



FCC 47 CFR PART 15 SUBPART C
CERTIFICATION TEST REPORT

For

Seura Outdoor Entertainment

MODEL NUMBER: SHD2-55

FCC ID: 2AVE3SHD3-55A

PROJECT NUMBER: 4789257350

REPORT NUMBER: 4789257350-5

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Prepared for

PAN International (USA)

Prepared by

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Revision History

Rev.	Issue Date	Revisions	Revised By
V0	04/02/2020	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	Complied
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.			



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1. ATTESTATION OF TESCT RESULTS

Applicant Information

Company Name: PAN International (USA)
Address: 48008 Fremont Blvd Fremont, CA 94538 United States

Manufacturer Information

Company Name: PAN International (USA)
Address: 48008 Fremont Blvd Fremont, CA 94538 United States

EUT Description

Product Name Seura Outdoor Entertainment
Model Name SHD2-55
Sample Status Normal
Sample Received date Dec 12, 2019
Date Tested Dec 12, 2019 ~ Apr 15, 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 KDB 558074 D01 15.247 Meas Guidance v05r02, 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	A2LA (Certificate No.: 4829.01) UL-CCIC COMPANY LIMITED has been assessed and proved to be in compliance with A2LA. 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. 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.
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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	Seura Outdoor Entertainment		
Model Name	SHD2-55		
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]	5.69
8DPSK	2402-2480	0-78[79]	8.38

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		SecureCRT		
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	Patch 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	RS232	USB	USB to RS232	1	N/A
2	HDMI	HDMI	HDMI Cable	1	N/A
3	LAN	LAN	LAN	1	N/A
4	USB	USB	USB	1	N/A

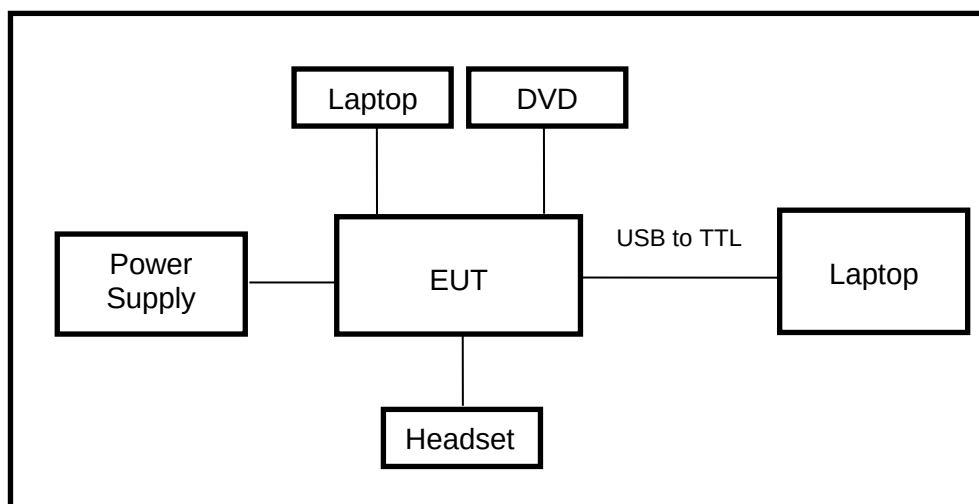
ACCESSORY

Item	Accessory	Brand Name	Model Name	Description
1	Headset	Logitech	H111	N/A
2	DVD	Philips	DVP3690K/93	N/A
3	Laptop	ThinkPad	E580	N/A
4	Laptop	ThinkPad	E550c	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.
☒	EMI Test Receiver	R&S	ESR3	126700	2018-12-13	2019-12-12	2020-12-11
☒	Two-Line V-Network	R&S	ENV216	126701	2018-12-13	2019-12-12	2020-12-11
☒	Artificial Mains Networks	R&S	ENY81	126711	2018-12-13	2019-12-12	2020-12-11
Software							
Used	Description		Manufacturer	Name	Version		
☒	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.
☒	Spectrum Analyzer	Keysight	N9010B	MY57110128	2018-05-30	2019-05-29	2020-05-28
☒	EMI test receiver	R&S	ESR26	1267603	2018-12-13	2019-12-12	2020-12-11
☒	Receiver Antenna (9kHz-30MHz)	Schwarzbeck	FMZB 1513	513-265	2018-06-17	2019-06-16	2020-06-15
☒	Receiver Antenna (30MHz-1GHz)	SunAR RF Motion	JB1	126704	N/A	2019-01-28	2022-01-27
☒	Receiver Antenna (1GHz-18GHz)	R&S	HF907	126705	2019-01-26	2020-01-25	2021-01-24
☒	Receiver Antenna (18GHz-26.5GHz)	Schwarzbeck	BBHA9170	126706	2019-02-06	2020-02-05	2021-02-04
☒	Pre-amplification (To 18GHz)	Compliance Direction System Inc.	PAP-1G18-50	14140-13467	2019-02-06	2020-02-05	2021-02-04
☒	Pre-amplification (To 26.5GHz)	R&S	SCU-26D	134668	2019-03-18	2020-03-17	2021-03-16
☒	Band Reject Filter	Wainwright	WRCJV8-2350-2400-2483.5-2533.5-40SS	1	2019-02-06	2020-02-05	2021-02-04
☒	Highpass Filter	Wainwright	WHKX10-2700-3000-18000-40SS	2	2018-05-30	2019-05-29	2020-05-28
Software							
Used	Description		Manufacturer	Name	Version		
☒	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.
☒	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

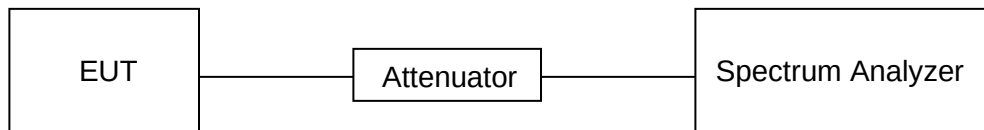
LIMITS

None; for reporting purposes only

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method

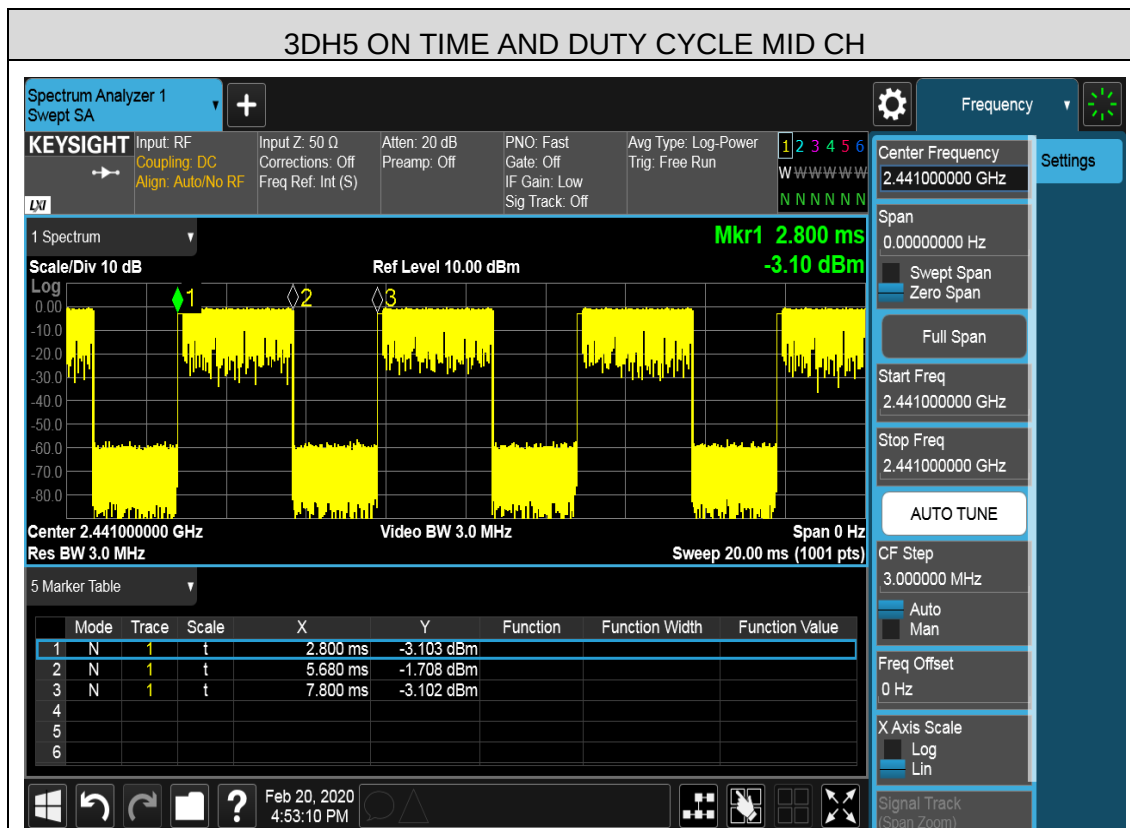
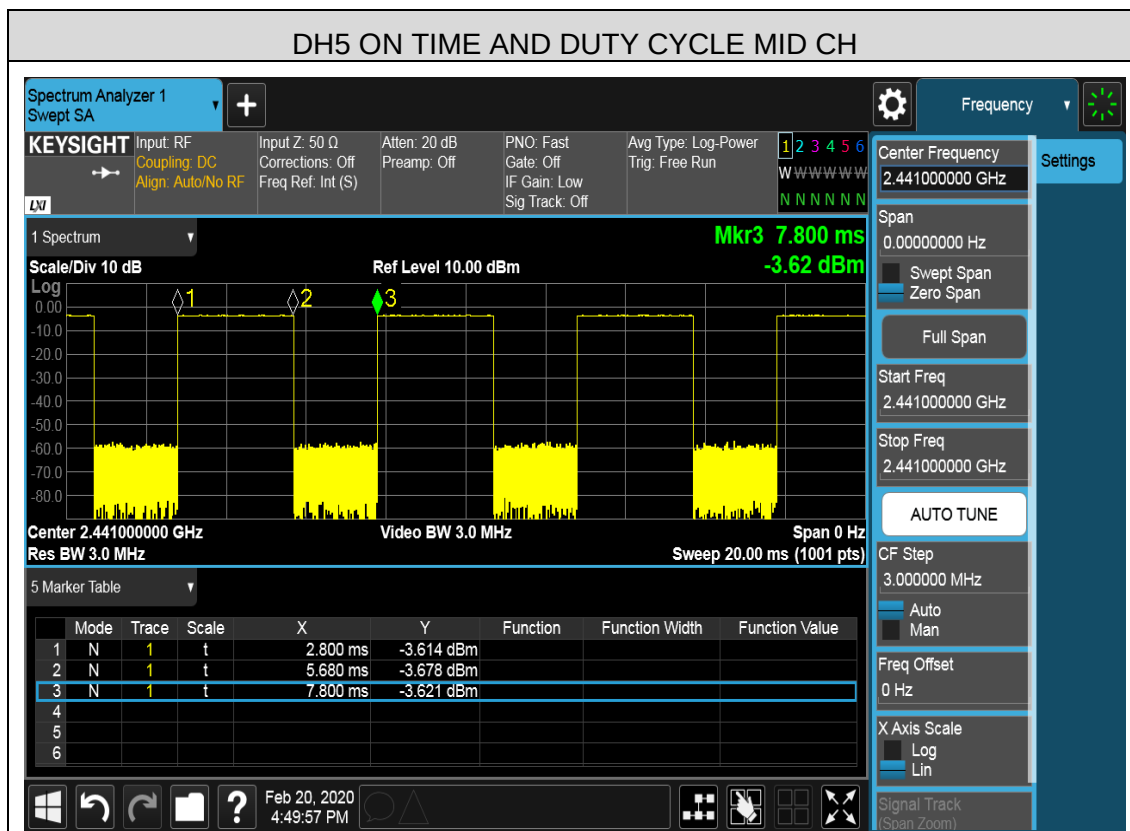
TEST SETUP



RESULTS

Mode	On Time (msec)	Period (msec)	Duty Cycle x (Linear)	Duty Cycle (%)	Duty Cycle Correction Factor (db)	1/T Minimum VBW (KHz)
GFSK	2.88	5.00	0.576	57.6%	2.40	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	N/A	2400-2483.5

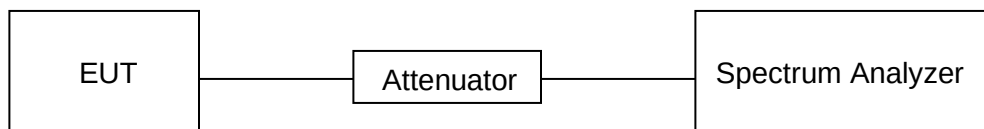
TEST PROCEDURE

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



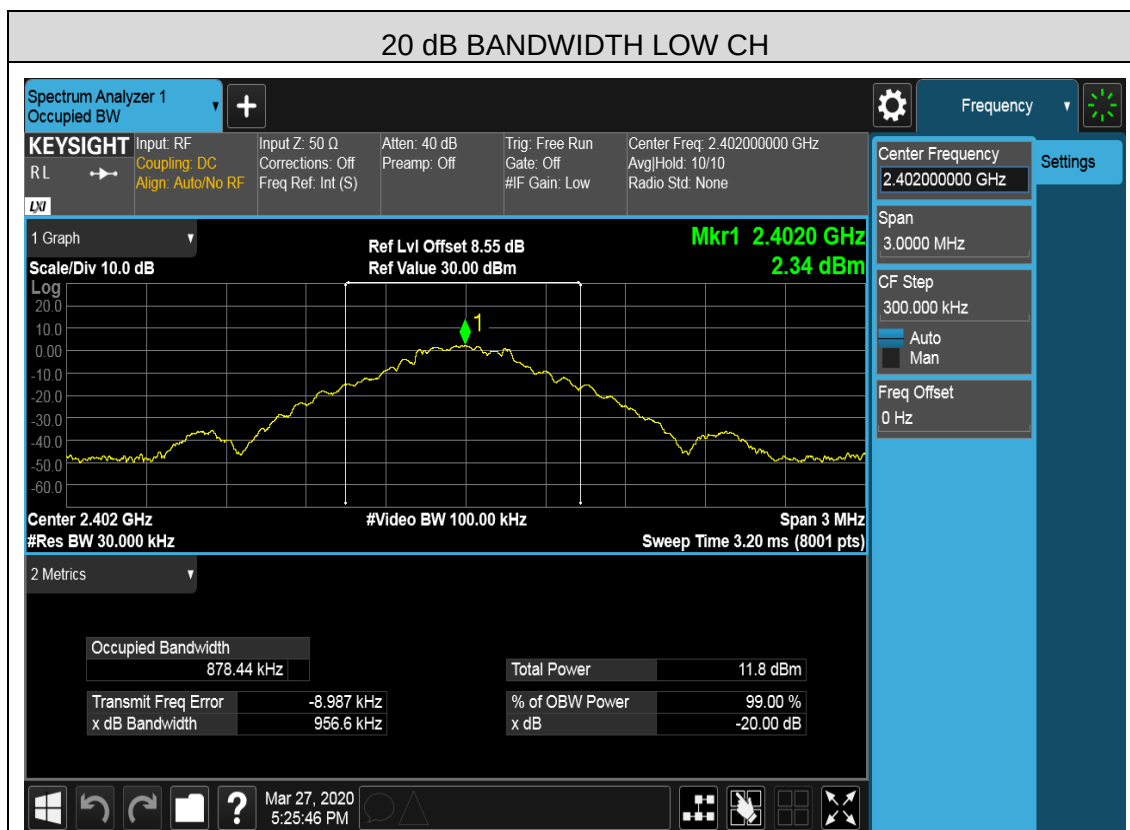


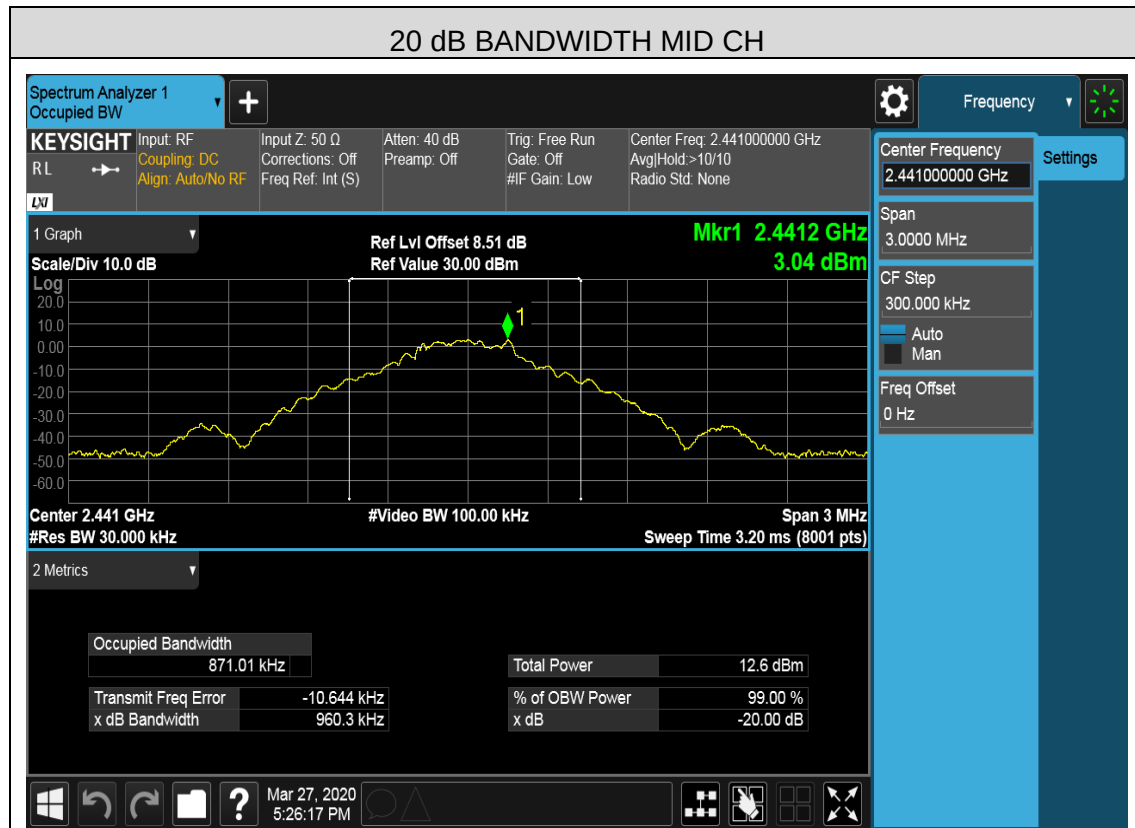
RESULTS

6.2.1. GFSK MODE

Channel	Frequency (MHz)	20dB bandwidth (MHz)	Result
Low	2402	0.9566	PASS
Middle	2441	0.9603	PASS
High	2480	0.9620	PASS

Test Graph

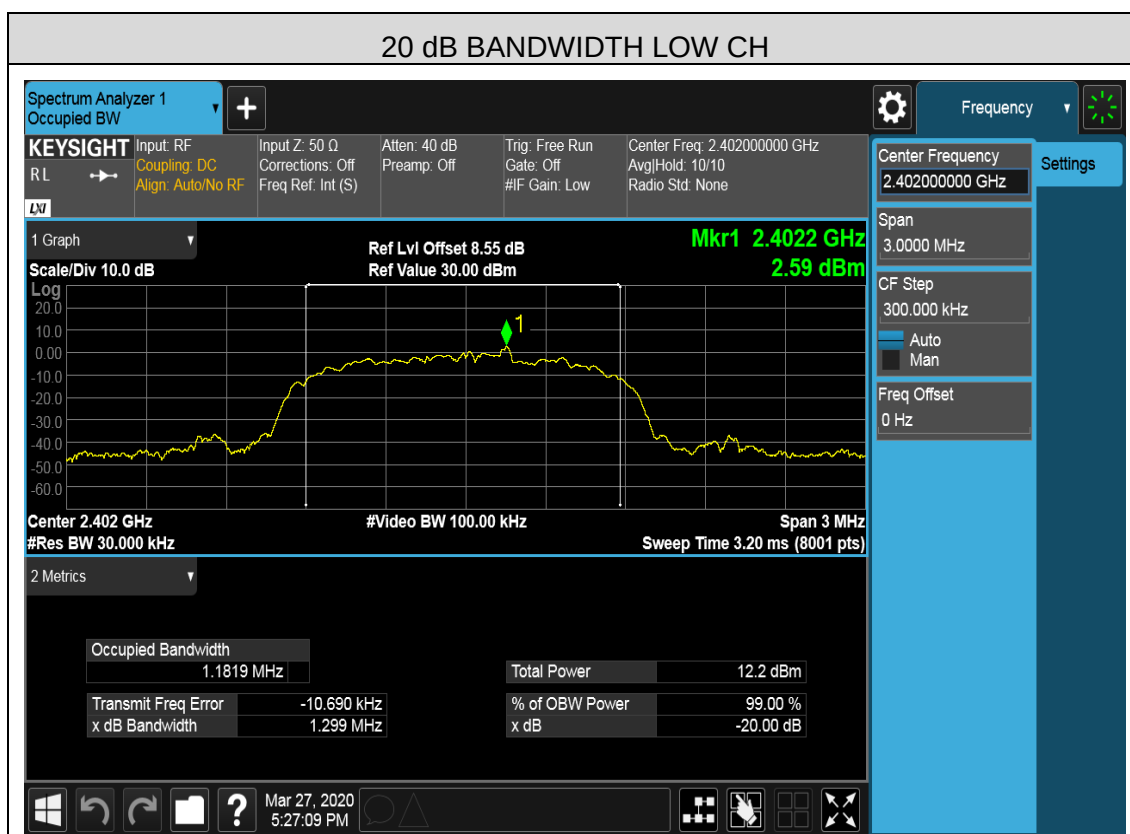


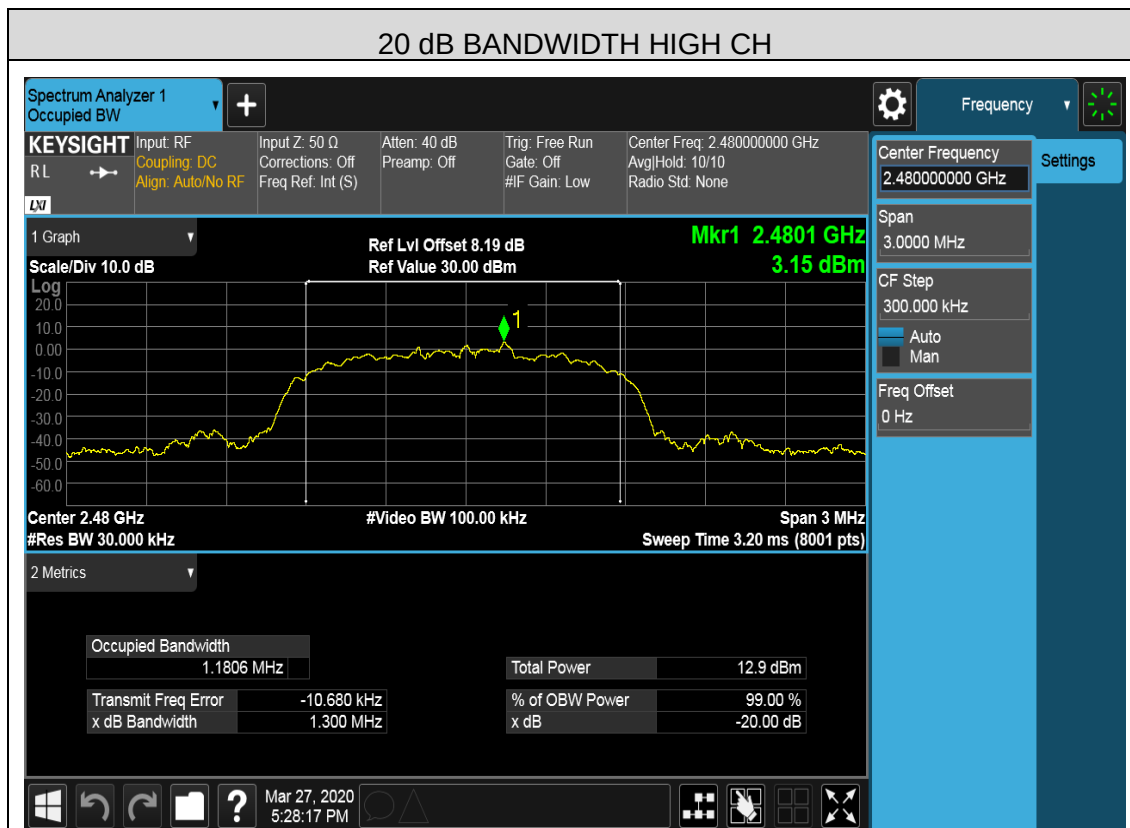
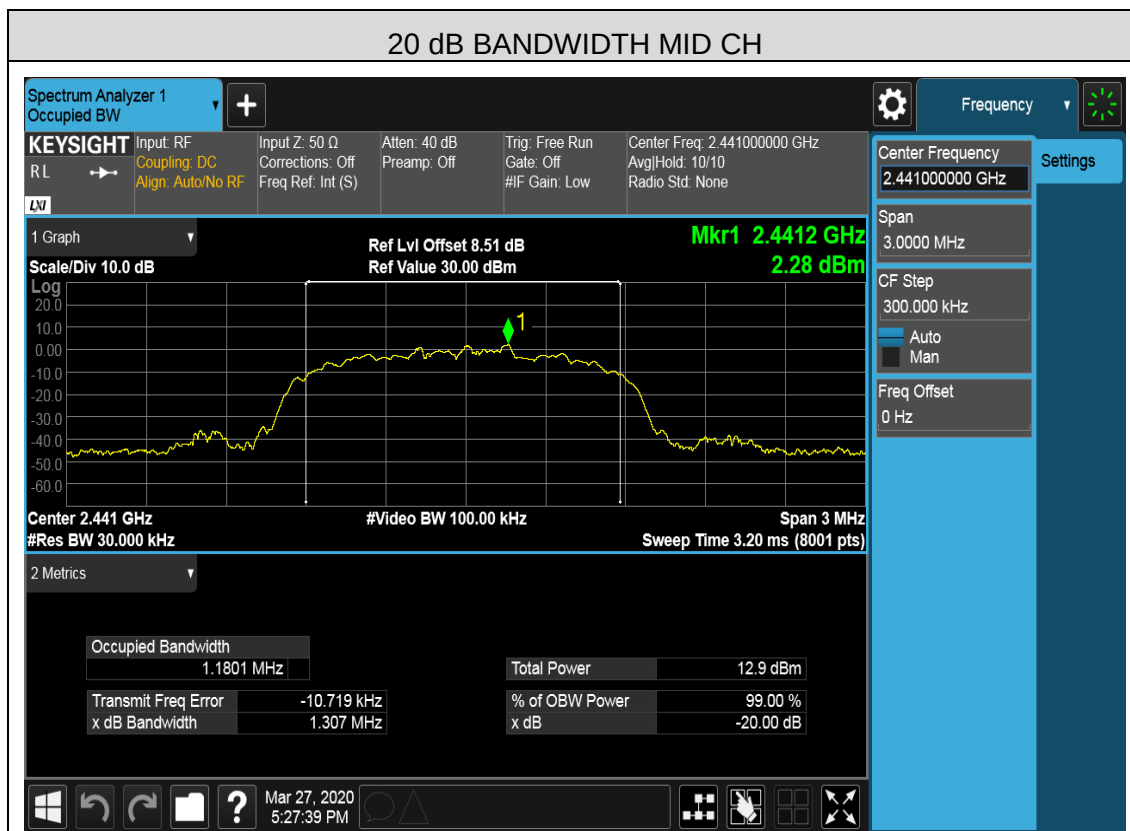


6.2.2. 8DPSK MODE

Channel	Frequency (MHz)	20dB bandwidth (MHz)	Result
Low	2402	1.299	PASS
Middle	2441	1.307	PASS
High	2480	1.300	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	Hopping channel carrier frequencies separated by a minimum of 25KHz or the 20dB bandwidth of the hopping channel: 1 watt or 30dBm; Hopping channel carrier frequencies that are separated by 25KHz or two-thirds of the 20 dB bandwidth of hopping channel: 125mW or 21dBm	2400-2483.5

TEST PROCEDURE

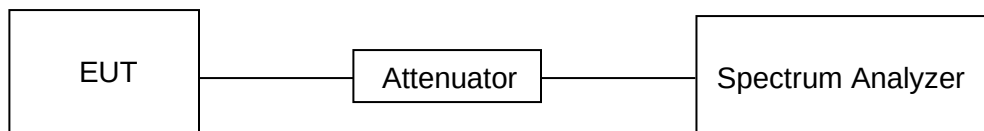
Disable the hopping function, connect the UUT to the spectrum Analyzer and use the following settings:

Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	≥ 20 dB bandwidth of the emission being measured
VBW	≥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

