HCT CO., LTD.

CERTIFICATE OF COMPLIANCE

FCC Certification

Applicant Name:
SAMSUNG Electronics Co., Ltd.

Address:
129, Samsung-ro, Yeongtong-gu Suwon-si, Gyeonggi-do, 443-742 Rep. of Korea

Date of Issue:
March 07, 2014

Test Site/Location:
HCT CO., LTD., 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea

Report No.: HCT-R-1403-F012

HCT FRN: 0005866421

FCC ID	**: A3LSHWM580D**
APPLICANT	**: SAMSUNG Electronics Co., Ltd.**

FCC Model(s):	SHW-M580D
Additional FCC Model(s):	SHW-M585D
EUT Type:	Mobile Phone
Max. RF Output Power:	9.33 dBm (8.57 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

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)

Report prepared by
: Kyoung Houn Seo
Test Engineer of RF Team

Approved by
: Chang Seok Choi
Manager of RF Team

Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-R-1403-F012	March 07, 2014	- First Approval Report

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1. GENERAL INFORMATION

Applicant:	SAMSUNG Electronics Co., Ltd.
Address:	129, Samsung-ro, Yeongtong-gu Suwon-si, Gyeonggi-do, 443-742 Rep. of Korea
FCC ID:	A3LSHWM580D
EUT Type:	Mobile Phone
Model name(s):	SHW-M580D
Additional Model name(s):	SHW-M585D
Date(s) of Tests:	February 27, 2014 ~ March 04, 2014
Place of Tests:	HCT Co., Ltd. 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea (IC Recognition No. : 5944A-3)

2. EUT DESCRIPTION

EUT Type	Mobile Phone
FCC Model Name	SHW-M580D
Additional FCC Model Name	SHW-M585D
Power Supply	DC 3.8 V
Battery type	Li-ion Battery(Standard)
Frequency Range	2402 MHz - 2480 MHz (Bluetooth)
Transmit Power	9.33 dBm (8.57 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: Partron Antenna type: FPCB Antenna Peak Gain : -0.63 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 C63.4-2003) 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 **SAMSUNG Electronics Co., Ltd.**
Mobile Phone FCC ID: A3LSHWM580D

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 13.1.4.1 of ANSI C63.4. (Version :2003) Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

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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. 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 13.1.4.1 of ANSI C63.4. (Version: 2003). 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 8.1 to 8.6.1.(DA 00-705)

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 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 :2003) and CISPR Publication 22. Detailed description of test facility was submitted to the Commission and accepted dated June 21, 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	FCC Part Section(s)	Test Limit	Test Condition	Test Result
20 dB Bandwidth	§15.247(a)(1)(ii) or (iii)	NA	CONDUCTED	PASS
Occupied Bandwidth	NA	NA		NA
Conducted Maximum Peak Output Power	§15.247(b)(1)	< 1 Watts for 1Mbps < 125 Milliwatts for 2, 3Mbps		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

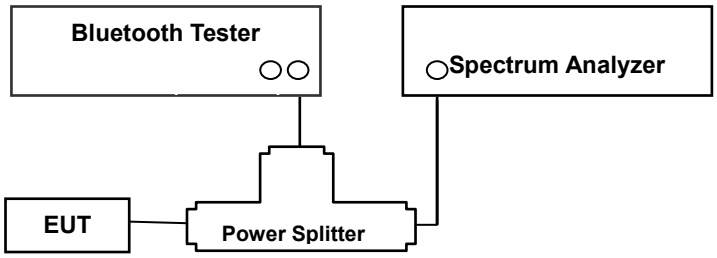
8.1 PEAK POWER

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 hopping mode, 125 mW for AFH mode
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 (DA 00-705)

Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
RBW > the 20 dB bandwidth of the emission being measured
VBW ≥ RBW
Sweep = Auto
Detector = Peak
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 7.18 dB at 2402 MHz and is 7.23 dB at 2480 MHz.
So, 7.2 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

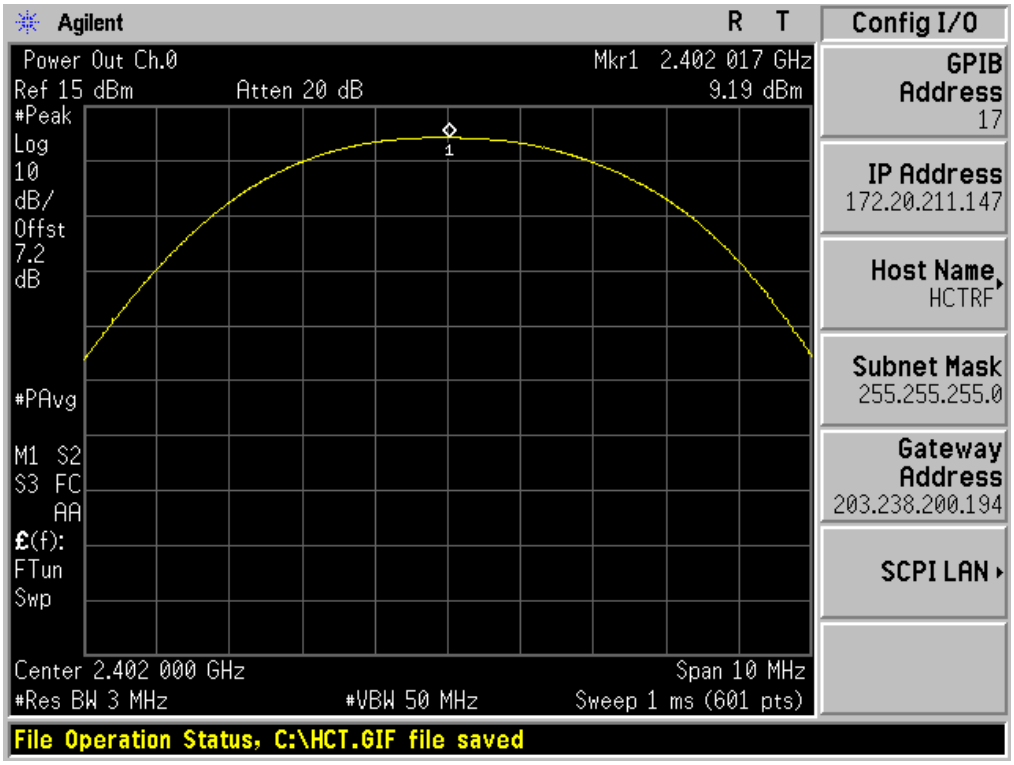
Test Data

Channel	Frequency (MHz)	Output Power (GFSK)		Limit (mW)	Result
		(dBm)	(mW)		
Low	2402	9.19	8.30	125	PASS
Mid	2441	9.33	8.57		PASS
High	2480	8.75	7.50		PASS

Channel	Frequency (MHz)	Output Power (8DPSK)		Output Power (π/4DQPSK)		Limit (mW)	Result
		(dBm)	(mW)	(dBm)	(mW)		
Low	2402	8.42	6.95	8.04	6.37	125	PASS
Mid	2441	8.56	7.18	8.17	6.56		PASS
High	2480	7.99	6.30	7.55	5.69		PASS

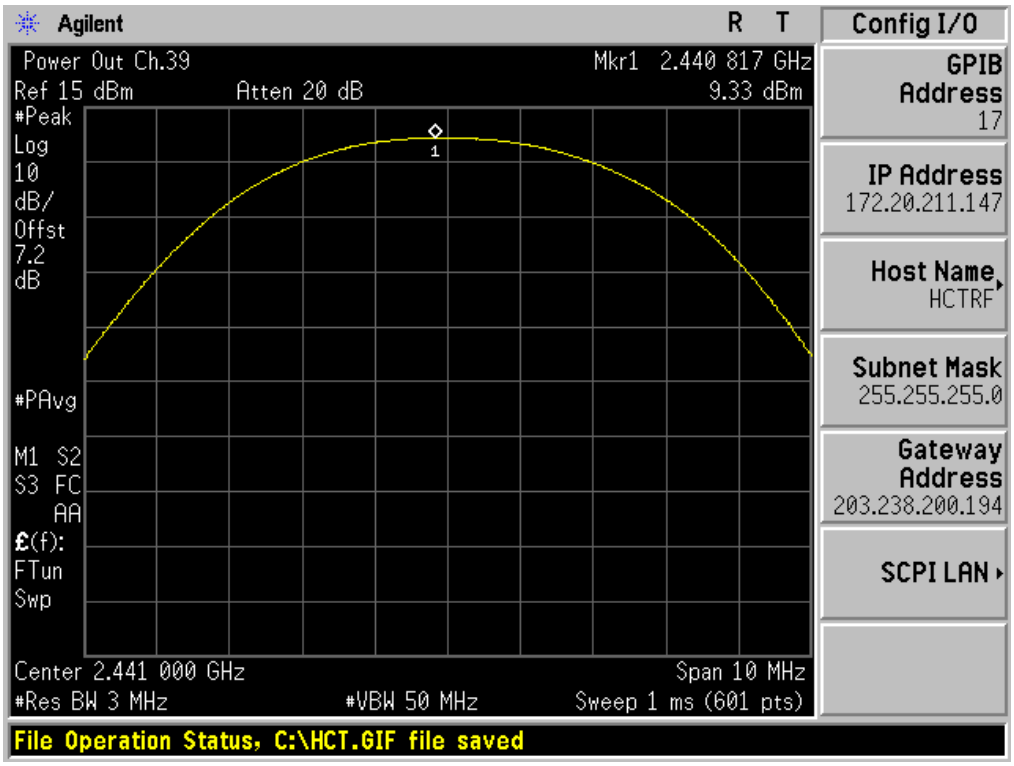
Test Plots (GFSK)

Peak Power (Low-CH)



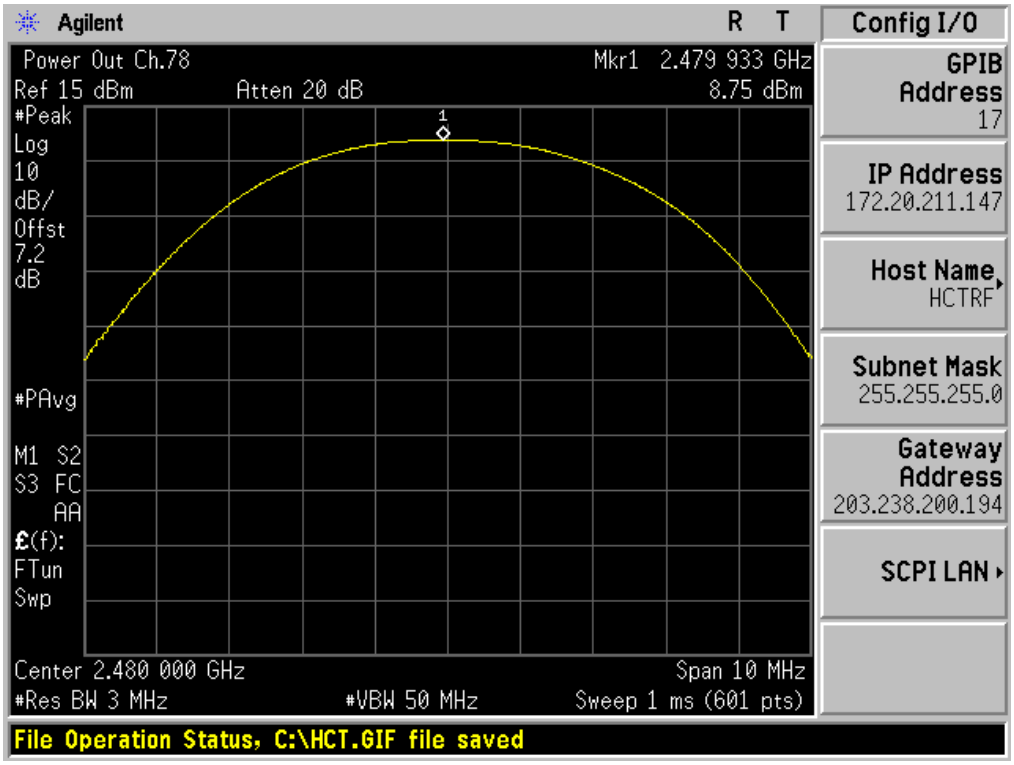
Test Plots (GFSK)

Peak Power (Mid-CH)



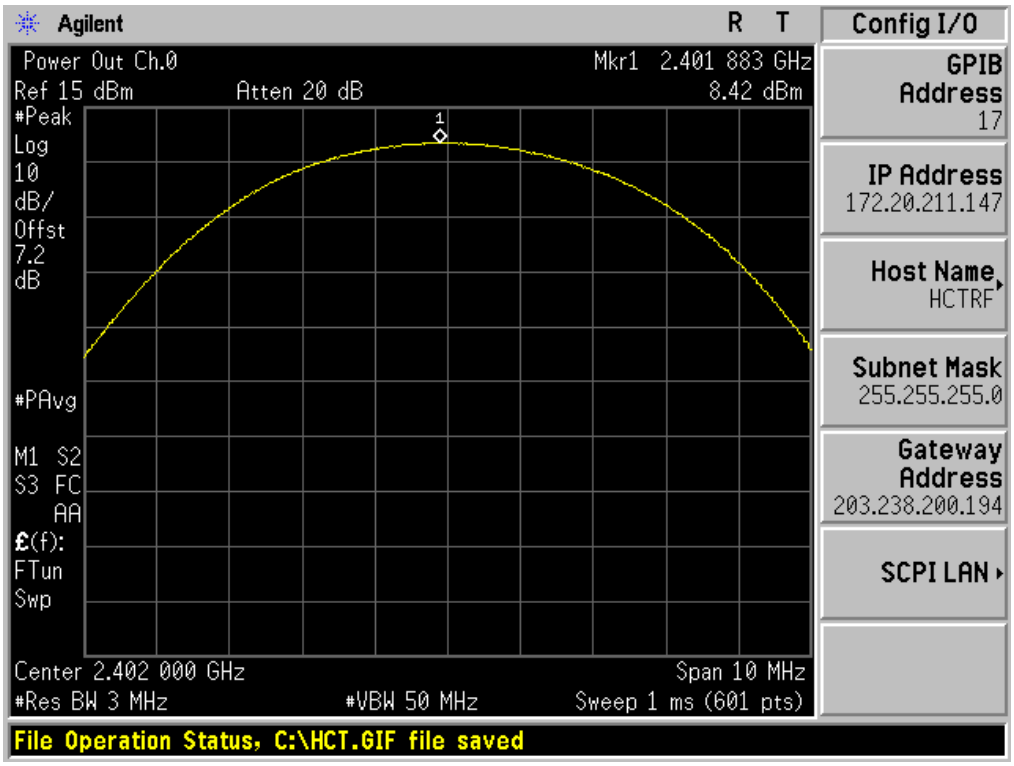
Test Plots (GFSK)

Peak Power (High-CH)



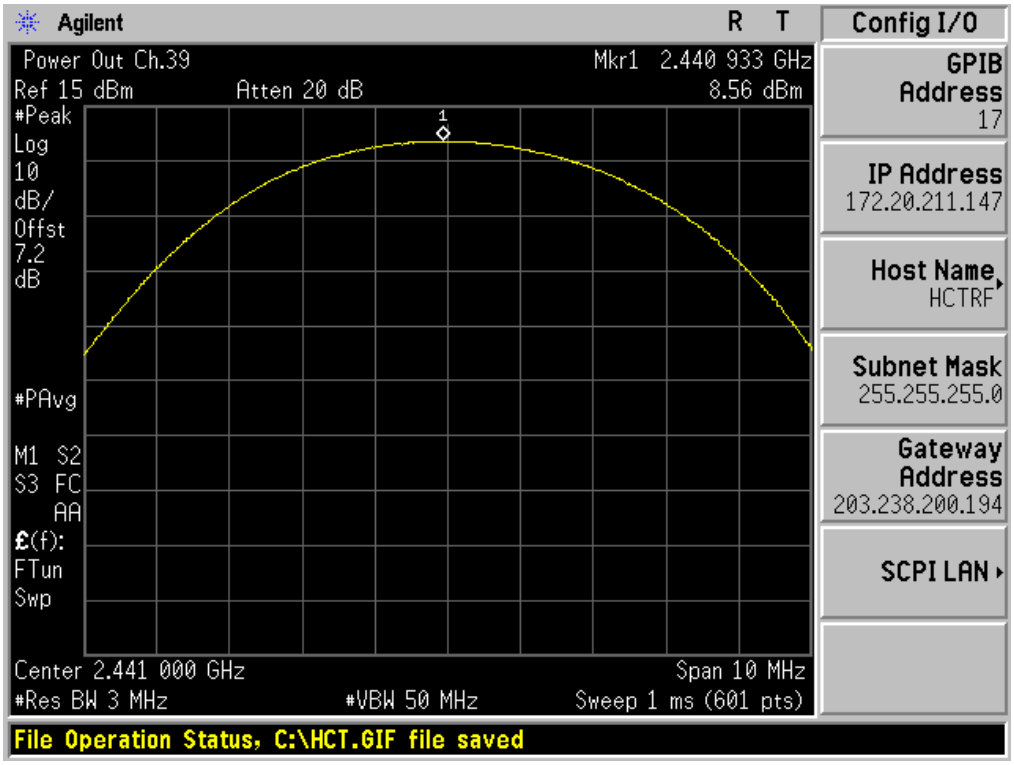
Test Plots (8DPSK)

Peak Power (Low-CH)



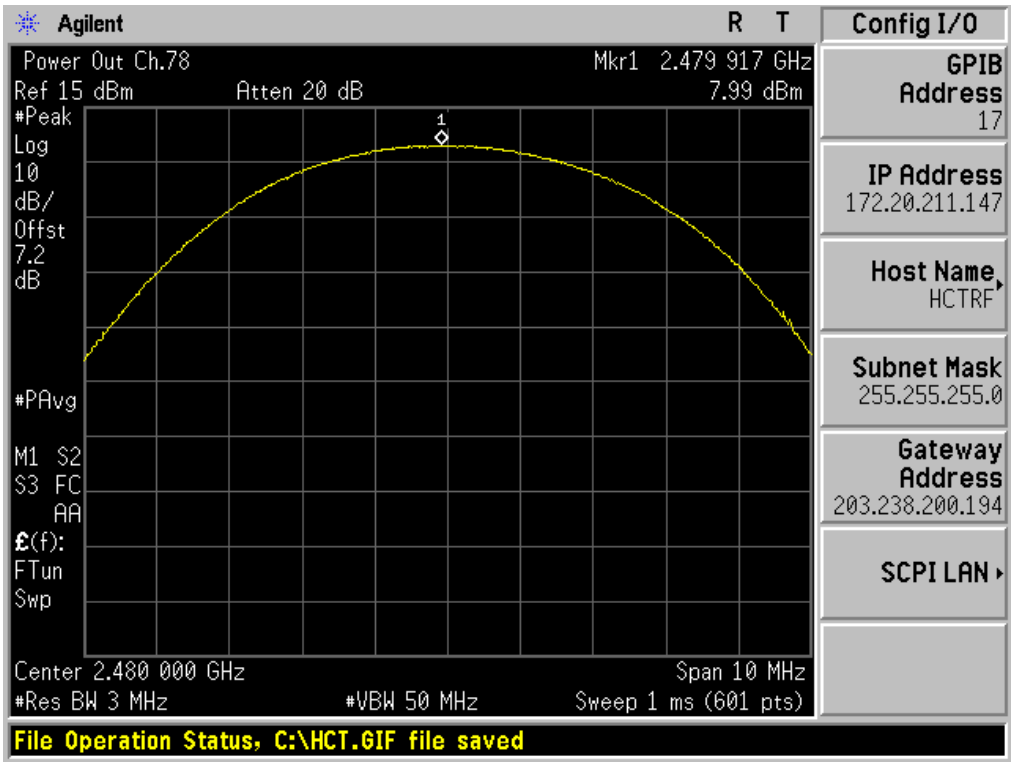
Test Plots (8DPSK)

Peak Power (Mid-CH)



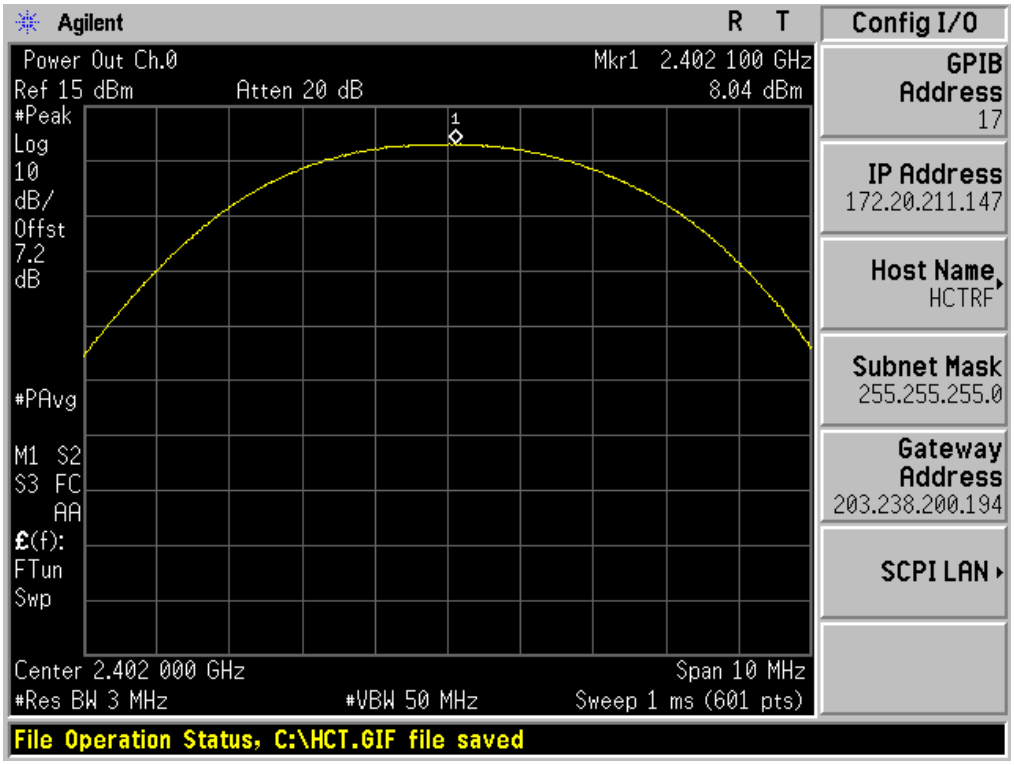
Test Plots (8DPSK)

Peak Power (High-CH)



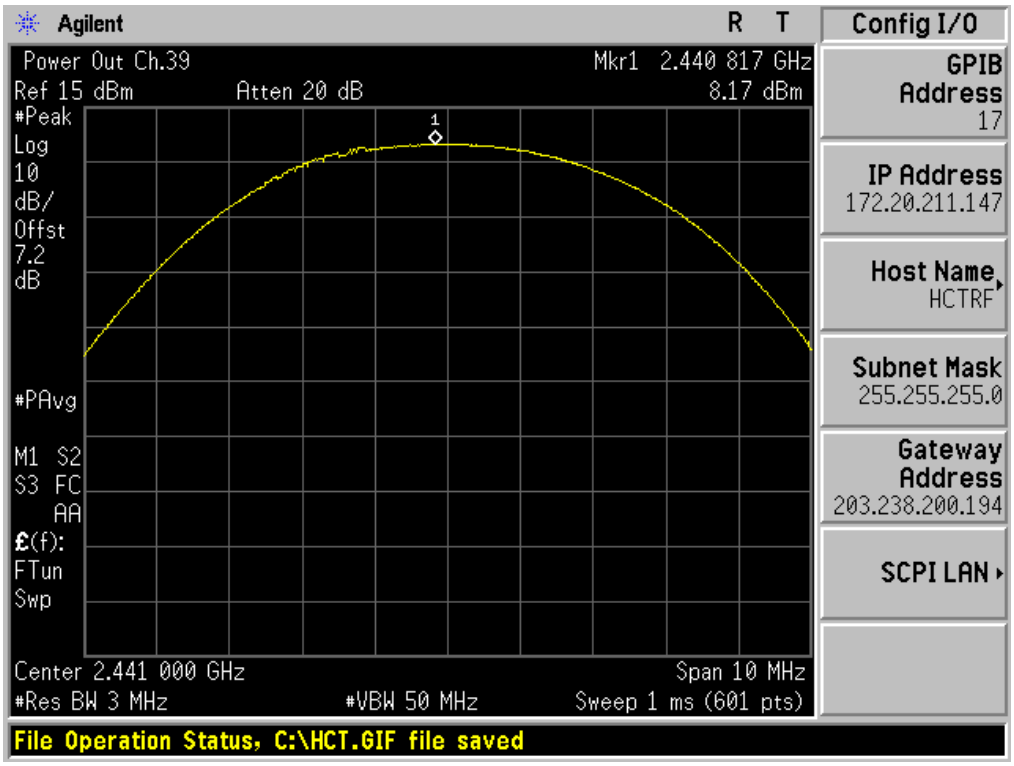
Test Plots (π/4DQPSK)

