HCT CO.,LTD
74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA
TEL: +82-31-645-6300 FAX: +82-31-645-6401

FCC BT REPORT

FCC Certification

Applicant Name:
LG Electronics MobileComm U.S.A., Inc.

Address:
1000 Sylvan Avenue, Englewood Cliffs NJ 07632

Date of Issue:
December 30, 2015
Test Site/Location:
HCT CO., LTD., 74,Seoicheon-ro 578beon-gil,Majang-myeo,Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA
Report No.: HCT-R-1512-F057
HCT FRN: 0005866421
IC Recognition No.: 5944A-5

FCC ID:	**ZNFK120F**
APPLICANT:	**LG Electronics MobileComm U.S.A., Inc.**

FCC Model(s):	LG-K120F
Additional Model(s):	LGK120F, K120F
EUT Type:	GSM WCDMA and LTE Phone with BT and WLAN
Max. RF Output Power:	6.658 dBm (4.632 mW)
Frequency Range:	2402 MHz - 2480 MHz (Bluetooth)
Modulation type	GFSK(Normal), π/4DQPSK and 8DPSK(EDR)
FCC Classification:	FCC Part 15 Spread Spectrum Transmitter
FCC Rule Part(s):	Part 15 subpart C 15.247
Note:	The device, LG-K120F (FCC ID: ZNFK120F) is electrically identical compare to LG-K120E (FCC ID: ZNFK120E), confirmed by spot-check tests. Therefore, the test result data of LG-K120E (FCC ID: ZNFK120E) shall be reused.

The measurements shown in this report were made in accordance with the procedures specified in §2.947. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them.

HCT CO., LTD. Certifies that no party to this application has subject to a denial of Federal benefits that includes FCC benefits pursuant to section 5301 of the Anti-Drug Abuse Act of 1998,21 U.S. C.853(a)

Report prepared by
: Kyung Soo Kang
Test Engineer of RF Team

Approved by
: Sang Jun Lee
Manager of RF Team

This report only responds to the tested sample and may not be reproduced, except in full, without written approval of the HCT Co., Ltd.

Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-R-1512-F057	December 30, 2015	- First Approval Report

Table of Contents

1. GENERAL INFORMATION 4
2. EUT DESCRIPTION 4
3. TEST METHODOLOGY 5
   - 3.1 EUT CONFIGURATION 5
   - 3.2 EUT EXERCISE 5
   - 3.3 GENERAL TEST PROCEDURES 5
   - 3.4 DESCRIPTION OF TEST MODES 6
4. INSTRUMENT CALIBRATION 6
5. FACILITIES AND ACCREDITATIONS 6
   - 5.1 FACILITIES 6
   - 5.2 EQUIPMENT 6
6. ANTENNA REQUIREMENTS 6
7. SUMMARY OF TEST RESULTS 7
8. FCC PART 15.247 REQUIREMENTS 8
   - 8.1 PEAK POWER 8
   - 8.2 BAND EDGES 15
   - 8.3 FREQUENCY SEPARATION / OCCUPIED BANDWIDTH (99% BW) 23
   - 8.4 NUMBER OF HOPPING FREQUENCY 32
   - 8.5 TIME OF OCCUPANCY (DWELL TIME) 36
   - 8.6 SPURIOUS EMISSIONS 43
     - 8.6.1 CONDUCTED SPURIOUS EMISSIONS 43
     - 8.6.2 RADIATED SPURIOUS EMISSIONS 52
     - 8.6.3 RADIATED RESTRICTED BAND EDGES 69
   - 8.7 POWERLINE CONDUCTED EMISSIONS 75
9. LIST OF TEST EQUIPMENT 80
   - 9.1 LIST OF TEST EQUIPMENT(Conducted Test) 80
   - 9.2 LIST OF TEST EQUIPMENT(Radiated Test) 81

1. GENERAL INFORMATION

Applicant:	LG Electronics MobileComm U.S.A., Inc
Address:	1000 Sylvan Avenue, Englewood Cliffs NJ 07632
FCC ID:	ZNFK120F
EUT Type:	GSM WCDMA and LTE Phone with BT and WLAN
FCC Model name(s):	LG-K120F
Additional Model name(s):	LGK120F, K120F
Date(s) of Tests:	November 23, 2015 ~ December 01, 2015
Place of Tests:	HCT Co., Ltd. 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea (IC Recognition No. : 5944A-5)

2. EUT DESCRIPTION

FCC Model Name	LG-K120F
Additional Model Name	LGK120F, K120F
EUT Type	GSM WCDMA and LTE Phone with BT and WLAN
Power Supply	DC 3.8 V
Battery Infomation	Model: BL-49JH Type: Li-ion Battery
Frequency Range	2402 MHz - 2480 MHz (Bluetooth)
Transmit Power	6.658 dBm (4.632 mW)
BT Operating Mode	Normal, EDR, AFH
Modulation Type	GFSK(Normal), π/4DQPSK and 8DPSK(EDR)
Modulation Technique	FHSS
Number of Channels	79Channels, Minimum 20 Channels(AFH)
Antenna Specification	Manufacturer: Ace Technology Antenna type: INTERNAL ANTENNA Peak Gain : 0.67 dBi

※ 15.247 Requirements for Bluetooth transmitter

▪ This Bluetooth module has been tested by a Bluetooth Qualification Lab, and we confirm the following:

1) This system is hopping pseudo-randomly.

2) Each frequency is used equally on the average by each transmitter.

3) The receiver input bandwidths that match the hopping channel bandwidths of their corresponding transmitters

4) The receiver shifts frequencies in synchronization with the transmitted signals.

▪ 15.247(g): The system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this Section 15.247 should the transmitter be presented with a continuous data (or information) stream.

▪ 15.247(h): The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

3. TEST METHODOLOGY

The measurement procedure described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2013) is used in the measurement of the **LG Electronics GSM WCDMA and LTE Phone with BT and WLAN**
FCC ID: ZNFK120F

3.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

3.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

3.3 GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2 of ANSI C63.10. (Version :2013) Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane below 1GHz. Above 1GHz with 1.5m using absorbers between the EUT and receive antenna. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes according to the requirements in Section 8 of ANSI C63.10. (Version: 2013). To record the final measurements, the analyzer detector function was set to CISPR quasi-peak mode and the bandwidth of the spectrum analyzer was set to 120 kHz for frequencies below 1 GHz or 1 MHz for frequencies above 1 GHz. For average measurements above 1 GHz, the analyzer was set to peak detector with a reduced VBW setting(RBW = 1 MHz, VBW = 1/T Hz, where T = Pulse width).

Conducted Antenna Terminal

See Section from 7.8.2 to 7.8.8.(ANSI 63.10-2013)

3.4 DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.
Channel low, mid and high with highest data rate (worst case) is chosen for full testing.

4. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipments, which is traceable to recognized national standards.
All equipments(spectrum, antenna, accessory, etc.) for measurement is calibrated in accordance with the requirements of C63.5 (latest edition).

5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

The SAC(Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at the 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea. The site is constructed in conformance with the requirements of ANSI C63.4. (Version :2014) and CISPR Publication 22. Detailed description of test facility was submitted to the Commission and accepted dated July 07, 2015 (Registration Number: 90661)

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements. Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.
All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

6. ANTENNA REQUIREMENTS

According to FCC 47 CFR §15.203:

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.”

* The antennas of this E.U.T are permanently attached.

*The E.U.T Complies with the requirement of §15.203

7. SUMMARY OF TEST RESULTS

Test Description	FCC Part Section(s)	Test Limit	Test Condition	Test Result
20 dB Bandwidth	§15.247(a)(1)(ii) or (iii)	N/A	CONDUCTED	PASS
Occupied Bandwidth	N/A	N/A		N/A
Conducted Maximum Peak Output Power	§15.247(b)(1)	< 1 W if ≥ 75 non-overlapping hopping channels used < 0.125 W if < 75 non-overlapping hopping channels used		PASS
Carrier Frequency Separation	§15.247(a)(1)	>25 kHz or >2/3 of the 20dB BW		PASS
Number of Hopping Frequencies	§15.247(a)(1)(iii)	≥ 15		PASS
Time of Occupancy	§15.247(a)(1)(iii)	<400 ms		PASS
Conducted Spurious Emissions	§15.247(d)	> 20 dB for all out-of band emissions		PASS
Band Edge(Out of Band Emissions)	§15.247(d)	> 20 dB for all out-of band emissions		PASS
AC Power line Conducted Emissions	§15.207(a)	cf. Section 8.7		PASS
Radiated Spurious Emissions	§15.247(d), 15.205, 15.209	cf. Section 8.6.2	RADIATED	PASS
Radiated Restricted Band Edge	§15.247(d), 15.205, 15.209	cf. Section 8.6.3		PASS

8. FCC PART 15.247 REQUIREMENTS

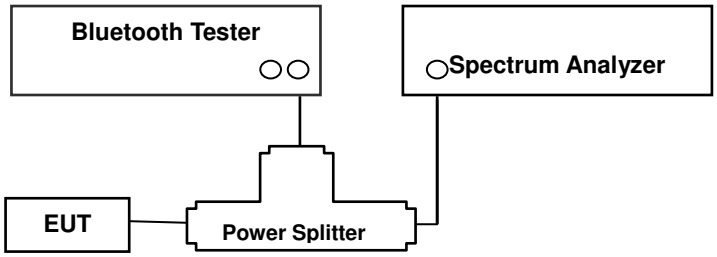
8.1 PEAK POWER

LIMIT

The maximum peak output power of the intentional radiator shall not exceed the following:

1. For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 W. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 W.
2. The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi.

Test Configuration



TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer. The Spectrum Analyzer is set to the peak detector mode. This test is performed with hopping off.

The Spectrum Analyzer is set to (7.8.5 in ANSI 63.10-2013)

1) Span: approximately 5 times the 20 dB bandwidth, centered on a hopping channel
2) RBW > the 20 dB bandwidth of the emission being measured
3) VBW ≥ RBW
4) Sweep = Auto
5) Detector = Peak
6) Trace = Max hold

SAMPLE CALCULATION

Output Power = Spectrum Reading Power + Power Splitter loss + Cable loss(2 ea)

= 10 dBm + 6 dB + 1.5 dB = 17.5 dBm

Note :

1. Spectrum reading values are not plot data. The power results in plot is already including the actual values of loss for the splitter and cable combination.
2. Spectrum offset = Power Splitter loss + Cable loss

3. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB. Actual value of loss for the splitter and cable combination is 7.36 dB at 2402 MHz and is 7.44 dB at 2480 MHz.
So, 7.4 dB is offset. And the offset gap in the 2.4 GHz range do not affect the conducted peak power final result

TEST RESULTS

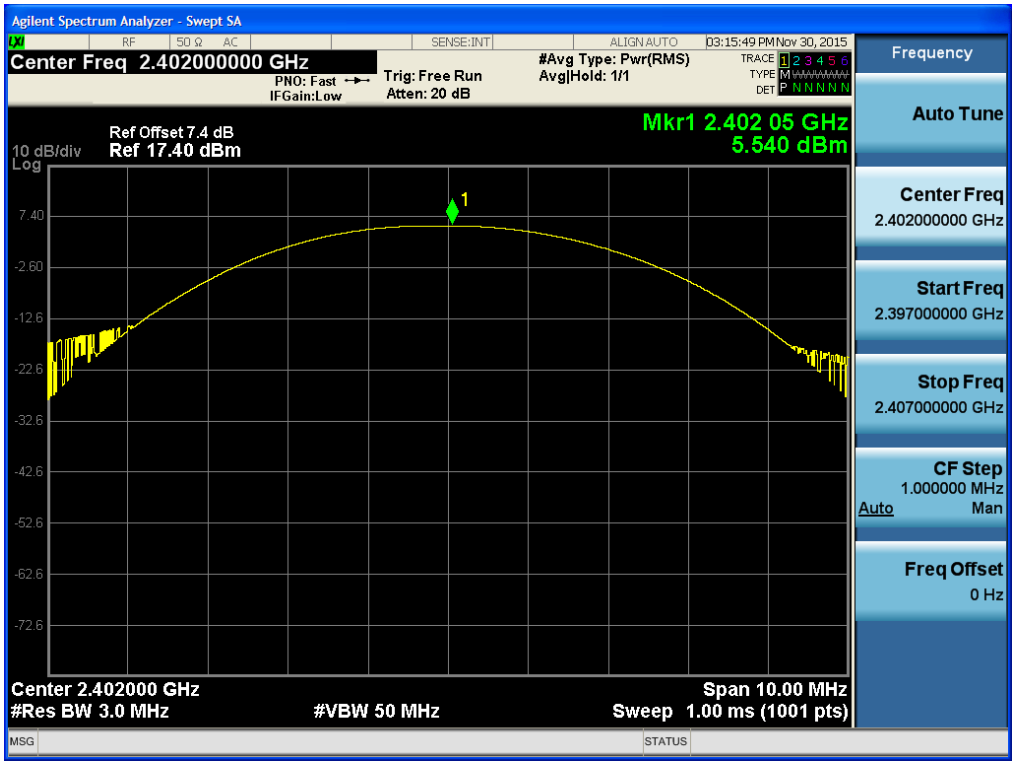
No non-compliance noted

Test Data

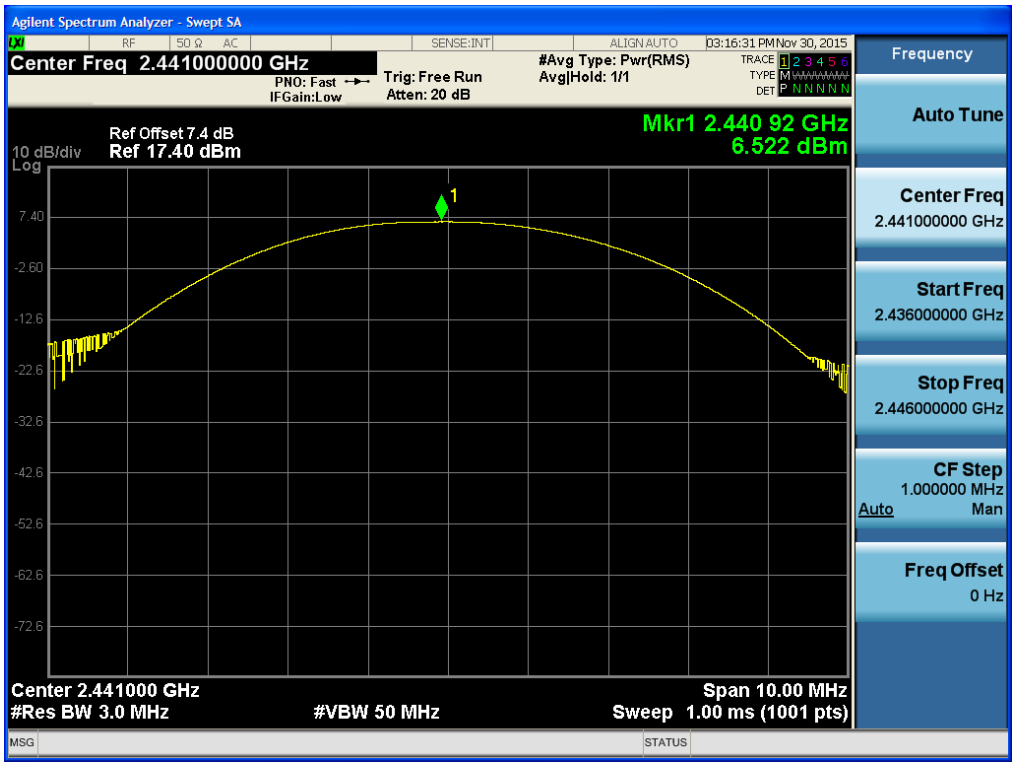
Channel	Frequency (MHz)	Output Power (GFSK)		Limit (mW)	Result
		(dBm)	(mW)		
Low	2402	5.540	3.581	125	PASS
Mid	2441	6.522	4.490		PASS
High	2480	6.658	4.632		PASS

Channel	Frequency (MHz)	Output Power (8DPSK)		Output Power (π/4DQPSK)		Limit (mW)	Result
		(dBm)	(mW)	(dBm)	(mW)		
Low	2402	4.960	3.133	4.869	3.068	125	PASS
Mid	2441	5.990	3.972	5.886	3.878		PASS
High	2480	6.079	4.054	5.964	3.948		PASS

Test Plots (GFSK)
Peak Power (Low-CH)

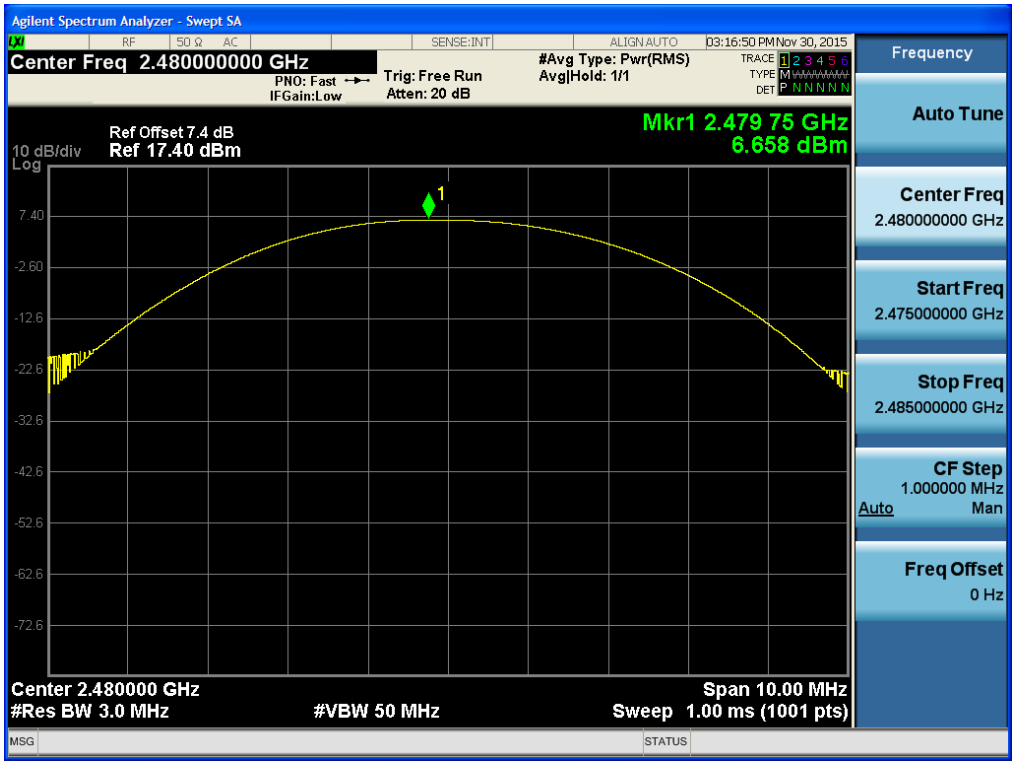


Test Plots (GFSK)
Peak Power (Mid-CH)



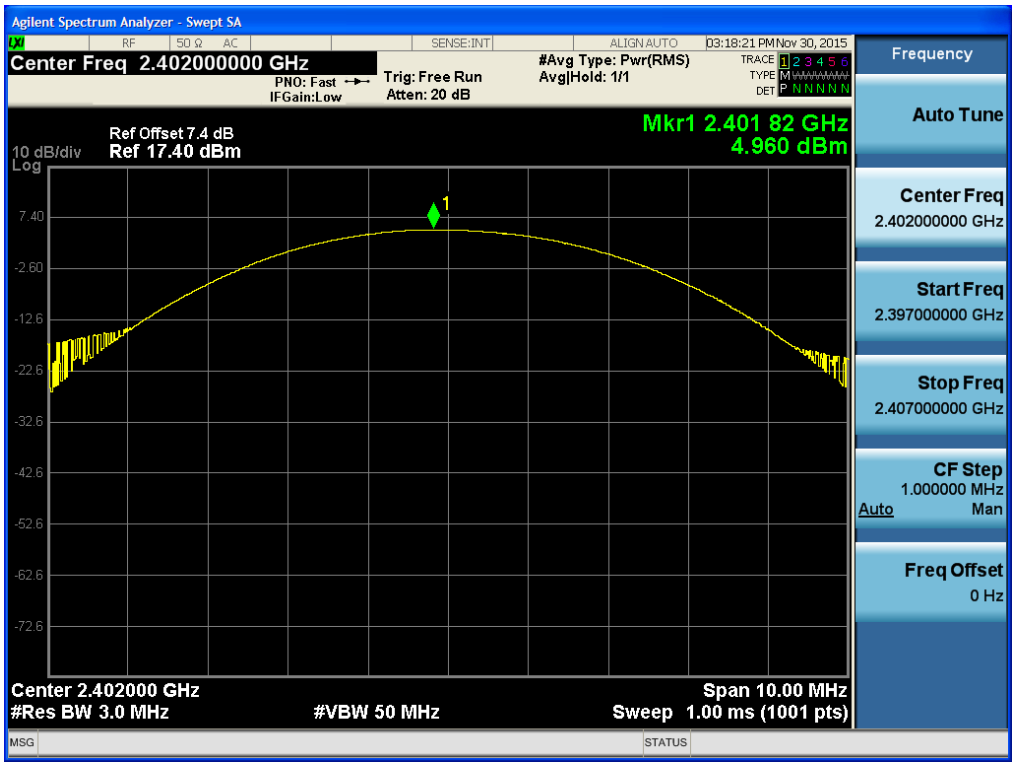
Test Plots (GFSK)

Peak Power (High-CH)

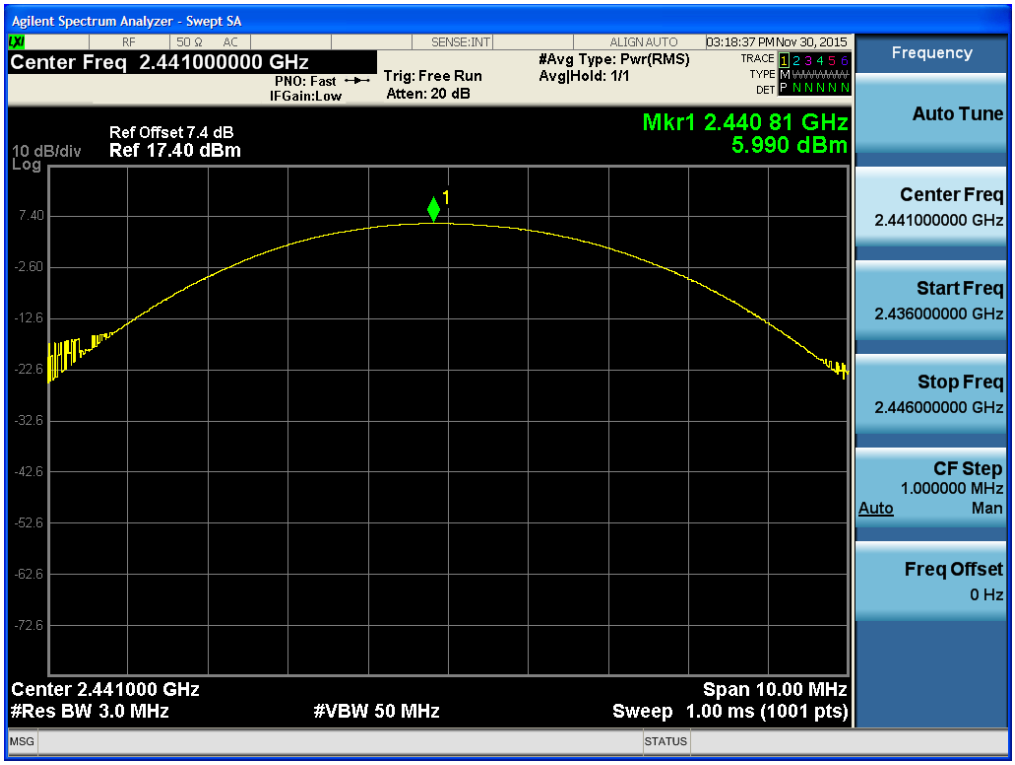


Test Plots (8DPSK)

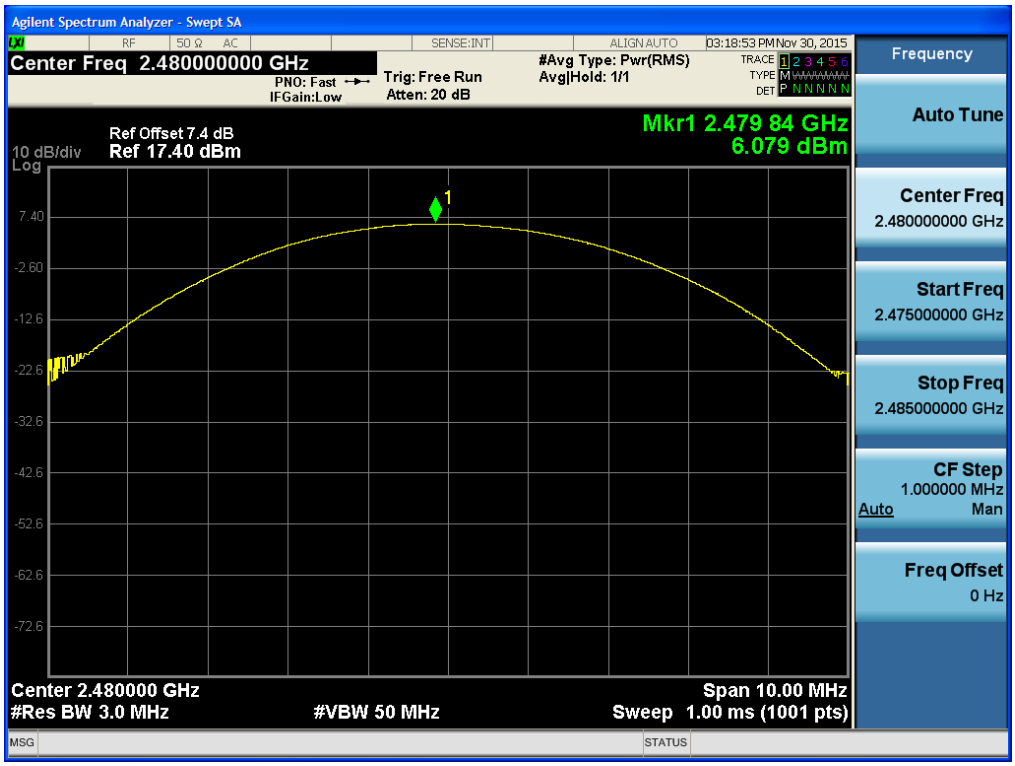
Peak Power (Low-CH)



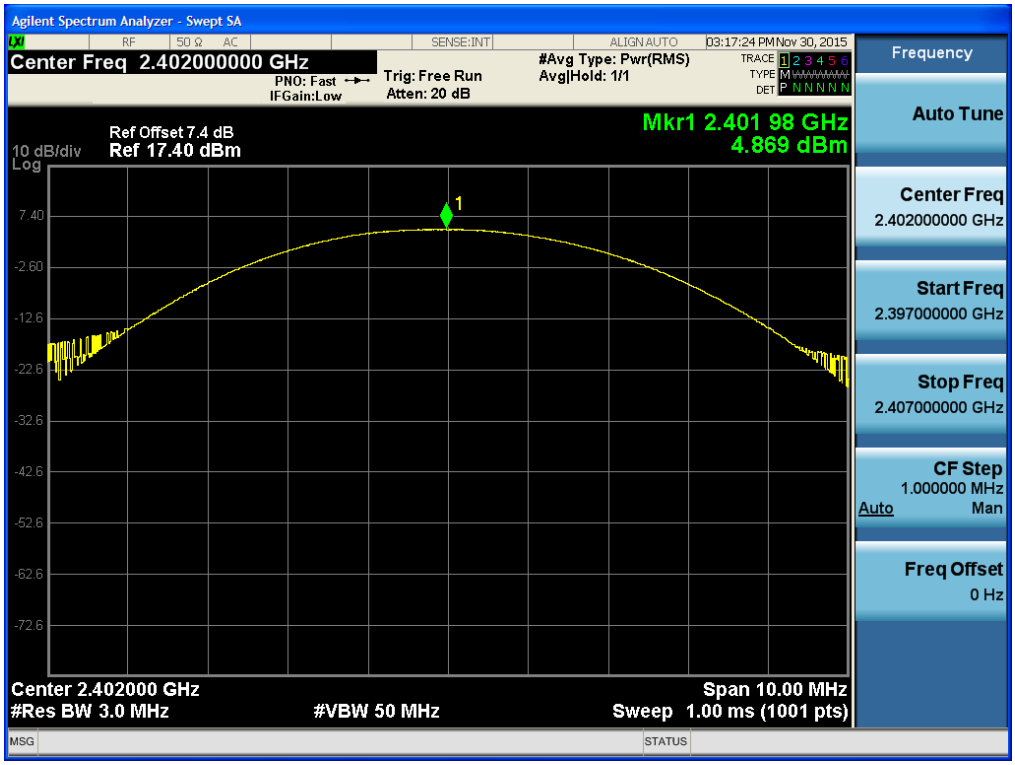
Test Plots (8DPSK)
Peak Power (Mid-CH)



