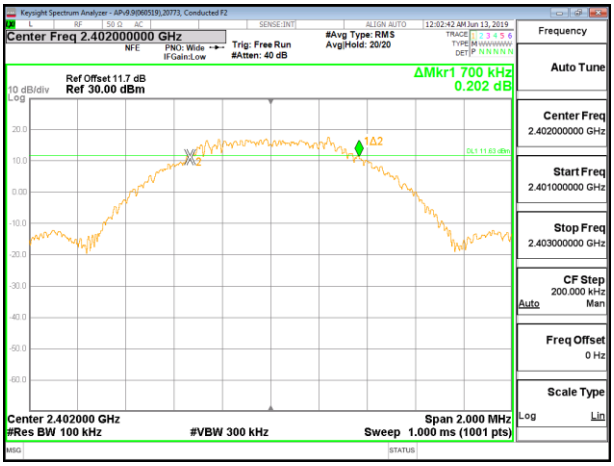
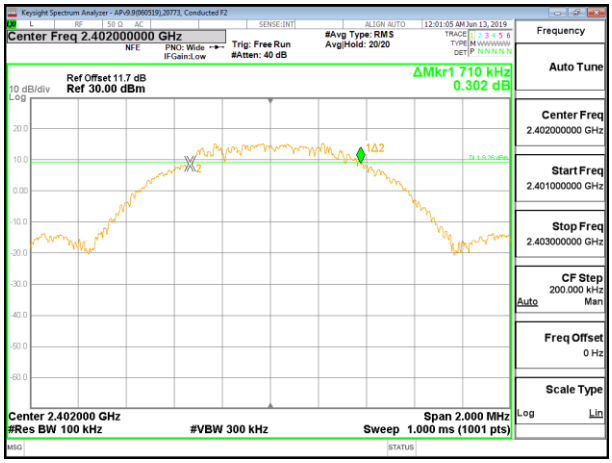
8.5. BEAMFORMING, 6dB BANDWIDTH

8.5.1. HIGH POWER BLE (1Mbps)

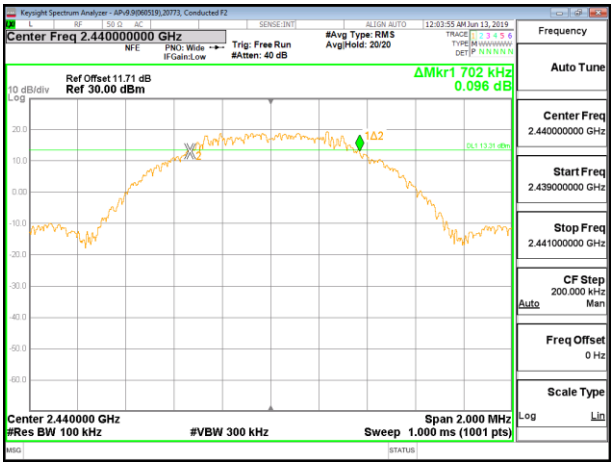
Channel	Frequency (MHz)	6dB Bandwidth ANT 4 (MHz)	6dB Bandwidth ANT 3 (MHz)
Low	2402	0.7000	0.7100
Mid	2440	0.7020	0.7360
High	2480	0.6760	0.6780



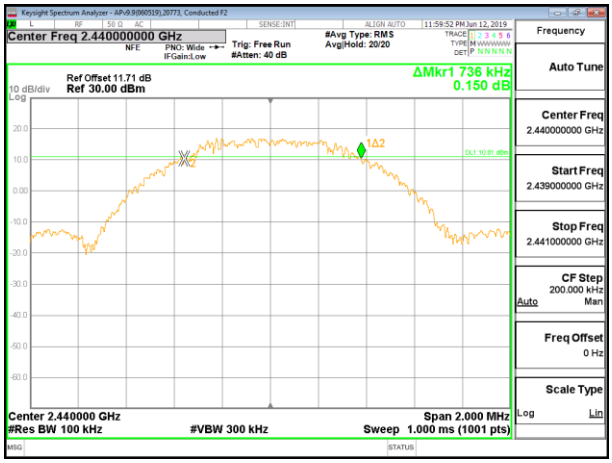
LOW CHANNEL ANT 4



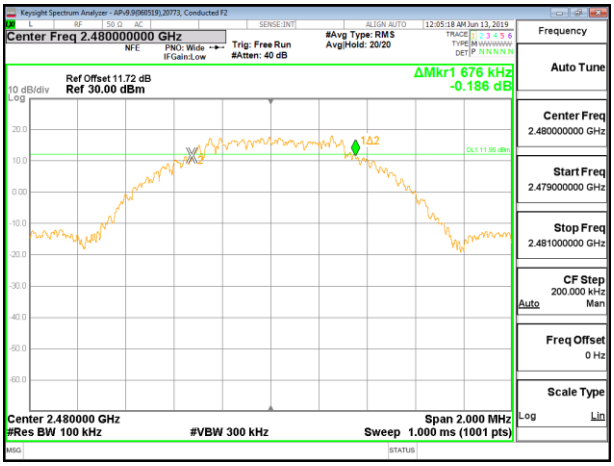
LOW CHANNEL ANT 3



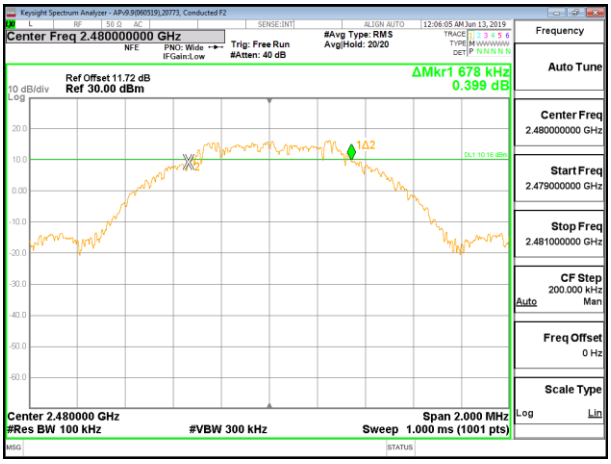
MID CHANNEL ANT 4



MID CHANNEL ANT 3



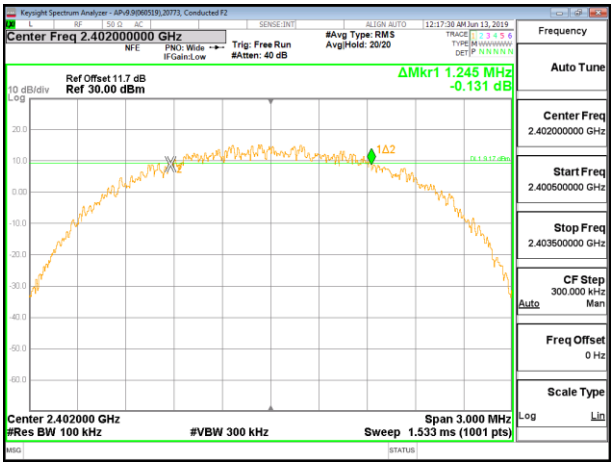
HIGH CHANNEL ANT 4



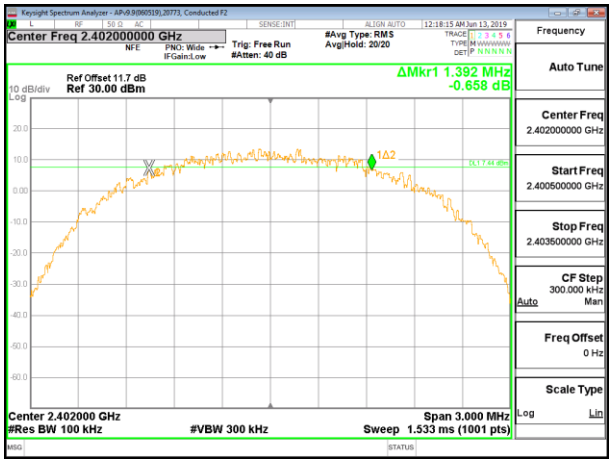
HIGH CHANNEL ANT 3

8.5.2. HIGH POWER BLE (2Mbps)

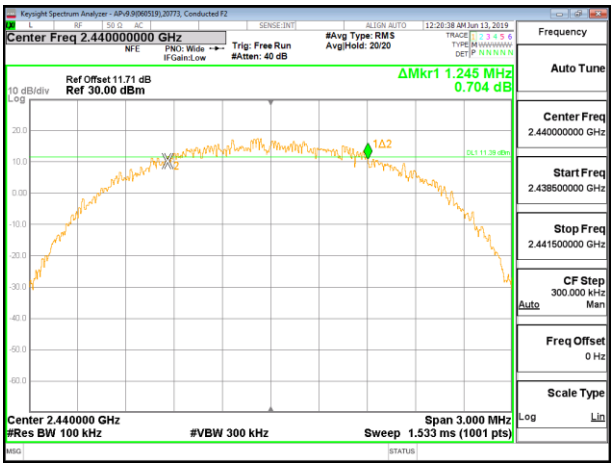
Channel	Frequency (MHz)	6dB Bandwidth ANT 4 (MHz)	6dB Bandwidth ANT 3 (MHz)
Low	2402	1.2450	1.3920
Mid	2440	1.2450	1.3710
High	2480	1.3050	1.3920



