

																												
<p>MOTOROLA PENANG ADV. COMM. LABORATORY Motorola Solutions Malaysia Sdn. Bhd. Innoplex Plot 2A Medan Bayan Lepas, Mukim 12, S.W.D. 11900 Bayan Lepas, Penang, Malaysia.</p>	<p>FCC / IC TEST REPORT Report Revision : Rev.C</p>																											
<table> <tr> <td>Date/s Tested</td> <td>: 27-November-2016 - 30-May-2017</td> <td rowspan="11" style="text-align: center; vertical-align: middle;">  </td> </tr> <tr> <td>Report Issue Date</td> <td>: 31-May-2017</td> </tr> <tr> <td>Manufacturer/Location</td> <td>: Motorola Solutions - Penang</td> </tr> <tr> <td>Requestor</td> <td>: MUNIANDY BARATH</td> </tr> <tr> <td>Product Type</td> <td>: Portable</td> </tr> <tr> <td>Model Number</td> <td>: H92QDH9PW7AN</td> </tr> <tr> <td>Frequency Band</td> <td>: 2.402-2.480 GHz</td> </tr> <tr> <td>Rated / Max RF Output Power</td> <td>: 8.9 mWatts / 10 mWatts</td> </tr> <tr> <td>Applicant Name</td> <td>: Motorola Solutions Malaysia Sdn Bhd</td> </tr> <tr> <td>Applicant Address</td> <td>: Innoplex Plot 2A, Medan Bayan lepas, Mukim 12, S.W.D. 11900 Bayan Lepas, Penang, Malaysia</td> </tr> <tr> <td>FCC Registrations</td> <td>: 772092</td> </tr> <tr> <td>IC Registrations</td> <td>: 109AK</td> </tr> </table> <p>The equipment was tested accordance to the requirement listed below:</p> <table style="width: 100%;"> <tr> <td style="width: 60%;">(2.4GHz BT) Part 15C IC RSS 247</td> <td style="text-align: center;">PASS</td> </tr> </table>		Date/s Tested	: 27-November-2016 - 30-May-2017		Report Issue Date	: 31-May-2017	Manufacturer/Location	: Motorola Solutions - Penang	Requestor	: MUNIANDY BARATH	Product Type	: Portable	Model Number	: H92QDH9PW7AN	Frequency Band	: 2.402-2.480 GHz	Rated / Max RF Output Power	: 8.9 mWatts / 10 mWatts	Applicant Name	: Motorola Solutions Malaysia Sdn Bhd	Applicant Address	: Innoplex Plot 2A, Medan Bayan lepas, Mukim 12, S.W.D. 11900 Bayan Lepas, Penang, Malaysia	FCC Registrations	: 772092	IC Registrations	: 109AK	(2.4GHz BT) Part 15C IC RSS 247	PASS
Date/s Tested	: 27-November-2016 - 30-May-2017																											
Report Issue Date	: 31-May-2017																											
Manufacturer/Location	: Motorola Solutions - Penang																											
Requestor	: MUNIANDY BARATH																											
Product Type	: Portable																											
Model Number	: H92QDH9PW7AN																											
Frequency Band	: 2.402-2.480 GHz																											
Rated / Max RF Output Power	: 8.9 mWatts / 10 mWatts																											
Applicant Name	: Motorola Solutions Malaysia Sdn Bhd																											
Applicant Address	: Innoplex Plot 2A, Medan Bayan lepas, Mukim 12, S.W.D. 11900 Bayan Lepas, Penang, Malaysia																											
FCC Registrations	: 772092																											
IC Registrations	: 109AK																											
(2.4GHz BT) Part 15C IC RSS 247	PASS																											
<p>This report shall not be reproduced without written approval from an officially designated representative of the Motorola Penang Adv. Comm. Laboratory. The results and statements contained in this report pertain only to the device(s) evaluated.</p>																												
<p>Prepared By:</p> <p>_____</p> <p>GAN BOON TEONG Test Personnel</p>	<p>Approved By:</p> <p>_____</p> <p>GOH AIK HONG Responsible Engineer</p>																											

Table of Contents

1.0.	General Information	3
2.0.	Summary of Test Results.....	4
3.0.	Measurement Uncertainty	4
4.0.	Equipment List	5
5.0.	Test Mode Applicability and Test Channel Detail	6
6.0.	Transmitter Test Parameters	7
6.1.	Conducted RF Output Power (Peak)	7
6.1.1.	Test Setup	7
6.1.2.	Test Limits:.....	7
6.1.3.	Test Data:	7
6.2.	20dB Channel Bandwidth & Occupied Bandwidth.....	11
6.2.1.	Test Setup	11
6.2.2.	Test Limits:.....	11
6.2.3.	Test Data:	11
6.3.	Band-edge Conducted Spurious Emission	15
6.3.1.	Test Setup	15
6.3.1.	Test Limits.....	15
6.3.2.	Test Result.....	15
6.4.	Dwell time on each channel	19
6.4.1.	Test Setup	19
6.4.2.	Test Limits:.....	19
6.4.3.	Test Result.....	19
6.5.	Number of hopping Frequency.....	23
6.5.1.	Test Setup	23
6.5.2.	Test Limits:.....	23
6.5.3.	Test Result.....	23
6.6.	Channel Separation.....	25
6.6.1.	Test Setup	25
6.6.2.	Test Limits:.....	25
6.6.3.	Test Result.....	25
6.7.	Conducted Spurious Emission.....	29
6.7.1.	Test Setup	29
6.7.1.	Test Limits:.....	29
6.7.2.	Test Data:	29
6.8.	Radiated Emission within restricted Bands	35
6.8.1.	Test Setup	35
6.8.2.	Test Limits:.....	36
6.8.3.	Test Data:	37
6.9.	AC Powerline Conducted Emission	92
6.9.1.	Test Setup	92
6.9.2.	Test Limits:.....	93
6.9.3.	Test Result.....	93

REVISION HISTORY

Revision History	Description	Date	Originator
Rev. A	Initial Report	10-January-2017	GAN BOON TEONG
Rev. B	Revise Section 6.1.1, Section 6.8.1 and Section 6.6.3	16-March-2017	GAN BOON TEONG
Rev. C	Revised Section 6.4.3	30-May-2017	GAN BOON TEONG

1.0. General Information

EUT Description:

Technologies	2.4GHz BT
TX Frequency range	2402MHz – 2480MHz
Modulation Type	GFSK, Pi/4DQPSK, 8DPSK
Input/Output	RF port
Connector type	PROGRAMMING, TEST & ALIGNMENT CABLE
Antenna type	ANTENNA, CHIP, BEIDOU BT/GPS ANTENNA MODULE

Channel number and frequency information:

79 channels are provided to this EUT:

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	2402	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	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		

The EUT contains following accessory devices and data cable:

Item	Brand	Model or P/N
Impres 3000 Mah, Li-Ion High Capacity Battery, Low Voltage, Ip68.	MOTOROLA	PMNN4493A
Programing, Test & Alignment Cable	MOTOROLA	PMKN4013C

General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, the EUT is to comply with the requirements of the following standards:

ANSI C63.10-2013

2.0. Summary of Test Results

FCC Clause	IC Clause	Test Item	Result	Remark
15.247 (b)(1)	RSS-247 5.1(2)	Conducted RF Output Power (Peak)	Pass	NA
15.247 (a)(1)	RSS-247 5.1(1) RSS-247 5.1(2)	(1) 20dB Channel Bandwidth (2) Channel Separation	Pass	NA
15.247(a)(1)(iii)	RSS-247 5.1(4)	Number of hopping Frequency used	Pass	NA
15.247(a)(1)(iii)	RSS-247 5.1(4)	Dwell time on each channel	Pass	NA
15.247 (d)	RSS-247 5.5	Band Edge Conducted Spurious Emission	Pass	NA
15.247 (d)	RSS-247 5.5	Conducted Spurious Emission	Pass	NA
15.205, 15.209, 15.247 (d)	RSS-247 5.5	Radiated Emission within Restricted Bands	Pass	NA
15.207	RSS-Gen 8.8	AC Powerline Conducted Emission	NA	Testing is not required, radio shall turn off during charging mode
15.203	-	Antenna Requirement	NA	Internal antenna is not accessible to the end-user

3.0. Measurement Uncertainty

Measurement	Frequency	Expanded Uncertainty (k=1.96) (±)
AC Power Line Conducted Spurious Emission	150KHz ~ 30MHz	3.43
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	5.01
	200MHz ~ 1000MHz	5.01
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	5.01
	18GHz ~ 25GHz	5.01

4.0. Equipment List

Bluetooth ATE # 1 (SW Version: Ate Main_3.1.9_R1)

Description	Model	Serial Number	Calibration Date	Calibration Due Date
POWER SUPPLY	6652A	3117A00162	6-Mar-16	6-Mar-17
POWER SUPPLY	6652A	3541A02403	7-Sep-15	7-Sep-17
SPECTRUM ANALYZER	E4445A	MY46181513	11-Dec-14	11-Dec-17
SPECTRUM ANALYZER	FSEK30	838495/014	29-Jun-15	29-Jun-17

Radiated Emission Station(SW Version: EMC FCC RE v1.5.1)

Description	Model	Serial Number	Calibration Date	Calibration Due Date
DRG HORN FREQ.	SAS-571	566	4-Sep-16	4-Sep-17
DRG HORN FREQ.	SAS-571	719	28-Apr-15	28-Apr-17
BILOG ANTENNA	CBL6112B	2964	23-Jan-15	23-Jan-17
POWER SUPPLY	6674A	3126A00133	12-Nov-15	12-Nov-17
MICROWAVE SIGNAL GENERATOR	SMP04	100127	3-Jul-16	3-Jul-17
EMI TEST RECEIVER	ESIB26	100336	19-Oct-16	19-Oct-17
SIGNAL ANALYZER	FSV40	101103	25-Jun-16	25-Jun-17
5M SEMI-ANECHOIC CHAMBER	S800-HX	J2308	29-Jul-16	29-Jul-17
BILOG ANTENNA	CBL6112D	25516	23-Jan-16	23-Jan-17
BROAD-BAND HORN ANTENNA	BBHA9170	BBHA9170143	24-Nov-14	24-Feb-17
DATA LOGGER	TM320	12249289	27-Apr-16	27-Apr-17
SYSTEM CONTROLLER	SC104V	050806-1	Not Required	Not Required
TRUNTABLE FLUSH MOUNT 2M	FM2011	NA	Not Required	Not Required
ANTENNA POSITIONNING TOWER	TLT2	NA	Not Required	Not Required
18 - 40GHz PREAMPLIFIER	BBV9721	9721-007	Not Required	Not Required
PREAMPLIFIER	PAM-0118P	361	Not Required	Not Required

5.0. Test Mode Applicability and Test Channel Detail

Radiated Emission Test (Above 1GHz)

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type
Test Mode	0 to 78	0,39,78	FHSS	GFSK, pi/4 DQPSK,8DPSK

Radiated Emission Test (Below 1GHz)

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type
Test Mode	0 to 78	0,39,78	FHSS	GFSK, pi/4 DQPSK,8DPSK

Power Line Conducted Emission Test

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type
Application Mode	0 to 78	AUTO	FHSS	AUTO

Antenna Port Conducted Measurement:

This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

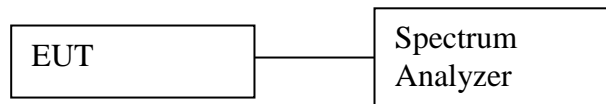
Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type
Test Mode	0 to 78	0,39,78	FHSS	GFSK, pi/4 DQPSK,8DPSK

6.0. Transmitter Test Parameters

6.1. Conducted RF Output Power (Peak)

6.1.1. Test Setup



- a) Check and ensure the spectrum analyzer well calibrate.
- b) Turn on the EUT and set EUT to transmit maximum data rate with hopping disable.
- c) Connect EUT's antenna terminal to spectrum analyzer with a low loss cable.
- d) Setting of Spectrum analyzer :
 - a. RBW = > 20 dB bandwidth
 - b. VBW = RBW
 - c. Detector mode = Peak
 - d. AMPLITUDE → Scale/Div = 10 dB
 - e. Trace = Max hold
 - f. Sweep = auto
- e) Measure the captured power within the band and recording the plot.
- f) Repeat above procedure with other different mode of operation.

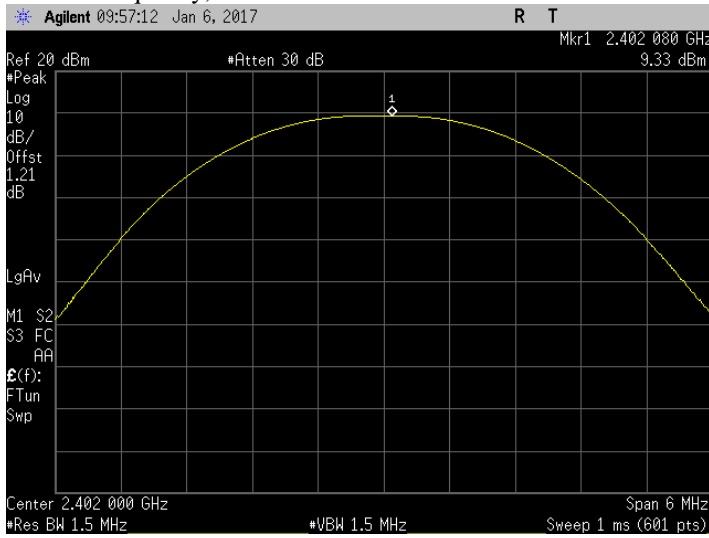
6.1.2. Test Limits:

Normal Condition (25 ° C)
≤ 125mW (or 20.9dBm)

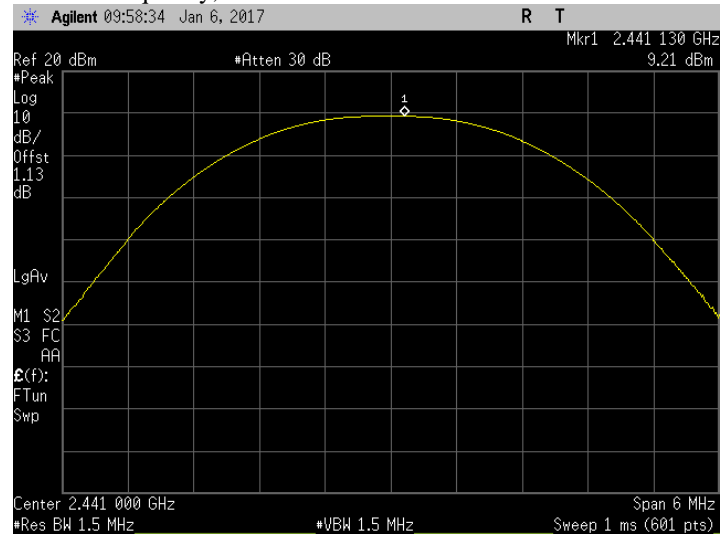
6.1.3. Test Data:

Test Conditions		Test Frequency (GHz)	Results	
Modulation	Voltage(V)		dBm	Status
GFSK	7.5	2.4020	9.330	Pass
		2.4410	9.210	Pass
		2.4800	9.300	Pass
Pi/4DQPSK	7.5	2.4020	6.740	Pass
		2.4410	6.590	Pass
		2.4800	6.660	Pass
8DPSK	7.5	2.4020	7.220	Pass
		2.4410	7.080	Pass
		2.4800	7.150	Pass

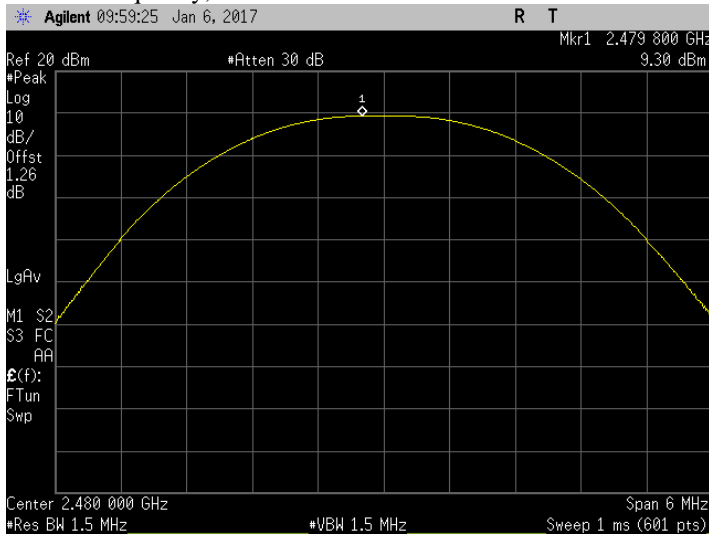
i. The Conducted RF Output Power test with result at low frequency, GFSK.



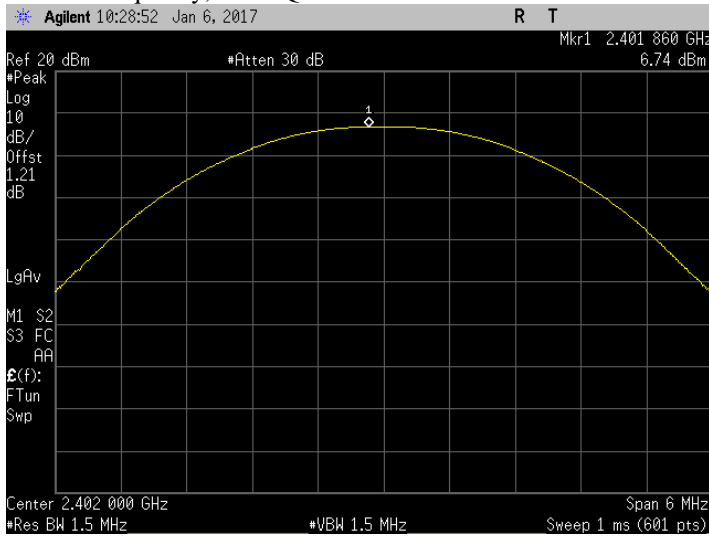
ii. The Conducted RF Output Power test with result at mid frequency, GFSK.



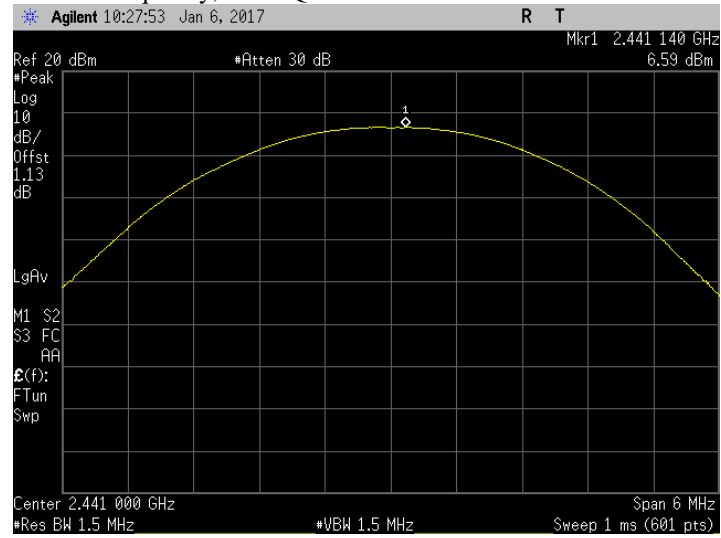
iii. The Conducted RF Output Power test with result at high frequency, GFSK.



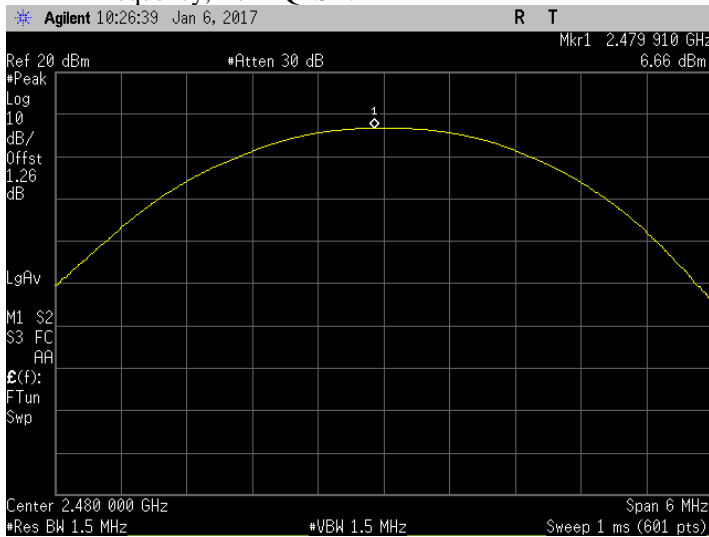
i. The Conducted RF Output Power test with result at low frequency, Pi/4DQPSK.



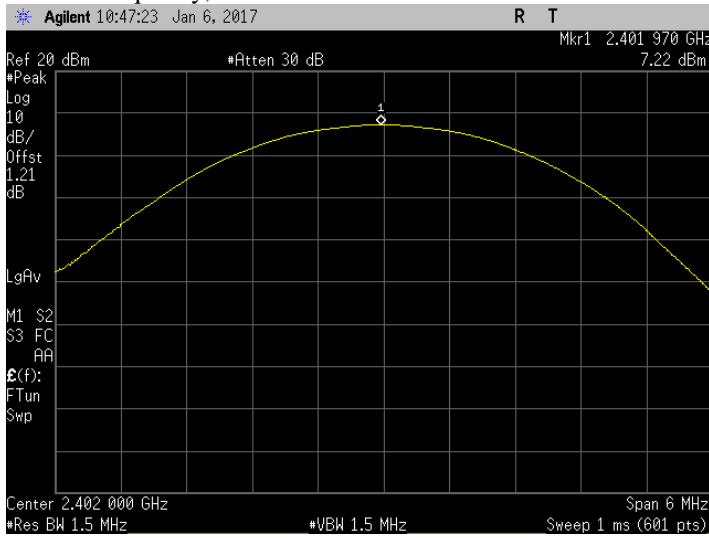
ii. The Conducted RF Output Power test with result at mid frequency, Pi/4DQPSK.



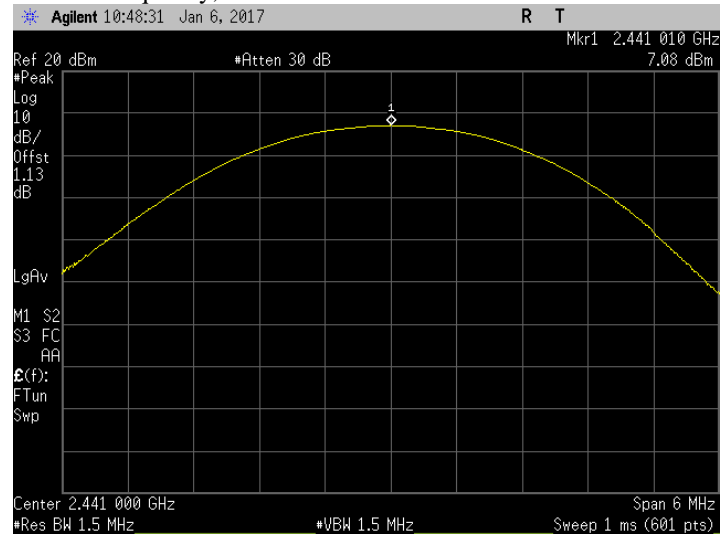
iii. The Conducted RF Output Power test with result at high frequency, Pi/4DQPSK.



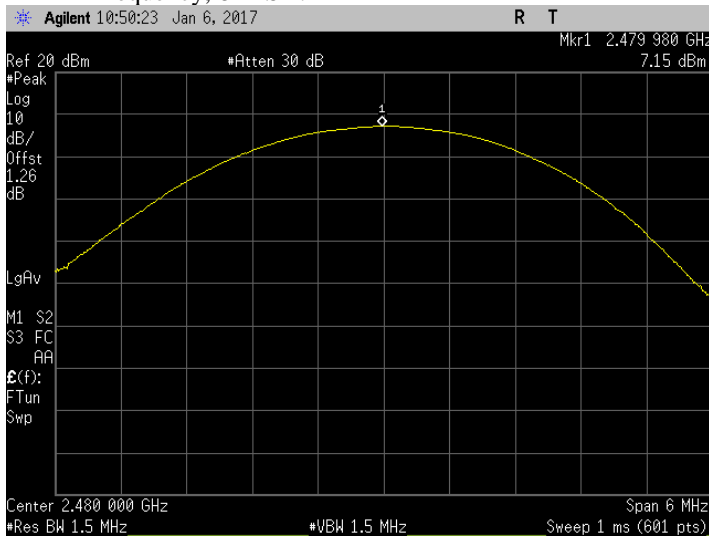
i. The Conducted RF Output Power test with result at low frequency, 8DPSK.



ii. The Conducted RF Output Power test with result at mid frequency, 8DPSK.

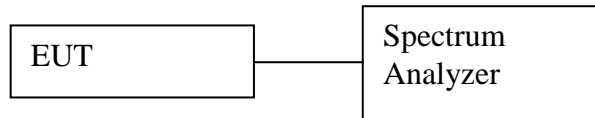


iii. The Conducted RF Output Power test with result at high frequency, 8DPSK.



6.2. 20dB Channel Bandwidth & Occupied Bandwidth

6.2.1. Test Setup



- a) Check and ensure the spectrum analyzer well calibrate.
- b) Turn on the EUT and set EUT to transmit maximum data rate with hopping disable.
- c) Connect EUT's antenna terminal to spectrum analyzer with a low loss cable.
- d) Setting of Spectrum analyzer :
 - a. RBW = 30 kHz
 - b. VBW = 100 kHz
 - c. SPAN = 3 MHz, center on test frequency
 - d. AMPLITUDE → Scale/Div = 10 dB
 - e. Detector mode = Peak
 - f. Trace = Max hold
 - g. Sweep = auto
- e) Measure the freq different of two frequencies that were attenuated 20dB from peak of the emission & record the frequency difference as the emission bandwidth.
- f) Save the plot result from spectrum analyzer screen.
- g) Repeat above procedure with other different mode of operation.

6.2.2. Test Limits:

Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

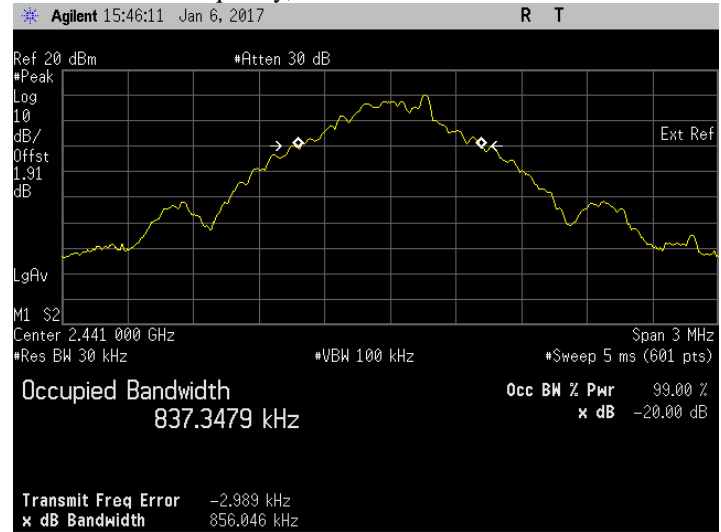
6.2.3. Test Data:

Test Conditions		Test Frequency (GHz)	Results (MHz)		
Modulation	Voltage(V)		20dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Status
GFSK	7.5	2.4020	0.860	0.836	Pass
		2.4410	0.856	0.837	Pass
		2.4800	0.855	0.836	Pass
Pi/4DQPSK	7.5	2.4020	1.238	1.164	Pass
		2.4410	1.235	1.165	Pass
		2.4800	1.235	1.166	Pass
8DPSK	7.5	2.4020	1.265	1.175	Pass
		2.4410	1.266	1.177	Pass
		2.4800	1.265	1.181	Pass

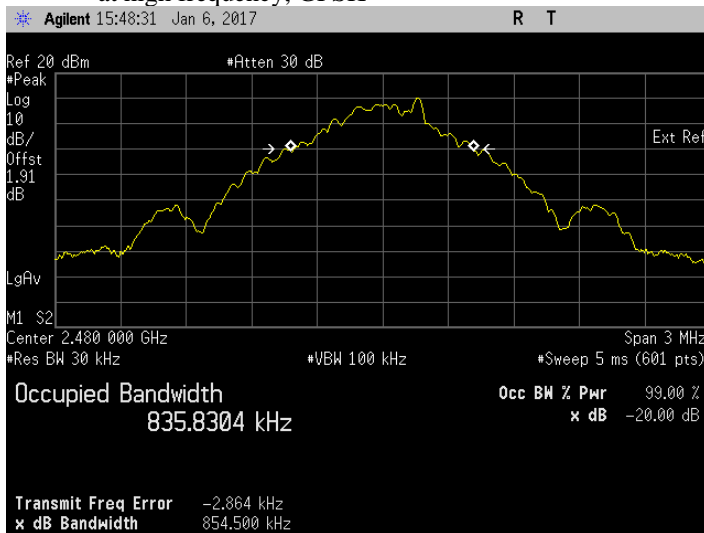
iv. The 20 dB BW & Occupied Bandwidth test with result at low frequency, GFSK.



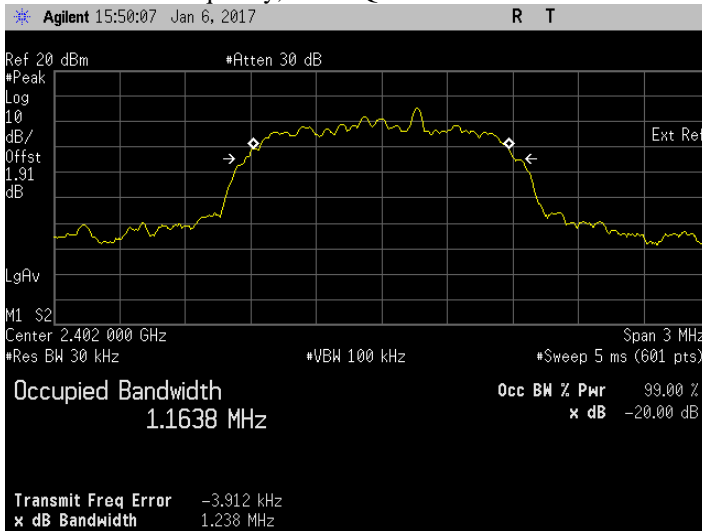
v. The 20 dB BW & Occupied Bandwidth test with result at mid frequency, GFSK.



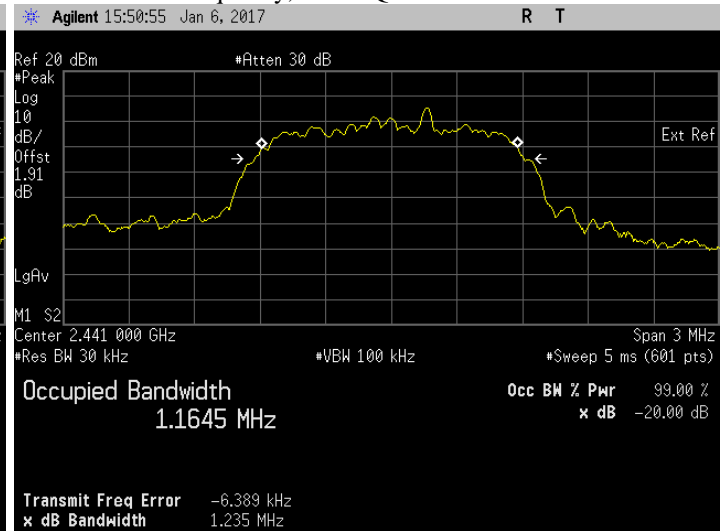
vi. The 20 dB BW & Occupied Bandwidth test with result at high frequency, GFSK



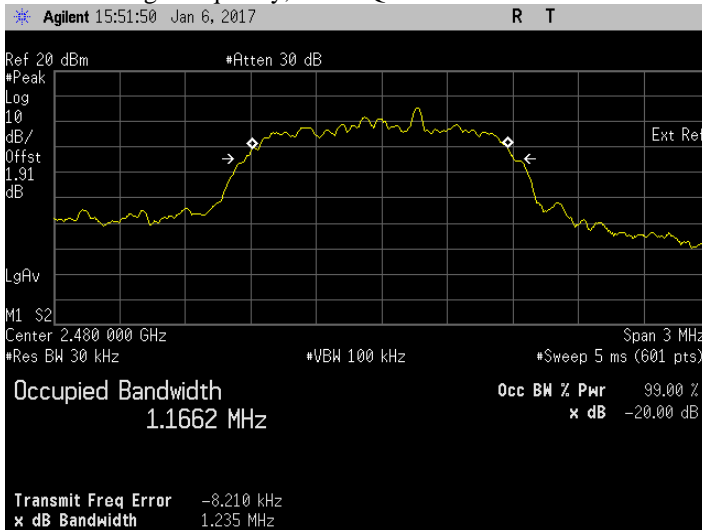
i. The 20 dB BW & occupied bandwidth test with result at low frequency, Pi/4 DQPSK.



ii. The 20 dB BW & occupied bandwidth test with result at mid frequency, Pi/4 DQPSK.



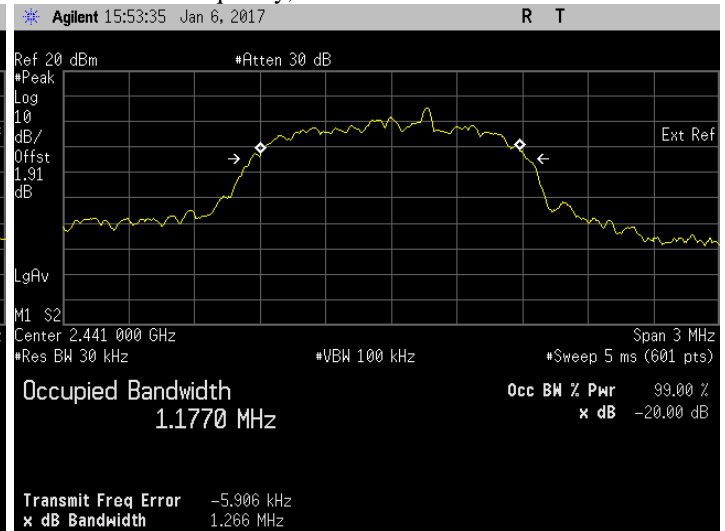
iii. The 20 dB BW & occupied bandwidth test with result at high frequency, Pi/4 DQPSK.



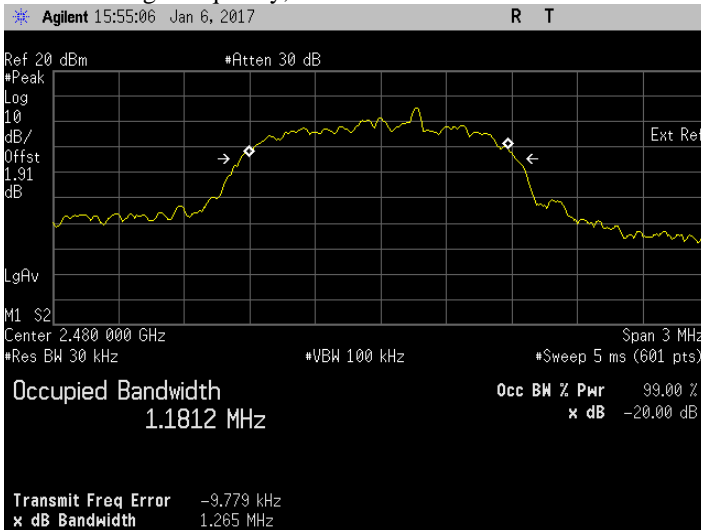
i. The 20 dB BW & occupied bandwidth test with result at low frequency, 8DPSK.



ii. The 20 dB BW & occupied bandwidth test with result at mid frequency, 8DPSK.

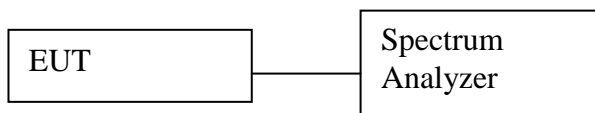


iii. The 20 dB BW & occupied bandwidth test with result at high frequency, 8DPSK.



6.3. Band-edge Conducted Spurious Emission

6.3.1. Test Setup



- a) Check and ensure the spectrum analyzer well calibrate.
- b) Turn on the EUT and keep the EUT in hopping mode.
- c) Connect EUT's antenna terminal to spectrum analyzer with a low loss cable.
- d) Setting of Spectrum analyzer :
 - a. RBW = 100 kHz
 - b. VBW = 300 kHz
 - c. SPAN = 4 MHz (Low channel) or 6MHz(High Channel)
 - d. Detector mode = Peak
 - e. AMPLITUDE → Scale/Div = 10 dB
 - f. Trace = Max hold
 - g. Sweep = auto
- e) Measure the captured band edge emission result and recording the plot.
- f) Repeat above on EUT with hopping disable.
- g) Repeat above procedure with other different test frequency.

