



FCC 47 CFR PART 15 SUBPART C
CERTIFICATION TEST REPORT

For

Séura Outdoor Entertainment

MODEL NUMBER: SHD2-65

FCC ID: 2AVE3SHD3-65A

PROJECT NUMBER: 4789257350

REPORT NUMBER: 4789257350-8

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Prepared for

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Revision History

Rev.	Issue Date	Revisions	Revised By
V0	01/26/2020	Initial Issue	



Summary of Test Results			
Clause	Test Items	FCC Rules	Test Results
1	20dB Bandwidth	FCC 15.247 (a) (1)	Complied
2	Peak Conducted Output Power	FCC 15.247 (b) (1)	Complied
3	Carrier Hopping Channel Separation	FCC 15.247 (a) (1)	Complied
4	Number of Hopping Frequency	15.247 (a) (1) III	Complied
5	Time of Occupancy (Dwell Time)	15.247 (a) (1) III	Complied
6	Conducted Bandedge	FCC 15.247 (d)	Complied
7	Radiated Bandedge and Spurious	FCC 15.247 (d) FCC 15.209 FCC 15.205	Complied
8	Conducted Emission Test for AC Power Port	FCC 15.207	N/A
9	Antenna Requirement	FCC 15.203	Complied
Remark: The measurement result for the sample received is <Pass> according to < ANSI C63.10-2013, FCC CFR 47 Part 2, FCC CFR 47 Part 15C> when <Accuracy Method> decision rule is applied.			



TABLE OF CONTENTS

1. ATTESTATION OF TESCT RESULTS	6
2. TEST METHODOLOGY	7
3. FACILITIES AND ACCREDITATION	7
4. CALIBRATION AND UNCERTAINTY	8
4.1. MEASURING INSTRUMENT CALIBRATION	8
4.2. MEASUREMENT UNCERTAINTY	8
5. EQUIPMENT UNDER TEST	9
5.1. DESCRIPTION OF EUT	9
5.2. MAXIMUM OUTPUT POWER	9
5.3. PACKET TYPE CONFIGURATION	9
5.4. CHANNEL LIST	10
5.5. TEST CHANNEL CONFIGURATION	10
5.6. THE WORSE CASE POWER SETTING PARAMETER	10
5.7. DESCRIPTION OF AVAILABLE ANTENNAS	11
5.8. WORST-CASE CONFIGURATIONS	12
5.9. TEST ENVIRONMENT	12
5.10. DESCRIPTION OF TEST SETUP	13
5.11. MEASURING INSTRUMENT AND SOFTWARE USED	14
6. ANTENNA PORT TEST RESULTS	15
6.1. ON TIME AND DUTY CYCLE	15
6.2. 20 dB BANDWIDTH	17
6.2.1. GFSK MODE	18
6.2.2. 8DPSK MODE	20
6.3. PEAK CONDUCTED OUTPUT POWER	22
6.3.1. GFSK MODE	23
6.3.2. 8DPSK MODE	25
6.4. CARRIER HOPPING CHANNEL SEPARATION	27
6.4.1. GFSK MODE	28
6.4.2. 8DPSK MODE	29
6.5. NUMBER OF HOPPING FREQUENCY	30
6.5.1. GFSK MODE	31
6.5.2. 8DPSK MODE	32
6.6. TIME OF OCCUPANCY (DWEIL TIME)	33
6.6.1. GFSK MODE	34
6.6.2. 8DPSK MODE	36



6.7.	CONDUCTED SPURIOUS EMISSION	38
6.7.1.	GFSK MODE	39
6.7.2.	8DPSK MODE	51
7.	RADIATED TEST RESULTS.....	63
7.1.	LIMITS AND PROCEDURE	63
7.2.	RESTRICTED BANDEDGE	69
7.2.1.	GFSK MODE	69
7.2.2.	8DPSK MODE	73
7.3.	SPURIOUS EMISSIONS (1~18GHz).....	77
7.3.1.	GFSK MODE	77
7.3.2.	8DPSK MODE	83
7.4.	SPURIOUS EMISSIONS 18G ~ 26GHz.....	89
7.4.1.	8DPSK MODE	89
7.5.	SPURIOUS EMISSIONS 30M ~ 1 GHz	91
7.5.1.	8DPSK MODE	91
7.6.	SPURIOUS EMISSIONS BELOW 30M.....	93
7.6.1.	8DPSK MODE	93
8.	AC POWER LINE CONDUCTED EMISSIONS	96
9.	ANTENNA REQUIREMENTS.....	99



1. ATTESTATION OF TESCT RESULTS

Applicant Information

Company Name: K-tronics (Su Zhou) Technology Co., LTD
Address: No.1088, Dajing Road, Economic and Technological Development Zone Wujiang District, Suzhou, Jiangsu, China

Manufacturer Information

Company Name: K-tronics (Su Zhou) Technology Co., LTD
Address: No.1088, Dajing Road, Economic and Technological Development Zone Wujiang District, Suzhou, Jiangsu, China

EUT Description

Product Name Séura Outdoor Entertainment
Model Name SHD2-65
Sample Status Normal
Sample Received date Dec 12, 2019
Date Tested Dec 12, 2019~Jan 14, 2020

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	PASS

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with DA 00-705, KDB414788 D01 Radiated Test Site v01r01, ANSI C63.10-2013, FCC CFR 47 Part 2, FCC CFR 47 Part 15.

3. FACILITIES AND ACCREDITATION

Accreditation Certificate	<p>A2LA (Certificate No.: 4829.01) UL-CCIC COMPANY LIMITED has been assessed and proved to be in compliance with A2LA.</p> <p>FCC (FCC Designation No.: CN1247) UL-CCIC COMPANY LIMITED has been recognized to perform compliance testing on equipment subject to the Commission's Declaration of Conformity (DoC) and Certification rules.</p> <p>IC (IC Designation No.: 25056) UL-CCIC COMPANY LIMITED has been recognized to perform compliance testing on equipment subject to the Commission's Declaration of Conformity (DoC) and Certification rules.</p>
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Note 1: All tests measurement facilities use to collect the measurement data are located at No. 2, Chengwan Road, Suzhou Industrial Park, Suzhou 215122, People's Republic of China

Note 2: For below 30MHz, lab had performed measurements at test anechoic chamber and comparing to measurements obtained on an open field site. These measurements below 30MHz had been correlated to measurements performed on an OFS.

Note 3: The test anechoic chamber in UL-CCIC COMPANY LIMITED had been calibrated and compared to the open field sites and the test anechoic chamber is shown to be equivalent to or worst case from the open field site.



4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test Item	Uncertainty
Conduction emission	3.00dB
Radiation Emission test(include Fundamental emission) (9KHz-30MHz)	3.32dB
Radiation Emission test(include Fundamental emission) (30MHz-1GHz)	3.27dB
Radiation Emission test (1GHz to 26GHz)(include Fundamental emission)	3.80dB (1GHz-18Gz)
	4.11dB (18GHz-26.5Gz)
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.	



5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

Equipment	Séura Outdoor Entertainment		
Model Name	SHD2-65		
Product Description (Bluetooth)	Operation Frequency	2402 MHz ~ 2480 MHz	
	Modulation Type		Data Rate
	GFSK		1Mbps
	π/4-DQPSK		2Mbps
	8DPSK		3Mbps
Power Supply	AC 120V		
Bluetooth Version	BR/EDR		
Hardware Version	V1.0		

5.2. MAXIMUM OUTPUT POWER

Bluetooth Mode	Frequency(MHz)	Channel Number	Max Output Power (dBm)
GFSK	2402-2480	0-78[79]	5.76
8DPSK	2402-2480	0-78[79]	8.39

5.3. PACKET TYPE CONFIGURATION

Test Mode	Packet Type	Setting(Packet Length)
GFSK	DH1	27
	DH3	183
	DH5	339
π/4-DQPSK	2-DH1	54
	2-DH3	367
	2-DH5	679
8DPSK	3-DH1	83
	3-DH3	552
	3-DH5	1021



5.4. CHANNEL LIST

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	20	2422	40	2442	60	2462
01	2403	21	2423	41	2443	61	2463
02	2404	22	2424	42	2444	62	2464
03	2405	23	2425	43	2445	63	2465
04	2406	24	2426	44	2446	64	2466
05	2407	25	2427	45	2447	65	2467
06	2408	26	2428	46	2448	66	2468
07	2409	27	2429	47	2449	67	2469
08	2410	28	2430	48	2450	68	2470
09	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461		

5.5. TEST CHANNEL CONFIGURATION

Test Mode	Test Channel Number	Test Channel
GFSK	CH 00, CH 39, CH 78	Low, Middle, High
8DPSK	CH 00, CH 39, CH 78	Low, Middle, High

5.6. THE WORSE CASE POWER SETTING PARAMETER

The Worst Case Power Setting Parameter under 2400 ~ 2483.5MHz Band				
Test Software		NA		
Modulation Type	Transmit Antenna Number	Test Channel		
		CH 00	CH 39	CH 78
GFSK	1	NA	NA	NA
8DPSK	1	NA	NA	NA



5.7. DESCRIPTION OF AVAILABLE ANTENNAS

Ant.	Frequency (MHz)	Antenna Type	Antenna Gain (dBi)
1	2402-2480	Internal Antenna	2.99

Test Mode	Transmit and Receive Mode	Description
GFSK	1TX, 1RX	Chain 1 can be used as transmitting/receiving antenna.
8DPSK	1TX, 1RX	Chain 1 can be used as transmitting/receiving antenna.



5.8. WORST-CASE CONFIGURATIONS

Bluetooth Mode	Modulation Technology	Modulation Type	Data Rate (Mbps)
BR	FHSS	GFSK	1Mbit/s
EDR	FHSS	8DPSK	3Mbit/s

Note: Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates.

5.9. TEST ENVIRONMENT

Environment Parameter	Selected Values During Tests	
Relative Humidity	55 ~ 65%	
Atmospheric Pressure:	1005Pa	
Temperature	TN	23 ~ 28°C
Voltage	VL	N/A
	VN	AC 120V
	VH	N/A

Note: VL= Lower Extreme Test Voltage
VN= Nominal Voltage.
VH= Upper Extreme Test Voltage
TN= Normal Temperature



5.10. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Item	Equipment	Brand Name	Model Name	Remarks
1	Laptop	ThinkPad	E550c	N/A

I/O CABLES

Cable No	Port	Connector Type	Cable Type	Cable Length(m)	Remarks
1	USB	USB Cable	N/A	0.8	Supply by UL Lab

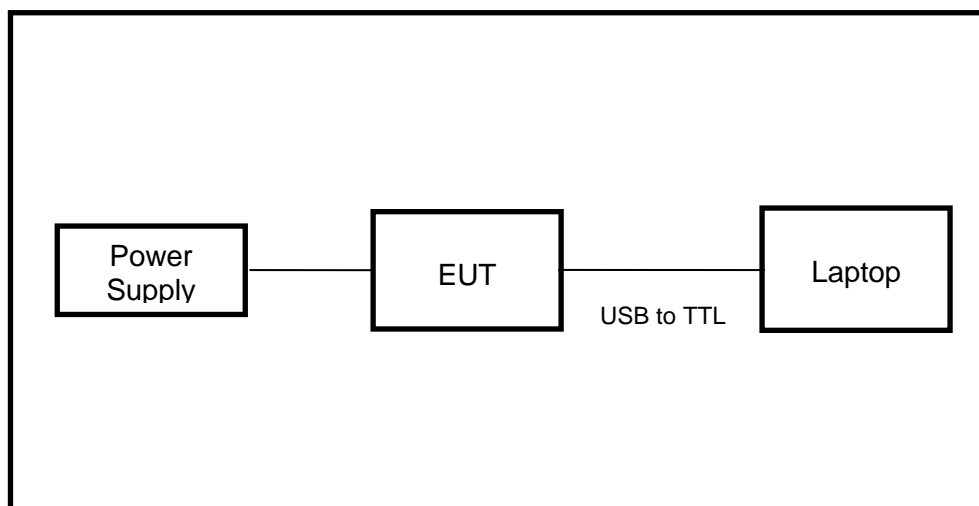
ACCESSORY

Item	Accessory	Brand Name	Model Name	Description
1	N/A	N/A	N/A	N/A

TEST SETUP

The EUT can work in an engineer mode with a software through a PC.

SETUP DIAGRAM FOR TESTS





5.11. MEASURING INSTRUMENT AND SOFTWARE USED

Conducted Emissions (Instrument)							
Used	Equipment	Manufacturer	Model No.	Serial No.	Upper Last Cal.	Last Cal.	Next Cal.
<input checked="" type="checkbox"/>	EMI Test Receiver	R&S	ESR3	126700	2018-12-13	2019-12-12	2020-12-11
<input checked="" type="checkbox"/>	Two-Line V-Network	R&S	ENV216	126701	2018-12-13	2019-12-12	2020-12-11
<input checked="" type="checkbox"/>	Artificial Mains Networks	R&S	ENY81	126711	2018-12-13	2019-12-12	2020-12-11
Software							
Used	Description		Manufacturer	Name	Version		
<input checked="" type="checkbox"/>	Test Software for Conducted disturbance		R&S	EMC32	Ver. 9.25		
Radiated Emissions (Instrument)							
Used	Equipment	Manufacturer	Model No.	Serial No.	Upper Last Cal.	Last Cal.	Next Cal.
<input checked="" type="checkbox"/>	Spectrum Analyzer	Keysight	N9010B	MY57110128	2018-05-30	2019-05-29	2020-05-28
<input checked="" type="checkbox"/>	EMI test receiver	R&S	ESR26	1267603	2018-12-13	2019-12-12	2020-12-11
<input checked="" type="checkbox"/>	Receiver Antenna (9kHz-30MHz)	Schwarzbeck	FMZB 1513	513-265	2018-06-17	2019-06-16	2020-06-15
<input checked="" type="checkbox"/>	Receiver Antenna (30MHz-1GHz)	SunAR RF Motion	JB1	126704	N/A	2019-01-28	2022-01-27
<input checked="" type="checkbox"/>	Receiver Antenna (1GHz-18GHz)	R&S	HF907	126705	2019-01-26	2020-01-25	2021-01-24
<input checked="" type="checkbox"/>	Receiver Antenna (18GHz-26.5GHz)	Schwarzbeck	BBHA9170	126706	2019-02-06	2020-02-05	2021-02-04
<input checked="" type="checkbox"/>	Pre-amplification (To 18GHz)	Compliance Direction System Inc.	PAP-1G18-50	14140-13467	2019-02-06	2020-02-05	2021-02-04
<input checked="" type="checkbox"/>	Pre-amplification (To 26.5GHz)	R&S	SCU-26D	134668	2019-03-18	2020-03-17	2021-03-16
<input checked="" type="checkbox"/>	Band Reject Filter	Wainwright	WRCJV8-2350-2400-2483.5-2533.5-40SS	1	2019-02-06	2020-02-05	2021-02-04
<input checked="" type="checkbox"/>	Highpass Filter	Wainwright	WHKX10-2700-3000-18000-40SS	2	2018-05-30	2019-05-29	2020-05-28
Software							
Used	Description		Manufacturer	Name	Version		
<input checked="" type="checkbox"/>	Test Software for Radiated disturbance		Tonscend	JS32	V1.0		
Other instruments							
Used	Equipment	Manufacturer	Model No.	Serial No.	Upper Last Cal.	Last Cal.	Next Cal.
<input checked="" type="checkbox"/>	Spectrum Analyzer	Keysight	N9010B	MY57110128	2018-05-30	2019-05-29	2020-05-28



