

Appendix A

RF Test Data for BT LE V5.0(DTS) (Conducted Measurement)

Product Name: Battery Operated LTE Cellular GPS Tracker

Trade Mark: Phillips Connect Technologies

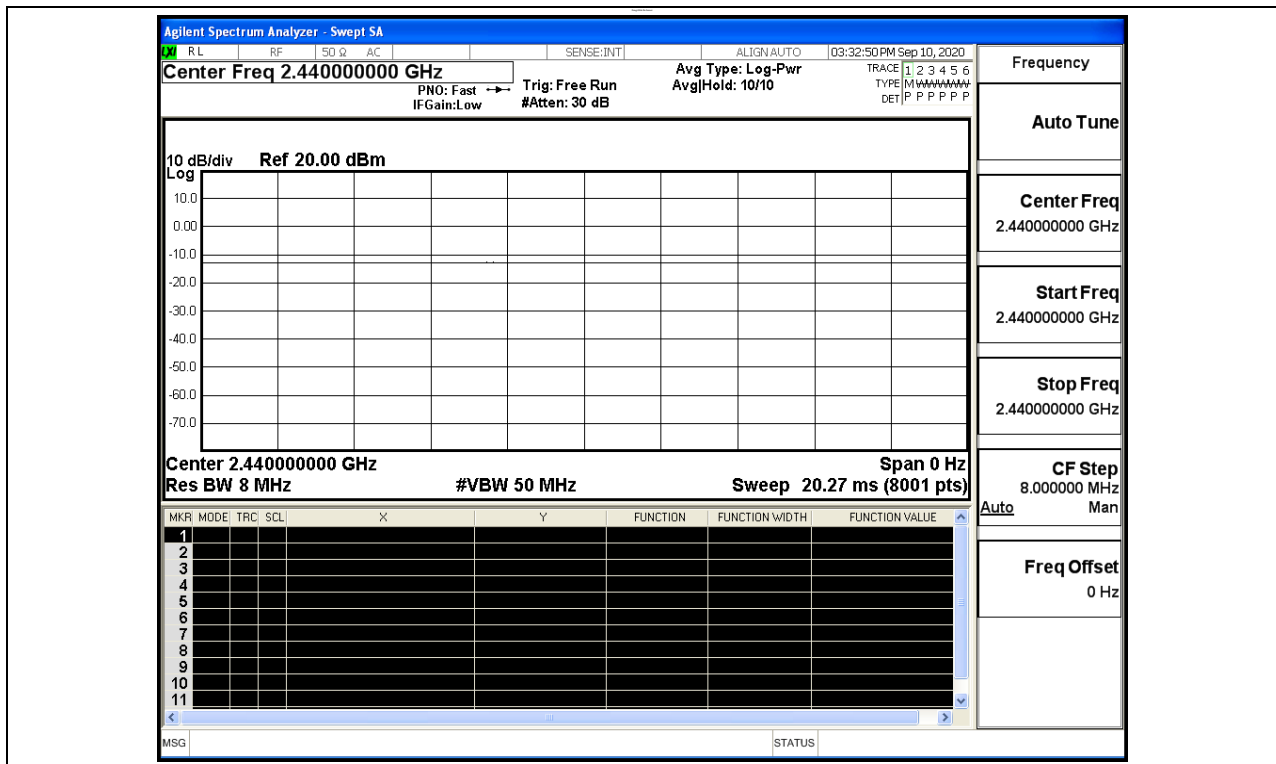
Test Model: Arrow-QA

Environmental Conditions

Temperature:	23.5 ° C
Relative Humidity:	54.1%
ATM Pressure:	100.0 kPa
Test Engineer:	Diamond Lu
Supervised by:	Li Huan

A.1 Duty Cycle

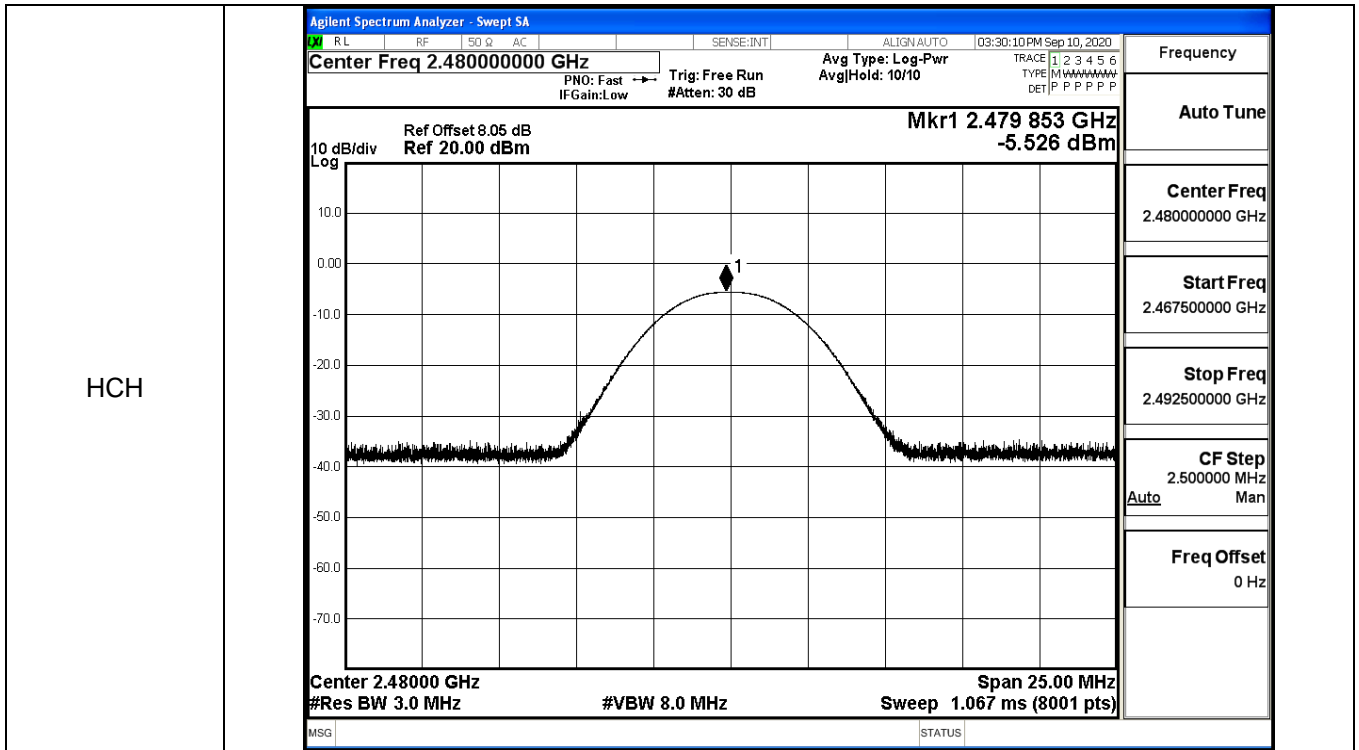
Test Mode	Test Channel	Ant	Duty Cycle[%]	Verdict
BT LE	2440	Ant1	100	PASS



