2.12 EMISSION MASK AND ADJACENT CHANNEL POWER

2.12.1 Specification Reference

FCC 47 CFR Part 90, Clause 90.210
FCC 47 CFR Part 90, Clause 90.219 (e)(4)(iii)
FCC 47 CFR Part 90, Clause 90.543(a)
RSS-119, Clause 5.8.9
KDB 935210 D05, Clause 4.4

2.12.2 Standard Applicable

FCC Part 90.219 (e)(4):
(iii) The retransmitted signals continue to meet the unwanted emissions limits of § 90.210 applicable to the corresponding received signals (assuming that these received signals meet the applicable unwanted emissions limits by a reasonable margin).

FCC Part 90.210:

APPLICABLE EMISSION MASKS

Frequency band (MHz)	Mask for equipment with audio low pass filter	Mask for equipment without audio low pass filter
Below 25[1]	A or B	A or C
25–50	B	C
72–76	B	C
150–174[2]	B, D, or E	C, D or E
150 paging only	B	C
220–222	F	F
421–512[2 5]	B, D, or E	C, D, or E
450 paging only	B	G
806–809/851–854[6]	B	H
809–824/854–869[3 5]	B	G
896–901/935–940	I	J
902–928	K	K
929–930	B	G
4940–4990 MHz	L or M	L or M
5850–5925[4].		
All other bands	B	C

[1] Equipment using single sideband J3E emission must meet the requirements of Emission Mask A. Equipment using other emissions must meet the requirements of Emission Mask B or C, as applicable.
[2] Equipment designed to operate with a 25 kHz channel bandwidth must meet the requirements of Emission Mask B or C, as applicable. Equipment designed to operate with a 12.5 kHz channel bandwidth must meet the requirements of Emission Mask D, and equipment designed to operate with a 6.25 kHz channel bandwidth must meet the requirements of Emission Mask E.
[3] Equipment used in this licensed to EA or non-EA systems shall comply with the emission mask provisions of § 90.691 of this chapter.
[4] DSRCS Roadside Units equipment in the 5850–5925 MHz band is governed under subpart M of this part.
[5] Equipment may alternatively meet the Adjacent Channel Power limits of § 90.221.
[6] Transmitters utilizing analog emissions that are equipped with an audio low-pass filter must meet Emission Mask B. All transmitters utilizing digital emissions and those transmitters using analog emissions without an audio low-pass filter must meet Emission Mask H.

(c) *Emission Mask C*. For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:
1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5 kHz, but not more than 10 kHz: at least 83 log(f_d/5) dB;
2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 10 kHz, but not more than 250 percent of the authorized bandwidth: At least 29 log (f_d^2/11)dB or 50 dB, which ever is the lesser attenuation;
3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

(g) Emission Mask G. For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:
(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 10 kHz, but no more than 250 percent of the authorized bandwidth:
At least 116 log (f_d/6.1) dB, or 50 + 10 log (P) dB, or 70 dB, whichever is the lesser attenuation;
(2) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

(h) Emission Mask H. For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:
(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of 4 kHz or less: Zero dB.
(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 4 kHz, but no more than 8.5 kHz: At least 107 log (fd/4) dB;
(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 8.5 kHz, but no more than 15 kHz: At least 40.5 log (f_d/1.16) dB;
(4) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 15 kHz, but no more than 25 kHz: At least 116 log (f_d/6.1) dB;
(5) On any frequency removed from the center of the authorized bandwidth by more than 25 kHz: At least 43 + 10 log (P) dB.

FCC Part 90.543:
Transmitters designed to operate in 769–775 MHz and 799–805 MHz frequency bands must meet the emission limitations in paragraphs (a) through (d) of this section. Class A and Class B signal boosterss retransmitting signals in the 769-775 MHz and 799-805 MHz frequency bands are exempt from the limits listed in paragraph (a) of this section when simutaneously retransmitting multiple signals and instead shall be subject to the limit listed in paragraph (c) of this section when operating in this manner.

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

April 27, 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	26.0°C
Relative Humidity	48.5%
ATM Pressure	99.0kPa

2.12.7 Justification

For LTE Band 14:

According to FCC Part 90.219 (e)(4)(iii), the retransmitted signals continue to meet the unwanted emissions limits of § 90.210 applicable to the corresponding received signals (assuming that these received signals meet the applicable unwanted emissions limits by a reasonable margin). As a equipment without audio low pass filter, Emission Mask C applies.

However, the EUT is an equipment without audio low pass filter and mask C applies. The received signal is wideband LTE 14 20 MHz signal, and it does not meet the unwanted Emission Mask C limits of § 90.210 which is for narrow band. Therefore, emission mask is not applicable to the retransmitted output signals.

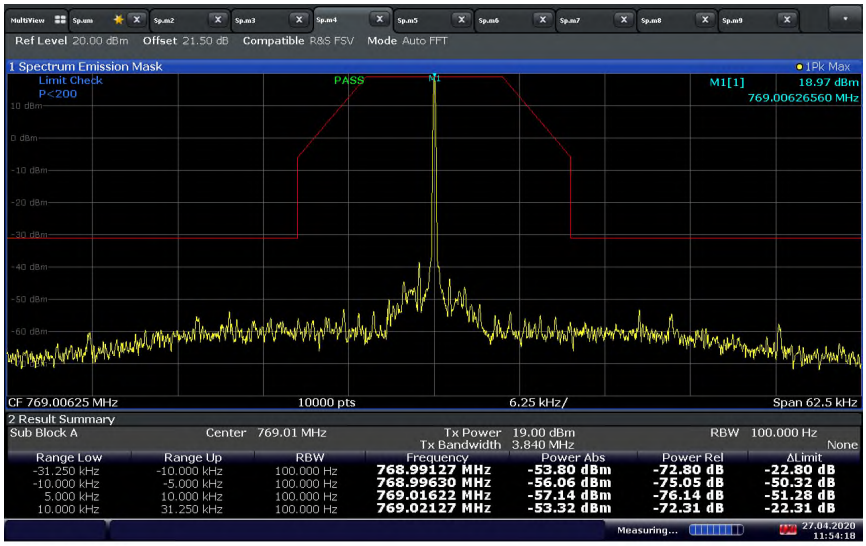
For 700 MHz Public Safety 90.543 ACP:

According to FCC Part 90.543, Class A and Class B signal boosters retransmitting signals in the 769-775 MHz and 799-805 MHz frequency bands are exempt from the limits listed in paragraph (a) of this section when simutaneously retransmitting multiple signals and instead shall be subject to the limit listed in paragraph (c) of this section when operating in this manner.

The EUT is a signal booster which retransmitting multiple signals simultaneously. Limit listed in paragraph (c) of FCC Par 90.543. Test Result refers to section 2.6 Conducted Spurious Emissions of this report.

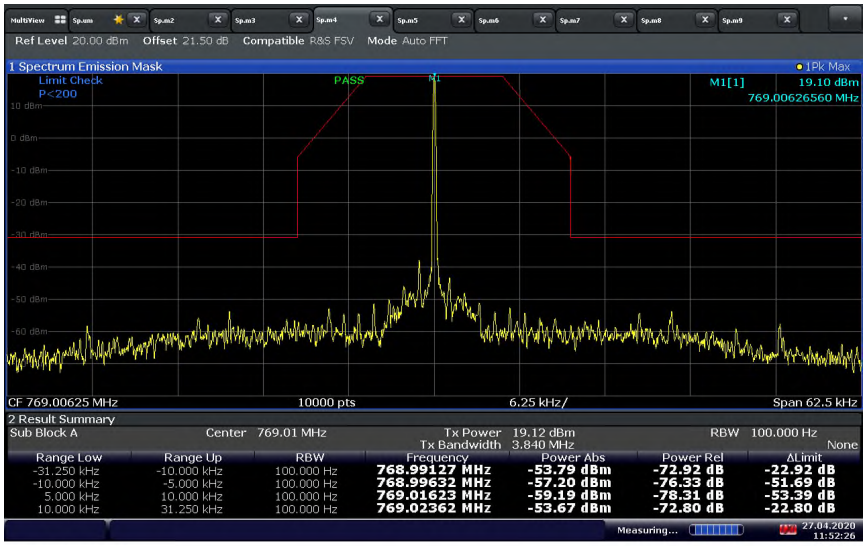
2.12.8 Test Results

700MHz Narrowband Public Safety Downlink (12.5 kHz BW) Low Channel Emissions Mask C (AGC Level)



11:54:18 27.04.2020

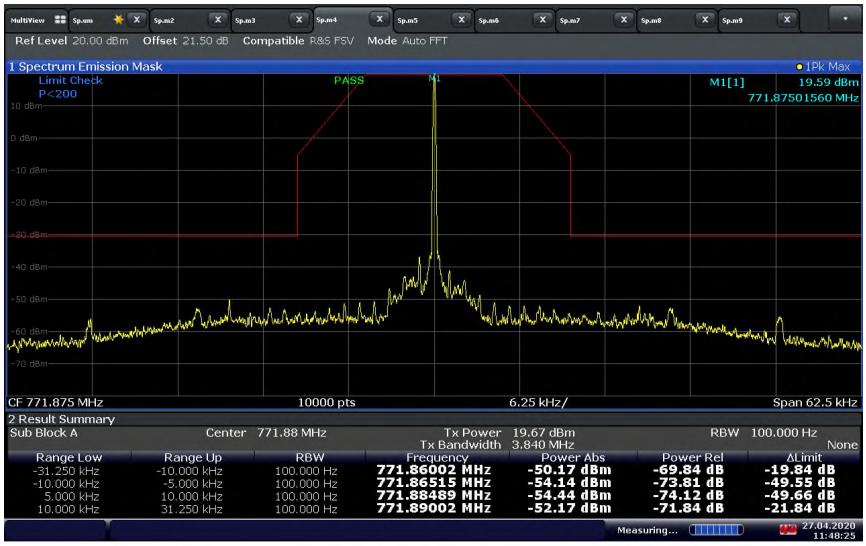
700MHz Narrowband Public Safety Downlink (12.5 kHz BW) Low Channel Emissions Mask C (AGC+3 Level)



11:52:27 27.04.2020

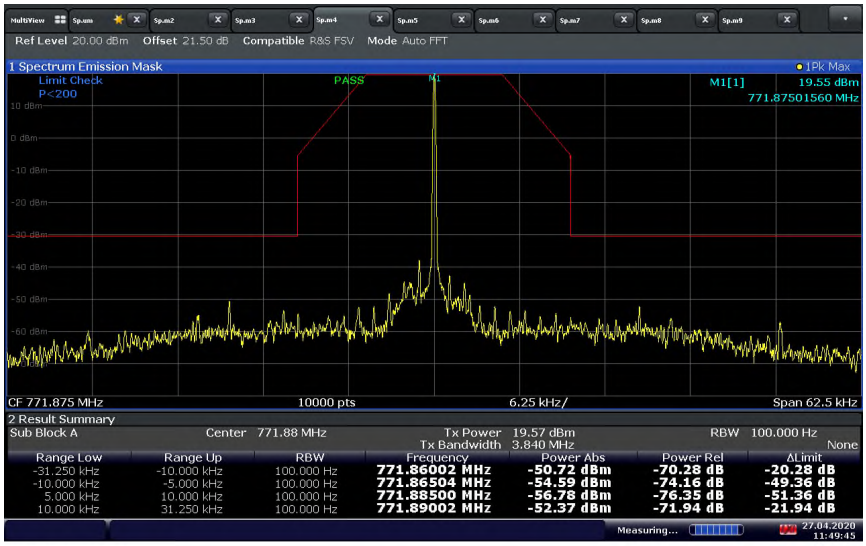
TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

700MHz Narrowband Public Safety Downlink (12.5 kHz BW) Middle Channel Emissions Mask C (AGC Level)



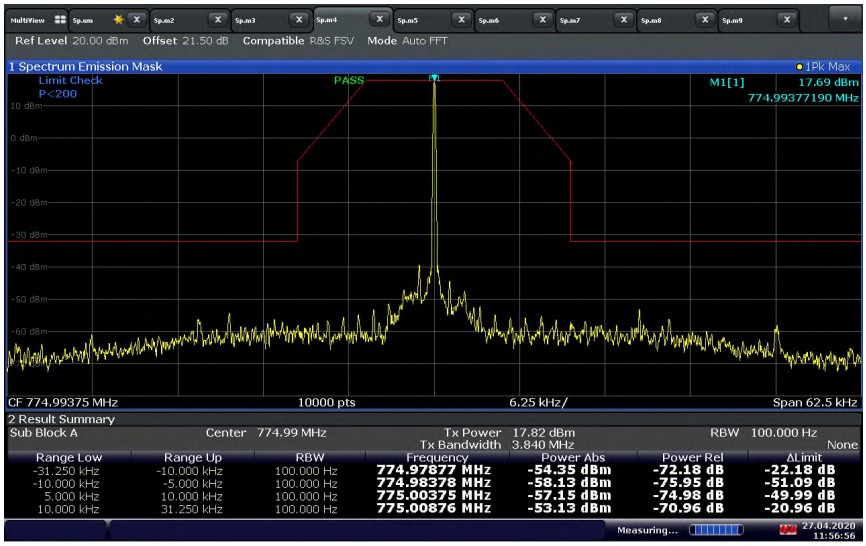
11:48:25 27.04.2020

700MHz Narrowband Public Safety Downlink (12.5 kHz BW) Middle Channel Emissions Mask C (AGC+3 Level)



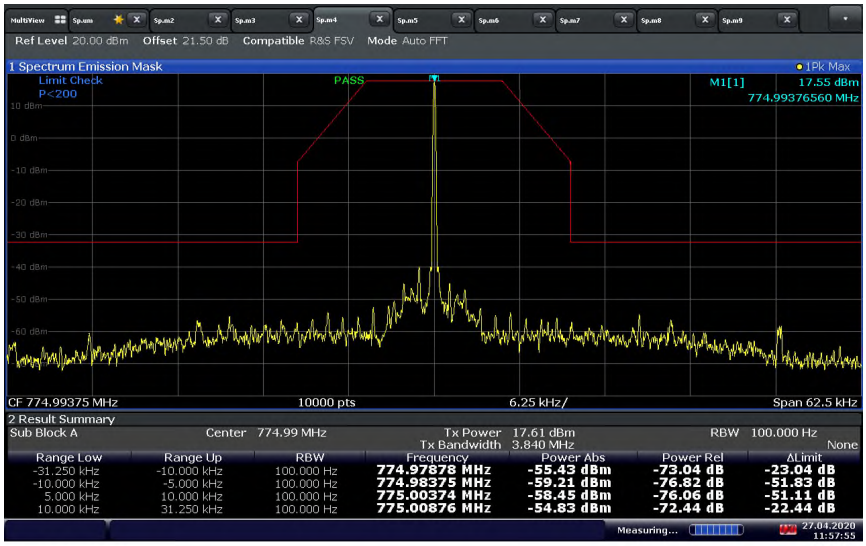
11:49:46 27.04.2020

700MHz Narrowband Public Safety Downlink (12.5 kHz BW) High Channel Emissions Mask C (AGC Level)



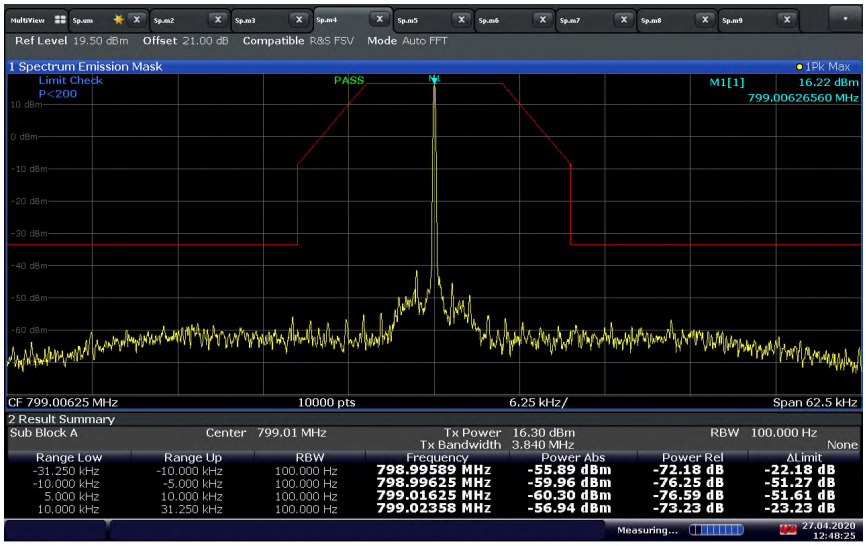
11:56:57 27.04.2020

700MHz Narrowband Public Safety Downlink (12.5 kHz BW) High Channel Emissions Mask C (AGC+3 Level)



