HCT CO.,LTD

HCT CO., LTD.

CERTIFICATE OF COMPLIANCE

FCC Certification

Applicant Name:
HYUNDAI MOBIS CO., LTD.

Address:
80-9, Mabook-Dong, Giheung-Gu Yongin-shi
Gyunggi-Do, 446-912 South Korea

Date of Issue:
May 31, 2012

Location:
HCT CO., LTD., 105-1, Jangam-ri, Majang-Myeon, Icheon-si, Kyunggi-Do, Korea

Test Report No.: HCTR1205FR36

HCT FRN: 0005866421

IC Recognition No.: 5944A-3

FCC ID	**: TQ8-AC140INAN**
IC	**: 5074A-AC1B2INKN**
APPLICANT	**: HYUNDAI MOBIS CO., LTD.**

FCC Model(s):	AC140INAN
IC Model(s):	AC1B2INKN
EUT Type:	CAR Audio
Max. RF Output Power:	3.78 dBm(2.39 mW)
Frequency Range:	2402 - 2480 MHz (Bluetooth)
Modulation type	GFSK(Normal), π/4DQPSK and 8DPSK(EDR)
FCC Classification:	FCC Part 15 Spread Spectrum Transceiver
FCC Rule Part(s):	Part 15 subpart C 15.247
IC Rule :	RSS-210 , RSS-GEN

Engineering Statement:

The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. 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)

Jong Seok Lee

Report prepared by
: Jong Seok Lee
Test Engineer of RF Team

Approved by
: Sang Jun Lee
Manager of RF Team

Version

TEST REPORT NO.	DATE	DESCRIPTION
HCTR1205FR36	May 31, 2012	- First Approval Report

Table of Contents

1. GENERAL INFORMATION

Applicant Name:	HYUNDAI MOBIS CO., LTD.
Address:	80-9, Mabook-Dong, Giheung-Gu Yongin-shi Gyunggi-Do, 446-912 South Korea
FCC ID:	TQ8-AC140INAN
IC	5074A-AC1B2INKN
EUT:	CAR Audio
FCC Model name(s):	AC140INAN
IC Model name(s):	AC1B2INKN
Date(s) of Tests:	April 30, 2012 ~ May 10, 2012
Contact Person:	Name: Jong Tae Kim Phone #: +82-31-288-6081 Fax #: +82-31-899-1788
Place of Tests:	HCT Co., Ltd. 105-1, Jangam-ri , Majang-Myeon, Icheon-si, Kyunggi-Do, 467-811, KOREA. (IC Recognition No. : 5944A-3)

2. EUT DESCRIPTION

EUT Type	CAR Audio
FCC Model Name	AC140INAN
IC Model Name	AC1B2INKN
Power Supply	DC 12 V
Frequency Range	2402 - 2480 MHz (Bluetooth)
Transmit Power	3.78 dBm(2.39 mW)
BT Operating Mode	Nomal, 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: AMOTECH Co., Ltd. Antenna type: Chip Antenna Peak Gain : 3.5 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 for Testing Unlicensed Wireless Devices(ANSI C63.10-2009) and FCC Public Notice DA 00-705 dated March 30, 2000 entitled “Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems” were used in the measurement of the **HYUNDAI MOBIS CO., LTD.**

CAR Audio FCC ID: TQ8-AC140INAN

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 :2009) 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. 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 according to the requirements in Section 6.3 of ANSI C63.10. (Version: 2009)

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.

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 105-1, Jangam-ri, Majang-Myeon, Icheon-si, Kyunggi-Do, 467-811, Korea. The site is constructed in conformance with the requirements of ANSI C63.4. (Version :2003) and CISPR Publication 22. Detailed description of test facility was submitted to the Commission and accepted dated March 02, 2011 (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	IC Part Section(s)	FCC Part Section(s)	Test Limit	Test Condition	Test Result
20 dB Bandwidth	RSS-210, A8.1(a)	§15.247(a)(1)(ii) or (iii)	NA	CONDUCTED	PASS
Occupied Bandwidth	RSS-210, A1.1.3	NA	NA		PASS
Conducted Maximum Peak Output Power	RSS-210, A8.4(2)	§15.247(b)(1)	< 1 Watts		PASS
Carrier Frequency Separation	RSS-210, A8.1(b)	§15.247(a)(1)	>25 kHz or >2/3 of the 20dB BW		PASS
Number of Hopping Frequencies	RSS-210, A8.1(d)	§15.247(a)(1)(iii)	>15		PASS
Time of Occupancy	RSS-210, A8.1(d)	§15.247(a)(1)(iii)	<400 ms		PASS
Conducted Spurious Emissions	RSS-210, A 8.5 RSS-GEN, Section 7.2.3	§15.247(d)	< 20 dB for all out-of band emissions		PASS
Band Edge(Out of Band Emissions)	RSS-210, A 8.5	§15.247(d)	< 20 dB for all out-of band emissions		PASS
AC Power line Conducted Emissions	RSS-GEN, Section 7.2.2	§15.207(a)	cf. Section 8.7		PASS
Radiated Spurious Emissions	RSS-210, A2.9, A 8.5	§15.247(d), 15.205, 15.209	cf. Section 8.6.2	RADIATED	PASS
Radiated Restricted Band Edge	RSS-210, A2.9, A 8.5	§15.247(d), 15.205, 15.209	cf. Section 8.6.4		PASS
Receiver Spurious Emissions	RSS-GEN, Section 7.2.3	§15.109	cf. Section 8.6.3		PASS

8. FCC PART 15.247 REQUIREMENTS

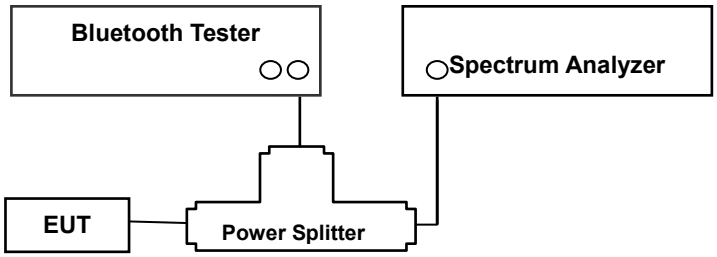
8.1 PEAK POWER

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 watt.
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.

1. Span = 2 MHz (GFSK) / 5 MHz (π/4DQPSK and 8DPSK)
2. RBW = 1 MHz (GFSK) / 3 MHz (π/4DQPSK and 8DPSK)
3. VBW = 1 MHz (GFSK) / 3 MHz (π/4DQPSK and 8DPSK)
4. Sweep = auto
5. Packet type= DH5 (GFSK) / 2-DH5 (π/4DQPSK) / 3-DH5 (8DPSK)

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 7.6 dB at 2.4 GHz. We used the particular cable type that is supported by manufacture.

TEST RESULTS

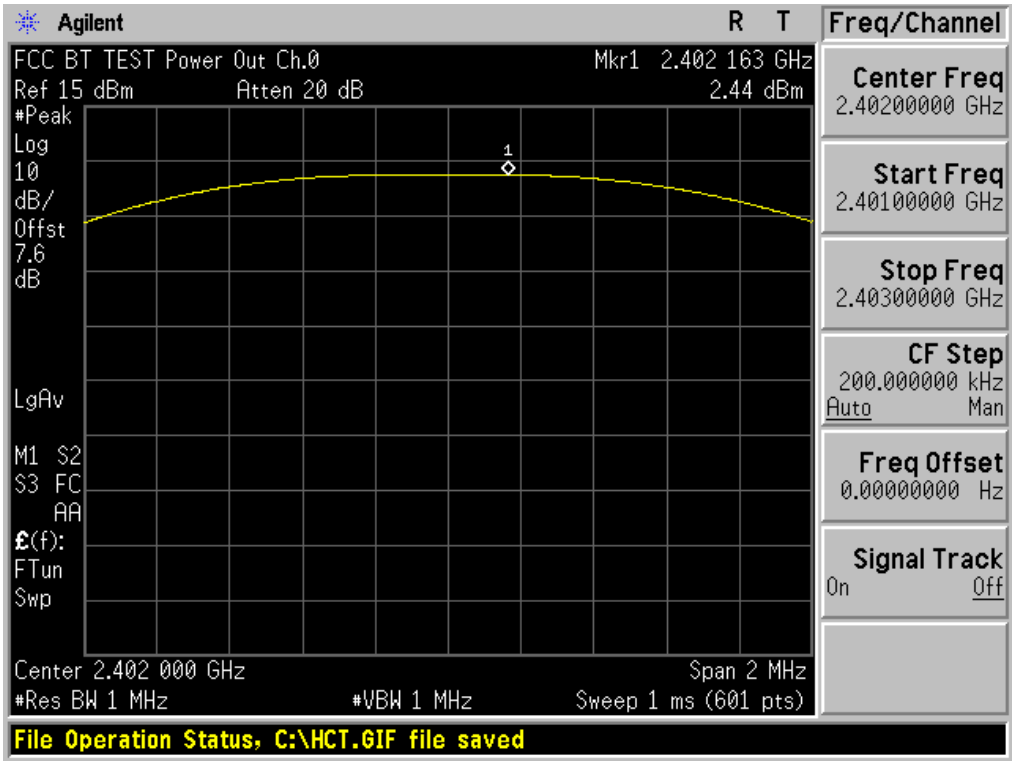
No non-compliance noted

Test Data

Channel	Frequency (MHz)	Output Power (GFSK)		Output Power (8DPSK)		Output Power (π/4DQPSK)		Limit (W)	Result
		(dBm)	(mW)	(dBm)	(mW)	(dBm)	(mW)		
Low	2402	2.44	1.75	3.78	2.39	3.61	2.30	1	PASS
Mid	2441	2.66	1.85	3.72	2.36	3.52	2.25		PASS
High	2480	2.19	1.66	2.97	1.98	2.72	1.87		PASS

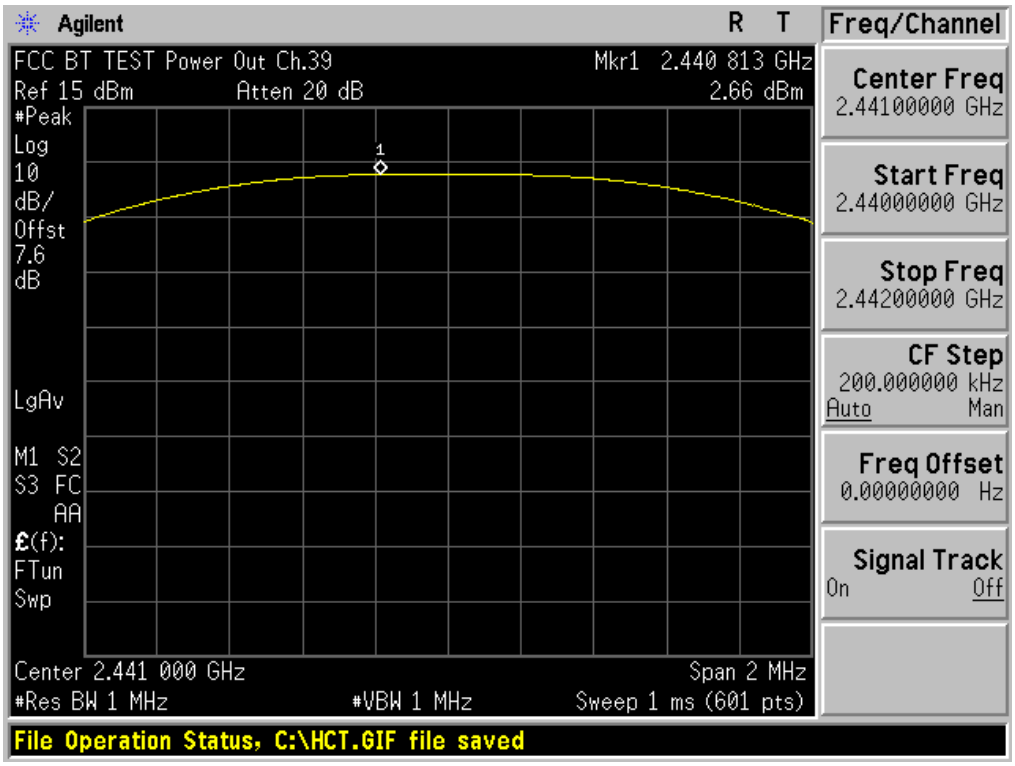
Test Plots (GFSK)

Peak Power (Low-CH)



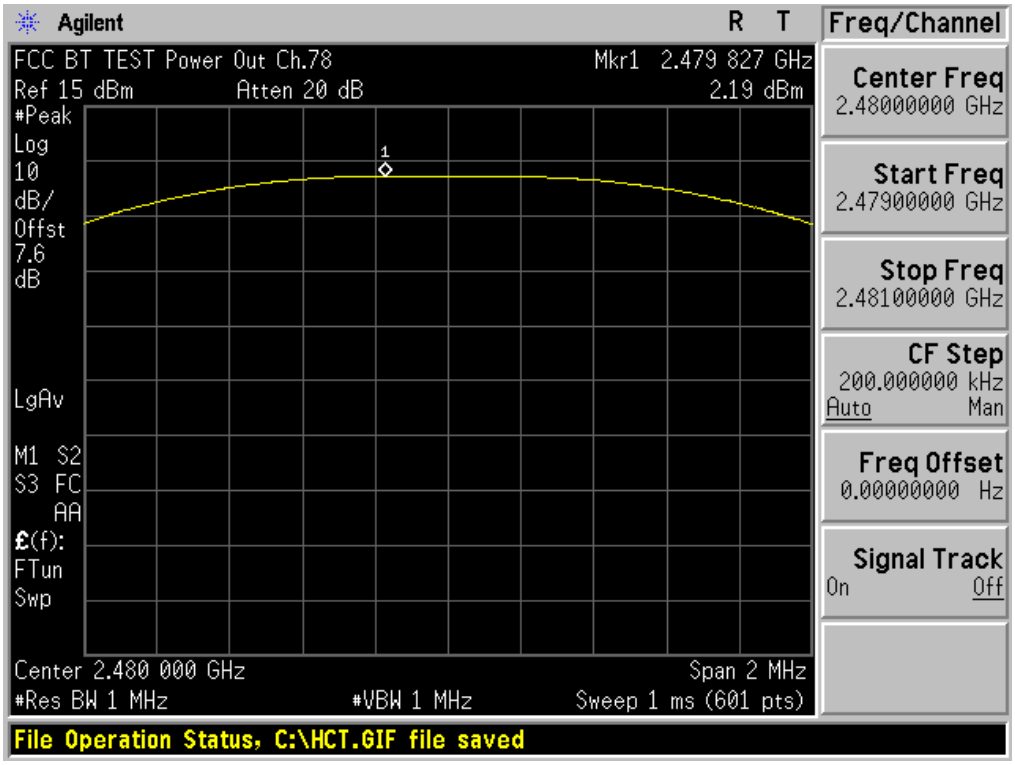
Test Plots (GFSK)

Peak Power (Mid-CH)



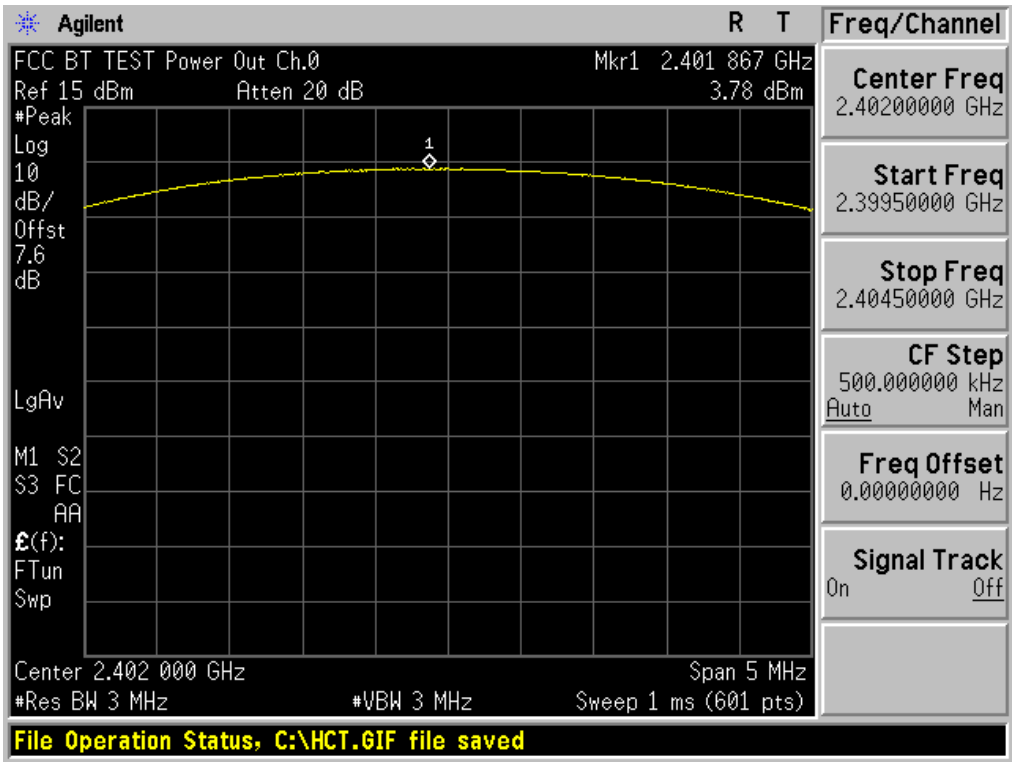
Test Plots (GFSK)

Peak Power (High-CH)



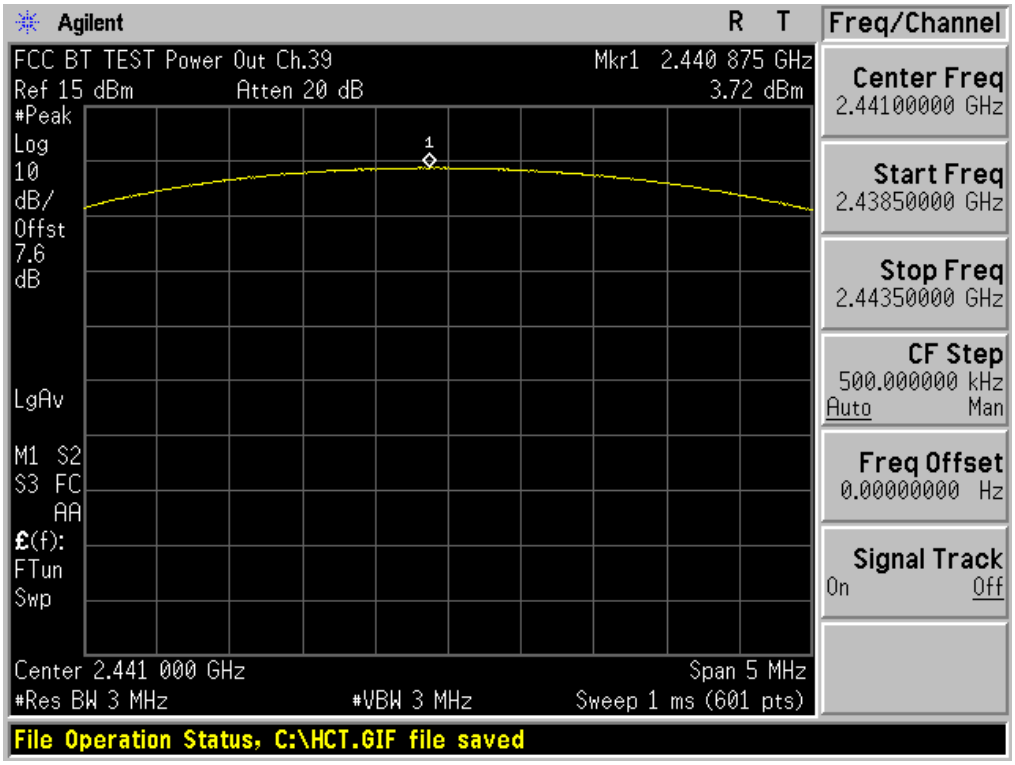
Test Plots (8DPSK)

Peak Power (Low-CH)



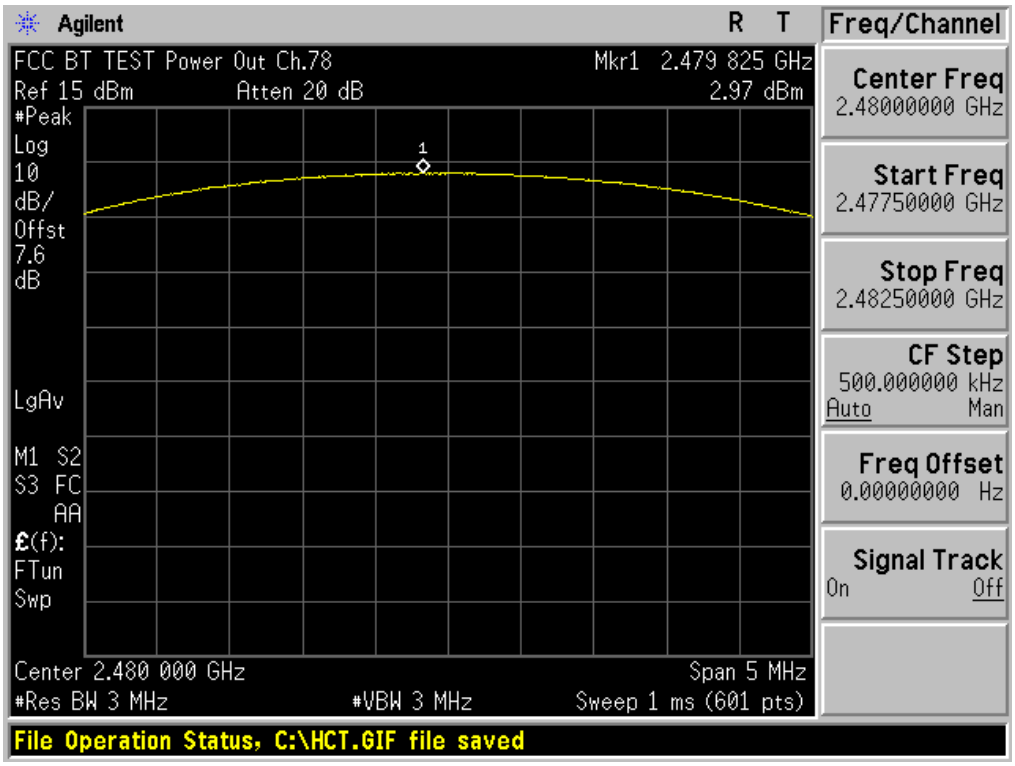
Test Plots (8DPSK)

Peak Power (Mid-CH)



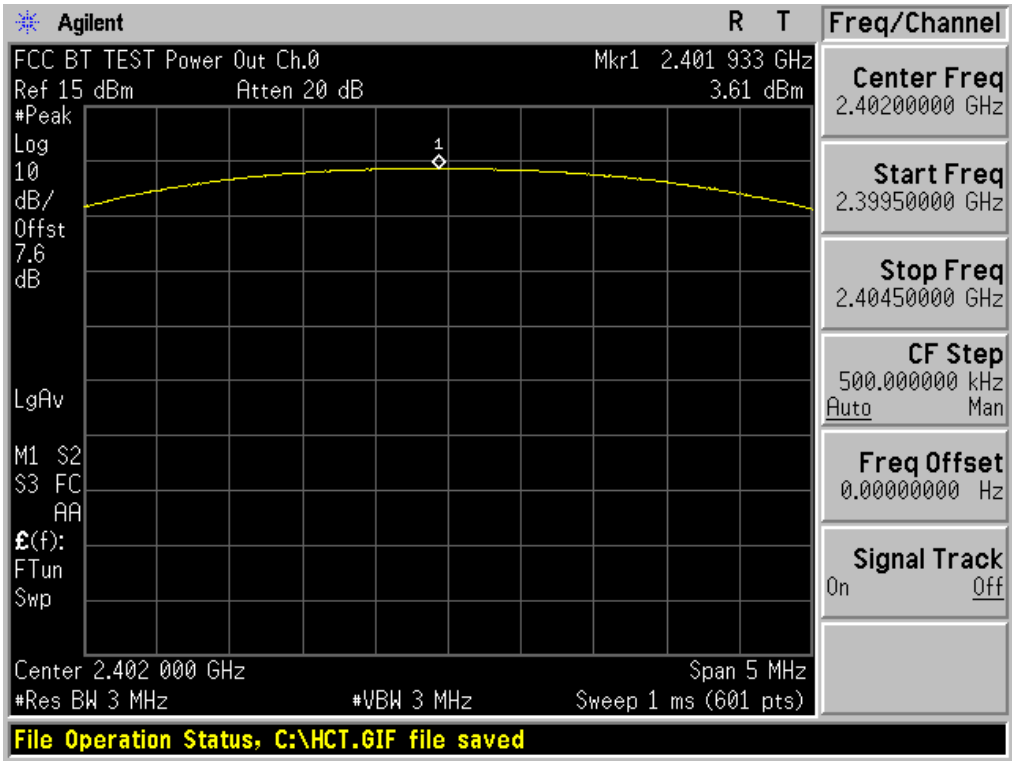
Test Plots (8DPSK)

Peak Power (High-CH)



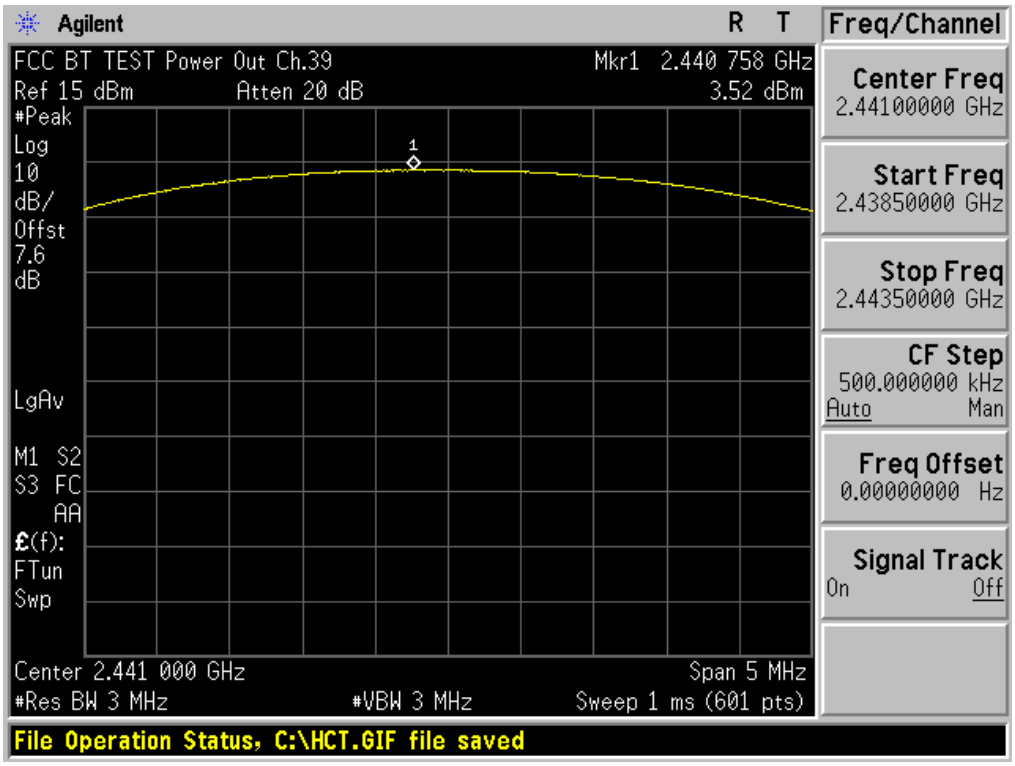
Test Plots (π/4DQPSK)

Peak Power (Low-CH)

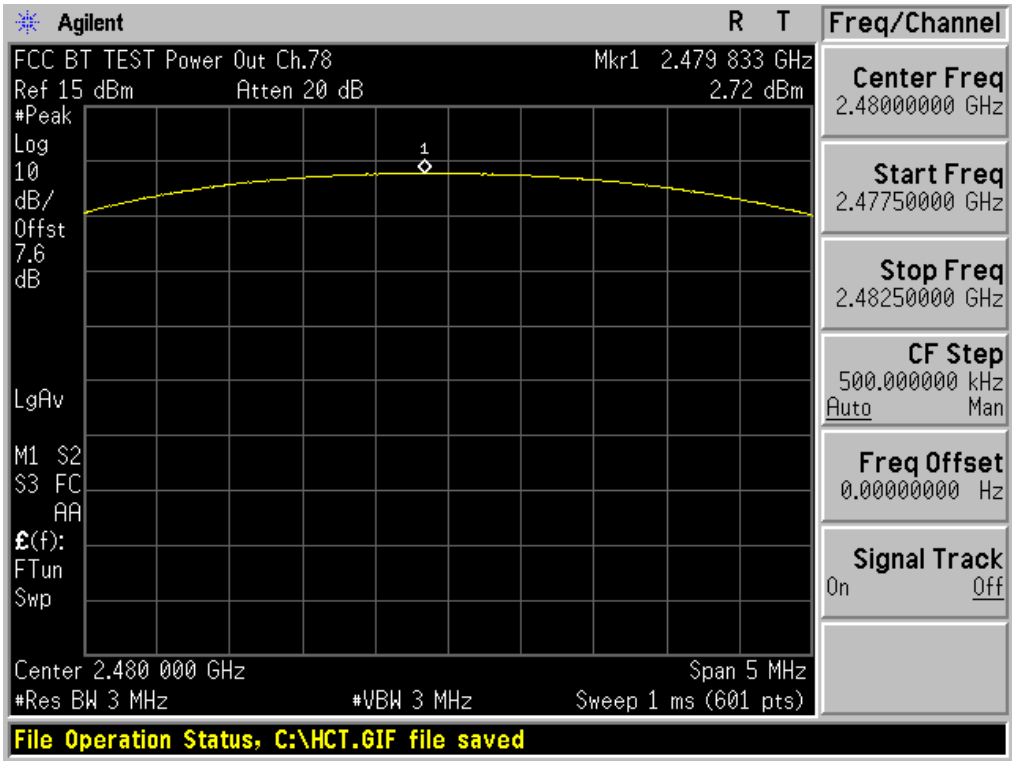


Test Plots (π/4DQPSK)

