RF TEST REPORT

Test item	:	Motorcycle Bluetooth Communication System
Model No.	:	20S
Order No.	:	DEMC1405-01869
Date of receipt	:	2014-05-16
Test duration	:	2014-06-02 ~ 2014-06-11
Date of issue	:	2014-06-18
Use of report	:	FCC Original Grant

Applicant : Sena Technologies,Inc.
210 Yangjae-dong Seocho-gu, Seoul, 137-130, South Korea

Test laboratory : Digital EMC Co., Ltd.
42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 449-935

Test specification	:	FCC Part 15 Subpart C.247
Test environment	:	See appended test report
Test result	:	☒ Pass ☐ Fail

Tested by:

Engineer
HyunSu Son

Reviewed by:

Deputy General Manager
HongHee Lee

Test Report Version

Test Report No.	Date	Description
DRTFCC1406-0799	Jun. 18, 2014	Initial issue

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1.General Information

1.1. Testing Laboratory

Digital EMC Co., Ltd.
42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 449-935
www.digitalemc.com
Telephone : + 82-31-321-2664
FAX : + 82-31-321-1664

1.2. Details of Applicant

Applicant : Sena Technologies,Inc.
Address : 210 Yangjae-dong Seocho-gu, Seoul, 137-130, Korea
Contact person : Seunghyun KIM
Phone No. : Research Engineer

1.3. Description of EUT

EUT	Motorcycle Bluetooth Communication System
Model Name	20S
Serial Number	Identical prototype
Power Supply	DC 3.7 V
Frequency Range	2402 MHz ~ 2480 MHz
Modulation Technique	GFSK, π/4-DQPSK, 8DPSK
Number of Channels	79
Antenna Type	Module 1: Internal Antenna Module 2: External Antenna
Antenna Gain	Module 1: PK : 0 dBi Module 2: PK : 2.25 dBi

1.4. Declaration by the manufacturer

- N/A

1.5. Information about the FHSS characteristics:

- This Bluetooth module has been tested by a Bluetooth Qualification Lab, and we confirm the following:
  A) The hopping sequence is pseudorandom
  B) All channels are used equally on average
  C) The receiver input bandwidth equals the transmit bandwidth
  D) The receiver hops in sequence with the transmit signal
- 15.247(g): In accordance with the Bluetooth Industry Standard, the system is designed to comply with all of the regulations in Section 15.247 when the transmitter is presented with a continuous data (or information) system.
- 15.247(h): In accordance with the Bluetooth Industry Standard, the system does not coordinate its channels selection/ hopping sequence with other frequency hopping systems for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters.
- 15.247(h): The EUT employs Adaptive Frequency Hopping (AFH) which identifies sources of interference namely devices operating in 802.11 WLAN and excludes them from the list of available channels. The process of re-mapping reduces the number of test channels from 79 channels to a minimum number of 20 channels.

1.6. Test Equipment List

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent	E4440A	13/10/24	14/10/24	US45303051
Spectrum Analyzer	Agilent	N9020A	14/03/28	15/03/28	MY50200816
Digital Multimeter	H.P	34401A	14/02/27	15/02/27	3146A13475
Vector Signal Generator	Rohde Schwarz	SMJ100A	14/01/07	15/01/07	100148
Signal Generator	Rohde Schwarz	SMF100A	13/07/22	14/07/22	102341
Attenuator	SMAJK	SMAJK-2-3	13/10/22	14/10/22	6
Thermo hygrometer	BODYCOM	BJ5478	14/05/13	15/05/13	120612-2
DC Power Supply	SM techno	SDP30-5D	14/02/10	15/02/10	305DLJ204
High-pass filter	Wainwright	WHKX3.0	13/09/12	14/09/12	9
LOOP Antenna	Schwarzbeck	FMZB1513	14/04/29	16/04/29	1513-128
BILOG ANTENNA	SCHAFFNER	CBL6112B	12/11/06	14/11/06	2737
Horn Antenna	ETS	3115	13/02/28	15/02/28	00021097
HORN ANT	A.H.Systems	SAS-574	13/03/20	15/03/20	154
Amplifier (22dB)	H.P	8447E	14/01/07	15/01/07	2945A02865
Amplifier (30dB)	Agilent	8449B	14/02/27	15/02/27	3008A00370
EMI TEST RECEIVER	Rohde Schwarz	ESU	14/01/08	15/01/08	100014
EMI TEST RECEIVER	ROHDE&SCHWARZ	ESR	14/02/07	15/02/07	101767
CVCF	NF	4420	13/09/12	14/09/12	3049354420023
LISN	R&S	ESH2-Z5	13/09/12	14/09/12	828739/006

1.7. Summary of Test Results

FCC Part RSS-210 & GEN	Parameter	Limit (Using in 2400~ 2483.5MHz)	Test Condition	Status Note 1
15.247(a) RSS-210(A8.1)	Carrier Frequency Separation	>= 20dB BW or >= Two-Thirds of the 20dB BW	Conducted	C
	Number of Hopping Frequencies	>= 15 hops		C
	20 dB Bandwidth	None		C
	Dwell Time	=< 0.4 seconds		C
15.247(b) RSS-210(A8.4)	Transmitter Output Power	=< 1Watt , if CHs >= 75 Others =<0.125W		C
15.247(d) RSS-210(A8.5)	Band-edge	The radiated emission to any 100 kHz of out-band shall be at least 20dB below the highest in-band spectral density.		C
	Conducted Spurious Emissions			C
RSS Gen	Occupied Bandwidth (99 %)	RSS-Gen(4.6.1)		NA
15.205 15.209 RSS-210(A8.5)	RadiatedEmissions	FCC 15.209 Limits	Radiated	C Note 2
15.207 RSS-Gen(7.2.4)	AC Conducted Emissions	FCC 15.207 Limits	AC Line Conducted	C
15.203 RSS-Gen(7.1.2)	Antenna Requirements	FCC 15.203	-	C

Note 1: C=Comply NC=Not Comply NT=Not Tested NA=Not Applicable

Note 2: The sample was tested according to the following specification:

ANSI C63.10-2009

1.8 Conclusion of worst-case and operation mode

The EUT has three type of modulation (GFSK, π/4DQPSK and 8DPSK).

Therefore all applicable requirements were tested with all the modulations.

The field strength of spurious emission was measured in three orthogonal EUT positions(X-axis, Y-axis and Z-axis).

Tested frequency information,

- Hopping Function: Enable

	TX Frequency(MHz)	RX Frequency(MHz)
Hopping Band	2402 ~ 2480	2402 ~ 2480

- Hopping Function: Disable

	TX Frequency(MHz)	RX Frequency(MHz)
Lowest Channel	2402	2402
Middle Channel	2441	2441
Highest Channel	2480	2480

2. Transmitter Radiated Spurious Emissions and Conducted Spurious Emission

2.1. Test Setup

Refer to the APPENDIX I.

2.2. Limit

According to §15.247(d), in any 100 ㎑ bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 ㏈ below that in the 100 ㎑ bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement , provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval , as permitted under paragraph(b)(3) of this section , the attenuation required under this paragraph shall be 30 ㏈ instead of 20 ㏈. Attenuation below the general limits specified in section §15.209(a) is not required. In addition, radiated emission which in the restricted band, as define in section §15.205(a), must also comply the radiated emission limits specified in section §15.209(a) (see section §15.205(c))

According to § 15.209(a), except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

Frequency (MHz)	Limit (uV/m)	Measurement Distance (meter)
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

** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88MHz, 174-216MHz or 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

According to § 15.205(a) and (b), only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	MHz	GHz	GHz
0.009 ~ 0.110	8.41425 ~ 8.41475	108 ~ 121.94	1300 ~ 1427	4.5 ~ 5.15	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1435 ~ 1626.5	5.35 ~ 5.46	15.35 ~ 16.2
2.1735 ~ 2.1905	12.51975 ~ 12.52025	149.9 ~ 150.05	1645.5 ~ 1646.5	7.25 ~ 7.75	17.7 ~ 21.4
4.125 ~ 4.128	12.57675 ~ 12.57725	156.52475 ~	1660 ~ 1710	8.025 ~ 8.5	22.01 ~ 23.12
4.17725 ~ 4.17775	13.36 ~ 13.41	156.52525	1718.8 ~ 1722.2	9.0 ~ 9.2	23.6 ~ 24.0
4.20725 ~ 4.20775	16.42 ~ 16.423	156.7 ~ 156.9	2200 ~ 2300	9.3 ~ 9.5	31.2 ~ 31.8
6.215 ~ 6.218	16.69475 ~ 16.69525	162.0125 ~ 167.17	2310 ~ 2390	10.6 ~ 12.7	36.43 ~ 36.5
6.26775 ~ 6.26825	16.80425 ~ 16.80475	167.72 ~ 173.2	2483.5 ~ 2500	13.25 ~ 13.4	Above 38.6
6.31175 ~ 6.31225	25.5 ~ 25.67	240 ~ 285	2655 ~ 2900		
8.291 ~ 8.294	37.5 ~ 38.25	322 ~ 335.4	3260 ~ 3267		
8.362 ~ 8.366	73 ~ 74.6	399.90 ~ 410	3332 ~ 3339		
8.37625 ~ 8.38675	74.8 ~ 75.2	608 ~ 614	3345.8 ~ 3358		
		960 ~ 1240	3600 ~ 4400		

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

2.3. Test Procedures

Radiated emissions from the EUT were measured according to the ANSI C63.10:2009

2.3.1. Test Procedures for Radiated Spurious Emissions

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 ㎓, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 ㎓, the EUT was set 3 meter away from the interference-receiving antenna.
3. For measurements above 1GHz absorbers are placed on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed.
4. The antenna is a broadband antenna, 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.
5. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
6. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
7. If the emission level of the EUT in peak mode was 10㏈ lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10㏈ margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

NOTE 1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120㎑ for Quasi-peak detection (QP) at frequency below 1㎓.

NOTE 2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1㎒ for Peak detection and frequency above 1㎓.

NOTE 3. The resolution bandwidth of test receiver/spectrum analyzer is 1㎒ and the video bandwidth is 1㎑ for Average detection (AV) at frequency above 1㎓.

2.3.2. Test Procedures for Conducted Spurious Emissions

1.The transmitter output was connected to the spectrum analyzer.
2.The **reference level** of the fundamental frequency was measured with the spectrum analyzer using RBW=100 ㎑, VBW=300 ㎑.
3. The conducted spurious emission was tested each ranges were set as below.

Frequency range: 9 kHz ~ 30 MHz
RBW= 100kHz, VBW= 300kHz, SWEEP TIME = AUTO, DETECTOR = PEAK, TRACE = MAX HOLD, SWEEP POINT: 40001

Frequency range: 30 MHz ~ 10 GHz, 10 GHz~25 GHz
RBW= 1MHz, VBW= 3MHz, SWEEP TIME = AUTO, DETECTOR = PEAK, TRACE = MAX HOLD, SWEEP POINT: 40001

LIMIT LINE = 20 dB below of the reference level of above measurement procedure Step 2. (RBW = 100 kHz, VBW = 300 kHz)

If the emission level with above setting was close to the limit (ie, less than 3 dB margin) then zoom scan is required using RBW = 100 kHz, VBW = 300 kHz, SAPN = 100 MHz and BINS = 2001 to get accurate emission level within 100 kHz BW.

Also the path loss for conducted measurement setup was used as described on the Appendix I of this test report.

2.4. Test Results

Ambient temperature : 26 °C
Relative humidity : 47 %

2.4.1. Radiated Emission

9kHz ~ 25GHz Data(Modulation: *GFSK*) Module 1

▪ Lowest Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F. (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2376.16	V	Z	PK	51.44	-4.27	N/A	N/A	47.17	74.00	26.83
2376.08	V	Z	AV	40.53	-4.27	-24.79	N/A	11.47	54.00	42.53
4804.70	V	Z	PK	53.63	6.56	N/A	N/A	60.19	74.00	13.81
4804.03	V	Z	AV	49.82	6.56	-24.79	N/A	31.59	54.00	22.41

▪ Middle Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F. (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4882.29	V	Z	PK	54.95	6.83	N/A	N/A	61.78	74.00	12.22
4882.21	V	Z	AV	52.50	6.83	-24.79	N/A	34.54	54.00	19.47

▪ Highest Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F. (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2483.53	V	Z	PK	59.99	-4.01	N/A	N/A	55.98	74.00	18.02
2483.52	V	Z	AV	45.88	-4.01	-24.79	N/A	17.08	54.00	36.92
4960.37	V	Z	PK	55.19	7.10	N/A	N/A	62.29	74.00	11.71
4960.04	V	Z	AV	52.26	7.10	-24.79	N/A	34.57	54.00	19.43

Note.

1. No other spurious and harmonic emissions were found greater than listed emissions on above table.
2. Above listed point data is the worst case data.
3. Sample Calculation.
   Margin = Limit – Result/Result = Reading + T.F + D.C.F./ T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
4. D.C.F Calculation. (D.C.F. = Duty Cycle Correction Factor)
   - Time to cycle through all channels= $\Delta t = T_{[ms]}$ X 20minimum hopping channels , where T = pulse width
   - 100ms / $\Delta t_{[ms]}$ = H -> Round up to next highest integer, to account for worst case, H'
   - The Worst Case Dwell Time = $T_{[ms]}$ x H' (For this case, H'=2, T=2.88 ms, 2 x 2.88 = 5.76)
   - D.C.F = 20 x Log(The Worst Case Dwell Time / 100ms) dB = 20 x Log(5.76 ms / 100 ms) = -24.79 dB
5. EUT had its hopping function disabled at the highest, middle and the lowest available channels.

