Table 8.2-2: *Output power measurement results*

Port	RF output power, dBm	RF output power, W	Dual band combined power, dBm	Dual band combined power, W
000	39.85	9.661	42.63	18.323
010	40.13	10.304	42.77	18.923
020	39.84	9.638	42.73	18.750
030	**40.16**	10.375	42.83	19.187
031	39.88	9.727	42.66	18.450
021	40.12	10.280	**42.84**	**19.231**
011	39.90	9.772	42.62	18.281
001	39.99	9.977	42.67	18.493
070	39.84	9.638	42.64	18.365
060	40.09	10.209	42.83	19.187
050	39.90	9.772	42.67	18.493
040	40.15	10.351	42.84	19.231
041	39.93	9.840	42.71	18.664
051	40.02	10.046	42.77	18.923
061	39.96	9.908	42.70	18.621

Note: The measurement results in the table above were obtained during single band and multi band operation. 10 MHz channel BW (worst case) was used. Frequency of carriers were 2155.0 MHz and 1962.5 MHz for dual band config.

Note: it was determined that the highest level of output power is at antenna port **021**, while tested together with Band 66, despite the fact, that the single band 2/25a the port 021 is not the highest. Since the difference between the highest measured level (at port **030**) and port **021** is only 0.04 dB, which was considered negligible and for testing time concerns it was decided to use port **021** as a representative one and all the rest of the measurements were performed on it.

Table 8.2-3: *Output power density measurement results for single-carrier configuration for Port* ***021***

Remarks	Frequency, MHz	RF power density, dBm/MHz	Antenna gain, dBi	EIRP, dBm/MHz	EIRP limit, dBm/MHz	Margin, dB
QPSK, 10 MHz, Low channel	1935.0	31.00	14.50	45.50	62.15	16.65
16QAM, 10 MHz, Low channel	1935.0	30.94	14.50	45.44	62.15	16.71
64QAM, 10 MHz, Low channel	1935.0	30.78	14.50	45.28	62.15	16.87
256QAM, 10 MHz, Low channel	1935.0	30.88	14.50	45.38	62.15	16.77
QPSK, 10 MHz, Mid channel	1962.5	31.01	14.50	45.51	62.15	16.64
QPSK, 10 MHz, High channel	1990.0	30.95	14.50	45.45	62.15	16.70
QPSK, 15 MHz, Low channel	1937.5	29.27	14.50	43.77	62.15	18.38
16QAM, 15 MHz, Low channel	1937.5	29.84	14.50	44.34	62.15	17.81
64QAM, 15 MHz, Low channel	1937.5	29.33	14.50	43.83	62.15	18.32
256QAM, 15 MHz, Low channel	1937.5	29.27	14.50	43.77	62.15	18.38
16QAM, 15 MHz, Mid channel	1962.5	30.07	14.50	44.57	62.15	17.58
16QAM, 15 MHz, High channel	1987.5	29.83	14.50	44.33	62.15	17.82
QPSK, 20 MHz, Low channel	1940.0	27.89	14.50	42.39	62.15	19.76
16QAM, 20 MHz, Low channel	1940.0	28.13	14.50	42.63	62.15	19.52
64QAM, 20 MHz, Low channel	1940.0	28.08	14.50	42.58	62.15	19.57
256QAM, 20 MHz, Low channel	1940.0	28.05	14.50	42.55	62.15	19.60
16QAM, 20 MHz, Mid channel	1962.5	28.18	14.50	42.68	62.15	19.47
16QAM, 20 MHz, High channel	1985.0	28.32	14.50	42.82	62.15	19.33

Linear sum of 8 ports of each polarization was based on the worst-case scenario, then all ports transmit at the maximum found power density of 31.01 dBm/MHz. Maximum PSD sum = 31.01 dBm/MHz + 10 × $Log_{10}(8)$ = 40.04 dBm/MHz

Table 8.2-4: *Total EIRP calculation for a single-carrier operation*

Maximum PSD sum, dBm/MHz	Antenna Gain, dBi	Antenna Array Column Gain[1], dB	EIRP per polarization[2], dBm/MHz	EIRP per polarization, W/MHz
40.04	14.50	9.00	63.54	2259.904

Notes: [1] Antenna Array Column Gain = 10 × $Log_{10}(8)$
[2]EIRP = PSD Sum + Antenna Gain + Antenna Array Column Gain
Total EIRP calculation for a single Macro Narrow traffic beam: 40.04 + 25 dBi *(directional beam)* = 65.04 dBm or 3191.5 W

Table 8.2-5: *Output power density measurement results for two-carrier operation for Port* ***021***

Frequency, MHz	RF power density, dBm/MHz	Antenna gain, dBi	EIRP, dBm/MHz	EIRP limit, dBm/MHz	Margin, dB
1935.0 + 1945.0	27.98	14.50	42.48	62.15	19.67
1957.5 + 1967.5	28.15	14.50	42.65	62.15	19.50
1980.0 + 1990.0	28.07	14.50	42.57	62.15	19.58
1937.5 + 1952.5	26.79	14.50	41.29	62.15	20.86
1955.0 + 1970.0	27.04	14.50	41.54	62.15	20.61
1972.5 + 1987.5	27.37	14.50	41.87	62.15	20.28
1940.0 + 1960.0	25.49	14.50	39.99	62.15	22.16
1952.5 + 1972.5	25.58	14.50	40.08	62.15	22.07
1965.0 + 1985.0	25.42	14.50	39.92	62.15	22.23

Linear sum of 8 ports of each polarization was based on the worst-case scenario, then all ports transmit at the maximum found power density of 28.15 dBm/MHz. Maximum PSD sum = 28.15 dBm/MHz + 10 × $Log_{10}(8)$ = 37.18 dBm/MHz

Table 8.2-6: *Total EIRP calculation for a two-carrier operation*

Maximum PSD sum, dBm/MHz	Antenna Gain, dBi	Antenna Array Column Gain[1], dB	EIRP per polarization[2], dBm/MHz	EIRP per polarization, W/MHz
37.18	14.50	9.00	60.68	1169.742

Notes: [1] Antenna Array Column Gain = 10 × $Log_{10}(8)$
[2]EIRP = PSD Sum + Antenna Gain + Antenna Array Column Gain

Table 8.2-7: *Output power density measurement results for LTE with IoT operation*

Remarks	Frequency, MHz	RF power density, dBm/MHz	Antenna gain, dBi	EIRP, dBm/MHz	EIRP limit, dBm/MHz	Margin, dB
10 MHz low channel with 2 × GB IoT	1935.0	30.81	14.50	45.31	62.15	16.84
10 MHz mid channel with 2 × GB IoT	1962.5	31.01	14.50	45.51	62.15	16.64
10 MHz high channel with 2 × GB IoT	1990.0	30.69	14.50	45.19	62.15	16.96
15 MHz low channel with 2 × GB IoT	1937.5	29.54	14.50	44.04	62.15	18.11
15 MHz mid channel with 2 × GB IoT	1962.5	29.53	14.50	44.03	62.15	18.12
15 MHz high channel with 2 × GB IoT	1987.5	29.23	14.50	43.73	62.15	18.42
20 MHz low channel with 2 × GB IoT	1940.0	28.47	14.50	42.97	62.15	19.18
20 MHz mid channel with 2 × GB IoT	1962.5	28.33	14.50	42.83	62.15	19.32
20 MHz high channel with 2 × GB IoT	1985.0	28.52	14.50	43.02	62.15	19.13

Linear sum of 8 ports of each polarization was based on the worst-case scenario, then all ports transmit at the maximum found power density of 31.01 dBm/MHz. Maximum PSD sum = 31.01 dBm/MHz + 10 × $Log_{10}(8)$ = 40.04 dBm/MHz

Table 8.2-8: *Total EIRP calculation for an LTE + IoT operation*

Maximum PSD sum, dBm/MHz	Antenna Gain, dBi	Antenna Array Column Gain[1], dB	EIRP per polarization[2], dBm/MHz	EIRP per polarization, W/MHz
40.04	14.50	9.00	63.54	2259.436

Notes: [1] Antenna Array Column Gain = 10 × $\text{Log}_{10}(8)$
[2]EIRP = PSD Sum + Antenna Gain + Antenna Array Column Gain