Peak Power (Mid-CH)



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

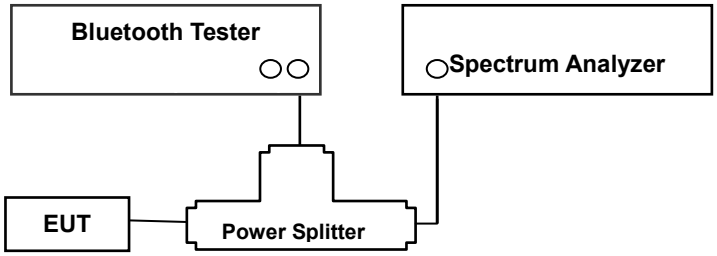


8.2 BAND EDGES

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 :

1. Span = 8 MHz / 10 MHz(with hopping)
2. RBW = 100 kHz
3. VBW = 300 kHz
4. Sweep = auto
5. Detector Mode = Peak

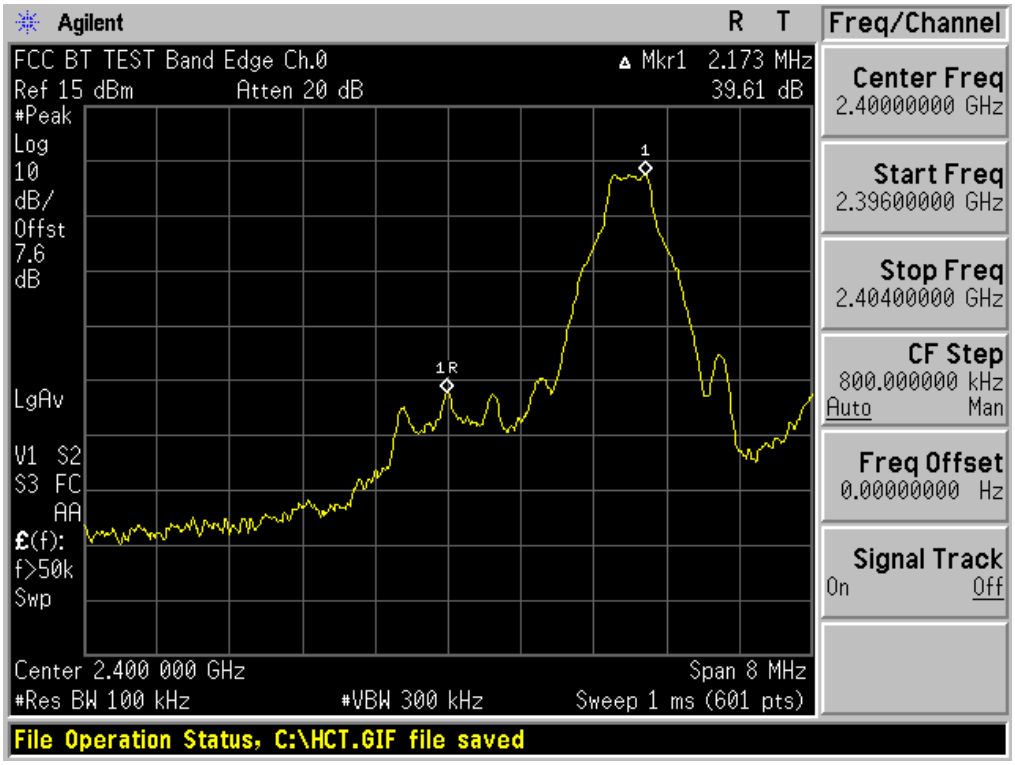
TEST RESULTS

See attached.

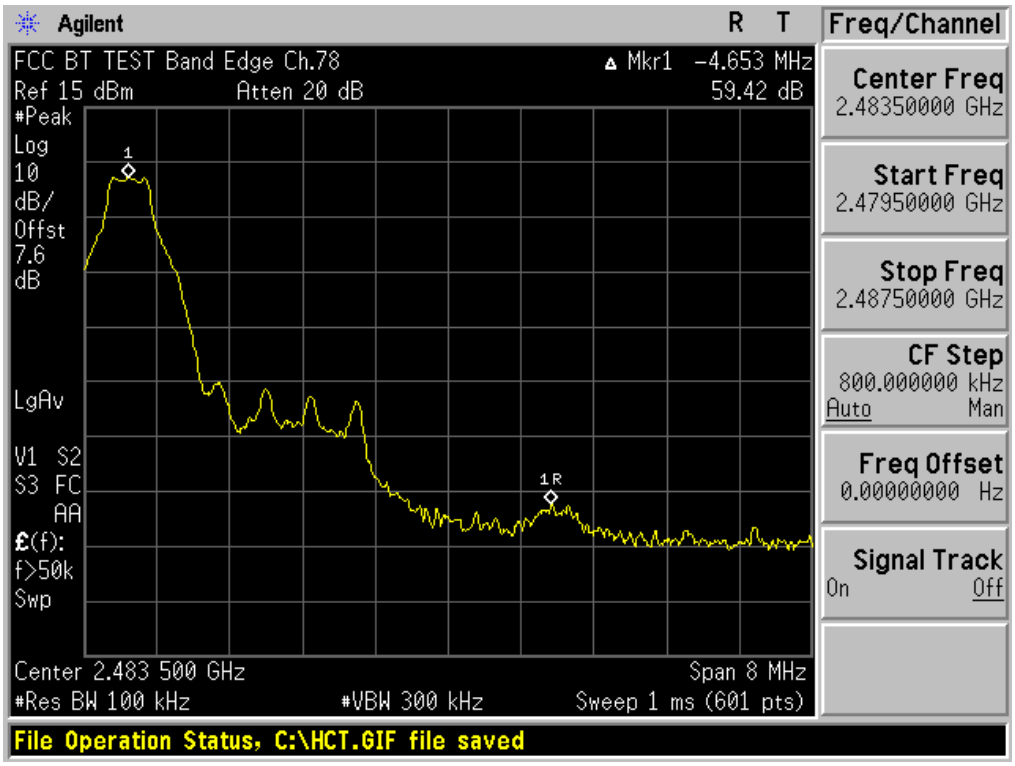
Note :

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 7.6 dB at 2.4 GHz. We used the particular cable type that is supported by manufacture.

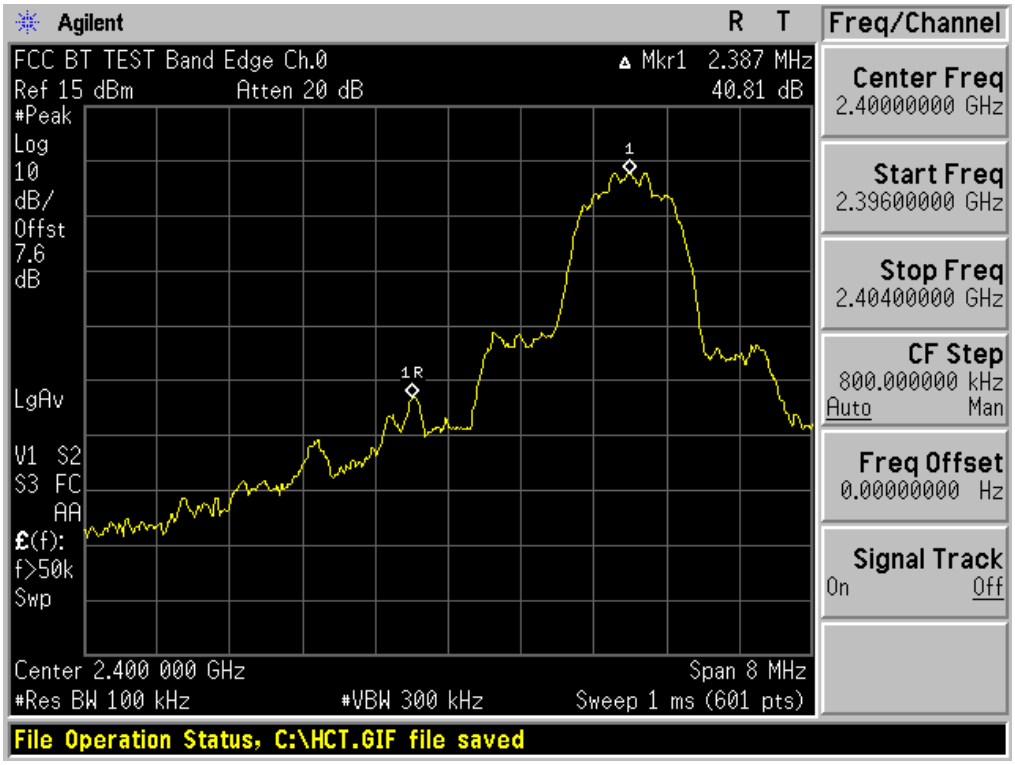
Test Plots without hopping (GFSK)
Band Edges (Low-CH)



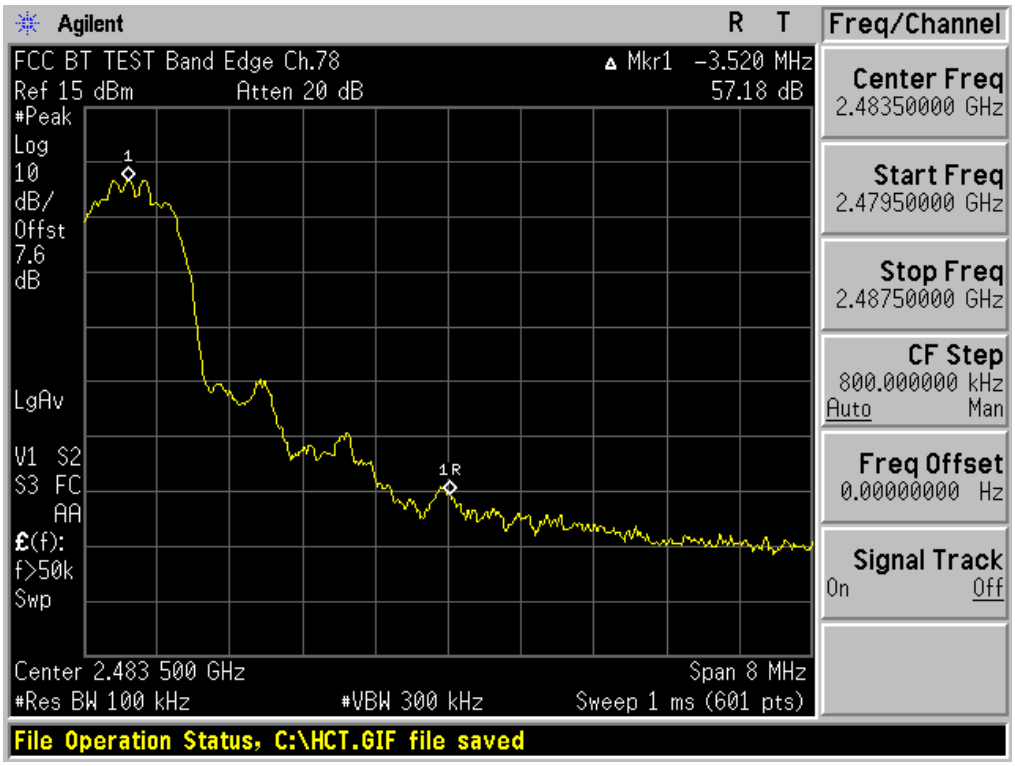
Test Plots without hopping (GFSK)
Band Edges (High-CH)



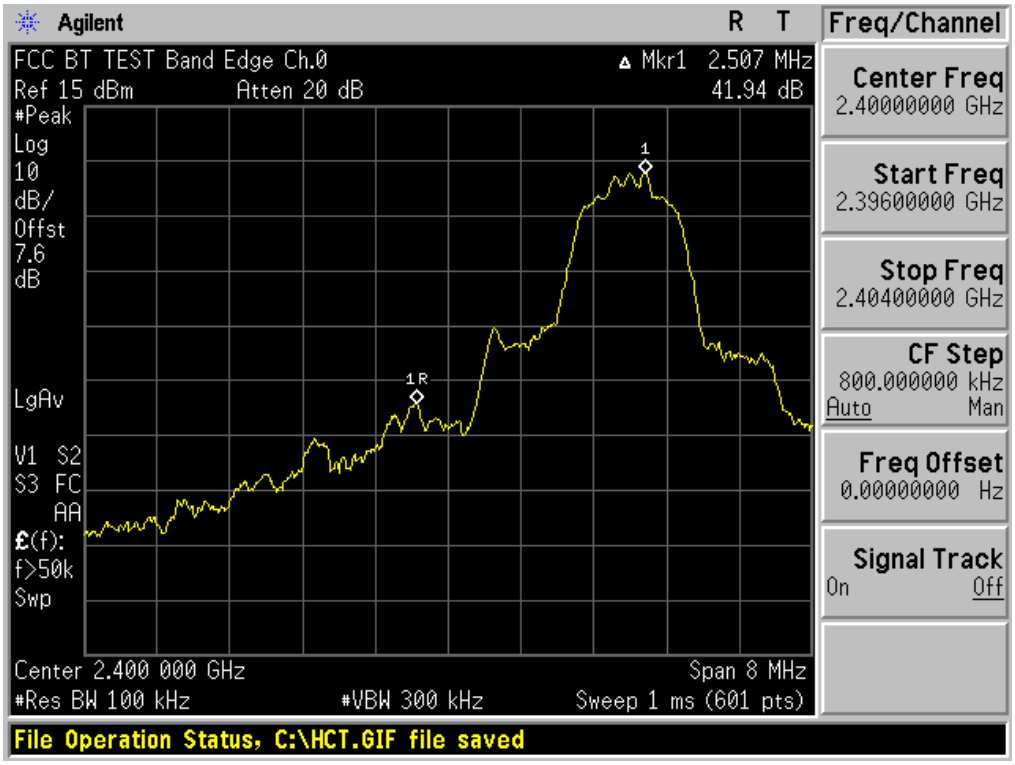
Test Plots without hopping (8DPSK)
Band Edges (Low-CH)



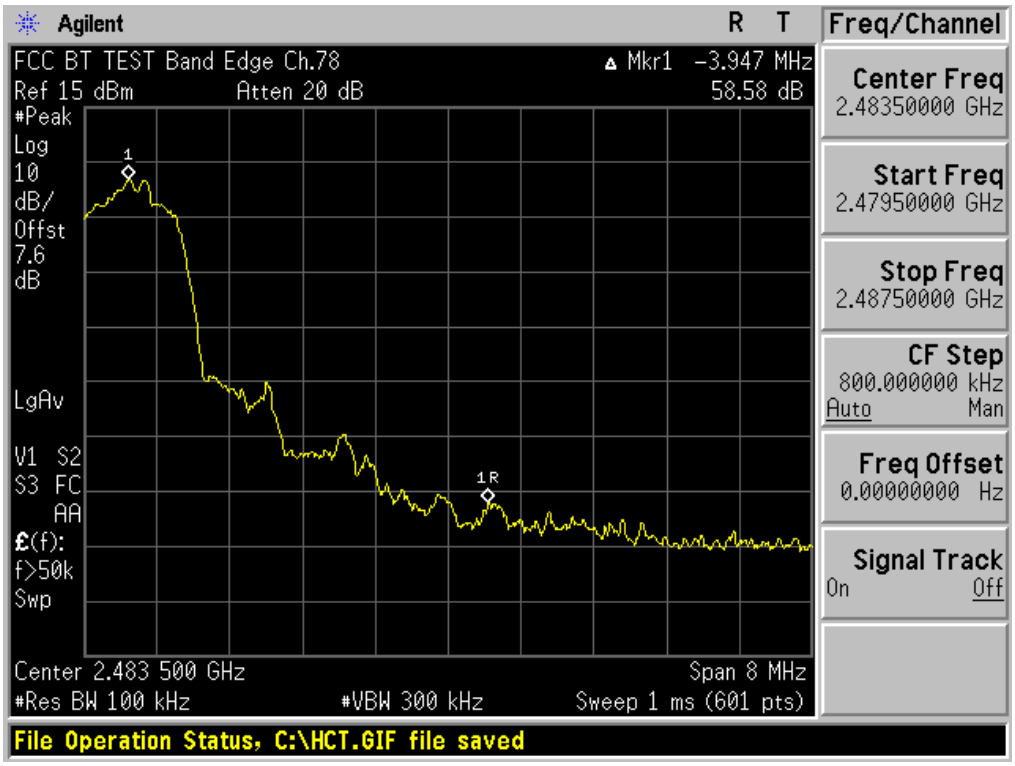
Test Plots without hopping (8DPSK)
Band Edges (High-CH)



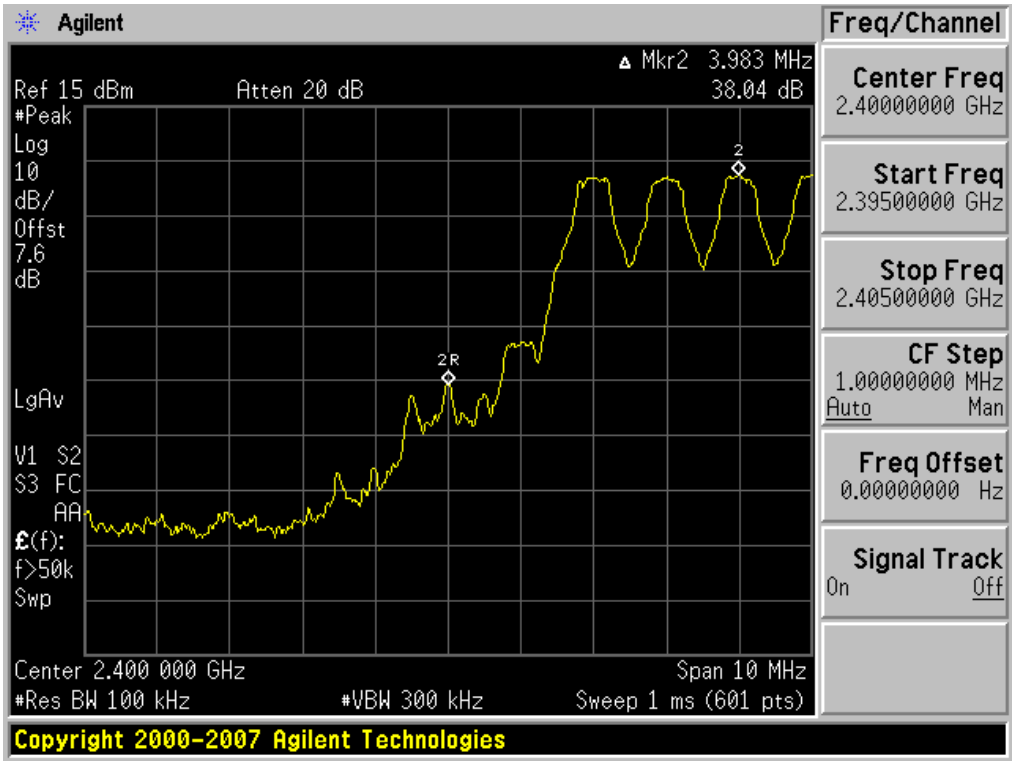
Test Plots without hopping (π/4DQPSK)
Band Edges (Low-CH)



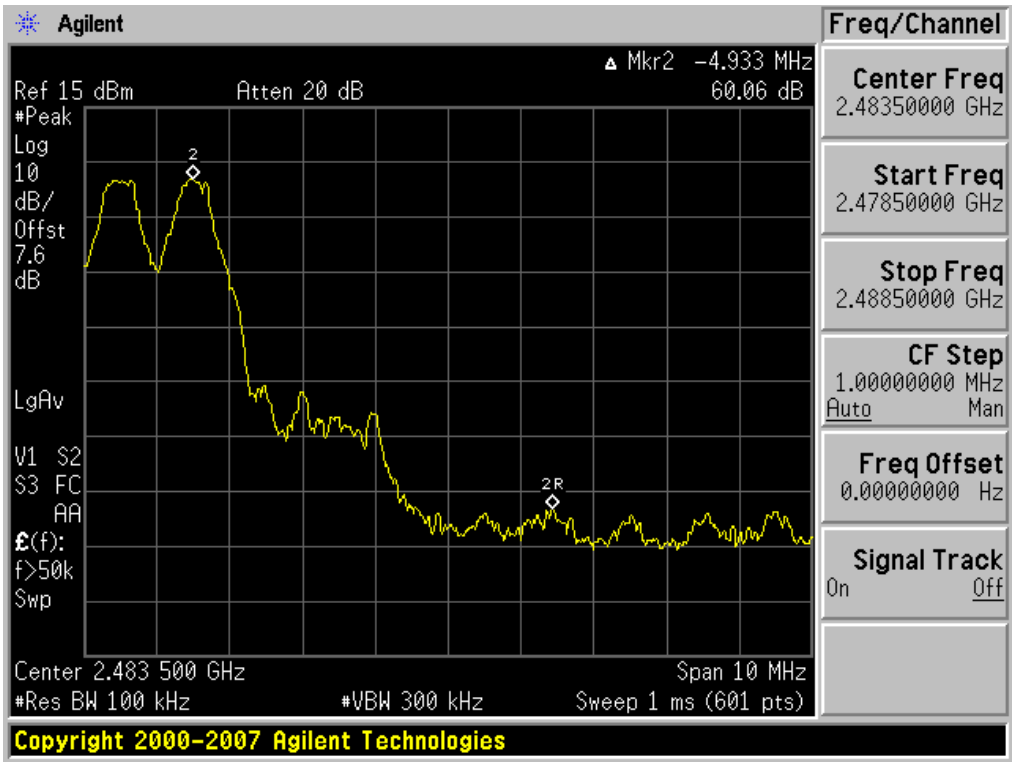
Test Plots without hopping (π/4DQPSK)
Band Edges (High-CH)



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

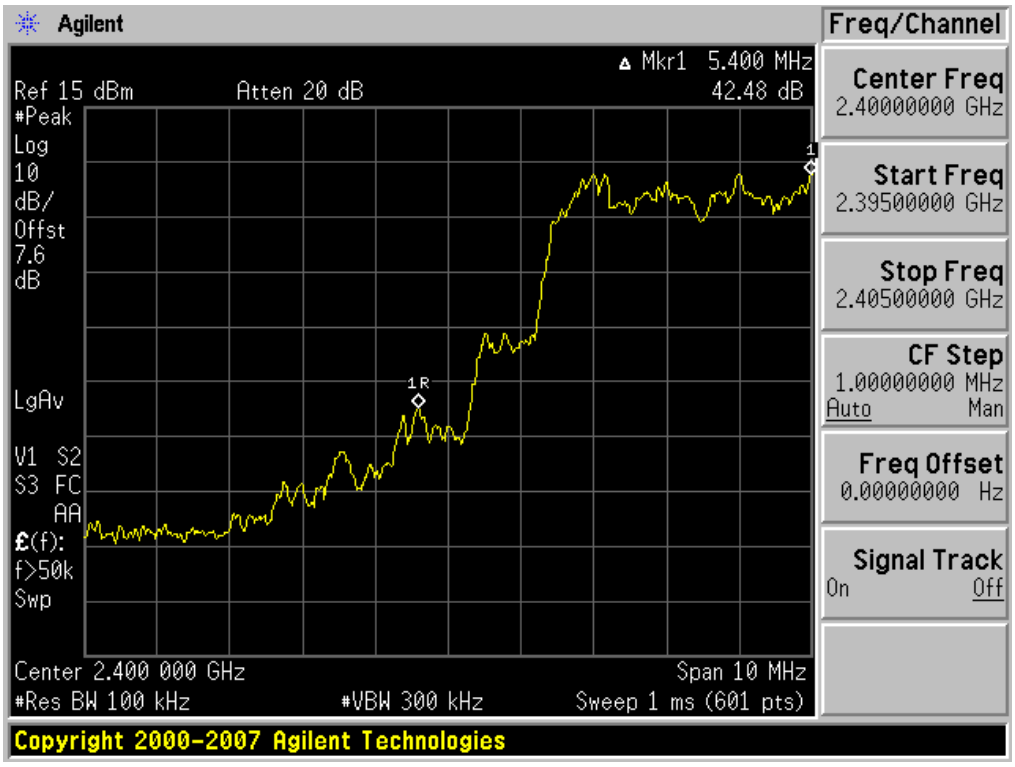


Test Plots with hopping (GFSK)
Band Edges (High-CH)



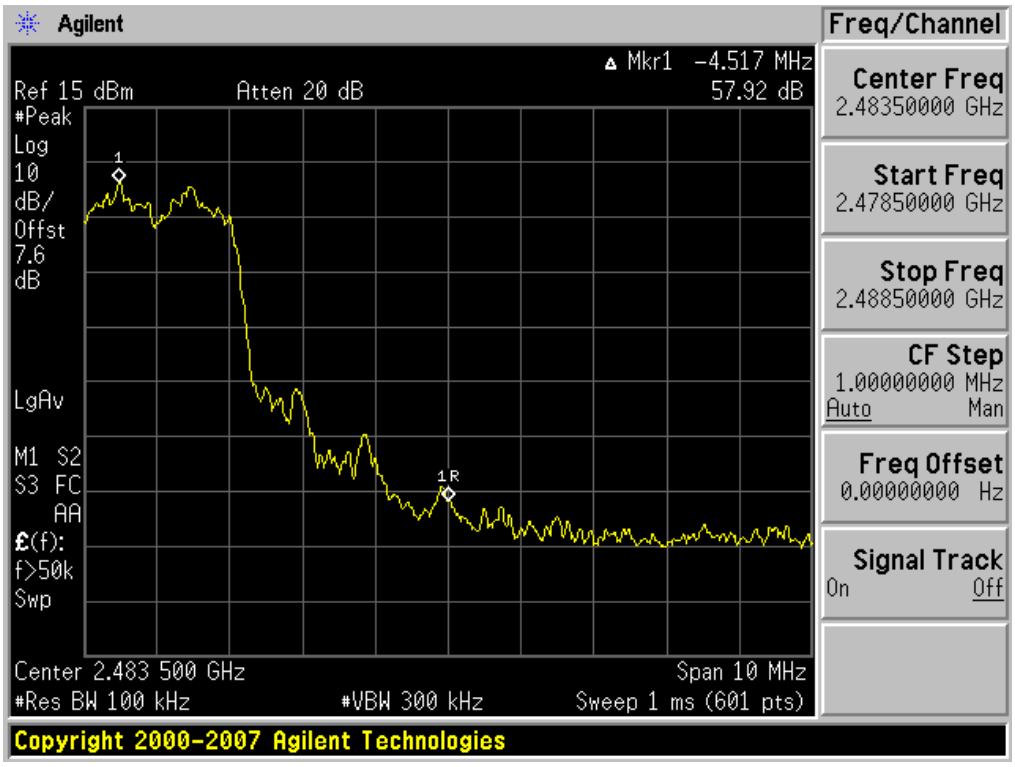
Test Plots with hopping (8DPSK)

Band Edges (Low-CH)