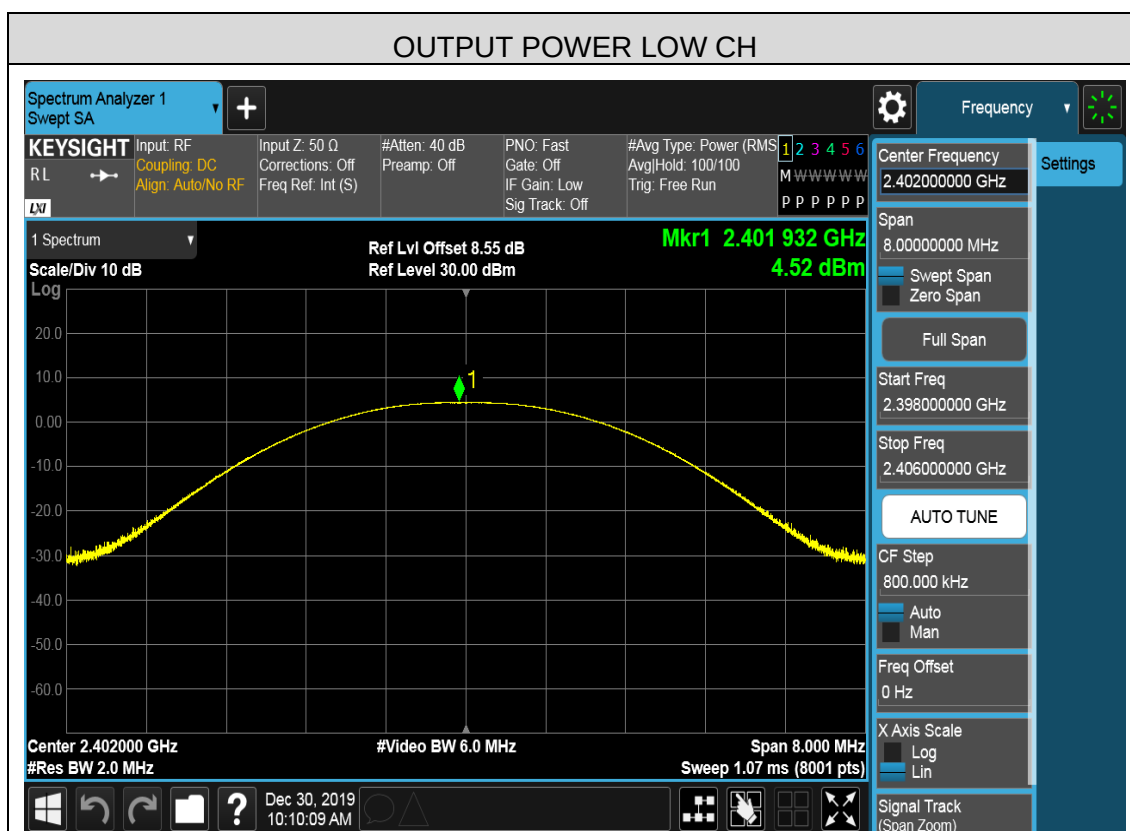
for peak power measurement:

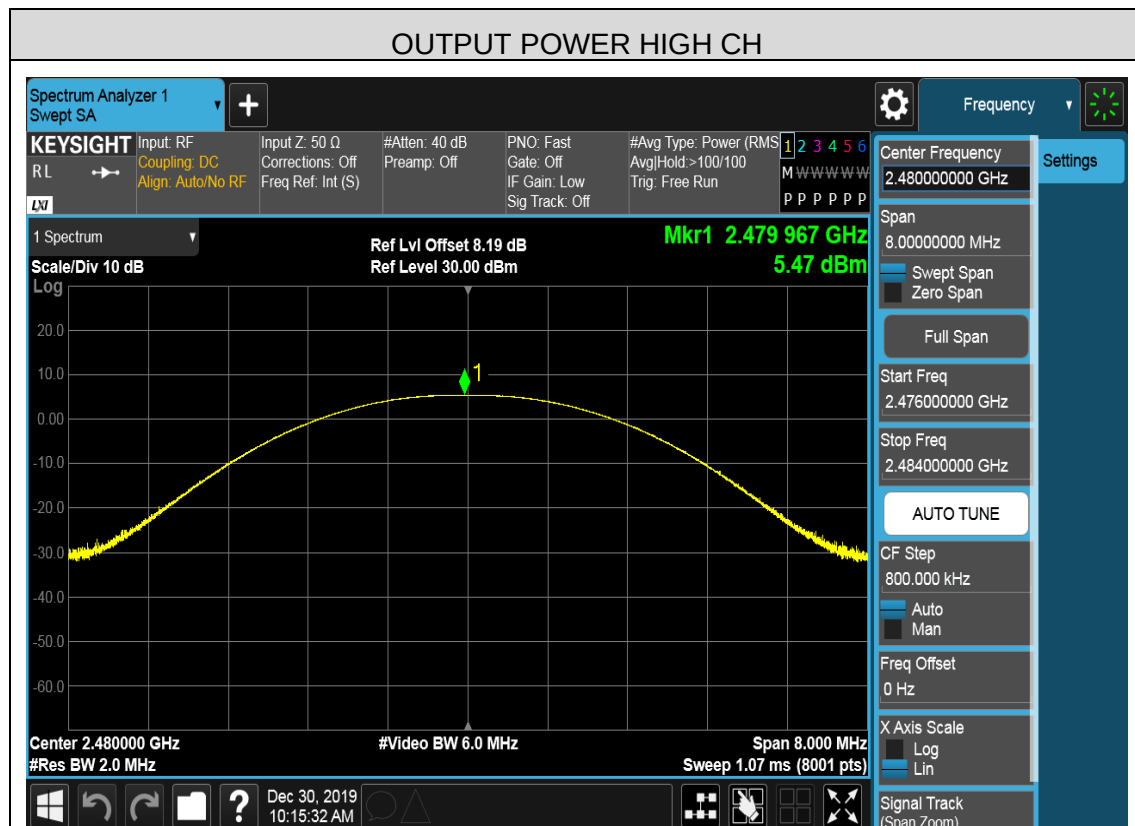
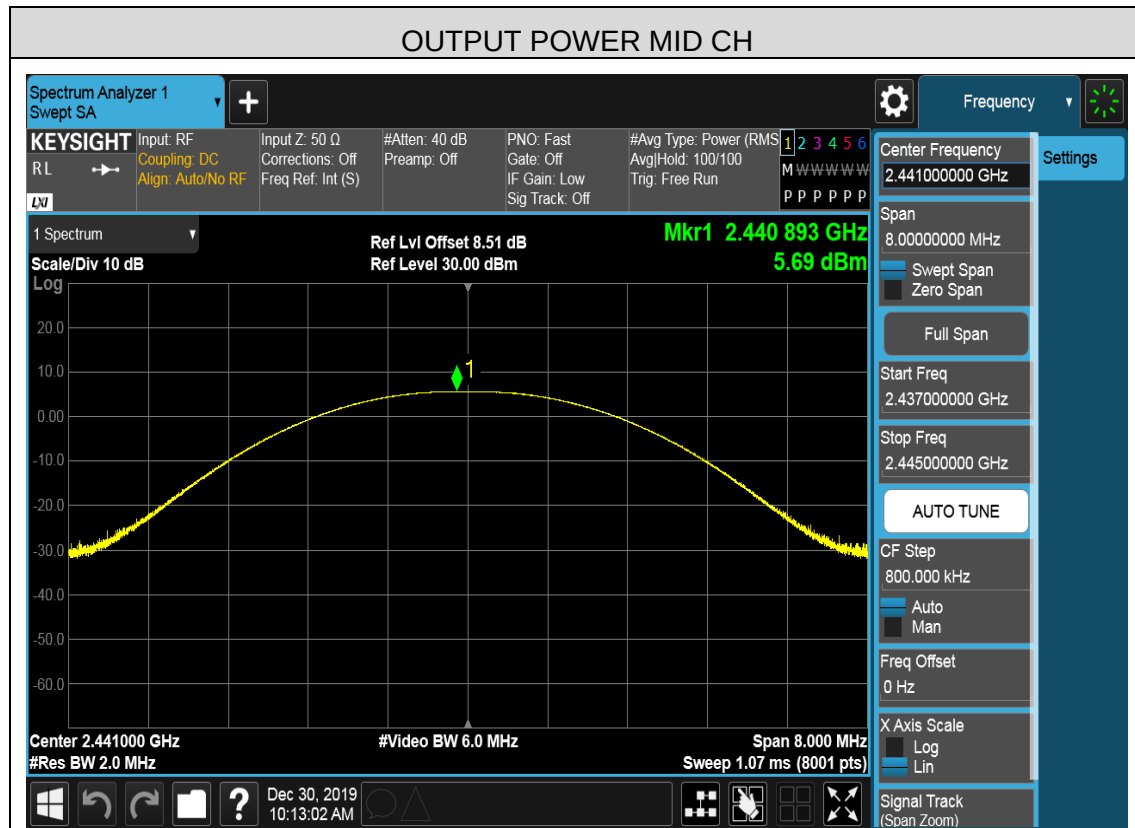


RESULTS

6.3.1. GFSK MODE

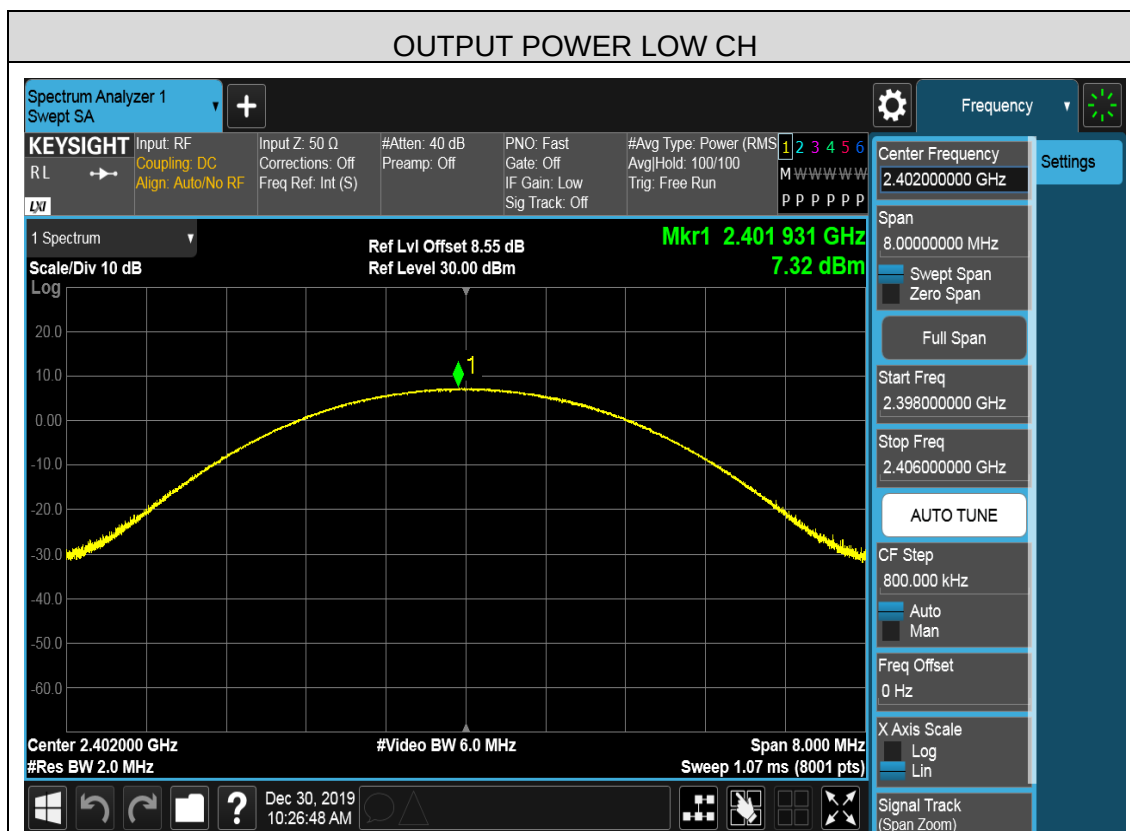
Channel	Frequency	Maximum PK Conducted Output Power	Result
	(MHz)	(dBm)	
Low	2402	4.52	Pass
Middle	2441	5.69	Pass
High	2480	5.47	Pass

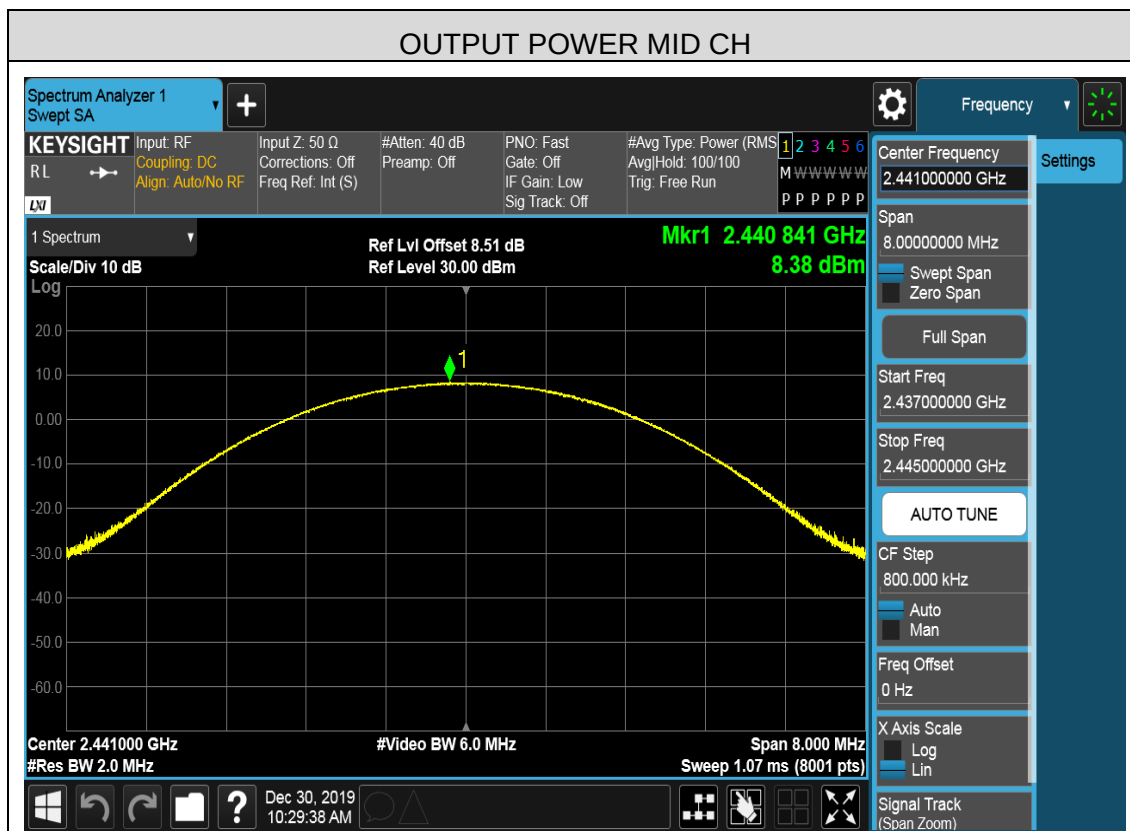




6.3.2. 8DPSK MODE

Channel	Frequency	Maximum PK Conducted Output Power	Result
	(MHz)	(dBm)	
Low	2402	7.32	Pass
Middle	2441	8.38	Pass
High	2480	8.04	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	Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25KHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5MHz band may have hopping channel carrier frequencies that are separated by 25KHz or two-thirds of the 20 dB bandwidth of the hopping channel.	2400-2483.5

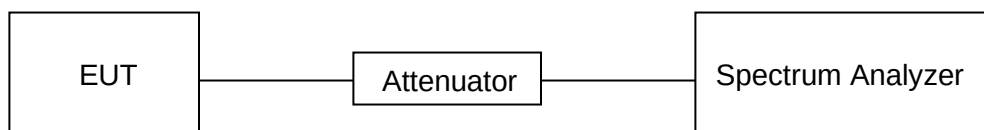
TEST PROCEDURE

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.

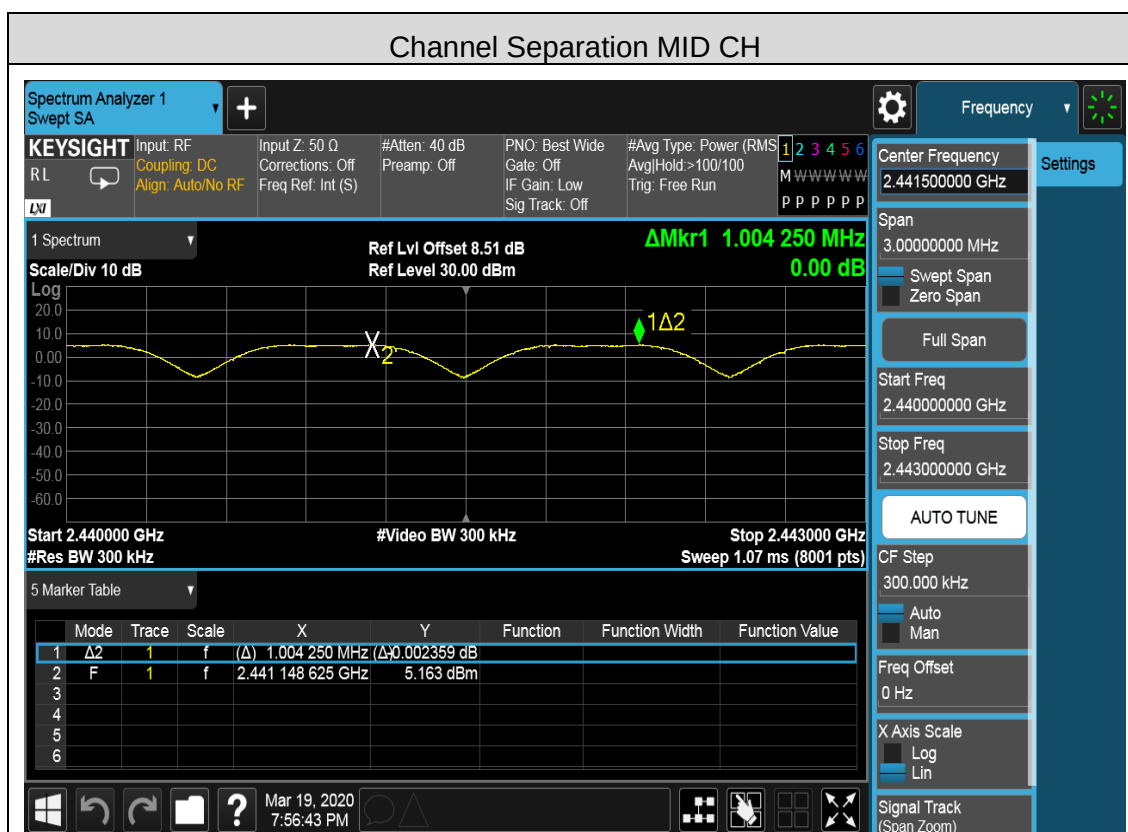
TEST SETUP



RESULTS

6.4.1. GFSK MODE

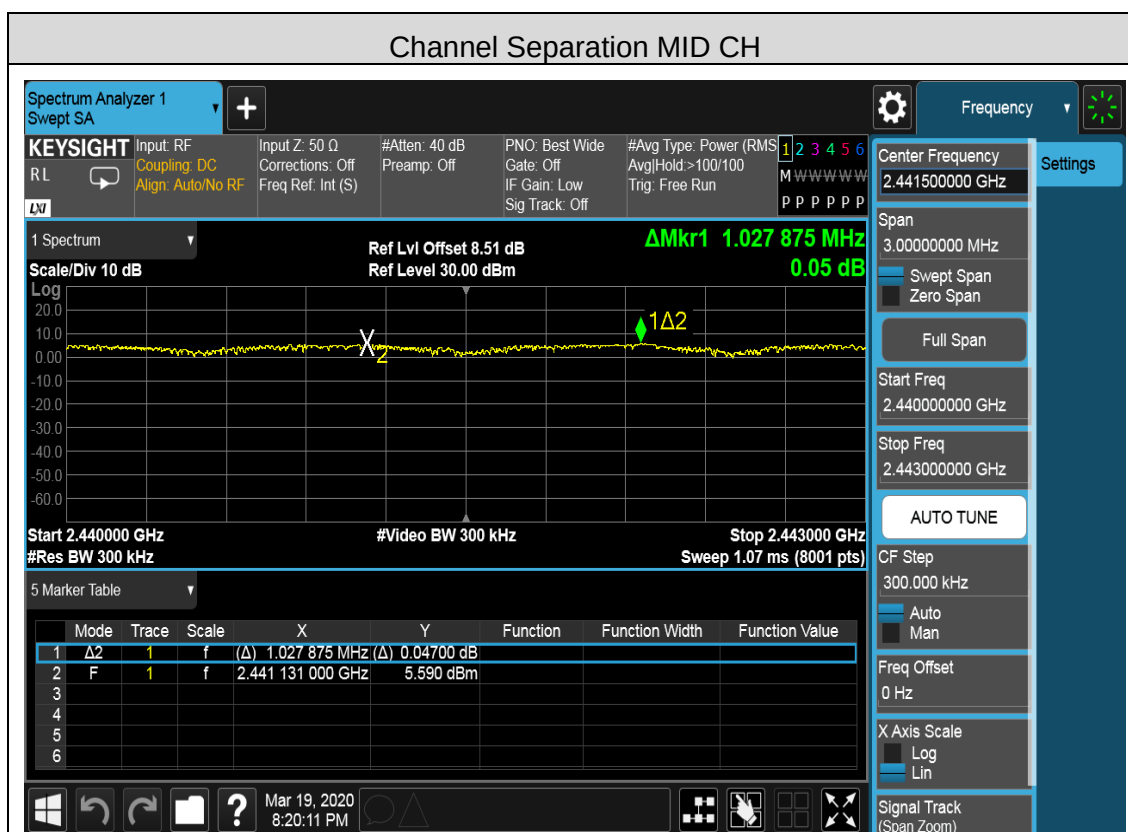
Channel	Carrier Hopping Channel Separation (MHz)	Limit (MHz)	Result
Middle	1.004250	$\geq 20\text{dB}$ Bandwidth of the hopping channel	PASS



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	1.027875	≥ 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

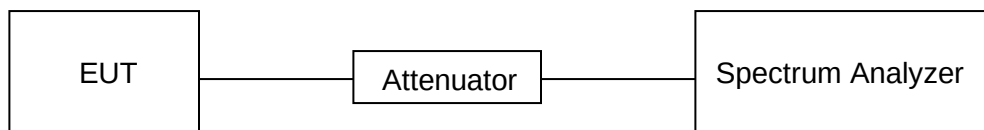
Set EUT to transmit maximum output power and switch on frequency hopping function. then set enough count time (larger than 5000 times) to get all the hopping frequency channel displayed on the screen of spectrum analyzer.

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

Normal Mode: 79 Channels observed.

AFH Mode: 20 Channels declared.

TEST SETUP

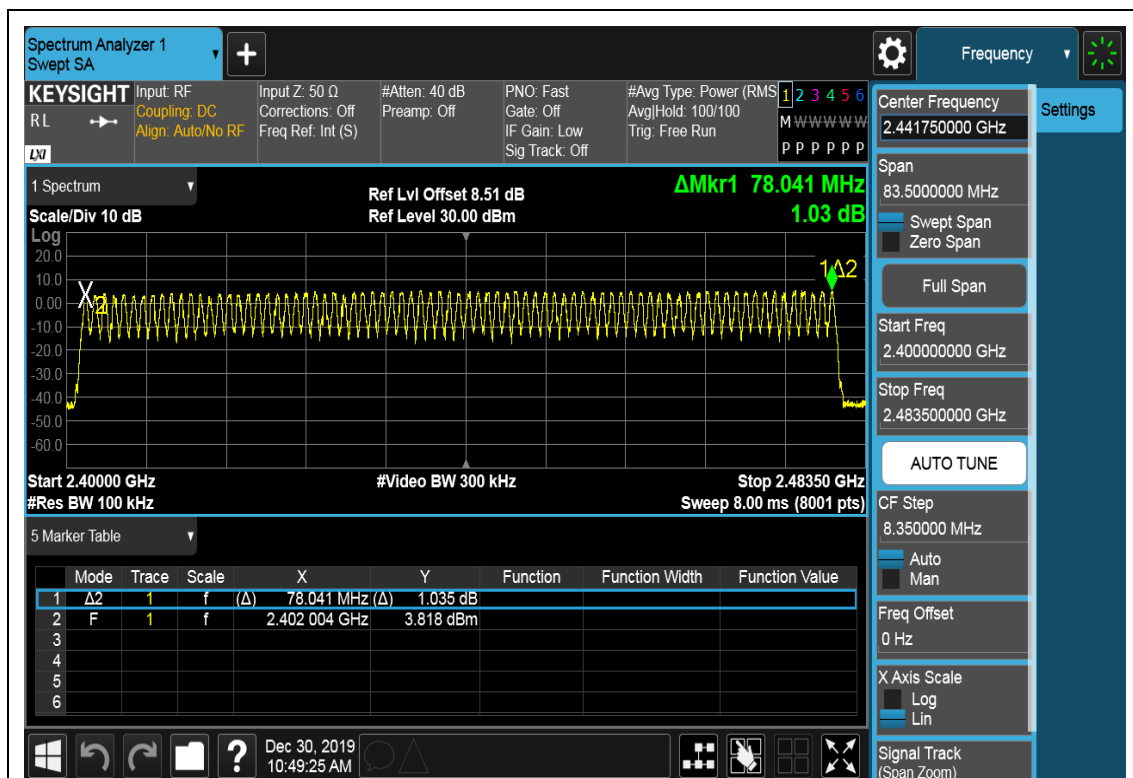




RESULTS

6.5.1. GFSK MODE

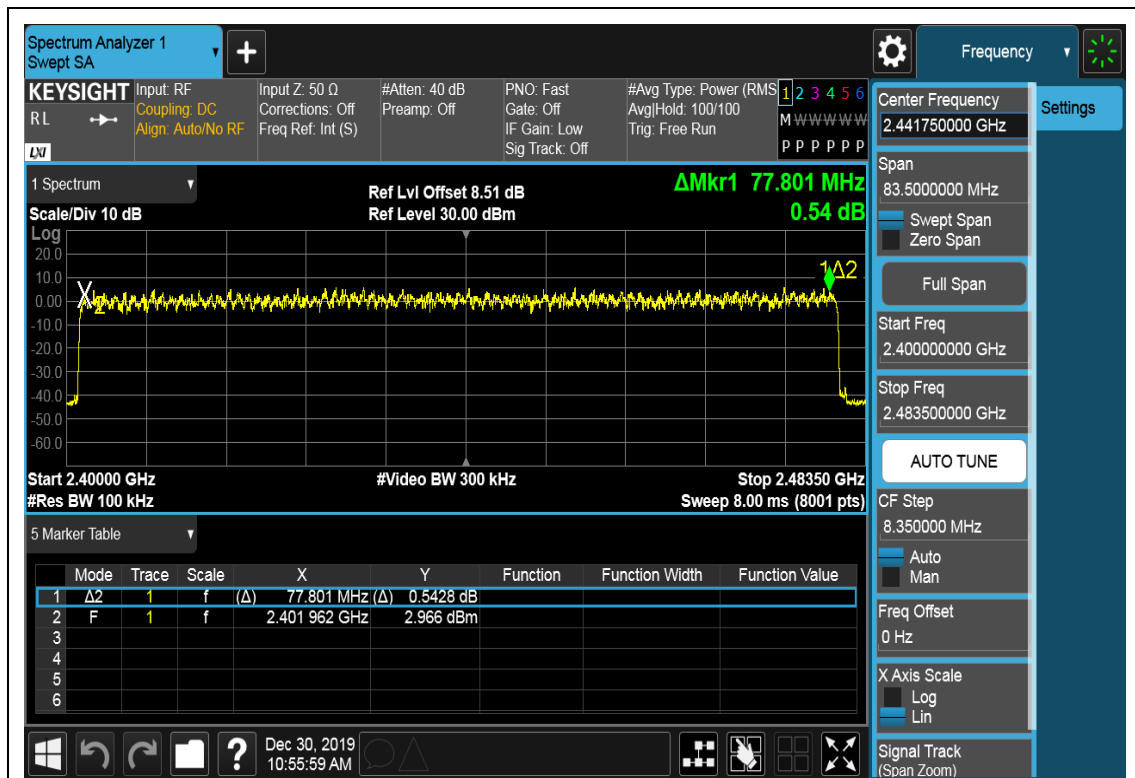
Hopping numbers	Limit	Results
79	>15	Pass





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 Period Time = (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)

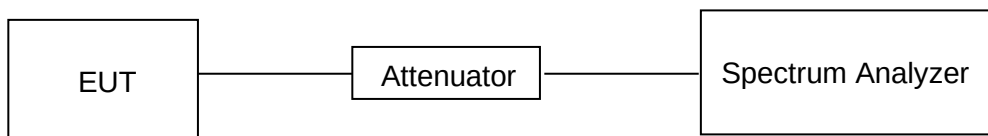
For AFH Mode (20 Channel):

DH1 Time Slot: Reading * (800/2)*8/(channel number)

DH3 Time Slot: Reading * (800/4)*8/(channel number)

DH5 Time Slot: Reading * (800/6)*8/(channel number)

