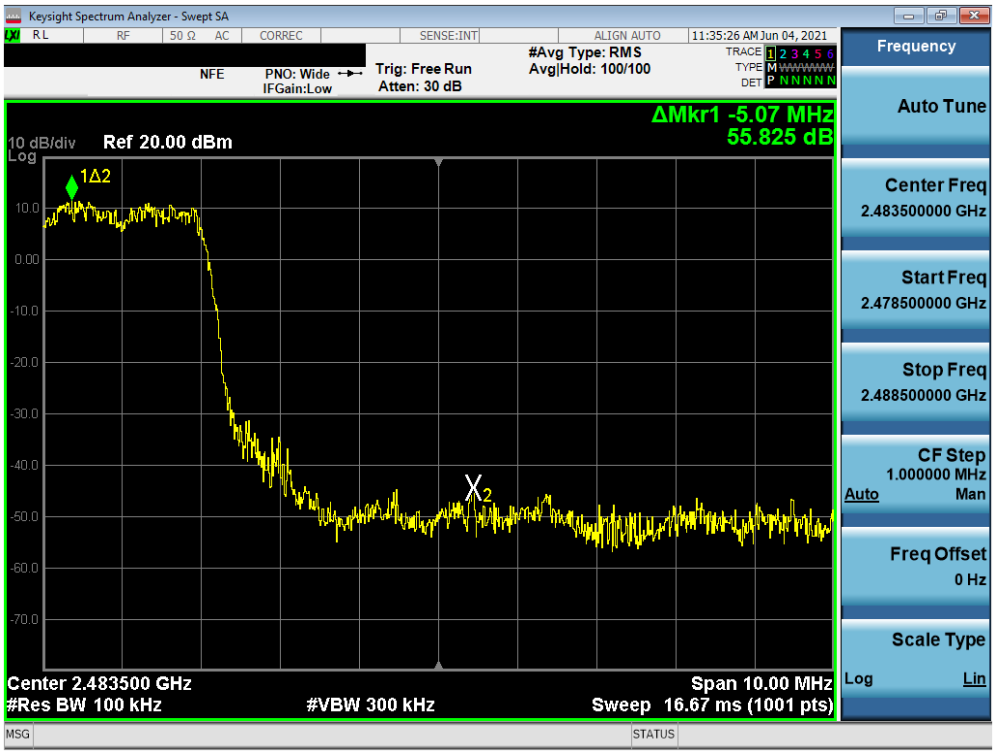
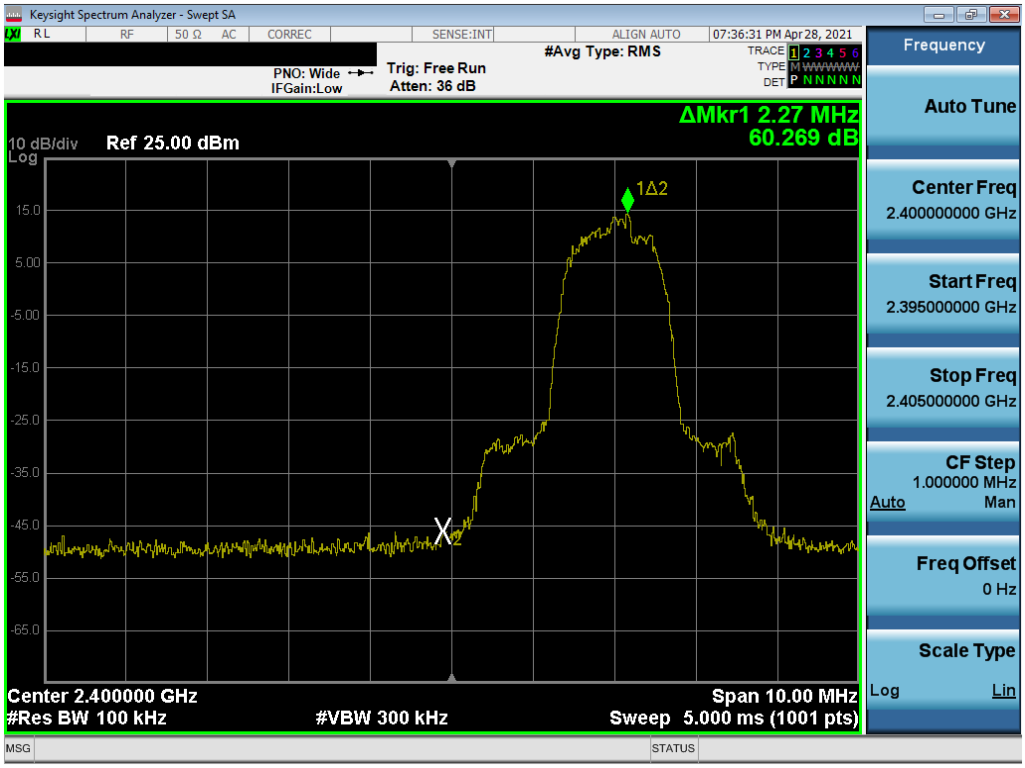
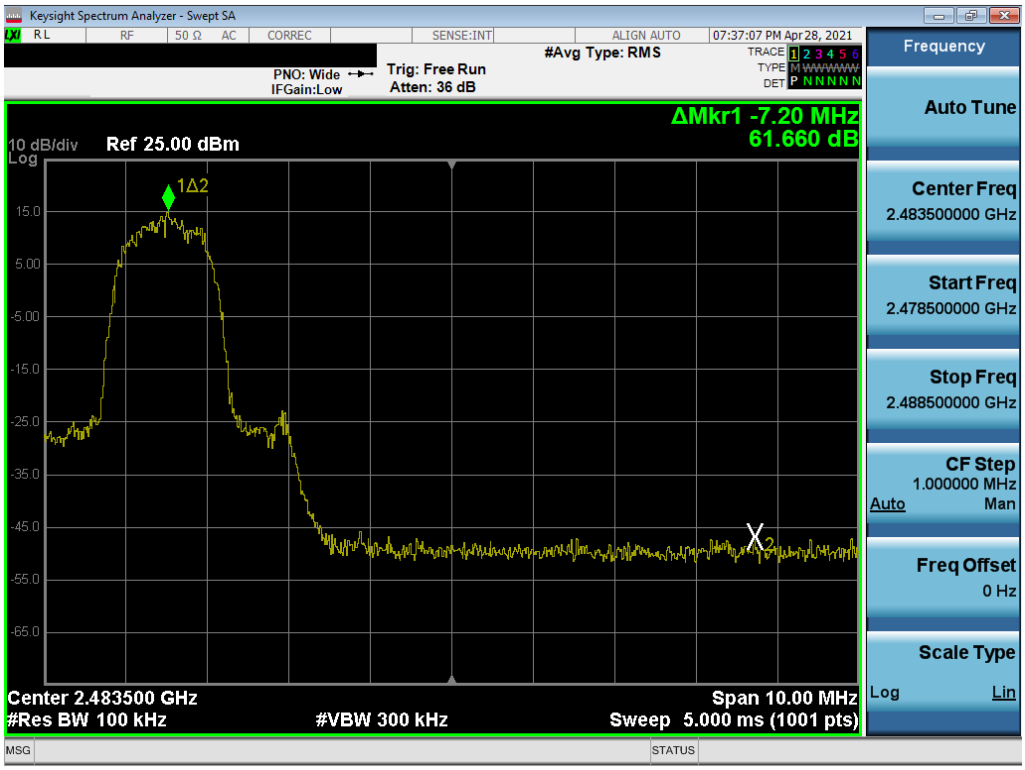


Plot 7-232. Band Edge Plot (Bluetooth with Hopping Enabled, iPA, 3 Mbps – Ch.78) – ANT0 (Q)

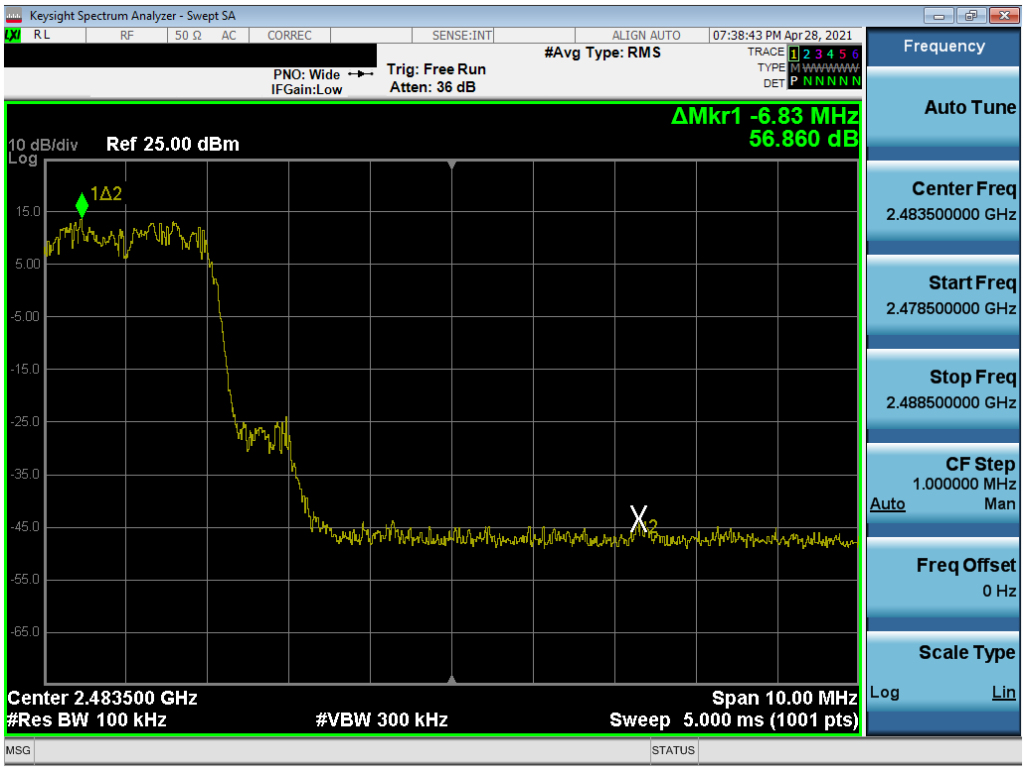


Plot 7-233. Band Edge Plot (Bluetooth with Hopping Disabled, ePA, 3 Mbps – Ch. 0) – ANT1 (N)

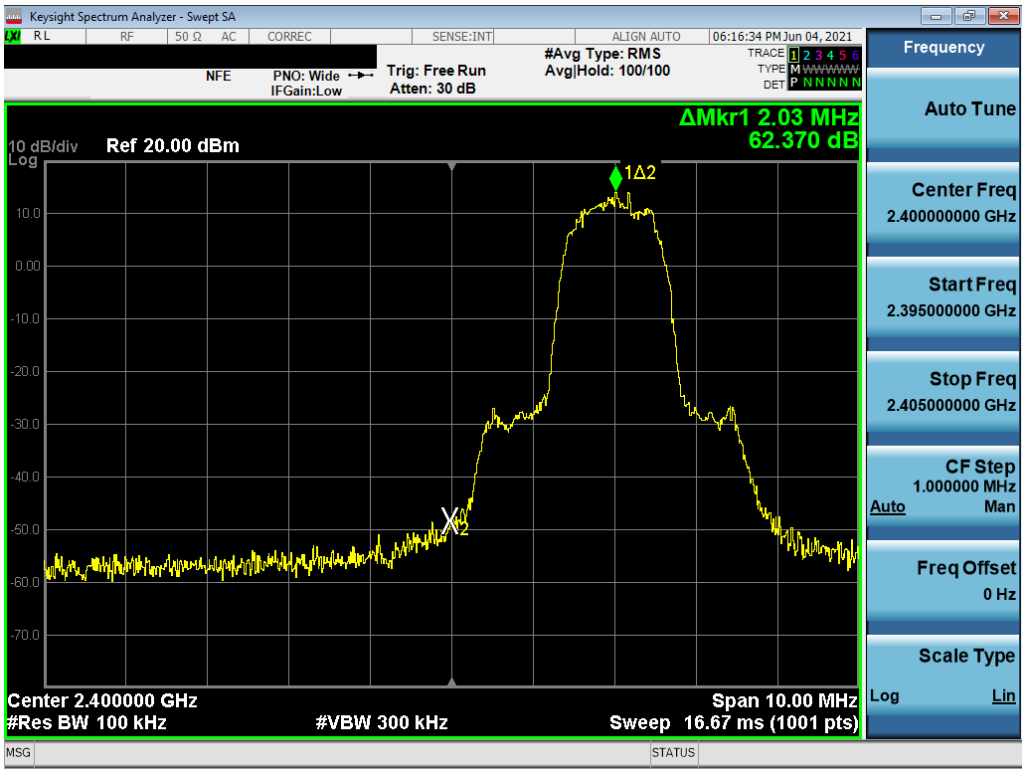


Plot 7-234. Band Edge Plot (Bluetooth with Hopping Disabled, ePA, 3 Mbps – Ch. 78) – ANT1 (N)

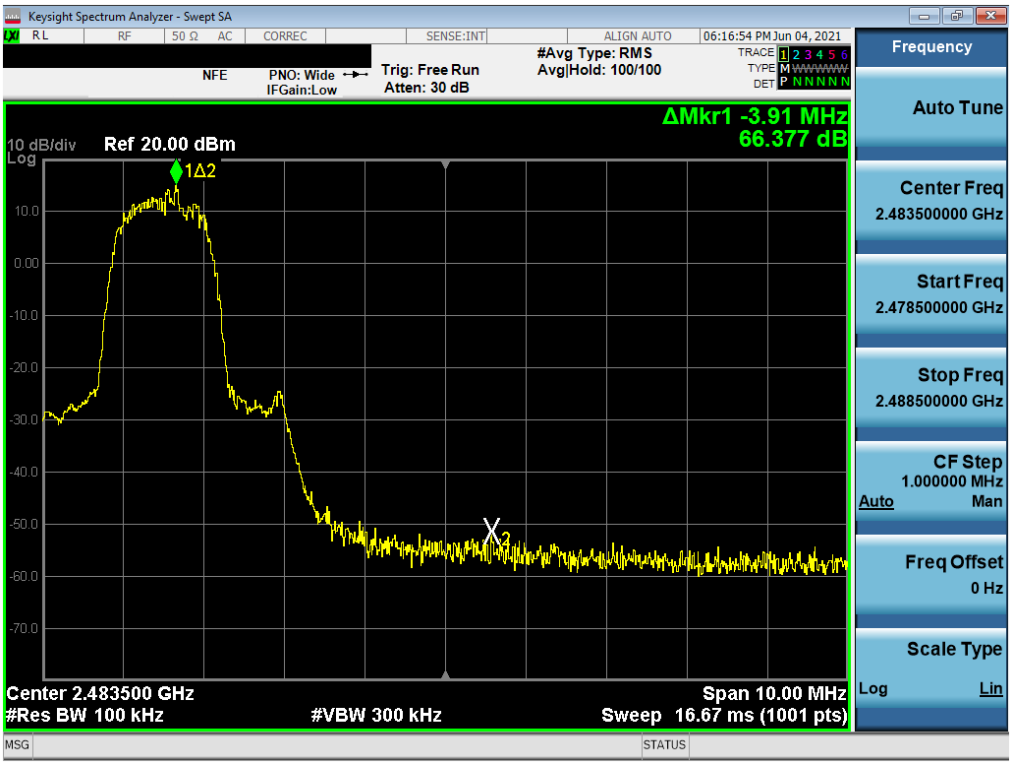
Plot 7-235. Band Edge Plot (Bluetooth with Hopping Enabled, ePA, 3 Mbps – Ch.0) – ANT1 (N)



Plot 7-236. Band Edge Plot (Bluetooth with Hopping Enabled, ePA, 3 Mbps – Ch.78) – ANT1 (N)

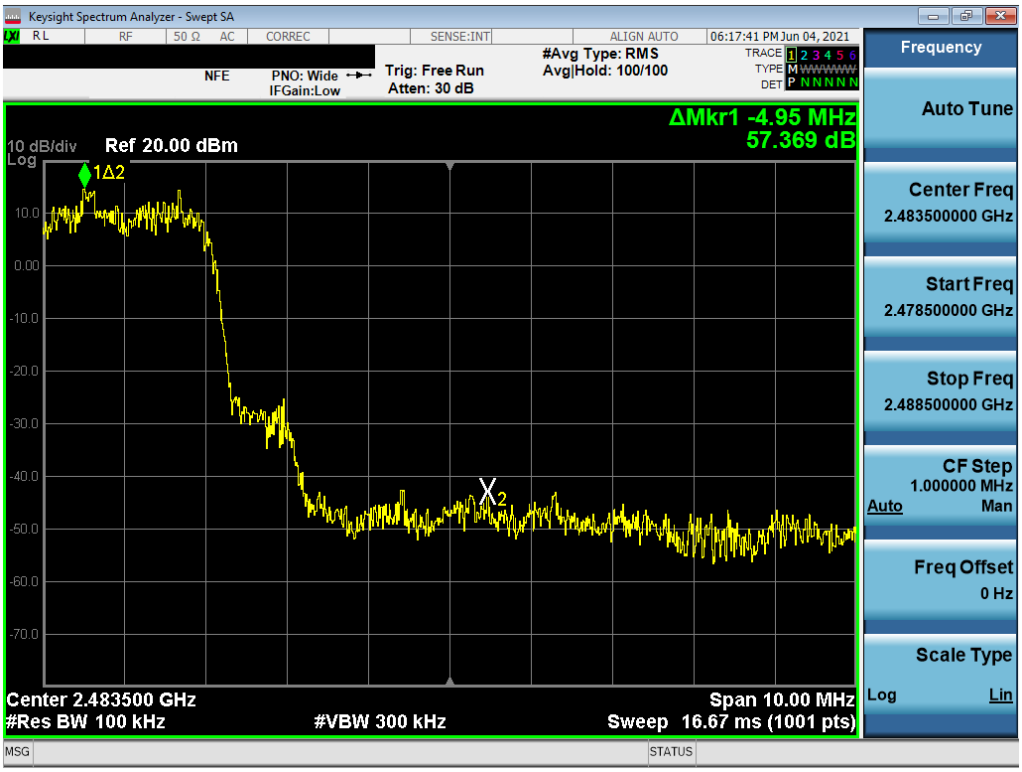


Plot 7-237. Band Edge Plot (Bluetooth with Hopping Disabled, iPA, 3 Mbps – Ch. 0) – ANT1 (N)

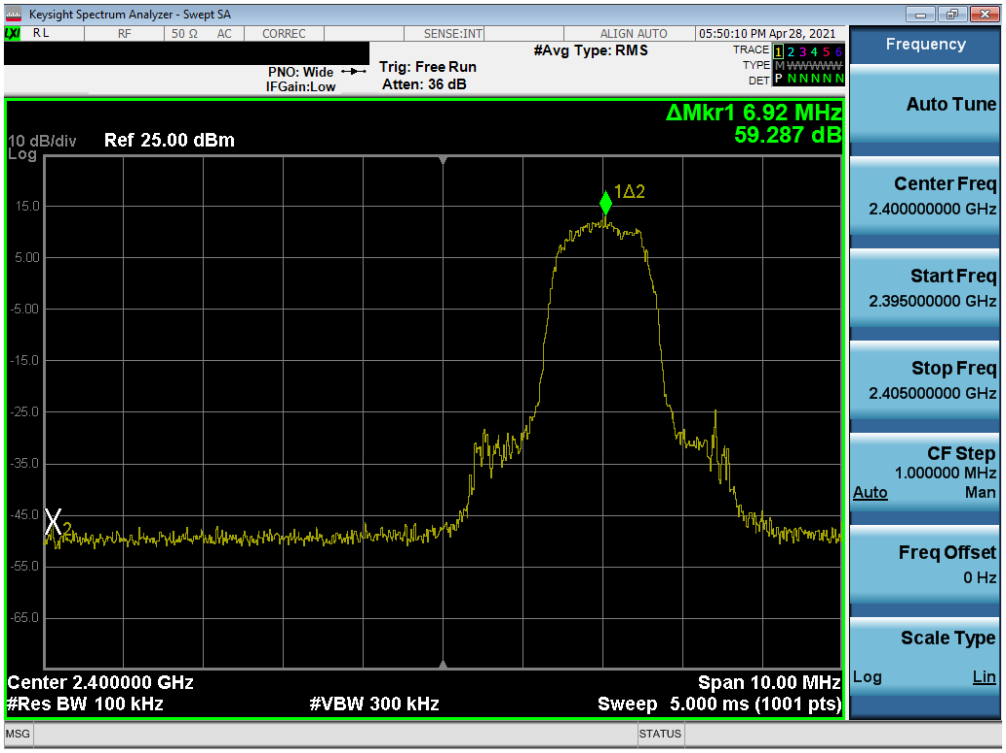


Plot 7-238. Band Edge Plot (Bluetooth with Hopping Disabled, iPA, 3 Mbps – Ch. 78) – ANT1 (N)

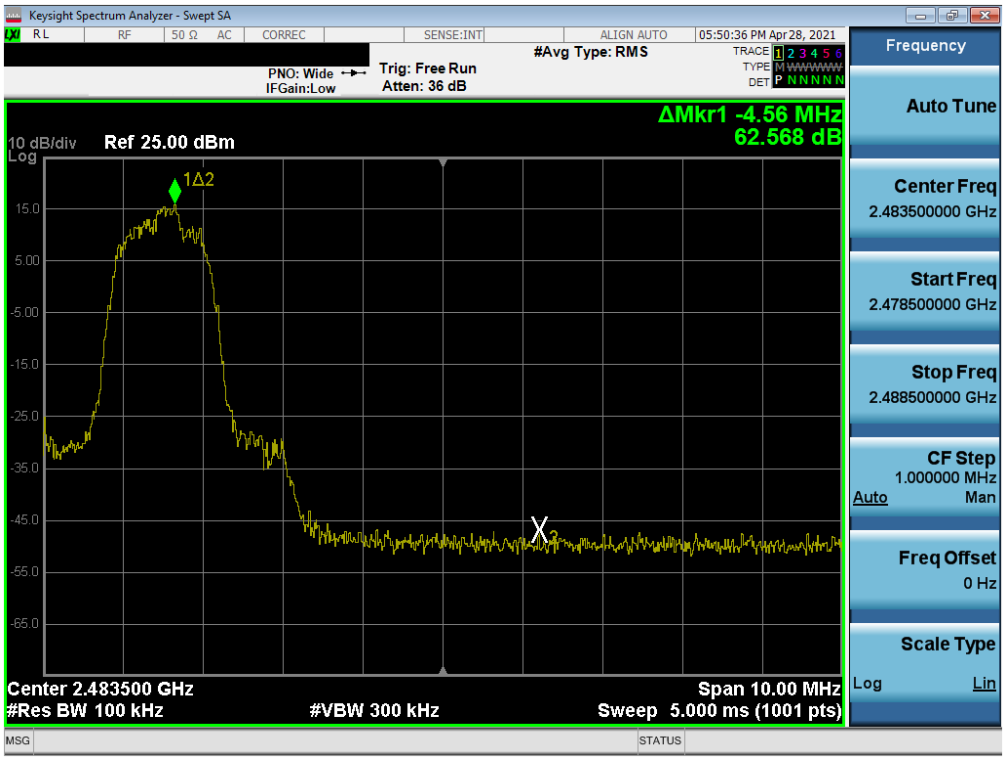
Plot 7-239. Band Edge Plot (Bluetooth with Hopping Enabled, iPA, 3 Mbps – Ch.0) – ANT1 (N)



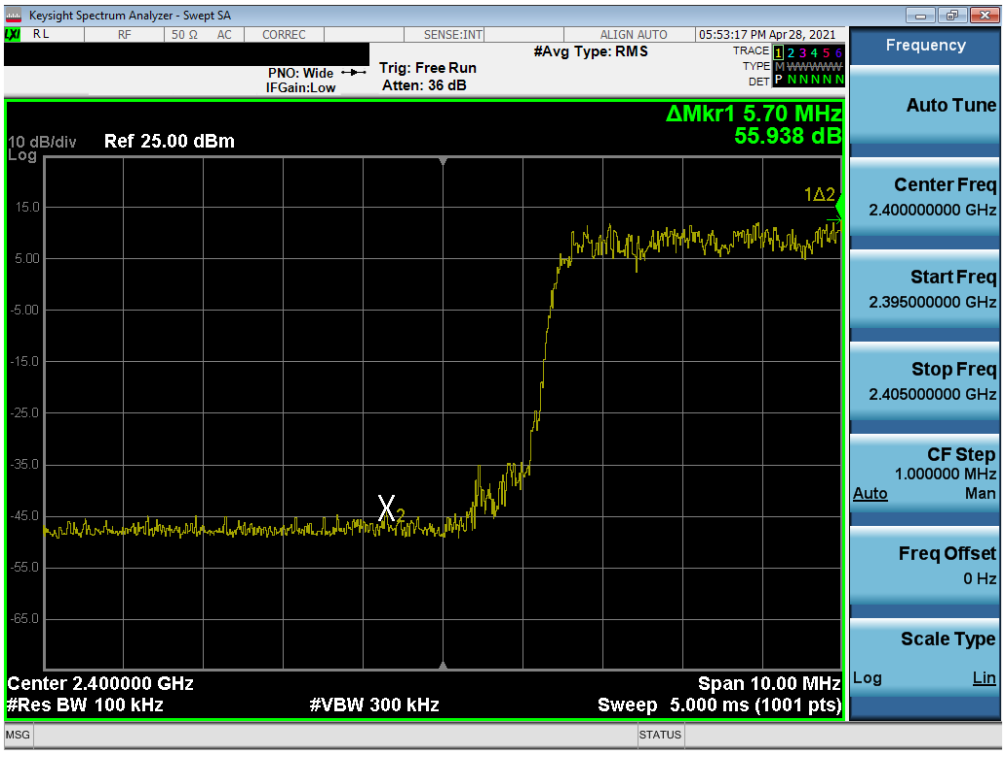
Plot 7-240. Band Edge Plot (Bluetooth with Hopping Enabled, iPA, 3 Mbps – Ch.78) – ANT1 (N)



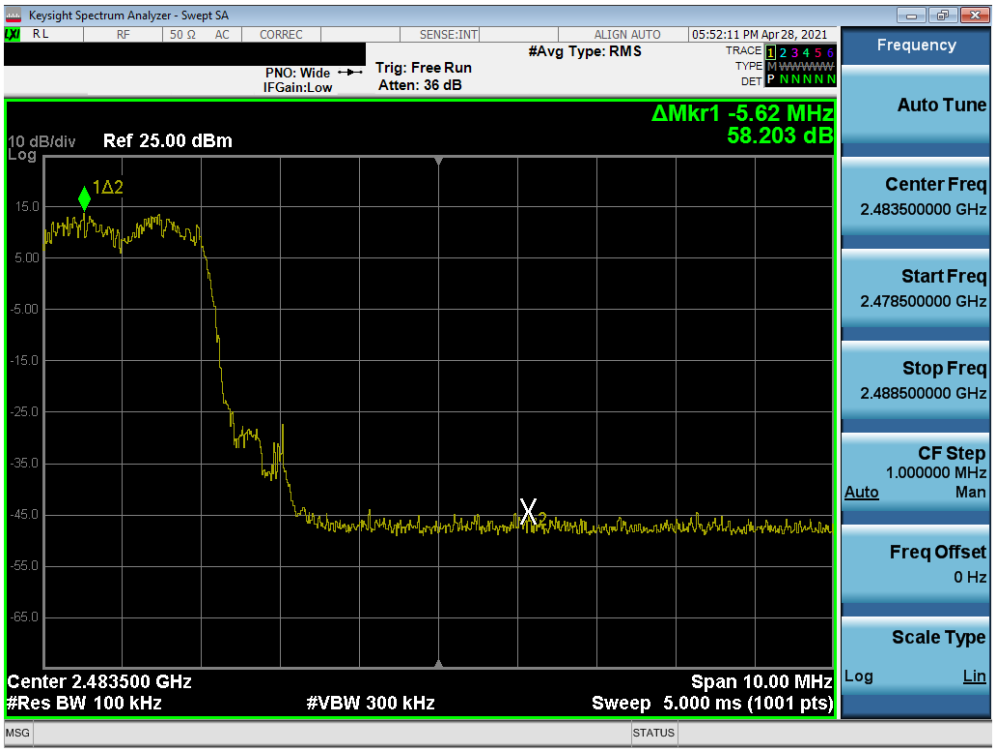
Plot 7-241. Band Edge Plot (Bluetooth with Hopping Disabled, ePA, 3 Mbps – Ch. 0) – ANT1 (Q)



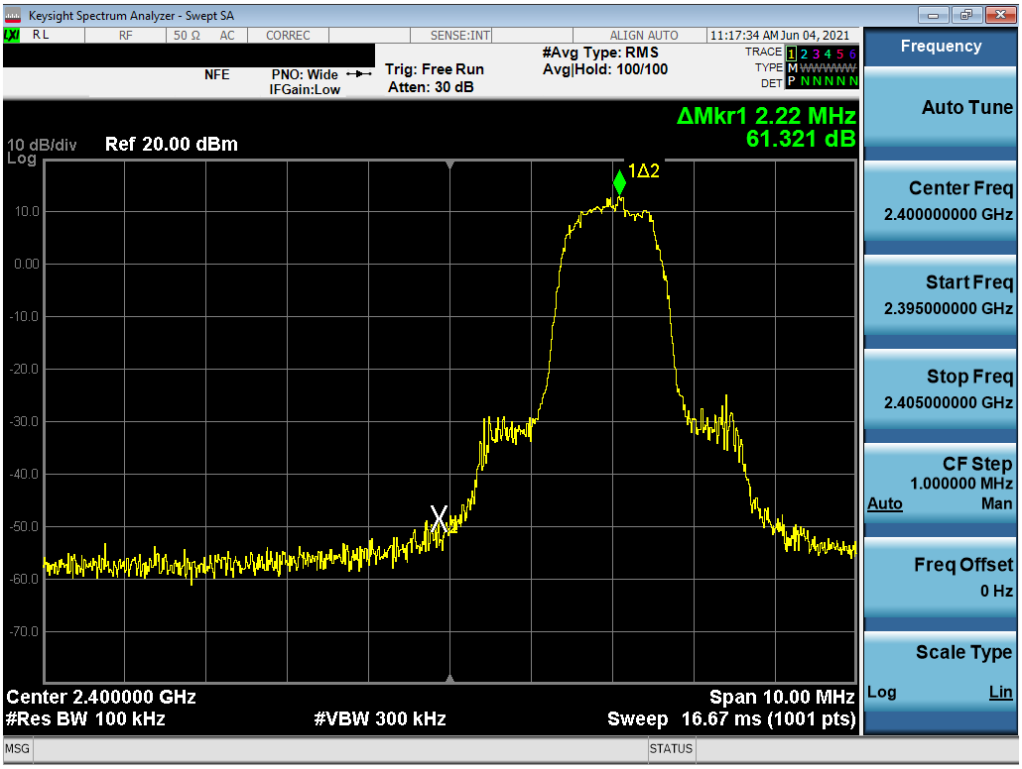
Plot 7-242. Band Edge Plot (Bluetooth with Hopping Disabled, ePA, 3 Mbps – Ch. 78) – ANT1 (Q)



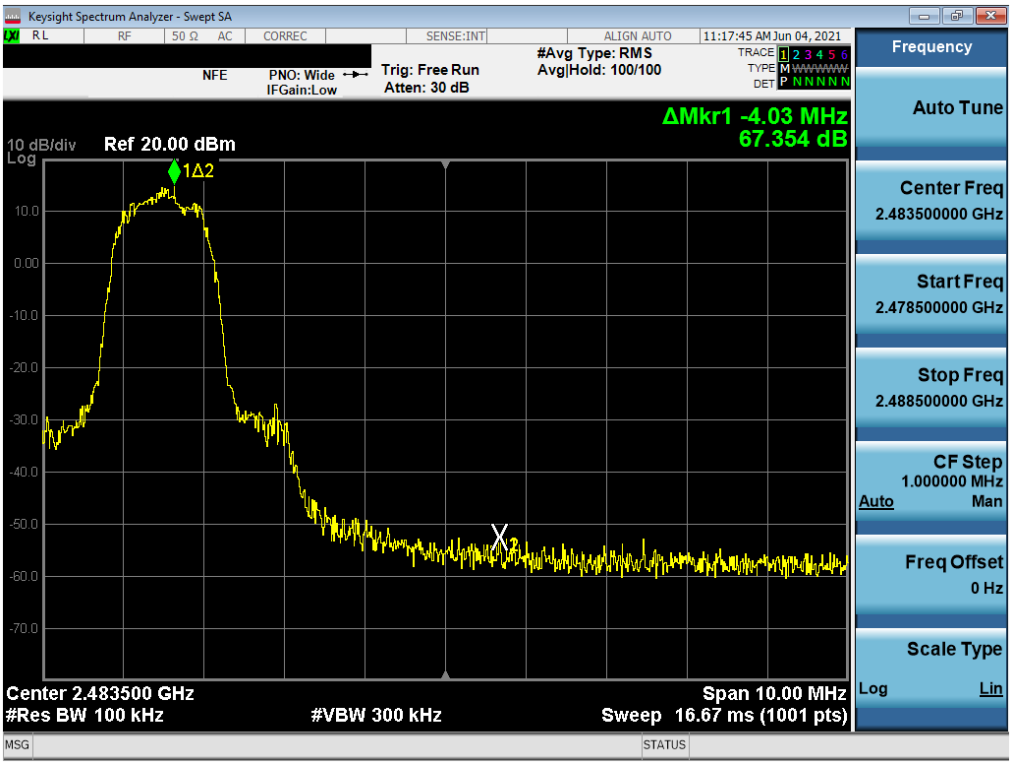
Plot 7-243. Band Edge Plot (Bluetooth with Hopping Enabled, ePA, 3 Mbps – Ch.0) – ANT1 (Q)



