

## Appendix B

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

Product Name: Butler



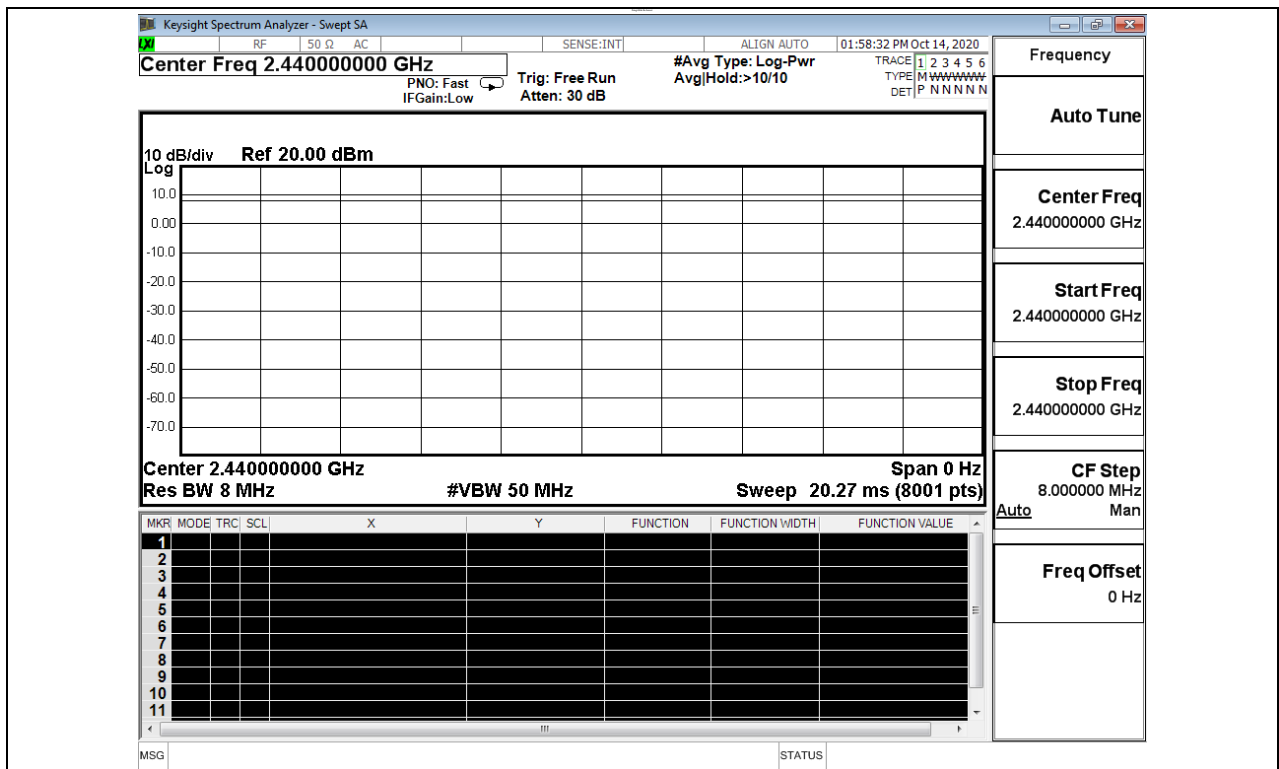
Test Model: VN-BTLR-01

#### Environmental Conditions

Temperature:	23.4°C
Relative Humidity:	54.5%
ATM Pressure:	100.0 kPa
Test Engineer:	Jam Zheng
Supervised by:	Li Huan

