2.10 AGC THRESHOLD LEVEL

2.10.1 Specification Reference

KDB 935210 D05, Clause 3.2

2.10.2 Standard Applicable

The AGC threshold shall be determined by applying the procedure of 3.2 (of the current KDB), but with the signal generator configured to produce representative broadband band-limited AWGN signal.

2.10.3 Equipment Under Test and Modification State

Serial No: 444002000024 (NU) and 247002000034 (CU) / Test Configuration A and B

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

Febraury 11, 2020 / XYZ

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 Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	23.2°C
Relative Humidity	32.0%
ATM Pressure	99.0kPa

2.10.7 Additional Observations

- This is a conducted test.
- LTE 20 MHz bandwidth Signal was used for LTE Band 2 and 4, and LTE Band 10 MHz bandwidth signal was used for LTE Band 12 as the applicable test signal type.
- When testing output power of the EUT, a power meter was used according to method 3.5.4 of this KDB, and a spectrum analyzer was used according to method 3.5.3 when testing input power of the EUT.
- The AGC threshold level was recorded when increasing the input level until a 1 dB increase in the input signal power no longer causes a 1 dB increase in the output signal power.
- Both downlink and uplink are tested.

2.10.8 Test Results

AGC Threshold Level						
Mode	Bandwidth (MHz)	Channel	Frequency (MHz)	Average Power		AGC Threshold Level (dBm)
				(dBm)	(W)	
LTE B2 Downlink	20	900	1960.0	23.36	0.22	-75.76
LTE B2 Uplink	20	18900	1880.0	24.23	0.26	-74.23
LTE B4 Downlink	20	2175	2132.5	23.93	0.25	-72.42
LTE B4 Uplink	20	20175	1732.5	24.33	0.27	-74.37
LTE B12 Downlink	10	5095	737.5	23.69	0.23	-71.55
LTE B12 Uplink	10	23095	707.5	24.09	0.26	-71.73

2.11 OUT-OF-BAND REJECTION

2.11.1 Specification Reference

RSS-131, Clause 5.2.1
KDB 935210 D05, Clause 3.3

2.11.2 Standard Applicable

RSS-131, Clause 5.2.1:
The gain-versus-frequency response and the 20 dB bandwidth of the zone enhancer shall be reported. The zone enhancer shall reject amplification of other signals outside the passband of the zone enhancer

2.11.3 Equipment Under Test and Modification State

Serial No: 444002000024 (NU) and 247002000034 (CU) / Test Configuration A and B

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

February 12, 2020 / ZXY

2.11.5 Test Equipment Used

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

2.11.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	22.0°C
Relative Humidity	34.4%
ATM Pressure	99.3kPa

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2.11.7 Additional Observations

- This is a conducted test.
- The path loss was measured and entered as an offset.
- A swept CW signal whose frequency range is ±250% of the manufacturer's specified pass band is configured for the testing.
- The internal gain control of the EUT is set to the maximum gain. The input signal type is set to tones.
- The CW is 3 dB below the ACG threshold (determined according to section 3.2 of the current KDB), and doesn't activate the AGC threshold throughout the test.
- Dwell time is 10 ms.
- RBW is between 1% and 5% of the manufacturer's rated pass band.
- VBW is 3 x RBW.
- Detector is peak and trace is max hold.
- The peak amplitude frequency f_0 is determined and two additional -20 dB markers are determined using the marker-delta method).
- The 20dB Bandwidth plot is recorded as the out-of-band rejection frequency response.
- Both downlink and uplink are tested.

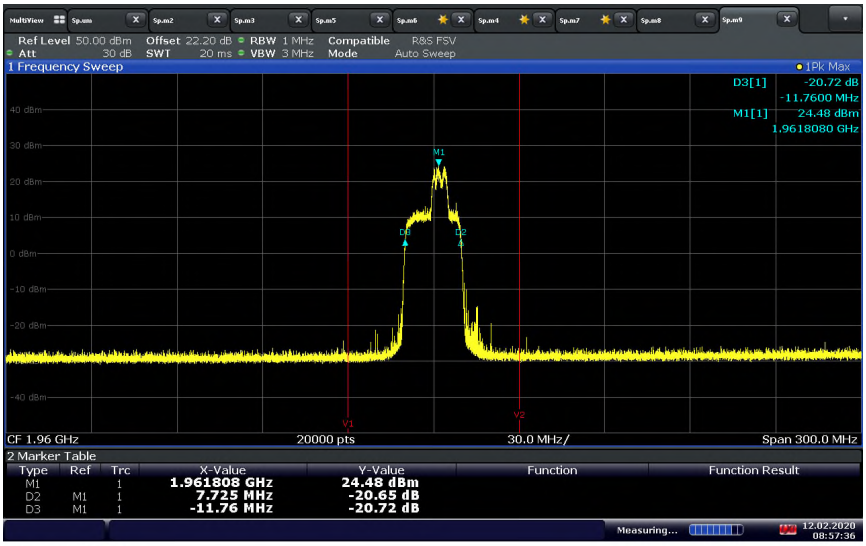
2.11.8 Test Results

LTE Band 2						
Mode	Bandwidth (MHz)	Channel	Frequency (MHz)	-20 dBc Point		20 dB BW (MHz)
				T1 (MHz)	T2 (MHz)	
Downlink	20	900	1960.0	1950.048	1969.533	19.485
Uplink	20	18900	1880.0	1869.958	1890.028	20.07

LTE Band 4 (FCC Market only)						
Mode	Bandwidth (MHz)	Channel	Frequency (MHz)	-20 dBc Point		20 dB BW (MHz)
				T1 (MHz)	T2 (MHz)	
Downlink	20	2175	2132.5	2123.151	2142.038	18.887
Uplink	20	20175	1732.5	1722.692	1772.355	19.643

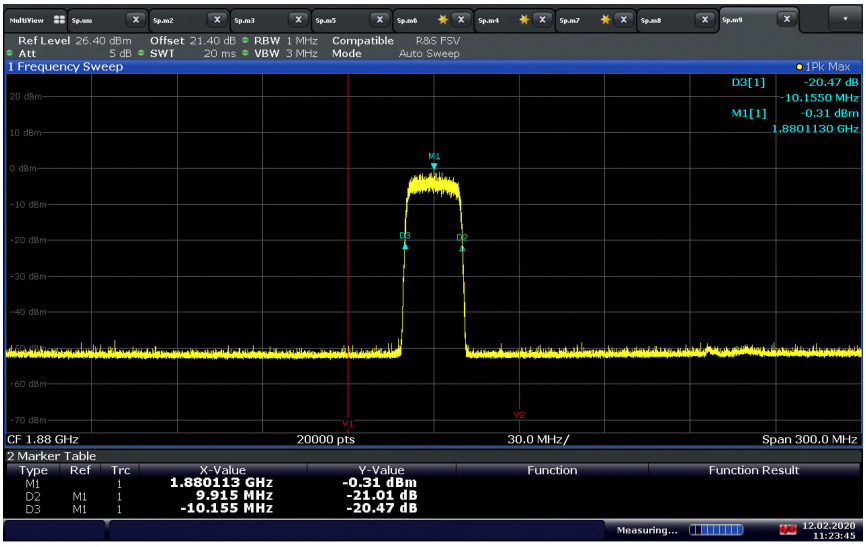
LTE Band 12						
Mode	Bandwidth (MHz)	Channel	Frequency (MHz)	-20 dBc Point		20 dB BW (MHz)
				T1 (MHz)	T2 (MHz)	
Downlink	10	5095	737.5	734.2998	742.3578	8.058
Uplink	10	23095	707.5	702.5403	712.4292	9.8889

