2.5 Out Of Band Emissions

2.5.1 Specification Reference

FCC 47 CFR Part 20. Clause 20.21(e)(9)(i)(F)
RSS 131 8.5
KDB935210 D04, Clause 7.5

2.5.2 Standard Applicable

FCC 47 CFR Part 20. Clause 20.21(e)(9)(i)(F) Out of Band Emissions Limits:

Booster out of band emissions (OOBE) shall meet the FCC's mobile emission limits for the supported bands of operation. Compliance to OOBE limits will utilize high peak-to-average CMRS signal types.

2.5.3 Equipment Under Test and Modification State

Serial No: 560311000026/ Test Configuration A and B

2.5.4 Date of Test/Initial of test personnel who performed the test

August 10, 2023/MARG

2.5.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.5.6 Environmental Conditions

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility.

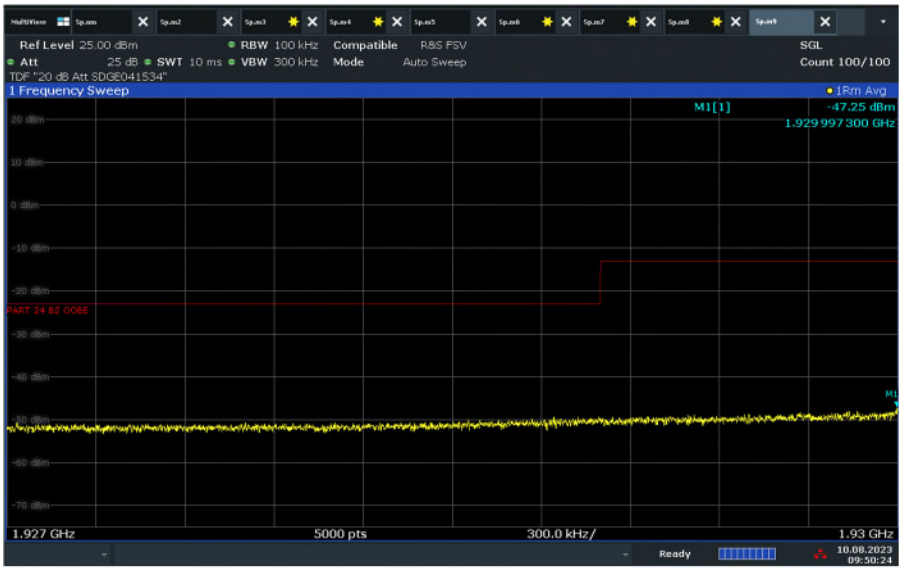
Ambient Temperature	26.0°C
Relative Humidity	53.3%
ATM Pressure	99.0kPa

2.5.7 Additional Observations

- This is conducted Test.
- Test procedure is per Section 7.5 of KDB935210 (D04 Provider Specific Booster Measurements v02r03). Appropriate offset (line losses) applied.
- The EUT operated in Test Mode, with the gain set to the maximum and a 5MHz bandwidth setting.
- The out of band emissions with Maximum Transmitter complies at 10 dB above AGC.
- Evaluations are conducted at antenna ports.
- The transducer factor (TDF) used is from the external attenuators and cables used.
- Per Client request only High Channel was tested for Band 25
- Operational uplink and downlink bands for LTE Band 2, 4, 5, 12, 13, 25 were tested.
- Signal: 5MHz LTE.

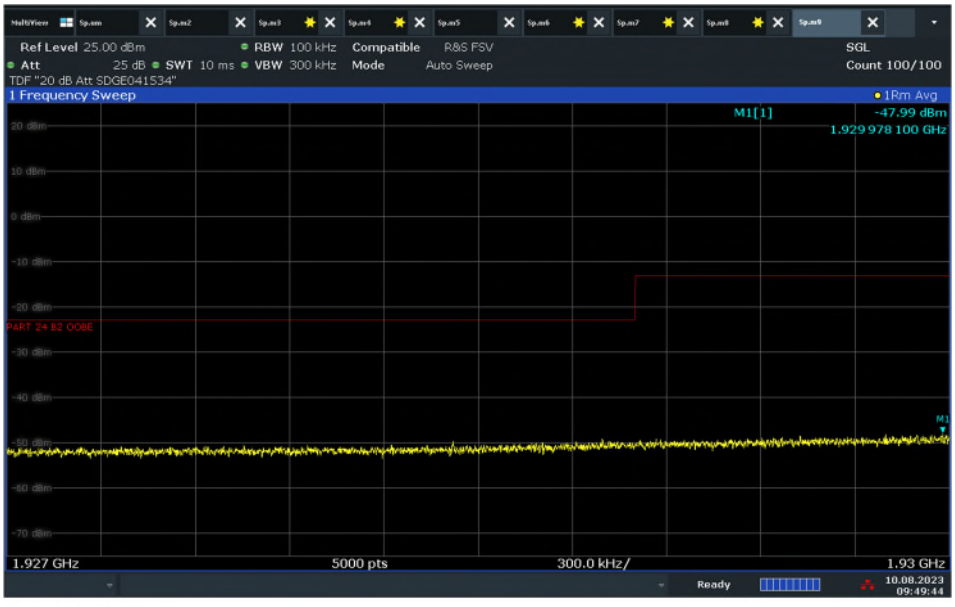
2.5.8 Test Results

LTE Band 2 Downlink 5MHz Bandwidth Low Channel (-82.5 dBm)

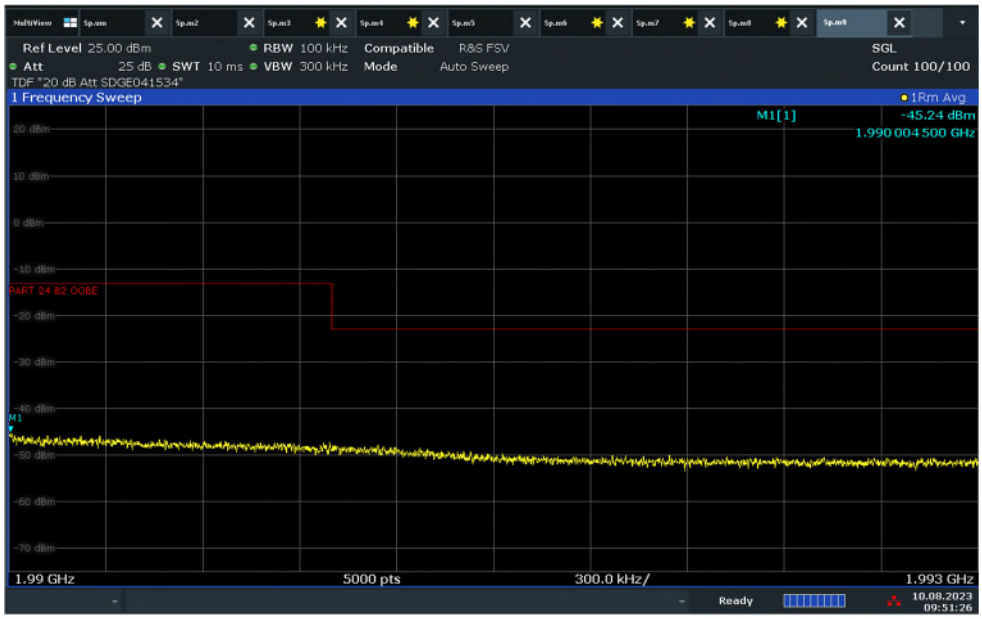
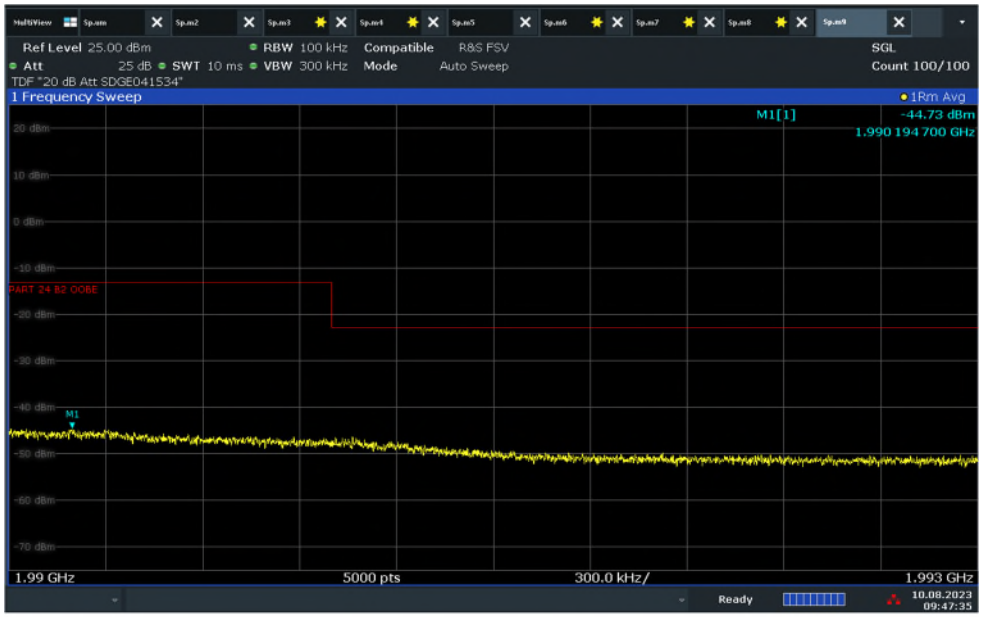


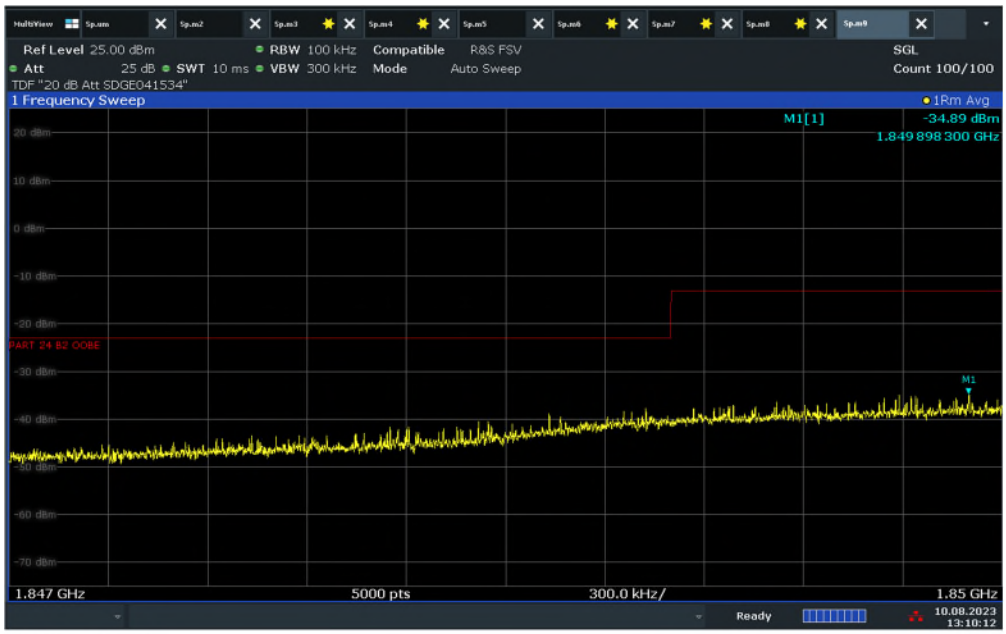
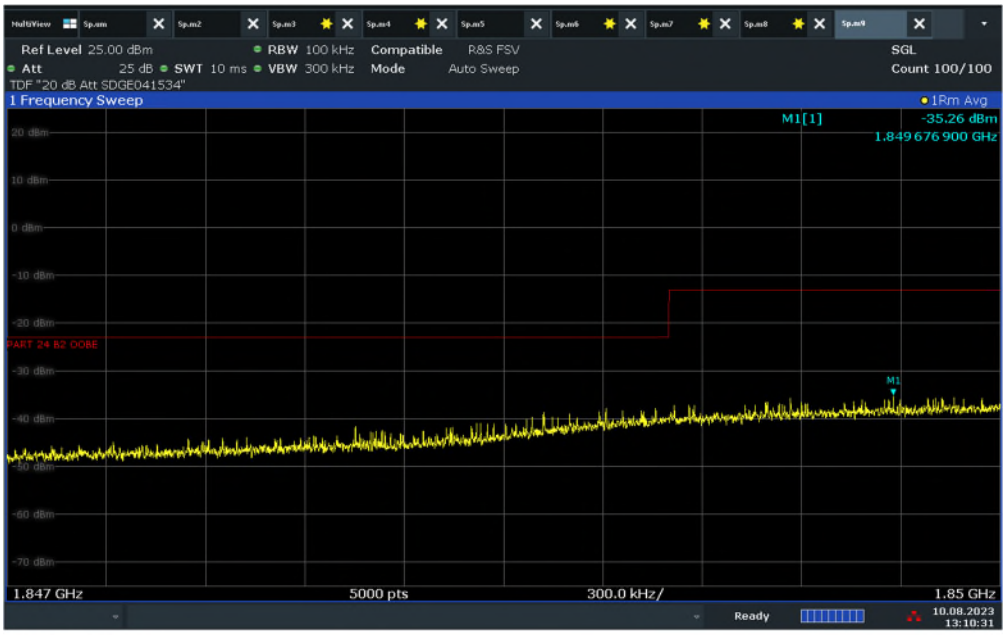
09:50:24 10.08.2023

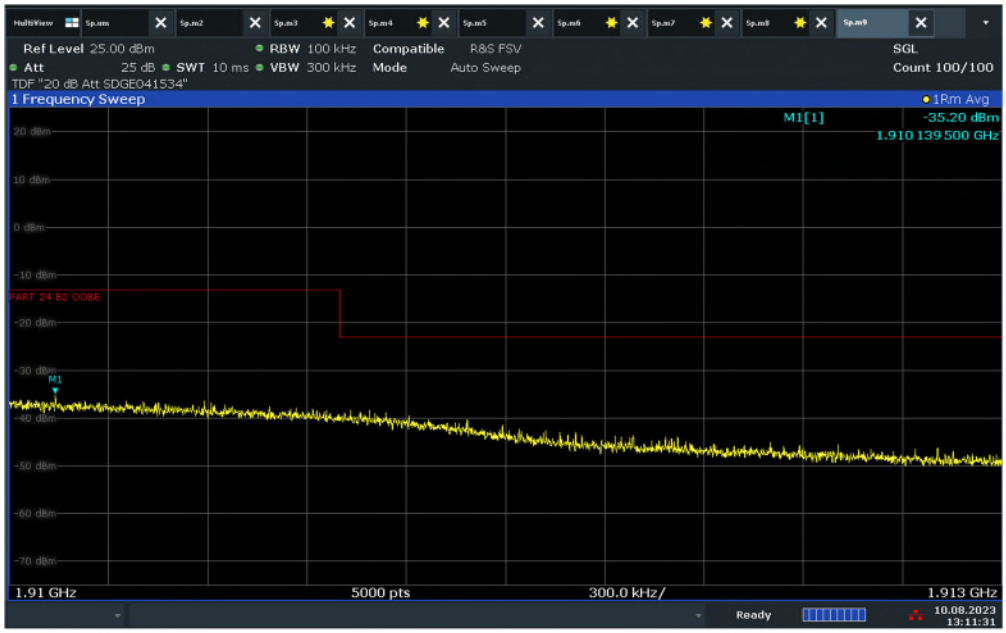
LTE Band 2 Downlink 5MHz Bandwidth Low Channel 10 dB Above AGC



09:49:45 10.08.2023

LTE Band 2 Downlink 5MHz Bandwidth High Channel (-82.5 dBm)
 09:51:26 10.08.2023
LTE Band 2 Downlink 5MHz Bandwidth High Channel 10 dB Above AGC
 09:47:36 10.08.2023

LTE Band 2 Uplink 5MHz Bandwidth Low Channel (-77.5 dBm)
 13:10:13 10.08.2023
LTE Band 2 Uplink 5MHz Bandwidth Low Channel 10 dB Above AGC
 13:10:31 10.08.2023

LTE Band 2 Uplink 5MHz Bandwidth High Channel (-77.5 dBm)
 13:11:31 10.08.2023
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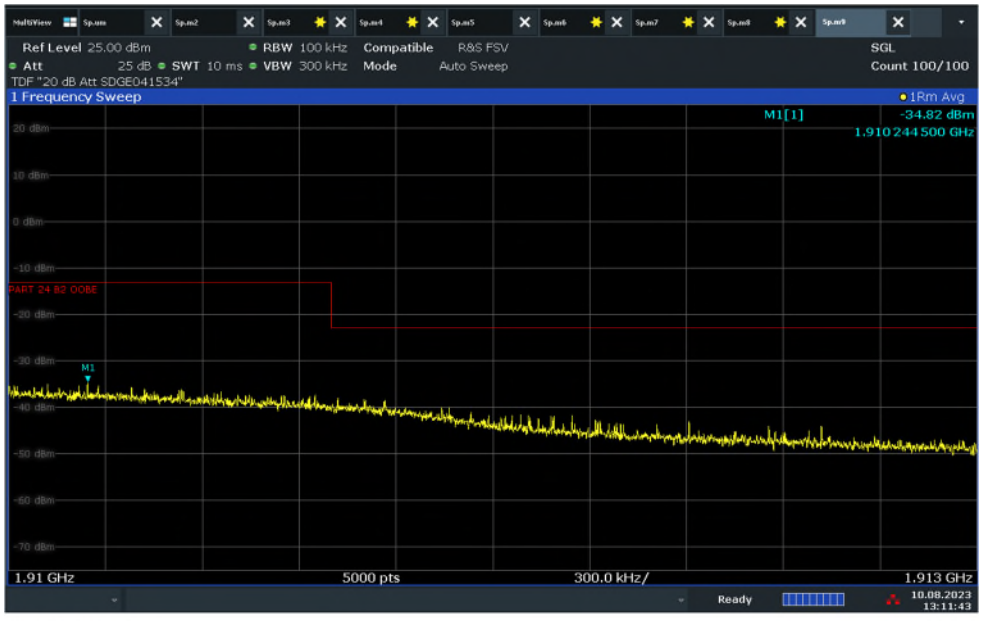
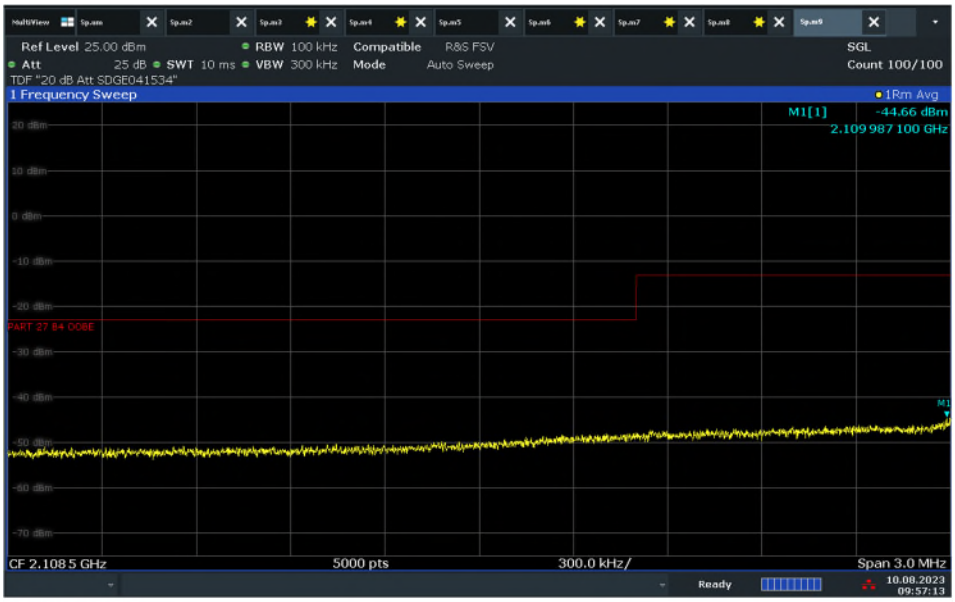
 13:11:43 10.08.2023

LTE Band 4 Downlink 5MHz Bandwidth Low Channel (-82.5 dBm)
 09:57:14 10.08.2023
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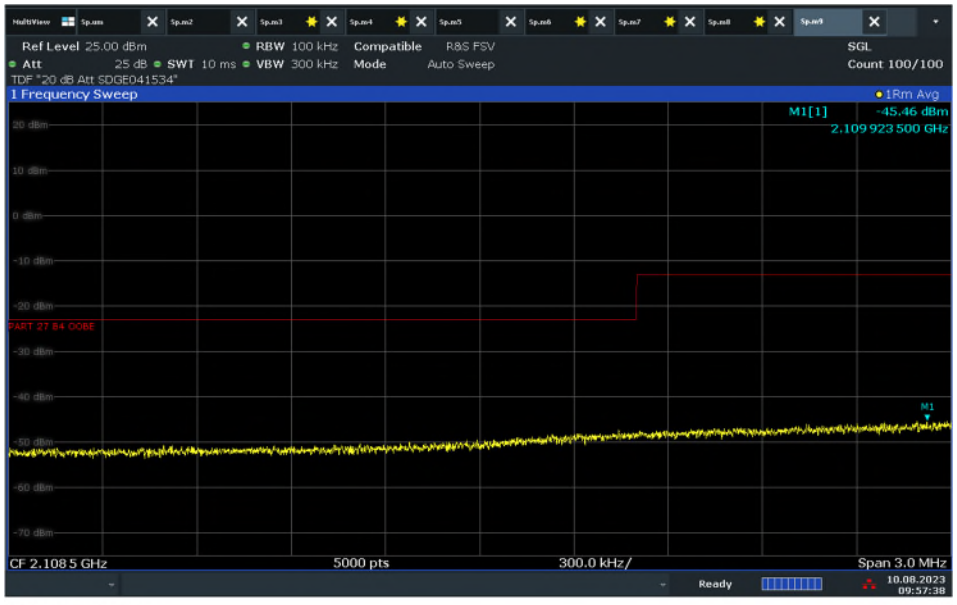 09:57:39 10.08.2023

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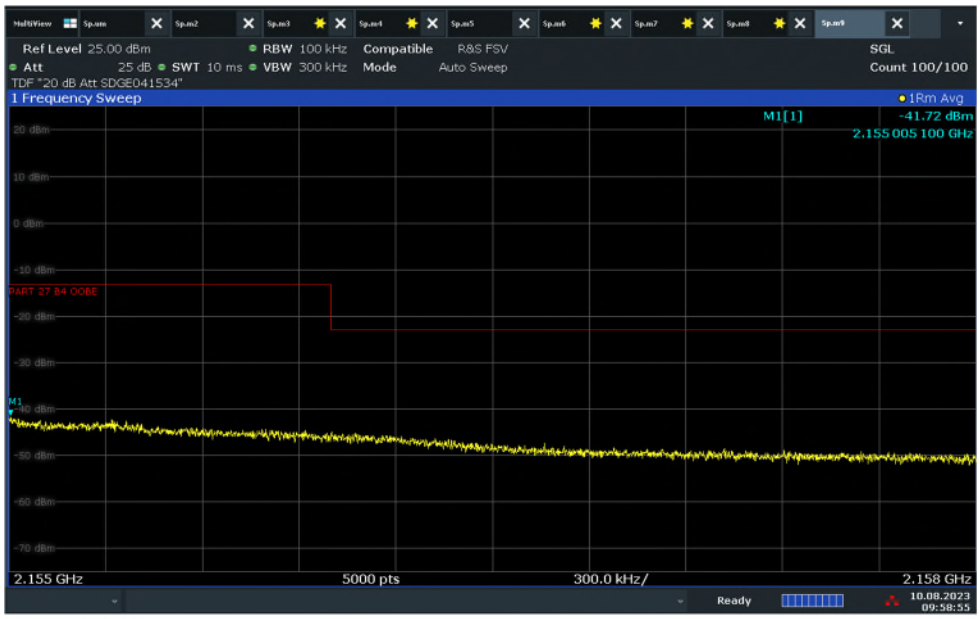 09:58:55 10.08.2023
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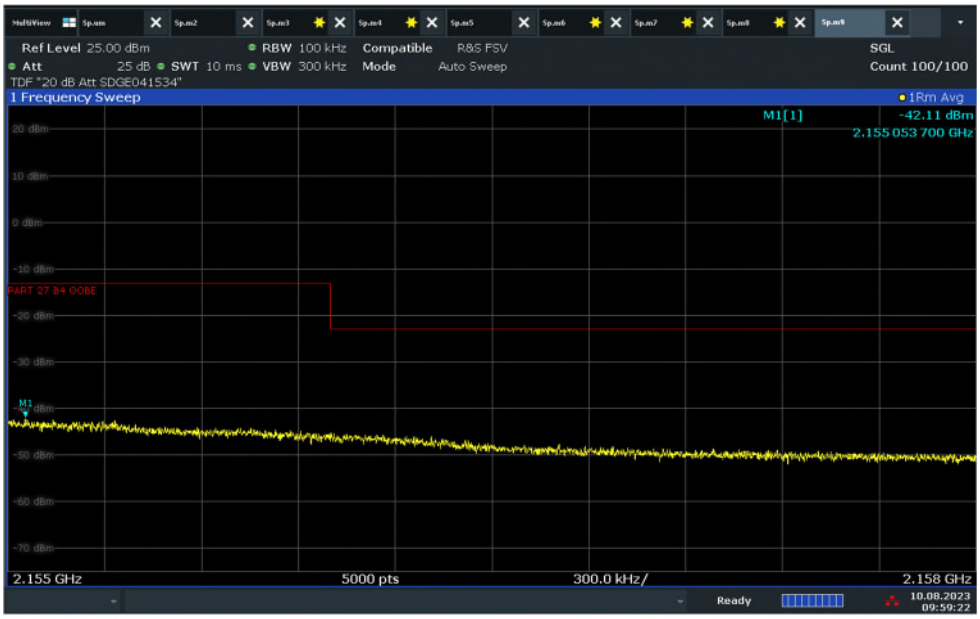
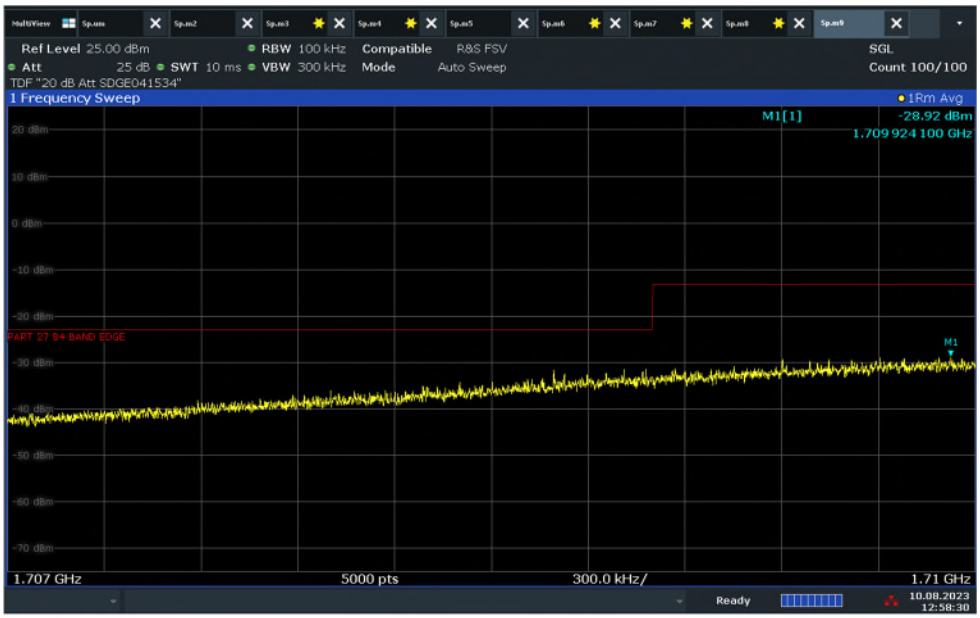
 09:59:23 10.08.2023

