

Test data, continued



Figure 8.1-55: PSD of GSM 0.2 MHz + IoT SA 0.4 MHz + LTE 10 MHz, 3-carrier non-contiguous operation, sample plot (1 MHz Resolution)



Figure 8.1-56: PSD of WCDMA 5 MHz + LTE 1.4 MHz + IoT SA 0.4 MHz, 3-carrier non-contiguous operation, sample plot (1 MHz Resolution)

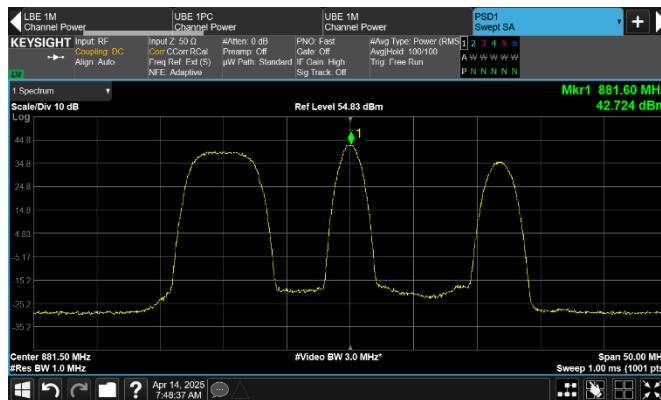


Figure 8.1-57: PSD of NR 5 MHz + IoT SA 0.4 + LTE 1.4 MHz, 3-carrier non-contiguous operation, sample plot (1 MHz Resolution)

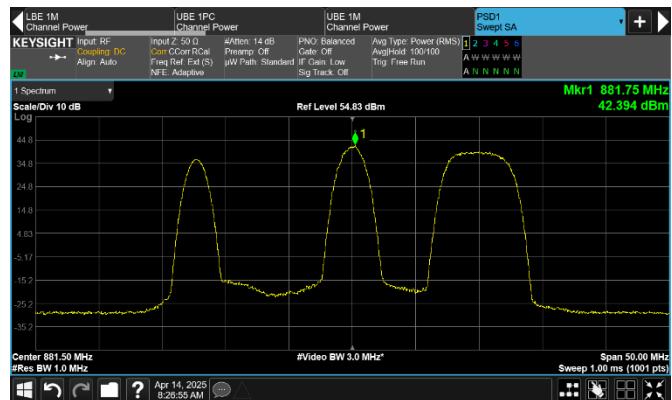


Figure 8.1-58: PSD of GSM 0.2 MHz + LTE 1.4 MHz + NR 5 MHz, 3-carrier non-contiguous operation, sample plot (1 MHz Resolution)

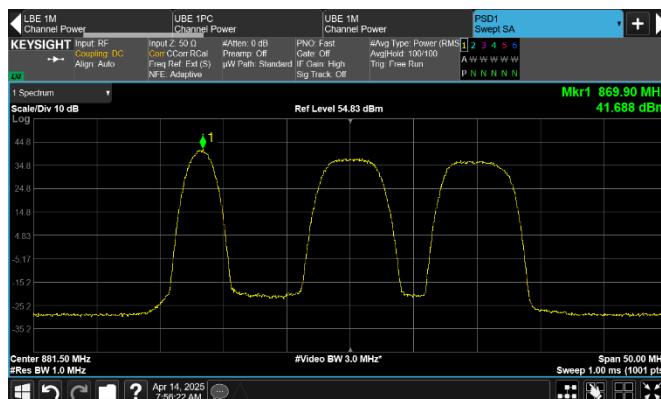


Figure 8.1-59: PSD of LTE 1.4 MHz + WCDMA 5 MHz + NR 5 MHz, 3-carrier non-contiguous operation, sample plot (1 MHz Resolution)



Figure 8.1-60: PSD of 3 x GSM 0.2 MHz + IoT SA 0.4 MHz, + 2 x LTE 5 MHz, 6-carrier non-contiguous operation, sample plot (1 MHz Resolution)

Test data, continued



Figure 8.1-61: PSD of 2 x WCDMA 5 MHz + 3 x LTE 1.4 MHz + IoT SA 0.4 MHz, 6-carrier non-contiguous operation, sample plot (1 MHz Resolution)

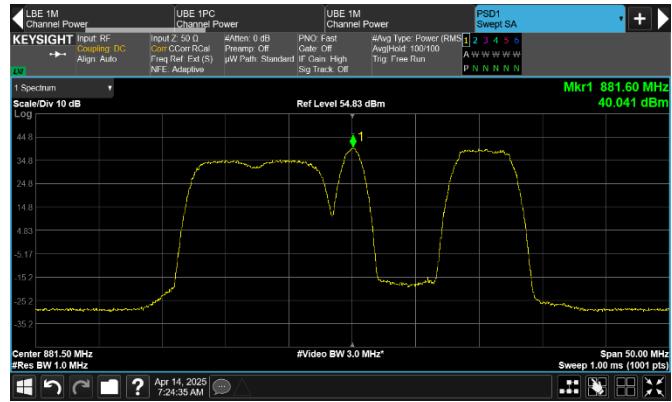


Figure 8.1-62: PSD of 2 x NR 5 MHz + IoT SA 0.4 + 3 x LTE 1.4 MHz, 6-carrier non-contiguous operation, sample plot (1 MHz Resolution)



Figure 8.1-63 PSD of 2 x GSM 0.2 MHz + 2 x LTE 1.4 MHz + 2 x NR 5 MHz, 6-carrier non-contiguous operation, sample plot (1 MHz Resolution)

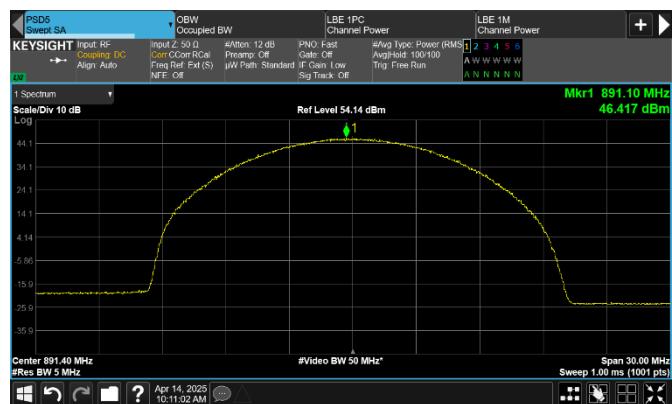


Figure 8.1-64: PSD of 2 x LTE 1.4 MHz + 2 x WCDMA 5 MHz + 2 x NR 5 MHz, 6-carrier non-contiguous operation, sample plot (1 MHz Resolution)

