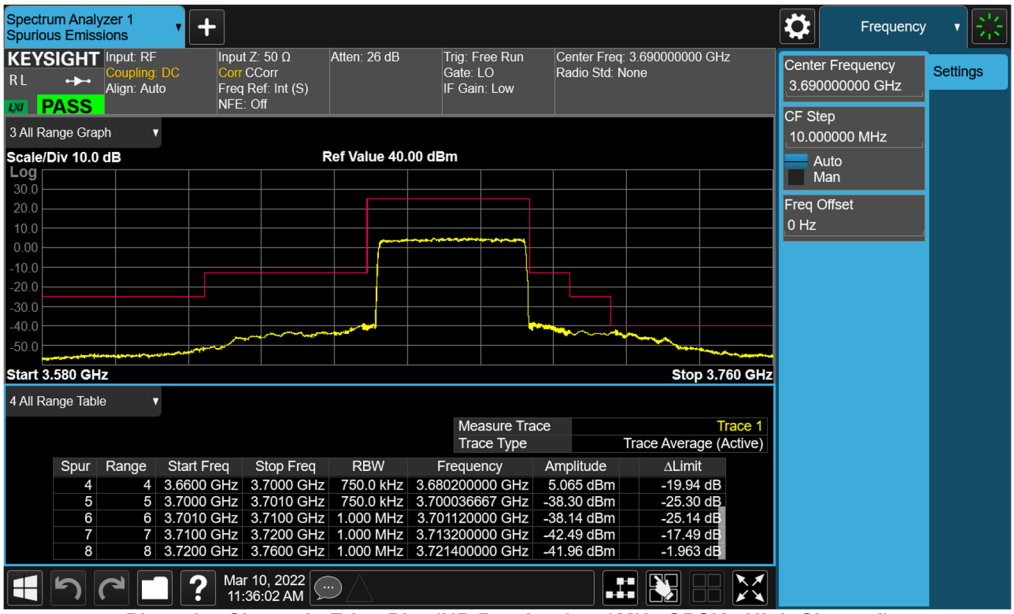
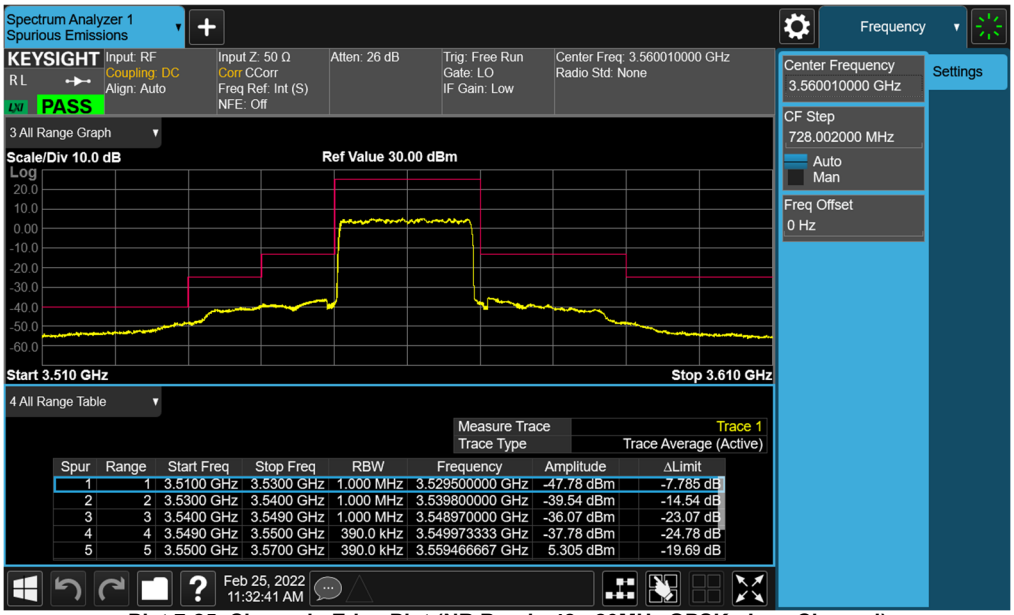
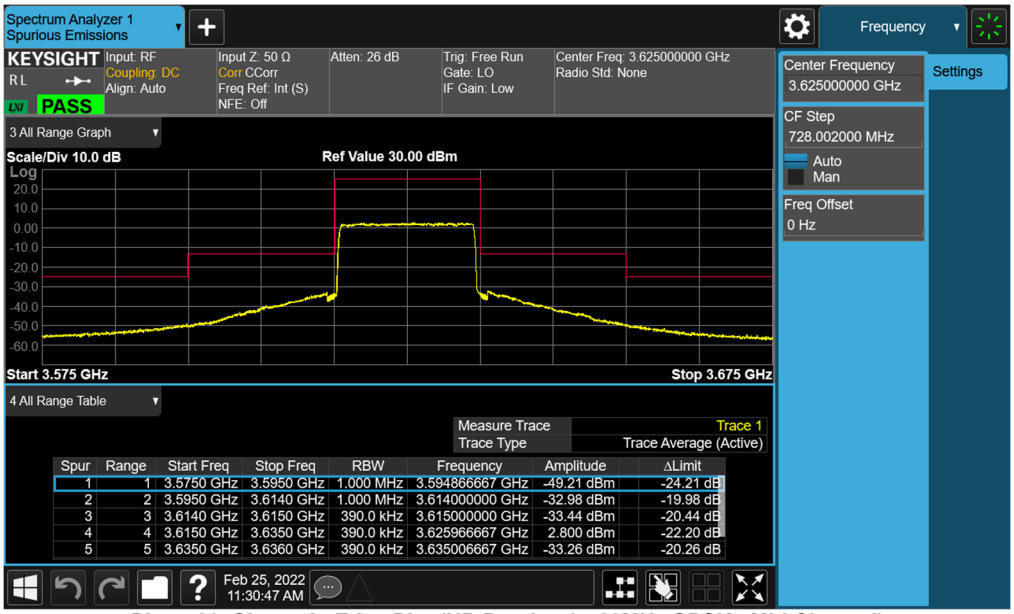


