

Agilent Spectrum Analyzer - APx10.0.1 (07/11/19), 12500.

Center Freq 2.462000000 GHz

Ref Offset 10.69 dB
Ref 30.00 dBm

PRO: Wide
#Gain: Low

Trig: Free Run
#Atten: 40 dB

Avg Type: RMS
Avg/Hold: 2020

Frequency

Auto Tune

Center Freq 2.462000000 GHz

Start Freq 2.442000000 GHz

Stop Freq 2.482000000 GHz

CF Step 4.0000000 MHz

Freq Offset 0 Hz

Center 2.462000 GHz

#Res BW 100 kHz

#VBW 300 kHz

Sweep 1.533 ms (1001 pts)

Span 40.00 MHz

ΔMkr1 17.84 MHz
0.616 dB

4.22 dBm

Agilent Spectrum Analyzer - APx10.0.1 (07/11/19), 12500.

Center Freq 2.462000000 GHz

Ref Offset 10.69 dB
Ref 30.00 dBm

PRO: Wide
#Gain: Low

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Avg Type: RMS
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Frequency

Auto Tune

Center Freq 2.462000000 GHz

Start Freq 2.442000000 GHz

Stop Freq 2.482000000 GHz

CF Step 4.0000000 MHz

Freq Offset 0 Hz

Center 2.462000 GHz

#Res BW 100 kHz

#VBW 300 kHz

Sweep 1.533 ms (1001 pts)

Span 40.00 MHz

ΔMkr1 17.80 MHz
0.900 dB

5.00 dBm

8.4. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

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.

DIRECTIONAL ANTENNA GAIN

For 1 TX:

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

For 2 TX:

Tx chains are uncorrelated for power and correlated for PSD due to the device supporting CDD in all MIMO modes. The directional gains are as follows:

Band (GHz)	Antenna 1	Antenna 2	Uncorrelated Chains	Correlated Chains
	Antenna Gain (dBi)	Antenna Gain (dBi)	Directional Gain (dBi)	Directional Gain (dBi)
2.4	4.50	4.50	4.50	7.51

RESULTS

8.4.1. 802.11b MODE

1TX Antenna 1 MODE

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	ISED Power Limit (dBm)	ISED EIRP Limit (dBm)	Max Power (dBm)
Low 1	2412	4.50	30.00	30	36	30.00
Mid 6	2437	4.50	30.00	30	36	30.00
High 11	2462	4.50	30.00	30	36	30.00

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

Channel	Frequency (MHz)	Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 1	2412	4.92	4.92	30.00	-25.08
Mid 6	2437	4.74	4.74	30.00	-25.26
High 11	2462	4.45	4.45	30.00	-25.55

1TX Antenna 2 MODE

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	ISED Power Limit (dBm)	ISED EIRP Limit (dBm)	Max Power (dBm)
Low 1	2412	4.50	30.00	30	36	30.00
Mid 6	2437	4.50	30.00	30	36	30.00
High 11	2462	4.50	30.00	30	36	30.00

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

Channel	Frequency (MHz)	Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 1	2412	8.93	8.93	30.00	-21.07
Mid 6	2437	8.65	8.65	30.00	-21.35
High 11	2462	8.49	8.49	30.00	-21.51

8.4.2. 802.11n HT20 MODE

1TX Antenna 1 MODE

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	ISED Power Limit (dBm)	ISED EIRP Limit (dBm)	Max Power (dBm)
Low 1	2412	4.50	30.00	30	36	30.00
Mid 6	2437	4.50	30.00	30	36	30.00
High 11	2462	4.50	30.00	30	36	30.00

Duty Cycle CF (dB)	0.09	Included in Calculations of Corr'd Power
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Results

Channel	Frequency (MHz)	Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 1	2412	16.32	16.32	30.00	-13.68
Mid 6	2437	16.45	16.45	30.00	-13.55
High 11	2462	16.22	16.22	30.00	-13.78

1TX Antenna 2 MODE

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	ISED Power Limit (dBm)	ISED EIRP Limit (dBm)	Max Power (dBm)
Low 1	2412	4.50	30.00	30	36	30.00
Mid 6	2437	4.50	30.00	30	36	30.00
High 11	2462	4.50	30.00	30	36	30.00

Duty Cycle CF (dB)	0.09	Included in Calculations of Corr'd Power
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Results

Channel	Frequency (MHz)	Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 1	2412	19.98	19.98	30.00	-10.02
Mid 6	2437	20.20	20.20	30.00	-9.80
High 11	2462	19.99	19.99	30.00	-10.01

2TX Antenna 1 + Antenna 2 CDD MODE

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC/ISED Power Limit (dBm)	ISED EIRP Limit (dBm)	Max Power (dBm)
Low 1	2412	7.51	29.00	36	28.49
Mid 6	2437	7.51	29.00	36	28.49
High 11	2462	7.51	29.00	36	28.49

Duty Cycle CF (dB)	0.19	Included in Calculations of Corr'd Power
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Results

Channel	Frequency (MHz)	Antenna 1 Meas Power (dBm)	Antenna 2 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margi (dB)
Low 1	2412	16.43	20.92	22.24	28.49	-6.25
Mid 6	2437	16.78	20.40	21.97	28.49	-6.52
High 11	2462	16.63	19.98	21.63	28.49	-6.86

8.5. 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

RESULTS

8.5.1. 802.11b MODE

1TX Antenna 1 MODE

Channel	Frequency (MHz)	Power (dBm)
Low 1	2412	3.03
Mid 6	2437	2.63
High 11	2462	2.20

1TX Antenna 2 MODE

Channel	Frequency (MHz)	Power (dBm)
Low 1	2412	7.10
Mid 6	2437	6.82
High 11	2462	6.55

8.5.2. 802.11n HT20 MODE

1TX Antenna 1 MODE

Channel	Frequency (MHz)	Power (dBm)
Low 1	2412	8.78
Mid 6	2437	8.32
High 11	2462	7.90

1TX Antenna 2 MODE

Channel	Frequency (MHz)	Power (dBm)
Low 1	2412	12.06
Mid 6	2437	11.87
High 11	2462	11.64

2TX Antenna 1 + Antenna 2 CDD MODE

Channel	Frequency	Antenna 1	Antenna 2	Total
	(MHz)	Power (dBm)	Power (dBm)	Power (dBm)
Low 1	2412	8.75	12.01	13.69
Mid 6	2437	8.33	11.75	13.38
High 11	2462	7.89	11.79	13.27

8.6. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

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

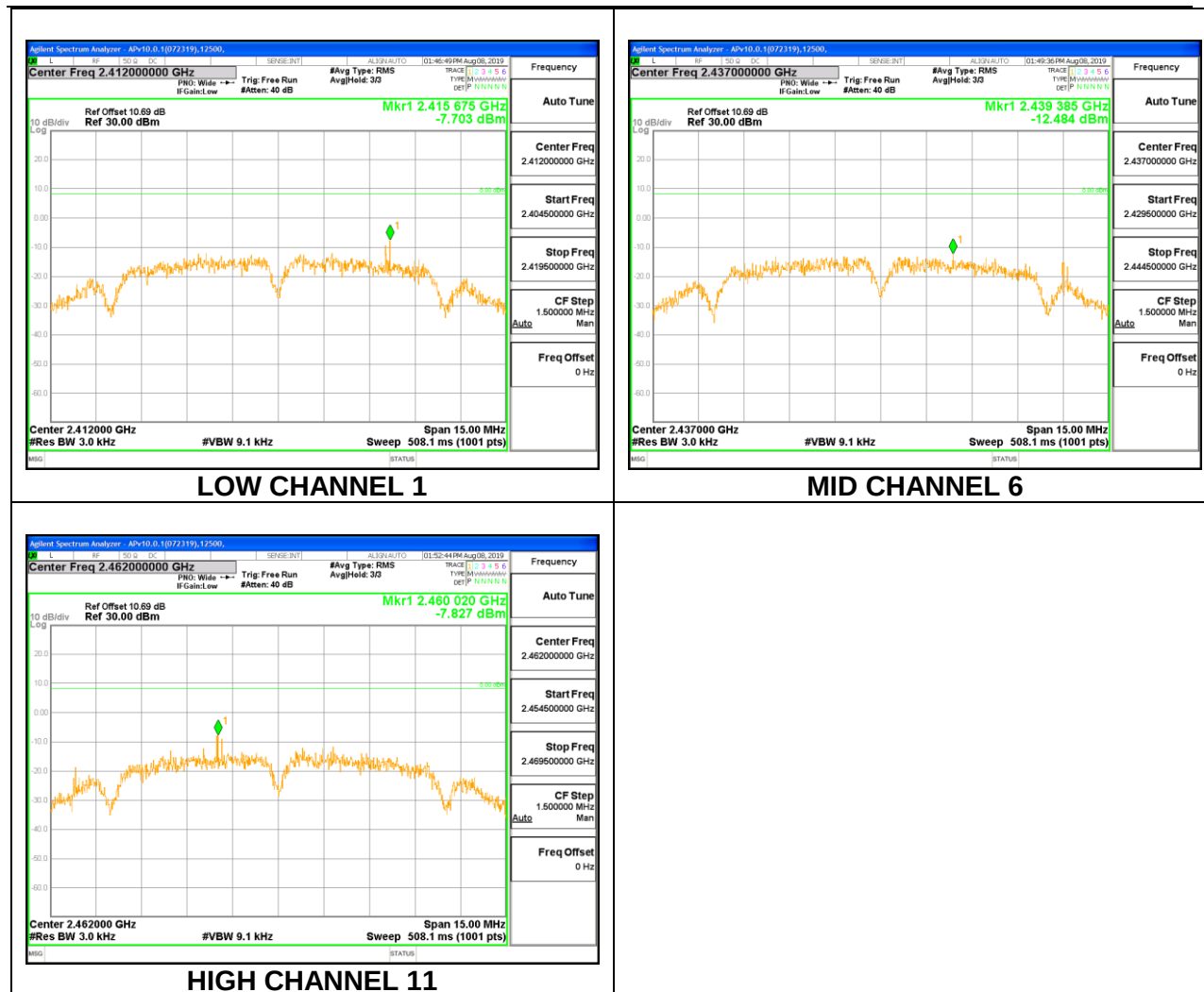
8.6.1. 802.11b MODE

1TX Antenna 1 MODE

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

Channel	Frequency (MHz)	Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low 1	2412	-7.70	-7.70	8.0	-15.7
Mid 6	2437	-12.48	-12.48	8.0	-20.5
High 11	2462	-7.83	-7.83	8.0	-15.8