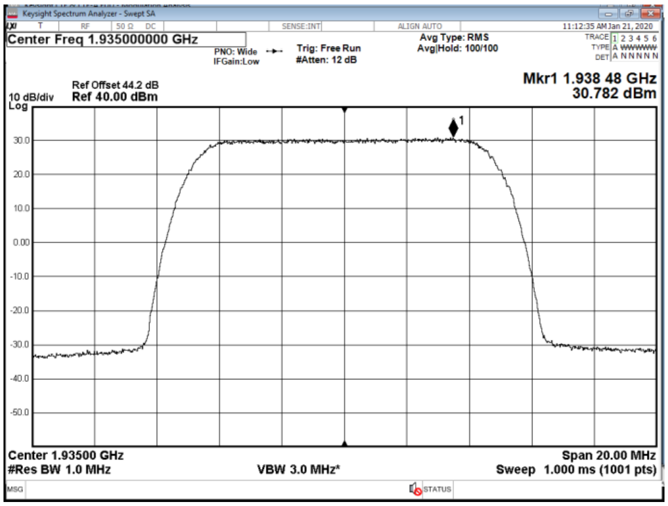


Figure 8.2-5: *PSD sample plot, single carrier 10 MHz bandwidth*

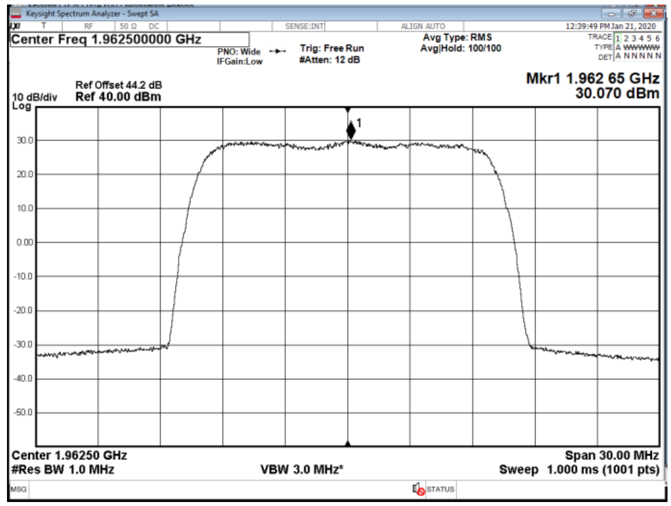


Figure 8.2-6: *PSD sample plot, single carrier 15 MHz bandwidth*

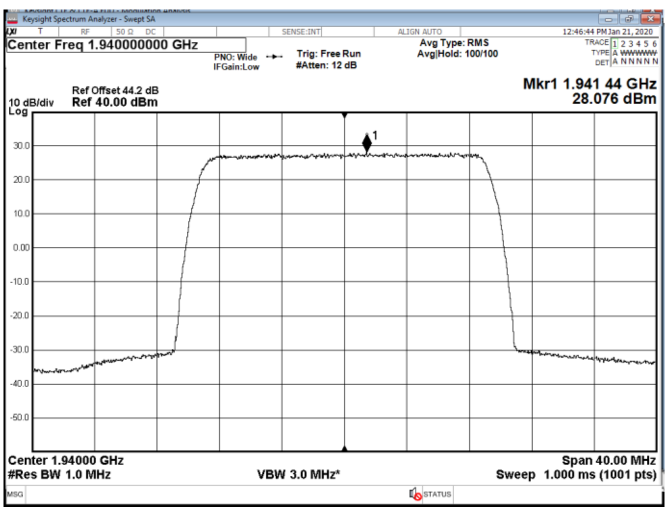


Figure 8.2-7: *PSD sample plot, single carrier 20 MHz bandwidth*

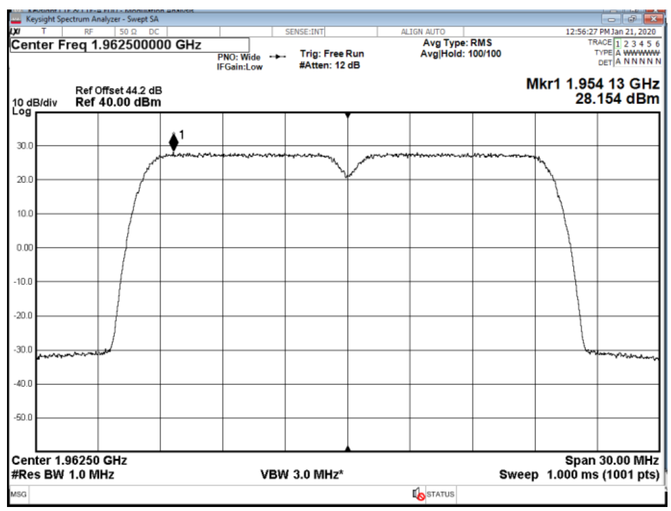


Figure 8.2-8: *PSD sample plot, two-carrier 10 MHz bandwidth*

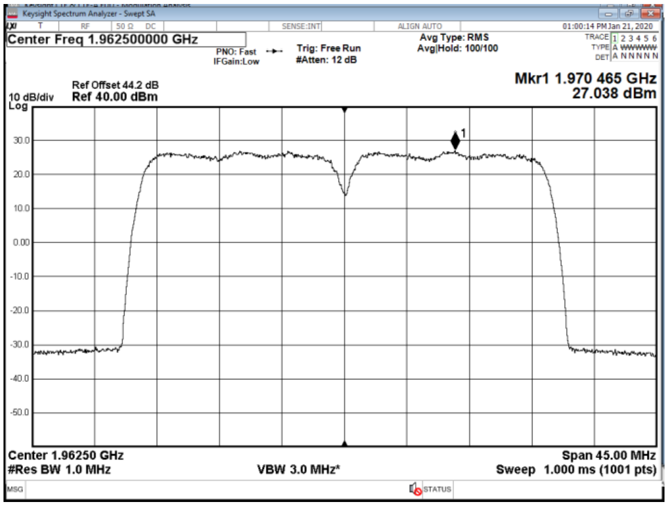


Figure 8.2-9: *PSD sample plot, two-carrier 15 MHz bandwidth*

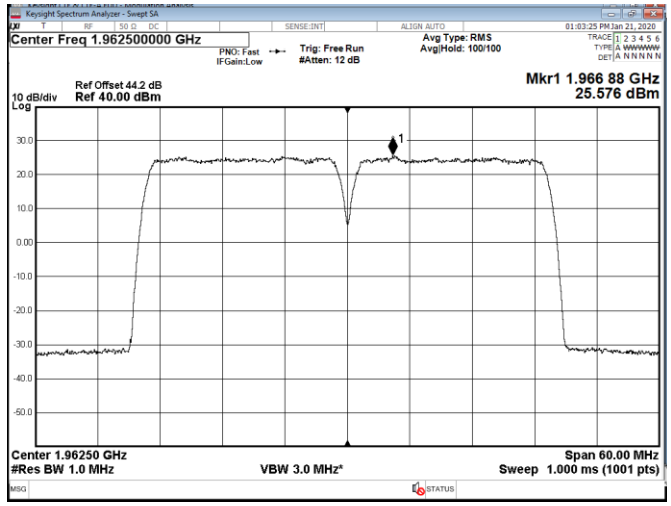


Figure 8.2-10: *PSD sample plot, two-carrier 20 MHz bandwidth*

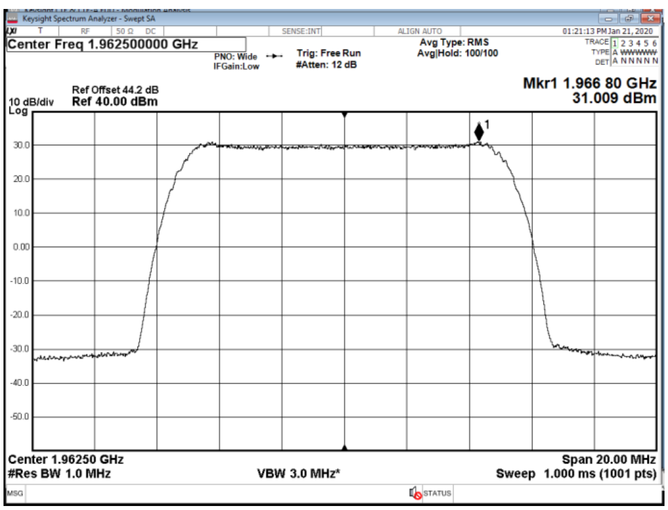


Figure 8.2-11: *PSD sample plot, 10 MHz channel bandwidth with IoT*

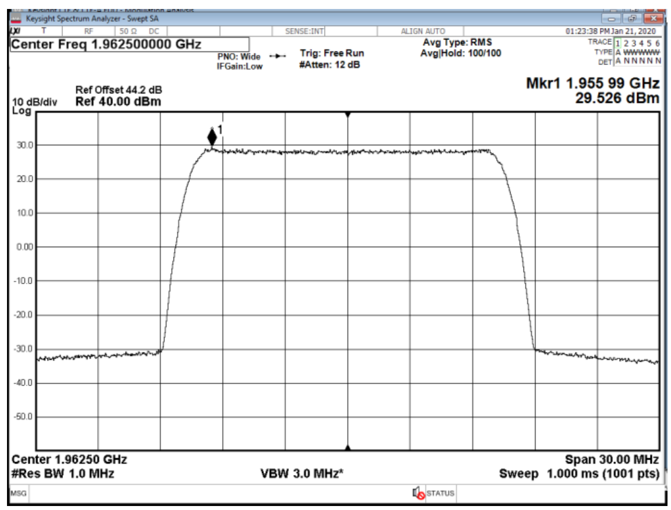


Figure 8.2-12: *PSD sample plot, 15 MHz channel bandwidth with IoT*

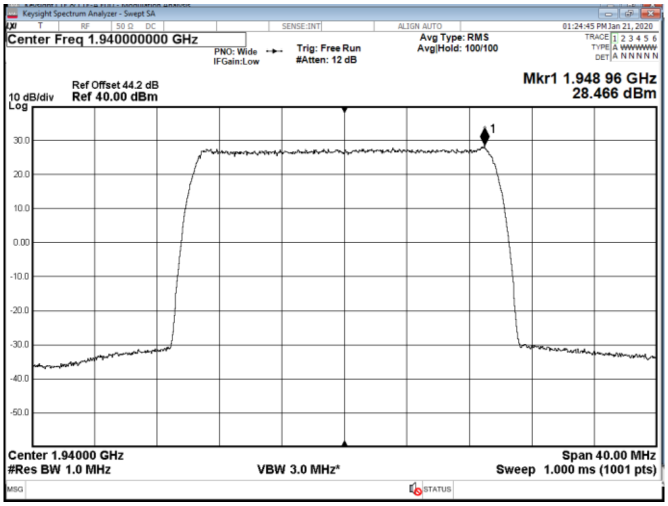


Figure 8.2-13: *PSD sample plot, 20 MHz channel bandwidth with IoT*

Table 8.2-9: *Complementary Cumulative Distribution Function (CCDF) of the PAPR reduction measurement results for single-carrier operation*

Remarks	Frequency, MHz	0.1% CCDF, dB	PAPR reduction limit, dB	Margin, dB
QPSK, 10 MHz, Low channel	1935.0	7.27	13.00	5.73
16QAM, 10 MHz, Low channel	1935.0	7.26	13.00	5.74
64QAM, 10 MHz, Low channel	1935.0	7.28	13.00	5.72
256QAM, 10 MHz, Low channel	1935.0	7.27	13.00	5.73
QPSK, 10 MHz, Mid channel	1962.5	7.36	13.00	5.64
QPSK, 10 MHz, High channel	1990.0	7.24	13.00	5.76
QPSK, 15 MHz, Low channel	1937.5	7.30	13.00	5.70
16QAM, 15 MHz, Low channel	1937.5	7.29	13.00	5.71
64QAM, 15 MHz, Low channel	1937.5	7.30	13.00	5.70
256QAM, 15 MHz, Low channel	1937.5	7.33	13.00	5.67
16QAM, 15 MHz, Mid channel	1962.5	7.36	13.00	5.64
16QAM, 15 MHz, High channel	1987.5	7.25	13.00	5.75
QPSK, 20 MHz, Low channel	1940.0	7.37	13.00	5.63
16QAM, 20 MHz, Low channel	1940.0	7.37	13.00	5.63
64QAM, 20 MHz, Low channel	1940.0	7.36	13.00	5.64
256QAM, 20 MHz, Low channel	1940.0	7.37	13.00	5.63
16QAM, 20 MHz, Mid channel	1962.5	7.37	13.00	5.63
16QAM, 20 MHz, High channel	1985.0	7.31	13.00	5.69

Table 8.2-10: *Complementary Cumulative Distribution Function (CCDF) of the PAPR reduction measurement results for single-carrier operation with IoT*

Remarks	Frequency, MHz	0.1% CCDF, dB	PAPR reduction limit, dB	Margin, dB
10 MHz low channel with 2 × GB IoT	1935.0	7.43	13.00	5.57
10 MHz mid channel with 2 × GB IoT	1962.5	7.54	13.00	5.46
10 MHz high channel with 2 × GB IoT	1990.0	7.40	13.00	5.60
15 MHz low channel with 2 × GB IoT	1937.5	7.38	13.00	5.62
15 MHz mid channel with 2 × GB IoT	1962.5	7.48	13.00	5.52
15 MHz high channel with 2 × GB IoT	1987.5	7.37	13.00	5.63
20 MHz low channel with 2 × GB IoT	1940.0	7.45	13.00	5.55
20 MHz mid channel with 2 × GB IoT	1962.5	7.46	13.00	5.54
20 MHz high channel with 2 × GB IoT	1985.0	7.41	13.00	5.59

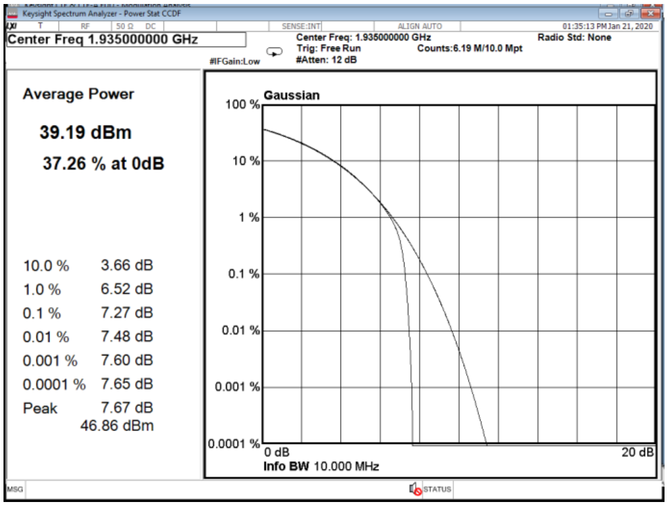


Figure 8.2-14: *CCDF sample plot, 10 MHz channel*

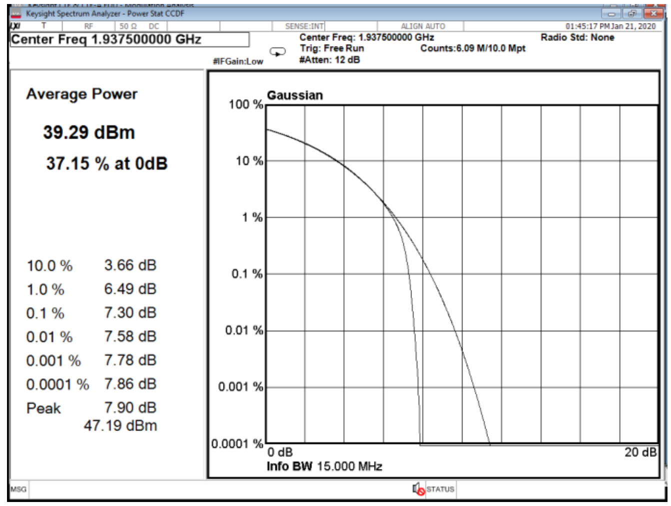


Figure 8.2-15: *CCDF sample plot, 15 MHz channel*

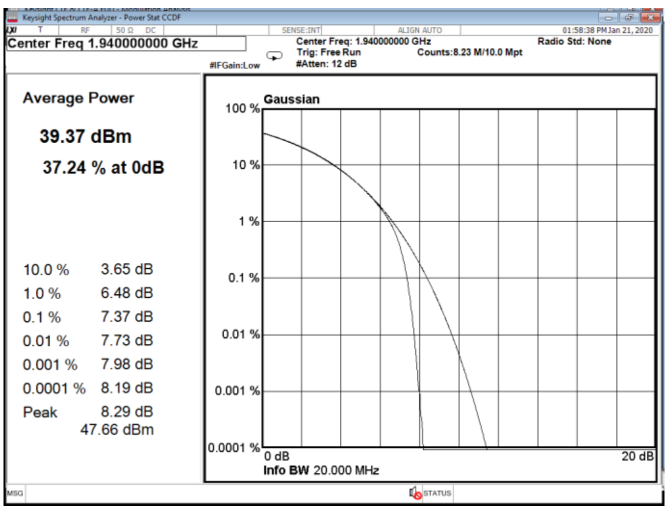


Figure 8.2-16: *CCDF sample plot, 20 MHz channel*

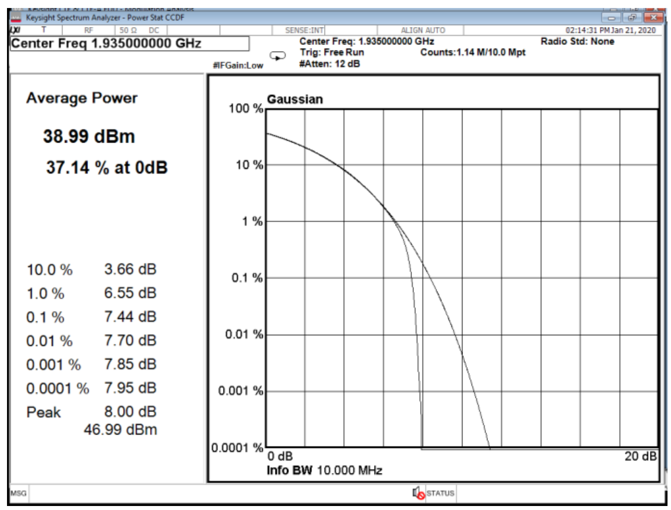


Figure 8.2-17: *CCDF sample plot, 10 MHz channel LTE + IoT*

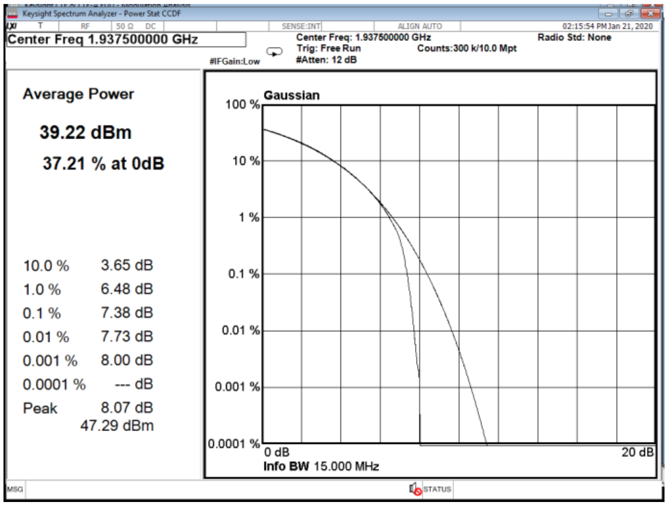


Figure 8.2-18: *CCDF sample plot, 15 MHz channel LTE + IoT*

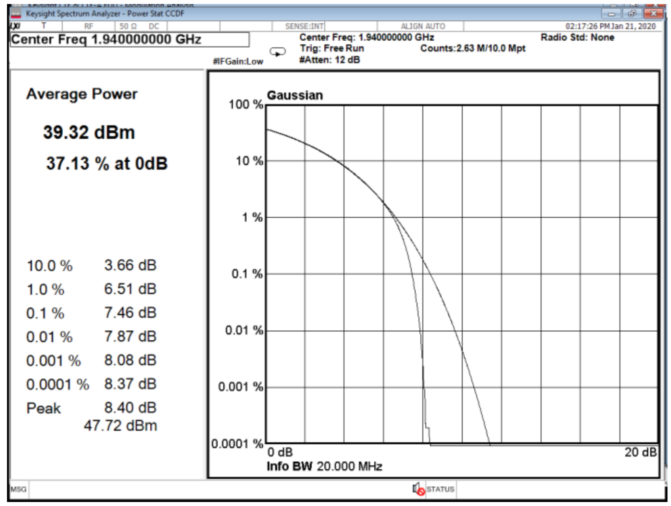


Figure 8.2-19: *CCDF sample plot, 20 MHz channel LTE + IoT*

8.3 FCC 27.53 and RSS-139, 4.2, RSS-170, 5.4 Spurious emissions at RF antenna connector (Band 66)

8.3.1 Definitions and limits

FCC:
(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.

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
The 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.

8.3.2 Test summary

Test date	January 21, 2020

8.3.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to the 10th harmonic.
All measurements were performed using an average (RMS) detector per ANSI C63.26 Paragraph 5.7.2 method.
Limit line was adjusted for MIMO operation by 12.04 dB (for *16* ports: 10 × Log_{10}(*16*)): −13 dBm – 12.04 dB = −25.04 dBm
RBW 1 MHz, VBW was wider than RBW.