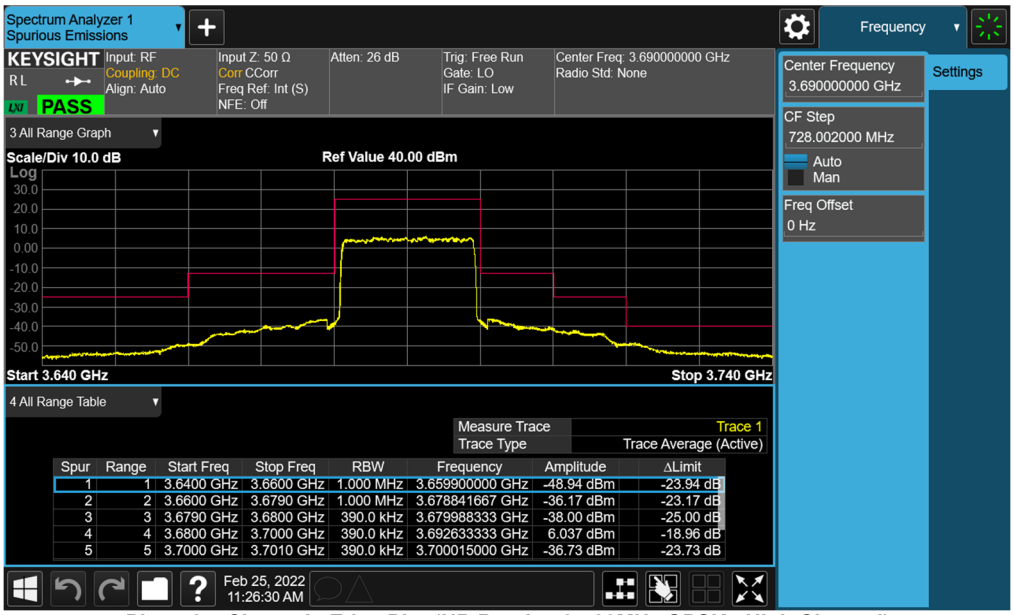
Plot 7-24. Channel - Edge Plot (NR Band n48 - 40MHz QPSK - High Channel)



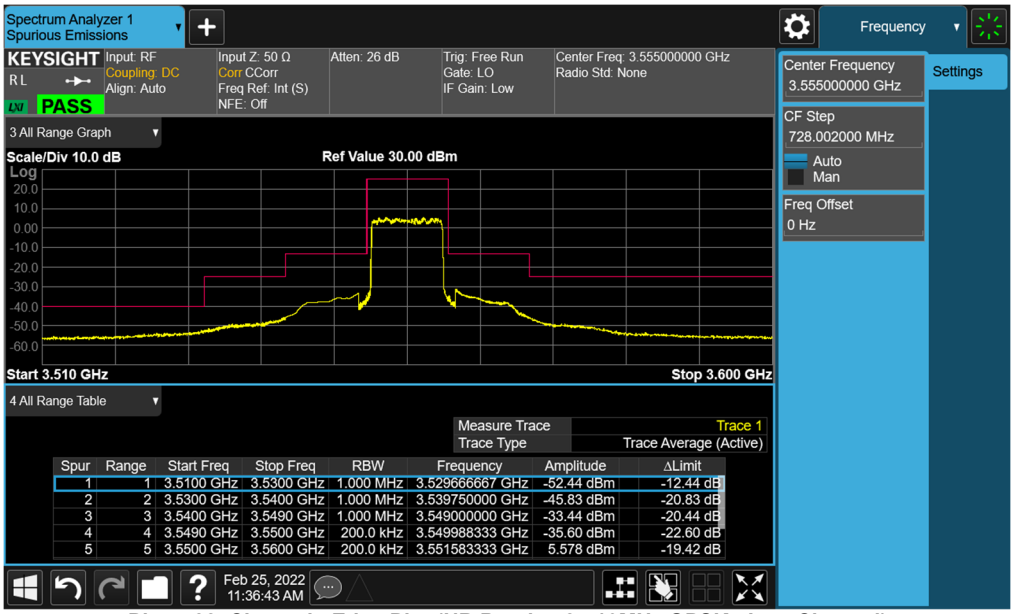
Plot 7-25. Channel - Edge Plot (NR Band n48 - 20MHz QPSK - Low Channel)



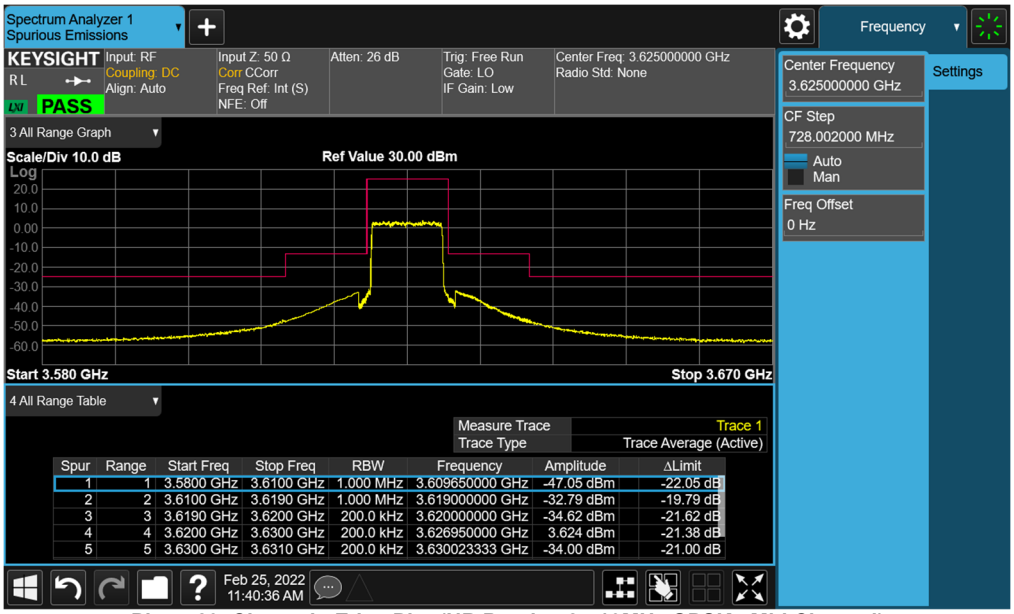
Plot 7-26. Channel - Edge Plot (NR Band n48 - 20MHz QPSK - Mid Channel)