LTE Band 2 Downlink (20 MHz BW) Middle Channel / Out-of-Band Rejection



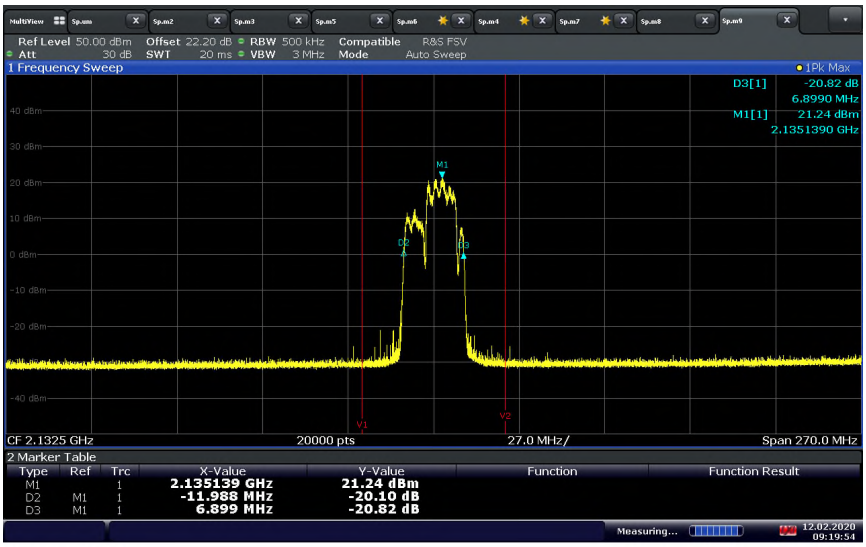
08:57:37 12.02.2020

LTE Band 2 Uplink (20 MHz BW) Middle Channel / Out-of-Band Rejection



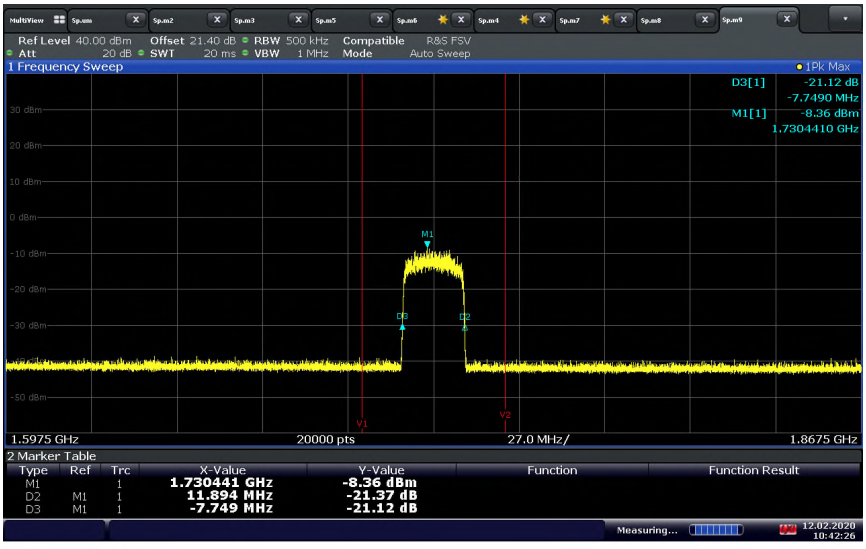
11:23:46 12.02.2020

LTE Band 4 Downlink (20 MHz BW) Middle Channel / Out-of-Band Rejection



09:19:55 12.02.2020

LTE Band 4 Uplink (20 MHz BW) Middle Channel / Out-of-Band Rejection



10:42:26 12.02.2020

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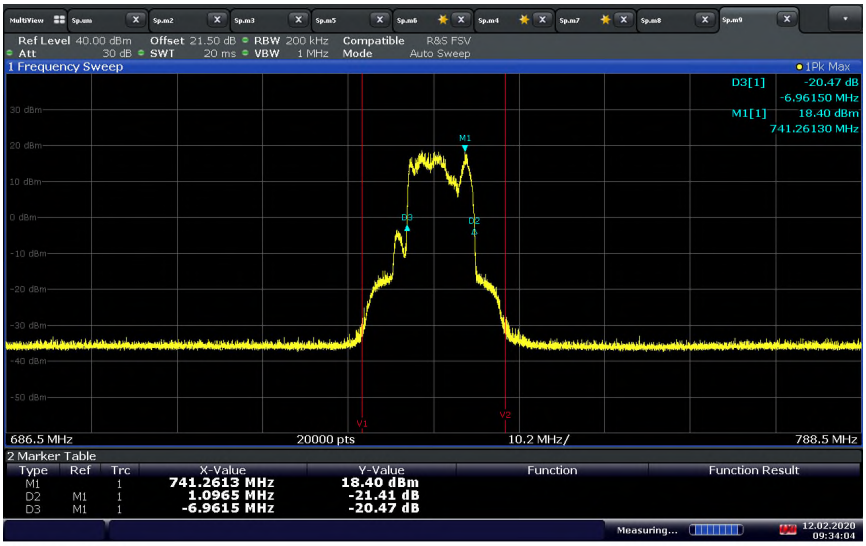
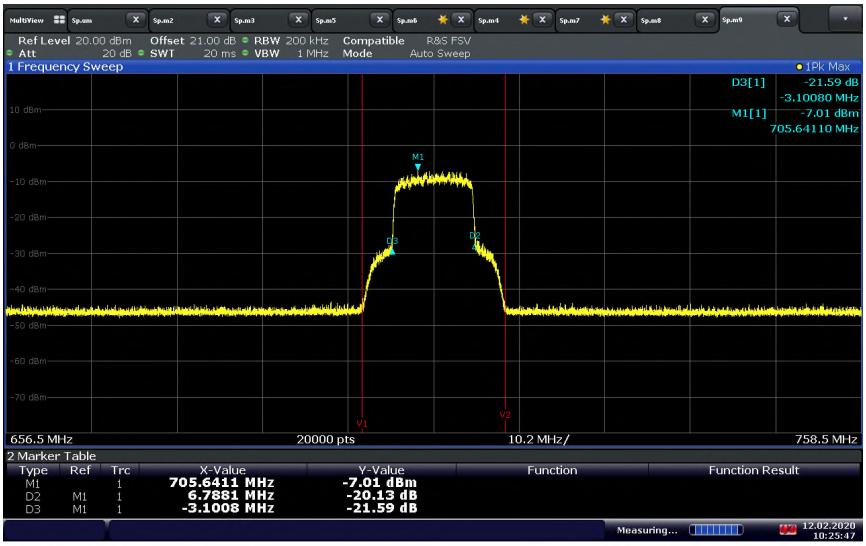
LTE Band 12 Downlink (10 MHz BW) Middle Channel / Out-of-Band Rejection



09:34:05 12.02.2020

LTE Band 12 Uplink (10 MHz BW) Middle Channel / Out-of-Band Rejection



10:25:48 12.02.2020

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2.12 INPUT-VERSUS-OUTPUT SIGNAL COMPARISON

2.12.1 Specification Reference

RSS-131, Clause 5.2.2
KDB 935210 D05, Clause 3.4

2.12.2 Standard Applicable

RSS-131, Clause 5.2.2:
The spectral growth of the 26 dB bandwidth of the output signal shall be less than 5% of the input signal spectrum.

2.12.3 Equipment Under Test and Modification State

Serial No: 444002000024 (NU) and 247002000034 (CU) / Test Configuration A and B

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

February 13, 2020 / ZXY

2.12.5 Test Equipment Used

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

2.12.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	22.0 – 23.0°C
Relative Humidity	34.4 – 40.6%
ATM Pressure	98.8 – 99.3kPa

2.12.7 Additional Observations

- The path loss was measured and entered as an offset.
- The signal generator is configured to transmit LTE 20 MHz Bandwidth signal for LTE Band 2 and 4, and LTE 10 MHz Bandwidth signal for LTE Band 12.
- The signal amplitude is just below the ACG threshold (determined according to section 3.2 of the current KDB), and not more than 0.5 dB below.
- Span is between 2 times to 5 times the emission bandwidth (EBW) or alternatively, the OBW.
- RBW is 1% to 5% of the anticipated OBW, VBW is > 3 x RBW.
- Set the reference level of spectrum analyzer to accommodate the maximum input amplitude level.
- The noise floor of the spectrum analyzer is at least 36 dB below the reference level.
- Detector is positive peak and trace is max hold.
- The peak amplitude frequency f0 is determined and the 99% occupied bandwidth was measured with the OBW function of spectrum analyzer.
- Repeat the testing with the input signal connected directly to the spectrum analyzer.
- Compare the spectral plot of the input signal to the output signal.
- Repeat the testing with input signal amplitude set to 3 dB above AGC threshold.
- Both downlink and uplink are tested.

2.12.8 Test Results

Compliant. There is no spectral growth of 26 dB bandwidth is less than 5% of the input signal spectrum.

LTE Band 2 Downlink							
Signal Level	Bandwidth (MHz)	Channel	Frequency (MHz)	99% OBW (MHz)		-26 dB BW (MHz)	
				Output	Input*	Output	Input*
AGC Threshold Level	20	900	1960.0	17.79	17.91	19.38	19.65
AGC + 3 dB Level				17.76	17.91	19.35	19.65

* Since the AGC Threshold level and AGC + 3 dB level for downlink are as low as -80 dBm, which is about the noise floor, the input levels are adjusted in order to get the right input 99% OBW and -26 dB BW when testing.

LTE Band 2 Uplink							
Signal Level	Bandwidth (MHz)	Channel	Frequency (MHz)	99% OBW (MHz)		-26 dB BW (MHz)	
				Output	Input*	Output	Input*
AGC Threshold Level	20	18900	1880.0	17.79	17.86	19.02	19.71
AGC + 3 dB Level				17.81	17.86	19.02	19.71

* Since the AGC Threshold level and AGC + 3 dB level for downlink are as low as -80 dBm, which is about the noise floor, the input levels are adjusted in order to get the right input 99% OBW and -26 dB BW when testing.

LTE Band 4 Downlink (FCC Market only)							
Signal Level	Bandwidth (MHz)	Channel	Frequency (MHz)	99% OBW (MHz)		-26 dB BW (MHz)	
				Output	Input*	Output	Input*
AGC Threshold Level	20	2175	2132.5	17.68	17.88	18.93	19.71
AGC + 3 dB Level				17.71	17.88	19.20	19.71

* Since the AGC Threshold level and AGC + 3 dB level for downlink are as low as -80 dBm, which is about the noise floor, the input levels are adjusted in order to get the right input 99% OBW and -26 dB BW when testing.

LTE Band 4 Uplink (FCC Market only)							
Signal Level	Bandwidth (MHz)	Channel	Frequency (MHz)	99% OBW (MHz)		-26 dB BW (MHz)	
				Output	Input*	Output	Input*
AGC Threshold Level	20	20175	1732.5	17.77	17.90	18.90	19.65
AGC + 3 dB Level				17.74	17.90	18.88	19.65

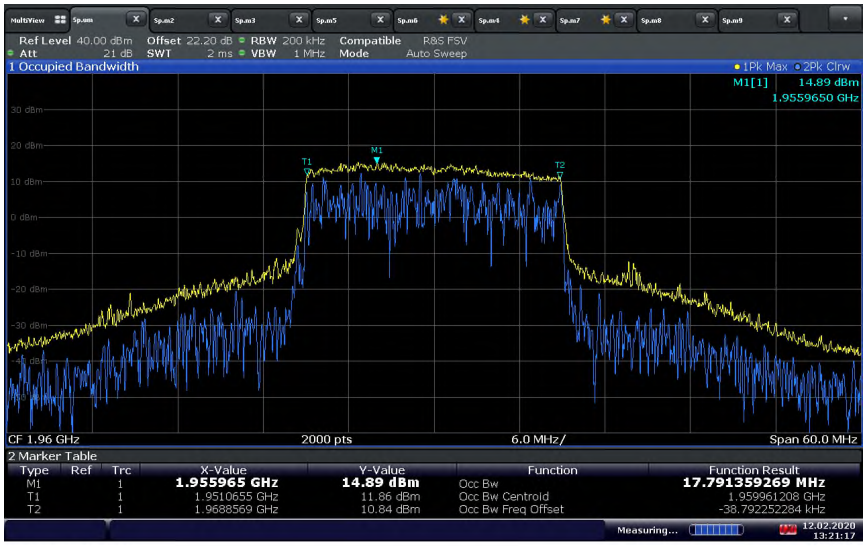
* Since the AGC Threshold level and AGC + 3 dB level for downlink are as low as -80 dBm, which is about the noise floor, the input levels are adjusted in order to get the right input 99% OBW and -26 dB BW when testing.

LTE Band 12 Downlink							
Signal Level	Bandwidth (MHz)	Channel	Frequency (MHz)	99% OBW (MHz)		-26 dB BW (MHz)	
				Output	Input*	Output	Input*
AGC Threshold Level	10	5095	737.5	9.02	8.98	9.68	9.96
AGC + 3 dB Level				8.99	8.98	9.71	9.96

* Since the AGC Threshold level and AGC + 3 dB level for downlink are as low as -80 dBm, which is about the noise floor, the input levels are adjusted in order to get the right input 99% OBW and -26 dB BW when testing.