9kHz ~ 25GHz Data(Modulation: *π/4DQPSK*) Module 1

▪ Lowest Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F. (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2375.28	V	Z	PK	52.12	-4.27	N/A	N/A	47.85	74.00	26.15
2375.44	V	Z	AV	38.40	-4.27	-24.79	N/A	9.34	54.00	44.66
4803.63	V	Z	PK	47.57	6.56	N/A	N/A	54.13	74.00	19.87
4803.98	V	Z	AV	34.67	6.56	-24.79	N/A	16.44	54.00	37.56

▪ Middle Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F. (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4882.55	V	Z	PK	49.42	6.83	N/A	N/A	56.25	74.00	17.75
4882.00	V	Z	AV	38.68	6.83	-24.79	N/A	20.72	54.00	33.28

▪ Highest Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F. (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2483.55	V	Z	PK	60.20	-4.01	N/A	N/A	56.19	74.00	17.81
2483.51	V	Z	AV	45.43	-4.01	-24.79	N/A	16.63	54.00	37.37
4959.74	V	Z	PK	48.72	7.10	N/A	N/A	55.82	74.00	18.18
4959.95	V	Z	AV	38.68	7.10	-24.79	N/A	20.99	54.00	33.01

Note.

1. No other spurious and harmonic emissions were found greater than listed emissions on above table.
2. Above listed point data is the worst case data.
3. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F + D.C.F. / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
4. D.C.F Calculation. (D.C.F. = Duty Cycle Correction Factor)
   - Time to cycle through all channels= $\Delta t = T_{[ms]}$ X 20minimum hopping channels , where T = pulse width
   - 100ms / $\Delta t_{[ms]}$ = H -> Round up to next highest integer, to account for worst case, H'
   - The Worst Case Dwell Time = $T_{[ms]}$ x H' (For this case, H'=2, T=2.88 ms, 2 x 2.88 = 5.76)
   - D.C.F = 20 x Log(The Worst Case Dwell Time / 100ms) dB = 20 x Log(5.76 ms / 100 ms) = -24.79 dB
5. EUT had its hopping function disabled at the highest, middle and the lowest available channels.

9kHz ~ 25GHz Data(Modulation: *8DPSK*) Module 1

▪ Lowest Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F. (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2375.64	V	Z	PK	52.43	-4.27	N/A	N/A	48.16	74.00	25.84
2375.68	V	Z	AV	38.21	-4.27	-24.79	N/A	9.15	54.00	44.85
4803.53	V	Z	PK	46.67	6.56	N/A	N/A	53.23	74.00	20.77
4803.99	V	Z	AV	34.82	6.56	-24.79	N/A	16.59	54.00	37.41

▪ Middle Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F. (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4881.69	V	Z	PK	48.73	6.83	N/A	N/A	55.56	74.00	18.44
4881.98	V	Z	AV	38.67	6.83	-24.79	N/A	20.71	54.00	33.29

▪ Highest Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F. (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2483.61	V	Z	PK	60.61	-4.01	N/A	N/A	56.60	74.00	17.40
2483.52	V	Z	AV	45.21	-4.01	-24.79	N/A	16.41	54.00	37.59
4959.93	V	Z	PK	49.37	7.10	N/A	N/A	56.47	74.00	17.53
4959.89	V	Z	AV	39.64	7.10	-24.79	N/A	21.95	54.00	32.05

Note.

1. No other spurious and harmonic emissions were found greater than listed emissions on above table.
2. Above listed point data is the worst case data.
3. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F + D.C.F. / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
4. D.C.F Calculation. (D.C.F. = Duty Cycle Correction Factor)
   - Time to cycle through all channels= $\Delta t = T_{[ms]}$ X 20minimum hopping channels , where T = pulse width
   - 100ms / $\Delta t_{[ms]}$ = H -> Round up to next highest integer, to account for worst case, H'
   - The Worst Case Dwell Time = $T_{[ms]}$ x H' (For this case, H'=2, T=2.88 ms, 2 x 2.88 = 5.76)
   - D.C.F = 20 x Log(The Worst Case Dwell Time / 100ms) dB = 20 x Log(5.76 ms / 100 ms) = -24.79 dB
5. EUT had its hopping function disabled at the highest, middle and the lowest available channels.

9kHz ~ 25GHz Data(Modulation: *GFSK*) Module 2

▪ Lowest Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F. (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2376.92	H	X	PK	54.18	-4.27	N/A	N/A	49.91	74.00	24.09
2376.84	H	X	AV	40.35	-4.27	-24.79	N/A	11.29	54.00	42.71
4804.03	H	X	PK	46.40	6.56	N/A	N/A	52.96	74.00	21.04
4804.06	H	X	AV	35.46	6.56	-24.79	N/A	17.23	54.00	36.78

▪ Middle Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F. (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4881.91	H	X	PK	52.36	6.83	N/A	N/A	59.19	74.00	14.81
4882.03	H	X	AV	48.53	6.83	-24.79	N/A	30.57	54.00	23.43

▪ Highest Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F. (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2483.59	H	X	PK	57.63	-4.01	N/A	N/A	53.62	74.00	20.38
2483.52	H	X	AV	43.59	-4.01	-24.79	N/A	14.79	54.00	39.21
4960.31	H	X	PK	48.40	7.10	N/A	N/A	55.50	74.00	18.50
4960.09	H	X	AV	41.32	7.10	-24.79	N/A	23.63	54.00	30.37

Note.

1. No other spurious and harmonic emissions were found greater than listed emissions on above table.
2. Above listed point data is the worst case data.
3. Sample Calculation.
   Margin = Limit – Result/Result = Reading + T.F + D.C.F./ T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
4. D.C.F Calculation. (D.C.F. = Duty Cycle Correction Factor)
   - Time to cycle through all channels= $\Delta t = T_{[ms]}$ X 20minimum hopping channels , where T = pulse width
   - 100ms / $\Delta t_{[ms]}$ = H -> Round up to next highest integer, to account for worst case, H'
   - The Worst Case Dwell Time = $T_{[ms]}$ x H' (For this case, H'=2, T=2.88 ms, 2 x 2.88 = 5.76)
   - D.C.F = 20 x Log(The Worst Case Dwell Time / 100ms) dB = 20 x Log(5.76 ms / 100 ms) = -24.79 dB
5. EUT had its hopping function disabled at the highest, middle and the lowest available channels.

9kHz ~ 25GHz Data(Modulation: *π/4DQPSK*) Module 2

▪ Lowest Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F. (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2376.12	H	X	PK	53.50	-4.27	N/A	N/A	49.23	74.00	24.77
2375.76	H	X	AV	39.80	-4.27	-24.79	N/A	10.74	54.00	43.26
4804.11	H	X	PK	46.89	6.56	N/A	N/A	53.45	74.00	20.55
4804.08	H	X	AV	36.27	6.56	-24.79	N/A	18.04	54.00	35.96

▪ Middle Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F. (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4882.04	H	X	PK	46.00	6.83	N/A	N/A	52.83	74.00	21.18
4881.97	H	X	AV	34.59	6.83	-24.79	N/A	16.63	54.00	37.37

▪ Highest Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F. (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2483.71	H	X	PK	56.74	-4.01	N/A	N/A	52.73	74.00	21.27
2483.54	H	X	AV	41.72	-4.01	-24.79	N/A	12.92	54.00	41.08
4960.07	H	X	PK	45.70	7.10	N/A	N/A	52.80	74.00	21.20
4959.94	H	X	AV	32.56	7.10	-24.79	N/A	14.87	54.00	39.13

Note.

1. No other spurious and harmonic emissions were found greater than listed emissions on above table.
2. Above listed point data is the worst case data.
3. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F + D.C.F. / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
4. D.C.F Calculation. (D.C.F. = Duty Cycle Correction Factor)
   - Time to cycle through all channels= $\Delta t = T_{[ms]}$ X 20minimum hopping channels , where T = pulse width
   - 100ms / $\Delta t_{[ms]}$ = H -> Round up to next highest integer, to account for worst case, H'
   - The Worst Case Dwell Time = $T_{[ms]}$ x H' (For this case, H'=2, T=2.88 ms, 2 x 2.88 = 5.76)
   - D.C.F = 20 x Log(The Worst Case Dwell Time / 100ms) dB = 20 x Log(5.76 ms / 100 ms) = -24.79 dB
5. EUT had its hopping function disabled at the highest, middle and the lowest available channels.

9kHz ~ 25GHz Data(Modulation: *8DPSK*) Module 2

▪ Lowest Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F. (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2379.72	H	X	PK	53.31	-4.27	N/A	N/A	49.04	74.00	24.96
2379.84	H	X	AV	39.50	-4.27	-24.79	N/A	10.44	54.00	43.56
4804.08	H	X	PK	47.13	6.56	N/A	N/A	53.69	74.00	20.31
4804.01	H	X	AV	36.27	6.56	-24.79	N/A	18.04	54.00	35.96

▪ Middle Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F. (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4882.40	H	X	PK	46.63	6.83	N/A	N/A	53.46	74.00	20.54
4881.78	H	X	AV	34.53	6.83	-24.79	N/A	16.57	54.00	37.44

▪ Highest Channel

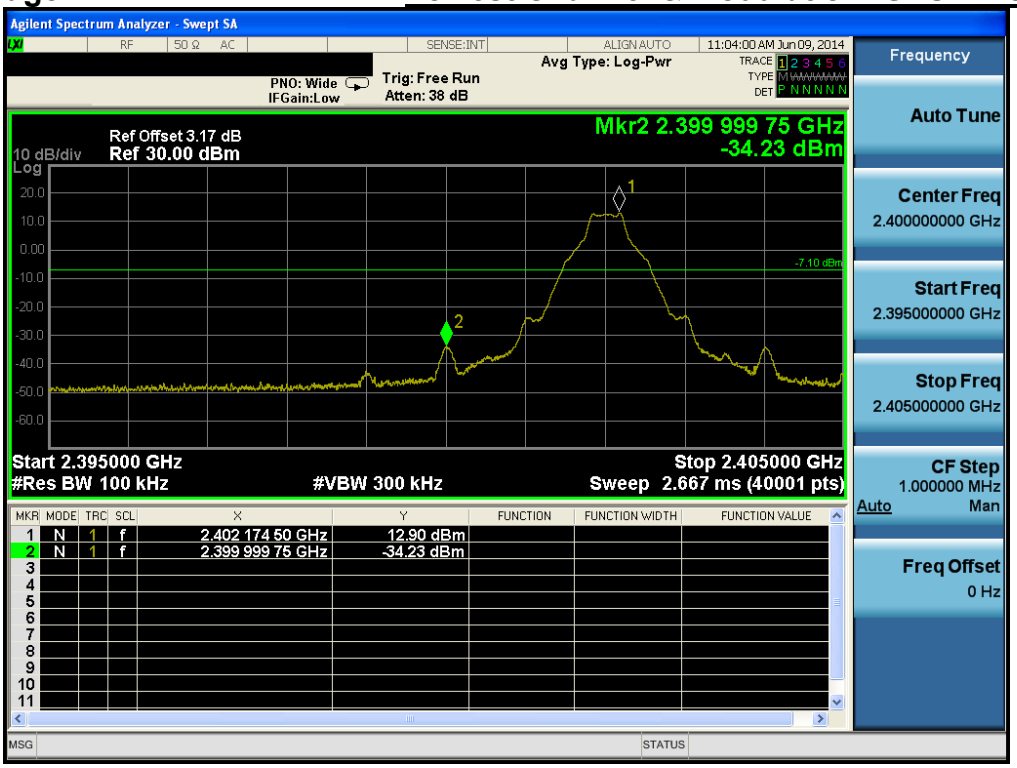
Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F. (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2483.72	H	X	PK	56.12	-4.01	N/A	N/A	52.11	74.00	21.90
2483.50	H	X	AV	41.57	-4.01	-24.79	N/A	12.77	54.00	41.23
4960.45	H	X	PK	45.66	7.10	N/A	N/A	52.76	74.00	21.24
4960.08	H	X	AV	32.64	7.10	-24.79	N/A	14.95	54.00	39.05

Note.

1. No other spurious and harmonic emissions were found greater than listed emissions on above table.
2. Above listed point data is the worst case data.
3. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F + D.C.F. / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
4. D.C.F Calculation. (D.C.F. = Duty Cycle Correction Factor)
   - Time to cycle through all channels= $\Delta t = T_{[ms]}$ X 20minimum hopping channels , where T = pulse width
   - 100ms / $\Delta t_{[ms]}$ = H -> Round up to next highest integer, to account for worst case, H'
   - The Worst Case Dwell Time = $T_{[ms]}$ x H' (For this case, H'=2, T=2.88 ms, 2 x 2.88 = 5.76)
   - D.C.F = 20 x Log(The Worst Case Dwell Time / 100ms) dB = 20 x Log(5.76 ms / 100 ms) = -24.79 dB
5. EUT had its hopping function disabled at the highest, middle and the lowest available channels.