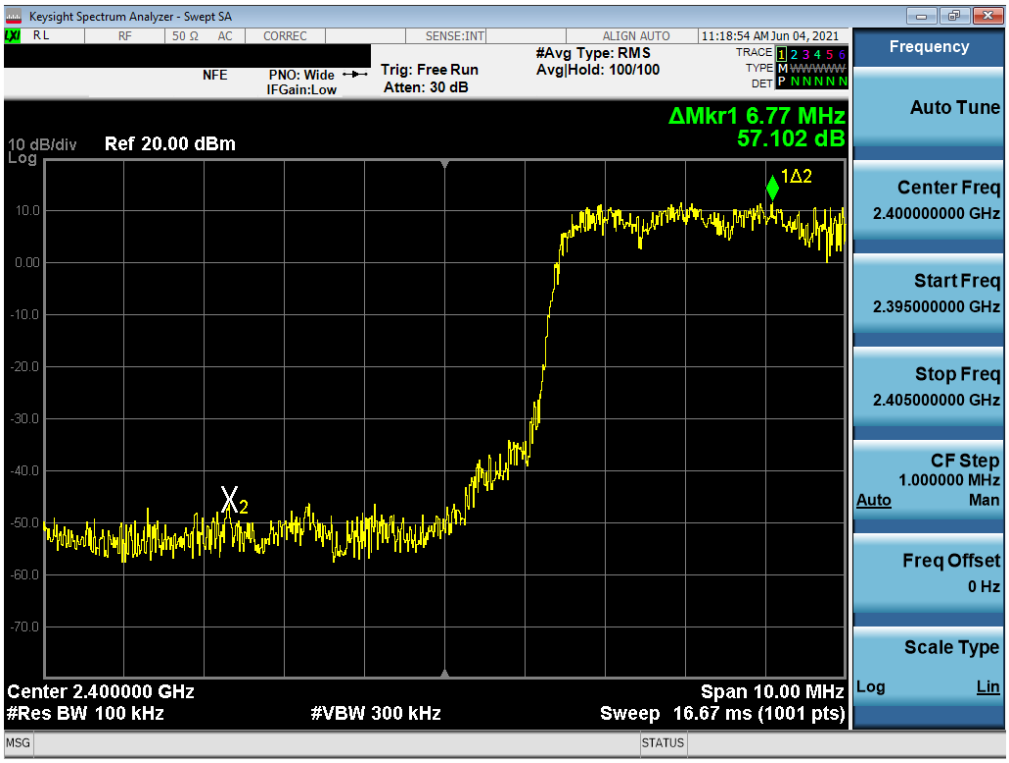
Plot 7-244. Band Edge Plot (Bluetooth with Hopping Enabled, ePA, 3 Mbps – Ch.78) – ANT1 (Q)



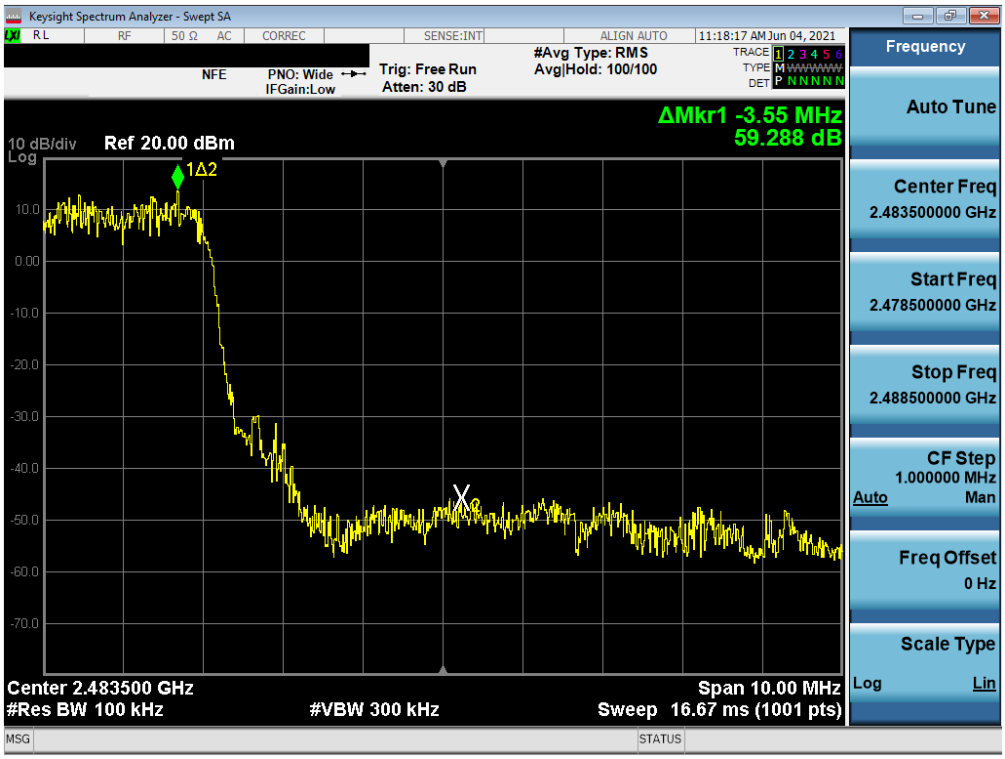
Plot 7-245. Band Edge Plot (Bluetooth with Hopping Disabled, iPA, 3 Mbps – Ch. 0) – ANT1 (Q)



Plot 7-246. Band Edge Plot (Bluetooth with Hopping Disabled, iPA, 3 Mbps – Ch. 78) – ANT1 (Q)



Plot 7-247. Band Edge Plot (Bluetooth with Hopping Enabled, iPA, 3 Mbps – Ch.0) – ANT1 (Q)



Plot 7-248. Band Edge Plot (Bluetooth with Hopping Enabled, iPA, 3 Mbps – Ch.78) – ANT1 (Q)

7.5 Carrier Frequency Separation

§15.247 (a.1); RSS-247 [5.1(2)]

Test Overview and Limit

Measurement is made with EUT operating in hopping mode. ***The minimum permissible channel separation for this system is 2/3 the value of the 20dB BW.***

Test Procedure Used

ANSI C63.10-2013 – Section 7.8.2

Test Settings

1. Span = Wide enough to capture peaks of two adjacent channels
2. RBW = 30% of channel spacing. Adjust as necessary to best identify center of each individual channel
3. VBW ≥ RBW
4. Sweep = Auto
5. Detector = Peak
6. Trace mode = max hold
7. The trace was allowed to stabilize.
8. Marker-delta function used to determine separation between peaks of the adjacent channels

Test Setup

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

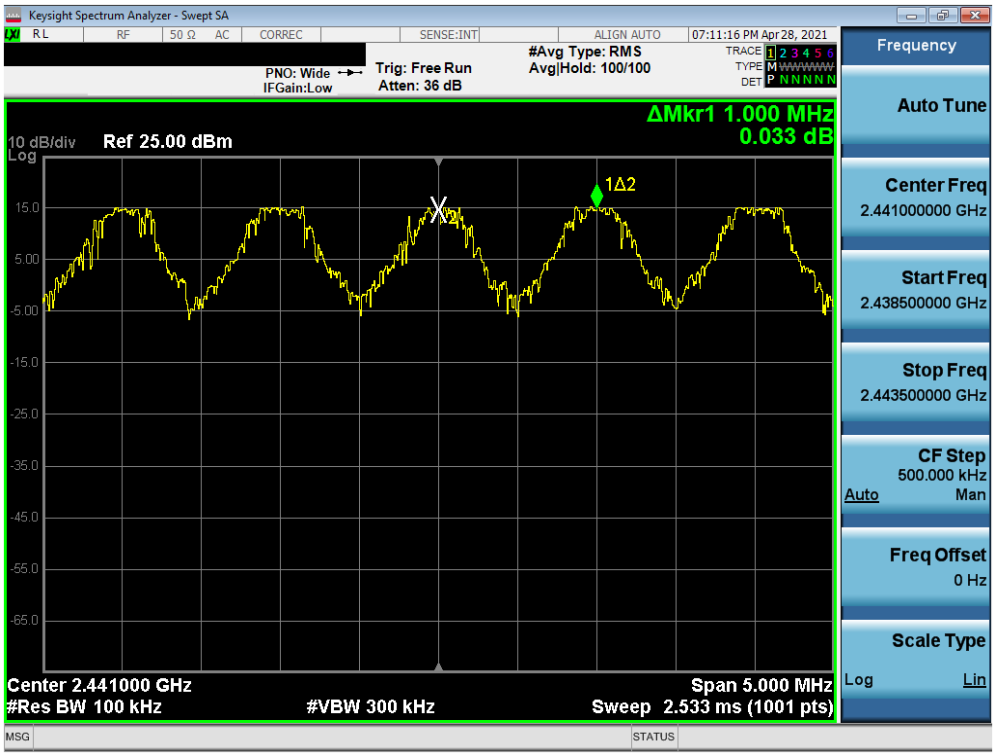
Figure 7-4. Test Instrument & Measurement Setup

Test Notes

1. The EUT complies with the minimum channel separation requirement when it is operating in 1x/EDR mode using 79 channels and when operating in AFH mode using 20 channels.
2. This device will be manufactured using two different WIFI chipsets (N and Q). Both two chipsets are tested, and both conducted emissions data is shown in this report.

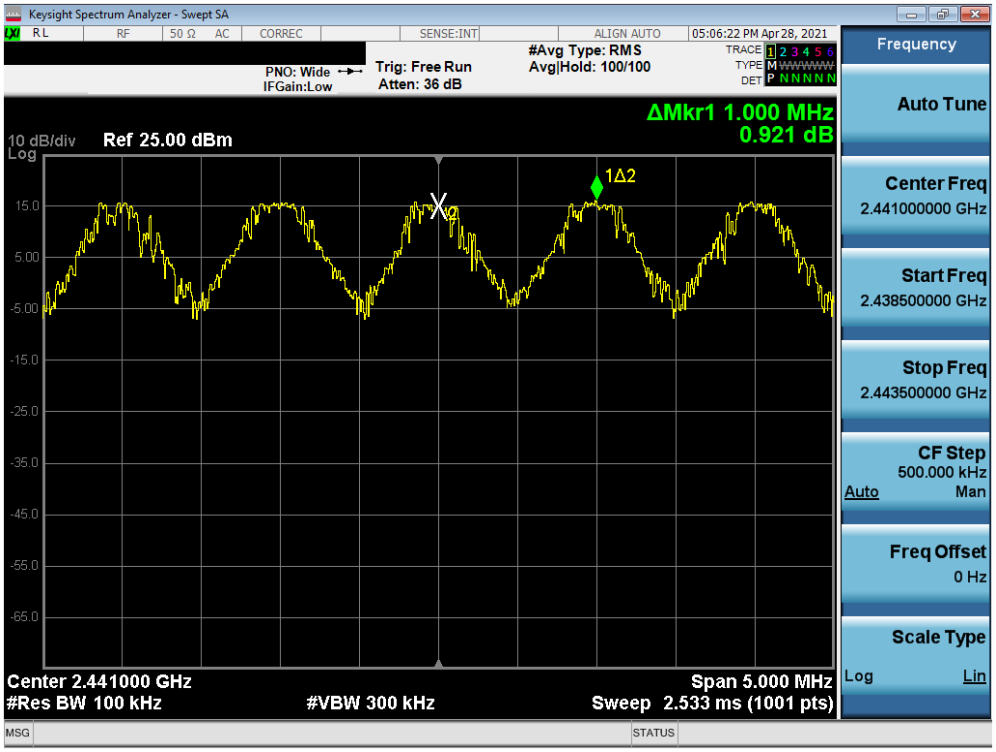
Frequency [MHz]	Data Rate [Mbps]	Mod.	Power Scheme	Channel No.	Min. Channel Separation [MHz] (N)	Min. Channel Separation [MHz] (Q)
2402	1.0	GFSK	ePA	0	0.570	0.614
2441	1.0	GFSK	ePA	39	0.608	0.622
2480	1.0	GFSK	ePA	78	0.608	0.624
2402	1.0	GFSK	iPA	0	0.615	0.617
2441	1.0	GFSK	iPA	39	0.610	0.622
2480	1.0	GFSK	iPA	78	0.624	0.626
2402	2.0	π/4-DQPSK	ePA	0	0.888	0.876
2441	2.0	π/4-DQPSK	ePA	39	0.882	0.895
2480	2.0	π/4-DQPSK	ePA	78	0.894	0.902
2402	2.0	π/4-DQPSK	iPA	0	0.866	0.902
2441	2.0	π/4-DQPSK	iPA	39	0.900	0.854
2480	2.0	π/4-DQPSK	iPA	78	0.852	0.905
2402	3.0	8DPSK	ePA	0	0.884	0.901
2441	3.0	8DPSK	ePA	39	0.867	0.798
2480	3.0	8DPSK	ePA	78	0.895	0.861
2402	3.0	8DPSK	iPA	0	0.874	0.840
2441	3.0	8DPSK	iPA	39	0.840	0.879
2480	3.0	8DPSK	iPA	78	0.887	0.866

Table 7-8. Minimum Channel Separation – ANT0



Plot 7-249. Channel Spacing Plot (Bluetooth, ePA) – ANT0 (N)

Plot 7-250. Channel Spacing Plot (Bluetooth, iPA) – ANT0 (N)

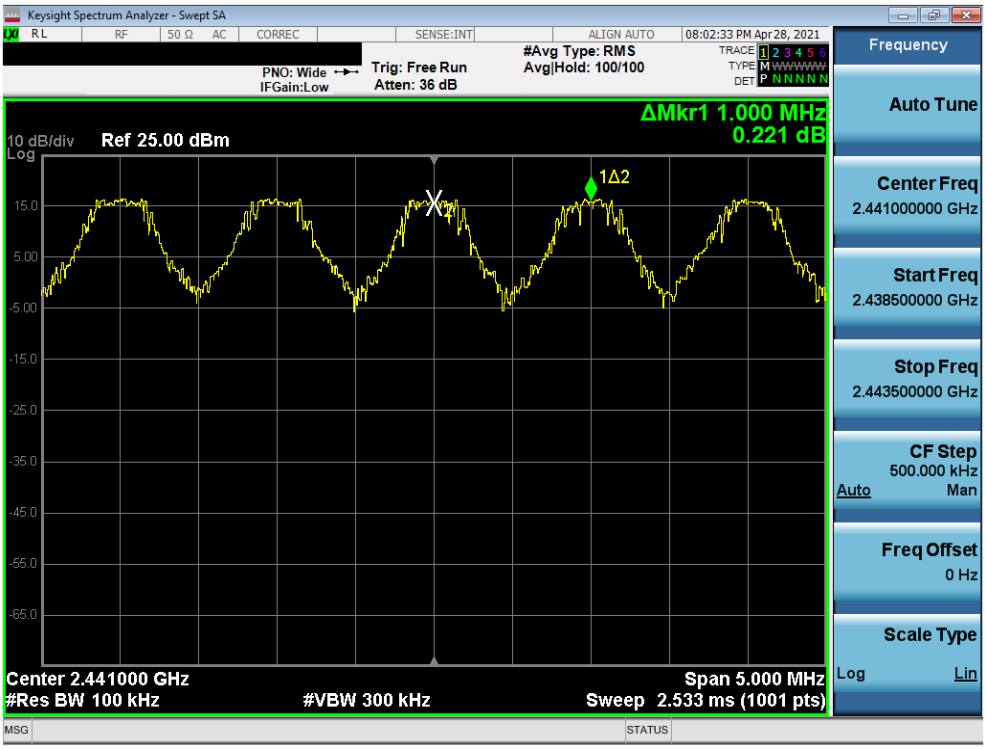


Plot 7-251. Channel Spacing Plot (Bluetooth, ePA) – ANT0 (Q)

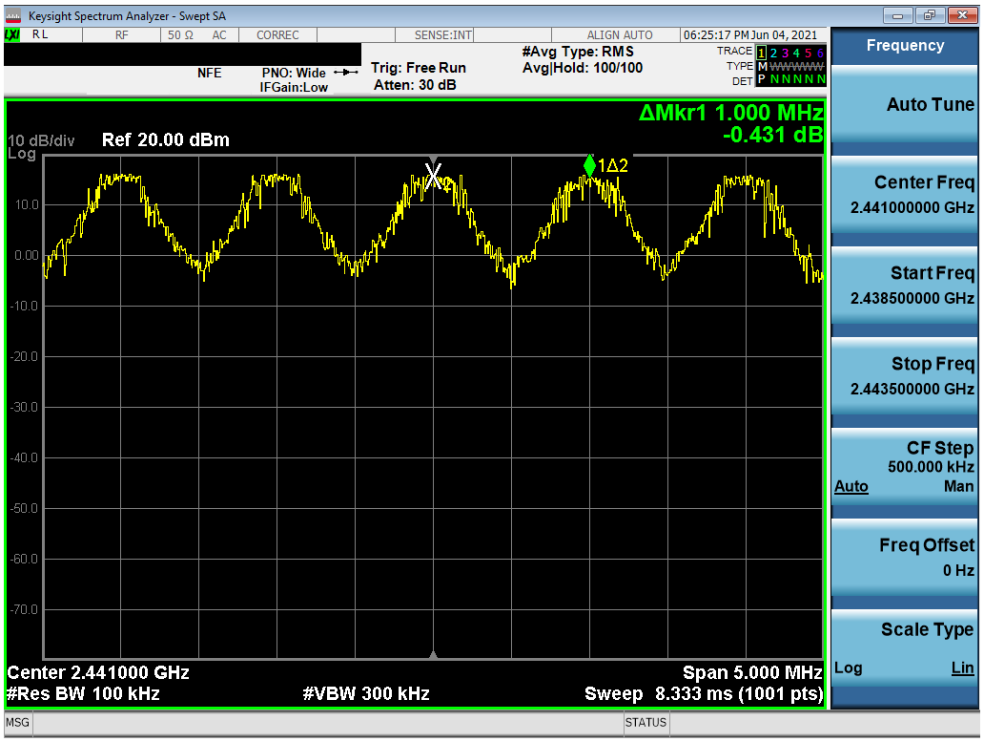
Plot 7-252. Channel Spacing Plot (Bluetooth, iPA) – ANT0 (Q)

Frequency [MHz]	Data Rate [Mbps]	Mod.	Power Scheme	Channel No.	Min. Channel Separation [MHz] (N)	Min. Channel Separation [MHz] (Q)
2402	1.0	GFSK	ePA	0	0.614	0.617
2441	1.0	GFSK	ePA	39	0.622	0.622
2480	1.0	GFSK	ePA	78	0.624	0.626
2402	1.0	GFSK	iPA	0	0.618	0.619
2441	1.0	GFSK	iPA	39	0.624	0.631
2480	1.0	GFSK	iPA	78	0.619	0.635
2402	2.0	π/4-DQPSK	ePA	0	0.876	0.902
2441	2.0	π/4-DQPSK	ePA	39	0.895	0.854
2480	2.0	π/4-DQPSK	ePA	78	0.902	0.905
2402	2.0	π/4-DQPSK	iPA	0	0.917	0.863
2441	2.0	π/4-DQPSK	iPA	39	0.843	0.833
2480	2.0	π/4-DQPSK	iPA	78	0.880	0.874
2402	3.0	8DPSK	ePA	0	0.901	0.840
2441	3.0	8DPSK	ePA	39	0.798	0.879
2480	3.0	8DPSK	ePA	78	0.861	0.866
2402	3.0	8DPSK	iPA	0	0.875	0.842
2441	3.0	8DPSK	iPA	39	0.873	0.883
2480	3.0	8DPSK	iPA	78	0.828	0.865

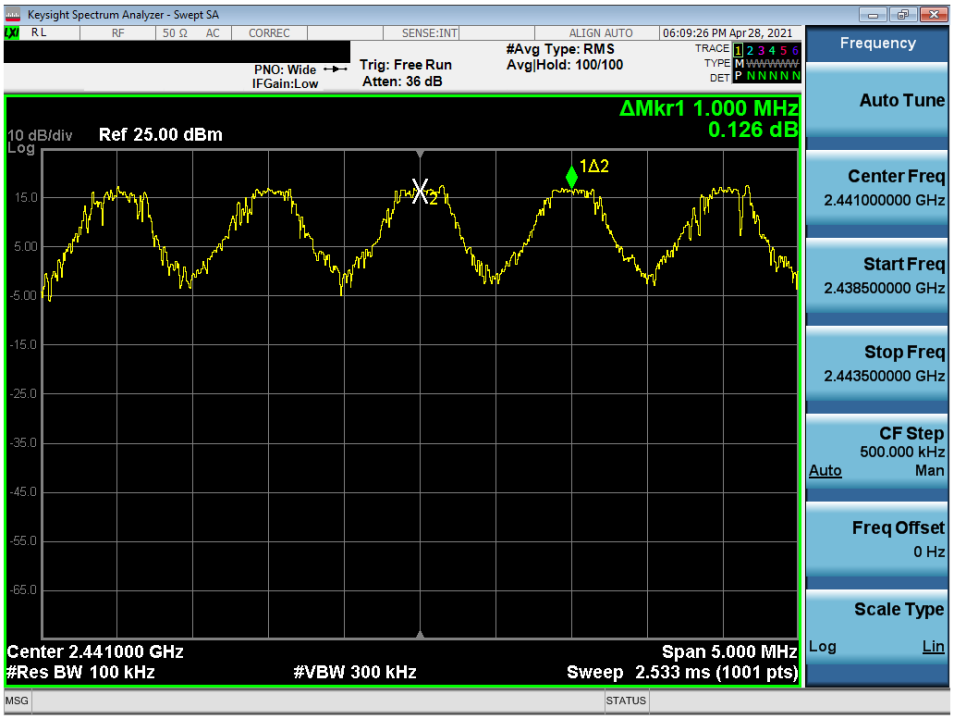
Table 7-9. Minimum Channel Separation – ANT1



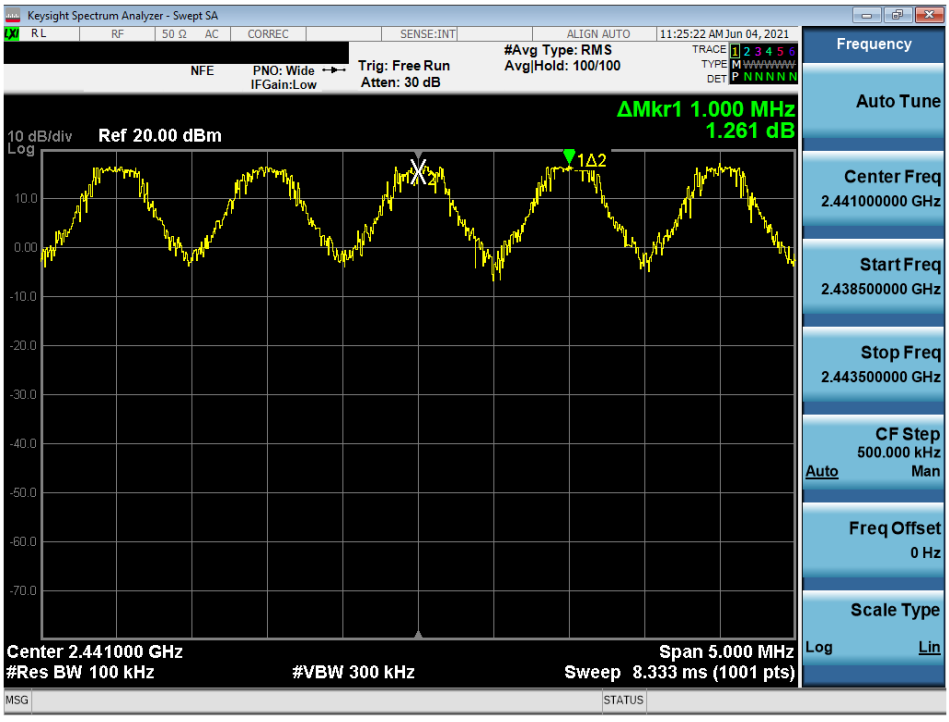
Plot 7-253. Channel Spacing Plot (Bluetooth, ePA) – ANT1 (N)



Plot 7-254. Channel Spacing Plot (Bluetooth, iPA) – ANT1 (N)



Plot 7-255. Channel Spacing Plot (Bluetooth, ePA) – ANT1 (Q)



Plot 7-256. Channel Spacing Plot (Bluetooth, iPA) – ANT1 (Q)

7.6 Time of Occupancy

§15.247 (a.1.iii); RSS-247 [5.1(4)]

Test Overview and Limit

Measurement is made while EUT is operating in hopping mode with the spectrum analyzer set to zero span. ***The maximum permissible time of occupancy is 400 ms within a period of 400ms multiplied by the number of hopping channels employed.***

Test Procedure Used

ANSI C63.10-2013 – Section 7.8.4

Test Settings

1. Span = zero span, centered on a hopping channel
2. RBW ≤ channel spacing and >> 1/T, where T is expected dwell time per channel
3. Sweep = as necessary to capture entire dwell time. Second plot may be required to demonstrate two successive hops on a channel
4. Trigger is set with appropriate trigger delay to place pulse near the center of the plot
5. Detector = peak
6. Trace mode = max hold
7. Marker-delta function used to determine transmit time per hop

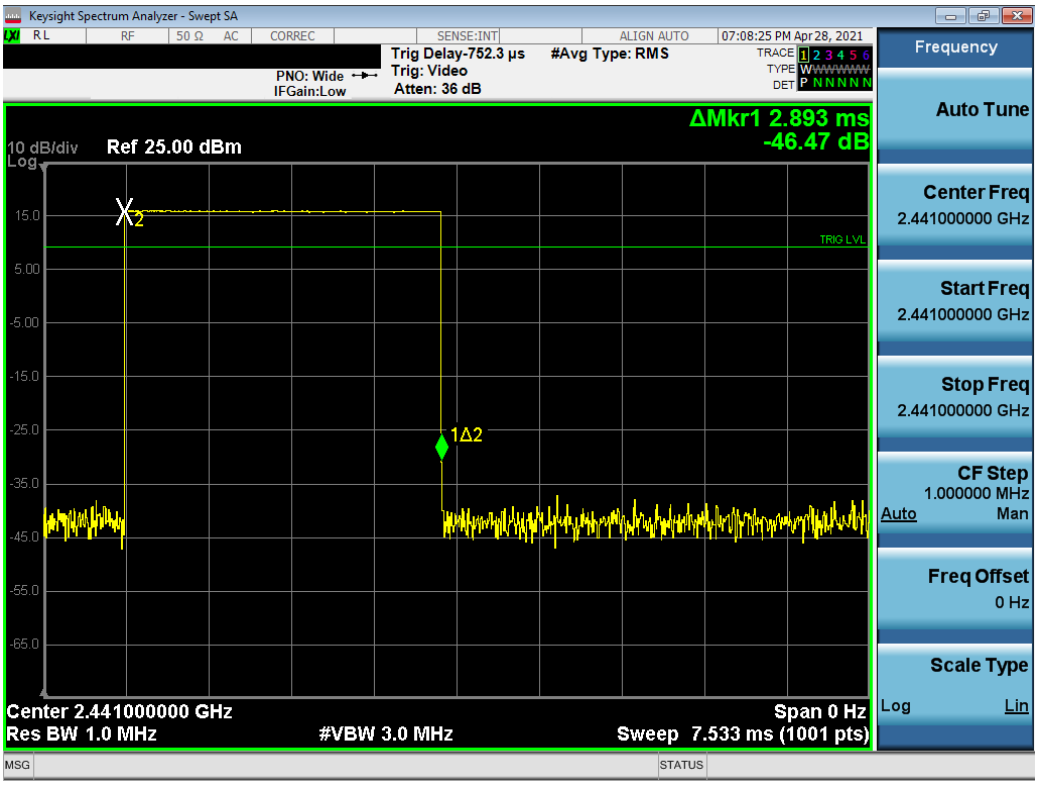
Test Setup

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

Figure 7-5. Test Instrument & Measurement Setup

Test Notes

This device will be manufactured using two different WIFI chipsets (N and Q). Both two chipsets are tested, and both conducted emissions data is shown in this report.