Peak Power (Low-CH)



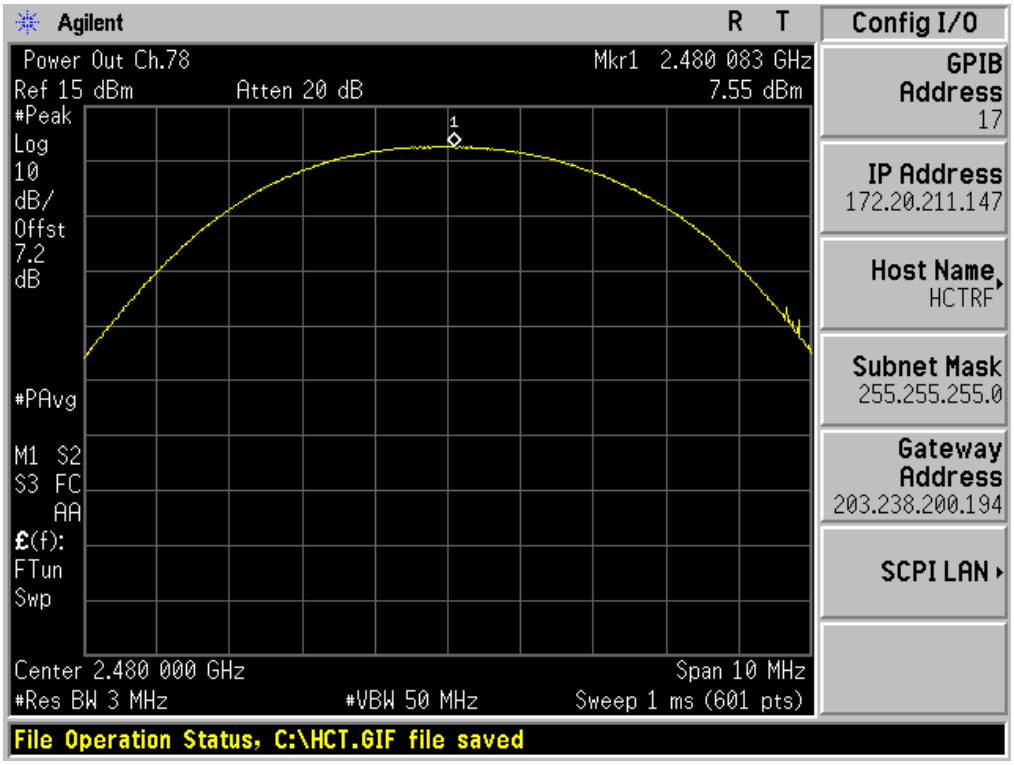
Test Plots (π/4DQPSK)

Peak Power (Mid-CH)



Test Plots (π/4DQPSK)

Peak Power (High-CH)

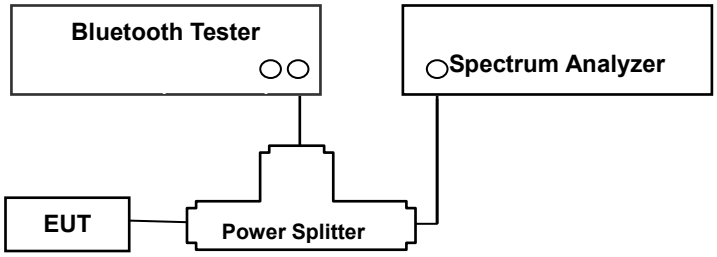


8.2 BAND EDGES

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 (DA 00-705)

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

RBW ≥ 1% of the span

VBW ≥ RBW

Sweep = Auto

Detector = Peak

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 7.18 dB at 2402 MHz and is 7.23 dB at 2480 MHz. So, 7.2 dB is offset. And the offset gap in the 2.4 GHz range do not affect the band edge measurement final result.

Test Data

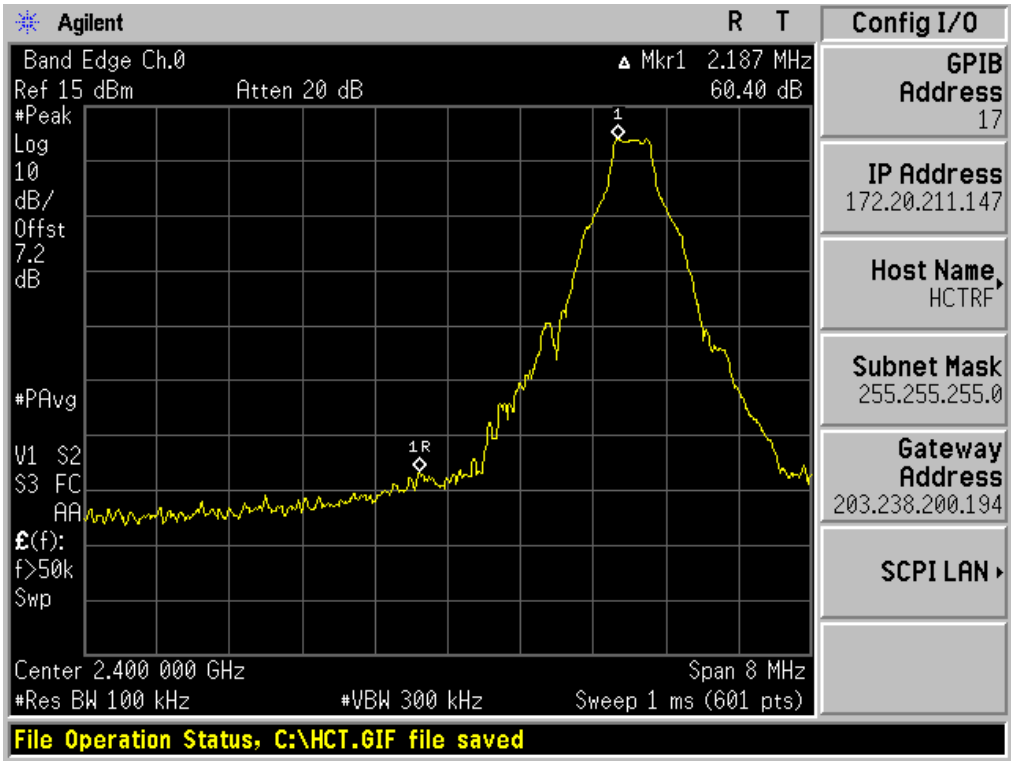
- Without hopping

Outside Frequency Band	GFSK (dB)	8DPSK (dB)	π/4DQPSK (dB)	Limit (dBc)	Margin GFSK (dBc)	Margin 8DPSK (dBc)	Margin π/4DQPSK (dBc)	Result
Lower	60.40	58.05	57.33	20	40.40	38.05	37.33	PASS
Upper	65.19	63.80	62.26		45.19	43.80	42.26	PASS

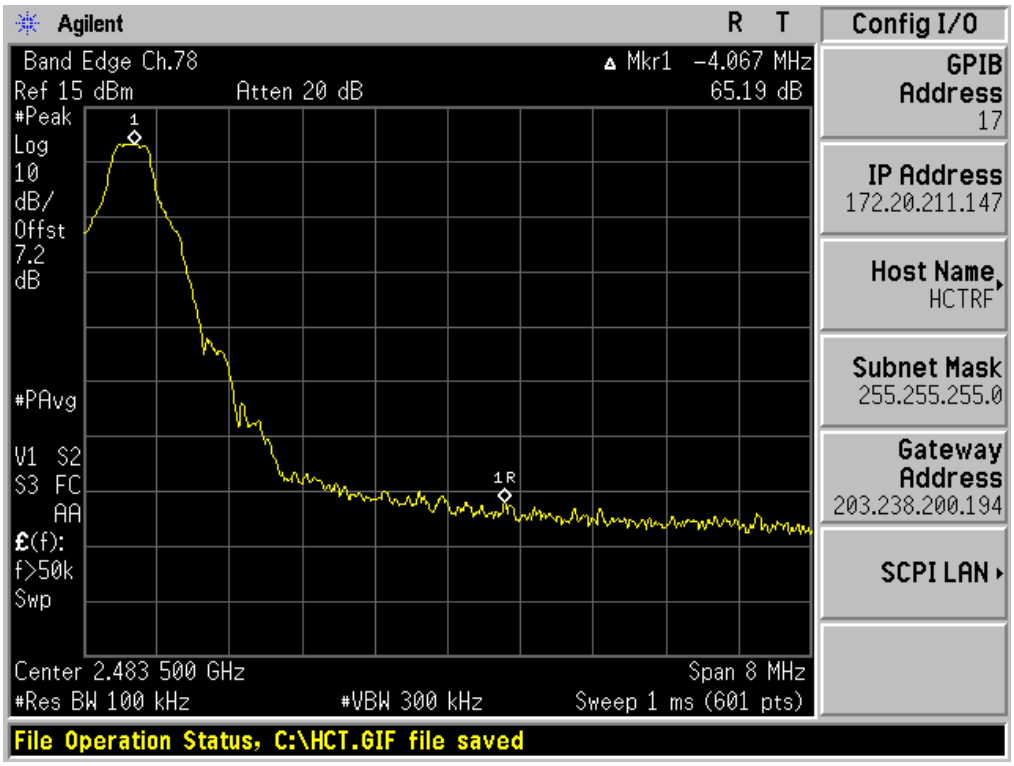
- With hopping

Outside Frequency Band	GFSK (dB)	8DPSK (dB)	π/4DQPSK (dB)	Limit (dBc)	Margin GFSK (dBc)	Margin 8DPSK (dBc)	Margin π/4DQPSK (dBc)	Result
Lower	61.50	61.18	58.26	20	41.50	41.18	38.26	PASS
Upper	66.34	62.68	56.20		46.34	42.68	36.20	PASS

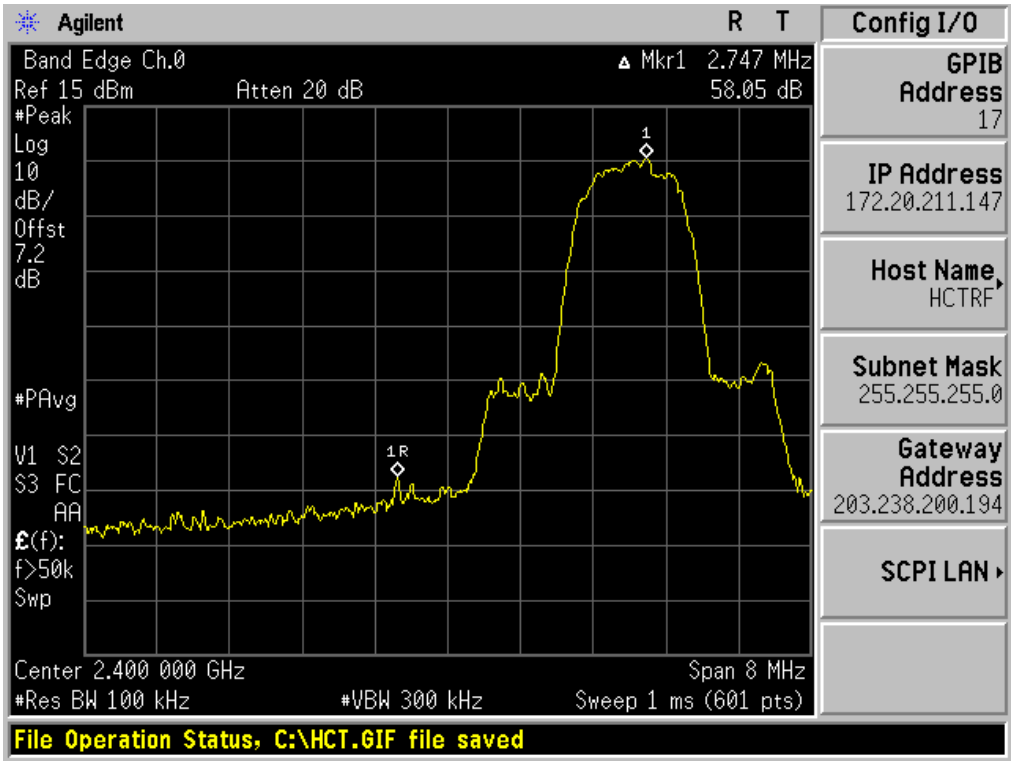
Test Plots without hopping (GFSK)
Band Edges (Low-CH)



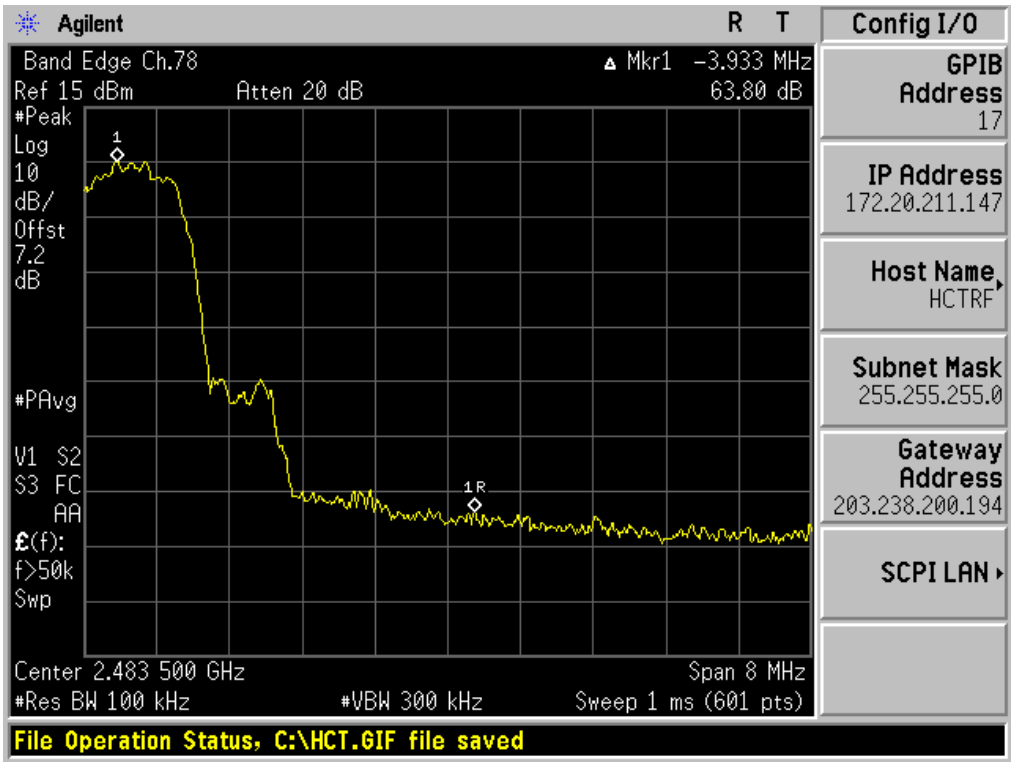
Test Plots without hopping (GFSK)
Band Edges (High-CH)



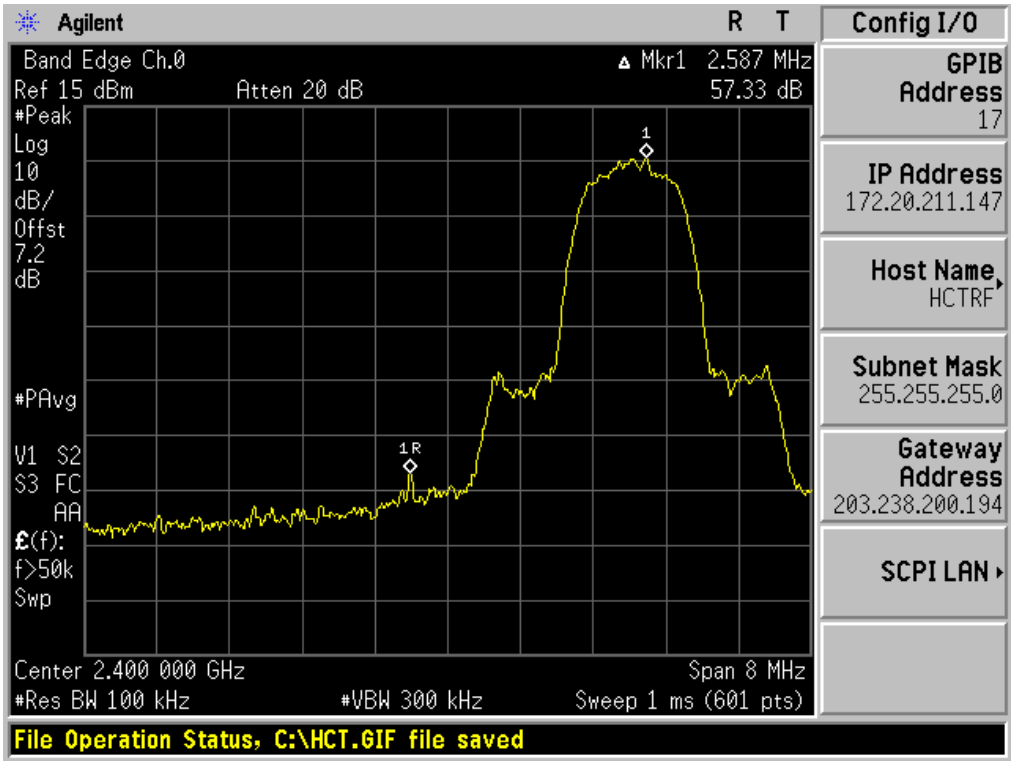
Test Plots without hopping (8DPSK)
Band Edges (Low-CH)



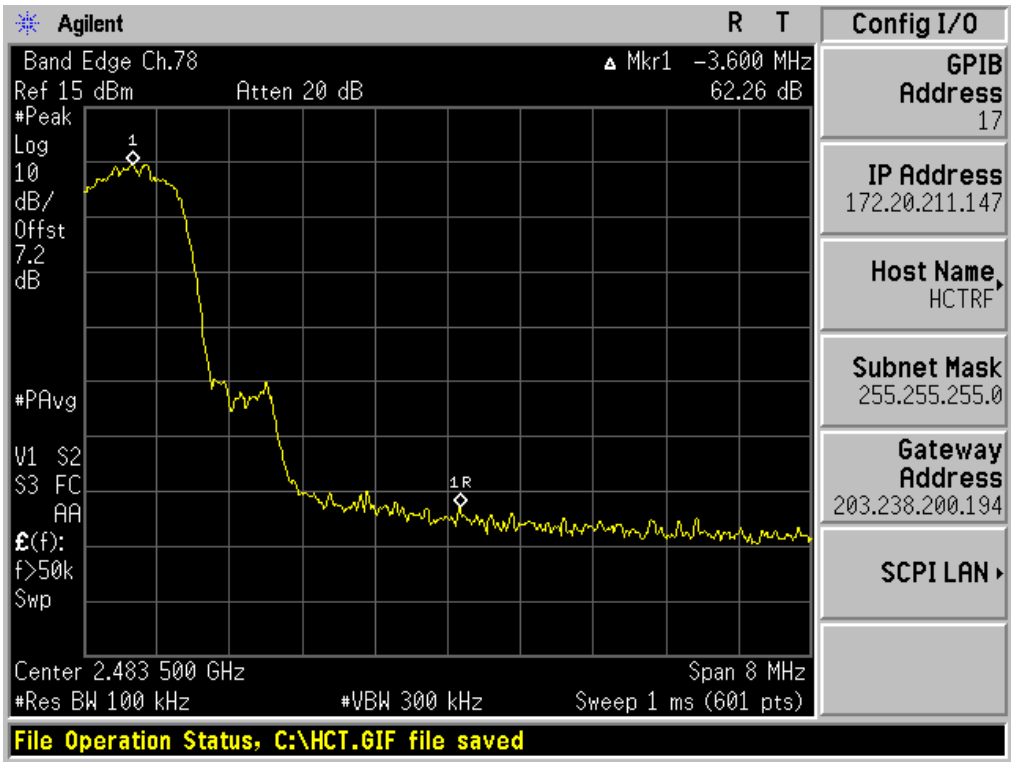
Test Plots without hopping (8DPSK)
Band Edges (High-CH)



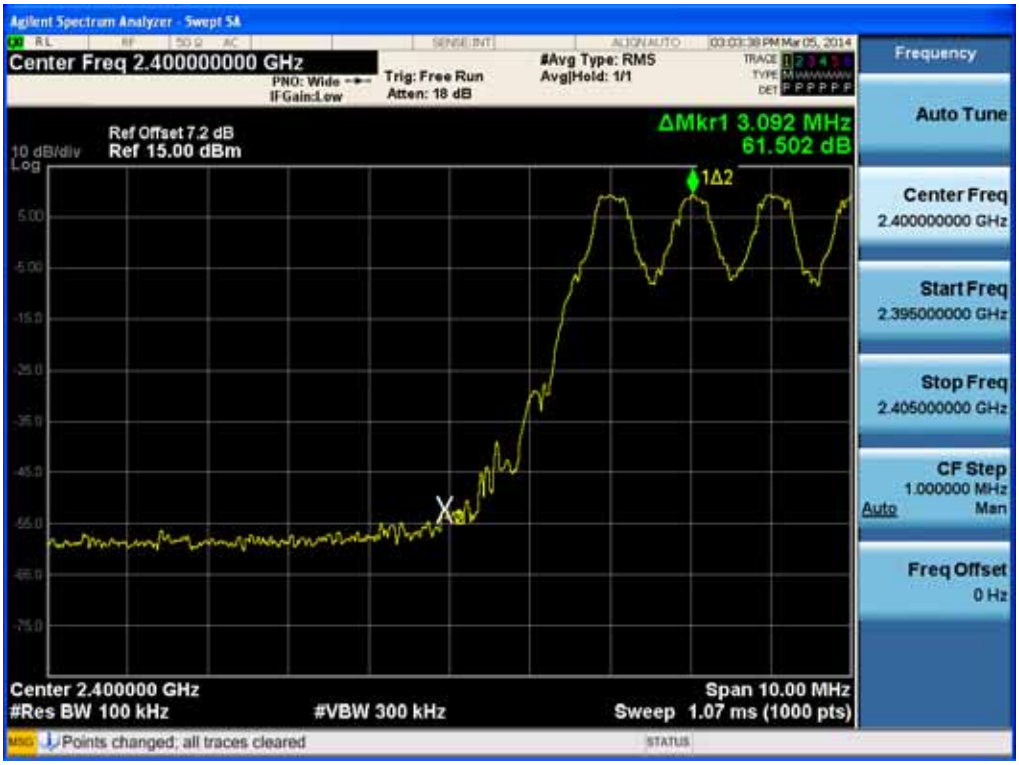
Test Plots without hopping (π/4DQPSK)
Band Edges (Low-CH)



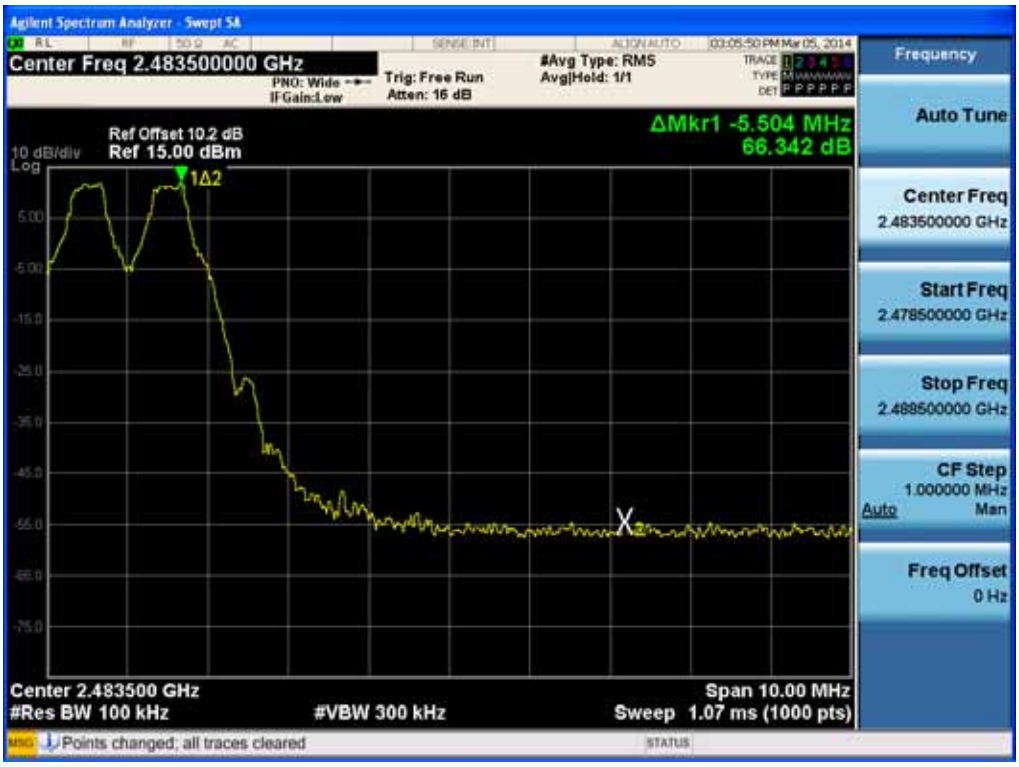
Test Plots without hopping (π/4DQPSK)
Band Edges (High-CH)