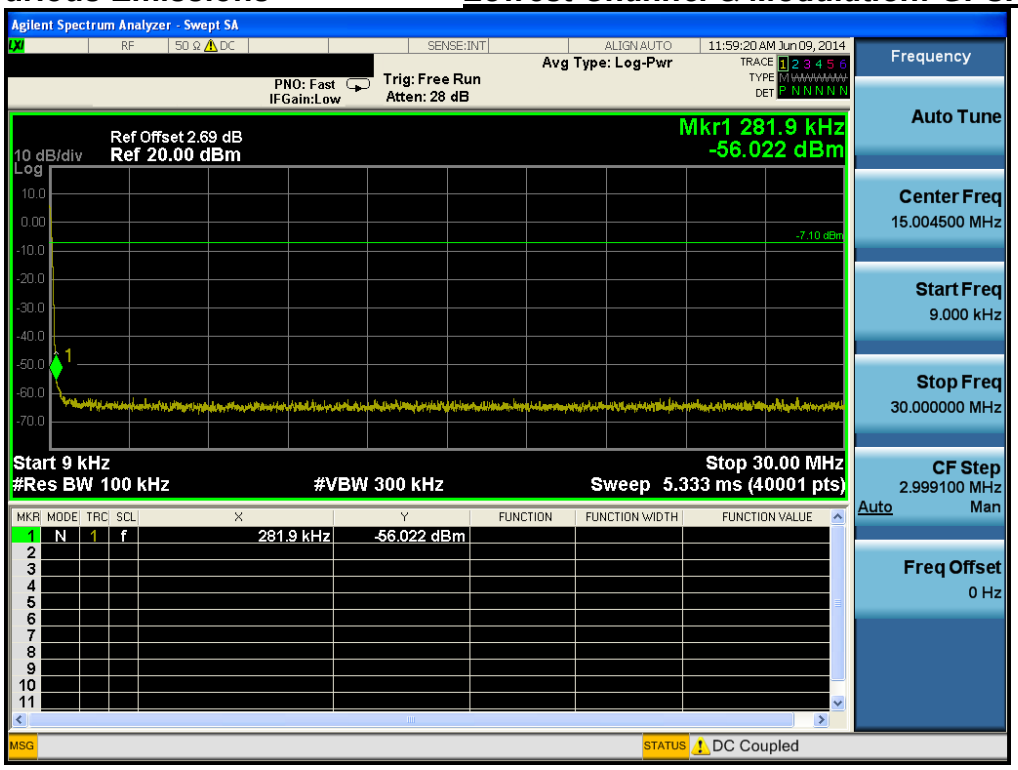
2.4.2. Conducted Spurious Emissions

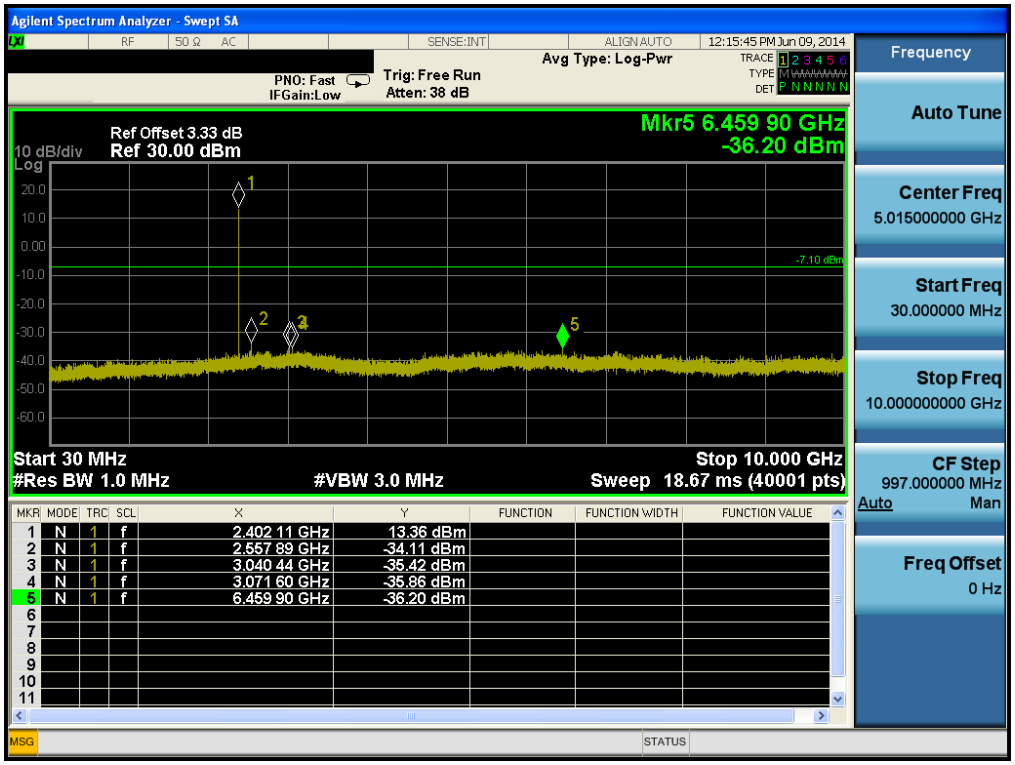
Low Band-edge ***Lowest Channel & Modulation: GFSK Module 1***



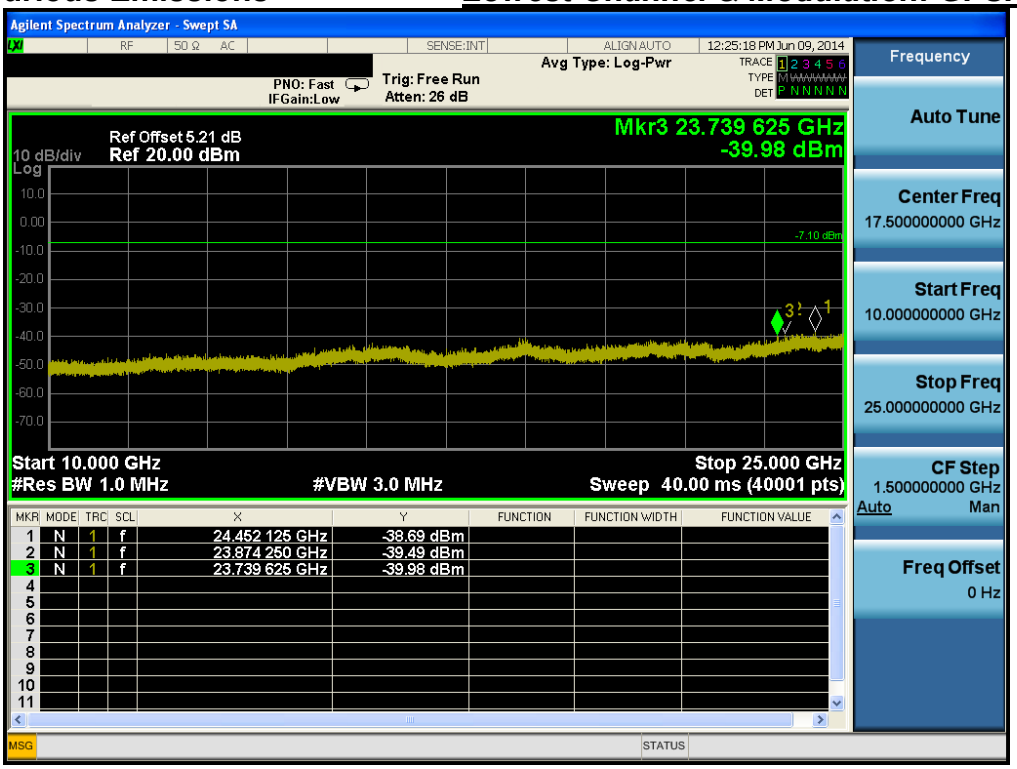
Low Band-edge ***Hopping mode & Modulation: GFSK Module 1***

Conducted Spurious Emissions *Lowest Channel & Modulation: GFSK Module 1*



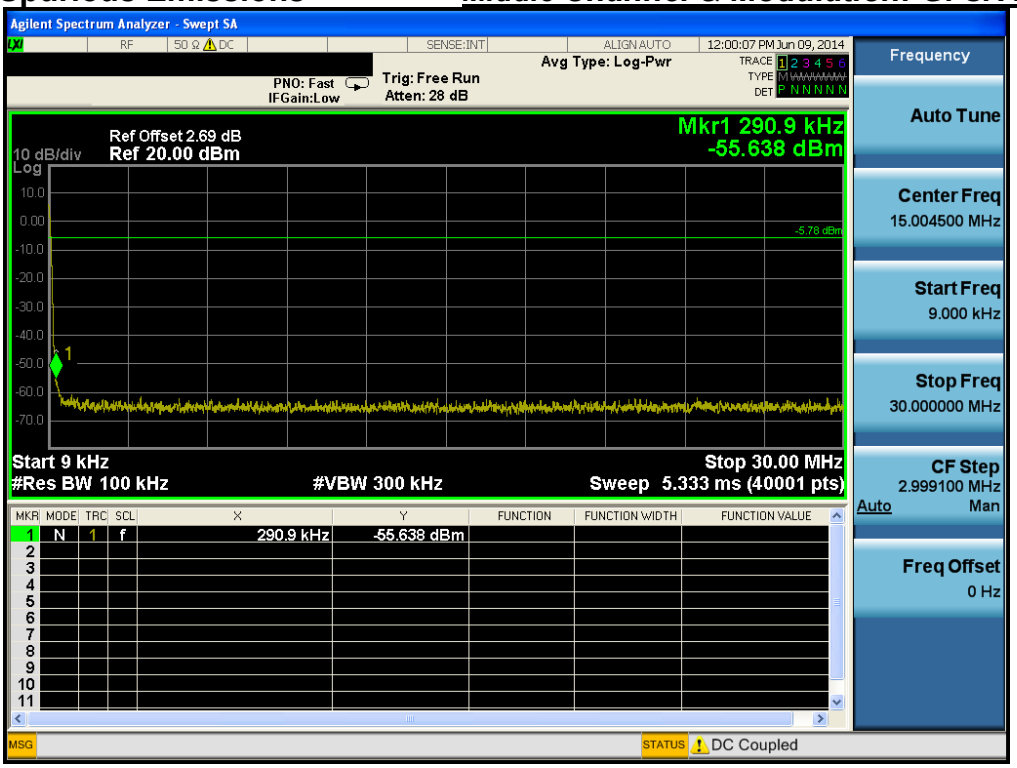


Conducted Spurious Emissions *Lowest Channel & Modulation: GFSK Module 1*

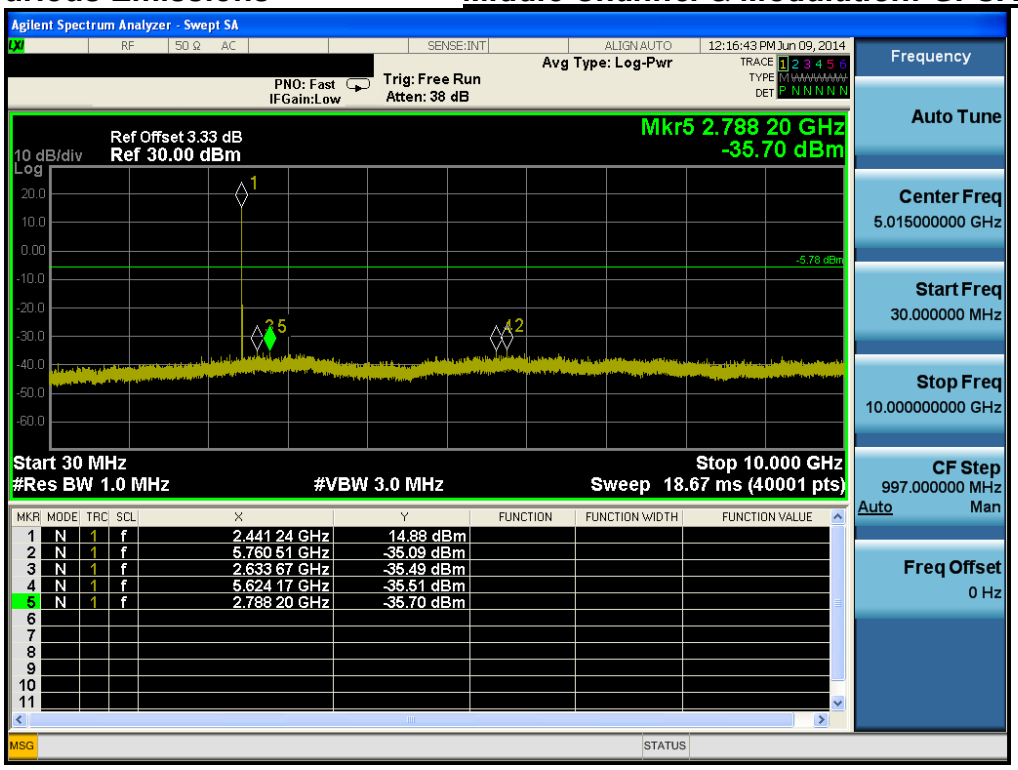


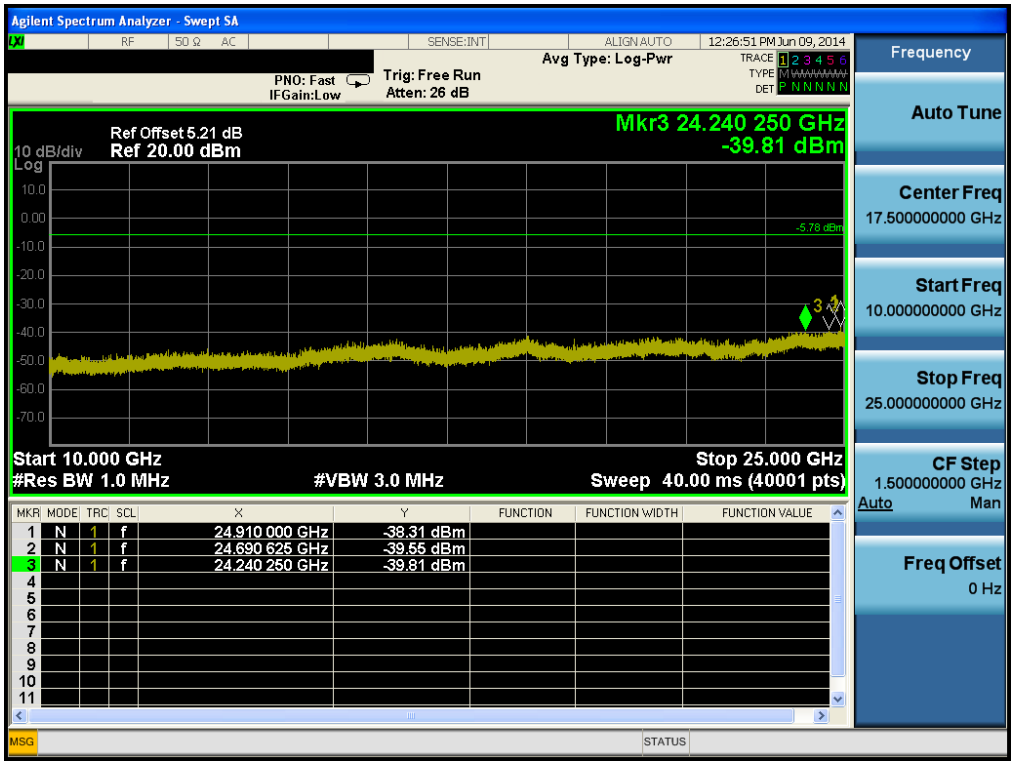
Reference for limit ***Middle Channel & Modulation: GFSK Module 1***

