

## Appendix B

### RF Test Data for ZigBee (Conducted Measurement)

Product Name: Aqua Illumination Nero Submersible Pump

Trade Mark: Aqua Illumination

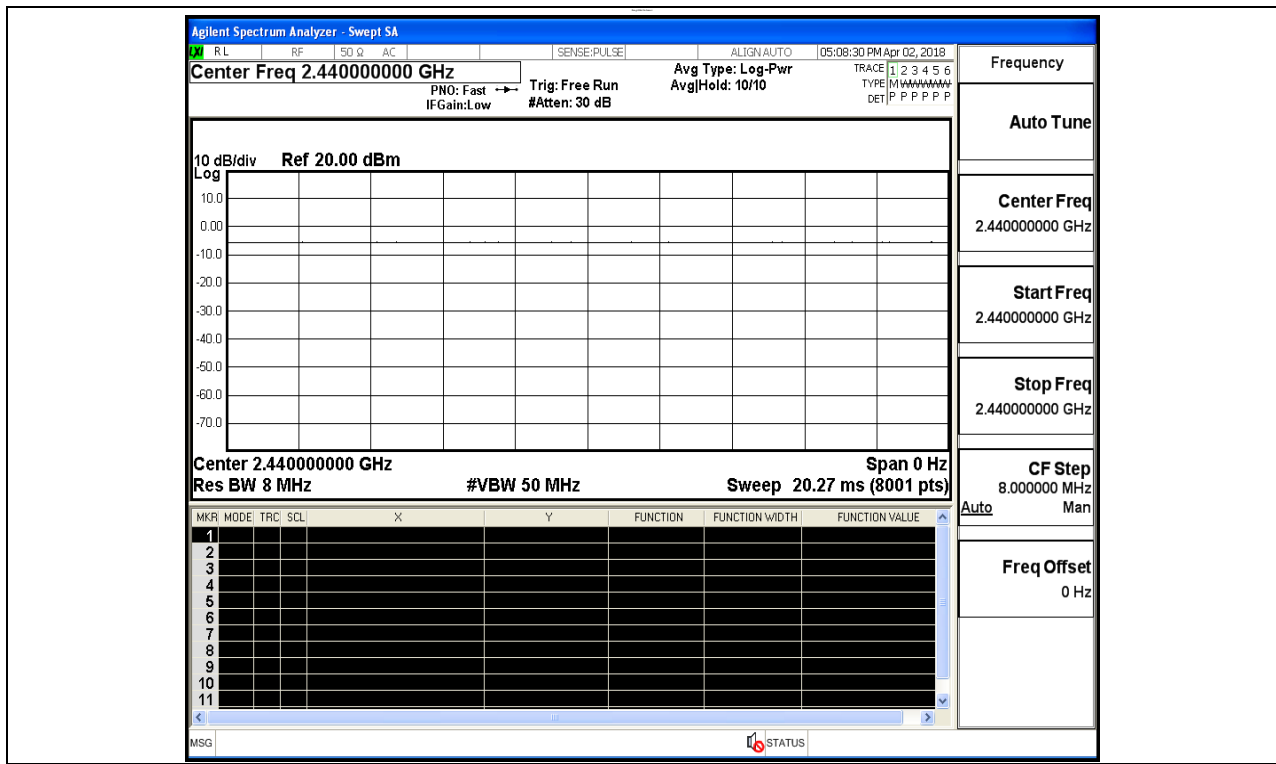
Test Model: Nero 5

#### Environmental Conditions

Temperature:	21.3 ° C
Relative Humidity:	52.4%
ATM Pressure:	100.0 kPa
Test Engineer:	Tom.Liu
Supervised by:	Jayden.zhuo