8.3.4 Test data

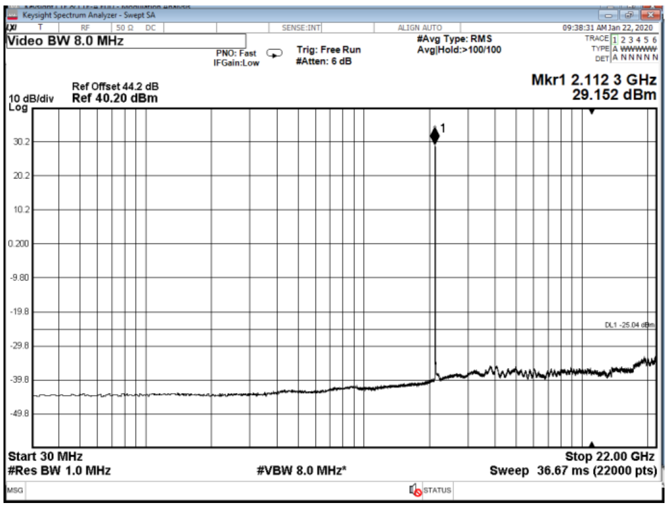


Figure 8.3-1: *Conducted spurious emissions of 10 MHz low channel, single carrier operation*

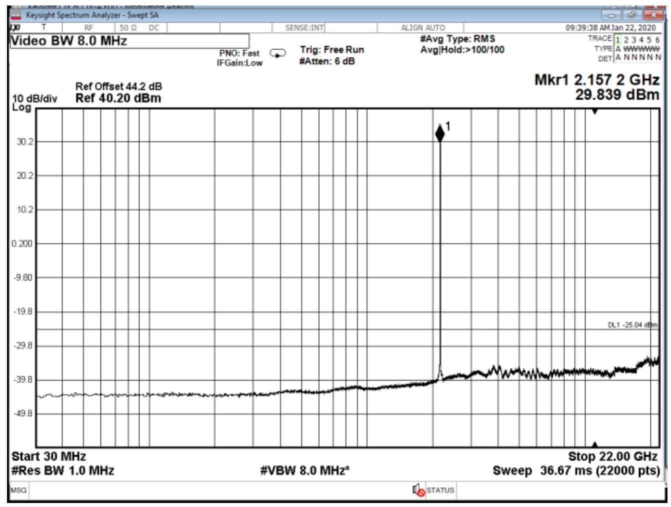


Figure 8.3-2: *Conducted spurious emissions of 10 MHz mid channel, single carrier operation*

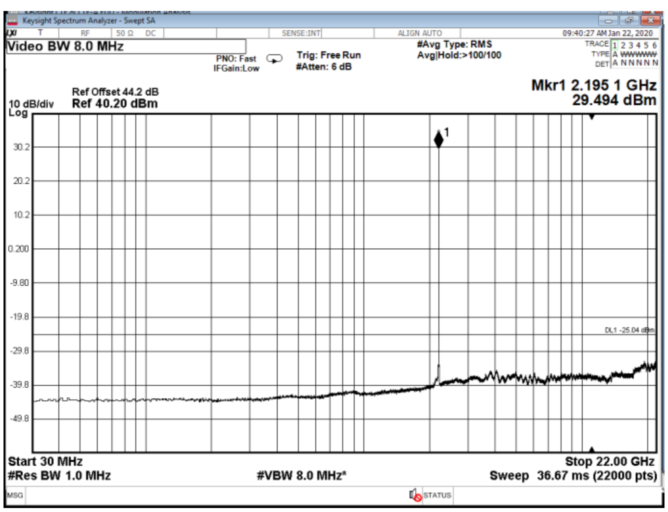


Figure 8.3-3: *Conducted spurious emissions of 10 MHz high channel, single carrier operation*

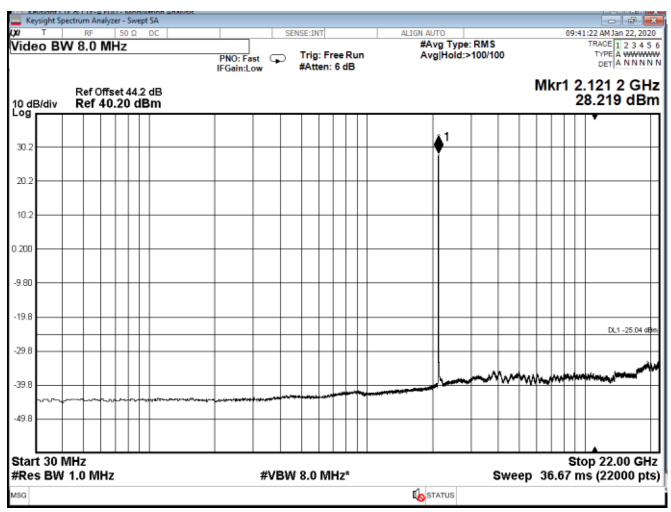


Figure 8.3-4: *Conducted spurious emissions of 15 MHz low channel, single carrier operation*

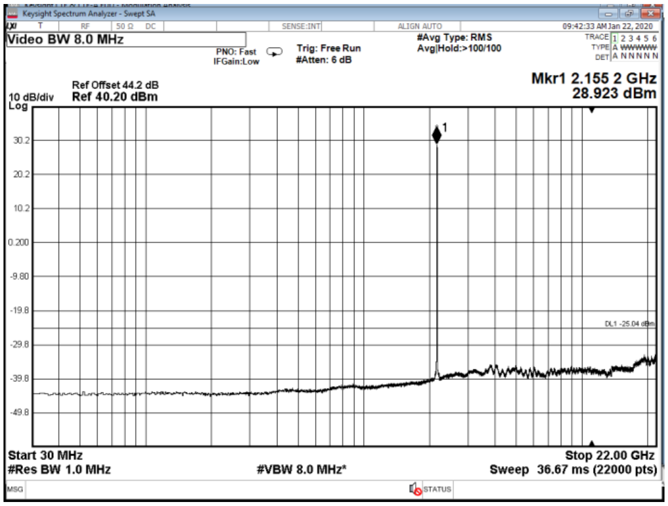


Figure 8.3-5: *Conducted spurious emissions of 15 MHz mid channel, single carrier operation*

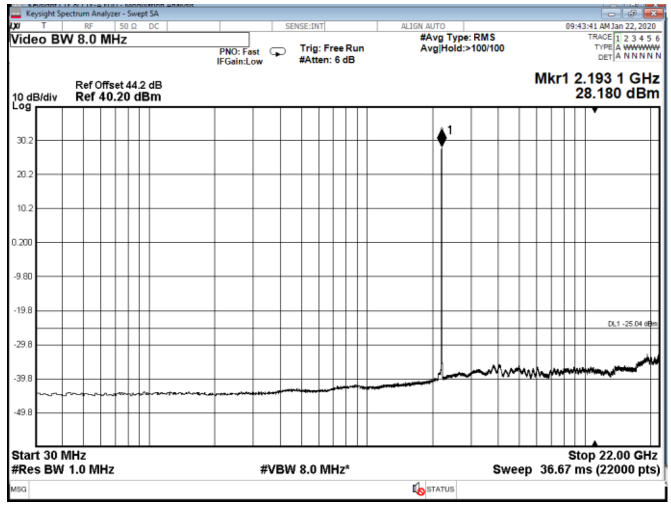


Figure 8.3-6: *Conducted spurious emissions of 15 MHz high channel, single carrier operation*

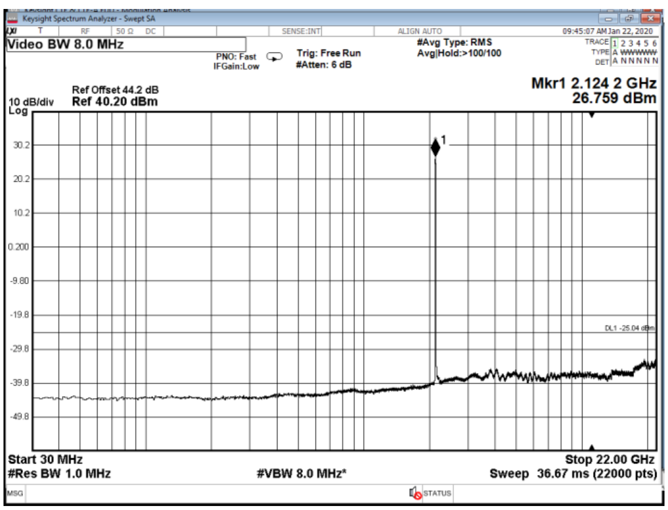


Figure 8.3-7: *Conducted spurious emissions of 20 MHz low channel, single carrier operation*

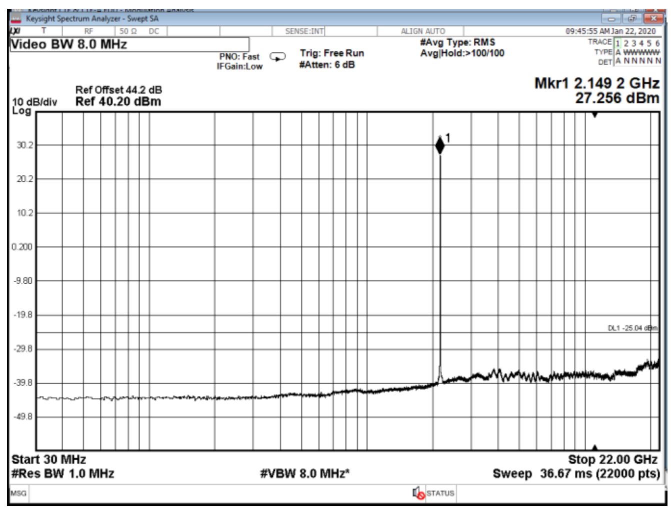


Figure 8.3-8: *Conducted spurious emissions of 20 MHz mid channel, single carrier operation*

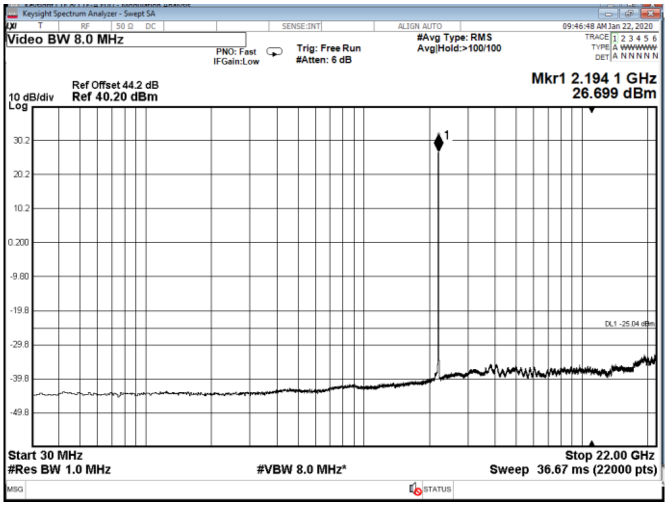


Figure 8.3-9: *Conducted spurious emissions of 20 MHz high channel, single carrier operation*

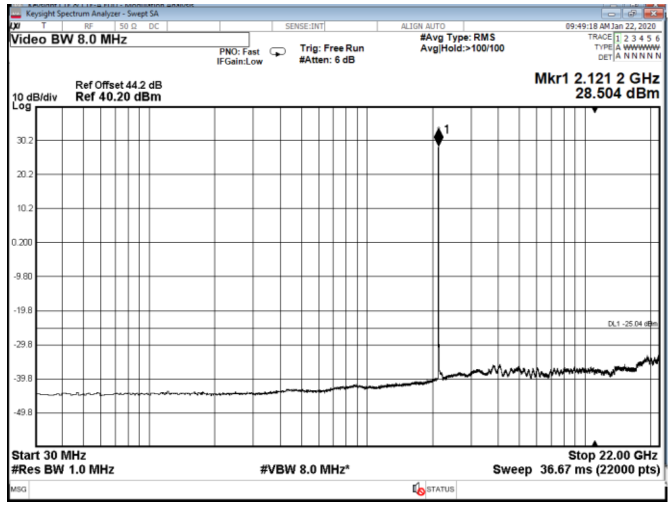


Figure 8.3-10: *Conducted spurious emissions of 10 MHz low channel, single carrier operation with IoT*

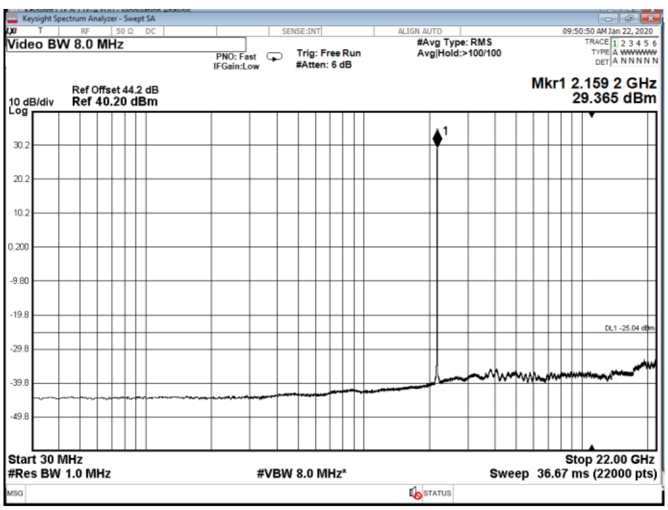


Figure 8.3-11: *Conducted spurious emissions of 10 MHz mid channel, single carrier operation with IoT*

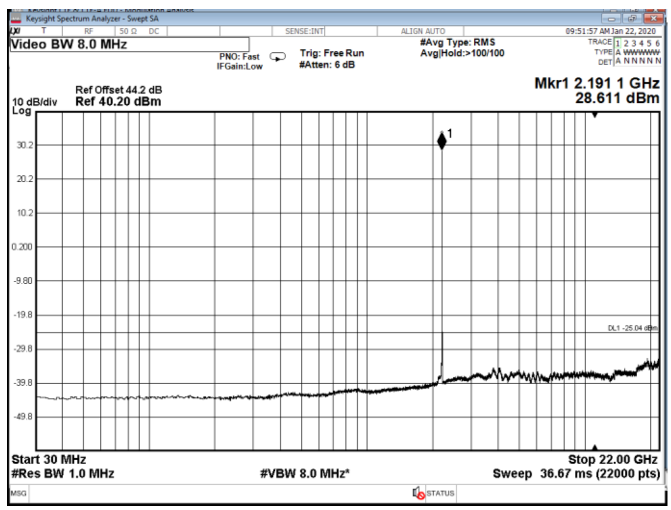


Figure 8.3-12: *Conducted spurious emissions of 10 MHz high channel, single carrier operation with IoT*

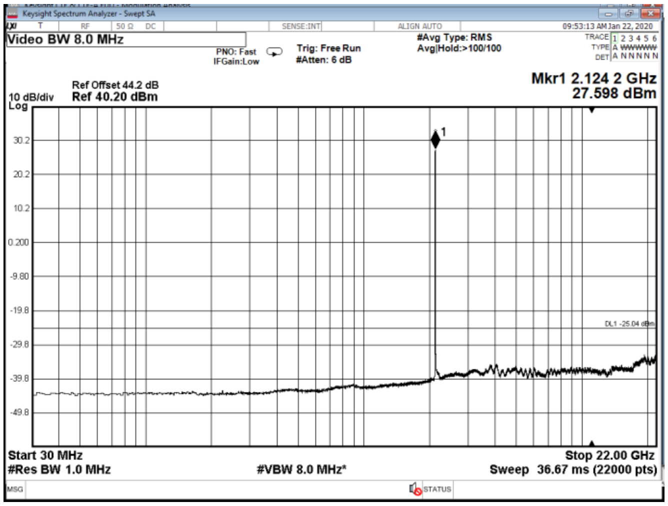


Figure 8.3-13: *Conducted spurious emissions of 15 MHz low channel, single carrier operation with IoT*

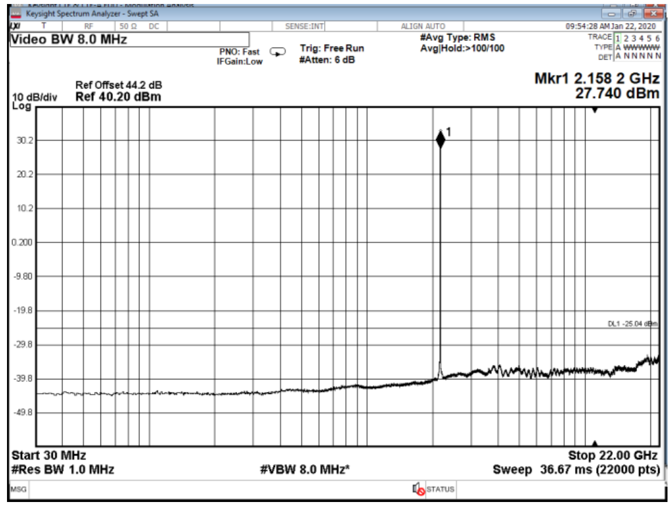


Figure 8.3-14: *Conducted spurious emissions of 15 MHz mid channel, single carrier operation with IoT*

