

# **TEST REPORT**

# **Report Number:** 14040867-E1V2

- Applicant : APPLE, INC. 1 APPLE PARK WAY CUPERTINO, CA 95014, U.S.A
  - Model: A2649 (Parent Model, Full Test) A2881, A2882, A2883, A2884 (Variant Models)
  - FCC ID : BCG-E8138A (Parent Model) BCG-E8142A, BCG-E8143A, BCG-E8144A (Variant Models)
    - IC : 579C-E8138A (Parent Model) 579C-E8142A, 579C-E8143A, 579C-E8144A (Variant Models)
- EUT Description : SMARTPHONE
- Test Standard(s) : FCC 47 CFR PART 15 SUBPART C ISED RSS-247 ISSUE 2 ISED RSS-GEN ISSUE 5 + A1 + A2

Date Of Issue: July 10, 2022

Prepared by: UL LLC 47173 Benicia Street Fremont, CA 94538 U.S.A. TEL: (510) 319-4000 FAX: (510) 661-0888



### **REPORT REVISION HISTORY**

Rev.	lssue Date	Revisions	Revised By
V1	7/1/2022	Initial Issue	Francisco deAnda
V2	7/10/2022	Addressed TCB Questions on Sections 6.5, 7, 9.2, 9.6.6, 9.7.6, and 10.1.7	Tony X. Li

Page 2 of 153

### TABLE OF CONTENTS

1.	ATTESTATION OF TEST RESULTS	5
2.	TEST SUMMARY	7
3.	TEST METHODOLOGY	7
4.	FACILITIES AND ACCREDITATION	
4.		
5.	DECISION RULES AND MEASUREMENT UNCERTAINTY	
-	5.1. METROLOGICAL TRACEABILITY	
-	5.2. DECISION RULES	
-	5.3. MEASUREMENT UNCERTAINTY	
5	5.4. SAMPLE CALCULATION	8
6.	EQUIPMENT UNDER TEST	9
6	6.1. EUT DESCRIPTION	9
6	2.2. MAXIMUM OUTPUT POWER	9
6	3.3. DESCRIPTION OF AVAILABLE ANTENNAS	
6	.4. SOFTWARE AND FIRMWARE	10
6	5.5. WORST-CASE CONFIGURATION AND MODE	
6	6. DESCRIPTION OF TEST SETUP	12
7.	TEST AND MEASUREMENT EQUIPMENT	15
8.	MEASUREMENT METHODS	16
9.	ANTENNA PORT TEST RESULTS	17
9	0.1. ON TIME AND DUTY CYCLE	17
9	0.2. 20 dB AND 99% BANDWIDTH	
	9.2.1. HIGH POWER BASIC DATA RATE GFSK MODULATION 9.2.2. HIGH POWER BASIC DATA RATE TXBF GFSK MODULATION	
	9.2.2. HIGH POWER BASIC DATA RATE TXBF GFSK MODULATION 9.2.3. HIGH POWER ENHANCED DATA RATE 8PSK MODULATION	
	9.2.4. HIGH POWER ENHANCED DATA RATE TXBF 8PSK MODULATION	
9	.3. HOPPING FREQUENCY SEPARATION	
	9.3.1. HIGH POWER BASIC DATA RATE GFSK MODULATION	-
9	9.4. NUMBER OF HOPPING CHANNELS 9.4.1. HIGH POWER BASIC DATA RATE GFSK MODULATION	
٥	9.4.1. HIGHT OWER BASIC DATA RATE OF SR MODOLATION	
9	9.5.1. HIGH POWER BASIC DATA RATE GFSK MODULATION	
9	0.6. OUTPUT POWER	
	9.6.1. HIGH POWER BASIC DATA RATE GFSK MODULATION	
	<ul><li>9.6.2. HIGH POWER BASIC DATA RATE TXBF GFSK MODULATION</li><li>9.6.3. HIGH POWER ENHANCED DATA RATE QPSK MODULATION</li></ul>	
	9.6.4. HIGH POWER ENHANCED DATA RATE QPSK MODULATION	
	Page 3 of 153	
	VERIFICATION SERVICES INC.	

9.6.5.	HIGH POWER ENHANCED DATA RATE 8PSK MODULATION	
9.6.6.	HIGH POWER ENHANCED DATA RATE TXBF 8PSK MODULATION	
9.6.7.	LOW POWER BASIC DATA RATE GFSK MODULATION	
9.6.8.	LOW POWER BASIC DATA RATE TXBF GFSK MODULATION	
9.6.9.	LOW POWER ENHANCED DATA RATE QPSK MODULATION	
9.6.10.	LOW POWER ENHANCED DATA RATE TXBF QPSK MODULATION	
9.6.11. 9.6.12.	LOW POWER ENHANCED DATA RATE 8PSK MODULATION LOW POWER ENHANCED DATA RATE TXBF 8PSK MODULATION	
	ERAGE POWER	
9.7.1.	HIGH POWER BASIC DATA RATE GFSK MODULATION	
9.7.2.	HIGH POWER BASIC DATA RATE TXBF GFSK MODULATION	-
9.7.3.	HIGH POWER ENHANCED DATA RATE QPSK MODULATION	
9.7.4.	HIGH POWER BASIC DATA RATE TXBF QPSK MODULATION	
9.7.5. 9.7.6.	HIGH POWER ENHANCED DATA RATE 8PSK MODULATION HIGH POWER BASIC DATA RATE TXBF 8PSK MODULATION	
9.7.0. 9.7.7.	LOW POWER BASIC DATA RATE GFSK MODULATION	-
9.7.8.	LOW POWER BASIC DATA RATE GESK MODULATION	
9.7.9.	LOW POWER ENHANCED DATA RATE QPSK MODULATION	
9.7.10.	LOW POWER BASIC DATA RATE TXBF QPSK MODULATION	
9.7.11.	LOW POWER ENHANCED DATA RATE 8PSK MODULATION	
9.7.12.	LOW POWER BASIC DATA RATE TXBF 8PSK MODULATION	
-		
	NDUCTED SPURIOUS EMISSIONS	
9.8.1.	HIGH POWER BASIC DATA RATE GFSK MODULATION	
9.8.2. 9.8.3.	HIGH POWER BASIC DATA RATE TXBF GFSK MODULATION HIGH POWER ENHANCED DATA RATE 8PSK MODULATION	-
9.8.3. 9.8.4.	HIGH POWER ENHANCED DATA RATE SPSK MODULATION	
9.8.4. 9.8.5.	LOW POWER BASIC DATA RATE GFSK MODULATION	-
9.8.6.	LOW POWER BASIC DATA RATE TXBF GFSK MODULATION	
9.8.7.	LOW POWER ENHANCED DATA RATE 8PSK MODULATION	
9.8.8.	LOW POWER ENHANCED DATA RATE TXBF 8PSK MODULATION	
10. RAD	IATED TEST RESULTS	82
10.1.	TRANSMITTER ABOVE 1 GHz	
10.1.1.		
10.1.2.	HIGH POWER BASIC DATA RATE TXBF GFSK MODULATION	92
10.1.3.	HIGH POWER ENHANCED DATA RATE 8PSK MODULATION	96
10.1.4.	HIGH POWER BASIC DATA RATE TXBF 8PSK MODULATION	104
10.1.5.	LOW POWER BASIC DATA RATE GFSK MODULATION	
10.1.6.	LOW POWER BASIC DATA RATE TXBF GFSK MODULATION	
10.1.7.	LOW POWER ENHANCED DATA RATE 8PSK MODULATION	
10.1.8.	LOW POWER BASIC DATA RATE TXBF 8PSK MODULATION	
10.1.9.	GFSK TXBF HARMONICS AND SPURIOUS EMISSIONS	
10.1.10	8PSK TXBF HARMONICS AND SPURIOUS EMISSIONS	138
10.2.	NORST CASE BELOW 1 GHZ	144
10.3.	NORST CASE 18-26 GHZ	146
11. AC P	OWER LINE CONDUCTED EMISSIONS	
	AC Power Line With AC/DC Adapter	
	AC Power Line With Laptop	
11.2. /		