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



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

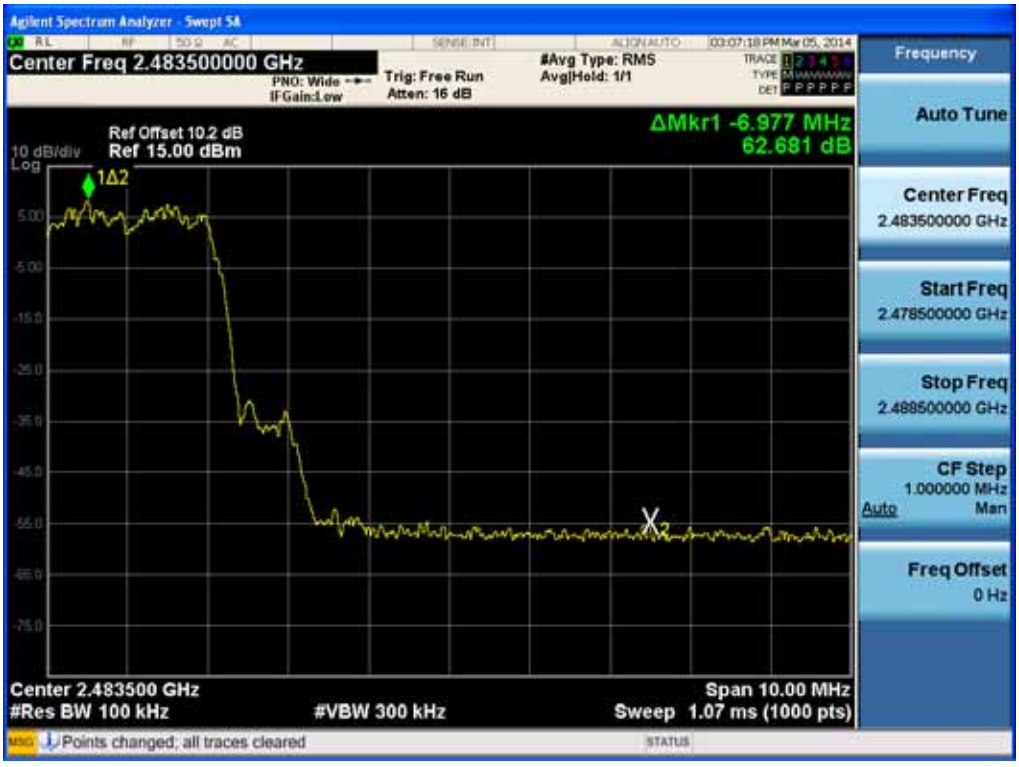


Test Plots with hopping (8DPSK)

Band Edges (Low-CH)

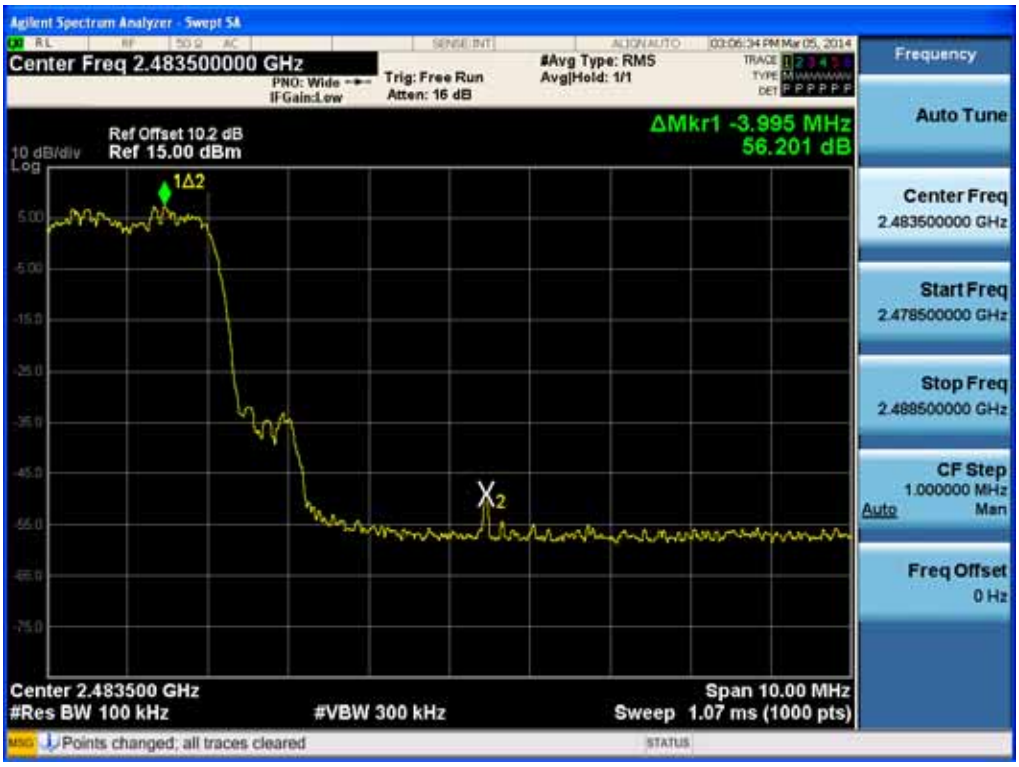
Test Plots with hopping (8DPSK)

Band Edges (High-CH)



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

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

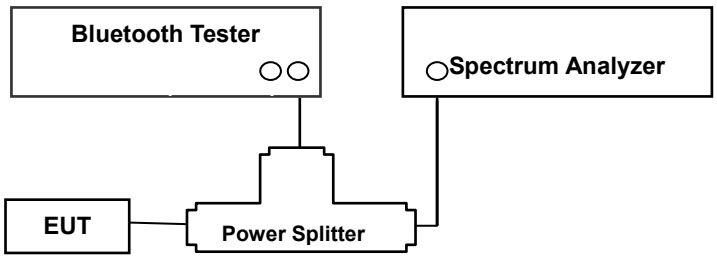


8.3 FREQUENCY SEPARATION / OCCUPIED BANDWIDTH (99% BW)

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 (DA 00-705)

Span = wide enough to capture the peaks of two adjacent channels

RBW ≥ 1% of the span

VBW ≥ RBW

Sweep = Auto

Detector = Peak

Trace = Max hold

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	π/4DQPSK		
870	990	995	Low CH	936.7	1307.0	1337.0	>25 or >2/3 of the 20dB BW	Pass
			Middle CH	937.3	1306.0	1311.0		
			High CH	936.9	1304.0	1336.0		

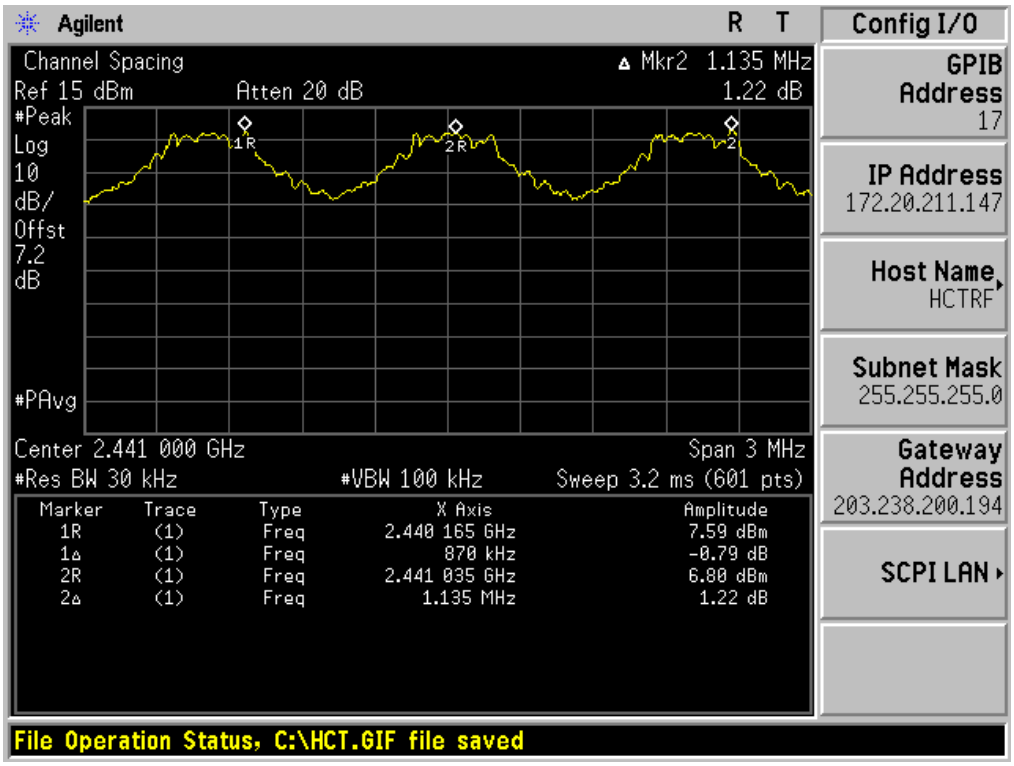
Occupied Bandwidth (99% BW)

99% BW (kHz)			
Channel	GFSK	8DPSK	π/4DQPSK
Low CH	877.6	1193.4	1192.0
Middle CH	877.8	1192.6	1192.0
High CH	877.2	1192.4	1197.6

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.

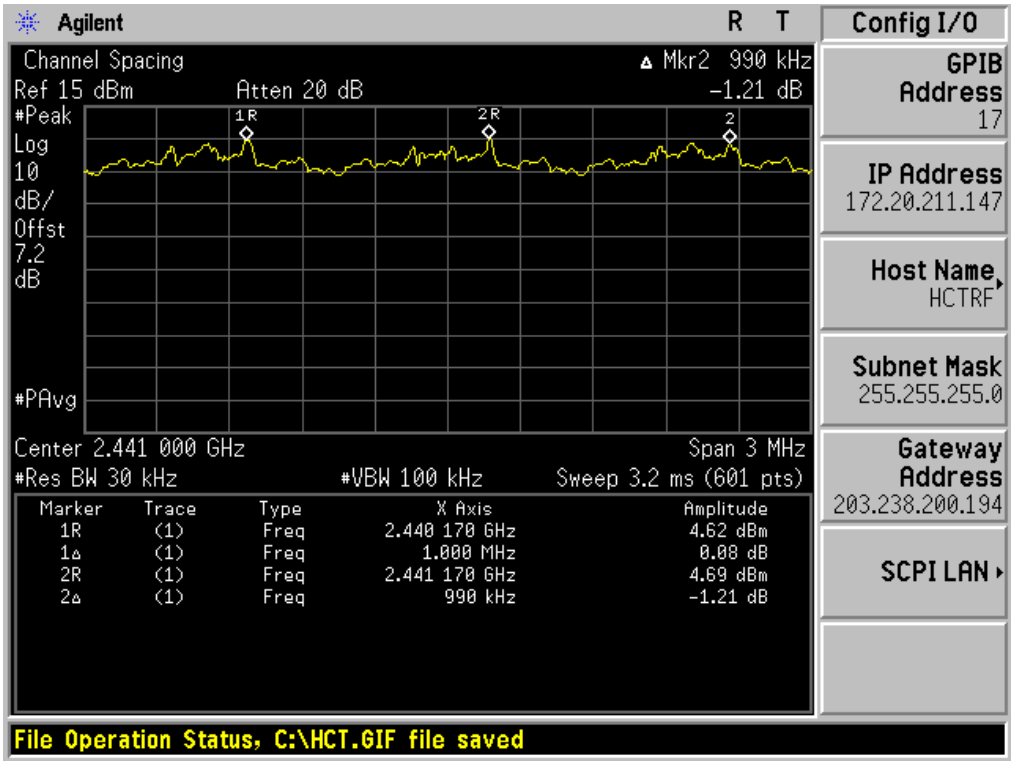
Test Plots (GFSK)

Channel Separation

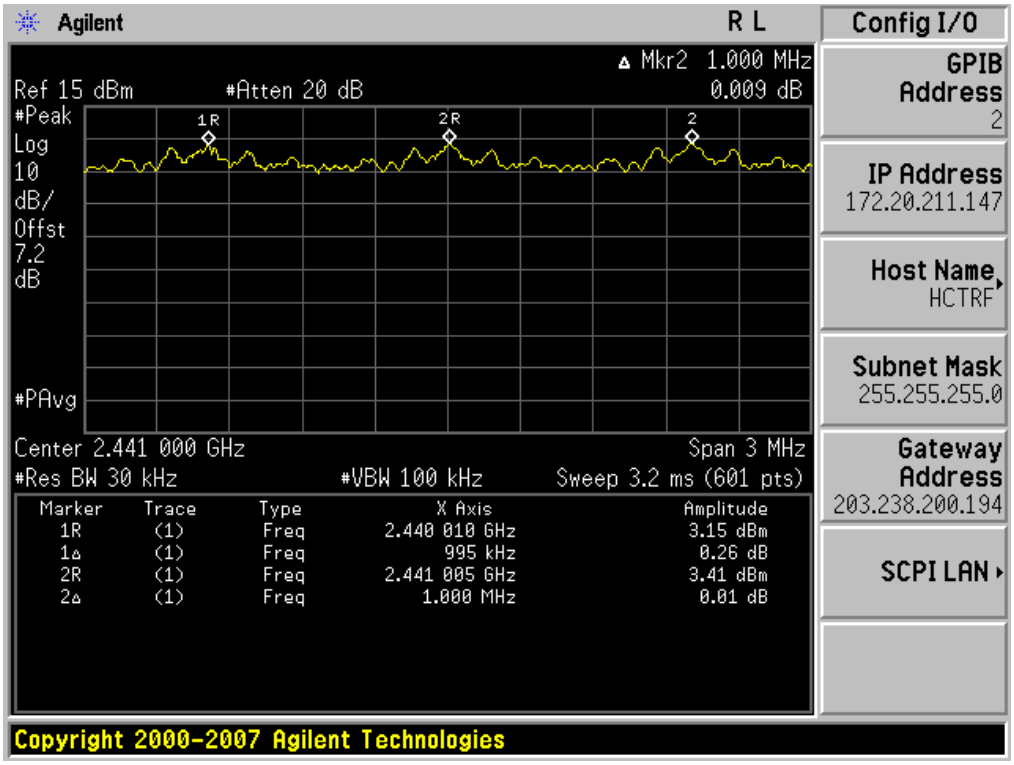


Test Plots (8DPSK)

Channel Separation

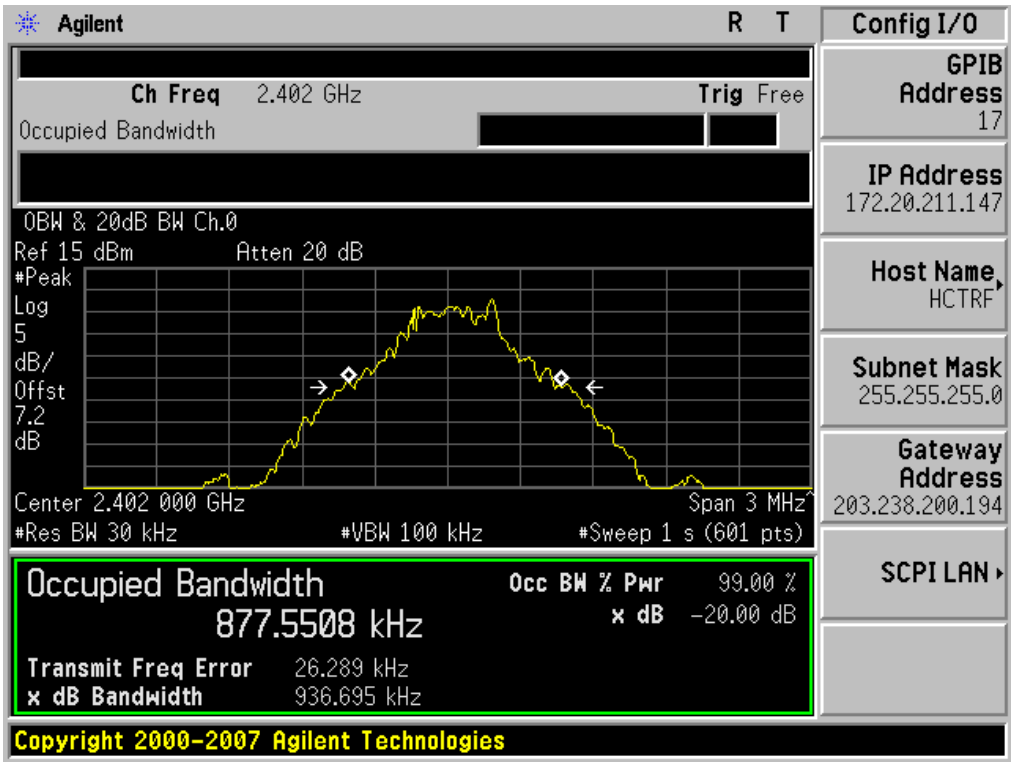


Test Plots (π/4DQPSK)
Channel Separation



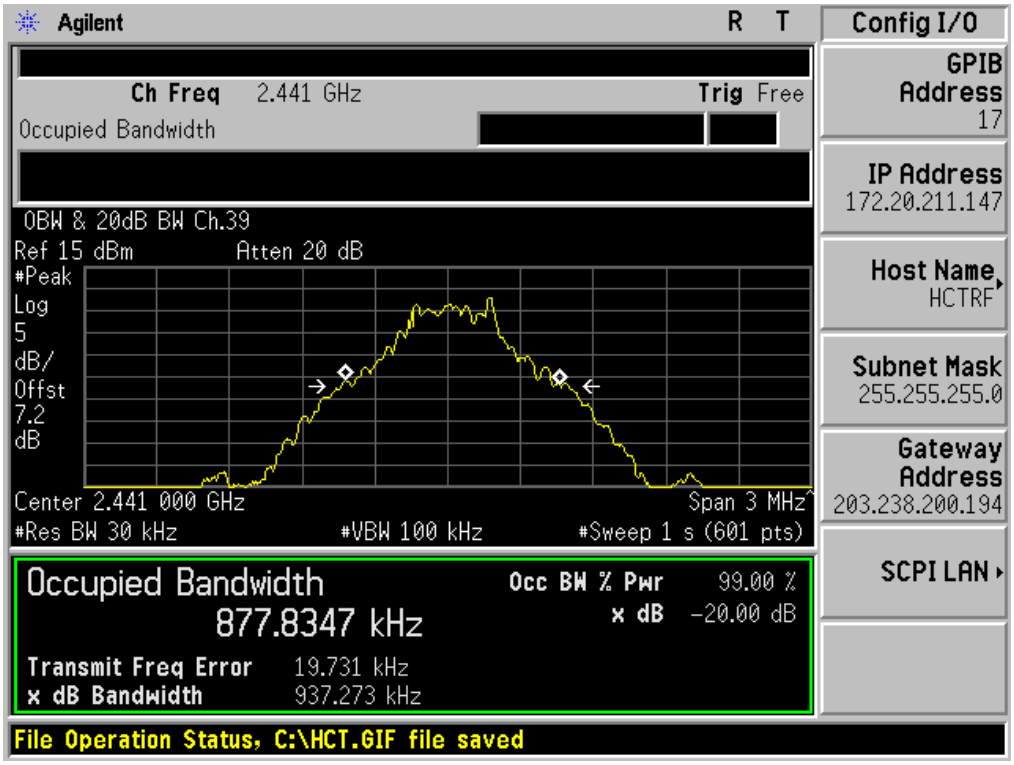
Test Plots (GFSK)

20 dB Bandwidth & Occupied Bandwidth (Low-CH)



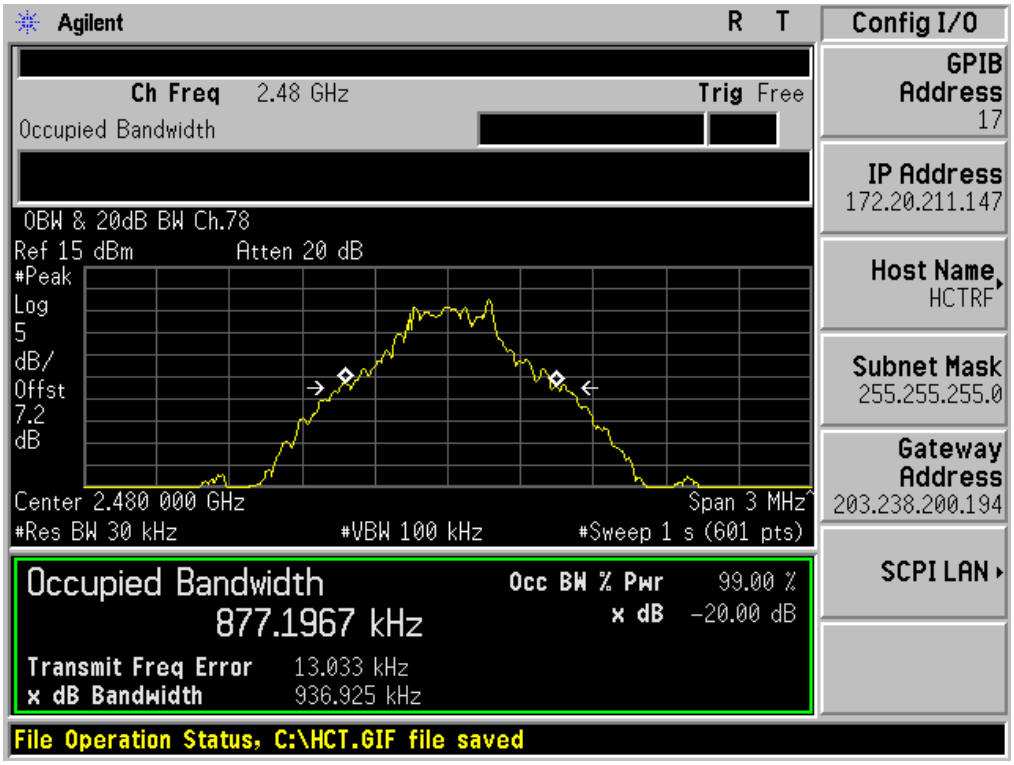
Test Plots (GFSK)

20 dB Bandwidth & Occupied Bandwidth (Mid-CH)



