

CERTIFICATION TEST REPORT

Report Number.: 12081839-E2V2

Applicant: SONY MOBILE COMMUNICATIONS INC.

4-12-3 HIGASHI-SHINAGAWA, SHINAGAWA-KU

TOKYO, 140-0002, JAPAN

FCC ID: PY7-24118Q

EUT Description: GSM/WCDMA/LTE PHONE with BT, DTS/UNII a/b/g/n/ac & NFC

Test Standard(s): FCC 47 CFR PART 15 SUBPART C

Date Of Issue:

JANUARY 24, 2018

Prepared by:

UL Verification Services Inc. 47173 Benicia Street Fremont, CA 94538, U.S.A. TEL: (510) 771-1000

FAX: (510) 661-0888



Revision History

Rev.	Issue Date	Revisions	Revised By
V1	01/05/18	Initial Issue	
V2	01/24/18	Updated Section 5.5	Kiya Kedida

TABLE OF CONTENTS

1.	AT	TESTATION OF TEST RESULTS	5
2.	TES	ST METHODOLOGY	6
3.	FA	CILITIES AND ACCREDITATION	6
4.	CA	LIBRATION AND UNCERTAINTY	7
4	1.1.	MEASURING INSTRUMENT CALIBRATION	7
4	1.2.	SAMPLE CALCULATION	7
4	1.3.	MEASUREMENT UNCERTAINTY	
5.	EQ	UIPMENT UNDER TEST	8
5	5.1.	DESCRIPTION OF EUT	8
5	5.2.	MAXIMUM OUTPUT POWER	8
5	5.3.	DESCRIPTION OF AVAILABLE ANTENNAS	8
5	5.4.	SOFTWARE AND FIRMWARE	8
5	5.5.	WORST-CASE CONFIGURATION AND MODE	
_	5.1.	DESCRIPTION OF TEST SETUP	
6.	TES	ST AND MEASUREMENT EQUIPMENT	13
7.	AN	TENNA PORT TEST RESULTS	14
7	7.1.	BASIC DATA RATE GFSK MODULATION	
	7.1.		
	7.1. 7.1.		
	7.1.		
	7.1.		
	7.1.		
	7.1.		
	7.1.	.8. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS	31
7	7.2.		
	7.2		
	7.2. 7.2		
	7.2		
	7.2		
	7.2		
	7.2	.6. AVERAGE POWER	51
	7.2	.7. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS	52

8. R	ADIATE	D TEST	RESULTS	57
8.1.	LIMIT	S AND	PROCEDURE	57
8.2.			RATE GFSK MODULATION	
			CTED BANDEDGE (LOW CHANNEL)	
8.	.2.2. A	UTHOR	RIZED BANDEDGE (HIGH CHANNEL)	60
8.	.2.3. F	HARMO	NICS AND SPURIOUS EMISSIONS	62
8.3.	ENHA	ANCED	DATA RATE 8PSK MODULATION	68
8.	.3.1. F	RESTRIC	CTED BANDEDGE (LOW CHANNEL)	68
8.	.3.2. A	UTHOR	RIZED BANDEDGE (HIGH CHANNEL)	70
8.	.3.3. ⊢	IARMO	NICS AND SPURIOUS EMISSIONS	72
8.4.	WOR	ST-CAS	SE BELOW 30 MHz	78
8.5.	WOR	ST-CAS	SE BELOW 1 GHz	79
8.6.	WOR	ST-CAS	SE ABOVE 18 GHz	81
9. A	C POWE	ER LINE	CONDUCTED EMISSIONS	83
10.	SETUP	РНОТО	os	86

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SONY MOBILE COMMUNICATIONS INC.

4-12-3 HIGASHI-SHINAGAWA, SHINAGAWA-KU

TOKYO, 140-0002, JAPAN

EUT DESCRIPTION: GSM/WCDMA/LTE PHONE with BT, DTS/UNII a/b/g/n/ac, & NFC

SERIAL NUMBER: RADIATED: BH9000A7AW & BH90002TAW

CONDUCTED: BH9000BMAW & BH90003HAW

DATE TESTED: December 17 – 26, 2017

APPLICABLE STANDARDS

STANDARD TEST RESULTS

CFR 47 Part 15 Subpart C Complies

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For UL Verification Services Inc By:

Prepared By:

Dan Coronia

Operations Leader

UL Verification Services Inc.