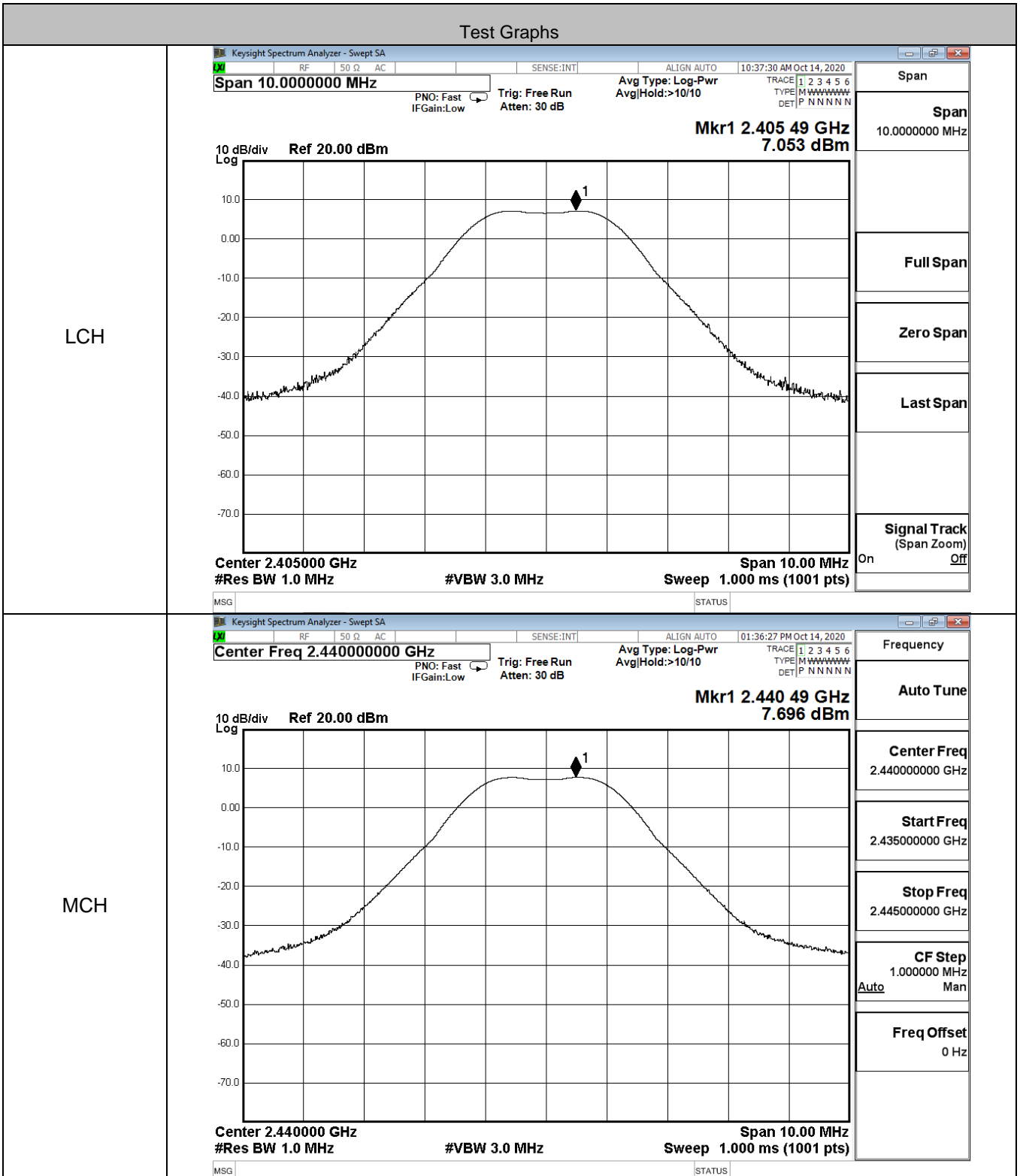
#### B.1 Duty Cycle

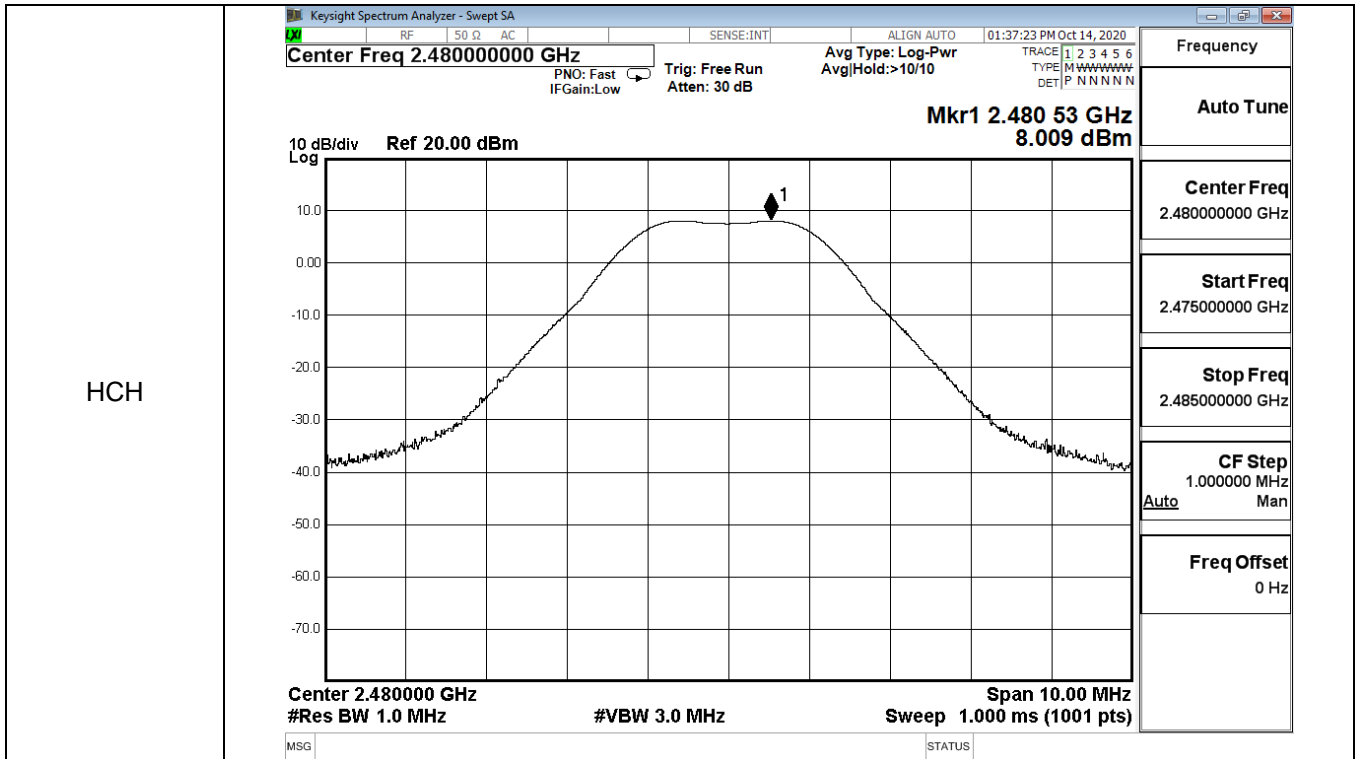
Test Mode	Test Channel	Ant	Duty Cycle[%]	Verdict
Zigbee	2440	Ant1	100	PASS