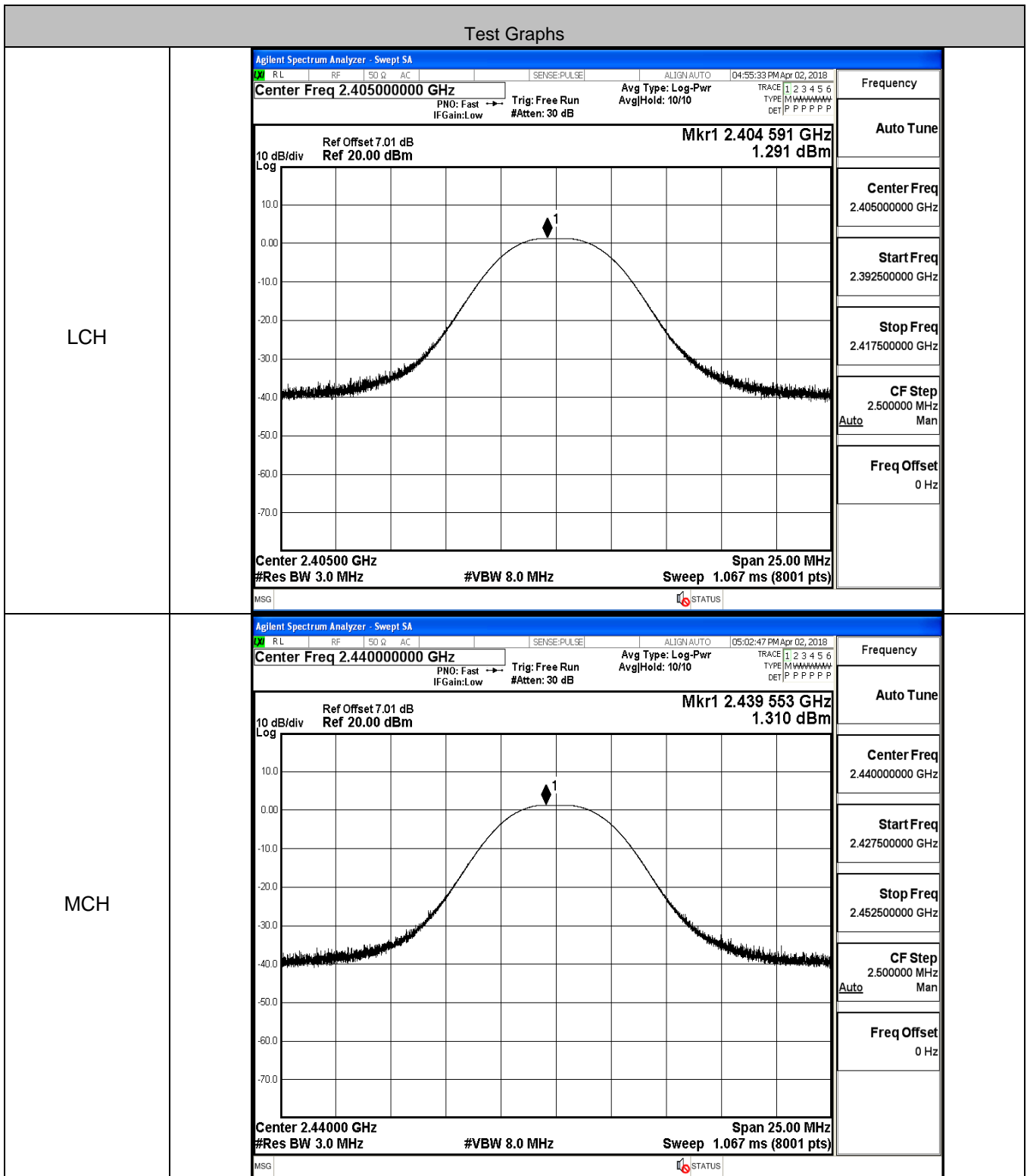
#### B.1 Duty Cycle

Test Mode	Test Channel	Ant	Duty Cycle[%]	Verdict
ZigBee	2440	Ant1	100	PASS

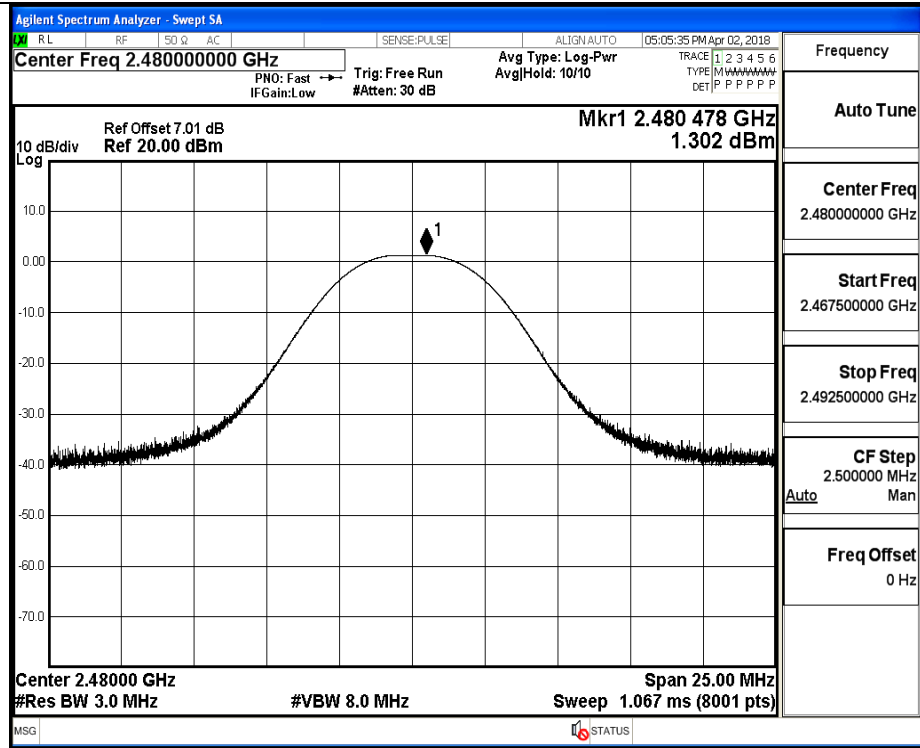


### B.2 Maximum Conducted Peak Output Power

Mode	Channel	Conduct Peak Power[dBm]	Limit [dBm]	Verdict
ZigBee	LCH	1.291	30	PASS
ZigBee	MCH	1.310	30	PASS
ZigBee	HCH	1.302	30	PASS



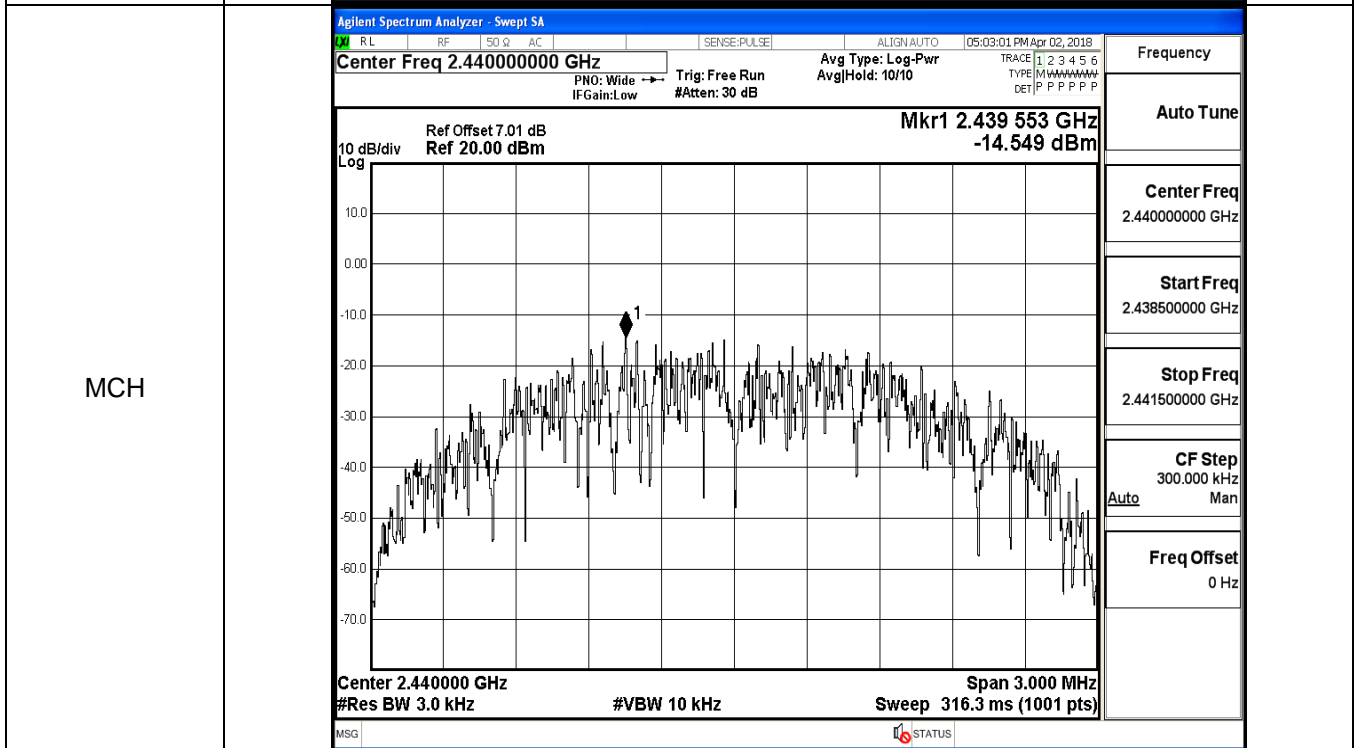
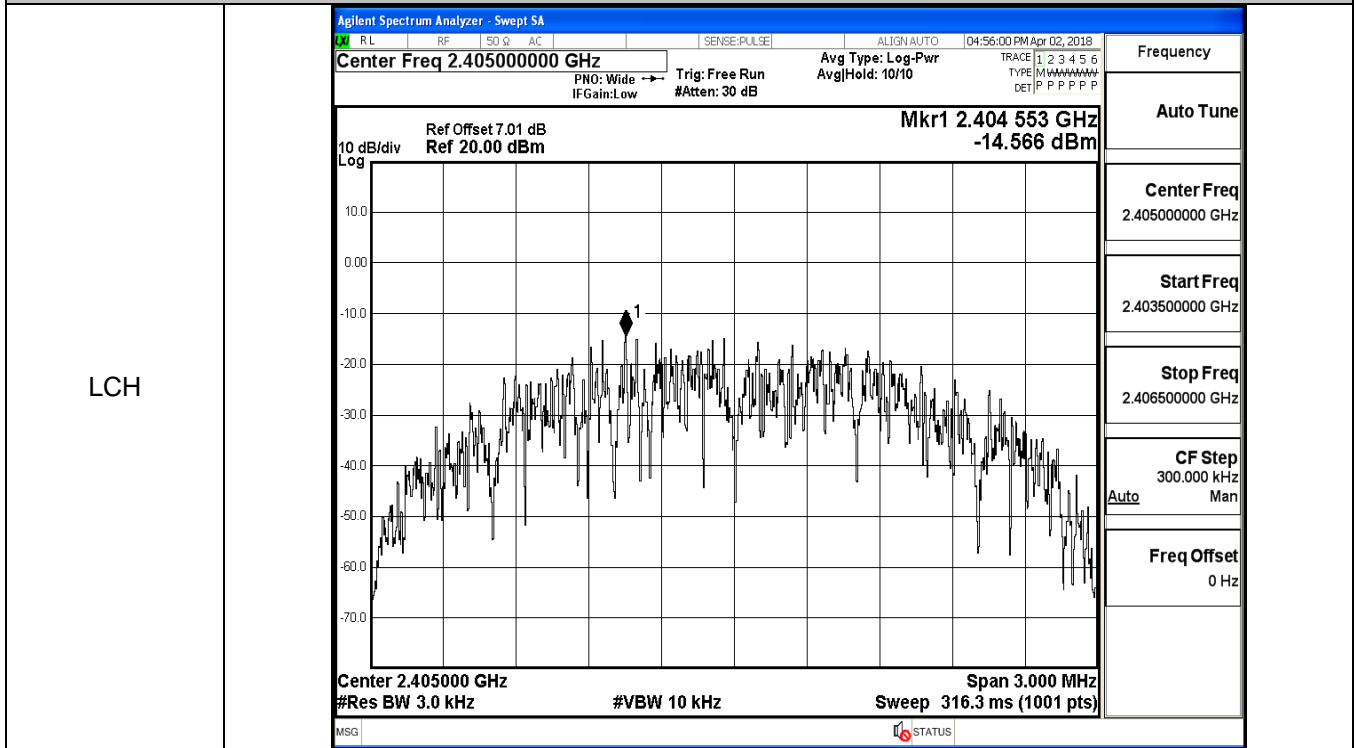
HCH