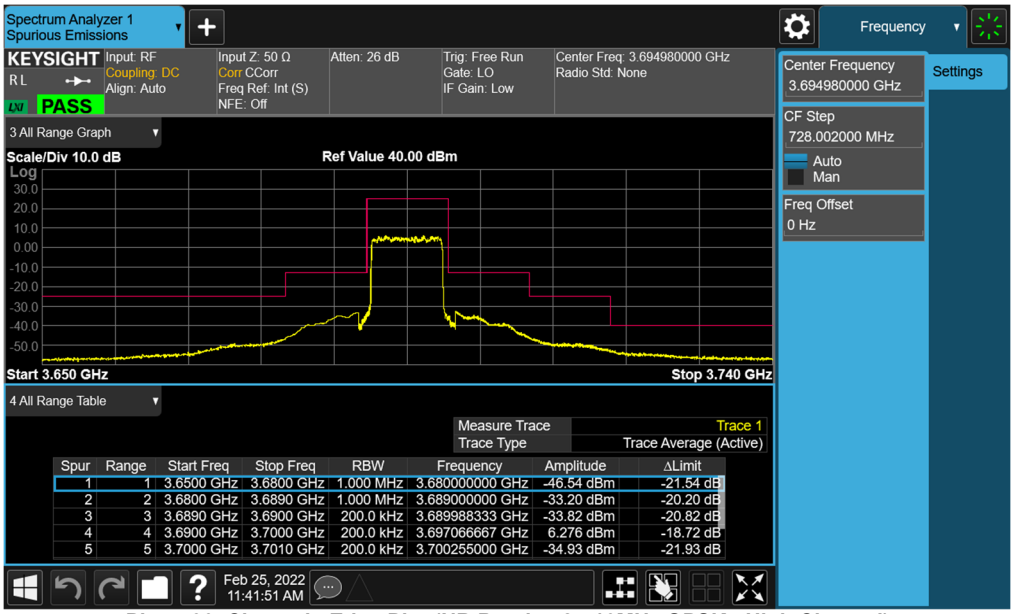
Plot 7-27. Channel - Edge Plot (NR Band n48 - 20MHz QPSK - High Channel)



Plot 7-28. Channel - Edge Plot (NR Band n48 - 10MHz QPSK - Low Channel)



Plot 7-29. Channel - Edge Plot (NR Band n48 - 10MHz QPSK - Mid Channel)



Plot 7-30. Channel - Edge Plot (NR Band n48 - 10MHz QPSK - High Channel)

7.6 Radiated Power (EIRP)

§96.41(b)

Test Overview

Equivalent Isotropic Radiated Power (EIRP) measurements are performed using the substitution method described in ANSI/TIA-603-E-2016 with the EUT transmitting into an integral antenna. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband horn antennas. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

Test Procedures Used

KDB 971168 D01 v03r01 – Section 5.2.1

ANSI/TIA-603-E-2016 – Section 2.2.17

Test Settings

1. Radiated power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation.
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".
8. The integration bandwidth was set equal to 10MHz.
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.

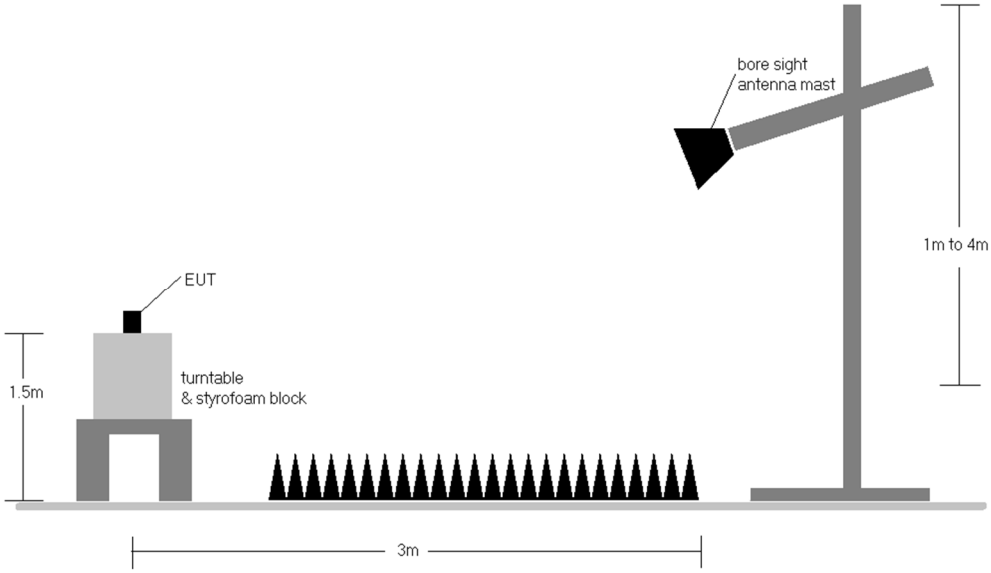


Figure 7-5. Radiated Test Setup >1GHz

Test Notes

1) 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.

2) This unit was tested with its standard battery.

3) The worst case EIRP shown in this section is found with NR operating only using 1RB. As such, the EIRP/10MHz and full channel EIRP values will be identical since 1RB is fully contained within all available channel bandwidths for NR Band 48 (i.e. 5, 10, 15, 20MHz).

Bandwidth	Mod.	Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Ant. Gain [dBi]	RB Size/Offset	Substitute Level [dBm]	EIRP [dBm/10MHz]	EIRP [Watts/10MHz]	EIRP Limit [dBm/10MHz]	Margin [dB]
40MHz	π/2 BPSK	3570.0	H	124	219	7.27	1 / 79	12.04	18.31	0.068	23.00	-4.69
	π/2 BPSK	3625.0	H	127	213	6.77	1 / 79	13.05	19.14	0.082	23.00	-3.86
	π/2 BPSK	3680.0	H	127	214	6.25	1 / 26	12.71	19.19	0.083	23.00	-3.81
	QPSK	3570.0	H	124	219	7.27	1 / 79	12.27	18.54	0.071	23.00	-4.46
	QPSK	3625.0	H	127	213	6.77	1 / 79	13.08	19.17	0.083	23.00	-3.83
	QPSK	3680.0	H	127	214	6.25	1 / 26	12.66	19.18	0.083	23.00	-3.82
	16-QAM	3625.0	H	127	213	6.77	1 / 79	13.01	18.16	0.065	23.00	-4.84
20MHz	π/2 BPSK	3560.0	H	124	219	7.37	1 / 38	12.04	18.42	0.069	23.00	-4.58
	π/2 BPSK	3625.0	H	127	213	6.77	1 / 38	12.85	18.94	0.078	23.00	-4.06
	π/2 BPSK	3690.0	H	127	214	6.15	1 / 13	12.62	19.05	0.080	23.00	-3.95
	QPSK	3560.0	H	124	219	7.37	1 / 38	12.33	18.70	0.074	23.00	-4.30
	QPSK	3625.0	H	127	213	6.77	1 / 38	12.85	18.94	0.078	23.00	-4.06
	QPSK	3690.0	H	127	214	6.15	1 / 13	12.54	18.98	0.079	23.00	-4.02
	16-QAM	3625.0	H	127	213	6.77	1 / 38	12.74	17.88	0.061	23.00	-5.12
10 MHz	π/2 BPSK	3555.0	H	124	219	7.43	1 / 17	12.14	18.56	0.072	23.00	-4.44
	π/2 BPSK	3625.0	H	127	213	6.77	1 / 17	12.88	18.96	0.079	23.00	-4.04
	π/2 BPSK	3695.0	H	127	214	6.09	1 / 6	12.65	19.03	0.080	23.00	-3.97
	QPSK	3555.0	H	124	219	7.43	1 / 17	12.37	18.80	0.076	23.00	-4.20
	QPSK	3625.0	H	127	213	6.77	1 / 17	12.88	18.97	0.079	23.00	-4.03
	QPSK	3695.0	H	127	214	6.09	1 / 6	12.50	18.88	0.077	23.00	-4.12
	16-QAM	3625.0	H	127	213	6.77	1 / 17	12.77	17.92	0.062	23.00	-5.08
40 MHz	QPSK (CP-OFDM)	3625.0	H	127	220	6.77	1 / 53	10.58	**17.35**	**0.054**	23.00	-5.65
	QPSK (Opposite Pol.)	3625.0	V	220	278	6.91	1 / 53	10.36	17.27	0.053	23.00	-5.73
	QPSK (WCP)	3625.0	H	213	322	6.77	1 / 53	8.20	14.97	0.031	23.00	-8.03

