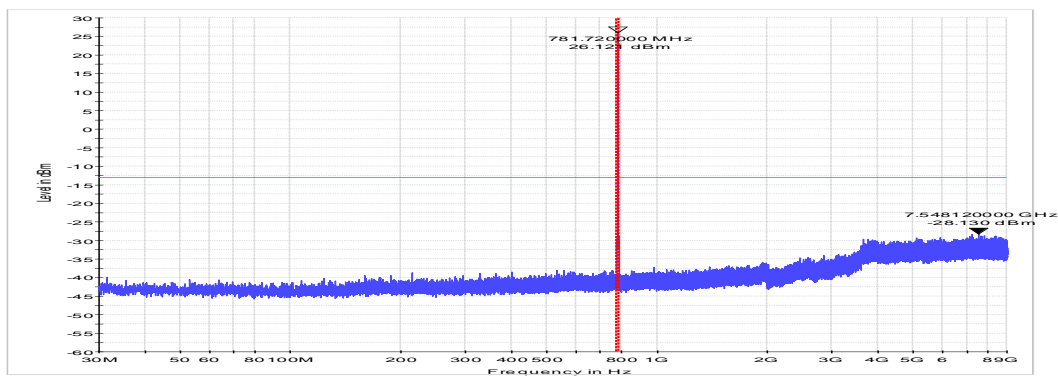


Diagram 45: 50.1311_CSE_Ch23230_1RBhigh_3NB_16QAM_Sweep2

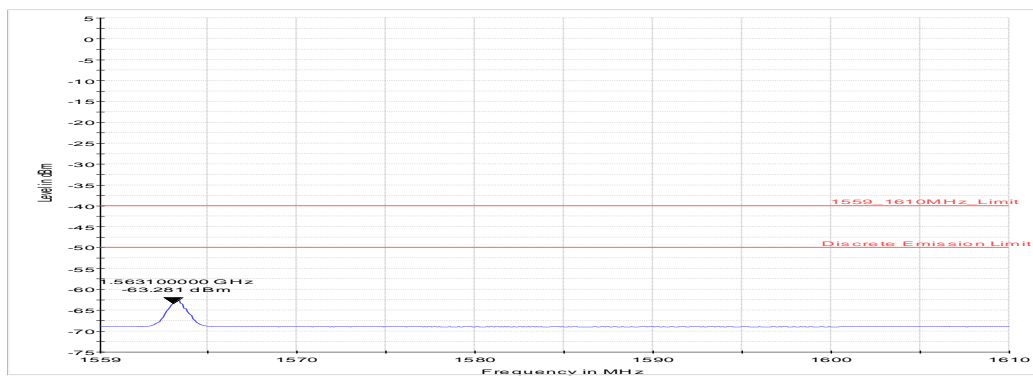


Diagram 46: 50.1315_CSE_Ch23230_1RBhigh_16QAM_GPS-Protection

2.9.4. Channel Middle QPSK

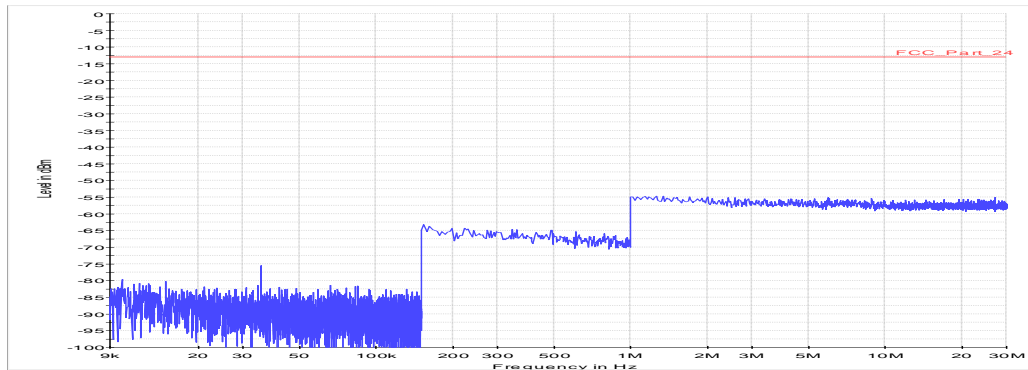


Diagram 47: 50.1312_CSE_Ch23230_1RBhigh_QPSK_Sweep1

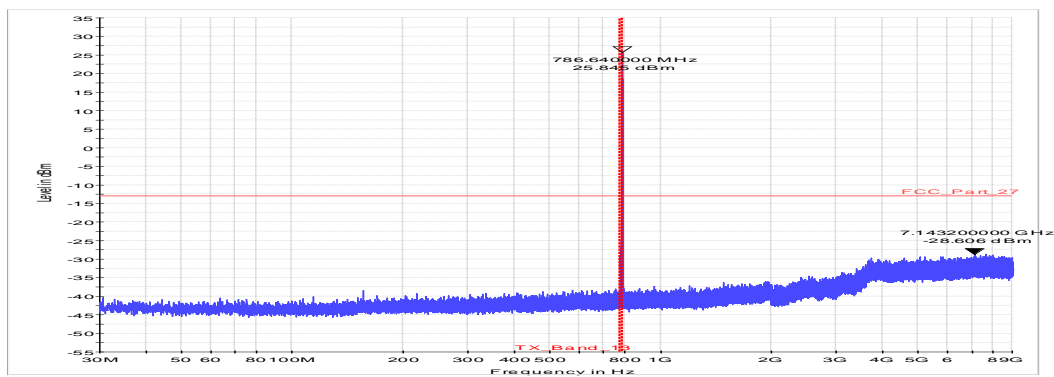


Diagram 48: 50.1313_CSE_Ch23230_1RBhigh_QPSK_Sweep2

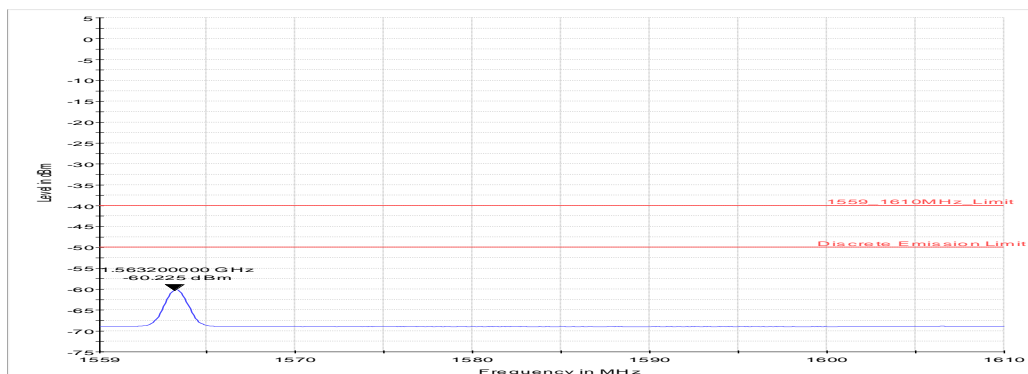


Diagram 49: 50.1314_CSE_Ch23230_1RBhigh_QPSK_GPS-Protection

2.9.5. Channel High 16-QAM

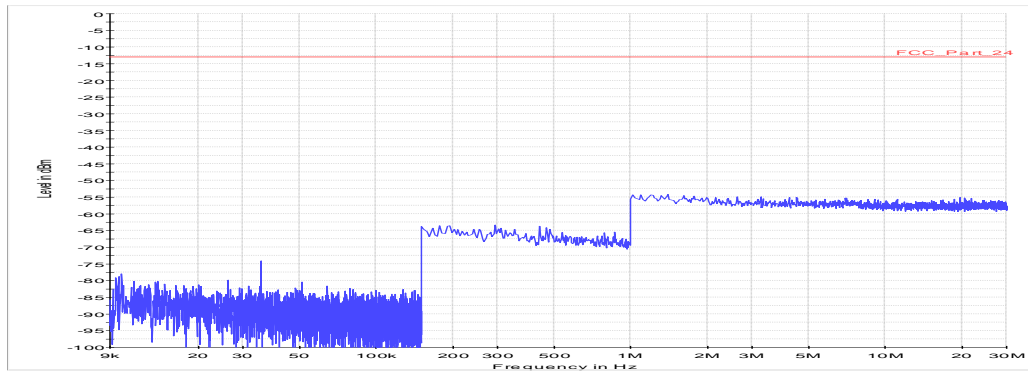


Diagram 50: 50.1320_CSE_Ch23255_1RBhigh_3NB_16QAM_Sweep1

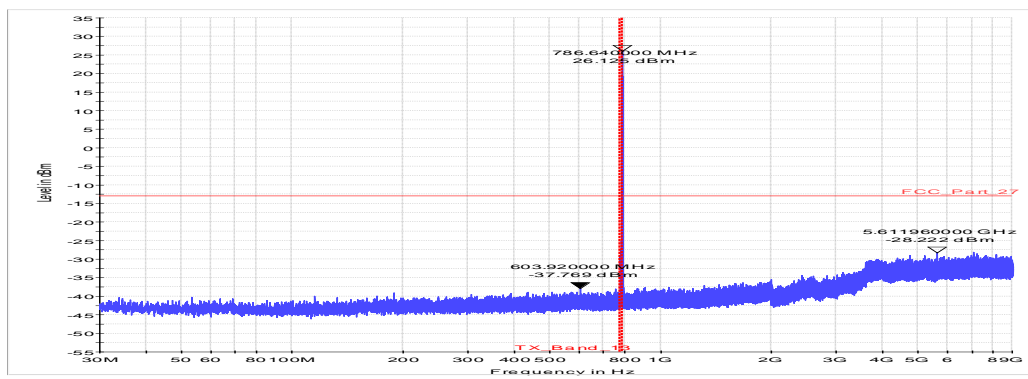