LTE Band 12 Uplink							
Signal Level	Bandwidth (MHz)	Channel	Frequency (MHz)	99% OBW (MHz)		-26 dB BW (MHz)	
				Output	Input*	Output	Input*
AGC Threshold Level	10	23095	707.5	8.87	8.97	9.51	9.88
AGC + 3 dB Level				8.86	8.97	9.51	9.88

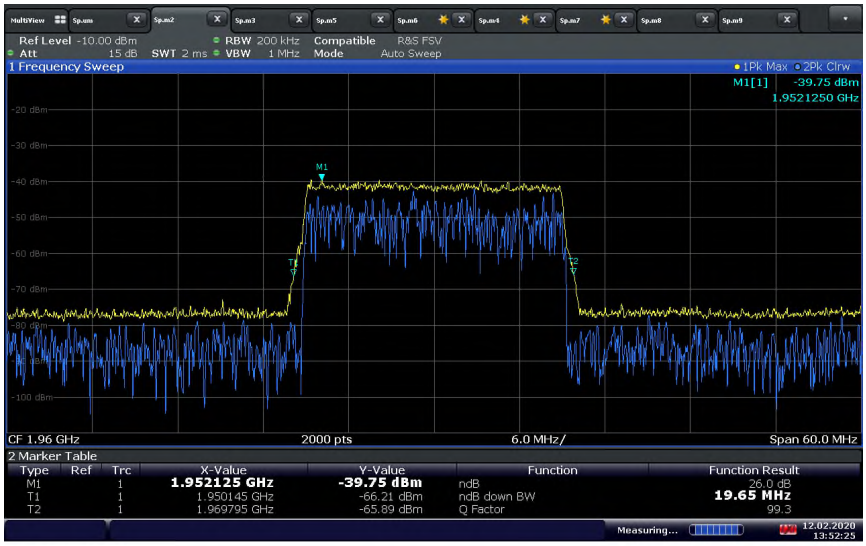
* Since the AGC Threshold level and AGC + 3 dB level for downlink are as low as -80 dBm, which is about the noise floor, the input levels are adjusted in order to get the right input 99% OBW and -26 dB BW when testing.

LTE Band 2 Downlink (20 MHz BW) Mid Channel / 99% OBW at Output port with Input signal at AGC Threshold Level
 13:21:18 12.02.2020
LTE Band 2 Downlink (20 MHz BW) Mid Channel / 99% OBW at Input port (Adjusted Level)
 13:39:14 12.02.2020

LTE Band 2 Downlink (20 MHz BW) Mid Channel / 26 dB BW at Output port with Input signal at AGC Threshold Level

13:21:44 12.02.2020

LTE Band 2 Downlink (20 MHz BW) Mid Channel / 26 dB BW at Input port (Adjusted Level)



13:52:26 12.02.2020

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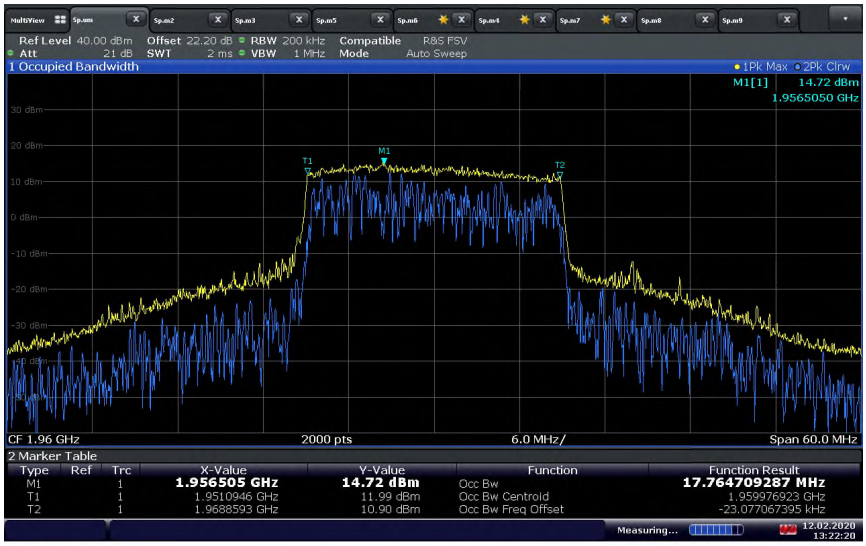
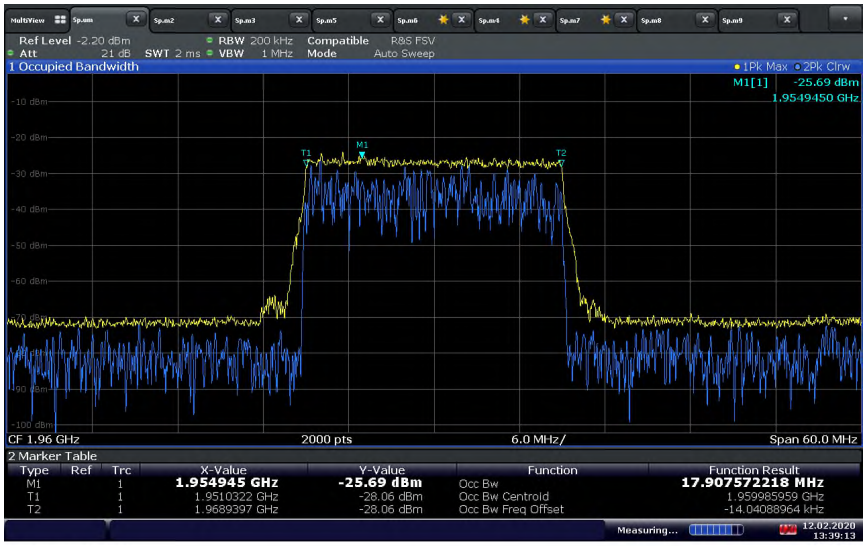
LTE Band 2 Downlink (20 MHz BW) Mid Channel / 99% OBW at Output port with Input signal at AGC + 3 dB Level



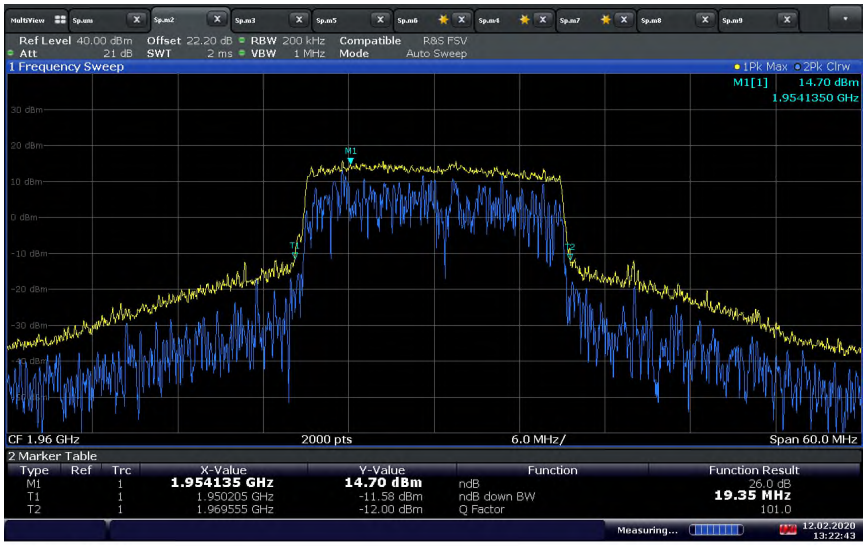
13:22:21 12.02.2020

LTE Band 2 Downlink (20 MHz BW) Mid Channel / 99% OBW at Input port (Adjusted Level)



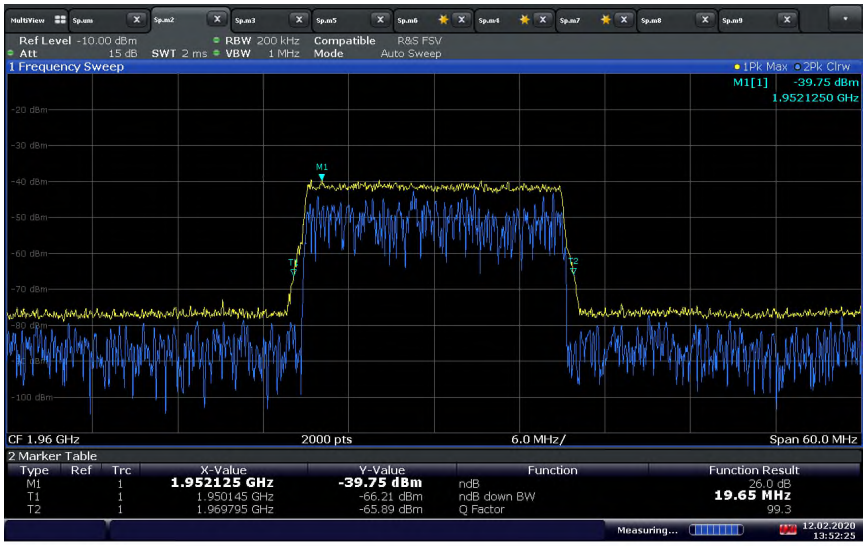
13:39:14 12.02.2020

LTE Band 2 Downlink (20 MHz BW) Mid Channel / 26 dB BW at Output port with Input signal at AGC + 3 dB Level



13:22:44 12.02.2020

LTE Band 2 Downlink (20 MHz BW) Mid Channel / 26 dB BW at Input port (Adjusted Level)



