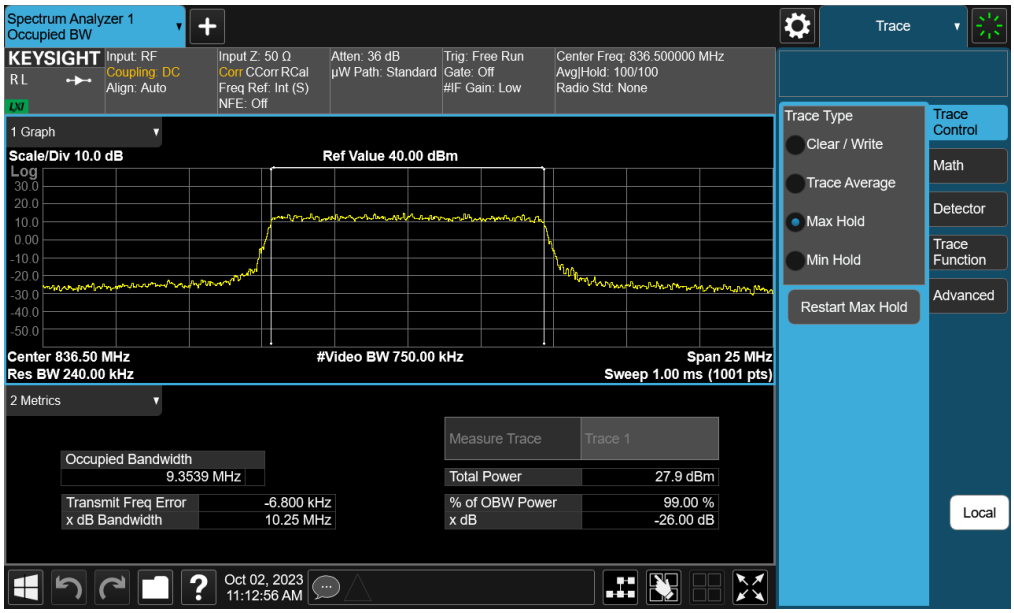
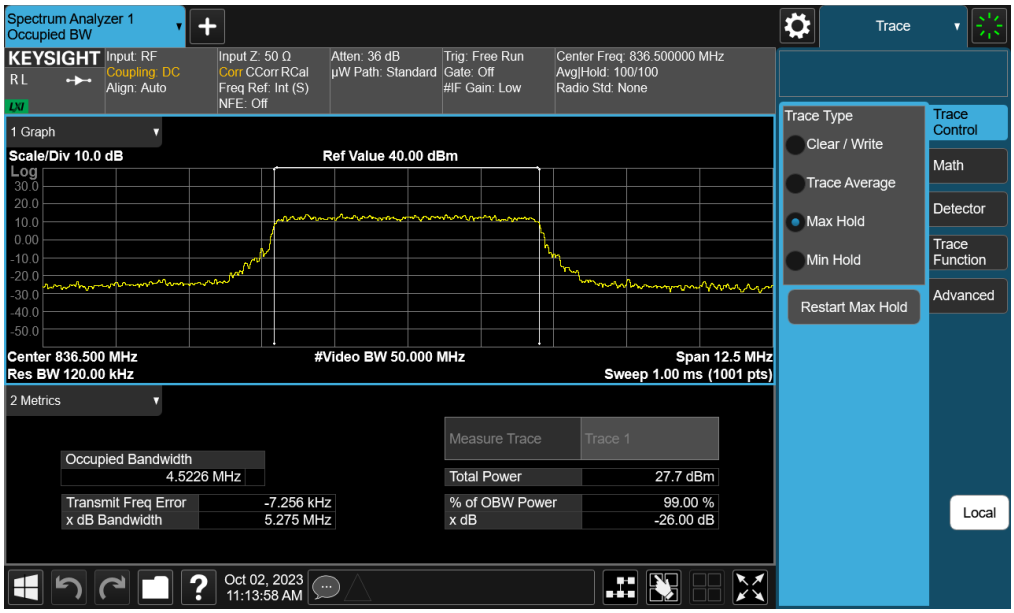
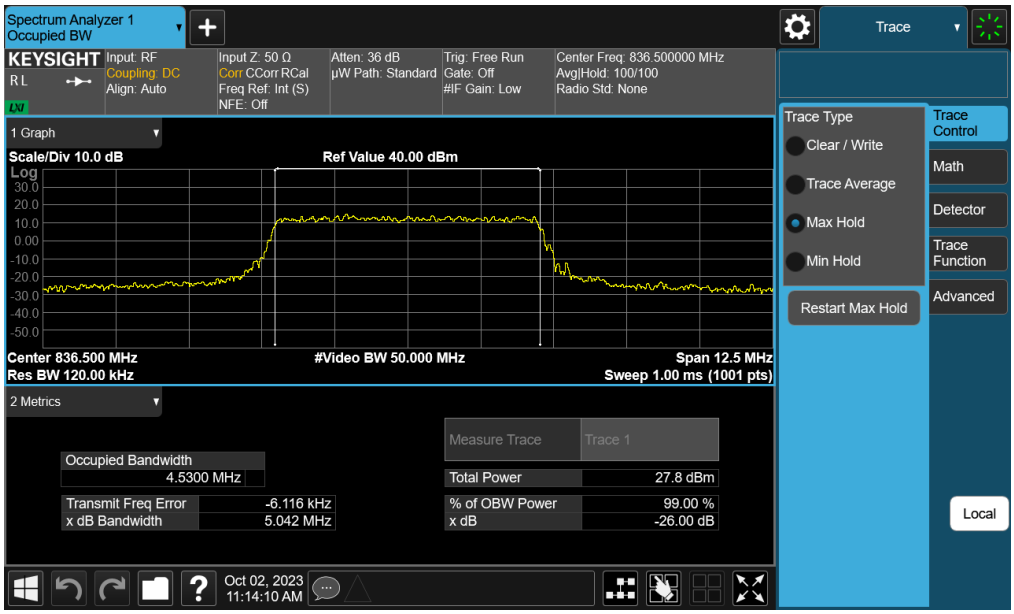


Plot 7-43. Occupied Bandwidth Plot (NR Band n5 - 10MHz 16-QAM - Full RB Configuration – Ant E)

Plot 7-44. Occupied Bandwidth Plot (NR Band n5 - 5MHz π/2 BPSK - Full RB Configuration – Ant E)



Plot 7-45. Occupied Bandwidth Plot (NR Band n5 - 5MHz QPSK - Full RB Configuration – Ant E)



Plot 7-46. Occupied Bandwidth Plot (NR Band n5 - 5MHz 16-QAM - Full RB Configuration – Ant E)

7.3 Spurious and Harmonic Emissions at Antenna Terminal

Test Overview

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

The minimum permissible attenuation level of any spurious emission is 43 + 10 $\log_{10}(P_{[Watts]})$, where P is the transmitter power in Watts.

Test Procedure Used

ANSI C63.26-2015 – Section 5.7.4

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to 10GHz (separated into at least two plots per channel)
2. Detector = RMS
3. Trace mode = trace average for continuous emissions, max hold for pulse emissions
4. Sweep time = auto couple
5. The trace was allowed to stabilize
6. Please see test notes below for RBW and VBW settings

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

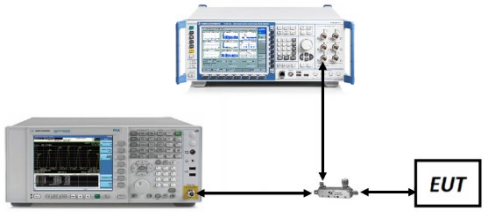


Figure 7-2. Test Instrument & Measurement Setup

Test Notes

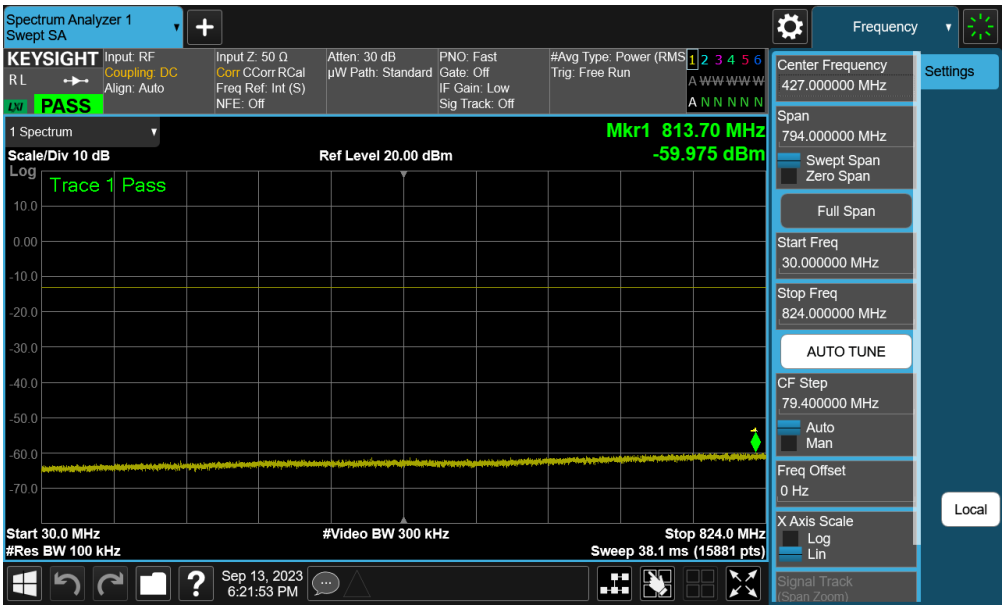
1. Per Part 22 and RSS-132, compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth 100 kHz or greater for measurements below 1GHz. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. 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 emission are attenuated at least 26 dB below the transmitter power.

2. For NR operation, all subcarrier spacings (SCS) and transmission schemes (e.g. CP-OFDM and DFT-s-OFDM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