LTE Band 4 Uplink 5MHz Bandwidth Low Channel (-77.3 dBm)
 12:58:30 10.08.2023
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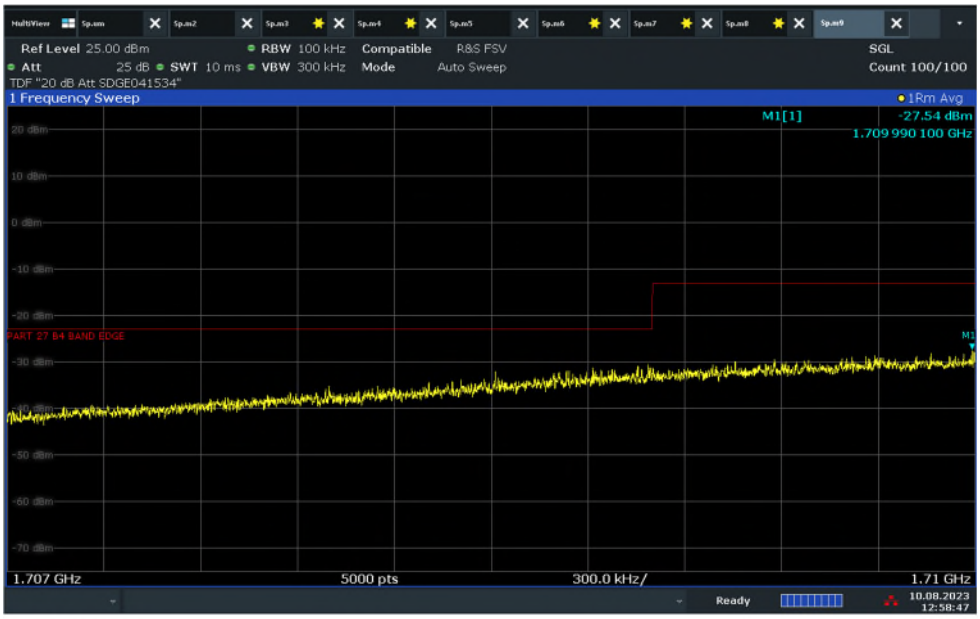
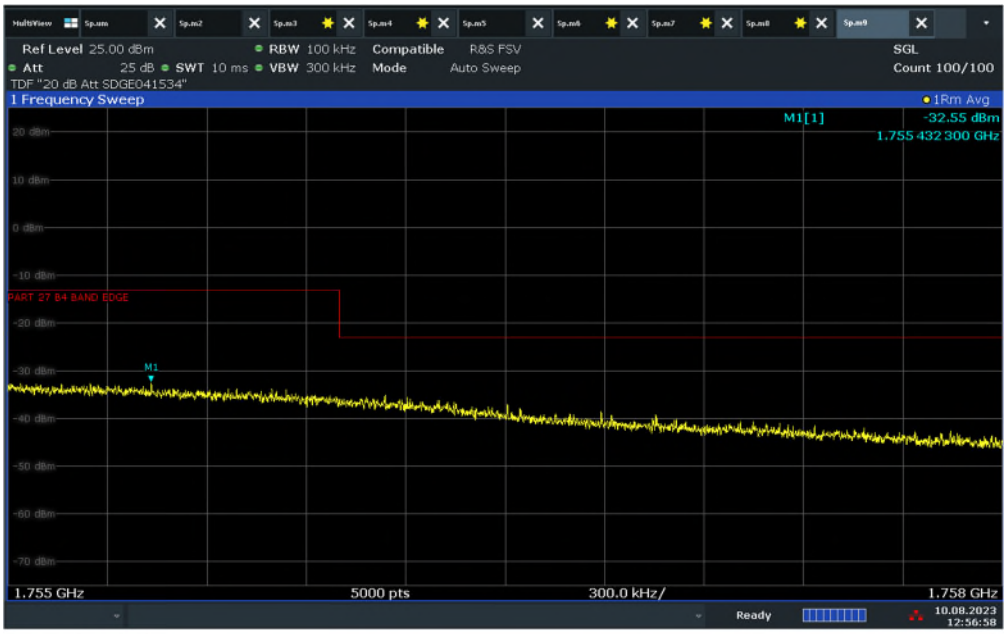
 12:58:47 10.08.2023

LTE Band 4 Uplink 5MHz Bandwidth High Channel (-77.3 dBm)
 12:56:59 10.08.2023
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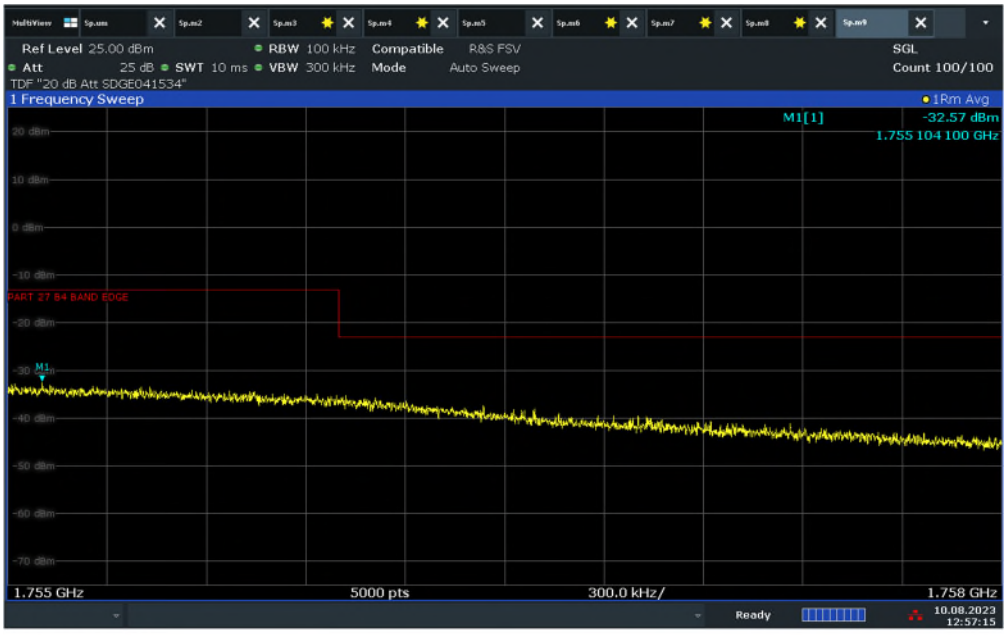
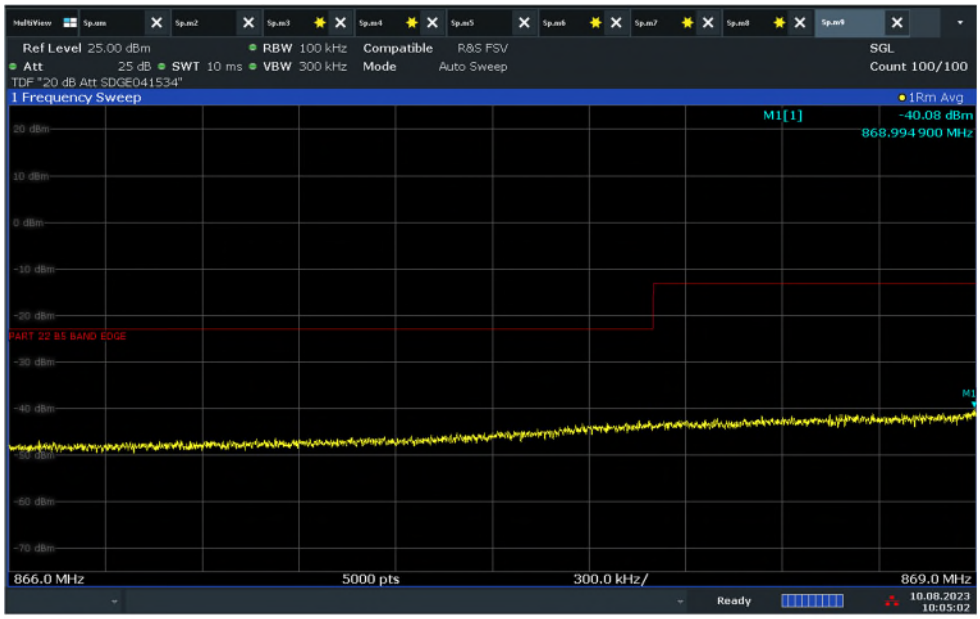
 12:57:16 10.08.2023

LTE Band 5 Downlink 5MHz Bandwidth Low Channel (-82.4 dBm)
 10:05:02 10.08.2023
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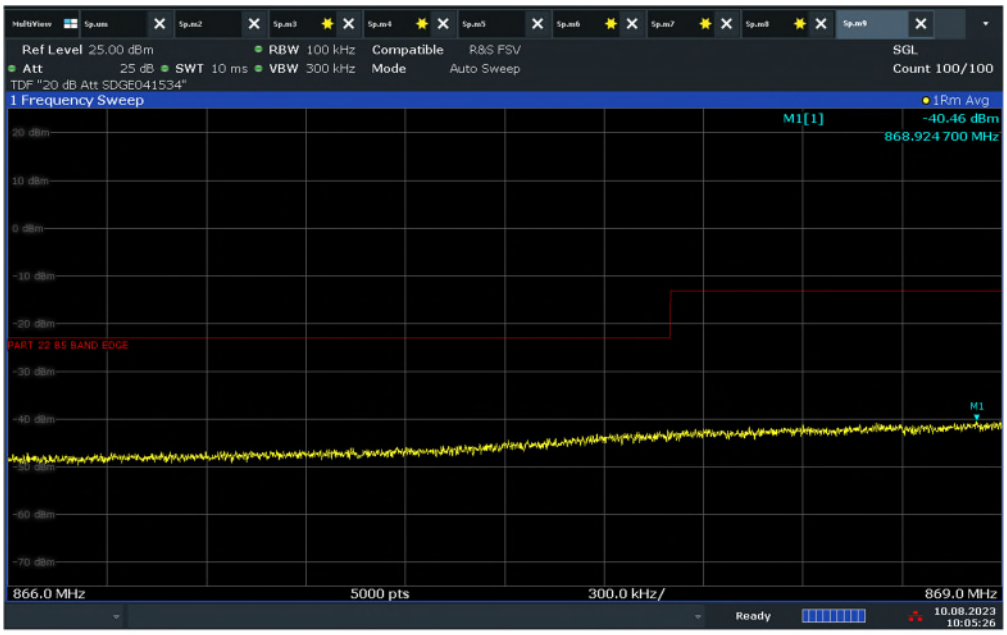
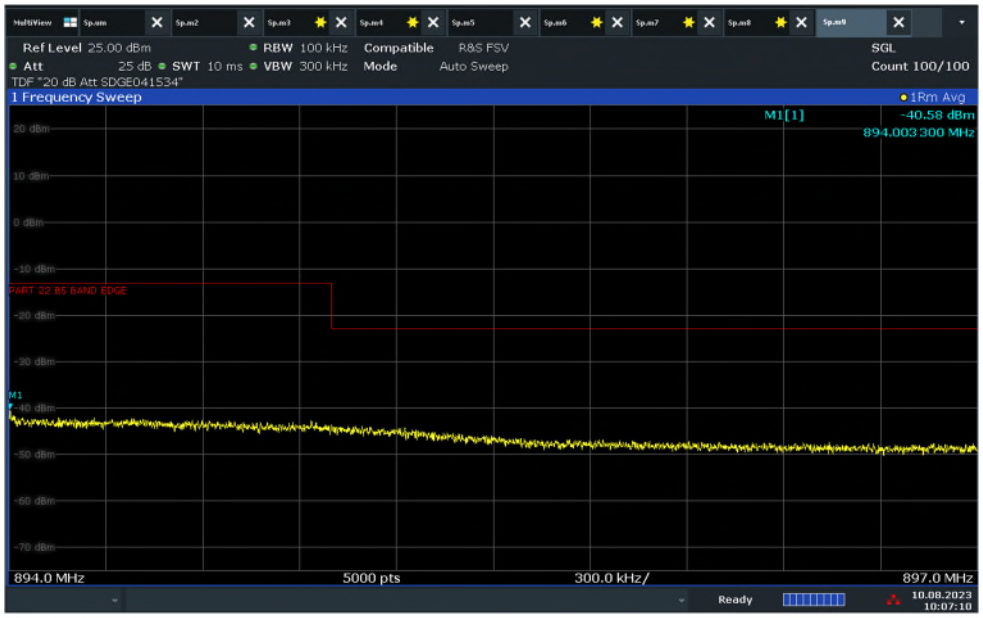
 10:05:27 10.08.2023

LTE Band 5 Downlink 5MHz Bandwidth High Channel (-82.4 dBm)
 10:07:10 10.08.2023
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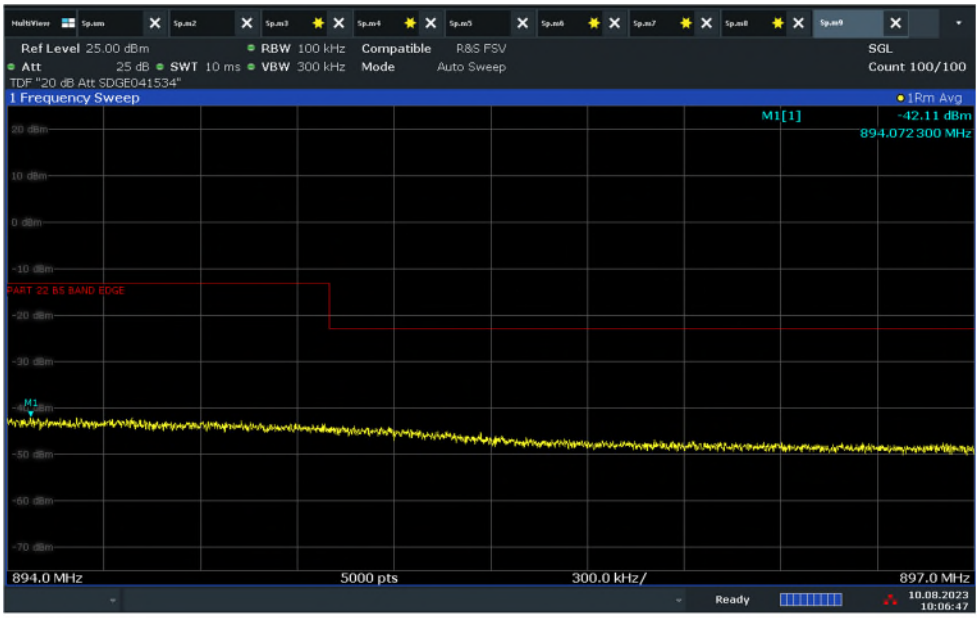
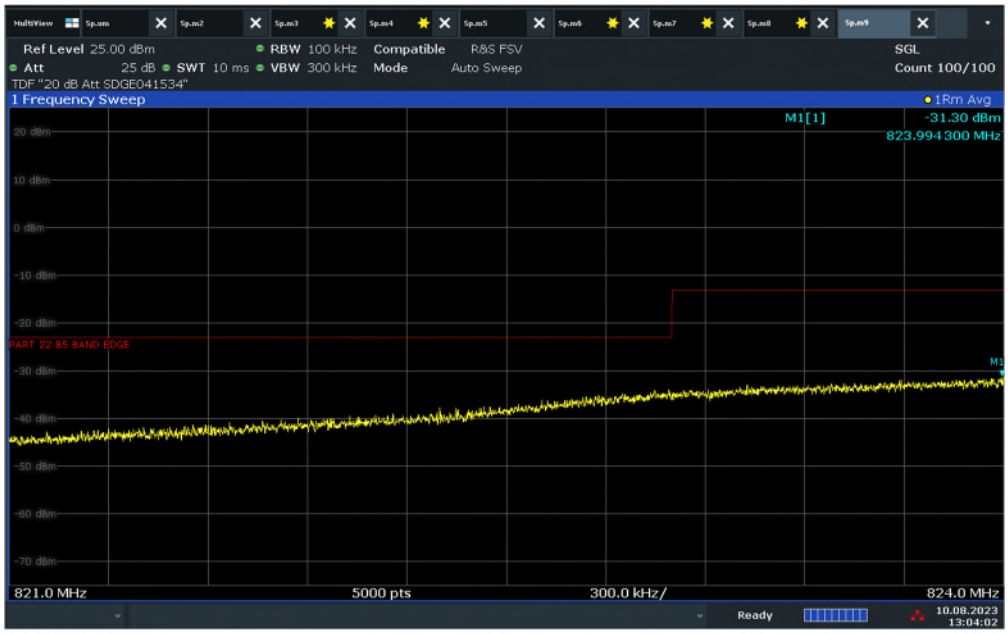
 10:06:48 10.08.2023

LTE Band 5 Uplink 5MHz Bandwidth Low Channel (-75.8 dBm)
 13:04:03 10.08.2023
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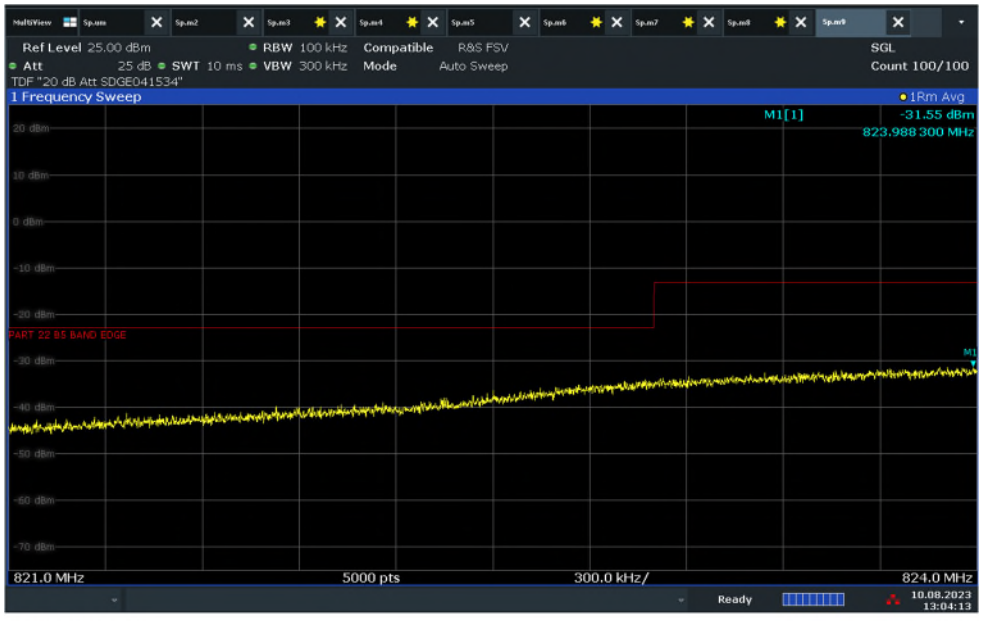
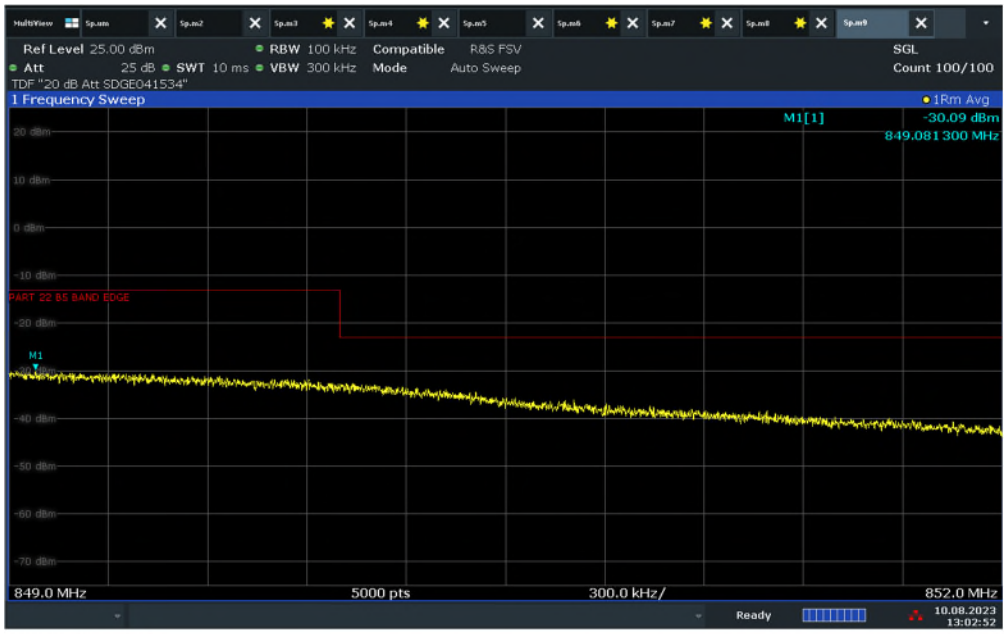
 13:04:14 10.08.2023

LTE Band 5 Uplink 5MHz Bandwidth High Channel (-75.8 dBm)
 13:02:53 10.08.2023
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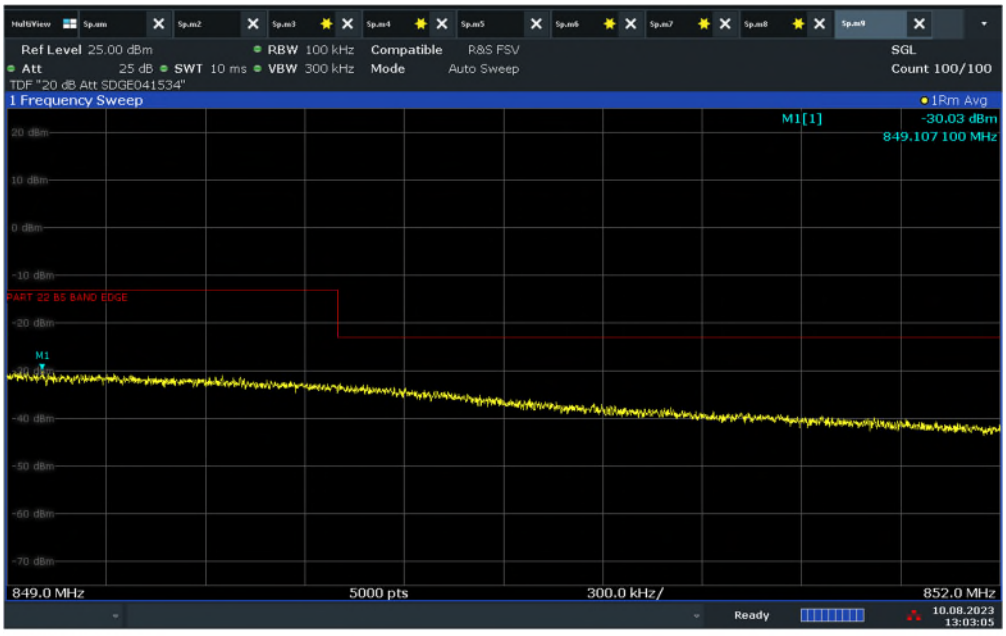
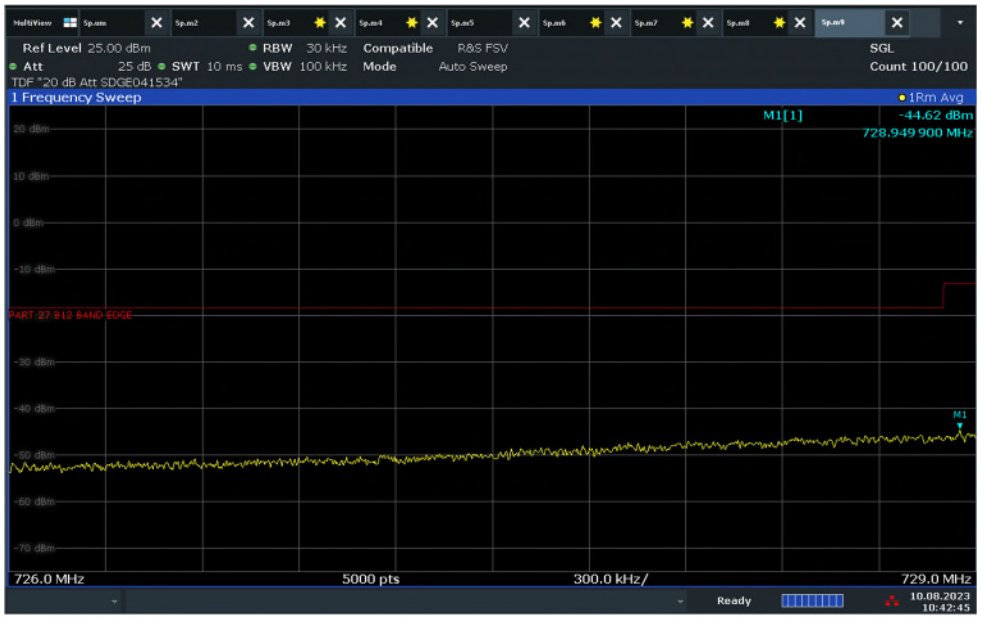
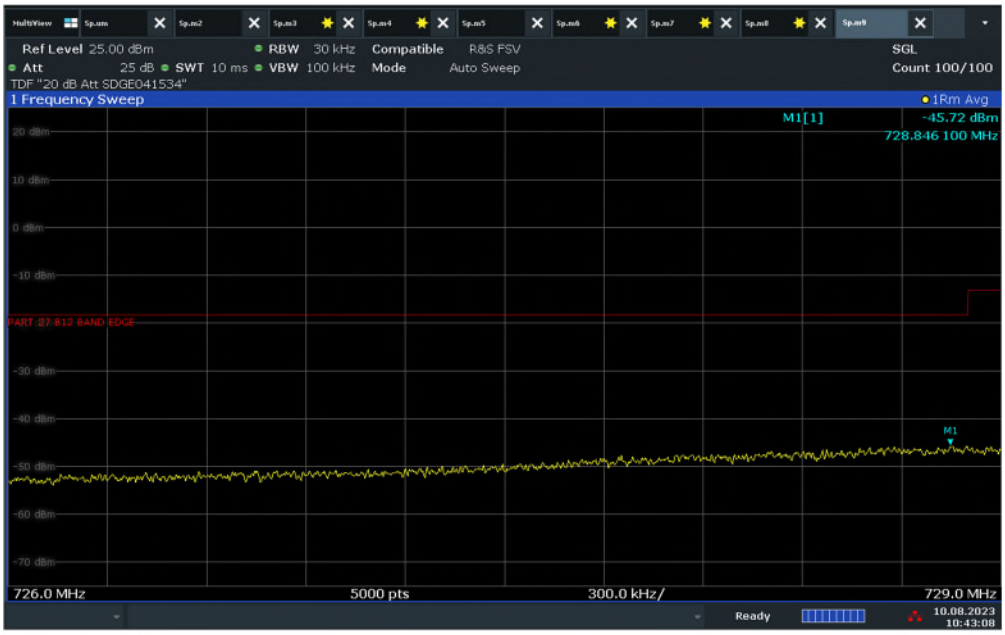
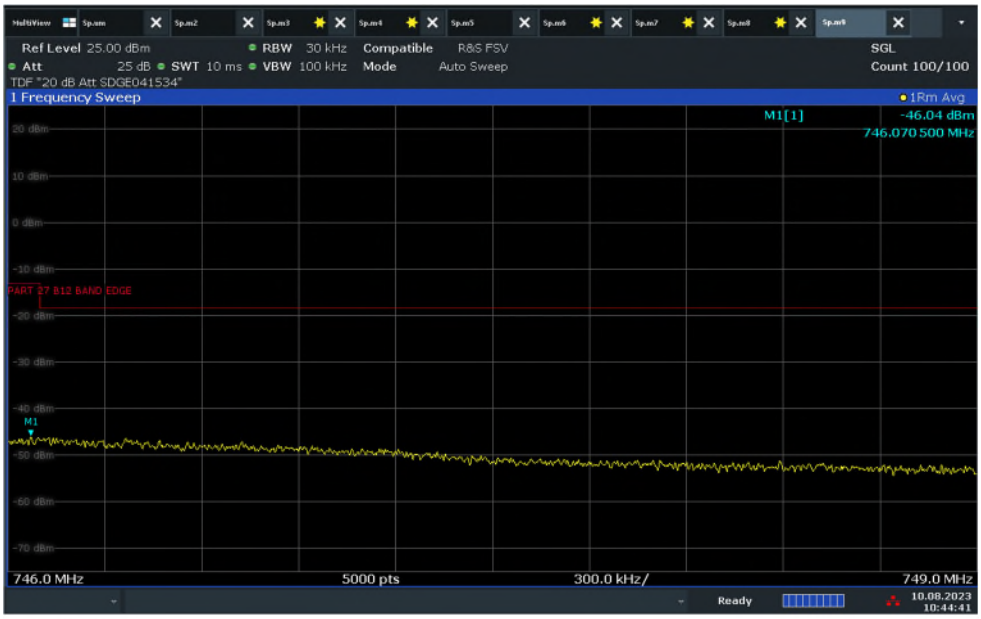
 13:03:05 10.08.2023

LTE Band 12 Downlink 5MHz Bandwidth Low Channel (-82.2 dBm)
 10:42:45 10.08.2023
LTE Band 12 Downlink 5MHz Bandwidth Low Channel 10 dB Above AGC
 10:43:08 10.08.2023