Diagram 51: 50.1321_CSE_Ch23255_1RBhigh_3NB_16QAM_Sweep2

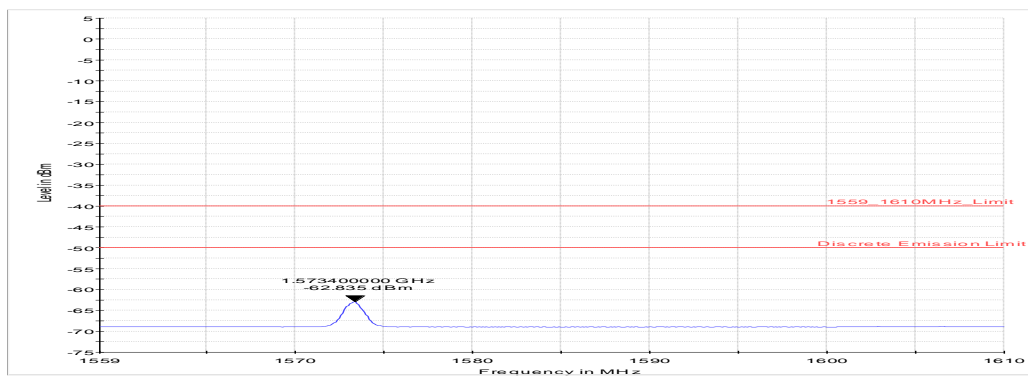


Diagram 52: 50.1325_CSE_Ch23255_1RBhigh_3NB_16QAM_GPS-Protection

2.9.6. Channel High QPSK

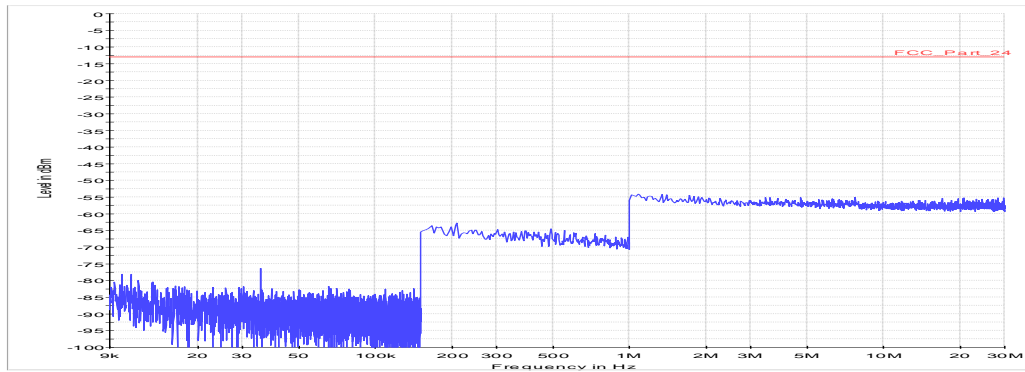


Diagram 53: 50.1322_CSE_Ch23255_1RBhigh_3NB_QPSK_Sweep1

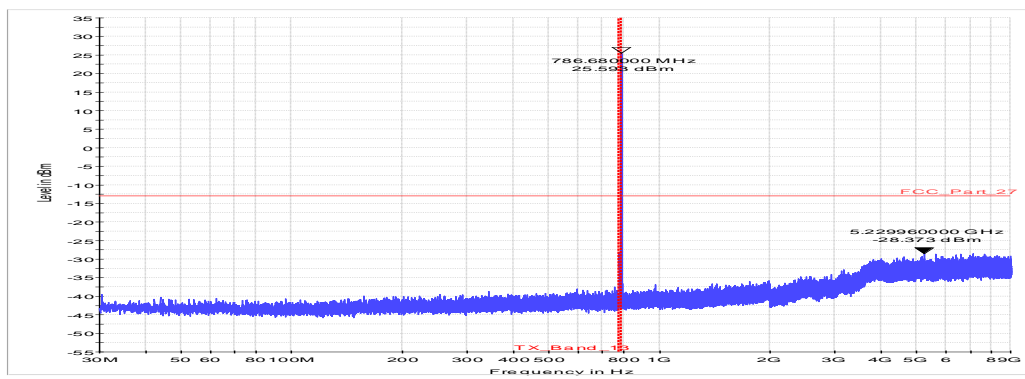


Diagram 54: 50.1323_CSE_Ch23255_1RBhigh_3NB_QPSK_Sweep2

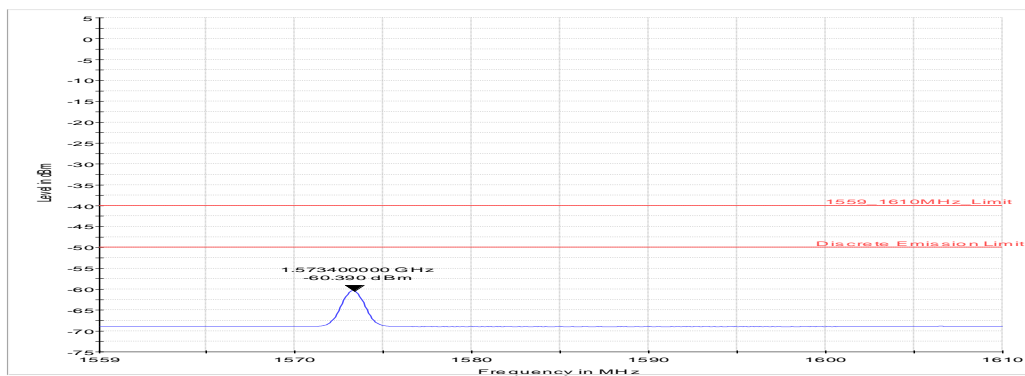


Diagram 55: 50.1324_CSE_Ch23255_1RBhigh_QPSK_GPS-Protection

2.10. Conducted emissions – band - edge (LTE Band 4)

2.10.1. Conducted emissions – band - edge low channels

2.10.1.1. Signal bandwidth 5MHz

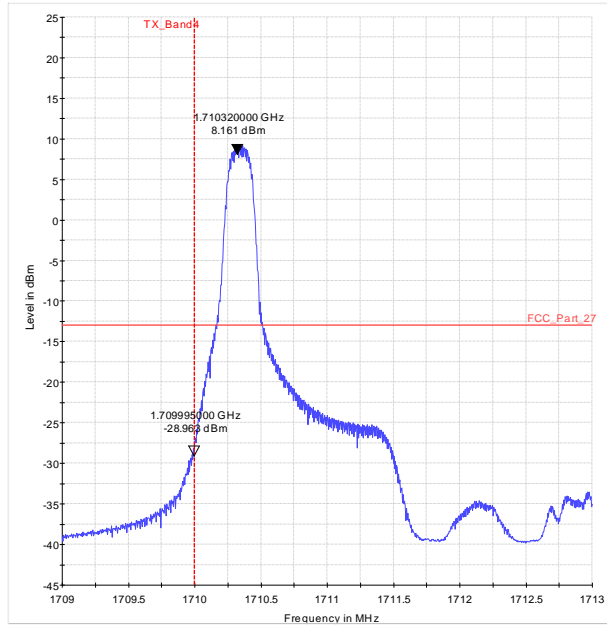


Diagram 56:
37.405a_Ch19975_BW_5_1RB_low_QPSK