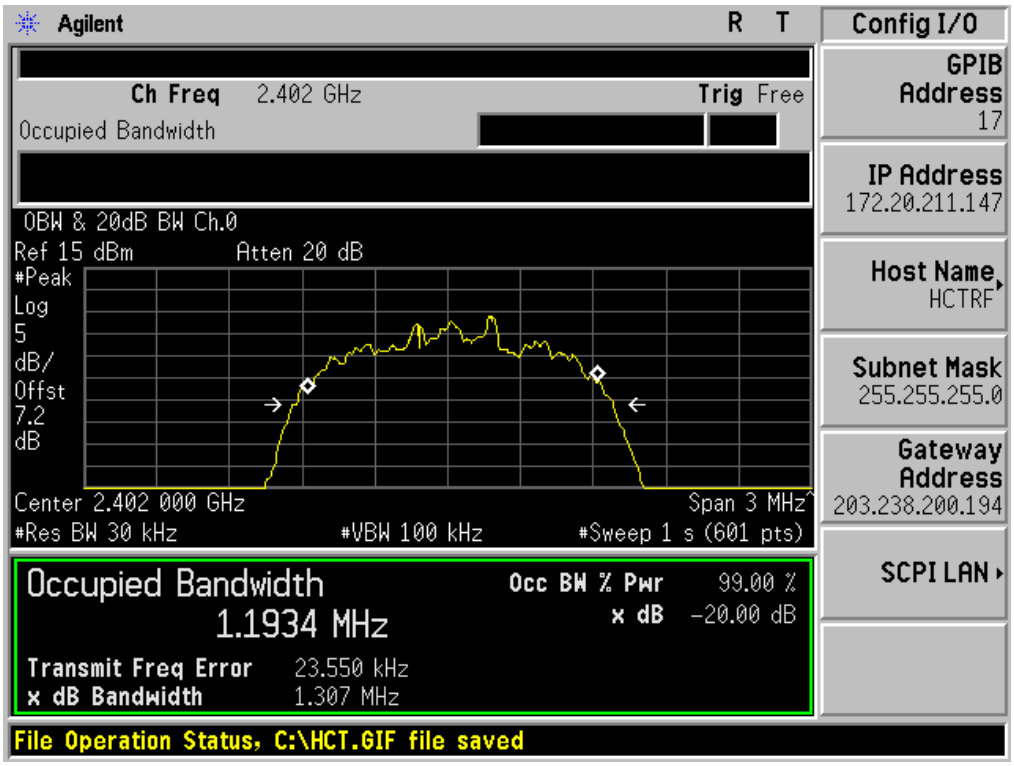
Test Plots (GFSK)

20 dB Bandwidth & Occupied Bandwidth (High-CH)



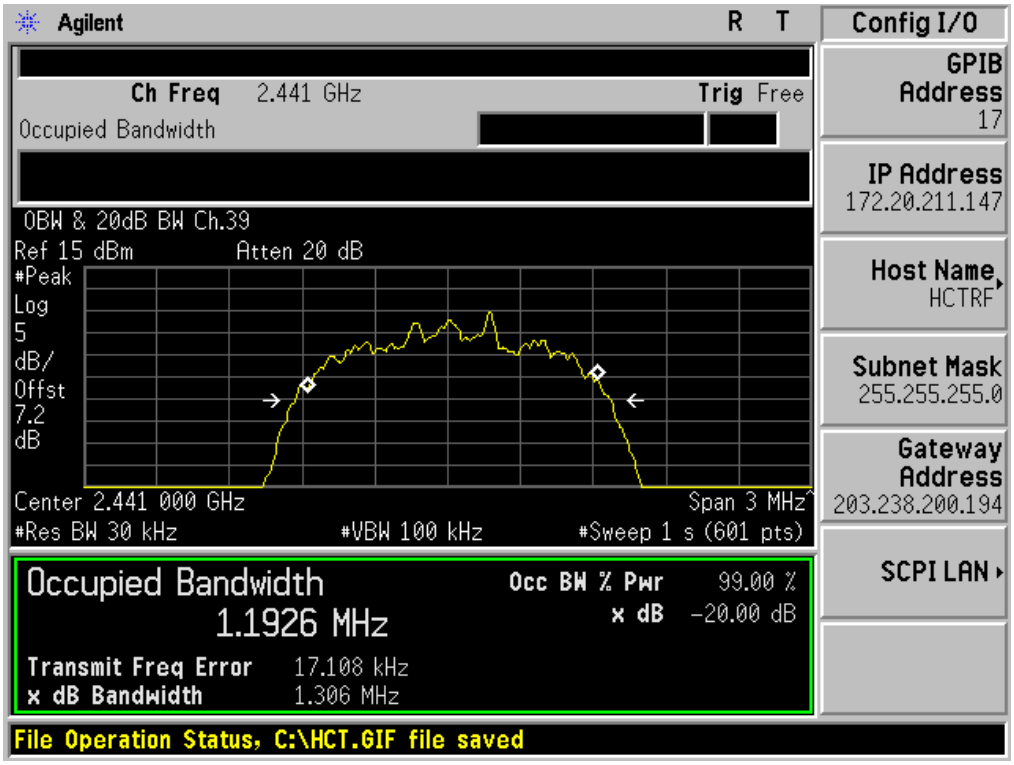
Test Plots (8DPSK)

20 dB Bandwidth & Occupied Bandwidth (Low-CH)



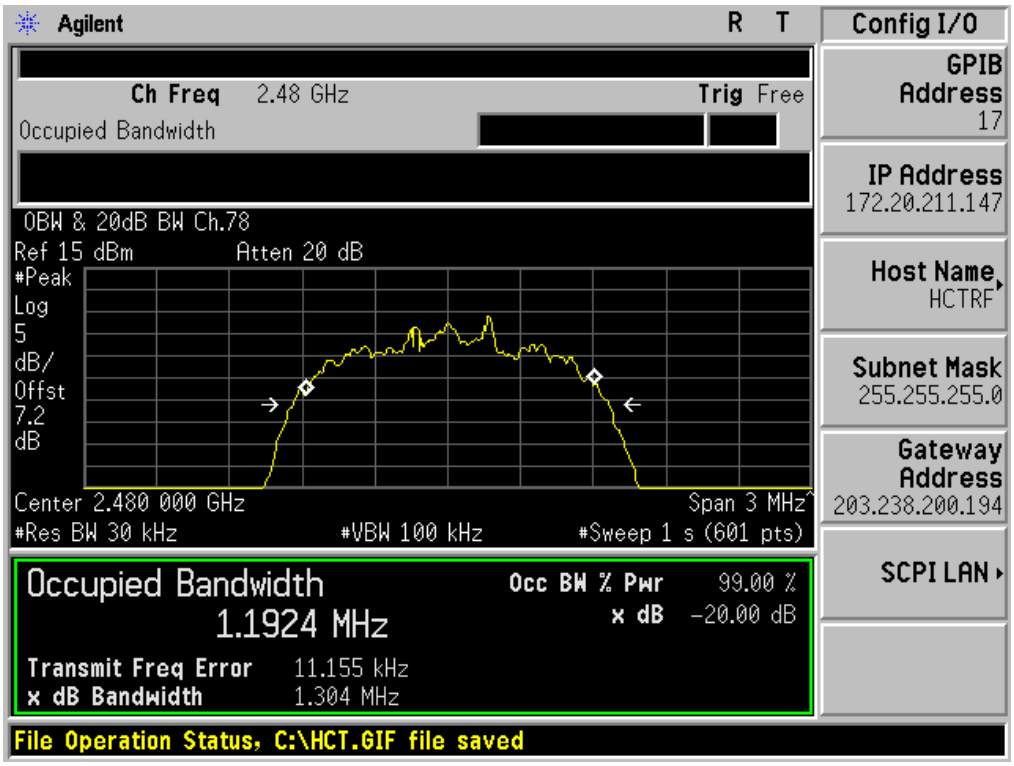
Test Plots (8DPSK)

20 dB Bandwidth & Occupied Bandwidth (Mid-CH)



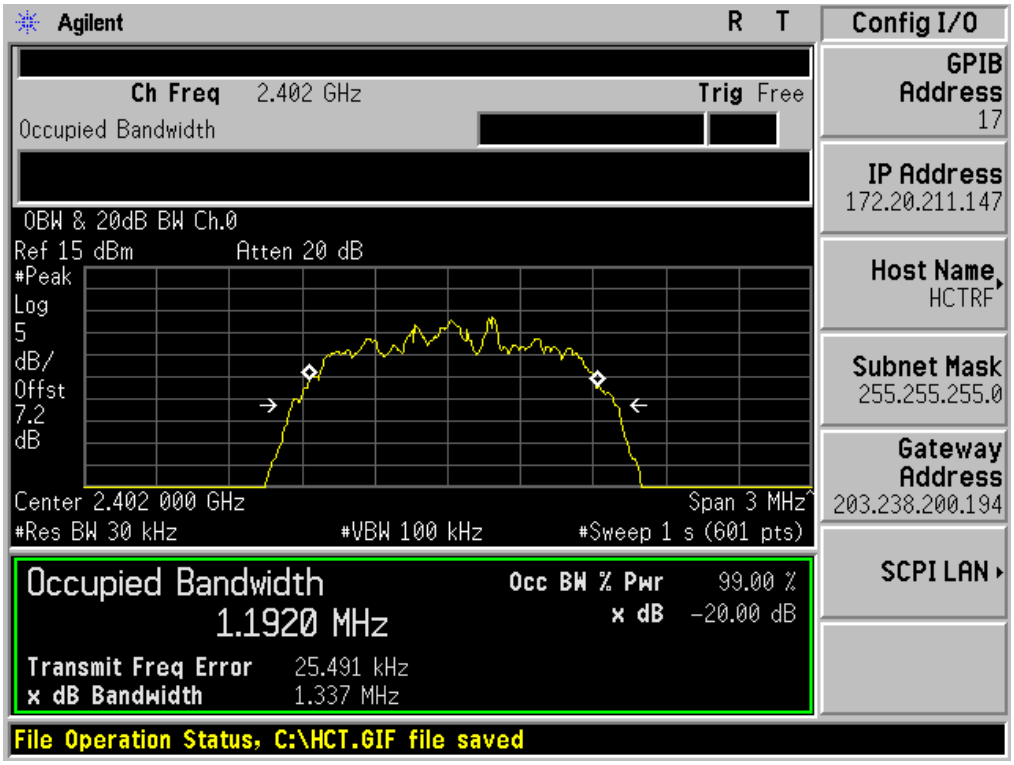
Test Plots (8DPSK)

20 dB Bandwidth & Occupied Bandwidth (High-CH)



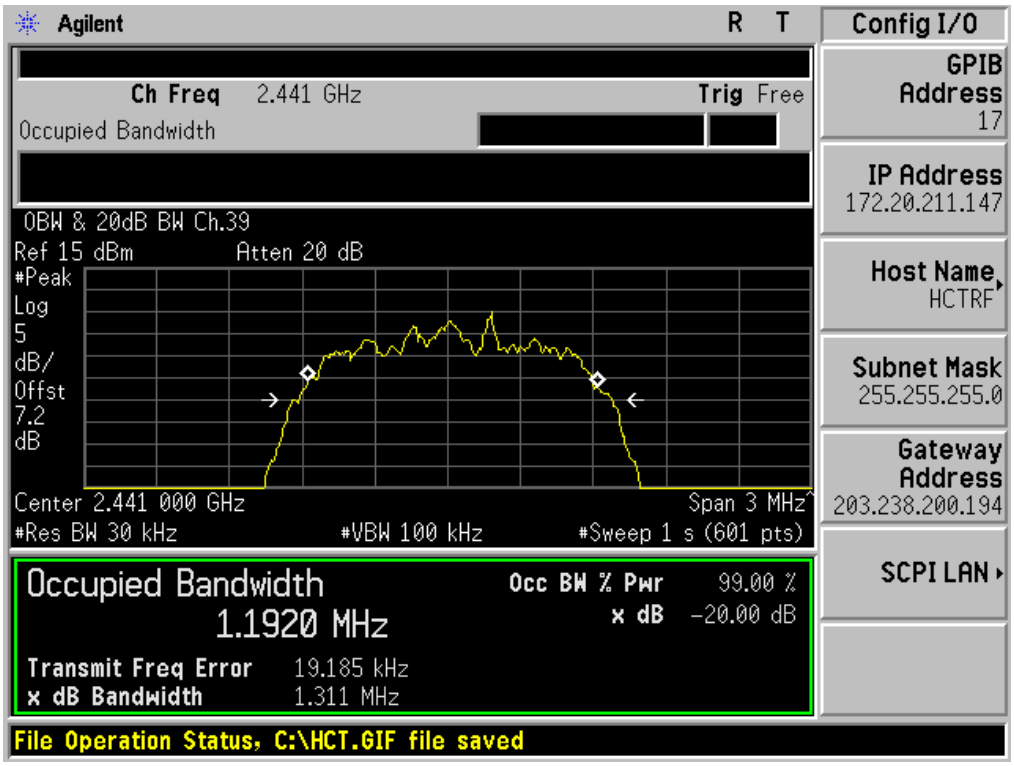
Test Plots (π/4DQPSK)

20 dB Bandwidth & Occupied Bandwidth (Low-CH)



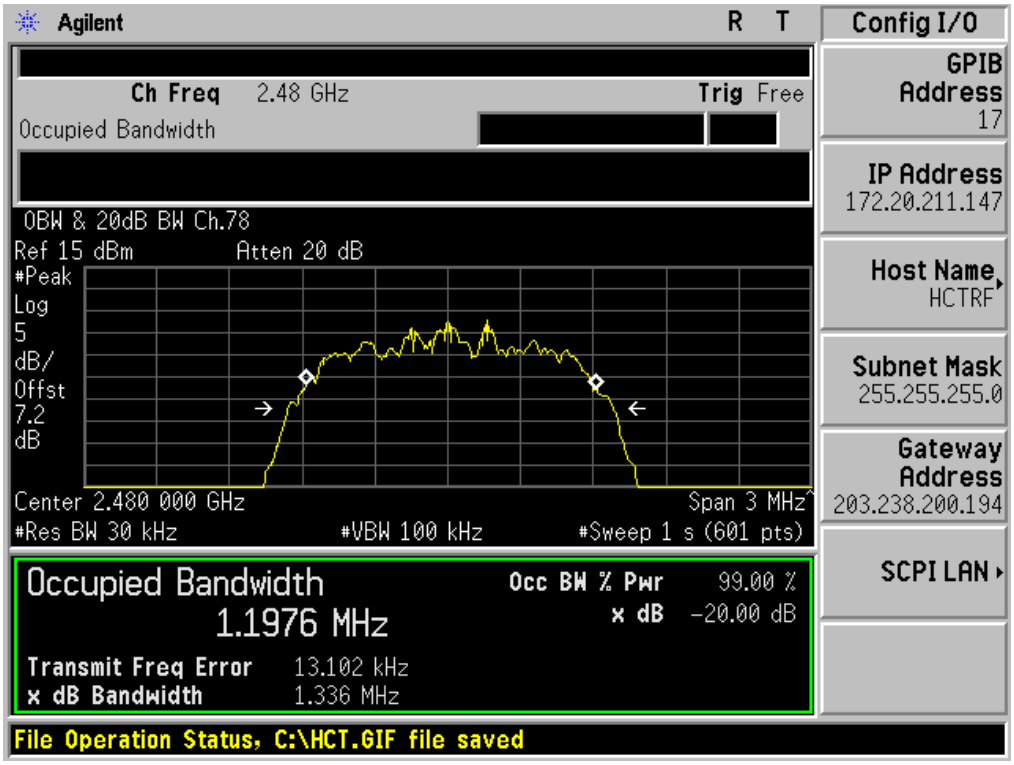
Test Plots (π/4DQPSK)

20 dB Bandwidth & Occupied Bandwidth (Mid-CH)



Test Plots (π/4DQPSK)

20 dB Bandwidth & Occupied Bandwidth (High-CH)

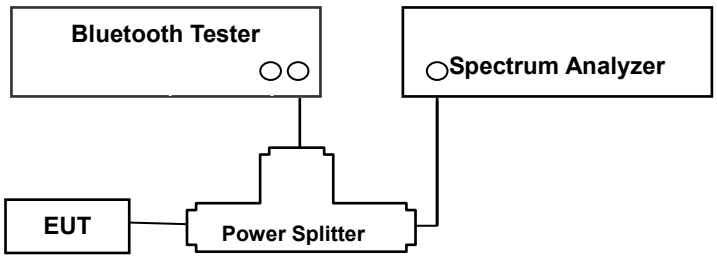


8.4 NUMBER OF HOPPING FREQUENCY

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 (DA 00-705)

Span = the frequency band of operation

RBW ≥ 1% of the span

VBW ≥ RBW

Sweep = Auto

Detector = Peak

Trace = Max hold

The trace was allowed to stabilize.

TEST RESULTS

No non-compliance noted

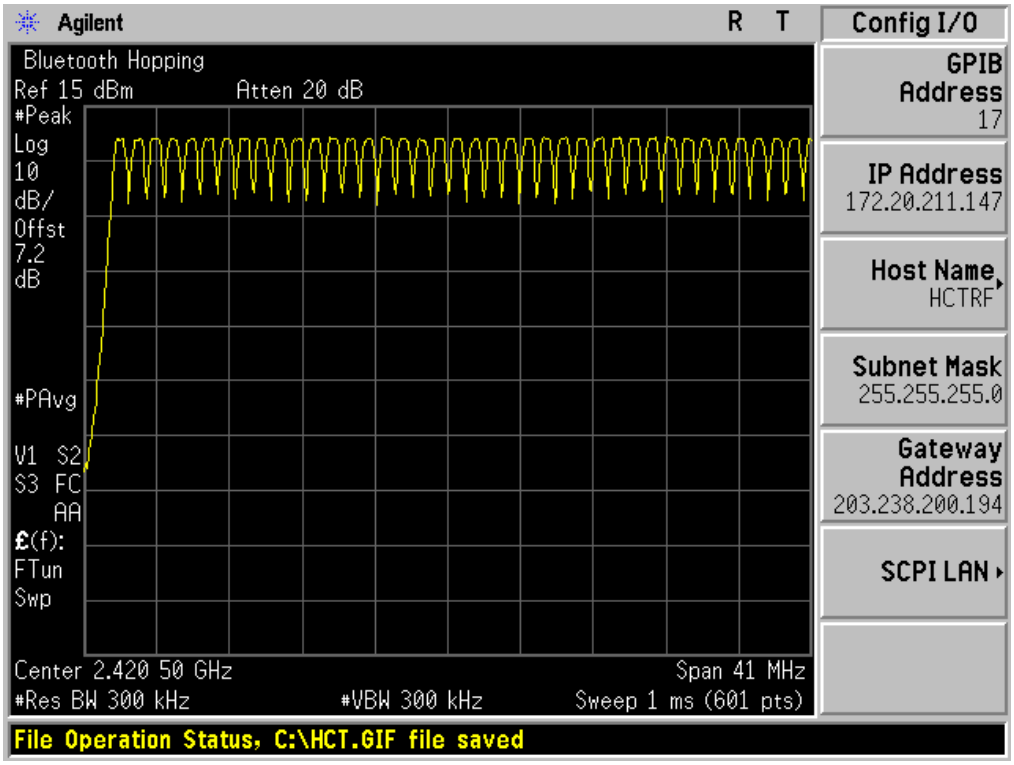
Test Data

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.

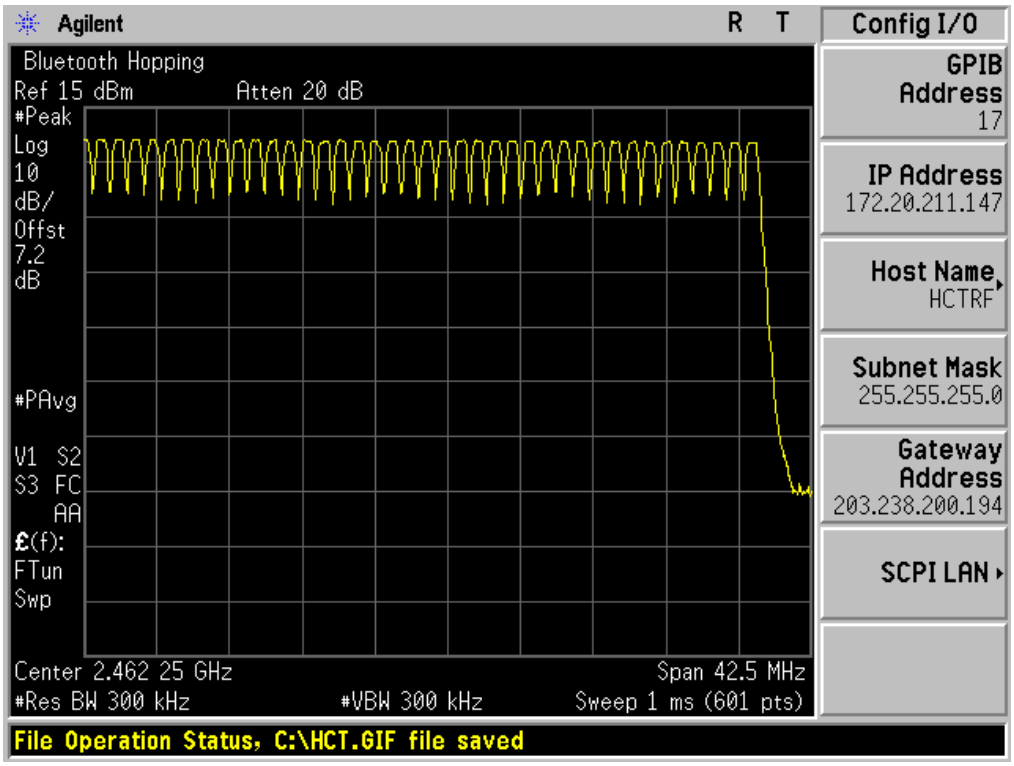
Test Plots (GFSK)

Number of Channels (2.4 GHz - 2.441 GHz)



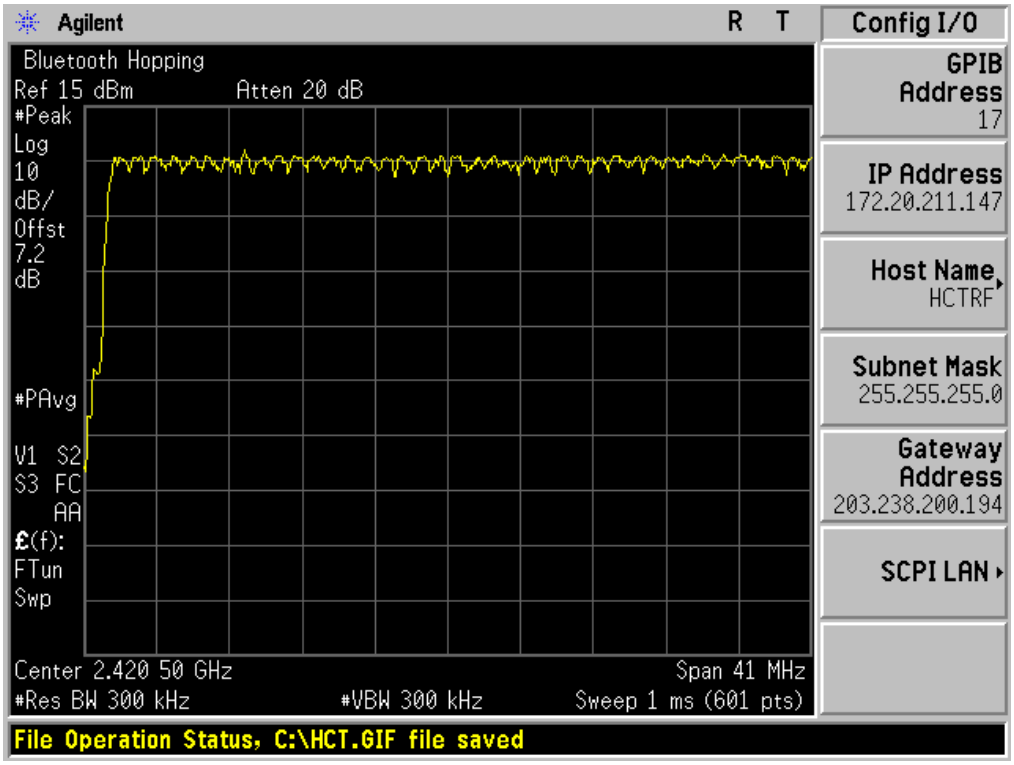
Test Plots (GFSK)

Number of Channels (2.441 GHz - 2.4835 GHz)



