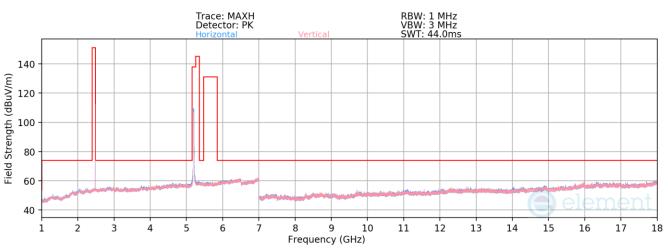


# 7.6.3 Simultaneous TX Radiated Spurious Emissions Measurements

Description	Bluetooth	UNII
Channel	78	40
Operating Frequency (MHz)	2480	5200
Mode/Modulation	GFSK - ePA	MCS0

Table 7-25. Worst Case Simultaneous Transmission Configuration



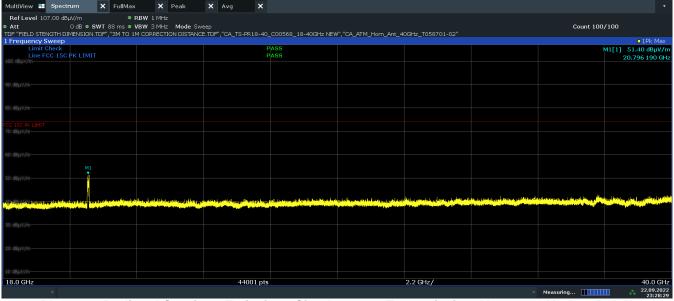
Plot 7-47. Radiated Spurious Emissions Simultaneous Transmission above 1GHz

	Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
*	4960.00	Peak	Н	344	198	-63.84	18.35	61.51	73.98	-12.47
*	7440.00	Peak	Н	161	200	-70.13	12.04	48.91	73.98	-25.07
*	12400.00	Peak	-	-	-	-71.88	17.81	52.93	73.98	-21.05
*	5143.00	Avg	Н	278	188	-78.40	19.26	47.86	53.98	-6.12
*	5143.00	Peak	Н	278	188	-66.15	19.26	60.11	73.98	-13.87
*	5373.00	Avg	Н	262	180	-80.01	19.52	46.51	53.98	-7.47
*	5373.00	Peak	Н	262	180	-69.06	19.52	57.46	73.98	-16.52
	10400.00	Peak	-	-	-	-71.72	15.24	50.52	68.20	-17.68
*	15600.00	Avg	-	-	-	-83.49	19.91	43.42	53.98	-10.56
*	15600.00	Peak	-	-	-	-72.66	19.91	54.25	73.98	-19.73

Table 7-26. Radiated Spurious Emissions Simultaneous Transmission above 1GHz Measurements

FCC ID: BCGA2825 IC: 579C-A2825	element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Dege 61 of 77
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Plot 7-48. Radiated Spurious Emissions Simultaneous Transmission Above 18GHz Ant. Pol. H



Plot 7-49. Radiated Spurious Emissions Simultaneous Transmission Above 18GHz Ant. Pol. V

