

Test data, continued

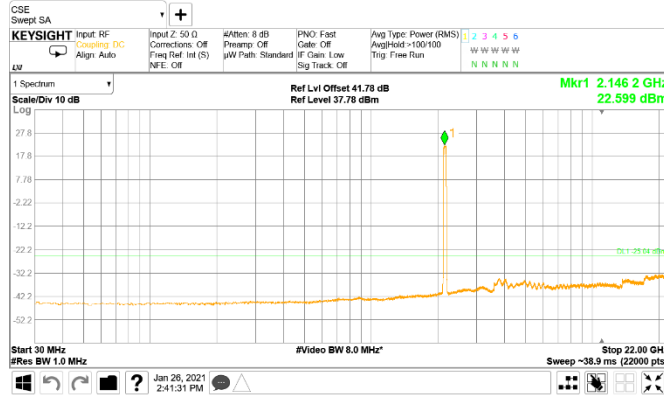


Figure 8.3-35: Conducted spurious emissions of 20 MHz three mid channels, three-carrier operation

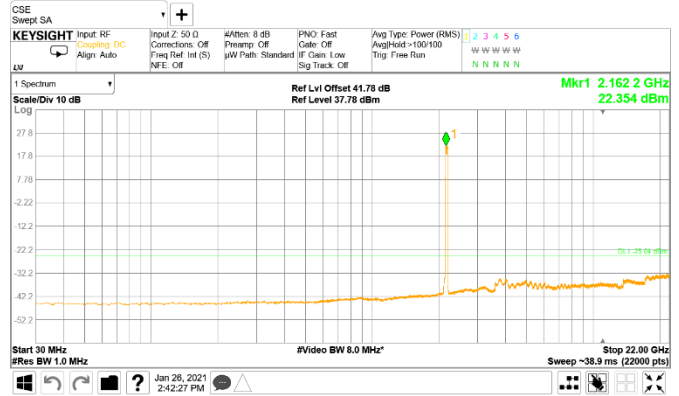


Figure 8.3-36: Conducted spurious emissions of 20 MHz three top channels, three-carrier operation

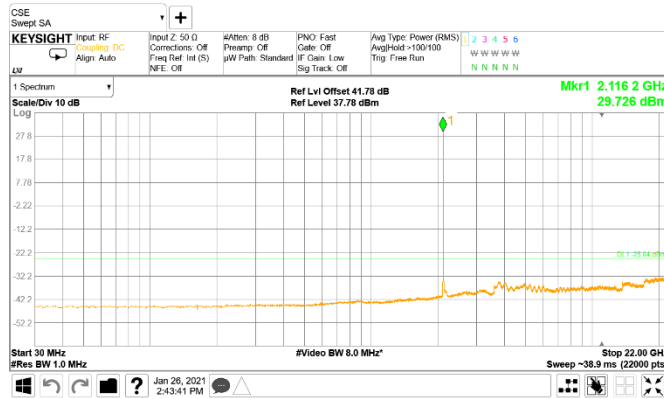


Figure 8.3-37: Conducted spurious emissions of 5 MHz two low channels, LTE + NR operation

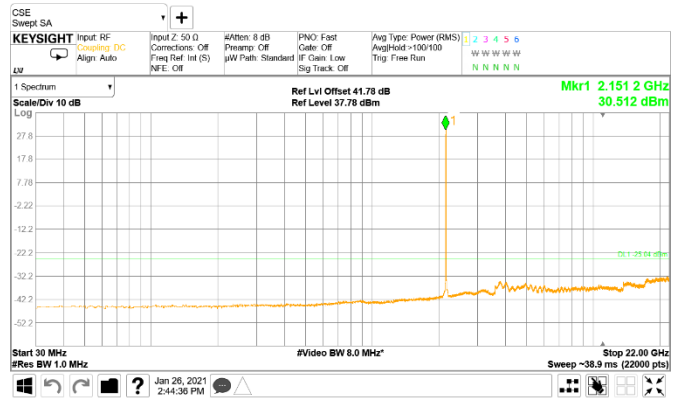


Figure 8.3-38: Conducted spurious emissions of 5 MHz two mid channels, LTE + NR operation

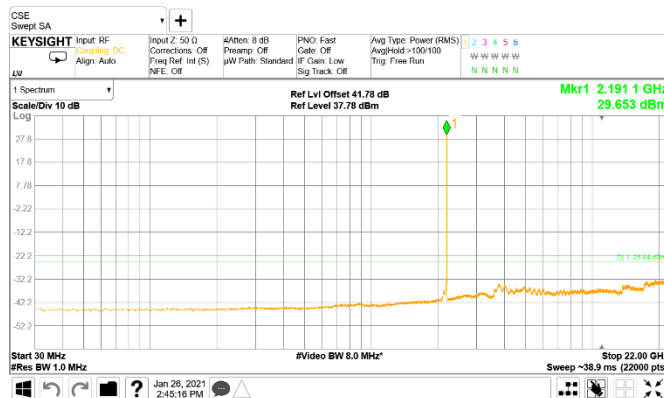


Figure 8.3-39: Conducted spurious emissions of 5 MHz two top channels, LTE + NR operation

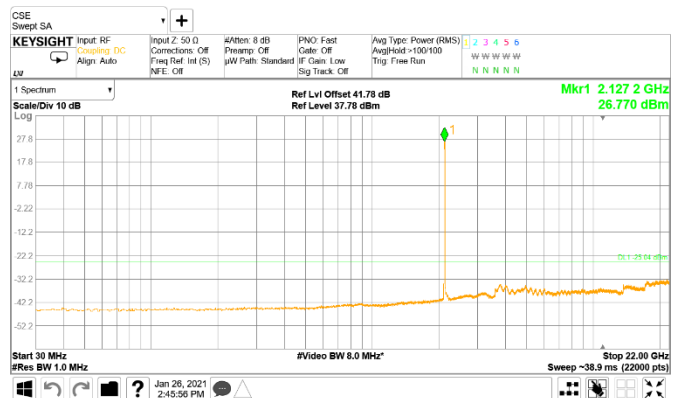


Figure 8.3-40: Conducted spurious emissions of 10 MHz two low channels, LTE + NR operation

Test data, continued

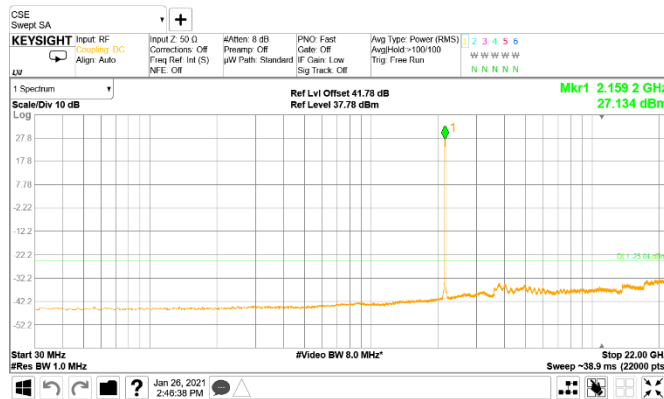


Figure 8.3-41: Conducted spurious emissions of 10 MHz two mid channels, LTE + NR operation

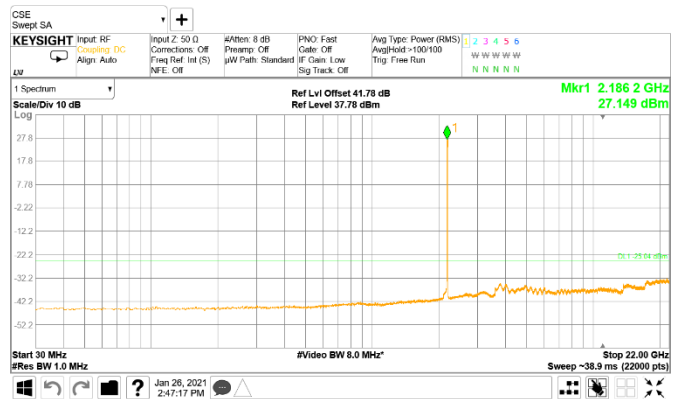


Figure 8.3-42: Conducted spurious emissions of 10 MHz two top channels, LTE + NR operation

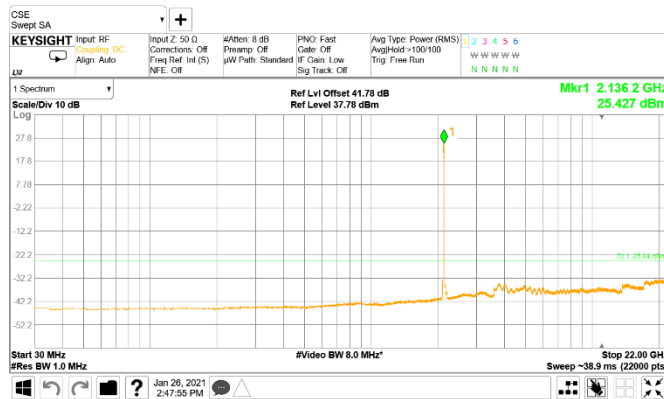


Figure 8.3-43: Conducted spurious emissions of 15 MHz two low channels, LTE + NR operation

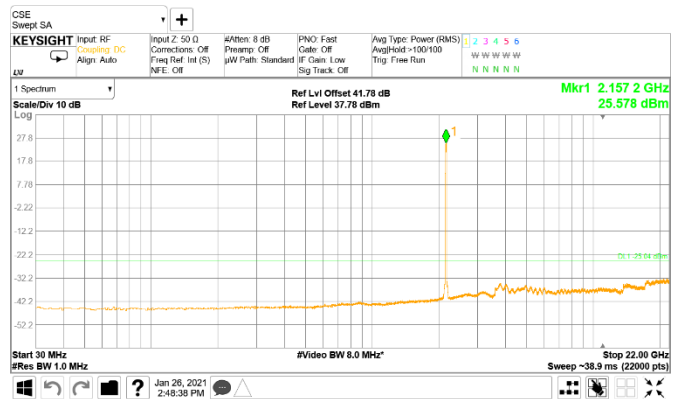


Figure 8.3-44: Conducted spurious emissions of 15 MHz two mid channels, LTE + NR operation

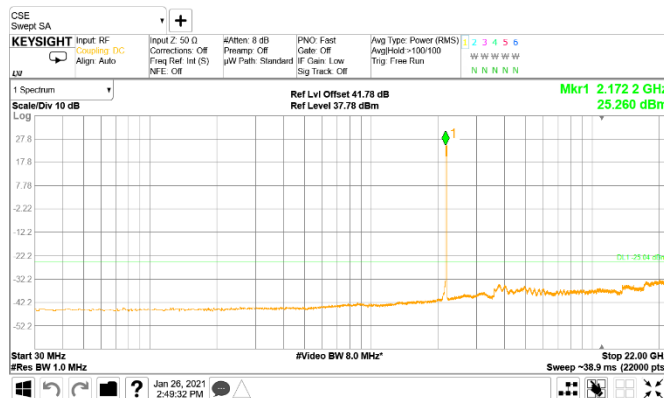


Figure 8.3-45: Conducted spurious emissions of 15 MHz two top channels, LTE + NR operation

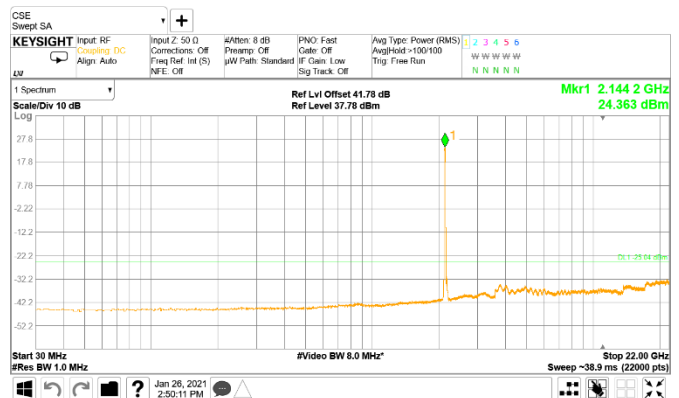


Figure 8.3-46: Conducted spurious emissions of 20 MHz two low channels, LTE + NR operation

Test data, continued

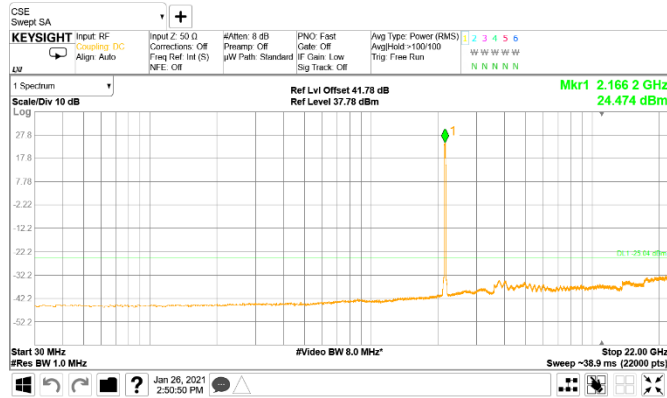


Figure 8.3-47: Conducted spurious emissions of 20 MHz two mid channels, LTE + NR operation

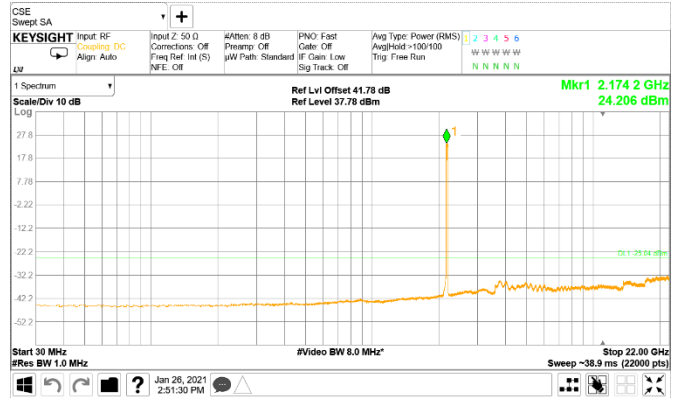


Figure 8.3-48: Conducted spurious emissions of 20 MHz two top channels, LTE + NR operation

Test data, continued

On the plots below the measured "Total Channel Power" value must be lower than -25.04 dBm

