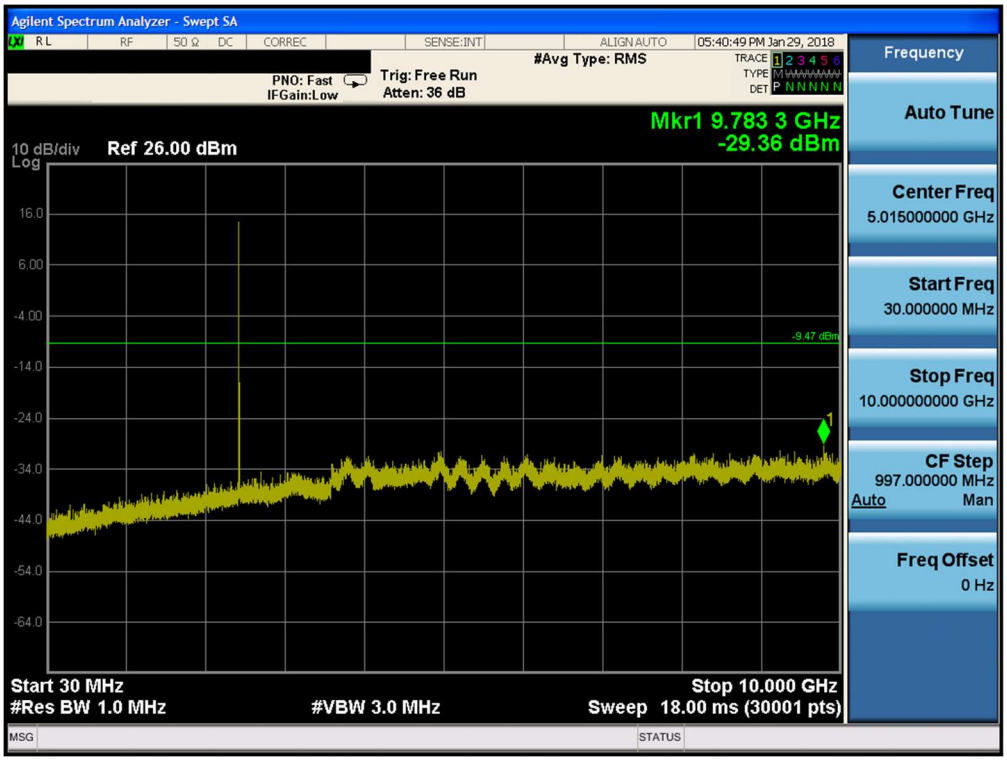
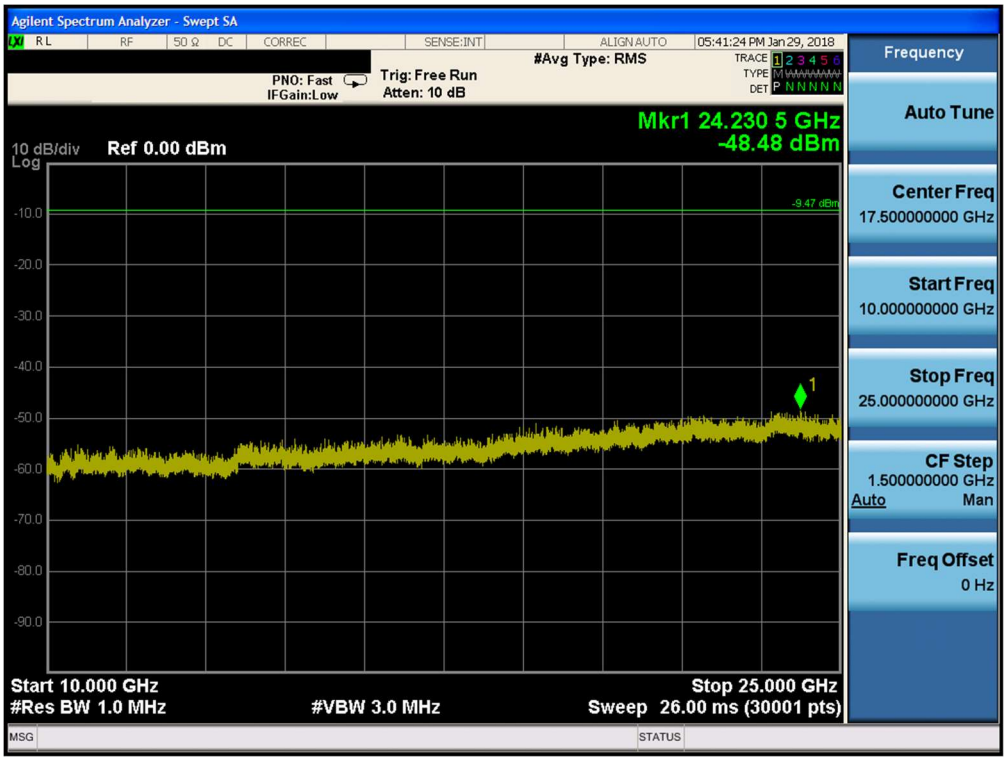
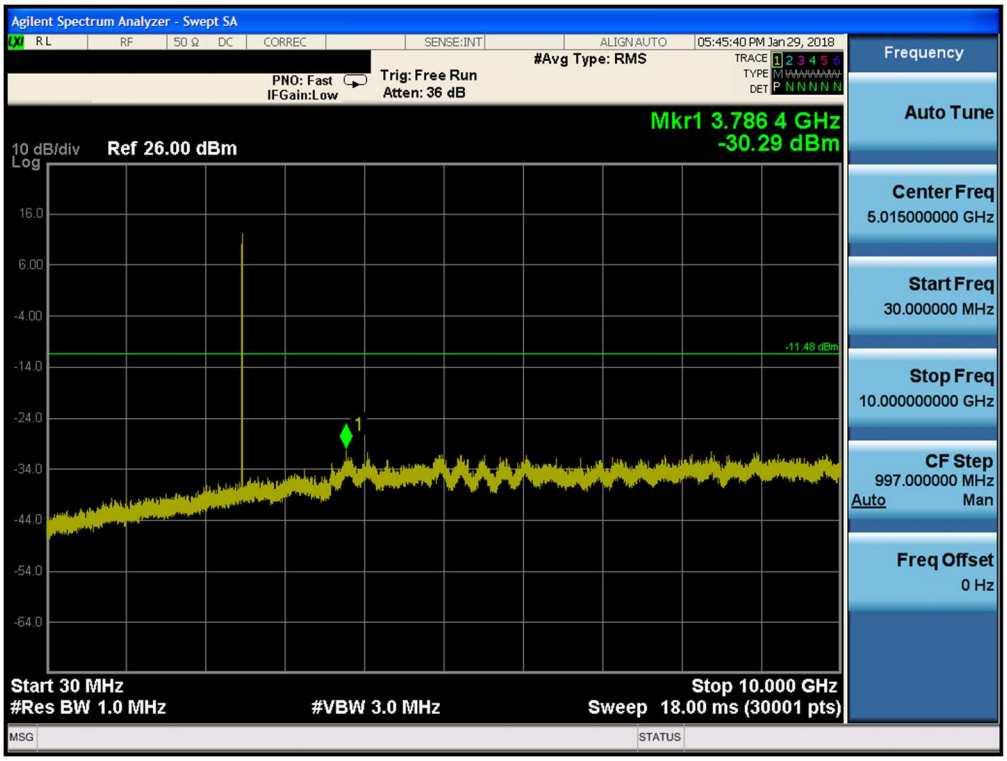


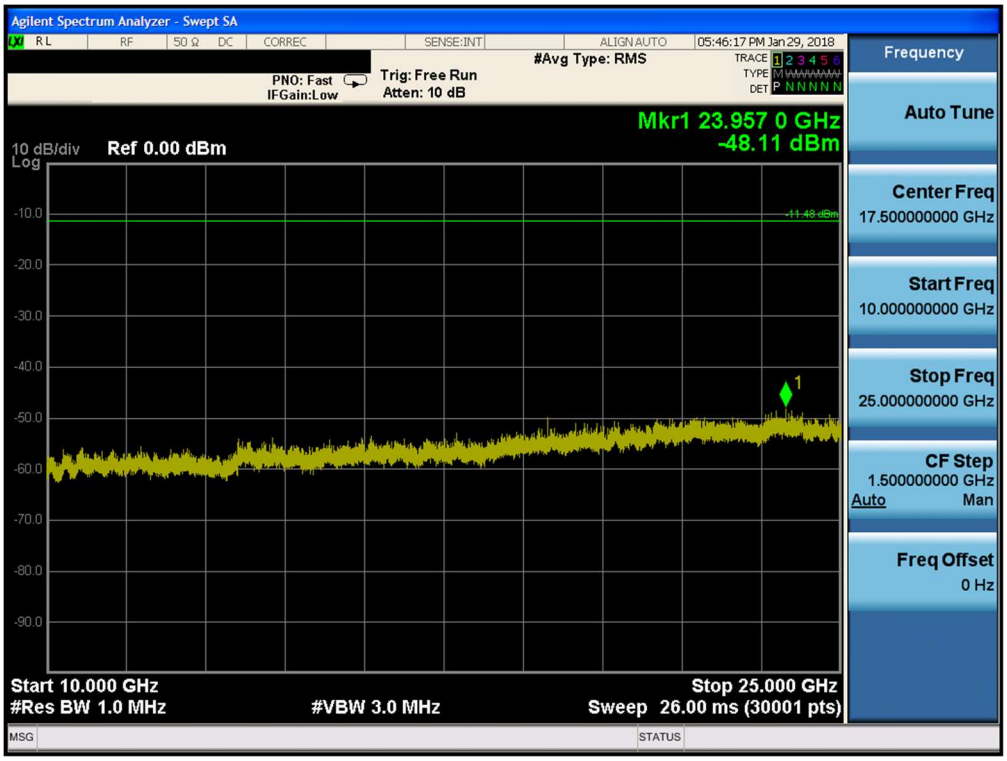
Plot 7-57. Conducted Spurious Plot (Bluetooth, 8DPSK, ePA – Ch. 39)



Plot 7-58. Conducted Spurious Plot (Bluetooth, 8DPSK, ePA – Ch. 39)



Plot 7-59. Conducted Spurious Plot (Bluetooth, 8DPSK, ePA – Ch. 78)



Plot 7-60. Conducted Spurious Plot (Bluetooth, 8DPSK, ePA – Ch. 78)

7.9 Radiated Spurious Emission Measurements – Above 1GHz

§15.205 §15.209 §15.247 (d); 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 maximum power and at the appropriate frequencies. 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 6 of RSS-Gen (8.10) must not exceed the limits shown in Table 7-6 per Section 15.209 and RSS-Gen (8.9).