Conducted Spurious Emissions ***Middle Channel & Modulation: GFSK Module 1***

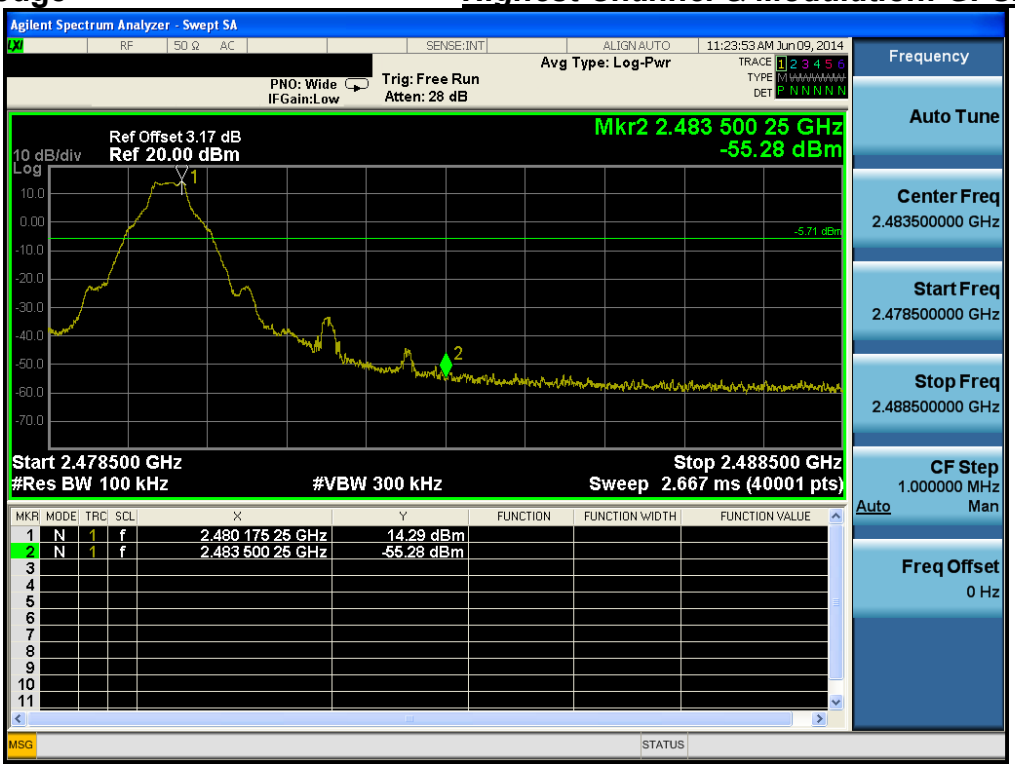


Conducted Spurious Emissions *Middle Channel & Modulation: GFSK Module 1*





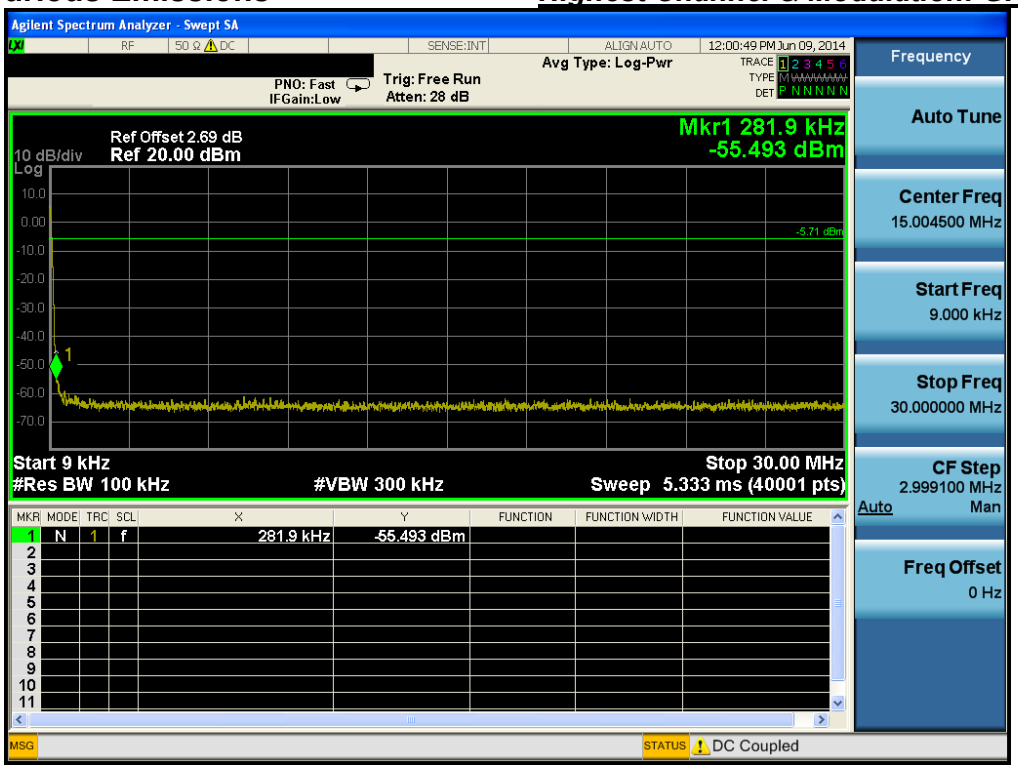
High Band-edge ***Highest Channel & Modulation: GFSK Module 1***

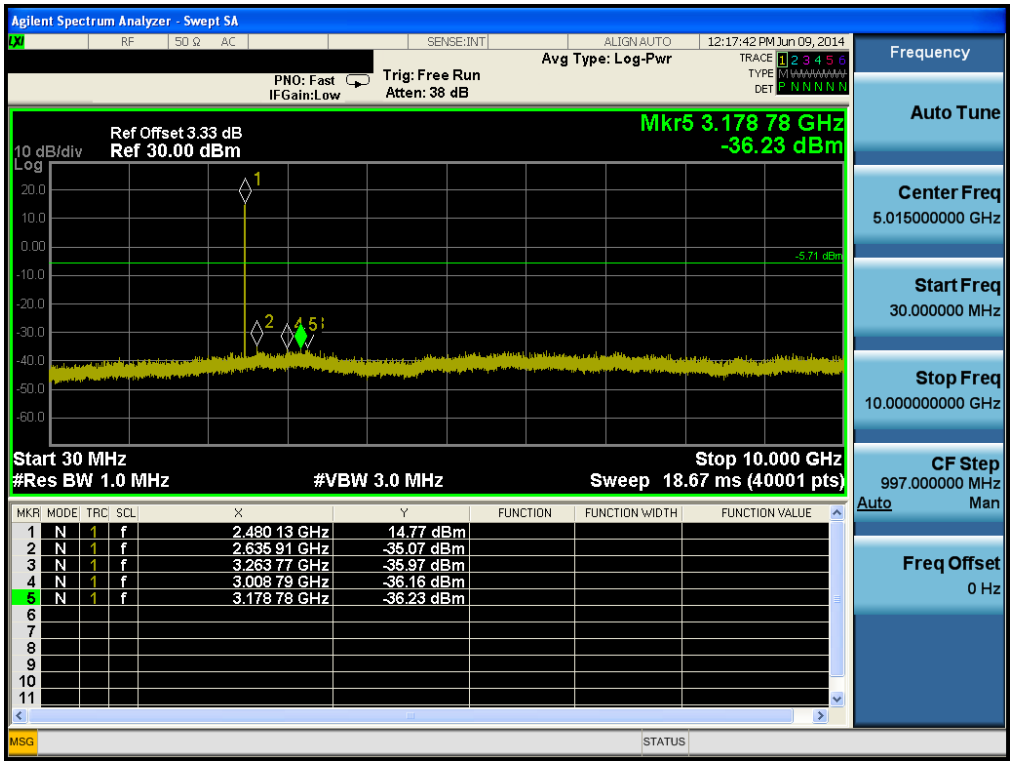


High Band-edge ***Hopping mode & Modulation: GFSK Module 1***

Conducted Spurious Emissions

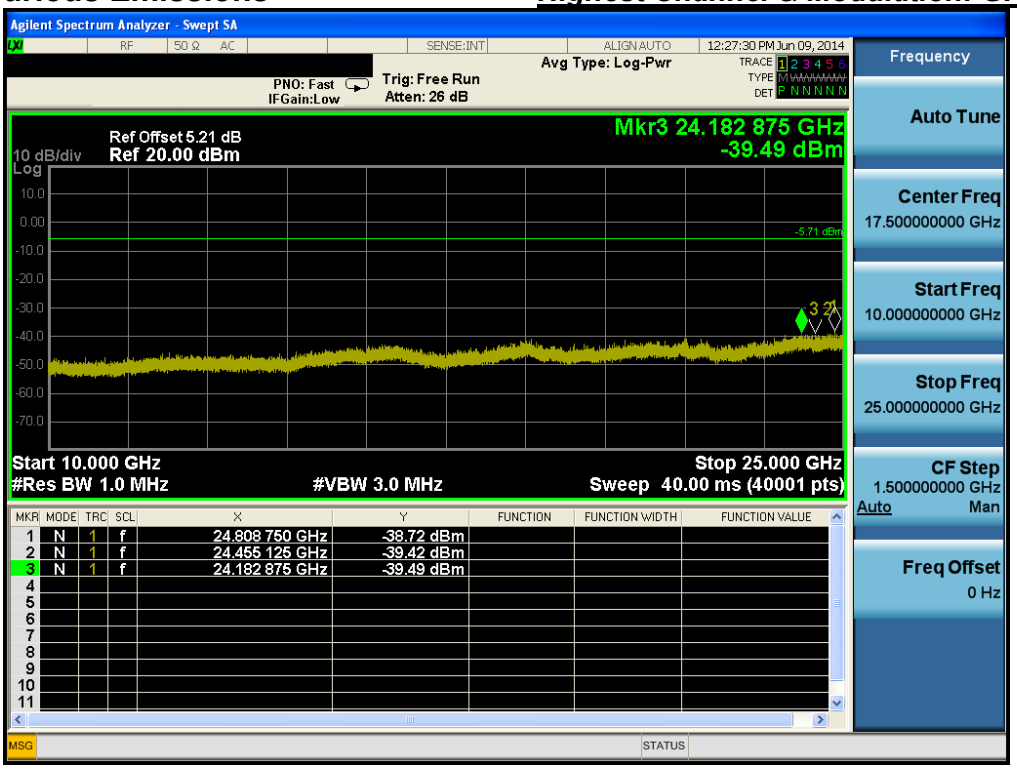
Highest Channel & Modulation: GFSK Module 1