### B.2 Maximum Conducted Peak Output Power

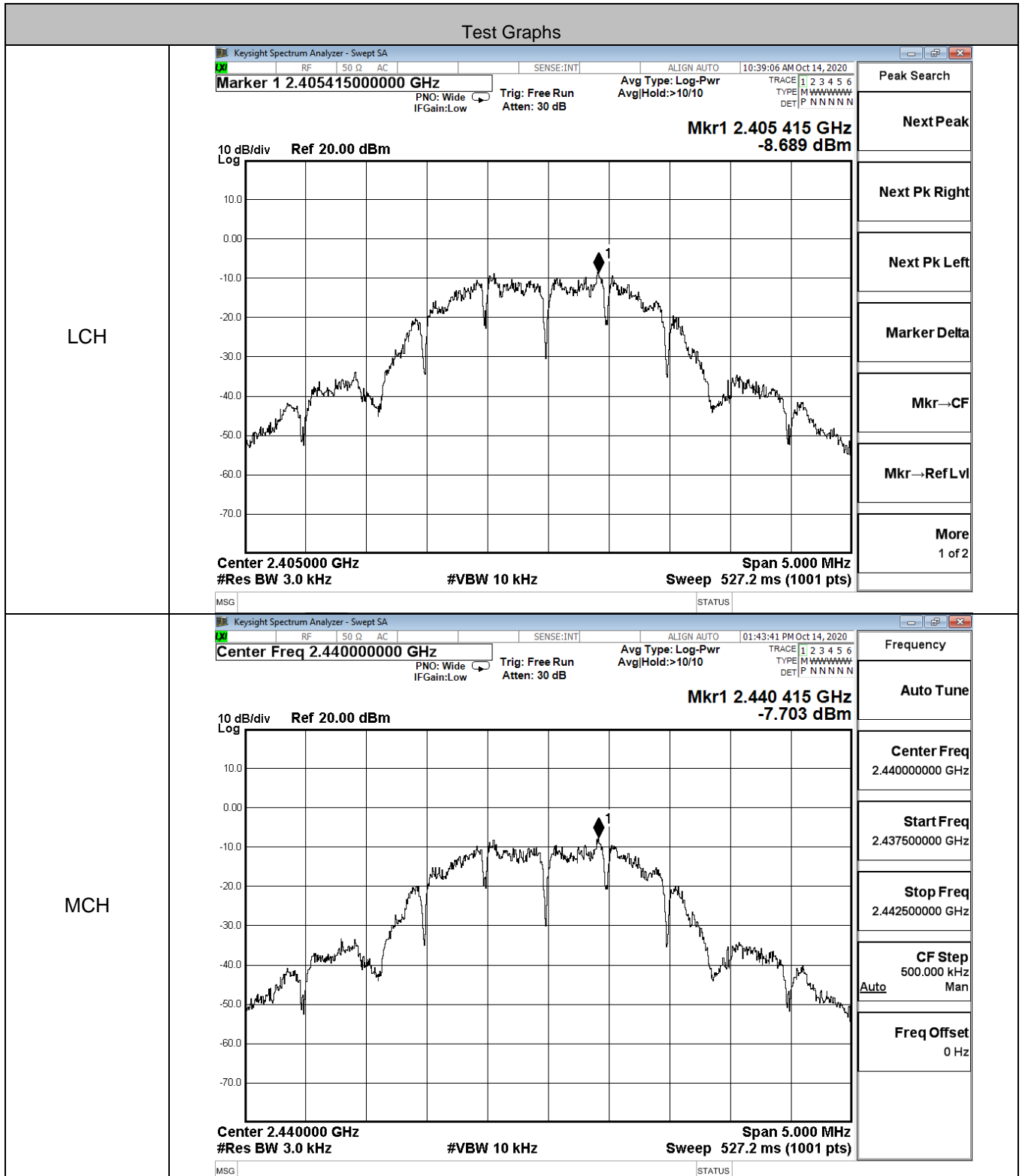
Mode	Channel	Conduct Peak Power[dBm]	Limit [dBm]	Verdict
Zigbee	LCH	7.053	30	PASS
Zigbee	MCH	7.896	30	PASS
Zigbee	HCH	8.009	30	PASS

