

# **CERTIFICATION TEST REPORT**

# **Report Number. :** 12204475-E1V3

- Applicant : APPLE, INC. 1 APPLE PARK WAY CUPERTINO, CA 95014, U.S.A.
  - **Model :** A2098
  - FCC ID : BCG-E3233A
    - IC : 579C-E3233A
- EUT Description : SMARTPHONE
- Test Standard(s) : FCC 47 CFR PART 15 SUBPART C IC RSS-247 ISSUE 2

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NVLAP LAB CODE 200065-0

# **REPORT REVISION HISTORY**

Rev.	lssue Date	Revisions	Revised By
V1	7/17/2018	Initial Issue	Chin Pang
V2	7/19/2018	Address TCB's Questions	Chin Pang
V3	8/10/2018	Address TCB's Questions	Jingang Li

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### **1. ATTESTATION OF TEST RESULTS**

COMPANY NAME:	APPLE, INC. 1 APPLE PARK WAY CUPERTINO, CA 95014, U.S.A.
EUT DESCRIPTION:	SMARTPHONE
MODEL:	A2098
SERIAL NUMBER:	C39WF025JVW1
DATE TESTED:	JANUARY 29, 2018 – JULY 23, 2018

APPLICABLE STANDARDS					
STANDARD	TEST RESULTS				
CFR 47 Part 15 Subpart C	Complies				
ISED RSS-247 Issue 2	Complies				
ISED RSS-GEN Issue 5	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 the U.S. government.

Approved & Released For UL Verification Services Inc. By:

Chin Pany

Chin Pang CONSUMER TECHNOLOGY DIVISION Senior Engineer UL Verification Services Inc.

Prepared By:

Jingey L

Jingang Li CONSUMER TECHNOLOGY DIVISION Lab Engineer UL Verification Services Inc.

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### 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, RSS-GEN Issue 5, and RSS-247 Issue 2.

### 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 A (ISED:2324B-1)	Chamber D (ISED:22541-1)
Chamber B (ISED:2324B-2)	Chamber E (ISED:22541-2)
Chamber C (ISED:2324B-3)	Chamber F (ISED:22541-3)
	Chamber G (ISED:22541-4)
	Chamber H (ISED:22541-5)

The above test sites and facilities are covered under FCC Test Firm Registration *#* 208313. Chambers A through C is covered under ISED company address code 2324B with site numbers 2324B -1 through 2324B-3, respectively. Chambers D through H are covered under ISED company address code 22541 with site numbers 22541 -1 through 22541-5, respectively.

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. The full scope of accreditation can be viewed at <u>NVLAP Lab Search</u>.

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### 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. EUT DESCRIPTION

The Apple iPhone, is a smartphone with multimedia functions (music, application support, and video), cellular GSM, GPRS, EGPRS, UMTS, LTE, TD-SCDMA, CDMA, IEEE 802.11a/b/g/n/ac, Bluetooth, GPS and NFC. All models support at least one UICC based SIM. The second SIM is either UICC based, electronic SIM (e-SIM), or second SIM is not present. The device has a built-in inductive charging receiver which is not user accessible. The rechargeable battery is not user accessible.

### 5.2. MAXIMUM OUTPUT POWER

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

Antenna	Config	Frequency Range Mode		Output Power	Output Power
		(MHz)		(dBm)	(mW)
		2402 - 2480	Basic GFSK	16.90	48.98
	High Power	2402 - 2480	DQPSK	19.04	80.17
Ant 4		2402 - 2480	Enhanced 8PSK	19.10	81.28
AIIL 4		2402 - 2480	Basic GFSK	11.40	13.80
	Low Power	2402 - 2480	DQPSK	10.05	10.12
		2402 - 2480	Enhanced 8PSK	10.16	10.38
		2402 - 2480	Basic GFSK	20.08	101.86
	High Power	2402 - 2480	DQPSK	20.02	100.46
Ant 2		2402 - 2480	Enhanced 8PSK	20.03	100.69
AIIL 5	Low Power	2402 - 2480	Basic GFSK	11.12	12.94
		2402 - 2480	DQPSK	10.03	10.07
		2402 - 2480	Enhanced 8PSK	10.08	10.19

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

Frequency Range	Ant. 4	Ant.3
(GHz)	(dBi)	(dBi)
2.4	-2.8	-4.1

### 5.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was v16.30.67.7

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### 5.5. WORST-CASE CONFIGURATION AND MODE

The EUT was investigated in three orthogonal orientations X, Y and Z on Ant 3 (Antenna 3) and Ant 4 (Antenna 4), it was determined that Z (Portrait) orientation was the worst-case orientation for Ant 4 and Ant 3.

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

Radiated emissions below 30MHz, below 1GHz, 18-26GHz and power line conducted emissions were performed with the EUT transmits at the channel with the highest output power as worst-case scenario

For below 1GHz tests EUT was connected to AC power adapter as the worst case; and for above 1GHz, the worst-case configuration reported was tested with EUT only. There were no emissions found below 30MHz within 20dB of the limit. For AC line conducted emission, test was investigated with AC power adapter and with laptop.

For simultaneous transmission of multiple channels in the 2.4GHz BT and 5GHz bands, No noticeable new emission was found

GFSK, DQPSK, 8PSK average power are all investigated, The GFSK & 8PSK power are the worst case. For average power data please refer to section 8.7.

Worst-case data rates as provided by the client were:

GFSK mode: DH5 8PSK mode: 3-DH5

There are two vendors of the WiFi/Bluetooth radio modules: variant 1 and variant 2. The Wi-Fi/Bluetooth radio modules have the same mechanical outline (e.g., the same package dimension and pin-out layout), use the same on-board antenna matching circuit, have an identical antenna structure, and are built and tested to conform to the same specifications and to operate within the same tolerances.