Kiya Kedida Project Engineer

UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street
	☐ Chamber D(IC: 22541-1)
	☐ Chamber E(IC: 22541-2)
Chamber C(IC: 2324B-3)	☐ Chamber F(IC: 22541-3)
	☐ Chamber G(IC: 22541-4)
	☐ Chamber H(IC: 22541-5)

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. Chambers A through C are covered under Industry Canada company address code 2324B with site numbers 2324B -1 through 2324B-3, respectively. Chambers D through H are covered under Industry Canada company address code 22541 with site numbers 22541 -1 through 22541-5, respectively.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring 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.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB) 36.5 dBuV + 18.7 dB/m + 0.6 dB - 26.9 dB = 28.9 dBuV/m

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.84 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	3.15 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	5.36 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.32 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.45 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.24 dB

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a GSM/WCDMA/LTE Phone with BT, DTS/UNII a/b/g/n/ac, & NFC.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range	Mode	Output Power	Output Power
(MHz)		(dBm)	(mW)
2402 - 2480	Basic GFSK	11.51	14.16
2402 - 2480	Enhanced 8PSK	10.00	10.00

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes the Loop antenna, with the maximum gains:

Frequency Band (GHz)	Antenna Gain (dBi)	
2402-2480	-3.94	

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was SONY, s_atp_1_00139_B_10_5. The test utility software used during testing was Tera Term Ver 4.79.

5.5. WORST-CASE CONFIGURATION AND MODE

Radiated band edge, harmonics, and spurious emissions from 1 GHz to 18GHz were performed with the EUT was set to transmit at the Low/Middle/High channels.

Radiated emission below 30MHz, below 1GHz, above 18GHz, and power line conducted emission were performed with the EUT was set to transmit at the channel with highest output power as worst-case scenario.

The fundamental of the EUT was investigated in three orthogonal orientations X, Y, & Z, using the following two configurations, AC/DC Adapter and headphone. It was determined that Y-Axis with only AC/DC Adapter was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y-Axis with AC/DC Adapter orientation.

Worst-case data rates were:

GFSK mode: DH5 8PSK mode: 3-DH5

DQPSK mode has been verified to have the lowest power.

5.1. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List							
Description Manufacturer Model Serial Number FCC ID							
Laptop	Lenovo	20B7S0A200	PC015REW	NA			
AC Adapter	SONY	1309-8864.1	VB17W46601037	NA			
DC Power Supply	Ametek	XT 15-4	T463	NA			

I/O CABLES (CONDUCTED TEST)

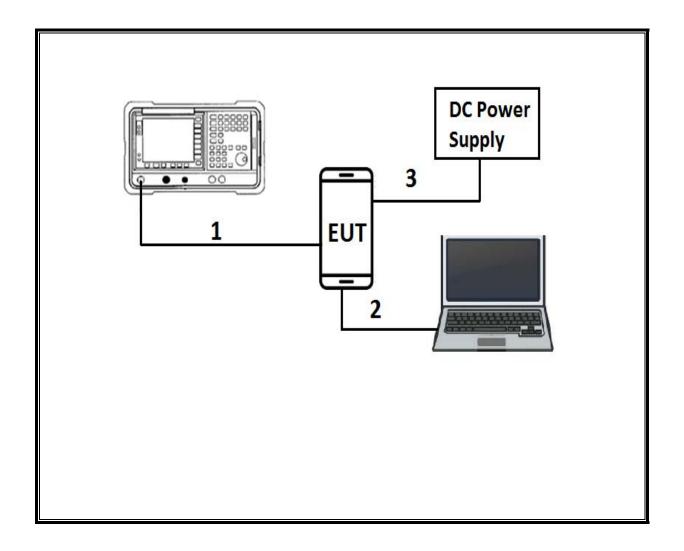
	I/O Cable List							
Cable Port # of identical Connector Cable Type Cable Remarks					Remarks			
No		ports	Туре		Length (m)			
1	Antenna	1	RF	Shielded	0.2	To spectrum Analyzer		
2	USB	1	USB	Shielded	1	N/A		
3	DC	1	DC	Shielded	0.3	N/A		

I/O CABLES (RADIATED AND CONDUCTED EMISSIONS)