Frequency	Field Strength [μV/m]	Measured Distance [Meters]
Above 960.0 MHz	500	3

Table 7-6. Radiated Limits

Test Procedure Used

ANSI C63.10-2013 – Section 6.6.4.3

Test Settings

Average Field Strength Measurements per Section 4.1.4.2.3 of ANSI C63.10-2013

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 1kHz $\geq 1/\tau$ Hz, where τ = pulse width in seconds
4. Averaging type was set to RMS to ensure that video filtering was applied in the power domain
5. Detector = peak
6. Sweep time = auto
7. Trace mode = max hold
8. Trace was allowed to stabilize

Peak Field Strength Measurements per Section 4.1.4.2.2 of ANSI C63.10-2013

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW is set depending on measurement frequency, as specified in Table 7-7 below
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

Frequency	RBW
9 – 150kHz	200 – 300Hz
0.15 – 30MHz	9 – 10kHz
30 – 1000MHz	100 – 120kHz
> 1000MHz	1MHz

Table 7-7. RBW as a Function of Frequency

Test Setup

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

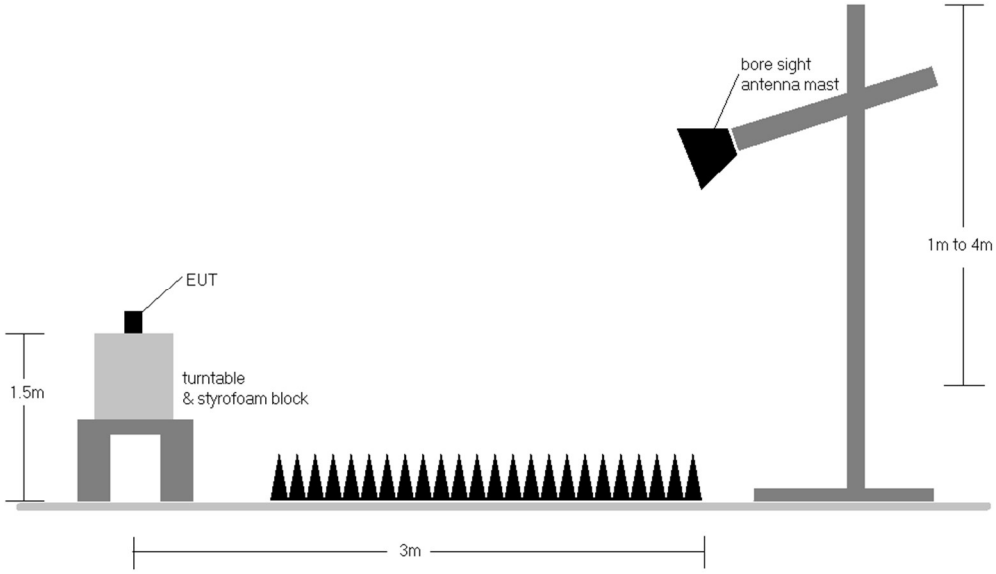


Figure 7-9. Radiated Test Setup >1GHz

Test Notes

4. All emissions lying in restricted bands specified in §15.205 and Section 8.10 of RSS-Gen are below the limit shown in Table 7-6.
5. No significant radiated emissions were found in the 2310 - 2390MHz restricted band.
6. The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
7. This unit was tested with its standard battery.
8. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported.
9. The duty cycle correction factor was not applied to noise floor measurements.
10. The wide spectrum spurious emissions plots shown on the following pages are used only for the purpose of emission identification. Any emissions found to be within 20dB of the limit are fully investigated and the results are shown in this section.
11. The "-" shown in the following RSE tables are used to denote a noise floor measurement.

Sample Calculation

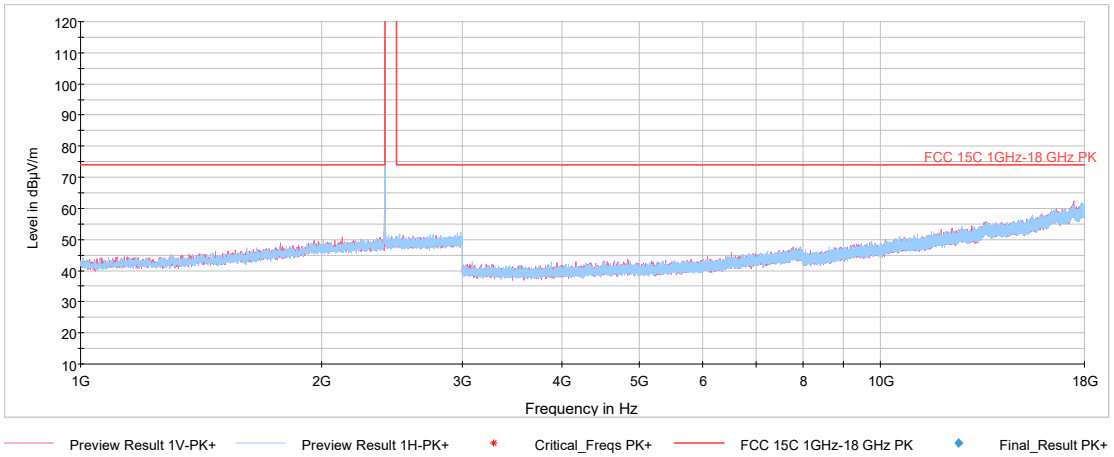
- Field Strength Level $_{[dB\mu V/m]}$ = Analyzer Level $_{[dBm]}$ + 107 + AFCL $_{[dB/m]}$ + Duty Cycle Correction $_{[dB]}$
- AFCL $_{[dB/m]}$ = Antenna Factor $_{[dB/m]}$ + Cable Loss $_{[dB]}$
- Margin $_{[dB]}$ = Field Strength Level $_{[dB\mu V/m]}$ – Limit $_{[dB\mu V/m]}$

Duty Cycle Correction Factor Calculation

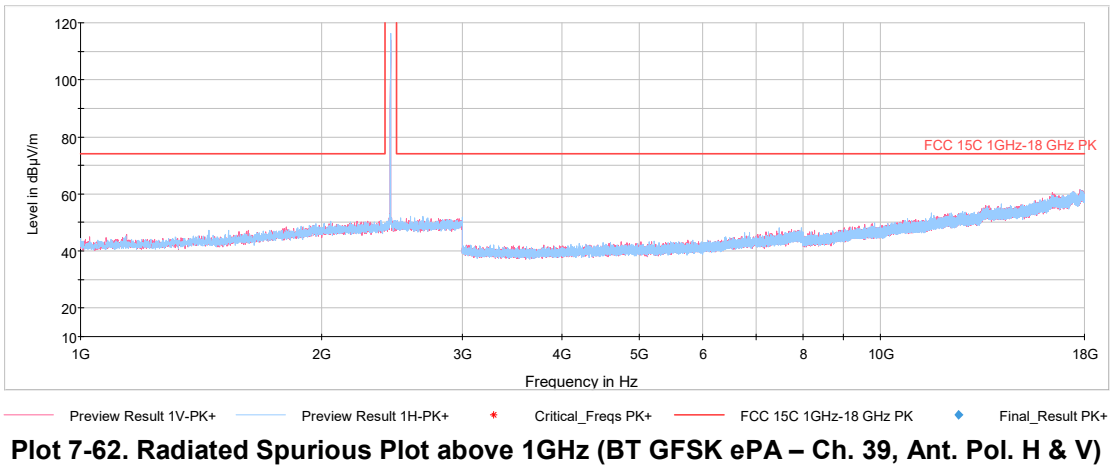
- Channel hop rate = 800 hops/second (AFH Mode)
- Adjusted channel hop rate for DH5 mode **=** 133.33 hops/second
- Time per channel hop **=** 1 / 133.33 hops/second = 7.50 ms
- Time to cycle through all channels = 7.50 x 20 channels = 150 ms
- Number of times transmitter hits on one channel = 100 ms / 150 ms = 1 time(s)
- Worst case dwell time = 7.5 ms
- Duty cycle correction factor = $20\log_{10}(7.5ms/100ms)$ = -22.5 dB
- The duty-cycle correction factor was not applied since the duty cycle for all modes were 100%

Radiated Spurious Emission Measurements

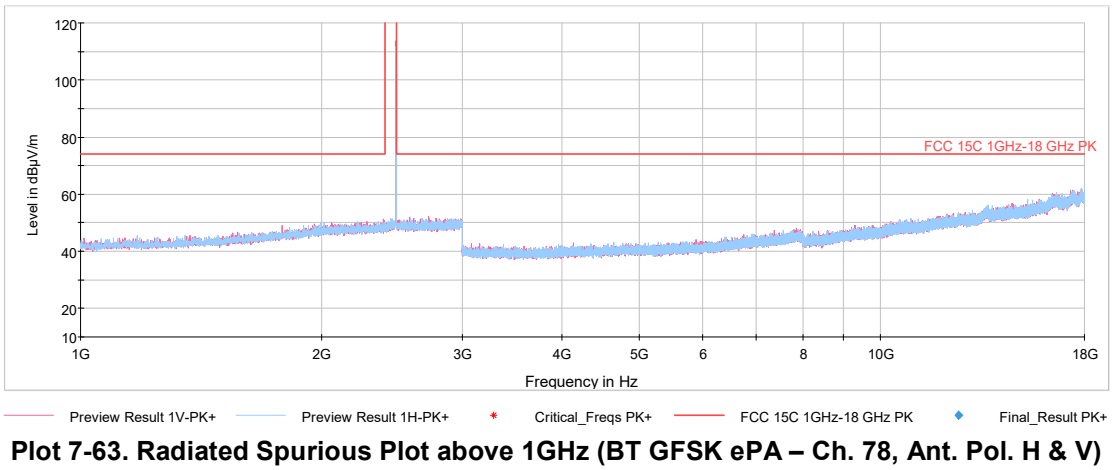
§15.205 §15.209 §15.247 (d); RSS-Gen [8.9]



Plot 7-61. Radiated Spurious Plot above 1GHz (BT GFSK ePA – Ch. 0, Ant. Pol. H & V)



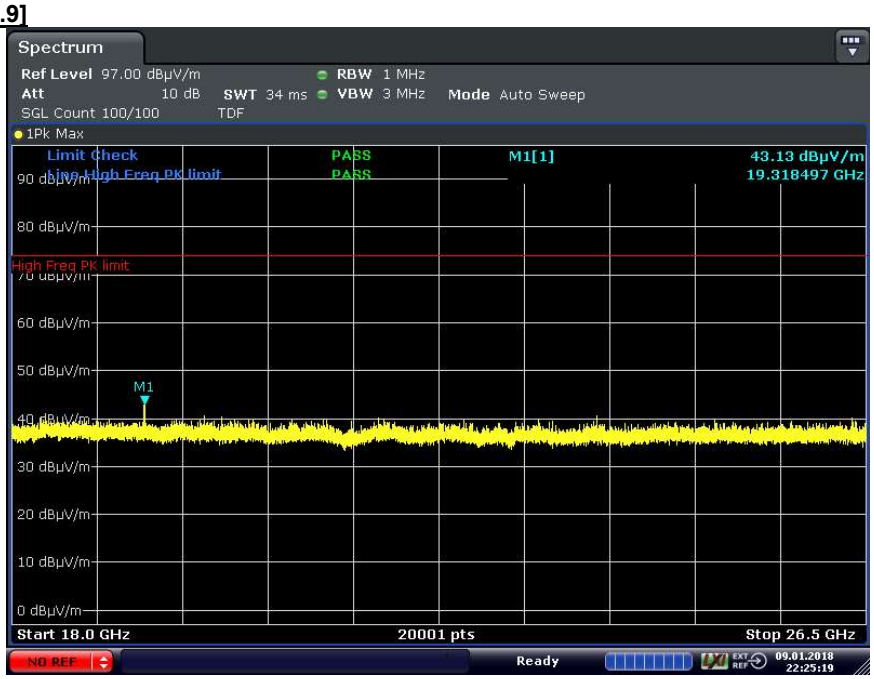
Plot 7-62. Radiated Spurious Plot above 1GHz (BT GFSK ePA – Ch. 39, Ant. Pol. H & V)