6. ANTENNA PORT TEST RESULTS

6.1. ON TIME AND DUTY CYCLE

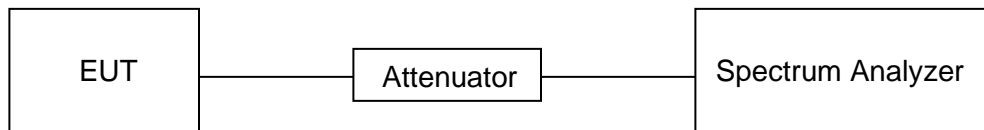
LIMITS

None; for reporting purposes only

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method

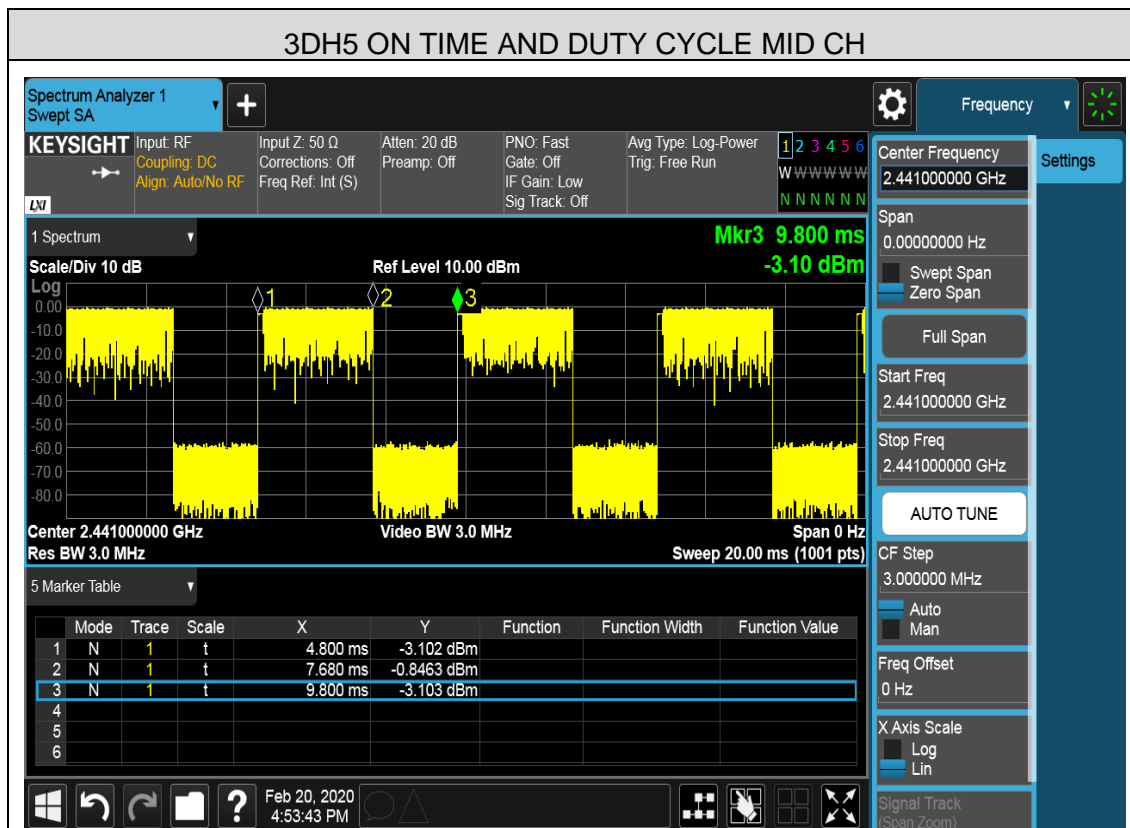
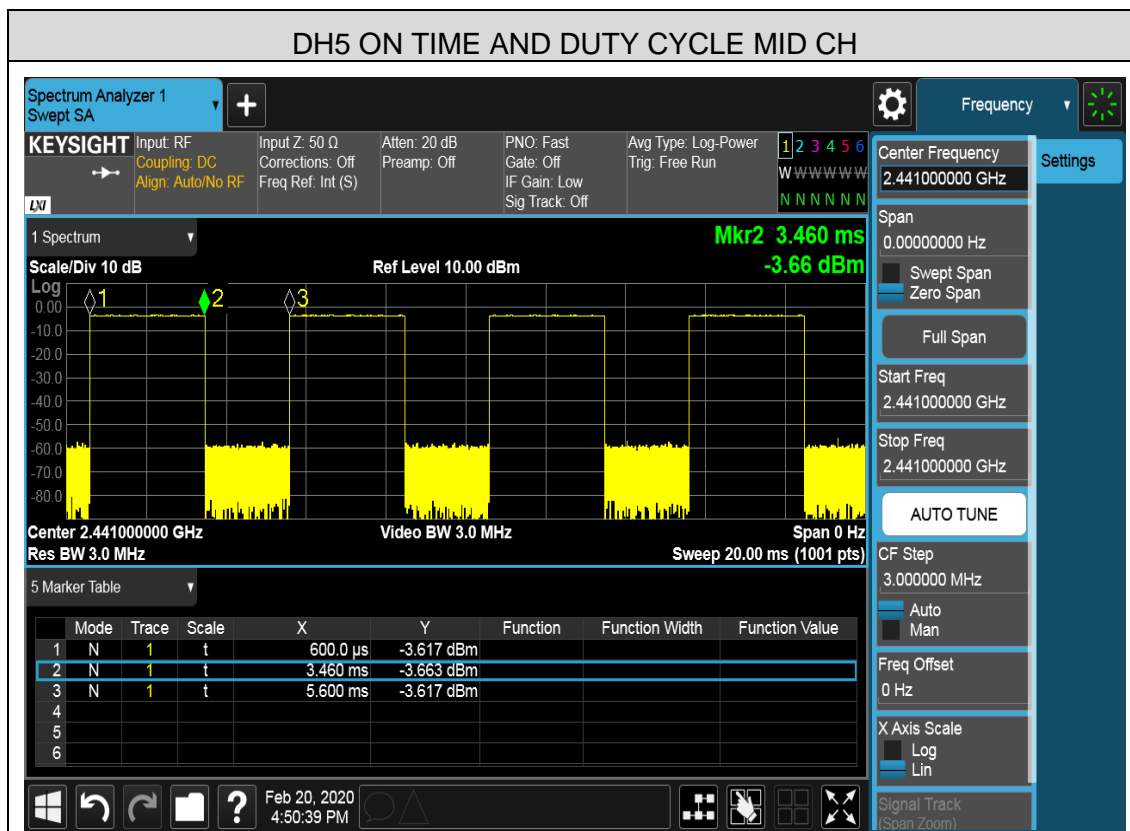
TEST SETUP



RESULTS

Mode	On Time (msec)	Period (msec)	Duty Cycle x (Linear)	Duty Cycle (%)	Duty Cycle Correction Factor (db)	1/T Minimum VBW (KHz)
GFSK	2.86	5.00	0.572	57.2%	2.43	0.35
8DPSK	2.88	5.00	0.576	57.6%	2.40	0.35

Note: Duty Cycle Correction Factor= $10\log(1/x)$.
Where: x is Duty Cycle (Linear)
Where: T is On Time (transmit duration)





6.2. 20 dB BANDWIDTH

LIMITS

FCC Part15 (15.247) Subpart C			
Section	Test Item	Limit	Frequency Range (MHz)
FCC 15.247 (a) (1)	20dB Bandwidth	500KHz	2400-2483.5

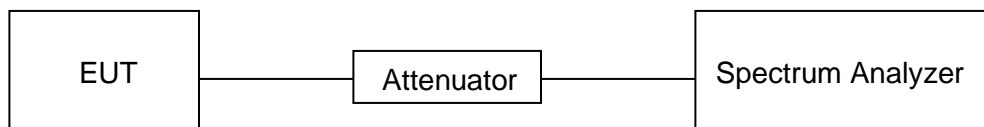
TEST PROCEDURE

Connect the UUT to the spectrum Analyzer and use the following settings:

Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	For 20dB Bandwidth:1% to 5% of the 20 dB bandwidth
VBW	For 20dB Bandwidth: $\geq 3 \times$ RBW
Span	approximately 2 to 5 times the 20 dB bandwidth
Trace	Max hold
Sweep	Auto couple

Allow the trace to stabilize and measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

TEST SETUP



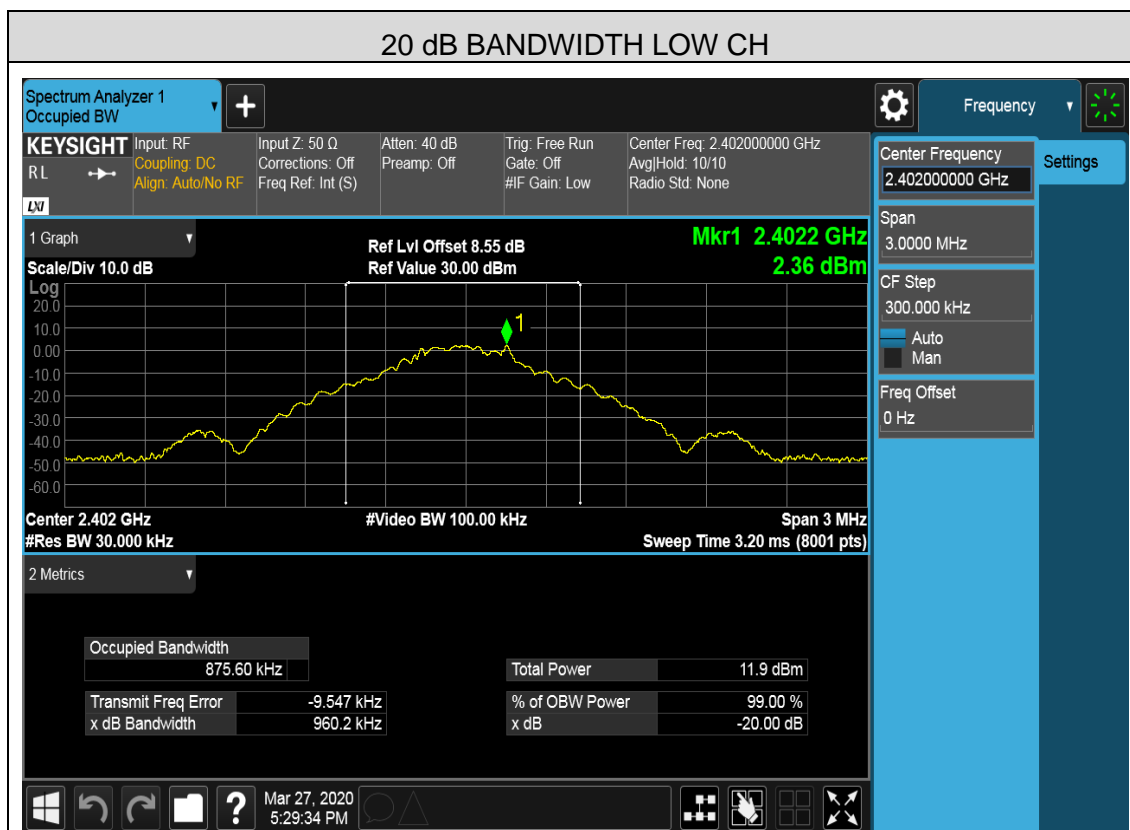


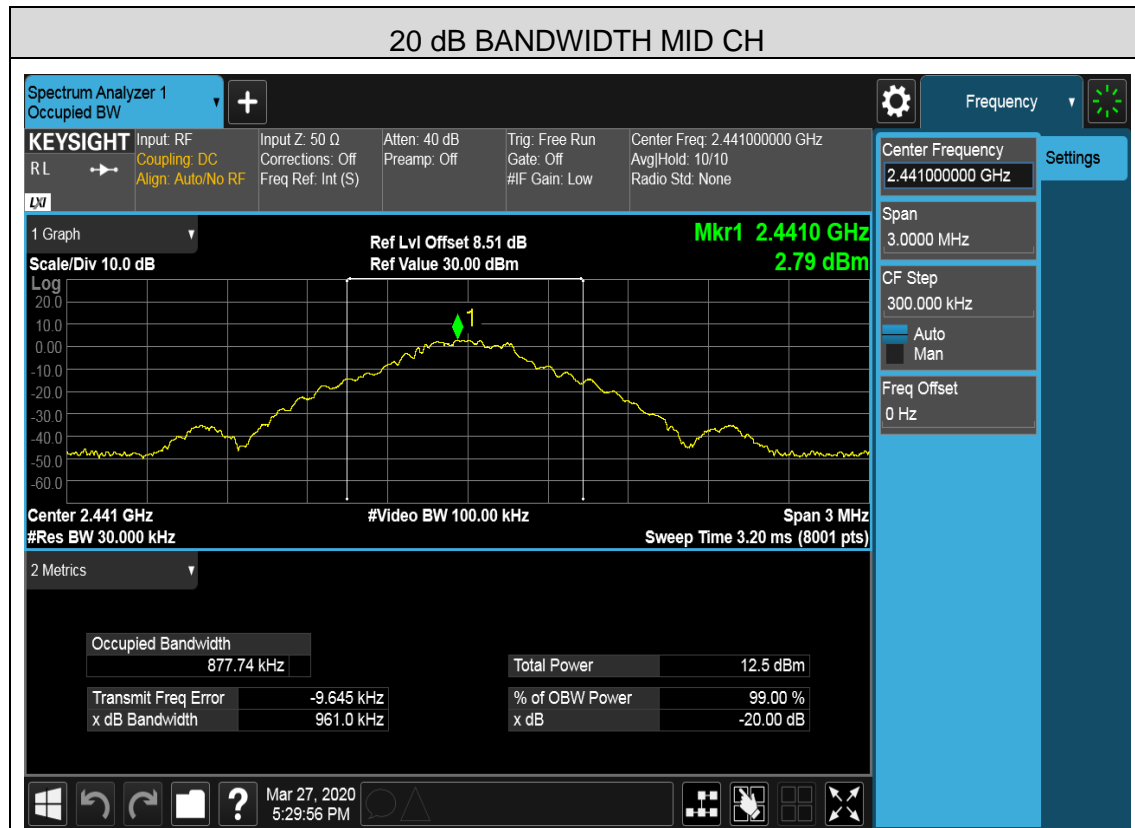
RESULTS

6.2.1. GFSK MODE

Channel	Frequency (MHz)	20dB bandwidth (MHz)	Result
Low	2402	0.9602	PASS
Middle	2441	0.9610	PASS
High	2480	0.9580	PASS

Test Graph

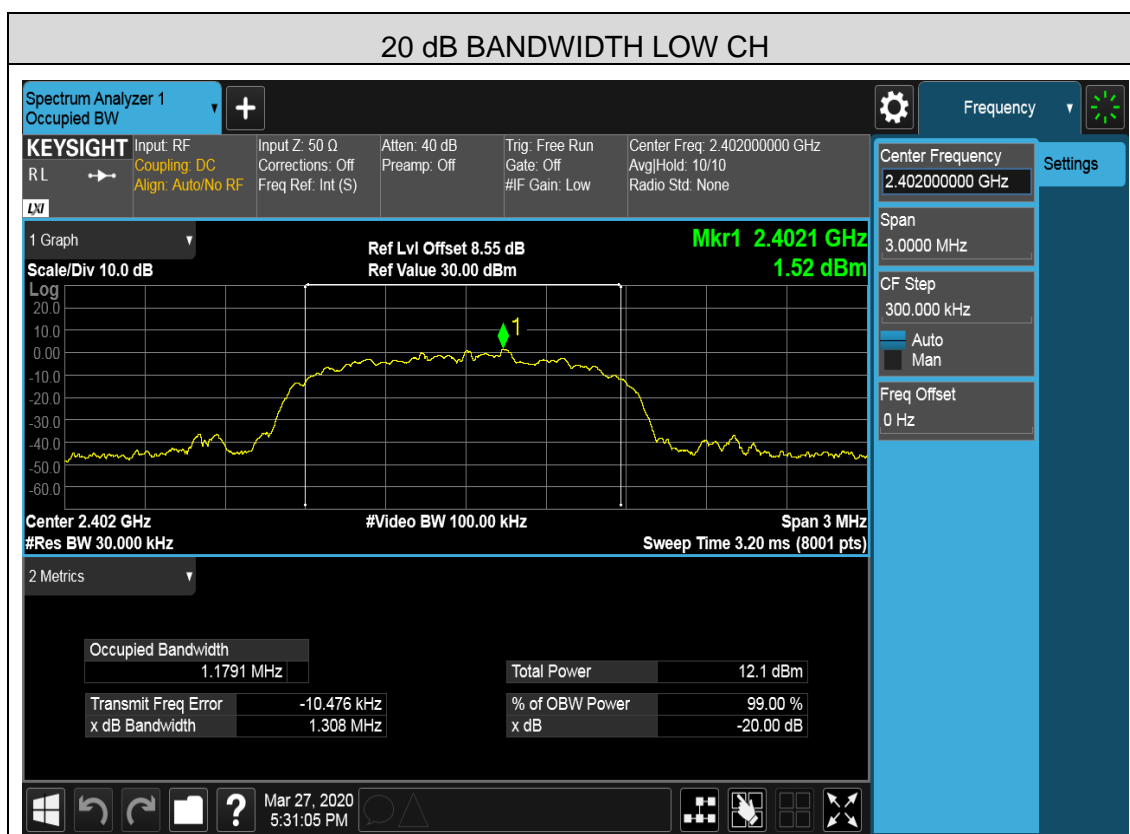


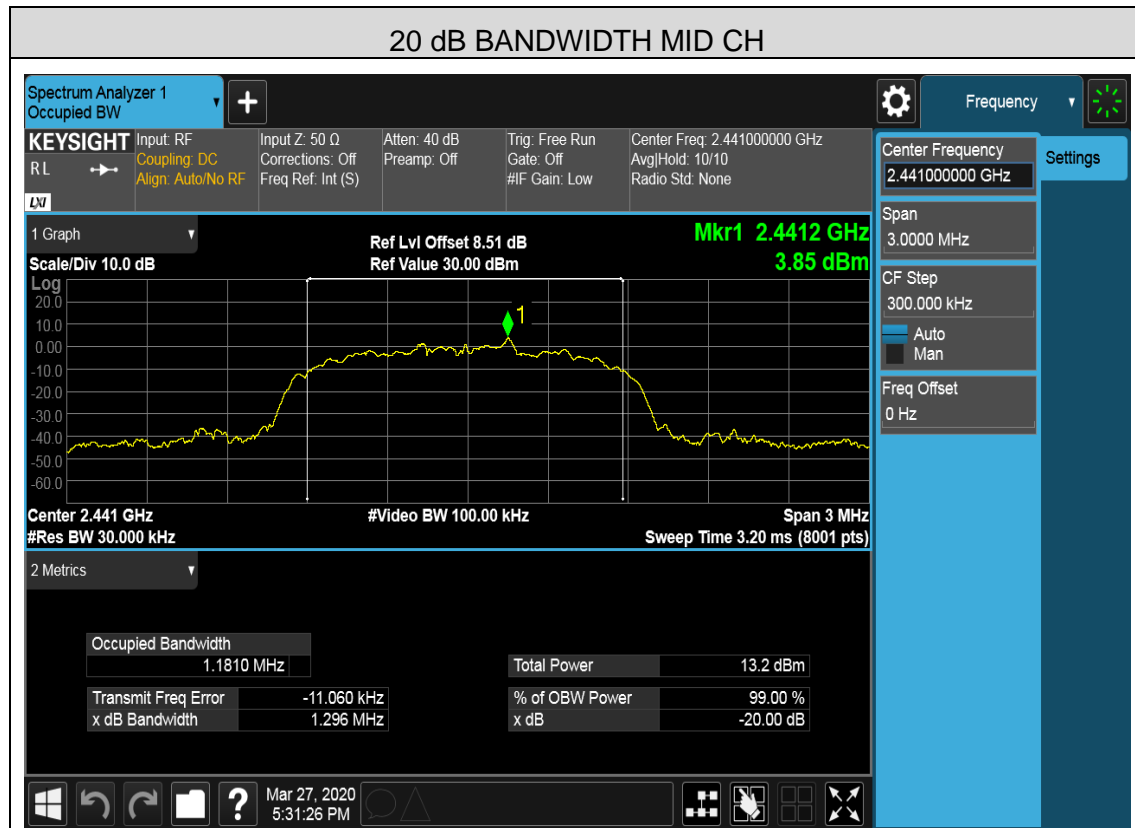


6.2.2. 8DPSK MODE

Channel	Frequency (MHz)	20dB bandwidth (MHz)	Result
Low	2402	1.308	PASS
Middle	2441	1.296	PASS
High	2480	1.297	PASS

Test Graph







6.3. PEAK CONDUCTED OUTPUT POWER

LIMITS

FCC Part15 (15.247) , Subpart C			
Section	Test Item	Limit	Frequency Range (MHz)
FCC 15.247 (b) (1)	Peak Conducted Output Power	1 watt or 30dBm	2400-2483.5

TEST PROCEDURE

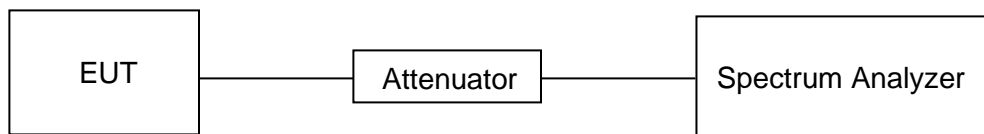
Connect the UUT to the spectrum Analyzer and use the following settings:

Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	≥ 20 dB bandwidth of the emission being measured
VBW	\geq RBW
Span	Approximately five times the 20 dB bandwidth
Trace	Max hold
Sweep time	Auto couple

Allow trace to fully stabilize and use peak marker function to determine the peak amplitude level.