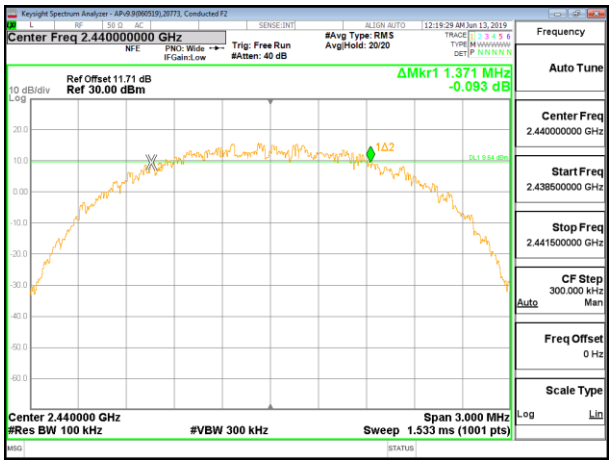
LOW CHANNEL ANT 4



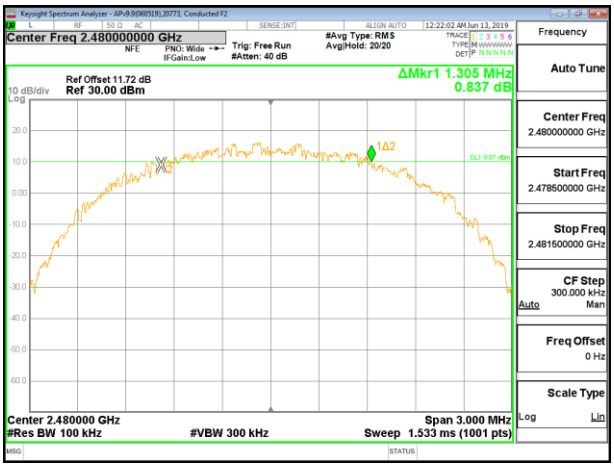
LOW CHANNEL ANT 3



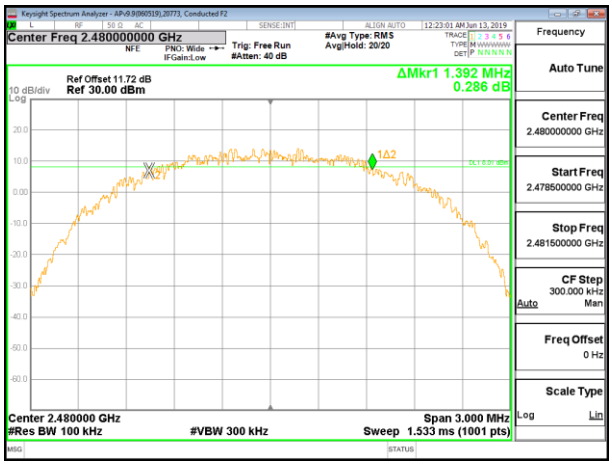
MID CHANNEL ANT 4



MID CHANNEL ANT 3



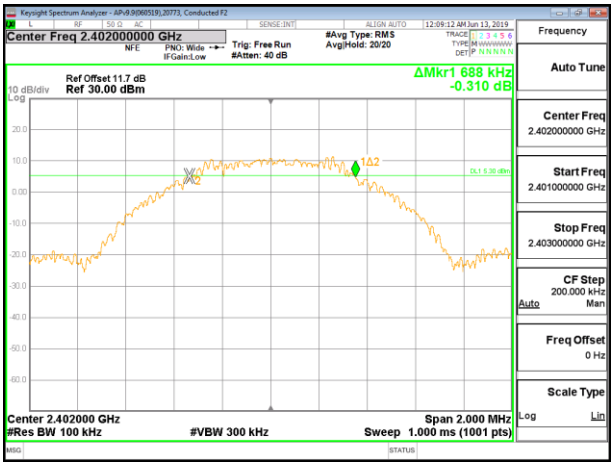
HIGH CHANNEL ANT 4



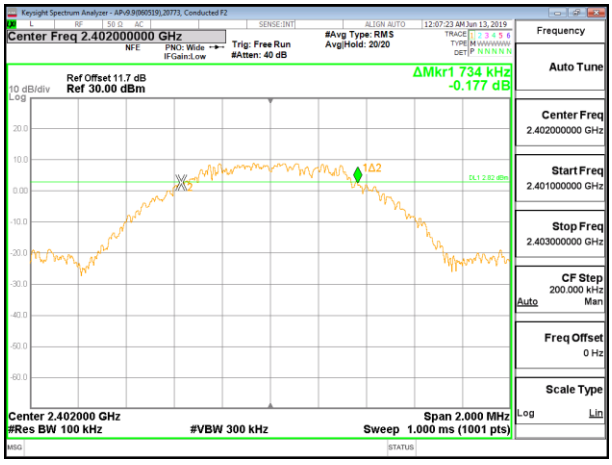
HIGH CHANNEL ANT 3

8.5.3. LOW POWER BLE (1Mbps)

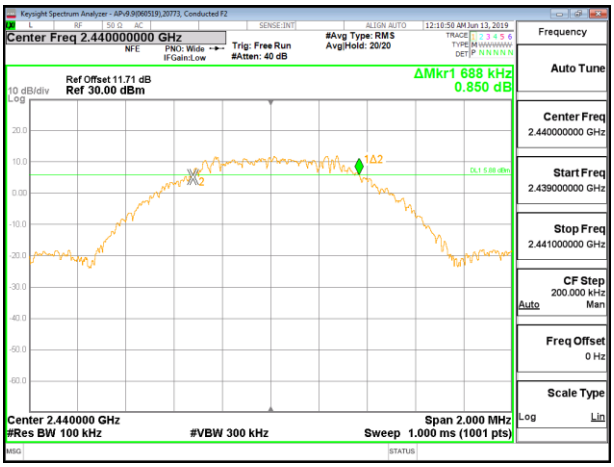
Channel	Frequency (MHz)	6dB Bandwidth ANT 4 (MHz)	6dB Bandwidth ANT 3 (MHz)
Low	2402	0.6880	0.7340
Mid	2440	0.6880	0.7260
High	2480	0.7380	0.6800



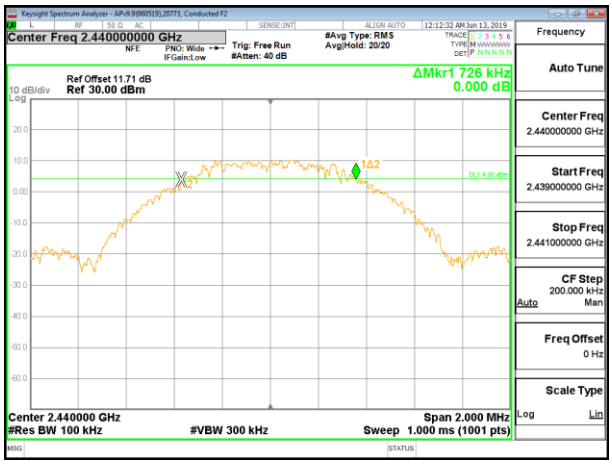
LOW CHANNEL ANT 4



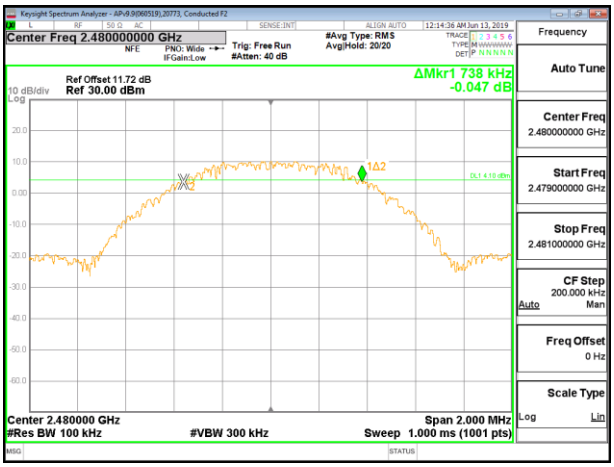
LOW CHANNEL ANT 3



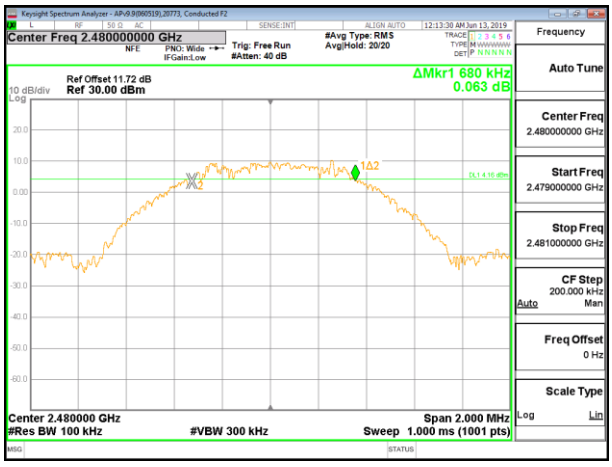
MID CHANNEL ANT 4



MID CHANNEL ANT 3



HIGH CHANNEL ANT 4



HIGH CHANNEL ANT 3

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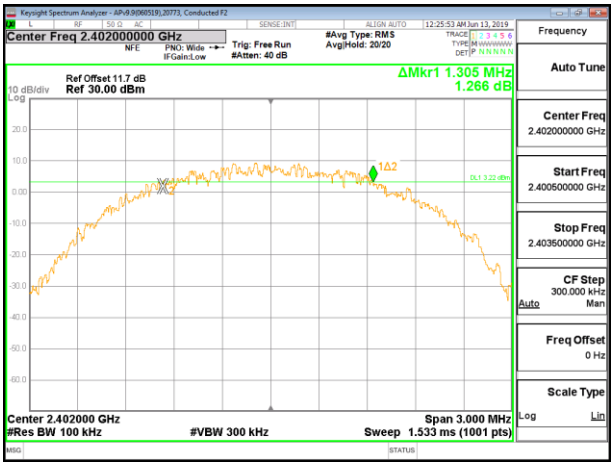
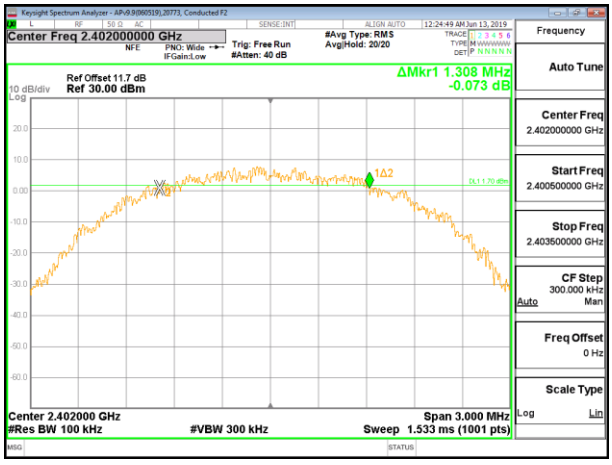
8.5.4. LOW POWER BLE (2Mbps)

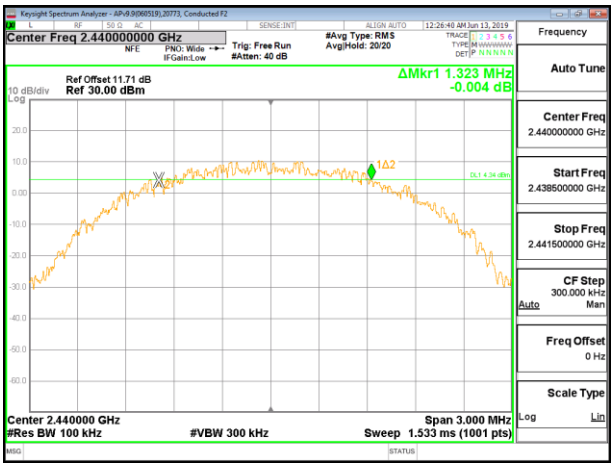
Channel	Frequency (MHz)	6dB Bandwidth ANT 4 (MHz)	6dB Bandwidth ANT 3 (MHz)
Low	2402	1.3050	1.3080
Mid	2440	1.3230	1.3770
High	2480	1.3260	1.2870



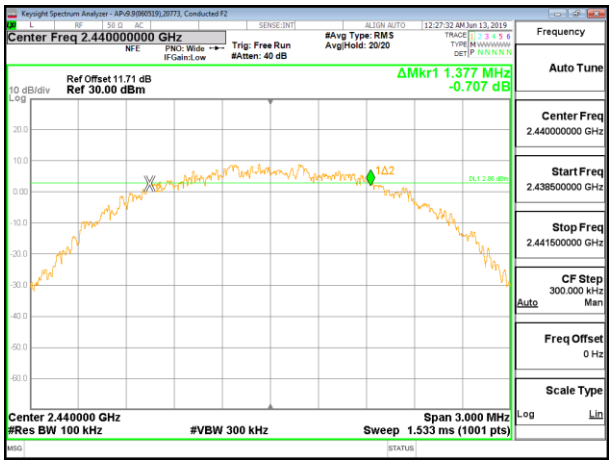
LOW CHANNEL ANT 4



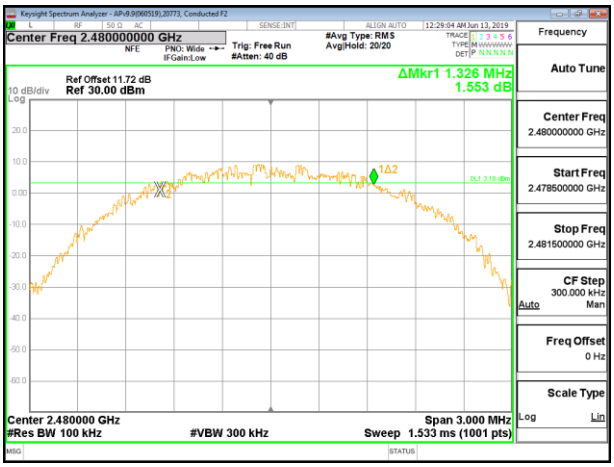
LOW CHANNEL ANT 3



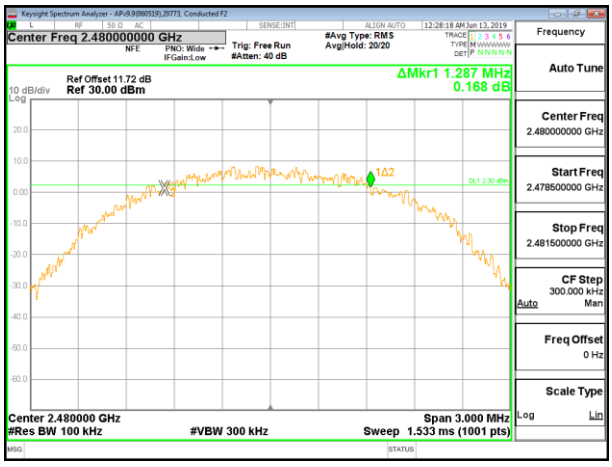
MID CHANNEL ANT 4



MID CHANNEL ANT 3



HIGH CHANNEL ANT 4



HIGH CHANNEL ANT 3

Note: Test procedures and setting are same as BLE normal mode.