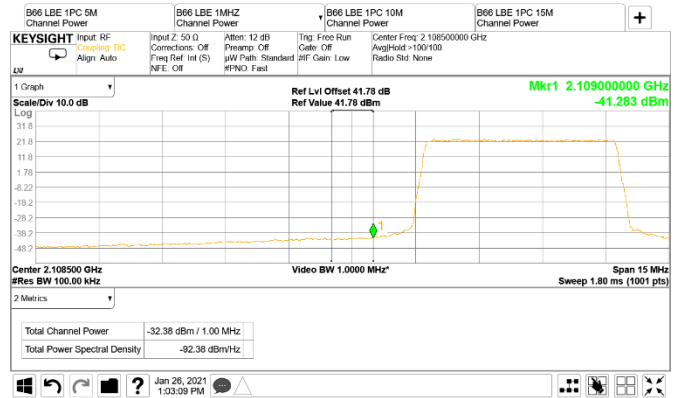
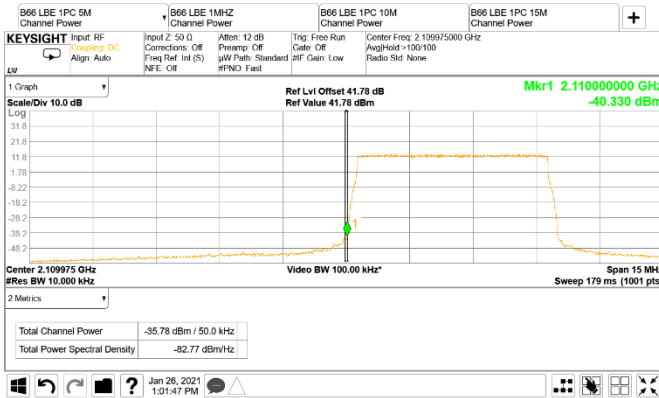


Figure 8.3-49: Conducted band edge emission at 2110 MHz, 5 MHz channel single-carrier operation (RBW = 1% of EBW)

Figure 8.3-50: Conducted band edge emission at 2109 MHz, 5 MHz channel single-carrier operation (RBW = 1 MHz)

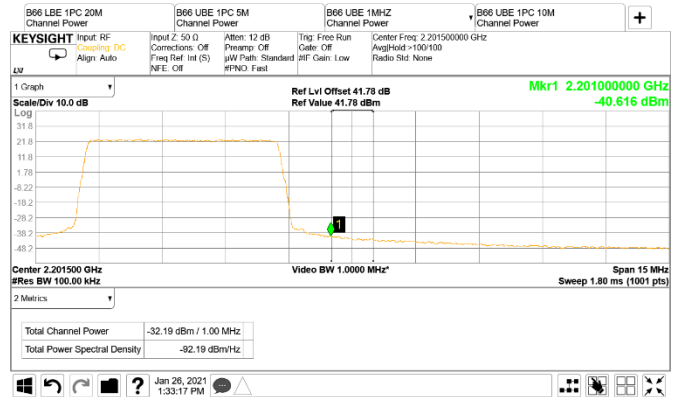
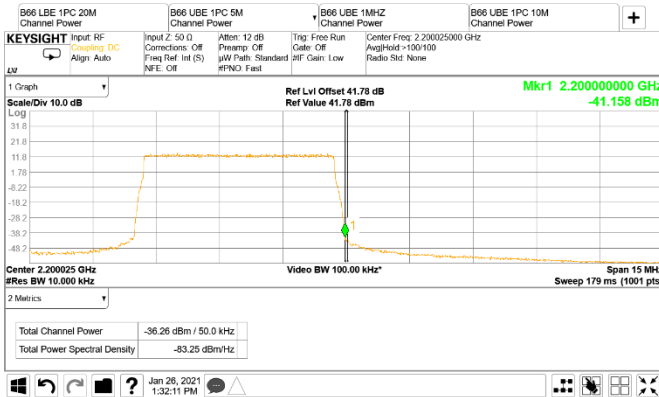


Figure 8.3-51: Conducted band edge emission at 2200 MHz, 5 MHz channel single-carrier operation (RBW = 1% of EBW)

Figure 8.3-52: Conducted band edge emission at 2201 MHz, 5 MHz channel single-carrier operation (RBW = 1 MHz)

Test data, continued

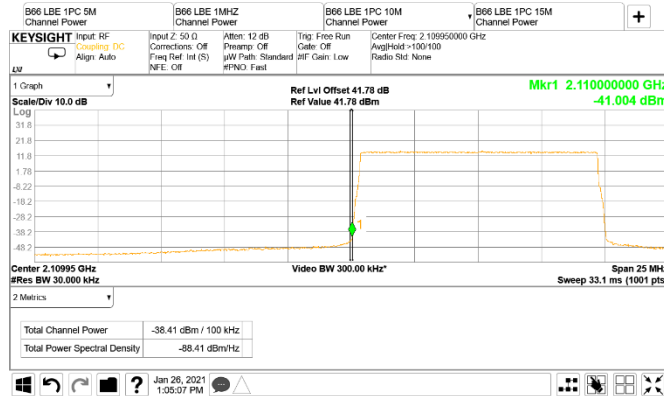


Figure 8.3-53: Conducted band edge emission at 2110 MHz, 10 MHz channel single-carrier operation (RBW = 1% of EBW)

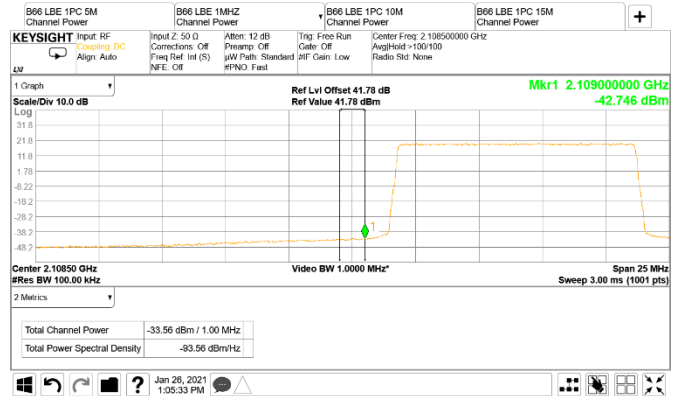


Figure 8.3-54: Conducted band edge emission at 2109 MHz, 10 MHz channel single-carrier operation (RBW = 1 MHz)

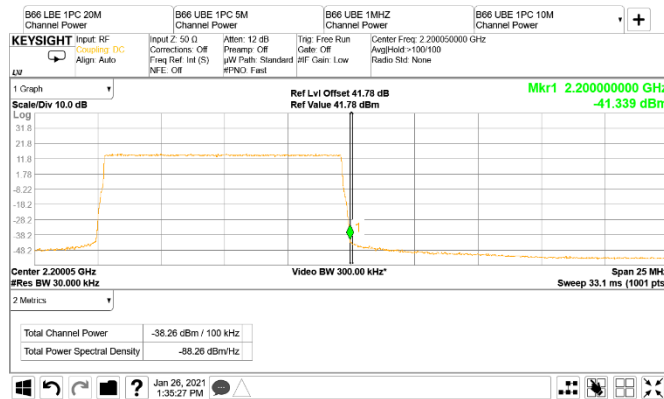
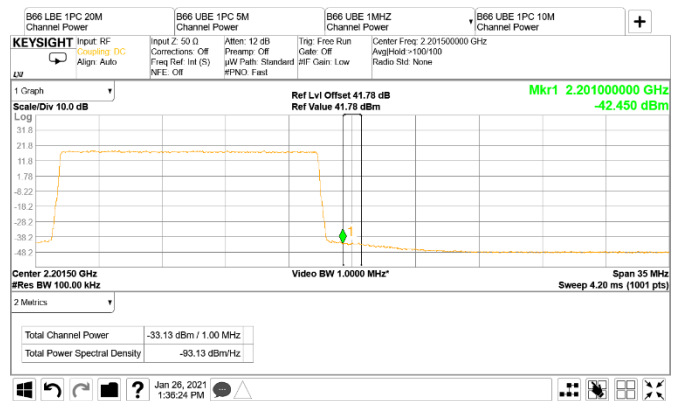
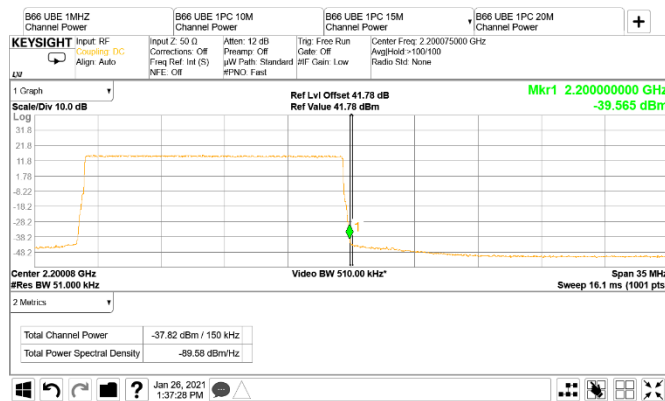
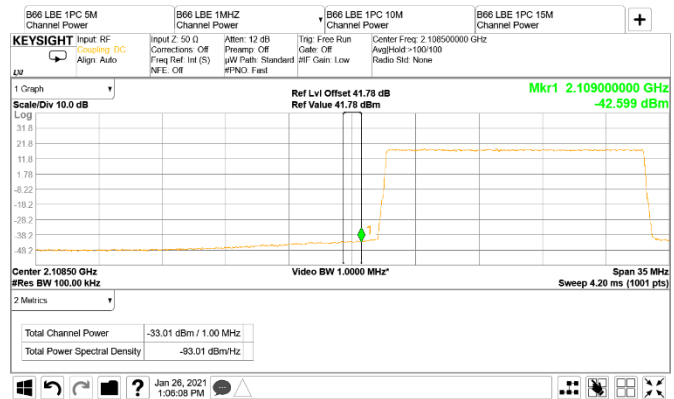
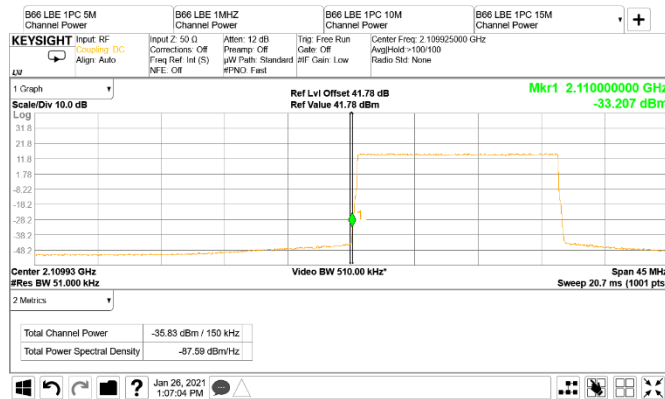


Figure 8.3-55: Conducted band edge emission at 2200 MHz, 10 MHz channel single-carrier operation (RBW = 1% of EBW)

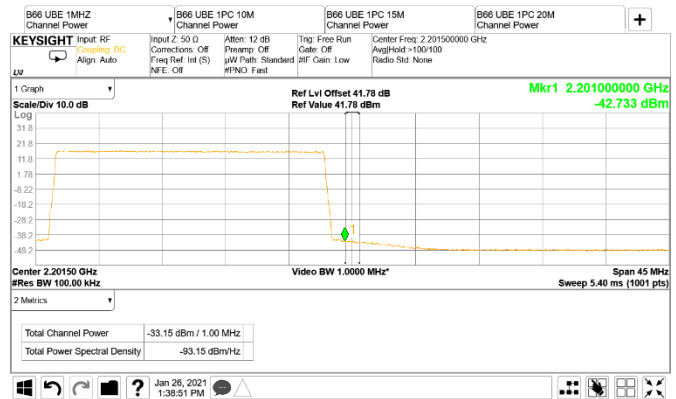
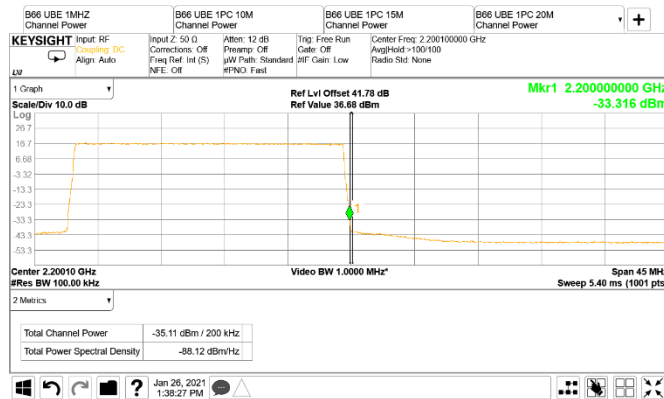
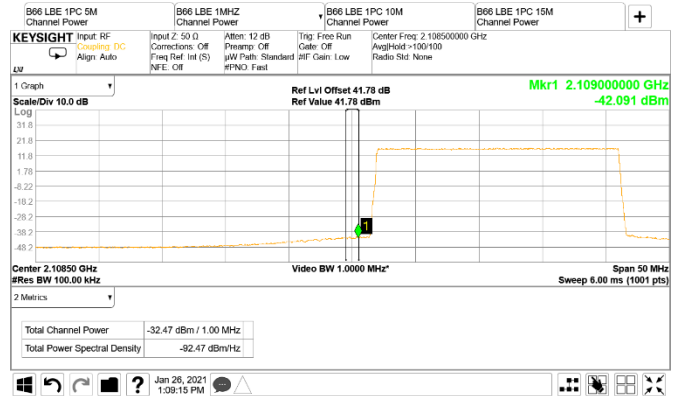
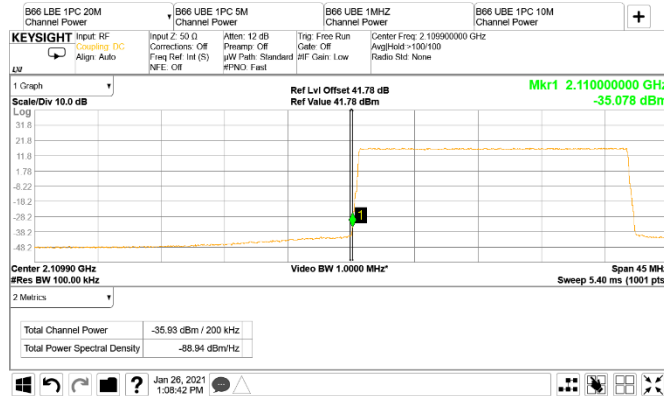