Table 7-4. EIRP Data (NR Band n48)

7.7 Radiated Spurious Emissions Measurements

§2.1053 §96.41(e)

Test Overview

Radiated spurious emissions measurements are performed using the field strength conversion method described in KDB 971168 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using horizontally and vertically polarized tuned dipole antennas. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband horn antennas.

Test Procedures Used

KDB 971168 D01 v03r01 – Section 5.8

ANSI/TIA-603-E-2016 – Section 2.2.12

Test Settings

1. RBW = 100kHz for emissions below 1GHz and 1MHz for emissions above 1GHz
2. VBW ≥ 3 x RBW
3. Span = 1.5 times the OBW
4. No. of sweep points ≥ 2 x span / RBW
5. Detector = RMS
6. Trace mode = Max Hold (In cases where the level is within 2dB of the limit, the final measurement is taken using triggering/gating and trace averaging.)
7. The trace was allowed to stabilize

Test Setup

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

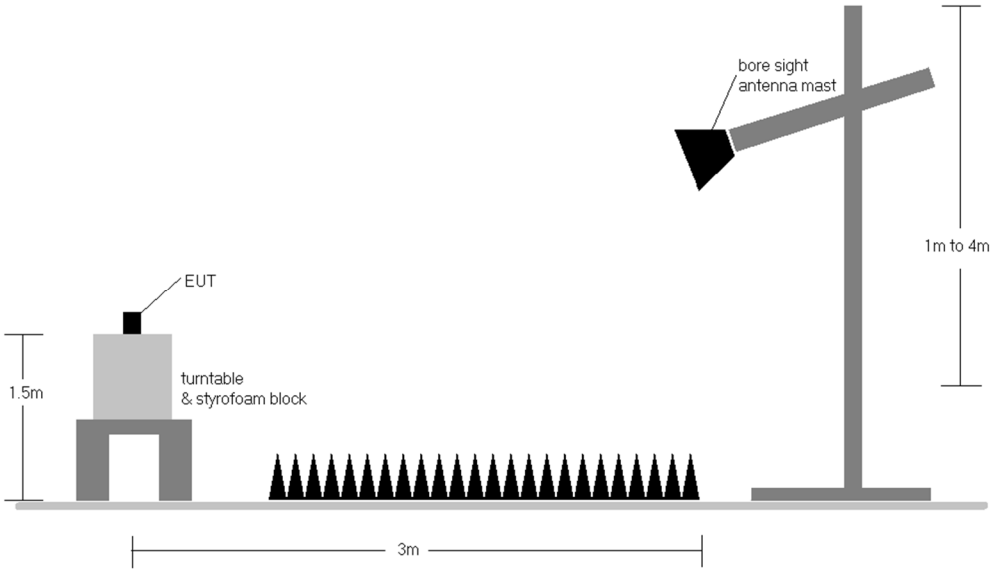


Figure 7-6. Test Instrument & Measurement Setup

Test Notes

1) 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.

2) This unit was tested with its standard battery.

3) The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter. The worst-case emissions are reported.

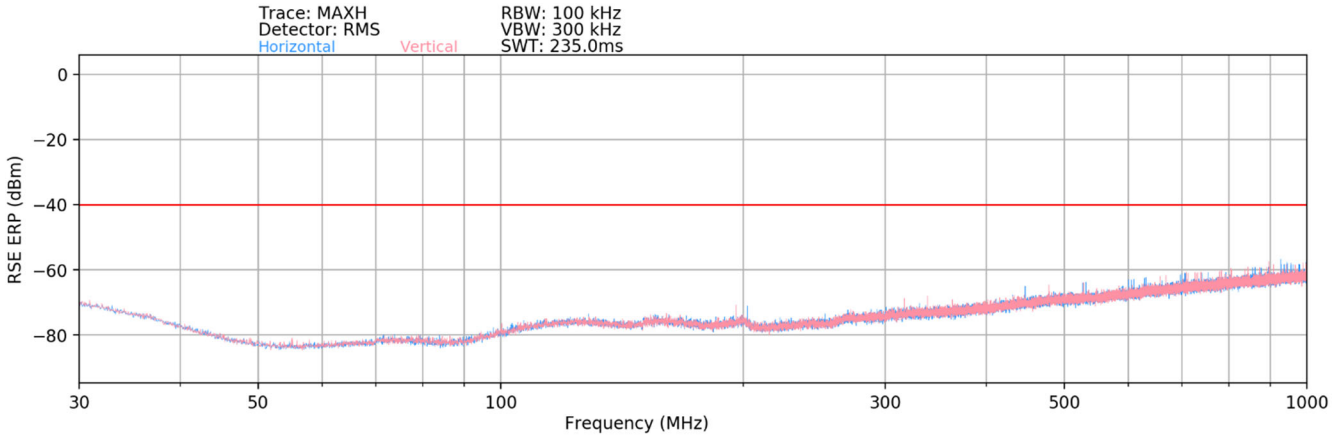
4) Emissions below 18GHz were measured at a 3 meter test distance while emissions above 18GHz were measured at a 1 meter test distance with the application of a distance correction factor.

5) The "-" shown in the following RSE tables are used to denote a noise floor measurement.

