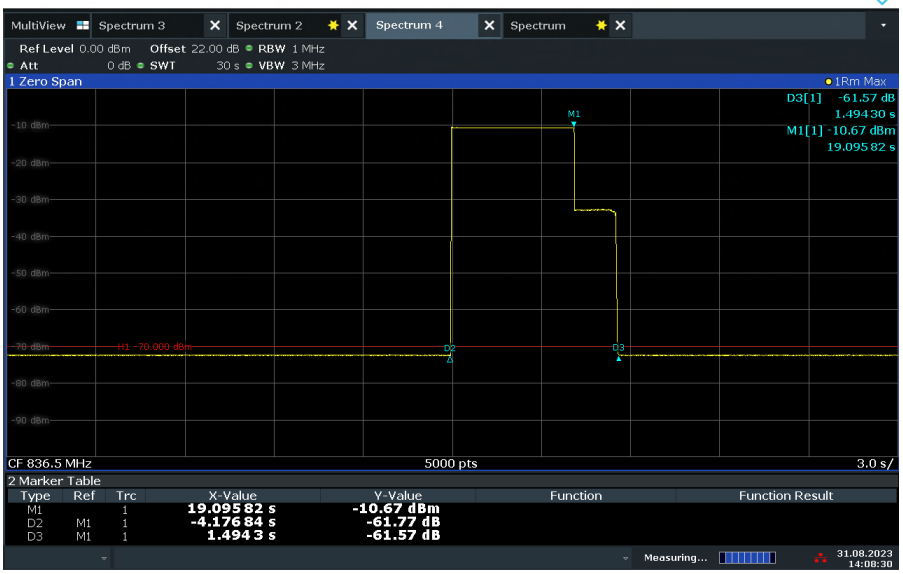
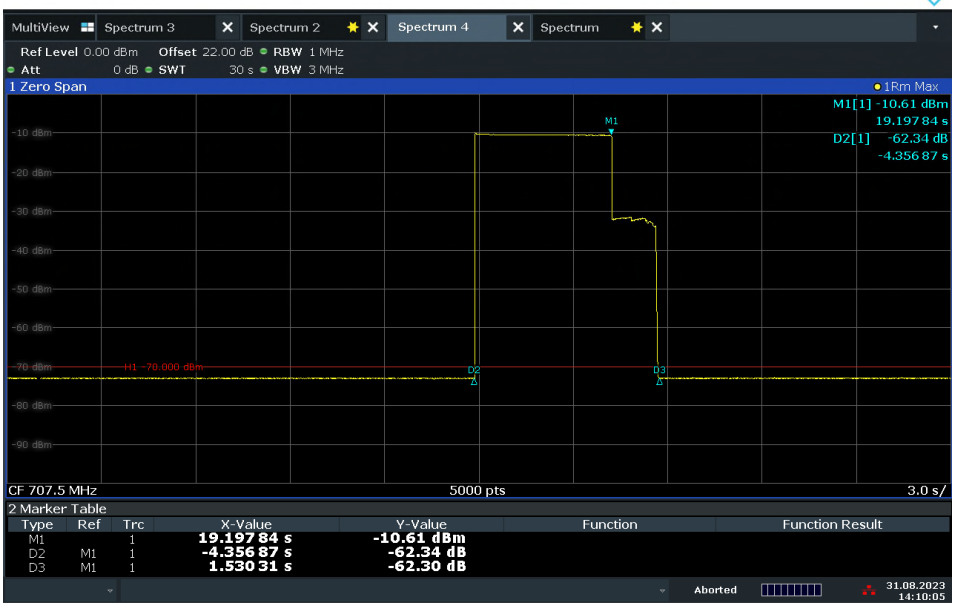
LTE Band 5 Uplink 5MHz Mid Channel



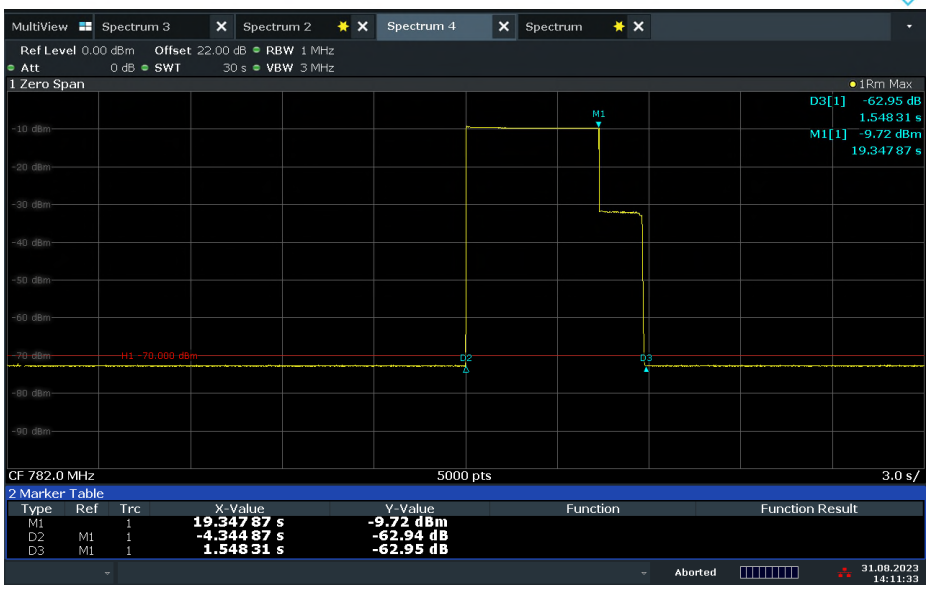
14:08:31 31.08.2023

LTE Band 12 Uplink 5MHz Mid Channel



14:10:05 31.08.2023

LTE Band 13 Uplink 5MHz Mid Channel



14:11:34 31.08.2023

LTE Band 25 Uplink 5MHz Mid Channel

14:16:23 31.08.2023

2.9 Variable Booster Gain

2.9.1 Specification Reference

FCC 47 CFR Part 20. Clause 20.21(e)(9)(i)(C)(1)
FCC 47 CFR Part 20. Clause 20.21(e)(9)(i)(I)
KDB935210 D04, Clause 7.9

2.9.2 Standard Applicable

FCC 47 CFR Part 20. Clause 20.21(e)(9)(i)(C)(1) Booster Gain Limits:
The gain of the frequency selective consumer booster shall meet the limits below.

1) The uplink and downlink gain in dB of a frequency selective consumer booster referenced to its input and output ports shall not exceed BSCL - 28dB - (40 dB - MSCL).
(i) Where BSCL is the coupling loss between the booster's donor port and the base station's input port, and MSCL is the minimum coupling loss in dB between the wireless device and the booster's server port. MSCL must be calculated or measured for each band of operation and provided in compliance test reports.
(ii) In order of preference, BSCL is determined as follows: determine path loss between the base station and the booster; such measurement shall be based on measuring the received forward pilot/control channel power at the booster and reading the pilot/control channel transmit power from the base station as defined in the system information messages sent by the base station; estimate BSCL by assuming that the base station is transmitting at a level of +25 dBm per channel (assume a small, lightly loaded cell) and measuring the total received signal power level within the channel in dBm (RPCH) received at the booster input port. BSCL is then calculated as 25– RPCH; or assume that the BSCL is 70dB without performing any 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.