8.6. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)

RSS-247 5.4 (d)

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.5 dB (including 10 dB pad and 0.5 dB cable) was entered as an offset in the power meter to allow for a gated peak reading of power.

Note: Test procedures and setting are same as BLE normal mode.

RESULTS

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8.6.1. HIGH POWER BLE (1Mbps)

Antenna 4

Tested By:	23530
Date:	7/17/2019

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	16.57	30	-13.430
Middle	2440	16.56	30	-13.440
High	2480	16.49	30	-13.510

Antenna 3

Tested By:	23530
Date:	7/17/2019

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	19.43	30	-10.570
Middle	2440	19.55	30	-10.450
High	2480	19.51	30	-10.490

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8.6.2. HIGH POWER BLE (2Mbps)

Antenna 4

Tested By:	23530
Date:	7/17/2019

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	16.70	30	-13.300
Middle	2440	16.65	30	-13.350
High	2480	16.67	30	-13.330

Antenna 3

Tested By:	23530
Date:	7/17/2019

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	19.61	30	-10.390
Middle	2440	19.55	30	-10.450
High	2480	19.64	30	-10.360

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8.6.3. LOW POWER BLE (1Mbps)

Antenna 4

Tested By:	23530
Date:	7/17/2019

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	12.56	30	-17.440
Middle	2440	12.63	30	-17.370
High	2480	12.64	30	-17.360

Antenna 3

Tested By:	23530
Date:	7/17/2019

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	12.59	30	-17.410
Middle	2440	12.61	30	-17.390
High	2480	12.54	30	-17.460

8.6.4. LOW POWER BLE (2Mbps)

Antenna 4

Tested By:	23530
Date:	7/17/2019

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	12.66	30	-17.340
Middle	2440	12.64	30	-17.360
High	2480	12.71	30	-17.290

Antenna 3

Tested By:	23530
Date:	7/17/2019

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	12.64	30	-17.360
Middle	2440	12.65	30	-17.350
High	2480	12.61	30	-17.390

8.7. BEAMFORMING OUTPUT POWER

1.1.1. HIGH POWER BLE (1Mbps)

Antenna 4 + Antenna 3

Tested By:	23530
Date:	7/17/2019

Channel	Frequency (MHz)	Output Power Antenna 4 (dBm)	Output Power Antenna 3 (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	16.56	17.03	19.81	30	-10.19
Middle	2440	16.70	17.15	19.94	30	-10.06
High	2480	16.54	17.11	19.84	30	-10.16

1.1.2. HIGH POWER BLE (2Mbps)

Antenna 4 + Antenna 3

Tested By:	23530
Date:	7/17/2019

Channel	Frequency (MHz)	Output Power Antenna 4 (dBm)	Output Power Antenna 3 (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	16.59	16.98	19.80	30	-10.20
Middle	2440	16.61	17.05	19.85	30	-10.15
High	2480	16.63	17.01	19.83	30	-10.17

Note: Test procedures and setting are same as BLE normal mode.

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1.1.3. LOW POWER BLE (1Mbps)

Antenna 4 + Antenna 3

Tested By:	23530
Date:	7/17/2019

Channel	Frequency (MHz)	Output Power Antenna 4 (dBm)	Output Power Antenna 3 (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	12.55	12.51	15.54	30	-14.46
Middle	2440	12.61	12.59	15.61	30	-14.39
High	2480	12.51	12.48	15.51	30	-14.49

1.1.4. LOW POWER BLE (2Mbps)

Antenna 4 + Antenna 3

Tested By:	23530
Date:	7/17/2019

Channel	Frequency (MHz)	Output Power Antenna 4 (dBm)	Output Power Antenna 3 (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	12.57	12.61	15.60	30	-14.40
Middle	2440	12.63	12.62	15.64	30	-14.36
High	2480	12.64	12.60	15.63	30	-14.37

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8.8. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.5 dB (including 10 dB pad and 0.5 dB cable) was entered as an offset in the power meter to allow for a gated average reading of power.

Note: Test procedures and setting are same as BLE normal mode.

RESULTS

8.8.1. HIGH POWER BLE (1Mbps)

Antenna 4

Tested By:	23530
Date:	7/17/2019

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	16.17
Middle	2440	16.25
High	2480	16.13

Antenna 3

Tested By:	23530
Date:	7/17/2019

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	19.17
Middle	2440	19.22
High	2480	19.20

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8.8.2. HIGH POWER BLE (2Mbps)

Antenna 4

Tested By:	23530
Date:	7/17/2019

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	16.23
Middle	2440	16.25
High	2480	16.24

Antenna 3

Tested By:	23530
Date:	7/17/2019

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	19.21
Middle	2440	19.17
High	2480	19.23

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8.8.3. LOW POWER BLE (1Mbps)

Antenna 4

Tested By:	23530
Date:	7/17/2019

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	12.21
Middle	2440	12.20
High	2480	12.19

Antenna 3

Tested By:	23530
Date:	7/17/2019

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	12.20
Middle	2440	12.21
High	2480	12.13

8.8.4. LOW POWER BLE (2Mbps)

Antenna 4

Tested By:	23530
Date:	7/17/2019

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	12.23
Middle	2440	12.22
High	2480	12.25

Antenna 3

Tested By:	23530
Date:	7/17/2019

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	12.22
Middle	2440	12.24
High	2480	12.19

8.9. BEAMFORMING AVERAGE POWER

8.9.1. HIGH POWER BLE (1Mbps)

Antenna 4 + Antenna 3

Tested By:	23530
Date:	7/17/2019

Channel	Frequency (MHz)	Average Power Antenna 4 (dBm)	Average Power Antenna 3 (dBm)	Total Power (dBm)
Low	2402	16.22	16.61	19.43
Middle	2440	16.19	16.70	19.46
High	2480	16.24	16.68	19.48

8.9.2. HIGH POWER BLE (2Mbps)

Antenna 4 + Antenna 3

Tested By:	23530
Date:	7/17/2019

Channel	Frequency (MHz)	Average Power Antenna 4 (dBm)	Average Power Antenna 3 (dBm)	Total Power (dBm)
Low	2402	16.19	16.58	19.40
Middle	2440	16.23	16.66	19.46
High	2480	16.22	16.64	19.45

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8.9.3. LOW POWER BLE (1Mbps)

Antenna 4 + Antenna 3

Tested By:	23530
Date:	7/17/2019

Channel	Frequency (MHz)	Average Power Antenna 4 (dBm)	Average Power Antenna 3 (dBm)	Total Power (dBm)
Low	2402	12.21	12.18	15.21
Middle	2440	12.25	12.21	15.24
High	2480	12.19	12.16	15.19

8.9.4. LOW POWER BLE (2Mbps)

Antenna 4 + Antenna 3

Tested By:	23530
Date:	7/17/2019

Channel	Frequency (MHz)	Average Power Antenna 4 (dBm)	Average Power Antenna 3 (dBm)	Total Power (dBm)
Low	2402	12.23	12.20	15.23
Middle	2440	12.20	12.19	15.21
High	2480	12.22	12.21	15.23

Note: Test procedures and setting are same as BLE normal mode.

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8.10. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

RSS-247 (5.2) (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

RESULTS

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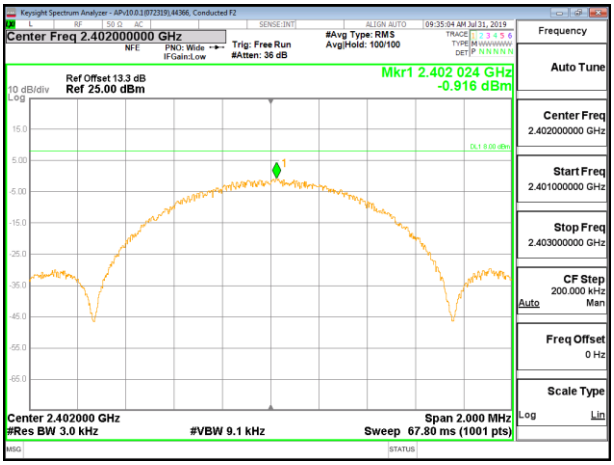
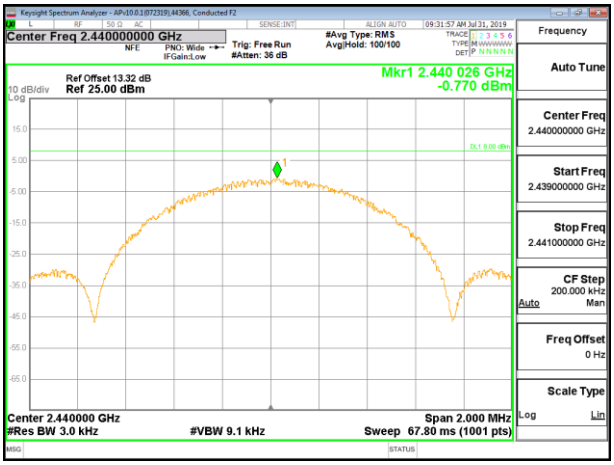
8.10.1. HIGH POWER BLE (1Mbps)

Antenna 4

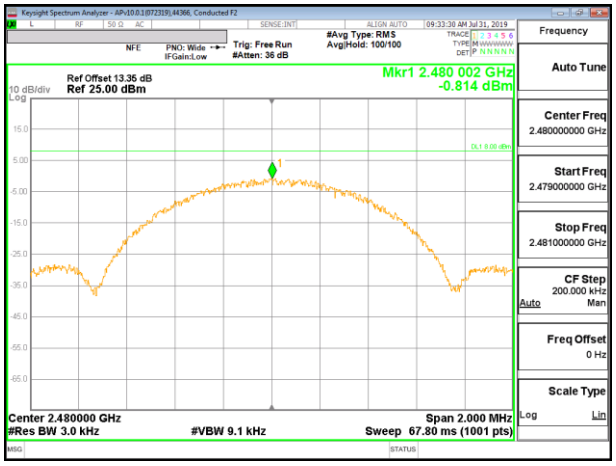
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-0.92	8	-8.92
Middle	2440	-0.77	8	-8.77
High	2480	-0.81	8	-8.81