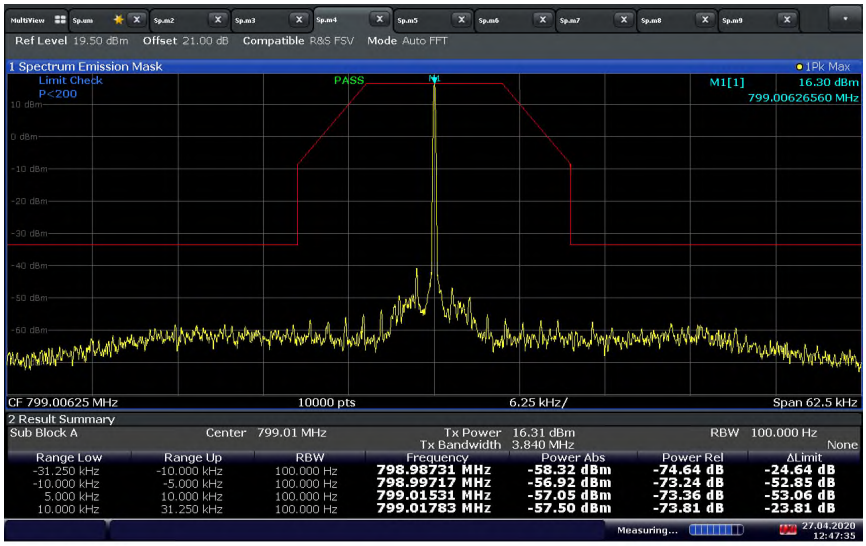
11:57:55 27.04.2020

700MHz Narrowband Public Safety Uplink (12.5 kHz BW) Low Channel Emissions Mask C (AGC Level)



12:48:26 27.04.2020

700MHz Narrowband Public Safety Uplink (12.5 kHz BW) Low Channel Emissions Mask C (AGC+3 Level)



12:47:36 27.04.2020

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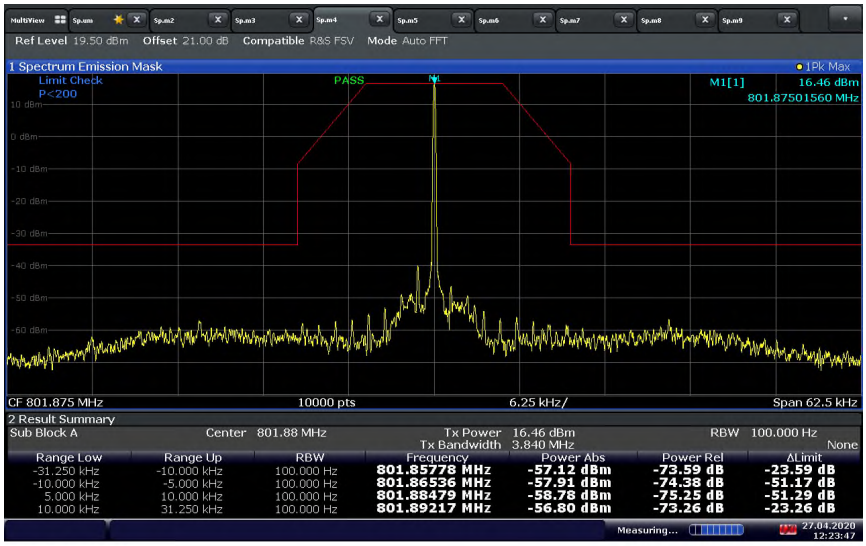
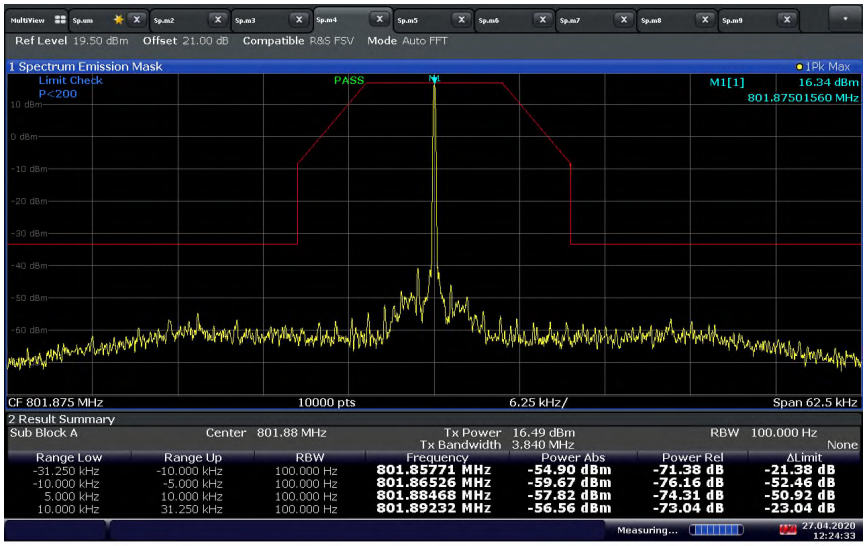
700MHz Narrowband Public Safety Uplink (12.5 kHz BW) Middle Channel Emissions Mask C (AGC Level)



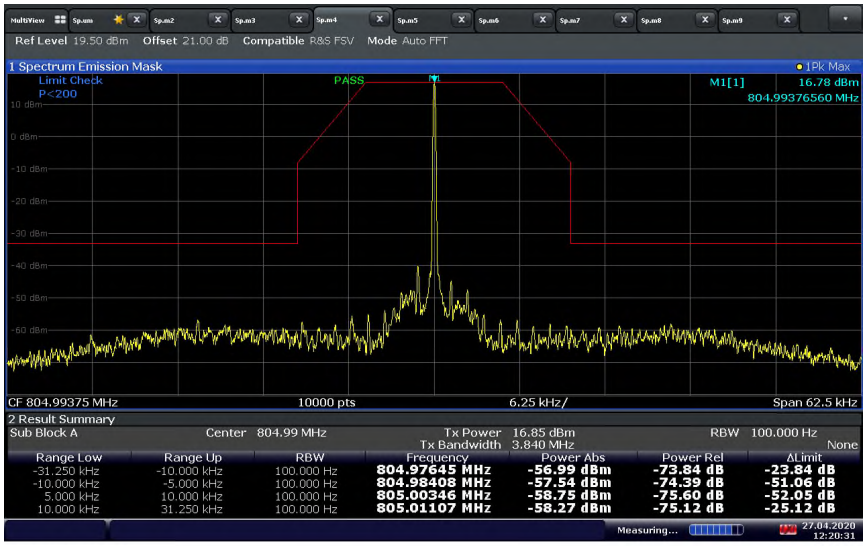
12:23:48 27.04.2020

700MHz Narrowband Public Safety Uplink (12.5 kHz BW) Middle Channel Emissions Mask C (AGC+3 Level)



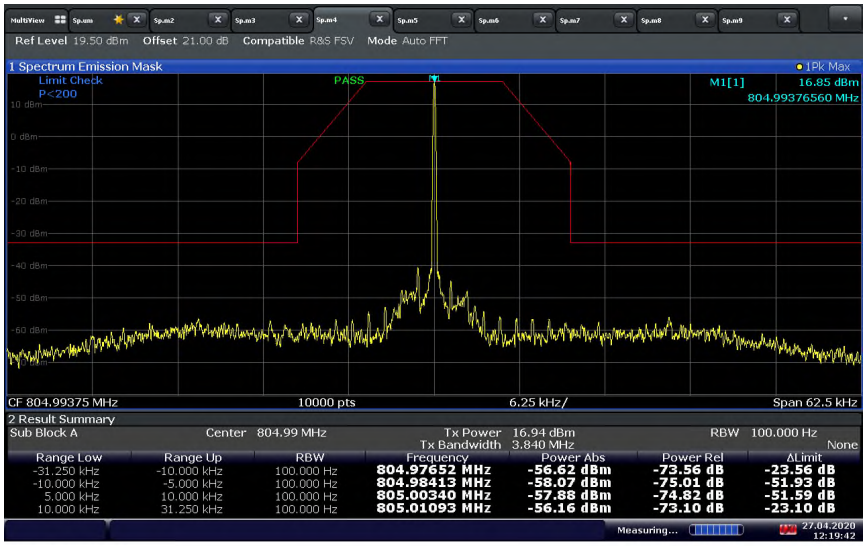
12:24:33 27.04.2020

700MHz Narrowband Public Safety Uplink (12.5 kHz BW) High Channel Emissions Mask C (AGC Level)



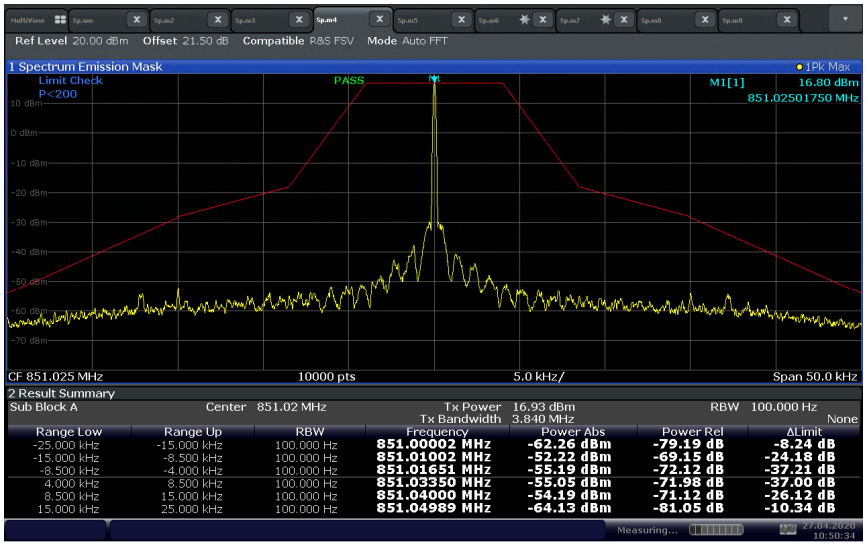
12:20:31 27.04.2020

700MHz Narrowband Public Safety Uplink (12.5 kHz BW) High Channel Emissions Mask C (AGC+3 Level)



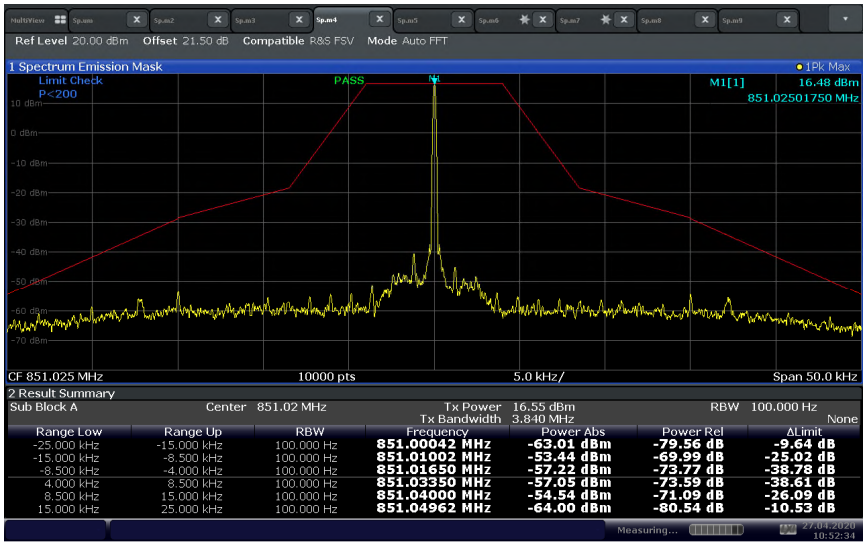
12:19:42 27.04.2020

800 MHz NPSPAC Public Safety Downlink (12.5 kHz BW) Low Channel 851.025 MHz Emissions Mask H (AGC Level)



10:50:35 27.04.2020

800 MHz NPSPAC Public Safety Downlink (12.5 kHz BW) Low Channel 851.025 MHz Emissions Mask H (AGC+3 Level)



10:52:34 27.04.2020

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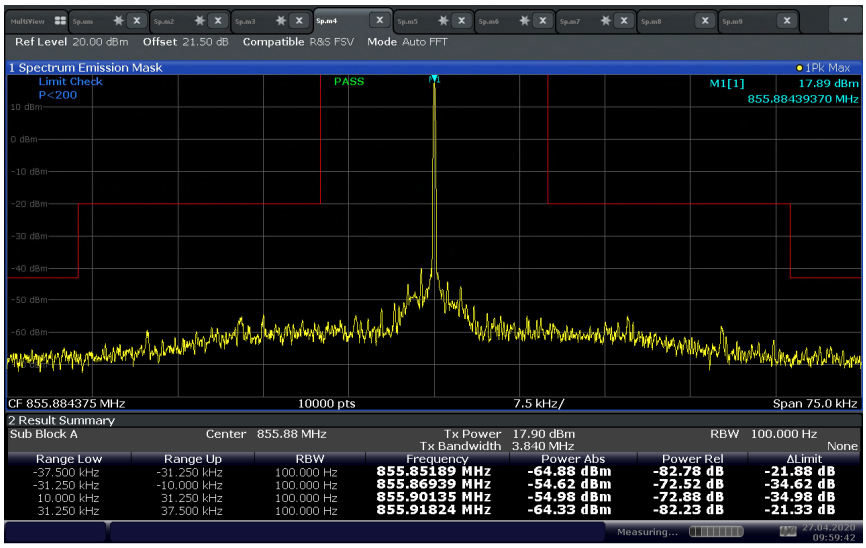
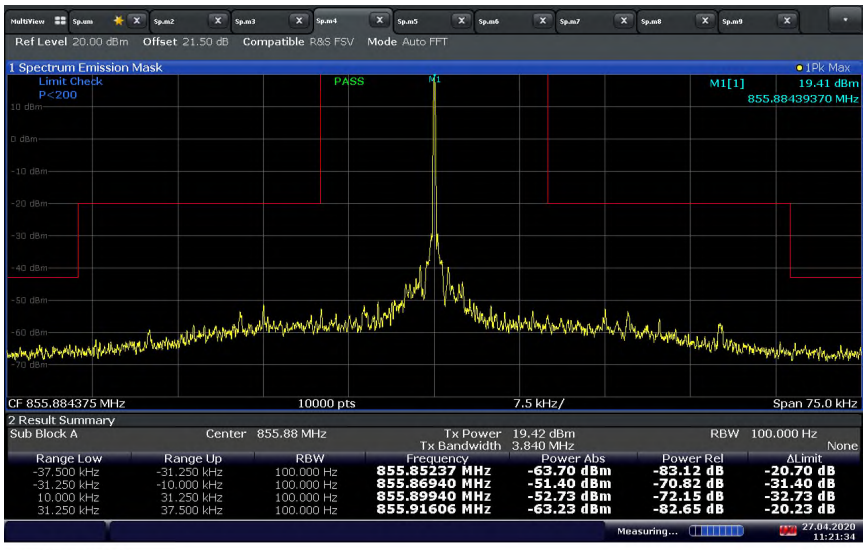
800 MHz NPSPAC Public Safety Downlink (12.5 kHz BW) Middle Channel 855.884375 MHz Emissions Mask G (AGC+3 Level)



09:59:43 27.04.2020

Frequency removed from the center by more than 250% of the authorized bandwidth limit:
-43 dBm = -13 dBm + 10log(100Hz/100kHz)

800 MHz NPSPAC Public Safety Downlink (12.5 kHz BW) Middle Channel 855.884375 MHz Emissions Mask G (AGC+3 Level)



11:21:34 27.04.2020

Frequency removed from the center by more than 250% of the authorized bandwidth limit:
-43 dBm = -13 dBm + 10log(100Hz/100kHz)

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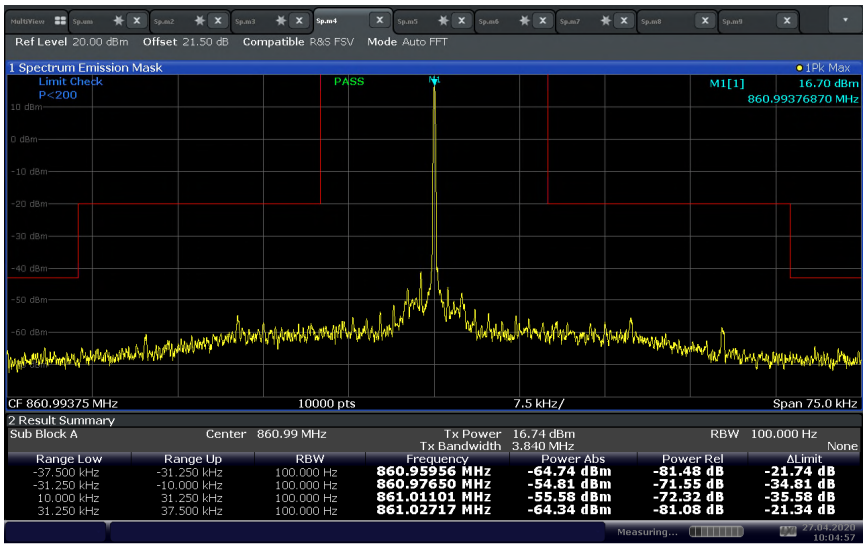
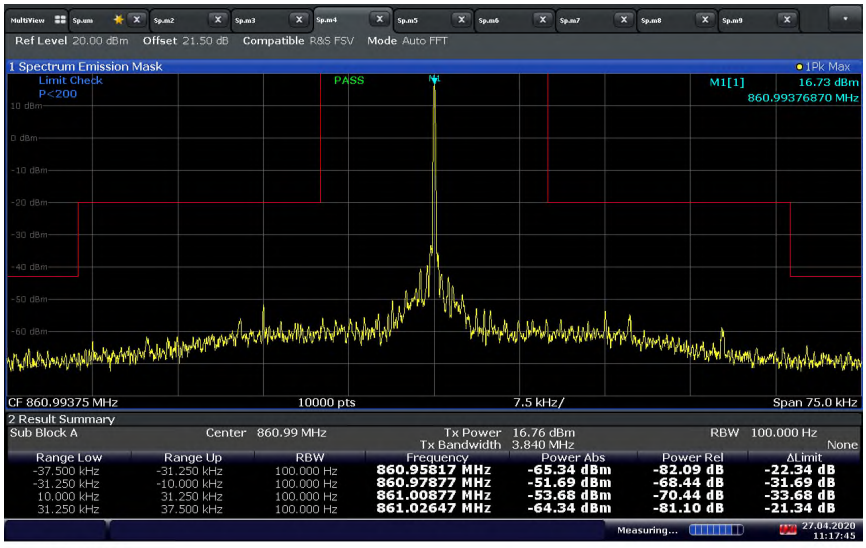
800 MHz NPSPAC Public Safety Downlink (12.5 kHz BW) High Channel 860.99375 MHz Emissions Mask G (AGC Level)