2.9.3 Equipment Under Test and Modification State

Serial No: 560311000026 / Test Configuration C and D

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

September 22, 2023/MARG

2.9.5 Test Equipment Used

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

2.9.6 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

2.9.7 Additional Observations

- This is conducted Test.
- Test procedure is per Section 7.9 of KDB935210 (D04 Provider Specific Booster Measurements v02r03). Appropriate offset (line losses) applied.
- The EUT operated in Normal Mode
- Setup the EUT according to Figure 1 of Section 6.3.2 of KDB935210.
- Evaluations are conducted at worst according to Maximum Booster Gain test result.
- Variable Gain: Operational uplink and downlink bands for LTE Band 2, 4, 5, 12, 13, 25 were tested.
- Uplink Gain Timing: Operational uplink bands for LTE Band 2, 4, 5, 12, 13, 25 were tested.
- Signal: 5MHz LTE.
- MSCL: Lp = 20logf + 20logd - 27.5

  Where: Lp = Basic free space path loss,
  f = frequency in MHz,
  d = separation distance in meters (2m)
  lowest MSCL value was utilized.
- BSCL: The coupling loss (in dB) between the donor port (NU) of the Consumer Booster and the input port of the Base Station

2.9.8 Test Results

LTE B2 Downlink Gain vs RPCH and BSCL - Middle Channel					
RPCH Power (dBm)	**BSCL (dB)**	**Measured Power (dBm)**	**Gain (dB)**	**Limit (dB)**	**Margin (dB)**
-42	67	-12.81	15.83	34	18.17
-52	77	3.7	42.39	44	1.61
-62	87	3.9	52.65	54	1.35
-72	97	4.18	63.14	64	0.86
-82	107	4.46	73.1	74	0.9
-92	117	4.49	83.43	84	0.57

LTE B2 Uplink Gain vs RPCH and BSCL - Middle Channel					
RPCH Power (dBm)	**BSCL (dB)**	**Measured Power (dBm)**	**Gain (dB)**	**Limit (dB)**	**Margin (dB)**
-52	77	-35.64	2.36	45	42.64
-62	87	-24.98	13.02	55	41.98
-72	97	-14.96	23.04	65	41.96
-82	107	-4.88	33.12	75	41.88
-92	117	5.69	43.69	85	41.31
-102	127	15.52	53.52	95	41.48

LTE B4 Downlink Gain vs RPCH and BSCL - Middle Channel					
RPCH Power (dBm)	**BSCL (dB)**	**Measured Power (dBm)**	**Gain (dB)**	**Limit (dB)**	**Margin (dB)**
-41.6	66.6	-16.75	72.79	33	20.21
-51.6	76.6	0.24	40.09	43	2.91
-61.6	86.6	0.56	50.22	53	2.78
-71.6	96.6	0.78	60.4	63	2.6
-81.6	106.6	0.8	70.55	73	2.45
-91.6	116.6	1.01	80.66	83	2.36

LTE B4 Uplink Gain vs RPCH and BSCL - Middle Channel					
RPCH Power (dBm)	**BSCL (dB)**	**Measured Power (dBm)**	**Gain (dB)**	**Limit (dB)**	**Margin (dB)**
-52.1	77.1	-5.01	32.99	45	12.01
-62.1	87.1	16.42	54.42	55	0.58
-72.1	97.1	21.27	59.57	65	5.73
-82.1	107.1	21.23	59.53	75	15.77
-92.1	117.1	21.18	59.18	85	25.82
-102.1	127.1	21.19	59.19	95	35.81

LTE B5 Downlink Gain vs RPCH and BSCL - Middle Channel					
RPCH Power (dBm)	**BSCL (dB)**	**Measured Power (dBm)**	**Gain (dB)**	**Limit (dB)**	**Margin (dB)**
-53.9	78.9	2.82	41.43	46	6.23
-63.9	88.9	3.14	51.58	56	4.57
-73.9	98.9	3.1	61.57	66	4.42
-83.9	108.9	3.47	72.14	76	4.43
-93.9	118.9	3.88	82.51	86	3.86
-103.9	128.9	3.88	92.24	96	3.49

3.76

LTE B5 Uplink Gain vs RPCH and BSCL - Middle Channel					
RPCH Power (dBm)	**BSCL (dB)**	**Measured Power (dBm)**	**Gain (dB)**	**Limit (dB)**	**Margin (dB)**
-53.9	78.9	-6.61	33.39	46	12.61
-63.9	88.9	4.44	44.44	56	11.56
-73.9	98.9	14	54	66	12
-83.9	108.9	18.8	58.8	76	17.2
-93.9	118.9	18.35	58.43	86	27.57
-103.9	128.9	18.39	58.35	96	37.65

LTE B12 Downlink Gain vs RPCH and BSCL - Middle Channel					
RPCH Power (dBm)	**BSCL (dB)**	**Measured Power (dBm)**	**Gain (dB)**	**Limit (dB)**	**Margin (dB)**
-53.2	78.2	3.18	41.45	45	5.12
-63.2	88	4.41	52.55	55	3.55
-73.2	98.2	4.42	62.78	65	2.45
-83.2	108.2	4.63	72.81	75	2.22
-93.2	118.2	4.6	83.08	85	2.19
-103.2	128.2	4.91	93.69	95	1.92

LTE B12 Uplink Gain vs RPCH and BSCL - Middle Channel					
RPCH Power (dBm)	**BSCL (dB)**	**Measured Power (dBm)**	**Gain (dB)**	**Limit (dB)**	**Margin (dB)**
-55.5	80.5	-7.04	32.96	57.5	24.54
-65.5	90.5	3.65	43.65	67.5	23.85
-75.5	100.5	14.14	54.14	77.5	23.36
-85.5	110.5	18.31	58.31	87.5	29.19
-95.5	120.5	18.25	58.25	97.5	39.25
-105.5	130.5	18.25	58.25	100	41.75

LTE B13 Downlink Gain vs RPCH and BSCL - Middle Channel					
RPCH Power (dBm)	**BSCL (dB)**	**Measured Power (dBm)**	**Gain (dB)**	**Limit (dB)**	**Margin (dB)**
-54.3	79.3	3.98	42.29	46	3.71
-64.3	89.3	4.47	53.35	56	2.65
-74.3	99.3	4.89	63.38	66	2.62
-84.3	109.3	5.13	73.48	76	2.52
-94.3	119.3	5.5	84.48	86	1.52
-104.3	129.3	5.7	94.63	96	1.37