	I/O Cable List						
Cable No							
1	USB	1	USB	Shielded	3	N/A	

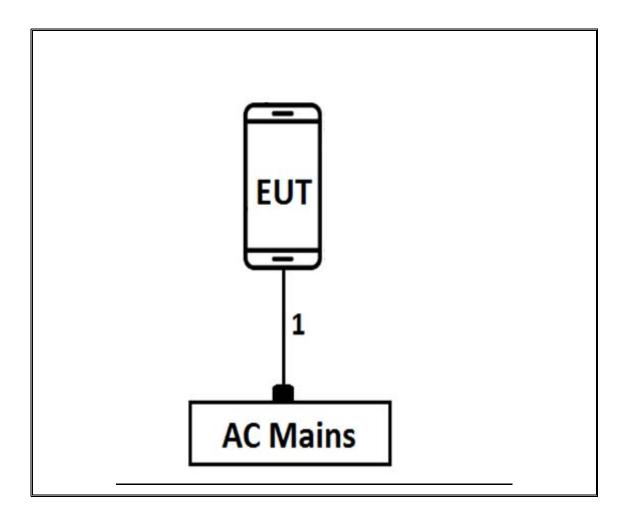
TEST SETUP

CONDCUTED TEST SETUP DIAGRAM



TEST SETUP

RADIATED AND AC LINE CONDUCTED EMISSIONS SETUP DIAGRAM



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

TEST EQUIPMENT LIST						
Description	Manufacturer	Model	Asset	Cal Due		
Antenna, Broadband Hybrid, 30MHz to 2000MHz w/4dB Pad	Sunol Sciences Corp.	JB3	T130	10/06/2018		
Antenna, Active Loop 9kHz-30MHz	Com-Power Corp.	AL-130R	T1866	10/10/2018		
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T862	06/09/2018		
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T346	03/28/2018		
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T712	01/30/2018		
Antenna, Horn 18-26.5GHz	ARA	MWH-1826	T89	01/04/2018		
Power Meter, P-series single channel	Agilent (Keysight) Technologies	N1911A	T1268	06/15/2018		
Power Sensor, P – series, 50MHz to 18GHz, Wideband	Agilent (Keysight) Technologies	N1921A	T1223	03/29/2018		
Amplifier, 1 - 18GHz	MITEQ	AFS42-00101800-25- S-42	T1165	11/25/2018		
Amplifier, 1 - 18GHz	MITEQ	AFS42-00101800-25- S-42	T931	09/20/2018		
Amplifier, 1 - 18GHz	MITEQ	AFS42-00101800-25- S-42	T493	06/23/2018		
Pre Amplifier, 1-26.5GHz	Agilent	8449B	T404	7/23/2018		
Amplifier, 10kHz-1GHz	Agilent (Keysight) Technologies	8447D	T15	08/14/2018		
Amplifier, 1-8GHz	MITEQ	AMF-4D-01000800- 30-29P	T1156	06/24/2018		
Amplifier, 1-8GHz	MITEQ	AMF-4D-01000800- 30-29P	T1573	11/25/2018		
Filter, HPF 3.0GHz	MICRO-TRONICS	HPM17543	T486	11/25/2018		
Filter, HPF 3.0GHz	MICRO-TRONICS	HPM17543	T485	6/24/2018		
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1210	07/17/2018		
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T905	01/11/2018		
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1466	04/11/2018		
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T907	01/23/2018		
Test Receiver, EMI, 10Hz-7GHz	Rhode&Schwarz	ESR	T1436	01/06/2018		
LISN	FISCHER	FCC-LISN-50/250-25- 2-01	T1310	01/17/2018		

Test Software List							
Description Manufacturer Model Version							
Radiated Software	UL	UL EMC	Ver 9.5, Dec 01, 2016				
Conducted Software	UL	UL EMC	Ver 9.5, May 26, 2015				
Antenna Port Software	UL	UL RF	Ver 7.7, Dec 14, 2017				

NOTE: *testing is completed before equipment calibration expiration date.

7. ANTENNA PORT TEST RESULTS

ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

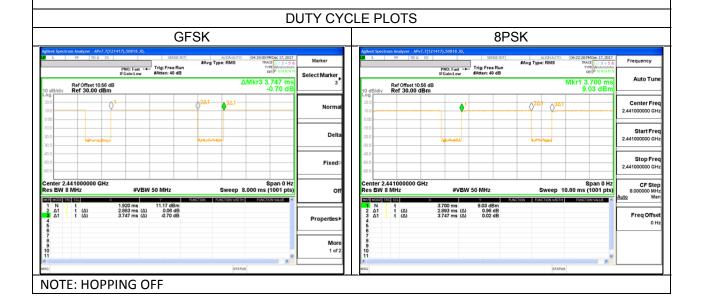
PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

ON TIME AND DUTY CYCLE RESULTS						
Mode	ON Time	Period	Duty Cycle	Duty	Duty Cycle	1/T
	В		х	Cycle	Correction Factor	Minimum VBW
	(msec)	(msec)	(linear)	(%)	(dB)	(kHz)
GFSK	2.883	3.747	0.769	76.94%	1.14	0.347
8PSK	2.893	3.747	0.772	77.21%	1.12	0.346

ON TIME AND DUTY OVOLE DECLIL TO



7.1. BASIC DATA RATE GFSK MODULATION

7.1.1. 20 dB BANDWIDTH

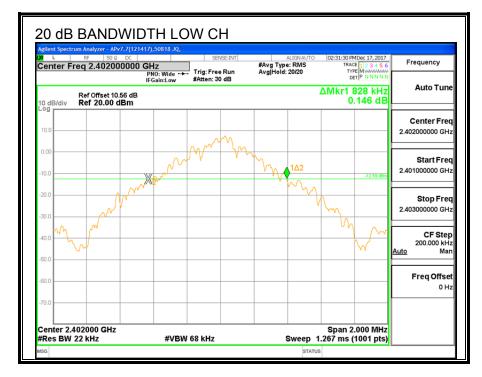
LIMITS

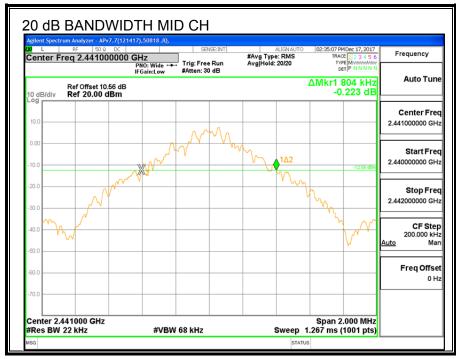
None; for reporting purposes only.