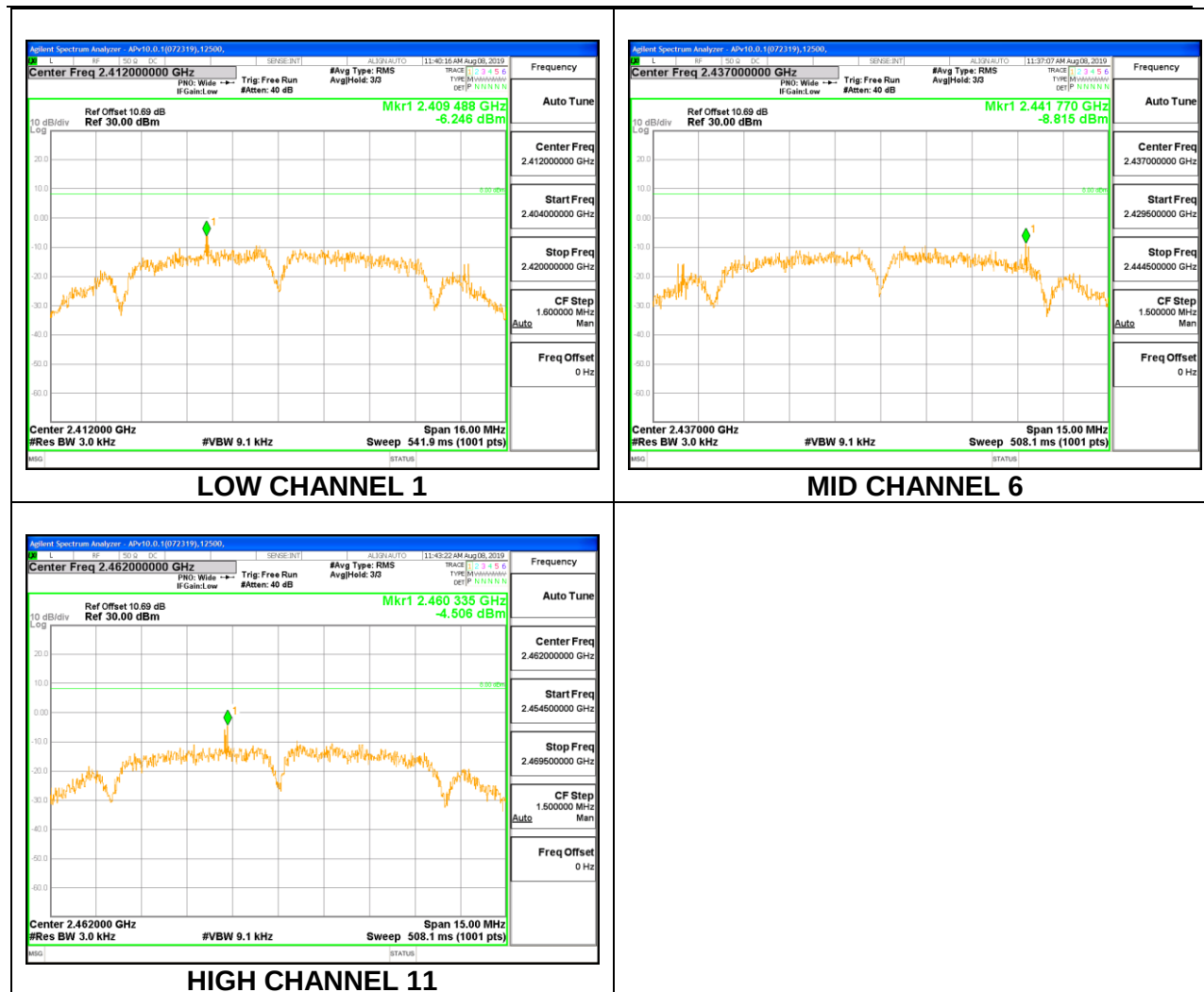


1TX Antenna 2 MODE

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

Channel	Frequency (MHz)	Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low 1	2412	-6.25	-6.25	8.0	-14.3
Mid 6	2437	-8.81	-8.81	8.0	-16.8
High 11	2462	-4.51	-4.51	8.0	-12.5



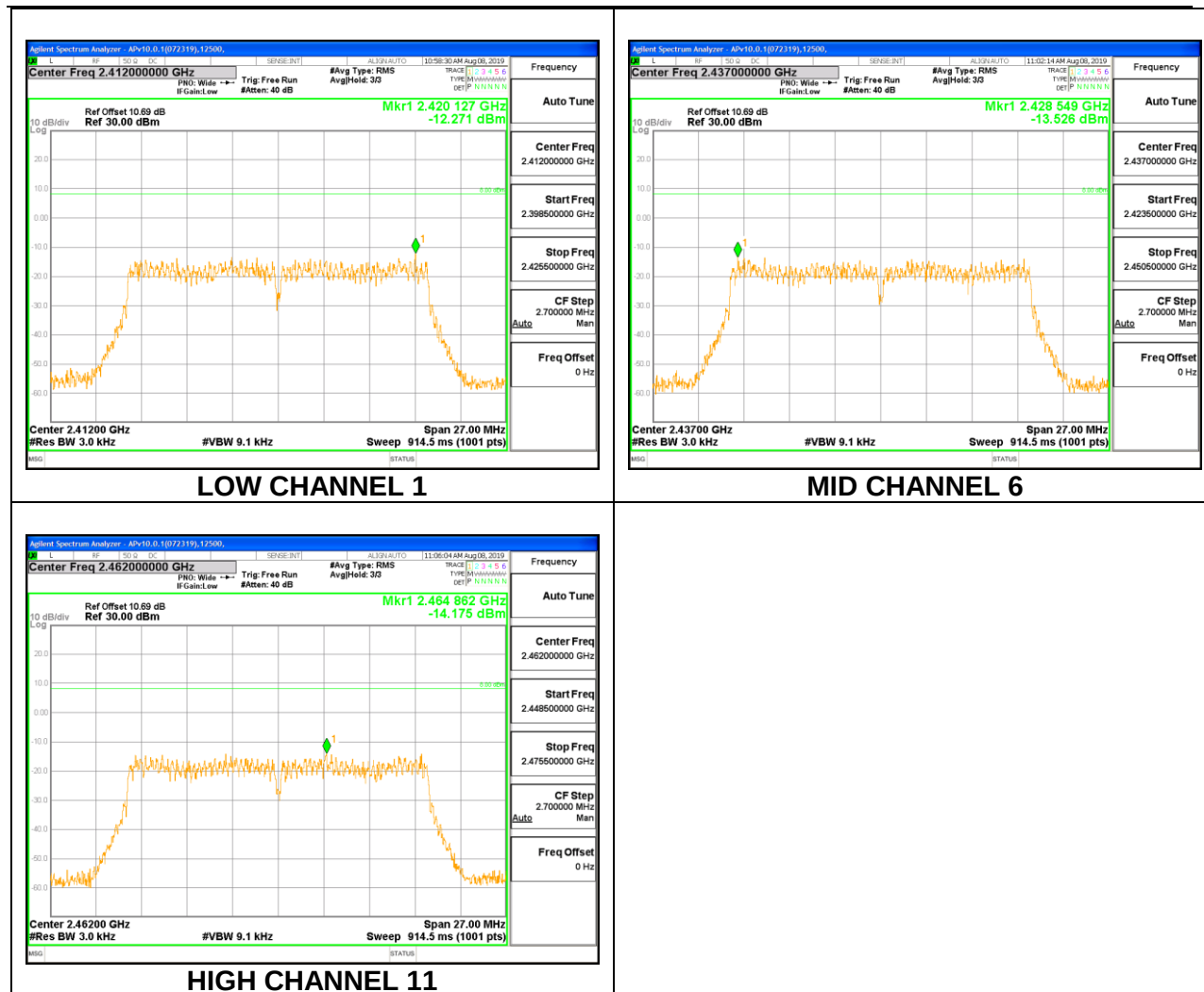
8.6.2. 802.11n HT20 MODE

1TX Antenna 1 MODE

Duty Cycle CF (dB)	0.09	Included in Calculations of Corr'd PSD
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PSD Results

