

Applicant:	Kyocera
FCC ID:	V65S1360
Report #:	CT-S1360-15C-0513-R0

## RF Emissions Test Report

FCC Part 15.247

For

Kyocera Corporation  
c/o Kyocera Communication Inc.

Product:	CDMA Cellular Phone
Model:	S1360



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## ATTESTATION

The tested device complies with the requirements in respect of all parameters subject to the test.

The test results and statements relate only to the items tested.

The test equipment used was suitable for the tests performed and within manufacturer's published specifications and operating parameters.

The test methods were consistent with the methods described in the relevant standards.

<b>Product:</b>	CDMA Cellular Phone with Bluetooth
<b>Model #:</b>	S1360
<b>FCC ID:</b>	V65S1360
<b>Tested in accordance with:</b>	FCC Part 15.247
<b>Test performed by:</b>	Comptest Services LLC
<b>Test Requested by:</b>	KYOCERA Corporation C/o KYOCERA Communication Inc 9520 Towne Centre Drive San Diego, CA 92121
<b>Date of Test:</b>	May 10 – May 15, 2013

**Responsible Engineer**

*Benjamin Nguyen*

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Benjamin Nguyen  
Test Engineer

**Reviewed and approved by:**

*Kelly Hill*

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Kelly Hill  
Quality Manager



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## 1 SUMMARY OF TESTING

### 1.1 Bluetooth EDR

Section #	Rule Part (FCC / IC)	Test Description	Verdict
5	§ 15.247(a)(1) / RSS-210 §A8.1	20 dB Bandwidth	Pass
6	§ 15.247(a)(1) / RSS-210 §A8.1(2)	Carrier Frequency Separation	Pass
7	§ 15.247(a)(1)(iii) / RSS-210 §A8.1 (4)	Number of Hopping Frequencies	Pass
8	§ 15.247(a)(1)(iii) / RSS-210 §A8.1 (4)	Time of Occupancy	Pass
9	§ 15.247(b)(1) / RSS-210 §A8.4	Conducted Output Power	Pass
10	§ 15.247(d) / RSS-210 §A8.5	Band-edge	Pass
11	§ 15.247(d) / RSS-210 §A8.5	Spurious Conducted Emissions	Pass
12	§ 15.207 / RSS-Gen §A7.2.2	AC Line Conducted Emissions	Pass
13	§ 15.209 / RSS-210 §A8.5	Spurious Radiated Emissions	Pass



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## 2 EQUIPMENT UNDER TEST INFORMATION

<b>EUT Serial Number:</b>	268435457816732379
<b>Type:</b>	[ ] Prototype, [X] Pre-Production, [ ] Production
<b>Equipment Category:</b>	Portable
<b>Bluetooth version:</b>	<input checked="" type="checkbox"/> 2.1 +EDR <input type="checkbox"/> 3.0 + EDR <input type="checkbox"/> 4.0 + LE
<b>Method:</b>	Frequency Hopping Spread Spectrum (FHSS) <input checked="" type="checkbox"/> Adaptive Frequency Hopping (AFH)
<b>Modulation:</b>	BT EDR: GFSK; π/4-DQPSK; 8DPSK
<b>TX Frequency (MHz):</b>	2402 to 2480
<b>Channel Numbers:</b>	BT EDR: 79 (AFH: ≥ 20)
<b>Channel Spacing (MHz):</b>	BT EDR: 1
<b>Max. Output Power (dBm):</b>	1.88
<b>Antenna:</b>	Internal
<b>Antenna Gain (dBi):</b>	-1.0 (Peak)

### Remarks:

- The Bluetooth module is tested by a Bluetooth Qualification Test Facility and the manufacturer confirm that:
  - The hopping sequence is pseudorandom
  - All channels are used equally on average
  - The receiver input bandwidth equals the transmit bandwidth
  - The receiver hops in sequence with the transmit signal
  - Bluetooth Protocol is used and Medium Access Protocol is implemented

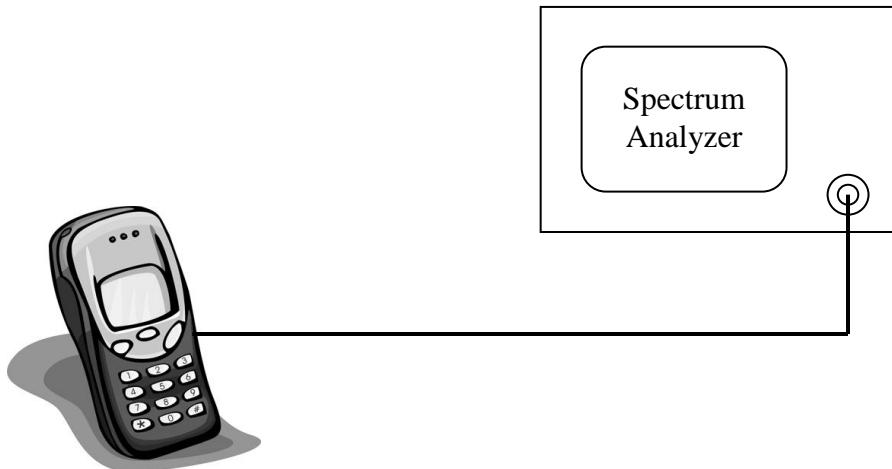
The device employs Adaptive Frequency Hopping (AFH) which identifies sources of interference namely devices operating in 802.1 WLAN and excludes them from the list of available channels. The process of re-mapping reduces the number of test channels from 79 channels to a minimum number of 20 channels.

## 3 TEST FACILITIES

The test sites and measurement facilities used to collect data are located at 8611 Balboa Avenue, San Diego, CA 92123, USA

## 4 TEST SETUP

The Bluetooth RF output of the equipment under test (EUT) was connected to the input of the spectrum analyzer through a RF cable with a specialized RF connector. The amplitude of the spectrum analyzer is corrected for the cable insertion loss and any other applicable losses. A fully charged battery was used as power supply voltage.



Tests were performed at the following channels:

<b>Bluetooth Mode:</b>	EDR
<b>Available Channel:</b>	0 to 78
<b>Tested Channel:</b>	0, 39, 78
<b>Tested Frequency (MHz):</b>	2402, 2441, 2480



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## 5 20 dB BANDWIDTH

### 5.1 Test Configuration

FCC: § 15.247(a)(1)

IC: RSS-210 §A8.1

The Bluetooth transmitter was enabled at low, mid, high channels. The automatic bandwidth measurement capability of the spectrum analyzer was used to perform the 20dB-bandwidth measurement at each channel and at each supporting modulation scheme.

Spectrum Analyzer Parameters:

RBW = 30kHz, VBW = 300kHz, Span=3MHz, Sweep Time = Coupled, Detector=Peak, x dB=-20

**Frequencies of Interest:** Spectrum was investigated from 2402 MHz – 2480 MHz.

**Limits:** < 1 MHz, unless more than 15 non-overlapping channels are employed.

### 5.2 20dB Bandwidth Plots and Results

Figure	Channel	Modulation	Results
5-1a	0	GFSK	848 kHz
5-1b		EDR DQPSK	1.17 MHz
5-2c		EDR D8PSK	1.16 MHz
5-2a	39	GFSK	849 kHz
5-2b		EDR DQPSK	1.17 MHz
5-2c		EDR D8PSK	1.16 MHz
5-3a	78	GFSK	846 kHz
5-3b		EDR DQPSK	1.16 MHz
5-3c		EDR D8PSK	1.16 MHz



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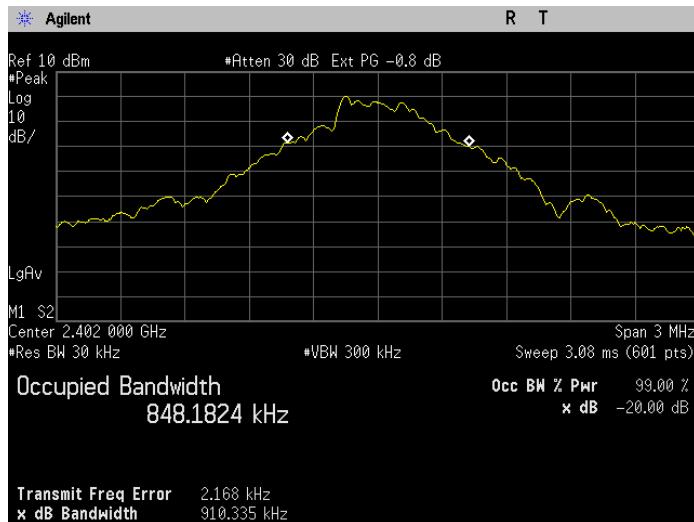


Figure 5-1a: 20dB Bandwidth Basic rate, Channel 0.

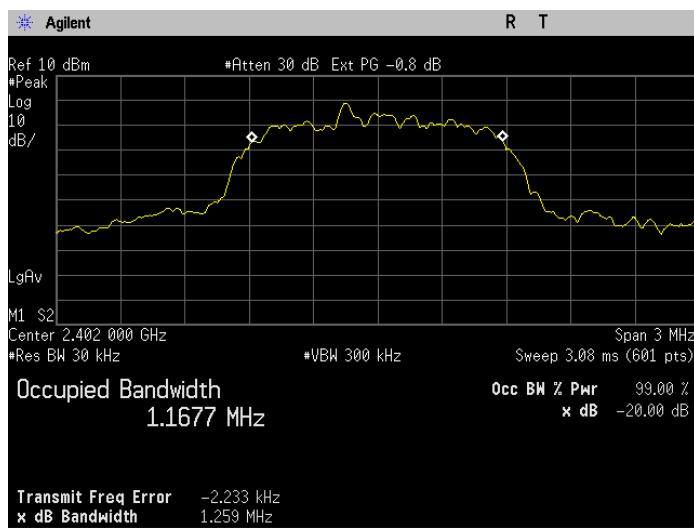


Figure 5-1b: 20dB Bandwidth EDR DQPSK, Channel 0.