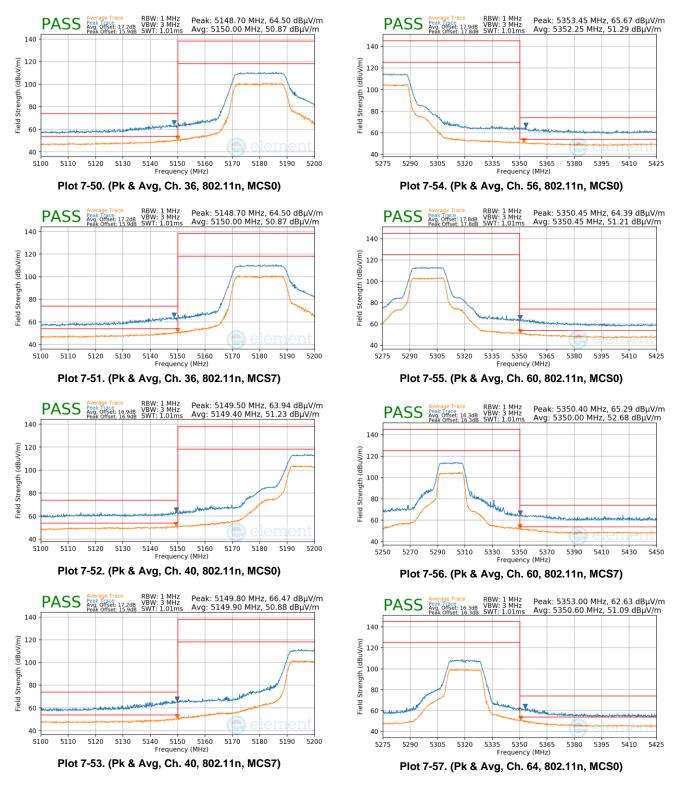
	Frequency [GHz]	Detector	Ant. Pol. [H/V]	Positioner [degree]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Dist. Corr. Factor [dB]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
*	20.80	Avg	V	2	278	-50.69	-7.12	-9.54	39.65	53.98	-23.87
*	20.80	Peak	V	2	278	-39.01	-7.12	-9.54	51.33	73.98	-32.19

Table 7-27. Radiated Spurious Emissions Simultaneous Transmission Above 18GHz Measurements

FCC ID: BCGA2825 IC: 579C-A2825	element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Dogo 62 of 77
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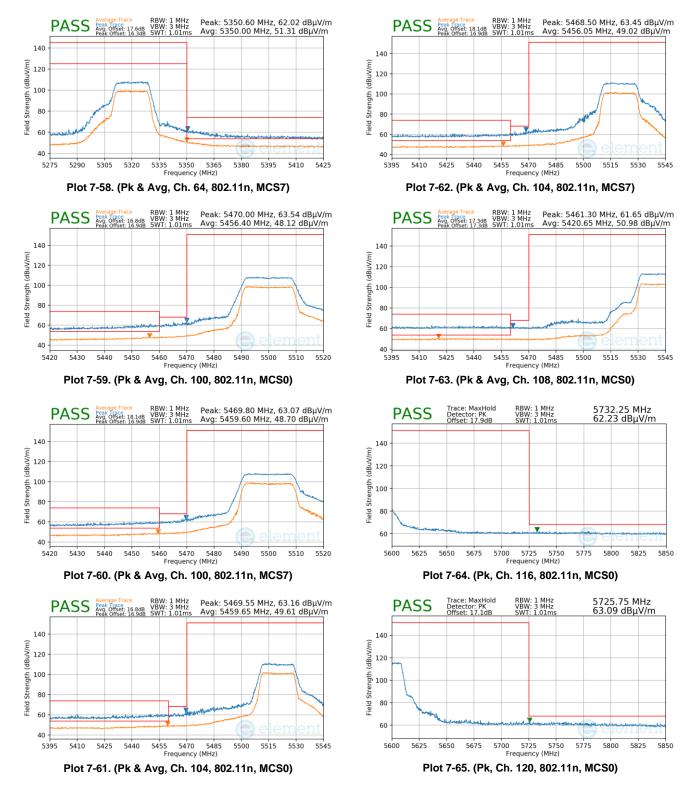