TEST SETUP

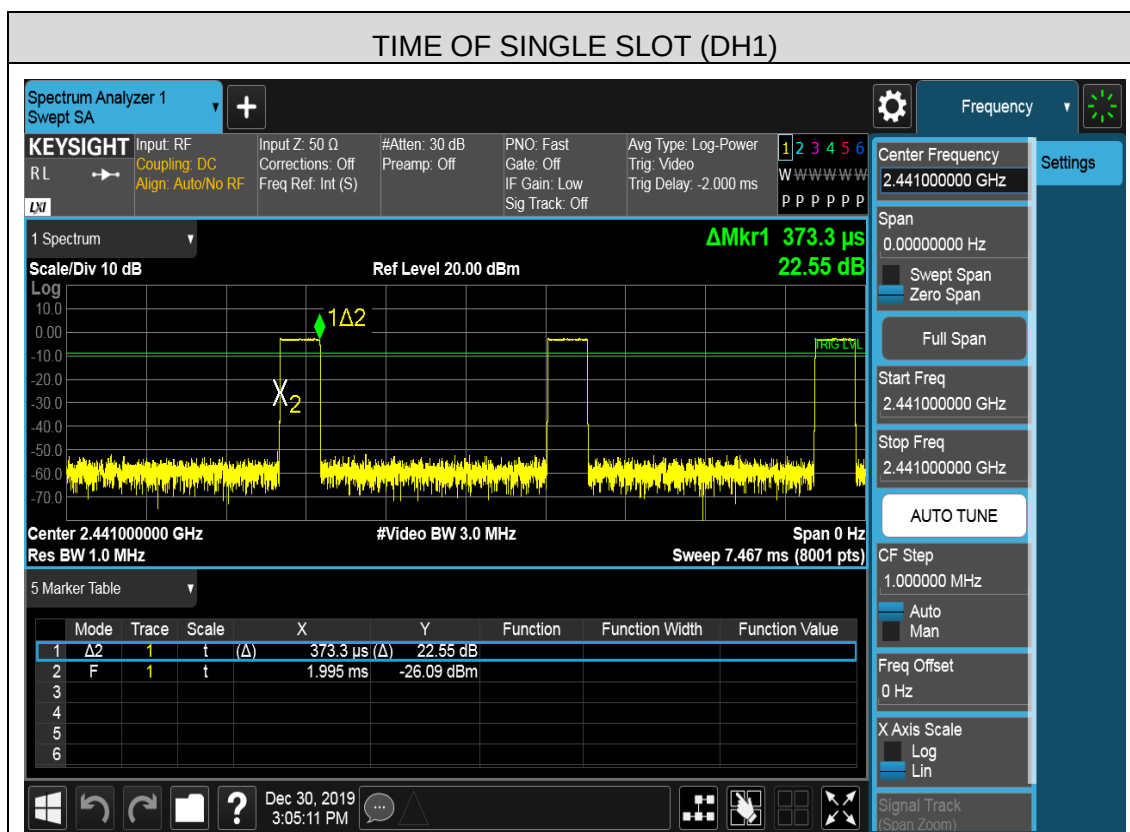


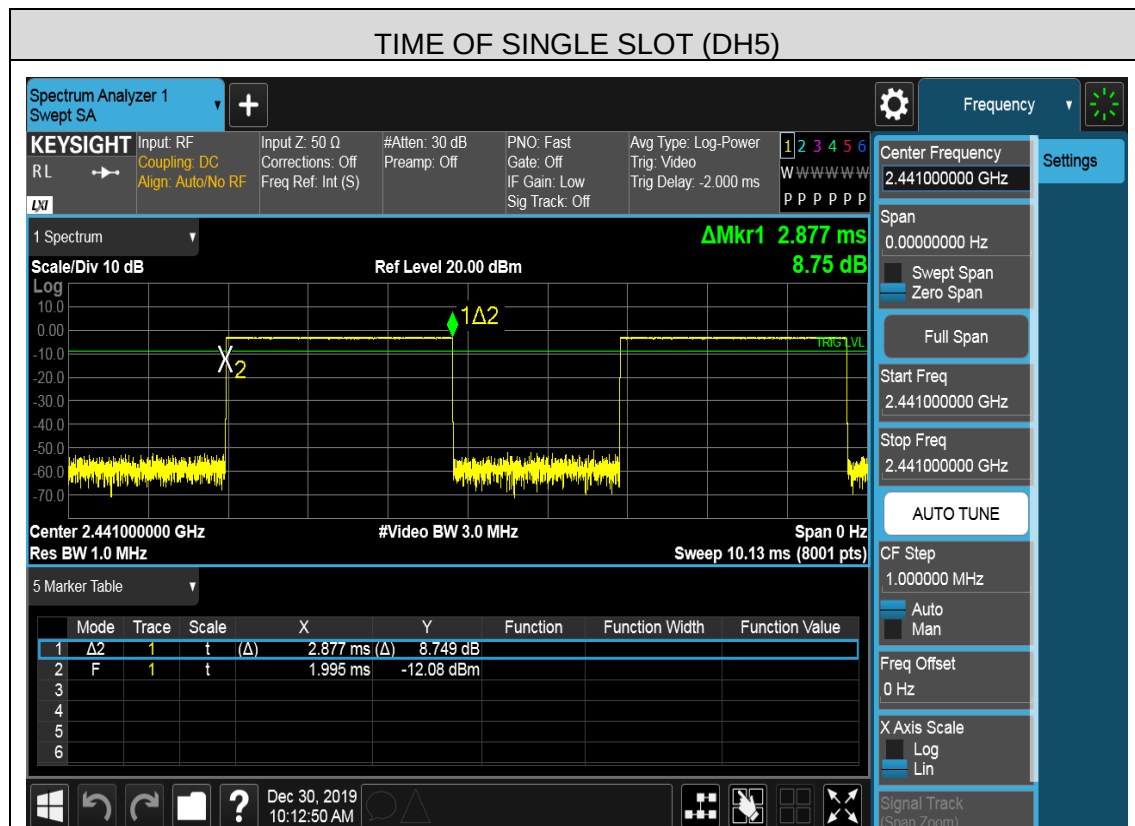
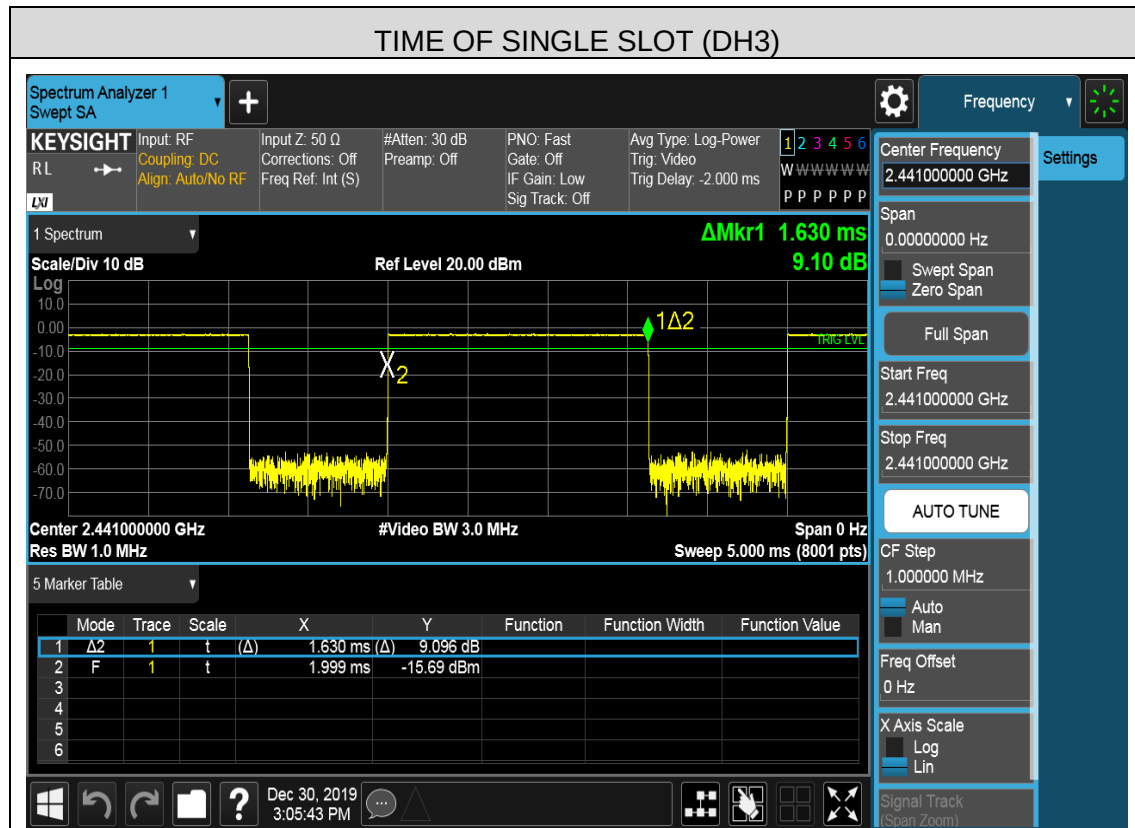
RESULTS

6.6.1. GFSK MODE

Normal Mode				
Packet	Channel	Burst Width [ms/hop/ch]	Dwell Time [s]	Results
DH1	MCH	0.3733	0.119	PASS
DH3	MCH	1.630	0.261	PASS
DH5	MCH	2.877	0.307	PASS
AFH Mode				
DH1	MCH	0.3733	0.060	PASS
DH3	MCH	1.630	0.130	PASS
DH5	MCH	2.877	0.153	PASS

Test Graph

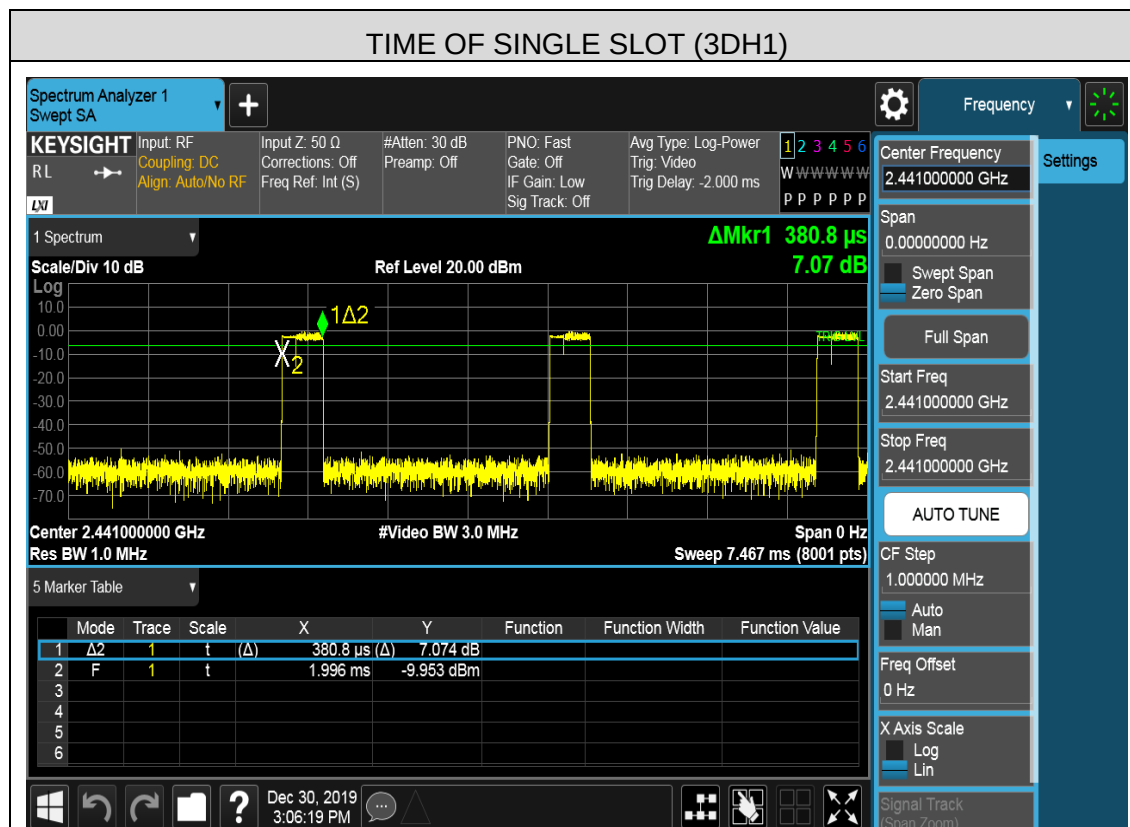


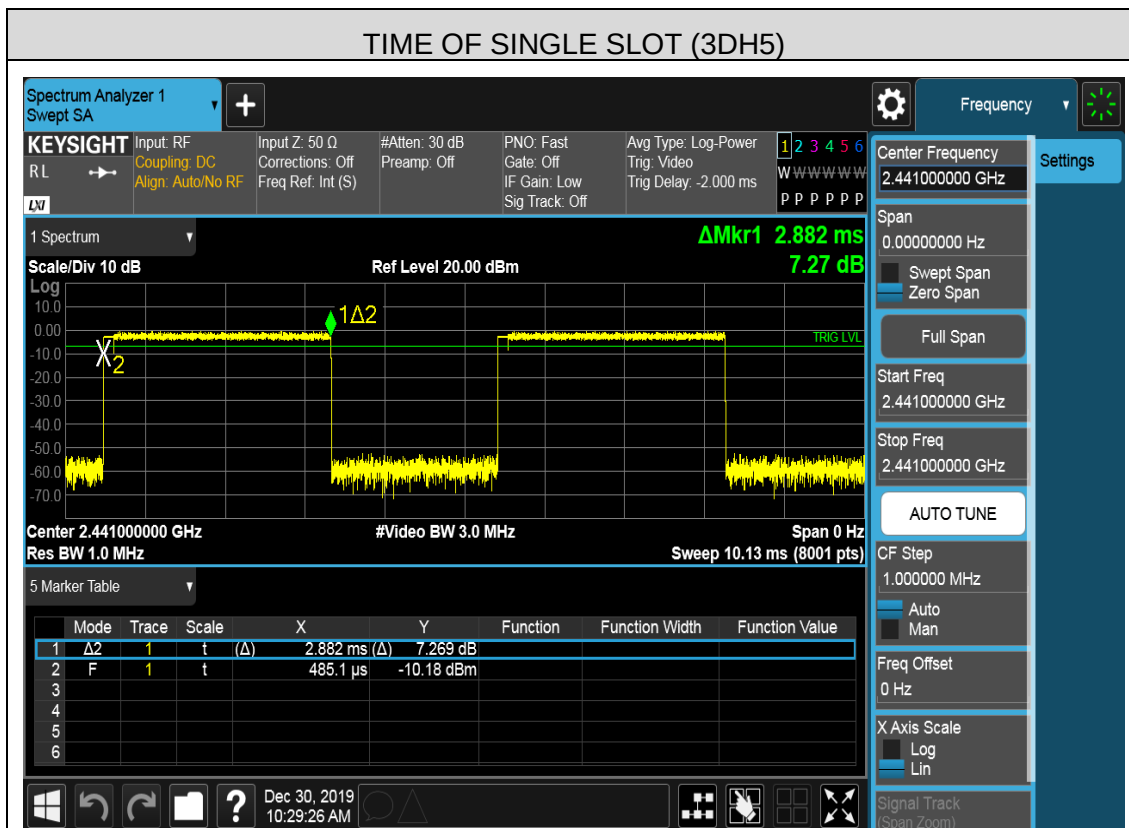
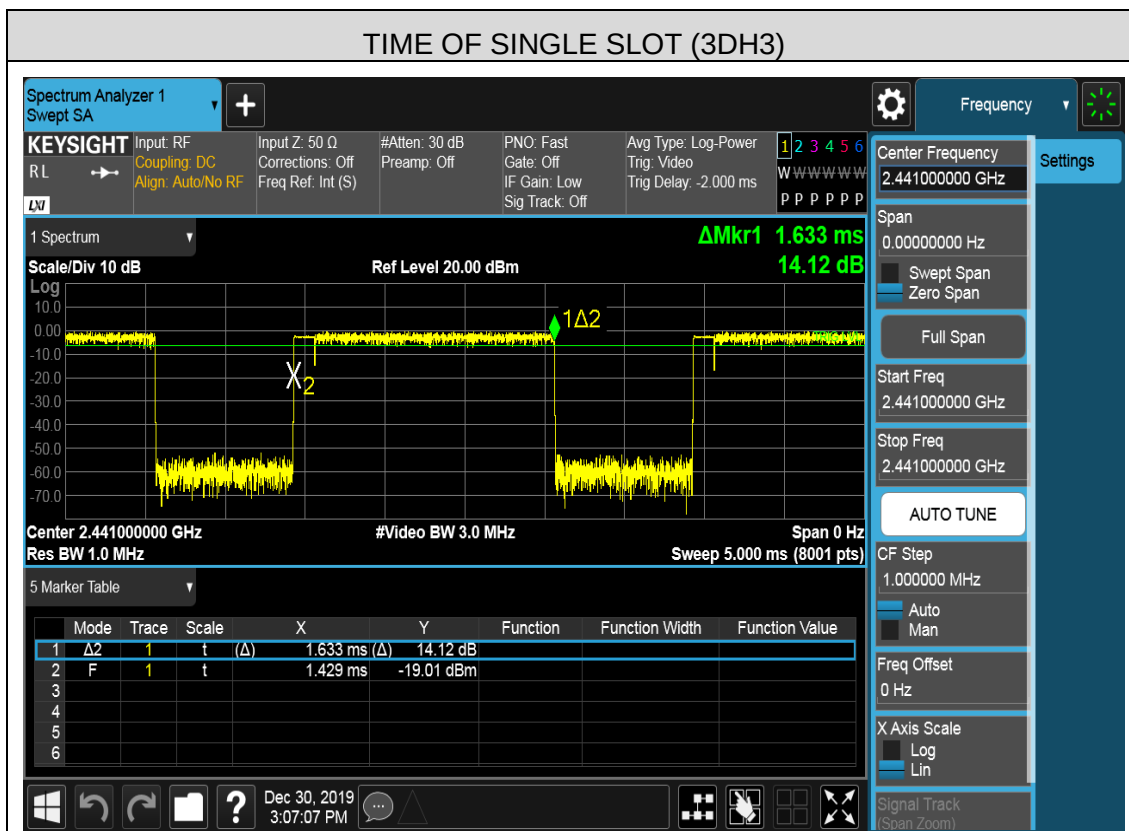


6.6.2. 8DPSK MODE

Normal Mode				
Packet	Channel	Burst Width [ms/hop/ch]	Dwell Time [s]	Results
3DH1	MCH	0.3808	0.122	PASS
3DH3	MCH	1.633	0.261	PASS
3DH5	MCH	2.882	0.307	PASS
AFH Mode				
3DH1	MCH	0.3808	0.061	PASS
3DH3	MCH	1.633	0.131	PASS
3DH5	MCH	2.882	0.154	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:

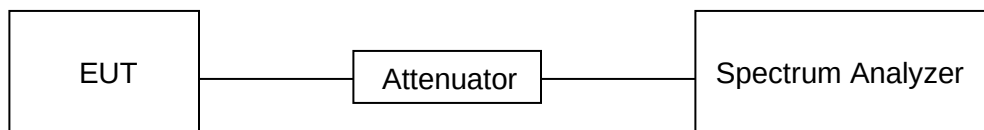
Detector	Peak
RBW	1 MHz
VBW	3 × RBW
Span	Wide enough to capture the peak level of the emission operating on the channel closest to the band edge
Trace	Max hold
Sweep time	Couple

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

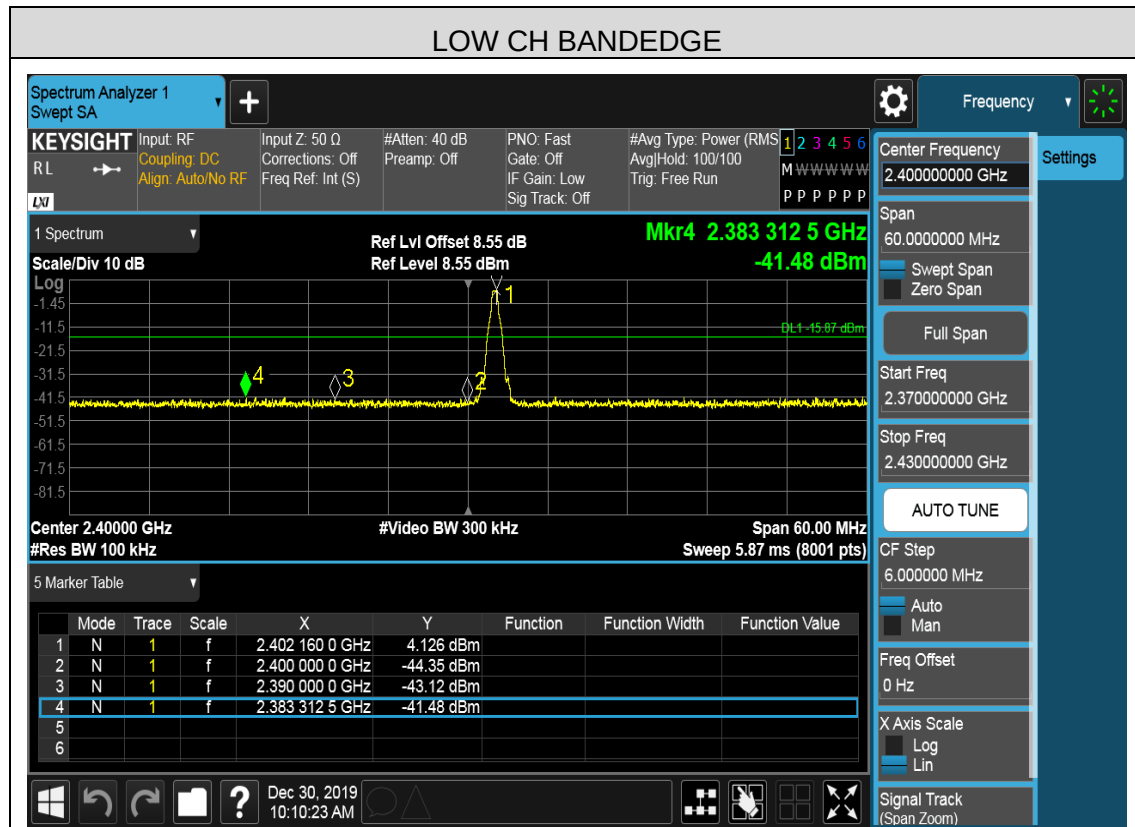


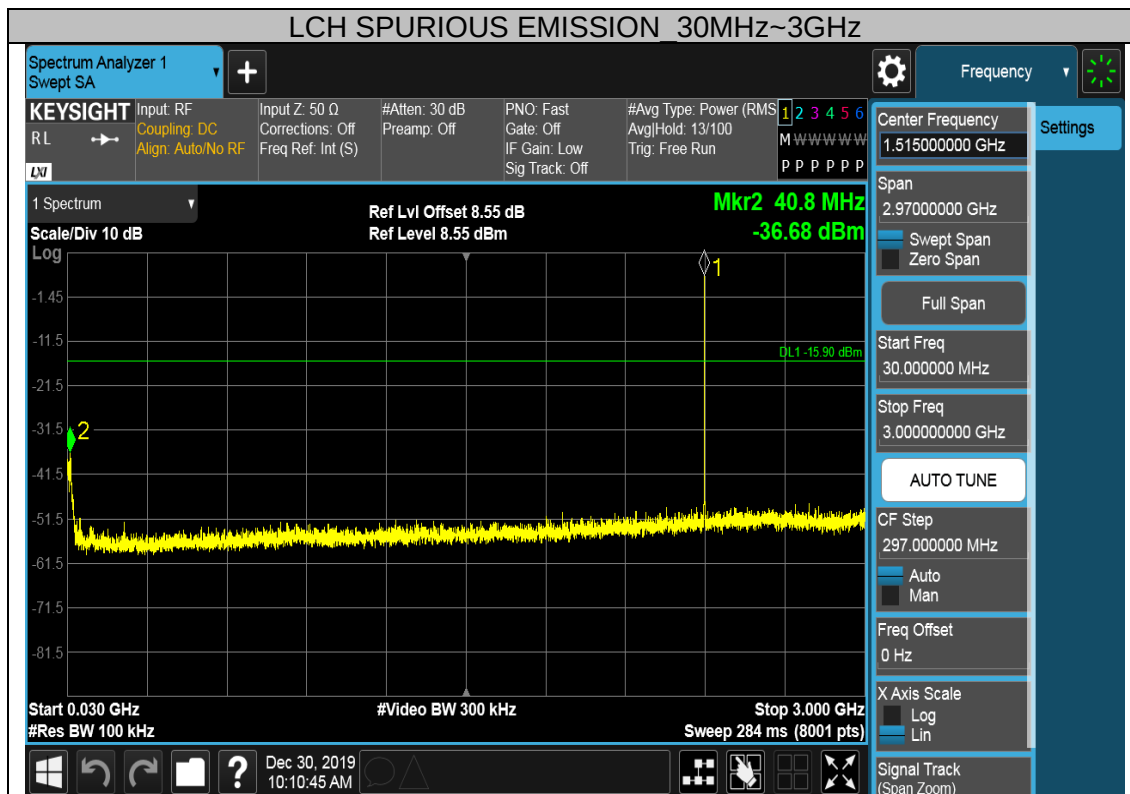


RESULTS

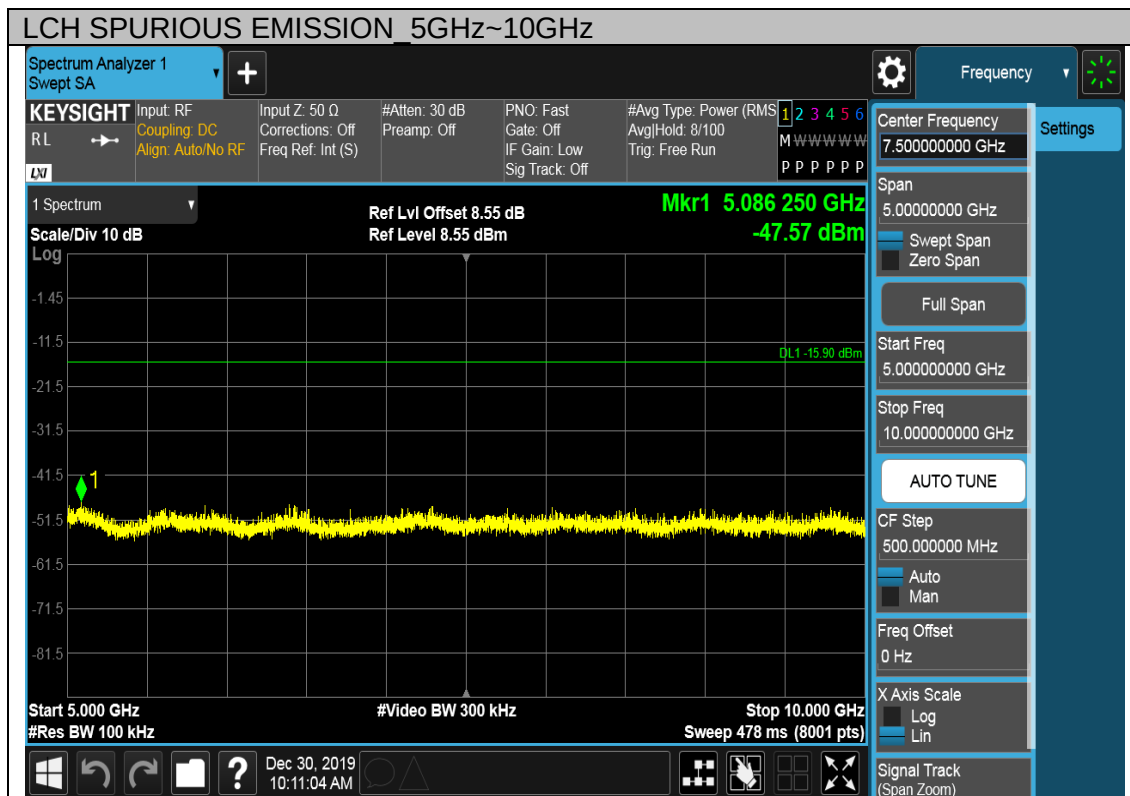
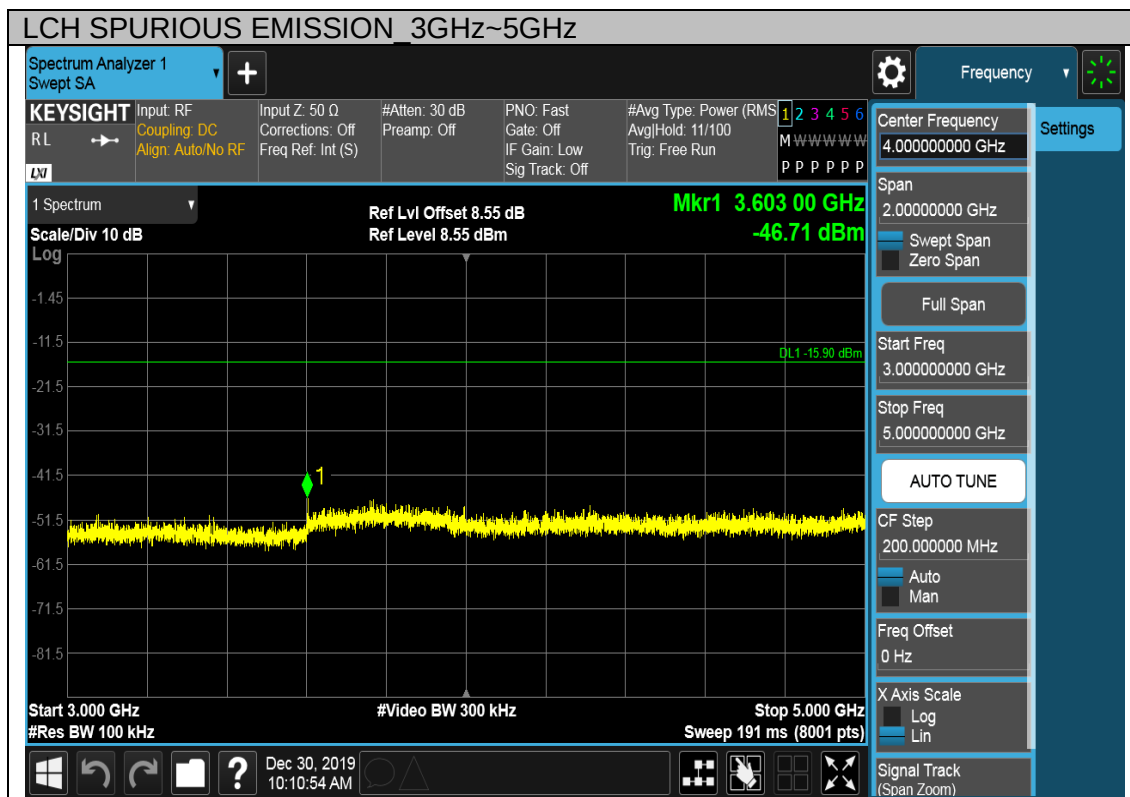
6.7.1. GFSK MODE