TEST SETUP

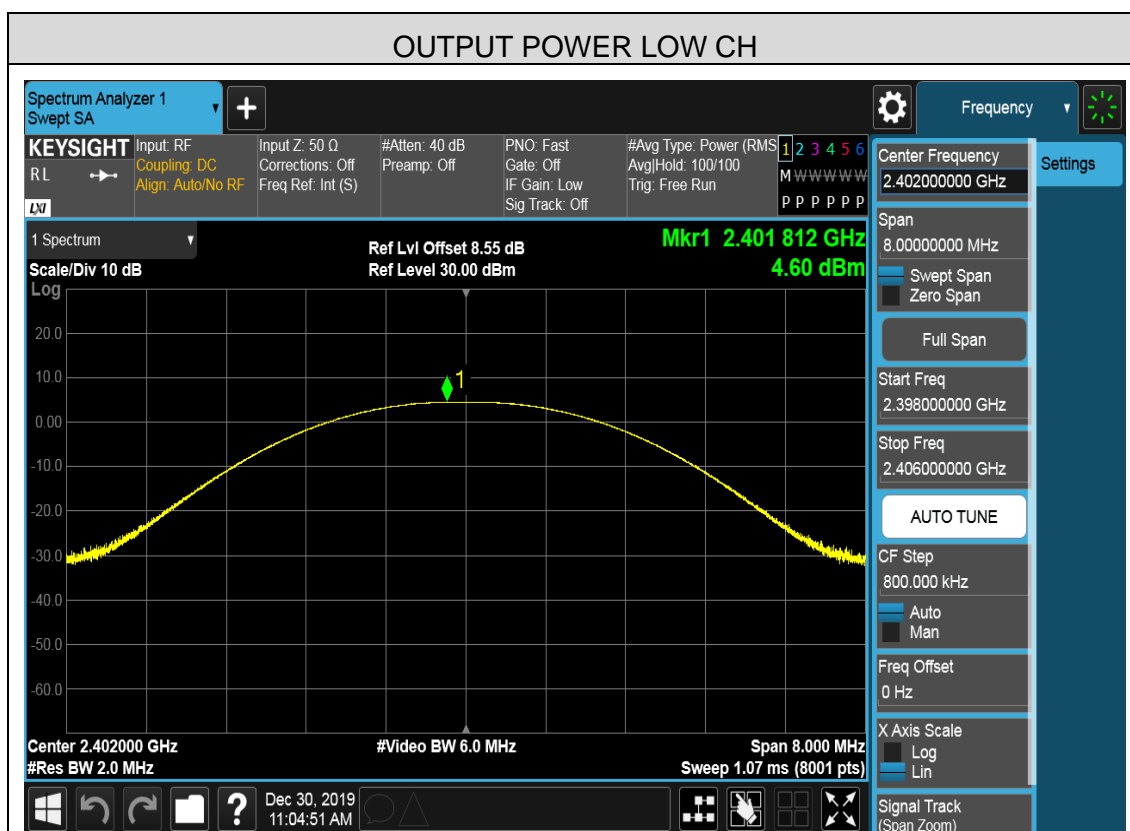
for peak power measurement:

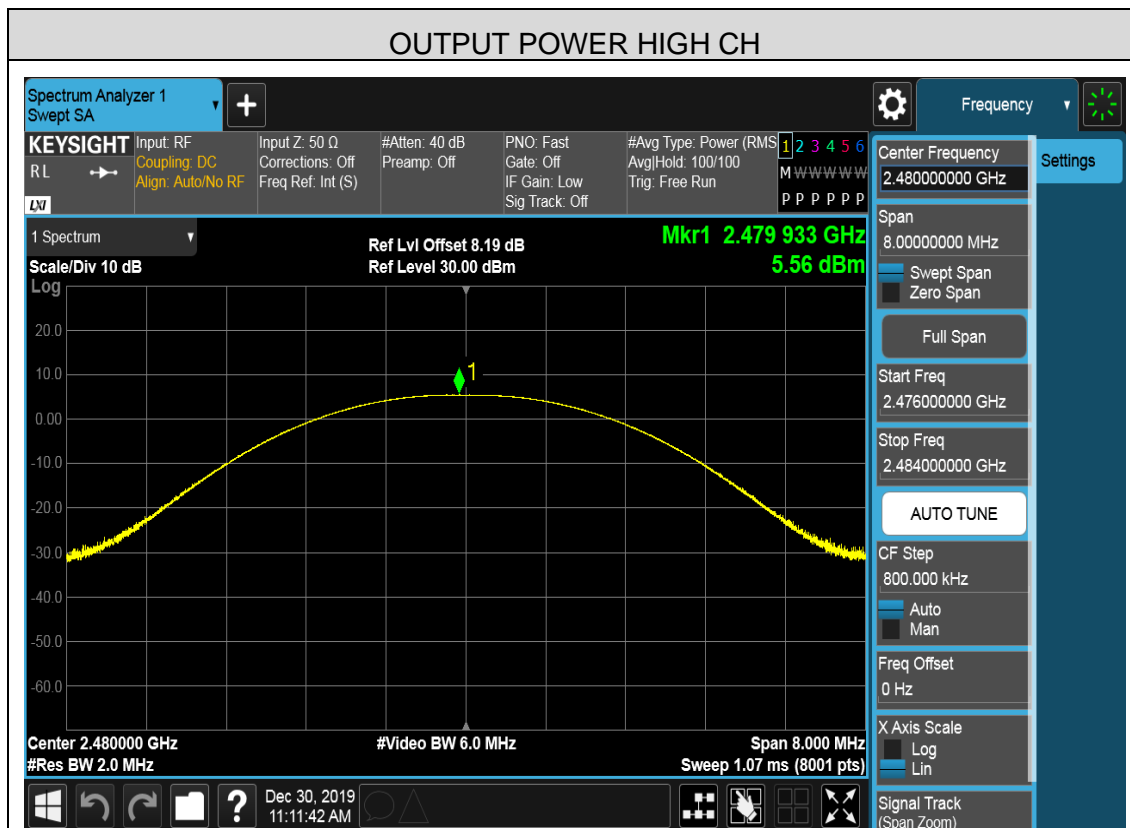
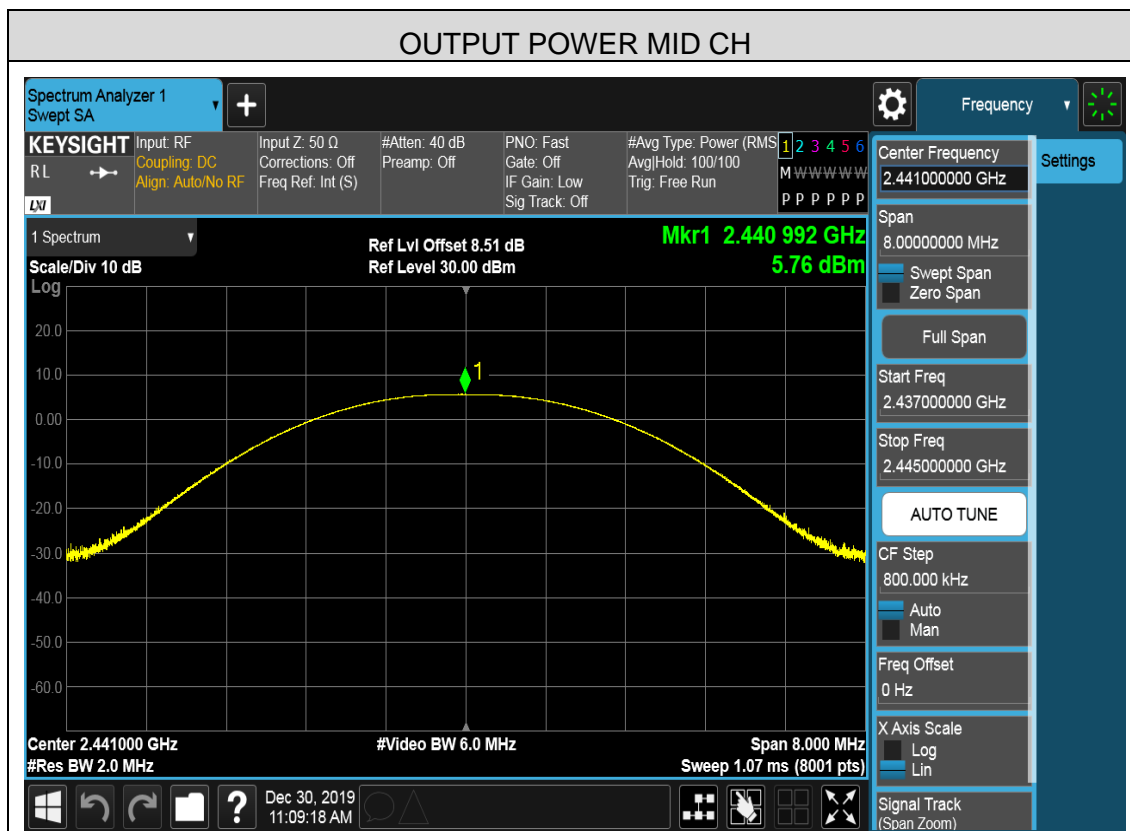


RESULTS

6.3.1. GFSK MODE

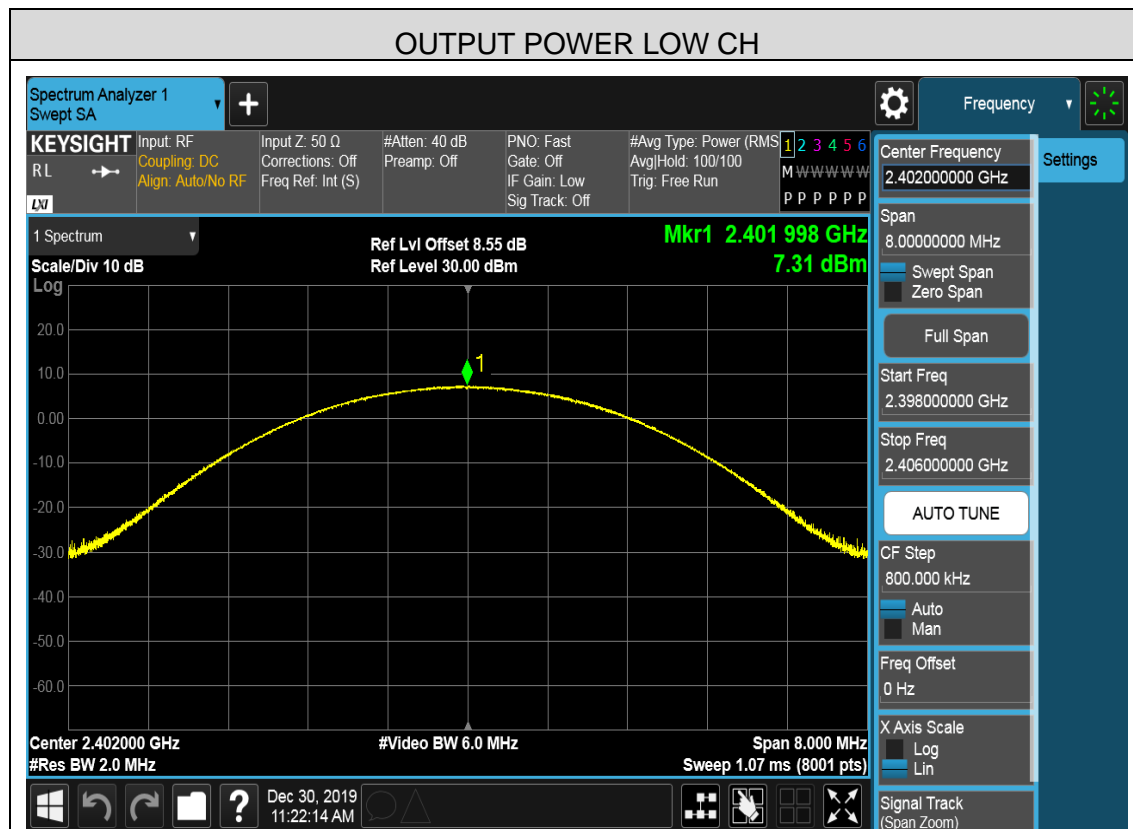
Channel	Frequency	Maximum PK Conducted Output Power	Result
	(MHz)	(dBm)	
Low	2402	4.60	Pass
Middle	2441	5.76	Pass
High	2480	5.56	Pass

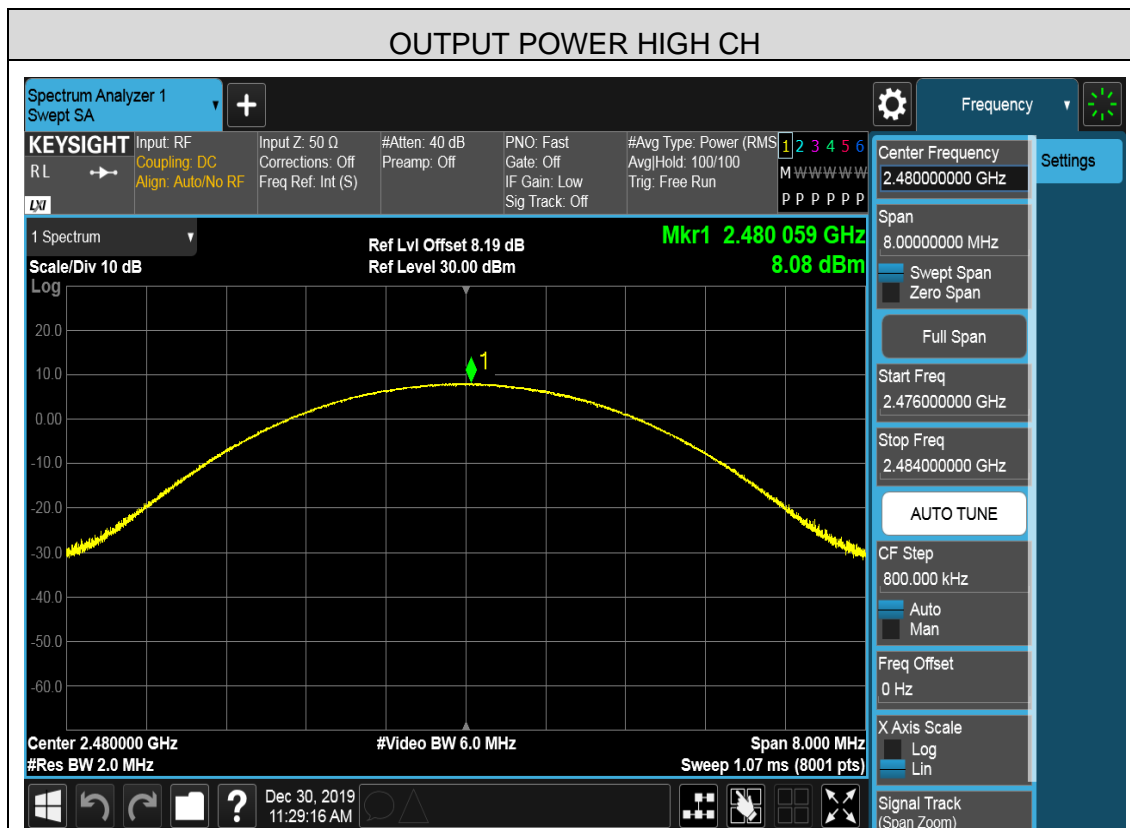
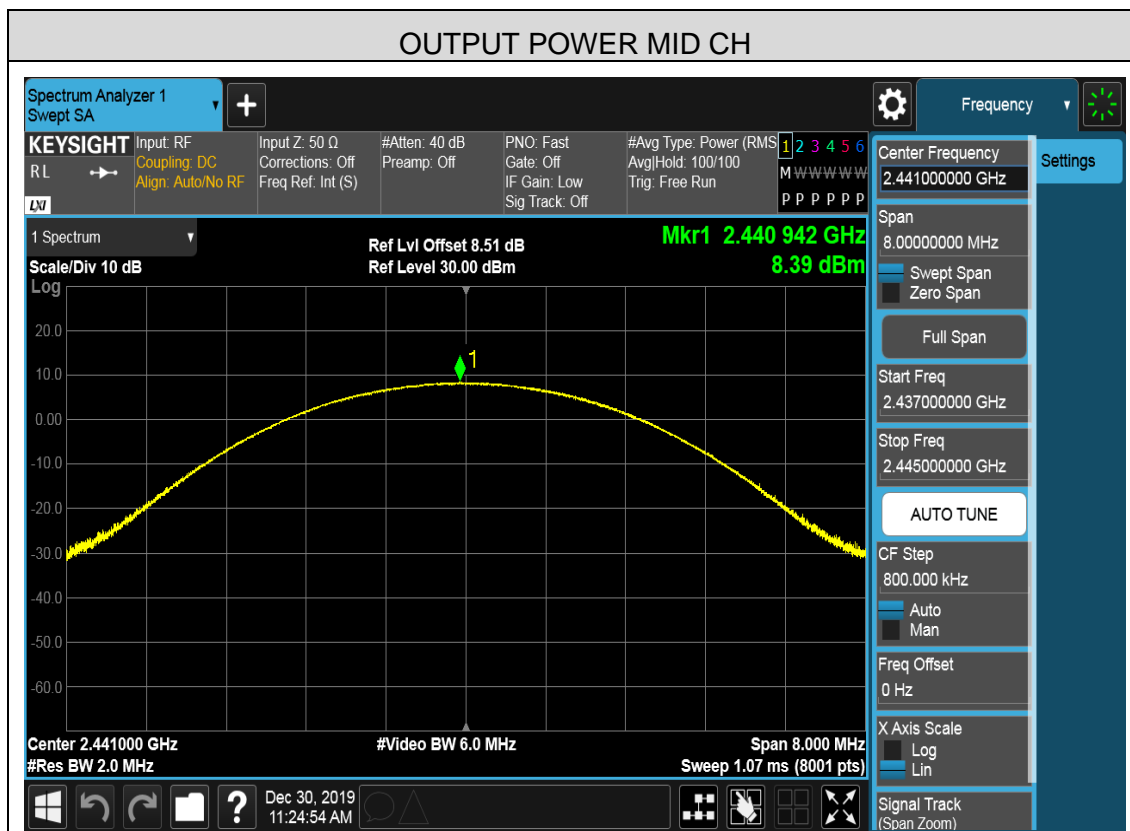




6.3.2. 8DPSK MODE

Channel	Frequency	Maximum PK Conducted Output Power	Result
	(MHz)	(dBm)	
Low	2402	7.31	Pass
Middle	2441	8.39	Pass
High	2480	8.08	Pass





6.4. CARRIER HOPPING CHANNEL SEPARATION

LIMITS

FCC Part15 (15.247) , Subpart C			
Section	Test Item	Limit	Frequency Range (MHz)
FCC 15.247 (a) (1)	Carrier Hopping Channel Separation	25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.	2400-2483.5

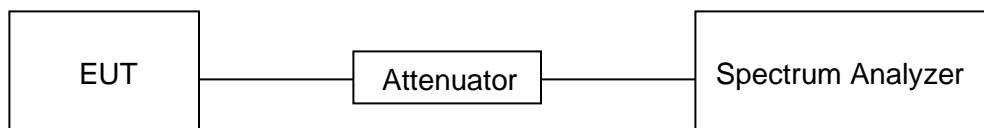
TEST PROCEDURE

Connect the UUT to the spectrum Analyzer and use the following settings:

Center Frequency	The center frequency of the channel under test
Span	wide enough to capture the peaks of two adjacent channels
Detector	Peak
RBW	Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel
VBW	\geq RBW
Trace	Max hold
Sweep time	Auto couple

Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section. Submit this plot.