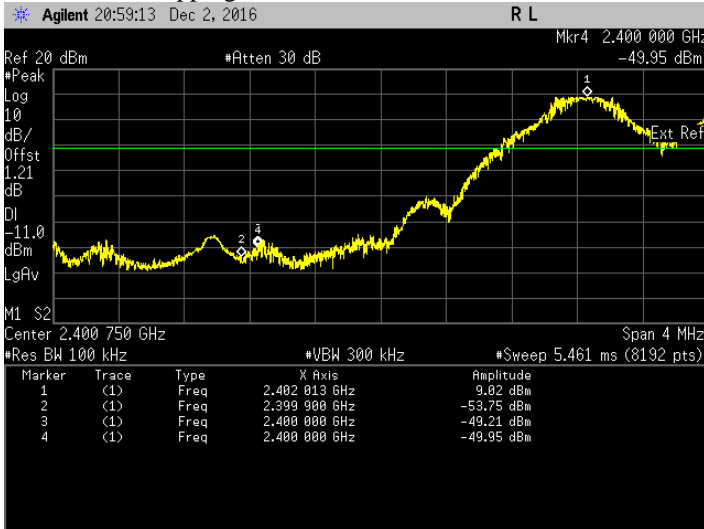
6.3.1. Test Limits

Normal Condition (25 ° C)
Shall be at least 20 dB below the peak power.

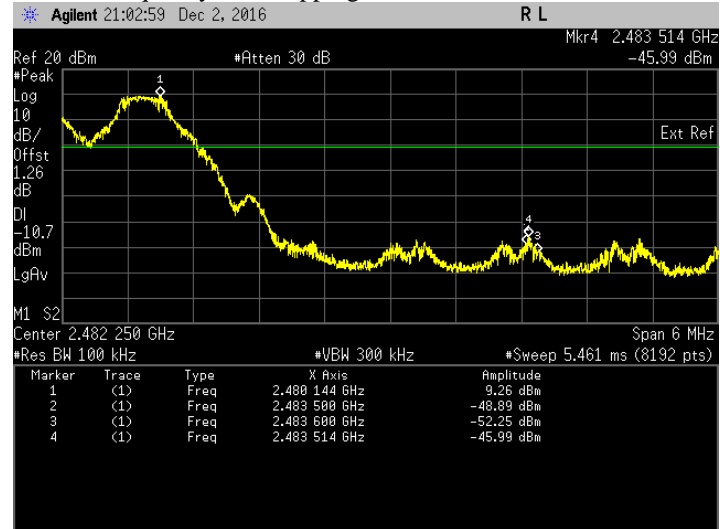
6.3.2. Test Result

Test Conditions		Hopping Method	Test Frequency(GHz)	Results	
Modulation	Voltage(V)			dB	Status
GFSK	7.5	Enabled (continuously)	2.4020	-49.21	Pass
			2.4800	-45.99	Pass
		Disabled (constantly)	2.4020	-50.21	Pass
			2.4800	-52.81	Pass
Pi/4 DQPSK	7.5	Enabled (continuously)	2.4020	-48.94	Pass
			2.4800	-55.88	Pass
		Disabled (constantly)	2.4020	-46.78	Pass
			2.4800	-55.85	Pass
8 DPSK	7.5	Enabled (continuously)	2.4020	-47.86	Pass
			2.4800	-54.73	Pass
		Disabled (constantly)	2.4020	-43.20	Pass
			2.4800	-53.52	Pass

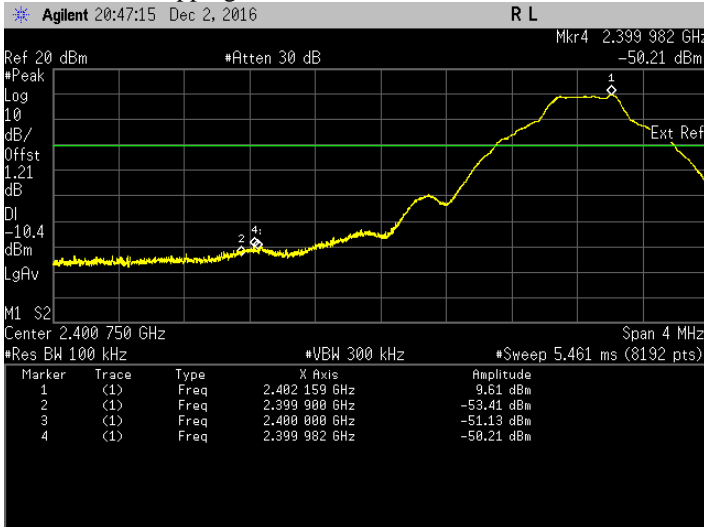
i. The highest band edge emission at low carrier frequency with hopping function enabled, GFSK



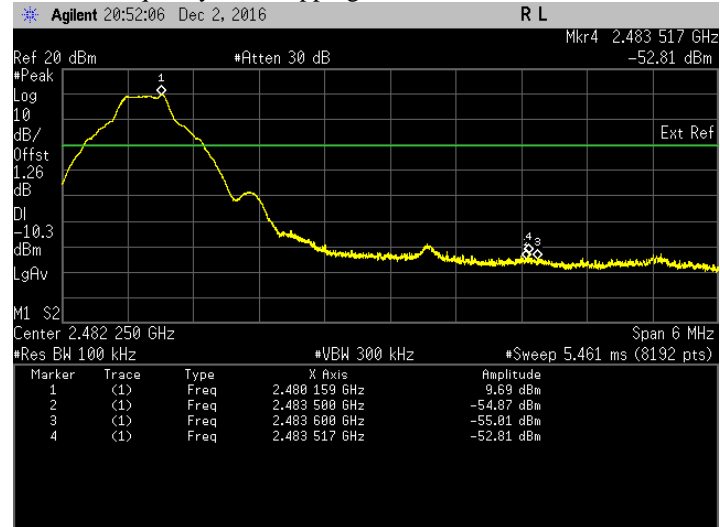
ii. The highest band edge emission at high carrier frequency with hopping function enabled, GFSK



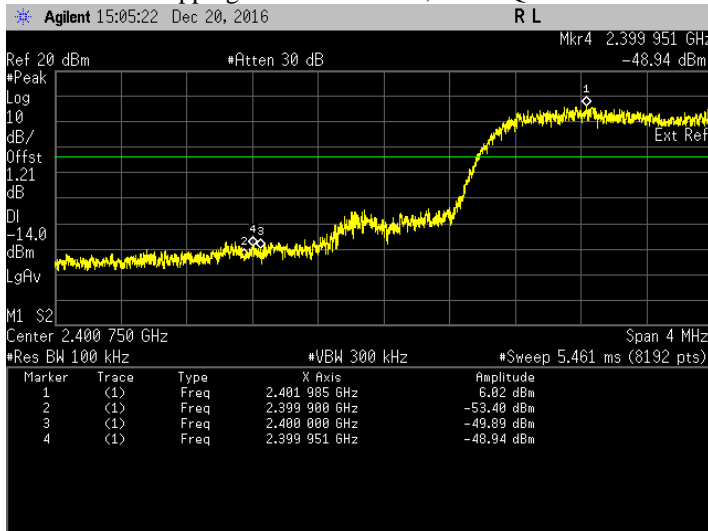
iii. The highest band edge emission at low carrier frequency with hopping function disabled, GFSK



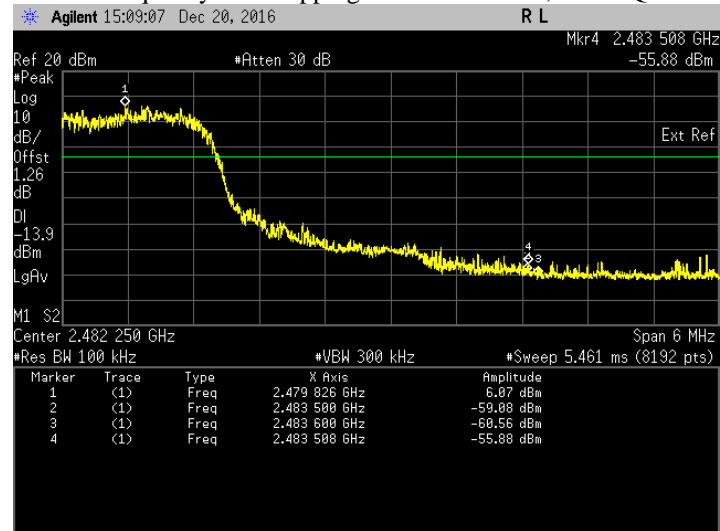
iv. The highest band edge emission at high carrier frequency with hopping function disabled, GFSK



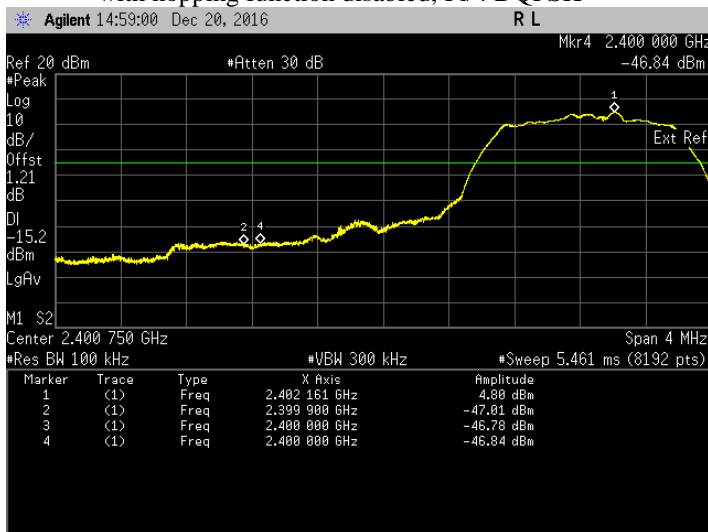
i. The highest band edge emission at low carrier frequency with hopping function enabled, Pi/4 DQPSK



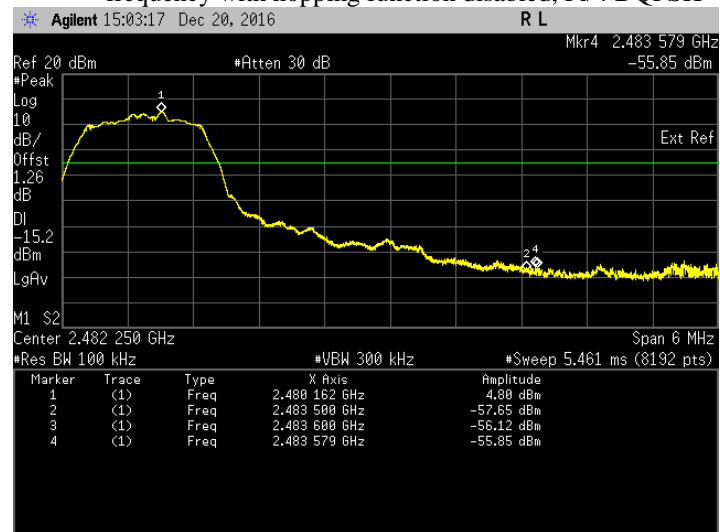
ii. The highest band edge emission at high carrier frequency with hopping function enabled, Pi/4 DQPSK



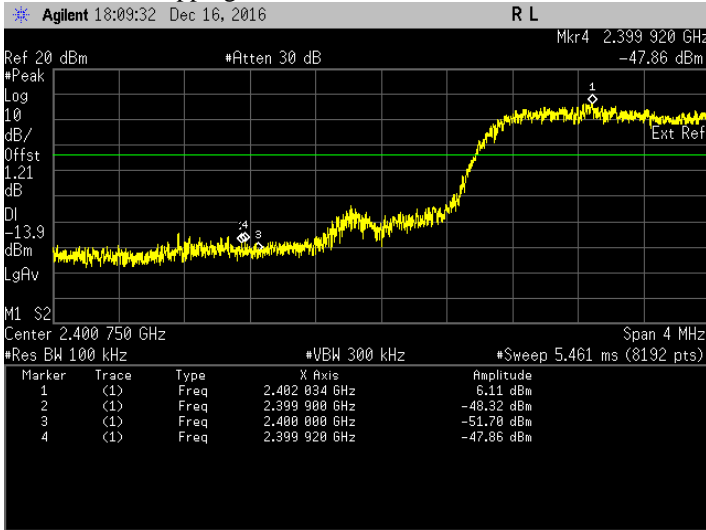
iii. The highest band edge emission at low carrier frequency with hopping function disabled, Pi/4 DQPSK



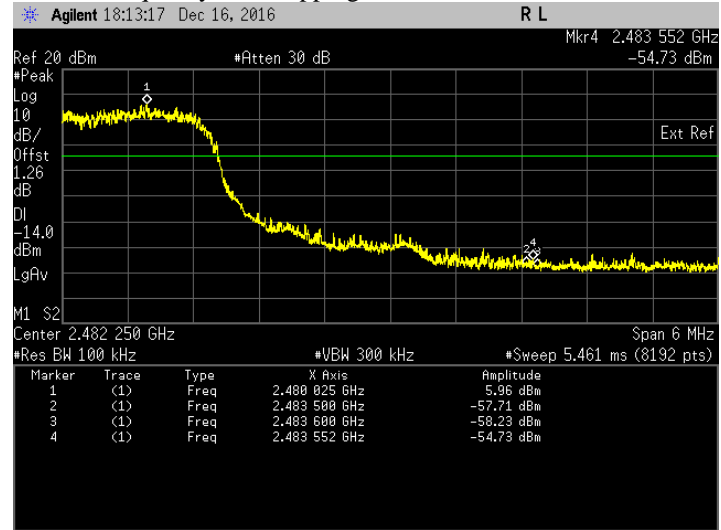
iv. The highest band edge emission at high carrier frequency with hopping function disabled, Pi/4 DQPSK



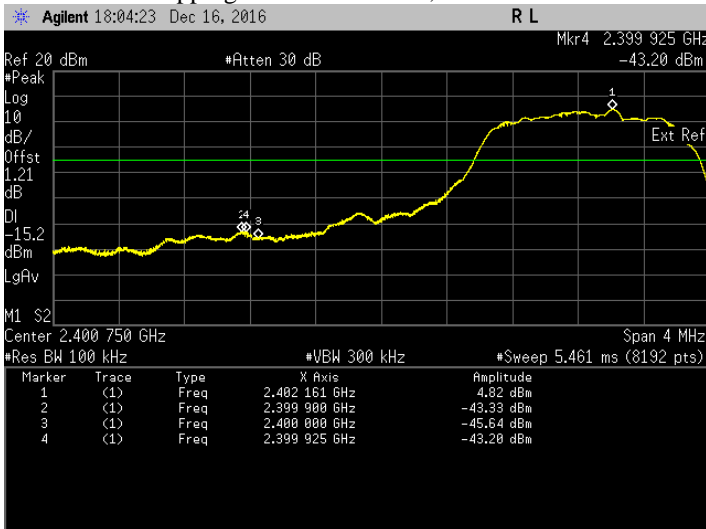
i. The highest band edge emission at low carrier frequency with hopping function enabled, 8DPSK



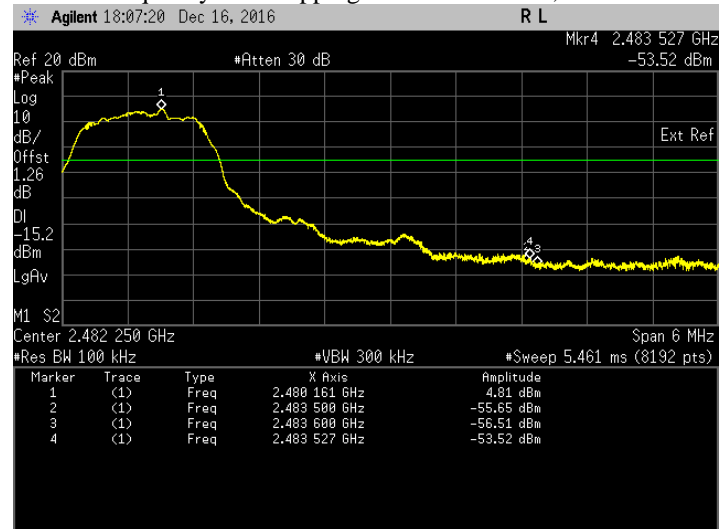
ii. The highest band edge emission at high carrier frequency with hopping function enabled, 8DPSK



iii. The highest band edge emission at low carrier frequency with hopping function disabled, 8DPSK

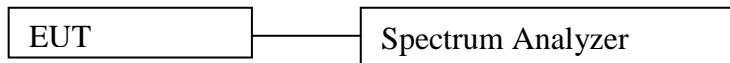


iv. The highest band edge emission at high carrier frequency with hopping function disabled, 8DPSK



6.4. Dwell time on each channel

6.4.1. Test Setup



- a) Check and ensure the spectrum analyzer well calibrate.
- b) Turn on the EUT and keep the EUT in hopping mode.
- c) Connect EUT’s antenna terminal to spectrum analyzer with a low loss cable.
- d) Setting of Spectrum analyzer :
 - a. RBW = 100 kHz
 - b. VBW = 300 kHz
 - c. Sweep time = sufficient to capture dwell time for 1 transmission
 - d. Sweep = Single
- e) Measure dwell time for 1 transmission and save the plot.
- f) Calculate accumulate dwell time.
- g) Repeat above procedure with other different mode of operation.

6.4.2. Test Limits:

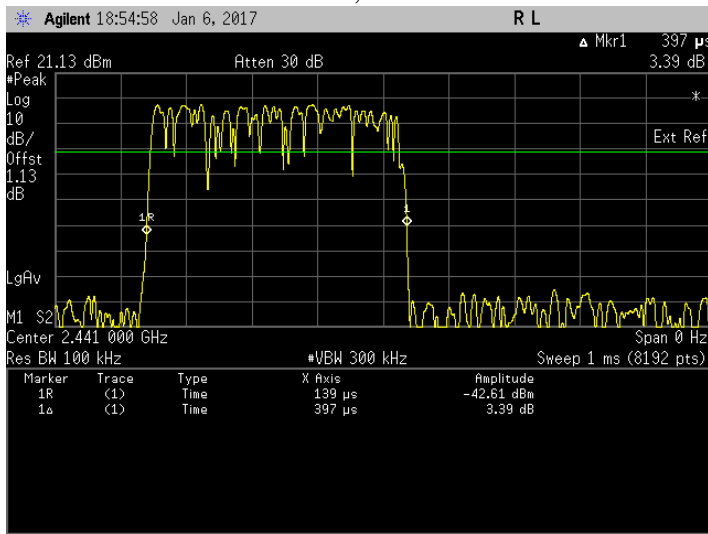
Normal Condition (25 ° C)
≤ 400ms

6.4.3. Test Result

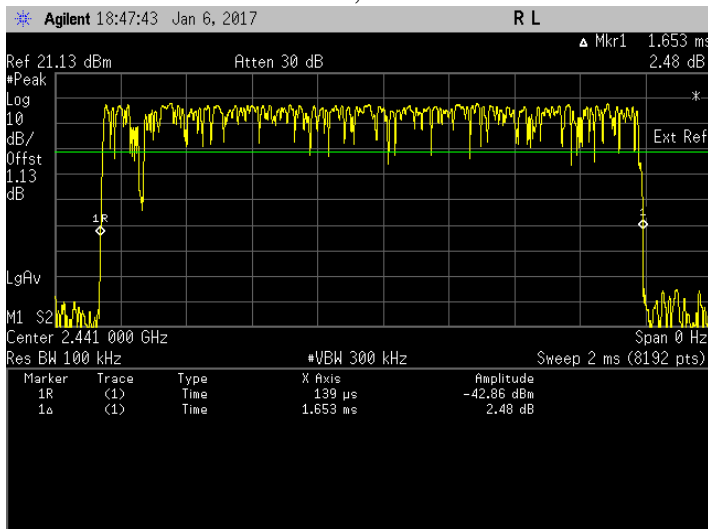
Test Conditions			Data Package	Results			
Modulation	Voltage (V)	Test Frequency (GHz)		(a) hops/s	Dwell time in one transmission (b) (msec)	Total accumulate dwell time in 31.6s. (c) (msec)	Status
GFSK	7.5	2.4410	DH1	1600/(2*79)	0.397	127.0402	Pass
			DH3	1600/(4*79)	1.653	264.4805	Pass
			DH5	1600/(6*79)	2.901	309.4375	Pass
Pi/4 DQPSK	7.5		DH1	1600/(2*79)	0.402	128.6402	Pass
			DH3	1600/(4*79)	1.655	264.8005	Pass
			DH5	1600/(6*79)	2.903	309.6508	Pass
8 DPSK	7.5		DH1	1600/(2*79)	0.402	128.6402	Pass
			DH3	1600/(4*79)	1.653	264.4805	Pass
			DH5	1600/(6*79)	2.903	309.6508	Pass

****Note:** Total dwell time (c) = (a) x (b) x (31.6s)

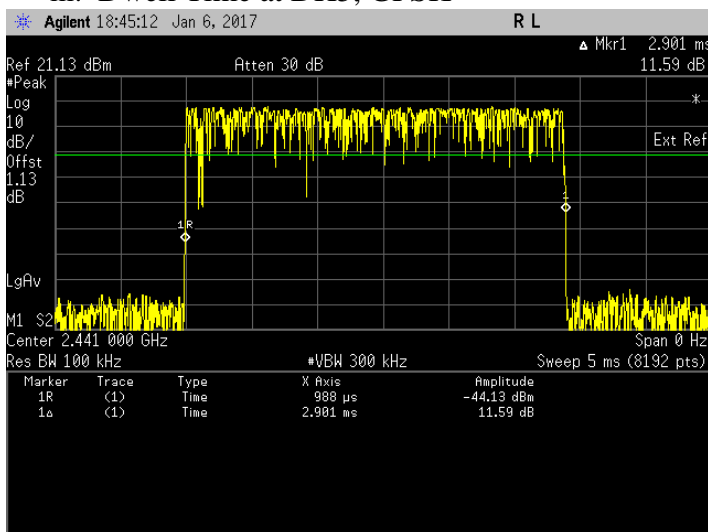
i. Dwell Time at DH1, GFSK



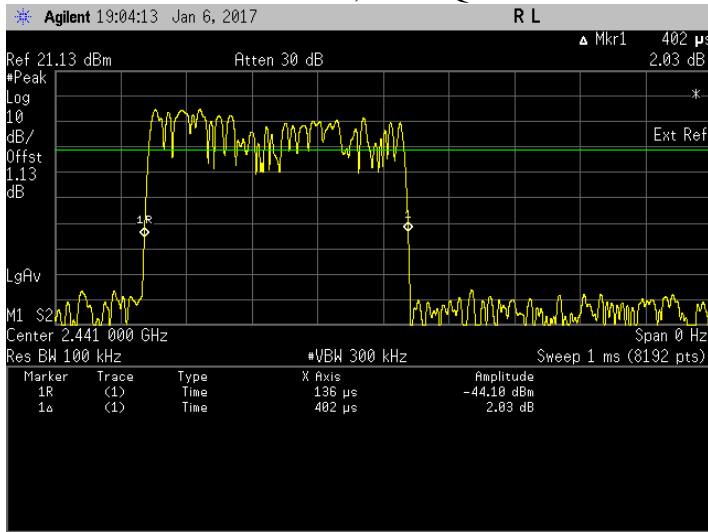
ii. Dwell Time at DH3, GFSK



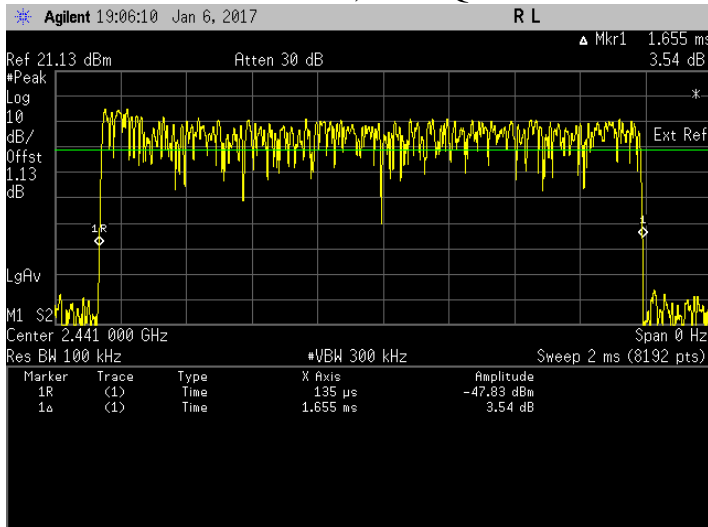
iii. Dwell Time at DH5, GFSK



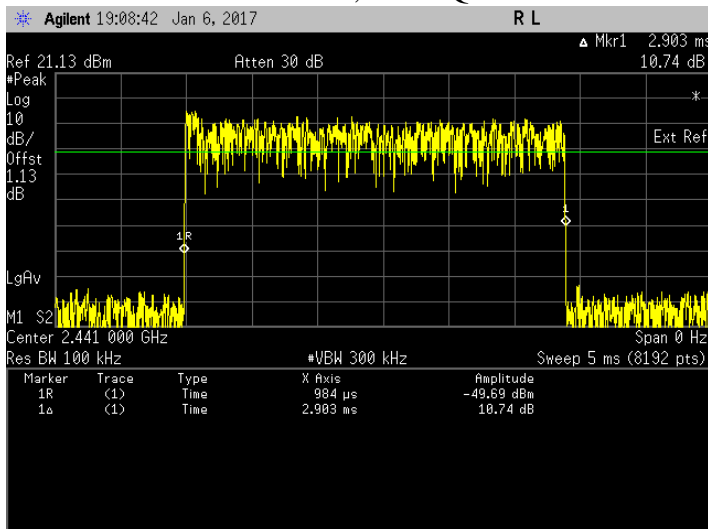
iv. Dwell Time at DH1, PI/4DQPSK



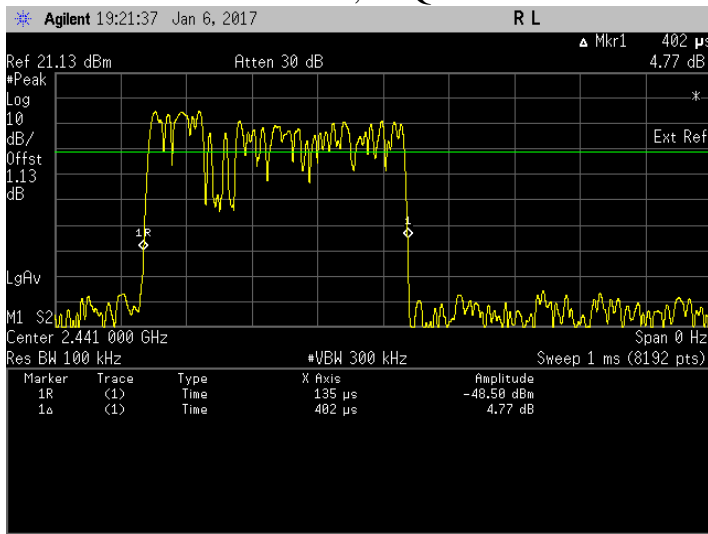
v. Dwell Time at DH3, PI/4DQPSK



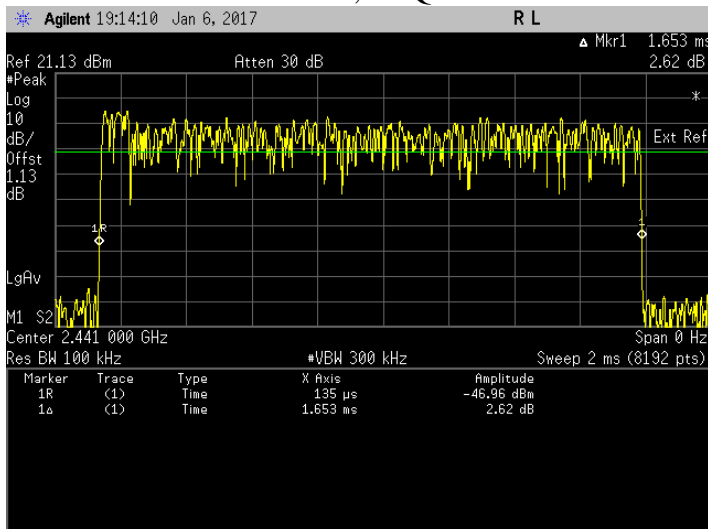
vi. Dwell Time at DH5, PI/4DQPSK



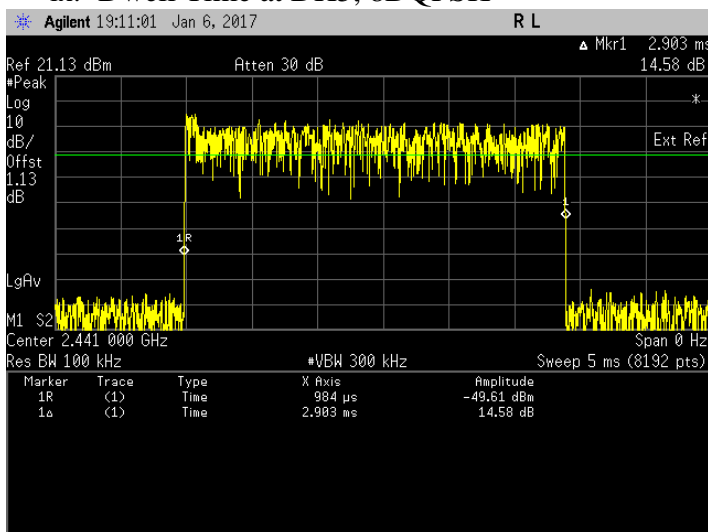
vii. Dwell Time at DH1, 8DQPSK



viii. Dwell Time at DH3, 8DQPSK

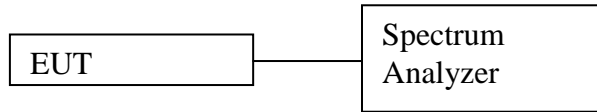


ix. Dwell Time at DH5, 8DQPSK



6.5. Number of hopping Frequency

6.5.1. Test Setup



- a) Check and ensure the spectrum analyzer well calibrate.
- b) Turn on the EUT and keep the EUT in hopping mode.
- c) Connect EUT's antenna terminal to spectrum analyzer with a low loss cable.
- d) Setting of Spectrum analyzer :
 - a. RBW = 300 kHz
 - b. VBW = 300 kHz
 - c. Detector mode = Peak
 - d. Trace = Max hold
- e) Allow the trace to stabilized & save the plot result from spectrum analyzer screen.
- f) Count number of channel frequency in the operating.
- g) Repeat above procedure for other test frequency.

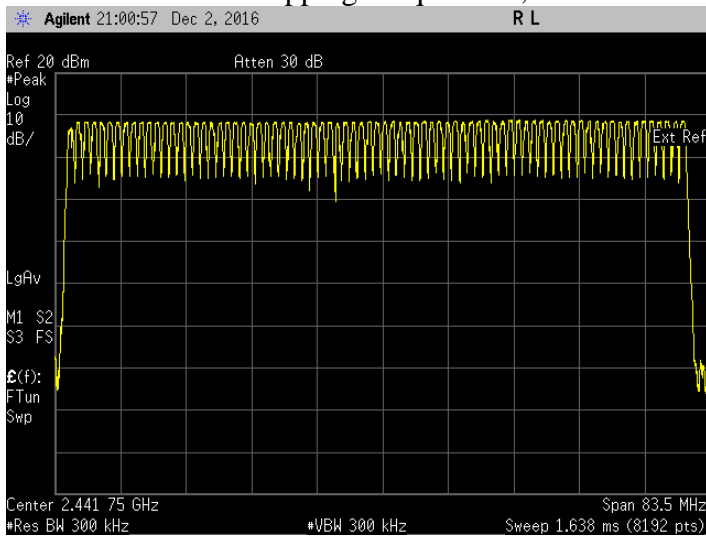
6.5.2. Test Limits:

Normal Condition (25 ° C)
≥ 15

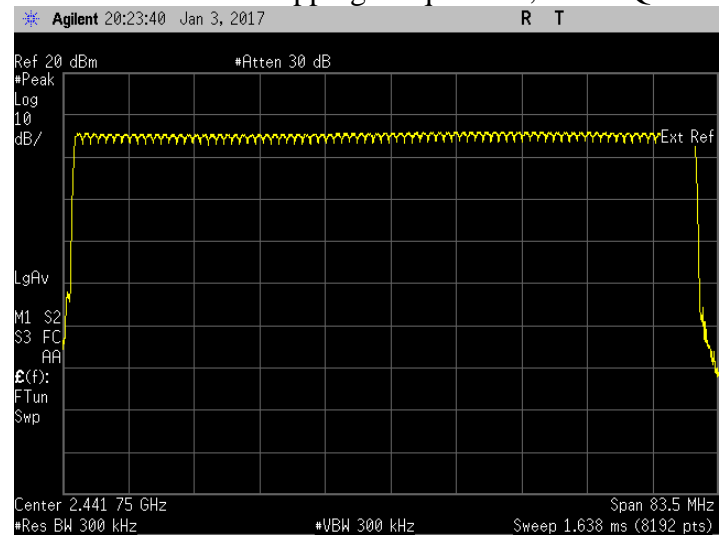
6.5.3. Test Result

Test Conditions		Sweep Range (GHz)	Results	
Modulation	Voltage(V)		No. of Hopping Frequencies	Status
GFSK	7.50	2.4020-2.4835	79	Pass
Pi/4DQPSK	7.50	2.4020-2.4835	79	Pass
8DPSK	7.50	2.4020-2.4835	79	Pass

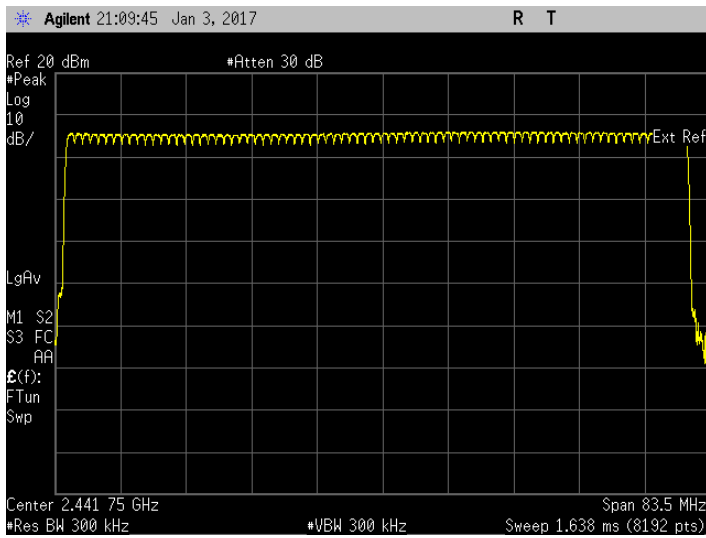
i. Number of Hopping Frequencies, GFSK



ii. Number of Hopping Frequencies, Pi/4 DQPSK

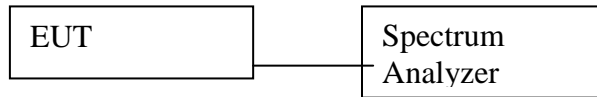


iii. Number of Hopping Frequencies, 8DPSK



6.6. Channel Separation

6.6.1. Test Setup



- a) Check and ensure the spectrum analyzer well calibrate.
- b) Turn on the EUT and keep the EUT in hopping mode.
- c) Connect EUT's antenna terminal to spectrum analyzer with a low loss cable.
- d) Setting of Spectrum analyzer :
 - a. RBW = 300 kHz
 - b. VBW = 300 kHz
 - c. SPAN = 3 MHz, center on test frequency
 - d. AMPLITUDE → Scale/Div = 5 dB
 - e. Detector mode = Peak
 - f. Trace = Max hold
 - g. Sweep = auto
- e) Measure the frequency different of these two adjacent channels with marker delta function & record the measurement results.
- f) Repeat above procedure with other different mode of operation.