Channel	Frequency (MHz)	Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low 1	2412	-12.27	-12.18	8.0	-20.2
Mid 6	2437	-13.53	-13.44	8.0	-21.4
High 11	2462	-14.18	-14.09	8.0	-22.1

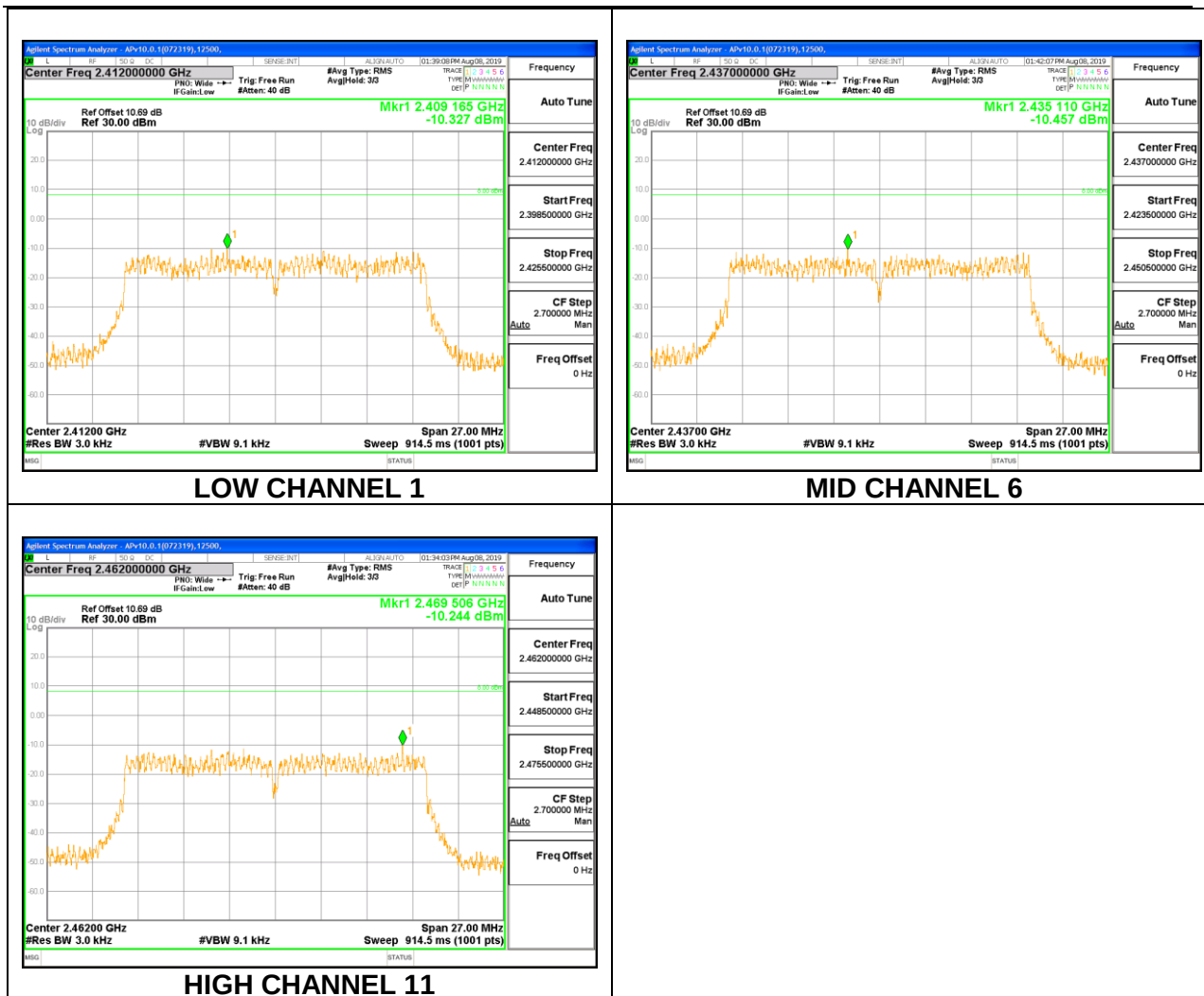


1TX Antenna 2 MODE

Duty Cycle CF (dB)	0.09	Included in Calculations of Corr'd PSD
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PSD Results

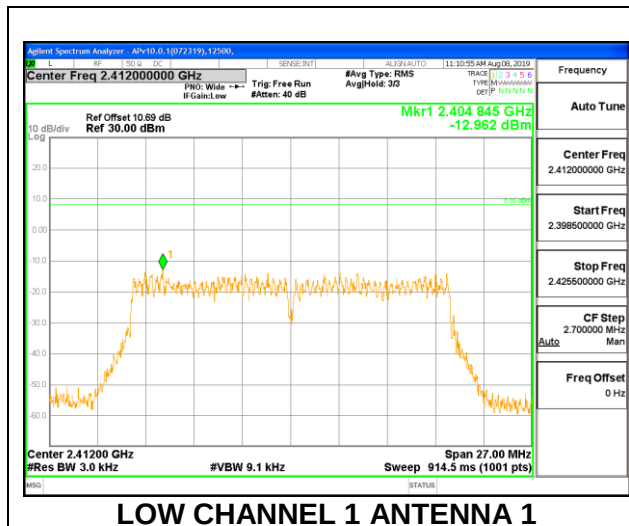
Channel	Frequency (MHz)	Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low 1	2412	-10.33	-10.24	8.0	-18.2
Mid 6	2437	-10.46	-10.37	8.0	-18.4
High 11	2462	-10.24	-10.15	8.0	-18.2



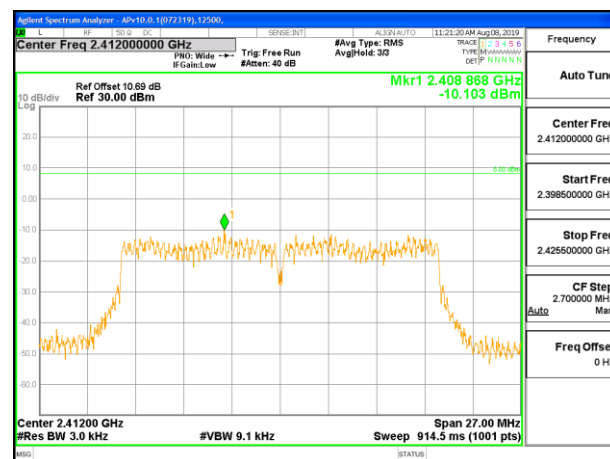
2TX Antenna 1 + Antenna 2 CDD MODE

Channel	Frequency (MHz)	Antenna 1 Meas (dBm/ 3kHz)	Antenna 2 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low 1	2412	-12.96	-10.10	-8.29	8.0	-16.3
Mid 6	2437	-13.69	-10.42	-8.74	8.0	-16.7
High 11	2462	-13.46	-12.37	-9.87	8.0	-17.9