# 7.6.4 Radiated Band Edge Measurements (20MHz BW) §15.407(b.1)(b.2) §15.205 §15.209; RSS-Gen [8.9]; RSS-Gen [8.9]



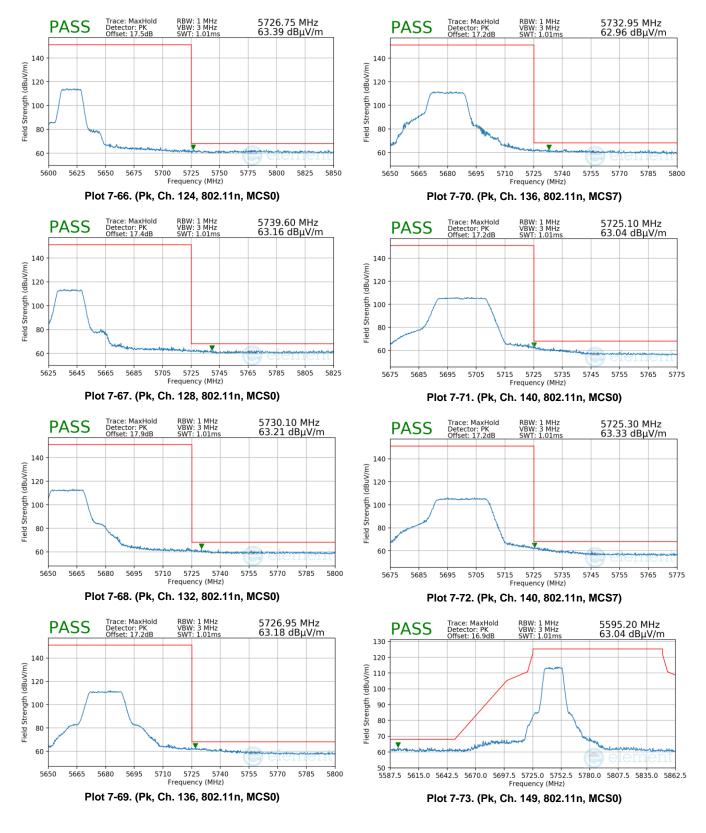
FCC ID: BCGA2825 IC: 579C-A2825	element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Dogo 62 of 77
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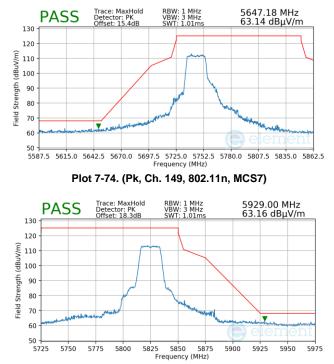
FCC ID: BCGA2825 IC: 579C-A2825	element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Dege 64 of 77
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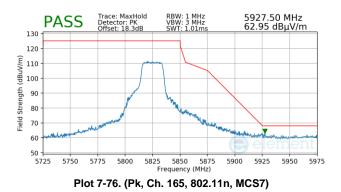


FCC ID: BCGA2825 IC: 579C-A2825	element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Dege CE of 77
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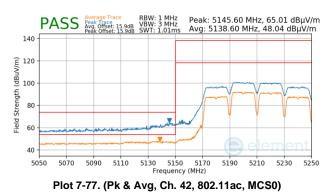
Plot 7-75. (Pk, Ch. 165, 802.11n, MCS0)

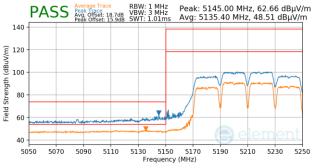


FCC ID: BCGA2825 IC: 579C-A2825	element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Dage 66 of 77
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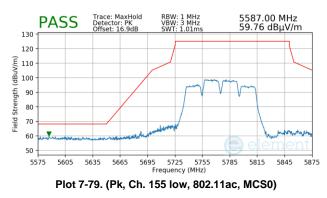


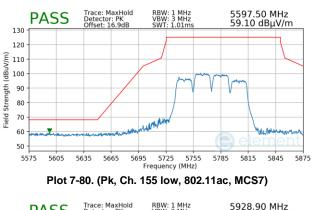
# Radiated Band Edge Measurements (80MHz BW) §15.407(b.1)(b.2) §15.205 §15.209; RSS-Gen [8.9]; RSS-Gen [8.9]