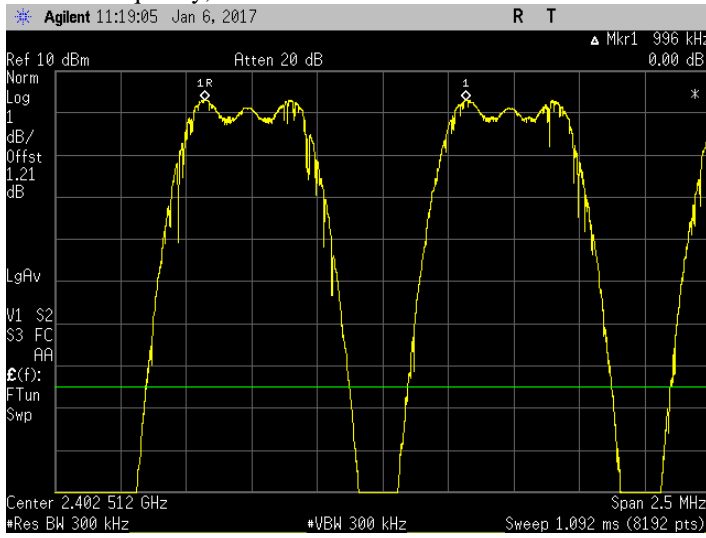
6.6.2. Test Limits:

Normal Condition (25 ° C)
≥ 2/3 of 20dB Bandwidth

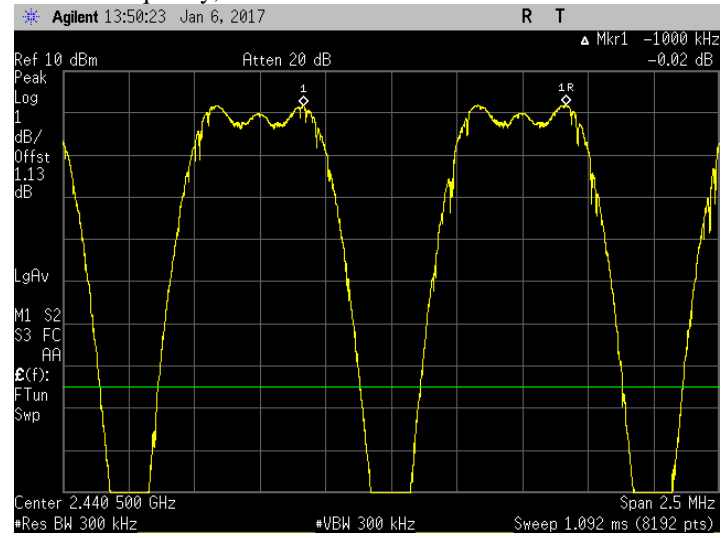
6.6.3. Test Result

Test Conditions		Test Frequency (GHz)	Results			
Modulation	Voltage(V)		Test Data Adjacent Channel Separation (MHz)	20dB Bandwidth (MHz)	Min Limit = 2/3 of 20dB Bandwidth (kHz)	Status
GFSK	7.50	2.4020	0.996	0.860	573.333	Pass
		2.4410	1.000	0.856	570.667	Pass
		2.4800	0.998	0.855	570.000	Pass
Pi/4DQPSK	7.50	2.4020	1.316	1.238	825.333	Pass
		2.4410	1.038	1.235	823.333	Pass
		2.4800	0.998	1.235	823.333	Pass
8DPSK	7.50	2.4020	1.331	1.265	843.333	Pass
		2.4410	0.973	1.266	844.000	Pass
		2.4800	1.045	1.265	843.333	Pass

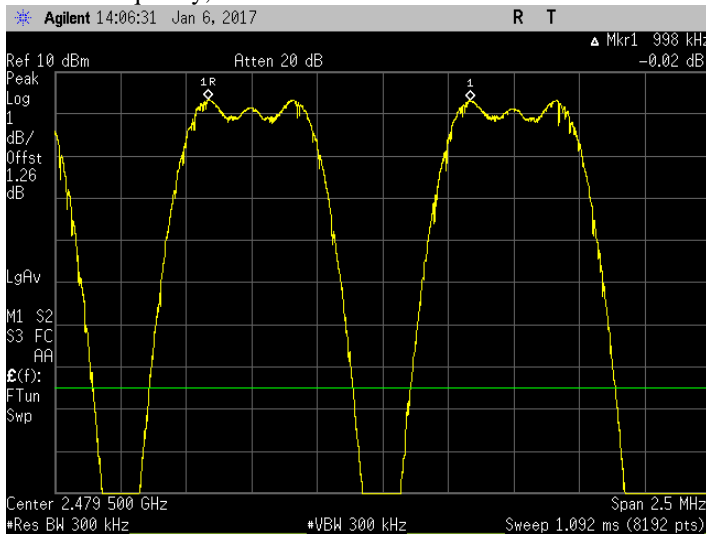
i. The Channel Separation test with result at low frequency, GFSK.



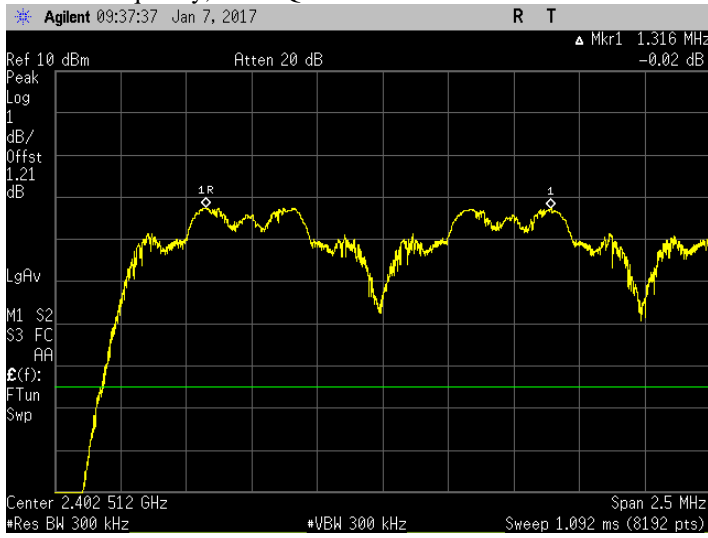
ii. The Channel Separation test with result at mid frequency, GFSK.



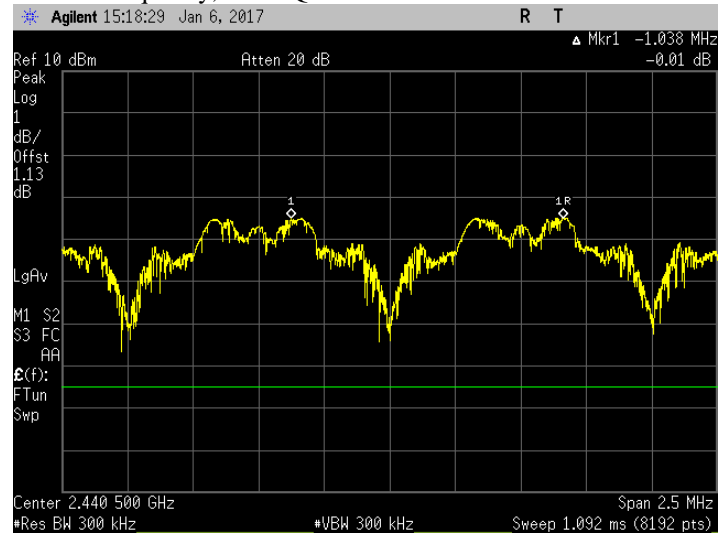
iii. The Channel Separation test with result at High frequency, GFSK.



i. The Channel Separation test with result at low frequency, PI/4QPSK.



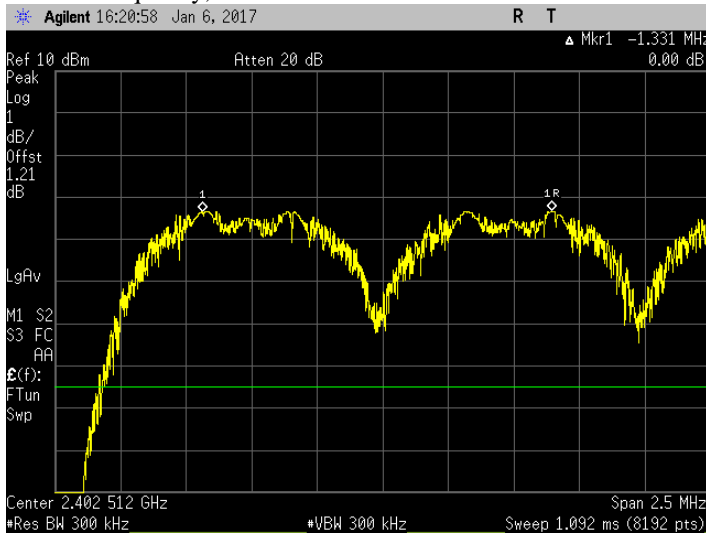
ii. The Channel Separation test with result at mid frequency, PI/4QPSK.



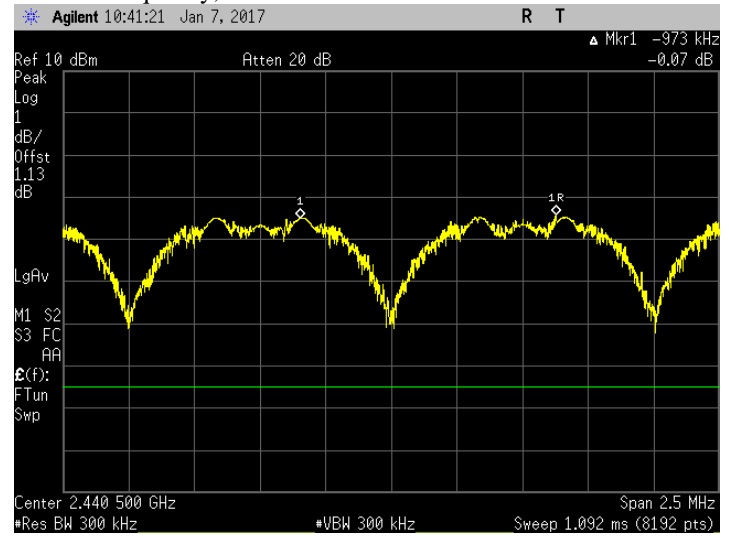
iii. The Channel Separation test with result at High frequency, PI/4QPSK.



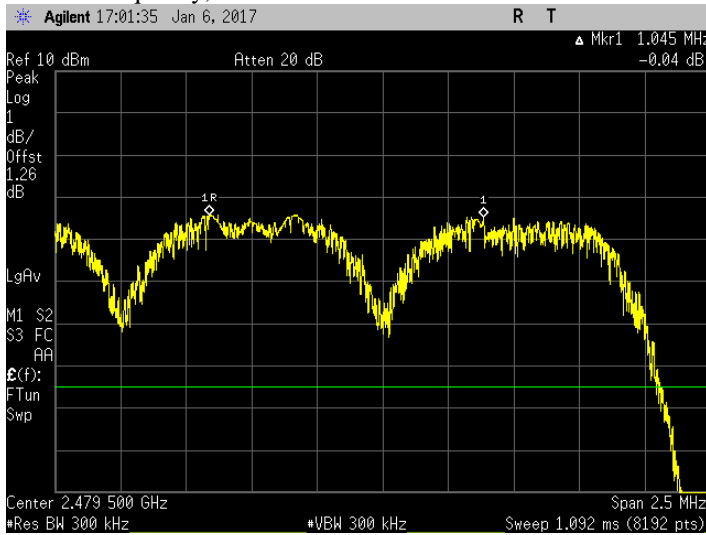
i. The Channel Separation test with result at low frequency, 8DPSK.



ii. The Channel Separation test with result at mid frequency, 8DPSK.

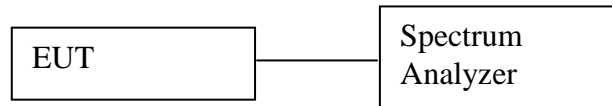


iii. The Channel Separation test with result at High frequency, 8DPSK.



6.7. Conducted Spurious Emission

6.7.1. Test Setup



- a) Check and ensure the spectrum analyzer well calibrate.
- b) Turn on the EUT and set EUT to transmit maximum data rate with hopping disable.
- c) Connect EUT's antenna terminal to spectrum analyzer with a low loss cable.
- d) Setting of Spectrum analyzer :
 - a. RBW = 100 kHz
 - b. VBW = 300 kHz
 - c. SPAN = Cover until 10th harmonic
 - d. Detector mode = Peak
 - e. AMPLITUDE → Scale/Div = 10 dB
 - f. Trace = Max hold
 - g. Sweep = auto
- e) Measure the captured spurious emission result and recording the plot.
- f) Repeat above procedure with other different mode of operation.

6.7.1. Test Limits:

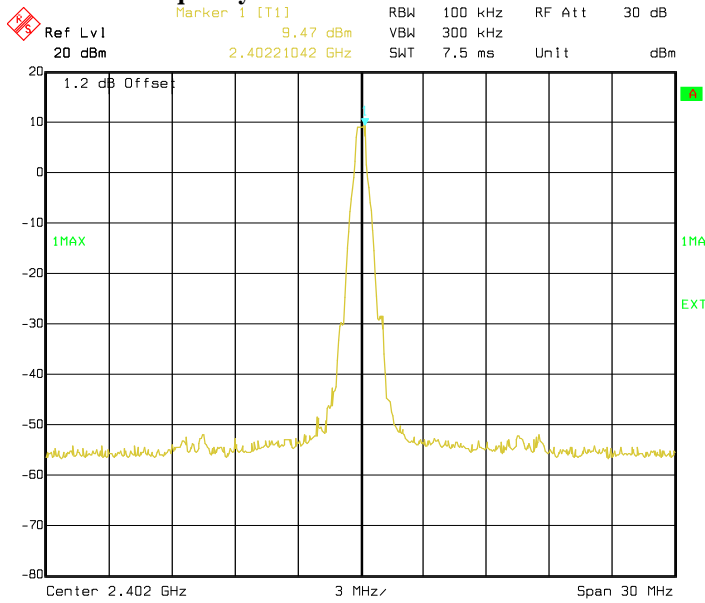
Normal Condition (25 ° C)
Shall be at least 20 dB below for peak power.

6.7.2. Test Data:

Test Conditions		Test Frequency (GHz)	Results
Modulation	Voltage(V)		Status
GFSK	7.5	2.4020	Pass
		2.4410	Pass
		2.4800	Pass
Pi/4DQPSK	7.5	2.4020	Pass
		2.4410	Pass
		2.4800	Pass
8DPSK	7.5	2.4020	Pass
		2.4410	Pass
		2.4800	Pass

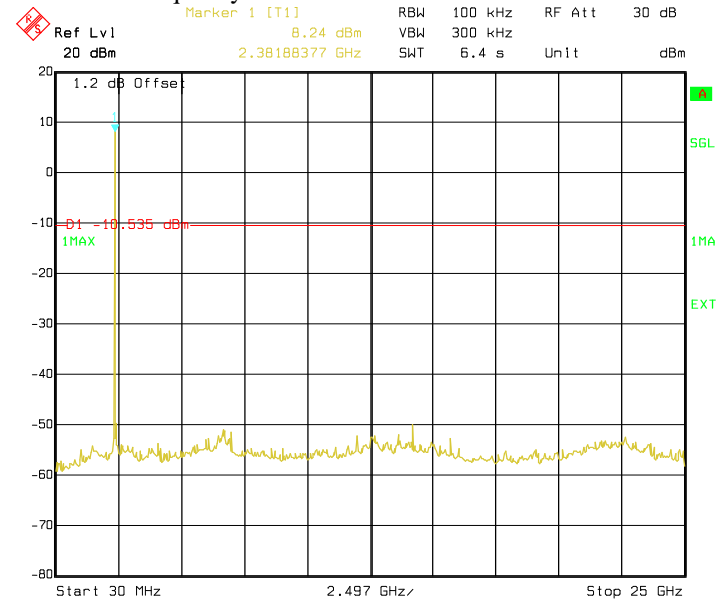
GFSK Modulation:

- The high emission level within the assigned band at low carrier frequency.



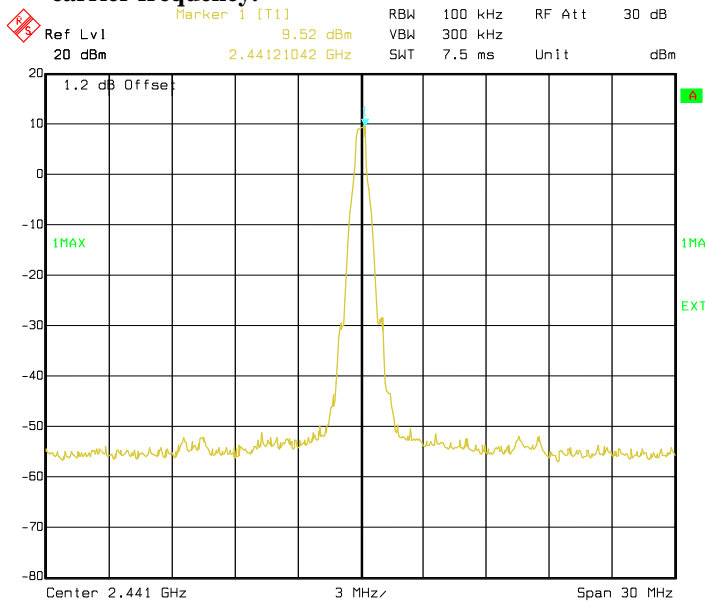
Date: 16.DEC.2016 14:25:40

- Spurious emission measurement in 30MHz – 25GHz at low carrier frequency.



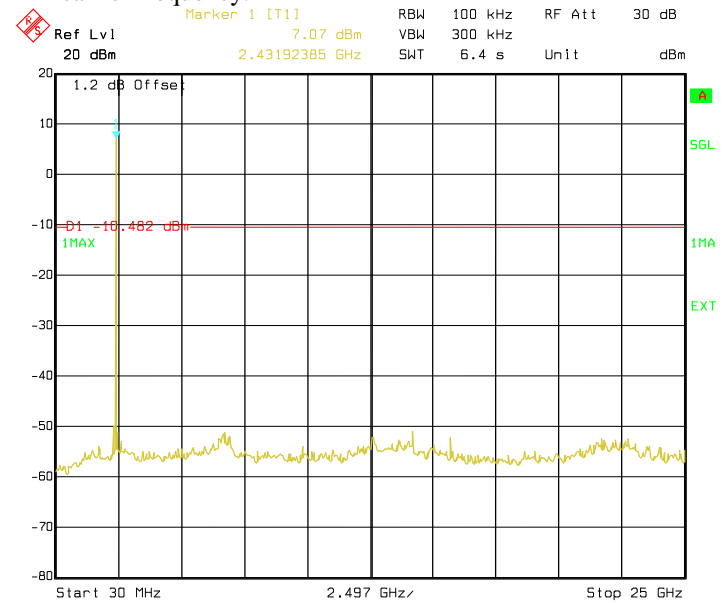
Date: 16.DEC.2016 14:26:39

- The high emission level within the assigned band at mid carrier frequency.



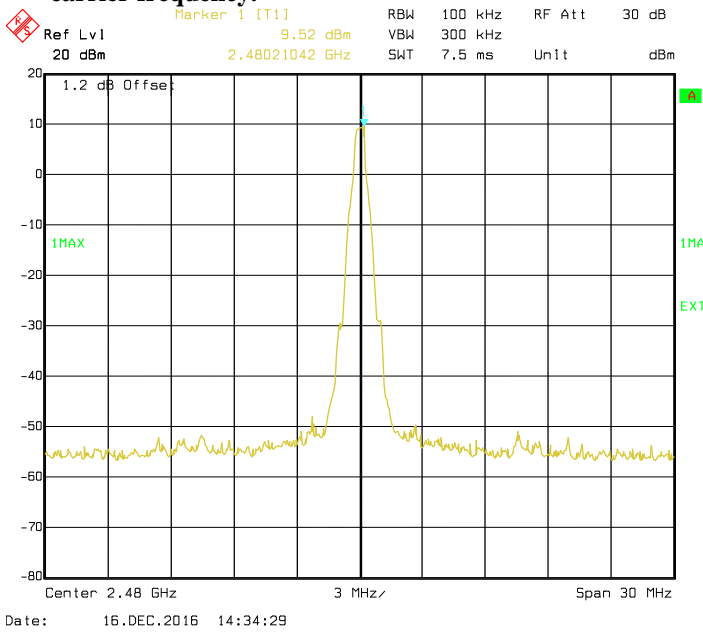
Date: 16.DEC.2016 14:30:04

- Spurious emission measurement in 30MHz – 25GHz at mid carrier frequency.

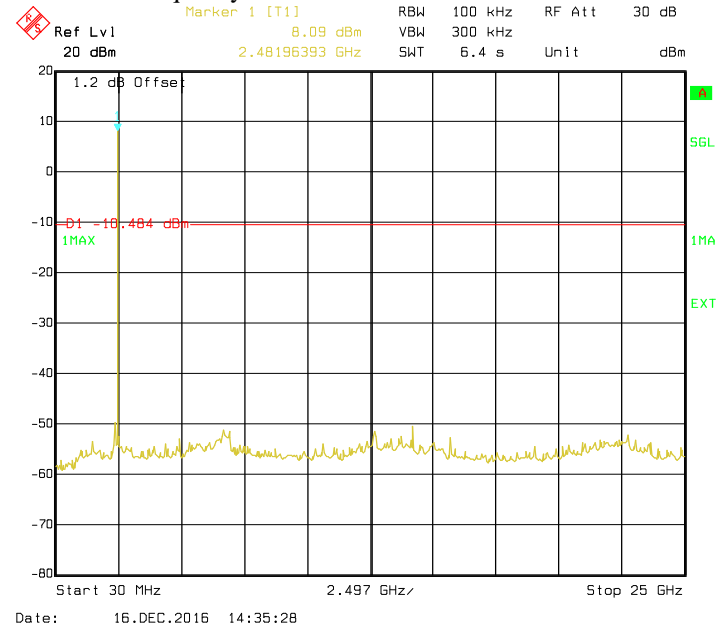


Date: 16.DEC.2016 14:31:03

• **The high emission level within the assigned band at high carrier frequency.**

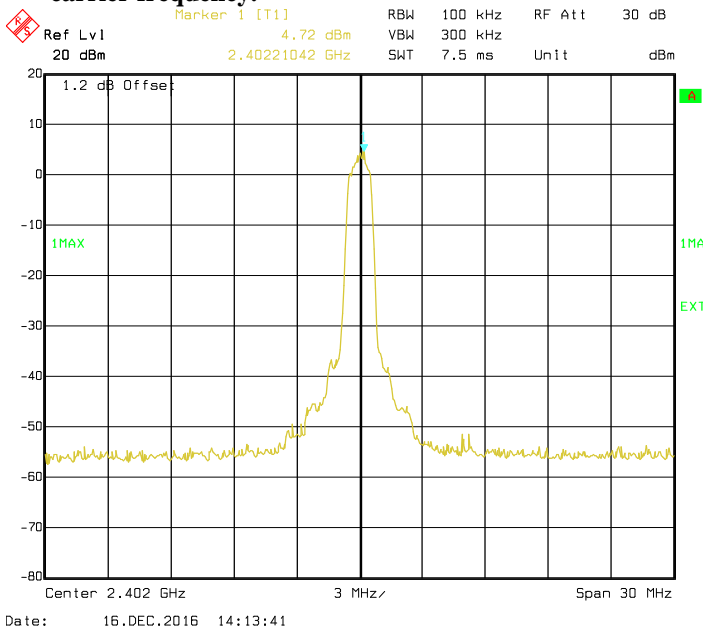


• **Spurious emission measurement in 30MHz – 25GHz at high carrier frequency.**

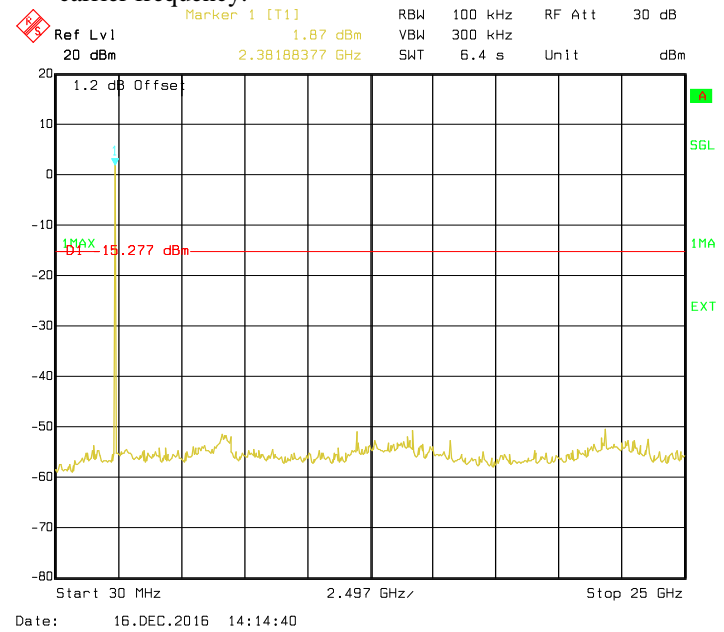


Pi/4 DQPSK Modulation:

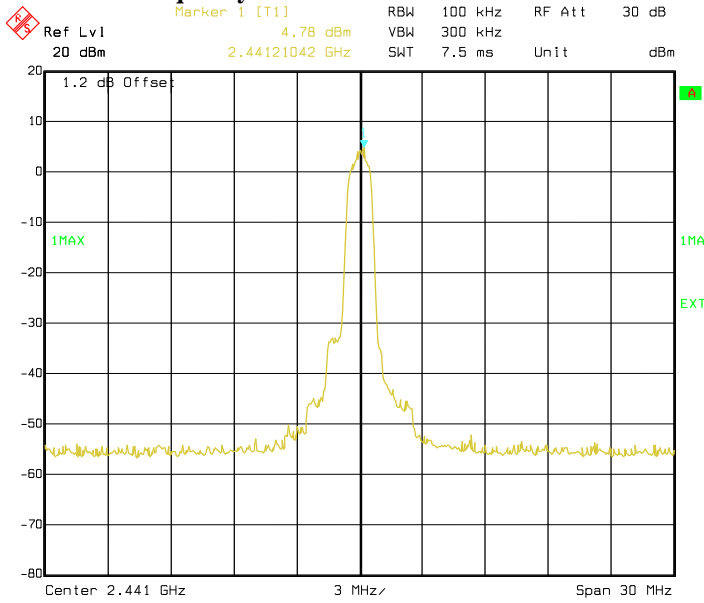
i. **The high emission level within the assigned band at low carrier frequency.**



ii. **Spurious emission measurement in 30MHz – 25GHz at low carrier frequency.**

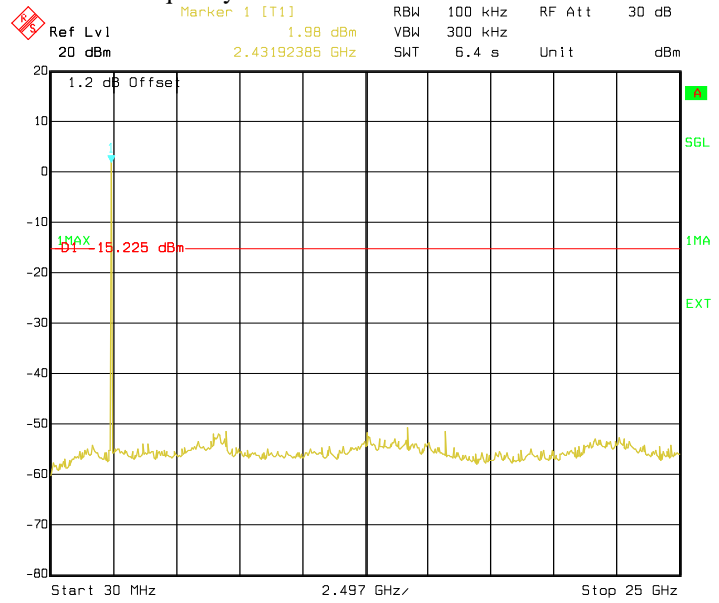


iii. The high emission level within the assigned band at mid carrier frequency.



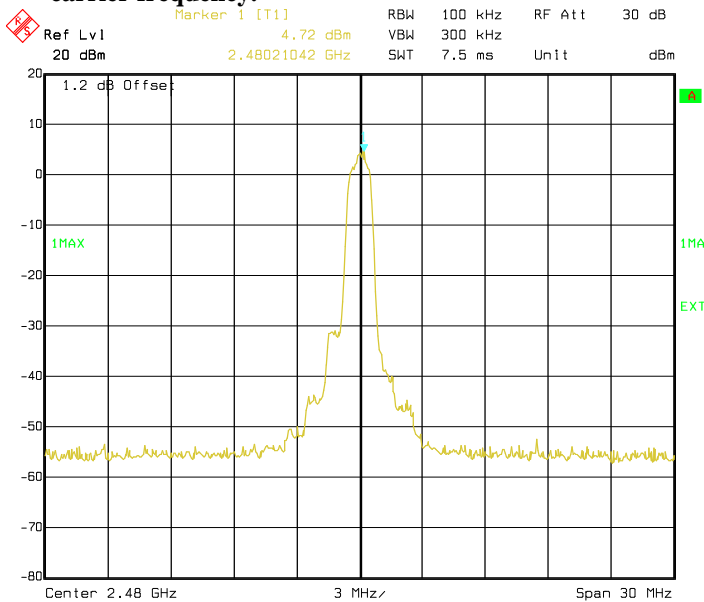
Date: 16.DEC.2016 14:17:58

iv. Spurious emission measurement in 30MHz – 25GHz at mid carrier frequency.



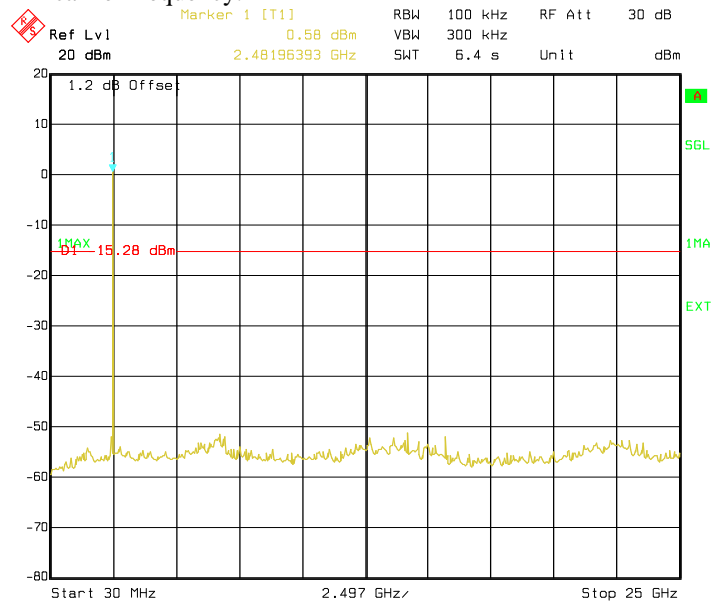
Date: 16.DEC.2016 14:18:58

v. The high emission level within the assigned band at high carrier frequency.



Date: 16.DEC.2016 14:20:18

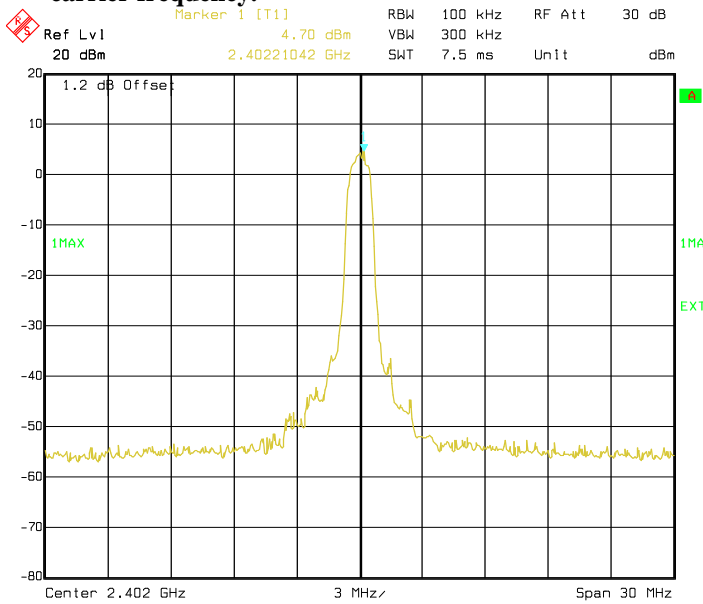
vi. Spurious emission measurement in 30MHz – 25GHz at high carrier frequency.



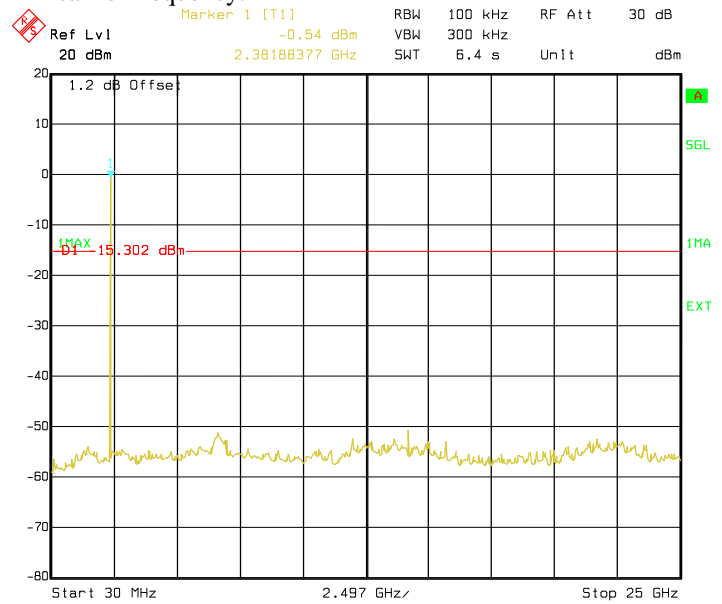
Date: 16.DEC.2016 14:21:17

8DPSK Modulation:

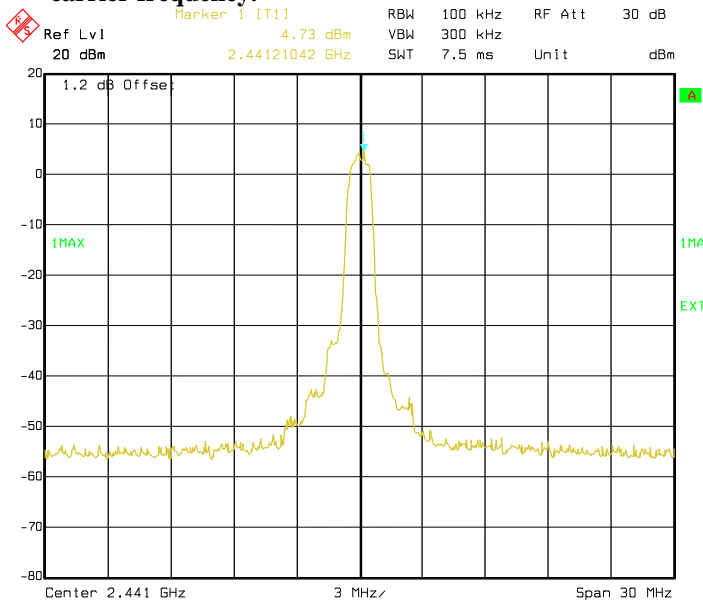
i. The high emission level within the assigned band at low carrier frequency.



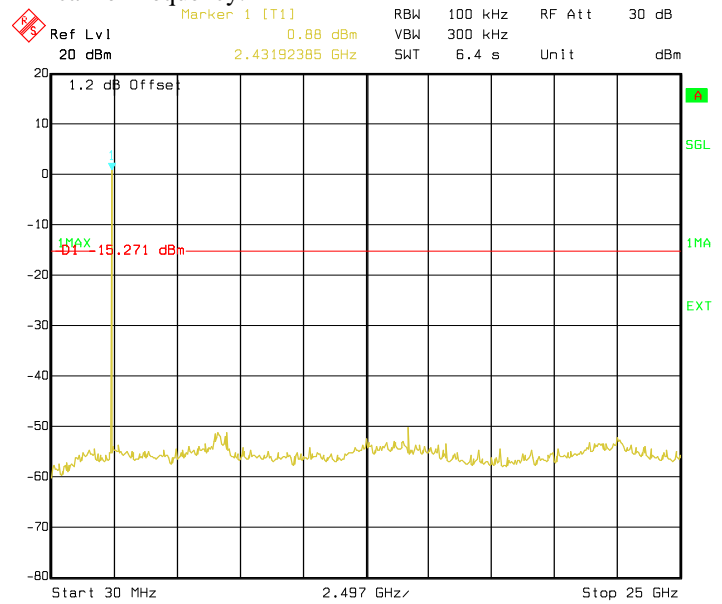
ii. Spurious emission measurement in 30MHz – 25GHz at low carrier frequency.



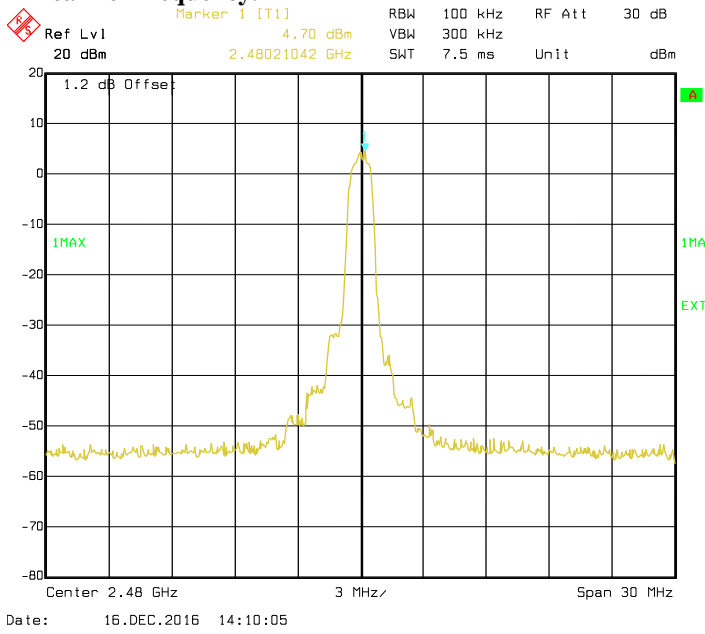
iii. The high emission level within the assigned band at mid carrier frequency.