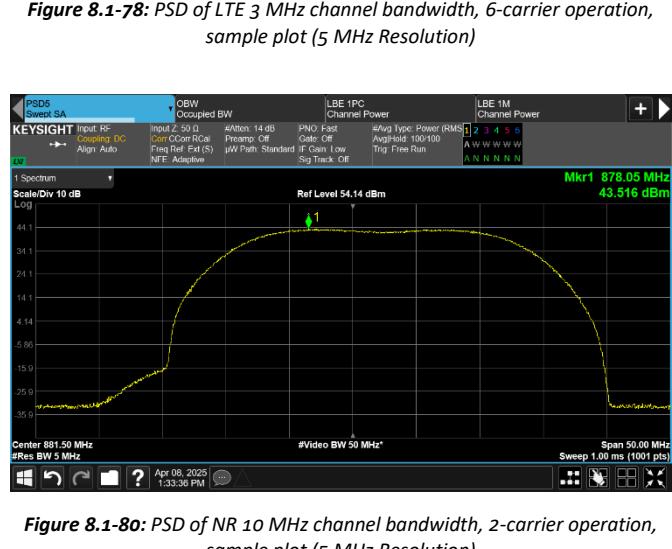
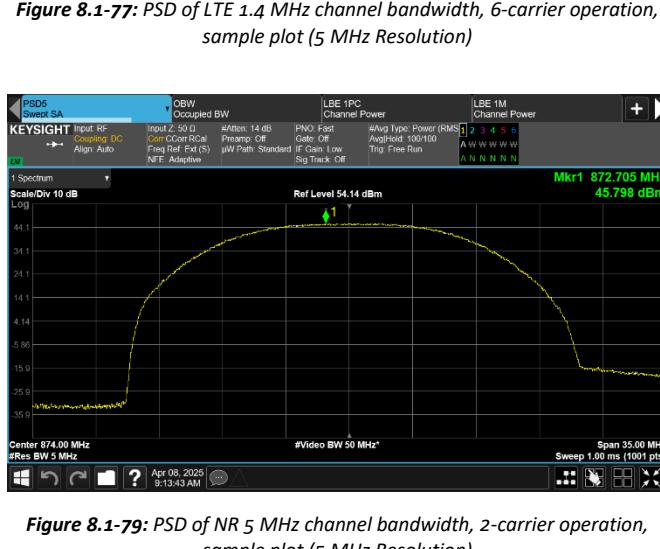
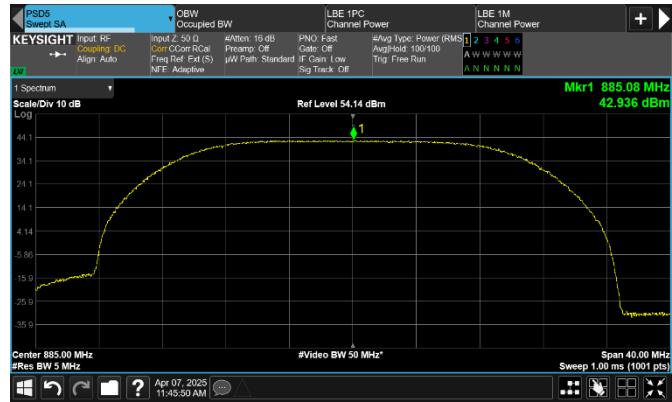
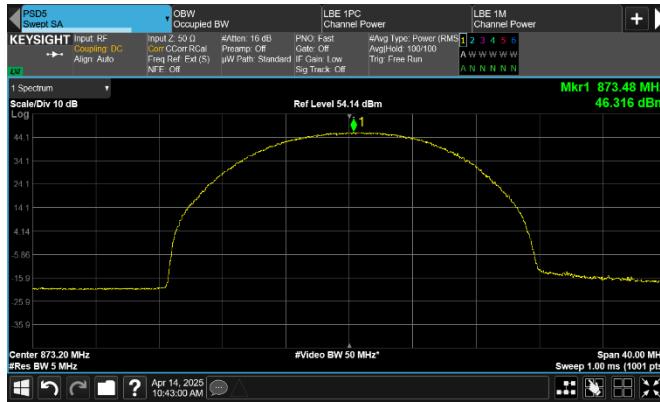
Test data, continued



Test data, continued



Test data, continued



Test data, continued

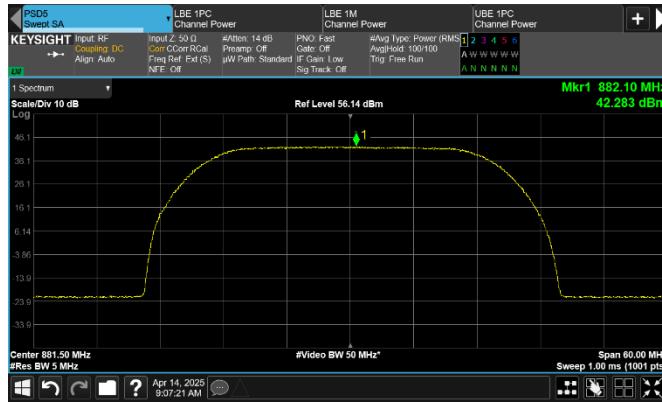


Figure 8.1-83: PSD of WCDMA 5 MHz channel bandwidth, 5-carrier operation, sample plot (5 MHz Resolution)