10:04:58 27.04.2020

Frequency removed from the center by more than 250% of the authorized bandwidth limit:
-43 dBm = -13 dBm + 10log(100Hz/100kHz)

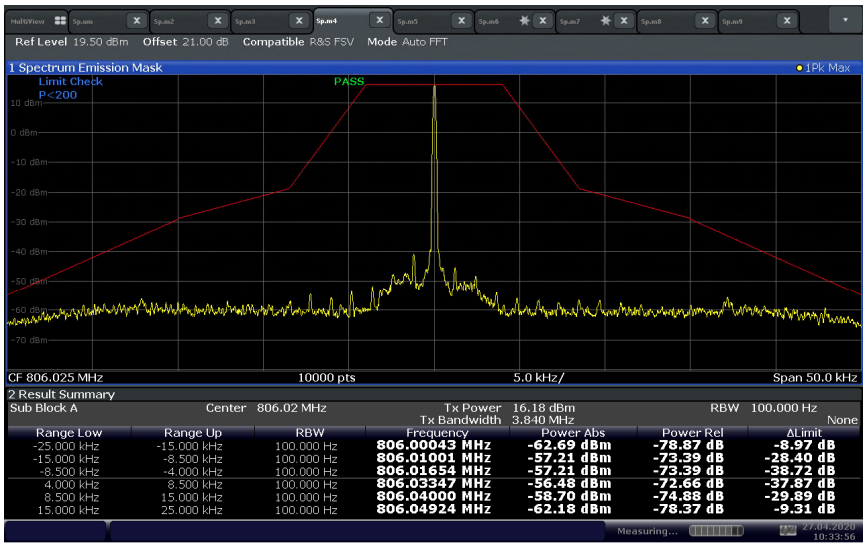
800 MHz NPSPAC Public Safety Downlink (12.5 kHz BW) High Channel 860.99375 MHz Emissions Mask G (AGC+3 Level)



11:17:45 27.04.2020

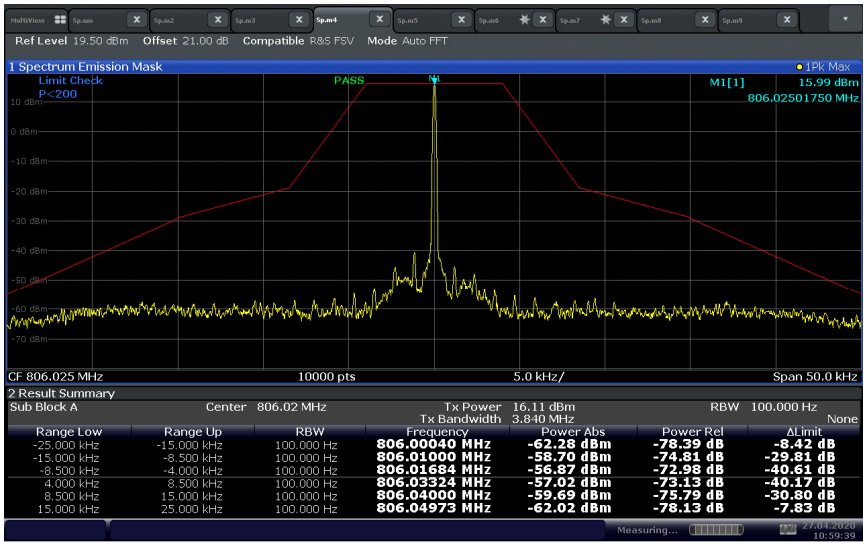
Frequency removed from the center by more than 250% of the authorized bandwidth limit:
-43 dBm = -13 dBm + 10log(100Hz/100kHz)

800 MHz NPSPAC Public Safety Uplink (12.5 kHz BW) Low Channel 806.025 MHz Emissions Mask H (AGC Level)



10:33:57 27.04.2020

800 MHz NPSPAC Public Safety Uplink (12.5 kHz BW) Low Channel 806.025 MHz Emissions Mask H (AGC+3 Level)



10:59:39 27.04.2020

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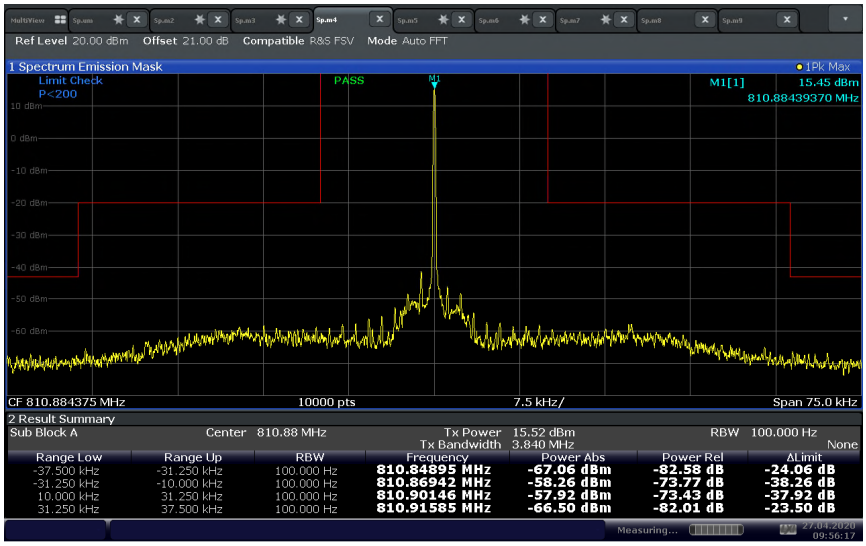
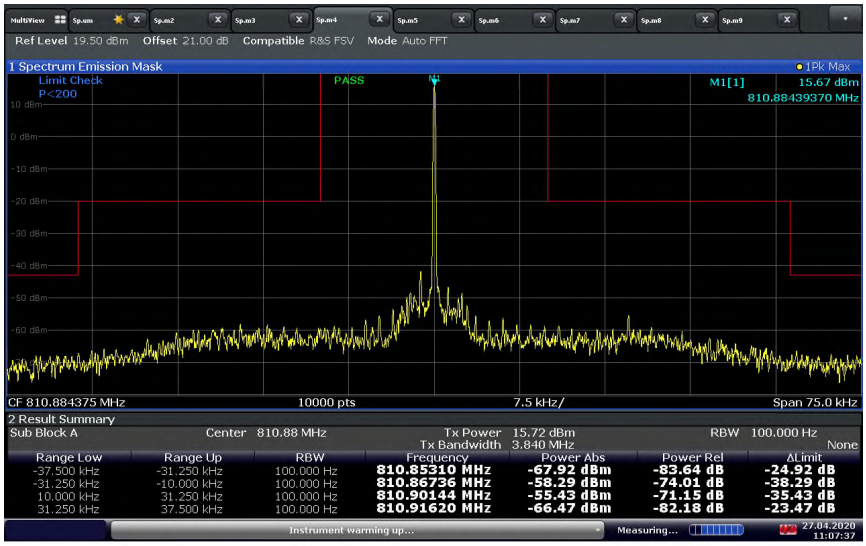
800 MHz NPSPAC Public Safety Uplink (12.5 kHz BW) Middle Channel 810.884375 MHz Emissions Mask G (AGC Level)



09:56:17 27.04.2020

Frequency removed from the center by more than 250% of the authorized bandwidth limit:
-43 dBm = -13 dBm + 10log(100Hz/100kHz)

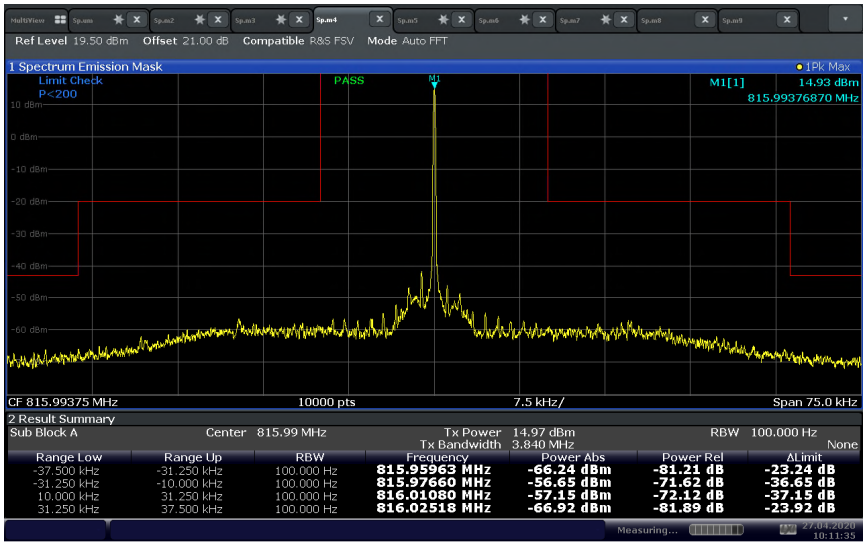
800 MHz NPSPAC Public Safety Uplink (12.5 kHz BW) Middle Channel 810.884375 MHz Emissions Mask G (AGC+3 Level)



11:07:38 27.04.2020

Frequency removed from the center by more than 250% of the authorized bandwidth limit:
-43 dBm = -13 dBm + 10log(100Hz/100kHz)

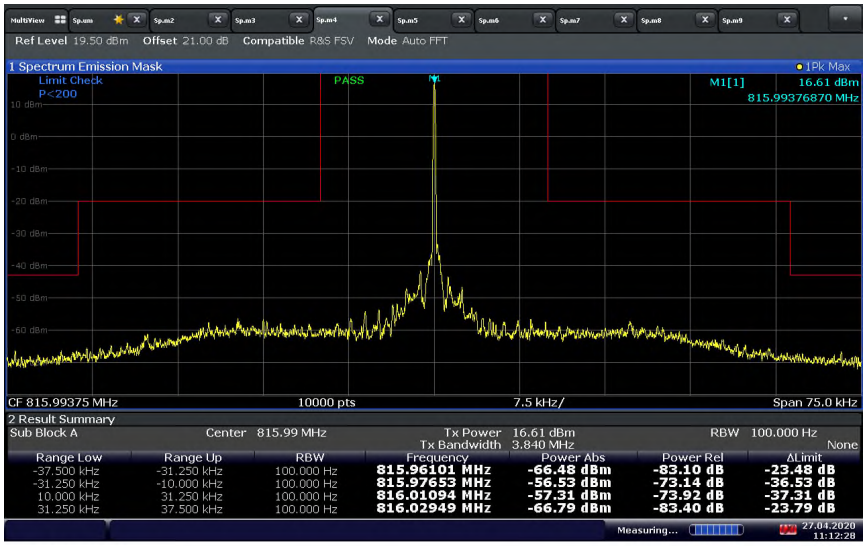
800 MHz NPSPAC Public Safety Uplink (12.5 kHz BW) High Channel 815.99375 MHz Emissions Mask G (AGC Level)



10:11:35 27.04.2020

Frequency removed from the center by more than 250% of the authorized bandwidth limit:
-43 dBm = -13 dBm + 10log(100Hz/100kHz)

800 MHz NPSPAC Public Safety Uplink (12.5 kHz BW) High Channel 815.99375 MHz Emissions Mask G (AGC+3 Level)



11:12:29 27.04.2020

Frequency removed from the center by more than 250% of the authorized bandwidth limit:
-43 dBm = -13 dBm + 10log(100Hz/100kHz)

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2.13 INPUT AND OUTPUT POWER AND AMPLIFIER/BOOSTER GAIN

2.13.1 Specification Reference

FCC 47 CFR Part 90, Clause 90.219(e)(1)
RSS-131, Clause 5.2.3
KDB 935210 D05, Clause 4.5

2.13.2 Standard Applicable

FCC 47 CFR Part 90, Clause 90.219(e):
(1) The output power capability of a signal booster must be designed for deployments providing a radiated power not exceeding 5 Watts ERP for each retransmitted channel.

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

Febraury 17, March 19 and May 11, 2020 / XYZ

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	23.0 - 24.9°C
Relative Humidity	40.6 - 50.2%
ATM Pressure	98.8 - 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 (95 dB for LTE B14 and 100 dB for 700MHz narrow band and 800MHz NPSPAC Public Safety bands).
- 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.
- For LTE B14, the signal generator was configured for LTE 10 MHz signal as the intended operating signal type.
- For 700MHz narrow band and 800MHz NPSPAC Public Safety bands, the signal generator is configured for 12.5 kHz bandwidth public safety signals as the intended operating signal type.
- A power meter 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 (95 dB for LTE B14 and 100 dB for 700MHz narrow band and 800MHz NPSPAC Public Safety bands) by more than 1.0 dB.

LTE Band 14 Input and Output Power and Gain						
Mode	**Bandwidth (MHz)**	**Channel**	**Frequency (MHz)**	**AGC Threshold Input (dBm)**	**Output Power (dBm)**	**Booster Gain (dB)**
Downlink	10	5330	763.0	-70.13	23.81	93.94
Uplink	10	23330	793.0	-72.47	22.22	94.69

LTE Band 14 Input and Output Power and Gain						
Mode	**Bandwidth (MHz)**	**Channel**	**Frequency (MHz)**	**AGC Threshold + 3dB Input (dBm)**	**Output Power (dBm)**	**Booster Gain (dB)**
Downlink	10	5330	763.0	-67.23	23.14	90.37
Uplink	10	23330	793.0	-69.32	22.39	91.71

700MHz Narrowband Public Safety C4FM Input and Output Power and Gain					
Mode	**Bandwidth (kHz)**	**Frequency (MHz)**	**AGC Threshold Input (dBm)**	**Output Power (dBm)**	**Booster Gain (dB)**
Downlink	12.5	771.875	-69.65	30.05	99.70
Uplink	12.5	801.875	-73.07	26.78	99.85

700MHz Narrowband Public Safety C4FM Input and Output Power and Gain					
Mode	**Bandwidth (kHz)**	**Frequency (MHz)**	**AGC Threshold + 3dB Input (dBm)**	**Output Power (dBm)**	**Booster Gain (dB)**
Downlink	12.5	771.875	-66.85	29.94	96.79
Uplink	12.5	801.875	-70.33	26.81	97.14

700MHz Narrowband Public Safety CQPSK Input and Output Power and Gain					
Mode	**Bandwidth (kHz)**	**Frequency (MHz)**	**AGC Threshold Input (dBm)**	**Output Power (dBm)**	**Booster Gain (dB)**
Downlink	12.5	771.875	-67.77	29.98	97.75
Uplink	12.5	801.875	-69.91	26.72	96.63

700MHz Narrowband Public Safety CQPSK Input and Output Power and Gain					
Mode	**Bandwidth (kHz)**	**Frequency (MHz)**	**AGC Threshold + 3dB Input (dBm)**	**Output Power (dBm)**	**Booster Gain (dB)**
Downlink	12.5	771.875	-64.81	29.92	94.73
Uplink	12.5	801.875	-66.83	26.90	93.73

700MHz Narrowband Public Safety H-DQPSK Downlink Input and Output Power and Gain					
Input	**Input Level (dBm)**	**Bandwidth (kHz)**	**Frequency (MHz)**	**Output Power (dBm)**	**Booster Gain (dB)**
AGC Threshold	-67.05	12.5	771.875	29.93	96.98
AGC Threshold + 3dB	-64.86			29.84	94.70

700MHz Narrowband Public Safety H-CPM Uplink Input and Output Power and Gain					
Input	**Input Level (dBm)**	**Bandwidth (kHz)**	**Frequency (MHz)**	**Output Power (dBm)**	**Booster Gain (dB)**
AGC Threshold	-69.82	12.5	801.875	26.49	96.31
AGC Threshold + 3dB	-66.71			26.52	93.23

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800 MHz NPSPAC Public Safety C4FM Input and Output Power and Gain					
Mode	**Bandwidth (kHz)**	**Frequency (MHz)**	**AGC Threshold Input (dBm)**	**Output Power (dBm)**	**Booster Gain (dB)**
Downlink	12.5	855.884375	-65.82	30.78	96.60
Uplink	12.5	810.884375	-70.93	25.97	96.90

800 MHz NPSPAC Public Safety C4FM Input and Output Power and Gain					
Mode	**Bandwidth (kHz)**	**Frequency (MHz)**	**AGC Threshold + 3dB Input (dBm)**	**Output Power (dBm)**	**Booster Gain (dB)**
Downlink	12.5	855.884375	-62.52	30.75	93.27
Uplink	12.5	810.884375	-67.33	25.97	93.30

800 MHz NPSPAC Public Safety CQPSK Input and Output Power and Gain					
Mode	**Bandwidth (kHz)**	**Frequency (MHz)**	**AGC Threshold Input (dBm)**	**Output Power (dBm)**	**Booster Gain (dB)**
Downlink	12.5	855.884375	-66.02	30.62	96.62
Uplink	12.5	810.884375	-70.08	26.12	96.20

800 MHz NPSPAC Public Safety CQPSK Input and Output Power and Gain					
Mode	**Bandwidth (kHz)**	**Frequency (MHz)**	**AGC Threshold + 3dB Input (dBm)**	**Output Power (dBm)**	**Booster Gain (dB)**
Downlink	12.5	855.884375	-63.81	30.54	94.35
Uplink	12.5	810.884375	-66.83	26.15	92.98

800 MHz NPSPAC Public Safety H-DQPSK Downlink Input and Output Power and Gain					
Input	**Input Level (dBm)**	**Bandwidth (kHz)**	**Frequency (MHz)**	**Output Power (dBm)**	**Booster Gain (dB)**
AGC Threshold	-66.10	12.5	855.884375	30.82	96.92
AGC Threshold + 3dB	-63.49			30.79	94.28

800 MHz NPSPAC Public Safety H-CPM Uplink Input and Output Power and Gain					
Input	**Input Level (dBm)**	**Bandwidth (kHz)**	**Frequency (MHz)**	**Output Power (dBm)**	**Booster Gain (dB)**
AGC Threshold	-70.51	12.5	810.884375	26.08	96.59
AGC Threshold + 3dB	-67.53			26.07	93.60

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Limit	
Band	**System Gain (dB)**
LTE Band 14	95
PS 700 MHz and 800 MHz	100

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2.14 NOISE FIGURE

2.14.1 Specification Reference

FCC 47 CFR Part 90, Clause 90.219 (e)(2)
KDB 935210 D05, Clause 4.6

2.14.2 Standard Applicable

FCC Part 90.219 (e)(2):
The noise figure of a signal booster must not exceed 9 dB in either direction.