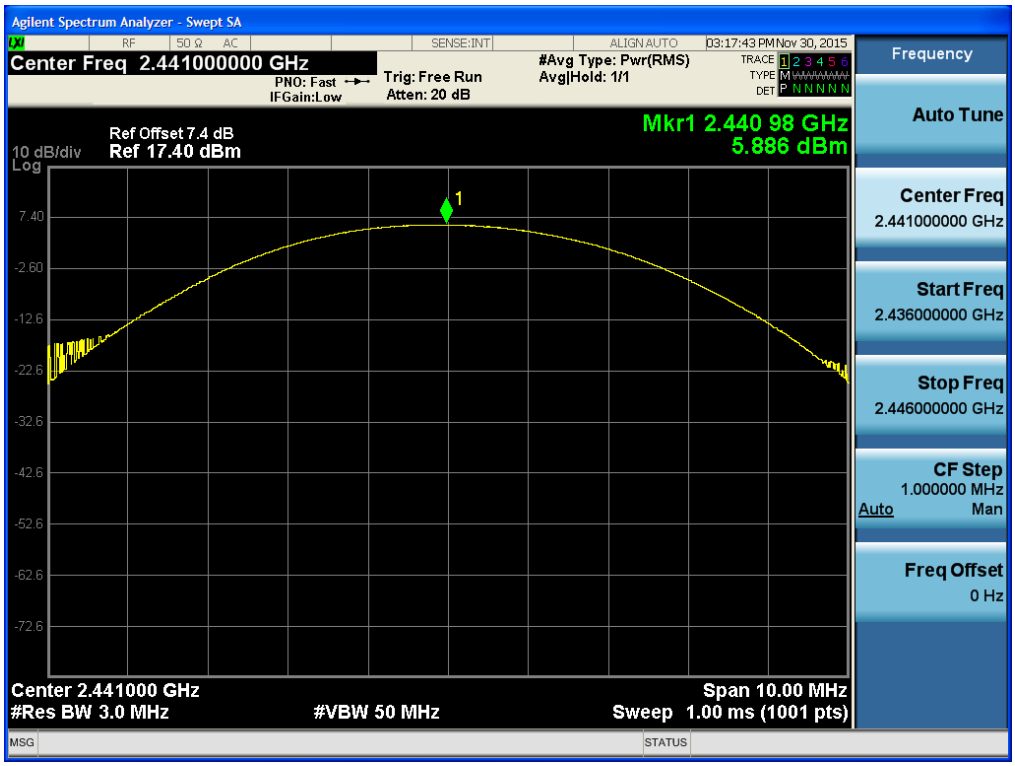
Test Plots (8DPSK)
Peak Power (High-CH)



Test Plots (π/4DQPSK)
Peak Power (Low-CH)

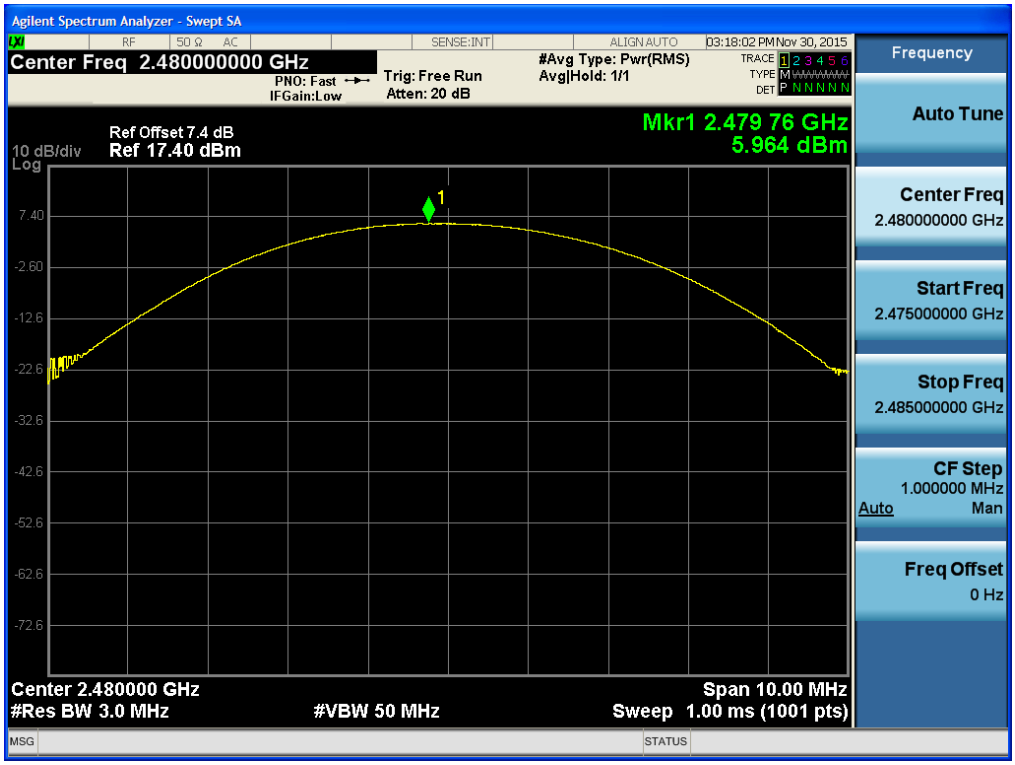


Test Plots (π/4DQPSK)
Peak Power (Mid-CH)



Test Plots (π/4DQPSK)

Peak Power (High-CH)

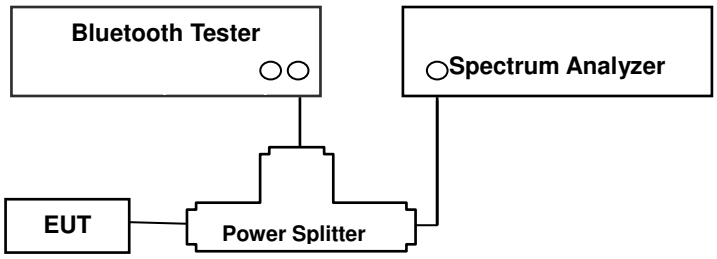


8.2 BAND EDGES

LIMIT

According to §15.247(d), in any 100 kHz 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 dB below that in the 100 kHz 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.

Test Configuration



TEST PROCEDURE

This test is performed with hopping off and hopping on.

The Spectrum Analyzer is set to (6.10.4 in ANSI 63.10-2013)

1) Span: Wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation
2) Reference level: As required to keep the signal from exceeding the maximum instrument input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level.
3) Attenuation: Auto (at least 10 dB preferred).
4) Sweep time: Coupled.
5) RBW: 100 kHz
6) VBW: 300 kHz
7) Detector: Peak
8) Trace: Max hold

TEST RESULTS

See attached.

Note :

1. The results in plot is already including the actual values of loss for the splitter and cable combination.
2. Spectrum offset = Power Splitter loss + Cable loss
3. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB. Actual value of loss for the splitter and cable combination is 7.36 dB at 2402 MHz and is 7.44 dB at 2480 MHz. So, 7.4 dB is offset. And the offset gap in the 2.4 GHz range do not affect the band edge measurement final result.

Test Data

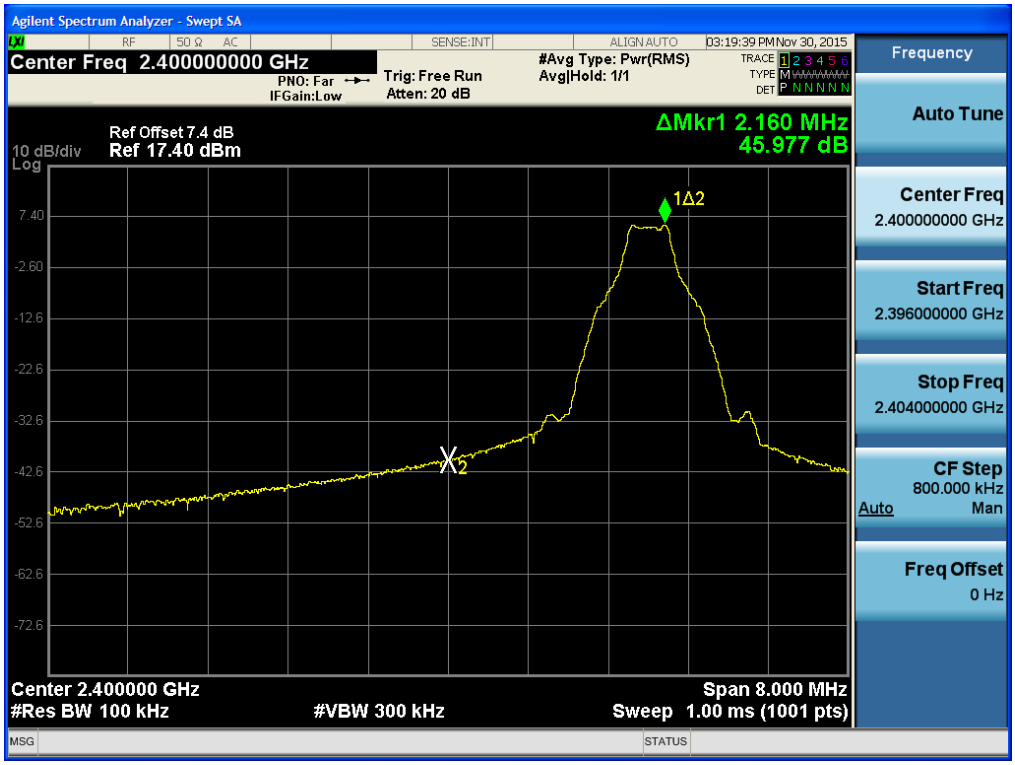
- Without hopping

Outside Frequency Band	GFSK (dB)	8DPSK (dB)	π/4DQPSK (dB)	Limit (dBc)	Margin GFSK (dBc)	Margin 8DPSK (dBc)	Margin π/4DQPSK (dBc)	Result
Lower	45.977	44.741	44.624	20	25.977	24.741	24.624	PASS
Upper	57.519	55.579	55.744		37.519	35.579	35.744	PASS

- With hopping

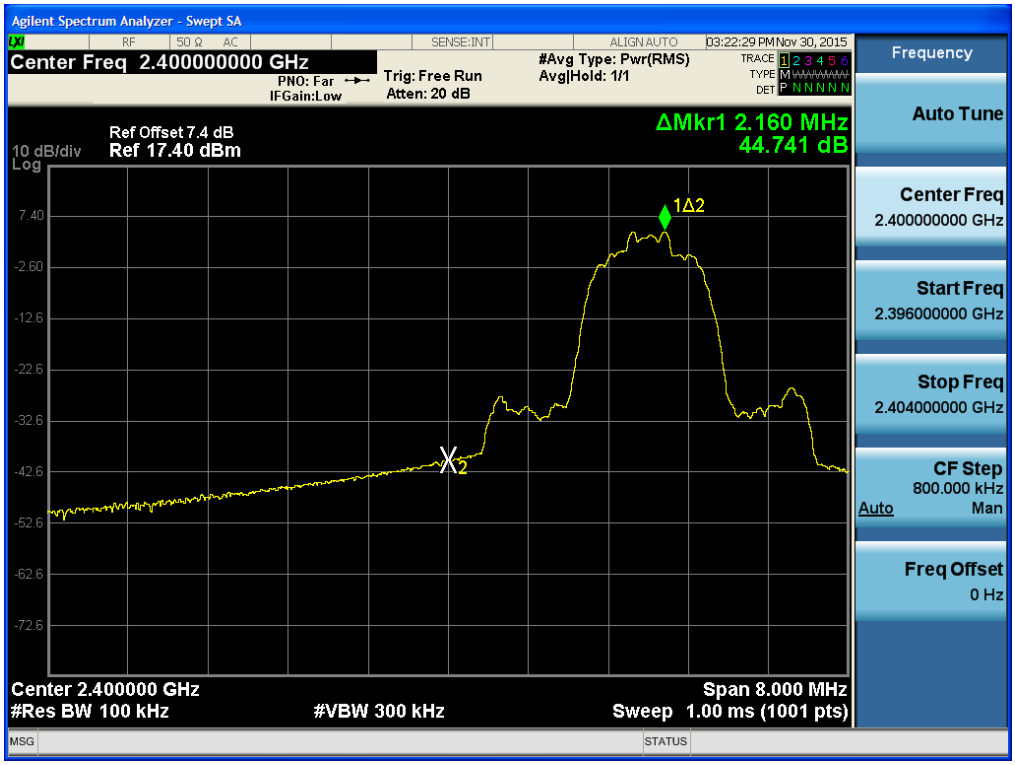
Outside Frequency Band	GFSK (dB)	8DPSK (dB)	π/4DQPSK (dB)	Limit (dBc)	Margin GFSK (dBc)	Margin 8DPSK (dBc)	Margin π/4DQPSK (dBc)	Result
Lower	46.345	48.653	47.505	20	26.345	28.653	27.505	PASS
Upper	57.372	54.606	55.918		37.372	34.606	35.918	PASS

Test Plots without hopping (GFSK)
Band Edges (Low-CH)



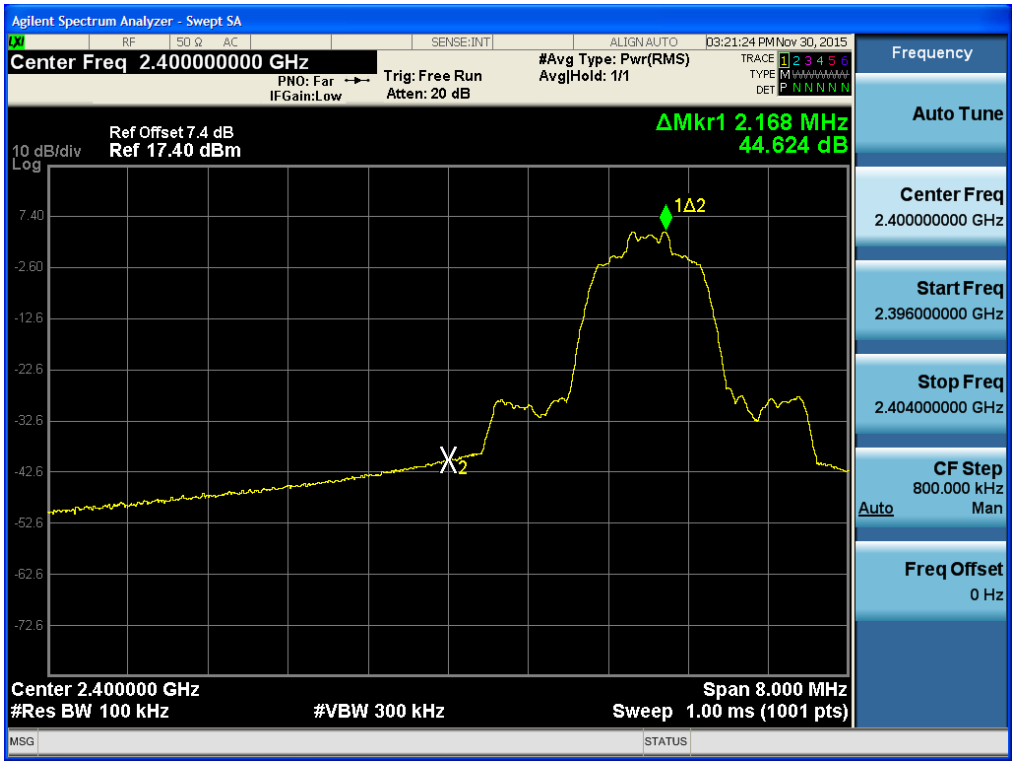
Test Plots without hopping (GFSK)
Band Edges (High-CH)

Test Plots without hopping (8DPSK)
Band Edges (Low-CH)



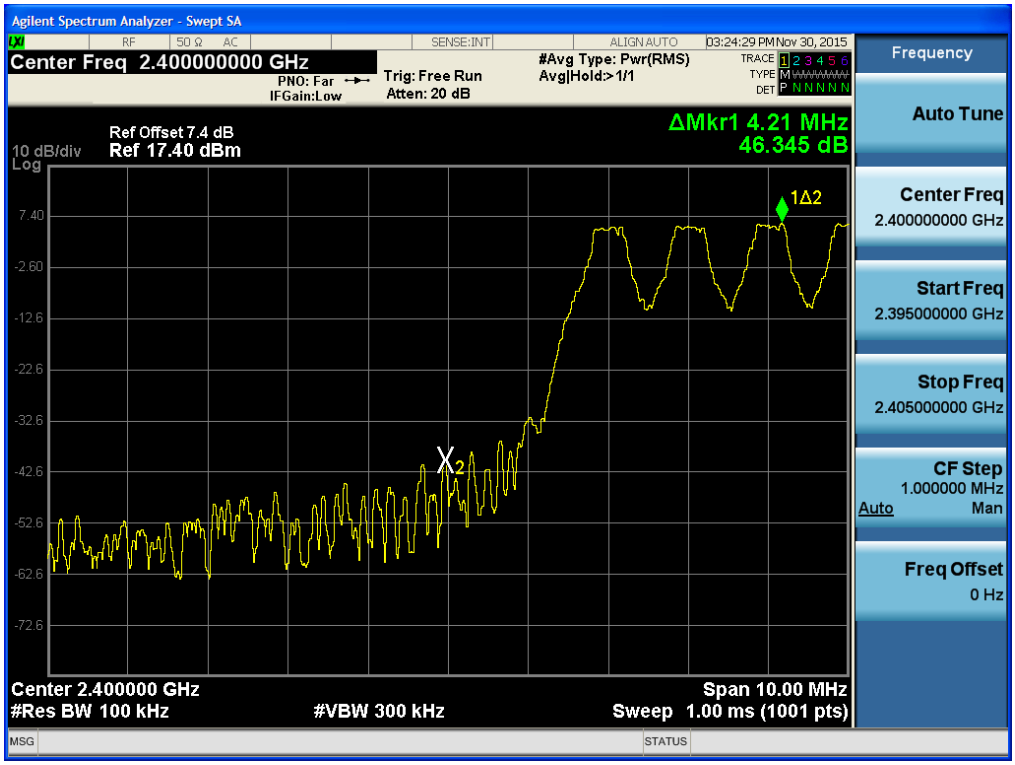
Test Plots without hopping (8DPSK)
Band Edges (High-CH)

Test Plots without hopping (π/4DQPSK)
Band Edges (Low-CH)

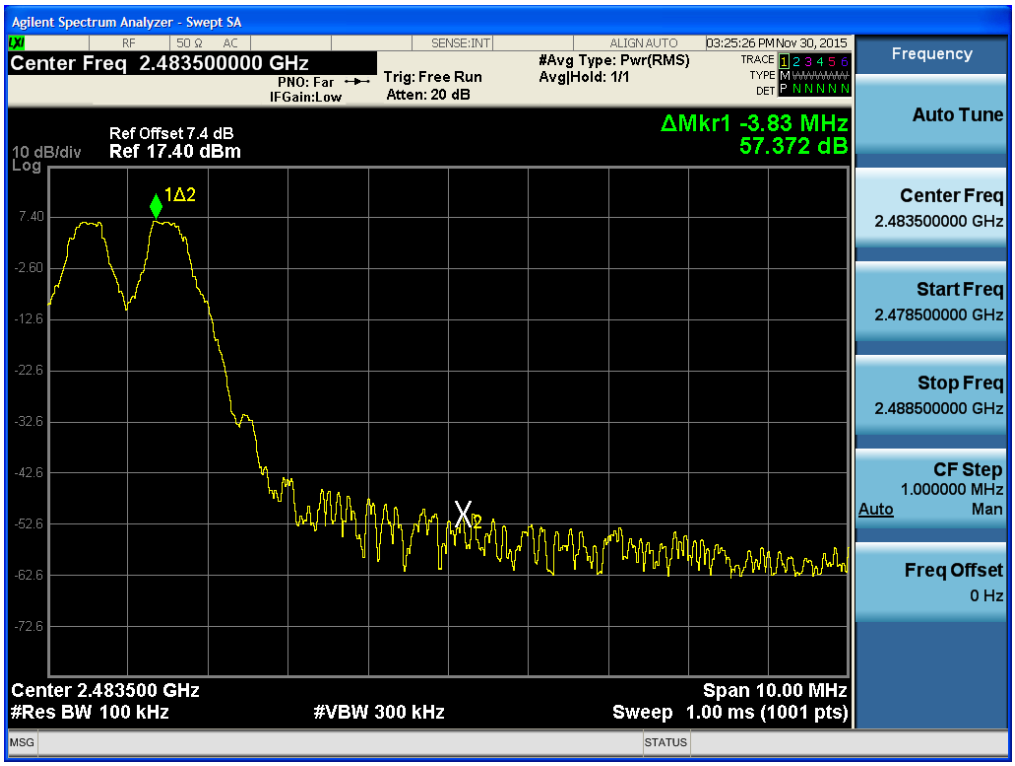


Test Plots without hopping (π/4DQPSK)
Band Edges (High-CH)

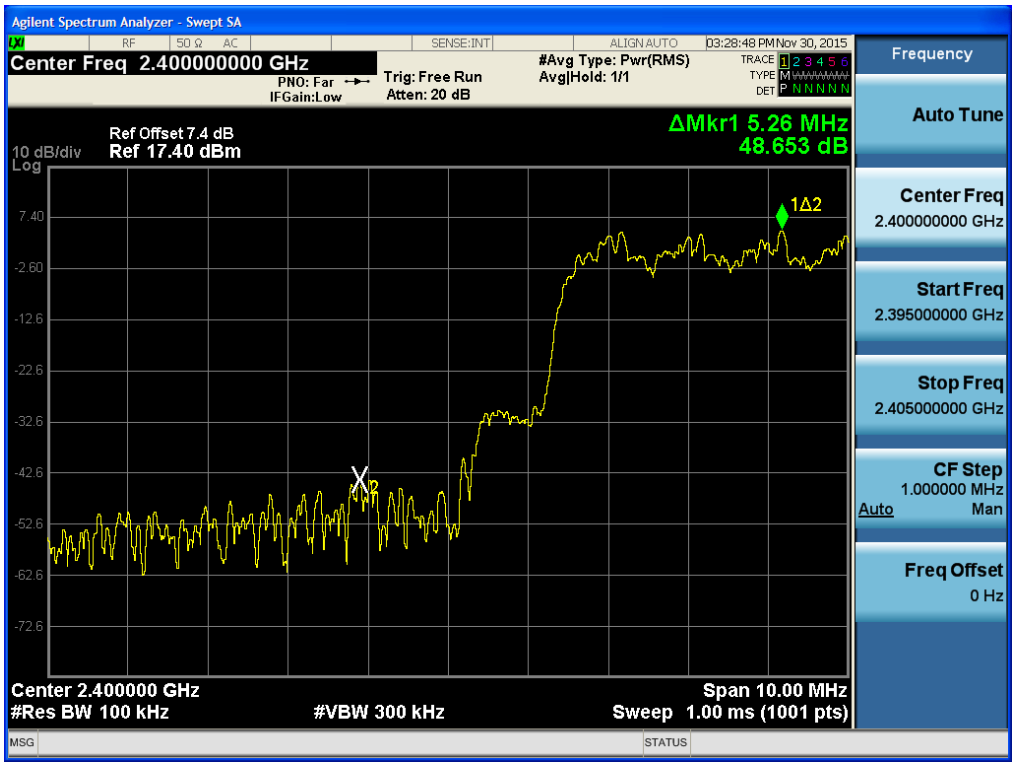
Test Plots with hopping (GFSK)
Band Edges (Low-CH)



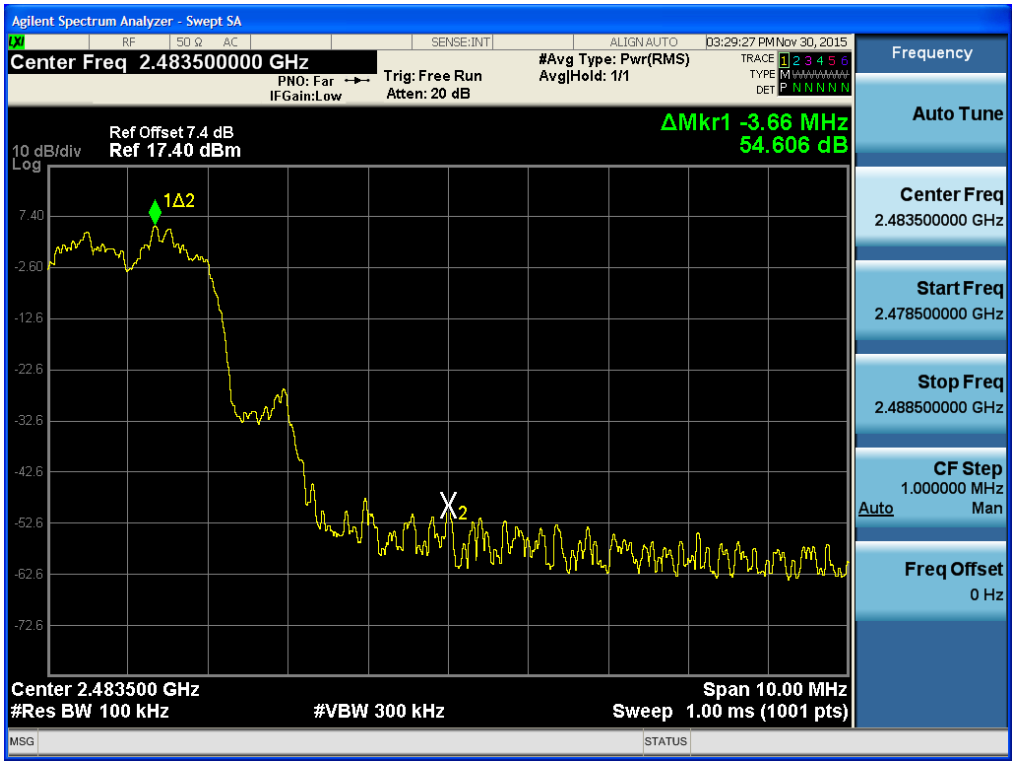
Test Plots with hopping (GFSK)
Band Edges (High-CH)



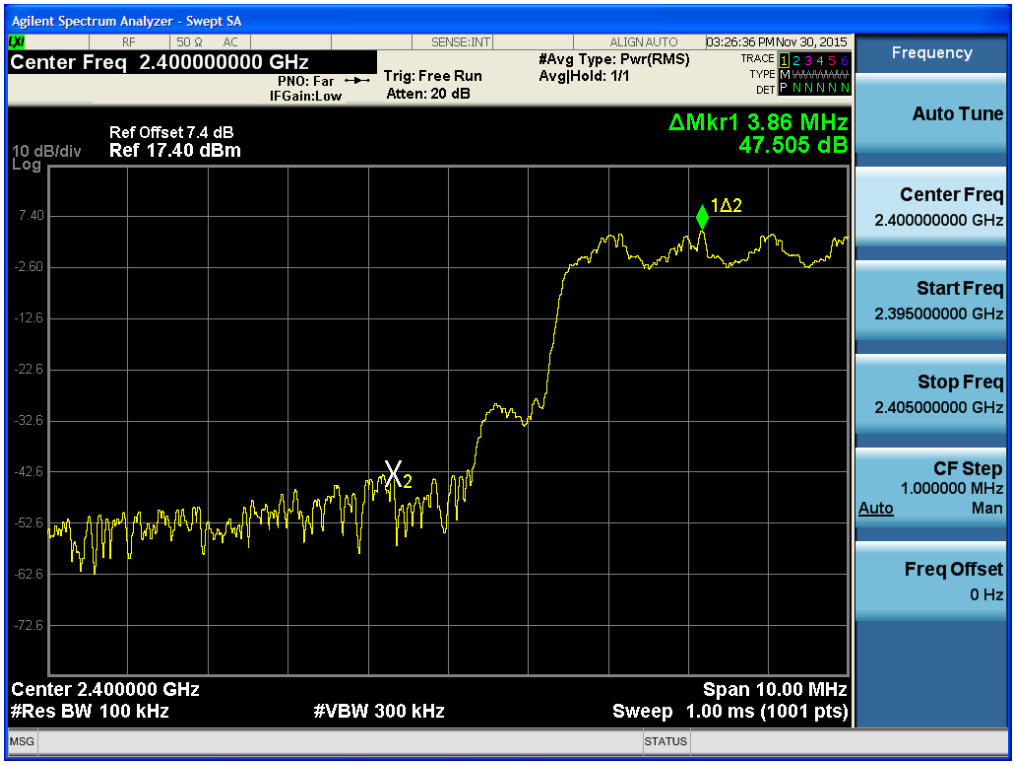
Test Plots with hopping (8DPSK)
Band Edges (Low-CH)



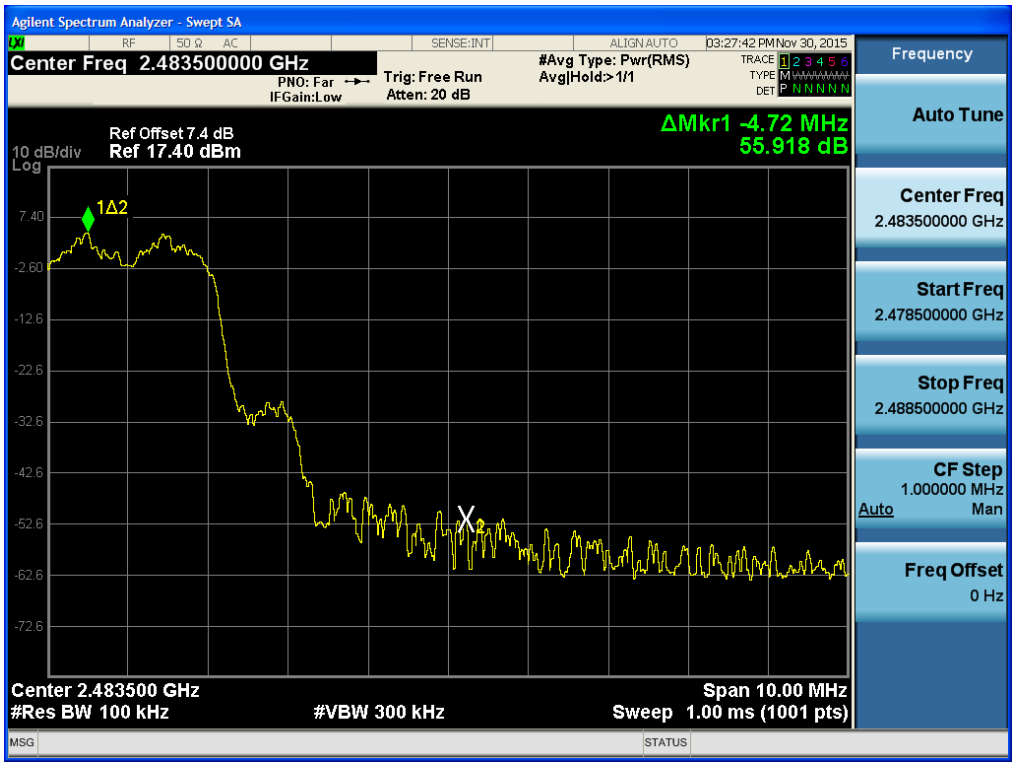
Test Plots with hopping (8DPSK)
Band Edges (High-CH)



Test Plots with hopping (π/4DQPSK)
Band Edges (Low-CH)



Test Plots with hopping (π/4DQPSK)
Band Edges (High-CH)

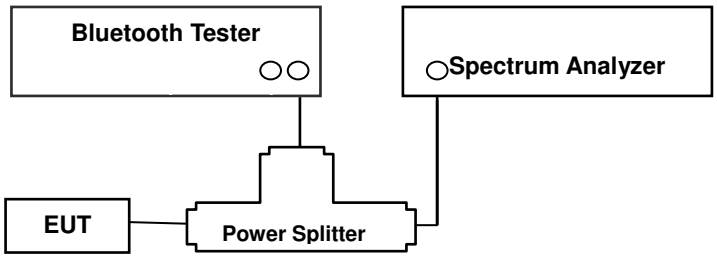


8.3 FREQUENCY SEPARATION / OCCUPIED BANDWIDTH (99% BW)

LIMIT

According to §15.247(a)(1), 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.