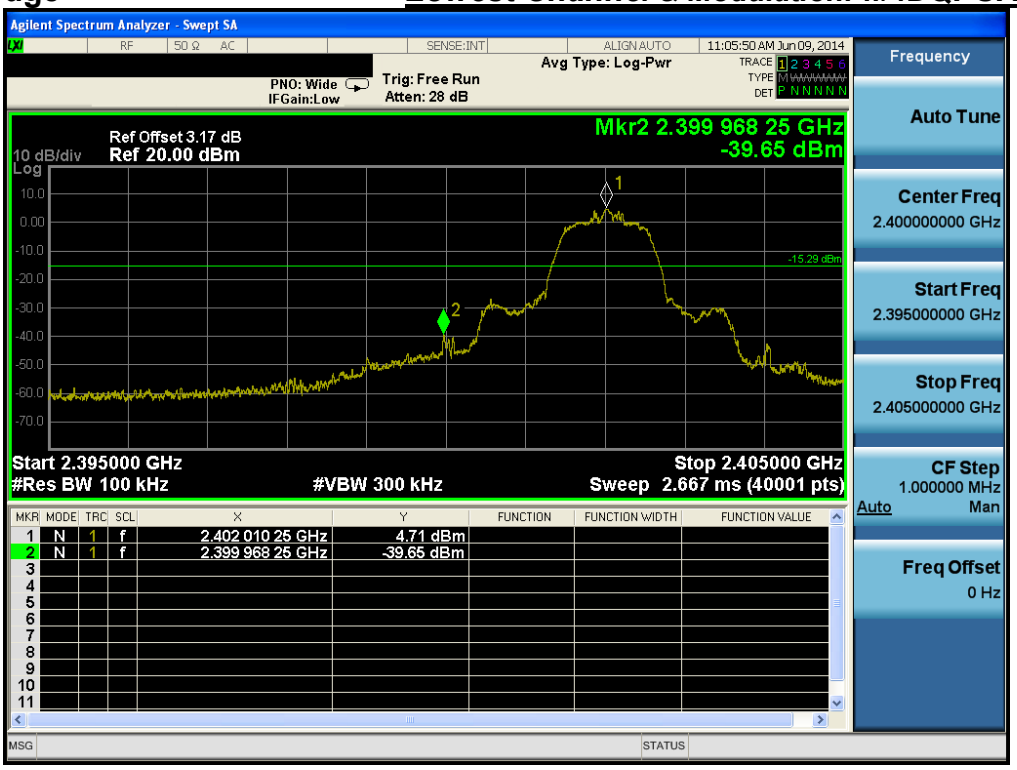


Conducted Spurious Emissions

Highest Channel & Modulation: GFSK Module 1



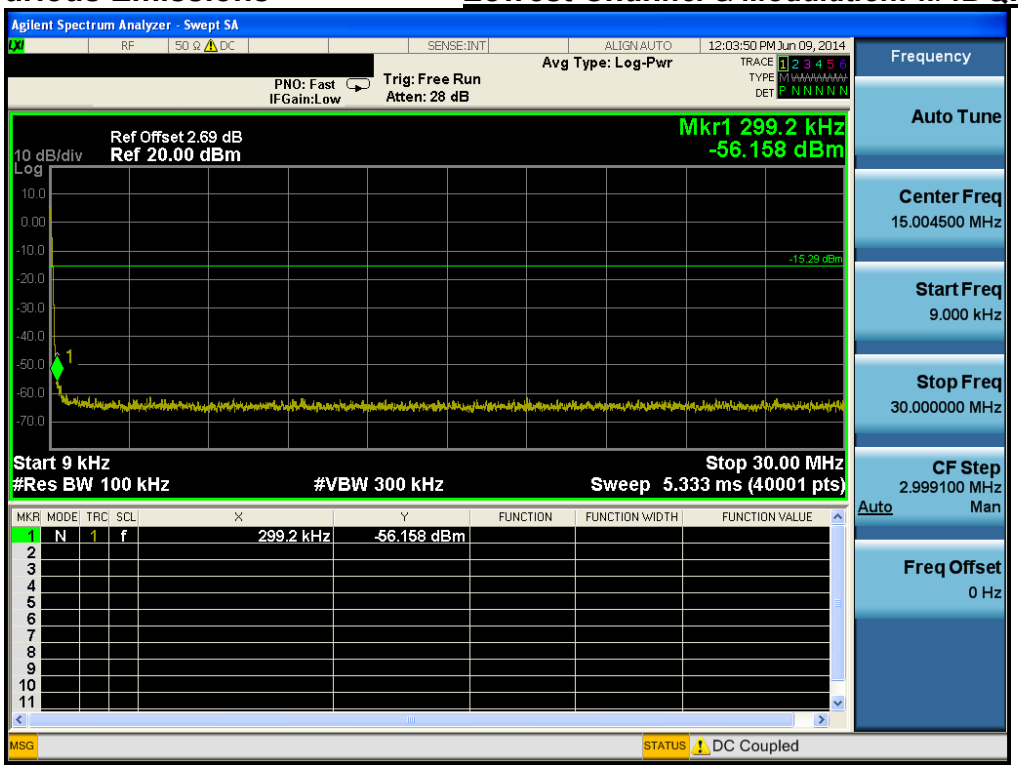
Low Band-edge ***Lowest Channel & Modulation: π/4DQPSK Module 1***

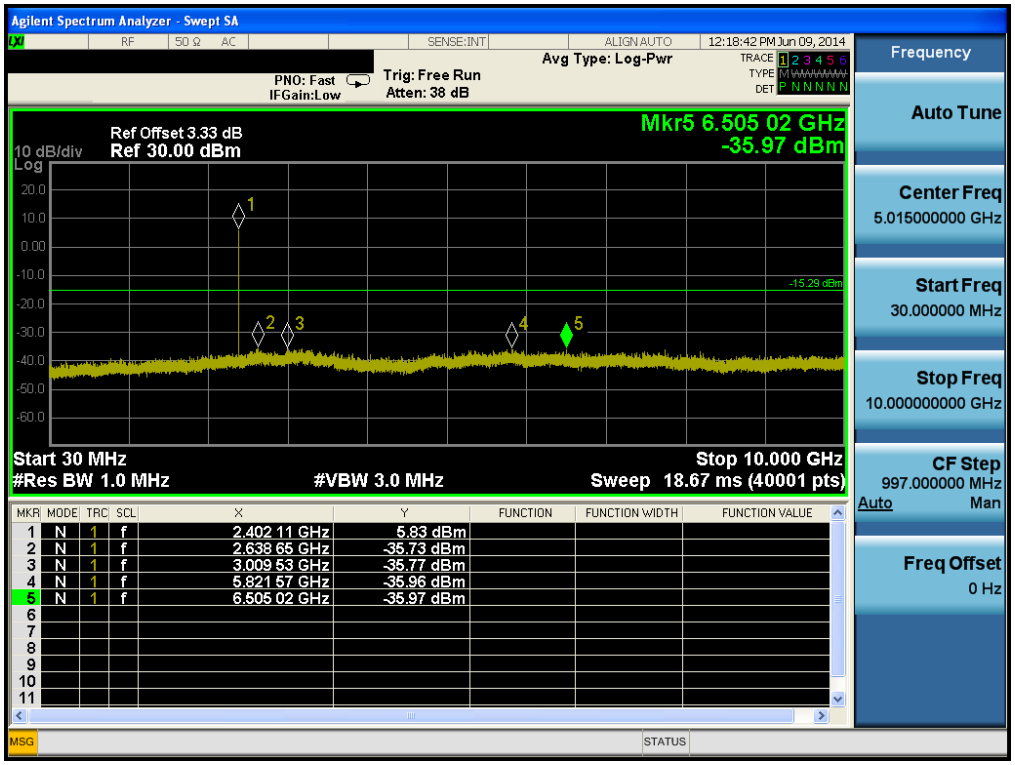


Low Band-edge ***Hopping mode & Modulation: π/4DQPSK Module 1***

Conducted Spurious Emissions

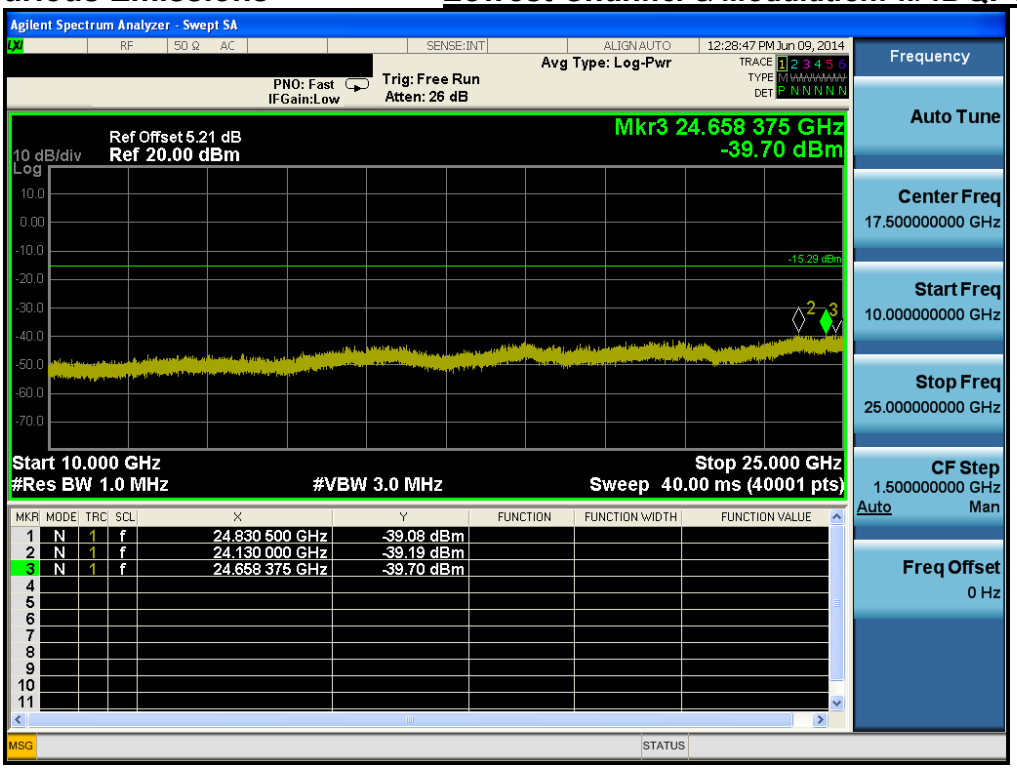
Lowest Channel & Modulation: π/4DQPSK Module 1





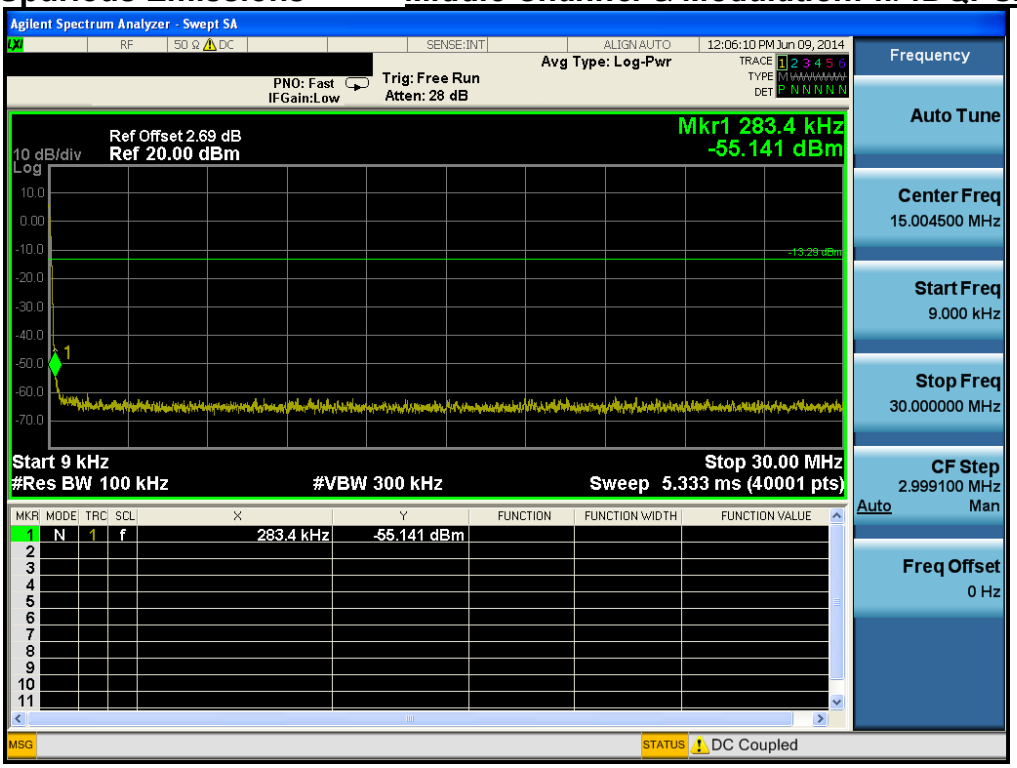
Conducted Spurious Emissions

Lowest Channel & Modulation: π/4DQPSK Module 1



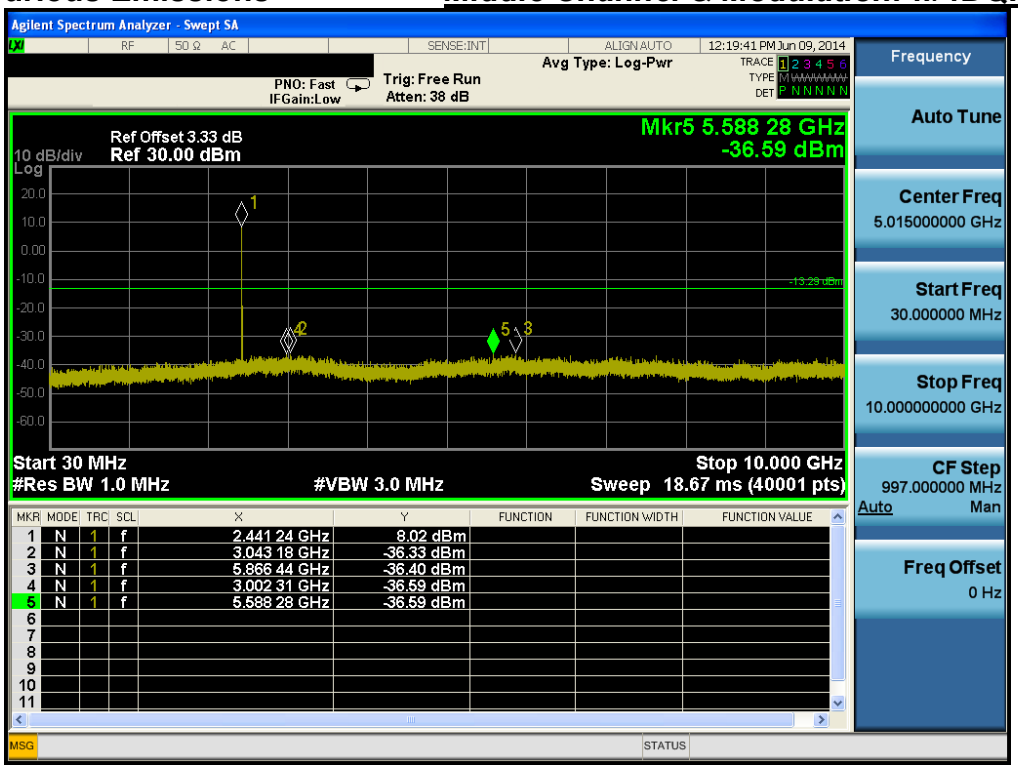
Reference for limit ***Middle Channel & Modulation: π/4DQPSK Module 1***