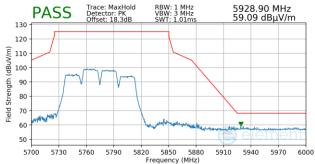




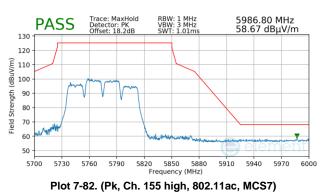
Plot 7-78. (Pk & Avg, Ch. 42, 802.11ac, MCS7)







Plot 7-81. (Pk, Ch. 155 high, 802.11ac, MCS0)



FCC ID: BCGA2825 IC: 579C-A2825	element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
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# 7.7 Radiated Spurious Emissions – Below 1GHz §15.209; RSS-Gen [8.9]

# **Test Overview and Limit**

All out of band radiated spurious emissions are measured with a spectrum analyzer connected to a receive antenna while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates and modes were investigated for radiated spurious emissions. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

# All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR and Table 7 of RSS-Gen (8.10) must not exceed the limits shown in Table 7-28 per Section 15.209 and RSS-Gen (8.9).

Frequency	Field Strength [μV/m]	Measured Distance [Meters]
0.009 – 0.490 MHz	2400/F (kHz)	300
0.490 – 1.705 MHz	24000/F (kHz)	30
1.705 – 30.00 MHz	30	30
30.00 – 88.00 MHz	100	3
88.00 – 216.0 MHz	150	3
216.0 – 960.0 MHz	200	3
Above 960.0 MHz	500	3

# Test Procedures Used

Table 7-28. Radiated Limits

ANSI C63.10-2013

### Test Settings

### **Quasi-Peak Field Strength Measurements**

- 1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
- 2. RBW = 120kHz (for emissions from 30MHz 1GHz)
- 3. Detector = quasi-peak
- 4. Sweep time = auto couple
- 5. Trace mode = max hold
- 6. Trace was allowed to stabilize

### Peak Field Strength Measurements

- 1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
- 2. RBW = 120kHz (for emissions from 30MHz 1GHz)
- 3. VBW = 300kHz
- 4. Detector = quasi-peak
- 5. Sweep time = auto couple
- 6. Trace mode = max hold
- 7. Trace was allowed to stabilize

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# Test Setup

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

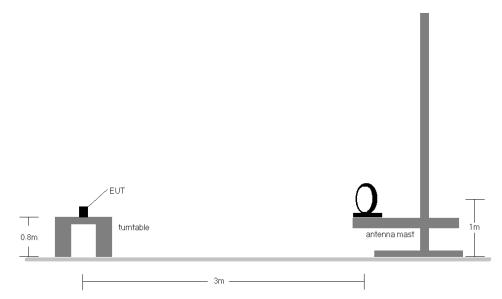
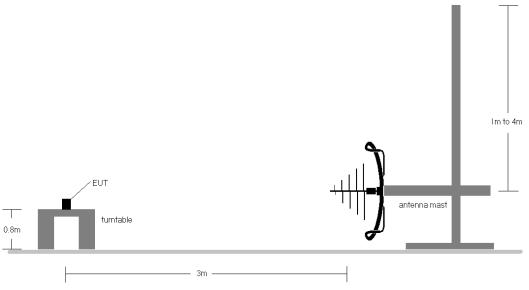
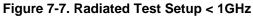