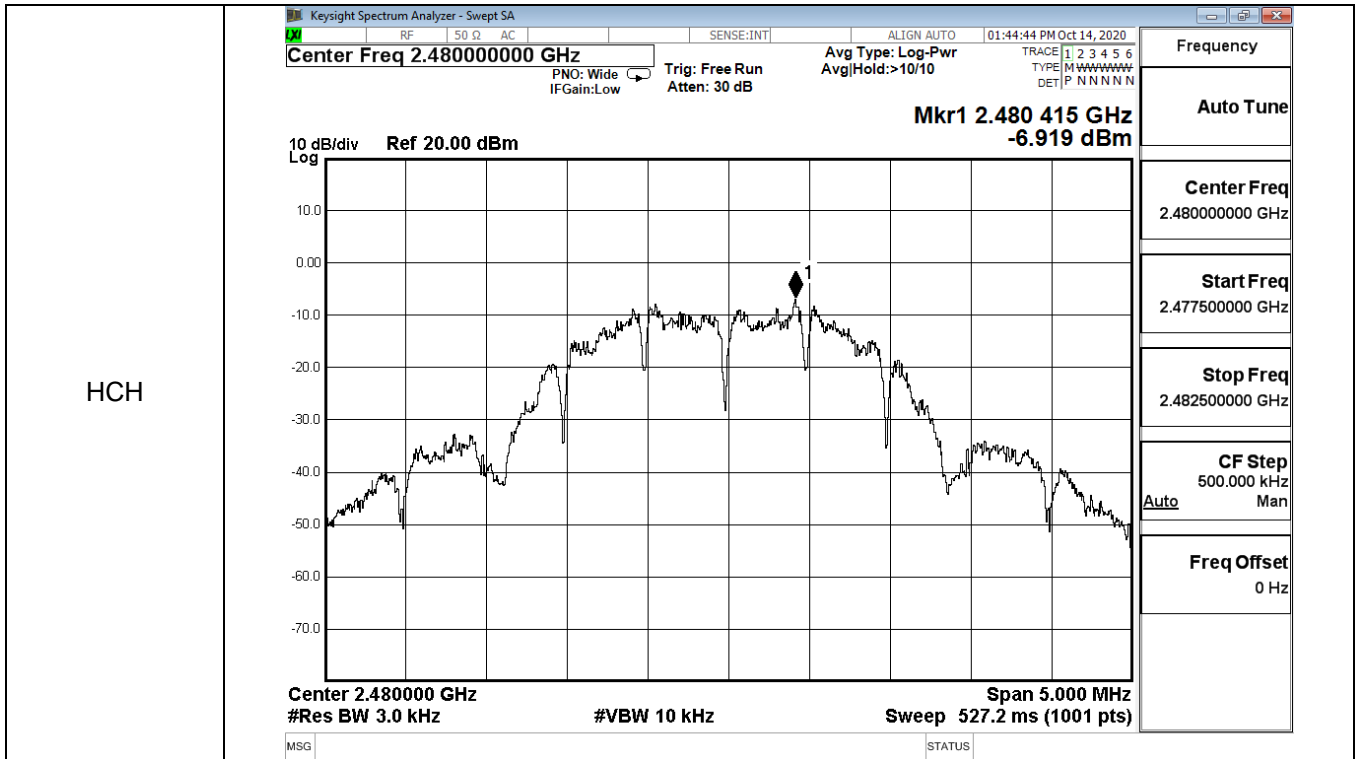




### B.3 Maximum Power Spectral Density

Mode	Channel	PSD [dBm/3KHz]	Limit [dBm/3KHz]	Verdict
Zigbee	LCH	-8.689	8	PASS
Zigbee	MCH	-7.703	8	PASS
Zigbee	HCH	-6.919	8	PASS





**B.4 6dB Bandwidth**

Mode	Channel	6dB Bandwidth [MHz]	Limit [MHz]	Verdict
Zigbee	LCH	1.640	≥0.5	PASS
Zigbee	MCH	1.643	≥0.5	PASS
Zigbee	HCH	1.636	≥0.5	PASS

**Test Graphs**

LCH

**Keysight Spectrum Analyzer - Occupied BW**

Center Freq: 2.405000000 GHz  
 Span 3 MHz  
 #Res BW 100 kHz  
 #VBW 300 kHz  
 Sweep 1 ms

**Occupied Bandwidth**      **Total Power**      **14.9 dBm**

**2.2153 MHz**

Transmit Freq Error    -18.917 kHz      **OBW Power**      **99.00 %**

x dB Bandwidth      1.640 MHz      x dB      **-6.00 dB**

BW

Res BW  
100.00 kHz  
Auto [Man](#)

Video BW  
300.00 kHz  
Auto [Man](#)

Filter Type  
Gaussian

MCH

**Keysight Spectrum Analyzer - Occupied BW**

Center Freq: 2.440000000 GHz  
 Span 3 MHz  
 #Res BW 100 kHz  
 #VBW 300 kHz  
 Sweep 1 ms

**Occupied Bandwidth**      **Total Power**      **14.4 dBm**

**2.2176 MHz**

Transmit Freq Error    -20.495 kHz      **OBW Power**      **99.00 %**

x dB Bandwidth      1.643 MHz      x dB      **-6.00 dB**

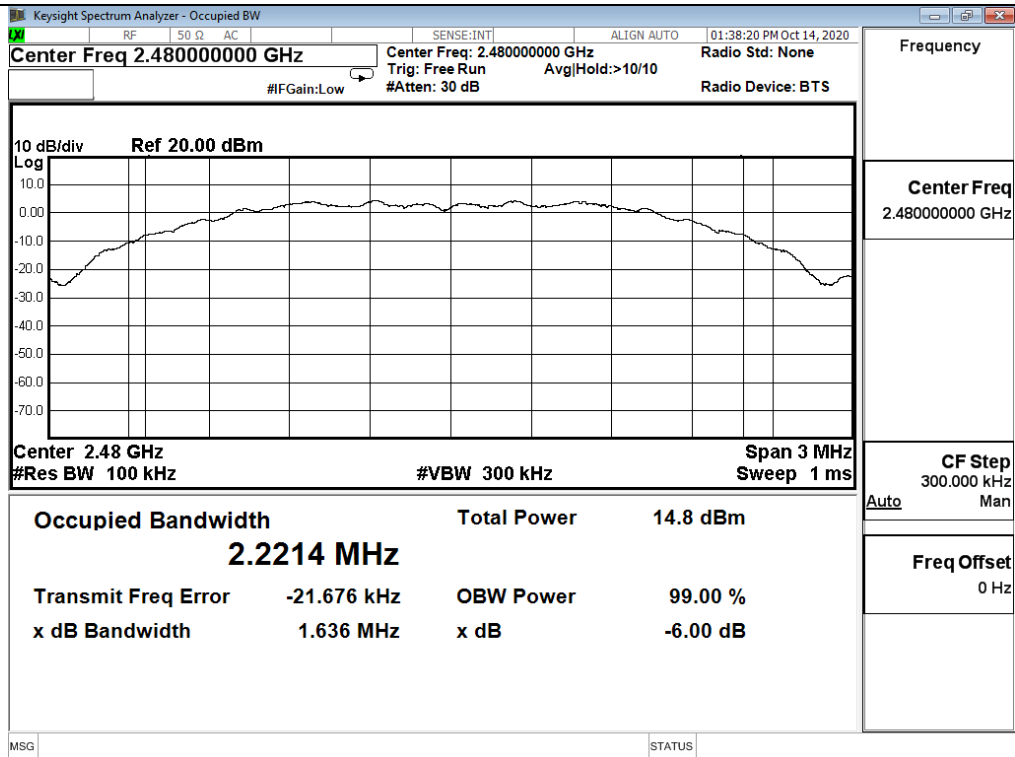
Frequency

Center Freq  
2.440000000 GHz

CF Step  
300.000 kHz  
Auto [Man](#)