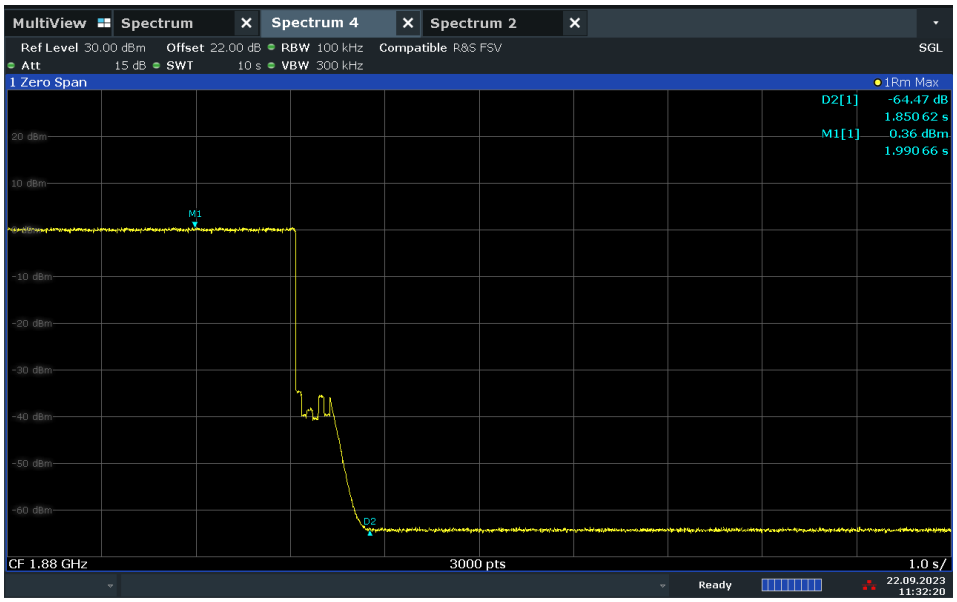
LTE B13 Uplink Gain vs RPCH and BSCL - Middle Channel					
RPCH Power (dBm)	**BSCL (dB)**	**Measured Power (dBm)**	**Gain (dB)**	**Limit (dB)**	**Margin (dB)**
-53.5	78.5	-8.22	31.78	45.5	13.72
-63.5	88.5	4.83	44.83	55.5	10.67
-73.5	98.5	15.15	55.15	65.5	10.35
-83.5	108.5	19.82	59.82	75.5	15.68
-93.5	118.5	19.24	59.24	85.5	26.26
-103.5	128.5	19.21	59.21	95.5	36.29

LTE B25 Downlink Gain vs RPCH and BSCL - Middle Channel					
RPCH Power (dBm)	**BSCL (dB)**	**Measured Power (dBm)**	**Gain (dB)**	**Limit (dB)**	**Margin (dB)**
-52.7	77.7	2.43	41.71	44	2.29
-62.7	87.7	2.73	52.16	54	1.84
-72.7	97.7	3.03	62.7	64	1.3
-82.7	107.7	3.38	73.34	74	0.66
-92.7	117.7	3.41	82.65	84	1.35
-102.7	127.7	3.72	93.07	94	0.93

LTE B25 Uplink Gain vs RPCH and BSCL - Middle Channel					
RPCH Power (dBm)	**BSCL (dB)**	**Measured Power (dBm)**	**Gain (dB)**	**Limit (dB)**	**Margin (dB)**
-52.1	77.1	-6.3	31.7	45	13.3
-62.1	87.1	6.31	44.31	55	10.69
-72.1	97.1	16.8	54.8	65	10.2
-82.1	107.1	22.22	60.22	75	14.78
-92.1	117.1	22.22	60.22	85	24.78
-102.1	127.1	22.19	60.19	95	34.8

2.9.9 Test Results Plots

LTE Band 2 Uplink Gain Timing 5MHz Bandwidth Mid Channel



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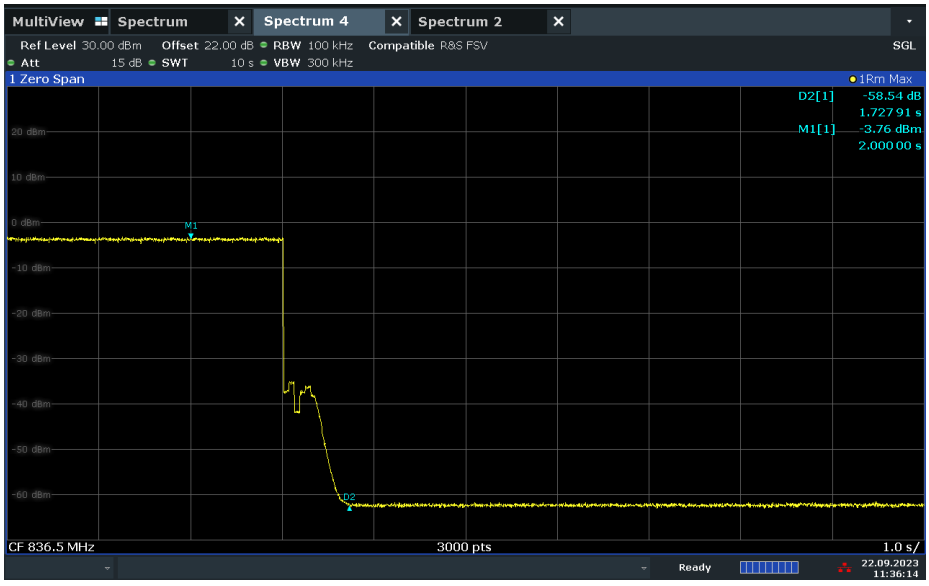
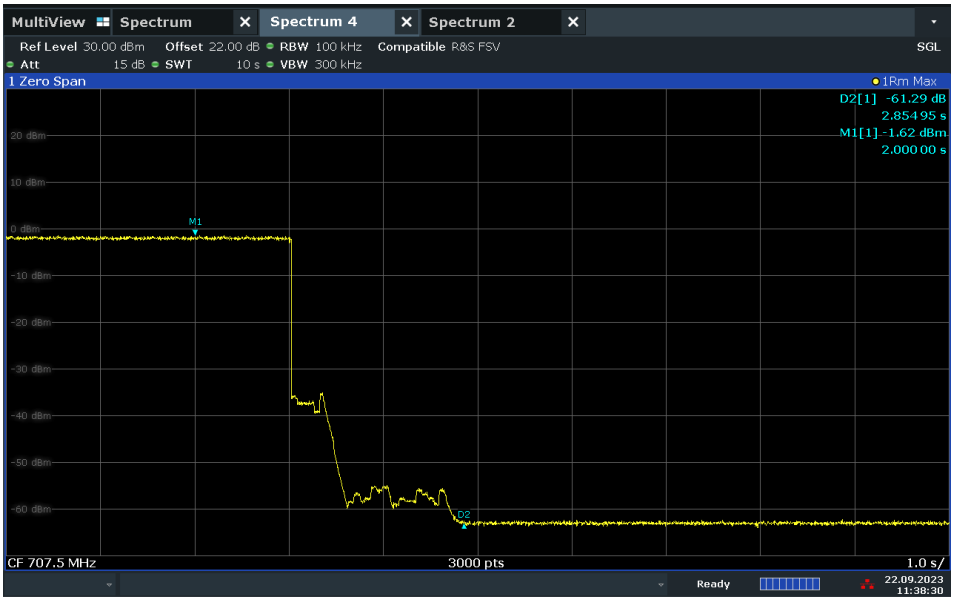
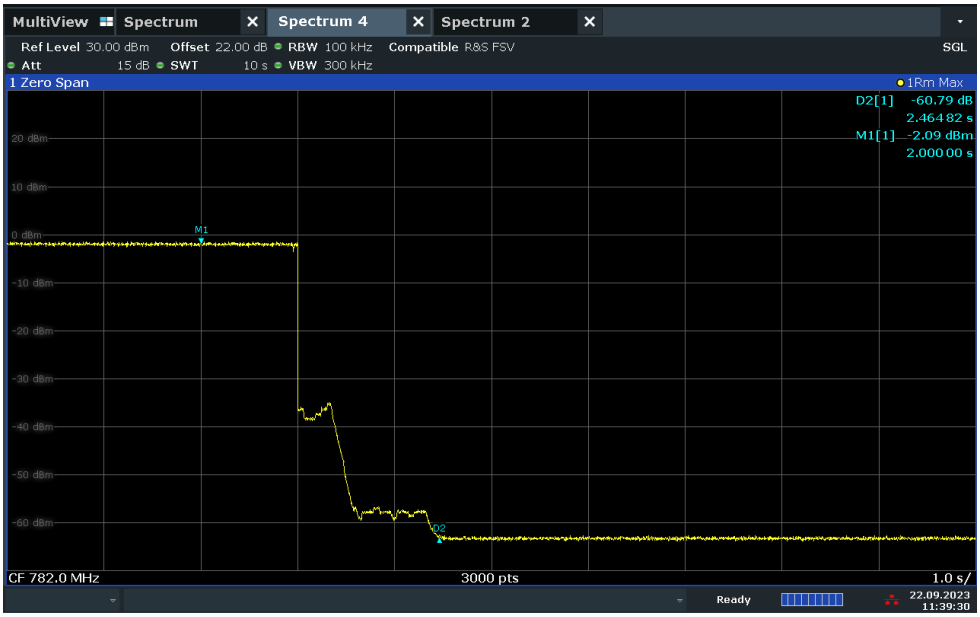
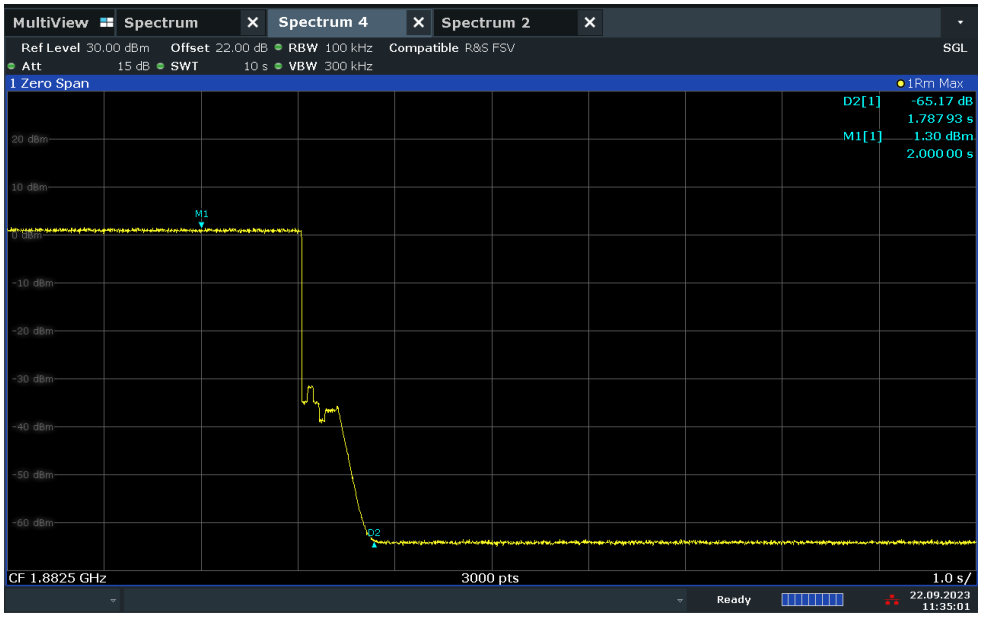
LTE Band 4 Uplink Gain Timing 5MHz Bandwidth Mid Channel

