Appendix A

RF Test Data for BT V4.0 (BLE) (Conducted Measurement)

Product Name: Builtin

Trade Mark: Crownstone

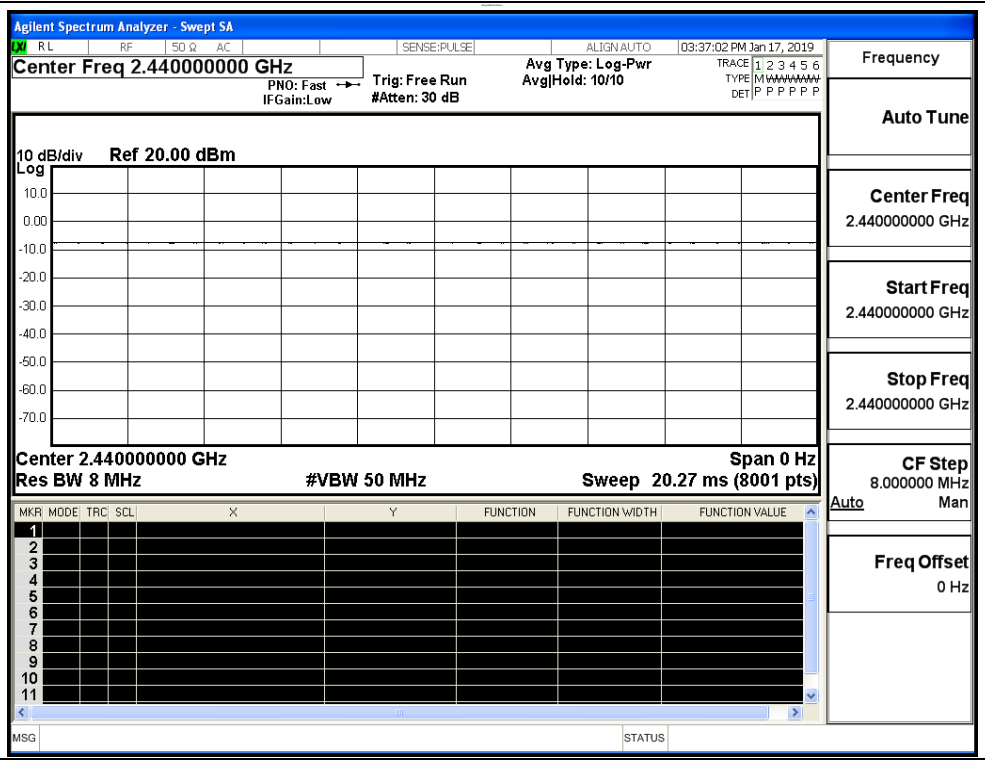
Test Model: CR101/02

Environmental Conditions

Temperature:	24.8° C
Relative Humidity:	54.3%
ATM Pressure:	100.0 kPa
Test Engineer:	Diamond.Lu
Supervised by:	Jayden.Zhuo

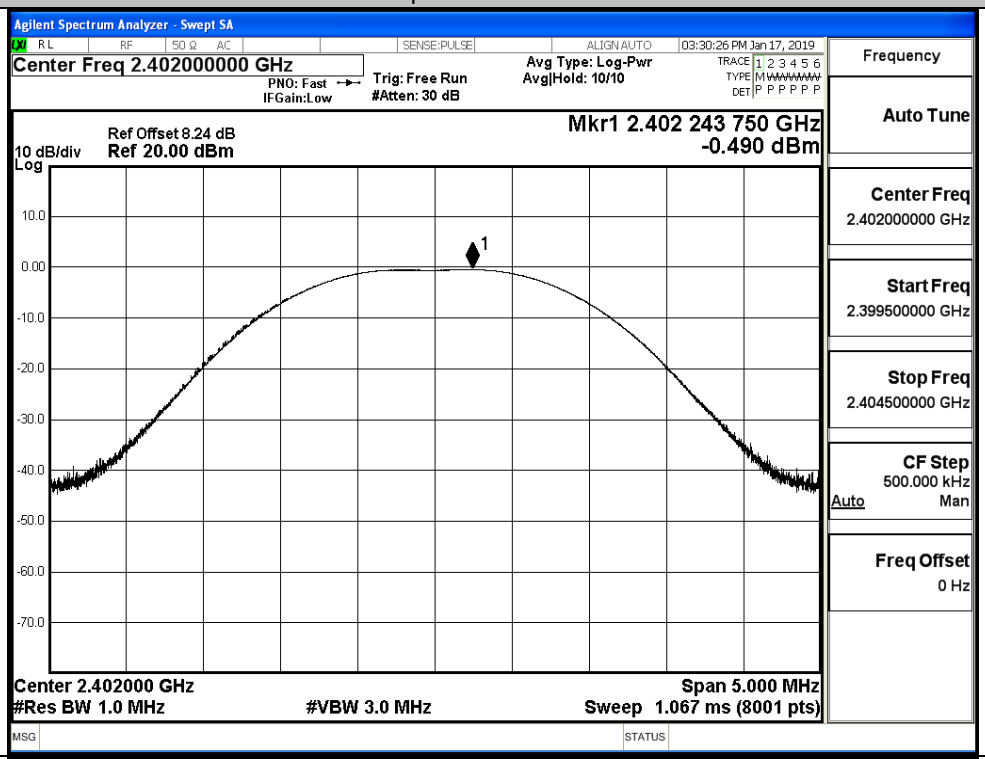
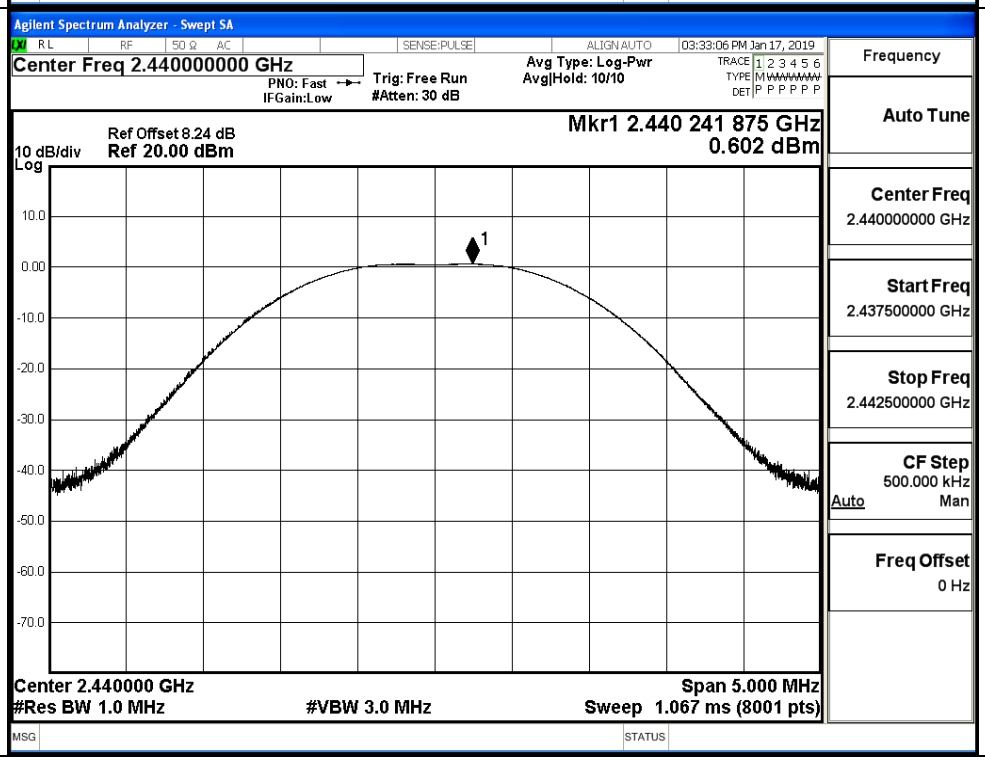
A.1 Duty Cycle