A.2 Maximum Conducted Peak Output Power

Mode	Channel	Conduct Peak Power[dBm]	Limit [dBm]	Verdict
BT LE	LCH	-4.343	30	PASS
BT LE	MCH	-4.868	30	PASS
BT LE	HCH	-5.526	30	PASS

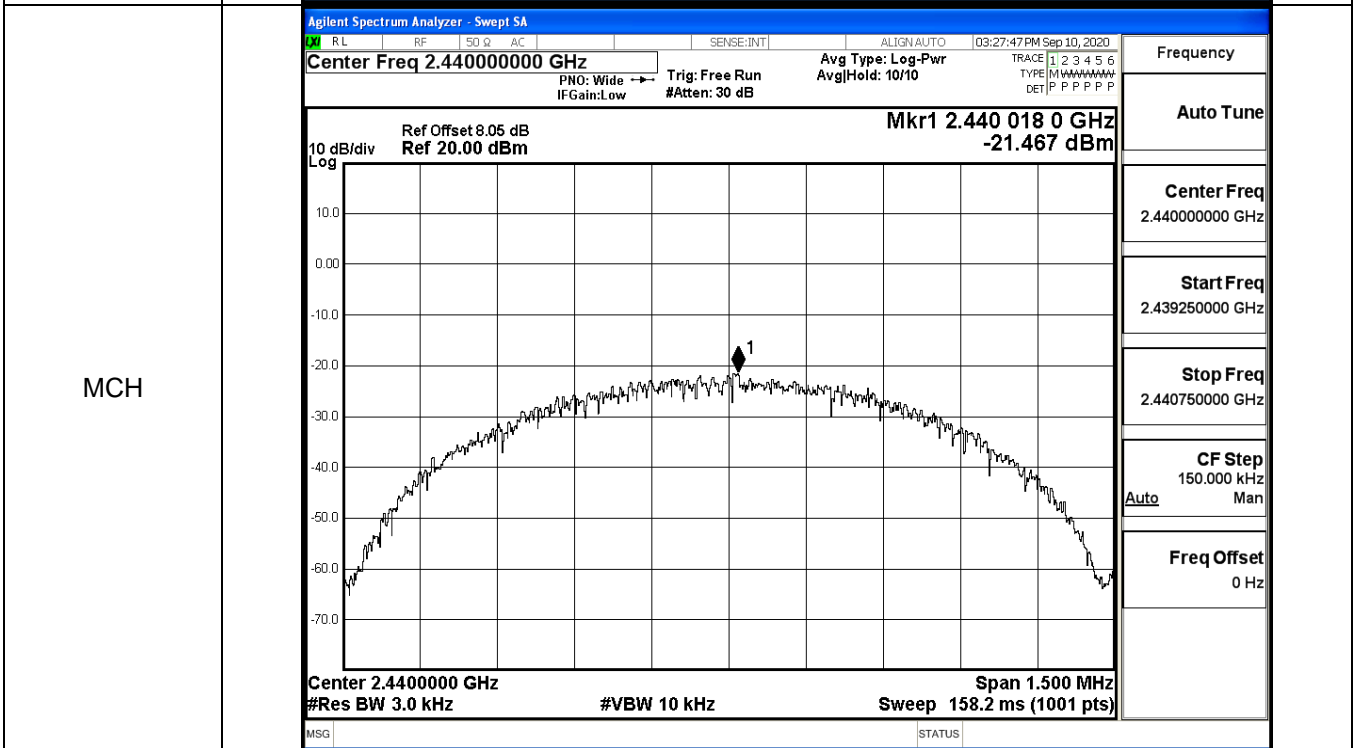
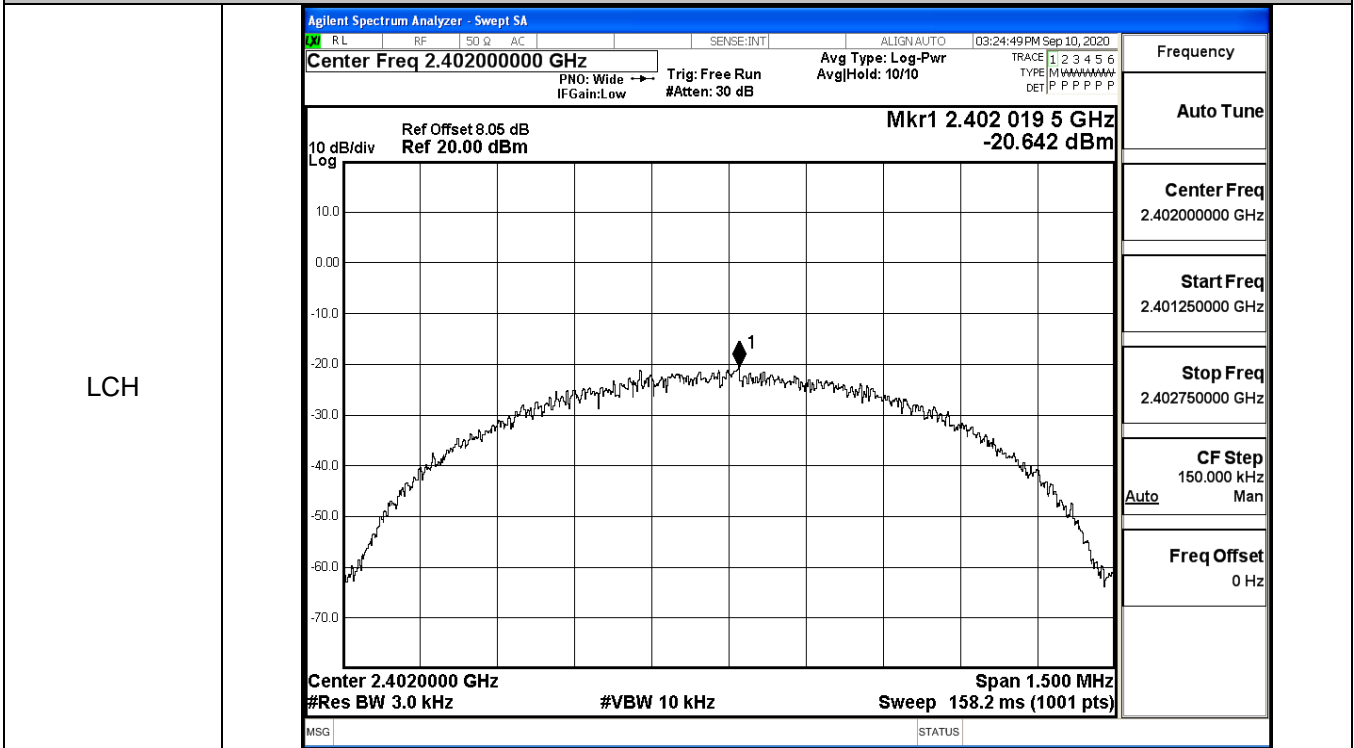
Test Graphs									
LCH	<div style="border: 1px solid black; padding: 5px;"> <p style="font-size: small; margin: 0;">Agilent Spectrum Analyzer - Swept SA</p> <p style="font-size: x-small; margin: 0;">RL RF 50 Ω AC SENSE:INT ALIGN:AUTO 03:24:36 PM Sep 10, 2020</p> <p style="font-size: small; margin: 0;">Center Freq 2.40200000 GHz Avg Type: Log-Pwr Trac: 1 2 3 4 5 6</p> <p style="font-size: x-small; margin: 0;">PNO: Fast Trig: Free Run #Atten: 30 dB AvgHold: 10/10 TYPE: M W W W W W W W</p> <p style="font-size: x-small; margin: 0;">IFGain: Low DET: P P P P P P</p> <div style="display: flex; justify-content: space-between; font-size: small;"> Ref Offset 8.05 dB Mkr1 2.401 963 GHz </div> <div style="display: flex; justify-content: space-between; font-size: small;"> Ref 20.00 dBm -4.343 dBm </div> <div style="display: flex; justify-content: space-between; font-size: x-small; margin-top: 5px;"> Center 2.40200 GHz #Res BW 3.0 MHz #VBW 8.0 MHz Sweep 1.067 ms (8001 pts) </div> <p style="font-size: x-small; margin: 0;">MSG STATUS</p> </div> <table border="1" style="width: 100%; border-collapse: collapse; font-size: x-small;"> <tr><td>Frequency</td></tr> <tr><td>Auto Tune</td></tr> <tr><td>Center Freq 2.402000000 GHz</td></tr> <tr><td>Start Freq 2.389500000 GHz</td></tr> <tr><td>Stop Freq 2.414500000 GHz</td></tr> <tr><td>CF Step 2.500000 MHz</td></tr> <tr><td>Auto Man</td></tr> <tr><td>Freq Offset 0 Hz</td></tr> </table>	Frequency	Auto Tune	Center Freq 2.402000000 GHz	Start Freq 2.389500000 GHz	Stop Freq 2.414500000 GHz	CF Step 2.500000 MHz	Auto Man	Freq Offset 0 Hz
Frequency									
Auto Tune									
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Freq Offset 0 Hz									
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Auto Man									
Freq Offset 0 Hz									