Figure 7-6. Radiated Test Setup < 30MHz





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# Test Notes

- 1. All emissions lying in restricted bands specified in §15.205 and RSS-Gen (8.10) are below the limit shown in Table 7-28.
- The broadband receive antenna is manipulated through vertical and horizontal polarizations during the tests. The EUT is manipulated through two orthogonal planes. For below 30MHz the loop antenna was positioned in 3 orthogonal planes (X front, Y side, Z top) to determine the orientation resulting in the worst case emissions.
- 3. This unit was tested while powered by an AC power source.
- 4. The spectrum is investigated using a peak detector and final measurements are recorded using CISPR guasi peak detector on emissions that were within 6dB of the limit.
- 5. Emissions were measured at a 3 meter test distance.
- 6. Emissions are investigated while operating on the center channel of the mode, band, and modulation that produced the worst case results during the transmitter spurious emissions testing.
- 7. No spurious emissions were detected within 20dB of the limit below 30MHz.
- 8. The results recorded using the broadband antenna is known to correlate with the results obtained by using a tuned dipole with an acceptable degree of accuracy. The VSWR for the measurement antenna was found to be less than 2:1.
- 9. The unit was tested with all possible modes and only the highest emission is reported.

# Sample Calculations

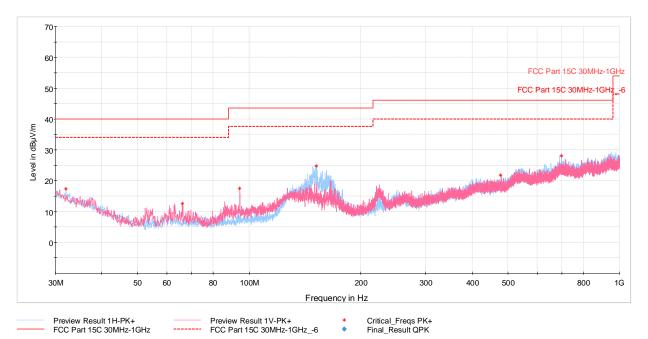
# **Determining Spurious Emissions Levels**

- Field Strength Level [dBμV/m] = Analyzer Level [dBm] + 107 + AFCL [dB/m]
- AFCL [dB/m] = Antenna Factor [dB/m] + Cable Loss [dB] Preamp Gain [dB]
- $\circ \quad \text{Margin}_{[dB]} = \text{Field Strength Level}_{[dB\mu V/m]} \text{Limit}_{[dB\mu V/m]}$

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# 7.7.1 Radiated Spurious Emissions Measurements (Below 1GHz) §15.209; RSS-Gen [8.9]



Plot 7-83. Radiated Spurious Emissions below 1GHz, 802.11n, Ch.36

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
32.04	Max Peak	Н	300	312	-79.88	-9.81	17.31	40.00	-22.69
66.04	Max Peak	V	100	223	-76.85	-17.53	12.62	40.00	-27.38
94.41	Max Peak	V	200	148	-72.29	-17.25	17.46	43.52	-26.06
152.07	Max Peak	н	200	195	-68.79	-13.35	24.86	43.52	-18.66
477.17	Max Peak	н	100	225	-80.92	-4.26	21.82	46.02	-24.20
696.97	Max Peak	Н	300	51	-81.52	2.60	28.08	46.02	-17.94

Table 7-29. Radiated Spurious Emissions below 1GHz, 802.11n, Ch.36

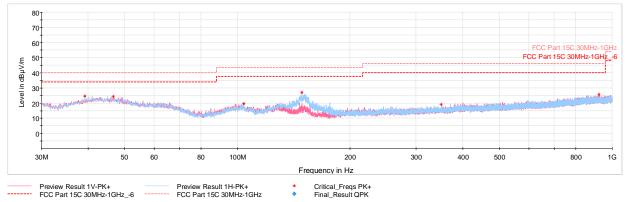
FCC ID: BCGA2825 IC: 579C-A2825	element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Daga 71 of 77
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# 7.7.2 Simultaneous TX Radiated Spurious Emissions Measurements (Below 1GHz) §15.209; RSS-Gen [8.9]

Description	Bluetooth	UNII
Channel	78	40
Operating Frequency (MHz)	2480	5200
Mode/Modulation	GFSK - ePA	MCS0

Table 7-30. Worst Case Simultaneous Transmission Configuration



Plot 7-84. Radiated Spurious Emissions – Simultaneous Transmission 30MHz – 1GHz)