LOW CHANNEL



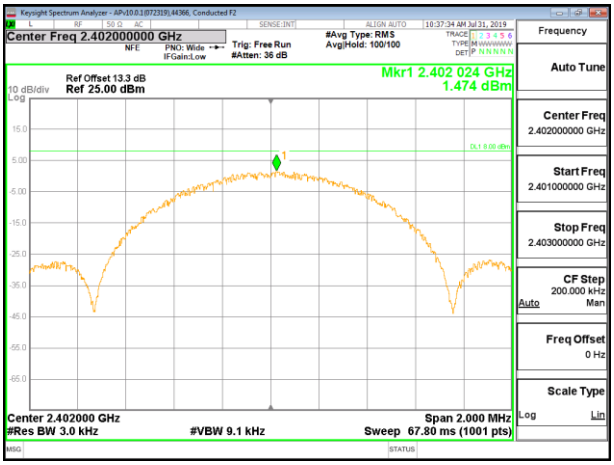
MID CHANNEL



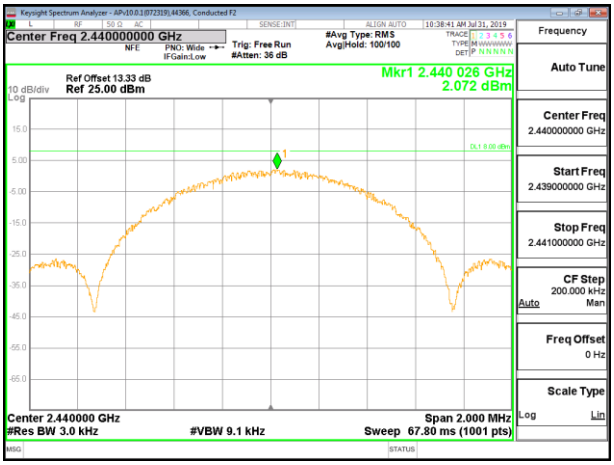
HIGH CHANNEL

Antenna 3

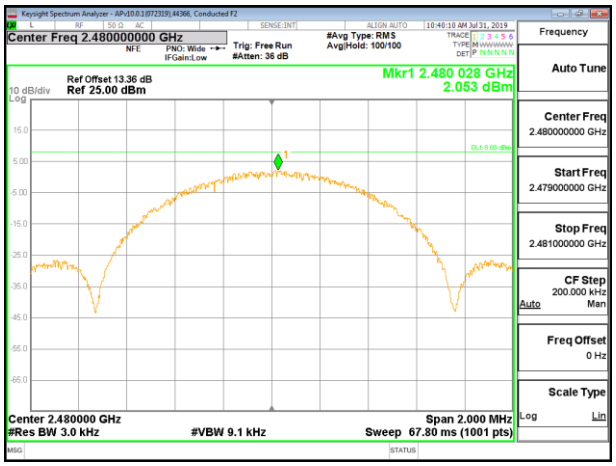
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	1.47	8	-6.53
Middle	2440	2.07	8	-5.93
High	2480	2.05	8	-5.95



LOW CHANNEL



MID CHANNEL

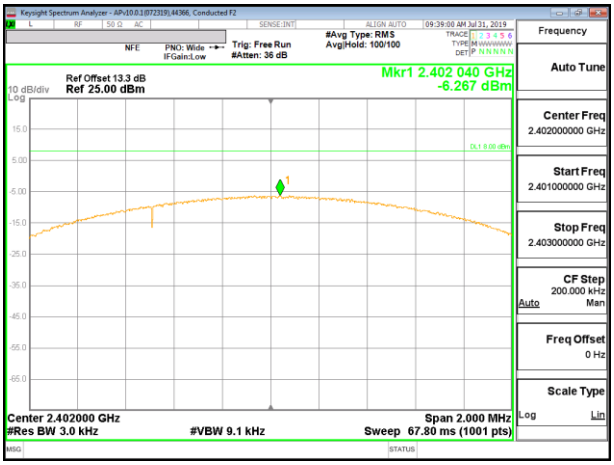


HIGH CHANNEL

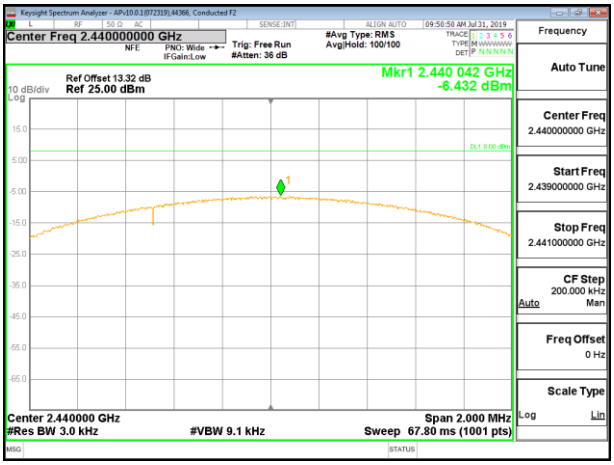
8.10.2. HIGH POWER BLE (2Mbps)

Antenna 4

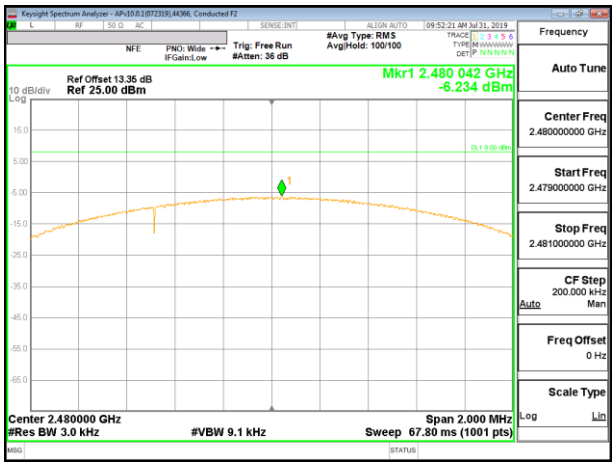
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-6.27	8	-14.27
Middle	2440	-6.43	8	-14.43
High	2480	-6.23	8	-14.23



LOW CHANNEL



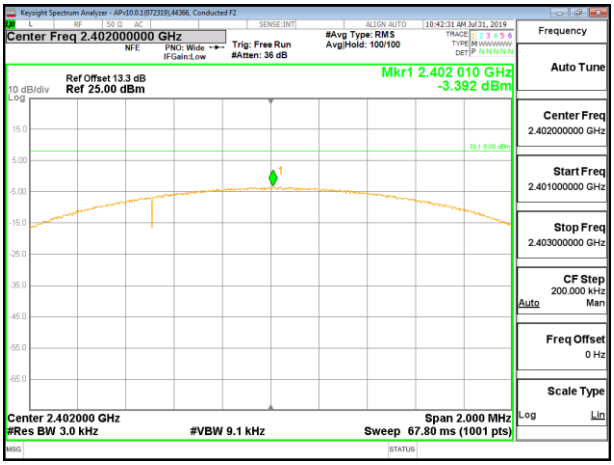
MID CHANNEL



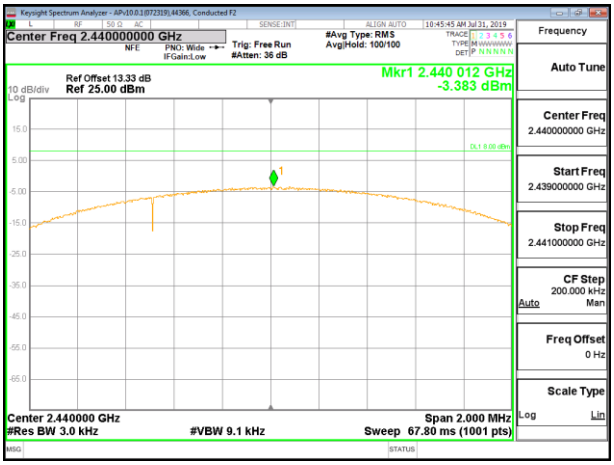
HIGH CHANNEL

Antenna 3

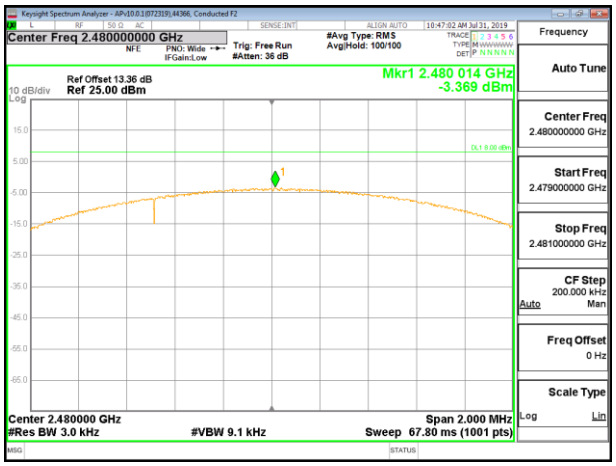
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-3.39	8	-11.39
Middle	2440	-3.38	8	-11.38
High	2480	-3.37	8	-11.37



LOW CHANNEL



MID CHANNEL

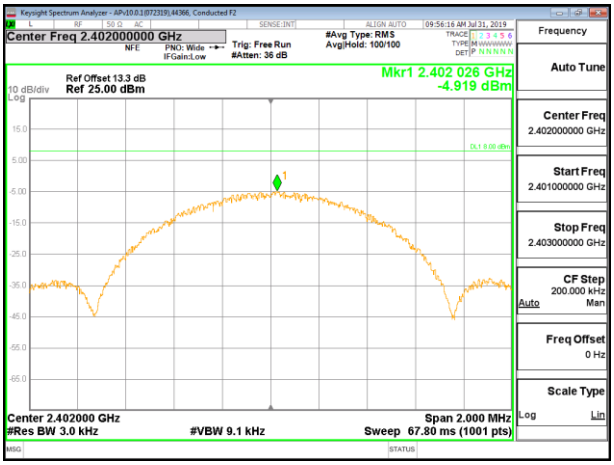


HIGH CHANNEL

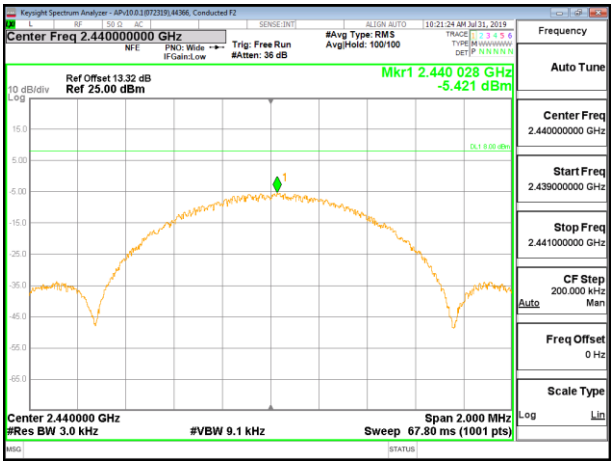
8.10.3. LOW POWER BLE (1Mbps)

Antenna 4

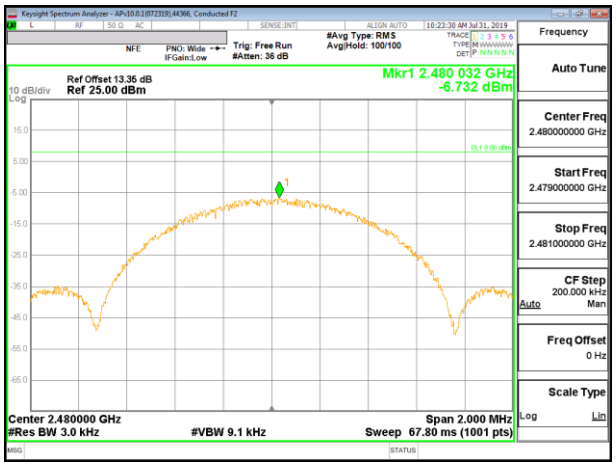
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-4.92	8	-12.92
Middle	2440	-5.42	8	-13.42
High	2480	-6.73	8	-14.73