13:52:26 12.02.2020

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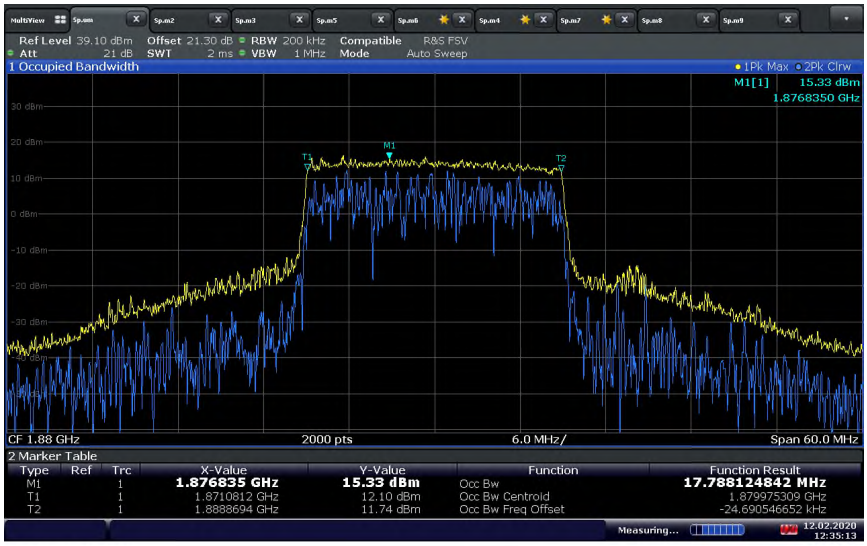
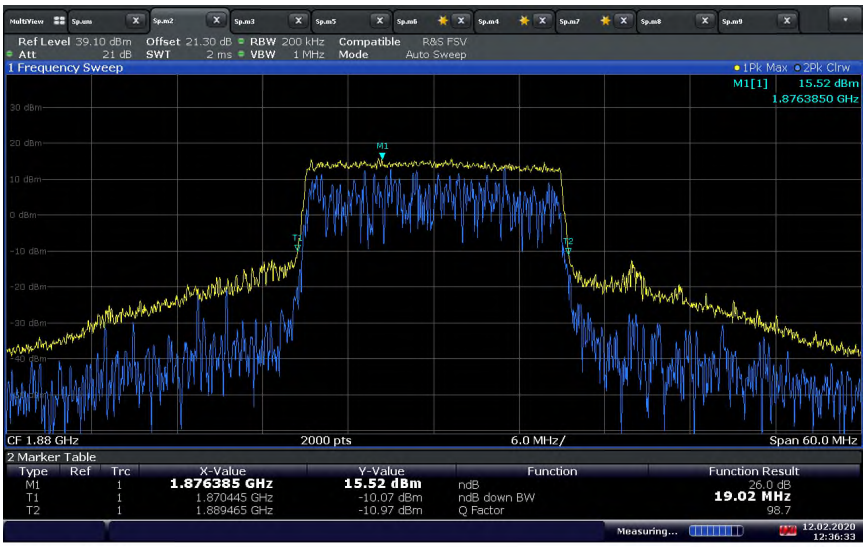
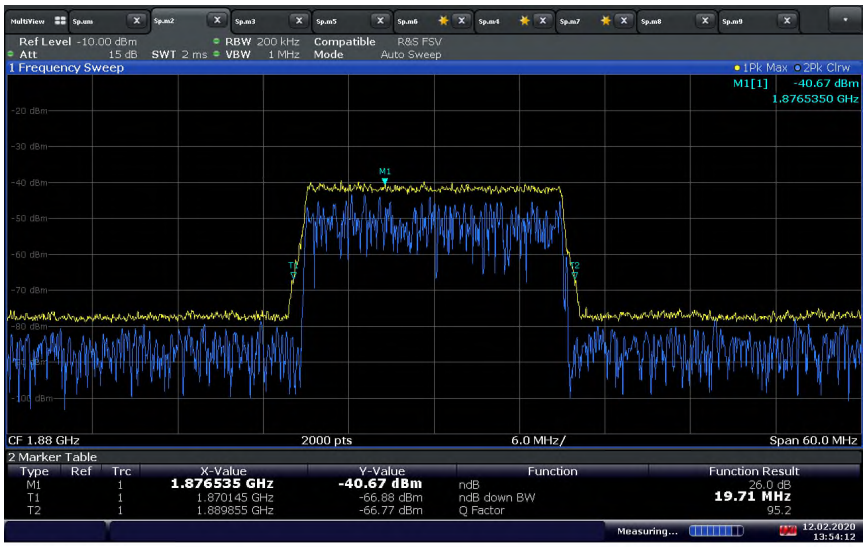
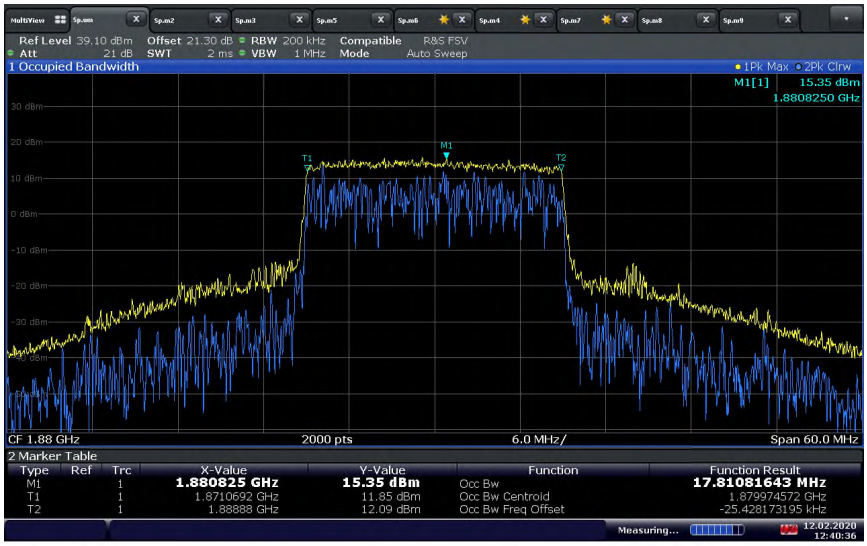
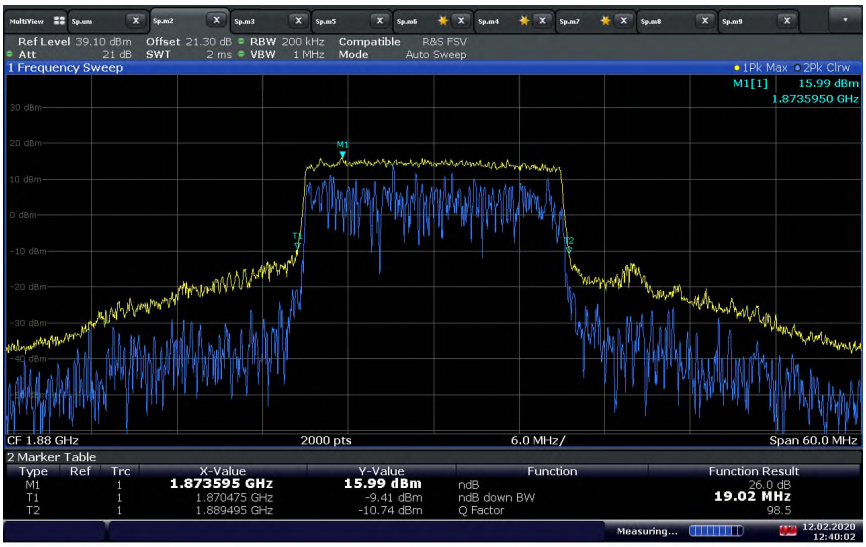
LTE Band 2 Uplink (20 MHz BW) Mid Channel / 99% OBW at Output port with Input signal at AGC Threshold Level
   12:35:14 12.02.2020
LTE Band 2 Uplink (20 MHz BW) Mid Channel / 99% OBW at Input port (Adjusted Level)
   13:40:48 12.02.2020

LTE Band 2 Uplink (20 MHz BW) Mid Channel / 26 dB BW at Output port with Input signal at AGC Threshold Level
 12:36:34 12.02.2020
LTE Band 2 Uplink (20 MHz BW) Mid Channel / 26 dB BW at Input port (Adjusted Level)
 13:54:13 12.02.2020

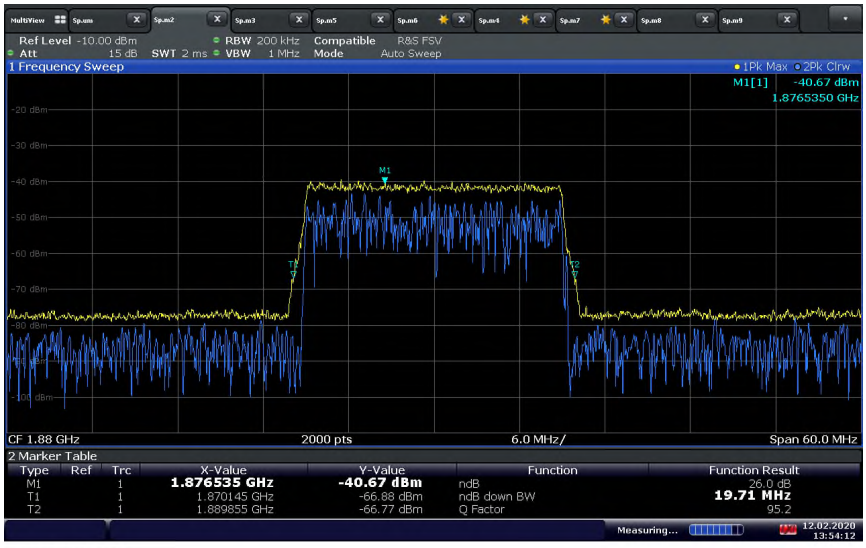
LTE Band 2 Uplink (20 MHz BW) Mid Channel / 99% OBW at Output port with Input signal at AGC + 3 dB Level
 12:40:36 12.02.2020
LTE Band 2 Uplink (20 MHz BW) Mid Channel / 99% OBW at Input port (Adjusted Level)
 13:40:48 12.02.2020

LTE Band 2 Uplink (20 MHz BW) Mid Channel / 26 dB BW at Output port with Input signal at AGC + 3 dB Level



12:40:03 12.02.2020

LTE Band 2 Uplink (20 MHz BW) Mid Channel / 26 dB BW at Input port (Adjusted Level)



13:54:13 12.02.2020

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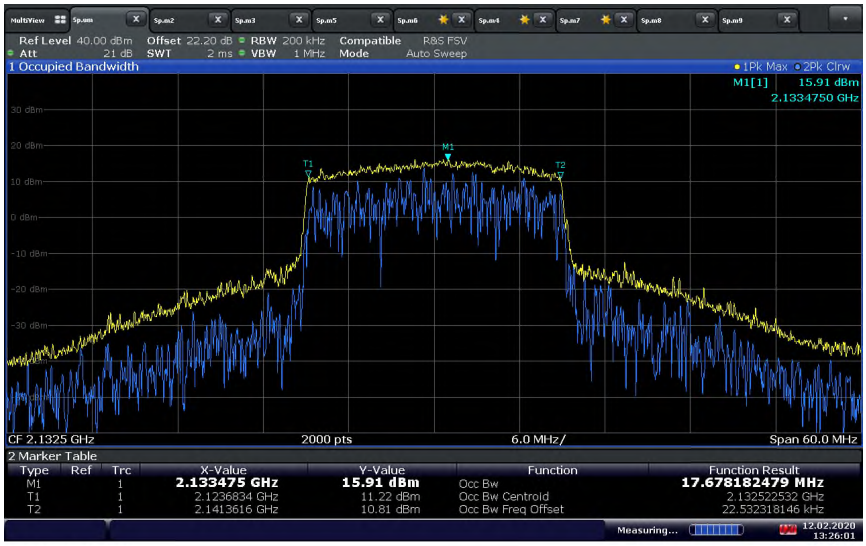
LTE Band 4 Downlink (20 MHz BW) Mid Channel / 99% OBW at Output port with Input signal at AGC Threshold Level
 13:26:01 12.02.2020
LTE Band 4 Downlink (20 MHz BW) Mid Channel / 99% OBW at Input port (Adjusted Level)
 13:35:56 12.02.2020