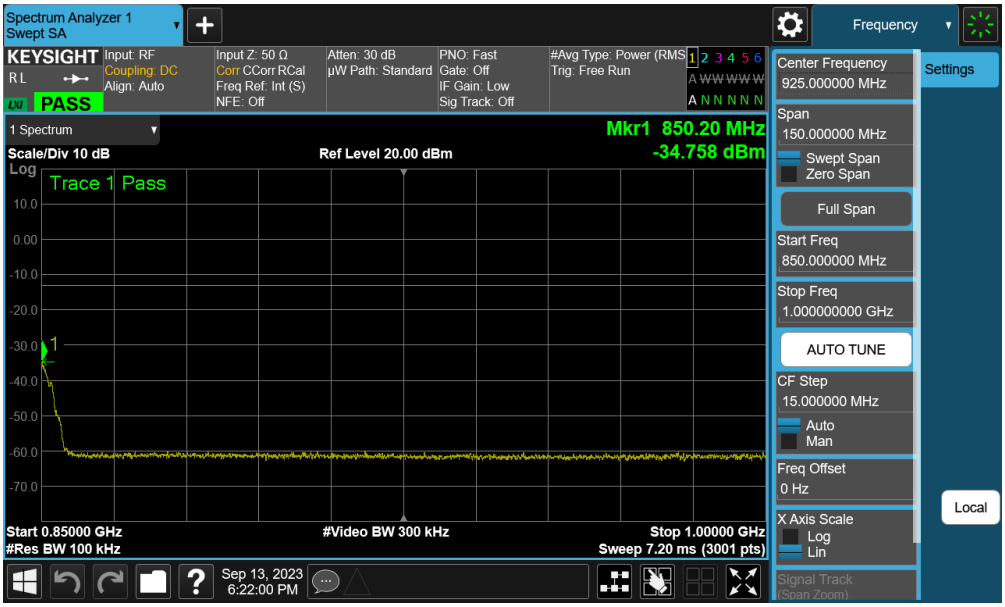
Mode	Bandwidth	Channel	Range [MHz]	Level [dBm]	Limit [dBm]	Margin [dB]
GSM-Cell	250 kHz	Low	30.0 - 823.0	-33.85	-13	-20.85
		Low	849.0 - 1000.0	-50.08	-13	-37.08
		Low	1000.0 - 10000.0	-31.55	-13	-18.55
		Mid	30.0 - 824.0	-50.56	-13	-37.56
		Mid	849.0 - 1000.0	-51.17	-13	-38.17
		Mid	1000.0 - 10000.0	-31.51	-13	-18.51
		High	30.0 - 824.0	-50.39	-13	-37.39
		High	850.0 - 1000.0	-35.35	-13	-22.35
		High	1000.0 - 10000.0	-31.42	-13	-18.42
WCDMA-Cell	5 MHz	Low	30.0 - 823.0	-33.89	-13	-20.89
		Low	849.0 - 1000.0	-60.33	-13	-47.33
		Low	1000.0 - 10000.0	-39.64	-13	-26.64
		Mid	30.0 - 824.0	-54.42	-13	-41.42
		Mid	849.0 - 1000.0	-55.80	-13	-42.80
		Mid	1000.0 - 10000.0	-39.92	-13	-26.92
		High	30.0 - 824.0	-59.98	-13	-46.98
		High	850.0 - 1000.0	-34.76	-13	-21.76
		High	1000.0 - 10000.0	-39.81	-13	-26.81
LTE-B26-5	10 MHz	Low	30.0 - 823.0	-59.05	-13	-46.05
		Low	849.0 - 1000.0	-59.96	-13	-46.96
		Low	1000.0 - 10000.0	-39.61	-13	-26.61
		Mid	30.0 - 824.0	-59.22	-13	-46.22
		Mid	849.0 - 1000.0	-59.90	-13	-46.90
		Mid	1000.0 - 10000.0	-39.75	-13	-26.75
		High	30.0 - 824.0	-59.66	-13	-46.66
		High	850.0 - 1000.0	-59.44	-13	-46.44
		High	1000.0 - 10000.0	-39.43	-13	-26.43
NR-n5	20 MHz	Low	30.0 - 823.0	-58.24	-13	-45.24
		Low	849.0 - 1000.0	-60.17	-13	-47.17
		Low	1000.0 - 10000.0	-39.43	-13	-26.43
		Mid	30.0 - 824.0	-59.01	-13	-46.01
		Mid	849.0 - 1000.0	-59.19	-13	-46.19
		Mid	1000.0 - 10000.0	-39.38	-13	-26.38
		High	30.0 - 824.0	-59.24	-13	-46.24
		High	850.0 - 1000.0	-58.61	-13	-45.61
		High	1000.0 - 10000.0	-39.05	-13	-26.05

Table 7-7. Conducted Spurious Emission Results – Ant A

GSM/GPRS Cell – Ant A



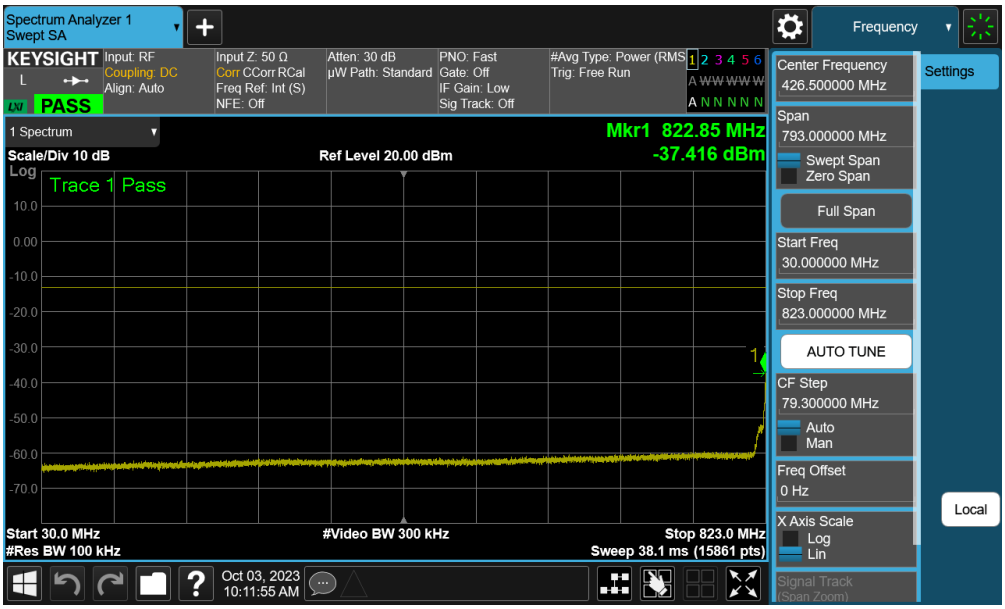
Plot 7-47. Conducted Spurious Plot (GPRS Ch. 190 – Ant A)



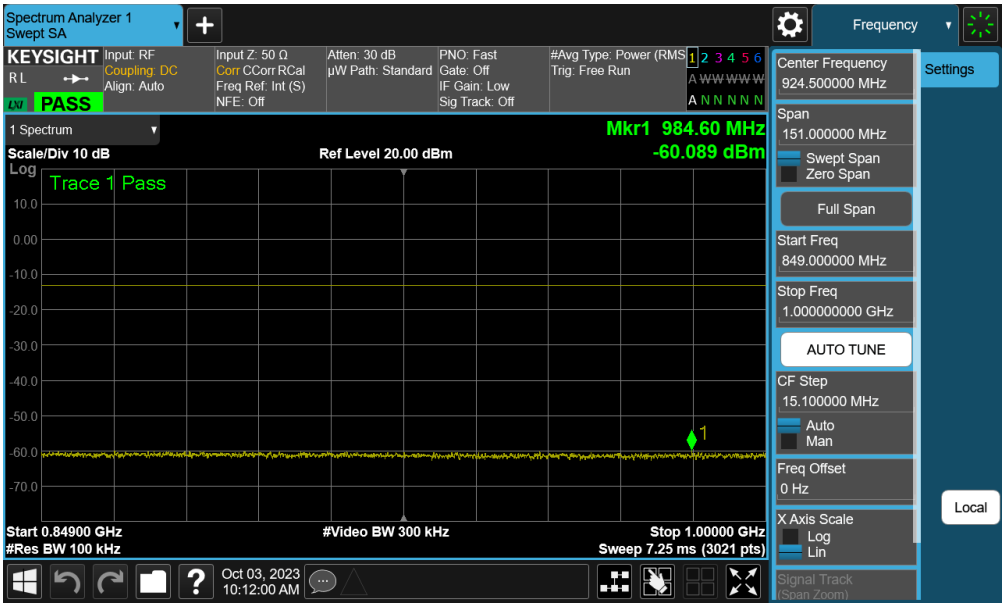
Plot 7-48. Conducted Spurious Plot (GPRS Ch. 190 – Ant A)

Plot 7-49. Conducted Spurious Plot (GPRS Ch. 190 – Ant A)

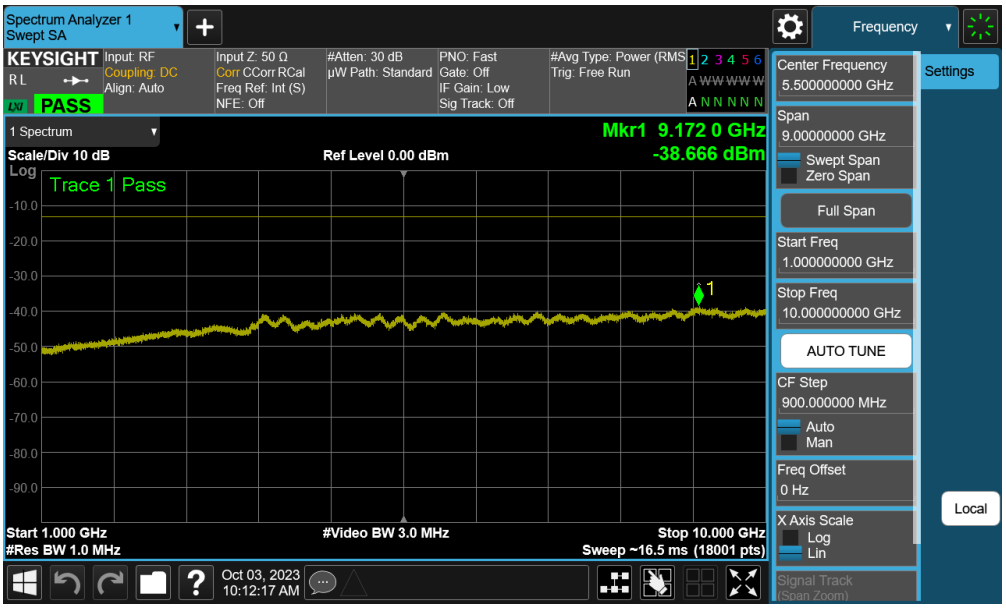
WCDMA Cell – Ant A



Plot 7-50. Conducted Spurious Plot (WCDMA Ch. 4183 – Ant A)

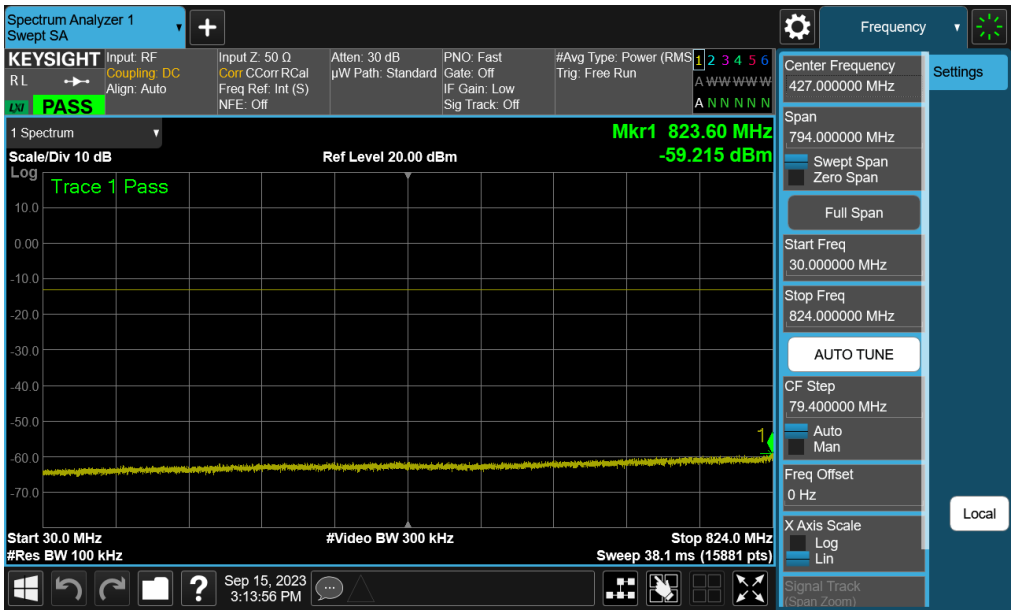


Plot 7-51. Conducted Spurious Plot (WCDMA Ch. 4183 – Ant A)