LOW CHANNEL



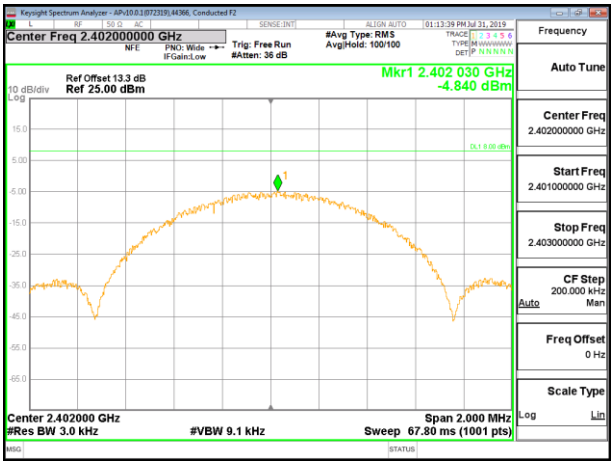
MID CHANNEL



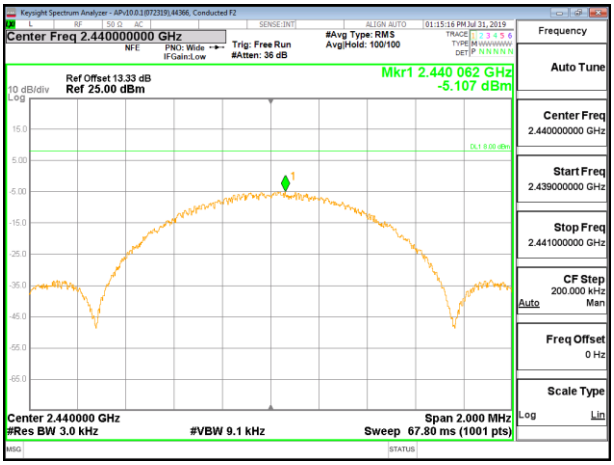
HIGH CHANNEL

Antenna 3

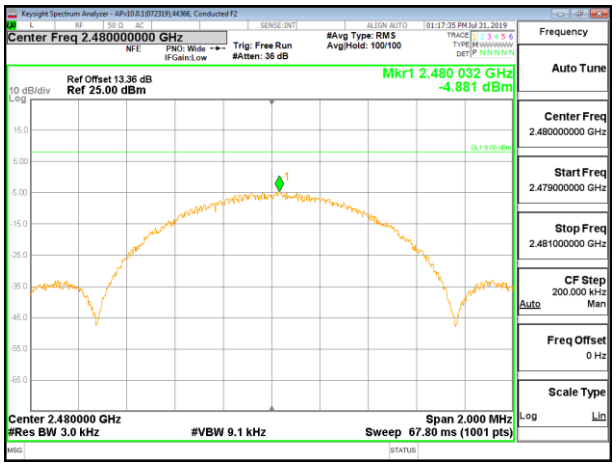
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-4.84	8	-12.84
Middle	2440	-5.11	8	-13.11
High	2480	-4.88	8	-12.88



LOW CHANNEL



MID CHANNEL

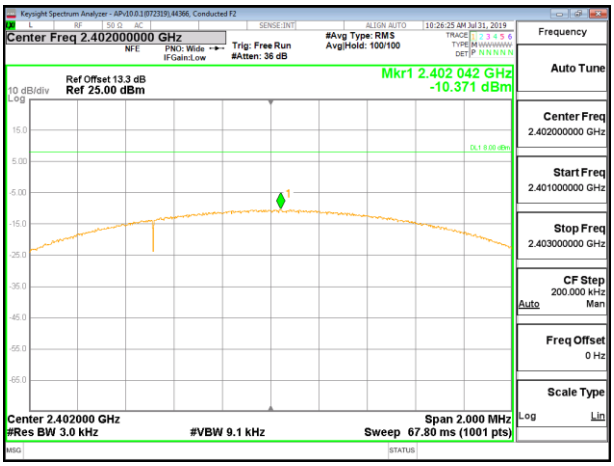


HIGH CHANNEL

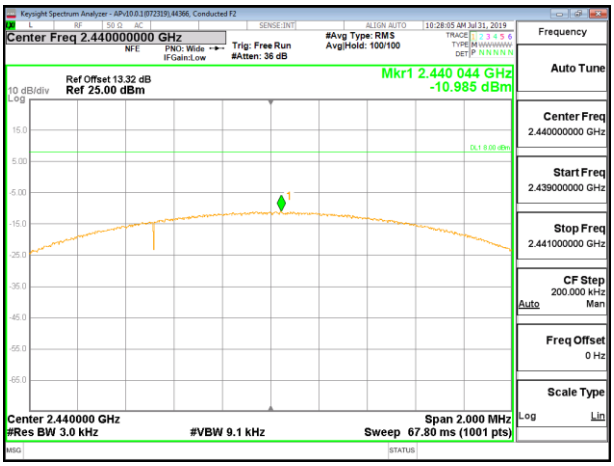
8.10.4. LOW POWER BLE (2Mbps)

Antenna 4

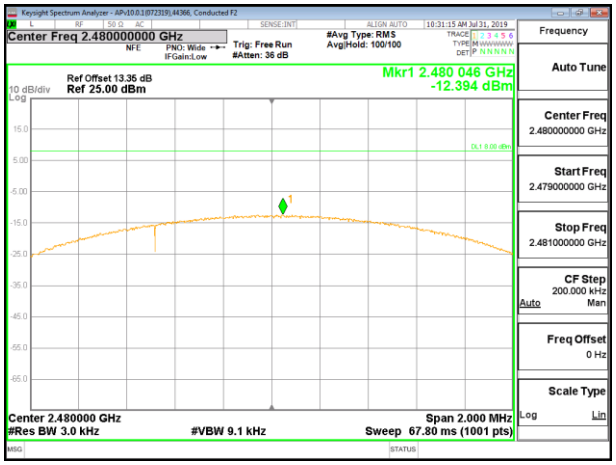
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-10.37	8	-18.37
Middle	2440	-10.99	8	-18.99
High	2480	-12.39	8	-20.39



LOW CHANNEL



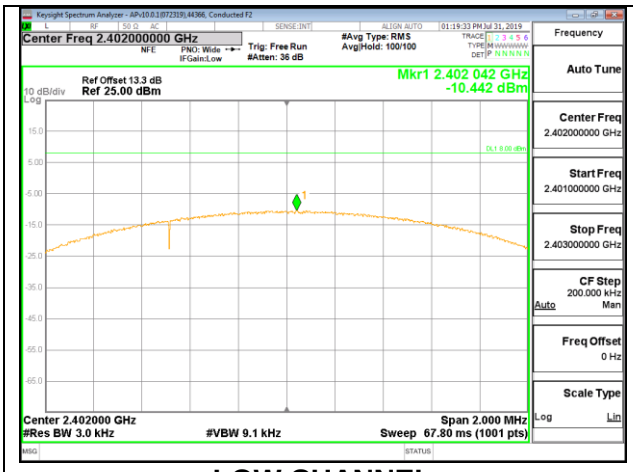
MID CHANNEL



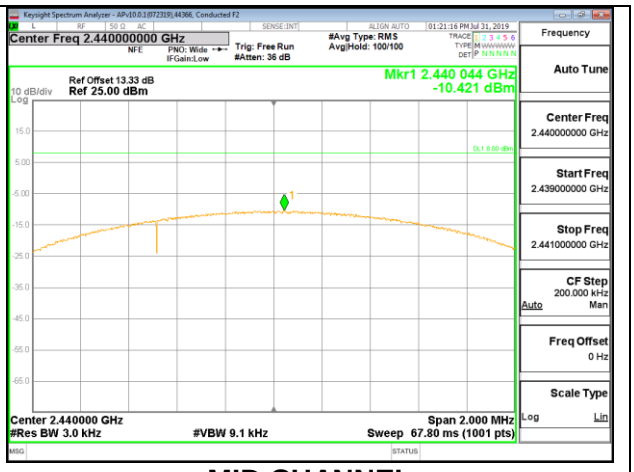
HIGH CHANNEL

Antenna 3

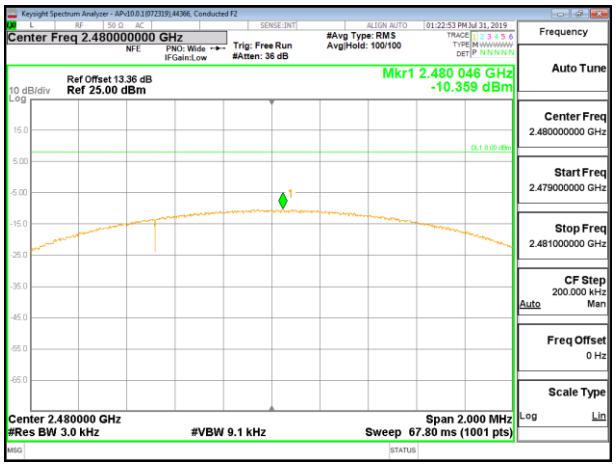
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-10.44	8	-18.44
Middle	2440	-10.42	8	-18.42
High	2480	-10.36	8	-18.36



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

8.11. BEAMFORMING, POWER SPECTRAL DENSITY

8.11.1. HIGH POWER BLE (1Mbps)

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD

PSD Results

Channel	Frequency (MHz)	ANT 4 Meas (dBm/ 3kHz)	ANT 3 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low	2402	-0.77	-0.58	2.34	8.0	-5.7
Mid	2440	-0.55	-0.55	2.46	8.0	-5.5
Hjigh	2480	-0.47	-0.44	2.56	8.0	-5.4

Note: Test procedures and setting are same as BLE normal mode.