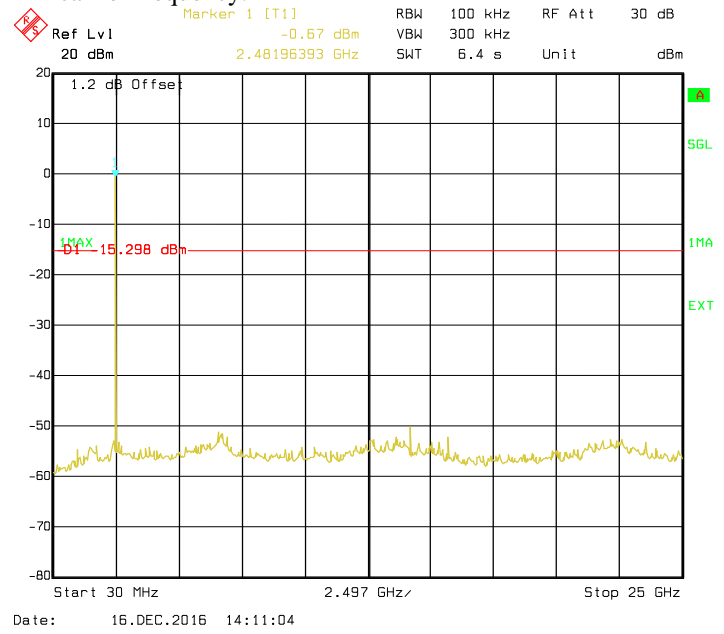
iv. Spurious emission measurement in 30MHz – 25GHz at mid carrier frequency.



v. The high emission level within the assigned band at high carrier frequency.

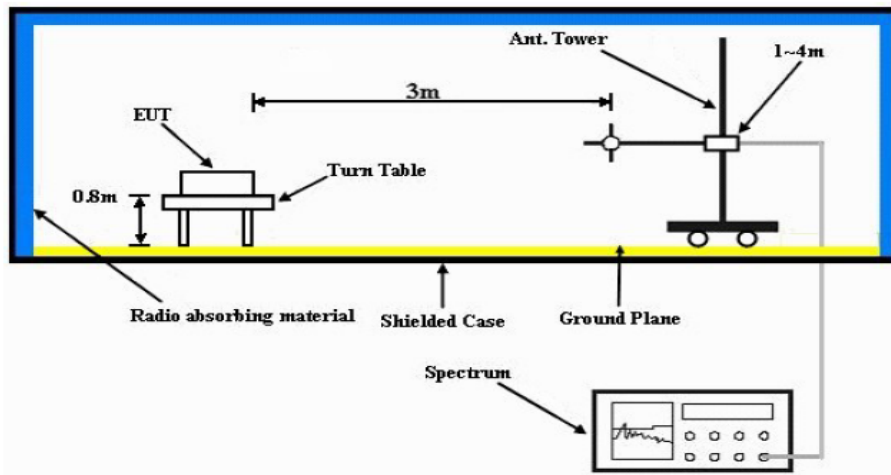


vi. Spurious emission measurement in 30MHz – 25GHz at high carrier frequency.



6.8. Radiated Emission within restricted Bands

6.8.1. Test Setup



- The EUT is placed on the top of a rotating table 0.8m above the ground (<1GHz) and 1.5m above the ground (>1GHz) at a 3m semi-anechoic chamber. The table is rotated 360 degrees to determine the position of the highest radiation.
- The EUT is set 3m away from the interference-receiving antenna, which is mounted on the top of a variable-height antenna tower.
- The antenna is Bilog/Horn antenna depend on which frequency range uses, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT is arranged to its worst case and then the antenna is tuned to heights from 1m to 4m and the rotatable table is turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system is set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- If the emission level of the EUT in peak mode is fall within the range of 10dB from the limit specified, the emissions would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. Otherwise, the testing could be stopped and the peak values of the EUT would be reported.

NOTE:

- The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection at frequency below 1GHz.
- The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3 MHz for Peak detection at frequency above 1 GHz.
- All modes of operation were investigated and the worst-case emissions are reported.

6.8.2. Test Limits:

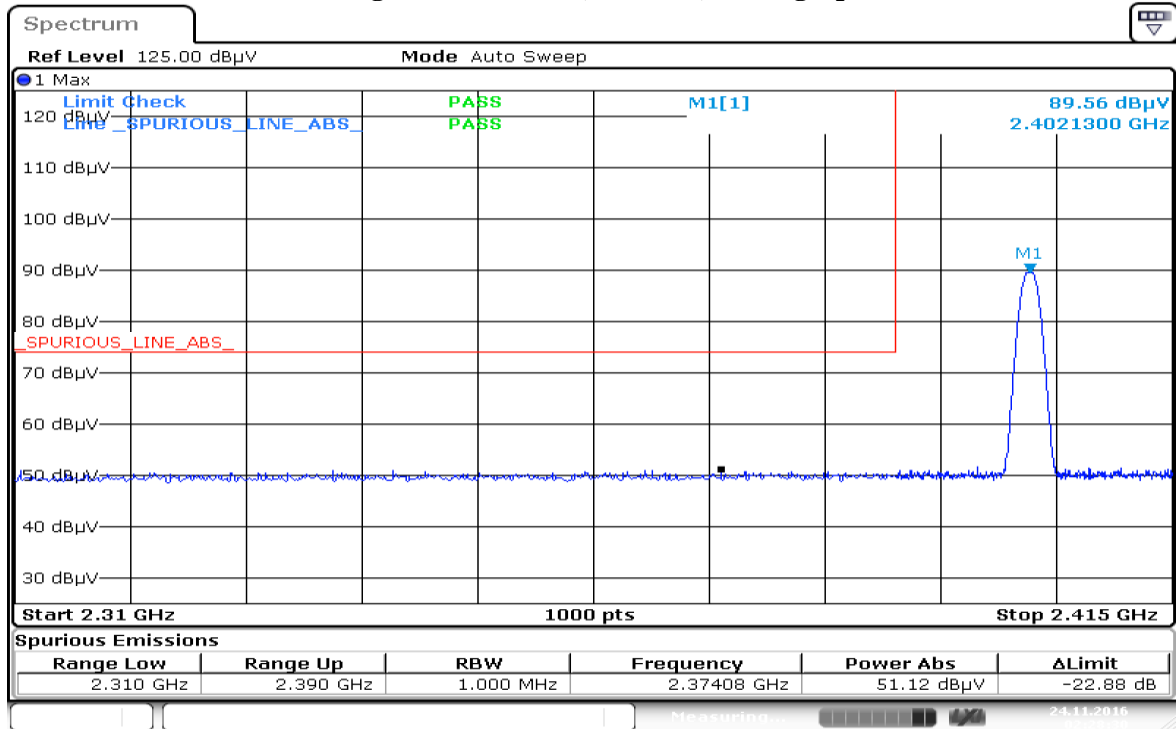
Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power.

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
Above 960	500	3

NOTE:

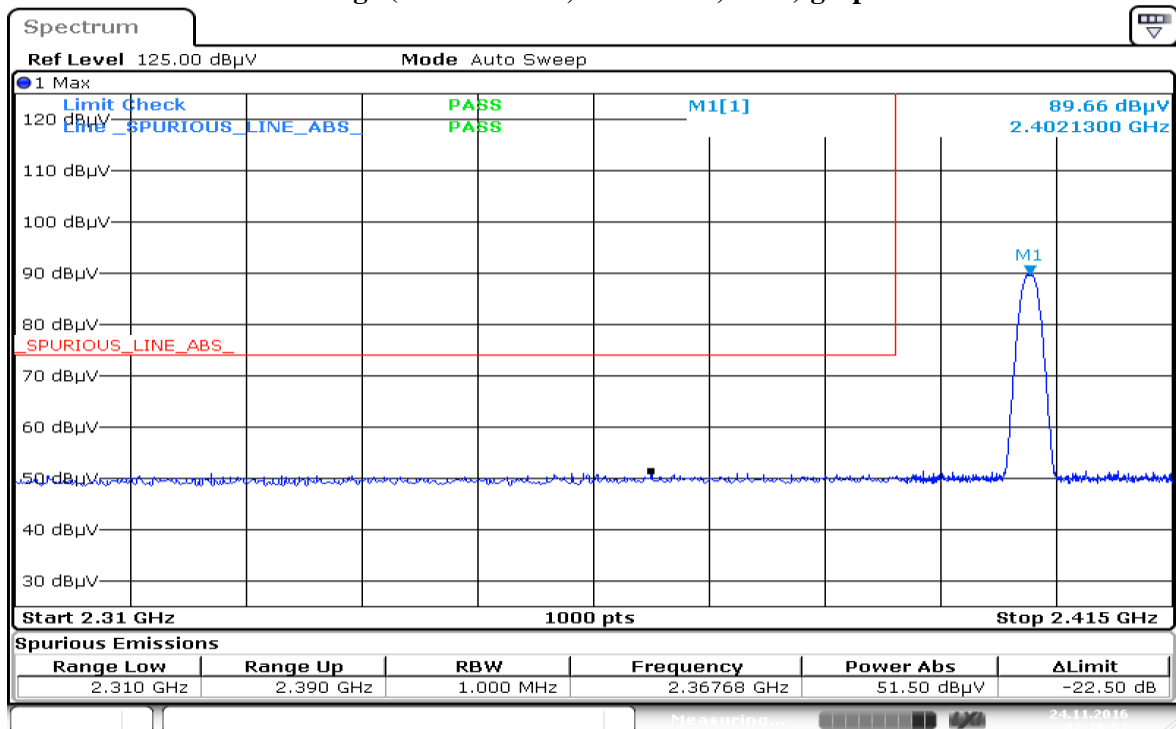
- a. The lower limit shall apply at the transition frequencies.
- b. Emission level (dBuV/m) = 20 log Emission level (uV/m).
- c. For frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