Page 4 of 153

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

COMPANY NAME:		APPLE INC. 1 APPLE PARK WAY CUPERTINO, CA 95014, U.S.A		
E	UT DESCRIPTION:	SMARTPHONE		
Μ	ODEL:	A2649 (Parent Model) A2881, A2882, A2883, A2884 (Variant Models)		
в	RAND:	APPLE		
FCC ID:		BCG-E8138A (Parent Model) BCG-E8142A, BCG-E8143A, BCG-E8144A (Variant Models)		
IC:		579C-E8138A (Parent Model) 579C-E8142A, 579C-E8143A, 579C-E8144A (Variant Models)		
S	ERIAL NUMBER:	V2V9KHF5W9		
S	AMPLE RECEIPT DATE:	DECEMBER 27, 2021		
D	ATE TESTED:	DECEMBER 28, 2021 – JUNE 30, 2022		
		APPLICABLE STANDARDS		
	S	TANDARD	TEST RESULTS	
	CFR 47	Part 15 Subpart C	Complies	
	ISED F	RSS-247 Issue 2	Complies	
	ISED RSS-0	GEN Issue 5 + A1 + A2	Complies	

UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC 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 A2LA, NIST, any agency of the Federal Government, or any agency of the U.S. government.

Page 5 of 153

Approved & Released For UL LLC By:

no de aver 2000

Francisco de Anda Staff Engineer Consumer Technology Division UL LLC. Prepared By:

Ŀ

Tony Li Test Engineer Consumer Technology Division UL LLC

Page 6 of 153

# 2. TEST SUMMARY

This report contains data provided by the customer which can impact the validity of results. UL LLC is only responsible for the validity of results after the integration of the data provided by the customer.

FCC Clause	ISED Clause	Requirement	Result	Comment
See Comment		Duty Cycle	Reporting	Per ANSI C63.10,
See Comment		Duly Cycle	purposes only	Section 11.6.
See Comment	RSS-GEN 6.7	20dB BW/99% OBW	Reporting	ANSI C63.10 Sections
See Comment		2008 800/99 /0 0800	purposes only	6.9.2 and 6.9.3
15.247 (a)(1)	RSS-247 (5.1) (b)	Hopping Frequency Separation	Complies	None.
15.247 (a)(1)(iii)	RSS-247 (5.1) (d)	Number of Hopping Channels	Complies	None.
15.247 (a)(1)(iii)	RSS-247 (5.1) (d)	Average Time of Occupancy	Complies	None.
15.247 (b)(1)	RSS-247 (5.4) (b)	Output Power	Complies	None.
See Comment		Average Dower	Reporting	Per ANSI C63.10,
See Comment		Average Power	purposes only	Section 11.9.2.3.2.
15.247 (d)	RSS-247 (5.5)	Conducted Spurious Emissions	Complies	None.
15.209, 15.205	RSS-GEN 8.9, 8.10	Radiated Emissions	Complies	None.
15.207	RSS-Gen 8.8	AC Mains Conducted Emissions	Complies	None.

# 3. 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, KDB 558074 D01 15.247 Meas Guidance v05r02, KDB 414788 D01 Radiated Test Site v01r01, KDB 662911, RSS-GEN Issue 5 + A1 + A2, and RSS-247 Issue 2.

# 4. FACILITIES AND ACCREDITATION

UL LLC is accredited by A2LA, certification #0751.05, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

Location	Address	ISED CABID	ISED Company Number	FCC Registration
	Building 1: 47173 Benicia Street, Fremont, CA 94538, USA	US0104	2324A	550739
$\boxtimes$	Building 2: 47266 Benicia Street, Fremont, CA 94538, USA	US0104	22541	550739
$\boxtimes$	Building 4: 47658 Kato Rd, Fremont, CA 94538, USA	US0104	2324B	550739

# 5. DECISION RULES AND MEASUREMENT UNCERTAINTY

# 5.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

Page 7 of 153

### 5.2. DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

### 5.3. MEASUREMENT UNCERTAINTY

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

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

PARAMETER	U <sub>Lab</sub>
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.78 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.40 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.87 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	6.01 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.73 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.51 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.29 dB

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

### 5.4. SAMPLE CALCULATION

### RADIATED EMISSIONS

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

### MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided: Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss. 36.5 dBuV + 0 dB +10.1 dB+ 0 dB = 46.6 dBuV

Page 8 of 153

# 6. EQUIPMENT UNDER TEST

### 6.1. EUT DESCRIPTION

The Apple iPhone is a smartphone with multimedia functions (music, application support, and video),cellular GSM, GPRS, EGPRS, UMTS, LTE, 5G, IEEE 802.11a/b/g/n/ac/ax, Bluetooth, Ultra-Wideband, GPS, NFC and MSS. All models except reference model support at least one UICC based SIM. The second SIM is either an UICC based p-SIM (physical SIM) or e-SIM (electronic SIM). The device supports a built-in inductive charging transmitter and receiver. The rechargeable battery is not user accessible.

Testing was performed on the parent model and is used to support the application for the parent and variants identified in this report based on the test plan submitted and approved via KDB inquiry by the FCC and by ISED-Canada.

The Model and FCC IDs / ISED covered by this report includes:

Parent Model: A2649, FCC ID: BCG-E8138A, IC: 579C-E8138A

Variant Models: A2881, FCC ID: BCG-E8142A, IC: 579C-E8142A A2882; FCC ID: BCG-E8143A, IC: 579C-E8143A A2883 & A2884, FCC ID: BCG-E8144A, IC: 579C-E8144A

### 6.2. MAXIMUM OUTPUT POWER

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

Antenna	Config	Frequency Range Mode		Output	Output
		(MHz)		Power	Power
				(dBm)	(mW)
		2402 - 2480	Basic GFSK	20.24	105.68
	High Power	2402 - 2480	DQPSK	18.75	74.99
ANT 4		2402 - 2480	Enhanced 8PSK	19.10	81.28
ANT 4		2402 - 2480	Basic GFSK	11.18	13.12
	Low Power	2402 - 2480	DQPSK	10.62	11.53
		2402 - 2480	Enhanced 8PSK	10.68	11.69
		2402 - 2480	Basic GFSK	20.14	103.28
	High Power	2402 - 2480	DQPSK	19.15	82.22
ANT 3		2402 - 2480	Enhanced 8PSK	19.17	82.60
ANTS		2402 - 2480	Basic GFSK	11.15	13.03
		2402 - 2480	DQPSK	10.73	11.83
		2402 - 2480	Enhanced 8PSK	10.76	11.91
		2402 - 2480	Basic GFSK TxBF	20.19	104.47
	High Power	2402 - 2480	DQPSK TxBF	19.05	80.35
BF, ANT 4 + ANT 3		2402 - 2480	Enhanced 8PSK TxBF	19.20	83.18
DI, ANT 4 TANT 5		2402 - 2480	Basic GFSK TxBF	14.17	26.12
	Low Power	2402 - 2480	DQPSK TxBF	13.69	23.39
		2402 - 2480	Enhanced 8PSK TxBF	13.75	23.71

Note: GFSK, DQPSK, 8PSK average Power are all investigated, The GFSK & 8PSK Power are the worst case. Testing is based on these modes to showing compliance. For average power data please refer to section 9.7.