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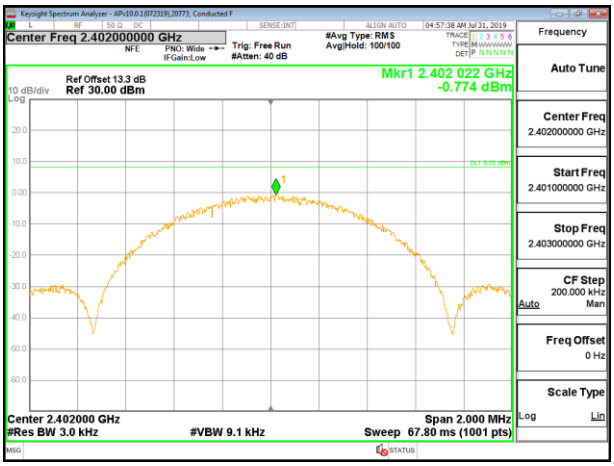
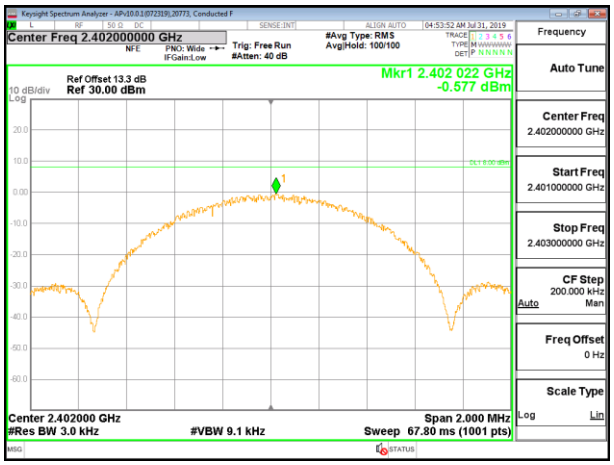
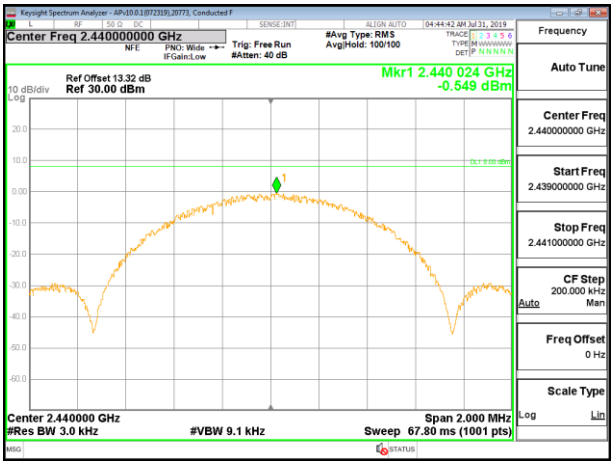


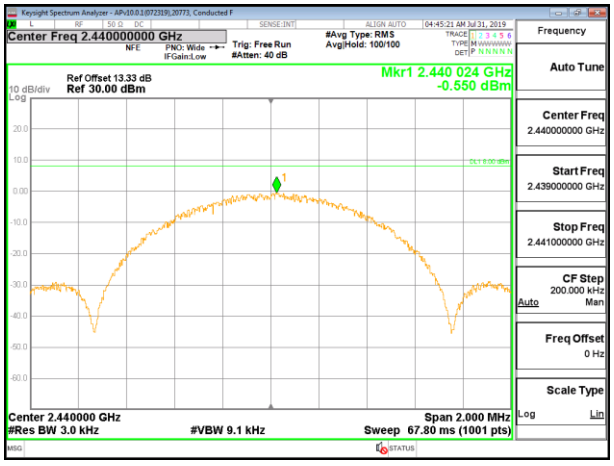
LOW CHANNEL ANT 4



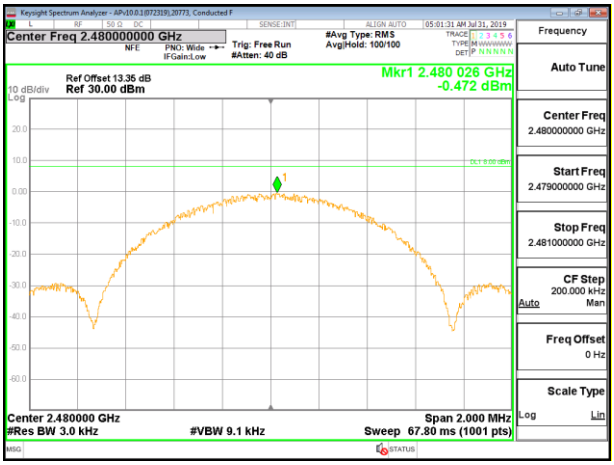
LOW CHANNEL ANT 3



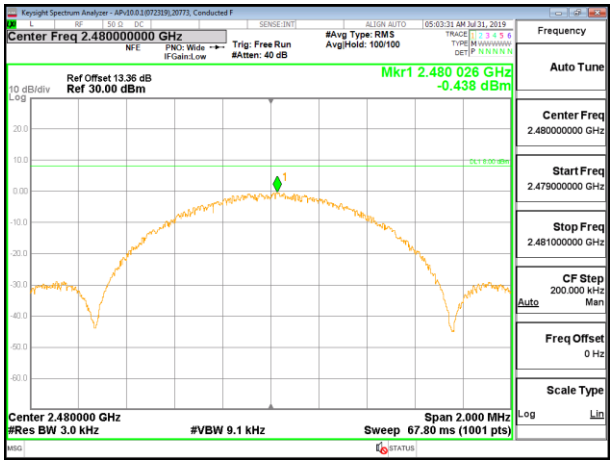
MID CHANNEL ANT 4



MID CHANNEL ANT 3



HIGH CHANNEL ANT 4



HIGH CHANNEL ANT 3

8.11.2. HIGH POWER BLE (2Mbps)

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD

PSD Results

Channel	Frequency (MHz)	ANT 4 Meas (dBm/ 3kHz)	ANT 3 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low	2402	-6.37	-5.87	-3.10	8.0	-11.1
Mid	2440	-5.03	-4.44	-1.71	8.0	-9.7
Hjigh	2480	-6.34	-5.91	-3.11	8.0	-11.1

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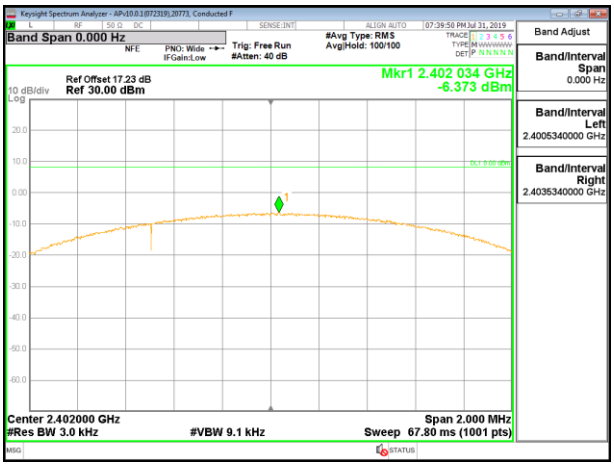
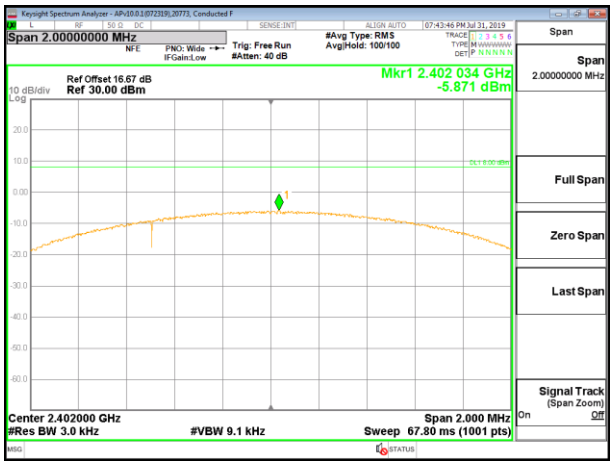
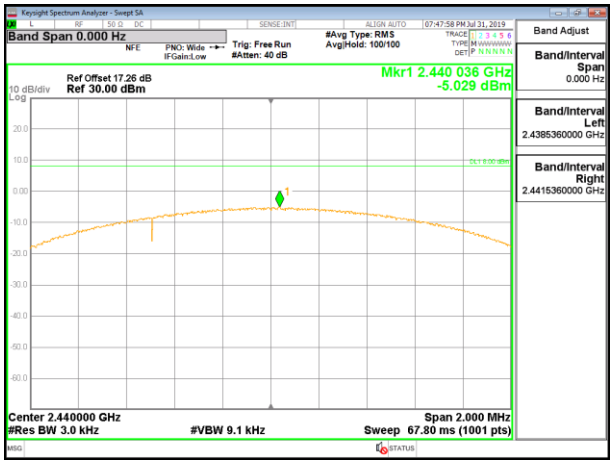


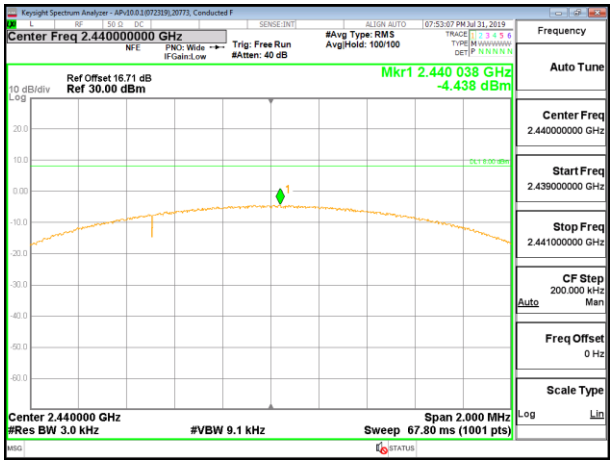
LOW CHANNEL ANT 4



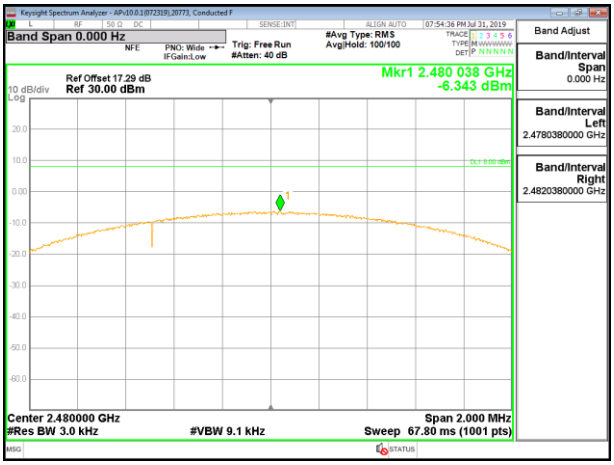
LOW CHANNEL ANT 3



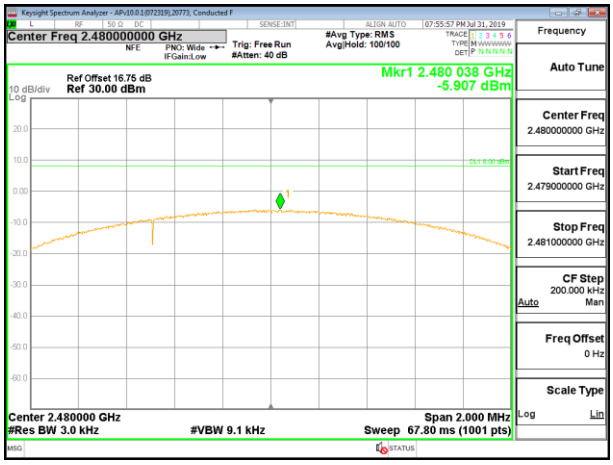
MID CHANNEL ANT 4



MID CHANNEL ANT 3



HIGH CHANNEL ANT 4



HIGH CHANNEL ANT 3

8.11.3. LOW POWER BLE (1Mbps)

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD

PSD Results

Channel	Frequency (MHz)	ANT 4 Meas (dBm/ 3kHz)	ANT 3 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low	2402	-4.92	-4.95	-1.92	8.0	-9.9
Mid	2440	-4.52	-4.96	-1.72	8.0	-9.7
Hjigh	2480	-4.92	-4.91	-1.90	8.0	-9.9