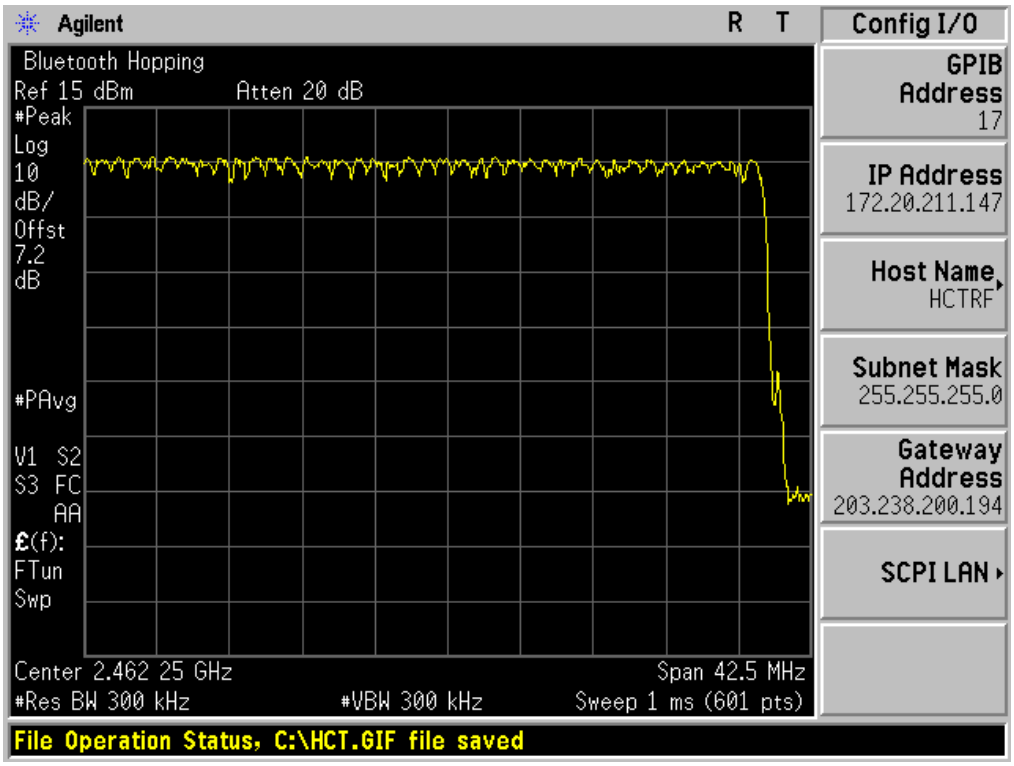
Test Plots (8DPSK)

Number of Channels (2.4 GHz - 2.441 GHz)

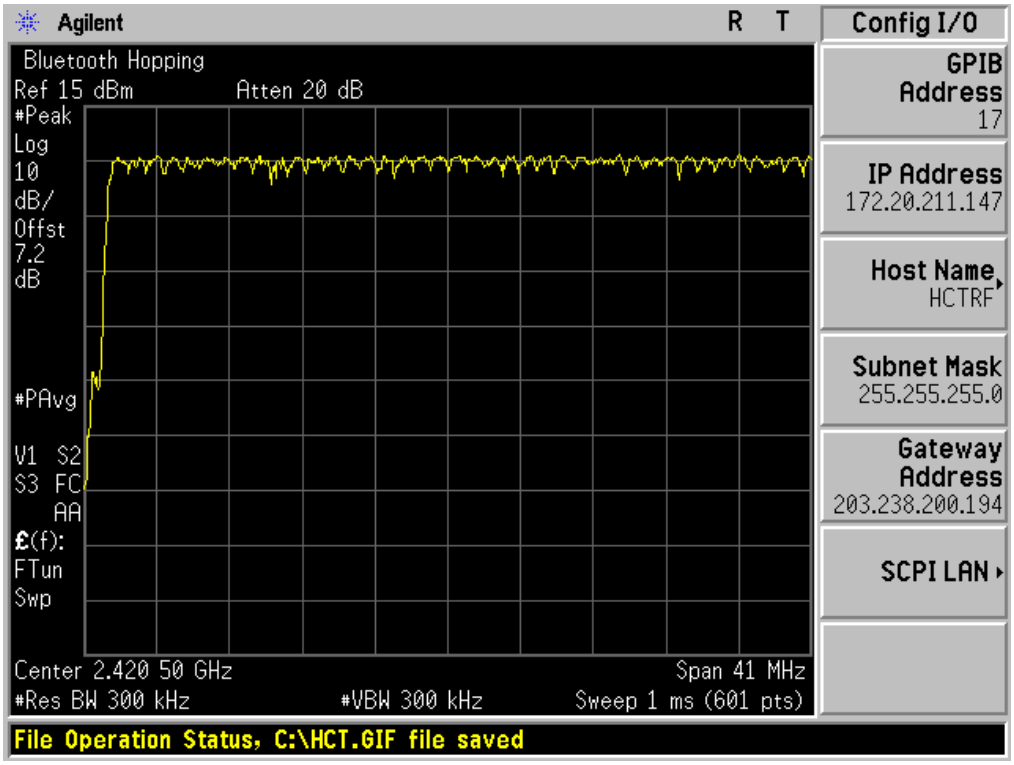


Test Plots (8DPSK)

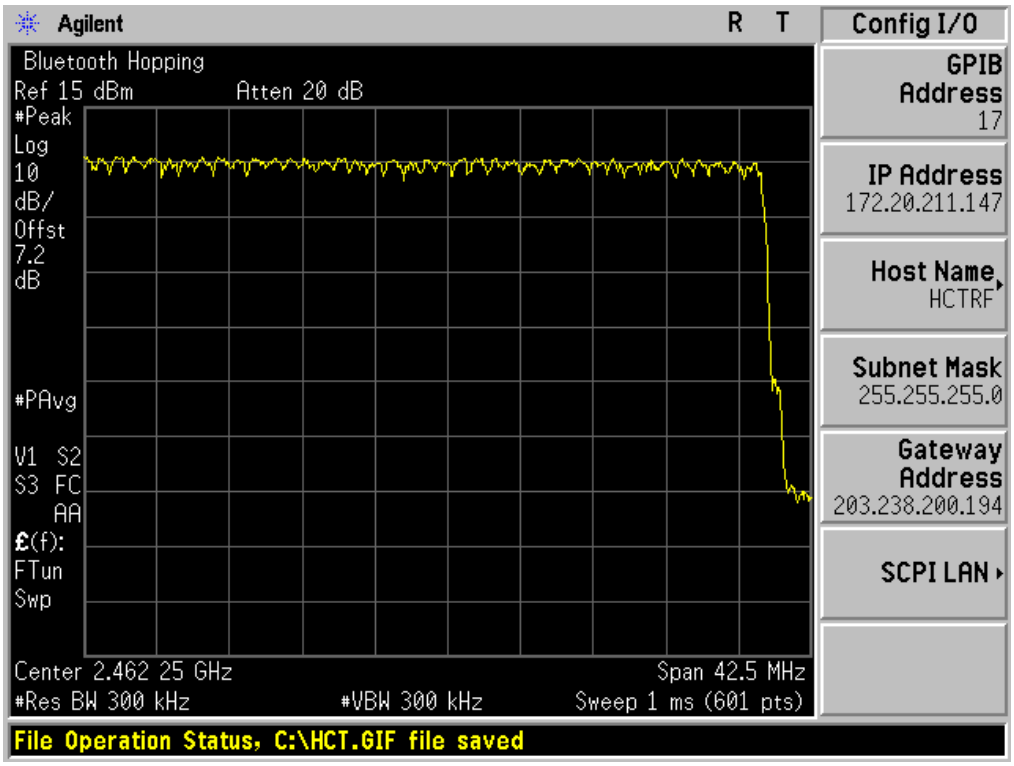
Number of Channels (2.441 GHz - 2.4835 GHz)



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)

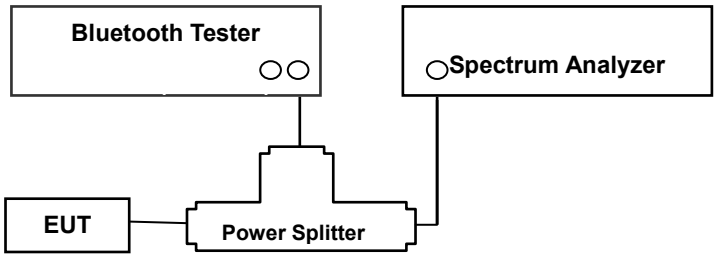


8.5 TIME OF OCCUPANCY (DWELL TIME)

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)

The Spectrum Analyzer is set to (DA 00-705)

Span = Zero span, Centered on a hopping channel

RBW = 1 MHz

VBW ≥ RBW

Sweep = as necessary to capture the entire dwell time per hopping channel

Detector = Peak

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 : 2.883 * (1600/6)/79 * 31.6 = 307.52 (ms)

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

CH Mid : 2.883 * (1600/6)/79 * 31.6 = 307.52 (ms)

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

CH Mid : 2.883 * (1600/6)/79 * 31.6 = 307.52 (ms)

AFH Mode

DH 5(The longest packet type for GFSK)

CH Mid : 2.883 * (800/6)/20 * 8.0 = 153.76 (ms)

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

CH Mid : 2.883 * (800/6)/20 * 8.0 = 153.76 (ms)

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

CH Mid : 2.883 * (800/6)/20 * 8.0 = 153.76 (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

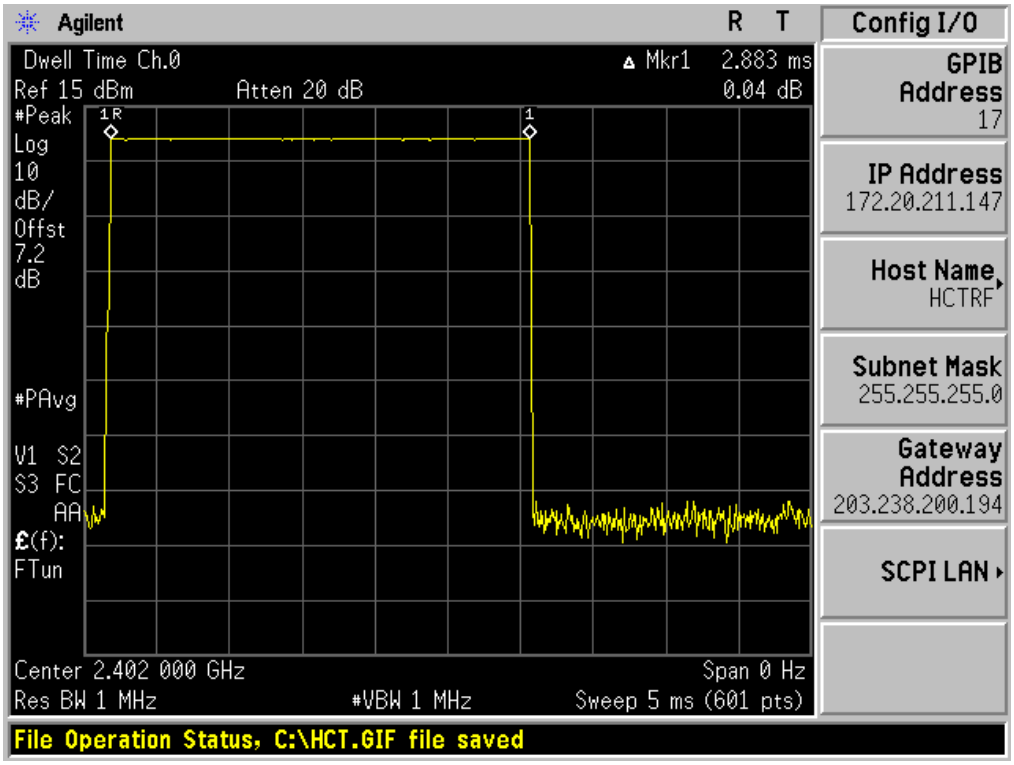
TEST RESULTS

See the table.

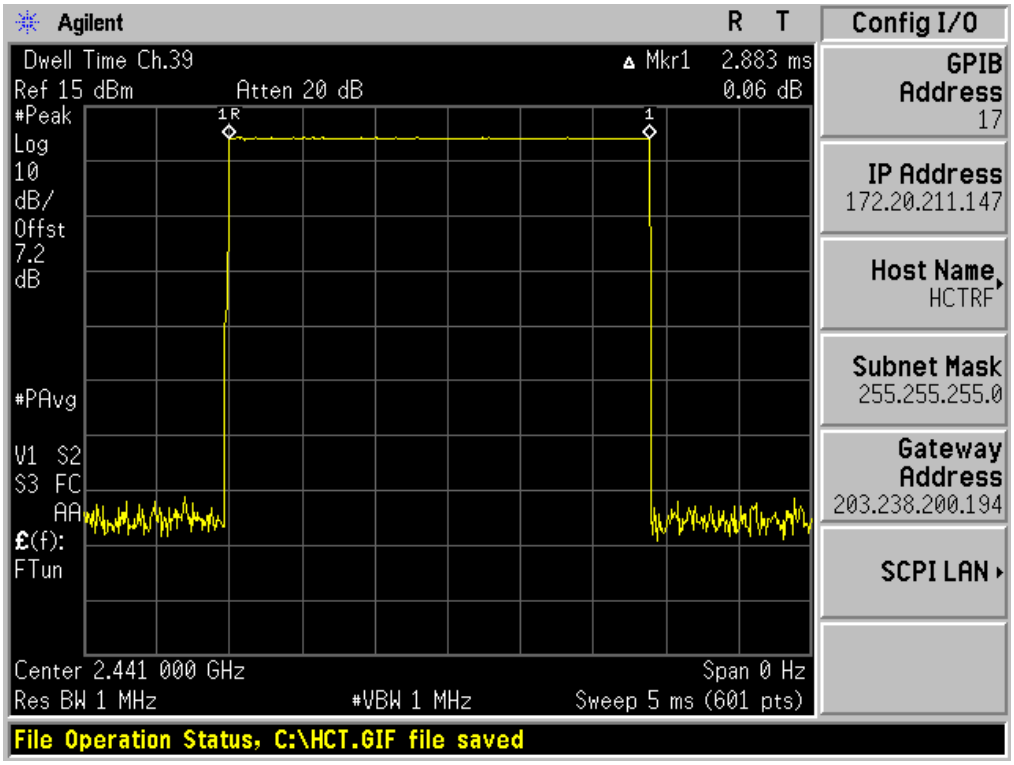
	Channel	GFSK	8DPSK	π/4DQPSK
Pulse Time (ms)	Low	2.883	2.892	2.892
	Mid	2.883	2.883	2.883
	High	2.892	2.892	2.892

	Channel	GFSK	8DPSK	π/4DQPSK	Period Time (s)	Limit (ms)	Result
Total of Dwell (ms)	Low	307.52	308.48	308.48	31.6	400	PASS
	Mid	307.52	307.52	307.52	31.6		PASS
	High	308.48	308.48	308.48	31.6		PASS

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

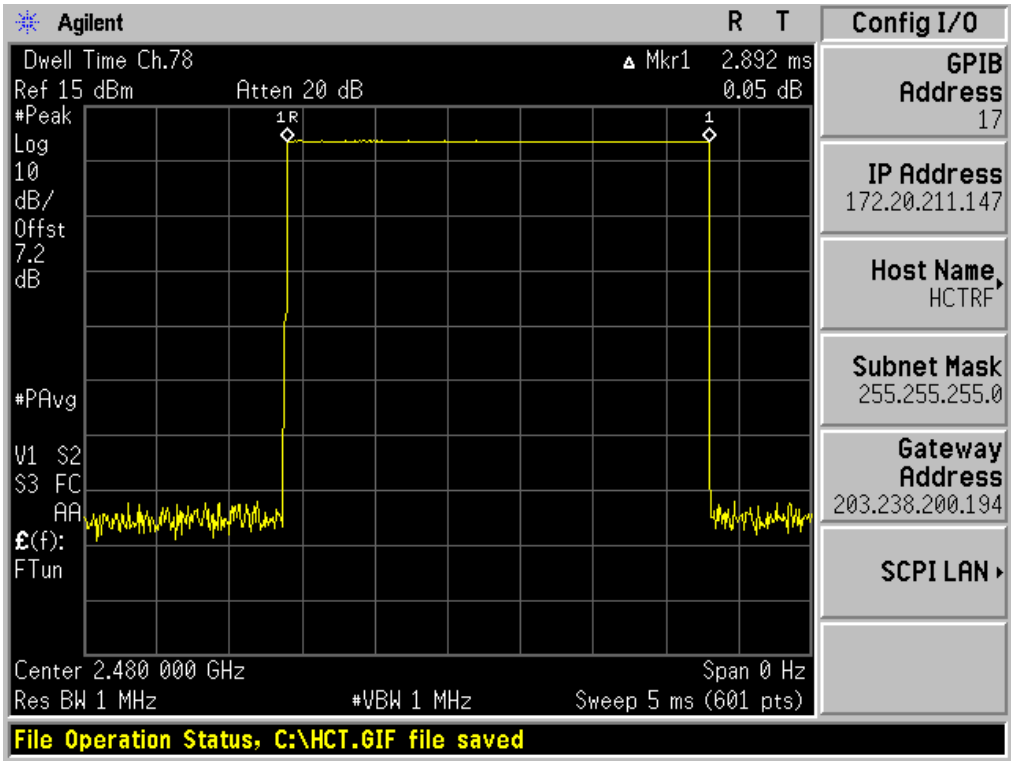


Test Plots (GFSK)
Dwell Time (Mid-CH)



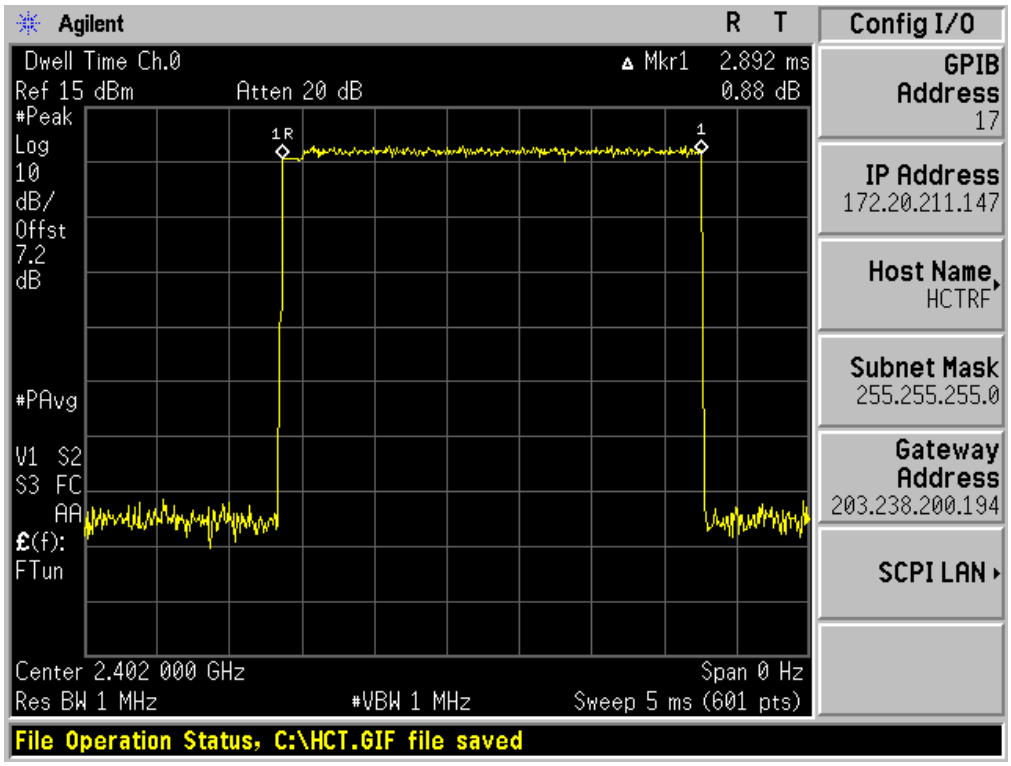
Test Plots (GFSK)

Dwell Time (High-CH)

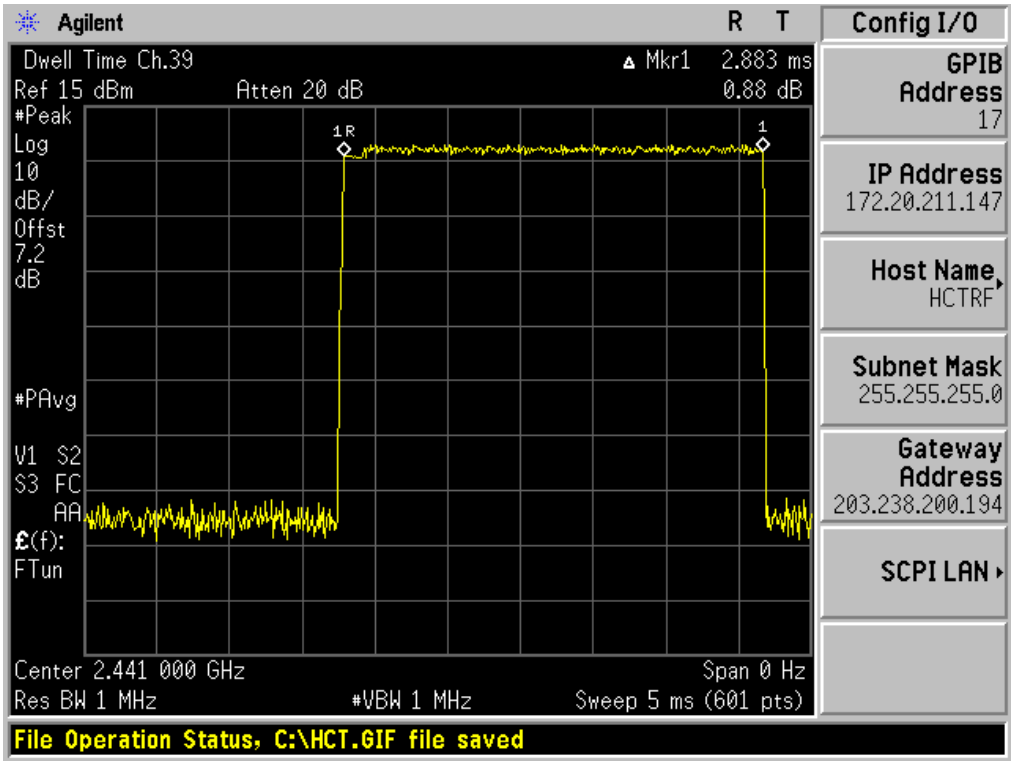


Test Plots (8DPSK)

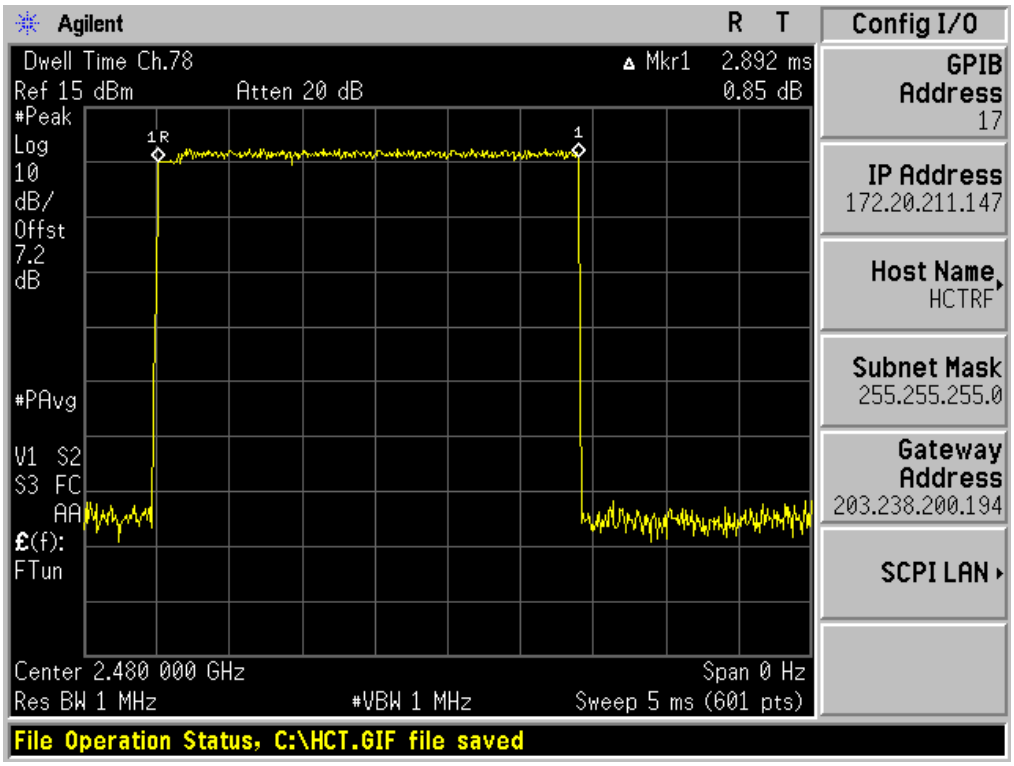
Dwell Time (Low-CH)