Baseline testing was performed on the two variants to determine the worst case on all conducted power and radiated emissions.

Bluetooth RF output path is switched when the power exceeds 11dBm. Measurements were made therefore at the maximum power setting (with amplifier switched in) and also at the 11dBm power level (amplifier switched out), and they are the high power and low power modes documented in this report respectively.

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### 5.6. DESCRIPTION OF TEST SETUP

#### SUPPORT EQUIPMENT

Support Equipment List							
Description Manufacturer Model Serial Number FCC ID							
Laptop	Apple	A1398	C02PM012G3QD	FCC DoC			
AC/DC power Adapter	Delta Electronic	A1435	N/A	N/A			
EUT AC/DC Adapter	Apple	A1385	D293062F3WVDHLHCF	NA			

#### I/O CABLES

I/O Cable List								
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks		
1	Antenna	1	SMA	Un-Shielded	0.2	To spectrum Analyzer		
2	USB	1	USB	Shielded	1	N/A		
3	AC	1	AC	Un-shielded	2	N/A		

#### I/O CABLES (RADIATED ABOVE 1 GHZ)

I/O Cable List							
Cable No	CablePort# of identical portsConnectorCable TypeCableRemarksNoportsTypeLength (m)						
None Used							

#### I/O CABLES (BELOW 1GHz AND AC POWER LINE TEST WITH ADAPTER AND LAPTOP)

	I/O Cable List							
Cable No	Port	# of identical	Connector Type	Cable Type	Cable Length (m)	Remarks		
1	AC	1	AC	Un-shielded	2	N/A		
2	USB	1	USB	Un-shielded	1	N/A		

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Antenna/Amp Radiated Test UT Spectrum Analyzer 1 AC/DC Adapter AC Source/LISN Conducted Test

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TEST SETUP- AC LINE CONDUCTED: LAPTOP CONFIGURATION



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## 6. TEST AND MEASUREMENT EQUIPMENT

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

Description	Manufacturer	Model	ID Num	Cal Due	
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T907	02/07/2019	
*Antenna, Horn 1-18GHz	ETS Lindgren	3117	T344	04/20/2018	
*Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB1	T185	03/30/2018	
Amplifier, 1 to 18GHz, 35dB	Amplical	AMP1G18-35	T1569	05/31/2018	
Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	T835	06/24/2018	
*Spectrum Analyzer, PSA, 3Hz to 44GHz	Agilent (Keysight) Technologies	E4446A	T177	03/20/2018	
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T119	04/03/2019	
	Mitor	AFS42-00101800-25-	T740	10/04/0010	
Ampliner, 1 to 18GHz	witteq	S-42	1742	12/04/2016	
Power Meter, P-series single channel	Keysight	N1912A	T1273	07/17/2018	
Power Sensor	Keysight	N1921A	T1226	08/30/2018	
Antenna Horn, 18 to 26GHz	ARA	MWH-1826	T447	06/24/2018	
Pre-Amp 18-26GHz	Agilent Technology	8449B	T404	07/23/2018	
Antenna, Active Loop 9KHz to 30MHz	ETS-Lindgren	6502	T757	09/14/2018	
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T342	02/22/2019	
	AC Line Cond	lucted			
EMI Test Receiver 9Khz-7GHz	Rohde & Schwarz	ESCI7	T1436	01/25/2019	
LISN for Conducted Emissions CISPR-16	Fischer	50/250-25-2-01	T1310	06/15/2018	
Power Cable, Line Conducted Emissions	UL	PG1	T861	08/31/2018	
LISN for Conducted Emissions CISPR-16	Fischer	50/250-25-2-01	T1310	06/15/2018	
	<b>UL AUTOMATION</b>	SOFTWARE			
Radiated Software	UL	UL EMC	Ver 9.5, A	April 26, 2016	
Conducted Software	UL	UL EMC	tober 13, 2016		
AC Line Conducted Software	UL	UL EMC	Ver 9.5, N	May 26, 2015	

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

### 7. MEASUREMENT METHODS

On Time and Duty Cycle: ANSI C63.10-2013 Section 11.6

Occupied BW (20dB): ANSI C63.10-2013 Section 6.9.2

Occupied BW (99%): ANSI C63.10-2013 Section 6.9.3

Carrier Frequency Separation: ANSI C63.10-2013 Section 7.8.2

Number of Hopping Frequencies: ANSI C63.10-2013 Section 7.8.3

Time of Occupancy (Dwell Time): ANSI C63.10-2013 Section 7.8.4

Peak Output Power: ANSI C63.10-2013 Section 7.8.5

Conducted Spurious Emissions: ANSI C63.10-2013 Section 7.8.8

Conducted Band-Edge: ANSI C63.10-2013 Section 6.10.4

Radiated Spurious Emissions 30-1000MHz: ANSI C63.10-2013 Section 6.3 and 6.5

Radiated Spurious Emissions above 1GHz: ANSI C63.10-2013 Section 6.3 and 6.6

Radiated Band-edge: ANSI C63.10-2013 Section 6.10.5

AC Power-line conducted emissions: ANSI C63.10-2013, Section 6.2.

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### 8. ANTENNA PORT TEST RESULTS

### 8.1. ON TIME AND DUTY CYCLE

#### <u>LIMITS</u>

None; for reporting purposes only.