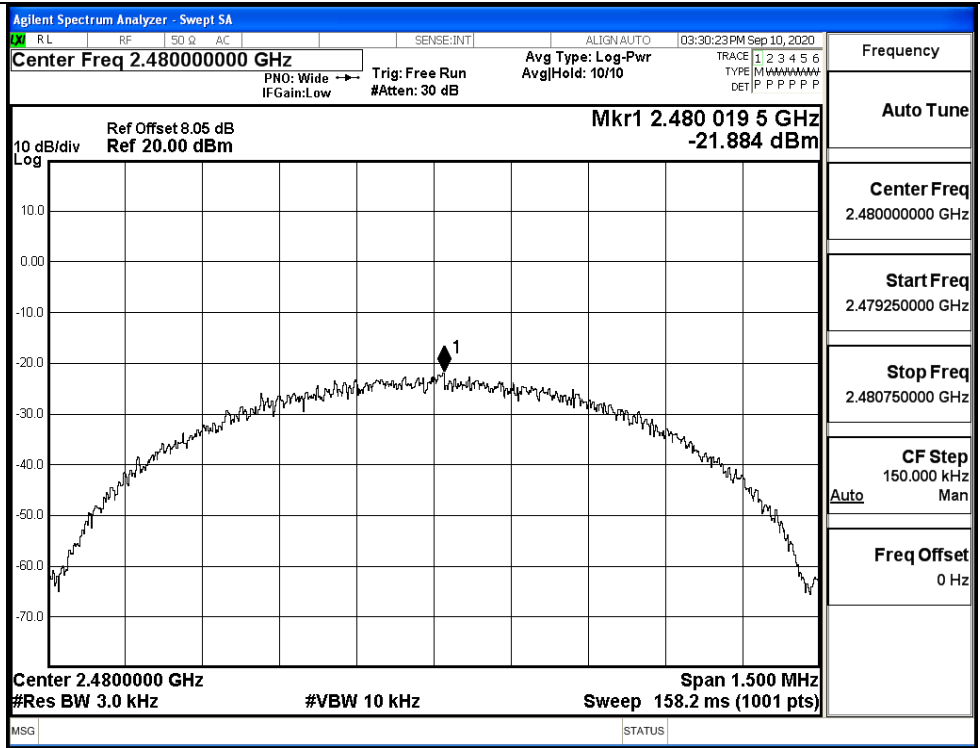
A.3 Maximum Power Spectral Density

Mode	Channel	PSD [dBm/3KHz]	Limit [dBm/3KHz]	Verdict
BT LE	LCH	-20.642	8	PASS
BT LE	MCH	-21.467	8	PASS
BT LE	HCH	-21.884	8	PASS