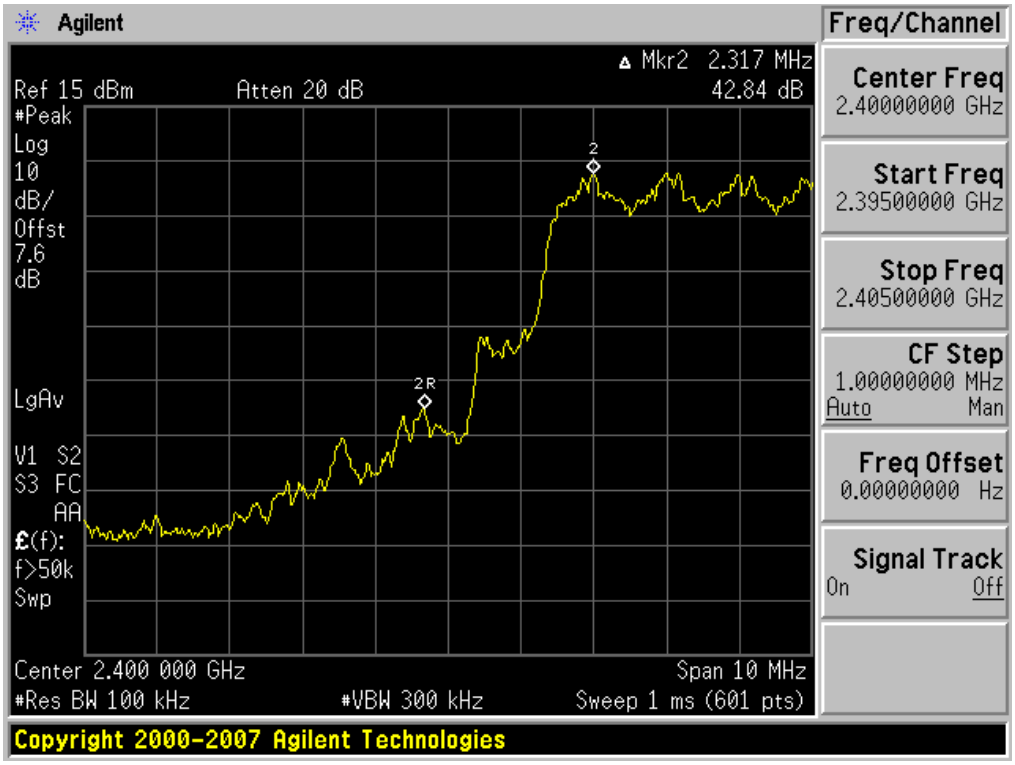


Test Plots with hopping (8DPSK)

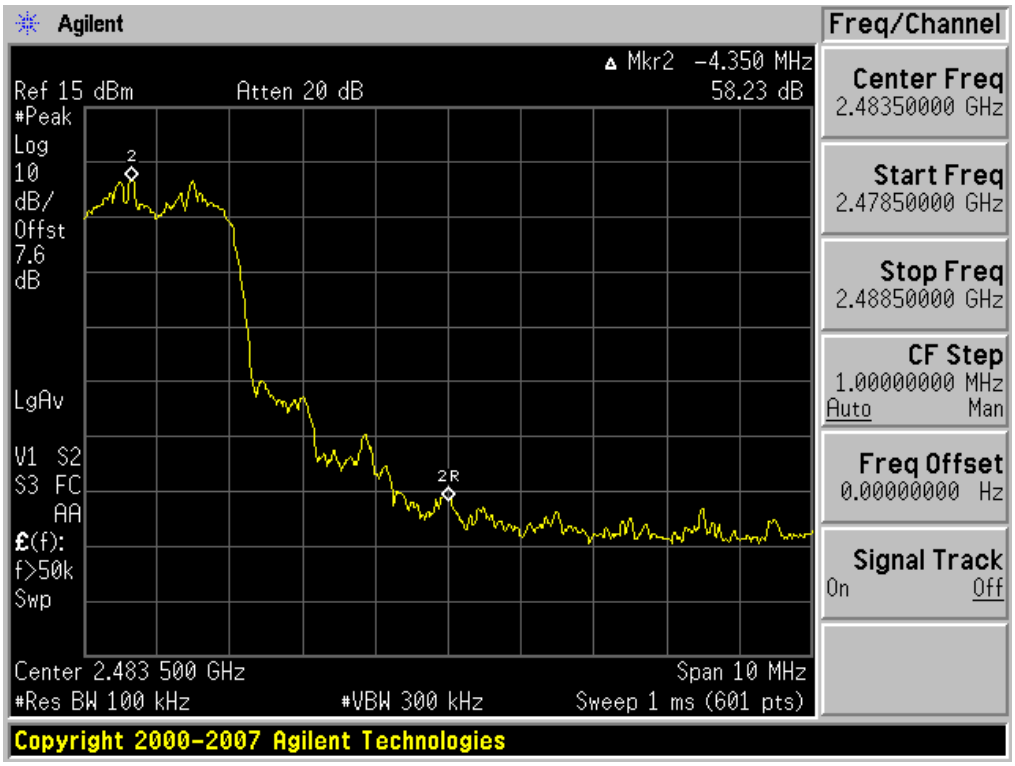
Band Edges (High-CH)



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



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

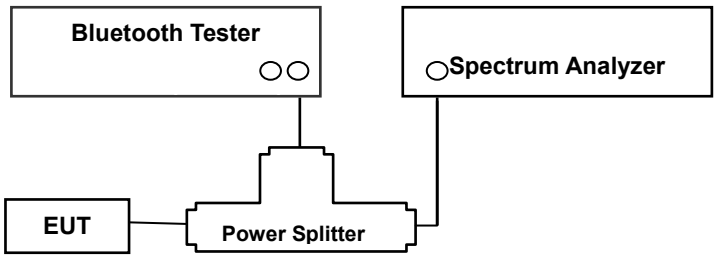


8.3 FREQUENCY SEPARATION / OCCUPIED BANDWIDTH (99% BW)

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 :

1. Span = 3 MHz
2. RBW = 30 kHz
3. VBW = 100 kHz
4. Sweep = auto

The trace was allowed to stabilize. The marker-delta function was used to determine the separation between the peaks of the adjacent channels.

TEST RESULTS

No non-compliance noted

Test Data

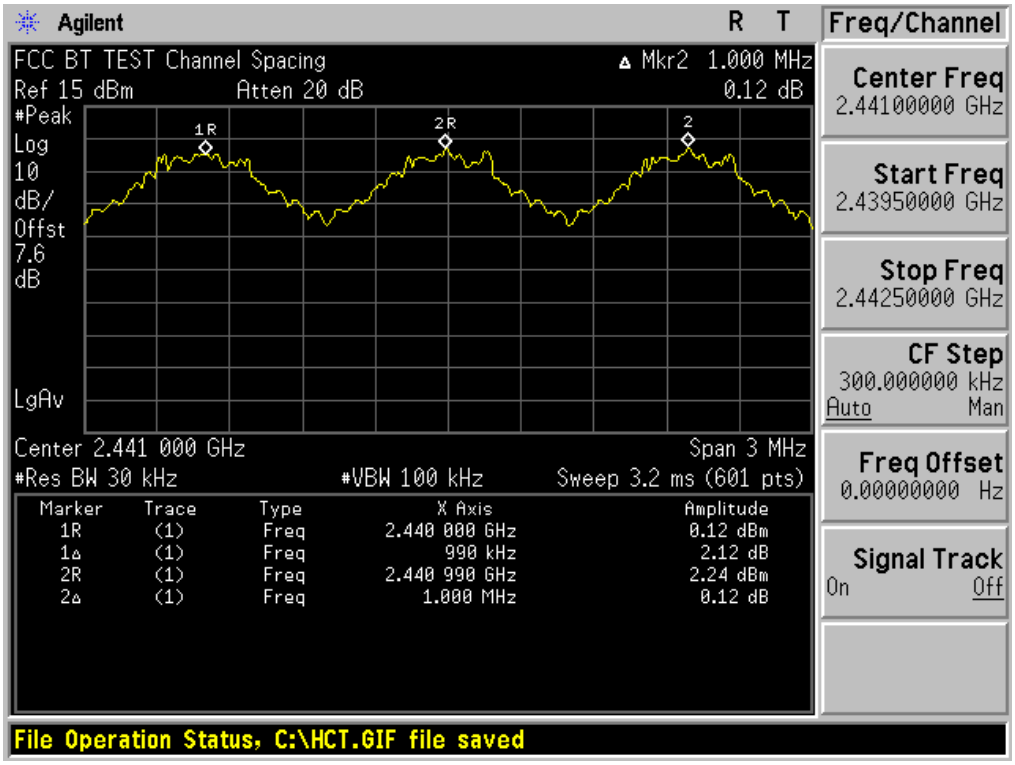
Channel Separation (kHz)			20dB Bandwidth (kHz)				Limit (kHz)	Result
GFSK	8DPSK	π/4DQPSK	Channel	GFSK	8DPSK	4DQPSK		
990	995	980	Low CH	931.4	1283.0	1254.0	>25 or >2/3 of the 20dB BW	Pass
			Middle CH	933.0	1264.0	1245.0		
			High CH	931.2	1261.0	1243.0		

Occupied Bandwidth (99% BW)

99% BW (kHz)			
Channel	GFSK	8DPSK	4DQPSK
Low CH	853.0	1205.8	1191.7
Middle CH	850.8	1183.9	1174.0
High CH	849.0	1175.9	1165.9

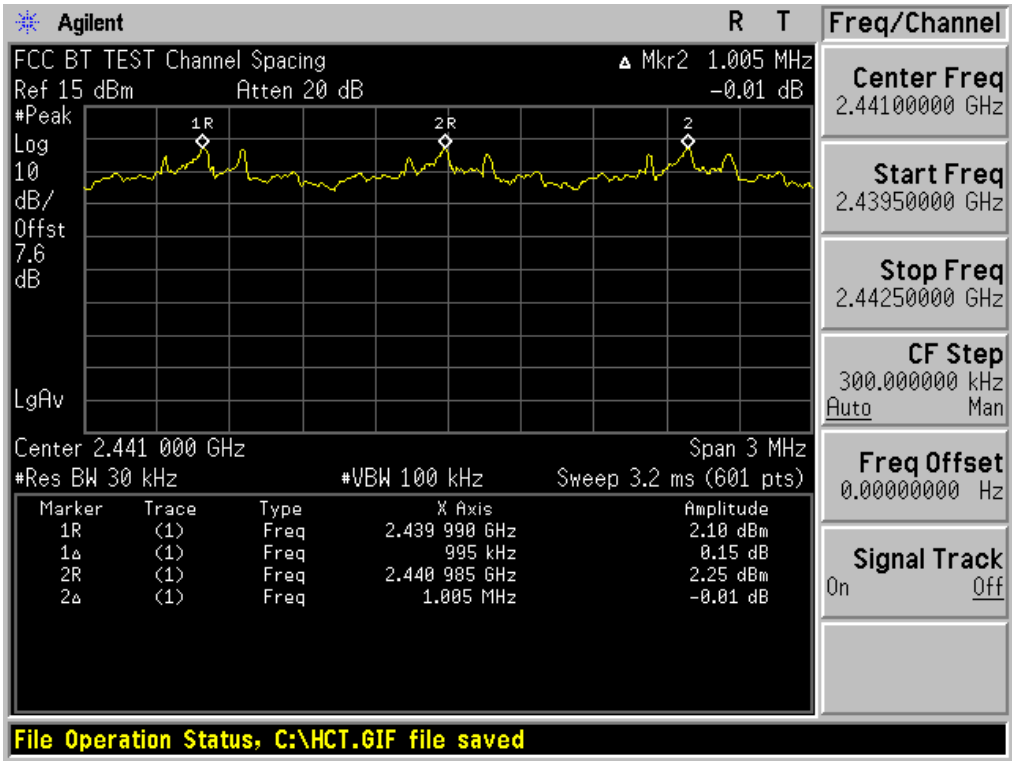
Test Plots (GFSK)

Channel Separation



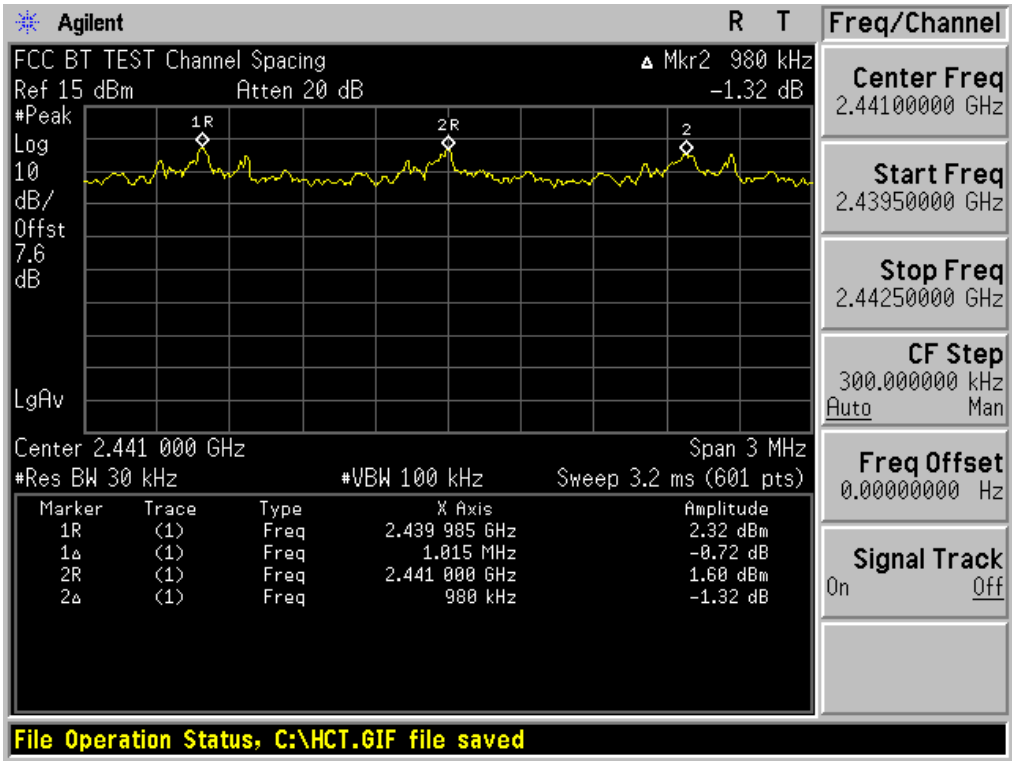
Test Plots (8DPSK)

Channel Separation



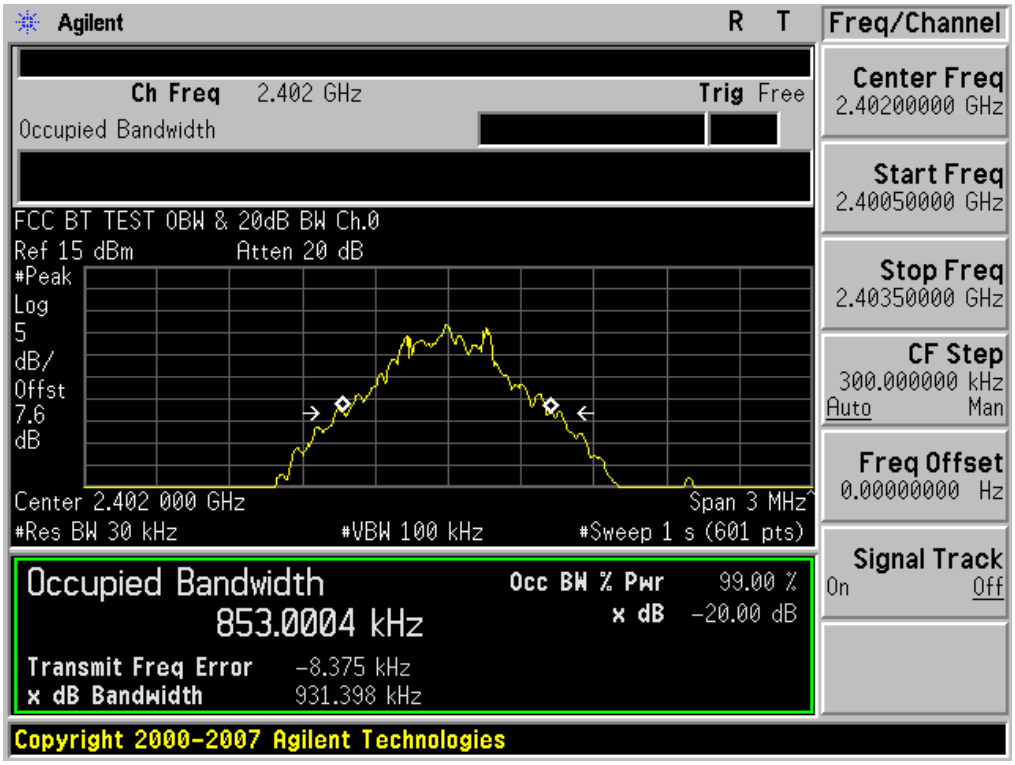
Test Plots (π/4DQPSK)

Channel Separation



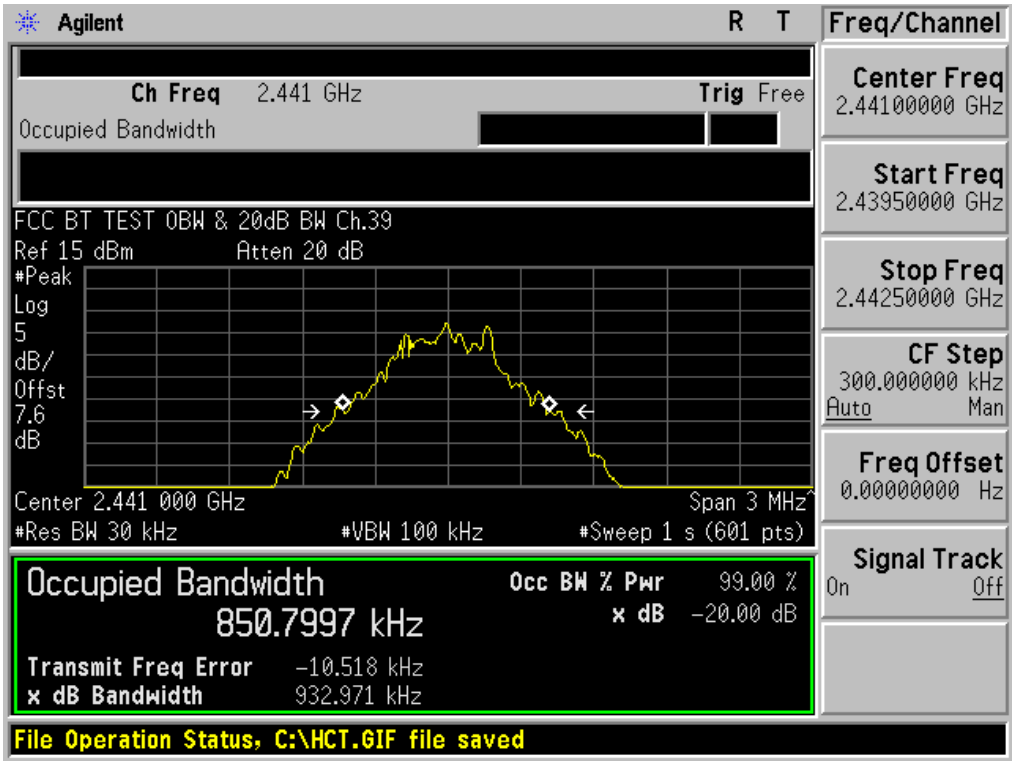
Test Plots (GFSK)

20 dB Bandwidth & Occupied Bandwidth (Low-CH)



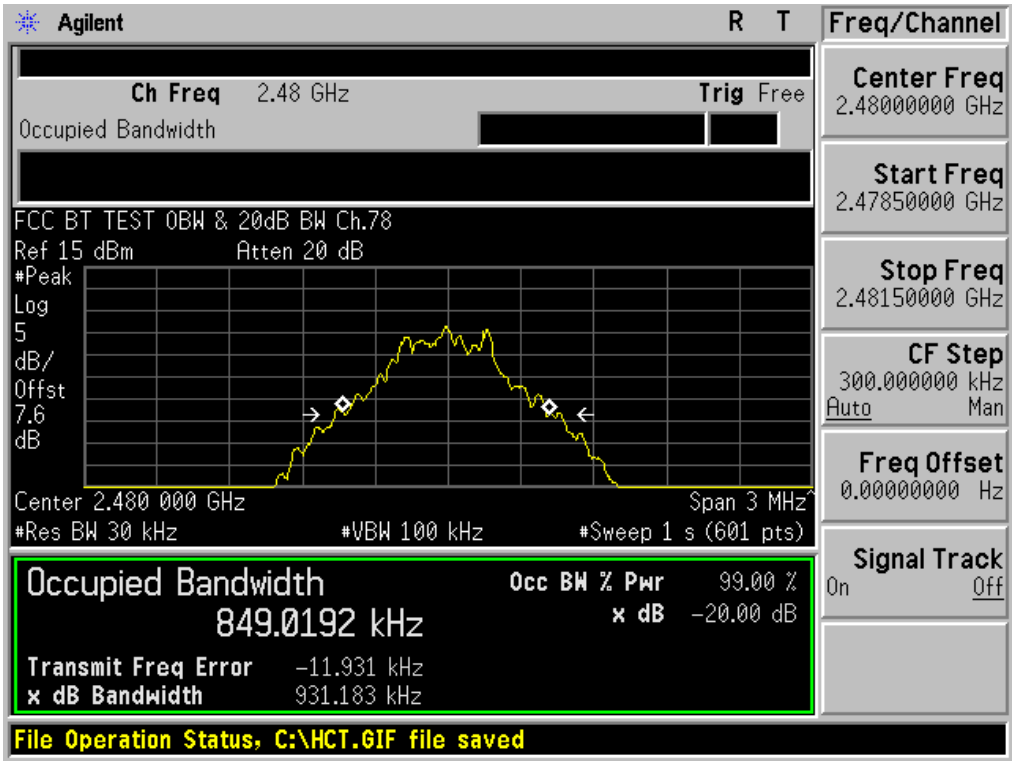
Test Plots (GFSK)

20 dB Bandwidth & Occupied Bandwidth (Mid-CH)



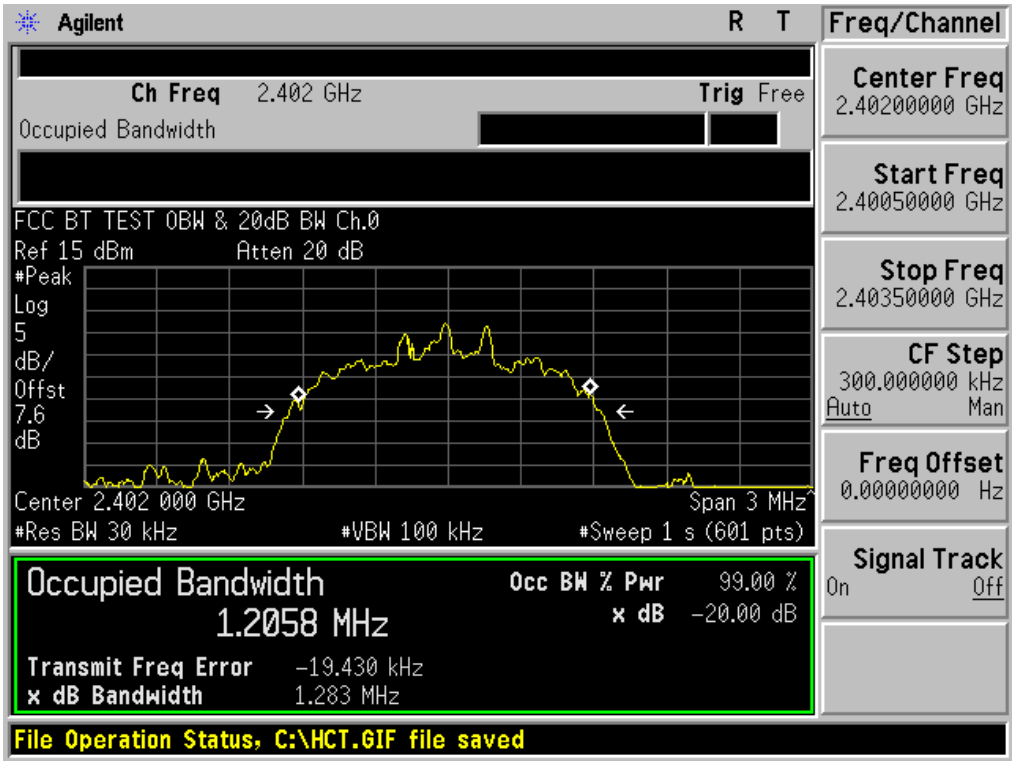
Test Plots (GFSK)

20 dB Bandwidth & Occupied Bandwidth (High-CH)



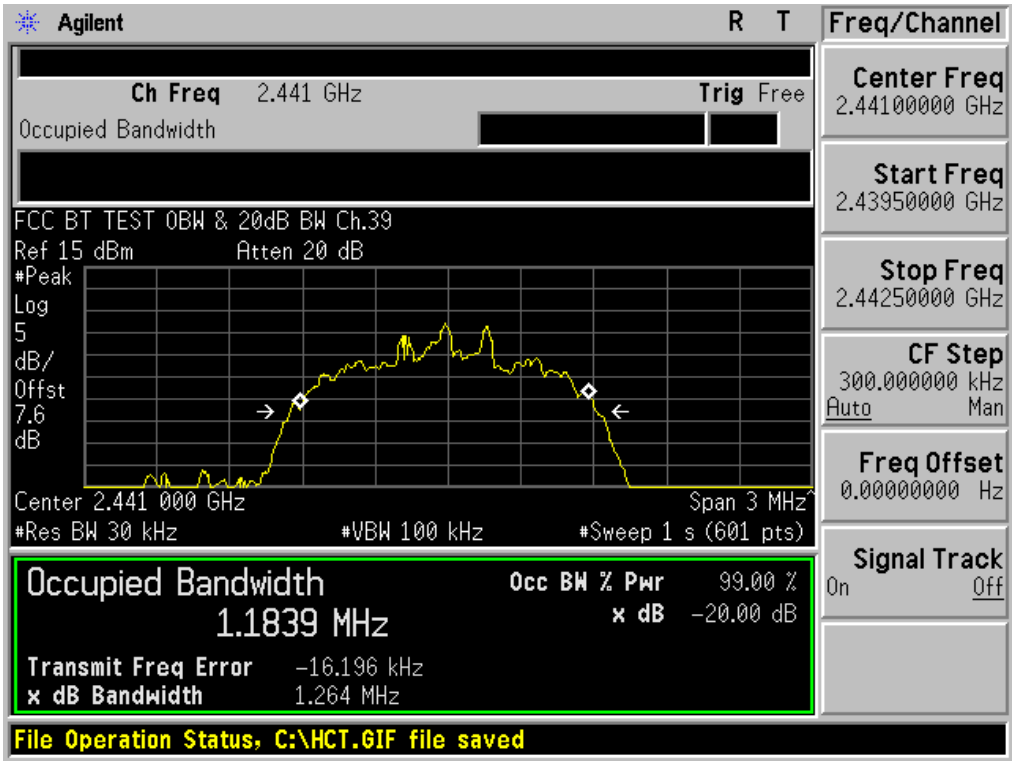
Test Plots (8DPSK)

20 dB Bandwidth & Occupied Bandwidth (Low-CH)



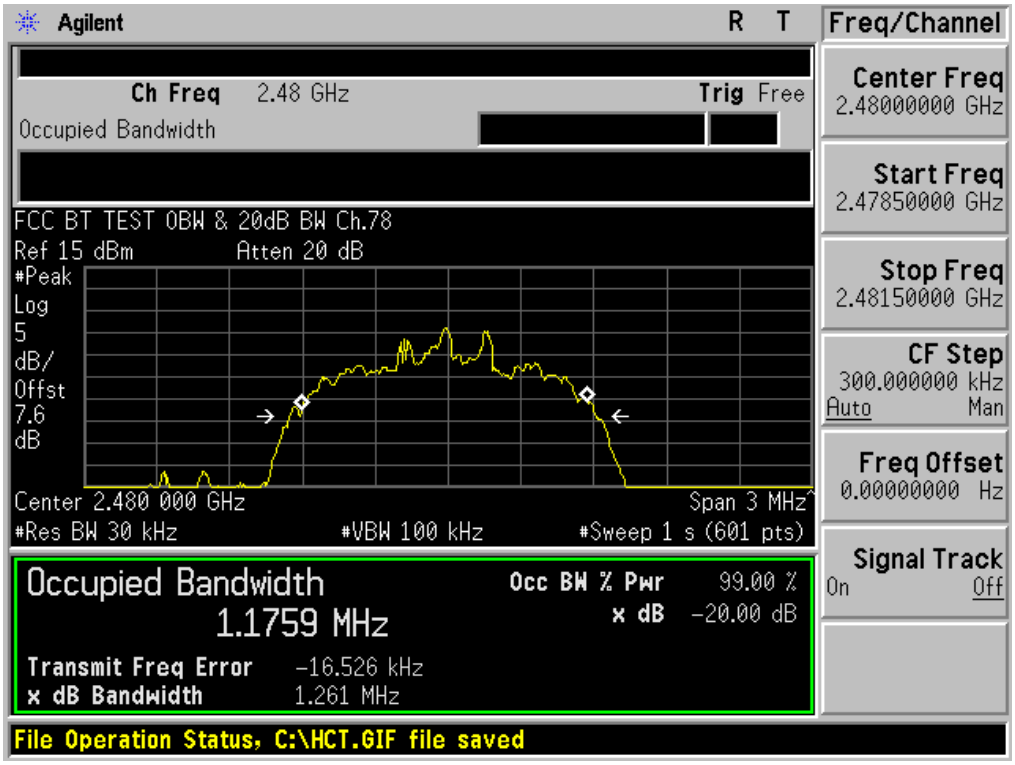
Test Plots (8DPSK)

20 dB Bandwidth & Occupied Bandwidth (Mid-CH)