Page 9 of 153

### 6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The antenna(s) gain and type, as provided by the manufacturer' are as follows:

Frequency Range (GHz)	ANT 4 (dBi)	ANT 3 (dBi)
2.4	-2.0	-0.8

### 6.4. SOFTWARE AND FIRMWARE

The EUT firmware version was 20.1.467.5699.

### 6.5. WORST-CASE CONFIGURATION AND MODE

The EUT was investigated in three orthogonal orientations X, Y and Z on ANT 4, ANT 3 and 2TX beamforming. It was determined that Y (Landscape)) was the worst-case orientation for , ANT 3, 2TX Beamforming and X (Flatbed) for ANT 4.

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. There were no emissions found below 30MHz within 20dB of the limit

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. 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 emission was found.

For radiated harmonic spurious emissions test, beamforming GFSK and 8PSK modes were set to maximum power per chain based on SISO power to cover both non-BF and BF modes to complies with radiated spurious emissions limits in the restricted bands between 1GHz and 18GHz low/mid/high channel.

For Radiated band edge, GFSK, 8PSK and TXBF modulations were all investigated on low and high power setting.

GFSK, DQPSK, 8PSK average power are all investigated, The GFSK & 8PSK power are the worst case. For average power data please refer to section 9.7.

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

GFSK mode: DH5 8PSK mode: 3-DH5 Beamforming : GFSK, DH5, 8PSK, 3-DH5

Page 10 of 153

There are three vendors of the Wi-Fi/Bluetooth radio modules: variant 1, 2 and 3.. The WiFi/BT radio modules have the same mechanical outline (e.g., the same package dimension and pinout 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 three variants to determine the worst case on all conducted power and radiated emissions.

### 6.6. DESCRIPTION OF TEST SETUP

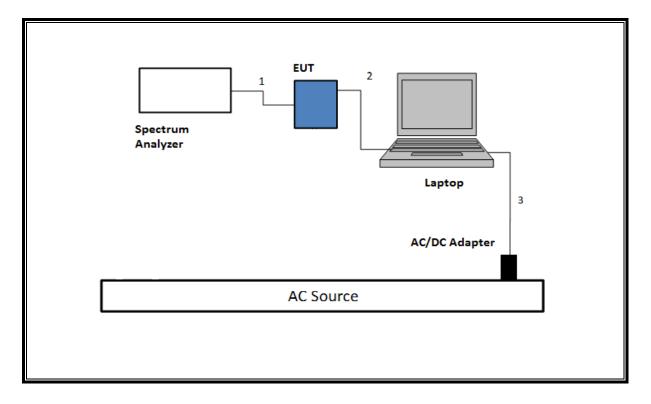
SUPPORT TEST EQUIPMENT							
D	Description Manufacturer Model Serial Number		FCC ID/ DoC				
	Laptop	Apple	Macbook Pro	C02VD7SA	AHV22	BCGA1708	
Laptop	AC/DC adapter	Liteon Technology	A1424	NSW25	679	DoC	
EUT /	AC/DC adapter	Apple	A1720	C3D8417A7R	93KVPA8	DoC	
		I/O CAE	BLES (RF CONDUC	TED TEST)			
Cable 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	1.0	N/A	
3	AC	1	AC	Un-shielded	2	N/A	
		I/O CABLES (R	F RADIATED AND	AC LINE AC TEST)			
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type Cable Length (m)		Remarks	
1	AC	1	AC	Un-shielded	2	N/A	
2	USB	1	USB	Shielded	1	N/A	

### TEST SETUP

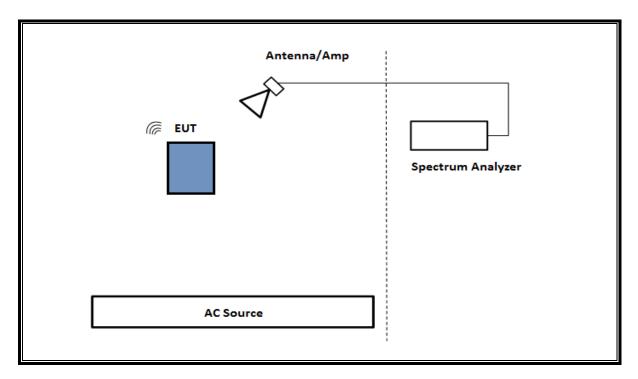
The EUT setup is shown as below. Test software exercised the radio card.