11:34:01 22.09.2023

LTE Band 5 Uplink Gain Timing 5MHz Bandwidth Mid Channel
 11:36:14 22.09.2023
LTE Band 12 Uplink Gain Timing_5MHz Bandwidth Mid Channel
 11:38:31 22.09.2023

LTE Band 13 Uplink Gain Timing_5MHz Bandwidth Mid Channel
 11:39:30 22.09.2023
LTE Band 25 Uplink Gain Timing_5MHz Bandwidth Mid Channel
 11:35:01 22.09.2023

2.10 Occupied Bandwidth

2.10.1 Specification Reference

FCC 47 CFR Part 2. Clause 2.1049
FCC 47 CFR Part 22, Clause 22.917(b)
FCC 47 CFR Part 24, Clause 24.238(b)
RSS-Gen, Clause 6.6

2.10.2 Standard Applicable

FCC 47 CFR Part 24, Clause 24.238(b)
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.

26dB 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 by at least 26 dB below the transmitter power.

Using the occupied bandwidth meansurement function in the spectrum analyzer, the 99% occupied bandwith was measured.

In addition, the 26dB bandwidth was measured in accorance with FCC KDB 971168 D01 V0202 Clause 4.1 using the ndB measurement function in the spectrum analyzer.

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be at least 3x RBW.

2.10.3 Equipment Under Test and Modification State

Serial No: 560311000026/ Test Configuration A and B

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

July 19, and October 11 2023 / MARG

2.10.5 Test Equipment Used

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

2.10.6 Environmental Conditions

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

Ambient Temperature	21.8 - 24.3 °C
Relative Humidity	40.0 – 45.3 %
ATM Pressure	99.8 – 101.1kPa

2.10.7 Additional Observations

- This is a conducted test. Both 26dB bandwidth and 99% bandwidth presented.

- Using the occupied bandwidth measurement function in the spectrum analyzer, the 99% occupied bandwith was measured.
- The 26dB bandwidth is measured in accordance with ANSI C63.26 clause 5.4.3 using the ndB measurement function in the spectrum analyzer.
- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
- The RBW is set to 1% of the OBW while the VBW is ≥3X RBW.
- The detector is peak, and the trace mode is max hold.
- The transducer factor (TDF) used is from the external attenuators and cables used.
- Per Client request only High Channel was tested for Band 25
- All low, middle, and high channels were verified for Band 2, 4, 5, 12, 13.
- Only test plots for middle channel presented as the representative configuration except for Band 25.