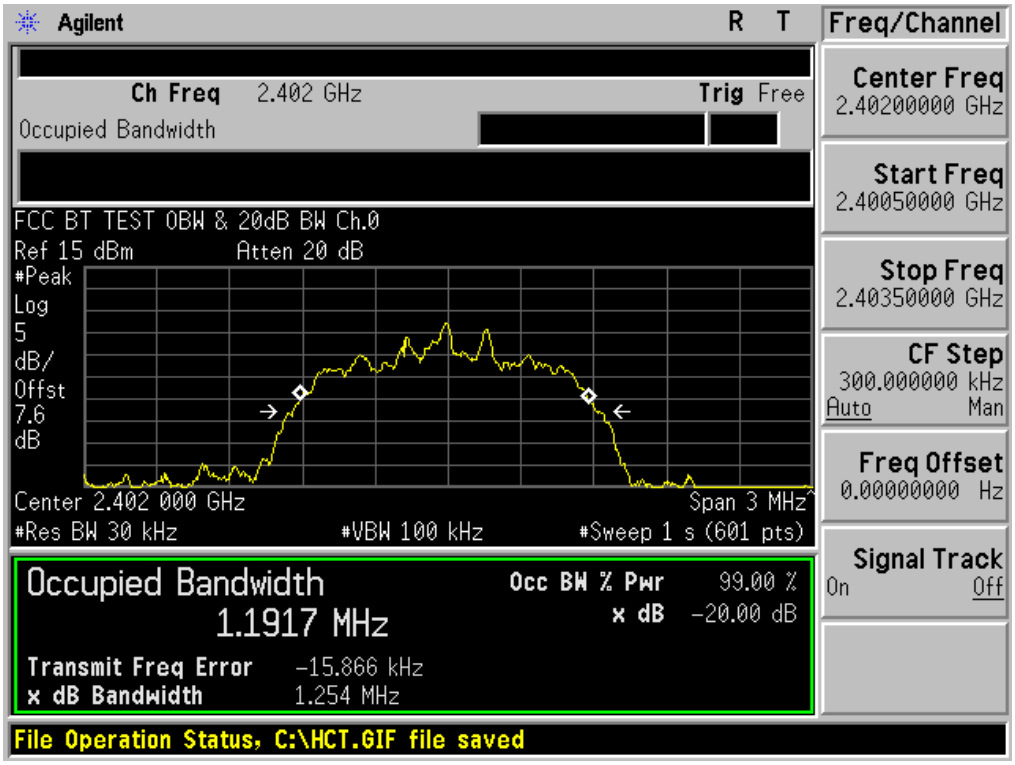
Test Plots (8DPSK)

20 dB Bandwidth & Occupied Bandwidth (High-CH)



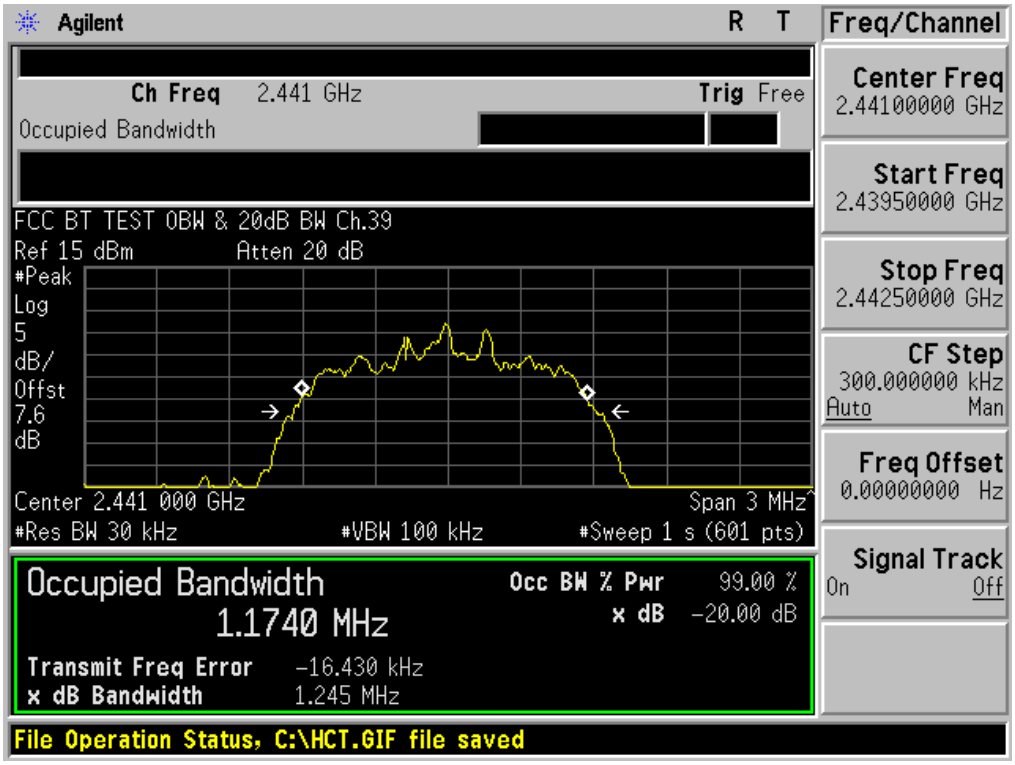
Test Plots (π/4DQPSK)

20 dB Bandwidth & Occupied Bandwidth (Low-CH)



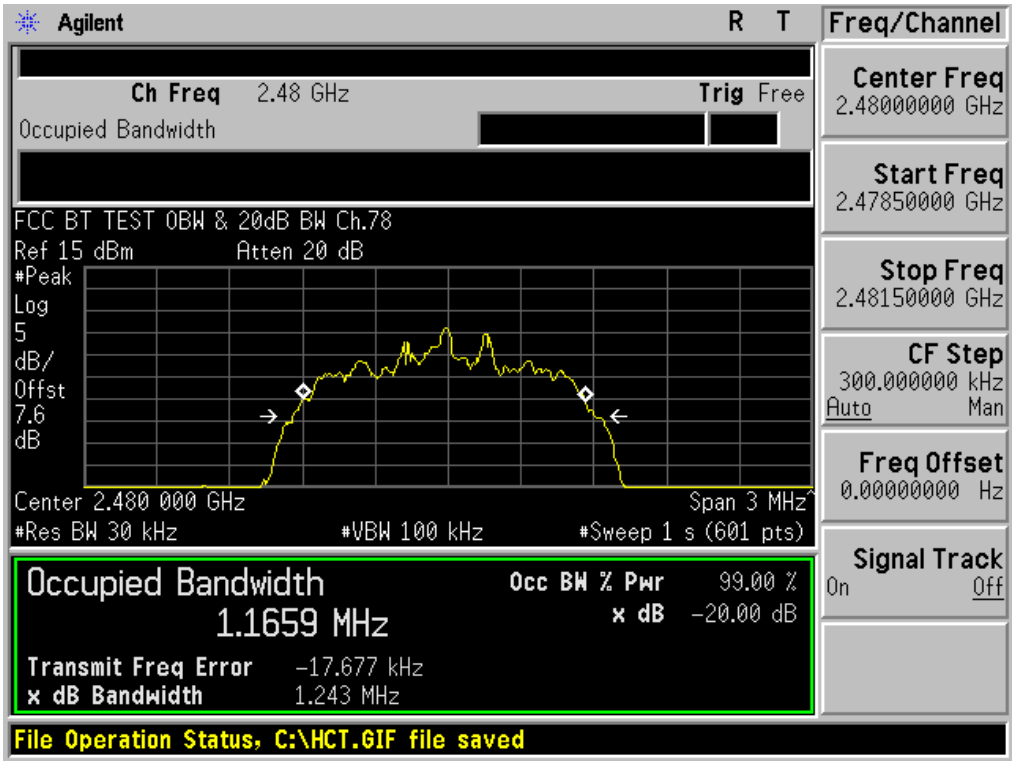
Test Plots (π/4DQPSK)

20 dB Bandwidth & Occupied Bandwidth (Mid-CH)



Test Plots (π/4DQPSK)

20 B Bandwidth & Occupied Bandwidth (High-CH)

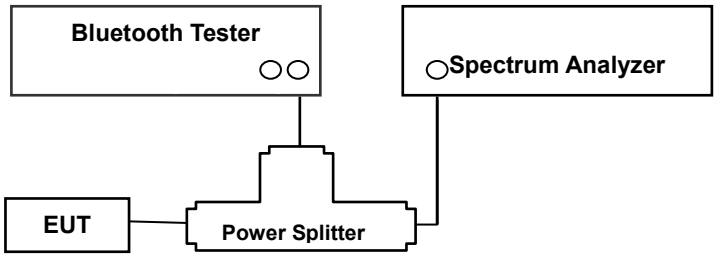


8.4 NUMBER OF HOPPING FREQUENCY

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 was set to :

1. Span = the frequency band of operation (Start = 2400 MHz, Stop = 2483.5 MHz)
2. RBW = 300 kHz
3. VBW = 300 kHz
4. Sweep = auto

The trace was allowed to stabilize.

TEST RESULTS

No non-compliance noted

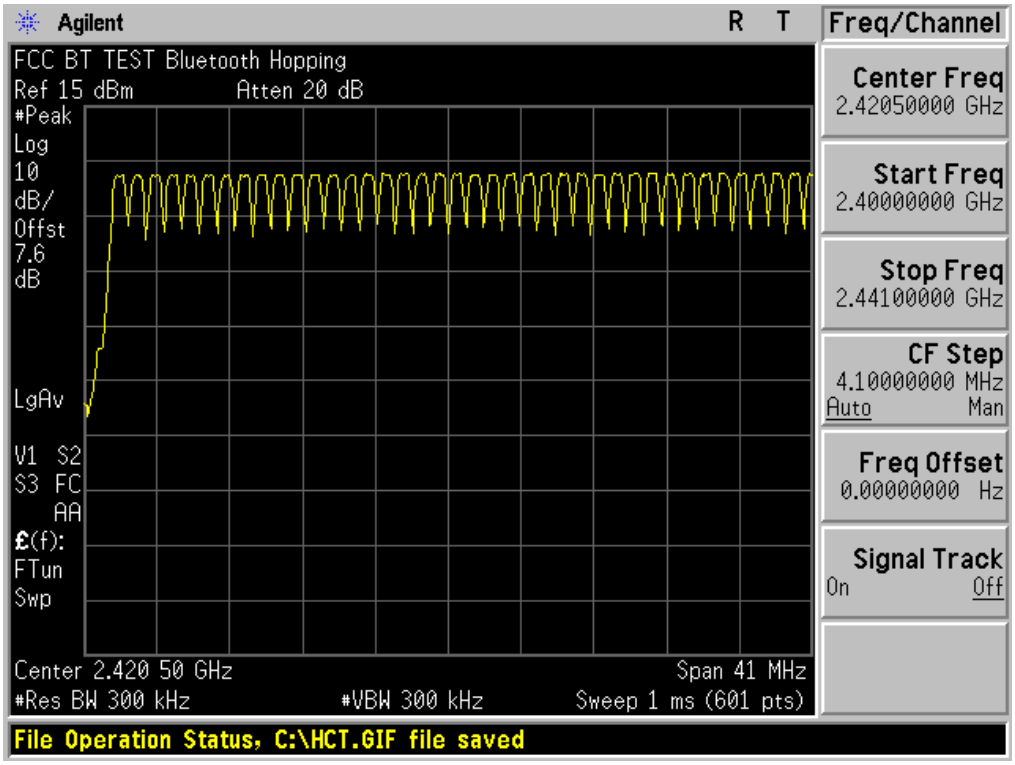
Test Data

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.

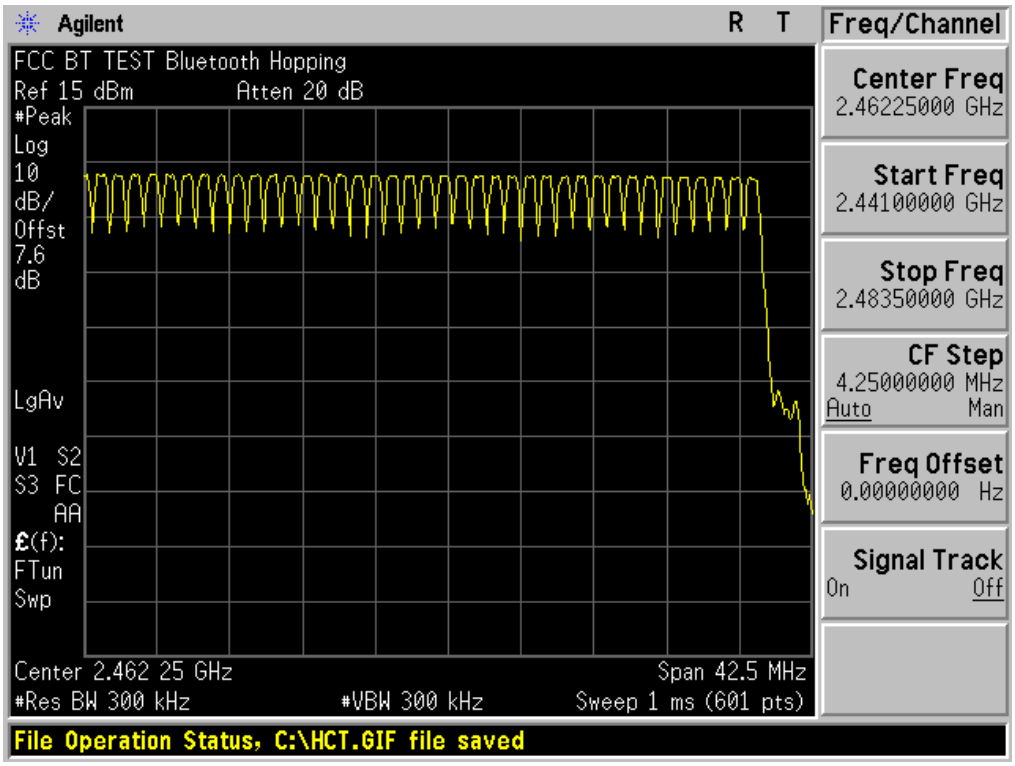
Test Plots (GFSK)

Number of Channels (2.4 GHz - 2.441 GHz)



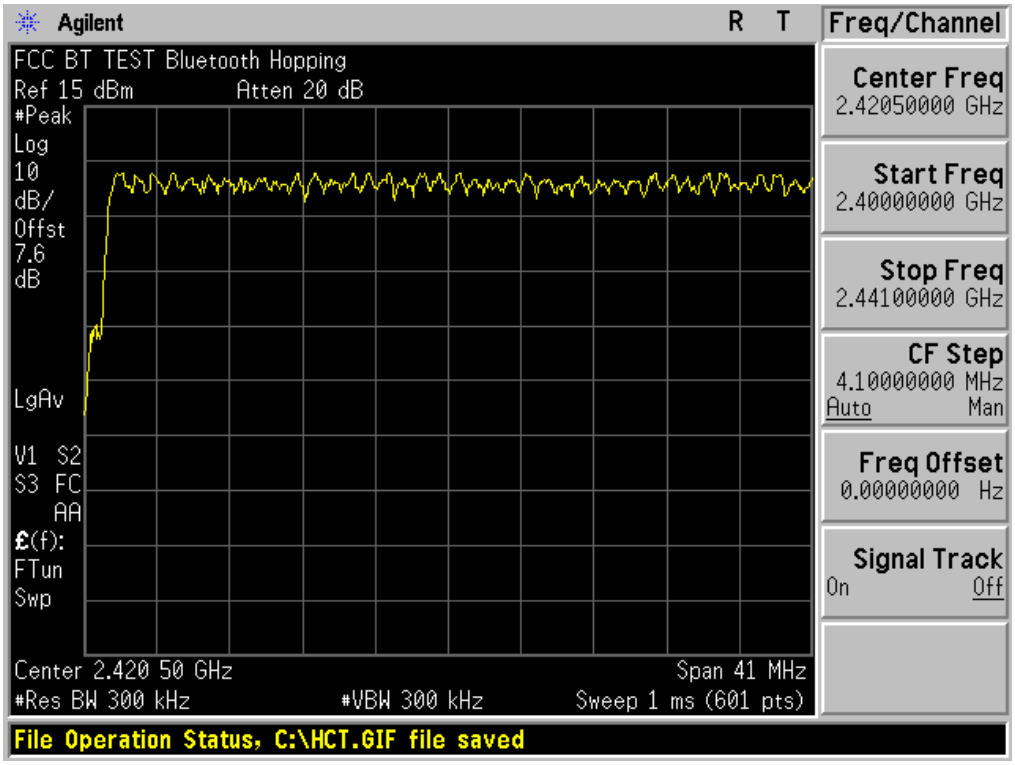
Test Plots (GFSK)

Number of Channels (2.441 GHz - 2.4835 GHz)



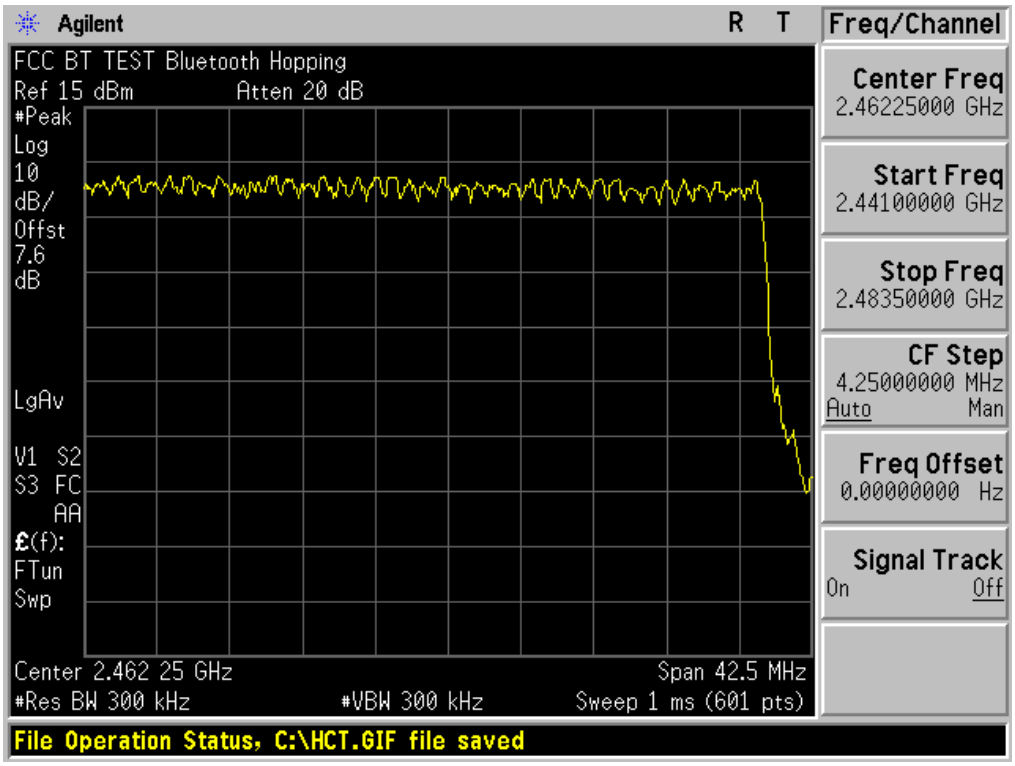
Test Plots (8DPSK)

Number of Channels (2.4 GHz - 2.441 GHz)

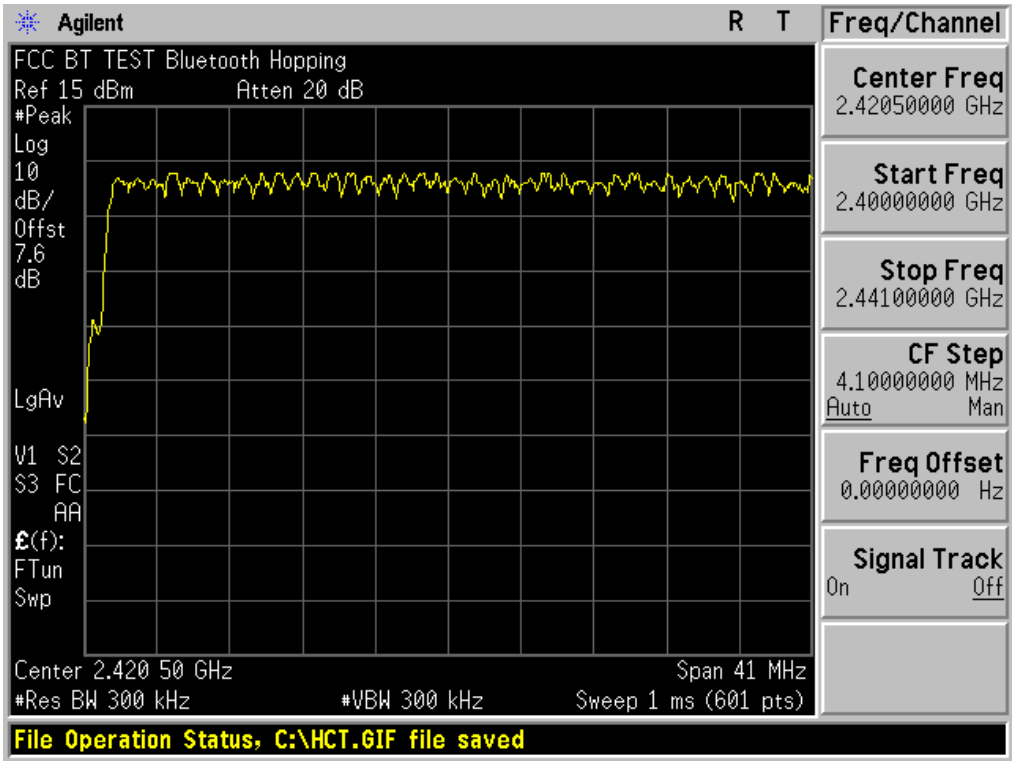


Test Plots (8DPSK)

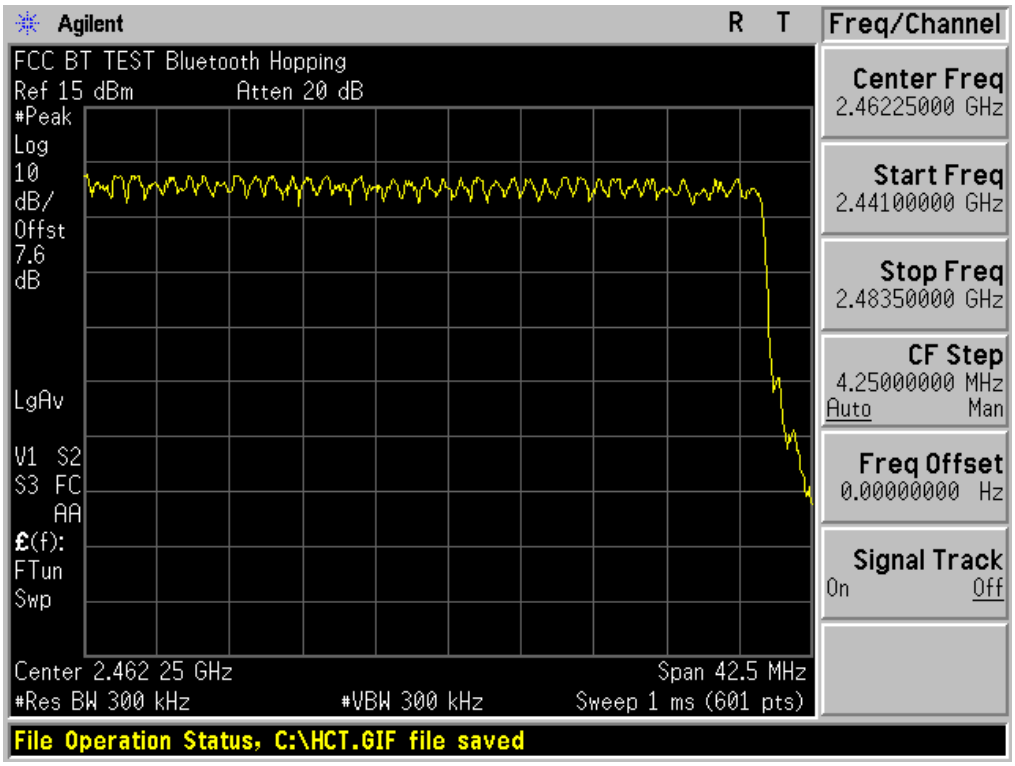
Number of Channels (2.441 GHz - 2.4835 GHz)



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)

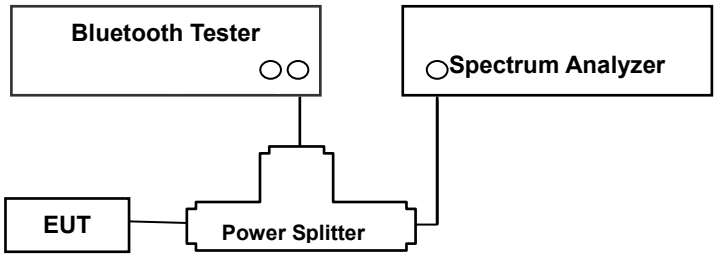


8.5 TIME OF OCCUPANCY (DWELL TIME)

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)

1. Span = zero span
2. RBW = 1 MHz
3. VBW = 1 MHz
4. Sweep = as necessary to capture the entire dwell time per channel

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 : 2.908 * (1600/6)/79 * 31.6 = 310.19 (ms)

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

CH Mid : 2.908 * (1600/6)/79 * 31.6 = 310.19 (ms)

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

CH Mid : 2.917 * (1600/6)/79 * 31.6 = 311.15 (ms)

AFH Mode

DH 5(The longest packet type for GFSK)

CH Mid : 2.908 * (800/6)/20 * 8.0 = 155.10 (ms)

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

CH Mid : 2.908 * (800/6)/20 * 8.0 = 155.10 (ms)

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

CH Mid : 2.917 * (800/6)/20 * 8.0 = 155.58 (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 2.883 ms.

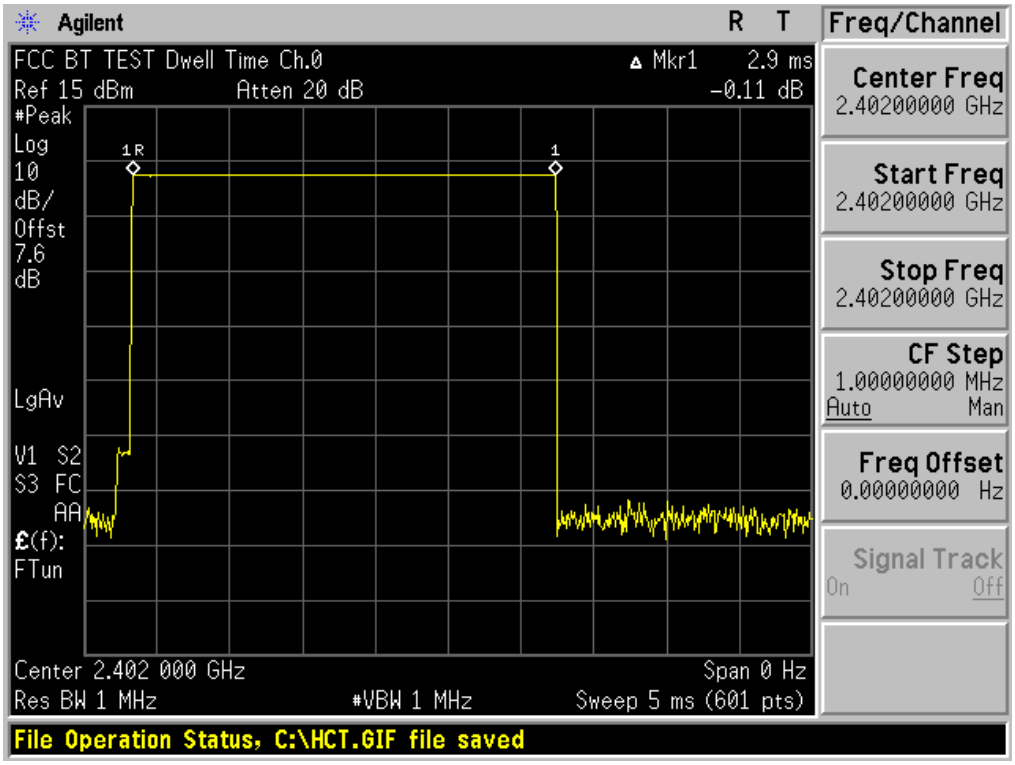
Dwell time = Tx-time * 106.7

TEST RESULTS

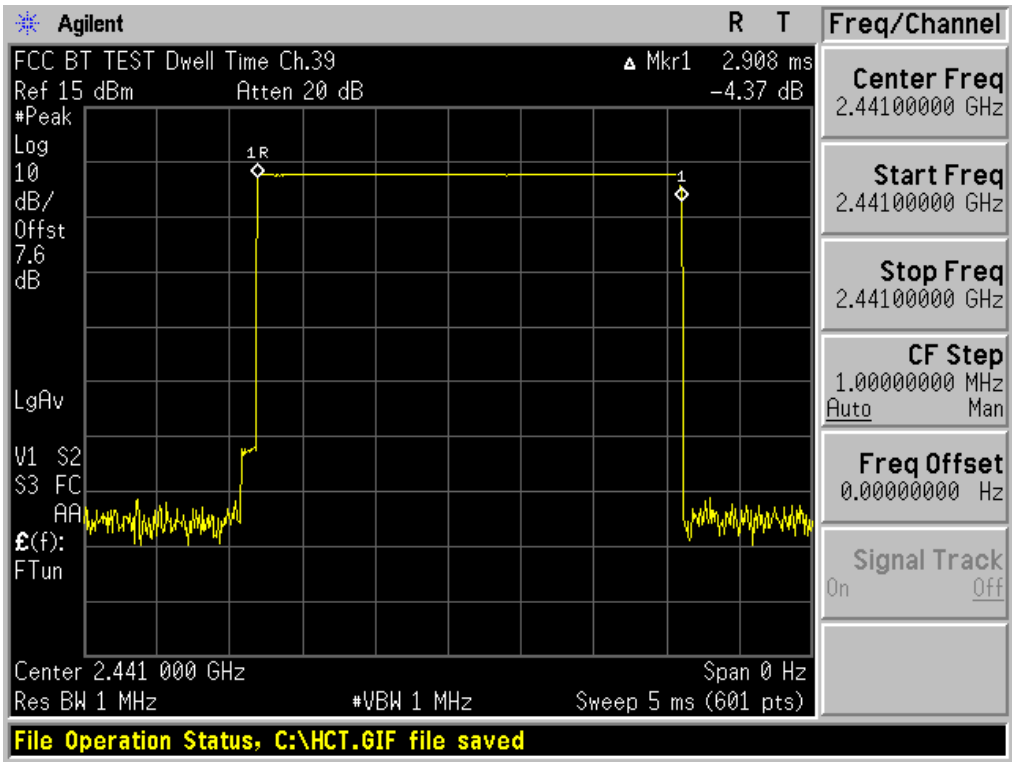
See the table.