#### PROCEDURE

ANSI C63.10-2013 Section 11.6

#### **ON TIME AND DUTY CYCLE RESULTS**

Mode	ON Time	Period	Duty Cycle	Duty	Duty Cycle	1/T
	В		х	Cycle	<b>Correction Factor</b>	Minimum VBW
	(msec)	(msec)	(linear)	(%)	(dB)	(kHz)
Bluetooth GFSK	1.00	1.00	1.000	100.0%	0.00	0.010
Bluetooth 8PSK	1.00	1.00	1.000	100.0%	0.00	0.010

### DUTY CYCLE PLOTS



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### 8.2. 20 dB AND 99% 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.

#### **RESULTS**

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### 8.2.1. HIGH POWER BASIC DATA RATE GFSK MODULATION

#### Antenna 4

Channel	Frequency	20dB Bandwidth	99% Bandwidth
	(MHz)	(MHz)	(MHz)
Low	2402	953.725	894.312
Mid	2441	953.699	893.118
High	2480	953.122	893.068





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#### REPORT NO: 12204475-E1V3 FCC ID: BCG-E3233A Antenna 3

#### DATE: 8/10/2018 IC: 579C-E3233A

#### Frequency 20dB Bandwidth 99% Bandwidth Channel (MHz) (MHz) (MHz) 2402 953.242 893.829 Low Mid 2441 952.985 893.918 2480 953.384 892.195 High





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### 8.2.2. HIGH POWER ENCHANCED DATA RATE 8PSK MODULATION

#### Antenna 4

Channel	Frequency	20dB Bandwidth	99% Bandwidth
	(MHz)	(MHz)	(MHz)
Low	2402	1.403	1.308
Mid	2441	1.401	1.29
High	2480	1.382	1.244





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### REPORT NO: 12204475-E1V3 FCC ID: BCG-E3233A

#### DATE: 8/10/2018 IC: 579C-E3233A

#### Antenna 3

Channel	Frequency	20dB Bandwidth	99% Bandwidth	
	(MHz)	(MHz)	(MHz)	
Low	2402	1.401	1.299	
Mid	2441	1.397	1.287	
High	2480	1.389	1.255	



🔆 Agilent 09:35:08 Jar	30,2018		L	Measure
Ch Freq 2 Occupied Bandwidth	.48 GHz	iverages: 100	Trig Free	Meas Off
DDu7 9 1/012518) 44252	Conducted E			Channel Power
Ref 20 dBm #Att #Peak	en 30 dB	•		Occupied BW
dB/ 0ffst	→ / ·		Vac and a	ACF
dB		-0 100	Span 5 MHz	Multi Carrier Power
Occupied Bandwi     1 20		#Sweep 100 ms Occ BW % Pwr x dB	(1001 pts) 99.00 % -20.00 dB	Power Stat CCDF
1.23 Transmit Freq Error x dB Bandwidth	-13.460 kHz 1.389 MHz			More 1 of 2
Copyright 2000-2011	Agilent Technologie	S		
	HIGH C	HANNEL	-	

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### 8.2.3. LOW POWER BASIC DATA RATE GFSK MODULATION

#### Antenna 4

Channel	Frequency	20dB Bandwidth	99% Bandwidth
	(MHz)	(MHz)	(MHz)
Low	2402	954.77	903.437
Mid	2441	954.007	894.826
High	2480	953.795	894.756





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#### REPORT NO: 12204475-E1V3 FCC ID: BCG-E3233A Antenna 3

#### DATE: 8/10/2018 IC: 579C-E3233A

#### Frequency 20dB Bandwidth 99% Bandwidth Channel (MHz) (MHz) (MHz) 2402 953.976 902.819 Low Mid 2441 954.16 896.934 2480 952.804 893.766 High





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### 8.2.4. LOW POWER ENCHANCED DATA RATE 8PSK MODULATION

#### Antenna 4

Channel	Frequency	20dB Bandwidth	99% Bandwidth
	(MHz)	(MHz)	(MHz)
Low	2402	1.407	1.316
Mid	2441	1.405	1.297
High	2480	1.389	1.267





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### REPORT NO: 12204475-E1V3 FCC ID: BCG-E3233A

#### DATE: 8/10/2018 IC: 579C-E3233A

#### Antenna 3

Channel Frequency		20dB Bandwidth	99% Bandwidth	
	(MHz)	(MHz)	(MHz)	
Low	2402	1.408	1.325	
Mid	2441	1.407	1.309	
High	2480	1.387	1.26	





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### 8.3. HOPPING FREQUENCY SEPARATION

#### LIMITS

FCC §15.247 (a) (1)

RSS-247 (5.1) (b)

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.

#### **RESULTS**

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### 8.3.1. HIGH POWER BASIC DATA RATE GFSK MODULATION

#### Antenna 4



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#### 🔆 Agilent 11:24:33 Jan 30, 2018 L Measure APv7.9.1(012518),44353, Conducted F ▲ Mkr1 1.000 MHz Ref 30 dBm #Atten 40 dB 0.00 dB Meas Off #Peak 1 R Log ሐ 10 Channel Power dB/ Offst 15 dB Occupied BW ACP #PAvg M1 S2 Multi Carrier S3 FC Power AA **£**(f): Power Stat FTun CCDF Swp More Center 2.441 500 GHz Span 5 MHz 1 of 2 #Res BW 300 kHz #VBW 910 kHz Sweep 1 ms (1001 pts) Copyright 2000–2011 Agilent Technologies HOPPING FREQUENCY SEPARATION PLOT