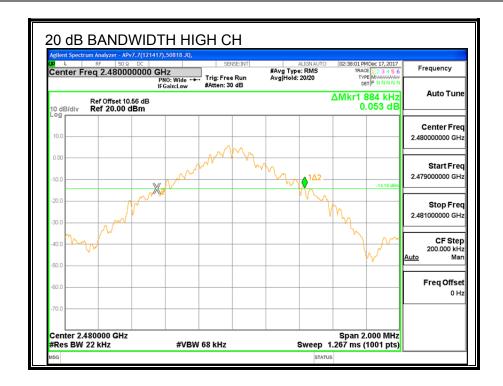
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to \geq 1% of the 20 dB bandwidth. The VBW is set to \geq RBW. The sweep time is coupled.

Channel	Frequency (MHz)	20 dB Bandwidth (KHz)	
Low	2402	828	
Middle	2441	804	
High	2480	884	







7.1.2. 99% BANDWIDTH

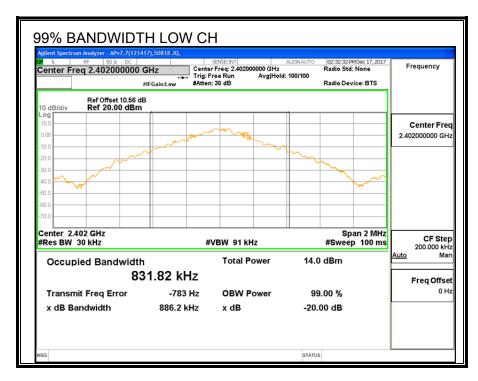
LIMITS

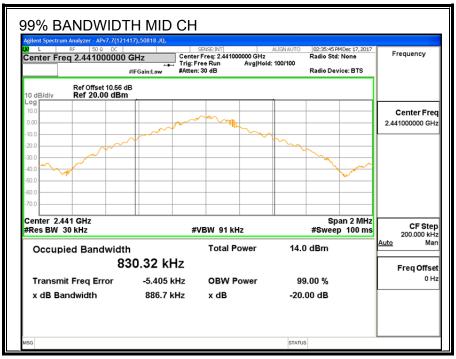
None; for reporting purposes only.

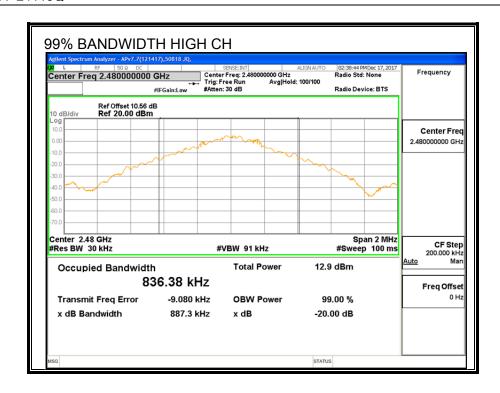
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 1%-5% the OBW. The VBW is set to \geq 3 times RBW. The sweep time is coupled.

Channel	Frequency (MHz)	99% Bandwidth (KHz)
Low	2402	831.82
Middle	2441	830.32
High	2480	836.38







7.1.3. HOPPING FREQUENCY SEPARATION

LIMITS

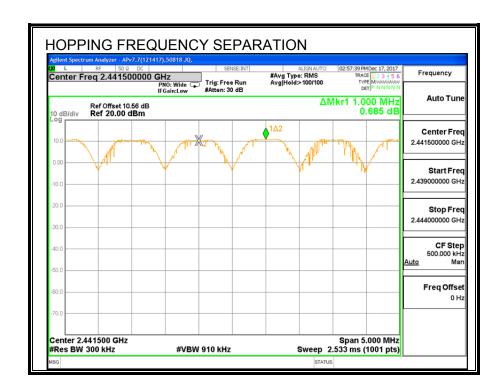
FCC §15.247 (a) (1)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hoping channel, whichever is greater.

Alternatively, 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, provided the systems operate with an output power no greater than 125 mW.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to 910 kHz. The sweep time is coupled.