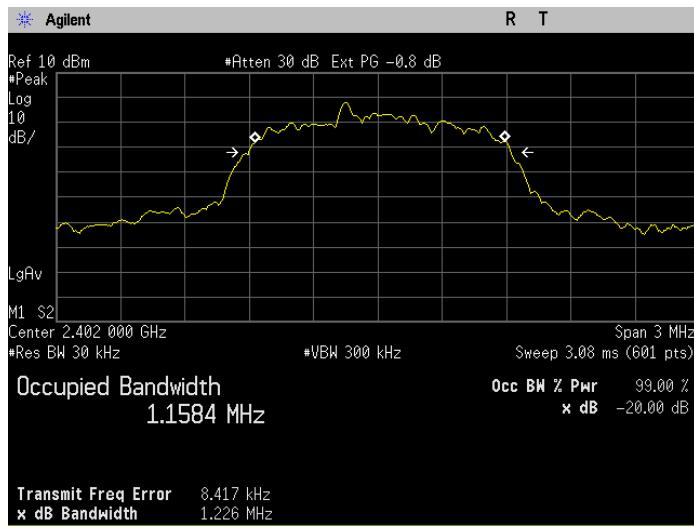


Figure 5-1c: 20dB Bandwidth EDR D8PSK, Channel 0.



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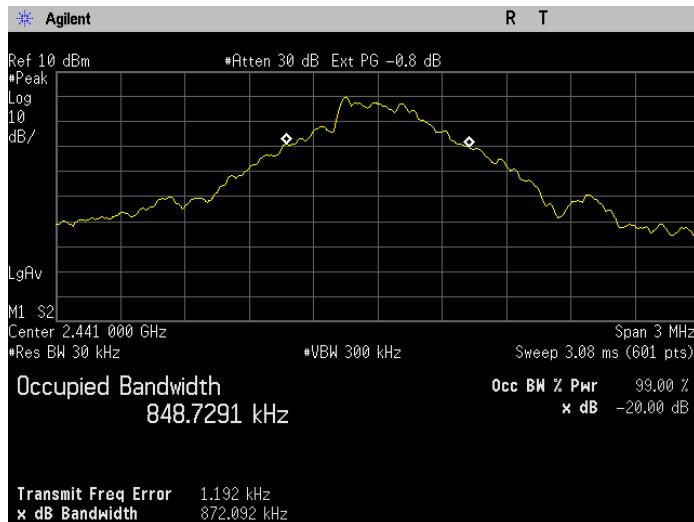


Figure 5-2a: 20dB Bandwidth Basic rate, Channel 39.

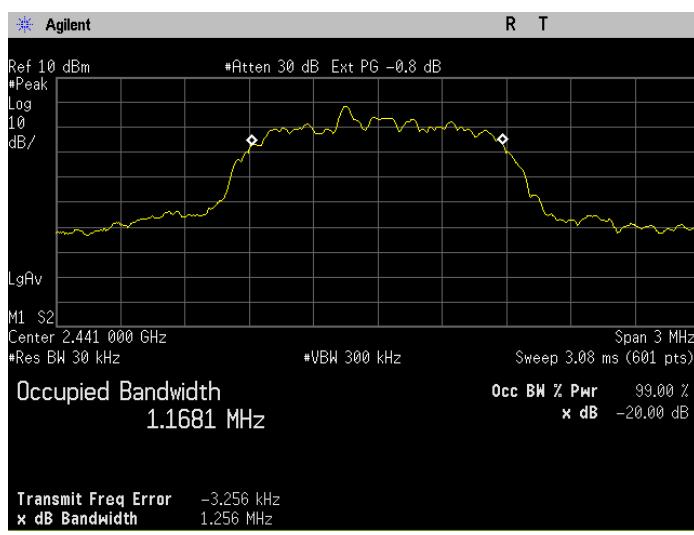


Figure 5-2b: 20dB Bandwidth EDR DQPSK, Channel 39.



Figure 5-2c: 20dB Bandwidth EDR D8PSK, Channel 39.



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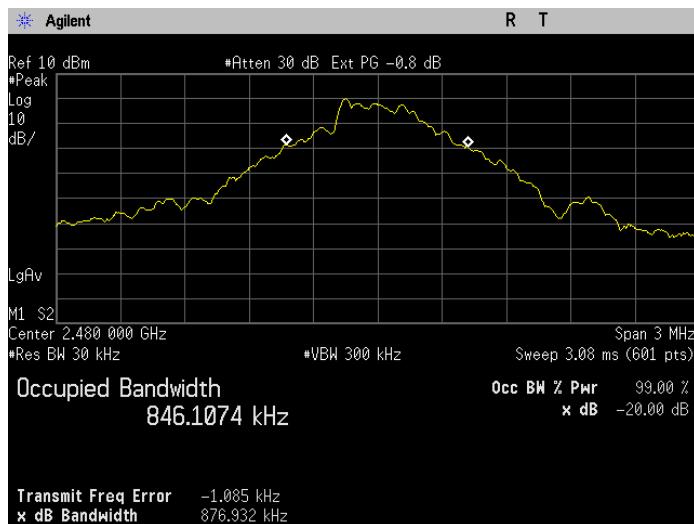


Figure 5-3a: 20dB Bandwidth Basic rate, Channel 78.

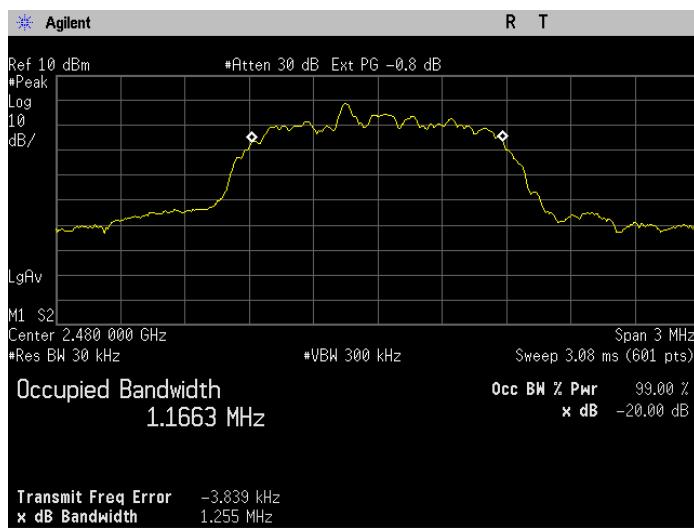


Figure 5-3b: 20dB Bandwidth EDR DQPSK, Channel 78.

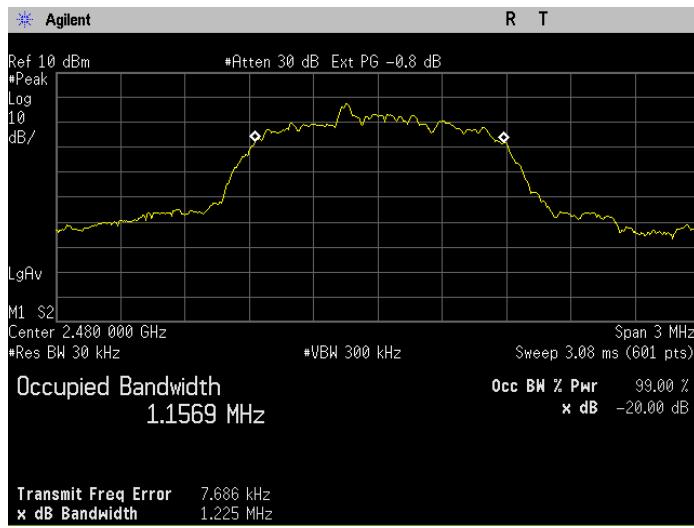


Figure 5-3c: 20dB Bandwidth EDR D8PSK, Channel 78.



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## 6 CARRIER FREQUENCY SEPARATION

### 6.1 Test Configuration

FCC: § 15.247(a)(1)

IC: RSS-210 §A8.1(2)

The Bluetooth transmitter was set in hopping mode to investigate the carrier frequency separation between mid-channel and its adjacent channels. The carrier frequency separation is independent of modulation and packet length (DH1, DH3, etc.).

**Limits:**

- a)  $\geq 25$  kHz or 20 dB Bandwidth, whichever is greater
- b) For FH systems operating in 2400-2483.5MHz and with output power less than 125mW the carrier frequency separation should be greater than 25kHz or 2/3 of 20dB Bandwidth.

### 6.2 Results: Carrier Frequency

Figure	Frequency Separation (kHz)	Measured 20dB BW (kHz)	Limits (kHz)	Result
6	1025	1170	780.0	Pass

**Note:** EUT complies with the minimum channel separation requirement when in x/EDR mode using 79 channels and when operating in AFH mode using 20 channels.

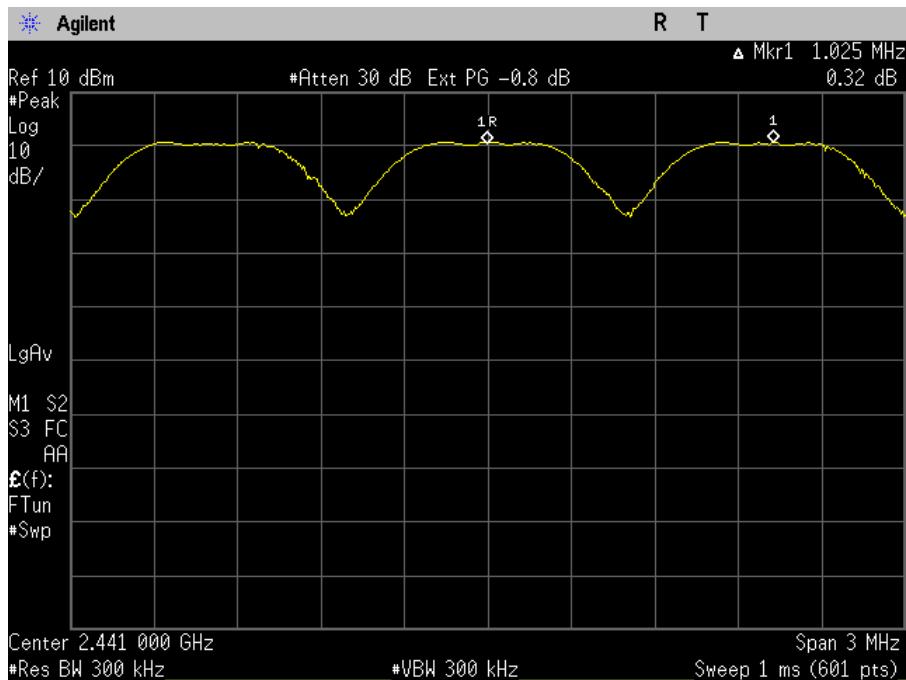


Figure 6: Carrier Frequency Separation between channels 38, 39 (mid-channel) & 40.