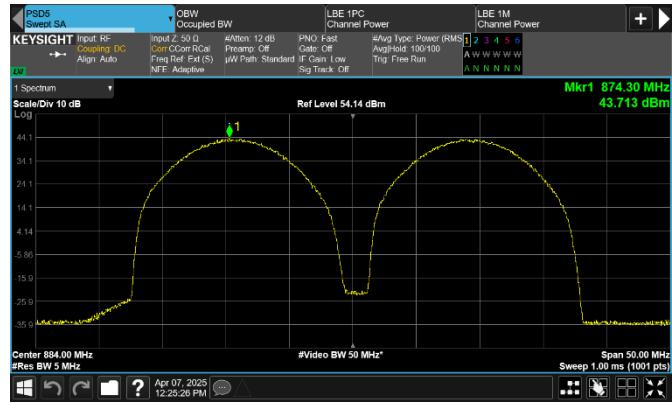


Figure 8.1-84: PSD of LTE 1.4 MHz, 2-carrier non-contiguous operation, sample plot (5 MHz Resolution)

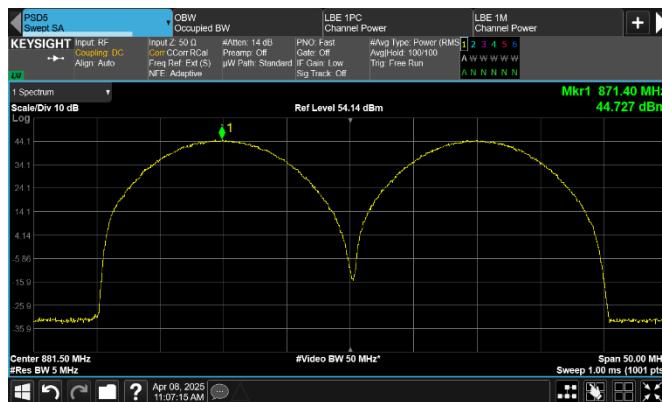


Figure 8.1-85: PSD of LTE 5 MHz, 2-carrier non-contiguous operation, sample plot (5 MHz Resolution)



Figure 8.1-86: PSD of LTE 1.4 MHz, 6-carrier non-contiguous operation, sample plot (5 MHz Resolution)

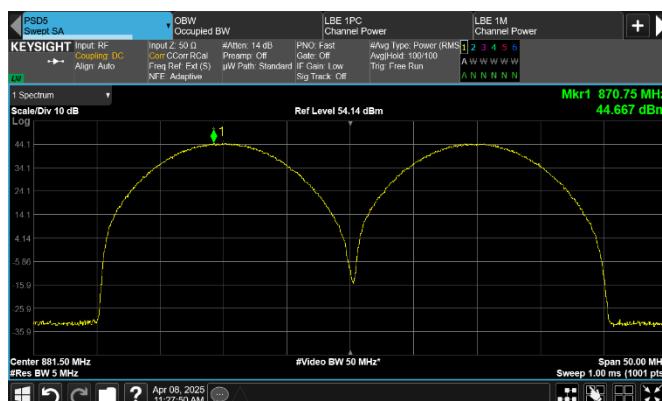


Figure 8.1-87: PSD of NR 5 MHz, 2-carrier non-contiguous operation, sample plot (5 MHz Resolution)

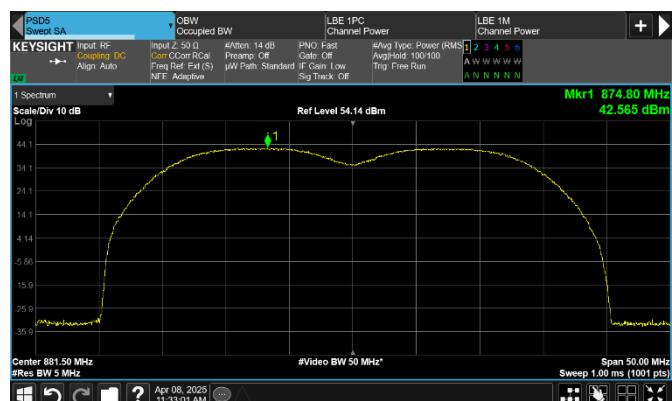


Figure 8.1-88: PSD of NR 5 MHz, 4-carrier non-contiguous operation, sample plot (5 MHz Resolution)

Test data, continued

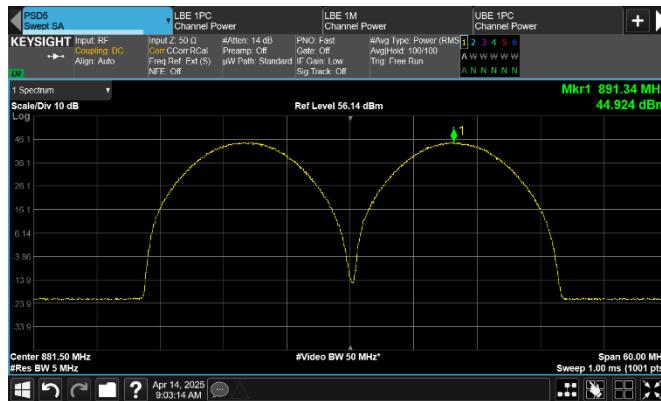


Figure 8.1-89: PSD of WCDMA 5 MHz, 2-carrier non-contiguous operation, sample plot (5 MHz Resolution)



Figure 8.1-90: PSD of WCDMA 5 MHz, 4-carrier non-contiguous operation, sample plot (5 MHz Resolution)



Figure 8.1-91: PSD of GSM 0.2 MHz + WCDMA 5 MHz, 2-carrier operation, sample plot (5 MHz Resolution)



Figure 8.1-92: PSD of GSM 0.2 MHz + LTE 5 MHz with IB, 2-carrier operation, sample plot (5 MHz Resolution)



Figure 8.1-93: PSD of GSM 0.2 MHz + NR 5 MHz, 2-carrier operation, sample plot (5 MHz Resolution)



Figure 8.1-94: PSD of LTE 1.4 MHz + WCDMA 5 MHz, 2-carrier operation, sample plot (5 MHz Resolution)

Test data, continued



Figure 8.1-95: PSD of WCDMA 5 MHz + NR 5 MHz, 2-carrier operation, sample plot (5 MHz Resolution)



Figure 8.1-96: PSD of IoT SA 0.4 MHz + WCDMA 5 MHz with IB, 2-carrier operation, sample plot (5 MHz Resolution)



Figure 8.1-97: PSD of NR 5 MHz + LTE 1.4 MHz, 2-carrier operation, sample plot (5 MHz Resolution)