Plot 7-63. Radiated Spurious Plot above 1GHz (BT GFSK ePA – Ch. 78, Ant. Pol. H & V)

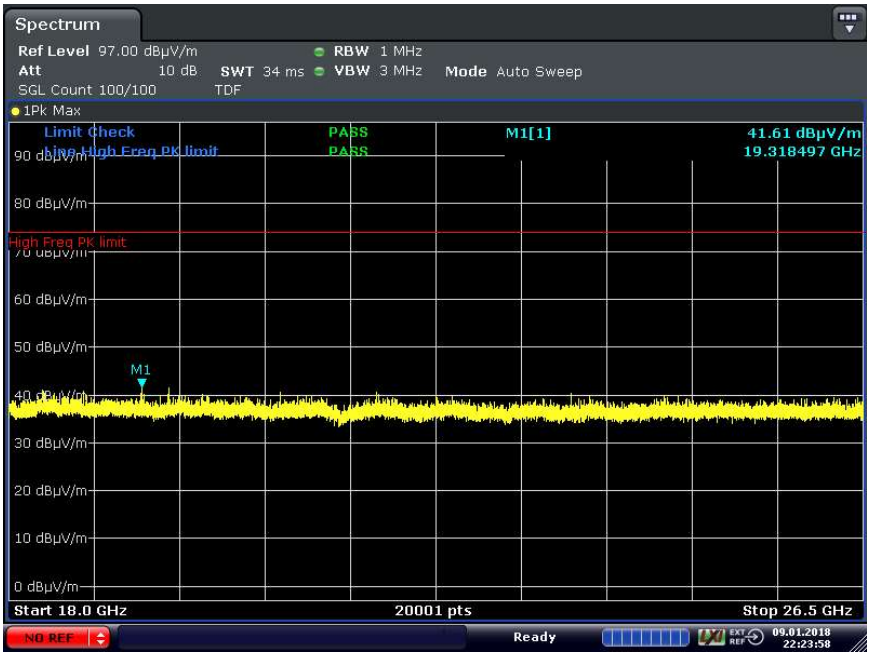
Radiated Spurious Emissions Measurements (Above 18GHz)

§15.209; RSS-Gen [8.9]



Date: 9.JAN.2018 22:25:19

Plot 7-64. Radiated Spurious Plot above 18GHz (GFSK ePA, Pol. H)



Date: 9.JAN.2018 22:23:58

Plot 7-65. Radiated Spurious Plot above 18GHz (GFSK ePA, Pol. V)

Radiated Spurious Emission Measurements

§15.205 §15.209 §15.247 (d); RSS-Gen [8.9]

Worst Case Mode:	Bluetooth
Worst Case Data Rate:	GFSK
Worst Case Power Scheme	ePA
Measurement Distance:	3 Meters
Operating Frequency:	2402MHz
Channel:	0

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]
4804.00	Avg	H	-	-	-84.08	9.47	32.39	53.98	-21.59
4804.00	Peak	H	-	-	-69.68	9.47	46.79	73.98	-27.19
12010.00	Avg	H	-	-	-89.04	25.29	43.25	53.98	-10.73
12010.00	Peak	H	-	-	-76.06	25.29	56.23	73.98	-17.75

Table 7-8. Radiated Measurements

Worst Case Mode:	Bluetooth
Worst Case Data Rate:	GFSK
Worst Case Power Scheme	ePA
Measurement Distance:	3 Meters
Operating Frequency:	2441MHz
Channel:	39

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]
4882.00	Avg	H	-	-	-83.81	9.53	32.72	53.98	-21.25
4882.00	Peak	H	-	-	-70.33	9.53	46.20	73.98	-27.77
7323.00	Avg	H	-	-	-85.72	15.15	36.43	53.98	-17.55
7323.00	Peak	H	-	-	-71.90	15.15	50.25	73.98	-23.73
12205.00	Avg	H	-	-	-88.92	25.31	43.39	53.98	-10.59
12205.00	Peak	H	-	-	-75.67	25.31	56.64	73.98	-17.34

Table 7-9. Radiated Measurements

Radiated Spurious Emission Measurements

§15.205 §15.209 §15.247 (d); RSS-Gen [8.9]

Worst Case Mode:	Bluetooth
Worst Case Data Rate:	GFSK
Worst Case Power Scheme	ePA
Measurement Distance:	3 Meters
Operating Frequency:	2480MHz
Channel:	78

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	Avg	H	-	-	-83.83	9.29	32.46	53.98	-21.52
4960.00	Peak	H	-	-	-70.01	9.29	46.28	73.98	-27.70
7440.00	Avg	H	-	-	-85.91	15.67	36.76	53.98	-17.22
7440.00	Peak	H	-	-	-72.03	15.67	50.64	73.98	-23.34
12400.00	Avg	H	-	-	-89.49	25.78	43.29	53.98	-10.69
12400.00	Peak	H	-	-	-76.09	25.78	56.69	73.98	-17.29

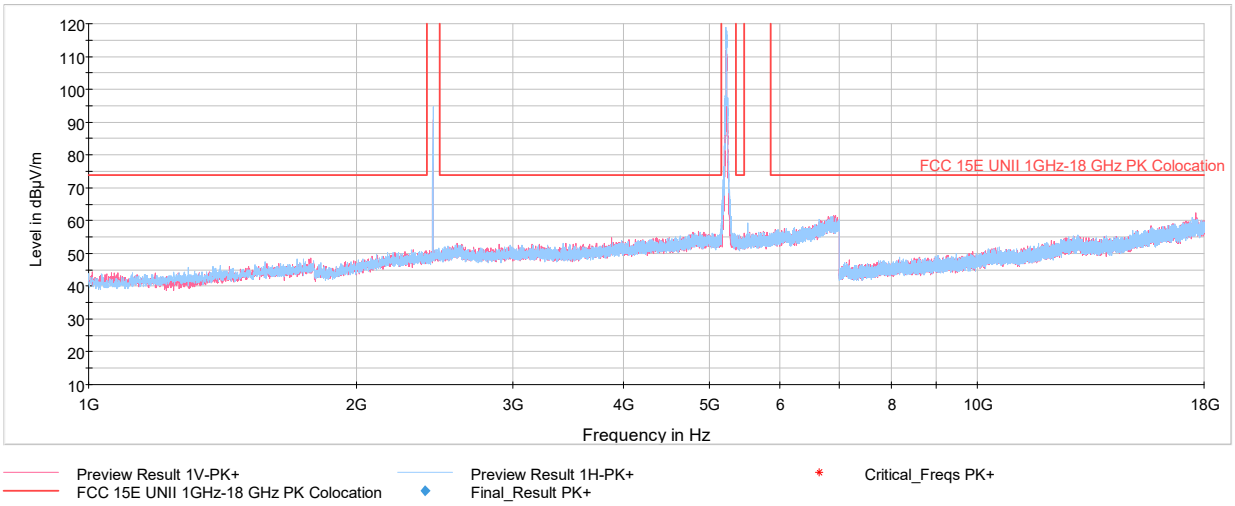
Table 7-10. Radiated Measurements

7.11 Simultaneous Tx Radiated Spurious Emissions Measurements

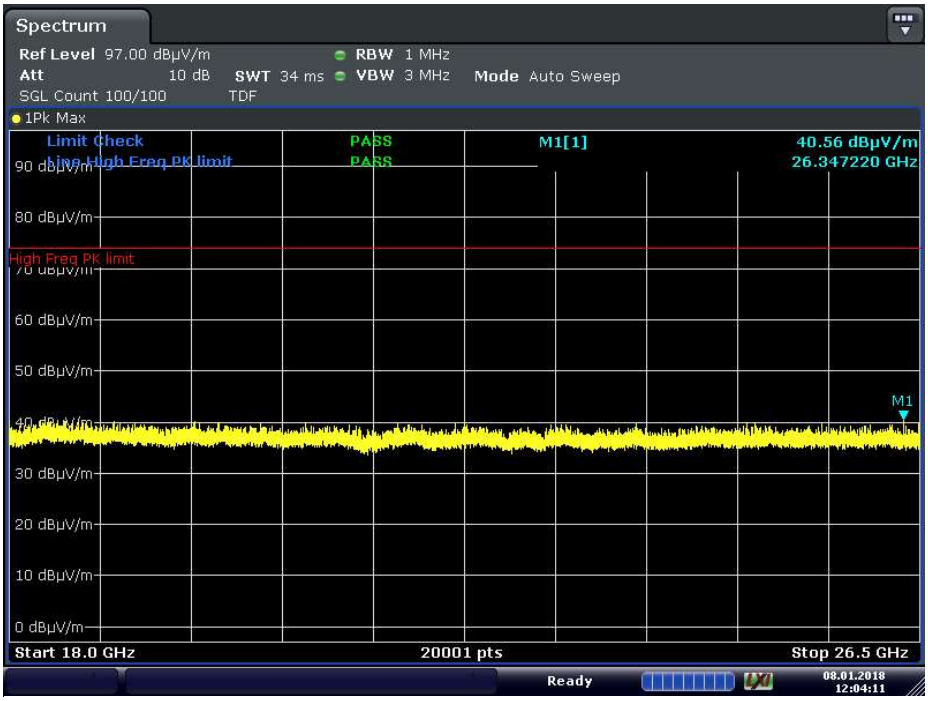
§15.247(d) §15.205 & §15.209; RSS-Gen [8.9]

Description	2.4 GHz Emission	5 GHz Emission
Antenna	1	1,2
Channel	39	44
Operating Frequency (MHz)	2441	5220
Data Rate (Mbps)	-	MCS0
Mode	GFSK_ePA	802.11n_HT20

Table 7-11. Simultaneous Transmission Config-1

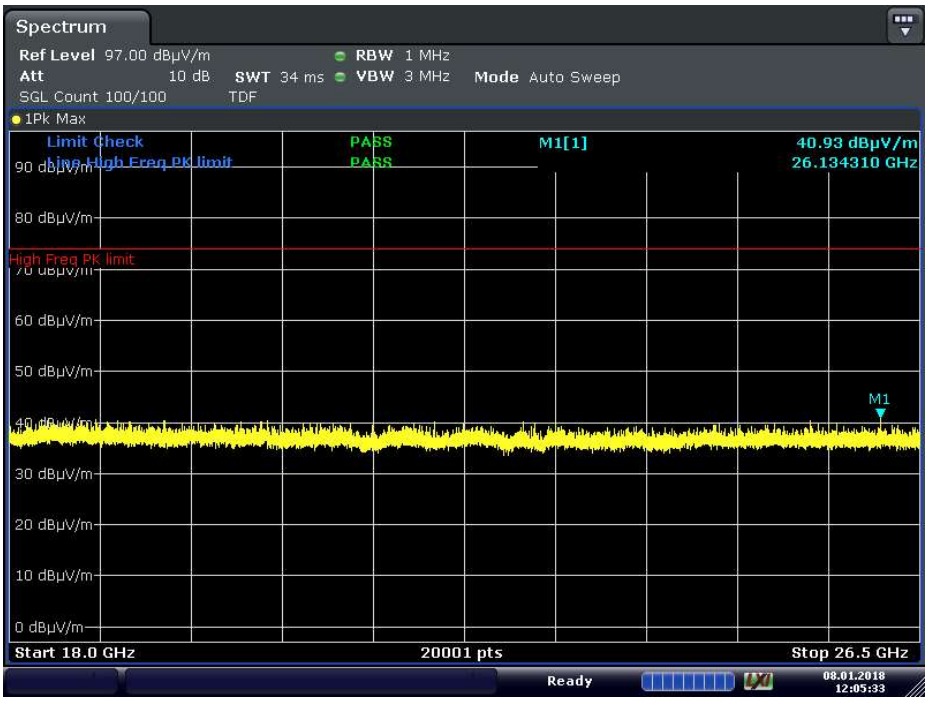


Plot 7-66. Radiated Spurious Plot above 1GHz (2.4GHz – 5GHz, Ant. Pol. H & V)