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
39.22	Max Peak	Н	100	176	-64.84	-17.53	24.63	40.00	-15.37
46.73	Max Peak	V	100	170	-67.13	-15.58	24.29	40.00	-15.71
104.11	Max Peak	Н	200	41	-69.17	-18.20	19.63	43.52	-23.89
148.58	Max Peak	Н	200	41	-58.47	-21.38	27.15	43.52	-16.37
350.25	Max Peak	Н	100	157	-74.35	-13.54	19.11	46.02	-26.91
922.74	Max Peak	V	300	20	-77.20	-3.96	25.84	46.02	-20.18

Table 7-31. Radiated Spurious Emissions – Simultaneous Transmission 30MHz – 1GHz)

FCC ID: BCGA2825 IC: 579C-A2825	element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
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# 7.8 AC Line-Conducted Emissions Measurement

§15.407; RSS-Gen [8.8]

# **Test Overview and Limit**

All AC line conducted spurious emissions are measured with a receiver connected to a grounded LISN while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates and modes were investigated for AC Line conducted spurious emissions. Only the conducted emissions of the configuration that produced the worst case emissions are reported in this section.

# All conducted emissions must not exceed the limits shown in the table below, per Section 15.207 and RSS-Gen (8.8).

Frequency of emission	Conducted Limit (dBµV)				
(MHz)	Quasi-peak	Average			
0.15 – 0.5	66 to 56*	56 to 46*			
0.5 – 5	56	46			
5 – 30	60	50			

Table 7-32. Conducted Limits

\*Decreases with the logarithm of the frequency.

# **Test Procedures Used**

ANSI C63.10-2013, Section 6.2

# **Test Settings**

### **Quasi-Peak Measurements**

- 1. Analyzer center frequency was set to the frequency of the spurious emission of interest
- 2. RBW = 9kHz (for emissions from 150kHz 30MHz)
- 3. Detector = quasi-peak
- 4. Sweep time = auto couple
- 5. Trace mode = max hold
- 6. Trace was allowed to stabilize

### Average Measurements

- 1. Analyzer center frequency was set to the frequency of the spurious emission of interest
- 2. RBW = 9kHz (for emissions from 150kHz 30MHz)
- 3. Detector = RMS
- 4. Sweep time = auto couple
- 5. Trace mode = max hold
- 6. 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.

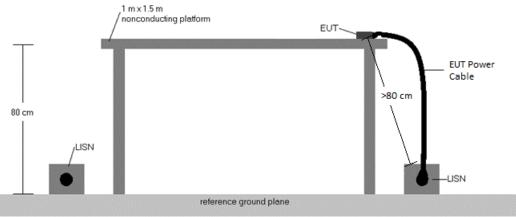


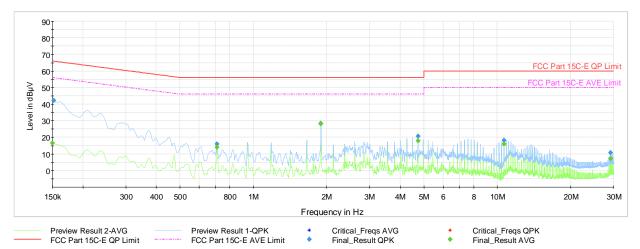
Figure 7-8. Test Instrument & Measurement Setup

# Test Notes

- 1. All modes of operation were investigated and the worst-case emissions are reported. The emissions found were not affected by the choice of channel used during testing.
- 2. The limit for an intentional radiator from 150kHz to 30MHz are specified in 15.207 and RSS-Gen (8.8).
- 3. Corr. (dB) = Cable loss (dB) + LISN insertion factor (dB)
- 4. QP/AV Level (dB $\mu$ V) = QP/AV Analyzer/Receiver Level (dB $\mu$ V) + Correction Factor (dB)
- 5. Margin (dB) = QP/AV Level (dB $\mu$ V) QP/AV Limit (dB $\mu$ V)
- 6. Traces shown in plots are made using quasi-peak and average detectors.
- 7. Deviations to the Specifications: None.
- 8. The unit was tested with all possible modes and only the highest emission is reported.