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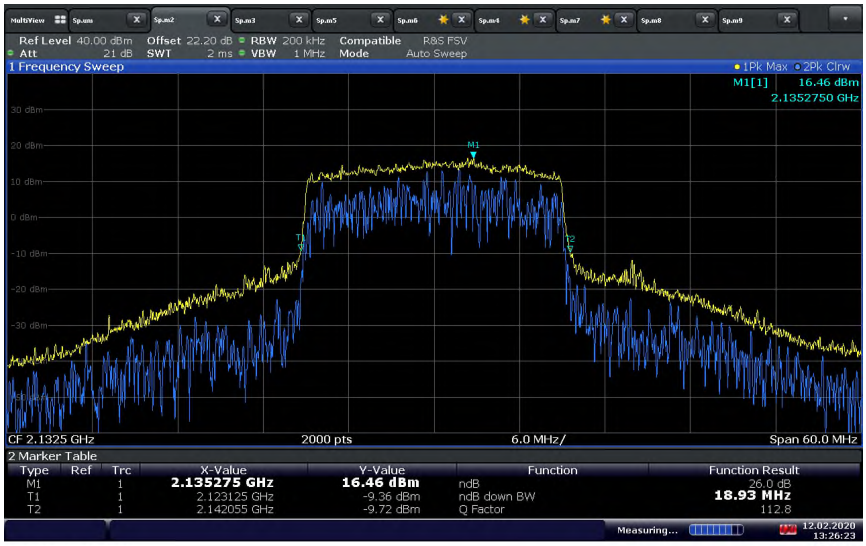
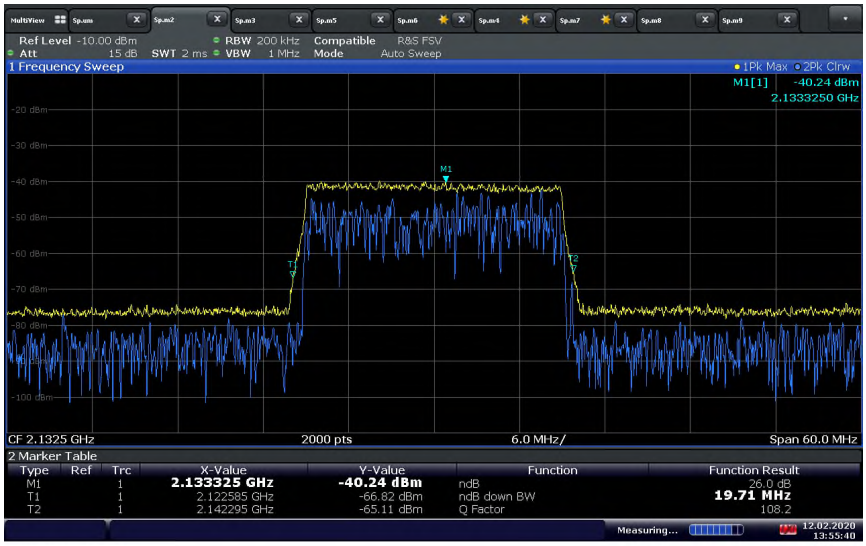
LTE Band 4 Downlink (20 MHz BW) Mid Channel / 26 dB BW at Output port with Input signal at AGC Threshold Level



13:26:23 12.02.2020

LTE Band 4 Downlink (20 MHz BW) Mid Channel / 26 dB BW at Input port (Adjusted Level)



13:55:40 12.02.2020

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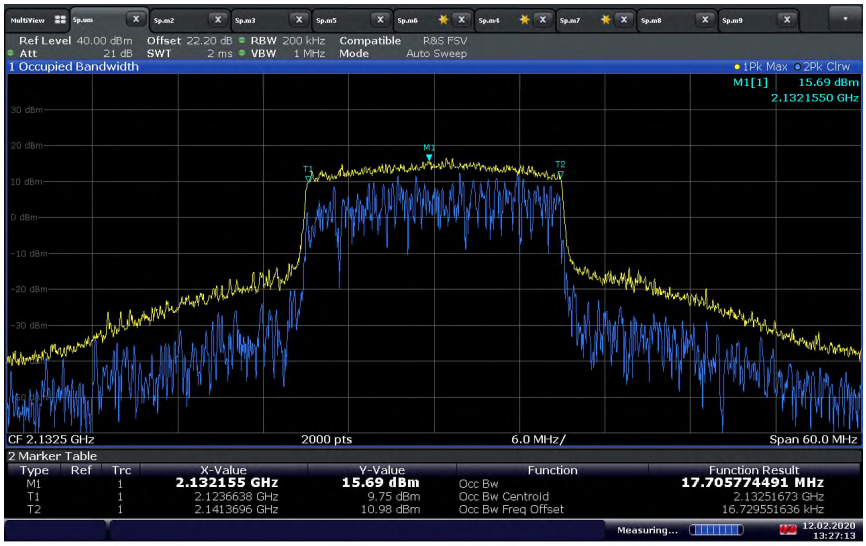
LTE Band 4 Downlink (20 MHz BW) Mid Channel / 99% OBW at Output port with Input signal at AGC + 3 dB Level

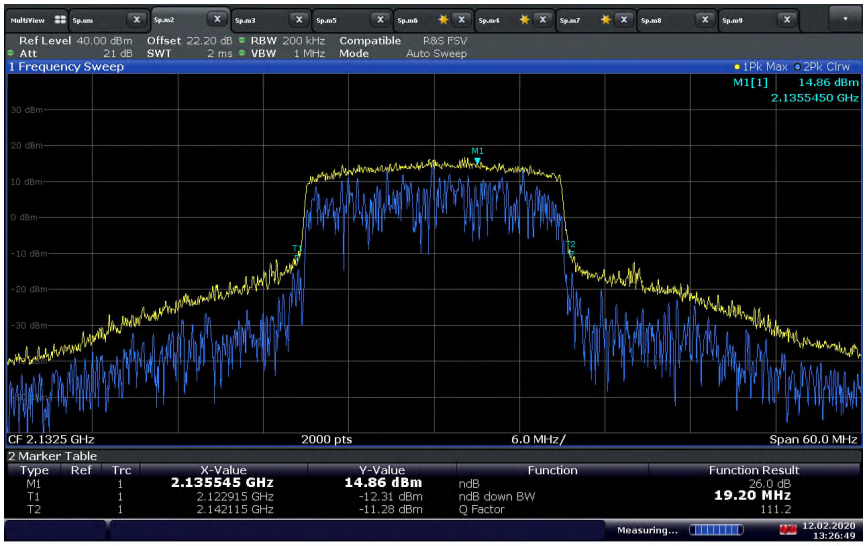


13:27:14 12.02.2020

LTE Band 4 Downlink (20 MHz BW) Mid Channel / 99% OBW at Input port (Adjusted Level)

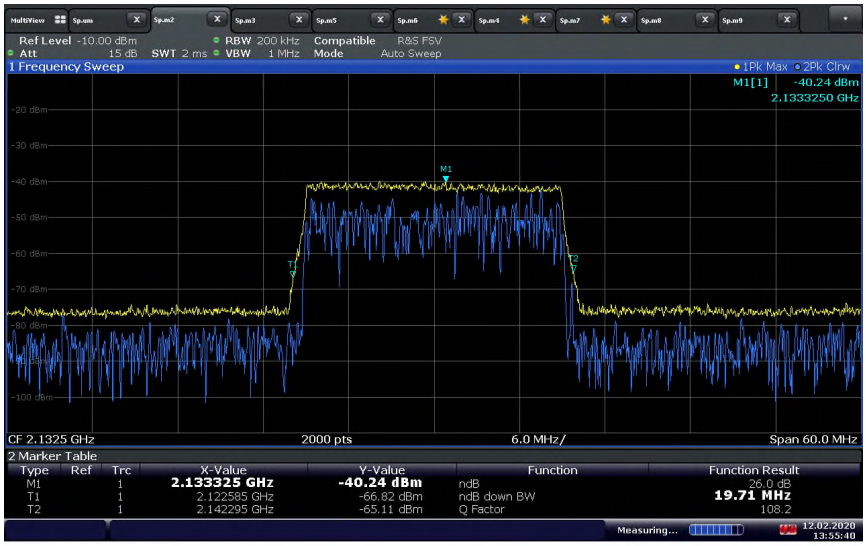
13:35:56 12.02.2020

LTE Band 4 Downlink (20 MHz BW) Mid Channel / 26 dB BW at Output port with Input signal at AGC + 3 dB Level



13:26:49 12.02.2020

LTE Band 4 Downlink (20 MHz BW) Mid Channel / 26 dB BW at Input port (Adjusted Level)