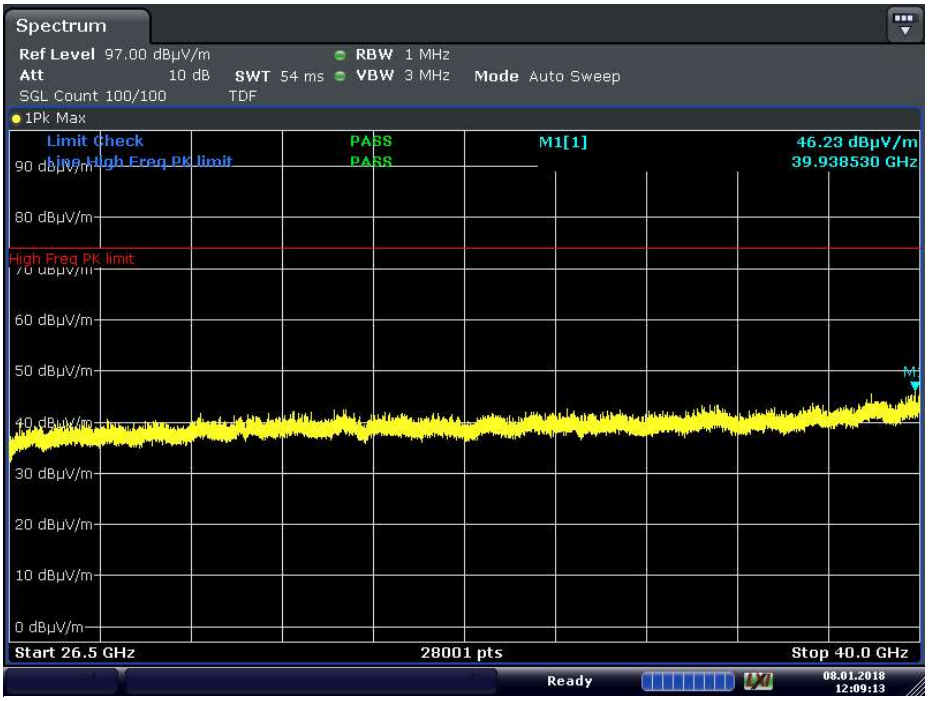
Date: 8.JAN.2018 12:04:12

Plot 7-67. Radiated Spurious Plot 18GHz – 26.5GHz (2.4GHz – 5GHz) H



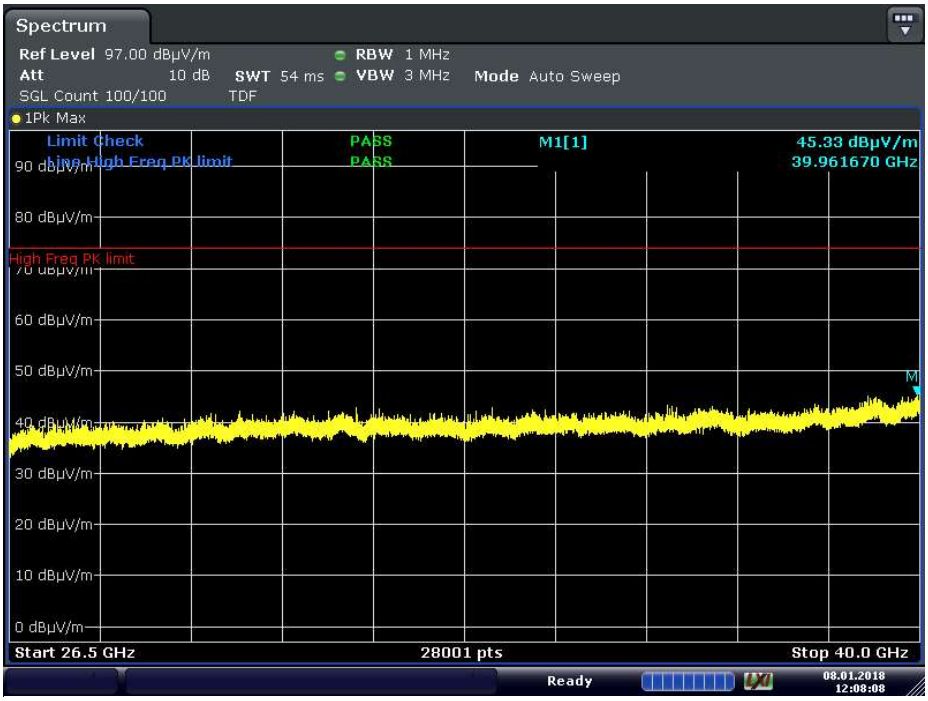
Date: 8.JAN.2018 12:05:33

Plot 7-68. Radiated Spurious Plot 18GHz – 26.5GHz (2.4GHz – 5GHz) V



Date: 8.JAN.2018 12:09:13

Plot 7-69. Radiated Spurious Plot above 26.5GHz (2.4GHz – 5GHz) H



Date: 8.JAN.2018 12:08:08

Plot 7-70. Radiated Spurious Plot above 26.5GHz (2.4GHz – 5GHz) V

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]
4882.00	Avg	H	-	-	-70.54	7.02	43.48	53.98	-10.49
4882.00	Peak	H	-	-	-58.82	7.02	55.20	73.98	-18.77
7323.00	Avg	H	-	-	-80.54	11.28	37.74	53.98	-16.24
7323.00	Peak	H	-	-	-68.54	11.28	49.74	73.98	-24.24
11160.00	Avg	H	-	-	-83.82	18.07	41.25	53.98	-12.73
11160.00	Peak	H	-	-	-72.60	18.07	52.47	73.98	-21.51
16740.00	Avg	H	-	-	-84.12	24.99	47.87	53.98	-6.11
16740.00	Peak	H	-	-	-73.28	24.99	58.71	73.98	-15.27

Table 7-12. Radiated Measurements (ANT1 2.4GHz – ANT2 5GHz)

7.12 Radiated Restricted Band Edge Measurements

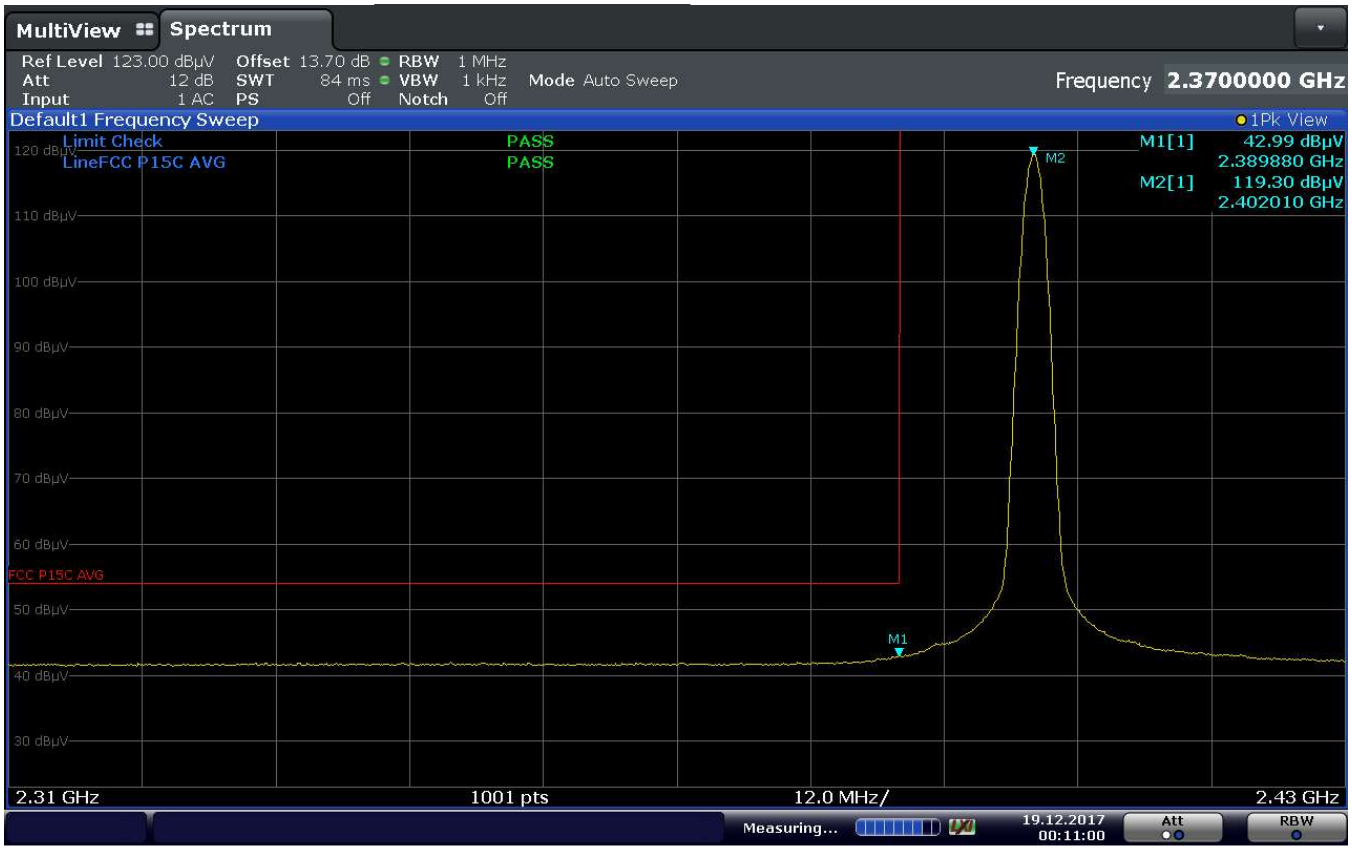
§15.205 §15.209 §15.247 (d); RSS-Gen [8.9]

The radiated restricted band edge measurements are measured with an EMI test receiver connected to the receive antenna while the EUT is transmitting. Two different amplitude offsets were used depending on whether peak or average measurements were measured. The average measurements use a duty cycle correction factor (DCCF).

