

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.

For LTE B26 operation under Part 90.691, the minimum permissible attenuation level of any spurious emission removed from the EA licensee's frequency block by greater than 37.5 kHz is $43 + 10\log_{10}(P_{\text{Watts}})$, where P is the transmitter power in Watts. The minimum permissible attenuation level of any spurious emission removed from the EA licensee's frequency block by up to and including 37.5 kHz is $50 + 10\log_{10}(P_{\text{Watts}})$, where P is the transmitter power in Watts.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0

Test Settings

1. Span was set large enough so as to capture all out of band emissions near the band edge
2. RBW = 100 kHz
3. VBW = 300 kHz
4. Detector = RMS
5. Trace mode = trace average
6. Sweep time = auto couple
7. The trace was allowed to stabilize

Test Setup

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

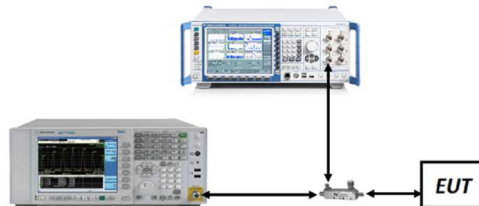


Figure 7-3. Test Instrument & Measurement Setup

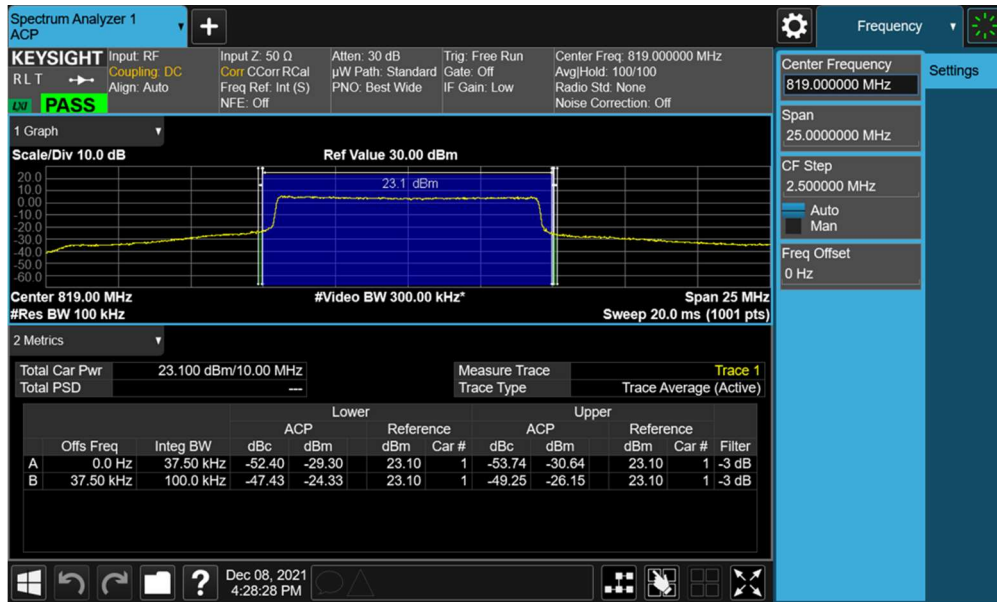
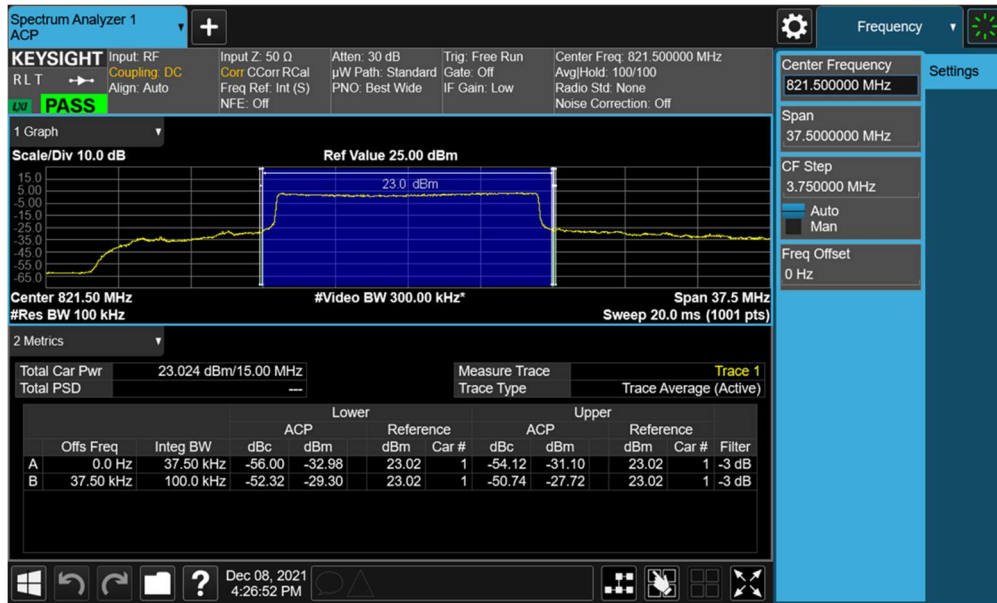
Test Notes