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## 7 NUMBER OF HOPPING FREQUENCIES

### 7.1 Test Configuration

FCC: § 15.247(a)(1)(iii)

IC: RSS-210 §A8.1(4)

The Bluetooth transmitter was set in hopping mode to investigate the number of hopping frequencies.

**Limits:**

At least 15 non-overlapping channels

### 7.2 Results: Number of Hopping Frequencies

Figure	Channel	Plot Description	Results
7a	Hopping	Number of Hopping Frequencies (Channels 0-39)	79 (Channels 0-78)
7b		Number of Hopping Frequencies (Channels 39-78)	

**Note:** In AFH mode, the device operates using 20 channels so the requirement for minimum number of hopping channels is satisfied.



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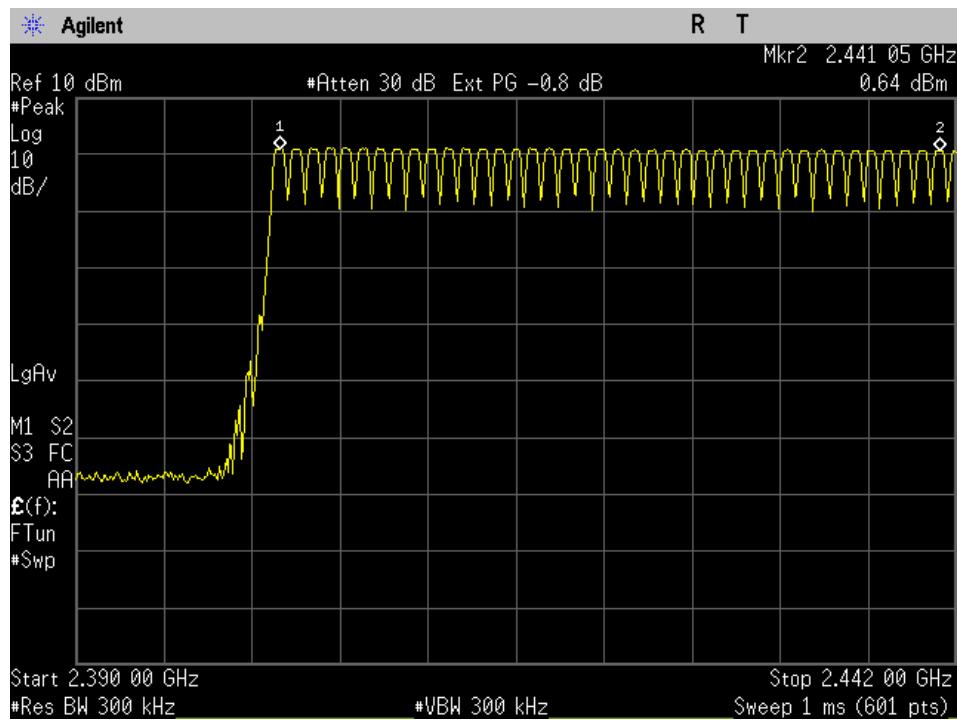


Figure 7a: Number of Hopping Frequencies (Channels 0-39).

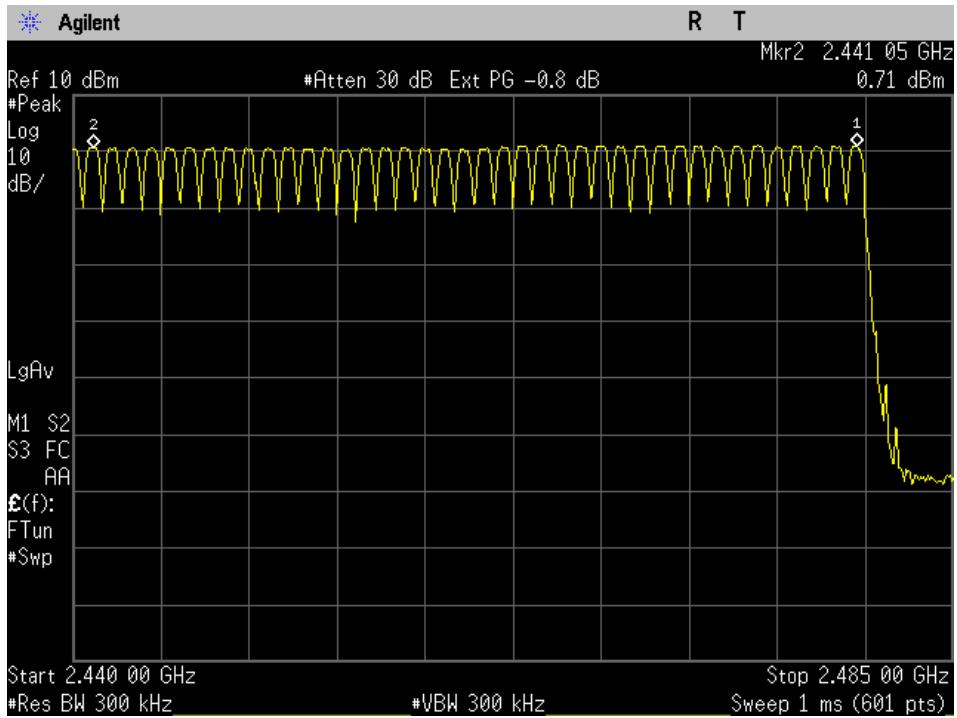


Figure 7b: Number of Hopping Frequencies (Channels 39-78).



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## 8 TIME OF OCCUPANCY (DWELL TIME)

### 8.1 Test Configuration

FCC: § 15.247(a)(1)(iii)

IC: RSS-210 §A8.1(4)

The Bluetooth transmitter was set in hopping mode to capture one of the transmissions.

Dwell Time for any given channel is calculated as follows:

$$\text{Dwell Time} = \text{Time Slot Length} \times \text{Hop Rate} \times 0.4\text{sec}$$

For 1x/EDR mode the hopping rate is 1600 hops/sec for a single slot packet. The worst case hopping rate is 1600/X, where X is the total packet slot including transmit and receive slots in DH packet operation. For example, in DH5 packet there are 5 transmit and 1 receive slot, for a total of 6 slots, the worst case hopping rate is 1600/6= 266.67 hops/sec.

For AFH mode the number of channels is reduced to a minimum of 20 channels and the channel hopping rate is reduced by 50%. For example, the worst case hopping rate is 800/6=133.3 hops/sec in DH5 packet with AFH.

Below are actual the hop rate for different package operations:

Mode	Hopping Rate (hops/sec)		
	DH1	DH3	DH5
EDR	800	400	266.7
EDR with AFH	400	200	133.3

#### Spectrum Analyzer Parameters:

RBW = 3MHz, VBW  $\geq$  RBW, Span=0 Hz, Detector=Peak, Sweep time=sufficient enough to capture one transmission.

#### Limits:

$\leq 0.4$  s (within a period of  $0.4\text{s} \times$  number of hopping channel employed)

### 8.2 Results: Dwell Time

Mode	Measured Time Slot (mS)	Hop Rate (Hops/Sec)	Dwell Time (mS)	Result
DH1	0.38	800	121.6	Pass
DH3	1.64	400	262.4	Pass
DH5	2.86	266.67	304.9	Pass
DH5 (AFH)	2.86	133.3	152.4	Pass



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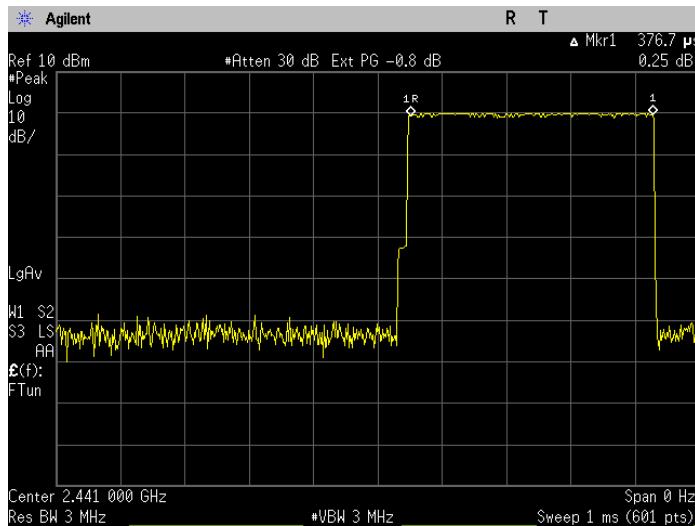


Figure 8-1: Duration of one transmission DH1 (Channel 39).