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### 8.3.2. HIGH POWER ENCHANCED DATA RATE 8PSK MODULATION

#### Antenna 4

Keysight S	pectrum Analyzer - APv8.1(0	22818),44353, Cond. F				
	RF 50 Ω A0		SENSE:INT	#Avg Type: PM	08:05:28 AM Mar 08, 20	Frequency
Center i	req 2.4415000 NFE	PNO: Wide	Trig: Free Run	Avg Hold:>100/	100 TYPE MWWW	N N
		IFGain:Low	#Atten: 40 dB		DEI	
10 dB/div	Ref Offset 13.89 ( Ref 30.00 dBn	dB N			ΔMkr1 1.000 MF -0.565 d	B
				102		Center Fred
20.0	Alex marked Marker	Marrian Marrier	2 many port	and	alter and a state of the state of the	
10.0						
0.00						2.439000000 GH
10.0						Stop Free
20.0						2.444000000 GH
-30.0						CF Step 500.000 kH Auto Mai
40.0						
-50.0						Freq Offse
-60.0						Scale Type
Center 2	.441500 GHz				Span 5.000 Mł	lz Log <u>Lir</u>
#Res B₩	/ 300 KHZ	#VBW	910 KHZ	Swe	ep 2.533 ms (1001 pt	.s)
ISG					STATUS	

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### Antenna 3

XI L	RF 50 C	AC	,44555, Cond. 1	SEN	SE:INT			08:30:41 AM Mar 08, 2018	
Center I	Freq 2.4415	00000 NFE	GHz PNO: Wide IFGain:Low	Trig: Free #Atten: 40	Run dB	#Avg Typ Avg Hold:	e: RMS >100/100	TRACE 1 2 3 4 5 0 TYPE M WWWW DET P N N N N	Frequency
0 dB/div	Ref Offset 16 Ref 30.00	5.14 dB dBm					ΔN	lkr1 1.000 MHz -0.365 dE	Auto Tuno
20.0			Will among and the	( Zarana and Jar	Mar Mary & Falgers	1∆2	wyestrawaya	weeken	Center Free 2.441500000 GH
10.0									Start Free
0.00									2.439000000 GH
10.0									Stop Free
20.0									
30.0									500.000 kH Auto Ma
50.0									Freq Offse
-60.0									он
									Scale Type
Center 2 ¢Res BW	2.441500 GHz V 300 kHz		#VBW	910 kHz			Sweep 2	Span 5.000 MHz 533 ms (1001 pts)	Log <u>Li</u>
ISG							STATUS		

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### 8.3.3. LOW POWER BASIC DATA RATE GFSK MODULATION

#### Antenna 4



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#### 🔆 Agilent 10:23:54 Jan 30, 2018 L Measure APv7.9.1(012518),44353, Conducted F ▲ Mkr1 1.000 MHz -0.05 dB Ref 30 dBm #Atten 40 dB Meas Off #Peak Log 10 1 R Channel Power dB/ φ Offst 15 dĐ Occupied BW ACP #PAvg M1 S2 Multi Carrier S3 FC Power AA **£**(f): Power Stat FTun CCDF Swp More Center 2.441 500 GHz Span 5 MHz 1 of 2 #Res BW 300 kHz #VBW 910 kHz Sweep 1 ms (1001 pts) Copyright 2000–2011 Agilent Technologies HOPPING FREQUENCY SEPARATION PLOT

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### 8.3.4. LOW POWER ENCHANCED DATA RATE 8PSK MODULATION

#### Antenna 4



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#### Antenna 3

👞 Keysight S	pectrum Analyzer - APv8.1	(022818),44353, C	ond. F					
<mark>U</mark> L	RF 50 Ω /	AC		SENSE:INT			07:47:38 AM Mar 08, 2018	Frequency
Center F	Freq 2.441500	DOO GHZ E PNO: N IFGain	Vide CP T Low #	rig: Free Run Atten: 40 dB	#Avg Tyj Avg Hold	be:RMS 1:>100/100	TRACE 1 2 3 4 5 6 TYPE M WWWW DET P N N N N N	riequency
Ref Offset 15.14 dB         ΔMkr1 1.000 MHz           10 dB/div         Ref 30.00 dBm         0.935 dB								Auto Tur
				Ť				Center Free
20.0					1/1/2			2.441500000 GH
10.0 Vm <b>yr</b> y	- My Virgan an	THUMPLAN	******************		Sand and a second	Contration of the second		Start Free
0.00								2.439000000 GH
10.0								Stop Free
20.0								2.444000000 GH
30.0								CF Stej 500.000 kH Auto Mai
40.0								
50.0								Freq Offse 0 H
60.0								Scale Type
L Lenter 2 ¢Res BW	.441500 GHz / 300 kHz	#VBW 91	0 kHz		Sweep 2	Span 5.000 MHz .533 ms (1001 pts)	Log <u>Lir</u>	
ISG						STATUS		

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### 8.4. NUMBER OF HOPPING CHANNELS

#### LIMITS

FCC §15.247 (a) (1) (iii)

RSS-247 (5.1) (d)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 nonoverlapping 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: All Channels Observed
## 8.4.1. HIGH POWER BASIC DATA RATE GFSK MODULATION

### Antenna 4





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Ref 30	dBm		Atte	<u>n 3</u>	0 d	B																_	Meas Off
#Peak Ing																							
10 dB/	M	M	ŴΫ	$\mathbb{M}$	Ŵ	V	V	Ŵ	V	V	V	V	$\langle n \rangle$	Δ	$\cap$	Ñ	V	V	Y	V	V	$\left< \right>$	Channel Power
Offst 14.4 dB	• • •					<u> </u>	' 	· ·		<u> </u>	'	۲ 	<u>,</u>	<u> </u>				<u>'</u>	<u>'</u>	•	<u> </u>	'	Occupied BW
#PAvg																							АСР
M1 S2 S3 FC																							Multi Carrier Power
€(f): FTun Swp																							Power Stat CCDF
Center	2.445	00 GH: ⊭⊔⇒	z					200					<u></u>				S	ipa	in :	30	MH	Z	More 1 of 2