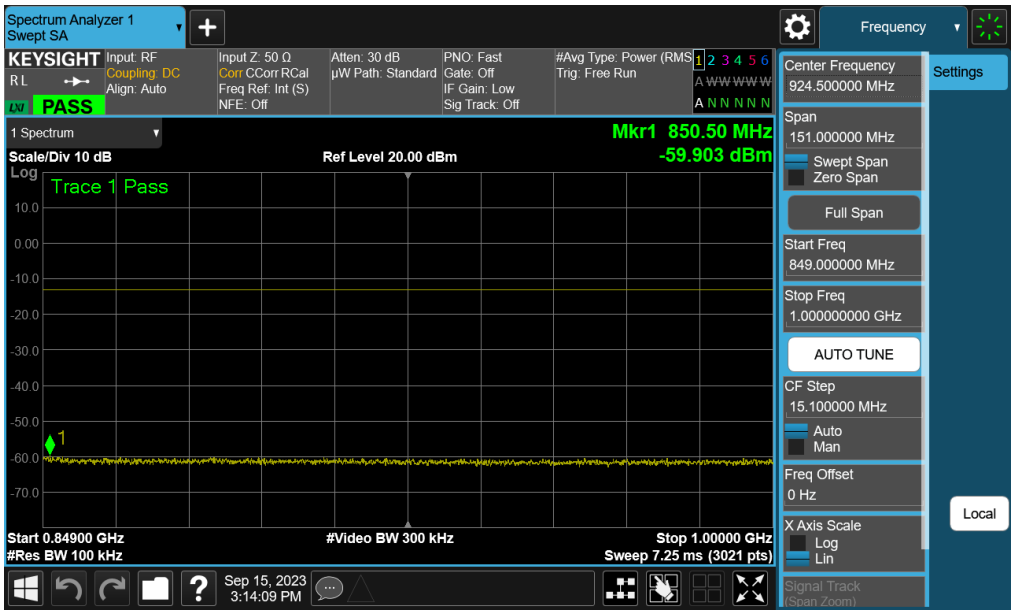


Plot 7-52. Conducted Spurious Plot (WCDMA Ch. 4183 – Ant A)

LTE Band 5 – Ant A



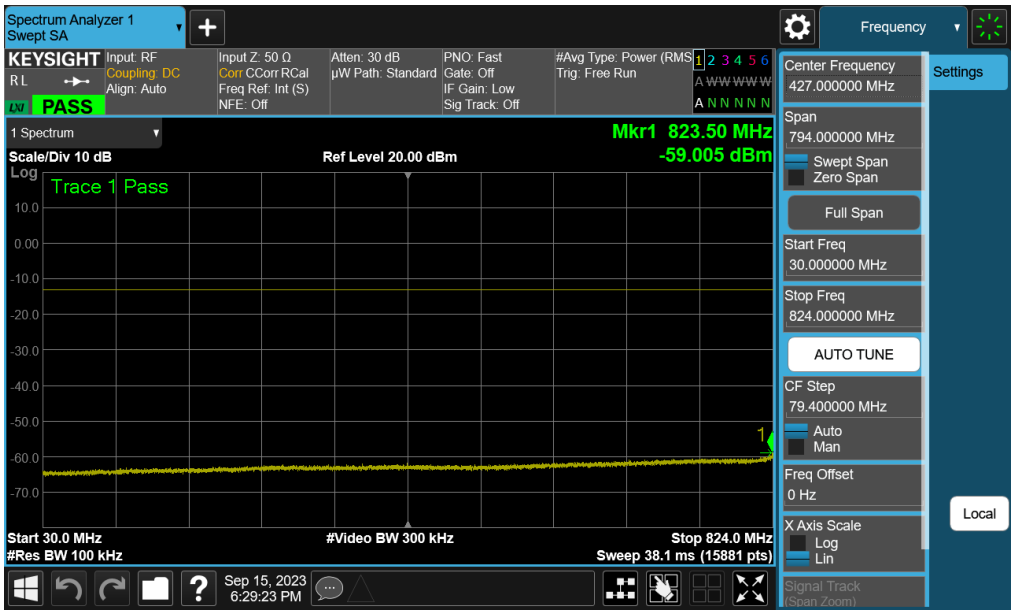
Plot 7-53. Conducted Spurious Plot (LTE Band 5 – 10MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel – Ant A)



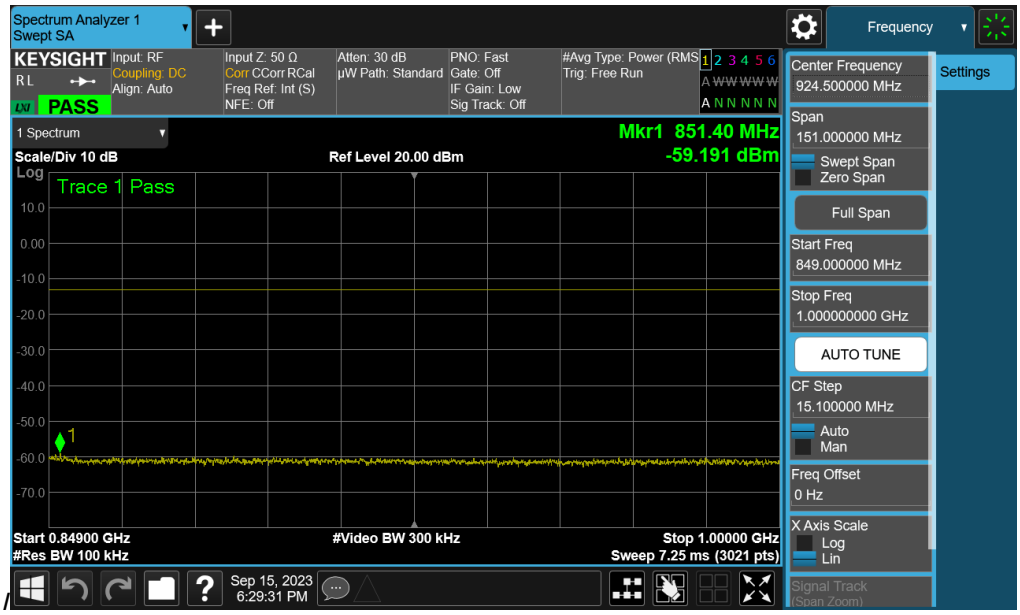
Plot 7-54. Conducted Spurious Plot (LTE Band 5 – 10MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel – Ant A)

Plot 7-55. Conducted Spurious Plot (LTE Band 5 – 10MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel – Ant A)

NR Band n5



Plot 7-56. Conducted Spurious Plot (NR Band n5 – 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel – Ant A)



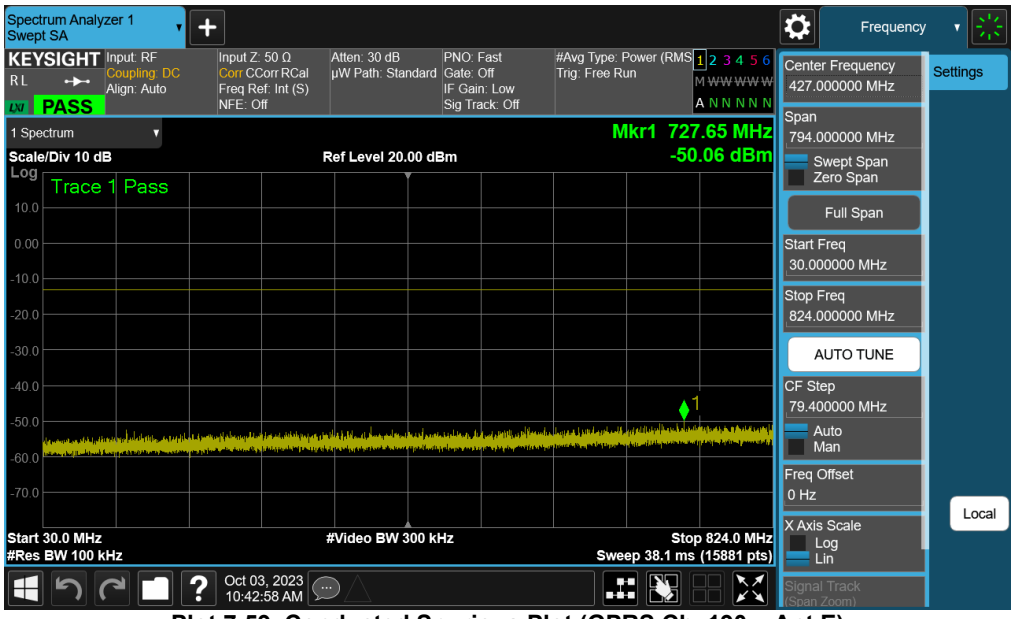
Plot 7-57. Conducted Spurious Plot (NR Band n5 – 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel – Ant A)

Plot 7-58. Conducted Spurious Plot (NR Band n5 – 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel – Ant A)

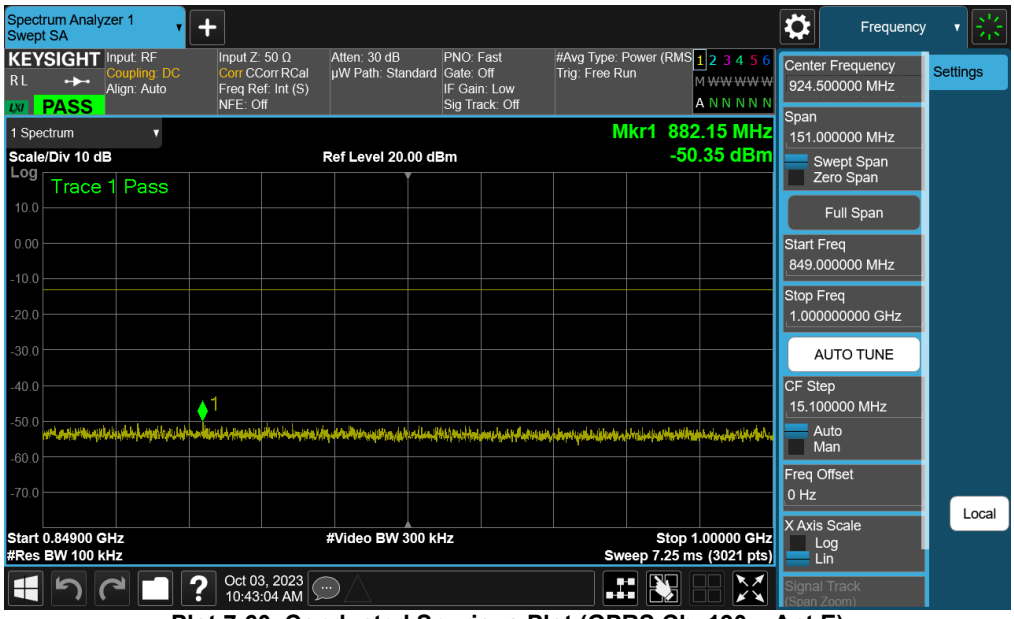
Mode	Bandwidth	Channel	Range [MHz]	Level [dBm]	Limit [dBm]	Margin [dB]
GSM-Cell	250 kHz	Low	30.0 - 823.0	-33.08	-13	-20.08
		Low	849.0 - 1000.0	-50.84	-13	-37.84
		Low	1000.0 - 10000.0	-29.72	-13	-16.72
		Mid	30.0 - 824.0	-50.06	-13	-37.06
		Mid	849.0 - 1000.0	-50.35	-13	-37.35
		Mid	1000.0 - 10000.0	-30.49	-13	-17.49
		High	30.0 - 824.0	-49.05	-13	-36.05
		High	850.0 - 1000.0	-36.38	-13	-23.38
		High	1000.0 - 10000.0	-30.33	-13	-17.33
WCDMA-Cell	5 MHz	Low	30.0 - 823.0	-37.42	-13	-24.42
		Low	849.0 - 1000.0	-60.09	-13	-47.09
		Low	1000.0 - 10000.0	-38.67	-13	-25.67
		Mid	30.0 - 824.0	-53.39	-13	-40.39
		Mid	849.0 - 1000.0	-55.52	-13	-42.52
		Mid	1000.0 - 10000.0	-38.50	-13	-25.50
		High	30.0 - 824.0	-59.37	-13	-46.37
		High	850.0 - 1000.0	-38.61	-13	-25.61
		High	1000.0 - 10000.0	-38.59	-13	-25.59
LTE-B26-5	10 MHz	Low	30.0 - 823.0	-58.61	-13	-45.61
		Low	849.0 - 1000.0	-59.91	-13	-46.91
		Low	1000.0 - 10000.0	-38.59	-13	-25.59
		Mid	30.0 - 824.0	-59.25	-13	-46.25
		Mid	849.0 - 1000.0	-59.91	-13	-46.91
		Mid	1000.0 - 10000.0	-38.40	-13	-25.40
		High	30.0 - 824.0	-59.28	-13	-46.28
		High	850.0 - 1000.0	-59.78	-13	-46.78
		High	1000.0 - 10000.0	-38.87	-13	-25.87
NR-n5	20 MHz	Low	30.0 - 823.0	-58.97	-13	-45.97
		Low	849.0 - 1000.0	-59.89	-13	-46.89
		Low	1000.0 - 10000.0	-38.88	-13	-25.88
		Mid	30.0 - 824.0	-58.64	-13	-45.64
		Mid	849.0 - 1000.0	-59.80	-13	-46.80
		Mid	1000.0 - 10000.0	-38.71	-13	-25.71
		High	30.0 - 824.0	-59.40	-13	-46.40
		High	850.0 - 1000.0	-59.06	-13	-46.06
		High	1000.0 - 10000.0	-38.20	-13	-25.20