2.14.3 Equipment Under Test and Modification State

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

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

Febraury 17 and March 18, 2020 / XYZ

2.14.5 Test Equipment Used

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

2.14.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	22.4 - 23.0°C
Relative Humidity	39.9 - 44.8%
ATM Pressure	98.3 - 99.1kPa

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2.14.7 Additional Observations

- The path loss was measured and entered as an offset.
- For LTE Band 14, 10 MHz Bandwidth LTE was tested as representative configuration. The Downlink and Uplink Gains are measured with a LTE signal injected to the device under test.
- 700 MHz Narrowband Public Safety and 800 MHz NPSPAC Public Safety, the Downlink and Uplink Gains are measured with the representative public safety signals injected to the device under test.
- The input of the EUT is terminated when measuring the noise output.
- The spectrum analyser was set to 100 trace average in RMS mode.
- RBW is 1 MHz, VBW is > 3 x RBW.
- Channel power was recorded.
- The noise figure was calculated using the following formula:

  Noise Figure (NF) = N – Gain + 174 dB – $10\lg_{10}$(B)

  - N = Noise Power Output in dBm/MHz
  - Gain = Gain of the device under test
  - B = Resolution Bandwidth of spectrum analyzer in Hz
  - 174 = Thermal noise for 1 Hz RBW at room temperature

- Both Downlink and Uplink are tested.

2.14.8 Test Results

LTE Band 14 Booster Gain					
Mode	**Bandwidth (MHz)**	**Frequency (MHz)**	**Input Power (dBm)**	**Output Power (dBm/MHz)**	**Gain (dB)**
Downlink	10	763.0	-70.71	23.81	94.52
Uplink	10	793.0	-72.47	22.22	94.69

LTE Band 14 Noise Figure							
Mode	**Bandwidth (MHz)**	**Frequency (MHz)**	**RBW (MHz)**	**Noise Output (dBm/MHz)**	**Booster Gain (dB)**	**Noise Figure (dB)**	**Limit (dB)**
Downlink	10	763.0	1	-15.93	94.52	3.55	9
Uplink	10	793.0	1	-16.18	94.69	3.13	9

.

Downlink Noise Figure = N – Gain + 174 dB – $10\lg_{10}$(B)
= -15.93 – 94.52 + 174 dB – $10\lg_{10}$(B)
= 3.55 dB

Uplink Noise Figure = N – Gain + 174 dB – $10\lg_{10}$(B)
= -16.18 – 94.69 + 174 dB – $10\lg_{10}$(B)
= 3.13 dB

700MHz Narrowband Public Safety CQPSK Input and Output Power and Gain					
Mode	**Bandwidth (kHz)**	**Frequency (MHz)**	**AGC Threshold Input (dBm)**	**Output Power (dBm)**	**Booster Gain (dB)**
Downlink	12.5	771.875	-67.77	29.98	97.75
Uplink	12.5	801.875	-69.91	26.72	96.63

700MHz Narrowband Public Safety Noise Figure (CQPSK as worst case)							
Mode	**Bandwidth (kHz)**	**Frequency (MHz)**	**RBW (MHz)**	**Noise Output (dBm/MHz)**	**Booster Gain (dB)**	**Noise Figure (dB)**	**Limit (dB)**
Downlink	12.5	771.875	1	-69.48	97.75	N/A*	9
Uplink	12.5	801.875	1	-68.09	96.63	N/A*	9

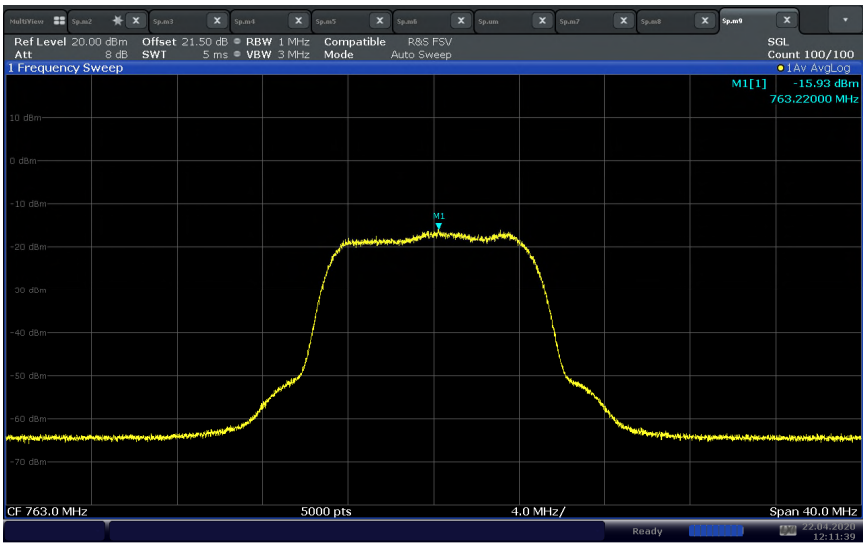
N/A* EUT doesn't setup the channel when there is no injected signal.

800 MHz NPSPAC Public Safety C4FM Input and Output Power and Gain					
Mode	**Bandwidth (kHz)**	**Frequency (MHz)**	**AGC Threshold Input (dBm)**	**Output Power (dBm)**	**Booster Gain (dB)**
Downlink	12.5	855.884375	-65.82	30.78	96.60
Uplink	12.5	810.884375	-70.93	25.97	96.90

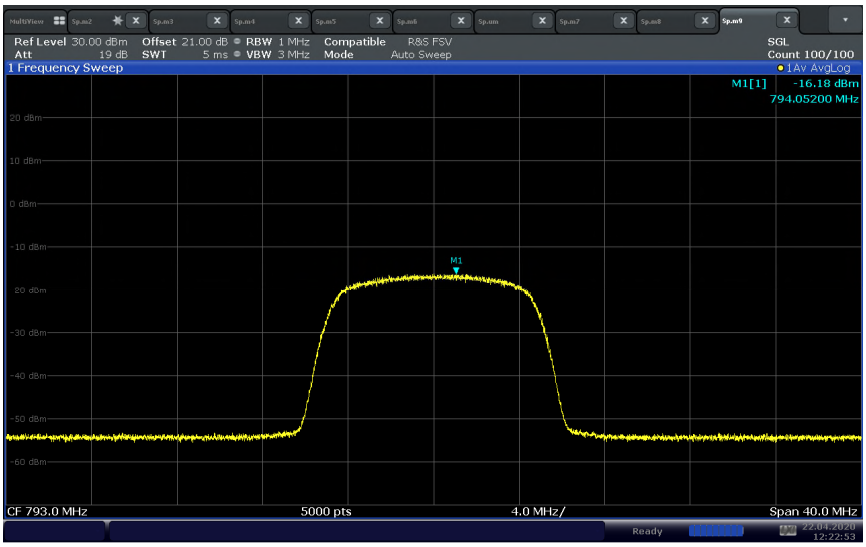
800 MHz NPSPAC Public Safety Noise Figure (C4FM as worst case)							
Mode	**Bandwidth (kHz)**	**Frequency (MHz)**	**RBW (MHz)**	**Noise Output (dBm/MHz)**	**Booster Gain (dB)**	**Noise Figure (dB)**	**Limit (dB)**
Downlink	12.5	855.884375	1	-66.93	96.45	N/A*	9
Uplink	12.5	810.884375	1	-67.64	96.90	N/A*	9

N/A* EUT doesn't setup the channel when there is no injected signal.

LTE Band 14 Downlink (10 MHz BW) Middle Channel / Noise Output



LTE Band 14 Uplink (10 MHz BW) Middle Channel / Noise Output



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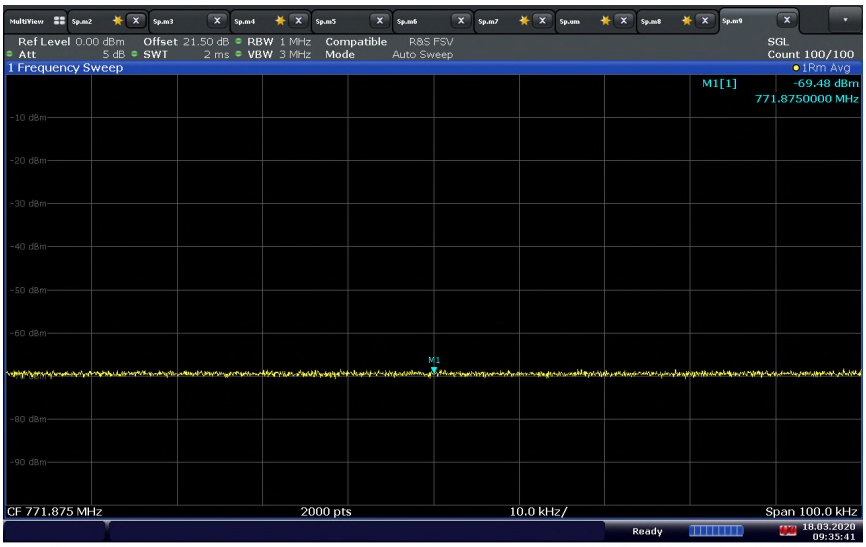
700MHz Narrowband Public Safety Downlink (12.5 kHz BW) Middle Channel / Noise Output



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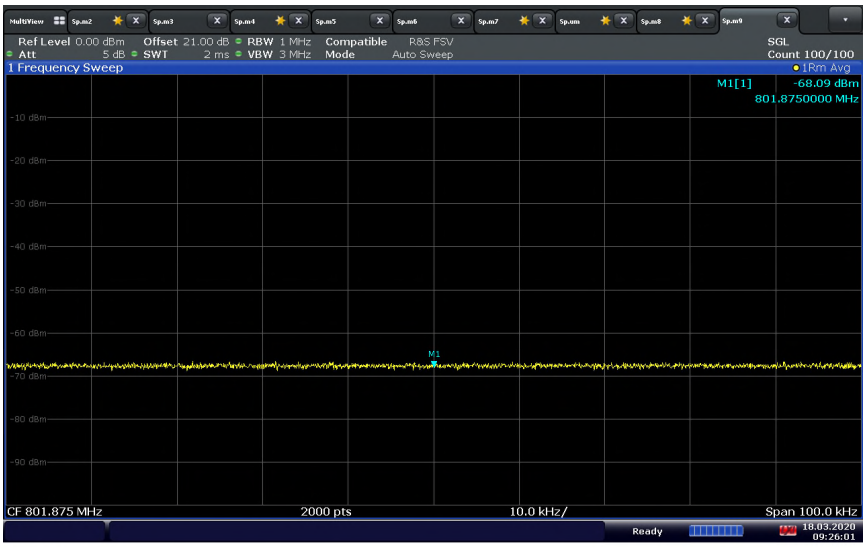
700MHz Narrowband Public Safety Uplink (12.5 kHz BW) Middle Channel / Noise Output



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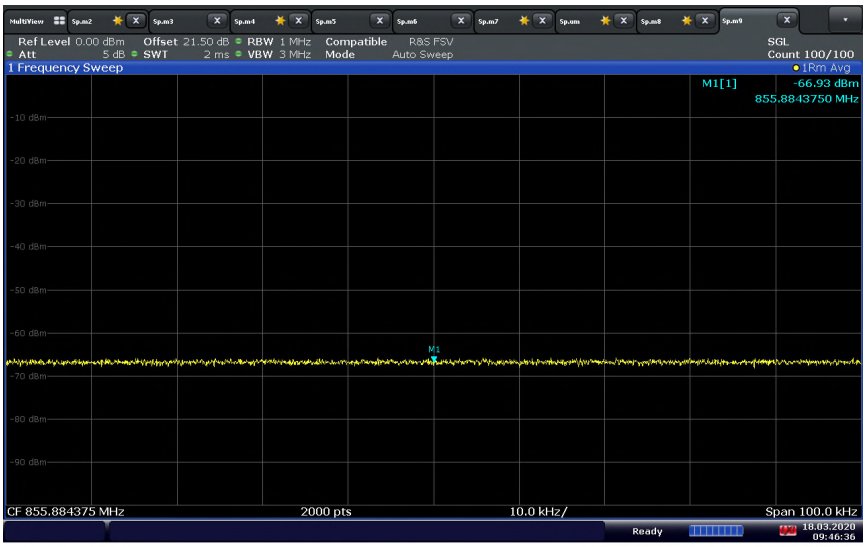
800 MHz NPSPAC Public Safety Downlink (12.5 kHz BW) Middle Channel / Noise Output



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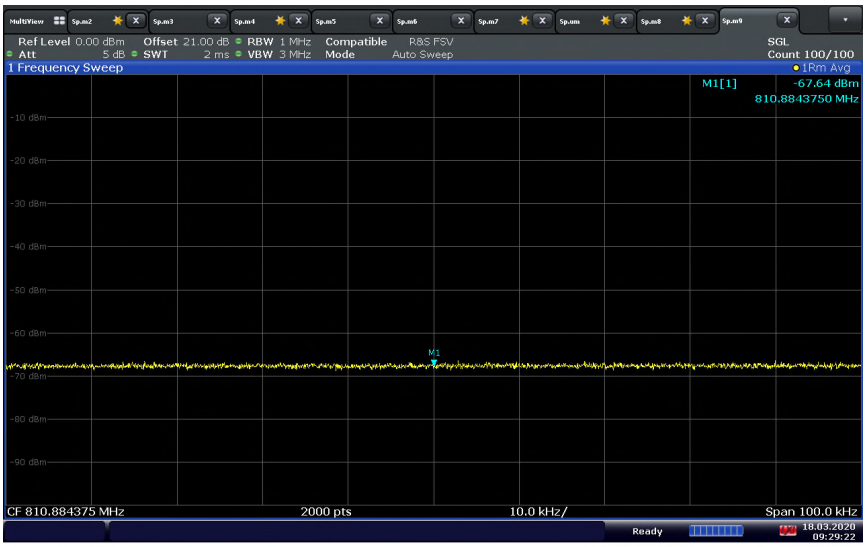
800 MHz NPSPAC Public Safety Uplink (12.5 kHz BW) Middle Channel / Noise Output



09:29:22 18.03.2020

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2.15 OUT-OF-BAND/OUT-OF-BLOCK (INTERMODULATION) AND SPURIOUS EMISSIONS

2.15.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1051
FCC 47 CFR Part 90, Clause 90.219(e)(3)
FCC 47 CFR Part 90, Clause 90.543(c)
RSS-140, Clause 4.4
RSS-119, Clause 5.8.9.2
KDB 935210 D05, Clause 4.7

2.15.2 Standard Applicable

FCC 47 CFR Part 90.219(e):
(3) Spurious emission from a signal booster must not exceed -13 dBm within any 100kHz measureemnt bandwith.

FCC 47 CFR Part 90.543:
(c) Out-of-band emission limit. On any frequency outside of the frequency ranges covered by the ACP tables in this section, the power of any emission must be reduced below the mean output power (P) by at least 43 + 10 log (p) dB in a 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.

RSS-140, Clause 4.4 Transmitter unwanted emissions limits:
The power of any unwanted emission outside the bands 758-768 MHz and 788-798 MHz shall be attenuated below the transmitter output power P in dBW as follows, where p is the transmitter output power in watts:
a. For any frequency between 769-775 MHz and 799-806 MHz:
i 76 + 10 log (p), dB in a 6.25 kHz band for fixed and base station equipment
ii 65 + 10 log (p), dB in a 6.25 kHz band for mobile and portable/hand-held equipment

b For any frequency between 775-788 MHz, above 806 MHz, and below 758 MHz: 43 + 10 log (p), dB in a bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency bands 758-768 MHz and 788-798 MHz, a resolution bandwidth of 30 kHz may be employed.