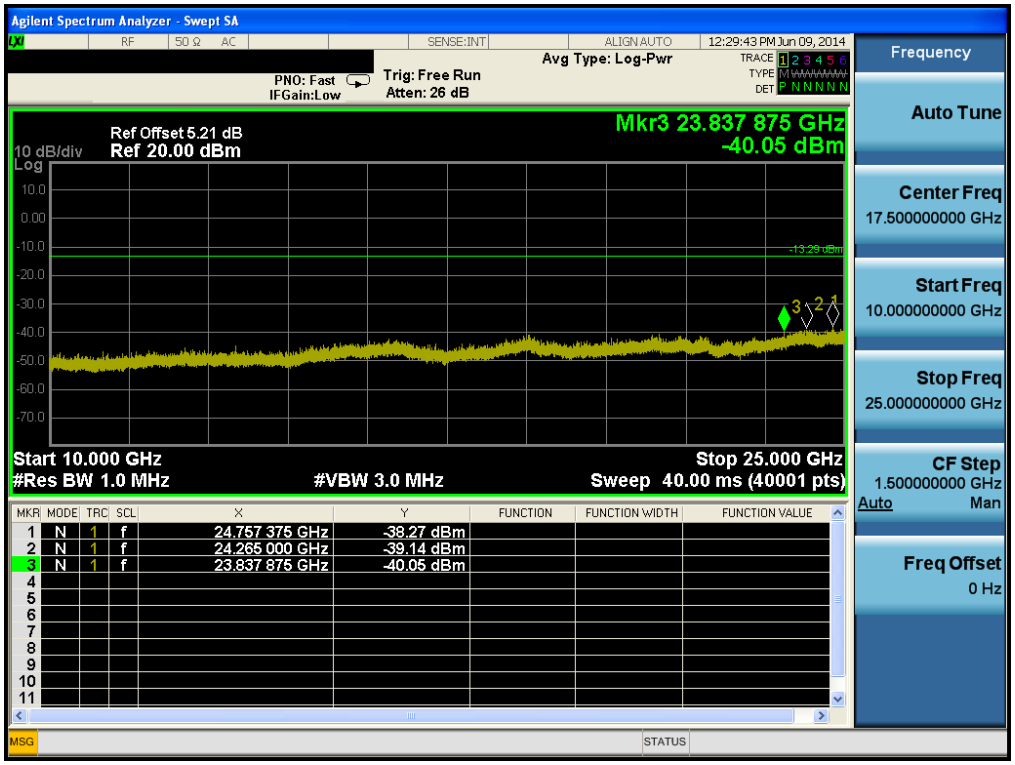
Conducted Spurious Emissions ***Middle Channel & Modulation: π/4DQPSK Module 1***



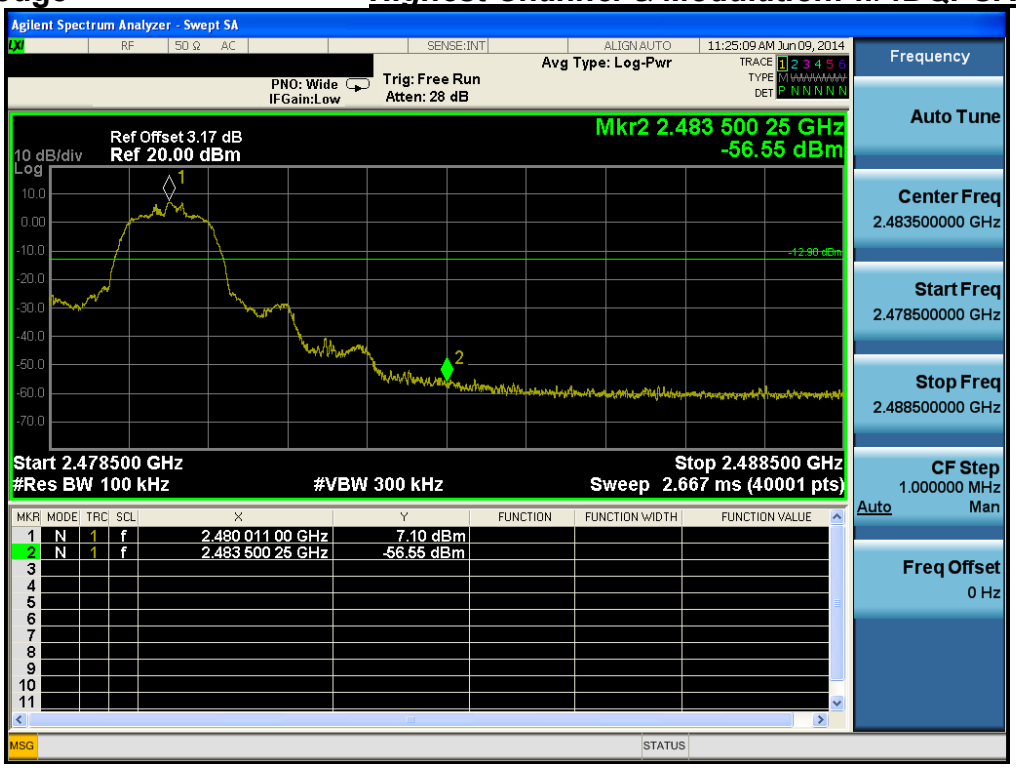
Conducted Spurious Emissions

Middle Channel & Modulation: π/4DQPSK Module 1



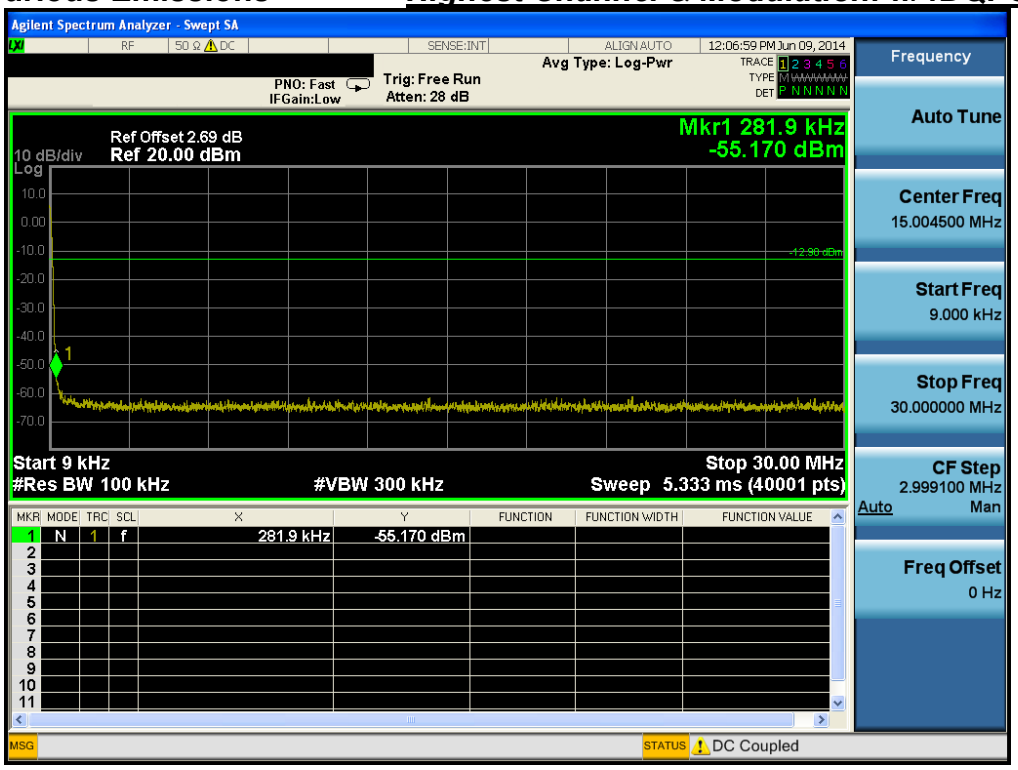


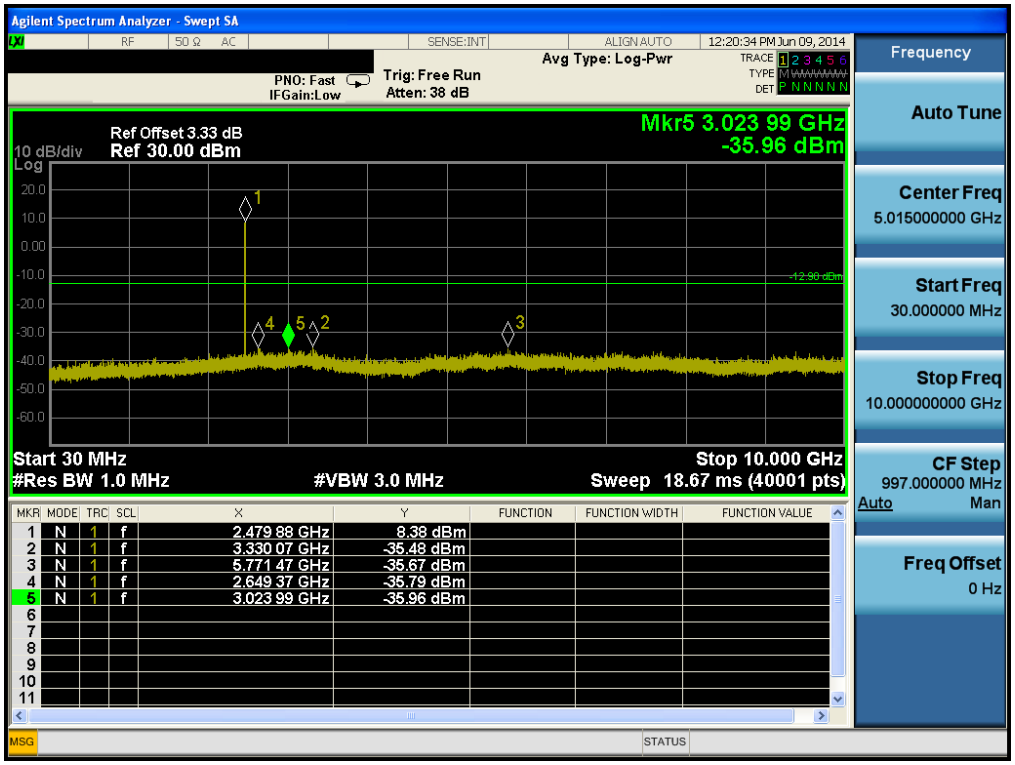
High Band-edge ***Highest Channel & Modulation: π/4DQPSK Module 1***



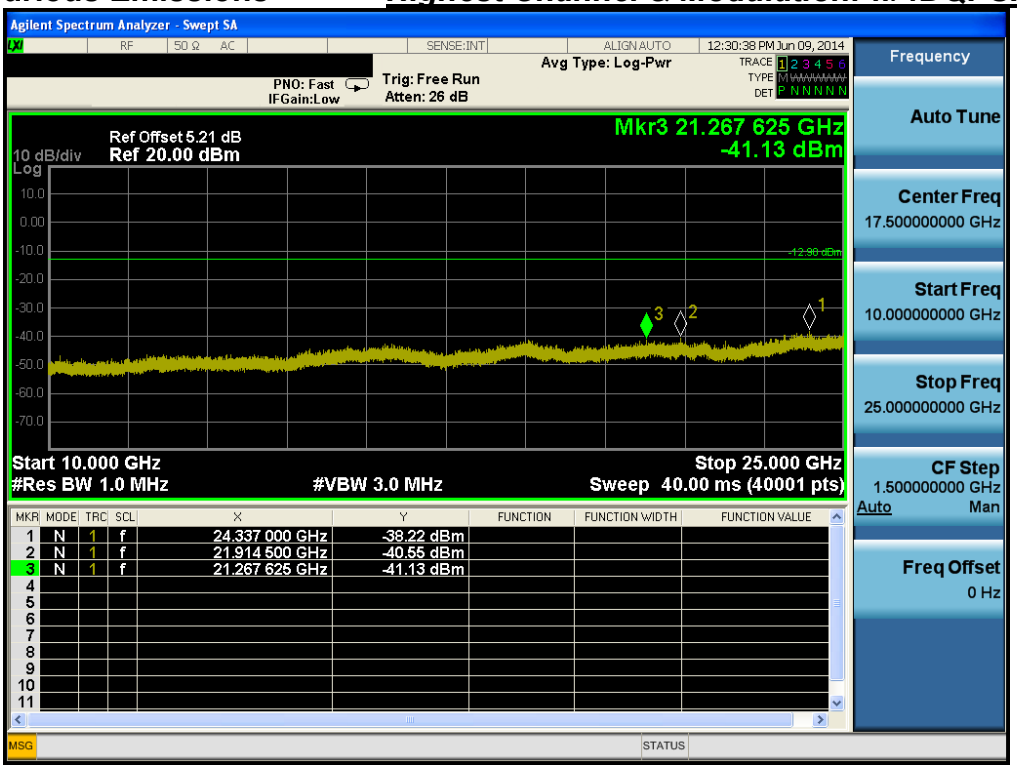
High Band-edge ***Hopping mode & Modulation: π/4DQPSK Module 1***