7.1.4. NUMBER OF HOPPING CHANNELS

LIMITS

FCC §15.247 (a) (1) (iii)

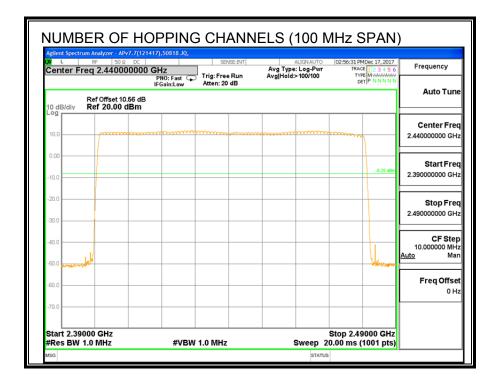
Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

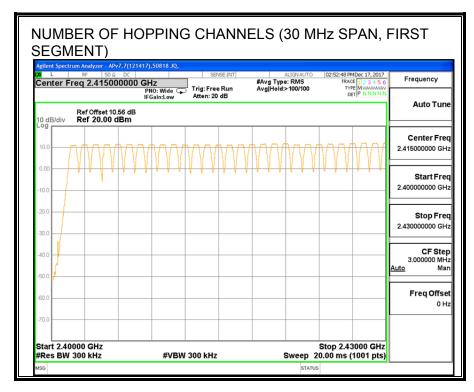
TEST PROCEDURE

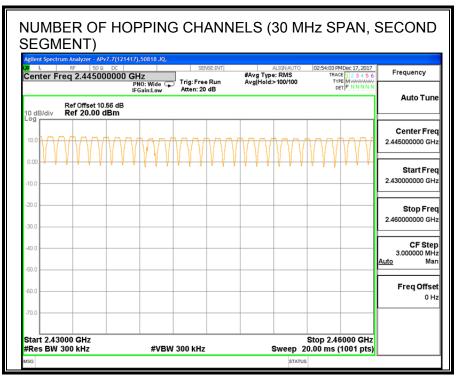
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

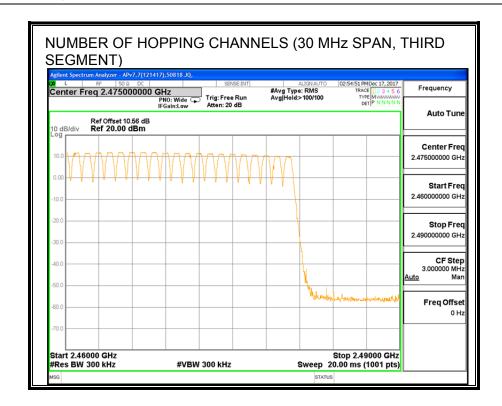
RESULTS

Normal Mode: 79 Channels observed.









DATE: JANUARY 24, 2018

7.1.5. AVERAGE TIME OF OCCUPANCY

LIMITS

FCC §15.247 (a) (1) (iii)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

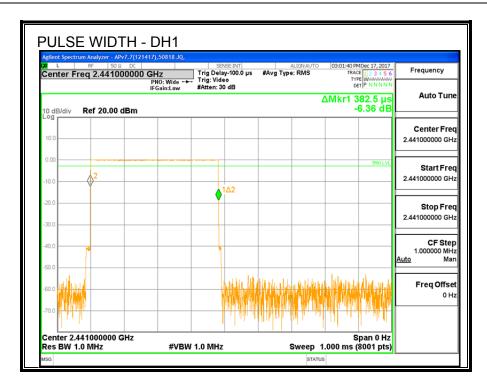
TEST PROCEDURE

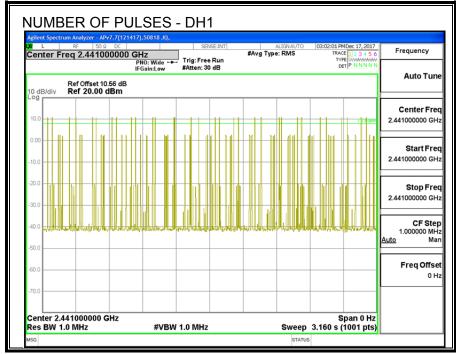
The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

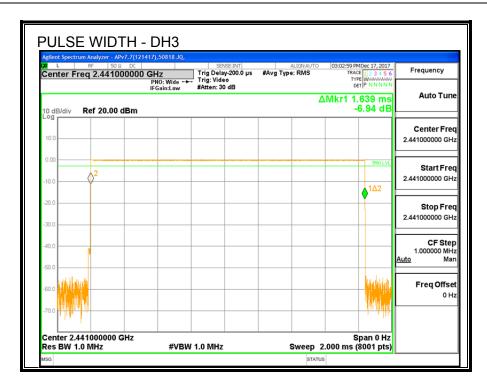
The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to 10 * (# of pulses in 3.16 s) * pulse width.