Restricted Band Edge (Low Channel, Vertical, Peak) graphical screen shot



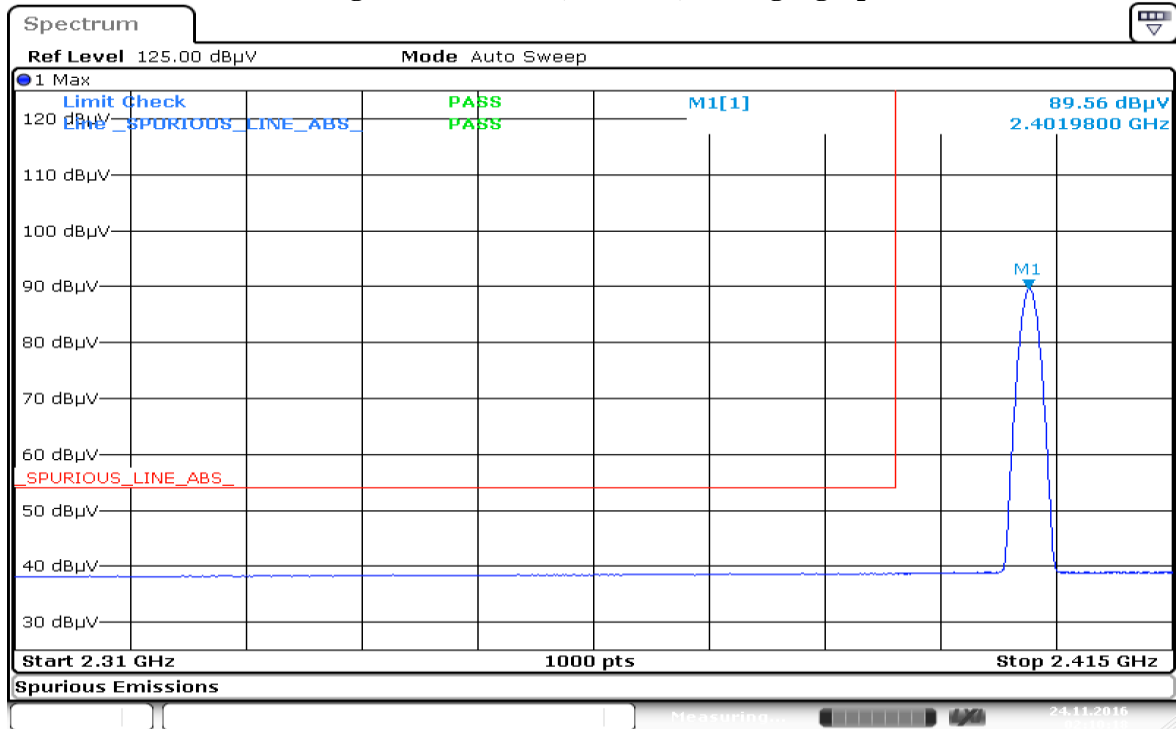
Date: 24.NOV.2016 02:28:30

Restricted Band Edge (Low Channel, Horizontal, Peak) graphical screen shot



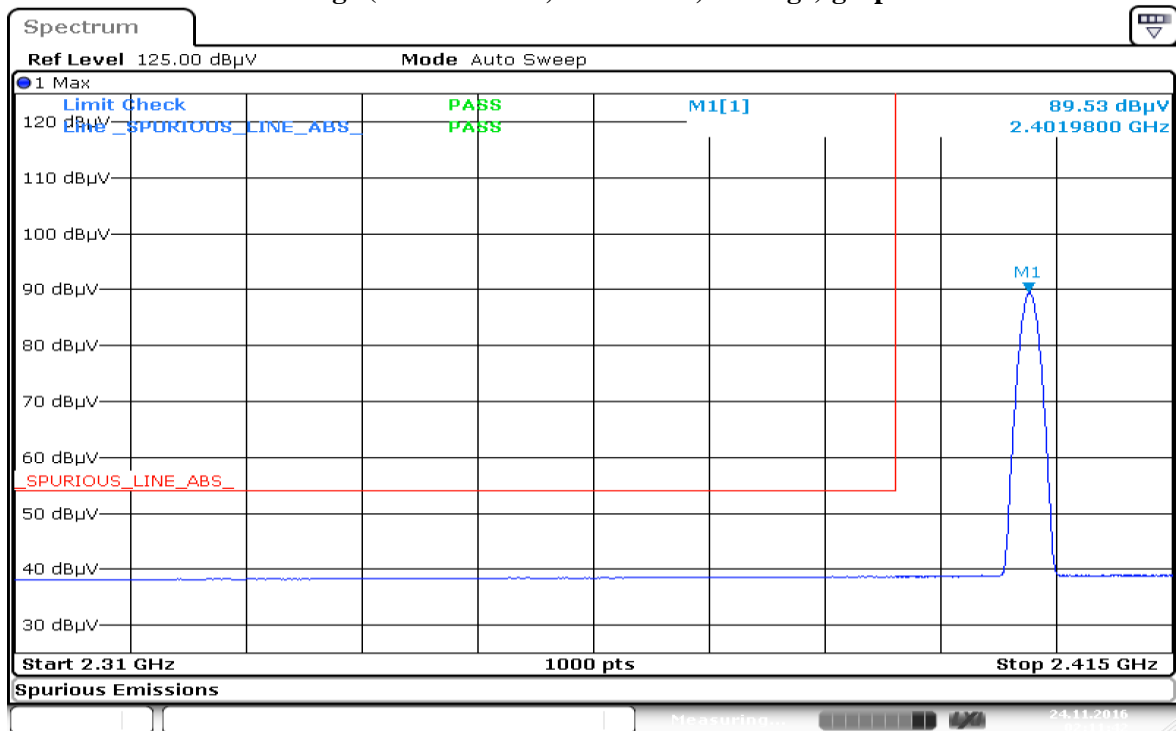
Date: 24.NOV.2016 02:29:53

Restricted Band Edge (Low Channel, Vertical, Average) graphical screen shot



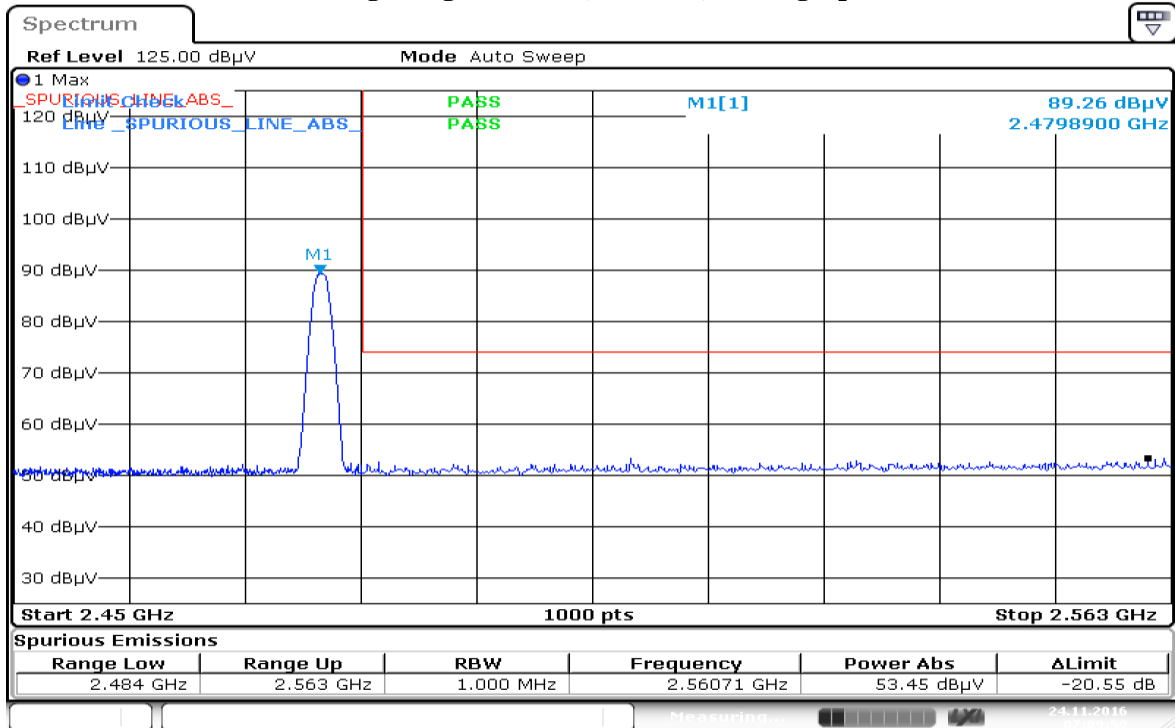
Date: 24.NOV.2016 02:10:18

Restricted Band Edge (Low Channel, Horizontal, Average) graphical screen shot



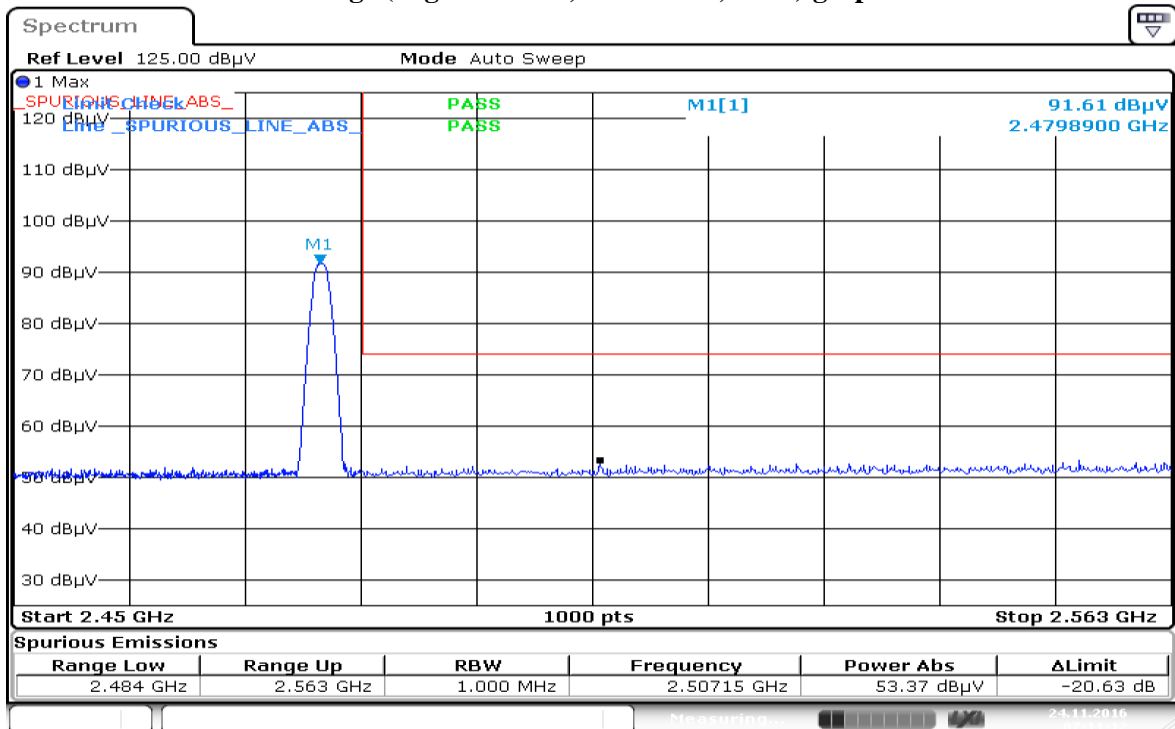
Date: 24.NOV.2016 02:11:43

Restricted Band Edge (High Channel, Vertical, Peak) graphical screen shot



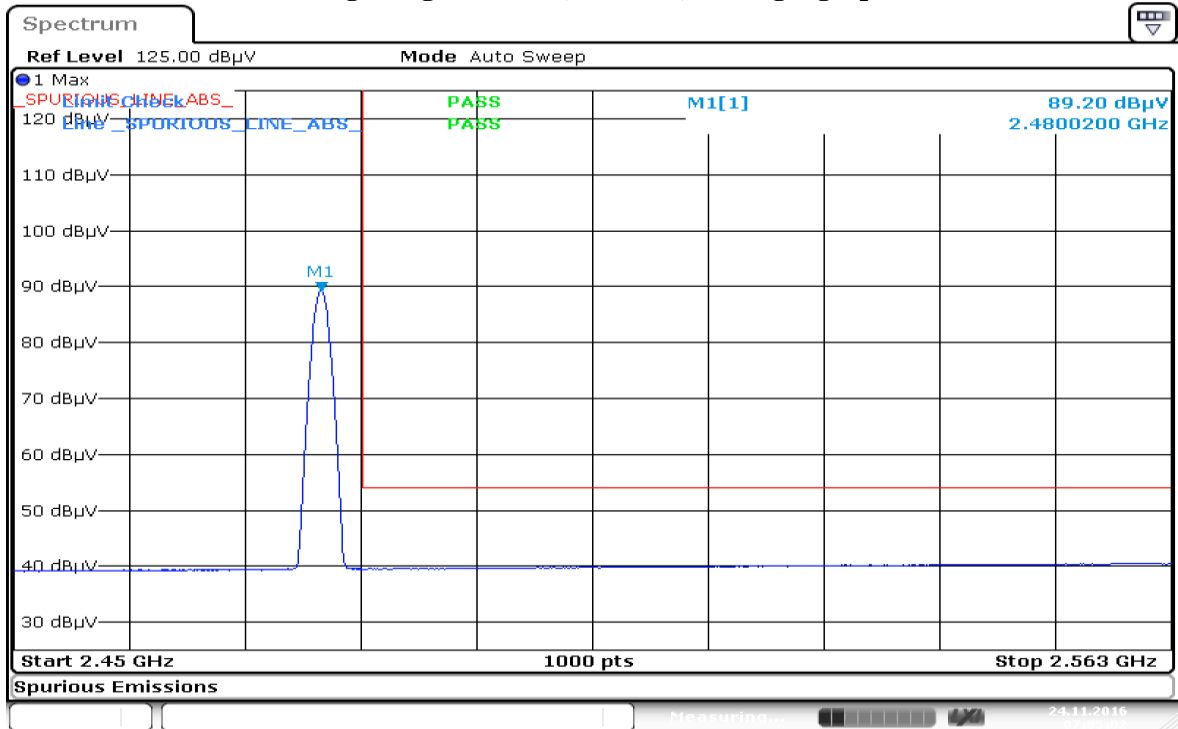
Date: 24.NOV.2016 07:09:50

Restricted Band Edge (High Channel, Horizontal, Peak) graphical screen shot



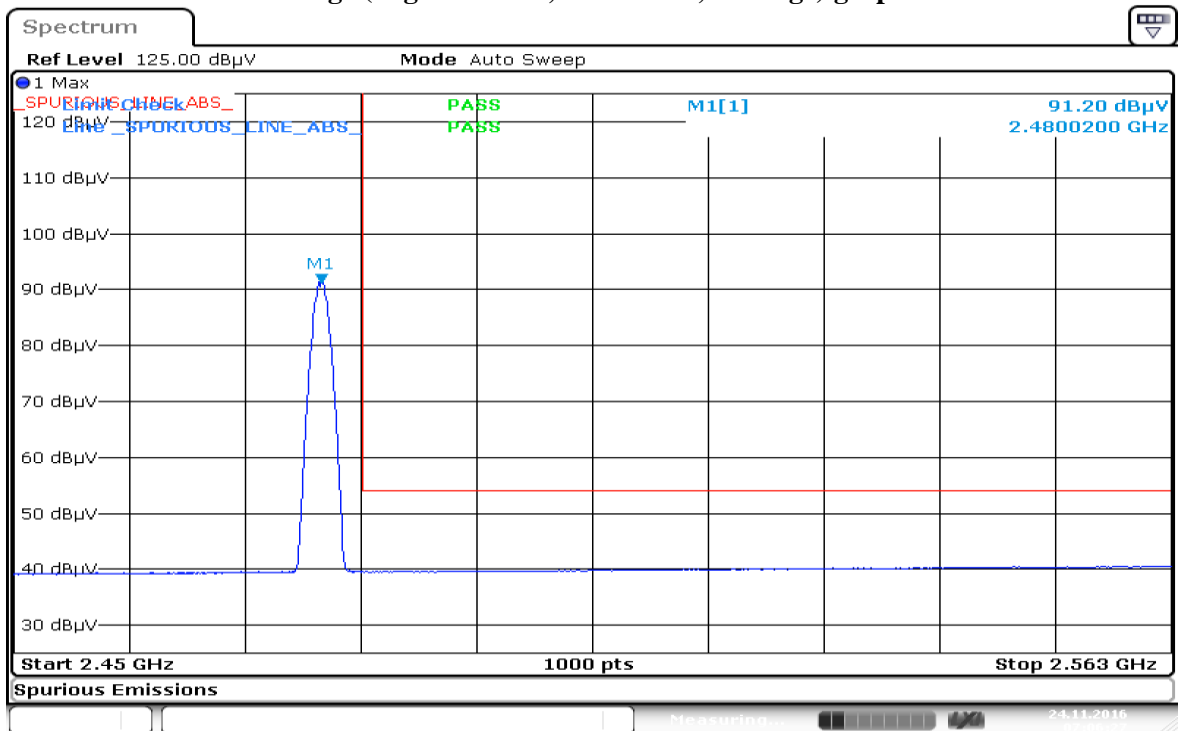
Date: 24.NOV.2016 07:11:13

Restricted Band Edge (High Channel, Vertical, Average) graphical screen shot



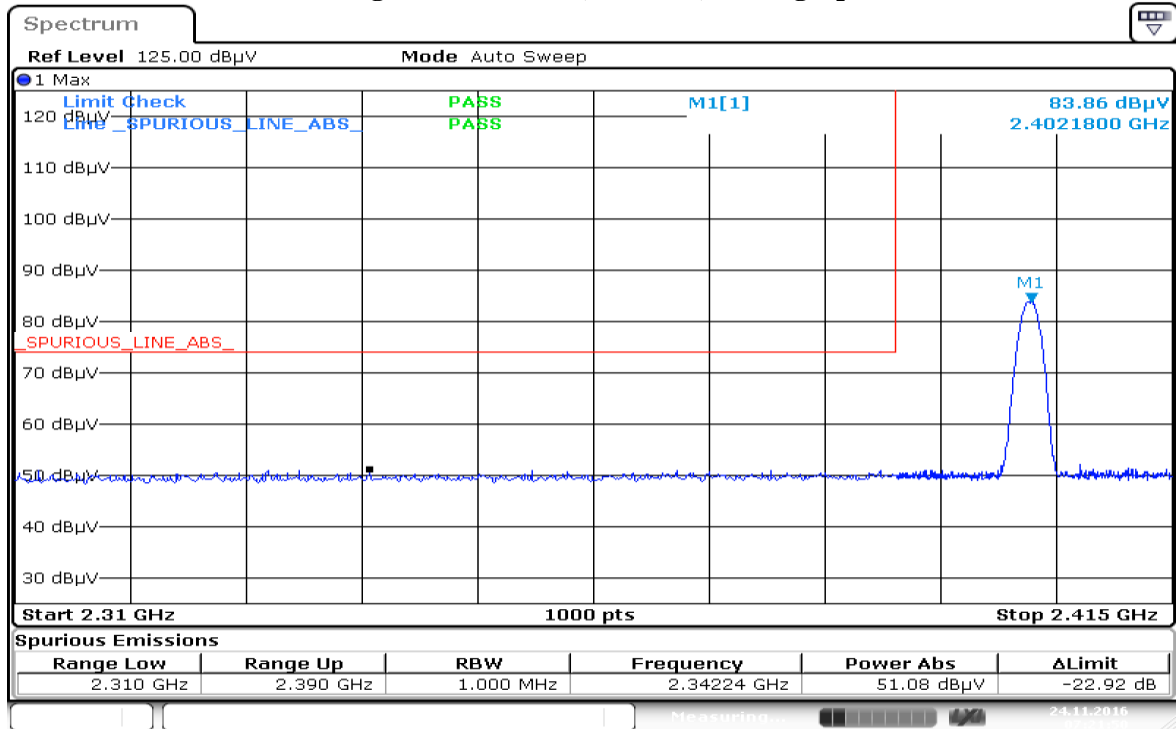
Date: 24.NOV.2016 07:05:03

Restricted Band Edge (High Channel, Horizontal, Average) graphical screen shot



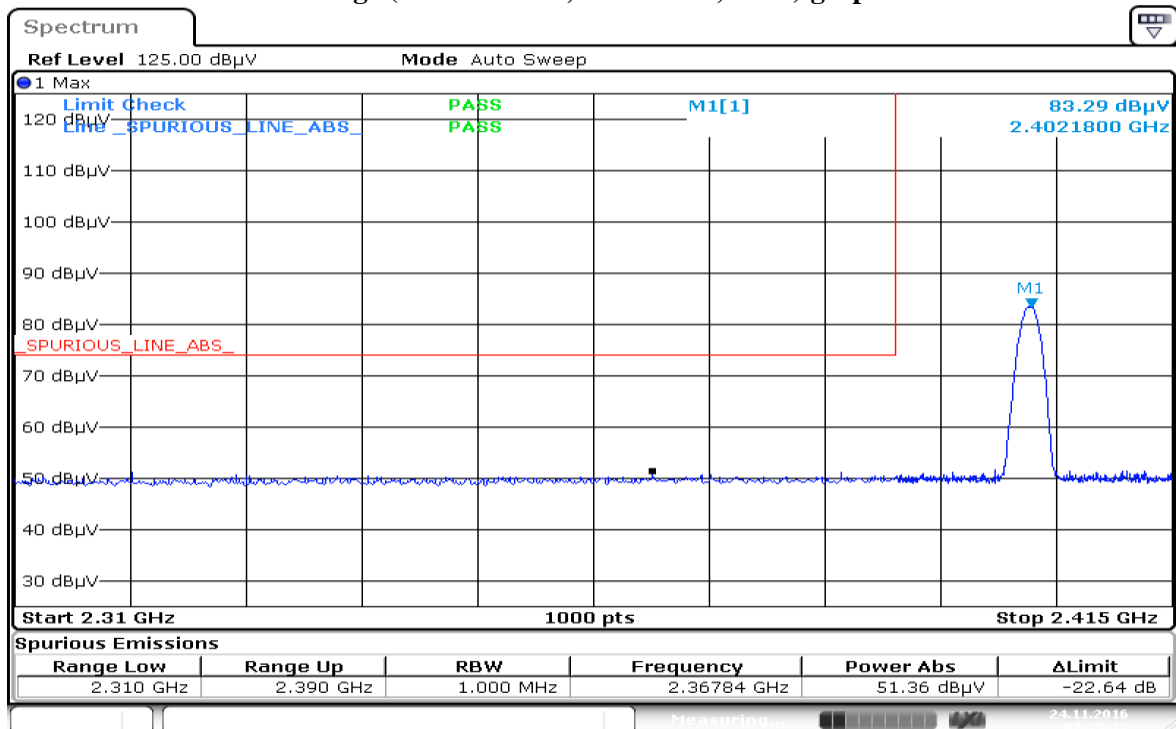
Date: 24.NOV.2016 07:06:28

Restricted Band Edge (Low Channel, Vertical, Peak) graphical screen shot



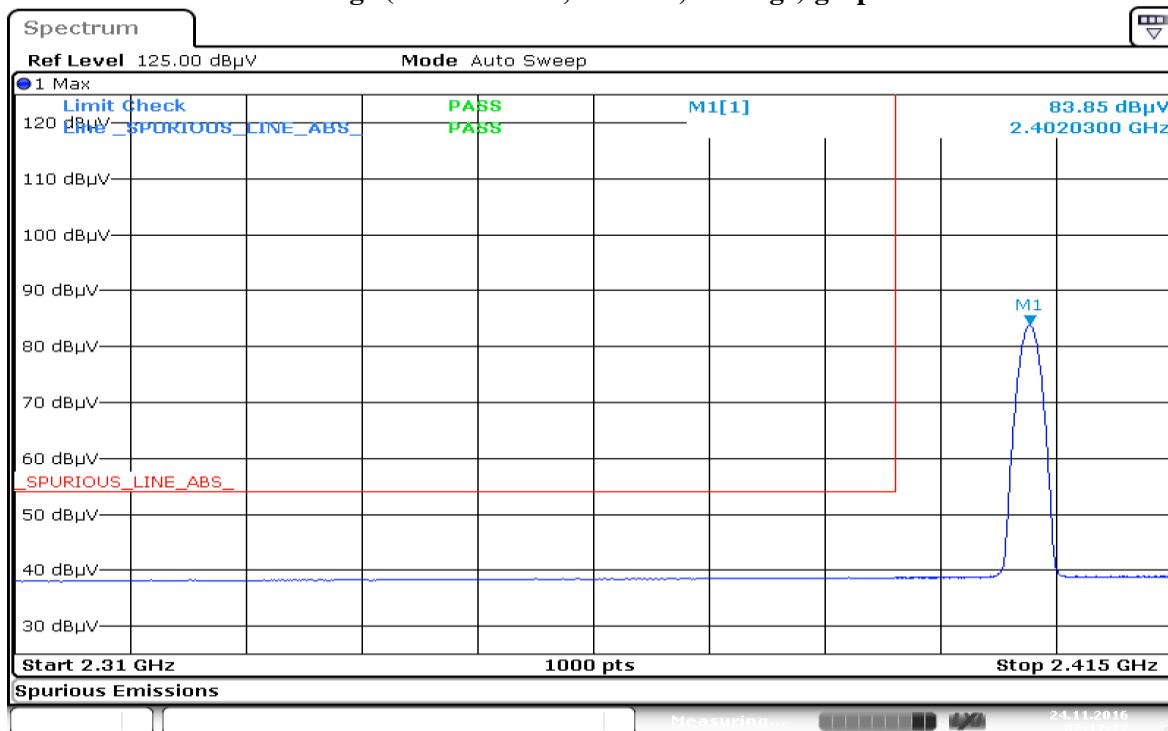
Date: 24.NOV.2016 07:21:50

Restricted Band Edge (Low Channel, Horizontal, Peak) graphical screen shot



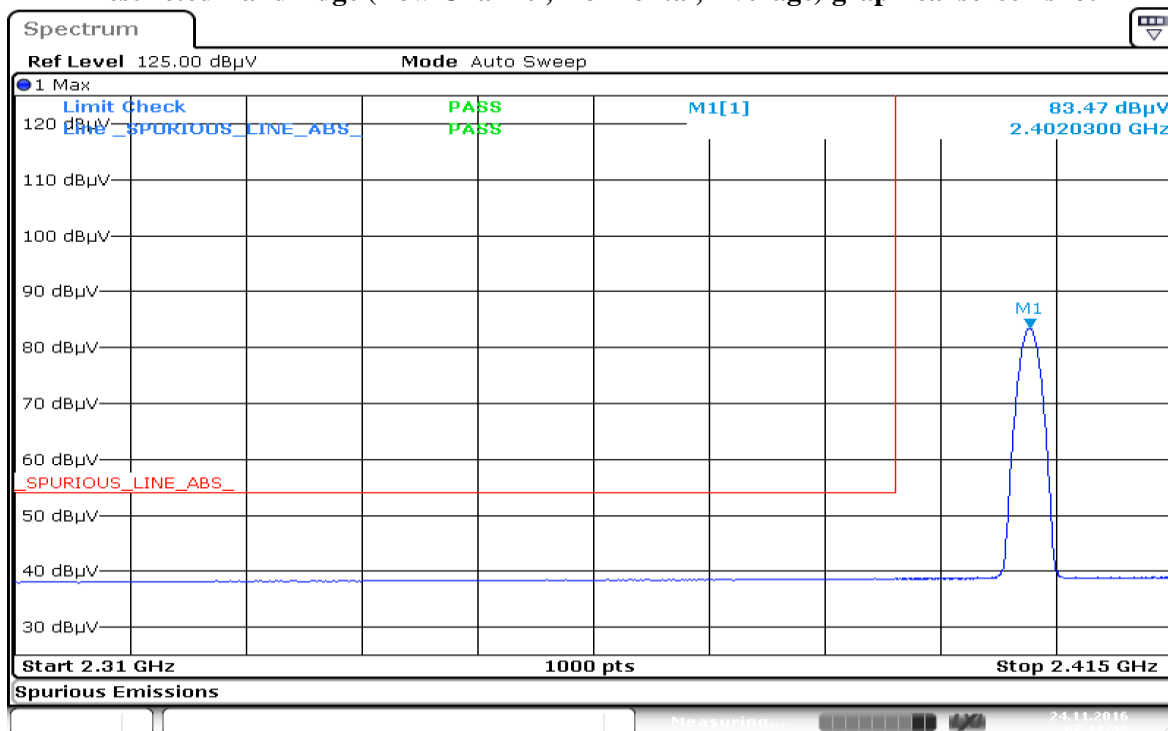
Date: 24.NOV.2016 07:23:13

Restricted Band Edge (Low Channel, Vertical, Average) graphical screen shot



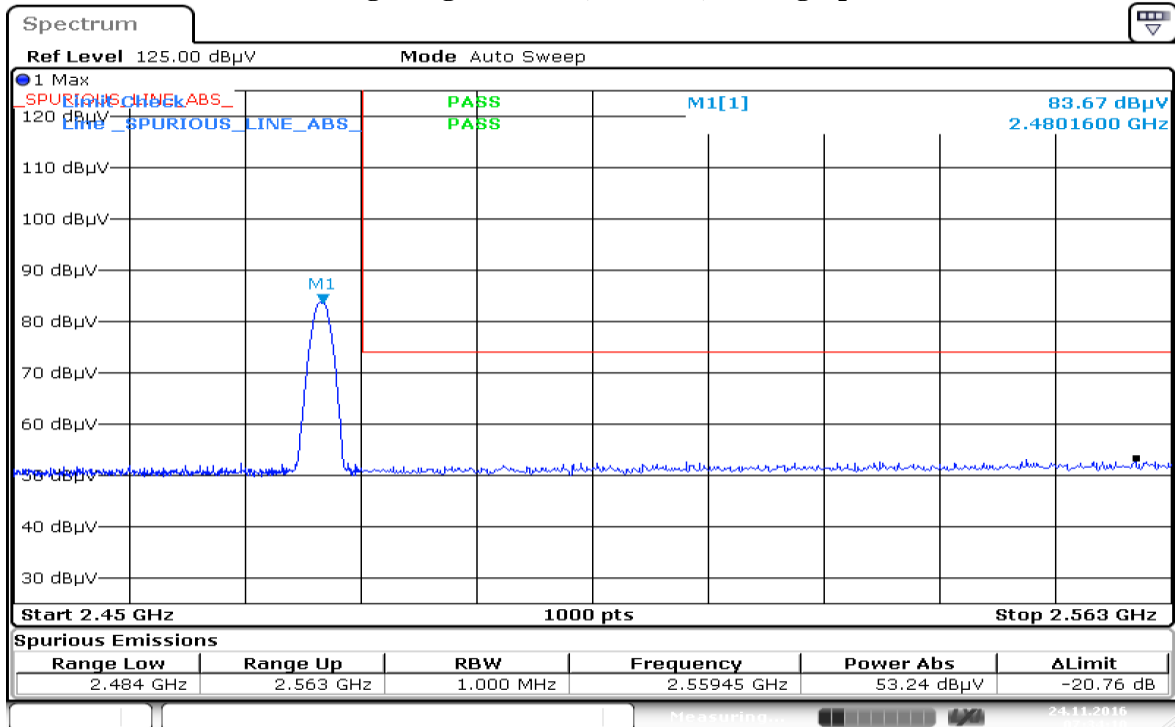
Date: 24.NOV.2016 07:17:23

Restricted Band Edge (Low Channel, Horizontal, Average) graphical screen shot



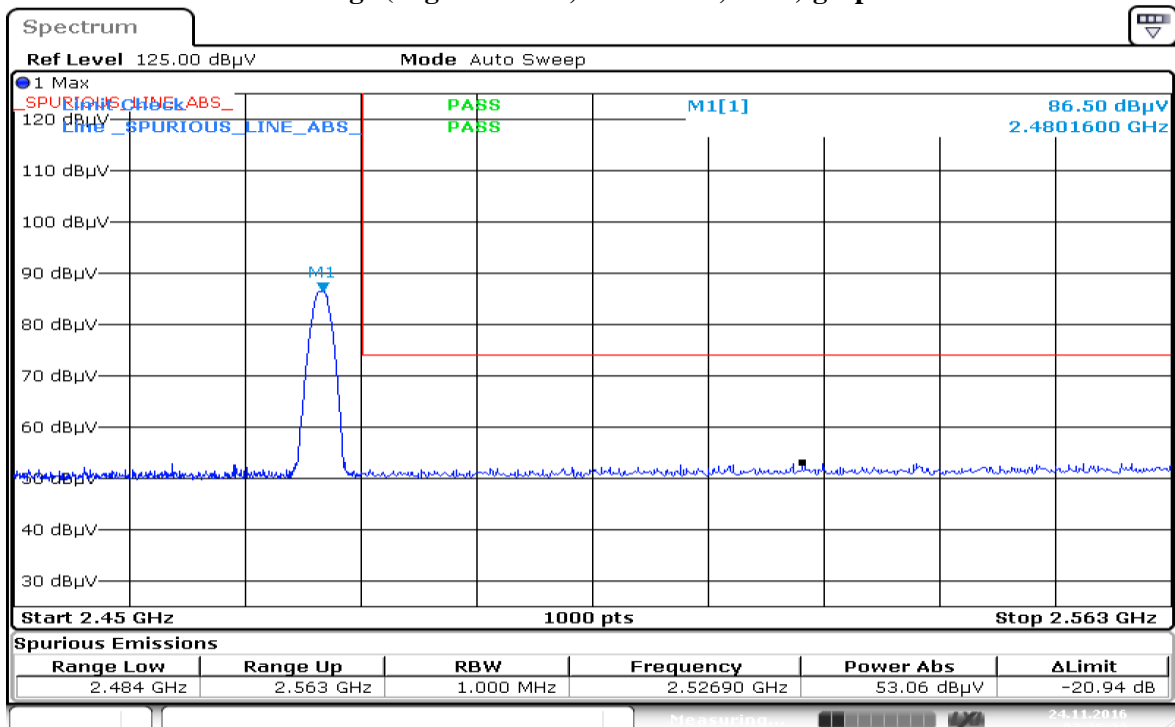
Date: 24.NOV.2016 07:18:48

Restricted Band Edge (High Channel, Vertical, Peak) graphical screen shot



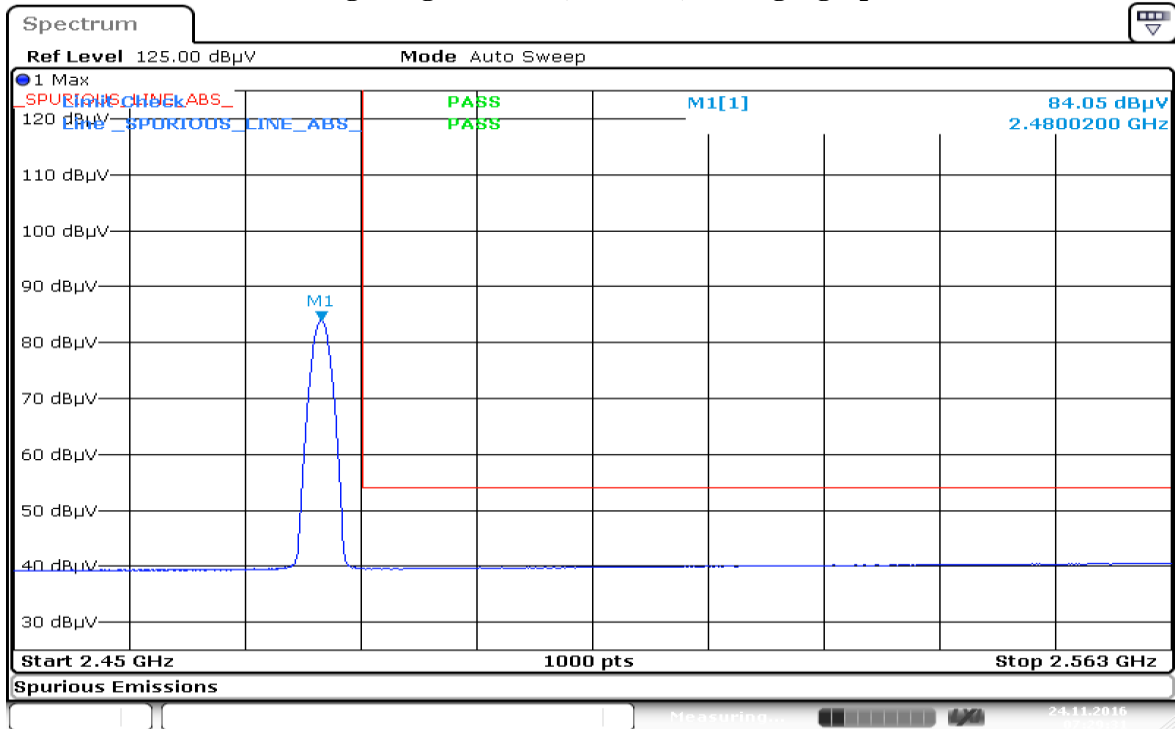
Date: 24.NOV.2016 07:34:10

Restricted Band Edge (High Channel, Horizontal, Peak) graphical screen shot



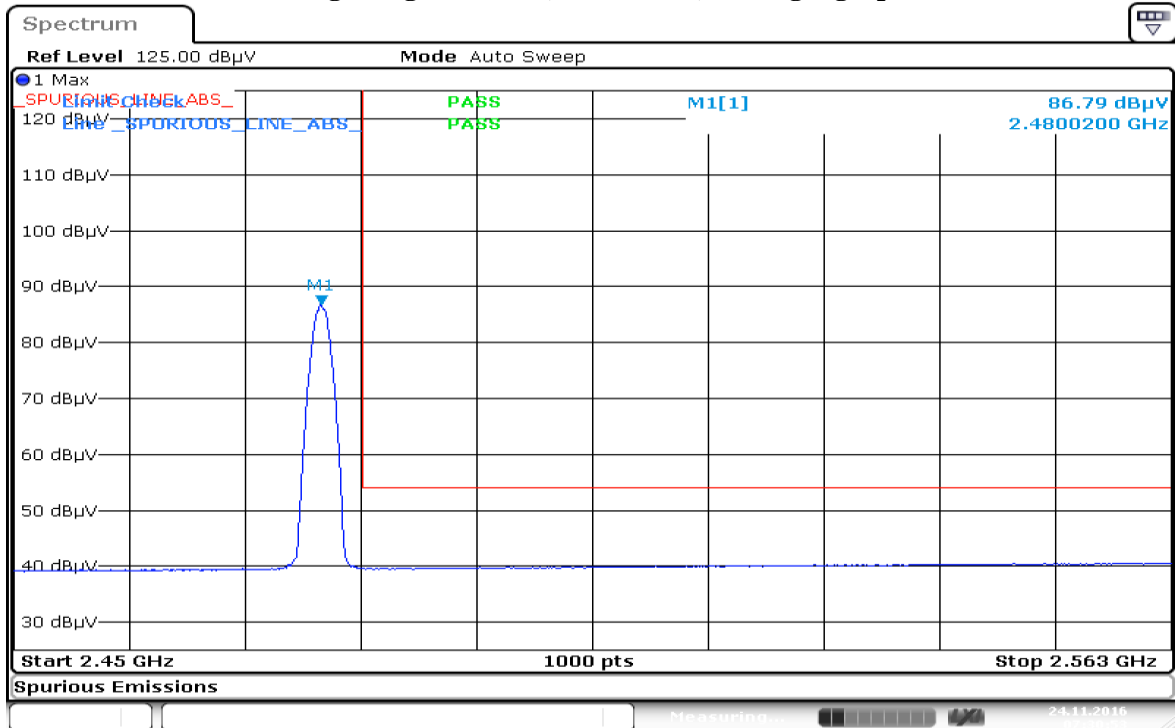
Date: 24.NOV.2016 07:35:33

Restricted Band Edge (High Channel, Vertical, Average) graphical screen shot



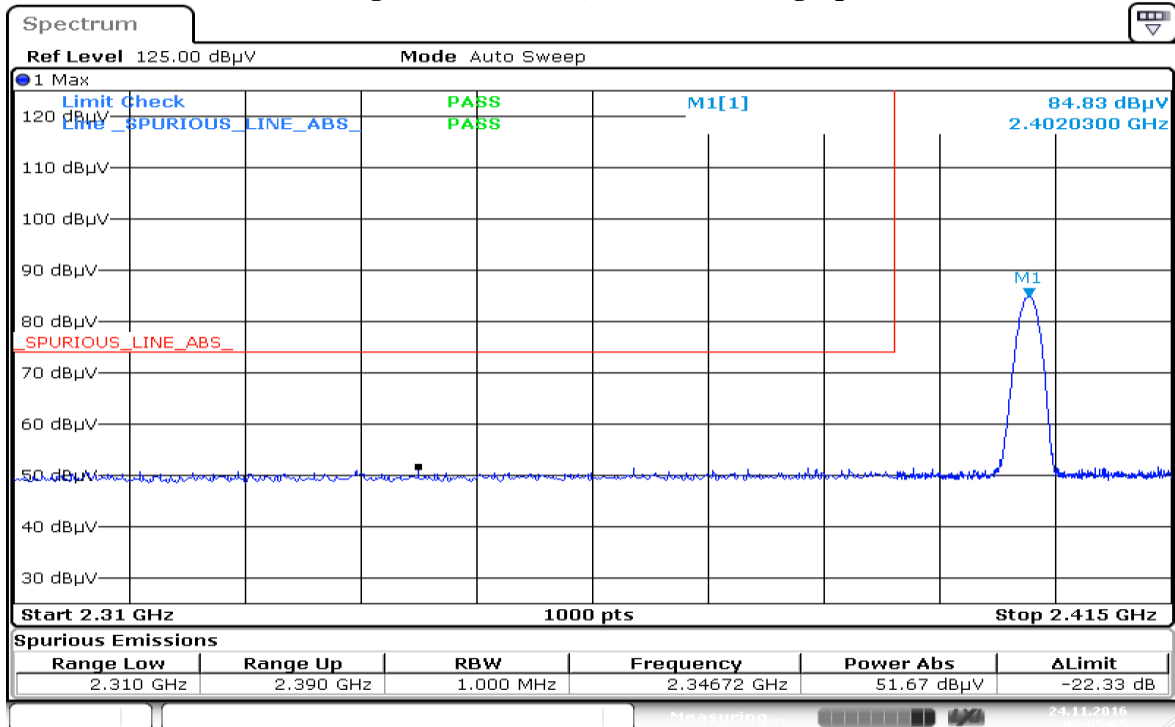