LTE Band 12 Downlink 5MHz Bandwidth High Channel (-82.2 dBm)
 10:44:42 10.08.2023
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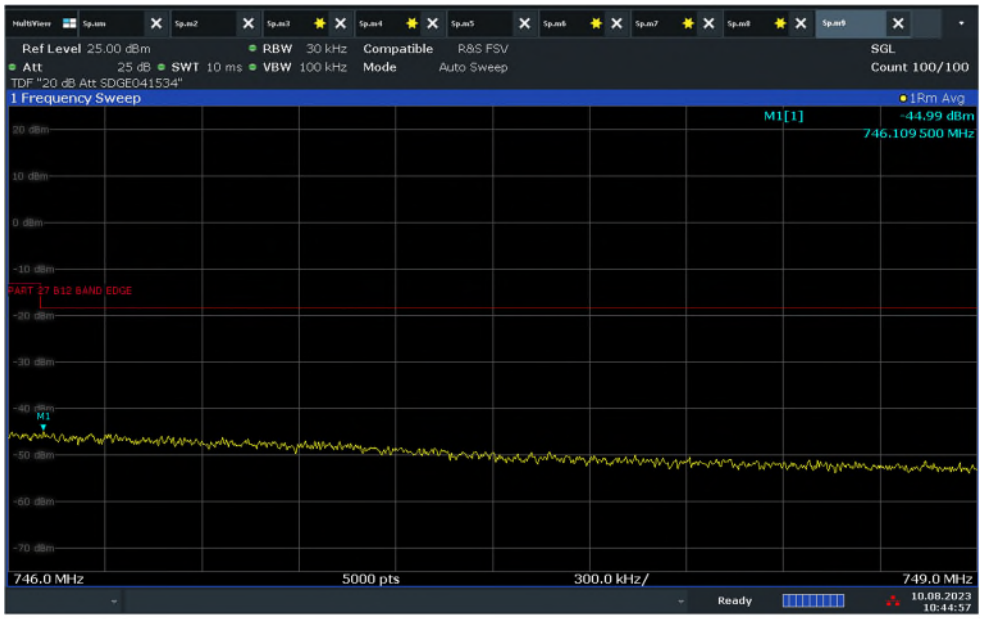
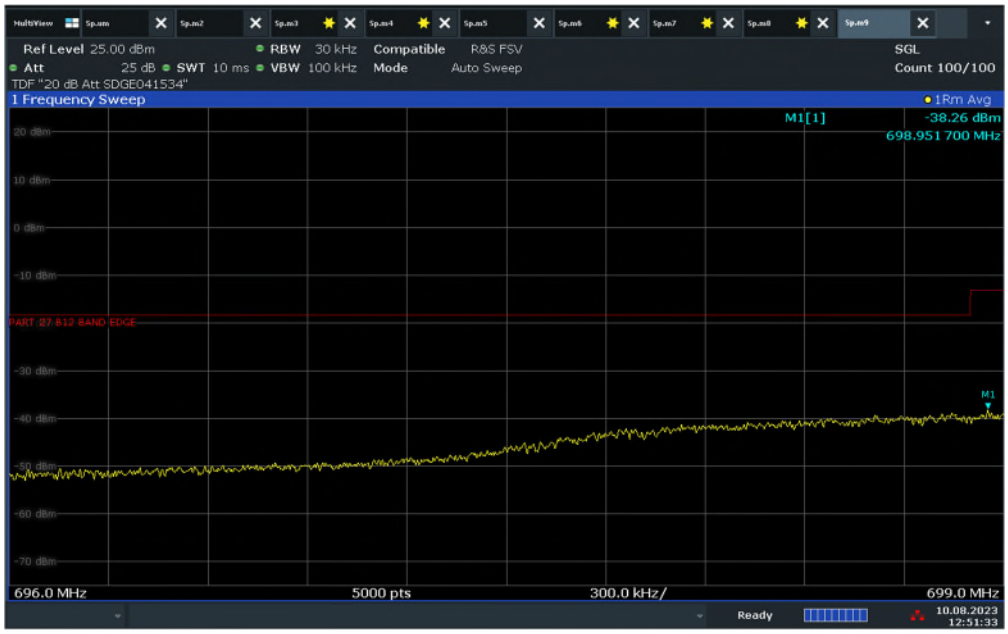
 10:44:58 10.08.2023

LTE Band 12 Uplink 5MHz Bandwidth Low Channel (-75.6 dBm)
 12:51:33 10.08.2023
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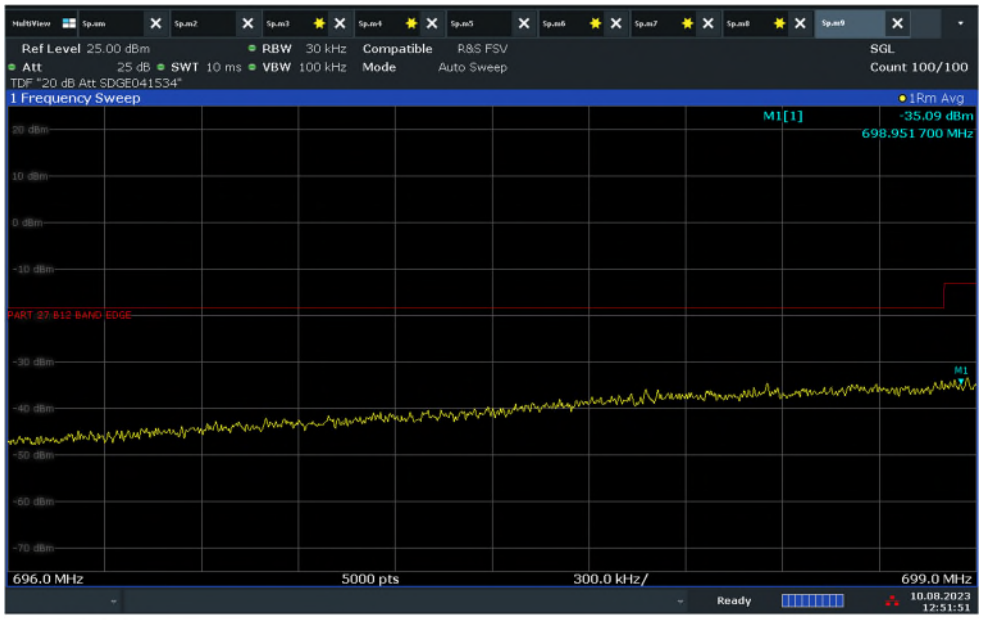
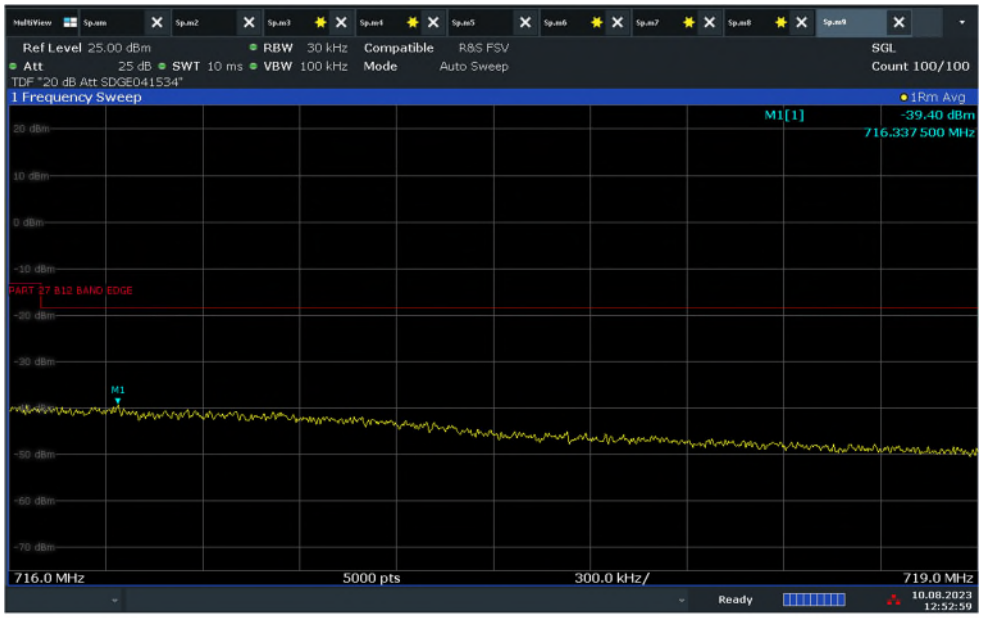
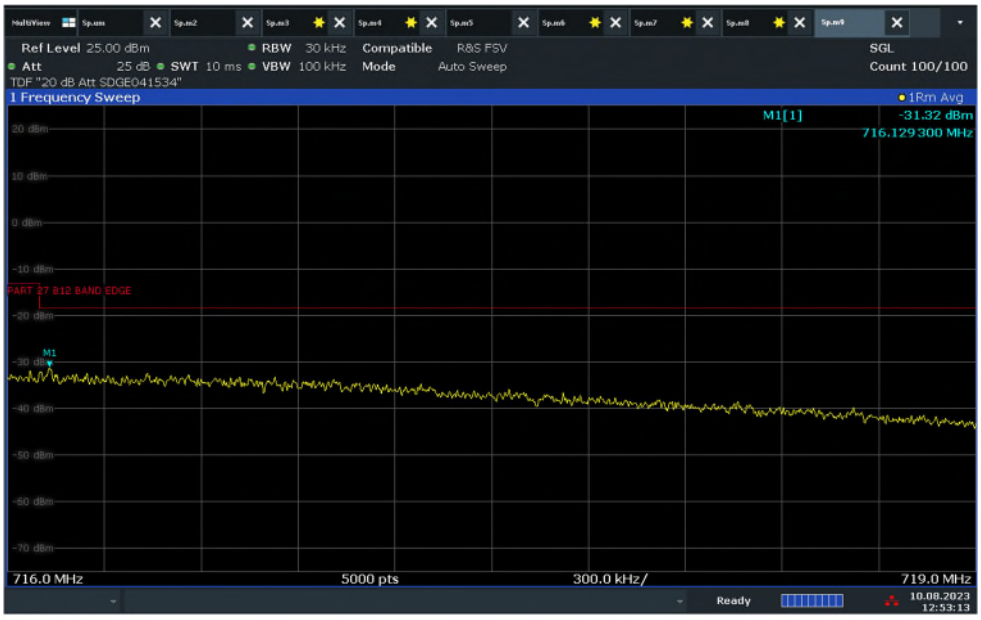
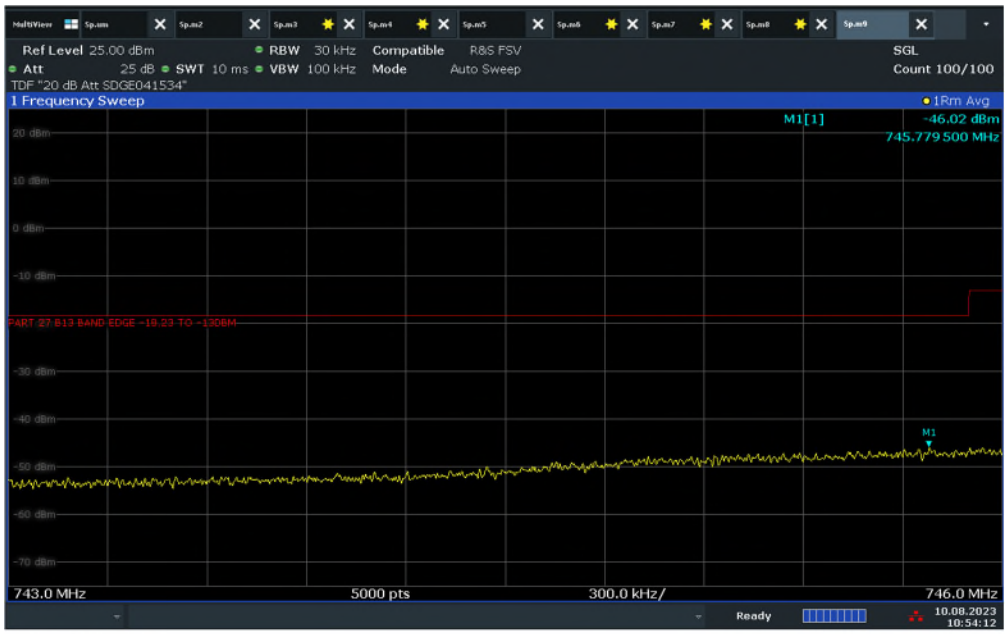
 12:51:52 10.08.2023

LTE Band 12 Uplink 5MHz Bandwidth High Channel (-75.6 dBm)
 12:52:59 10.08.2023
LTE Band 12 Uplink 5MHz Bandwidth High Channel 10 dB Above AGC
 12:53:14 10.08.2023

LTE Band 13 Downlink 5MHz Bandwidth Low Channel (-82.5 dBm)
 10:54:12 10.08.2023
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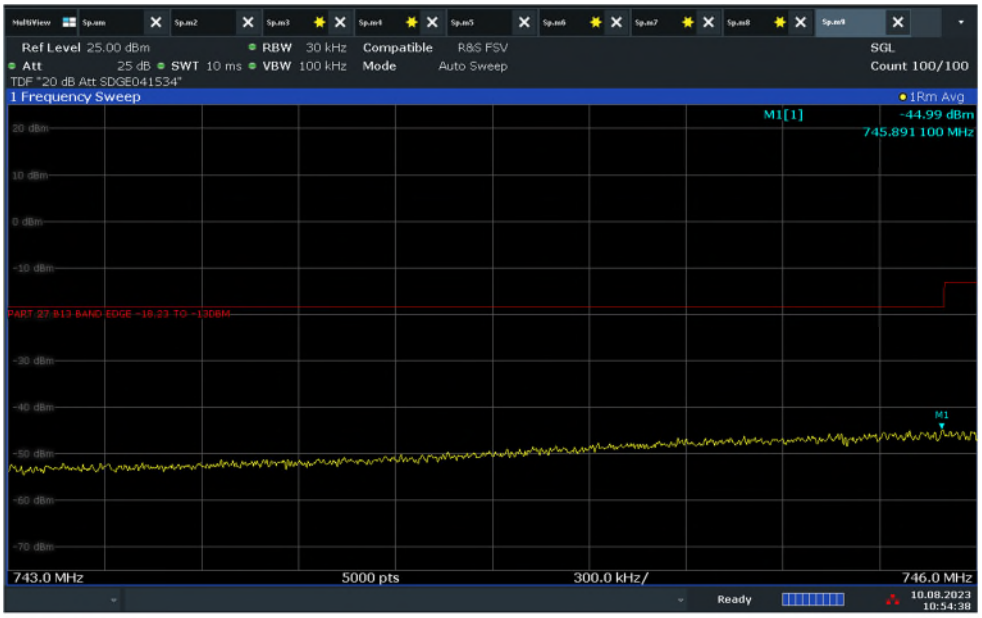
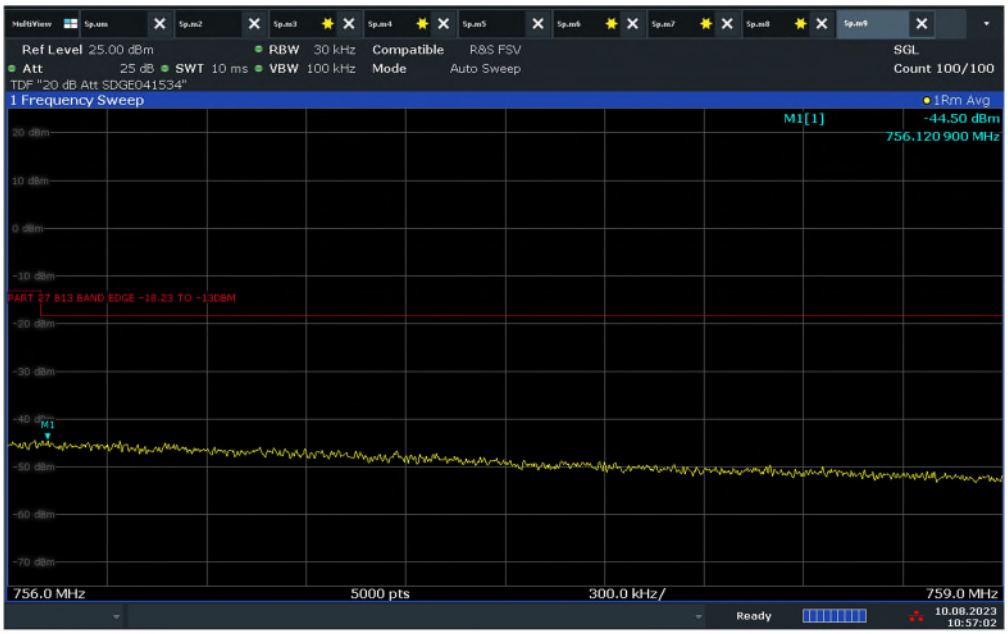
 10:54:38 10.08.2023

LTE Band 13 Downlink 5MHz Bandwidth High Channel (-82.5 dBm)
 10:57:03 10.08.2023
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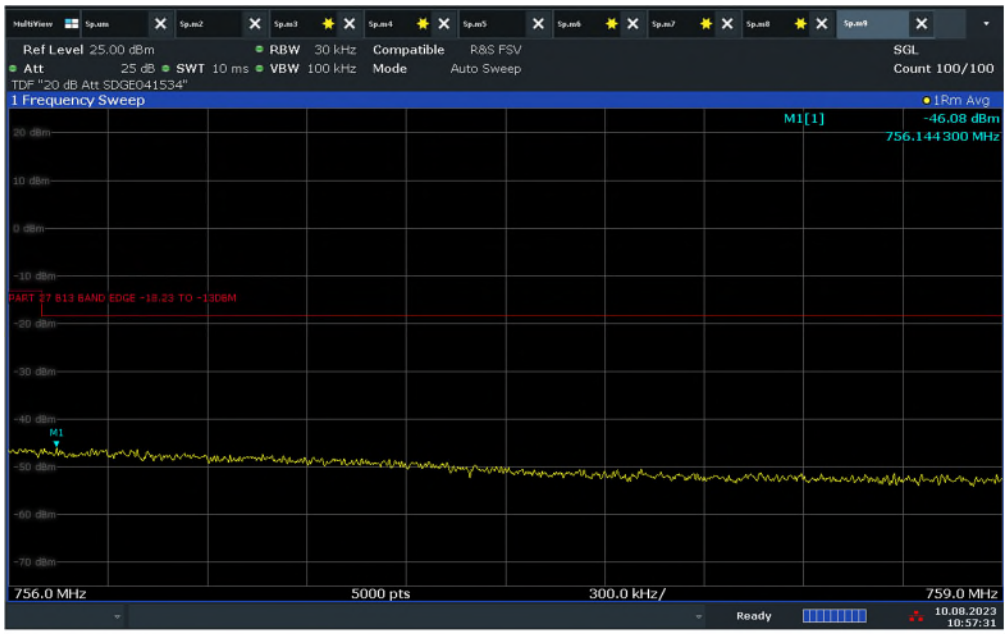
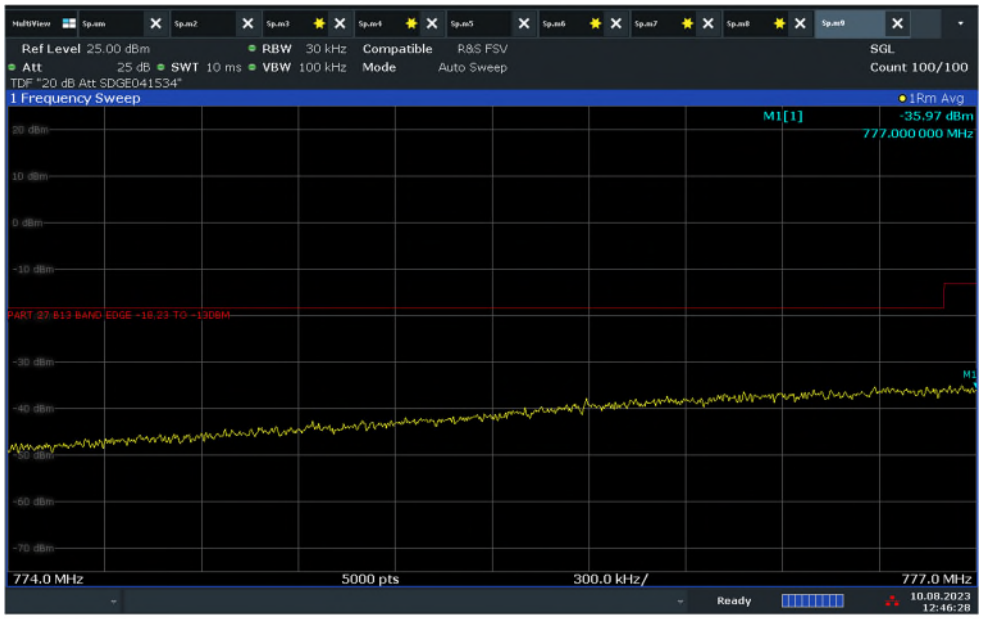
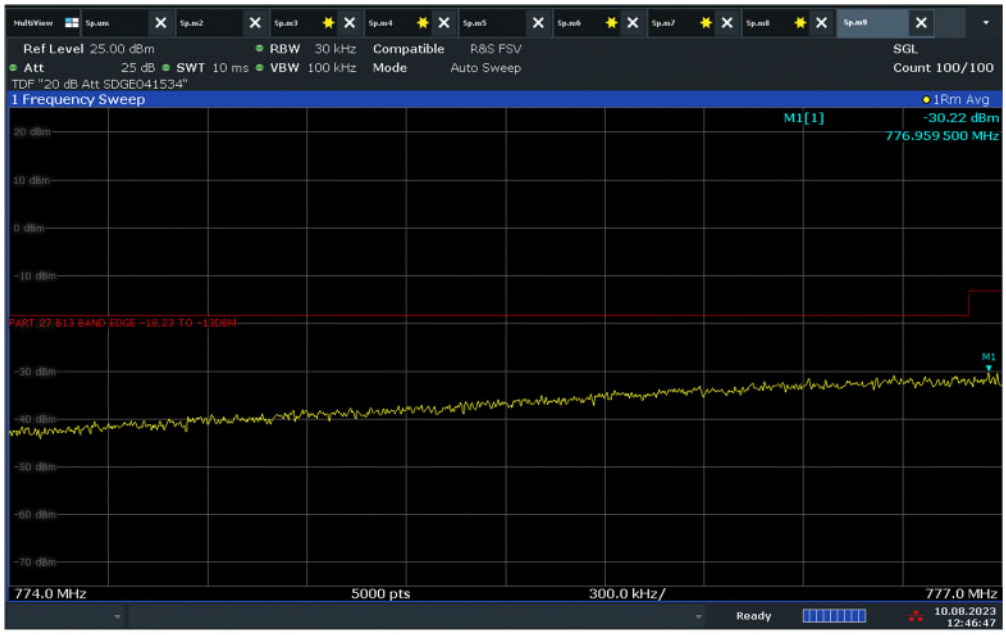
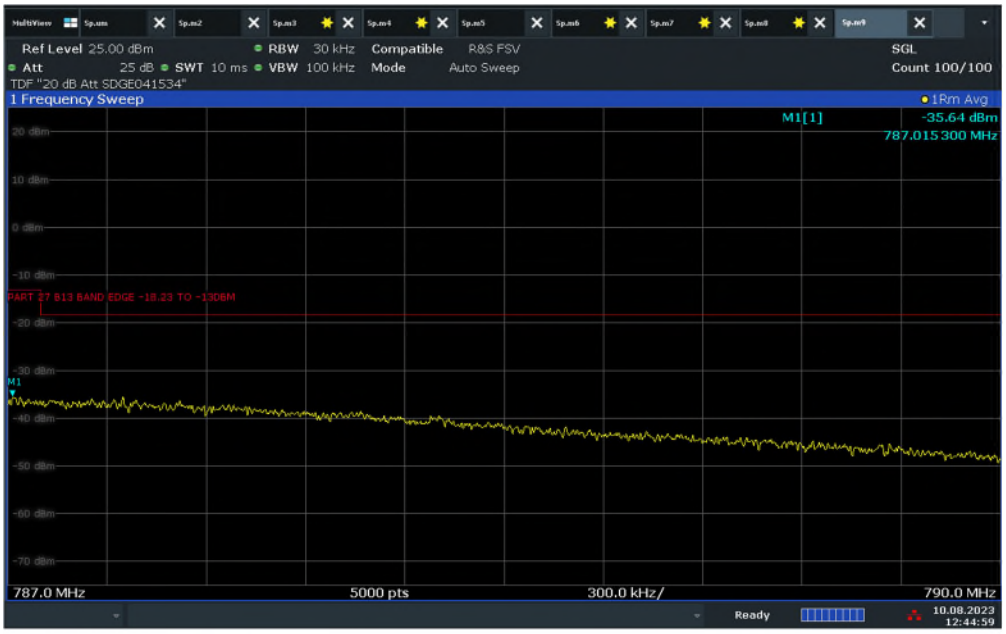
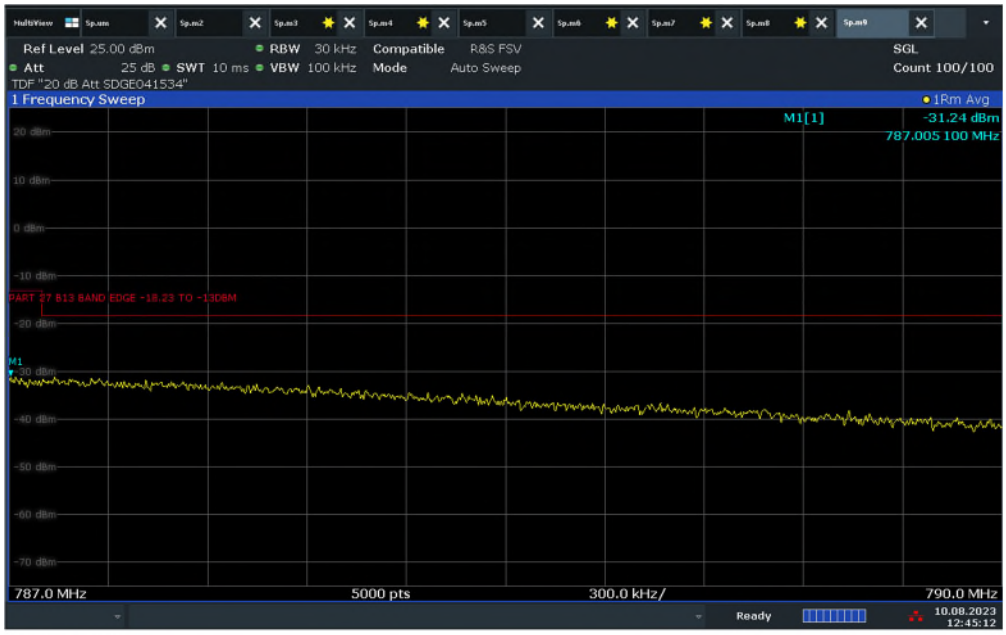
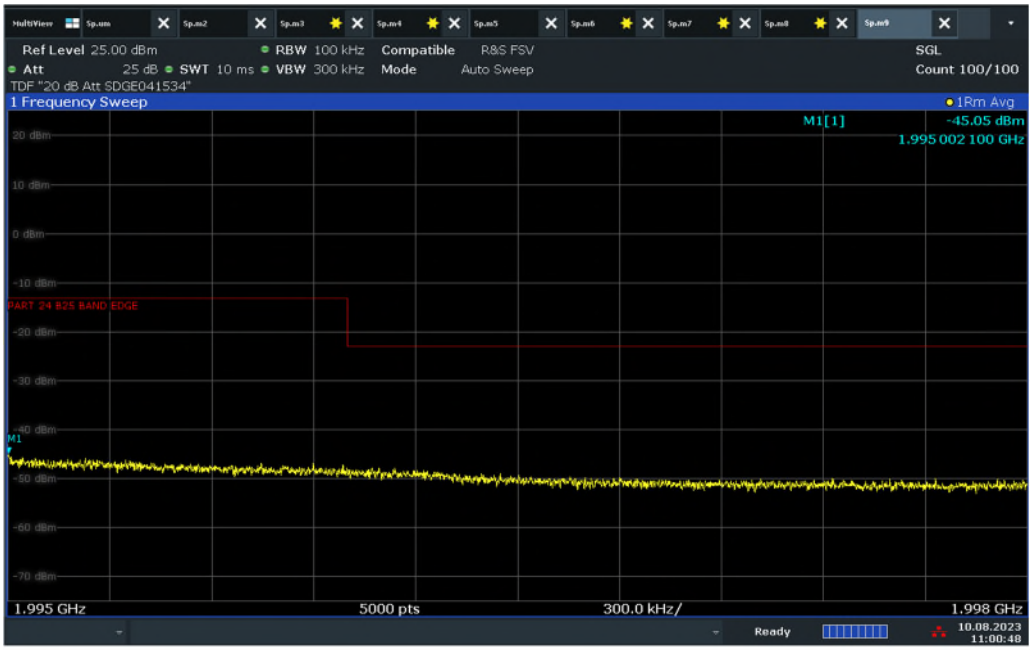
 10:57:32 10.08.2023