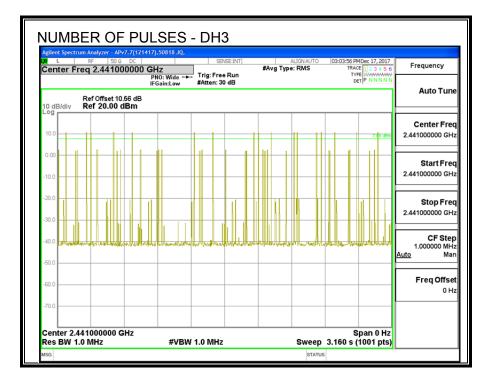
For AFH mode, the average time of occupancy in the specified 8 second period (20 channels * 0.4 seconds) is equal to 10 * (# of pulses in 0.8 s) * pulse width.

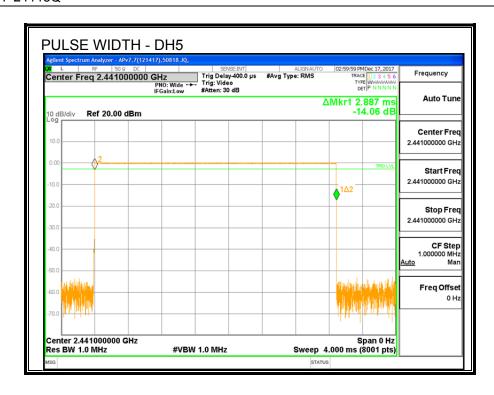
	AVERAGE TIME OF OCCUPANCY					
DH Pack	et Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)	
GFSK No	rmal Mode					
DH1	0.383	31	0.1186	0.4	-0.2814	
DH3	1.639	17	0.2786	0.4	-0.1214	
DH5	2.887	14	0.4042	0.4	0.0042	
DH Pack	et Pulse Width (sec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)	
GFSK AF	GFSK AFH Mode					
DH1	0.383	7.75	0.02964	0.4	-0.3704	
DH3	1.639	4.25	0.06966	0.4	-0.3303	
DH5	2.887	3.5	0.10105	0.4	-0.2990	
IOTE:						

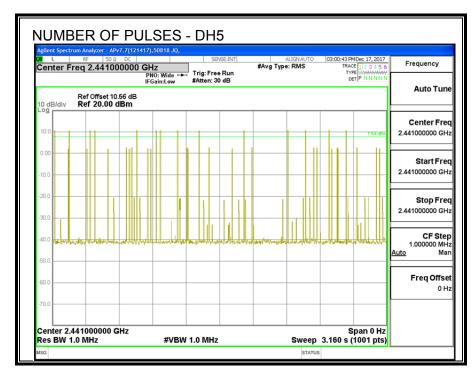












REPORT NO: 12081839-E2V2 FCC ID: PY7-24118Q

7.1.6. OUTPUT POWER

LIMITS

§15.247 (b) (1)

The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.6 dB (consisting of 10 dB pad and 0.6 dB cable) is entered as an offset in the power meter to enable direct reading of the power. The power meter is gated to measure peak power during the ON time of the transmitter.

RESULTS

TEST ENGINEER:	12506 JM	Date:	12/19/2017
-------------------	----------	-------	------------

Channel	Frequency	Output Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	11.51	30	-18.49
Middle	2441	11.49	30	-18.51
High	2480	10.11	30	-19.89

DATE: JANUARY 24, 2018

7.1.7. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.6 dB (consisting of 10 dB pad and 0.6 dB cable) is entered as an offset in the power meter to enable direct reading of the power. The power meter is gated to measure average power during the ON time of the transmitter.

TEST ENGINEER:	12506 JM	Date:	12/19/2017
-------------------	----------	-------	------------

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	11.28
Middle	2441	11.24
High	2480	10.04

REPORT NO: 12081839-E2V2 FCC ID: PY7-24118Q

7.1.8. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

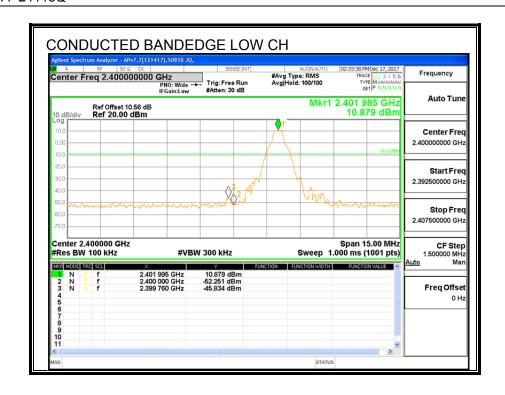
TEST PROCEDURE

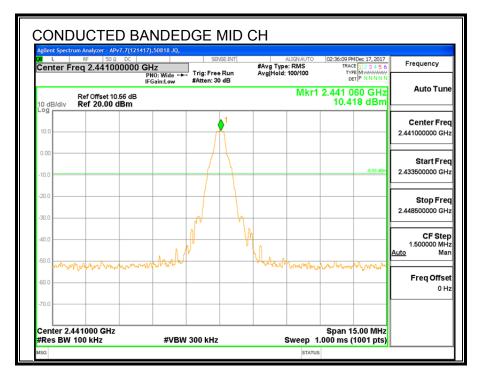
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