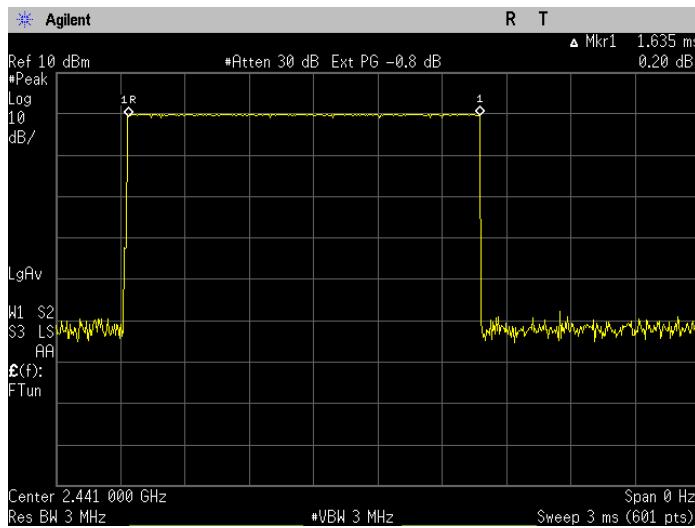


Figure 8-2: Duration of one transmission DH3 (Channel 39).

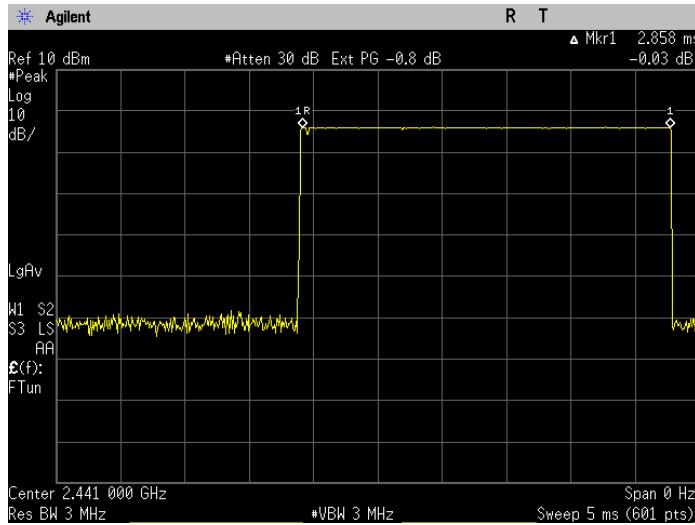


Figure 8-3: Duration of one transmission DH5 (Channel 39).



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## 9 OUTPUT POWER

### 9.1 Test Configuration

FCC: § 15.247(b)(1)

IC: RSS-210 §A8.4(2)

The Bluetooth transmitter was enabled at low, mid and high channels of separately to investigate the peak output power for each channel.

Spectrum Analyzer Parameters:

RBW = 3MHz, VBW  $\geq$  RBW, Span=10MHz, Sweep Time = Coupled, Detector=Peak

Frequencies of Interest: Spectrum was investigated from 2400 MHz – 2483.5 MHz.

Limits: < 1 watt (30dBm) for systems using digital modulation

### 9.2 Results and Limits:

Freq (MHz)	Channel	Modulation	Results (dBm)
2402	0	Basic Rate	1.24
		DQPSK	1.77
		D8PSK	1.28
2441	39	Basic Rate	0.84
		EDR DQPSK	1.40
		EDR D8PSK	0.88
2480	78	Basic Rate	1.12
		EDR DQPSK	1.81
		EDR D8PSK	1.21

**Comments:** Pass



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## 10 BANDEDGE

### 10.1 Test Configuration

FCC:	§ 15.247(d)
IC:	RSS-210 §A8.5

The Bluetooth RF output port of the EUT was directly connected to the input of the spectrum analyzer with sufficient attenuation. Subsequently, the low and high channels of Bluetooth transmitter were enabled separately to investigate the band-edge compliance of conducted emissions. To ensure the band-edge compliance when the channels are hopping, measurements were also conducted at low and high channels in this mode. A fully charged battery was used as supply voltage

Spectrum Analyzer Parameters:

RBW = 100kHz, VBW = 300kz, Span=10MHz, Sweep Time = Coupled, Detector=Peak, Trace=Max hold

Frequencies of Interest: Spectrum was investigated from 2400 MHz – 2483.5 MHz.

Limits:  $\leq$  -20 dBc

In any 100kHz band, the highest radio frequency power outside the band (2400-2483.5 MHz) is measured to be at least 20 dB below the desired power of intentional radiator within the band.

### 10.2 Results: Bandedge

Figure	Channel/Edge	Modulation	Plot Description	Results (dBc)
10-1a	0 -- Low Band Edge	Basic Rate	Hopping disabled	-55.93
10-1b			Hopping enabled	-51.66
10-2a		EDR DQPSK	Hopping disabled	-51.62
10-2b			Hopping enabled	-51.15
10-3a		EDR D8PSK	Hopping disabled	-51.92
10-3b			Hopping enabled	-50.88
10-4a	78 -- High Band Edge	Basic Rate	Hopping disabled	-60.64
10-4b			Hopping enabled	-59.95
10-5a		EDR DQPSK	Hopping disabled	-59.55
10-5b			Hopping enabled	-56.74
10-6a		EDR D8PSK	Hopping disabled	-58.40
10-6b			Hopping enabled	-57.91



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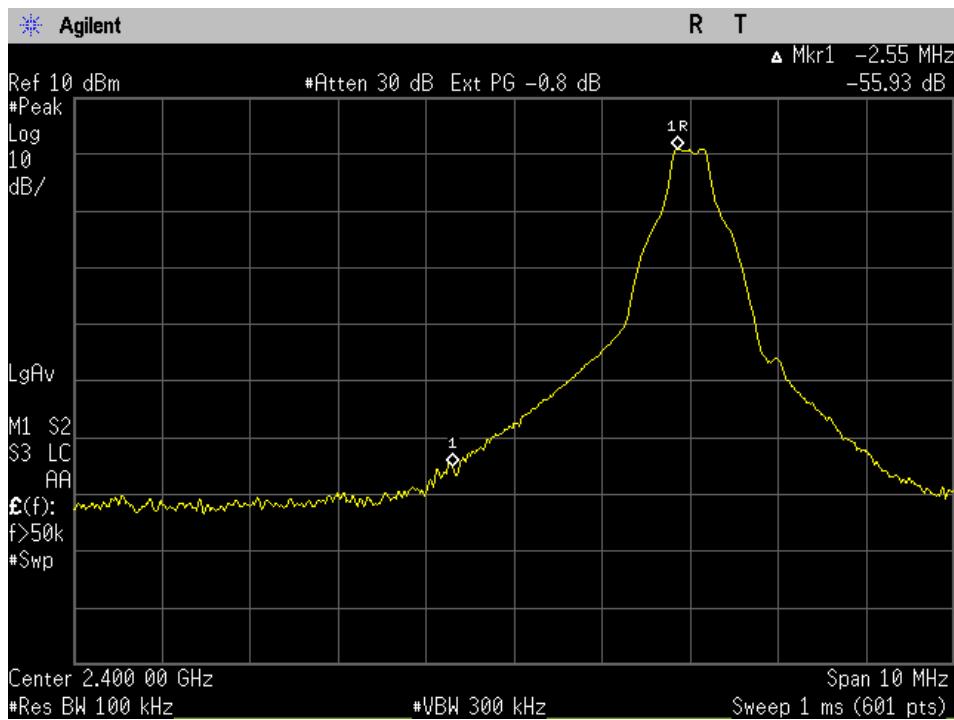


Figure 10-1a: Basic Rate Low band edge with hopping disabled.

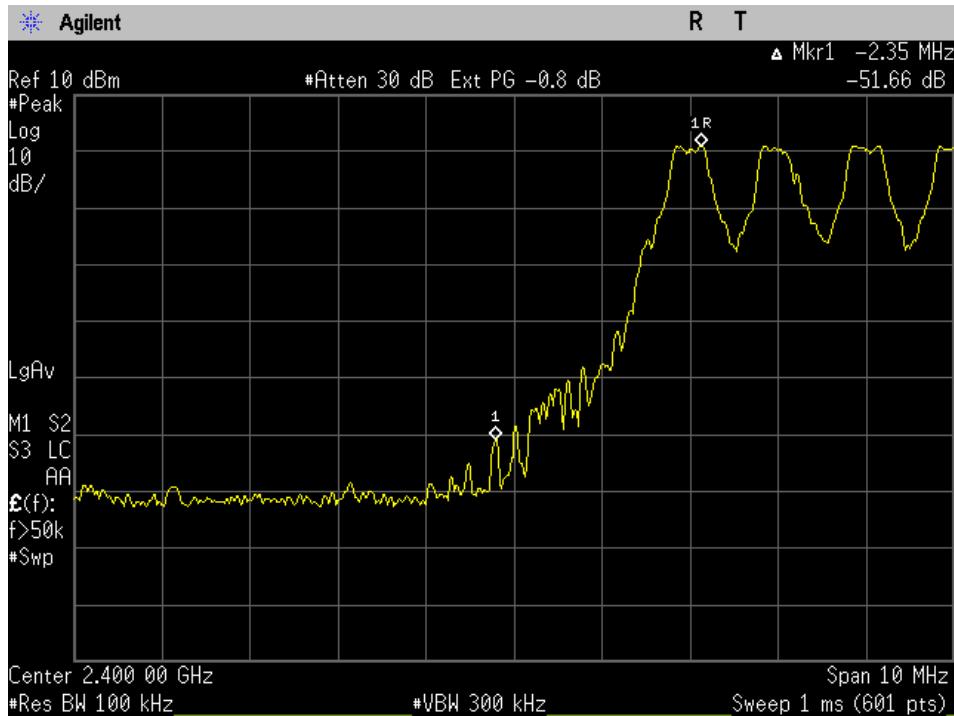


Figure 10-1b: Basic Rate Low band edge with hopping enabled.