LOW CHANNEL 1

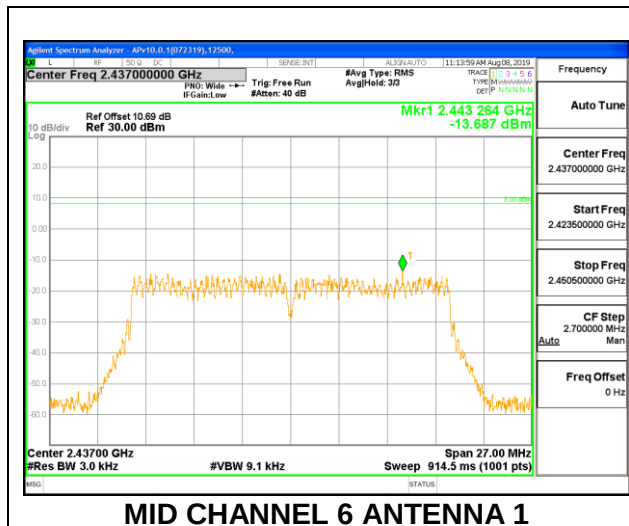


LOW CHANNEL 1 ANTENNA 1

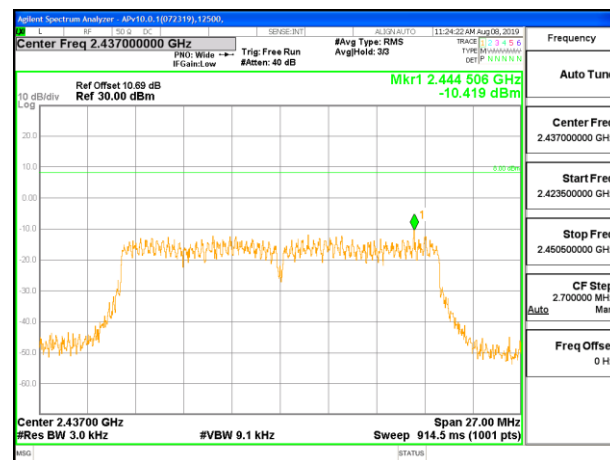


LOW CHANNEL 1 ANTENNA 2

MID CHANNEL 6

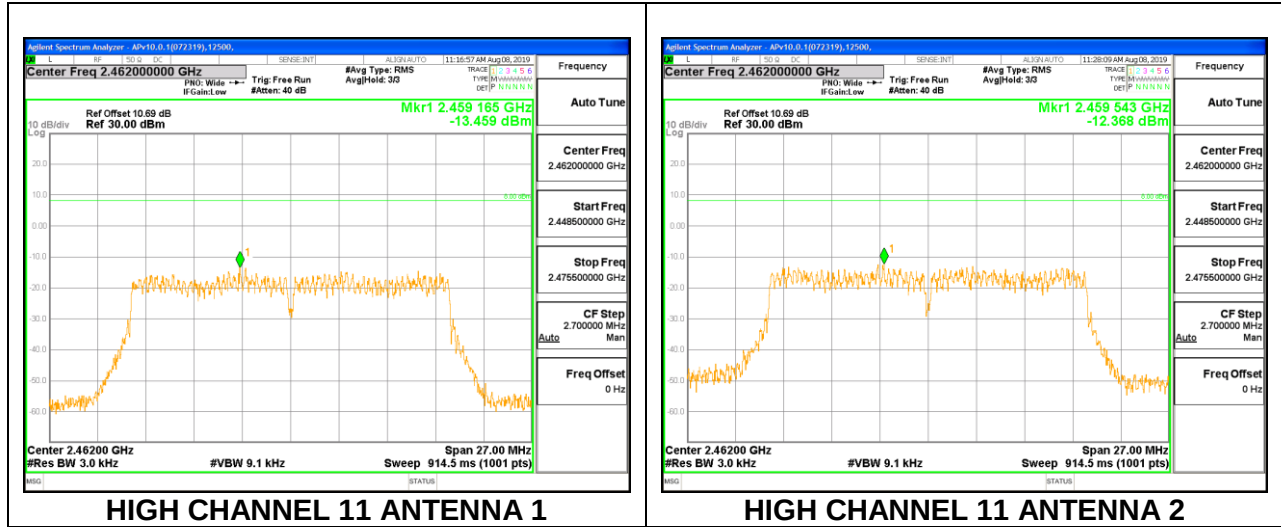


MID CHANNEL 6 ANTENNA 1



MID CHANNEL 6 ANTENNA 2

HIGH CHANNEL 11



8.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

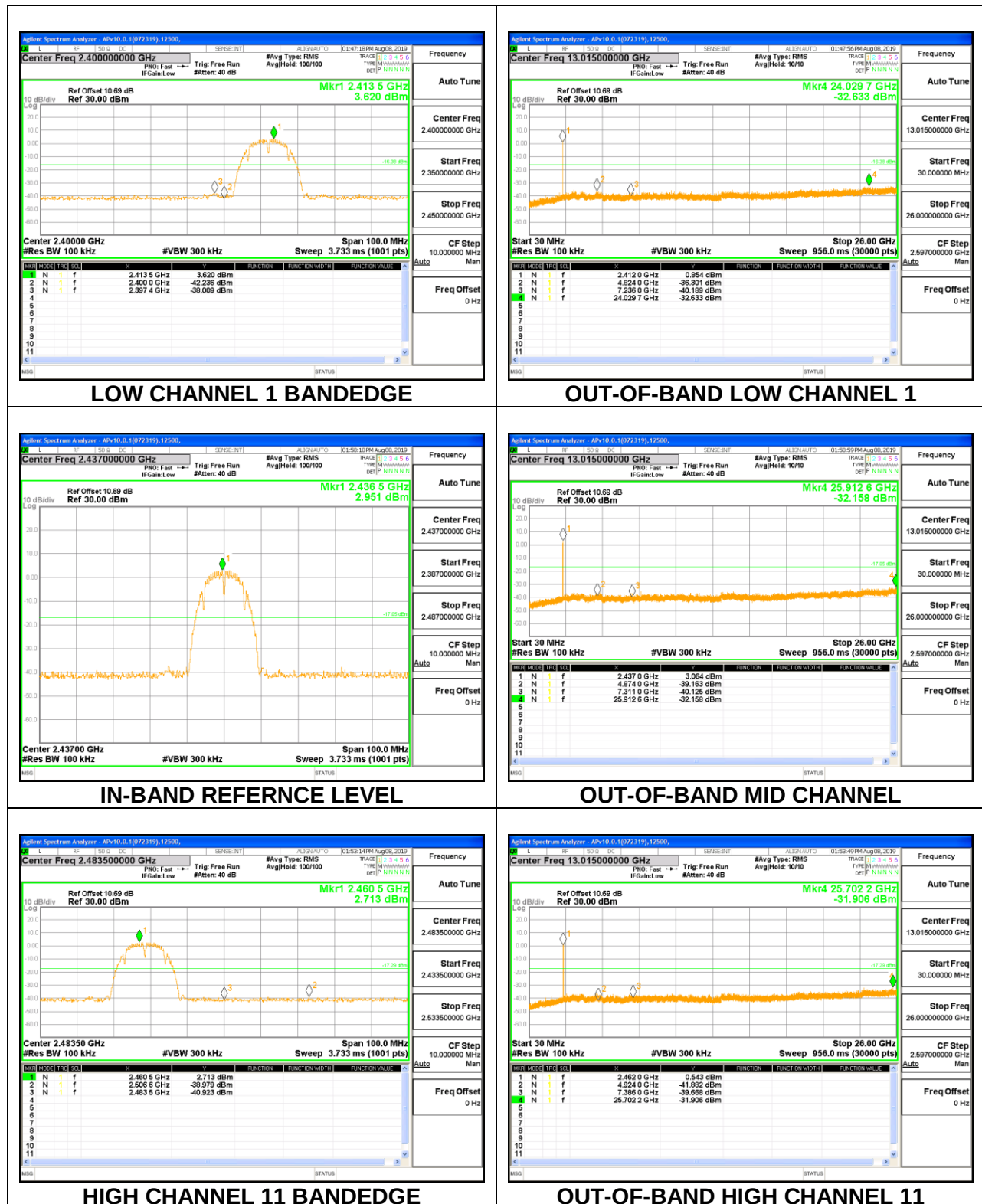
FCC §15.247 (d)