Test Graphs

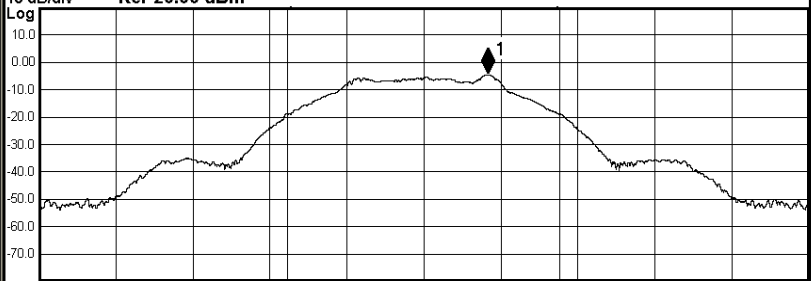
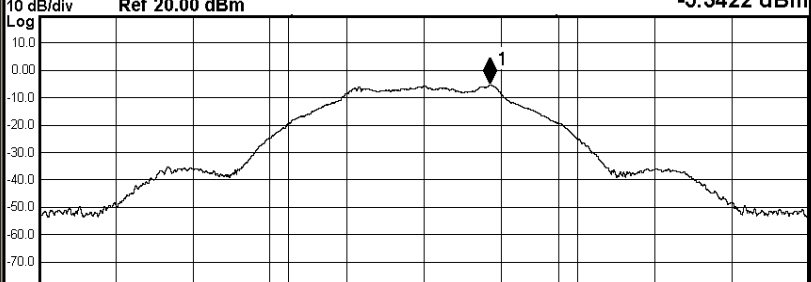


HCH

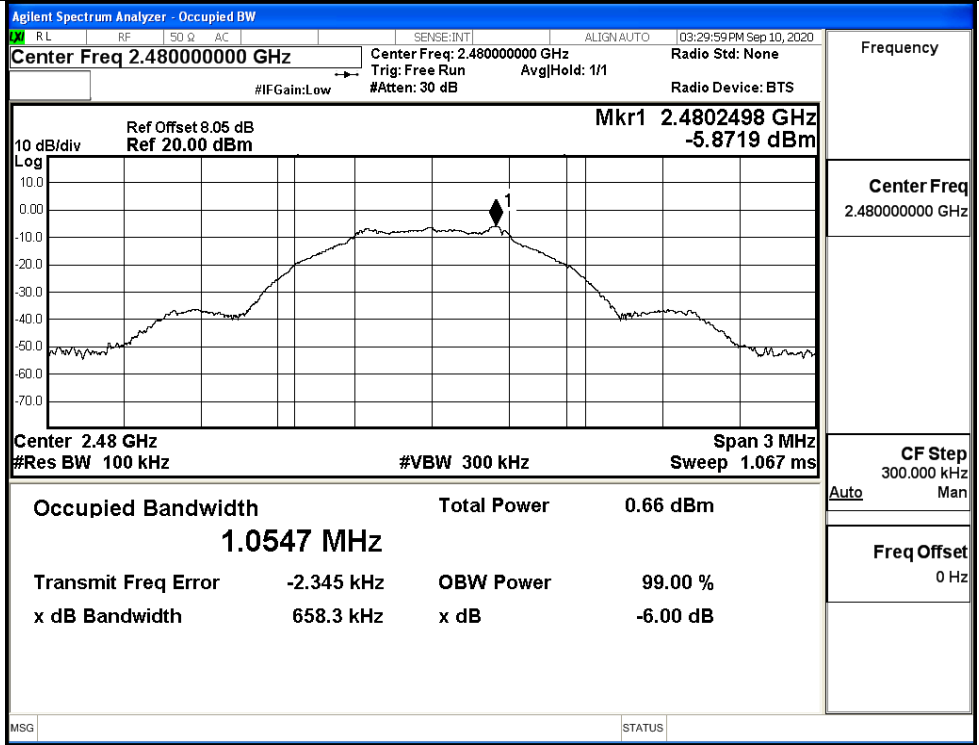


A.4 6dB Bandwidth

Mode	Channel	6dB Bandwidth [MHz]	Limit [MHz]	Verdict
BT LE	LCH	0.6610	≥0.5	PASS
BT LE	MCH	0.6701	≥0.5	PASS
BT LE	HCH	0.6583	≥0.5	PASS

Test Graphs																			
LCH	<div style="border: 1px solid black; padding: 5px;"> <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:INT ALIGN:AUTO 03:24:25 PM Sep 10, 2020</p> <p style="font-size: small; margin: 0;">Center Freq 2.402000000 GHz Center Freq: 2.402000000 GHz Radio Std: None</p> <p style="font-size: x-small; margin: 0;">Trig: Free Run AvgHold: 1/1</p> <p style="font-size: x-small; margin: 0;">#IFGain:Low #Atten: 30 dB Radio Device: BTS</p> <div style="border: 1px solid black; padding: 2px; margin: 5px 0;"> <p style="font-size: x-small; margin: 0;">10 dB/div Ref Offset 8.05 dB Mkr1 2.4022486 GHz</p> <p style="font-size: x-small; margin: 0;">Log Ref 20.00 dBm -4.6330 dBm</p>  </div> <p style="font-size: x-small; margin: 0;">Center 2.402 GHz Span 3 MHz</p> <p style="font-size: x-small; margin: 0;">#Res BW 100 kHz #VBW 300 kHz Sweep 1.067 ms</p> <table style="width: 100%; font-size: x-small; border-collapse: collapse;"> <tr> <td>Occupied Bandwidth</td> <td>Total Power</td> <td>1.92 dBm</td> </tr> <tr> <td style="text-align: center;">1.0535 MHz</td> <td></td> <td></td> </tr> <tr> <td>Transmit Freq Error</td> <td>-199 Hz</td> <td>OBW Power</td> </tr> <tr> <td>x dB Bandwidth</td> <td>661.0 kHz</td> <td>x dB</td> </tr> <tr> <td></td> <td></td> <td>99.00 %</td> </tr> <tr> <td></td> <td></td> <td>-6.00 dB</td> </tr> </table> <p style="font-size: x-small; margin: 0;">MSG STATUS</p> </div>	Occupied Bandwidth	Total Power	1.92 dBm	1.0535 MHz			Transmit Freq Error	-199 Hz	OBW Power	x dB Bandwidth	661.0 kHz	x dB			99.00 %			-6.00 dB
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MCH	<div style="border: 1px solid black; padding: 5px;"> <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:INT ALIGN:AUTO 03:27:22 PM Sep 10, 2020</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</p> <p style="font-size: x-small; margin: 0;">#IFGain:Low #Atten: 30 dB Radio Device: BTS</p> <div style="border: 1px solid black; padding: 2px; margin: 5px 0;"> <p style="font-size: x-small; margin: 0;">10 dB/div Ref Offset 8.05 dB Mkr1 2.4402569 GHz</p> <p style="font-size: x-small; margin: 0;">Log Ref 20.00 dBm -5.3422 dBm</p>  </div> <p style="font-size: x-small; margin: 0;">Center 2.44 GHz Span 3 MHz</p> <p style="font-size: x-small; margin: 0;">#Res BW 100 kHz #VBW 300 kHz Sweep 1.067 ms</p> <table style="width: 100%; font-size: x-small; border-collapse: collapse;"> <tr> <td>Occupied Bandwidth</td> <td>Total Power</td> <td>1.36 dBm</td> </tr> <tr> <td style="text-align: center;">1.0509 MHz</td> <td></td> <td></td> </tr> <tr> <td>Transmit Freq Error</td> <td>-81 Hz</td> <td>OBW Power</td> </tr> <tr> <td>x dB Bandwidth</td> <td>670.1 kHz</td> <td>x dB</td> </tr> <tr> <td></td> <td></td> <td>99.00 %</td> </tr> <tr> <td></td> <td></td> <td>-6.00 dB</td> </tr> </table> <p style="font-size: x-small; margin: 0;">MSG STATUS</p> </div>	Occupied Bandwidth	Total Power	1.36 dBm	1.0509 MHz			Transmit Freq Error	-81 Hz	OBW Power	x dB Bandwidth	670.1 kHz	x dB			99.00 %			-6.00 dB
Occupied Bandwidth	Total Power	1.36 dBm																	
1.0509 MHz																			
Transmit Freq Error	-81 Hz	OBW Power																	
x dB Bandwidth	670.1 kHz	x dB																	
		99.00 %																	
		-6.00 dB																	