Figure 8.1-98: PSD of IoT SA 0.4 MHz + LTE 5 MHz with IB, 2-carrier operation, sample plot (5 MHz Resolution)



Figure 8.1-99: PSD of NR 5 MHz + IoT SA 0.4 MHz, 2-carrier operation, sample plot (5 MHz Resolution)



Figure 8.1-100: PSD of GSM 0.2 MHz + LTE 5 MHz + IoT SA 0.4 MHz, 3-carrier operation, sample plot (5 MHz Resolution)

Test data, continued



Figure 8.1-101: PSD of WCDMA 5 MHz + LTE 1.4 MHz + IoT SA 0.4 MHz, 3-carrier operation, sample plot (5 MHz Resolution)



Figure 8.1-102: PSD of NR 5 MHz + LTE 1.4 MHz + IoT SA 0.4 MHz, 3-carrier operation, sample plot (5 MHz Resolution)



Figure 8.1-103: PSD of GSM 0.2 MHz + LTE 1.4 MHz + NR 5 MHz, 3-carrier operation, sample plot (5 MHz Resolution)



Figure 8.1-104: PSD of LTE 1.4 MHz + WCDMA 5 MHz + NR 5 MHz, 3-carrier operation, sample plot (5 MHz Resolution)



Figure 8.1-105: PSD of 3 x GSM 0.2 MHz + 2 x LTE 5 MHz + IoT SA 0.4 MHz, 6-carrier operation, sample plot (5 MHz Resolution)



Figure 8.1-106: PSD of 2 x WCDMA 5 MHz + 3 x LTE 1.4 MHz + IoT SA 0.4 MHz, 6-carrier operation, sample plot (5 MHz Resolution)

Test data, continued



Figure 8.1-107: PSD of 2 x NR 5 MHz + 3 x LTE 1.4 MHz + IoT SA 0.4 MHz, 6-carrier operation, sample plot (5 MHz Resolution)



Figure 8.1-108: PSD of 2 x GSM 0.2 MHz + 2 x LTE 1.4 MHz + 2 x NR 5 MHz, 6-carrier operation, sample plot (5 MHz Resolution)



Figure 8.1-109: PSD of 2 x LTE 1.4 MHz + 2 x WCDMA 5 MHz + 2 x NR 5 MHz, 6-carrier operation, sample plot (5 MHz Resolution)



Figure 8.1-110: PSD of GSM 0.2 MHz + WCDMA 5 MHz, 2-carrier non-contiguous operation, sample plot (5 MHz Resolution)



Figure 8.1-111: PSD of GSM 0.2 MHz + LTE 5 MHz with IB, 2-carrier non-contiguous operation, sample plot (5 MHz Resolution)



Figure 8.1-112: PSD of GSM 0.2 MHz + NR 5 MHz, 2-carrier non-contiguous operation, sample plot (5 MHz Resolution)

Test data, continued

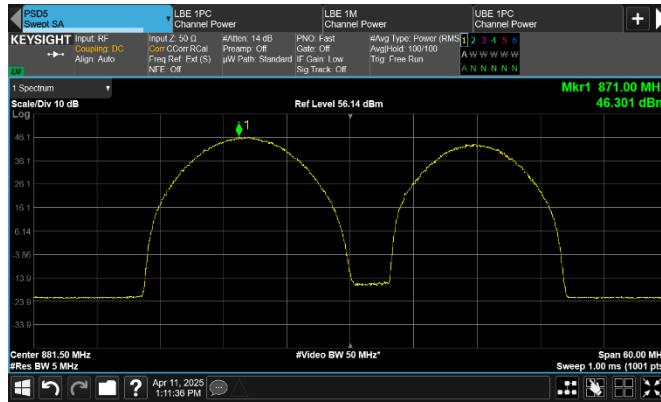


Figure 8.1-113: PSD of WCDMA 5 MHz + LTE 1.4 MHz, 2-carrier non-contiguous operation, sample plot (5 MHz Resolution)

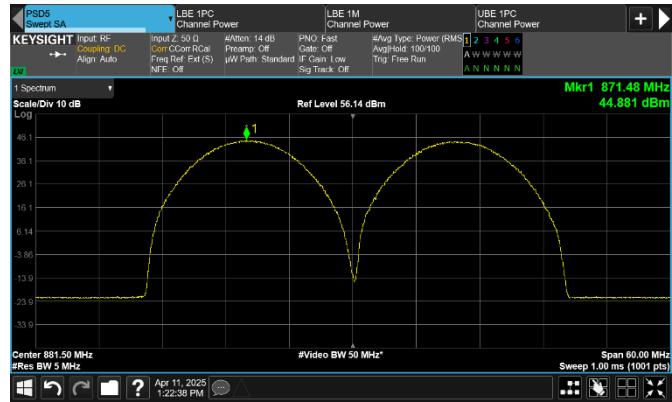


Figure 8.1-114: PSD of WCDMA 5 MHz + NR 5 MHz, 2-carrier non-contiguous operation, sample plot (5 MHz Resolution)

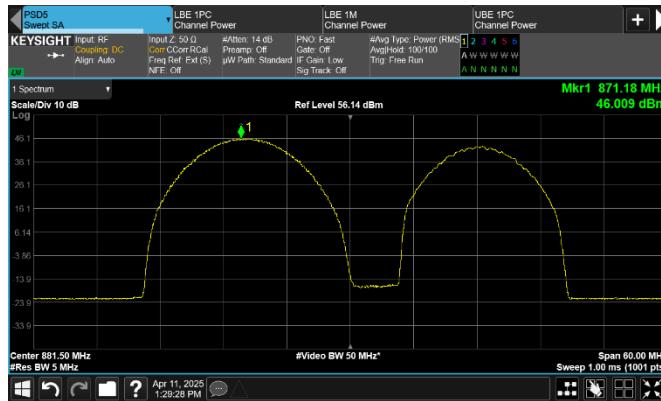


Figure 8.1-115: PSD of IoT WCDMA 5 MHz + SA 0.4 MHz with IB, 2-carrier non-contiguous operation, sample plot (5 MHz Resolution)