Plot 7-257. Time of Occupancy Plot (Bluetooth, ePA) – ANT0 (N)

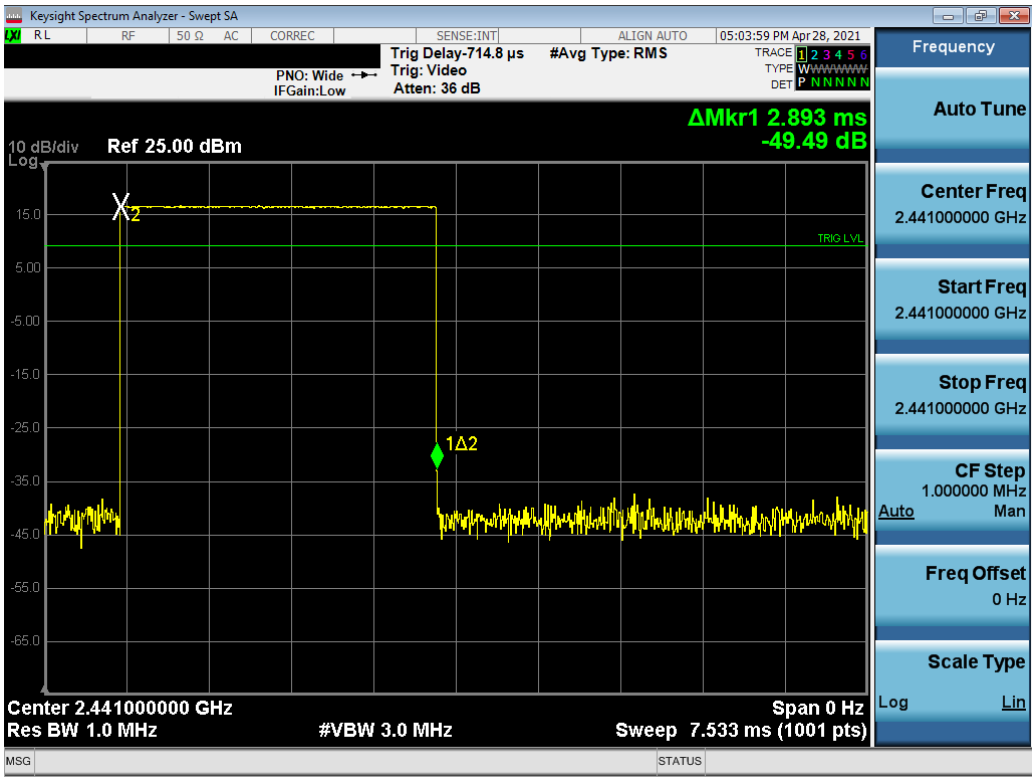
Bluetooth Time of Occupancy Calculation

Typically, Bluetooth 1x/EDR mode has a channel hopping rate of 1600 hops/s. Since 1x/EDR modes use 5 transmit and 1 receive slot, for a total of 6 slots, the Bluetooth transmitter is actually hopping at a rate of 1600 / 6 = 266.67 hops/s/slot

- 400ms x 79 hopping channels = 31.6 sec (Time of Occupancy Limit)
- Worst case BT has 266.67 hops/second (for 1x/EDR modes with DH5 operation)
- 266.67 hops/second / 79 channels = 3.38 hops/second (# of hops/second on one channel)
- 3.38 hops/second/channel x 31.6 seconds = 106.67 hops (# hops over a 31.6 second period)
- 106.67 hops x 2.893 ms/channel = 308.60 ms (worst case dwell time for one channel in 1x/EDR modes)

With AFH, the number of channels is reduced to a minimum of 20 channels and the channel hopping rate is reduced by 50% to 800 hops/s. AFH mode also uses 6 total slots so the Bluetooth transmitter hops at a rate of 800 / 6 = 133.3 hops/s/slot

- 400ms x 20 hopping channels = 8 sec (Time of Occupancy Limit)
- Worst case BT has 133.3 hops/second/slot (for AFH mode with DH5 operation)
- 133.3 hops/s / 20 channels = 6.67 hops/second (# of hops/second on one channel)
- 6.67 hops/s / channel x 8 seconds = 53.34 hops (# hops over a 8 second period)
- 53.34 hops x 2.893 ms/channel = 154.31 ms (worst case dwell time for one channel in AFH mode)



Plot 7-258. Time of Occupancy Plot (Bluetooth, ePA) – ANT0 (Q)

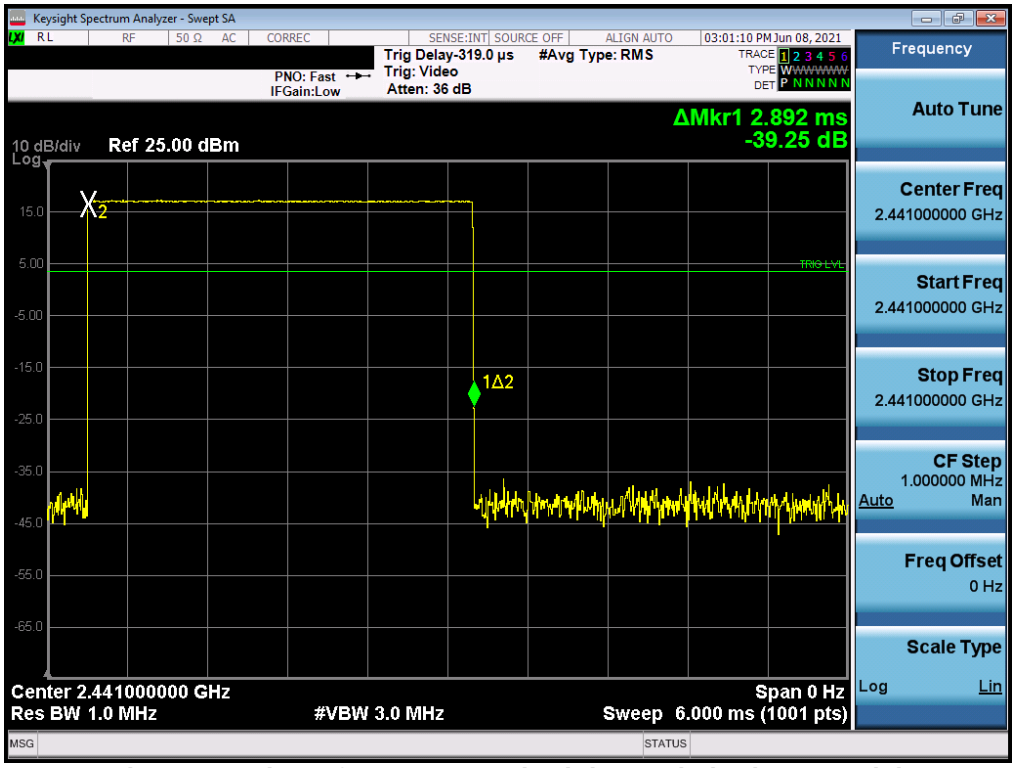
Bluetooth Time of Occupancy Calculation

Typically, Bluetooth 1x/EDR mode has a channel hopping rate of 1600 hops/s. Since 1x/EDR modes use 5 transmit and 1 receive slot, for a total of 6 slots, the Bluetooth transmitter is actually hopping at a rate of 1600 / 6 = 266.67 hops/s/slot

- 400ms x 79 hopping channels = 31.6 sec (Time of Occupancy Limit)
- Worst case BT has 266.67 hops/second (for 1x/EDR modes with DH5 operation)
- 266.67 hops/second / 79 channels = 3.38 hops/second (# of hops/second on one channel)
- 3.38 hops/second/channel x 31.6 seconds = 106.67 hops (# hops over a 31.6 second period)
- 106.67 hops x 2.893 ms/channel = 308.60 ms (worst case dwell time for one channel in 1x/EDR modes)

With AFH, the number of channels is reduced to a minimum of 20 channels and the channel hopping rate is reduced by 50% to 800 hops/s. AFH mode also uses 6 total slots so the Bluetooth transmitter hops at a rate of 800 / 6 = 133.3 hops/s/slot

- 400ms x 20 hopping channels = 8 sec (Time of Occupancy Limit)
- Worst case BT has 133.3 hops/second/slot (for AFH mode with DH5 operation)
- 133.3 hops/s / 20 channels = 6.67 hops/second (# of hops/second on one channel)
- 6.67 hops/s / channel x 8 seconds = 53.34 hops (# hops over a 8 second period)
- 53.34 hops x 2.893 ms/channel = 154.31 ms (worst case dwell time for one channel in AFH mode)



Plot 7-259. Time of Occupancy Plot (Bluetooth, iPA) – ANT0 (N)

Bluetooth Time of Occupancy Calculation

Typically, Bluetooth 1x/EDR mode has a channel hopping rate of 1600 hops/s. Since 1x/EDR modes use 5 transmit and 1 receive slot, for a total of 6 slots, the Bluetooth transmitter is actually hopping at a rate of 1600 / 6 = 266.67 hops/s/slot

- 400ms x 79 hopping channels = 31.6 sec (Time of Occupancy Limit)
- Worst case BT has 266.67 hops/second (for 1x/EDR modes with DH5 operation)
- 266.67 hops/second / 79 channels = 3.38 hops/second (# of hops/second on one channel)
- 3.38 hops/second/channel x 31.6 seconds = 106.67 hops (# hops over a 31.6 second period)
- 106.67 hops x 2.892 ms/channel = 308.49 ms (worst case dwell time for one channel in 1x/EDR modes)

With AFH, the number of channels is reduced to a minimum of 20 channels and the channel hopping rate is reduced by 50% to 800 hops/s. AFH mode also uses 6 total slots so the Bluetooth transmitter hops at a rate of 800 / 6 = 133.3 hops/s/slot

- 400ms x 20 hopping channels = 8 sec (Time of Occupancy Limit)
- Worst case BT has 133.3 hops/second/slot (for AFH mode with DH5 operation)
- 133.3 hops/s / 20 channels = 6.67 hops/second (# of hops/second on one channel)
- 6.67 hops/s / channel x 8 seconds = 53.34 hops (# hops over a 8 second period)
- 53.34 hops x 2.892 ms/channel = 154.26 ms (worst case dwell time for one channel in AFH mode)

Plot 7-260. Time of Occupancy Plot (Bluetooth, iPA) – ANT0 (Q)

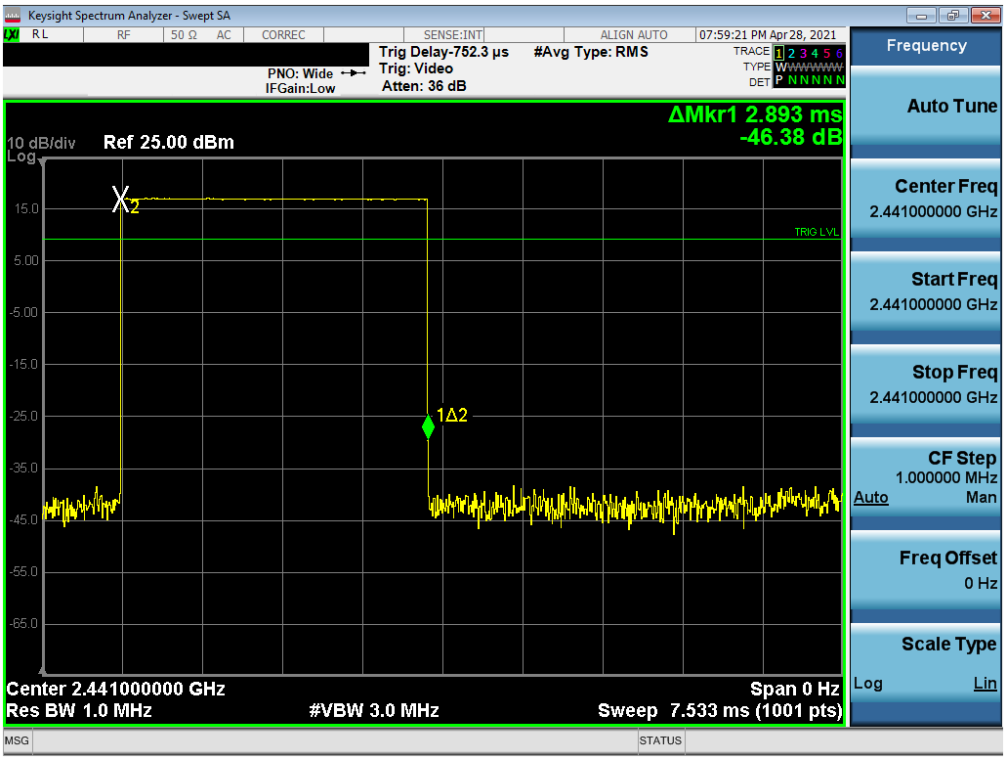
Bluetooth Time of Occupancy Calculation

Typically, Bluetooth 1x/EDR mode has a channel hopping rate of 1600 hops/s. Since 1x/EDR modes use 5 transmit and 1 receive slot, for a total of 6 slots, the Bluetooth transmitter is actually hopping at a rate of 1600 / 6 = 266.67 hops/s/slot

- 400ms x 79 hopping channels = 31.6 sec (Time of Occupancy Limit)
- Worst case BT has 266.67 hops/second (for 1x/EDR modes with DH5 operation)
- 266.67 hops/second / 79 channels = 3.38 hops/second (# of hops/second on one channel)
- 3.38 hops/second/channel x 31.6 seconds = 106.67 hops (# hops over a 31.6 second period)
- 106.67 hops x 2.890 ms/channel = 308.28 ms (worst case dwell time for one channel in 1x/EDR modes)

With AFH, the number of channels is reduced to a minimum of 20 channels and the channel hopping rate is reduced by 50% to 800 hops/s. AFH mode also uses 6 total slots so the Bluetooth transmitter hops at a rate of 800 / 6 = 133.3 hops/s/slot

- 400ms x 20 hopping channels = 8 sec (Time of Occupancy Limit)
- Worst case BT has 133.3 hops/second/slot (for AFH mode with DH5 operation)
- 133.3 hops/s / 20 channels = 6.67 hops/second (# of hops/second on one channel)
- 6.67 hops/s / channel x 8 seconds = 53.34 hops (# hops over a 8 second period)
- 53.34 hops x 2.890 ms/channel = 154.15 ms (worst case dwell time for one channel in AFH mode)



Plot 7-261. Time of Occupancy Plot (Bluetooth, ePA) – ANT1 (N)

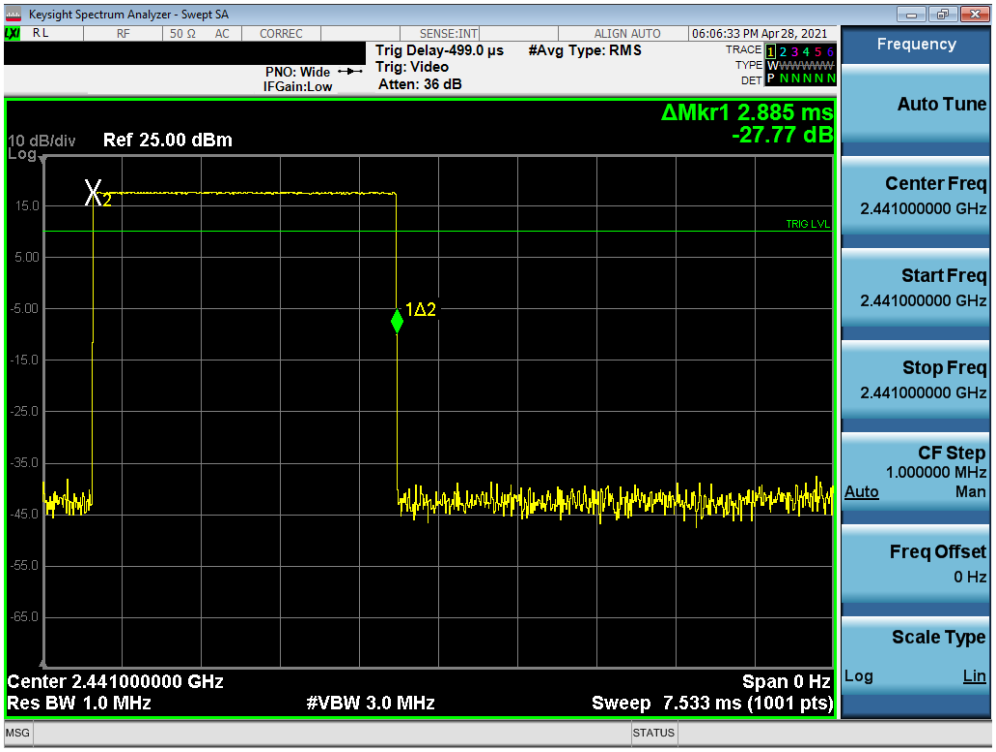
Bluetooth Time of Occupancy Calculation

Typically, Bluetooth 1x/EDR mode has a channel hopping rate of 1600 hops/s. Since 1x/EDR modes use 5 transmit and 1 receive slot, for a total of 6 slots, the Bluetooth transmitter is actually hopping at a rate of 1600 / 6 = 266.67 hops/s/slot

- 400ms x 79 hopping channels = 31.6 sec (Time of Occupancy Limit)
- Worst case BT has 266.67 hops/second (for 1x/EDR modes with DH5 operation)
- 266.67 hops/second / 79 channels = 3.38 hops/second (# of hops/second on one channel)
- 3.38 hops/second/channel x 31.6 seconds = 106.67 hops (# hops over a 31.6 second period)
- 106.67 hops x 2.893 ms/channel = 308.60 ms (worst case dwell time for one channel in 1x/EDR modes)

With AFH, the number of channels is reduced to a minimum of 20 channels and the channel hopping rate is reduced by 50% to 800 hops/s. AFH mode also uses 6 total slots so the Bluetooth transmitter hops at a rate of 800 / 6 = 133.3 hops/s/slot

- 400ms x 20 hopping channels = 8 sec (Time of Occupancy Limit)
- Worst case BT has 133.3 hops/second/slot (for AFH mode with DH5 operation)
- 133.3 hops/s / 20 channels = 6.67 hops/second (# of hops/second on one channel)
- 6.67 hops/s / channel x 8 seconds = 53.34 hops (# hops over a 8 second period)
- 53.34 hops x 2.893 ms/channel = 154.31 ms (worst case dwell time for one channel in AFH mode)



Plot 7-262. Time of Occupancy Plot (Bluetooth, ePA) – ANT1 (Q)

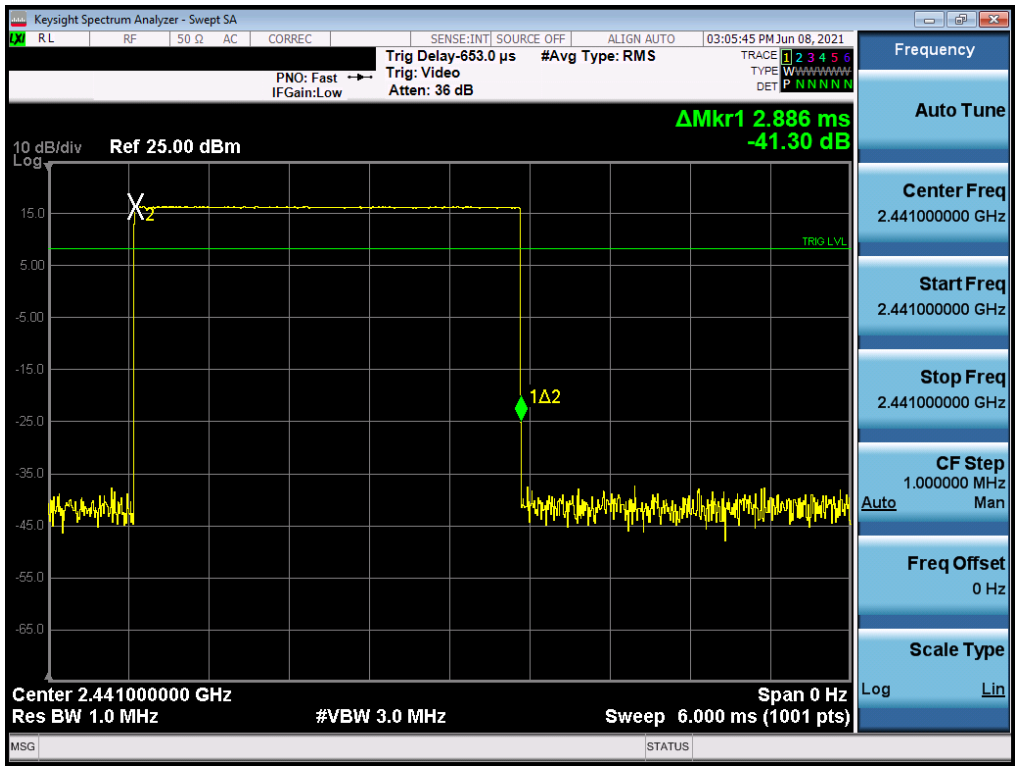
Bluetooth Time of Occupancy Calculation

Typically, Bluetooth 1x/EDR mode has a channel hopping rate of 1600 hops/s. Since 1x/EDR modes use 5 transmit and 1 receive slot, for a total of 6 slots, the Bluetooth transmitter is actually hopping at a rate of 1600 / 6 = 266.67 hops/s/slot

- 400ms x 79 hopping channels = 31.6 sec (Time of Occupancy Limit)
- Worst case BT has 266.67 hops/second (for 1x/EDR modes with DH5 operation)
- 266.67 hops/second / 79 channels = 3.38 hops/second (# of hops/second on one channel)
- 3.38 hops/second/channel x 31.6 seconds = 106.67 hops (# hops over a 31.6 second period)
- 106.67 hops x 2.885 ms/channel = 307.74 ms (worst case dwell time for one channel in 1x/EDR modes)

With AFH, the number of channels is reduced to a minimum of 20 channels and the channel hopping rate is reduced by 50% to 800 hops/s. AFH mode also uses 6 total slots so the Bluetooth transmitter hops at a rate of 800 / 6 = 133.3 hops/s/slot

- 400ms x 20 hopping channels = 8 sec (Time of Occupancy Limit)
- Worst case BT has 133.3 hops/second/slot (for AFH mode with DH5 operation)
- 133.3 hops/s / 20 channels = 6.67 hops/second (# of hops/second on one channel)
- 6.67 hops/s / channel x 8 seconds = 53.34 hops (# hops over a 8 second period)
- 53.34 hops x 2.885 ms/channel = 153.89 ms (worst case dwell time for one channel in AFH mode)



Plot 7-263. Time of Occupancy Plot (Bluetooth, iPA) – ANT1 (N)

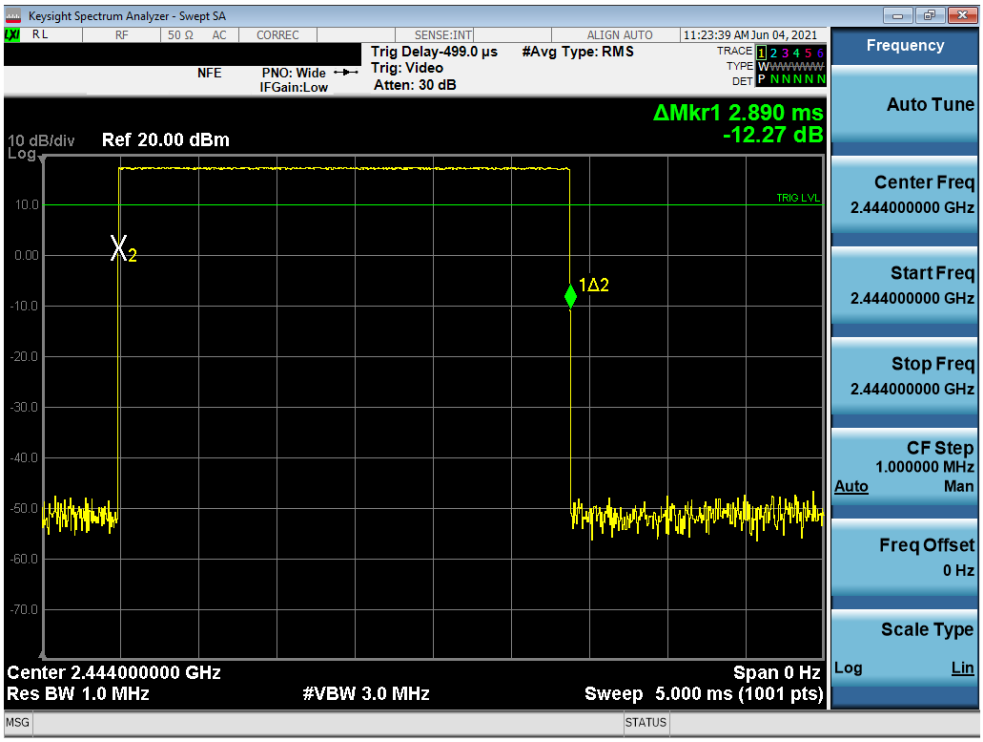
Bluetooth Time of Occupancy Calculation

Typically, Bluetooth 1x/EDR mode has a channel hopping rate of 1600 hops/s. Since 1x/EDR modes use 5 transmit and 1 receive slot, for a total of 6 slots, the Bluetooth transmitter is actually hopping at a rate of 1600 / 6 = 266.67 hops/s/slot

- 400ms x 79 hopping channels = 31.6 sec (Time of Occupancy Limit)
- Worst case BT has 266.67 hops/second (for 1x/EDR modes with DH5 operation)
- 266.67 hops/second / 79 channels = 3.38 hops/second (# of hops/second on one channel)
- 3.38 hops/second/channel x 31.6 seconds = 106.67 hops (# hops over a 31.6 second period)
- 106.67 hops x 2.886 ms/channel = 307.85 ms (worst case dwell time for one channel in 1x/EDR modes)

With AFH, the number of channels is reduced to a minimum of 20 channels and the channel hopping rate is reduced by 50% to 800 hops/s. AFH mode also uses 6 total slots so the Bluetooth transmitter hops at a rate of 800 / 6 = 133.3 hops/s/slot

- 400ms x 20 hopping channels = 8 sec (Time of Occupancy Limit)
- Worst case BT has 133.3 hops/second/slot (for AFH mode with DH5 operation)
- 133.3 hops/s / 20 channels = 6.67 hops/second (# of hops/second on one channel)
- 6.67 hops/s / channel x 8 seconds = 53.34 hops (# hops over a 8 second period)
- 53.34 hops x 2.886 ms/channel = 153.94 ms (worst case dwell time for one channel in AFH mode)



Plot 7-264. Time of Occupancy Plot (Bluetooth, iPA) – ANT1 (Q)

Bluetooth Time of Occupancy Calculation

Typically, Bluetooth 1x/EDR mode has a channel hopping rate of 1600 hops/s. Since 1x/EDR modes use 5 transmit and 1 receive slot, for a total of 6 slots, the Bluetooth transmitter is actually hopping at a rate of 1600 / 6 = 266.67 hops/s/slot

- 400ms x 79 hopping channels = 31.6 sec (Time of Occupancy Limit)
- Worst case BT has 266.67 hops/second (for 1x/EDR modes with DH5 operation)
- 266.67 hops/second / 79 channels = 3.38 hops/second (# of hops/second on one channel)
- 3.38 hops/second/channel x 31.6 seconds = 106.67 hops (# hops over a 31.6 second period)
- 106.67 hops x 2.890 ms/channel = 308.28 ms (worst case dwell time for one channel in 1x/EDR modes)

With AFH, the number of channels is reduced to a minimum of 20 channels and the channel hopping rate is reduced by 50% to 800 hops/s. AFH mode also uses 6 total slots so the Bluetooth transmitter hops at a rate of 800 / 6 = 133.3 hops/s/slot

- 400ms x 20 hopping channels = 8 sec (Time of Occupancy Limit)
- Worst case BT has 133.3 hops/second/slot (for AFH mode with DH5 operation)
- 133.3 hops/s / 20 channels = 6.67 hops/second (# of hops/second on one channel)
- 6.67 hops/s / channel x 8 seconds = 53.34 hops (# hops over a 8 second period)
- 53.34 hops x 2.890 ms/channel = 154.15 ms (worst case dwell time for one channel in AFH mode)

7.7 Number of Hopping Channels

§15.247 (a.1.iii); RSS-247 [5.1(4)]

Test Overview and Limit

Measurement is made while EUT is operating in hopping mode. ***This frequency hopping system must employ a minimum of 15 hopping channels.***

Test Procedure Used

ANSI C63.10-2013 – Section 7.8.3

Test Settings

1. Span = frequency of band of operation (divided into two plots)
2. RBW < 30% of channel spacing or 20dB bandwidth, whichever is smaller.
3. VBW ≥ RBW
4. Sweep = auto
5. Detector = peak
6. Trace mode = max hold
7. Trace was allowed to stabilize

Test Setup

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

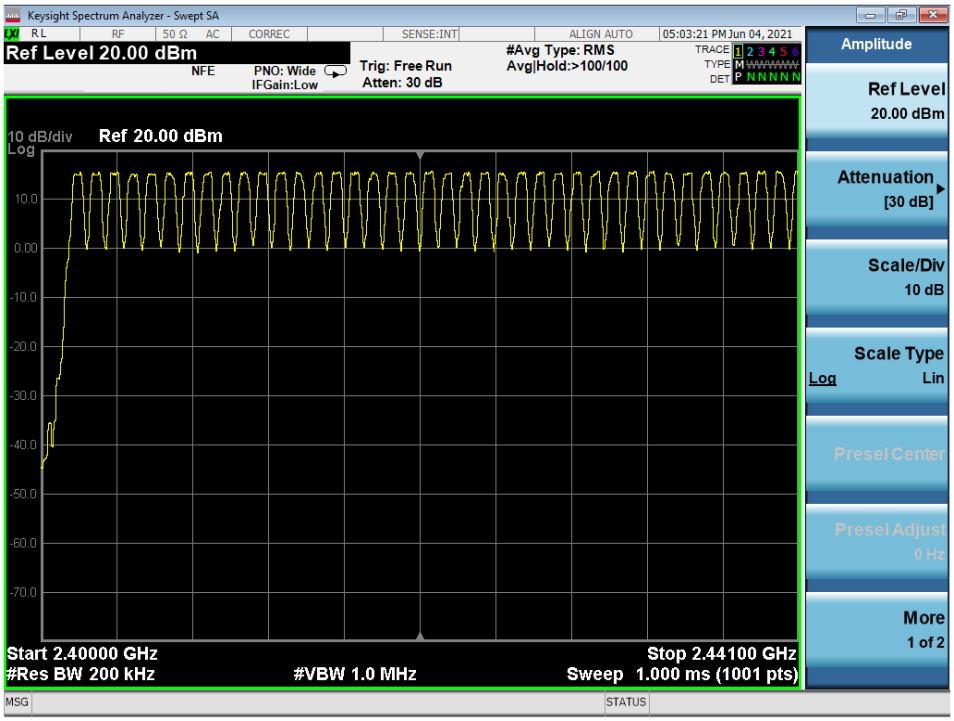
Figure 7-6. Test Instrument & Measurement Setup

Test Notes

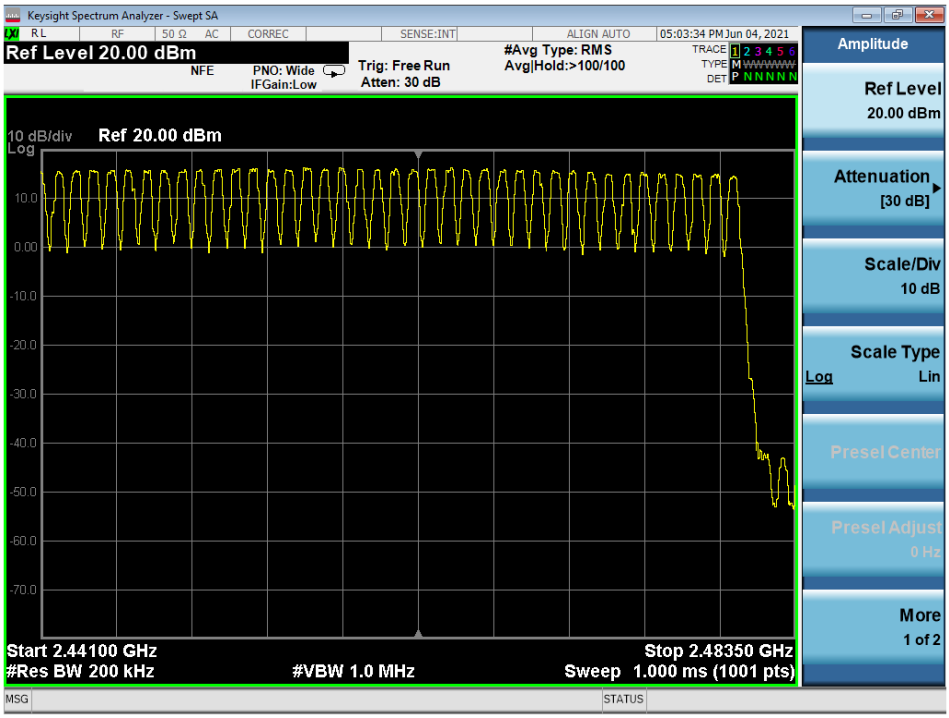
The frequency spectrum was broken up into two sub-ranges to clearly show all of the hopping frequencies. In AFH mode, this device operates using 20 channels so the requirement for minimum number of hopping channels is satisfied.