For channel edge emission, the signal analyzer's "ACP" measurement capability is used.

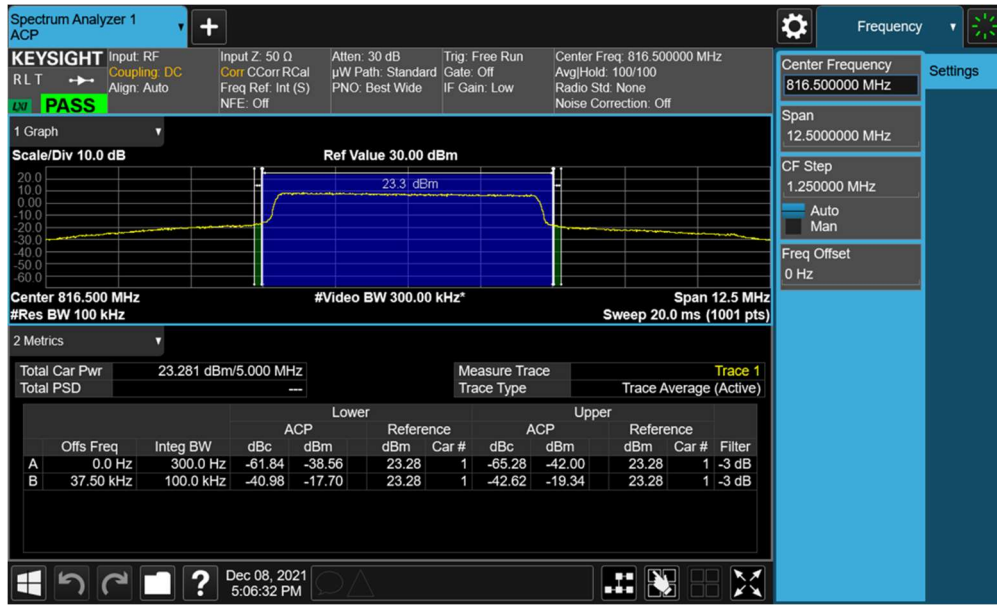
Per 22.917(b) in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to demonstrate compliance with the out-of-band emissions limit. The emission 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.