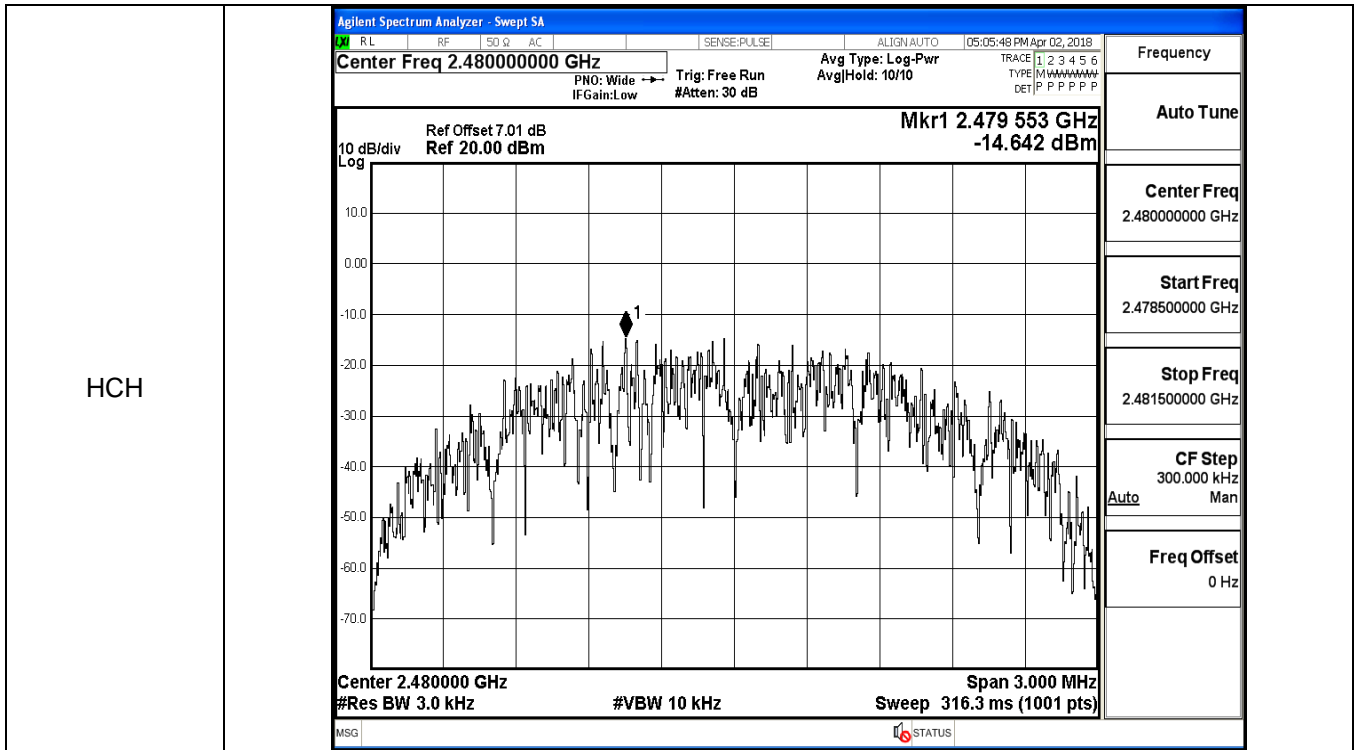


### B.3 Maximum Power Spectral Density

Mode	Channel	PSD [dBm/3KHz]	Limit [dBm/3KHz]	Verdict
ZigBee	LCH	-14.566	8	PASS
ZigBee	MCH	-14.549	8	PASS
ZigBee	HCH	-14.642	8	PASS