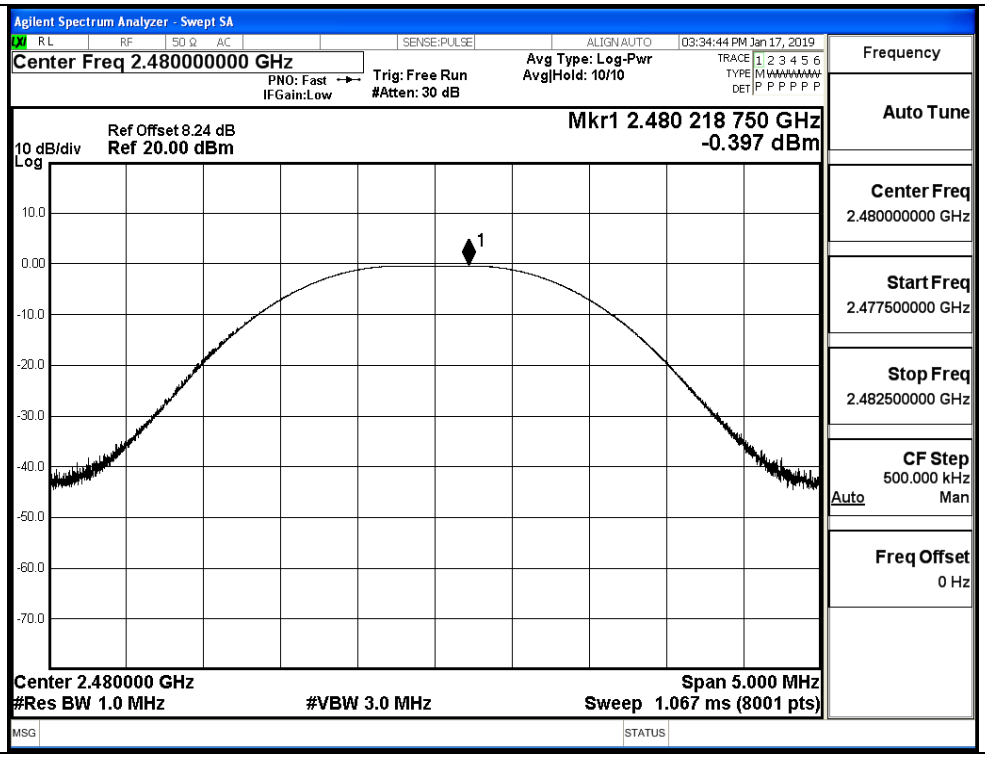
Test Mode	Test Channel	Ant	Duty Cycle[%]	Verdict
BT LE	2440	Ant1	100	PASS



A.2 Maximum Conducted Peak Output Power

Mode	Channel	Conduct Peak Power[dBm]	Limit [dBm]	Verdict
BT LE	LCH	-0.490	30	PASS
BT LE	MCH	0.602	30	PASS
BT LE	HCH	-0.397	30	PASS

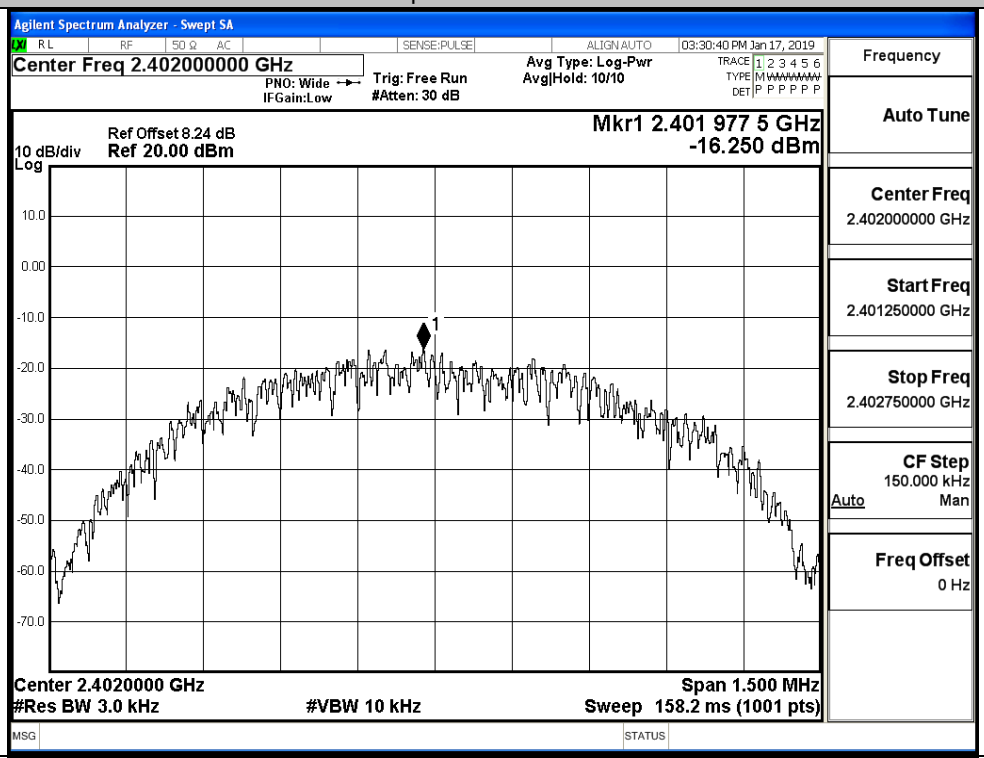
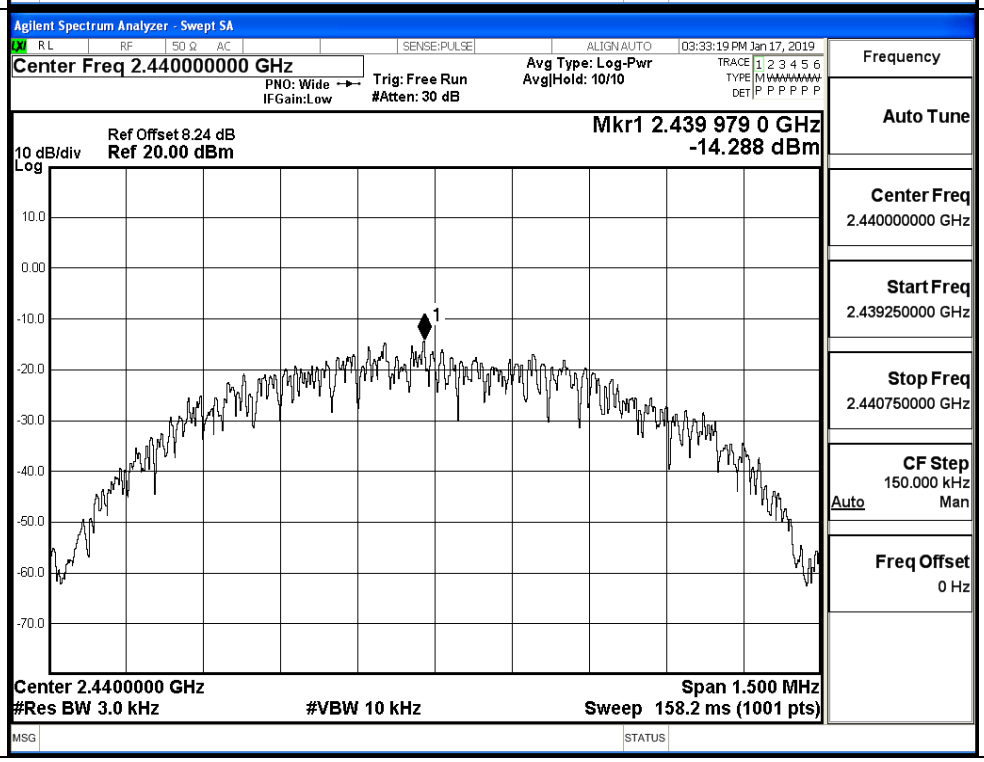
Test Graphs		
LCH		
MCH		