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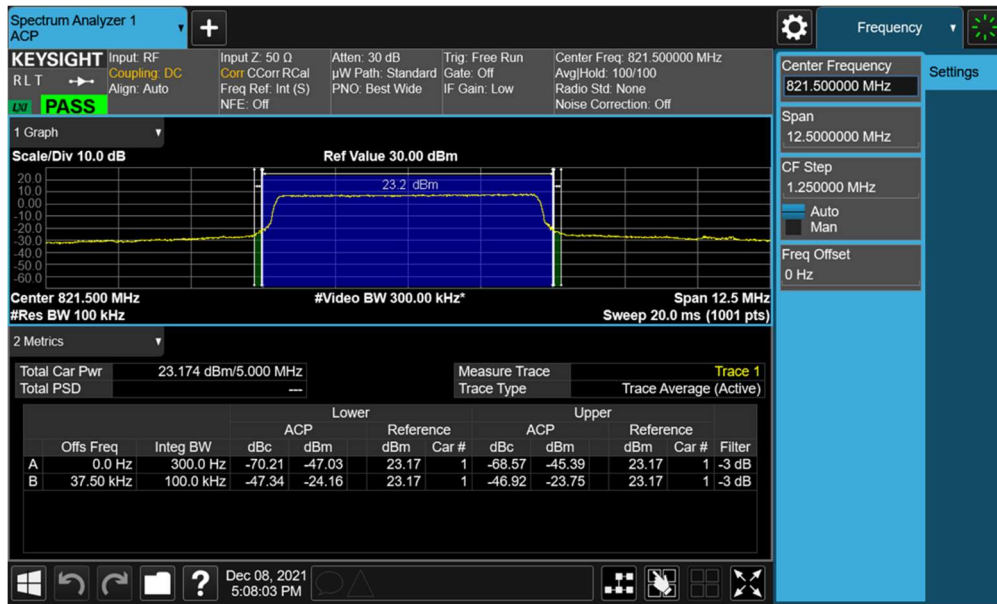
LTE Band 26



FCC ID: A3LSMS906E	PCTEST Proud to be part of element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
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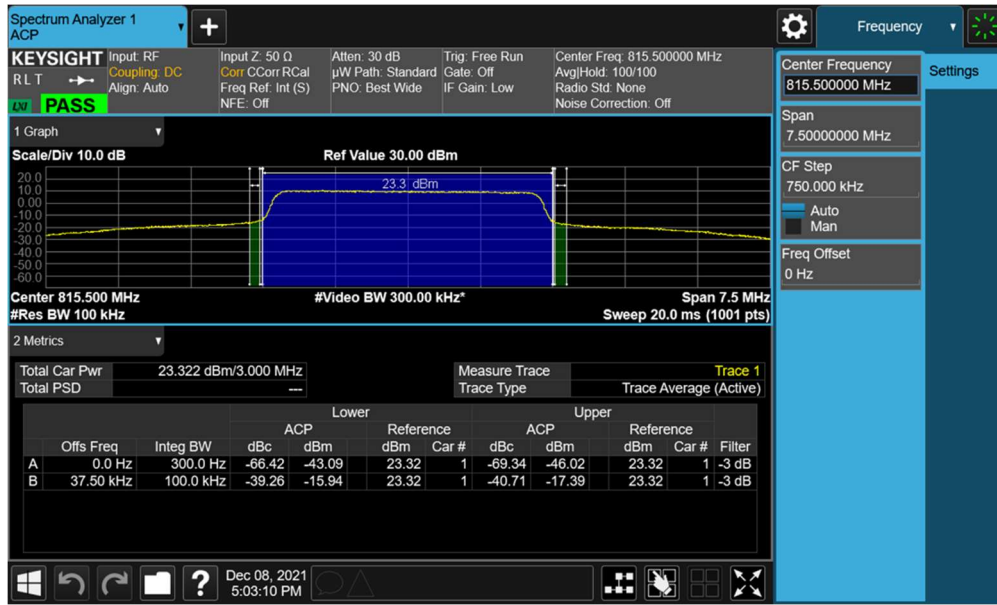


Plot 7-16. Channel Edge Plot (LTE Band 26 - 5MHz QPSK - Low Channel)