LTE Band 13 Uplink 5MHz Bandwidth Low Channel (-75.5 dBm)
 12:46:29 10.08.2023
LTE Band 13 Uplink 5MHz Bandwidth Low Channel 10 d Above AGC
 12:46:48 10.08.2023

LTE Band 13 Uplink 5MHz Bandwidth High Channel (-75.5 dBm)
 12:44:59 10.08.2023
LTE Band 13 Uplink 5MHz Bandwidth High Channel 10 dB Above AGC
 12:45:12 10.08.2023

LTE Band 25 Downlink 5MHz Bandwidth High Channel (-82.5 dBm)
 11:00:49 10.08.2023
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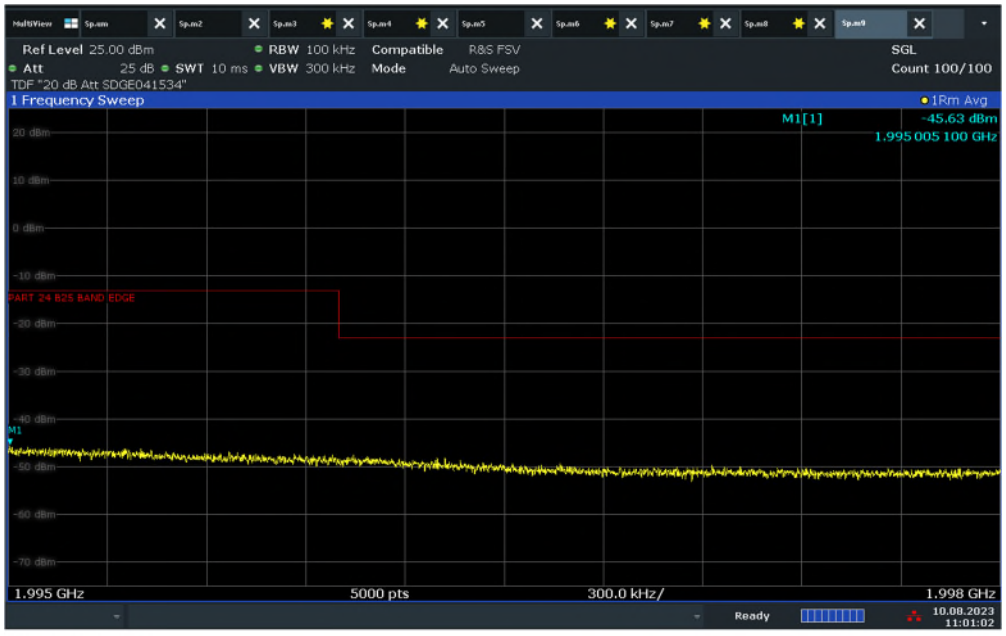
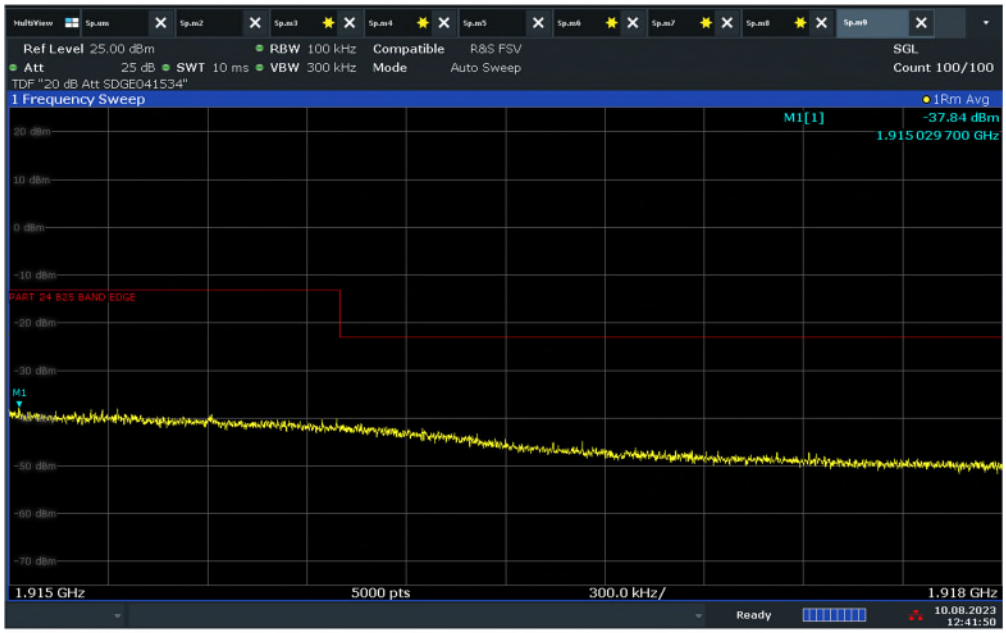
 11:01:03 10.08.2023

LTE Band 25 Uplink 5MHz Bandwidth High Channel (-77.5 dBm)
 12:41:50 10.08.2023
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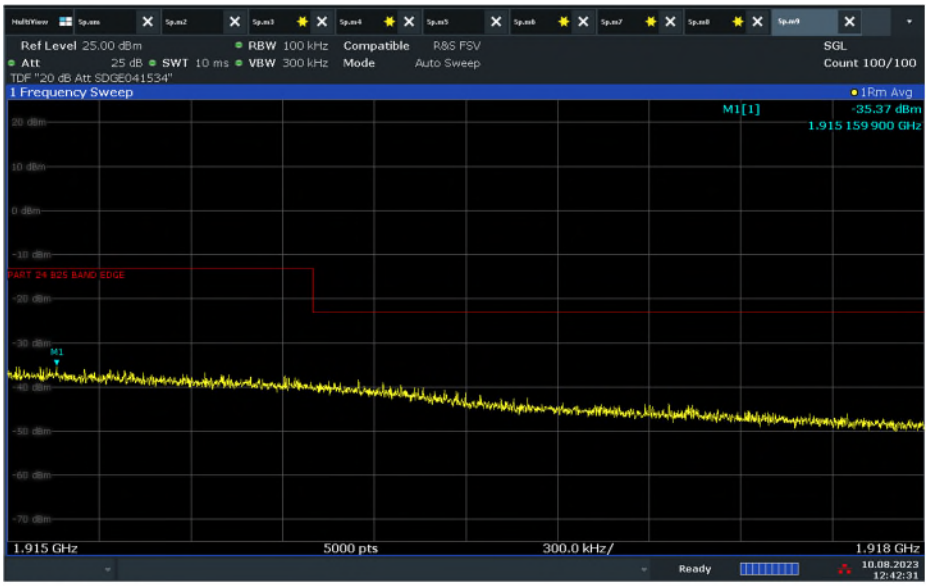
 12:42:32 10.08.2023

2.6 Conducted Spurious Emissions

2.6.1 Specification Reference

FCC 47 CFR Part 20. Clause 20.21(e)(9)(i)(F)
RSS 131 8.5

2.6.2 Standard Applicable

FCC 47 CFR Part 24, Clause 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.

FCC 47 CFR Part 27, Clause 27.53:

(h) AWS emission limits – (1) General protection levels. Except as otherwise specified below, for operatios 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 MHz 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 log10 (P) dB.

(g) For operations in the 600 MHz band and the 698–746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

(c) For operations in the 746–758 MHz band and the 776–788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(1) On any frequency outside the 746–758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

(2) On any frequency outside the 776–788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

(3) On all frequencies between 763–775 MHz and 793–805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations;

(f) For operations in the 746–758 MHz, 775–788 MHz, and 805–806 MHz bands, emissions in the band 1559–1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

(a) For operations in the 2305–2320 MHz band and the 2345–2360 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power P (with averaging performed only during periods of transmission) within the licensed band(s) of operation, in watts, by the following amounts:

(1) For base and fixed stations' operations in the 2305–2320 MHz band and the 2345–2360 MHz band:

(i) By a factor of not less than 43 + 10 log (P) dB on all frequencies between 2305 and 2320 MHz and on all frequencies between 2345 and 2360 MHz that are outside the licensed band(s) of operation, and not less than 75 + 10 log (P) dB on all frequencies between 2320 and 2345 MHz;

(ii) By a factor of not less than 43 + 10 log (P) dB on all frequencies between 2300 and 2305 MHz, 70 + 10 log (P) dB on all frequencies between 2287.5 and 2300 MHz, 72 + 10 log (P) dB on all frequencies between 2285 and 2287.5 MHz, and 75 + 10 log (P) dB below 2285 MHz;

(iii) By a factor of not less than 43 + 10 log (P) dB on all frequencies between 2360 and 2362.5 MHz, 55 + 10 log (P) dB on all frequencies between 2362.5 and 2365 MHz, 70 + 10 log (P) dB on all frequencies between 2365 and 2367.5 MHz, 72 + 10 log (P) dB on all frequencies between 2367.5 and 2370 MHz, and 75 + 10 log (P) dB above 2370 MHz.

RSS-139, Clause 6.6:

(i) In the first 1.0 MHz bands immediatel outside and adjacent to the equipment's smallest opreating 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 (dBW), by at least 43 + 10 $\log_{10}$ p (watts) dB.

RSS-130:
4.7.1 General unwanted emissions limits
The unwanted emissions in any 100 kHz bandwidth on any frequency outside the low frequency edge and the high frequency edge of each frequency block range(s), shall be attenuated below the transmitter power, P (dBW), by at least 43 + 10 log10 p (watts), dB. However, in the 100 kHz band immediately outside of the equipment's frequency block range, a resolution bandwidth of 30 kHz may be employed.

4.7.2 Additional unwanted emissions limits
In addition to the limit outlined in section 4.7.1 above, equipment operating in the frequency bands 746-756 MHz and 777-787 MHz shall also comply with the following restrictions:
a) The power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power, P (dBW), by at least:

(i) 76 + 10 log10 p (watts), dB, for base and fixed equipment, and
(ii) 65 + 10 log10 p (watts), dB, for mobile and portable equipment.

b) The e.i.r.p. in the band 1559-1610 MHz shall not exceed -70 dBW/MHz for wideband signal and -80 dBW for discrete emission with bandwidth less than 700 Hz.

RSS-195, Clause 5.6.1:
The power of any emission outside the frequency range(s) in which the equipment operates shall be attenuated below the transmitter power, P(dBW), by the amount indicated in Table 1 and graphically represented in Figure 1, where p is the transmitter output power measured in watts.

Table 1 – Unwanted Emissions for Base Stations, Fixed Station and High-Power Fixed Subscriber Equipment

Frequency (MHz)	Attenuation (dB)
<2200	$43 + 10 \log_{10} (p)$
2200 - 2285	$75 + 10 \log_{10} (p)$
2285 – 2287.5	$72 + 10 \log_{10} (p)$
2287.5 - 2300	$70 + 10 \log_{10} (p)$
2300 - 2305	$43 + 10 \log_{10} (p)$
2305 - 2320	$43 + 10 \log_{10} (p)$ Note
2320 -2345	$75 + 10 \log_{10} (p)$
2345 -2360	$43 + 10 \log_{10} (p)$ Note
2360 – 2362.5	$43 + 10 \log_{10} (p)$
2362.5 - 2365	$55 + 10 \log_{10} (p)$
2365 – 2367.5	$70 + 10 \log_{10} (p)$
2367.5 - 2370	$72 + 10 \log_{10} (p)$
2370 - 2395	$75 + 10 \log_{10} (p)$
>2395	$43 + 10 \log_{10} (p)$

Note: Measured at the edges of the highest and lowest frequency range(s) in which the equipment is designed to operate. See Section 5.2 for the permitted frequency ranges for the various equipment types.

2.6.3 Equipment Under Test and Modification State

Serial No: 560311000026 / Configuration A and B

2.6.4 Date of Test/Initial of test personnel who performed the test

July 17 and October 9, 2023 / MARG

2.6.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.6.6 Environmental Conditions

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility.

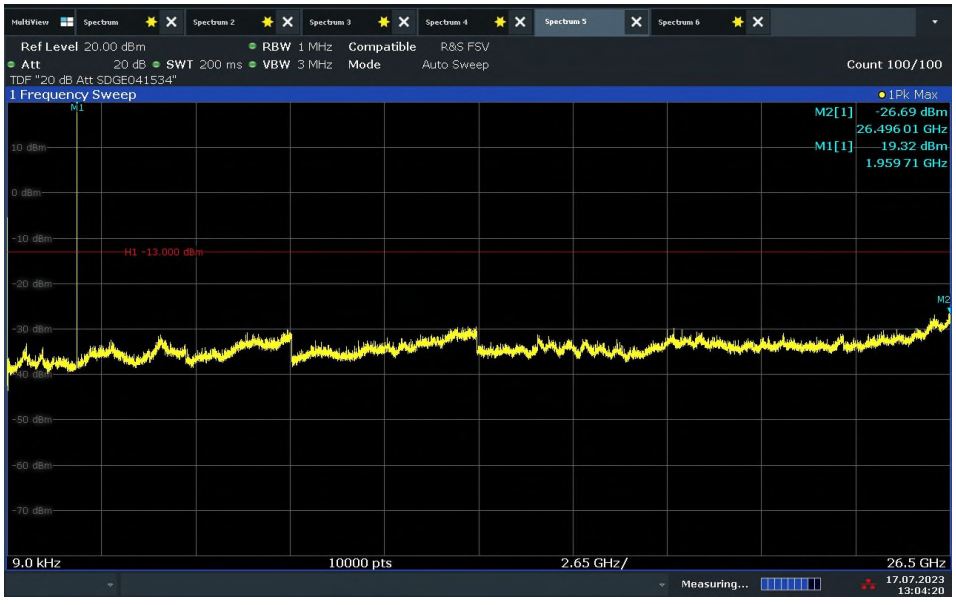
Ambient Temperature	22.7 – 26.7 °C
Relative Humidity	50.7 – 56.5%
ATM Pressure	101.1 - 98.8kPa

2.6.7 Additional Observations

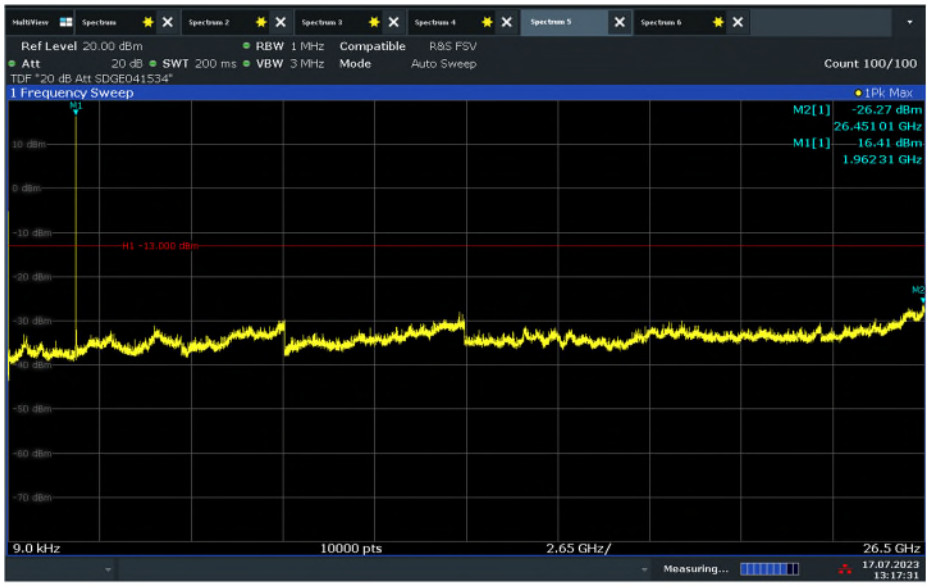
- This is a conducted test. Test guidance is per Section 6.1 of KDB971168 (D01 Power Meas License Digital Systems v03r01).
- The transducer factor (TDF) used is from the external attenuators and cables used.
- The limit is set to -13dBm.
- Detector is peak and trace is set to max hold as the worst-case setting.
- All low, middle and high channels for all bandwidths were verified and only middle channel presented in this test report as representative configuration.
- Plots with 20dB attenuation (to prevent overloading the front end of the SA) were also verified with lesser attenuation to validate conformance with noise floor requirements.

2.6.8 Test Results

LTE Band 2 5MHz Bandwidth Downlink Middle Channel Conducted Spurious Emissions



LTE Band 2 10MHz Bandwidth Downlink Middle Channel Conducted Spurious Emissions



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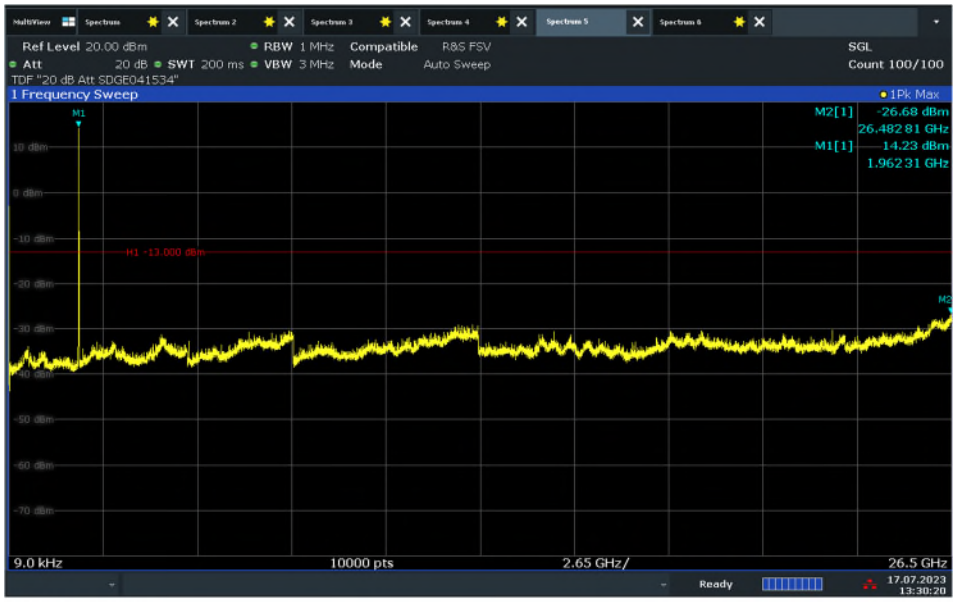
LTE Band 2 15MHz Bandwidth Downlink Middle Channel Conducted Spurious Emissions



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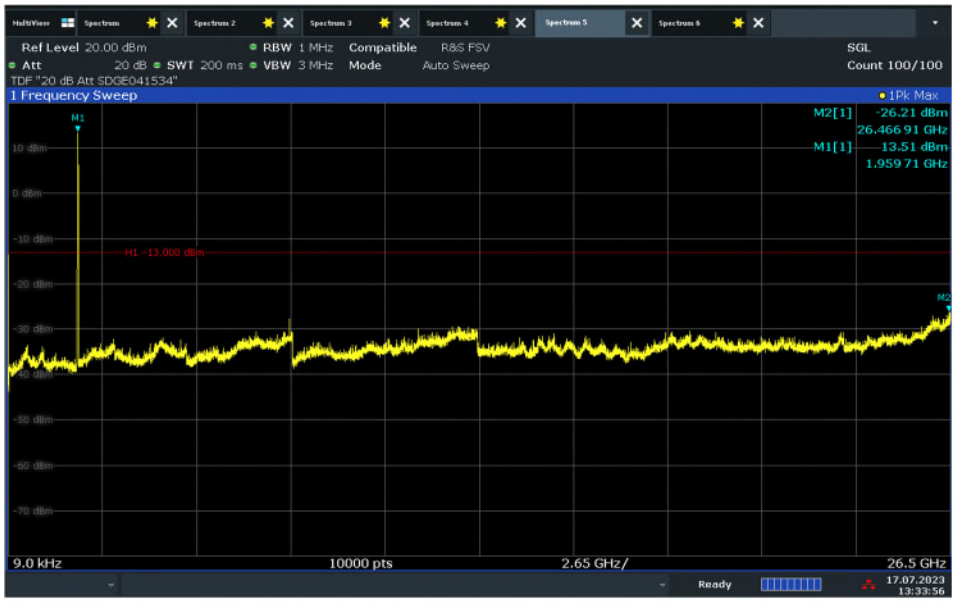
LTE Band 2 20MHz Bandwidth Downlink Middle Channel Conducted Spurious Emissions



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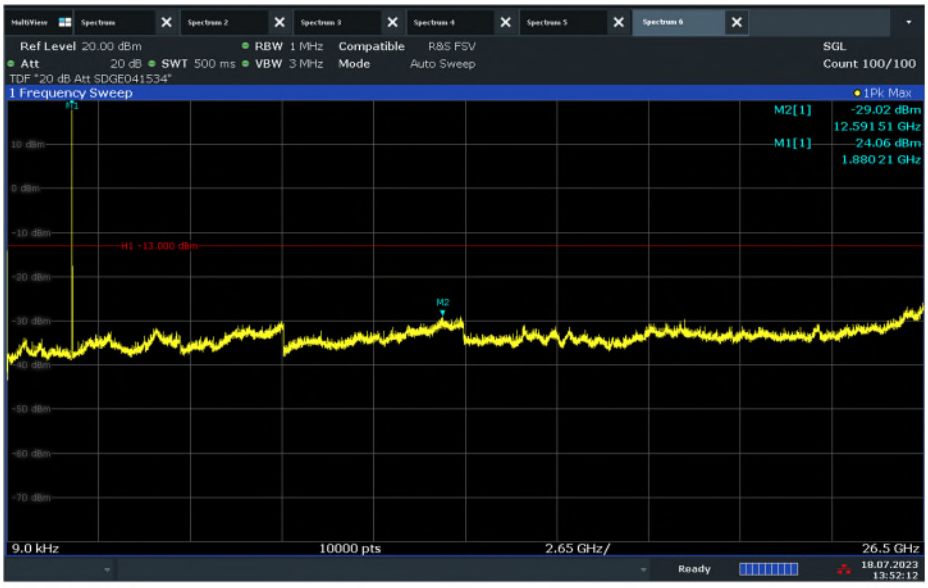
LTE Band 2 5MHz Bandwidth Uplink Middle Channel Conducted Spurious Emissions



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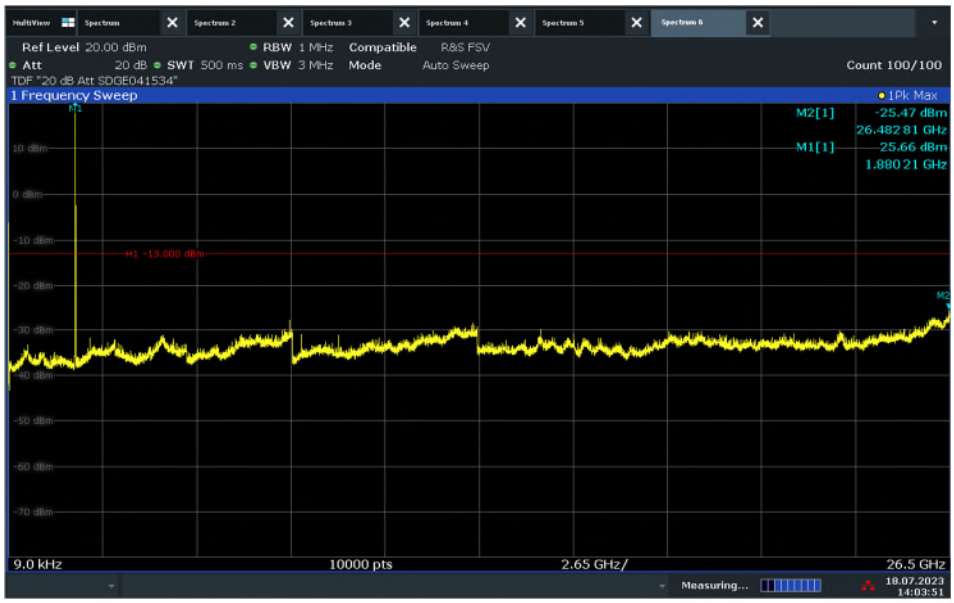
LTE Band 2 10MHz Bandwidth Uplink Middle Channel Conducted Spurious Emissions



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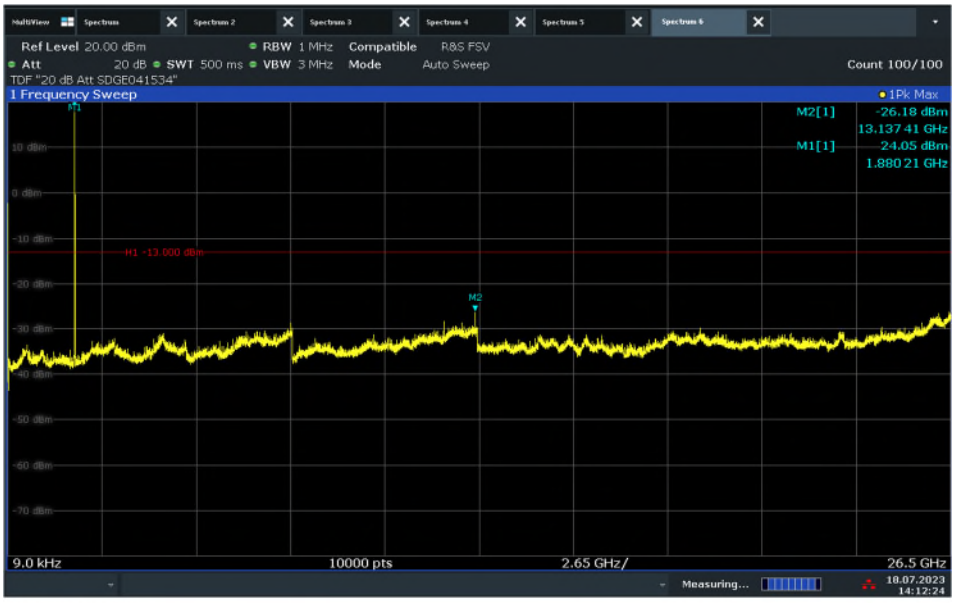
LTE Band 2 15MHz Bandwidth Uplink Middle Channel Conducted Spurious Emissions



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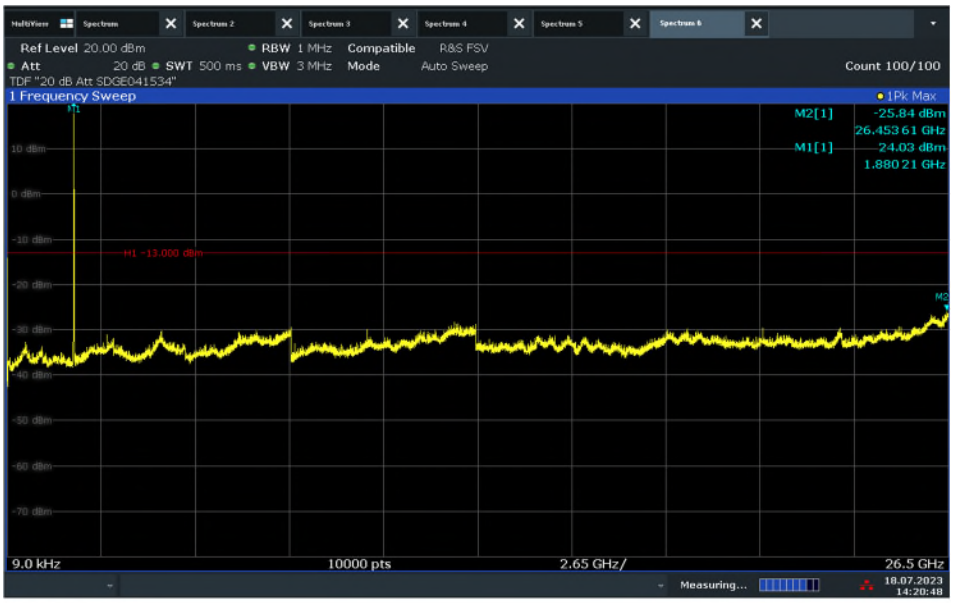