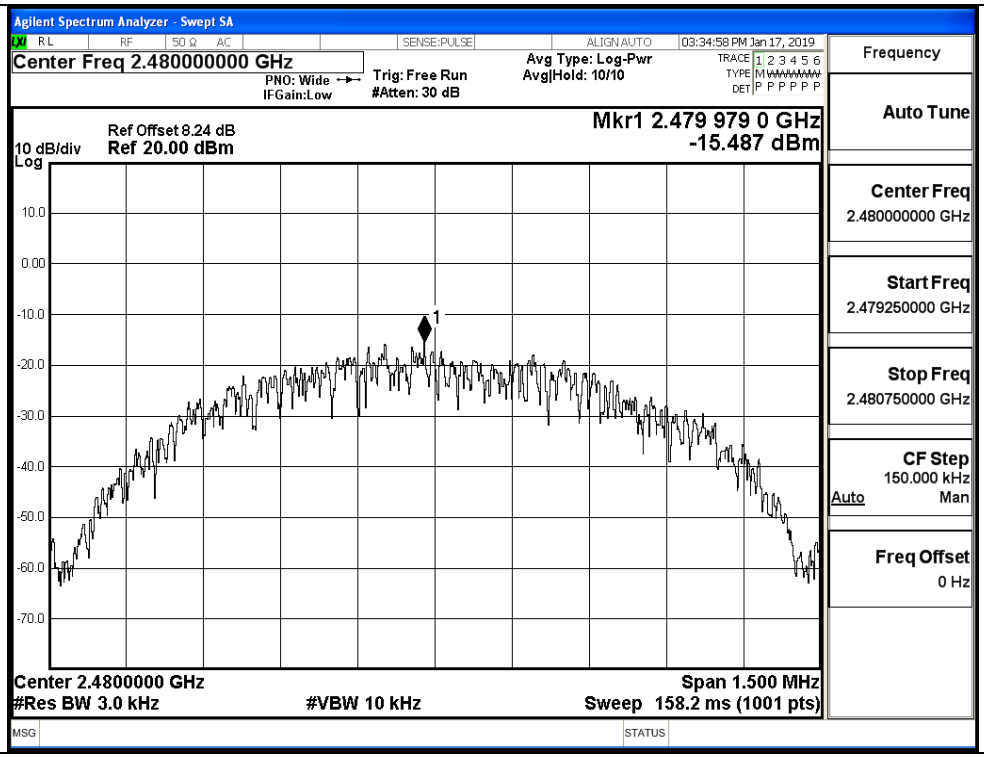
HCH		

Agilent Spectrum Analyzer - Swept SA
RL
RF
50 Ω AC
SENSE:PULSE
ALIGN AUTO
03:34:44 PM Jan 17, 2019
Center Freq 2.480000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
TRACE 1 2 3 4 5 6
TYPE M
DET P P P P P
Ref Offset 8.24 dB
10 dB/div
Ref 20.00 dBm
Log
Mkr1 2.480 218 750 GHz
-0.397 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
1
Center 2.480000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Span 5.000 MHz
Sweep 1.067 ms (8001 pts)
MSG
STATUS
Frequency
Auto Tune
Center Freq
2.480000000 GHz
Start Freq
2.477500000 GHz
Stop Freq
2.482500000 GHz
CF Step
500.000 kHz
Auto
Man
Freq Offset
0 Hz

A.3 Maximum Power Spectral Density

Mode	Channel	PSD [dBm/3KHz]	Limit [dBm/3KHz]	Verdict
BT LE	LCH	-16.250	8	PASS
BT LE	MCH	-14.288	8	PASS
BT LE	HCH	-15.487	8	PASS

Test Graphs		
LCH		
MCH		

HCH		

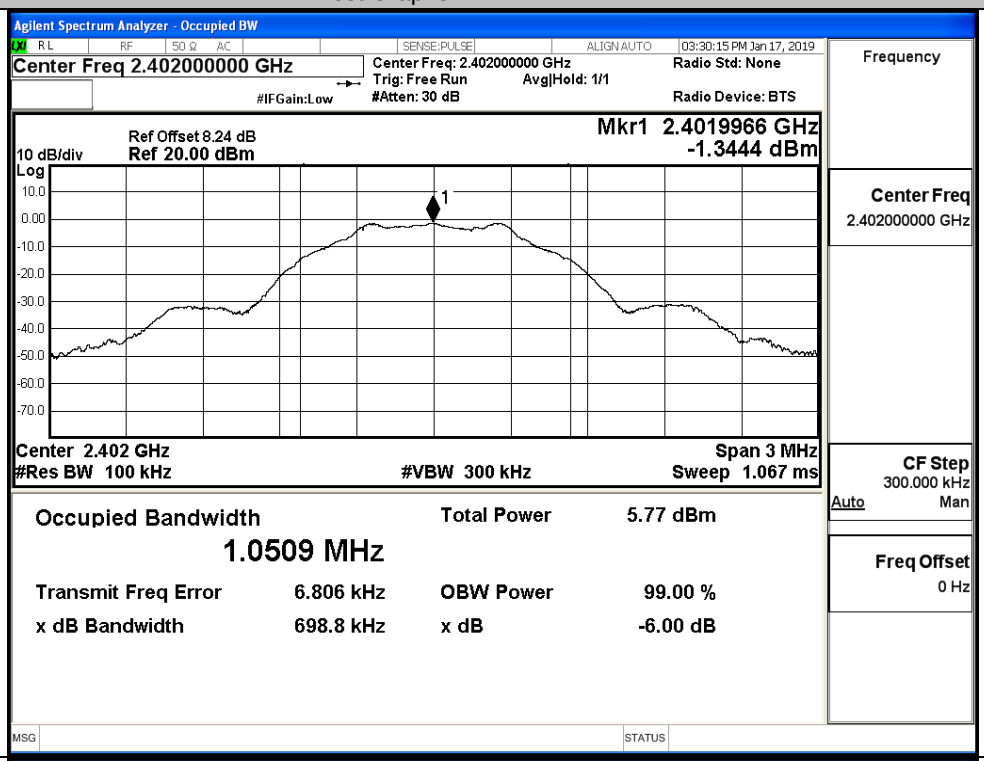
Agilent Spectrum Analyzer - Swept SA
Center Freq 2.480000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
03:34:58 PM Jan 17, 2019
Ref Offset 8.24 dB
10 dB/div
Ref 20.00 dBm
Log
Mkr1 2.479 979 0 GHz
-15.487 dBm
Center 2.4800000 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 1.500 MHz
Sweep 158.2 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.480000000 GHz
Start Freq
2.479250000 GHz
Stop Freq
2.480750000 GHz
CF Step
150.000 kHz
Auto
Man
Freq Offset
0 Hz