Test Configuration



TEST PROCEDURE

The Channel Separation test is performed with hopping on. And the 20 dB Bandwidth test is performed with hopping off.

The Spectrum Analyzer is set to (7.8.2 in ANSI 63.10-2013)

1) Span: Wide enough to capture the peaks of two adjacent channels
2) RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
3) VBW ≥ RBW
4) Sweep: Auto
5) Detector: Peak
6) Trace: Max hold
7) All the trace to stabilize.

Use the marker-delta function to determine the separation between the peaks of the adjacent channels. Compliance of an EUT with the appropriate regulatory limit shall be determined. A plot of the data shall be included in the test report.

TEST RESULTS

No non-compliance noted

Test Data

Channel Separation (kHz)			20dB Bandwidth (kHz)				Limit (kHz)	Result
GFSK	8DPSK	π/4DQPSK	Channel	GFSK	8DPSK	π/4DQPSK		
999	996	996	Low CH	1033.0	1281.0	1279.0	>25 or >2/3 of the 20dB BW	Pass
			Middle CH	1036.0	1303.0	1289.0		
			High CH	1040.0	1301.0	1288.0		

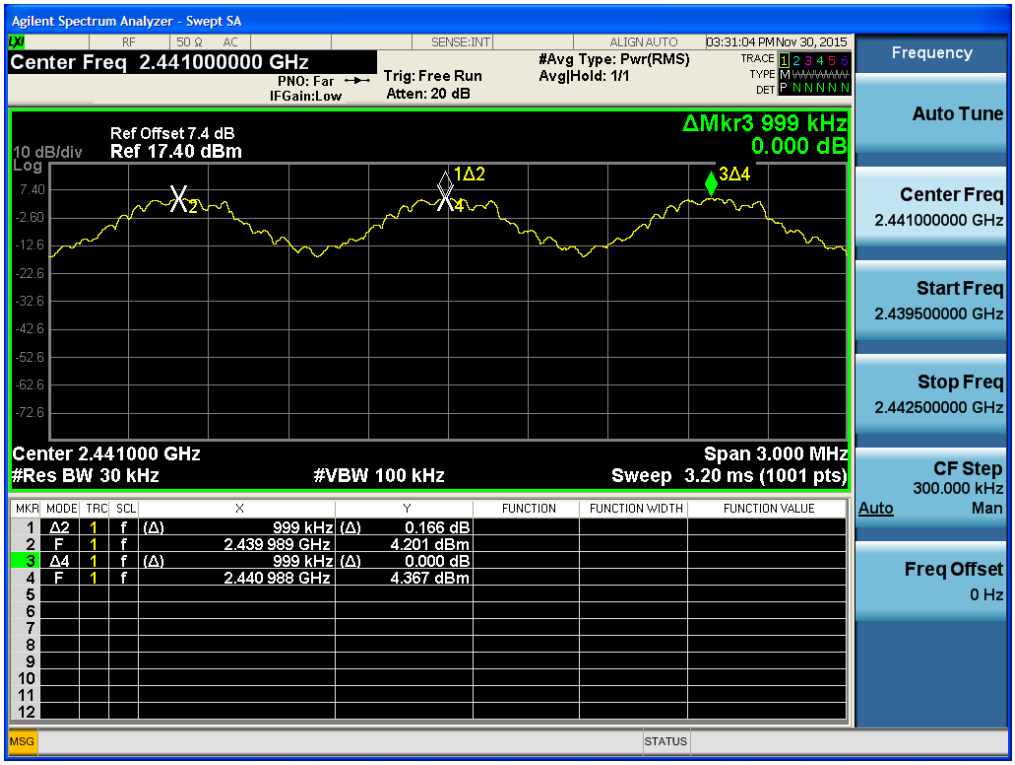
Occupied Bandwidth (99% BW)

99% BW (kHz)			
Channel	GFSK	8DPSK	π/4DQPSK
Low CH	896.74	1170.90	1171.30
Middle CH	898.26	1192.00	1180.40
High CH	901.49	1186.10	1175.10

Note : We can not know what use channel in AFH mode. So, we can not test in AFH mode. Also, if the test performs some channel in AFH mode, the test result is not different with normal mode.

Test Plots (GFSK)

Channel Separation

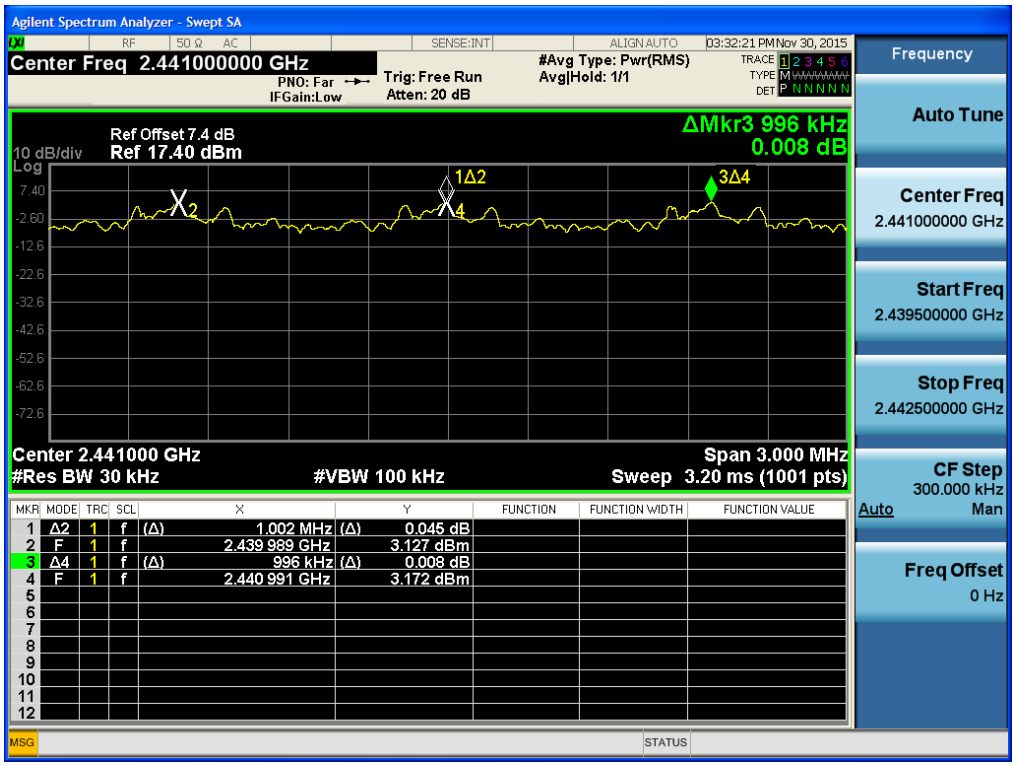


Test Plots (8DPSK)

Channel Separation

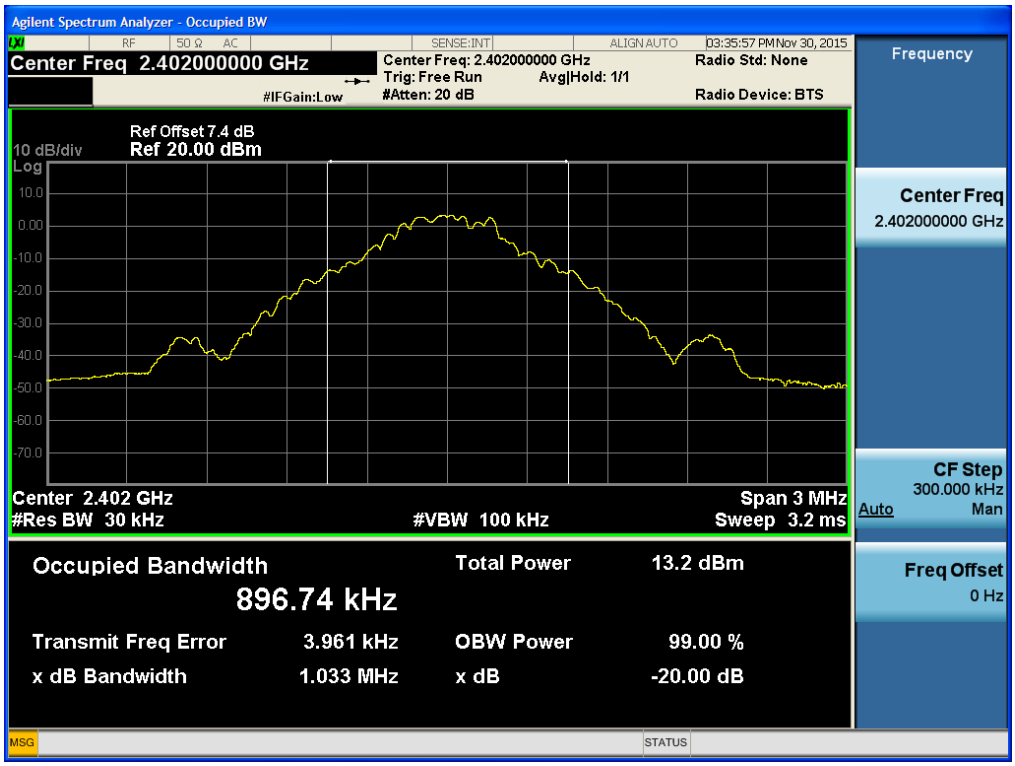
Test Plots (π/4DQPSK)

Channel Separation



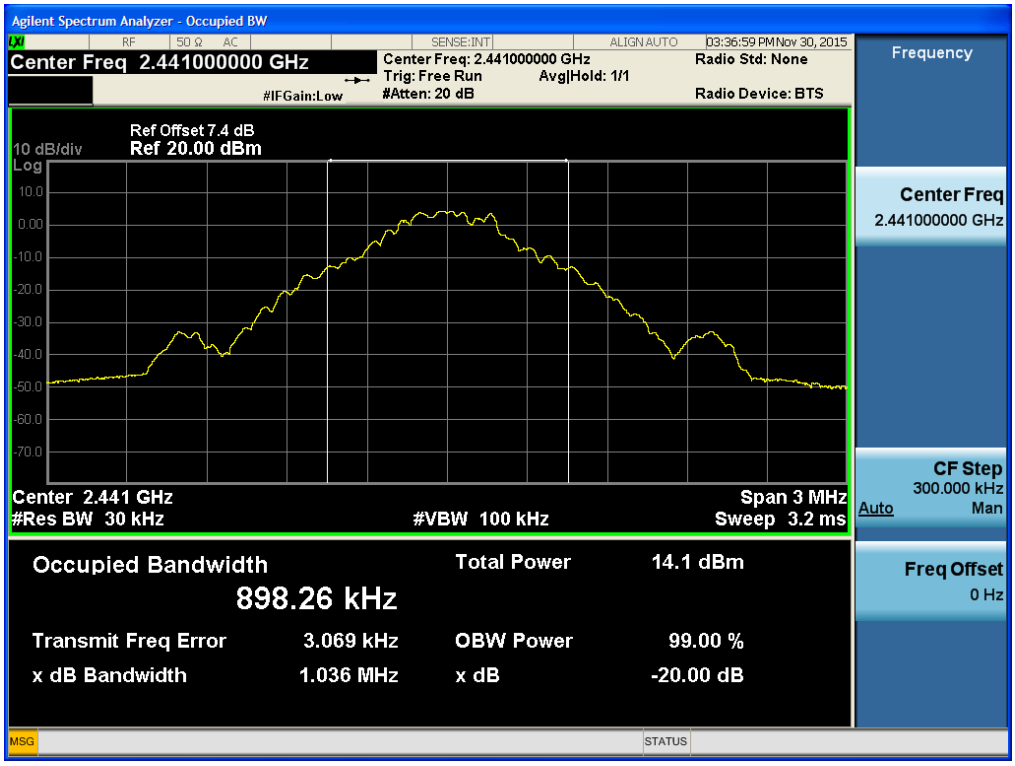
Test Plots (GFSK)

20 dB Bandwidth & Occupied Bandwidth (Low-CH)



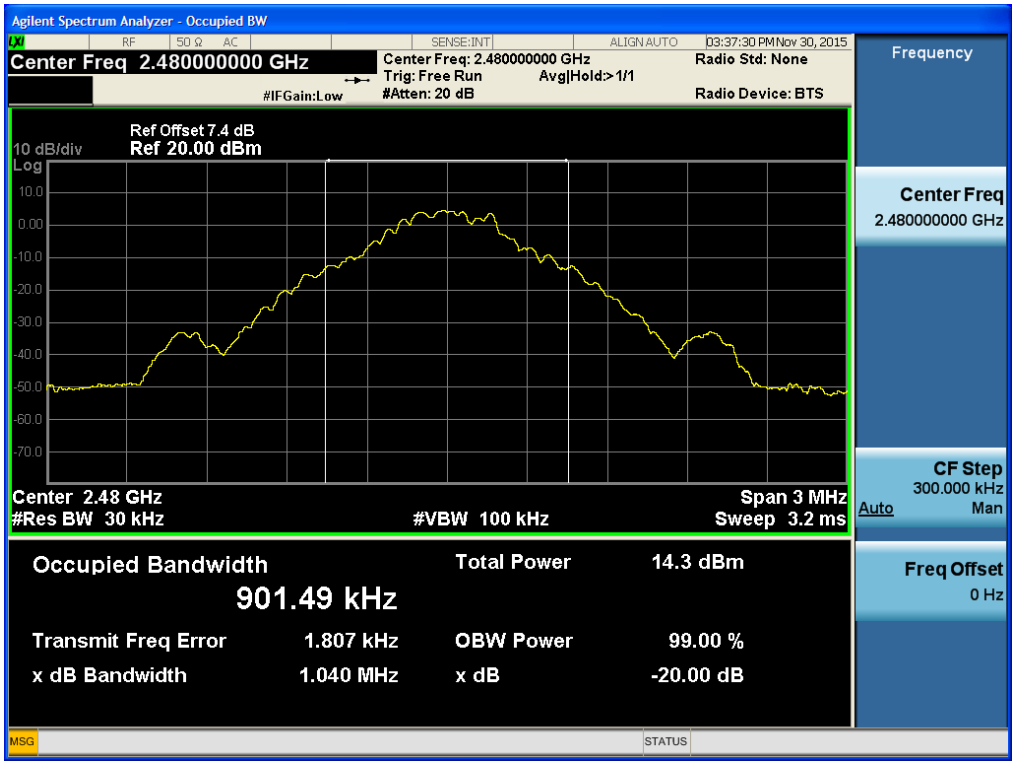
Test Plots (GFSK)

20 dB Bandwidth & Occupied Bandwidth (Mid-CH)



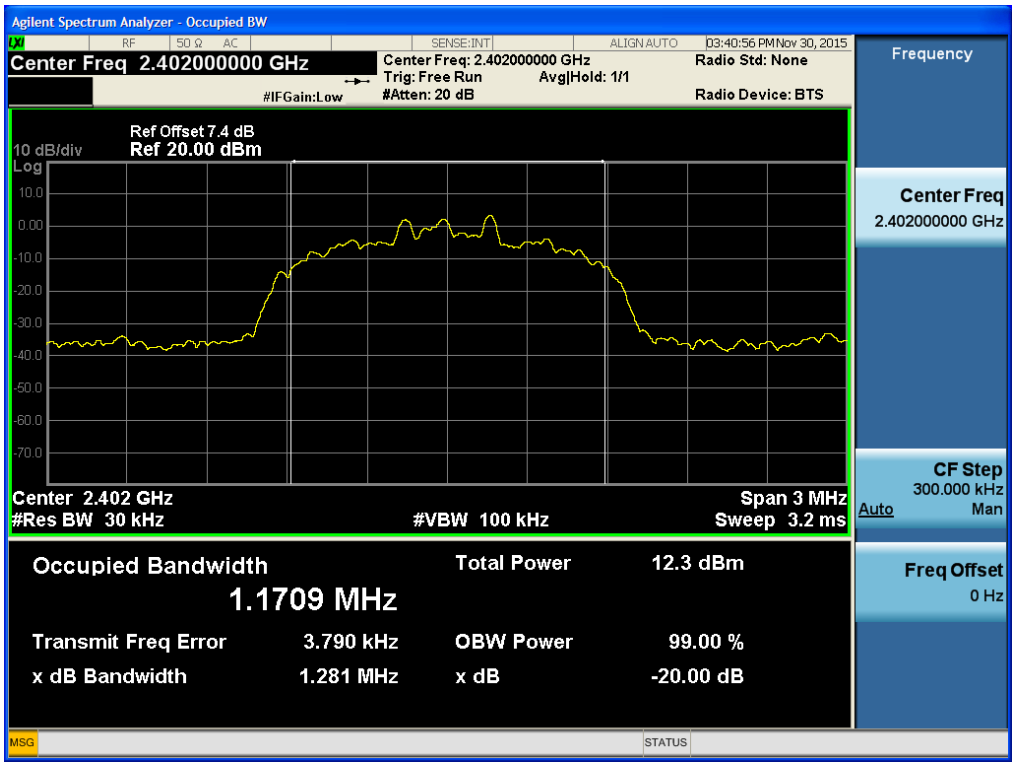
Test Plots (GFSK)

20 dB Bandwidth & Occupied Bandwidth (High-CH)



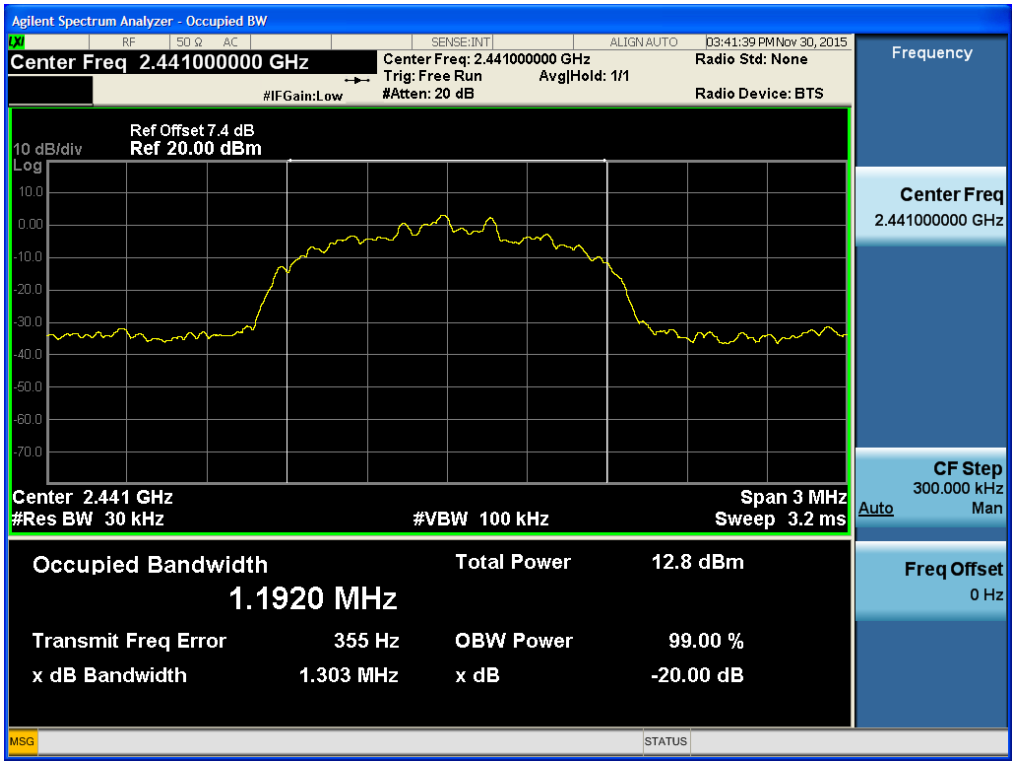
Test Plots (8DPSK)

20 dB Bandwidth & Occupied Bandwidth (Low-CH)



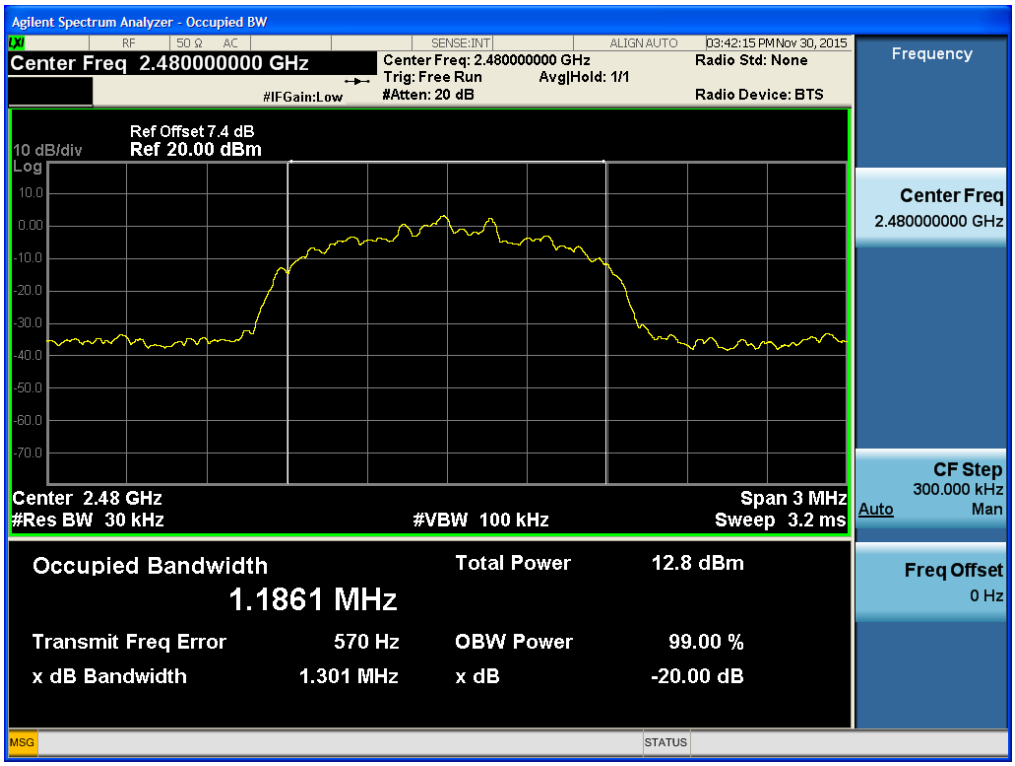
Test Plots (8DPSK)

20 dB Bandwidth & Occupied Bandwidth (Mid-CH)



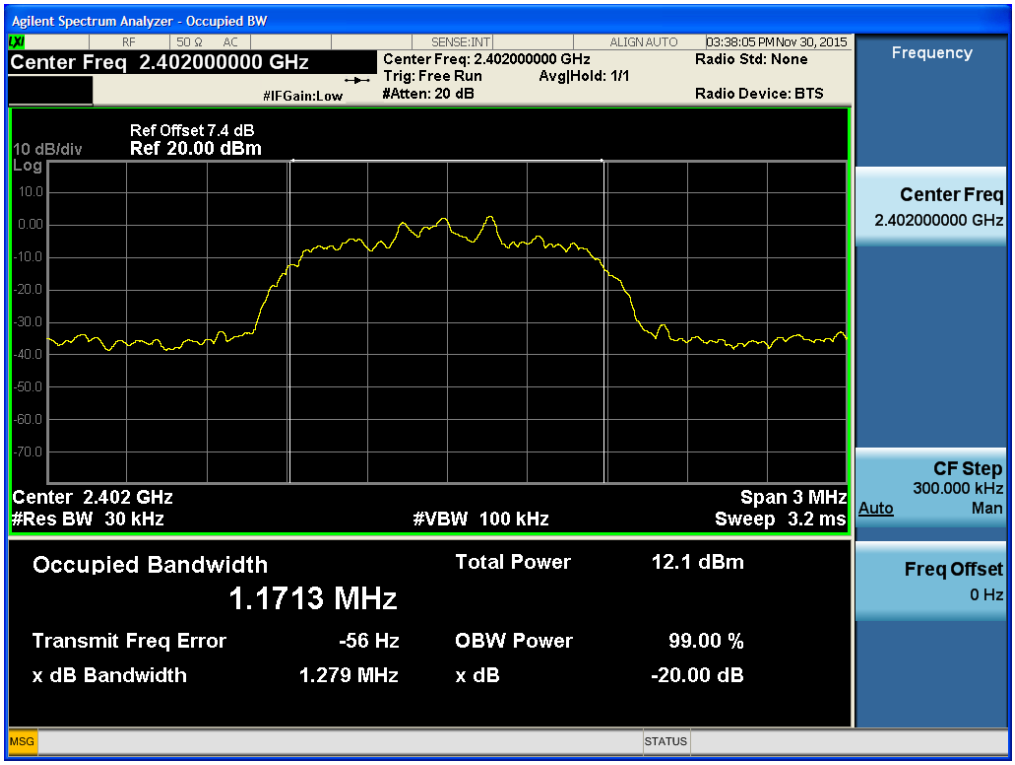
Test Plots (8DPSK)