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

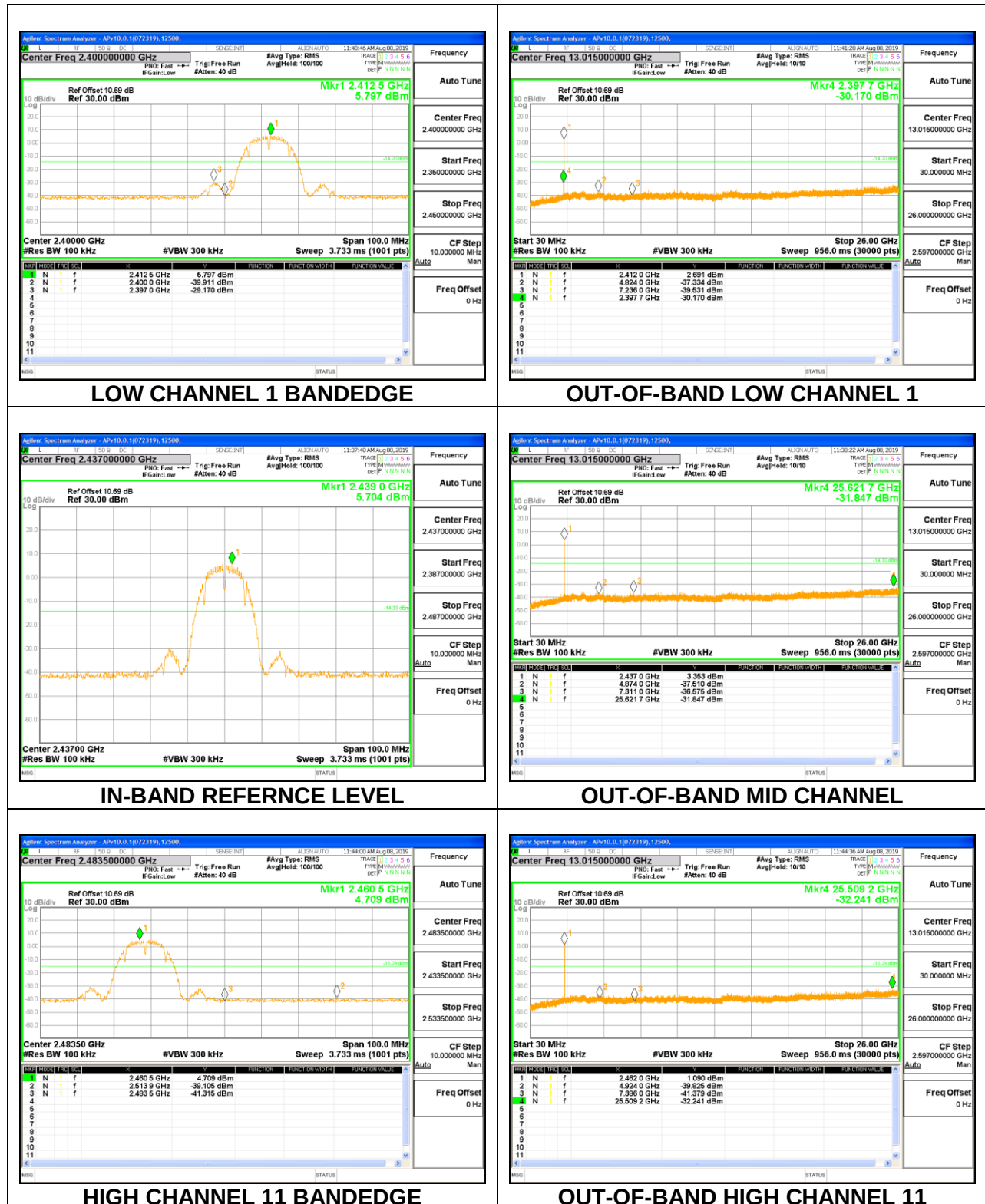
RESULTS

8.7.1. 802.11b MODE

1TX Antenna 1 MODE

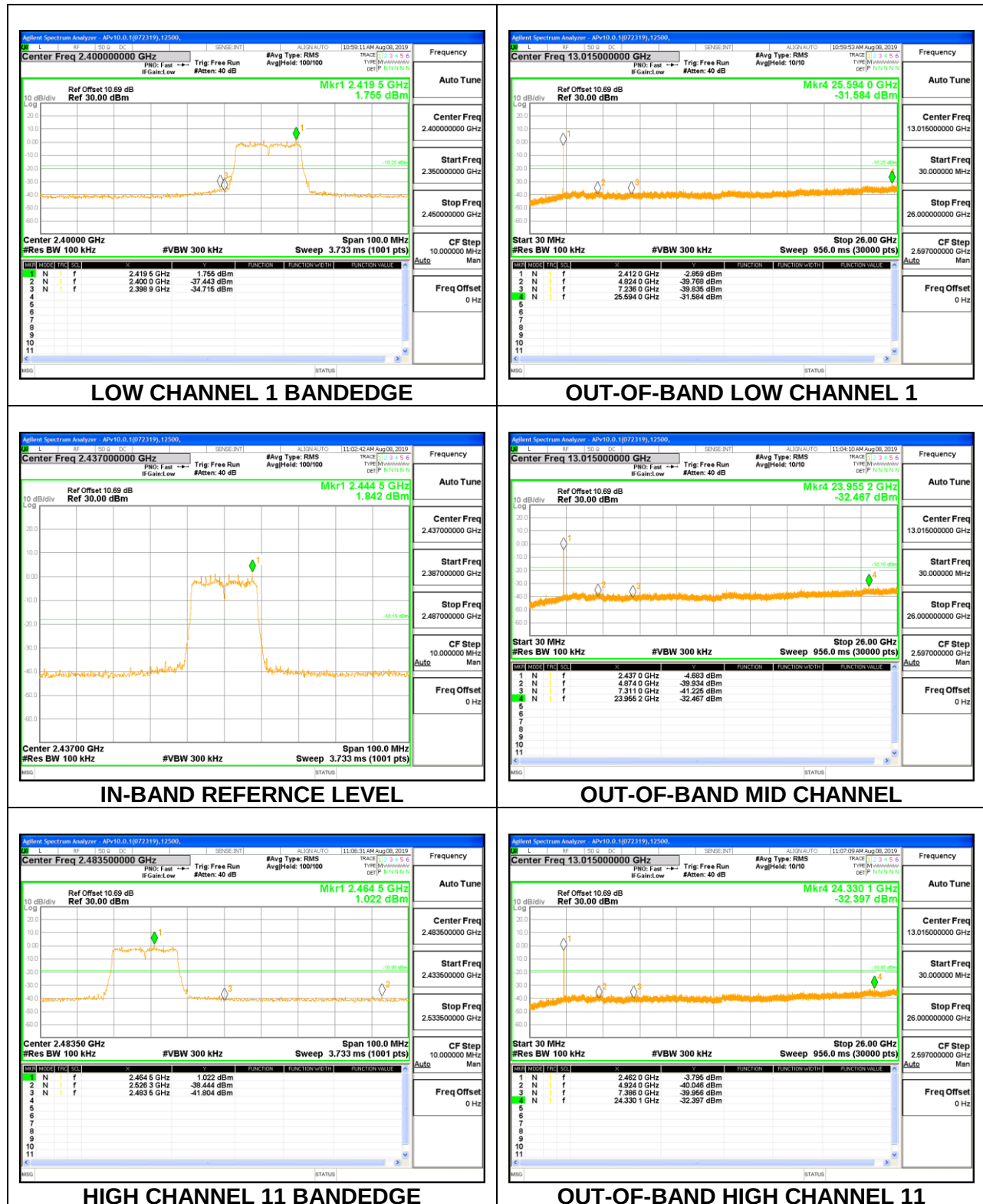


1TX Antenna 2 MODE

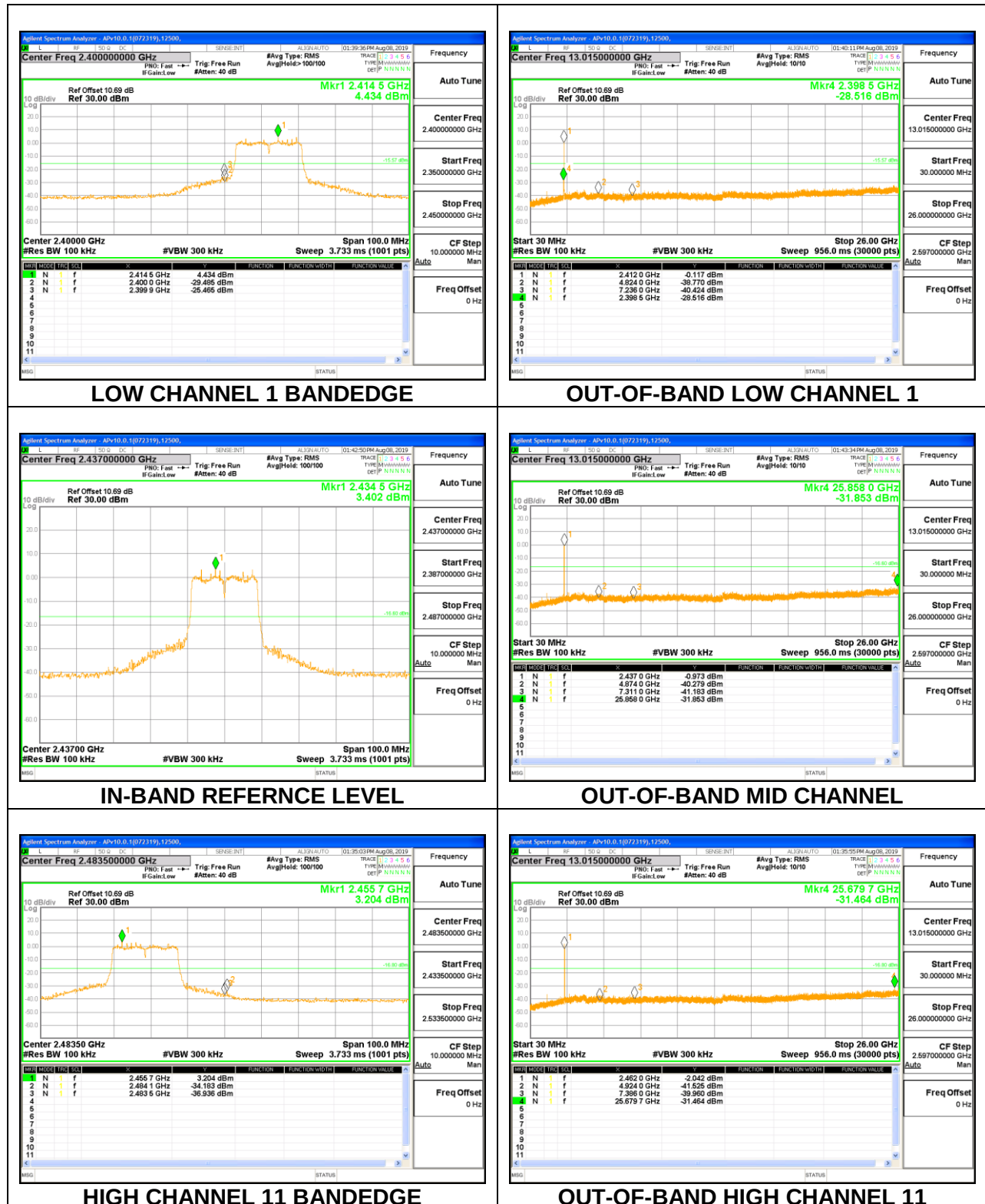


8.7.2. 802.11n HT20 MODE

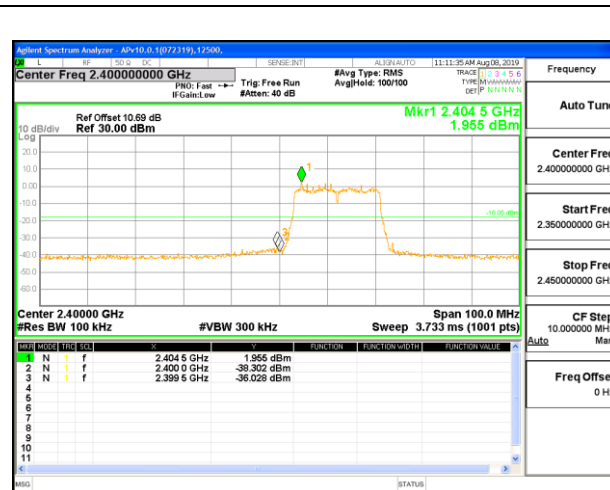
1TX Antenna 1 MODE



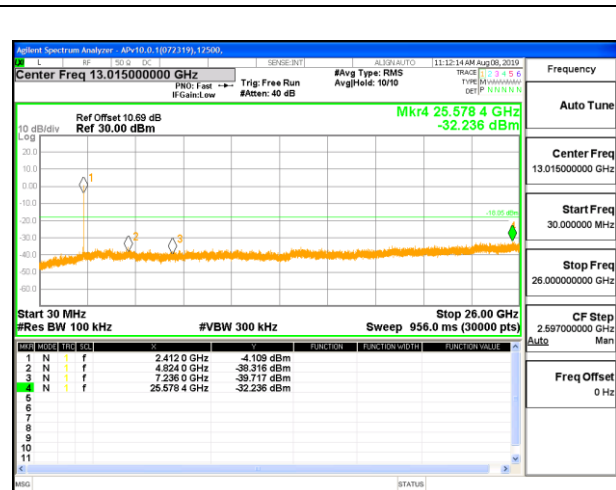
1TX Antenna 2 MODE



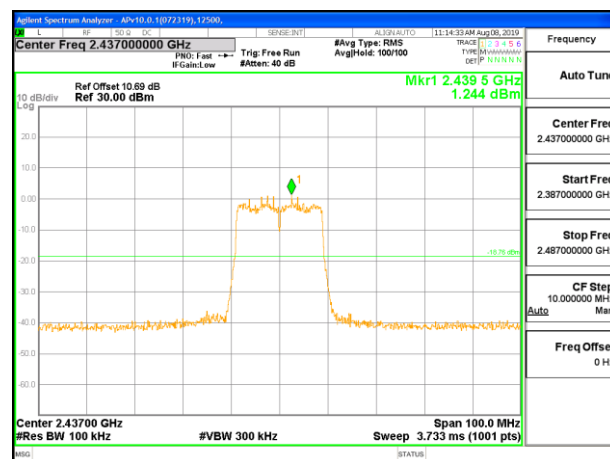
2TX Antenna 1 + Antenna 2 CDD MODE



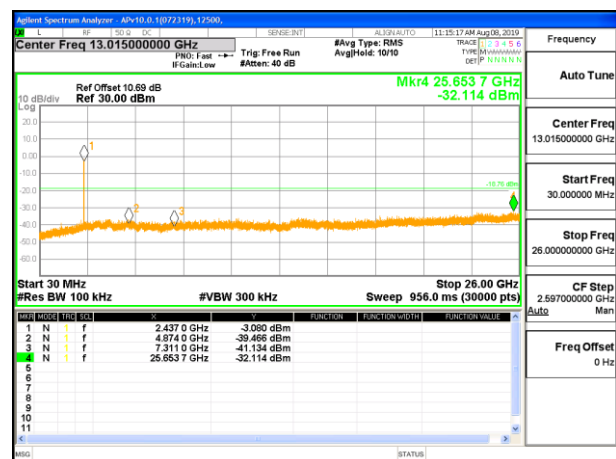
LOW CHANNEL 1 BANDEDGE ANTENNA 1



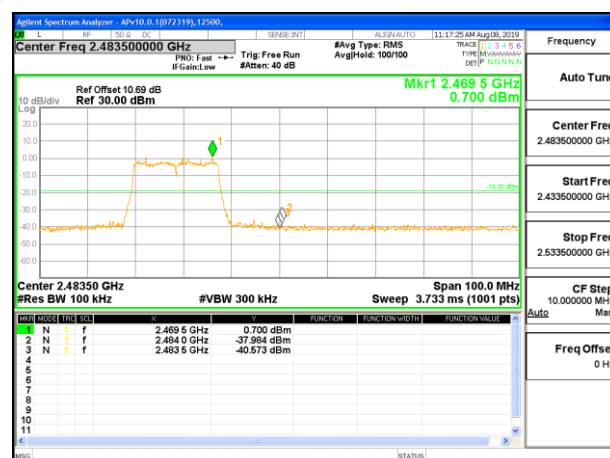
OUT-OF-BAND LOW CHANNEL 1 ANTENNA 1



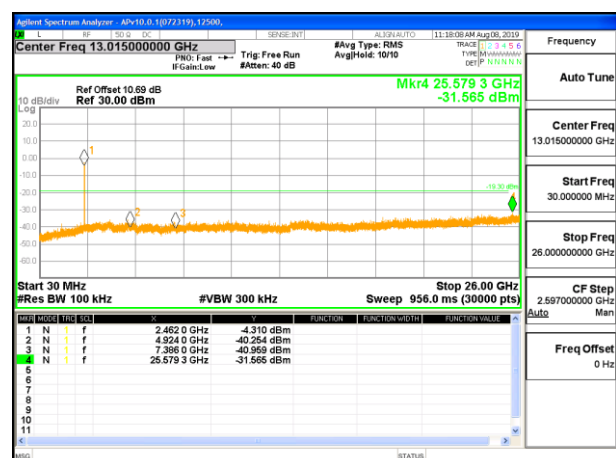
IN-BAND REFERENCE LEVEL ANTENNA 1



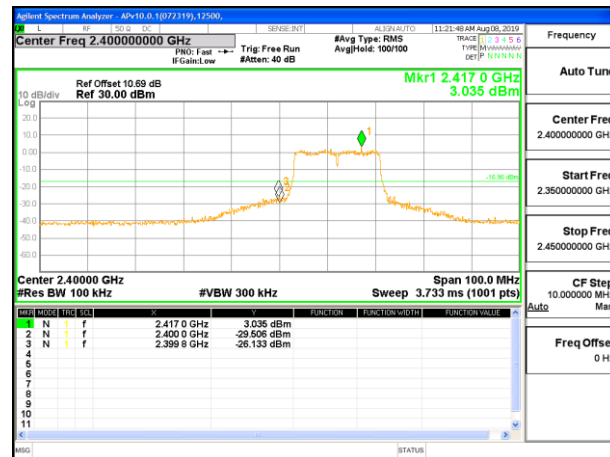
OUT-OF-BAND MID CHANNEL ANTENNA 1



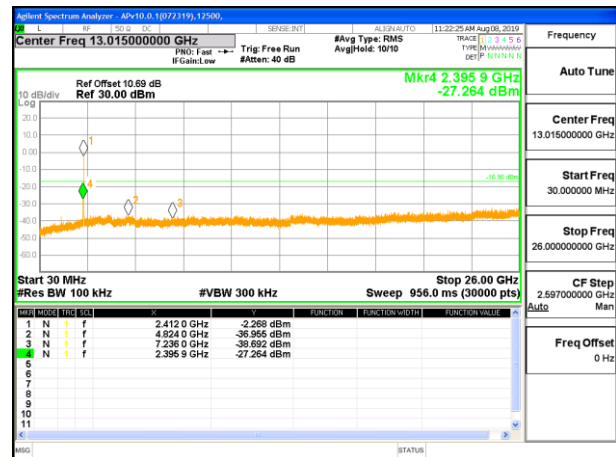
HIGH CHANNEL 11 BANDEDGE ANTENNA 1



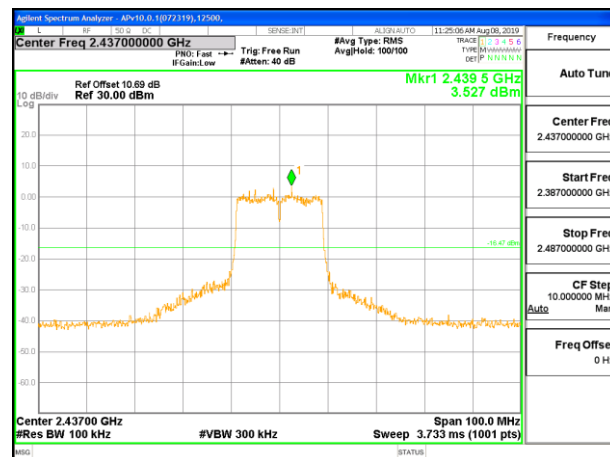
OUT-OF-BAND HIGH CHANNEL 11 ANTENNA 1



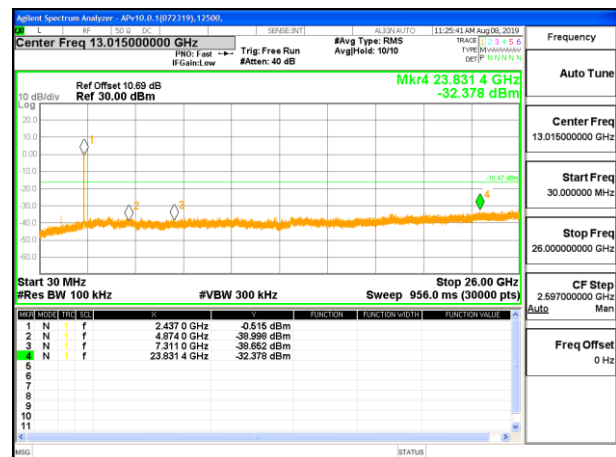
LOW CHANNEL 1 BANDEDGE ANTENNA 2



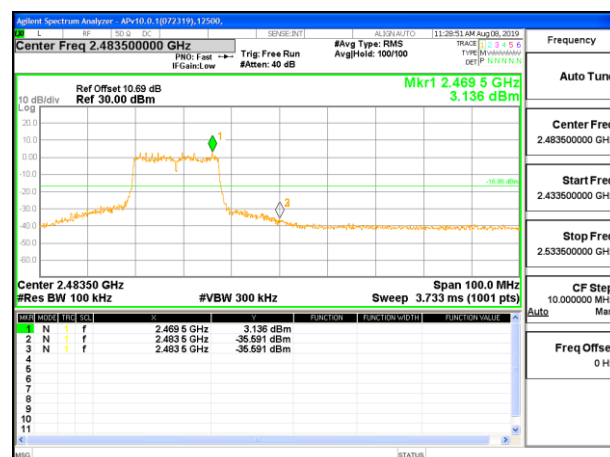
OUT-OF-BAND LOW CHANNEL 1
ANTENNA 2