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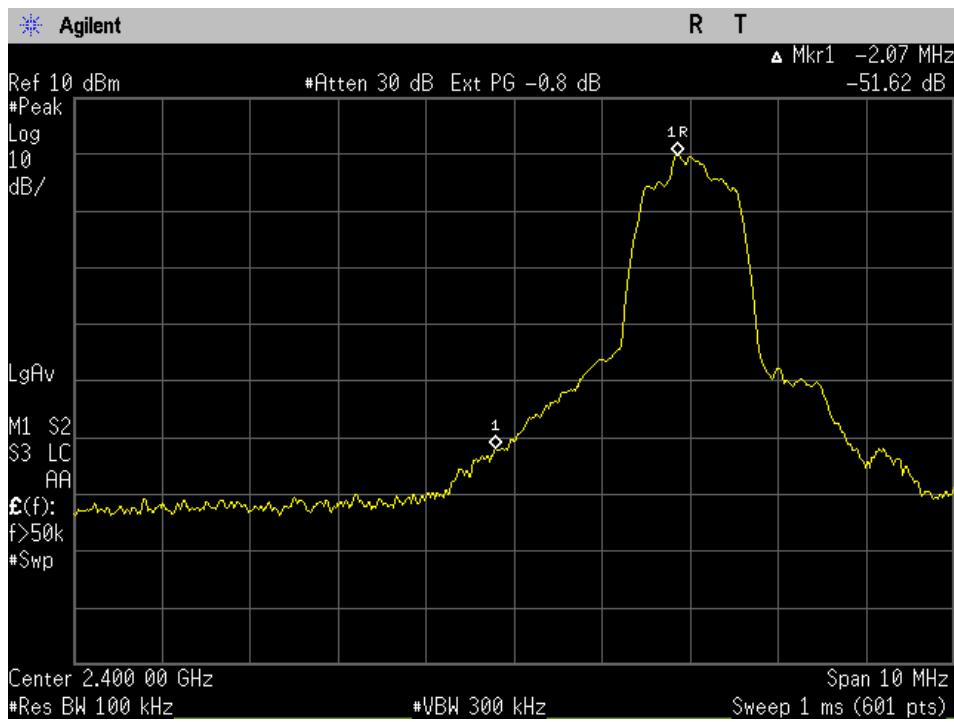


Figure 10-2a: EDR DQPSK Low band edge with hopping disabled.

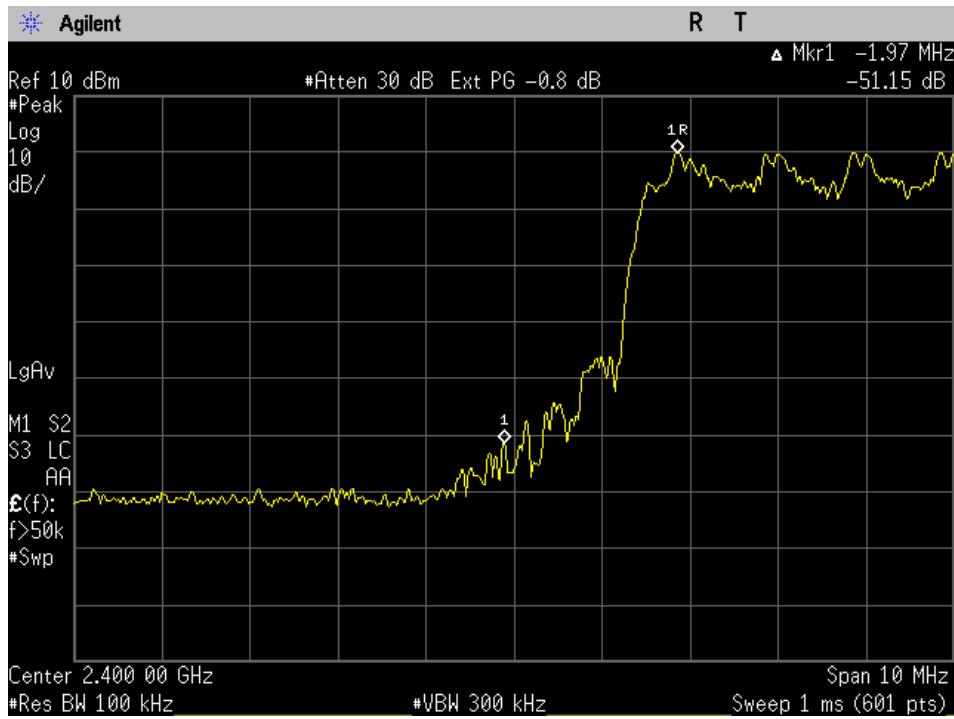


Figure 10-2b: EDR DQPSK Low band edge with hopping enabled.



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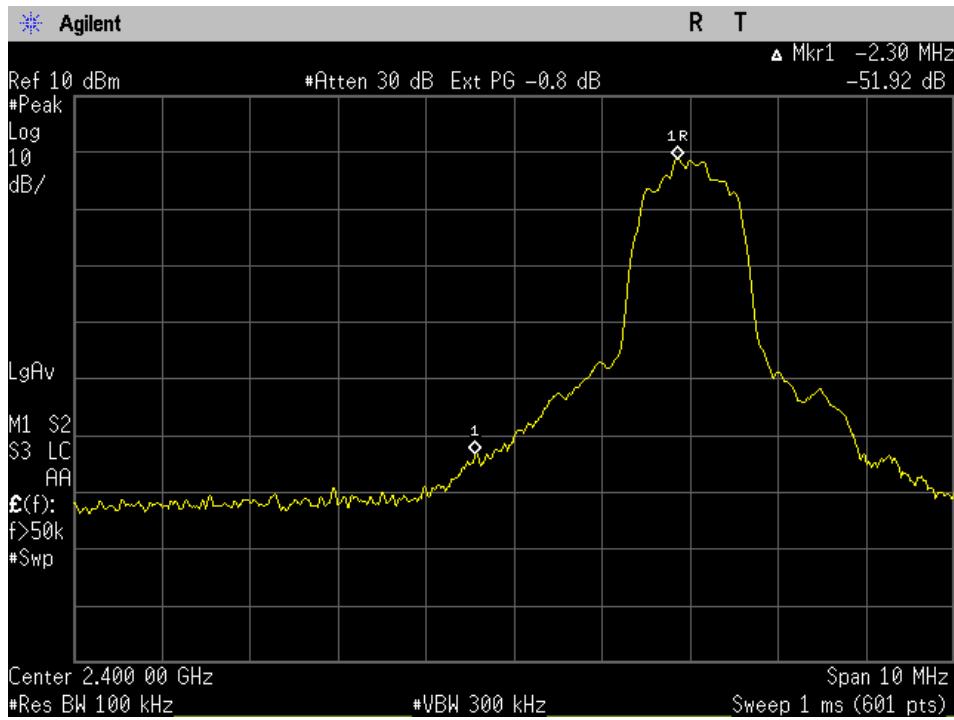


Figure 10-3a: EDR D8PSK Low band edge with hopping disabled.

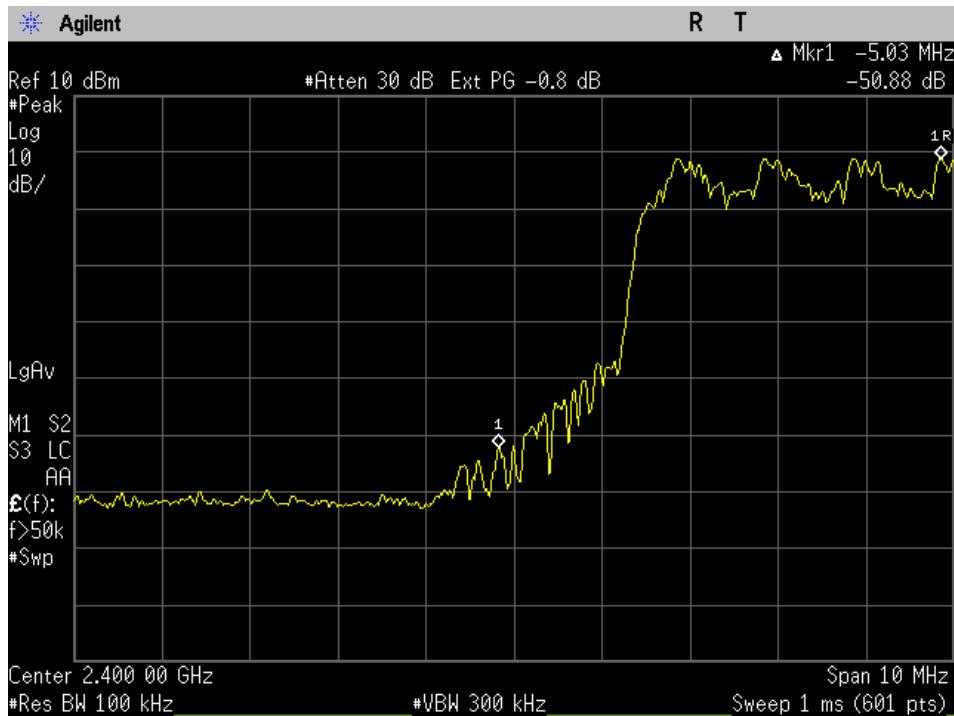


Figure 10-3b: EDR D8PSK Low band edge with hopping enabled.