The amplitude offset shown in the following plots for average measurements was calculated using the formula:

Offset (dB) = (Antenna Factor + Cable Loss + Attenuator) – Preamplifier Gain + DCCF

Worst Case Mode:	Bluetooth
Worst Case Data Rate:	GFSK
Worst Case Power Scheme	ePA
Measurement Distance:	3 Meters
Operating Frequency:	2402MHz
Channel:	0



00:11:01 19.12.2017

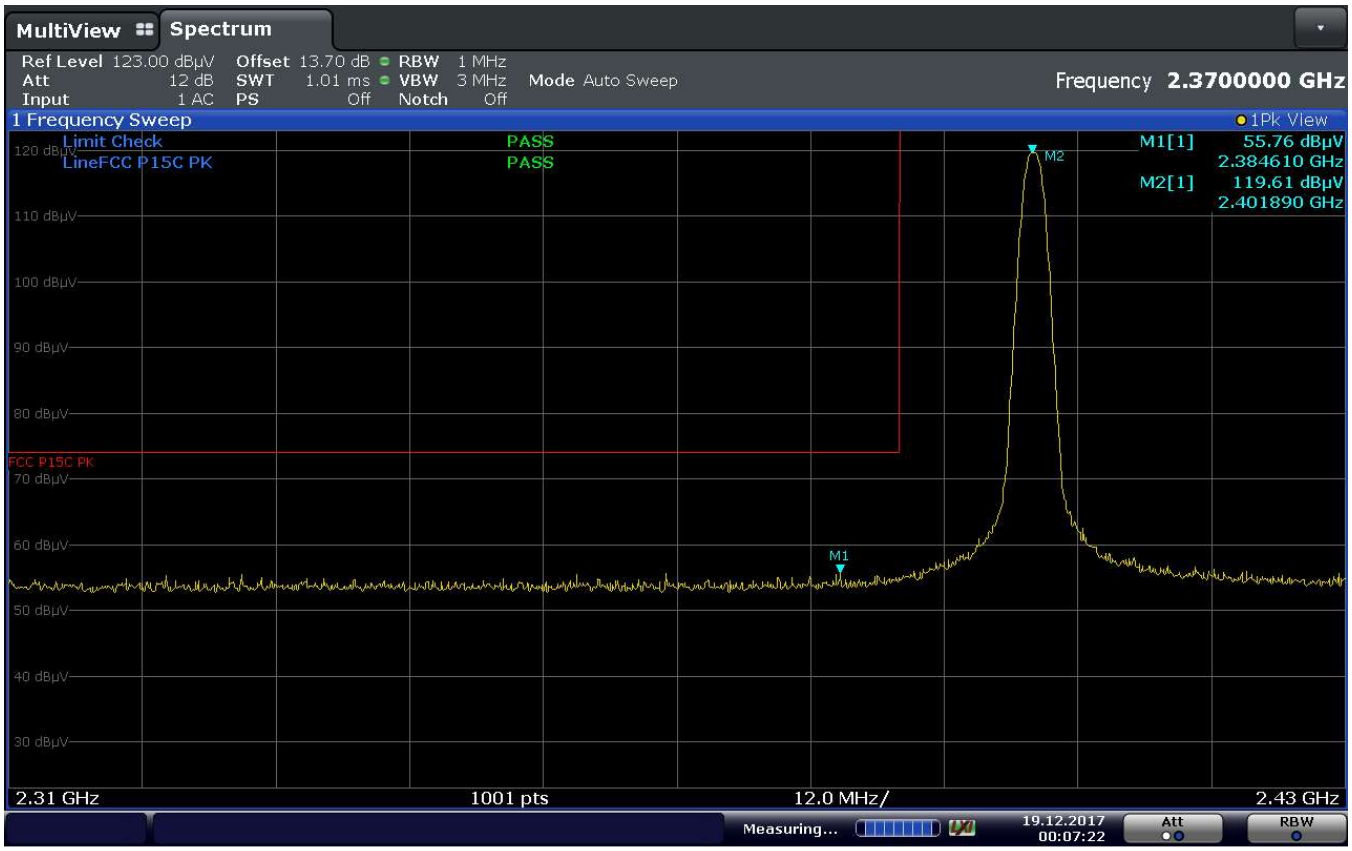
Plot 7-71. Radiated Restricted Lower Band Edge Measurement (Average)

Radiated Restricted Band Edge Measurements

§15.205 §15.209 §15.247 (d); RSS-Gen [8.9]

The amplitude offset shown in the following plots for peak measurements was calculated using the formula:

Offset (dB) = (Antenna Factor + Cable Loss + Attenuator) – Preamplifier Gain



00:07:23 19.12.2017

Plot 7-72. Radiated Restricted Lower Band Edge Measurement (Peak)

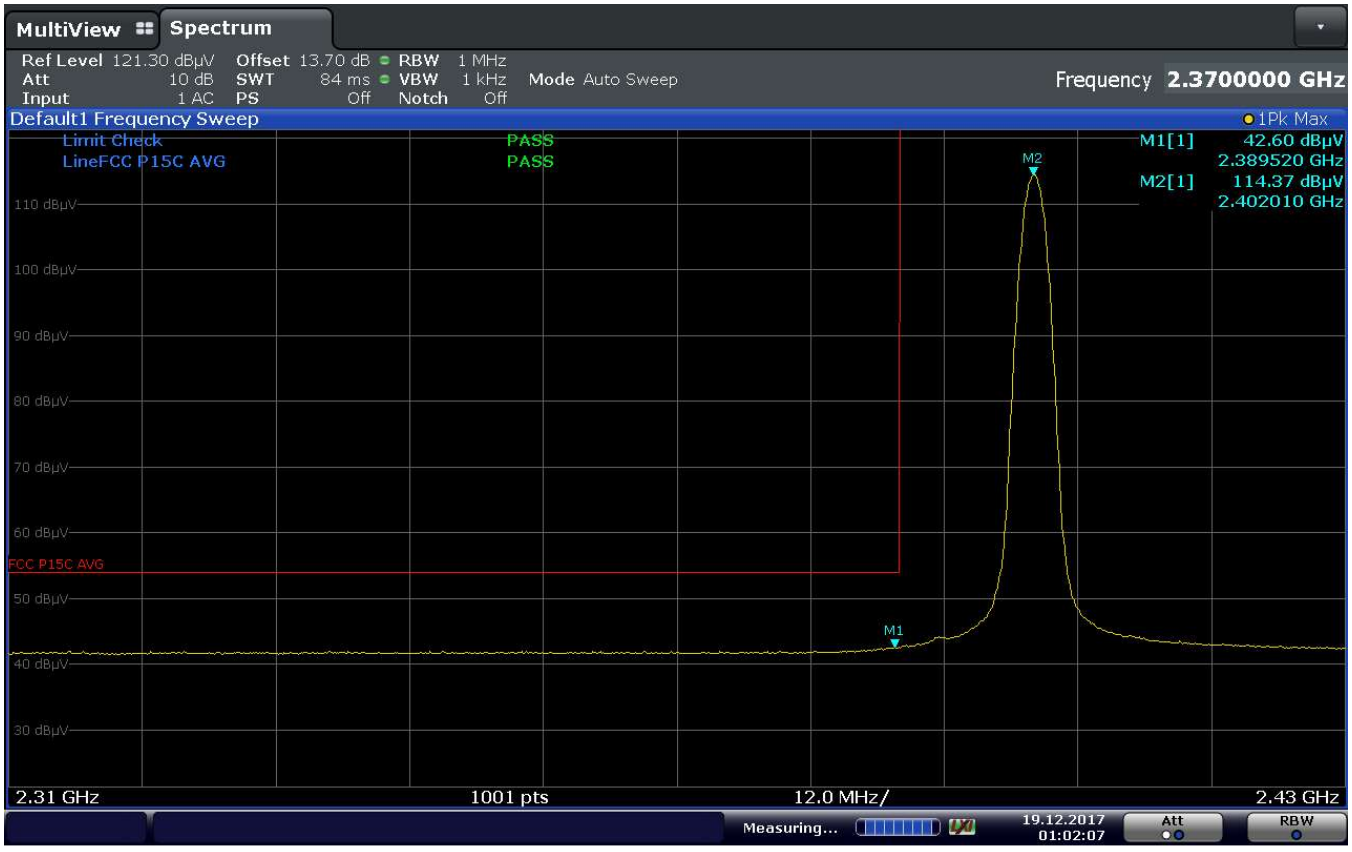
Radiated Restricted Band Edge Measurements

§15.205 §15.209 §15.247 (d); RSS-Gen [8.9]

The amplitude offset shown in the following plots for peak measurements was calculated using the formula:

Offset (dB) = (Antenna Factor + Cable Loss + Attenuator) – Preamplifier Gain

Worst Case Mode:	Bluetooth
Worst Case Modulation:	8DPSK
Worst Case Power Scheme:	ePA
Measurement Distance:	3 Meters
Operating Frequency:	2402MHz
Channel:	0



01:02:07 19.12.2017

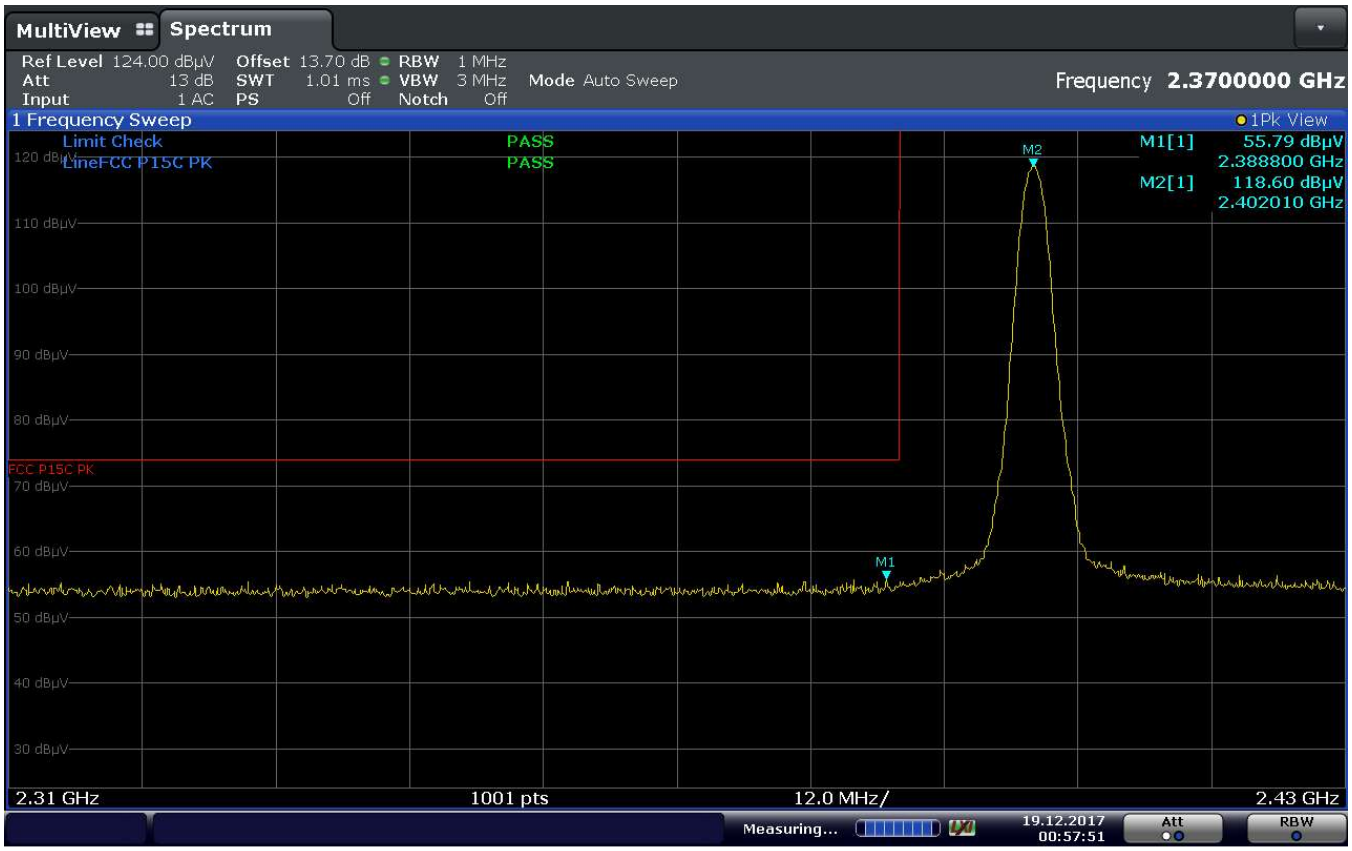
Plot 7-73. Radiated Restricted Lower Band Edge Measurement (Average)