A.4 6dB Bandwidth

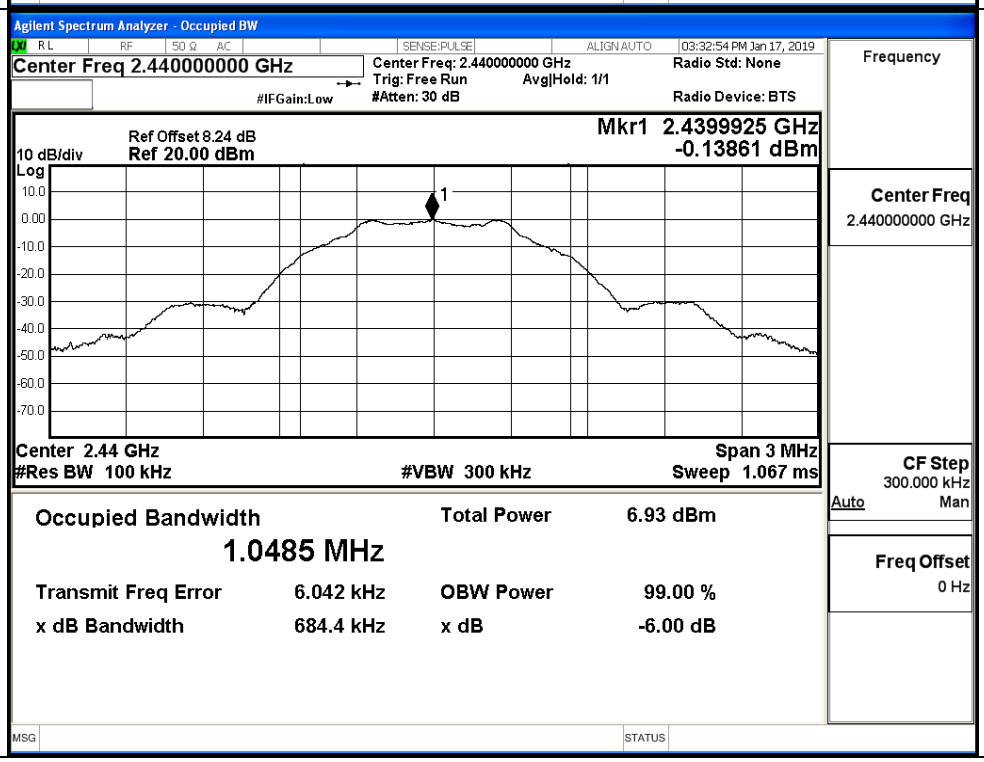
Mode	Channel	6dB Bandwidth [MHz]	Limit [MHz]	Verdict
BT LE	LCH	0.6988	≥0.5	PASS
BT LE	MCH	0.6844	≥0.5	PASS
BT LE	HCH	0.6984	≥0.5	PASS