Figure 8.3-56: Conducted band edge emission at 2201 MHz, 10 MHz channel single-carrier operation (RBW = 1 MHz)

Test data, continued



Test data, continued



Test data, continued

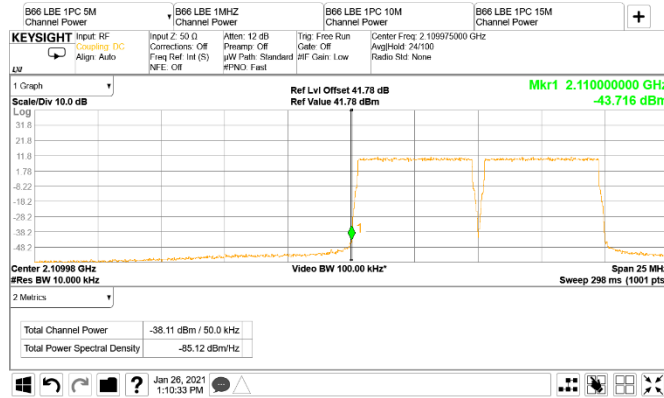


Figure 8.3-65: Conducted band edge emission at 2110 MHz, 5 MHz channel two-carrier operation (RBW = 1% of EBW)

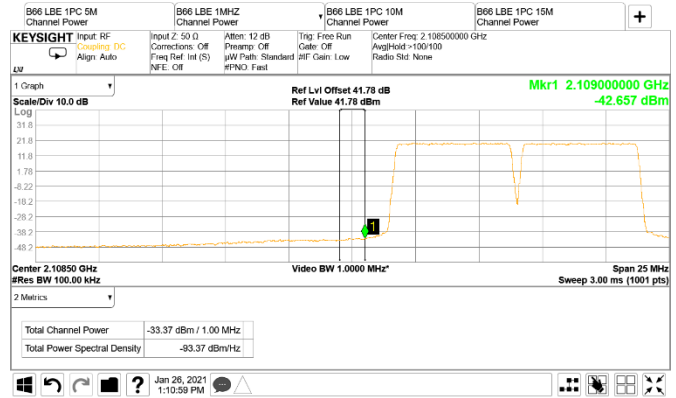


Figure 8.3-66: Conducted band edge emission at 2109 MHz, 5 MHz channel two-carrier operation (RBW = 1 MHz)

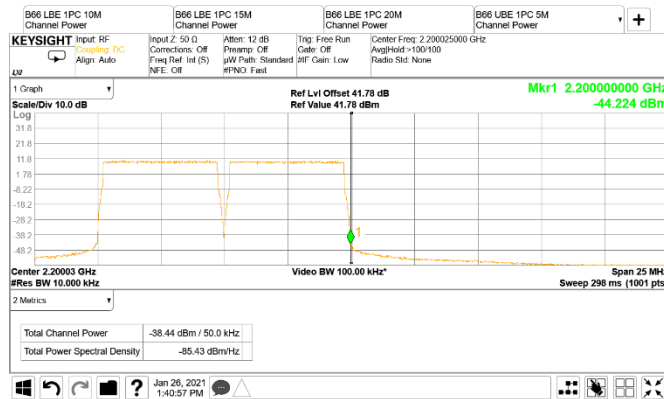


Figure 8.3-67: Conducted band edge emission at 2200 MHz, 5 MHz channel two-carrier operation (RBW = 1% of EBW)



Figure 8.3-68: Conducted band edge emission at 2201 MHz, 5 MHz channel two-carrier operation (RBW = 1 MHz)



Test data, continued

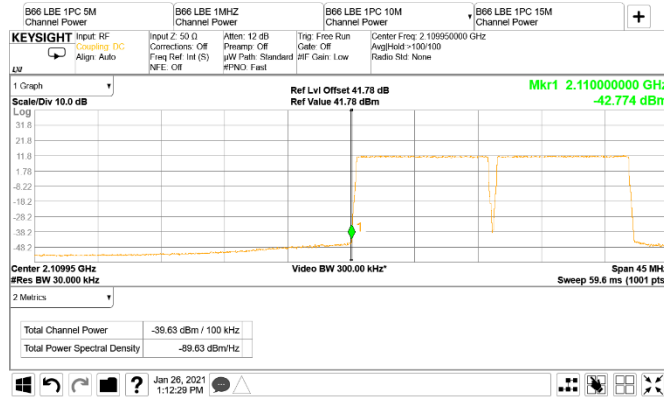


Figure 8.3-69: Conducted band edge emission at 2110 MHz, 10 MHz channel two-carrier operation (RBW = 1% of EBW)

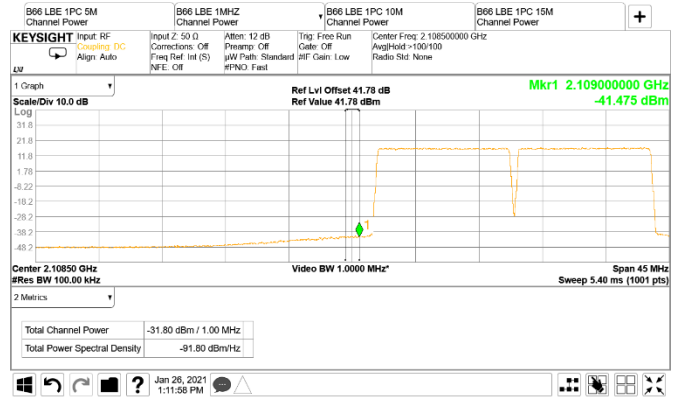


Figure 8.3-70: Conducted band edge emission at 2109 MHz, 10 MHz channel two-carrier operation (RBW = 1 MHz)

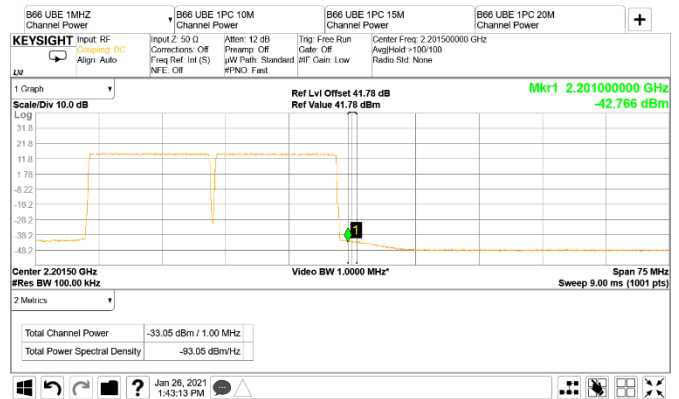
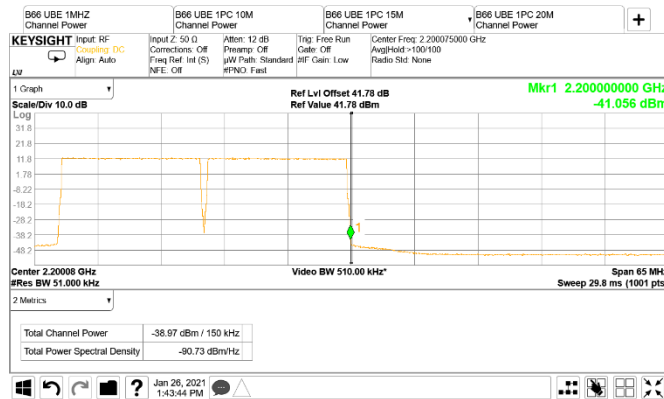
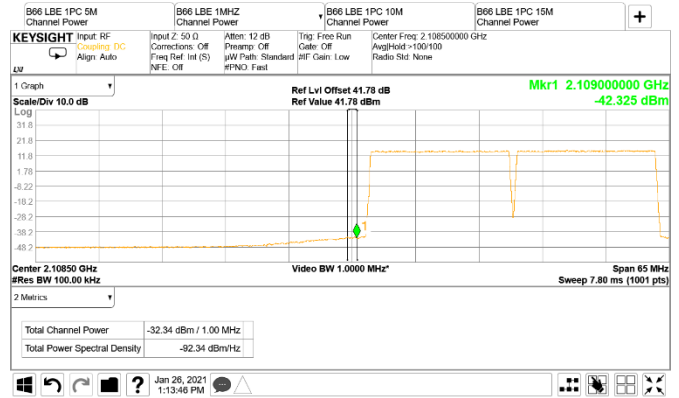


Figure 8.3-71: Conducted band edge emission at 2200 MHz, 10 MHz channel two-carrier operation (RBW = 1% of EBW)



Figure 8.3-72: Conducted band edge emission at 2201 MHz, 10 MHz channel two-carrier operation (RBW = 1 MHz)

Test data, continued



Test data, continued



Figure 8.3-77: Conducted band edge emission at 2110 MHz, 20 MHz channel two-carrier operation (RBW = 1% of EBW)

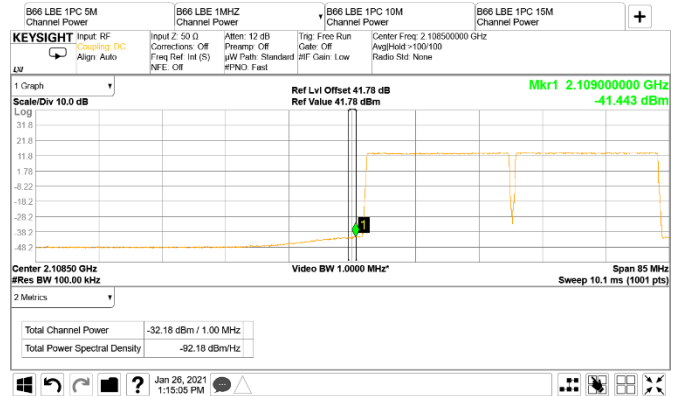


Figure 8.3-78: Conducted band edge emission at 2109 MHz, 20 MHz channel two-carrier operation (RBW = 1 MHz)

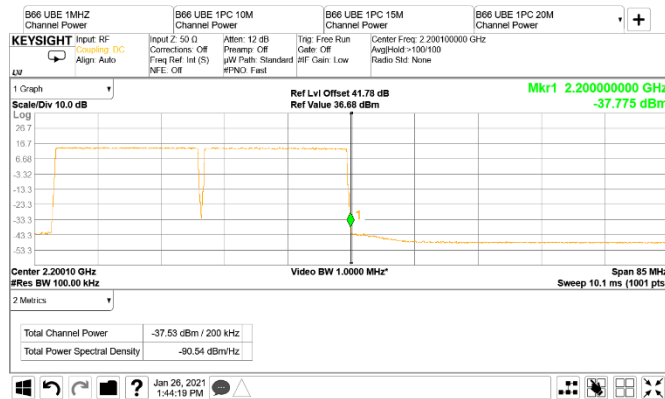


Figure 8.3-79: Conducted band edge emission at 2200 MHz, 20 MHz channel two-carrier operation (RBW = 1% of EBW)

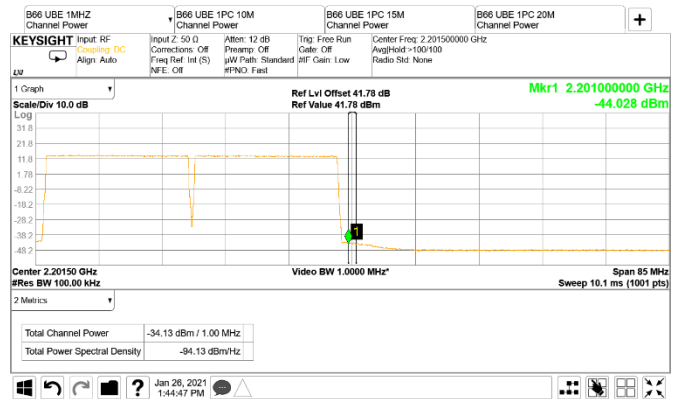
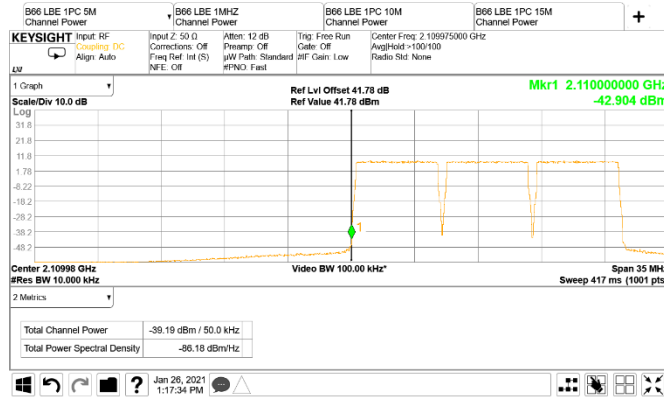
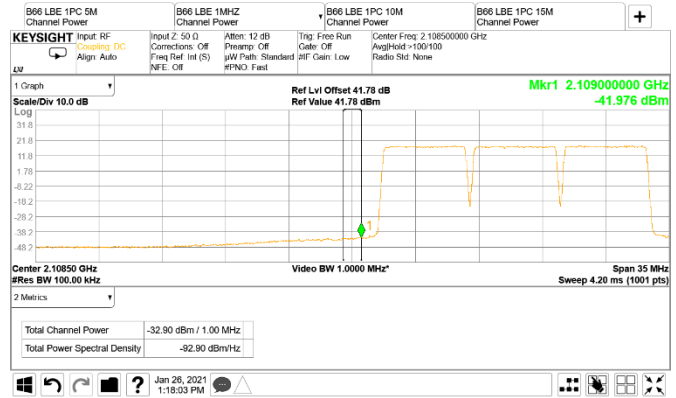


Figure 8.3-80: Conducted band edge emission at 2201 MHz, 20 MHz channel two-carrier operation (RBW = 1 MHz)