Plot 7-265. Low End Spectrum Channel Hopping Plot (Bluetooth, ePA) – ANT0 (N)

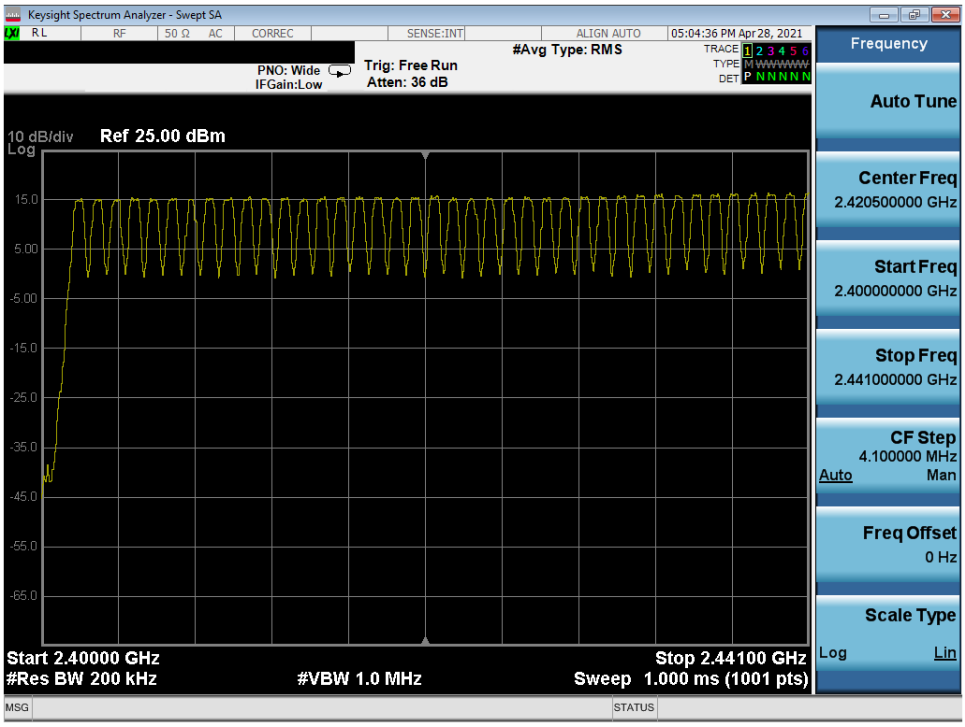
Plot 7-266. High End Spectrum Channel Hopping Plot (Bluetooth, ePA) – ANT0 (N)



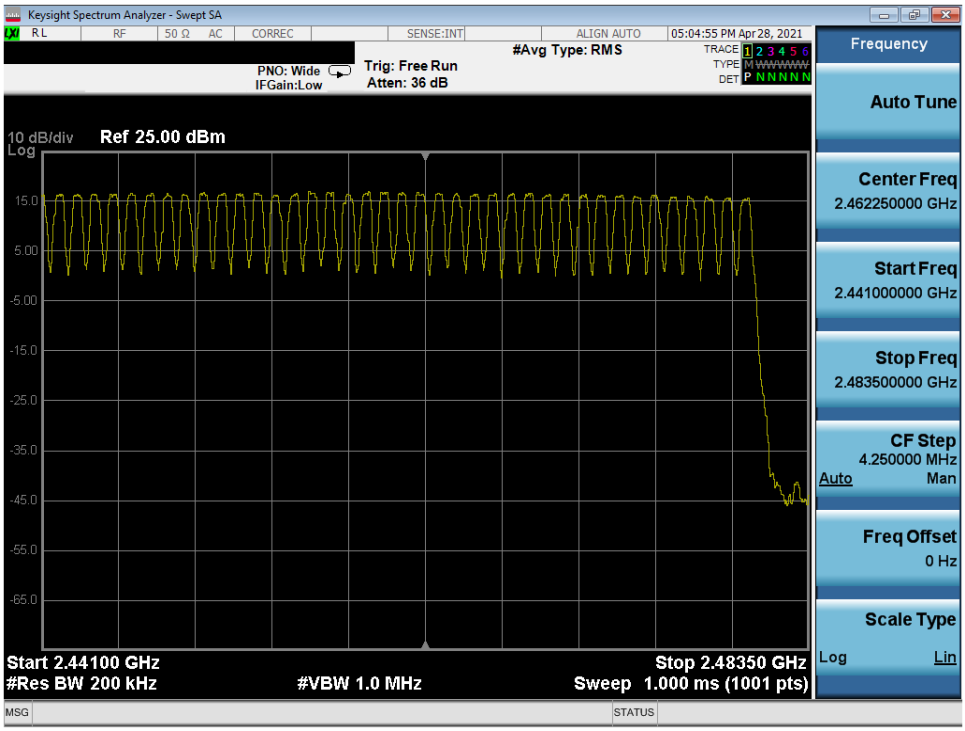
Plot 7-267. Low End Spectrum Channel Hopping Plot (Bluetooth, iPA) – ANT0 (N)



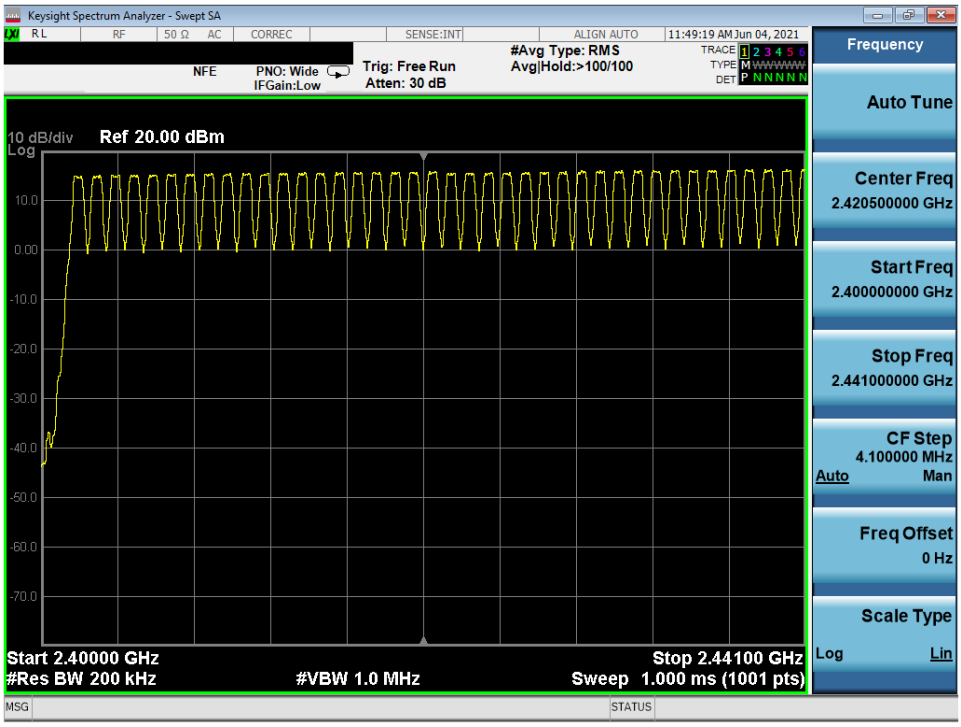
Plot 7-268. High End Spectrum Channel Hopping Plot (Bluetooth, iPA) – ANT0 (N)



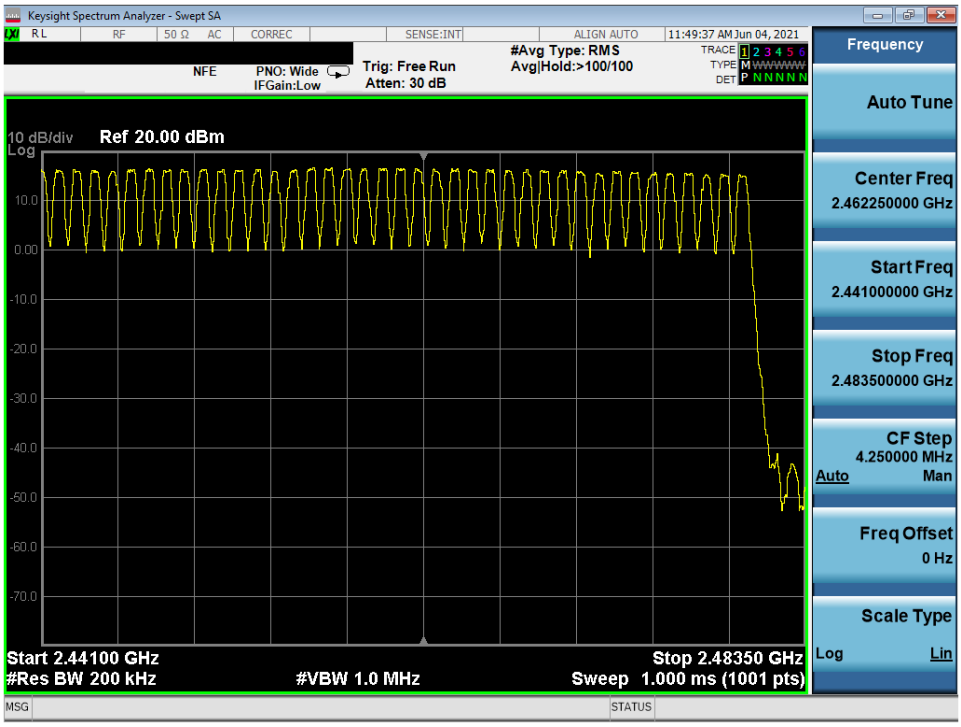
Plot 7-269. Low End Spectrum Channel Hopping Plot (Bluetooth, ePA) – ANT0 (Q)



Plot 7-270. High End Spectrum Channel Hopping Plot (Bluetooth, ePA) – ANT0 (Q)



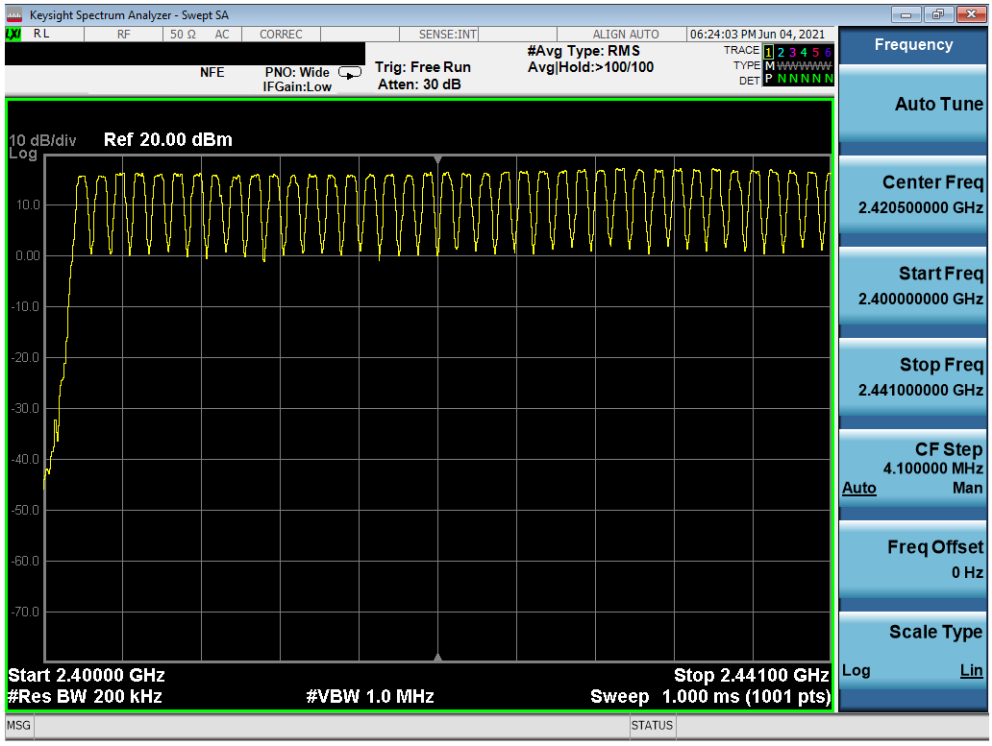
Plot 7-271. Low End Spectrum Channel Hopping Plot (Bluetooth, iPA) – ANT0 (Q)



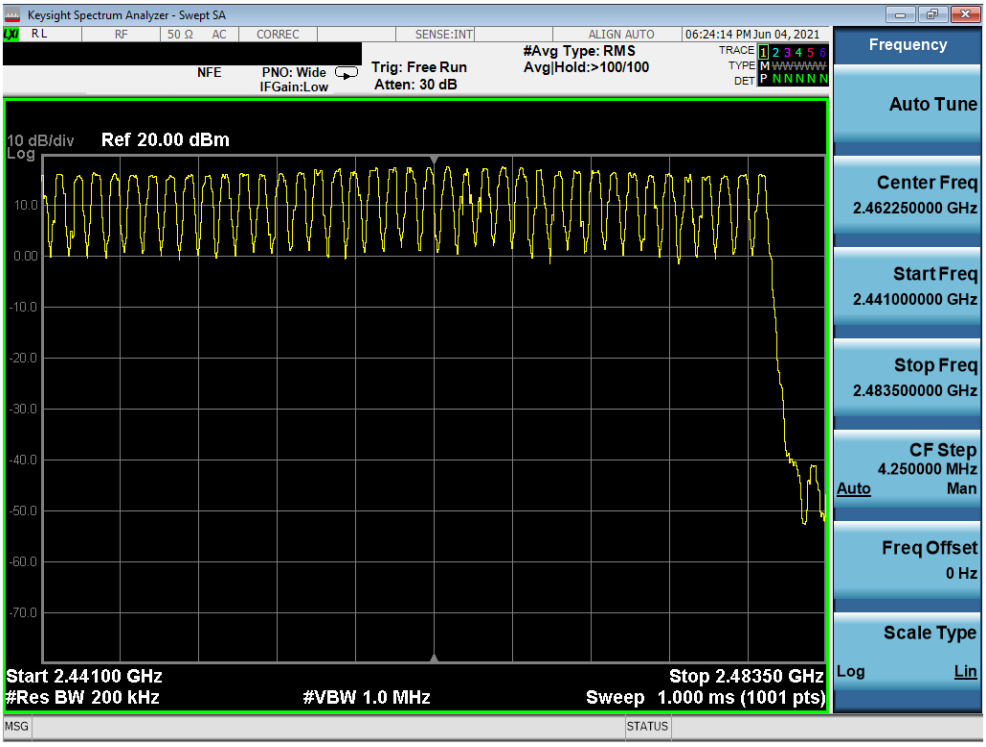
Plot 7-272. High End Spectrum Channel Hopping Plot (Bluetooth, iPA) – ANT0 (Q)

Plot 7-273. Low End Spectrum Channel Hopping Plot (Bluetooth, ePA) – ANT1 (N)

Plot 7-274. High End Spectrum Channel Hopping Plot (Bluetooth, ePA) – ANT1 (N)

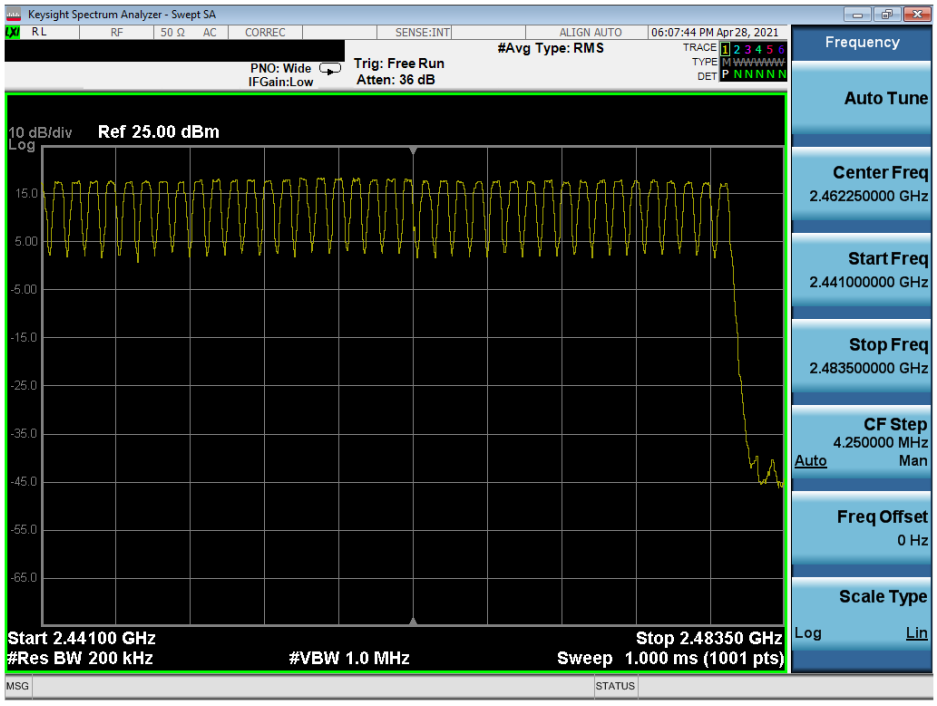


Plot 7-275. Low End Spectrum Channel Hopping Plot (Bluetooth, iPA) – ANT1 (N)

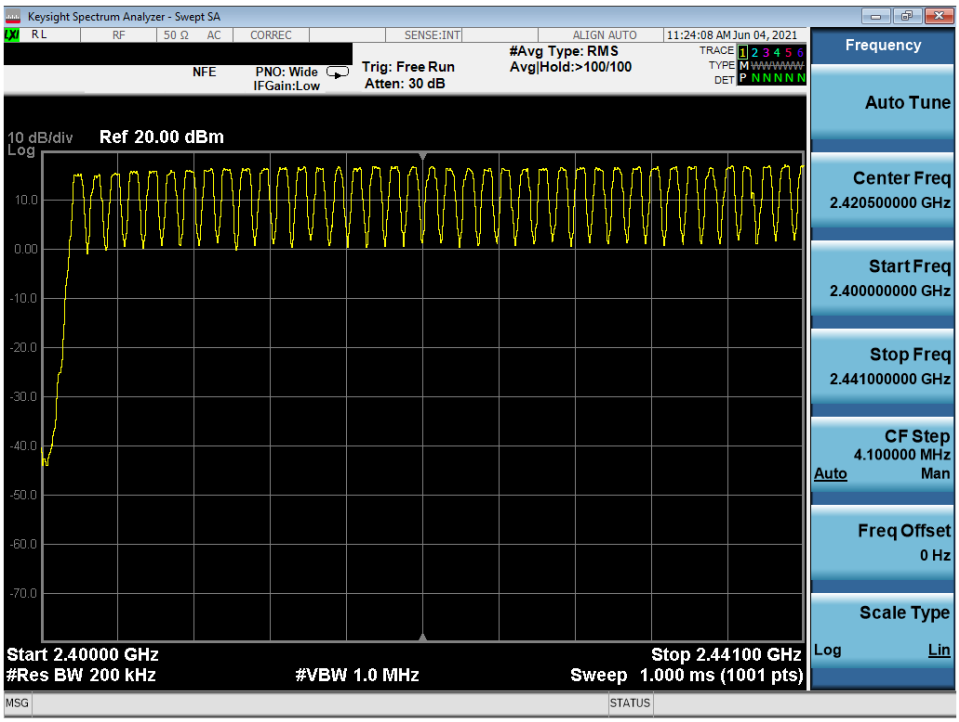


Plot 7-276. High End Spectrum Channel Hopping Plot (Bluetooth, iPA) – ANT1 (N)

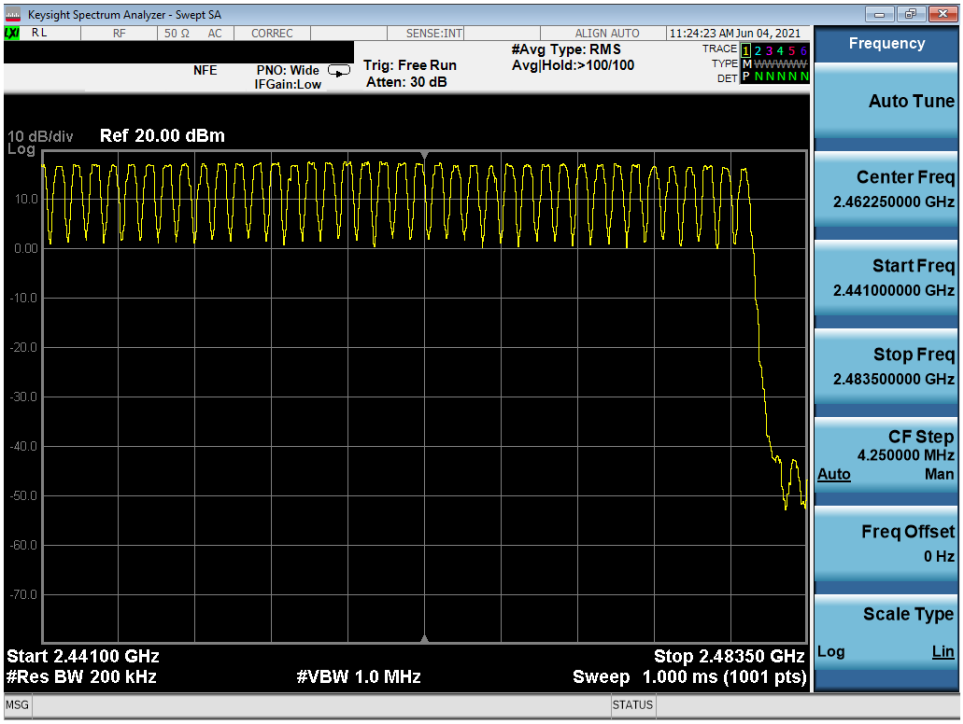
Plot 7-277. Low End Spectrum Channel Hopping Plot (Bluetooth, ePA) – ANT1 (Q)



Plot 7-278. High End Spectrum Channel Hopping Plot (Bluetooth, ePA) – ANT1 (Q)



Plot 7-279. Low End Spectrum Channel Hopping Plot (Bluetooth, iPA) – ANT1 (Q)



Plot 7-280. High End Spectrum Channel Hopping Plot (Bluetooth, iPA) – ANT1 (Q)

7.8 Conducted Spurious Emissions

§15.247 (d); RSS-247 [5.5]

Test Overview and Limit

Conducted out-of-band spurious emissions were investigated from 30MHz up to 25GHz to include the 10th harmonic of the fundamental transmit frequency. ***The maximum permissible out-of-band emission level is 20 dBc.***

Test Procedure Used

ANSI C63.10-2013 – Section 7.8.8

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to 25GHz (separated into two plots per channel)
2. RBW = 1MHz* (See note below)
3. VBW = 3MHz
4. Detector = Peak
5. Trace mode = max hold
6. Sweep time = auto couple
7. The trace was allowed to stabilize

Test Setup

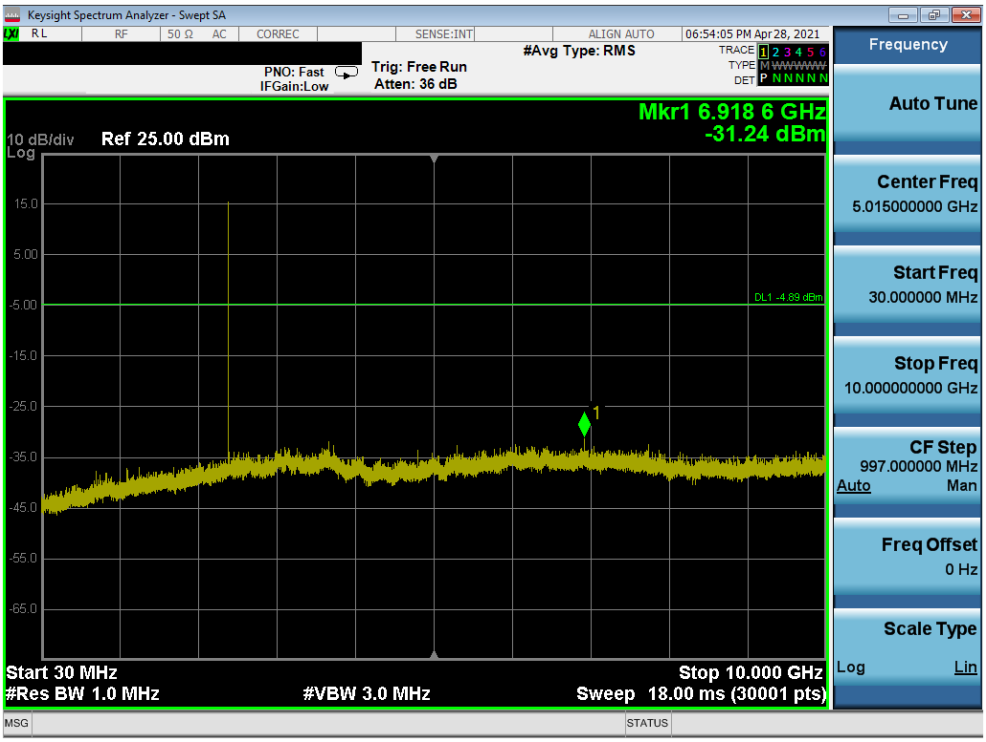
The EUT and measurement equipment were set up as shown in the diagram below.

Figure 7-7. Test Instrument & Measurement Setup

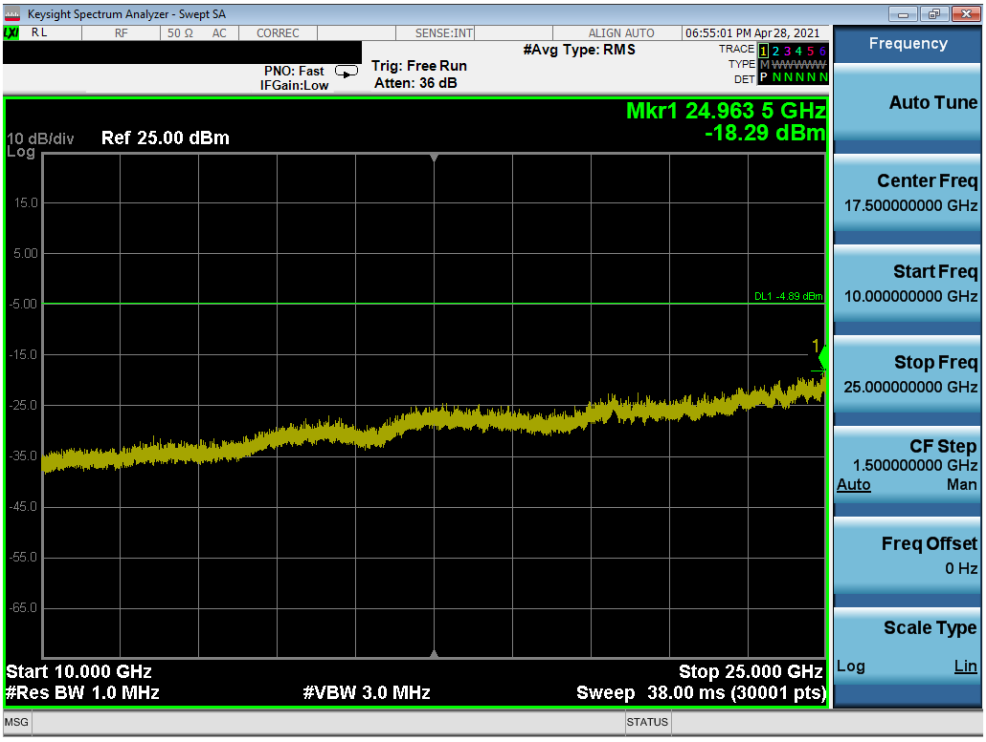
Test Notes

1. Out-of-band conducted spurious emissions were investigated for all data rates and the worst case emissions were found with the EUT transmitting at 1Mbps. The display line shown in the following plots is the limit at 20dB below the fundamental emission level measured in a 100kHz bandwidth. However, the traces in the following plots are measured with a 1MHz RBW to reduce test time, so the display line may not necessarily appear to be 20dB below the level of the fundamental in a 1MHz bandwidth.

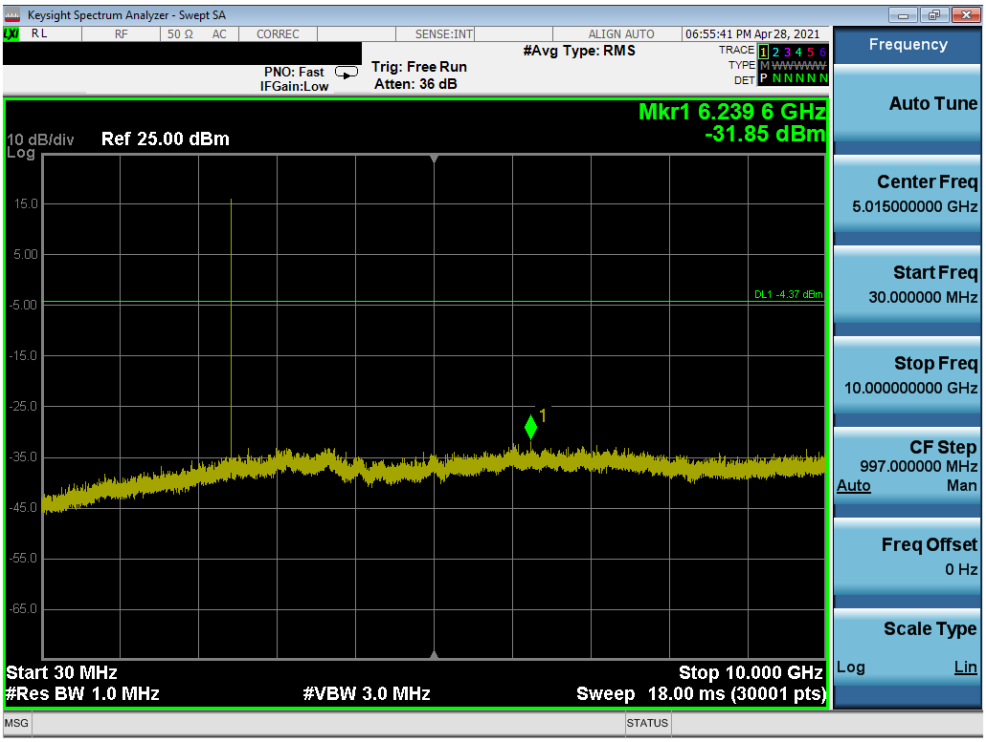
2. This device will be manufactured using two different WIFI chipsets (N and Q). Both two chipsets are tested, and both conducted emissions data is shown in this report.



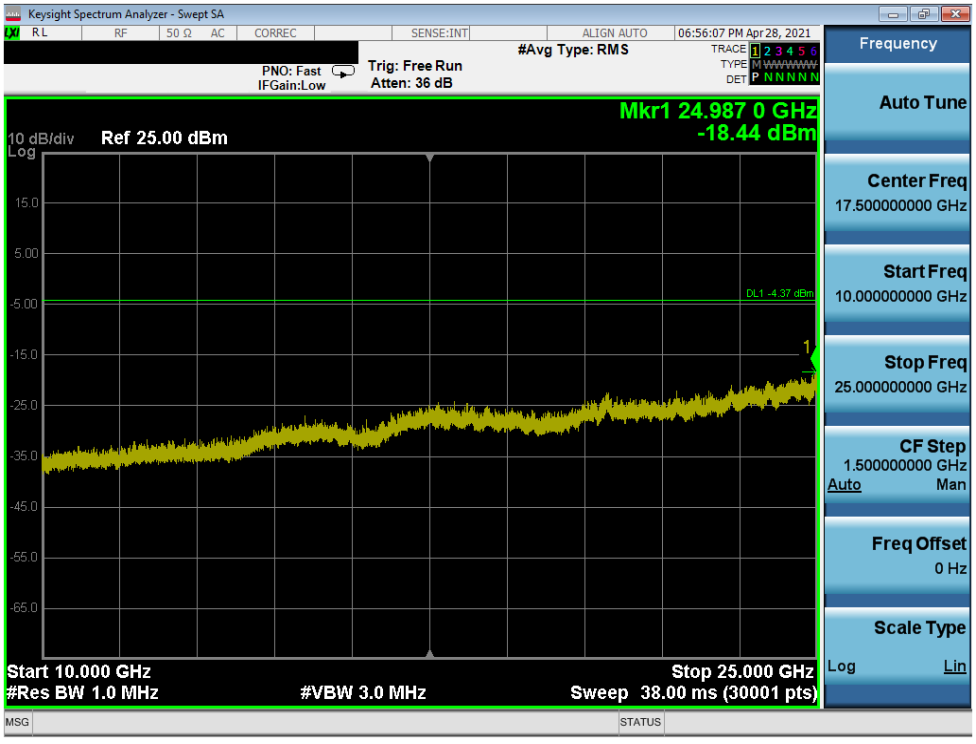
Plot 7-281. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 0, ePA) – ANT0 (N)



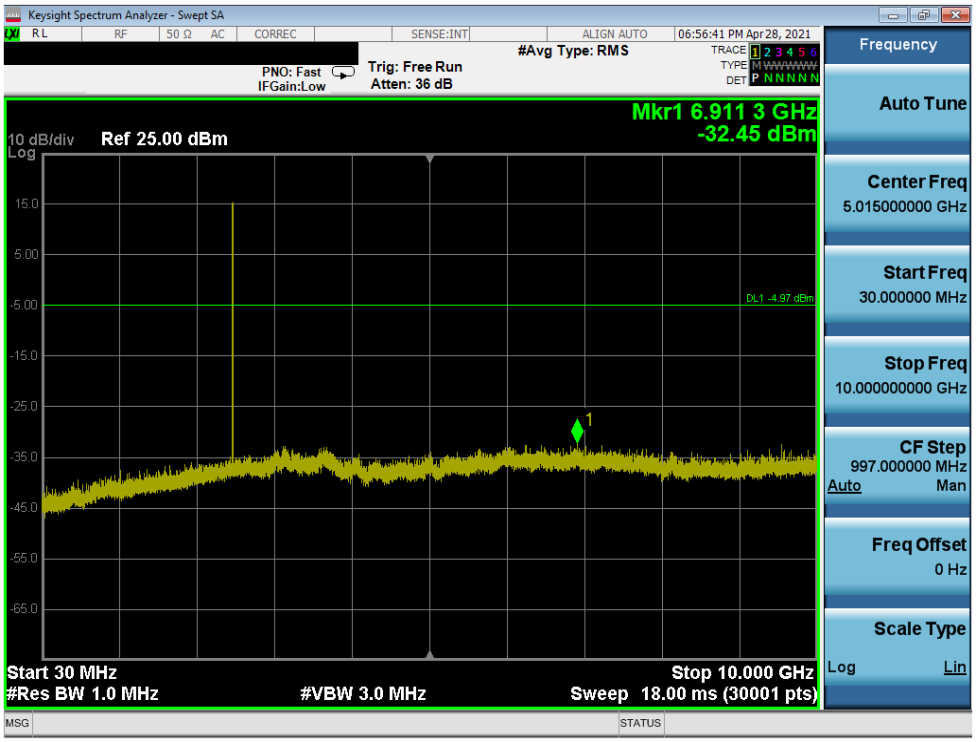
Plot 7-282. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 0, ePA) – ANT0 (N)