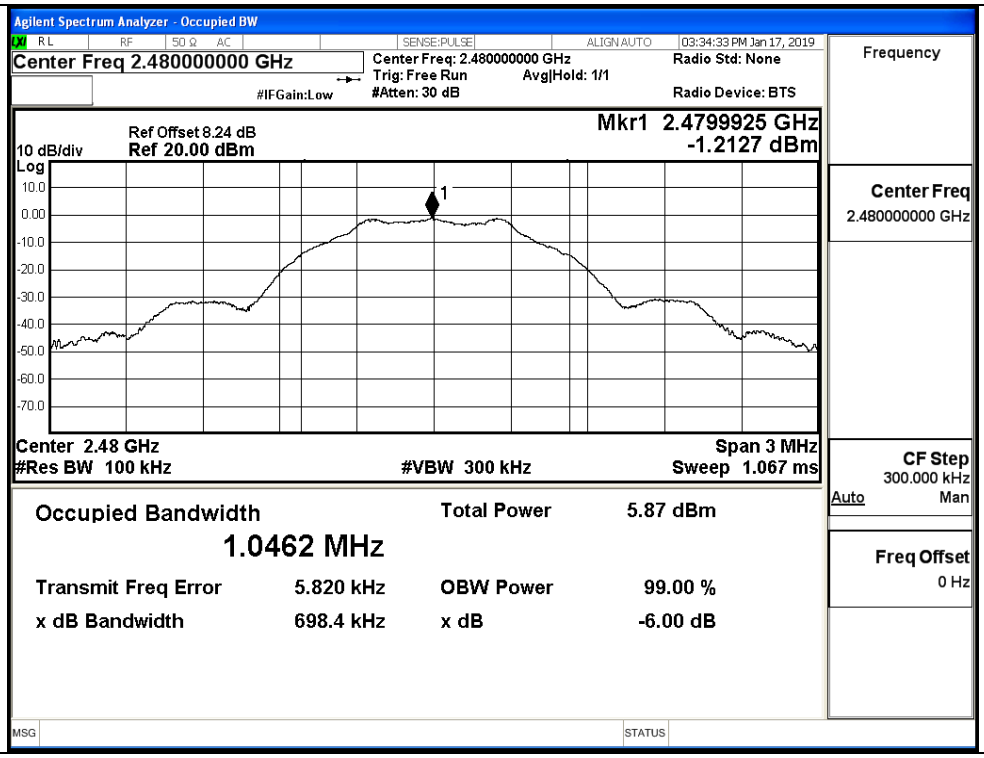
Test Graphs

LCH



MCH

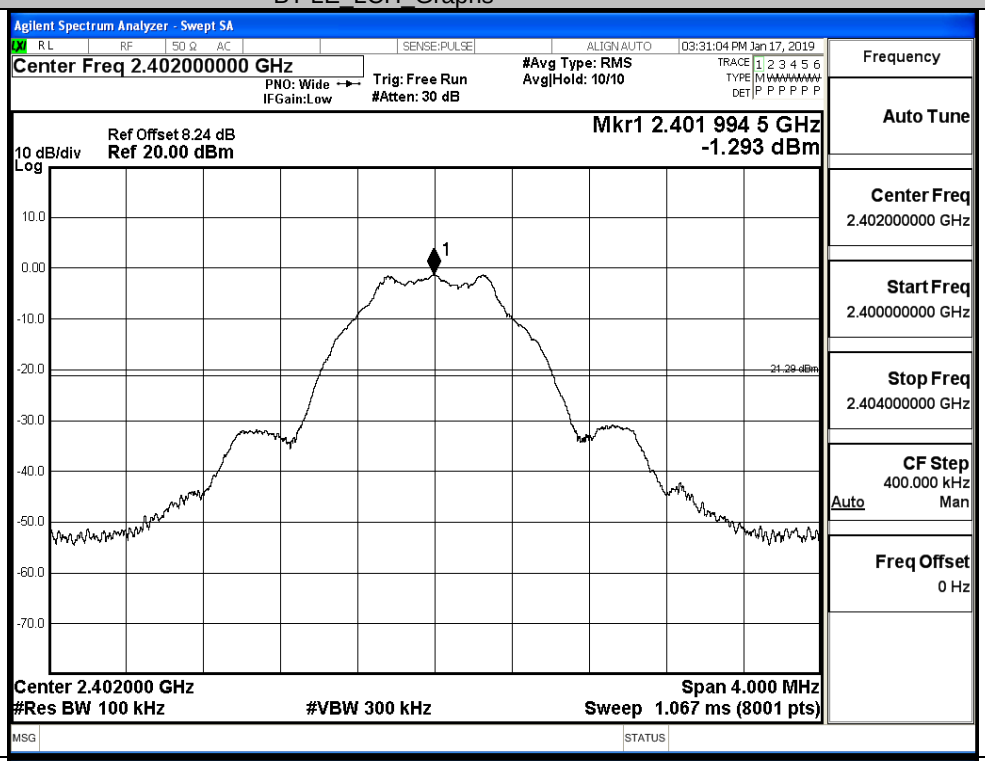
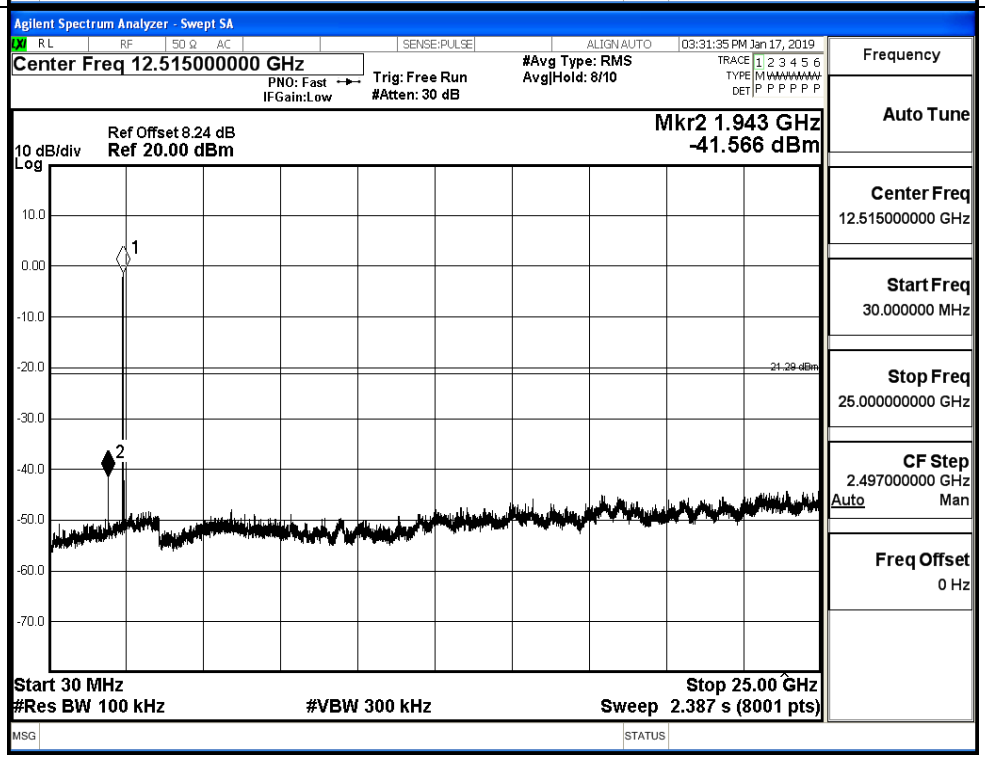


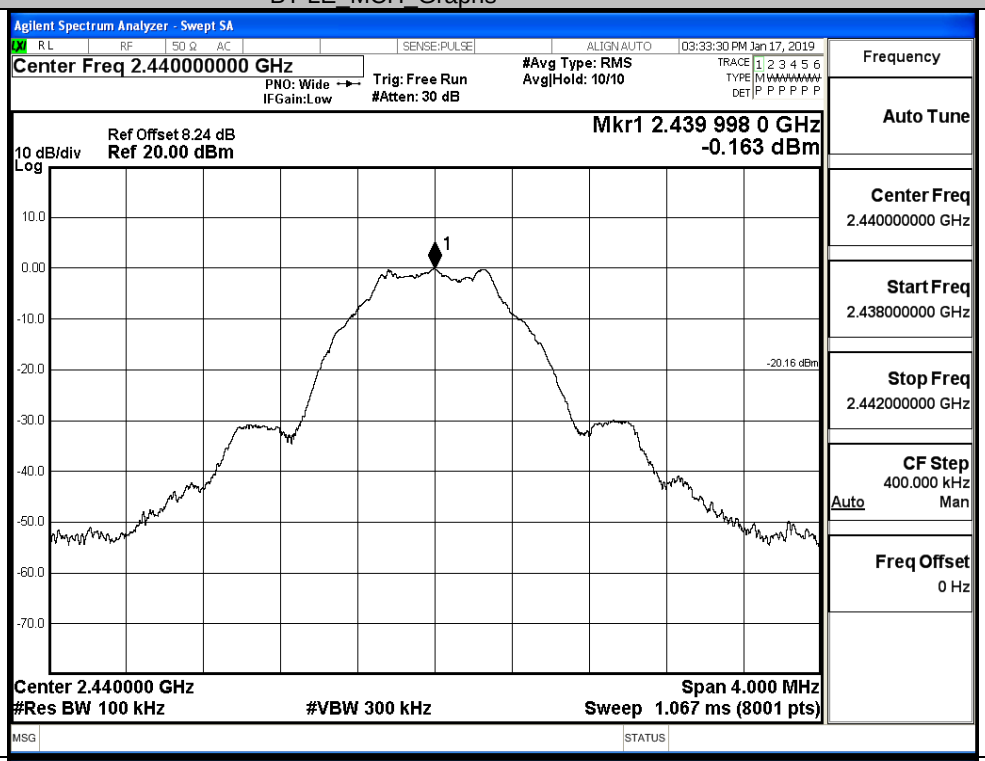
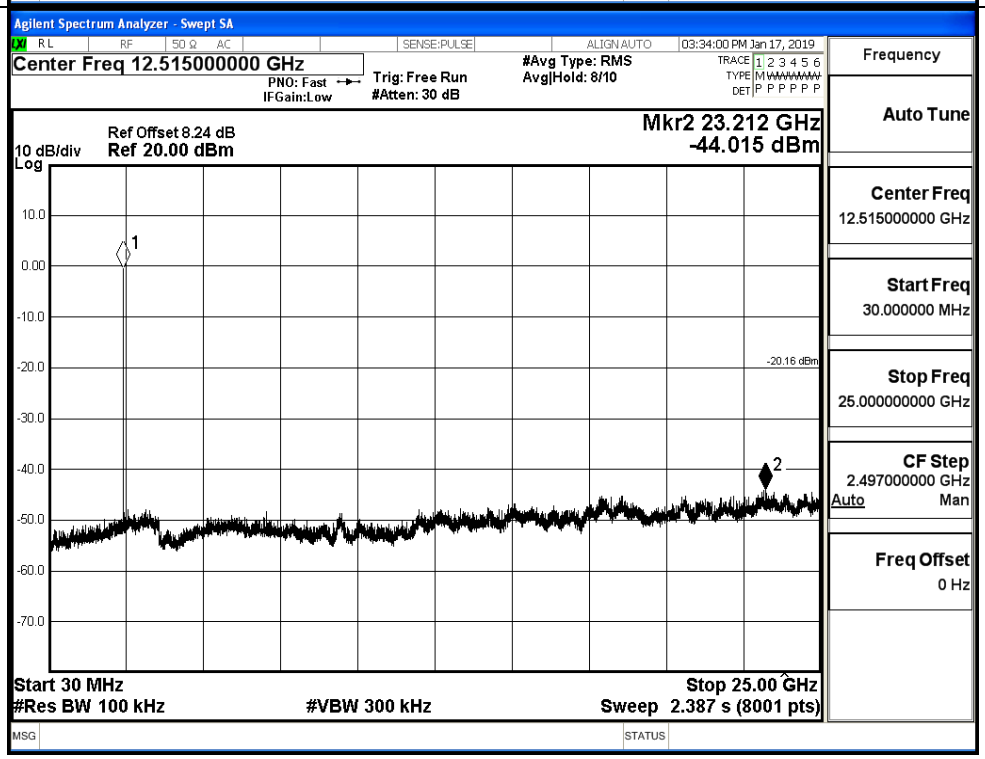
HCH		