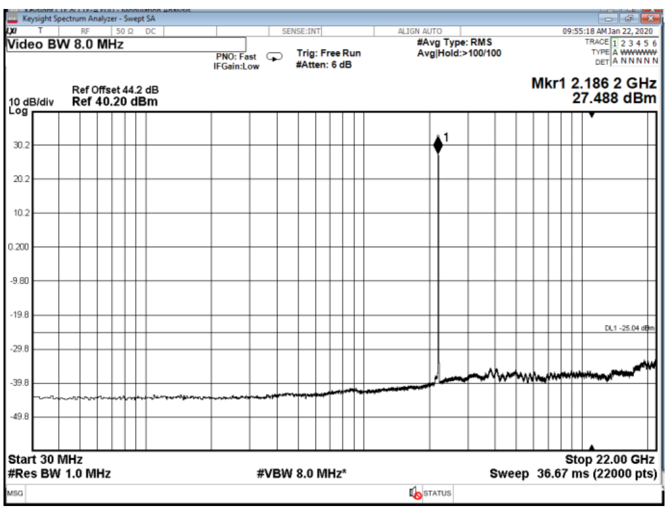


Figure 8.3-15: *Conducted spurious emissions of 15 MHz high channel, single carrier operation with IoT*

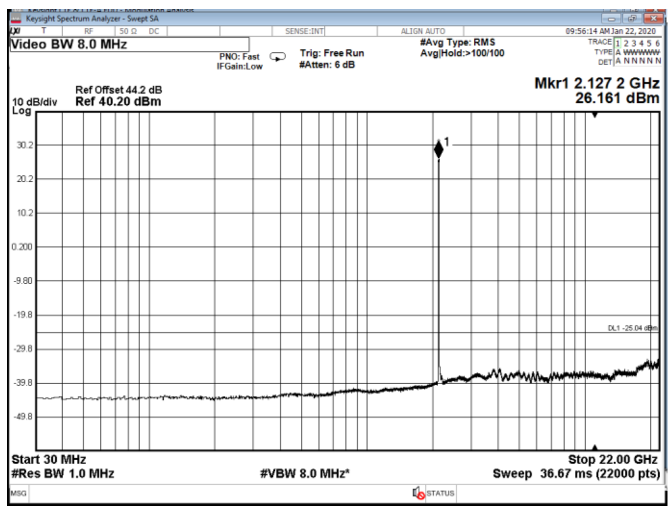


Figure 8.3-16: *Conducted spurious emissions of 20 MHz low channel, single carrier operation with IoT*

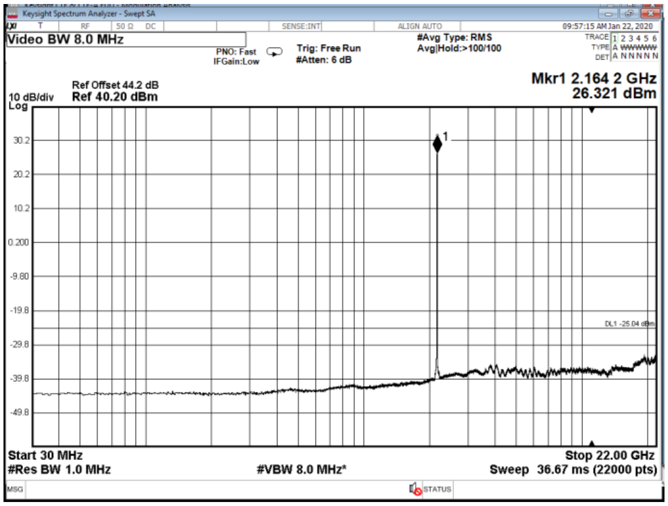


Figure 8.3-17: *Conducted spurious emissions of 20 MHz mid channel, single carrier operation with IoT*

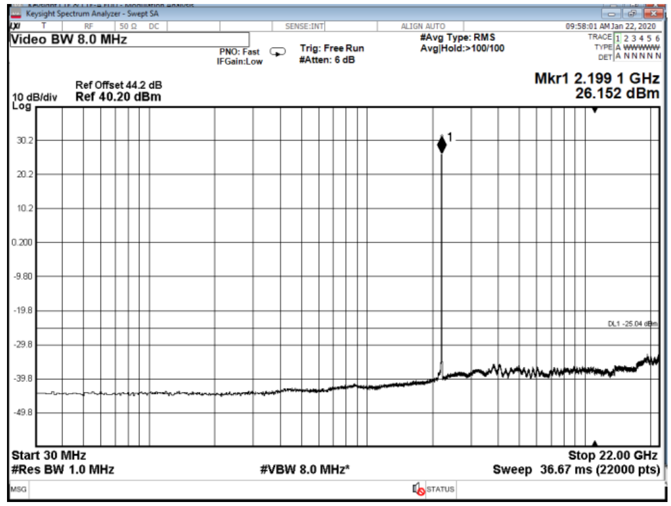


Figure 8.3-18: *Conducted spurious emissions of 20 MHz high channel, single carrier operation with IoT*

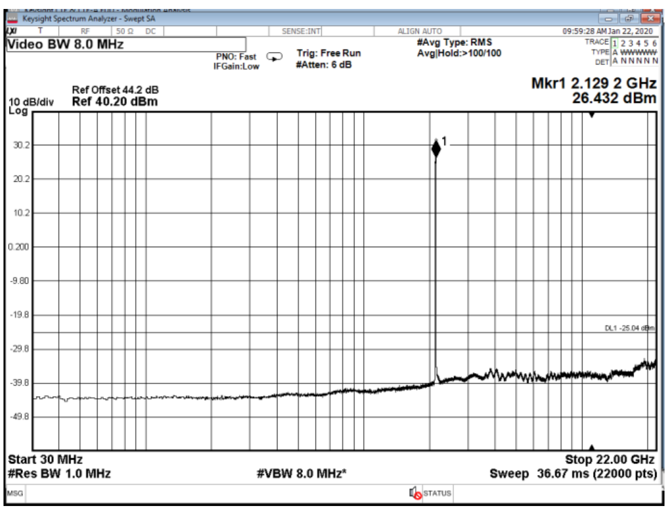


Figure 8.3-19: *Conducted spurious emissions of 10 MHz bottom channels, two-carrier operation with IoT*

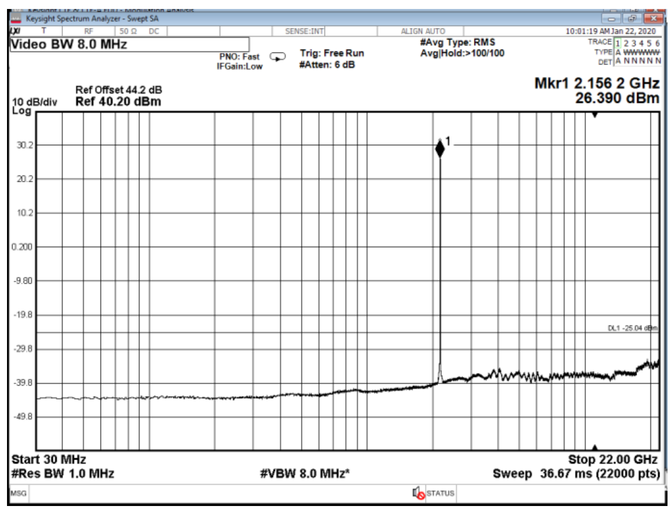


Figure 8.3-20: *Conducted spurious emissions of 10 MHz middle channels, two-carrier operation with IoT*

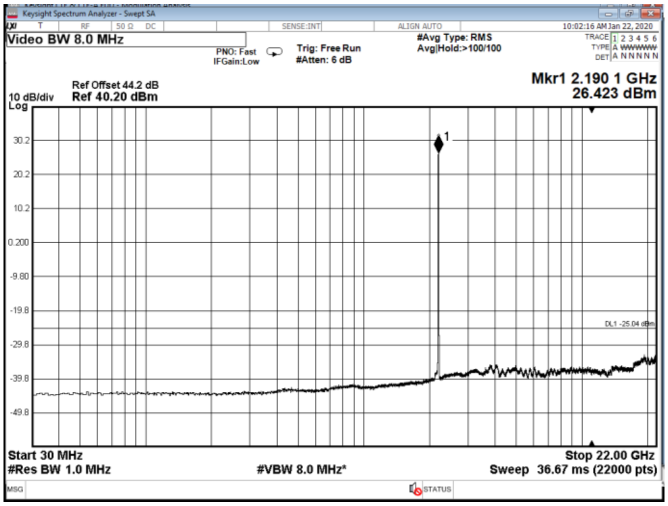


Figure 8.3-21: *Conducted spurious emissions of 10 MHz top channels, two-carrier operation with IoT*

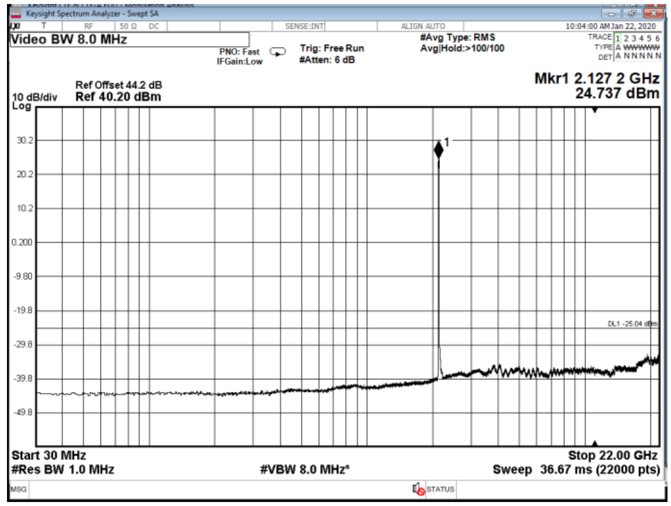


Figure 8.3-22: *Conducted spurious emissions of 15 MHz bottom channels, two-carrier operation with IoT*

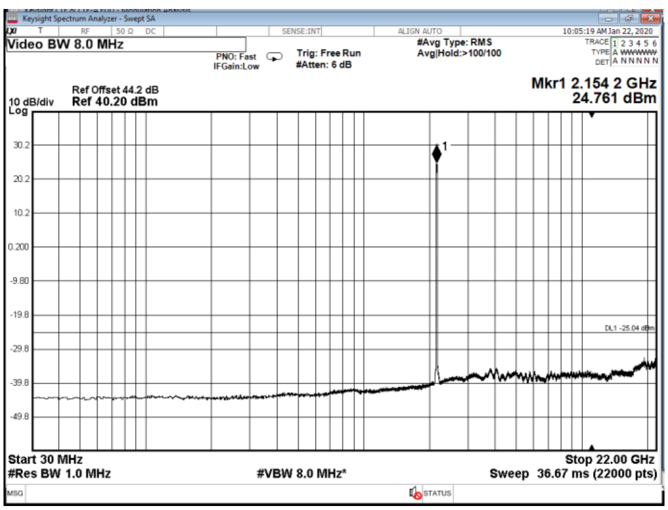


Figure 8.3-23: *Conducted spurious emissions of 15 MHz middle channels, two-carrier operation with IoT*

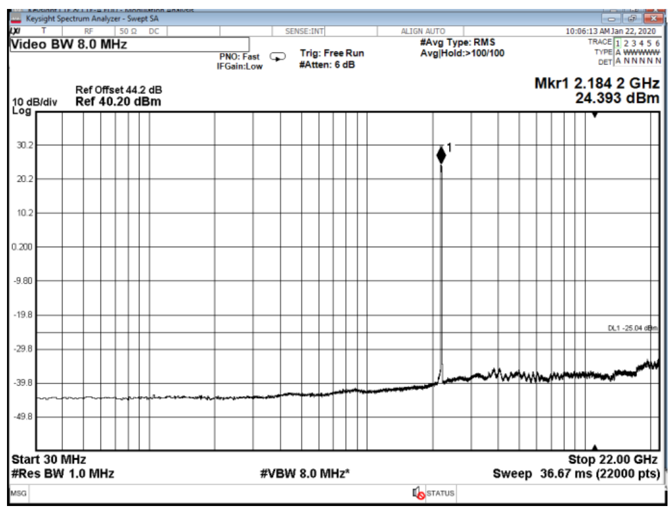


Figure 8.3-24: *Conducted spurious emissions of 15 MHz top channels, two-carrier operation with IoT*

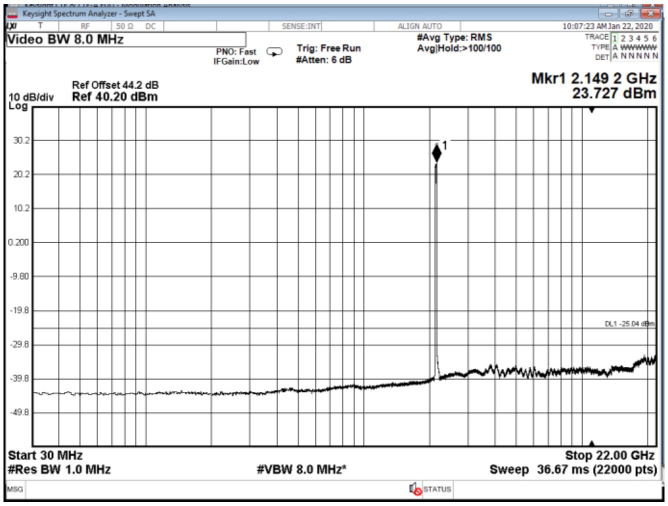


Figure 8.3-25: *Conducted spurious emissions of 20 MHz bottom channels, two-carrier operation with IoT*

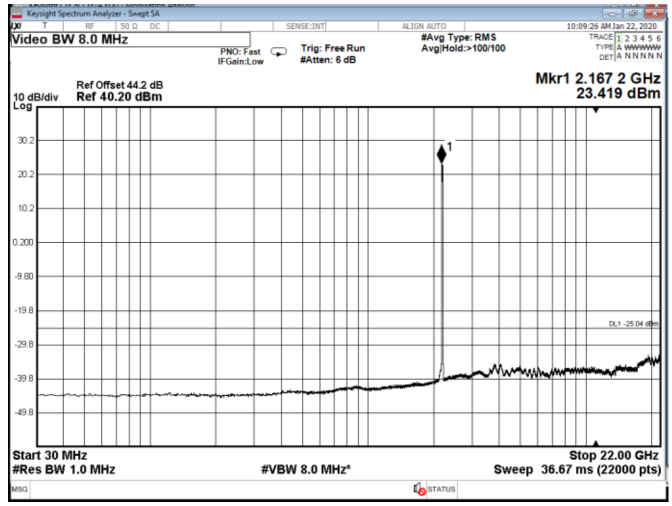


Figure 8.3-26: *Conducted spurious emissions of 20 MHz middle channels, two-carrier operation with IoT*