13:55:40 12.02.2020

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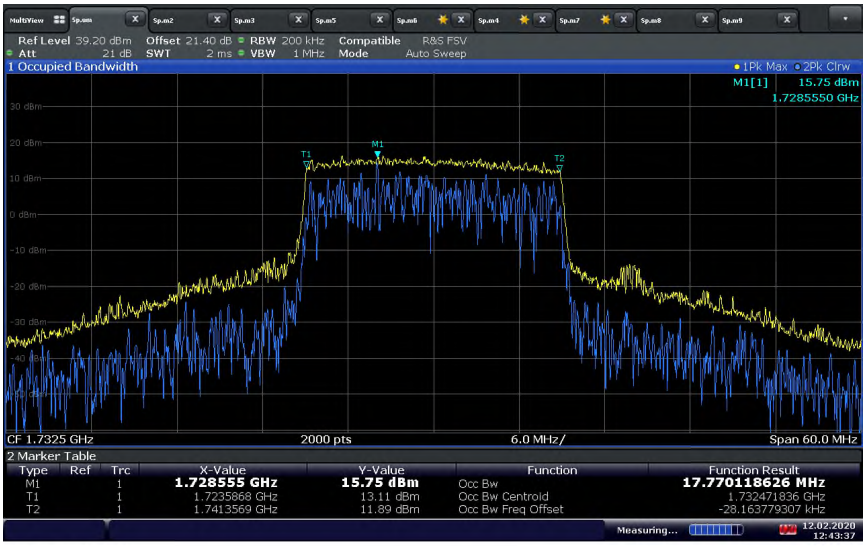
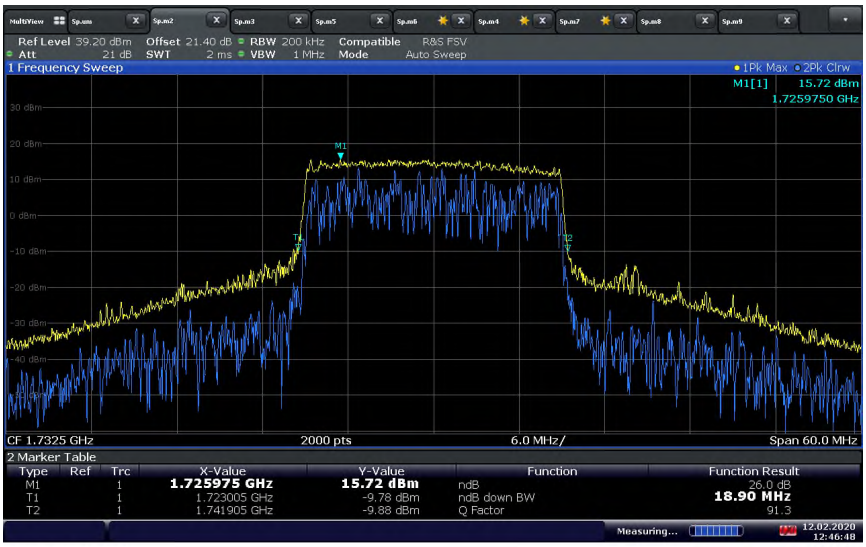
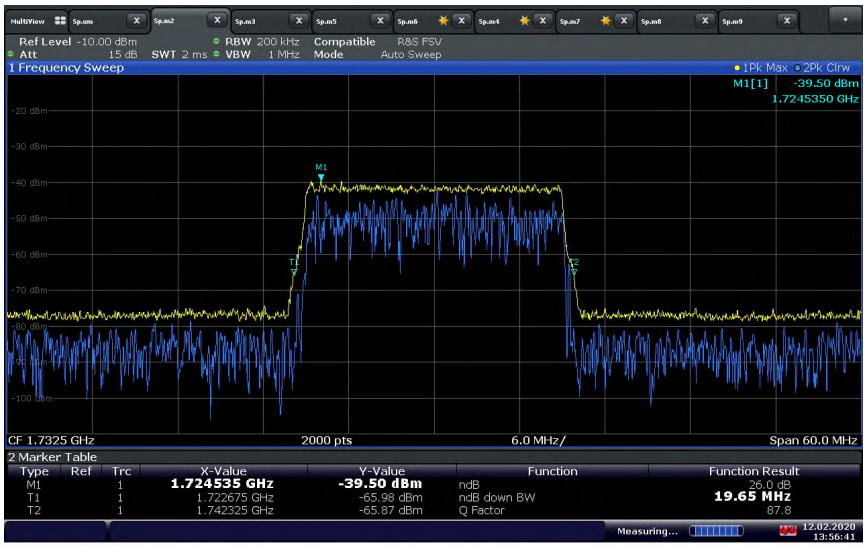
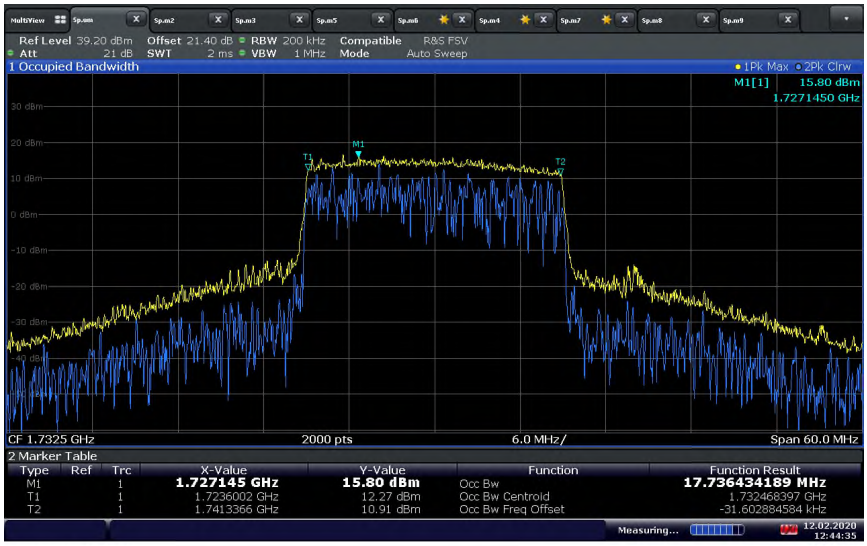
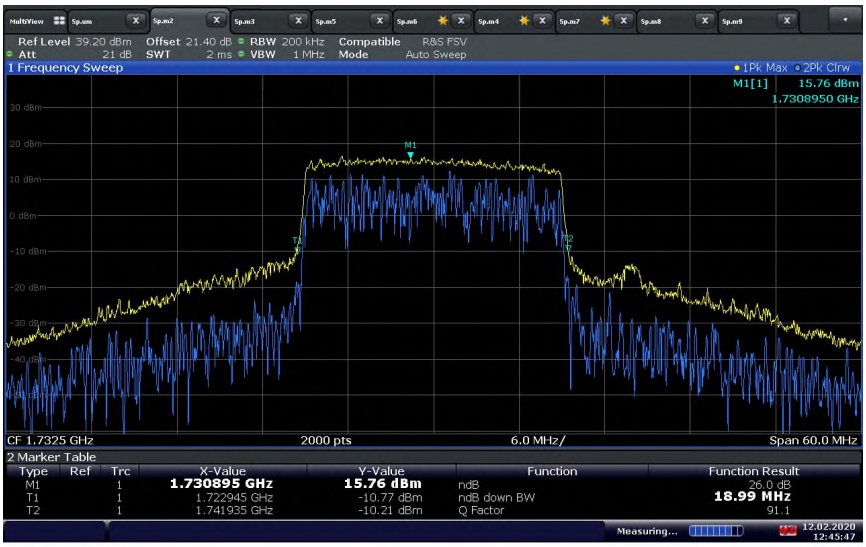
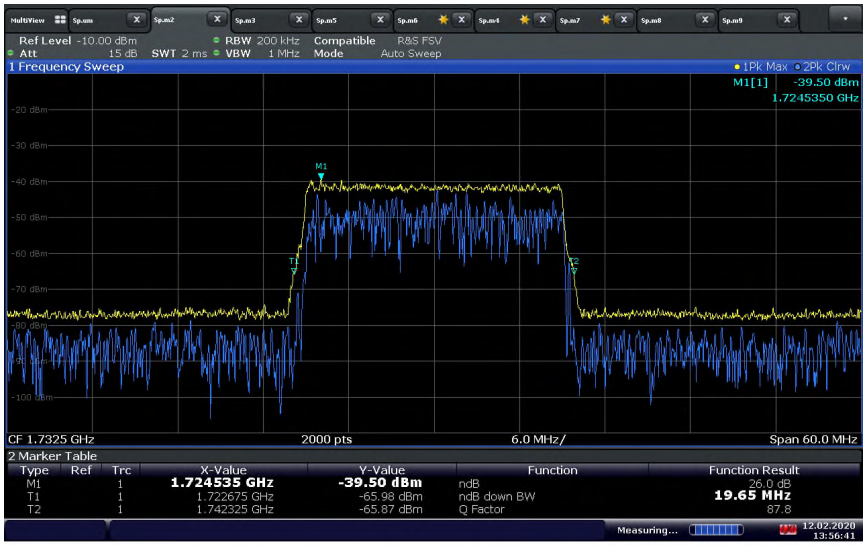
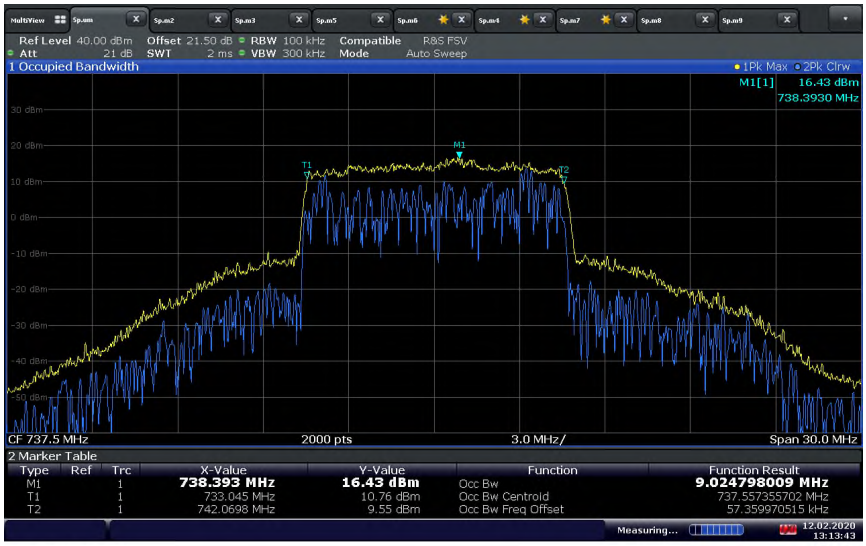
LTE Band 4 Uplink (20 MHz BW) Mid Channel / 99% OBW at Output port with Input signal at AGC Threshold Level
 12:43:37 12.02.2020
LTE Band 4 Uplink (20 MHz BW) Mid Channel / 99% OBW at Input port (Adjusted Level)
 13:42:40 12.02.2020

LTE Band 4 Uplink (20 MHz BW) Mid Channel / 26 dB BW at Output port with Input signal at AGC Threshold Level
 12:46:48 12.02.2020
LTE Band 4 Uplink (20 MHz BW) Mid Channel / 26 dB BW at Input port (Adjusted Level)
 13:56:41 12.02.2020

LTE Band 4 Uplink (20 MHz BW) Mid Channel / 99% OBW at Output port with Input signal at AGC + 3 dB Level
 12:44:36 12.02.2020
LTE Band 4 Uplink (20 MHz BW) Mid Channel / 99% OBW at Input port (Adjusted Level)
 13:42:40 12.02.2020