#### Test Graphs





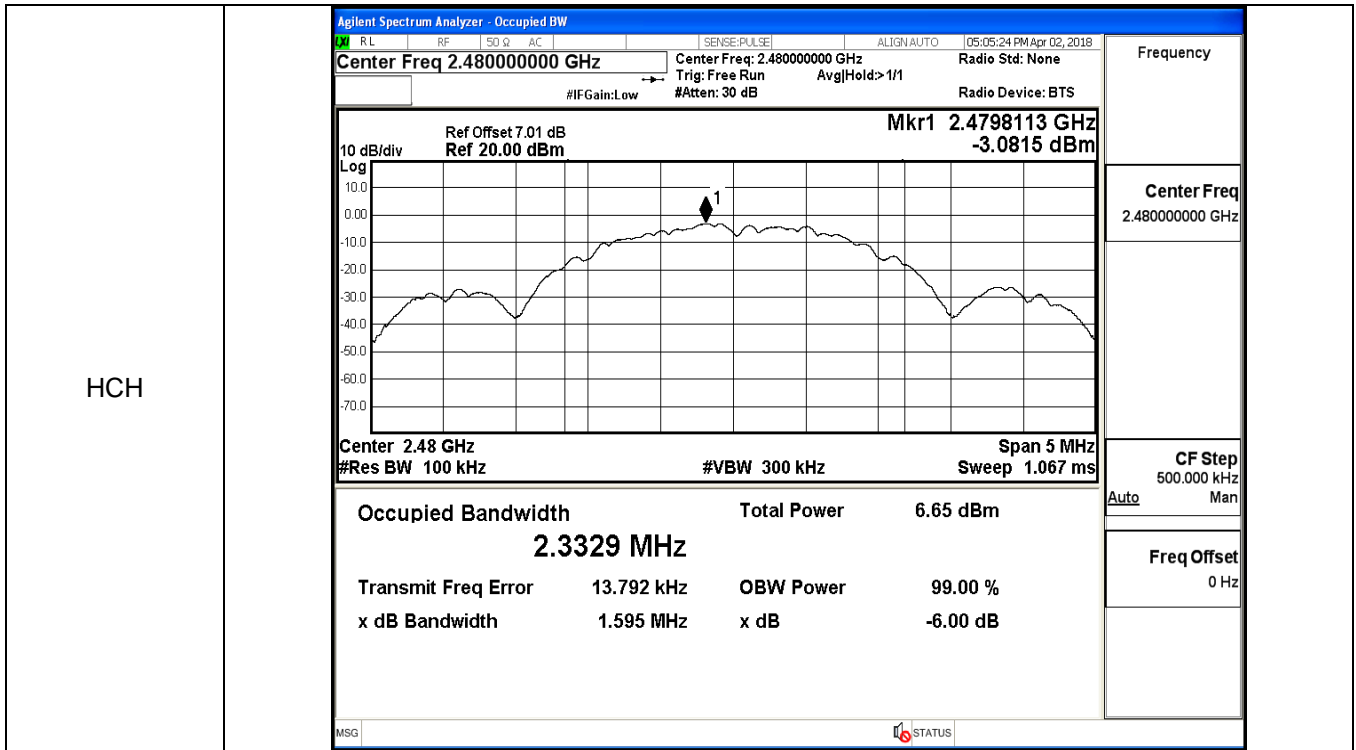
**B.4 6dB Bandwidth**

Mode	Channel	6dB Bandwidth [MHz]	Limit [MHz]	Verdict
ZigBee	LCH	1.599	≥0.5	PASS
ZigBee	MCH	1.615	≥0.5	PASS
ZigBee	HCH	1.595	≥0.5	PASS

**Test Graphs**

LCH	<p style="font-size: small; margin: 0;">Agilent Spectrum Analyzer - Occupied BW</p> <p style="font-size: x-small; margin: 0;">RL RF 50 Ω AC SENSE:PULSE ALIGN: AUTO 04:55:22 PM Apr 02, 2018</p> <p style="font-size: small; margin: 0;">Center Freq: 2.405000000 GHz Center Freq: 2.405000000 GHz Radio Std: None</p> <p style="font-size: x-small; margin: 0;">Trig: Free Run AvgHold: 1/1 #IFGain: Low #Atten: 30 dB Radio Device: BTS</p>	Frequency
		Center Freq 2.405000000 GHz
	<p style="font-size: x-small; margin: 0;">Center 2.405 GHz Span 5 MHz</p> <p style="font-size: x-small; margin: 0;">#Res BW 100 kHz #VBW 300 kHz Sweep 1.067 ms</p>	CF Step 500.000 kHz <small>Auto Man</small>
	<p style="font-size: small; margin: 0;"><b>Occupied Bandwidth</b> Total Power 6.64 dBm</p> <p style="font-size: x-large; margin: 0; text-align: center;"><b>2.3363 MHz</b></p> <p style="font-size: small; margin: 0;">Transmit Freq Error 11.824 kHz OBW Power 99.00 %</p> <p style="font-size: small; margin: 0;">x dB Bandwidth 1.599 MHz x dB -6.00 dB</p>	Freq Offset 0 Hz
	<p style="font-size: x-small; margin: 0;">MSG <span style="float: right;">STATUS</span></p>	

MCH	<p style="font-size: small; margin: 0;">Agilent Spectrum Analyzer - Occupied BW</p> <p style="font-size: x-small; margin: 0;">RL RF 50 Ω AC SENSE:PULSE ALIGN: AUTO 05:02:36 PM Apr 02, 2018</p> <p style="font-size: small; margin: 0;">Center Freq: 2.440000000 GHz Center Freq: 2.440000000 GHz Radio Std: None</p> <p style="font-size: x-small; margin: 0;">Trig: Free Run AvgHold: 1/1 #IFGain: Low #Atten: 30 dB Radio Device: BTS</p>	Frequency
		Center Freq 2.440000000 GHz
	<p style="font-size: x-small; margin: 0;">Center 2.44 GHz Span 5 MHz</p> <p style="font-size: x-small; margin: 0;">#Res BW 100 kHz #VBW 300 kHz Sweep 1.067 ms</p>	CF Step 500.000 kHz <small>Auto Man</small>
	<p style="font-size: small; margin: 0;"><b>Occupied Bandwidth</b> Total Power 6.63 dBm</p> <p style="font-size: x-large; margin: 0; text-align: center;"><b>2.3448 MHz</b></p> <p style="font-size: small; margin: 0;">Transmit Freq Error 13.133 kHz OBW Power 99.00 %</p> <p style="font-size: small; margin: 0;">x dB Bandwidth 1.615 MHz x dB -6.00 dB</p>	Freq Offset 0 Hz
	<p style="font-size: x-small; margin: 0;">MSG <span style="float: right;">STATUS</span></p>	



### B.5 Occupied Bandwidth

Mode	Channel	Occupied Bandwidth [MHz]	Limit [MHz]	Verdict
ZigBee	LCH	2.3053	Not Specified	PASS
ZigBee	MCH	2.3126	Not Specified	PASS
ZigBee	HCH	2.3112	Not Specified	PASS