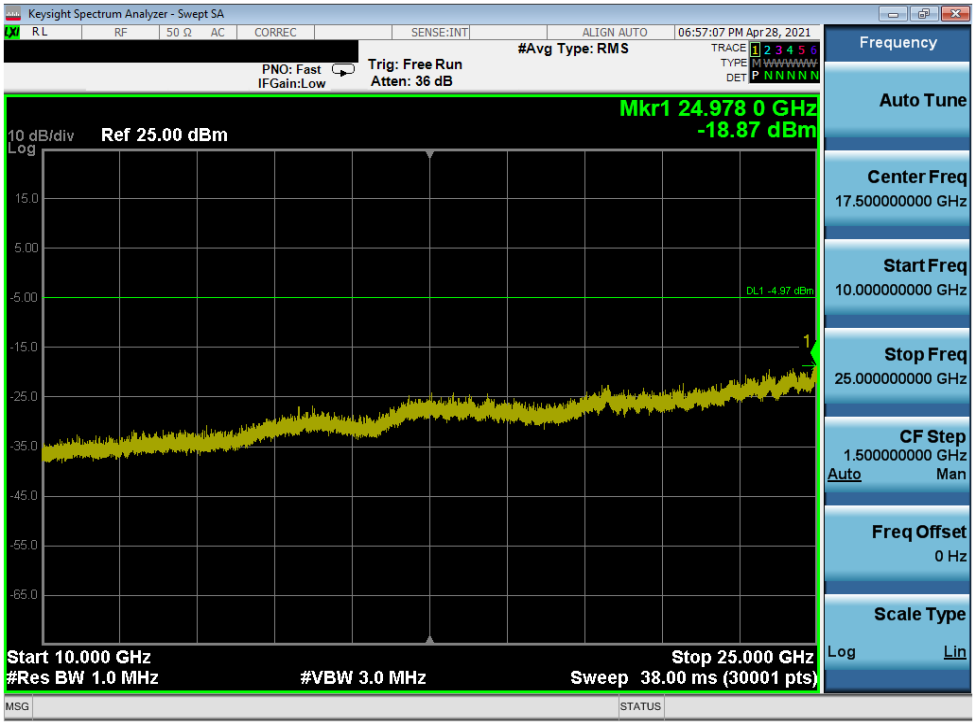
Plot 7-283. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 39, ePA) – ANT0 (N)



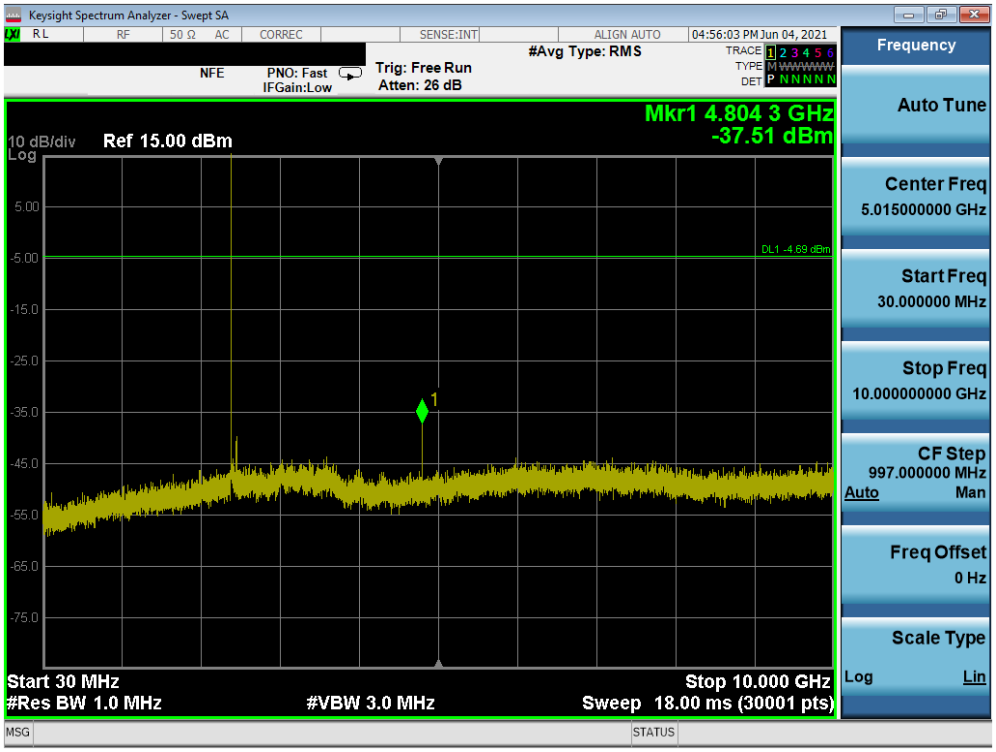
Plot 7-284. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 39, ePA) – ANT0 (N)



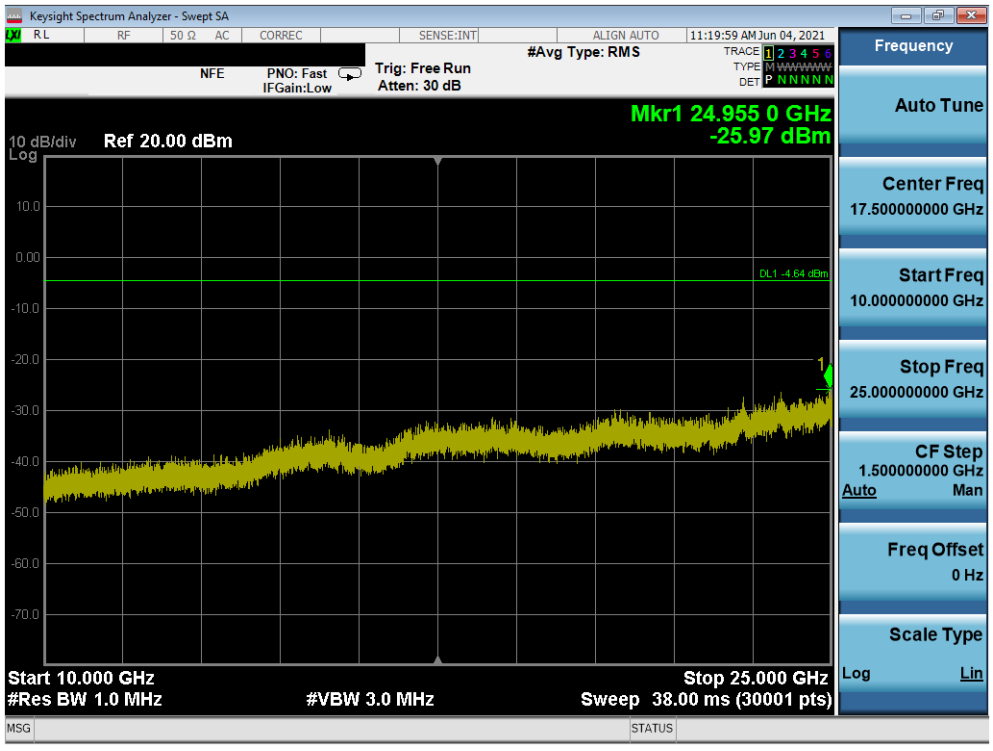
Plot 7-285. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 78, ePA) – ANT0 (N)



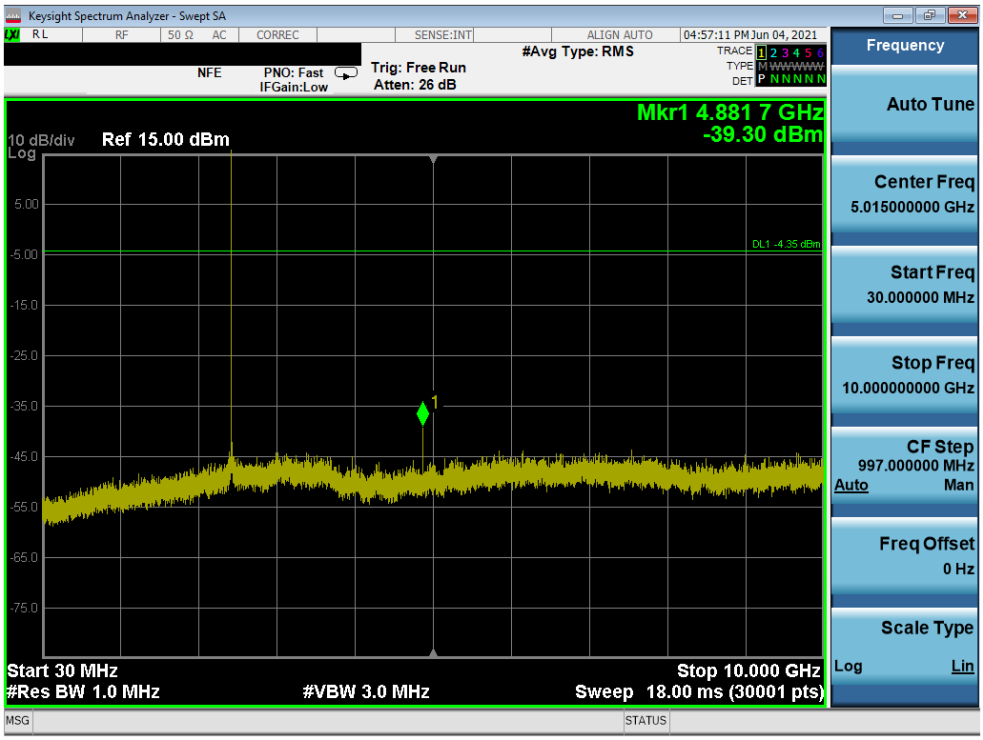
Plot 7-286. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 78, ePA) – ANT0 (N)



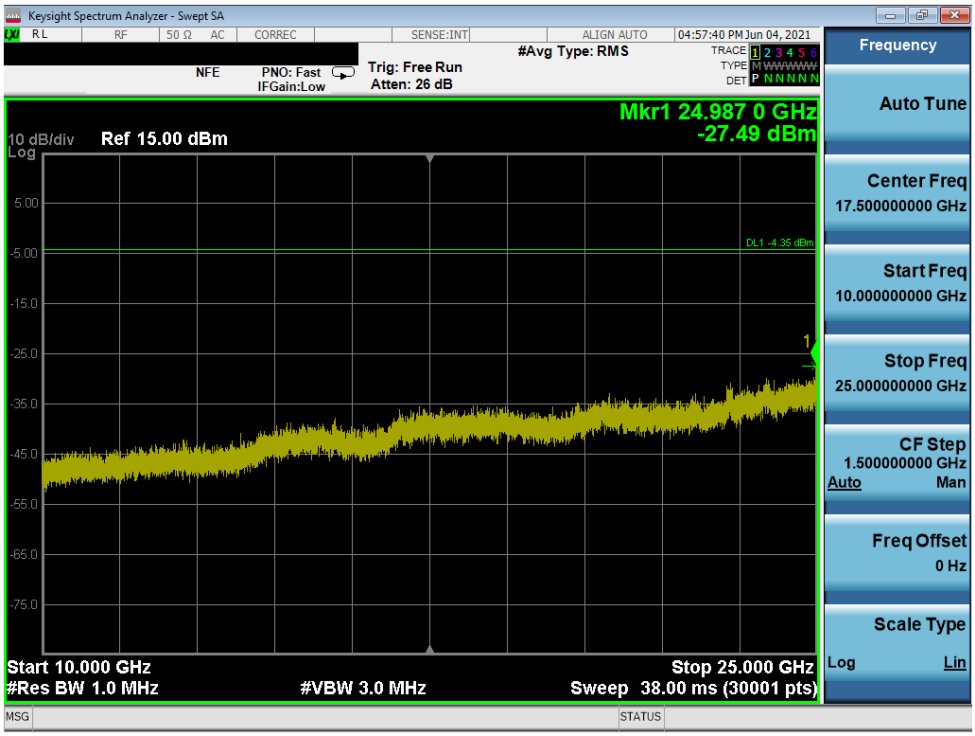
Plot 7-287. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 0, iPA) – ANT0 (N)



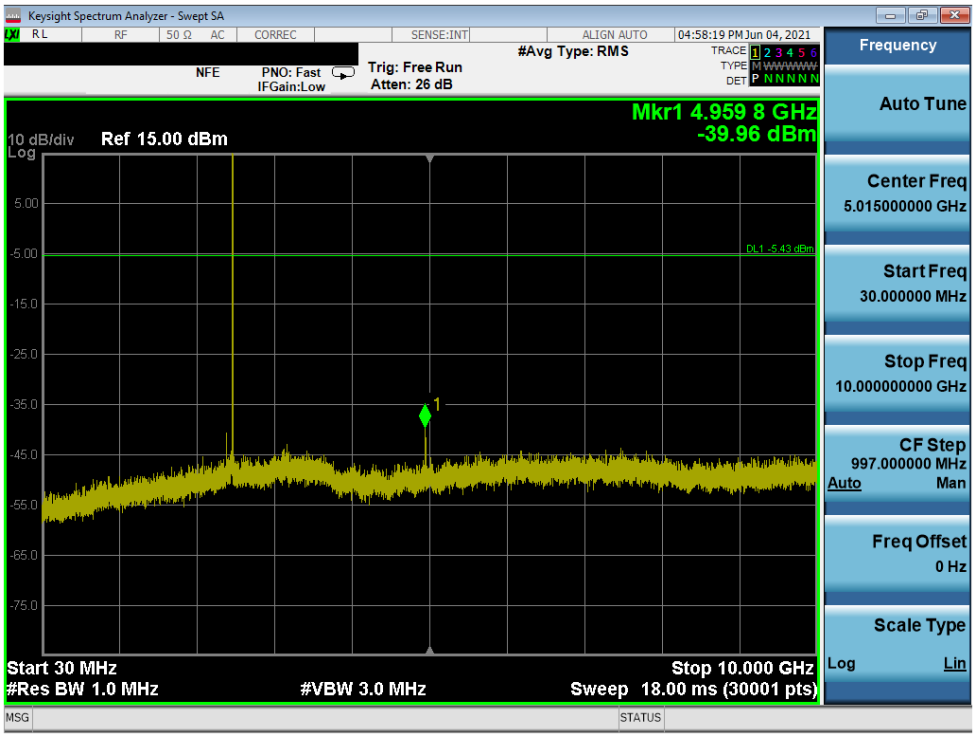
Plot 7-288. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 0, iPA) – ANT0 (N)



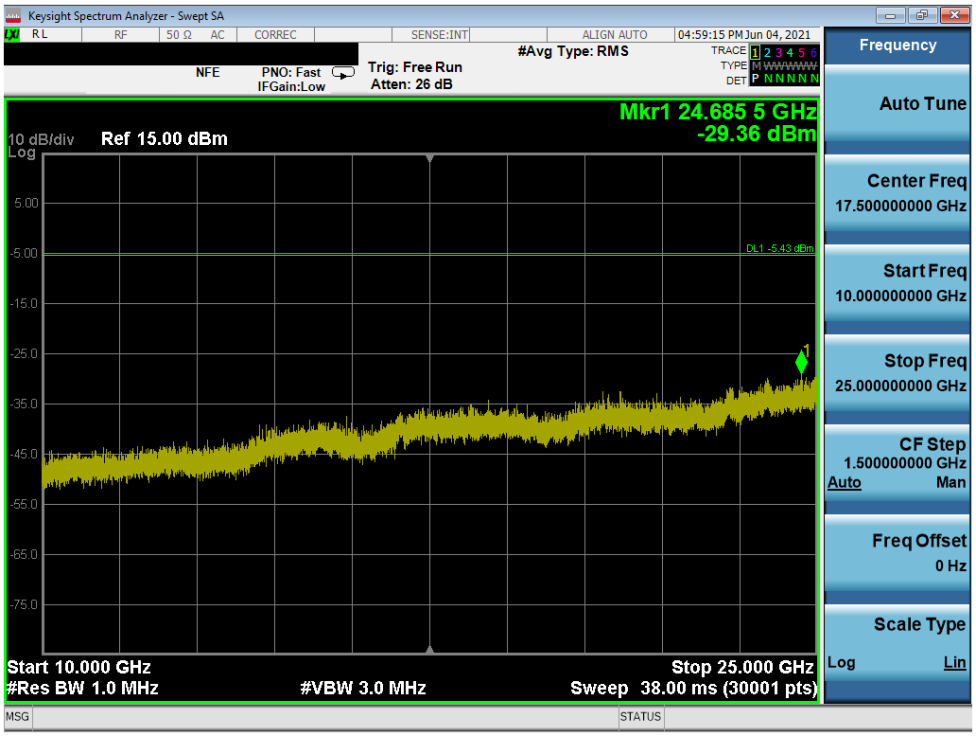
Plot 7-289. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 39, iPA) – ANT0 (N)



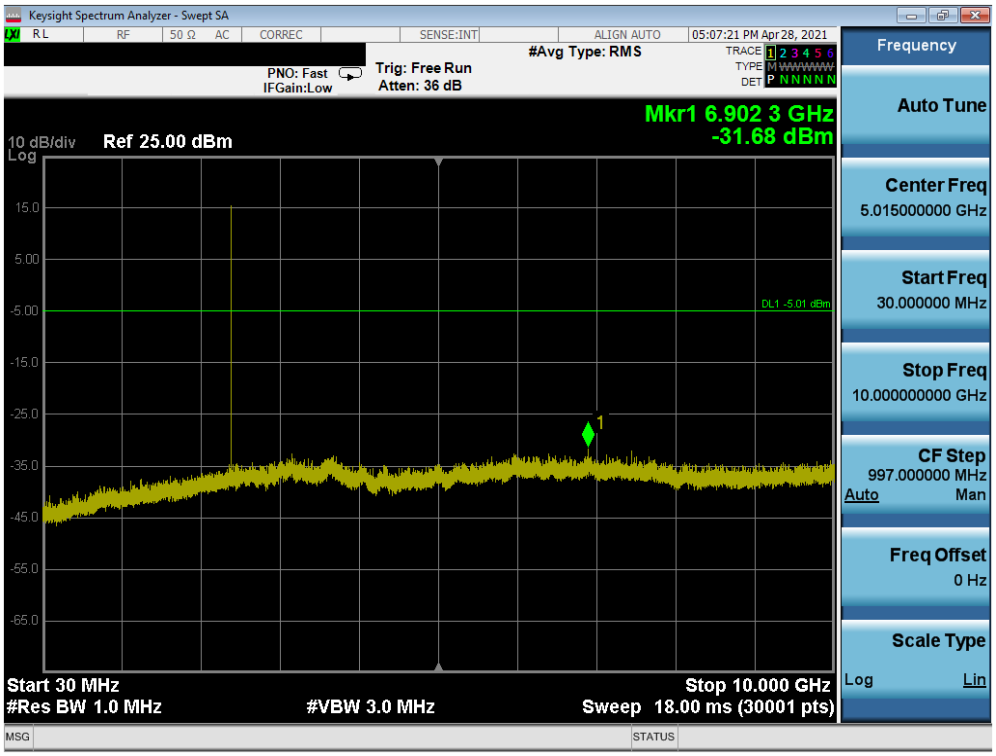
Plot 7-290. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 39, iPA) – ANT0 (N)



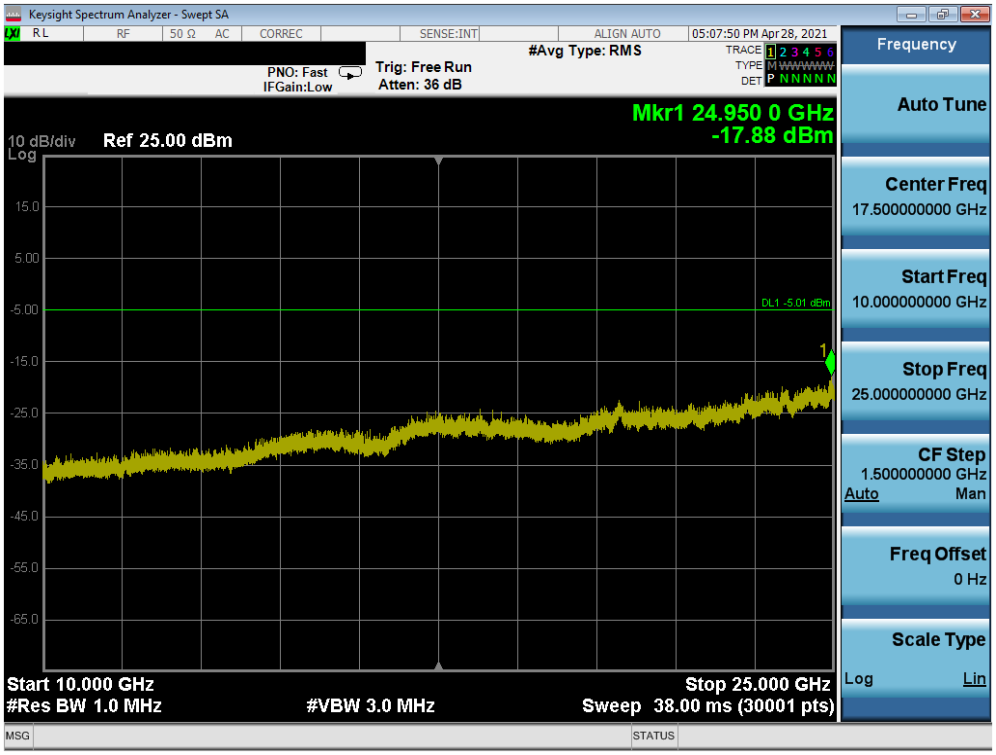
Plot 7-291. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 78, iPA) – ANT0 (N)



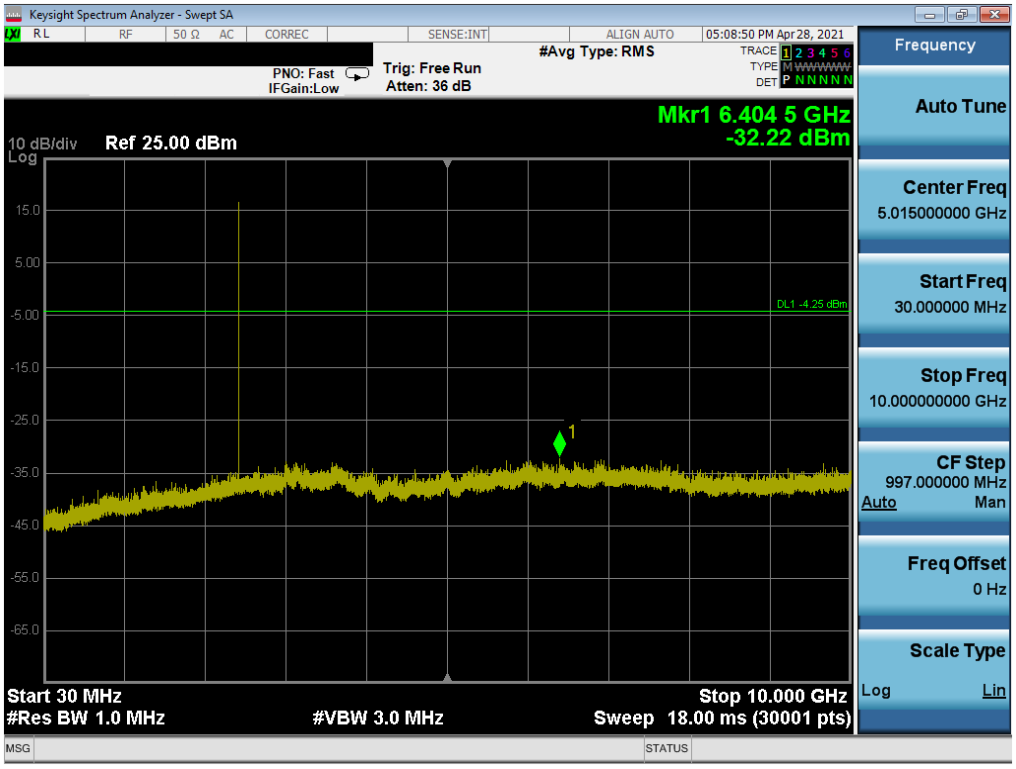
Plot 7-292. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 78, iPA) – ANT0 (N)



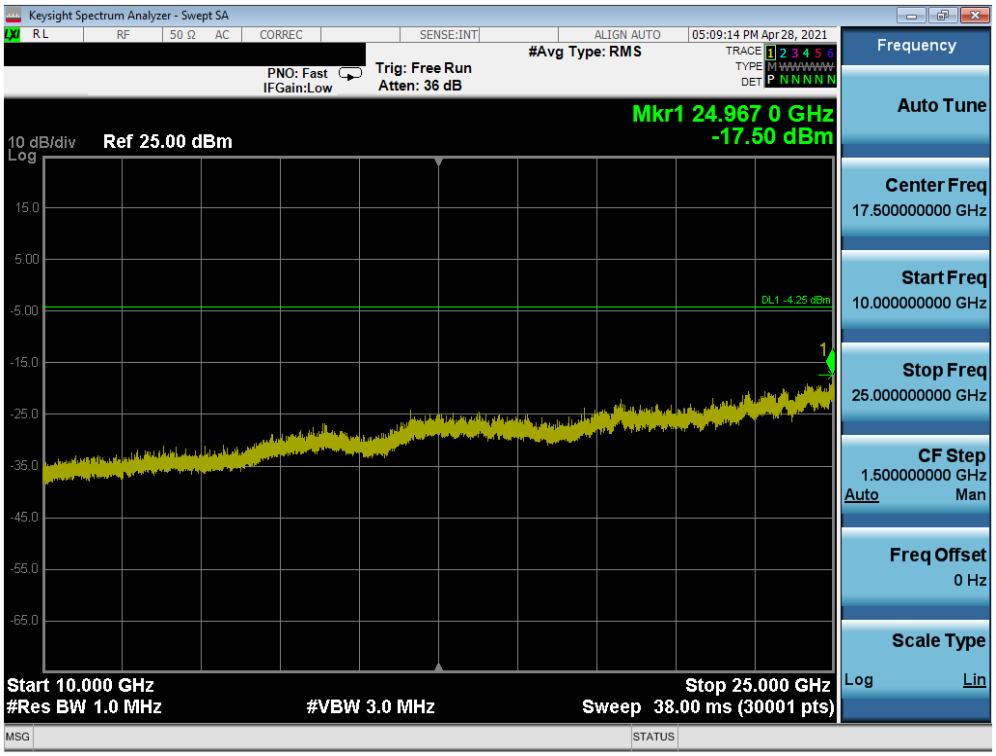
Plot 7-293. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 0, ePA) – ANT0 (Q)



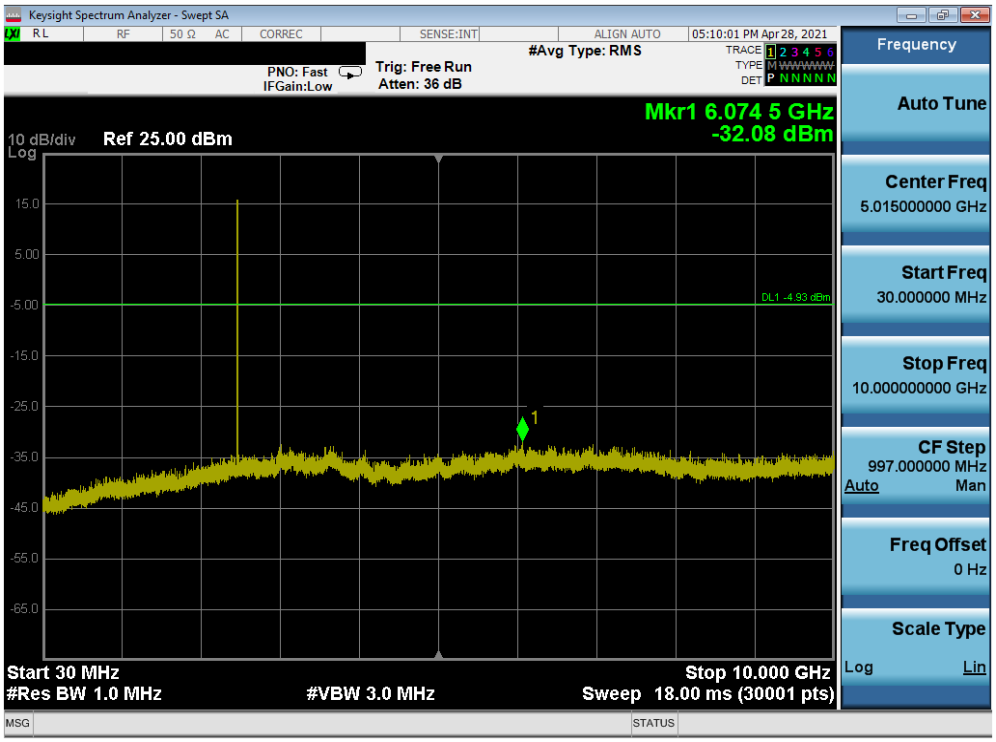
Plot 7-294. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 0, ePA) – ANT0 (Q)



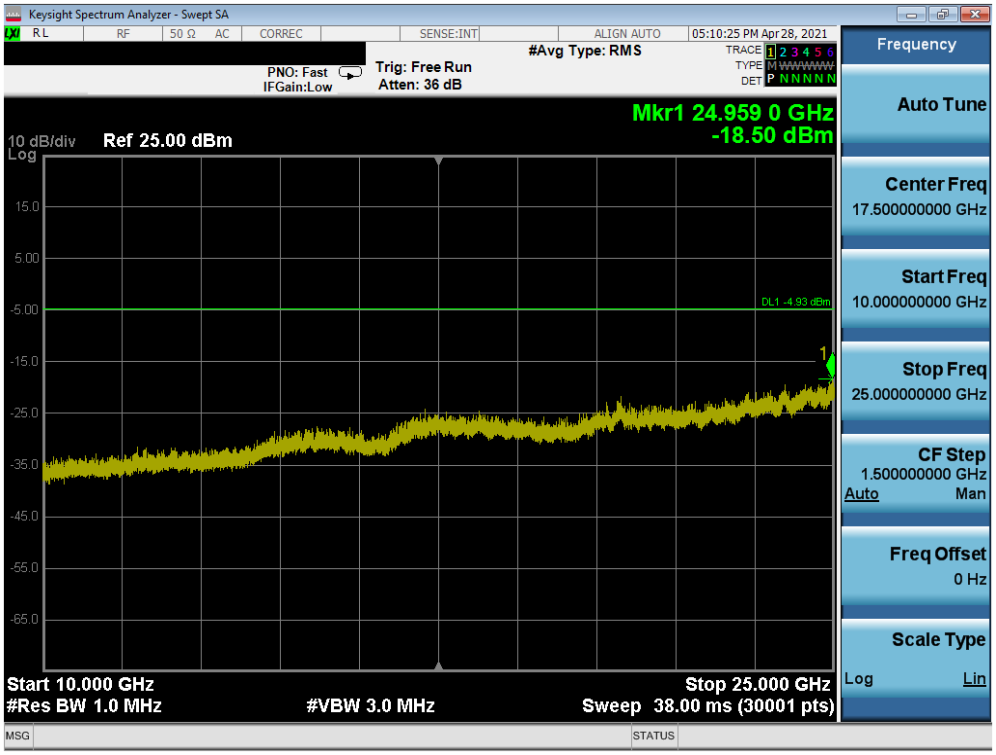
Plot 7-295. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 39, ePA) – ANT0 (Q)



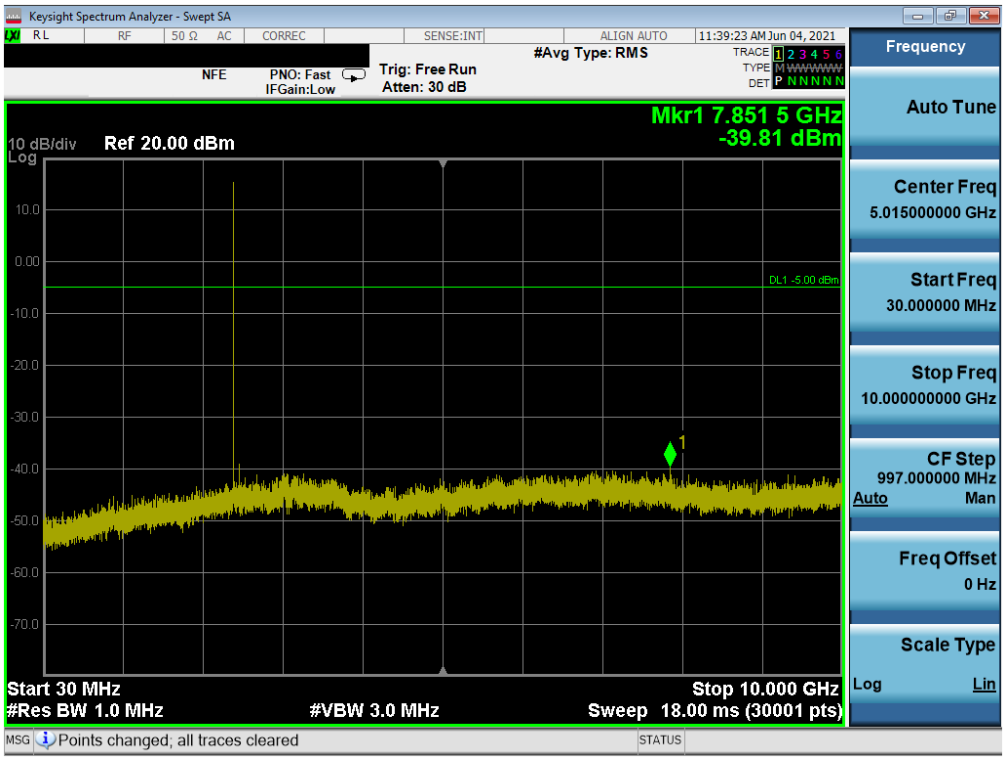
Plot 7-296. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 39, ePA) – ANT0 (Q)