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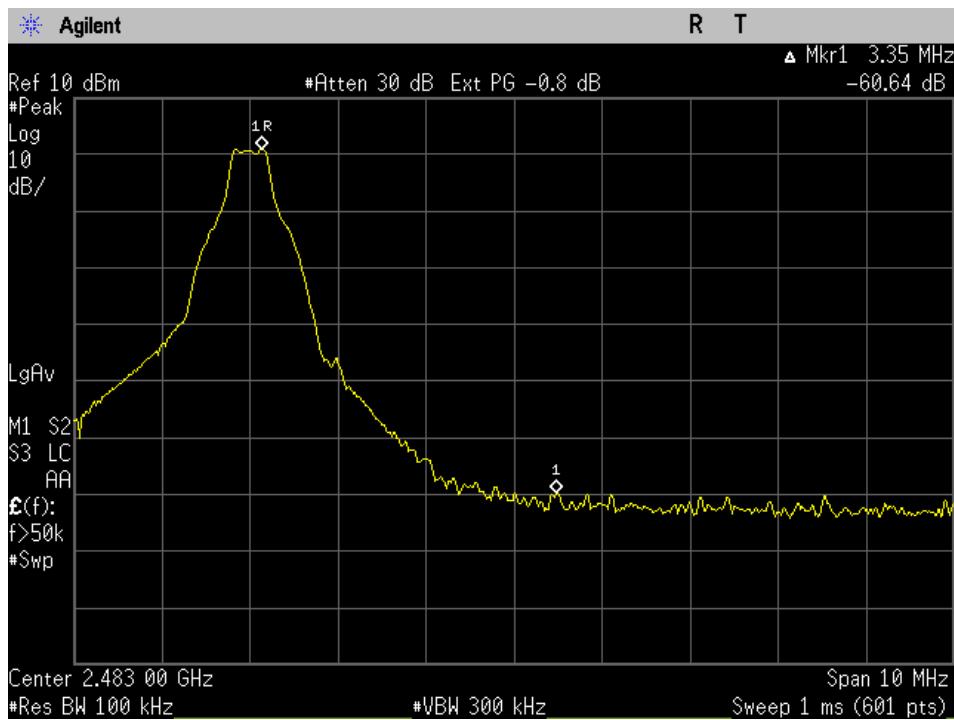


Figure 10-4a: Basic Rate High band edge with hopping disabled.

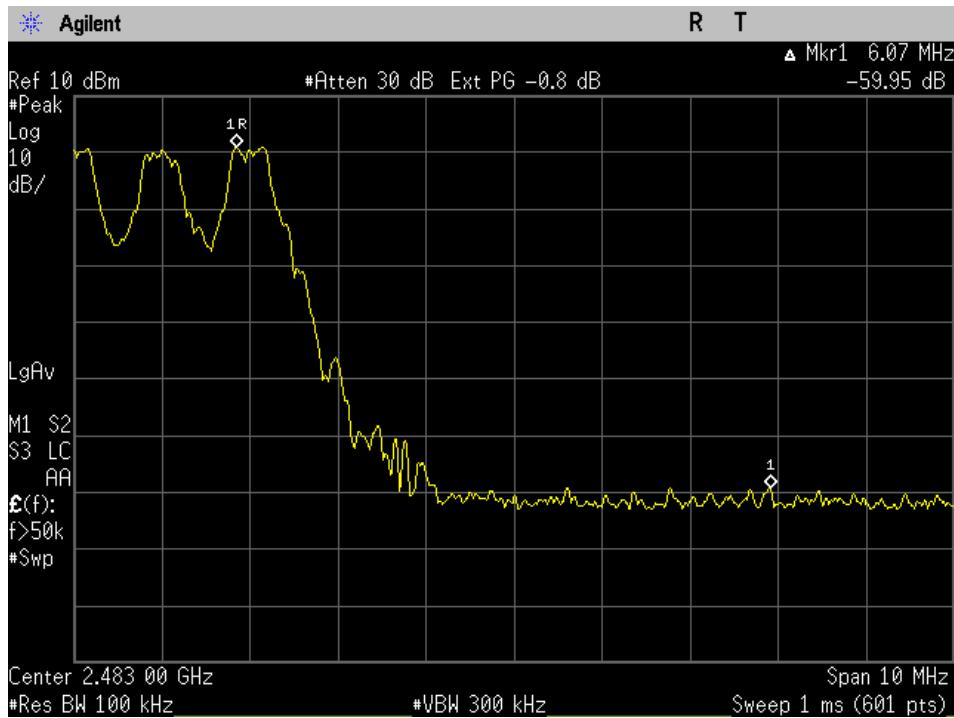


Figure 10-4b: Basic Rate High band edge with hopping enabled.



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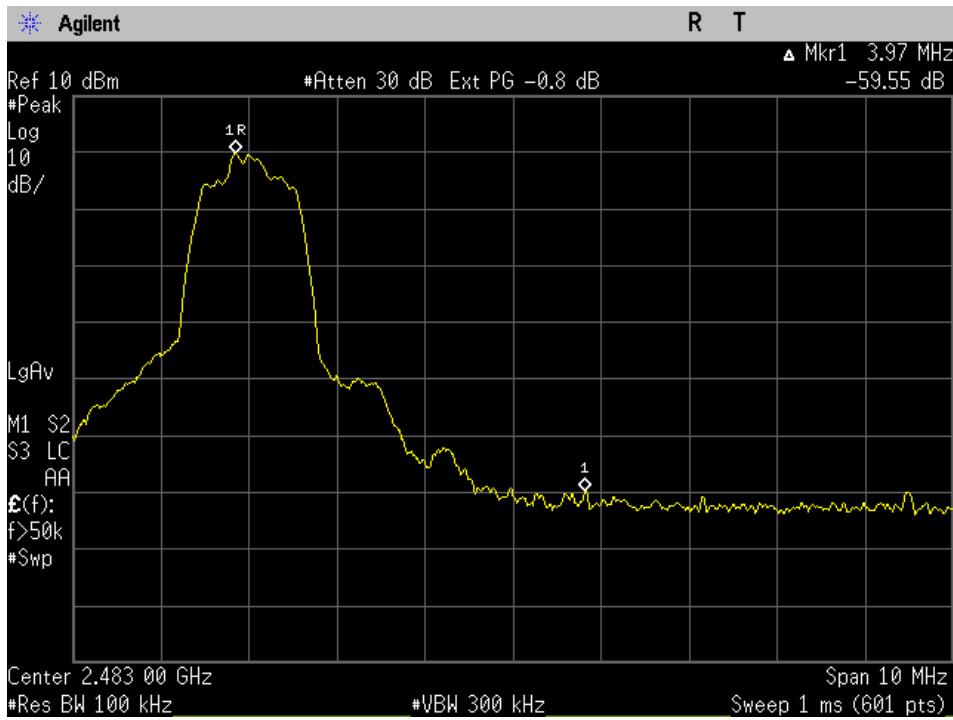


Figure 10-5a: EDR DQPSK High band edge with hopping disabled.

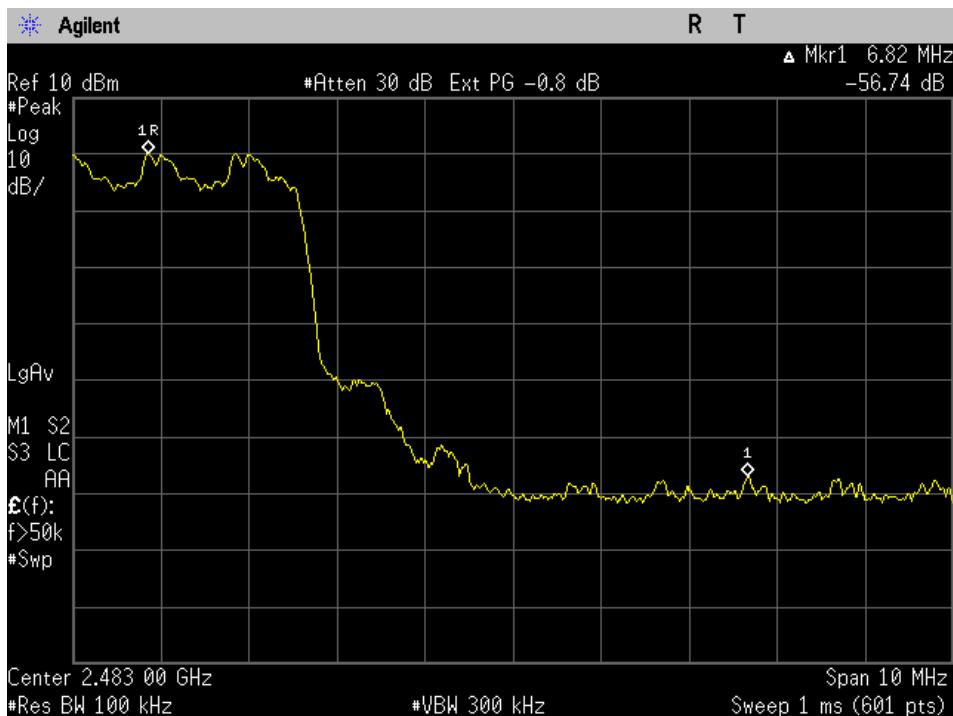


Figure 10-5b: EDR DQPSK High band edge with hopping enabled.



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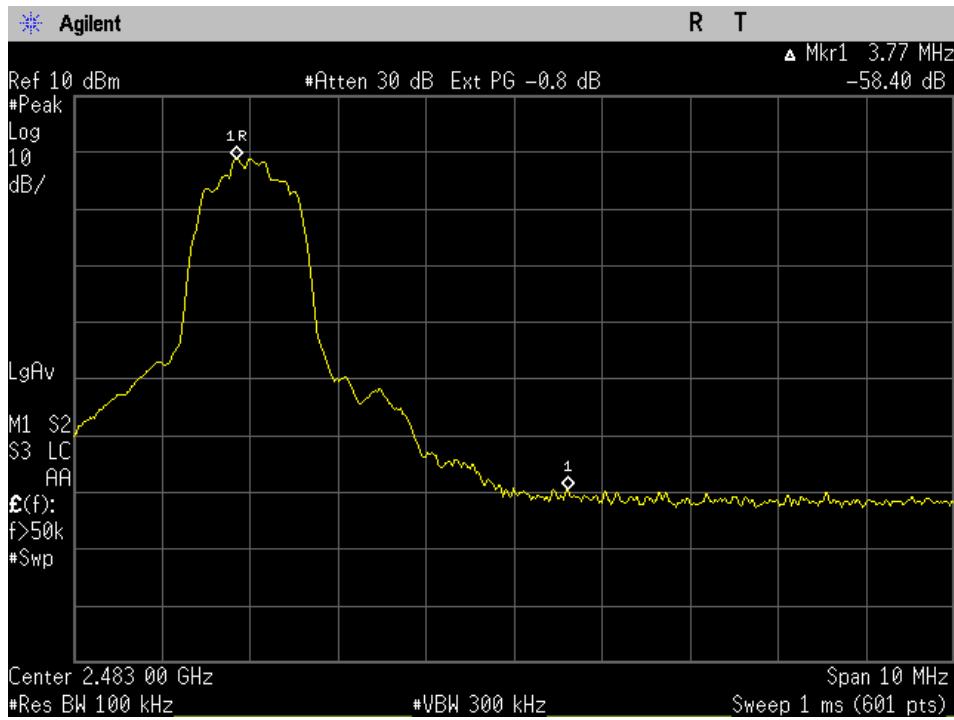


Figure 10-6a: EDR D8PSK High band edge with hopping disabled.