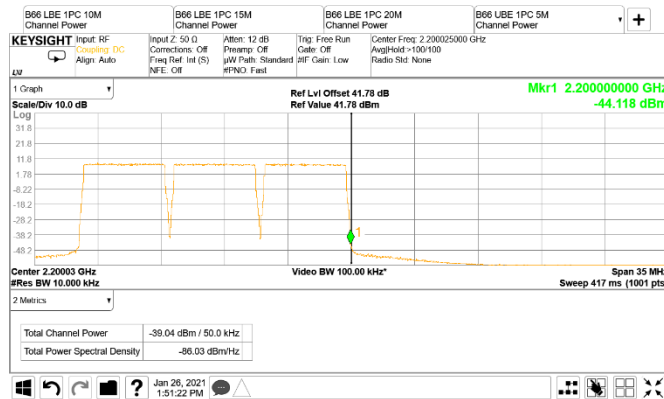
Test data, continued



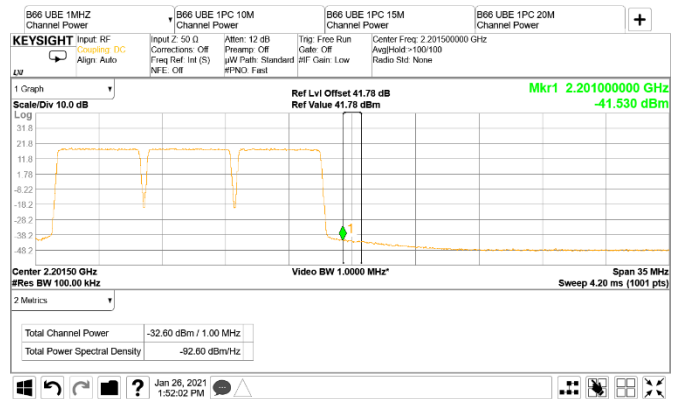
**Figure 8.3-81:** Conducted band edge emission at 2110 MHz, 5 MHz channel tree-carrier operation (RBW = 1% of EBW)



**Figure 8.3-82:** Conducted band edge emission at 2109 MHz, 5 MHz channel tree-carrier operation (RBW = 1 MHz)



**Figure 8.3-83:** Conducted band edge emission at 2200 MHz, 5 MHz channel tree-carrier operation (RBW = 1% of EBW)



**Figure 8.3-84:** Conducted band edge emission at 2201 MHz, 5 MHz channel tree-carrier operation (RBW = 1 MHz)

Test data, continued



Figure 8.3-85: Conducted band edge emission at 2110 MHz, 10 MHz channel tree-carrier operation (RBW = 1% of EBW)

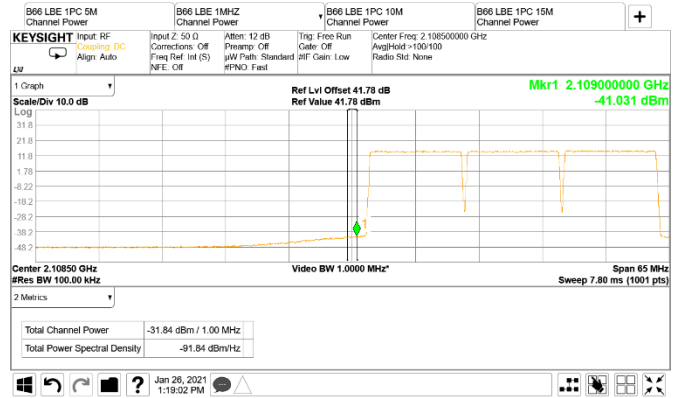


Figure 8.3-86: Conducted band edge emission at 2109 MHz, 10 MHz channel tree-carrier operation (RBW = 1 MHz)



Figure 8.3-87: Conducted band edge emission at 2200 MHz, 10 MHz channel tree-carrier operation (RBW = 1% of EBW)



Figure 8.3-88: Conducted band edge emission at 2201 MHz, 10 MHz channel tree-carrier operation (RBW = 1 MHz)

Test data, continued

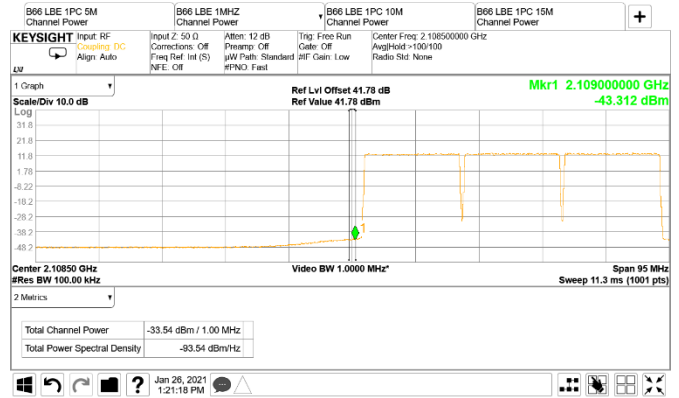
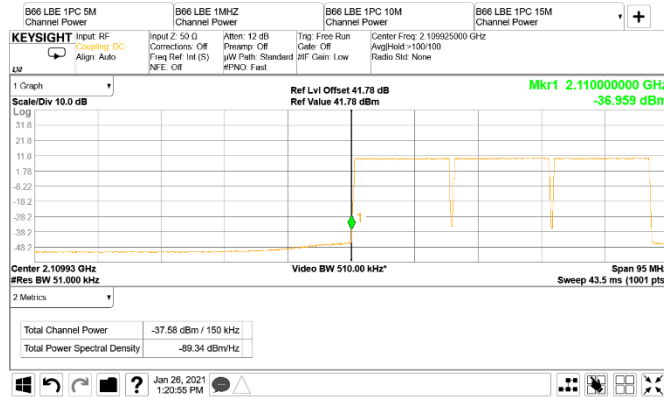


Figure 8.3-89: Conducted band edge emission at 2110 MHz, 15 MHz channel tree-carrier operation (RBW = 1% of EBW)

Figure 8.3-90: Conducted band edge emission at 2109 MHz, 15 MHz channel tree-carrier operation (RBW = 1 MHz)

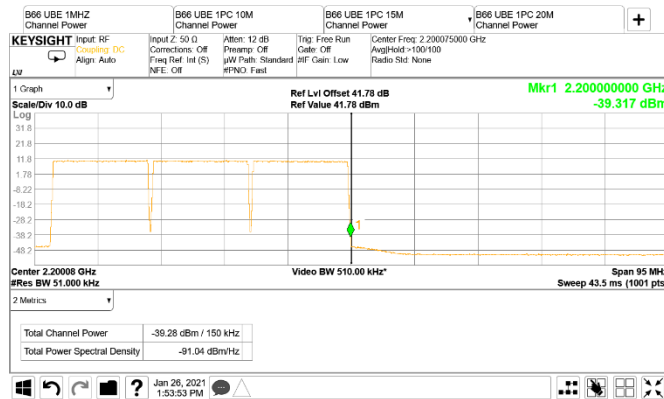


Figure 8.3-91: Conducted band edge emission at 2200 MHz, 15 MHz channel tree-carrier operation (RBW = 1% of EBW)

Figure 8.3-92: Conducted band edge emission at 2201 MHz, 15 MHz channel tree-carrier operation (RBW = 1 MHz)

Test data, continued

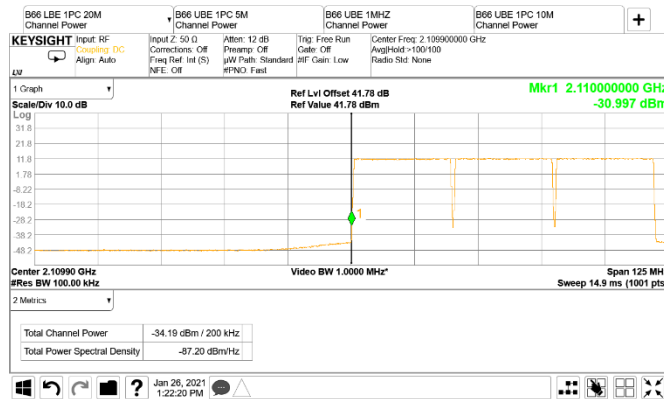


Figure 8.3-93: Conducted band edge emission at 2110 MHz, 20 MHz channel tree-carrier operation (RBW = 1% of EBW)

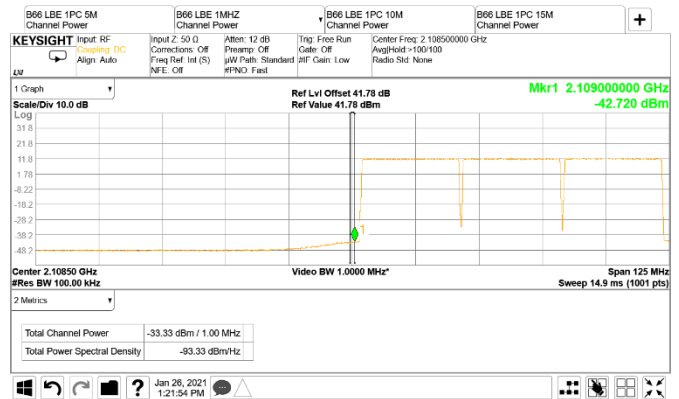


Figure 8.3-94: Conducted band edge emission at 2109 MHz, 20 MHz channel tree-carrier operation (RBW = 1 MHz)

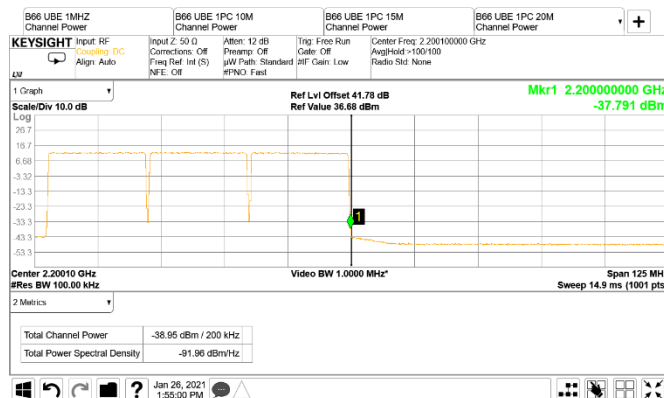


Figure 8.3-95: Conducted band edge emission at 2200 MHz, 20 MHz channel tree-carrier operation (RBW = 1% of EBW)

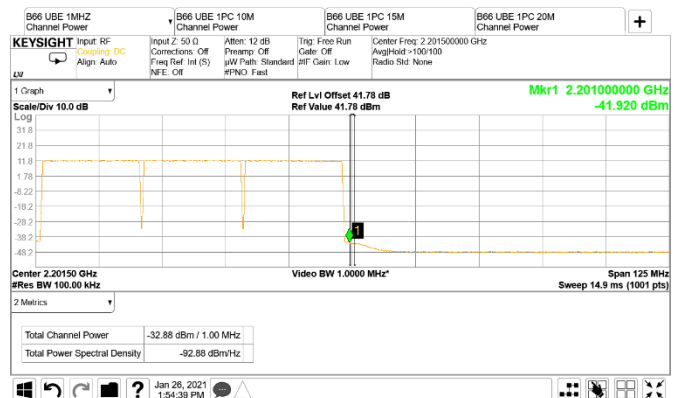


Figure 8.3-96: Conducted band edge emission at 2201 MHz, 20 MHz channel tree-carrier operation (RBW = 1 MHz)

Test data, continued

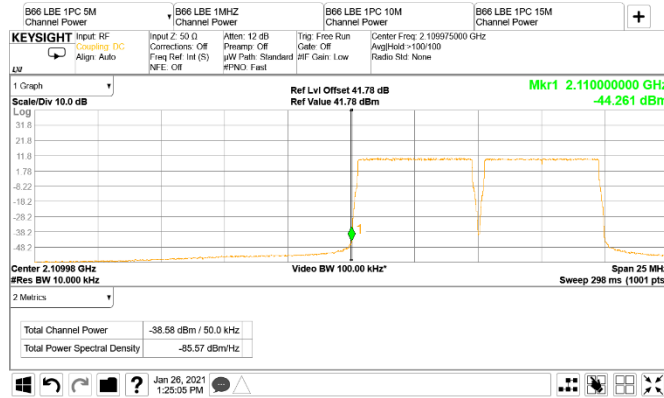


Figure 8.3-97: Conducted band edge emission at 2110 MHz, 5 MHz channel two-carrier LTE + NR operation (RBW = 1% of EBW)

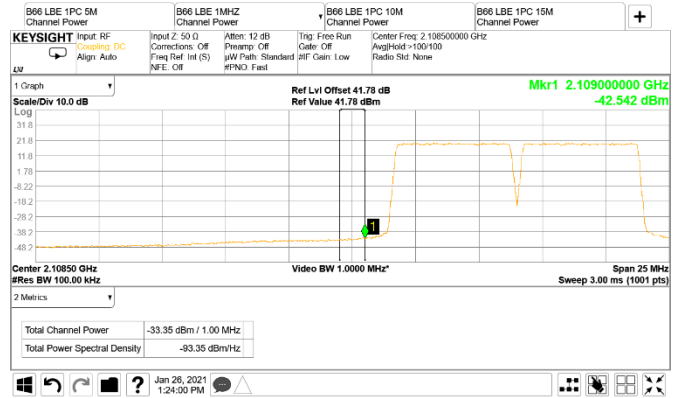


Figure 8.3-98: Conducted band edge emission at 2109 MHz, 5 MHz channel two-carrier LTE + NR operation (RBW = 1 MHz)

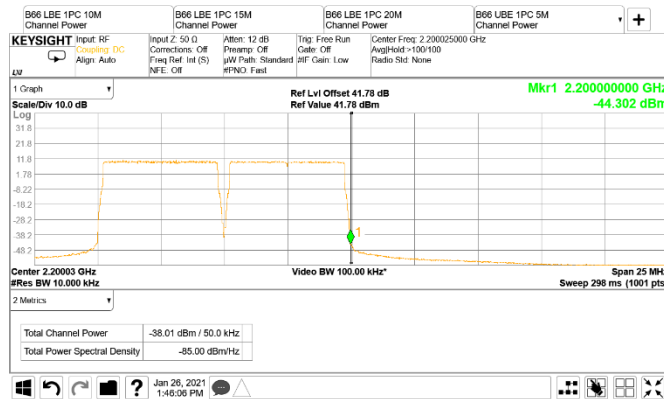


Figure 8.3-99: Conducted band edge emission at 2200 MHz, 5 MHz channel two-carrier LTE + NR operation (RBW = 1% of EBW)