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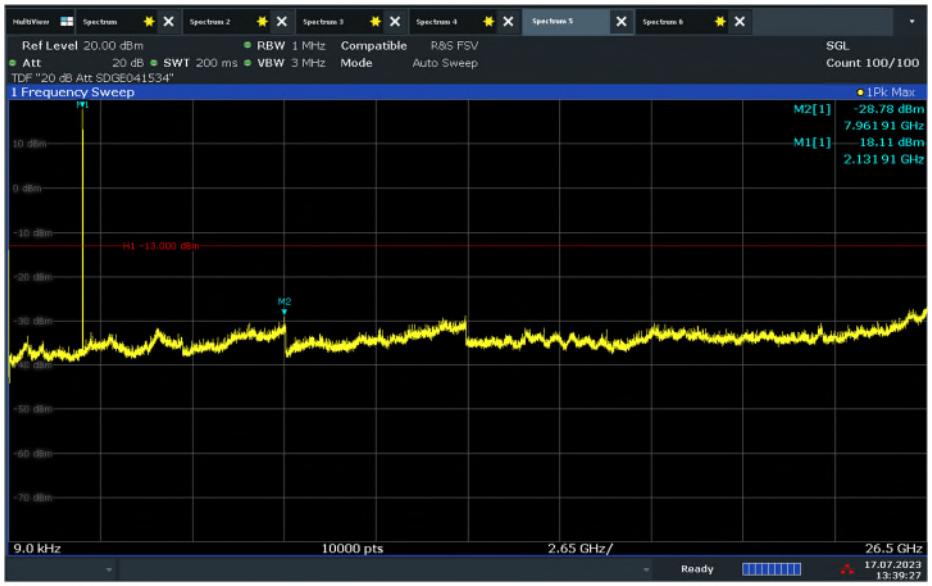
LTE Band 4 5MHz Bandwidth Downlink Middle Channel Conducted Spurious Emissions



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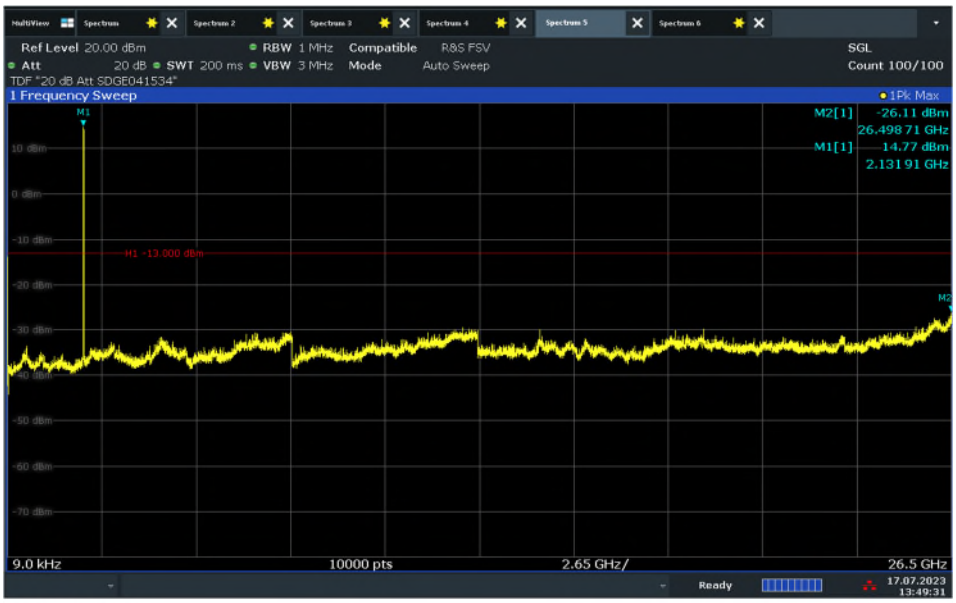

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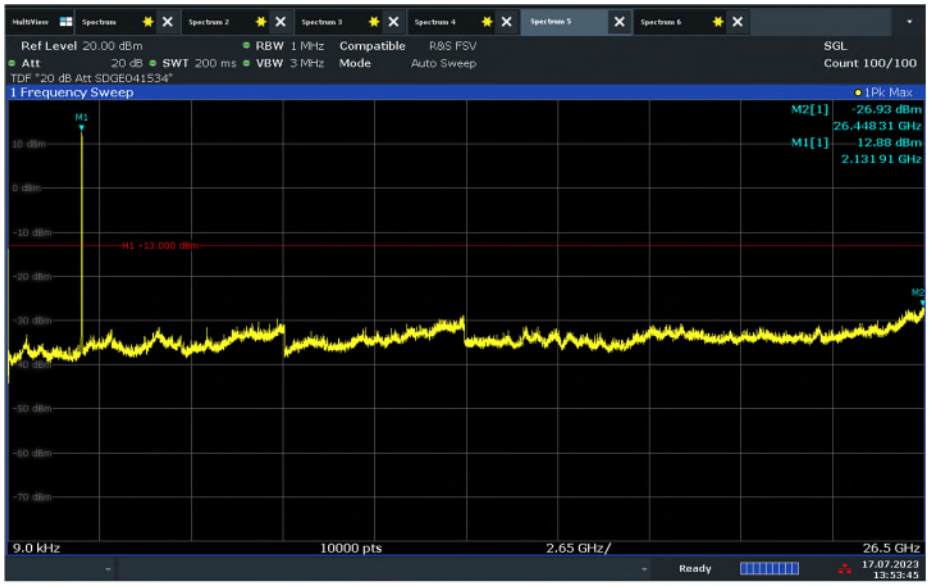
LTE Band 4 20MHz Bandwidth Downlink Middle Channel Conducted Spurious Emissions



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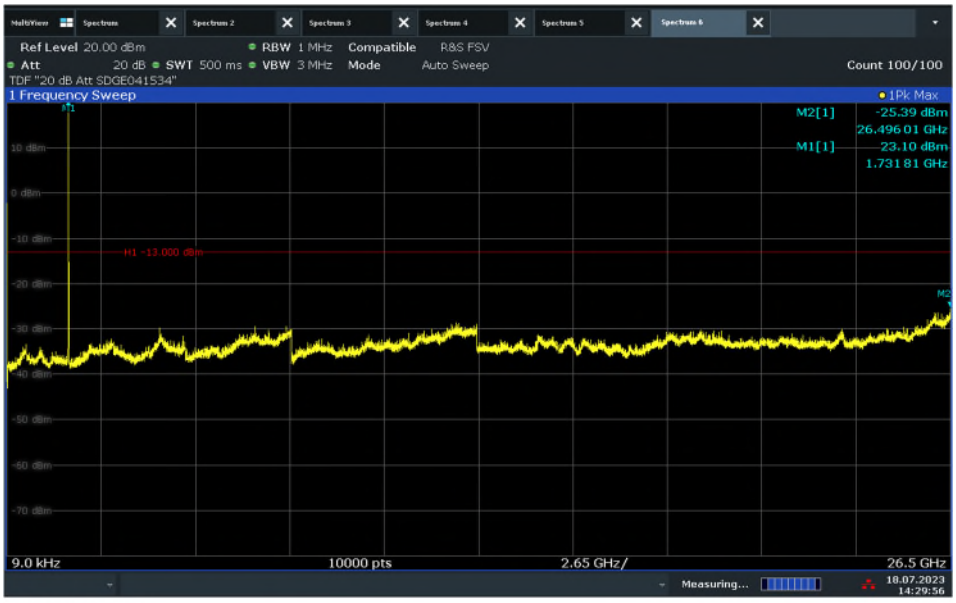
LTE Band 4 5MHz Bandwidth Uplink Middle Channel Conducted Spurious Emissions



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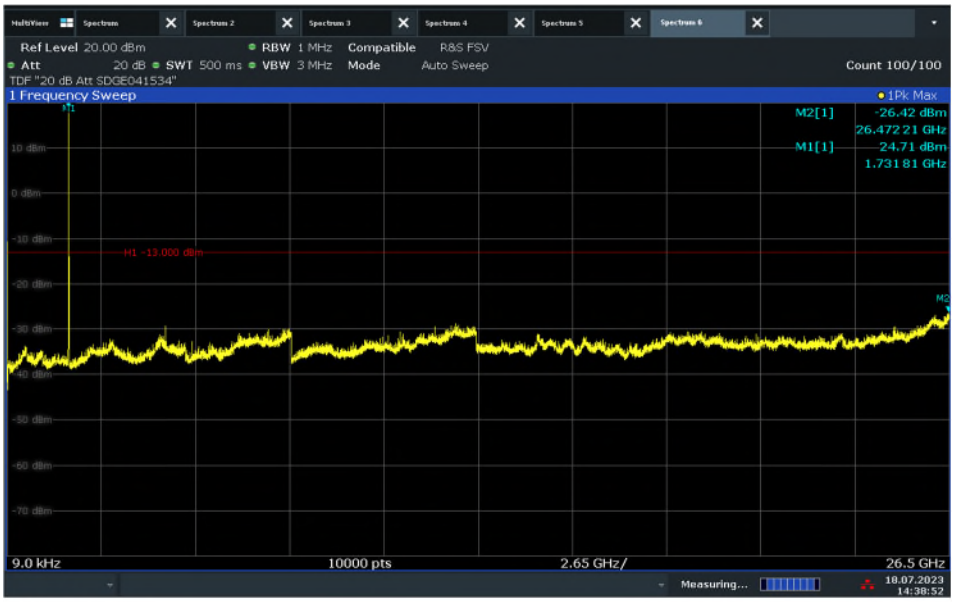

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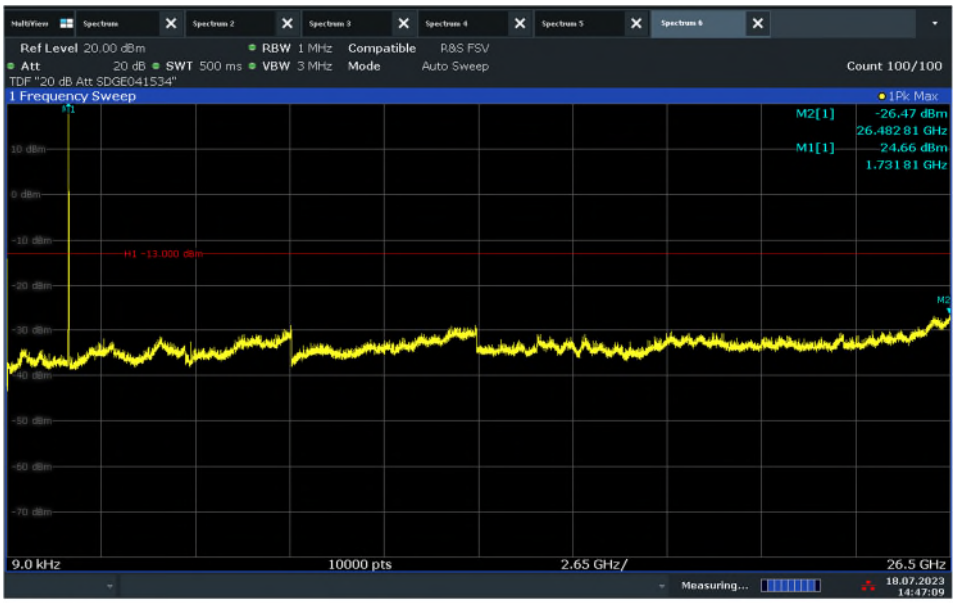
LTE Band 4 15MHz Bandwidth Uplink Middle Channel Conducted Spurious Emissions



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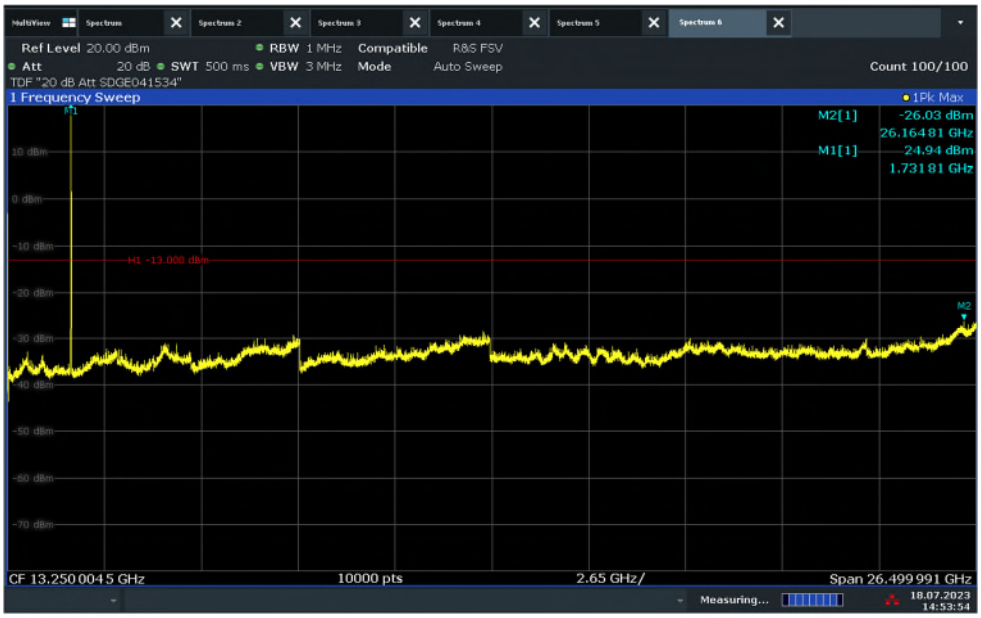
LTE Band 4 20MHz Bandwidth Uplink Middle Channel Conducted Spurious Emissions



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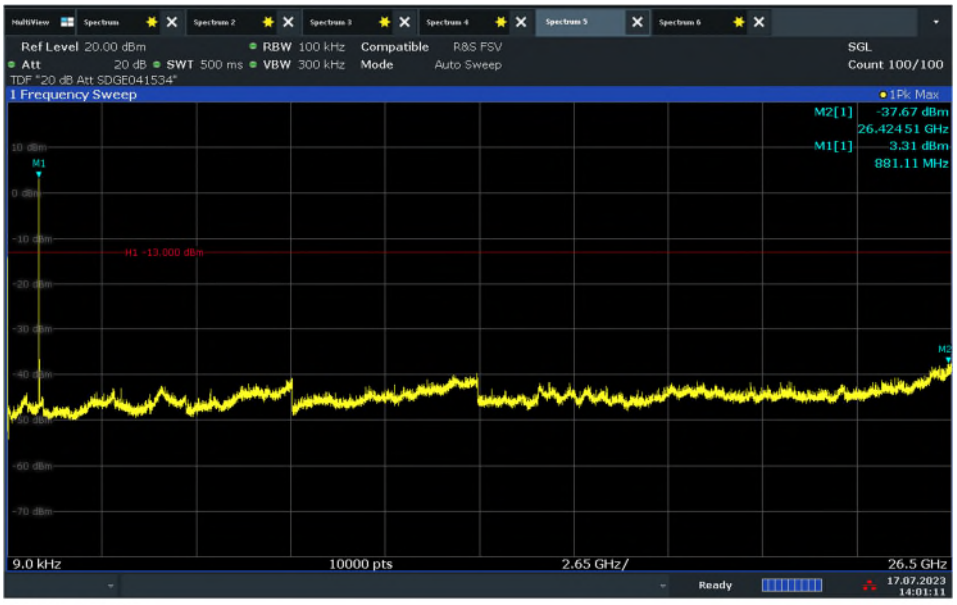
LTE Band 5 5MHz Bandwidth Downlink Middle Channel Conducted Spurious Emissions



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LTE Band 5 10MHz Bandwidth Downlink Middle Channel Conducted Spurious Emissions

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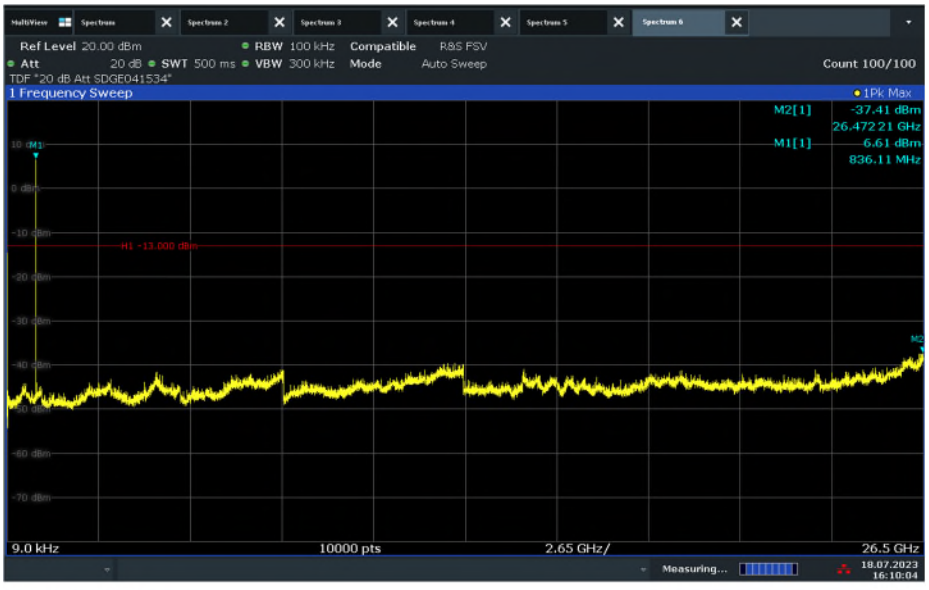
LTE Band 5 5MHz Bandwidth Uplink Middle Channel Conducted Spurious Emissions



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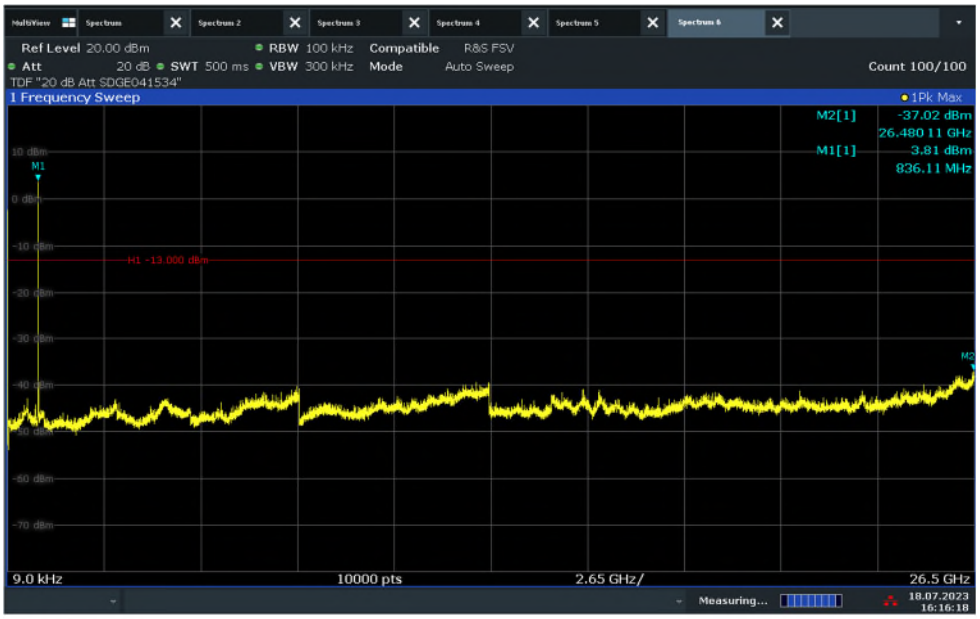
LTE Band 5 10MHz Bandwidth Uplink Middle Channel Conducted Spurious Emissions



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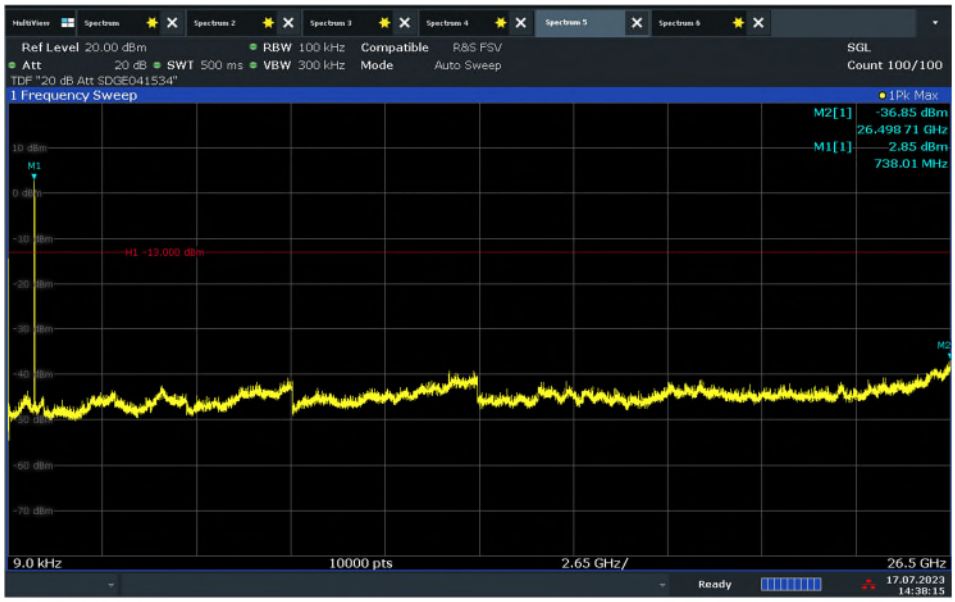
LTE Band 12 5MHz Bandwidth Downlink Middle Channel Conducted Spurious Emissions



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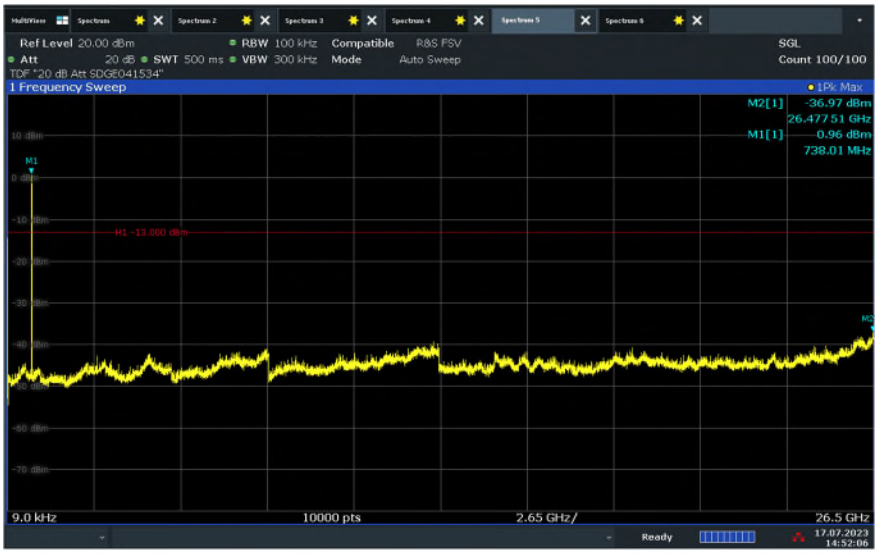

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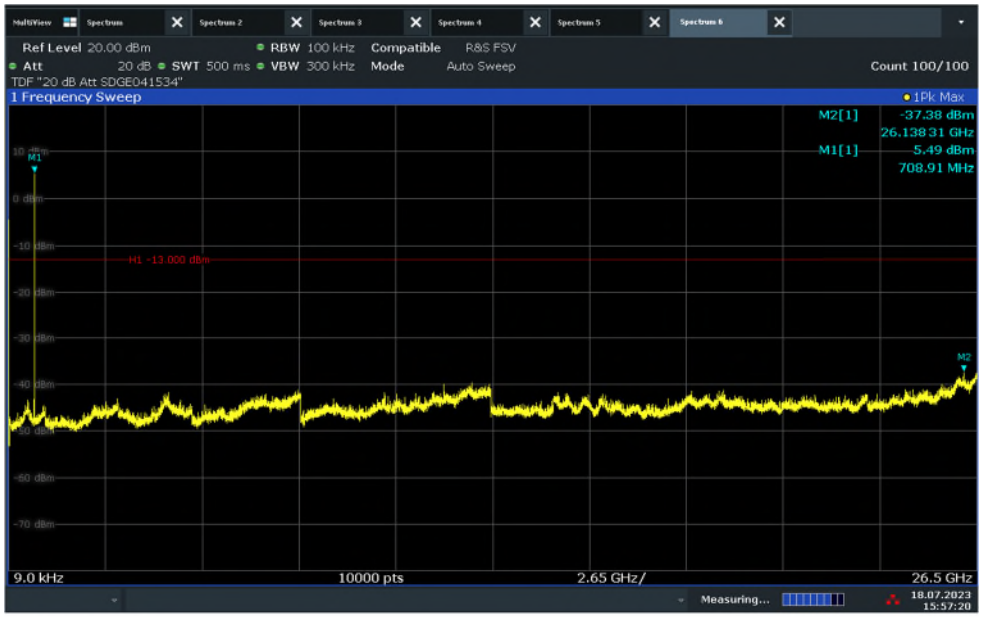
LTE Band 12 5MHz Bandwidth Uplink Middle Channel Conducted Spurious Emissions



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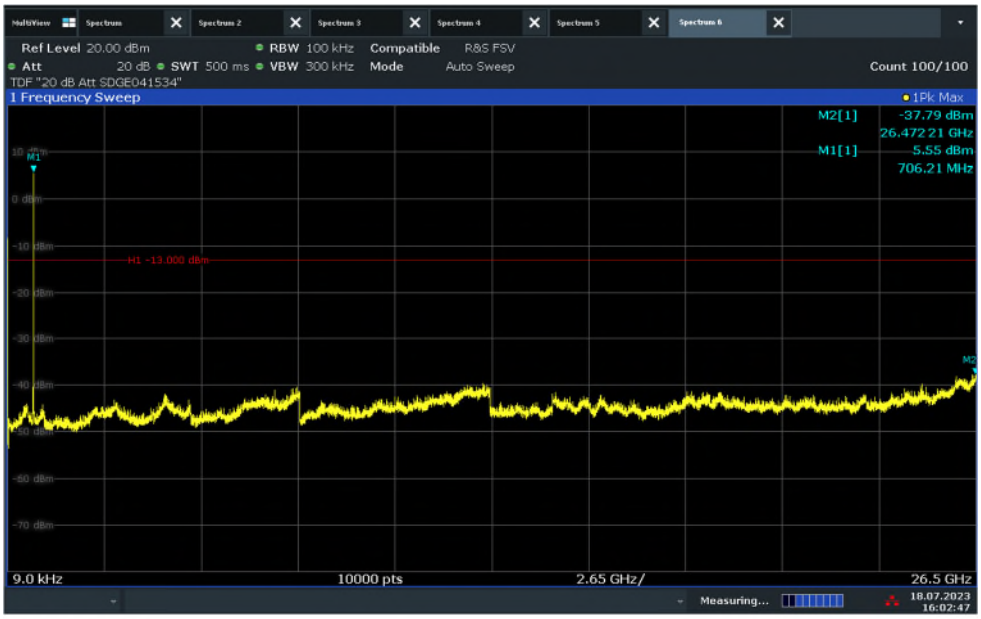
LTE Band 12 10MHz Bandwidth Uplink Middle Channel Conducted Spurious Emissions



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LTE Band 13 Downlink 5MHz Bandwidth Low Channel Conducted Spurious Emissions

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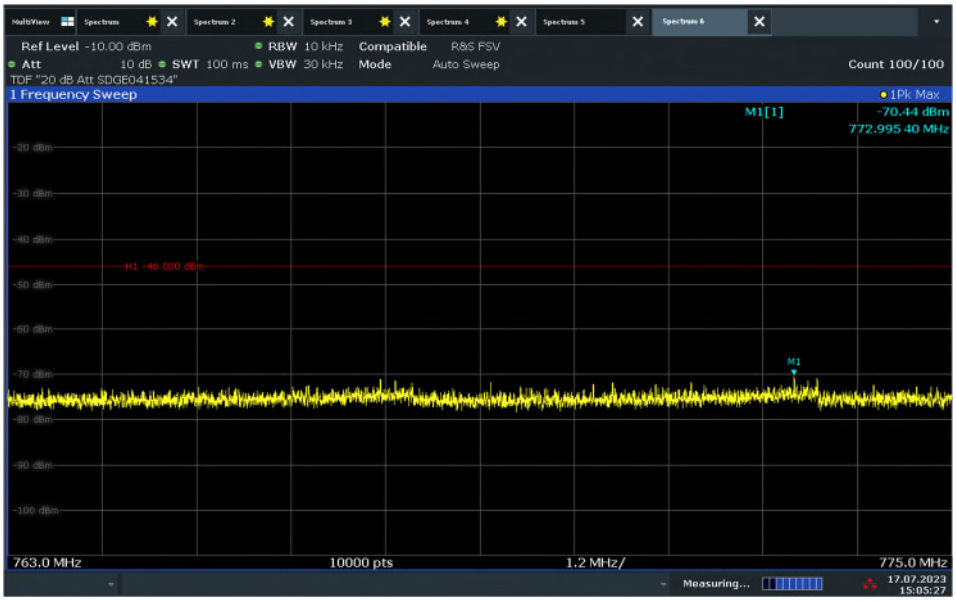
LTE Band 13 Downlink 5MHz Bandwidth Low Channel Conducted Spurious Emissions (763-775 MHz)