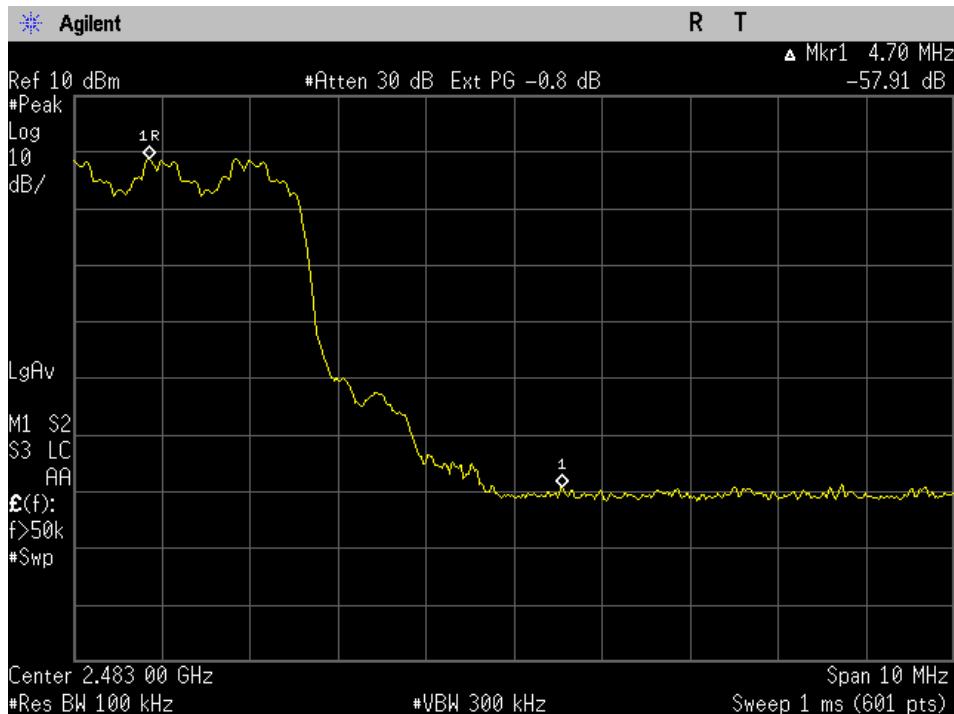


Figure 10-6b: EDR D8PSK High band edge with hopping enabled.



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## 11 SPURIOUS RF CONDUCTED EMISSIONS

### 11.1 Test Configuration

FCC:	§ 15.247(d)
IC:	RSS-210 §A8.5

The Bluetooth RF output port of the EUT was directly connected to the input of the spectrum analyzer with sufficient attenuation. Subsequently, the low, mid and high channels of Bluetooth transmitter were enabled separately and the frequency spectrum was investigated for any spurious emissions. A fully charged battery was used as supply voltage.

Spectrum Analyzer Parameters:

RBW=1MHz, VBW=1MHz, Span=300kHz, Sweep Time=coupled, Detector=Peak, Trace=Max hold

Tests were performed with 1MHz RBW instead of 100kHz to increase the measurement speed. In case emissions are near the limit, the frequencies were investigated with a reduced RBW.

Frequencies of Interest: Spectrum was investigated from 30MHz – 25 GHz.

Limits: <-20 dBc

### 11.2 Results: Conducted Spurious Emissions

Figure	Channel	Plot Description	Results (dBc)
11-1a	0	Conducted spurious emissions, 30MHz to 8GHz	-53.89
11-1b		Conducted spurious emissions, 8GHz to 25GHz	
11-2a	39	Conducted spurious emissions, 30MHz to 8GHz	-54.01
11-2b		Conducted spurious emissions, 8GHz to 25GHz	
11-3a	78	Conducted spurious emissions, 30MHz to 8GHz	-53.70
11-3b		Conducted spurious emissions, 8GHz to 25GHz	

Comments:

Spurious RF Conducted Emission testing was performed on the modulation that has the highest conducted power in comparison with the other modulation.



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FCC ID:	V65S1360
Report #:	CT-S1360-15C-0513-R0

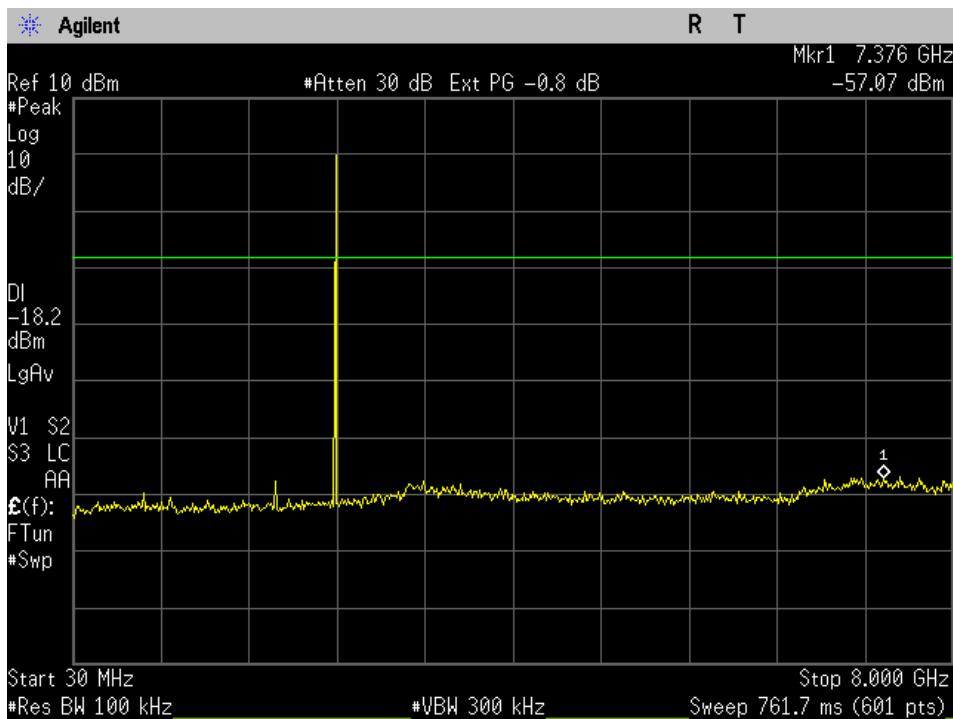


Figure 11-1a: Conducted Spurious Emissions (CH 0).

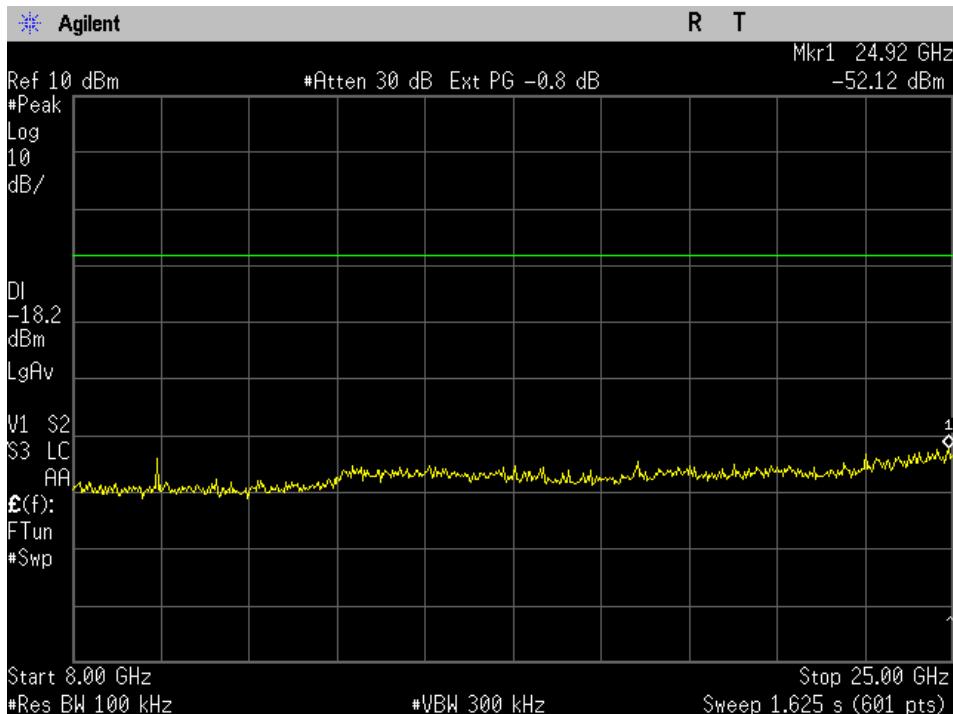
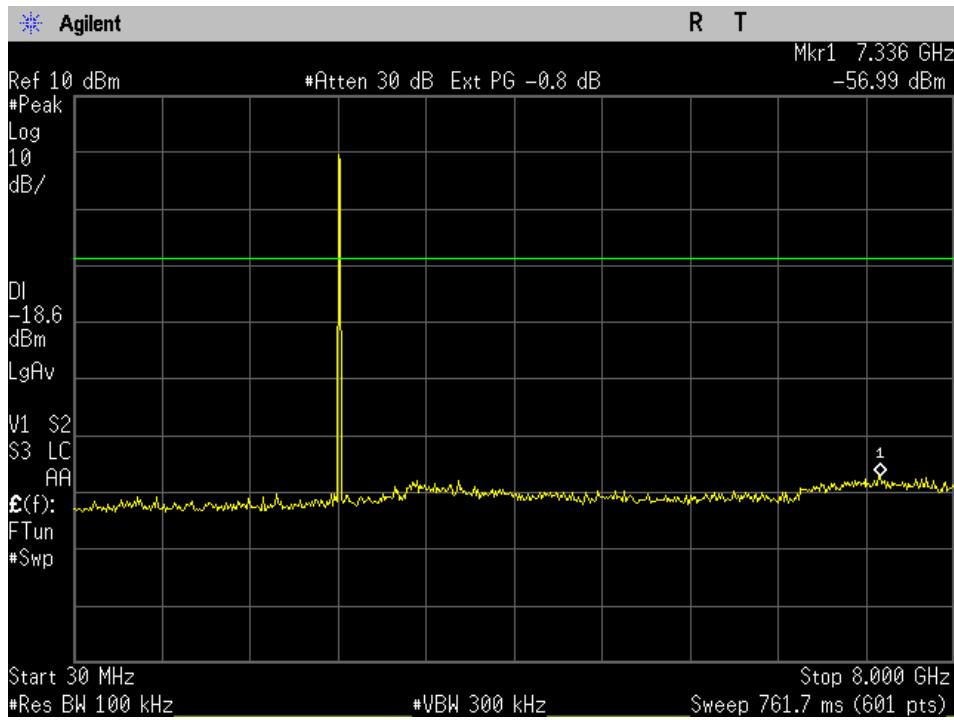