TEST SETUP

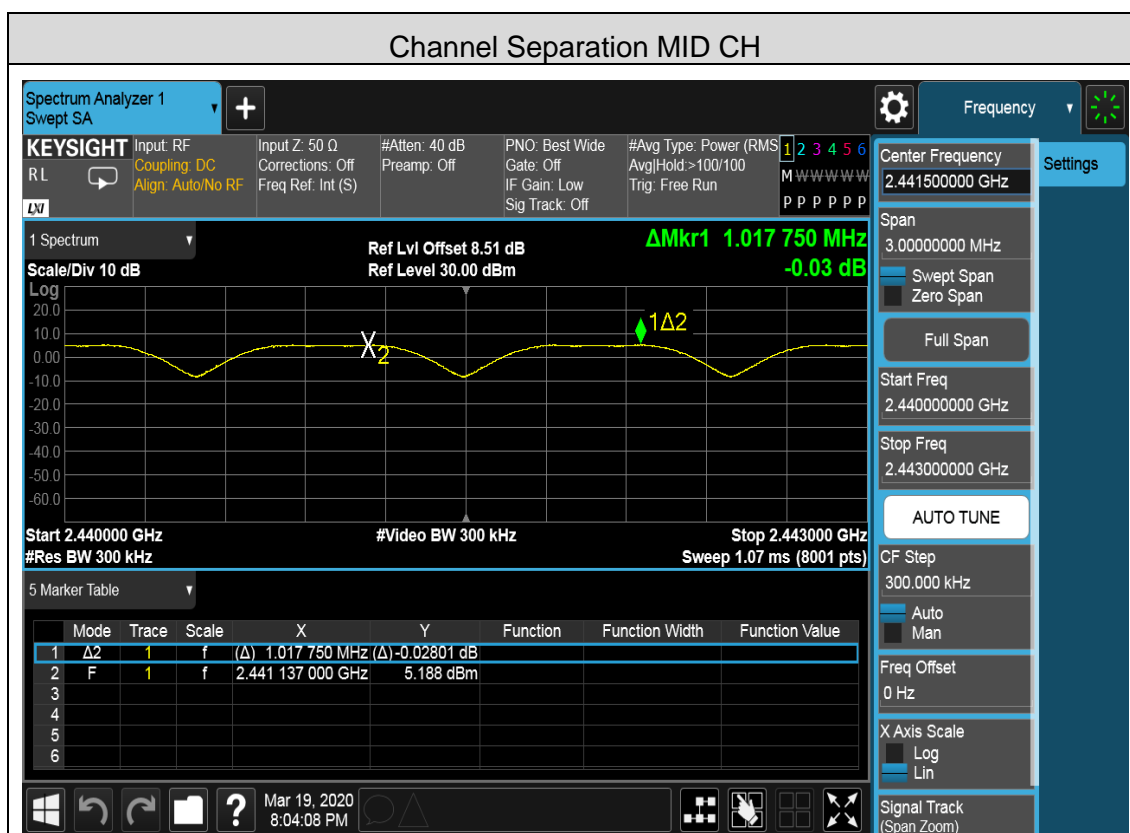




RESULTS

6.4.1. GFSK MODE

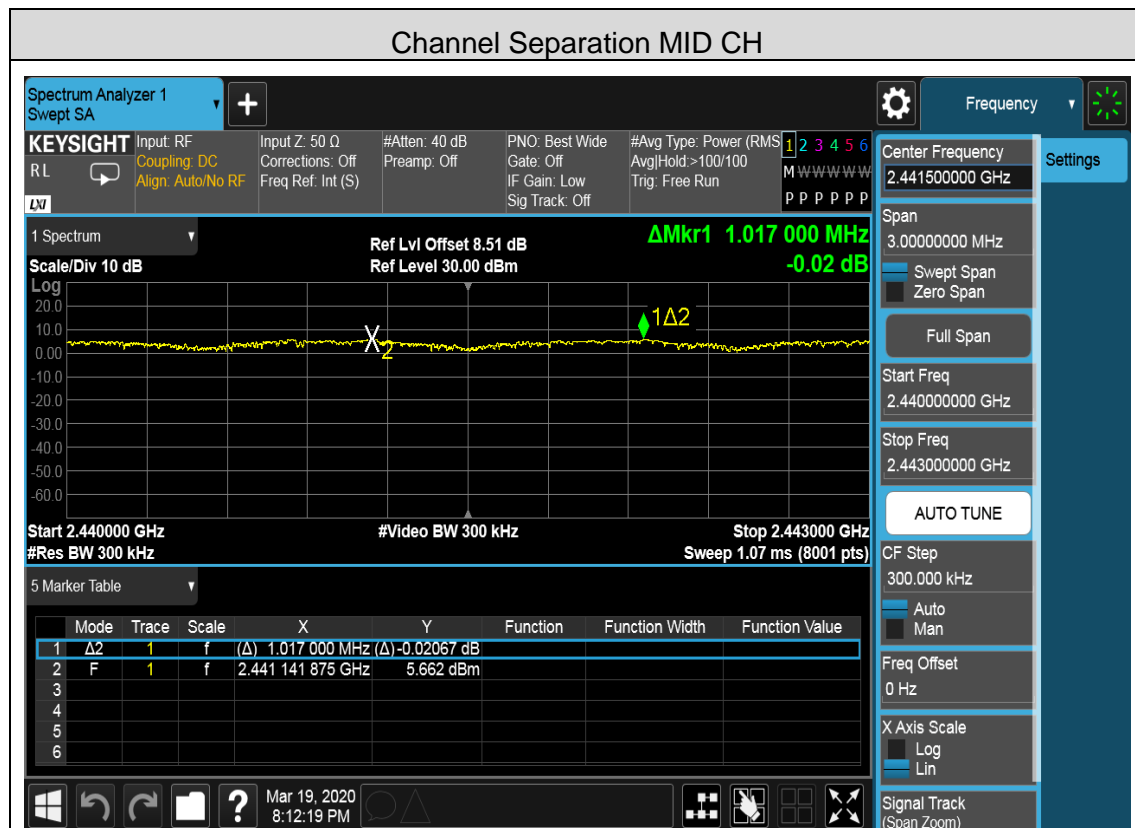
Channel	Carrier Hopping Channel Separation (MHz)	Limit (MHz)	Result
Middle	1.018	≥ two-thirds of the 20 dB Bandwidth Of The Hopping Channel	PASS



Note: For 20 dB Bandwidth of The Hopping Channel, please refer to clause 6.2.1.

6.4.2. 8DPSK MODE

Channel	Carrier Hopping Channel Separation (MHz)	Limit (MHz)	Result
Middle	1.017	≥ two-thirds of the 20 dB Bandwidth Of The Hopping Channel	PASS



Note: For 20 dB Bandwidth of The Hopping Channel, please refer to clause 6.2.1.

6.5. NUMBER OF HOPPING FREQUENCY

LIMITS

FCC Part15 (15.247) , Subpart C		
Section	Test Item	Limit
15.247 (a) (1) III	Number of Hopping Frequency	at least 15 hopping channels

TEST PROCEDURE

Connect the EUT to the spectrum Analyzer and use the following settings:

Detector	Peak
RBW	To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller
VBW	\geq RBW
Span	The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen
Trace	Max hold
Sweep time	Auto couple

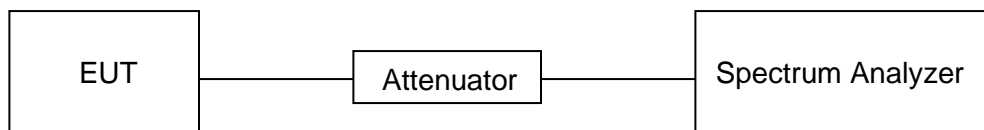
Set EUT to transmit maximum output power and switch on frequency hopping function. then set enough count time (larger than 5000 times) to get all the hopping frequency channel displayed on the screen of spectrum analyzer.

Count the quantity of peaks to get the number of hopping channels.

Normal Mode: 79 Channels observed.

AFH Mode: 20 Channels declared.

TEST SETUP

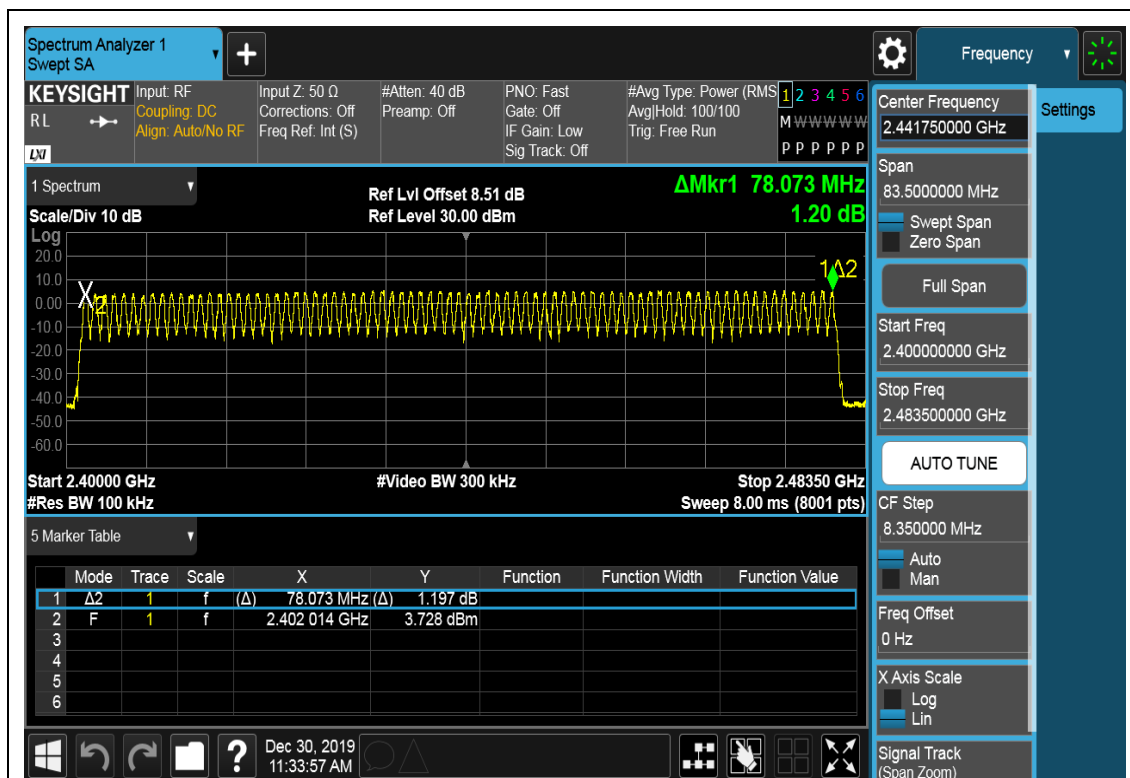




RESULTS

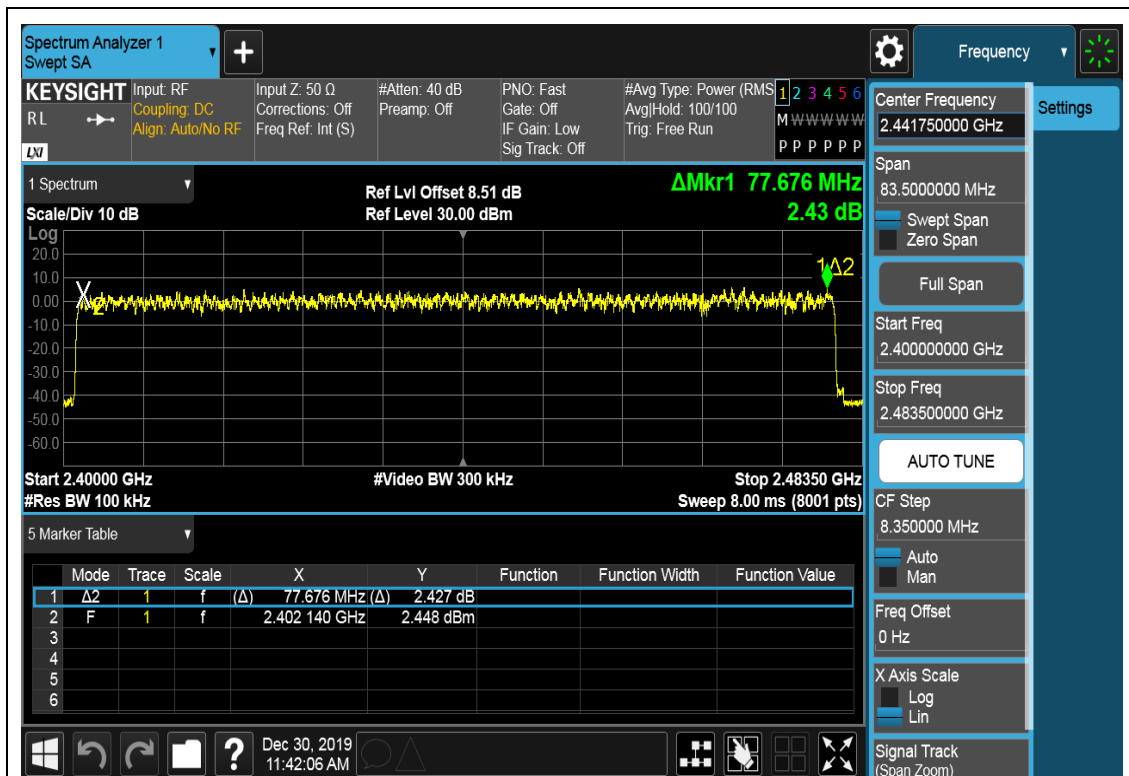
6.5.1. GFSK MODE

Hopping numbers	Limit	Results
79	>15	Pass



6.5.2. 8DPSK MODE

Hopping numbers	Limit	Results
79	>15	Pass



6.6. TIME OF OCCUPANCY (DWELL TIME)

LIMITS

FCC Part15 (15.247) , Subpart C		
Section	Test Item	Limit
15.247 (a) (1) III	Time of Occupancy (Dwell Time)	The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds, multiplied by the number of hopping channels employed.

TEST PROCEDURE

Connect the UUT to the spectrum Analyzer and use the following settings:

Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	1 MHz
VBW	≥RBW
Span	zero span
Trace	Max hold
Sweep time	As necessary to capture the entire dwell time per hopping channel

- The transmitter output (antenna port) was connected to the spectrum analyzer
- Set RBW of spectrum analyzer to 1MHz and VBW to 1MHz.
- Use a video trigger with the trigger level set to enable triggering only on full pulses.
- Sweep Time is more than once pulse time.
- Set the center frequency on any frequency would be measure and set the frequency span to zero span.
- Measure the maximum time duration of one single pulse.
- Set the EUT for DH5, DH3 and DH1 packet transmitting.
- Measure the maximum time duration of one single pulse.
 $A \text{ Period Time} = (\text{channel number}) * 0.4$

For Normal Mode (79 Channel):

DH1 Time Slot: Reading * (1600/2)*31.6/(channel number)

DH3 Time Slot: Reading * (1600/4)*31.6/(channel number)

DH5 Time Slot: Reading * (1600/6)*31.6/(channel number)

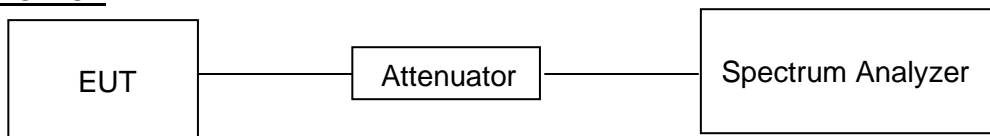
For AFH Mode (20 Channel):

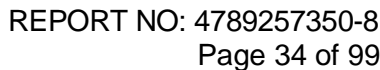
DH1 Time Slot: Reading * (1600/2)*8/(channel number)

DH3 Time Slot: Reading * (1600/4)*8/(channel number)

DH5 Time Slot: Reading * (1600/6)*8/(channel number)