Freq Offset  
0 Hz

HCH



### B.5 RF Conducted Spurious Emissions

Mode	Channel	Pref [dBm]	Max. Level [dBm]	Limit [dBm]	Verdict
Zigbee	LCH	3.524	-54.273	-16.48	PASS
Zigbee	MCH	3.981	-54.954	-16.02	PASS
Zigbee	HCH	4.446	-54.951	-15.55	PASS

Zigbee\_LCH\_Graphs

Pref/Zigbee/LCH

Keyshot Spectrum Analyzer - Swept SA  
 Display Line -16.48 dBm  
 Mkr1 2.404 720 GHz  
 3.524 dBm  
 Center 2.405000 GHz  
 #Res BW 100 kHz  
 #VBW 300 kHz  
 Span 5.000 MHz  
 Sweep 1.000 ms (1001 pts)

Trace/Detector  
 Select Trace 1  
 Clear Write  
 Trace Average  
 Max Hold  
 Min Hold  
 View Blank Trace On  
 More 1 of 3

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Puw/Zigbee/LCH

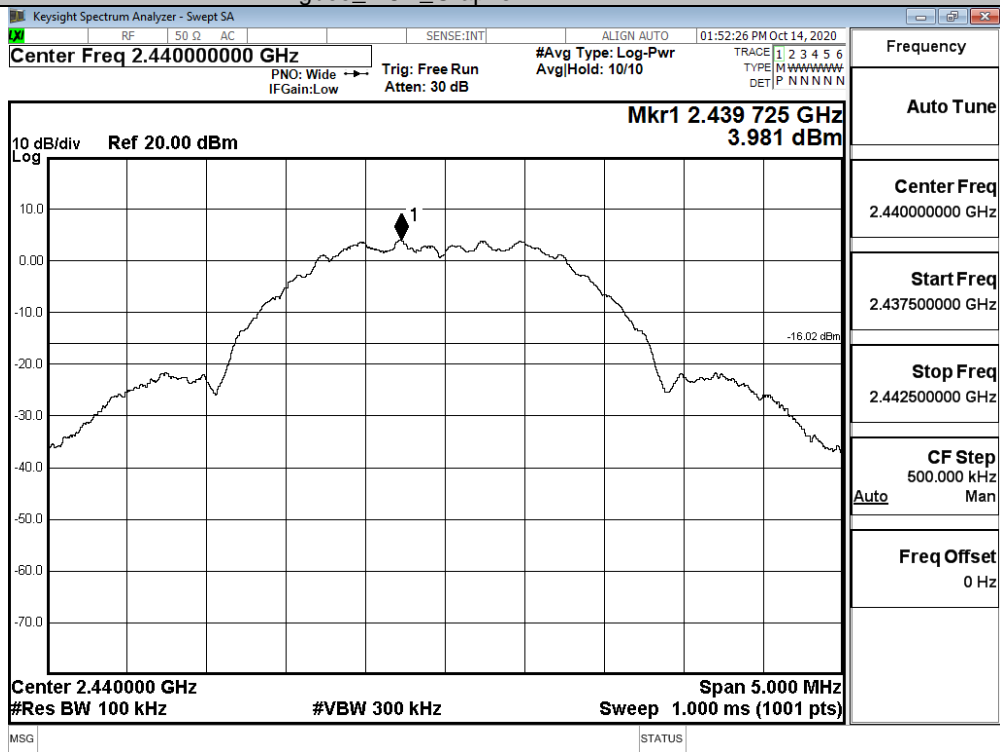
Keyshot Spectrum Analyzer - Swept SA  
 Marker 2 7.221360000000 GHz  
 Mkr2 7.221 GHz  
 -54.273 dBm  
 Start 30 MHz  
 #Res BW 100 kHz  
 #VBW 300 kHz  
 Stop 25.00 GHz  
 Sweep 2.386 s (1001 pts)

Peak Search  
 Next Peak  
 Next Pk Right  
 Next Pk Left  
 Marker Delta  
 Mkr--CF  
 Mkr--Ref Lvl  
 More 1 of 2