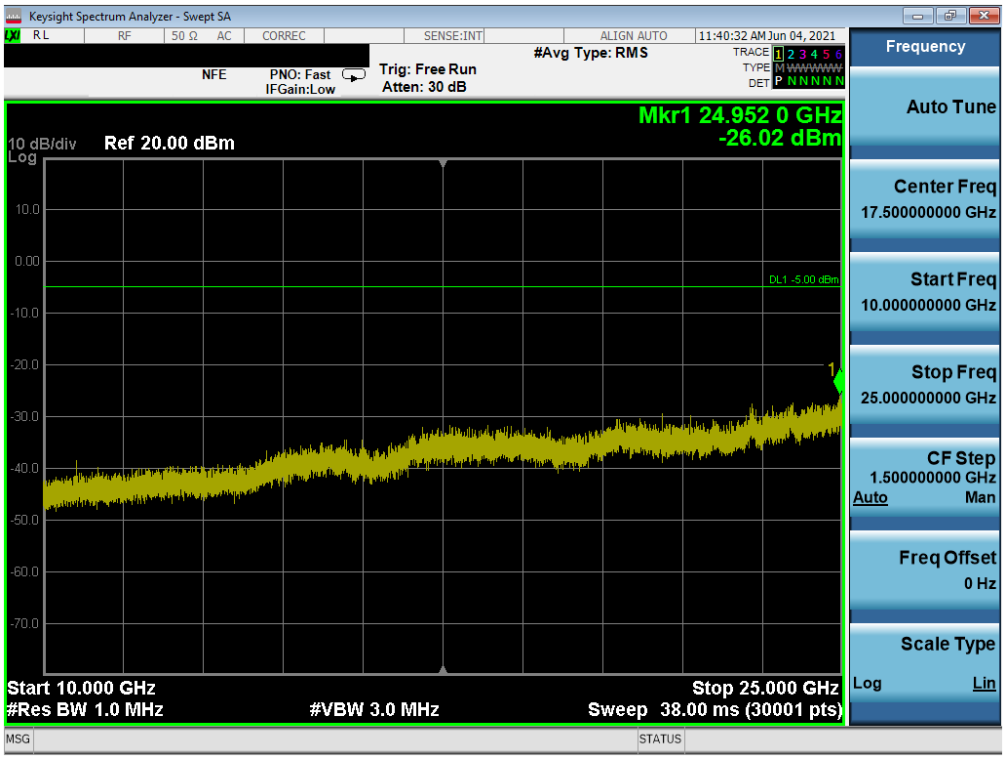
Plot 7-297. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 78, ePA) – ANT0 (Q)



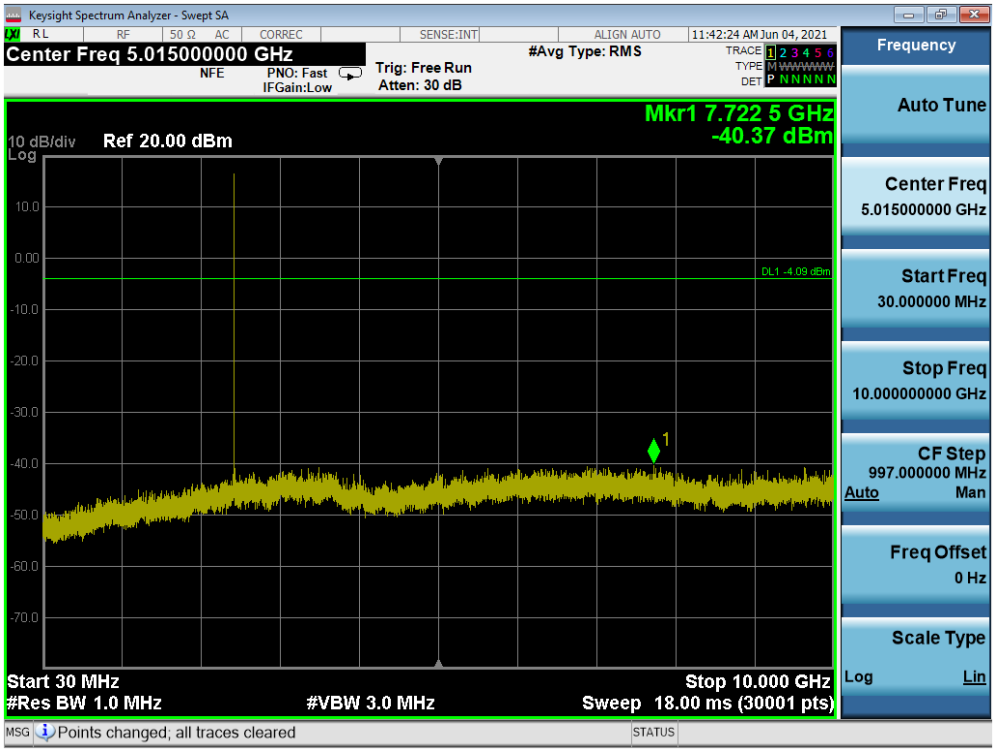
Plot 7-298. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 78, ePA) – ANT0 (Q)



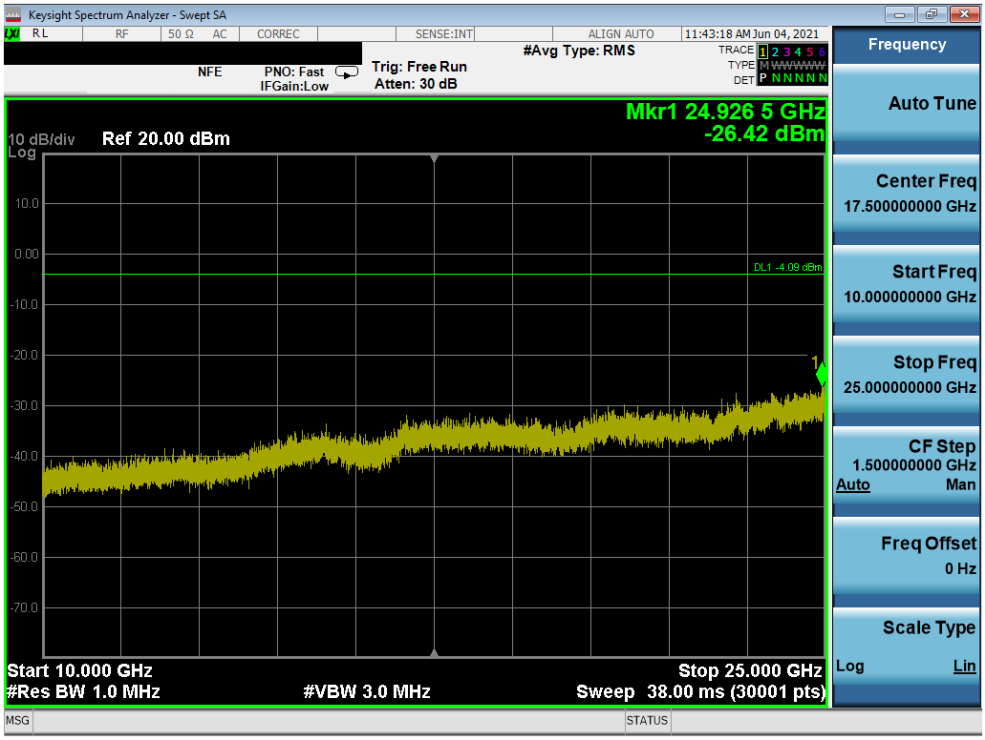
Plot 7-299. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 0, iPA) – ANT0 (Q)



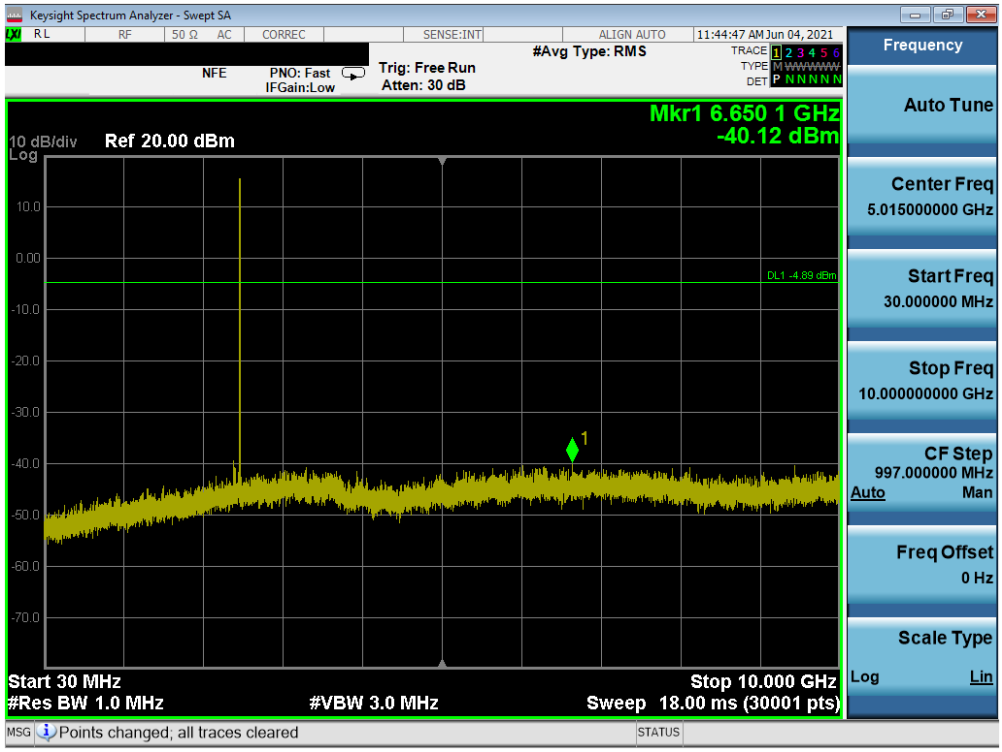
Plot 7-300. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 0, iPA) – ANT0 (Q)



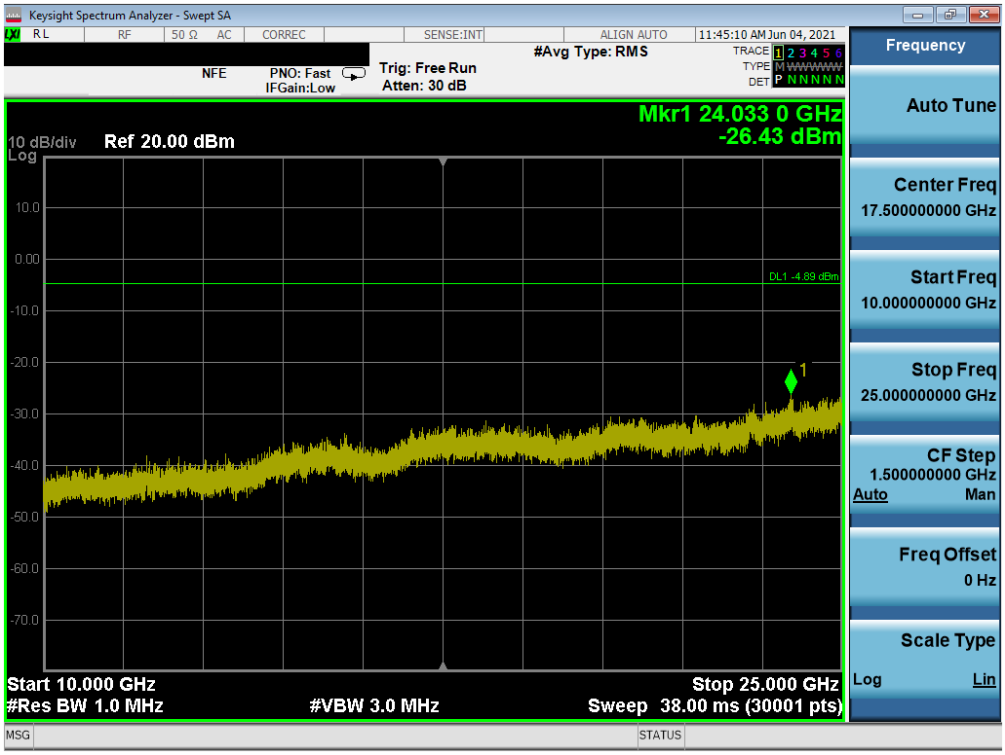
Plot 7-301. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 39, iPA) – ANT0 (Q)



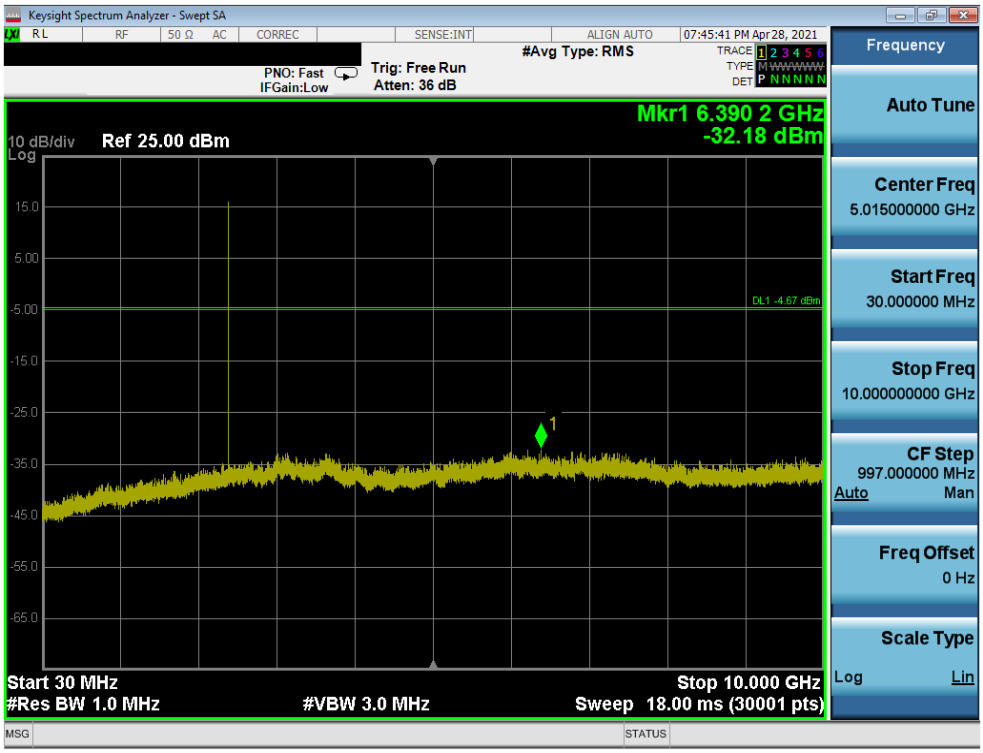
Plot 7-302. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 39, iPA) – ANT0 (Q)



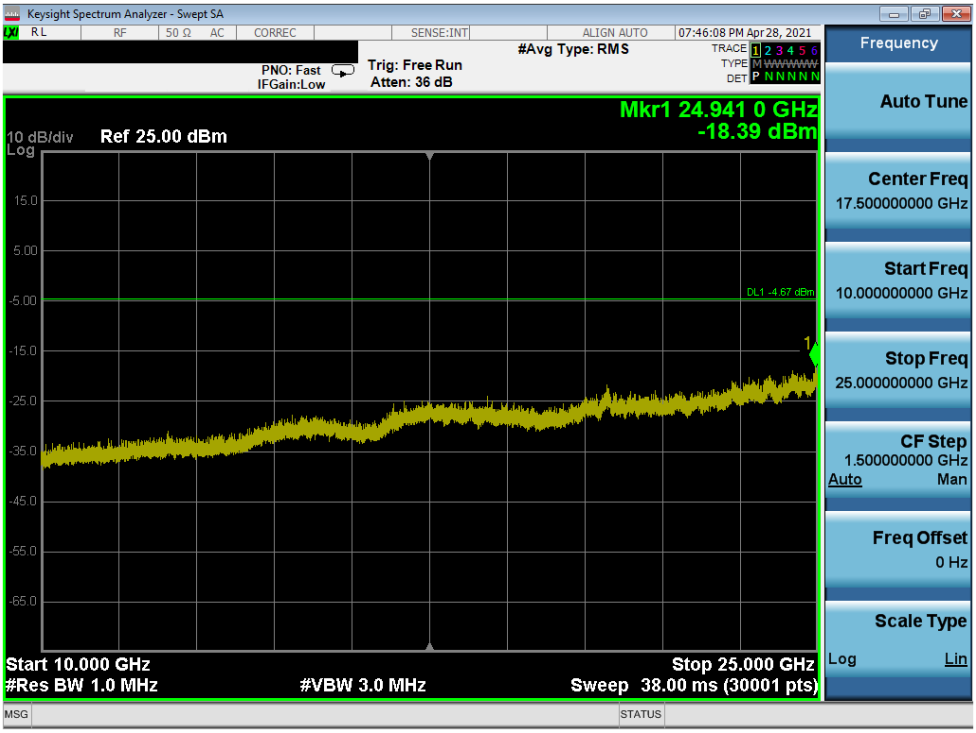
Plot 7-303. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 78, iPA) – ANT0 (Q)



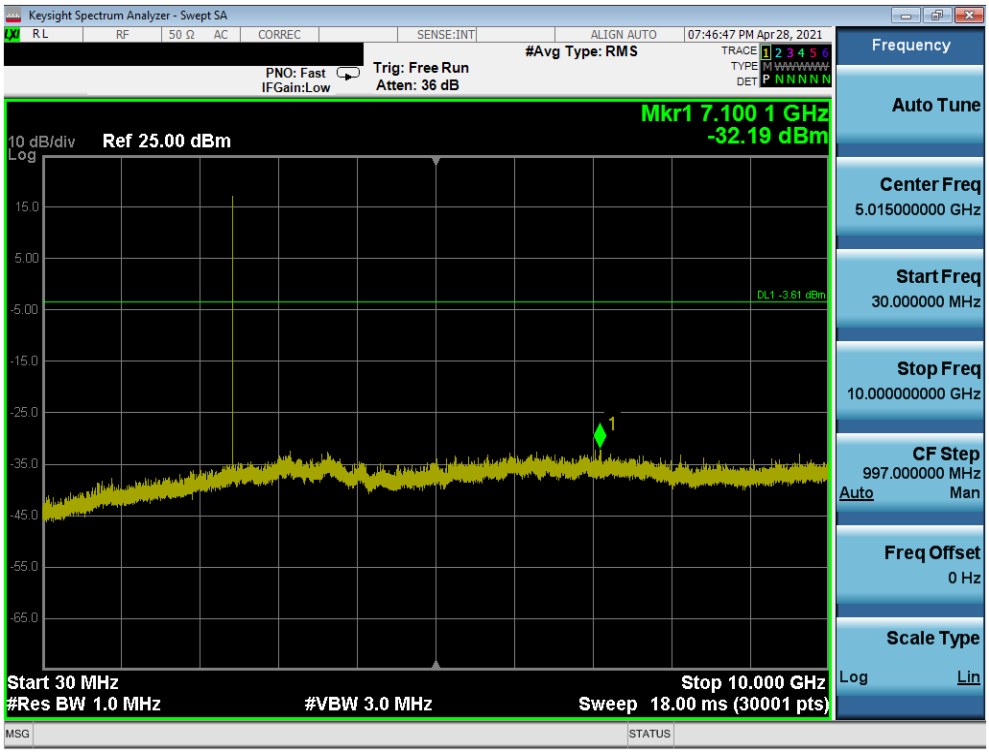
Plot 7-304. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 78, iPA) – ANT0 (Q)



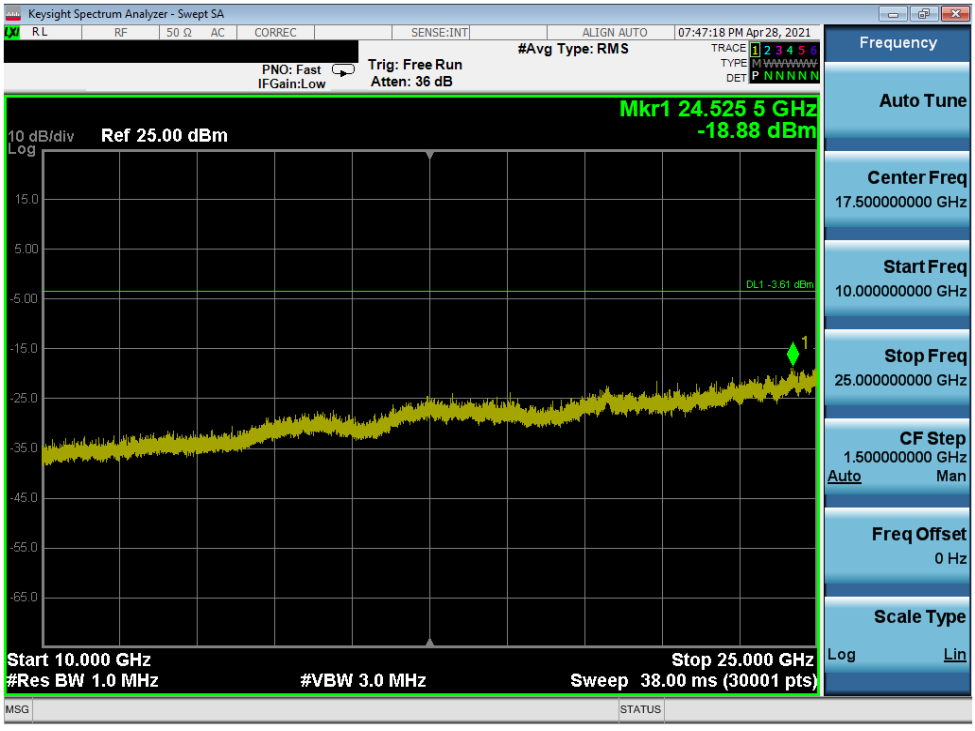
Plot 7-305. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 0, ePA) – ANT1 (N)



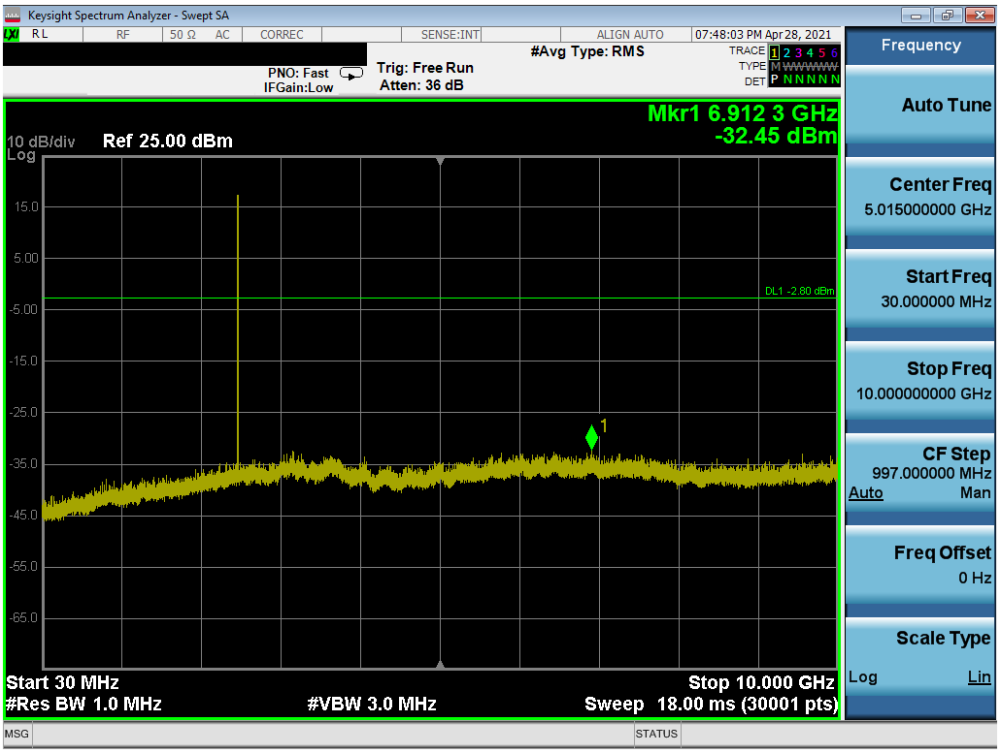
Plot 7-306. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 0, ePA) – ANT1 (N)



Plot 7-307. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 39, ePA) – ANT1 (N)

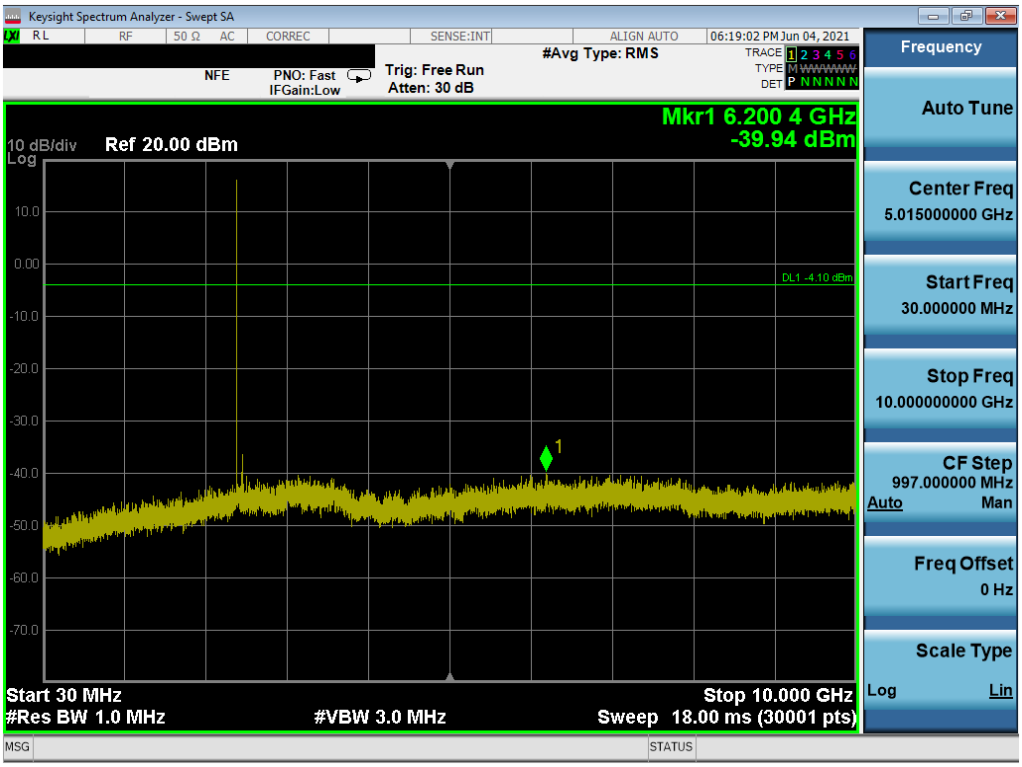


Plot 7-308. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 39, ePA) – ANT1 (N)

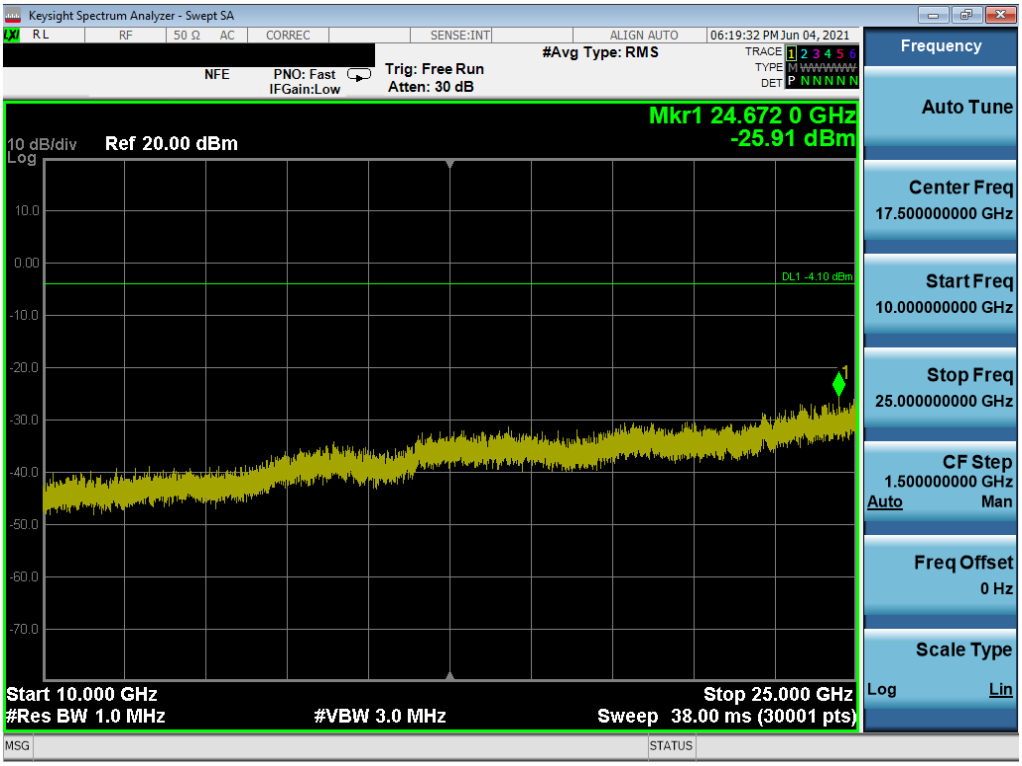


Plot 7-309. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 78, ePA) – ANT1 (N)

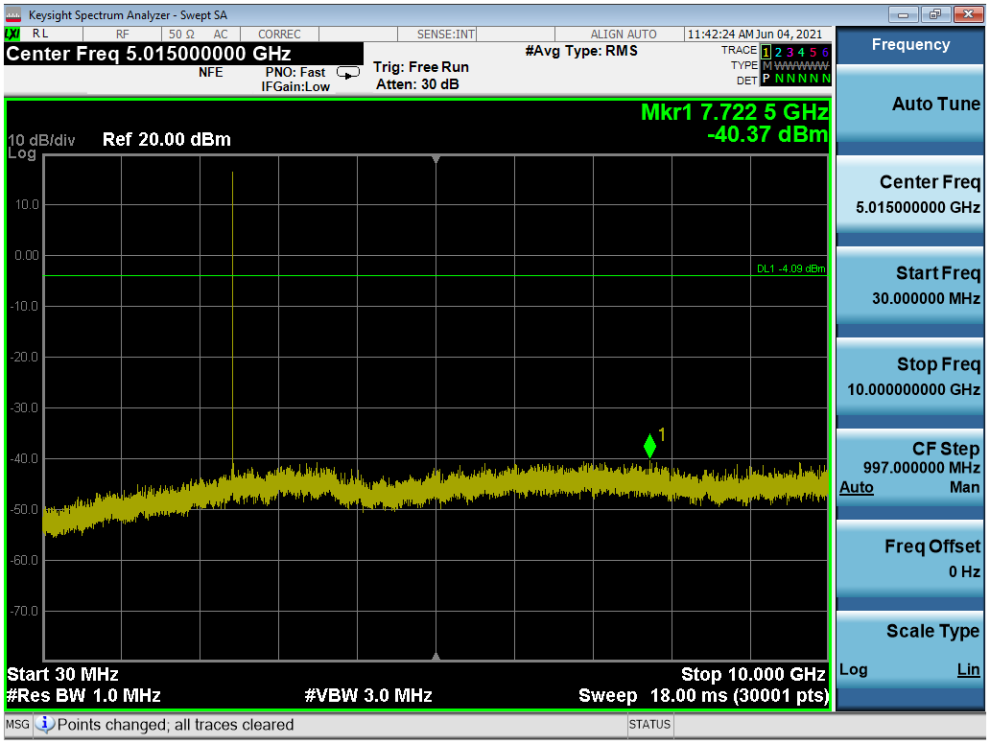
Plot 7-310. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 78, ePA) – ANT1 (N)