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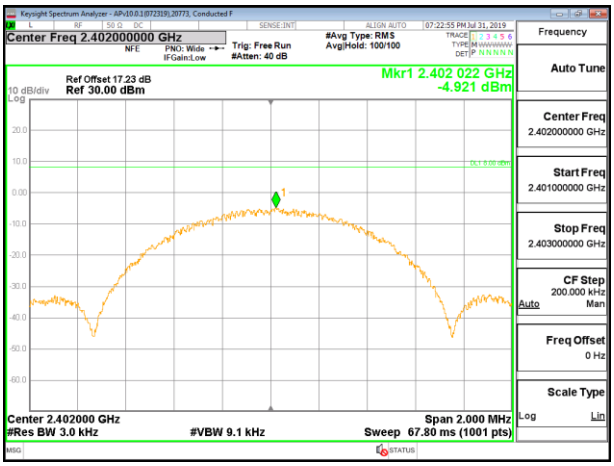
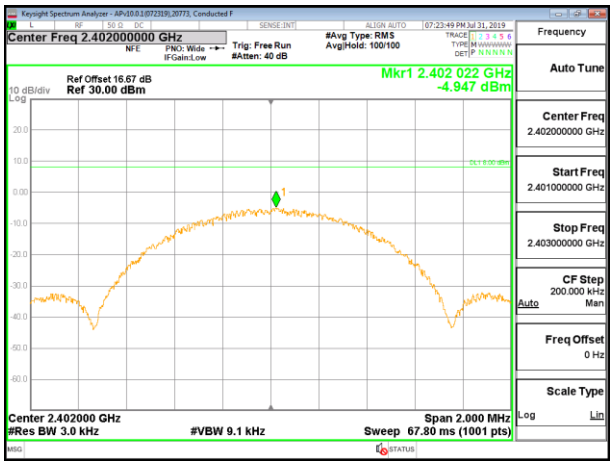
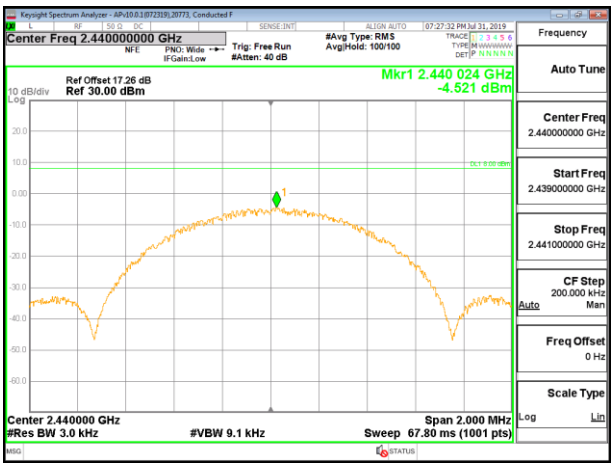


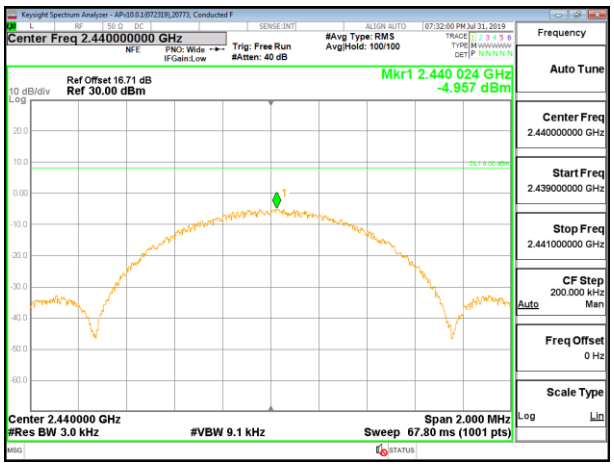
LOW CHANNEL ANT 4



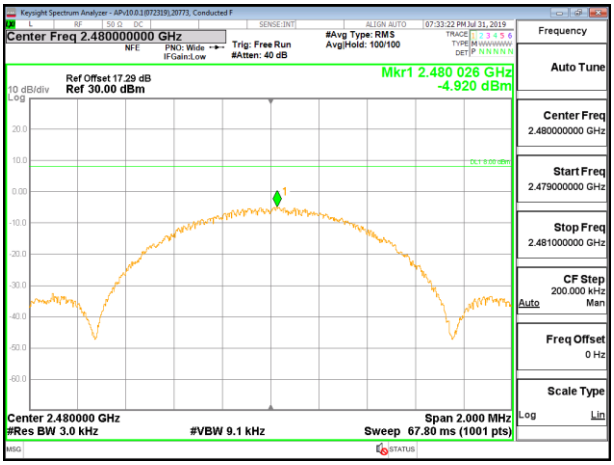
LOW CHANNEL ANT 3



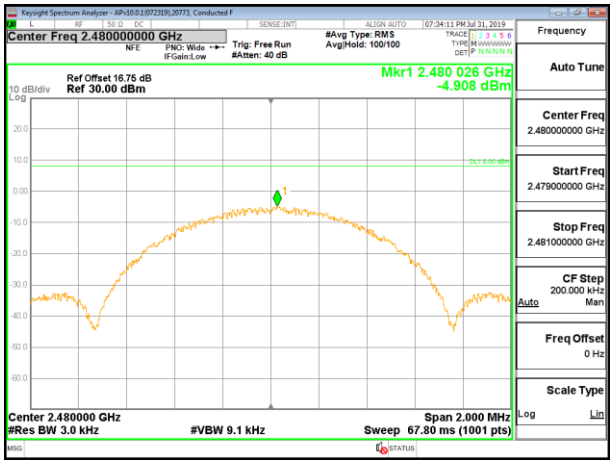
MID CHANNEL ANT 4



MID CHANNEL ANT 3



HIGH CHANNEL ANT 4



HIGH CHANNEL ANT 3

8.11.4. LOW POWER BLE (2Mbps)

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD

PSD Results

Channel	Frequency (MHz)	ANT 4 Meas (dBm/ 3kHz)	ANT 3 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low	2402	-10.59	-10.64	-7.60	8.0	-15.6
Mid	2440	-10.38	-10.05	-7.20	8.0	-15.2
Hjigh	2480	-9.67	-10.53	-7.07	8.0	-15.1

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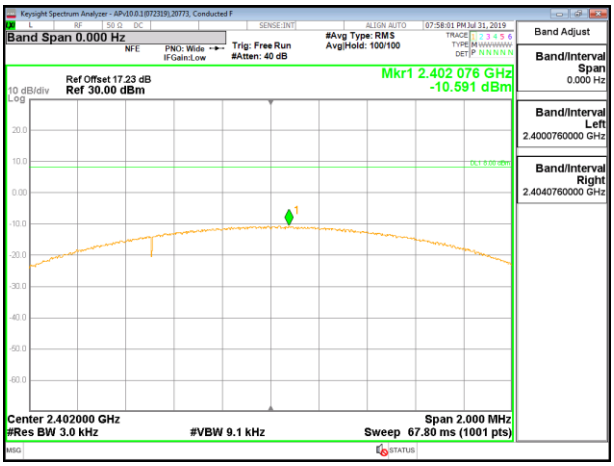
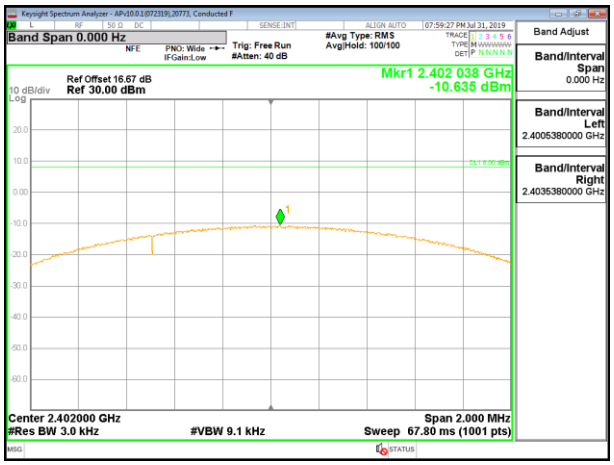
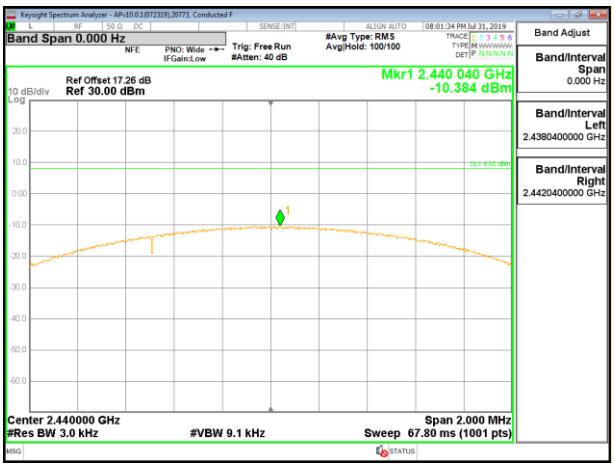


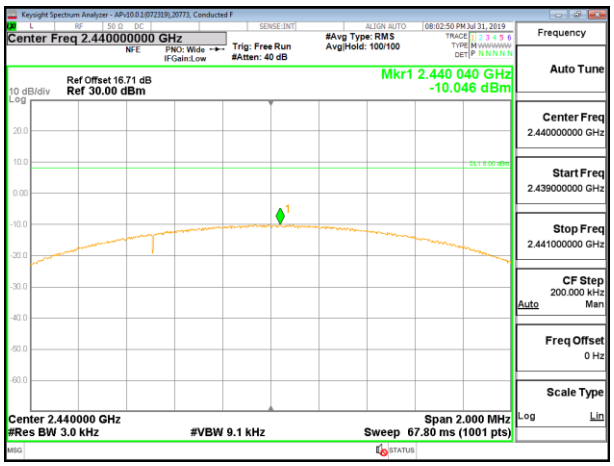
LOW CHANNEL ANT 4



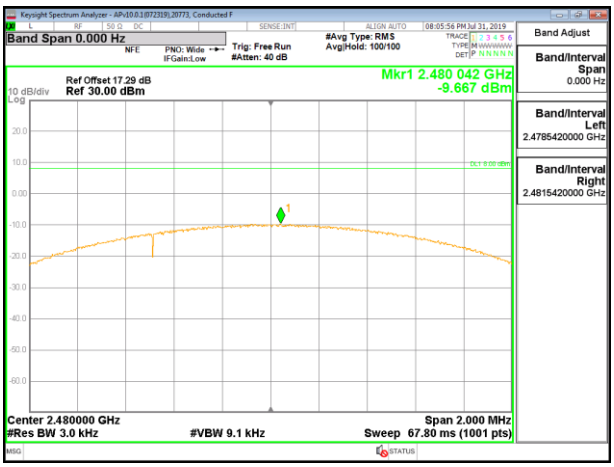
LOW CHANNEL ANT 3



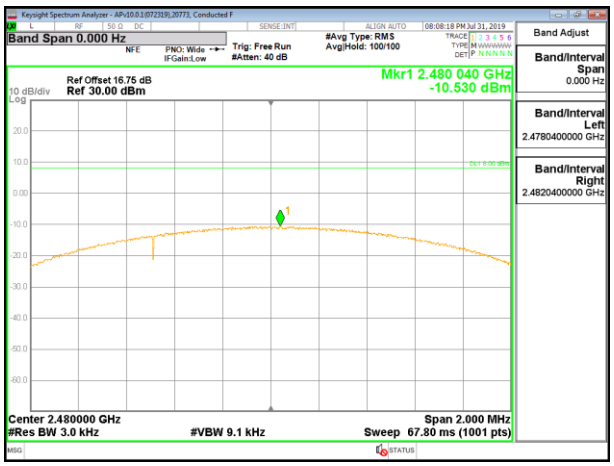
MID CHANNEL ANT 4



MID CHANNEL ANT 3



HIGH CHANNEL ANT 4



HIGH CHANNEL ANT 3

8.12. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

RSS-247 5.5

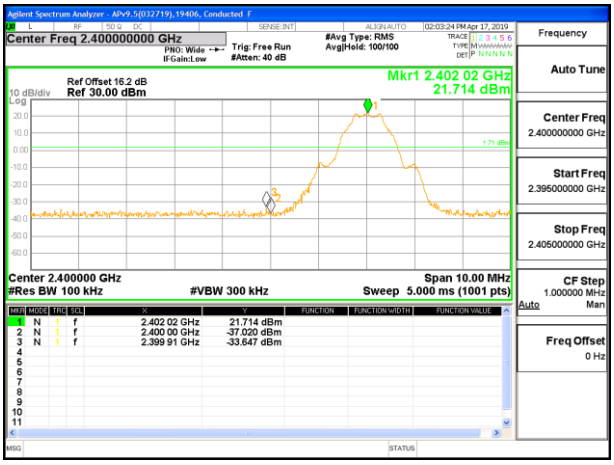
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

Note: Test procedures and setting are same as BLE normal mode.