2.10.8 Test Results

LTE Band 2 Downlink				
Bandwidth (MHz)	**Channels**	**Frequency (MHz)**	**OBW (MHz)**	**-26dB BW (MHz)**
5 MHz	625	1932.5	4.44	4.77
	900	1960	4.45	4.76
	1175	1987.5	4.45	4.77
10 MHz	650	1935	8.88	9.46
	900	1960	8.91	9.49
	1150	1985	8.91	9.49
15 MHz	675	1937.5	12.95	14.37
	900	1960	13.27	14.18
	1125	1982.5	13.36	14.29
20 MHz	700	1940	17.67	18.92
	900	1960	17.70	18.95
	1100	1980	17.79	18.98

LTE Band 2 Uplink				
Bandwidth (MHz)	**Channels**	**Frequency (MHz)**	**OBW (MHz)**	**-26dB BW (MHz)**
5 MHz	18625	1852.5	4.44	4.74
	18900	1880	4.44	4.77
	19175	1907.5	4.44	4.76
10 MHz	18650	1855	8.87	9.44

	18900	1880	8.91	9.50
	19150	1905	8.89	9.45
15 MHz	18675	1857.5	13.21	14.16
	18900	1880	13.34	14.22
	19125	1902.5	13.29	14.18
20 MHz	18700	1860	17.67	18.82
	18900	1880	17.78	18.92
	19100	1900	17.71	18.85

LTE Band 4 Downlink				
Bandwidth (MHz)	**Channels**	**Frequency (MHz)**	**OBW (MHz)**	**-26dB BW (MHz)**
5 MHz	1975	2112.5	4.45	4.79
	2175	2132.5	4.45	4.78
	2375	2152.5	4.45	4.78
10 MHz	2000	2115	8.90	9.51
	2175	2132.5	8.90	9.51
	2350	2150	8.92	9.53
15 MHz	2025	2117.5	13.32	14.23
	2175	2132.5	13.30	14.24
	2325	2147.5	13.35	14.33
20 MHz	2050	2120	17.76	18.99
	2175	2132.5	17.80	19.10
	2300	2145	17.77	19.07

LTE Band 4 Uplink				
Bandwidth (MHz)	**Channels**	**Frequency (MHz)**	**OBW (MHz)**	**-26dB BW (MHz)**
5 MHz	19975	1712.5	4.45	4.74
	20175	1732.5	4.45	4.78
	20375	1752.5	4.45	4.77
10 MHz	20000	1715	8.90	9.46
	20175	1732.5	8.91	9.49

	20350	1750	8.90	9.46
15 MHz	20025	1717.5	13.33	14.23
	20175	1732.5	13.34	14.24
	20325	1747.5	13.35	14.21
20 MHz	20050	1720	17.76	18.85
	20175	1732.5	17.78	18.94
	20300	1745	17.76	18.81
LTE Band 5 Downlink				
Bandwidth (MHz)	**Channels**	**Frequency (MHz)**	**OBW (MHz)**	**-26dB BW (MHz)**
5 MHz	2425	871.5	4.44	4.76
	2525	881.5	4.45	4.75
	2625	891.5	4.44	4.75
10 MHz	2450	874	8.89	9.47
	2525	881.5	8.89	9.45
	2600	889	8.91	9.48

LTE Band 5 Uplink				
Bandwidth (MHz)	**Channels**	**Frequency (MHz)**	**OBW (MHz)**	**-26dB BW (MHz)**
5 MHz	20425	826.5	4.43	4.73
	20525	836.5	4.43	4.74
	20625	846.5	4.43	4.75
10 MHz	20450	829	8.91	9.46
	20525	836.5	8.84	9.40
	20600	844	8.91	9.45

LTE Band 12 Downlink				
Bandwidth (MHz)	**Channels**	**Frequency (MHz)**	**OBW (MHz)**	**-26dB BW (MHz)**
5 MHz	5035	731.5	4.45	4.75
	5095	737.5	4.43	4.76
	5155	743.5	4.45	9.46

10 MHz	5060	734	8.92	9.44
	5095	737.5	8.88	9.45
	5130	741	8.91	9.47

LTE Band 12 Uplink				
Bandwidth (MHz)	**Channels**	**Frequency (MHz)**	**OBW (MHz)**	**-26dB BW (MHz)**
5 MHz	23035	701.5	4.44	4.75
	23095	707.5	4.47	4.76
	23155	713.5	4.46	4.78
10 MHz	23060	704.0	8.85	9.38
	23095	707.5	8.92	9.45
	23130	711.0	8.91	9.46

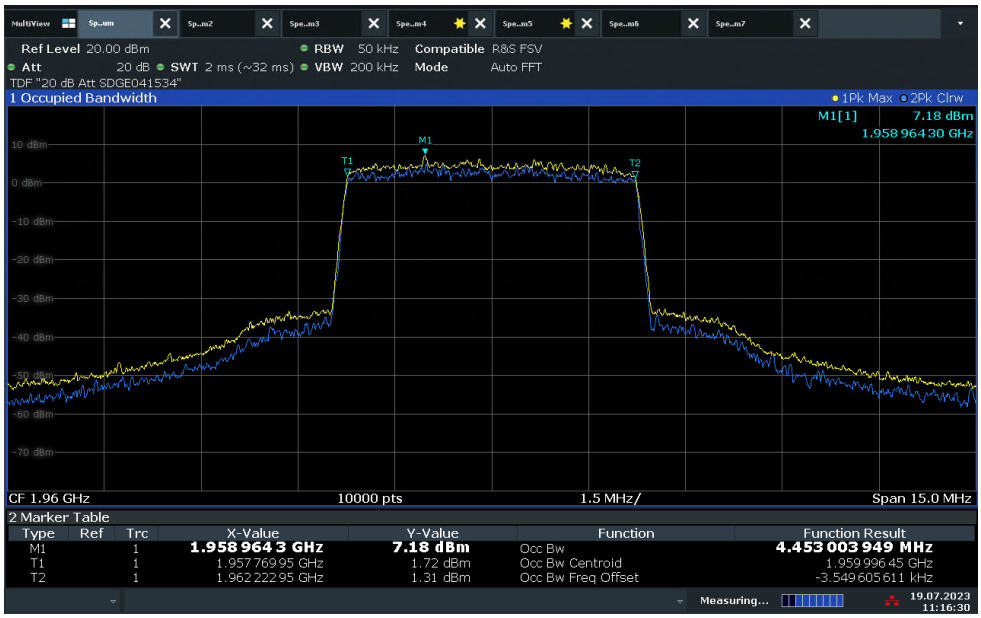
LTE Band 13 Downlink				
Bandwidth (MHz)	**Channels**	**Frequency (MHz)**	**OBW (MHz)**	**-26dB BW (MHz)**
5 MHz	5205	748.5	4.44	4.77
	5230	751.0	4.46	4.78
	5255	753.5	4.44	4.76
10 MHz	-	-	-	-
	5230	751.0	8.93	9.48
	-	-	-	-

LTE Band 13 Uplink				
Bandwidth (MHz)	**Channels**	**Frequency (MHz)**	**OBW (MHz)**	**-26dB BW (MHz)**
5 MHz	23205	779.5	4.44	4.75
	23230	782.0	4.45	4.76
	23255	784.5	4.45	4.77
10 MHz	-	-	-	-
	23230	782.0	8.93	9.46
	-	-	-	-

LTE Band 25 Downlink				
Bandwidth (MHz)	**Channels**	**Frequency (MHz)**	**OBW (MHz)**	**-26dB BW (MHz)**
5 MHz	8665	1992.5	4.46	4.78
10 MHz	8640	1990.0	8.90	9.48
15 MHz	8615	1987.5	13.32	14.23
20 MHz	8590	1985.0	17.77	19.02

LTE Band 25 Uplink				
Bandwidth (MHz)	**Channels**	**Frequency (MHz)**	**OBW (MHz)**	**-26dB BW (MHz)**
5 MHz	26665	1912.5	4.44	4.75
10 MHz	26640	1910.0	8.88	9.44
15 MHz	26615	1907.5	13.26	14.12
20 MHz	26590	1905.0	17.64	18.76