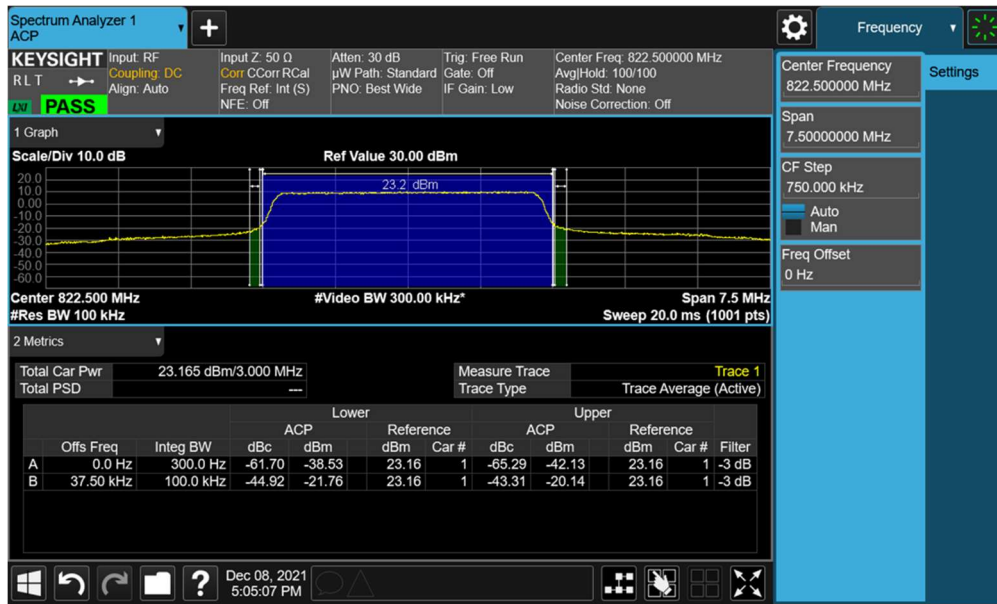


Plot 7-17. Channel Edge Plot (LTE Band 26 - 5MHz QPSK - High Channel)

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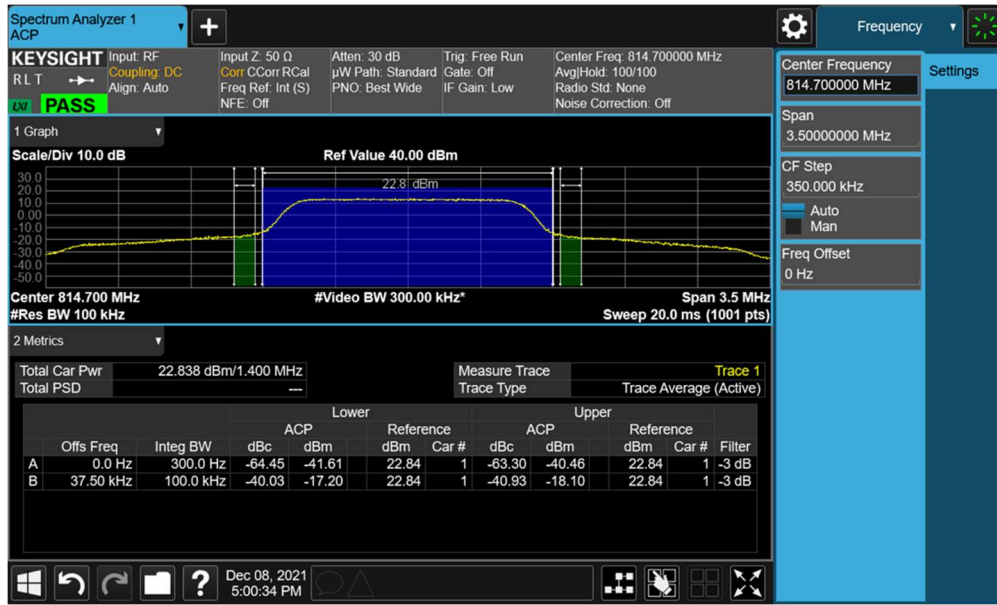


Plot 7-18. Channel Edge Plot (LTE Band 26 - 3MHz QPSK - Low Channel)