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Pv7.9.1(012	518),44	353, C	onducte	d F					
ef 30 dBm Peak D		Atten	30 dB	1		1			Meas Off
bg 0 B/				·····					Channel Power
									Occupied BW
0./ Bm gAv									ACP
1 S2 3 FC								houses	Multi Carrier Power
(f): Tun									Power Stat CCDF
tart 2.390 0 Res BW 1 MH	0 GHz z		+V	BW 1 MHz	: Swe	Stop 9ep 20 m	 2.490 0 ns (100:	)0 GHz 1 pts)	More 1 of 2



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Ref 30 #Peak	dBm	1	Atten	30 dB				1	1		Meas Off
Log 10 dB/									MY		Channel Power
dB	1 9 9	• • •					* * (	* * *		111	Occupied Bk
#PAvg											ACP
M1 S2 S3 FC											Multi Carrier Power
€(f): FTun Swp											Power Stat CCDF
Center #Res Bl	2.445 W 300	00 GH kHz	z	 #V	 ВЫ ЗОО	kH7	Swei	en 20 m	Span 3 ns (100	30 MHz	More 1 of 2

Ref 30 #Peak I	dBm			A	tte	<u>n 3</u>	0 0	ΙB									1			Meas Off
Log																				
10 dB/ Offer	¥Υ	YΛ	$\gamma \rho$	Д	¥	Щ	Д	¥	$\mathbb{N}$	Д	₩	$\mathcal{V}$	Щ	Д						Channel Power
dB	1 '		¥	• • 	<u> </u>	'		• 	-		'  -	• •		-				_		Occupied BW
#PAva						1							-							ACP
		_		_		_					_		_					_		.∥
M1 S2 S3 FC		_		_		_									4			_		Multi Carrier Power
нн £(f):																		***		
FTun Swp		_				_												_		Power Stat CCDF
Center	2.47	5.0	0 GF	  z													 Spar	1 30	MHz	More
#Res B	W 30	0 k⊦	lz					ŧVB	W З	800	kН	z		Swe	ep 2	20 r	ns (10	001	pts)	

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## 8.4.2. HIGH POWER ENCHANCED DATA RATE 8PSK MODULATION

### Antenna 4





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		R	F	50 Ω	AC	1					SEI	NSE:I	T						08:00	0:51 A	M Mar 08, 2018	3	
Cent	ter F	req	2.4	4500	DOOC NFE	00 G		: Wide	• 🖵	Trig	g: Fre	e Rui	n	#A	vg Ty g Hold	pe: F d:>1(	RM S 00/10	0		TRAC		= F	requency
10 dE	3/div	Re Re	f Off	set 13 ).00 (	.89 d dBm	в	IFGa	in:Lov	w T	Att	en: 28	3 dB								DI			Auto Tun
Log																							Center Fre
20.0	~~~	$\sim$	$\sim$	$\sqrt{-1}$		᠕᠊ᢇ	V	√~`\⁄	~~~	<b>ک</b> ر کر	5-17		V~\	T	$\sqrt{\gamma}$	T	$\sim$	V	$\sim$	$\sim$		2.4	45000000 GF
10.0																						2.4	<b>Start Fre</b> 30000000 GH
-10.0							_									-						2.4	Stop Fre 60000000 G⊦
-20.0																-							
-30.0							_															Auto	CF Ste 3.000000 MH Ma
-40.0																-						-	
-50.0					-		_																FreqOffso 0⊦
-60.0							_																Scale Typ
 Starf #Res	t 2.43 s BW	3000 300	GH kH:	z z				#\	/BW	300	kHz	<u> </u>				Sw	/een	) 21	Stop ).00 i	2.4 ns (	6000 GH: (1001 pts	Log	<u>Li</u>
MSG				_												5.1	ST	ATUS					



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Center Freq 2.44500	NFE PNO: Wide C	Trig: Free Run	#Avg Type: RMS Avg Hold:>100/100	TRACE 1 2 3 4 5 6 TYPE M	Frequency
Ref Offset 15. 10 dB/div <b>Ref 30.00 d</b>	IFGain:Low 14 dB IBm	Atten: 26 dB		DETJENNINN	Auto Tun
20.0 20.0	Var Arter	v v v v v v v	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	Center Fre 2.445000000 GH
0.00					<b>Start Fre</b> 2.430000000 GH
-10.0					<b>Stop Fre</b> 2.460000000 GH
-30.0					CF Ste 3.000000 M⊢ <u>Auto</u> Ma
-50.0					Freq Offse
-60.0					Scale Typ
Start 2.43000 GHz #Res BW 300 kHz	#VB	W 300 kHz	Sweep 2	Stop 2.46000 GHz 0.00 ms (1001 pts)	Log <u>Li</u>



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## 8.4.3. LOW POWER BASIC DATA RATE GFSK MODULATION

### Antenna 4





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Ref 30 #Peak∥	dBm		Atten	30 dB	1	1				Meas Off
Log 10 dB/										Channel Power
Offst 14.4 dB	¥₩	M	W	M	M	W	VV	VVV	¥¥¥	Occupied BW
#PAvg										ACP
M1 S2 S3 FC AA										Multi Carrier Power
<b>£</b> (f): FTun Swp										Power Stat CCDF
Center #Res Bl	2.445 W 300	00 GH kHz	z	 #VI	 BW 300	 Swe	en 20 r	Span ( ns (100	30 MHz 1 nts)	More 1 of 2