TEST SETUP

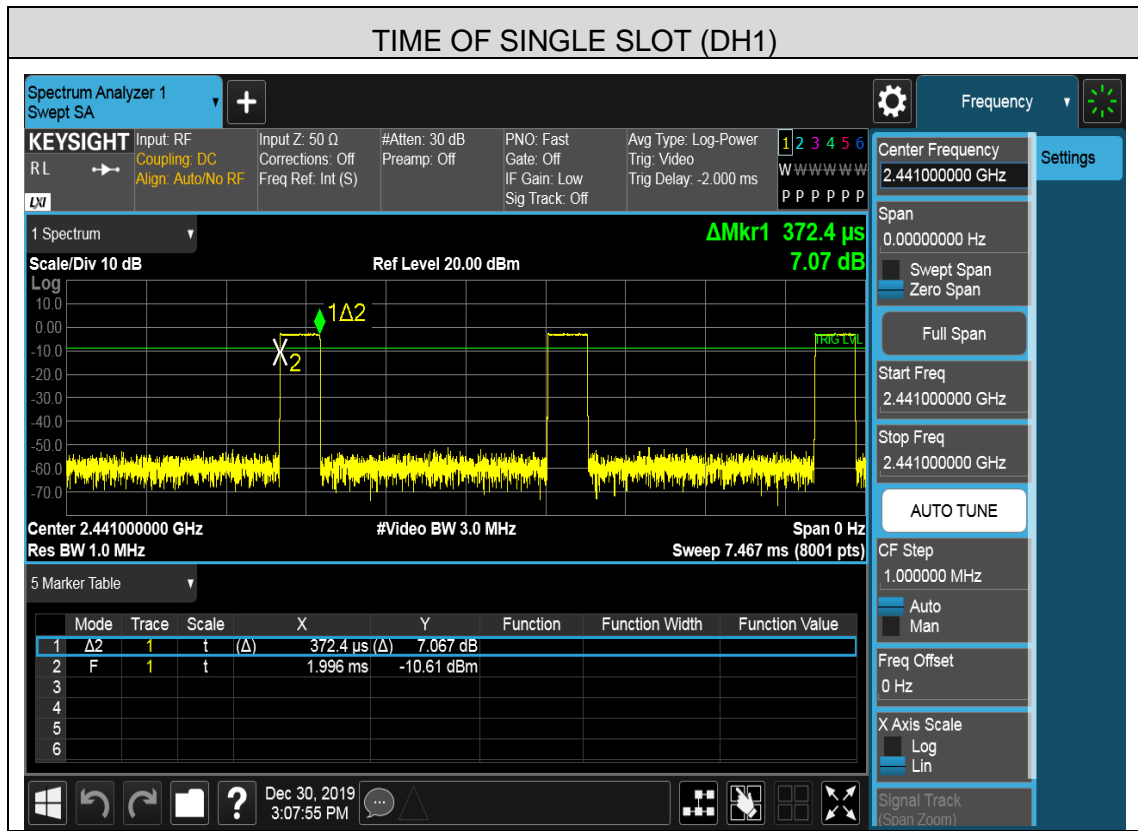


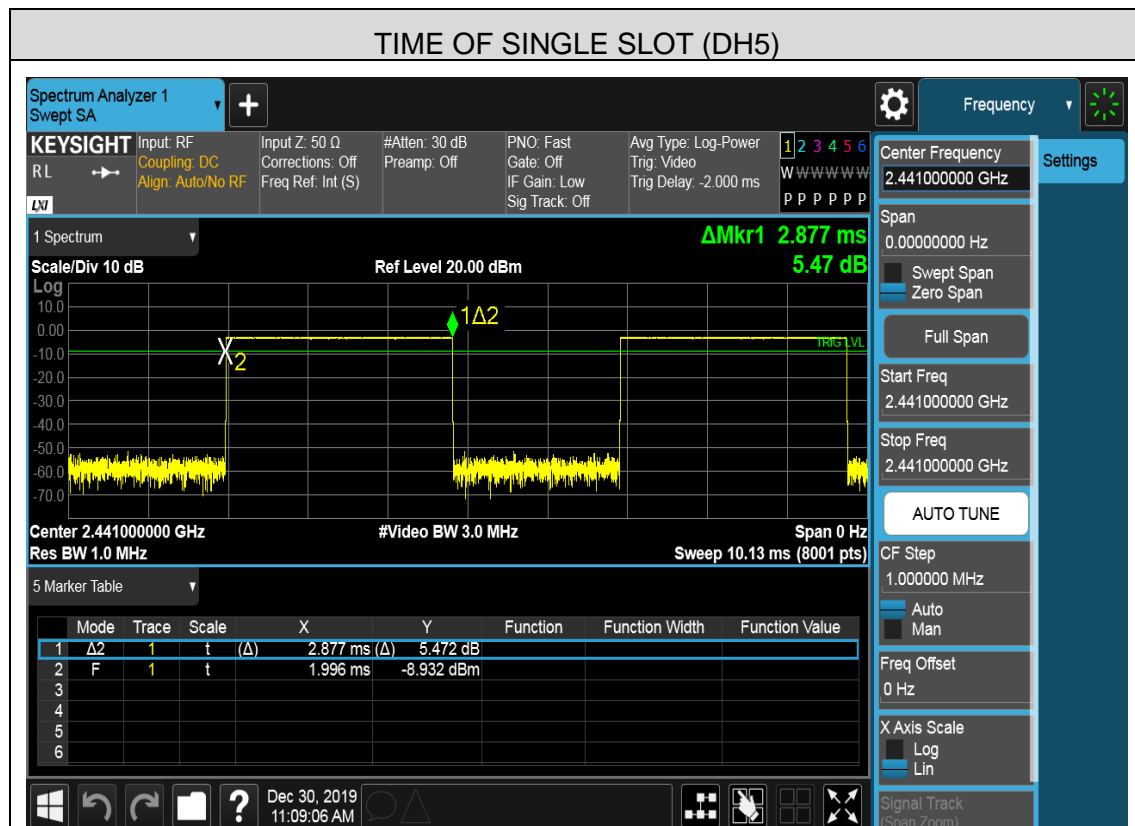
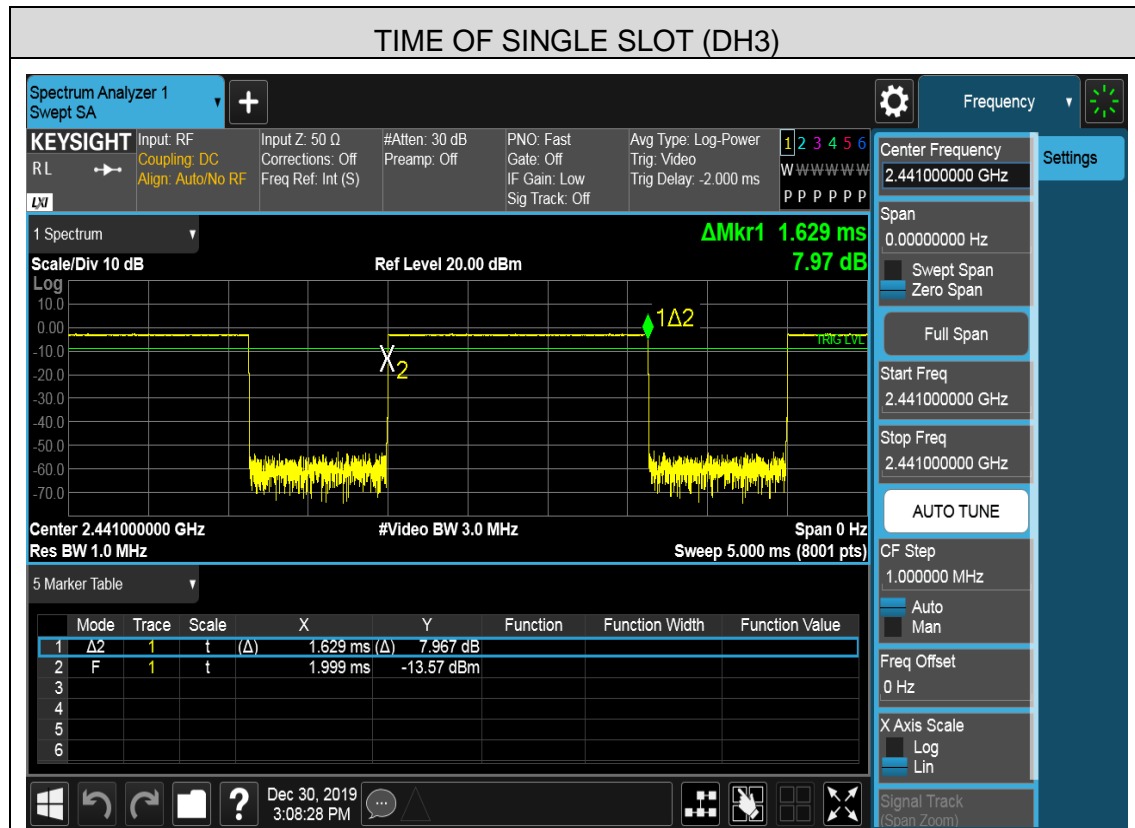


6.6.1. GFSK MODE

Normal Mode				
Packet	Channel	Burst Width [ms/hop/ch]	Dwell Time [s]	Results
DH1	MCH	0.3724	0.119	PASS
DH3	MCH	1.629	0.261	PASS
DH5	MCH	2.877	0.307	PASS
AFH Mode				
DH1	MCH	0.3724	0.119	PASS
DH3	MCH	1.63	0.261	PASS
DH5	MCH	2.877	0.307	PASS

Test Graph

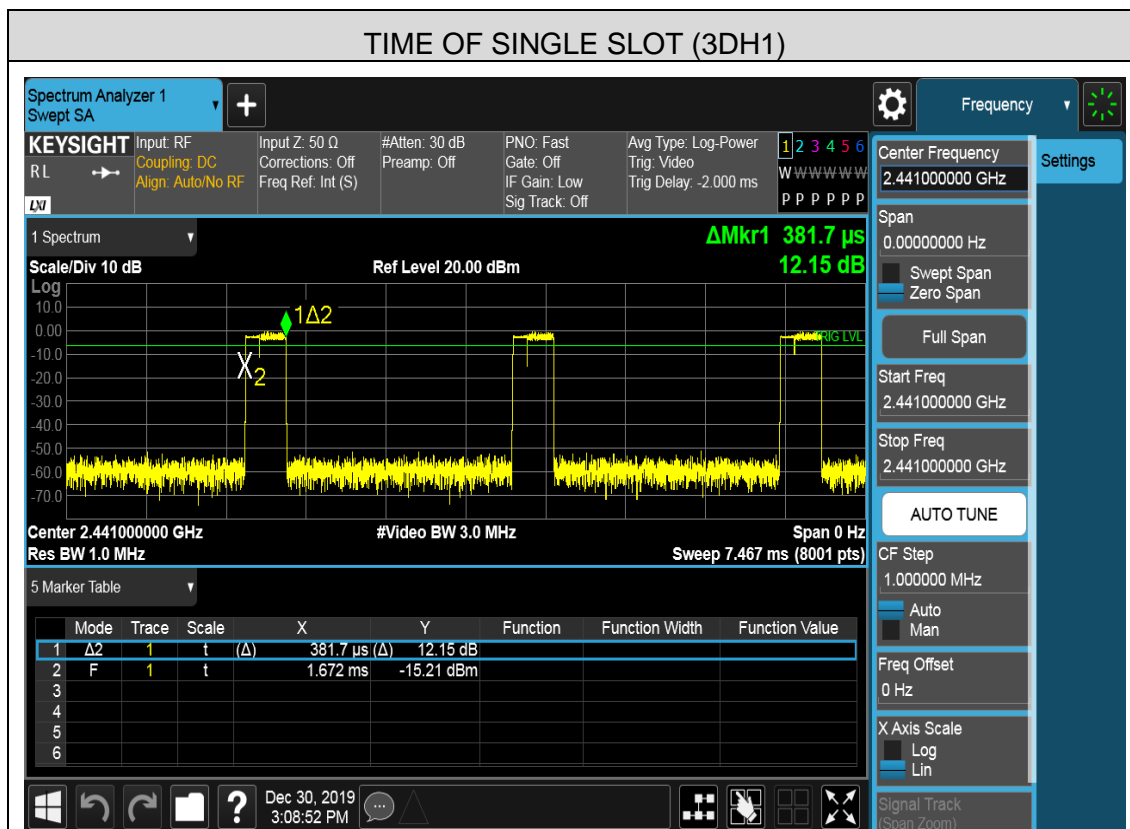


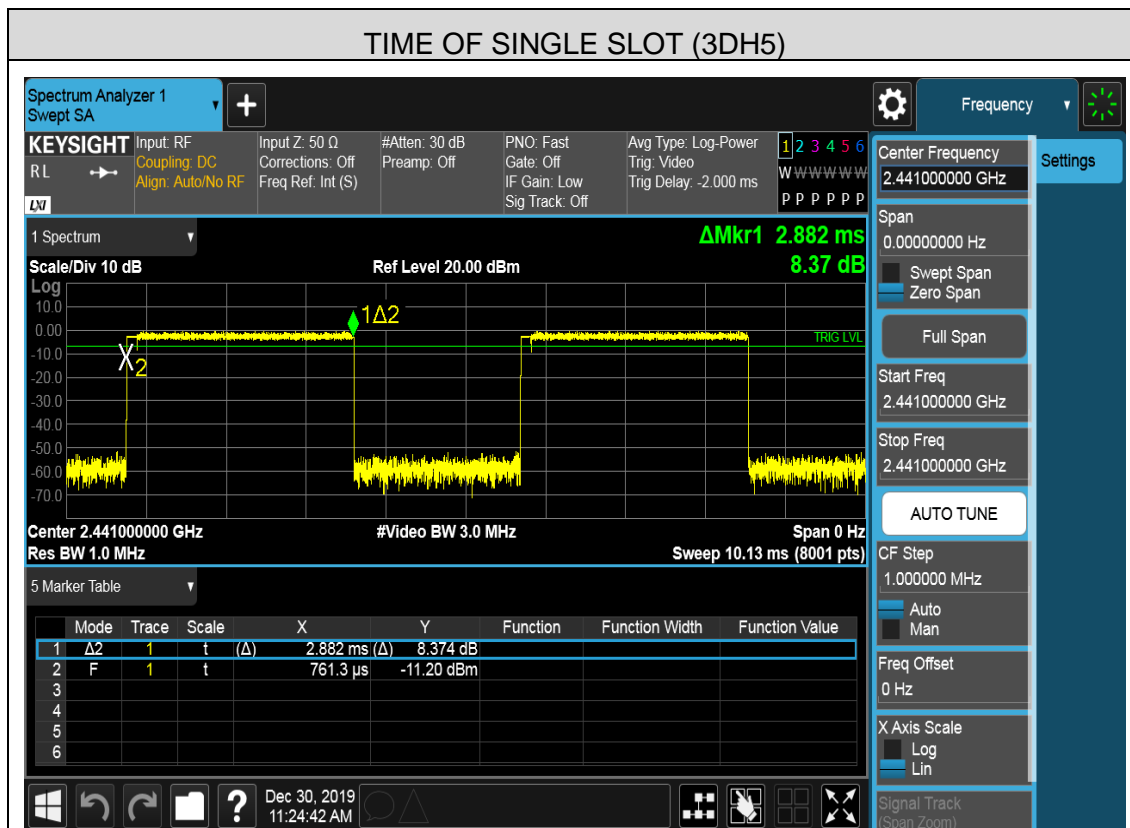
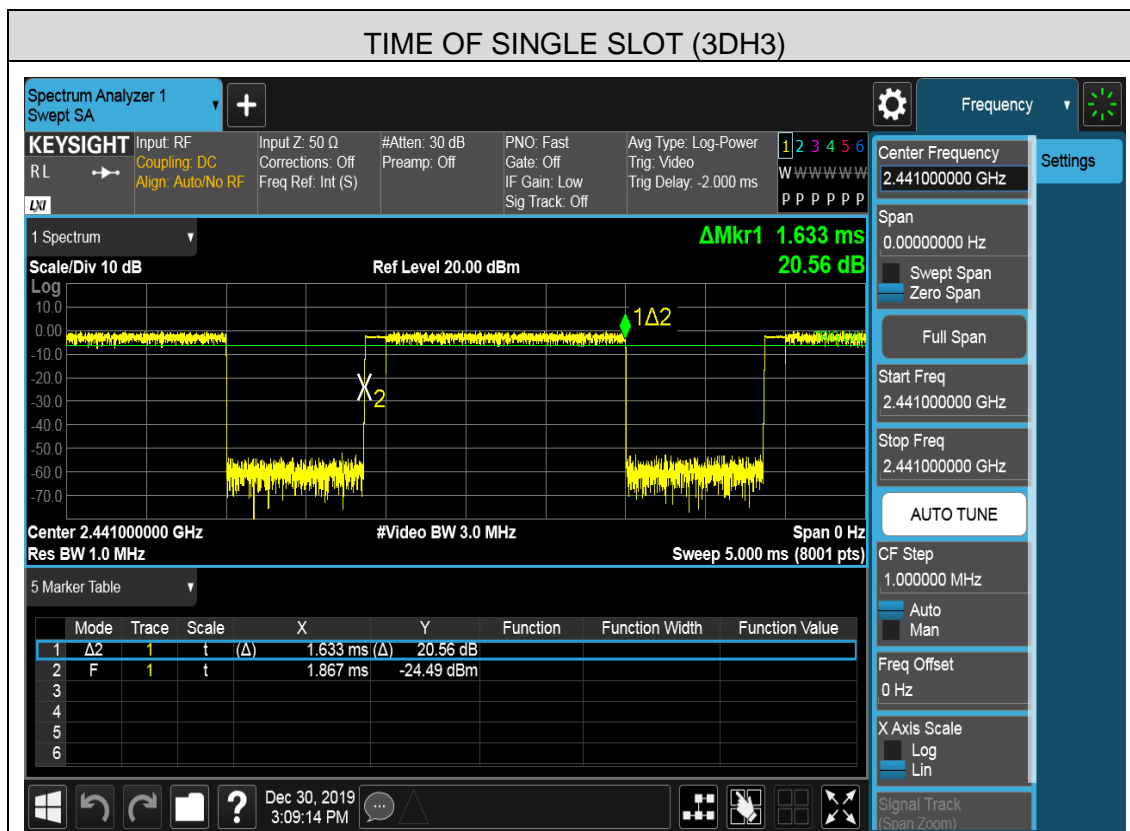


6.6.2. 8DPSK MODE

Normal Mode				
Packet	Channel	Burst Width [ms/hop/ch]	Dwell Time [s]	Results
3DH1	MCH	0.3817	0.122	PASS
3DH3	MCH	1.633	0.261	PASS
3DH5	MCH	2.882	0.231	PASS
AFH Mode				
3DH1	MCH	0.3817	0.122	PASS
3DH3	MCH	1.633	0.261	PASS
3DH5	MCH	2.882	0.231	PASS

Test Graph







6.7. CONDUCTED SPURIOUS EMISSION

LIMITS

FCC Part15 (15.247) , Subpart C		
Section	Test Item	Limit
FCC §15.247 (d)	Conducted Spurious Emission	at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power

TEST PROCEDURE

For Band-edge use the following settings:

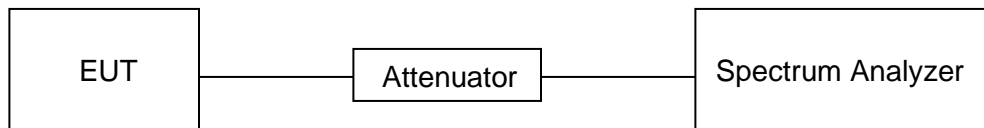
Detector	Peak
RBW	1 MHz
VBW	3 × RBW
Span	Wide enough to capture the peak level of the emission operating on the channel closest to the band edge
Trace	Max hold
Sweep time	Couple

For Spurious Emission use the following settings:

Detector	Peak
RBW	100K
VBW	300 kHz
Span	Wide enough to capture the peak level of the emission operating on the channel closest to the band edge
Trace	Max hold
Sweep time	Couple

Use the peak marker function to determine the maximum amplitude level.