LTE Band 2 Downlink (5 MHz BW) Mid Channel 1960 MHz 99% OBW



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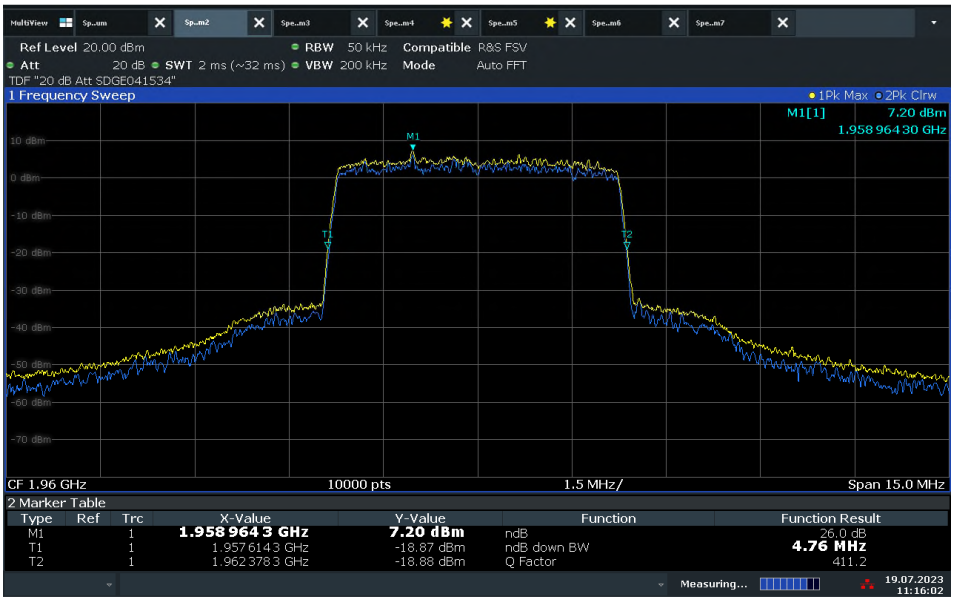
LTE Band 2 Downlink (5 MHz BW) Mid Channel 1960 MHz -26dB BW



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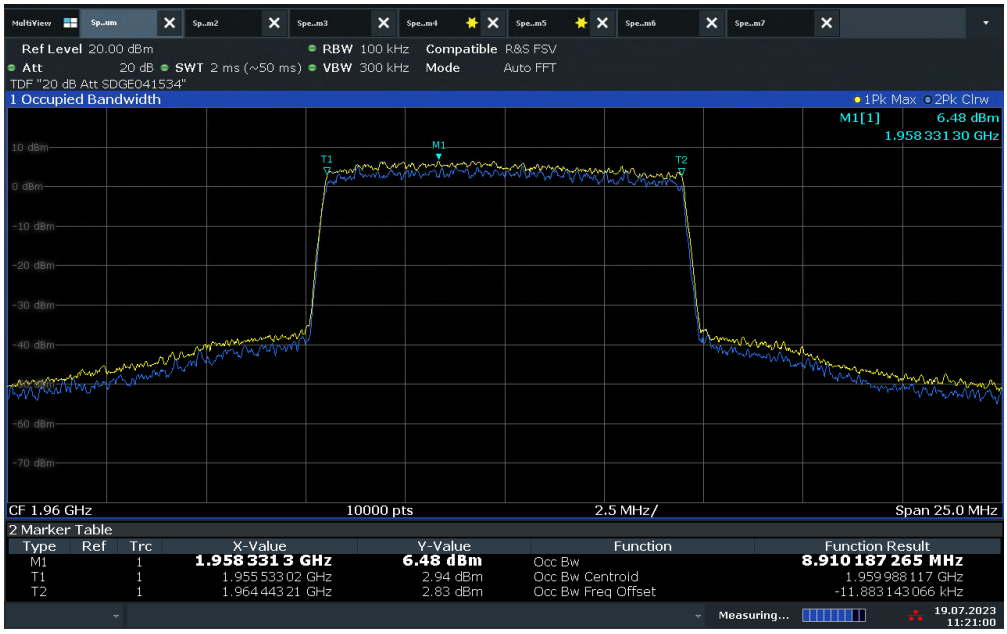
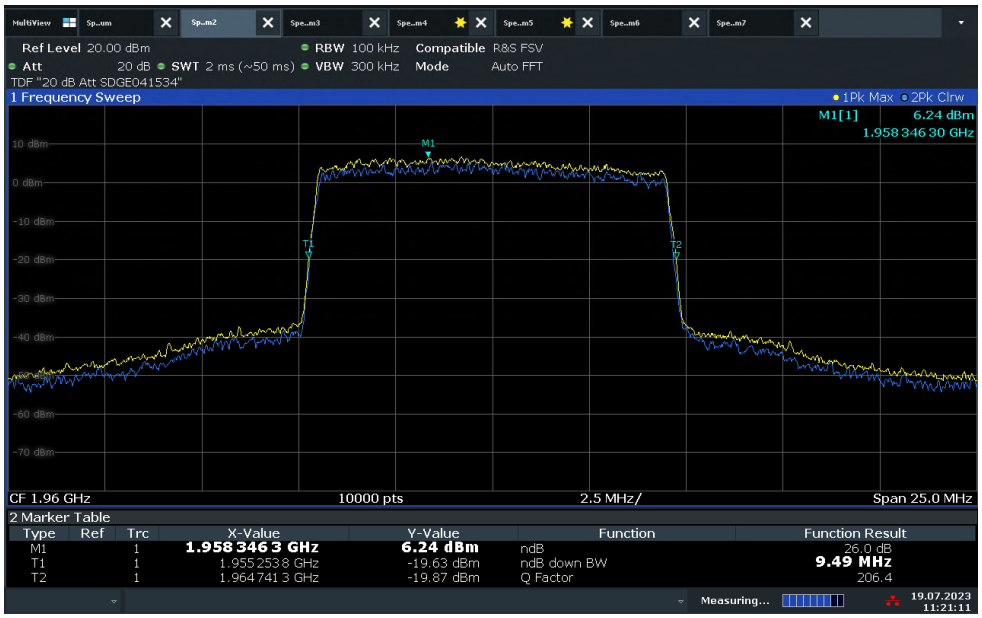
LTE Band 2 Downlink (10 MHz BW) Mid Channel 1960 MHz 99% OBW