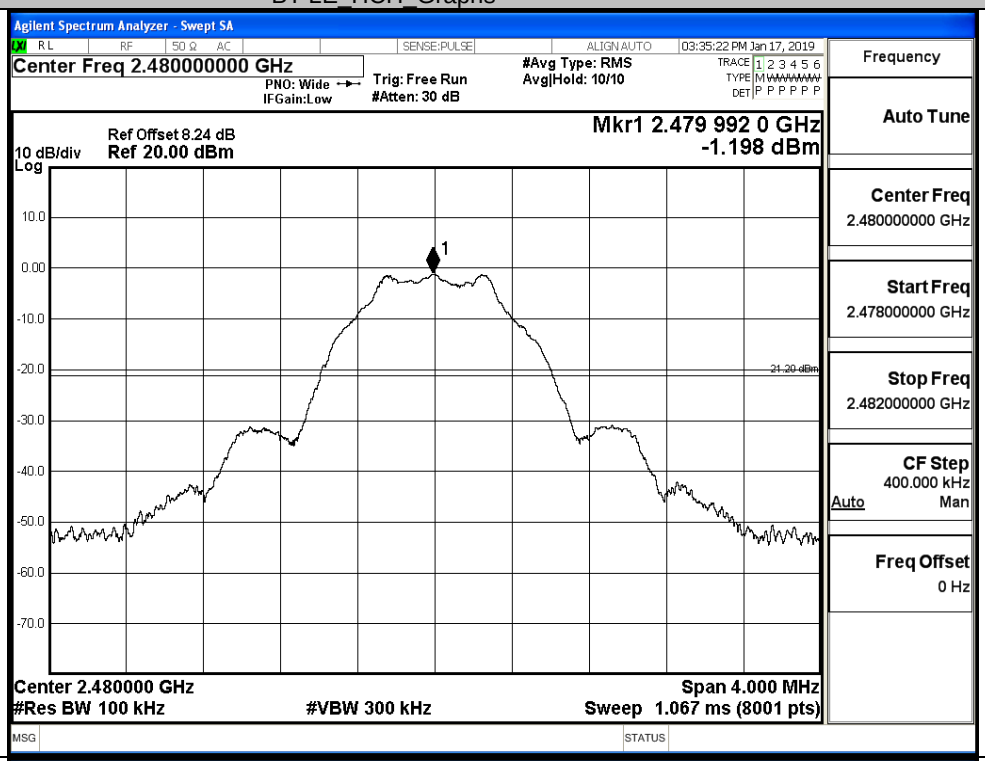
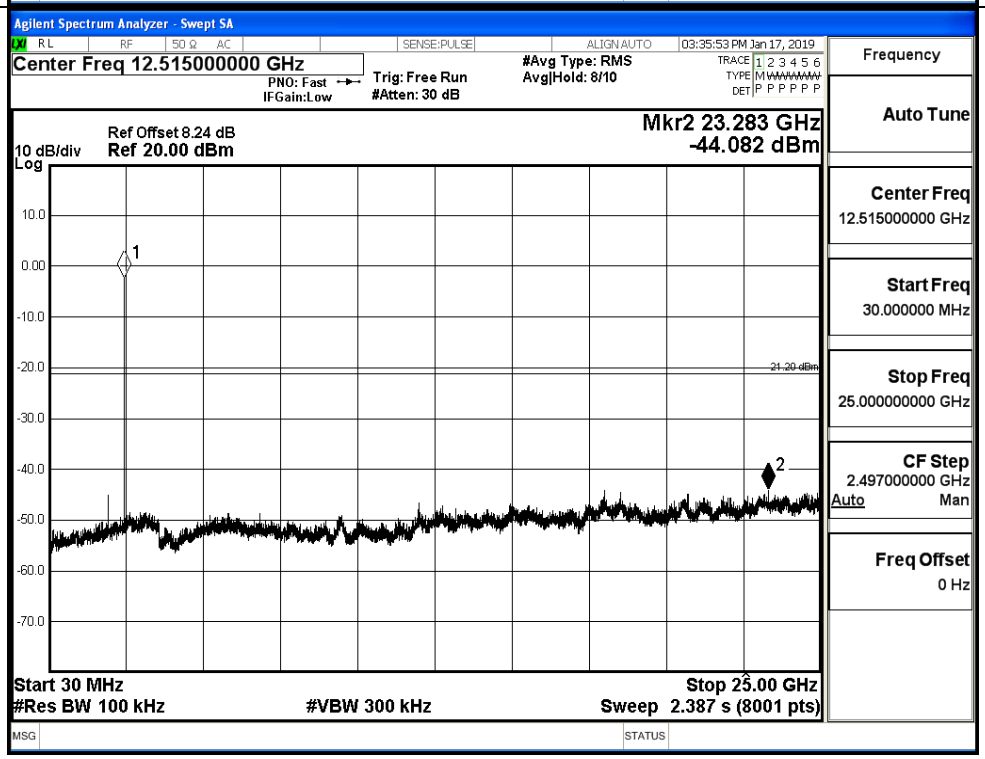
Agilent Spectrum Analyzer - Occupied BW
RL
RF
50 Ω AC
SENSE:PULSE
ALIGN AUTO
03:34:33 PM Jan 17, 2019
Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold: 1/1
#Atten: 30 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
Frequency
Ref Offset 8.24 dB
10 dB/div
Ref 20.00 dBm
Log
Mkr1 2.4799925 GHz
-1.2127 dBm
Center Freq
2.480000000 GHz
Center 2.48 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 3 MHz
Sweep 1.067 ms
CF Step
300.000 kHz
Auto
Man
Occupied Bandwidth
1.0462 MHz
Total Power 5.87 dBm
Transmit Freq Error 5.820 kHz
OBW Power 99.00 %
x dB Bandwidth 698.4 kHz
x dB -6.00 dB
Freq Offset
0 Hz
MSG
STATUS

A.6 RF Conducted Spurious Emissions

Mode	Channel	Pref [dBm]	Max. Level [dBm]	Limit [dBm]	Verdict
BT LE	LCH	-1.293	-41.566	-21.293	PASS
BT LE	MCH	-0.163	-44.015	-20.163	PASS
BT LE	HCH	-1.198	-44.082	-21.198	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		