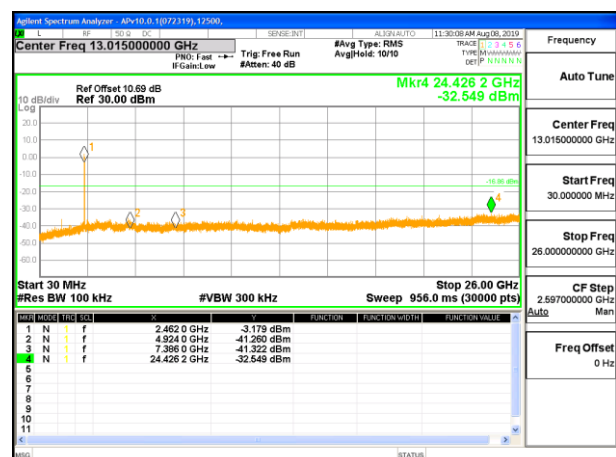
IN-BAND REFERENCE LEVEL ANTENNA 2



OUT-OF-BAND MID CHANNEL ANTENNA 2



HIGH CHANNEL 11 BANDEDGE ANTENNA
2



OUT-OF-BAND HIGH CHANNEL 11
ANTENNA 2

9. RADIATED TEST RESULTS

LIMITS

FCC §15.205 and §15.209

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
0.009-0.490	2400/F(kHz) @ 300 m	-
0.490-1.705	24000/F(kHz) @ 30 m	-
1.705 - 30	30 @ 30m	-
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1GHz; 1.5 m above the ground plane for measurement above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For pre-scans above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 KHz for peak measurements.

For final measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements and as applicable for average measurements.

The spectrum from 1 GHz to 18 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band. Below 1GHz and above 18GHz emissions, the channel with the highest output power was tested.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel), parallel and perpendicular are the worst orientations, therefore testing was performed on these two orientations only.