Channel	Pulse Time (ms)			Total of Dwell (ms)			Period Time (s)	Limit (ms)	Result
	GFSK	8DPSK	π/4DQPSK	GFSK	8DPSK	π/4DQPSK			
Low	2.900	2.908	2.908	309.33	310.19	310.19	31.6	400	PASS
Mid	2.908	2.917	2.908	310.19	311.15	310.19	31.6		PASS
High	2.908	2.908	2.908	310.19	310.19	310.19	31.6		PASS

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

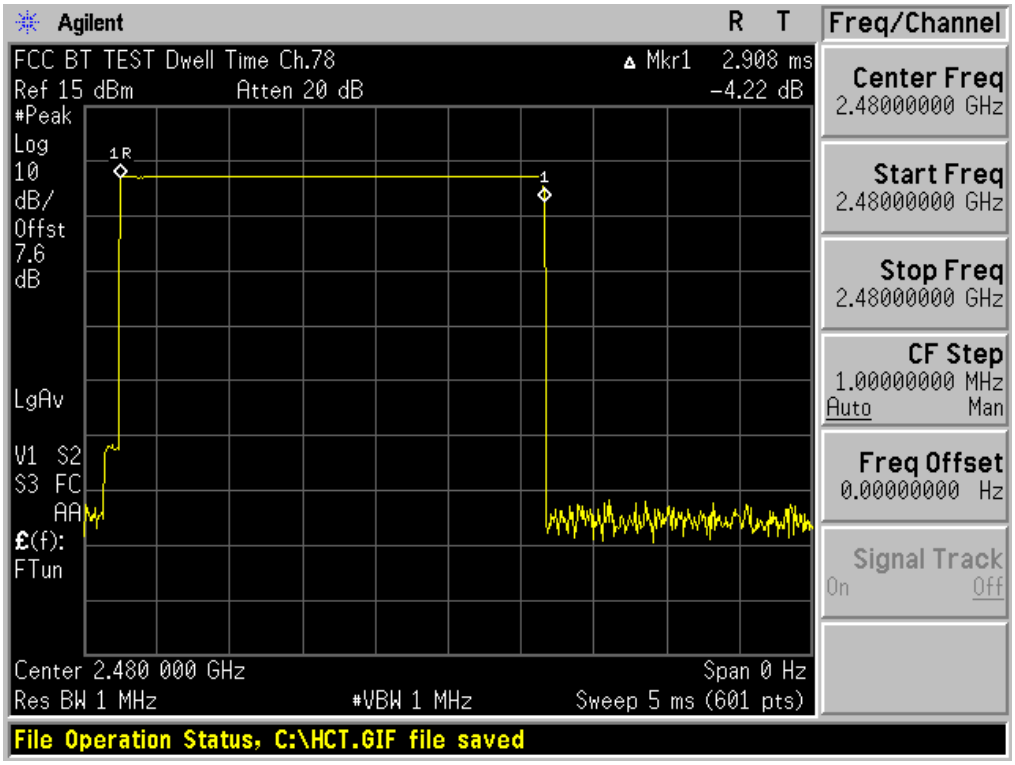


Test Plots (GFSK)
Dwell Time (Mid-CH)



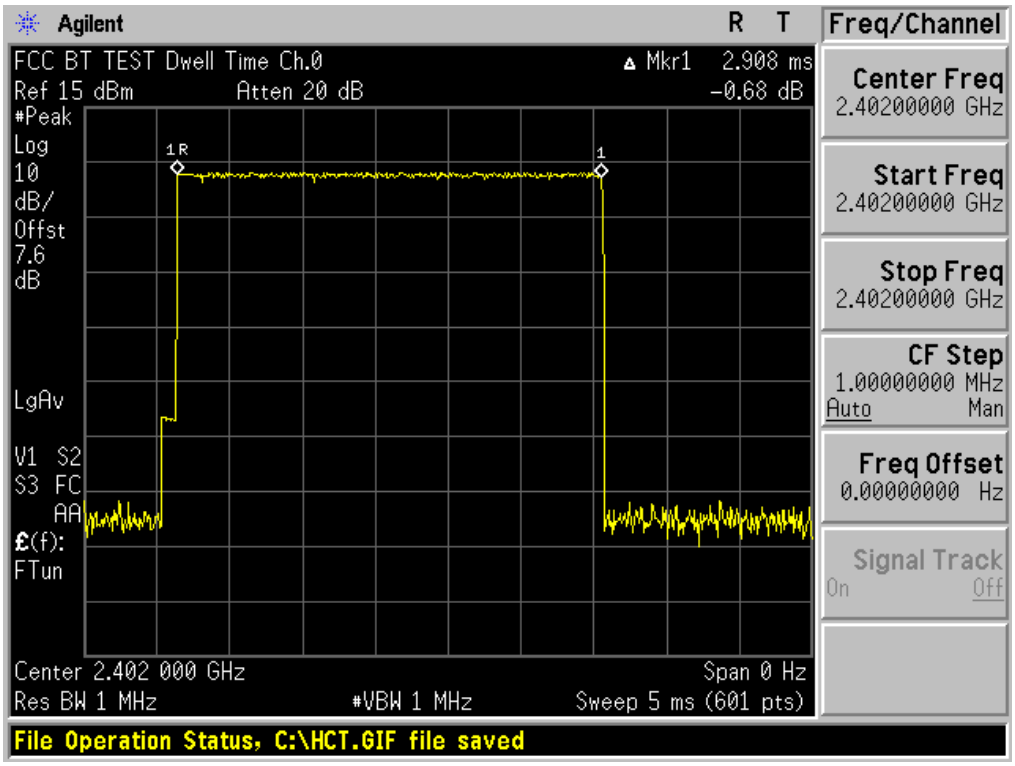
Test Plots (GFSK)

Dwell Time (High-CH)

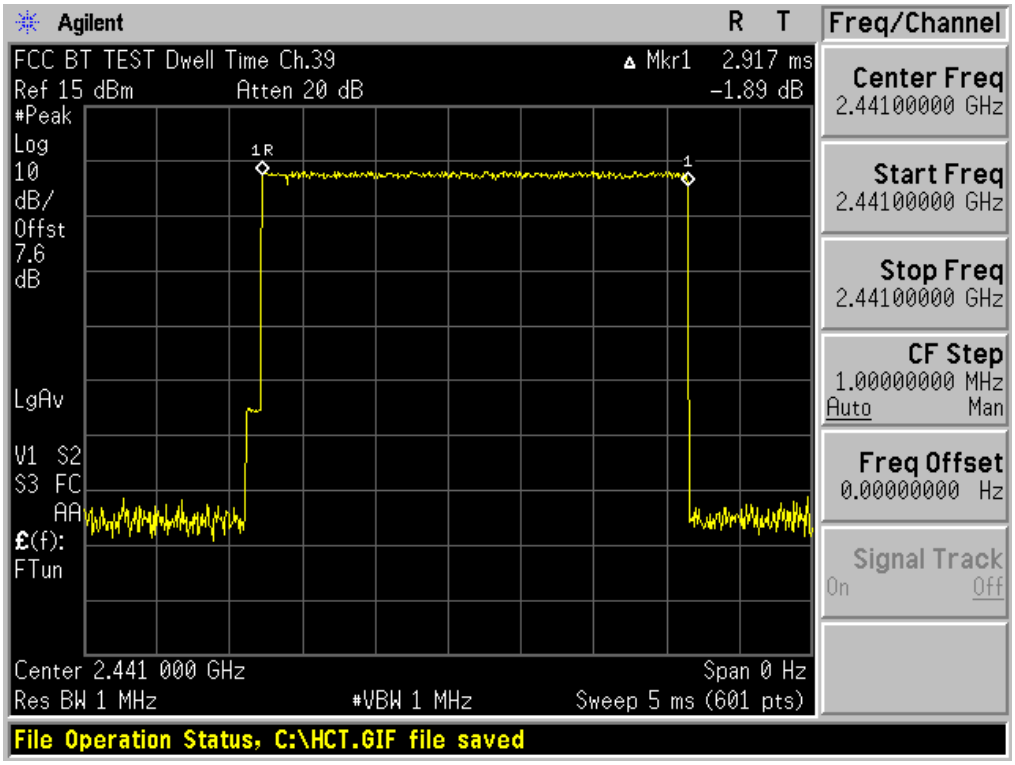


Test Plots (8DPSK)

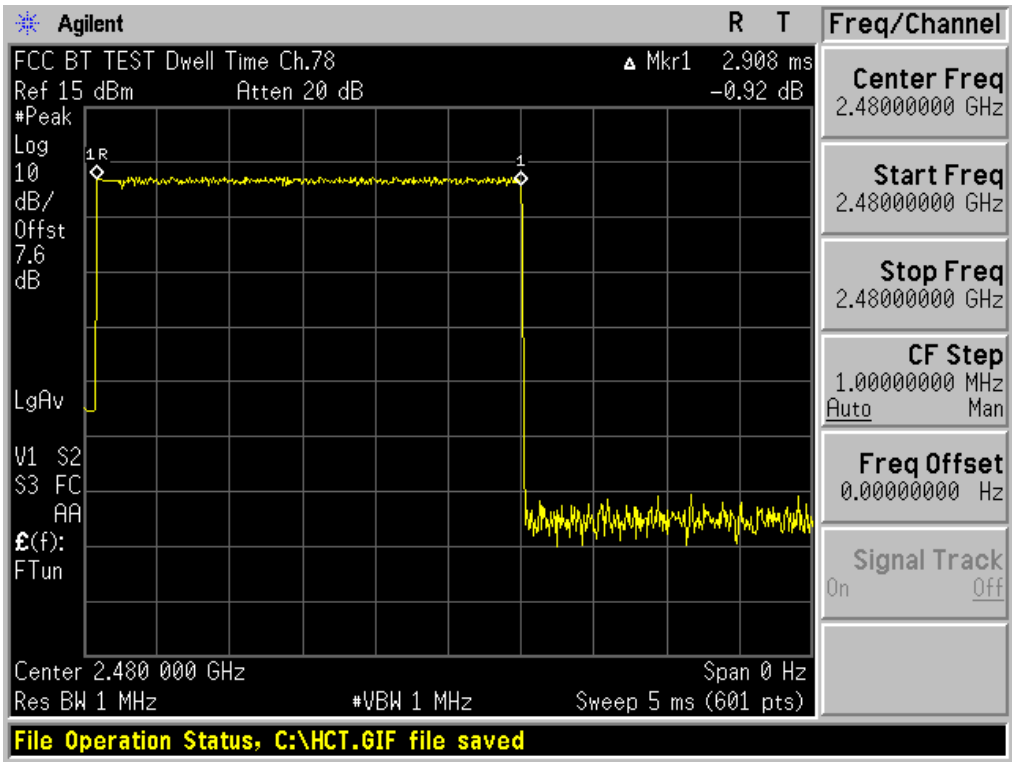
Dwell Time (Low-CH)



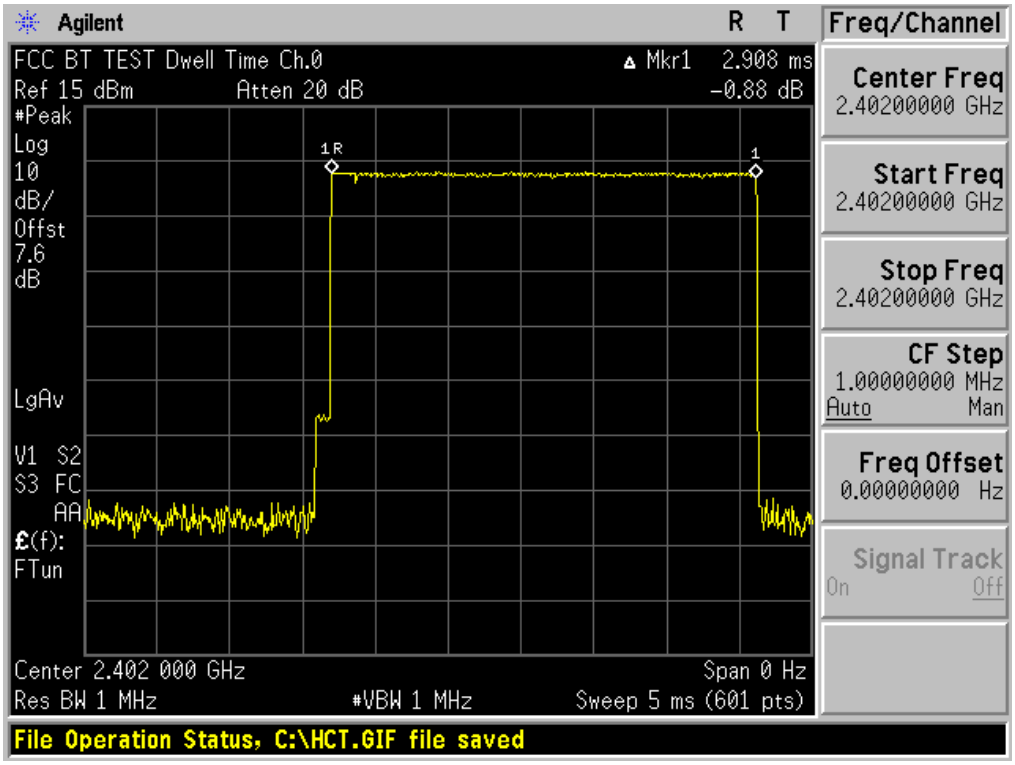
Test Plots (8DPSK)
Dwell Time (Mid-CH)



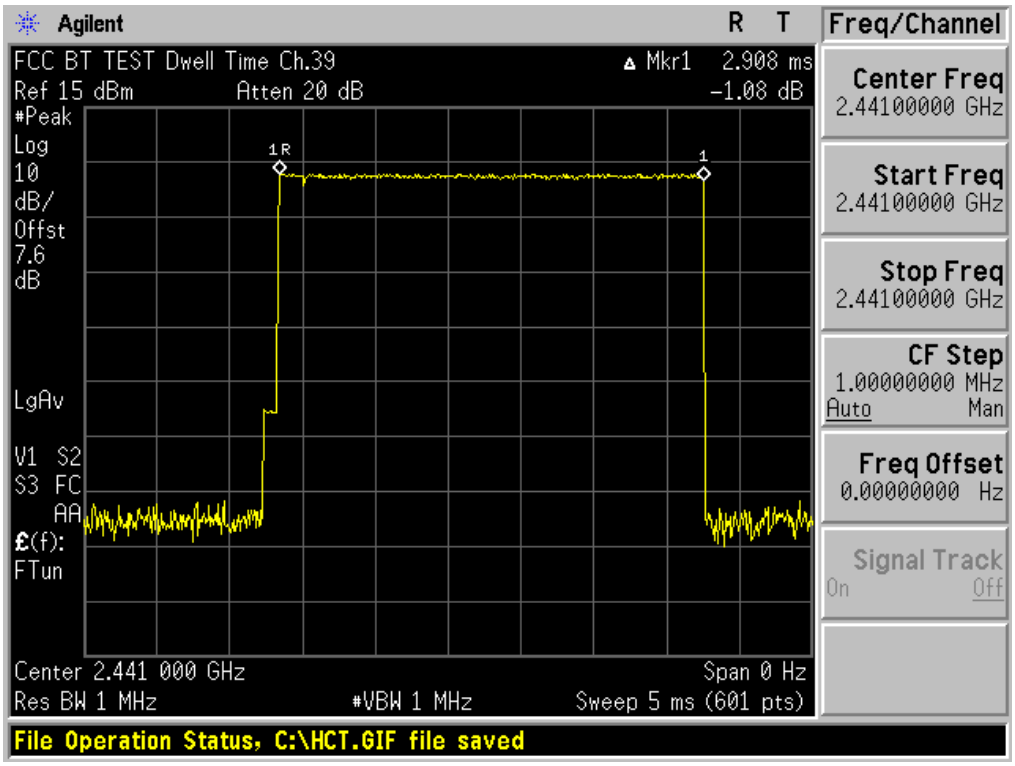
Test Plots (8DPSK)
Dwell Time (High-CH)



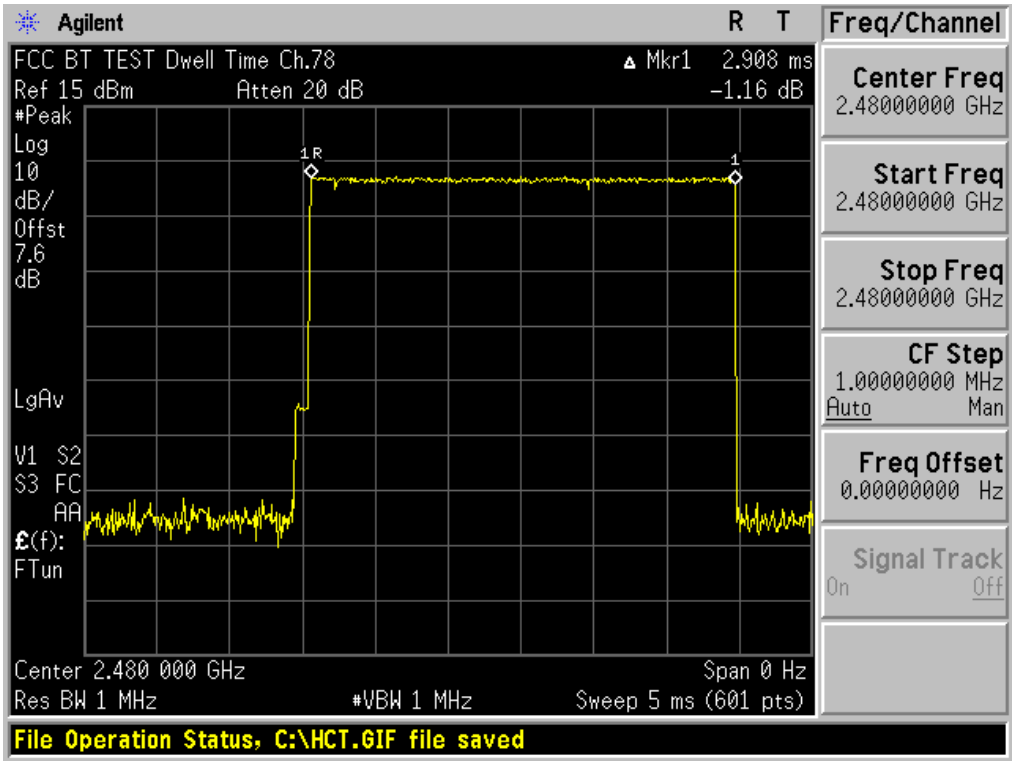
Test Plots (π/4DQPSK)
Dwell Time (Low-CH)



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



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



8.6 SPURIOUS EMISSIONS

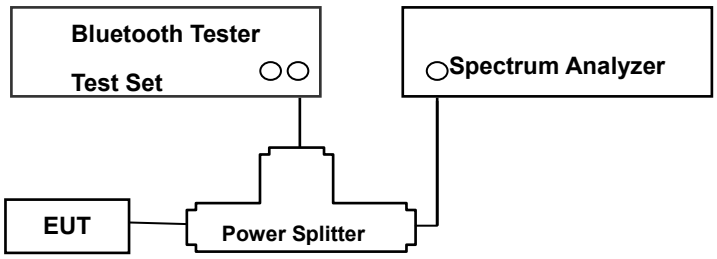
8.6.1 CONDUCTED SPURIOUS EMISSIONS

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 resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

Detector Mode is set to a peak detector Mode.

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

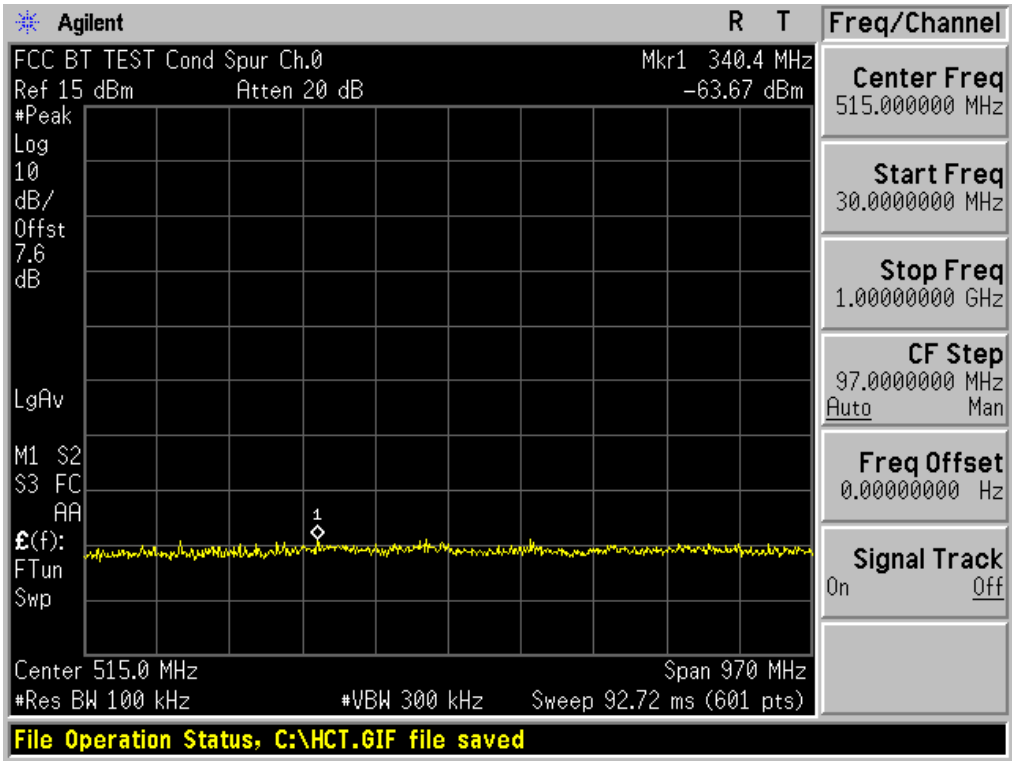
This test is performed with hopping off.

Note : We applied the offset values at 2.4 GHz for conducted spurious emission test. Because we used the particular cable type that is supported by manufacture. So, we don't know exactly cable loss from 30 MHz to 26 GHz.

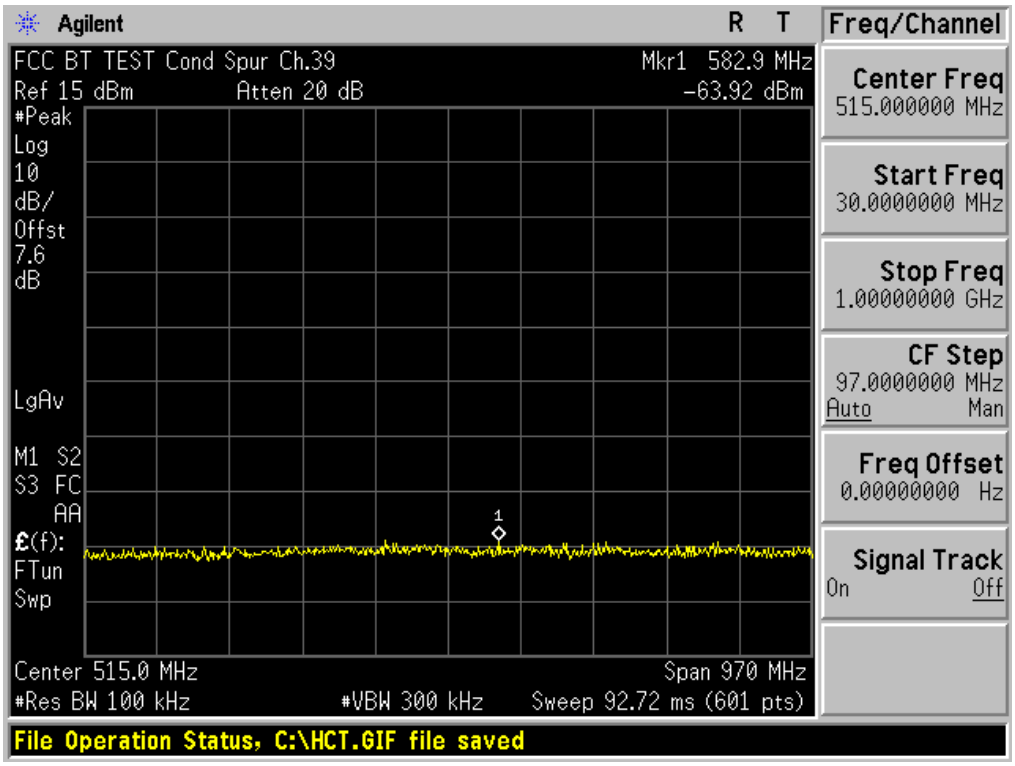
TEST RESULTS

No non-compliance noted.