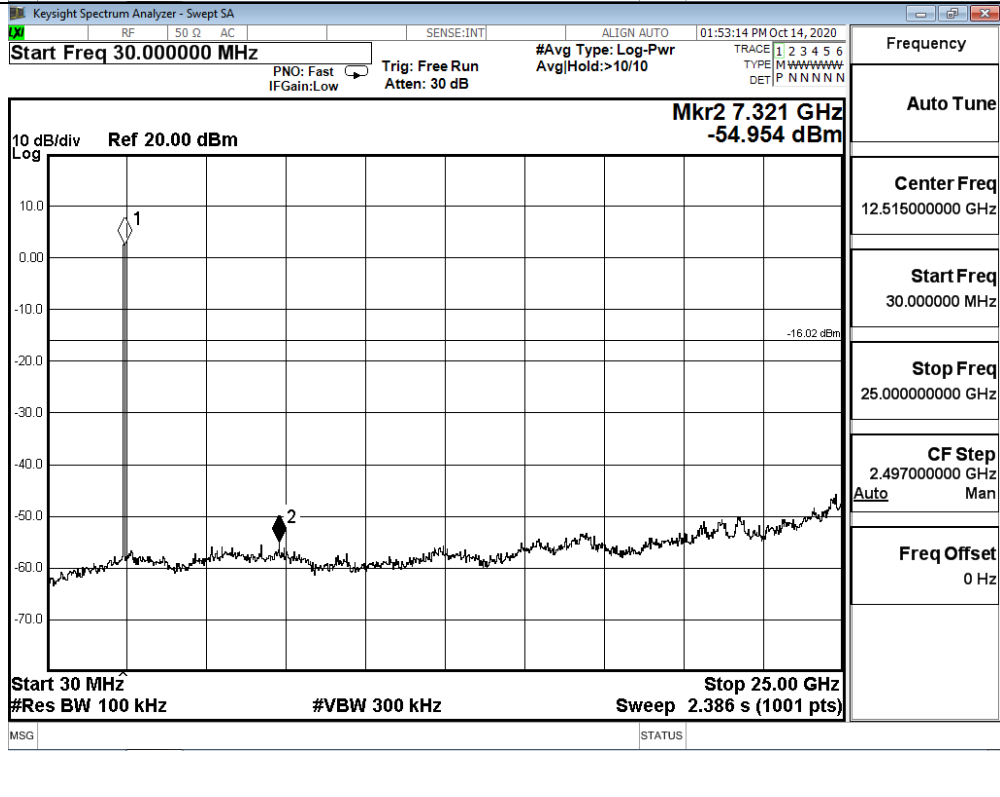


Zigbee\_MCH\_Graphs

Pref/Zigbee/MCH

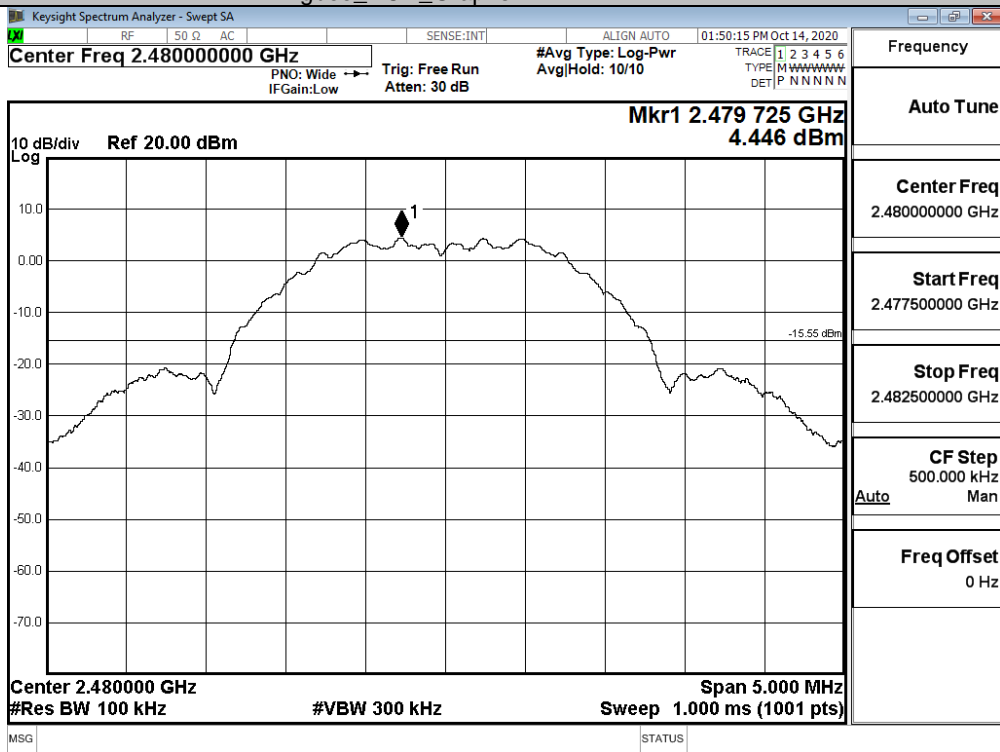


Puw/Zigbee/MCH

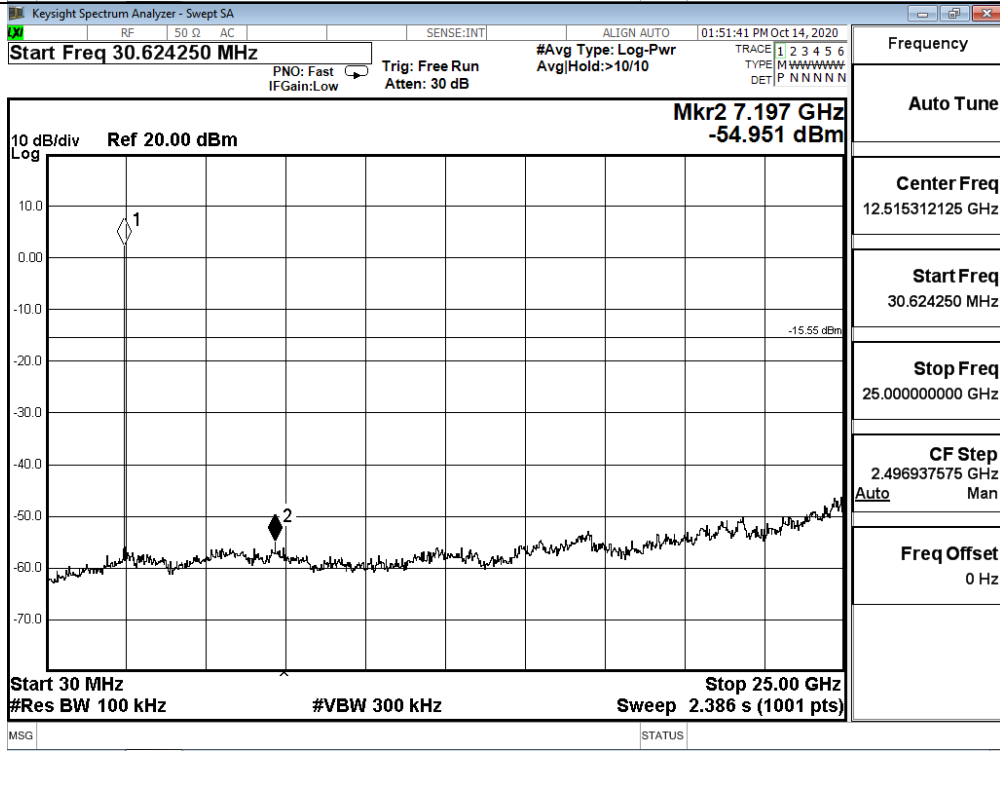


Zigbee\_HCH\_Graphs

Pref/Zigbee/HCH



Puw/Zigbee/HCH



### B.6 Band-edge for RF Conducted Emissions

Mode	Channel	Carrier Power[dBm]	Max.Spurious Level [dBm]	Limit [dBm]	Verdict
Zigbee	LCH	3.428	-50.336	-16.57	PASS
Zigbee	HCH	4.728	-45.286	-15.27	PASS