Figure 8.3-100: Conducted band edge emission at 2201 MHz, 5 MHz channel two-carrier LTE + NR operation (RBW = 1 MHz)



Test data, continued

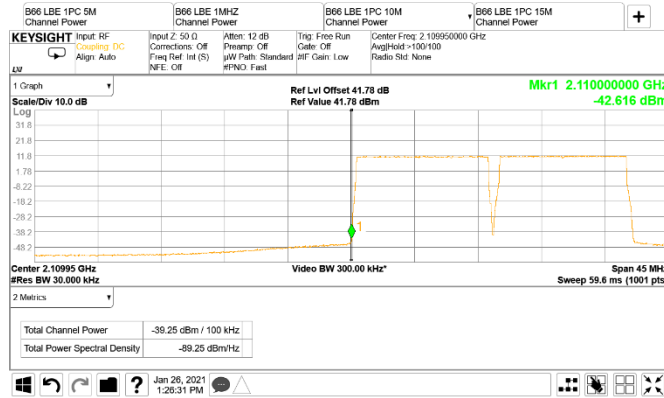


Figure 8.3-101: Conducted band edge emission at 2110 MHz, 10 MHz channel two-carrier LTE + NR operation (RBW = 1% of EBW)

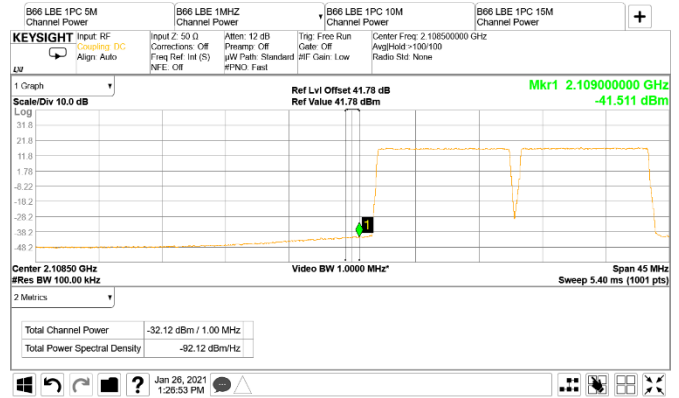


Figure 8.3-102: Conducted band edge emission at 2109 MHz, 10 MHz channel two-carrier LTE + NR operation (RBW = 1 MHz)

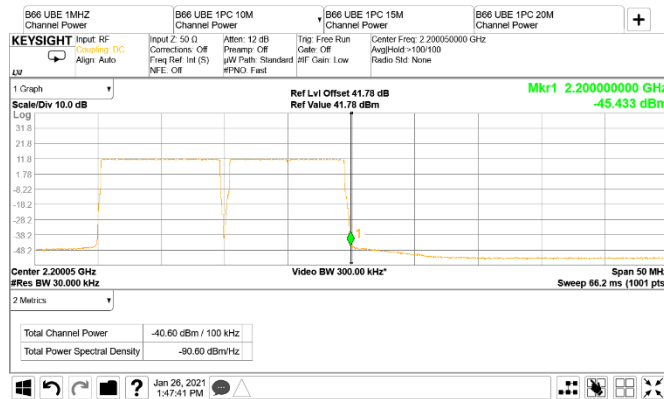


Figure 8.3-103: Conducted band edge emission at 2200 MHz, 10 MHz channel two-carrier LTE + NR operation (RBW = 1% of EBW)

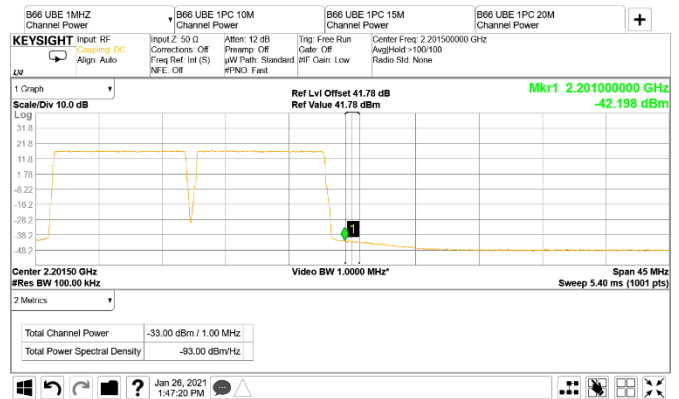
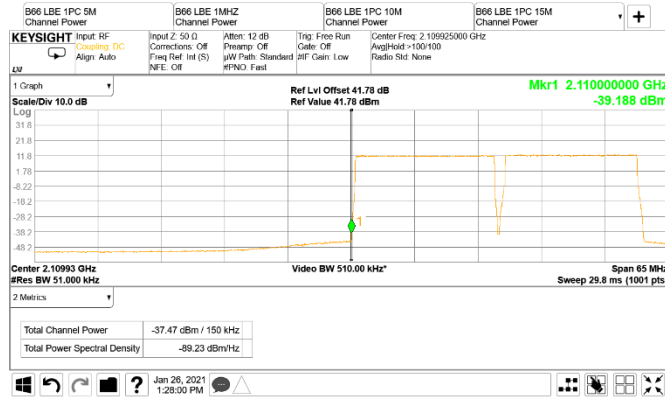
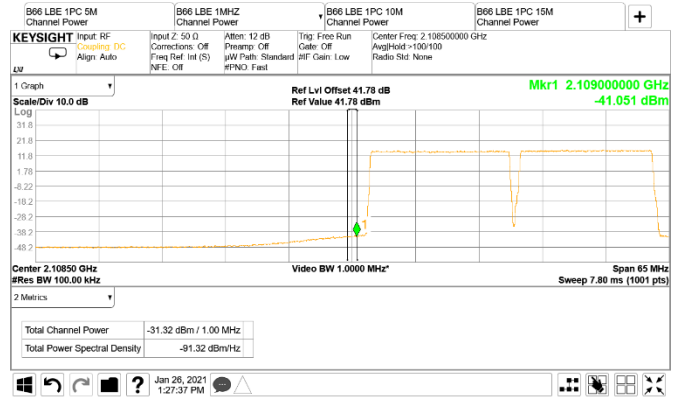


Figure 8.3-104: Conducted band edge emission at 2201 MHz, 10 MHz channel two-carrier LTE + NR operation (RBW = 1 MHz)

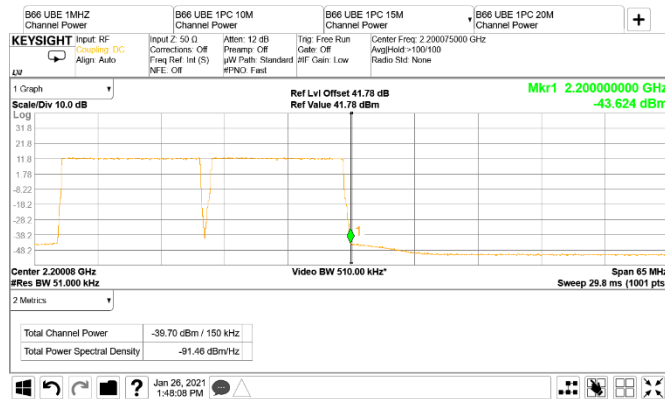
Test data, continued



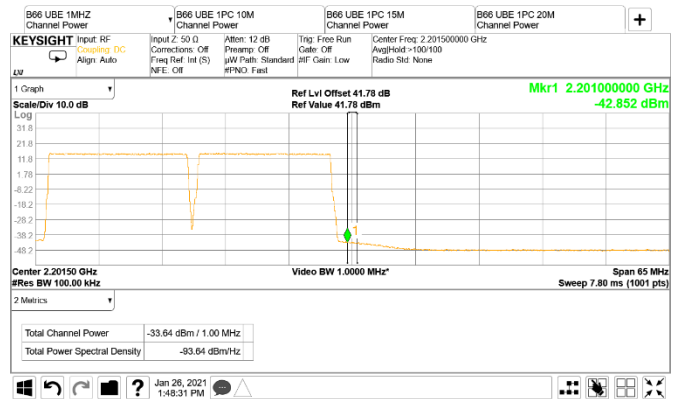
**Figure 8.3-105:** Conducted band edge emission at 2110 MHz, 15 MHz channel two-carrier LTE + NR operation (RBW = 1% of EBW)



**Figure 8.3-106:** Conducted band edge emission at 2109 MHz, 15 MHz channel two-carrier LTE + NR operation (RBW = 1 MHz)



**Figure 8.3-107:** Conducted band edge emission at 2200 MHz, 15 MHz channel two-carrier LTE + NR operation (RBW = 1% of EBW)



**Figure 8.3-108:** Conducted band edge emission at 2201 MHz, 15 MHz channel two-carrier LTE + NR operation (RBW = 1 MHz)

Test data, continued

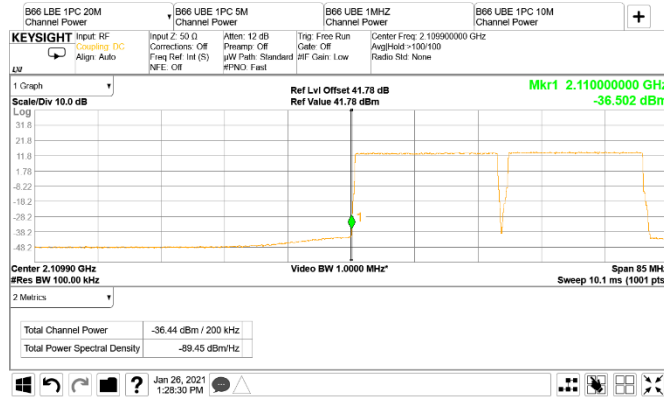


Figure 8.3-109: Conducted band edge emission at 2110 MHz, 20 MHz channel two-carrier LTE + NR operation (RBW = 1% of EBW)

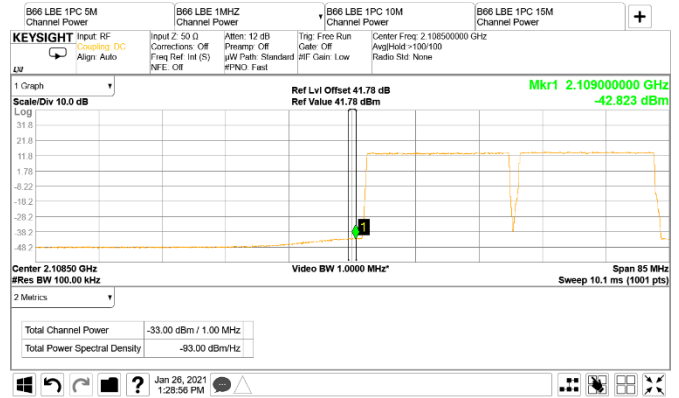


Figure 8.3-110: Conducted band edge emission at 2109 MHz, 20 MHz channel two-carrier LTE + NR operation (RBW = 1 MHz)

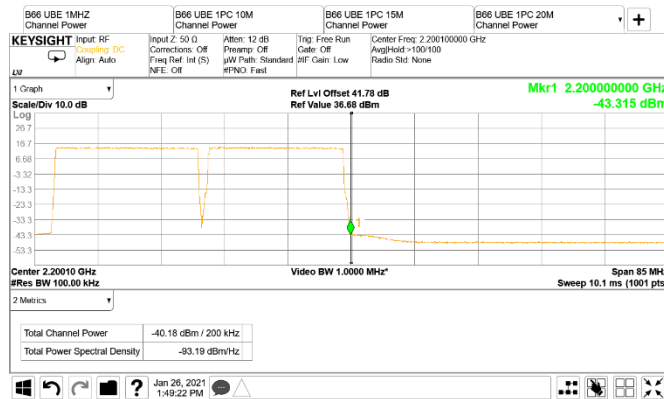


Figure 8.3-111: Conducted band edge emission at 2200 MHz, 20 MHz channel two-carrier LTE + NR operation (RBW = 1% of EBW)

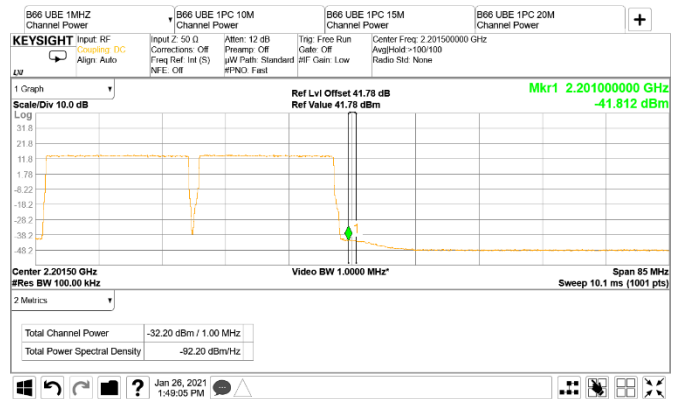


Figure 8.3-112: Conducted band edge emission at 2201 MHz, 20 MHz channel two-carrier LTE + NR operation (RBW = 1 MHz)

## 8.4 Radiated spurious emissions (Band 66 & 2/25a)

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### 8.4.1 Definitions and limits

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#### **FCC §27.53:**

(h) AWS emission limits

(1) General protection levels. Except as otherwise specified below, for operations in the 1695–1710 MHz, 1710–1755 MHz, 1755–1780 MHz, 1915–1920 MHz, 1995–2000 MHz, 2000–2020 MHz, 2110–2155 MHz, 2155–2180 MHz, and 2180–2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least  $43 + 10 \log_{10}(P)$  dB.

(3) Measurement procedure.

(i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1-megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter 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 dB below the transmitter power.

(ii) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.

(iii) The measurements of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

#### **FCC §24.238(a):**

Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

(b) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz 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 employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). 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 dB below the transmitter power.

#### **RSS-139, Section 6.6:**

i. In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least  $43 + 10 \log_{10} p$  (watts) dB.

ii. After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least  $43 + 10 \log_{10} p$  (watts) dB.

#### **RSS-170, Section 5.4:**

The transmitter unwanted emissions shall be measured for all channel bandwidths with the carrier frequency set at both the highest and lowest channels in which the equipment is designed to operate.

The e.i.r.p. density of unwanted and carrier-off state emissions outlined in this section (Section 5.4) shall be averaged over any 2-ms active transmission using an RMS detector with a resolution bandwidth of 1 MHz for broadband emissions and a resolution bandwidth of 1 kHz for discrete emissions, unless stated otherwise.