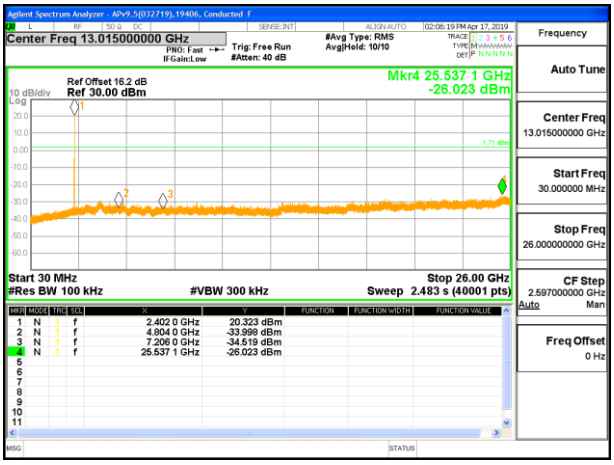
RESULTS

8.12.1. HIGH POWER BLE (1Mbps)

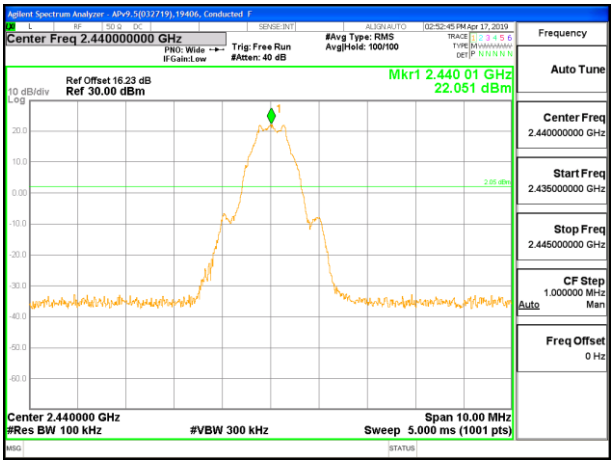
Antenna 4



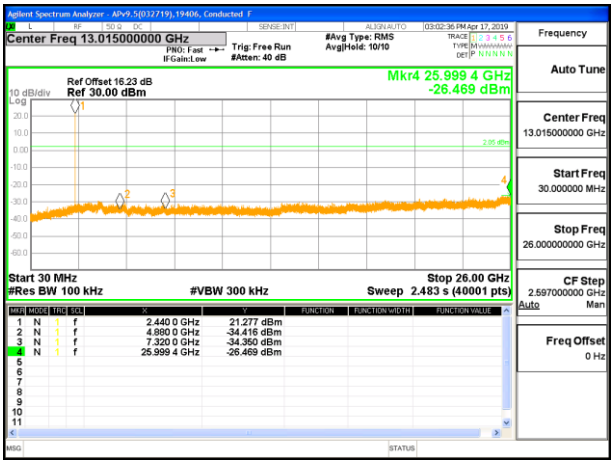
LOW CHANNEL BANDEDGE



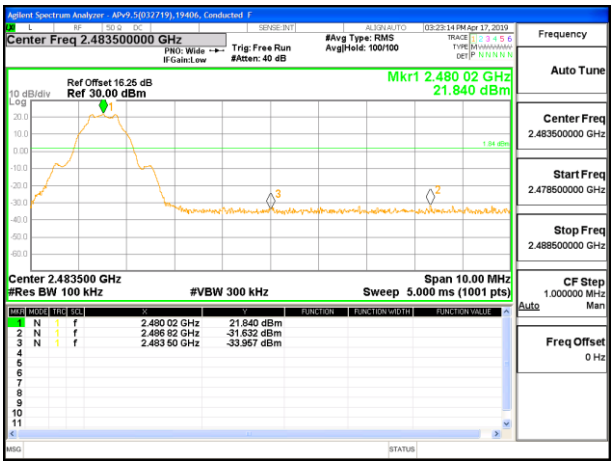
OUT-OF-BAND LOW CHANNEL



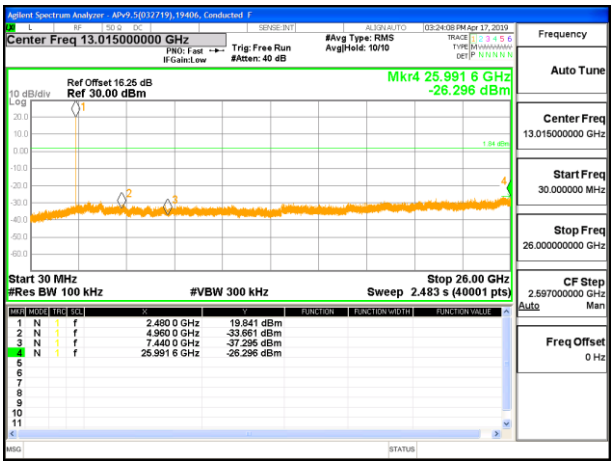
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL

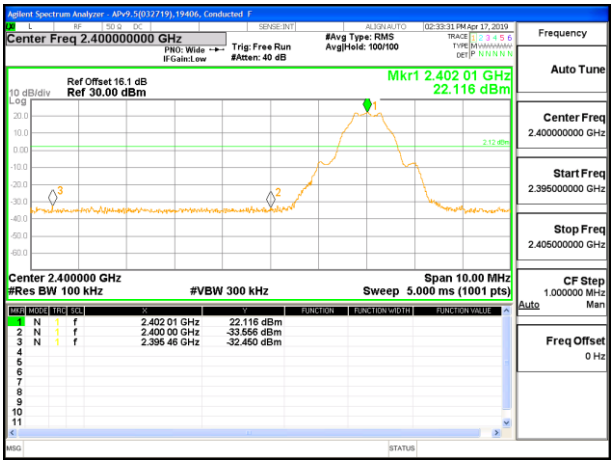


HIGH CHANNEL BANDEDGE

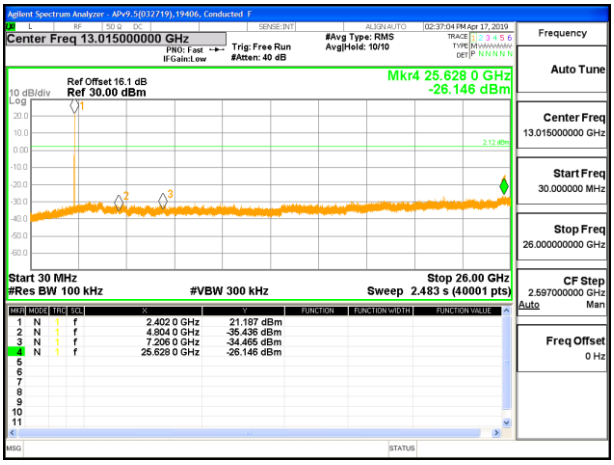


OUT-OF-BAND HIGH CHANNEL

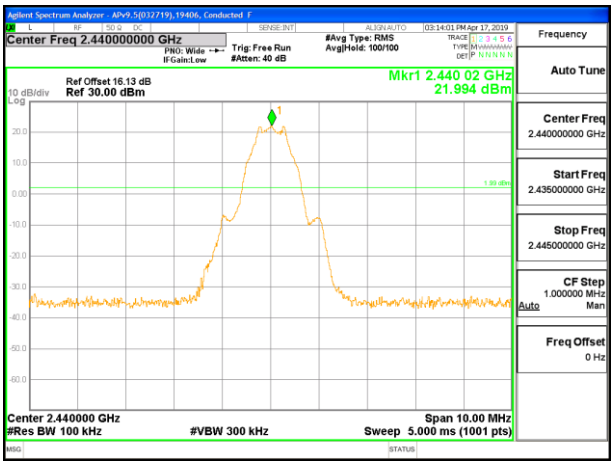
Antenna 3



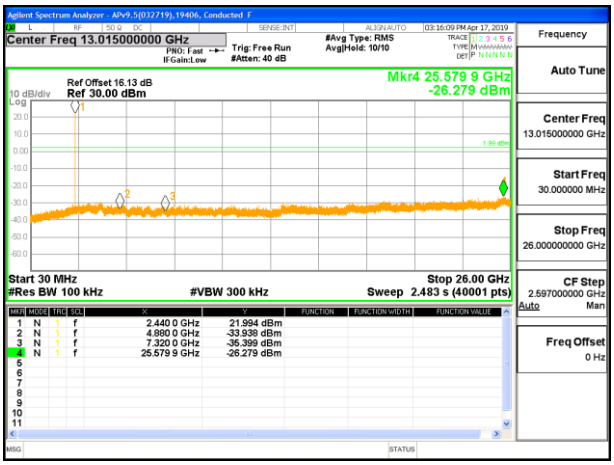
LOW CHANNEL BANDEDGE



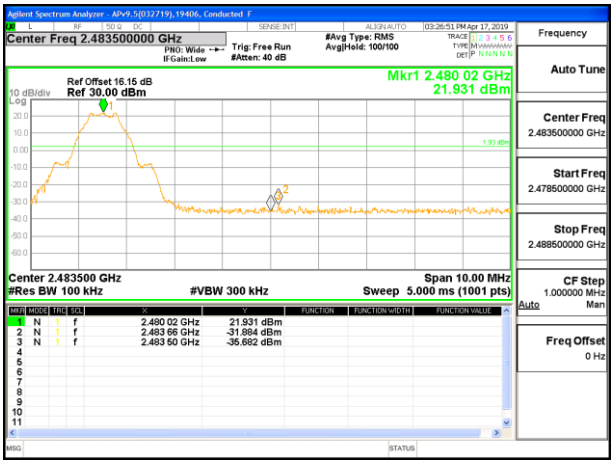
OUT-OF-BAND LOW CHANNEL



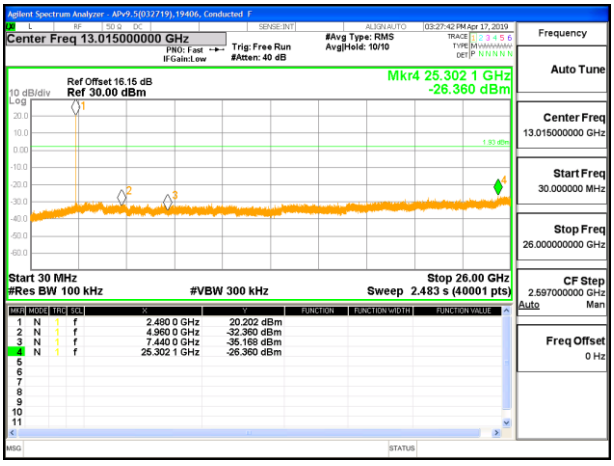
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL



HIGH CHANNEL BANDEDGE



OUT-OF-BAND HIGH CHANNEL

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