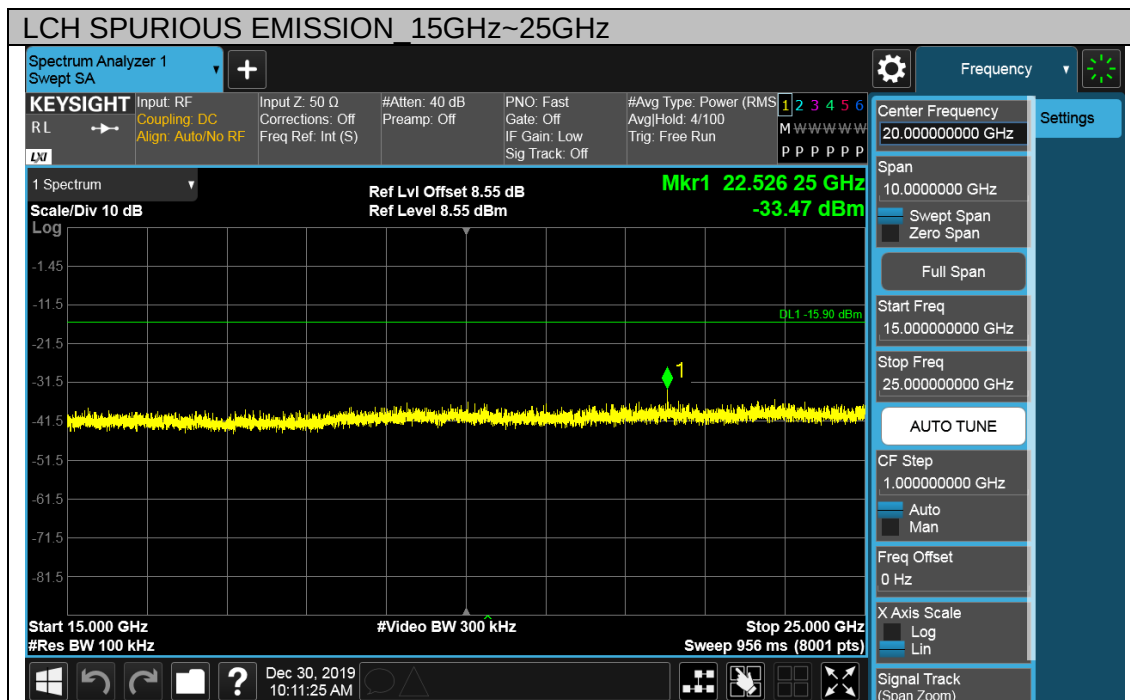
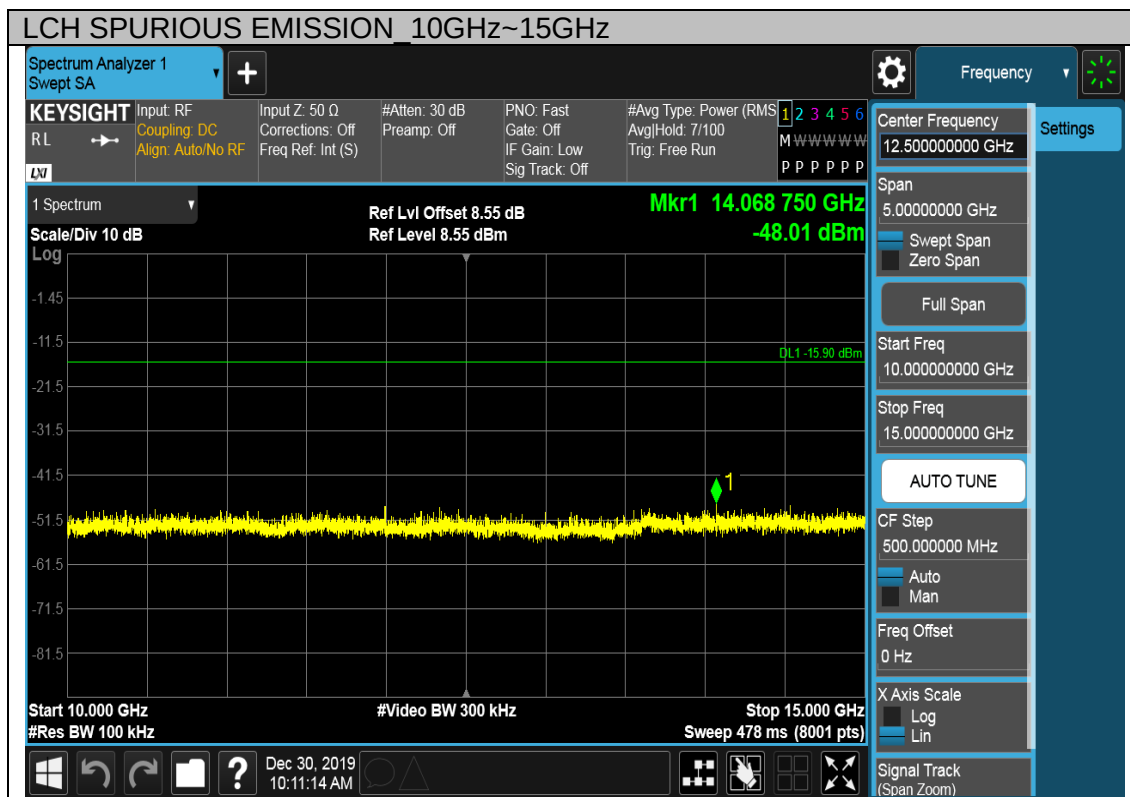
SPURIOUS EMISSIONS, LOW CHANNEL





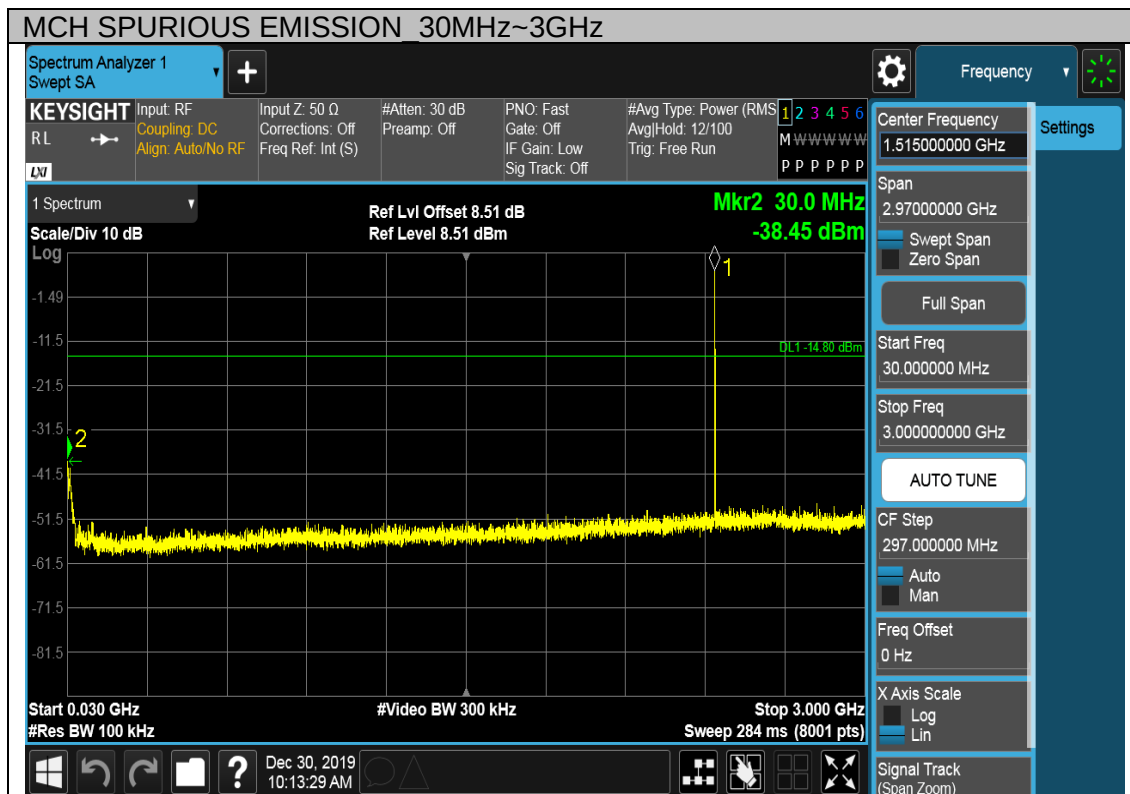
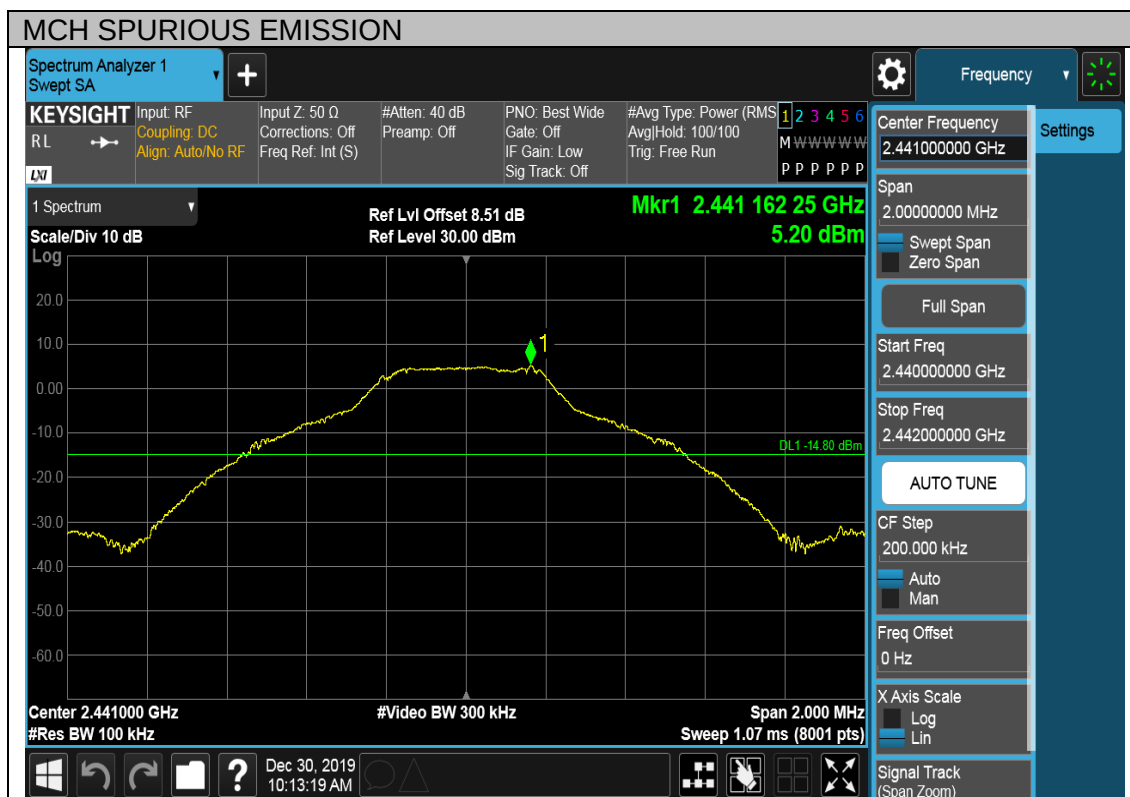
Note: The point 1 which exceeds the limit is 2.4G main carrier.



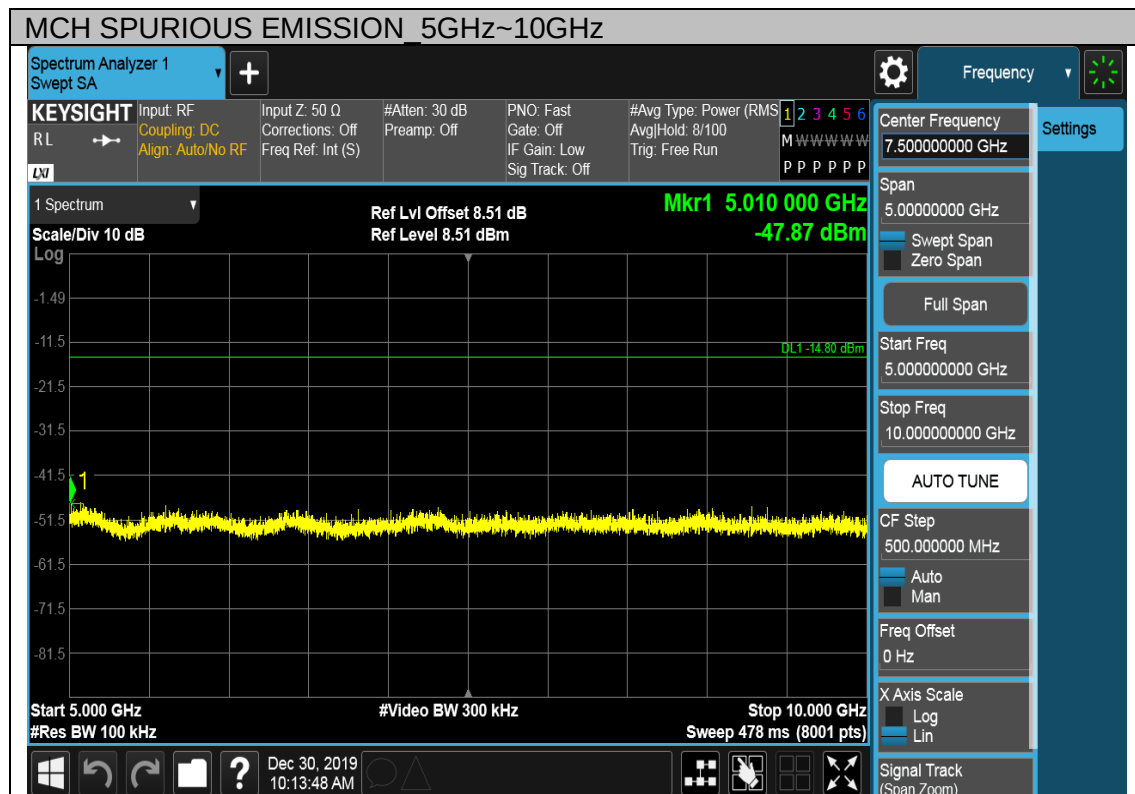
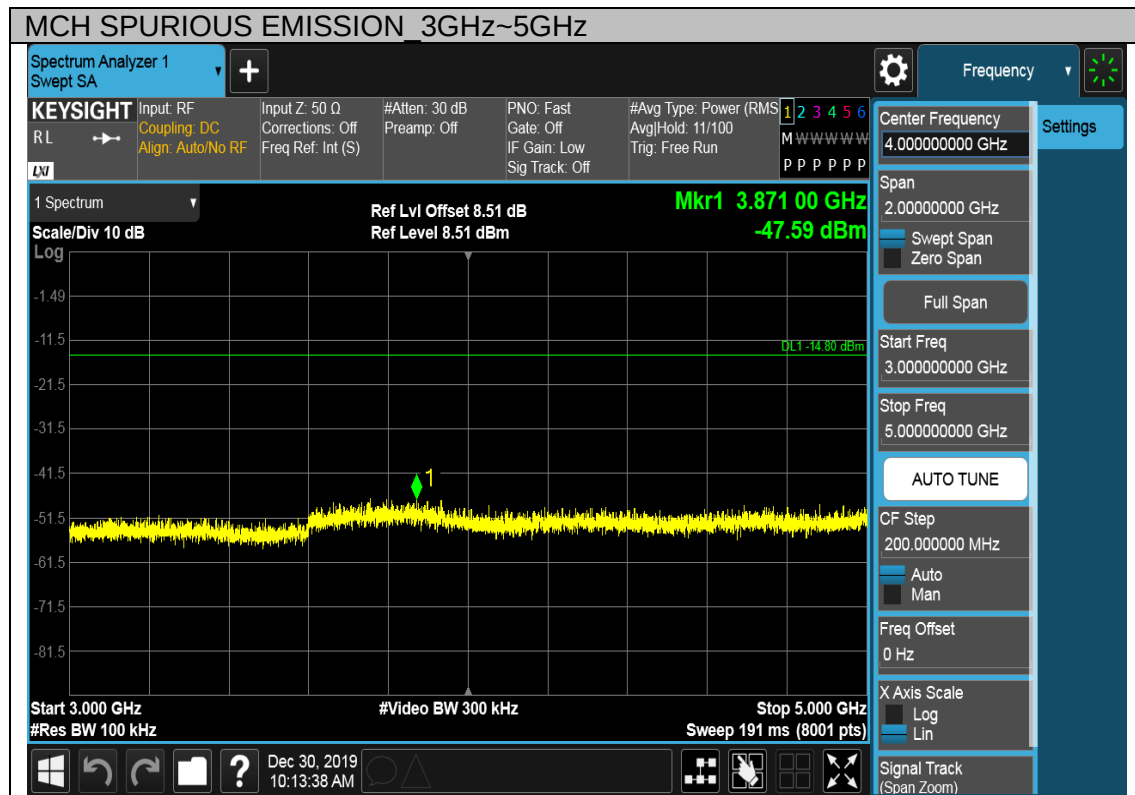


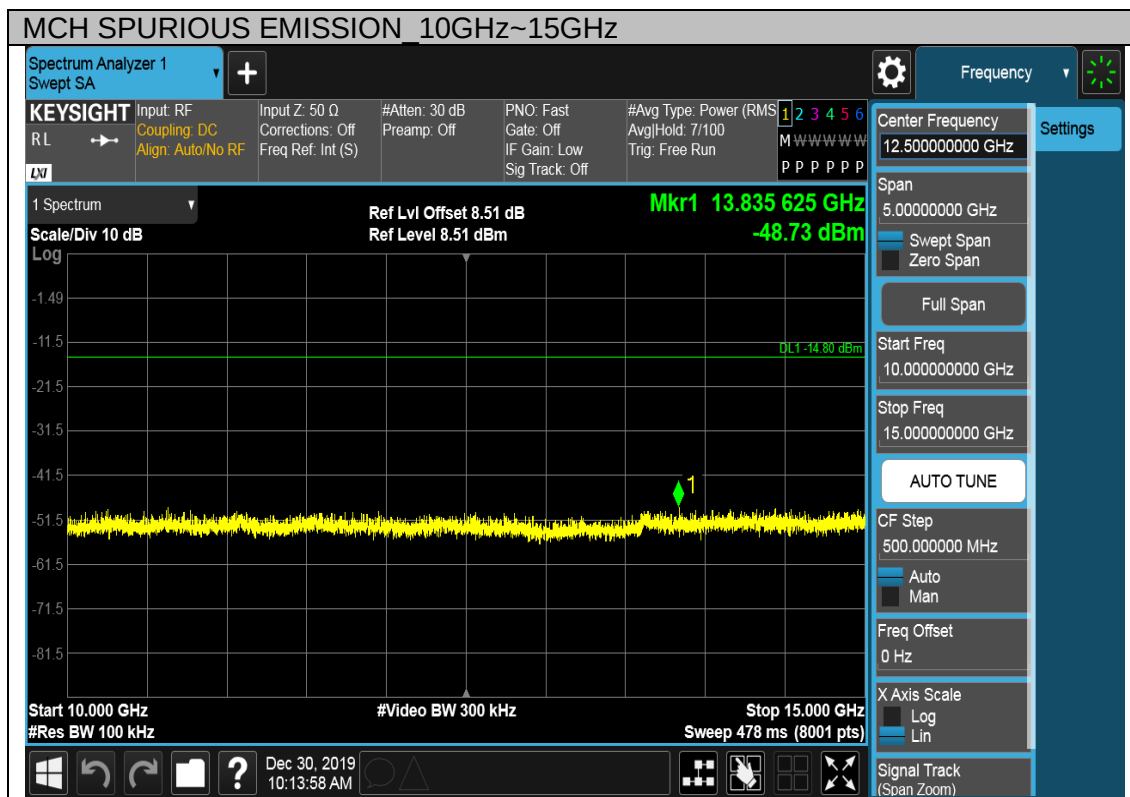


SPURIOUS EMISSIONS, MID CHANNEL



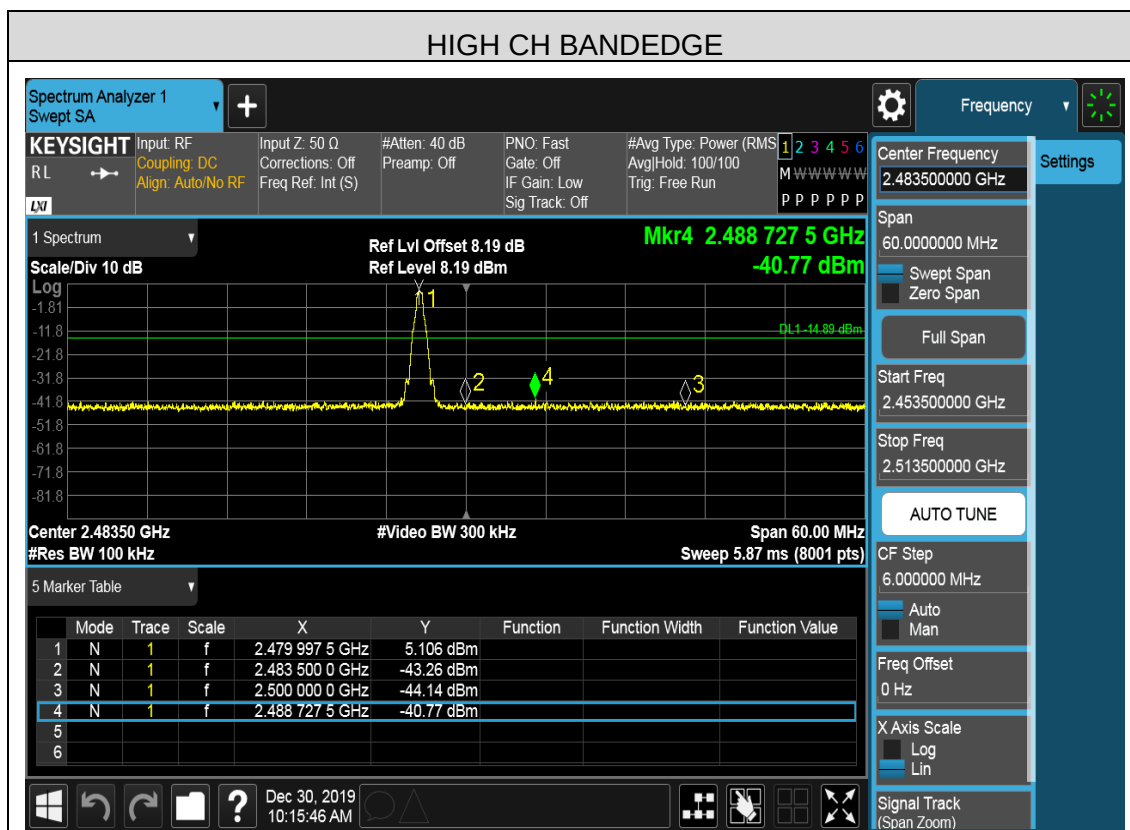
Note: The point 1 which exceeds the limit is 2.4G main carrier.

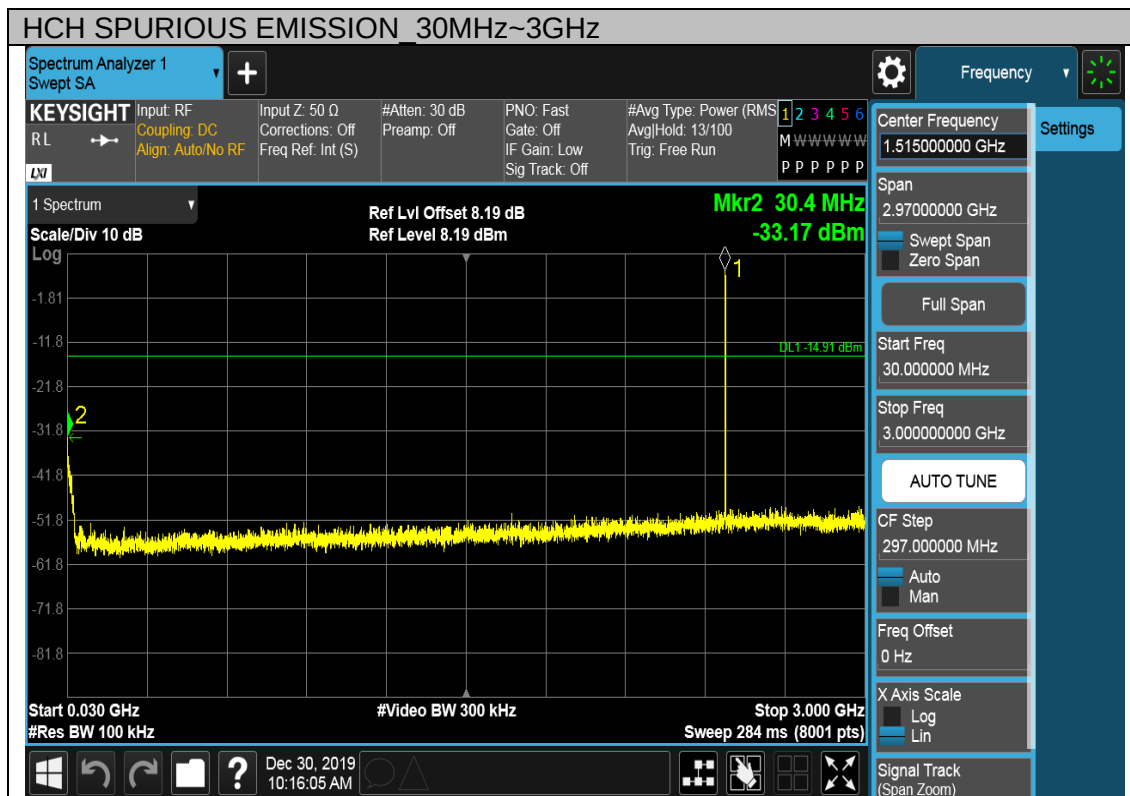
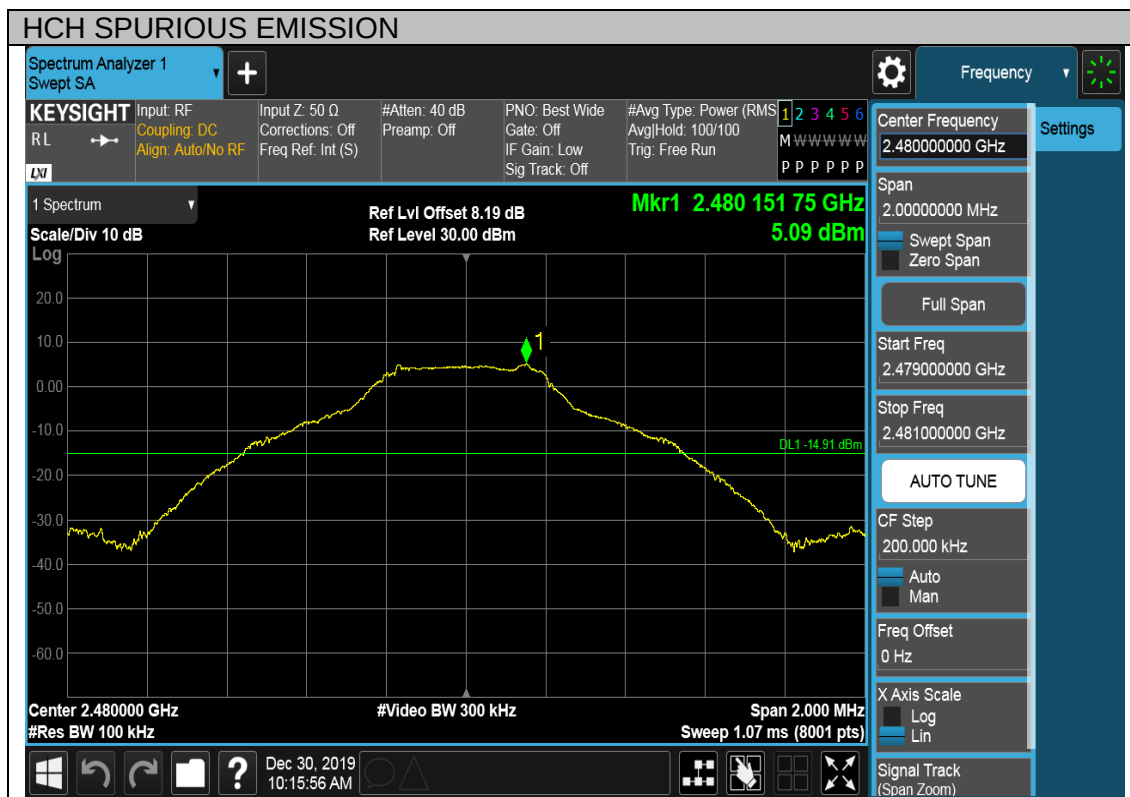