Radiated Restricted Band Edge Measurements

§15.205 §15.209 §15.247 (d); RSS-Gen [8.9]

The amplitude offset shown in the following plots for peak measurements was calculated using the formula:

Offset (dB) = (Antenna Factor + Cable Loss + Attenuator) – Preamplifier Gain



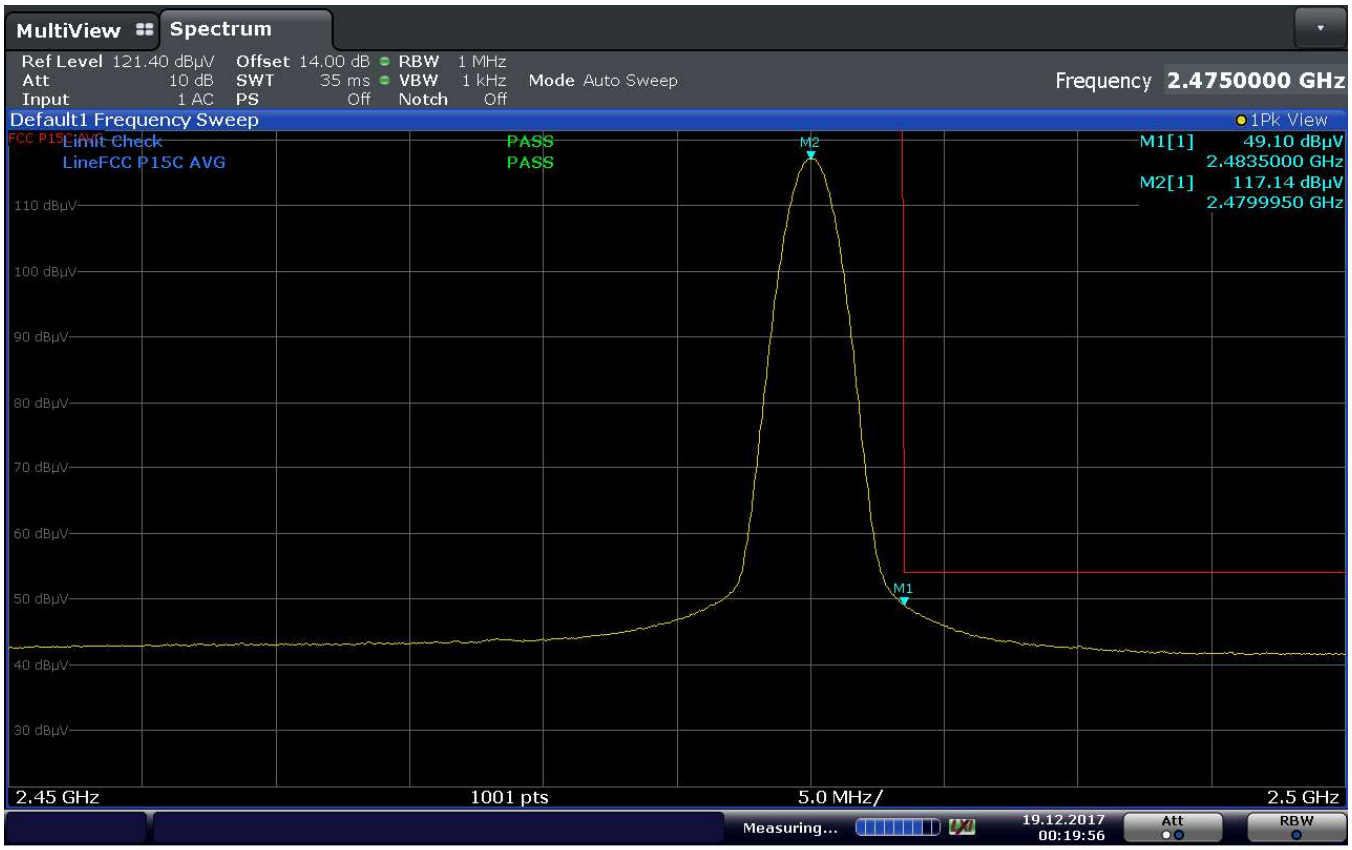
00:57:51 19.12.2017

Plot 7-74. Radiated Restricted Lower Band Edge Measurement (Peak)

Radiated Restricted Band Edge Measurements

§15.205 §15.209 §15.247 (d); RSS-Gen [8.9]

Worst Case Mode:	Bluetooth
Worst Case Modulation:	GFSK
Worst Case Power Scheme:	ePA
Measurement Distance:	3 Meters
Operating Frequency:	2480MHz
Channel:	78



00:19:56 19.12.2017

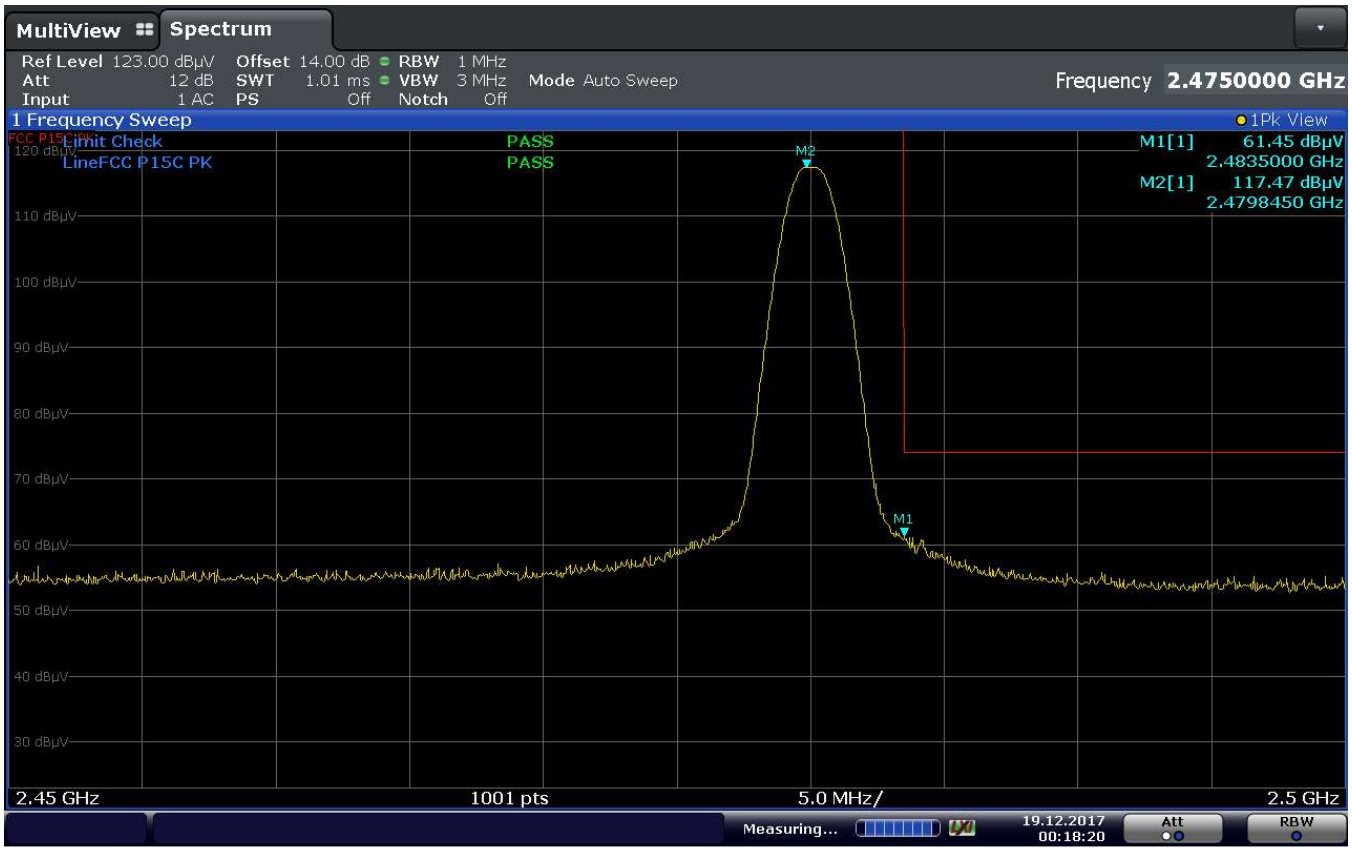
Plot 7-75. Radiated Restricted Upper Band Edge Measurement (Average)

Radiated Restricted Band Edge Measurements

§15.205 §15.209 §15.247 (d); RSS-Gen [8.9]

The amplitude offset shown in the following plots for peak measurements was calculated using the formula:

Offset (dB) = (Antenna Factor + Cable Loss + Attenuator) – Preamplifier Gain



00:18:21 19.12.2017

Plot 7-76. Radiated Restricted Upper Band Edge Measurement (Peak)

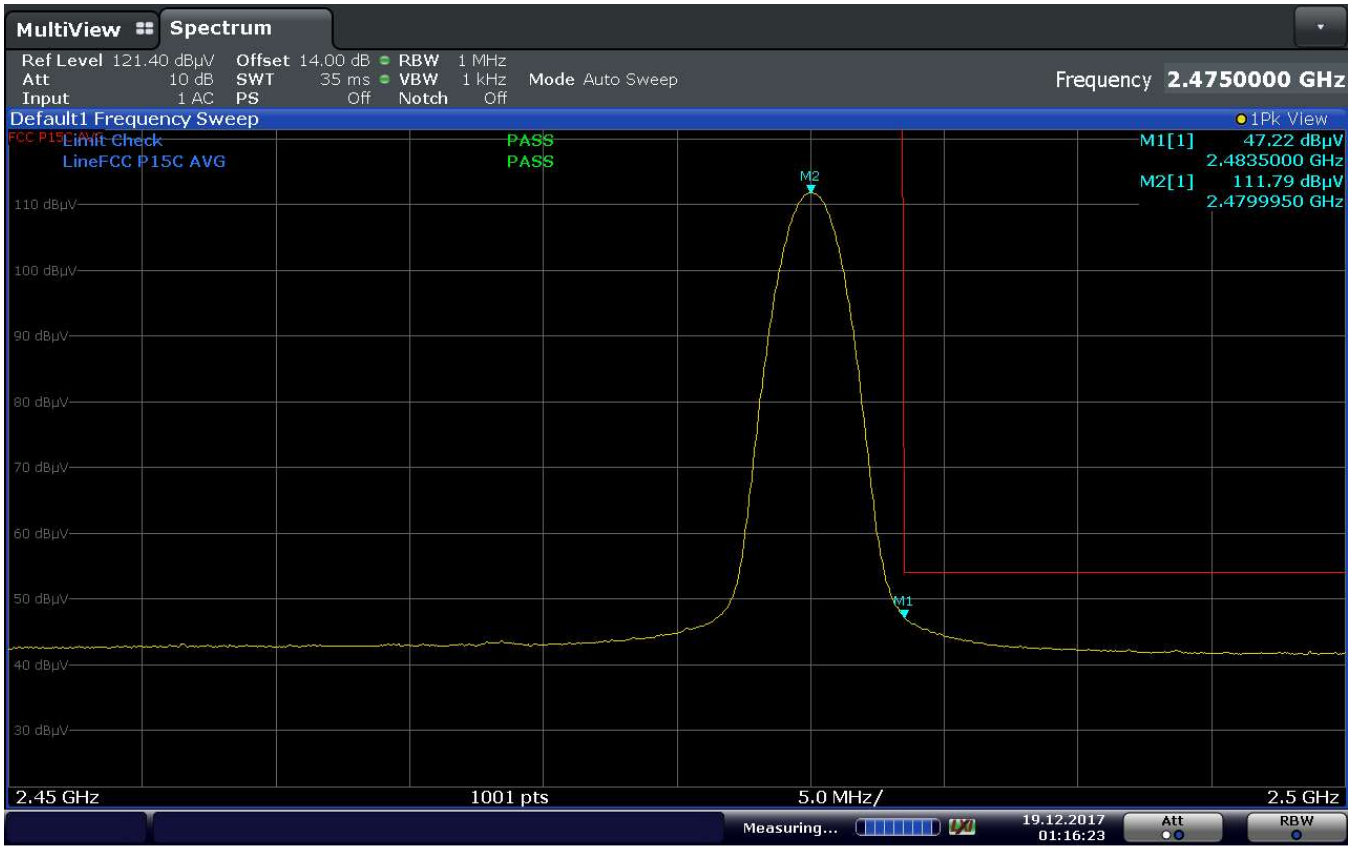
Radiated Restricted Band Edge Measurements