TEST SETUP

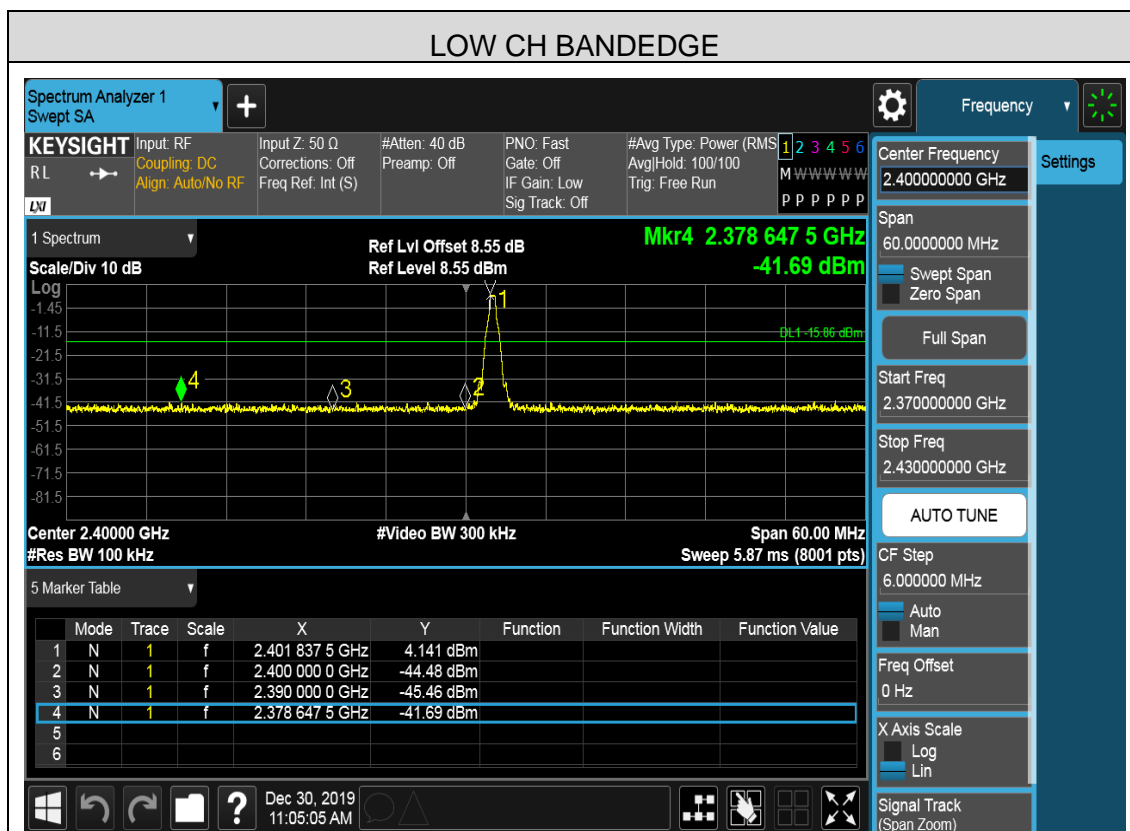


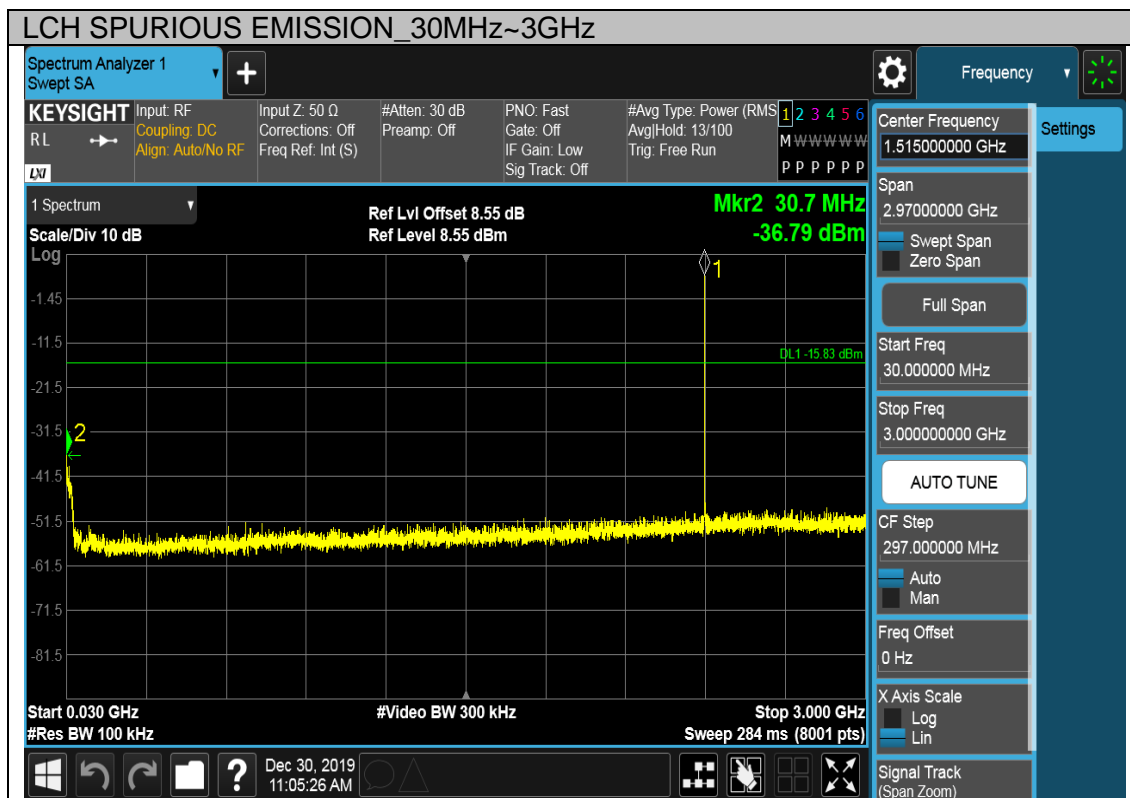
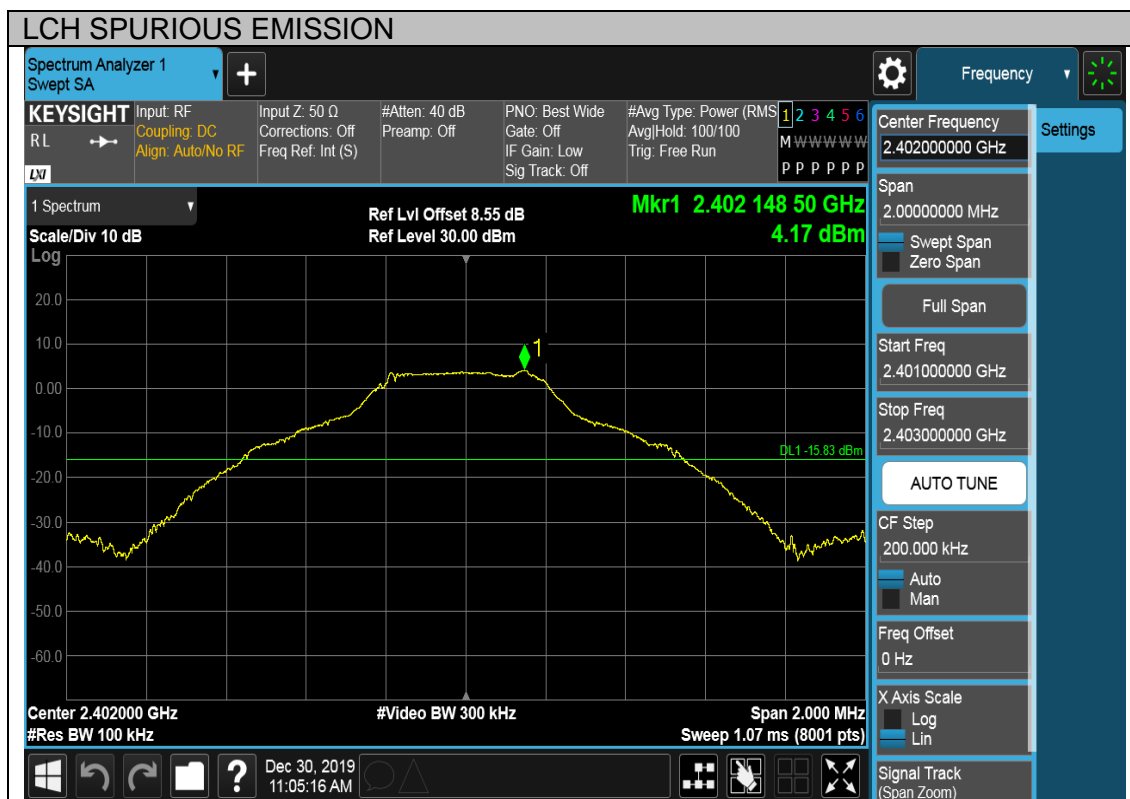


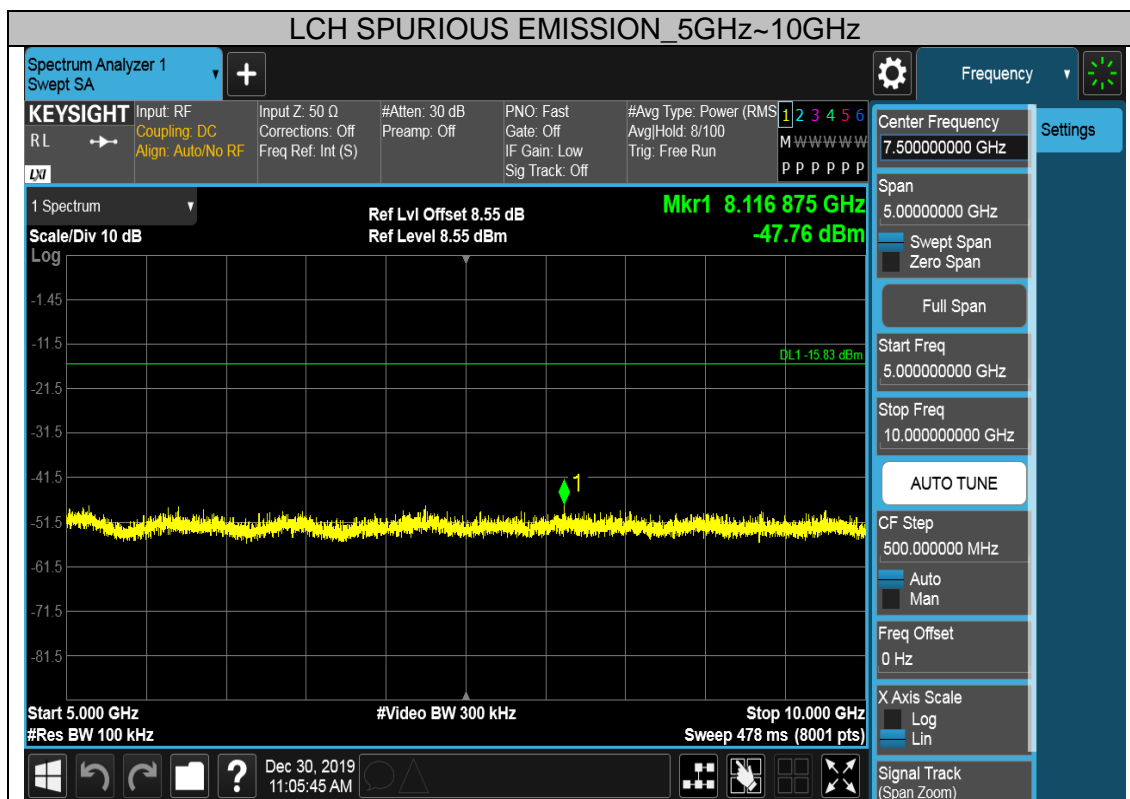
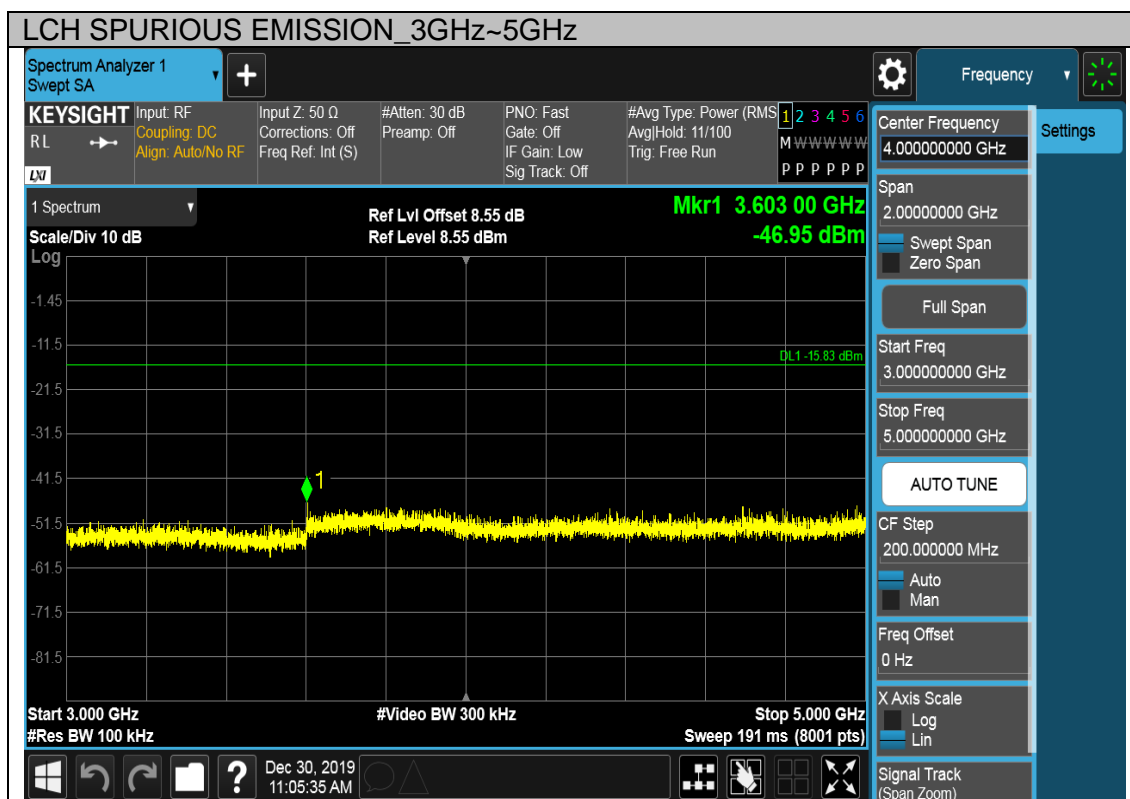
RESULTS

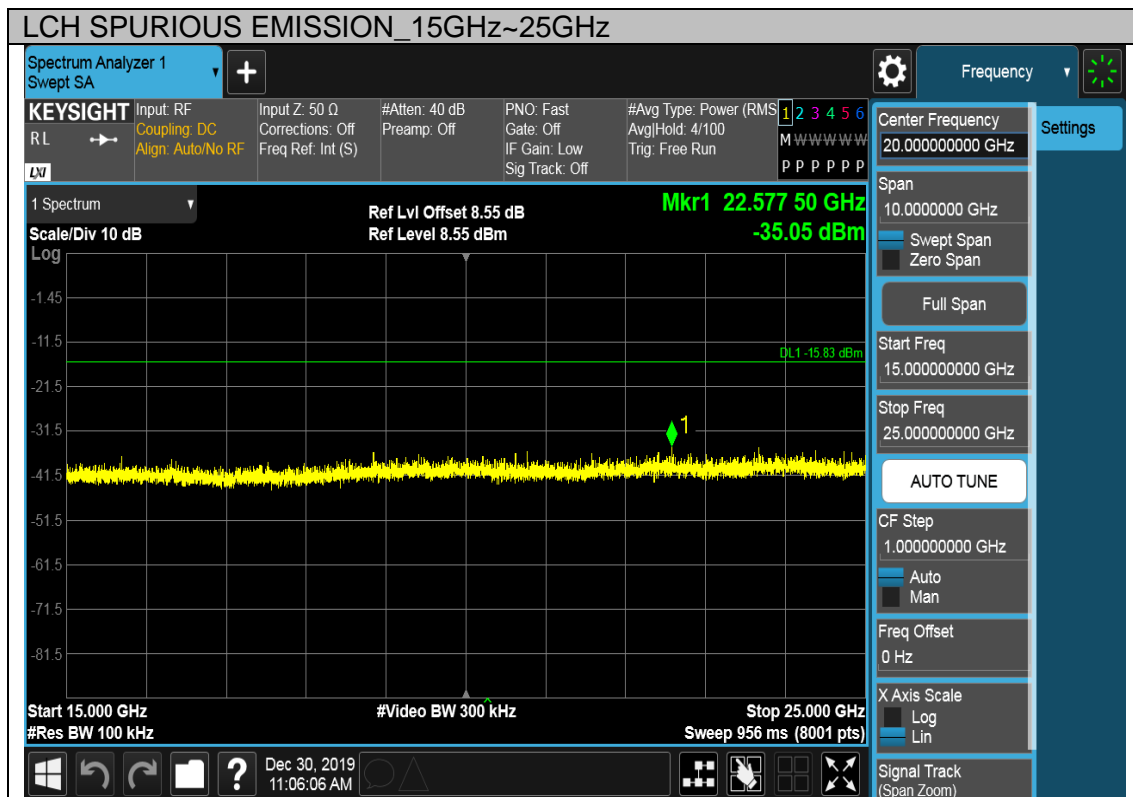
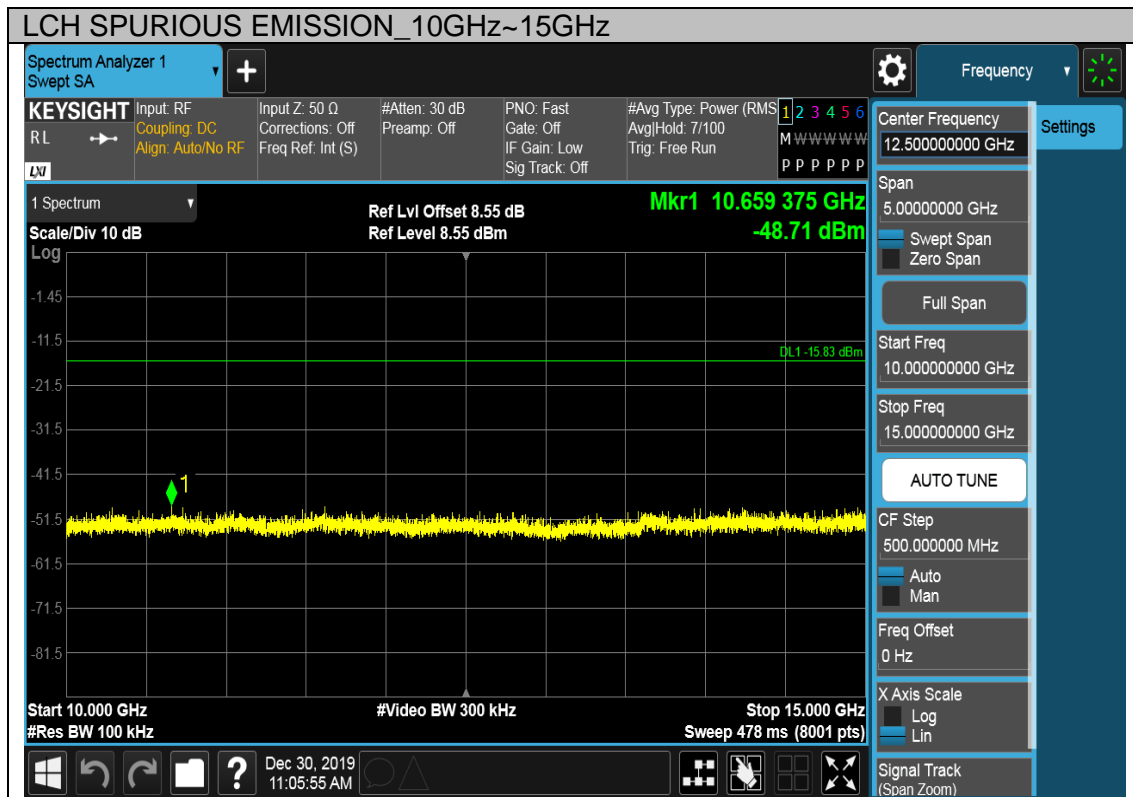
6.7.1. GFSK MODE