20 dB Bandwidth & Occupied Bandwidth (High-CH)



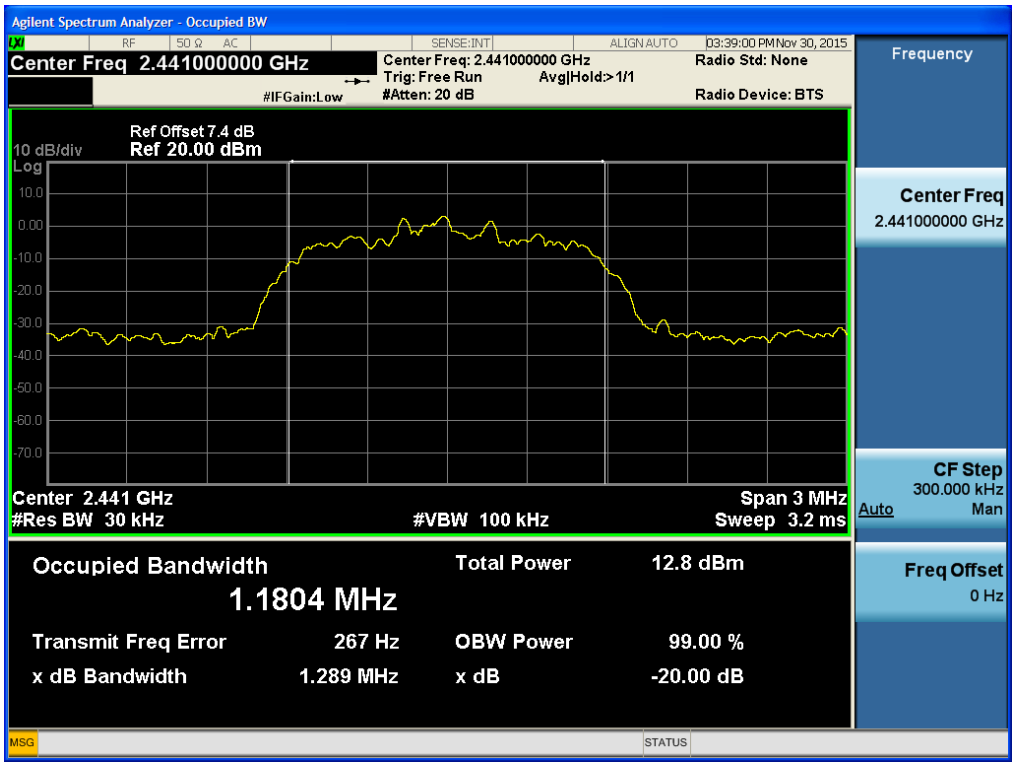
Test Plots (π/4DQPSK)

20 dB Bandwidth & Occupied Bandwidth (Low-CH)



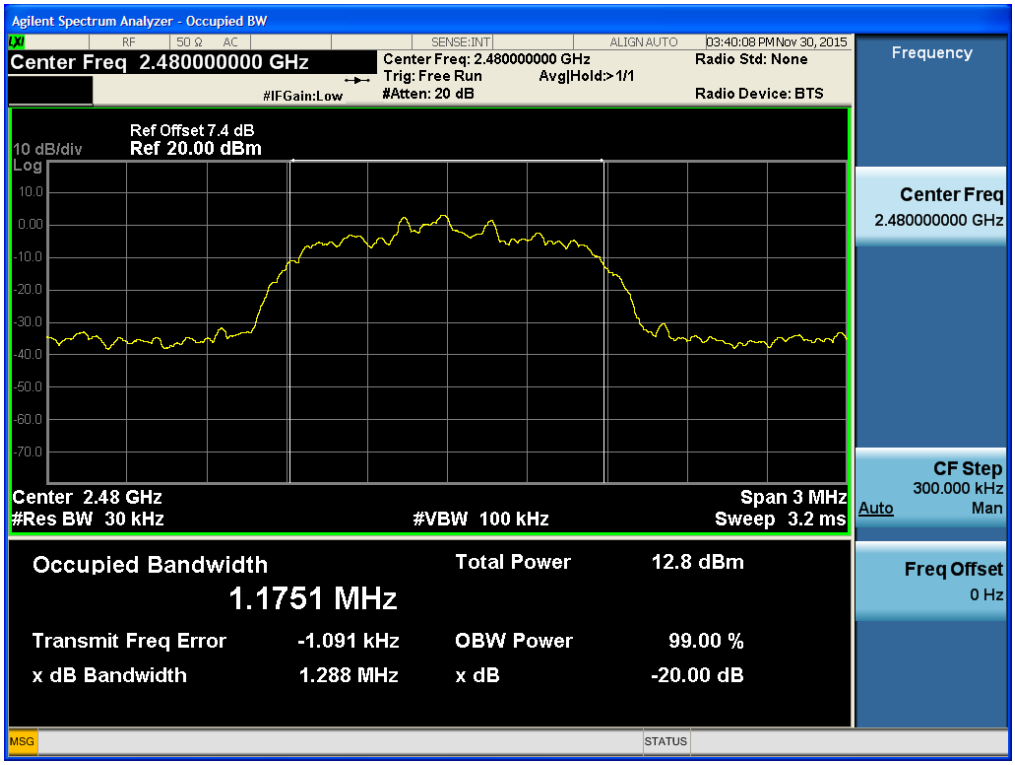
Test Plots (π/4DQPSK)

20 dB Bandwidth & Occupied Bandwidth (Mid-CH)



Test Plots (π/4DQPSK)

20 dB Bandwidth & Occupied Bandwidth (High-CH)

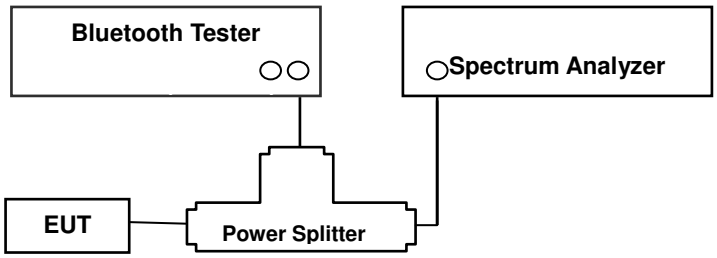


8.4 NUMBER OF HOPPING FREQUENCY

LIMIT

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400 MHz ~ 2483.5 MHz bands shall use at least 15 hopping frequencies.

Test Configuration



TEST PROCEDURE

The Bluetooth frequency hopping function of the EUT was enabled.

The Spectrum Analyzer is set to (7.8.3 in ANSI 63.10-2013)

1) Span: the frequency band of operation
2) RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
3) VBW ≥ RBW
4) Sweep: Auto
5) Detector: Peak
6) Trace: Max hold
7) Allow the trace to stabilize.

TEST RESULTS

No non-compliance noted

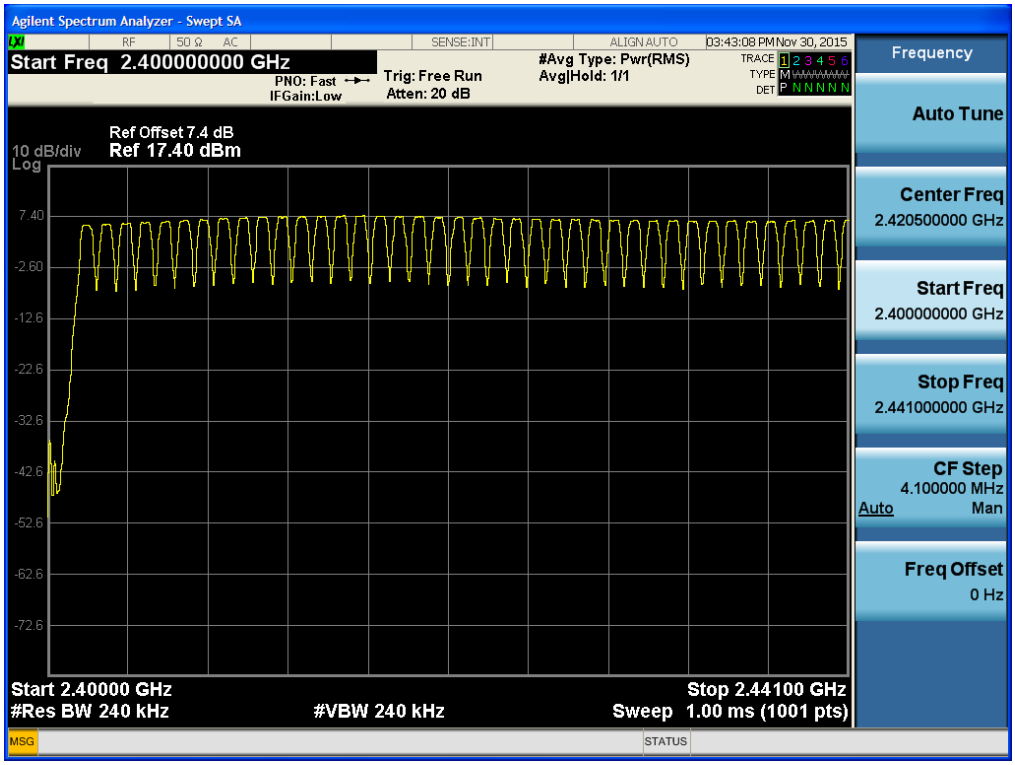
Test Data

Result (No. of CH)			Limit	Result
GFSK	8DPSK	π/4DQPSK		
79	79	79	>15	Pass

Note : In case of AFH mode, minimum number of hopping channels is 20.

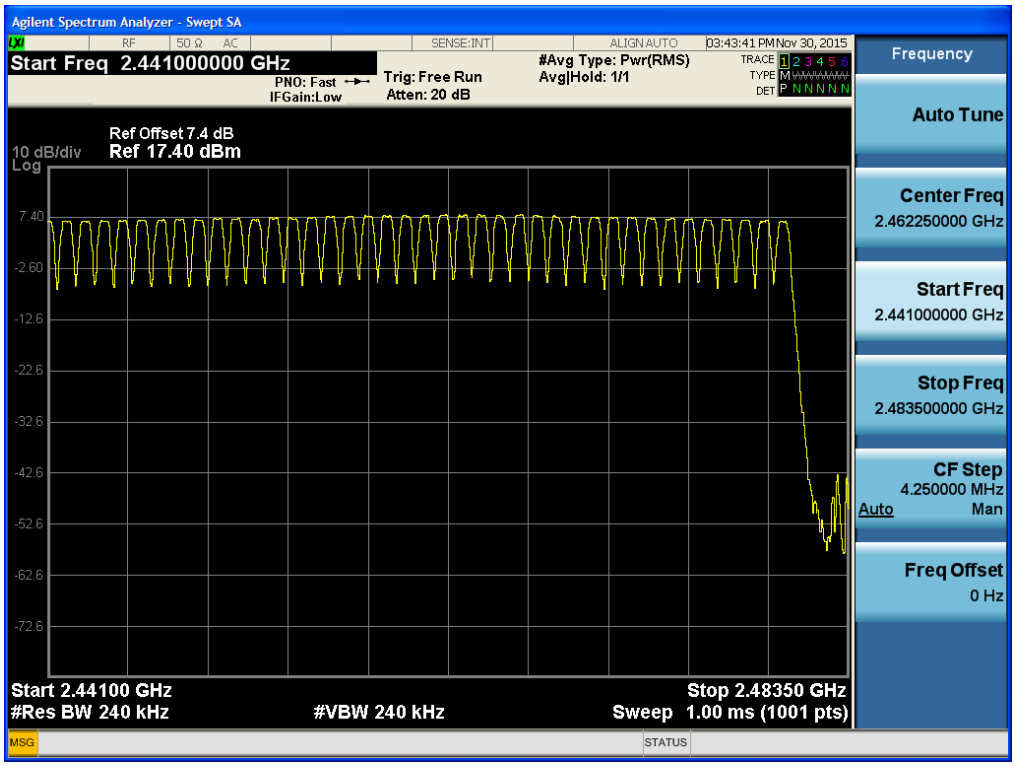
Test Plots (GFSK)

Number of Channels (2.4 GHz - 2.441 GHz)



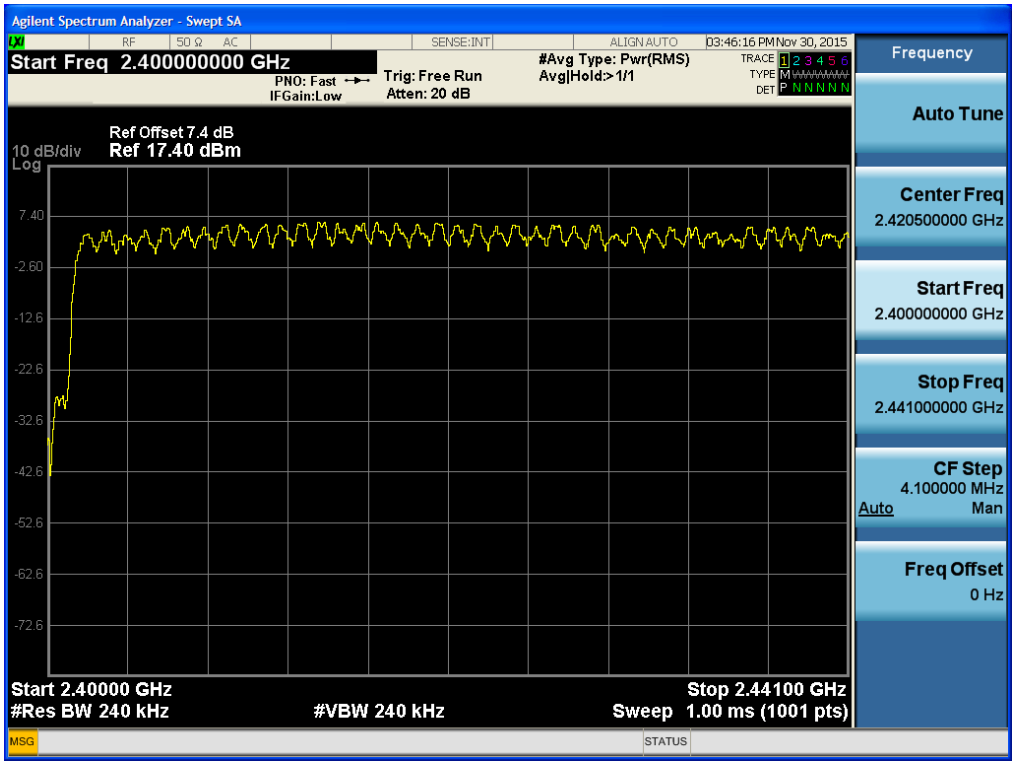
Test Plots (GFSK)

Number of Channels (2.441 GHz - 2.4835 GHz)



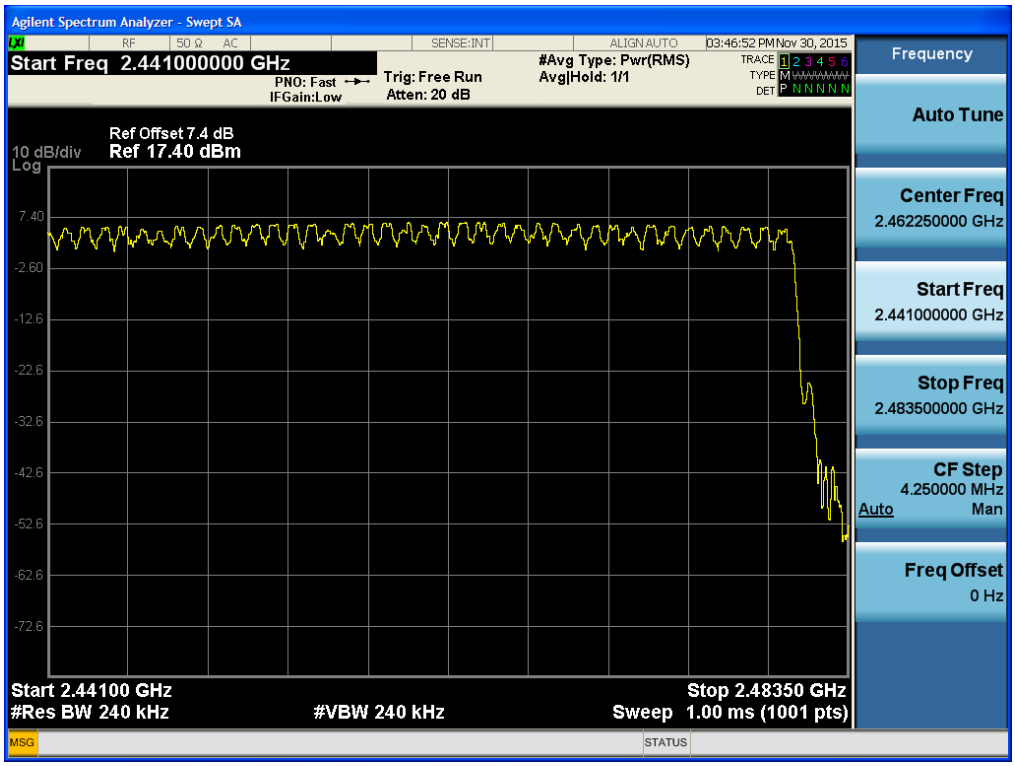
Test Plots (8DPSK)

Number of Channels (2.4 GHz - 2.441 GHz)

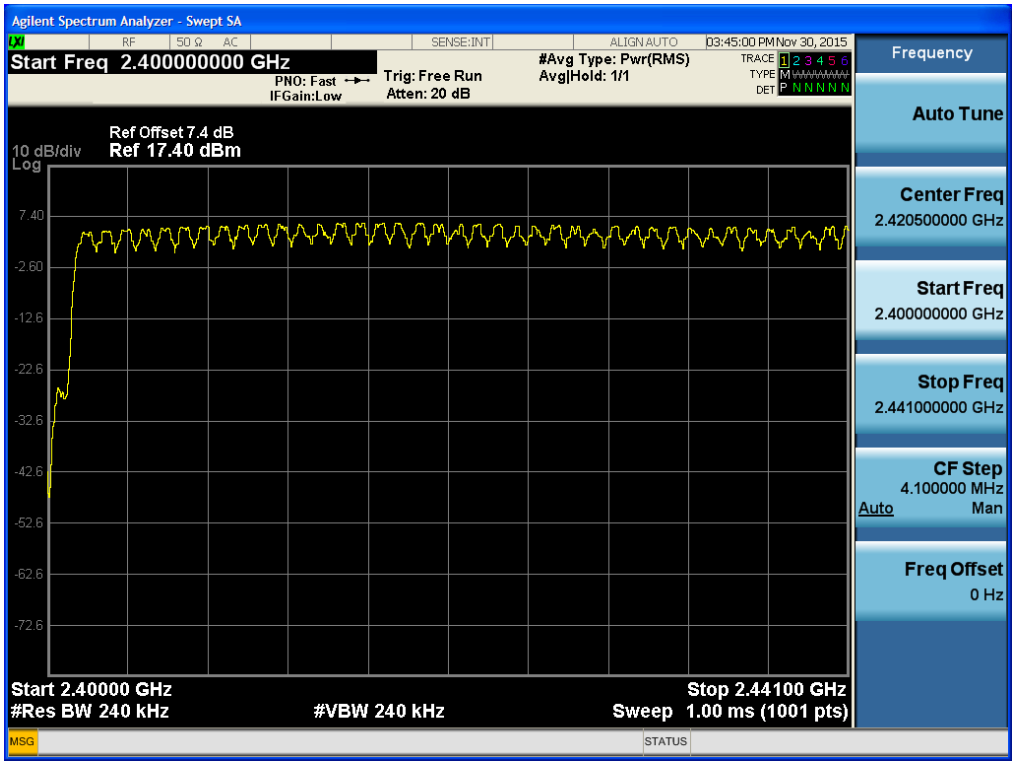


Test Plots (8DPSK)

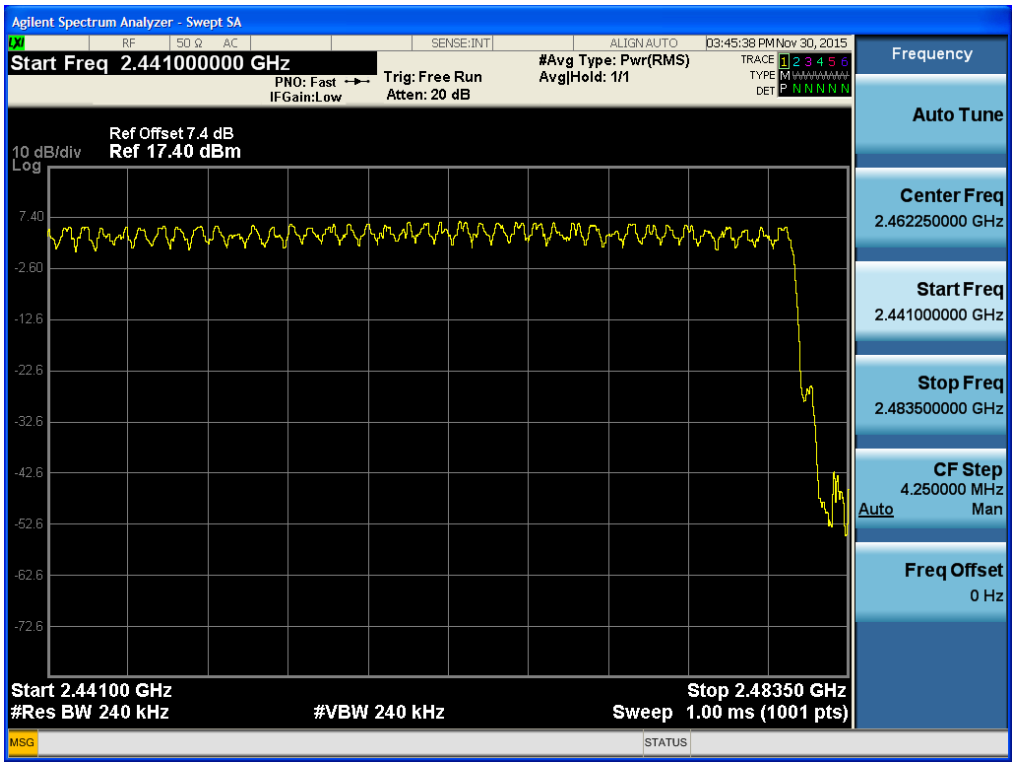
Number of Channels (2.441 GHz - 2.4835 GHz)



Test Plots (π/4DQPSK)
Number of Channels (2.4 GHz - 2.441 GHz)



Test Plots (π/4DQPSK)
Number of Channels (2.441 GHz - 2.4835 GHz)

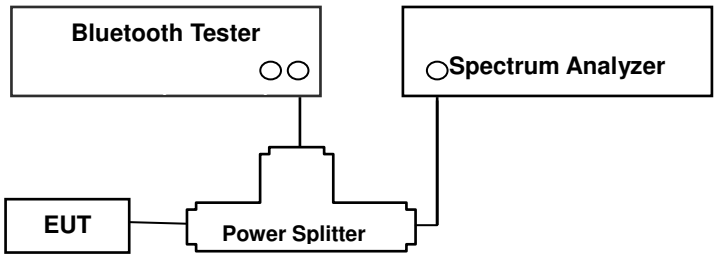


8.5 TIME OF OCCUPANCY (DWELL TIME)

LIMIT

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400 MHz ~ 2483.5 MHz bands. The average time of occupancy on any channels shall not greater than 0.4 s within a period 0.4 s multiplied by the number of hopping channels employed.

Test Configuration



TEST PROCEDURE

This test is performed with hopping off.

EUT was set to transmit the longest packet type (DH5)

The Spectrum Analyzer is set to (7.8.4 in ANSI 63.10-2013)

1) Span: Zero span, centered on a hopping channel
2) RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.
3) Sweep = as necessary to capture the entire dwell time per hopping channel
4) Detector: Peak
5) Trace: Max hold

The marker-delta function was used to determine the dwell time.

Normal Mode / EDR Mode

DH 5(The longest packet type for GFSK)

CH Mid : 2.875 * (1600/6)/79 * 31.6 = 306.67 (ms)

2-DH 5(The longest packet type for π/4DQPSK)

CH Mid : 2.880 * (1600/6)/79 * 31.6 = 307.20 (ms)

3-DH 5(The longest packet type for 8DPSK)

CH Mid : 2.880 * (1600/6)/79 * 31.6 = 307.20 (ms)

AFH Mode

DH 5(The longest packet type for GFSK)

CH Mid : 2.875 * (800/6)/20 * 8.0 = 153.33 (ms)

2-DH 5(The longest packet type for π/4DQPSK)

CH Mid : 2.880 * (800/6)/20 * 8.0 = 153.60 (ms)

3-DH 5(The longest packet type for 8DPSK)

CH Mid : 2.880 * (800/6)/20 * 8.0 = 153.60 (ms)

Note :

A DH5 Packet need 5 time slot for transmitting and 1 time slot for receiving. Then the system makes worst case 1600/6 hops per second with 79 channels. So the system have each channel 3.3755 times per second and so for 31.6 seconds the system have 106.7 times of appearance. Each tx-time per appearance of DH5 is 2.892 ms.

Dwell time = Tx-time * 106.7

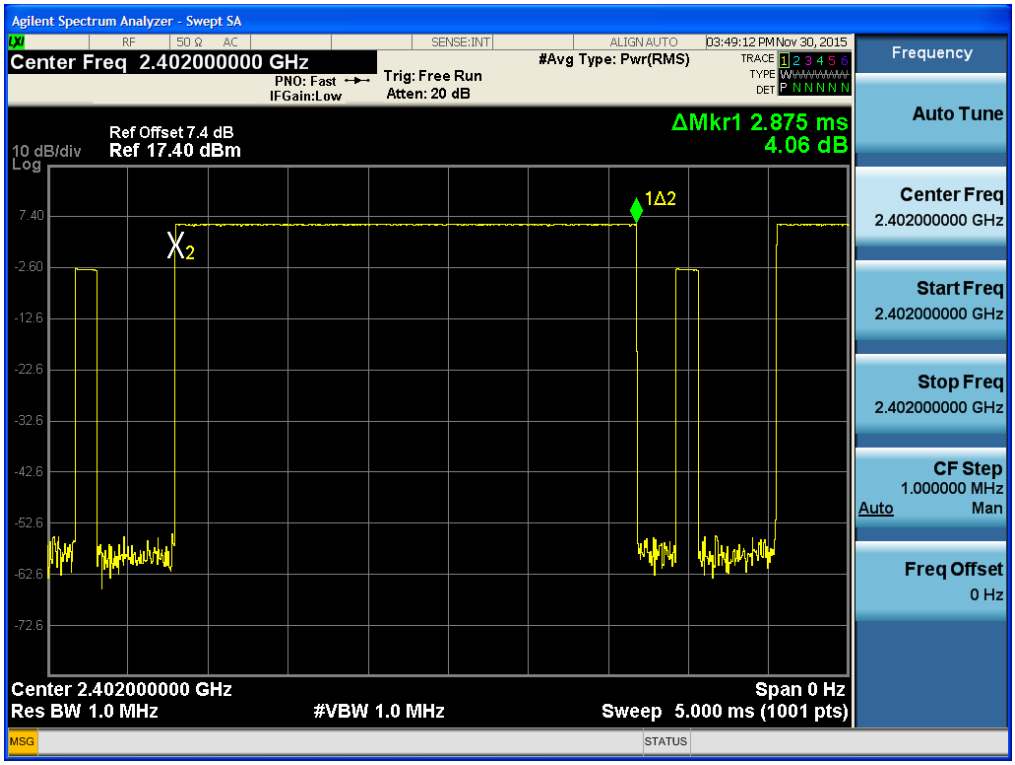
TEST RESULTS

See the table.