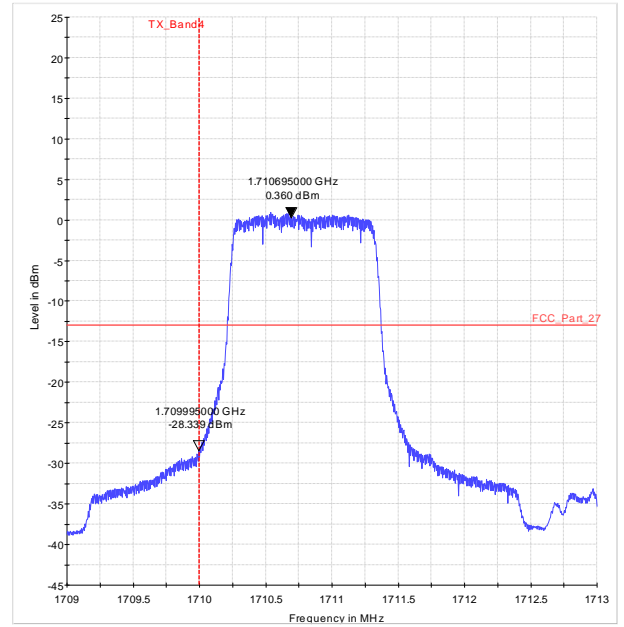


Diagram 58:
37.406a_Ch19975_BW_5_6RBs_QPSK

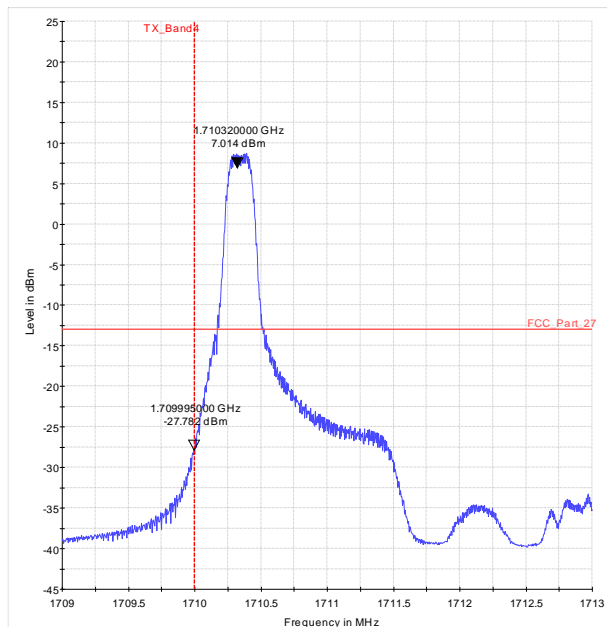


Diagram 57:
37.405b_Ch19975_BW_5_1RB_low_16QAM

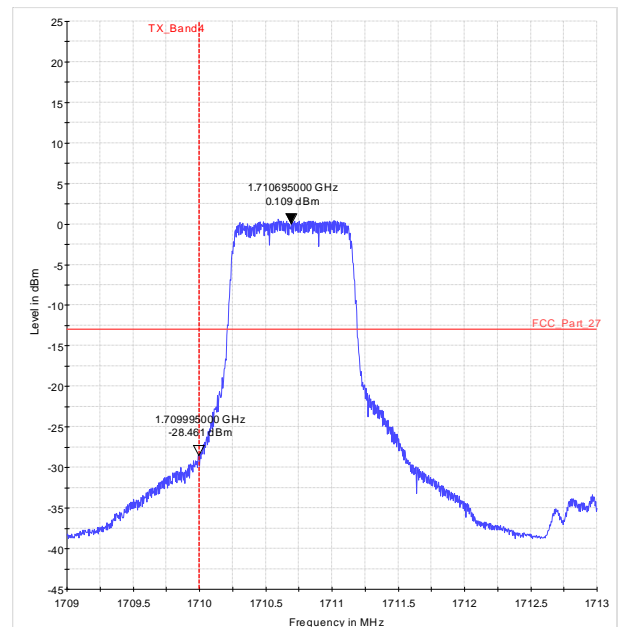


Diagram 59:
37.406b_Ch19975_BW_5_5RBs_16QAM

2.10.1.2. Signal bandwidth 10MHz

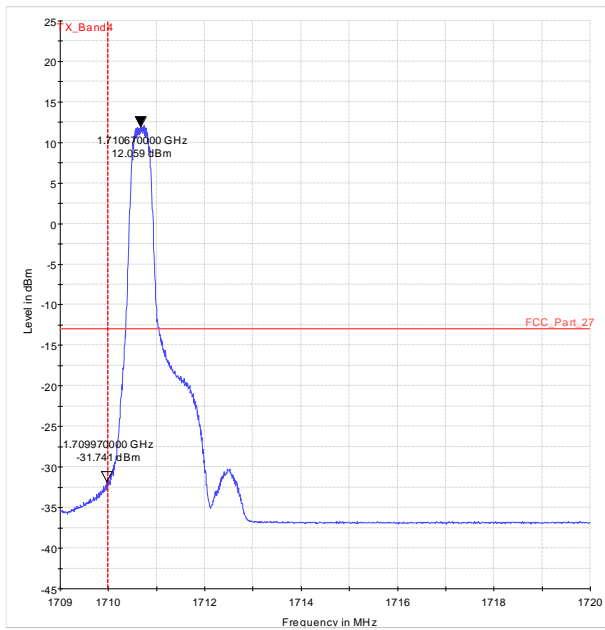


Diagram 60:
37.407a_Ch20000_BW_10_1RB_low_QPSK

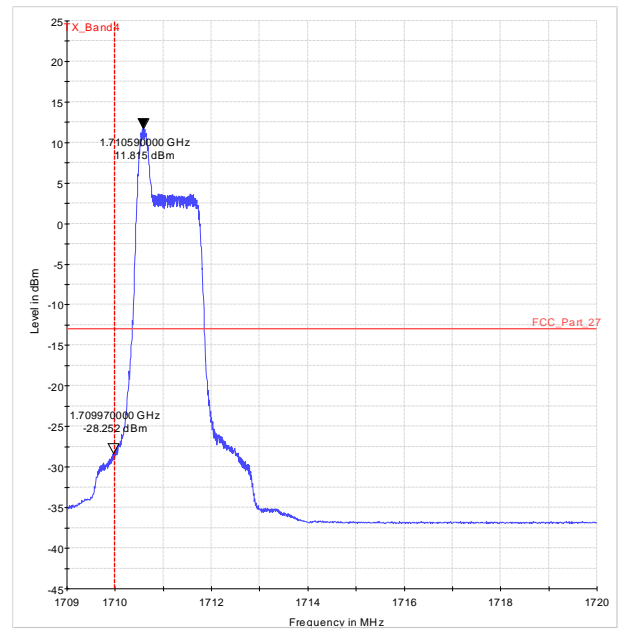


Diagram 62:
37.408a_Ch20000_BW_10_6RBs_QPSK

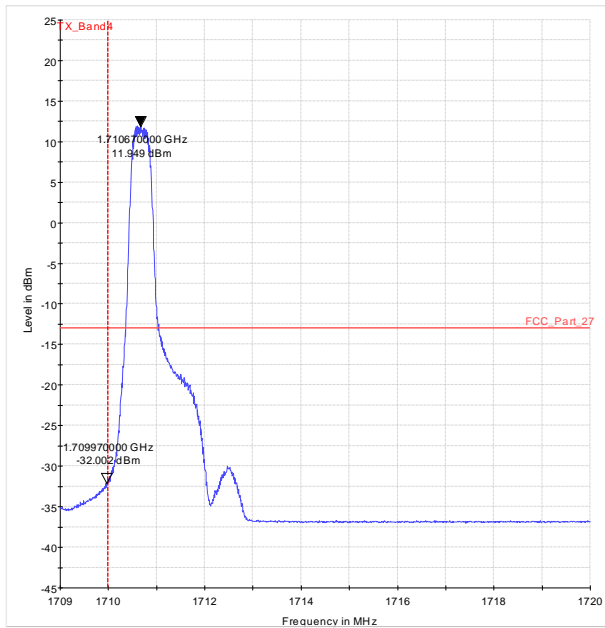


Diagram 61:
37.407b_Ch20000_BW_10_1RB_low_16QAM

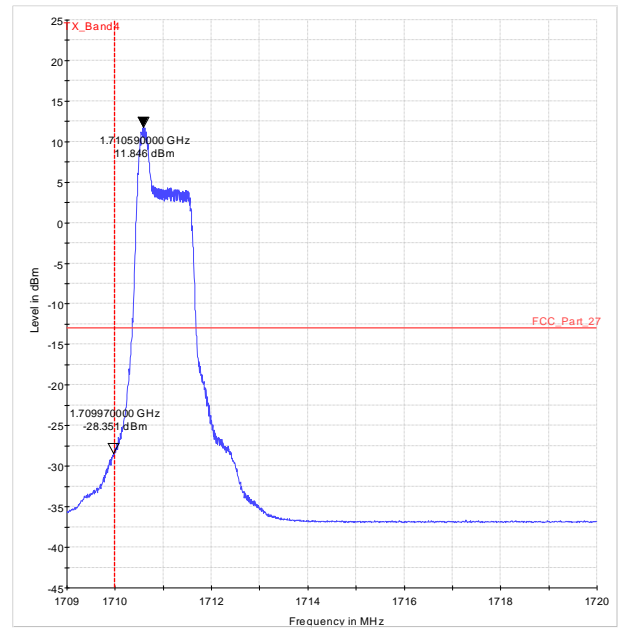


Diagram 63:
37.408b_Ch20000_BW_10_5RBs_16QAM

2.10.1.3. Signal bandwidth 15MHz

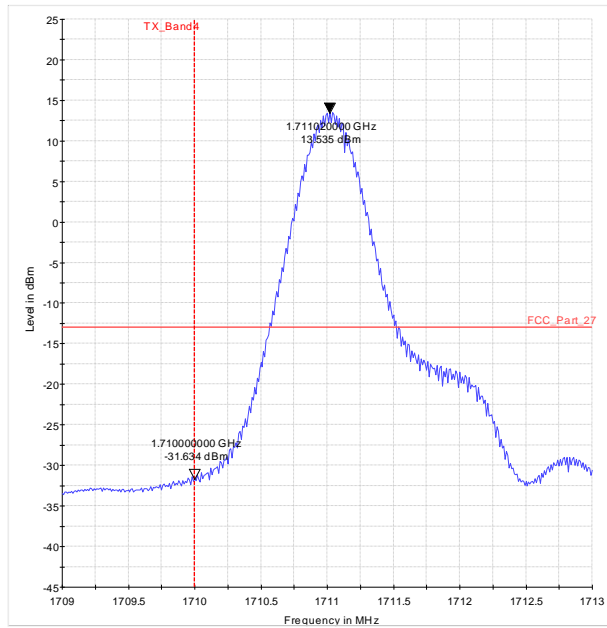