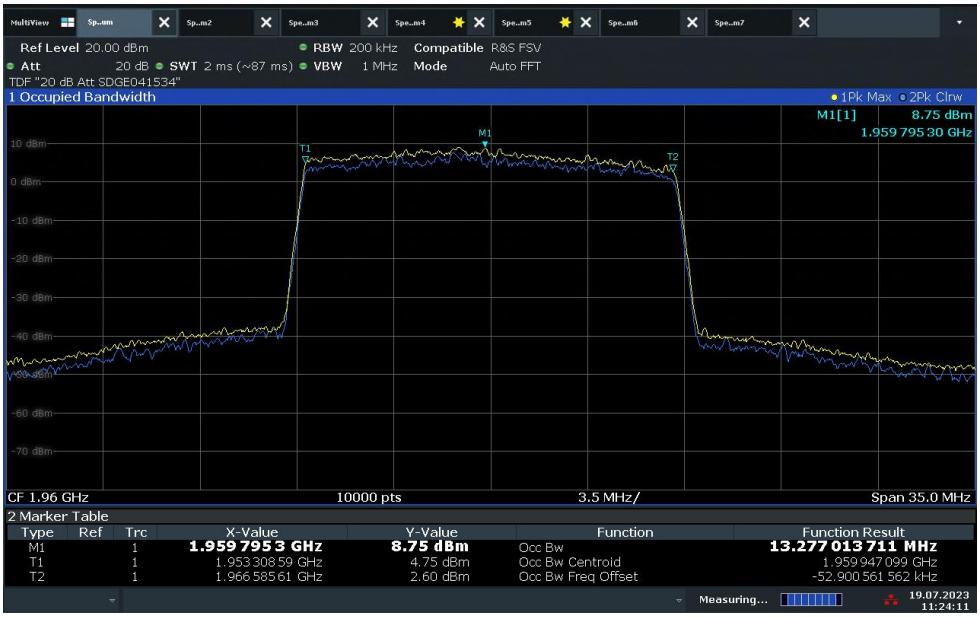
11:21:01 19.07.2023

LTE Band 2 Downlink (10 MHz BW) Mid Channel 1960 MHz -26 dB BW



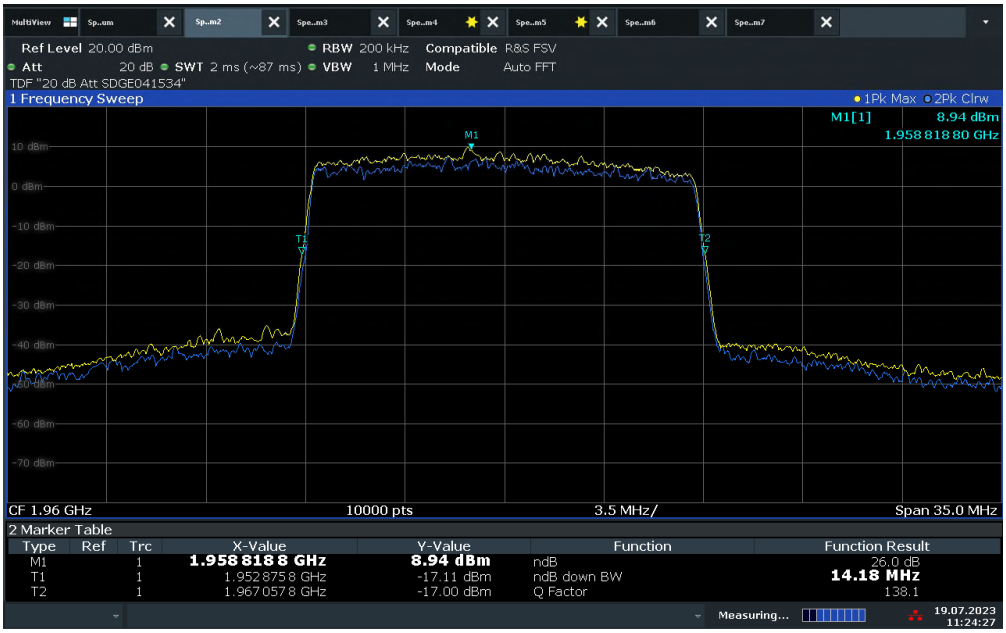
11:21:12 19.07.2023

LTE Band 2 Downlink (15 MHz BW) Mid Channel 1960 MHz 99% OBW



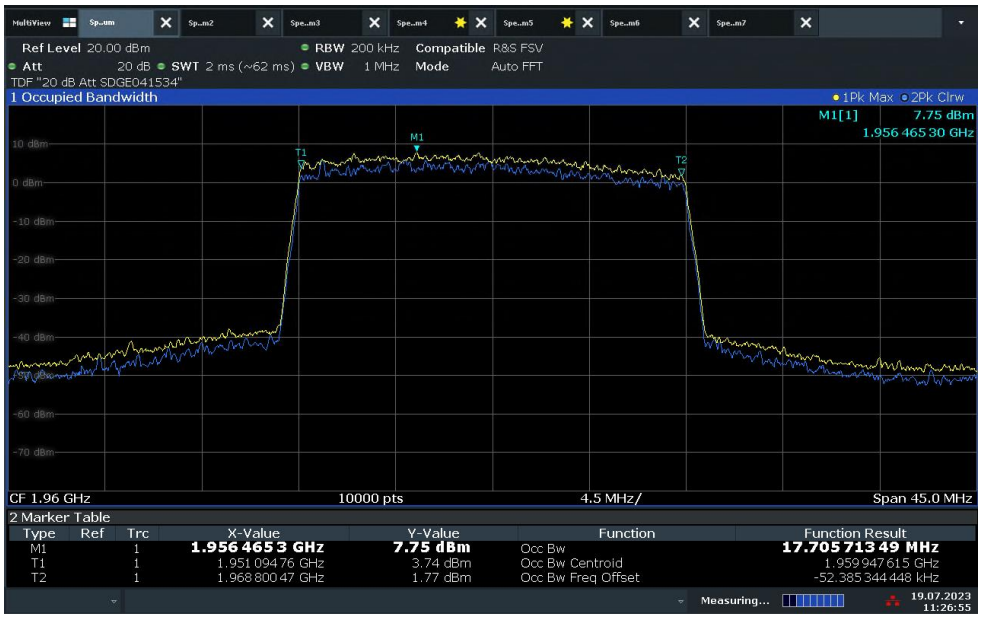
11:24:12 19.07.2023

LTE Band 2 Downlink (15 MHz BW) Mid Channel 1960 MHz -26 dB BW



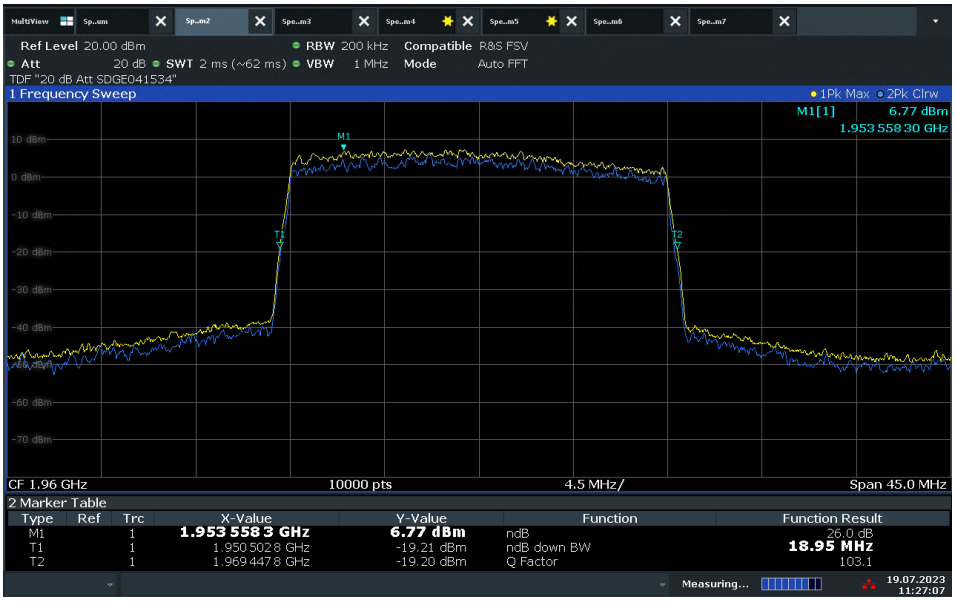
11:24:28 19.07.2023

LTE Band 2 Downlink (20 MHz BW) Mid Channel 1960 MHz 99% OBW