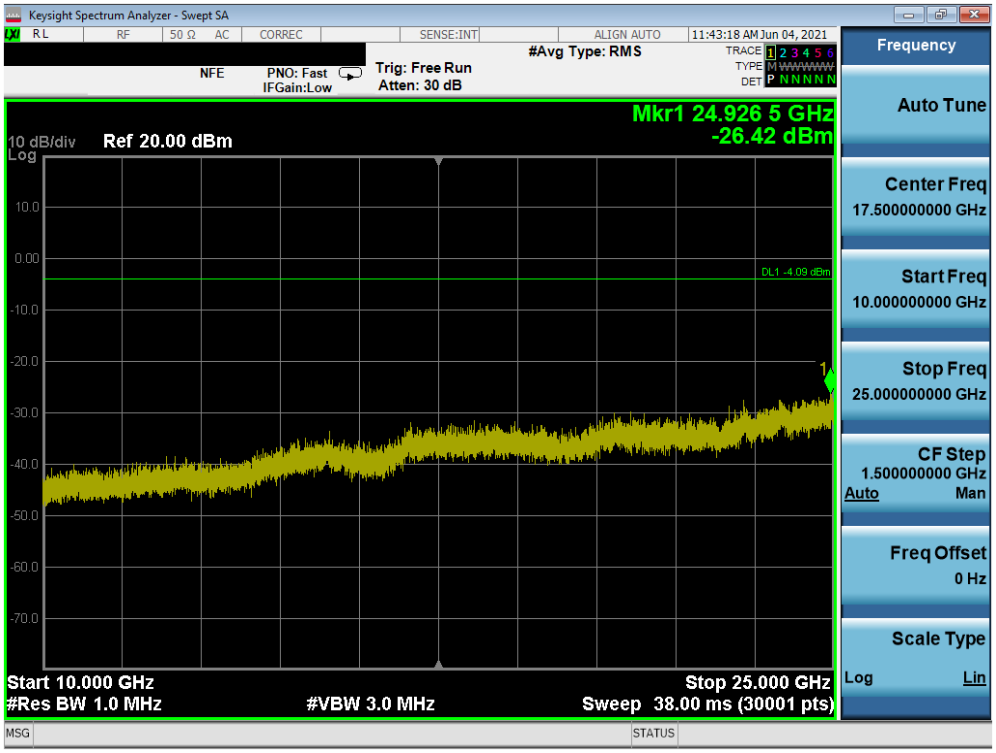
Plot 7-311. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 0, iPA) – ANT1 (N)



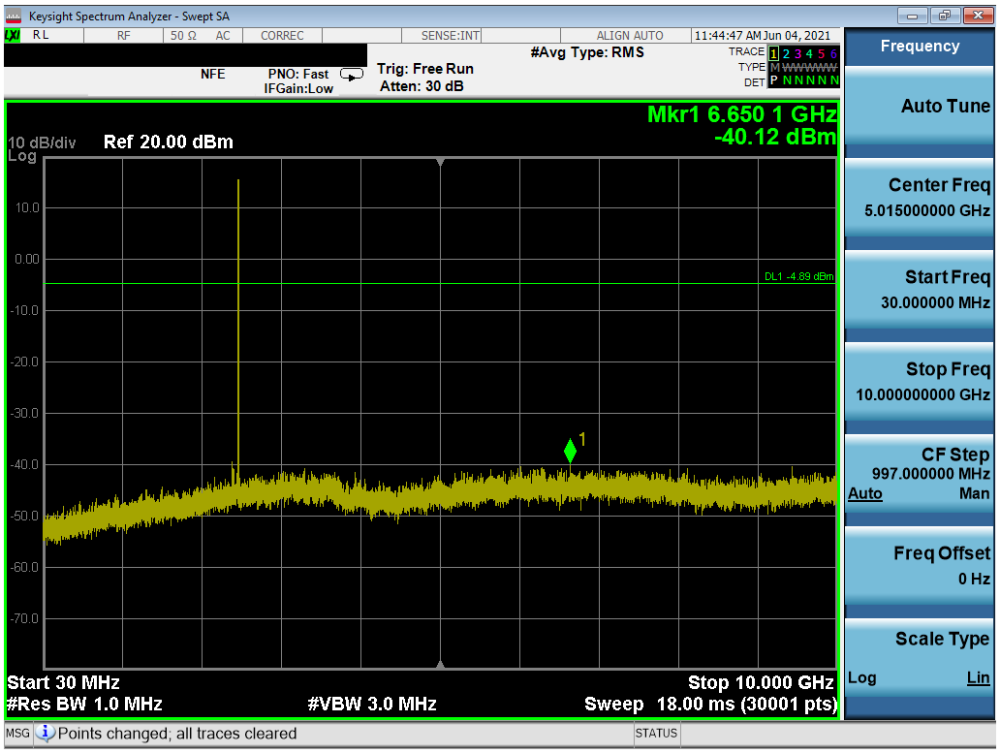
Plot 7-312. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 0, iPA) – ANT1 (N)



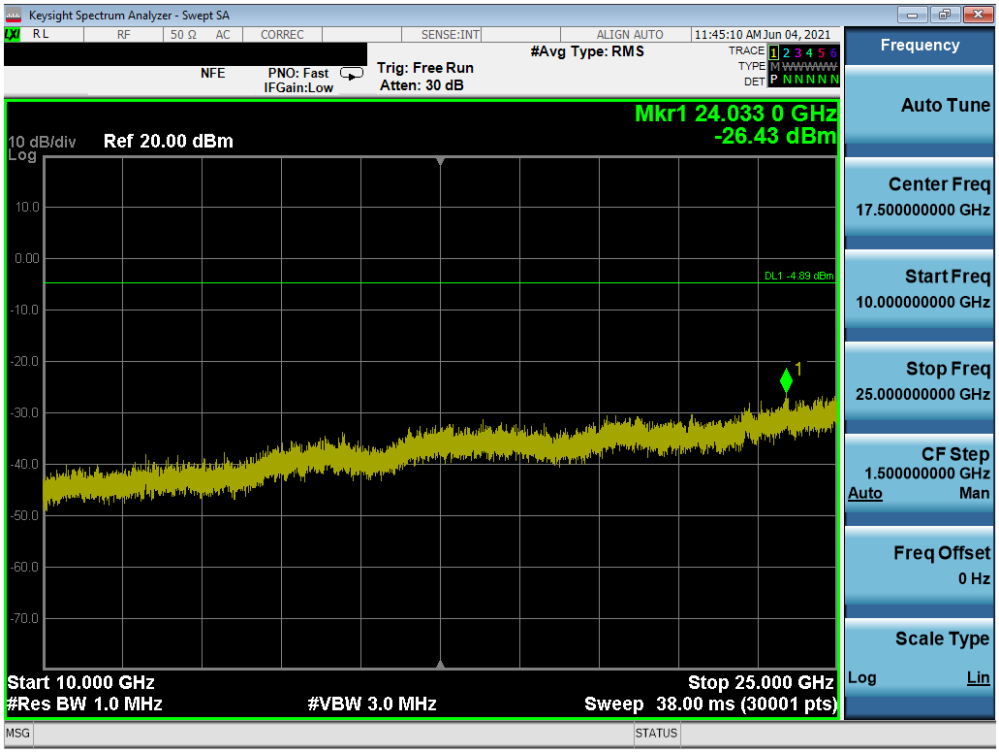
Plot 7-313. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 39, iPA) – ANT1 (N)



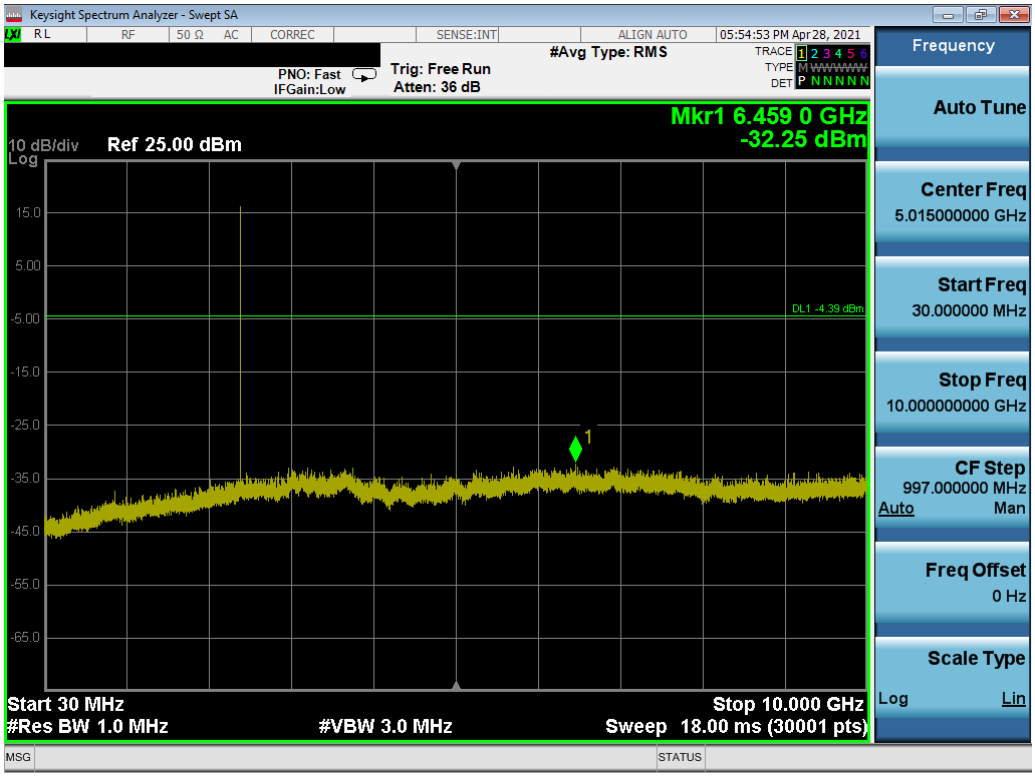
Plot 7-314. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 39, iPA) – ANT1 (N)



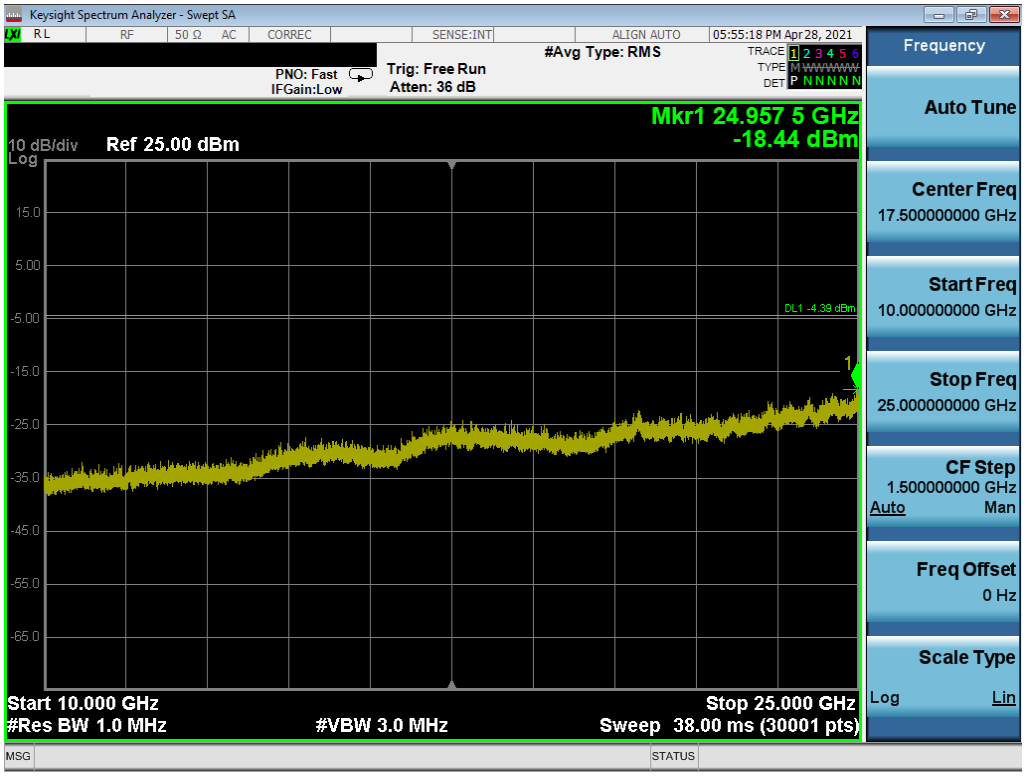
Plot 7-315. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 78, iPA) – ANT1 (N)



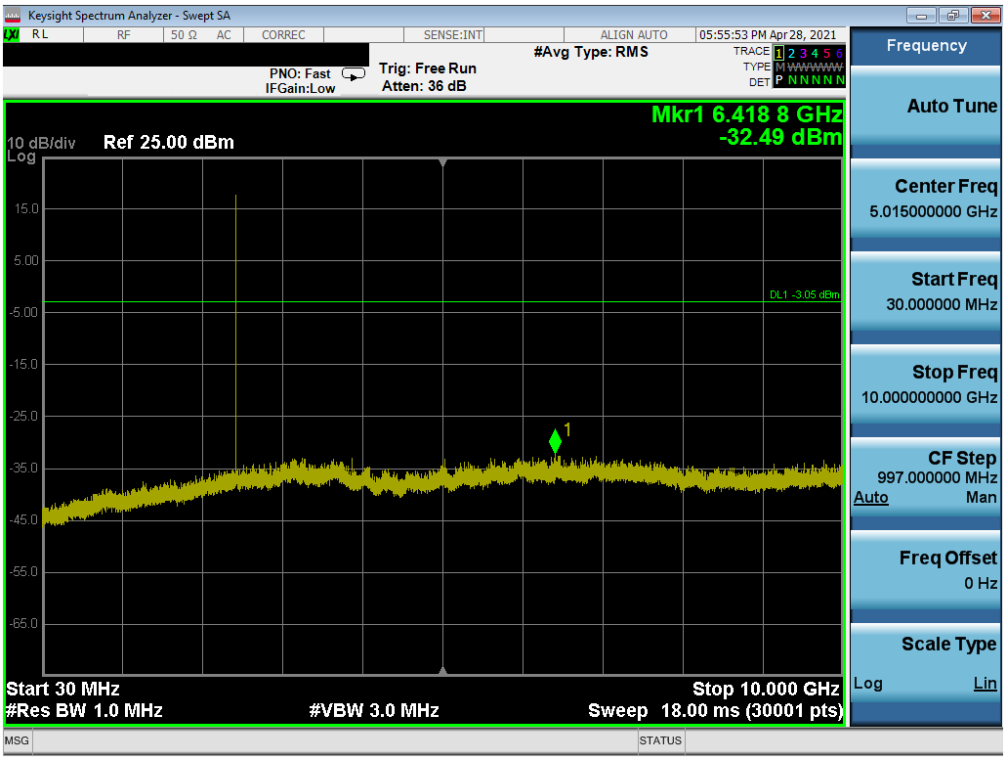
Plot 7-316. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 78, iPA) – ANT1 (N)



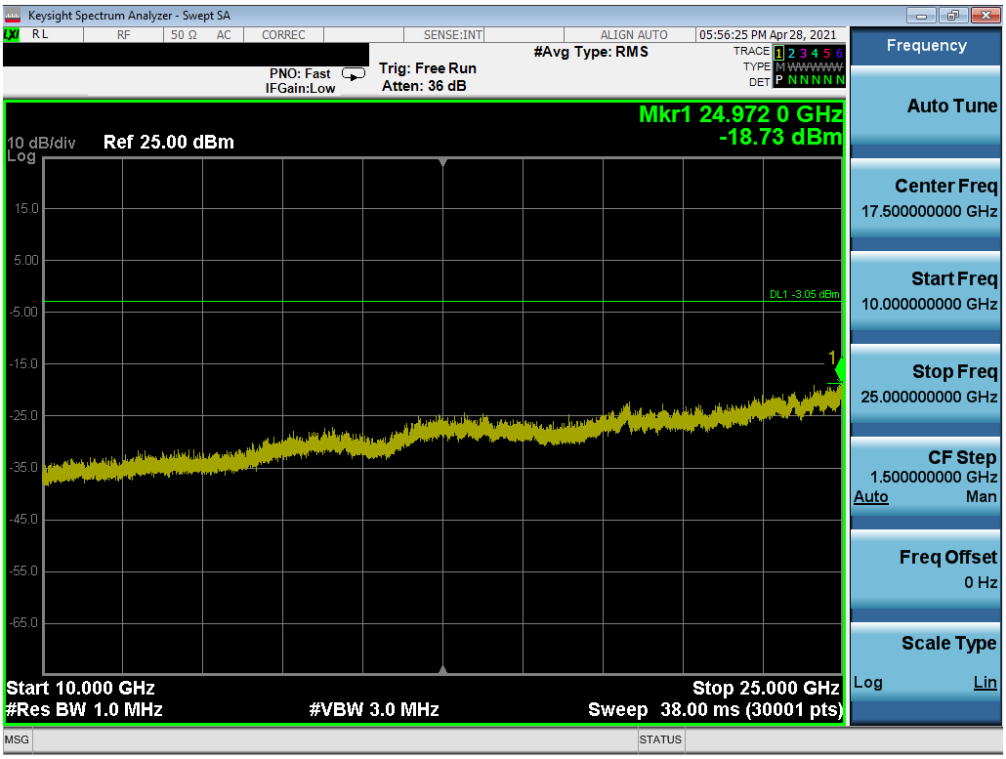
Plot 7-317. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 0, ePA) – ANT1 (Q)



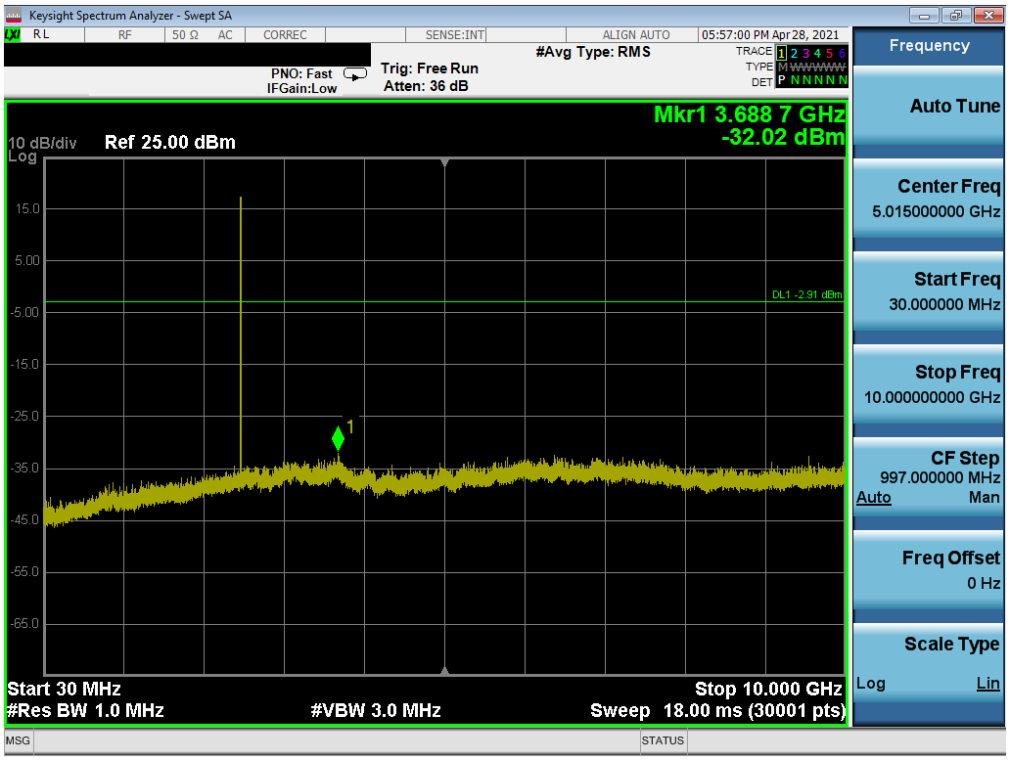
Plot 7-318. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 0, ePA) – ANT1 (Q)



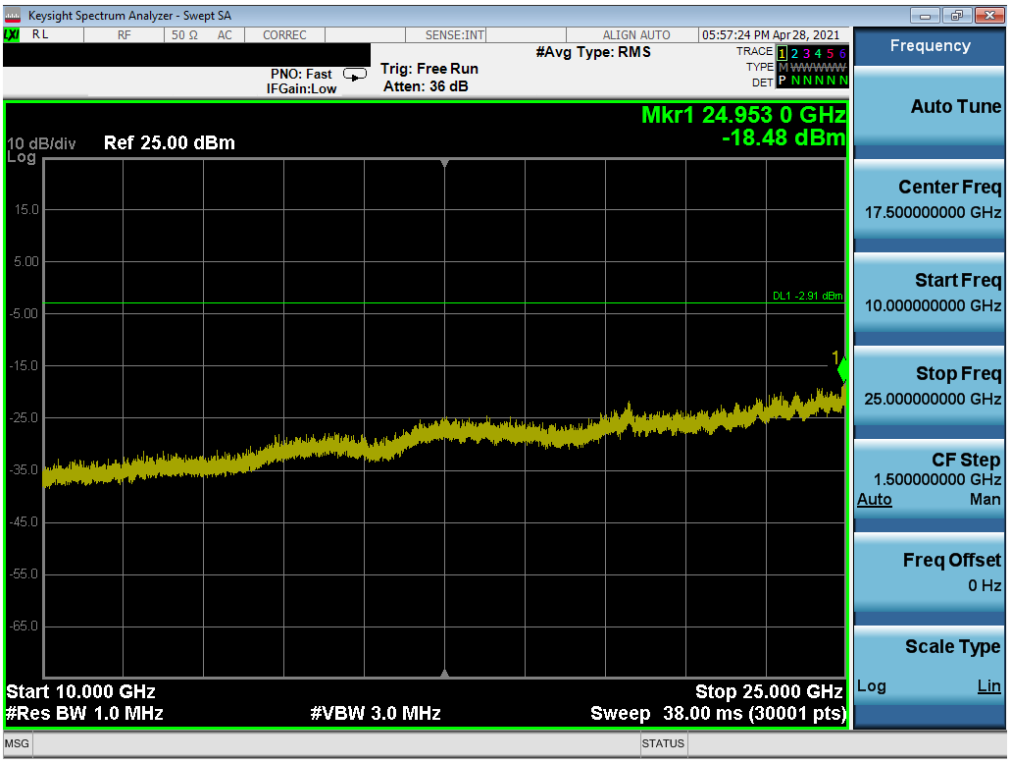
Plot 7-319. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 39, ePA) – ANT1 (Q)



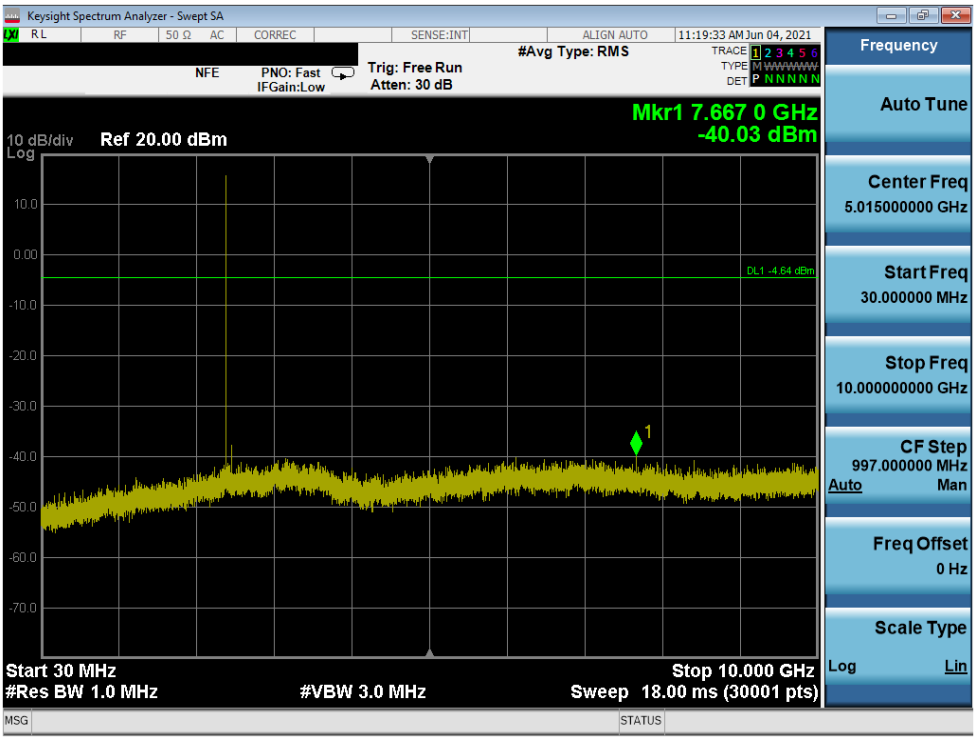
Plot 7-320. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 39, ePA) – ANT1 (Q)



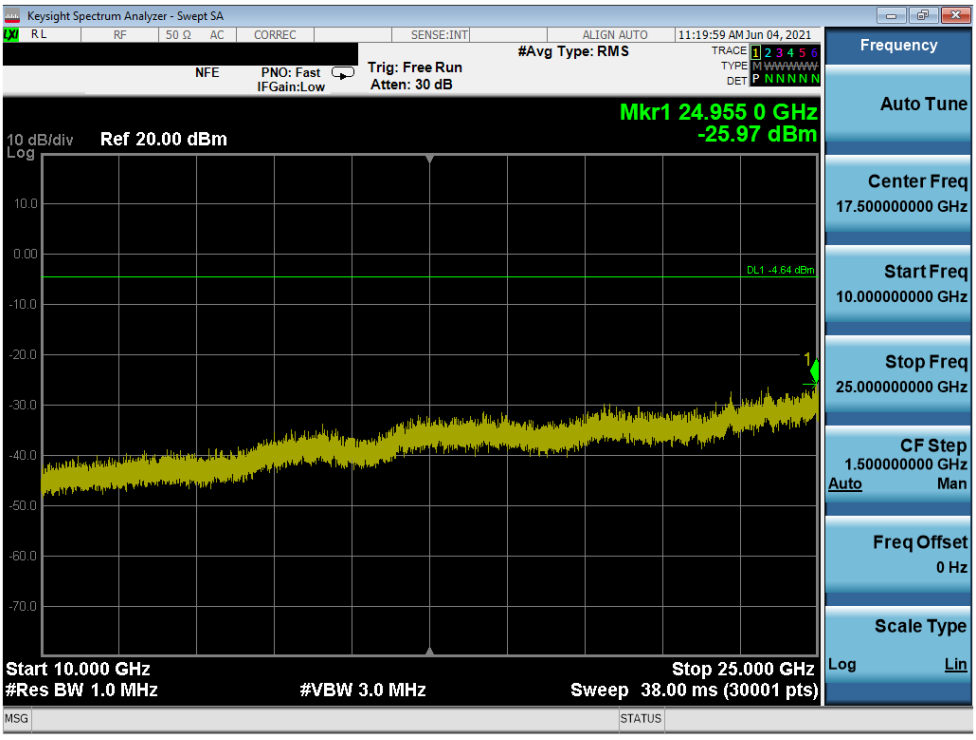
Plot 7-321. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 78, ePA) – ANT1 (Q)



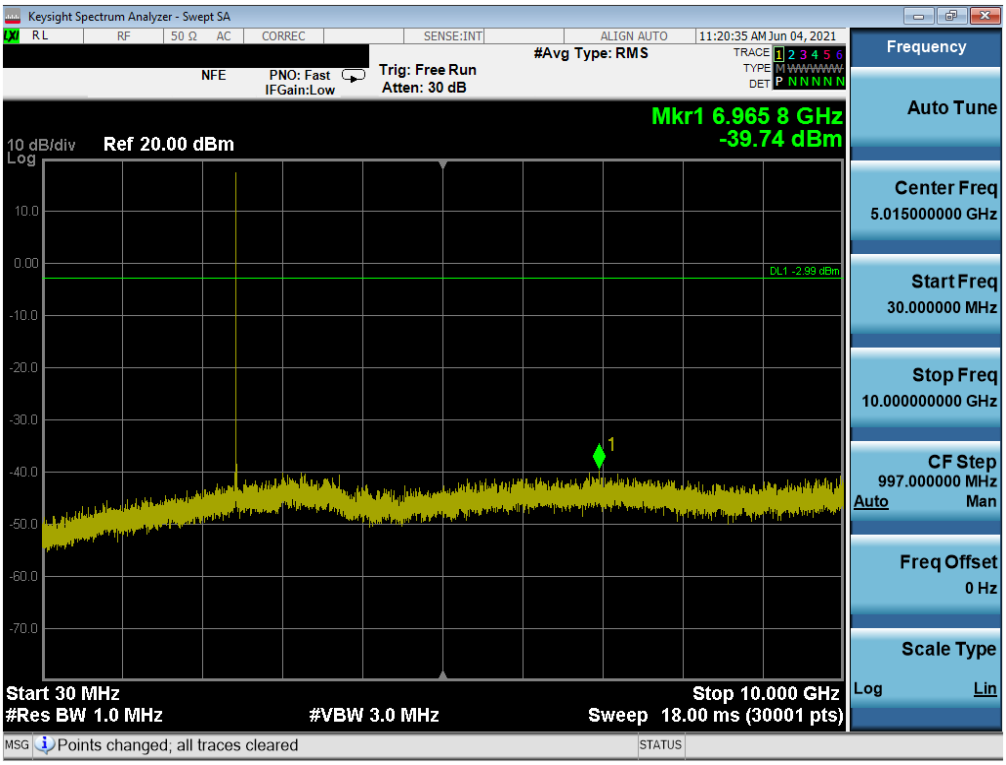
Plot 7-322. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 78, ePA) – ANT1 (Q)



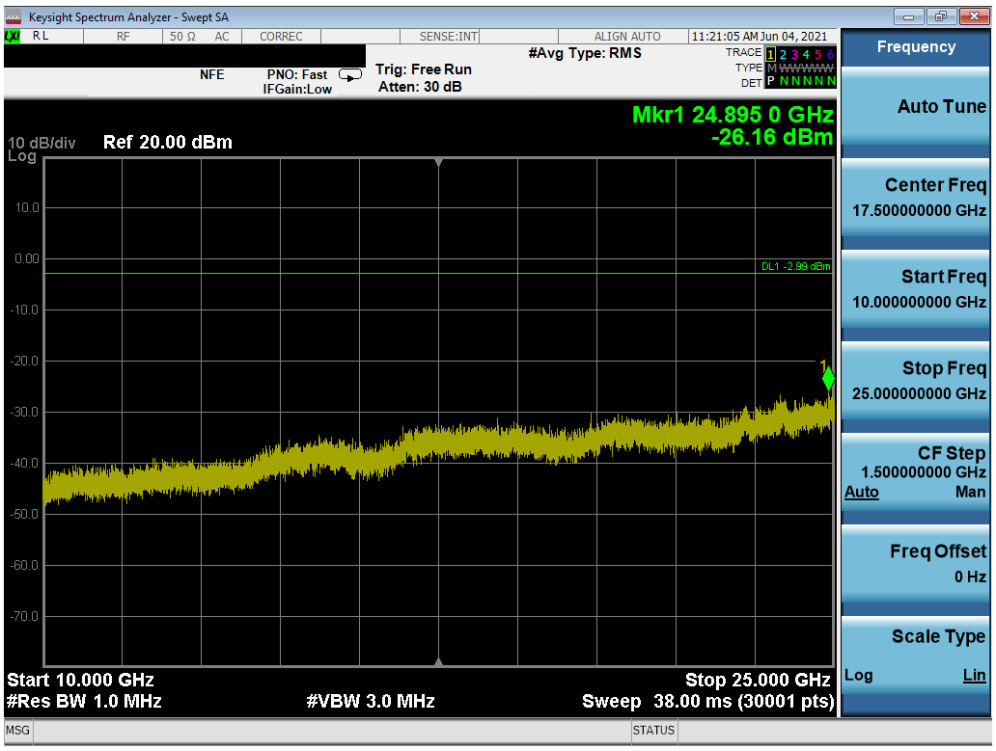
Plot 7-323. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 0, iPA) – ANT1 (Q)



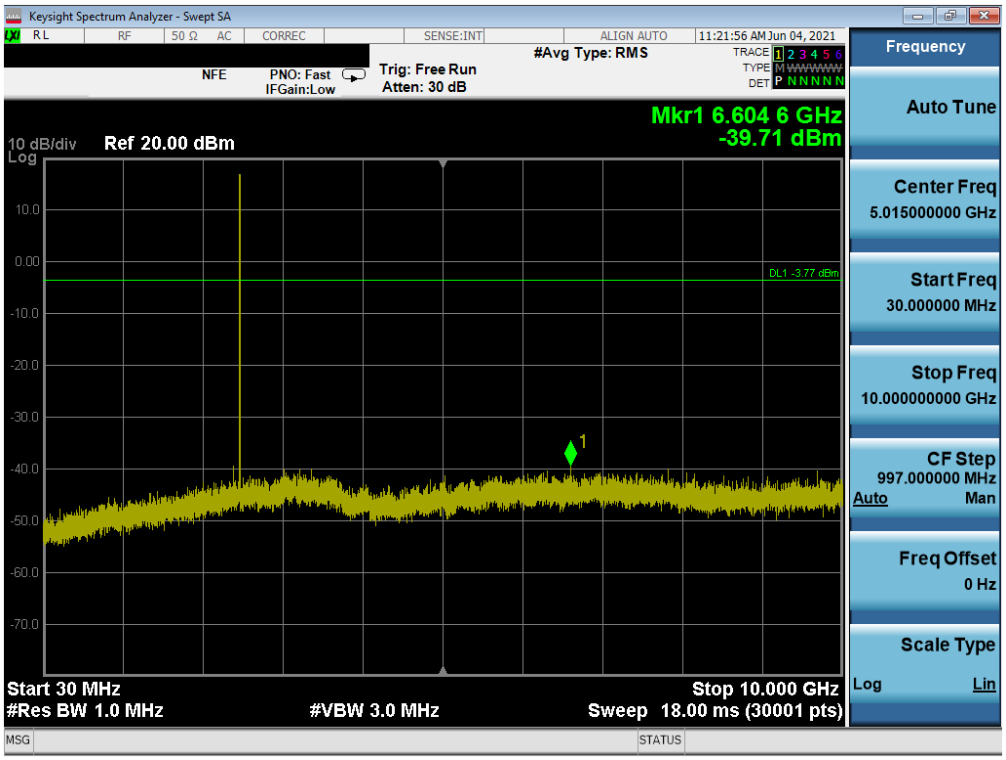
Plot 7-324. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 0, iPA) – ANT1 (Q)



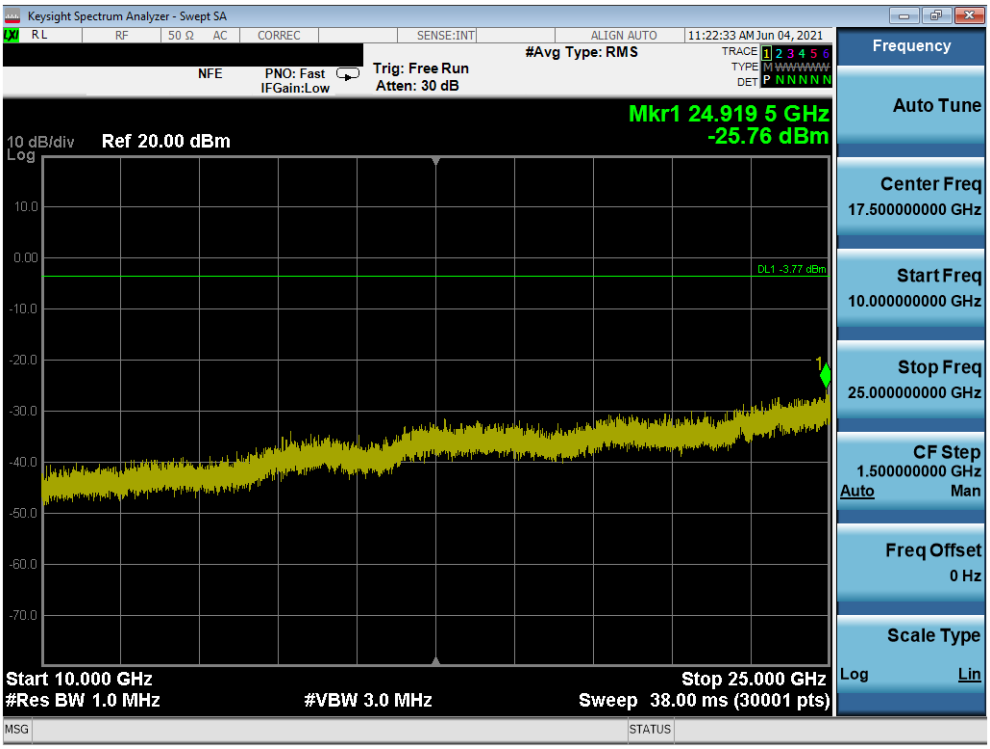
Plot 7-325. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 39, iPA) – ANT1 (Q)



Plot 7-326. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 39, iPA) – ANT1 (Q)



Plot 7-327. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 78, iPA) – ANT1 (Q)



Plot 7-328. Conducted Spurious Plot (Bluetooth, 1Mbps – Ch. 78, iPA) – ANT1 (Q)

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 7-10 per Section 15.209 and RSS-Gen (8.9).