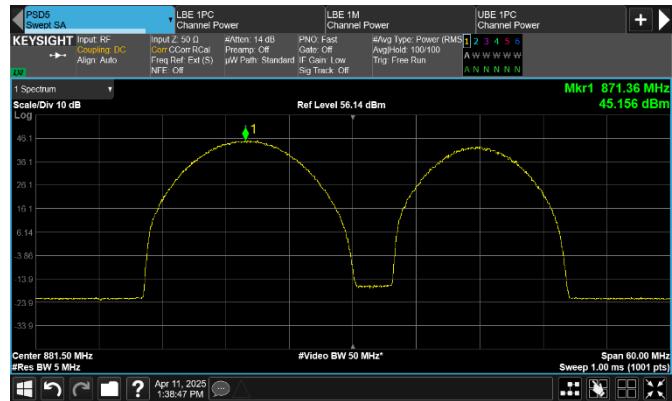


Figure 8.1-116: PSD of NR 5 MHz + LTE 1.4 MHz, 2-carrier non-contiguous operation, sample plot (5 MHz Resolution)



Figure 8.1-117: PSD of LTE 5 with IB + IoT SA 0.4 MHz, 2-carrier non-contiguous operation, sample plot (5 MHz Resolution)

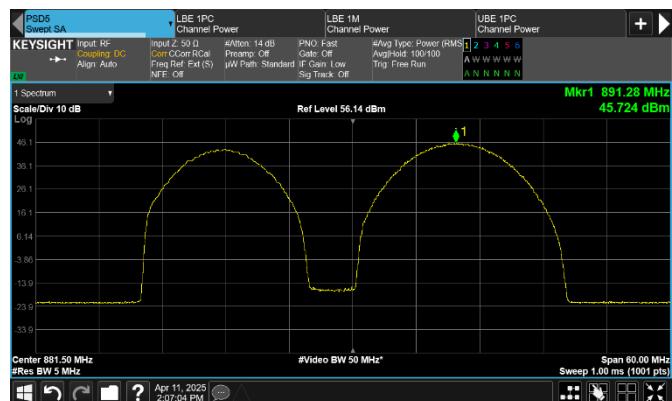


Figure 8.1-118: PSD of IoT SA 0.4 MHz + NR 5 MHz, 2-carrier non-contiguous operation, sample plot (5 MHz Resolution)

Test data, continued

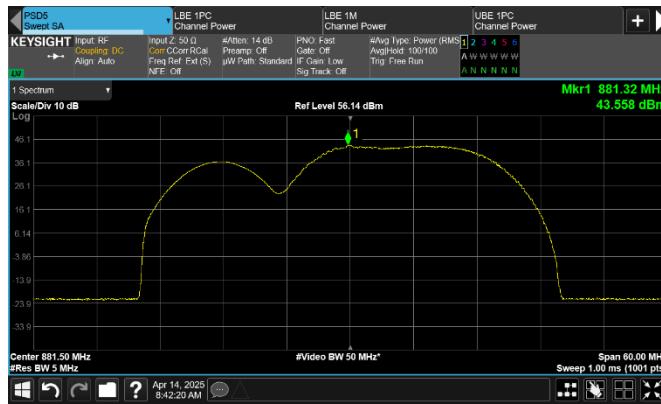


Figure 8.1-119: PSD of GSM 0.2 MHz + IoT SA 0.4 MHz + LTE 10 MHz, 3-carrier non-contiguous operation, sample plot (5 MHz Resolution)

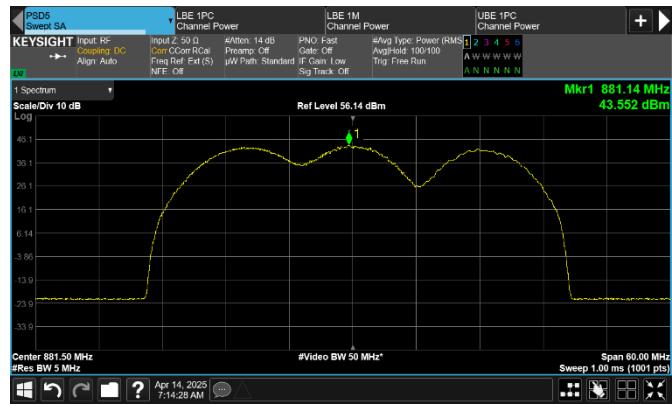


Figure 8.1-120: PSD of WCDMA 5 MHz + LTE 1.4 MHz + IoT SA 0.4 MHz, 3-carrier non-contiguous operation, sample plot (5 MHz Resolution)



Figure 8.1-121: PSD of NR 5 MHz + IoT SA 0.4 + LTE 1.4 MHz, 3-carrier non-contiguous operation, sample plot (5 MHz Resolution)



Figure 8.1-122: PSD of GSM 0.2 MHz + LTE 1.4 MHz + NR 5 MHz, 3-carrier non-contiguous operation, sample plot (5 MHz Resolution)



Figure 8.1-123: PSD of LTE 1.4 MHz + WCDMA 5 MHz + NR 5 MHz, 3-carrier non-contiguous operation, sample plot (5 MHz Resolution)



Figure 8.1-124: PSD of 3 x GSM 0.2 MHz + IoT SA 0.4 MHz, + 2 x LTE 5 MHz 6-carrier non-contiguous operation, sample plot (5 MHz Resolution)

Test data, continued

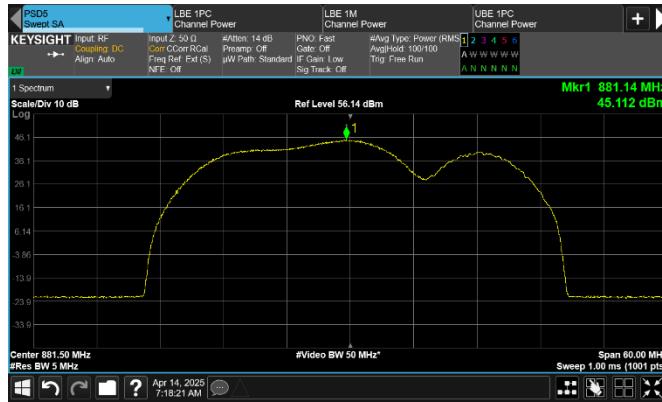


Figure 8.1-125: PSD of 2 x WCDMA 5 MHz + 3 x LTE 1.4 MHz + IoT SA 0.4 MHz, 6-carrier non-contiguous operation, sample plot (5 MHz Resolution)