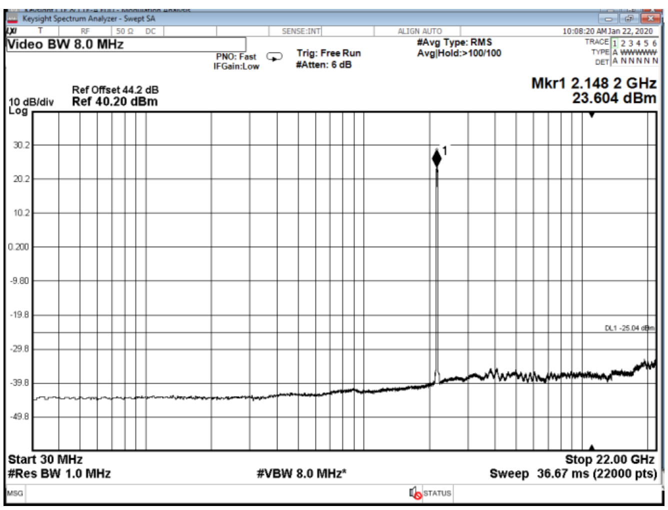


Figure 8.3-27: *Conducted spurious emissions of 20 MHz top channels, two-carrier operation with IoT*

b

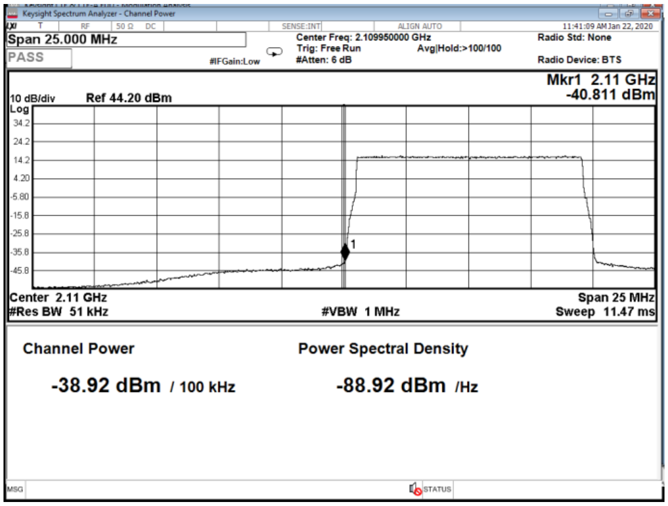


Figure 8.3-28: *Conducted band edge emission at 2110 MHz, 10 MHz channel single-carrier operation (RBW = 1% of EBW)*

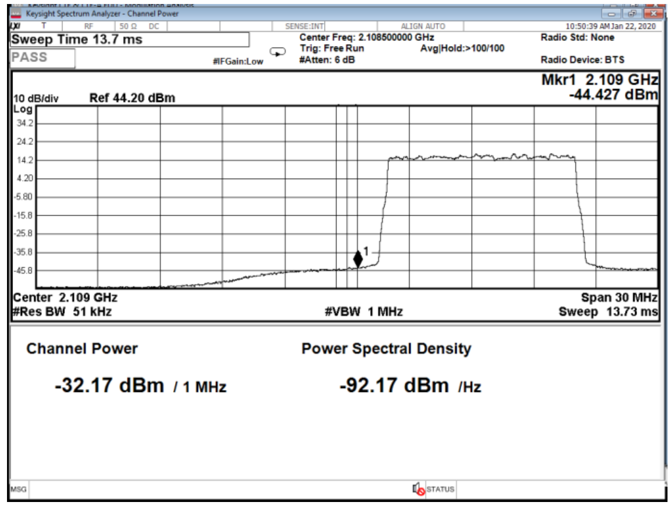


Figure 8.3-29: *Conducted band edge emission at 2109 MHz, 10 MHz channel single-carrier operation (RBW = 1 MHz)*

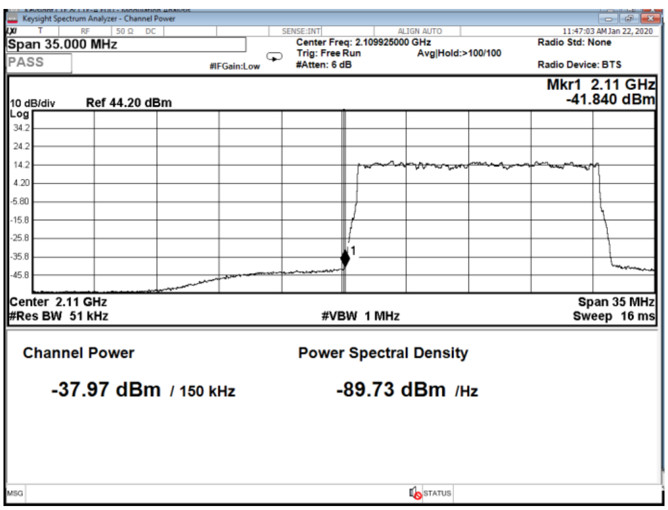


Figure 8.3-30: *Conducted band edge emission at 2110 MHz, 15 MHz channel single-carrier operation (RBW = 1% of EBW)*

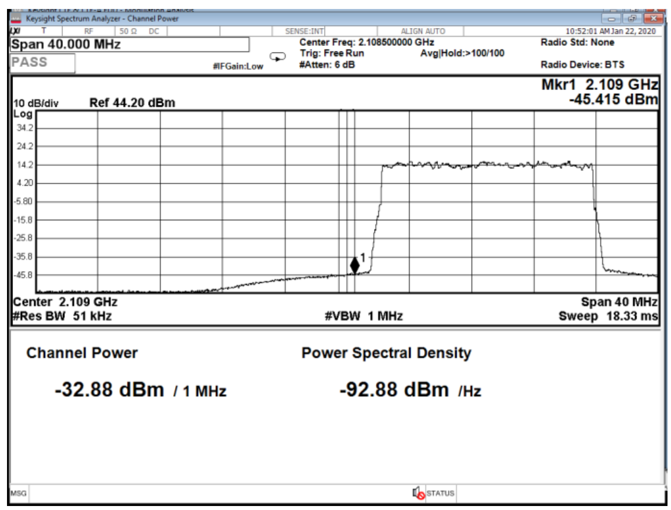


Figure 8.3-31: *Conducted band edge emission at 2109 MHz, 15 MHz channel single-carrier operation (RBW = 1 MHz)*

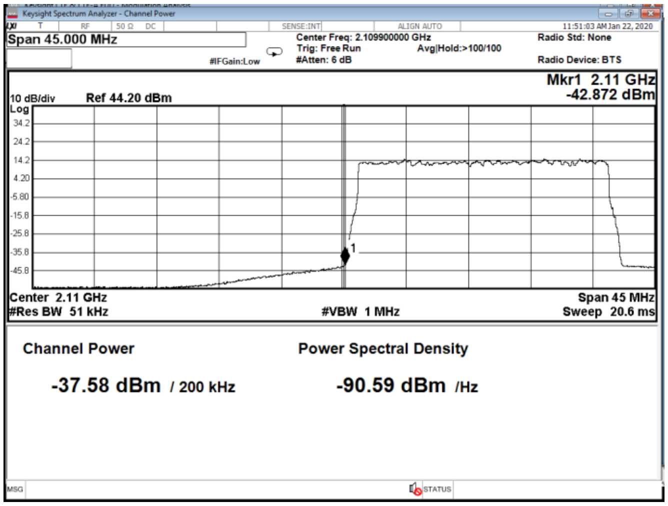


Figure 8.3-32: *Conducted band edge emission at 2110 MHz, 20 MHz channel single-carrier operation (RBW = 1% of EBW)*

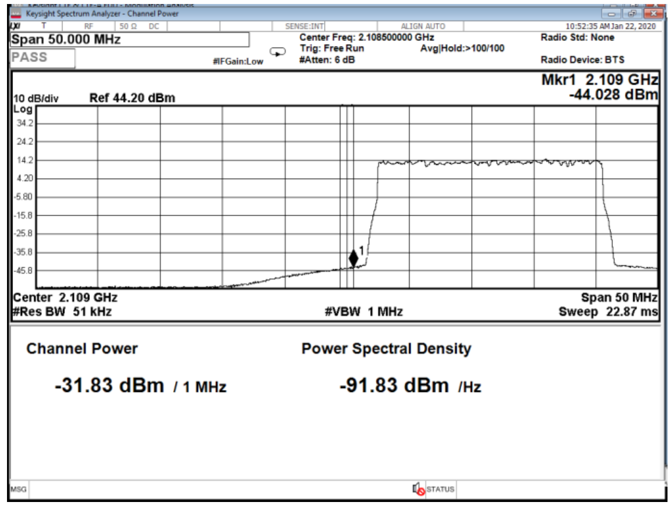


Figure 8.3-33: *Conducted band edge emission at 2109 MHz, 20 MHz channel single-carrier operation (RBW = 1 MHz)*

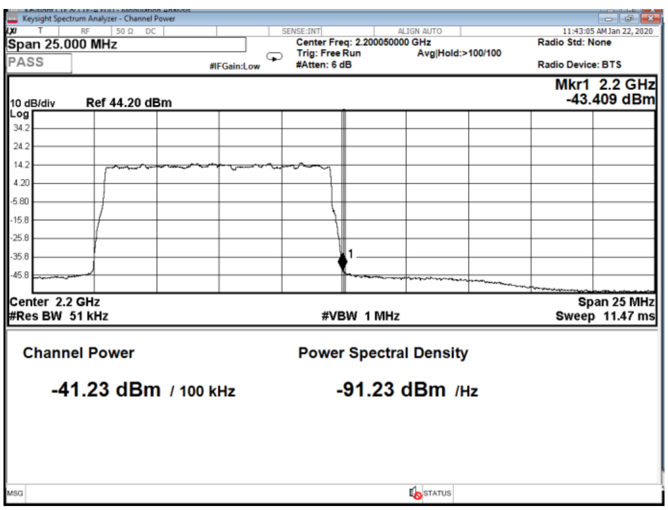


Figure 8.3-34: *Conducted band edge emission at 2200 MHz, 10 MHz channel single-carrier operation (RBW = 1% of EBW)*

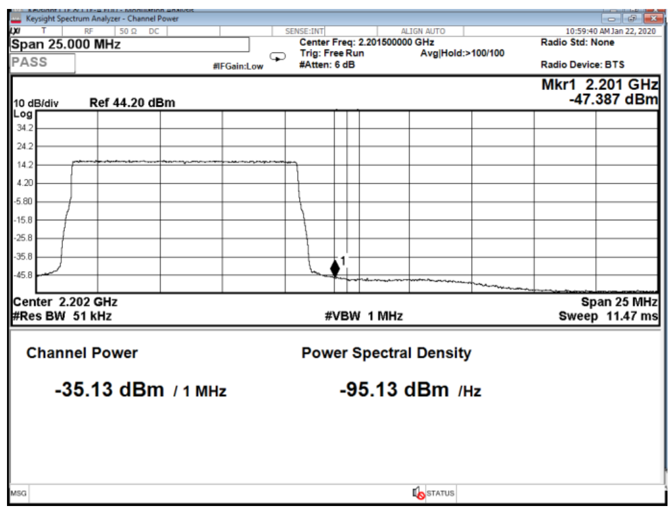


Figure 8.3-35: *Conducted band edge emission at 2201 MHz, 10 MHz channel single-carrier operation (RBW = 1 MHz)*

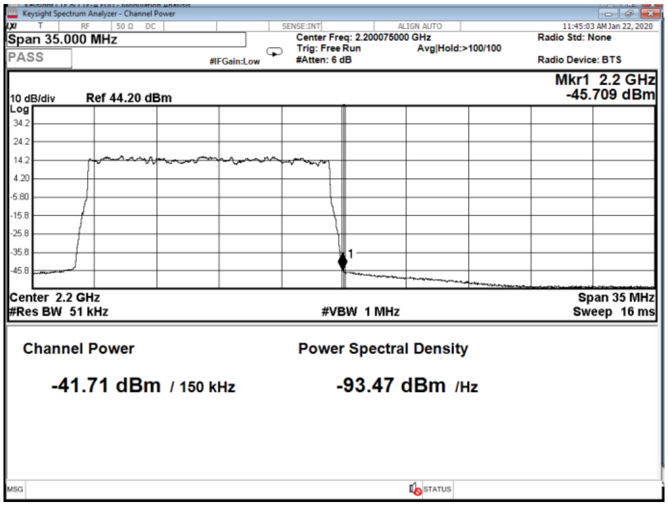


Figure 8.3-36: *Conducted band edge emission at 2200 MHz, 15 MHz channel single-carrier operation (RBW = 1% of EBW)*

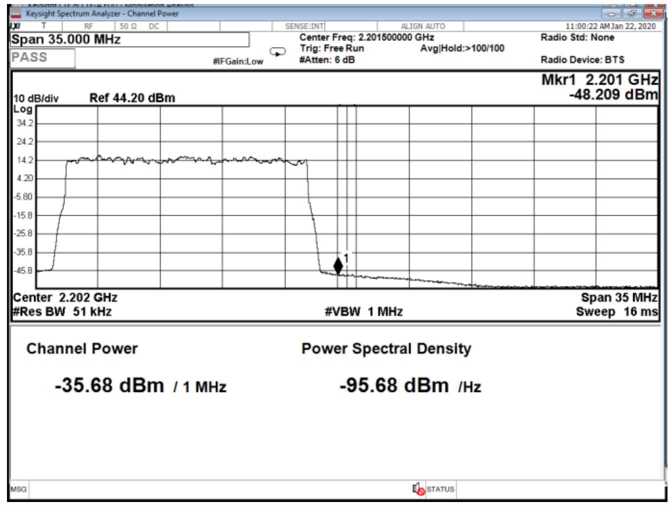


Figure 8.3-37: *Conducted band edge emission at 2201 MHz, 15 MHz channel single-carrier operation (RBW = 1 MHz)*

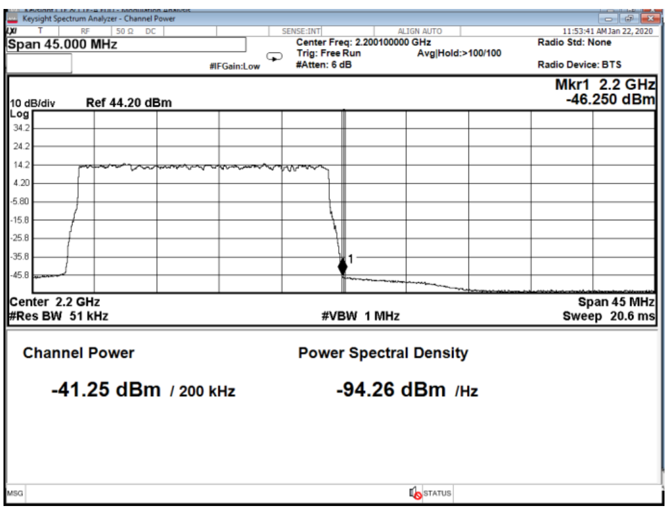


Figure 8.3-38: *Conducted band edge emission at 2200 MHz, 20 MHz channel single-carrier operation (RBW = 1% of EBW)*

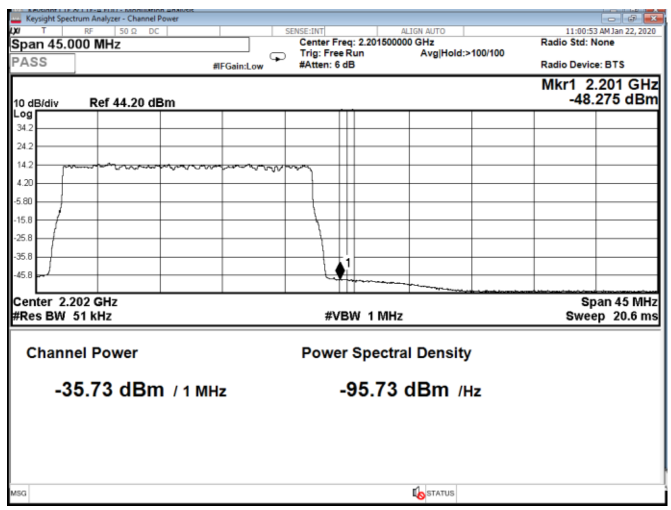


Figure 8.3-39: *Conducted band edge emission at 2201 MHz, 20 MHz channel single-carrier operation (RBW = 1 MHz)*