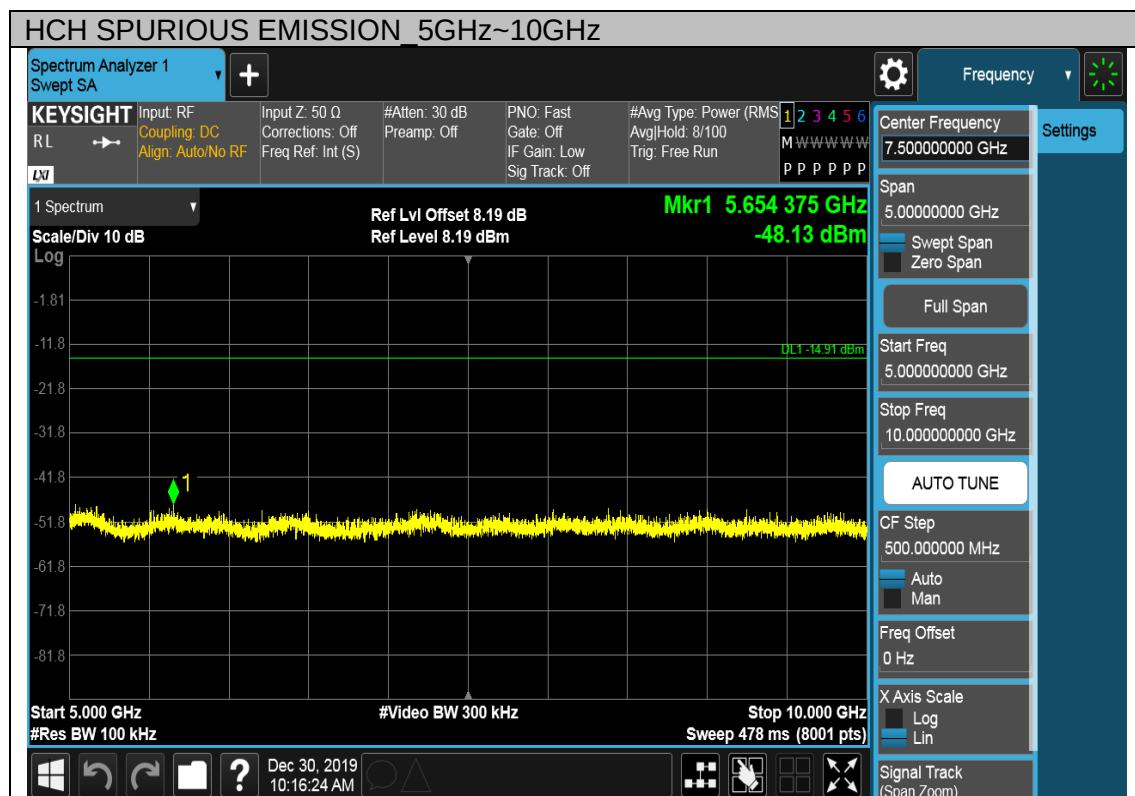


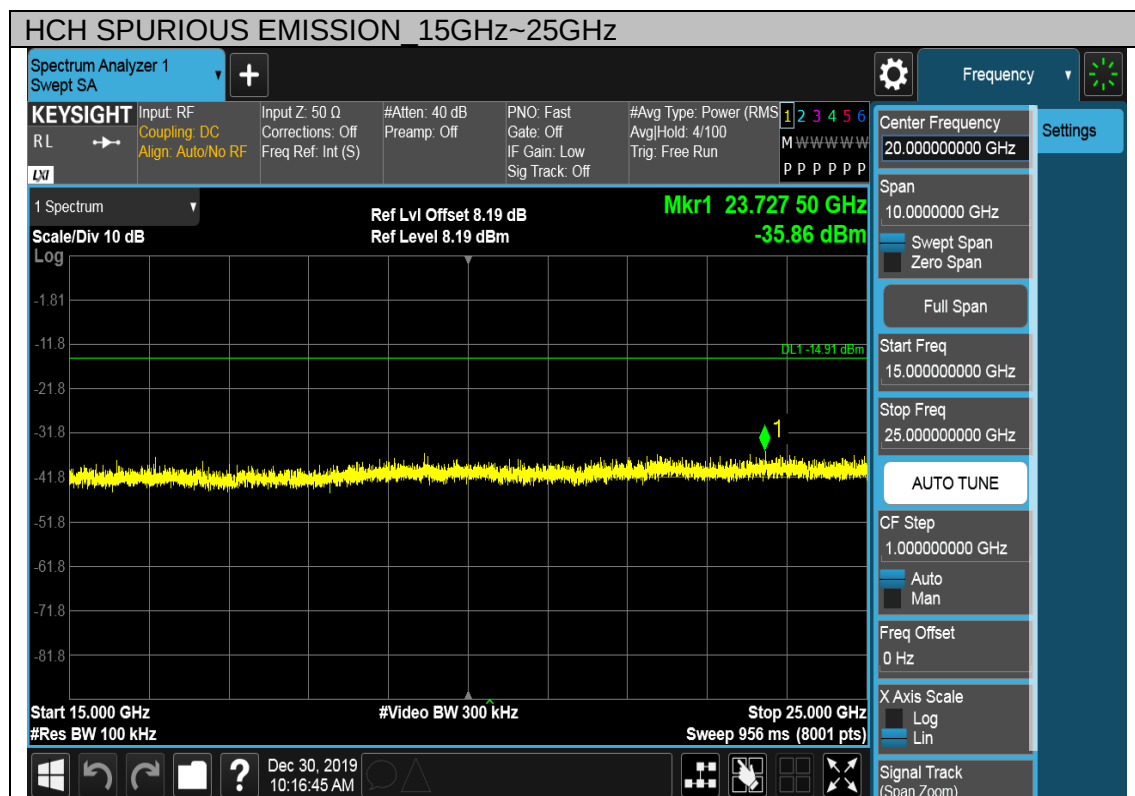
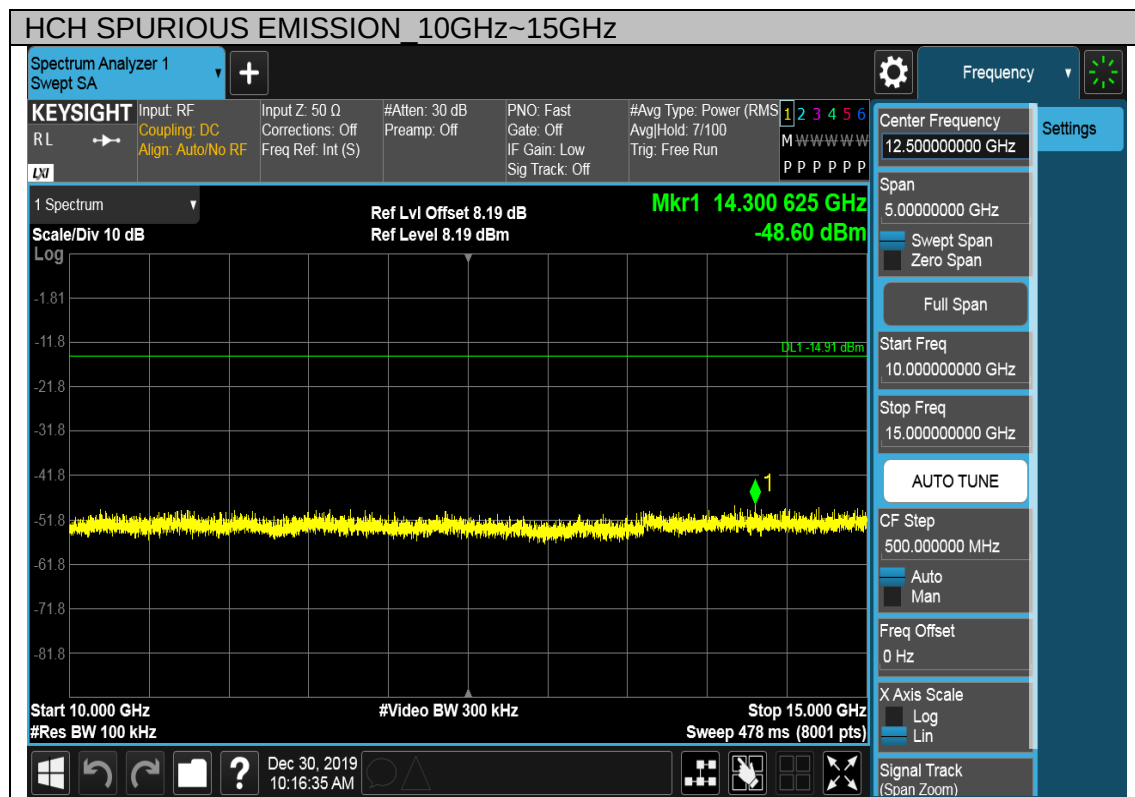
SPURIOUS EMISSIONS, HIGH CHANNEL





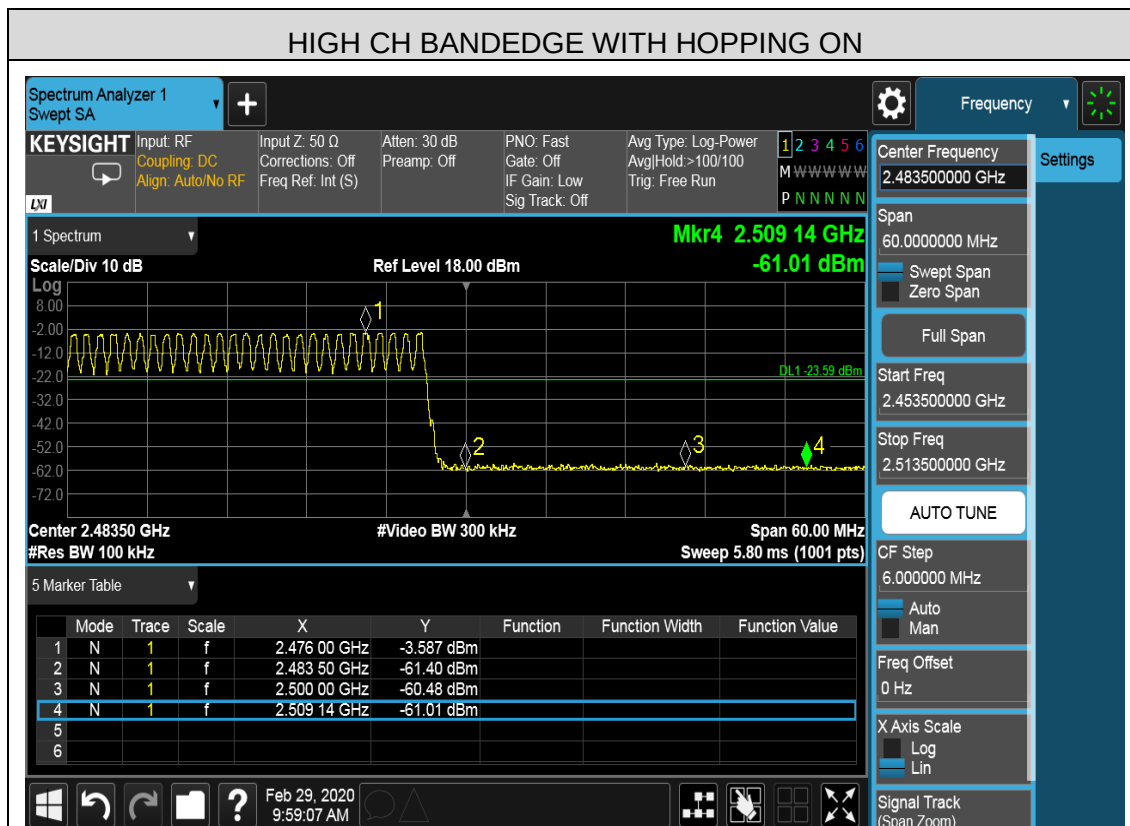
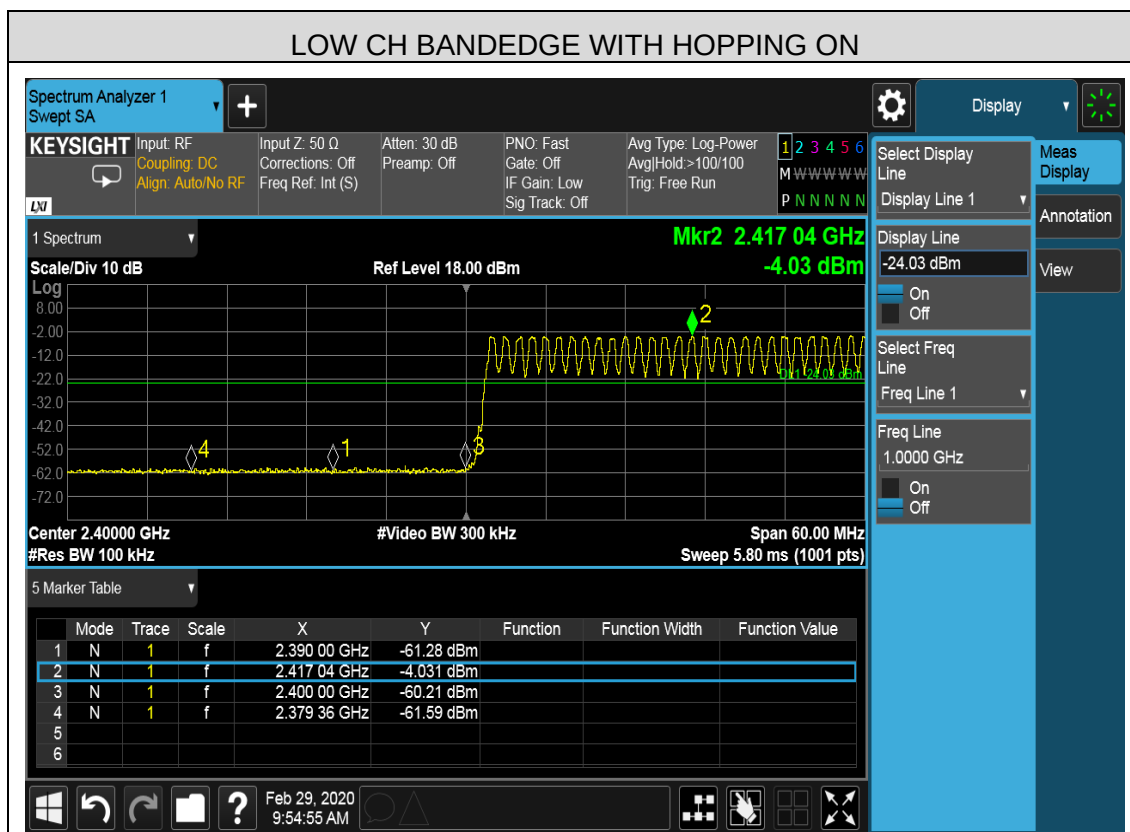
Note: The point 1 which exceeds the limit is 2.4G main carrier.







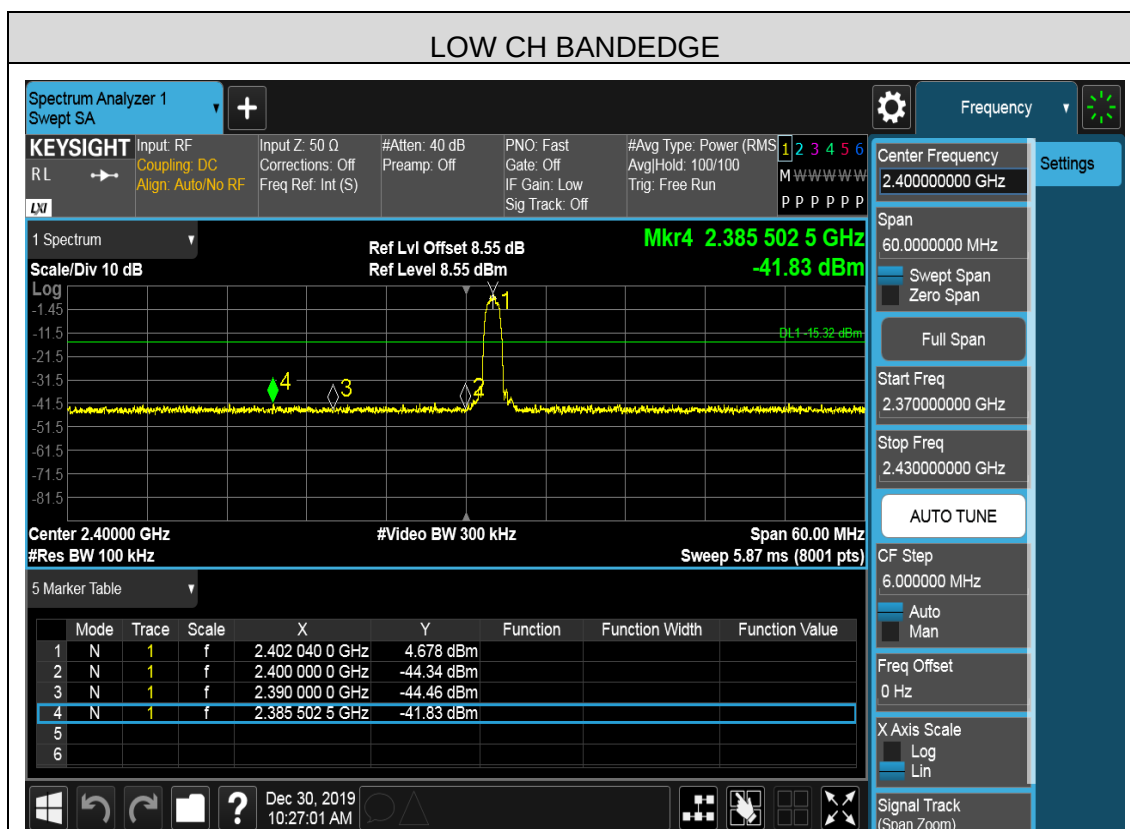
SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

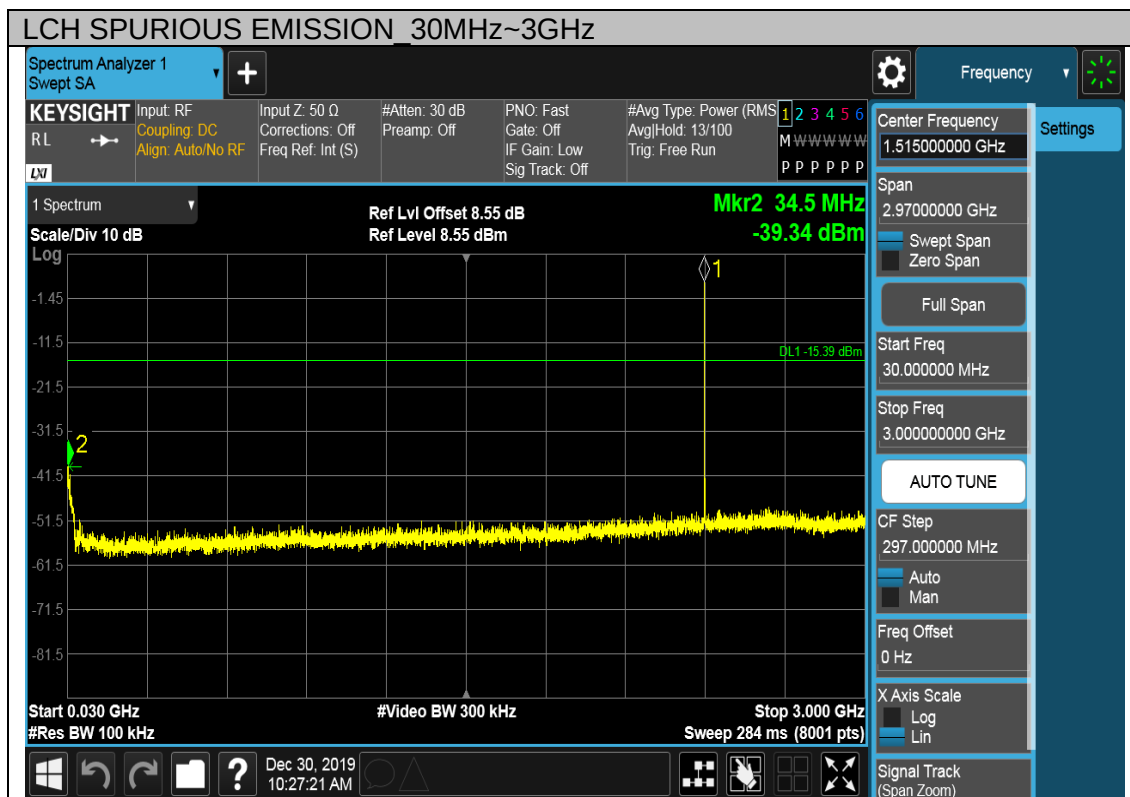
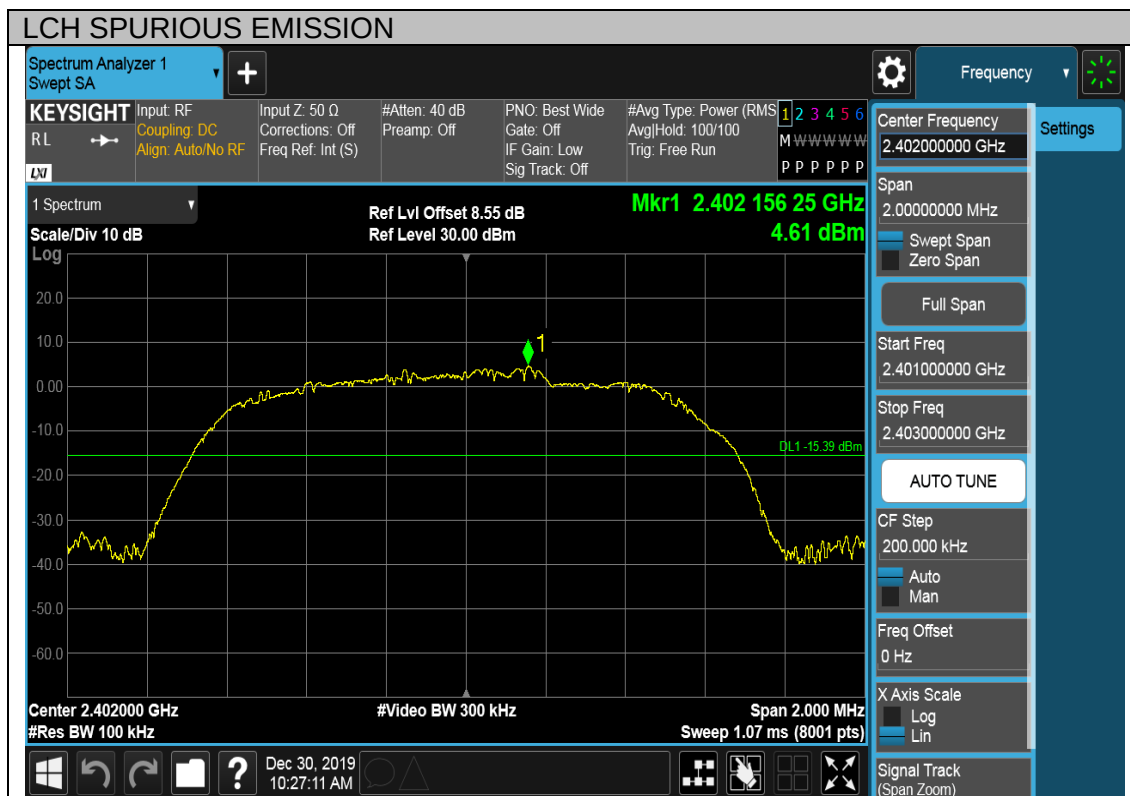




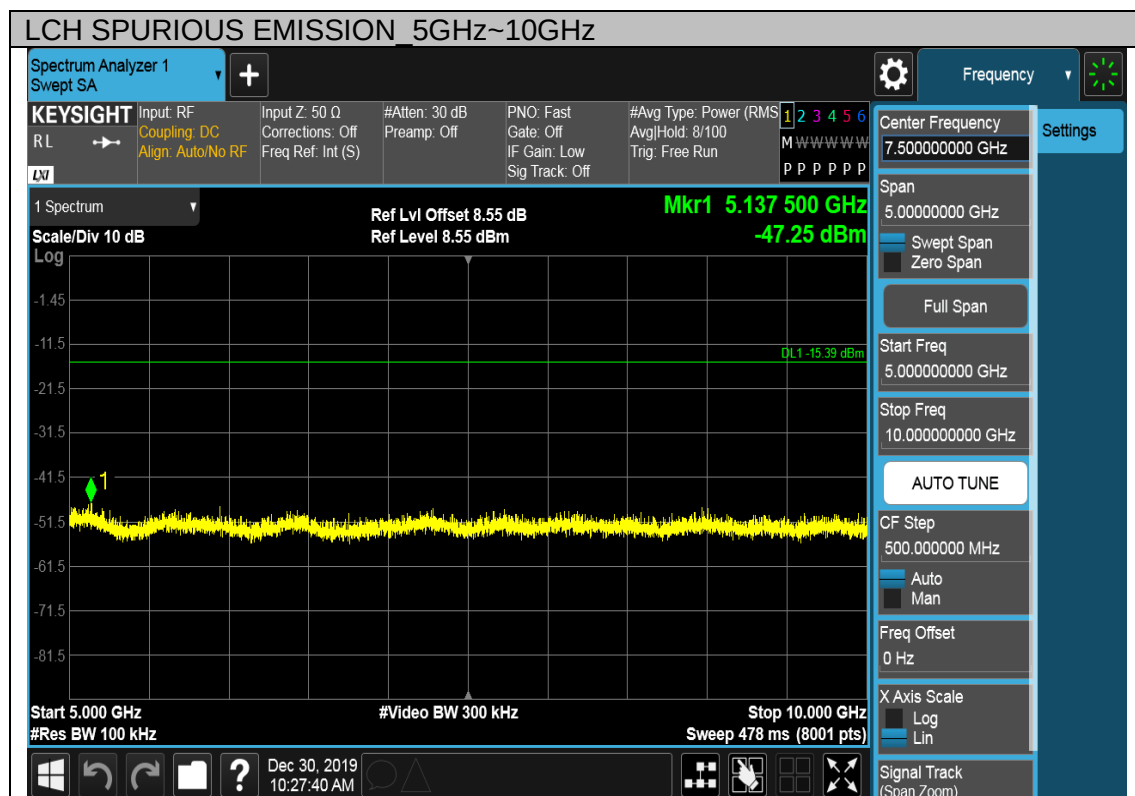
6.7.2. 8DPSK MODE

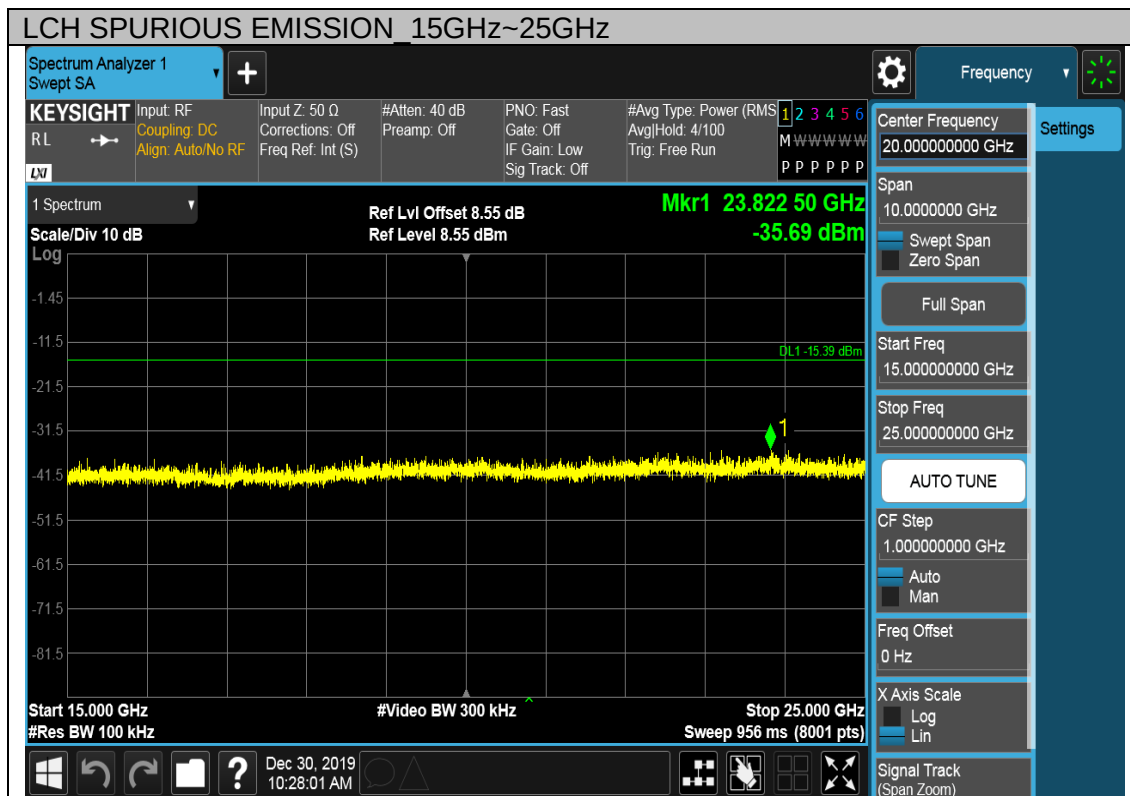
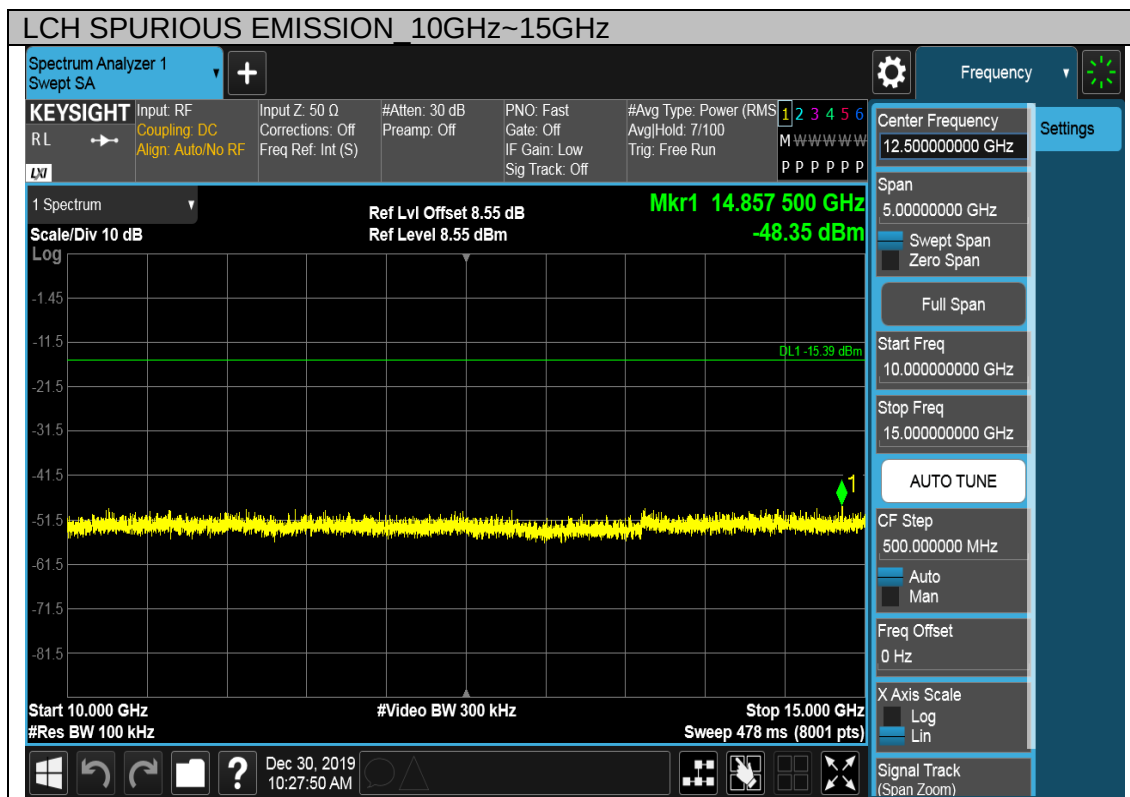
SPURIOUS EMISSIONS, LOW CHANNEL