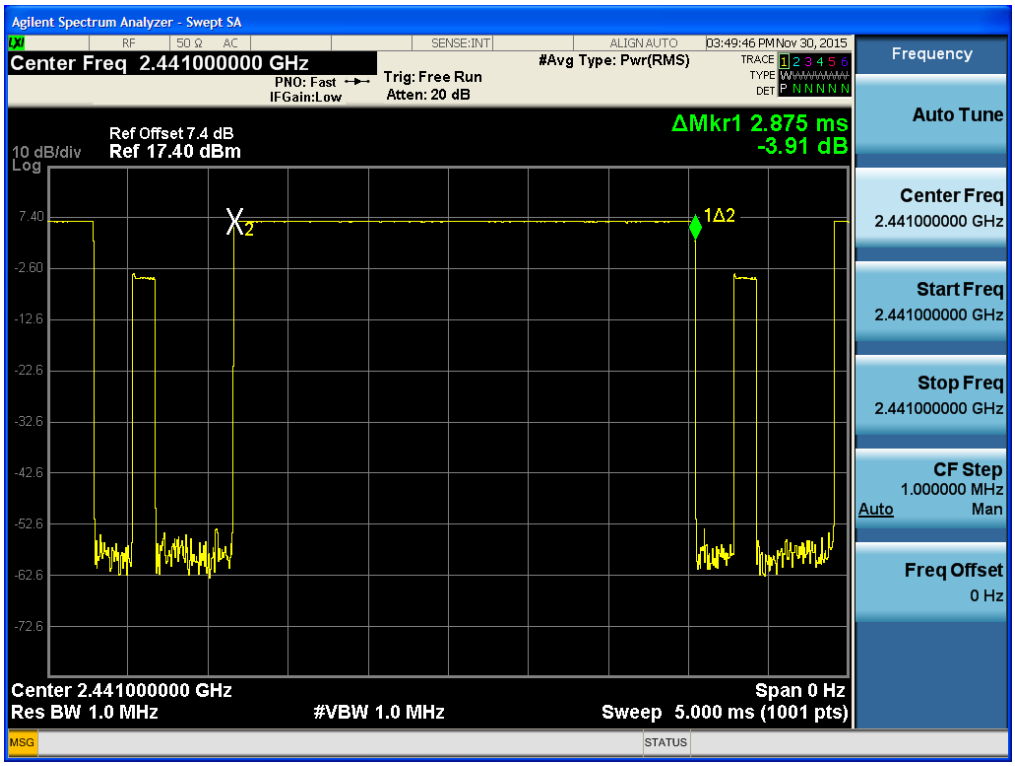
	Channel	GFSK	8DPSK	π/4DQPSK
Pulse Time (ms)	Low	2.875	2.885	2.880
	Mid	2.875	2.880	2.880
	High	2.875	2.880	2.880

	Channel	GFSK	8DPSK	π/4DQPSK	Period Time (s)	Limit (ms)	Result
Total of Dwell (ms)	Low	306.67	307.73	307.20	31.6	400	PASS
	Mid	306.67	307.20	307.20	31.6		PASS
	High	306.67	307.20	307.20	31.6		PASS

Test Plots (GFSK)
Dwell Time (Low-CH)

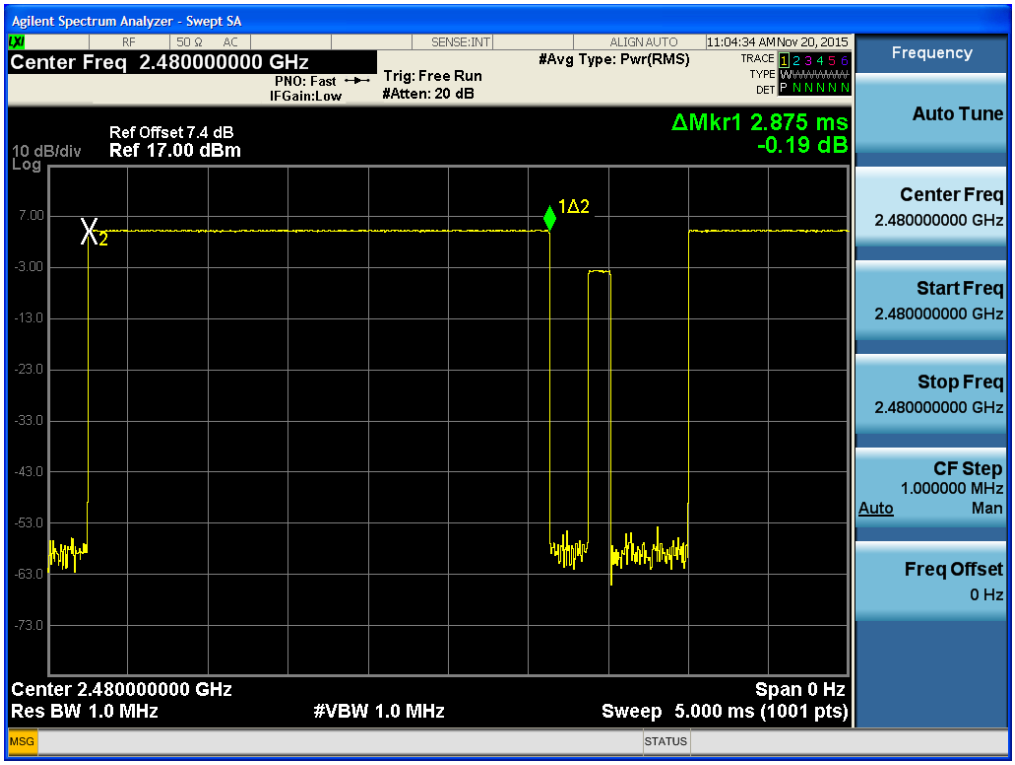


Test Plots (GFSK)
Dwell Time (Mid-CH)



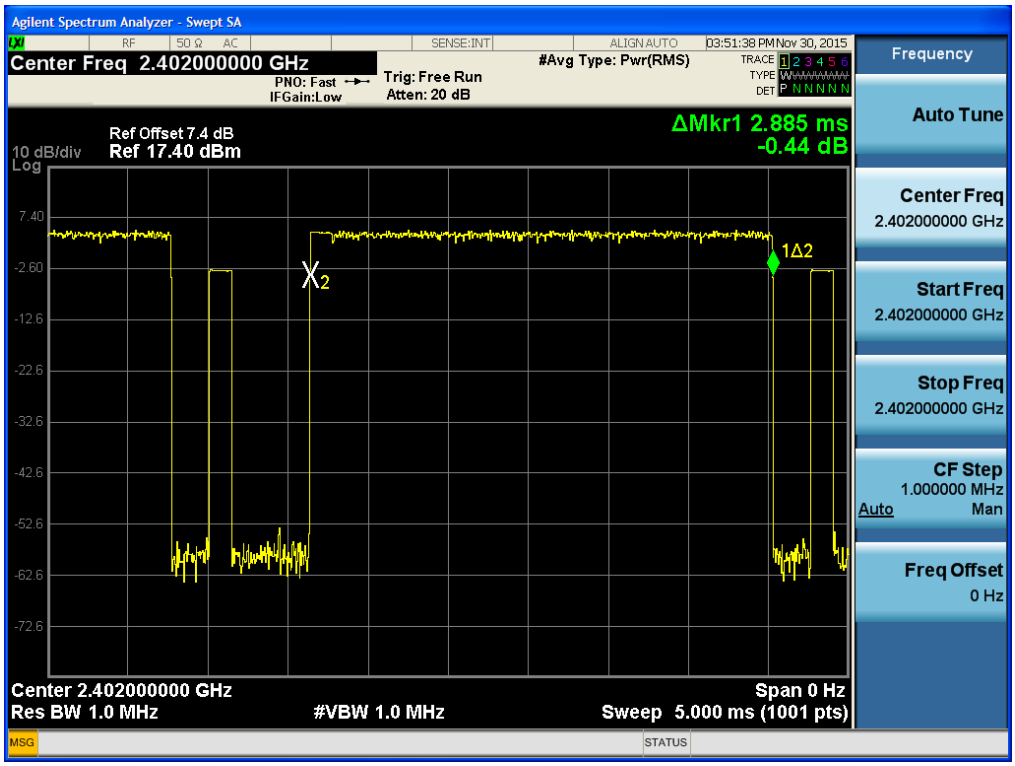
Test Plots (GFSK)

Dwell Time (High-CH)

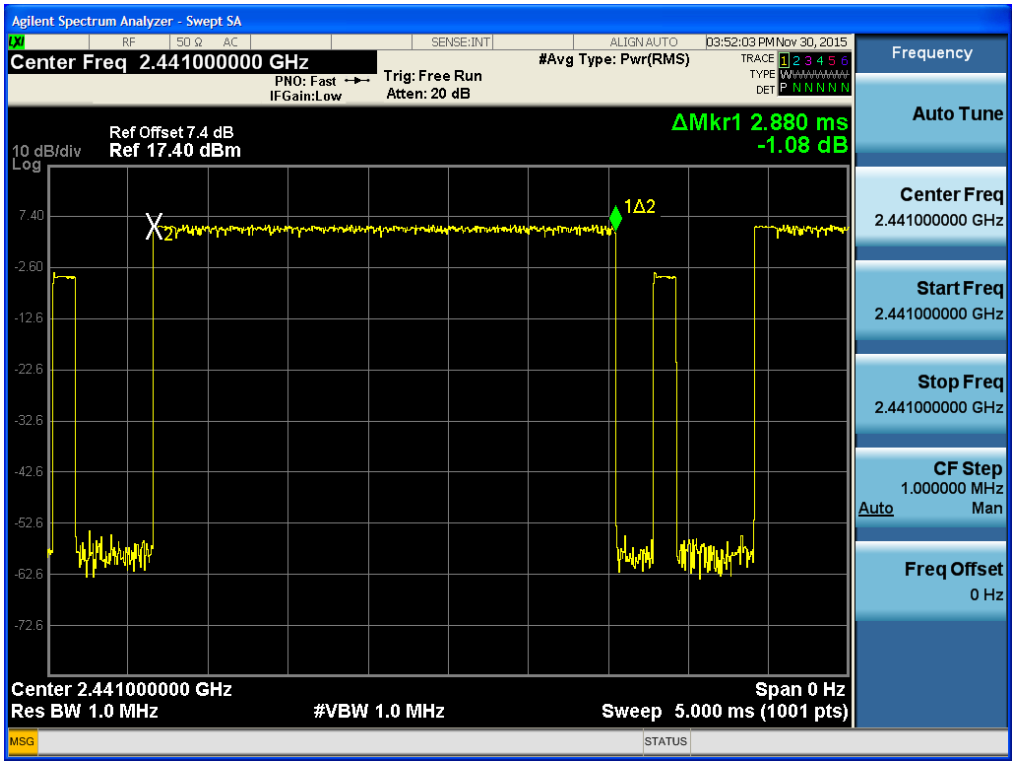


Test Plots (8DPSK)

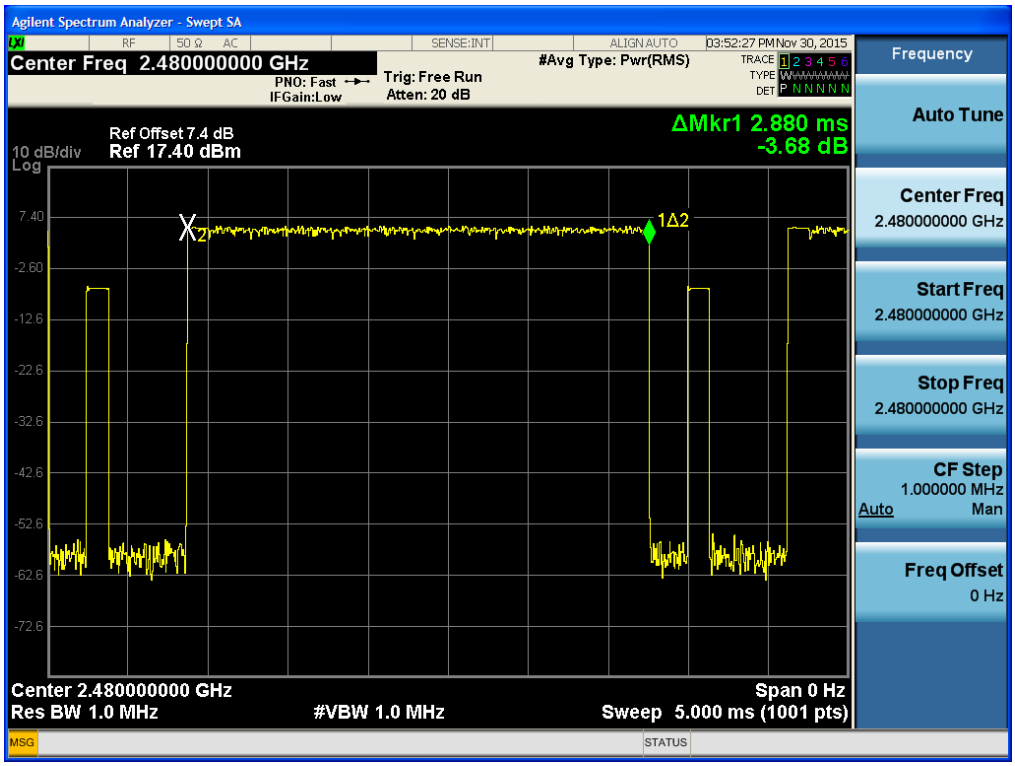
Dwell Time (Low-CH)



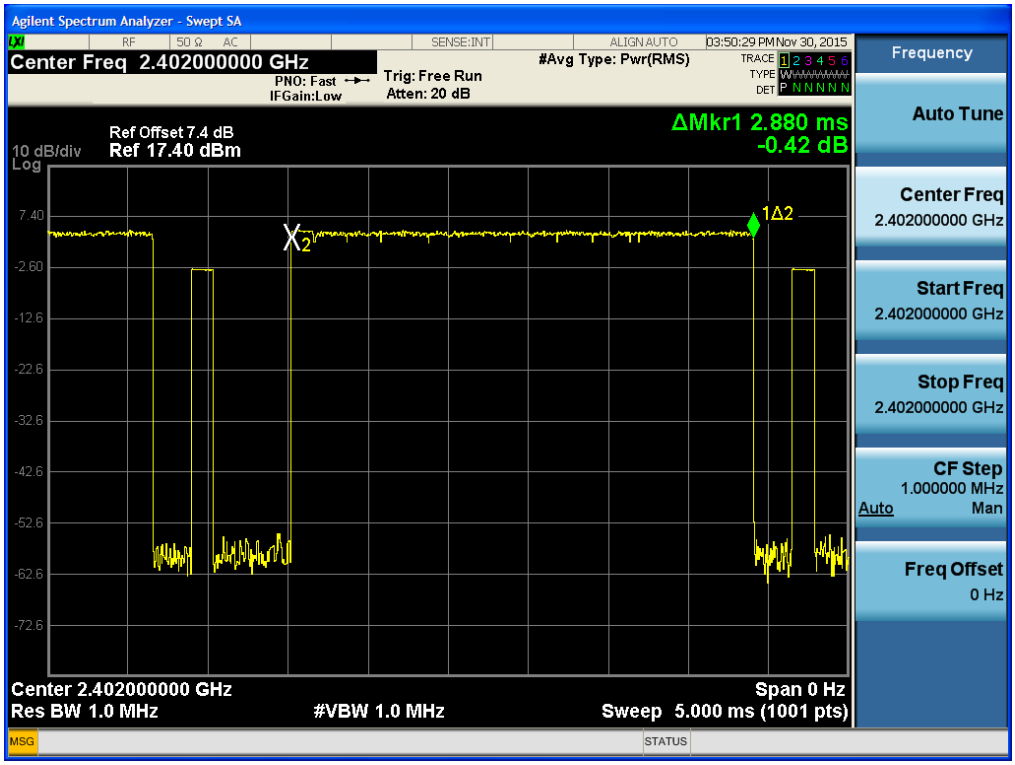
Test Plots (8DPSK)
Dwell Time (Mid-CH)



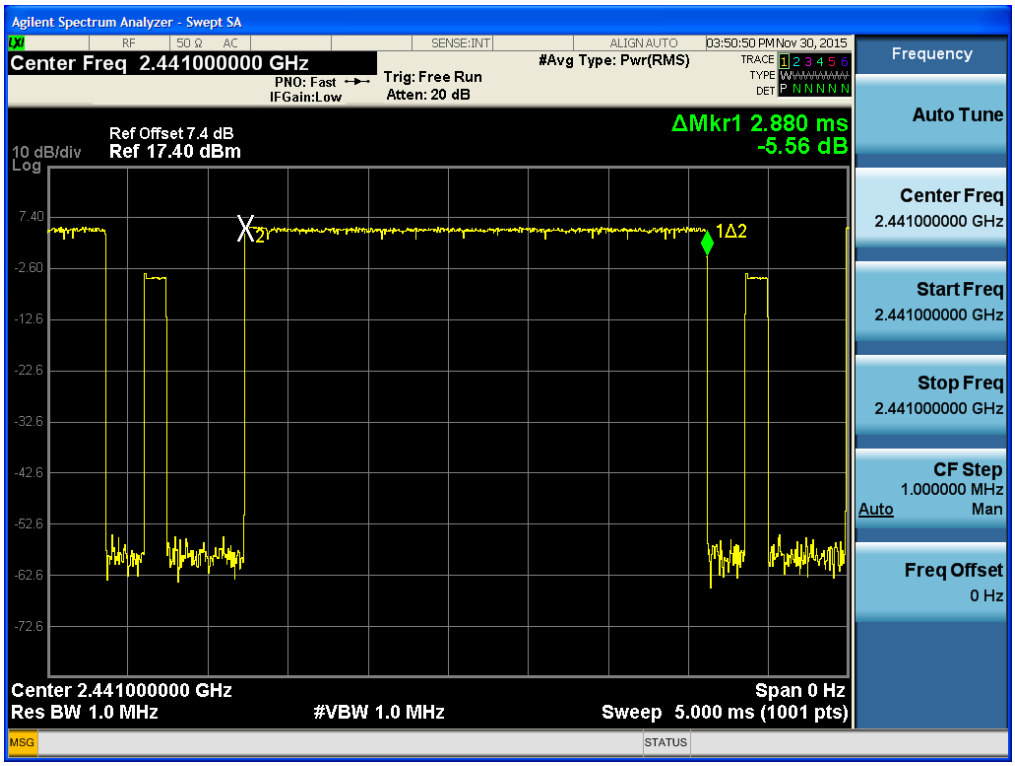
Test Plots (8DPSK)
Dwell Time (High-CH)



Test Plots (π/4DQPSK)
Dwell Time (Low-CH)

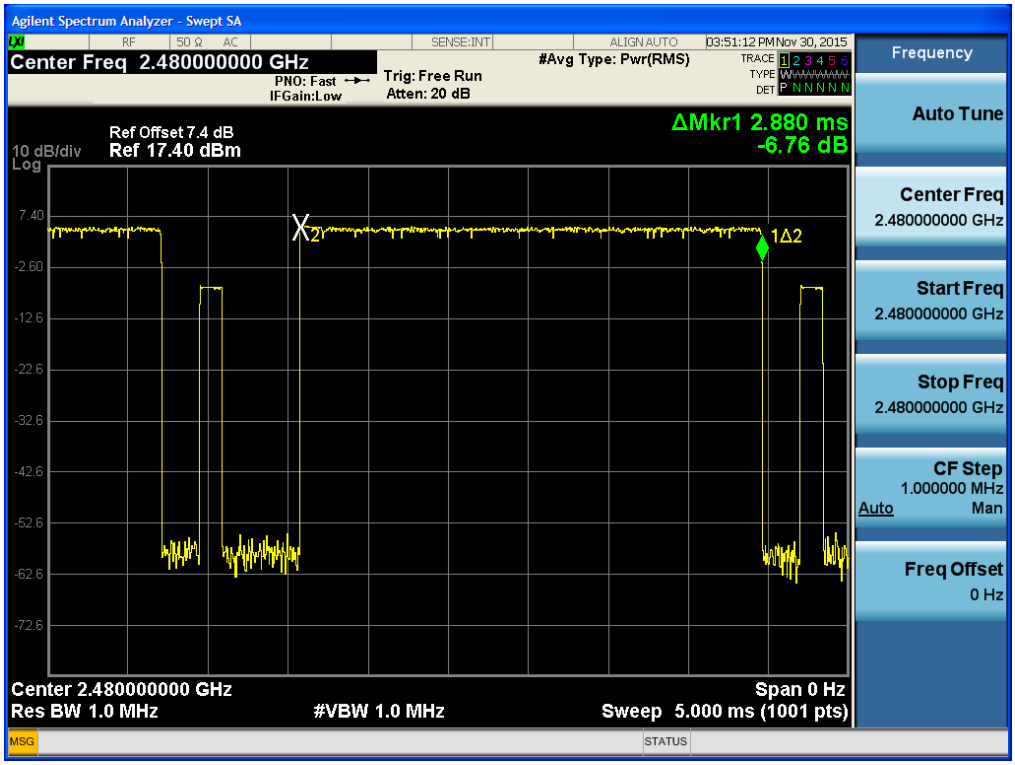


Test Plots (π/4DQPSK)
Dwell Time (Mid-CH)



Test Plots (π/4DQPSK)

Dwell Time (High-CH)



8.6 SPURIOUS EMISSIONS

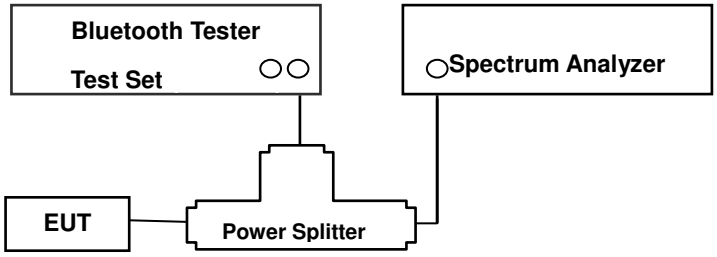
8.6.1 CONDUCTED SPURIOUS EMISSIONS

Test Requirements and limit, §15.247(d)

In any 100 kHz 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 dB below that in the 100 kHz 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 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

Limit : 20 dBc

Test Configuration



TEST PROCEDURE

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer.

The Spectrum Analyzer is set to (7.8.8 in ANSI 63.10-2013)

1) Span: 30 MHz to 10 times the operating frequency in GHz.
2) RBW: 100 kHz
3) VBW: 300 kHz
4) Sweep: Coupled
5) Detector: Peak

Measurements are made over the 30 MHz to 26 GHz range with the transmitter set to the lowest, middle, and highest channels.

This test is performed with hopping off.

TEST RESULTS

No non-compliance noted.

Note : In order to simplify the report, attached plots were only the worst case channel and data rate.

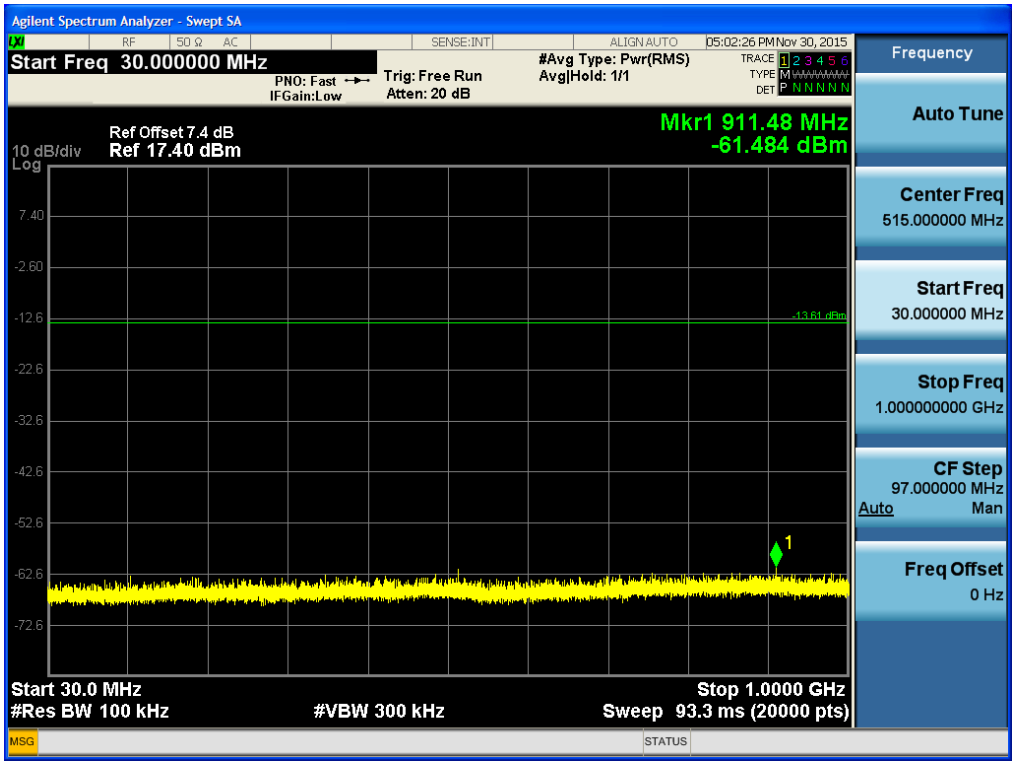
FACTORS FOR FREQUENCY

Freq(MHz)	Factor(dB)
30	7.18
100	6.35
200	7.04
300	6.58
400	6.26
500	5.95
600	6.17
700	6.34
800	6.72
900	7.08
1000	7.38
2000	7.78
2400*	7.36
2500*	7.44
3000	7.88
4000	8.95
5000	9.57
6000	6.68
7000	9.99
8000	8.34
9000	9.61
10000	10.47
11000	8.96
12000	9.73
13000	8.84
14000	9.50
15000	11.54
16000	8.14
17000	11.73
18000	9.71
19000	10.40
20000	11.69
21000	10.72
22000	12.31
23000	9.85
24000	12.52
25000	11.07
26000	10.50

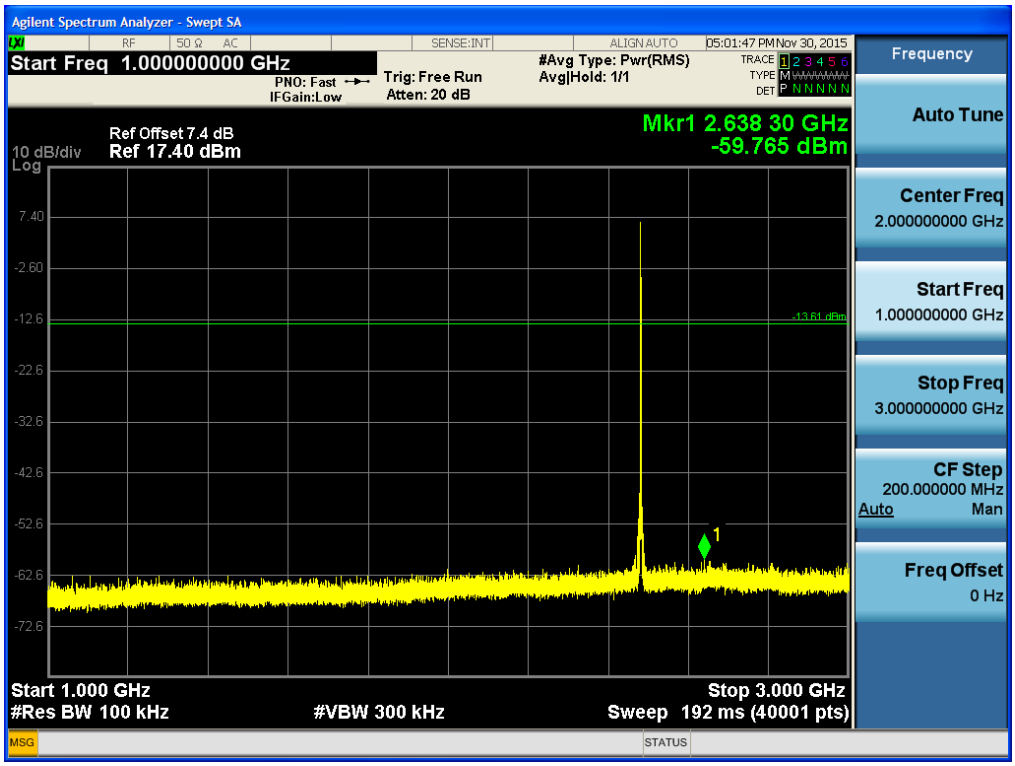
Note : 1. '*' is fundamental frequency range.