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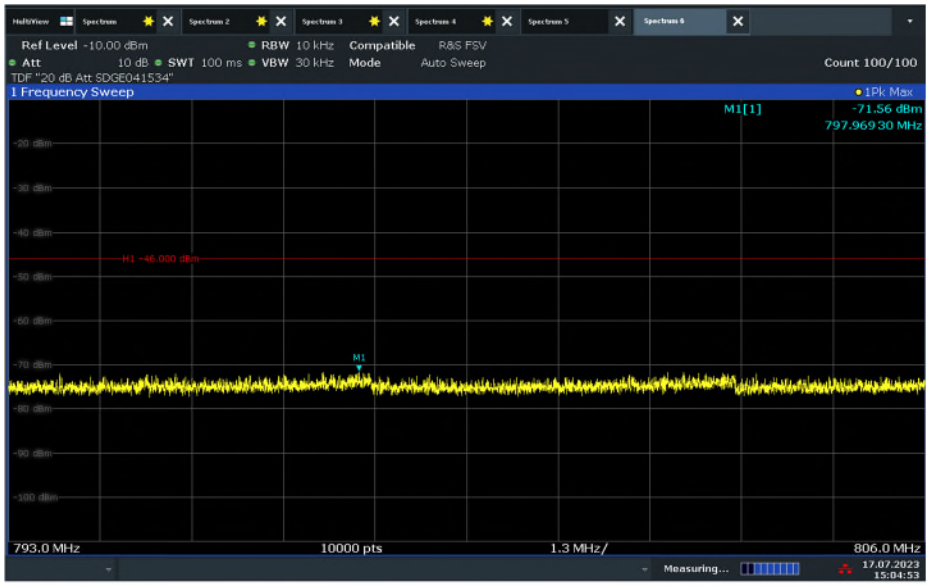
LTE Band 13 Downlink 5MHz Bandwidth Low Channel Conducted Spurious Emissions (793-806 MHz)



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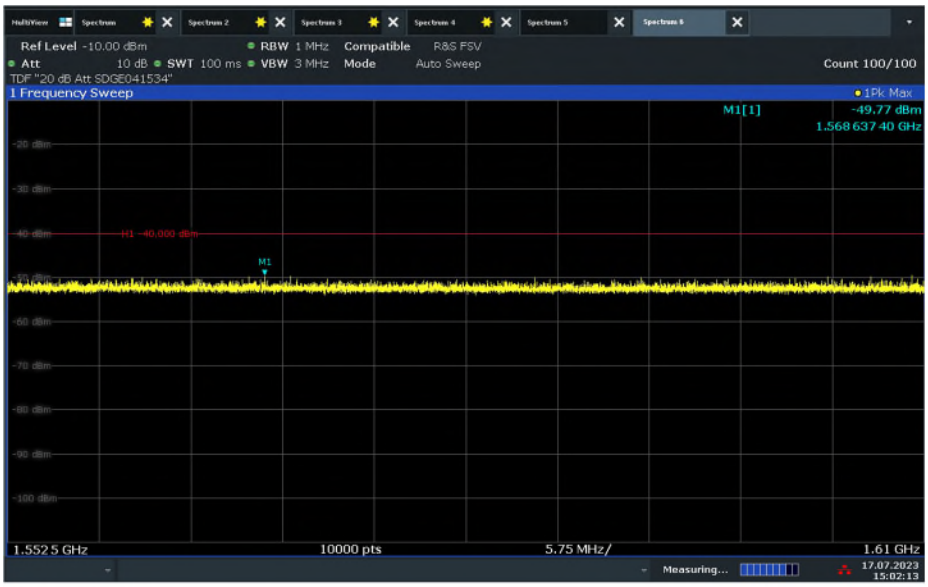
LTE Band 13 Downlink 5MHz Bandwidth Low Channel Conducted Spurious Emissions (1559-1610 MHz)
 15:02:14 17.07.2023
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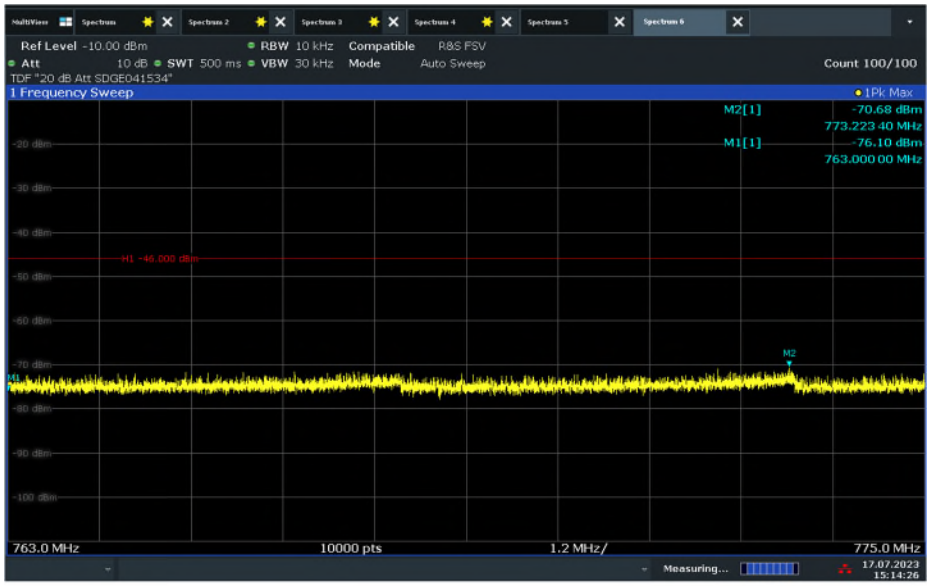

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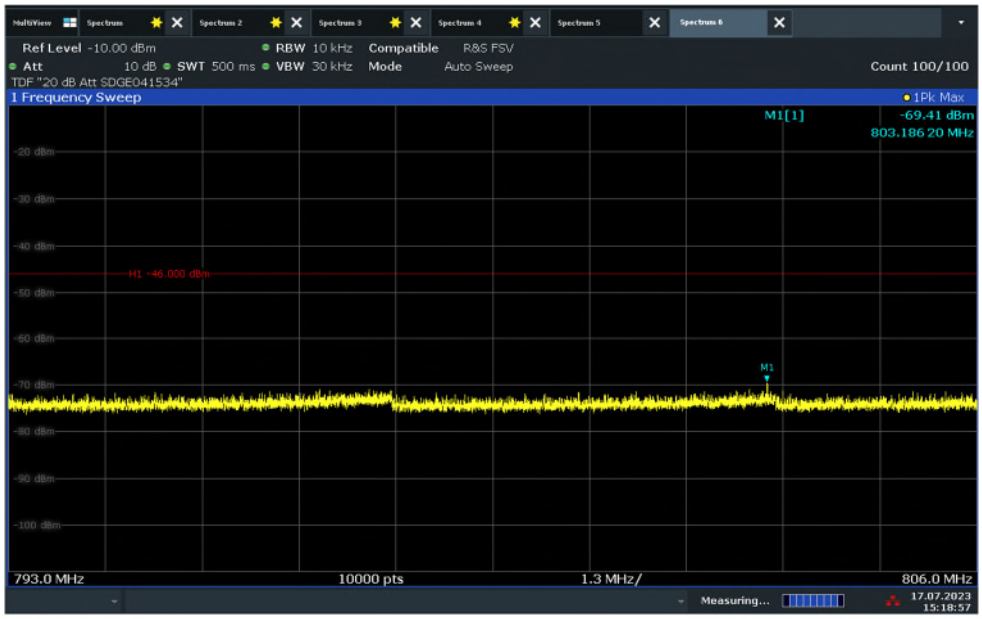
LTE Band 13 Downlink 5MHz Bandwidth Middle Channel Conducted Spurious Emissions (793-806 MHz)



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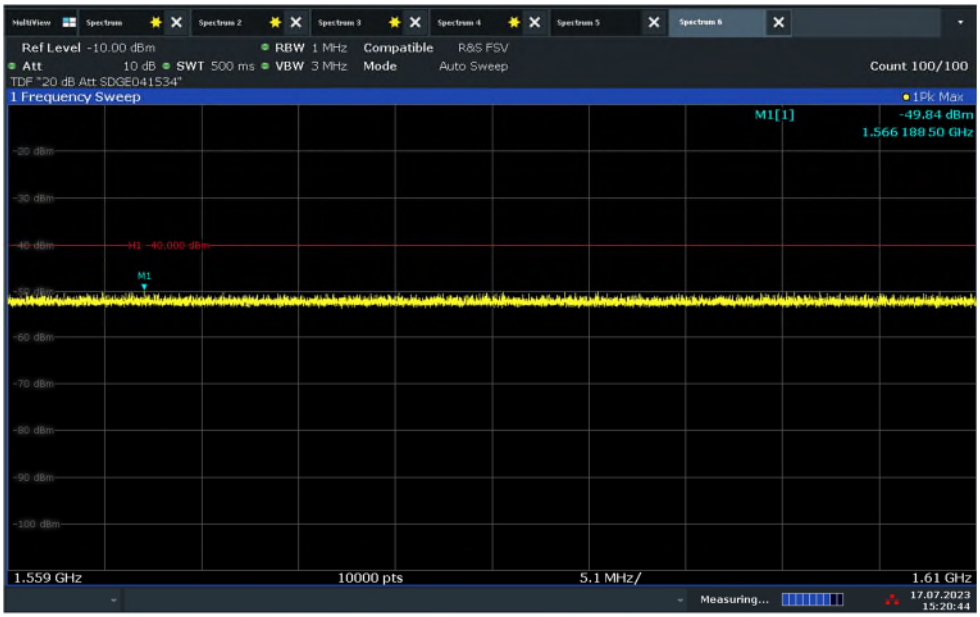
LTE Band 13 Downlink 5MHz Bandwidth Middle Channel Conducted Spurious Emissions (1559-1610 MHz)



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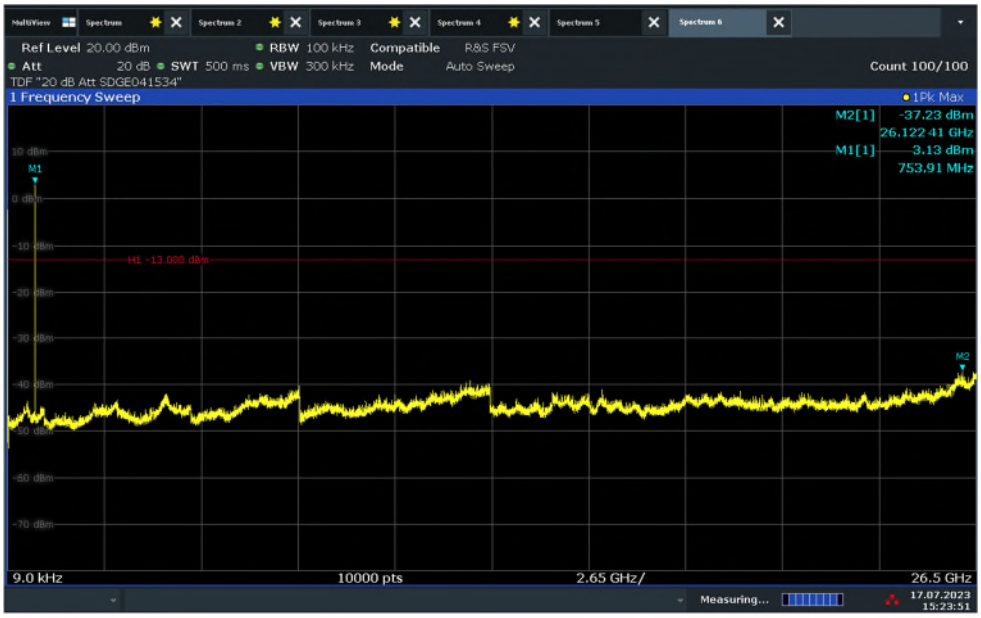
LTE Band 13 Downlink 5MHz Bandwidth High Channel Conducted Spurious Emissions



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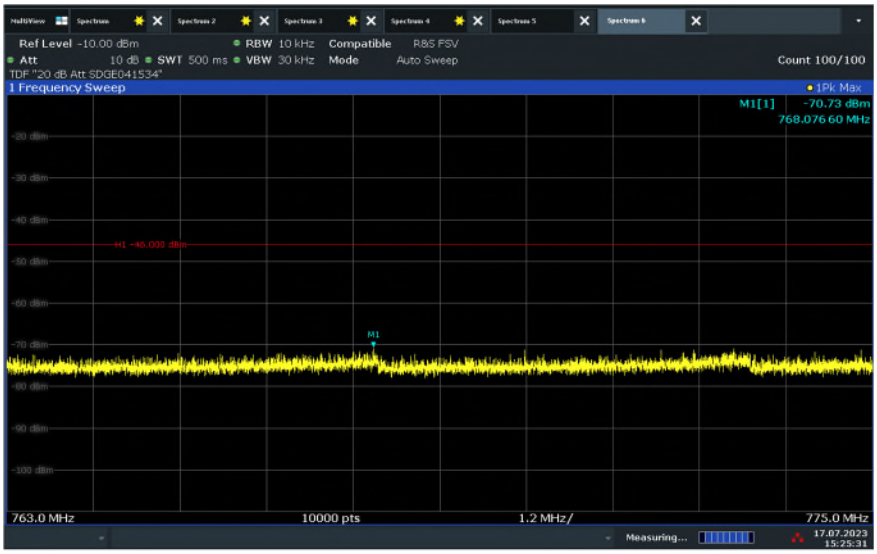
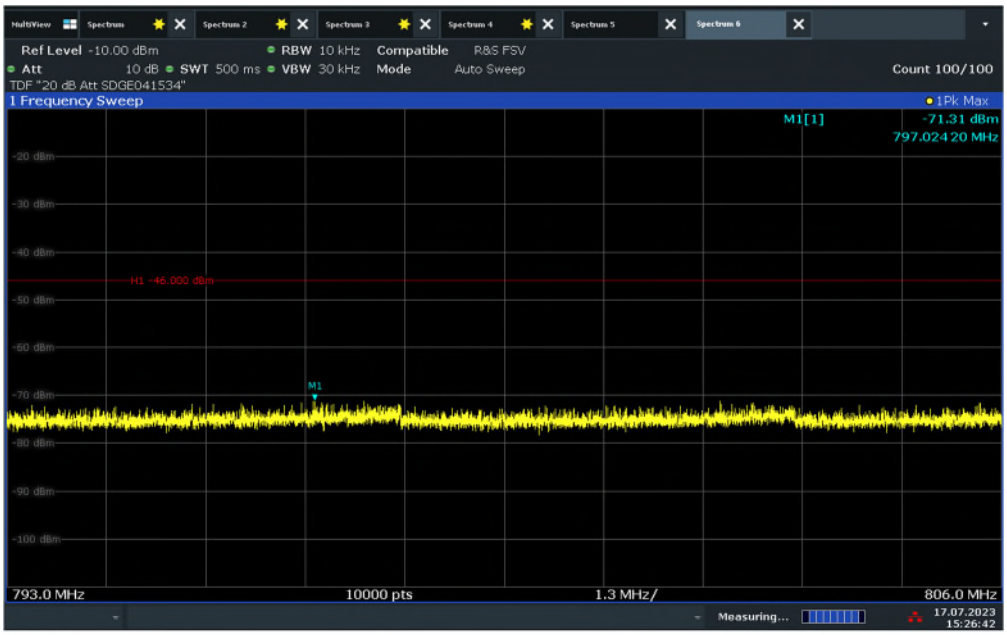
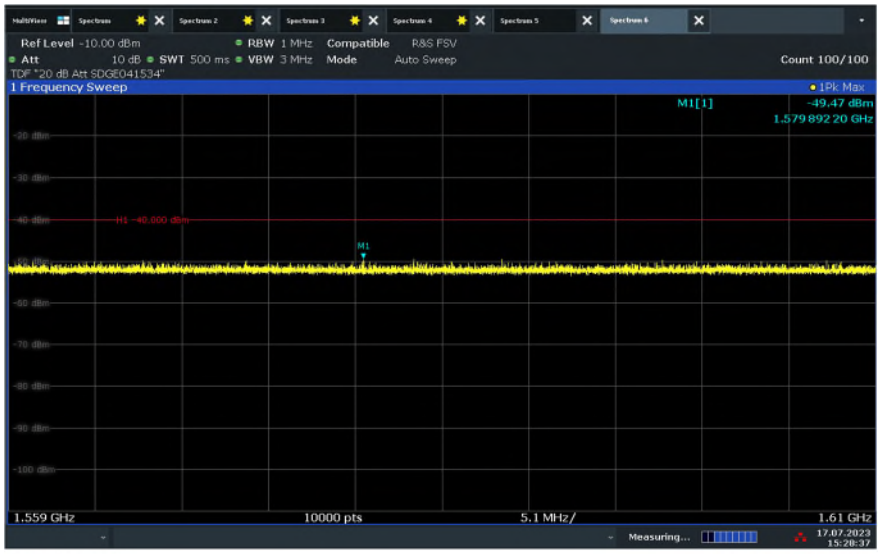
LTE Band 13 Downlink 5MHz Bandwidth High Channel Conducted Spurious Emissions (763-775 MHz)
 15:25:31 17.07.2023

LTE Band 13 Downlink 5MHz Bandwidth High Channel Conducted Spurious Emissions (793-806 MHz)
 15:26:42 17.07.2023

LTE Band 13 Downlink 5MHz Bandwidth High Channel Conducted Spurious Emissions (1559-1610 MHz)



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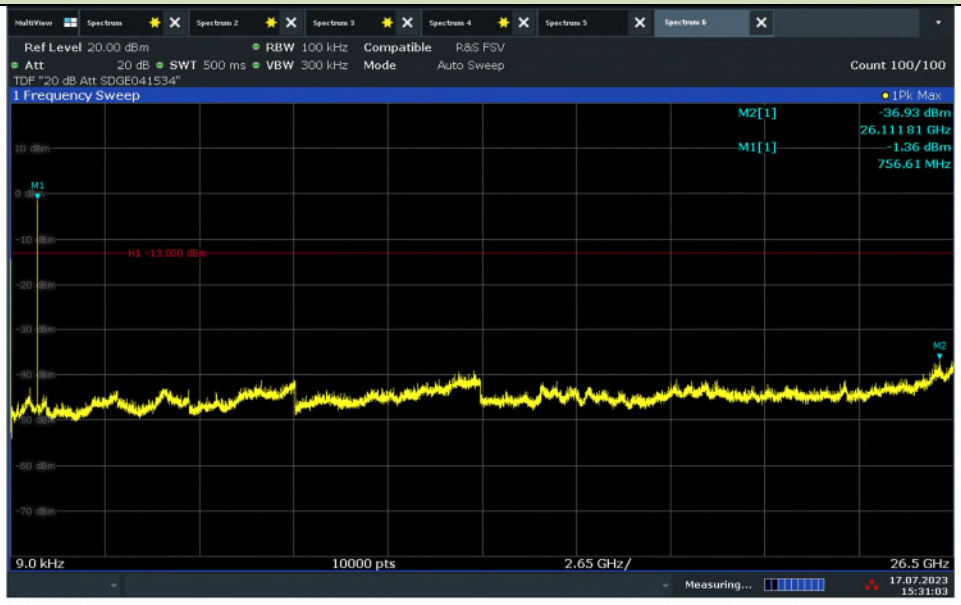
LTE Band 13 Downlink 10MHz Bandwidth Middle Channel Conducted Spurious Emissions



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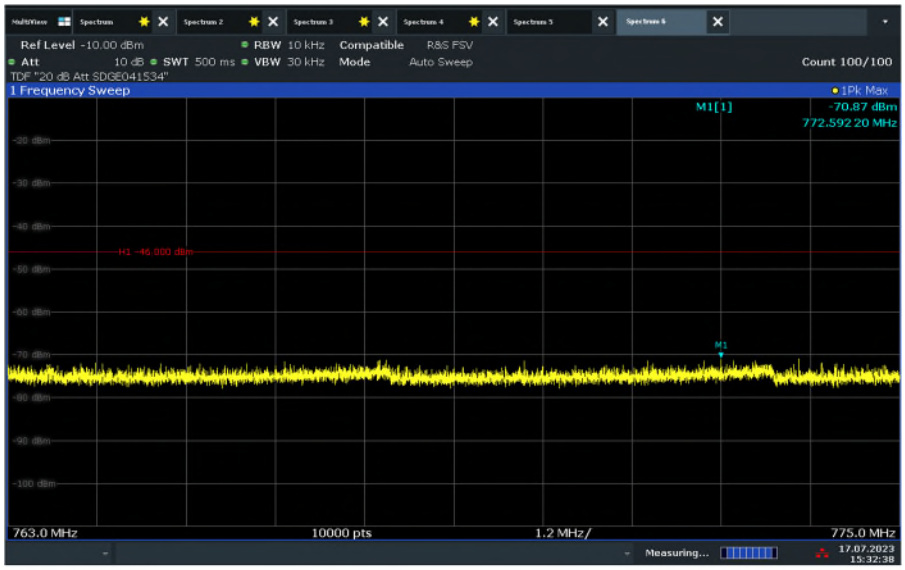
LTE Band 13 Downlink 10MHz Bandwidth Middle Channel Conducted Spurious Emissions (763-775 MHz)



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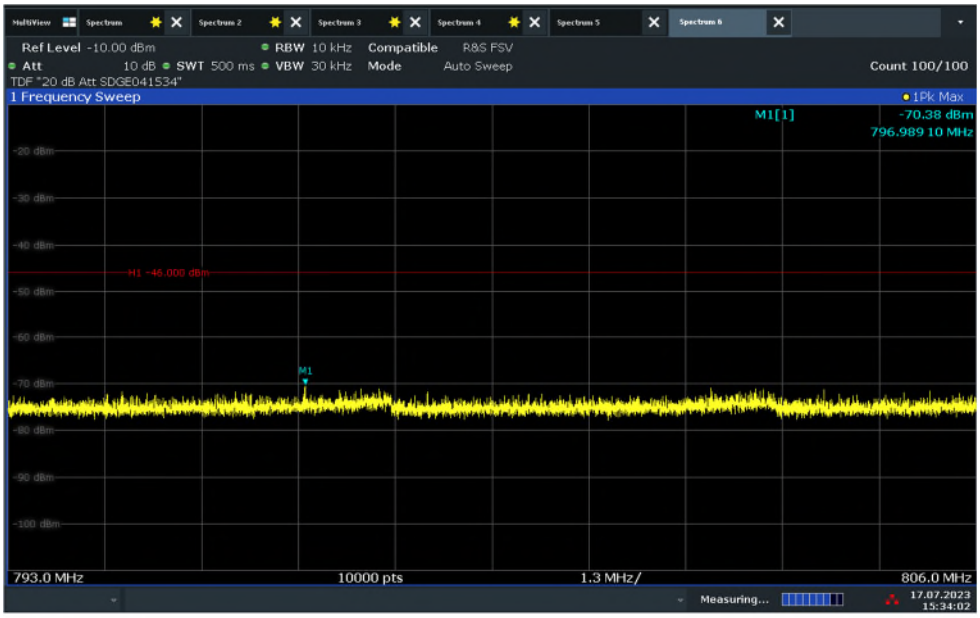
LTE Band 13 Downlink 10MHz Bandwidth Middle Channel Conducted Spurious Emissions (793-806 MHz)



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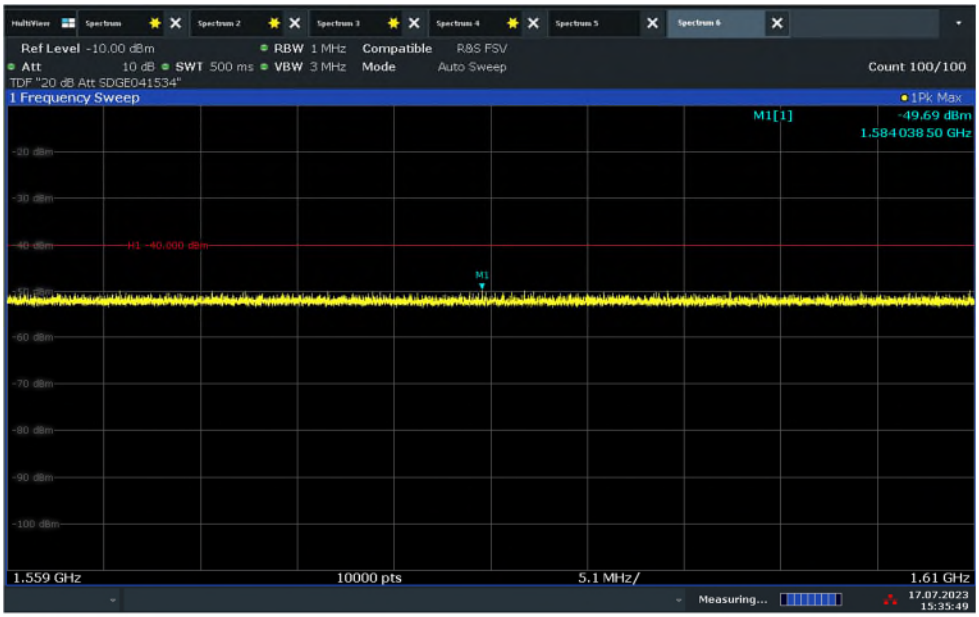
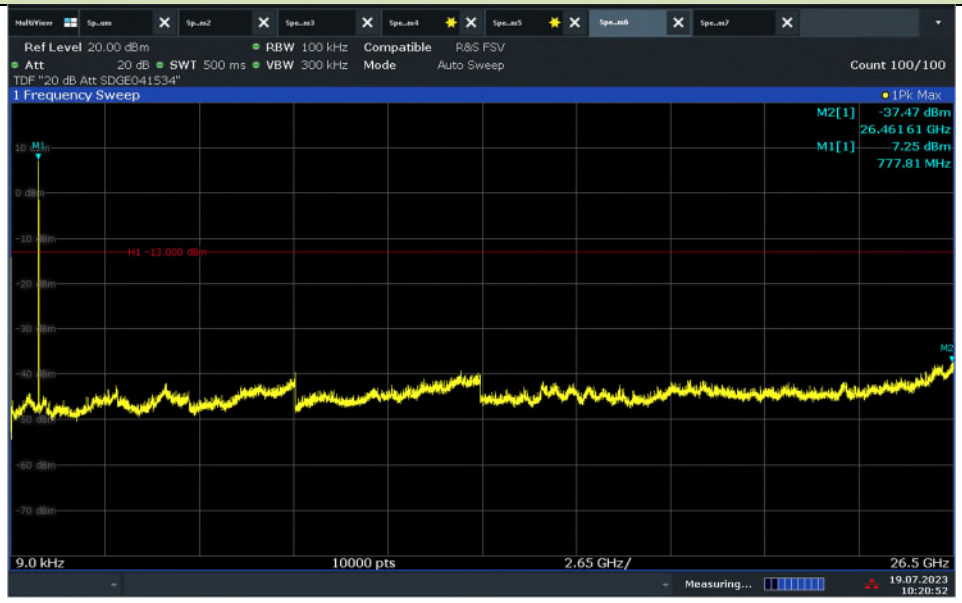
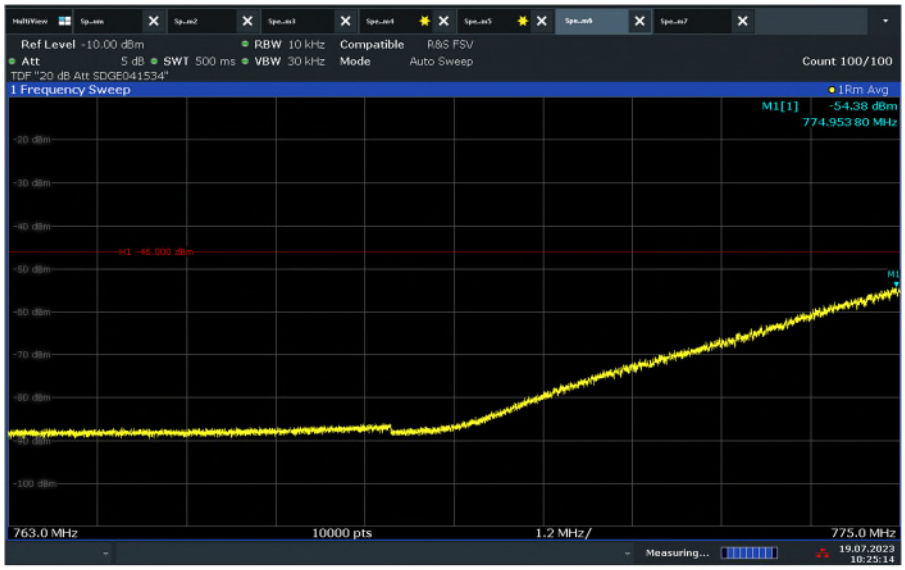
LTE Band 13 Downlink 10MHz Bandwidth Middle Channel Conducted Spurious Emissions (1559-1610 MHz)
 15:35:49 17.07.2023
LTE Band 13 Uplink 5MHz Bandwidth Low Channel Conducted Spurious Emissions
 10:20:53 19.07.2023