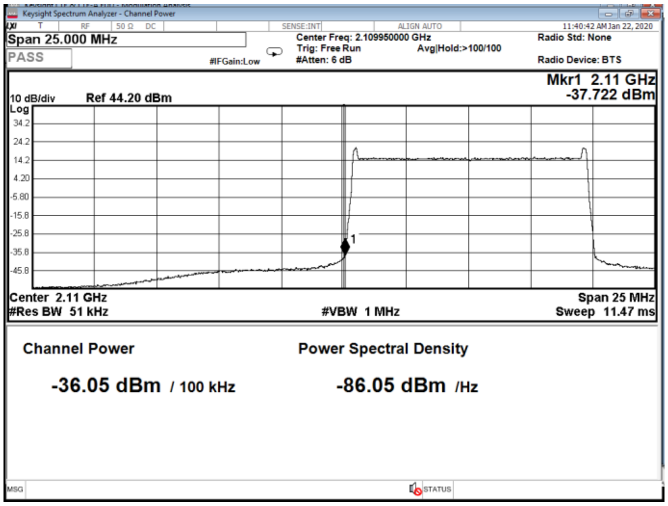


Figure 8.3-40: *Conducted band edge emission at 2110 MHz,*
10 MHz channel single-carrier operation with IoT (RBW = 1% of EBW)

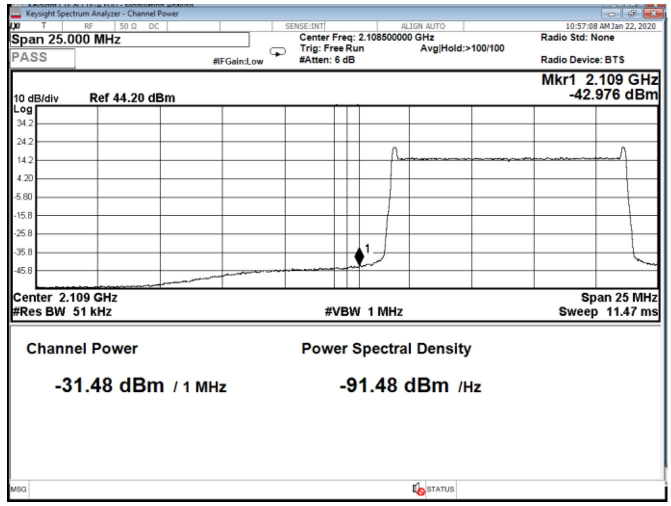


Figure 8.3-41: *Conducted band edge emission at 2109 MHz,*
10 MHz channel single-carrier operation with IoT (RBW = 1 MHz)

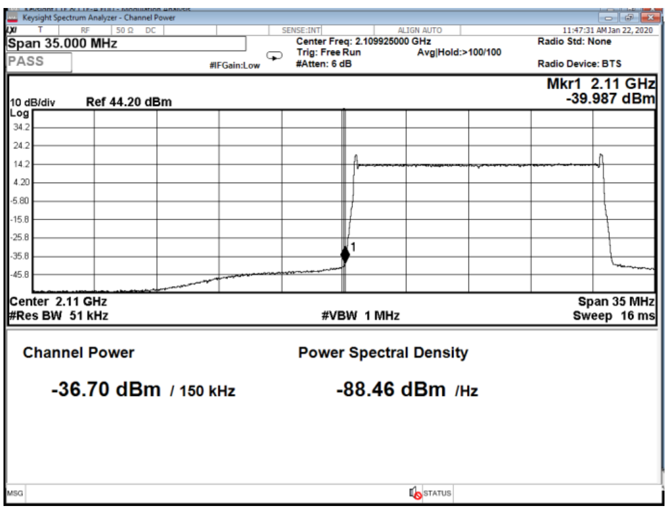


Figure 8.3-42: *Conducted band edge emission at 2110 MHz,*
15 MHz channel single-carrier operation with IoT (RBW = 1% of EBW)

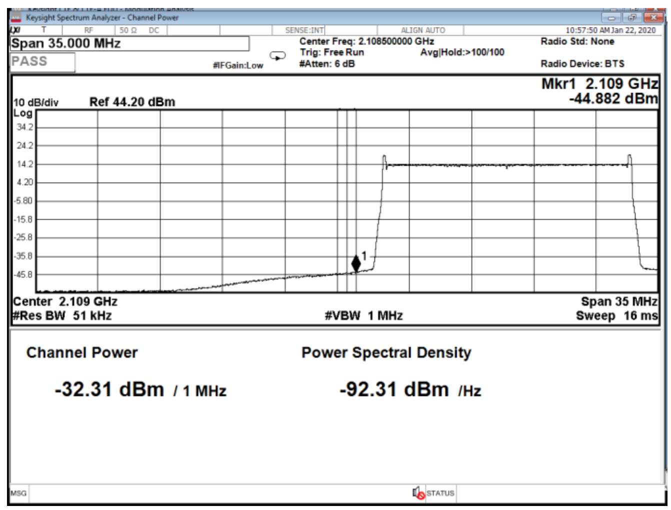


Figure 8.3-43: *Conducted band edge emission at 2109 MHz,*
15 MHz channel single-carrier operation with IoT (RBW = 1 MHz)

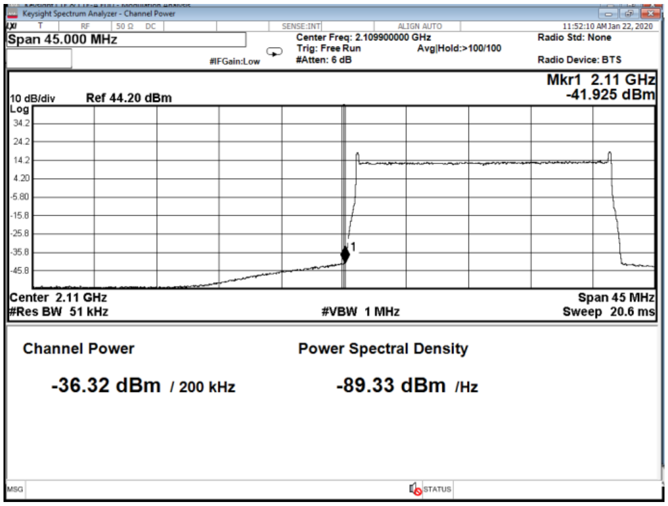


Figure 8.3-44: *Conducted band edge emission at 2110 MHz, 20 MHz channel single-carrier operation with IoT (RBW = 1% of EBW)*

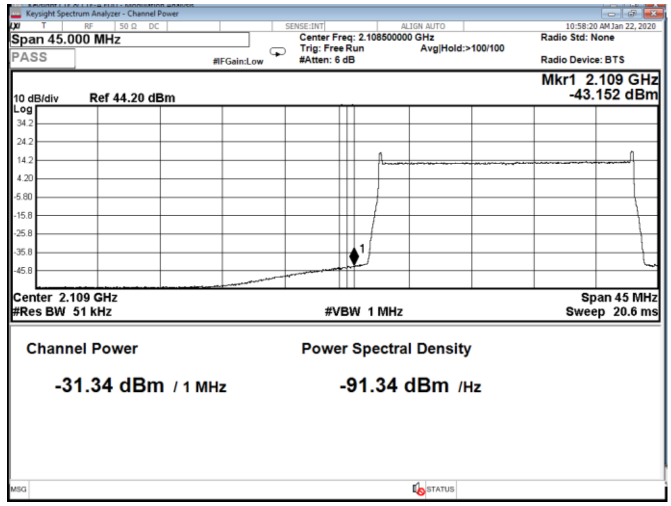


Figure 8.3-45: *Conducted band edge emission at 2109 MHz, 20 MHz channel single-carrier operation with IoT (RBW = 1 MHz)*

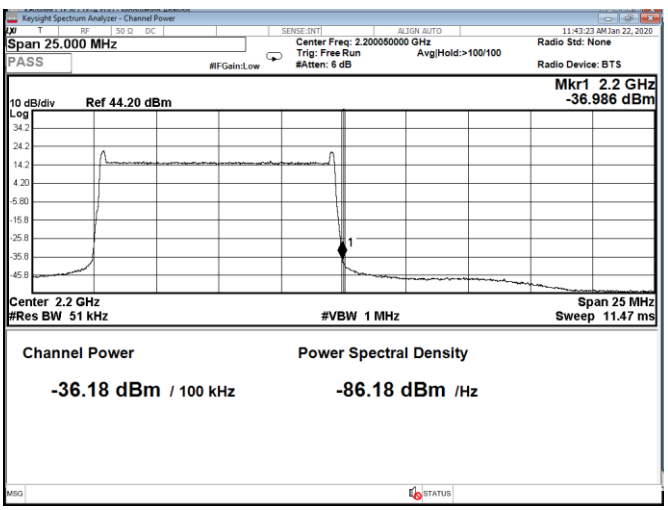


Figure 8.3-46: *Conducted band edge emission at 2200 MHz, 10 MHz channel single-carrier operation with IoT (RBW = 1% of EBW)*

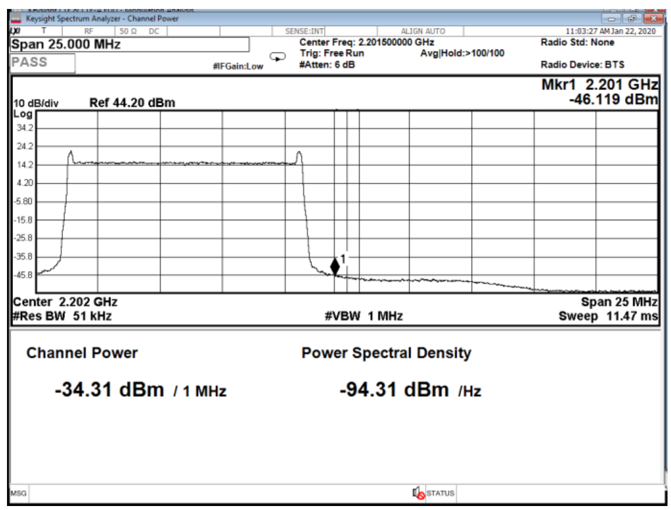


Figure 8.3-47: *Conducted band edge emission at 2201 MHz, 10 MHz channel single-carrier operation with IoT (RBW = 1 MHz)*

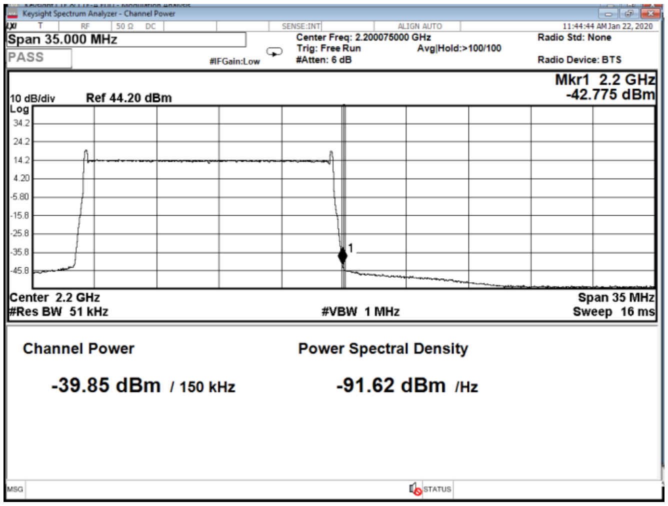


Figure 8.3-48: *Conducted band edge emission at 2200 MHz, 15 MHz channel single-carrier operation with IoT (RBW = 1% of EBW)*

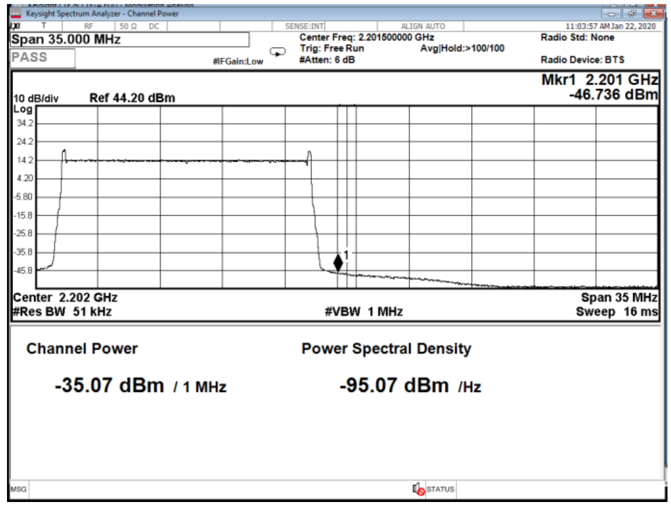


Figure 8.3-49: *Conducted band edge emission at 2201 MHz, 15 MHz channel single-carrier operation with IoT (RBW = 1 MHz)*

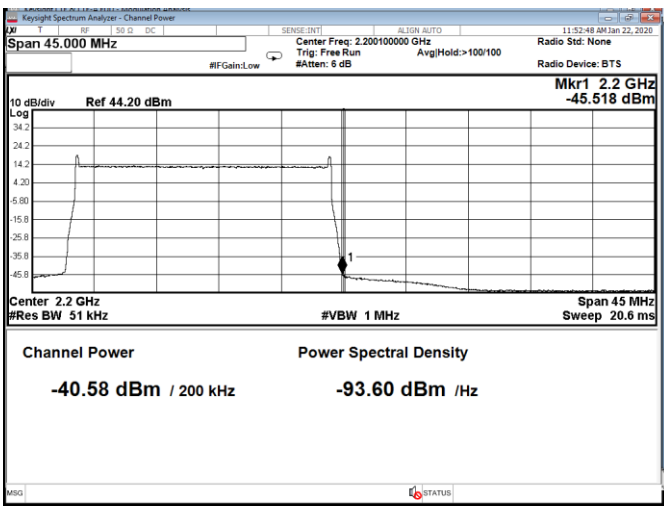


Figure 8.3-50: *Conducted band edge emission at 2200 MHz, 20 MHz channel single-carrier operation with IoT (RBW = 1% of EBW)*

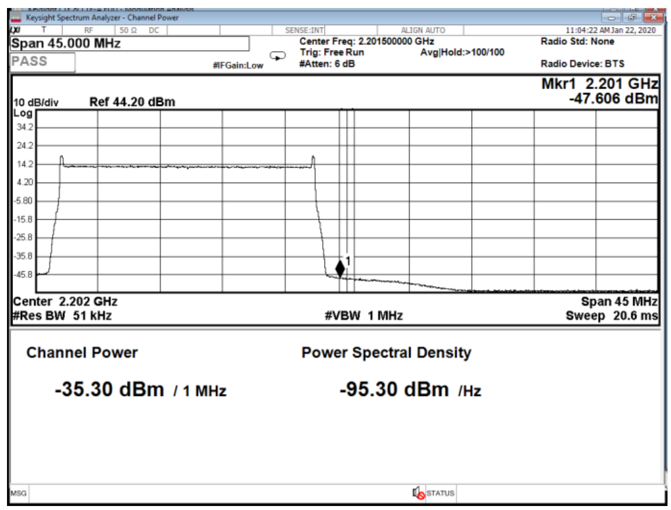


Figure 8.3-51: *Conducted band edge emission at 2201 MHz, 20 MHz channel single-carrier operation with IoT (RBW = 1 MHz)*