§15.205 §15.209 §15.247 (d); RSS-Gen [8.9]

The amplitude offset shown in the following plots for peak measurements was calculated using the formula:

Offset (dB) = (Antenna Factor + Cable Loss + Attenuator) – Preamplifier Gain

Worst Case Mode:	Bluetooth
Worst Case Modulation:	8DPSK
Worst Case Power Scheme:	ePA
Measurement Distance:	3 Meters
Operating Frequency:	2480MHz
Channel:	78



01:16:24 19.12.2017

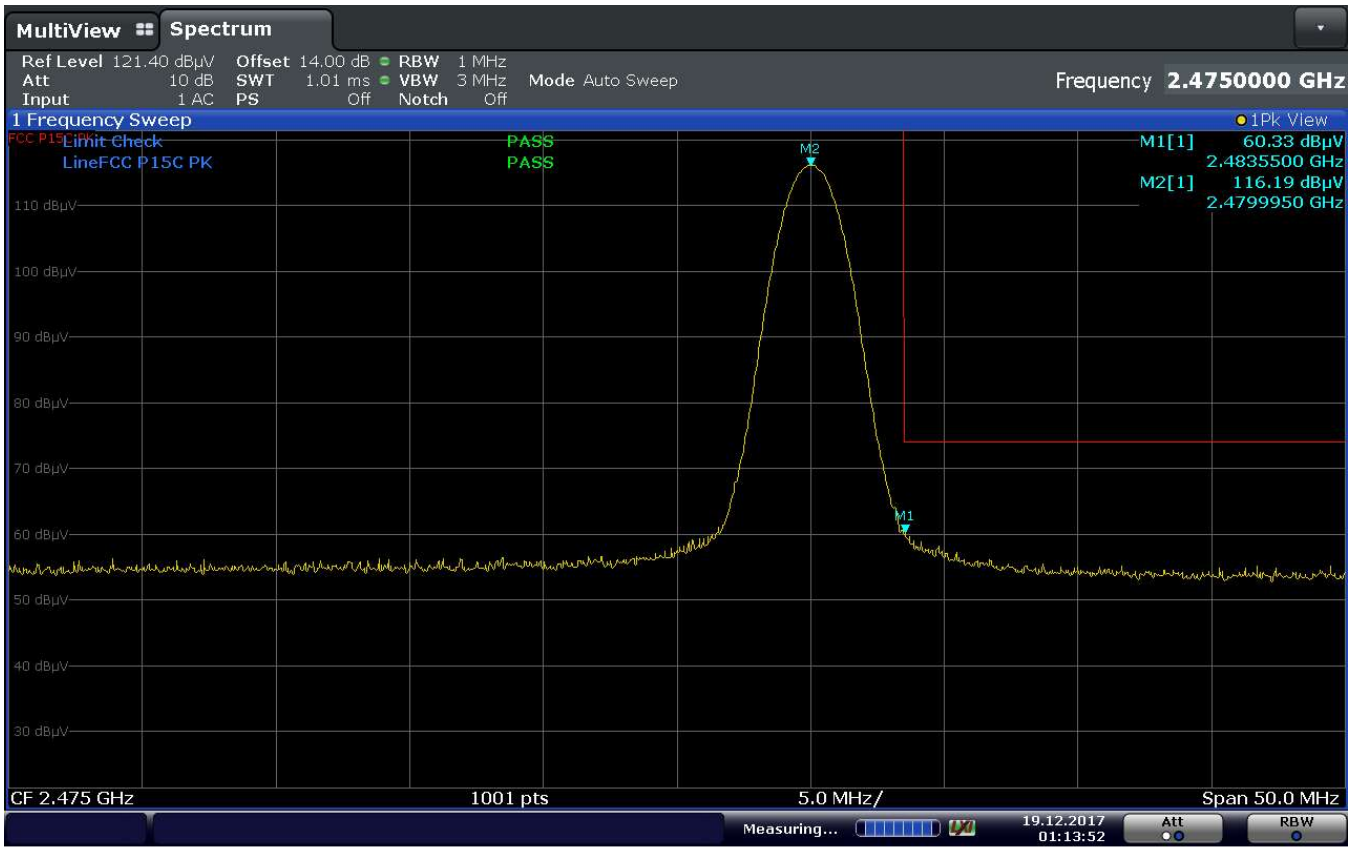
Plot 7-77. Radiated Restricted Upper Band Edge Measurement (Average)

Radiated Restricted Band Edge Measurements

§15.205 §15.209 §15.247 (d); RSS-Gen [8.9]

The amplitude offset shown in the following plots for peak measurements was calculated using the formula:

Offset (dB) = (Antenna Factor + Cable Loss + Attenuator) – Preamplifier Gain



01:13:53 19.12.2017

Plot 7-78. Radiated Restricted Upper Band Edge Measurement (Peak)

7.13 Radiated Spurious Emissions Measurements – 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 6 of RSS-Gen (8.10) must not exceed the limits shown in Table 7-13 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

Table 7-13. Radiated Limits

Test Procedures Used

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

Test Setup

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

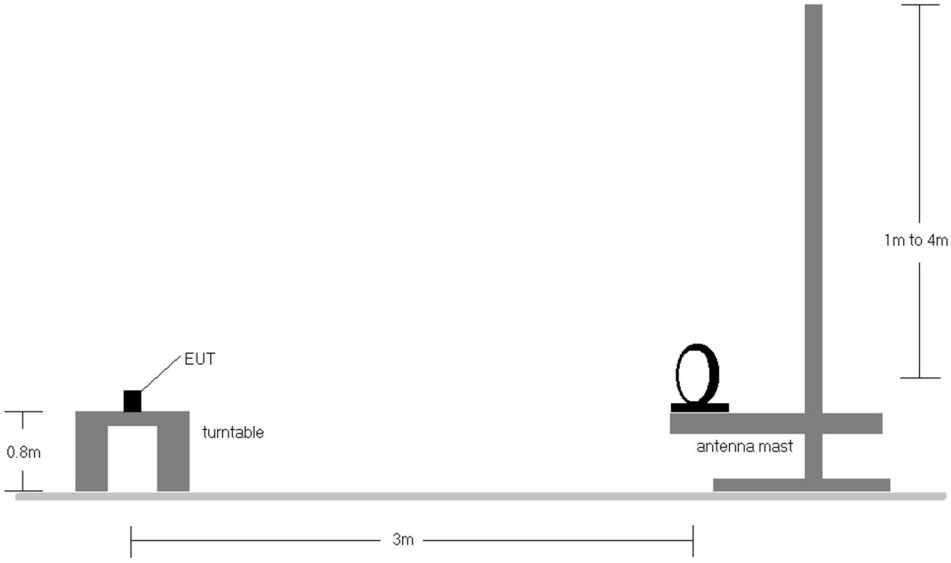


Figure 7-10. Radiated Test Setup < 30Mhz

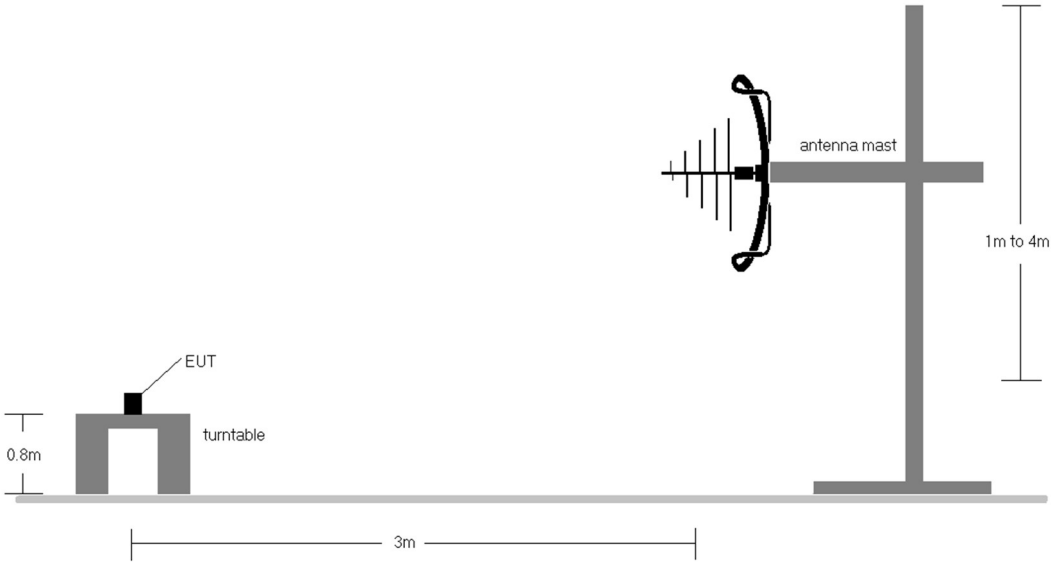


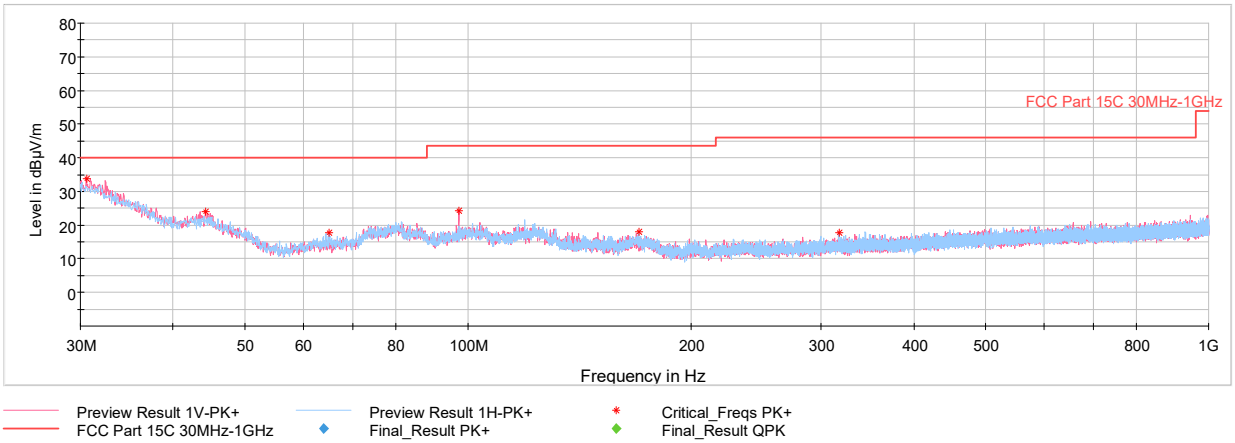
Figure 7-11. Radiated Test Setup < 1GHz

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 7-13.
2. The broadband receive antenna is manipulated through vertical and horizontal polarizations during the tests. The EUT is manipulated through three orthogonal planes.
3. This unit was tested with its standard battery.
4. The spectrum is investigated using a peak detector and final measurements are recorded using CISPR quasi peak detector. The worst-case emissions are reported however emissions whose levels were not within 20dB of the respective limits were not reported.
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 wide spectrum spurious emissions plots shown on the following pages are used only for the purpose of emission identification. There were no emissions detected in the 30MHz – 1GHz frequency range, as shown in the subsequent plots.
10. The unit was tested with all possible mode and power schemes and only the highest emission is reported.