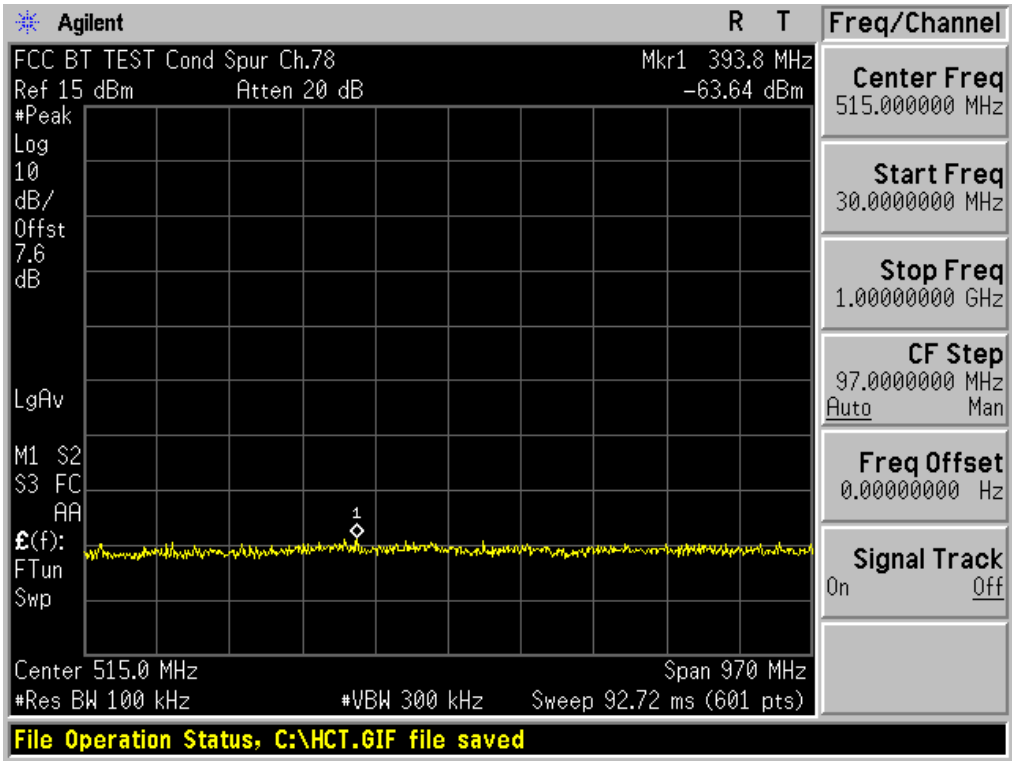
Test Plots (GFSK) - 30 MHz - 1 GHz (RBW:100 kHz, VBW: 300 kHz)
Spurious Emission (Low-CH)



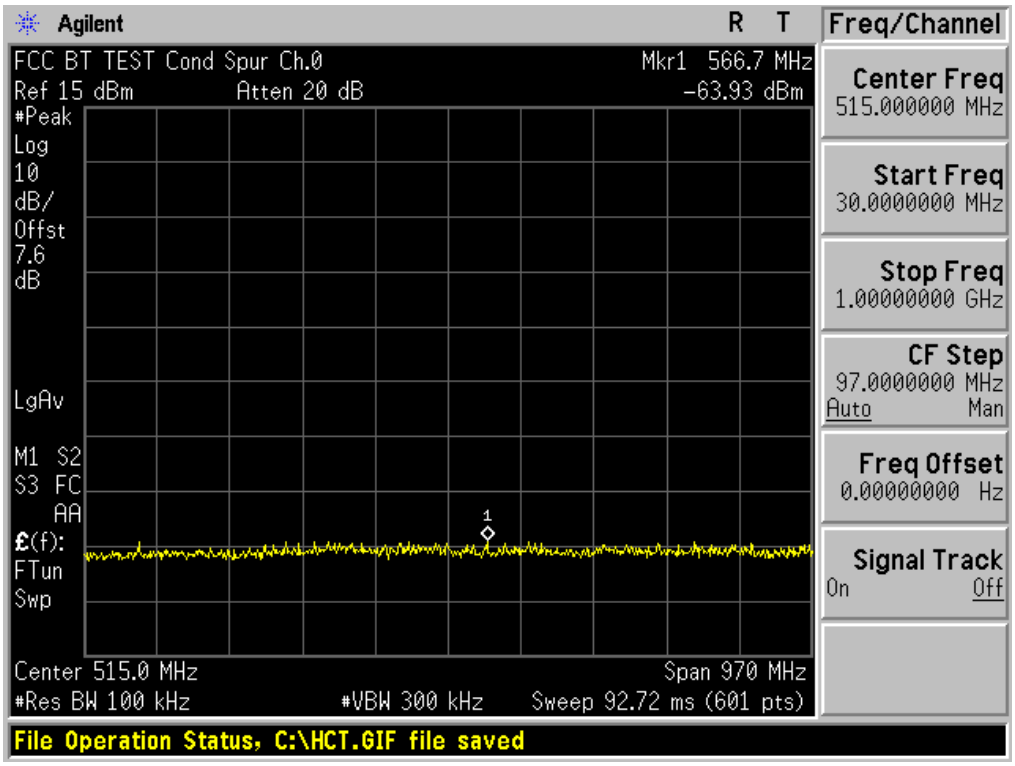
Test Plots (GFSK) - 30 MHz - 1 GHz (RBW:100 kHz, VBW: 300 kHz)
Spurious Emission (Mid-CH)



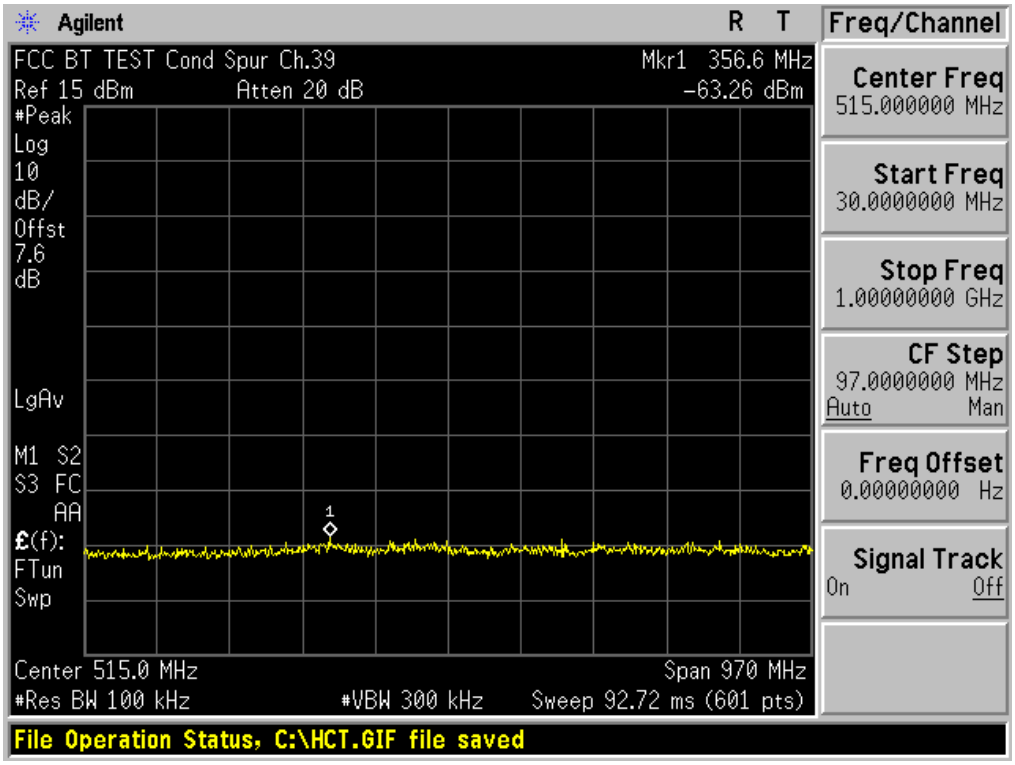
Test Plots (GFSK) - 30 MHz - 1 GHz (RBW:100 kHz, VBW: 300 kHz)
Spurious Emission (High-CH)



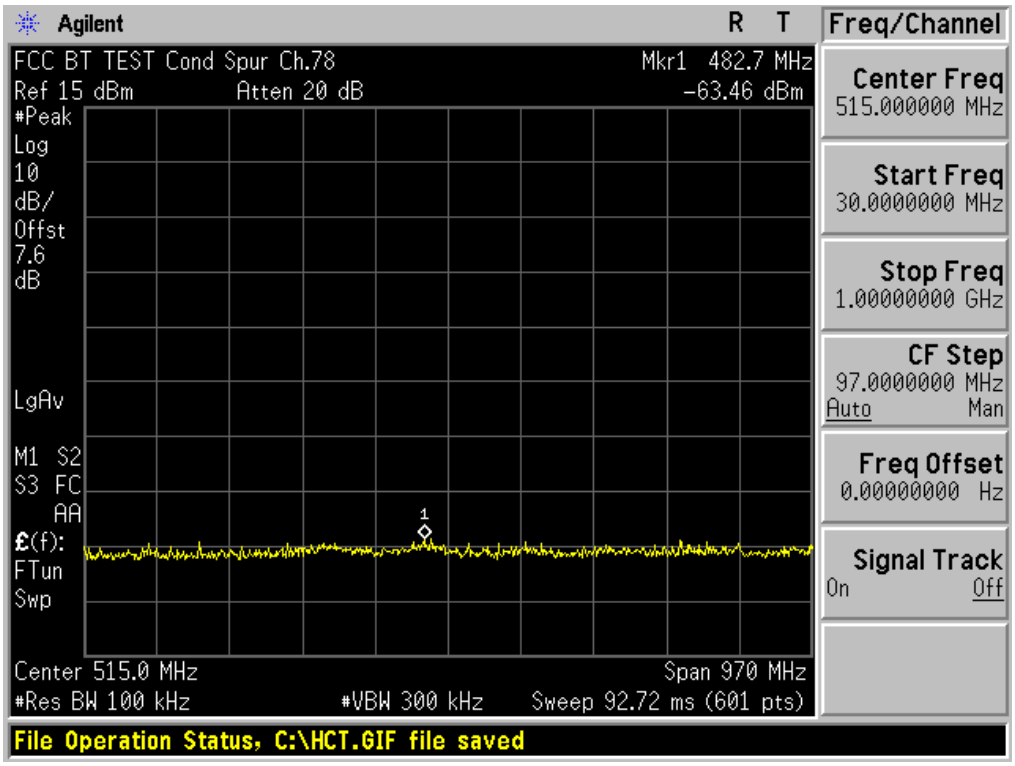
Test Plots (8DPSK) - 30 MHz - 1 GHz (RBW:100 kHz, VBW: 300 kHz)
Spurious Emission (Low-CH)



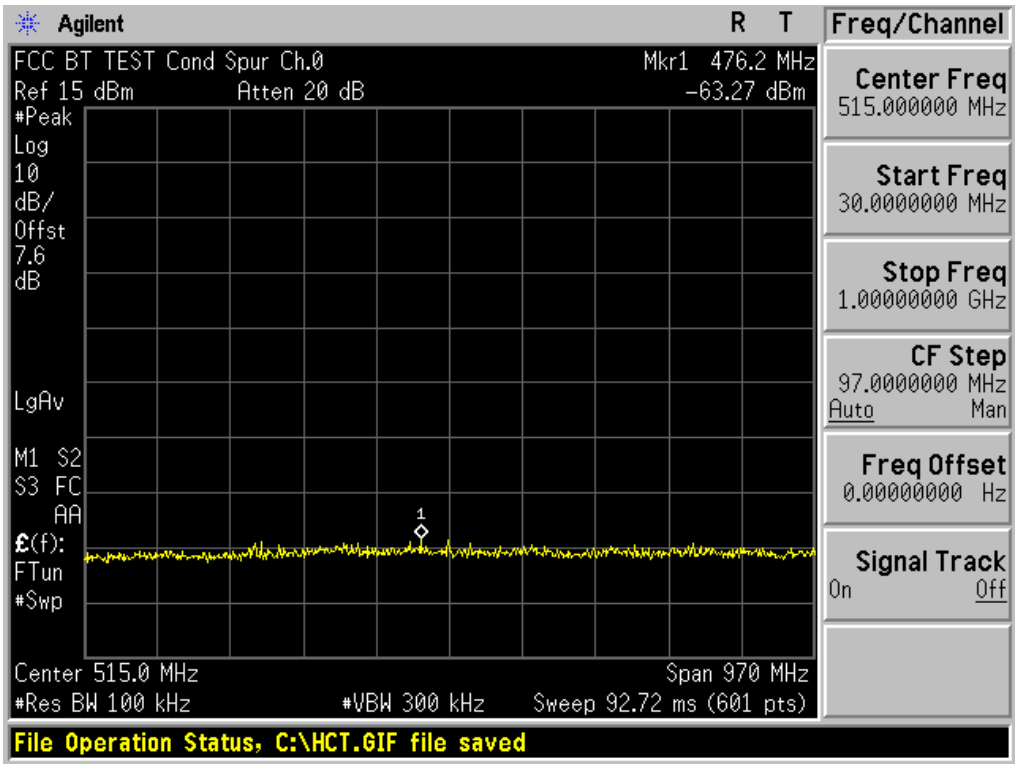
Test Plots (8DPSK) - 30 MHz - 1 GHz (RBW:100 kHz, VBW: 300 kHz)
Spurious Emission (Mid-CH)



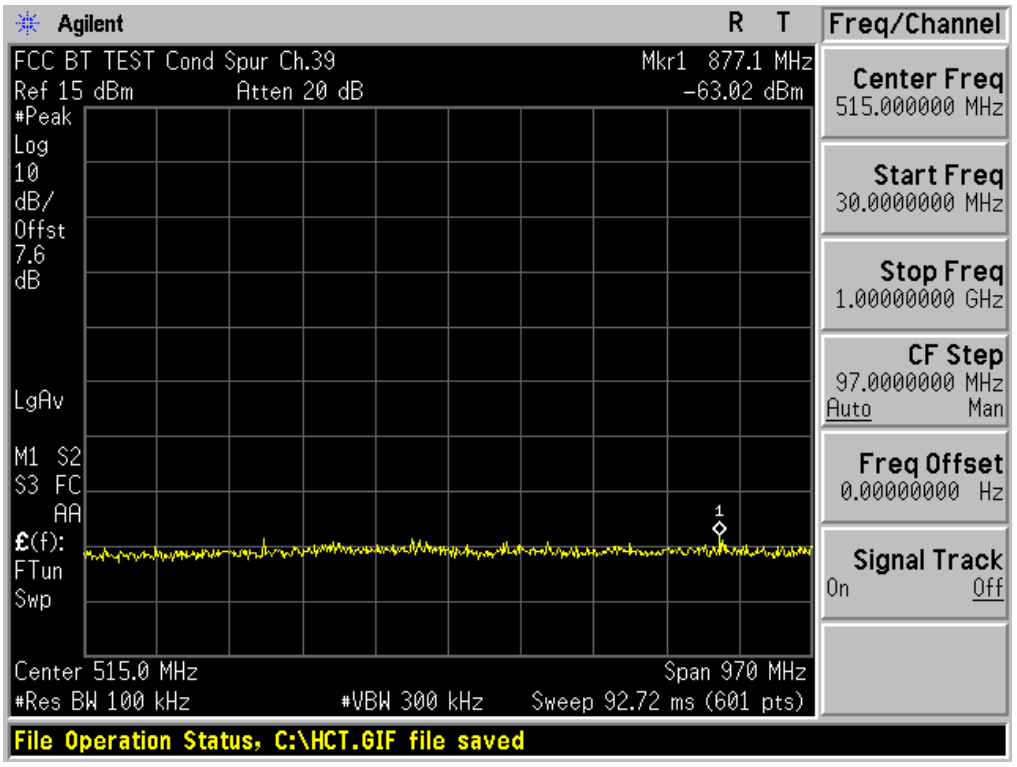
Test Plots (8DPSK) - 30 MHz - 1 GHz (RBW:100 kHz, VBW: 300 kHz)
Spurious Emission (High-CH)



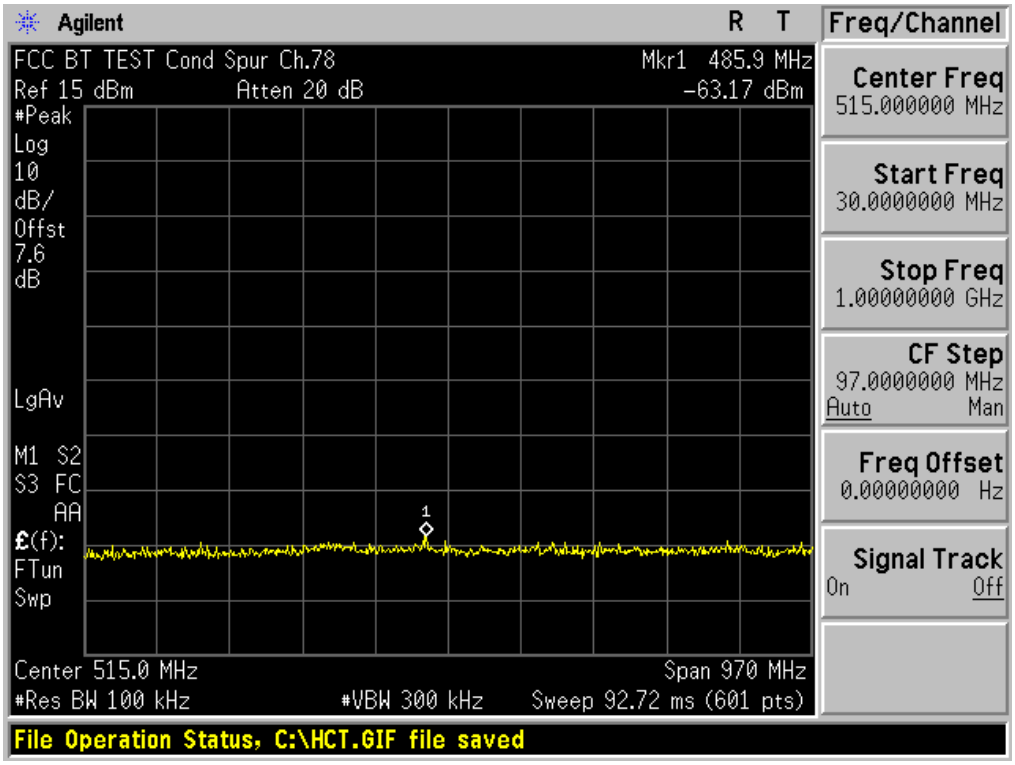
Test Plots (π/4DQPSK) - 30 MHz - 1 GHz (RBW:100 kHz, VBW: 300 kHz)
Spurious Emission (Low-CH)



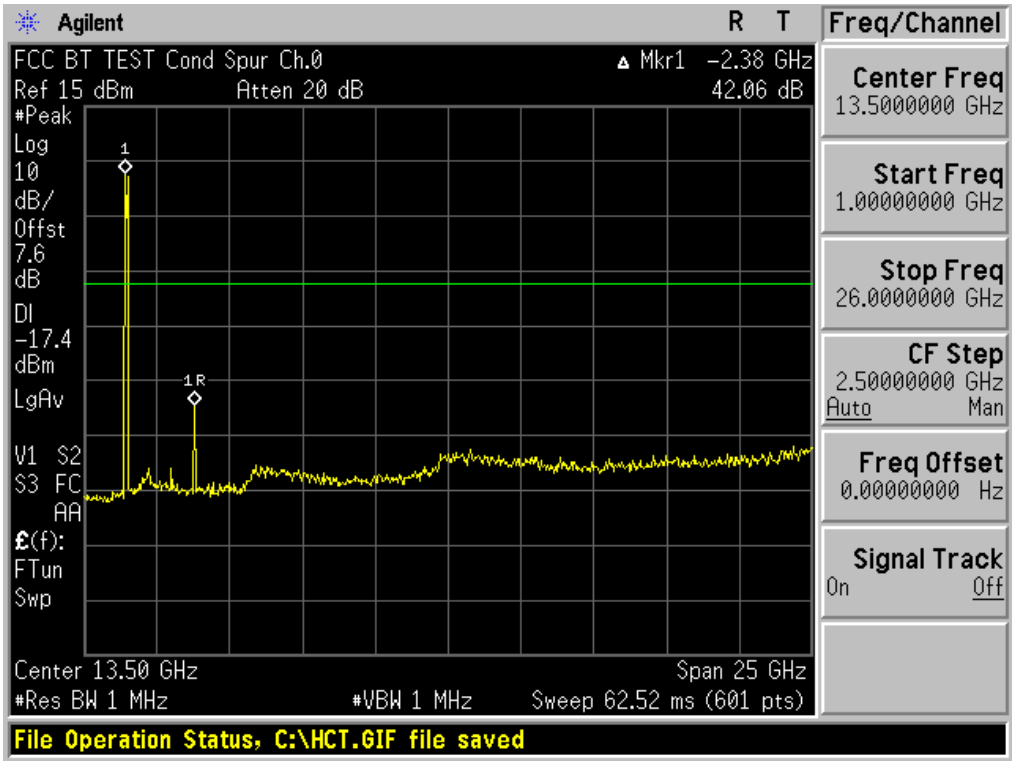
Test Plots (π/4DQPSK) - 30 MHz - 1 GHz (RBW:100 kHz, VBW: 300 kHz)
Spurious Emission (Mid-CH)



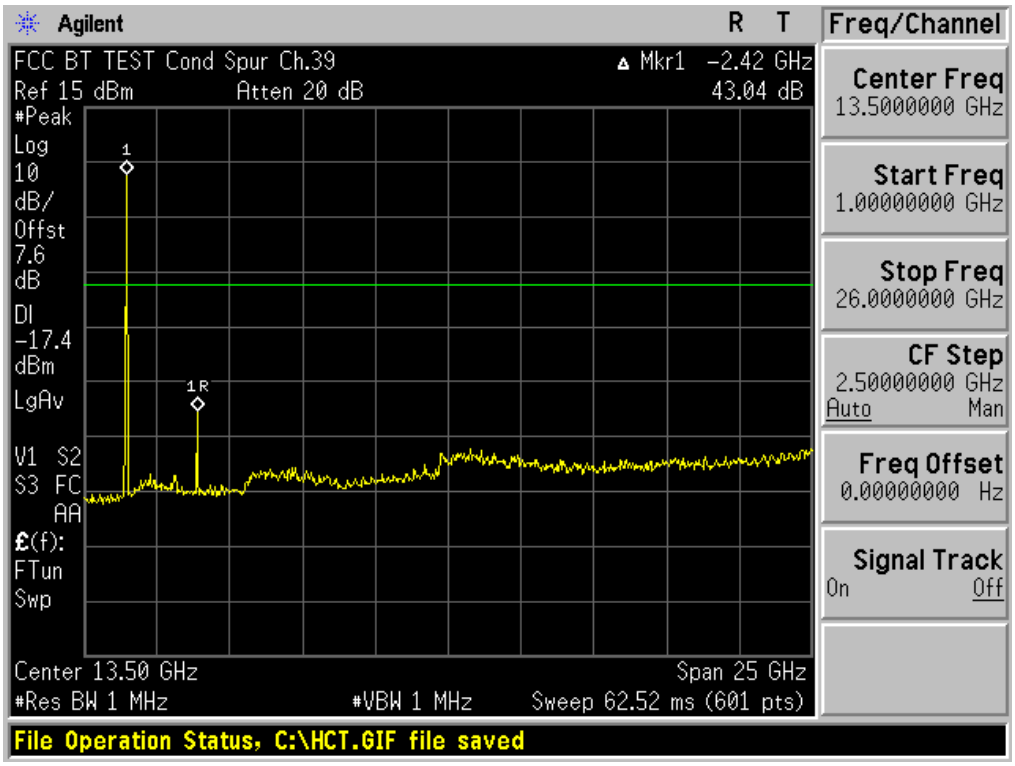
Test Plots (π/4DQPSK) - 30 MHz - 1 GHz (RBW:100 kHz, VBW: 300 kHz)
Spurious Emission (High-CH)



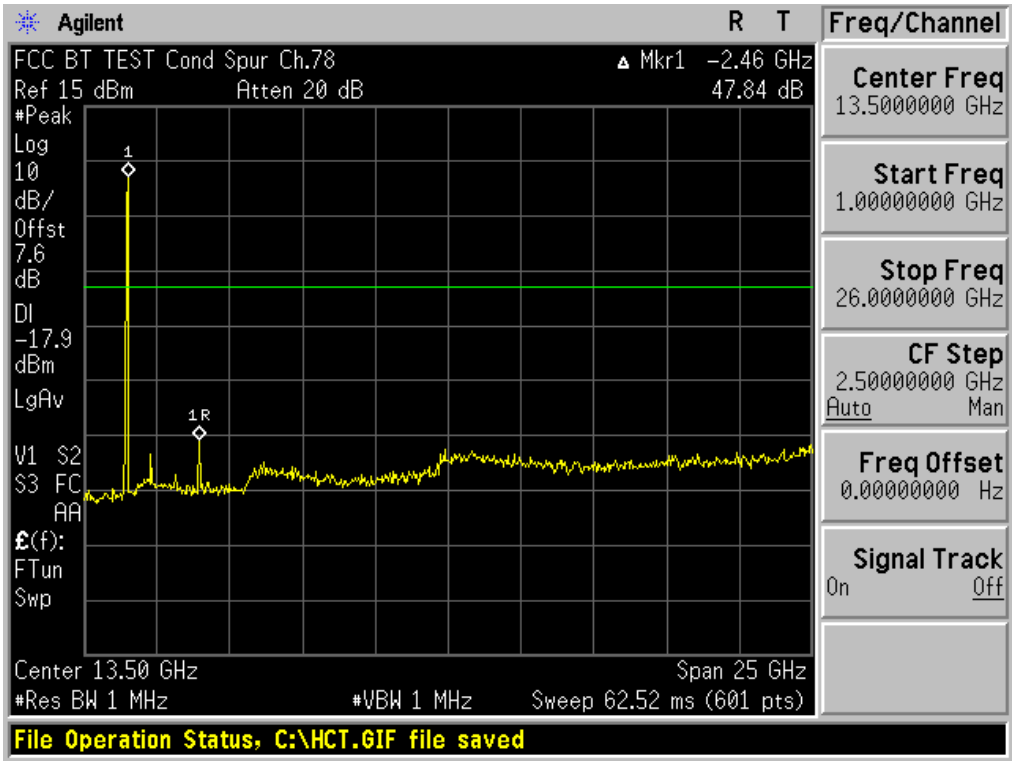
Test Plots (GFSK) - 1 GHz - 26 GHz (RBW:1 MHz, VBW: 1 MHz)
Spurious Emission (Low-CH)



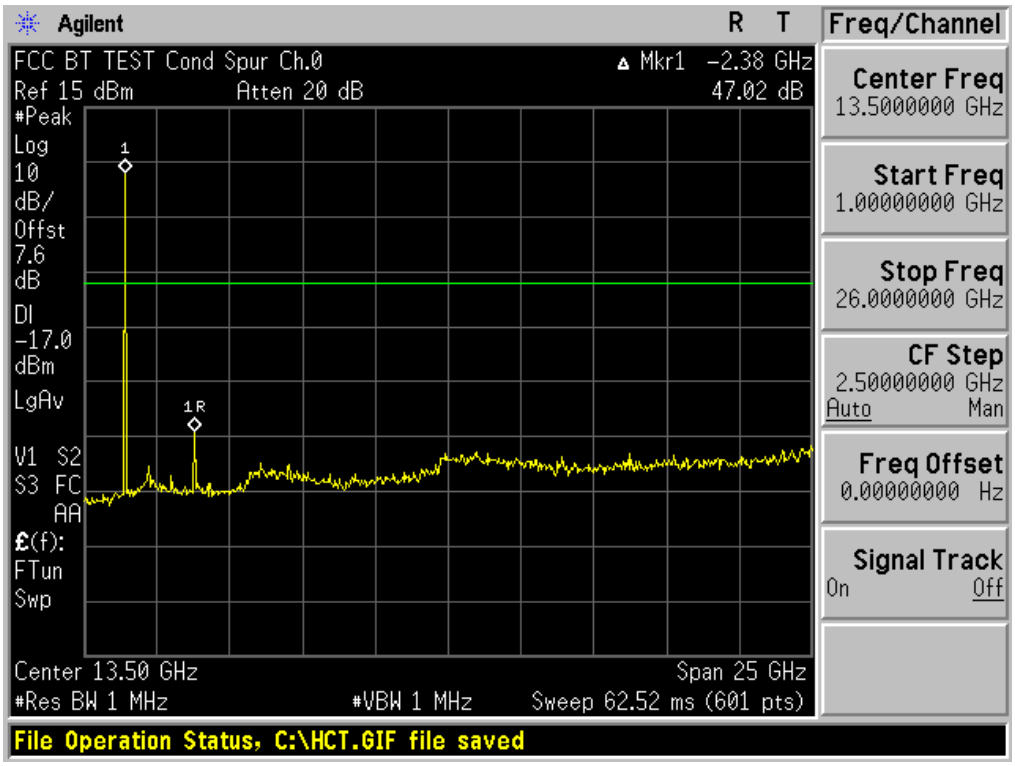
Test Plots (GFSK) - 1 GHz - 26 GHz (RBW:1 MHz, VBW: 1 MHz)
Spurious Emission (Mid-CH)



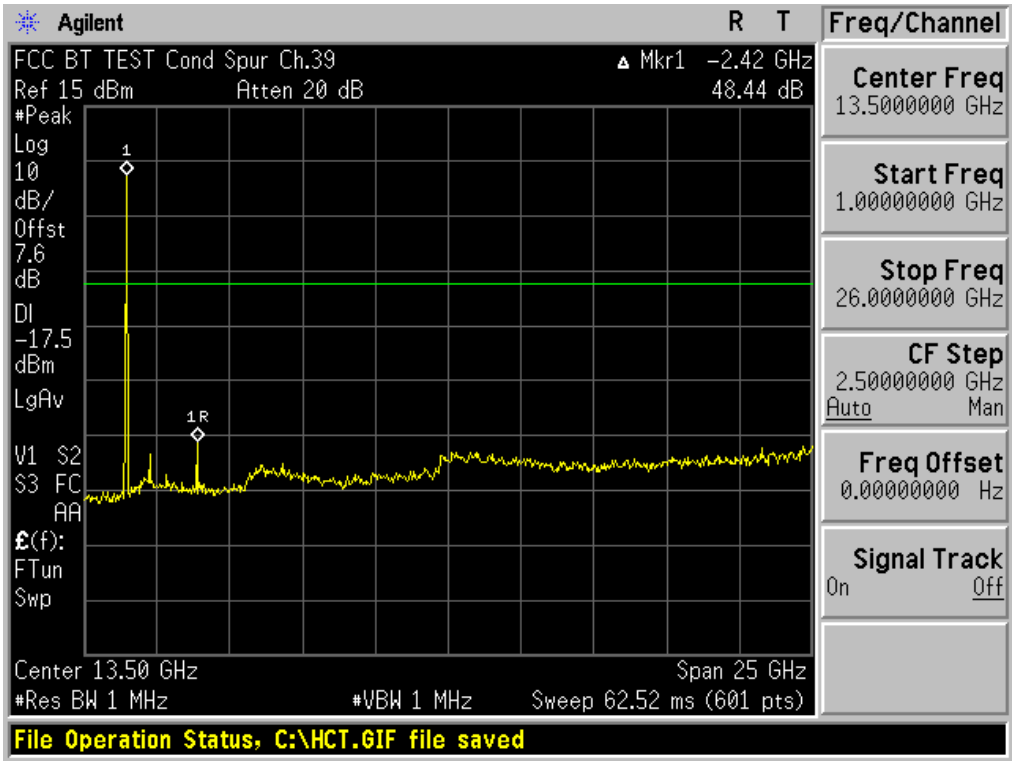
Test Plots (GFSK) - 1 GHz - 26 GHz (RBW:1 MHz, VBW: 1 MHz)
Spurious Emission (High-CH)