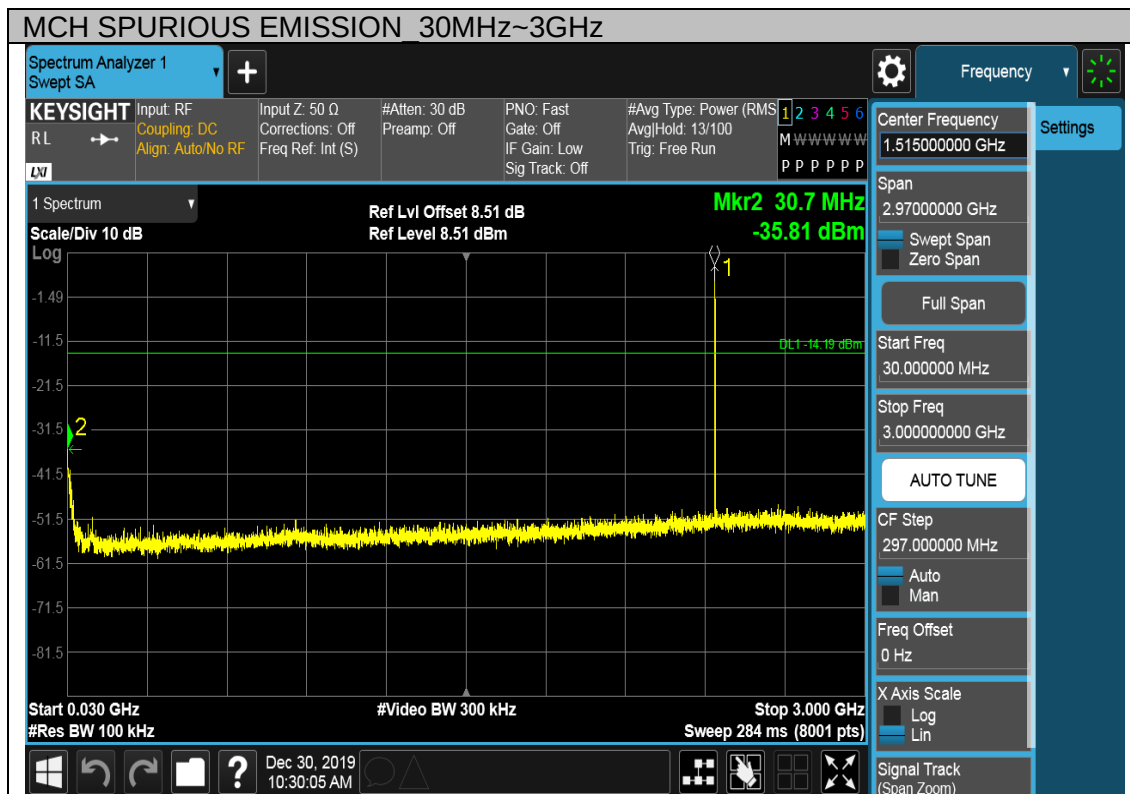
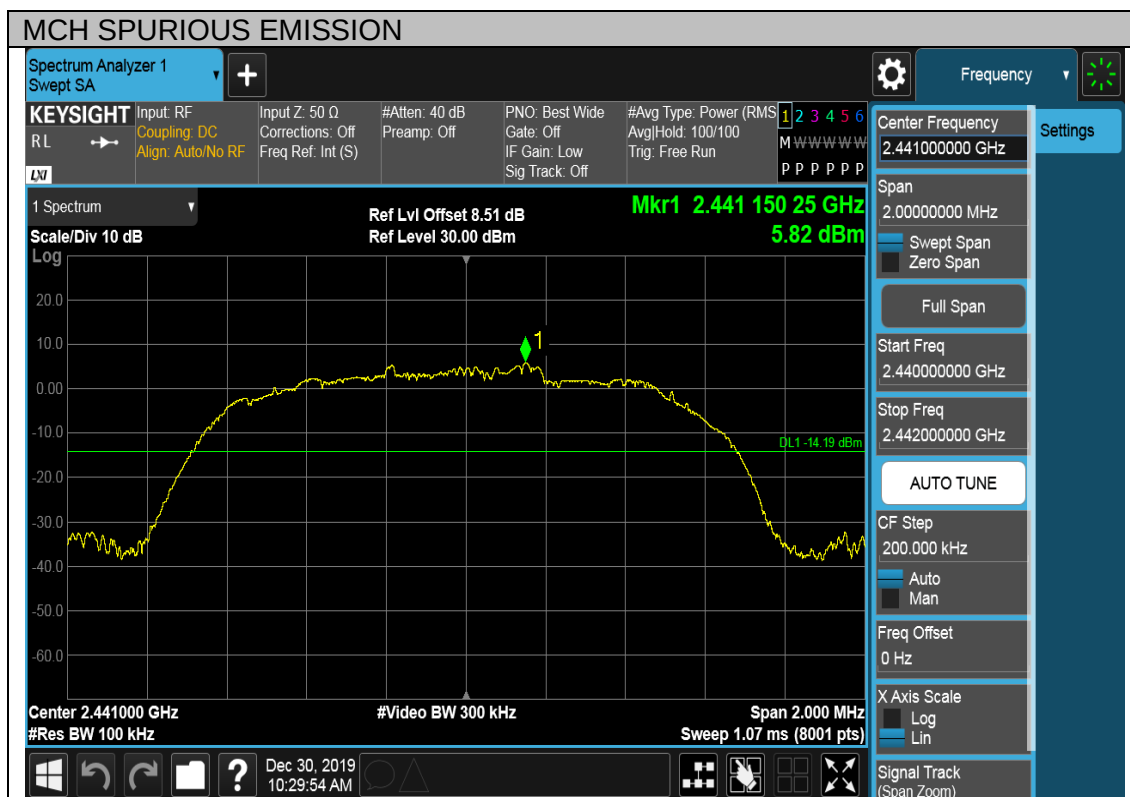
Note: The point 1 which exceeds the limit is 2.4G main carrier.



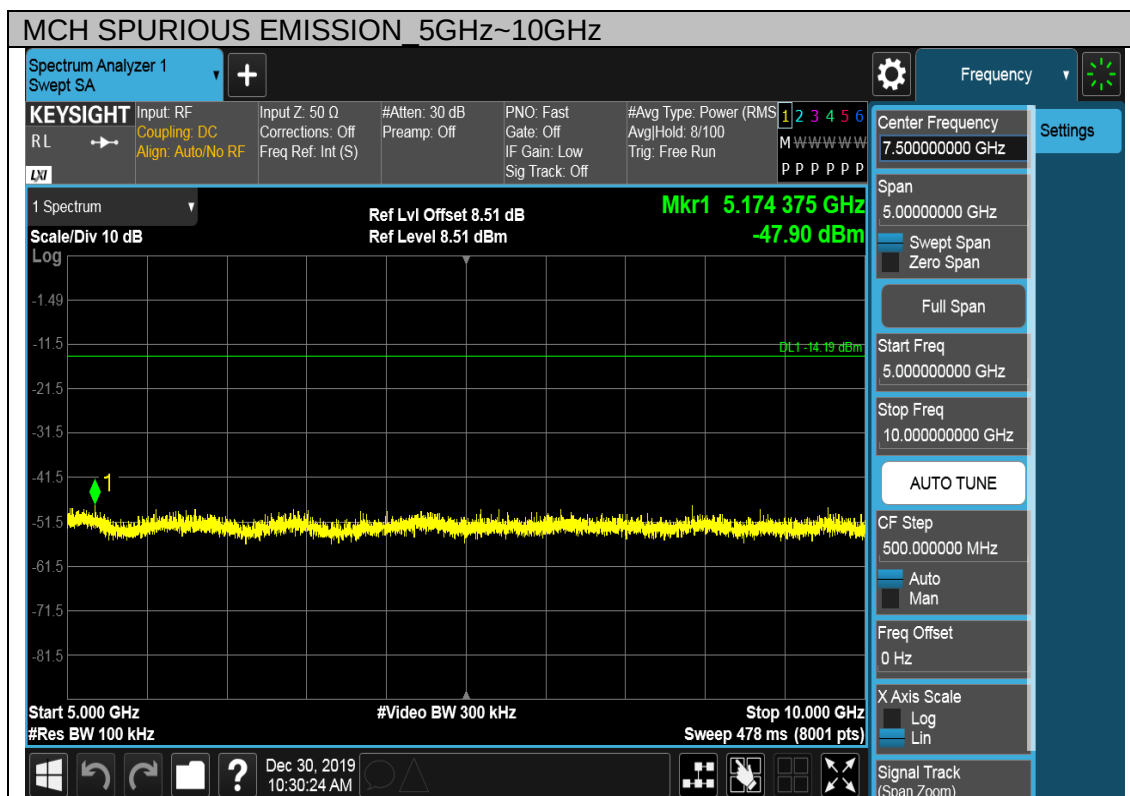
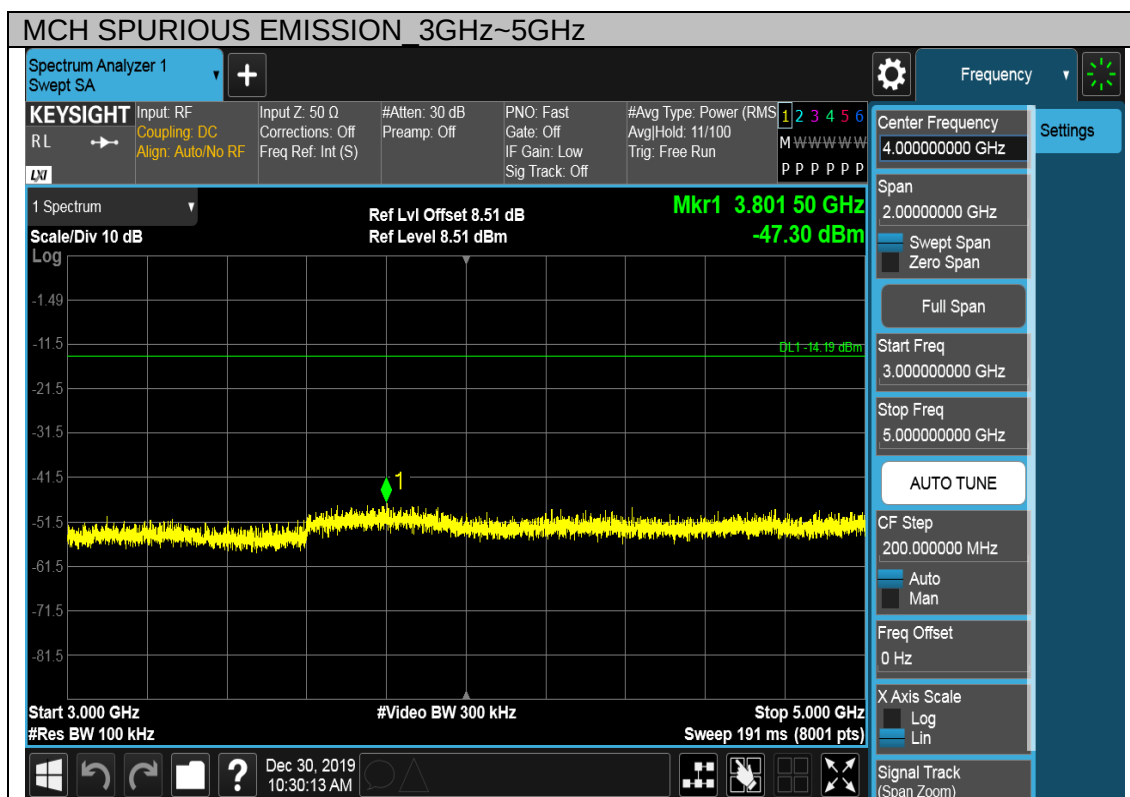


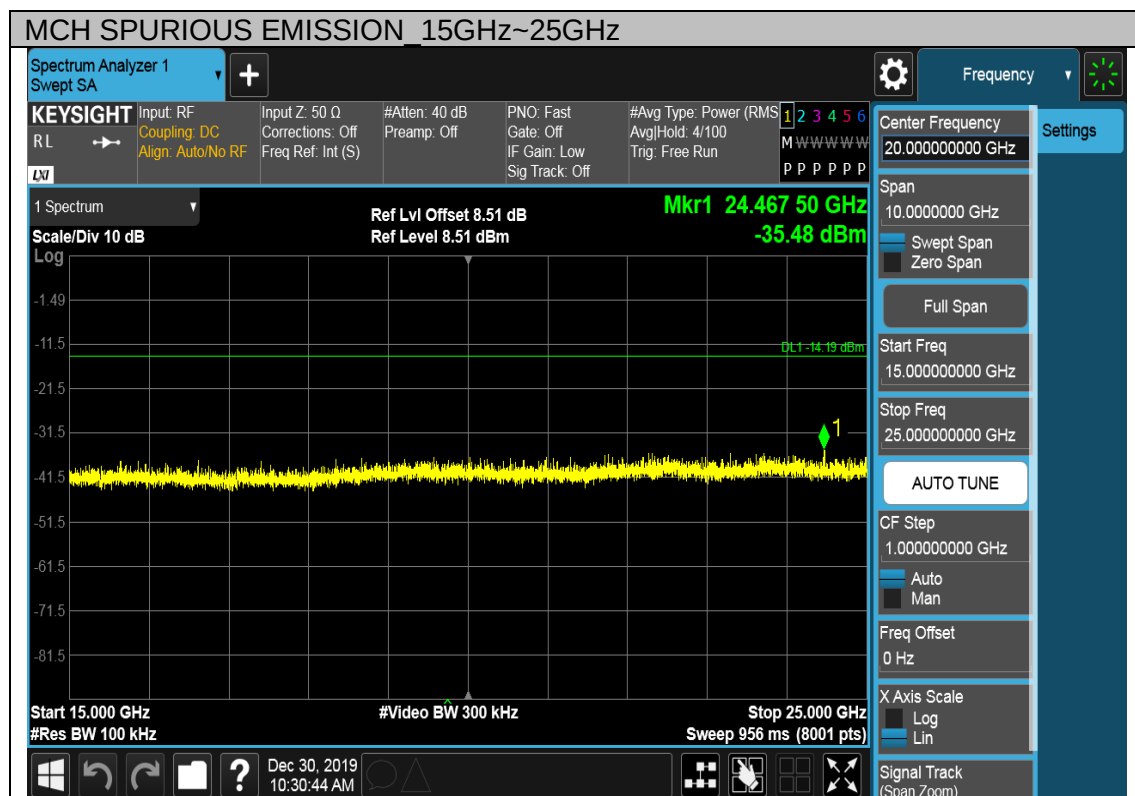
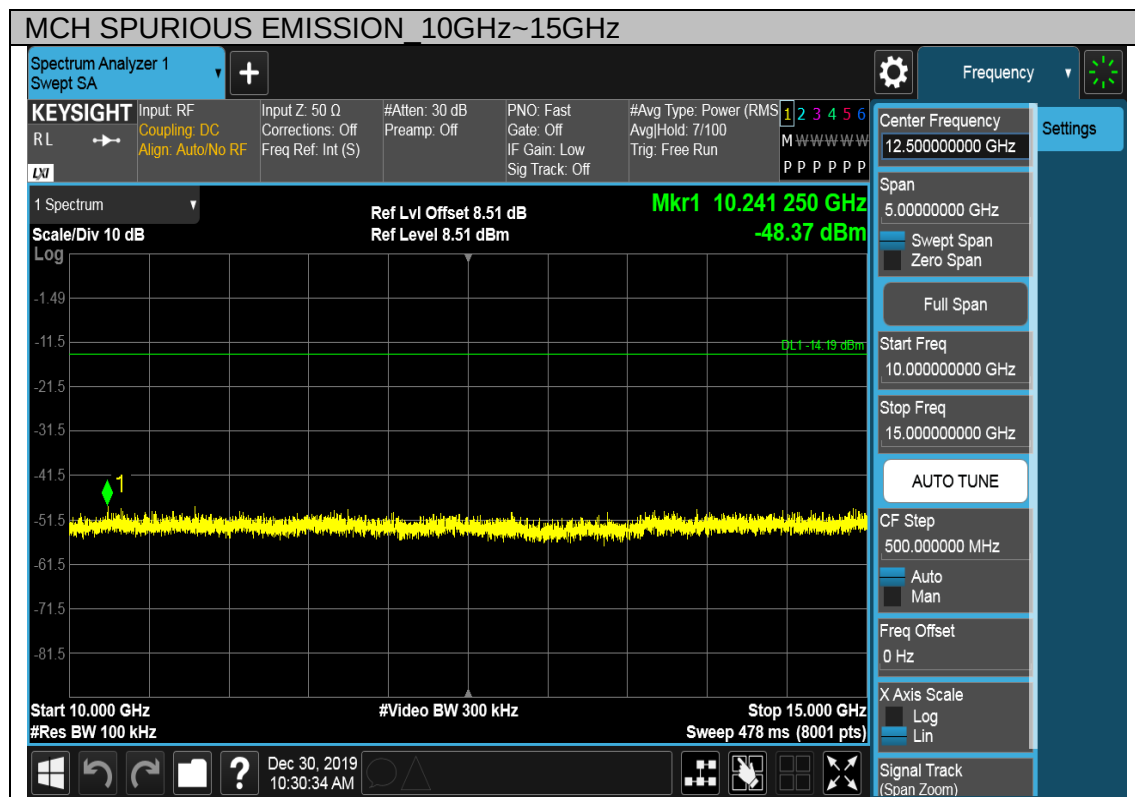


SPURIOUS EMISSIONS, MID CHANNEL



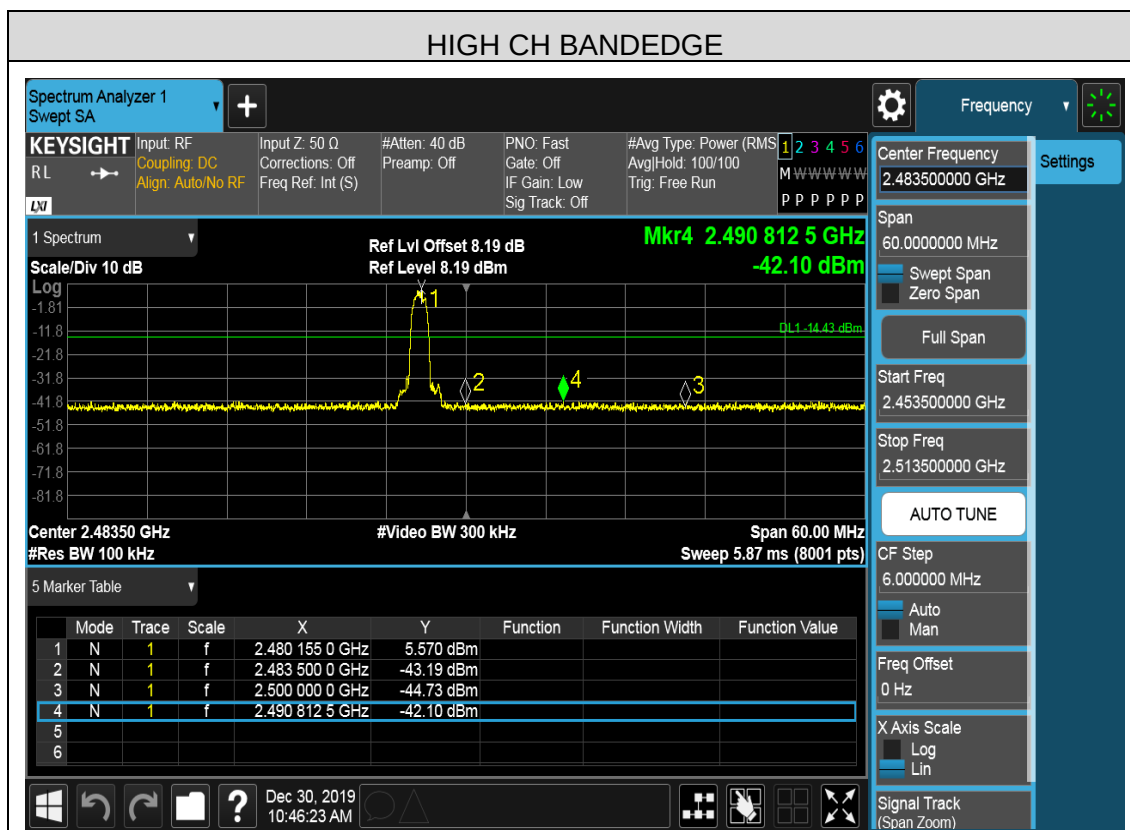
Note: The point 1 which exceeds the limit is 2.4G main carrier.

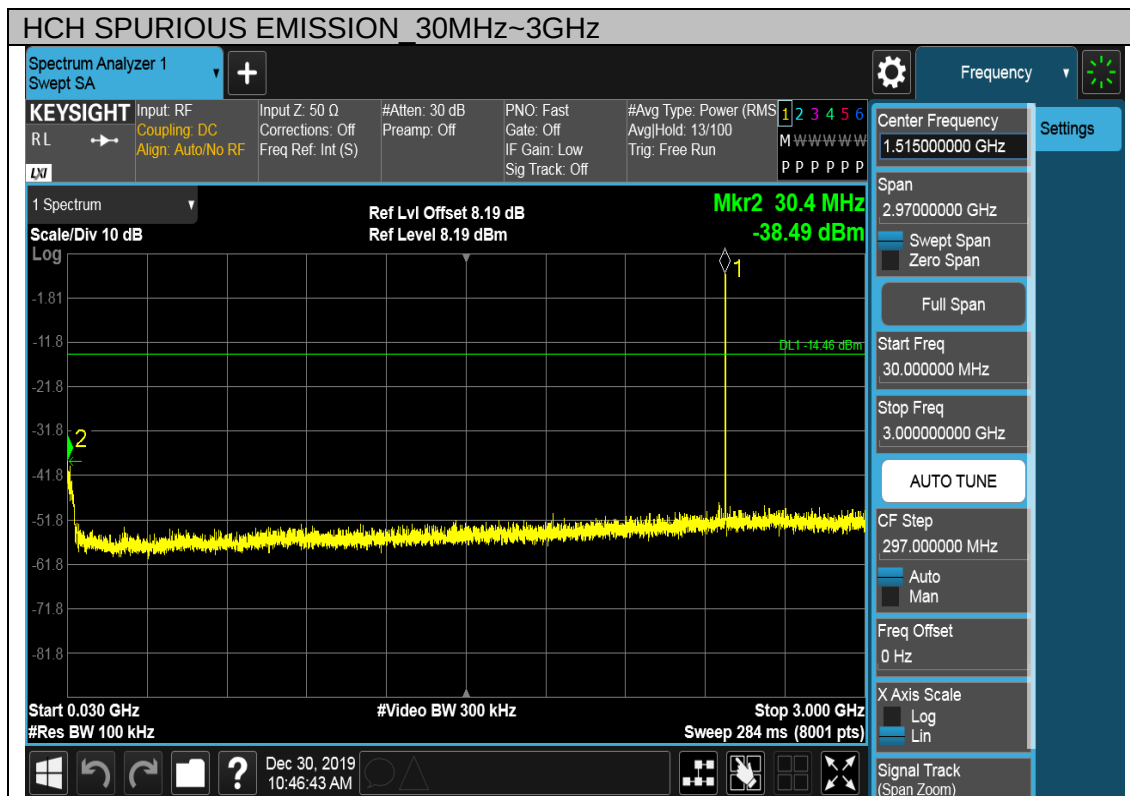
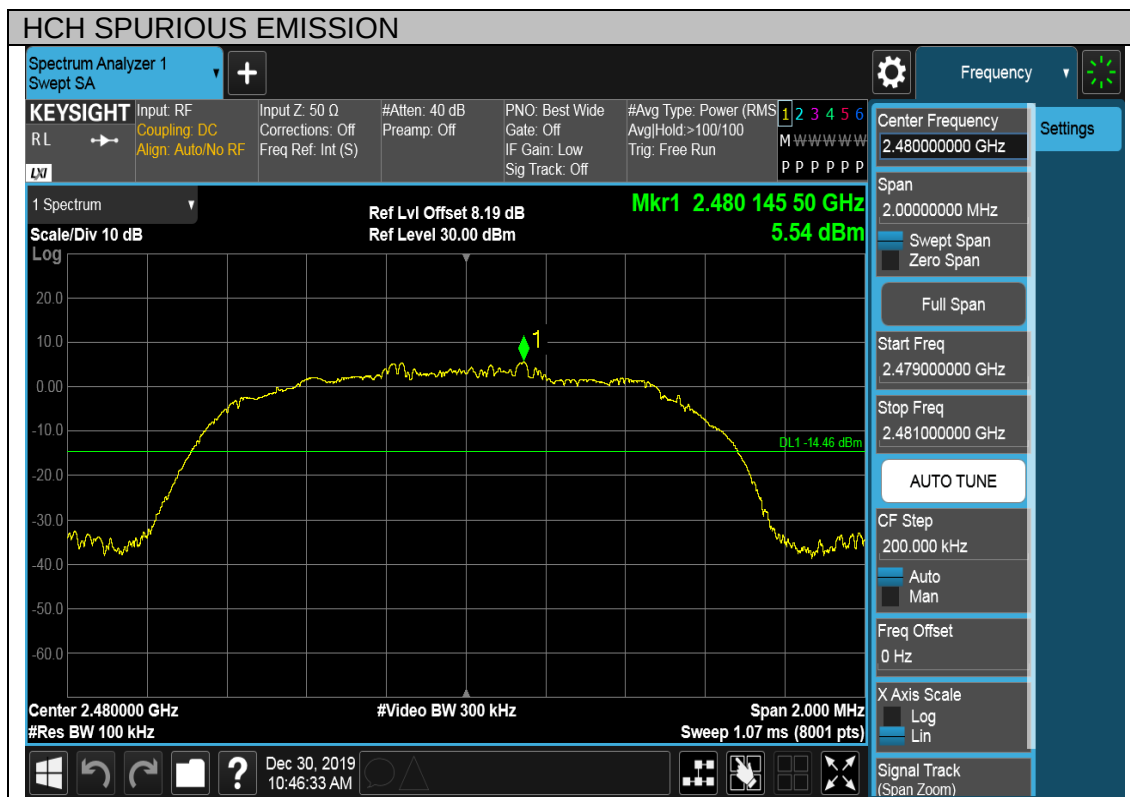