LTE Band 4 Uplink (20 MHz BW) Mid Channel / 26 dB BW at Output port with Input signal at AGC + 3 dB Level
 12:45:48 12.02.2020
LTE Band 4 Uplink (20 MHz BW) Mid Channel / 26 dB BW at Input port (Adjusted Level)
 13:56:41 12.02.2020

LTE Band 12 Downlink (10 MHz BW) Mid Channel / 99% OBW at Output port with Input signal at AGC Threshold Level

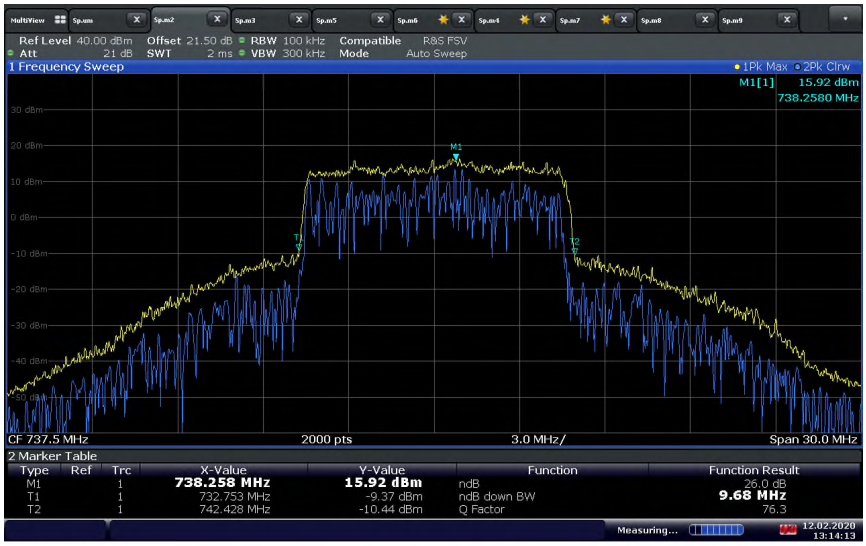


13:13:43 12.02.2020

LTE Band 12 Downlink (10 MHz BW) Mid Channel / 99% OBW at Input port (Adjusted Level)

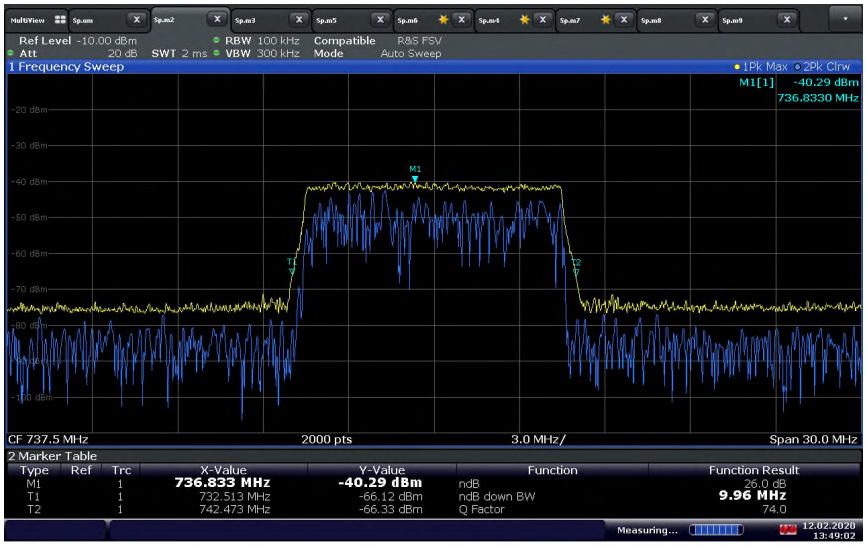
13:46:18 12.02.2020

LTE Band 12 Downlink (10 MHz BW) Mid Channel / 26 dB BW at Output port with Input signal at AGC Threshold Level



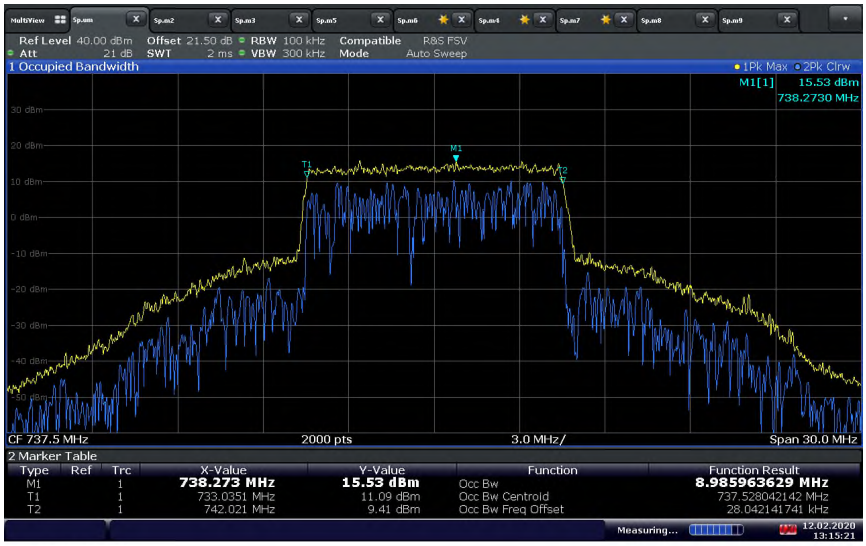
13:14:14 12.02.2020

LTE Band 12 Downlink (10 MHz BW) Mid Channel / 26 dB BW at Input port (Adjusted Level)



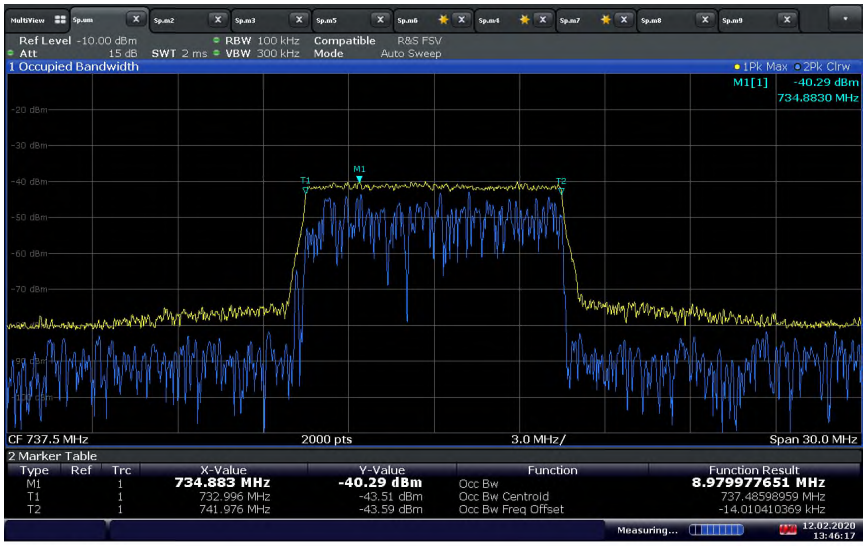
13:49:03 12.02.2020

LTE Band 12 Downlink (10 MHz BW) Mid Channel / 99% OBW at Output port with Input signal at AGC + 3 dB Level



13:15:22 12.02.2020

LTE Band 12 Downlink (10 MHz BW) Mid Channel / 99% OBW at Input port (Adjusted Level)



13:46:18 12.02.2020

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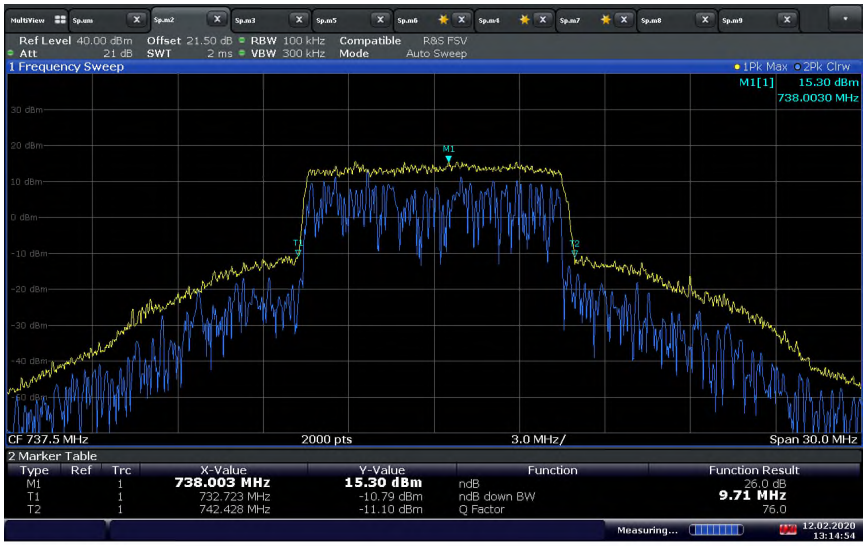
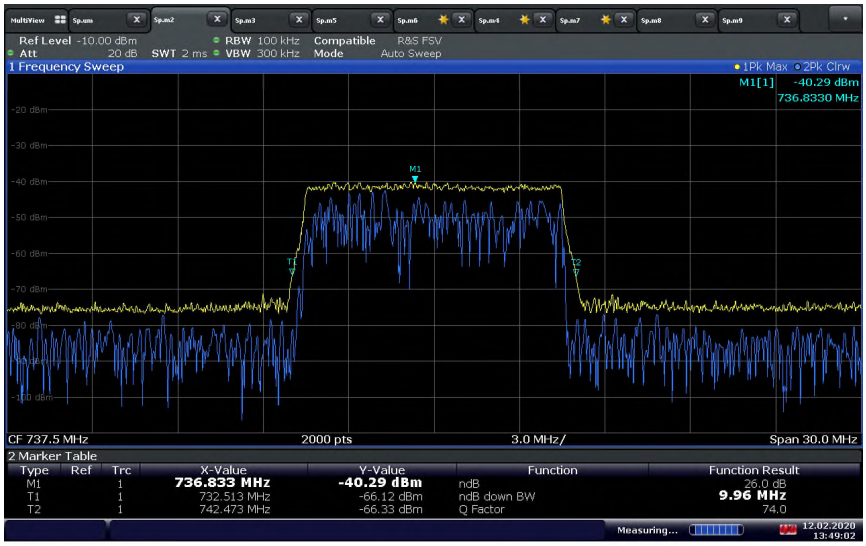
LTE Band 12 Downlink (10 MHz BW) Mid Channel / 26 dB BW at Output port with Input signal at AGC + 3 dB Level