Conducted Spurious Emissions *Highest Channel & Modulation: π/4DQPSK Module 1*





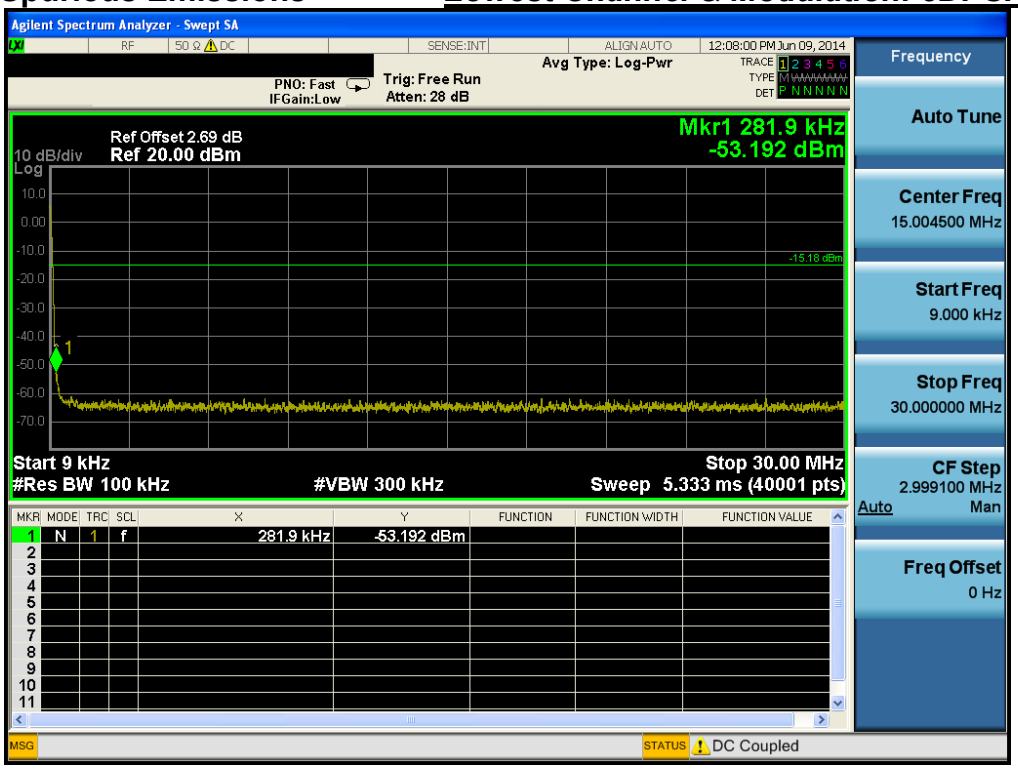
Conducted Spurious Emissions *Highest Channel & Modulation: π/4DQPSK Module 1*

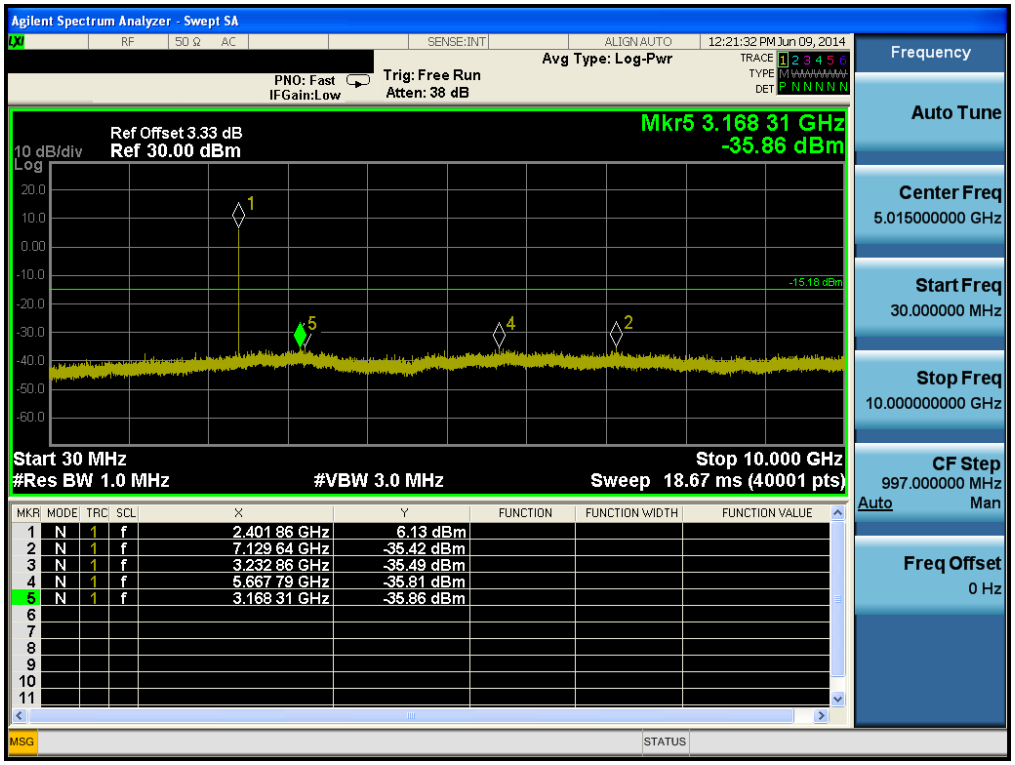


Low Band-edge ***Lowest Channel & Modulation: 8DPSK Module 1***

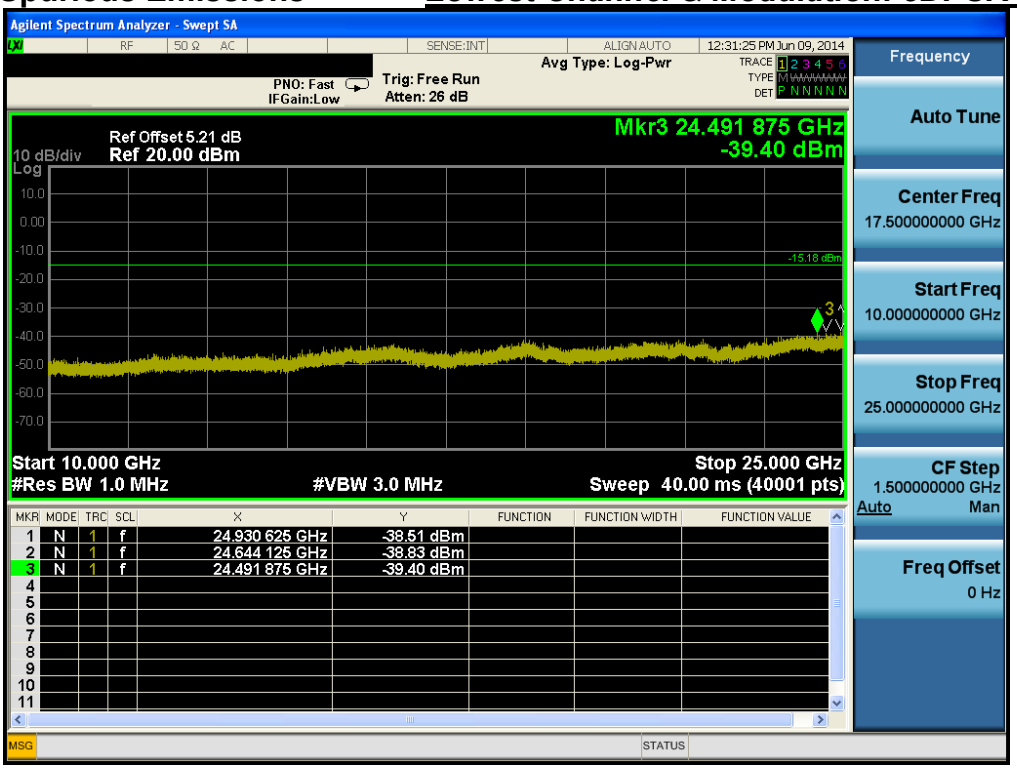
Low Band-edge ***Hopping mode & Modulation: 8DPSK Module 1***