SPURIOUS EMISSIONS, LOW CHANNEL



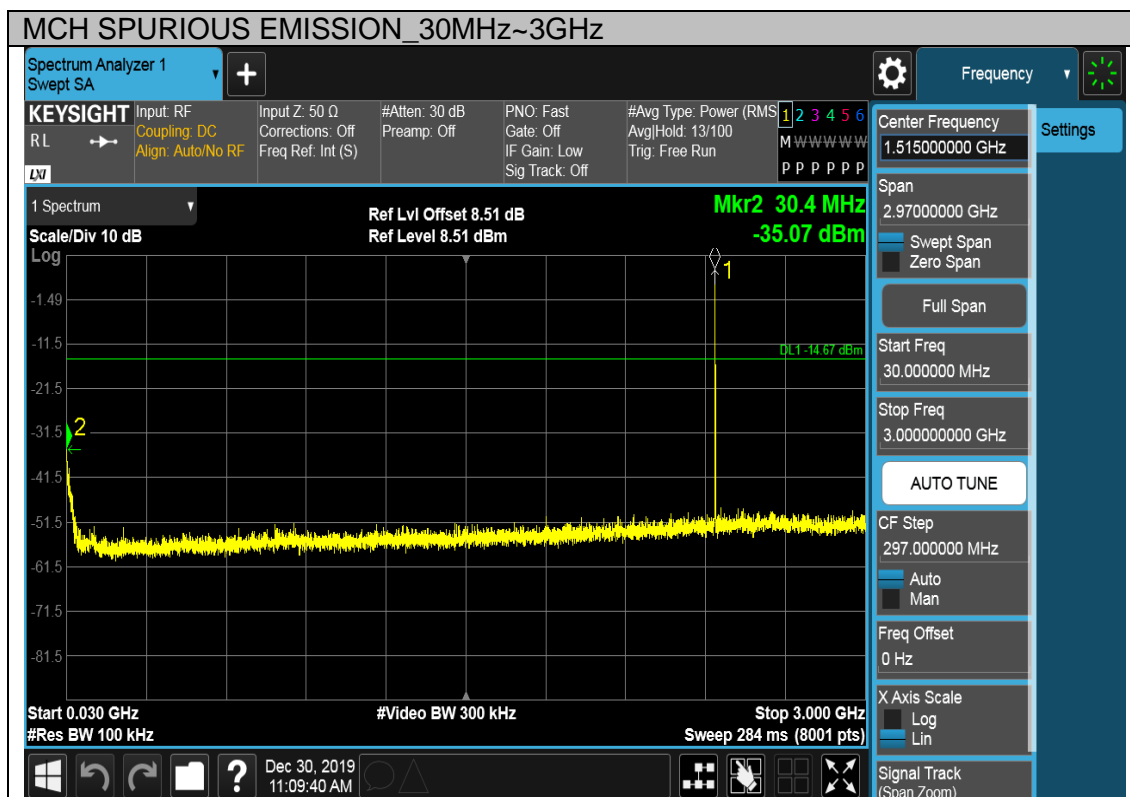
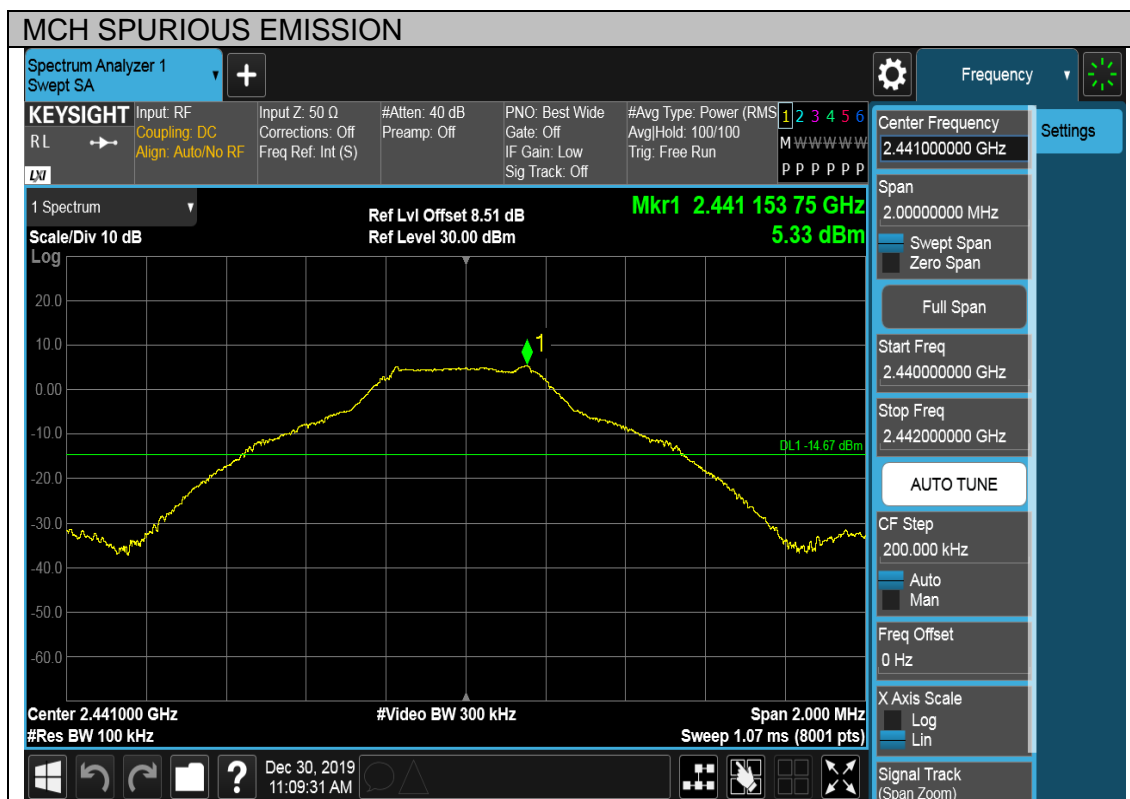


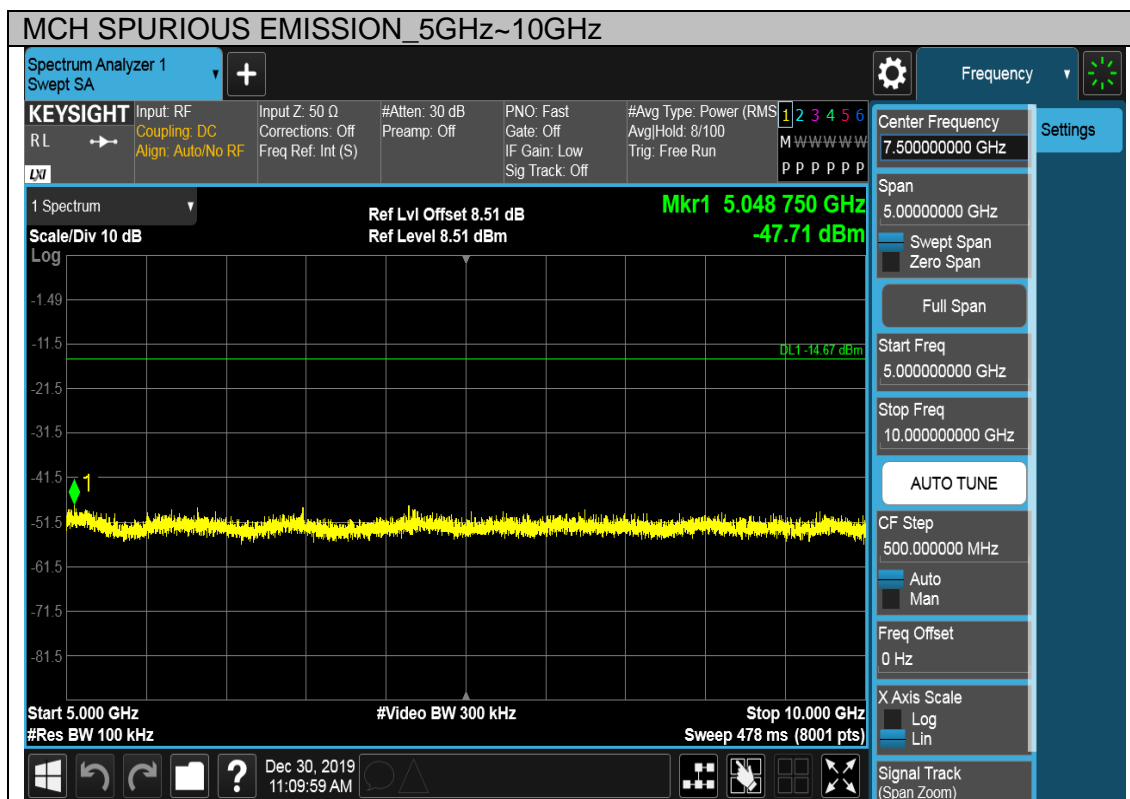
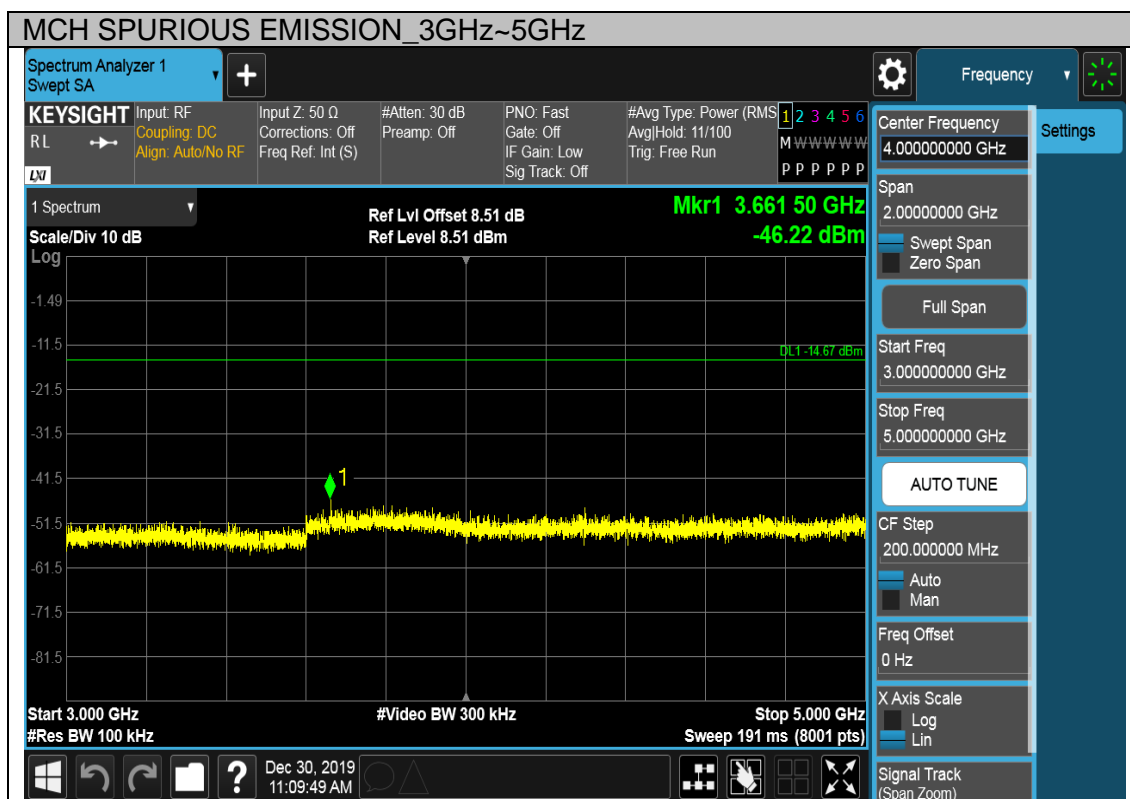


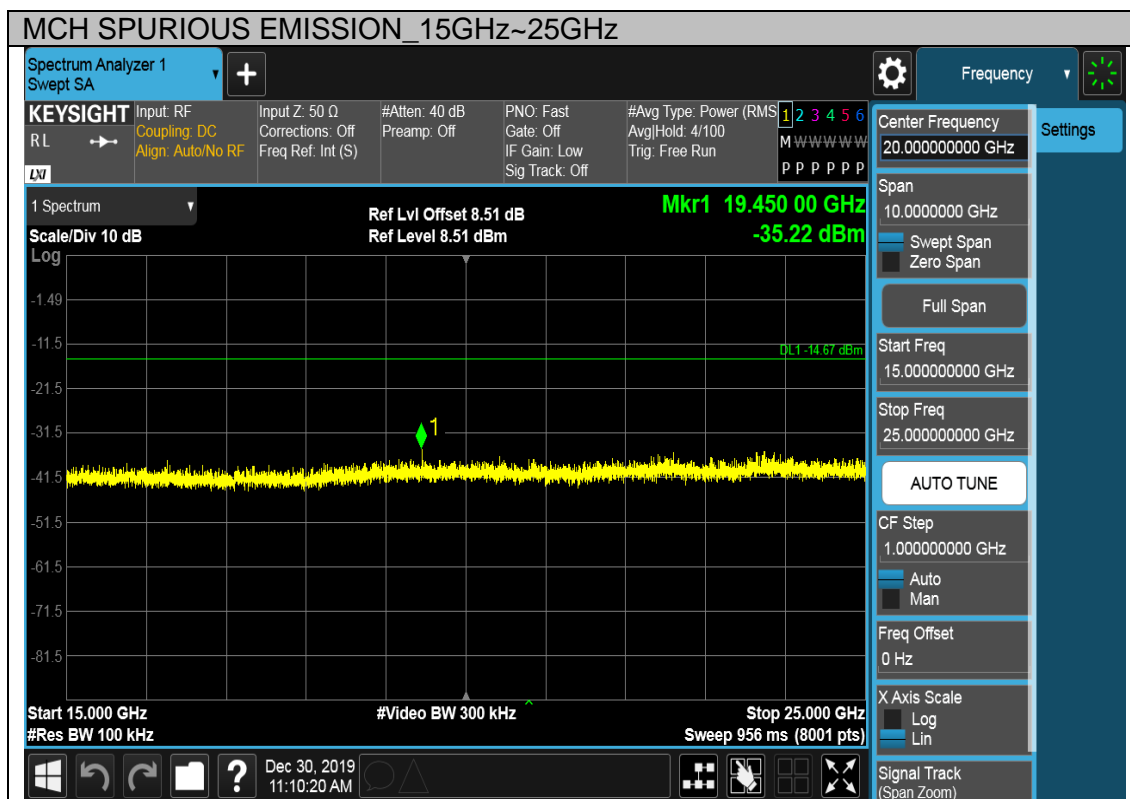
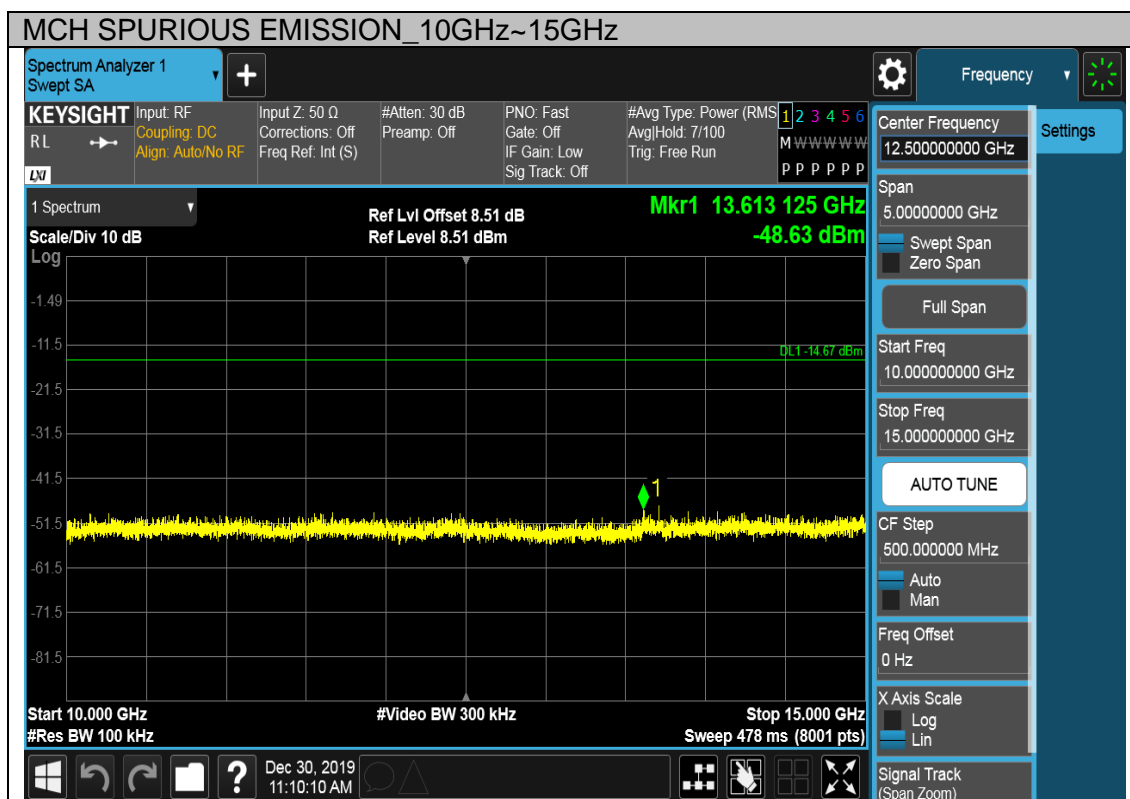