In addition, the equivalent isotropically radiated power (e.i.r.p.) of all emissions, including harmonics in the band 1559-1610 MHz, shall not exceed −70 dBW/MHz for wideband emissions, and −80 dBW/kHz for discrete emissions of less than 700 Hz bandwidth.
For LTE Band 41, out-of-Band/Out-of-Block and spurious emissions is tested according to KDB 935210 D05, Clause 3.6.

RSS-119, Clause 5.8.9.2 Out-of-Band Emission Limit:
On any frequency outside of the ranges specified in the ACP tables 13 to 16, the power of any emission shall be attenuated below the mean output power P (dBW) by at least 43 + 10 log10(p), measured in a 100 kHz bandwidth for frequencies less than or equal to 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.

In addition, for operations in the bands 768-776 MHz and 798-806 MHz, all emissions (including harmonics in the band 1559-1610 MHz), shall not exceed:
-70 dBW/MHz equivalent isotropically radiated power (e.i.r.p.) for wideband emissions, and
-80 dBW/kHz e.i.r.p. for discrete emissions of less than 700 Hz bandwidth

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2.15.3 Equipment Under Test and Modification State

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

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

February 05, April 22, 23 and 30, 2020 / XYZ

2.15.5 Test Equipment Used

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

2.15.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	22.5 - 25.9°C
Relative Humidity	43.6 - 51.6%
ATM Pressure	99.3 - 98.9kPa

2.15.7 Additional Observations

- The path loss or the transducer factor (TDF) from the external attenuators and cables was measured and entered as an offset.
- 10 MHz Bandwidth was tested as representative configuration for LTE Band 14, and representative public safety signals were tested as representative configuration for 700 MHz Narrowband Public Safety and 800 MHz NPSPAC Public Safety.
- For spurious emissions, the spectrum analyser was set to peak detector and trace is max hold.
- RBW is 100 kHz, VBW is > 3 x RBW.
- Intermodulation-product spurious emission measurements are not required for LTE Band 14 since it only support single-channel boosters and can't accommodate two simultaneous signals within the pass band.
- Intermodulation-product spurious emission measurements were tested for 700 MHz Narrowband Public Safety and 800 MHz NPSPAC Public Safety.
- For intermodulation, the spectrum analyser was set to RMS detector and at least 100 trace averaging.
- RBW is 300 Hz, VBW is > 3 x RBW.
- Both Downlink and Uplink are tested.

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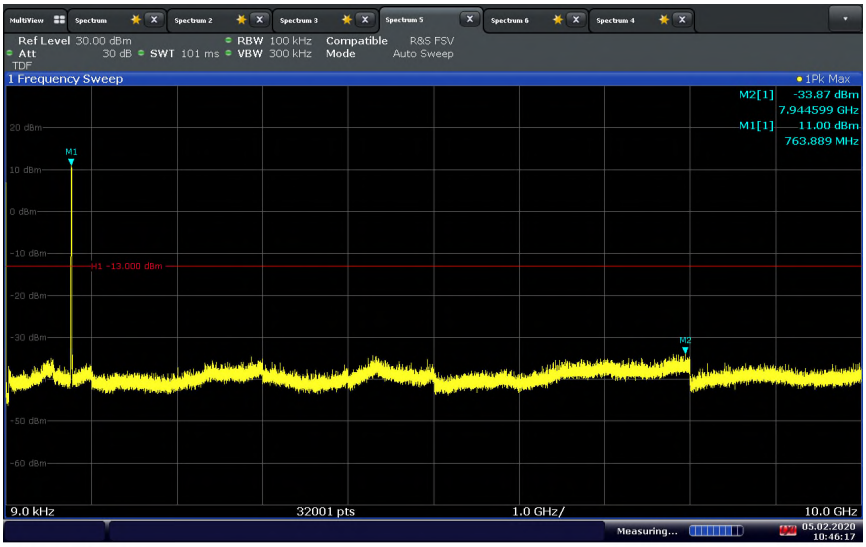
2.15.8 Test Results

LTE Band 14 Downlink (10 MHz BW) Middle Channel / Spurious Emissions



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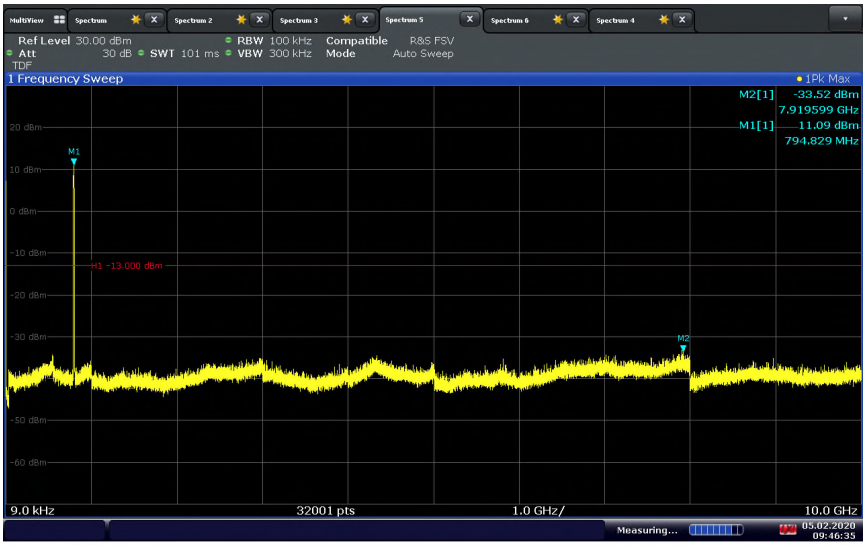
LTE Band 14 Uplink (10 MHz BW) Middle Channel / Spurious Emissions



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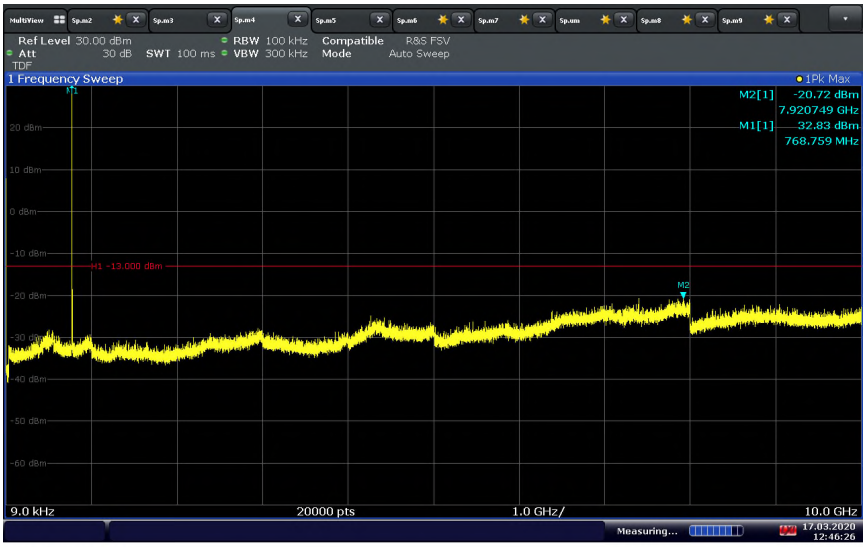
700MHz Narrowband Public Safety Downlink (12.5 kHz BW) C4FM Low Channel / Spurious Emissions



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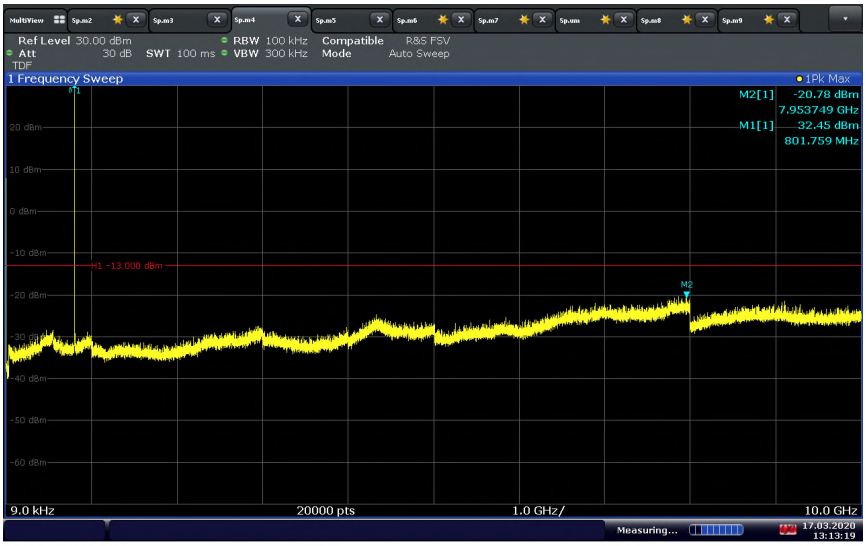
700MHz Narrowband Public Safety Downlink (12.5 kHz BW) C4FM Mid Channel / Spurious Emissions



13:13:19 17.03.2020

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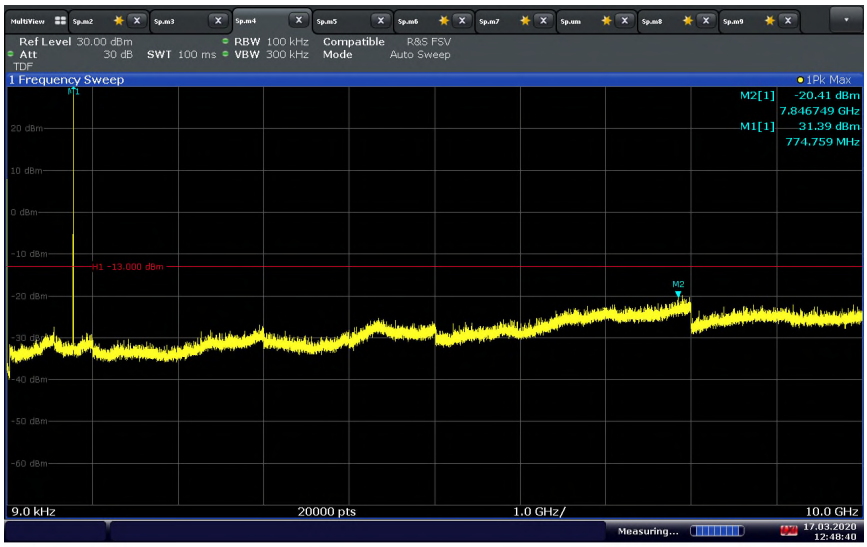
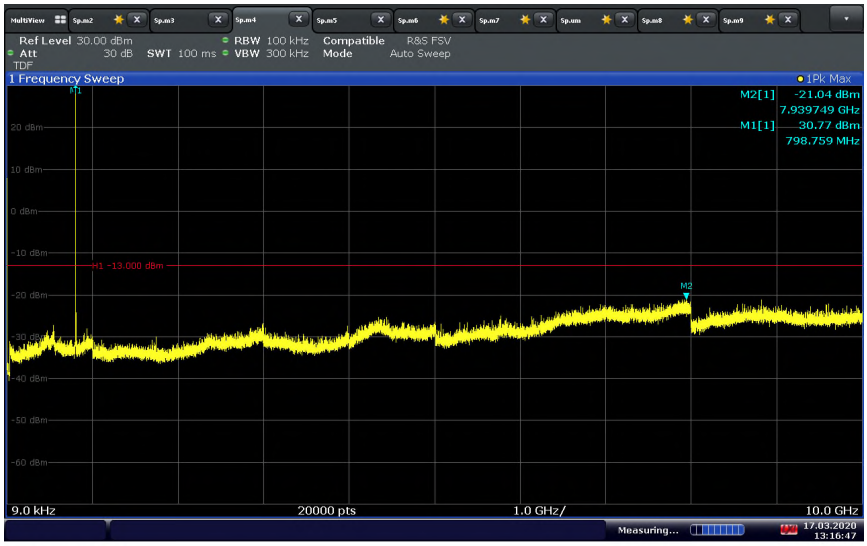
700MHz Narrowband Public Safety Downlink (12.5 kHz BW) C4FM High Channel / Spurious Emissions
 12:48:41 17.03.2020
700MHz Narrowband Public Safety Uplink (12.5 kHz BW) C4FM Low Channel / Spurious Emissions
 13:16:47 17.03.2020

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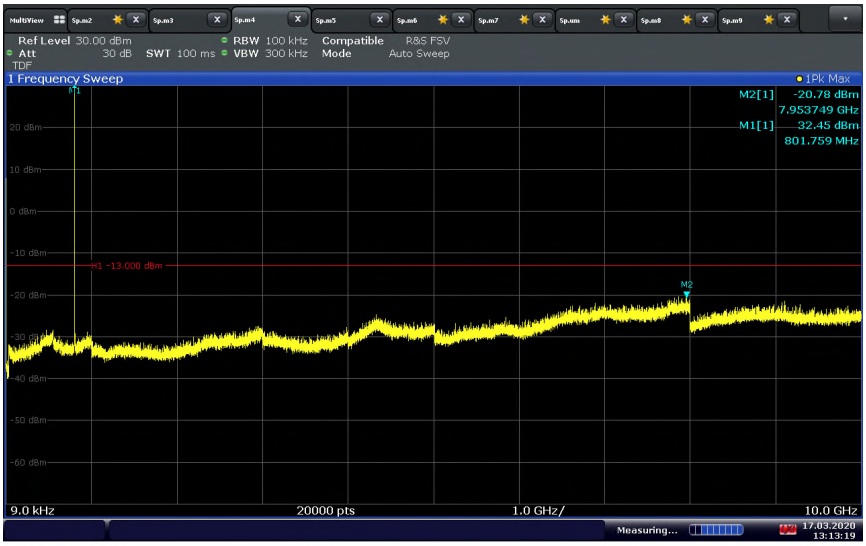
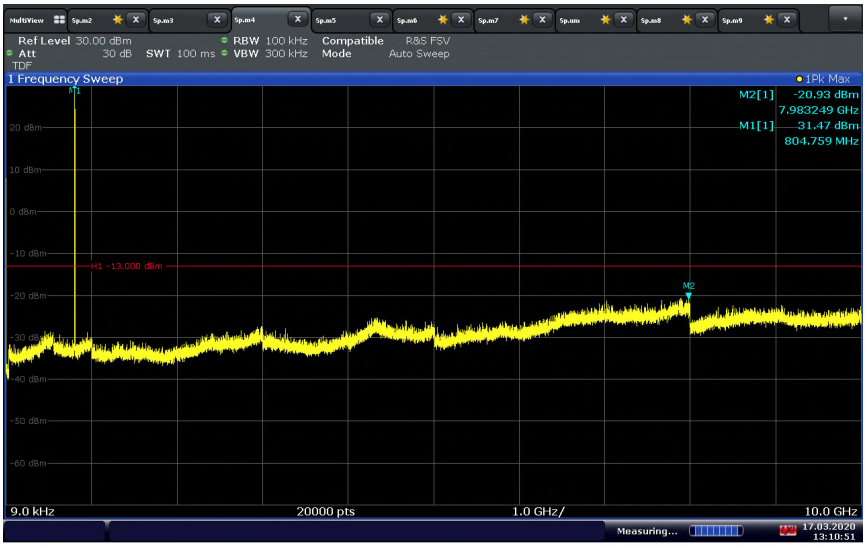
700MHz Narrowband Public Safety Uplink (12.5 kHz BW) C4FM Mid Channel / Spurious Emissions
 13:13:19 17.03.2020

700MHz Narrowband Public Safety Uplink (12.5 kHz BW) C4FM High Channel / Spurious Emissions
 13:10:51 17.03.2020

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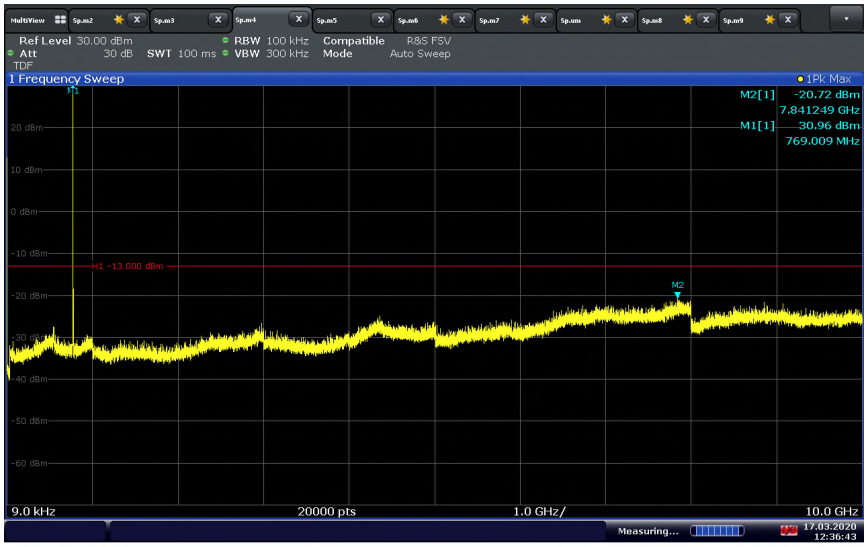
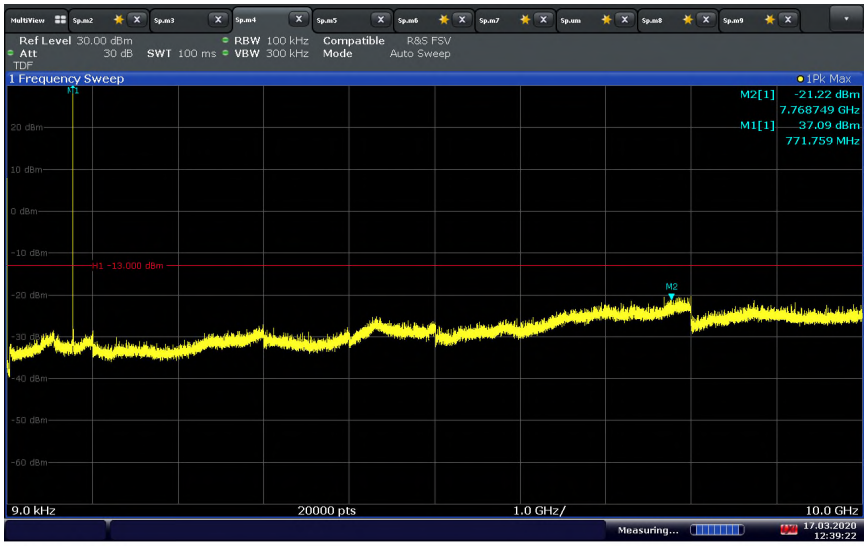
700MHz Narrowband Public Safety Downlink (12.5 kHz BW) CQPSK Low Channel / Spurious Emissions
 12:36:44 17.03.2020
700MHz Narrowband Public Safety Downlink (12.5 kHz BW) CQPSK Mid Channel / Spurious Emissions
 12:39:22 17.03.2020