KDB 414788 Open Field Site(OFS) and Chamber Correlation Justification

Based on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

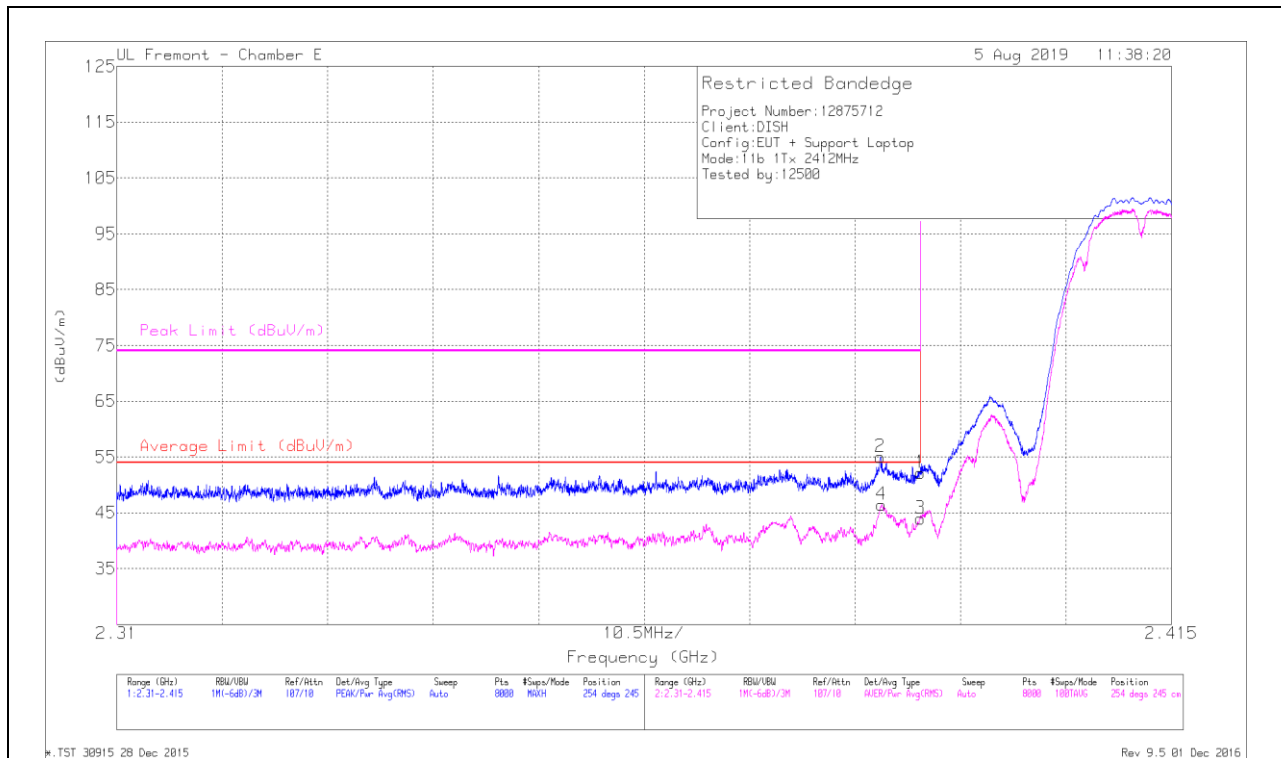
9.1. TRANSMITTER ABOVE 1 GHz

9.1.1. TX ABOVE 1 GHz 802.11b MODE IN THE 2.4 GHz BAND

1TX Antenna 1 MODE

BANDEDGE (LOW CHANNEL, CH 1)

HORIZONTAL RESULT



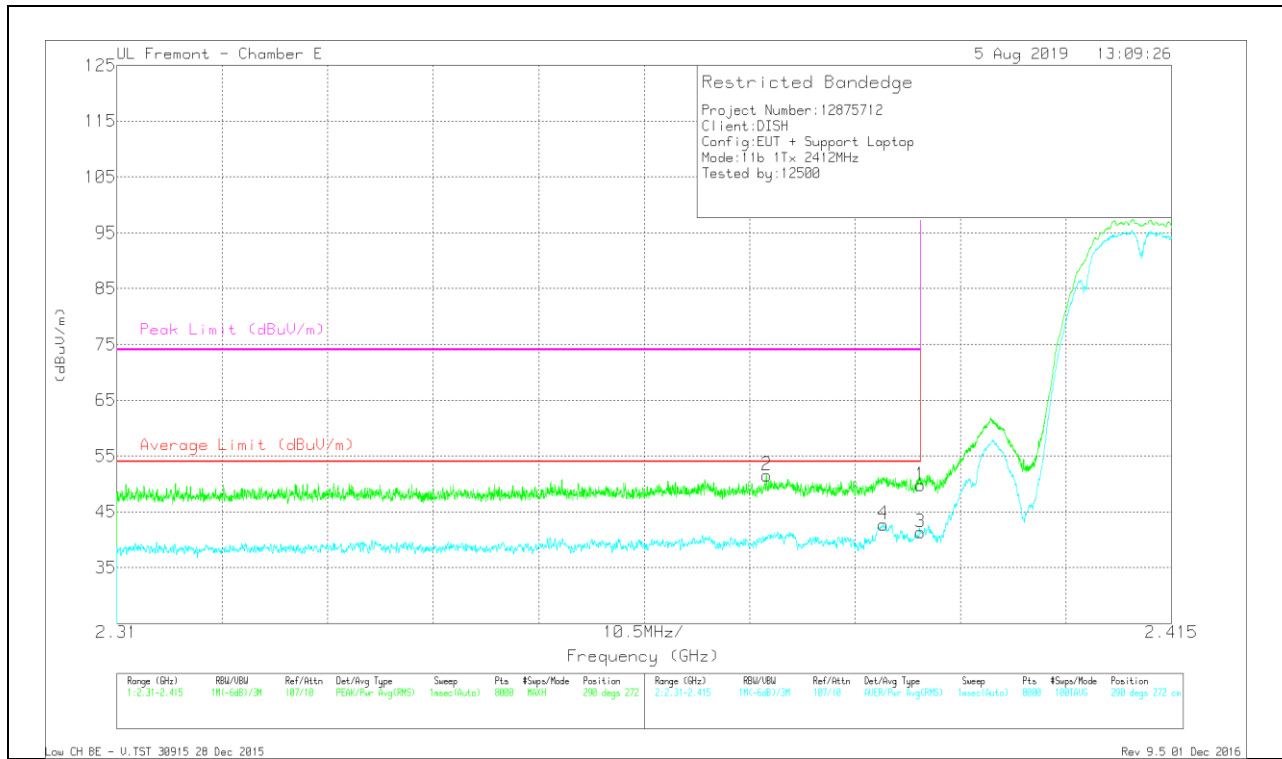
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dBm)	Amp/Cbl/Filtr/P ad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	46.06	Pk	32.3	-26.2	52.16	-	-	74	-21.84	254	245	H
2	* 2.386	49.01	Pk	32.3	-26.3	55.01	-	-	74	-18.99	254	245	H
3	* 2.39	37.89	RMS	32.3	-26.2	43.99	54	-10.01	-	-	254	245	H
4	* 2.386	40.49	RMS	32.3	-26.3	46.49	54	-7.51	-	-	254	245	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dBm)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 2.375	45.69	Pk	32.2	-26.3	51.59	-	-	74	-22.41	290	272	V
4	* 2.386	36.78	RMS	32.3	-26.3	42.78	54	-11.22	-	-	290	272	V
1	* 2.39	43.67	Pk	32.3	-26.2	49.77	-	-	74	-24.23	290	272	V
3	* 2.39	35.3	RMS	32.3	-26.2	41.4	54	-12.6	-	-	290	272	V