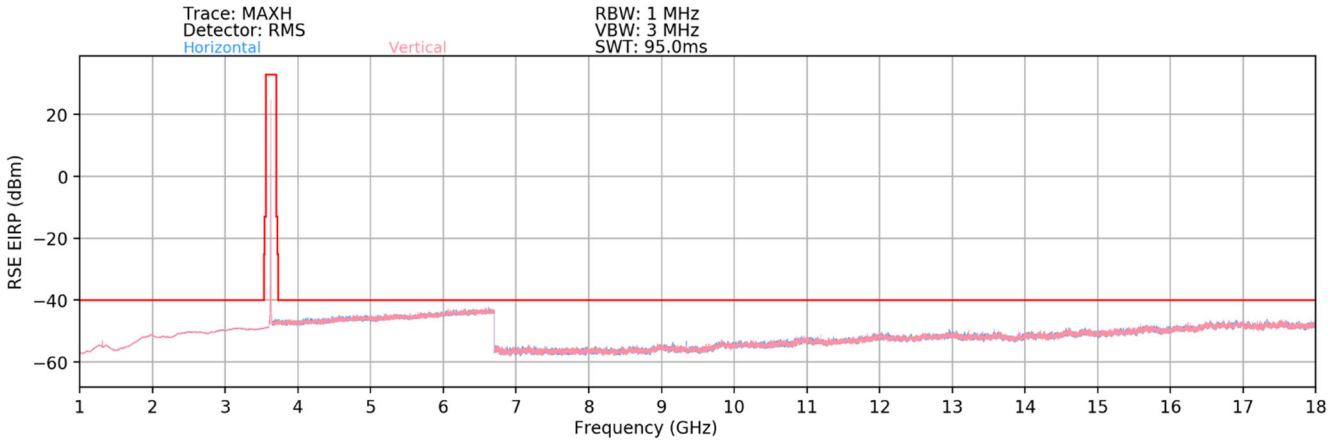
6) Per KDB 971168, Field Strength Level (dBµV/m) is converted to EIRP Spurious Emission Level (dBm) using the formula in Section 5.8.4 (d):

$$EIRP\ (dBm) = E\ (dB\mu V/m) + 20 \log D - 104.8;\ \text{where D is the measurement distance in meters}$$

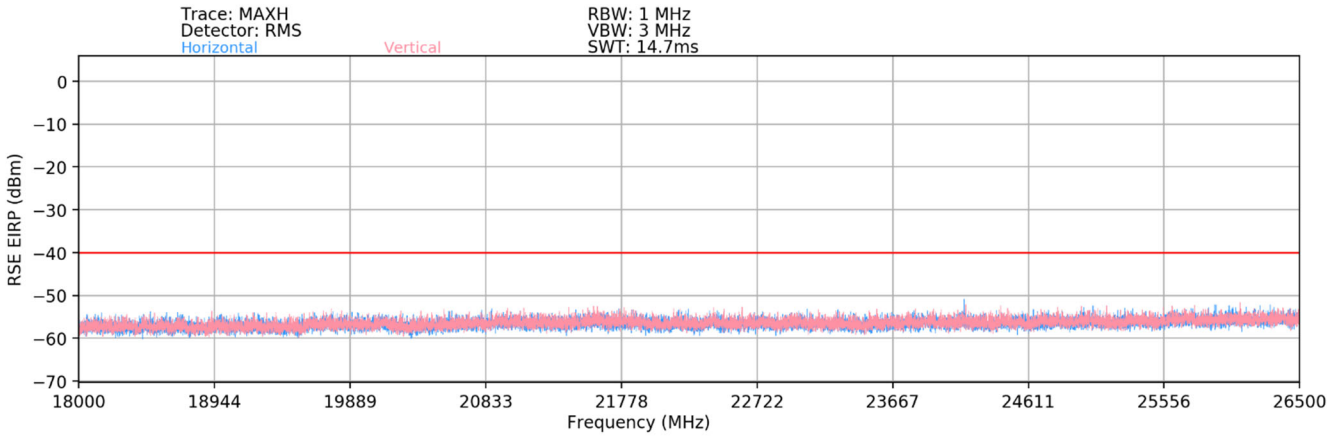
NR Band n48



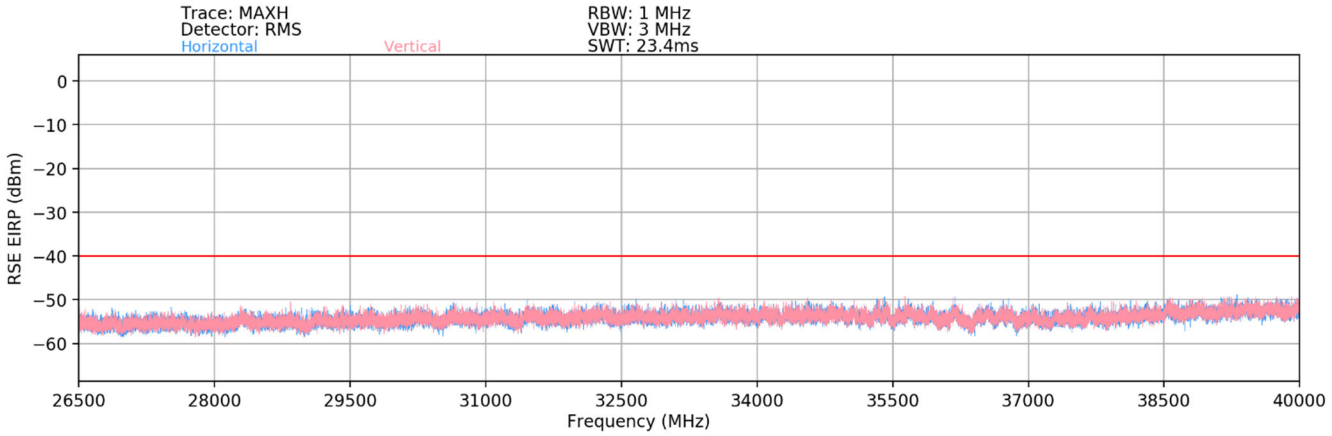
Plot 7-31. Radiated Spurious Plot (NR Band n48 – 30Mhz-1GHz)



Plot 7-32. Radiated Spurious Plot (NR Band n48 – 1-18GHz)



Plot 7-33. Radiated Spurious Plot (NR Band n48 – 18-26.5GHz)



Plot 7-34. Radiated Spurious Plot (NR Band n48 – 26.5-40GHz)

Bandwidth (MHz):	40
Frequency (MHz):	3570.0
Modulation Signal:	BPSK
RB Config (Size / Offset):	1 / 53

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
7140.00	V	288	255	-71.80	8.24	43.44	-51.82	-40.00	-11.82
10710.00	V	281	261	-75.78	11.93	43.15	-52.11	-40.00	-12.11
14280.00	V	-	-	-78.73	14.42	42.69	-52.56	-40.00	-12.56
17850.00	V	-	-	-78.81	18.10	46.29	-48.96	-40.00	-8.96
21420.00	V	-	-	-57.57	2.96	52.39	-52.41	-40.00	-12.41
24990.00	V	-	-	-58.07	3.65	52.58	-52.22	-40.00	-12.22