Table 7-8. Conducted Spurious Emission Results – Ant E

GSM/GPRS Cell – Ant E



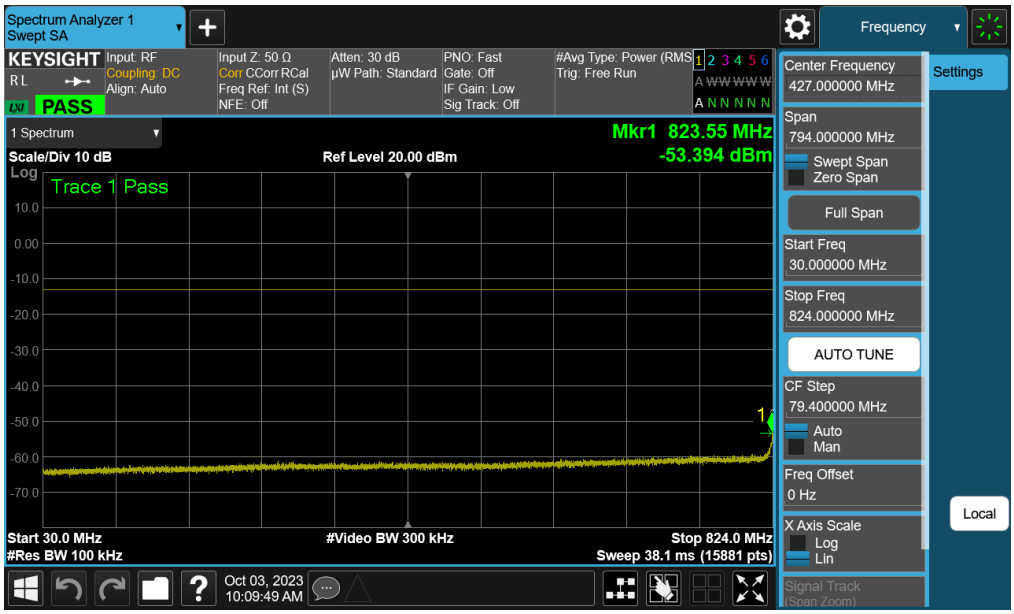
Plot 7-59. Conducted Spurious Plot (GPRS Ch. 190 – Ant E)



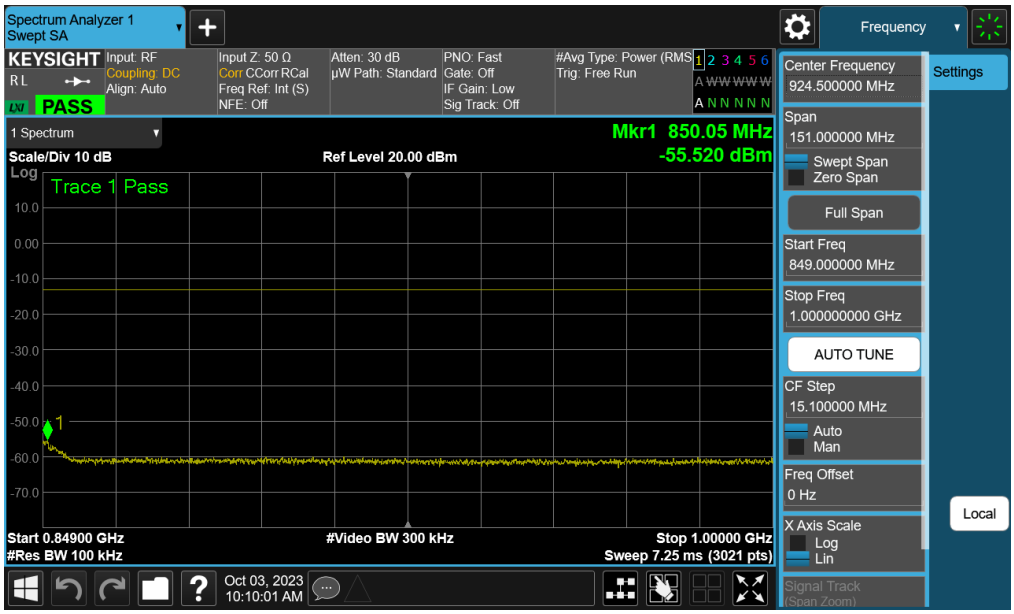
Plot 7-60. Conducted Spurious Plot (GPRS Ch. 190 – Ant E)

Plot 7-61. Conducted Spurious Plot (GPRS Ch. 190 – Ant E)

WCDMA Cell – Ant E



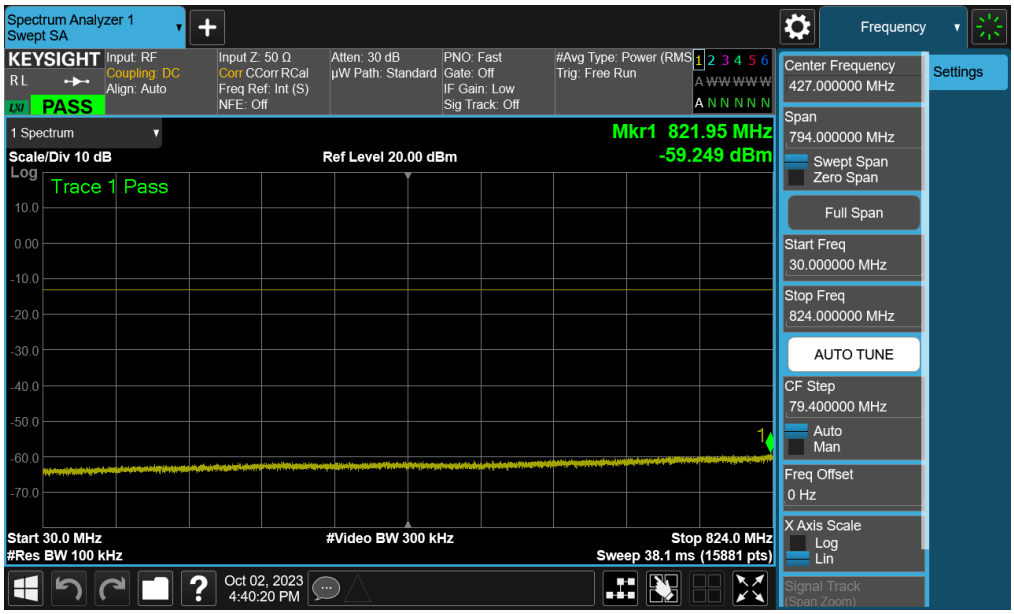
Plot 7-62. Conducted Spurious Plot (WCDMA Ch. 4183 – Ant E)



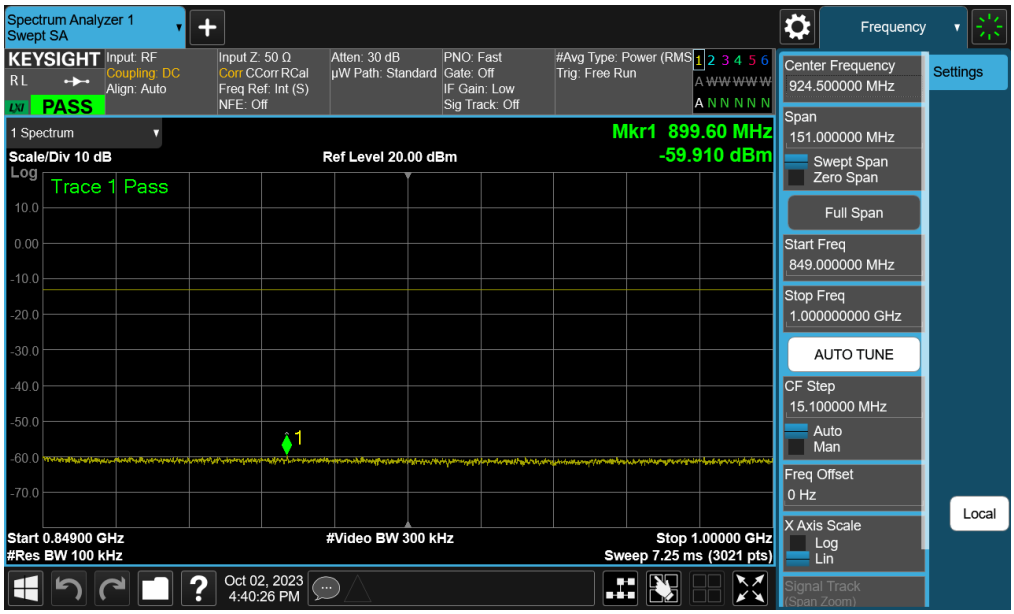
Plot 7-63. Conducted Spurious Plot (WCDMA Ch. 4183 – Ant E)

Plot 7-64. Conducted Spurious Plot (WCDMA Ch. 4183 – Ant E)