Diagram 64:
37.409a_Ch20025_BW_15_1RB_low_QPSK

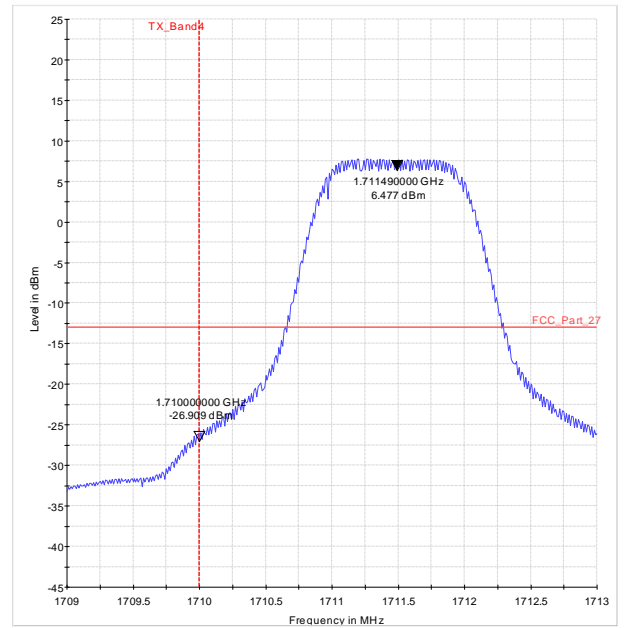


Diagram 66:
37.410a_Ch20025_BW_15_6RBs_QPSK

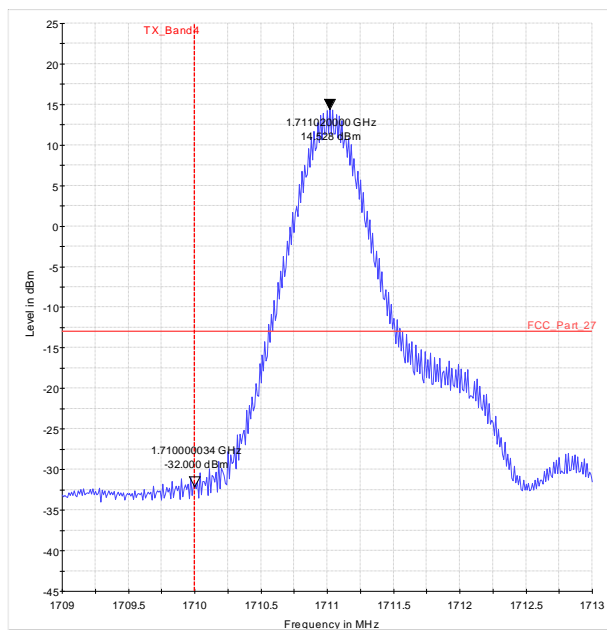


Diagram 65:
37.409b_Ch20025_BW_15_1RB_low_16QAM

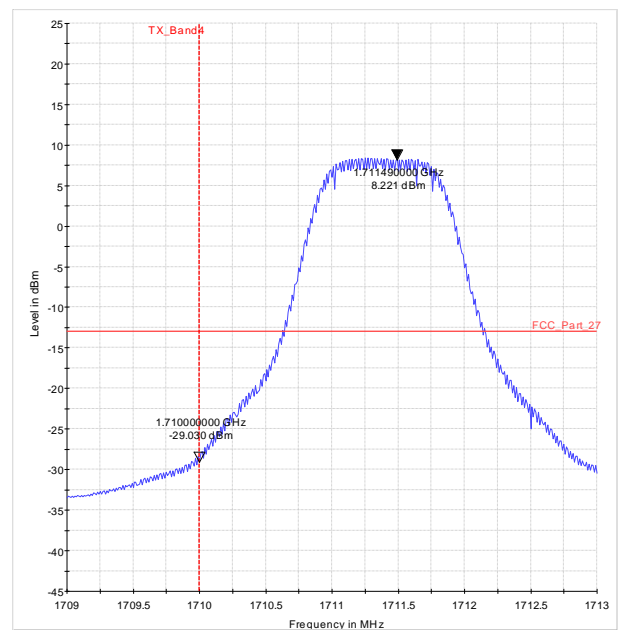


Diagram 67:
37.410b_Ch20025_BW_15_5RBs_16QAM

2.10.1.4. Signal bandwidth 20MHz

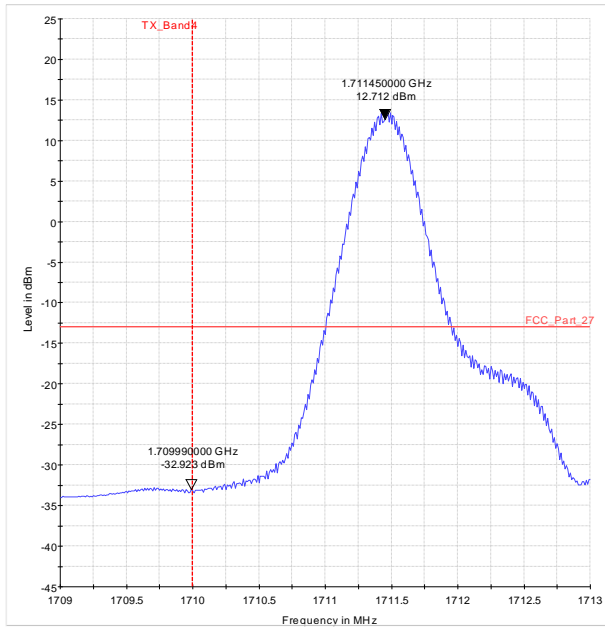


Diagram 68:
37.411a_Ch20050_BW_20_1RB_low_QPSK

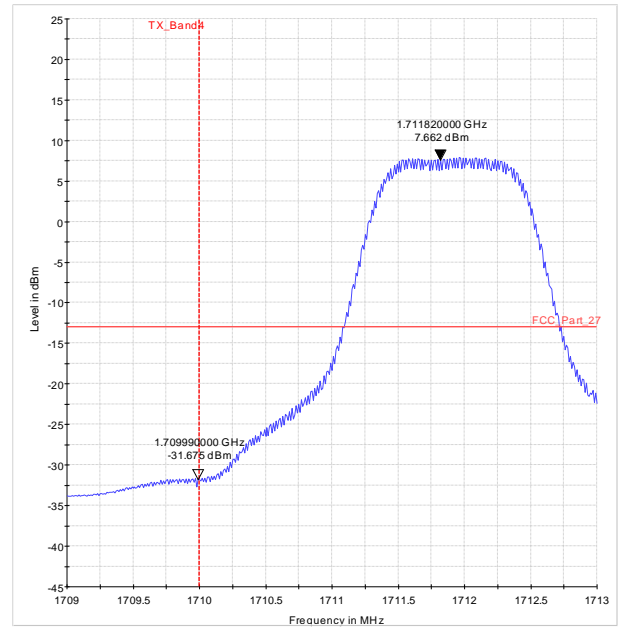


Diagram 70:
37.412a_Ch20050_BW_20_6RBs_QPSK

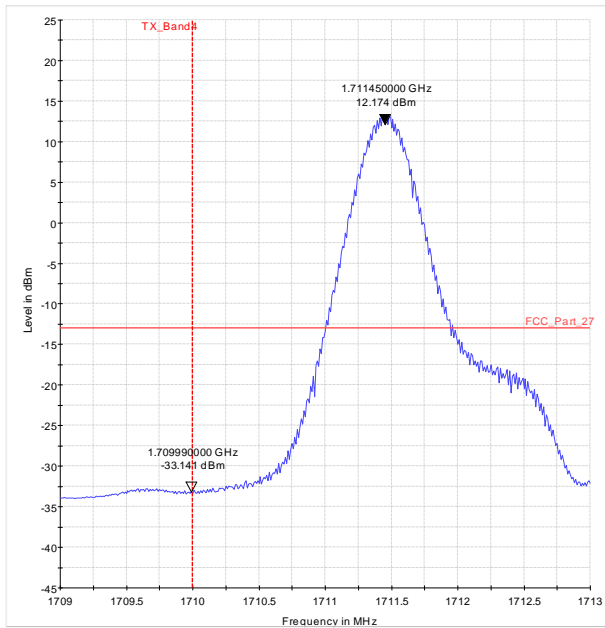


Diagram 69:
37.411b_Ch20050_BW_20_1RB_low_16QAM

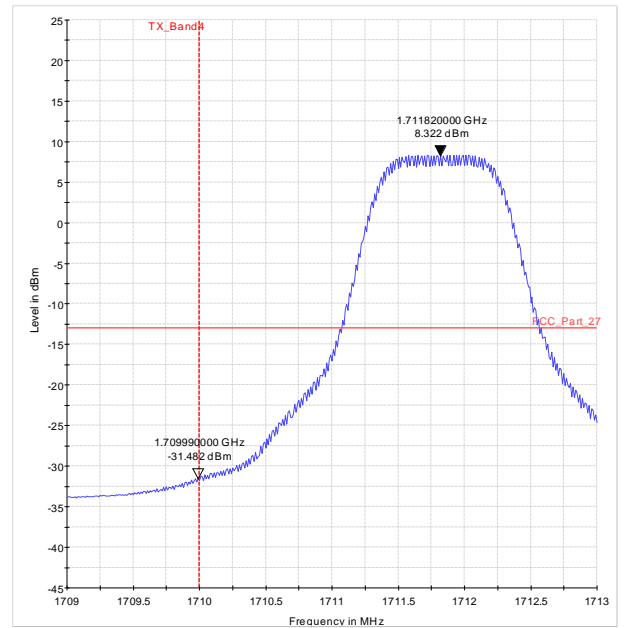


Diagram 71:
37.412b_Ch20050_BW_20_5RBs_16QAM