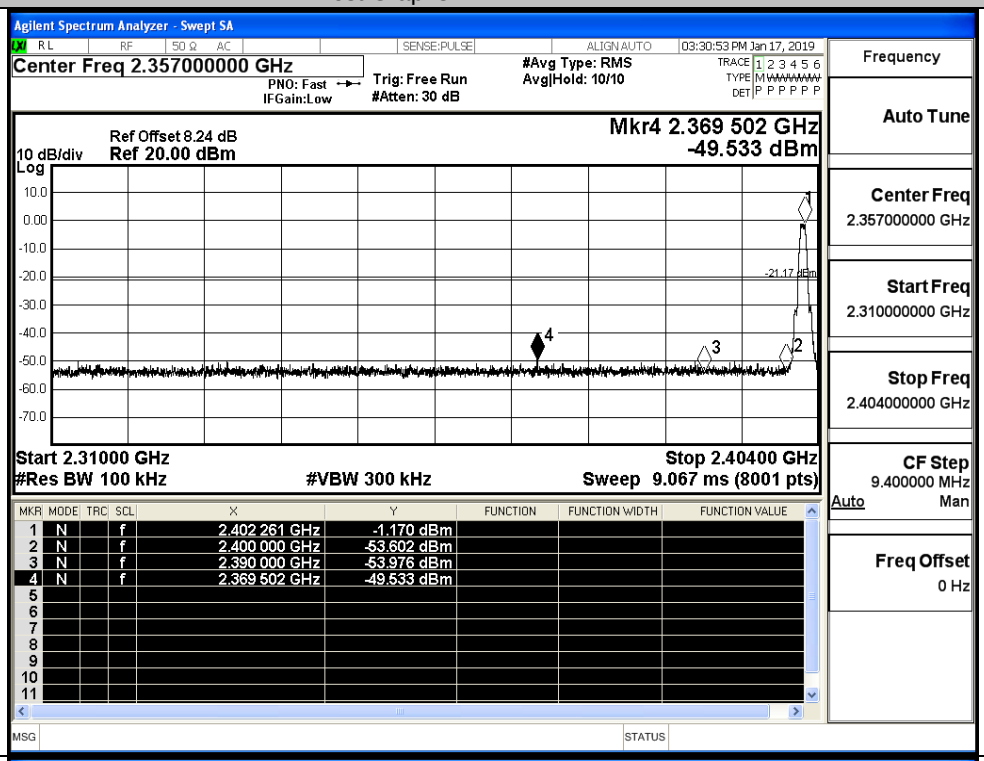
BT LE_HCH_Graphs		
Pref/BT LE/HCH		
Puw/BT LE/HCH		

A.7 Band-edge for RF Conducted Emissions

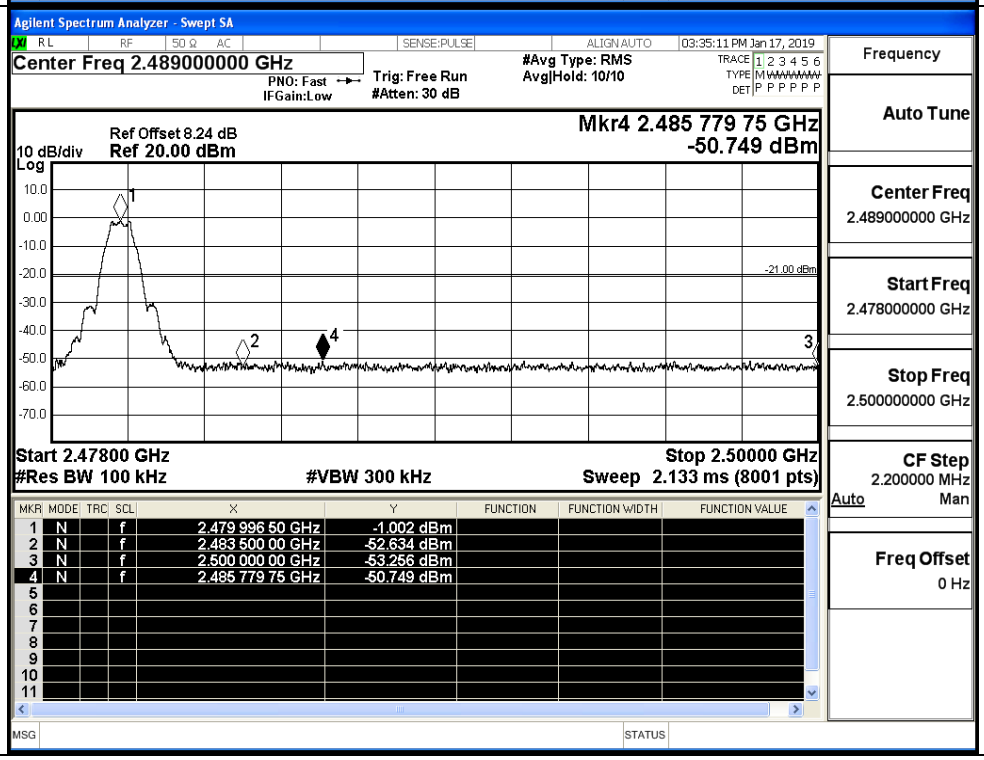
Mode	Channel	Carrier Power[dBm]	Max.Spurious Level [dBm]	Limit [dBm]	Verdict
BT LE	LCH	-1.170	-49.533	-21.17	PASS
BT LE	HCH	-1.002	-50.749	-21	PASS