For ATC equipment operating in the bands 2000-2020 MHz and 2180-2200 MHz, the unwanted emission limits shall be determined using a measurement bandwidth of 1 MHz or greater. However, in the 1 MHz band immediately outside and adjacent to the equipment's operating frequency block, a resolution bandwidth of at least 1% of the occupied bandwidth may be employed.

#### **5.4.1.2 ATC Base Station Equipment operating in bands 2000-2020 MHz and 2180-2200 MHz**

he unwanted emissions of ATC base station equipment transmitting in the bands 2000–2020 MHz and 2180–2200 MHz shall comply with the following:

(1) The power of any unwanted emissions at frequencies outside the equipment's operating frequency block shall be attenuated below the transmitter power P (dBW), by  $43 + 10 \log p$  (watts), dB.

(2) \*For equipment operating in the band 2180–2200 MHz, in addition to (1), the power of any emissions on all frequencies between 2200 MHz and 2290 MHz shall not exceed an e.i.r.p. of  $-100.6$  dBW/4 kHz ( $-70.6$  dBm/4 kHz).

**\* This requirement is for implementation and is enforced at the time of licensing. Therefore, results are not included in this report.**

Definitions and limits, continued

**RSS-133, Section 6.5.1:**

- i. In the first 1.0 MHz bands immediately outside and adjacent to the equipment’s operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least  $43 + 10 \log_{10} p$  (watts) dB.
- ii. After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least  $43 + 10 \log_{10} p$  (watts) dB. If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

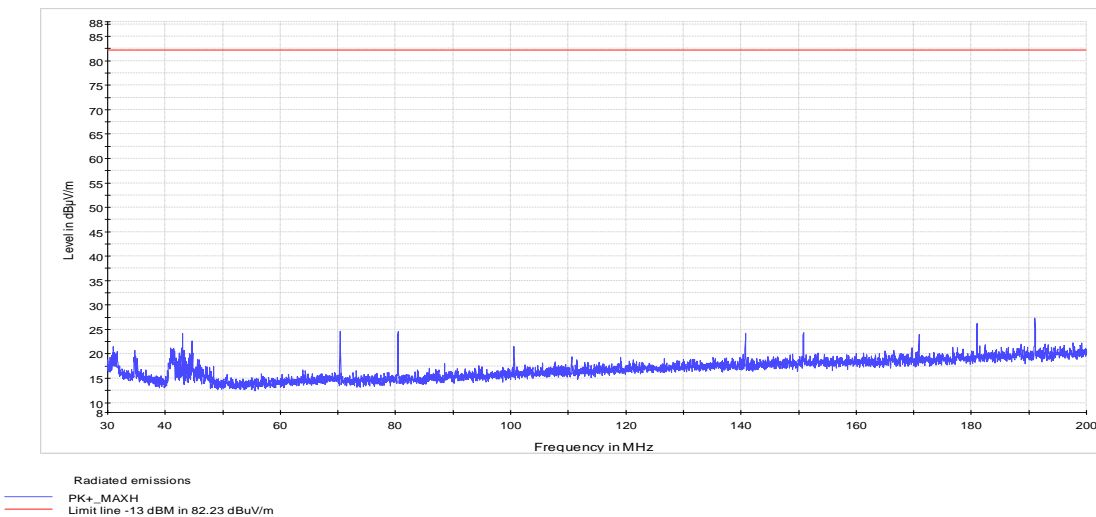
8.4.2 Test summary

Test date	January 27, 2021
Test engineer	Andrey Adelberg

8.4.3 Observations, settings and special notes

- The spectrum was searched from 30 MHz to the 10<sup>th</sup> harmonic per ANSI C63.26 Paragraph 5.5.3.2 method.
- RBW within 30–1000 MHz was 100 kHz and 1 MHz above 1 GHz. VBW was wider than RBW.
- Testing was performed with RF ports terminated with 50 Ohm load.
- **Testing was performed with dual band (Band 2/25a and Band 66a) simultaneous transmission.**

8.4.4 Test data



**Figure 8.4-1:** Radiated spurious emissions within 30–200 MHz dual band, NR only

Test data, continued

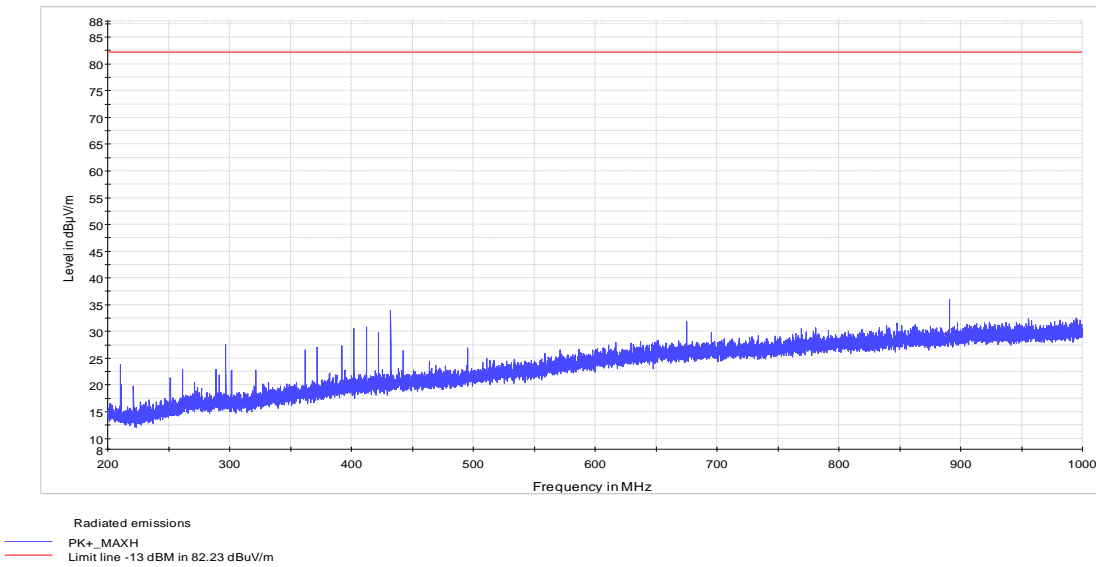


Figure 8.4-2: Radiated spurious emissions within 200–1000 MHz dual band, NR only

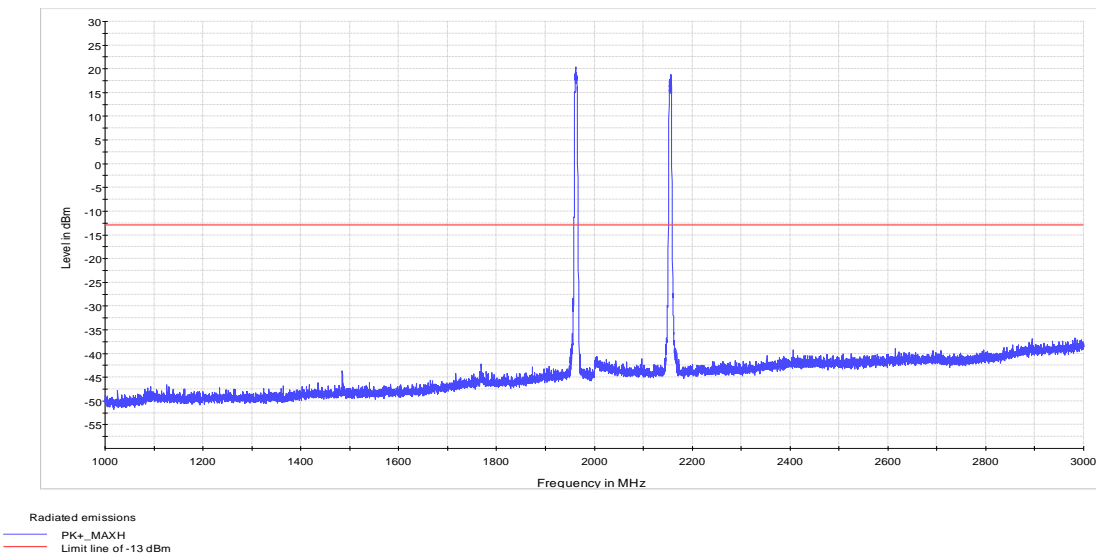
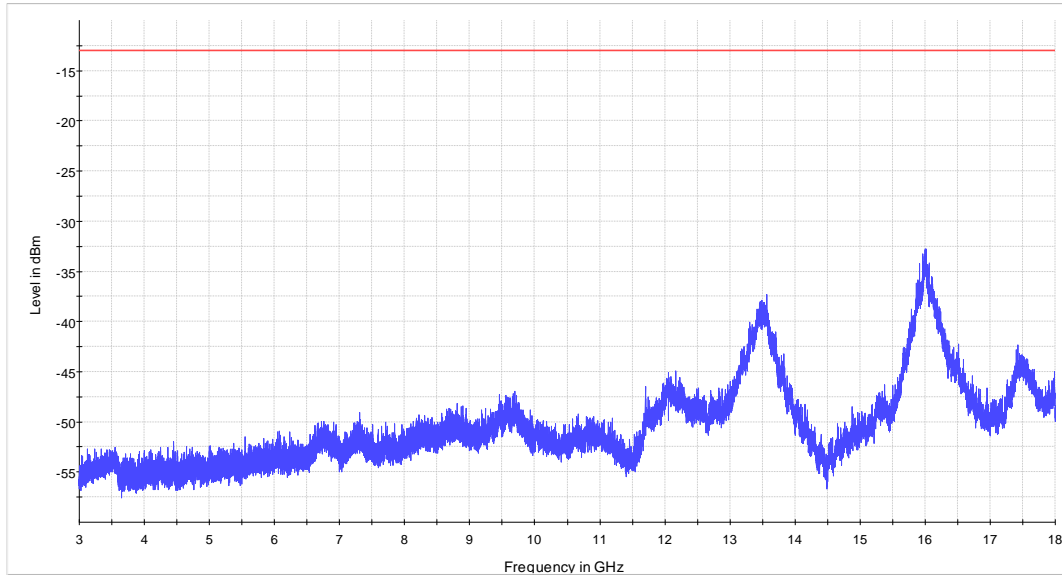


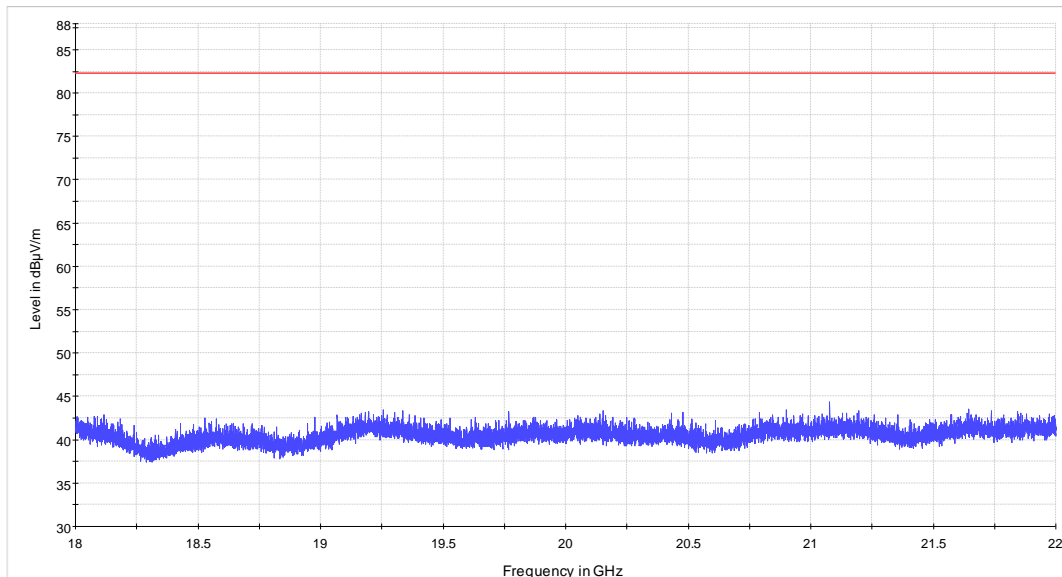
Figure 8.4-3: Radiated spurious emissions within 1–3 GHz dual band, NR only

Test data, continued



Radiated emissions  
— PK+\_MAXH  
— Limit line of -13 dBm

**Figure 8.4-4:** Radiated spurious emissions within 3–18 GHz dual band, NR only



Radiated emissions  
— Spurious emissions limite line (-13 dBm)  
— PK+\_MAXH

**Figure 8.4-5:** Radiated spurious emissions within 18–22 GHz dual band, NR only

Test data, continued

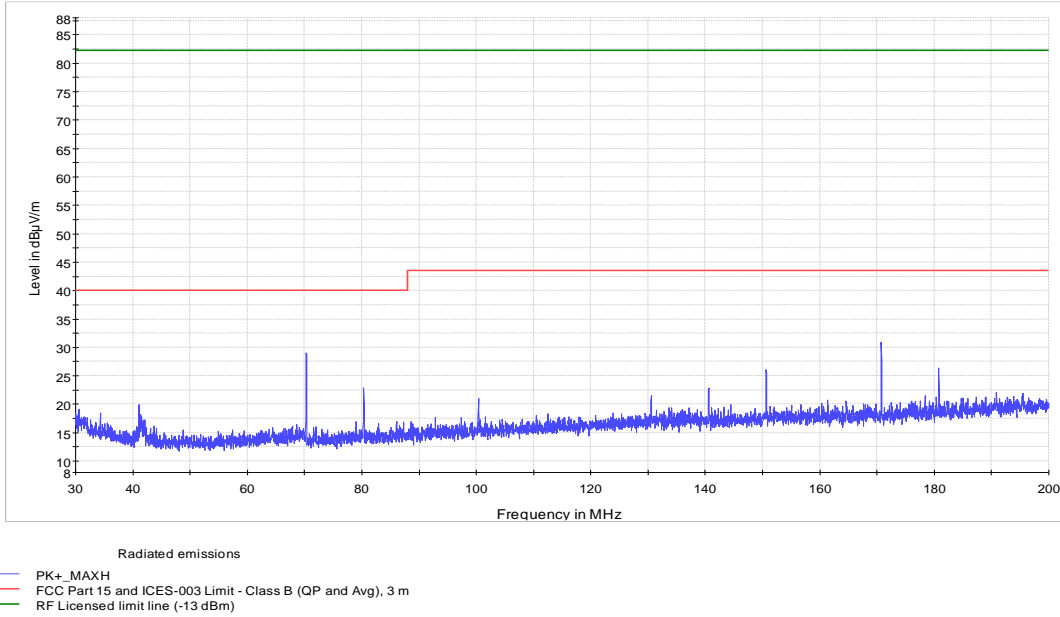


Figure 8.4-6: Radiated spurious emissions within 30–200 MHz dual band, multi-RAT (NR + LTE)