13:14:55 12.02.2020

LTE Band 12 Downlink (10 MHz BW) Mid Channel / 26 dB BW at Input port (Adjusted Level)



13:49:03 12.02.2020

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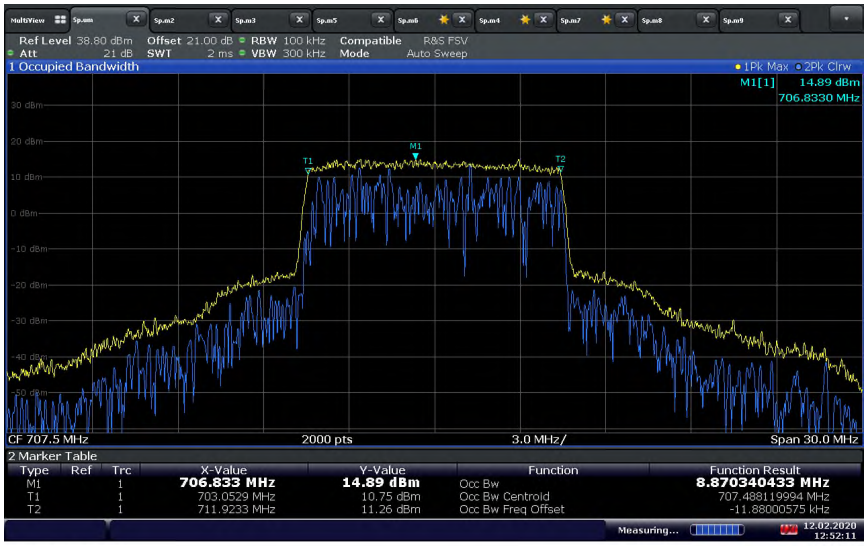
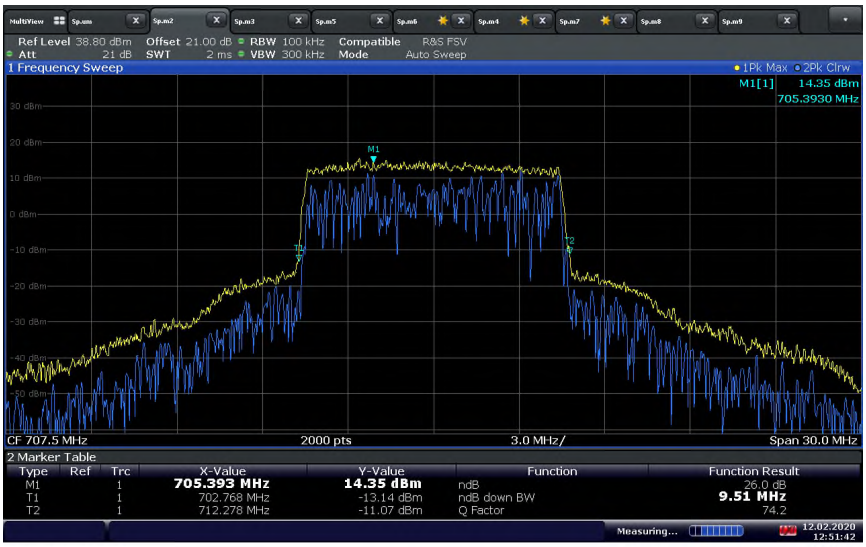
LTE Band 12 Uplink (10 MHz BW) Mid Channel / 99% OBW at Output port with Input signal at AGC Threshold Level



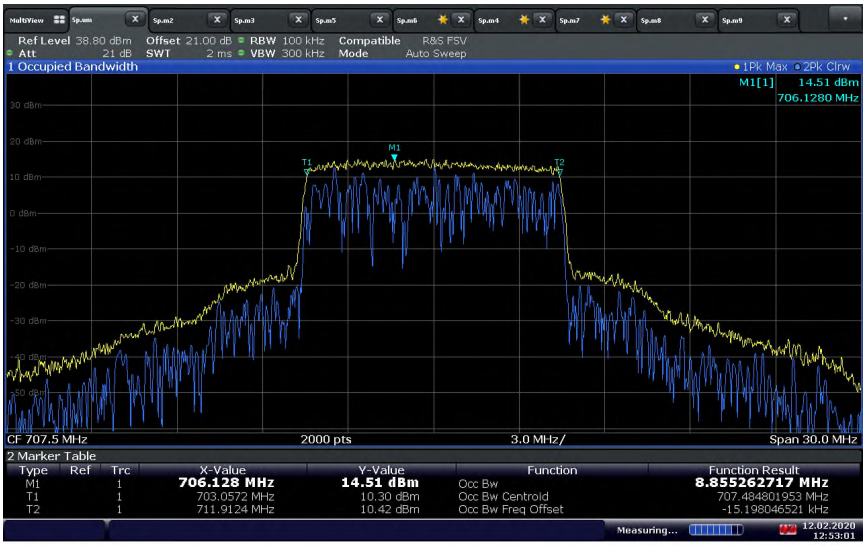
12:52:12 12.02.2020

LTE Band 12 Uplink (10 MHz BW) Mid Channel / 99% OBW at Input port (Adjusted Level)

13:50:05 12.02.2020

LTE Band 12 Uplink (10 MHz BW) Mid Channel / 26 dB BW at Output port with Input signal at AGC Threshold Level
 12:51:43 12.02.2020
LTE Band 12 Uplink (10 MHz BW) Mid Channel / 26 dB BW at Input port (Adjusted Level)
 13:50:39 12.02.2020

LTE Band 12 Uplink (10 MHz BW) Mid Channel / 99% OBW at Output port with Input signal at AGC + 3 dB Level



12:53:01 12.02.2020

LTE Band 12 Uplink (10 MHz BW) Mid Channel / 99% OBW at Input port (Adjusted Level)

13:50:05 12.02.2020

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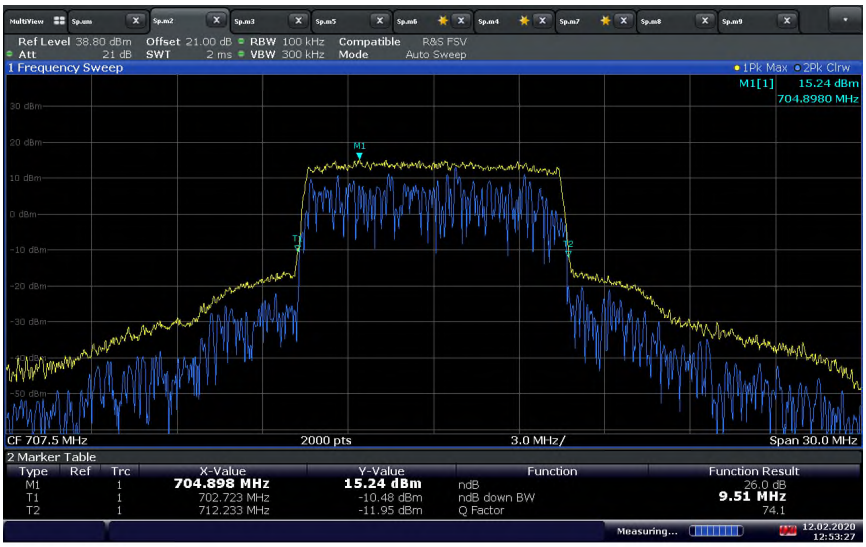
LTE Band 12 Uplink (10 MHz BW) Mid Channel / 26 dB BW at Output port with Input signal at AGC + 3 dB Level



12:53:28 12.02.2020

LTE Band 12 Uplink (10 MHz BW) Mid Channel / 26 dB BW at Input port (Adjusted Level)

13:50:39 12.02.2020

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2.13 MEAN OUTPUT POWER AND AMPLIFIER/BOOSTER GAIN

2.13.1 Specification Reference

RSS-131, Clause 5.2.3
KDB 935210 D05, Clause 3.5

2.13.2 Standard Applicable

RSS-131, Clause 5.2.3:
The zone enhancer gain shall not exceed the nominal gain by more than 1.0 dB.

2.13.3 Equipment Under Test and Modification State

Serial No: 444002000024 (NU) and 247002000034 (CU) / Test Configuration A and B

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

February 12, 2020 / ZXY

2.13.5 Test Equipment Used

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

2.13.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	22.0°C
Relative Humidity	34.4%
ATM Pressure	99.3kPa

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2.13.7 Additional Observations

- This is a conducted test.
- The path loss was measured and entered as an offset.
- The internal gain control of the EUT is adjusted to the maximum gain.
- The input power levels (uplink and downlink) are set to maximum input ratings, and confirm the device is not capable of operating in saturation (non-linear mode) during the test.
- The signal generator is configured to LTE 20 MHz bandwidth signal for LTE Band 2 and 4, and LTE 10 MHz signal for LTE Band 12. A spectrum analyzer was used to measure the power according to KDB 935210 D05 clause 3.5.3.
- Both downlink and uplink are tested.

2.13.8 Test Results

Compliant. The booster gain does not exceed the nominal gain by more than 1.0 dB.

Input and Output Power and Gain						
Mode	**Bandwidth (MHz)**	**Channel**	**Frequency (MHz)**	**AGC Threshold Input (dBm)**	**Output Power (dBm)**	**Booster Gain (dB)**
LTE B2 Downlink	20	900	1960.0	-75.76	23.49	99.25
LTE B2 Uplink	20	18900	1880.0	-74.23	23.31	97.54
LTE B4 Downlink	20	2175	2132.5	-72.42	24.05	96.47
LTE B4 Uplink	20	20175	1732.5	-74.37	23.38	97.75
LTE B12 Downlink	10	5095	737.5	-71.01	23.92	94.93
LTE B12 Uplink	10	23095	707.5	-71.73	23.13	94.86

Input and Output Power and Gain						
Mode	**Bandwidth (MHz)**	**Channel**	**Frequency (MHz)**	**AGC Threshold + 3dB Input (dBm)**	**Output Power (dBm)**	**Booster Gain (dB)**
LTE B2 Downlink	20	900	1960.0	-73.16	23.46	96.62
LTE B2 Uplink	20	18900	1880.0	-71.50	23.32	94.82
LTE B4 Downlink	20	2175	2132.5	-69.58	24.01	93.59
LTE B4 Uplink	20	20175	1732.5	-71.65	23.41	95.06
LTE B12 Downlink	10	5095	737.5	-67.65	24.08	91.73
LTE B12 Uplink	10	23095	707.5	-68.75	23.09	91.84

Limit	
Band	**System Gain (dB)**
LTE Band 2, 4	100
LTE Band 12	95

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