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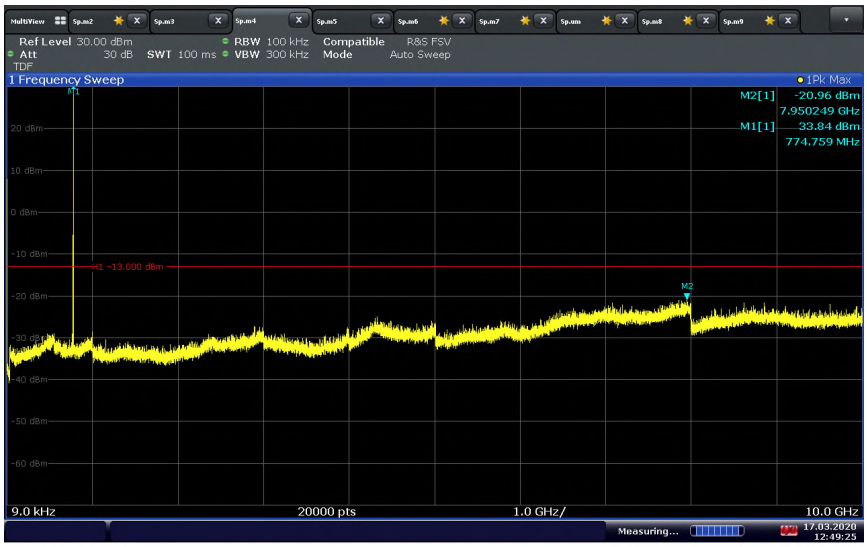
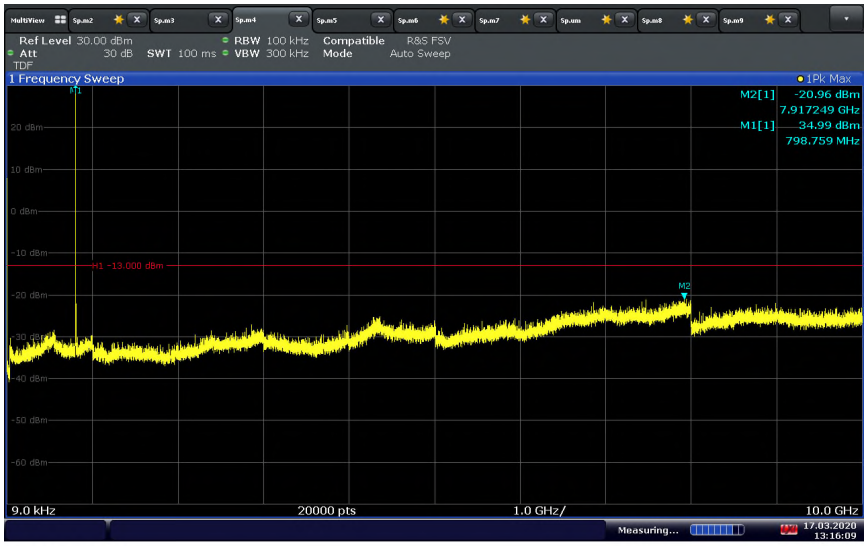
700MHz Narrowband Public Safety Downlink (12.5 kHz BW) CQPSK High Channel / Spurious Emissions
 12:49:26 17.03.2020
700MHz Narrowband Public Safety Uplink (12.5 kHz BW) CQPSK Low Channel / Spurious Emissions
 13:16:09 17.03.2020

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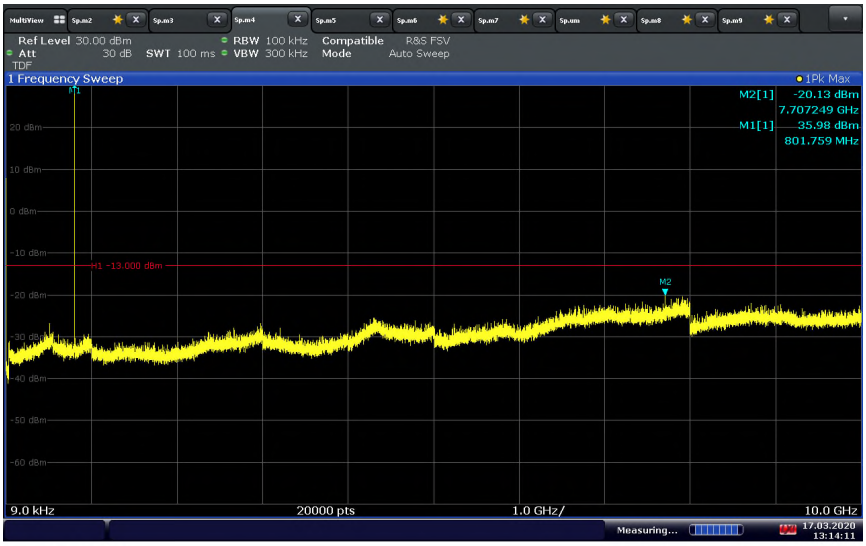
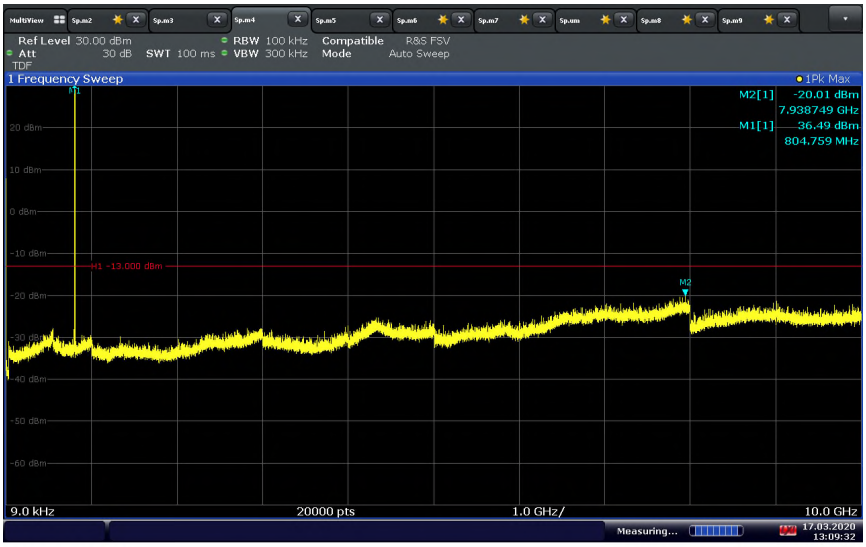
700MHz Narrowband Public Safety Uplink (12.5 kHz BW) CQPSK Mid Channel / Spurious Emissions
 13:14:12 17.03.2020
700MHz Narrowband Public Safety Uplink (12.5 kHz BW) CQPSK High Channel / Spurious Emissions
 13:09:32 17.03.2020

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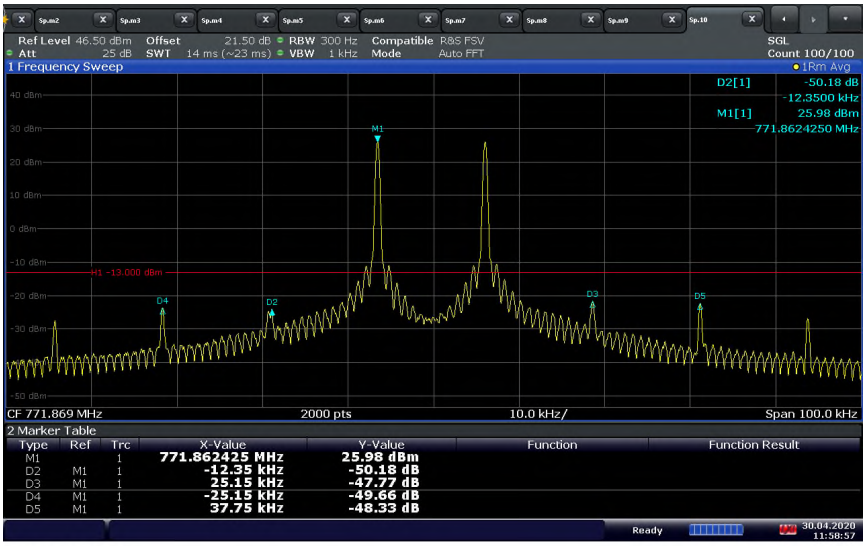
700MHz Narrowband Public Safety Downlink 2 Channels - Intermodulation (AGC Level)
(771.8625 MHz and 771.875 MHz, 12.5 kHz Channel Space)



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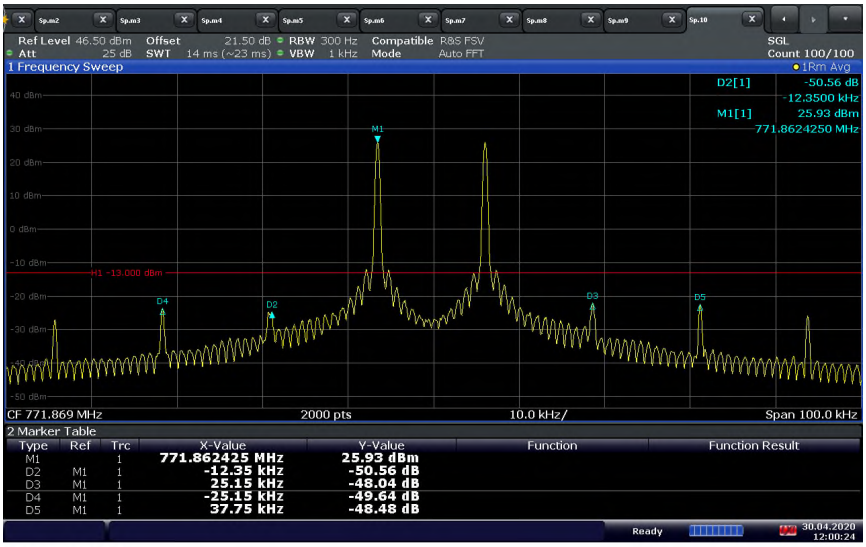
700MHz Narrowband Public Safety Downlink 2 Channels - Intermodulation (AGC + 3 Level)
(771.8625 MHz and 771.875 MHz, 12.5 kHz Channel Space)



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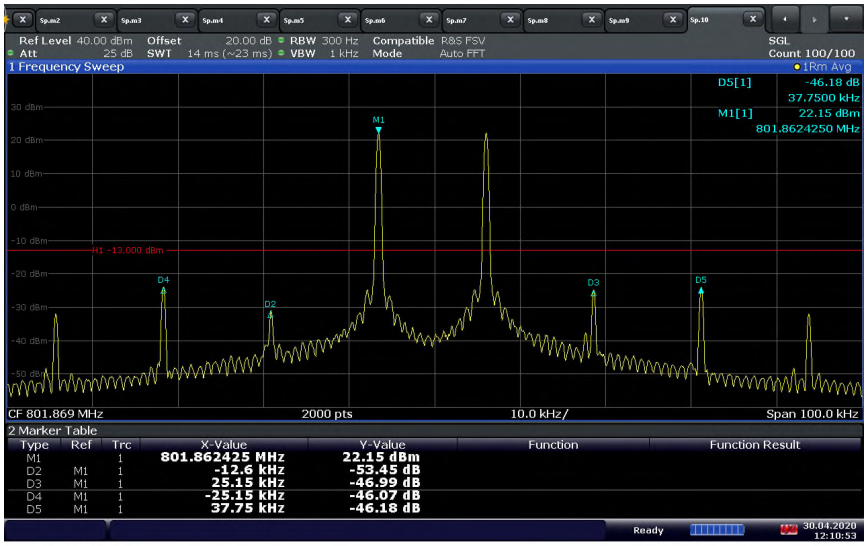
700MHz Narrowband Public Safety Uplink 2 Channels - Intermodulation (AGC Level)
(801.8625 MHz and 801.875 MHz, 12.5 kHz Channel Space)



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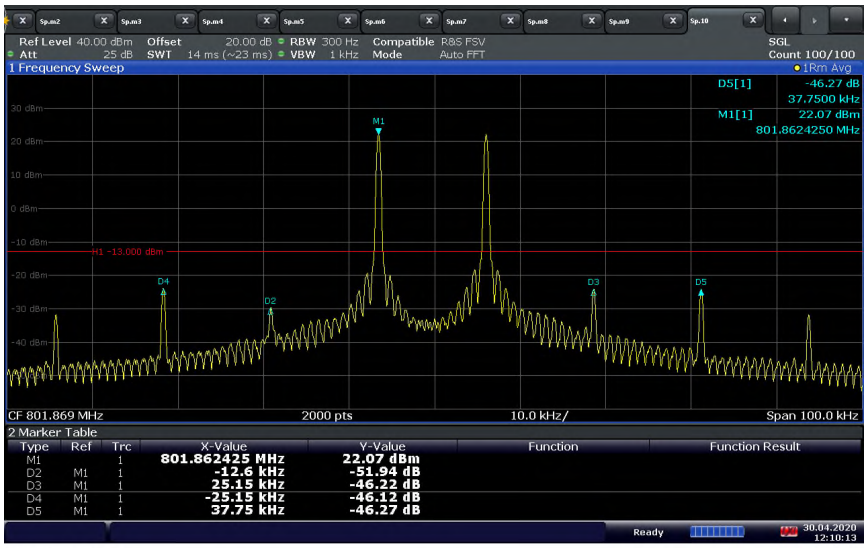
700MHz Narrowband Public Safety Uplink 2 Channels - Intermodulation (AGC + 3 Level)
(801.8625 MHz and 801.875 MHz, 12.5 kHz Channel Space)



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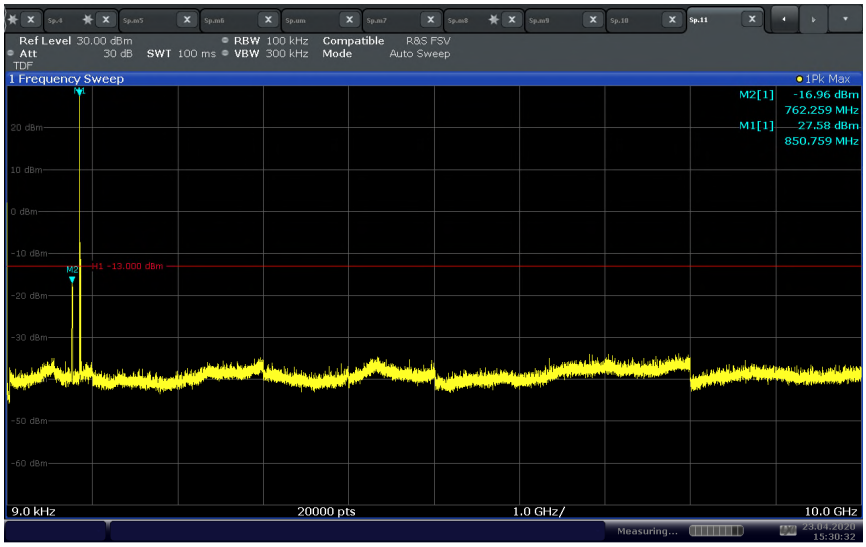
800 MHz NPSPAC Public Safety Downlink (12.5 kHz BW) H-DQPSK Low Channel / Spurious Emissions
 15:30:33 23.04.2020
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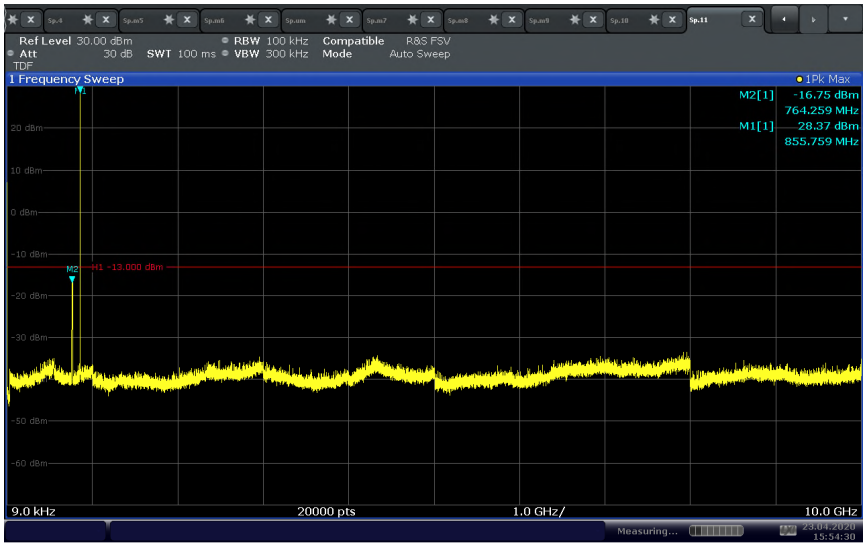 15:54:30 23.04.2020