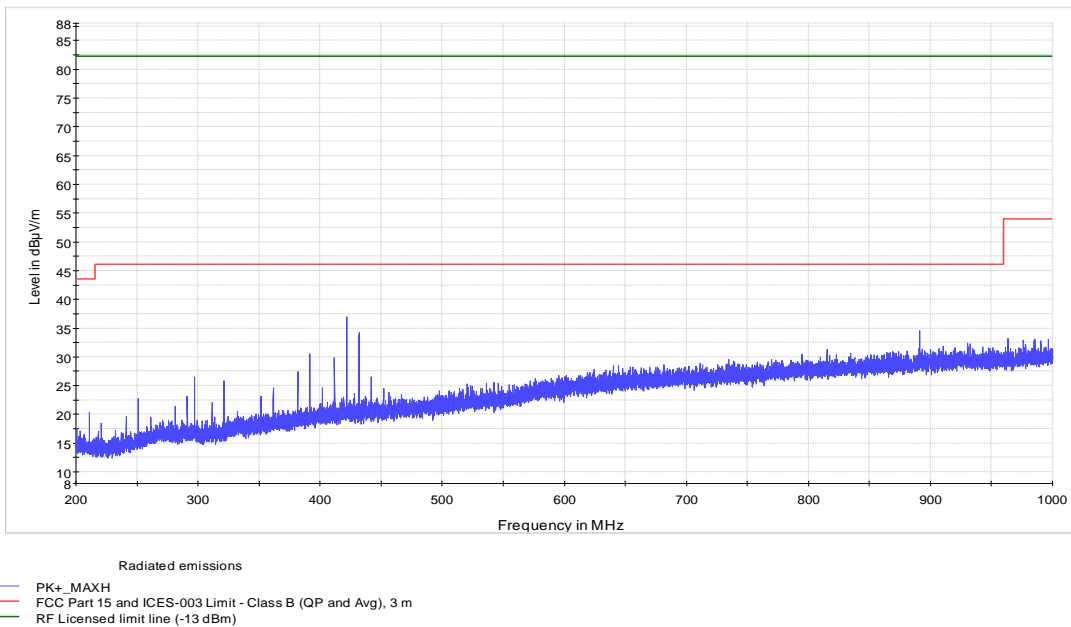
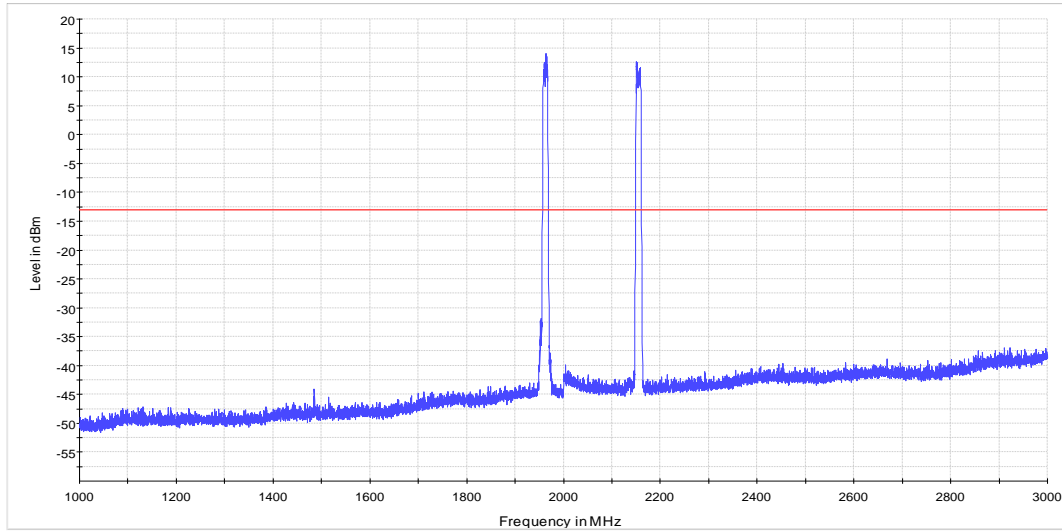


Figure 8.4-7: Radiated spurious emissions within 200–1000 MHz dual band, multi-RAT (NR + LTE)

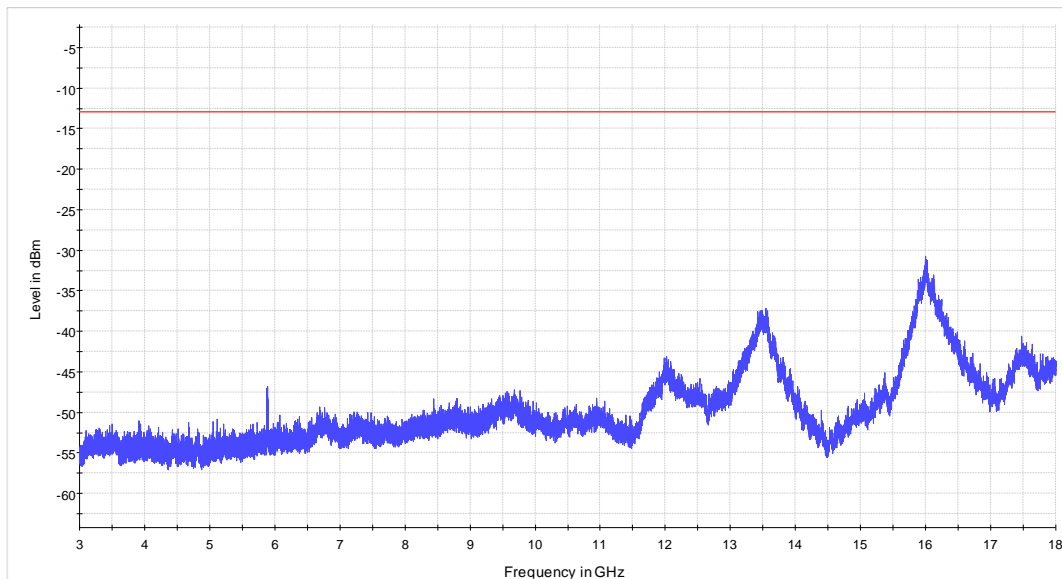


Test data, continued



Radiated emissions  
— PK+ MAXH  
— Limit line of -13 dBm

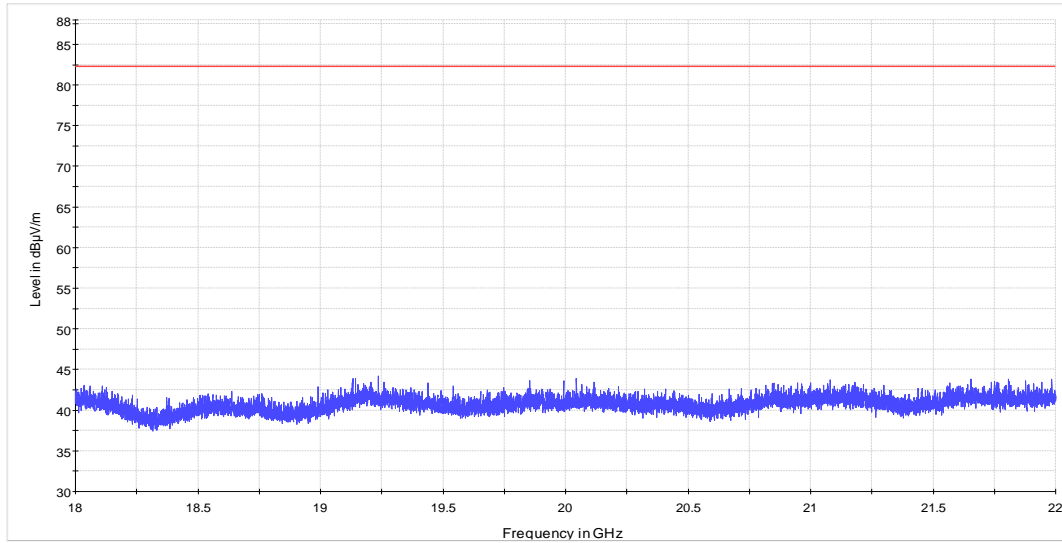
**Figure 8.4-8:** Radiated spurious emissions within 1–3 GHz dual band, multi-RAT (NR + LTE)



Radiated emissions  
— PK+ MAXH  
— Spurious emissions -13 dBm limit line

**Figure 8.4-9:** Radiated spurious emissions within 3–18 GHz dual band, multi-RAT (NR + LTE)

Test data, continued



Radiated emissions  
— Spurious emissions limite line (-13 dBm)  
— PK+\_MAXH

**Figure 8.4-10:** Radiated spurious emissions within 18–22 GHz dual band, multi-RAT (NR + LTE)

## 8.5 Spurious out-of-band emissions (Band 2/25a)

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### 8.5.1 Definitions and limits

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**FCC §24.238(a):**

Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

(b) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz 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 employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). 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 dB below the transmitter power.

**RSS-133, Section 6.5.1:**

- i. In the first 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least  $43 + 10 \log_{10} p$  (watts) dB.
- ii. After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least  $43 + 10 \log_{10} p$  (watts) dB. If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

### 8.5.2 Test summary

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Test date	January 25, 2021
Test engineer	Andrey Adelberg

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### 8.5.3 Observations, settings and special notes

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- The spectrum was searched from 30 MHz to the 10<sup>th</sup> harmonic.
- All measurements were performed using an average (RMS) detector per ANSI C63.26 Paragraph 5.7.2 method.
- Limit line ( $43 + 10 \log_{10}(P)$  or -13 dBm) was adjusted for MIMO operation by 12.04 dB\*: -13 dBm - 12.04 dB = -25.04 dBm  
\*MIMO correction factor for 16 antenna ports:  $10 \times \log_{10}(16) = 12.04$  dB
- RBW 1 MHz, VBW was wider than RBW.

8.5.4 Test data

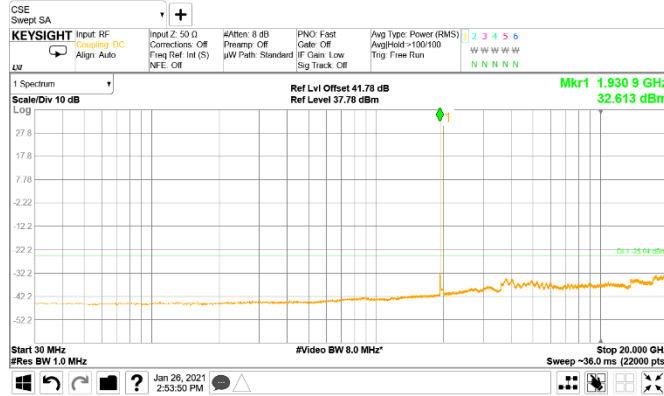


Figure 8.5-1: Conducted spurious emissions of 5 MHz low channel, single carrier operation

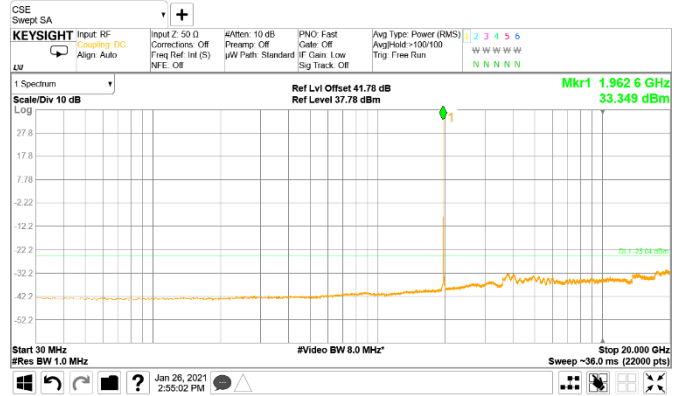


Figure 8.5-2: Conducted spurious emissions of 5 MHz mid channel, single carrier operation

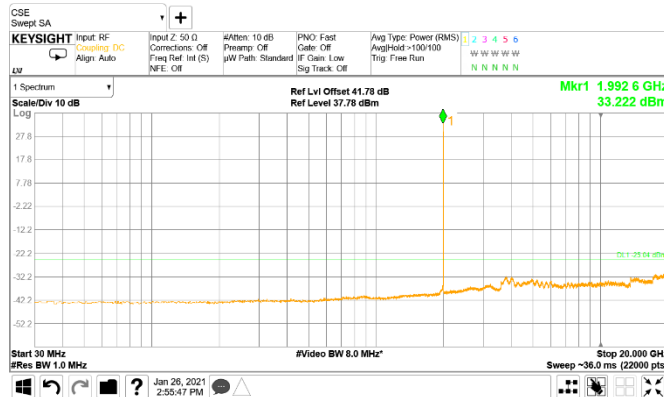


Figure 8.5-3: Conducted spurious emissions of 5 MHz top channel, single carrier operation

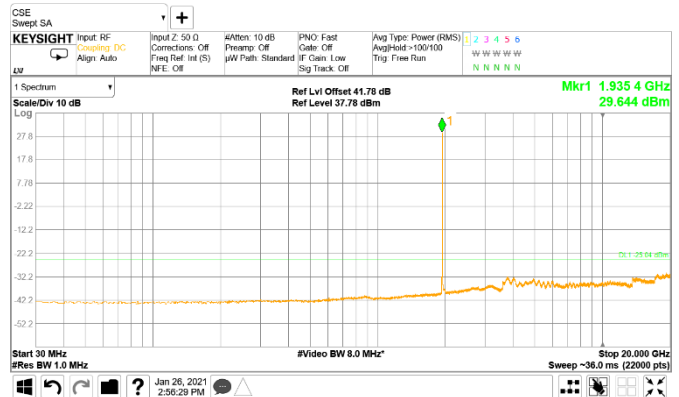


Figure 8.5-4: Conducted spurious emissions of 10 MHz low channel, single carrier operation