Test Graphs

LCH

Keysight Spectrum Analyzer - Swept SA  
 Start Freq 2.31000000 GHz #Avg Type: RMS  
 PNO: Fast Trg: Free Run #AvgHold: 10/10  
 IFGain:Low Atten: 30 dB

10 dB/div Ref 20.00 dBm  
 Mkr4 2.344 594 GHz  
 -59.549 dBm

Start 2.31000 GHz Stop 2.40800 GHz  
 #Res BW 100 kHz #VBW 300 kHz Sweep 9.400 ms (1001 pts)

MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	f		2.405 550 GHz	3.428 dBm			
2	N	f		2.400 000 GHz	-50.336 dBm			
3	N	f		2.390 000 GHz	-58.817 dBm			
4	N	f		2.344 594 GHz	-59.549 dBm			

Frequency

Auto Tune

Center Freq  
2.359000000 GHz

Start Freq  
2.310000000 GHz

Stop Freq  
2.408000000 GHz

CF Step  
9.800000 MHz  
Man

Freq Offset  
0 Hz

HCH

Keysight Spectrum Analyzer - Swept SA  
 Start Freq 2.47600000 GHz #Avg Type: RMS  
 PNO: Fast Trg: Free Run #AvgHold: 10/10  
 IFGain:Low Atten: 30 dB

10 dB/div Ref 20.00 dBm  
 Mkr4 2.492 824 GHz  
 -57.795 dBm

Start 2.47600 GHz Stop 2.50000 GHz  
 #Res BW 100 kHz #VBW 300 kHz Sweep 2.333 ms (1001 pts)

MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	f		2.479 720 GHz	4.728 dBm			
2	N	f		2.483 500 GHz	-45.286 dBm			
3	N	f		2.500 000 GHz	-59.911 dBm			
4	N	f		2.492 824 GHz	-57.795 dBm			