Date: 24.NOV.2016 07:29:30

Restricted Band Edge (High Channel, Horizontal, Average) graphical screen shot



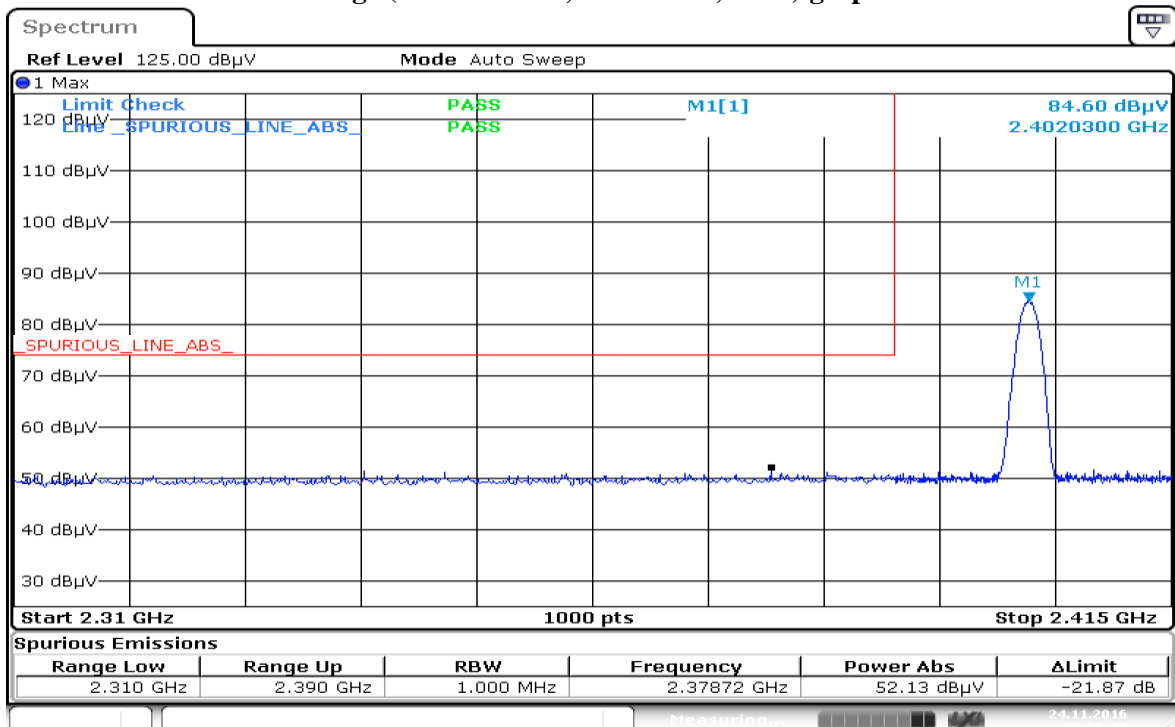
Date: 24.NOV.2016 07:30:53

Restricted Band Edge (Low Channel, Vertical, Peak) graphical screen shot



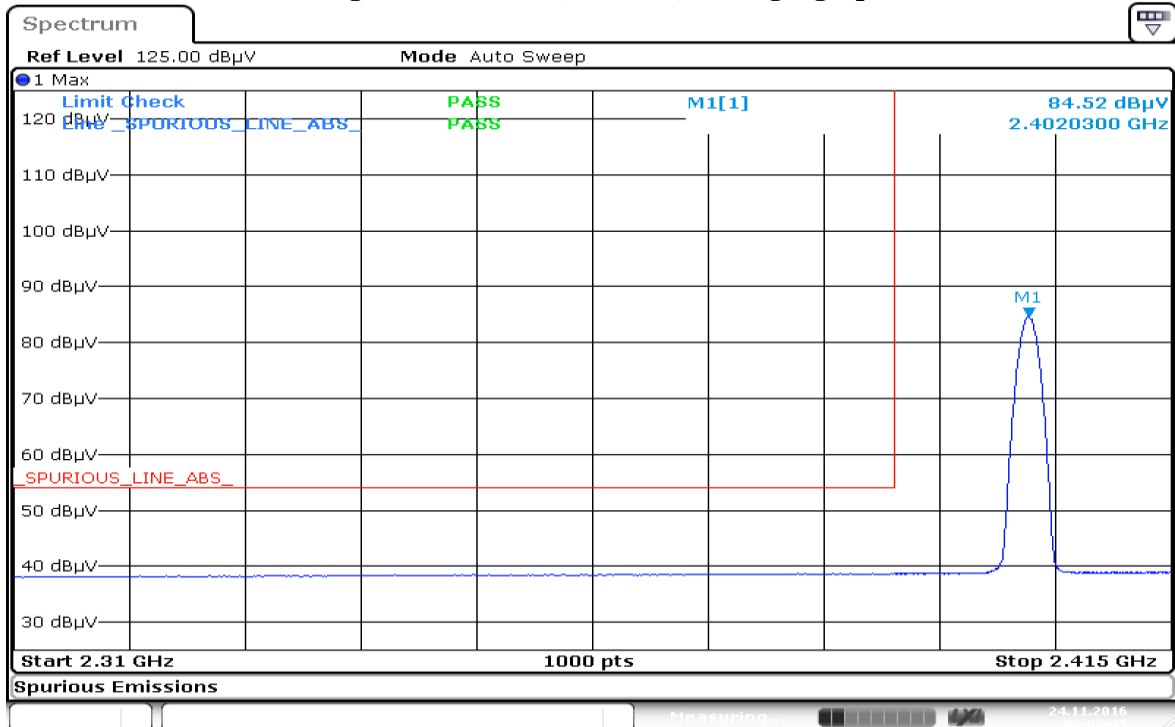
Date: 24.NOV.2016 08:05:05

Restricted Band Edge (Low Channel, Horizontal, Peak) graphical screen shot



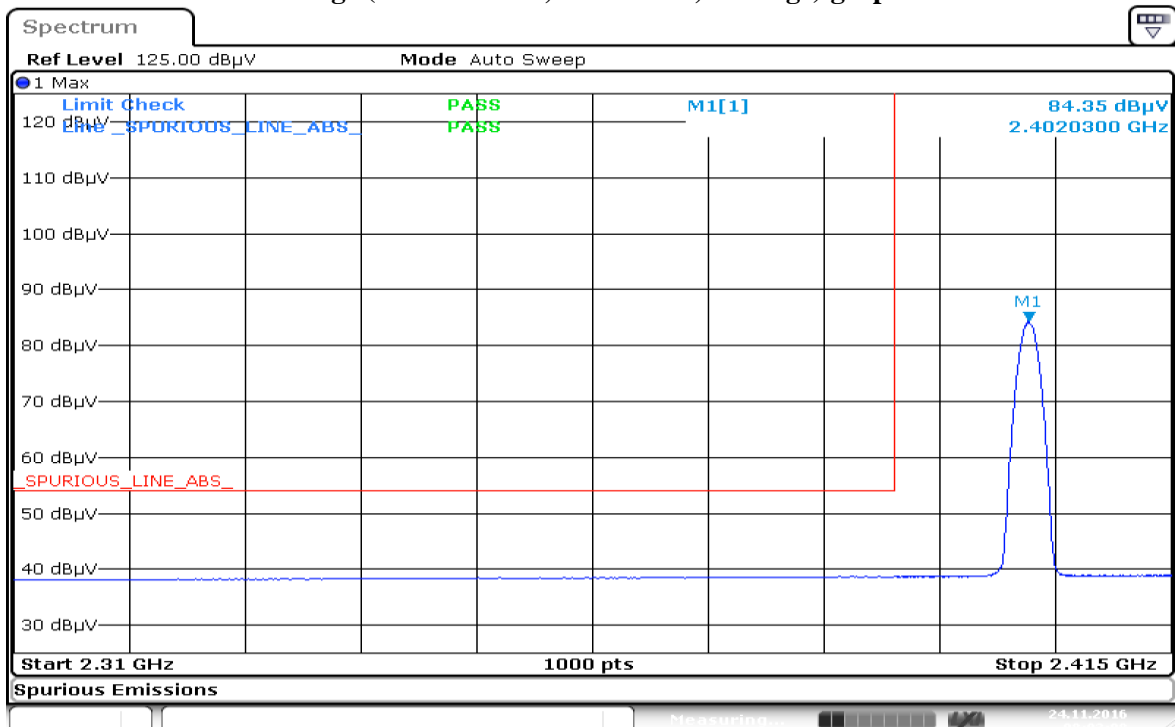
Date: 24.NOV.2016 08:06:28

Restricted Band Edge (Low Channel, Vertical, Average) graphical screen shot



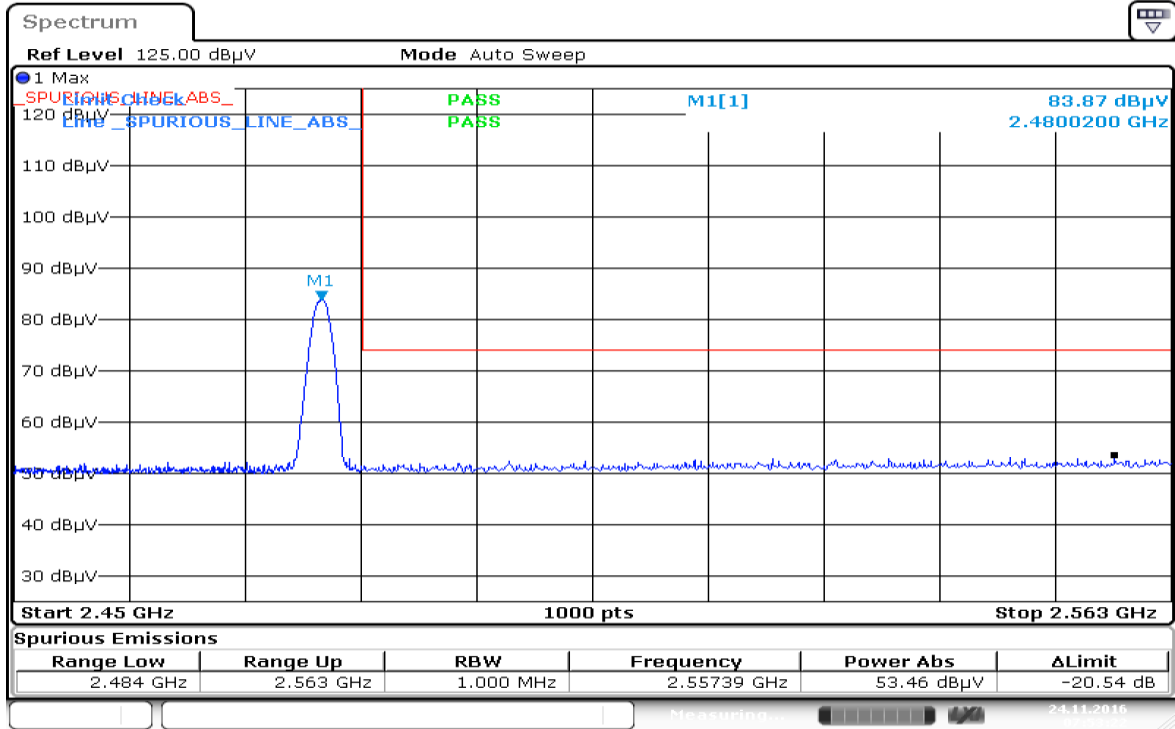
Date: 24.NOV.2016 08:00:45

Restricted Band Edge (Low Channel, Horizontal, Average) graphical screen shot



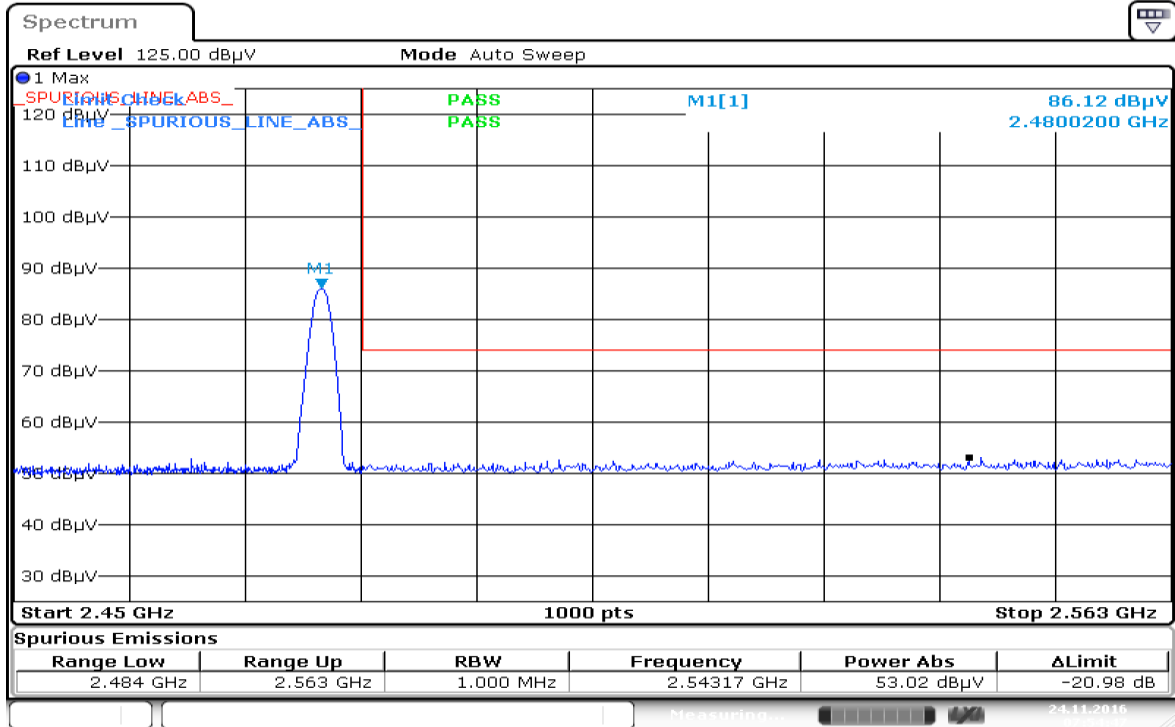
Date: 24.NOV.2016 08:02:08

Restricted Band Edge (High Channel, Vertical, Peak) graphical screen shot



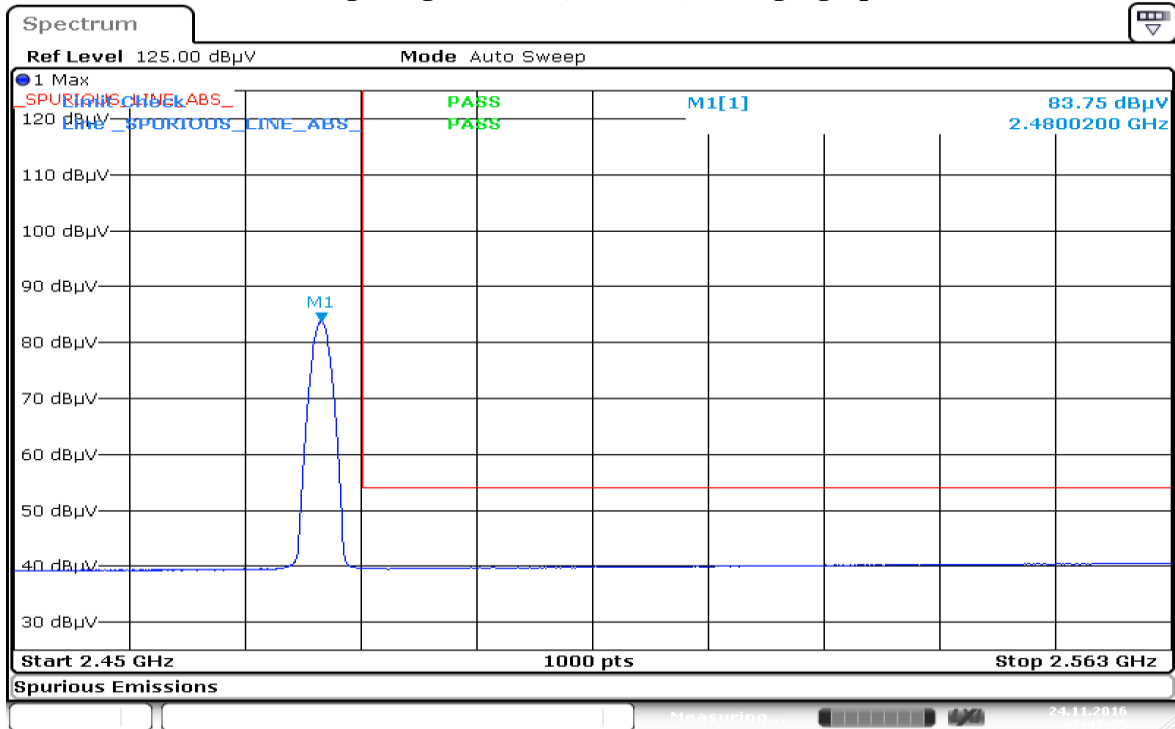
Date: 24.NOV.2016 07:53:23

Restricted Band Edge (High Channel, Horizontal, Peak) graphical screen shot



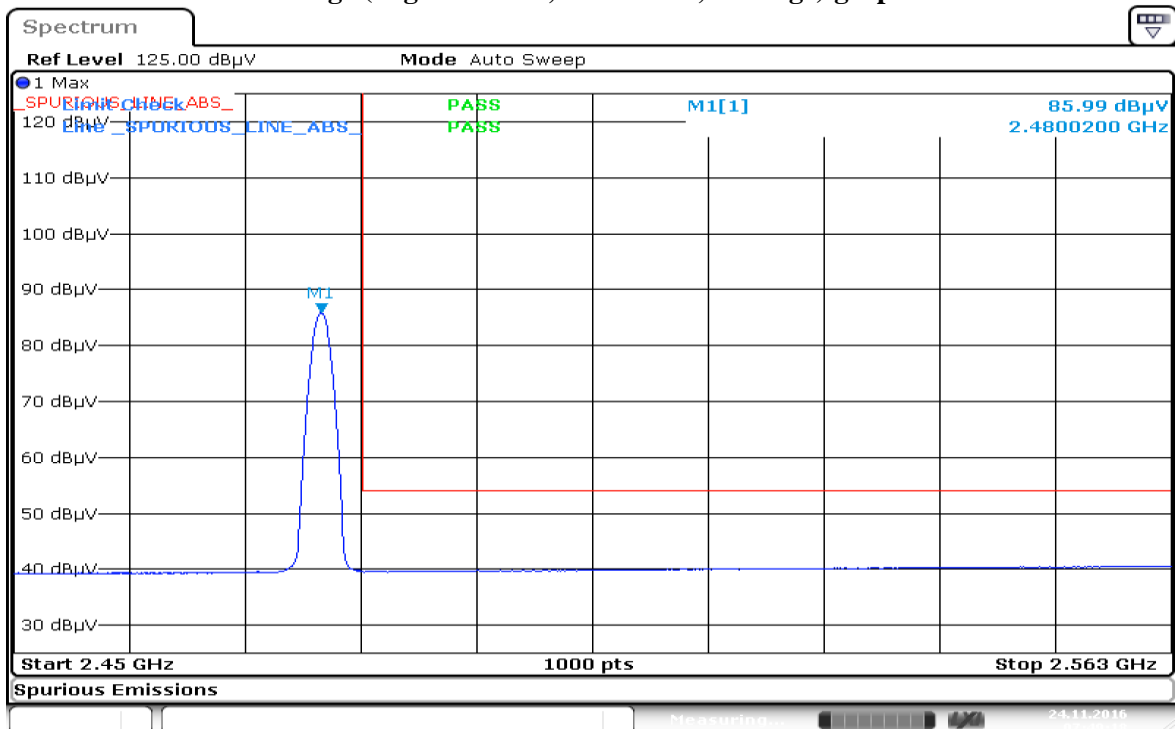
Date: 24.NOV.2016 07:54:48

Restricted Band Edge (High Channel, Vertical, Average) graphical screen shot



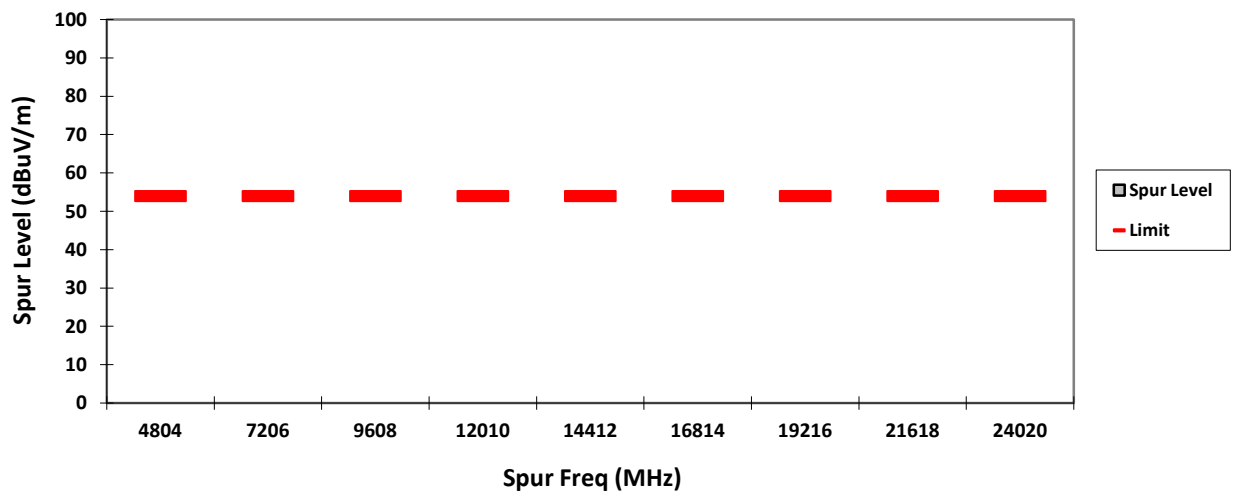
Date: 24.NOV.2016 07:47:55

Restricted Band Edge (High Channel, Horizontal, Average) graphical screen shot

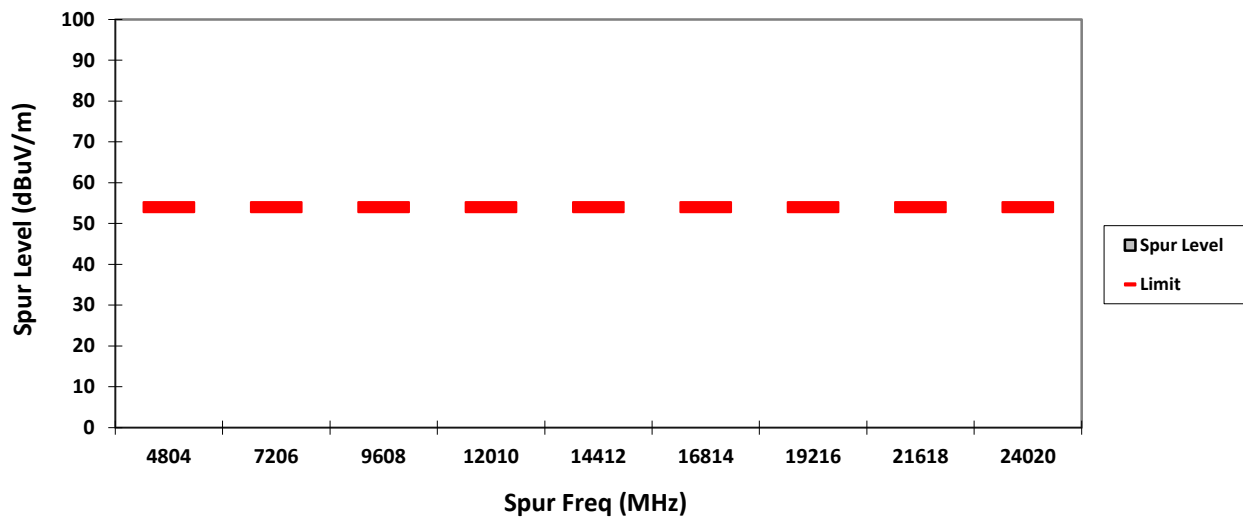


Date: 24.NOV.2016 07:49:18

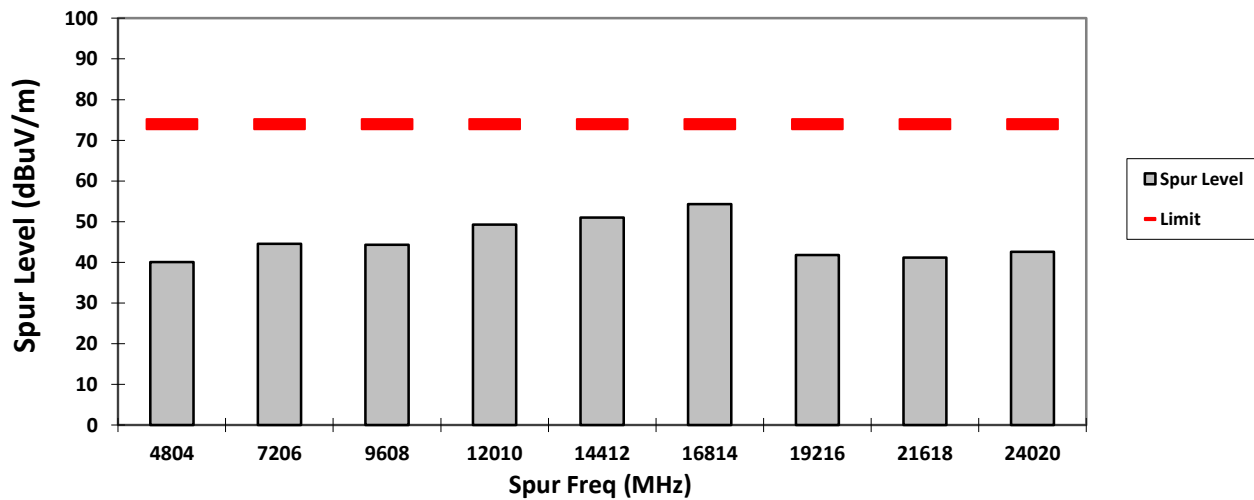
VERTICAL, QPK



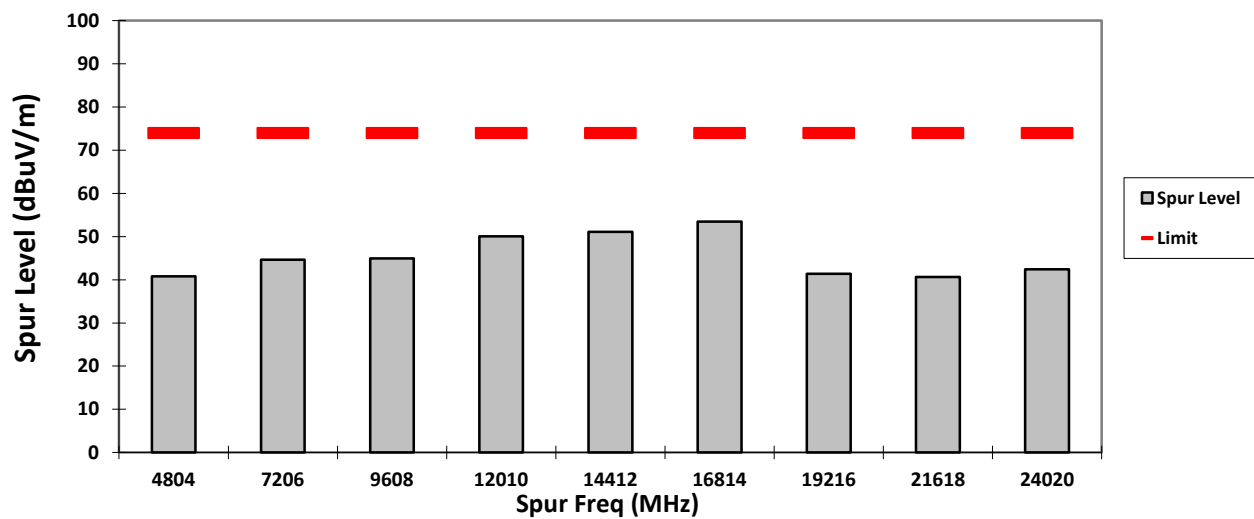
HORIZONTAL, QPK



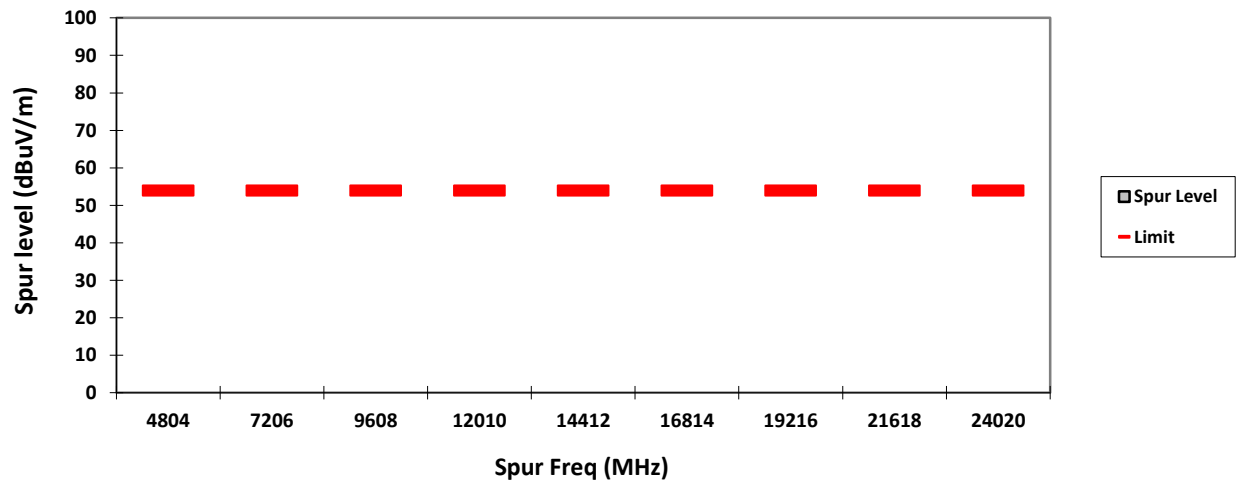
VERTICAL, PK



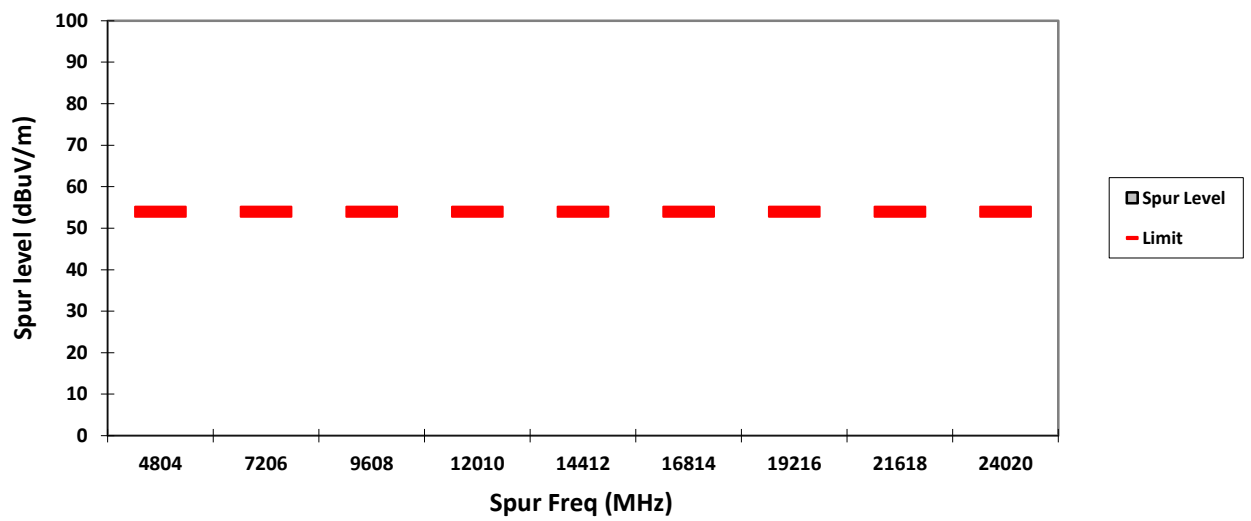
HORIZONTAL, PK



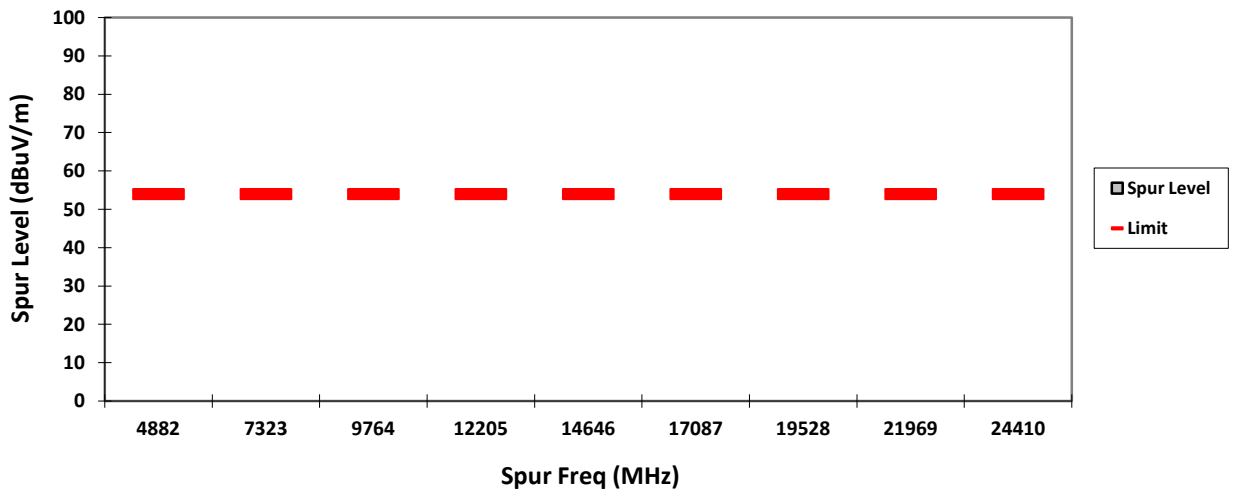
VERTICAL, AV



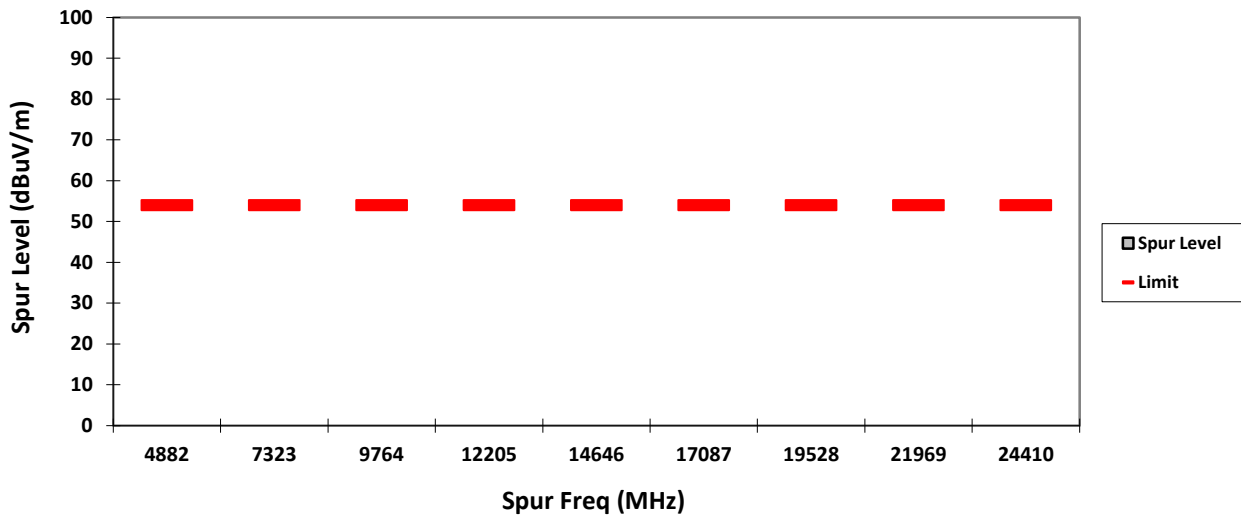
HORIZONTAL, AV



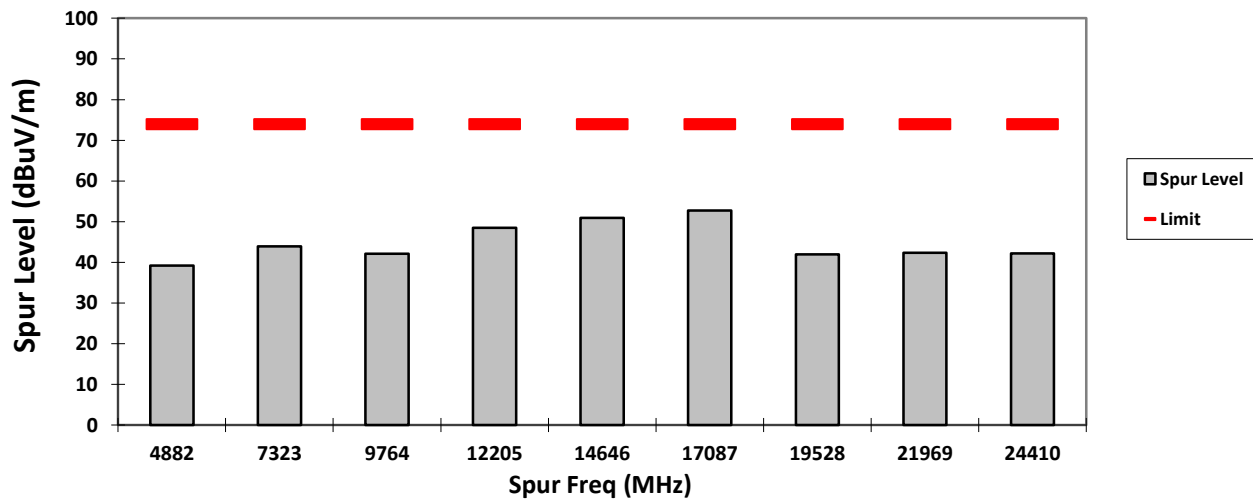
VERTICAL, QPK



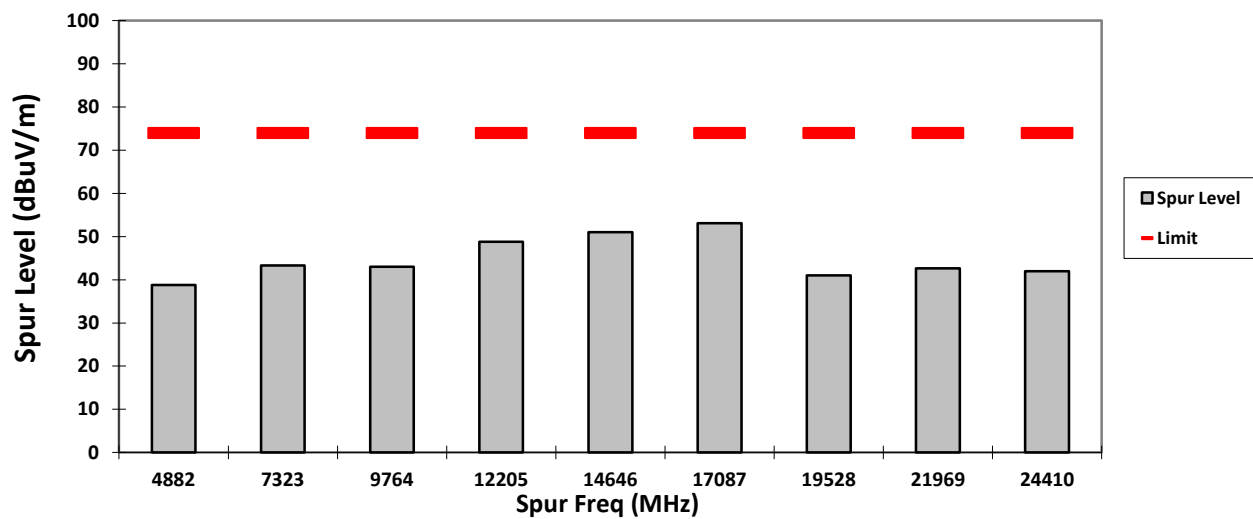
HORIZONTAL, QPK



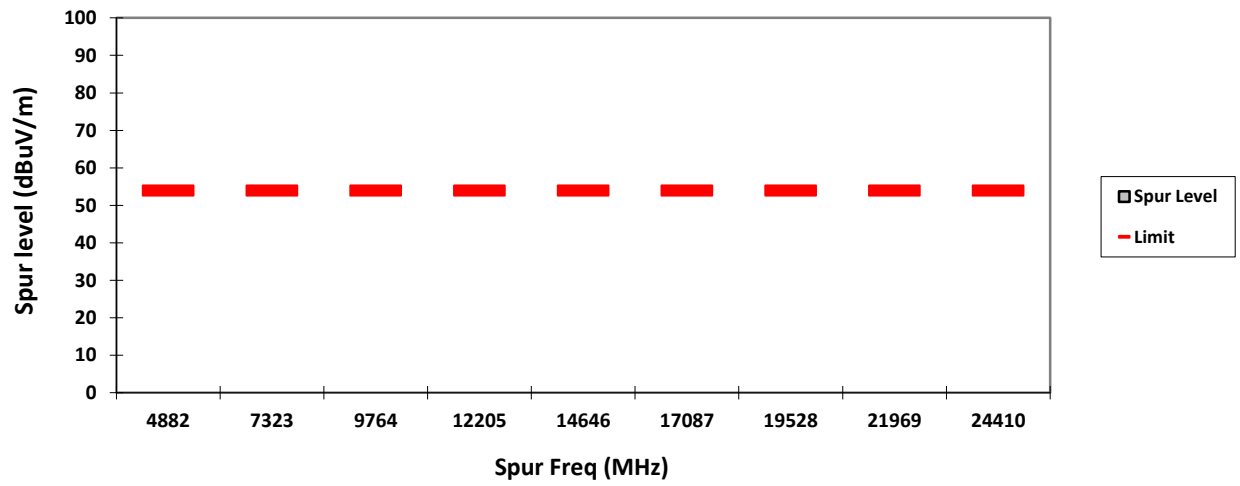
VERTICAL, PK



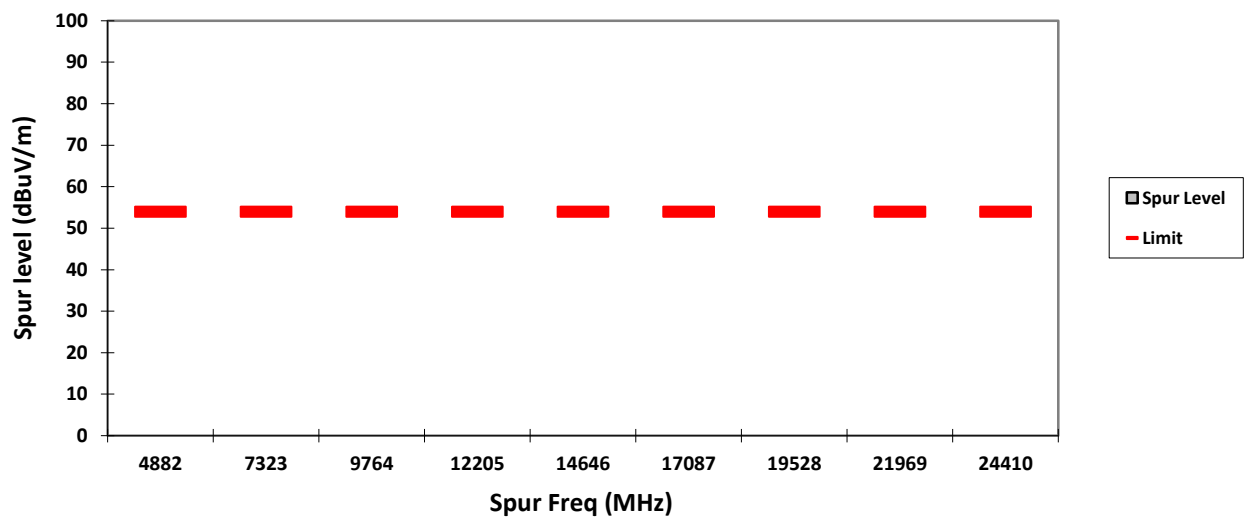
HORIZONTAL, PK



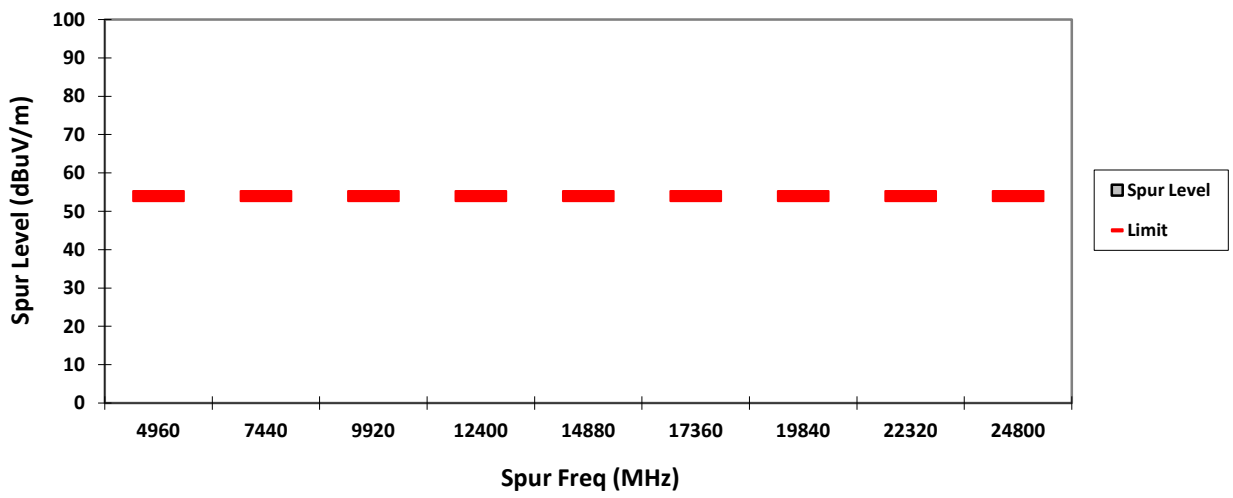
VERTICAL, AV



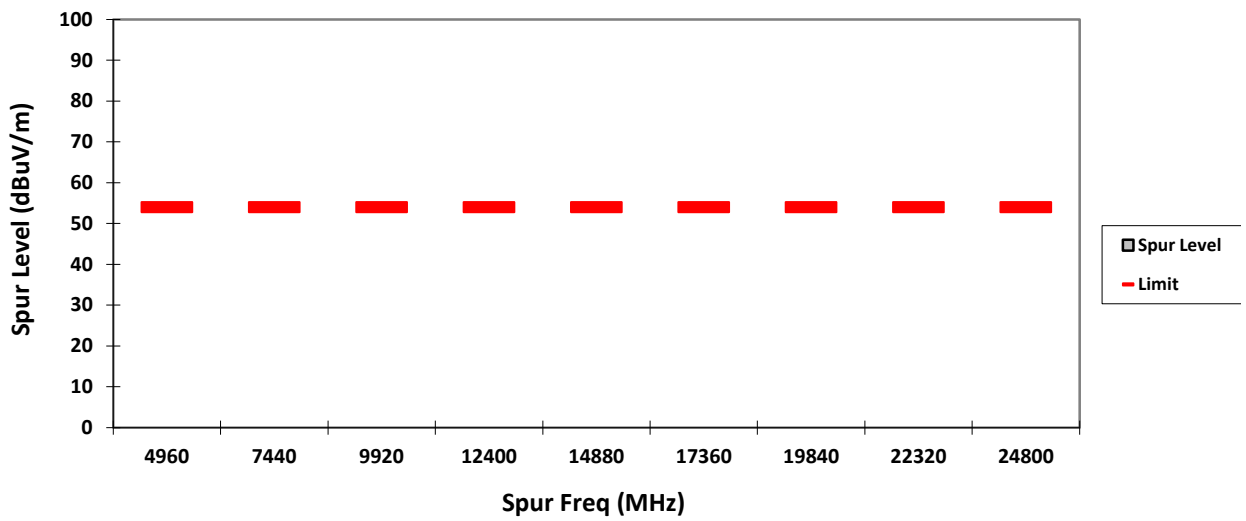
HORIZONTAL, AV



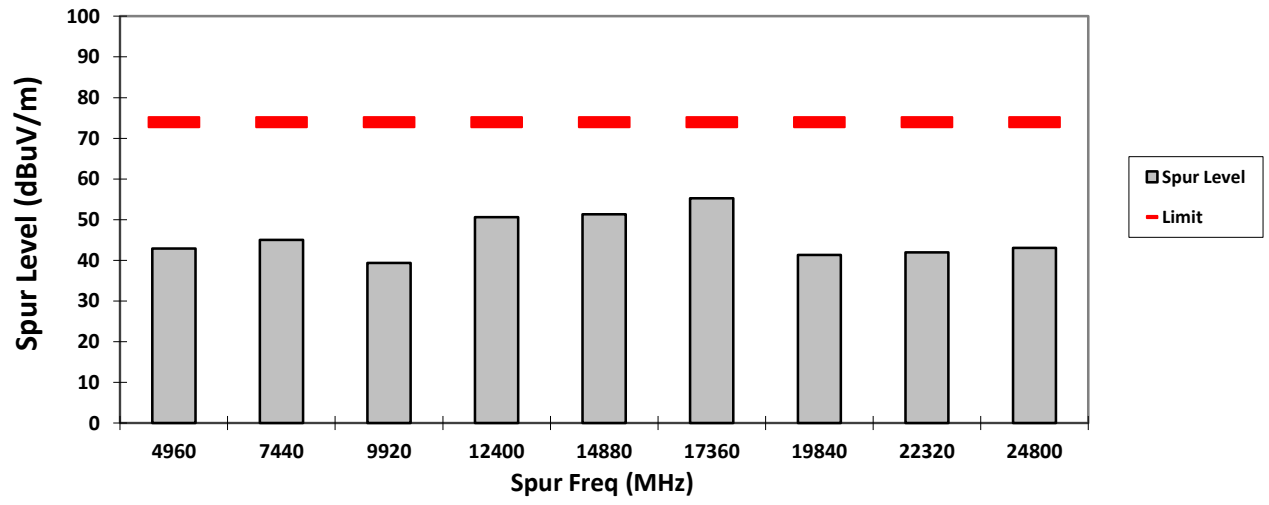
VERTICAL, QPK



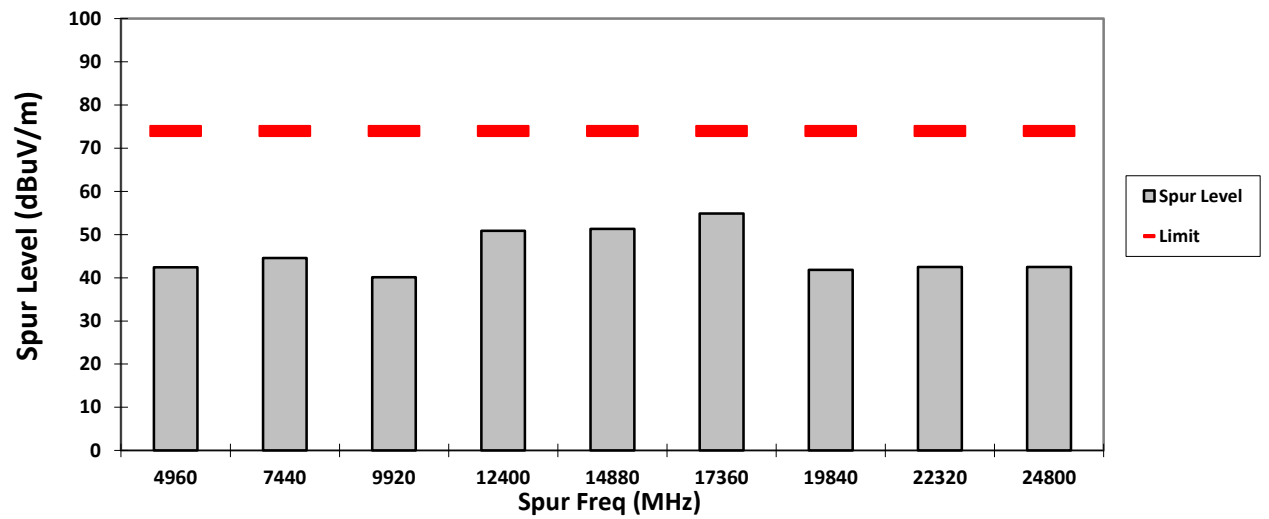
HORIZONTAL, QPK