2. Factor = Cable loss + Splitter loss

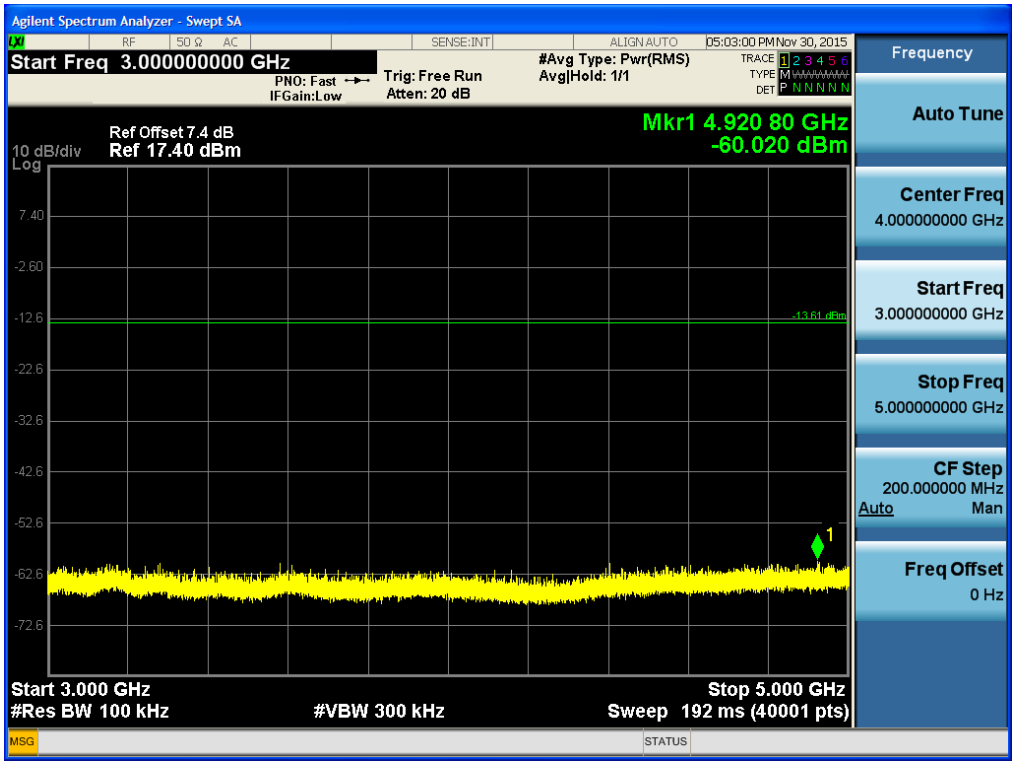
Test Plots (GFSK)- 30 MHz - 1 GHz
Spurious Emission (High-CH)



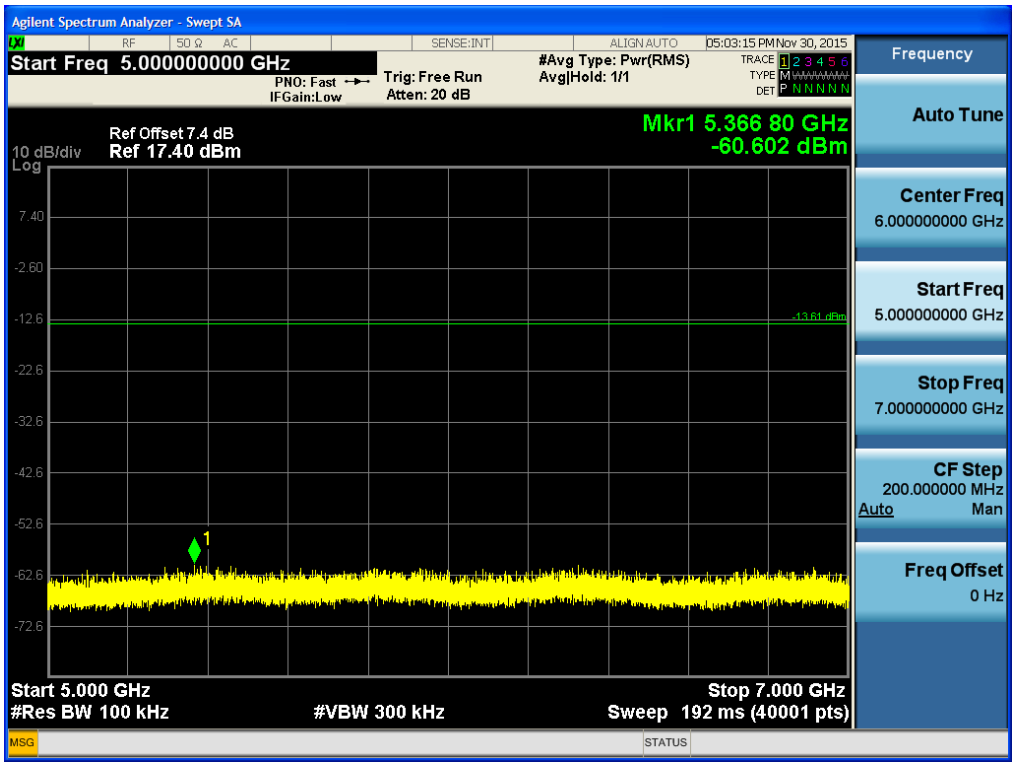
Test Plots (GFSK)- 1 GHz – 3 GHz
Spurious Emission (High-CH)



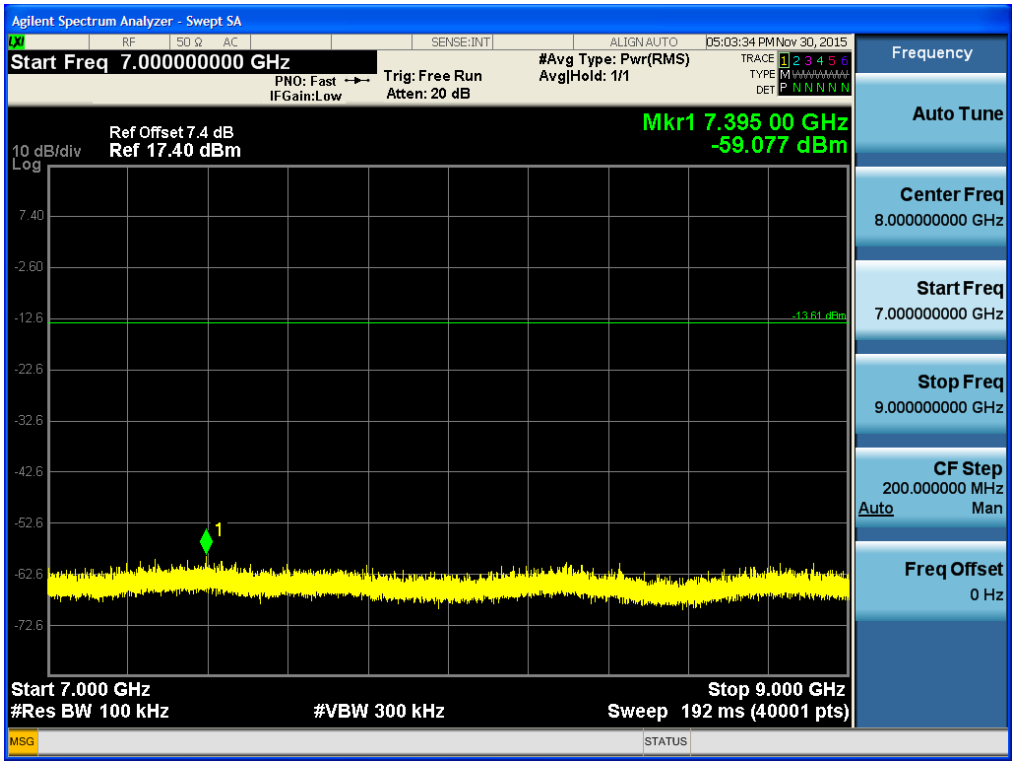
Test Plots (GFSK)- 3 GHz - 5 GHz
Spurious Emission (High-CH)



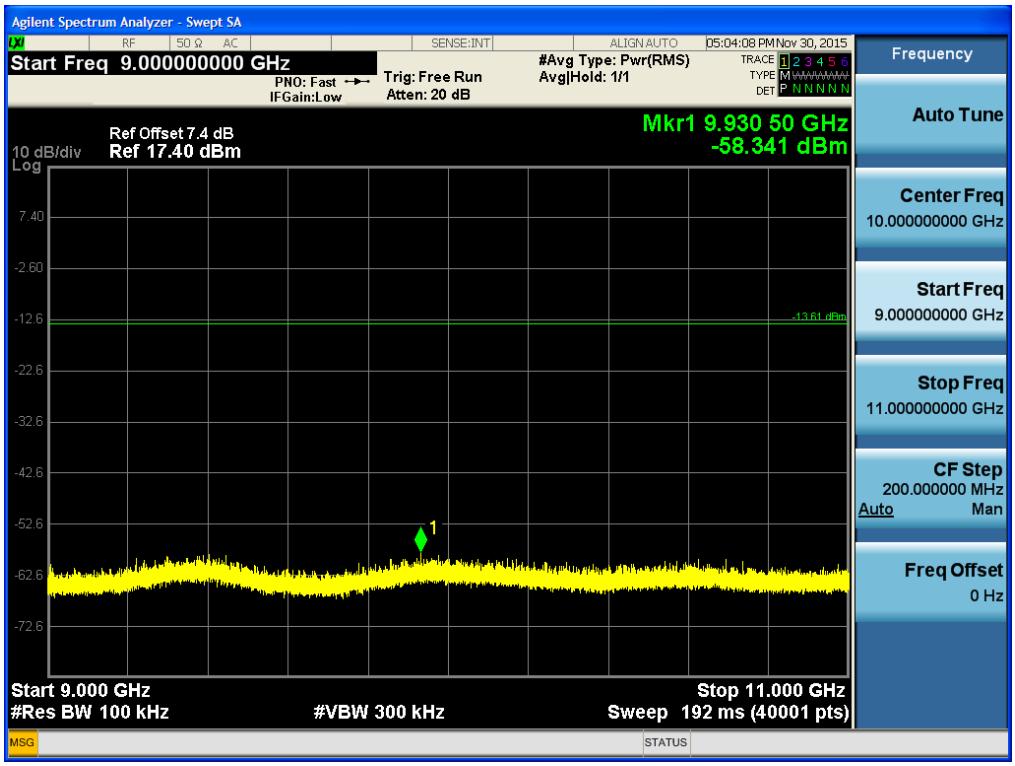
Test Plots (GFSK)- 5 GHz - 7 GHz
Spurious Emission (High-CH)



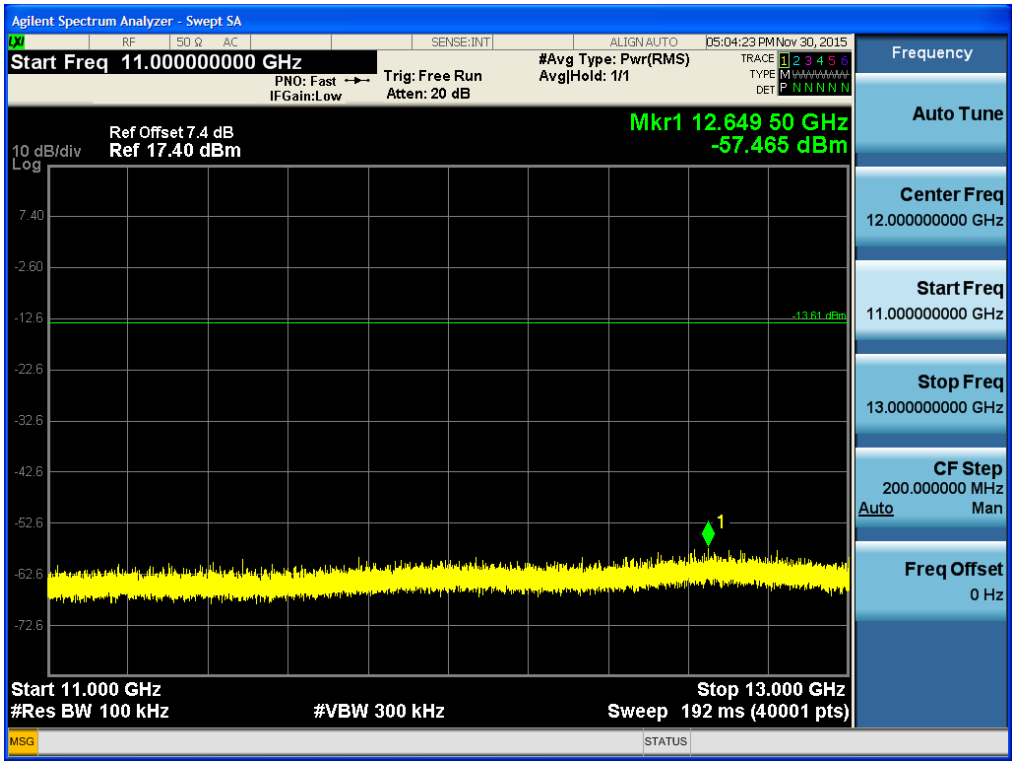
Test Plots (GFSK)- 7 GHz - 9 GHz
Spurious Emission (High-CH)



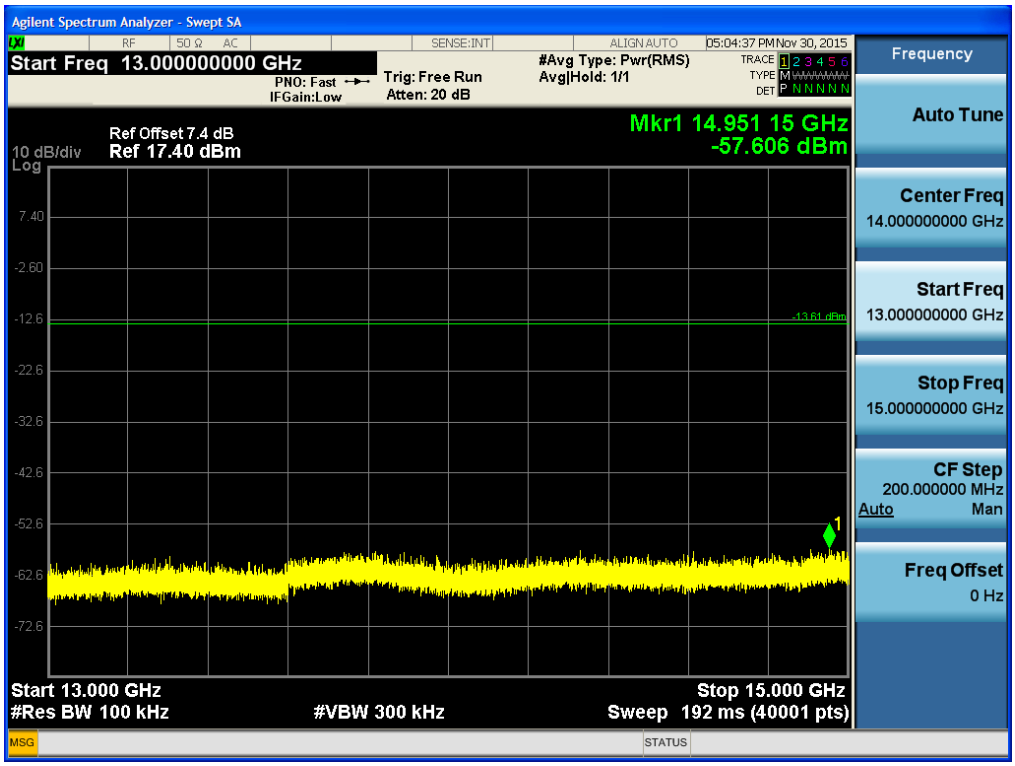
Test Plots (GFSK)- 9 GHz - 11 GHz
Spurious Emission (High-CH)



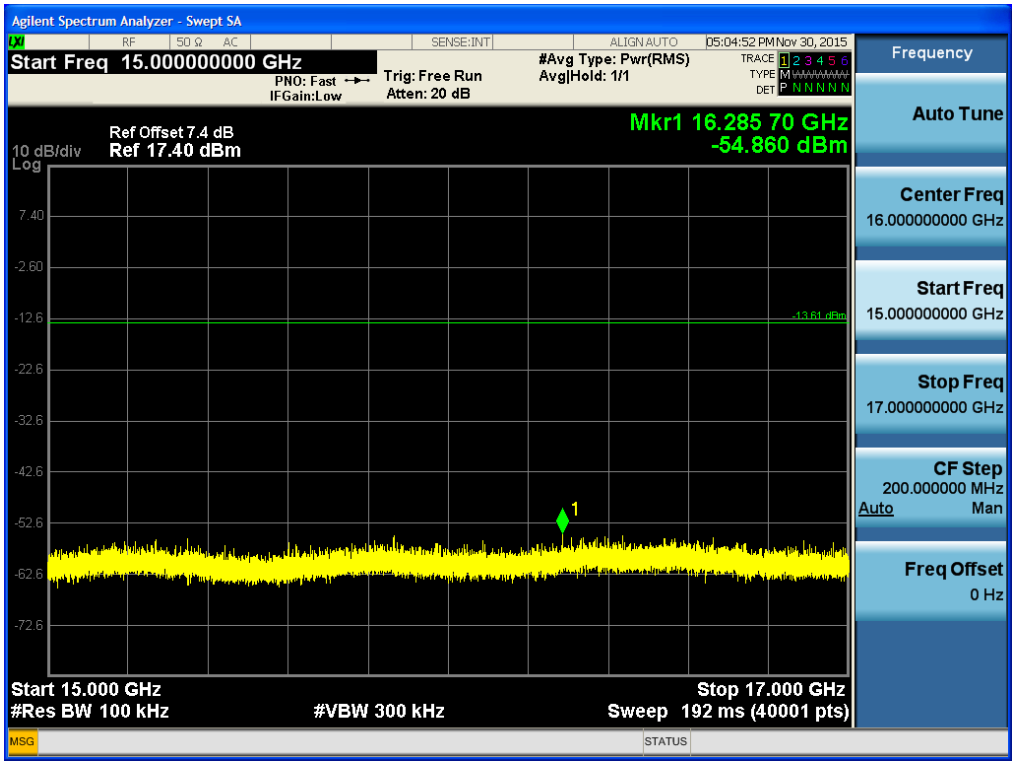
Test Plots (GFSK)- 11 GHz - 13 GHz
Spurious Emission (High-CH)



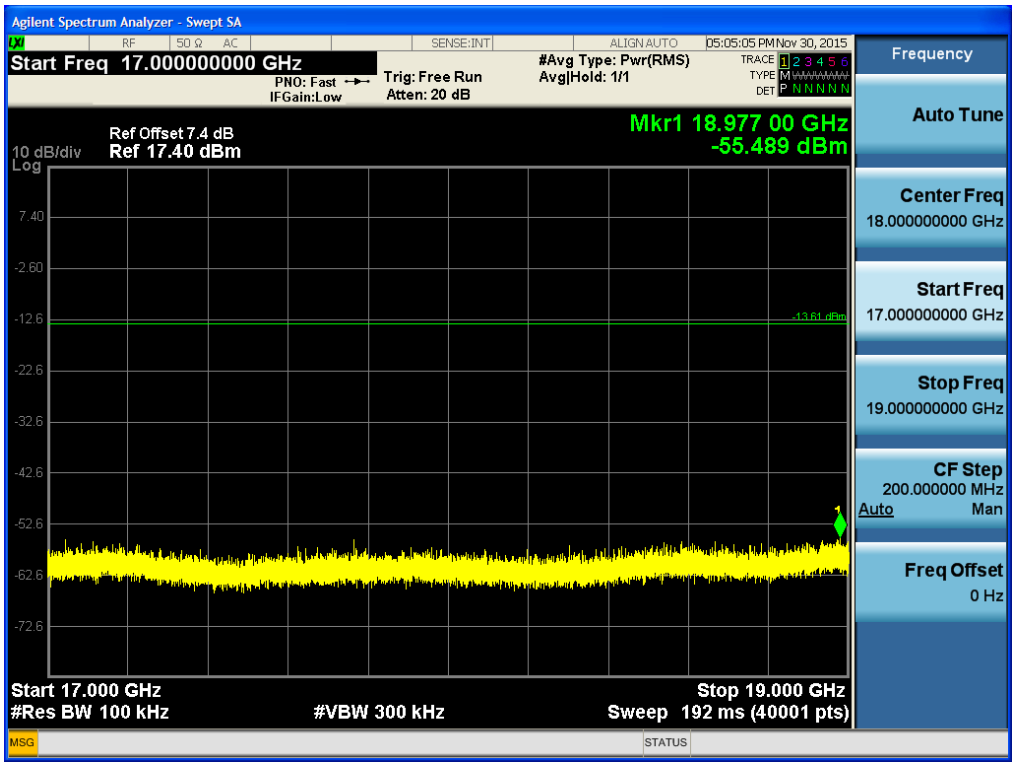
Test Plots (GFSK)- 13 GHz – 15 GHz
Spurious Emission (High-CH)



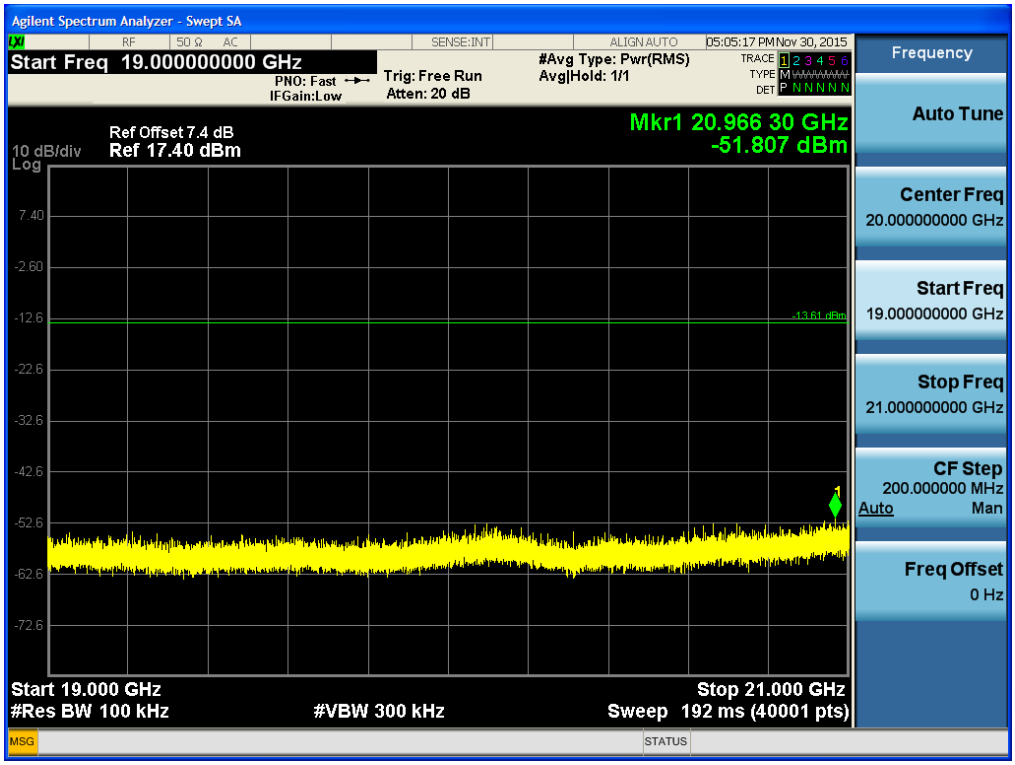
Test Plots (GFSK)– 15 GHz - 17 GHz
Spurious Emission (High-CH)



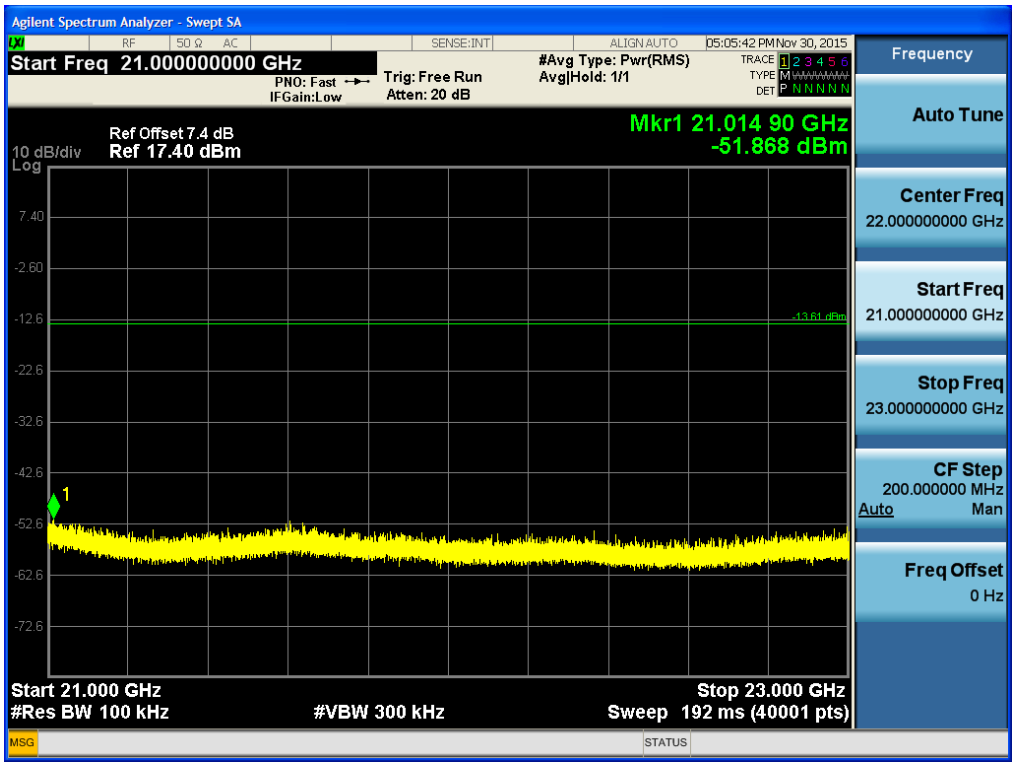
Test Plots (GFSK)- 17 GHz - 19 GHz
Spurious Emission (High-CH)



Test Plots (GFSK)- 19 GHz - 21 GHz
Spurious Emission (High-CH)

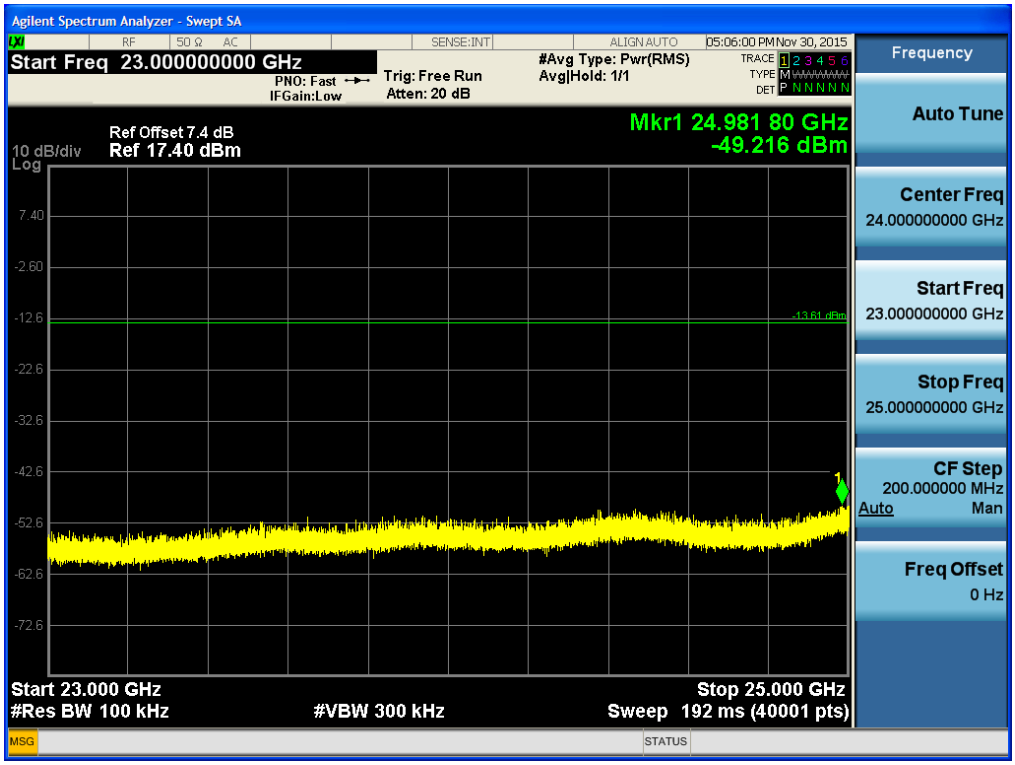


Test Plots (GFSK)- 21 GHz - 23 GHz
Spurious Emission (High-CH)



Test Plots (GFSK)- 23 GHz - 25 GHz

Spurious Emission (High-CH)