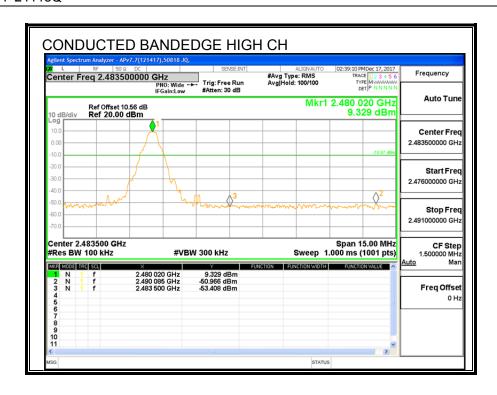
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

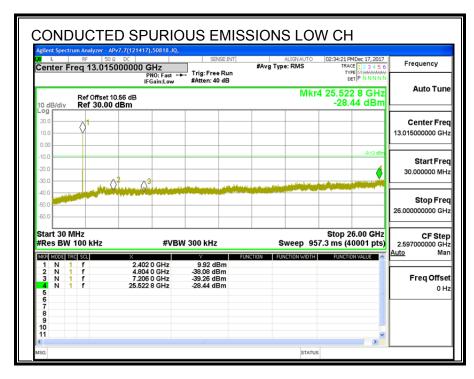
The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