Table 7-5. Radiated Spurious Data (NR Band n48 – Low Channel)

Bandwidth (MHz):	40
Frequency (MHz):	3625.0
Modulation Signal:	BPSK
RB Config (Size / Offset):	1 / 53

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
7250.00	V	314	271	-71.30	7.53	43.23	-52.03	-40.00	-12.03
10875.00	V	-	-	-78.02	11.78	40.76	-54.50	-40.00	-14.50
14500.00	V	-	-	-78.98	14.96	42.98	-52.28	-40.00	-12.28
18125.00	V	-	-	-57.42	0.91	50.49	-54.31	-40.00	-14.31
21750.00	V	-	-	-58.49	3.22	51.73	-53.07	-40.00	-13.07
25375.00	V	-	-	-58.08	3.59	52.51	-52.29	-40.00	-12.29

Table 7-6. Radiated Spurious Data (NR Band n48 – Mid Channel)

Bandwidth (MHz):	40
Frequency (MHz):	3680.0
Modulation Signal:	BPSK
RB Config (Size / Offset):	1 / 53

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
7360.00	V	247	261	-74.05	7.82	40.77	-54.49	-40.00	-14.49
11040.00	V	-	-	-77.91	12.09	41.18	-54.08	-40.00	-14.08
14720.00	V	-	-	-79.19	15.57	43.38	-51.88	-40.00	-11.88
18400.00	V	-	-	-58.03	1.10	50.07	-54.73	-40.00	-14.73
22080.00	V	-	-	-58.46	2.90	51.44	-53.36	-40.00	-13.36
25760.00	V	-	-	-58.29	3.92	52.63	-52.17	-40.00	-12.17

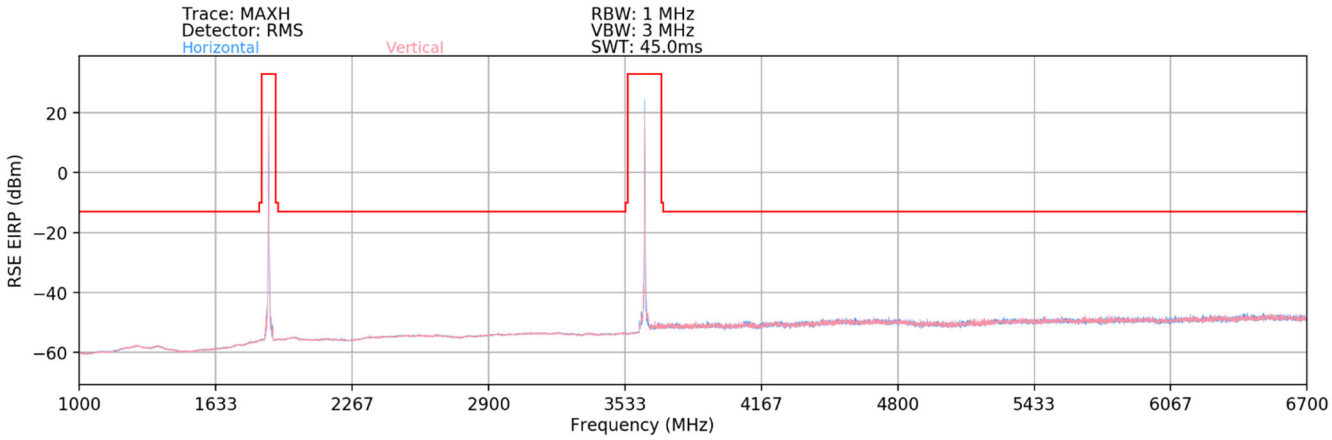
Table 7-7. Radiated Spurious Data (NR Band n48 – High Channel)

Case:	w/ Wireless Charging Pad
Bandwidth (MHz):	40
Frequency (MHz):	3570.0
Modulation Signal:	BPSK
RB Config (Size / Offset):	19360.0

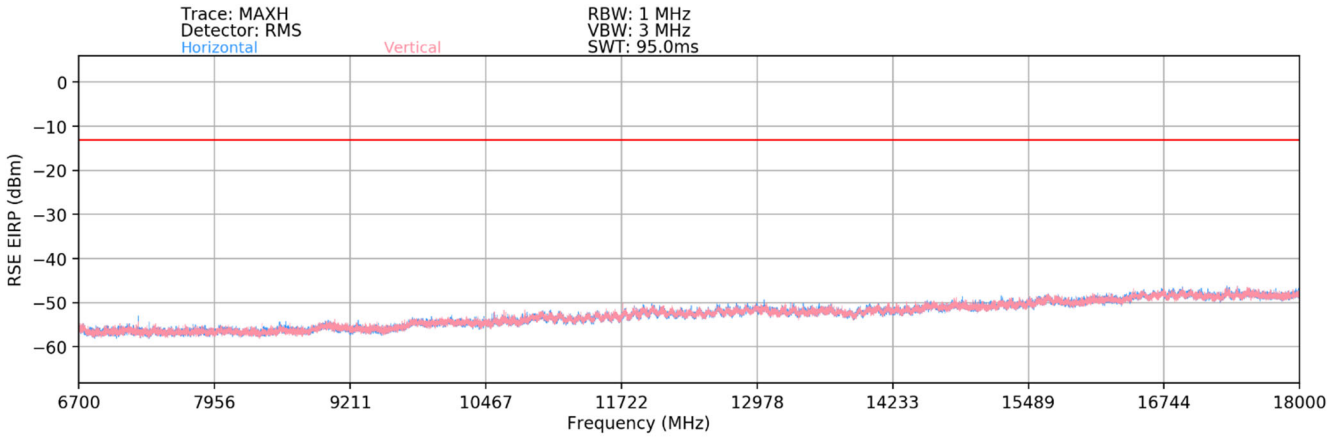
Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
7140.00	V	192	41	-72.13	8.07	42.94	-52.32	-40.00	-12.32
10710.00	V	141	351	-76.79	12.38	42.59	-52.67	-40.00	-12.67
14280.00	V	-	-	-78.80	14.78	42.98	-52.28	-40.00	-12.28
17850.00	V	-	-	-79.10	17.91	45.81	-49.45	-40.00	-9.45
21420.00	V	-	-	-58.78	3.01	51.23	-53.57	-40.00	-13.57
24990.00	V	-	-	-58.15	3.47	52.32	-52.48	-40.00	-12.48

Table 7-8. Radiated Spurious Data with WCP (NR Band n48)

EN-DC: NR Band n48 – Band 2



Plot 7-35. Radiated Spurious Plot (EN-DC: n48 – Band 2 - 1-6.7GHz)



Plot 7-36. Radiated Spurious Plot (EN-DC: n48 – Band 2 - 6.7-18GHz)