#### Test Graphs

LCH	<div data-bbox="443 510 1362 1249"> <p>Agilent Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.40500000 GHz</p> <p>Center Freq: 2.405000000 GHz</p> <p>Trig: Free Run</p> <p>#IFGain:Low</p> <p>#Atten: 30 dB</p> <p>ALIGN AUTO</p> <p>AvgHold: &gt;10/10</p> <p>Radio Std: None</p> <p>Radio Device: BTS</p> <p>05:28:29 PM Apr 02, 2018</p> <p>Ref Offset 7.01 dB</p> <p>Ref 20.00 dBm</p> <p>10 dB/div</p> <p>Log</p> <p>Center 2.405 GHz</p> <p>#Res BW 51 kHz</p> <p>#VBW 150 kHz</p> <p>Span 5 MHz</p> <p>Sweep 2.133 ms</p> <p>Occupied Bandwidth <b>2.3053 MHz</b></p> <p>Total Power <b>6.52 dBm</b></p> <p>Transmit Freq Error <b>15.882 kHz</b></p> <p>OBW Power <b>99.00 %</b></p> <p>x dB Bandwidth <b>1.420 MHz</b></p> <p>x dB <b>-6.00 dB</b></p> <p>MSG STATUS</p> </div>	<p>Frequency</p> <p>Center Freq 2.405000000 GHz</p> <p>CF Step 500.000 kHz</p> <p>Auto Man</p> <p>Freq Offset 0 Hz</p>
MCH	<div data-bbox="443 1256 1362 1995"> <p>Agilent Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.44000000 GHz</p> <p>Center Freq: 2.440000000 GHz</p> <p>Trig: Free Run</p> <p>#IFGain:Low</p> <p>#Atten: 30 dB</p> <p>ALIGN AUTO</p> <p>AvgHold: 10/10</p> <p>Radio Std: None</p> <p>Radio Device: BTS</p> <p>05:28:54 PM Apr 02, 2018</p> <p>Ref Offset 7.01 dB</p> <p>Ref 20.00 dBm</p> <p>10 dB/div</p> <p>Log</p> <p>Center 2.44 GHz</p> <p>#Res BW 51 kHz</p> <p>#VBW 150 kHz</p> <p>Span 5 MHz</p> <p>Sweep 2.133 ms</p> <p>Occupied Bandwidth <b>2.3126 MHz</b></p> <p>Total Power <b>6.46 dBm</b></p> <p>Transmit Freq Error <b>16.780 kHz</b></p> <p>OBW Power <b>99.00 %</b></p> <p>x dB Bandwidth <b>1.422 MHz</b></p> <p>x dB <b>-6.00 dB</b></p> <p>MSG STATUS</p> </div>	<p>Frequency</p> <p>Center Freq 2.440000000 GHz</p> <p>CF Step 500.000 kHz</p> <p>Auto Man</p> <p>Freq Offset 0 Hz</p>



HCH

Agilent Spectrum Analyzer - Occupied BW

<input checked="" type="checkbox"/> RL	<input type="checkbox"/> RF	<input type="checkbox"/> SO G	<input type="checkbox"/> AC	<input type="checkbox"/> SENSE:PULSE	<input type="checkbox"/> ALIGN AUTO	05:29:19 PM Apr 02, 2018
<b>Center Freq 2.480000000 GHz</b>				Center Freq: 2.480000000 GHz	Radio Std: None	Frequency
				Trig: Free Run	Avg Hold: 10/10	Radio Device: BTS
				#IFGain:Low	#Atten: 30 dB	

10 dB/div      Ref Offset 7.01 dB  
Log              Ref 20.00 dBm

Center 2.48 GHz      Span 5 MHz  
#Res BW 51 kHz      #VBW 150 kHz      Sweep 2.133 ms

Occupied Bandwidth	Total Power	6.44 dBm
<b>2.3112 MHz</b>		
Transmit Freq Error	17.345 kHz	OBW Power
		99.00 %
x dB Bandwidth	1.422 MHz	x dB
		-6.00 dB

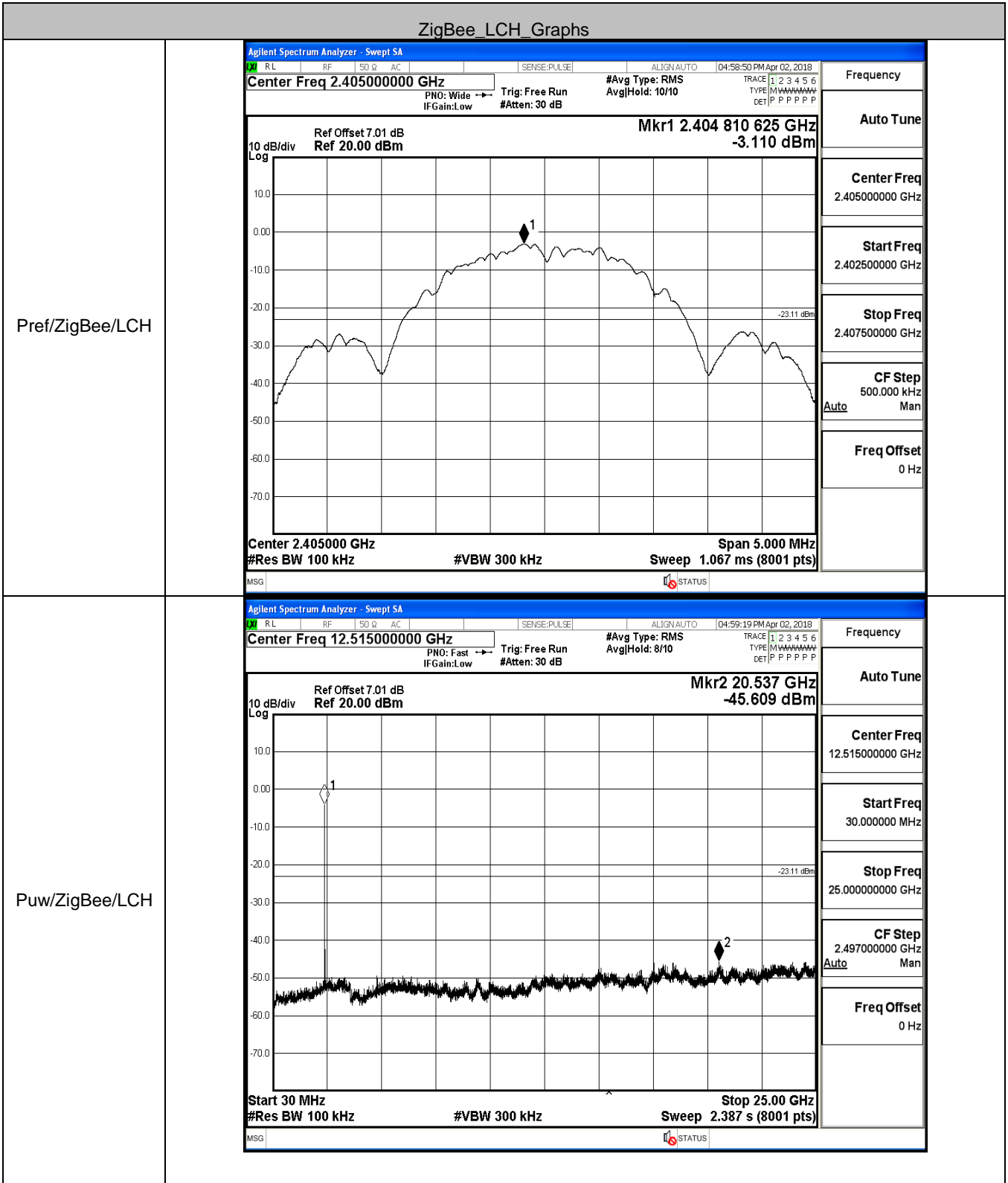
Center Freq	2.480000000 GHz
CF Step	500.000 kHz
Auto	Man
Freq Offset	0 Hz