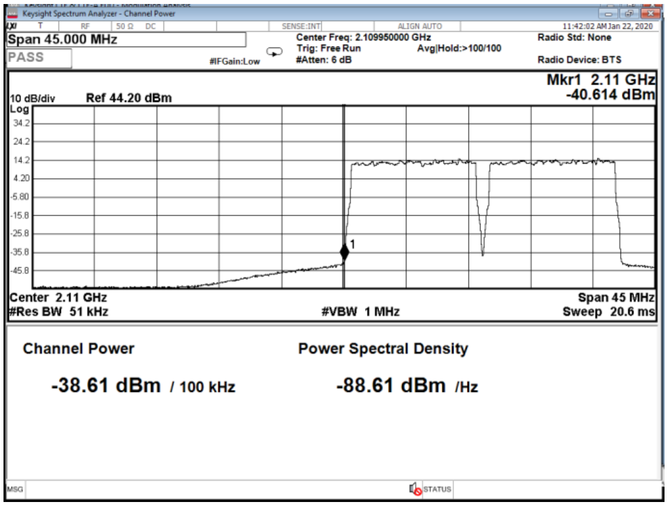


Figure 8.3-52: *Conducted band edge emission at 2110 MHz, 10 MHz channel two-carrier operation (RBW = 1% of EBW)*

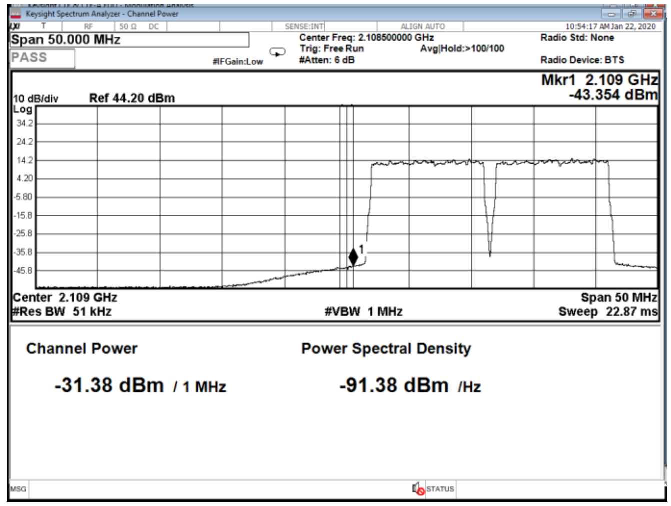


Figure 8.3-53: *Conducted band edge emission at 2109 MHz, 10 MHz channel two-carrier operation (RBW = 1 MHz)*

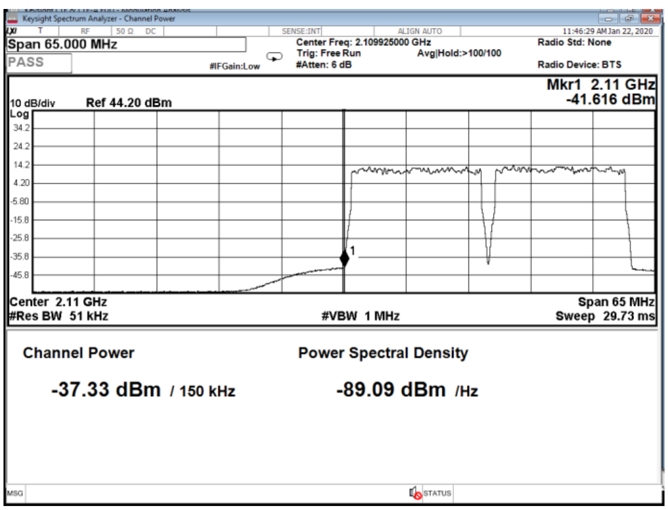


Figure 8.3-54: *Conducted band edge emission at 2110 MHz, 15 MHz channel two-carrier operation (RBW = 1% of EBW)*

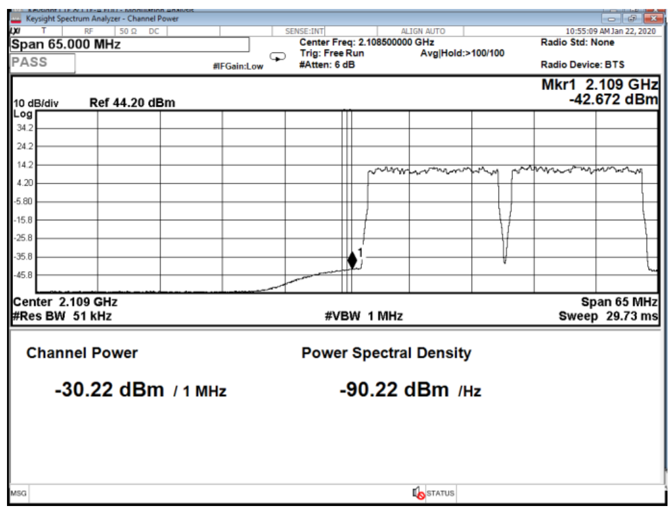


Figure 8.3-55: *Conducted band edge emission at 2109 MHz, 15 MHz channel two-carrier operation (RBW = 1 MHz)*

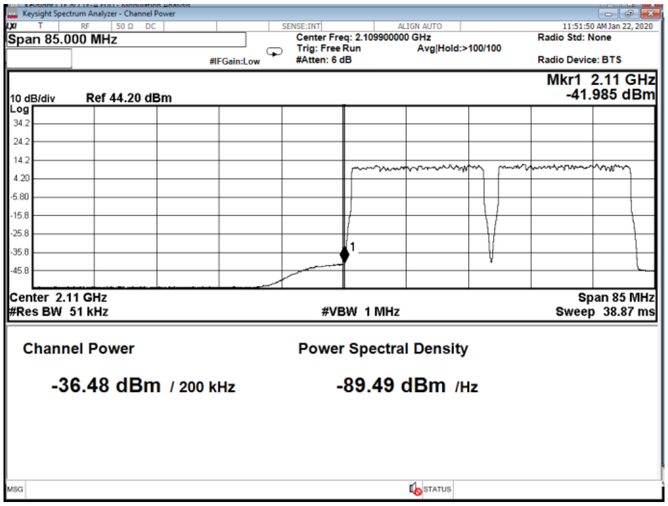


Figure 8.3-56: *Conducted band edge emission at 2110 MHz, 20 MHz channel two-carrier operation (RBW = 1% of EBW)*

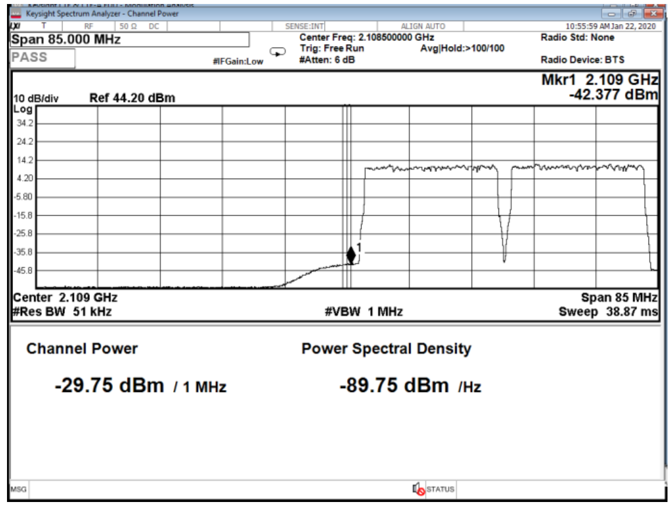


Figure 8.3-57: *Conducted band edge emission at 2109 MHz, 20 MHz channel two-carrier operation (RBW = 1 MHz)*

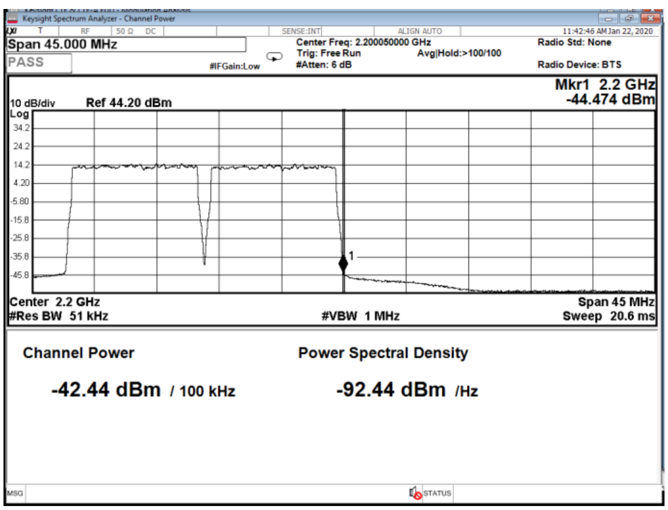


Figure 8.3-58: *Conducted band edge emission at 2200 MHz, 10 MHz channel two-carrier operation (RBW = 1% of EBW)*

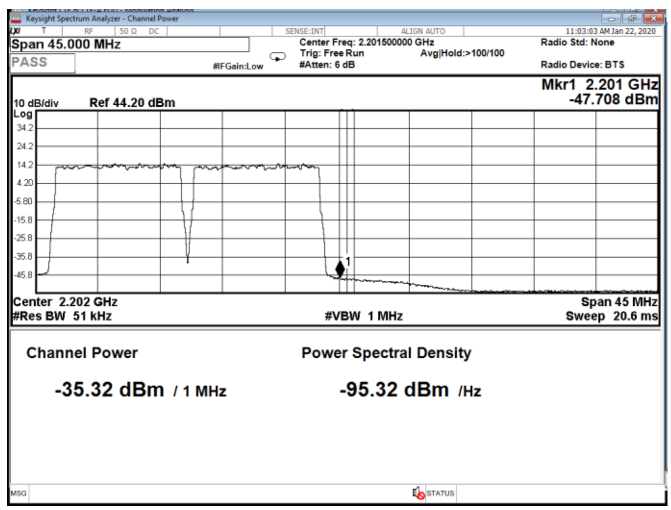


Figure 8.3-59: *Conducted band edge emission at 2201 MHz, 10 MHz channel two-carrier operation (RBW = 1 MHz)*

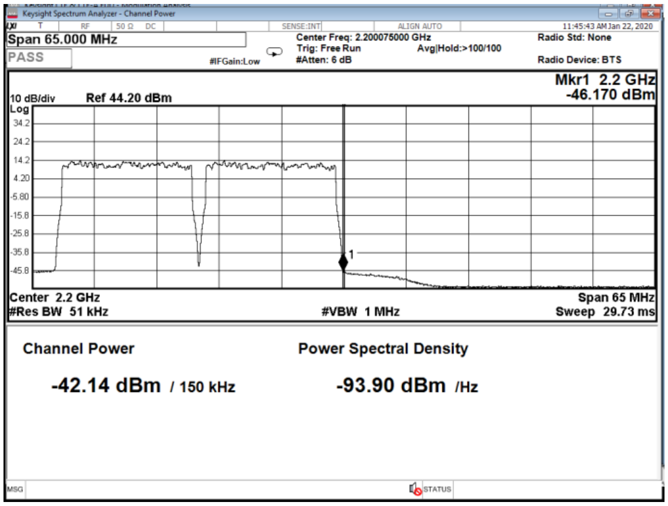


Figure 8.3-60: *Conducted band edge emission at 2200 MHz, 15 MHz channel two-carrier operation (RBW = 1% of EBW)*

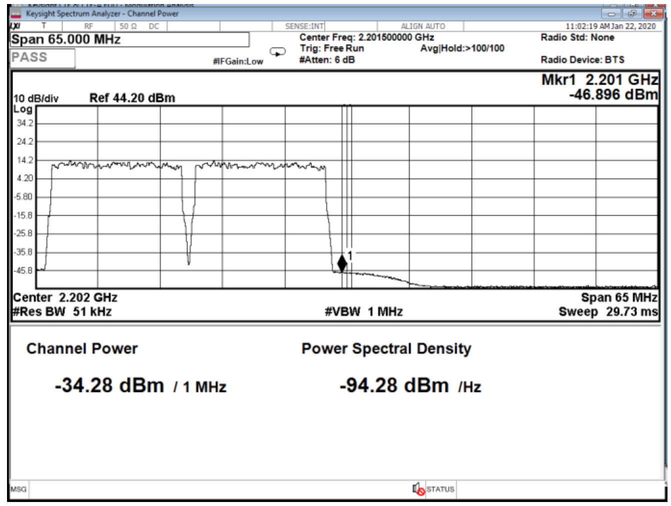


Figure 8.3-61: *Conducted band edge emission at 2201 MHz, 15 MHz channel two-carrier operation (RBW = 1 MHz)*

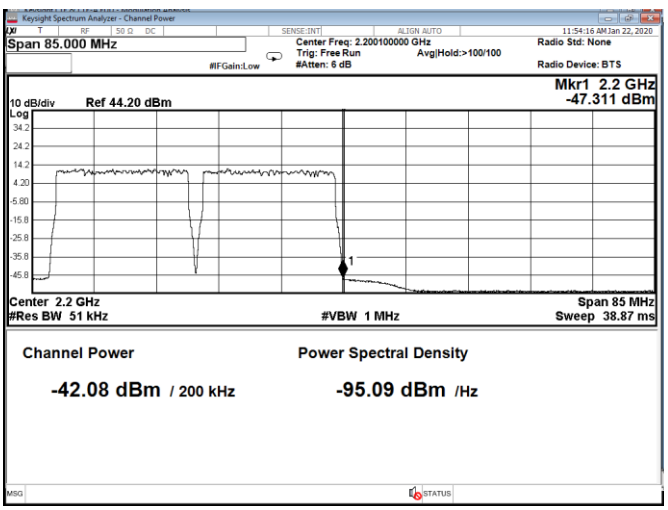


Figure 8.3-62: *Conducted band edge emission at 2200 MHz, 20 MHz channel two-carrier operation (RBW = 1% of EBW)*

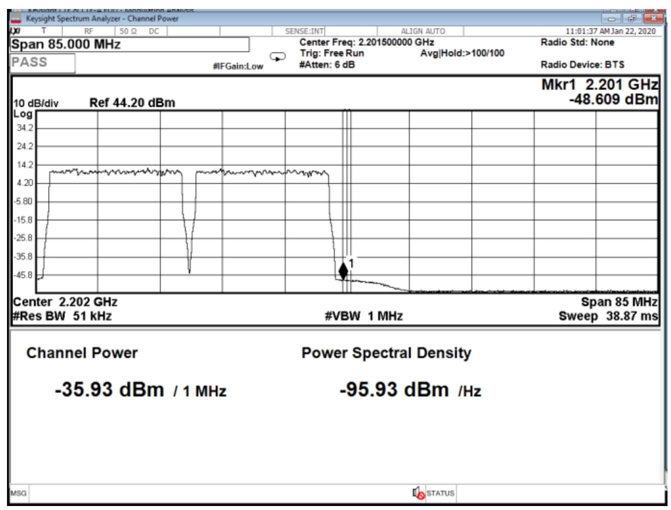


Figure 8.3-63: *Conducted band edge emission at 2201 MHz, 20 MHz channel two-carrier operation (RBW = 1 MHz)*

8.4 FCC 27.53 and RSS-139, 4.2, RSS-170, 5.4 Radiated spurious emissions (**Band 66 & Band 2/25**)

8.4.1 Definitions and limits

FCC:
(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.