LTE Band 5 – Ant E



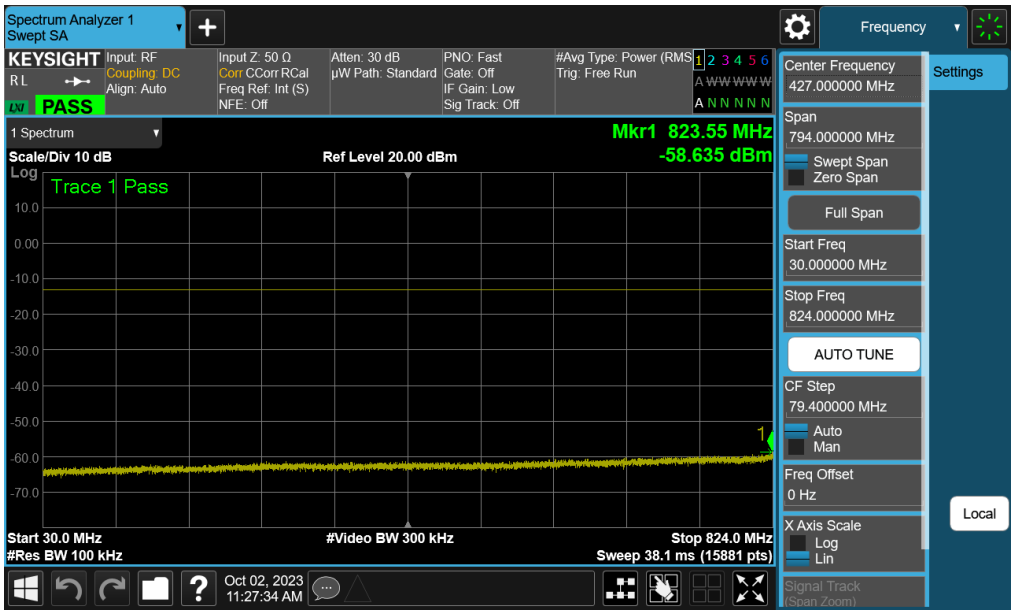
Plot 7-65. Conducted Spurious Plot (LTE Band 5 – 10MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel – Ant E)



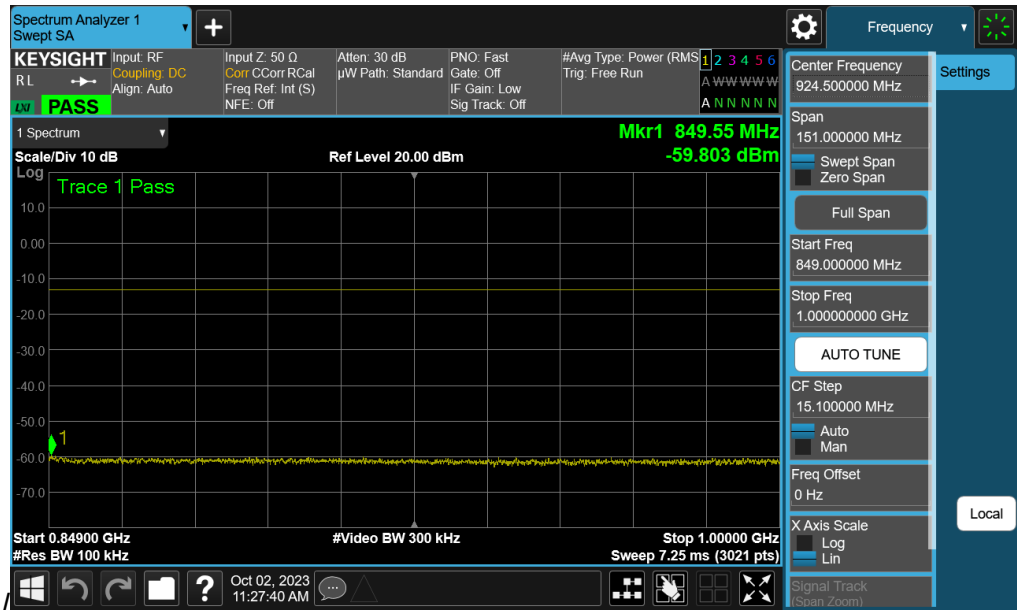
Plot 7-66. Conducted Spurious Plot (LTE Band 5 – 10MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel – Ant E)

Plot 7-67. Conducted Spurious Plot (LTE Band 5 – 10MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel – Ant E)

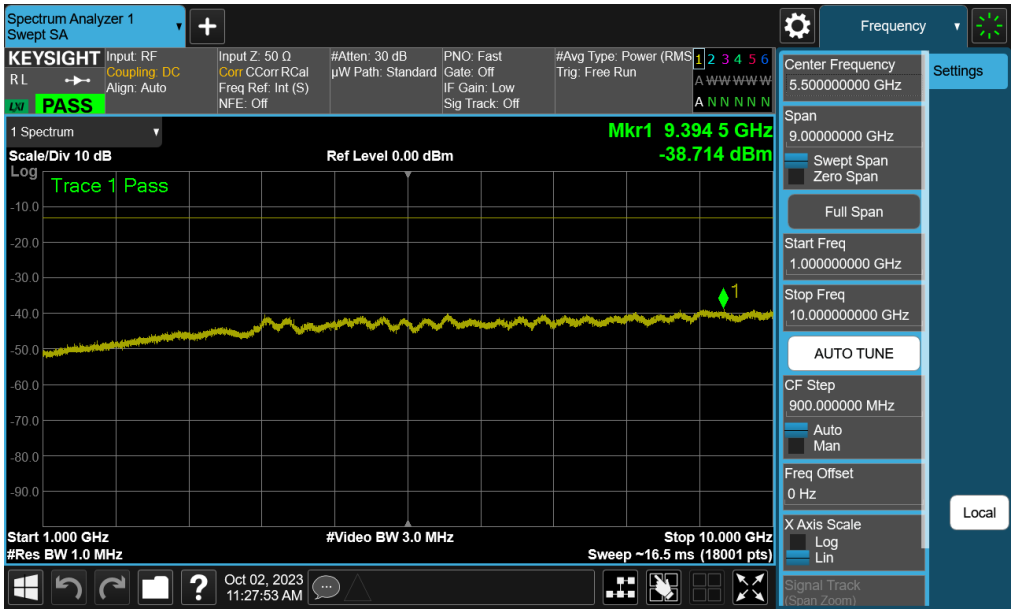
NR Band n5



Plot 7-68. Conducted Spurious Plot (NR Band n5 – 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel – Ant E)



Plot 7-69. Conducted Spurious Plot (NR Band n5 – 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel – Ant E)



Plot 7-70. Conducted Spurious Plot (NR Band n5 – 20MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel – Ant E)

7.4 Band Edge Emissions at Antenna Terminal

Test Overview

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

The minimum permissible attenuation level of any spurious emission is 43 + 10 $log_{10}(P_{[Watts]})$, where P is the transmitter power in Watts.

Test Procedure Used

ANSI C63.26-2015 – Section 5.7.3

Test Settings

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW ≥ 1% of the emission bandwidth
4. VBW ≥ 3 x RBW
5. Detector = RMS
6. Number of sweep points ≥ 2 x Span/RBW
7. Trace mode = trace average for continuous emissions, max hold for pulse emissions
8. Sweep time = auto couple
9. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

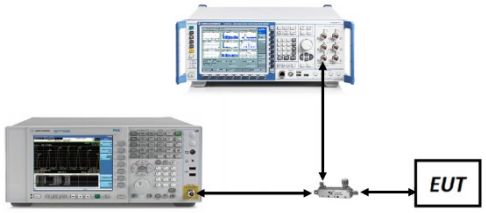


Figure 7-3. Test Instrument & Measurement Setup

Test Notes

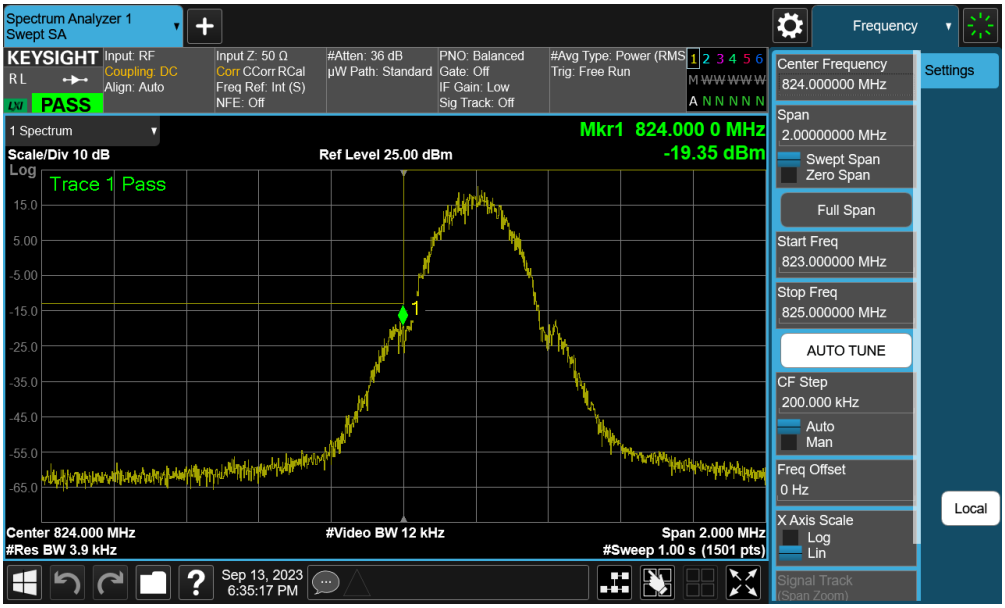
1. Per 22.917(b) and RSS-132(5.5), in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to demonstrate compliance with the out-of-band emissions limit. 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 emission are attenuated at least 26 dB below the transmitter power.

2. For NR operation, all subcarrier spacings (SCS) and transmission schemes (e.g. CP-OFDM and DFT-s-OFDM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

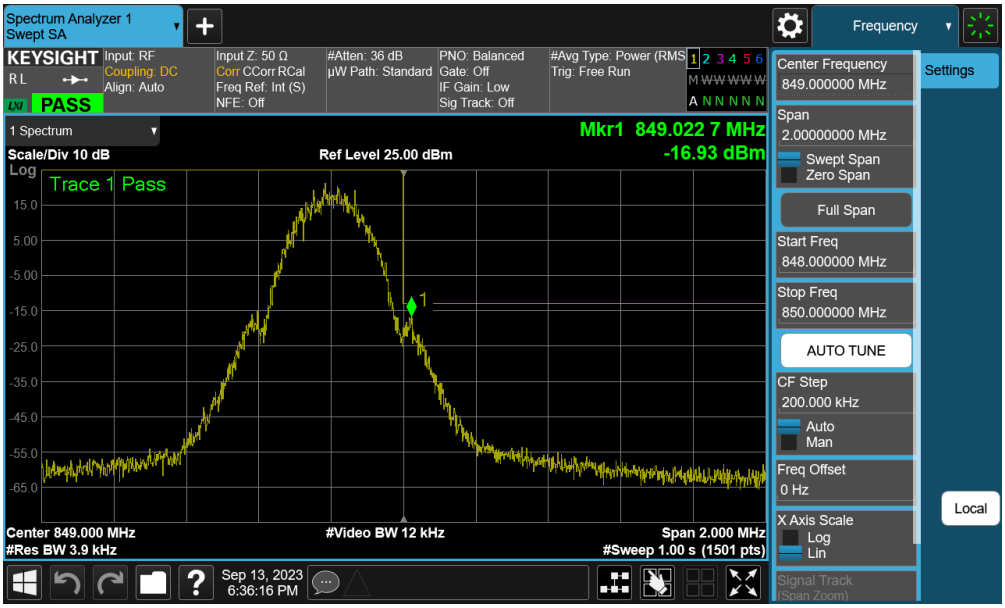
Mode	Bandwidth	Channel	Test Case	Level [dBm]	Limit [dBm]	Margin [dB]
GSM-Cell	250kHz	Low	Band Edge	-19.35	-13	-6.35
		Low	Extended	-16.93	-13	-3.93
WCDMA-Cell	5MHz	High	Band Edge	-21.77	-13	-8.77
		High	Extended	-19.81	-13	-6.81
LTE-B5	10MHz	Low	Band Edge	-30.03	-13	-17.03
		High	Band Edge	-31.11	-13	-18.11
	5MHz	Low	Band Edge	-20.72	-13	-7.72
		High	Band Edge	-24.32	-13	-11.32
	3MHz	Low	Band Edge	-19.20	-13	-6.20
		High	Band Edge	-20.75	-13	-7.75
	1.4MHz	Low	Band Edge	-16.21	-13	-3.21
		High	Band Edge	-20.38	-13	-7.38
NR-n5	20MHz	Low	Band Edge	-27.53	-13	-14.53
		High	Band Edge	-29.56	-13	-16.56
	15MHz	Low	Band Edge	-25.51	-13	-12.51
		High	Band Edge	-26.57	-13	-13.57
	10MHz	Low	Band Edge	-26.83	-13	-13.83
		High	Band Edge	-27.53	-13	-14.53
	5MHz	Low	Band Edge	-21.21	-13	-8.21
		High	Band Edge	-21.64	-13	-8.64