Test Graphs

LCH



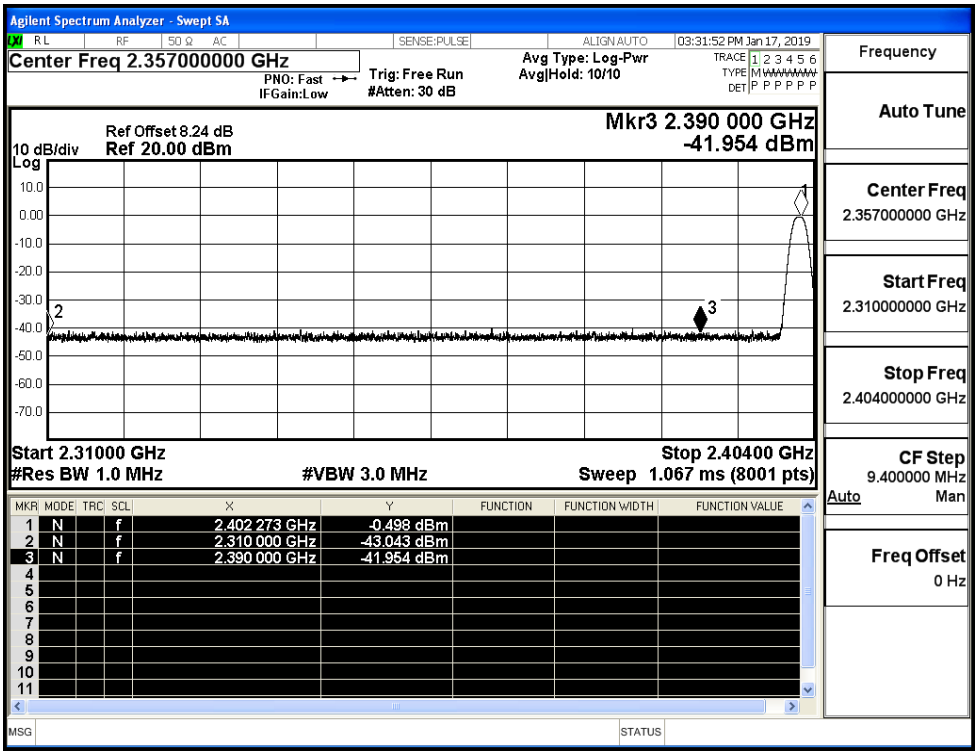
HCH



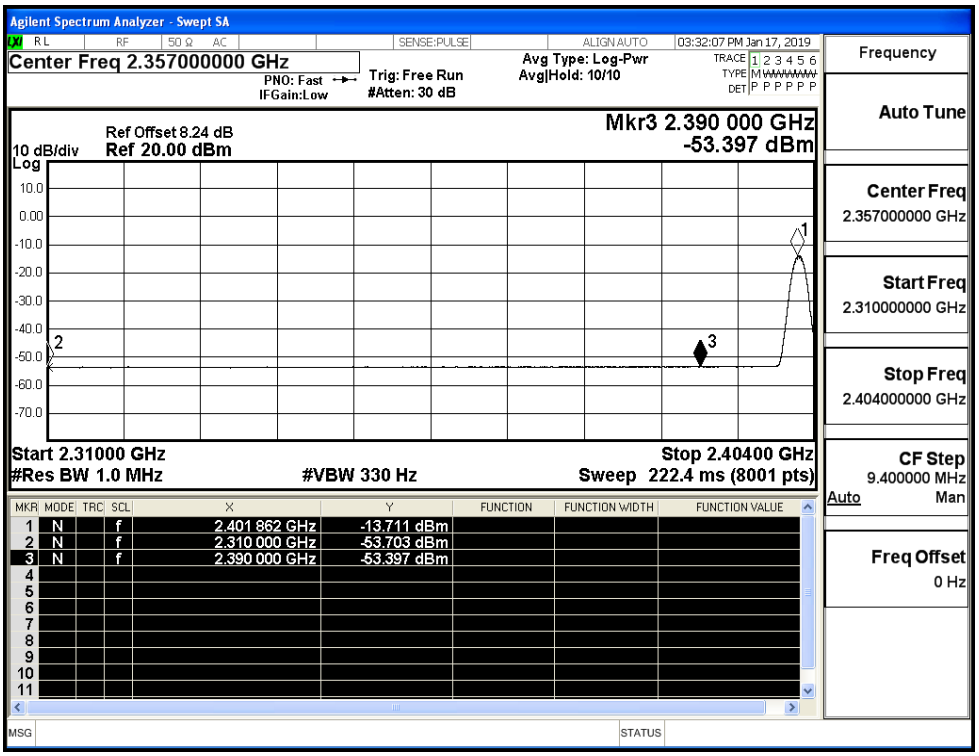
A.8 Restrict-band band-edge measurements

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	-43.043	4.00	0	56.185	PEAK	74	PASS
		Ant1	2310.0	-53.703	4.00	0	45.525	AV	54	PASS
		Ant1	2390.0	-41.954	4.00	0	57.274	PEAK	74	PASS
		Ant1	2390.0	-53.397	4.00	0	45.831	AV	54	PASS
	2480	Ant1	2483.5	-43.520	4.00	0	55.708	PEAK	74	PASS
		Ant1	2483.5	-53.202	4.00	0	46.026	AV	54	PASS
		Ant1	2500.0	-41.086	4.00	0	58.142	PEAK	74	PASS
		Ant1	2500.0	-53.017	4.00	0	46.211	AV	54	PASS

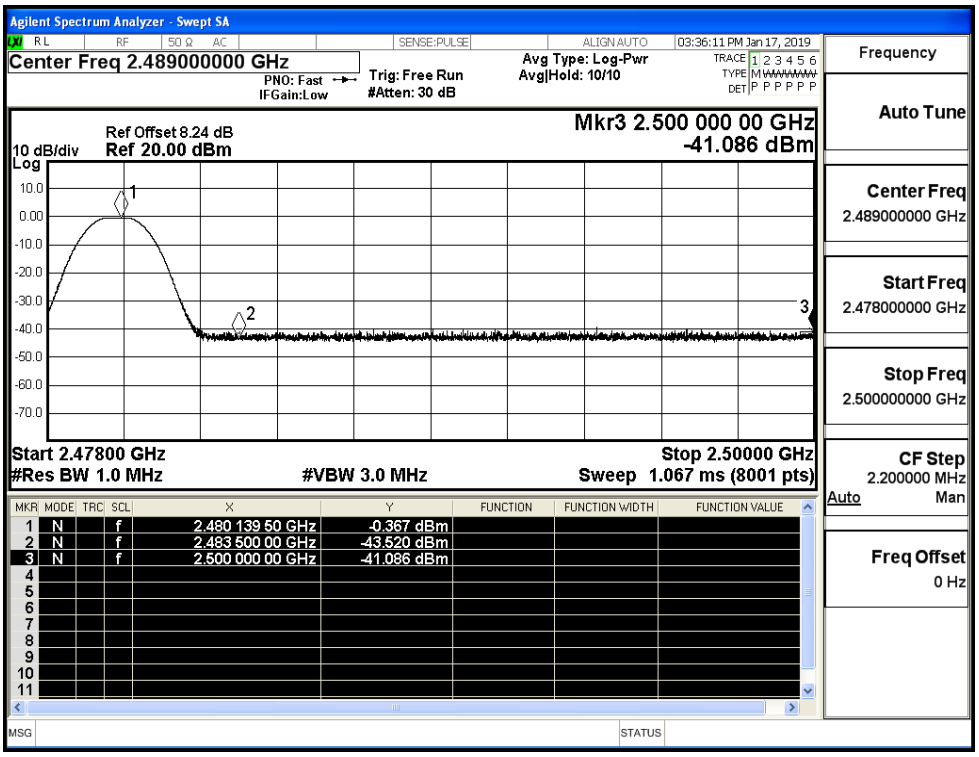
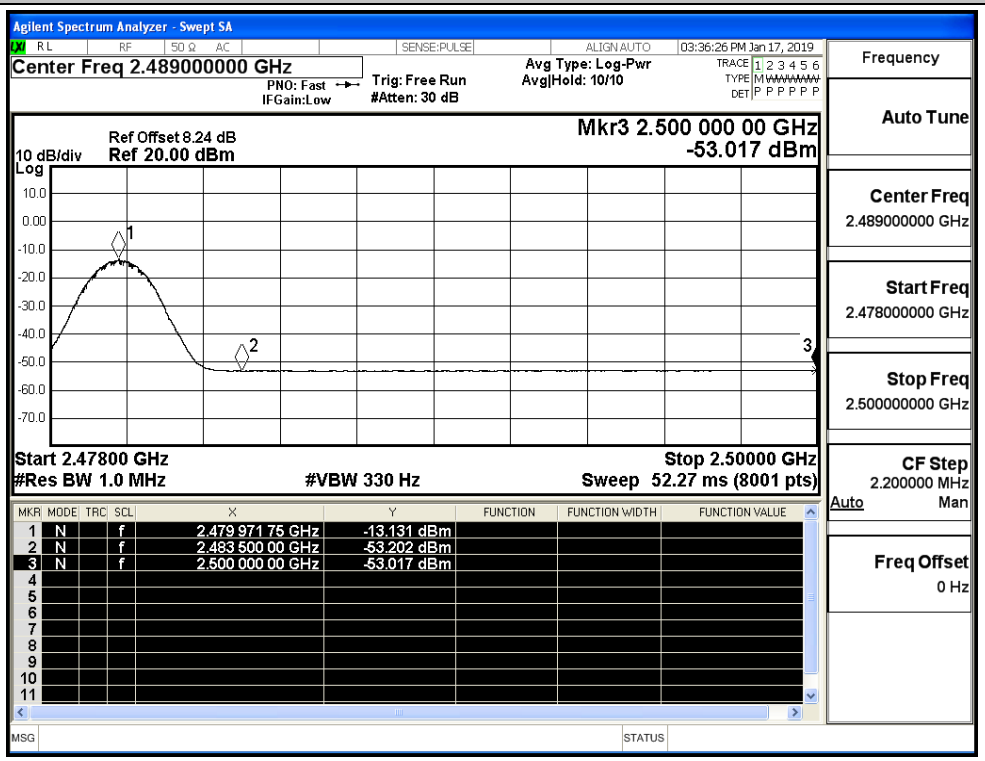
Restrict-band band-edge measurements_BT LE_2402_Ant1_PEAK



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