8.6.2 RADIATED SPURIOUS EMISSIONS

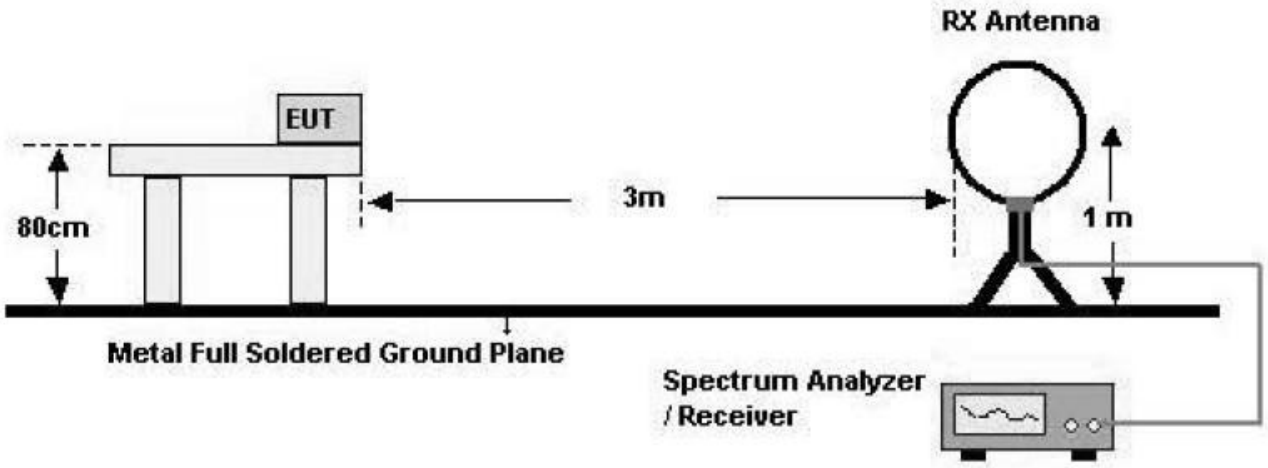
LIMIT : §15.247(d), §15.205, §15.209

1. 20dBc in any 100kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

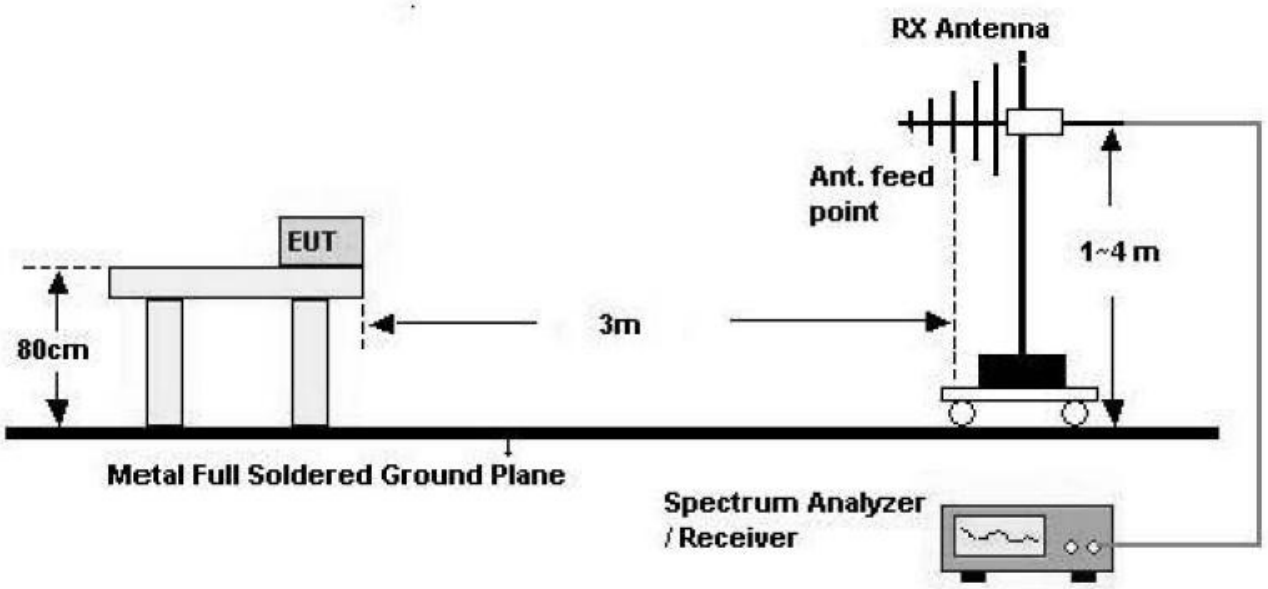
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Configuration

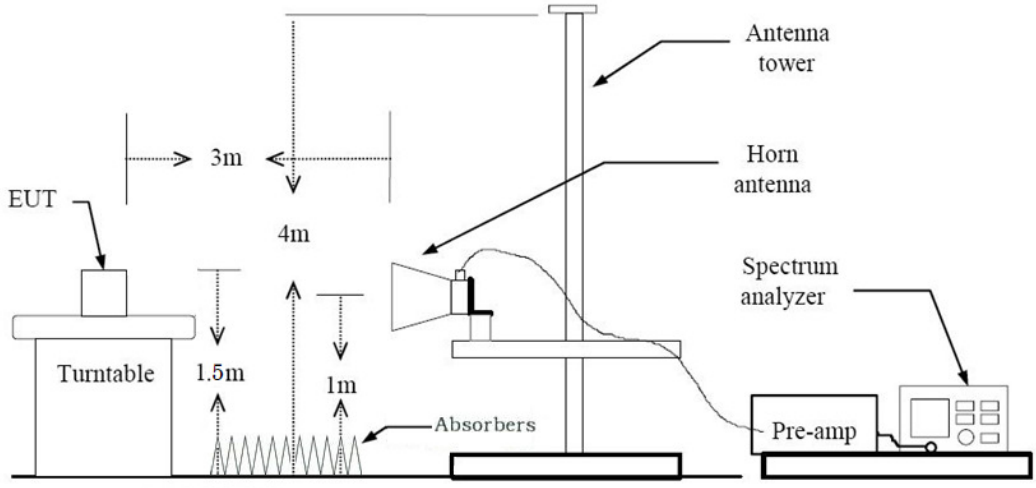
Below 30 MHz



30 MHz - 1 GHz



Above 1 GHz



TEST PROCEDURE

1. The EUT is placed on a turntable, which is 1.5 m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. Spectrum Setting
   a. Peak: 1 GHz – 25 GHz, RBW = 1 MHz, VBW ≥3*RBW
   b. Average: 1 GHz – 25 GHz, RBW = 1 MHz, VBW ≥ 1/τ Hz, where τ = pulse width in seconds.

Note :

1. We are performed the RSE and radiated band edge using standard radiated method.
2. The duty cycle factor for BT mode.

BT Mode	T_{on} (ms)	VBW(1/T) (Hz)	The actual setting value of VBW (Hz)
	2.875	348	1000
	2.880	347	1000
	2.885	347	1000

TEST RESULTS

9 kHz – 30MHz

Operation Mode: Normal Mode

Frequency	Reading	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
㎒	dB㎶	dB /m	dB	(H/V)	dB㎶/m	dB㎶/m	dB
No Critical peaks found							

Notes:

1. Measuring frequencies from 9 kHz to the 30MHz.
2. The reading of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to be measured.
3. Distance extrapolation factor = 40 log (specific distance / test distance) (dB)
4. Limit line = specific Limits (dBuV) + Distance extrapolation factor
5. This test is performed with hopping off.
6. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

TEST RESULTS

Below 1 GHz

Operation Mode: Normal Mode

Frequency	Reading	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
㎒	dB㎶	dB /m	dB	(H/V)	dB㎶/m	dB㎶/m	dB
No Critical peaks found							

Notes:

1. Measuring frequencies from 30 MHz to the 1 GHz.
2. Radiated emissions measured in frequency range from 30 MHz to 1000 MHz were made with an instrument using Quasi peak detector mode.
3. This test is performed with hopping off.
4. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

Above 1 GHz

Operation Mode: CH Low(GFSK)

Frequency [MHz]	Reading DBuV	※A.F+CL-AMP GAIN [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4804	48.77	-2.96	V	45.81	73.98	28.17	PK
4804	35.25	-2.96	V	32.29	53.98	21.69	AV
7206	45.80	6.88	V	52.68	73.98	21.30	PK
7206	32.39	6.88	V	39.27	53.98	14.71	AV
4804	48.87	-2.96	H	45.91	73.98	28.07	PK
4804	35.30	-2.96	H	32.34	53.98	21.64	AV
7206	45.92	6.88	H	52.8	73.98	21.18	PK
7206	32.39	6.88	H	39.27	53.98	14.71	AV

Operation Mode: CH Low(8DPSK)

Frequency [MHz]	Reading DBuV	※A.F+CL-AMP GAIN [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4804	48.71	-2.96	V	45.75	73.98	28.23	PK
4804	35.21	-2.96	V	32.25	53.98	21.73	AV
7206	45.75	6.88	V	52.63	73.98	21.35	PK
7206	32.36	6.88	V	39.24	53.98	14.74	AV
4804	49.81	-2.96	H	46.85	73.98	27.13	PK
4804	35.27	-2.96	H	32.31	53.98	21.67	AV
7206	46.01	6.88	H	52.89	73.98	21.09	PK
7206	32.38	6.88	H	39.26	53.98	14.72	AV

Operation Mode: CH Low(π/4DQPSK)

Frequency [MHz]	Reading DBuV	※A.F+CL-AMP GAIN [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4804	48.73	-2.96	V	45.77	73.98	28.21	PK
4804	35.22	-2.96	V	32.26	53.98	21.72	AV
7206	45.77	6.88	V	52.65	73.98	21.33	PK
7206	32.37	6.88	V	39.25	53.98	14.73	AV
4804	49.84	-2.96	H	46.88	73.98	27.10	PK
4804	35.29	-2.96	H	32.33	53.98	21.65	AV
7206	45.83	6.88	H	52.71	73.98	21.27	PK
7206	32.47	6.88	H	39.35	53.98	14.63	AV

※ A·F: ANTENNA FACTOR
C·L: CABLE LOSS
AMP GAIN: AMPLIFIER GAIN

Notes:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000 MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain
5. Spectrum setting:
   a. Peak Setting 1 GHz – 25 GHz, RBW = 1 MHz, VBW = 3 MHz.
   b. Average Setting 1 GHz – 25 GHz, RBW = 1 MHz, VBW ≥ 1/τ Hz, where τ = pulse width in seconds. We performed using a reduced video BW method was done with the analyzer in linear mode.
6. FYI : Duty Cycle Correction Factor (79 channel hopping)
   a. Time to cycle through all channels= Δ t= τ [ms] x 79 channels = 229.100 ms, where τ = pulse width
   b. 100 ms/ Δt [ms] = *H* → Round up to next highest integer, *H ' =1*
   c. Worst Case Dwell Time = τ [ms] x *H '* = 2.900 ms
   d. Duty Cycle Correction = 20log (Worst Case Dwell Time/ 100ms) dB = -30.752 dB
7. Duty Cycle Correction Factor(AFH mode – minimum channel number case - 20 channels)
   a. Time to cycle through all channels= Δ t= τ [ms] x 20 channels = 58.00 ms, where τ = pulse width
   b. 100 ms/ Δt [ms] = *H* → Round up to next highest integer, *H ' = 2*
   c. Worst Case Dwell Time = τ [ms] x *H '* = 5.800 ms
   d. Duty Cycle Correction(AFH) = 20log (Worst Case Dwell Time/ 100ms) dB = -24.7314 dB

e. We applied DCCF in the test result which hopping channel number is 20.

8. We have done Normal Mode and EDR Mode test.

9. This test is performed with hopping off.

10. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

Operation Mode: CH Mid(GFSK)

Frequency [MHz]	Reading DBuV	※A.F+CL-AMP GAIN [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4882	49.47	-2.60	V	46.87	73.98	27.11	PK
4882	35.81	-2.60	V	33.21	53.98	20.77	AV
7323	45.86	6.11	V	51.97	73.98	22.01	PK
7323	32.58	6.11	V	38.69	53.98	15.29	AV
4882	49.57	-2.60	H	46.97	73.98	27.01	PK
4882	35.84	-2.60	H	33.24	53.98	20.74	AV
7323	45.95	6.11	H	52.06	73.98	21.92	PK
7323	32.62	6.11	H	38.73	53.98	15.25	AV

Operation Mode: CH Mid(8DPSK)

Frequency [MHz]	Reading DBuV	※A.F+CL-AMP GAIN [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4882	49.41	-2.60	V	46.81	73.98	27.17	PK
4882	35.78	-2.60	V	33.18	53.98	20.80	AV
7323	45.79	6.11	V	51.90	73.98	22.08	PK
7323	32.55	6.11	V	38.66	53.98	15.32	AV
4882	49.52	-2.60	H	46.92	73.98	27.06	PK
4882	35.82	-2.60	H	33.22	53.98	20.76	AV
7323	45.83	6.11	H	51.94	73.98	22.04	PK
7323	32.58	6.11	H	38.69	53.98	15.29	AV

Operation Mode: CH Mid(π/4DQPSK)

Frequency [MHz]	Reading DBuV	※A.F+CL-AMP GAIN [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4882	49.44	-2.60	V	46.84	73.98	27.14	PK
4882	35.80	-2.60	V	33.2	53.98	20.78	AV
7323	45.81	6.11	V	51.92	73.98	22.06	PK
7323	32.55	6.11	V	38.66	53.98	15.32	AV
4882	49.51	-2.60	H	46.91	73.98	27.07	PK
4882	35.82	-2.60	H	33.22	53.98	20.76	AV
7323	45.88	6.11	H	51.99	73.98	21.99	PK
7323	32.59	6.11	H	38.7	53.98	15.28	AV

※ A·F: ANTENNA FACTOR
C·L: CABLE LOSS
AMP GAIN: AMPLIFIER GAIN

Notes:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000 MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain
5. Spectrum setting:
   a. Peak Setting 1 GHz – 25 GHz, RBW = 1 MHz, VBW = 3 MHz.
   b. Average Setting 1 GHz – 25 GHz, RBW = 1 MHz, VBW ≥ 1/τ Hz, where τ = pulse width in seconds. We performed using a reduced video BW method was done with the analyzer in linear mode.
6. FYI : Duty Cycle Correction Factor (79 channel hopping)
   a. Time to cycle through all channels= Δ t= τ [ms] x 79 channels = 229.100 ms, where τ = pulse width
   b. 100 ms/ Δt [ms] = $H \rightarrow$ Round up to next highest integer, $H' = 1$
   c. Worst Case Dwell Time = τ [ms] x H' = 2.900 ms
   d. Duty Cycle Correction = 20log (Worst Case Dwell Time/ 100ms) dB = -30.752 dB
7. Duty Cycle Correction Factor(AFH mode – minimum channel number case - 20 channels)
   a. Time to cycle through all channels= Δ t= τ [ms] x 20 channels = 58.00 ms, where τ = pulse width
   b. 100 ms/ Δt [ms] = $H \rightarrow$ Round up to next highest integer, $H' = 2$
   c. Worst Case Dwell Time = τ [ms] x H' = 5.800 ms
   d. Duty Cycle Correction(AFH) = 20log (Worst Case Dwell Time/ 100ms) dB = -24.7314 dB

e. We applied DCCF in the test result which hopping channel number is 20.

8. We have done Normal Mode and EDR Mode test.

9. This test is performed with hopping off.

10. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

Operation Mode: CH High(GFSK)

Frequency [MHz]	Reading DBuV	※A.F+CL-AMP GAIN [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4960	50.18	-2.53	V	47.65	73.98	26.33	PK
4960	36.08	-2.53	V	33.55	53.98	20.43	AV
7440	46.26	5.73	V	51.99	73.98	21.99	PK
7440	32.27	5.73	V	38	53.98	15.98	AV
4960	50.22	-2.53	H	47.69	73.98	26.29	PK
4960	36.12	-2.53	H	33.59	53.98	20.39	AV
7440	46.33	5.73	H	52.06	73.98	21.92	PK
7440	32.29	5.73	H	38.02	53.98	15.96	AV

Operation Mode: CH High(8DPSK)

Frequency [MHz]	Reading DBuV	※A.F+CL-AMP GAIN [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4960	50.08	-2.53	V	47.55	73.98	26.43	PK
4960	36.03	-2.53	V	33.50	53.98	20.48	AV
7440	46.23	5.73	V	51.96	73.98	22.02	PK
7440	32.25	5.73	V	37.98	53.98	16.00	AV
4960	50.14	-2.53	H	47.61	73.98	26.37	PK
4960	36.08	-2.53	H	33.55	53.98	20.43	AV
7440	46.32	5.73	H	52.05	73.98	21.93	PK
7440	32.26	5.73	H	37.99	53.98	15.99	AV

Operation Mode: CH High (π/4DQPSK)

Frequency [MHz]	Reading DBuV	※A.F+CL-AMP GAIN [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4960	50.13	-2.53	V	47.60	73.98	26.38	PK
4960	36.05	-2.53	V	33.52	53.98	20.46	AV
7440	46.22	5.73	V	51.95	73.98	22.03	PK
7440	32.24	5.73	V	37.97	53.98	16.01	AV
4960	50.12	-2.53	H	47.59	73.98	26.39	PK
4960	36.09	-2.53	H	33.56	53.98	20.42	AV
7440	46.30	5.73	H	52.03	73.98	21.95	PK
7440	32.25	5.73	H	37.98	53.98	16.00	AV

※ A·F: ANTENNA FACTOR
C·L: CABLE LOSS
AMP GAIN: AMPLIFIER GAIN

Notes:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000 MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain
5. Spectrum setting:
   a. Peak Setting 1 GHz – 25 GHz, RBW = 1 MHz, VBW = 3 MHz.
   b. Average Setting 1 GHz – 25 GHz, RBW = 1 MHz, VBW ≥ 1/τ Hz, where τ = pulse width in seconds. We performed using a reduced video BW method was done with the analyzer in linear mode.
6. FYI : Duty Cycle Correction Factor (79 channel hopping)
   a. Time to cycle through all channels= Δ t= τ [ms] x 79 channels = 229.100 ms, where τ = pulse width
   b. 100 ms/ Δt [ms] = *H* → Round up to next highest integer, *H ' =1*
   c. Worst Case Dwell Time = τ [ms] x *H '* = 2.900 ms
   d. Duty Cycle Correction = 20log (Worst Case Dwell Time/ 100ms) dB = -30.752 dB
7. Duty Cycle Correction Factor(AFH mode – minimum channel number case - 20 channels)
   a. Time to cycle through all channels= Δ t= τ [ms] x 20 channels = 58.00 ms, where τ = pulse width
   b. 100 ms/ Δt [ms] = *H* → Round up to next highest integer, *H ' = 2*
   c. Worst Case Dwell Time = τ [ms] x *H '* = 5.800 ms
   d. Duty Cycle Correction(AFH) = 20log (Worst Case Dwell Time/ 100ms) dB = -24.7314 dB

e. We applied DCCF in the test result which hopping channel number is 20.

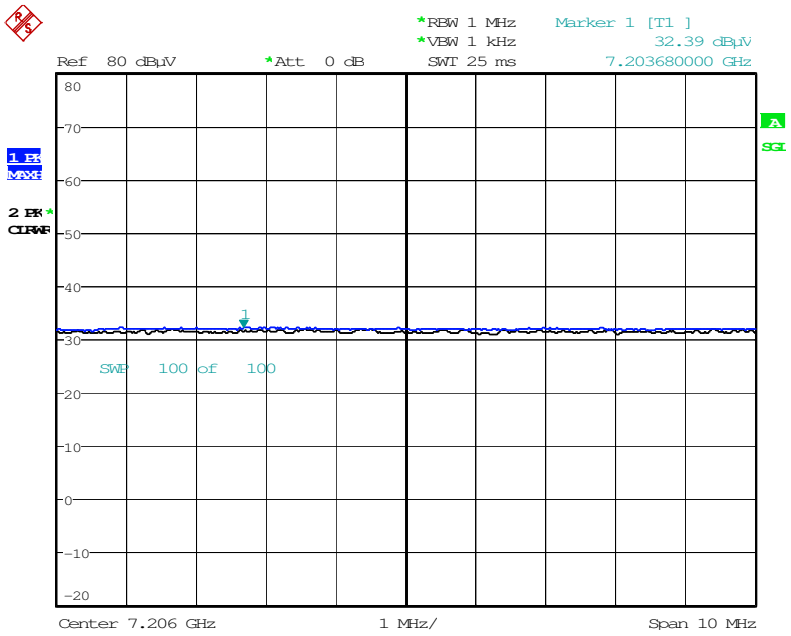
8. We have done Normal Mode and EDR Mode test.

9. This test is performed with hopping off.

10. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

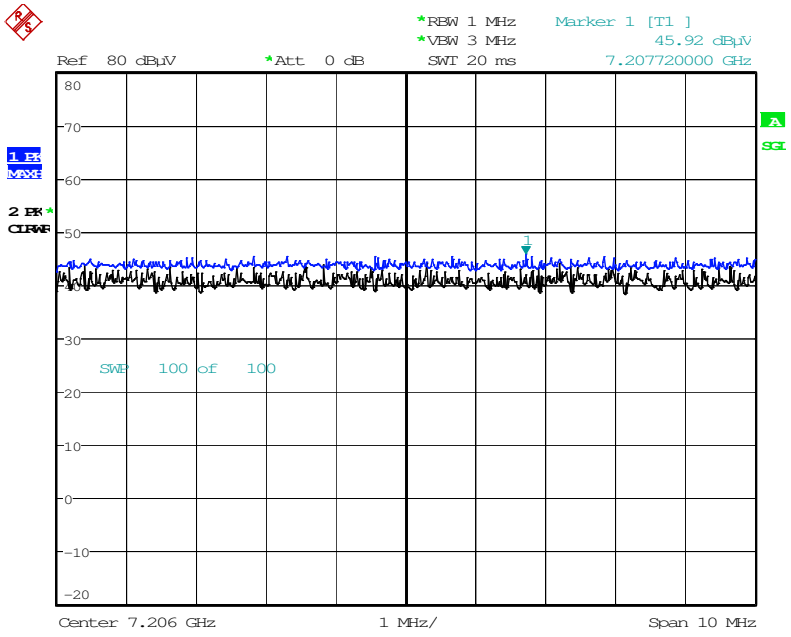
▣ RESULT PLOTS

Radiated Spurious Emissions plot – Average Reading (GFSK, Ch. Low 3rd Harmonic)



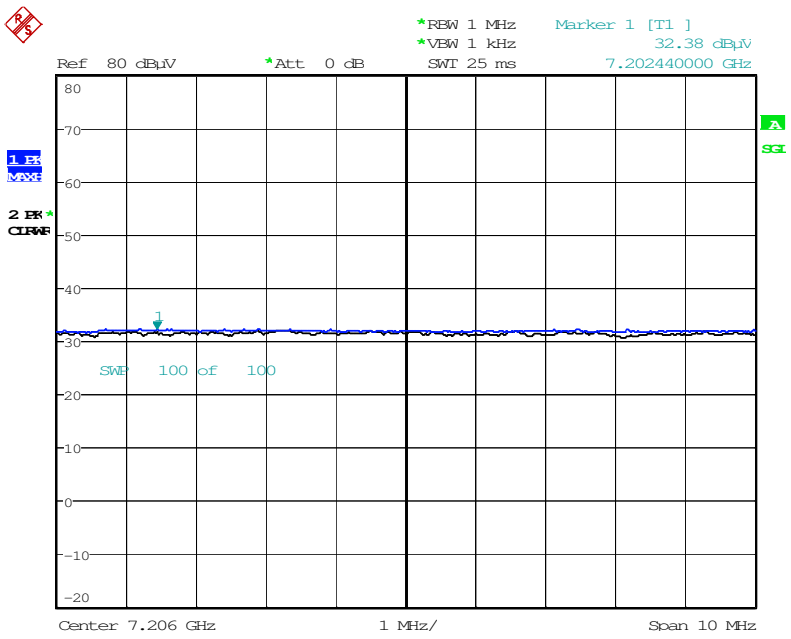
Date: 30.NOV.2015 06:05:48

Radiated Spurious Emissions plot – Peak Reading (GFSK, Ch. Low 3rd Harmonic)



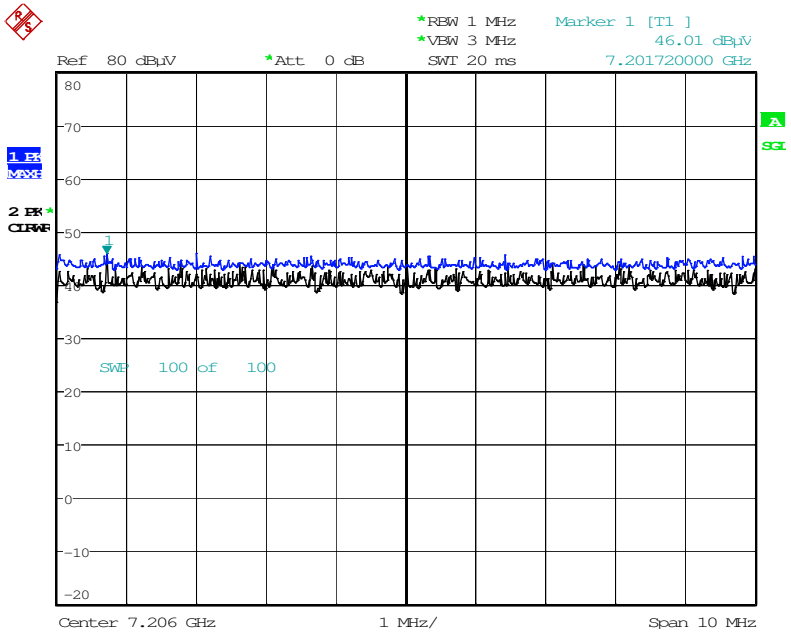
Date: 30.NOV.2015 06:06:13

Radiated Spurious Emissions plot – Average Reading (8DPSK, Ch. Low 3rd Harmonic)



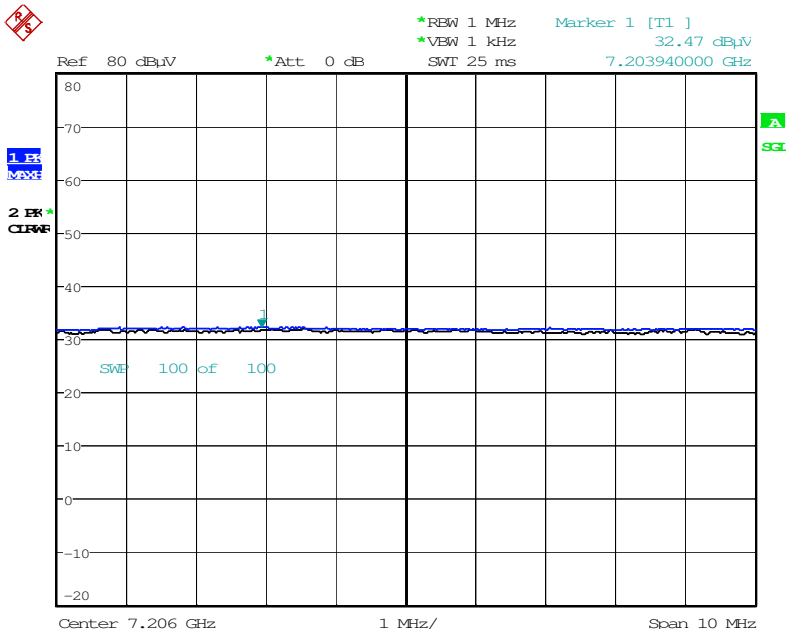
Date: 30.NOV.2015 06:07:10

Radiated Spurious Emissions plot – Peak Reading (8DPSK, Ch. Low 3rd Harmonic)



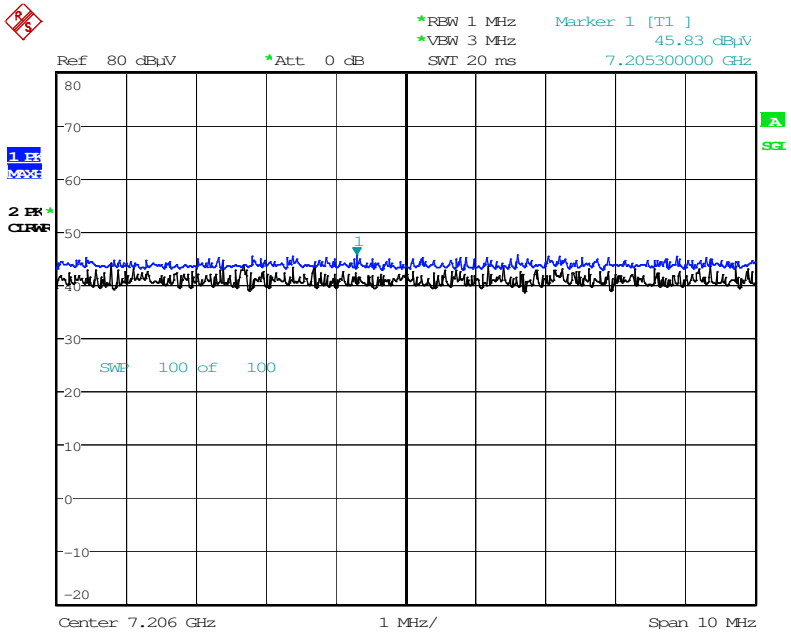
Date: 30.NOV.2015 06:07:28

Radiated Spurious Emissions plot – Average Reading (π/4DQPSK, Ch. Low 3rd Harmonic)



Date: 30.NOV.2015 06:06:50

Radiated Spurious Emissions plot – Peak Reading (π/4DQPSK, Ch. Low 3rd Harmonic)



Date: 30.NOV.2015 06:06:26

Note : Only the worst case plots for Radiated Spurious Emissions.