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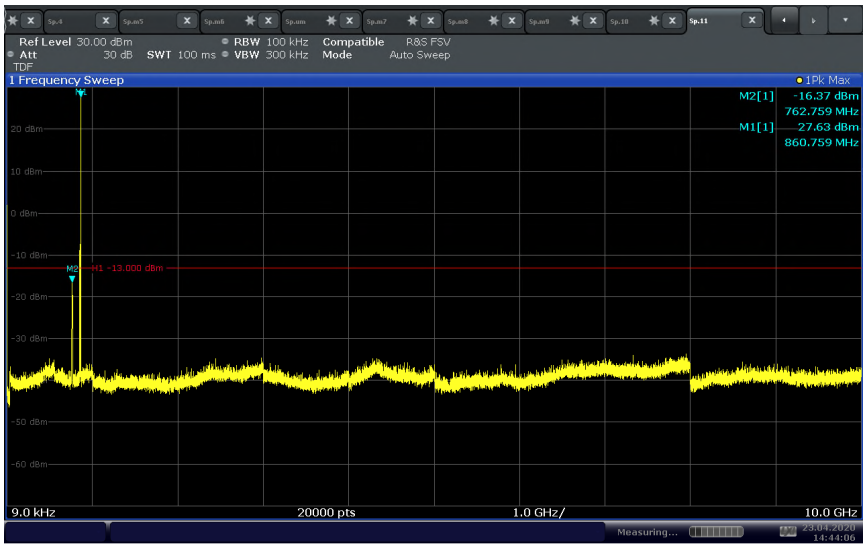
800 MHz NPSPAC Public Safety Downlink (12.5 kHz BW) H-DQPSK High Channel / Spurious Emissions
 14:44:06 23.04.2020
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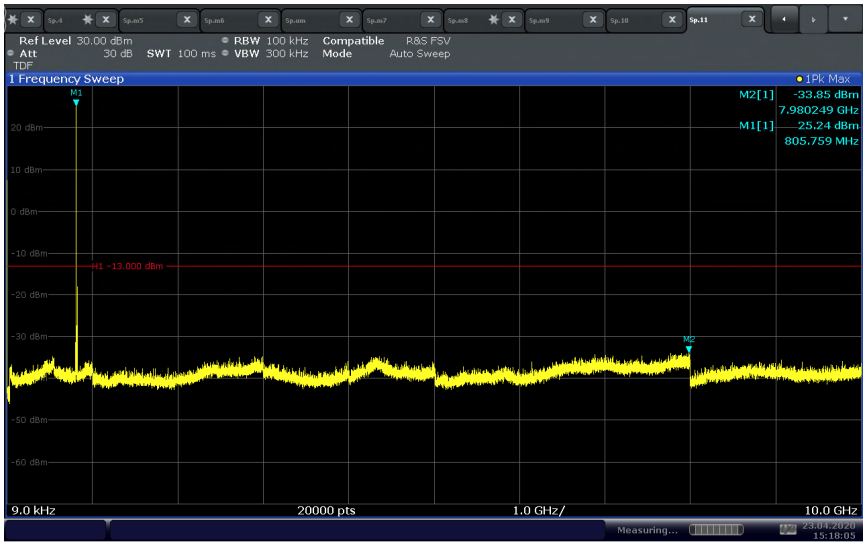 15:18:06 23.04.2020

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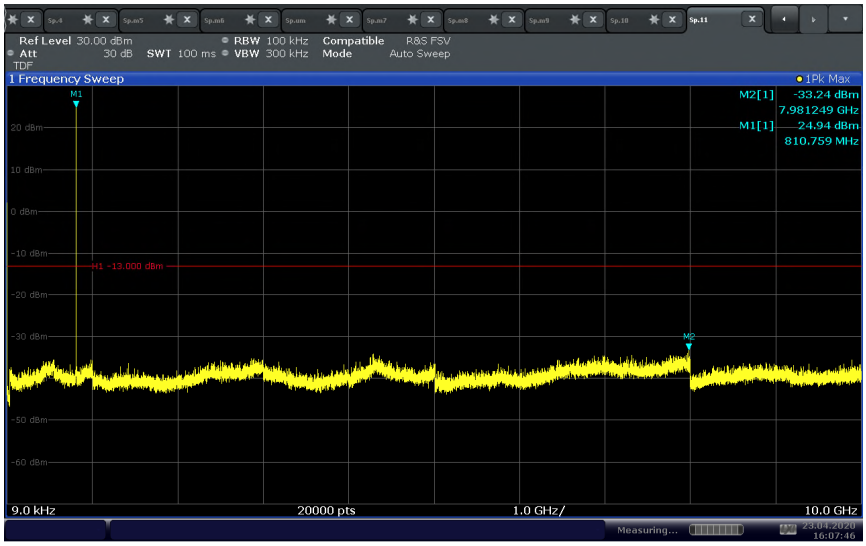
800 MHz NPSPAC Public Safety Uplink (12.5 kHz BW) H-CPM Mid Channel / Spurious Emissions
 16:07:47 23.04.2020
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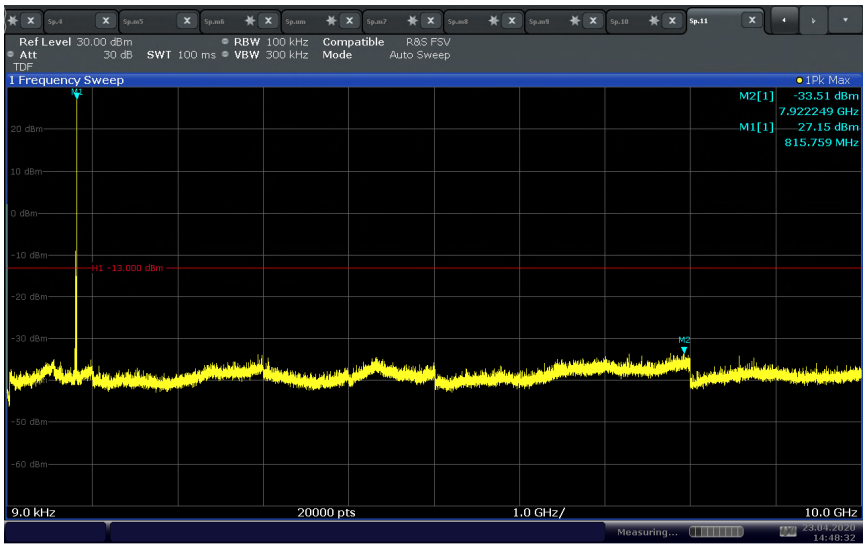 14:48:33 23.04.2020

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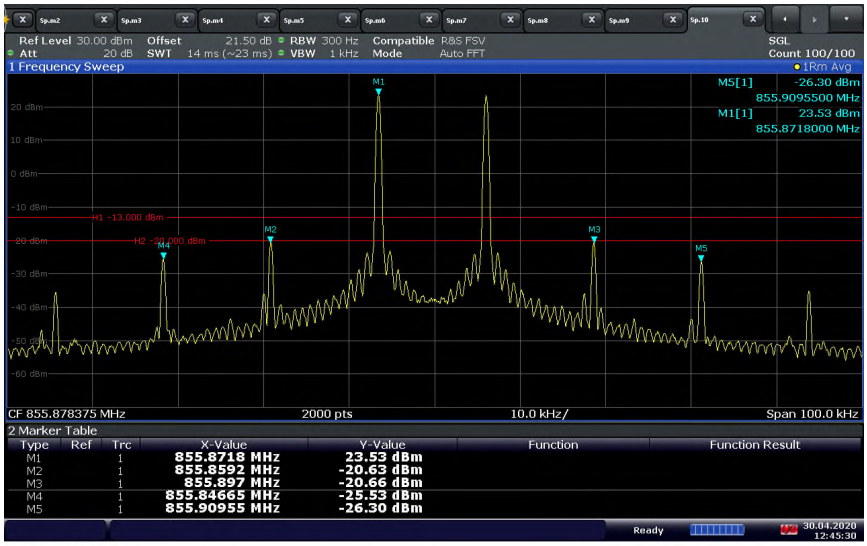
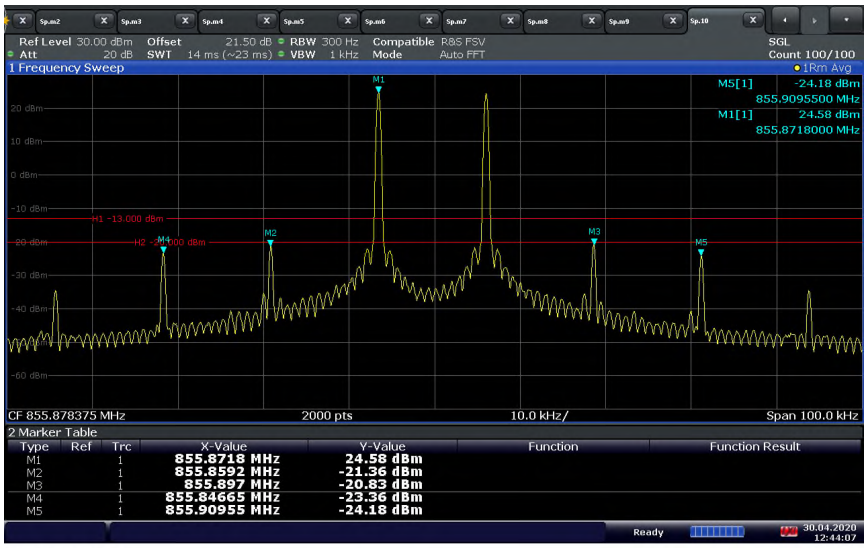
800 MHz NPSPAC Public Safety Downlink 2 Channels - Intermodulation (AGC Level) (855.871875 MHz and 855.884375 MHz, 12.5 kHz Channel Space)
   12:45:31 30.04.2020
800 MHz NPSPAC Public Safety Downlink 2 Channels - Intermodulation (AGC + 3 Level) (855.871875 MHz and 855.884375 MHz, 12.5 kHz Channel Space)
   12:44:08 30.04.2020

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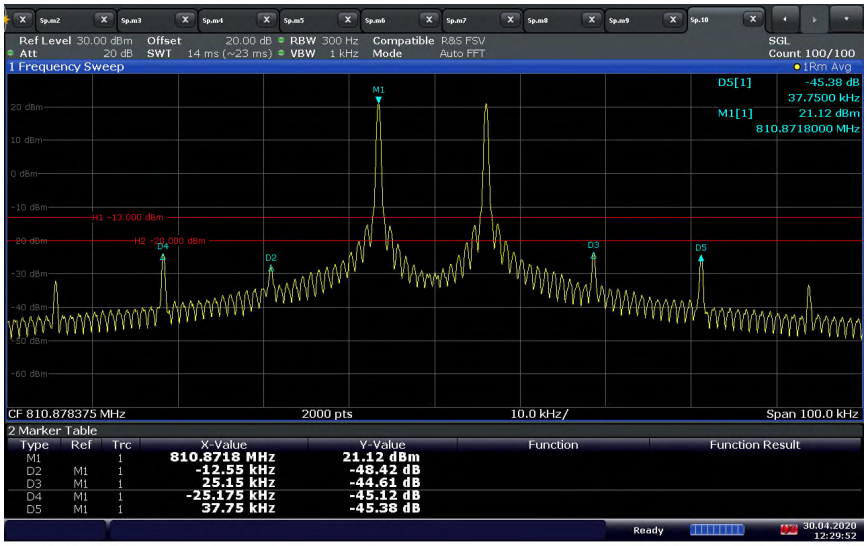
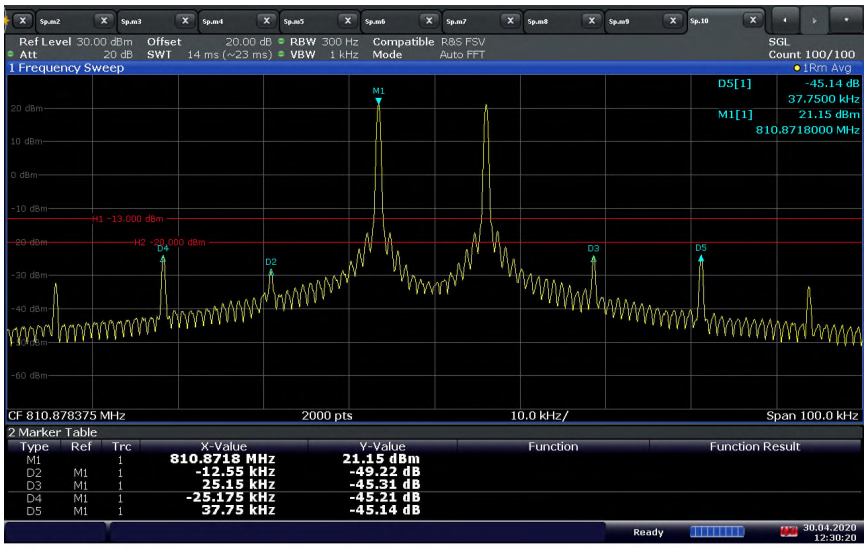
800 MHz NPSPAC Public Safety Uplink 2 Channels - Intermodulation (AGC Level)
(810.871875 MHz and 810.884375 MHz, 12.5 kHz Channel Space)



12:29:53 30.04.2020

800 MHz NPSPAC Public Safety Uplink 2 Channels - Intermodulation (AGC + 3 Level)
(810.871875 MHz and 810.884375 MHz, 12.5 kHz Channel Space)



12:30:20 30.04.2020

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SECTION 4

TEST EQUIPMENT USED

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3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

ID Number (SDGE/SDRB)	Test Equipment	Type	Serial Number	Manufacturer	Cal Date	Cal Due Date
Antenna Conducted Port Setup						
7662	P-Series Power Meter	N1911A	MY45100951	Agilent	06/28/19	06/28/20
7661	50MHz-18GHz Wideband Power Sensor	N1921A	MY45241383	Agilent	07/24/19	07/24/20
7608	Vector Signal Generator	SMBV100A	259021	Rhode & Schwarz	10/10/19	10/10/21
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	01/22/20	01/22/21
8825	20dB Attenuator	46-20-34	BK5773	Weinschel Corp.	Verified by 7608 and 7582	
Radiated Test Setup						
1033	Bilog Antenna	3142C	00044556	EMCO	09/05/19	09/05/21
7575	Double-ridged waveguide horn antenna	3117	00155511	EMCO	06/16/18	06/16/20
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	02/26/20	02/26/21
1016	Pre-amplifier	PAM-0202	187	A.H. Systems, Inc.	02/26/20	02/26/21
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	10/11/19	10/11/20
7620	EMI Test Receiver	ESU	100399	Rhode & Schwarz	10/18/19	10/18/20
7608	Vector Signal Generator	SMBV100A	259021	Rhode & Schwarz	10/10/19	10/10/21
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	01/22/20	01/22/21
1153	High-frequency cable	SucoFlex 100 SX	N/A	Suhner	Verified by 7608 and 7582	
8543	High-frequency cable	Micropore 19057793	N/A	United Microwave Products	Verified by 7608 and 7582	
Miscellaneous						
43003	True RMS Multimeter	85 III	96880143	Fluke	10/07/19	10/07/20
7579	Temperature Chamber	115	151617	TestQuity	09/09/19	09/09/20
7619	Barometer/Temperature/ Humidity Transmitter	iBTHX-W	15250268	Omega	06/18/19	06/18/20
	Test Software	EMC32	V8.53	Rhode & Schwarz	N/A	

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3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:

3.2.1 CONDUCTED ANTENNA PORT MEASUREMENT

	Input Quantity (Contribution) X_i	Value		Prob. Dist.	Divisor	$u_i(x)$	$u_i(x)^2$
1	Receiver reading	0.10	dB	Normal, k=1	1.000	0.10	0.01
2	Cable attenuation	1.00	dB	Normal, k=2	2.000	0.50	0.25
3	Received sinewave accuracy	0.07	dB	Normal, k=2	2.000	0.04	0.00
4	Receiver pulse amplitude	0.00	dB	Rectangular	1.732	0.00	0.00
5	Receiver pulse repetition rate	0.00	dB	Rectangular	1.732	0.00	0.00
6	Noise floor proximity	0.00	dB	Rectangular	1.732	0.00	0.00
7	Frequency interpolation	0.10	dB	Rectangular	1.732	0.06	0.00
8	Mismatch	0.07	dB	U-shaped	1.414	0.05	0.00
	Combined standard uncertainty			Normal		0.52	dB
	Expanded uncertainty			Normal, k=2		**1.03**	**dB**