Conducted Spurious Emissions *Lowest Channel & Modulation: 8DPSK Module 1*



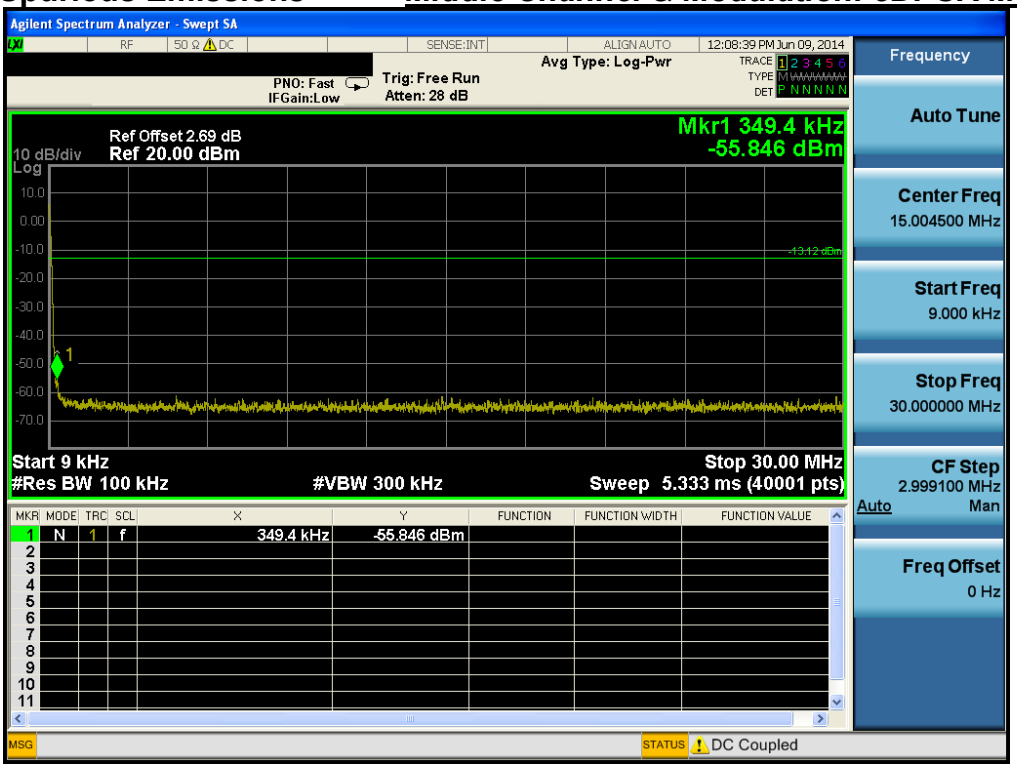


Conducted Spurious Emissions *Lowest Channel & Modulation: 8DPSK Module 1*

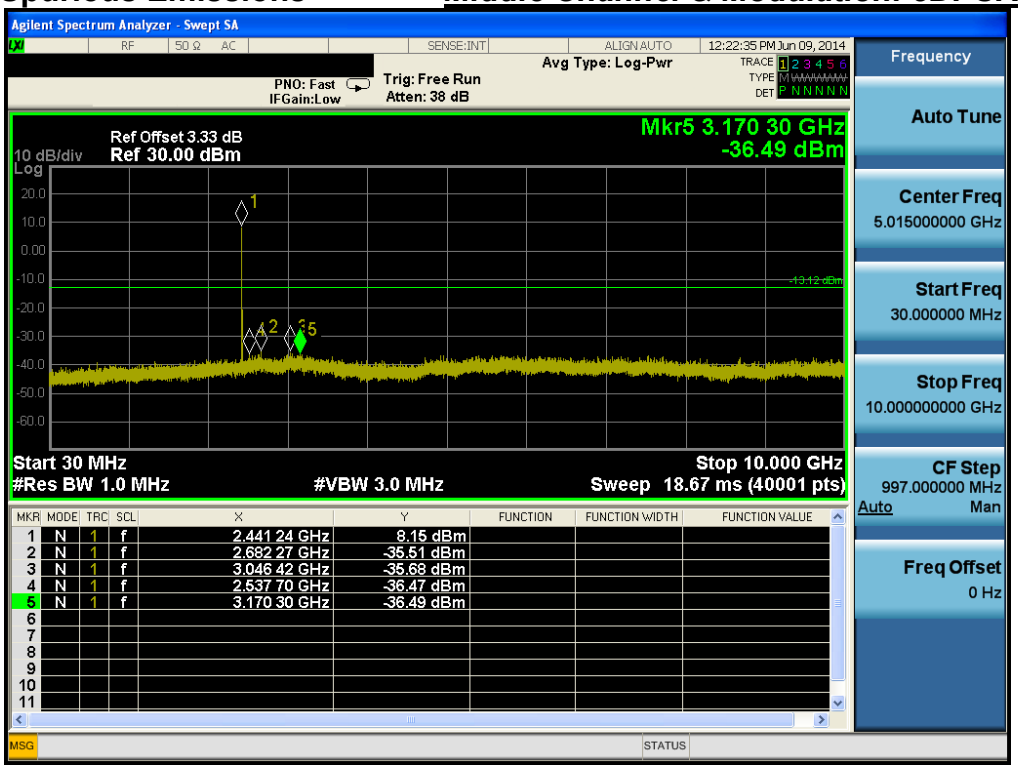


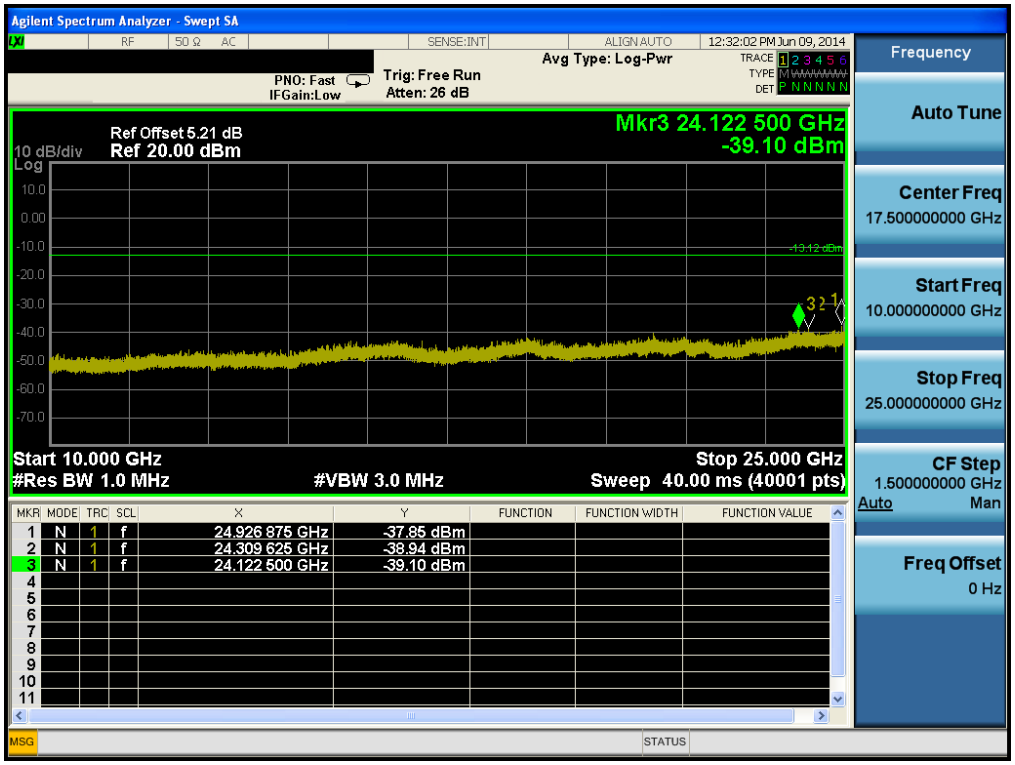
Reference for limit ***Middle Channel & Modulation: 8DPSK Module 1***

Conducted Spurious Emissions ***Middle Channel & Modulation: 8DPSK Module 1***



Conducted Spurious Emissions *Middle Channel & Modulation: 8DPSK Module 1*

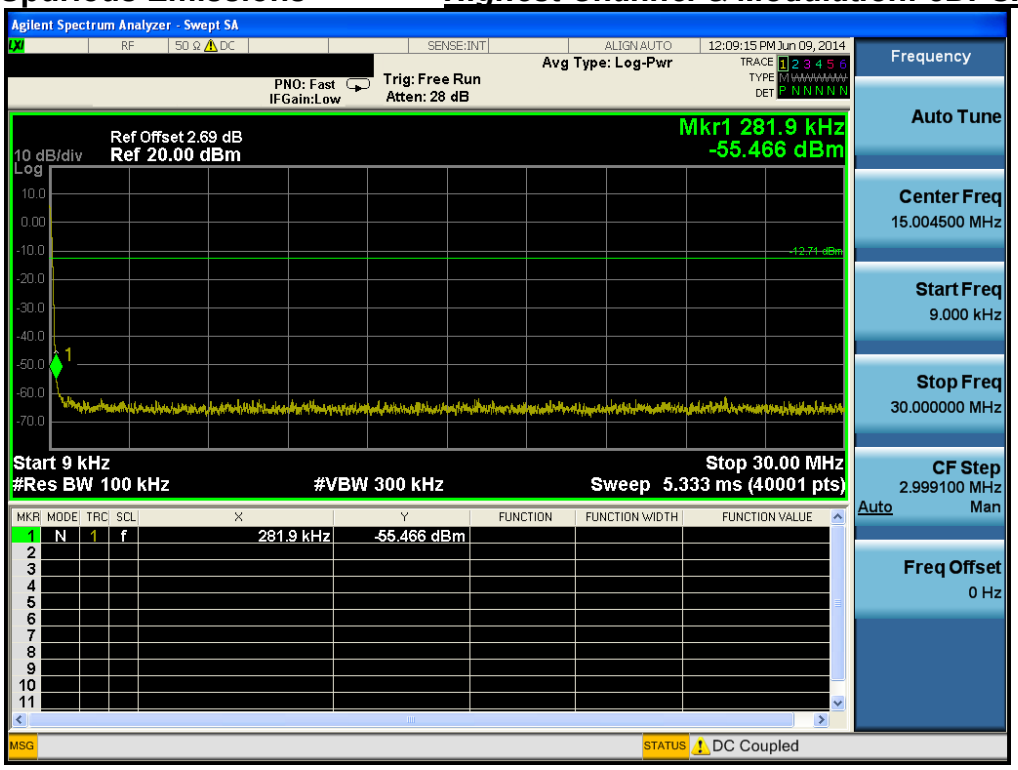


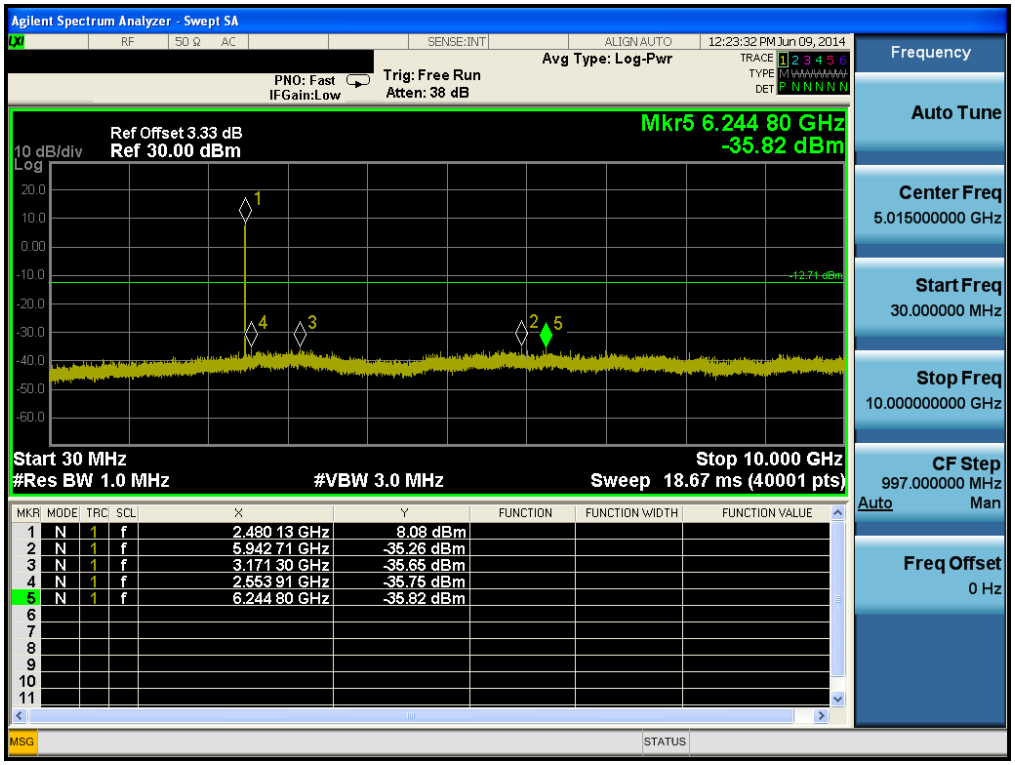


High Band-edge ***Highest Channel & Modulation: 8DPSK Module 1***

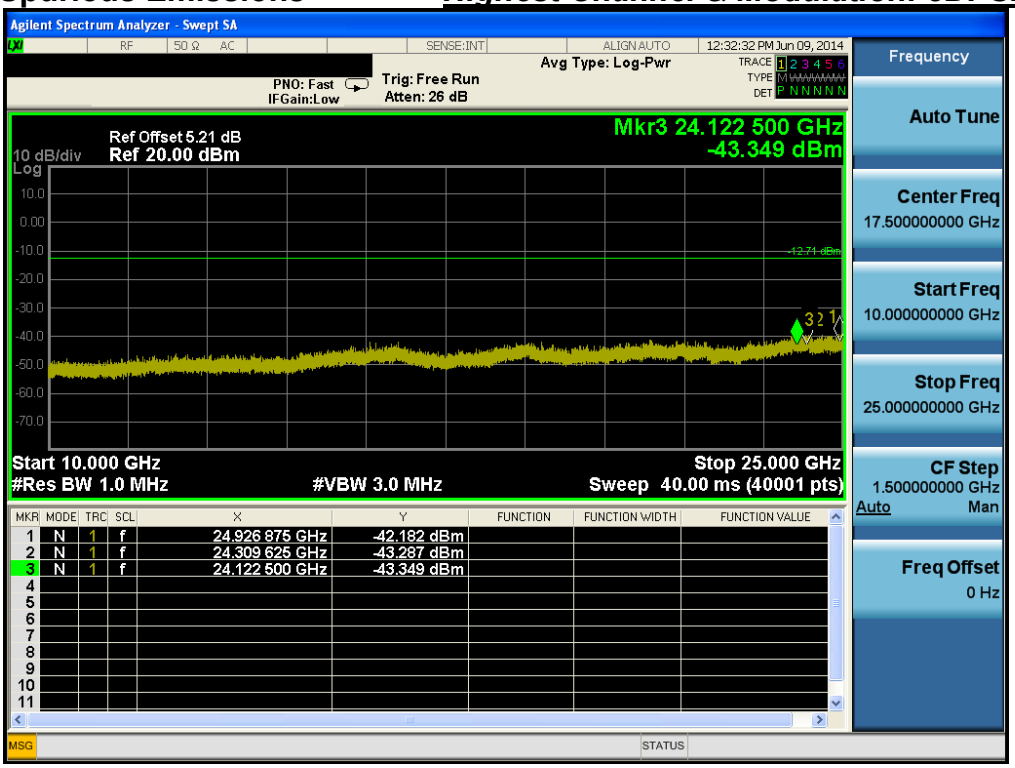
High Band-edge ***Hopping mode & Modulation: 8DPSK Module 1***

Conducted Spurious Emissions *Highest Channel & Modulation: 8DPSK Module 1*

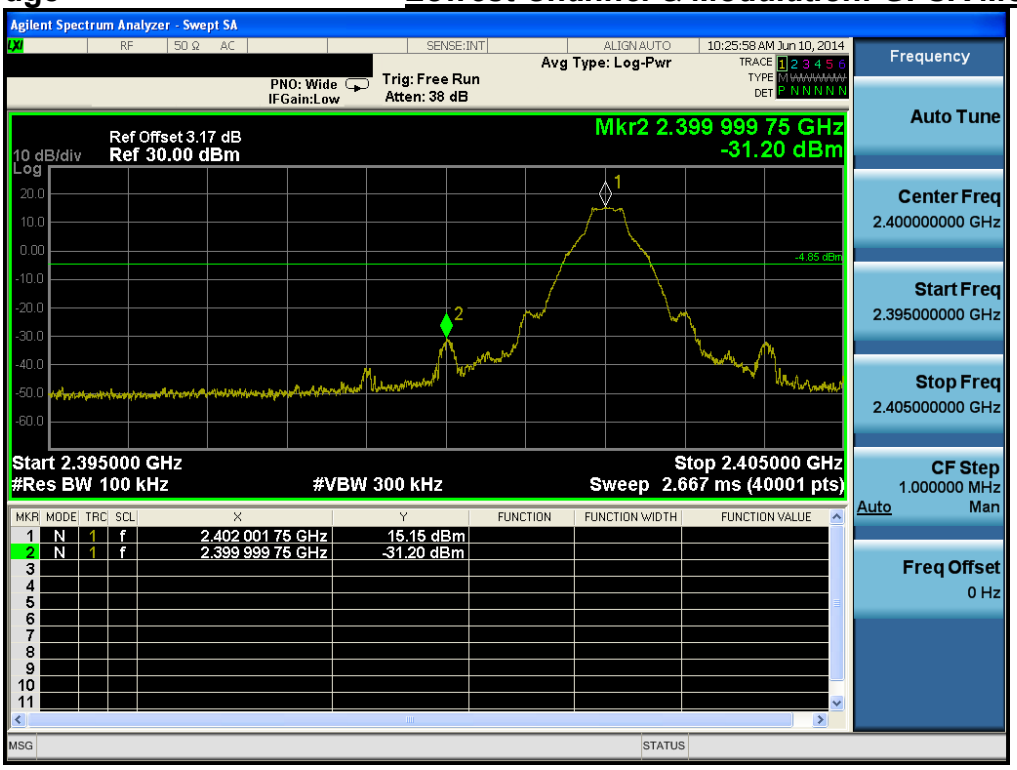




Conducted Spurious Emissions *Highest Channel & Modulation: 8DPSK Module 1*



Low Band-edge ***Lowest Channel & Modulation: GFSK Module 2***



Low Band-edge ***Hopping mode & Modulation: GFSK Module 2***