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.

8.4.2 Test summary

Test date	July 18, 2018
Test engineer	Predrag Golic

8.4.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to the 10th 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

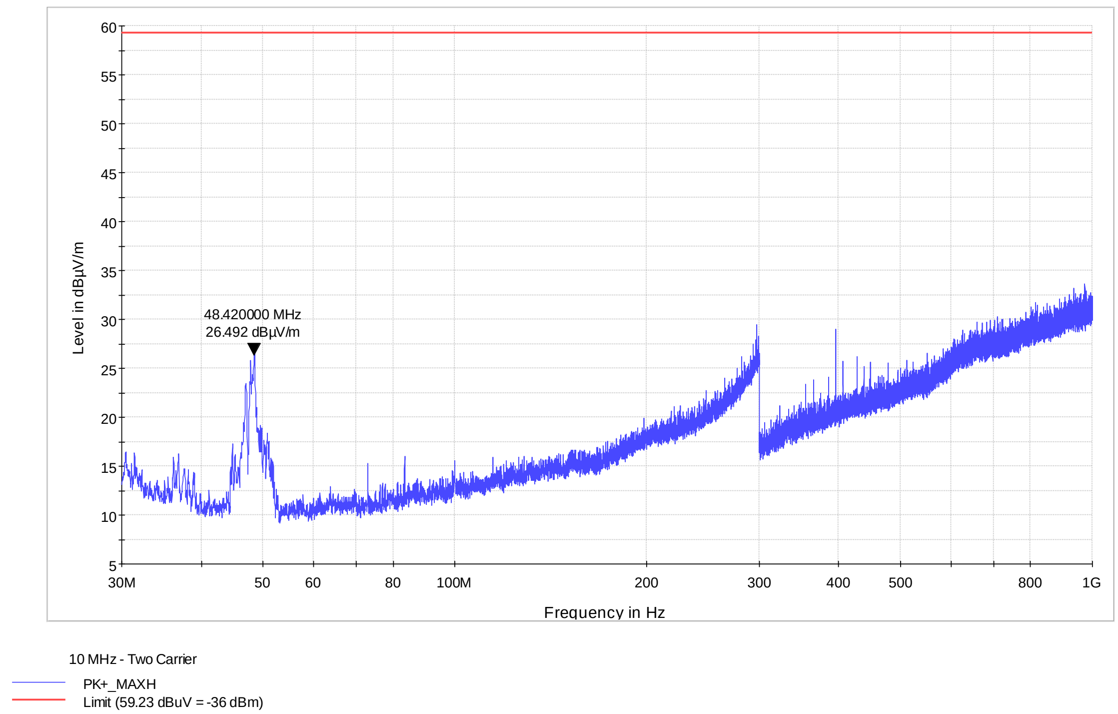
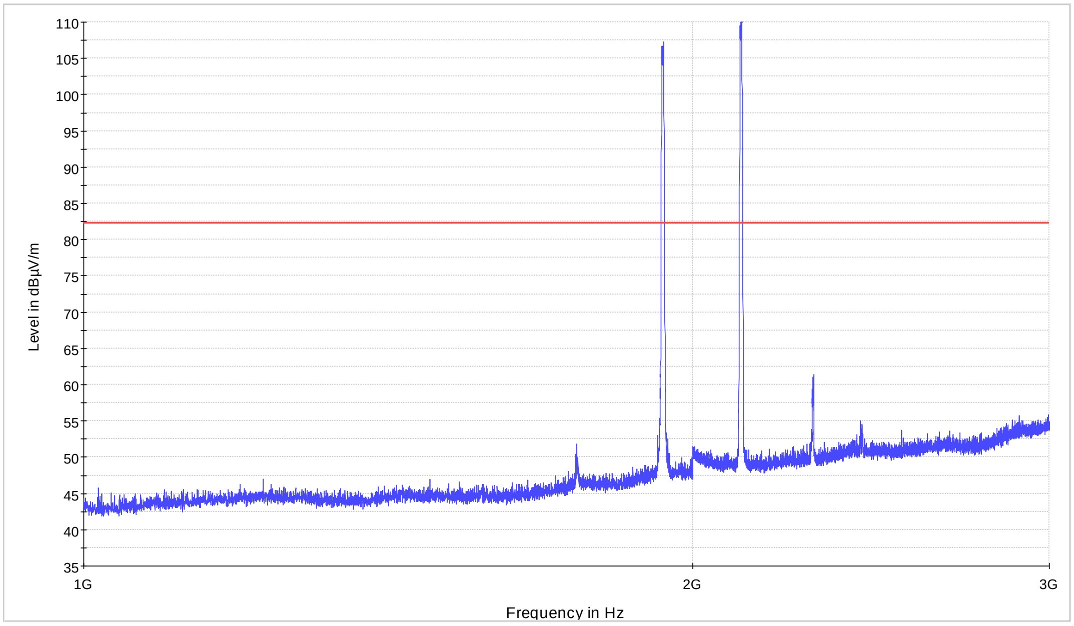
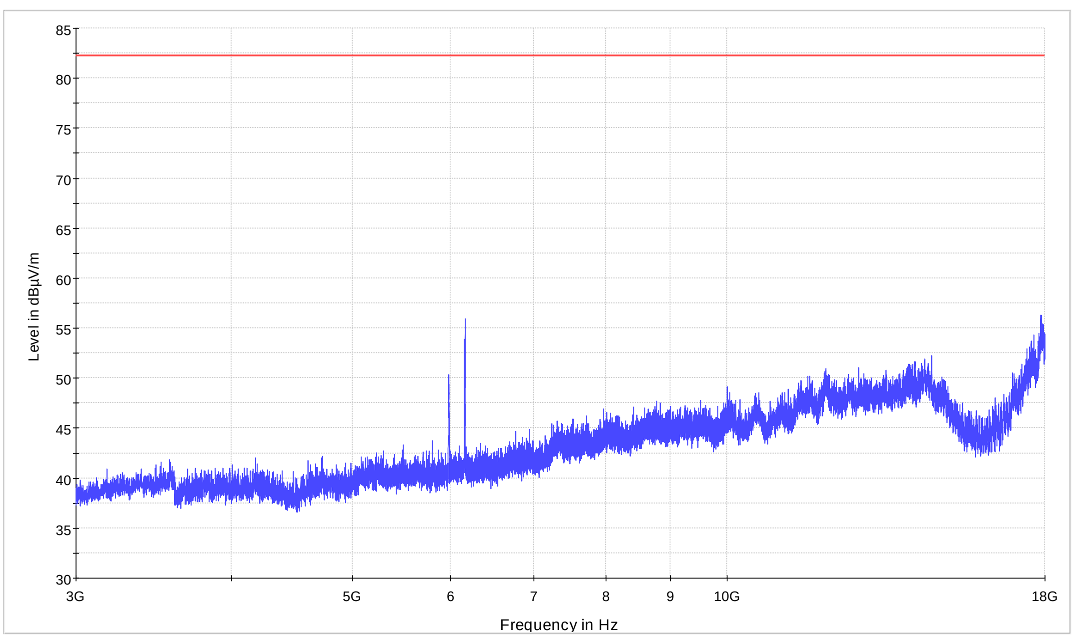


Figure 8.4-1: *Radiated spurious emissions below 1 GHz*



PK+_MAXH
-13DBM in 82-23dBuV

Figure 8.4-2: *Radiated spurious emissions within 1–3 GHz*



-13DBM in 82-23dBuV
PK+_MAXH

Figure 8.4-3: *Radiated spurious emissions within 3–18 GHz*

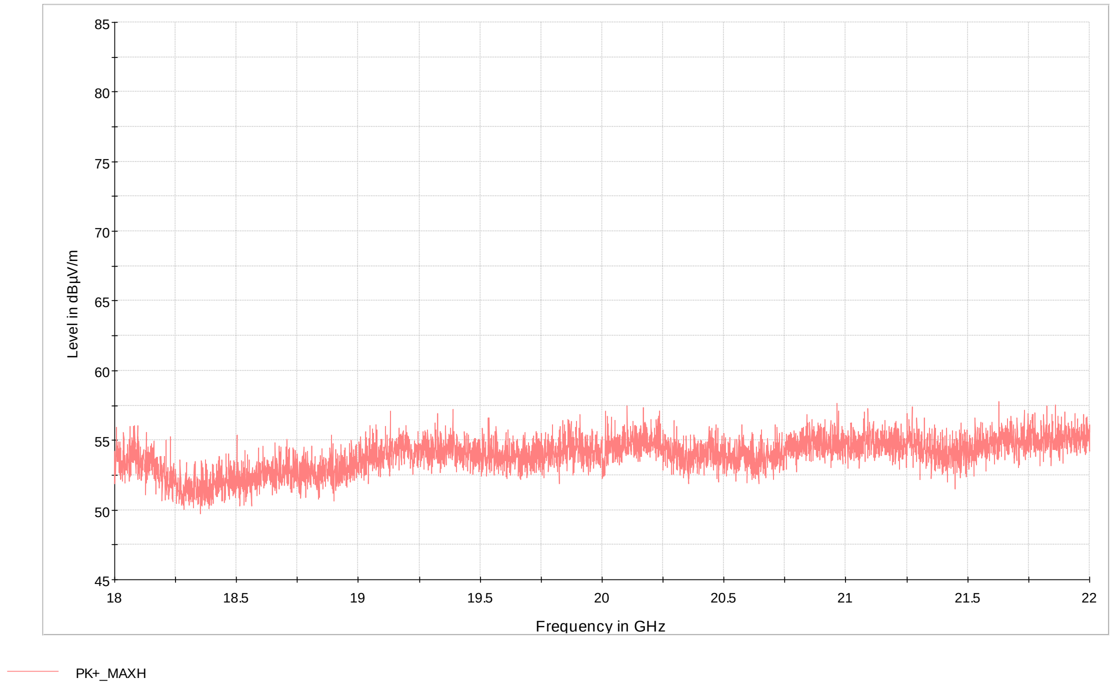


Figure 8.4-1: *Radiated spurious emissions above 18 GHz*

8.5 FCC 24.238(a) and RSS-133, 6.5.1 Spurious out-of-band emissions (Band 2/25a)

8.5.1 Definitions and limits

FCC:
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

Test date	January 22, 2020

8.5.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to the 10th harmonic.
All measurements were performed using an average (RMS) detector per ANSI C63.26 Paragraph 5.7.2 method.
Limit line was adjusted for MIMO operation by 12.04 dB (for *16* ports: 10 × Log_{10}(*16*)): −13 dBm – 12.04 dB = −25.04 dBm
RBW 1 MHz, VBW was wider than RBW.

8.5.4 Test data

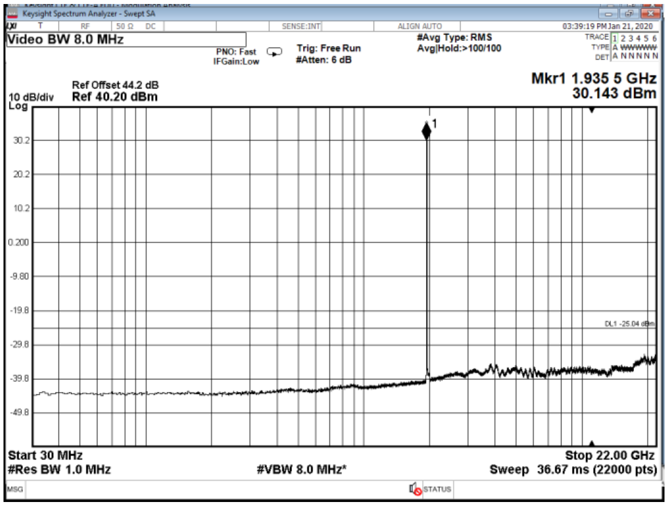


Figure 8.5-1: *Conducted spurious emissions of 10 MHz low channel, single-carrier operation*

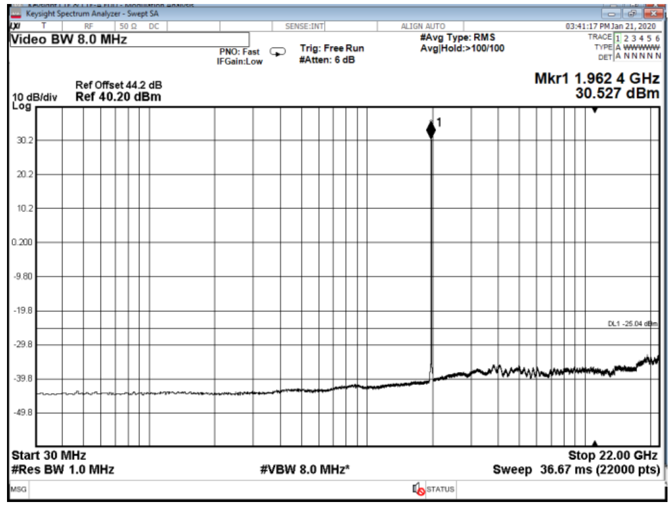


Figure 8.5-2: *Conducted spurious emissions of 10 MHz mid channel, single-carrier operation*

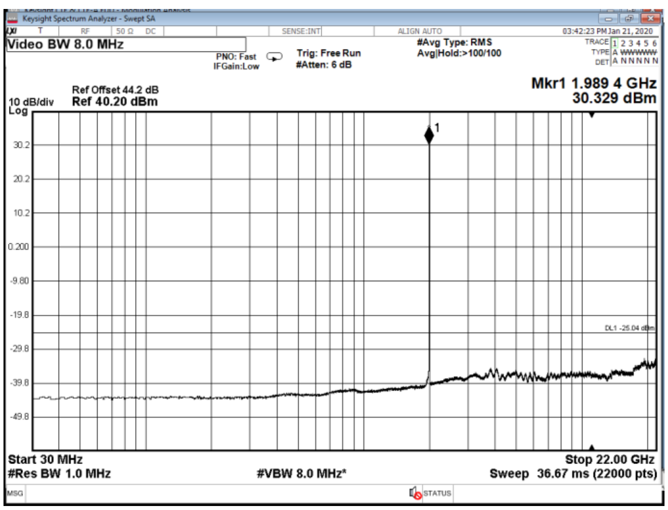


Figure 8.5-3: *Conducted spurious emissions of 10 MHz high channel, single-carrier operation*

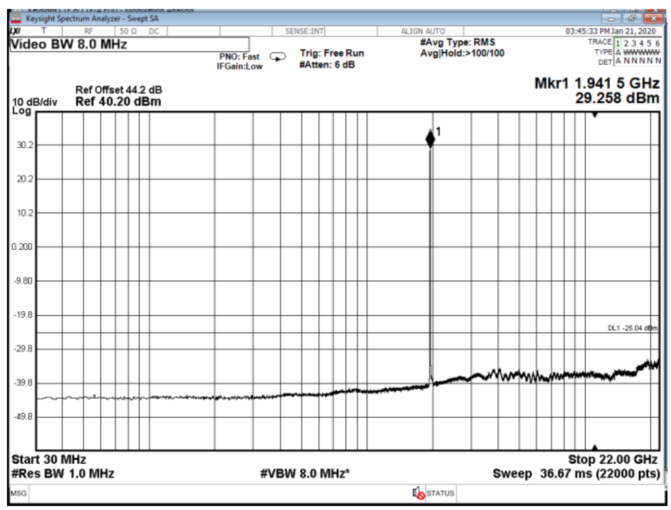


Figure 8.5-4: *Conducted spurious emissions of 15 MHz low channel, single-carrier operation*