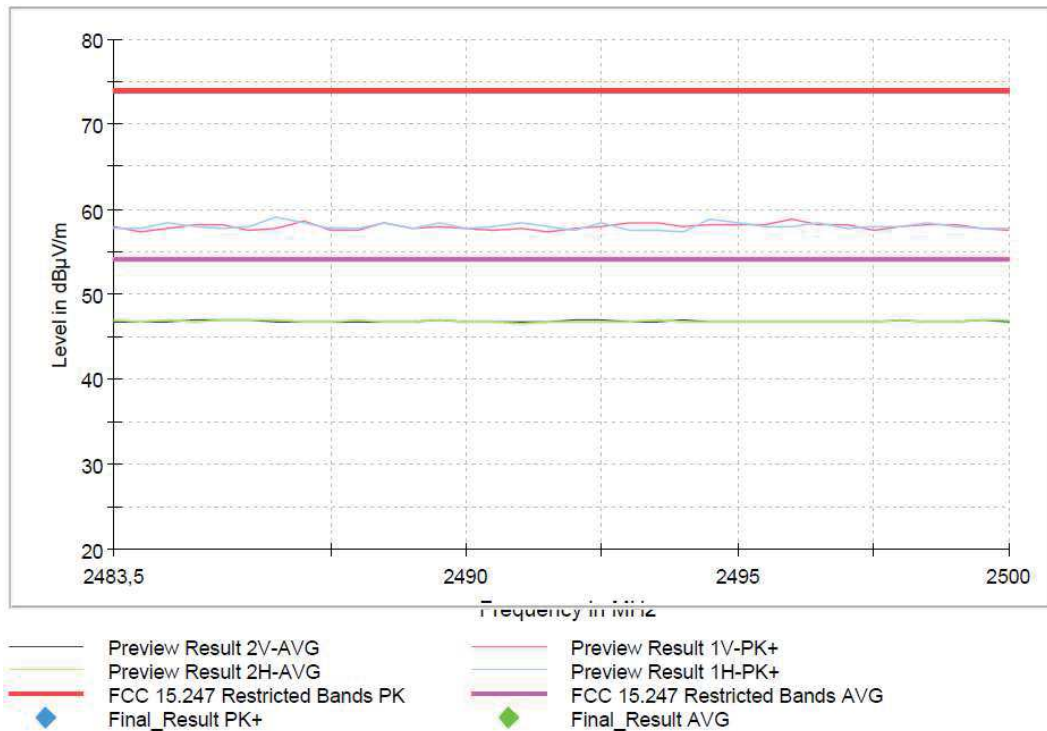
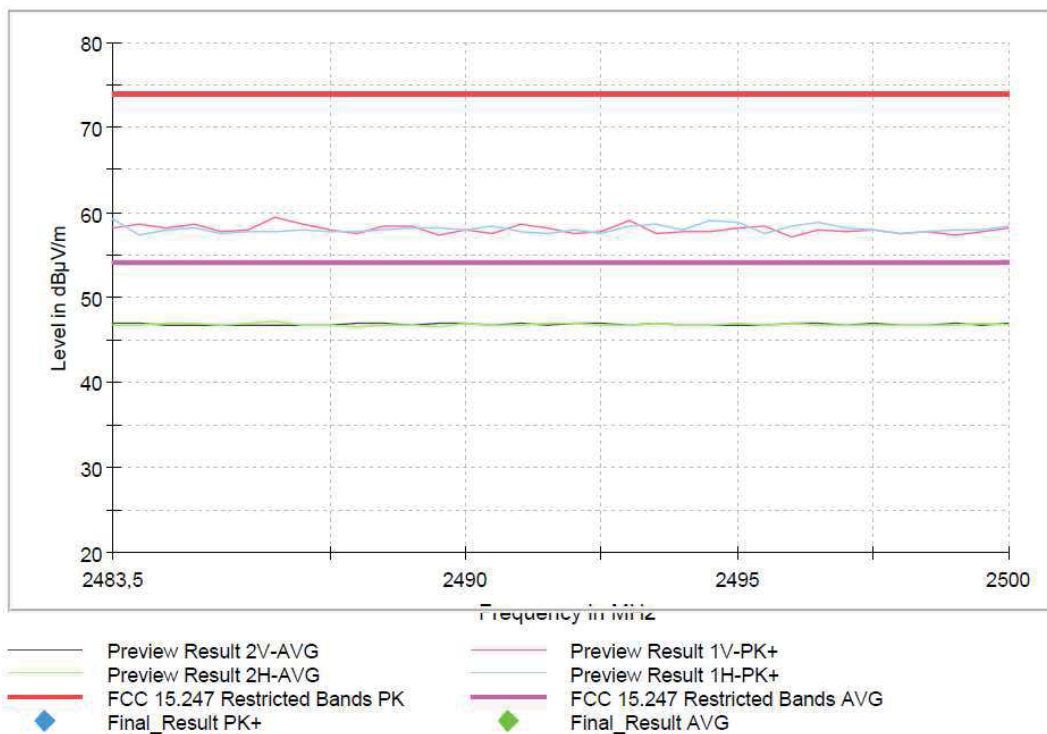


• **8-DPSK modulation (3DH5)**

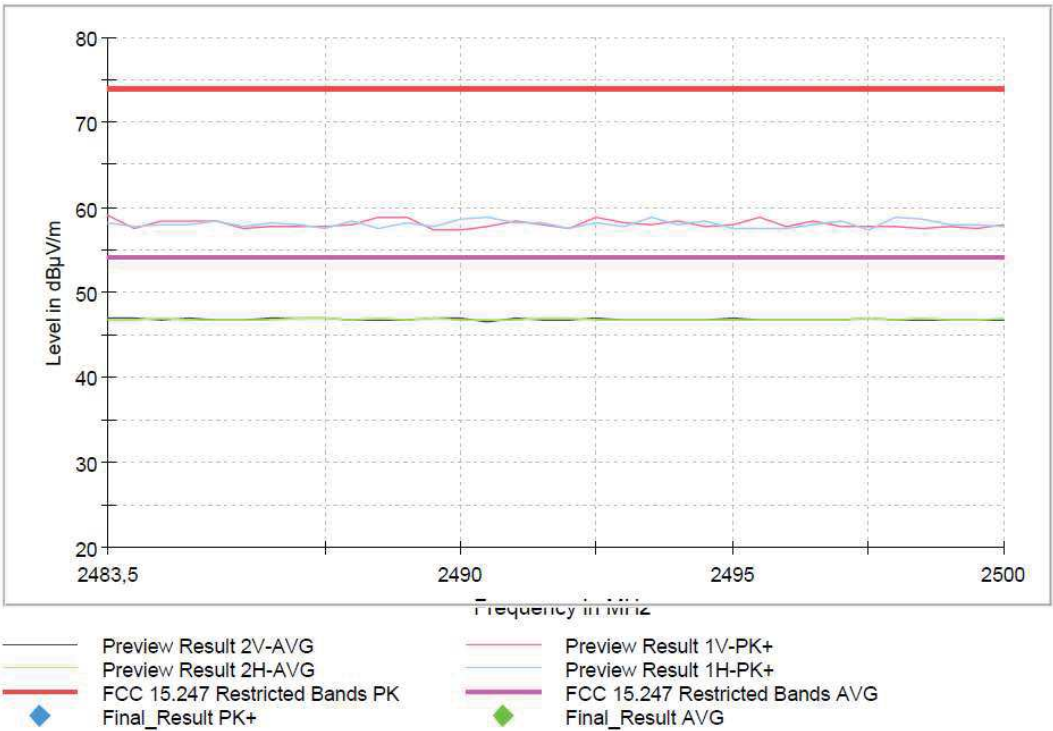
- Low Channel:



- Middle Channel:



- High Channel:



Appendix B: Test results. 802.11 bgn20 2x2

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TEST CONDITIONS

POWER SUPPLY (V):

V nominal:	12 Vdc
Type of Power Supply:	DC voltage from external power supply (car battery).

ANTENNAS:

Type of Antenna:	External.
Maximum Declared Antenna Gain:	
CORE1_Port4:	+2.4 dBi
CORE0_Port2:	-0.3 dBi

Directional Antenna Gain Calculations for CDD MIMO:

For 2Tx CDD MIMO modes, in accordance with KDB 662911 D01 v02r01 Section F)2)f)(ii), directional gain was calculated as (worst case):

$N_{ss} = 1$, $N_{ANT} = 2$, $G_{CORE1} = 2.4$ dBi, $G_{CORE1} = -0.3$ dBi

$$\begin{aligned} \text{Directional Gain} &= 10 \log \left[\frac{\sum_{j=1}^{N_{ss}} \left(\sum_{k=1}^{N_{ANT}} g_{j,k} \right)^2}{N_{ANT}} \right] = 10 \log \left[\frac{\sum_{j=1}^1 \left(\sum_{k=1}^2 g_{j,k} \right)^2}{2} \right] \\ &= 10 \log \left[\frac{(g_{1,1} + g_{1,2})^2}{2} \right] = 10 \log \left[\frac{\left(10^{\frac{G_1}{20}} + 10^{\frac{G_2}{20}} \right)^2}{2} \right] = 10 \log \left[\frac{\left(10^{\frac{2.4}{20}} + 10^{\frac{-0.3}{20}} \right)^2}{2} \right] = +4.16 \text{ dBi} \end{aligned}$$

TEST FREQUENCIES:

For 802.11b/g/n20:

Low Channel (1):	2412 MHz
Middle Channel (6):	2437 MHz
High Channel (11):	2462 MHz

The sample was used to configure the EUT to continuously transmit at a specified output power in all channels with different modes and modulation schemes.

The field strength at the band edges was evaluated for each mode for the channel under test.

During transmitter test the EUT was being controlled by the SW tool to operate in a continuous transmit mode on the test channel as required and in each of the different modulation modes.

The EUT has four separate antennas which correspond to one port of the equipment.

For the Transmitter Minimum 6 dB Bandwidth test, only SISO modes were tested since the bandwidth does not change depending on chains used.

The data rates of 1Mb/s for 802.11b, 6.5Mb/s for 802.11g, MCS0 for 802.11n20 were selected based on preliminary testing that identified those rates corresponding to the worst cases for output power and band edge levels at restricted bands.

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and it is connected to the spectrum analyser using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.



RADIATED MEASUREMENTS

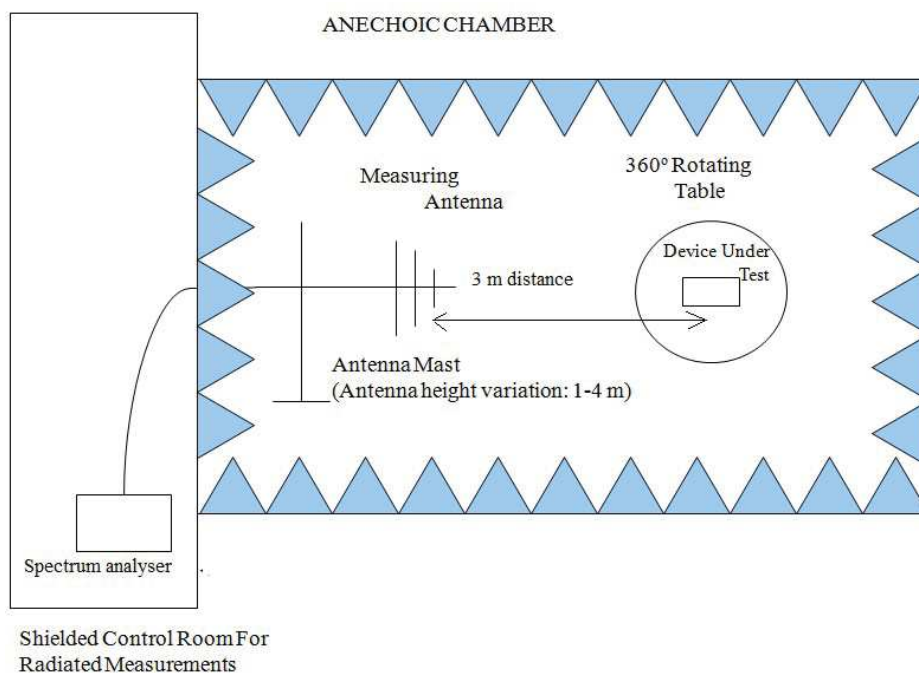
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1 GHz and 1 GHz-17 GHz Double ridge horn antenna) is situated at a distance of 3 m and at a distance of 1m for the frequency range 17 GHz-26 GHz (17 GHz-26 GHz horn antenna).