Ref 30	dBm		,,,,,	Atte	∋n 3	30 dE	3	<u> </u>								Meas Of
#Peak Ing																
10 dB/																Channel Power
Offst	WW	W.	W	M	M	$M^{n}$	ſΜ	ΠN	M	М	nn					
dB	¥ ¥	¥¦₽	* *	<del>                                     </del>	┦	¥ ¥	¥†¥	11	{ ∛	¥	$\{\}$					Occupied B
							+					$\mathbb{H}^{-}$				
					_		_					<u> </u>				- ACF
#PAvg																
M1 S2							$\top$					1				Multi Carrier
S3 FC		_			-+		_			_		$\mathbb{H}^{-}$	_			Power
F(F)												سابه	****	a and a second	ul-lainstein)	
FTun																Power Stat
Swp		_			-		+						_			
																More
Center	2.47	5 00	GHz	2										Span	30 MH	z 1 of 2
#Res B	M 306	) kHz	Z			#\	/BM	300	kHz		Swe	ep 20	1 m	ns (100	01 pts	.)

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ef 30 dBm	Atten	30 dB				Meas Off
						Channel Power
B						Occupied BW
o.s Bm gAv						ACP
1 S2 3 FC					to -	Multi Carrier Power
(f): Tun Wp						Power Stat CCDF
tart 2.390 0 GH Res BW 1 MHz	z	#VBW 1	MHz	Stop Sweep 20 m	2.490 0 GHz s (1001 pts)	More 1 of 2



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Ref 30 #Peak	dBm		Atten	30 dB							Meas Of
Log 10 dB/											Channel Power
Offst 15 dB	V V V	V V V	<u> v v v</u>	VVV	¥Υ	<u>V V V</u>	¥¥¥	¥¥¥	<u>VV</u>	¥₩	Occupied Bk
#PAvg											ACF
M1 S2 S3 FC AA											Multi Carrier Power
<b>£</b> (f): FTun Swp											Power Stat CCDF
Center #Res B	2.445 W 300	00 GH	z	#VF	 :ม 300	kH7	Swee		Span ( ns (100	30 MHz	More 1 of 2

Ref 30	dBm			At	ten	30	dB											Meas Of
+геак Log 10 dB/					- <u></u>													Channel Power
Uffst 15 dB	¥Ψ	Щ.	¥Υ	Į I	Ц	¥	¥ ¥	¥	¥Ц	ĮĮ	Ţ	¥	¥Ц	Ą				Occupied Bk
#PAvg																		ACF
M1 S2 S3 FC																diel e trees		Multi Carrier Power
£(f): FTun Swn																		Power Stat
Center #Res B	2.475 W 300	5 00 kHz	GHz	 z			#VF	 3W 3	300					òwe	ep 20	 pan 3 (100	30 MH 1 pts	Z 1 of 2

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## 8.4.4. LOW POWER ENCHANCED DATA RATE 8PSK MODULATION

### Antenna 4





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Ref30 ≢Peak ∥	dBm		Atten	30 dB							Meas Off
Log 10 dB/											Channel Power
0††st 14.4 dB	*~~		×~~~	****	***			~~~	~~~~	Y V Y	Occupied BW
#PAvg											АСР
M1 S2 S3 FC											Multi Carrier Power
€(f): FTun Swp											Power Stat CCDF
Center #Res Bl	2.445 J 300	00 GHz kHz	2	#VB	W 300	kH7	Swer	en 20 m	Span 3 s (100	30 MHz 1 nts)	More 1 of 2

Ref 30 ≢Peak <b>[</b>	dBm		Atten	30 dB							Meas Off
Log 10 dB/											Channel Power
14.4 dB	v v v	~~~		~~~	<u>v</u> v~v	~~~	m				Occupied Bł
#PAvg											ACF
M1 S2 S3 FC											Multi Carrier Power
£(f): - FTun Swp -											Power Stat CCDF
Center #Res Bk	2.475 \ 300	 00 GHz kHz	2	#VB	W 300	kHz	Swee	ep 20 i	   Span ( ms (100	30 MHz 1 pts)	More 1 of 2

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## 8.5. AVERAGE TIME OF OCCUPANCY

### **LIMITS**

FCC §15.247 (a) (1) (iii)

RSS-247 (5.1) (d)

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 3.16 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.

### **RESULTS**

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# 8.5.1. HIGH POWER BASIC DATA RATE GFSK MODULATION

## <u>Antenna 4</u>

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)		
GFSK Norma	I Mode						
DH1	0.383	32	0.12256	0.4	-0.2774		
DH3	1.639	16	0.26224	0.4	-0.1378		
DH5	2.887	9	0.25983	0.4	-0.1402		
DH Packet	Pulse Width (sec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)		
GFSK AFH M	GFSK AFH Mode						
DH1	0.383	8	0.03064	0.4	-0.3694		
DH3	1.639	4	0.06556	0.4	-0.3344		
DH5	2.887	2.25	0.06496	0.4	-0.3350		

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### REPORT NO: 12204475-E1V3 FCC ID: BCG-E3233A

### DATE: 8/10/2018 IC: 579C-E3233A



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DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)			
<b>GFSK Norma</b>	I Mode							
DH1	0.383	32	0.1226	0.4	-0.2774			
DH3	1.639	17	0.2786	0.4	-0.1214			
DH5	2.887	11	0.3176	0.4	-0.0824			
DH Packet	Pulse Width (sec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)			
GFSK AFH M	GFSK AFH Mode							
DH1	0.383	8	0.03064	0.4	-0.3694			
DH1 DH3	0.383 1.639	8 4.25	0.03064 0.06966	0.4 0.4	-0.3694 -0.3303			

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# 8.5.2. HIGH POWER ENCHANCED DATA RATE 8PSK MODULATION

### Antenna 4

DH Packet	Pulse	Number of	Average Time	Limit	Margin
	Width	Pulses in	of Occupancy		
	(msec)	3.16	(sec)	(sec)	(sec)
		seconds			
8PSK Normal	Mode				
3DH1	0.389	32	0.12448	0.4	-0.2755
3DH3	1.640	15	0.24600	0.4	-0.154
3DH5	2.892	12	0.34704	0.4	-0.053

Note: for AFH (8PSK) mode, please refer to the results of AFH (GFSK) mode; the channel selection and hopping rate are the same for both EDR and Basic Rate operation, data for Basic Rate in section 8.5.1 demonstrates compliance with channel occupancy when AFH is employed.