Figure 8.1-126: PSD of 2 x NR 5 MHz + IoT SA 0.4 + 3 x LTE 1.4 MHz, 6-carrier non-contiguous operation, sample plot (5 MHz Resolution)



Figure 8.1-127: PSD of 2 x GSM 0.2 MHz + 2 x LTE 1.4 MHz + 2 x NR 5 MHz, 6-carrier non-contiguous operation, sample plot (5 MHz Resolution)



Figure 8.1-128: PSD of 2 x LTE 1.4 MHz + 2 x WCDMA 5 MHz + 2 x NR 5 MHz, 6-carrier non-contiguous operation, sample plot (5 MHz Resolution)

Test data, continued

**Table 8.1-195:** Complementary Cumulative Distribution Function (CCDF) of the PAPR reduction measurement results for single carrier operation for LTE 1.4 MHz

Channel size, notes	Frequency, MHz	0.1% CCDF, dB	PAPR reduction limit, dB	Margin, dB
1.4 MHz, Low channel	869.7	8.14	13.00	4.86
1.4 MHz, Mid channel	881.5	8.16	13.00	4.84
1.4 MHz, Top channel	893.3	8.14	13.00	4.86

**Table 8.1-196:** Complementary Cumulative Distribution Function (CCDF) of the PAPR reduction measurement results for single carrier operation for LTE 3 MHz

Channel size, notes	Frequency, MHz	0.1% CCDF, dB	PAPR reduction limit, dB	Margin, dB
3 MHz, Low channel	870.5	8.08	13.00	4.92
3 MHz, Mid channel	881.5	8.10	13.00	4.90
3 MHz, Top channel	892.5	8.15	13.00	4.85

**Table 8.1-197:** Complementary Cumulative Distribution Function (CCDF) of the PAPR reduction measurement results for single carrier operation for LTE 5 with 1B MHz

Channel size, notes	Frequency, MHz	0.1% CCDF, dB	PAPR reduction limit, dB	Margin, dB
5 MHz, Low channel	871.5	8.09	13.00	4.91
5 MHz, Mid channel	881.5	8.14	13.00	4.86
5 MHz, Top channel	891.5	8.14	13.00	4.86

**Table 8.1-198:** Complementary Cumulative Distribution Function (CCDF) of the PAPR reduction measurement results for single carrier operation for LTE 10 with 6B MHz

Channel size, notes	Frequency, MHz	0.1% CCDF, dB	PAPR reduction limit, dB	Margin, dB
10 MHz, Low channel	874.0	7.43	13.00	5.57
10 MHz, Mid channel	881.5	7.33	13.00	5.67
10 MHz, Top channel	889.0	7.45	13.00	5.55

**Table 8.1-199:** Complementary Cumulative Distribution Function (CCDF) of the PAPR reduction measurement results for single carrier operation for NR 5 MHz

Channel size, notes	Frequency, MHz	0.1% CCDF, dB	PAPR reduction limit, dB	Margin, dB
5 MHz, Low channel	871.5	8.12	13.00	4.88
5 MHz, Mid channel	881.5	8.16	13.00	4.84
5 MHz, Top channel	891.5	8.10	13.00	4.90

**Table 8.1-200:** Complementary Cumulative Distribution Function (CCDF) of the PAPR reduction measurement results for single carrier operation for NR 10 MHz

Channel size, notes	Frequency, MHz	0.1% CCDF, dB	PAPR reduction limit, dB	Margin, dB
10 MHz, Low channel	874.0	7.31	13.00	5.69
10 MHz, Mid channel	881.5	7.23	13.00	5.77
10 MHz, Top channel	889.0	7.30	13.00	5.70

**Table 8.1-201:** Complementary Cumulative Distribution Function (CCDF) of the PAPR reduction measurement results for single carrier operation for NR 15 MHz

Channel size, notes	Frequency, MHz	0.1% CCDF, dB	PAPR reduction limit, dB	Margin, dB
15 MHz, Low channel	876.5	7.39	13.00	5.61
15 MHz, Mid channel	881.5	7.24	13.00	5.76
15 MHz, Top channel	886.5	7.42	13.00	5.58

Test data, continued

**Table 8.1-202:** Complementary Cumulative Distribution Function (CCDF) of the PAPR reduction measurement results for single carrier operation for NR 20 MHz

Channel size, notes	Frequency, MHz	0.1% CCDF, dB	PAPR reduction limit, dB	Margin, dB
20 MHz, Low channel	879.0	7.37	13.00	5.63
20 MHz, Mid channel	881.5	7.26	13.00	5.74
20 MHz, Top channel	884.0	7.38	13.00	5.62

**Table 8.1-203:** Complementary Cumulative Distribution Function (CCDF) of the PAPR reduction measurement results for single carrier operation for NR 25 MHz

Channel size, notes	Frequency, MHz	0.1% CCDF, dB	PAPR reduction limit, dB	Margin, dB
25 MHz, Mid channel	881.5	7.43	13.00	5.57

**Table 8.1-204:** Complementary Cumulative Distribution Function (CCDF) of the PAPR reduction measurement results for single carrier operation for WCDMA 5 MHz

Channel size, notes	Frequency, MHz	0.1% CCDF, dB	PAPR reduction limit, dB	Margin, dB
5 MHz, Low channel	871.4	8.06	13.00	4.94
5 MHz, Mid channel	881.6	8.08	13.00	4.92
5 MHz, Top channel	891.6	7.98	13.00	5.02