MSG      STATUS

### B.6 RF Conducted Spurious Emissions

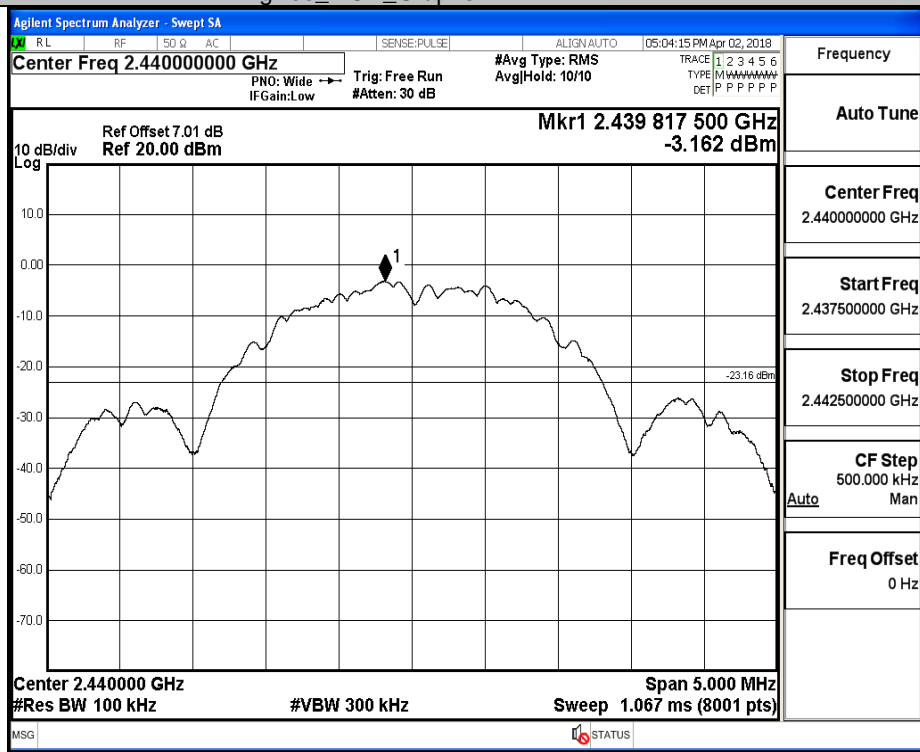
Mode	Channel	Pref [dBm]	Max. Level [dBm]	Limit [dBm]	Verdict
ZigBee	LCH	-3.11	-45.609	-23.110	PASS
ZigBee	MCH	-3.162	-44.812	-23.162	PASS
ZigBee	HCH	-3.016	-45.505	-23.016	PASS