8.6.3 RADIATED RESTRICTED BAND EDGES

Test Requirements and limit, §15.247(d), §15.205, §15.209

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in section 15.209(a) (See section 15.205(c).

Operation Mode	Normal(GFSK)
Operating Frequency	2402 MHz, 2480 MHz
Channel No	CH 0, CH 78

Frequency [MHz]	Reading dBuV	※ A.F.+CL [dB]	Ant. Pol. [H/V]	Duty Cycle Correction [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2390.0	25.33	31.31	H	0	56.64	73.98	17.34	PK
2390.0	12.17	31.31	H	-24.73	18.75	53.98	35.23	AV
2390.0	25.37	31.31	V	0	56.68	73.98	17.30	PK
2390.0	12.18	31.31	V	-24.73	18.76	53.98	35.22	AV
2483.5	31.11	31.37	H	0	62.48	73.98	11.50	PK
2483.5	27.93	31.37	H	-24.73	34.57	53.98	19.41	AV
2483.5	31.31	31.37	V	0	62.68	73.98	11.30	PK
2483.5	28.25	31.37	V	-24.73	34.89	53.98	19.09	AV

Operation Mode	EDR(8DPSK)
Operating Frequency	2402 MHz , 2480 MHz
Channel No	CH 0, CH 78

Frequency [MHz]	Reading dBuV	※ A.F.+CL [dB]	Ant. Pol. [H/V]	Duty Cycle Correction [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2390.0	24.98	31.31	H	0	56.29	73.98	17.69	PK
2390.0	12.13	31.31	H	-24.73	18.71	53.98	35.27	AV
2390.0	25.29	31.31	V	0	56.60	73.98	17.38	PK
2390.0	12.15	31.31	V	-24.73	18.73	53.98	35.25	AV
2483.5	30.27	31.37	H	0	61.64	73.98	12.34	PK
2483.5	25.49	31.37	H	-24.73	32.13	53.98	21.85	AV
2483.5	30.46	31.37	V	0	61.83	73.98	12.15	PK
2483.5	25.67	31.37	V	-24.73	32.31	53.98	21.67	AV

Operation Mode	EDR(π/4DQPSK)
Operating Frequency	2402 MHz , 2480 MHz
Channel No	CH 0, CH 78

Frequency [MHz]	Reading dBuV	※ A.F.+CL [dB]	Ant. Pol. [H/V]	Duty Cycle Correction [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2390.0	25.37	31.31	H	0	56.68	73.98	17.30	PK
2390.0	12.15	31.31	H	-24.73	18.73	53.98	35.25	AV
2390.0	25.39	31.31	V	0	56.70	73.98	17.28	PK
2390.0	12.16	31.31	V	-24.73	18.74	53.98	35.24	AV
2483.5	30.89	31.37	H	0	62.26	73.98	11.72	PK
2483.5	25.44	31.37	H	-24.73	32.08	53.98	21.90	AV
2483.5	30.98	31.37	V	0	62.35	73.98	11.63	PK
2483.5	25.68	31.37	V	-24.73	32.32	53.98	21.66	AV

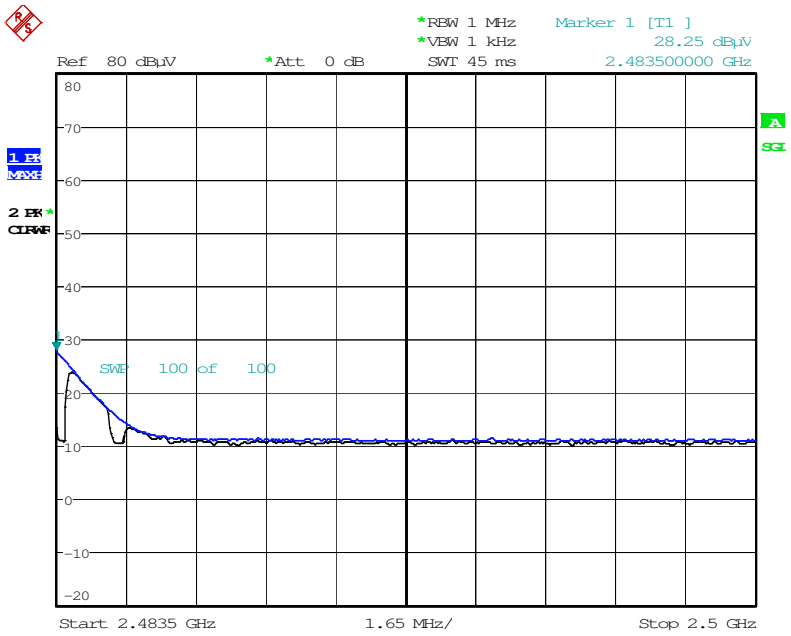
※ A·F: ANTENNA FACTOR
C·L: CABLE LOSS
AMP GAIN: AMPLIFIER GAIN

Notes:

1. Frequency range of measurement = 2483.5 MHz ~ 2500 MHz
2. Total = Reading Value + Antenna Factor + Cable Loss + Duty Cycle Correction Factor
3. Spectrum setting:
   a. Peak Setting 1 GHz – 25 GHz, RBW = 1 MHz, VBW = 3 MHz.
   b. Average Setting 1 GHz – 25 GHz, RBW = 1 MHz, VBW ≥ 1/τ Hz, where τ = pulse width in seconds.
   We performed using a reduced video BW method was done with the analyzer in linear mode.
4. FYI : Duty Cycle Correction Factor (79 channel hopping)
   a. Time to cycle through all channels= Δ t= τ [ms] x 79 channels = 229.100 ms, where τ = pulse width
   b. 100 ms/ Δt [ms] = $H \rightarrow$ Round up to next highest integer, $H' = 1$
   c. Worst Case Dwell Time = τ [ms] x H' = 2.900 ms
   d. Duty Cycle Correction = 20log (Worst Case Dwell Time/ 100ms) dB = -30.752 dB
5. Duty Cycle Correction Factor(AFH mode – minimum channel number case - 20 channels)
   a. Time to cycle through all channels= Δ t= τ [ms] x 20 channels = 58.00 ms, where τ = pulse width
   b. 100 ms/ Δt [ms] = $H \rightarrow$ Round up to next highest integer, $H' = 2$
   c. Worst Case Dwell Time = τ [ms] x H' = 5.800 ms
   d. Duty Cycle Correction(AFH) = 20log (Worst Case Dwell Time/ 100ms) dB = -24.7314 dB
   e. We applied DCCF in the test result which hopping channel number is 20.
6. We have done Normal Mode, EDR Mode.
7. This test is performed with hopping off.
8. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

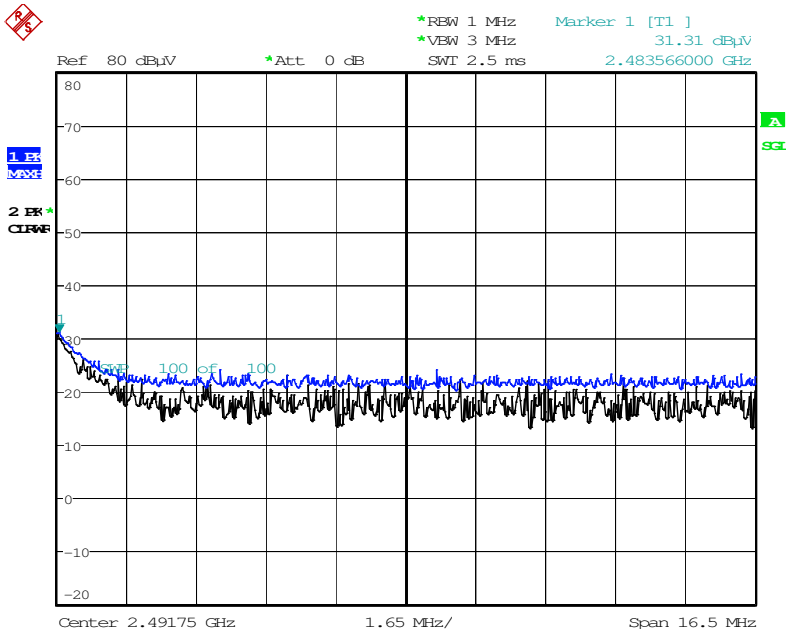
▣ RESULT PLOTS

Radiated Restricted Band Edges plot – Average Reading (GFSK, Ch.78)



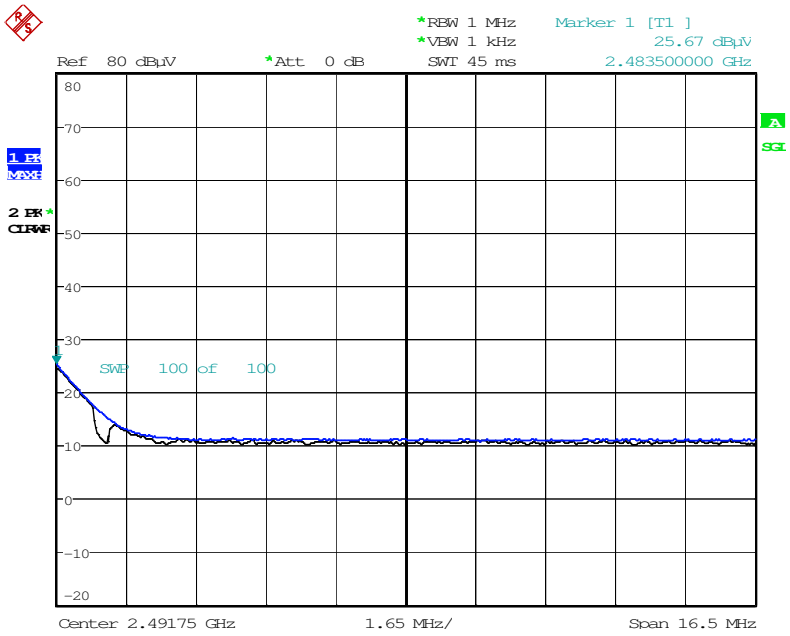
Date: 30.NOV.2015 03:42:53

Radiated Restricted Band Edges plot – Peak Reading (GFSK, Ch.78)



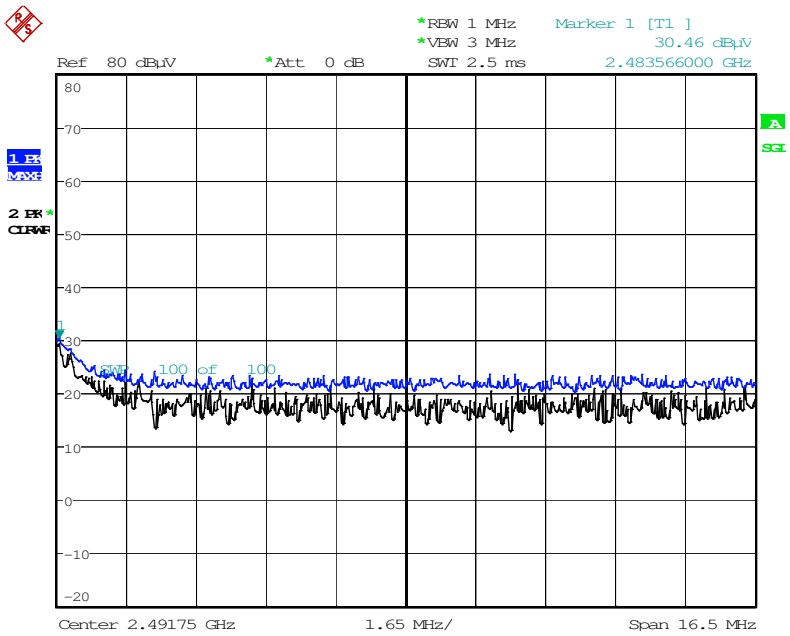
Date: 30.NOV.2015 03:43:16

Radiated Restricted Band Edges plot – Average Reading (8DPSK, Ch.78)



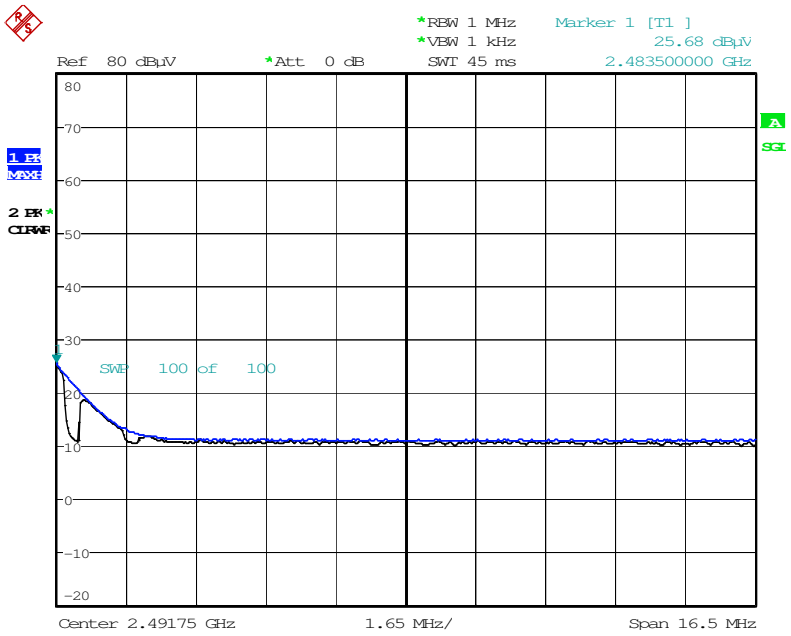
Date: 30.NOV.2015 03:44:19

Radiated Restricted Band Edges plot – Peak Reading (8DPSK, Ch.78)



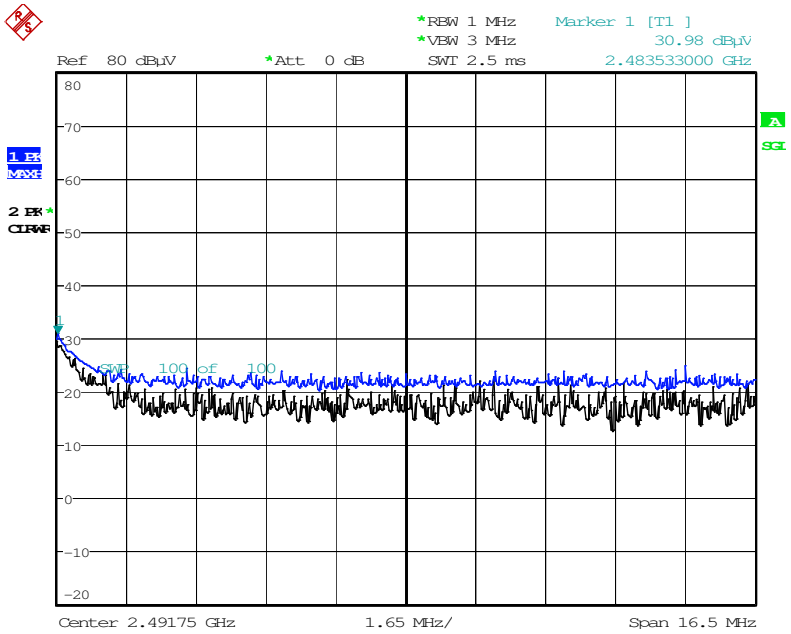
Date: 30.NOV.2015 03:46:18

Radiated Restricted Band Edges plot – Average Reading (π/4DQPSK, Ch.78)



Date: 30.NOV.2015 03:44:01

Radiated Restricted Band Edges plot – Peak Reading (π/4DQPSK, Ch.78)



Date: 30.NOV.2015 03:43:46

Note : Only the worst case plots for Radiated Restricted Band Edges.

8.7 POWERLINE CONDUCTED EMISSIONS

LIMIT

For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolt (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

Frequency Range (MHz)	Limits (dBμV)	
	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

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

Test Configuration

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

TEST PROCEDURE

1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
2. The EUT is connected via LISN to a test power supply.
3. The measurement results are obtained as described below:
4. Detectors – Quasi Peak and Average Detector.

Sample Calculation

Quasi-peak(Final Result) = Reading Value + Correction Factor

▣ RESULT PLOTS

Conducted Emissions (Line 1)

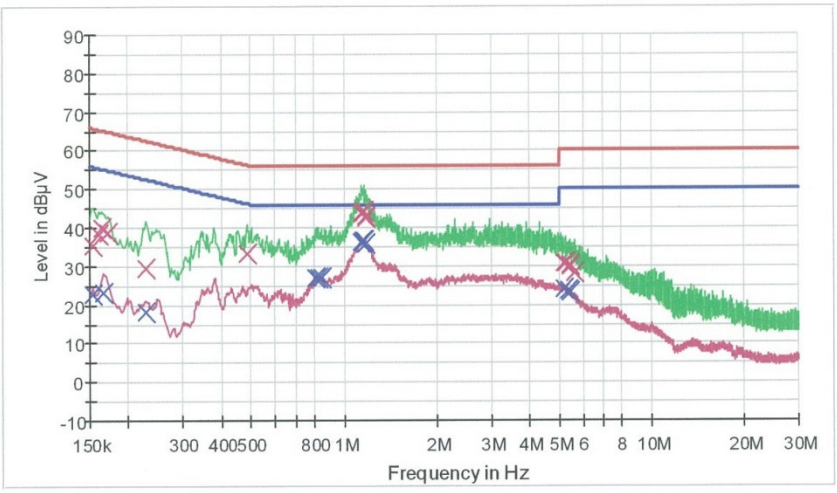
EMI Auto Test(13) 1 / 2

HCT TEST Report

Common Information

EUT:	LG-K120E
Manufacturer:	LG
Test Site:	SHIELD ROOM
Operating Conditions:	BT MODE
Operator Name:	K.S. KANG

FCC CLASS B



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.154000	35.5	9.000	Off	N	9.6	30.3	65.8
0.160000	38.3	9.000	Off	N	9.6	27.2	65.5
0.164000	40.1	9.000	Off	N	9.6	25.2	65.3
0.172000	38.6	9.000	Off	N	9.6	26.3	64.9
0.228000	29.5	9.000	Off	N	9.6	33.0	62.5
0.486000	33.4	9.000	Off	N	9.6	22.8	56.2
1.142000	43.6	9.000	Off	N	9.7	12.4	56.0
1.146000	44.1	9.000	Off	N	9.7	11.9	56.0
1.156000	43.8	9.000	Off	N	9.7	12.2	56.0
1.168000	44.0	9.000	Off	N	9.7	12.0	56.0
1.174000	42.7	9.000	Off	N	9.7	13.3	56.0
1.178000	42.8	9.000	Off	N	9.7	13.2	56.0
5.184000	30.8	9.000	Off	N	9.8	29.2	60.0
5.192000	30.9	9.000	Off	N	9.8	29.1	60.0
5.258000	30.7	9.000	Off	N	9.8	29.3	60.0
5.400000	30.0	9.000	Off	N	9.8	30.0	60.0

12/1/2015 10:04:49

EMI Auto Test(13) 2 / 2

Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
5.434000	30.2	9.000	Off	N	9.8	29.8	60.0
5.622000	28.3	9.000	Off	N	9.8	31.7	60.0

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.154000	22.7	9.000	Off	N	9.6	33.1	55.8
0.166000	23.2	9.000	Off	N	9.6	32.0	55.2
0.228000	18.4	9.000	Off	N	9.6	34.1	52.5
0.808000	26.8	9.000	Off	N	9.7	19.2	46.0
0.828000	27.1	9.000	Off	N	9.7	18.9	46.0
0.846000	27.1	9.000	Off	N	9.7	18.9	46.0
1.142000	36.4	9.000	Off	N	9.7	9.6	46.0
1.148000	36.6	9.000	Off	N	9.7	9.4	46.0
1.156000	36.4	9.000	Off	N	9.7	9.6	46.0
1.162000	36.8	9.000	Off	N	9.7	9.2	46.0
1.166000	36.7	9.000	Off	N	9.7	9.3	46.0
1.174000	35.8	9.000	Off	N	9.7	10.2	46.0
5.186000	24.0	9.000	Off	N	9.8	26.0	50.0
5.192000	23.8	9.000	Off	N	9.8	26.2	50.0
5.352000	23.7	9.000	Off	N	9.8	26.3	50.0
5.366000	23.5	9.000	Off	N	9.8	26.5	50.0
5.400000	23.2	9.000	Off	N	9.8	26.8	50.0
5.434000	23.1	9.000	Off	N	9.8	26.9	50.0

12/1/2015 10:04:49

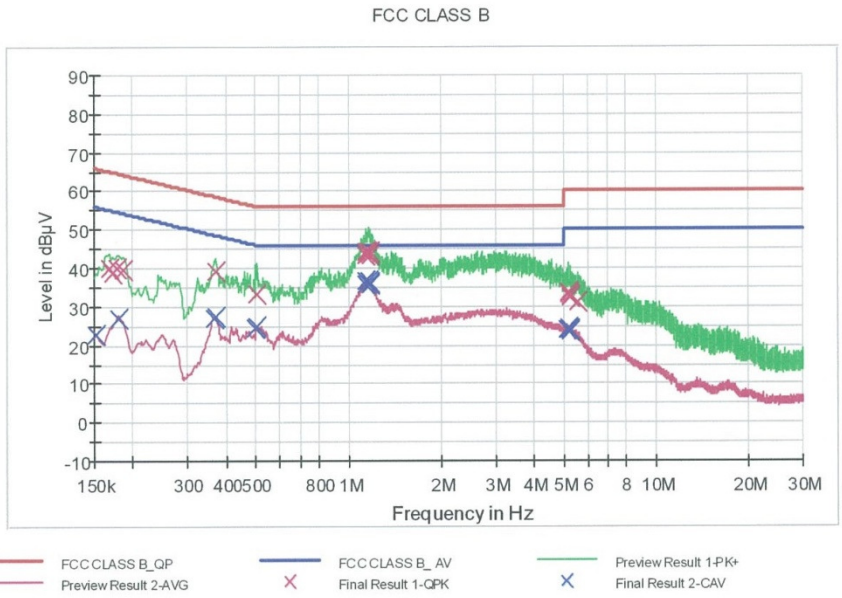
Conducted Emissions (Line 2)

EMI Auto Test(13) 1 / 2

HCT TEST Report

Common Information

EUT:	LG-K120E
Manufacturer:	LG
Test Site:	SHIELD ROOM
Operating Conditions:	BT MODE
Operator Name:	K.S. KANG



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.168000	39.8	9.000	Off	L1	9.6	25.3	65.1
0.172000	38.8	9.000	Off	L1	9.6	26.1	64.9
0.178000	40.2	9.000	Off	L1	9.6	24.4	64.6
0.186000	39.5	9.000	Off	L1	9.6	24.7	64.2
0.370000	39.2	9.000	Off	L1	9.6	19.3	58.5
0.506000	33.3	9.000	Off	L1	9.7	22.7	56.0
1.134000	43.4	9.000	Off	L1	9.7	12.6	56.0
1.142000	44.4	9.000	Off	L1	9.7	11.6	56.0
1.148000	44.2	9.000	Off	L1	9.7	11.8	56.0
1.160000	43.7	9.000	Off	L1	9.7	12.3	56.0
1.174000	44.2	9.000	Off	L1	9.7	11.8	56.0
1.178000	43.3	9.000	Off	L1	9.7	12.7	56.0
5.170000	33.6	9.000	Off	L1	9.8	26.4	60.0
5.178000	33.5	9.000	Off	L1	9.8	26.5	60.0
5.188000	33.2	9.000	Off	L1	9.8	26.8	60.0
5.252000	32.7	9.000	Off	L1	9.8	27.3	60.0

12/1/2015 10:13:42

EMI Auto Test(13) 2 / 2

Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
5.270000	32.2	9.000	Off	L1	9.8	27.8	60.0
5.550000	31.1	9.000	Off	L1	9.9	28.9	60.0

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.152000	22.8	9.000	Off	L1	9.6	33.1	55.9
0.180000	26.8	9.000	Off	L1	9.6	27.7	54.5
0.368000	26.9	9.000	Off	L1	9.6	21.6	48.5
0.372000	27.4	9.000	Off	L1	9.6	21.1	48.5
0.500000	24.6	9.000	Off	L1	9.7	21.4	46.0
0.506000	24.9	9.000	Off	L1	9.7	21.1	46.0
1.134000	35.8	9.000	Off	L1	9.7	10.2	46.0
1.142000	36.6	9.000	Off	L1	9.7	9.4	46.0
1.152000	36.2	9.000	Off	L1	9.7	9.8	46.0
1.160000	36.5	9.000	Off	L1	9.7	9.5	46.0
1.174000	36.2	9.000	Off	L1	9.7	9.8	46.0
1.178000	35.9	9.000	Off	L1	9.7	10.1	46.0
5.156000	24.2	9.000	Off	L1	9.8	25.8	50.0
5.170000	24.4	9.000	Off	L1	9.8	25.6	50.0
5.178000	24.3	9.000	Off	L1	9.8	25.7	50.0
5.188000	24.2	9.000	Off	L1	9.8	25.8	50.0
5.252000	23.9	9.000	Off	L1	9.8	26.1	50.0
5.270000	23.8	9.000	Off	L1	9.8	26.2	50.0

12/1/2015 10:13:42

9. LIST OF TEST EQUIPMENT

9.1 LIST OF TEST EQUIPMENT(Conducted Test)

Manufacturer	Model / Equipment	Calibration Date	Calibration Interval	Serial No.
Rohde & Schwarz	ENV216/ LISN	01/13/2015	Annual	100073
Agilent	E4440A/ Spectrum Analyzer	03/18/2015	Annual	US45303008
Agilent	N9020A / SIGNAL ANALYZER	06/30/2015	Annual	MY51110085
Agilent	N9020A / SIGNAL ANALYZER	07/02/2015	Annual	MY50510304
Agilent	N1911A/Power Meter	07/09/2015	Annual	MY45100523
Agilent	N1921A /POWER SENSOR	07/09/2015	Annual	MY45241059
Agilent	87300B/Directional Coupler	12/08/2014	Annual	3116A03621
Hewlett Packard	11667B / Power Splitter	06/15/2015	Annual	5001
Hewlett Packard	E3632A / DC POWER SUPPLY	03/11/2015	Annual	KR75303962
Agilent	8493C / Attenuator(10 dB)	07/23/2015	Annual	07560
Rohde & Schwarz	CBT / BLUETOOTH TESTER	05/11/2015	Annual	100422

9.2 LIST OF TEST EQUIPMENT(Radiated Test)

Manufacturer	Model / Equipment	Calibration Date	Calibration Interval	Serial No.
Schwarzbeck	VULB 9160/ TRILOG Antenna	10/10/2014	Biennial	3368
HD	MA240/ Antenna Position Tower	N/A	N/A	556
EMCO	1050/ Turn Table	N/A	N/A	114
HD GmbH	HD 100/ Controller	N/A	N/A	13
HD GmbH	KMS 560/ SlideBar	N/A	N/A	12
Schwarzbeck	BBHA 9120D/ Horn Antenna	05/07/2015	Biennial	937
Schwarzbeck	BBHA9170 / Horn Antenna(15 GHz ~ 40 GHz)	04/30/2015	Biennial	BBHA9170124
Rohde & Schwarz	FSP / Spectrum Analyzer	01/22/2015	Annual	839117/011
Wainwright Instrument	WHF3.0/18G-10EF / High Pass Filter	06/29/2015	Annual	8
Wainwright Instrument	WRCJ2400/2483.5-2370/2520-60/14SS / Band Reject Filter	06/15/2015	Annual	1
Rohde & Schwarz	LOOP ANTENNA	09/03/2014	Biennial	1513-175
CERNEX	CBL18265035 / POWER AMP	07/27/2015	Annual	22966
CERNEX	CBL06185030 / POWER AMP	07/21/2015	Annual	22965
CERNEX	CBLU1183540 / POWER AMP	07/21/2015	Annual	22964
Rohde & Schwarz	CBT / BLUETOOTH TESTER	05/11/2015	Annual	100422