Test data, continued



Figure 8.1-129: CCDF sample plot, LTE 1.4 MHz



Figure 8.1-130: CCDF sample plot, LTE 3 MHz



Figure 8.1-131: CCDF sample plot, LTE 5 MHz



Figure 8.1-132: CCDF sample plot, LTE 10 MHz



Figure 8.1-133: CCDF sample plot, NR 5 MHz

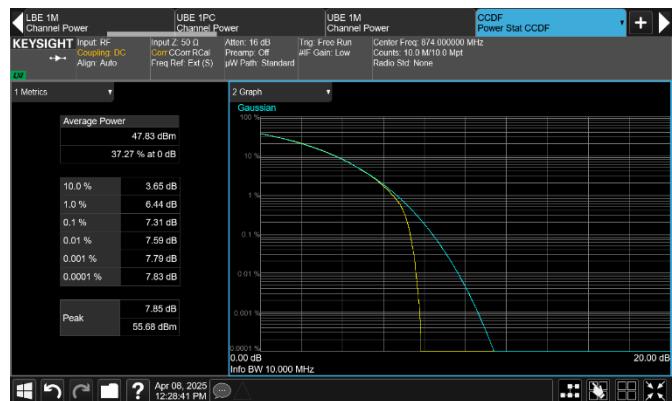


Figure 8.1-134: CCDF sample plot, NR 10 MHz



**Figure 8.1-135:** CCDF sample plot, NR 15 MHz



**Figure 8.1-136:** CCDF sample plot, NR 20 MHz



**Figure 8.1-137:** CCDF sample plot, NR 25 MHz



**Figure 8.1-138:** CCDF sample plot, WCDMA 5 MHz

## 8.2 Spurious emissions at RF antenna connector

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### 8.2.1 Definitions and limits

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#### FCC §22.917 Emission limitations for cellular equipment.

**(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 reference bandwidth as follows:

(1) In the spectrum below 1 GHz, instrumentation should employ a reference bandwidth of 100 kHz or greater. 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 that the measured power is integrated over the full required reference bandwidth (i.e., 100 kHz 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.

(2) In the spectrum above 1 GHz, instrumentation should employ a reference bandwidth of 1 MHz

#### RSS-132, Section 5.5: Transmitter Unwanted Emissions

(i) In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated below the transmitter output power P (dBW) by at least  $43 + 10 \log(p)$  dB

(ii) After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz bandwidth shall be attenuated below the transmitter output power P (dBW) by at least  $43 + 10 \log(p)$  dB. If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

### 8.2.2 Test summary

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Test date	April 7, 2025
Test engineer	Dhara Patel

### 8.2.3 Observations, settings and special notes

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The spectrum was analyzed from 30 MHz to the 10th harmonic. All measurements were conducted using an average (RMS) detector in accordance with ANSI C63.26 Paragraph 5.7.2.

All NR and LTE limit lines were adjusted for MIMO operation by 6 dB, for example:  $-13 \text{ dBm} - 6 \text{ dB} = -19 \text{ dBm}$ .

MIMO correction factor for 4 antenna ports:  $10 \times \log_{10}(4) = 6 \text{ dB}$ .

All IoT SA limit lines were adjusted for MIMO operation by 3 dB, for example:  $-13 \text{ dBm} - 3 \text{ dB} = -16 \text{ dBm}$ .

MIMO correction factor for 2 antenna ports:  $10 \times \log_{10}(2) = 3 \text{ dB}$ .

GSM transmits completely uncorrelated signal from each antenna port, therefore there were no MIMO factors used.

Modulation Selection: The EUT supports multiple Quadrature Amplitude Modulation (QAM) schemes. QPSK was chosen as the worst-case modulation due to its higher power output

For general scan, the RBW was set to 1 MHz, with the VBW set wider than the RBW.

Band edges were tested using the channel power function of the spectrum analyzer, which calculates the total power within a specific band. This method is correlated with the resolution bandwidths specified in the regulations.

On the plots below the measured *Channel Power* value in the “*Total Channel Power*” column must be:

-19 dBm and lower for LTE, NR, WCDMA;

-16 dBm and lower for NB-IoT SA;

-13 dBm and lower for GSM

## 8.2.4 Test data



Figure 8.2-1: Conducted spurious emissions 30 MHz to 3.6 GHz of LTE 1.4 MHz low channel, single carrier operation



Figure 8.2-2: Conducted spurious emissions 3.6 GHz to 10 GHz of LTE 1.4 MHz low channel, single carrier operation

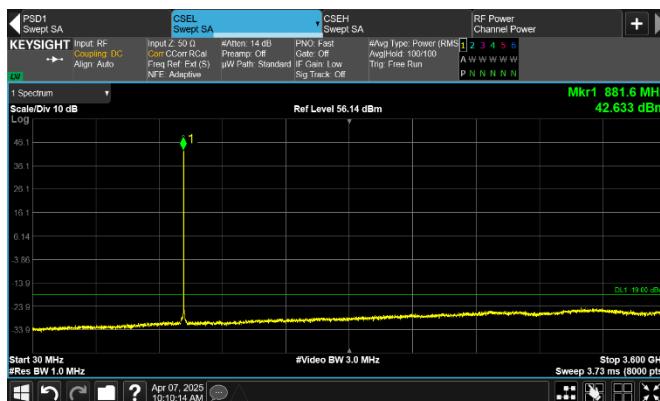


Figure 8.2-3: Conducted spurious emissions 30 MHz to 3.6 GHz of LTE 1.4 MHz mid channel, single carrier operation



Figure 8.2-4: Conducted spurious emissions 3.6 GHz to 10 GHz of LTE 1.4 MHz mid channel, single carrier operation



Figure 8.2-5: Conducted spurious emissions 30 MHz to 3.6 GHz of LTE 1.4 MHz top channel, single carrier operation



Figure 8.2-6: Conducted spurious emissions 3.6 GHz to 10 GHz of LTE 1.4 MHz top channel, single carrier operation

Test data, continued



Figure 8.2-7: Conducted spurious emissions 30 MHz to 3.6 GHz of LTE 3 MHz low channel, single carrier operation



Figure 8.2-8: Conducted spurious emissions 3.6 GHz to 10 GHz of LTE 3 low channel, single carrier operation

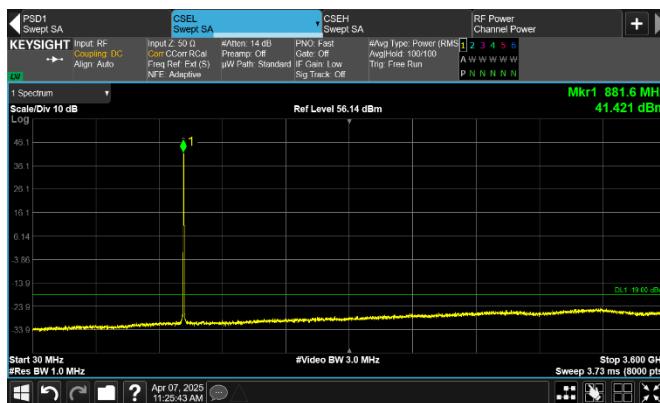


Figure 8.2-9: Conducted spurious emissions 30 MHz to 3.6 GHz of LTE 3 MHz mid channel, single carrier operation