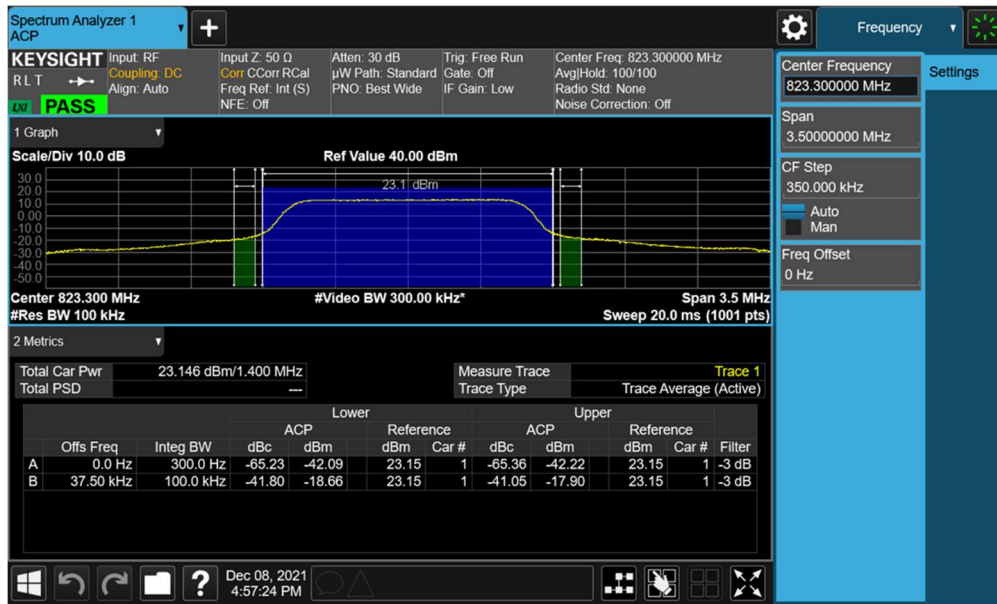


Plot 7-19. Channel Edge Plot (LTE Band 26 - 3MHz QPSK - High Channel)

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Plot 7-20. Channel Edge Plot (LTE Band 26 - 1.4MHz QPSK - Low Channel)



Plot 7-21. Channel Edge Plot (LTE Band 26 - 1.4MHz QPSK - High Channel)

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7.5 Conducted Power Output Data

§2.1046 §90.635

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]	Conducted Power [Watts]	Conducted Power Limit [dBm]	Margin [dB]
15 MHz	QPSK	26765	821.5	1 / 0	24.20	0.263	50.00	-25.80
	16-QAM	26765	821.5	1 / 37	23.42	0.220	50.00	-26.58
	64-QAM	26765	821.5	1 / 0	22.33	0.171	50.00	-27.67
	256-QAM	26765	821.5	1 / 37	19.46	0.088	50.00	-30.54
10 MHz	QPSK	26740	819.0	1 / 25	24.56	0.286	50.00	-25.44
	16-QAM	26740	819.0	1 / 0	23.79	0.240	50.00	-26.21
	64-QAM	26740	819.0	1 / 0	22.85	0.193	50.00	-27.15
	256-QAM	26740	819.0	1 / 25	19.22	0.084	50.00	-30.78
5 MHz	QPSK	26715	816.5	1 / 24	24.39	0.275	50.00	-25.61
		26765	821.5	1 / 0	24.24	0.266	50.00	-25.76
	16-QAM	26715	816.5	1 / 12	23.74	0.237	50.00	-26.26
		26765	821.5	1 / 24	23.58	0.228	50.00	-26.42
	64-QAM	26715	816.5	1 / 12	22.62	0.183	50.00	-27.38
		26765	821.5	1 / 0	22.60	0.182	50.00	-27.40
	256-QAM	26715	816.5	1 / 12	19.48	0.089	50.00	-30.52
		26765	821.5	1 / 12	19.70	0.093	50.00	-30.30
3 MHz	QPSK	26705	815.5	1 / 7	24.37	0.274	50.00	-25.63
		26775	822.5	1 / 0	24.16	0.261	50.00	-25.84
	16-QAM	26705	815.5	1 / 7	23.77	0.238	50.00	-26.23
		26775	822.5	1 / 14	23.45	0.221	50.00	-26.55
	64-QAM	26705	815.5	1 / 0	22.79	0.190	50.00	-27.21
		26775	822.5	1 / 0	22.50	0.178	50.00	-27.50
	256-QAM	26705	815.5	1 / 14	19.30	0.085	50.00	-30.70
		26775	822.5	1 / 7	19.46	0.088	50.00	-30.54
1.4 MHz	QPSK	26697	814.7	1 / 3	24.50	0.282	50.00	-25.50
		26783	823.3	1 / 3	24.27	0.267	50.00	-25.73
	16-QAM	26697	814.7	1 / 5	23.75	0.237	50.00	-26.25
		26783	823.3	1 / 3	23.48	0.223	50.00	-26.52
	64-QAM	26697	814.7	1 / 3	22.74	0.188	50.00	-27.26
		26783	823.3	1 / 0	22.26	0.168	50.00	-27.74
	256-QAM	26697	814.7	1 / 3	19.67	0.093	50.00	-30.33
		26783	823.3	1 / 0	19.28	0.085	50.00	-30.72