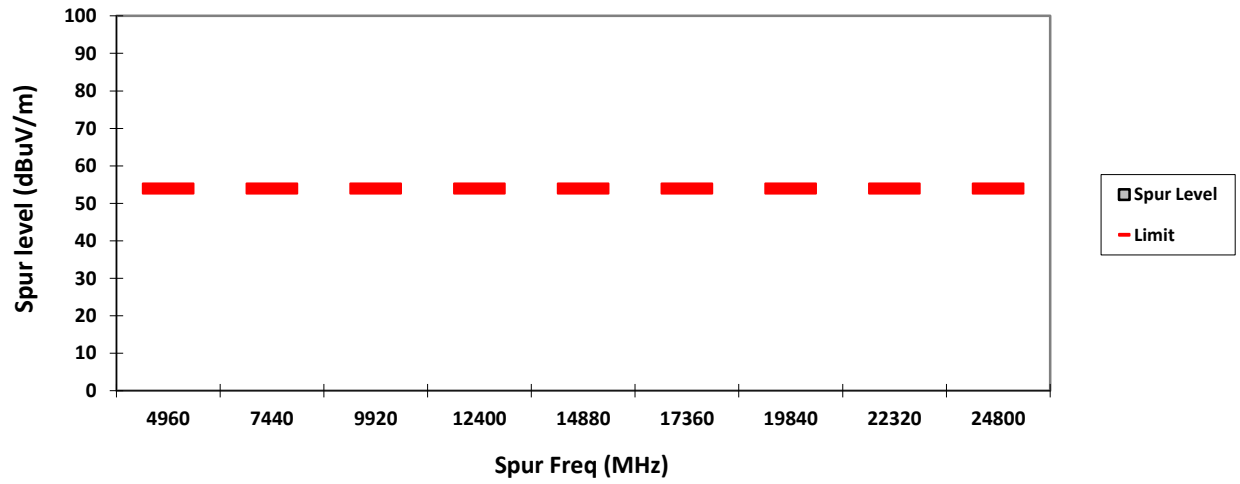
VERTICAL, PK



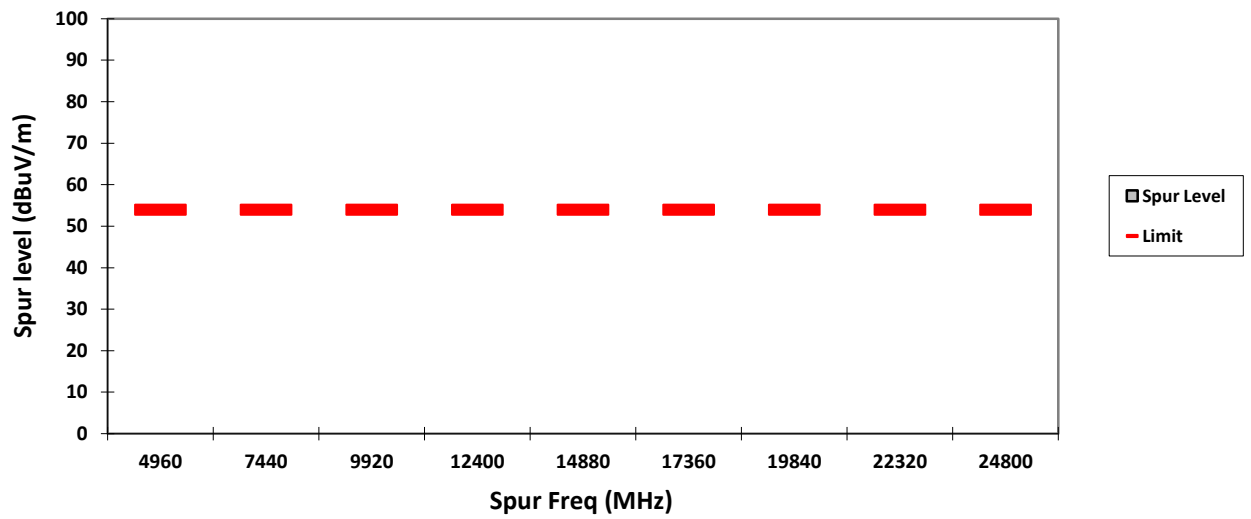
HORIZONTAL, PK



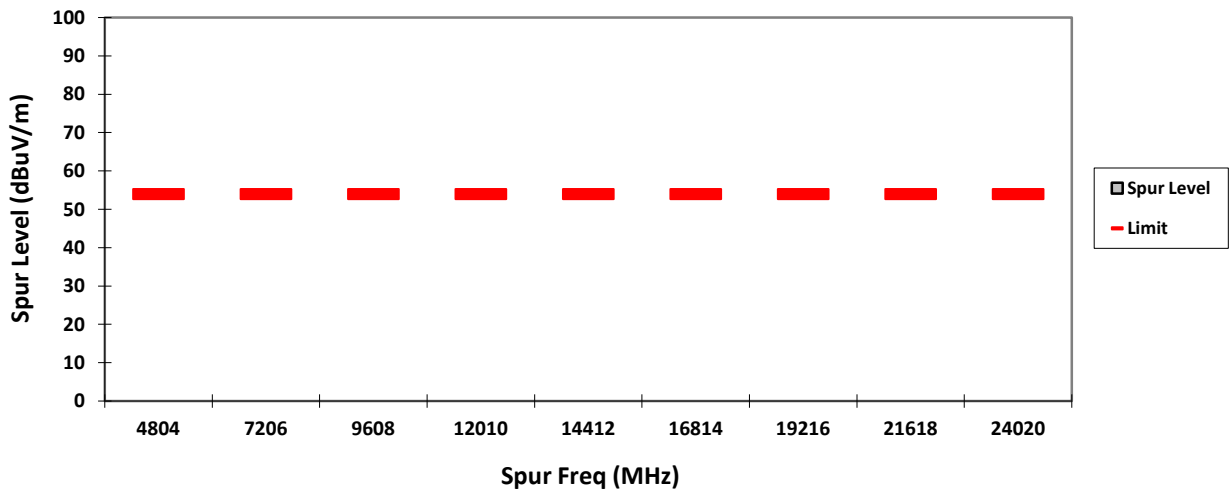
VERTICAL, AV



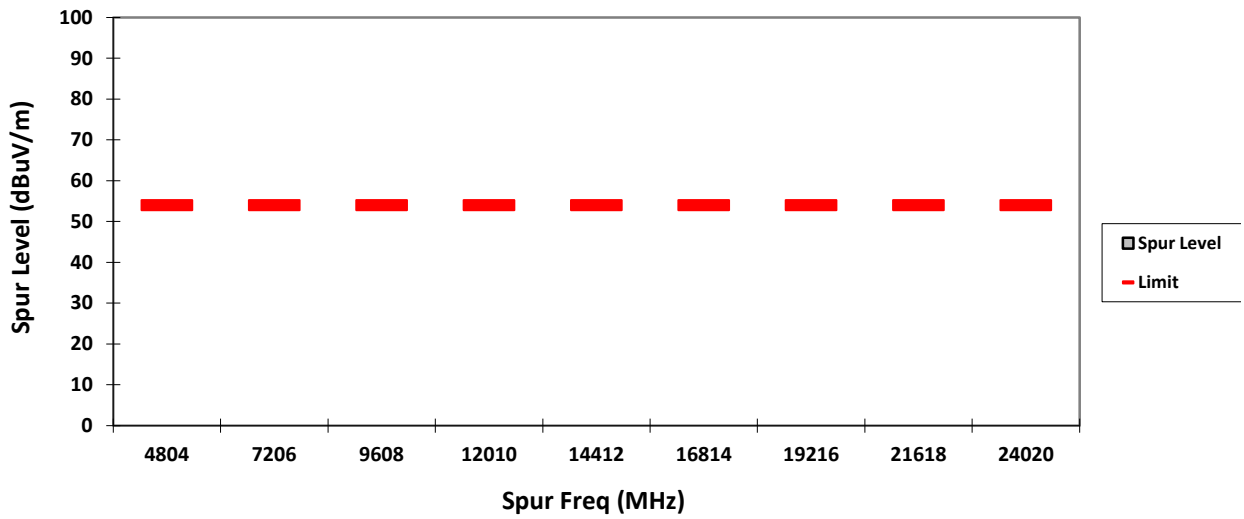
HORIZONTAL, AV



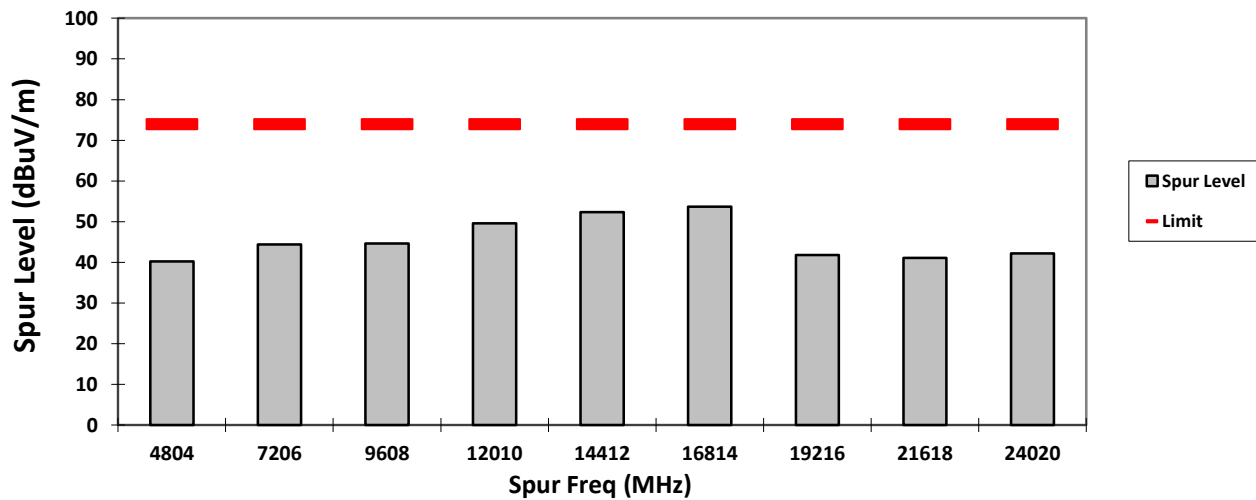
VERTICAL, QPK



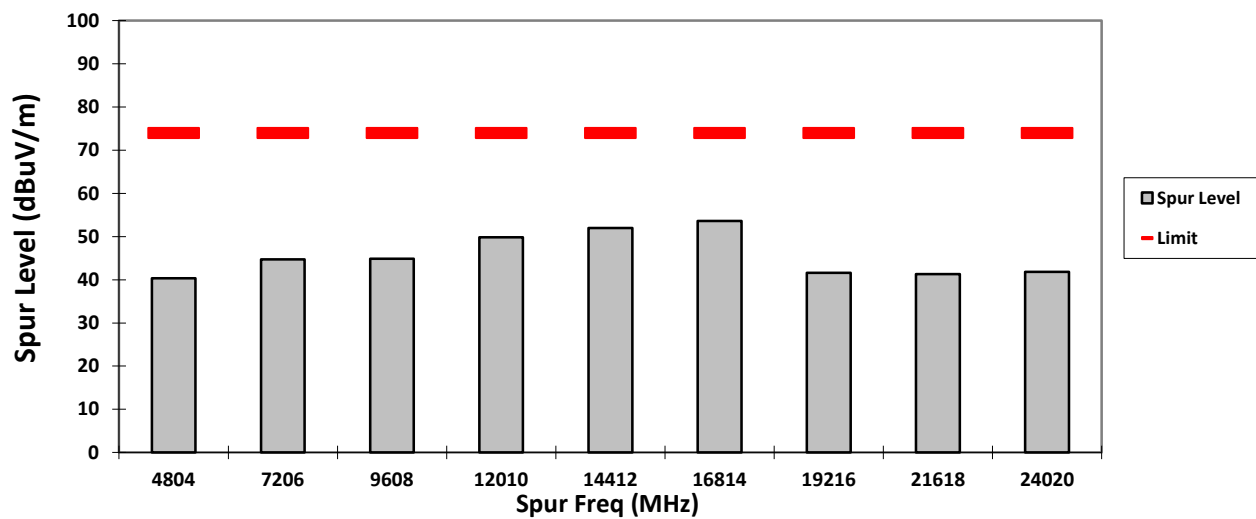
HORIZONTAL, QPK



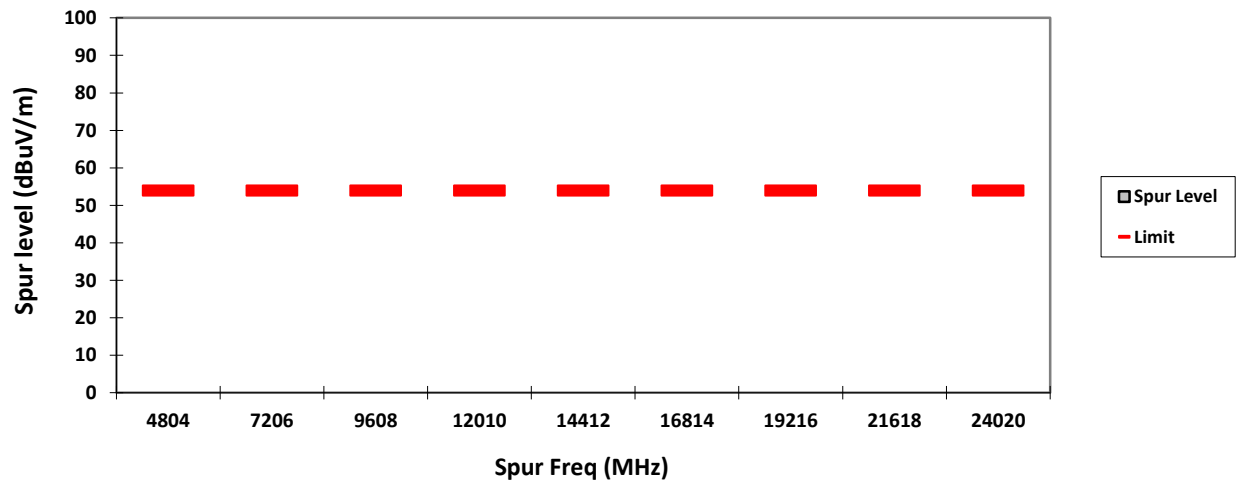
VERTICAL, PK



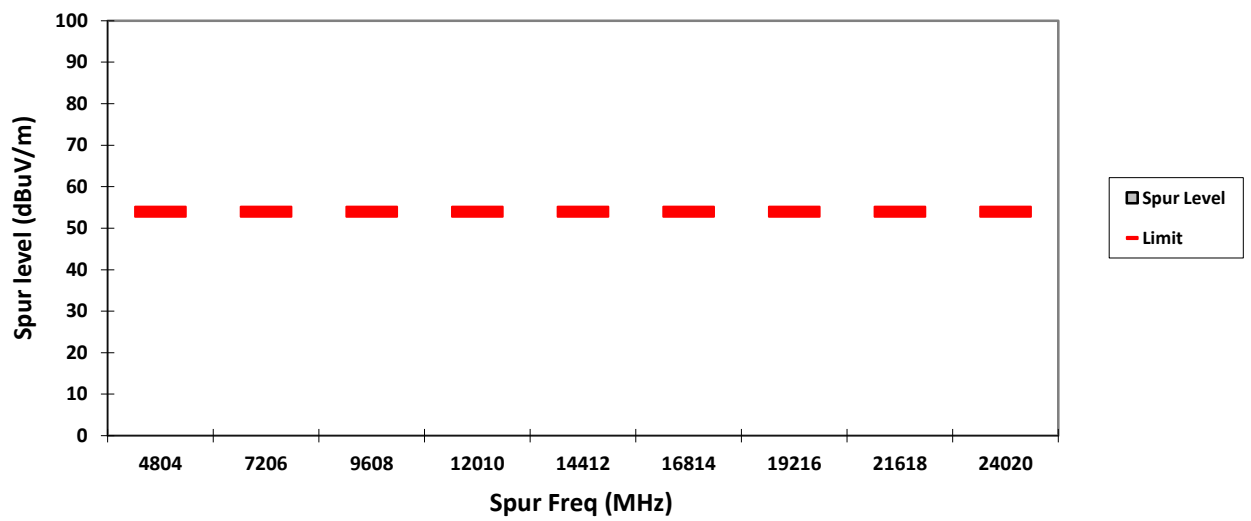
HORIZONTAL, PK



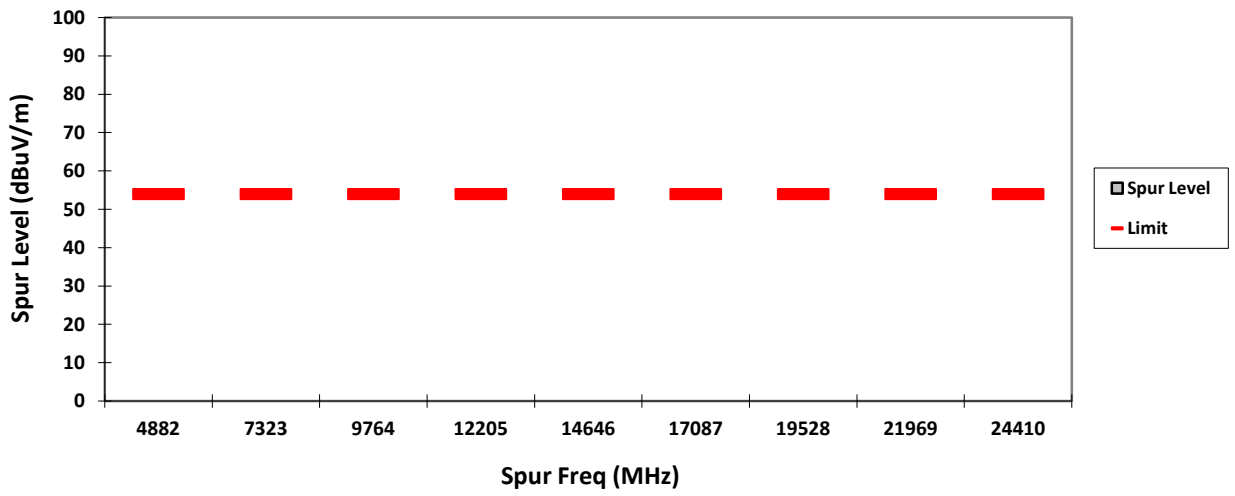
VERTICAL, AV



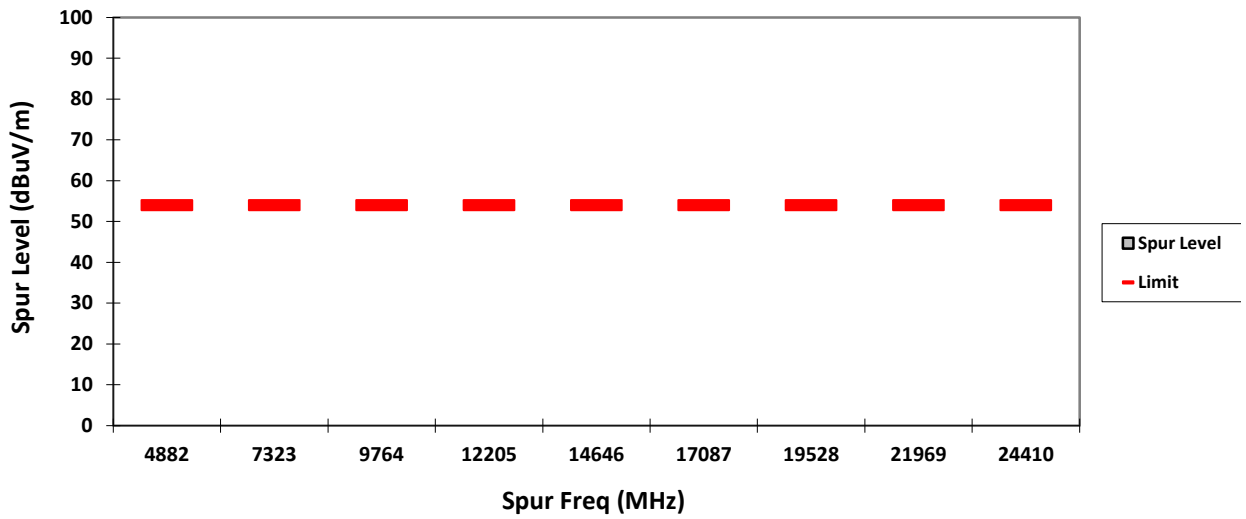
HORIZONTAL, AV



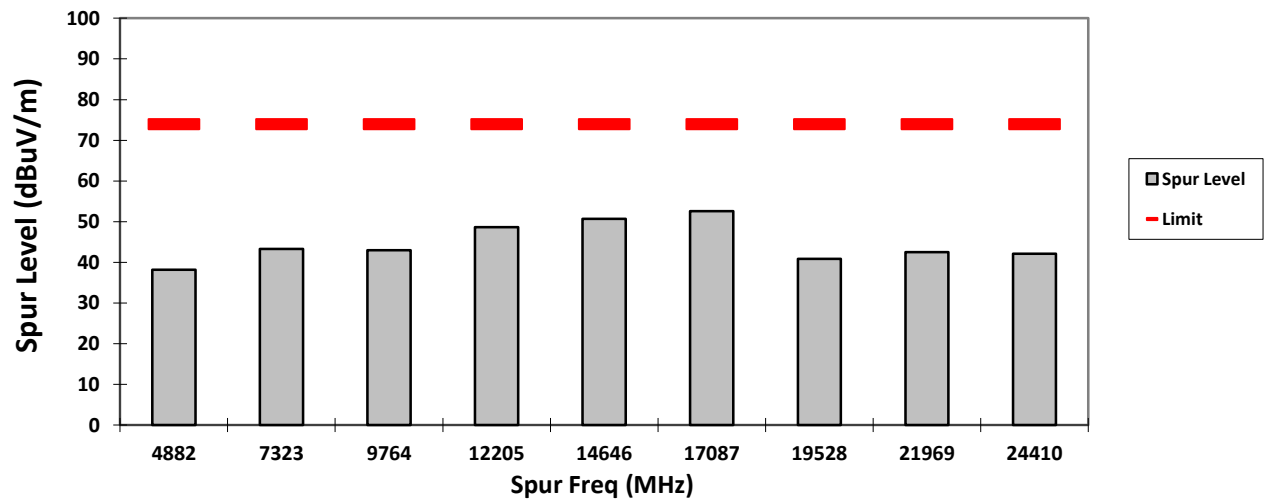
VERTICAL, QPK



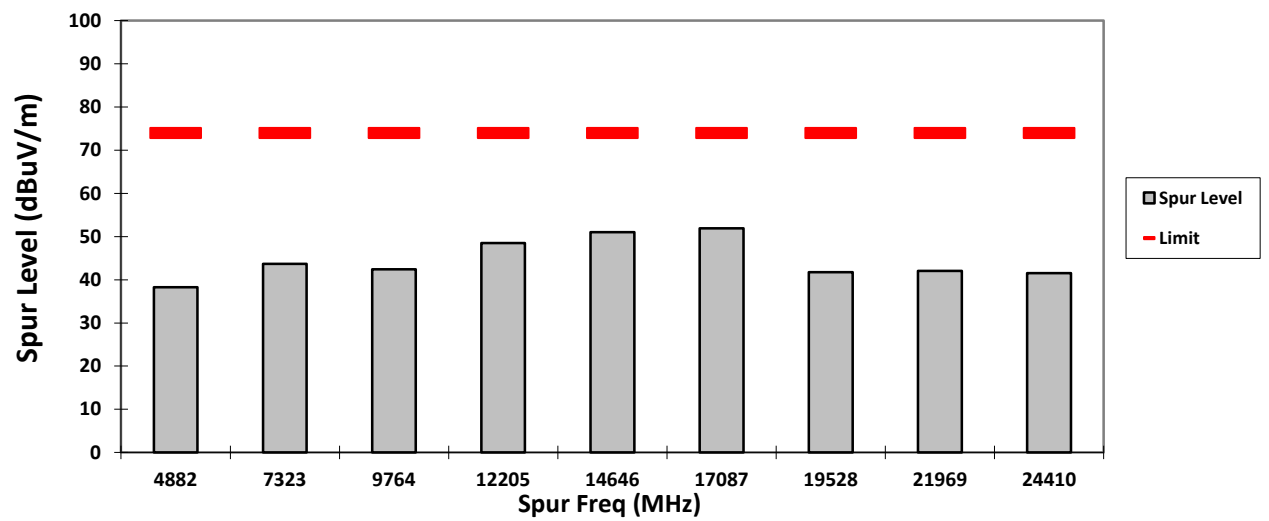
HORIZONTAL, QPK



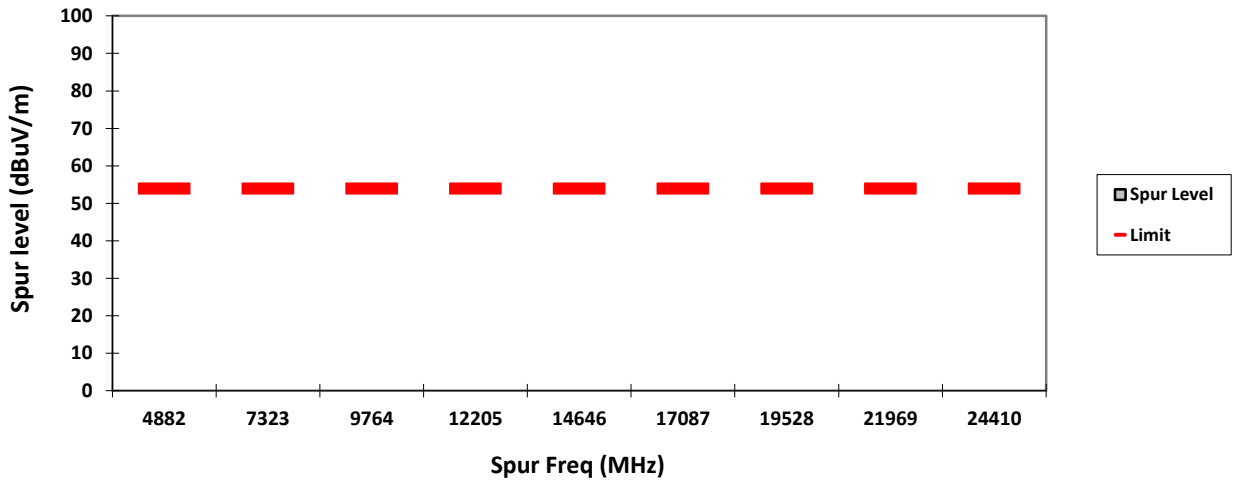
VERTICAL, PK



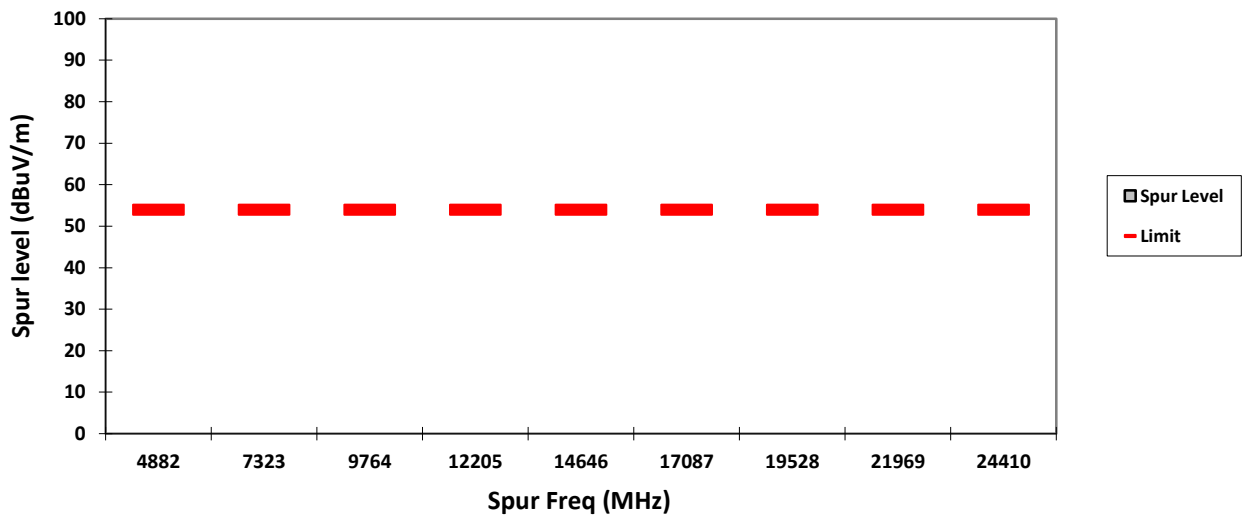
HORIZONTAL, PK



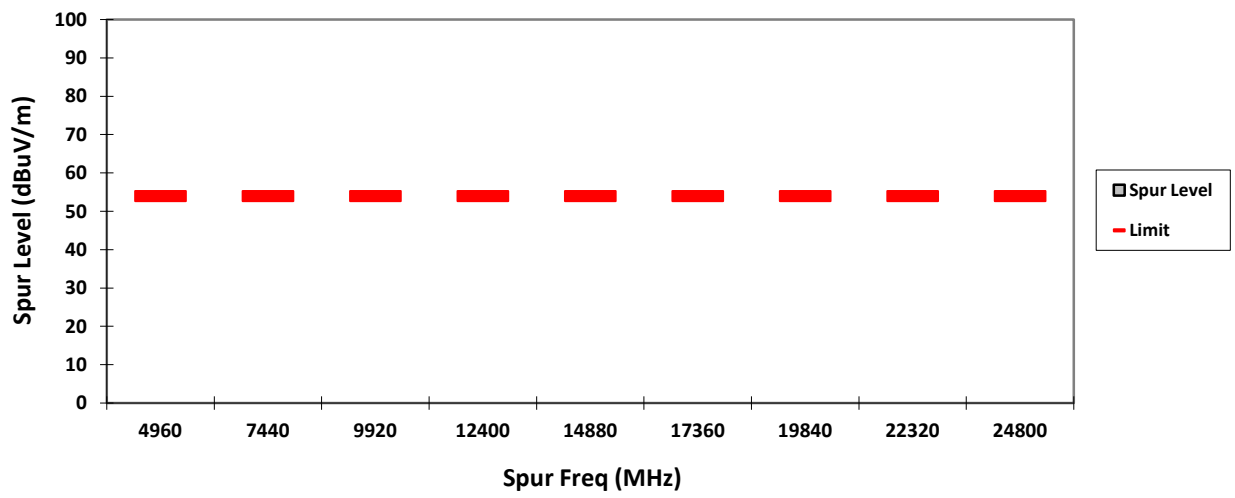
VERTICAL, AV



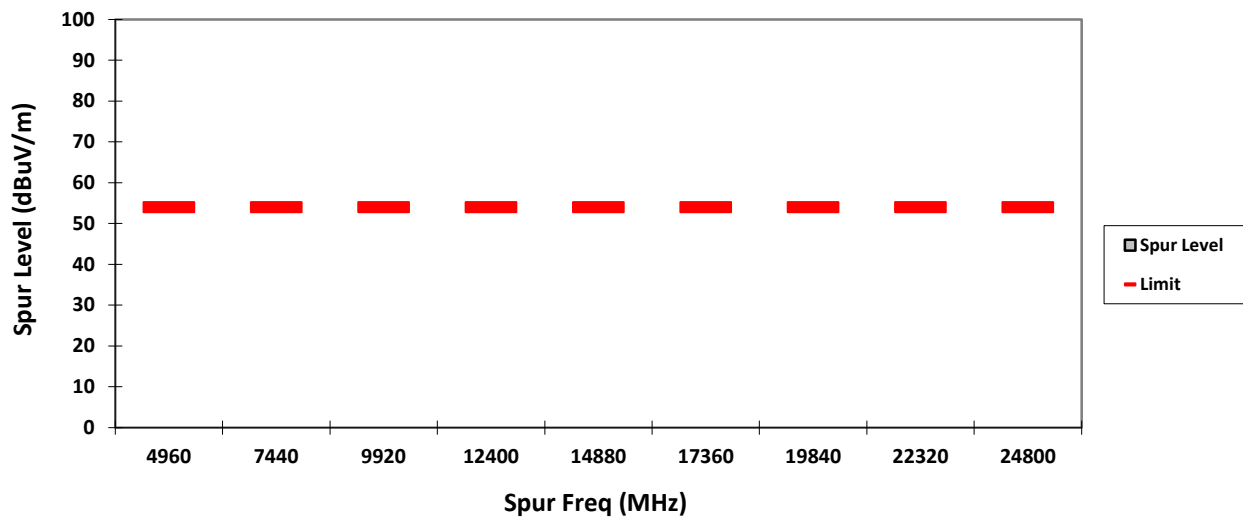
HORIZONTAL, AV



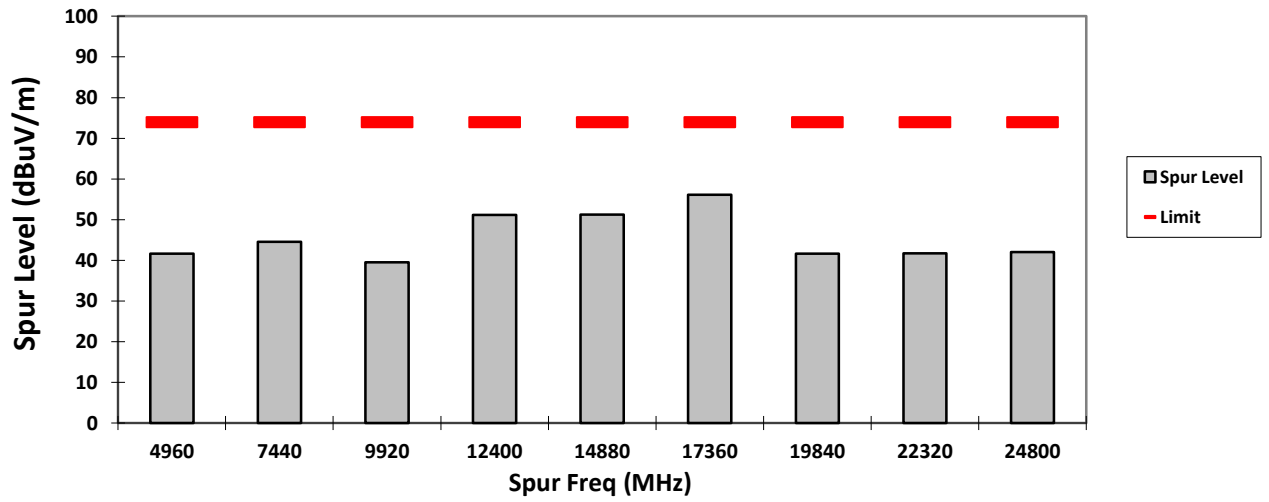
VERTICAL, QPK



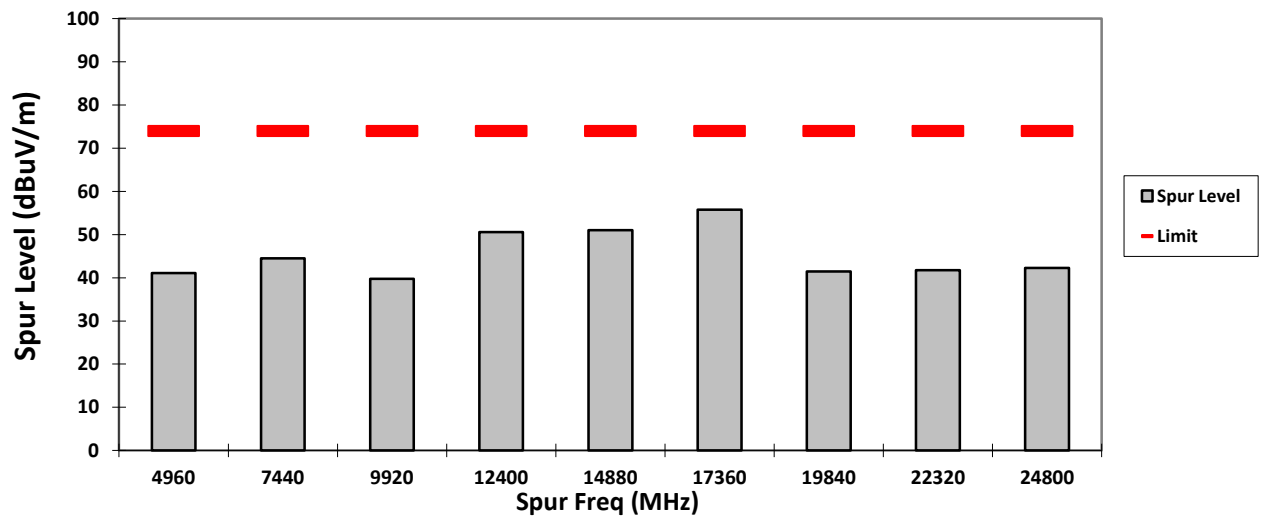
HORIZONTAL, QPK



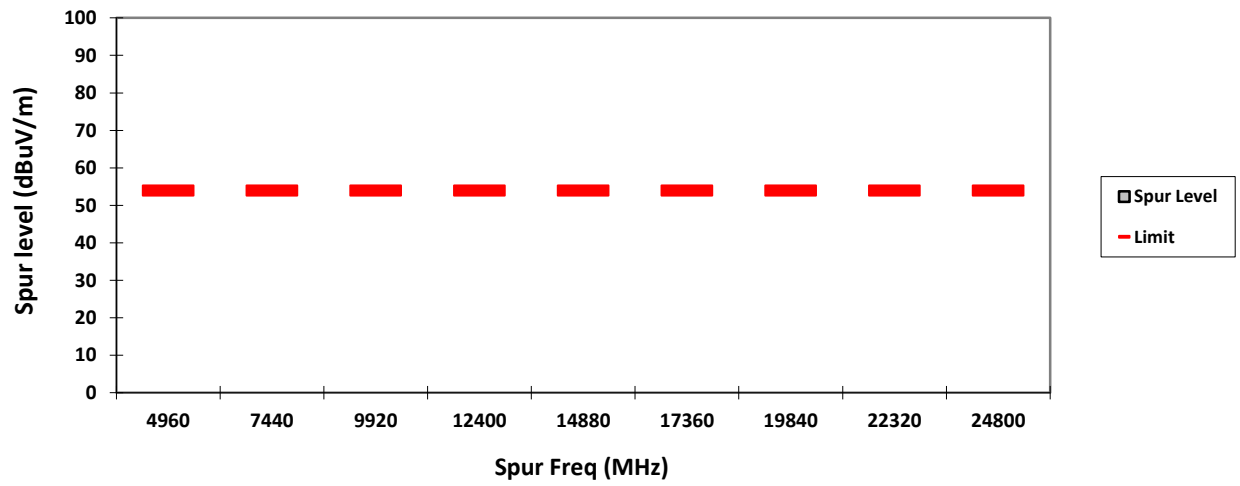
VERTICAL, PK



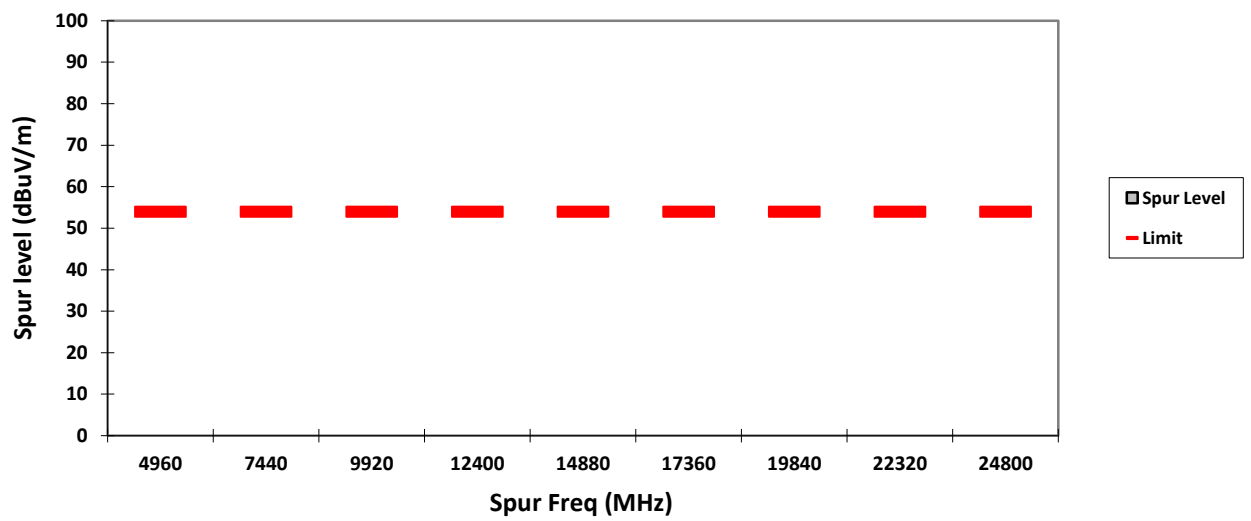
HORIZONTAL, PK



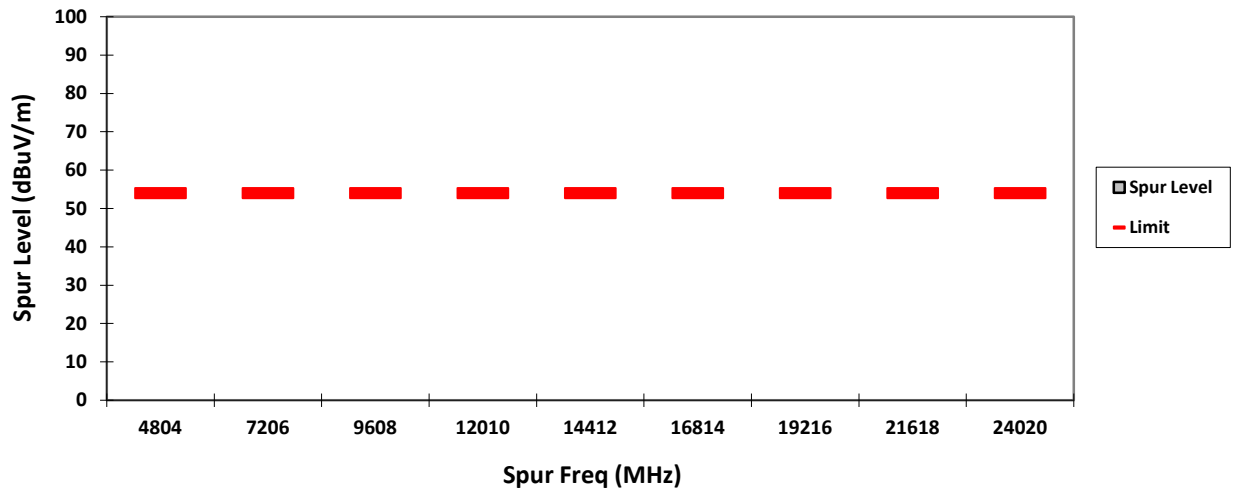
VERTICAL, AV



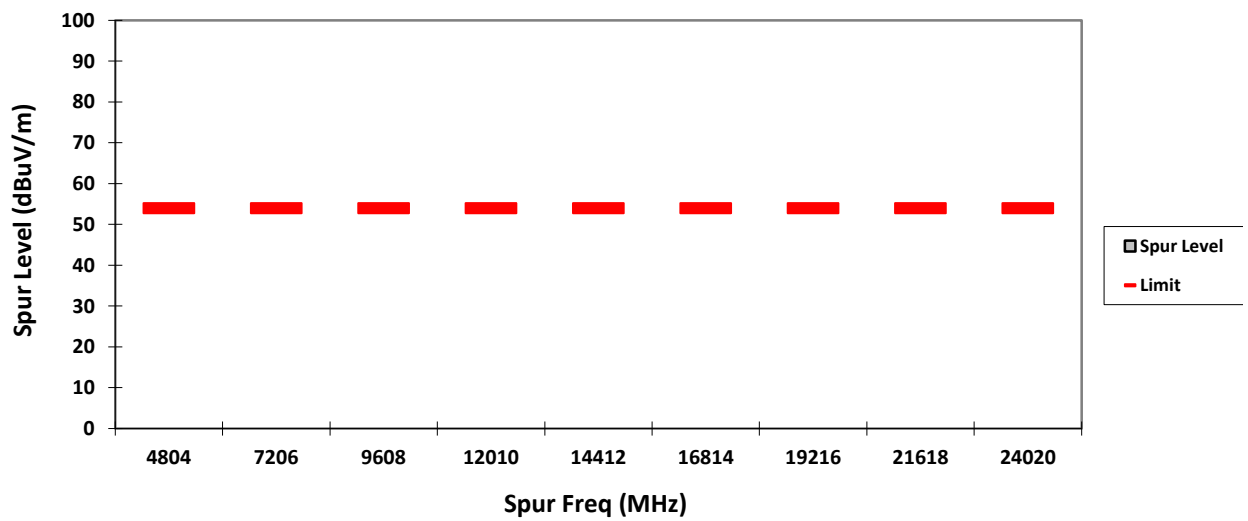
HORIZONTAL, AV



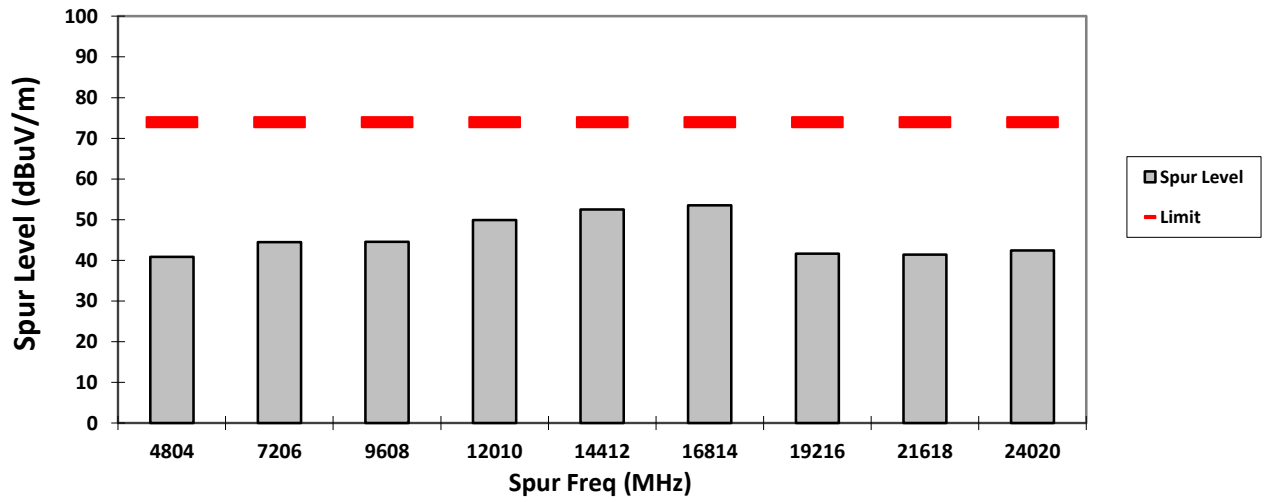
VERTICAL, QPK



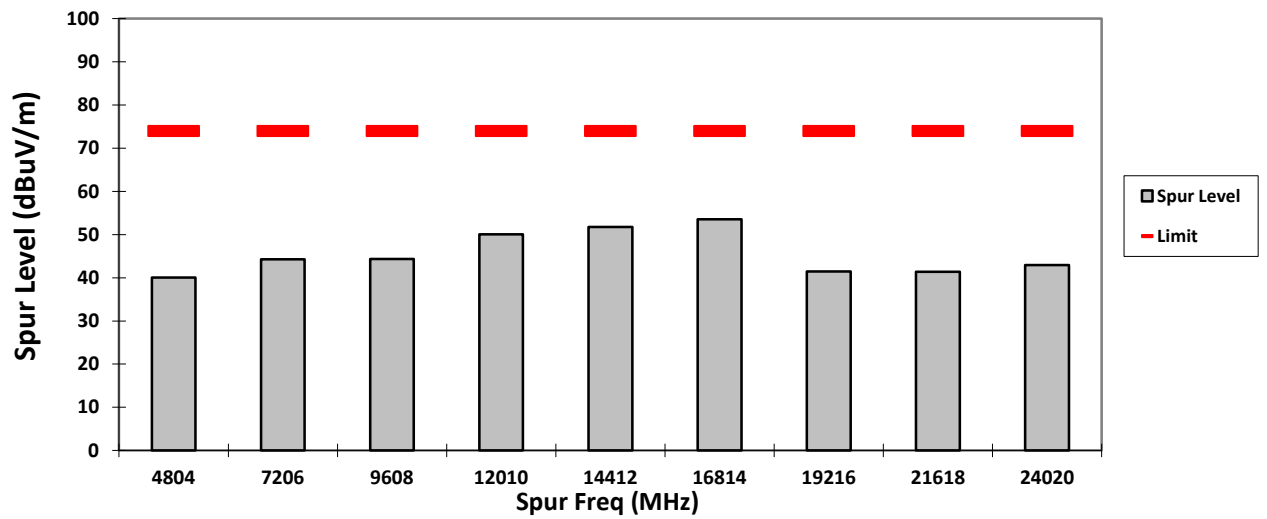
HORIZONTAL, QPK



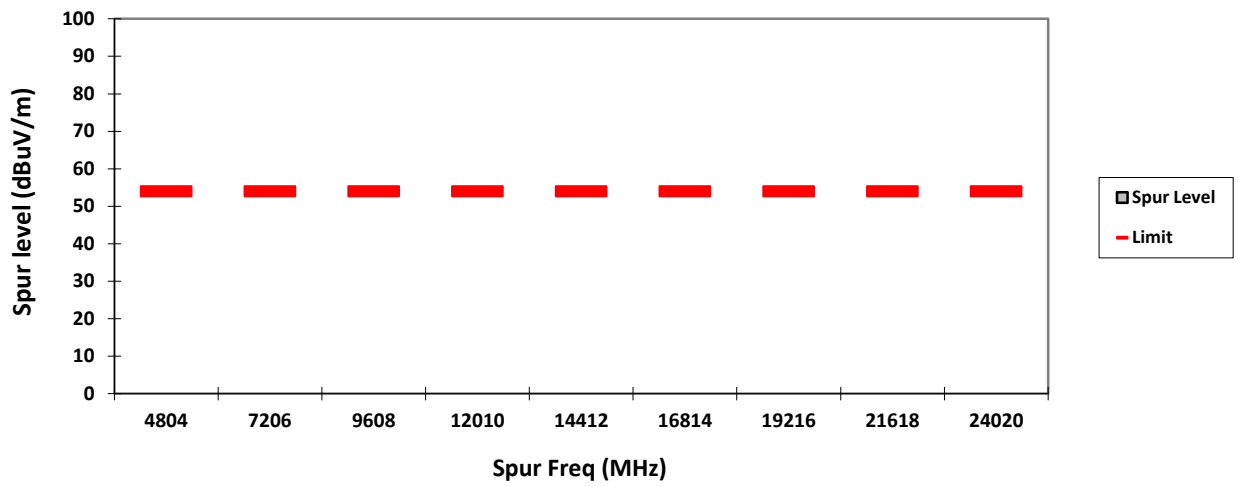
VERTICAL, PK



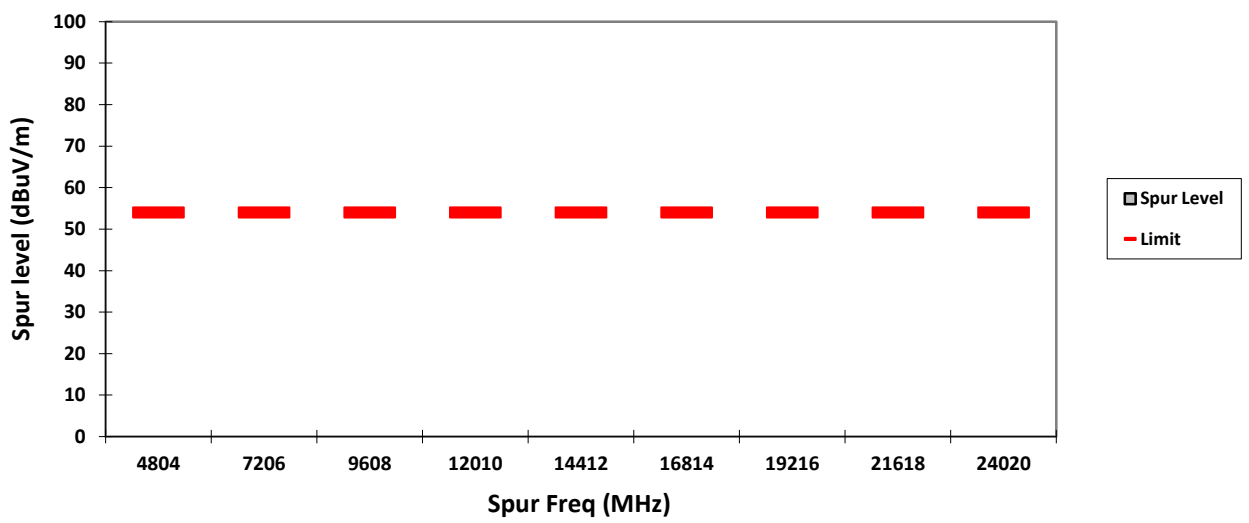
HORIZONTAL, PK



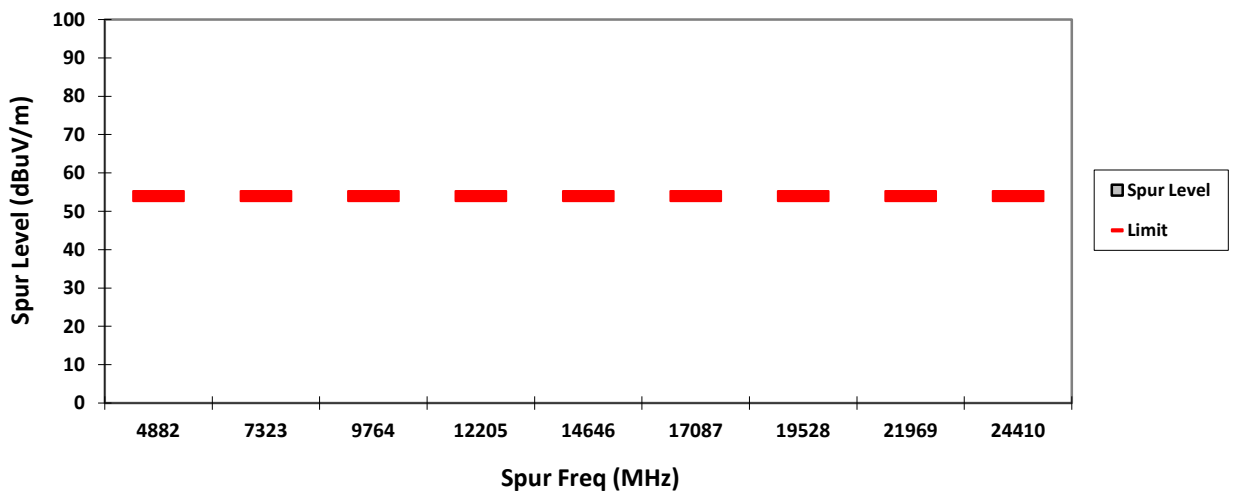
VERTICAL, AV



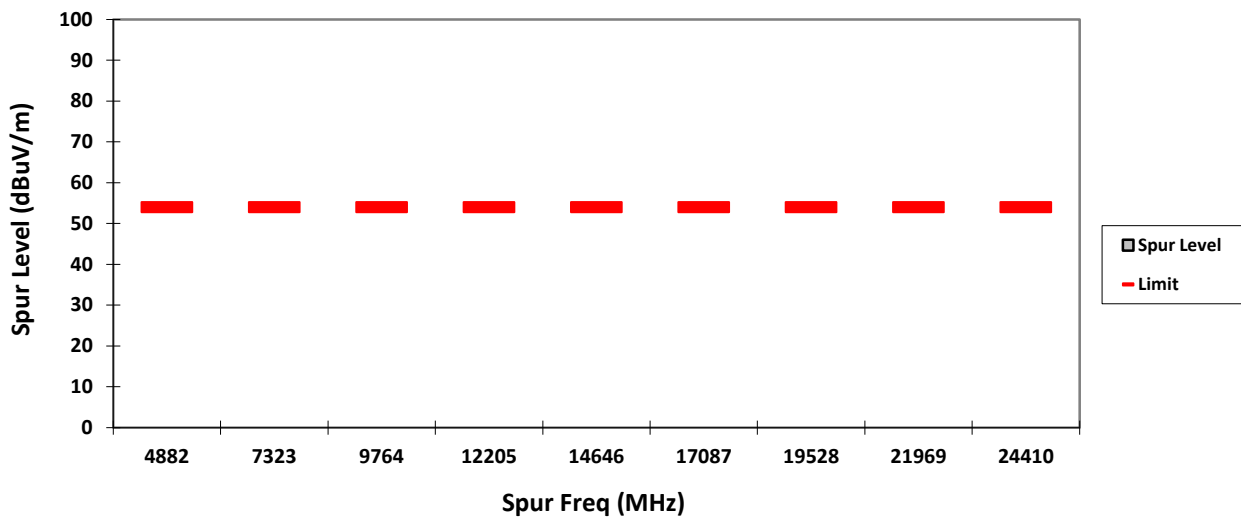
HORIZONTAL, AV



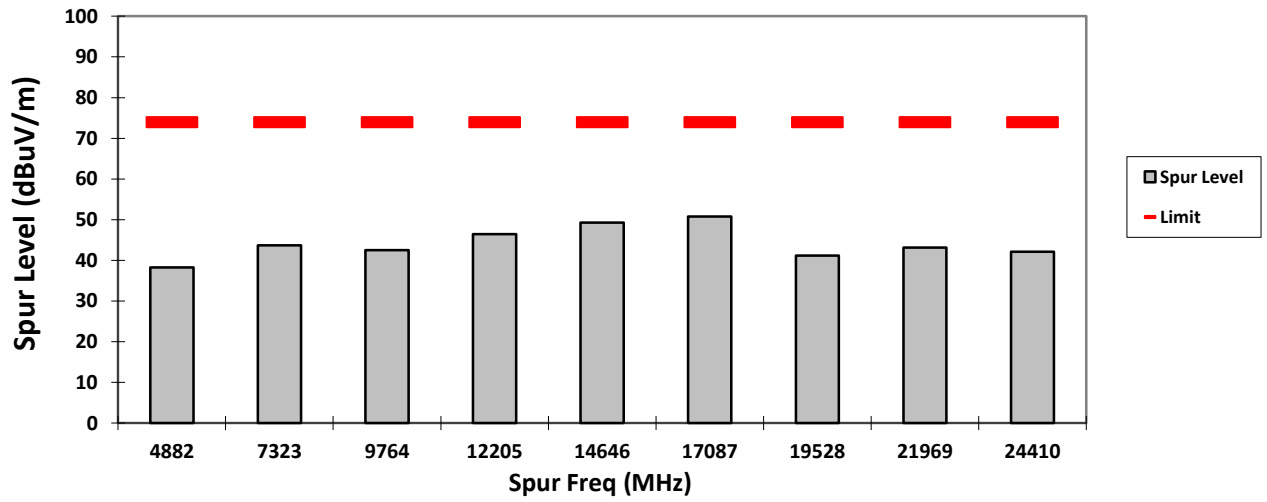
VERTICAL, QPK



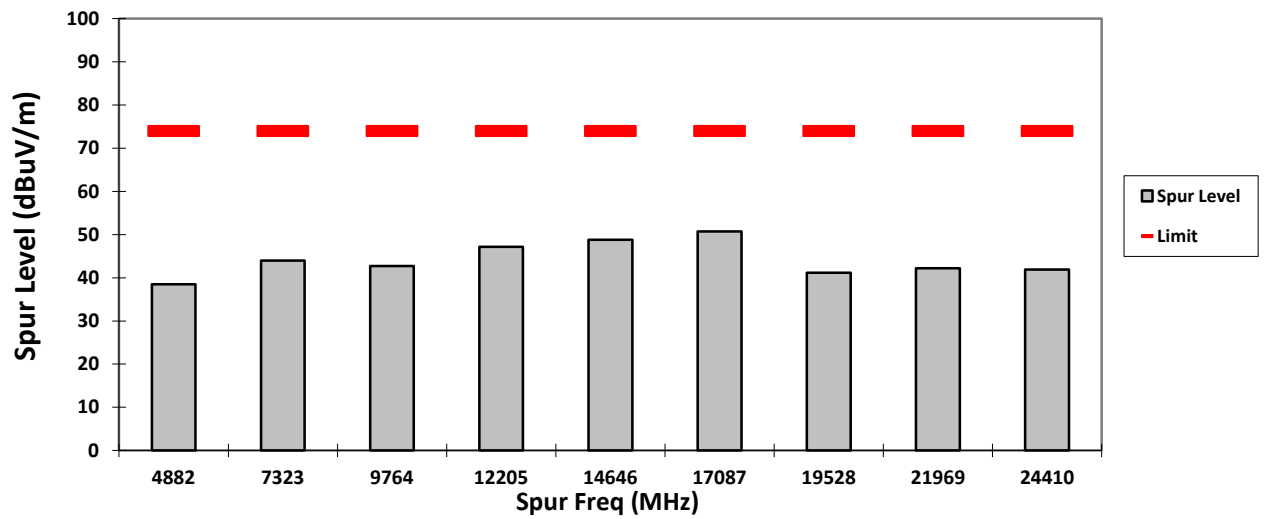
HORIZONTAL, QPK



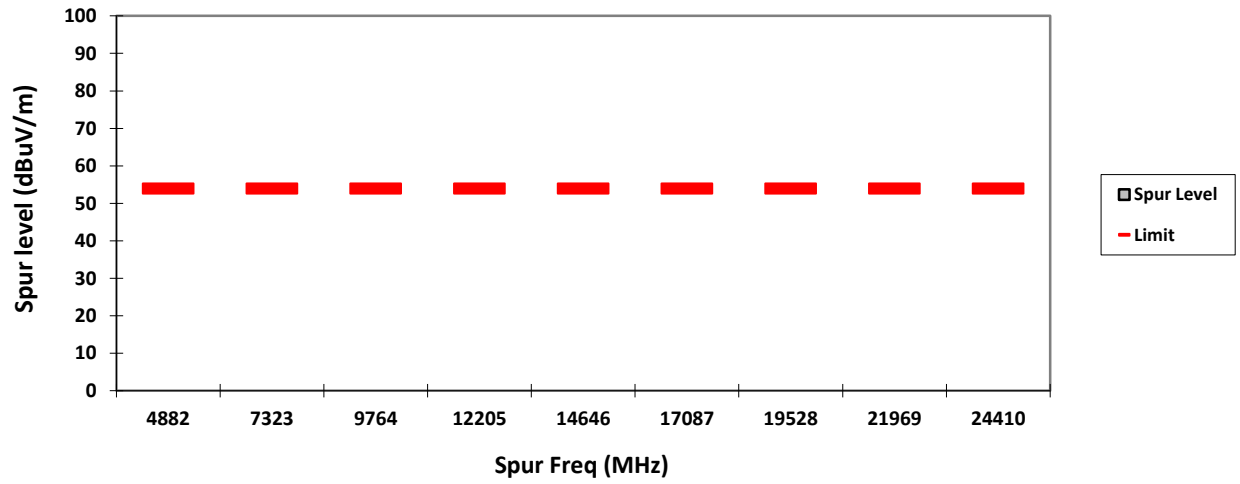
VERTICAL, PK



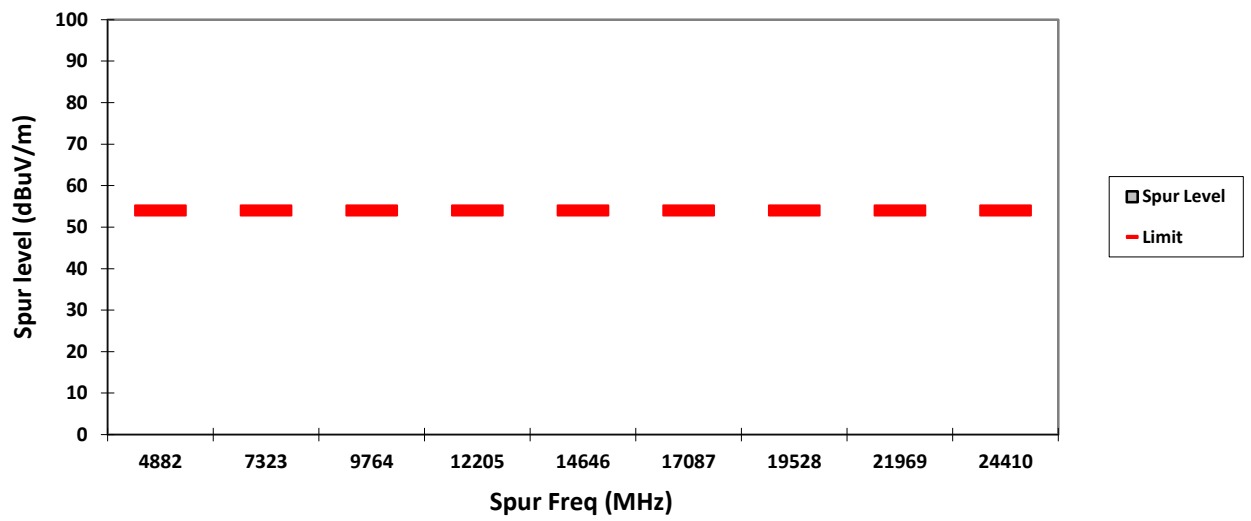
HORIZONTAL, PK



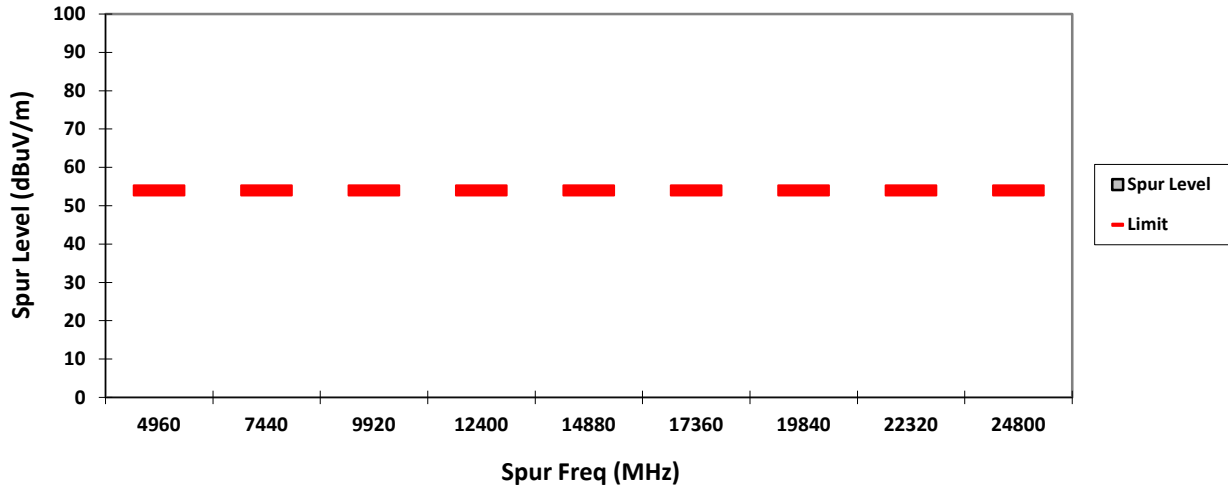
VERTICAL, AV



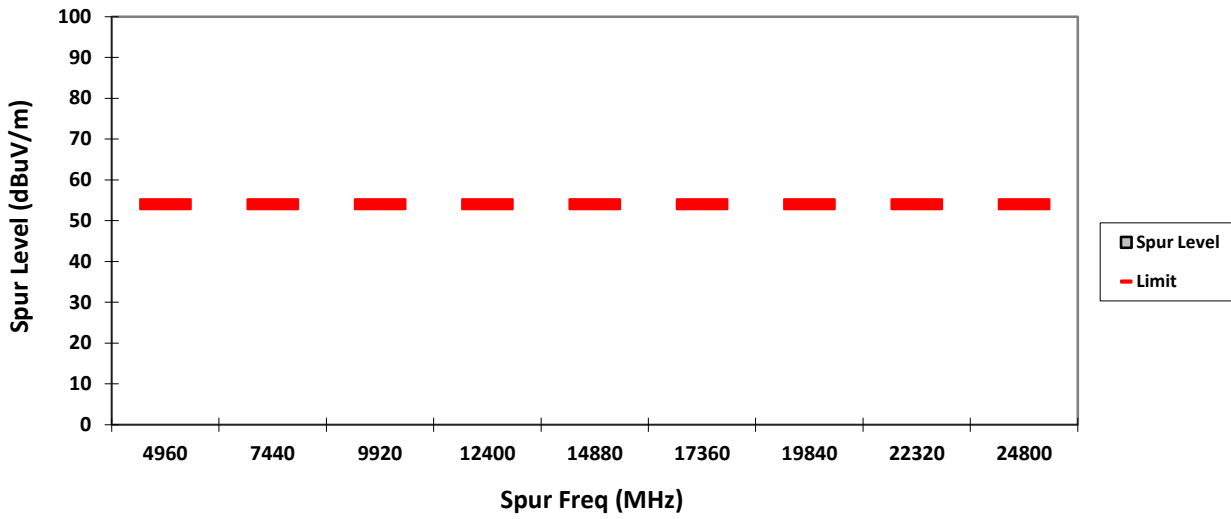
HORIZONTAL, AV



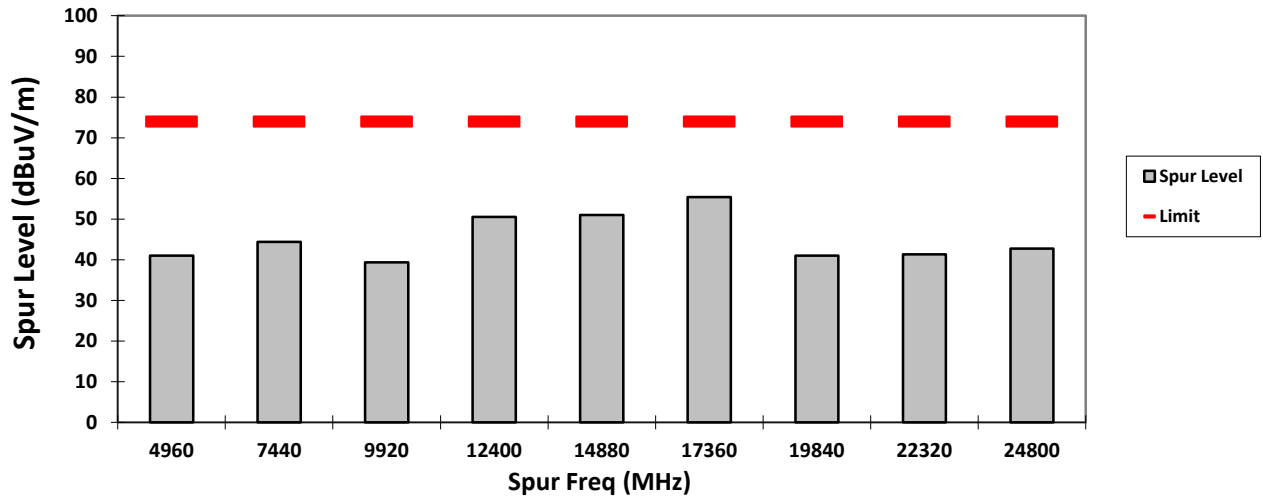
VERTICAL, QPK



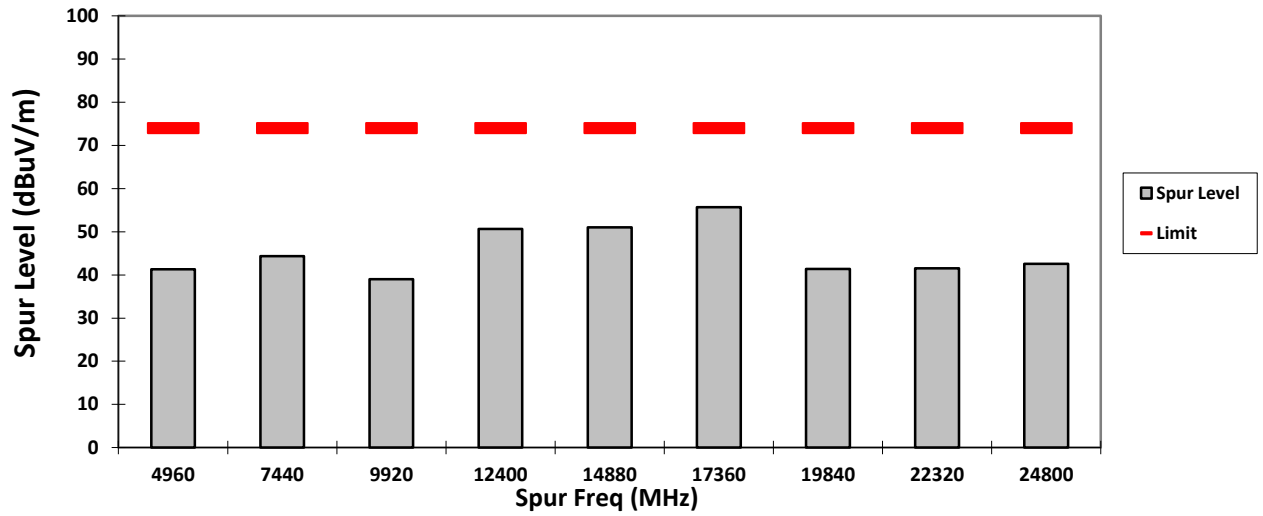
HORIZONTAL, QPK



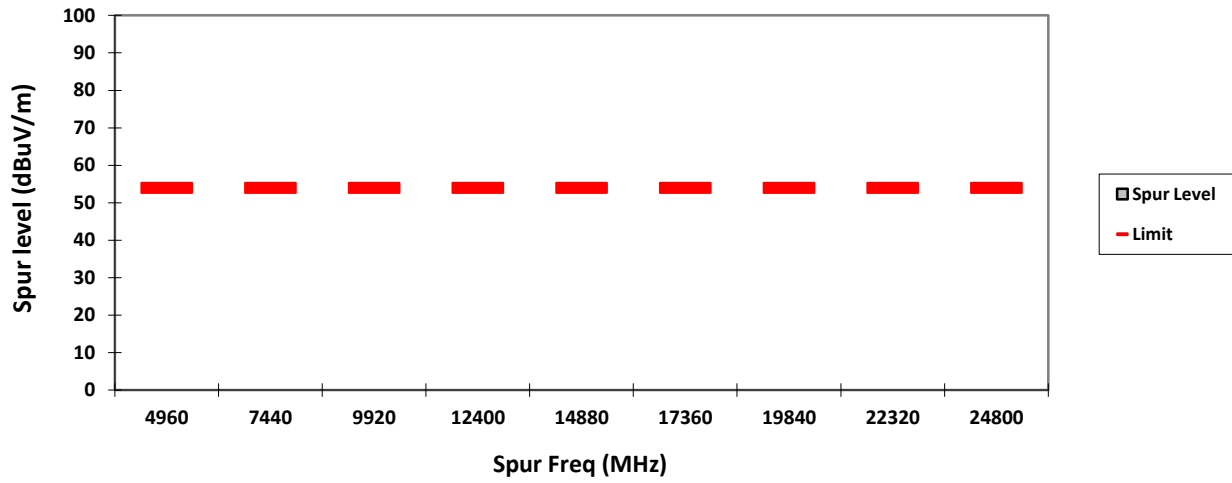
VERTICAL, PK



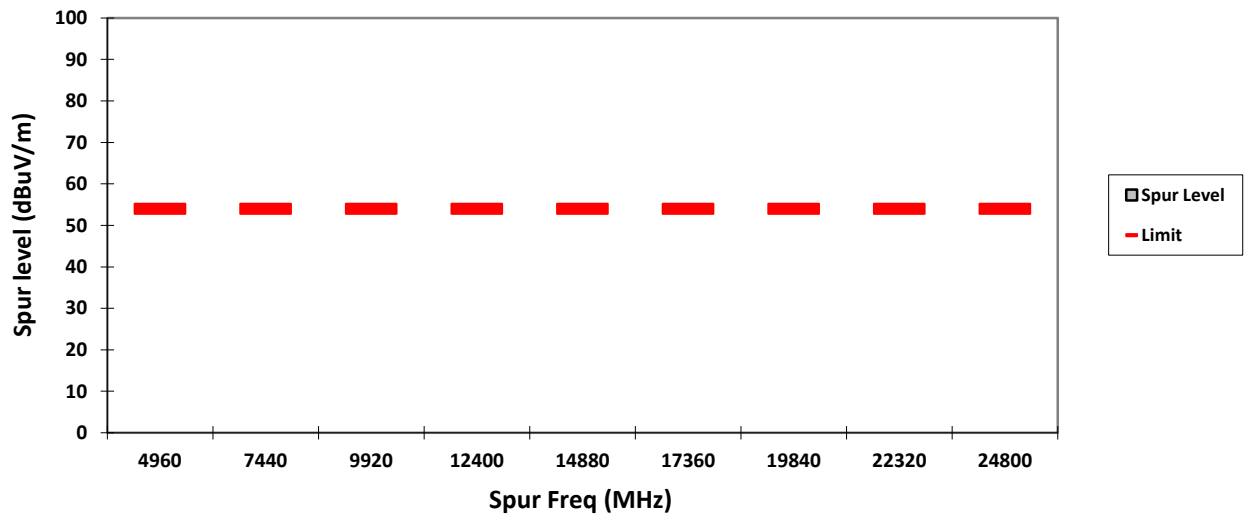
HORIZONTAL, PK