Page 12 of 153

#### SETUP DIAGRAM FOR CONDUCTED TESTS

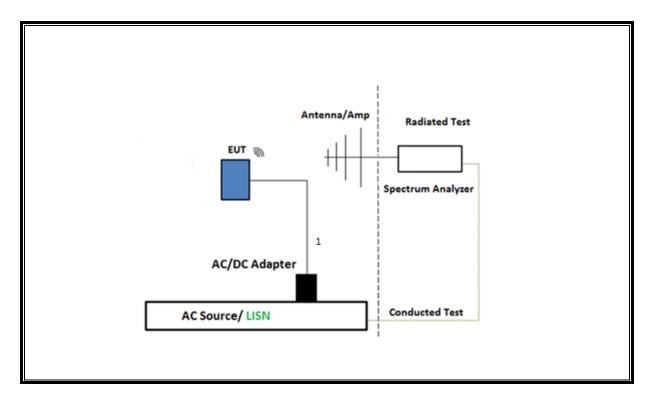


#### SETUP DIAGRAM FOR RADIATED TESTS Above 1 GHz

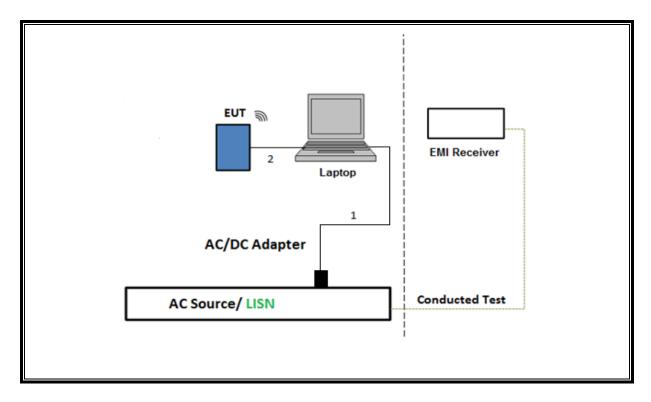


Page 13 of 153

#### SETUP DIAGRAM FOR BELOW 1GHz and AC LINE CONDUCTED TEST



#### **TEST SETUP- AC LINE CONDUCTED: LAPTOP CONFIGURATION**



Page 14 of 153

# 7. 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	Last Cal
Spectrum Analyzer, PXA 3Hz to 44GHz	Keysight	N9030A	125188	01/30/2023	01/30/2022
Antenna, Horn 1-18GHz	ETS Lindgren	3117	200786	02/24/2023	02/24/2022
*RF Filter Box	UL-FR1	N/A	PRE0182865	03/30/2022	03/30/2021
Antenna, Horn 1-18GHz	ETS Lindgren	3117	80430	07/21/2022	07/21/2021
RF Filter Box 1-18GHz	UL-FR	NA	169334	04/15/2023	04/15/2022
RF Filter Box 1-18GHz	UL-FR1	NA	PRE0183530	11/17/2022	11/17/2021
Antenna, Horn 1-18GHz	ETS Lindgren	3117	200897	02/24/2023	02/24/2022
Spectrum Analyzer, PXA 3Hz to 44GHz	Keysight	N9030A	125179	02/01/2023	02/01/2022
Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	79584	07/21/2022	07/21/2021
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences Corp.	JB3	204044	01/31/2023	01/31/2022
*Antenna Horn 18 to 26.5GHz	ARA	MWH-1826/B	81139	05/25/2022	05/25/2021
RF Filter 1-18GHz	UL-FR1	SAC 6 port rf box	203957	02/12/2023	02/12/2022
*Pre-Amp 18-26GHz	Agilent Technology	8449B	T404	04/19/2022	04/19/2021
Power Meter, P-series single channel	Keysight	N1911A	T1244	01/24/2023	01/24/2022
Power Sensor	Keysight	N1921A	90389	03/02/2023	03/02/2022
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	200895	10/13/2022	10/13/2021
*Spectrum Analyzer, PXA 3Hz to 44GHz	Keysight	N9030A	T1466	01/25/2022	01/25/2021
*Amplifier, 1 to 8GHz 35dB	Amplical	AMF-4D-01000800- 30-29P	T1169	03/30/2022	03/30/2021
Antenna, Active Loop 9KHz to 30MHz	EMCO	6502	T35	10/05/2022	10/05/2021
Spectrum Analyzer, PXA 3Hz to 44GHz	Keysight	N9030A	125179	02/01/2023	02/01/2022
Amplifier, 1 to 18GHz, 35dB	AMPLICAL	AMP1G18-35	T1571	08/19/2022	08/19/2021

AC Line Conducted							
Description	Manufacturer	Model	ID Num	Cal Due	Last Cal		
EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESR	T1436	02/21/2023	02/21/2022		
Power Cable, Line Conducted Emissions	UL	PR1	T861	10/27/2022	10/27/2021		
LISN for Conducted Emissions CISPR-16	FISCHER CUSTOM COMMUNICATIONS	FCC-LISN- 50/250-25-2-01- 480V	175765	01/26/2023	01/26/2022		
	UL AUTOMA	<b>TION SOFTWAR</b>	E	•			
Radiated Software UL UL EMC Ver 9.5, Mar 6, 2020					20		
Conducted Software UL UL EMC AP2021.4.1, AP2021.8.27			.8.27				
AC Line Conducted Software	UL	UL EMC	Ve	er 9.5, July, 202	0		

\*Testing is completed before equipment expiration date.

Page 15 of 153

### 8. 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 Below 30MHz: ANSI C63.10-2013 Section 6.4 & 13

Radiated Spurious Emissions 30-1000MHz: ANSI C63.10-2013 Section 6.3, 6.5 & 13

Radiated Spurious Emissions above 1GHz: ANSI C63.10-2013 Section 6.3, 6.6 & 13

Radiated Band-edge: ANSI C63.10-2013 Section 6.10.5 & 13

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

Page 16 of 153

# 9. ANTENNA PORT TEST RESULTS

### 9.1. ON TIME AND DUTY CYCLE

#### LIMITS

None; for reporting purposes only.

#### PROCEDURE

ANSI C63.10, Section 11.6 : Zero-Span Spectrum Analyzer Method.

### 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	0.40	0.40	1.000	100.0%	0.00	0.010
Bluetooth 8PSK	0.40	0.40	1.000	100.0%	0.00	0.010
Bluetooth GFSK TxBF	0.40	0.40	1.000	100.0%	0.00	0.010
Bluetooth 8PSK TxBF	0.40	0.40	1.000	100.0%	0.00	0.010

Page 17 of 153

### DUTY CYCLE PLOTS

Agilent Spectrum Analyzer - AP2021.8	.27,26118,			Agilent Spectrum Analyzer - AP2021.8.27	7,26118,		
22 RL RF 50 9 DC Center Freq 2.40200000	0 GHz PNO: Fast IFGain:Low Atten: 32 dB	ALIGNAUTO 10:20:25 AM Apr 28, 2022 Avg Type: Log-Pwr TRACE 1 2 3 4 5 TYPE WWWWWW ott P NNNN	6 Prequency	Center Freq 2.402000000	GHZ PNO: Fast Trig: Free Run IFGain:Low Atten: 32 dB	ALIGNAUTO 10:36:17 AM Apr 28, 2022 Avg Type: Log-Pwr TRACE 12:34:5:6 TYPE WWWWWWWW Det F N N N N N	Frequency
10 dB/div Ref 21.00 dBm		Mkr1 400.0 µs 6.62 dBr		10 dB/div Ref 21.00 dBm	Poanticow Priori of the	Mkr1 400.0 μs 5.94 dBm	Auto Tune
	1		Center Freq 2.402000000 GHz		1	2Δ1	Center Freq 2.402000000 GHz
-19.0			Start Freq 2.402000000 GHz	-900 -19.0 -29.0			Start Freq 2.402000000 GHz
-39.0			Stop Freg	-39.0			Stop Free
-69.0			2.402000000 GHz	-59.0			2.402000000 GH
Center 2.402000000 GHz Res BW 8 MHz	#VBW 50 MHz	Span 0 Ha Sweep 1.000 ms (1001 pts	CF Step 8.000000 MHz Auto Man	Center 2.402000000 GHz Res BW 8 MHz	#VBW 50 MHz	Span 0 Hz Sweep 1.000 ms (1001 pts)	CF Step 8.000000 MHz Auto Mar
1 N 1 t 2 Δ1 1 t (Δ) 3 4	400.0 μs 6.60 dBm 199.0 μs (Δ) 0.00 dB		Freq Offset 0 Hz	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	400.0 μs 6.36 dBm 199.0 μs (Δ) 0.53 dB		Freq Offse 0 H
5 6 7 8 9 10				7 8 9 10			
11 K		STATUS		11 < wsg		STATUS	
L № 50Ω DC Center Freq 2.40200000	O GHz PNO: Fast IFGain:Low Atten: 32 dB	ALIONAUTO 10:35:02 AM Apr 28,202 Avg Type: Log.Pwr TRACE 12.3 4 5 Type P NNNN Det P NNNN Mkr1 400.0 µs	6 Prequency	Agilent Spectrum Analyzer - AP2021.8.27	SENSE: INT	ALIGNAUTO 10:36:40 AM Apr 28, 2022 Avg Type: Log-Pwr TRACE 12:34:56 TYPE DEI P N N N N Mkr1 400.0 µs	Frequency Auto Tun
10 dB/div Ref 21.00 dBm	1	Mkr1 400.0 µt 6.17 dBn	Center Freq	10 dB/div Ref 21.00 dBm	1	Mkr1 400.0 µs 6.31 dBm	Center Fre
9.00			2.40200000 GHz	-9.00			2.402000000 GH
29.0			2.402000000 GHz	-29.0 -39.0 -49.0			2.402000000 GH
			Stop Freq 2.402000000 GHz	-69.0			Stop Fre 2.402000000 GH
Center 2.402000000 GHz Res BW 8 MHz	#VBW 50 MHz	Span 0 Hz Sweep 1.000 ms (1001 pts UNCTION FUNCTION WIDTH FUNCTION VALUE		Center 2.402000000 GHz Res BW 8 MHz	#VBW 50 MHz	Span 0 Hz Sweep 1.000 ms (1001 pts)	CF Stej 8.000000 MH Auto Ma
1 N 1 t 2 Δ1 1 t (Δ) 3 4	400.0 μs 6.17 dBm 199.0 μs (Δ) 0.10 dB		Freq Offset 0 Hz	1 Ν 1 t 2 Δ1 1 t (Δ) 3 4 5	400.0 μs 6.38 dBm 199.0 μs (Δ) 0.08 dB		Freq Offse 0 H
5 6 7 8 9 10				6 7 8 9 10 11			
11 < MSG	Ľ	STATUS	×	11 MSG		STATUS	
		I TxBF GFSK		I BI		I TxBF 8PSK	