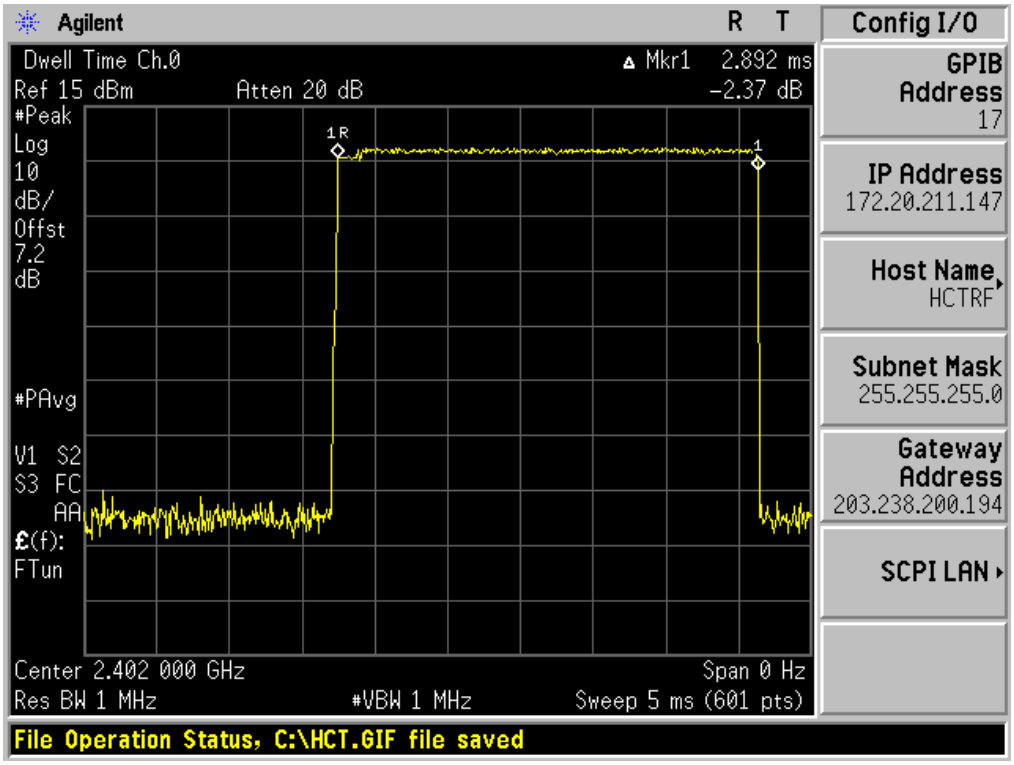
Test Plots (8DPSK)
Dwell Time (Mid-CH)



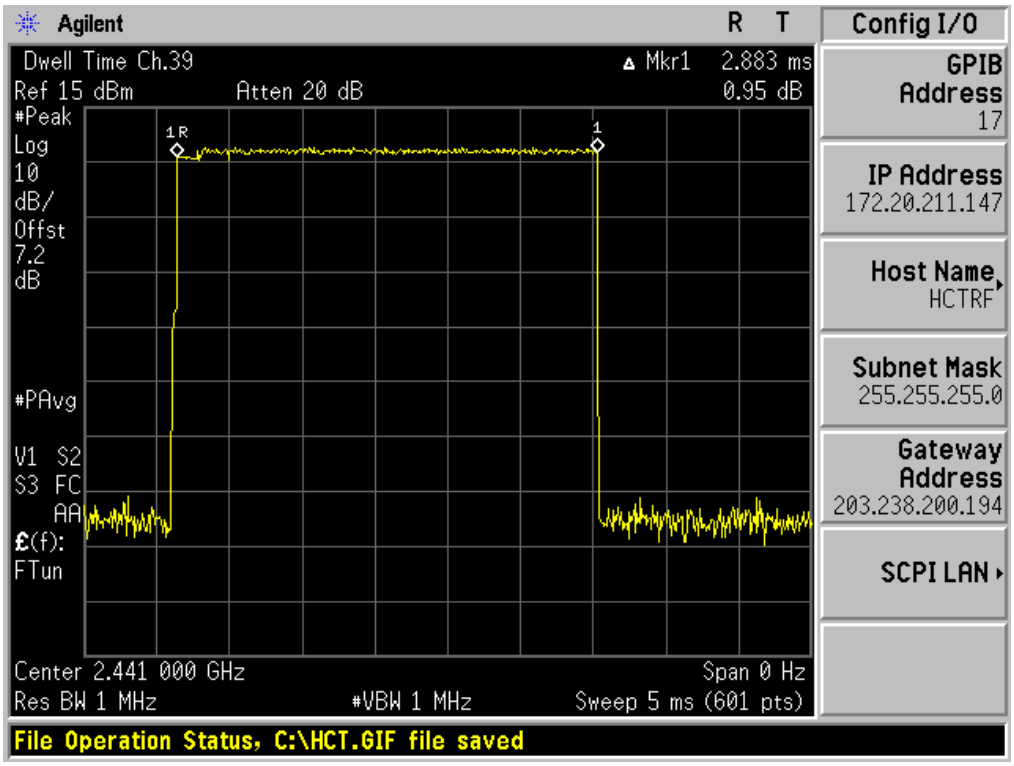
Test Plots (8DPSK)
Dwell Time (High-CH)



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

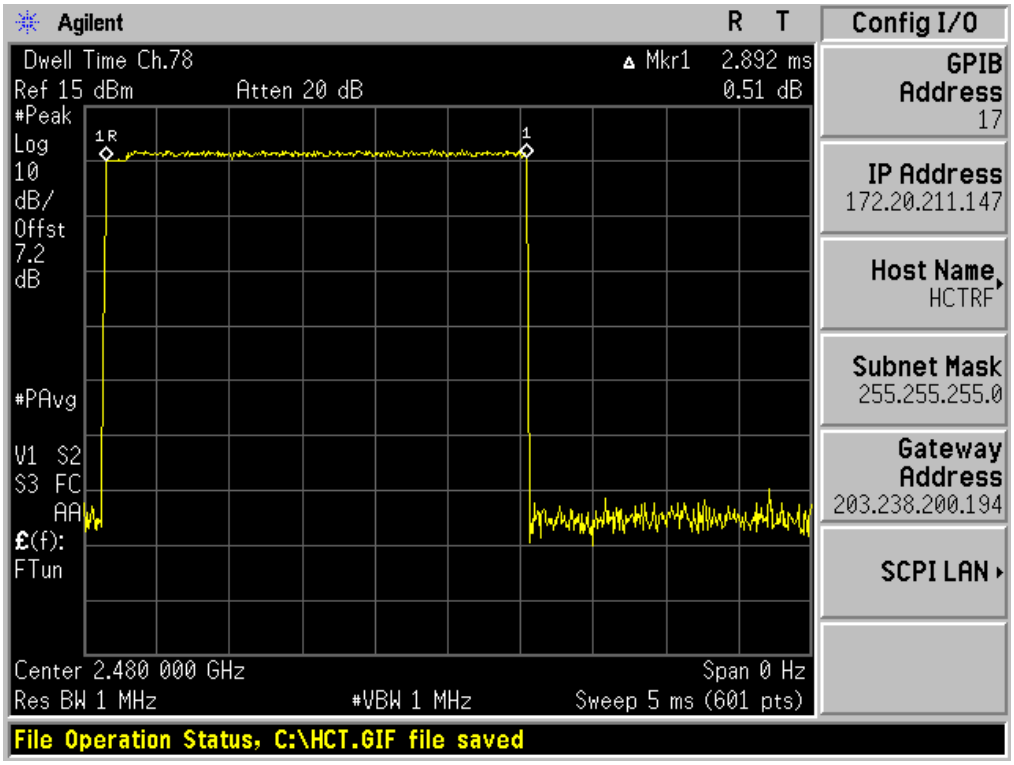


Test Plots (π/4DQPSK)
Dwell Time (Mid-CH)



Test Plots (π/4DQPSK)

Dwell Time (High-CH)



8.6 SPURIOUS EMISSIONS

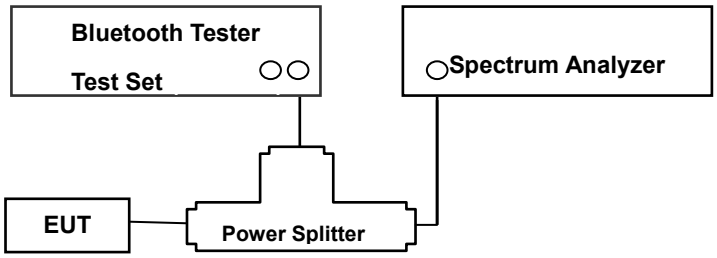
8.6.1 CONDUCTED SPURIOUS EMISSIONS

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 (DA 00-705)

1. Span = wide enough to capture the peak level of the in-band emission and all spurious emissions(e.g.,harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic.
2. RBW = 100 kHz
3. VBW ≥ 300 kHz
4. Sweep = auto
5. Sweep point ≥ 2*span/RBW
5. Detector function = peak

6. Trace = max hold

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.

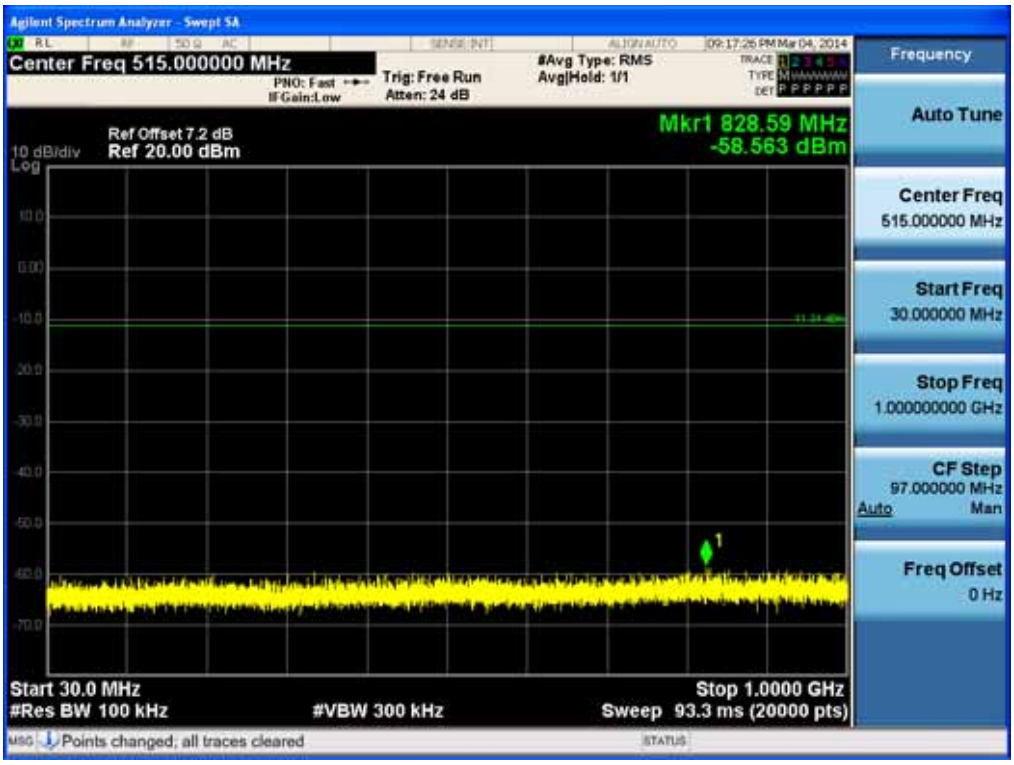
FACTORS FOR FREQUENCY

Freq(MHz)	Factor(dB)
30	10.01
100	10.02
200	10.10
300	10.09
400	10.13
500	10.21
600	10.13
700	10.31
800	10.18
900	10.30
1000	10.17
2000	8.53
2400*	7.18
2500*	7.21
3000	8.59
4000	10.02
5000	9.88
6000	5.70
7000	10.21
8000	6.13
9000	8.79
10000	12.46
11000	8.11
12000	9.52
13000	8.98
14000	8.13
15000	11.82
16000	6.92
17000	13.23
18000	10.25
19000	10.28
20000	9.10
21000	10.94
22000	11.54
23000	8.81
24000	11.71
25000	9.37
26000	9.34

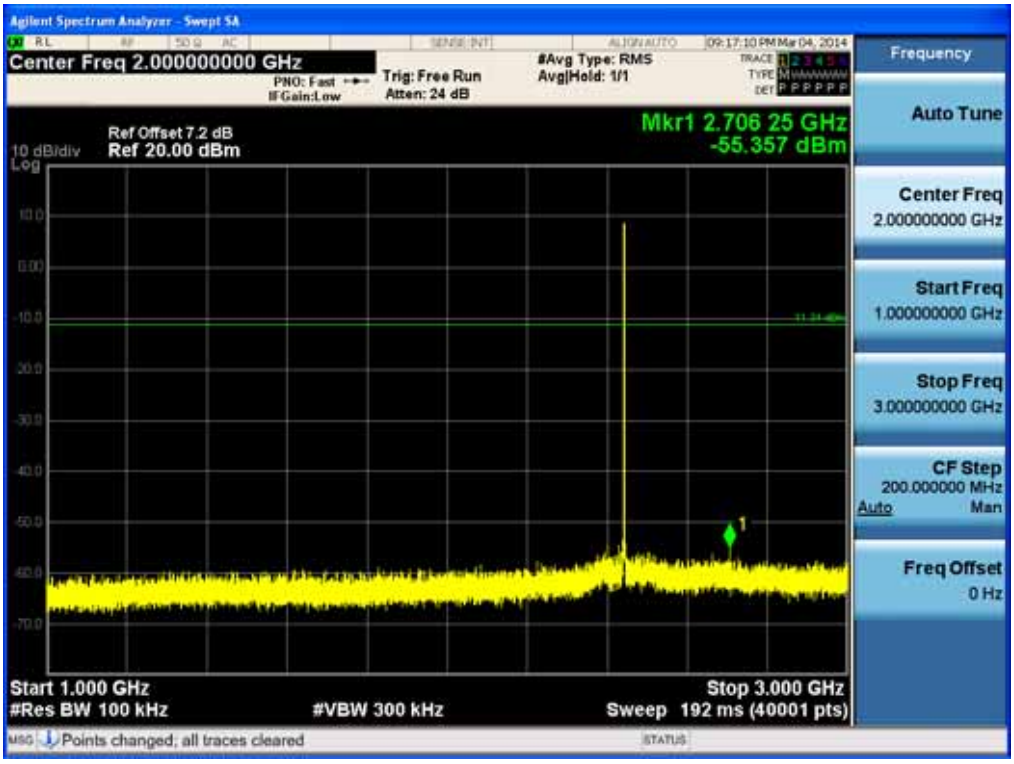
Note : 1. '*' is fundamental frequency range.

2. Factor = Cable loss + Splitter loss

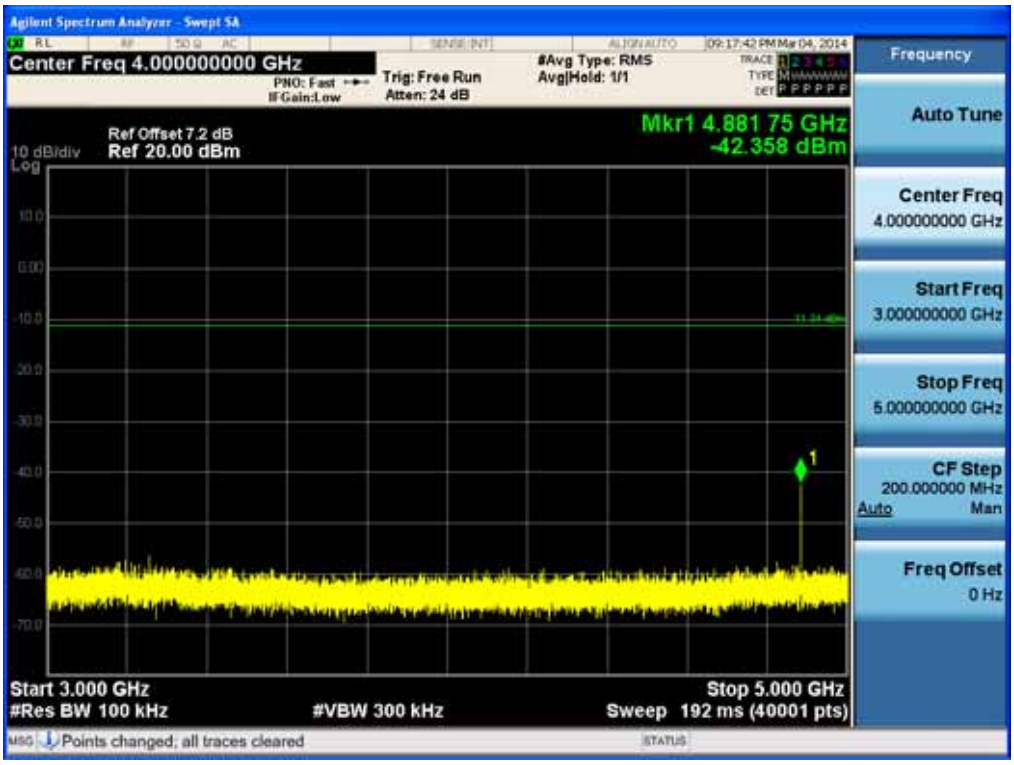
Test Plots (GFSK) - 30 MHz - 1 GHz
Spurious Emission (Mid-CH)



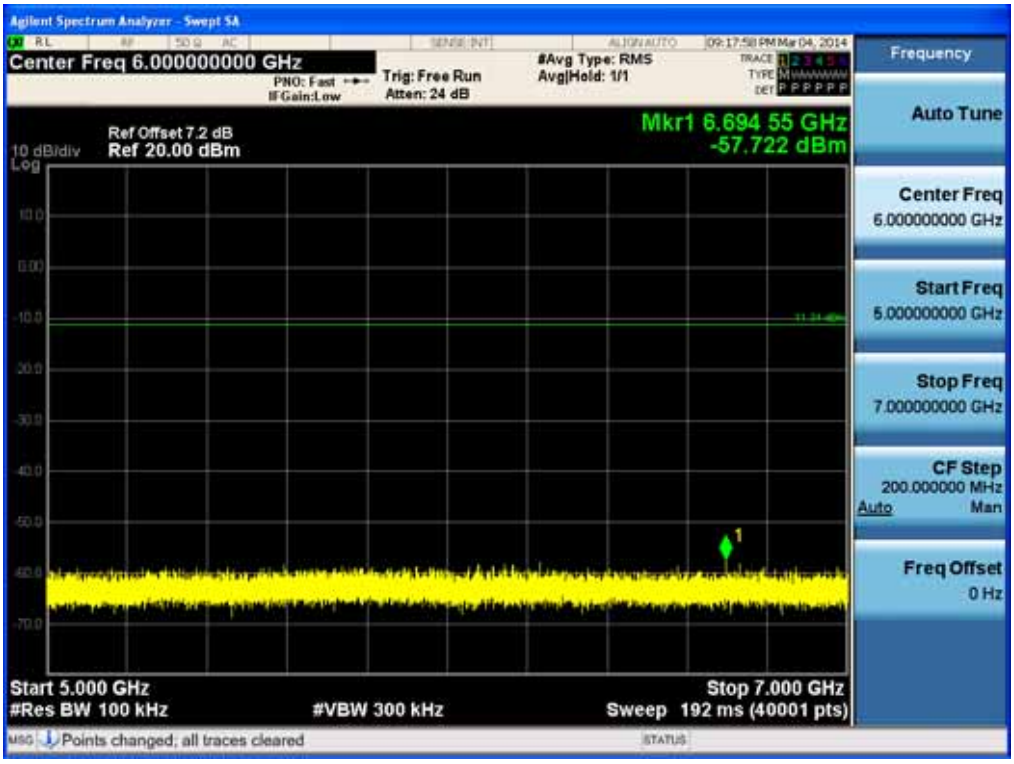
Test Plots (GFSK) - 1 GHz – 3 GHz
Spurious Emission (Mid-CH)



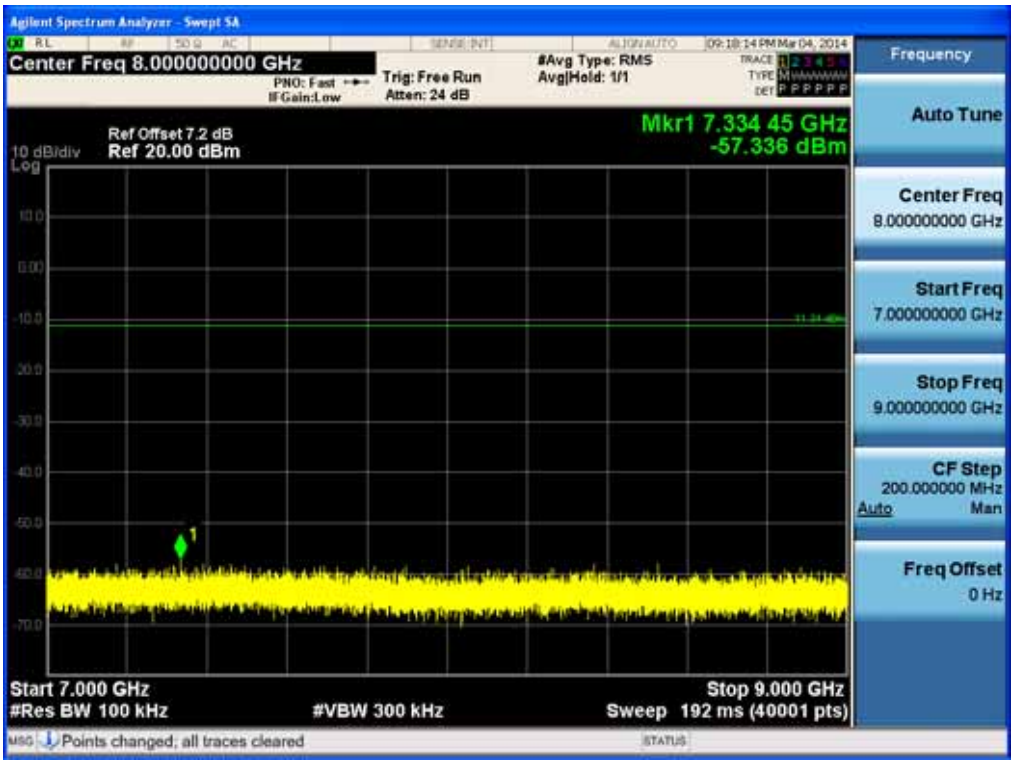
Test Plots (GFSK) - 3 GHz - 5 GHz
Spurious Emission (Mid-CH)



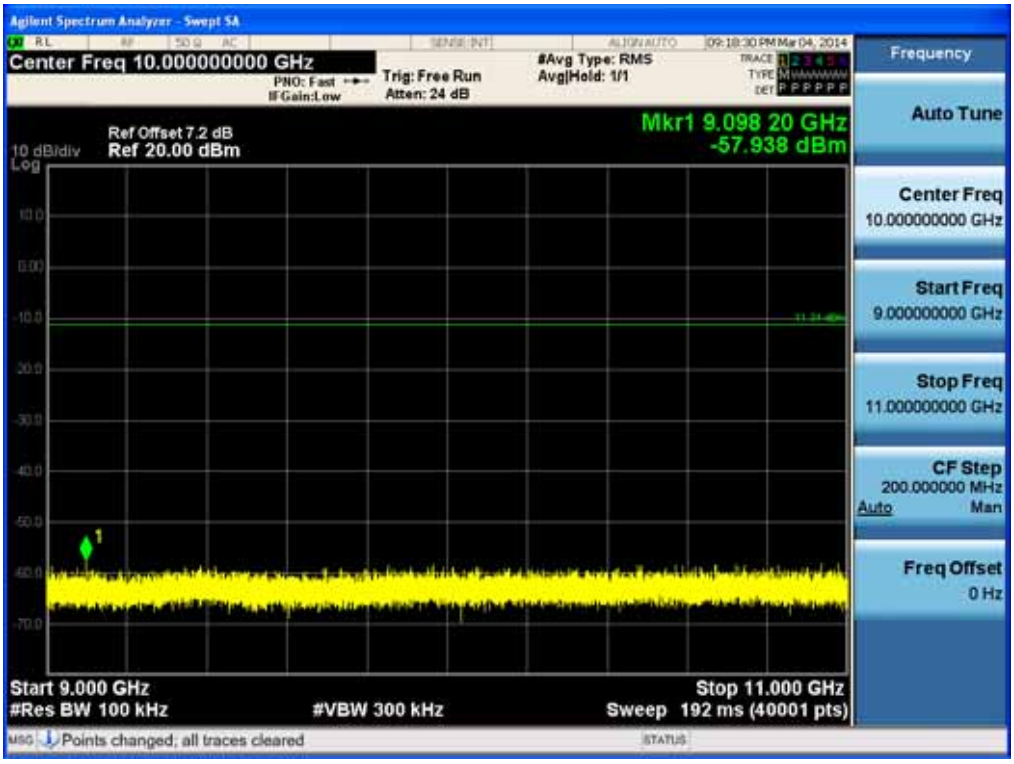
Test Plots (GFSK) - 5 GHz - 7 GHz
Spurious Emission (Mid-CH)