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DH Packet	Pulse	Number of	Average Time	Limit	Margin
	Width	Pulses in	of Occupancy		
	(msec)	3.16	(sec)	(sec)	(sec)
		seconds			
8PSK Normal	Mode				
3DH1	0.389	32	0.12448	0.4	-0.2755
3DH3	1.641	16	0.26256	0.4	-0.1374
3DH5	2.892	12	0.34704	0.4	-0.053

Note: for AFH (8PSK) mode, please refer to the results of AFH (GFSK) mode; the channel selection and hopping rate are the same for both EDR and Basic Rate operation, data for Basic Rate in section 8.5.1 demonstrates compliance with channel occupancy when AFH is employed.



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# 8.5.3. LOW POWER BASIC DATA RATE GFSK MODULATION

## Antenna 4

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)			
GFSK Norma	I Mode							
DH1	0.383	31	0.11873	0.4	-0.2813			
DH3	1.639	18	0.29502	0.4	-0.1050			
DH5	2.887	10	0.28870	0.4	-0.1113			
	iiii							
DH Packet	Pulse Width (sec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)			
GFSK AFH M	GFSK AFH Mode							
DH1	0.383	7.75	0.02968	0.4	-0.3703			
DH3	1.639	4.5	0.07376	0.4	-0.3262			
DH5	2.887	2.5	0.07218	0.4	-0.3278			

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DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)		
<b>GFSK Norma</b>	I Mode						
DH1	0.383	31	0.1187	0.4	-0.2813		
DH3	1.639	16	0.2622	0.4	-0.1378		
DH5	2.887	12	0.3464	0.4	-0.0536		
DH Packet	Pulse Width (sec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)		
GFSK AFH M	GFSK AFH Mode						
DH1	0.383	7.75	0.02968	0.4	-0.3703		
			0.00550	04	0 2 2 4 4		
DH3	1.639	4	0.06556	0.4	-0.3344		

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# 8.5.4. LOW POWER ENCHANCED DATA RATE 8PSK MODULATION

### Antenna 4

DH Packet	Pulse	Number of	Average Time	Limit	Margin
	Width	Pulses in	of Occupancy		
	(msec)	3.16	(sec)	(sec)	(sec)
		seconds			
8PSK Normal	Mode				
3DH1	0.389	32	0.12448	0.4	-0.2755
3DH3	1.640	16	0.26240	0.4	-0.1376
3DH5	2.891	12	0.34692	0.4	-0.0531

Note: for AFH (8PSK) mode, please refer to the results of AFH (GFSK) mode; the channel selection and hopping rate are the same for both EDR and Basic Rate operation, data for Basic Rate in section 8.5.3 demonstrates compliance with channel occupancy when AFH is employed.



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DH Packet	Pulse	Number of	Average Time	Limit	Margin
	Width	Pulses in	of Occupancy		
	(msec)	3.16	(sec)	(sec)	(sec)
		seconds			
8PSK Normal	Mode				
3DH1	0.389	32	0.12448	0.4	-0.2755
3DH3	1.640	14	0.22960	0.4	-0.1704
3DH5	2.891	13	0.37583	0.4	-0.0242

Note: for AFH (8PSK) mode, please refer to the results of AFH (GFSK) mode; the channel selection and hopping rate are the same for both EDR and Basic Rate operation, data for Basic Rate in section 8.5.3 demonstrates compliance with channel occupancy when AFH is employed.



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# 8.6. OUTPUT POWER

### LIMITS

§15.247 (b) (1)

RSS-247 (5.4) (b)

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

### TEST PROCEDURE

The transmitter output is connected to a peak power meter.

The cable assembly insertion loss of 10.5 dB (including 10 dB pad and 0.5 dB cable) was entered as an offset in the power meter to allow for a gated peak reading of power.

**RESULTS** 

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# 8.6.1. HIGH POWER BASIC DATA RATE GFSK MODULATION

### Antenna 4

Tested By:	44366
Date:	5/3/2018

Channel	Frequency	Output Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	16.79	30	-13.21
Middle	2441	16.90	30	-13.1
High	2480	16.88	30	-13.12

### Antenna 3

Tested By:	44366
Date:	5/3/2018

Channel	Frequency	Output Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	20.01	21	-0.99
Middle	2441	20.08	21	-0.92
High	2480	20.03	21	-0.97

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# 8.6.2. HIGH POWER ENCHANCED DATA RATE 8PSK MODULATION

### Antenna 4

Tested By:	44366
Date:	5/3/2018

Channel	Frequency	Output Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	18.92	21	-2.08
Middle	2441	19.10	21	-1.9
High	2480	19.04	21	-1.96

### Antenna 3

Tested By:	44366
Date:	5/3/2018

Channel	Frequency	Output Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	19.92	21	-1.08
Middle	2441	20.03	21	-0.97
High	2480	20.01	21	-0.99