Radiated Spurious Emissions Measurements (Below 1GHz)

§15.209; RSS-Gen [8.9]



Plot 7-79. Radiated Spurious Plot below 1GHz (GFSK ePA, Pol. H & V)

7.14 Line Conducted Measurement Data

§15.207; 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 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 (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30	60	50

Table 7-14. Conducted Limits

*Decreases with the logarithm of the frequency.

Test Procedures Used

ANSI C63.10-2013, Section 6.2

Test Settings

Quasi-Peak Field Strength 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 Field Strength 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

Test Setup

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

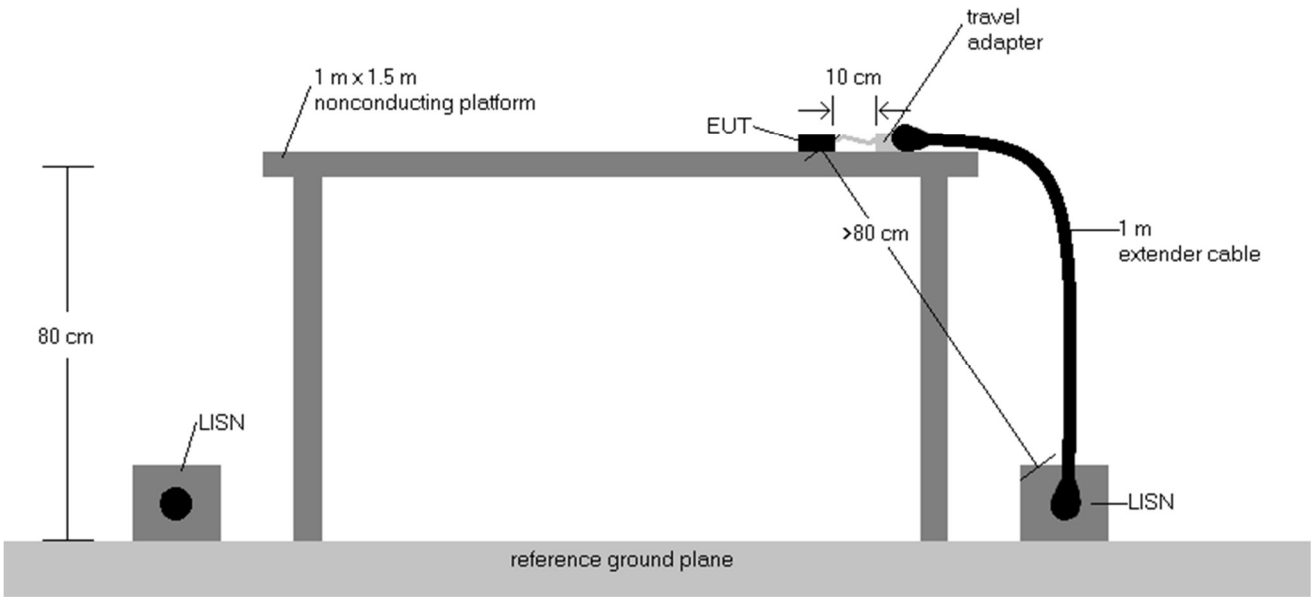
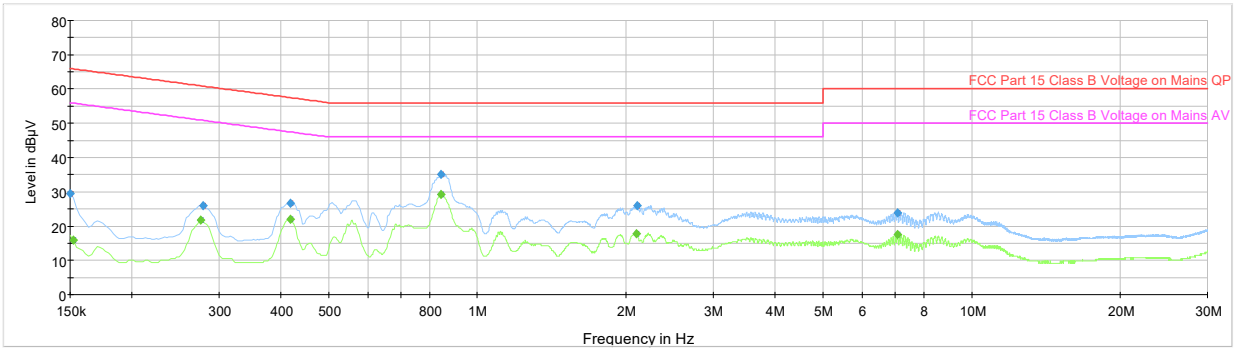


Figure 7-12. Test Instrument & Measurement Setup

Test Notes

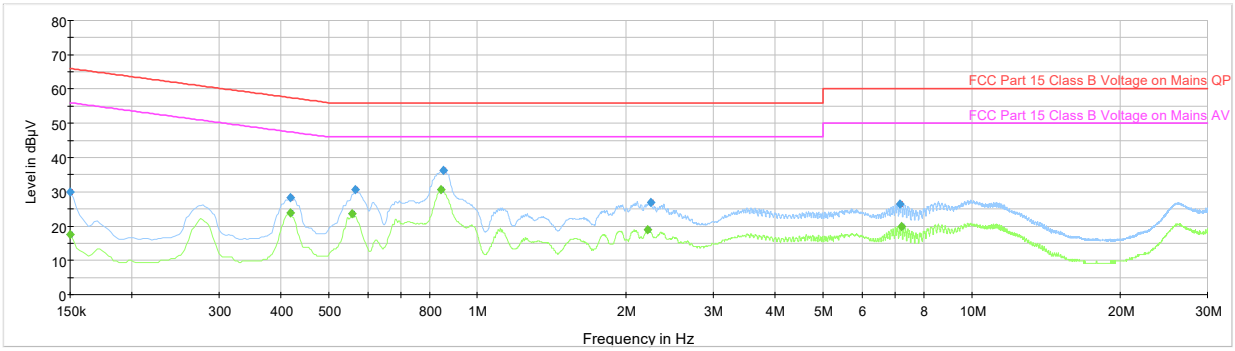
1. All modes of operation were investigated and the worst-case emissions are reported using mid channel. The emissions found were not affected by the choice of channel used during testing.
2. The limit for an intentional radiator from 150kHz to 30MHz are specified in 15.207 and RSS-Gen (8.8).
3. Corr. (dB) = Cable loss (dB) + LISN insertion factor (dB)
4. QP/AV Level (dBμV) = QP/AV Analyzer/Receiver Level (dBμV) + Corr. (dB)
5. Margin (dB) = QP/AV Limit (dBμV) - QP/AV Level (dBμV)
6. Traces shown in plot are made using a peak detector.
7. Deviations to the Specifications: None.



Plot 7-80. Line-Conducted Test Plot (L1)

Frequency MHz	Process State	QuasiPeak dBµV	Average dBµV	Limit dBµV	Margin dB	Meas. Time ms	Bandwidth kHz	Line	PE
0.150000	FINAL	29.55	---	66.00	36.45	10000.0	9.000	L1	GND
0.152250	FINAL	---	15.93	55.88	39.95	10000.0	9.000	L1	GND
0.276000	FINAL	---	21.72	50.94	29.22	10000.0	9.000	L1	GND
0.278250	FINAL	25.89	---	60.87	34.98	10000.0	9.000	L1	GND
0.417750	FINAL	---	22.01	47.49	25.48	10000.0	9.000	L1	GND
0.417750	FINAL	26.73	---	57.49	30.77	10000.0	9.000	L1	GND
0.845250	FINAL	---	29.33	46.00	16.67	10000.0	9.000	L1	GND
0.845250	FINAL	35.03	---	56.00	20.97	10000.0	9.000	L1	GND
2.096250	FINAL	---	17.77	46.00	28.23	10000.0	9.000	L1	GND
2.105250	FINAL	26.01	---	56.00	29.99	10000.0	9.000	L1	GND
7.066500	FINAL	23.84	---	60.00	36.16	10000.0	9.000	L1	GND
7.071000	FINAL	---	17.44	50.00	32.56	10000.0	9.000	L1	GND

Plot 7-81. Line-Conducted Test Table (L1)



Plot 7-82. Line-Conducted Test Plot (N)

Frequency MHz	Process State	QuasiPeak dBµV	Average dBµV	Limit dBµV	Margin dB	Meas. Time ms	Bandwidth kHz	Line	PE
0.150000	FINAL	29.83	---	66.00	36.17	10000.0	9.000	N	GND
0.150000	FINAL	---	17.49	56.00	38.51	10000.0	9.000	N	GND
0.417750	FINAL	28.19	---	57.49	29.30	10000.0	9.000	N	GND
0.417750	FINAL	---	23.78	47.49	23.71	10000.0	9.000	N	GND
0.557250	FINAL	---	23.53	46.00	22.47	10000.0	9.000	N	GND
0.566250	FINAL	30.60	---	56.00	25.40	10000.0	9.000	N	GND
0.845250	FINAL	---	30.63	46.00	15.37	10000.0	9.000	N	GND
0.854250	FINAL	36.25	---	56.00	19.75	10000.0	9.000	N	GND
2.213250	FINAL	---	18.94	46.00	27.06	10000.0	9.000	N	GND
2.244750	FINAL	26.92	---	56.00	29.08	10000.0	9.000	N	GND
7.147500	FINAL	26.38	---	60.00	33.62	10000.0	9.000	N	GND
7.212750	FINAL	---	19.95	50.00	30.05	10000.0	9.000	N	GND

Plot 7-83. Line-Conducted Test Table (N)

8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Apple Tablet Device FCC ID: BCGA1954** is in compliance with Part 15 Subpart C (15.247) of the FCC Rules and RSS-247 of the Innovation, Science and Economic Development Canada Rules.