Frequency

Auto Tune

Center Freq  
2.488000000 GHz

Start Freq  
2.476000000 GHz

Stop Freq  
2.500000000 GHz

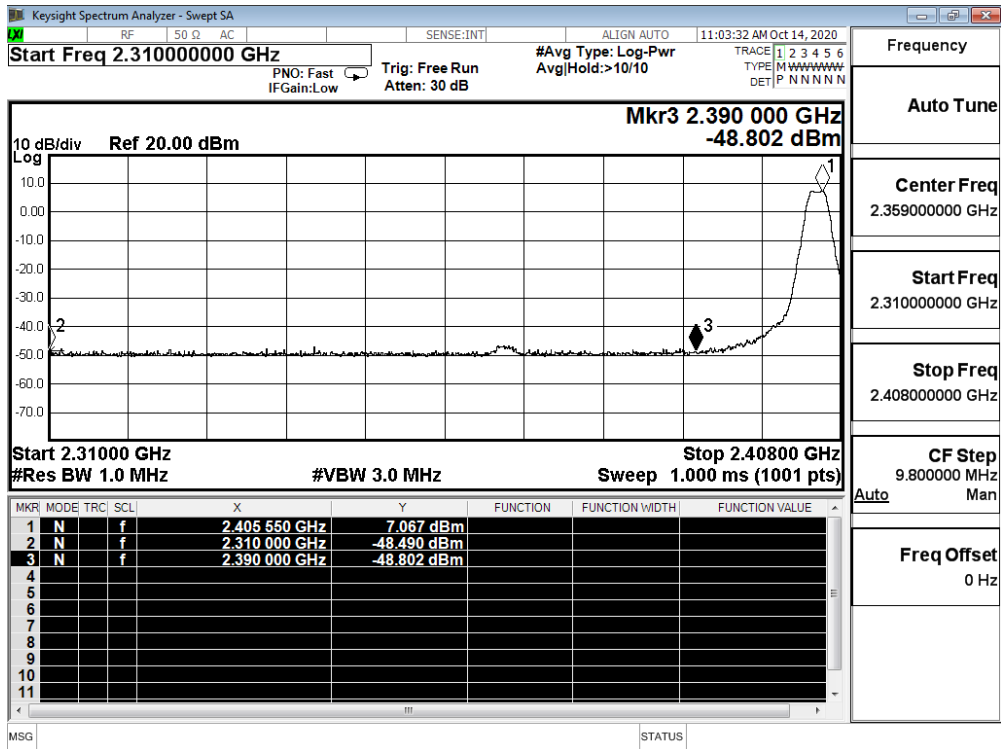
CF Step  
2.400000 MHz  
Man

Freq Offset  
0 Hz

### B.7 Restrict-band band-edge measurements

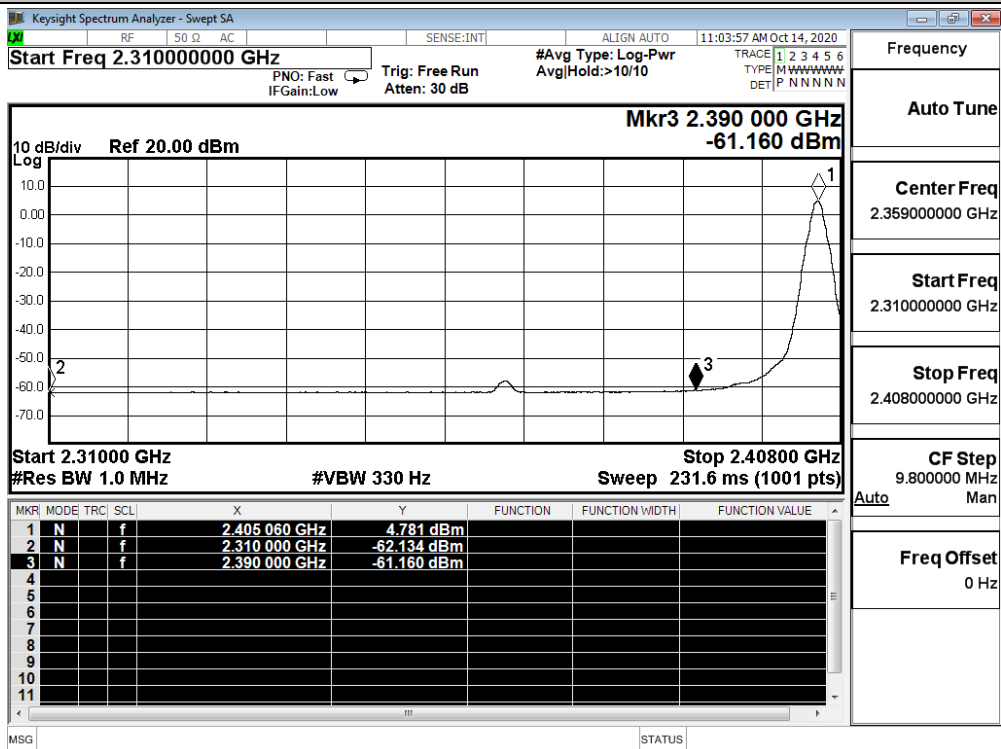
Test Mode	Test Channel	Ant	Freq.	Power [dBm]	Gain	Ground Factor	E [dBuV/m]	Detector	Limit [dBuV/m]	Verdi
Zigbee	2402	Ant1	2310.0	-48.49	3.0	0	49.77	PEAK	74	PASS
		Ant1	2310.0	-62.13	3.0	0	36.13	AV	54	PASS
		Ant1	2390.0	-48.80	3.0	0	49.46	PEAK	74	PASS
		Ant1	2390.0	-61.16	3.0	0	37.10	AV	54	PASS
	2480	Ant1	2483.5	-32.86	3.0	0	65.40	PEAK	74	PASS
		Ant1	2483.5	-44.81	3.0	0	53.45	AV	54	PASS
		Ant1	2500.0	-49.26	3.0	0	49.00	PEAK	74	PASS
		Ant1	2500.0	-61.43	3.0	0	36.83	AV	54	PASS

Restrict-band band-edge measurements\_Zigbee\_2402\_Ant1\_PEAK



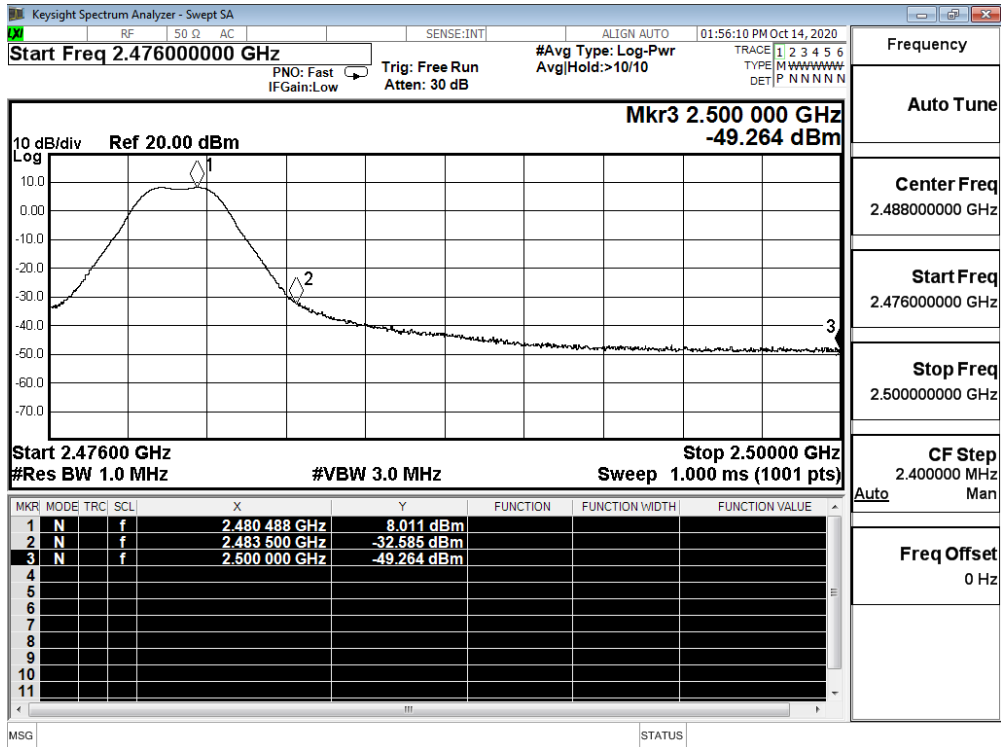
Frequency
Auto Tune
Center Freq 2.359000000 GHz
Start Freq 2.310000000 GHz
Stop Freq 2.408000000 GHz
CF Step 9.800000 MHz Auto Man
Freq Offset 0 Hz

Restrict-band band-edge measurements\_Zigbee\_2402\_Ant1\_AV



Frequency
Auto Tune
Center Freq 2.359000000 GHz
Start Freq 2.310000000 GHz
Stop Freq 2.408000000 GHz
CF Step 9.800000 MHz Auto Man
Freq Offset 0 Hz

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



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