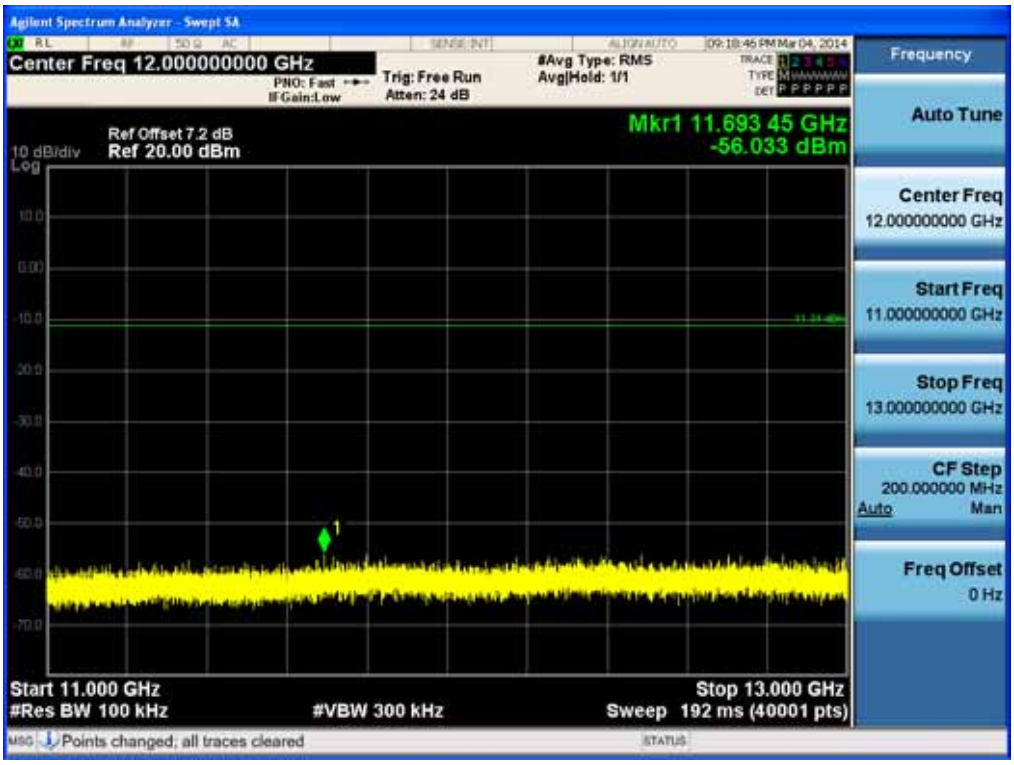
Test Plots (GFSK) - 7 GHz - 9 GHz
Spurious Emission (Mid-CH)



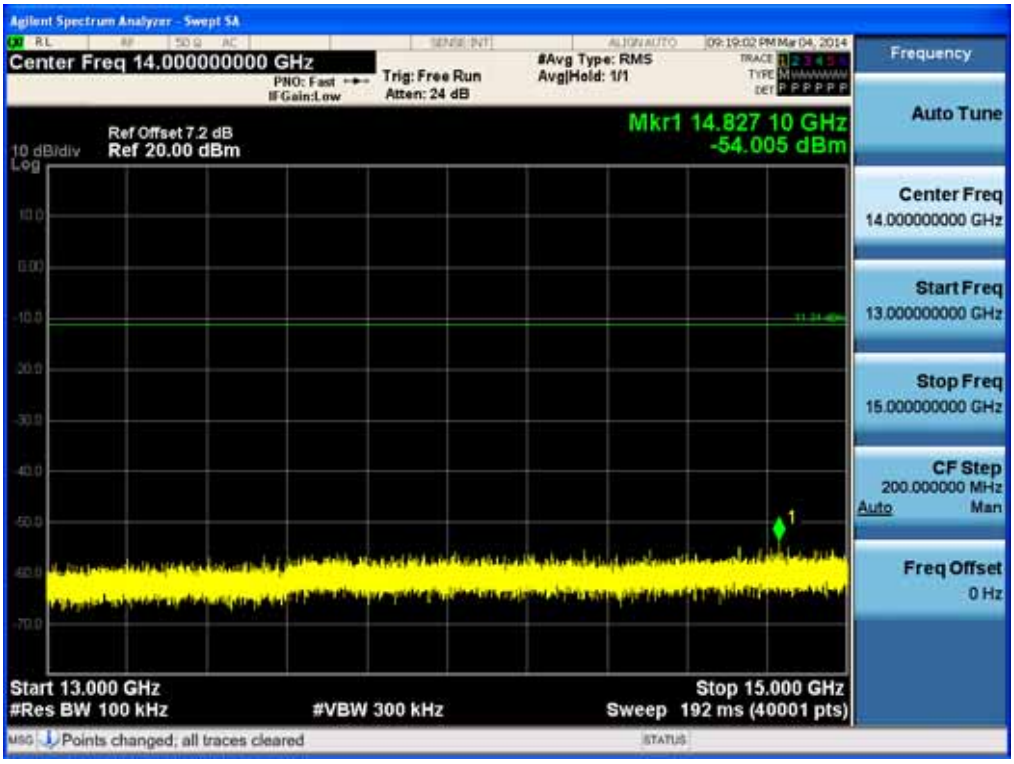
Test Plots (GFSK) - 9 GHz - 11 GHz
Spurious Emission (Mid-CH)



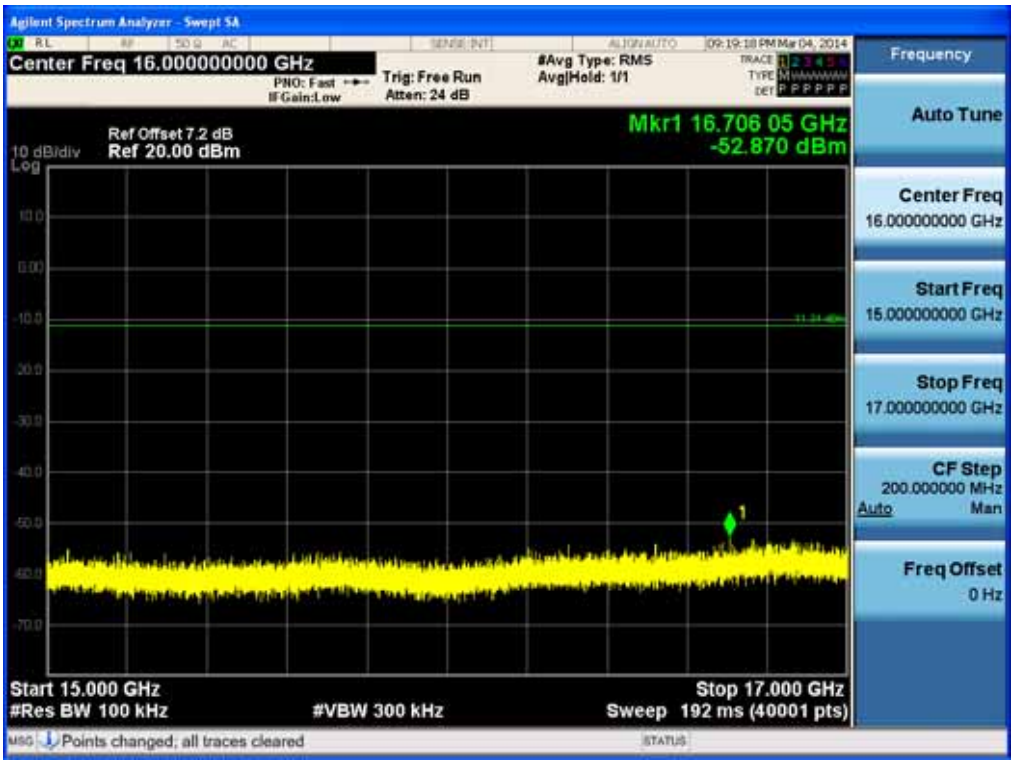
Test Plots (GFSK) - 11 GHz - 13 GHz
Spurious Emission (Mid-CH)



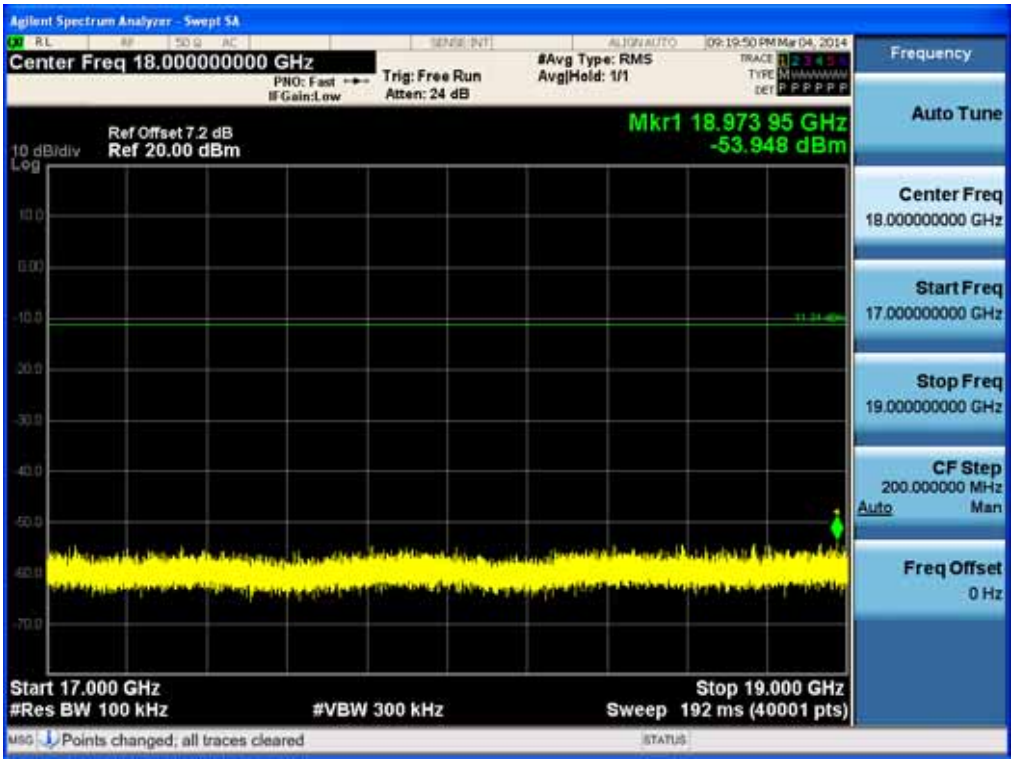
Test Plots (GFSK) - 13 GHz – 15 GHz
Spurious Emission (Mid-CH)



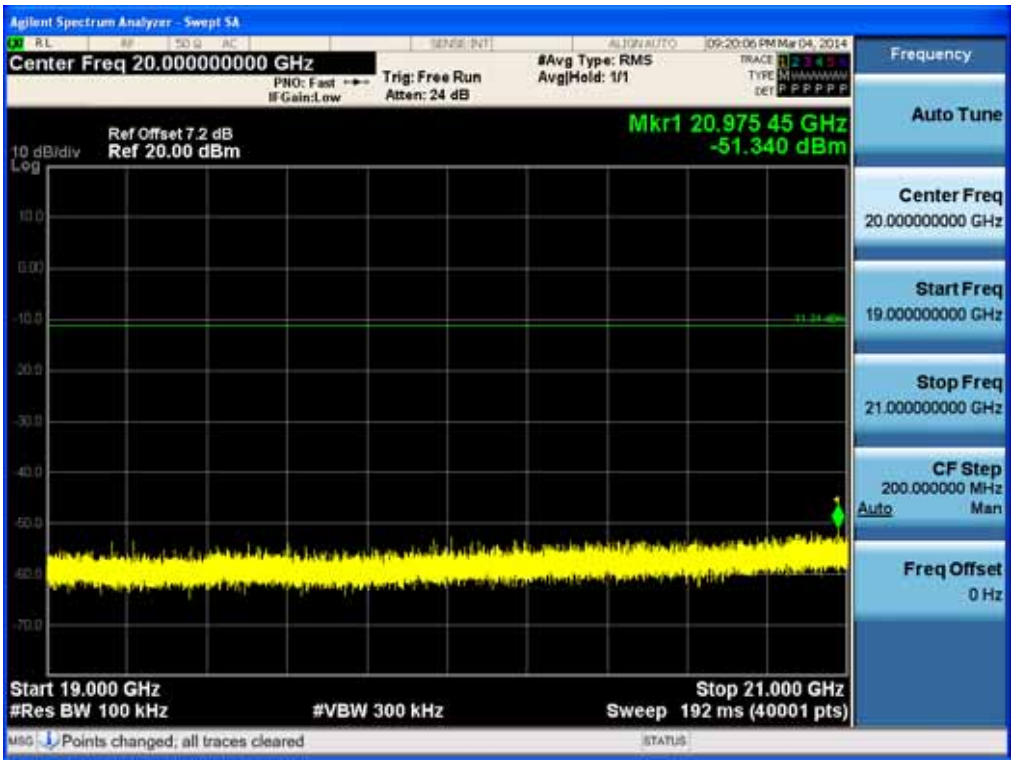
Test Plots (GFSK) – 15 GHz - 17 GHz
Spurious Emission (Mid-CH)



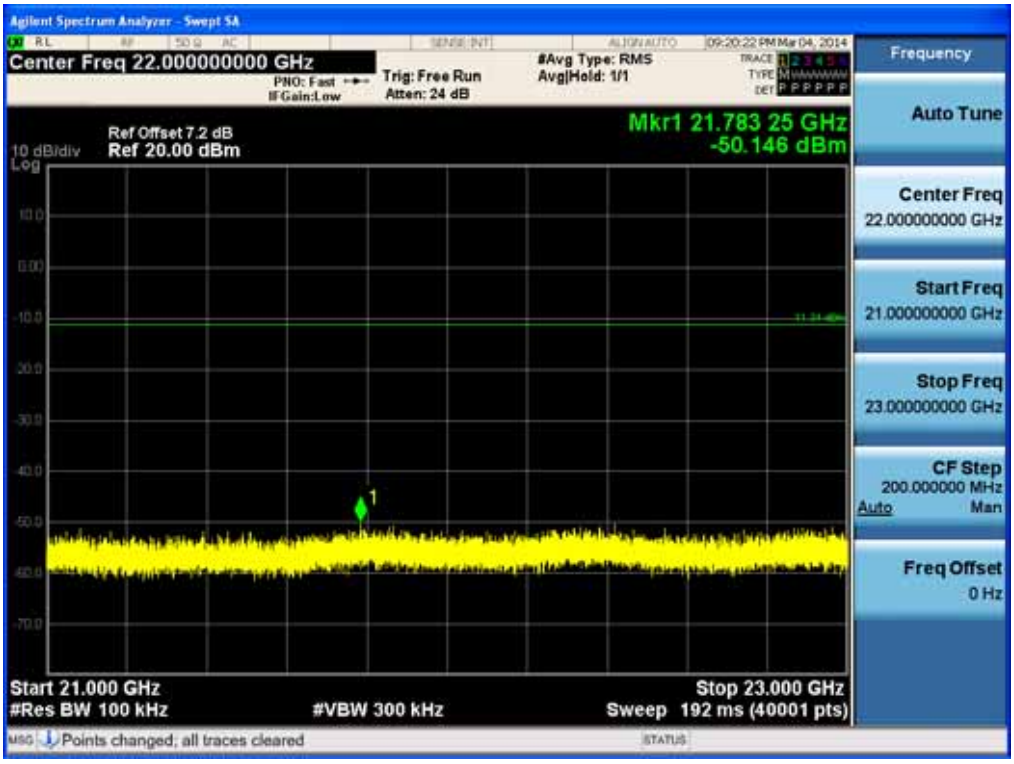
Test Plots (GFSK) - 17 GHz - 19 GHz
Spurious Emission (Mid-CH)



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

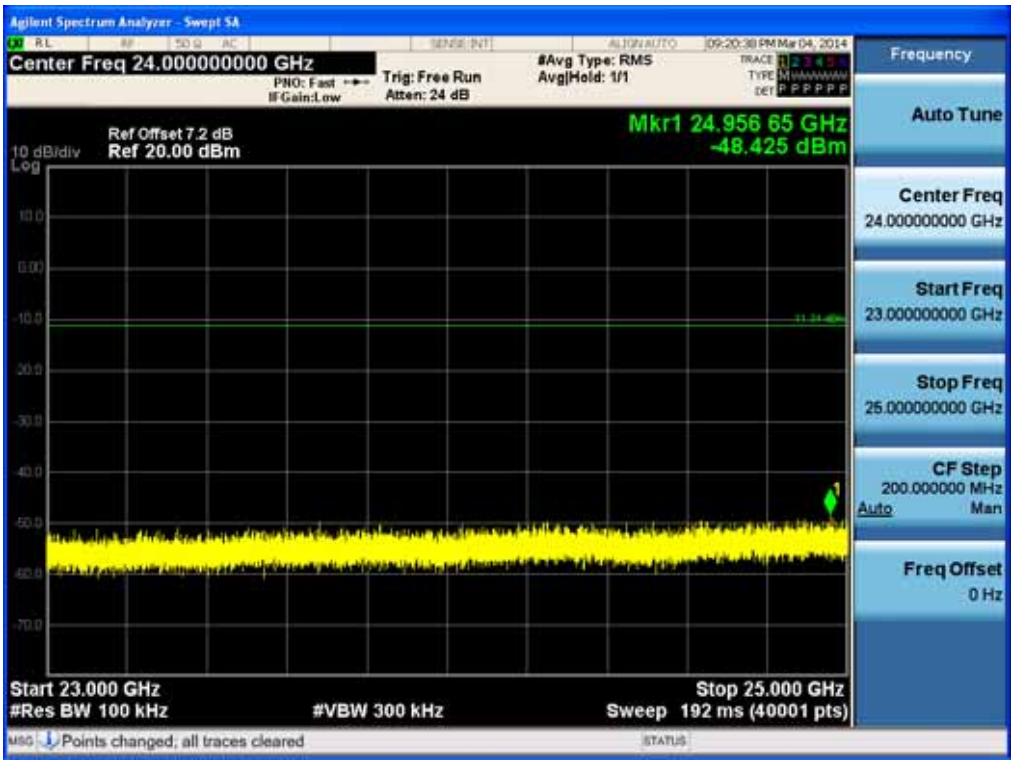


Test Plots (GFSK) - 21 GHz - 23 GHz
Spurious Emission (Mid-CH)



Test Plots (GFSK) - 23 GHz - 25 GHz

Spurious Emission (Mid-CH)



8.6.2 RADIATED SPURIOUS EMISSIONS

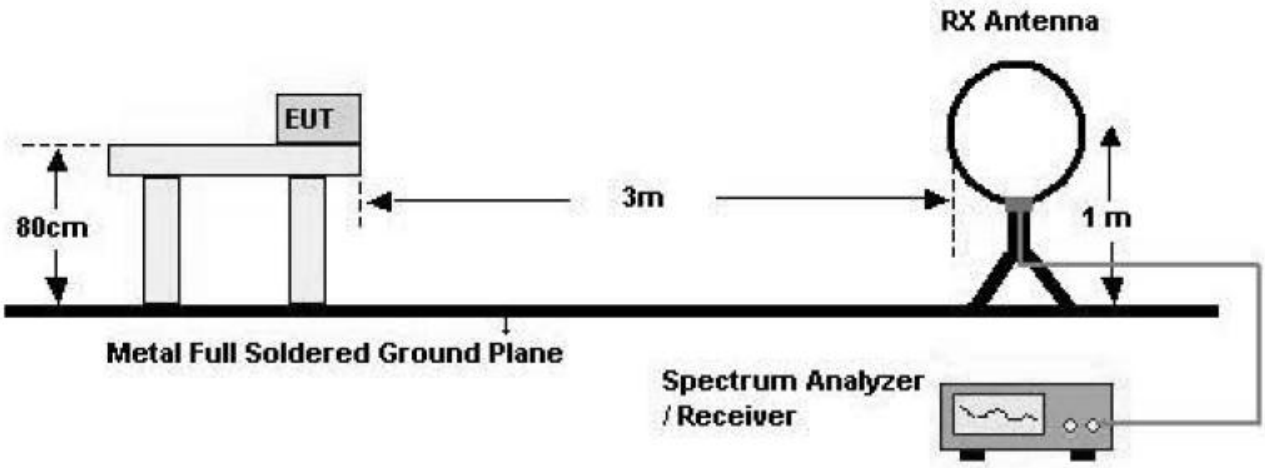
LIMIT : §15.247(d), §15.205, §15.209

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.

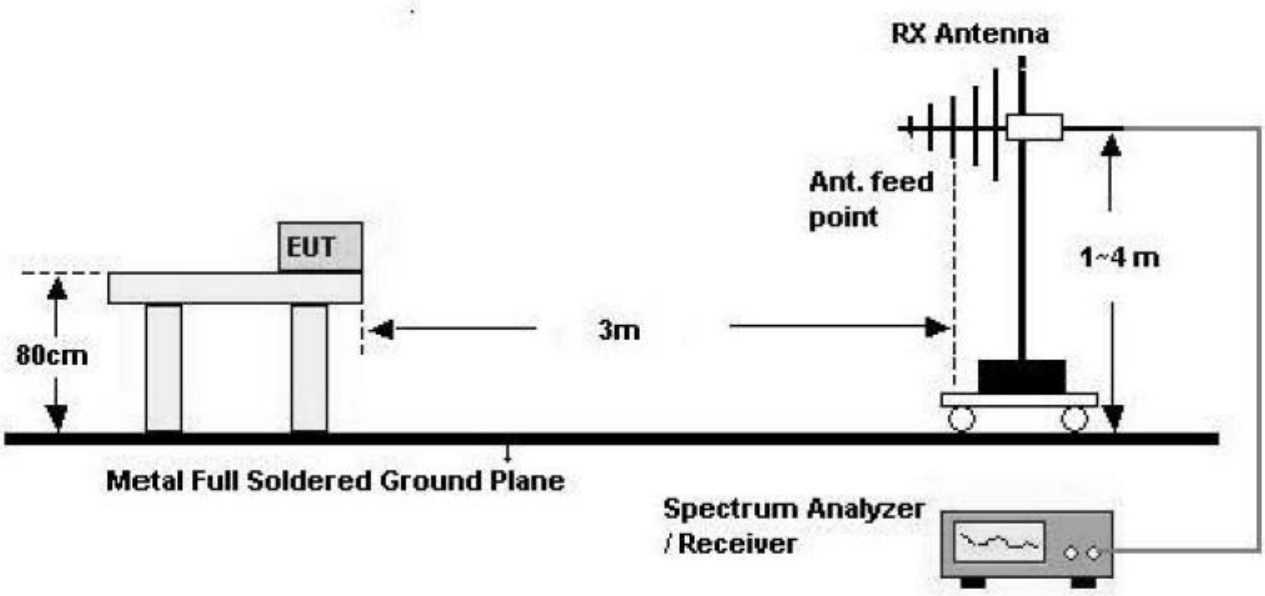
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Configuration

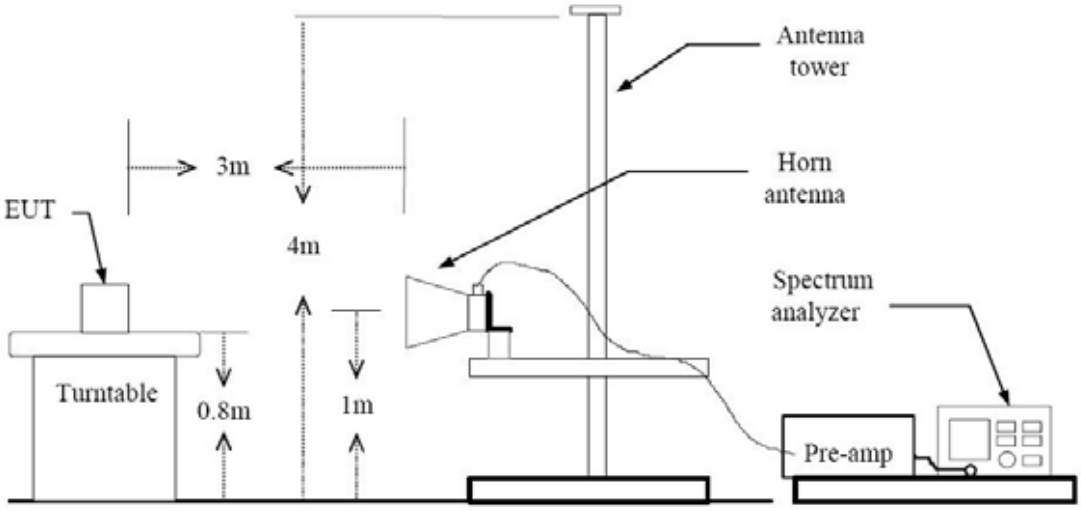
Below 30 MHz



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.
7. 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.