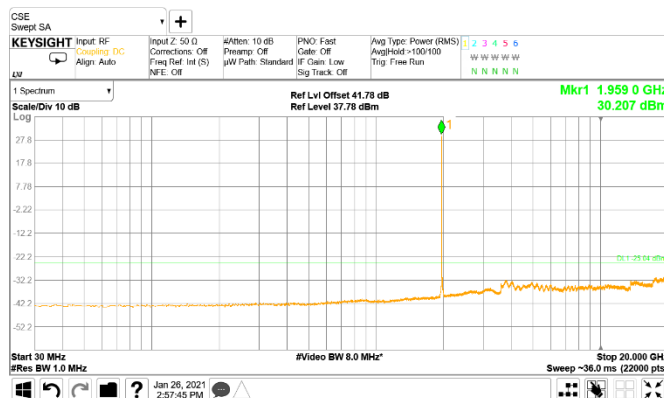


Figure 8.5-5: Conducted spurious emissions of 10 MHz mid channel, single carrier operation

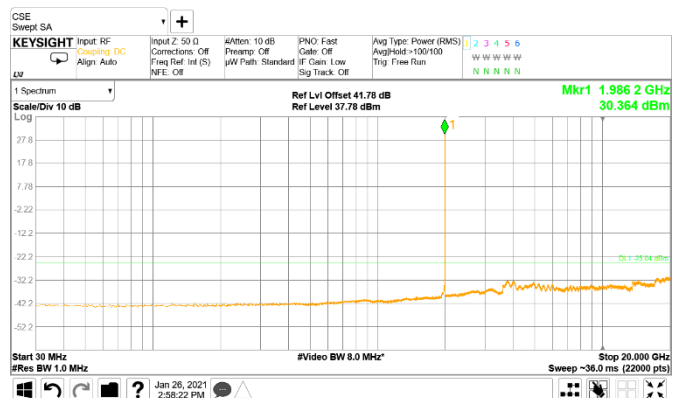


Figure 8.5-6: Conducted spurious emissions of 10 MHz top channel, single carrier operation

Test data, continued

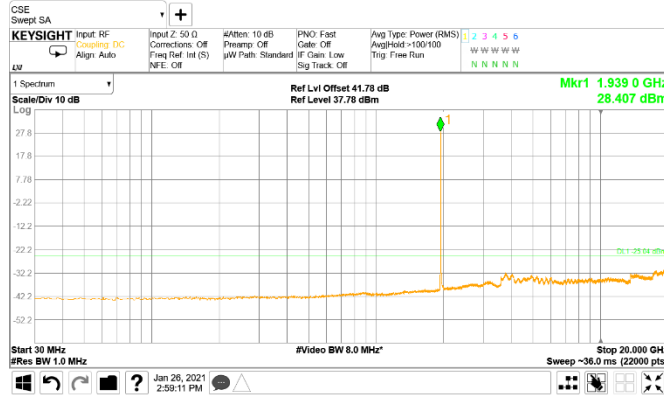


Figure 8.5-7: Conducted spurious emissions of 15 MHz low channel, single carrier operation

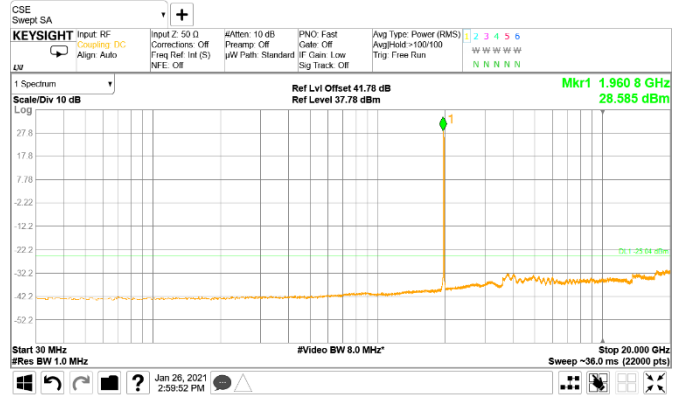


Figure 8.5-8: Conducted spurious emissions of 15 MHz mid channel, single carrier operation

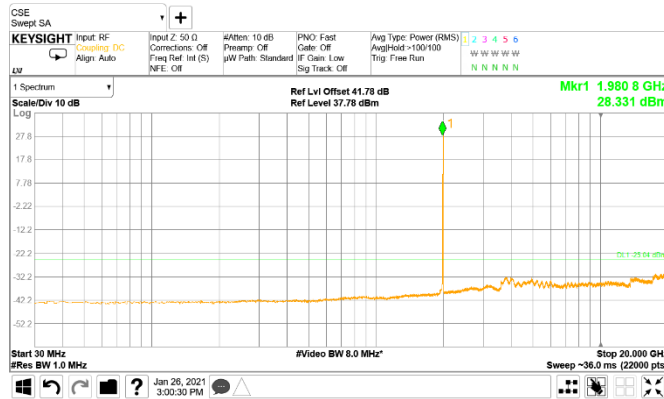


Figure 8.5-9: Conducted spurious emissions of 15 MHz top channel, single carrier operation

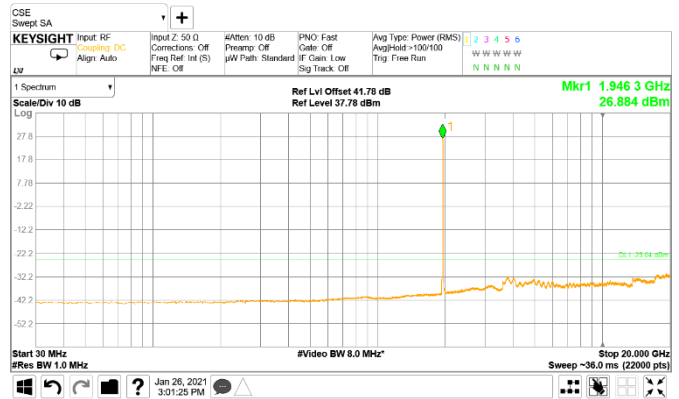


Figure 8.5-10: Conducted spurious emissions of 20 MHz low channel, single carrier operation

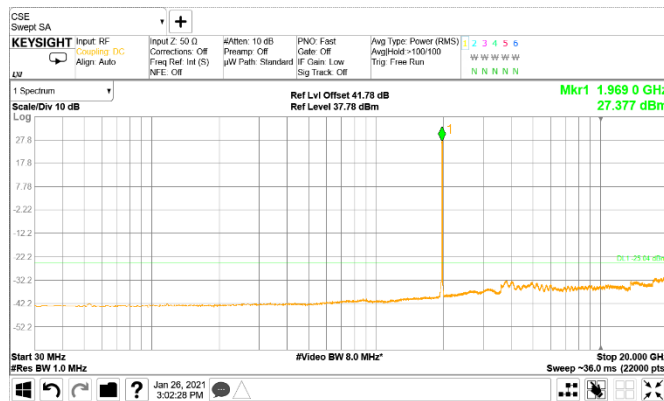


Figure 8.5-11: Conducted spurious emissions of 20 MHz mid channel, single carrier operation

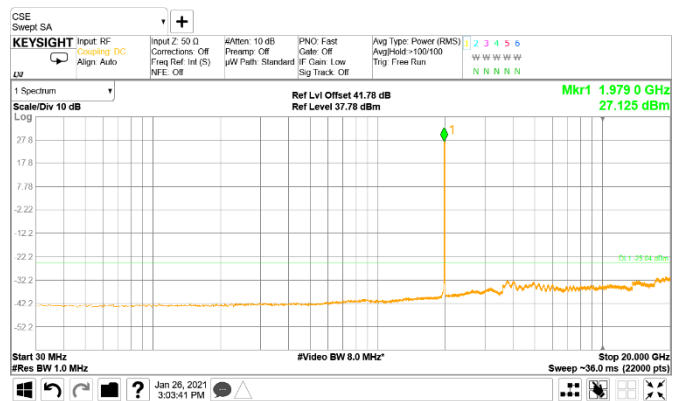


Figure 8.5-12: Conducted spurious emissions of 20 MHz top channel, single carrier operation

Test data, continued

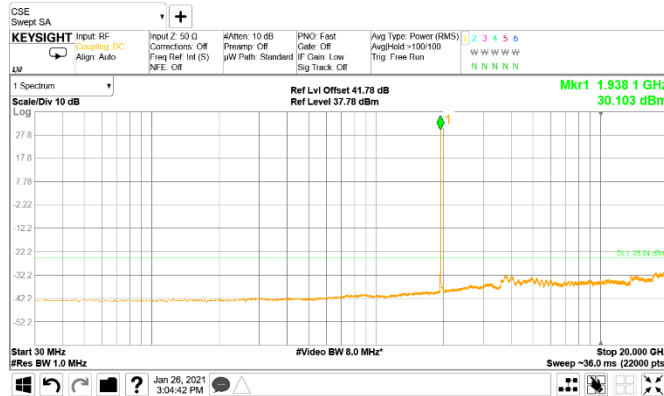


Figure 8.5-13: Conducted spurious emissions of 5 MHz two low channels, two-carrier operation

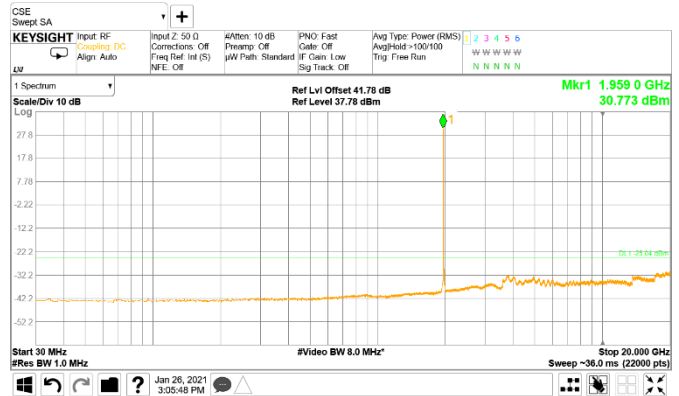


Figure 8.5-14: Conducted spurious emissions of 5 MHz two mid channels, two-carrier operation

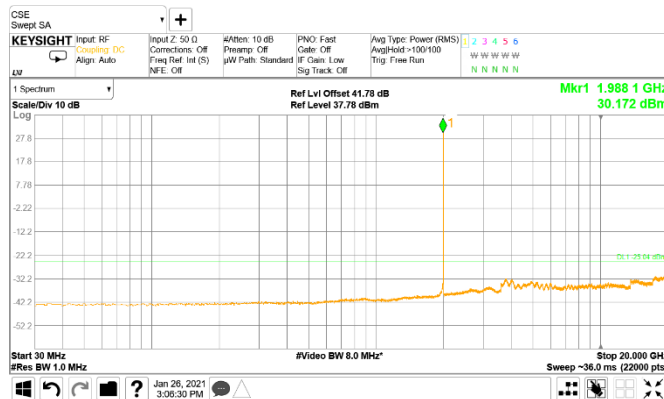


Figure 8.5-15: Conducted spurious emissions of 5 MHz two top channels, two-carrier operation

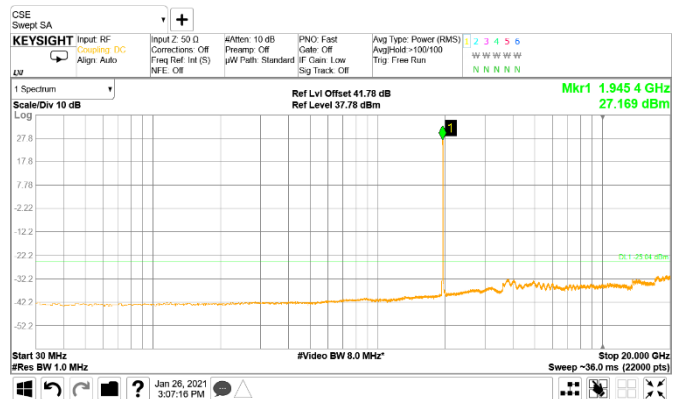


Figure 8.5-16: Conducted spurious emissions of 10 MHz two low channels, two-carrier operation

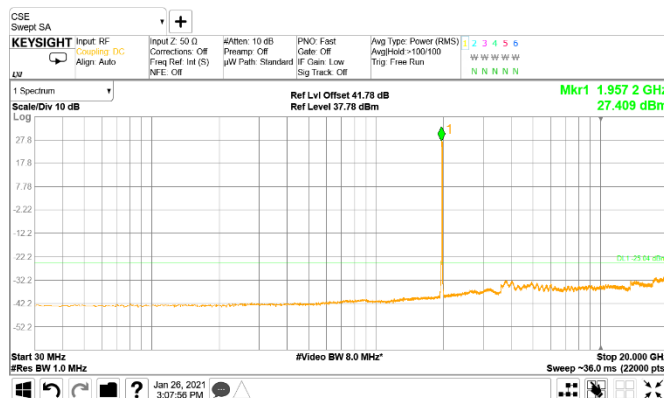


Figure 8.5-17: Conducted spurious emissions of 10 MHz two mid channels, two-carrier operation

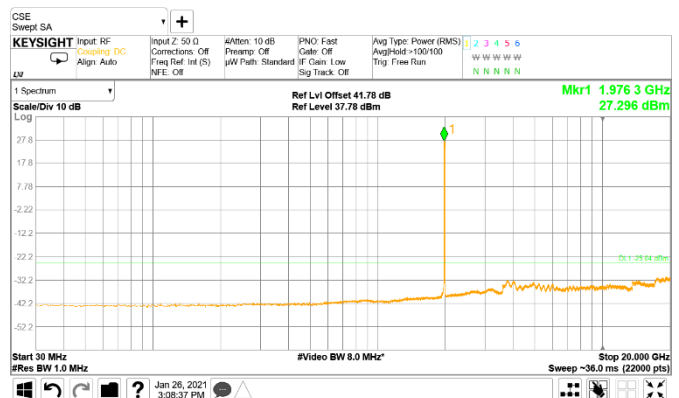


Figure 8.5-18: Conducted spurious emissions of 10 MHz two top channels, two-carrier operation