LTE Band 13 Uplink 5MHz Bandwidth Low Channel Conducted Spurious Emissions (763-775 MHz)



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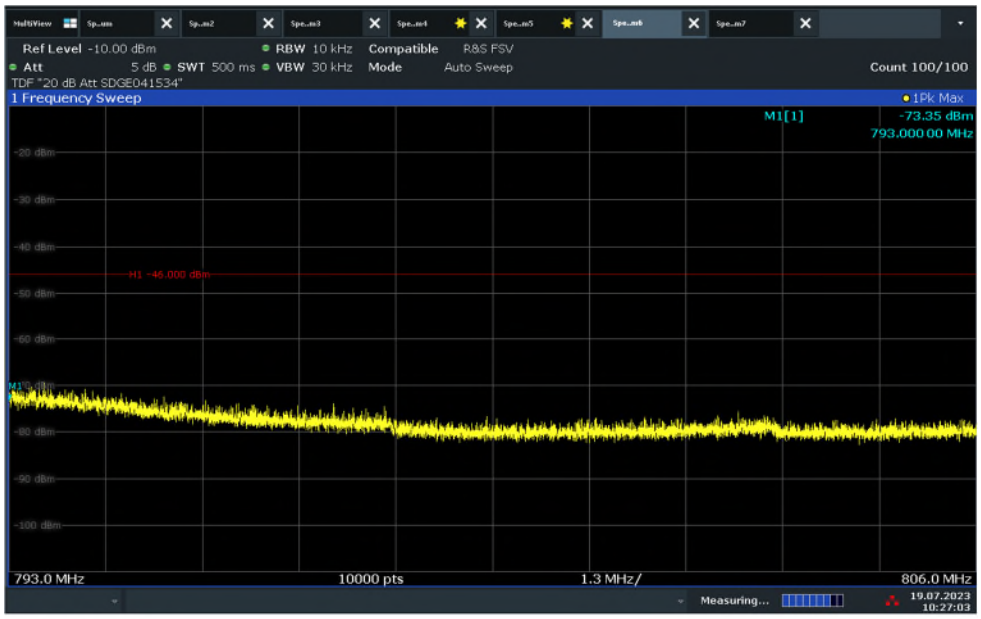
LTE Band 13 Uplink 5MHz Bandwidth Low Channel Conducted Spurious Emissions (793-806 MHz)



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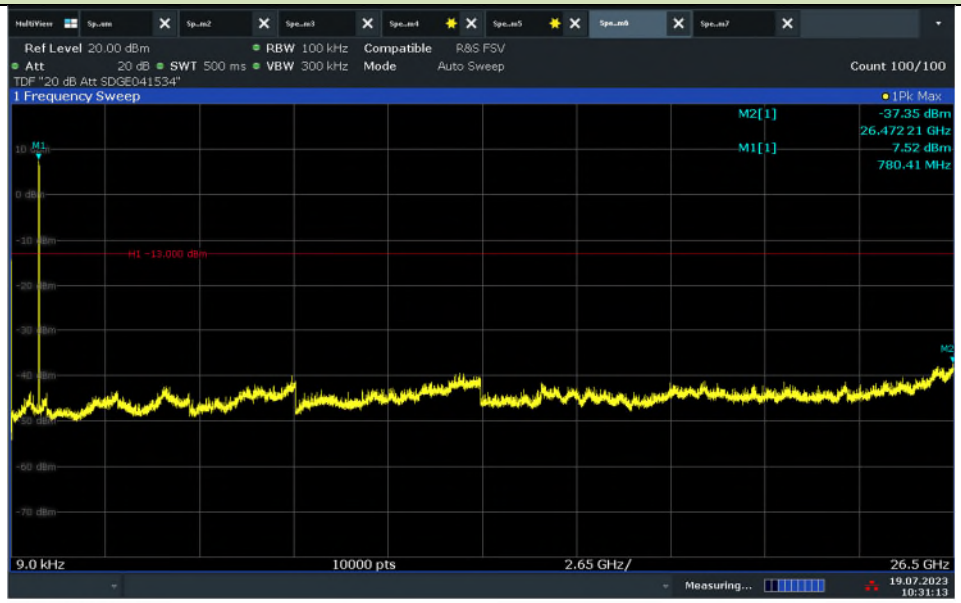
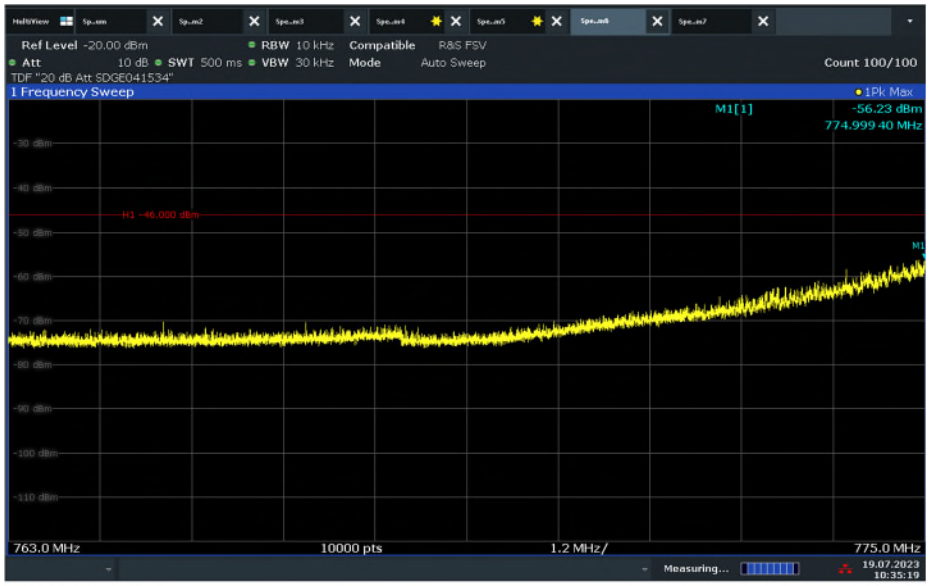
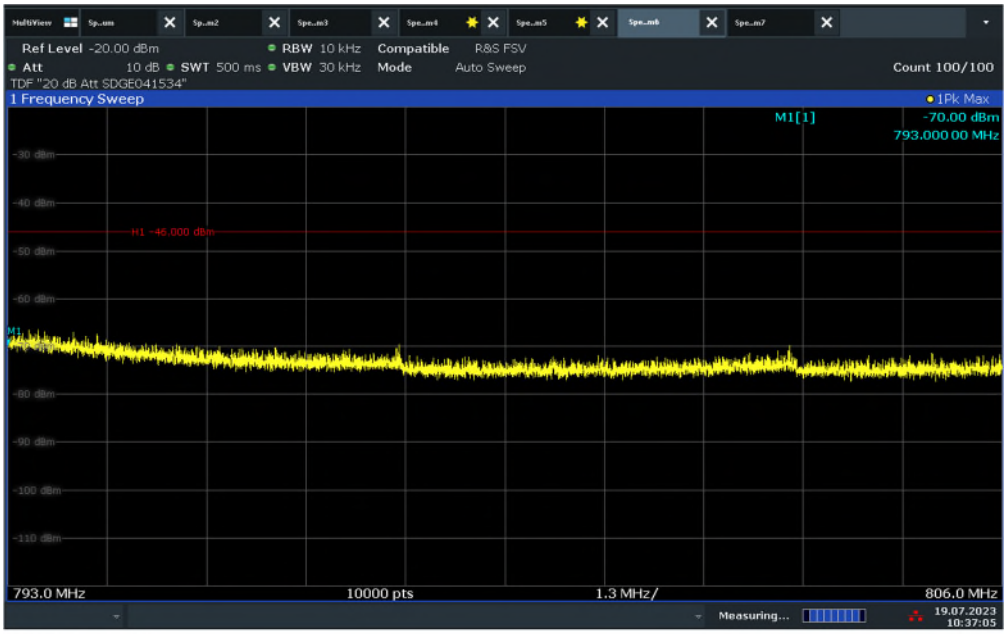
LTE Band 13 Uplink 5MHz Bandwidth Low Channel Conducted Spurious Emissions (1559-1610 MHz)
 10:29:03 19.07.2023
LTE Band 13 Uplink 5MHz Bandwidth Middle Channel Conducted Spurious Emissions
 10:31:14 19.07.2023

LTE Band 13 Uplink 5MHz Bandwidth Middle Channel Conducted Spurious Emissions (763-775 MHz)



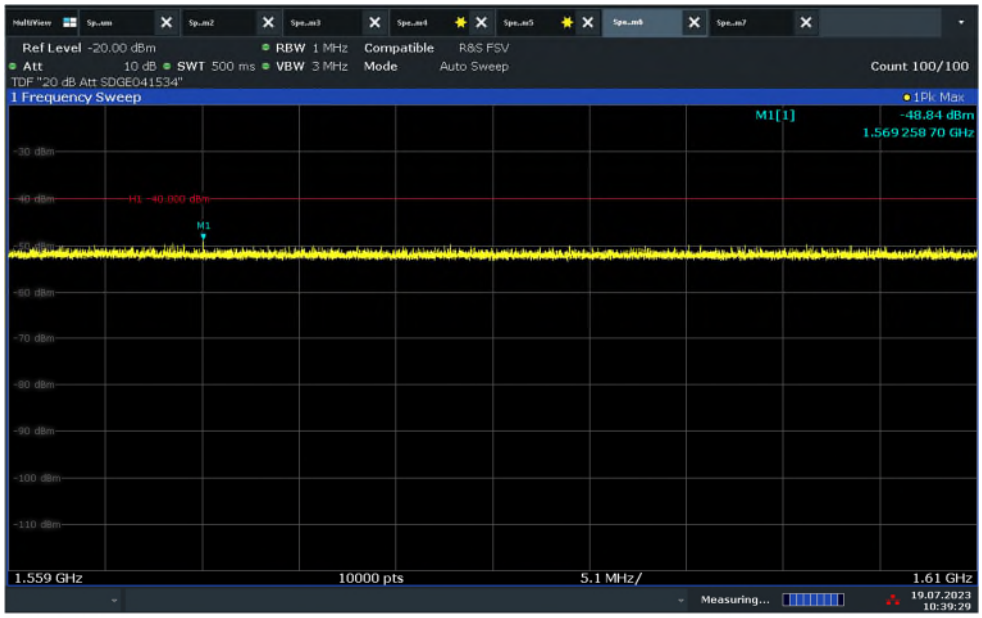
10:35:20 19.07.2023

LTE Band 13 Uplink 5MHz Bandwidth Middle Channel Conducted Spurious Emissions (793-806 MHz)



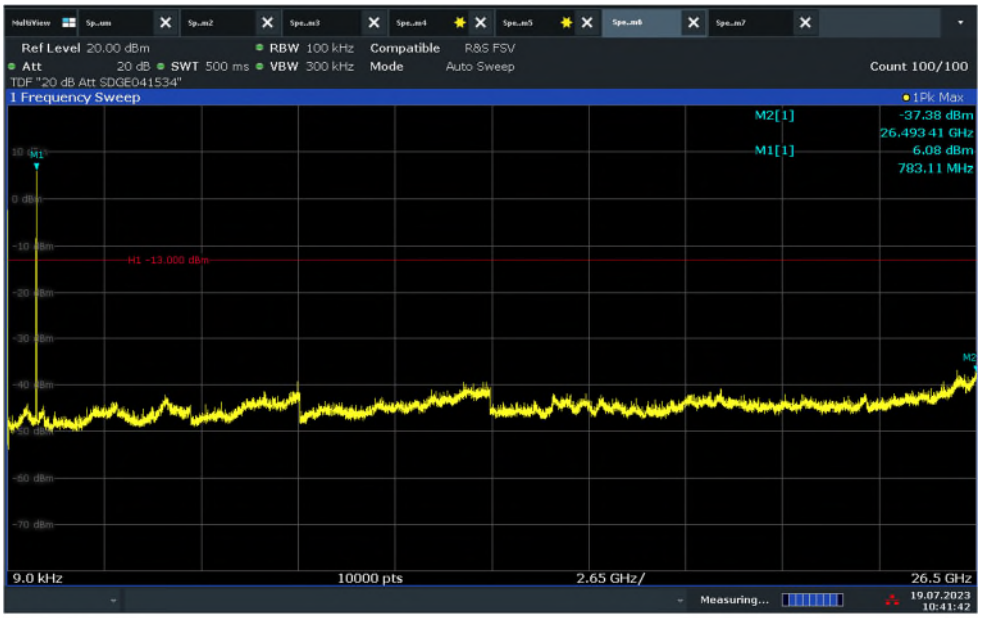
10:37:05 19.07.2023

LTE Band 13 Uplink 5MHz Bandwidth Middle Channel Conducted Spurious Emissions (1559-1610 MHz)



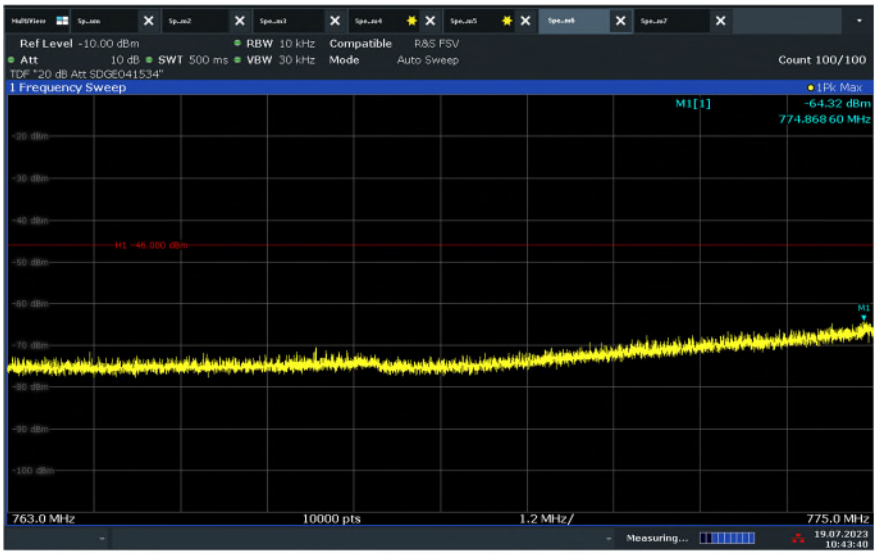
10:39:30 19.07.2023

LTE Band 13 Uplink 5MHz Bandwidth High Channel Conducted Spurious Emissions



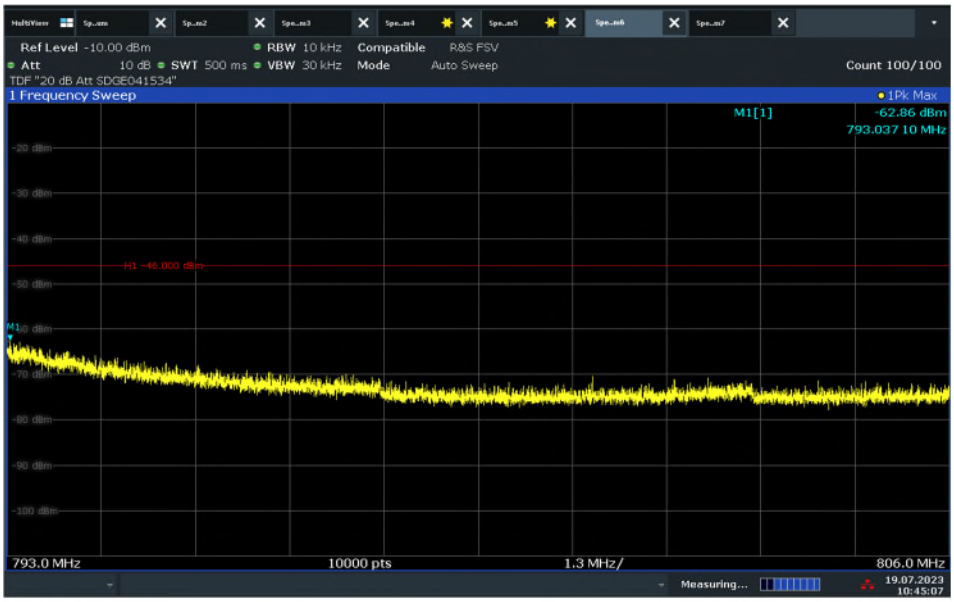
10:41:42 19.07.2023

LTE Band 13 Uplink 5MHz Bandwidth High Channel Conducted Spurious Emissions (763-775 MHz)



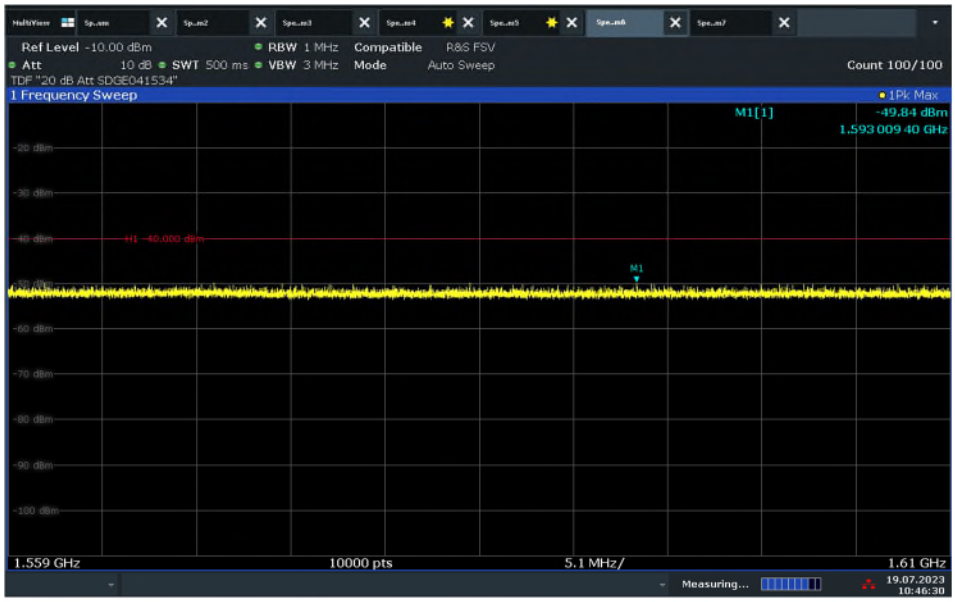
10:43:40 19.07.2023

LTE Band 13 Uplink 5MHz Bandwidth High Channel Conducted Spurious Emissions (793-806 MHz)



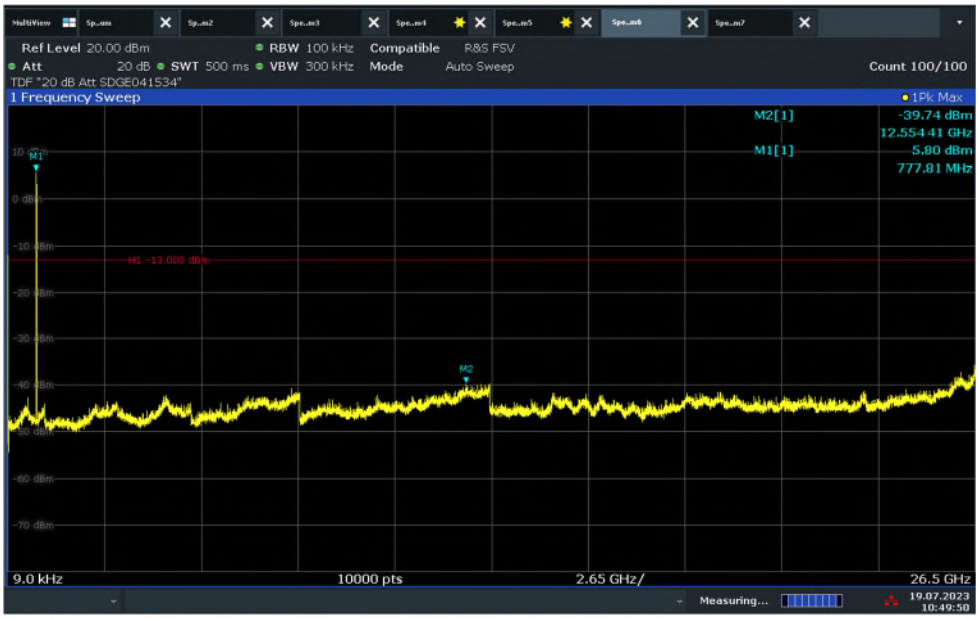
10:45:08 19.07.2023

LTE Band 13 Uplink 5MHz Bandwidth High Channel Conducted Spurious Emissions (1559-1610 MHz)



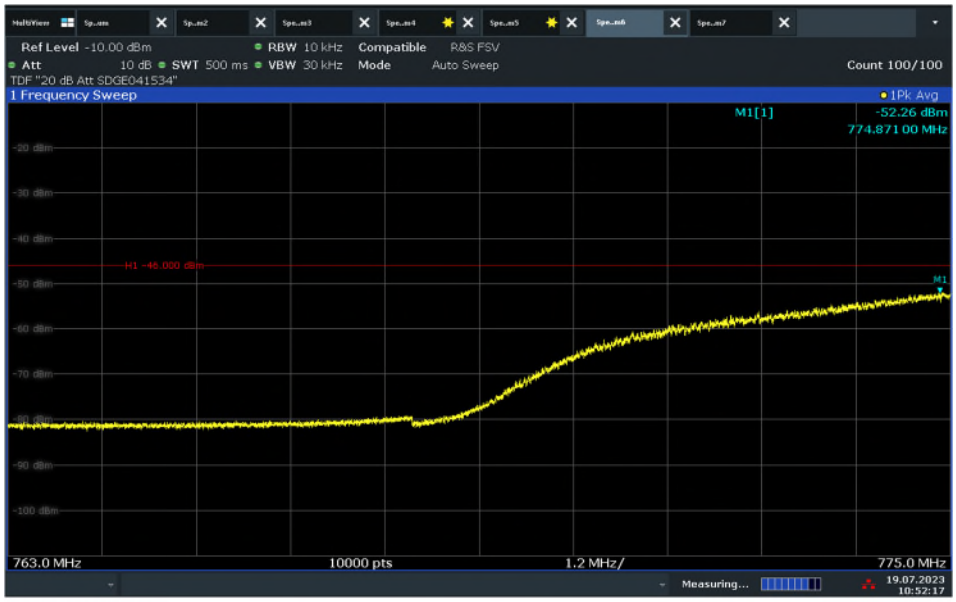
10:46:31 19.07.2023

LTE Band 13 Uplink 10MHz Bandwidth Middle Channel Conducted Spurious Emissions



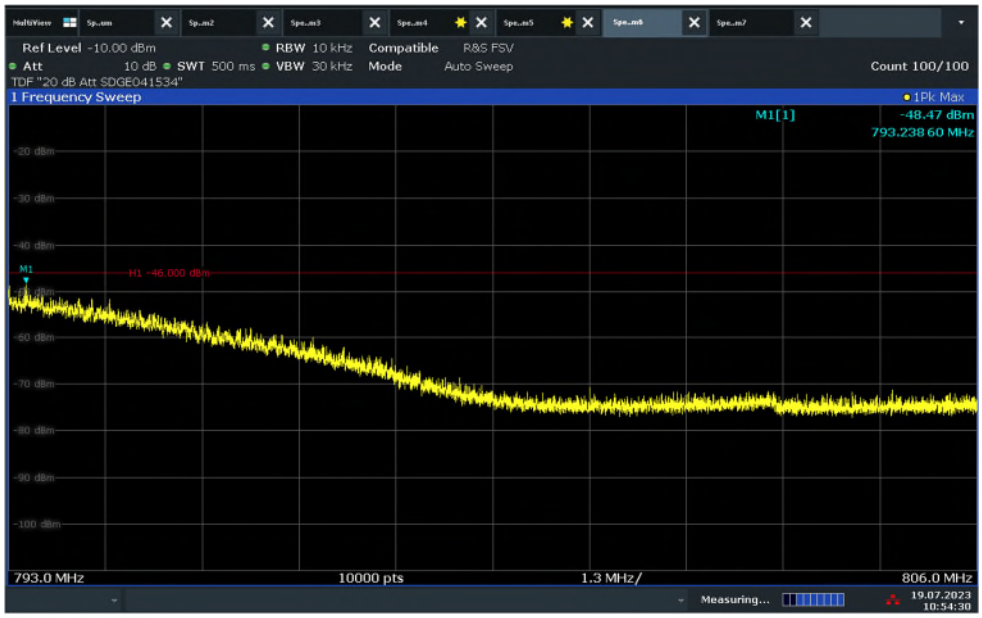
10:49:50 19.07.2023

LTE Band 13 Uplink 10MHz Bandwidth Middle Channel Conducted Spurious Emissions (763-775 MHz)



10:52:18 19.07.2023

LTE Band 13 Uplink 10MHz Bandwidth Middle Channel Conducted Spurious Emissions (793-806 MHz)

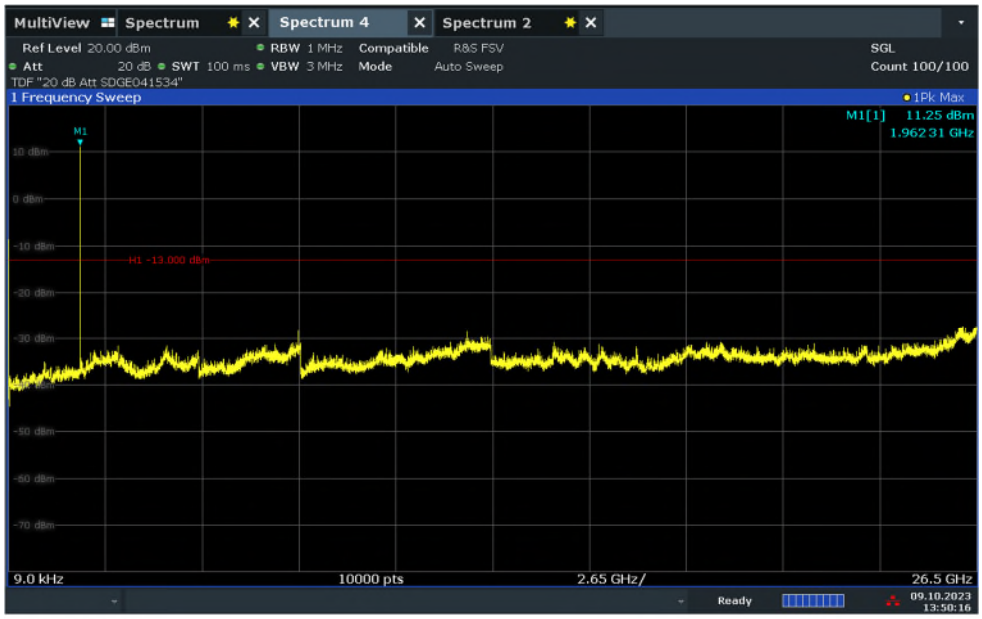


10:54:31 19.07.2023

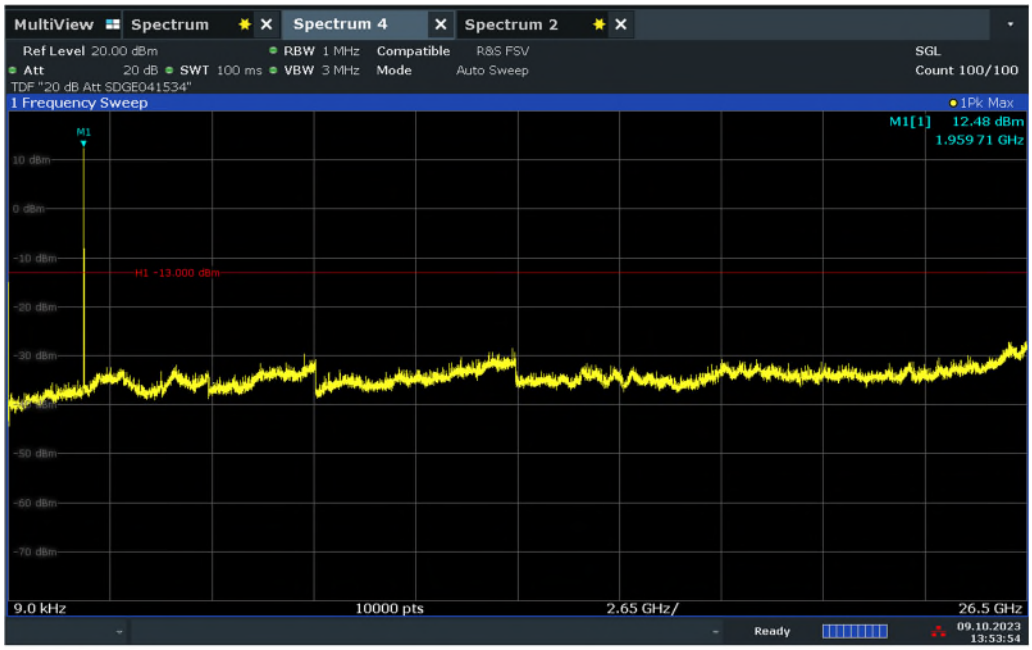
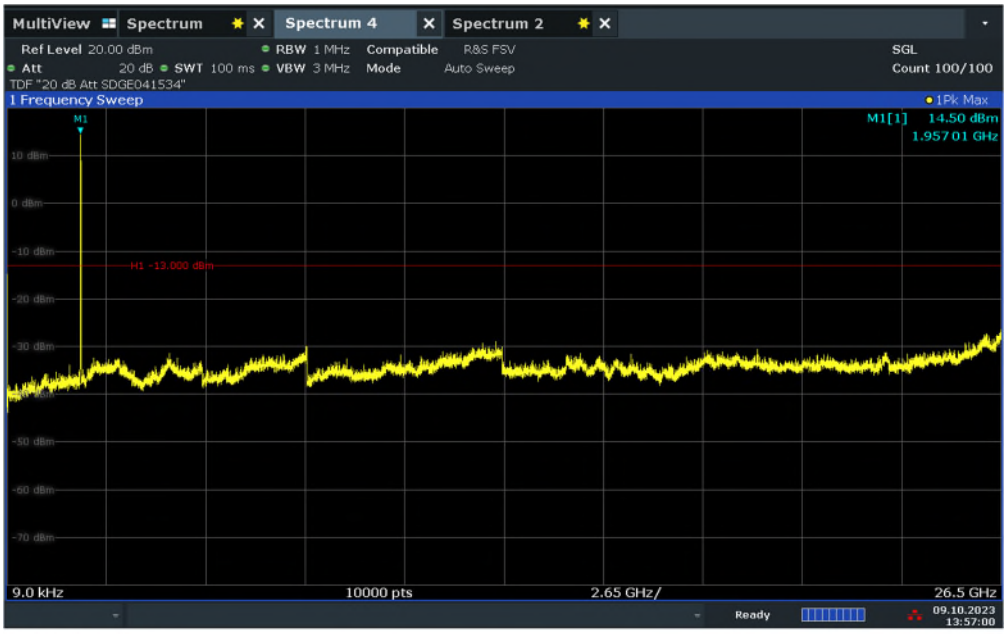
LTE Band 13 Uplink 10MHz Bandwidth Middle Channel Conducted Spurious Emissions (1559-1610 MHz)