TEST RESULTS

9 kHz – 30MHz

Operation Mode: Normal Mode

Frequency	Reading	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
㎒	dBμV	dB /m	dB	(H/V)	dBμV/m	dBμV/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
㎒	dBμV	dB /m	dB	(H/V)	dBμV/m	dBμV/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]	Duty Cycle Correction [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
4804	61.33	-4.32	V	0	57.01	73.98	16.97	PK
4804	57.51	-4.32	V	-24.76	28.43	53.98	25.55	AV
7206	52.61	5.18	V	0	57.79	73.98	16.19	PK
7206	38.40	5.18	V	-24.76	18.83	53.98	35.15	AV
4804	60.98	-4.32	H	0	56.66	73.98	17.32	PK
4804	57.34	-4.32	H	-24.76	28.26	53.98	25.72	AV
7206	52.61	5.18	H	0	57.79	73.98	16.19	PK
7206	38.51	5.18	H	-24.76	18.94	53.98	35.04	AV

Operation Mode: CH Low(8DPSK)

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	59.08	-4.32	V	0	54.76	73.98	19.22	PK
4804	50.60	-4.32	V	-24.76	21.52	53.98	32.46	AV
7206	52.63	5.18	V	0	57.81	73.98	16.17	PK
7206	38.44	5.18	V	-24.76	18.87	53.98	35.11	AV
4804	59.26	-4.32	H	0	54.94	73.98	19.04	PK
4804	50.60	-4.32	H	-24.76	21.52	53.98	32.46	AV
7206	51.79	5.18	H	0	56.97	73.98	17.01	PK
7206	38.38	5.18	H	-24.76	18.81	53.98	35.17	AV

Operation Mode: CH Low(π/4DQPSK)

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	58.83	-4.32	V	0	54.51	73.98	19.47	PK
4804	50.50	-4.32	V	-24.76	21.42	53.98	32.56	AV
7206	52.54	5.18	V	0	57.72	73.98	16.26	PK
7206	38.38	5.18	V	-24.76	18.81	53.98	35.17	AV
4804	58.39	-4.32	H	0	54.07	73.98	19.91	PK
4804	50.45	-4.32	H	-24.76	21.37	53.98	32.61	AV
7206	52.21	5.18	H	0	57.39	73.98	16.59	PK
7206	38.62	5.18	H	-24.76	19.05	53.98	34.93	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.
   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 = 228.468 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 '* = 2.892 ms
   d. Duty Cycle Correction = 20log (Worst Case Dwell Time/ 100ms) dB = -30.776 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 = 57.84 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 '* = 5.784 ms
   d. Duty Cycle Correction(AFH) = 20log (Worst Case Dwell Time/ 100ms) dB = -24.7554 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]	Duty Cycle Correction [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
4882	56.86	-3.95	V	0	52.91	73.98	21.07	PK
4882	51.69	-3.95	V	-24.78	22.96	53.98	31.02	AV
7323	52.28	5.46	V	0	57.74	73.98	16.25	PK
7323	38.55	5.46	V	-24.78	19.22	53.98	34.76	AV
4882	56.12	-3.95	H	0	52.17	73.98	21.81	PK
4882	50.03	-3.95	H	-24.78	21.30	53.98	32.68	AV
7323	52.06	5.46	H	0	57.52	73.98	16.47	PK
7323	38.54	5.46	H	-24.78	19.21	53.98	34.77	AV

Operation Mode: CH Mid(8DPSK)

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	55.42	-3.95	V	0	51.47	73.98	22.51	PK
4882	45.98	-3.95	V	-24.78	17.25	53.98	36.73	AV
7323	52.33	5.46	V	0	57.79	73.98	16.20	PK
7323	38.37	5.46	V	-24.78	19.04	53.98	34.94	AV
4882	54.40	-3.95	H	0	50.45	73.98	23.53	PK
4882	44.44	-3.95	H	-24.78	15.71	53.98	38.27	AV
7323	52.20	5.46	H	0	57.66	73.98	16.33	PK
7323	38.38	5.46	H	-24.78	19.05	53.98	34.93	AV

Operation Mode: CH Mid(π/4DQPSK)

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	55.91	-3.95	V	0	51.96	73.98	22.02	PK
4882	45.80	-3.95	V	-24.78	17.07	53.98	36.91	AV
7323	52.24	5.46	V	0	57.70	73.98	16.29	PK
7323	38.31	5.46	V	-24.78	18.98	53.98	35.00	AV
4882	54.20	-3.95	H	0	50.25	73.98	23.73	PK
4882	44.31	-3.95	H	-24.78	15.58	53.98	38.40	AV
7323	51.82	5.46	H	0	57.28	73.98	16.71	PK
7323	38.41	5.46	H	-24.78	19.08	53.98	34.90	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.
   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 = 227.757 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 '* = 2.883 ms
   d. Duty Cycle Correction = 20log (Worst Case Dwell Time/ 100ms) dB = -30.803 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 = 57.66 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 '* = 5.766 ms
   d. Duty Cycle Correction(AFH) = 20log (Worst Case Dwell Time/ 100ms) dB = -24.7825 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]	Duty Cycle Correction [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
4960	54.25	-3.49	V	0	50.76	73.98	23.22	PK
4960	45.96	-3.49	V	-24.76	17.72	53.98	36.26	AV
7440	51.90	5.10	V	0	57.00	73.98	16.98	PK
7440	38.16	5.10	V	-24.76	18.50	53.98	35.48	AV
4960	54.72	-3.49	H	0	51.23	73.98	22.75	PK
4960	47.57	-3.49	H	-24.76	19.33	53.98	34.65	AV
7440	52.22	5.10	H	0	57.32	73.98	16.66	PK
7440	38.21	5.10	H	-24.76	18.55	53.98	35.43	AV

Operation Mode: CH High(8DPSK)

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	52.73	-3.49	V	0	49.24	73.98	24.74	PK
4960	41.35	-3.49	V	-24.76	13.11	53.98	40.87	AV
7440	51.43	5.10	V	0	56.53	73.98	17.45	PK
7440	38.20	5.10	V	-24.76	18.54	53.98	35.44	AV
4960	52.99	-3.49	H	0	49.50	73.98	24.48	PK
4960	42.20	-3.49	H	-24.76	13.96	53.98	40.02	AV
7440	52.54	5.10	H	0	57.64	73.98	16.34	PK
7440	38.30	5.10	H	-24.76	18.64	53.98	35.34	AV

Operation Mode: CH High (π/4DQPSK)

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	52.29	-3.49	V	0	48.80	73.98	25.18	PK
4960	41.23	-3.49	V	-24.76	12.99	53.98	40.99	AV
7440	51.68	5.10	V	0	56.78	73.98	17.20	PK
7440	38.29	5.10	V	-24.76	18.63	53.98	35.35	AV
4960	53.79	-3.49	H	0	50.30	73.98	23.68	PK
4960	42.30	-3.49	H	-24.76	14.06	53.98	39.92	AV
7440	51.93	5.10	H	0	57.03	73.98	16.95	PK
7440	38.23	5.10	H	-24.76	18.57	53.98	35.41	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.
   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 = 228.468 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 '* = 2.892 ms
   d. Duty Cycle Correction = 20log (Worst Case Dwell Time/ 100ms) dB = -30.776 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 = 57.84 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 '* = 5.784 ms
   d. Duty Cycle Correction(AFH) = 20log (Worst Case Dwell Time/ 100ms) dB = -24.7554 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.

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

Channel No: CH 0

Frequency [MHz]	Reading dBuV	※A.F+CL [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
2390.0	25.07	33.90	H	58.97	73.98	15.01	PK
2390.0	11.92	33.90	H	45.82	53.98	8.16	AV
2390.0	25.12	33.90	V	59.02	73.98	14.96	PK
2390.0	11.91	33.90	V	45.81	53.98	8.17	AV

Operation Mode: EDR(8DPSK)

Operating Frequency: 2402 MHz

Channel No: CH 0

Frequency [MHz]	Reading dBuV	※A.F+CL [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
2390.0	25.32	33.90	H	59.22	73.98	14.76	PK
2390.0	11.95	33.90	H	45.85	53.98	8.13	AV
2390.0	25.40	33.90	V	59.30	73.98	14.68	PK
2390.0	11.92	33.90	V	45.82	53.98	8.16	AV

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

Frequency [MHz]	Reading dBuV	※A.F+CL [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
2390.0	25.09	33.90	H	58.99	73.98	14.99	PK
2390.0	11.88	33.90	H	45.78	53.98	8.20	AV
2390.0	24.63	33.90	V	58.53	73.98	15.45	PK
2390.0	11.93	33.90	V	45.83	53.98	8.15	AV

※ A·F: ANTENNA FACTOR

C·L: CABLE LOSS

Notes:

1.. Frequency range of measurement = 2310 MHz ~ 2390 MHz

2. Total = Fundamental Reading Value + Antenna Factor + Cable Loss

3. 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.

We performed using a reduced video BW method was done with the analyzer in linear mode.

4. We have done Normal Mode and EDR Mode.

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

Operation Mode	Normal(GFSK)
Operating Frequency	2480 MHz
Channel No	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]	Detect
2483.5	35.15	33.99	H	0	69.14	73.98	4.84	PK
2483.5	32.70	33.99	H	-24.76	41.93	53.98	12.05	AV
2483.5	32.38	33.99	V	0	66.37	73.98	7.61	PK
2483.5	28.92	33.99	V	-24.76	38.15	53.98	15.83	AV

Operation Mode	EDR(8DPSK)
Operating Frequency	2480 MHz
Channel No	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]	Detect
2483.5	34.08	33.99	H	0	68.07	73.98	5.91	PK
2483.5	30.09	33.99	H	-24.76	39.32	53.98	14.66	AV
2483.5	31.29	33.99	V	0	65.28	73.98	8.70	PK
2483.5	26.26	33.99	V	-24.76	35.49	53.98	18.49	AV

Operation Mode	EDR(π/4DQPSK)
Operating Frequency	2480 MHz
Channel No	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]	Detect
2483.5	34.25	33.99	H	0	68.24	73.98	5.74	PK
2483.5	29.91	33.99	H	-24.76	39.14	53.98	14.84	AV
2483.5	31.40	33.99	V	0	65.39	73.98	8.59	PK
2483.5	26.21	33.99	V	-24.76	35.44	53.98	18.54	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 = Fundamental Reading Value + Antenna Factor + Cable Loss – Delta Value + Duty Cycle Correction Factor
3. 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.
   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 = 228.468 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 '* = 2.892 ms
   d. Duty Cycle Correction = 20log (Worst Case Dwell Time/ 100ms) dB = -30.776 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 = 57.84 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 '* = 5.784 ms
   d. Duty Cycle Correction(AFH) = 20log (Worst Case Dwell Time/ 100ms) dB = -24.7554 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.

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.
5. This test is performed with hopping off and 3 Mbps (3-DH5) data rate of No.78 channel.

▣ RESULT PLOTS

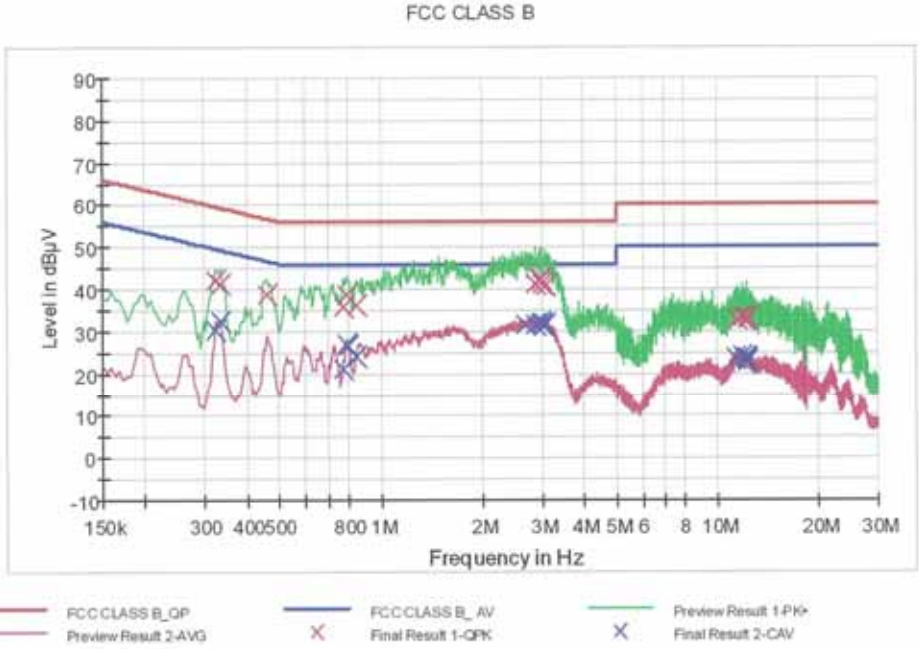
Conducted Emissions (Line 1)

EMI Auto Test(1) 1 / 2

HCT TEST Report

Common Information

EUT:	SHW-M580D
Manufacturer:	SAMSUNG
Test Site:	SHIELD ROOM
Operating Conditions:	BT MODE
Operator Name:	JC SHIN



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.325500	41.9	9.000	Off	L1	9.7	17.7	59.6
0.334500	41.1	9.000	Off	L1	9.7	18.2	59.3
0.460500	38.9	9.000	Off	L1	9.7	17.8	56.7
0.774500	35.8	9.000	Off	L1	9.8	20.2	56.0
0.792500	38.5	9.000	Off	L1	9.8	17.5	56.0
0.846500	36.3	9.000	Off	L1	9.8	19.7	56.0
2.885000	41.4	9.000	Off	L1	10.0	14.6	56.0
2.966000	42.2	9.000	Off	L1	10.0	13.8	56.0
2.979500	42.7	9.000	Off	L1	10.0	13.3	56.0
3.015500	41.2	9.000	Off	L1	10.0	14.8	56.0
3.024500	41.2	9.000	Off	L1	10.0	14.8	56.0
3.083000	40.9	9.000	Off	L1	10.0	15.1	56.0
11.520500	32.8	9.000	Off	L1	10.5	27.2	60.0
11.894000	33.4	9.000	Off	L1	10.5	26.6	60.0
12.204500	33.2	9.000	Off	L1	10.5	26.8	60.0
12.281000	33.0	9.000	Off	L1	10.5	27.0	60.0

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EMI Auto Test(1) 2 / 2

Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
12.294500	32.9	9.000	Off	L1	10.5	27.1	60.0
12.312500	33.2	9.000	Off	L1	10.5	26.8	60.0

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.325500	30.3	9.000	Off	L1	9.7	19.3	49.6
0.334500	32.6	9.000	Off	L1	9.7	16.7	49.3
0.774500	21.0	9.000	Off	L1	9.8	25.0	46.0
0.792500	27.0	9.000	Off	L1	9.8	19.0	46.0
0.801500	26.7	9.000	Off	L1	9.8	19.3	46.0
0.846500	24.1	9.000	Off	L1	9.8	21.9	46.0
2.696000	31.6	9.000	Off	L1	9.9	14.4	46.0
2.885000	31.7	9.000	Off	L1	10.0	14.3	46.0
2.966000	32.1	9.000	Off	L1	10.0	13.9	46.0
3.015500	31.5	9.000	Off	L1	10.0	14.5	46.0
3.024500	31.7	9.000	Off	L1	10.0	14.3	46.0
3.083000	31.4	9.000	Off	L1	10.0	14.6	46.0
11.358500	23.4	9.000	Off	L1	10.5	26.6	50.0
11.894000	23.9	9.000	Off	L1	10.5	26.1	50.0
12.137000	23.7	9.000	Off	L1	10.5	26.3	50.0
12.204500	23.4	9.000	Off	L1	10.5	26.6	50.0
12.281000	22.9	9.000	Off	L1	10.5	27.1	50.0
12.312500	23.2	9.000	Off	L1	10.5	26.8	50.0

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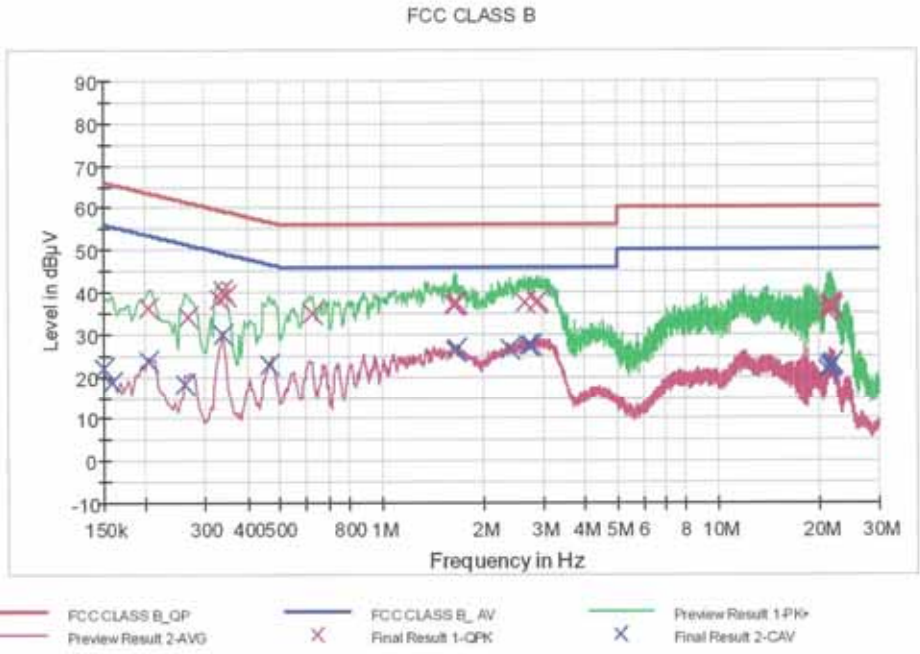
Conducted Emissions (Line 2)

EMI Auto Test(1) 1 / 2

HCT TEST Report

Common Information

EUT:	SHW-M580D
Manufacturer:	SAMSUNG
Test Site:	SHIELD ROOM
Operating Conditions:	BT MODE
Operator Name:	JC SHIN



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.204000	36.2	9.000	Off	N	9.7	27.2	63.4
0.267000	34.3	9.000	Off	N	9.7	26.9	61.2
0.330000	38.4	9.000	Off	N	9.7	21.1	59.5
0.339000	40.3	9.000	Off	N	9.7	18.9	59.2
0.348000	39.1	9.000	Off	N	9.7	19.9	59.0
0.626000	35.0	9.000	Off	N	9.8	21.0	56.0
1.638500	37.2	9.000	Off	N	9.9	18.8	56.0
1.661000	37.2	9.000	Off	N	9.9	18.8	56.0
1.670000	37.5	9.000	Off	N	9.9	18.5	56.0
2.655500	37.3	9.000	Off	N	9.9	18.7	56.0
2.889500	37.4	9.000	Off	N	10.0	18.6	56.0
2.925500	37.9	9.000	Off	N	10.0	18.1	56.0
21.236000	35.6	9.000	Off	N	10.8	24.4	60.0
21.312500	36.1	9.000	Off	N	10.8	23.9	60.0
21.326000	37.0	9.000	Off	N	10.8	23.0	60.0
21.645500	36.8	9.000	Off	N	10.9	23.2	60.0

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EMI Auto Test(1) 2 / 2

Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
21.668000	37.2	9.000	Off	N	10.9	22.8	60.0
21.938000	36.4	9.000	Off	N	10.9	23.6	60.0

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	21.8	9.000	Off	N	9.7	34.2	56.0
0.159000	18.6	9.000	Off	N	9.7	36.9	55.5
0.204000	23.6	9.000	Off	N	9.7	29.8	53.4
0.262500	18.2	9.000	Off	N	9.7	33.2	51.4
0.339000	29.9	9.000	Off	N	9.7	19.3	49.2
0.465000	22.7	9.000	Off	N	9.8	23.9	46.6
1.652000	26.3	9.000	Off	N	9.9	19.7	46.0
1.661000	26.3	9.000	Off	N	9.9	19.7	46.0
1.670000	26.4	9.000	Off	N	9.9	19.6	46.0
2.394500	26.4	9.000	Off	N	9.9	19.6	46.0
2.714000	27.4	9.000	Off	N	10.0	18.6	46.0
2.772500	27.4	9.000	Off	N	10.0	18.6	46.0
21.236000	21.7	9.000	Off	N	10.8	28.3	50.0
21.312500	22.3	9.000	Off	N	10.8	27.7	50.0
21.326000	22.5	9.000	Off	N	10.8	27.5	50.0
21.384500	22.6	9.000	Off	N	10.8	27.4	50.0
21.650000	22.8	9.000	Off	N	10.9	27.2	50.0
21.857000	23.3	9.000	Off	N	10.9	26.7	50.0

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9. LIST OF TEST EQUIPMENT

Manufacturer	Model / Equipment	Calibration Interval	Calibration Due	Serial No.
Rohde & Schwarz	ENV216/ LISN	Annual	01/29/2015	100073
Schwarzbeck	VULB 9160/ TRILOG Antenna	Biennial	12/17/2014	3150
Rohde & Schwarz	ESCI / EMI TEST RECEIVER	Annual	01/24/2015	100584
Agilent	E4440A/ Spectrum Analyzer	Annual	04/25/2014	US45303008
Agilent	N9020A/ SIGNAL ANALYZER	Annual	05/14/2014	MY51110063
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	SCU-18/ Signal Conditioning Unit	Annual	09/10/2014	10094
CERNEX	CBL18265035 / POWER AMP	Annual	07/24/2014	22966
CERNEX	CBL26405040 / POWER AMP	Annual	04/16/2014	19660
Schwarzbeck	BBHA 9120D/ Horn Antenna	Biennial	07/05/2015	1151
Schwarzbeck	BBHA9170 / Horn Antenna(15 GHz ~ 40 GHz)	Biennial	10/30/2014	BBHA9170124
Rohde & Schwarz	FSP / Spectrum Analyzer	Annual	01/24/2015	839117/011
Agilent	N1911A/Power Meter	Annual	01/24/2015	MY45100523
Agilent	N1921A /POWER SENSOR	Annual	07/11/2014	MY45241059
Wainwright Instrument	WHF3.0/18G-10EF / High Pass Filter	Annual	02/03/2015	F6
Wainwright Instrument	WHNX6.0/26.5G-6SS / High Pass Filter	Annual	04/16/2014	1
Wainwright Instrument	WHNX7.0/18G-8SS / High Pass Filter	Annual	04/16/2014	29
Wainwright Instrument	WRCJ2400/2483.5-2370/2520-60/14SS / Band Reject Filter	Annual	06/24/2014	1
Hewlett Packard	11636B/Power Divider	Annual	10/22/2014	11377
Agilent	87300B/Directional Coupler	Annual	12/18/2014	3116A03621
Hewlett Packard	11667B / Power Splitter	Annual	05/29/2014	05001
DIGITAL	EP-3010 /DC POWER SUPPLY	Annual	10/29/2014	3110117
ITECH	IT6720 / DC POWER SUPPLY	Annual	11/05/2014	010002156287001199
TESCOM	TC-3000C / BLUETOOTH TESTER	Annual	04/24/2014	3000C000276
Rohde & Schwarz	CBT / BLUETOOTH TESTER	Annual	04/25/2014	100422
Rohde & Schwarz	LOOP ANTENNA	Biennial	08/14/2014	100179
Agilent	8493C / Attenuator(10 dB)	Annual	07/24/2014	76649
WEINSCHEL	2-3 / Attenuator(3 dB)	Annual	10/28/2014	BR0617
CERNEX	CBL06185030 / POWER AMP	Annual	07/24/2014	22965
CERNEX	CBLU1183540 / POWER AMP	Annual	07/24/2014	22964