Page 18 of 153

### 9.2. 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  $\ge 1\%$  of the 20 dB bandwidth. The VBW is set to  $\ge 3x$ RBW. The sweep time is coupled.

#### **RESULTS**

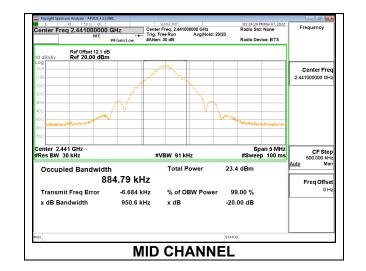
Only High Power modes result is reported, it covers all Low Power modes. Only Mid channel plot is reported to show setting parameter complies with testing method/procedure.

Page 19 of 153

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

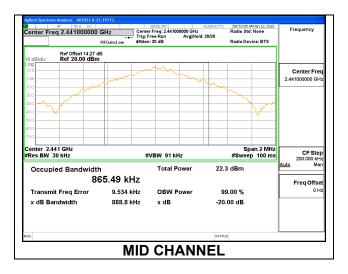
#### <u>ANT 4</u>

Channel	Frequency	20dB Bandwidth	99% Bandwidth
	(MHz)	(MHz)	(MHz)
Low	2402	0.954	0.887
Mid	2441	0.951	0.885
High	2480	0.952	0.881



#### <u>ANT 3</u>

Channel	Frequency	20dB Bandwidth	99% Bandwidth
	(MHz)	(MHz)	(MHz)
Low	2402	0.889	0.865
Mid	2441	0.889	0.865
High	2480	0.888	0.866

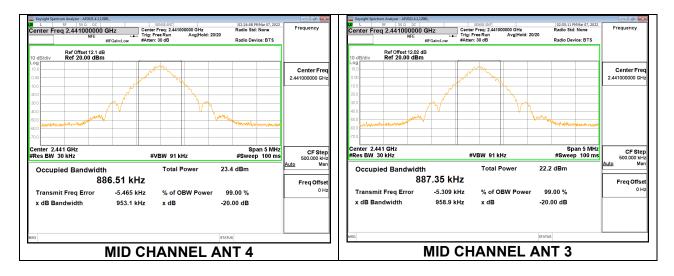


Page 20 of 153

### 9.2.2. HIGH POWER BASIC DATA RATE TXBF GFSK MODULATION

Note: Test procedure on beamforming mode is same as BT basic and EDR mode

Channel	Frequency	20dB Bandwidth	20dB Bandwidth	99% Bandwidth	99% Bandwidth
		ANT 4	ANT 3	ANT 4	ANT 3
	(MHz)	(MHz)	(MHz)	(MHz)	(MHz)
Low	2402	0.954	0.953	0.887	0.888
Mid	2441	0.953	0.959	0.887	0.887
High	2480	0.958	0.955	0.885	0.887

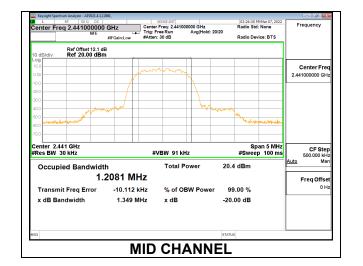


Page 21 of 153

### 9.2.3. HIGH POWER ENHANCED DATA RATE 8PSK MODULATION

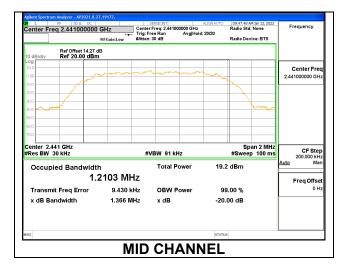
#### <u>ANT 4</u>

Channel	Frequency	20dB Bandwidth	99% Bandwidth
	(MHz)	(MHz)	(MHz)
Low	2402	1.353	1.209
Mid	2441	1.349	1.208
High	2480	1.351	1.207



#### <u>ANT 3</u>

Channel	Frequency	20dB Bandwidth	99% Bandwidth
	(MHz)	(MHz)	(MHz)
Low	2402	1.208	1.362
Mid	2441	1.210	1.366
High	2480	1.209	1.366

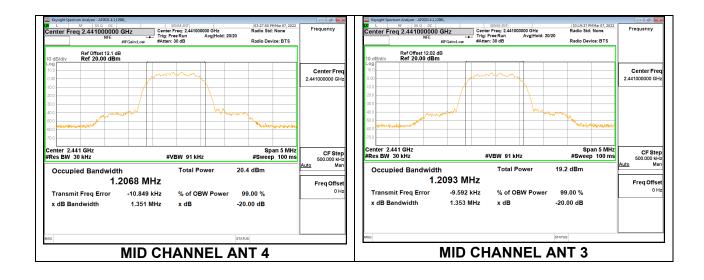


Page 22 of 153

### 9.2.4. HIGH POWER ENHANCED DATA RATE TXBF 8PSK MODULATION

Note: Test procedure on beamforming mode is same as BT basic and EDR mode

Channel	Frequency	20dB Bandwidth	20dB Bandwidth	99% Bandwidth	99% Bandwidth
		ANT 4	ANT 3	ANT 4	ANT 3
	(MHz)	(MHz)	(MHz)	(MHz)	(MHz)
Low	2402	1.353	1.352	1.209	1.206
Mid	2441	1.351	1.353	1.207	1.209
High	2480	1.351	1.353	1.208	1.206



Page 23 of 153

### 9.3. 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 VBW >= 3xRBW. The sweep time is coupled.

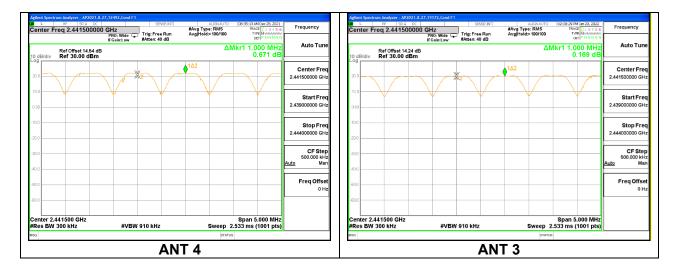
#### **RESULTS**

Only High Power GFSK mode result is reported since EDR (QPSK/8PSK) has exact same channel plan.