Table 7-2. Conducted Power Output Data (LTE Band 26)

NOTES:

- For LTE mode, the device was tested under all modulations, RB sizes and offsets, and channel bandwidth configurations and the worst case emissions are reported with 1 RB.
- This unit was tested with its standard battery.

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7.6 Radiated Power (ERP)

Test Overview

Effective Radiated Power (ERP) 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 below 1GHz are performed using vertically and horizontally polarized tuned dipole 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 $\geq 3 \times$ RBW
4. Span = 1.5 times the OBW
5. No. of sweep points $\geq 2 \times$ 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 roughly set equal to the measured OBW of the signal for signals with continuous operation.
9. Trace mode = trace averaging (RMS) over 100 sweeps
10. The trace was allowed to stabilize

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Test Setup

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

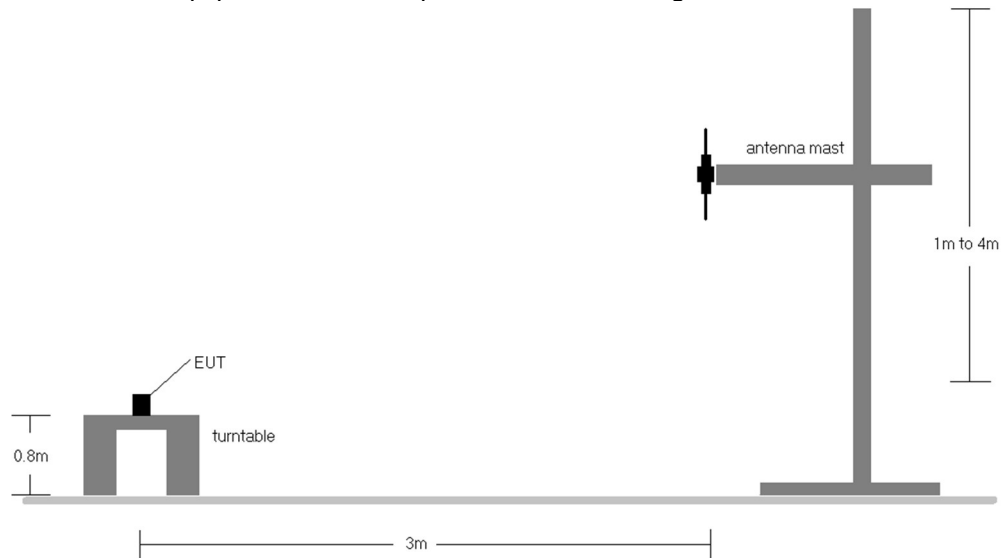


Figure 7-4. Radiated Test Setup <1GHz

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.

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Bandwidth	Mod.	Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Ant. Gain [dBi]	RB Size/Offset	Substitute Level [dBm]	ERP [dBm]	ERP [Watts]	ERP Limit [dBm]	Margin [dB]
15 MHz	QPSK	821.5	V	140	248	1.24	1 / 37	19.52	18.61	0.073	38.45	-19.84
	16-QAM	821.5	V	140	248	1.24	1 / 37	18.67	17.76	0.060	38.45	-20.69
10 MHz	QPSK (WCP)	821.5	V	137	292	1.24	1 / 0	15.76	14.85	0.031	38.45	-23.60

Table 7-3. ERP Data (LTE Band 26)

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7.7 Radiated Spurious Emissions Measurements

Test Overview

Radiated spurious emissions 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 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. All measurements are performed as RMS measurements while the EUT is operating at maximum power, and at the appropriate frequencies.