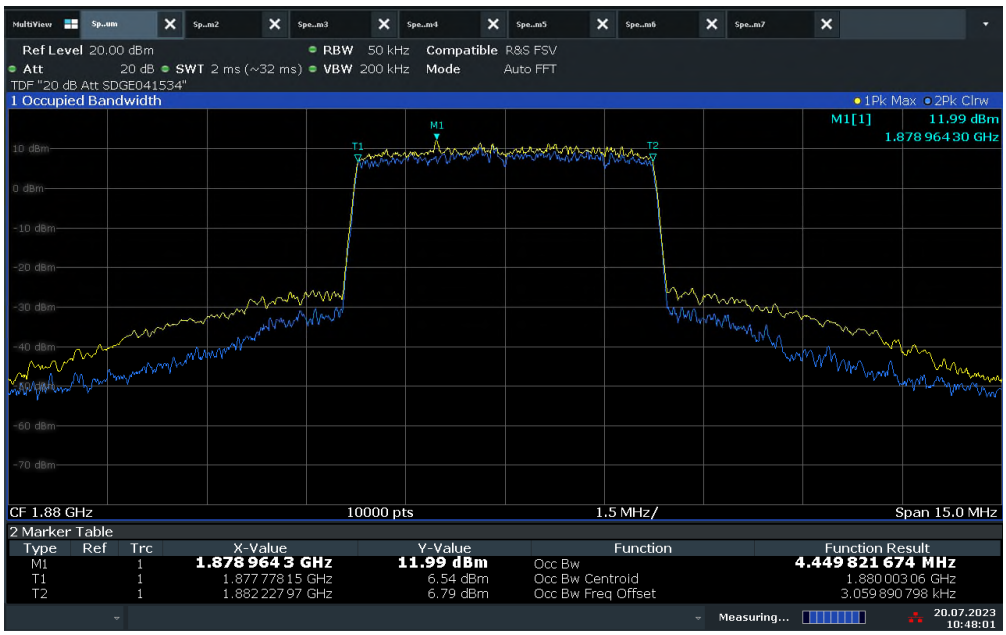
11:26:56 19.07.2023

LTE Band 2 Downlink (20 MHz BW) Mid Channel 1960 MHz -26 dB BW



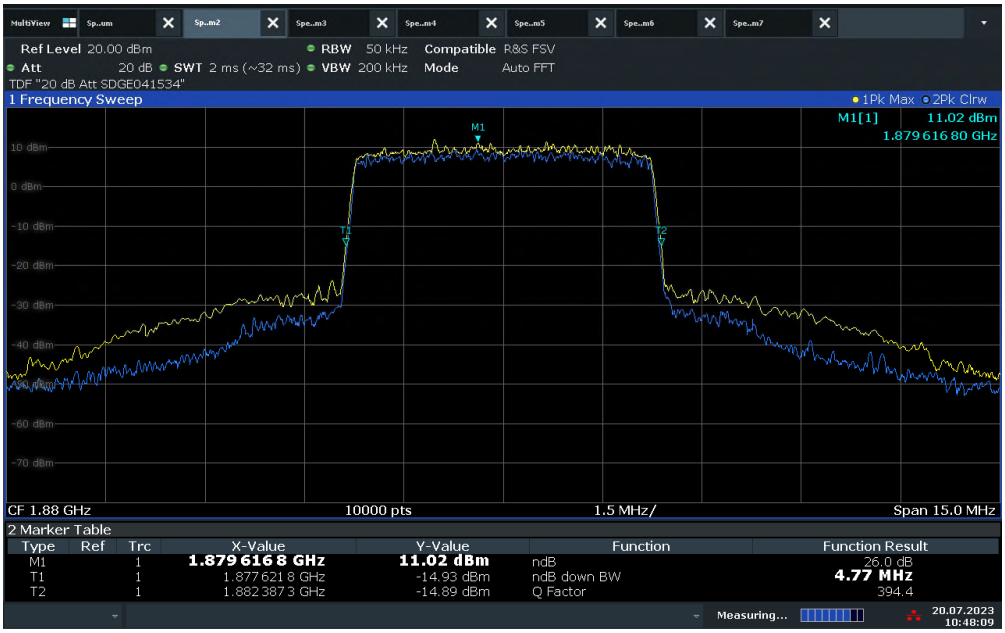
11:27:08 19.07.2023

LTE Band 2 Uplink (5 MHz BW) Mid Channel 1880 MHz 99% OBW



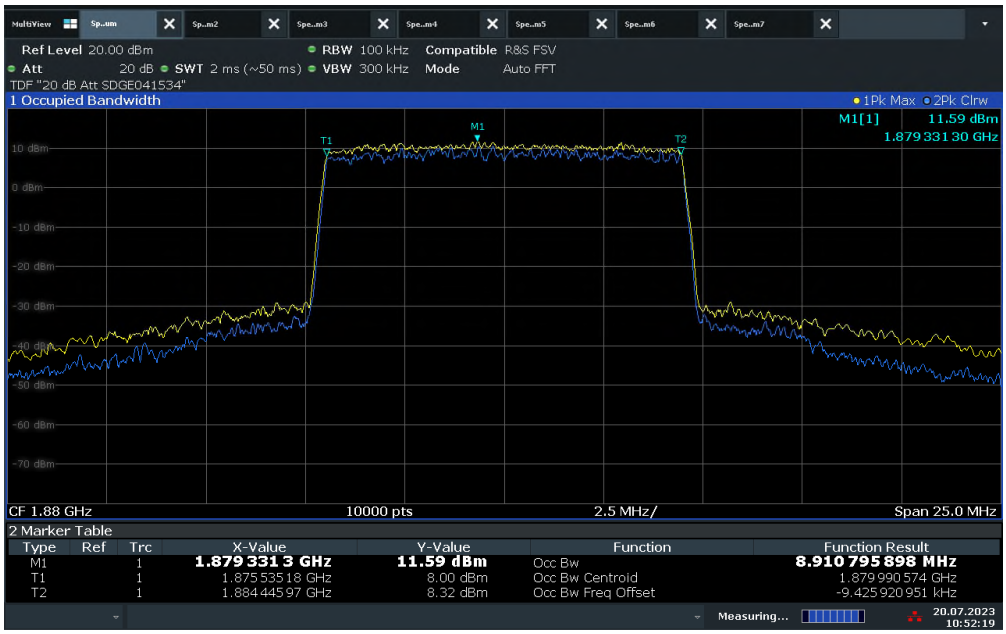
10:48:02 20.07.2023

LTE Band 2 Uplink (5 MHz BW) Mid Channel 1880 MHz -26dB BW



10:48:10 20.07.2023

LTE Band 2 Uplink (10 MHz BW) Mid Channel 1880 MHz 99% OBW



10:52:20 20.07.2023