HCH



A.5 Occupied Bandwidth

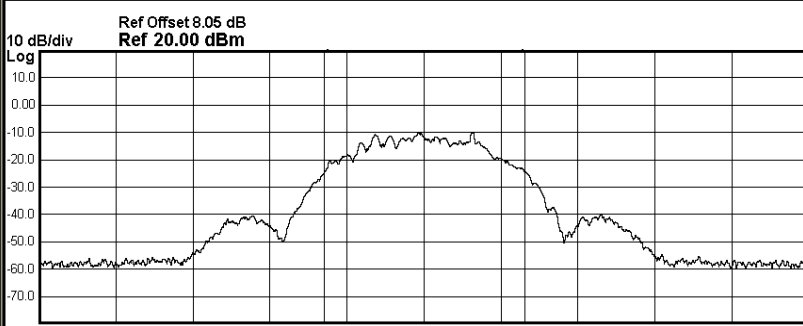
Mode	Channel	Occupied Bandwidth [MHz]	Limit [MHz]	Verdict
BT LE	LCH	1.0354	≥0.5	PASS
BT LE	MCH	1.0403	≥0.5	PASS
BT LE	HCH	1.0418	≥0.5	PASS

Test Graphs

LCH	<p>Agilent Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.40200000 GHz</p> <p>Center Freq: 2.40200000 GHz</p> <p>Trig: Free Run</p> <p>Avg/Hold: 10/10</p> <p>Radio Std: None</p> <p>#IFGain:Low</p> <p>#Atten: 30 dB</p> <p>Radio Device: BTS</p> <p>Ref Offset 8.05 dB</p> <p>Ref 20.00 dBm</p> <p>10 dB/div</p> <p>Log</p> <p>Center 2.402 GHz</p> <p>#Res BW 30 kHz</p> <p>#VBW 100 kHz</p> <p>Span 4 MHz</p> <p>Sweep 4.267 ms</p> <p>Occupied Bandwidth 1.0354 MHz</p> <p>Total Power 2.15 dBm</p> <p>Transmit Freq Error 4.262 kHz</p> <p>OBW Power 99.00 %</p> <p>x dB Bandwidth 662.0 kHz</p> <p>x dB -6.00 dB</p>	<p>Frequency</p> <p>Center Freq 2.40200000 GHz</p> <p>CF Step 400.000 kHz</p> <p>Auto Man</p> <p>Freq Offset 0 Hz</p>
	MCH	<p>Agilent Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.44000000 GHz</p> <p>Center Freq: 2.44000000 GHz</p> <p>Trig: Free Run</p> <p>Avg/Hold: >10/10</p> <p>Radio Std: None</p> <p>#IFGain:Low</p> <p>#Atten: 30 dB</p> <p>Radio Device: BTS</p> <p>Ref Offset 8.05 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 30 kHz</p> <p>#VBW 100 kHz</p> <p>Span 4 MHz</p> <p>Sweep 4.267 ms</p> <p>Occupied Bandwidth 1.0403 MHz</p> <p>Total Power 1.69 dBm</p> <p>Transmit Freq Error 5.398 kHz</p> <p>OBW Power 99.00 %</p> <p>x dB Bandwidth 660.4 kHz</p> <p>x dB -6.00 dB</p>

HCH

Agilent Spectrum Analyzer - Occupied BW

RL	RF	50 Ω	AC	SENSE:INT	ALIGN:AUTO	03:21:55 PM Sep 10, 2020
Center Freq 2.480000000 GHz				Center Freq: 2.480000000 GHz	Radio Std: None	Frequency
				Trig: Free Run	AvgHold: 10/10	Center Freq 2.480000000 GHz
				#IFGain:Low	#Atten: 30 dB	
<div style="display: flex; justify-content: space-between; font-size: 8px;"> 10 dB/div Ref Offset 8.05 dB </div> <div style="display: flex; justify-content: space-between; font-size: 8px;"> Log Ref 20.00 dBm </div>  <div style="display: flex; justify-content: space-between; font-size: 8px; margin-top: 5px;"> Center 2.48 GHz #VBW 100 kHz Span 4 MHz </div> <div style="display: flex; justify-content: space-between; font-size: 8px;"> #Res BW 30 kHz Sweep 4.267 ms </div>						
Occupied Bandwidth		Total Power		0.80 dBm		
1.0418 MHz						
Transmit Freq Error	4.199 kHz	OBW Power	99.00 %			
x dB Bandwidth	660.1 kHz	x dB	-6.00 dB			