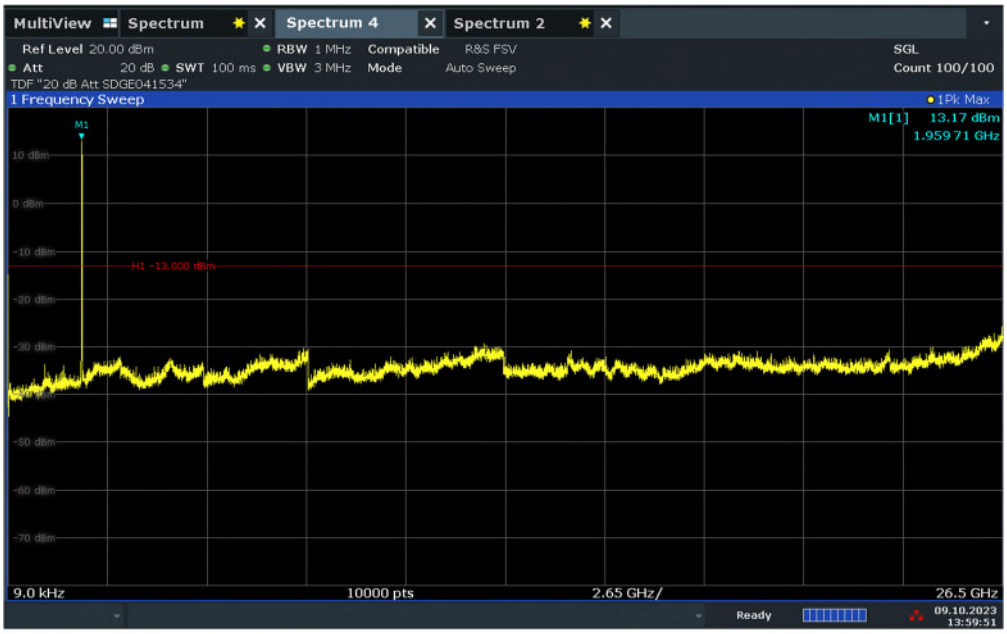
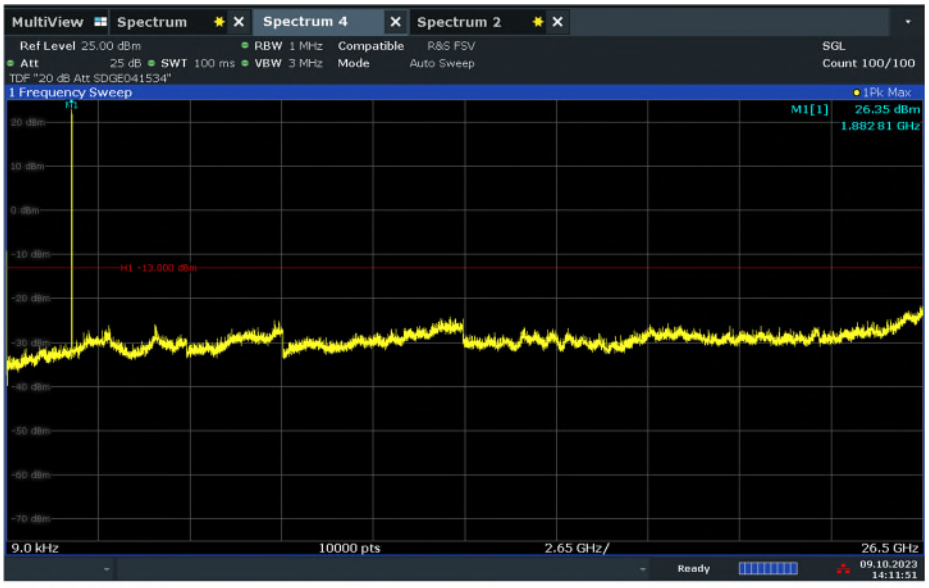
10:56:32 19.07.2023

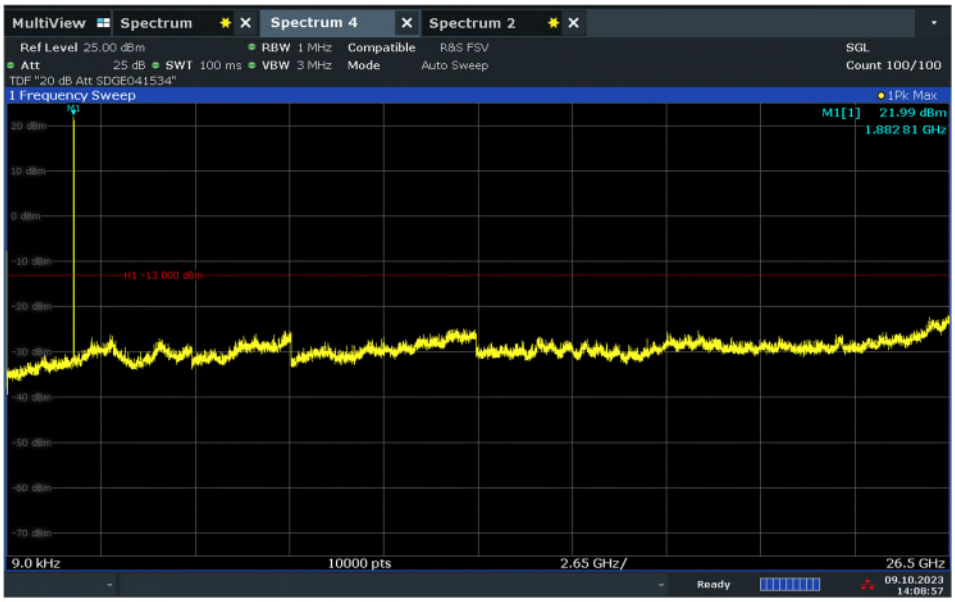
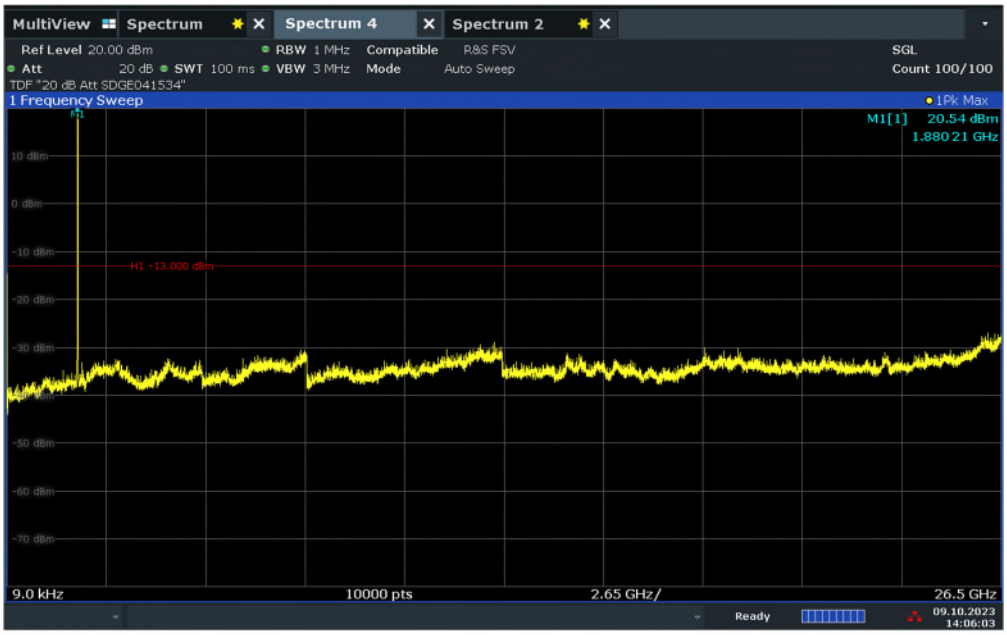
LTE Band 25 5MHz Bandwidth Downlink Middle Channel Conducted Spurious Emissions

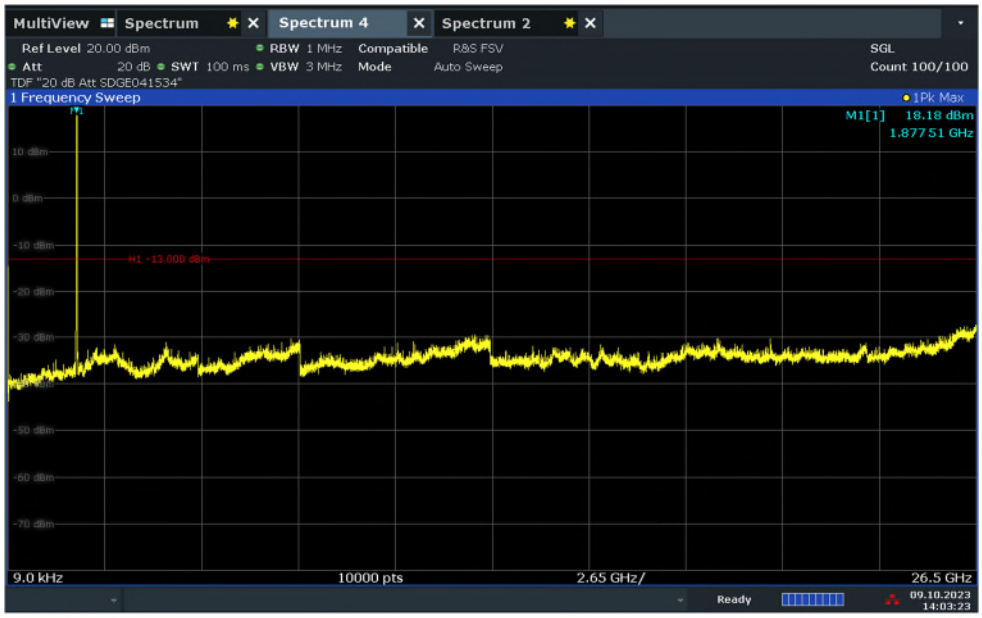
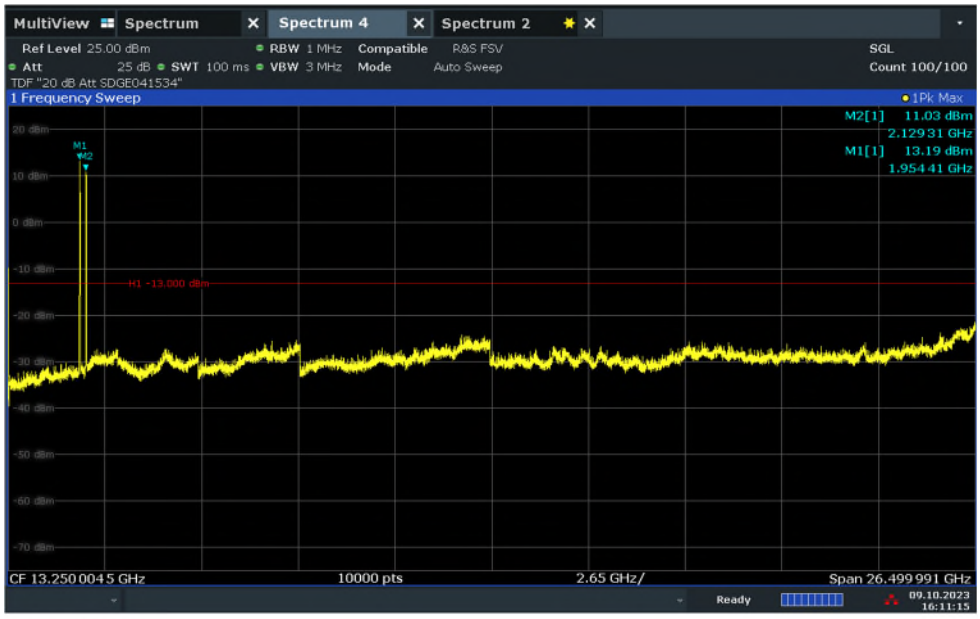


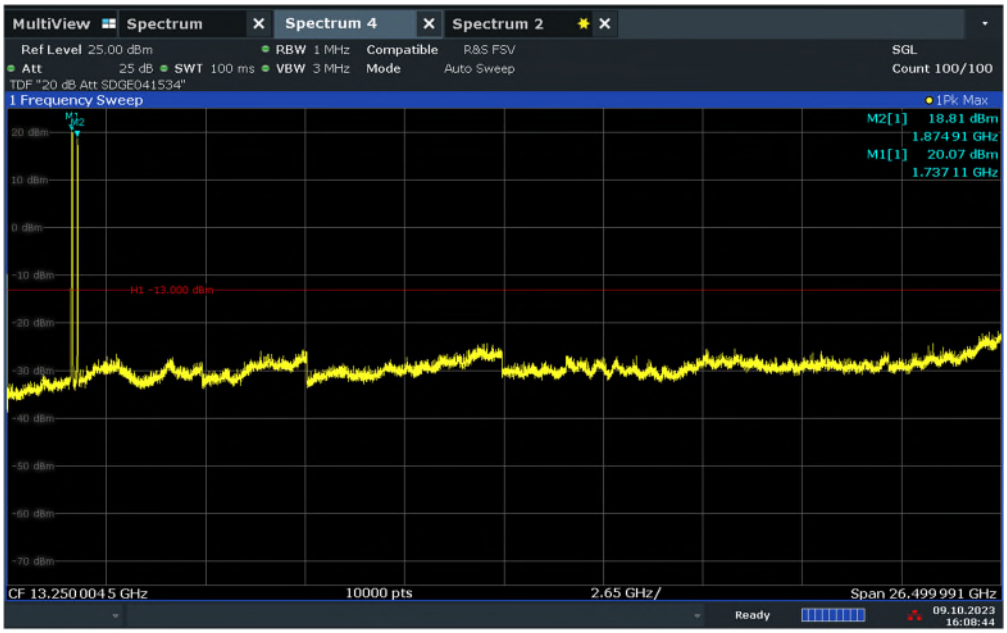
13:50:17 09.10.2023

LTE Band 25 10MHz Bandwidth Downlink Middle Channel Conducted Spurious Emissions
 13:53:55 09.10.2023
LTE Band 25 15MHz Bandwidth Downlink Middle Channel Conducted Spurious Emissions
 13:57:00 09.10.2023

LTE Band 25 20MHz Bandwidth Downlink Middle Channel Conducted Spurious Emissions
 13:59:51 09.10.2023
LTE Band 25 5MHz Bandwidth Uplink Middle Channel Conducted Spurious Emissions
 14:11:52 09.10.2023

LTE Band 25 10MHz Bandwidth Uplink Middle Channel Conducted Spurious Emissions
 14:08:58 09.10.2023
LTE Band 25 15MHz Bandwidth Uplink Middle Channel Conducted Spurious Emissions
 14:06:04 09.10.2023

LTE Band 25 20MHz Bandwidth Uplink Middle Channel Conducted Spurious Emissions
 14:03:24 09.10.2023
2 Bands per antenna port Conducted Spurious Emissions Downlink: Band 2 20MHz BW Middle Ch & Band 4 20MHz BW Middle Ch
 16:11:15 09.10.2023

2 Bands per antenna port Conducted Spurious Emissions Uplink: Band 2 20MHz BW Middle Ch & Band 4 20MHz BW Middle Ch


2.7 Noise Limit

2.7.1 Specification Reference

FCC 47 CFR Part 20. Clause 20.21(e)(9)(i)(A)
FCC 47 CFR Part 20. Clause 20.21(e)(9)(i)(I)
KDB935210 D04, Clause 7.7

2.7.2 Standard Applicable

FCC 47 CFR Part 20. Clause 20.21(e)(9)(i)(A) Noise Limits.:

The transmitted noise power in dBm/MHz of frequency selective consumer boosters outside the licensee's spectrum blocks at their uplink and downlink ports shall not exceed the following limits:
(1) -103 dBm/MHz - RSSI
(i) Where RSSI is the downlink composite signal power received in dBm for frequencies in the band of operation outside the licensee's spectrum block as measured after spectrum block filtering is applied and is referenced to the booster's donor port for each band of operation. RSSI is expressed in negative dB units relative to 1 mW.
(ii) Boosters with MSCL less than 40 dB, shall reduce the Noise output in (A) by 40 dB - MSCL, where MSCL is the minimum coupling loss in dB between the wireless device and booster's server port. MSCL must be calculated or measured for each band of operation and provided in compliance test reports.

(2)(i) Maximum downlink noise power shall not exceed -102.5 dBm/MHz + 20 Log10(Frequency), where Frequency is the uplink mid-band frequency of the supported spectrum bands in MHz.
(ii) Compliance with Noise limits will use instrumentation calibrated in terms of RMS equivalent voltage, and with booster input ports terminated or without input signals applied within the band of measurement.

FCC 47 CFR Part 20. Clause 20.21(e)(9)(i)(I) Transmit Power Off Mode.
When the consumer booster cannot otherwise meet the noise and gain limits defined herein it must operate in ''Transmit Power OFF Mode.'' In this mode of operation, the uplink and downlink noise power shall not exceed -70 dBm/MHz and uplink gain shall not exceed the lesser of 23 dB or MSCL.

2.7.3 Equipment Under Test and Modification State

Serial No: 560311000026 / Test Configuration A and B

2.7.4 Date of Test/Initial of test personnel who performed the test

August 29 and September 29, 2023/MARG

2.7.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.7.6 Environmental Conditions

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility.

Ambient Temperature	24.5 - 26.7°C
Relative Humidity	45.0 - 49.6%
ATM Pressure	98.9 - 99.0kPa

2.7.7 Additional Observations

- This is conducted Test. Test procedure is per Section 7.7 of KDB935210 (D04 Provider Specific Booster Measurements v02r03). Appropriate offset (line losses) applied.
- The EUT operated in Test Mode with the gain set to the maximum gain and a minimum bandwidth setting (5MHz).
- For Maximum Noise (frequency Dependent) testing, setup the EUT according to Figure 6 of Section 7.7 of KDB935210.
- Maximum Noise (frequency Dependent) evaluations are conducted at Server Port. Operational downlink band for LTE Band 2, 4, 5, 12, 13 and 25 were tested.
- For Maximum Noise (RSSI Dependent and Transmit Power off mode) and Noise Response Time tests, set up the EUT according to Figure 7 or 8 of Section 7.7 of KDB935210 as appropriate.
- Maximum Noise (RSSI Dependent and Transmit Power off mode) and Noise Response Time evaluations are conducted at Donor Port and Server Port. Operational uplink and downlink bands for LTE Band 2, 4, 5, 12, 13 and 25 were tested. The signal generator was configured to transmit: 4.1 MHz AWGN.

2.7.8 Test Results

Maximum Noise (Frequency Dependent)				
Band	**Frequency Range (MHz)**	**Max Noise (dBm/MHz)**	**Limit* (dBm/MHz)**	**Margin (dB)**
LTE Band 2 Downlink	1930-1990	-54.33	-37.01	17.32
LTE Band 4 Downlink	2110 - 2155	-53.72	-37.72	16
LTE Band 5 Downlink	869 - 894	-53.59	-44.05	9.54
LTE Band 12 Downlink	729 - 746	-53.82	-45.50	8.32
LTE Band 13 Downlink	746 - 756	-54.35	-44.65	9.7
LTE Band 25 Downlink	1930 - 1995	-53.93	-37	16.93

*: -102.5 dBm/MHz + 20 Log_{10}(Frequency), where Frequency is the uplink mid-band frequency of the supported spectrum bands in MHz. (Downlink only)

Maximum Noise (RSSI Dependent and Transmit Power off mode)					
Band	**Frequency (MHz)**	**RRSI level (dBm)**	**Max Noise (dBm/MHz)**	**Limit (dBm/MHz)**	**Margin (dB)**
LTE Band 2 Downlink	1930 - 1990	-57.11	-55.9	-51	4.9
		-56.82	-56.86	-51.8	5.06
		-56.92	-57.1	-51.9	5.2
		-56.89	-57.29	-51.8	5.49
		-57.12	-57.26	-51	6.26
		-56.84	-57.27	-51.8	5.47
LTE Band 2 Uplink	1850 - 1910	-57.84	-56.83	-50.3	6.53
		-57.51	-56.87	-50.5	6.37
		-57.3	-56.87	-50.6	6.27
		-57.67	-56.9	-50.4	6.5
		-57.67	-56.85	-50.4	6.45
		-57.29	-56.89	-50.6	6.29
LTE Band 4 Downlink	2110 - 2155	-56.42	-55.75	-51.5	4.25
		-56.03	-56.17	-51.9	4.27
		-56.67	-56.15	-50.4	5.75
		-56.44	-56.6	-51.5	5.1
		-56.32	-56.62	-51.5	5.12
		-56.11	-56.55	-51.9	4.65
LTE Band 4 Uplink	1710 - 1755	-57.22	-56.43	-51.1	5.33
		-57.22	-56.51	-51.1	5.41
		-57.37	-57.1	-50.8	6.3
		-57.13	-57.19	-51	6.19
		-57.31	-57.3	-50.8	6.5
		-56.97	-57.31	-51	6.31
LTE Band 5 Downlink	869 - 894	-56.38	-56.36	-51	5.36
		-56.34	-56.32	-51	5.32
		-56.19	-56.22	-50.8	5.42
		-56.16	-56.18	-50.8	5.38
		-56.24	-56.23	-51	5.23
		-56.46	-56.46	-51.2	5.26
LTE Band 5 Uplink	824 - 849	-54.12	-54.04	-54	0.04
		-54.29	-54.14	-54.1	0.04
		-54.13	-54.06	-54	0.06

		-54.11	-54.03	-54	0.03
		-54.14	-54.35	-54	0.35
		-54.18	-54.28	-54	0.28
LTE Band 12 Downlink	729 - 746	-56.64	-56.65	-51.3	5.35
		-56.94	-56.92	-52	4.92
		-56.17	-56.18	-50.8	5.38
		-56.37	-56.67	-51	5.67
		-56.64	-56.66	-51.3	5.36
		-56.46	-56.48	-51.2	5.28
LTE Band 12 Uplink	699 - 716	-54.15	-54.04	-54	0.04
		-54.27	-54.14	-54.1	0.04
		-54.16	-54.06	-54	0.06
		-54.1	-54.03	-54	0.03
		-54.13	-54.35	-54	0.35
		-54.18	-54.28	-54	0.28
LTE Band 13 Downlink	746 - 756	-56.46	-56.43	-51.2	5.23
		-56.43	-56.45	-51.2	5.25
		-56.92	-56.87	-52	4.87
		-56.78	-56.75	-51.5	5.25
		-56.28	-56.32	-50.9	5.42
		-56.92	-56.9	-52	4.9
LTE Band 13 Uplink	777 - 787	-54.1	-54.04	-54	0.04
		-54.25	-54.14	-54.1	0.04
		-54.1	-54.06	-54	0.06
		-54.1	-54.03	-54	0.03
		-54.11	-54.35	-54	0.35
		-54.16	-54.28	-54	0.28
LTE Band 25 Downlink	1930 - 1995	-57.11	-55.65	-50.9	4.75
		-57.19	-55.84	-50.9	4.94
		56.9	-56.92	-50.8	6.12
		-57.29	-57.24	-51	6.24
		-56.94	-57.29	-50.8	6.49
		-56.62	-57.35	-51	6.35
LTE Band 25 Uplink	1850 - 1915	-57.49	-56.56	-50.09	6.47
		-57.73	-57.05	-50.5	6.55
		-57.66	-57.33	-50.4	6.93
		-57.4	-57.43	-50.3	7.13
		-57.43	-57.4	-50.3	7.1

		-57.35	-57.37	-50.2	7.17

Noise Response Time				
Band	**Frequency (MHz)**	**Noise Response Time (Sec)**	**Limit (Sec)**	**Margin (Sec)**
LTE Band 2 Downlink	1930-1990	0.422	3	2.575
LTE Band 2 Uplink	1850-1910	0.762	3	2.238
LTE Band 4 Downlink	2110 - 2155	0.442	3	2.558
LTE Band 4 Uplink	1710 - 1755	0.788	3	2.212
LTE Band 5 Downlink	869 - 894	0.462	3	2.538
LTE Band 5 Uplink	824 - 849	0.918	3	2.082
LTE Band 12 Downlink	729 - 746	0.496	3	2.504
LTE Band 12 Uplink	699 - 716	0.576	3	2.424
LTE Band 13 Downlink	746 - 756	0.473	3	2.527
LTE Band 13 Uplink	777 - 787	0.678	3	2.322
LTE Band 25 Downlink	1930 - 1995	0.427	3	2.573
LTE Band 25 Uplink	1850 - 1915	0.718	3	2.282

N/A*: Not Applicable. Maximum Noise always complies with Noise Limit requirement. There is no noise limit change during testing.

2.8 Uplink Inactivity

2.8.1 Specification Reference

FCC 47 CFR Part 20. Clause 20.21(e)(9)(i)(J)
KDB935210 D04, Clause 7.8

2.8.2 Standard Applicable

FCC 47 CFR Part 20. Clause 20.21(e)(9)(i)(J) Uplink Inactivity:

Uplink Inactivity. When a consumer booster is not serving an active device connection after 5 seconds the uplink noise power shall not exceed -70 dBm/MHz.

2.8.3 Equipment Under Test and Modification State

Serial No: 560311000026 / Test Configuration C and D

2.8.4 Date of Test/Initial of test personnel who performed the test

August 31, 2023/MARG

2.8.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.8.6 Environmental Conditions

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility.

Ambient Temperature	25.8°C
Relative Humidity	53.3%
ATM Pressure	99.0kPa

2.8.7 Additional Observations

- This is conducted Test.
- Test procedure is per Section 7.8 of KDB935210 (D04 Provider Specific Booster Measurements v02r03). Appropriate offset (line losses) applied.
- The EUT operated in Normal Mode with a minimum bandwidth setting (5MHz).
- Setup the EUT according to Figure 1 of Section 6.3.2 of KDB935210.
- Evaluations are conducted at NU antenna ports.
- Operational uplink bands for LTE Band 2, 4, 5, 12, 13, 25 were tested.
- Signal: 5MHz LTE.

2.8.8 Test Results

Uplink Inactivity				
Band	**Frequency (MHz)**	**UL Inactive Time (Sec)**	**Limit (Sec)**	**Margin (Sec)**
LTE Band 2	1880	1.51	5.0	3.49
LTE Band 4	1732.5	1.52	5.0	3.48
LTE Band 5	836.6	1.49	5.0	3.51
LTE Band 12	707.5	1.53	5.0	3.47
LTE Band 13	782	1.54	5.0	3.46
LTE Band 25	1882.5	1.50	5.0	3.5