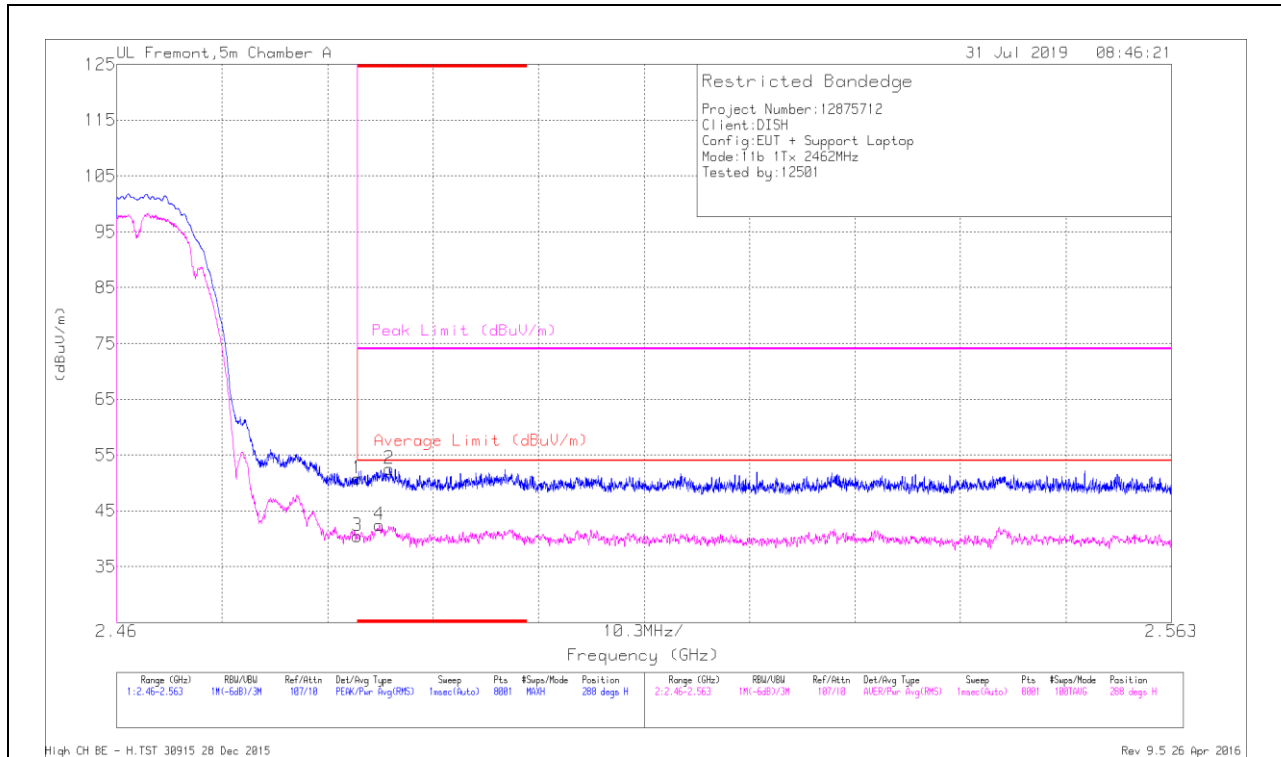
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

BANDEDGE (HIGH CHANNEL, CH 11)

HORIZONTAL RESULT



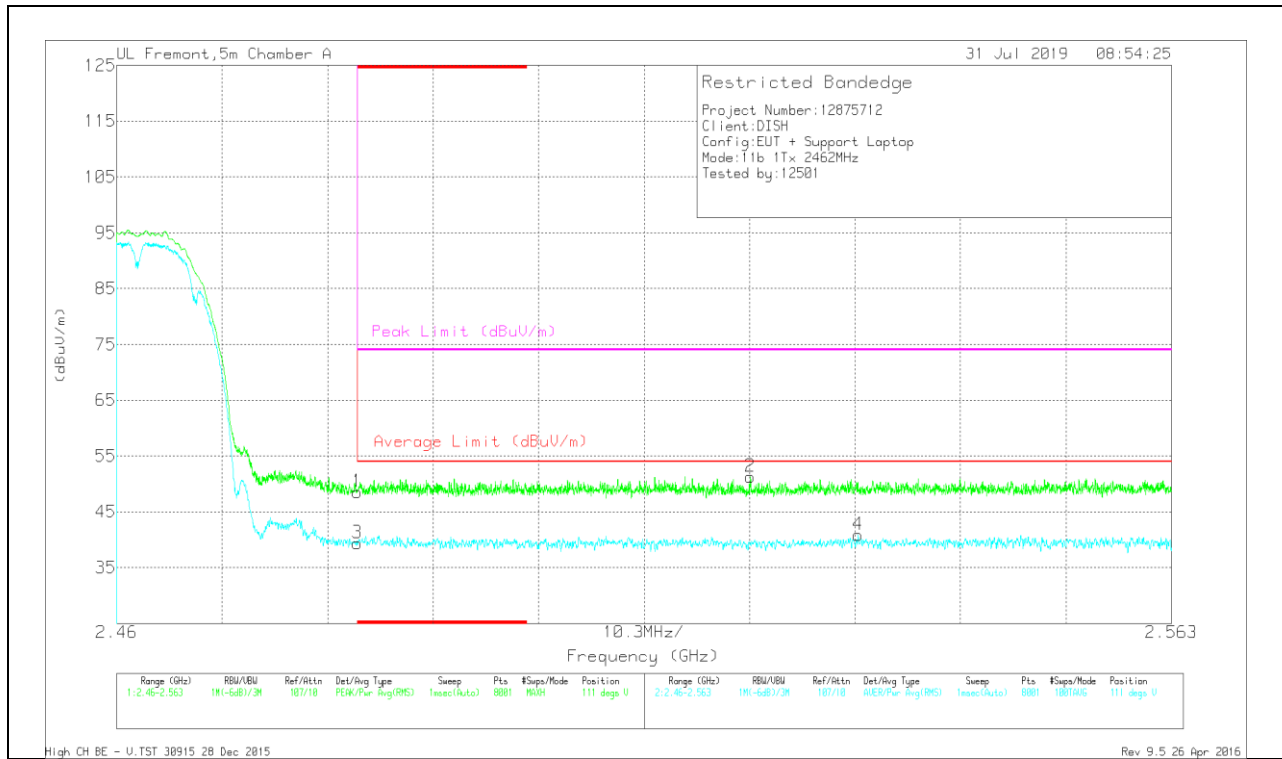
Marker	Frequenc y (GHz)	Meter Reading (dBuV)	Det	AF T346 (dBlim)	Amp/CbI/Ftr/Pad (dB)	DC Corr (dB)	Correcte d Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	40.27	Pk	32.6	-22.1	0	50.77	-	-	74	-23.23	288	198	H
2	* 2.487	42.04	Pk	32.6	-22.1	0	52.54	-	-	74	-21.46	288	198	H
3	* 2.484	29.94	RMS	32.6	-22.1	0	40.44	54	-13.56	-	-	288	198	H
4	* 2.486	31.95	RMS	32.6	-22.1	0	42.45	54	-11.55	-	-	288	198	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dBm)	Amp/Ch/EItr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	38.05	Pk	32.6	-22.1	0	48.55	-	-	74	-25.45	111	384	V
3	* 2.484	28.83	RMS	32.6	-22.1	0	39.33	54	-14.67	-	-	111	384	V
2	2.522	40.58	Pk	32.6	-21.9	0	51.28	-	-	74	-22.72	111	384	V
4	2.532	30.01	RMS	32.6	-21.8	0	40.81	54	-13.19	-	-	111	384	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL, CH 1 RESULTS