Figure 8.2-10: Conducted spurious emissions 3.6 GHz to 10 GHz of LTE 3 MHz mid channel, single carrier operation

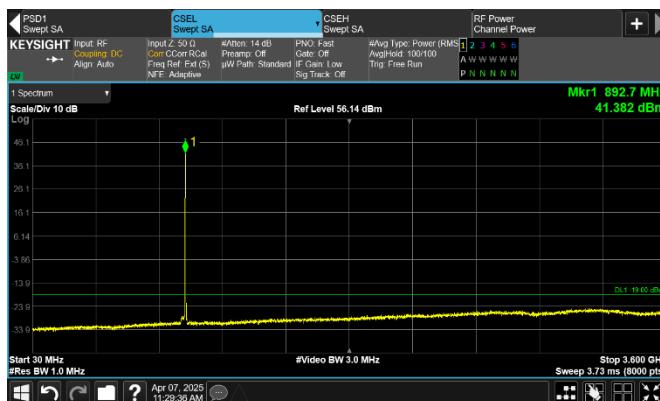


Figure 8.2-11: Conducted spurious emissions 30 MHz to 3.6 GHz of LTE 3 MHz top channel, single carrier operation



Figure 8.2-12: Conducted spurious emissions 3.6 GHz to 10 GHz of LTE 3 MHz top channel, single carrier operation

Test data, continued

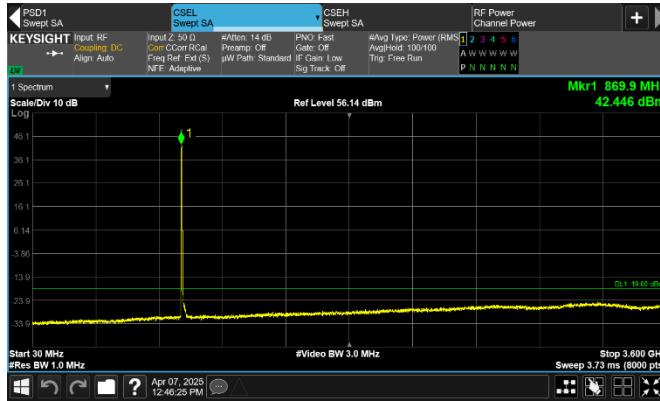


Figure 8.2-13: Conducted spurious emissions 30 MHz to 3.6 GHz of LTE 5 MHz with IB low channel, single carrier operation



Figure 8.2-14: Conducted spurious emissions 3.6 GHz to 10 GHz of LTE 5 MHz with IB low channel, single carrier operation

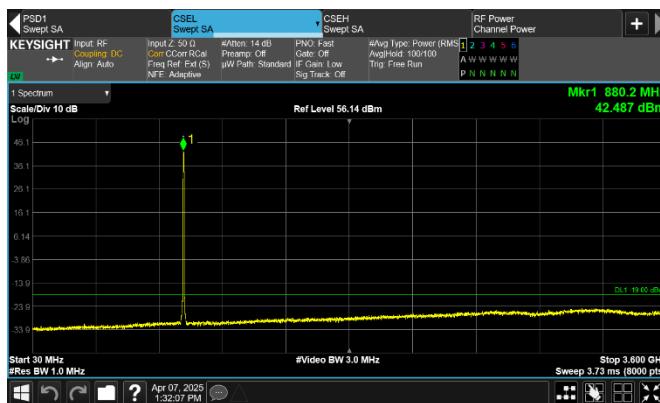


Figure 8.2-15: Conducted spurious emissions 30 MHz to 3.6 GHz of LTE 5 MHz with IB mid channel, single carrier operation

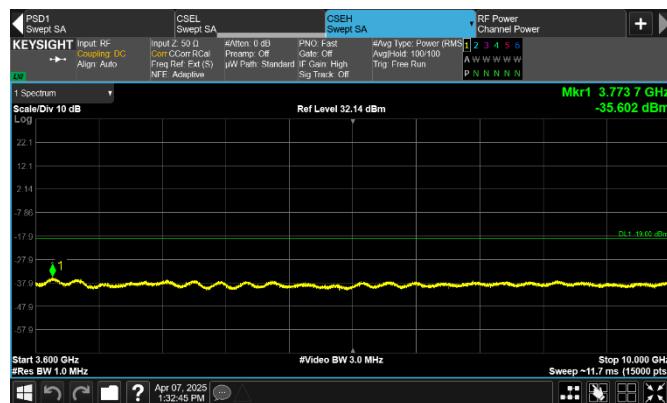


Figure 8.2-16: Conducted spurious emissions 3.6 GHz to 10 GHz of LTE 5 MHz with IB mid channel, single carrier operation



Figure 8.2-17: Conducted spurious emissions 30 MHz to 3.6 GHz of LTE 5 MHz with IB top channel, single carrier operation

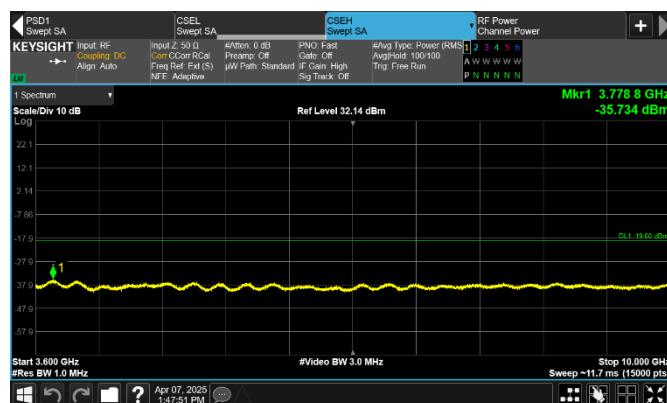


Figure 8.2-18: Conducted spurious emissions 3.6 GHz to 10 GHz of LTE 5 MHz with IB top channel, single carrier operation