Case:	EN-DC NR n48 - LTE B2
Bandwidth (MHz):	40MHz & 20MHz
Frequency (MHz):	3625MHz & 1880MHz
Modulation Signal:	BPSK & QPSK
RB Config (Size / Offset):	1 / 53 & 1 / 50

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1610.00	V	-	-	-77.45	6.81	36.36	-58.90	-13.00	-45.90
2150.00	V	-	-	-77.67	11.36	40.69	-54.57	-13.00	-41.57
3895.00	V	-	-	-78.47	20.04	48.57	-46.69	-13.00	-33.69
5370.00	V	-	-	-78.93	15.43	43.50	-51.75	-13.00	-38.75
5505.00	V	-	-	-78.61	14.76	43.15	-52.11	-13.00	-39.11
7385.00	V	-	-	-79.58	17.84	45.26	-50.00	-13.00	-37.00

Table 7-9. Radiated Spurious Data (ENDC: n48 – Band 2)

7.8 Frequency Stability / Temperature Variation

§2.1055

Test Overview and Limit

Frequency stability testing is performed in accordance with the guidelines of ANSI/TIA-603-E-2016. The frequency stability of the transmitter is measured by:

a.) **Temperature:** The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.

b.) **Primary Supply Voltage:** The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

For Part 96, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Procedure Used

ANSI/TIA-603-E-2016

Test Settings

1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
2. The equipment is turned on in a "standby" condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

Test Setup

The EUT was connected via an RF cable to a spectrum analyzer with the EUT placed inside an environmental chamber.

Test Notes

None

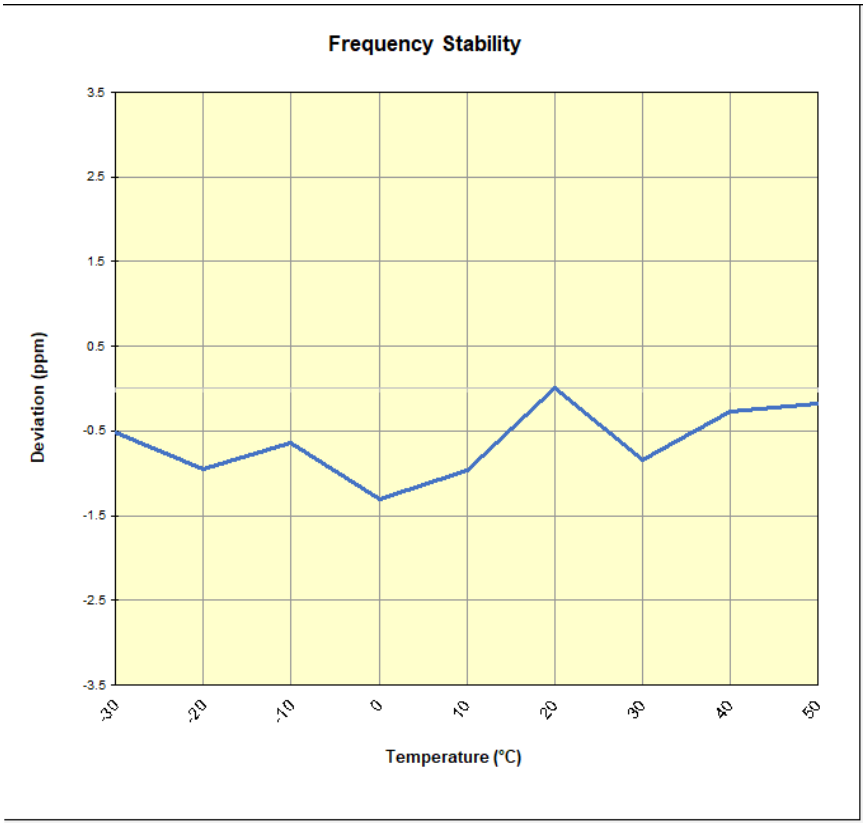
Frequency Stability / Temperature Variation

NR Band n48

Operating Frequency (Hz):	3,625,000,000
Ref. Voltage (VDC):	4.41

Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	4.41	- 30	3,625,156,122	-1,882	-0.0000519
		- 20	3,625,154,559	-3,445	-0.0000950
		- 10	3,625,155,650	-2,354	-0.0000649
		0	3,625,153,295	-4,709	-0.0001299
		+ 10	3,625,154,475	-3,529	-0.0000973
		+ 20 (Ref)	3,625,158,004	0	0.0000000
		+ 30	3,625,154,930	-3,074	-0.0000848
		+ 40	3,625,157,005	-999	-0.0000276
		+ 50	3,625,157,342	-662	-0.0000183
Battery Endpoint	3.37	+ 20	3,625,155,130	-2,874	-0.0000793

Table 7-10. NR Band n48 Frequency Stability Data



Plot 7-37. NR Band n48 Frequency Stability Chart

7.9 End User Device Additional Requirement (CBSD Protocol)

§96.47

Test Overview and Limit

End user device additional requirements (CBSD Protocol) are tested per the test procedures listed below. During testing, the EUT is connected to a certified 5G NR CBSD as a companion device to show compliance with Part 96.47.

End User Devices may operate only if they can positively receive and decode an authorization signal transmitted by a CBSD, including the frequencies and power limits for their operation.

An End User Device must discontinue operations, change frequencies, or change its operational power level within 10 seconds of receiving instructions from its associated CBSD.

Test Procedure Used

KDB 940660 D01 v03, WINNF-18-IN-00178 v1.0.0.00

Test Setup/Method

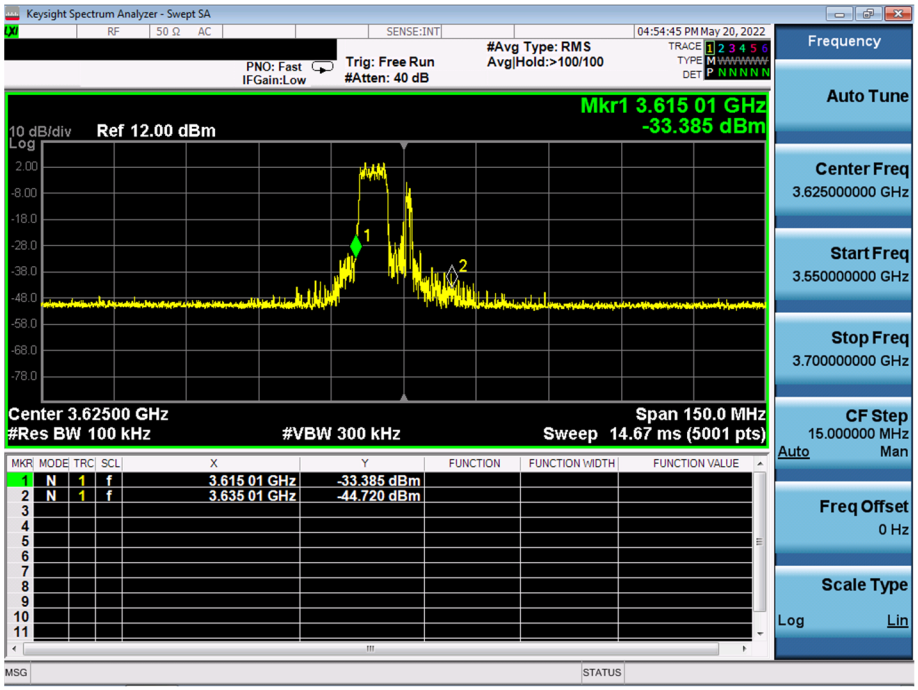
The EUT was connected via an RF cable to a certified 5G CBSD and spectrum analyzer. The following procedure is performed by applying WINNF-18-IN-00178 v1.0.0.00 CBRS End User Device as UUT Test Guidelines