Page 24 of 153

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

#### **HOPPING FREQUENCY SEPARATION**



Page 25 of 153

### 9.4. 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 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.

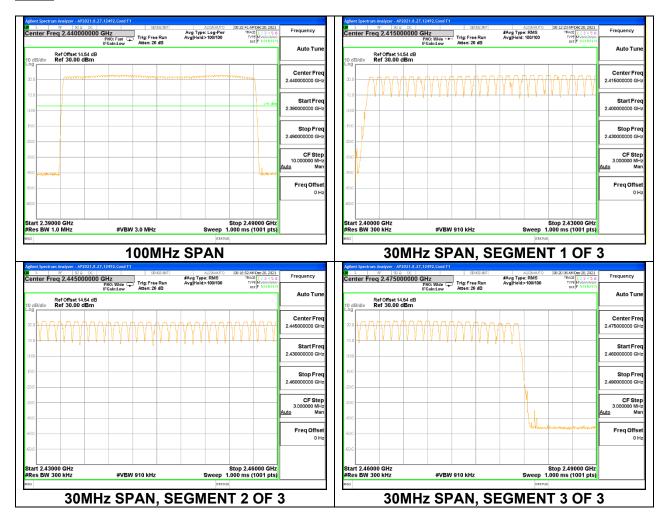
#### <u>RESULTS</u>

Normal Mode: 79 Channels Observed. Only High Power GFSK mode result is reported since EDR (QPSK/8PSK) has exact same channel plan.

Page 26 of 153

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

#### <u>ANT 4</u>



Page 27 of 153

### <u>ANT 3</u>

Ref Offset 14.24 db  Ref 30.00 dbm    0  0  0    0  0  0    0  0  0    0  0  0    0  0  0    0  0  0    0  0  0    0  0  0    0  0  0    0  0  0    0  0  0    0  0  0    0  0  0    0  0  0    0  0  0    0  0  0    0  0  0    0  0  0    0  0  0	IFGain:Low Atten: 26 dB		CEIP NNNN		Certific Free 2.4.100000 Ref 30.00 dBn 20.0 10.0 10.0 10.0 20.0 10.0 10.0 20.0 10.0 10.0 20.0 10.0 10.0 20.0 1	PHO: Wide Trig: Free Run IFGain:Low Atten: 26 dB		ani) NUNN ani) NUNN ani ani ani ani ani ani ani ani	Auto Tu Center Fr 2.475000000 G Start Fr 2.460000000 G 300000 M Auto N Freq Offs 0 0
detidu Ref 30.00 dBm 0 0 0 0 0 0 0 0 0 0 0 0 0	IFGain:Low Atten: 26 dB			Center Freq    2.44500000 GHz    Start Freq    2.430000000 GHz    Stop Freq    2.460000000 GHz    CF Step    3.000000 MHz    Man    Freq Offset    0 Hz	No.00  Ref Offset 14.24    10 dBldld  Ref 30.00 dBn    20 0  0    10 0  0    10 0  0    10 0  0    10 0  0    10 0  0    10 0  0    10 0  0    10 0  0    10 0  0    10 0  0    10 0  0    10 0  0    40 0  0    40 0  0    40 0  0	PHO: Wide Trig: Free Run IFGain:Low Atten: 26 dB			Auto Tu Center Fr 2.47500000 G Start Fr 2.46000000 G Stop Fr 2.49000000 G 3.00000 M Auto W Freq Offs
atidu Ref 30.00 dBm	IFGain:Low Atten: 26 dB			Center Freq    2.44500000 GHz    Start Freq    2.450000000 GHz    Stop Freq    3.000000 GHz    3.000000 GHz    3.000000 GHz    Auto    Freq Offset	Ref Offset 14.24    10 dBidiv  Ref 30.00 dBn    200	PHO: Wide Trig: Free Run IFGain:Low Atten: 26 dB			Auto Tu Center Fr 2.47500000 G Start Fr 2.46000000 G Stop Fr 2.49000000 G 3.00000 M Auto W Freq Offs
atidu Ref 30.00 dBm	IFGain:Low Atten: 26 dB			Center Freq 2.44500000 GHz Start Freq 2.43000000 GHz 2.40000000 GHz 2.40000000 GHz 3.00000 MHz Auto Man	Ref Offset 14.24    10 dBidle  Ref 30.00 dBn    20 0  0    10 dBidle  0    20 0  0    10 dBidle  0    20 0  0    300  0    40 0  0	PHO: Wide Trig: Free Run IFGain:Low Atten: 26 dB			Auto Tu Center Fi 2.475000000 C Start Fr 2.46000000 C Stop Fi 2.49000000 C CF St 3.000000 M Auto
atridue Ref 30.00 dBm	IFGain:Low Atten: 26 dB			Center Freq    2.44500000 GHz    Start Freq    2.43000000 GHz    Stop Freq    2.46000000 GHz    CF Step    3.000000 MHz	Ref Offset 14.24    10 dBldlu  Ref 30.00 dBn    20 0  0    10 dBldlu  0    20 0  0    10 0  0    10 0  0    10 0  0    10 0  0    10 0  0    10 0  0    10 0  0    10 0  0	PHO: Wide Trig: Free Run IFGain:Low Atten: 26 dB			Auto Tu Center Fr 2.47500000 G Start Fr 2.46000000 G Stop Fr 2.49000000 G
addidiv Ref 30.00 dBm 0 0 0 0 0 0 0 0 0 0 0 0 0	IFGain:Low Atten: 26 dB			Center Freq 2.44500000 GHz Start Freq 2.430000000 GHz Stop Freq 2.460000000 GHz CF Step	10 dBldlv Ref Offset 1424 Log 20 0 100 100 200 200 200	PHO: Wide Trig: Free Run IFGain:Low Atten: 26 dB			Auto Tu Center Fr 2.475000000 G Start Fr 2.46000000 G Stop Fr 2.49000000 G
albidiv Ref 30.00 dBm	IFGain:Low Atten: 26 dB			Center Freq 2.445000000 GHz Start Freq 2.430000000 GHz Stop Freq	Ref Offset 1424    Log  Ref 30.00 dBn    20.0  0.00    10.0  0.00	PHO: Wide Trig: Free Run IFGain:Low Atten: 26 dB			Auto Tu Center Fi 2.475000000 C Start Fi 2.460000000 C
dB/div Ref 30.00 dBm	IFGain:Low Atten: 26 dB			Center Freq 2.445000000 GHz Start Freq 2.430000000 GHz	Ref Offset 14.24. Log 20.0 10.0 10.0 10.0	PHO: Wide Trig: Free Run IFGain:Low Atten: 26 dB			Auto TL Center Fi 2.475000000 0 Start Fi 2.460000000 0
dB/div Ref 30.00 dBm	IFGain:Low Atten: 26 dB			Center Freq 2.445000000 GHz Start Freq	10 dB/dlv Ref 00%st 1424 Log 200	PHO: Wide Trig: Free Run IFGain:Low Atten: 26 dB			Auto Tu Center Fr 2.47500000 c Start Fr
dB/div Ref 30.00 dBm	IFGain:Low Atten: 26 dB			Center Freq	Ref Offset 14.24 ( 10 dB/div Ref 30.00 dBn	PHO: Wide Trig: Free Run IFGain:Low Atten: 26 dB		TYPE (Routenation Det) (P NHHH N	Auto Tu Center Fi
dB/div Ref 30.00 dBm	IFGain:Low Atten: 26 dB			Center Freq	Ref Offset 14.24 ( 10 dB/div Ref 30.00 dBn	PHO: Wide Trig: Free Run IFGain:Low Atten: 26 dB	AvgiHeid>100/100	Det P NNNN	Auto Tu Center Fi
dB/div Ref 30.00 dBm	IFGain:Low Atten: 26 dB	Avginitia.> 100/100	DET P N N N N	Auto Tune	Ref Offset 14.24 ( 10 dB/div Ref 30.00 dBn	PHO: Wide Trig: Free Run IFGain:Low Atten: 26 dB	Avg Hold>100/100	TYPE MONOMOUND DET P N N N N N	
	IFGain:Low Atten: 26 dB	Avginola;>100/100	DET P N N N N N	Auto Tune	Center Freq 2.4750000	PNO: Wide 🔔 Trig: Free Run	Avg Hold>100/100	DET P NNNN N	
nter Freq 2.44500000	0 GHz	#Avg Type: RMS Avg Hold:>100/100	TRACE 1 2 3 4 5 6	Frequency	Center Freq 2.4750000	00 GHz	#Avg Type: RMS	TRACE 1 2 3 4 5 6 TYPE R WARAAAAA	Frequency
nt Spectrum Analyzer - AP2021.8	3.27,19172,Cond F1		02:26:23 PM Jan 20, 2022		Agilent Spectrum Analyzer - AP2021	.8.27.19172.Cond F1	ALIGNAUTO		
	100MHz		15		30M	Hz SPAN, SI			3
art 2.39000 GHz es BW 1.0 MHz	#VBW 3.0 MHz		Stop 2.49000 GHz 1.000 ms (1001 pts)		Start 2.40000 GHz #Res BW 300 kHz	#VBW 910 kHz		Stop 2.43000 GHz 1.000 ms (1001 pts)	
0				0 Hz	-60.0				C
0			2.240-242	Freq Offset	-50.0				Freq Off
0				10.000000 MHz <u>Auto</u> Man	-40.0				3.000000 N Auto
0				CF Step	-200				CF St
0				Stop Freq 2.490000000 GHz	-10.0				Stop Fr 2.430000000 0
10				2.390000000 GHz	0.00				2.400000000
0			1.53 dBm	Start Freq	10.0	<u> </u>	/ ¥ ₩ ₩ ₩ ₩ ₩	* * * * * *	Start F
0	******	and the second s	mmm	2.440000000 GHz	20.0		MMM		2.415000000 0
				Center Freg	10 dB/div Ref 30.00 dBn	n			Center F
dB/div Ref 30.00 dBm				Auto Tune	Ref Offset 14.24 d	dB		DET P N N N N	Auto Tu
Ref Offset 14.24 dt dB/div Ref 30.00 dBm	PNO: Fast Trig: Free Run IFGain:Low Atten: 26 dB		DETPNNNNN	Auto Tune		PNO: Wide Trig: Free Run IFGain:Low Atten: 26 dB			