Table 7-9. Band Edge Test Results – Ant A

GSM/GPRS Cell – Ant A

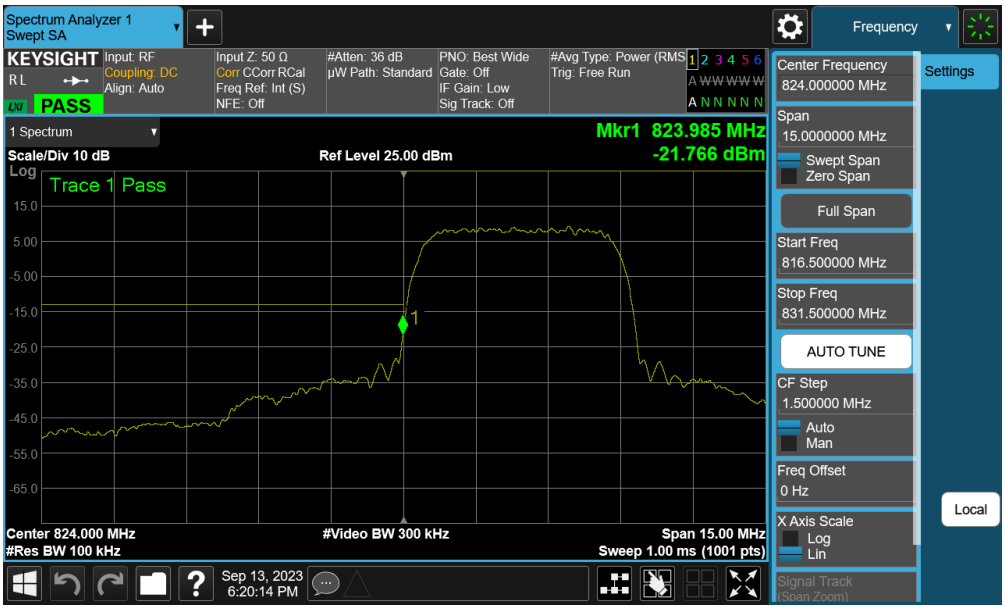


Plot 7-71. Lower Band Edge Plot (GPRS Cell – Ch. 128 – Ant A)

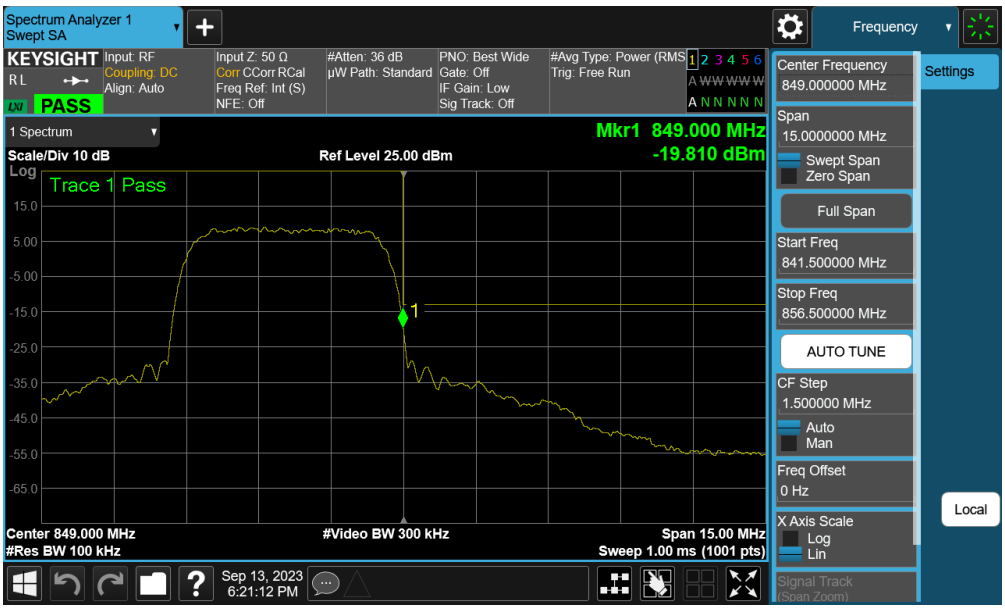


Plot 7-72. Upper Band Edge Plot (GPRS Cell – Ch. 251 – Ant A)

WCDMA Cell – Ant A



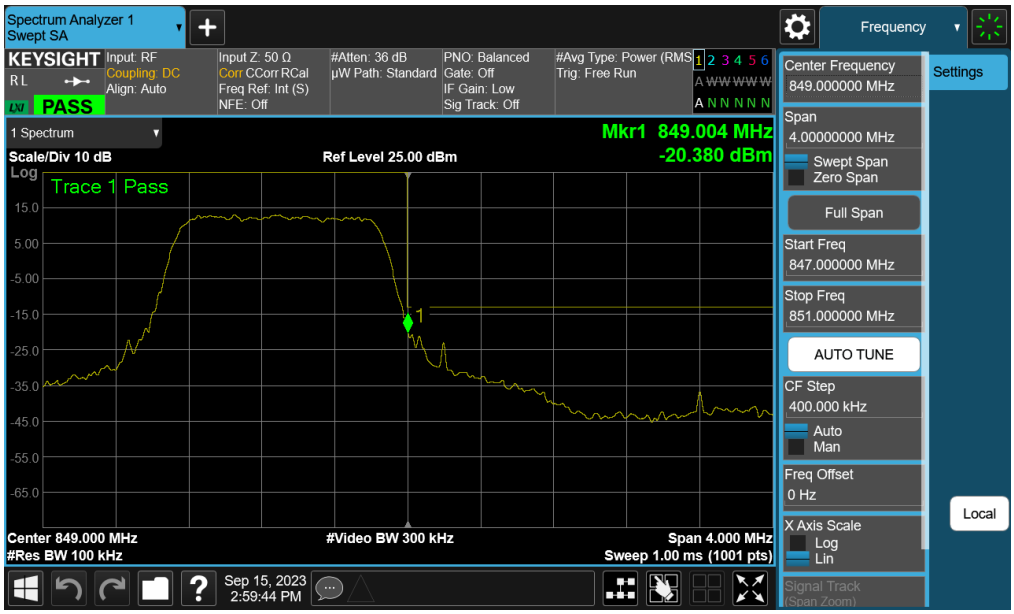
Plot 7-73. Lower Band Edge Plot (WCDMA Cell – Ch. 4132 – Ant A)



Plot 7-74. Upper Band Edge Plot (WCDMA Cell – Ch. 4233 – Ant A)

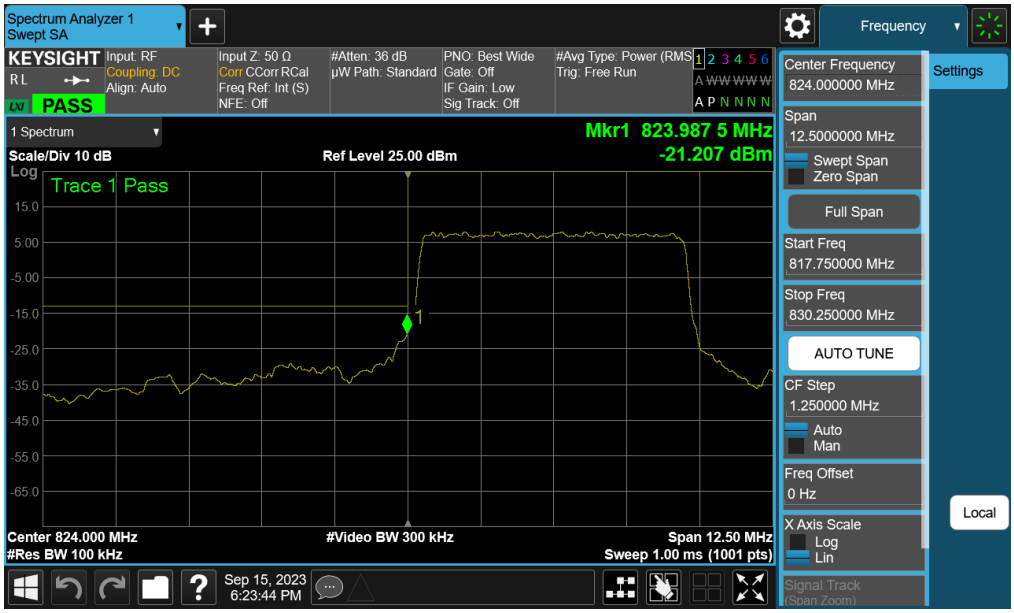
LTE Band 5 – Ant A

Plot 7-75. Lower Band Edge Plot (LTE Band 5 – 1.4MHz QPSK – Full RB Configuration – Ant A)

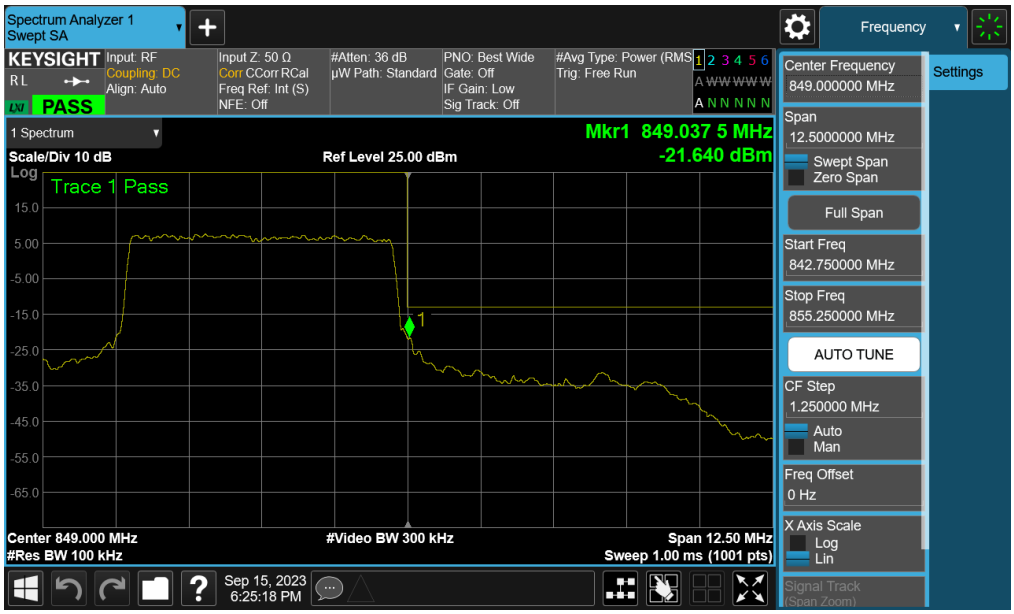


Plot 7-76. Upper Band Edge Plot (LTE Band 5 – 1.4MHz QPSK – Full RB Configuration – Ant A)