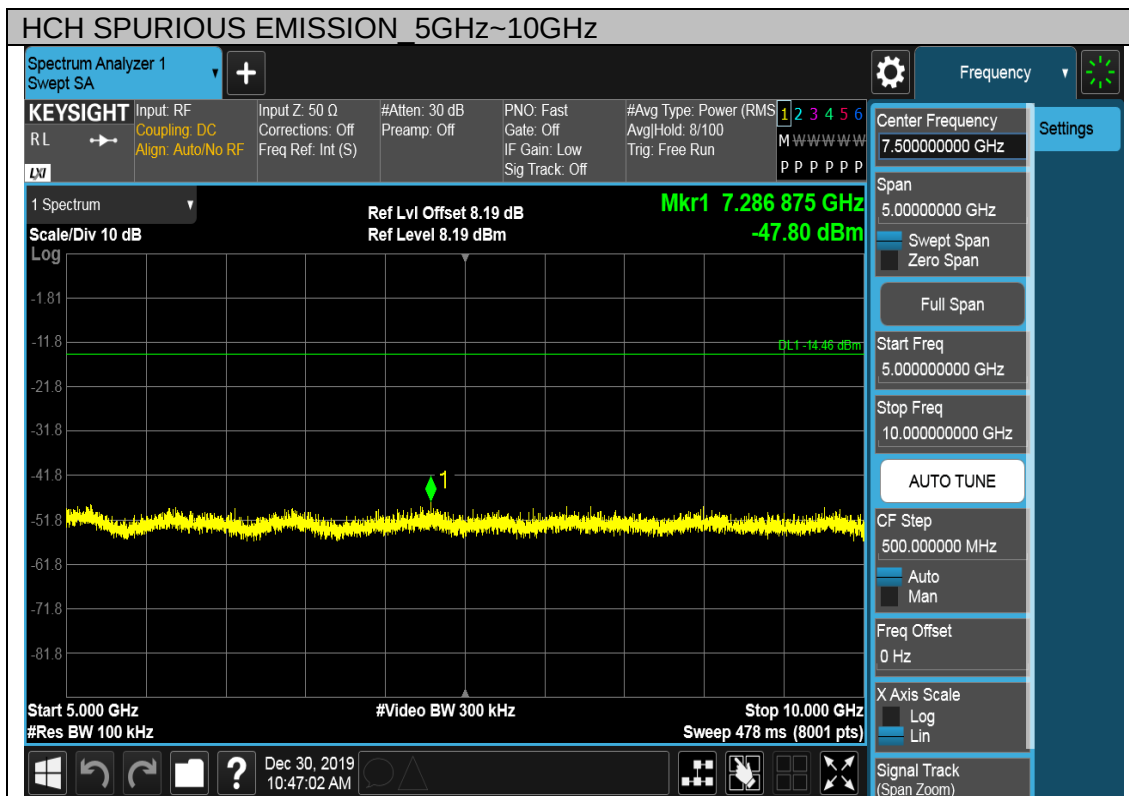


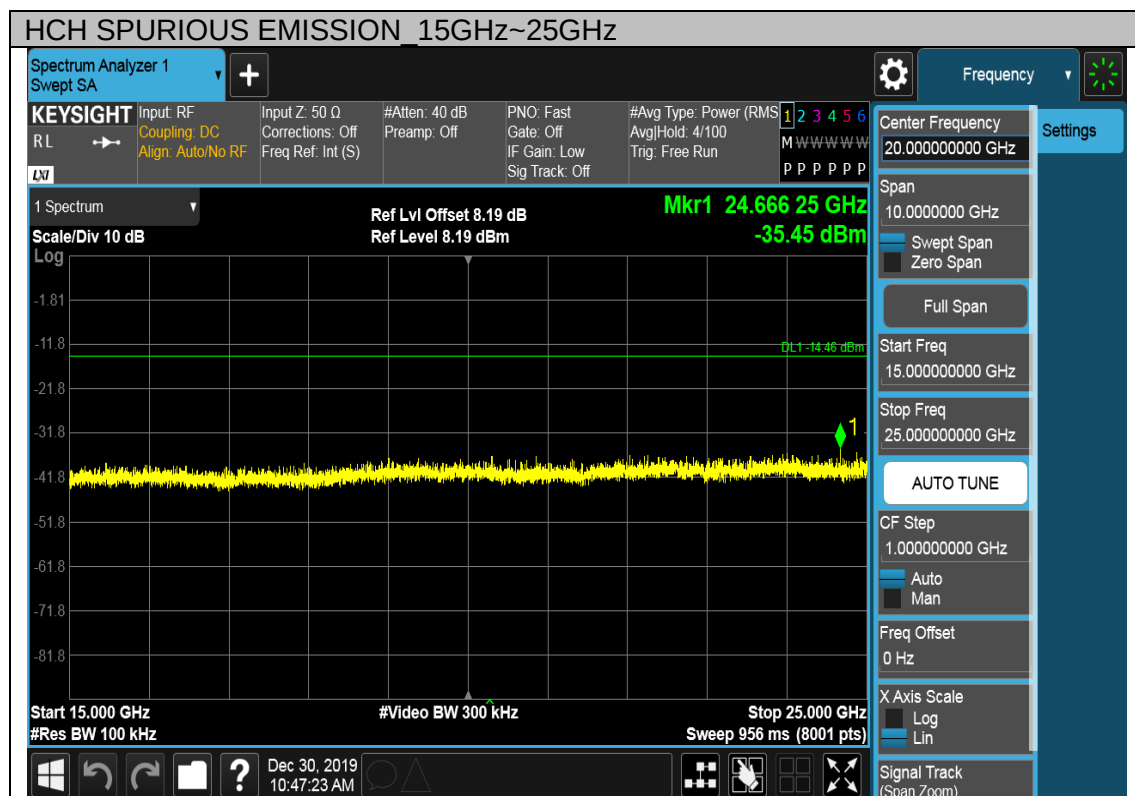
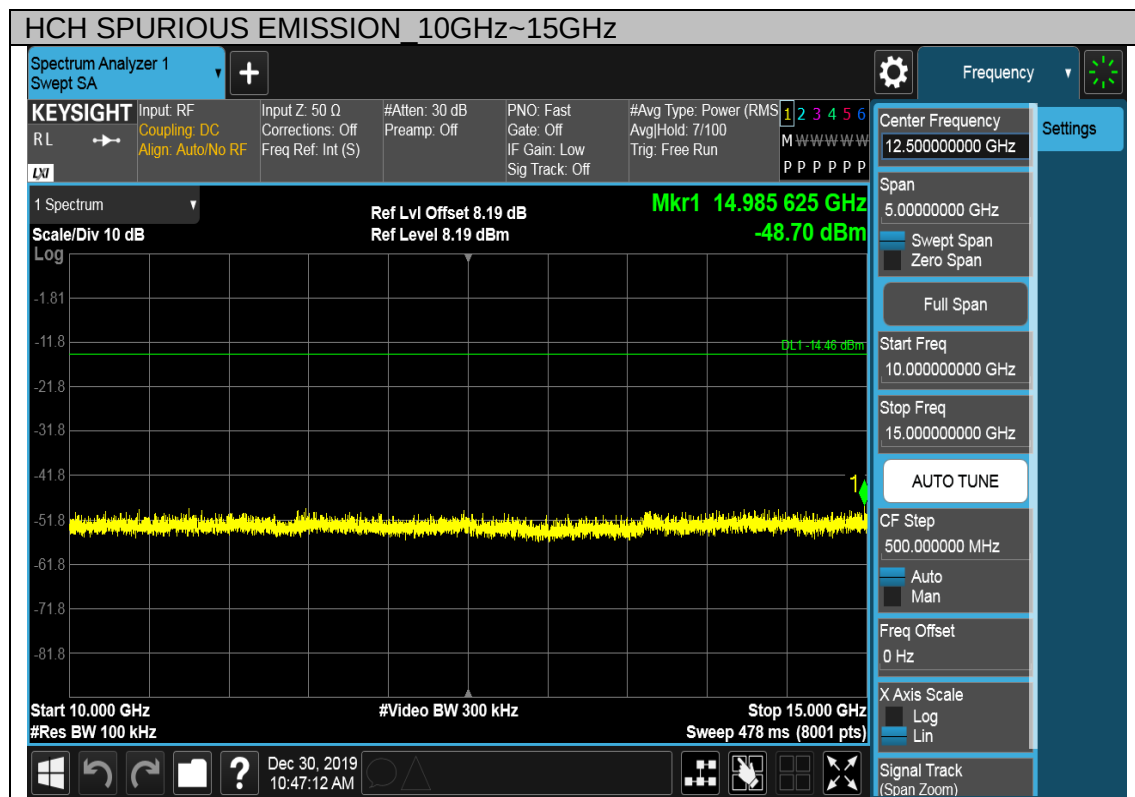
SPURIOUS EMISSIONS, HIGH CHANNEL





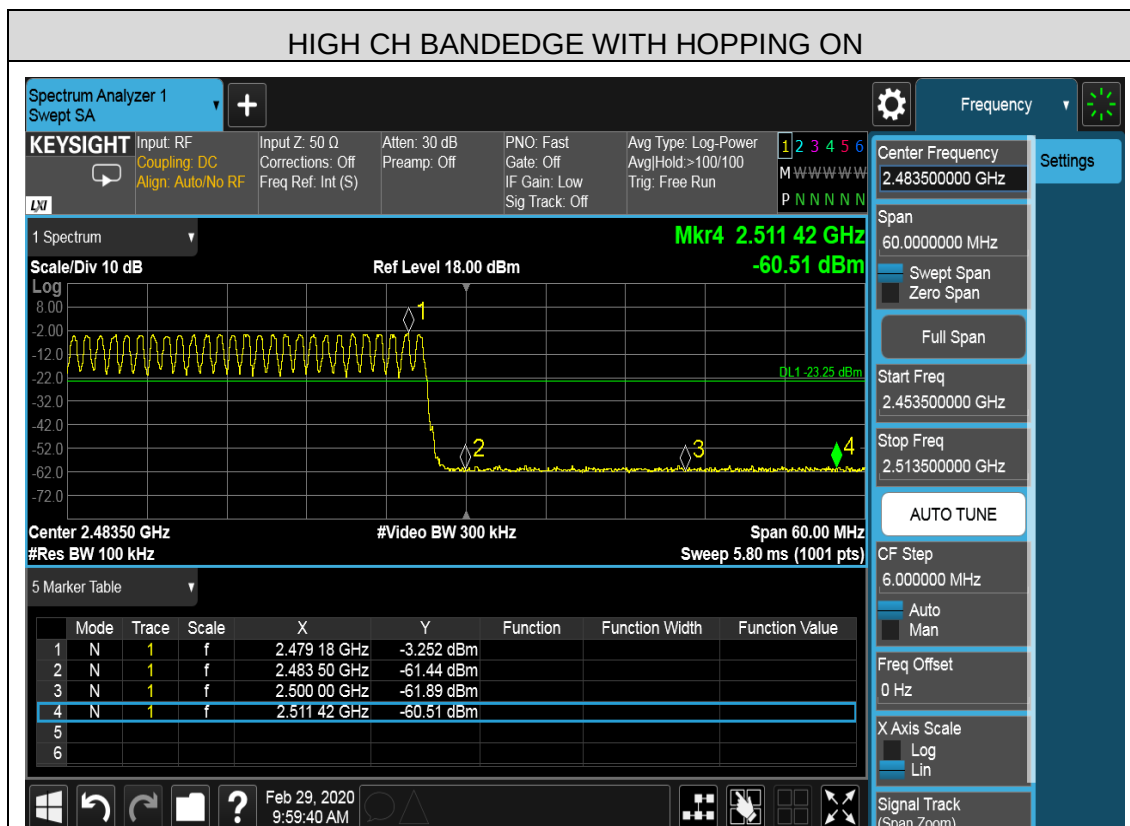
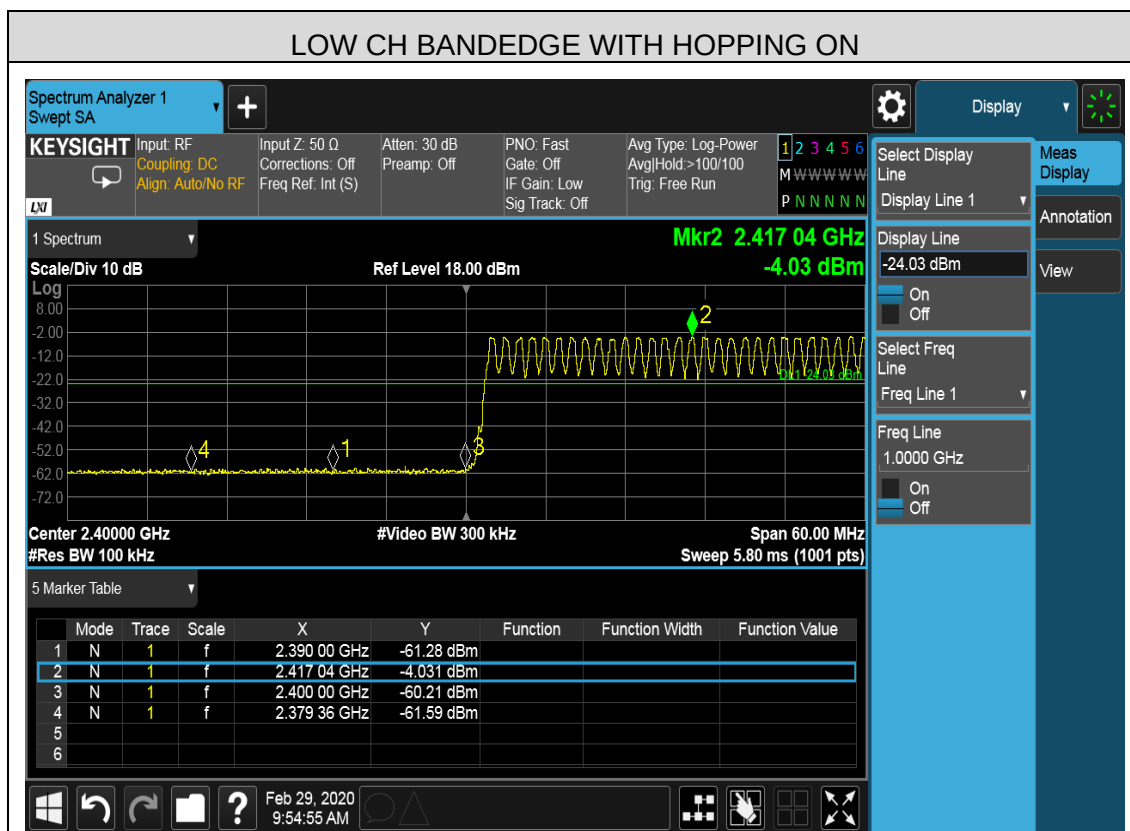
Note: The point 1 which exceeds the limit is 2.4G main carrier.







SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON





7. RADIATED TEST RESULTS

7.1. LIMITS AND PROCEDURE

LIMITS

Please refer to FCC §15.205 and §15.209

Please refer to SS-GEN Clause 8.9 and Clause 8.10

Radiation Disturbance Test Limit for FCC (Class B)(9KHz-1GHz)

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
960~1000	500	3

Note: 1) At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. Measurements shall not be performed at a distance greater than 30 meters unless it can be further demonstrated that measurements at a distance of 30 meters or less are impractical. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

(2) At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). This paragraph (f) shall not apply to Access BPL devices operating below 30 MHz.



Radiation Disturbance Test Limit for FCC (Above 1G)

Frequency (MHz)	dB(uV/m) (at 3 meters)	
	Peak	Average
Above 1000	74	54

Restricted bands of operation

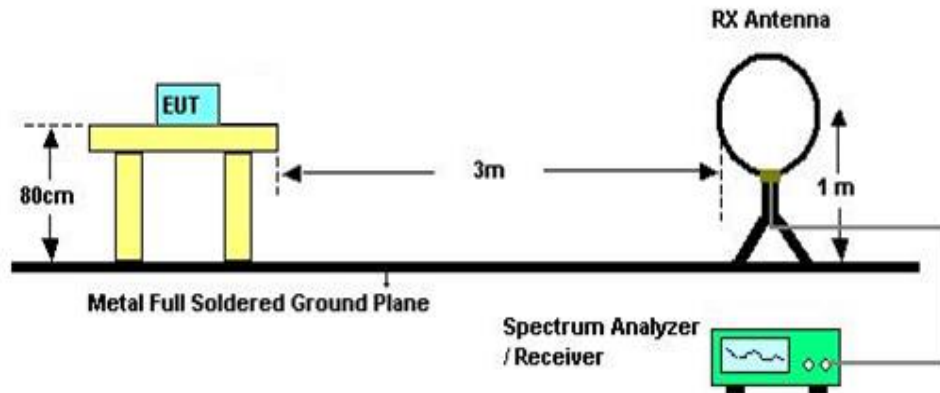
MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
¹ 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(²)
13.36-13.41			

Note: ¹Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

²Above 38.6c

TEST SETUP AND PROCEDURE

Below 30MHz

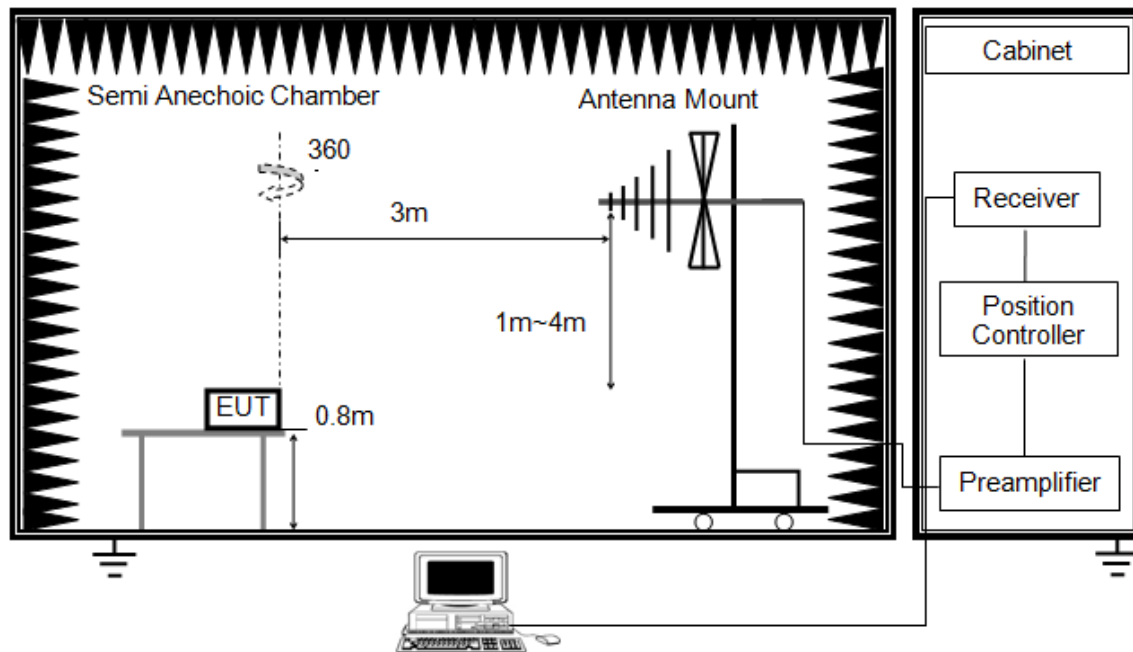


The setting of the spectrum Analyzer

RBW	200Hz (From 9kHz to 0.15MHz)/ 9KHz (From 0.15MHz to 30MHz)
VBW	200Hz (From 9kHz to 0.15MHz)/ 9KHz (From 0.15MHz to 30MHz)
Sweep	Auto
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013
2. The EUT was arranged to its worst case and then turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
3. The EUT was placed on a turntable with 80cm meter above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. The radiated emission limits are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.
6. For measurement below 1GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
7. For the actual test configuration, please refer to the related item in this test report (Photographs of the Test Configuration)

Below 1G and above 30MHz

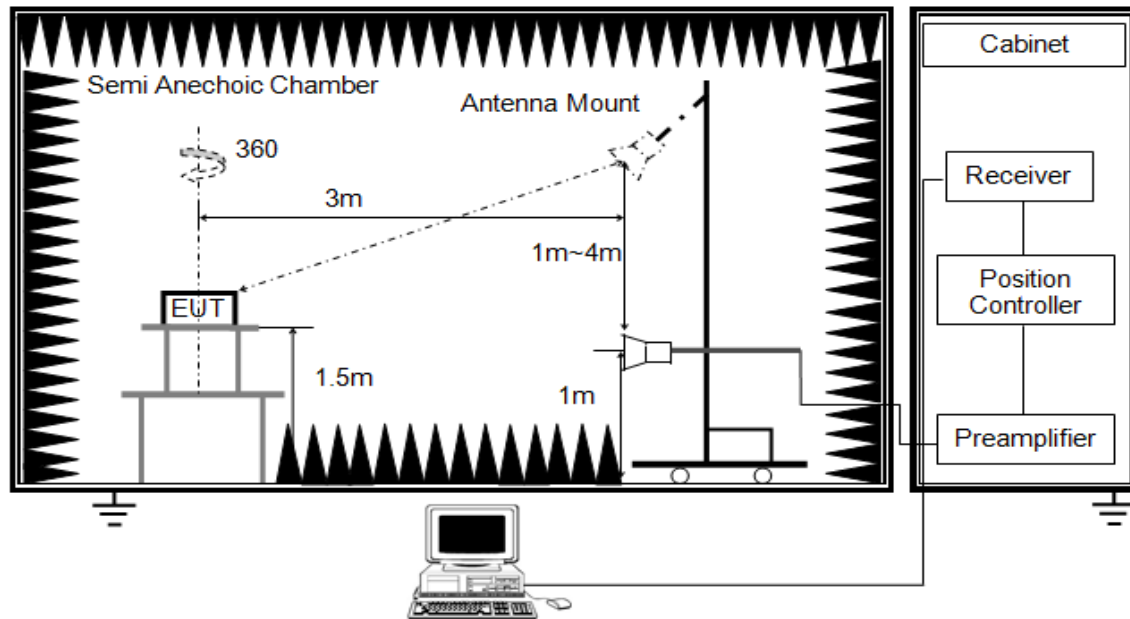


The setting of the spectrum Analyzer

RBW	120K
VBW	300K
Sweep	Auto
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
3. The EUT was placed on a turntable with 80cm above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. For measurement below 1GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
6. For the actual test configuration, please refer to the related item in this test report.

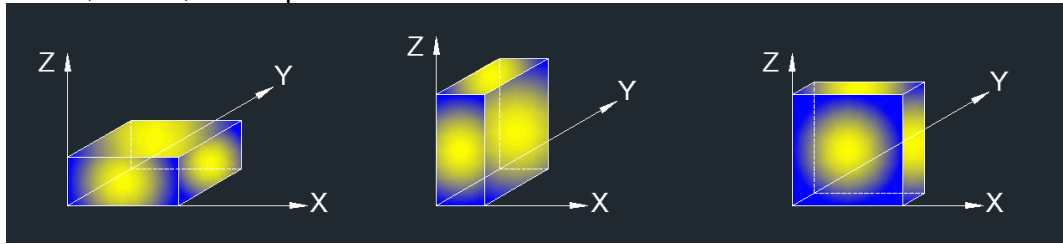
Above 1G



RBW	1M
VBW	PEAK: 3M AVG: see note 6
Sweep	Auto
Detector	Peak
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
3. The EUT was placed on a turntable with 1.5m above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 1/T video bandwidth with peak detector, max hold to be run for at least 50 x (1/duty cycle) traces for average measurements.
6. For the actual test configuration, please refer to the related item in this test report (Photographs of the Test Configuration)

X axis, Y axis, Z axis positions:

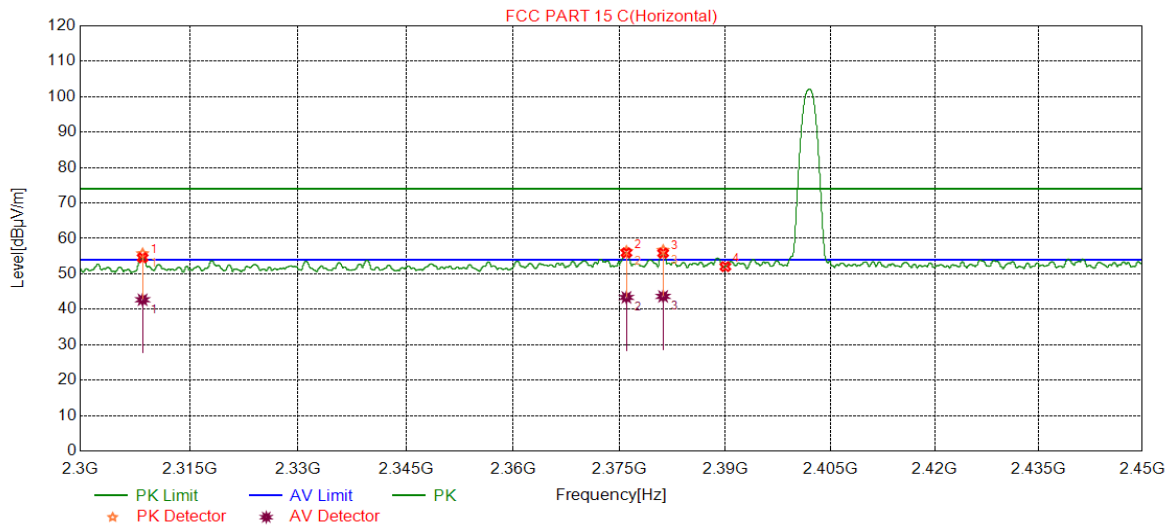


Note: For all radiated test, EUT can only work in one axis(Z axis), so only this case (Z axis) data recorded in the report.

7.2. RESTRICTED BANDEDGE

7.2.1. GFSK MODE

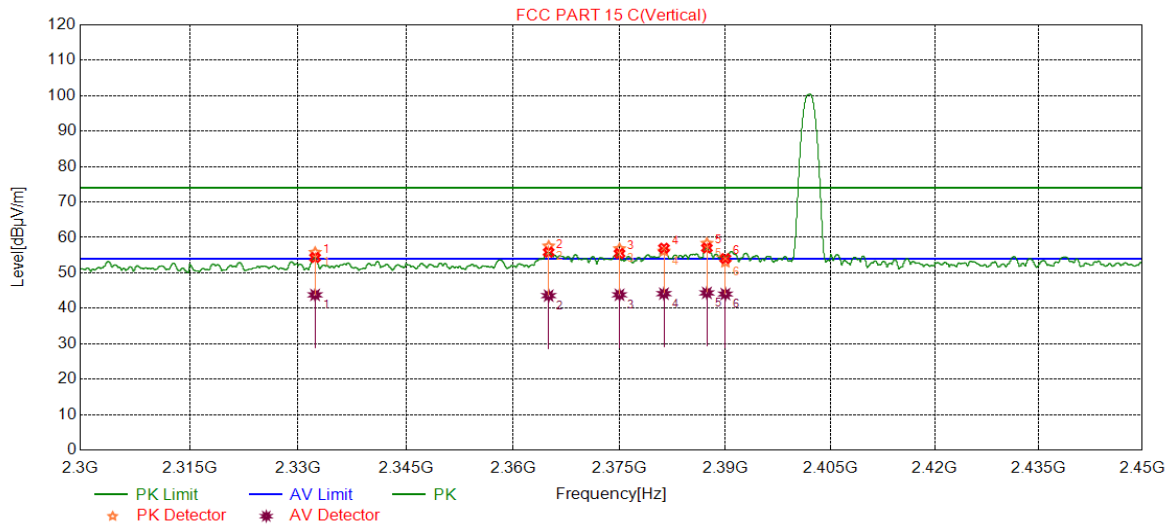
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



No.	Frequency	Reading Level	Correct Factor	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
1	2308.5323	42.47	13.22	55.69	74.00	-18.31	peak
		29.47	13.22	42.69	54.00	-11.31	average
2	2375.9657	42.42	13.94	56.36	74.00	-17.64	peak
		29.42	13.94	43.36	54.00	-10.64	average
3	2381.1601	42.61	14.04	56.65	74.00	-17.35	peak
		29.61	14.04	43.65	54.00	-10.35	average
4	2390.0000	37.95	14.09	52.04	74.00	-21.96	peak

Note: 1. Measurement = Reading Level + Correct Factor.
 2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
 3. Peak: Peak detector.
 4. Only the worst case emission was recorded, if it complies with the limit, the other emissions deemed to comply with the limit.