For radiated emissions in the range 17 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

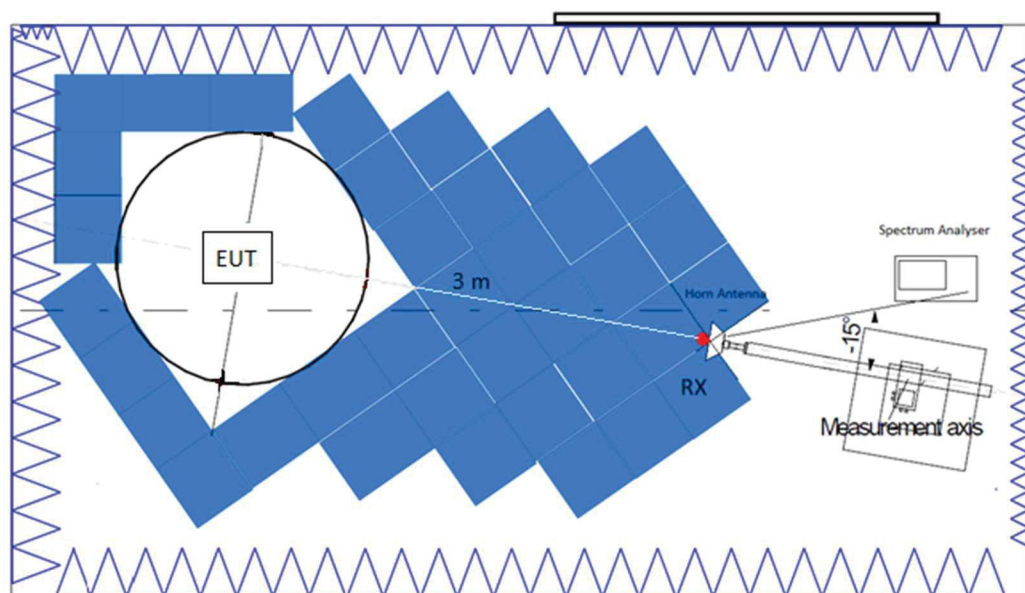
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

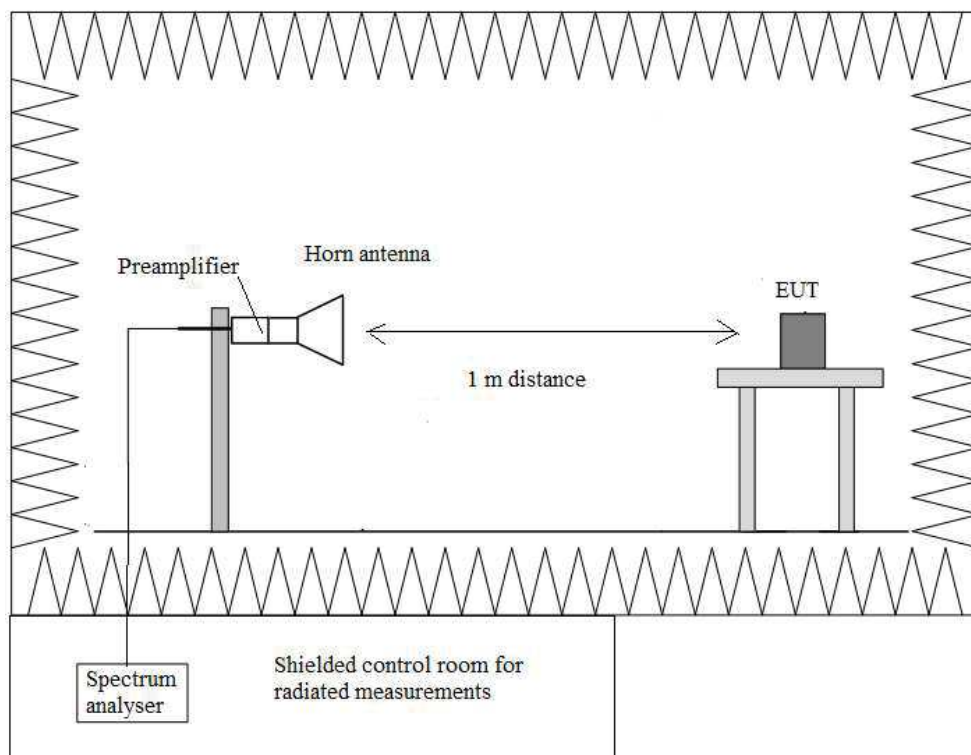
Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 17GHz:



Radiated measurements setup $f > 17\text{GHz}$:



Occupied Bandwidth

RESULTS:

Preliminary tests determined as the SISO worst case the CORE1_Port4 Antenna.
MIMO case is CORE1_Port4 Antenna & CORE0_Port2 Antenna.

SISO CORE1_Port4 Antenna:

- **Mode 802.11 b:**

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
99% bandwidth (MHz)	10.200	10.190	10.160
-26 dBc bandwidth (MHz)	14.108	14.149	13.739
Measurement uncertainty (kHz)	<± 40.42		

- **Mode 802.11 g:**

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
99% bandwidth (MHz)	16.867	16.850	16.883
-26 dBc bandwidth (MHz)	21.341	21.366	21.419
Measurement uncertainty (kHz)	<± 44.27		

- **Mode 802.11 n20**

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
99% bandwidth (MHz)	18.017	18.017	18
-26 dBc bandwidth (MHz)	21.625	21.716	21.652
Measurement uncertainty (kHz)	<± 44.27		

Verdict: PASS

MIMO – CORE1_Port4 Antenna & CORE0_Port2 Antenna:

- Mode 802.11 b**

	Low Channel		Middle Channel		High Channel	
	CORE1_ Port4	CORE0_ Port2	CORE1_ Port4	CORE0_ Port2	CORE1_ Port4	CORE0_ Port2
99% bandwidth (MHz)	10.187	10.213	10.227	10.24	10.213	10.213
-26 dBc bandwidth (MHz)	13.387	13.76	14.187	14.213	14.147	13.787
Measurement uncertainty (kHz)	<± 42.34					

- Mode 802.11 g**

	Low Channel		Middle Channel		High Channel	
	CORE1_ Port4	CORE0_ Port2	CORE1_ Port4	CORE0_ Port2	CORE1_ Port4	CORE0_ Port2
99% bandwidth (MHz)	16.827	16.867	16.813	16.880	16.800	16.880
-26 dBc bandwidth (MHz)	21.347	21.307	21.373	21.307	21.360	21.387
Measurement uncertainty (kHz)	<± 42.34					

- Mode 802.11 n20**

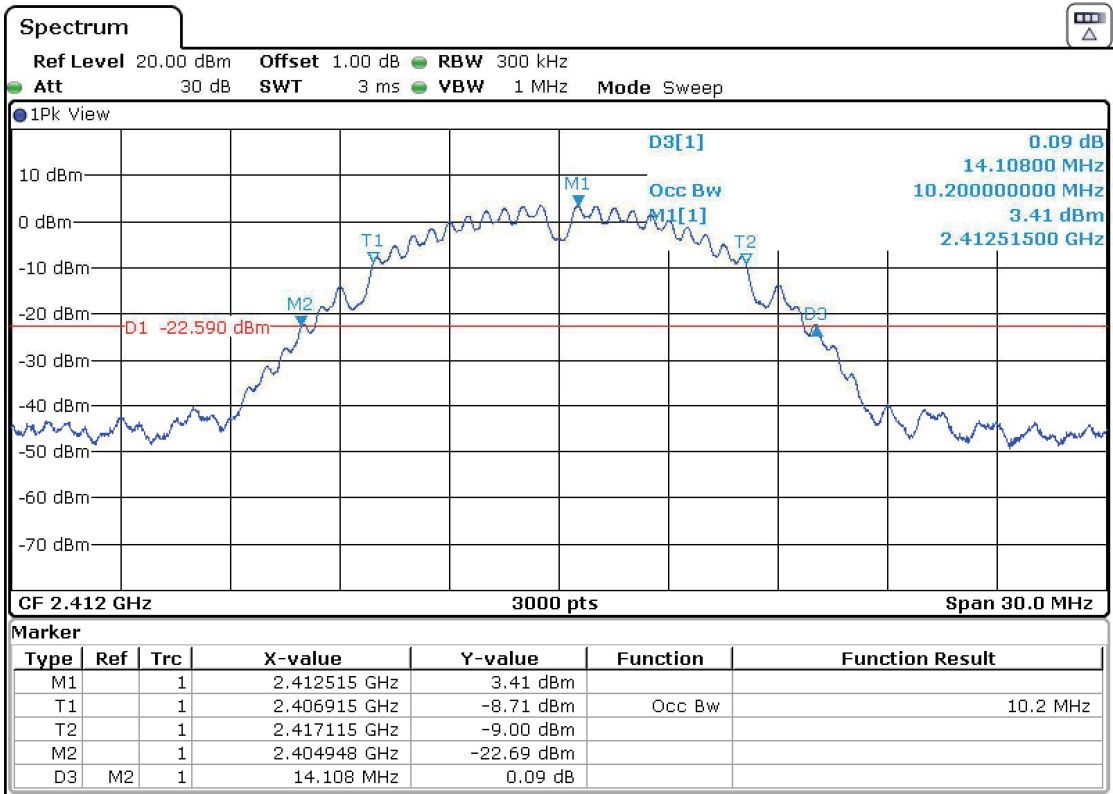
	Low Channel		Middle Channel		High Channel	
	CORE1_ Port4	CORE0_ Port2	CORE1_ Port4	CORE0_ Port2	CORE1_ Port4	CORE0_ Port2
99% bandwidth (MHz)	17.733	16.867	17.733	16.880	17.747	16.867
-26 dBc bandwidth (MHz)	21.507	21.36	21.307	21.356	21.32	21.387
Measurement uncertainty (kHz)	<± 42.34					

Verdict: PASS

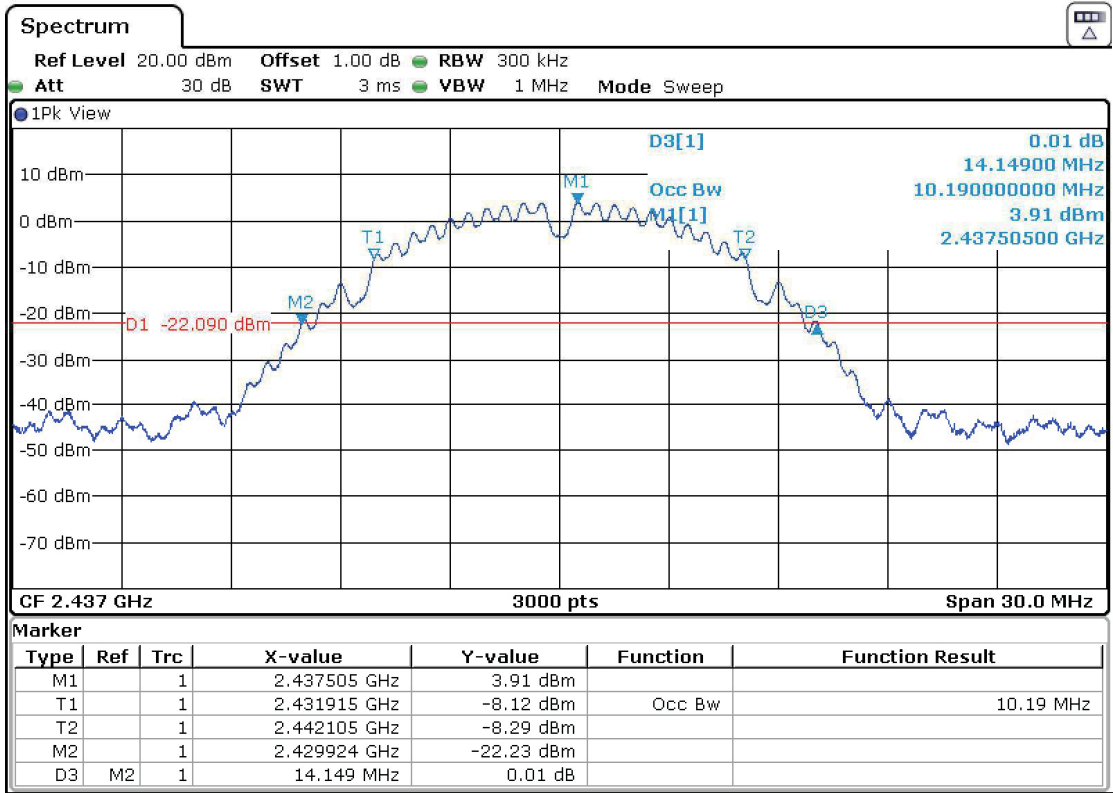
SISO CORE1_Port4 Antenna:

- Mode 802.11 b – Occupied Bandwidth

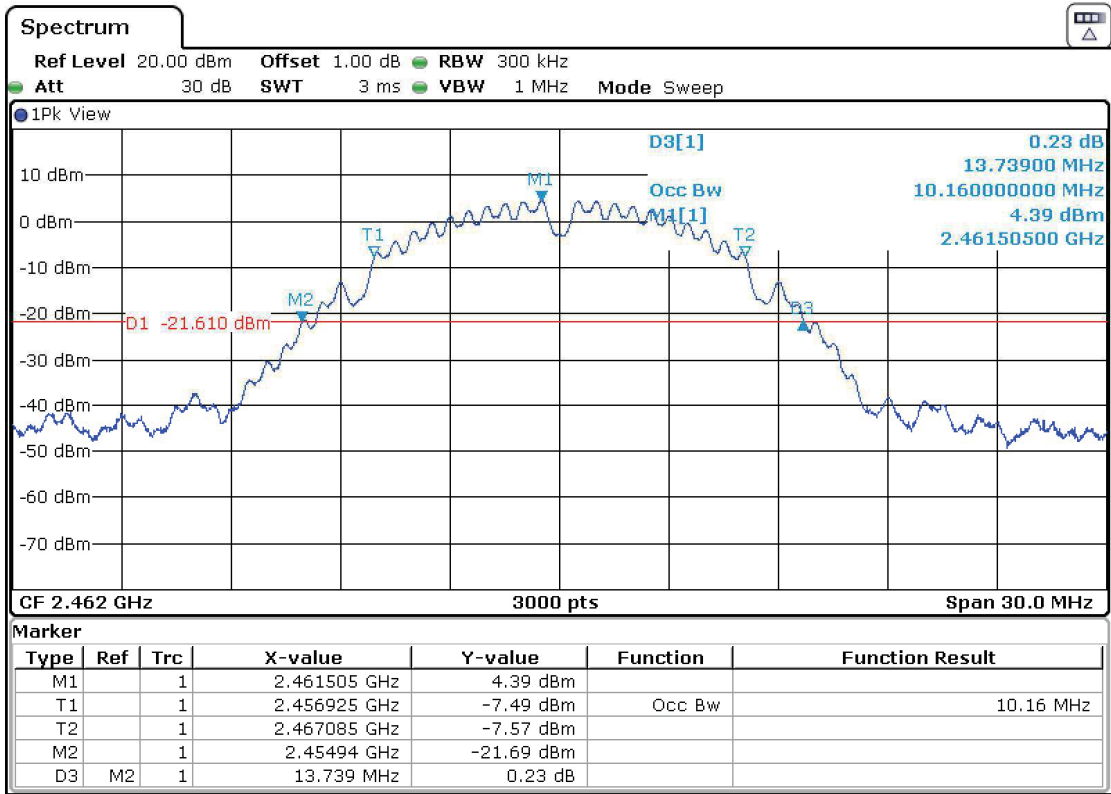
- Low Channel:



- Middle Channel:

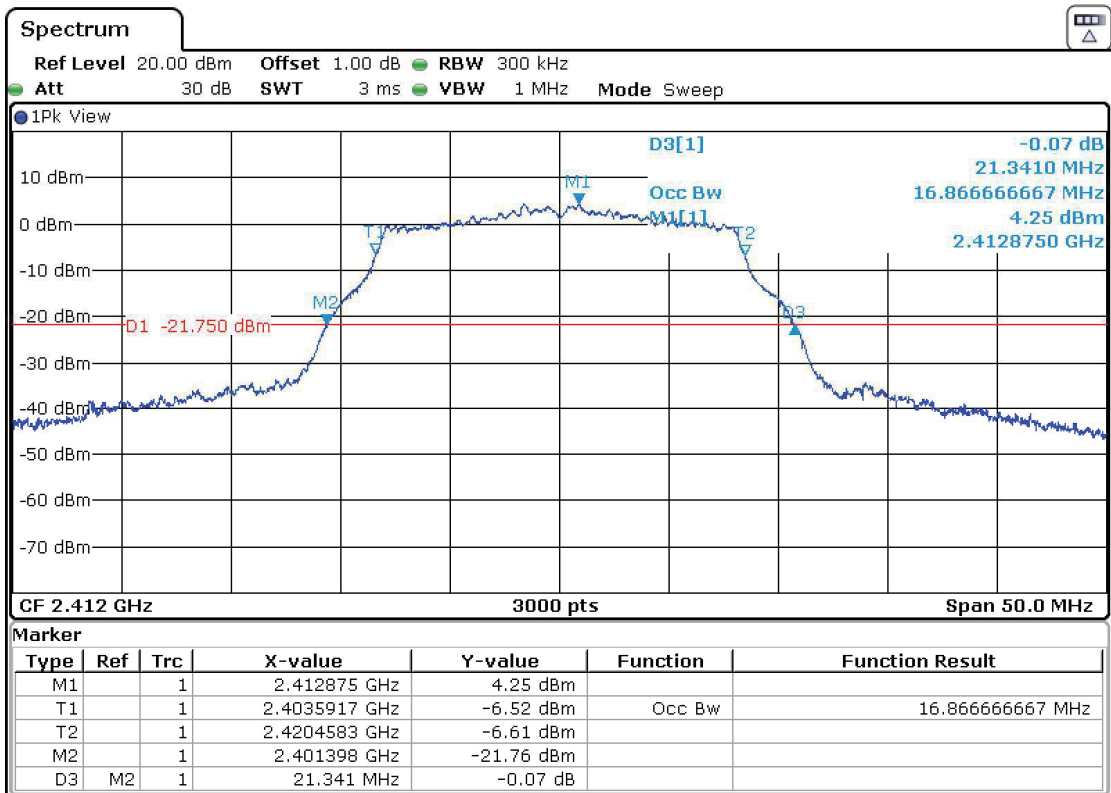


- High Channel:

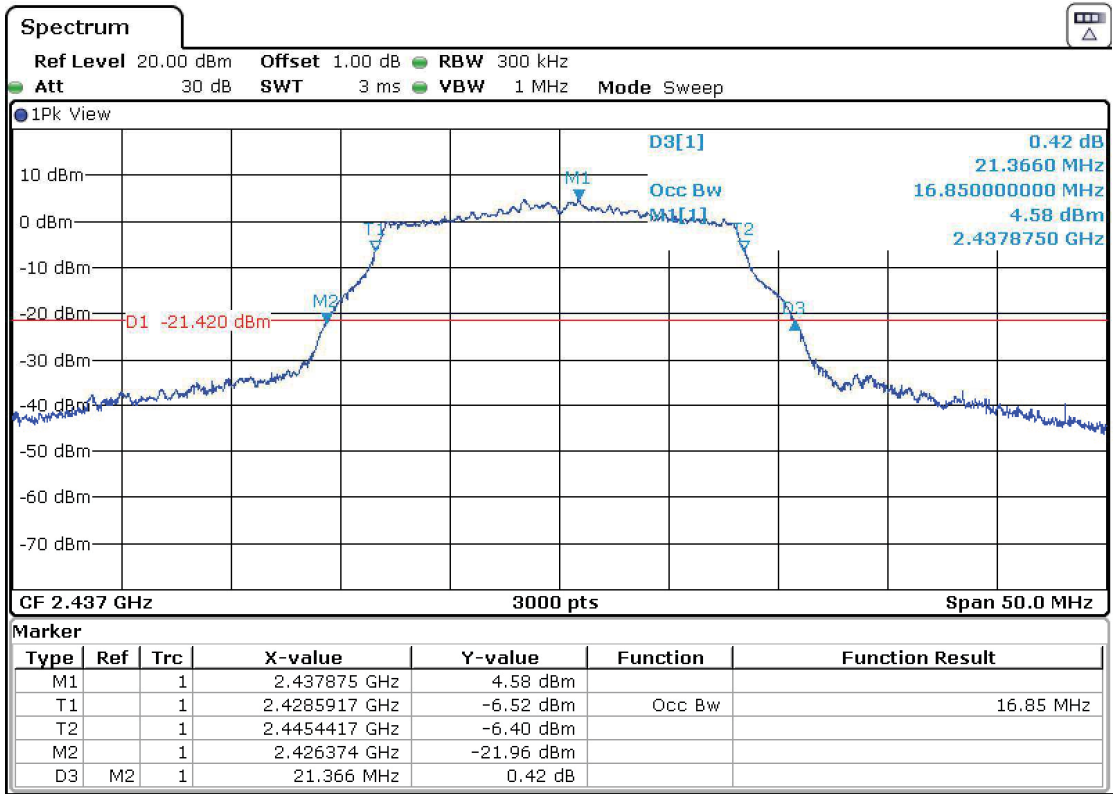


• Mode 802.11 g – Occupied Bandwidth

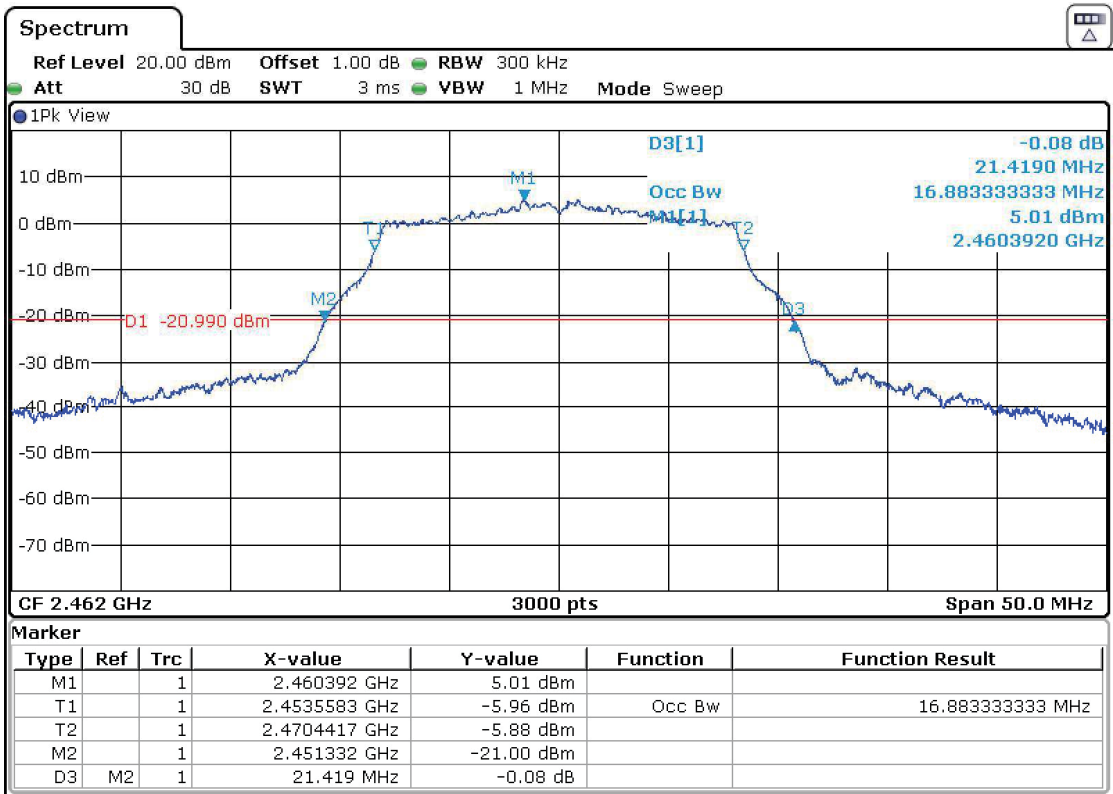
- Low Channel:



- Middle Channel:

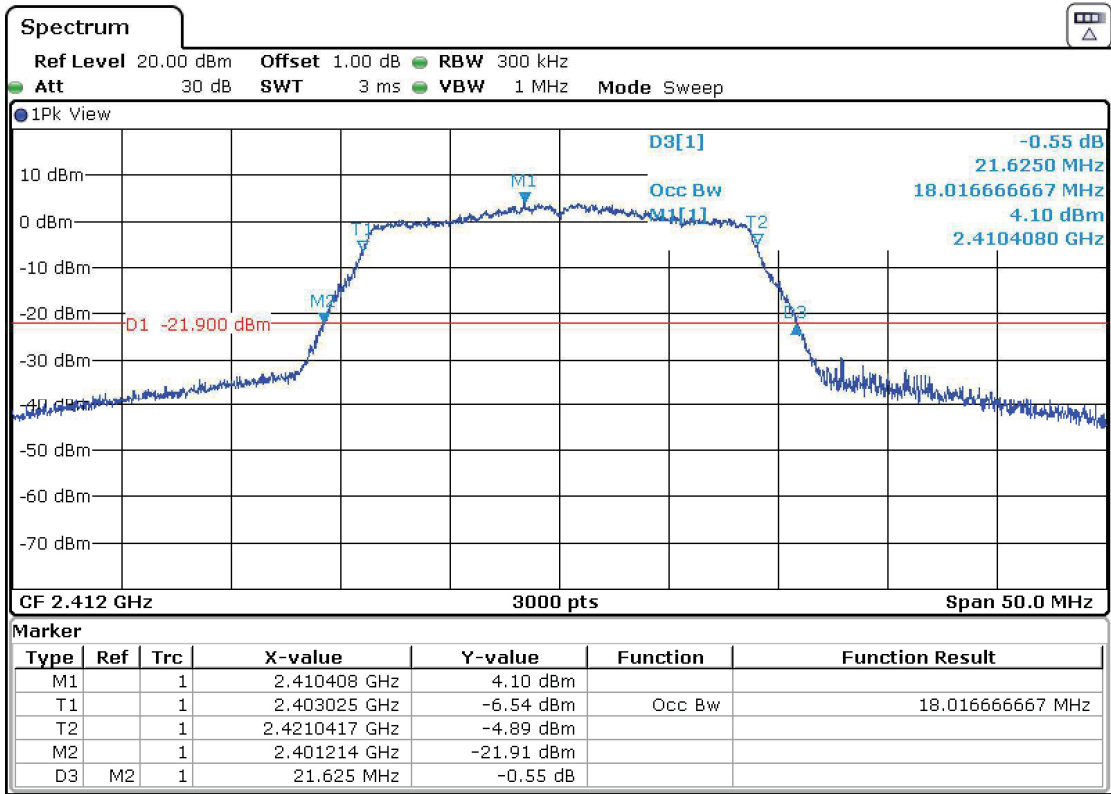


- High Channel:

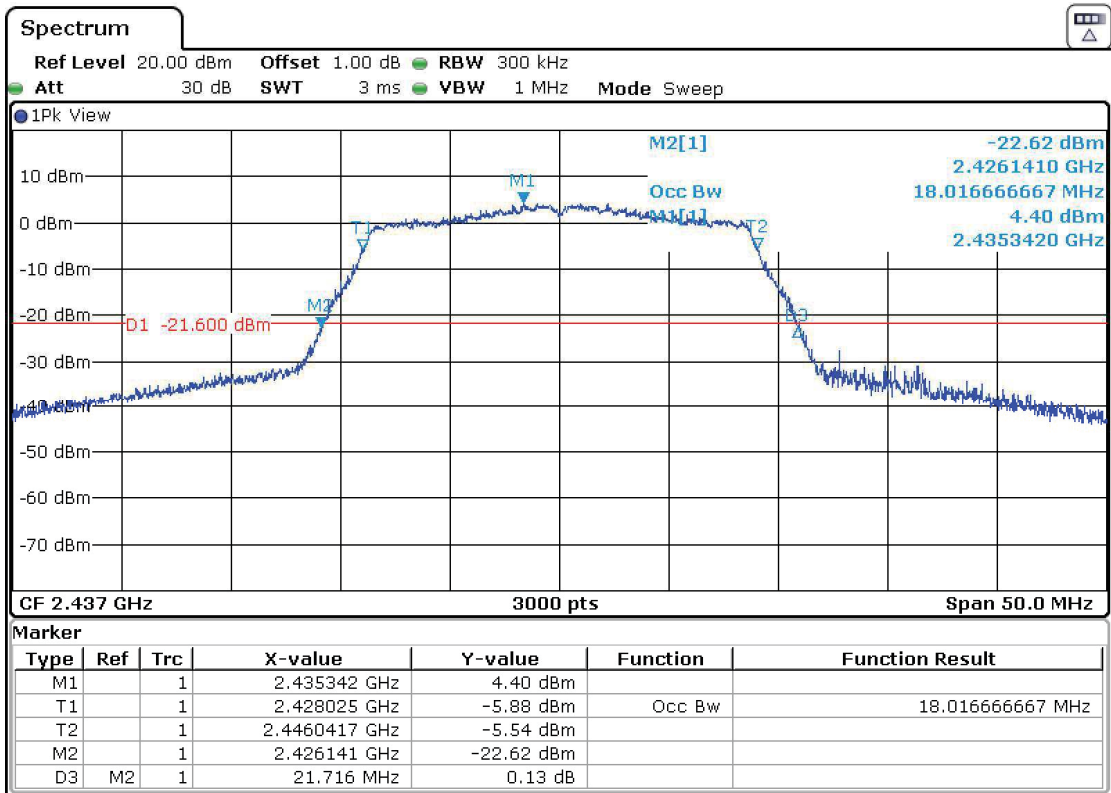


• Mode 802.11 n20 – Occupied Bandwidth

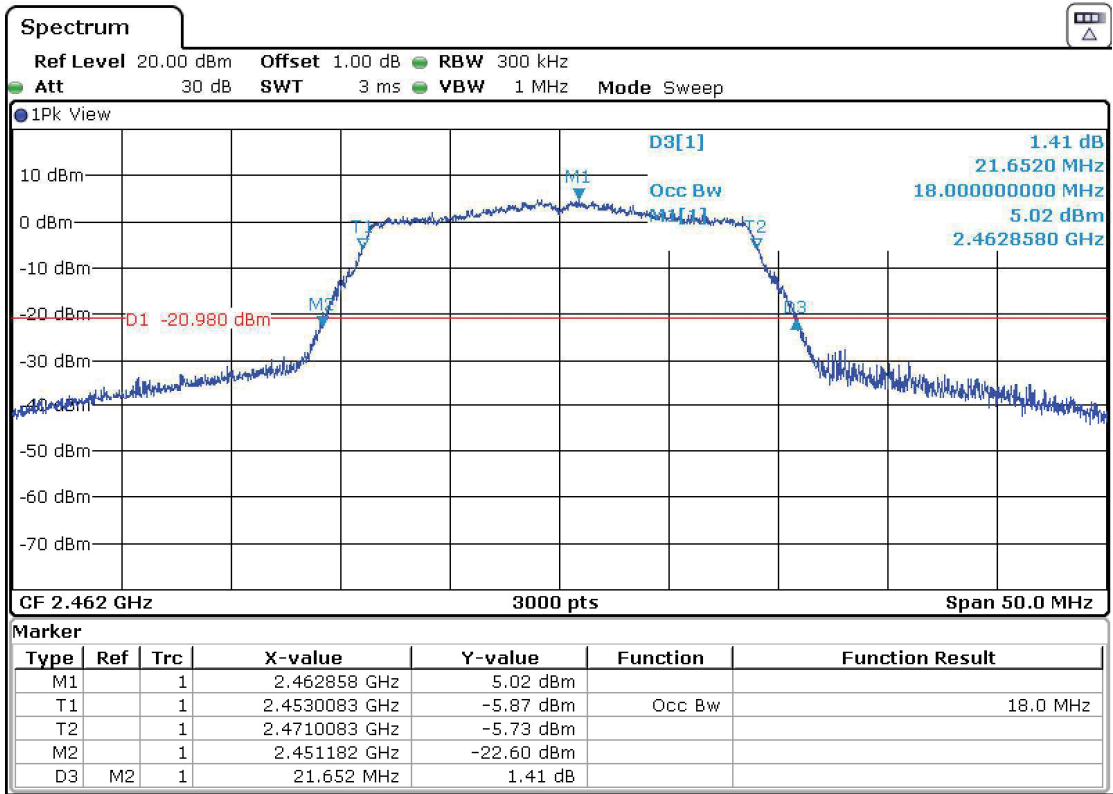
- Low Channel:



- Middle Channel:



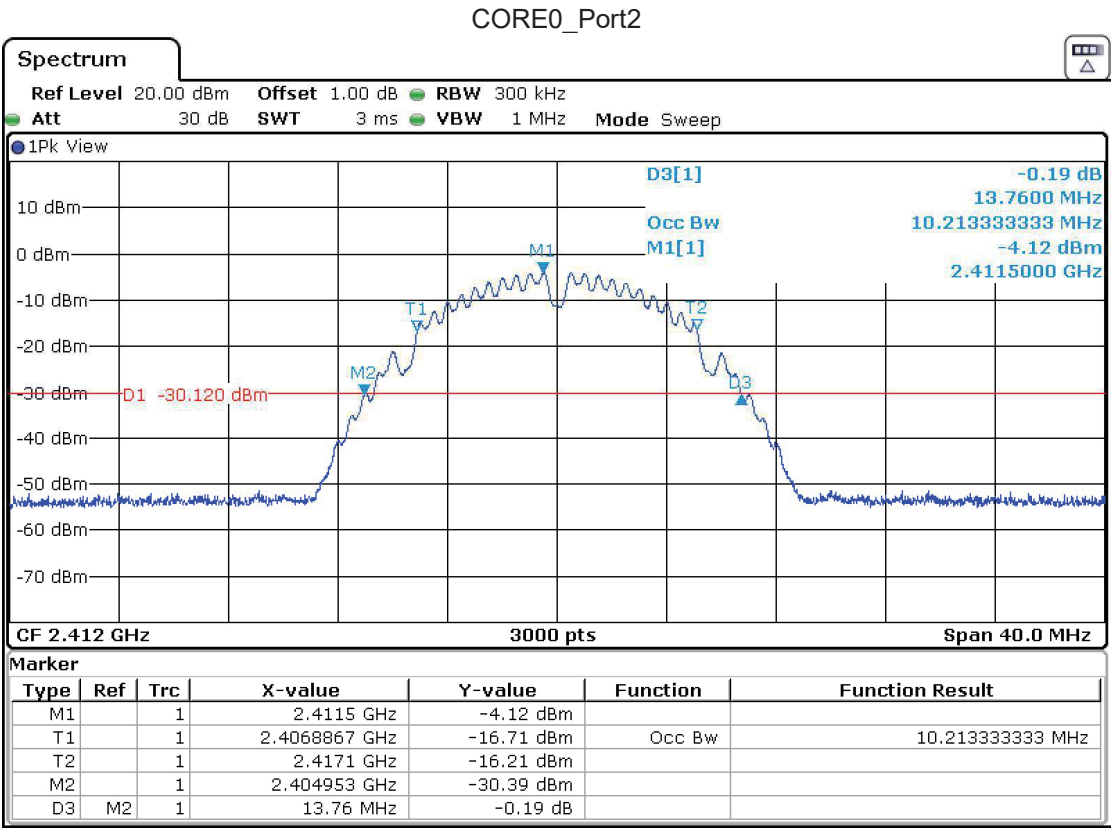
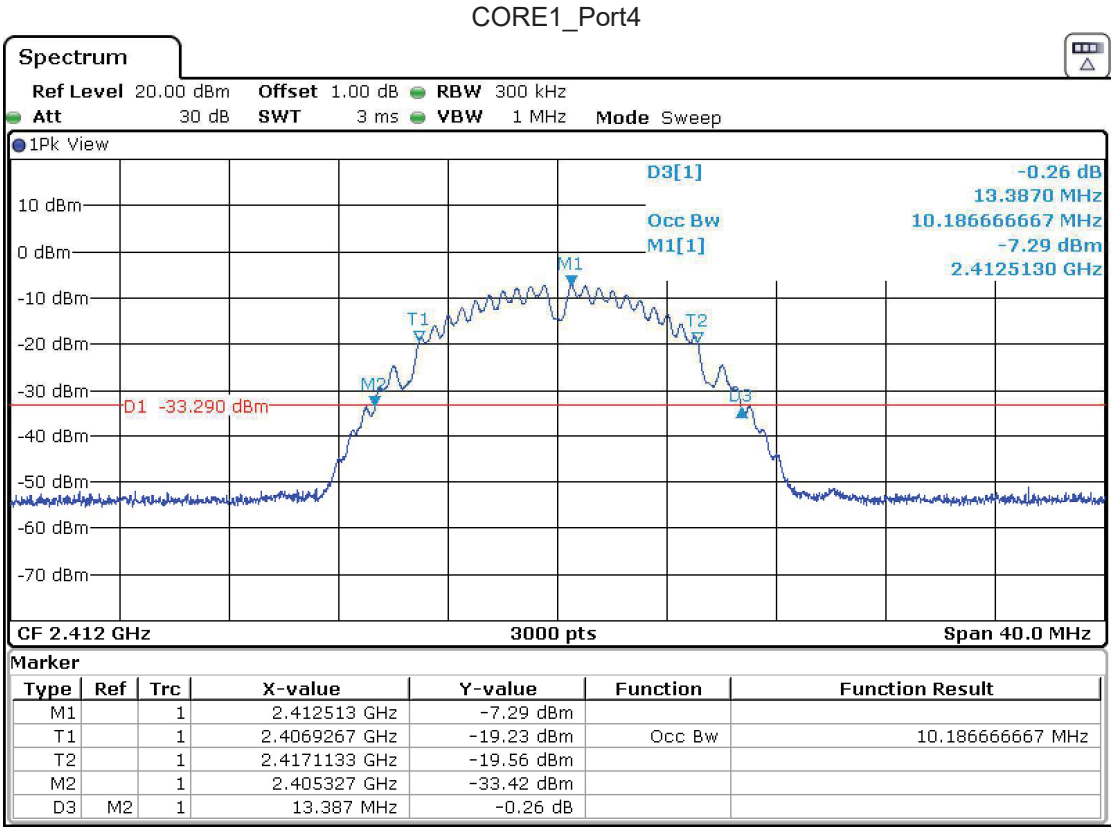
- High Channel:



MIMO – CORE1_Port4 Antenna & CORE0_Port2 Antenna:

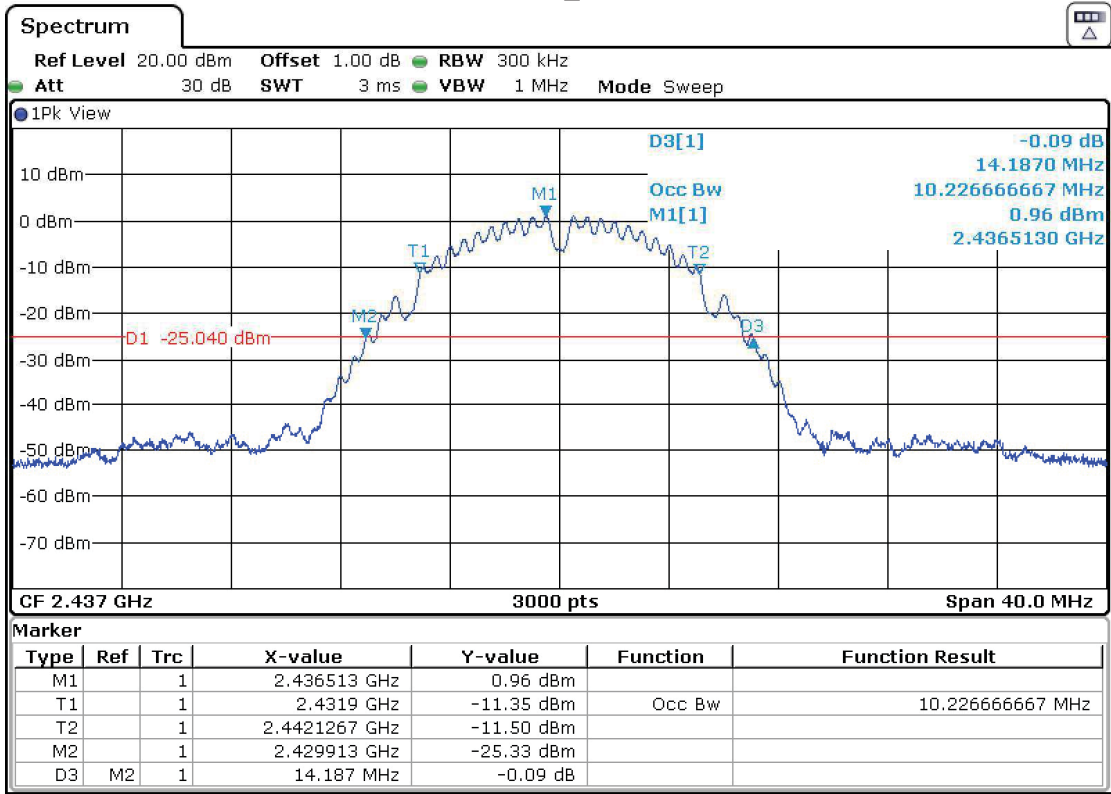
- Mode 802.11 b – Occupied Bandwidth

- Low Channel:

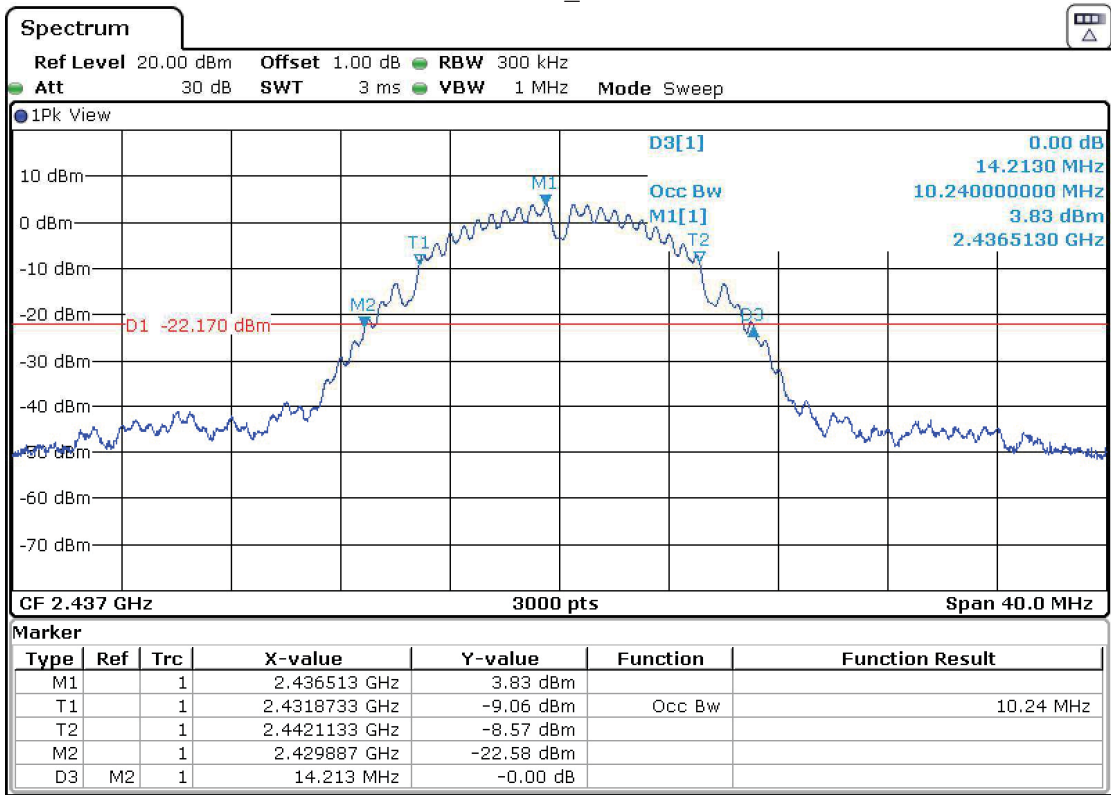


- Middle Channel:

CORE1_Port4

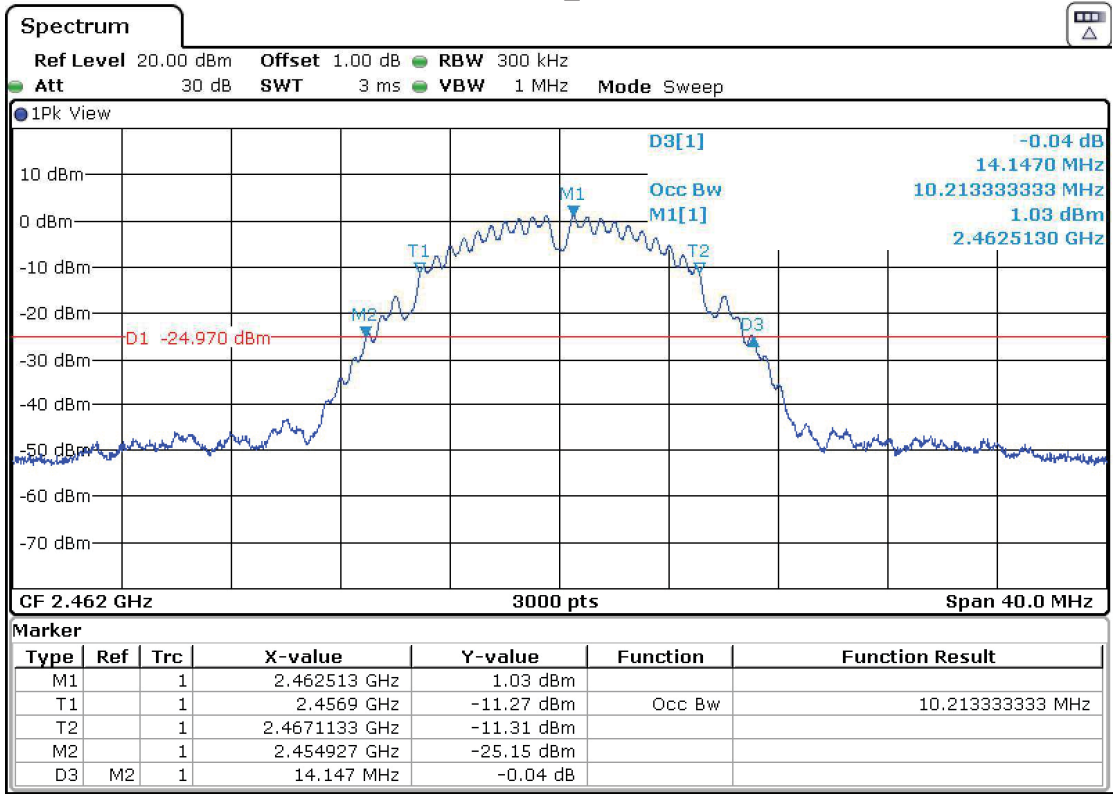


CORE0_Port2

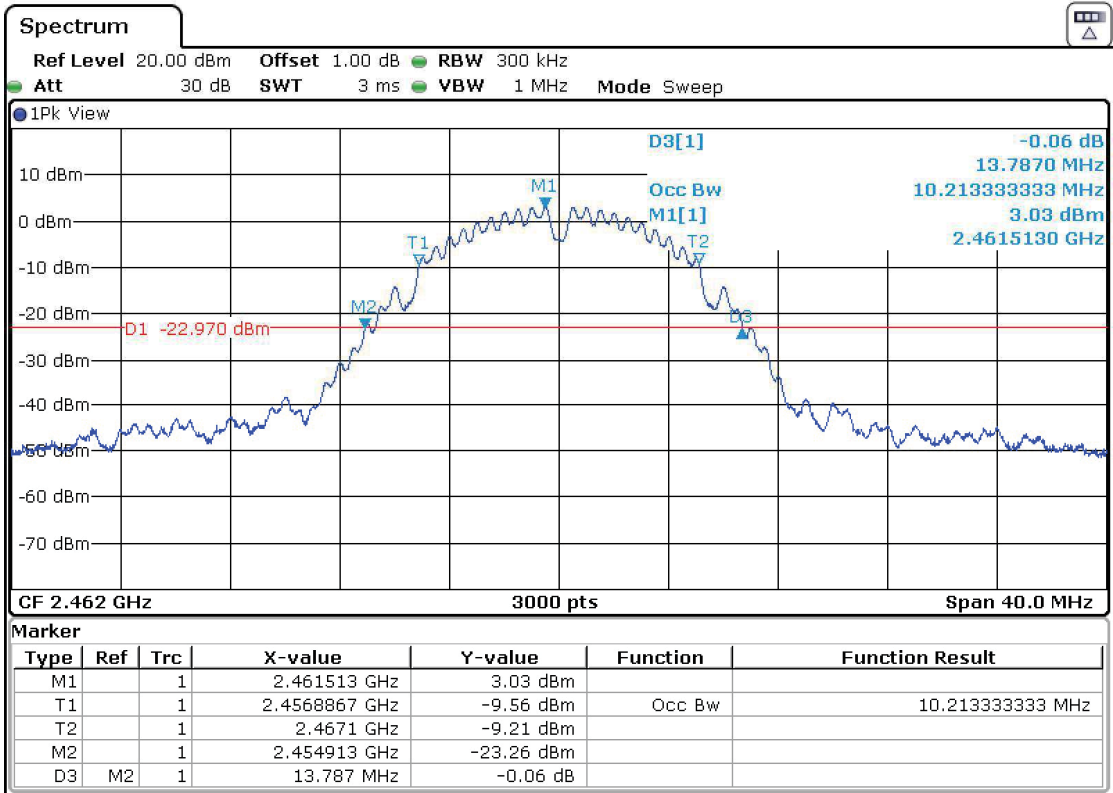


- High Channel:

CORE1_Port4



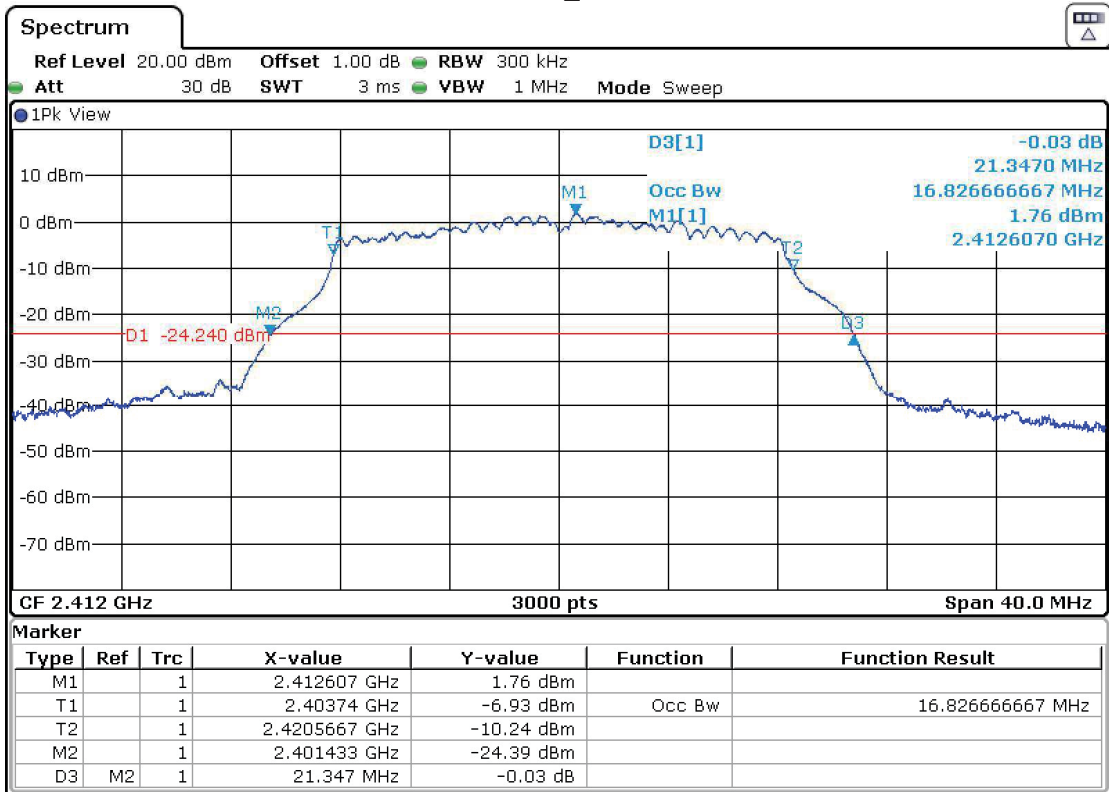
CORE0_Port2



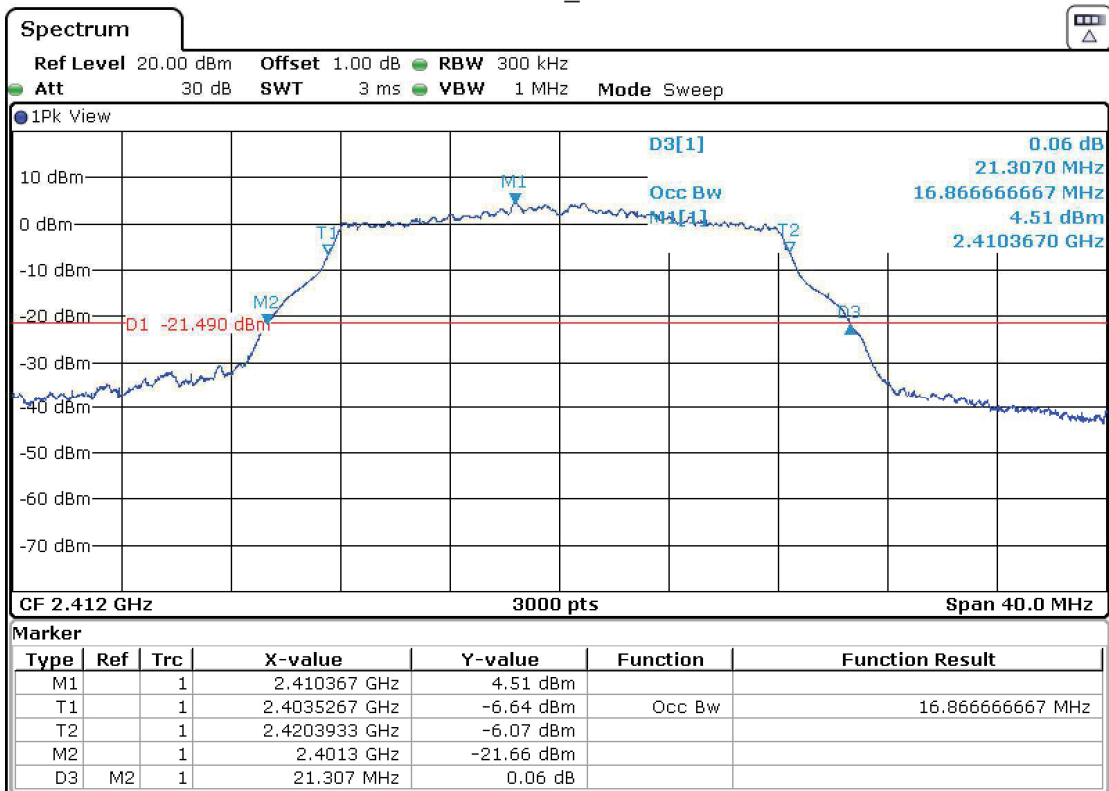
• Mode 802.11 g – Occupied Bandwidth

- Low Channel:

CORE1_Port4

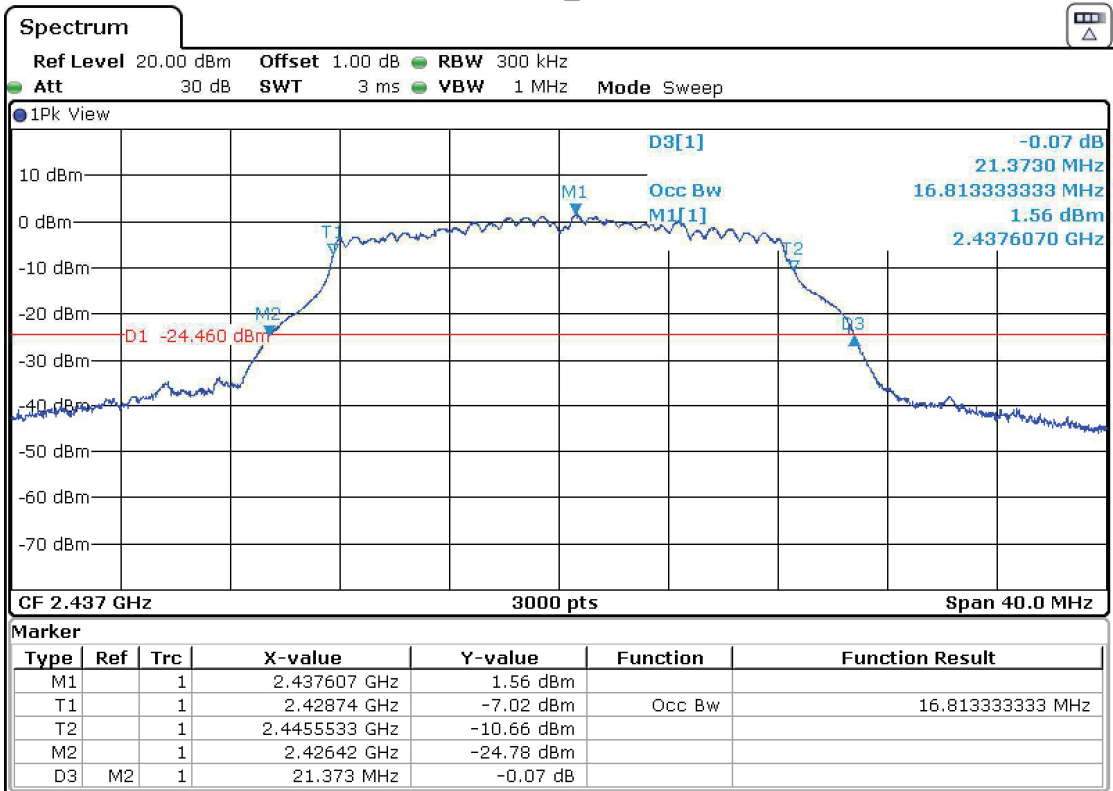


CORE0_Port2

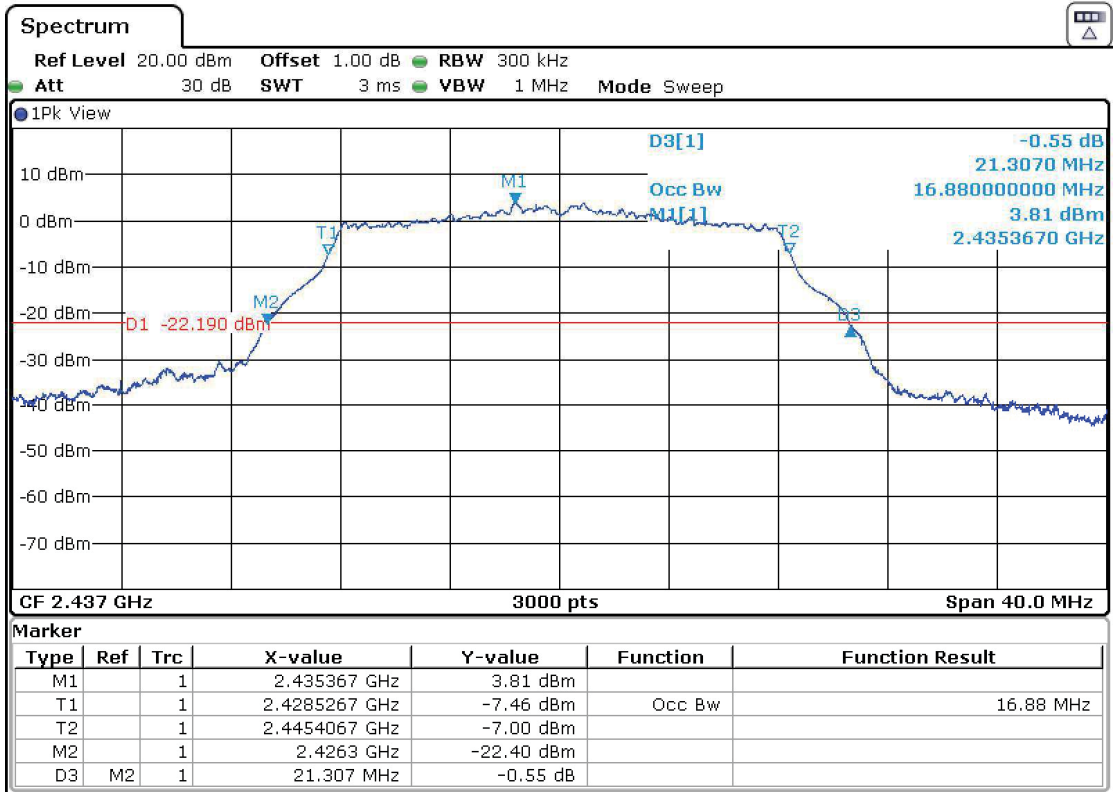


- Middle Channel:

CORE1_Port4

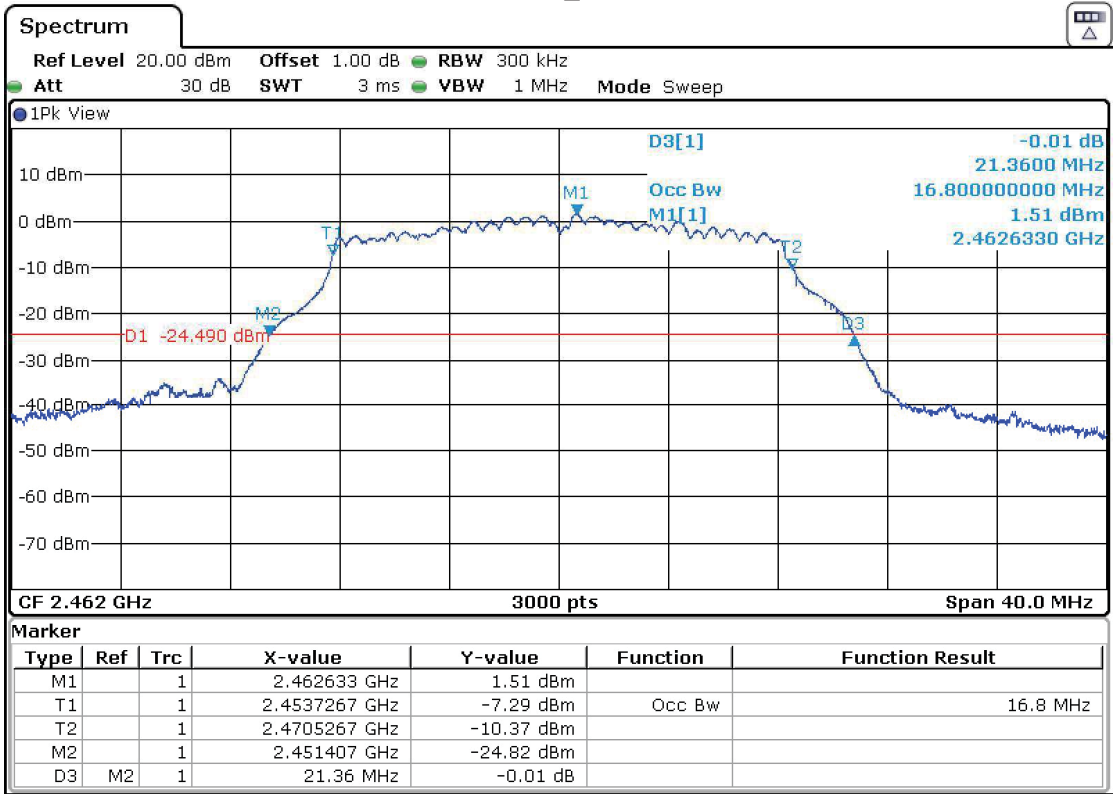


CORE0_Port2

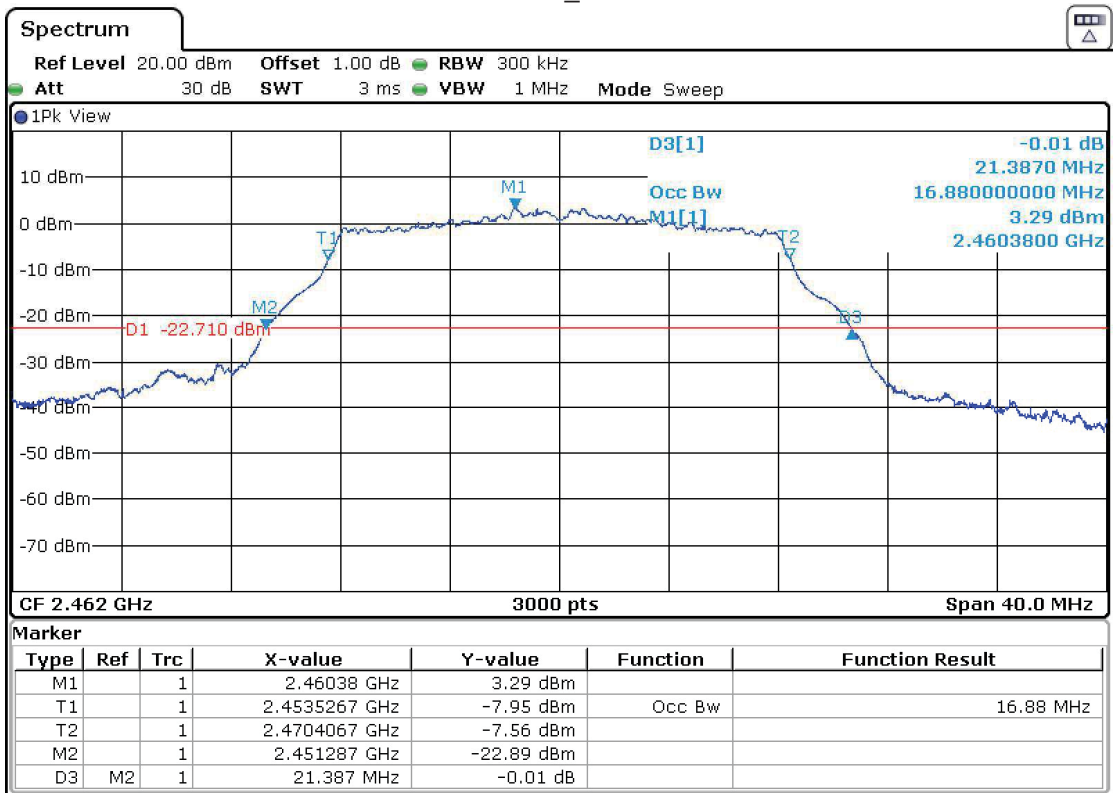


- High Channel:

CORE1_Port4

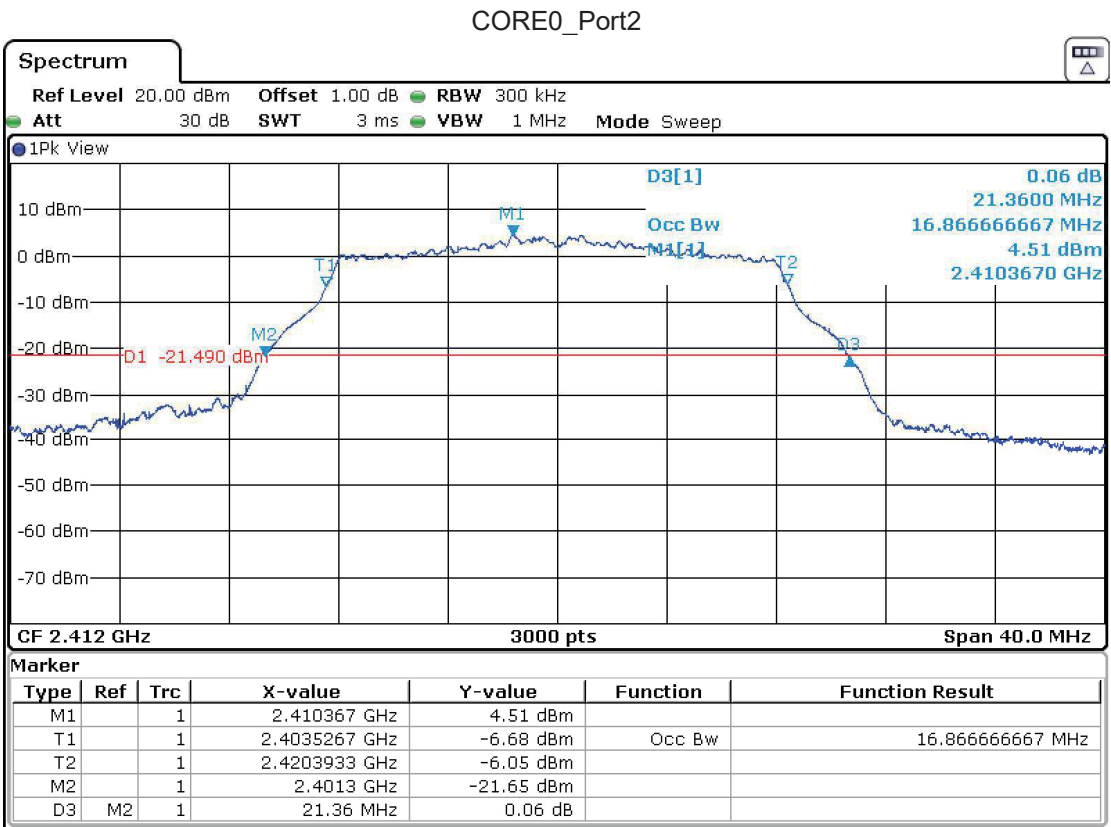
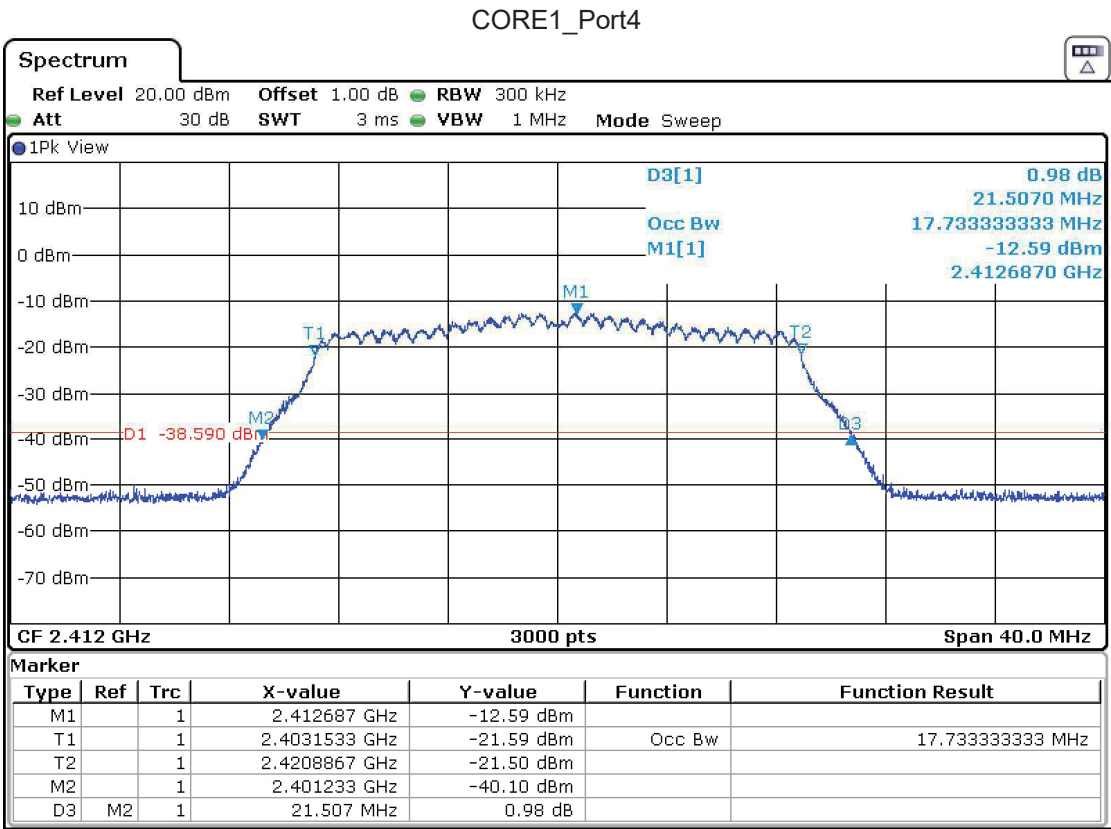