VERTICAL, AV



HORIZONTAL, AV



NOTE:

Transmitter Duty Cycle Calculation, FCC Rule 15.35 (b,c)

Based on the Bluetooth Specification Version 2.1+EDR, and worst case AFH mode, transmitter ON time is independent of packet type (DH1, DH3 and DH5) and packet length, the AFH mode Duty cycle connection factor as below:

Channel hop rate = 800 hops/second (AFH Mode)

Adjusted channel hop rate for DH5 mode = 133.33 hops/second

Time per channel hop = $1 / 133.33 \text{ hops/second} = 7.5 \text{ ms}$

Time to cycle through all channels = $7.5 \times 20 \text{ channels} = 150 \text{ ms}$

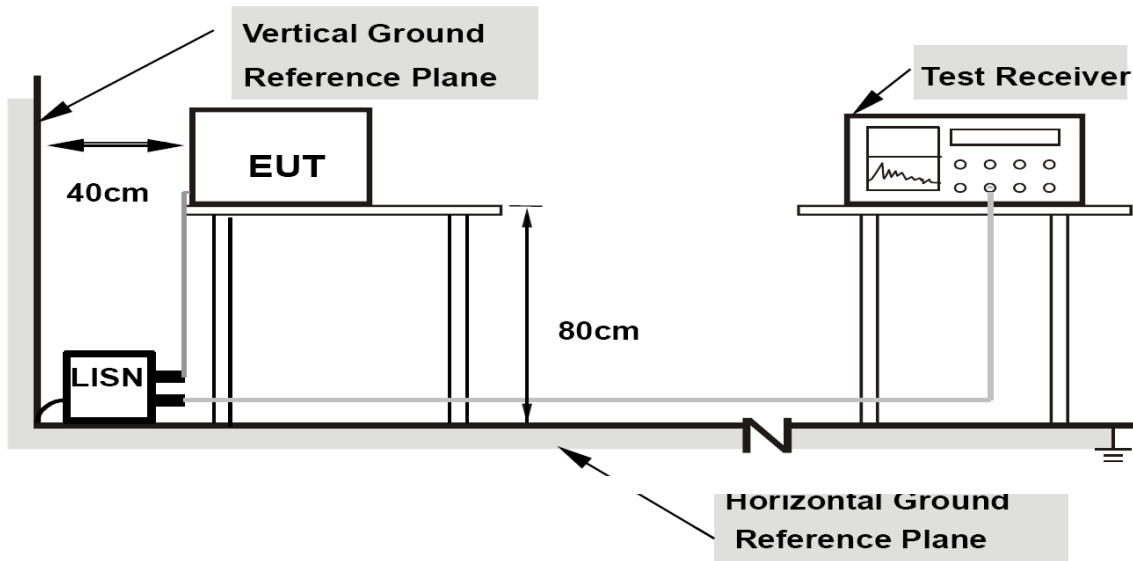
Number of times transmitter hits on one channel = $100 \text{ ms} / 150 \text{ ms} = 1 \text{ time(s)}$

Worst case dwell time = 7.5 ms

Duty cycle connection factor = $20\log_{10} (7.5\text{ms} / 100\text{ms}) = -22.5 \text{ dB}$

6.9. AC Powerline Conducted Emission

6.9.1. Test Setup



- 1) Tests were conducted for both Receive and Transmit Mode of the EUT.
- 2) The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/50uH of coupling impedance for the measuring instrument.
- 3) Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- 4) The frequency range from 150 kHz to 30MHz was measured.

6.9.2. Test Limits:

For AC Power Line Conducted Test Limit can be Class A or B depends on product classification.

Limits for conducted disturbance at the mains ports of class A ITE

Frequency range MHz	Limits dB(μ V)	
	Quasi-peak	Average
0,15 to 0,50	79	66
0,50 to 30	73	60
NOTE The lower limit shall apply at the transition frequency.		

Table 1: Limits for Conducted Disturbance at the Mains Ports of Class A ITE.

Limits for conducted disturbance at the mains ports of class B ITE

Frequency range MHz	Limits dB(μ V)	
	Quasi-peak	Average
0,15 to 0,50	66 to 56	56 to 46
0,50 to 5	56	46
5 to 30	60	50
NOTE 1 The lower limit shall apply at the transition frequencies. NOTE 2 The limit decreases linearly with the logarithm of the frequency in the range 0,15 MHz to 0,50 MHz.		

Table 2: Limits for Conducted Disturbance at the Mains Ports of Class B ITE

6.9.3. Test Result

Not Applicable. Testing is not required, radio shall turn off during charging mode