ZigBee\_LCH\_Graphs

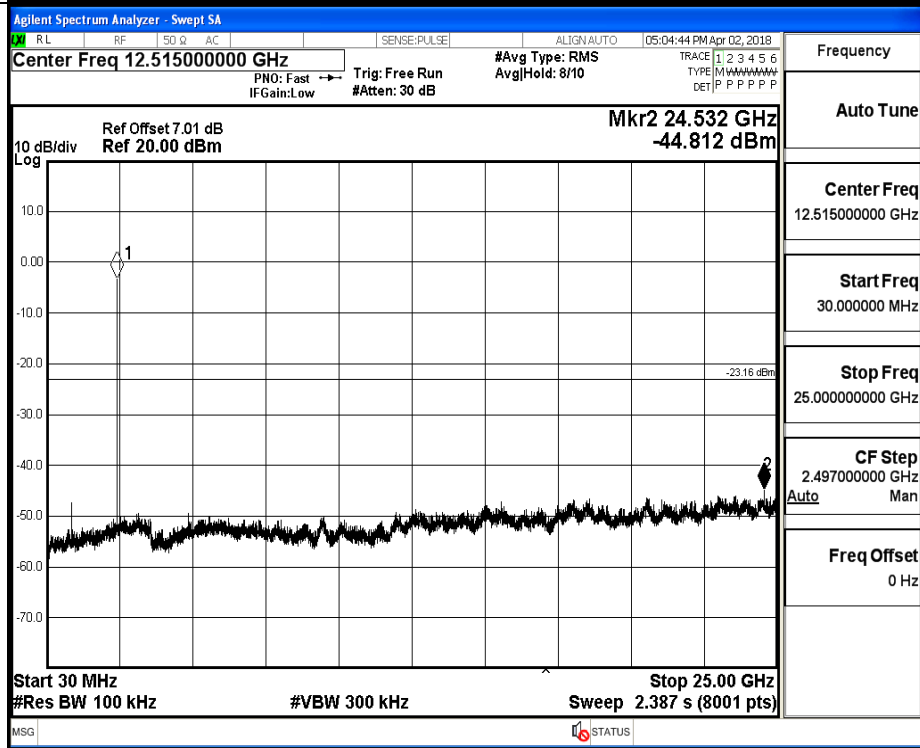


ZigBee\_MCH\_Graphs

Pref/ZigBee/MCH

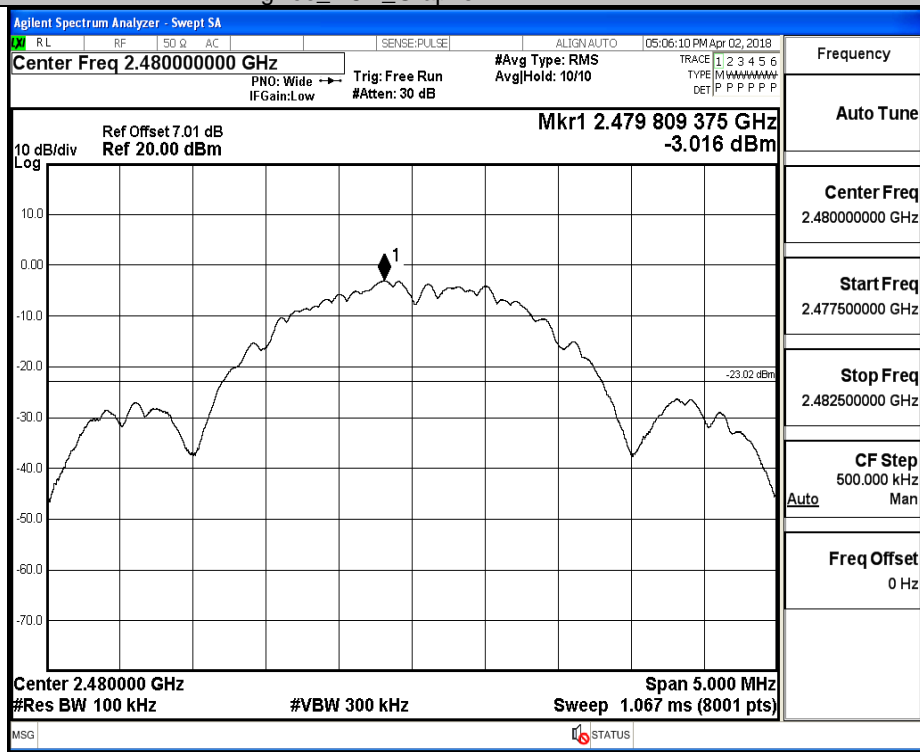


Puw/ZigBee/  
MCH

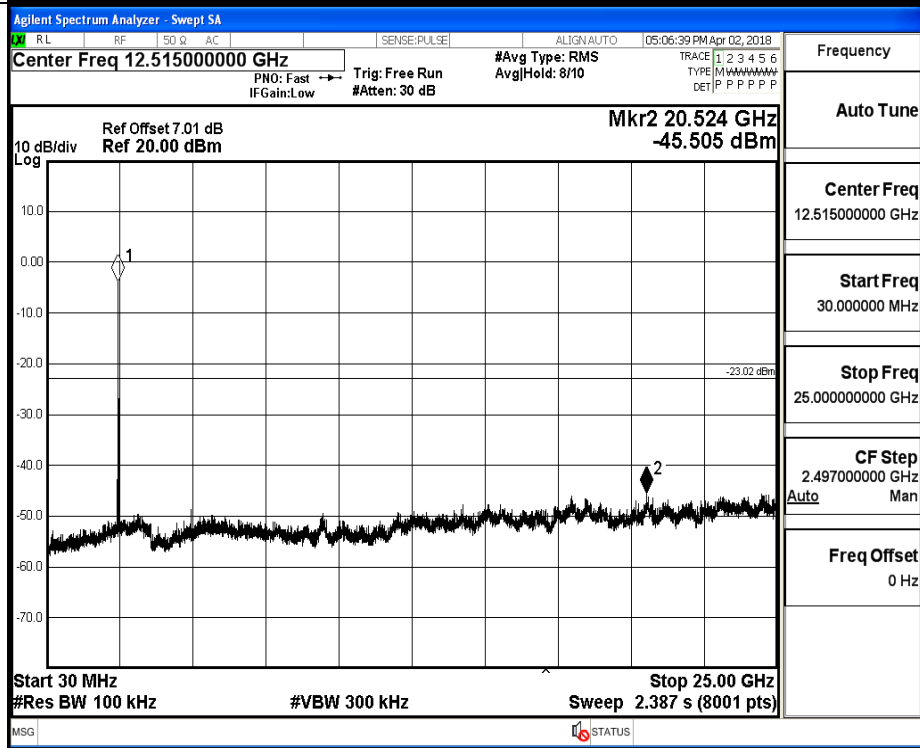


ZigBee\_HCH\_Graphs

Pref/ZigBee/HCH



Puw/ZigBee/HCH



### B.7 Band-edge for RF Conducted Emissions

Mode	Channel	Carrier Power[dBm]	Max.Spurious Level [dBm]	Limit [dBm]	Verdict
ZigBee	LCH	-2.501	-53.958	-22.501	PASS
ZigBee	HCH	-2.612	-39.857	-22.612	PASS

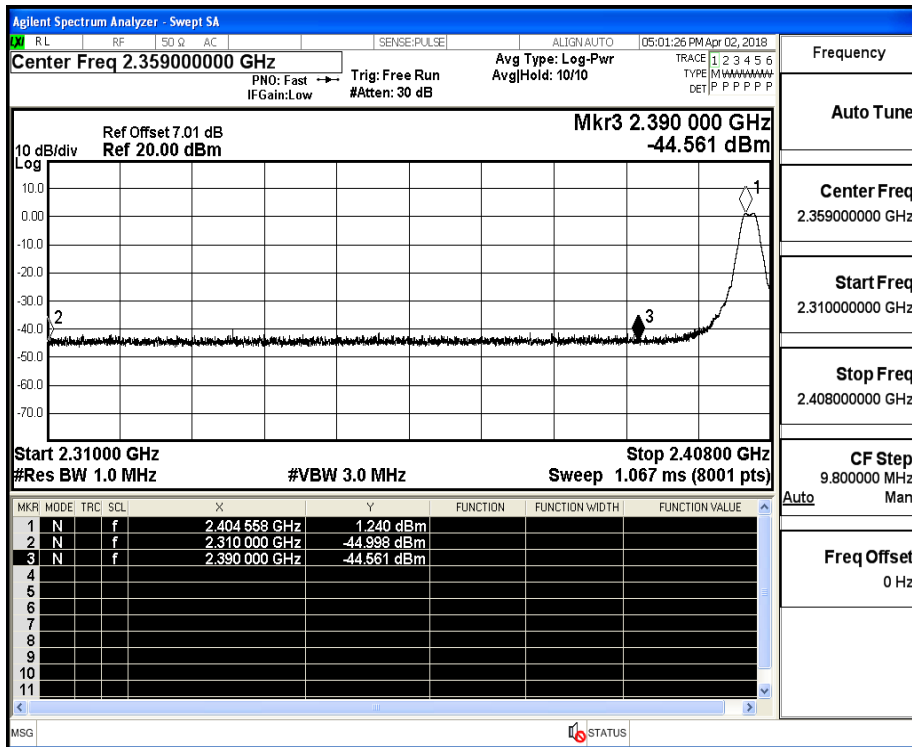
Test Graphs

LCH	<p>Agilent Spectrum Analyzer - Swept SA                  Center Freq 2.359000000 GHz                  Mkr3 2.400 000 GHz -53.958 dBm                  Start 2.31000 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 9.600 ms (8001 pts)                  Stop 2.40800 GHz</p> <table border="1" style="font-size: small;"> <thead> <tr> <th>MKR</th> <th>MODE</th> <th>TRC</th> <th>SCL</th> <th>X</th> <th>Y</th> <th>FUNCTION</th> <th>FUNCTION WIDTH</th> <th>FUNCTION VALUE</th> </tr> </thead> <tbody> <tr><td>1</td><td>N</td><td>f</td><td></td><td>2.404 803 GHz</td><td>-2.501 dBm</td><td></td><td></td><td></td></tr> <tr><td>2</td><td>N</td><td>f</td><td></td><td>2.310 000 GHz</td><td>-54.036 dBm</td><td></td><td></td><td></td></tr> <tr><td>3</td><td>N</td><td>f</td><td></td><td>2.400 000 GHz</td><td>-53.958 dBm</td><td></td><td></td><td></td></tr> </tbody> </table>	MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	N	f		2.404 803 GHz	-2.501 dBm				2	N	f		2.310 000 GHz	-54.036 dBm				3	N	f		2.400 000 GHz	-53.958 dBm				Frequency Auto Tune Center Freq 2.359000000 GHz Start Freq 2.310000000 GHz Stop Freq 2.408000000 GHz CF Step 9.800000 MHz Freq Offset 0 Hz									
MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE																																							
1	N	f		2.404 803 GHz	-2.501 dBm																																										
2	N	f		2.310 000 GHz	-54.036 dBm																																										
3	N	f		2.400 000 GHz	-53.958 dBm																																										
HCH	<p>Agilent Spectrum Analyzer - Swept SA                  Center Freq 2.488000000 GHz                  Mkr4 2.483 917 GHz -39.857 dBm                  Start 2.47600 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 2.667 ms (8001 pts)                  Stop 2.50000 GHz</p> <table border="1" style="font-size: small;"> <thead> <tr> <th>MKR</th> <th>MODE</th> <th>TRC</th> <th>SCL</th> <th>X</th> <th>Y</th> <th>FUNCTION</th> <th>FUNCTION WIDTH</th> <th>FUNCTION VALUE</th> </tr> </thead> <tbody> <tr><td>1</td><td>N</td><td>f</td><td></td><td>2.479 819 GHz</td><td>-2.612 dBm</td><td></td><td></td><td></td></tr> <tr><td>2</td><td>N</td><td>f</td><td></td><td>2.483 500 GHz</td><td>-50.923 dBm</td><td></td><td></td><td></td></tr> <tr><td>3</td><td>N</td><td>f</td><td></td><td>2.500 000 GHz</td><td>-54.128 dBm</td><td></td><td></td><td></td></tr> <tr><td>4</td><td>N</td><td>f</td><td></td><td>2.483 917 GHz</td><td>-39.857 dBm</td><td></td><td></td><td></td></tr> </tbody> </table>	MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	N	f		2.479 819 GHz	-2.612 dBm				2	N	f		2.483 500 GHz	-50.923 dBm				3	N	f		2.500 000 GHz	-54.128 dBm				4	N	f		2.483 917 GHz	-39.857 dBm				Frequency Auto Tune Center Freq 2.488000000 GHz Start Freq 2.476000000 GHz Stop Freq 2.500000000 GHz CF Step 2.400000 MHz Freq Offset 0 Hz
MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE																																							
1	N	f		2.479 819 GHz	-2.612 dBm																																										
2	N	f		2.483 500 GHz	-50.923 dBm																																										
3	N	f		2.500 000 GHz	-54.128 dBm																																										
4	N	f		2.483 917 GHz	-39.857 dBm																																										