NR Band n5 – Ant A



Plot 7-77. Lower Band Edge Plot (NR Band n5 – 5.0MHz BPSK - Full RB – Ant A)

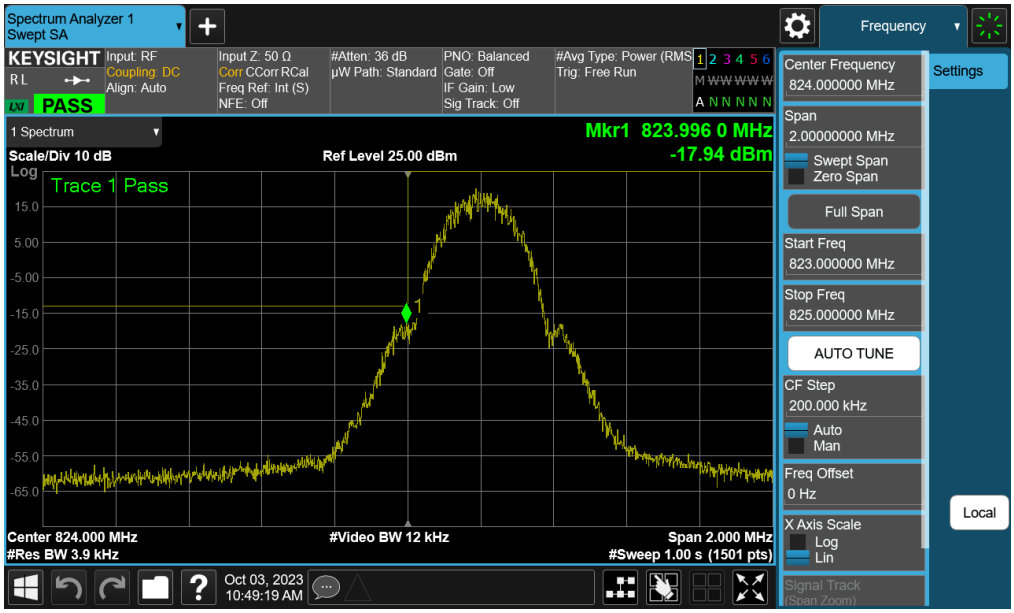


Plot 7-78. Upper Band Edge Plot (NR Band n5 – 5.0MHz QPSK - Full RB – Ant A)

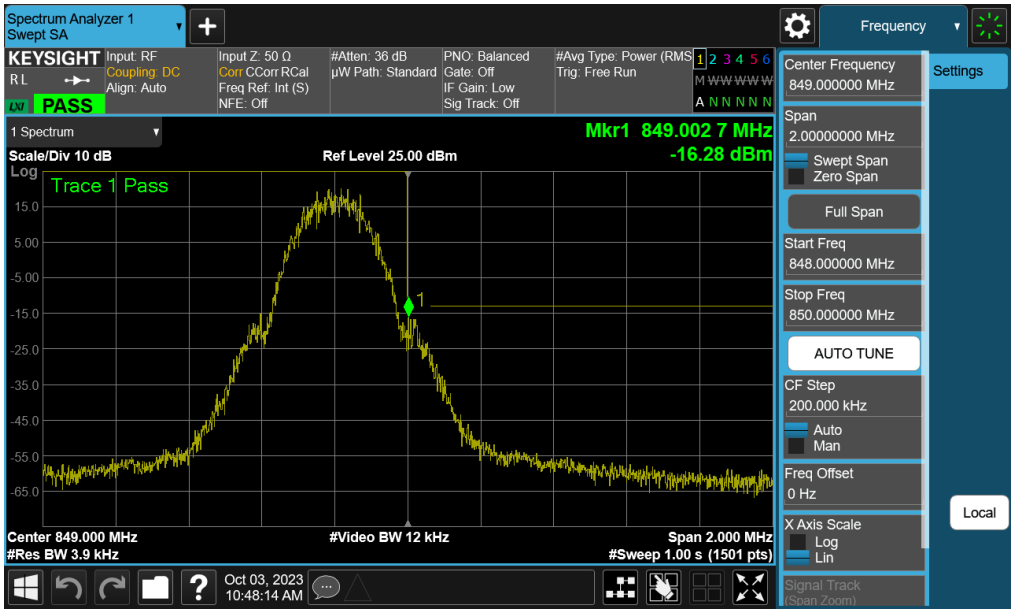
Mode	Bandwidth	Channel	Test Case	Level [dBm]	Limit [dBm]	Margin [dB]
GSM-Cell	250kHz	Low	Band Edge	-17.94	-13	-4.94
		Low	Extended	-16.28	-13	-3.28
WCDMA-Cell	5MHz	High	Band Edge	-22.81	-13	-9.81
		High	Extended	-21.68	-13	-8.68
LTE-B5	10MHz	Low	Band Edge	-29.14	-13	-16.14
		High	Band Edge	-30.79	-13	-17.79
	5MHz	Low	Band Edge	-24.02	-13	-11.02
		High	Band Edge	-22.88	-13	-9.88
	3MHz	Low	Band Edge	-21.52	-13	-8.52
		High	Band Edge	-19.70	-13	-6.70
	1.4MHz	Low	Band Edge	-19.23	-13	-6.23
		High	Band Edge	-18.19	-13	-5.19
NR-n5	20MHz	Low	Band Edge	-30.46	-13	-17.46
		High	Band Edge	-30.16	-13	-17.16
	15MHz	Low	Band Edge	-27.89	-13	-14.89
		High	Band Edge	-29.27	-13	-16.27
	10MHz	Low	Band Edge	-27.44	-13	-14.44
		High	Band Edge	-28.30	-13	-15.30
	5MHz	Low	Band Edge	-21.32	-13	-8.32
		High	Band Edge	-20.98	-13	-7.98

Table 7-10. Band Edge Test Results – Ant E

GSM/GPRS Cell – Ant E

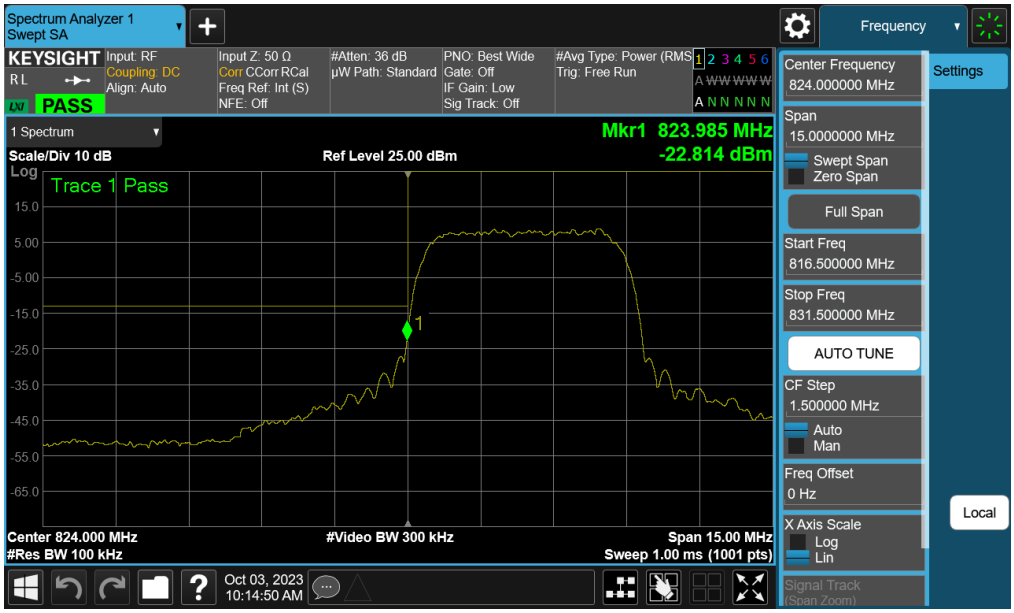


Plot 7-79. Lower Band Edge Plot (GPRS Cell – Ch. 128 – Ant E)

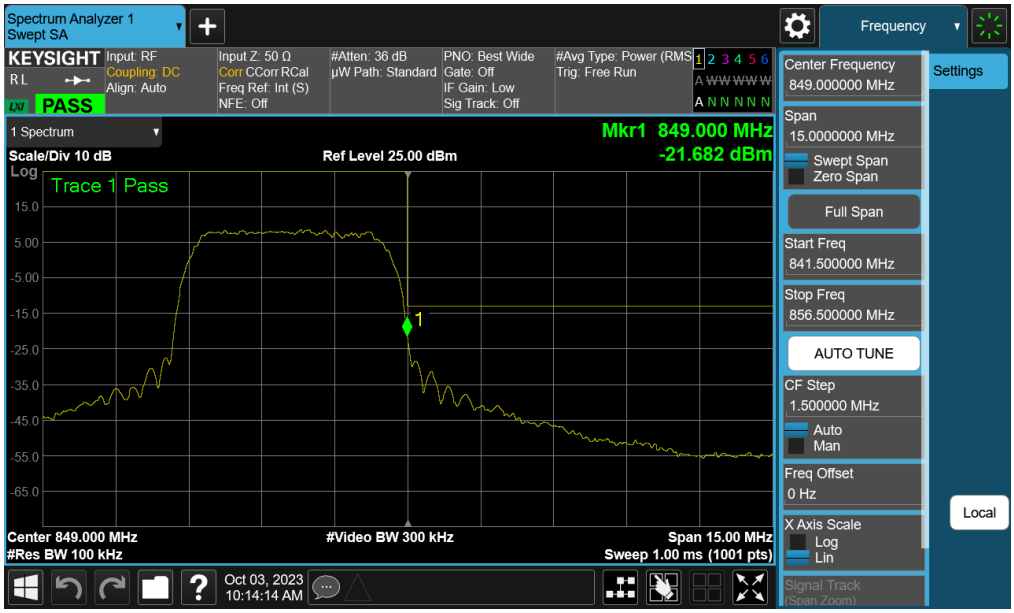


Plot 7-80. Upper Band Edge Plot (GPRS Cell – Ch. 251 – Ant E)