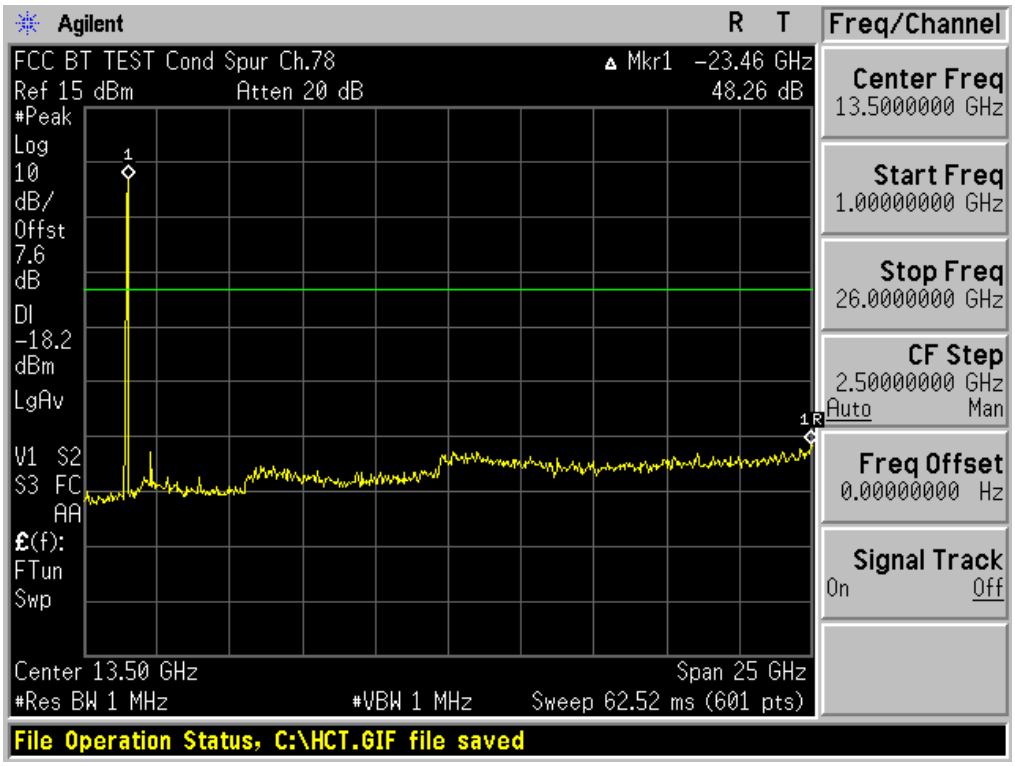
Test Plots (8DPSK) - 1 GHz - 26 GHz (RBW:1 MHz, VBW: 1 MHz)
Spurious Emission (Low-CH)



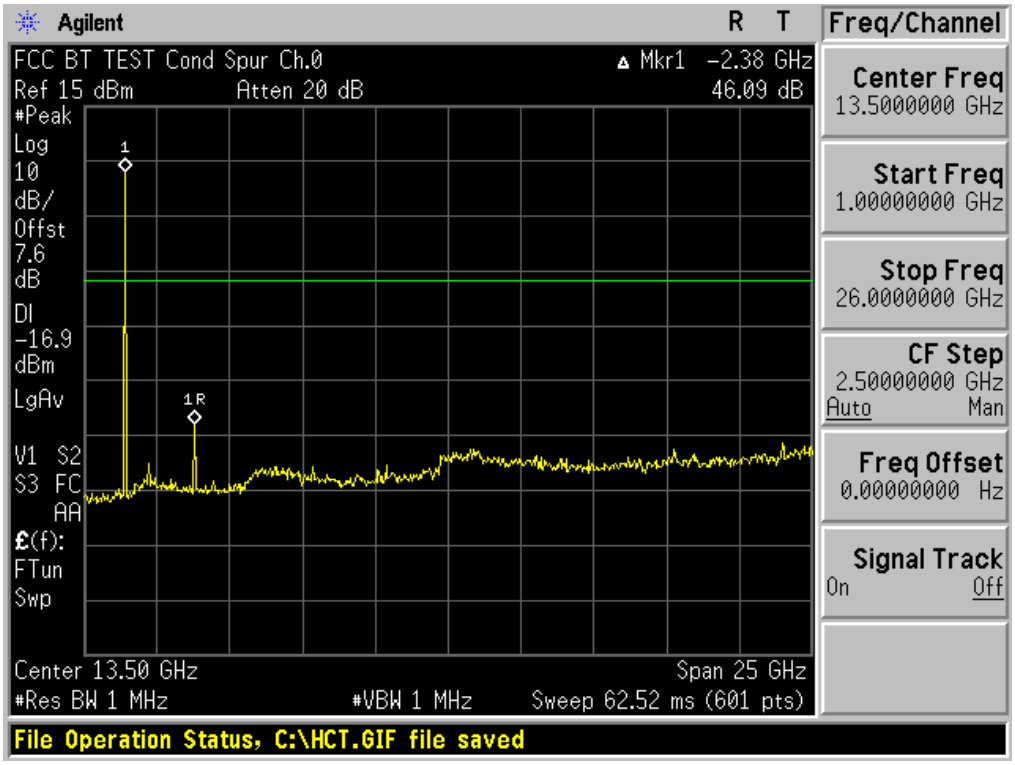
Test Plots (8DPSK) - 1 GHz - 26 GHz (RBW:1 MHz, VBW: 1 MHz)
Spurious Emission (Mid-CH)



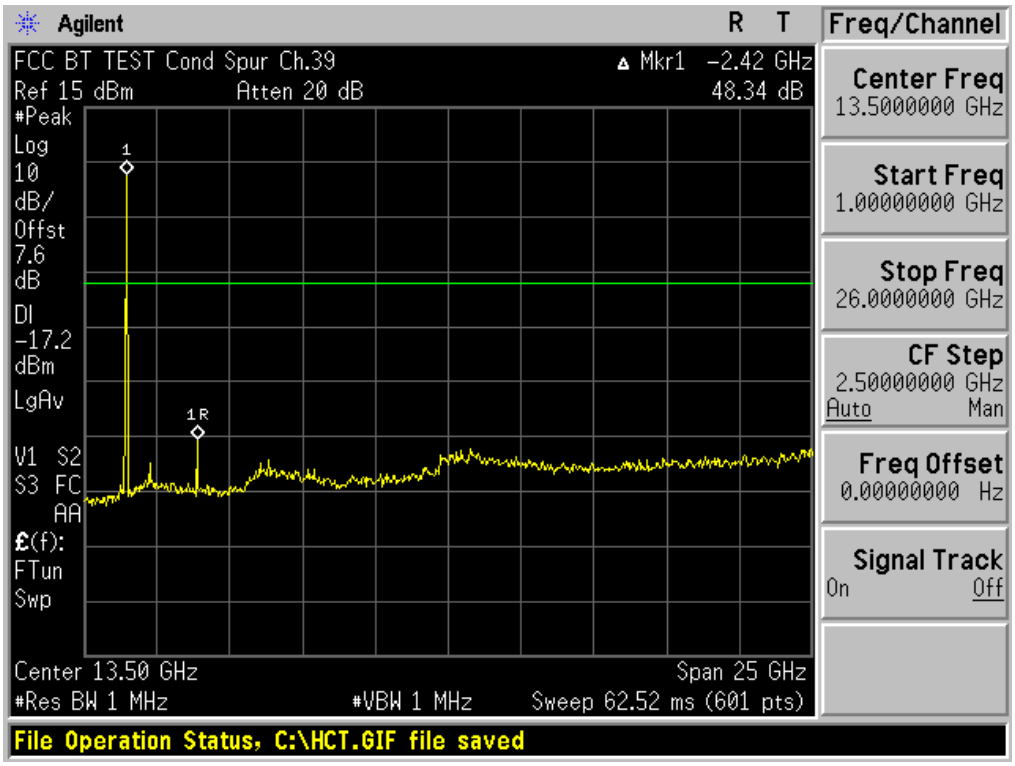
Test Plots (8DPSK) - 1 GHz - 26 GHz (RBW:1 MHz, VBW: 1 MHz)
Spurious Emission (High-CH)



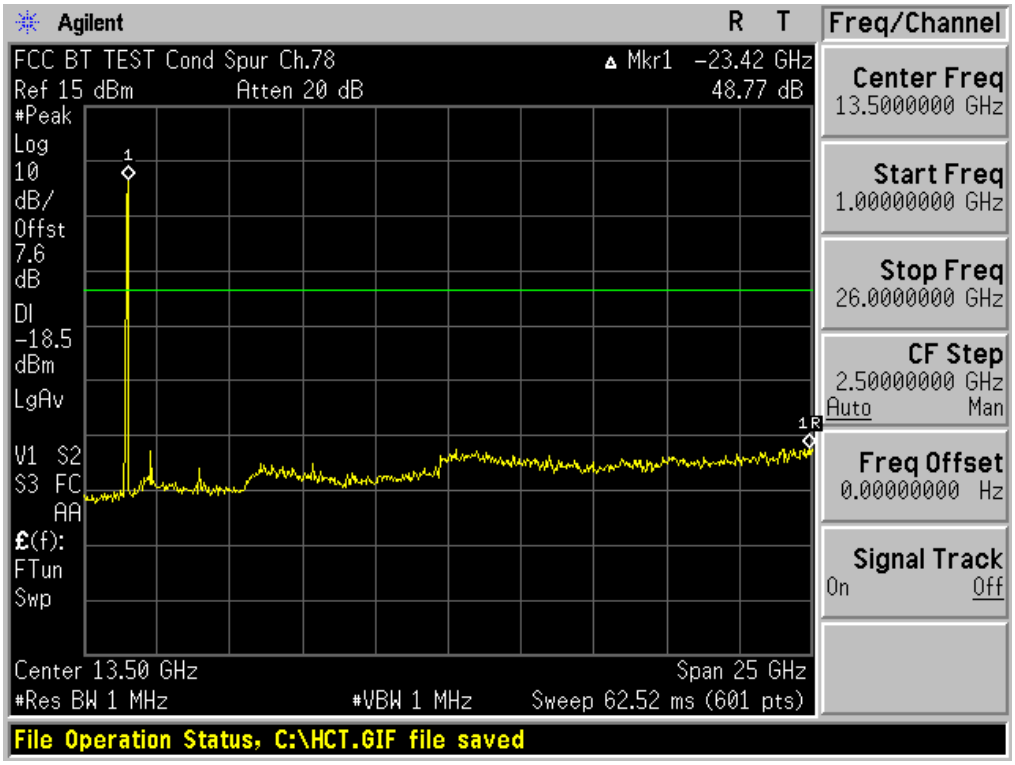
Test Plots (π/4DQPSK) - 1 GHz - 26 GHz (RBW:1 MHz, VBW: 1 MHz)
Spurious Emission (Low-CH)



Test Plots (π/4DQPSK) - 1 GHz - 26 GHz (RBW:1 MHz, VBW: 1 MHz)
Spurious Emission (Mid-CH)



Test Plots (π/4DQPSK) - 1 GHz - 26 GHz (RBW:1 MHz, VBW: 1 MHz)
Spurious Emission (High-CH)



8.6.2 RADIATED SPURIOUS EMISSIONS

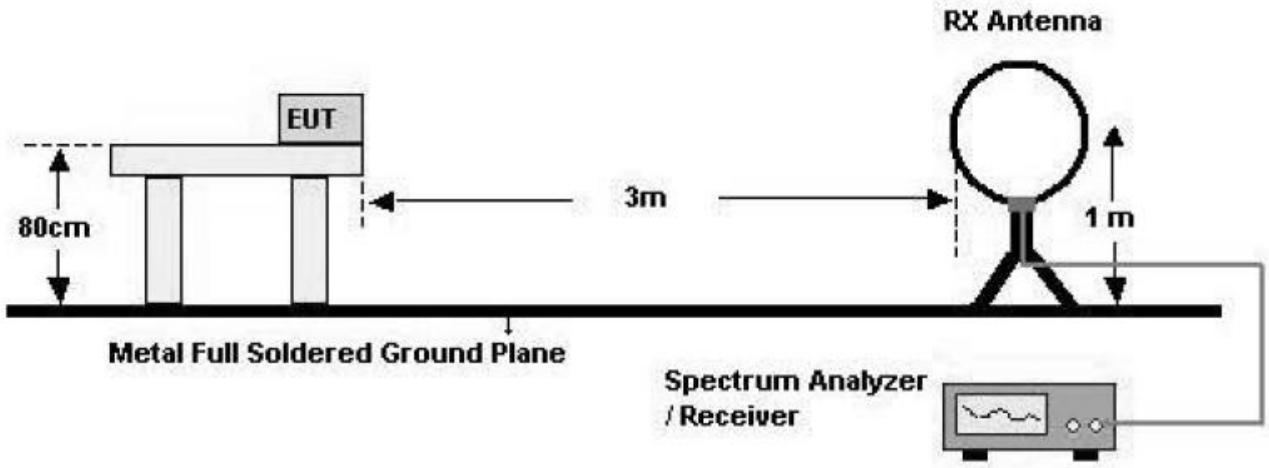
LIMIT : §15.247(d), §15.205, §15.209

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.

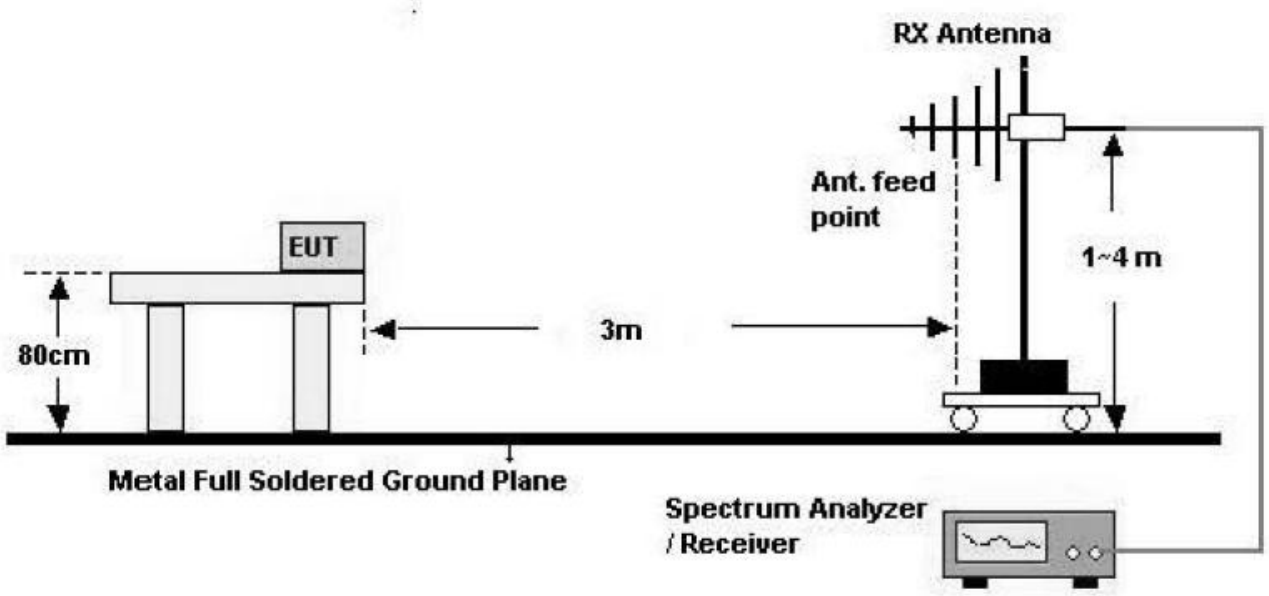
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Configuration

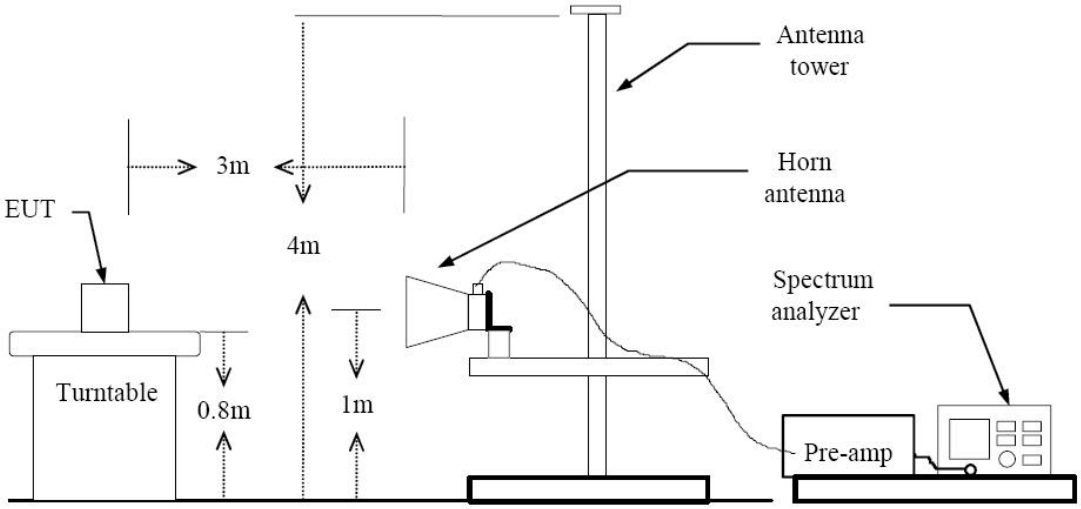
Below 30 MHz



30 MHz - 1 GHz



Above 1 GHz



TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8 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.

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.

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
111.84	26.20	9.95	1.06	H	37.2	43.5	6.3
111.84	26.45	9.95	1.06	V	37.5	43.5	6.0
253.10	27.12	11.85	1.71	V	40.7	46.0	5.3
277.10	27.80	12.39	1.77	H	42.0	46.0	4.0
297.70	26.35	13.20	1.88	H	41.4	46.0	4.6
297.70	27.10	13.20	1.88	V	42.2	46.0	3.8

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.

Above 1 GHz

Operation Mode: CH Low(GFSK)

Frequency [MHz]	Reading dBuV	※A.F+CL-AMP GAIN [dB]	ANT. POL [H/V]	Duty Cycle Correction [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
4804	59.17	-0.2	V	0	58.97	74	15.03	PK
4804	55.60	-0.2	V	-30.73	24.67	54	29.33	AV
7206	48.27	10.34	V	0	58.61	74	15.39	PK
7206	35.89	10.34	V	-30.73	15.50	54	38.50	AV
4804	57.19	-0.2	H	0	56.99	74	17.01	PK
4804	52.36	-0.2	H	-30.73	21.43	54	32.57	AV
7206	48.31	10.34	H	0	58.65	74	15.35	PK
7206	36.00	10.34	H	-30.73	15.61	54	38.39	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 + Duty Cycle Correction Factor
5. Spectrum setting:
   a. Peak Setting 1 GHz – 26 GHz, RBW = 1 MHz, VBW = 1 MHz.
   b. AV Setting 1 GHz – 26 GHz, RBW = 1 MHz, VBW = 1 kHz ≥ 1/τ Hz, where τ = pulse width in seconds.
6. Duty Cycle Correction Factor (79 channel hopping)
   a. Time to cycle through all channels= Δ t= τ [ms] x 79 channels = 229.732 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 '* = 2.908 ms
   d. Duty Cycle Correction = 20log (Worst Case Dwell Time/ 100ms) dB = -30.728 dB
   e. We applied DCCF in the test result which hopping channel number is 79.
7. FYI : 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 = 58.16 ms, where τ = pulse width
   b. 100 ms/ Δt [ms] = *H* → Round up to next highest integer, *H ' =1.719395*
   c. Worst Case Dwell Time = τ [ms] x *H '* = 5.0 ms

d. Duty Cycle Correction(AFH) = 20log (Worst Case Dwell Time/ 100ms) dB = -26.02 dB

8. We have done Normal Mode and EDR Mode test. Worst case of EUT is Normla Mode.

9. This test is performed with hopping off.

Operation Mode: CH Mid(GFSK)

Frequency [MHz]	Reading dBuV	※A.F+CL-AMP GAIN [dB]	ANT. POL [H/V]	Duty Cycle Correction [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
4882	57.22	0.25	V	0	57.47	74	16.53	PK
4882	52.78	0.25	V	-30.73	22.30	54	31.70	AV
7323	49.25	10.01	V	0	59.26	74	14.74	PK
7323	35.94	10.01	V	-30.73	15.22	54	38.78	AV
4882	55.46	0.25	H	0	55.71	74	18.29	PK
4882	50.10	0.25	H	-30.73	19.62	54	34.38	AV
7323	48.80	10.01	H	0	58.81	74	15.19	PK
7323	36.07	10.01	H	-30.73	15.35	54	38.65	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 + Duty Cycle Correction Factor
5. Spectrum setting:
   a. Peak Setting 1 GHz – 26 GHz, RBW = 1 MHz, VBW = 1 MHz.
   b. AV Setting 1 GHz – 26 GHz, RBW = 1 MHz, VBW = 1 kHz ≥ 1/τ Hz, where τ = pulse width in seconds.
6. Duty Cycle Correction Factor (79 channel hopping)
   a. Time to cycle through all channels= Δ t= τ [ms] x 79 channels = 229.732 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 '* = 2.908 ms
   d. Duty Cycle Correction = 20log (Worst Case Dwell Time/ 100ms) dB = -30.728 dB
   e. We applied DCCF in the test result which hopping channel number is 79.
7. FYI : 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 = 58.16 ms, where τ = pulse width
   b. 100 ms/ Δt [ms] = *H* → Round up to next highest integer, *H ' =1.719395*
   c. Worst Case Dwell Time = τ [ms] x *H '* = 5.0 ms
   d. Duty Cycle Correction(AFH) = 20log (Worst Case Dwell Time/ 100ms) dB = -26.02 dB
8. We have done Normal Mode and EDR Mode test. Worst case of EUT is Normla Mode.

9. This test is performed with hopping off.

Operation Mode: CH High(GFSK)

Frequency [MHz]	Reading dBuV	※A.F+CL-AMP GAIN [dB]	ANT. POL [H/V]	Duty Cycle Correction [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
4960	54.86	0.75	V	0	55.61	74	18.39	PK
4960	48.42	0.75	V	-30.73	18.44	54	35.56	AV
7440	48.87	10.11	V	0	58.98	74	15.02	PK
7440	35.77	10.11	V	-30.73	15.15	54	38.85	AV
4960	54.17	0.75	H	0	54.92	74	19.08	PK
4960	47.01	0.75	H	-30.73	17.03	54	36.97	AV
7440	48.53	10.11	H	0	58.64	74	15.36	PK
7440	36.04	10.11	H	-30.73	15.42	54	38.58	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 + Duty Cycle Correction Factor
5. Spectrum setting:
   a. Peak Setting 1 GHz – 26 GHz, RBW = 1 MHz, VBW = 1 MHz.
   b. AV Setting 1 GHz – 26 GHz, RBW = 1 MHz, VBW = 1 kHz ≥ 1/τ Hz, where τ = pulse width in seconds.
6. Duty Cycle Correction Factor (79 channel hopping)
   a. Time to cycle through all channels= Δ t= τ [ms] x 79 channels = 229.732 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 '* = 2.908 ms
   d. Duty Cycle Correction = 20log (Worst Case Dwell Time/ 100ms) dB = -30.728 dB
   e. We applied DCCF in the test result which hopping channel number is 79.
7. FYI : 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 = 58.16 ms, where τ = pulse width
   b. 100 ms/ Δt [ms] = *H* → Round up to next highest integer, *H ' =1.719395*
   c. Worst Case Dwell Time = τ [ms] x *H '* = 5.0 ms
   d. Duty Cycle Correction(AFH) = 20log (Worst Case Dwell Time/ 100ms) dB = -26.02 dB
8. We have done Normal Mode and EDR Mode test. Worst case of EUT is Normla Mode.

9. This test is performed with hopping off.

8.6.3 RECEIVER SPURIOUS EMISSIONS

FCC Rule(s)	**§15.109 (see Table Below)**
Test Requirements:	**Emission Level shall not exceed §15.109 limits**
Operating conditions:	**Under normal test conditions**
Method of testing:	**Radiated**
S/A. Settings:	**F < 1 GHz: RBW: 120 kHz, VBW: 300 kHz (Quasi Peak)** **F > 1 GHz: RBW: 1 MHz, VBW: 1 MHz (Peak)**
Mode of operation:	**Receive**

Frequency (MHz)	Field Strength (mV/m)	Measurement Distance (m)
30 – 88	100 (40 dBuV)	3
88 - 216	150 (43.5 dBuV))	3
216 – 960	200 (46 dBuV)	3
Above 960	500 (54 dBuV)	3

Operation Mode: Receive:

30 MHz ~ 1 GHz

Frequency MHz	Reading dBuV	Ant. Factor dB/m	Cable Loss dB	ANT POL (H/V)	Total dBuV/m	Limit dBuV/m	Margin dB
111.35	25.89	9.95	1.06	H	36.9	43.5	6.6
111.35	27.10	9.95	1.06	V	38.1	43.5	5.4
255.10	26.30	11.91	1.72	V	39.9	46.0	6.1
277.20	27.23	12.39	1.77	H	41.4	46.0	4.6
298.47	27.00	13.20	1.88	V	42.1	46.0	3.9
298.47	27.20	13.20	1.88	H	42.3	46.0	3.7

Above 1 GHz

Frequency MHz	Reading dBuV	Ant. Factor dB/m	Cable Loss dB	ANT POL (H/V)	Total dBuV/m	Limit dBuV/m	Margin dB
No Critical peaks found							

8.6.4 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]	*Fund. Reading dBuV	※ A.F.+CL [dB]	Ant. Pol. [H/V]	*Fundamental [dBuV/m]	Delta Value [dBuV/m]	Duty Cycle Correction [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
2390.0	53.43	33.86	H	87.29	34.07	0	53.22	74	20.78	PK
2390.0	53.00	33.86	H	86.86	34.07	-30.73	22.06	54	31.94	AV
2390.0	54.97	33.86	V	88.83	35.79	0	53.04	74	20.96	PK
2390.0	54.47	33.86	V	88.33	35.79	-30.73	21.81	54	32.19	AV
2483.5	56.59	34.02	H	90.61	41.42	0	49.19	74	24.81	PK
2483.5	56.10	34.02	H	90.12	41.42	-30.73	17.97	54	36.03	AV
2483.5	59.31	34.02	V	93.33	44.39	0	48.94	74	25.06	PK
2483.5	58.81	34.02	V	92.83	44.39	-30.73	17.71	54	36.29	AV

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

Notes:

1. Total = Fundamental Reading Value + Antenna Factor + Cable Loss – Delta Value + Duty Cycle Correction Factor
2. Spectrum setting:
   a. Peak Setting 1 GHz – 26 GHz, RBW = 1 MHz, VBW = 1 MHz.
   b. AV Setting 1 GHz – 26 GHz, RBW = 1 MHz, VBW = 1 kHz ≥ 1/τ Hz, where τ = pulse width in seconds.
3. Duty Cycle Correction Factor (79 channel hopping)
   a. Time to cycle through all channels= Δ t= τ [ms] x 79 channels = 229.732 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 '* = 2.908 ms
   d. Duty Cycle Correction = 20log (Worst Case Dwell Time/ 100ms) dB = -30.728 dB
   e. We applied DCCF in the test result which hopping channel number is 79.

4. FYI : 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 = 58.16 ms, where τ = pulse width
   b. 100 ms/ Δt [ms] = *H* → Round up to next highest integer, *H ' =1.719395*
   c. Worst Case Dwell Time = τ [ms] x *H '* = 5.0 ms
   d. Duty Cycle Correction(AFH) = 20log (Worst Case Dwell Time/ 100ms) dB = -26.02 dB
5. Radiated Restricted Band Edge measures by marker-delta method according to ANSI C63.10(version : 2009)
6. We have done Normal Mode, EDR Mode. Worst case of EUT is Normla Mode.
7. This test is performed with hopping off.
8. Marker-Delta Method

In making radiated band-edge measurements, there can be a problem obtaining meaningful data because a measurement instrument that is tuned to a band-edge frequency may also capture some in-band signals when using the resolution bandwidth (RBW).In an effort to compensate for this problem, the following technique for determining band-edge compliance shall be used.