MSG
STATUS

CF Step 400.000 kHz Auto Man
Freq Offset 0 Hz

A.6 RF Conducted Spurious Emissions

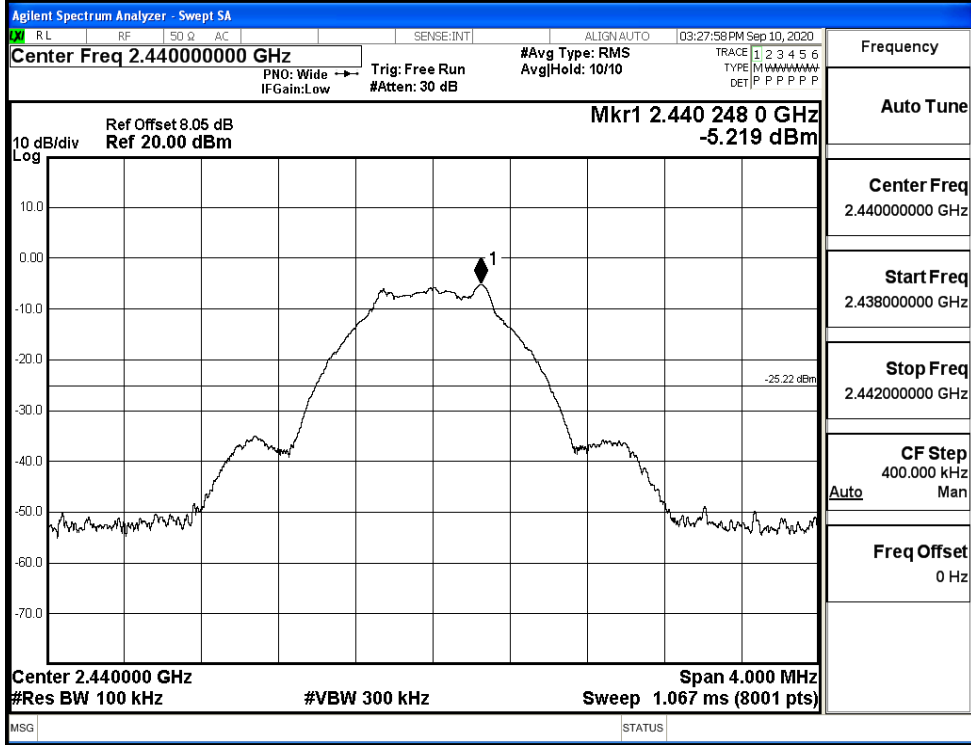
Mode	Channel	Pref [dBm]	Max. Level [dBm]	Limit [dBm]	Verdict
BT LE	LCH	-4.644	-37.461	-24.644	PASS
BT LE	MCH	-5.219	-37.841	-25.219	PASS
BT LE	HCH	-6.049	-37.724	-26.049	PASS