2.10.2. Conducted emissions – band - edge high channels

2.10.2.1. Signal bandwidth 5MHz

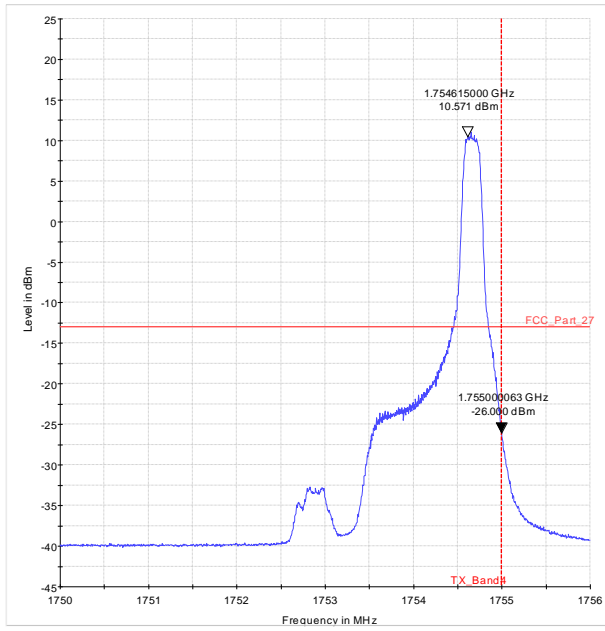


Diagram 72:
37.418a_Ch20375_BW_5_1RB_high_QPSK

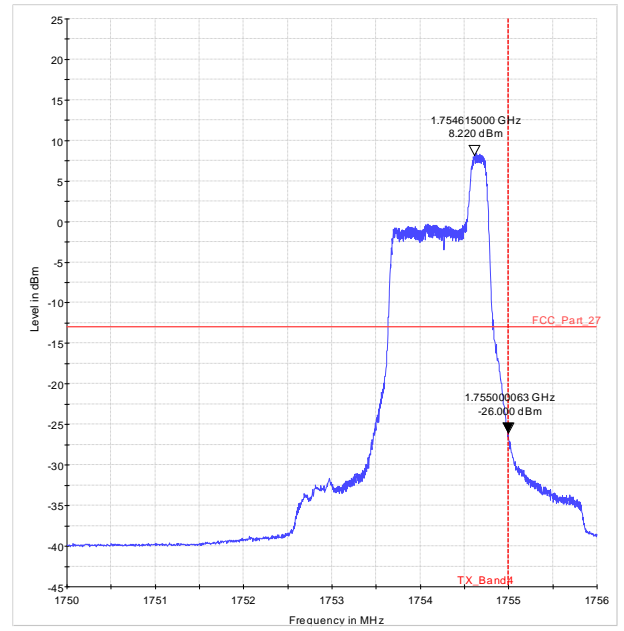


Diagram 74:
37.417a_Ch20375_BW_5_6RBs_QPSK

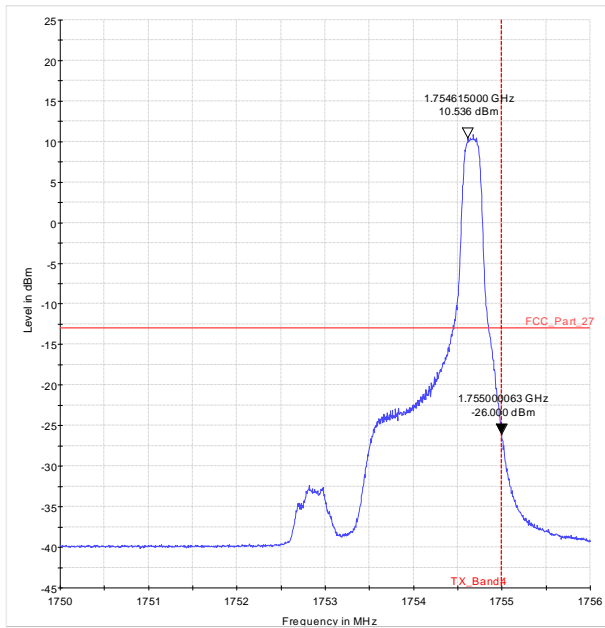


Diagram 73:
37.418b_Ch20375_BW_5_1RB_high_16QAM

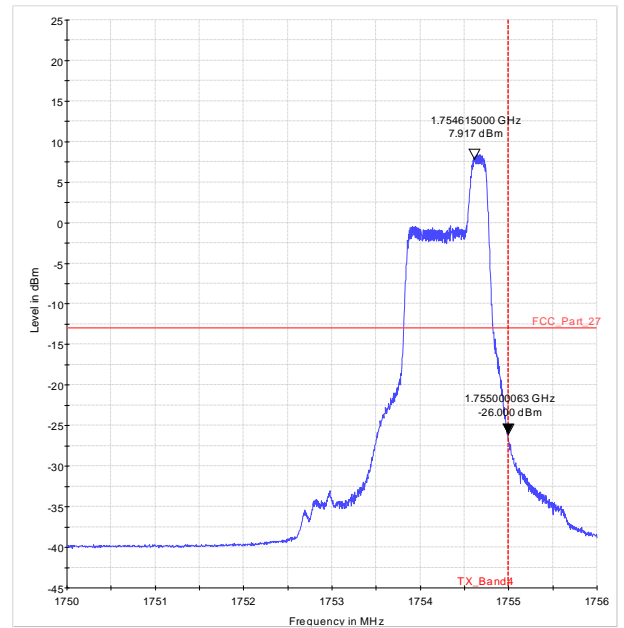


Diagram 75:
37.417b_Ch20375_BW_5_5RBs_16QAM

2.10.2.2. Signal bandwidth 10MHz

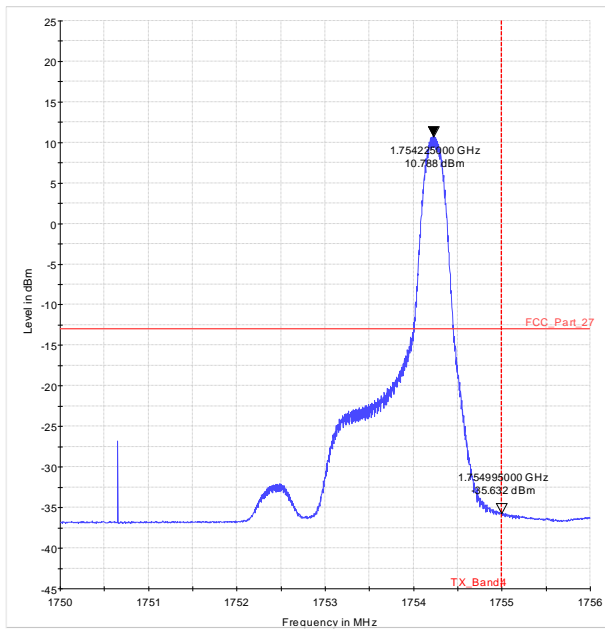


Diagram 76:
37.419a_Ch20350_BW_10_1RB_high_QPSK

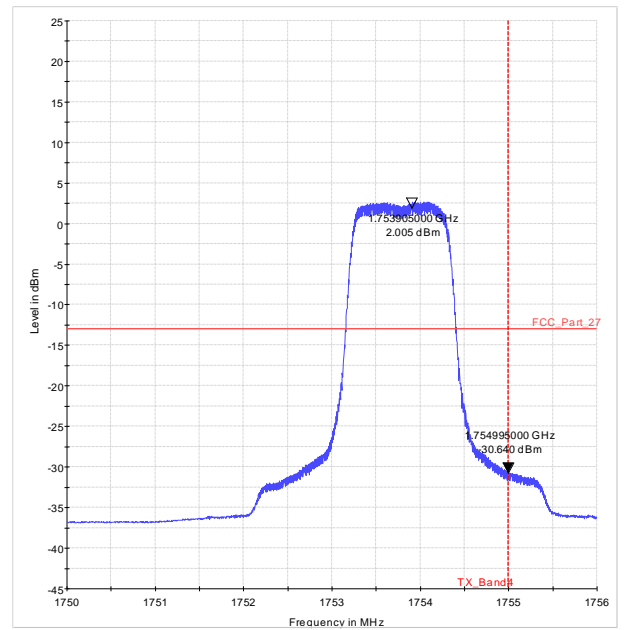


Diagram 78:
37.420a_Ch20350_BW_10_6RBs_QPSK

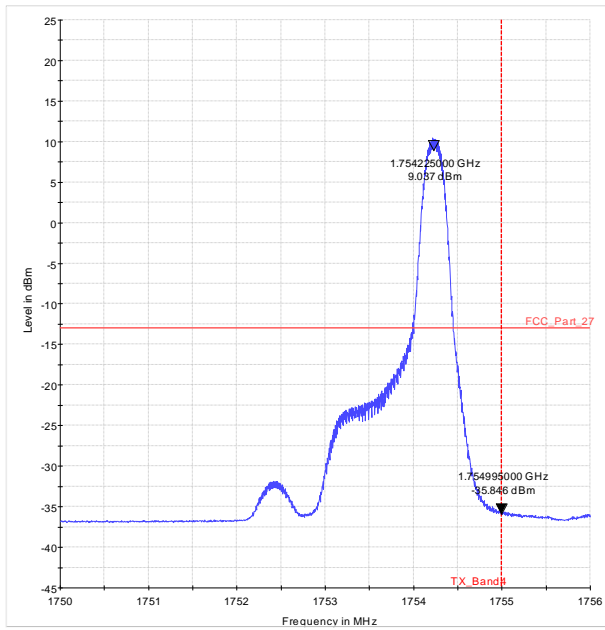