WCDMA Cell – Ant E



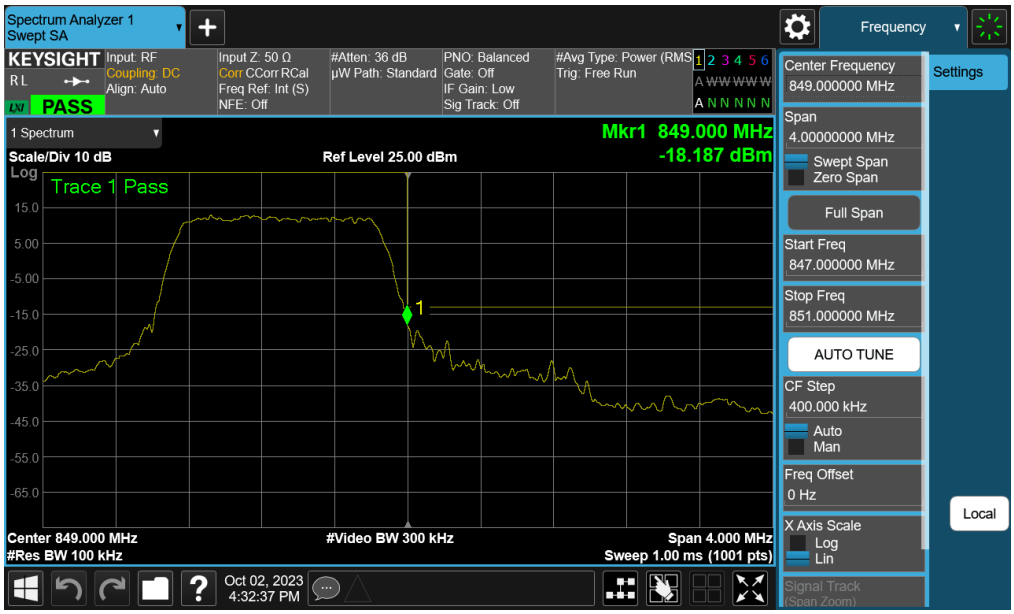
Plot 7-81. Lower Band Edge Plot (WCDMA Cell – Ch. 4132 – Ant E)



Plot 7-82. Upper Band Edge Plot (WCDMA Cell – Ch. 4233 – Ant E)

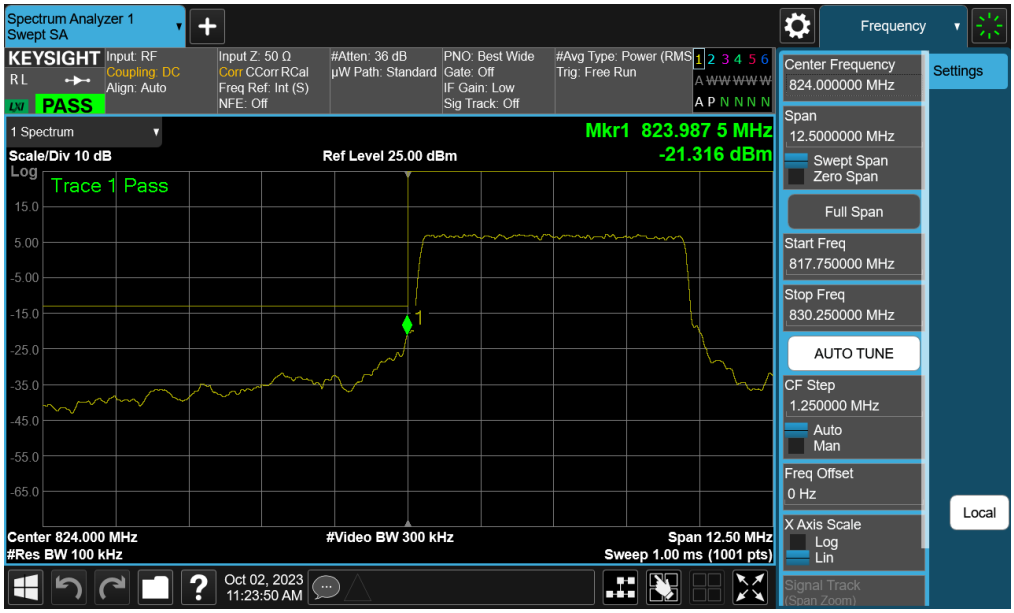
LTE Band 5 – Ant E

Plot 7-83. Lower Band Edge Plot (LTE Band 5 – 1.4MHz QPSK – Full RB Configuration – Ant E)

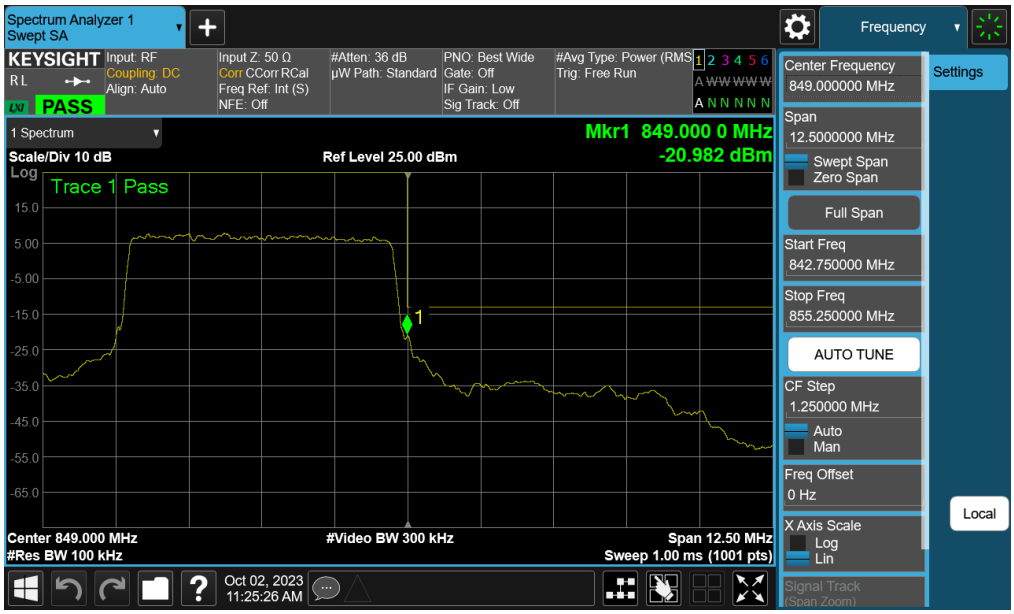


Plot 7-84. Upper Band Edge Plot (LTE Band 5 – 1.4MHz QPSK – Full RB Configuration – Ant E)

NR Band n5 – Ant E



Plot 7-85. Lower Band Edge Plot (NR Band n5 – 5.0MHz BPSK - Full RB – Ant E)



Plot 7-86. Upper Band Edge Plot (NR Band n5 – 5.0MHz BPSK - Full RB – Ant E)

7.5 Radiated Power (ERP)

Test Overview

Effective Radiated Power (ERP) measurements are performed using the substitution method described in ANSI C63.26-2015 with the EUT transmitting into an integral antenna. Measurements are performed using vertically and horizontally polarized broadband horn antennas. All measurements are performed as RMS average measurements while the EUT is operating at maximum power, and at the appropriate frequencies.

Test Procedures Used

ANSI C63.26-2015 – Section 5.2.4.4

Test Settings

1. Radiated power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation. For signals with burst transmission, the signal analyzer's "time domain power" measurement capability is used.
2. RBW = 1 – 5% of the expected OBW, not to exceed 1MHz
3. VBW ≥ 3 x RBW
4. Span = 1.5 times the OBW
5. No. of sweep points ≥ 2 x span / RBW
6. Detector = RMS
7. Trigger is set to "free run" for signals with continuous operation with the sweep times set to "auto". Trigger is set to enable triggering only on full power bursts with the sweep time set less than or equal to the transmission burst duration.
8. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation. For signals with burst transmission, the "gating" function was enabled to ensure that measurements are performed during times in which the transmitter is operating at its maximum power.
9. Trace mode = trace averaging (RMS) over 100 sweeps
10. The trace was allowed to stabilize.

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

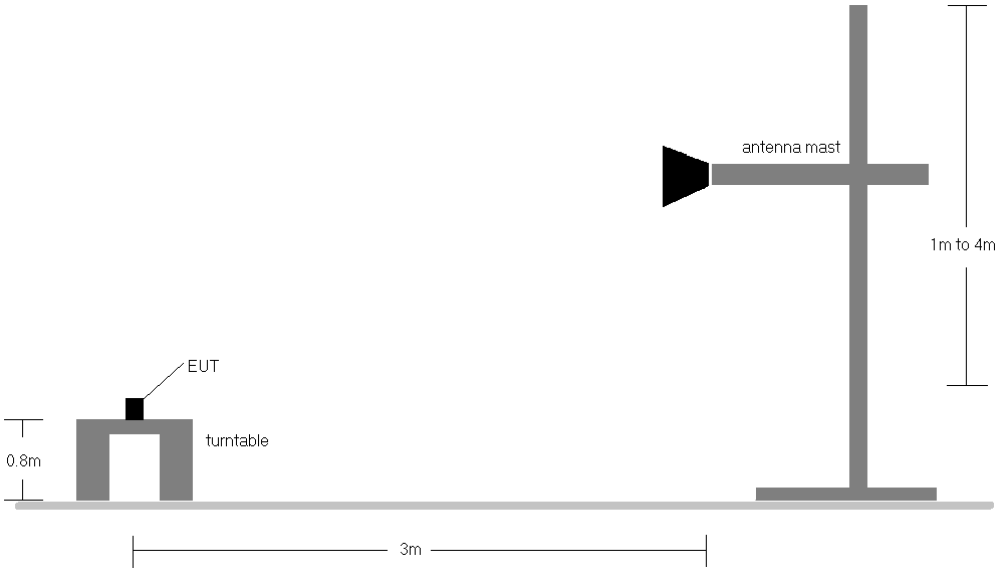


Figure 7-4. Radiated Test Setup < 1GHz

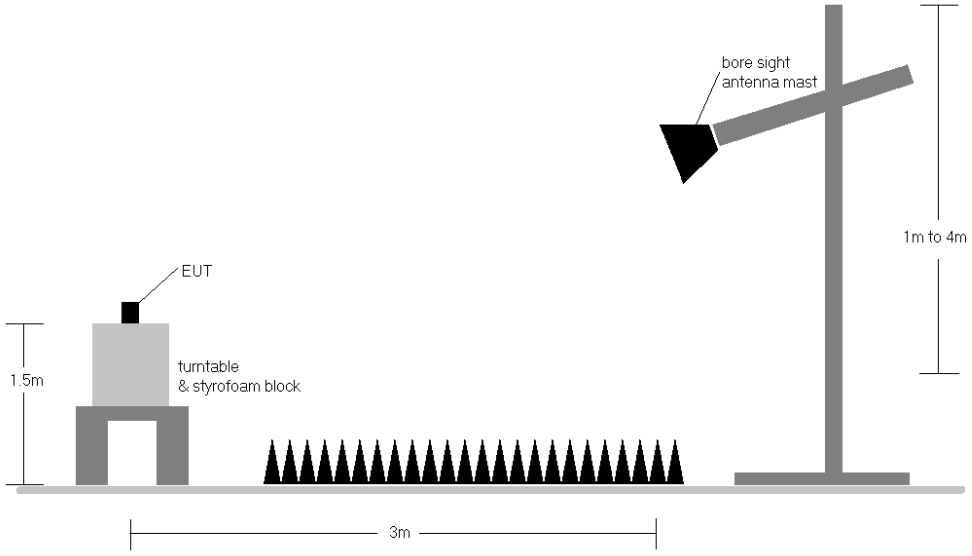


Figure 7-5. Radiated Test Setup > 1GHz

Test Notes

1) This device employs GSM, GPRS, and EDGE capabilities. The EUT was tested under all configurations and the highest powers are reported in GPRS mode while transmitting with one slot active.

2) This device employs UMTS technology with WCDMA (AMR/RMC) and HSDPA capabilities. The EUT was tested under all configurations and the highest powers are reported in WCDMA mode with HSDPA Inactive at 12.2 kbps RMC and TPC bits all set to “1”.

3) The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst-case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below.

4) This unit was tested with its standard battery.

5) For NR operation, all subcarrier spacings (SCS) and transmission schemes (e.g. CP-OFDM and DFT-s-OFDM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst-case configuration results are reported in this section.