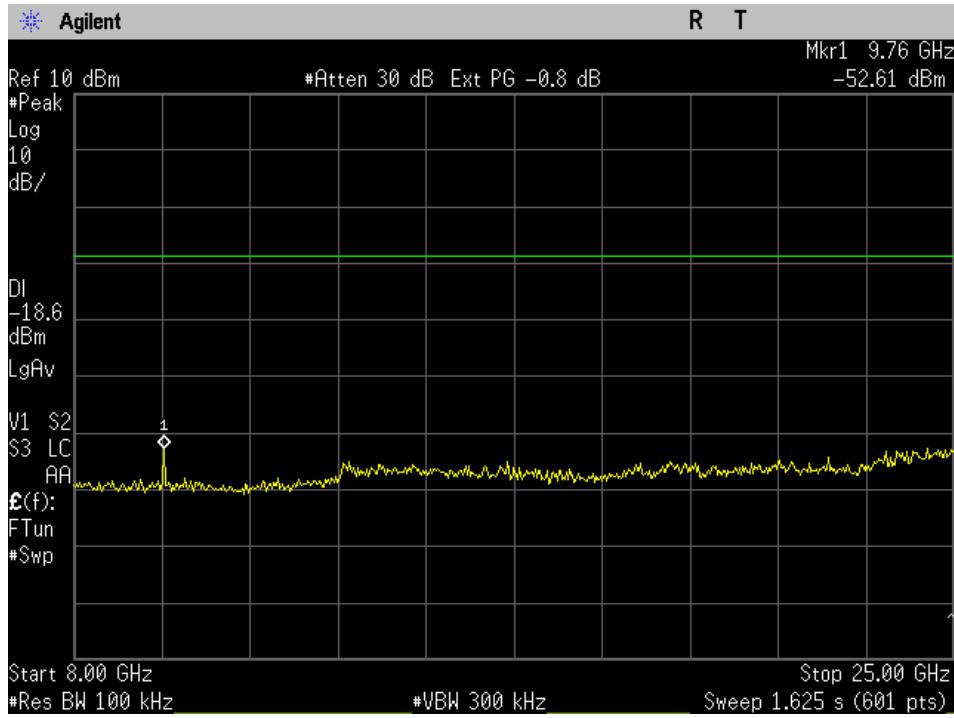
Figure 11-1b: Conducted Spurious Emissions (CH 0).



Applicant:	Kyocera
FCC ID:	V65S1360
Report #:	CT-S1360-15C-0513-R0



**Figure 11-2a: Conducted Spurious Emissions (CH 39).**



**Figure 11-2b: Conducted Spurious Emissions (CH 39).**



Applicant:	Kyocera
FCC ID:	V65S1360
Report #:	CT-S1360-15C-0513-R0

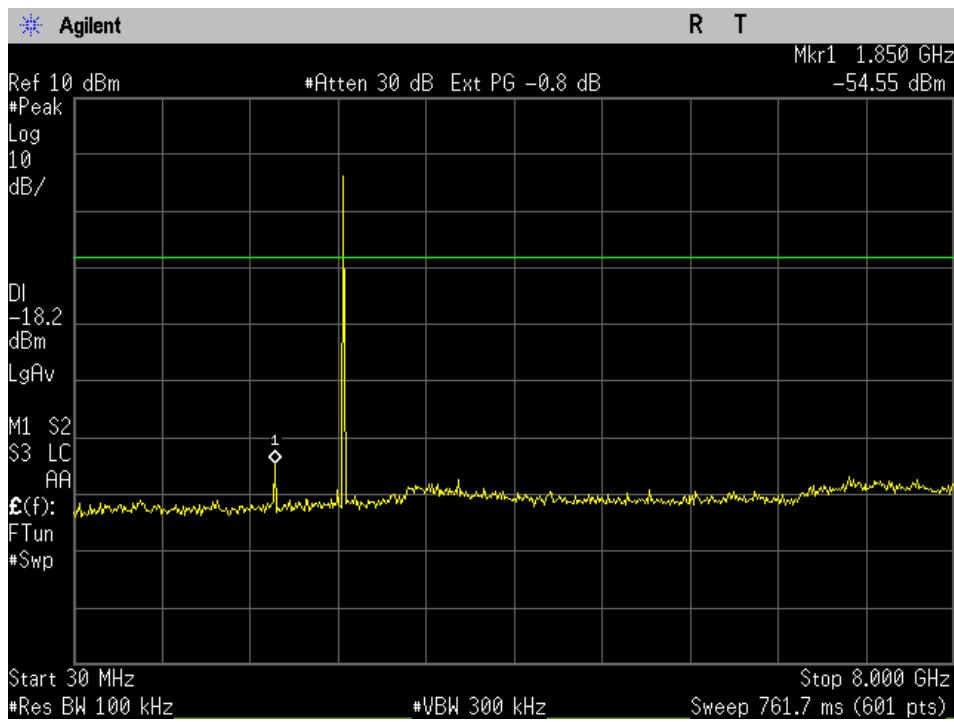


Figure 11-3a: Conducted Spurious Emissions (CH 78).

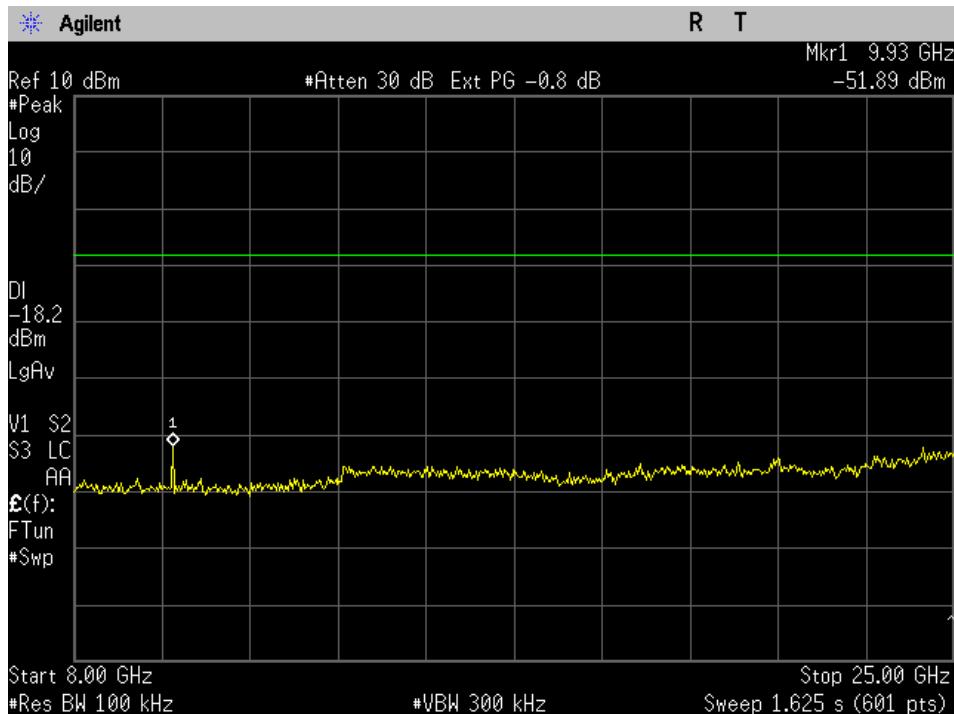


Figure 11-3b: Conducted Spurious Emissions (CH 78).



Applicant:	Kyocera
FCC ID:	V65S1360
Report #:	CT-S1360-15C-0513-R0

## 12 AC POWER LINE CONDUCTED EMISSIONS

### 12.1 Test Configuration & Results

FCC: § 15.207

IC: RSS-Gen §A7.2.2

See separate report

## 13 RADIATED EMISSIONS

### 13.1 Test Configuration & Results

FCC: § 15.209

IC: RSS-210 §A8.5

See separate report

## 14 TEST EQUIPMENT

The test equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations and is traceable to recognized national standards.

Description	Manufacturer	Model No.	Serial No.	Cal Due Date
Spectrum Analyzer	Agilent	E4440A	MY44303130	12/11/13