3.2.2 RADIATED MEASUREMENTS (BELOW 1GHZ)

	Input Quantity (Contribution) X_i	Value		Prob. Dist.	Divisor	$u_i(x)$	$u_i(x)^2$
1	Receiver reading	0.10	dB	Normal, k=1	1.000	0.10	0.01
2	Attenuation: antenna-receiver	0.20	dB	Normal, k=2	2.000	0.10	0.01
3	Antenna factor AF	0.75	dB	Normal, k=2	2.000	0.38	0.14
4	Receiver sinewave accuracy	0.45	dB	Normal, k=2	2.000	0.23	0.05
5	Receiver pulse amplitude	1.50	dB	Rectangular	1.732	0.87	0.75
6	Receiver pulse repetition rate	1.50	dB	Rectangular	1.732	0.87	0.75
7	Noise floor proximity	0.50	dB	Rectangular	1.732	0.29	0.08
8	Mismatch: antenna-receiver	0.95	dB	U-shaped	1.414	0.67	0.45
9	AF frequency interpolation	0.30	dB	Rectangular	1.732	0.17	0.03
10	AF height deviations	0.10	dB	Rectangular	1.732	0.06	0.00
11	Directivity difference at 3 m	3.12	dB	Rectangular	1.732	1.80	3.24
12	Phase center location at 3 m	1.00	dB	Rectangular	1.732	0.58	0.33
13	Cross-polarisation	0.90	dB	Rectangular	1.732	0.52	0.27
14	Balance	0.00	dB	Rectangular	1.732	0.00	0.00
15	Site imperfections	3.76	dB	Triangular	2.449	1.54	2.36
16	Separation distance at 3 m	0.30	dB	Rectangular	1.732	0.17	0.03
17	Effect of setup table material	0.77	dB	Rectangular	1.732	0.44	0.20
18	Table height at 3 m	0.10	dB	Normal, k=2	2.000	0.05	0.00
19	Near-field effects	0.00	dB	Triangular	2.449	0.00	0.00
20	Effect of ambient noise on OATS	0.00	dB				0.00
	Combined standard uncertainty			Normal		2.95	dB
	Expanded uncertainty			Normal, k=2		**5.90**	**dB**

3.2.3 RADIATED EMISSION MEASUREMENTS (ABOVE 1GHZ)

	Input Quantity (Contribution) X_i	Value		Prob. Dist.	Divisor	$u_i(x)$	$u_i(x)^2$
1	Receiver reading	0.10	dB	Normal, k=1	1.000	0.10	0.01
2	Attenuation: antenna-receiver	0.30	dB	Normal, k=2	2.000	0.15	0.02
3	Preamplifier Gain	0.20	dB	Normal, k=2	2.000	0.10	0.01
4	Antenna factor AF	0.37	dB	Normal, k=2	2.000	0.19	0.03
5	Sinewave accuracy	0.57	dB	Normal, k=2	2.000	0.29	0.08
6	Instability of preamp gain	1.21	dB	Rectangular	1.732	0.70	0.49
7	Noise floor proximity	0.70	dB	Rectangular	1.732	0.40	0.16
8	Mismatch: antenna-preamplifier	1.41	dB	U-shaped	1.414	1.00	0.99
9	Mismatch: preamplifier-receiver	1.30	dB	U-shaped	1.414	0.92	0.85
10	AF frequency interpolation	0.30	dB	Rectangular	1.732	0.17	0.03
11	Directivity difference at 3 m	1.50	dB	Rectangular	1.732	0.87	0.75
12	Phase center location at 3 m	0.30	dB	Rectangular	1.732	0.17	0.03
13	Cross-polarisation	0.90	dB	Rectangular	1.732	0.52	0.27
14	Site imperfections VSWR (Method 2)	3.00	dB	Triangular	2.449	1.22	1.50
15	Effect of setup table material	1.15	dB	Rectangular	1.732	0.87	0.75
16	Separation distance at 3 m	0.30	dB	Rectangular	1.732	0.17	0.03
17	Table height at 3 m	0.00	dB	Normal, k=2	2.000	0.00	0.00
	Combined standard uncertainty			Normal	2.45	dB	
	Expanded uncertainty			Normal, k=2	**4.90**	**dB**	

3.2.4 CONDUCTED MEASUREMENTS

	Input Quantity (Contribution) X_i	Value		Prob. Dist.	Divisor	$u_i(x)$	$u_i(x)^2$
1	Receiver reading	0.10	dB	Normal, k=1	1.000	0.10	0.01
2	LISN-receiver attenuation	0.10	dB	Normal, k=2	2.000	0.05	0.00
3	LISN voltage division factor	0.30	dB	Normal, k=2	2.000	0.15	0.02
4	Receiver sinewave accuracy	0.36	dB	Normal, k=2	2.000	0.18	0.03
5	Receiver pulse amplitude	1.50	dB	Rectangular	1.732	0.87	0.75
6	Receiver pulse repetition rate	1.50	dB	Rectangular	1.732	0.87	0.75
7	Noise floor proximity	0.00	dB	Rectangular	1.732	0.00	0.00
8	AMN VDF frequency interpolation	0.10	dB	Rectangular	1.732	0.06	0.00
9	Mismatch	0.07	dB	U-shaped	1.414	0.05	0.00
10	LISN impedance	2.65	dB	Triangular	2.449	1.08	1.17
11	Effect of mains disturbance	0.00	dB			0.00	0.00
12	Effect of the environment						
	Combined standard uncertainty			Normal	1.66	dB	
	Expanded uncertainty			**Normal, k=2**	**3.31**	**dB**	

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SECTION 5

DIAGRAM OF TEST SETUP

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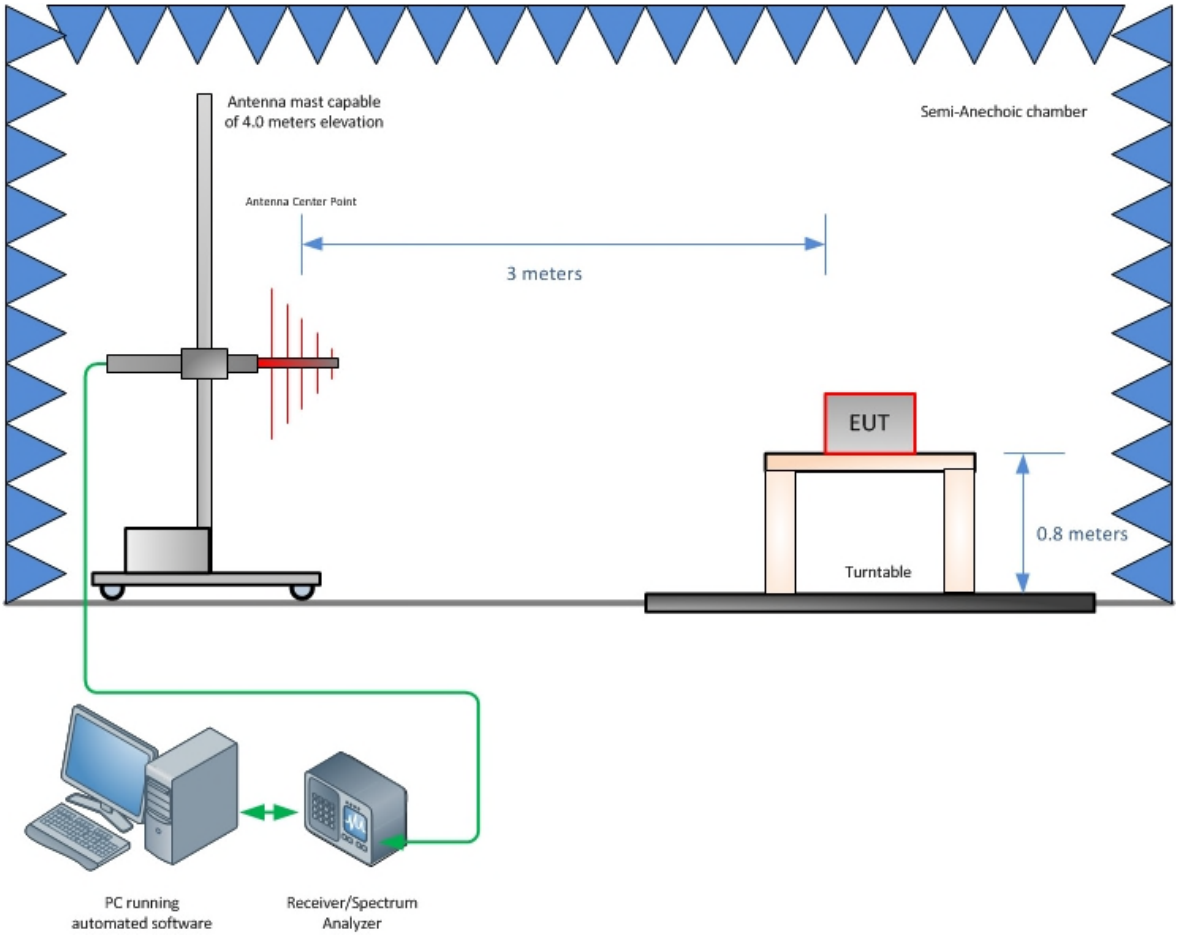
4.1 TEST SETUP DIAGRAM



Radiated Emission Test Setup (Below 1GHz)

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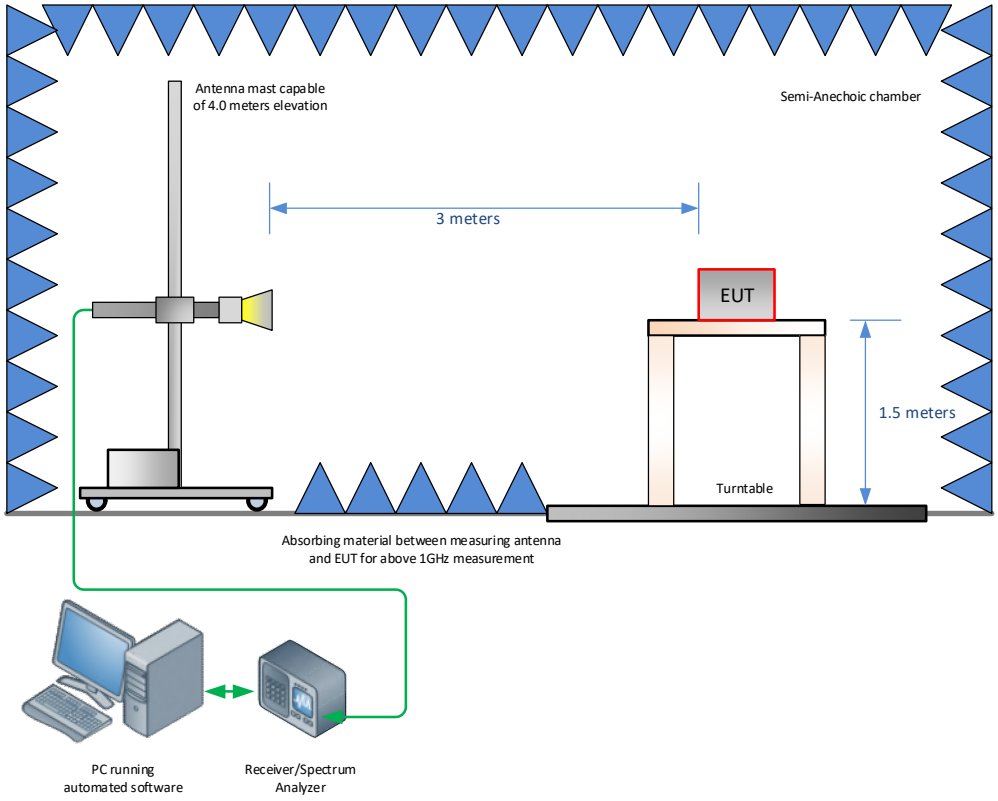
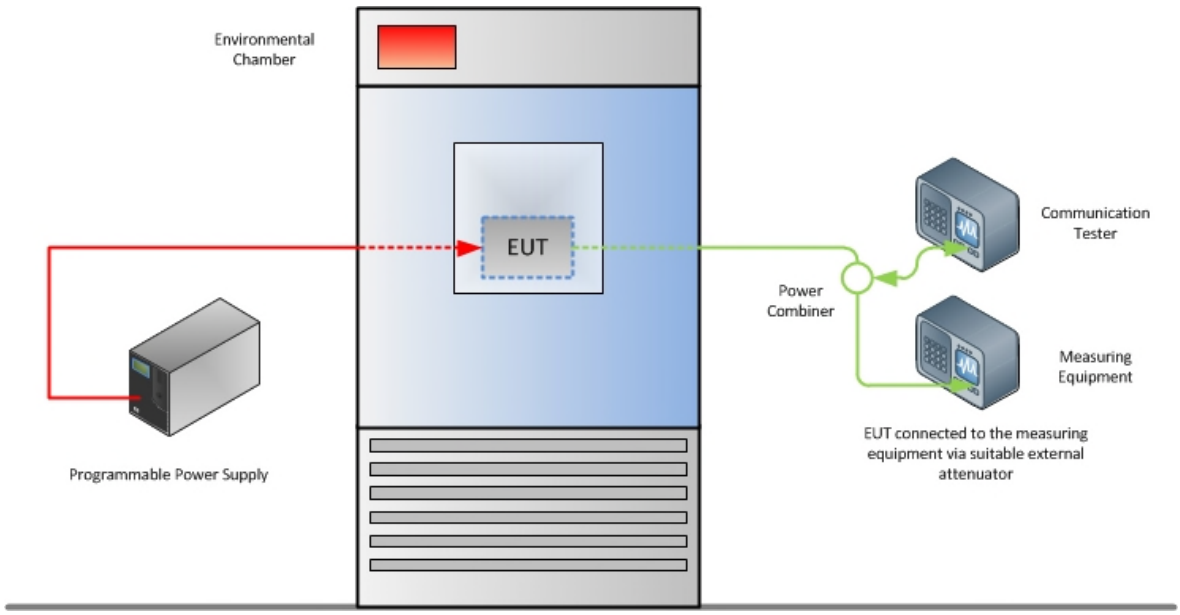


Radiated Emission Test Setup (Above 1GHz)



Frequency Stability Test Comfiguration

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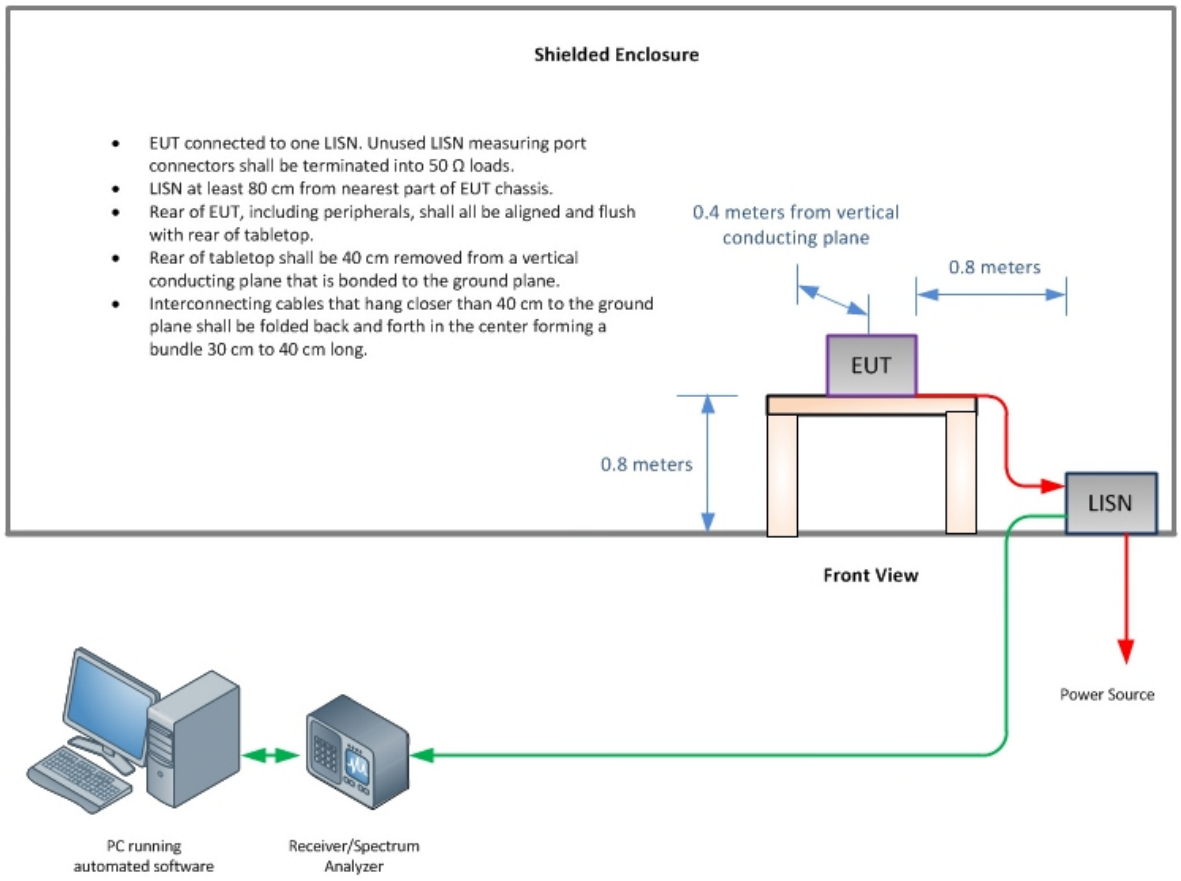

Conducted Emissions Test Configuration (if applicable)

SECTION 6

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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