Diagram 77:
37.419b_Ch20350_BW_10_1RB_high_16QAM

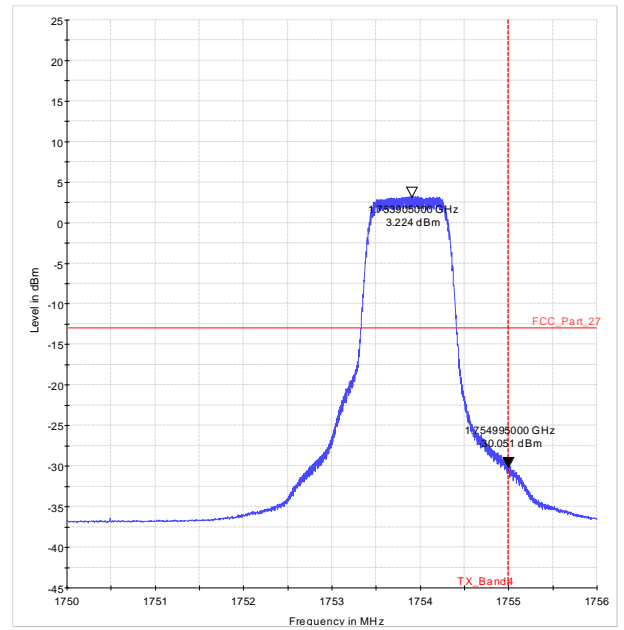


Diagram 79:
37.420b_Ch20350_BW_10_5RBs_16QAM

2.10.2.3. Signal bandwidth 15MHz

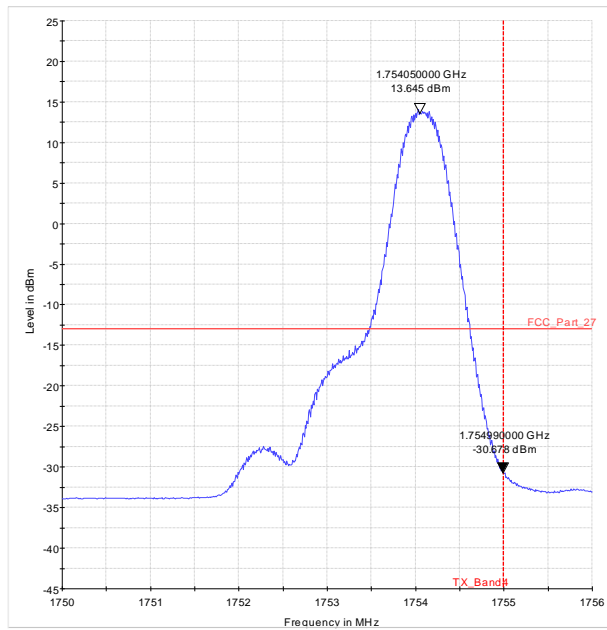


Diagram 80:
37.421a_Ch20325_BW_15_1RB_high_QPSK

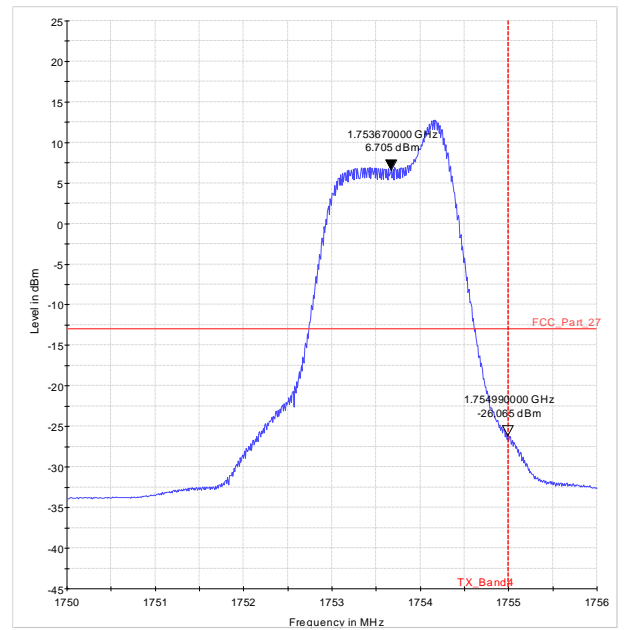


Diagram 82:
37.422a_Ch20325_BW_15_6RBs_QPSK

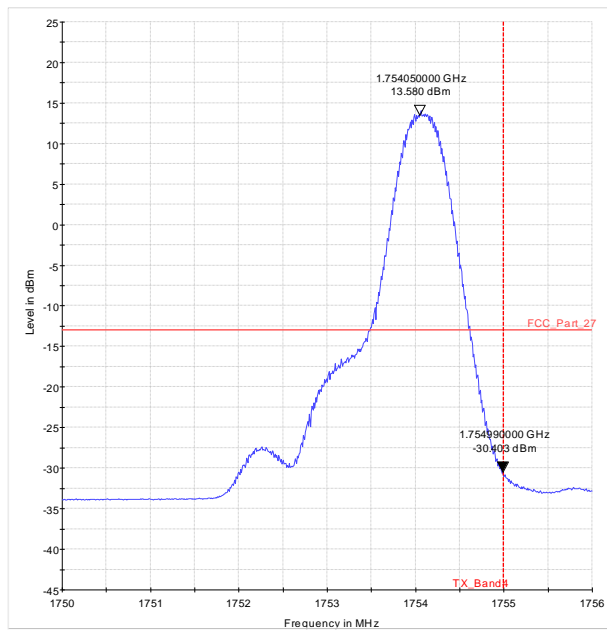


Diagram 81:
37.421b_Ch20325_BW_15_1RB_high_16QAM

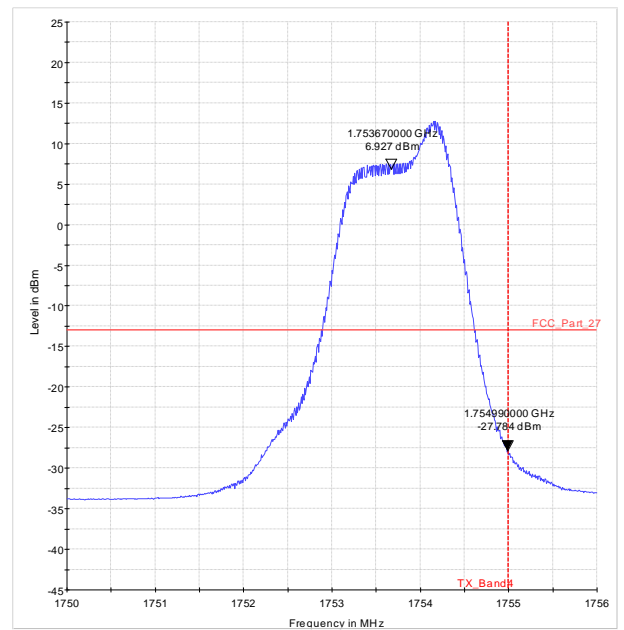


Diagram 83:
37.422b_Ch20325_BW_15_5RBs_16QAM

2.10.2.4. Signal bandwidth 20MHz

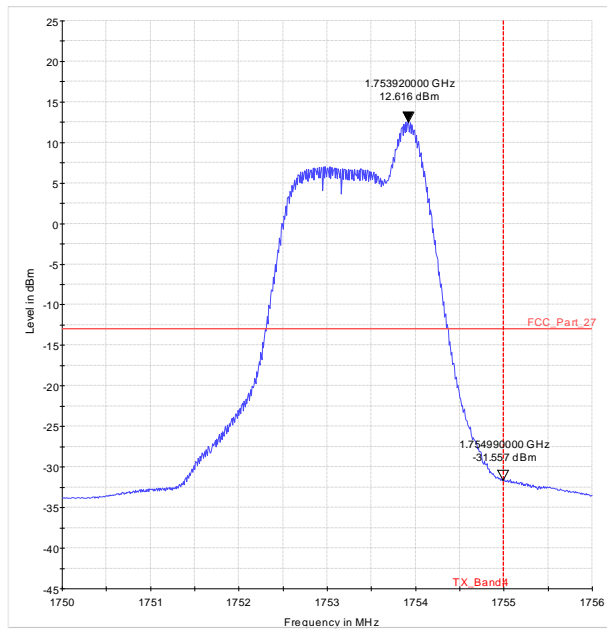


Diagram 84:
37.423a_Ch20300_BW_20_6RB_high_QPSK

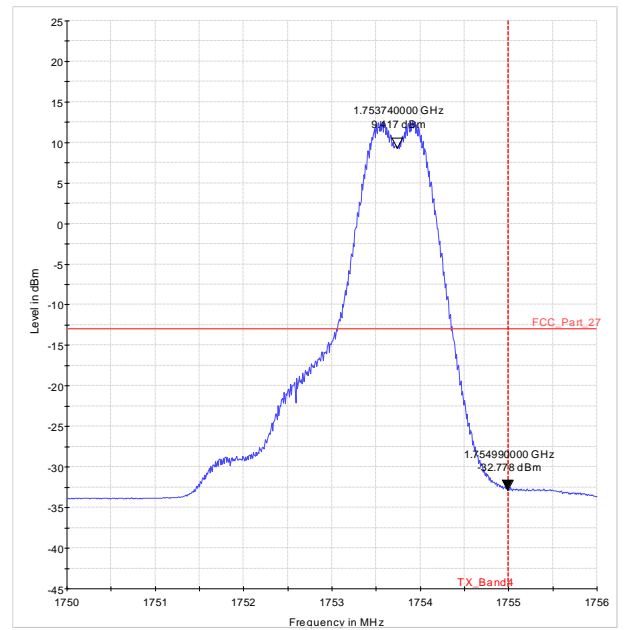


Diagram 86:
37.424a_Ch20300_BW_20_1RBhigh_QPSK

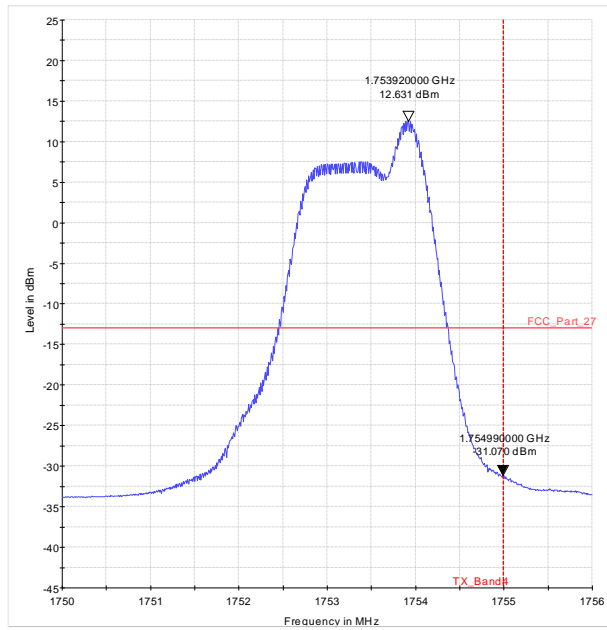


Diagram 85:
37.423b_Ch20300_BW_20_5RB_high_16QAM

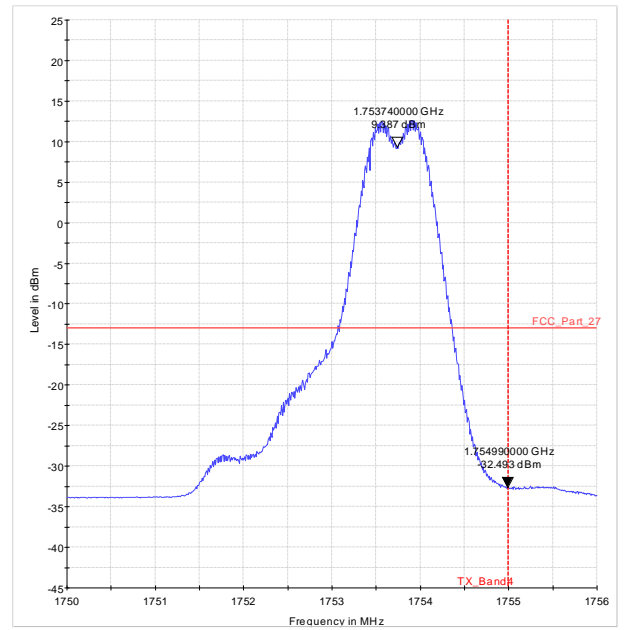


Diagram 87:
37.424b_Ch20300_BW_20_1RBhigh_16QAM

2.11. Conducted emissions – band - edge (LTE Band 13)

2.11.1. Conducted emissions – band - edge low channels

2.11.1.1. Signal bandwidth 5MHz

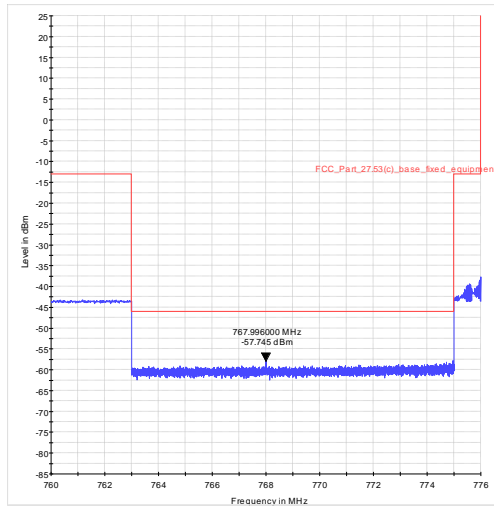


Diagram 88:

37.131a_BE_C_Ch23205_BW5_1RBlow_0NB_Q PSK

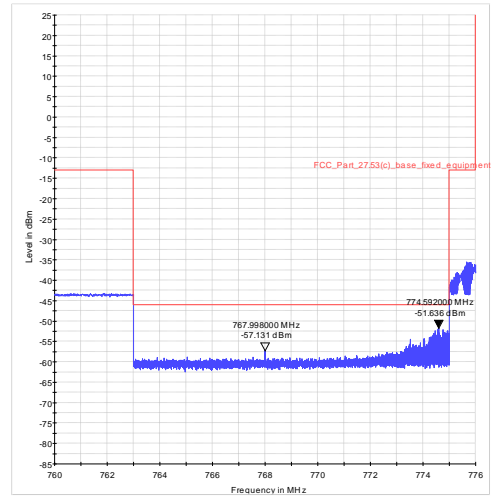


Diagram 90:

37.132a_BE_C_Ch23205_BW5_6RBs_0NB_QPS K

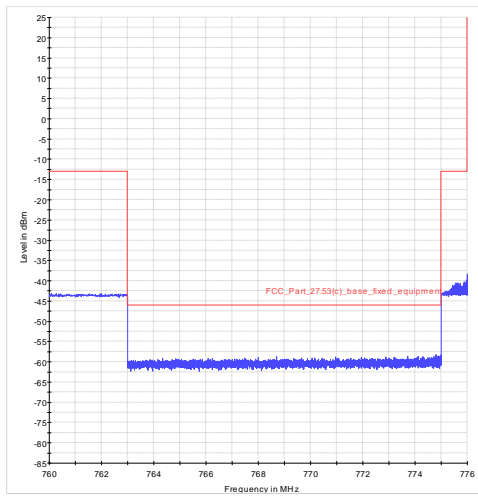


Diagram 89:

37.131b_BE_C_Ch23205_BW5_1RBlow_0NB_16 QAM

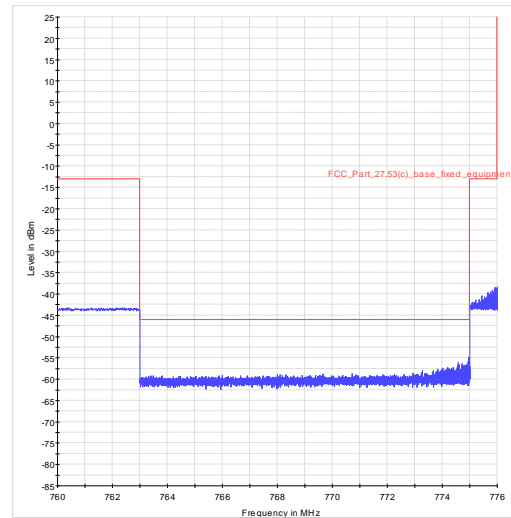


Diagram 91:

37.132b_BE_C_Ch23205_BW5_5RB_0NB_16QA M

2.11.1.2. Signal bandwidth 10MHz

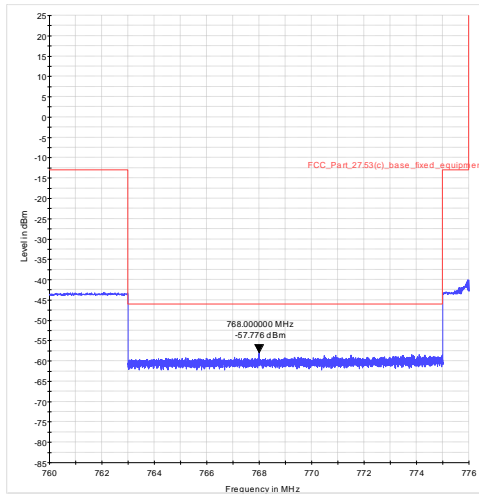


Diagram 92:
37.133a_BE_C_Ch23230_BW10_1RBlow_0NB_Q PSK

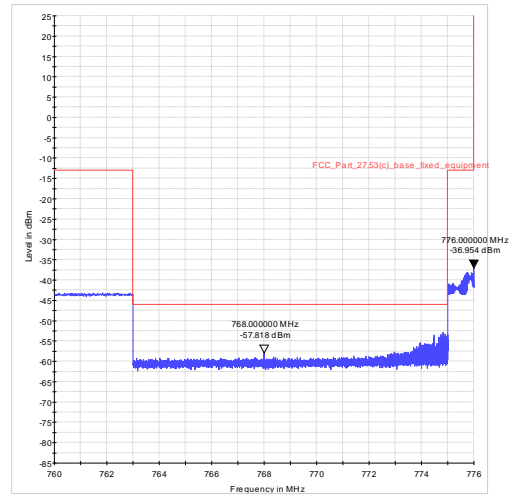


Diagram 94:
37.134a_BE_C_Ch23230_BW10_6RBs_0NB_QPS K

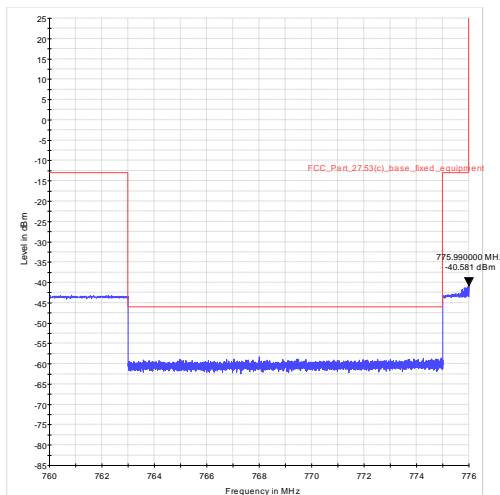


Diagram 93:
37.133b_BE_low_Ch23230_BW10_1RBlow_0NB_16QAM

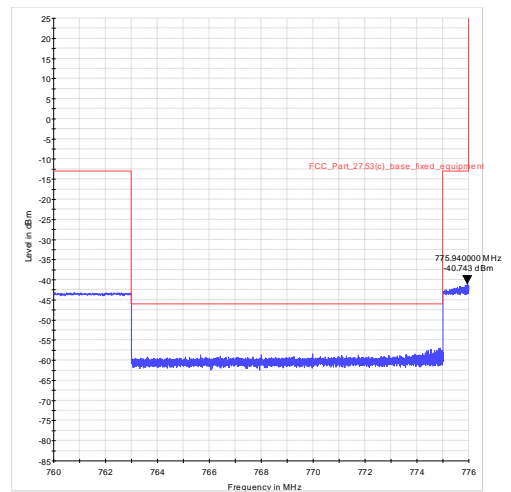


Diagram 95:
37.134b_BE_low_Ch23230_BW10_5RBs_0NB_16QAM

2.11.2. Conducted emissions – band - edge high channels

2.11.2.1. Signal bandwidth 5MHz

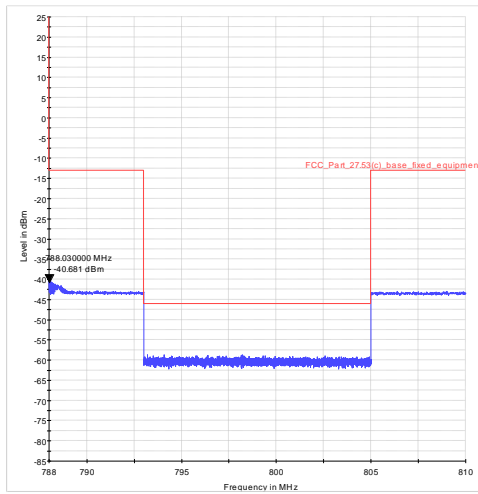


Diagram 96:
37.135a_BE_high_Ch23255_BW5_1RBhigh_QPS
K

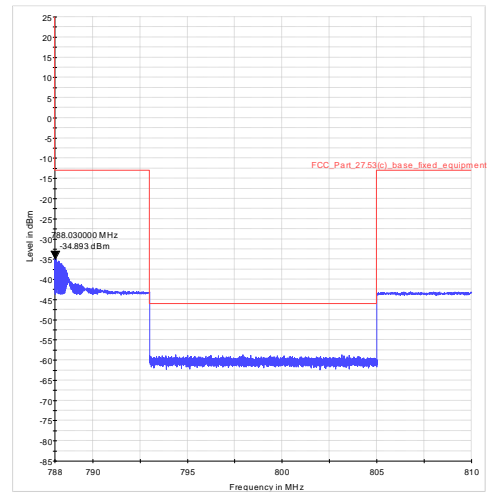


Diagram 98:
37.136a_BE_high_Ch23255_BW5_6RBs_NB3_Q
PSK

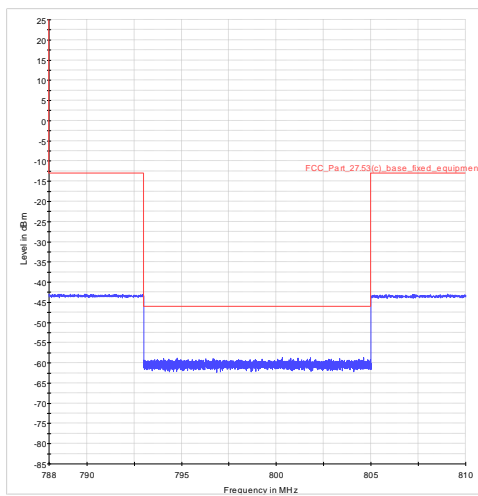


Diagram 97:
37.135b_BE_high_Ch23255_BW5_1RBhigh_NB3
_16QAM

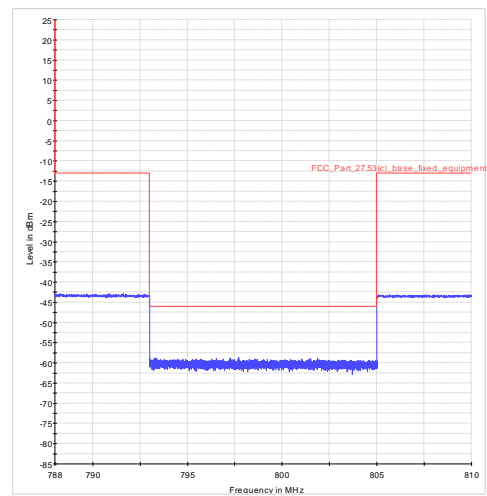


Diagram 99:
37.136b_BE_high_Ch23255_BW5_5RBs_NB3_16
QAM

2.11.2.2. Signal bandwidth 10MHz

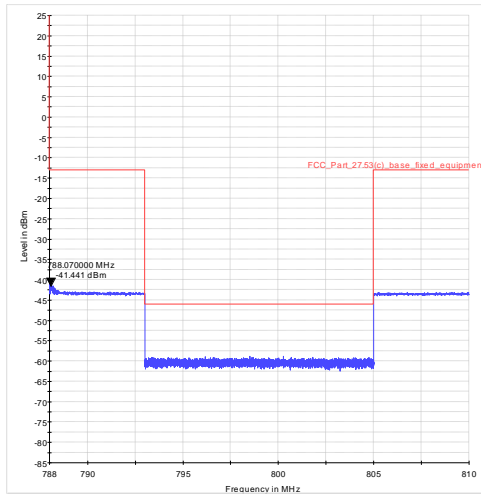


Diagram 100:
37.137a_BE_high_C_Ch23230_BW10_1RBhigh_QP
SK

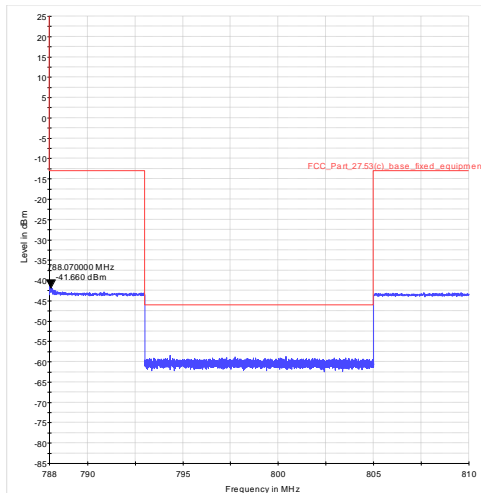


Diagram 101:
37.137b_BE_high_C_Ch23230_BW10_1RBhigh_7N
B_16QAM

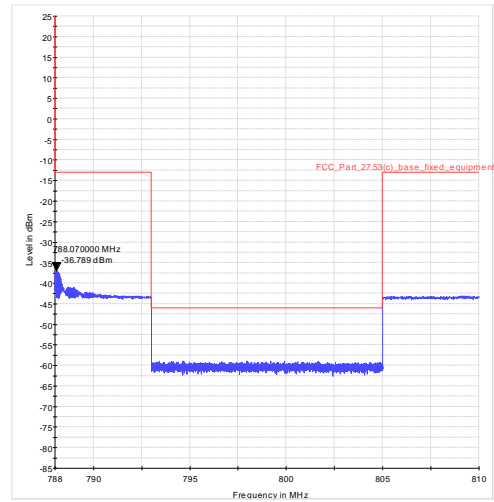


Diagram 102:
37.138a_BE_high_C_Ch23230_BW10_6RBs_QPSK

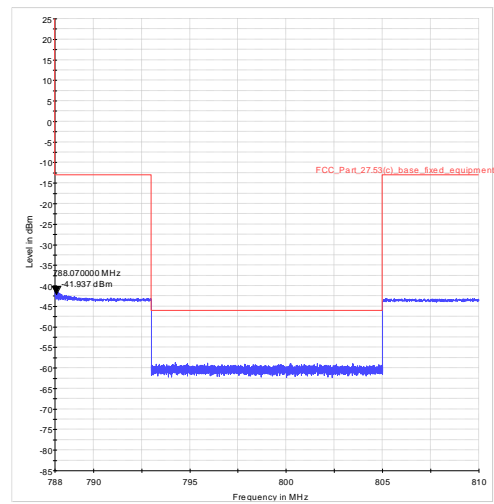


Diagram 103:
37.138b_BE_high_C_Ch23230_BW10_5RB_7NB_1
6QAM