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 $\geq 3 \times$ RBW
3. Span = 1.5 times the OBW
4. No. of sweep points $\geq 2 \times$ span / RBW
5. Detector = RMS
6. Trace mode = Average (Max Hold for pulsed emissions)
7. The trace was allowed to stabilize

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Test Setup

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

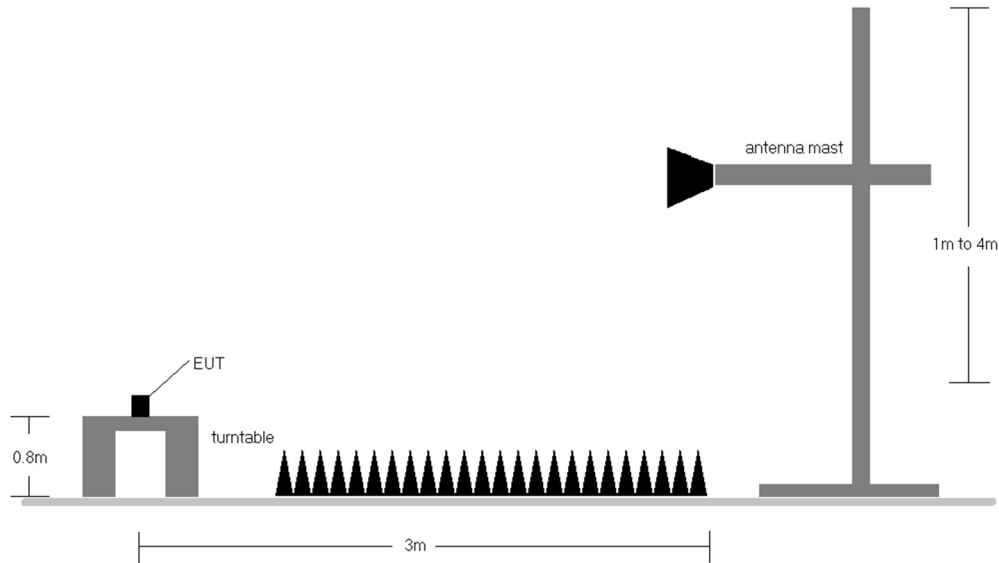


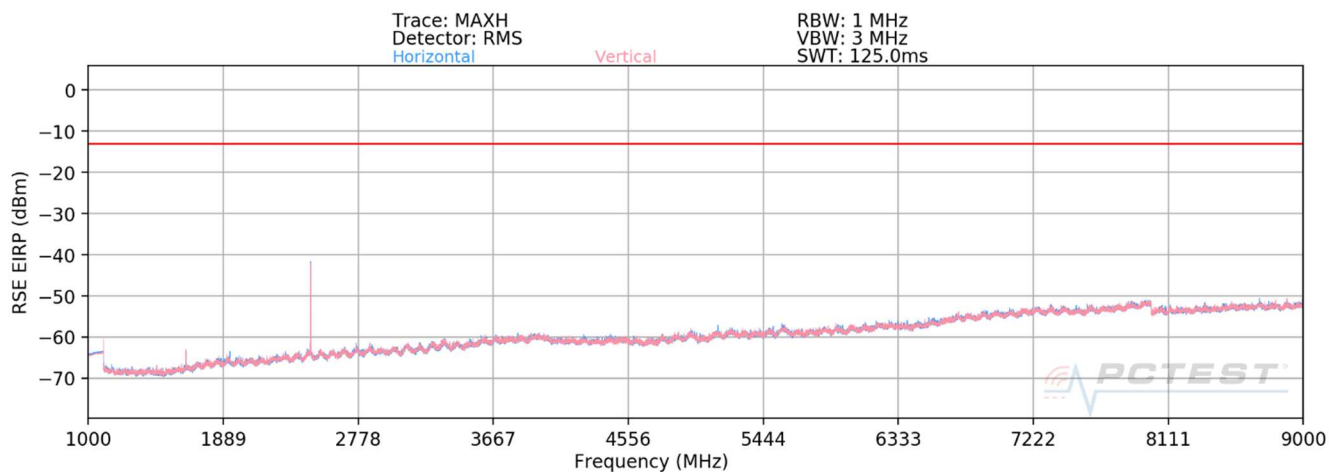
Figure 7-5. Test Instrument & Measurement Setup

Test Notes

1. For LTE mode, the device was tested under all modulations, RB sizes and offsets, and channel bandwidth configurations and the worst case emissions are reported with 1 RB.
2. This unit was tested with its standard battery.
3. The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case setup is reported in the tables below.
4. The "-" shown in the following RSE tables are used to denote a noise floor measurement.