BT LE_LCH_Graphs

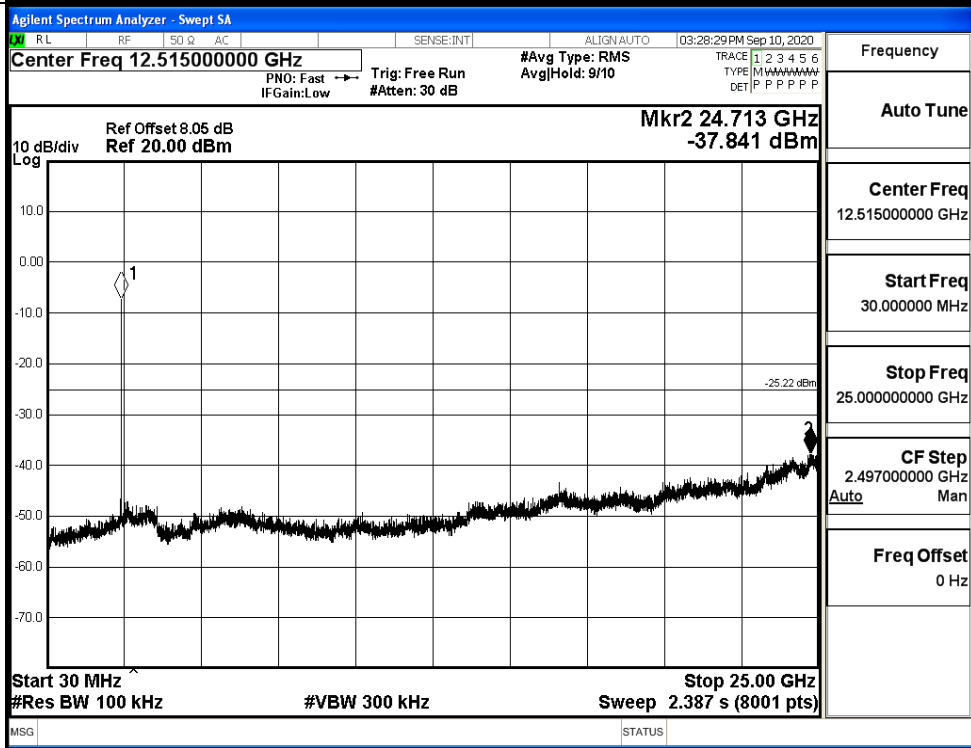
Pref/BT LE/LCH	
Puw/BT LE/LCH	

BT LE_MCH_Graphs

Pref/BT LE/MCH

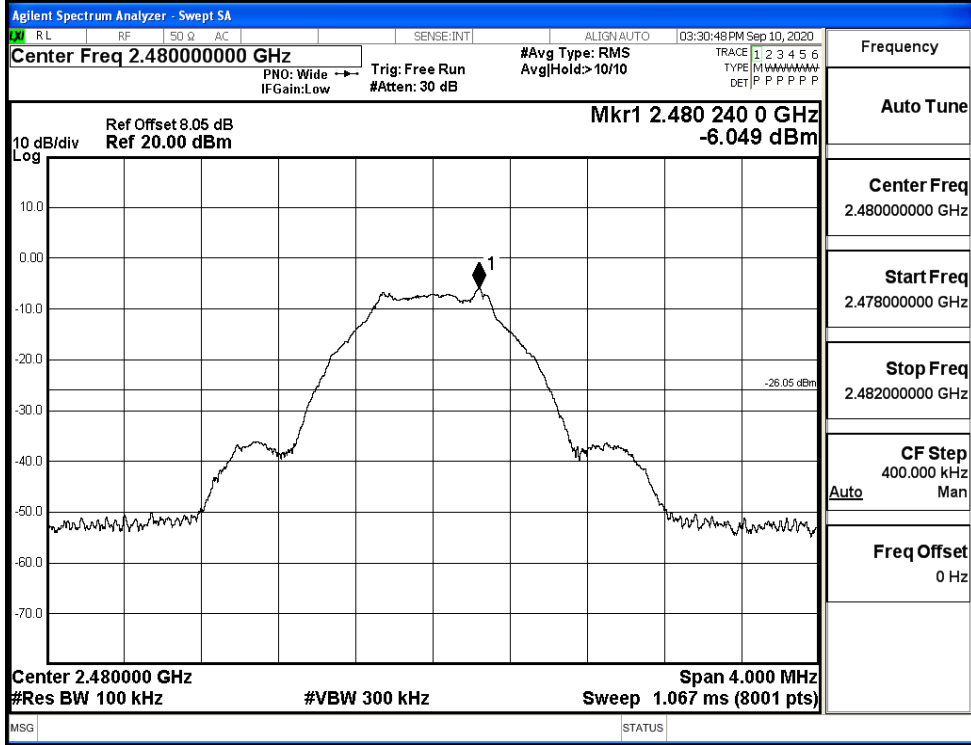


Puw/BT LE/MCH

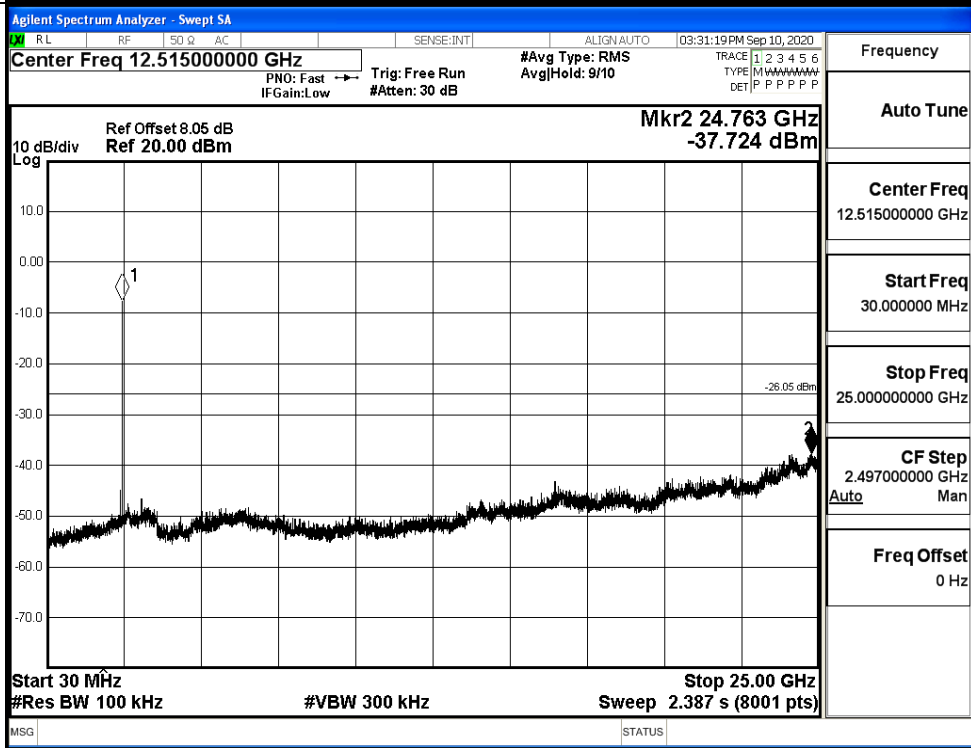


BT LE_HCH_Graphs

Pref/BT LE/HCH



Puw/BT LE/HCH



A.7 Band-edge for RF Conducted Emissions

Mode	Channel	Carrier Power[dBm]	Max.Spurious Level [dBm]	Limit [dBm]	Verdict
BT LE	LCH	-5.081	-49.634	-25.08	PASS
BT LE	HCH	-6.446	-48.633	-26.45	PASS

Test Graphs

LCH

Agilent Spectrum Analyzer - Swept SA
 Center Freq 2.35700000 GHz
 Mkr4 2.386 833 GHz
 -49.634 dBm
 Start 2.31000 GHz Stop 2.40400 GHz
 #Res BW 100 kHz #VBW 300 kHz Sweep 9.067 ms (8001 pts)

MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	f		2.402 003 GHz	-5.081 dBm			
2	N	f		2.400 000 GHz	-52.653 dBm			
3	N	f		2.390 000 GHz	-52.717 dBm			
4	N	f		2.386 833 GHz	-49.634 dBm			

Frequency

Auto Tune

Center Freq
2.35700000 GHz

Start Freq
2.31000000 GHz

Stop Freq
2.40400000 GHz

CF Step
9.400000 MHz

Freq Offset
0 Hz

HCH

Agilent Spectrum Analyzer - Swept SA
 Center Freq 2.48900000 GHz
 Mkr4 2.489 907 50 GHz
 -48.633 dBm
 Start 2.47800 GHz Stop 2.50000 GHz
 #Res BW 100 kHz #VBW 300 kHz Sweep 2.133 ms (8001 pts)

MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	f		2.480 244 00 GHz	-6.446 dBm			
2	N	f		2.483 500 00 GHz	-52.094 dBm			
3	N	f		2.500 000 00 GHz	-51.735 dBm			
4	N	f		2.489 907 50 GHz	-48.633 dBm			