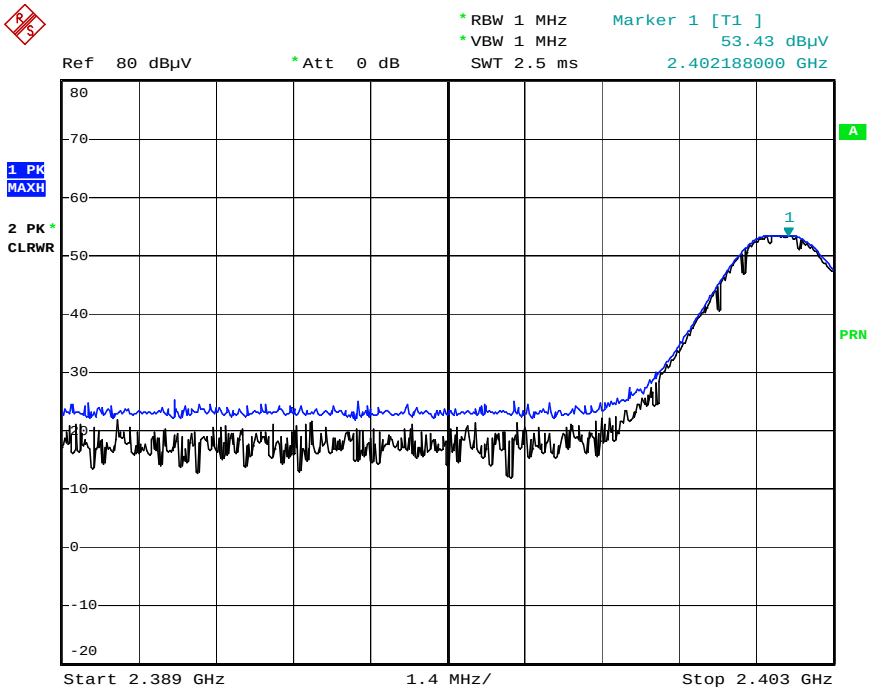
a) Perform an in-band field strength measurement of the fundamental emission using the RBW and detector function specified in 6.3 and 6.4, 6.5, or 6.6, as applicable, and the appropriate regulatory requirements for the frequency being measured. and our Rules for the frequency being measured.
   For example, for a device operating in the 902-928 MHz band under 47 CFR 15.249, use a 120 kHz RBW with a CISPR QP detector (a peak detector with 100 kHz RBW may alternatively be used). For unlicensed wireless devices operating above 1 GHz, use a 1 MHz RBW, a 1 MHz VBW, and a peak detector as required by 47 CFR 15.35. Repeat the measurement with an average detector (i.e., 1 MHz RBW with 10 Hz VBW). For pulsed emissions, other factors must be included. For example note that radiated measurements of the fundamental emission of a spread spectrum unlicensed wireless device operating under 47 CFR 15.247 are not normally required, but they are necessary in connection with this procedure.

b) Choose a spectrum analyzer span that encompasses both the peak of the fundamental emission and the band-edge emission under investigation. Set the analyzer RBW to approximately 1% to 5 % of the total span, unless otherwise specified, with a video bandwidth equal to or greater than the RBW. Record the peak levels of the fundamental emission and the relevant band-edge emission (i.e., run several sweeps in peak hold mode). Observe the stored trace and measure the amplitude delta between the peak of the fundamental and the peak of the band-edge emission. This is not an abosolute field strength measurement; it is only a relative measurement to determine the amount by which the emission drops at the band-edge relative to the highest fundamental emission level.

c) Subtract the delta measured in b) from the field strengths measured in a). The resultant field strengths (CISPR QP, average, or peak, as appropriate) are then used to determine band-edge compliance of the resricted bands, described in 5.9.

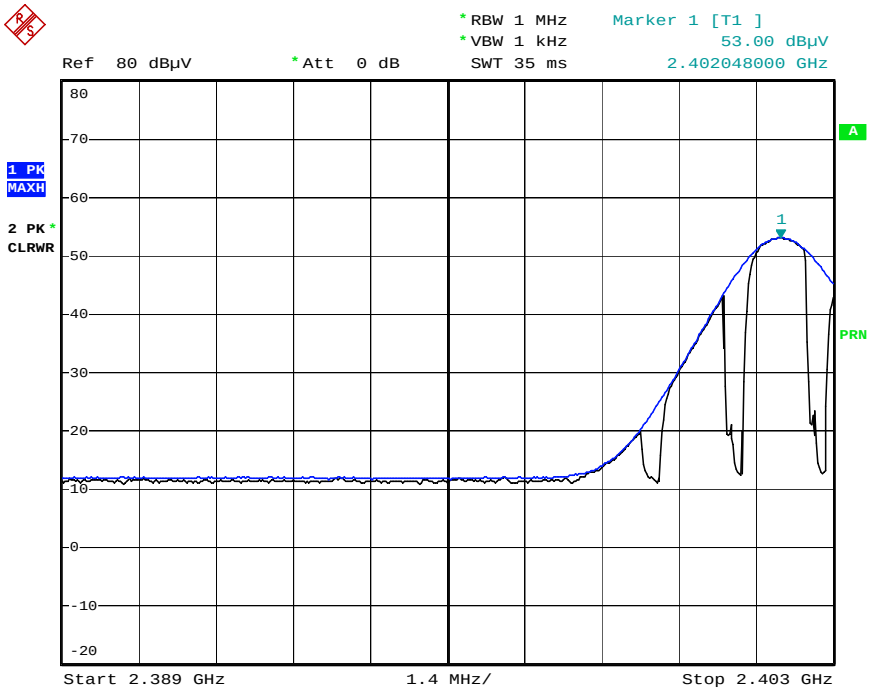
Test Plots (GFSK)

Fund. (Peak_Horizontal _CH 0)



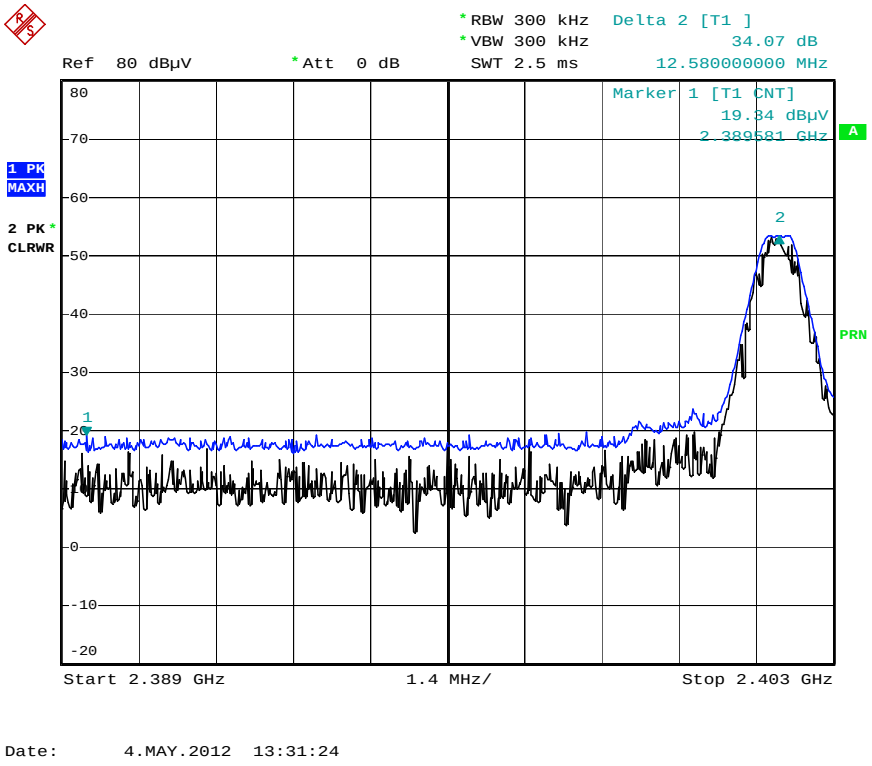
Date: 4.MAY.2012 13:30:23

Fund. (Average_Horizontal _CH 0)



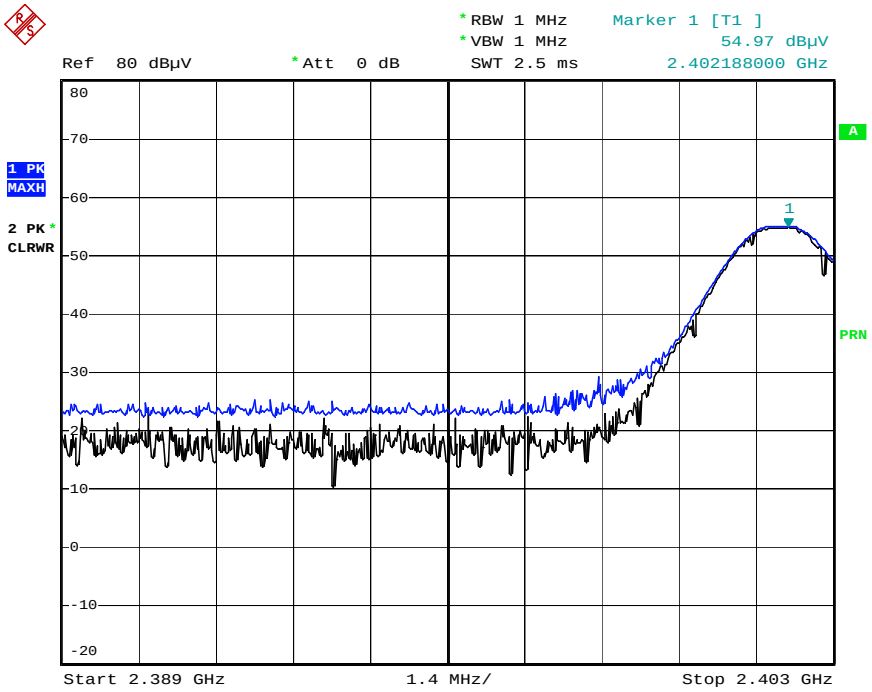
Date: 4.MAY.2012 13:30:42

Delta (Horizontal _CH 0)



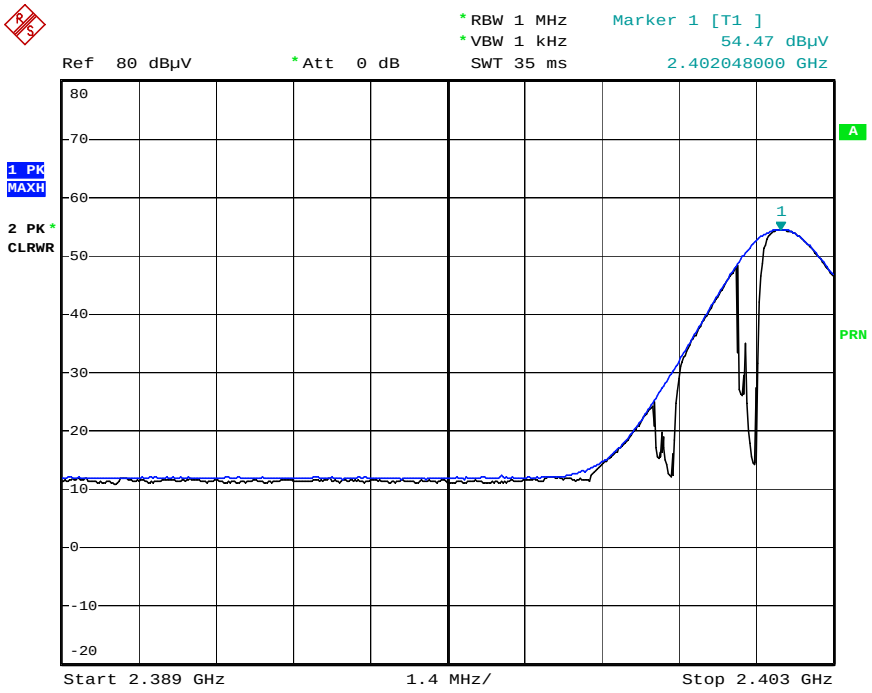
Date: 4.MAY.2012 13:31:24

Fund. (Peak_Vertical_CH 0)



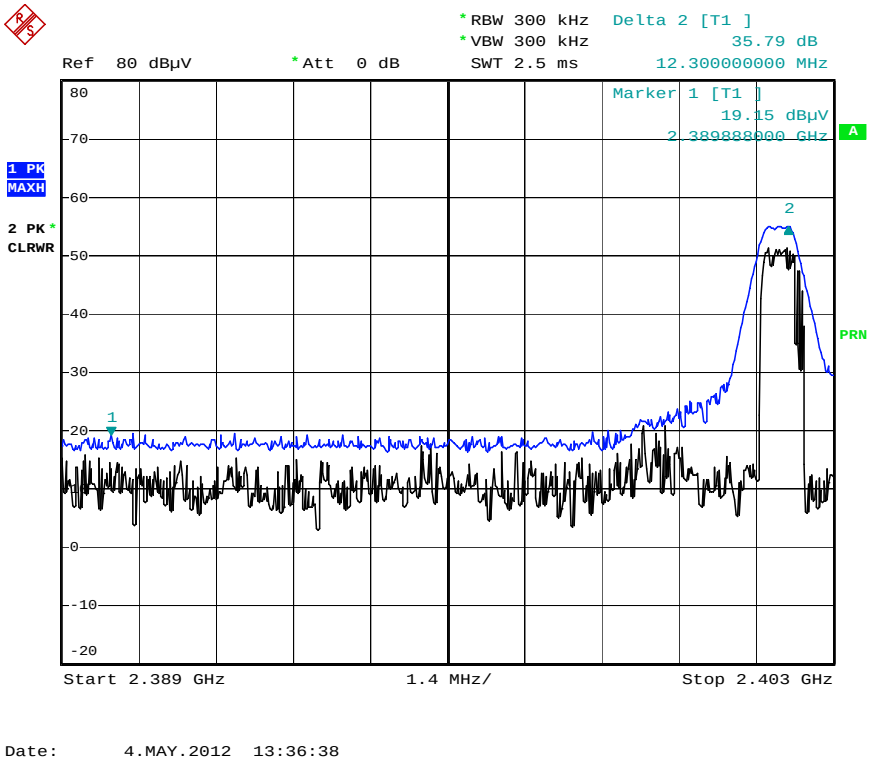
Date: 4.MAY.2012 13:35:37

Fund. (Average_Vertical_CH 0)



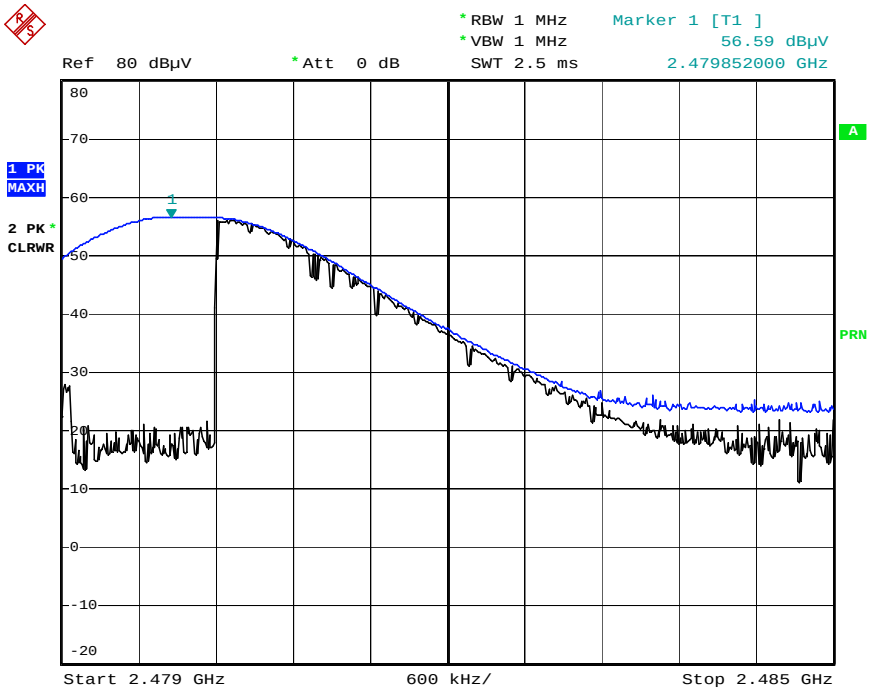
Date: 4.MAY.2012 13:35:55

Delta (Vertical_CH 0)



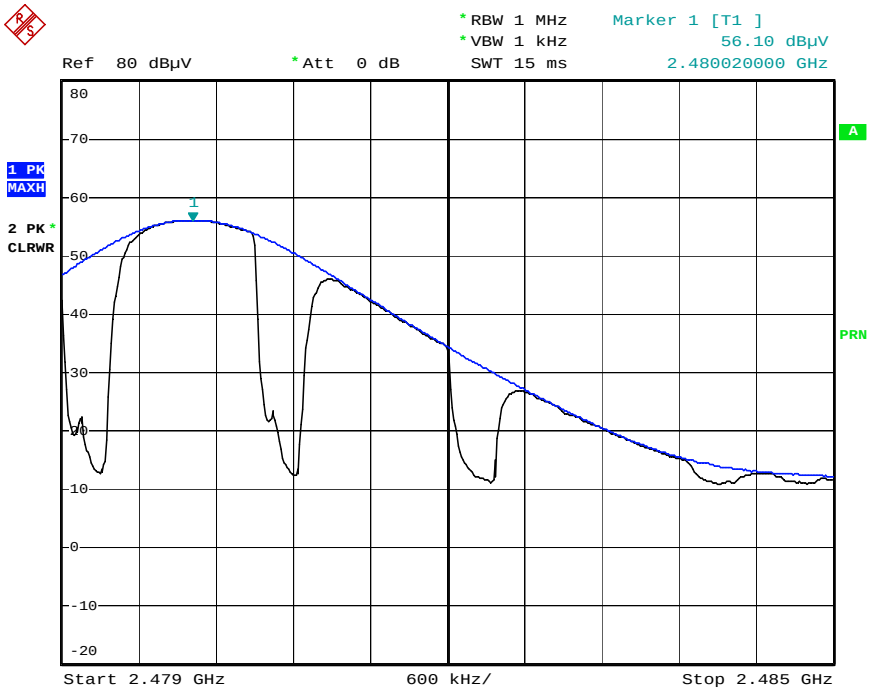
Date: 4.MAY.2012 13:36:38

Fund. (Peak_Horizontal_CH 79)



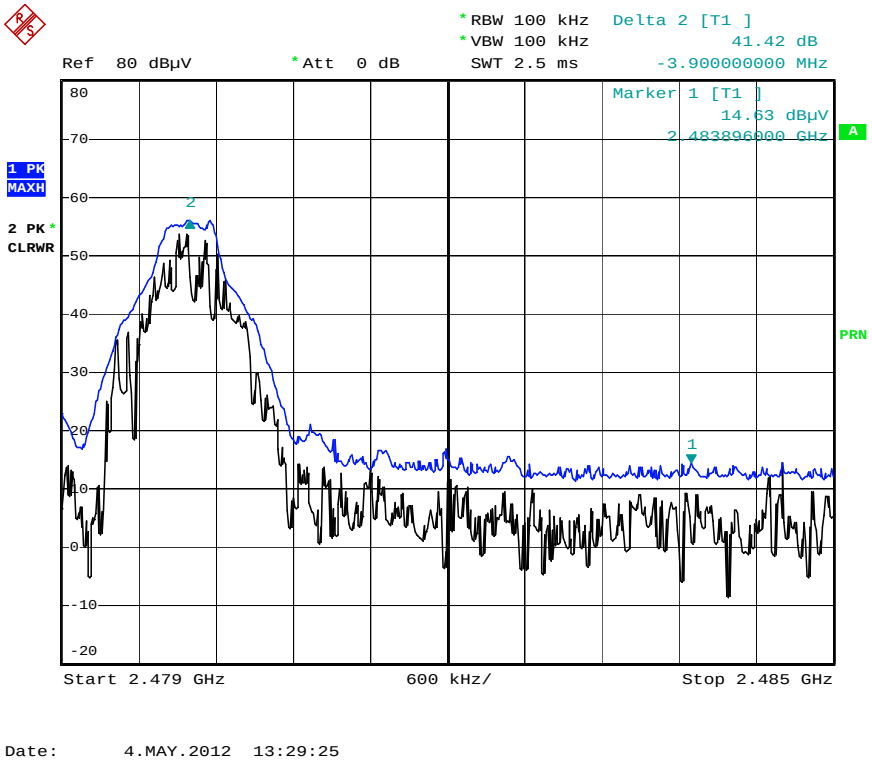
Date: 4.MAY.2012 13:28:25

Fund. (Average_Horizontal_CH 79)

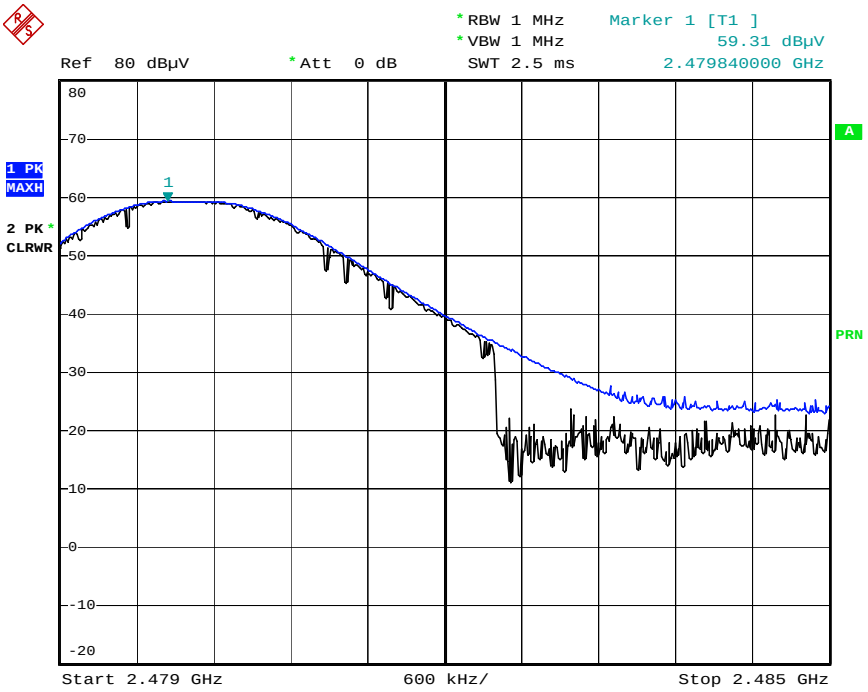


Date: 4.MAY.2012 13:28:44

Delta (Horizontal_CH 79)

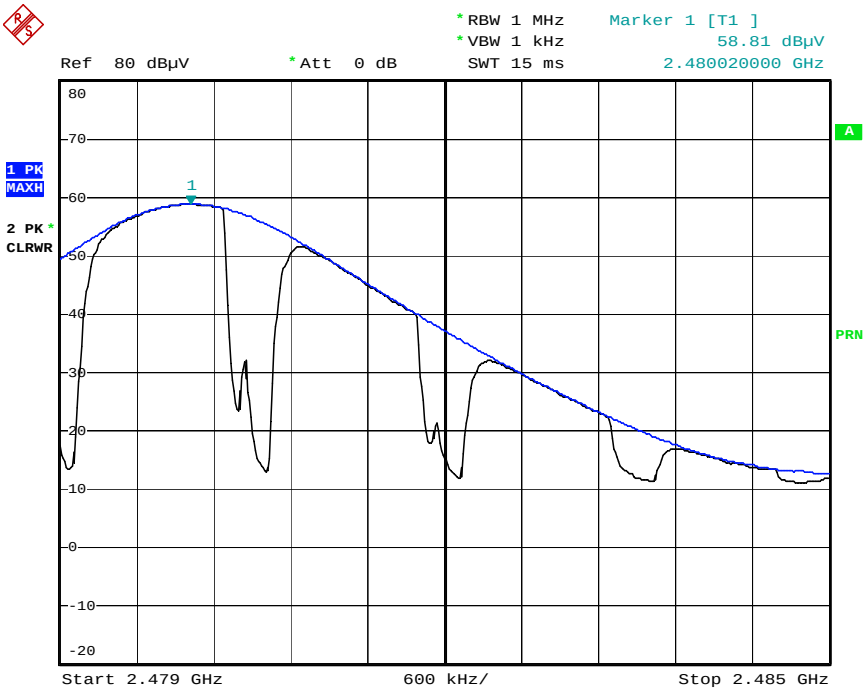


Fund. (Peak_Vertical_CH 79)



Date: 4.MAY.2012 13:33:26

Fund. (Average_Vertical_CH 79)



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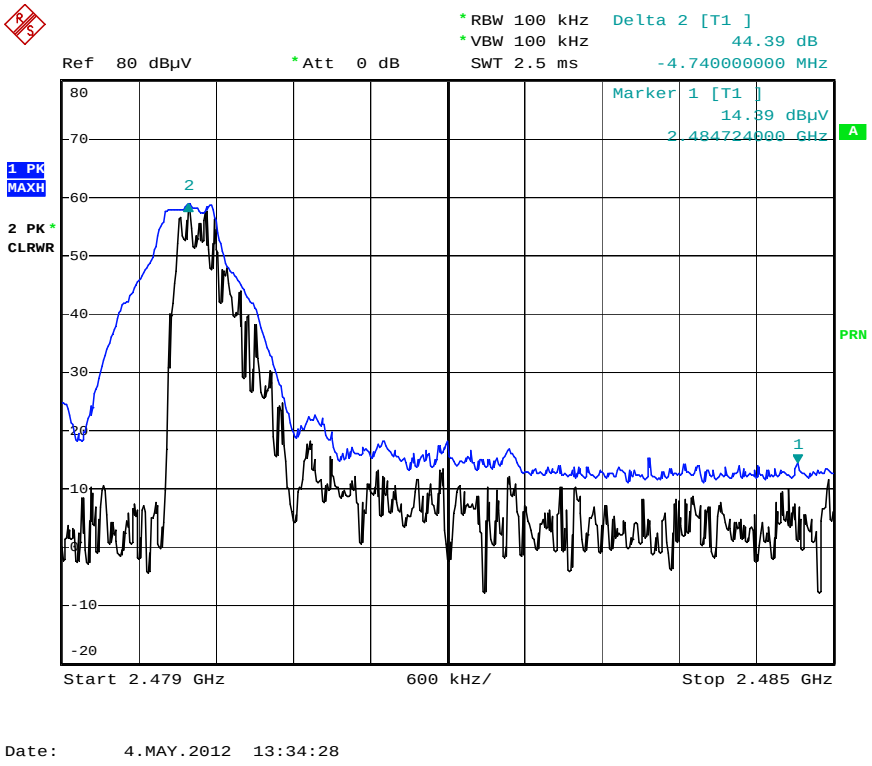
Delta (Vertical_CH 79)



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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.

Note : We don’t perform powerline conducted emission test. Because this EUT is used with vehicle.

9. LIST OF TEST EQUIPMENT

Manufacturer	Model / Equipment	Calibration Interval	Calibration Due	Serial No.
Rohde & Schwarz	ESH2-Z5/ LISN	Annual	02/03/2013	861741/013
Schwarzbeck	VULB 9168/ TRILOG Antenna	Biennial	02/09/2013	200
Rohde & Schwarz	ESI 40 / EMI TEST RECEIVER	Annual	05/03/2013	831564103
Agilent	E4440A/ Spectrum Analyzer	Annual	05/02/2013	US45303008
Agilent	N9020A/ SIGNAL ANALYZER	Annual	09/23/2012	MY51110020
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
Rohde & Schwarz	ESH3-Z2/ PULSE LIMITER	Annual	08/01/2012	375.8810.352
Rohde & Schwarz	SCU-18/ Signal Conditioning Unit	Annual	09/19/2012	10094
MITEQ	AFS44-00102650-42-10P-44-PS/ POWER AMP	Annual	09/23/2012	1532439
Schwarzbeck	BBHA 9120D/ Horn Antenna	Biennial	10/17/2013	937
Schwarzbeck	BBHA9170 / Horn Antenna(15 GHz ~ 40 GHz)	Biennial	10/26/2012	BBHA9170342
Rohde & Schwarz	FSP / Spectrum Analyzer	Annual	02/09/2013	839117/011
Agilent	E4416A /Power Meter	Annual	11/07/2012	GB41291412
Agilent	E9327A /POWER SENSOR	Annual	05/02/2013	MY4442009
Wainwright Instrument	WHF3.3/18G-10EF / High Pass Filter	Annual	05/02/2013	1
Wainwright Instrument	WRCJ2400/2483.5-2370/2520-60/14SS / Band Reject Filter	Annual	05/02/2013	1
Hewlett Packard	11636B/Power Divider	Annual	11/07/2012	11377
Hewlett Packard	11667B / Power Splitter	Annual	11/04/2012	10126
DIGITAL	EP-3010 /DC POWER SUPPLY	Annual	11/07/2012	3110117
ITECH	IT6720 / DC POWER SUPPLY	Annual	11/07/2012	010002156287001199
TESCOM	TC-3000C / BLUETOOTH TESTER	Annual	11/14/2012	3000C000276
Rohde & Schwarz	CBT / BLUETOOTH TESTER	Annual	05/02/2013	100422
EMCO	6502.LOOP ANTENNA	Biennial	01/11/2014	9009-2536
MITEQ	AMF-6D-001180-35-20P/ POWER AMP	Annual	12/26/2012	990893