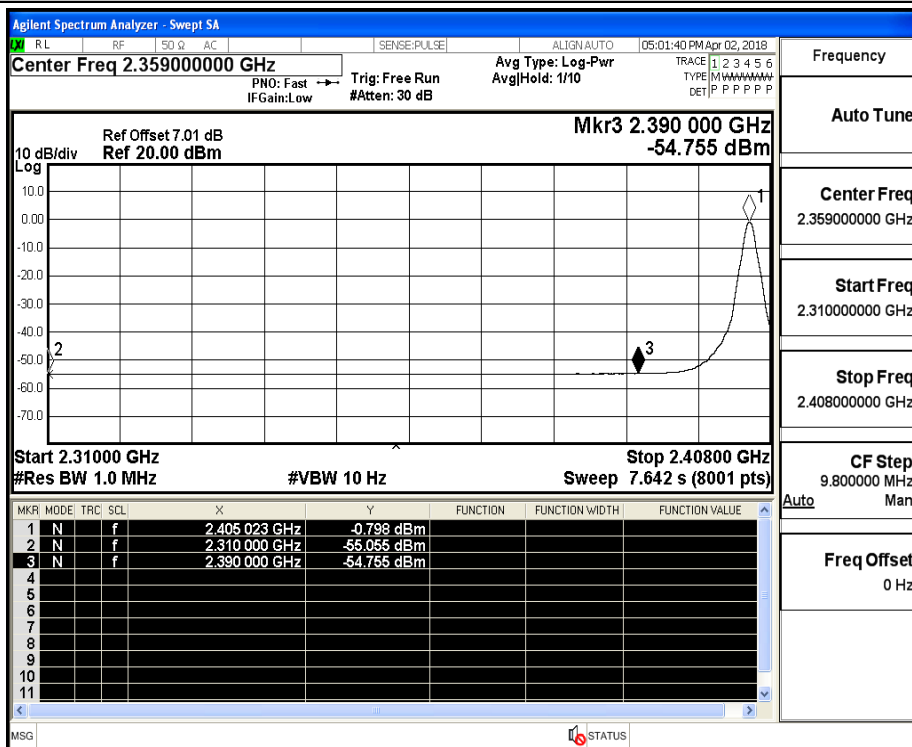
**B.8 Restrict-band band-edge measurements**

Test Mode	Test Channel	Ant	Freq.	Power [dBm]	Gain	Ground Factor	E [dBuV/m]	Detector	Limit [dBuV/m]	Verdict
ZigBee	2405	Ant1	2310.0	-45.00	2.55	0	52.81	PEAK	74	PASS
		Ant1	2310.0	-55.06	2.55	0	42.75	AV	54	PASS
		Ant1	2390.0	-44.56	2.55	0	53.25	PEAK	74	PASS
		Ant1	2390.0	-54.76	2.55	0	43.05	AV	54	PASS
	2480	Ant1	2483.5	-33.34	2.55	0	64.47	PEAK	74	PASS
		Ant1	2483.5	-44.86	2.55	0	52.95	AV	54	PASS
		Ant1	2500.0	-43.32	2.55	0	54.49	PEAK	74	PASS
		Ant1	2500.0	-54.47	2.55	0	43.34	AV	54	PASS

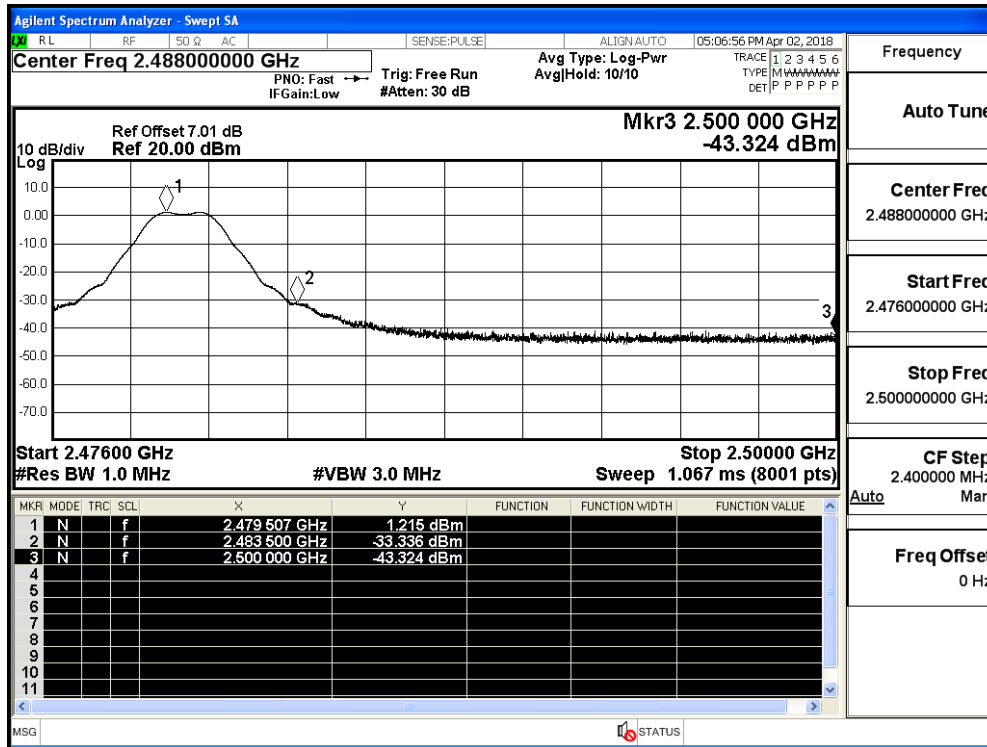
Restrict-band band-edge measurements\_ZigBee\_2405\_Ant1\_PEAK



Restrict-band band-edge measurements\_ZigBee\_2405\_Ant1\_AV



Restrict-band band-edge measurements\_ZigBee\_2480\_Ant1\_PEAK



Restrict-band band-edge measurements\_ZigBee\_2480\_Ant1\_AV