Page 28 of 153

### 9.5. 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**

Only High Power GFSK mode result is reported since EDR (QPSK/8PSK) has exact same timing.

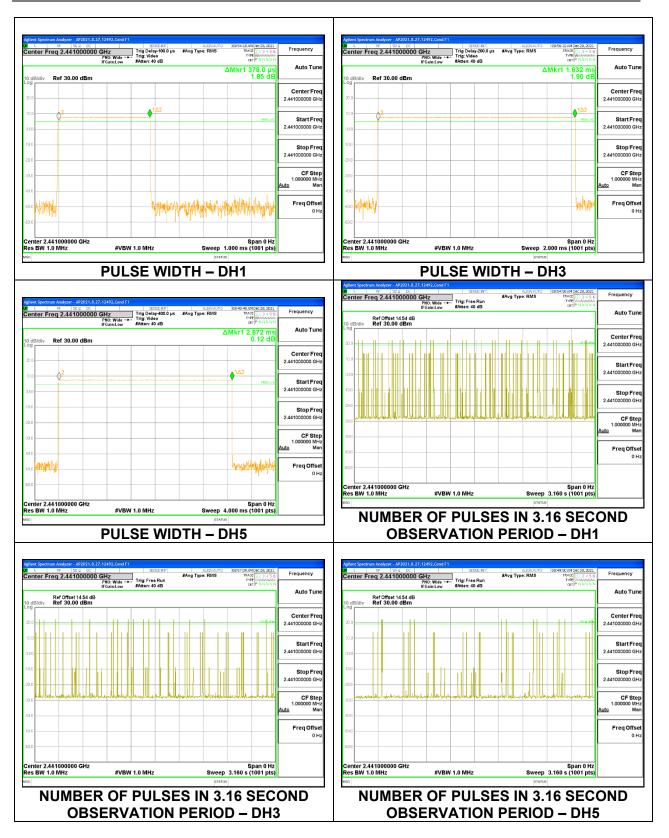
Page 29 of 153

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

### <u>ANT 4</u>

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)			
GFSK Normal	GFSK Normal Mode							
DH1	0.378	32	0.121	0.4	-0.279			
DH3	1.632	16	0.261	0.4	-0.139			
DH5	2.872	10	0.287	0.4	-0.113			
DH Packet	Pulse Width (sec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)			
GFSK AFH Mo	ode							
DH1	0.378	8	0.030	0.4	-0.370			
DH3	1.632	4	0.065	0.4	-0.335			
DH5	2.872	2.5	0.072	0.4	-0.328			

Page 30 of 153

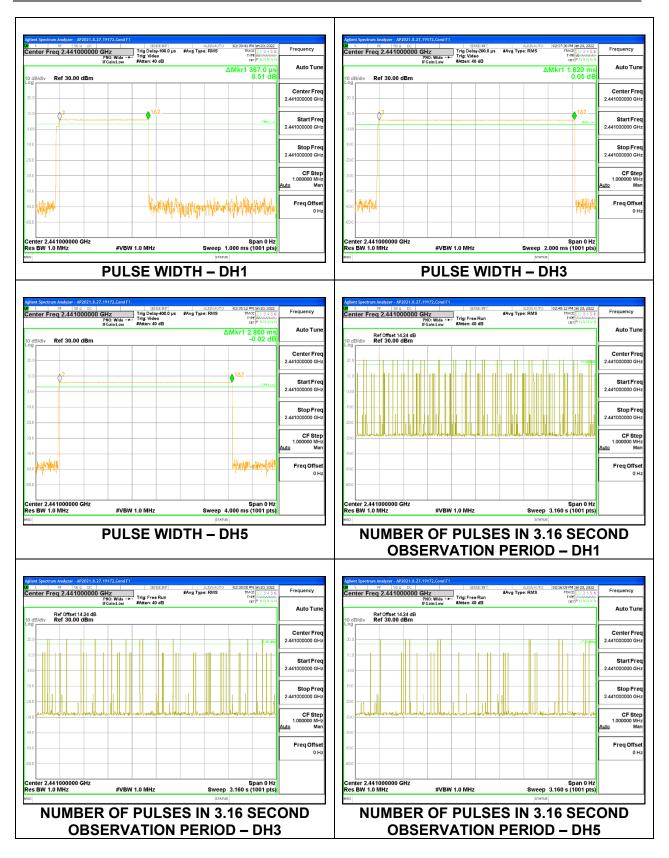


Page 31 of 153

### <u>ANT 3</u>

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)		
<b>GFSK Normal</b>	GFSK Normal Mode						
DH1	0.367	32	0.117	0.4	-0.283		
DH3	1.620	14	0.227	0.4	-0.173		
DH5	2.860	11	0.315	0.4	-0.085		
DH Packet	Pulse Width (sec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)		
GFSK AFH Mo	ode						
DH1	0.367	8.00	0.029	0.4	-0.371		
DH3	1.62	3.50	0.057	0.4	-0.343		
DH5	2.860	2.75	0.079	0.4	-0.321		

47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.