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# 8.6.3. HIGH POWER ENCHANCED DATA RATE DQPSK MODULATION

## Antenna 4

Tested By:	44366
Date:	5/3/2018

Channel	Frequency	Output Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	19.03	21	-1.97
Middle	2441	19.04	21	-1.96
High	2480	18.91	21	-2.09

## Antenna 3

Tested By:	44366
Date:	5/3/2018

Channel	Frequency	Output Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	19.85	21	-1.15
Middle	2441	19.97	21	-1.03
High	2480	20.02	21	-0.98

# 8.6.4. LOW POWER BASIC DATA RATE GFSK MODULATION

## Antenna 4

Tested By:	44366
Date:	5/3/2018

Channel	Frequency	Output Power	Limit	Margin
	(MH7)	(dBm)	(dBm)	(dB)
	(101112)	(dbiii)	(ubiii)	(ub)
Low	2402	11.28	30	-18.72
Middle	2441	11.33	30	-18.67
High	2480	11.40	30	-18.6

## Antenna 3

Tested By:	44366
Date:	5/3/2018

Channel	Frequency	Output Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	11.12	30	-18.88
Middle	2441	11.09	30	-18.91
High	2480	11.11	30	-18.89

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# 8.6.5. LOW POWER ENCHANCED DATA RATE 8PSK MODULATION

## Antenna 4

Tested By:	44366
Date:	5/3/2018

Channel	Frequency	Output Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	10.04	21	-10.96
Middle	2441	10.14	21	-10.86
High	2480	10.16	21	-10.84

#### Antenna 3

Tested By:	44366
Date:	5/3/2018

Channel	Frequency	Output Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	9.87	21	-11.13
Middle	2441	9.97	21	-11.03
High	2480	10.08	21	-10.92

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## 8.6.6. LOW POWER ENCHANCED DATA RATE DQPSK MODULATION

## Antenna 4

Tested By:	44366			
Date:	5/3/2018			
Channel	Frequency	Output Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	10.02	21	-10.98
Middle	2441	10.05	21	-10.95
High	2480	9.89	21	-11.11

## Antenna 3

Tested By:	44366
Date:	5/3/2018

Channel	Frequency	Output Power	Limit	Margin
				-
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	9.99	21	-11.01
Middle	2441	10.03	21	-10.97
High	2480	9.84	21	-11.16

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# 8.7. AVERAGE POWER

## <u>LIMITS</u>

None; for reporting purposes only

## TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.5 dB (including 10 dB pad and 0.5 dB cable) was entered as an offset in the power meter to allow for a gated average reading of power.

### RESULTS

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# 8.7.1. HIGH POWER BASIC DATA RATE GFSK MODULATION

## Antenna 4

Tested By:	44366
Date	5/3/2018

Channel	Frequency	Average Power
	(MHz)	(dBm)
Low	2402	16.36
Middle	2441	16.47
High	2480	16.35

## Antenna 3

Tested By:	44366
Date	5/3/2018

Channel	Frequency	Average Power
	(MHz)	(dBm)
Low	2402	19.58
Middle	2441	19.64
High	2480	19.61

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# 8.7.2. HIGH POWER ENCHANCED DATA RATE 8PSK MODULATION

### Antenna 4

Tested By:	443366
Date	5/3/2018

Channel	Frequency	Average Power
	(MHz)	(dBm)
Low	2402	16.35
Middle	2441	16.44
High	2480	16.41

### Antenna 3

Tested By:	44366
Date	5/3/2018

Channel	Frequency	Average Power
	(MHz)	(dBm)
Low	2402	17.46
Middle	2441	17.42
High	2480	17.40

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# 8.7.3. HIGH POWER ENCHANCED DATA RATE DQPSK MODULATION

#### Antenna 4

Tested By:	44366
Date	5/3/2018

Channel	Frequency	Average Power
	(MHz)	(dBm)
Low	2402	16.43
Middle	2441	16.46
High	2480	16.39

## Antenna 3

Tested By:	44366
Date	5/3/2018

Channel	Frequency	Average Power
	(MHz)	(dBm)
Low	2402	17.40
Middle	2441	17.42
High	2480	17.36

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# 8.7.4. LOW POWER BASIC DATA RATE GFSK MODULATION

### Antenna 4

Tested By:	44366
Date	5/3/2018

Channel	Frequency	Average Power
	(MHz)	(dBm)
Low	2402	10.87
Middle	2441	10.85
High	2480	10.92

## Antenna 3

Tested By:	44366
Date	5/3/2018

Channel	Frequency	Average Power
	(MHz)	(dBm)
Low	2402	10.68
Middle	2441	10.64
High	2480	10.62

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# 8.7.5. LOW POWER ENCHANCED DATA RATE 8PSK MODULATION

## Antenna 4

/3/2018

Channel	Frequency	Average Power
	(MHz)	(dBm)
Low	2402	7.42
Middle	2441	7.50
High	2480	7.47

### Antenna 3

Tested By:	44366
Date	5/3/2018

Channel	Frequency	Average Power
	(MHz)	(dBm)
Low	2402	7.36
Middle	2441	7.40
High	2480	7.43

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## 8.7.6. LOW POWER ENCHANCED DATA RATE DQPSK MODULATION

#### Antenna 4

Tested By:	44366	
Date	5/3/2018	
Channel	Frequency	Average Power
	(MHz)	(dBm)
Low	2402	7.35
Middle	2441	7.41
High	2480	7.33

### Antenna 3

Tested By:	44366
Date	5/3/2018

Channel	Frequency	Average Power
	(MHz)	(dBm)
Low	2402	7.34
Middle	2441	7.39
High	2480	7.32

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