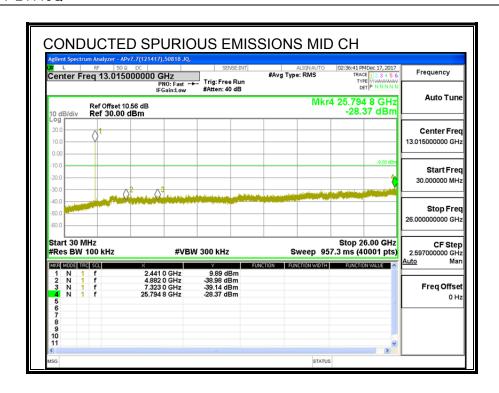
DATE: JANUARY 24, 2018

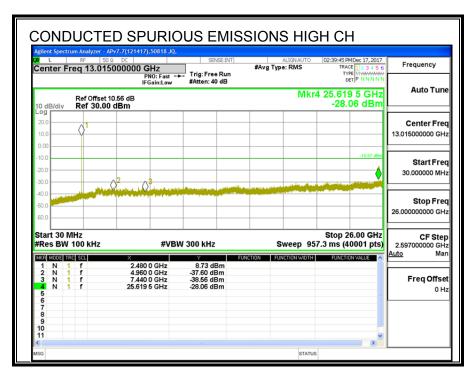


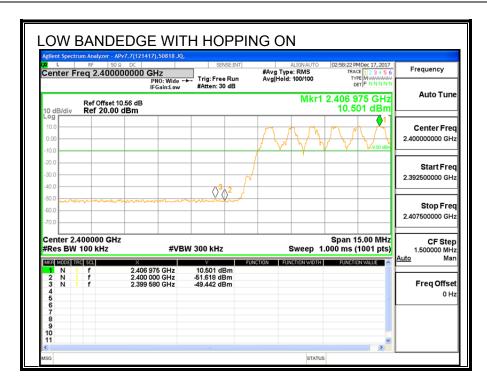


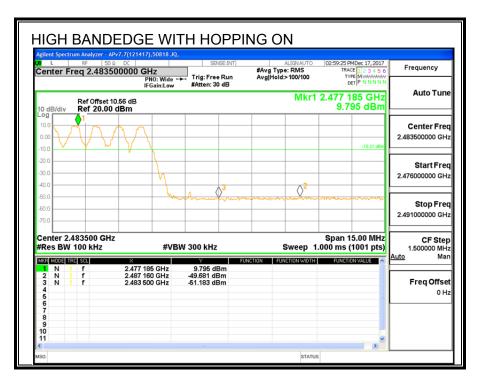












7.2. ENHANCED DATA RATE 8PSK MODULATION

7.2.1. 20 dB BANDWIDTH

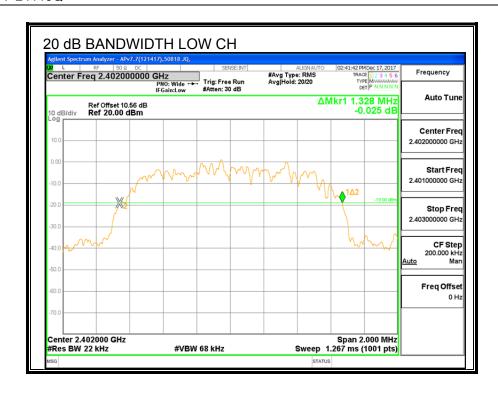
LIMITS

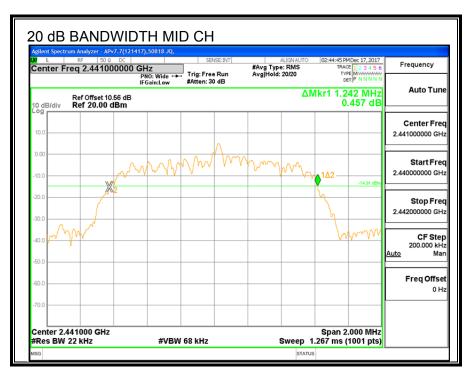
None; for reporting purposes only.

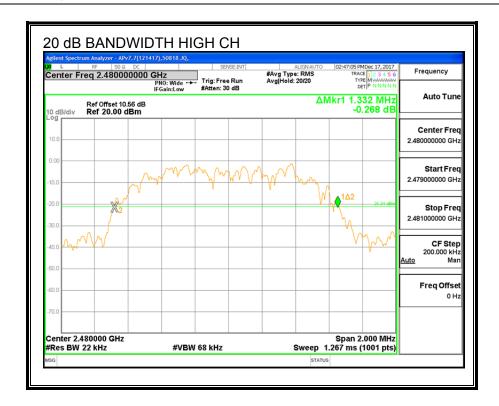
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to \geq 1% of the 20 dB bandwidth. The VBW is set to \geq RBW. The sweep time is coupled.

Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	
Low	2402	1.328	
Middle	2441	1.242	
High	2480	1.332	







7.2.1. 99% BANDWIDTH

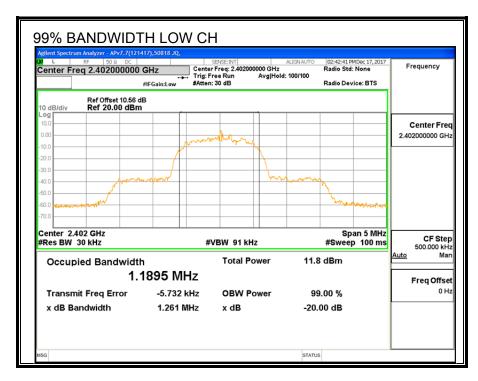
LIMITS

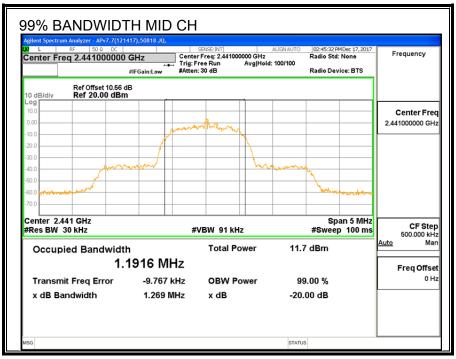
None; for reporting purposes only.

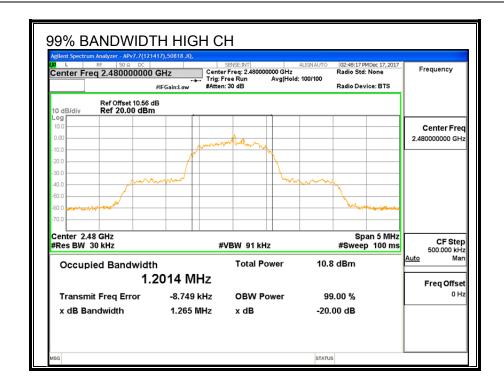
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 1%-5% the OBW. The VBW is set to \geq 3 times RBW. The sweep time is coupled.

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.1895
Middle	2441	1.1916
High	2480	1.2014







7.2.2. HOPPING FREQUENCY SEPARATION

LIMITS

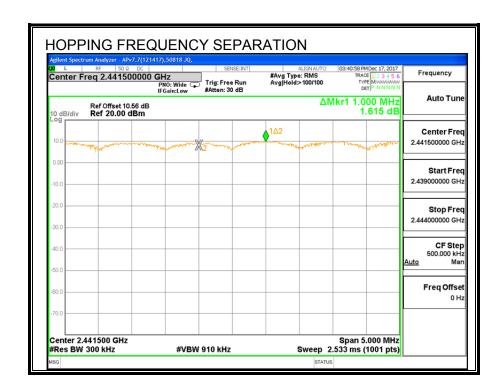
FCC §15.247 (a) (1)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hoping channel, whichever is greater.

Alternatively, 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, provided the systems operate with an output power no greater than 125 mW.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to 910 kHz. The sweep time is coupled.



7.2.3. NUMBER OF HOPPING CHANNELS

LIMITS

FCC §15.247 (a) (1) (iii)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

Normal Mode: 79 Channels observed.