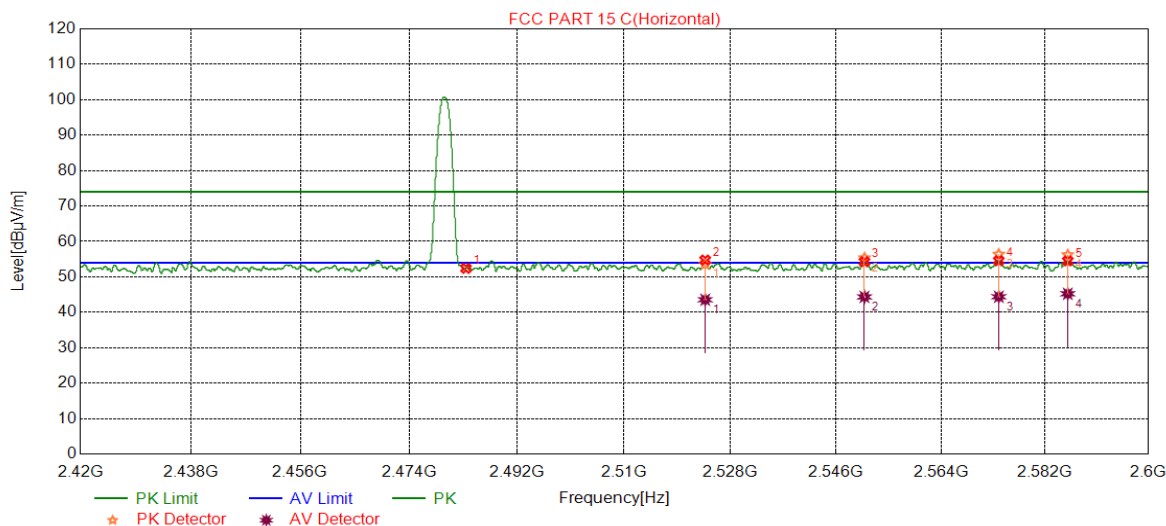
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



No.	Frequency	Reading Level	Correct Factor	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
1	2332.3478	42.28	13.50	55.78	74.00	-18.22	peak
		30.28	13.50	43.78	54.00	-10.22	average
2	2364.9956	43.79	13.78	57.57	74.00	-16.43	peak
		29.79	13.78	43.57	54.00	-10.43	average
3	2374.9906	42.88	13.93	56.81	74.00	-17.19	peak
		29.88	13.93	43.81	54.00	-10.19	average
4	2381.2727	42.10	14.04	56.14	74.00	-17.86	peak
		30.09	14.04	44.13	54.00	-9.87	average
5	2387.3672	44.30	14.05	58.35	74.00	-15.65	peak
		30.30	14.05	44.35	54.00	-9.65	average
6	2390.0000	38.94	14.09	53.03	74.00	-20.97	peak
		29.94	14.09	44.03	54.00	-9.97	average

Note: 1. Measurement = Reading Level + Correct Factor.
 2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
 3. Peak: Peak detector.
 4. Only the worst case emission was recorded, if it complies with the limit, the other emissions deemed to comply with the limit.

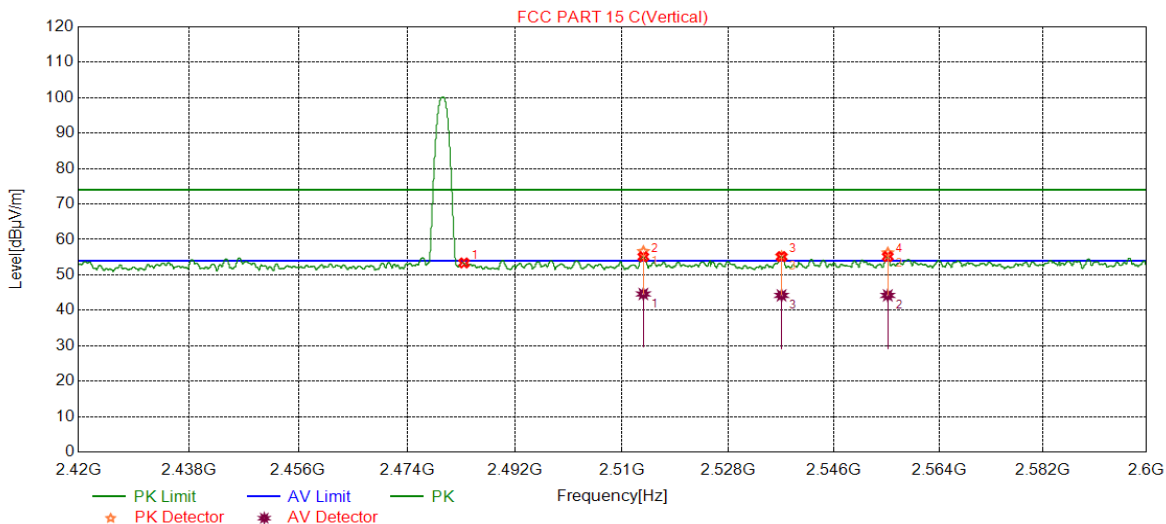
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



No.	Frequency	Reading Level	Correct Factor	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
1	2483.5000	38.51	13.88	52.39	74.00	-21.61	peak
2	2523.7084	39.30	14.24	43.54	54.00	-20.46	peak
		29.30	14.24	43.54	54.00	-10.46	average
3	2550.8551	40.93	14.42	55.35	74.00	-18.65	peak
		29.93	14.42	44.35	54.00	-9.65	average
4	2573.9694	41.96	14.43	56.39	74.00	-17.61	peak
		29.96	14.43	44.39	54.00	-9.61	average
5	2585.9226	41.75	14.48	56.23	74.00	-17.77	peak
		30.75	14.48	45.23	54.00	-8.77	average

- Note: 1. Measurement = Reading Level + Correct Factor.
 2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
 3. Peak: Peak detector.
 4. Only the worst case emission was recorded, if it complies with the limit, the other emissions deemed to comply with the limit.

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

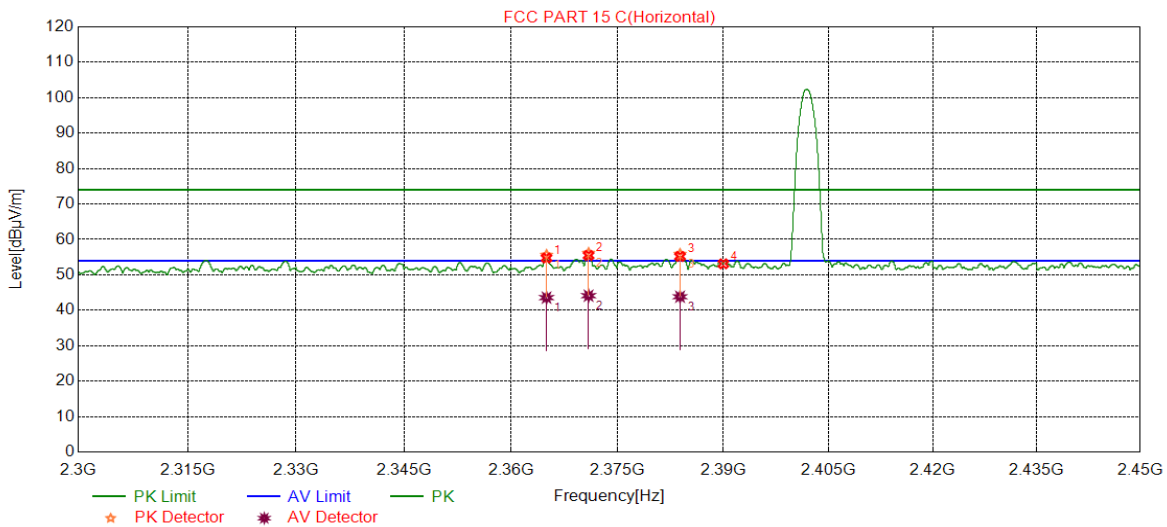


No.	Frequency (MHz)	Reading Level (dBuV/m)	Correct Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.5000	39.48	13.88	53.36	74.00	-20.64	peak
2	2513.5914	42.38	14.22	56.60	74.00	-17.40	peak
		30.38	14.22	44.60	54.00	-9.40	average
3	2537.0297	40.94	14.27	55.21	74.00	-18.79	peak
		29.94	14.27	44.21	54.00	-9.79	average
4	2555.1935	41.4	14.47	55.87	74.00	-18.13	peak
		29.40	14.47	43.87	54.00	-10.13	average

- Note: 1. Measurement = Reading Level + Correct Factor.
 2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
 3. Peak: Peak detector.
 4. Only the worst case emission was recorded, if it complies with the limit, the other emissions deemed to comply with the limit.

7.2.2. 8DPSK MODE

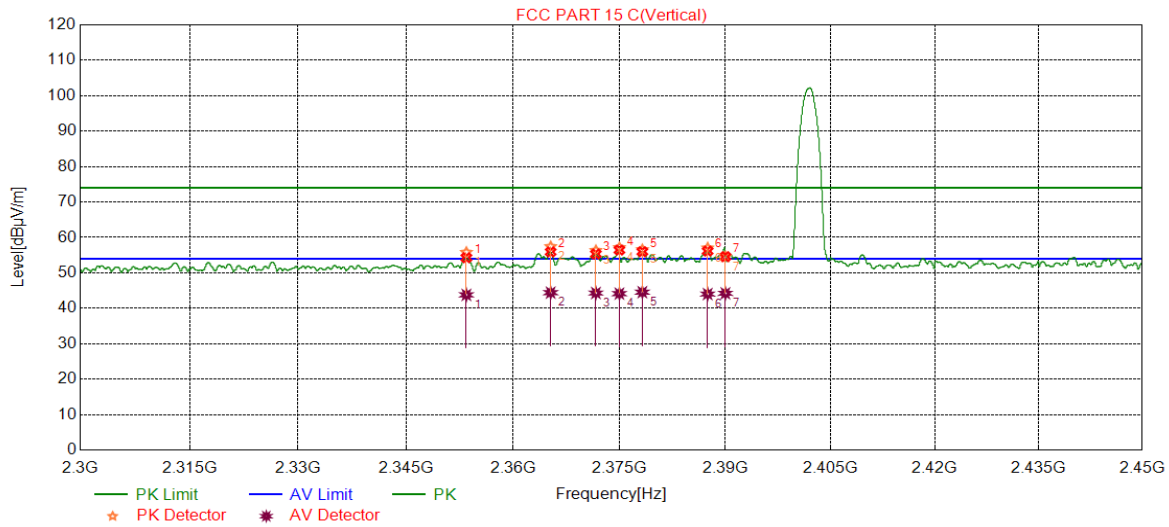
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



No.	Frequency	Reading Level	Correct Factor	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
1	2364.9769	41.79	13.78	55.57	74.00	-18.43	peak
		29.79	13.78	43.57	54.00	-10.43	average
2	2370.9026	42.25	13.87	56.12	74.00	-17.88	peak
		30.25	13.87	44.12	54.00	-9.88	average
3	2383.8417	41.78	14.05	55.83	74.00	-18.17	peak
		29.78	14.05	43.83	54.00	-10.17	average
4	2390.0000	39.03	14.09	53.12	74.00	-20.88	peak

- Note: 1. Measurement = Reading Level + Correct Factor.
 2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
 3. Peak: Peak detector.
 4. Only the worst case emission was recorded, if it complies with the limit, the other emissions deemed to comply with the limit.

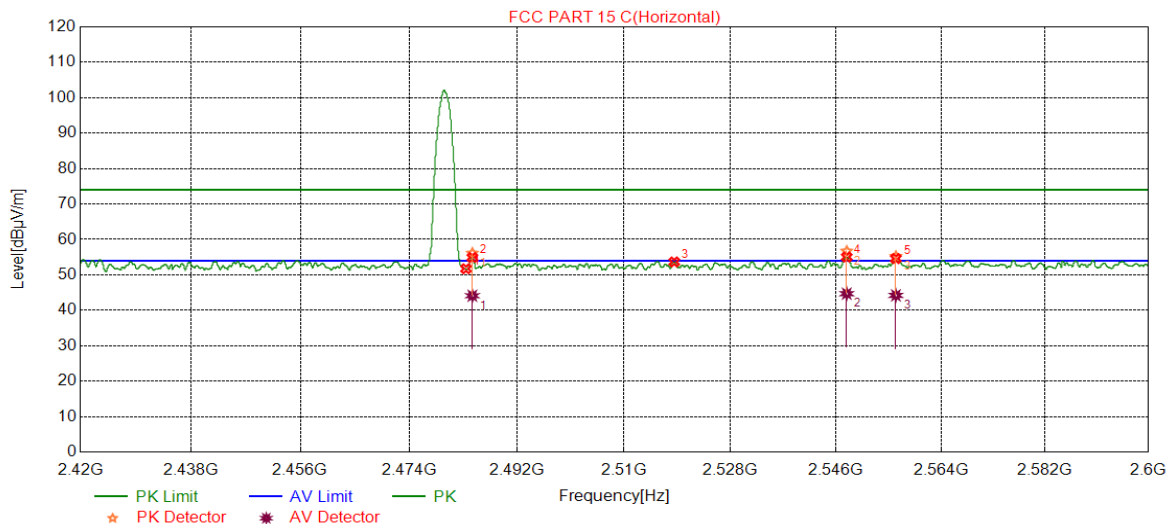
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



No.	Frequency	Reading Level	Correct Factor	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
1	2353.4442	42.10	13.69	55.79	74.00	-18.21	peak
		30.10	13.69	43.79	54.00	-10.21	average
2	2365.2769	43.62	13.79	57.41	74.00	-16.59	peak
		30.62	13.79	44.41	54.00	-9.59	average
3	2371.6527	42.43	13.88	56.31	74.00	-17.69	peak
		30.43	13.88	44.31	54.00	-9.69	average
4	2374.9719	43.21	13.93	57.14	74.00	-16.86	peak
		30.21	13.93	44.14	54.00	-9.86	average
5	2378.2160	42.58	13.97	56.55	74.00	-17.45	peak
		30.58	13.97	44.55	54.00	-9.45	average
6	2387.4797	42.97	14.05	57.02	74.00	-16.98	peak
		29.97	14.05	44.02	54.00	-9.98	average
7	2390.0000	40.44	14.09	54.53	74.00	-19.47	peak
		30.14	14.09	44.23	54.00	-9.77	average

Note: 1. Measurement = Reading Level + Correct Factor.
 2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
 3. Peak: Peak detector.
 4. Only the worst case emission was recorded, if it complies with the limit, the other emissions deemed to comply with the limit.

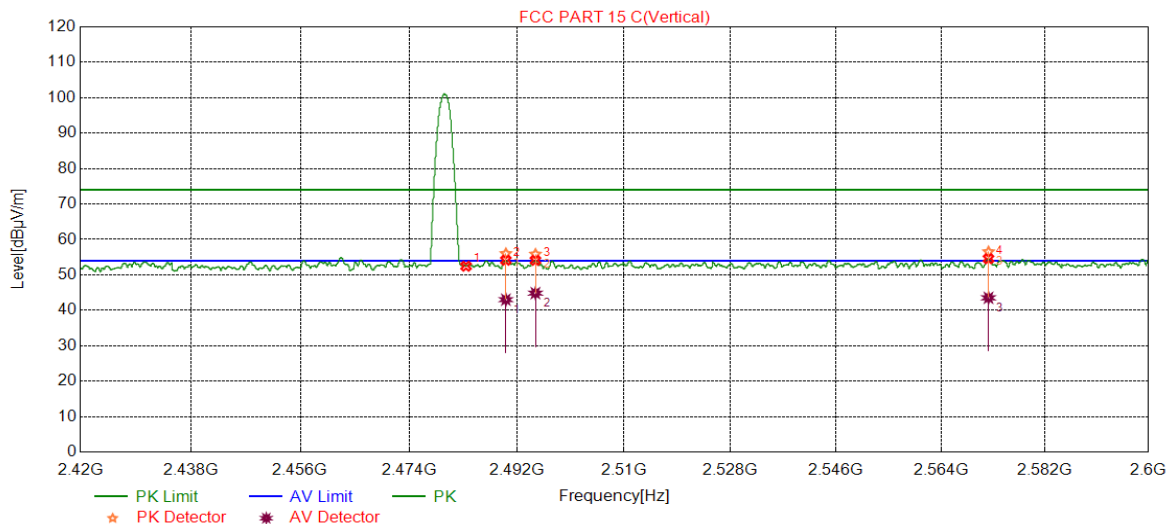
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



No.	Frequency (MHz)	Reading Level (dBuV/m)	Correct Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.5000	37.85	13.88	51.73	74.00	-22.27	peak
2	2484.5545	42.20	13.91	56.11	74.00	-17.89	peak
		30.20	13.91	44.11	54.00	-9.89	average
3	2518.4698	39.37	14.28	53.65	74.00	-20.35	peak
4	2547.8128	42.30	14.39	56.69	74.00	-17.31	peak
		30.30	14.39	44.69	54.00	-9.31	average
5	2556.2376	40.73	14.48	55.21	74.00	-18.79	peak
		29.73	14.48	44.21	54.00	-9.79	average

Note: 1. Measurement = Reading Level + Correct Factor.
 2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
 3. Peak: Peak detector.
 4. Only the worst case emission was recorded, if it complies with the limit, the other emissions deemed to comply with the limit.

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



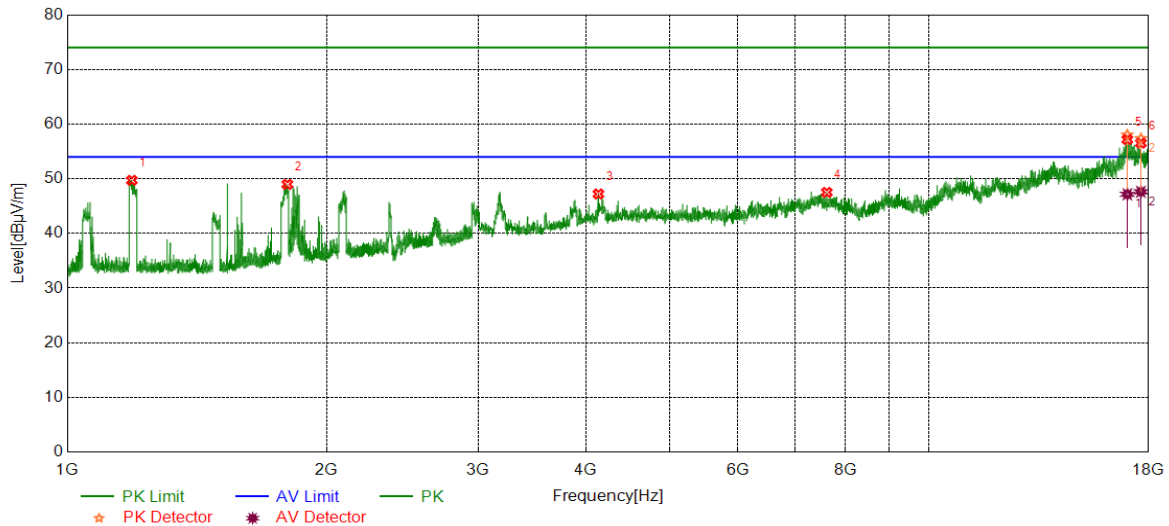
No.	Frequency (MHz)	Reading Level (dBuV/m)	Correct Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.5000	38.55	13.88	52.43	74.00	-21.57	peak
2	2490.1530	42.03	13.97	56.00	74.00	-18.00	peak
		29.03	13.97	43.00	54.00	-11.00	average
3	2495.1035	41.83	14.01	55.84	74.00	-18.16	peak
		30.83	14.01	44.84	54.00	-9.16	average
4	2572.1872	42.08	14.44	56.52	74.00	-17.48	peak
		29.08	14.44	43.52	54.00	-10.48	average

- Note: 1. Measurement = Reading Level + Correct Factor.
 2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
 3. Peak: Peak detector.
 4. Only the worst case emission was recorded, if it complies with the limit, the other emissions deemed to comply with the limit.

7.3. SPURIOUS EMISSIONS (1~18GHz)

7.3.1. GFSK MODE

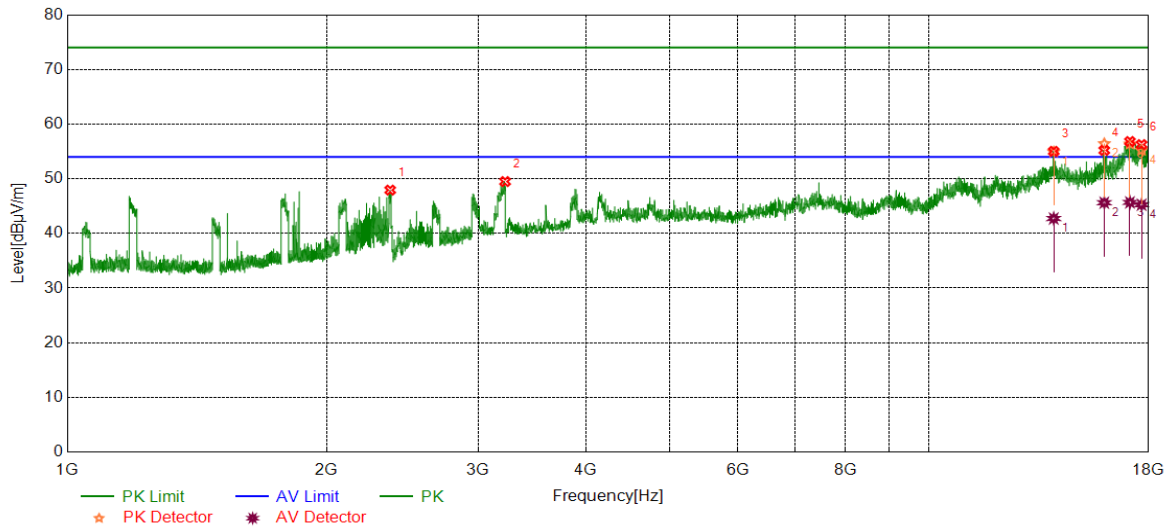
HARMONICS AND SPURIOUS EMISSIONS (LOW CHANNEL, HORIZONTAL)



No.	Frequency (MHz)	Reading Level (dBuV/m)	Correct Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1188.5236	55.28	-5.56	49.72	74.00	-24.28	peak
2	1801.1001	52.86	-3.88	48.98	74.00	-25.02	peak
3	4136.3920	42.58	4.64	47.22	74.00	-26.78	peak
4	7616.8271	38.78	8.73	47.51	74.00	-26.49	peak
5	17004.2505	38.39	19.62	58.01	74.00	-15.99	peak
		27.54	19.62	47.16	54.00	-6.84	average
6	17632.4541	38.02	19.33	57.35	74.00	-16.65	peak
		28.29	19.33	47.62	54.00	-6.38	average

- Note:
1. Measurement = Reading Level + Correct Factor.
 2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
 3. Peak: Peak detector.
 4. For below 3GHz part, Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for Band Reject Filter losses.
 5. For above 3GHz part, Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for HPF losses.
 6. Proper operation of the transmitter prior to adding the filter to the measurement chain.
 7. Only the worst case emission was recorded, if it complies with the limit, the other emissions deemed to comply with the limit.

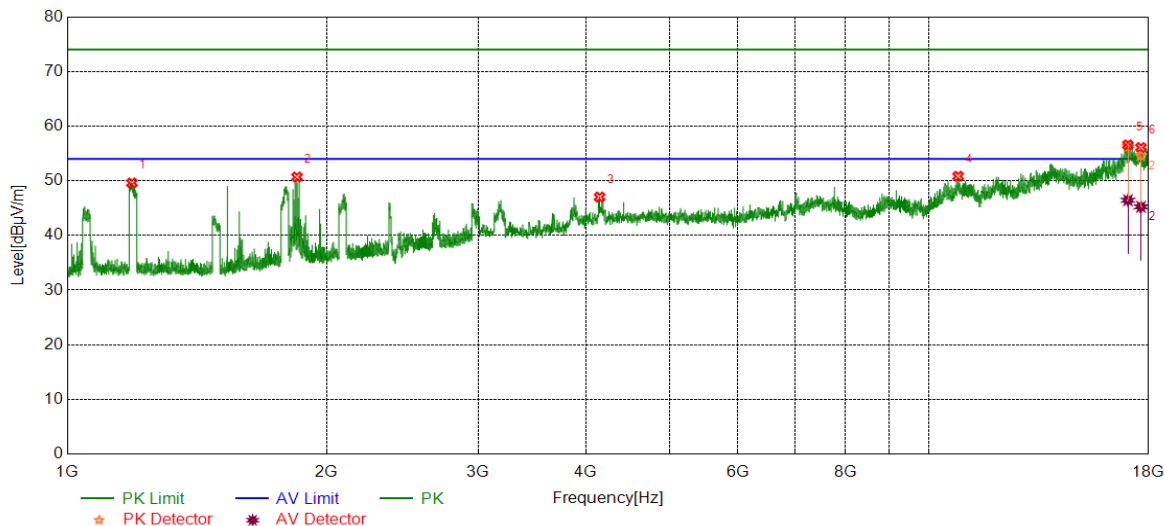
HARMONICS AND SPURIOUS EMISSIONS (LOW CHANNEL, VERTICAL)



No.	Frequency (MHz)	Reading Level (dBuV/m)	Correct Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2370.9214	49.49	-1.56	47.93	74.00	-26.07	peak
2	3223.1529	47.72	1.77	49.49	74.00	-24.51	peak
3	13966.3708	38.97	15.94	54.91	74.00	-19.09	peak
		26.79	15.94	42.73	54.00	-11.27	average
4	15987.8735	39.05	17.37	56.42	74.00	-17.58	peak
		28.25	17.37	45.62	54.00	-8.38	average
5	17122.3903	37.30	19.07	56.37	74.00	-17.63	peak
		26.61	19.07	45.68	54.00	-8.32	average
6	17664.3330	35.72	19.49	55.21	74.00	-18.79	peak
		25.76	19.49	45.25	54.00	-8.75	average

- Note: 1. Measurement = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.
4. For below 3GHz part, Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for Band Reject Filter losses.
5. For above 3GHz part, Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for HPF losses.
6. Proper operation of the transmitter prior to adding the filter to the measurement chain.
7. Only the worst case emission was recorded, if it complies with the limit, the other emissions deemed to comply with the limit.

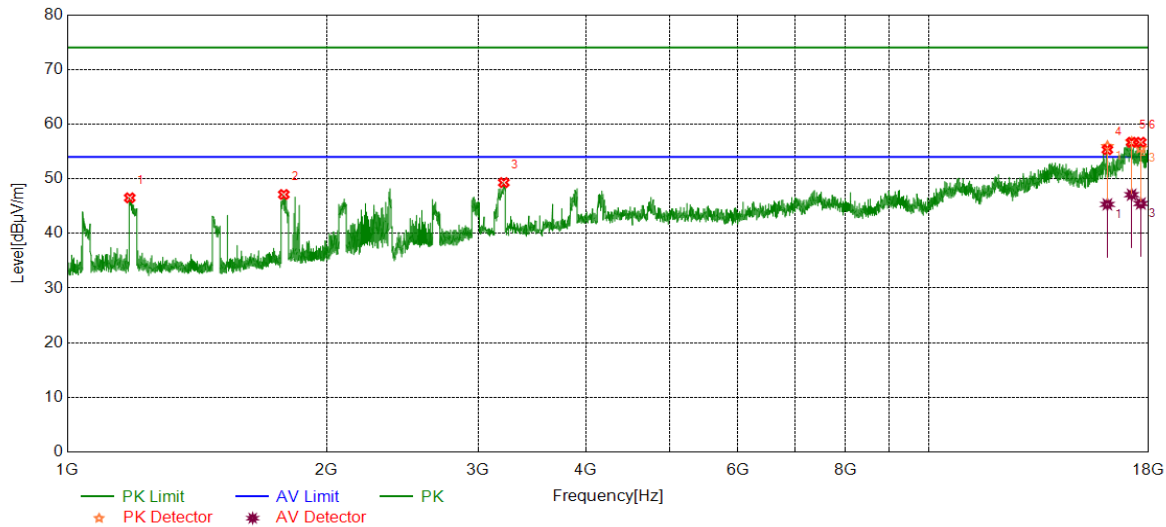
HARMONICS AND SPURIOUS EMISSIONS (MID CHANNEL, HORIZONTAL)



No.	Frequency	Reading Level	Correct Factor	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
1	1188.7736	55.17	-5.56	49.61	74.00	-24.39	peak
2	1848.3560	54.38	-3.69	50.69	74.00	-23.31	peak
3	4149.5187	42.27	4.76	47.03	74.00	-26.97	peak
4	10817.8522	38.08	12.75	50.83	74.00	-23.17	peak
5	17030.5038	36.09	20.18	56.27	74.00	-17.73	peak
		26.26	20.18	46.44	54.00	-7.56	average
6	17636.2045	35.22	19.38	54.60	74.00	-19.40	peak
		25.85	19.38	45.23	54.00	-8.77	average

- Note: 1. Measurement = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.
4. For below 3GHz part, Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for Band Reject Filter losses.
5. For above 3GHz part, Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for HPF losses.
6. Proper operation of the transmitter prior to adding the filter to the measurement chain.
7. Only the worst case emission was recorded, if it complies with the limit, the other emissions deemed to comply with the limit.

HARMONICS AND SPURIOUS EMISSIONS (MID CHANNEL, VERTICAL)



No.	Frequency	Reading Level	Correct Factor	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
1	1182.0228	52.13	-5.62	46.51	74.00	-27.49	peak
2	1784.0980	51.06	-3.94	47.12	74.00	-26.88	peak
3	3211.9015	47.48	1.82	49.30	74.00	-24.70	peak
4	16121.0151	39.04	16.88	55.92	74.00	-18.08	peak
		28.44	16.88	45.32	54.00	-8.68	average
5	17201.1501	37.78	18.91	56.69	74.00	-17.31	peak
		28.18	18.91	47.09	54.00	-6.91	average
6	17626.8284	36.52	19.09	55.61	74.00	-18.39	peak
		26.38	19.09	45.47	54.00	-8.53	average

- Note: 1. Measurement = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.
4. For below 3GHz part, Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for Band Reject Filter losses.
5. For above 3GHz part, Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for HPF losses.
6. Proper operation of the transmitter prior to adding the filter to the measurement chain.
7. Only the worst case emission was recorded, if it complies with the limit, the other emissions deemed to comply with the limit.