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LTE Band 26



Plot 7-22. Radiated Spurious Plot (LTE Band 26)

Bandwidth (MHz):	15
Frequency (MHz):	821.5
Modulation Signal:	QPSK
RB Config (Size / Offset):	1 / 37

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]
1643.00	H	131	30	-73.67	-7.55	25.78	-69.48	-13.00	-56.48
2464.50	H	102	41	-55.68	-4.01	47.31	-47.95	-13.00	-34.95
3286.00	H	-	-	-77.13	-0.82	29.05	-66.21	-13.00	-53.21
4107.50	H	-	-	-76.72	1.18	31.46	-63.79	-13.00	-50.79
4929.00	H	-	-	-77.33	1.35	31.02	-64.24	-13.00	-51.24
5750.50	H	-	-	-77.72	3.52	32.80	-62.46	-13.00	-49.46

Table 7-4. Radiated Spurious Data (LTE Band 26 – Mid Channel)

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7.8 Frequency Stability / Temperature Variation

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.

The frequency stability of the transmitter shall be maintained within $\pm 0.00025\%$ (± 2.5 ppm) of the center frequency.

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

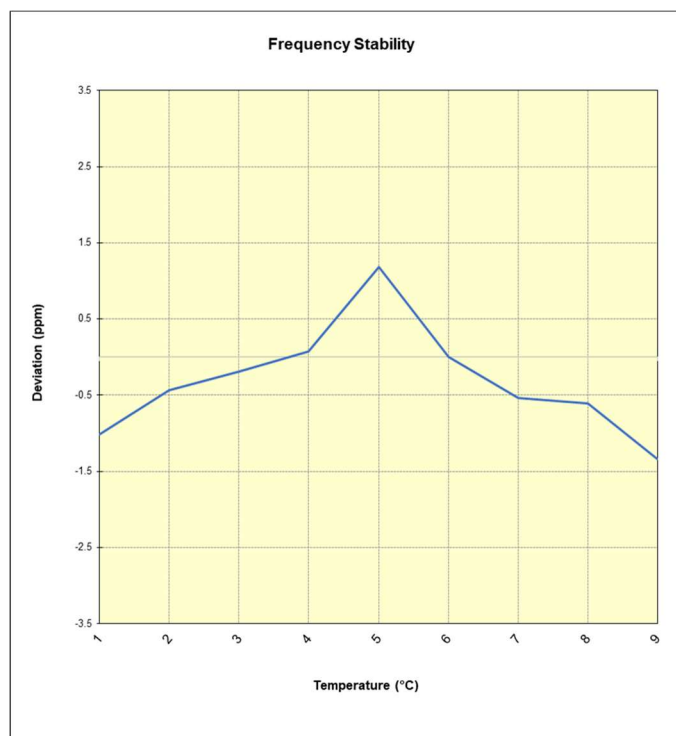
None

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LTE Band 26

LTE Band 26					
Operating Frequency (Hz):		819,000,000			
Ref. Voltage (VDC):		4.39			
Deviation Limit:		± 0.00025% or 2.5 ppm			
Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	4.39	- 30	818,999,817	-827	-0.0001010
		- 20	819,000,288	-356	-0.0000435
		- 10	819,000,490	-154	-0.0000188
		0	819,000,705	61	0.0000074
		+ 10	819,001,611	967	0.0001181
		+ 20 (Ref)	819,000,644	0	0.0000000
		+ 30	819,000,203	-441	-0.0000538
		+ 40	819,000,147	-498	-0.0000607
		+ 50	818,999,549	-1,095	-0.0001337
Battery Endpoint	3.80	+ 20	819,001,327	683	0.0000834

Table 7-5. LTE Band 26 Frequency Stability Data



Plot 7-23. LTE Band 26 Frequency Stability Chart

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8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Samsung Portable Handset FCC ID: A3LSMS906E** complies with all the requirements of Parts 22(H) and 90 of the FCC rules.

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