1. Run#1:
    a. Setup WINNF.PT.C.HBT.1 with 3615MHz – 3635MHz.
    b. Enable 5G AP service from CBSD.
    c. Check EUT Tx frequency.
    d. Disable AP service and check EUT stop transmission within 10s.
2. Run#2:
    a. Setup WINNF.PT.C.HBT.1 with 3660MHz – 3680MHz.
    b. Enable 5G AP service from CBSD.
    c. Check EUT Tx frequency.
    d. Disable AP service and check EUT stop transmission within 10s.

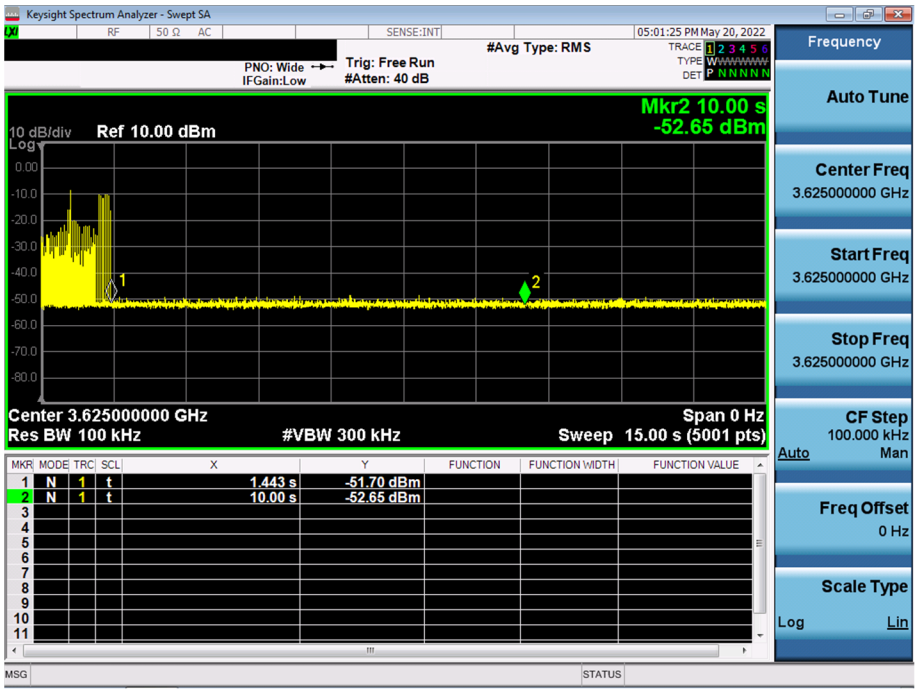
Test Notes

The EUT is an End User Device.

Run#1:



Plot 7-38. Run#1 End User Device Frequency of Operations



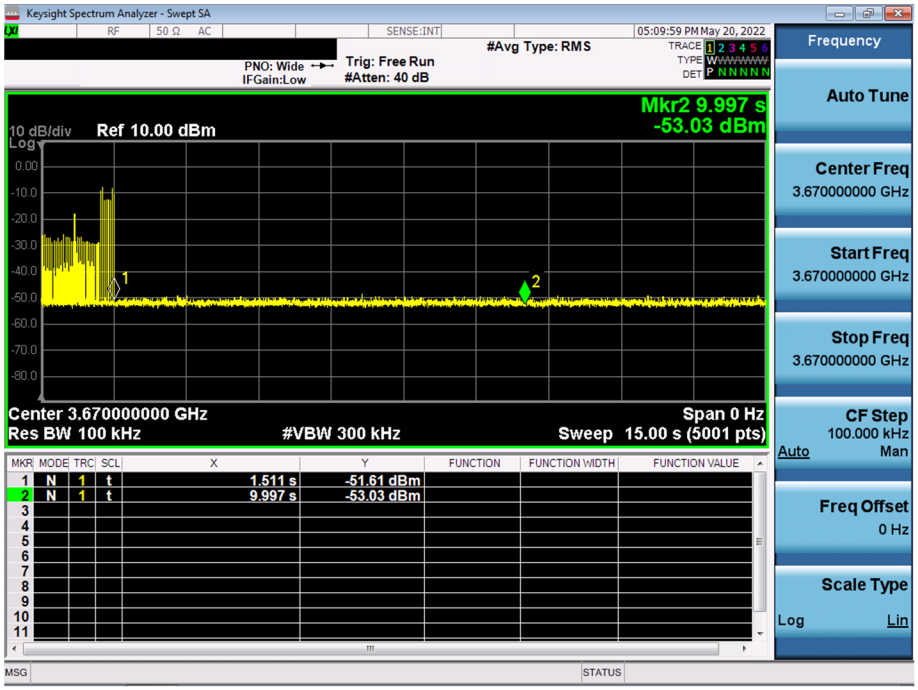
Plot 7-39. Run#1 End User Device Discontinues Operations within 10s

Note:

CBSD sends instructions to discontinue NR operations (beginning of plot at time = 0 seconds)
Marker 1: EUT discontinues operation.
Marker 2: 10 seconds elapsed time from CBSD sending instructions to EUT.

Run#2:

Plot 7-40. Run#2 End User Device Frequency of Operations



Plot 7-41. Run#2 End User Device Discontinues Operations within 10s

Note:

CBSD sends instructions to discontinue NR operations (beginning of plot at time = 0 seconds)
Marker 1: EUT discontinues operation.
Marker 2: 10 seconds elapsed time from CBSD sending instructions to EUT.

8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Samsung Portable Handset FCC ID : A3LSMG996U** complies with all of the End User Device requirements of Part 96 of the FCC Rules for NR operation.