CORE0_Port2



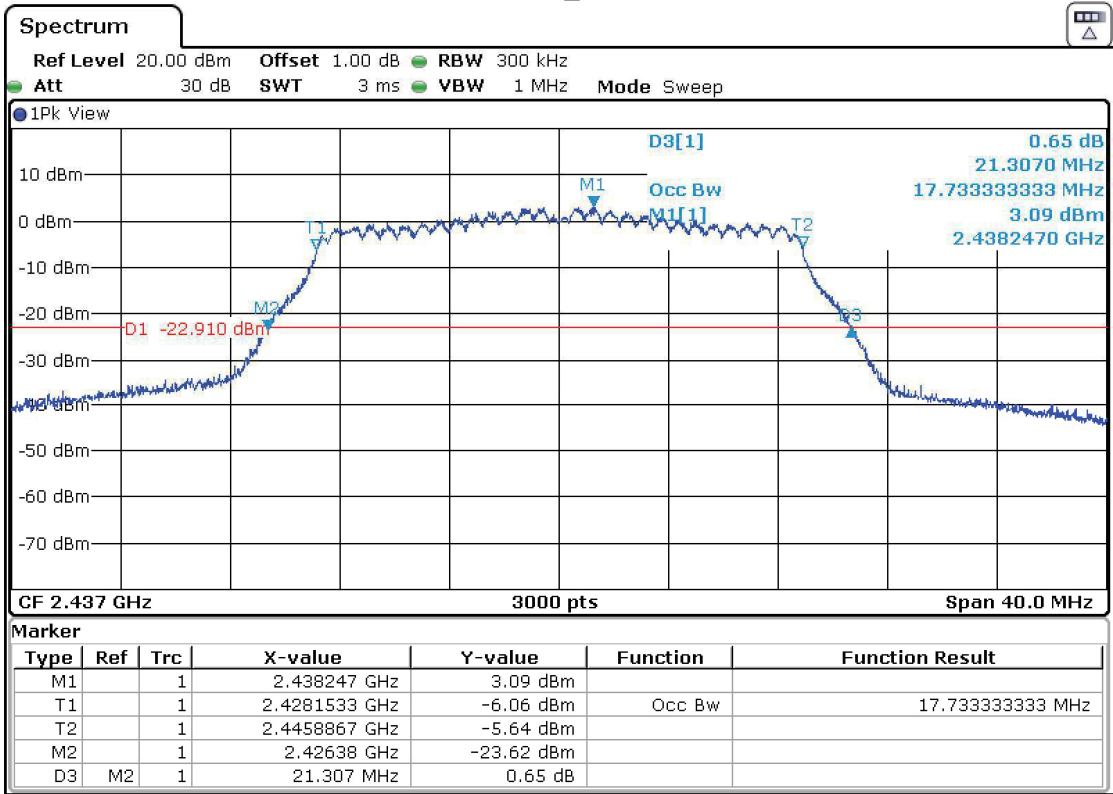
• Mode 802.11 n20 – Occupied Bandwidth

- Low Channel:

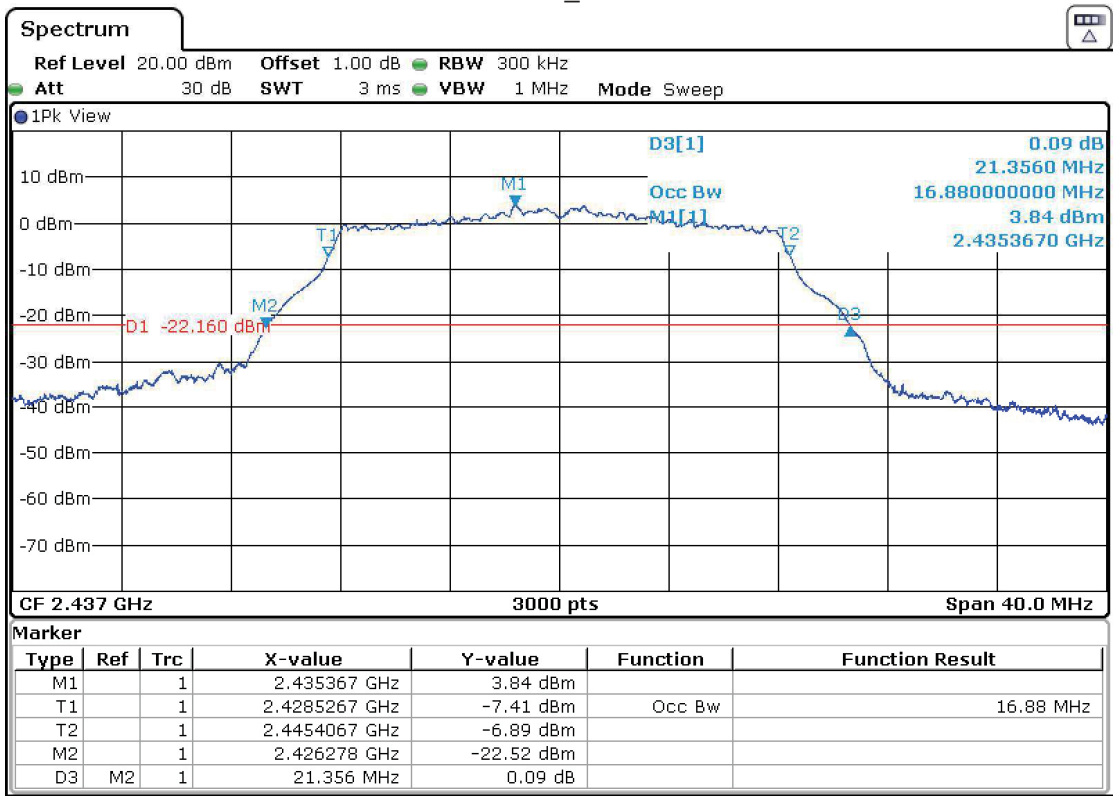


- Middle Channel:

CORE1_Port4

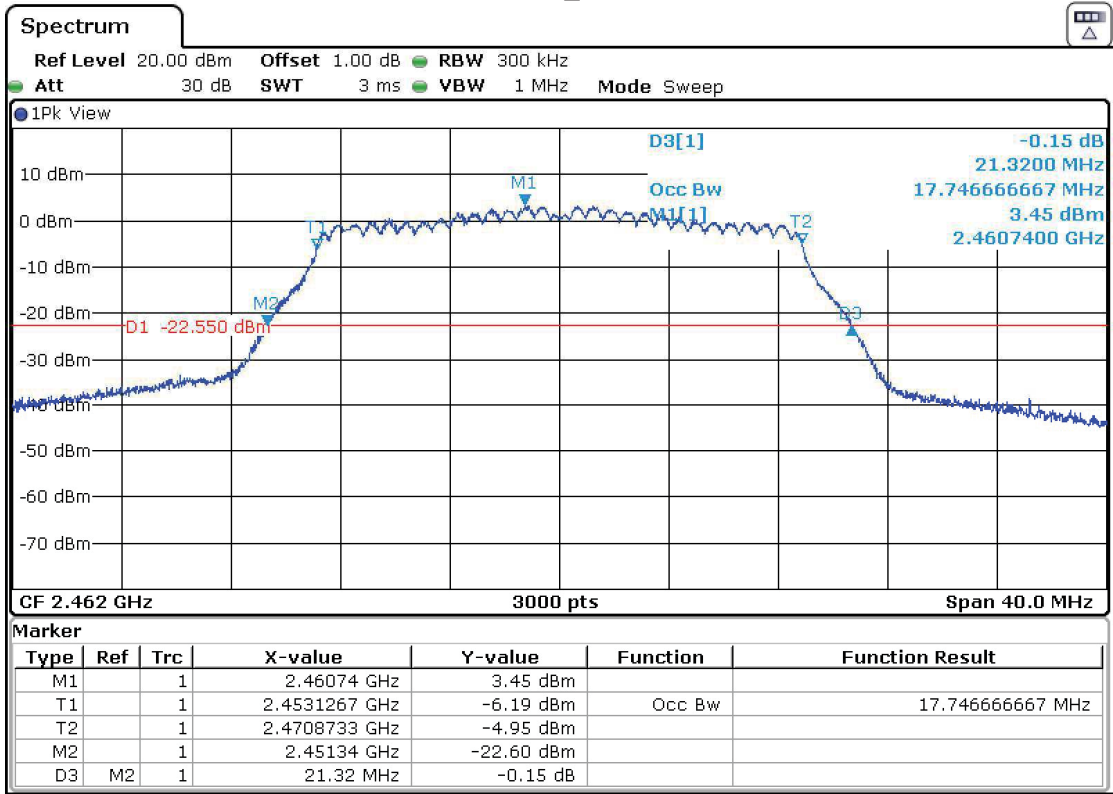


CORE0_Port2

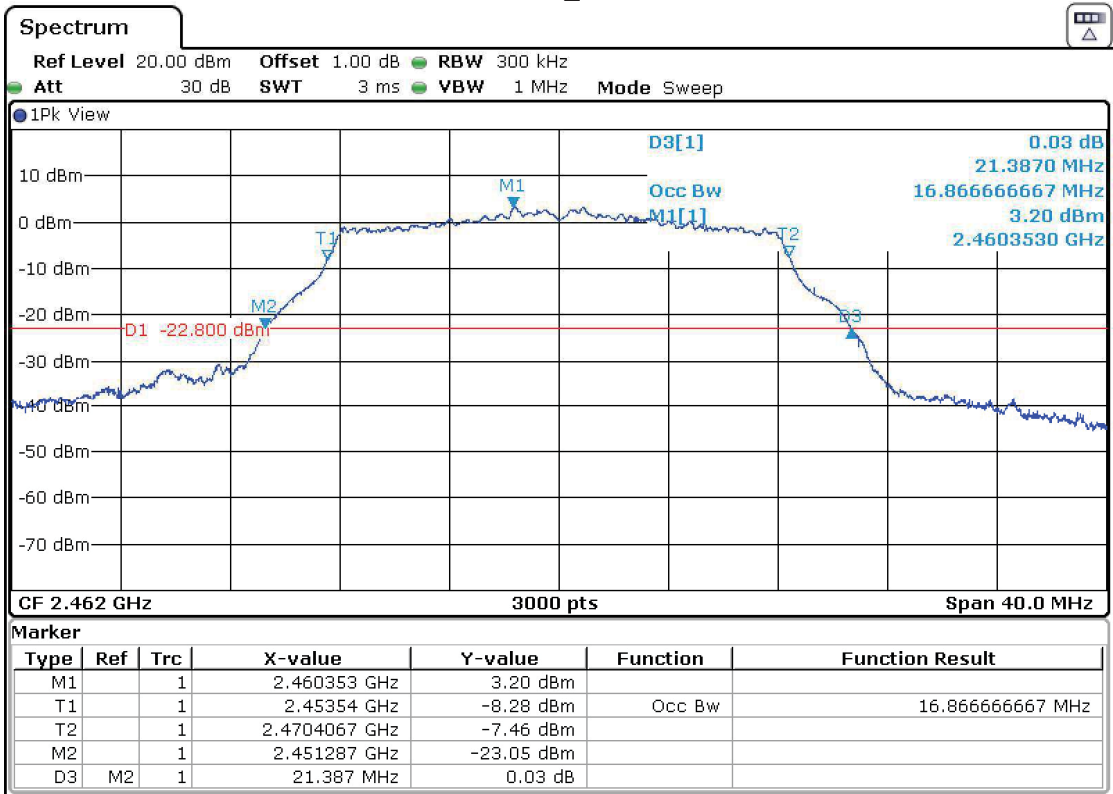


- High Channel:

CORE1_Port4



CORE0_Port2



FCC 15.247 (a) (2) / RSS-247 5.2 (a) 6 dB Bandwidth

SPECIFICATION:

The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS:

SISO CORE1_Port4 Antenna:

- **Mode 802.11 b**

	Low Channel	Middle Channel	High Channel
6 dB Spectrum Bandwidth (kHz)	7093	7085.8	7080
Measurement uncertainty (kHz)	<±17.32		

- **Mode 802.11 g**

	Low Channel	Middle Channel	High Channel
6 dB Spectrum Bandwidth (kHz)	16309	16336	16325
Measurement uncertainty (kHz)	<±21.17		

- **Mode 802.11 n20**

	Low Channel	Middle Channel	High Channel
6 dB Spectrum Bandwidth (kHz)	17543	17286	17525
Measurement uncertainty (kHz)	<±21.17		

Verdict: PASS