Frequency

Auto Tune

Center Freq
2.48900000 GHz

Start Freq
2.47800000 GHz

Stop Freq
2.50000000 GHz

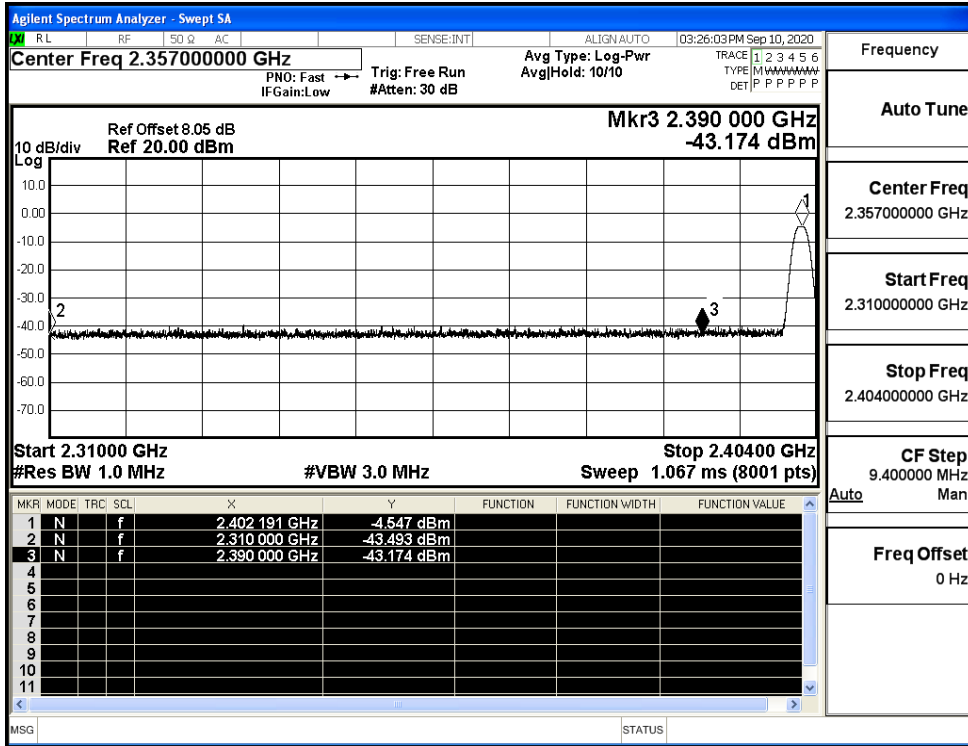
CF Step
2.200000 MHz

Freq Offset
0 Hz

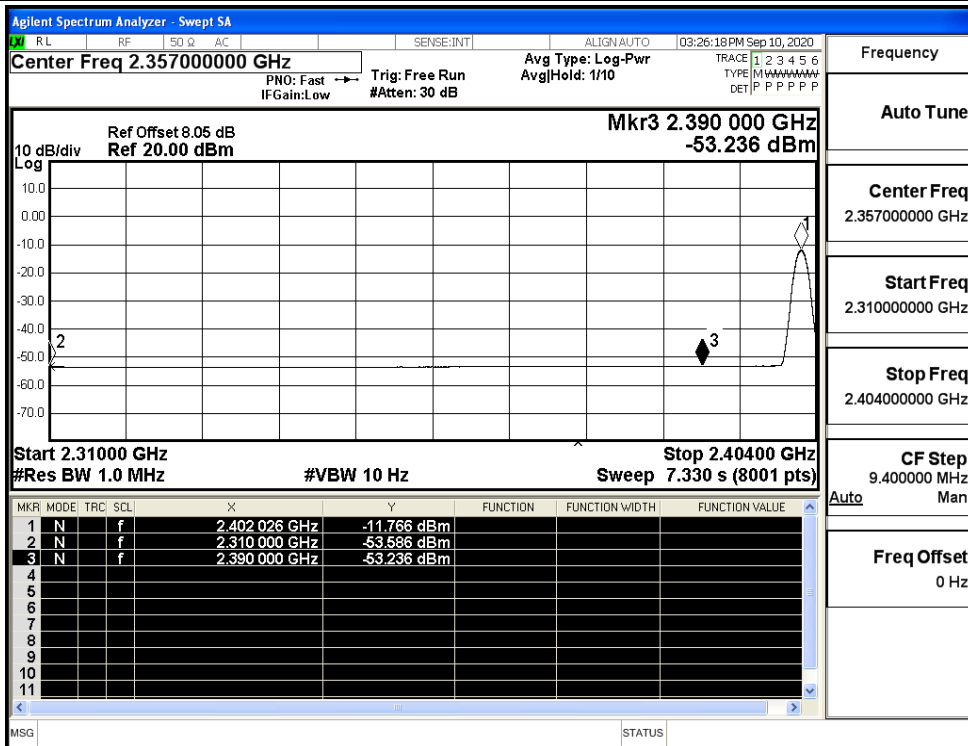
A.8 Restrict-band band-edge measurements

Test Mode	Test Channel	Ant	Freq.	Power [dBm]	Gain	Ground Factor	E [dBuV/m]	Detector	Limit [dBuV/m]	Verdi
BT LE	2402	Ant1	2310.0	-43.49	2.57	0	54.34	PEAK	74	PASS
		Ant1	2310.0	-53.59	2.57	0	44.24	AV	54	PASS
		Ant1	2390.0	-43.17	2.57	0	54.66	PEAK	74	PASS
		Ant1	2390.0	-53.24	2.57	0	44.59	AV	54	PASS
	2480	Ant1	2483.5	-41.93	2.57	0	55.90	PEAK	74	PASS
		Ant1	2483.5	-52.78	2.57	0	45.05	AV	54	PASS
		Ant1	2500.0	-42.25	2.57	0	55.58	PEAK	74	PASS
		Ant1	2500.0	-52.60	2.57	0	45.23	AV	54	PASS

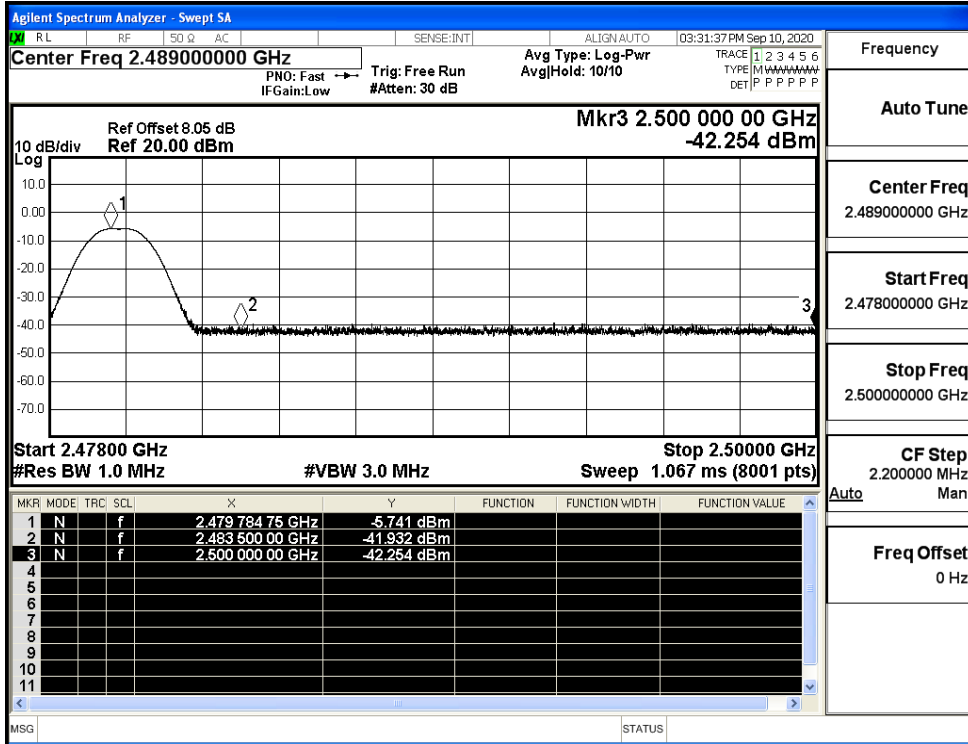
Restrict-band band-edge measurements_BT LE_2402_Ant1_PEAK



Restrict-band band-edge measurements_BT LE_2402_Ant1_AV



Restrict-band band-edge measurements_BT LE_2480_Ant1_PEAK



Restrict-band band-edge measurements_BT LE_2480_Ant1_AV