SPURIOUS EMISSIONS, MID CHANNEL

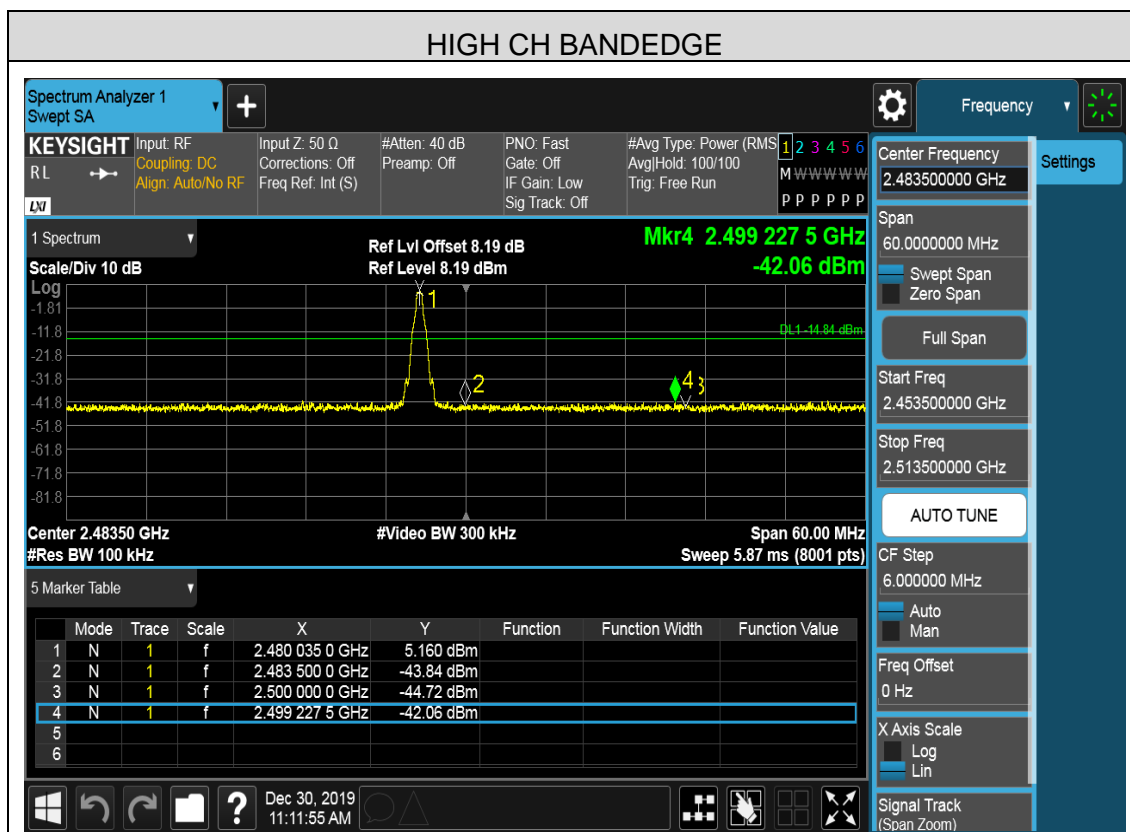


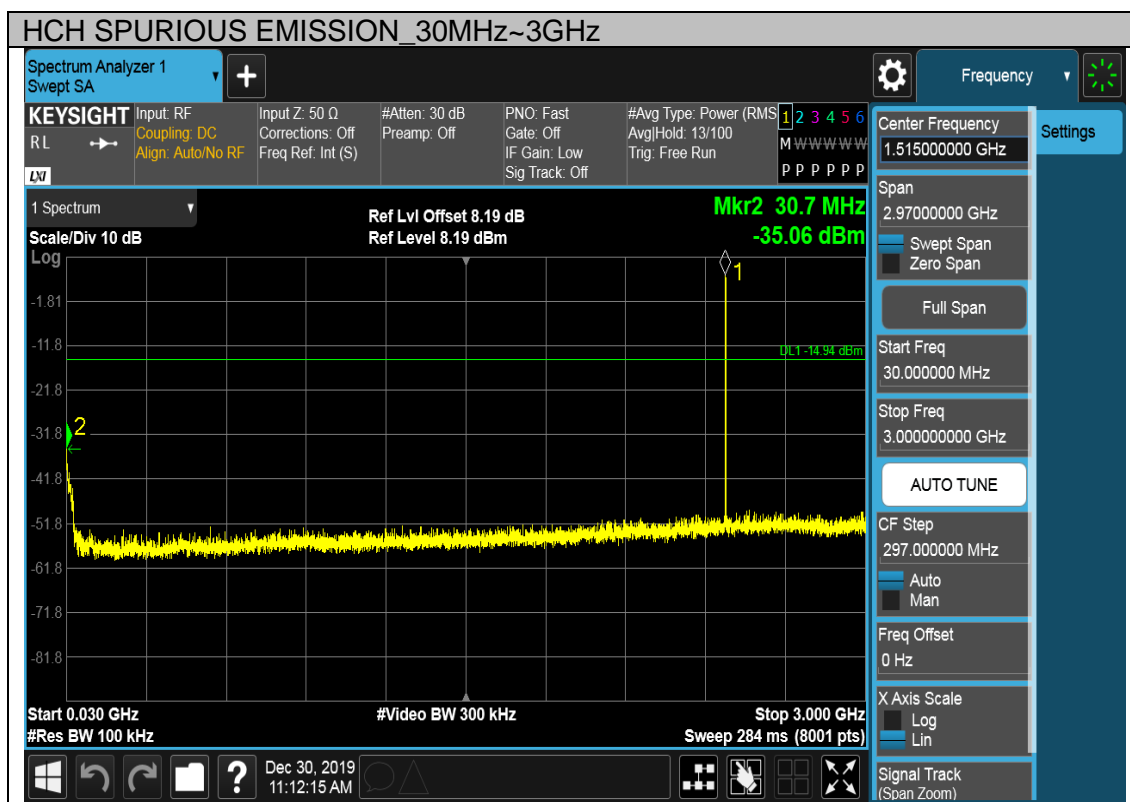
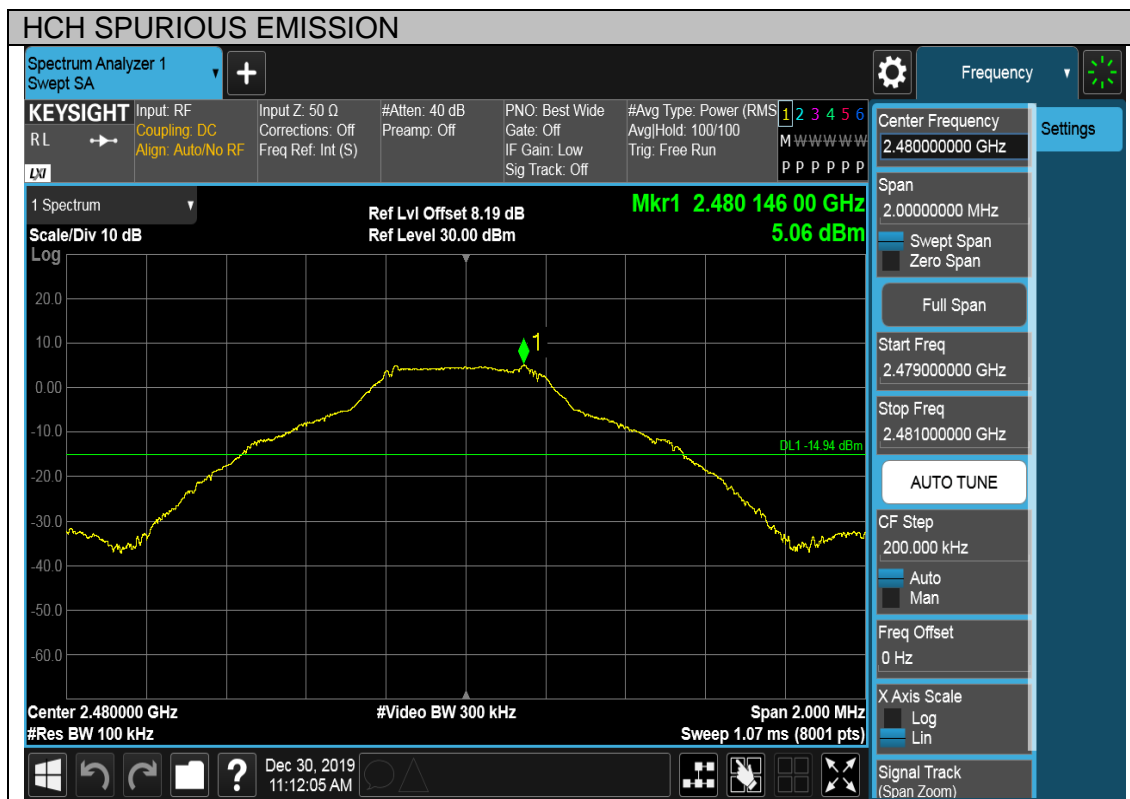


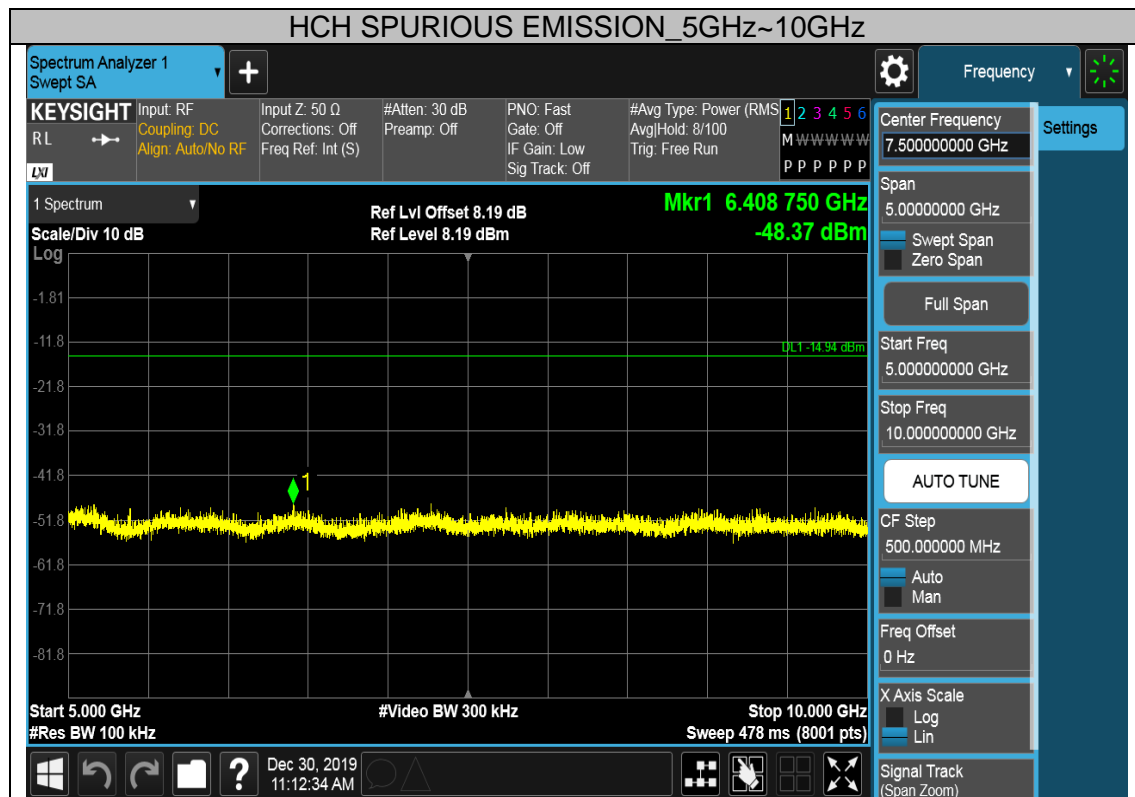
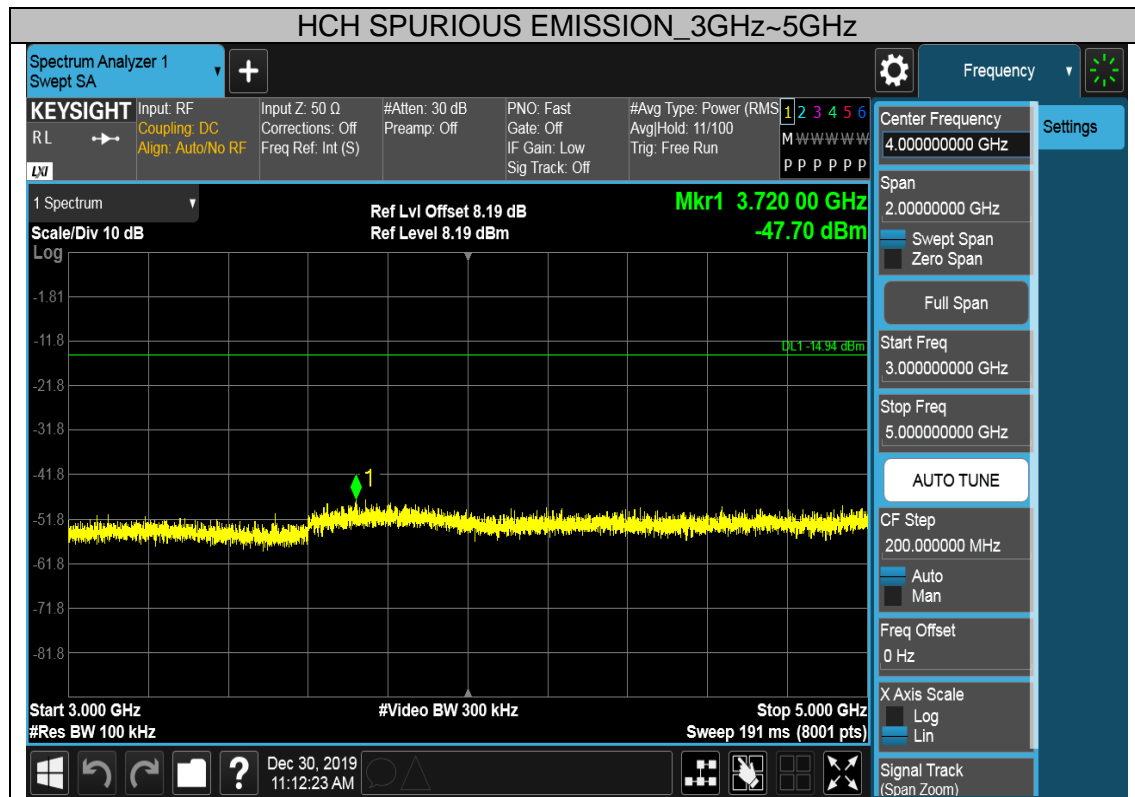


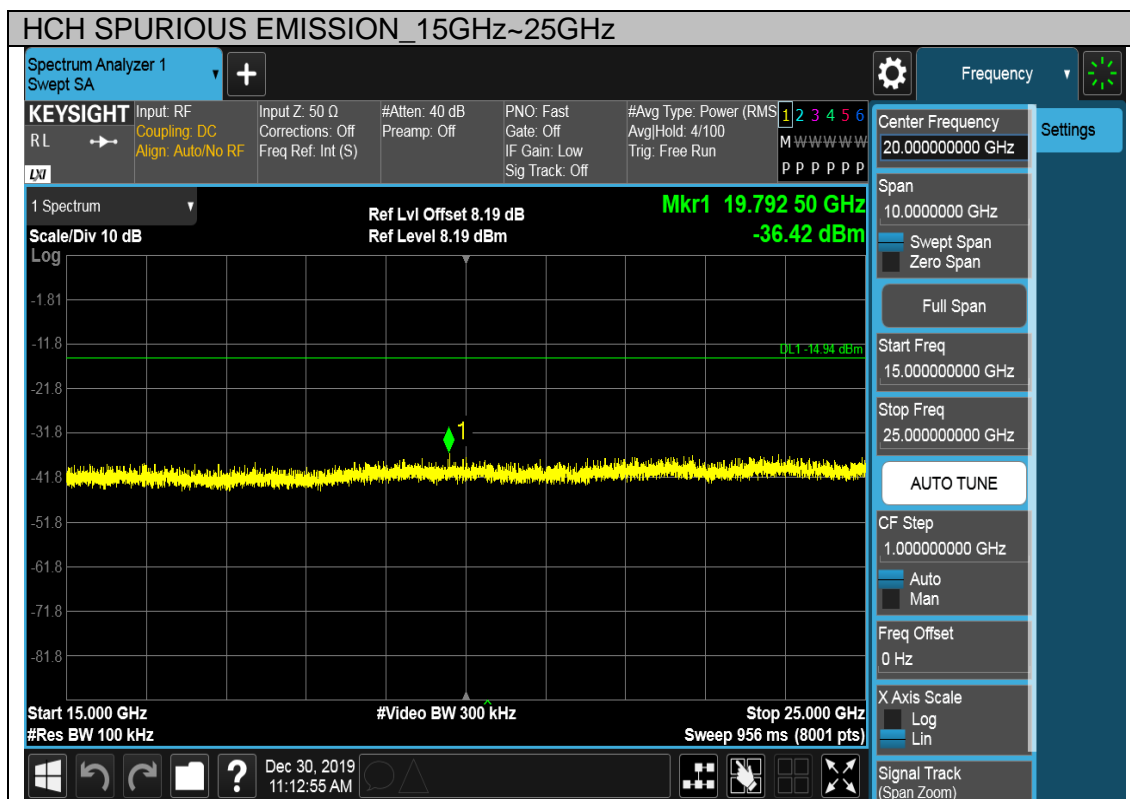
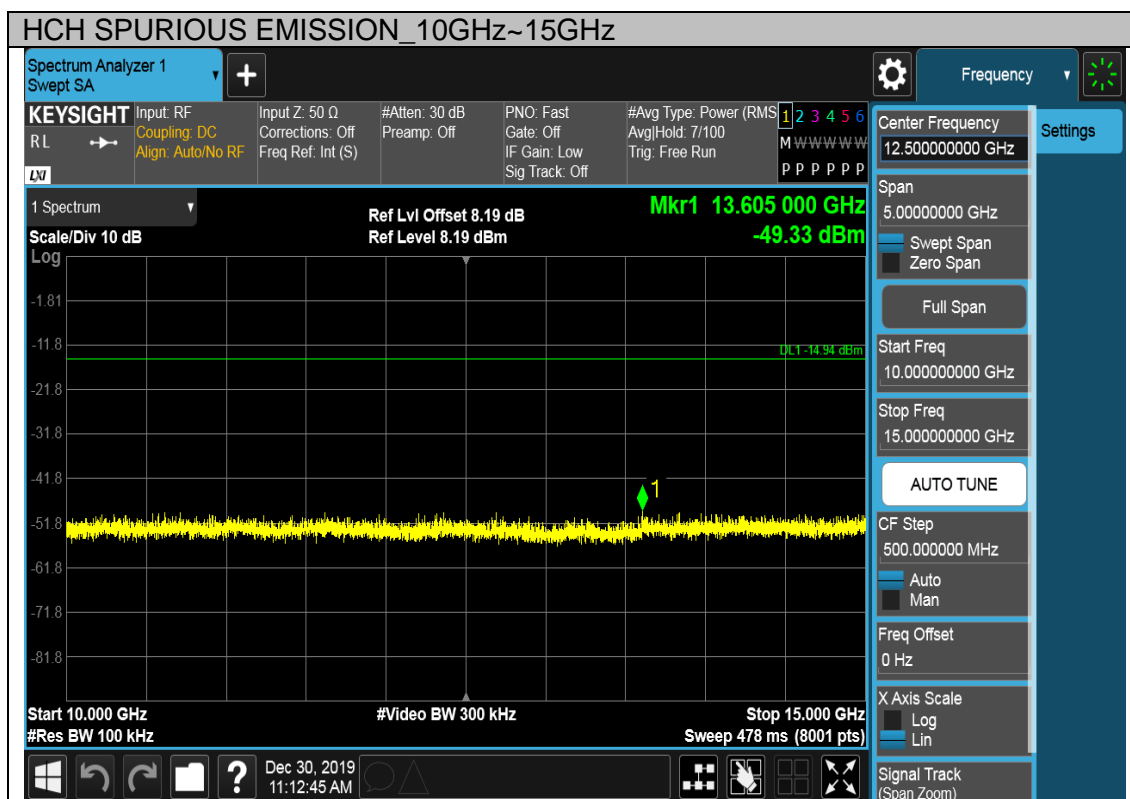


SPURIOUS EMISSIONS, HIGH CHANNEL











SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