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

Table 7-10. 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 7-11 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 7-11. RBW as a Function of Frequency

Test Setup

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

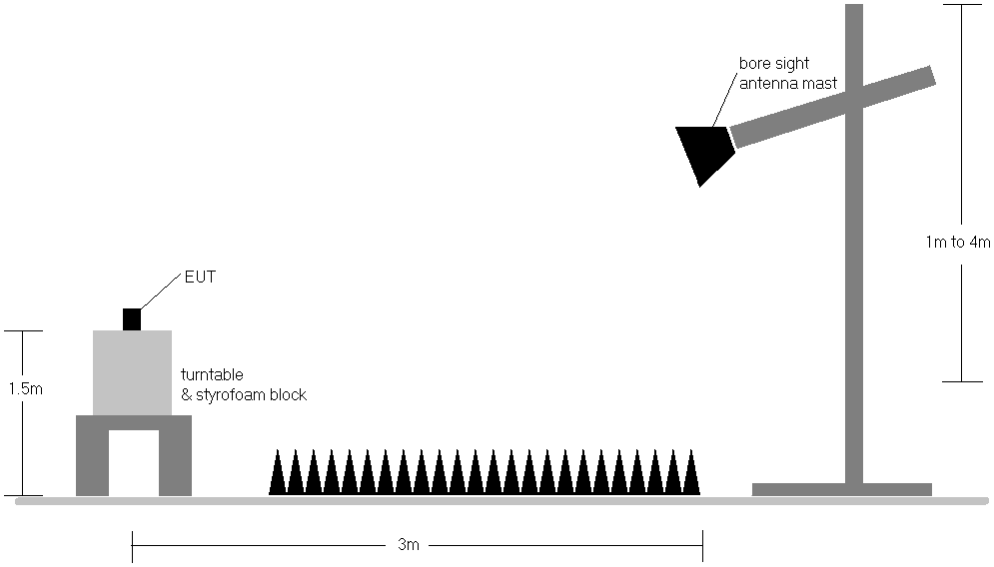


Figure 7-8. Radiated Test Setup >1GHz

Test Notes

1. All emissions lying in restricted bands specified in §15.205 and Section 8.10 of RSS-Gen are below the limit shown in Table 7-10.
2. No significant radiated emissions were found in the 2310 - 2390MHz restricted band.
3. The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
4. This unit was tested with its standard battery.
5. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported.
6. The duty cycle correction factor was not applied to noise floor measurements.
7. 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.
8. The "-" shown in the following RSE tables are used to denote a noise floor measurement.

9. This device will be manufactured using two different WIFI chipsets (N and Q) and each chipset supports two configurations: one is with screen open, and one is with screen closed. Both configurations for each chipset are tested, and the worst case radiated emissions data is shown in this report.

Sample Calculation

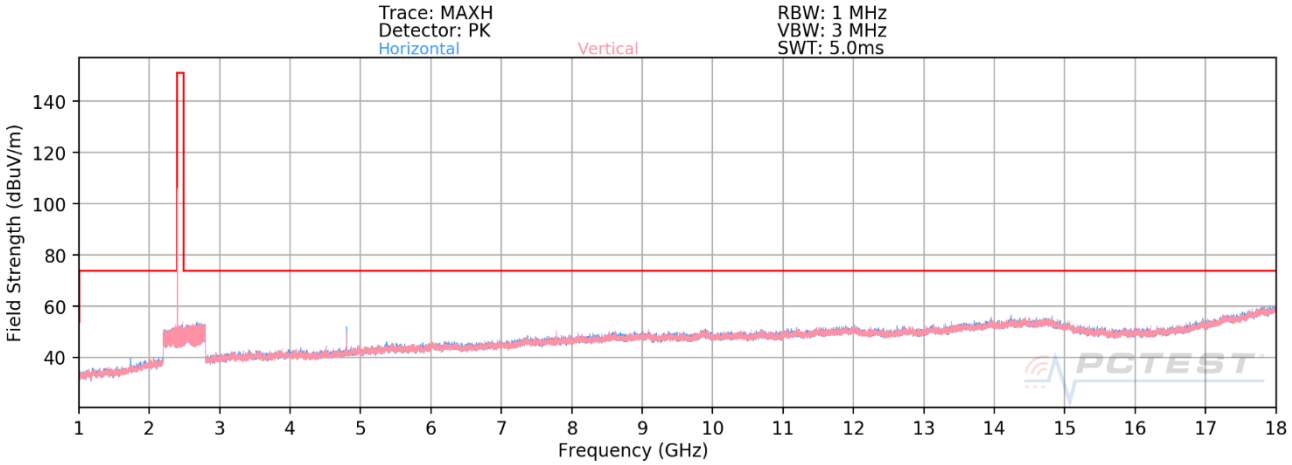
- Field Strength Level $_{[dB\mu V/m]}$ = Analyzer Level $_{[dBm]}$ + 107 + AFCL $_{[dB/m]}$ + Duty Cycle Correction $_{[dB]}$
- AFCL $_{[dB/m]}$ = Antenna Factor $_{[dB/m]}$ + Cable Loss $_{[dB]}$
- Margin $_{[dB]}$ = Field Strength Level $_{[dB\mu V/m]}$ – Limit $_{[dB\mu V/m]}$

Duty Cycle Correction Factor Calculation

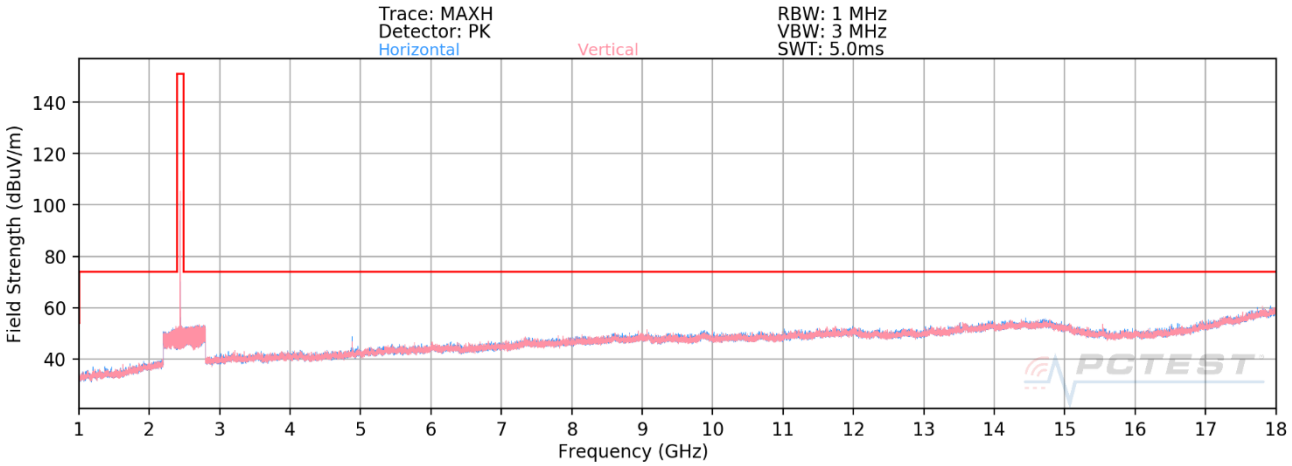
- Channel hop rate = 800 hops/second (AFH Mode)
- Adjusted channel hop rate for DH5 mode **=** 133.33 hops/second
- Time per channel hop **=** 1 / 133.33 hops/second = 7.50 ms
- Time to cycle through all channels = 7.50 x 20 channels = 150 ms
- Number of times transmitter hits on one channel = 100 ms / 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

Radiated Spurious Emission Measurements

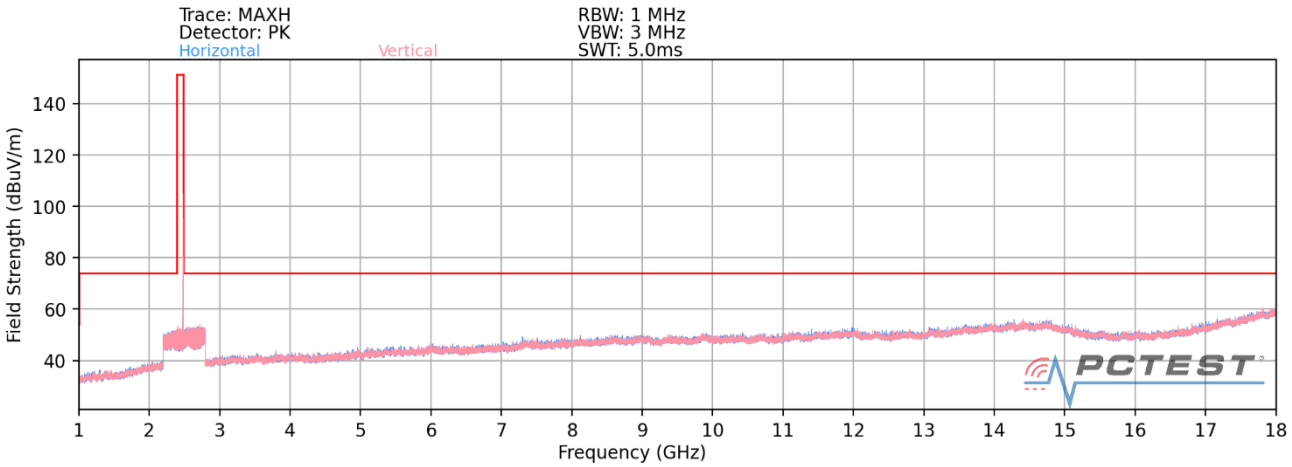
§15.205 §15.209 §15.247 (d); RSS-Gen [8.9]



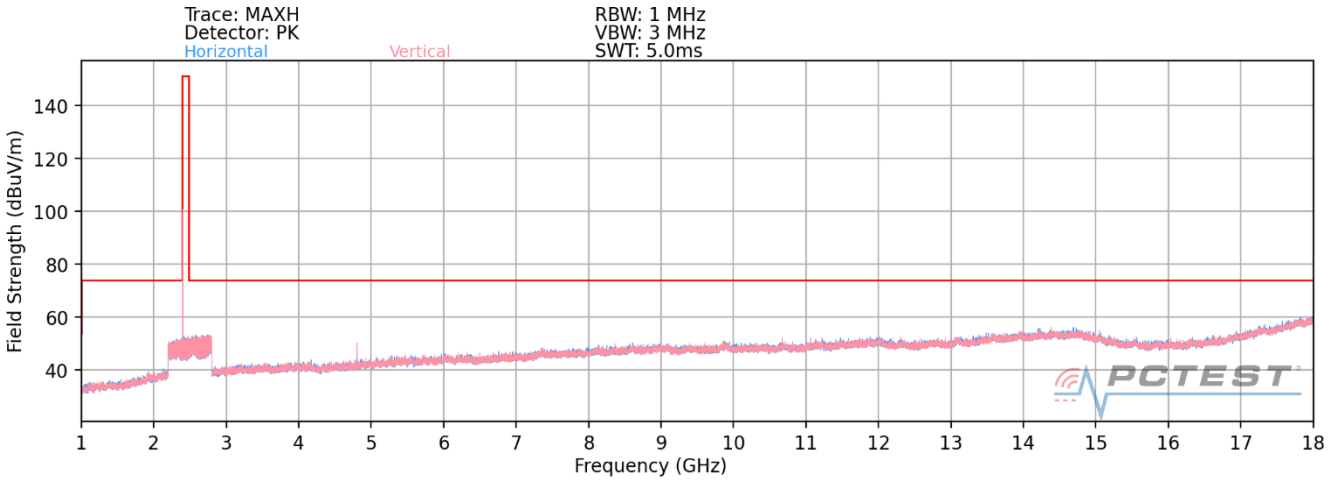
Plot 7-329. Radiated Spurious Plot above 1GHz (BT– Ch. 0) – OPEN (N)



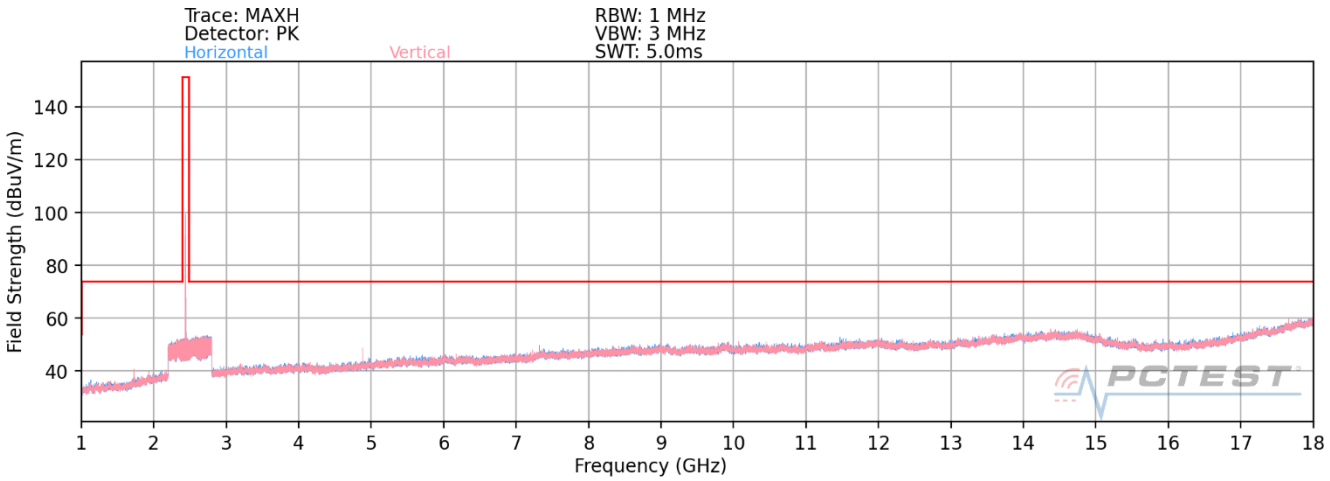
Plot 7-330. Radiated Spurious Plot above 1GHz (BT– Ch. 39) -- OPEN (N)



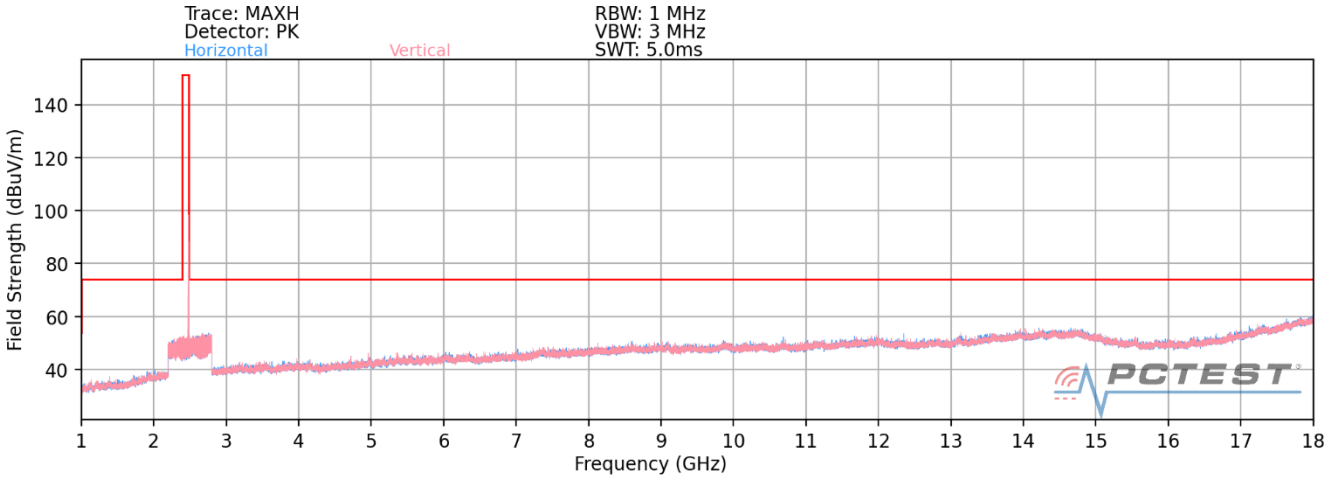
Plot 7-331. Radiated Spurious Plot above 1GHz (BT– Ch. 78) – OPEN (N)



Plot 7-332. Radiated Spurious Plot above 1GHz (BT– Ch. 0) -- CLOSED (N)



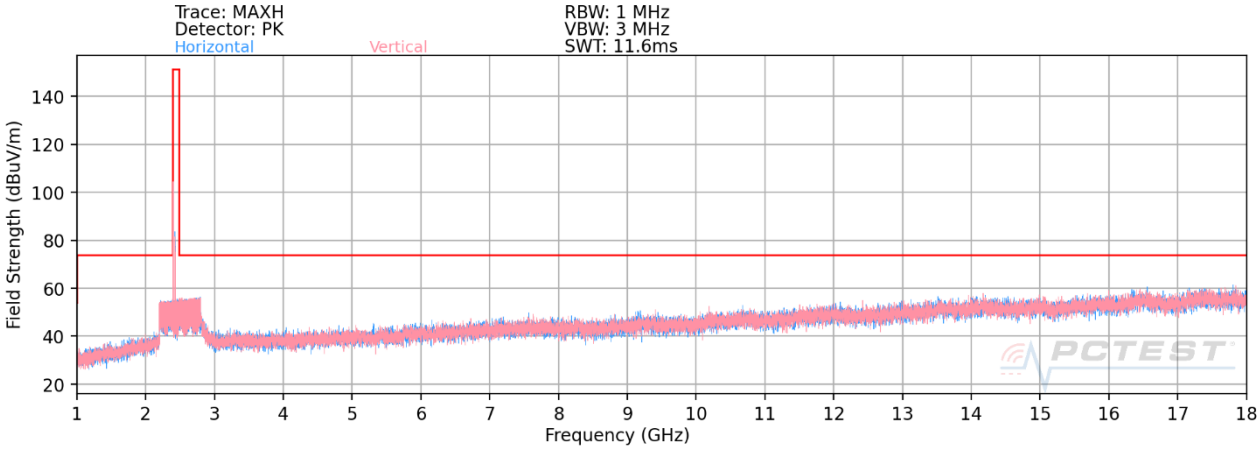
Plot 7-333. Radiated Spurious Plot above 1GHz (BT– Ch. 39) -- CLOSED (N)



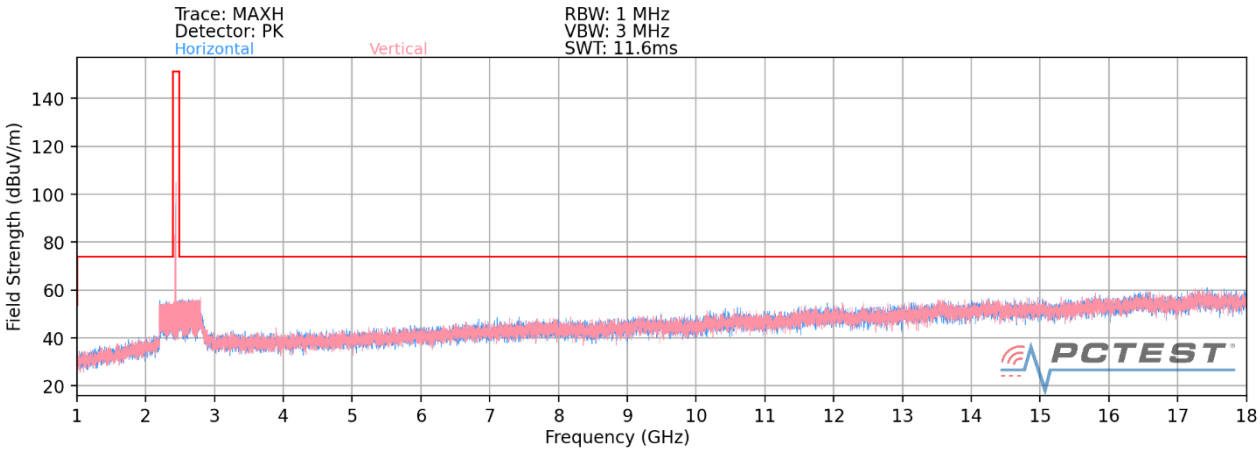
Plot 7-334. Radiated Spurious Plot above 1GHz (BT– Ch. 78) -- CLOSED (N)

Radiated Spurious Emission Measurements

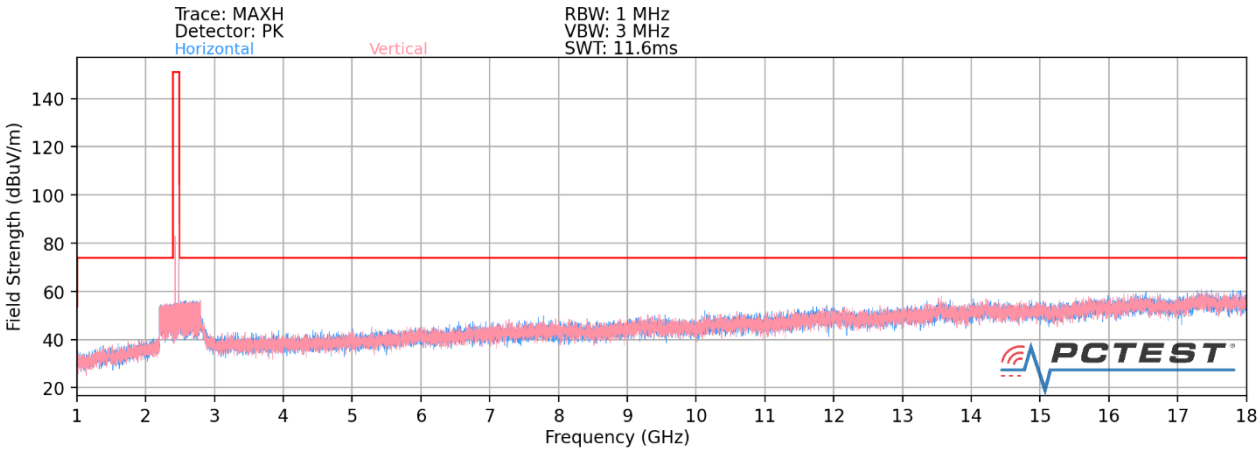
§15.205 §15.209 §15.247 (d); RSS-Gen [8.9]



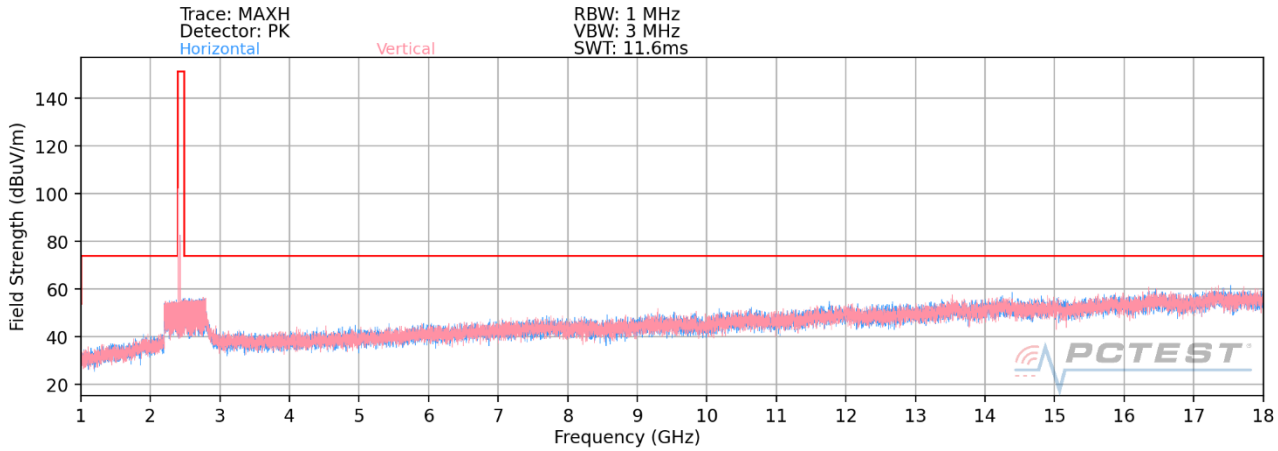
Plot 7-335. Radiated Spurious Plot above 1GHz (BT– Ch. 0) – OPEN (Q)



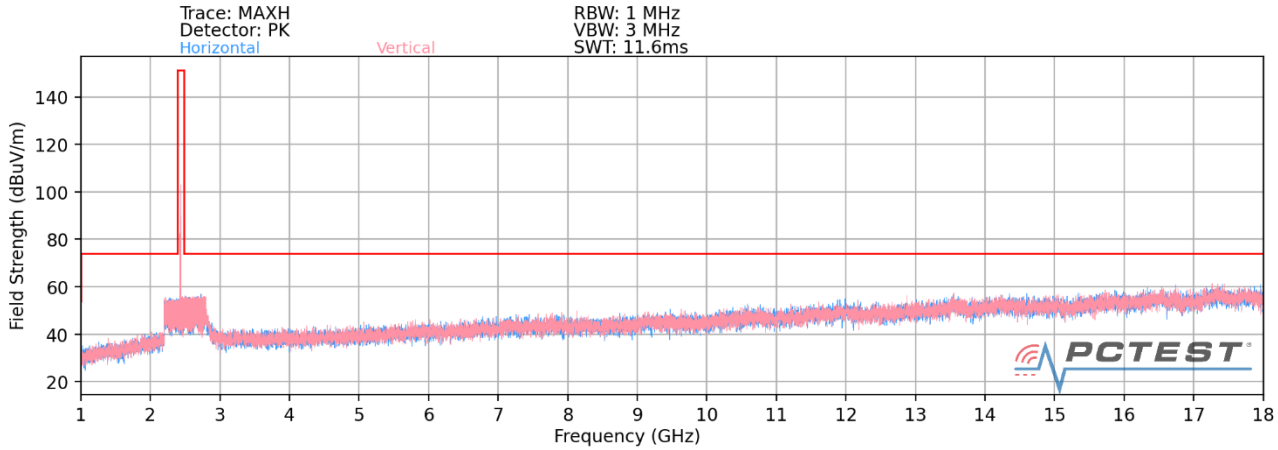
Plot 7-336. Radiated Spurious Plot above 1GHz (BT– Ch. 39) – OPEN (Q)



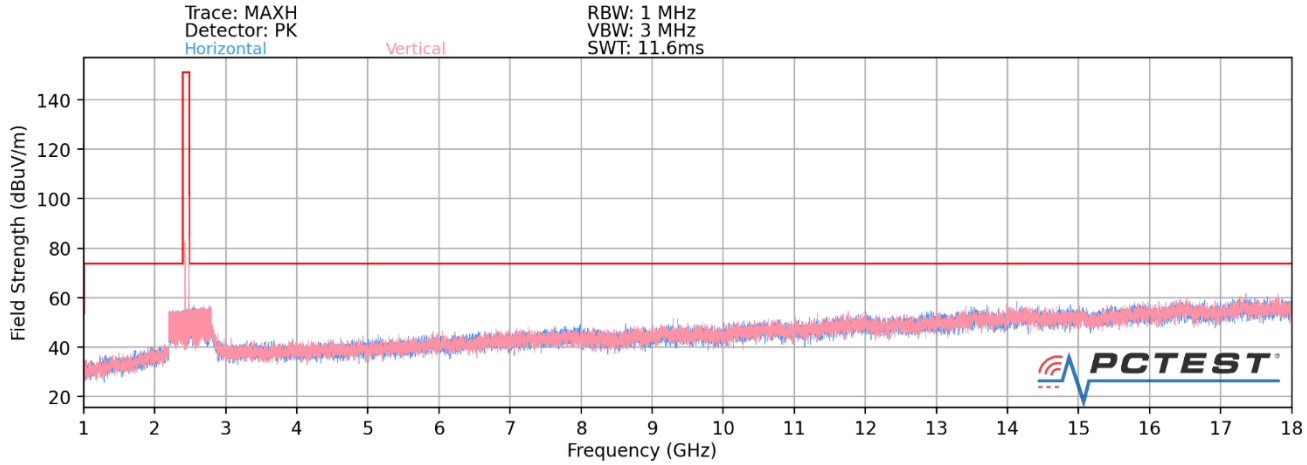
Plot 7-337. Radiated Spurious Plot above 1GHz (BT– Ch. 78) – OPEN (Q)



Plot 7-338. Radiated Spurious Plot above 1GHz (BT– Ch. 0) – CLOSED (Q)



Plot 7-339. Radiated Spurious Plot above 1GHz (BT– Ch. 39) – CLOSED (Q)



Plot 7-340. Radiated Spurious Plot above 1GHz (BT– Ch. 78) – CLOSED (Q)