FCC ID: BCGA2825 IC: 579C-A2825	element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
Test Report S/N:	Test Dates:	EUT Type:	Dogo 74 of 77
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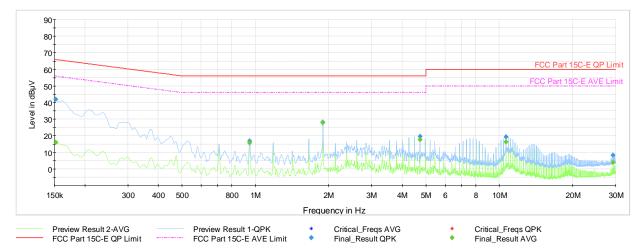


Frequency [MHz]	Process State	QuasiPeak [dBµV]	Average [dBµV]	Limit [dBµV]	Margin [dB]	Line	PE
0.150	FINAL		16.43	56.00	-39.57	L1	GND
0.152	FINAL	42.2		65.88	-23.67	L1	GND
0.710	FINAL		14.14	46.00	-31.86	L1	GND
0.710	FINAL	16.0		56.00	-39.99	L1	GND
1.892	FINAL		28.00	46.00	-18.00	L1	GND
1.892	FINAL	28.4		56.00	-27.61	L1	GND
4.731	FINAL	20.6		56.00	-35.43	L1	GND
4.731	FINAL		18.03	46.00	-27.97	L1	GND
10.644	FINAL	18.1		60.00	-41.94	L1	GND
10.644	FINAL		16.00	50.00	-34.00	L1	GND
29.157	FINAL		7.02	50.00	-42.98	L1	GND
29.157	FINAL	10.8		60.00	-49.21	L1	GND

Table 7-33. AC Line Conducted Data with 802.11n- Ch.36 (L1)

FCC ID: BCGA2825 IC: 579C-A2825	element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager
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Frequency [MHz]	Process State	QuasiPeak [dBµV]	Average [dBµV]	Limit [dBµV]	Margin [dB]	Line	PE
0.152	FINAL		15.90	55.88	-39.98	Ν	GND
0.152	FINAL	41.9		65.88	-24.02	Ν	GND
0.947	FINAL		15.83	46.00	-30.17	Ν	GND
0.947	FINAL	16.7		56.00	-39.28	Ν	GND
1.892	FINAL		27.73	46.00	-18.27	Ν	GND
1.892	FINAL	28.1		56.00	-27.86	Ν	GND
4.729	FINAL	19.6		56.00	-36.40	Ν	GND
4.731	FINAL		17.70	46.00	-28.30	Ν	GND
10.642	FINAL	19.2		60.00	-40.81	Ν	GND
10.644	FINAL		16.13	50.00	-33.87	Ν	GND
29.180	FINAL		3.71	50.00	-46.29	Ν	GND
29.180	FINAL	8.4		60.00	-51.64	N	GND

Table 7-34. AC Line Conducted Data with 802.11n - Ch.36 (N)

FCC ID: BCGA2825 IC: 579C-A2825	element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager	
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# 8.0 CONCLUSION

The data collected relate only the item(s) tested and show that the **Apple Smart Speaker FCC ID: BCGA2825** and **IC: 579C-A2825** is in compliance with Part 15 Subpart E (15.407) of the FCC Rules and RSS-247 of the Innovation, Science and Economic Development Canada Rules.

FCC ID: BCGA2825 IC: 579C-A2825	element	MEASUREMENT REPORT (CERTIFICATION)	Approved by: Technical Manager	
Test Report S/N:	Test Dates:	EUT Type:	Dogo 77 of 77	
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