Page 33 of 153

### 9.6. OUTPUT POWER

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

§15.247 (b) (1)

RSS-247 (5.4) (b)

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

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts

#### TEST PROCEDURE

Measurements was perform using a power meter with wideband peak power sensor.

The power output was measured on the EUT antenna port using SMA cable with 10dB attenuator connected to a power meter via wideband peak power sensor. Peak output power was read directly from the power meter.

#### DIRECTIONAL ANTENNA GAIN

For 1 TX:

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

For 2 TX:

Tx chains are correlated for power due to the device supporting Beamforming. The directional gains are as follows:

	ANT 4	ANT 3	<b>Correlated Chains</b>
			Directional
Band	Gain	Gain	Gain
(GHz)	(dBi)	(dBi)	(dBi)
2.4	-2.00	-0.80	1.63

#### **DIRECTIONAL GAIN CALCULATION:**

ANSI C63.10-2013 section 14.4.3

Uncorrelated directional gain=10\*LOG((10^(Ant1/10)+10^(Ant2/10))/2) Correlated directional Gain=10\*LOG(((10^(Ant1/20)+10^(Ant2/20))^2)/2)

Sample Calculation:

Ant1=-2.0, Ant2=-0.8

Uncorrelated Antenna gain=10log[(10^(-2.0/10)+10^(-0.8/10))/2]=-1.36

Correlated Antenna gain=10log[(10^(-2.0/20)+10^(-0.8/20))^2)/2]=1.63

RESULTS

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

### <u>ANT 4</u>

Tested By:	19172
Date:	5/31/2022

Channel	Frequency	Output Power	Limit	Margin	
	(MHz)	(dBm)	(dBm)	(dB)	
Low	2402	20.20	21	-0.8	
Middle	2441	20.24 21		-0.76	
High	2480	20.19	21	-0.81	

#### <u>ANT 3</u>

Tested By:	19172	
Date:	5/31/2022	

Channel	Frequency	Output Power	Limit	Margin	
	(MHz)	(dBm)	(dBm)	(dB)	
Low	2402	20.14	21	-0.86	
Middle	2441	20.10	21	-0.9	
High	2480	20.05	21	-0.95	

### 9.6.2. HIGH POWER BASIC DATA RATE TXBF GFSK MODULATION

### <u>ANT 4 + ANT 3</u>

Tested By:	19172
Date:	5/31/2022

Channel	Frequency	Output Power	Output Power	Total Power	Limit	Margin
		ANT 4	ANT 3			
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Low	2402	17.14	17.16	20.16	21	-0.84
Middle	2441	17.12	17.15	20.15	21	-0.85
High	2480	17.17	17.18	20.19	21	-0.81

## 9.6.3. HIGH POWER ENHANCED DATA RATE QPSK MODULATION

#### <u>ANT 4</u>

Tested By:	19172
Date:	5/31/2022

Channel	Frequency	Output Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	18.75	21	-2.25
Middle	2441	18.55	21	-2.45
High	2480	18.62	21	-2.38

#### <u>ANT 3</u>

Tested By:	19172
Date:	5/31/2022

Channel	Frequency	Output Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	19.10	21	-1.9
Middle	2441	18.82	21	-2.18
High	2480	19.15	21	-1.85

## 9.6.4. HIGH POWER ENHANCED DATA RATE TXBF QPSK MODULATION

Tested By:	19172
Date:	5/31/2022

Channel	Frequency	Output Power	Output Power	Total Power	Limit	Margin
		ANT 4	ANT 3			
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Low	2402	16.02	15.90	18.97	21	-2.03
Middle	2441	16.03	16.05	19.05	21	-1.95
High	2480	15.85	15.92	18.90	21	-2.10

## 9.6.5. HIGH POWER ENHANCED DATA RATE 8PSK MODULATION

### <u>ANT 4</u>

Tested By:	19172
Date:	5/31/2022

Channel	Frequency	Output Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	18.90	21	-2.1
Middle	2441	19.10	21	-1.9
High	2480	18.85	21	-2.15

## <u>ANT 3</u>

Tested By:	19172
Date:	5/31/2022

Channel	Frequency	Output Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	19.16	21	-1.84
Middle	2441	19.16	21	-1.84
High	2480	19.17	21	-1.83

## 9.6.6. HIGH POWER ENHANCED DATA RATE TXBF 8PSK MODULATION

Tested By:	19172
Date:	5/31/2022

Channel	Frequency	Output Power	Output Power	Total Power	Limit	Margin
		ANT 4	ANT 3			
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Low	2402	16.18	16.15	19.18	21	-1.82
Middle	2441	16.17	16.18	19.19	21	-1.81
High	2480	16.18	16.20	19.20	21	-1.80

## 9.6.7. LOW POWER BASIC DATA RATE GFSK MODULATION

#### <u>ANT 4</u>

Tested By:	19172
Date:	5/31/2022

Channel	Frequency	Output Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	11.15	21	-9.85
Middle	2441	11.18	21	-9.82
High	2480	11.11	21	-9.89

## <u>ANT 3</u>

Tested By:	19172
Date:	5/31/2022

Channel	Frequency	Output Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	11.15	21	-9.85
Middle	2441	11.11	21	-9.89
High	2480	11.00	21	-10

## 9.6.8. LOW POWER BASIC DATA RATE TXBF GFSK MODULATION

Tested By:	19172
Date:	5/31/2022

Channel	Frequency	Output Power	Output Power	Total Power	Limit	Margin
		ANT 4	ANT 3			
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Low	2402	11.13	11.12	14.14	21	-6.86
Middle	2441	11.16	11.16	14.17	21	-6.83
High	2480	11.15	11.14	14.16	21	-6.84

## 9.6.9. LOW POWER ENHANCED DATA RATE QPSK MODULATION

#### <u>ANT 4</u>

Tested By:	19172
Date:	5/31/2022

Channel	Frequency	Output Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	10.62	21	-10.38
Middle	2441	10.50	21	-10.5
High	2480	10.62	21	-10.38

## <u>ANT 3</u>

Tested By:	19172
Date:	5/31/2022

Channel	Frequency	Output Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	10.73	21	-10.27
Middle	2441	10.63	21	-10.37
High	2480	10.61	21	-10.39

# 9.6.10. LOW POWER ENHANCED DATA RATE TXBF QPSK MODULATION

#### <u>ANT 4 + ANT 3</u>

Tested By:	19172
Date:	5/31/2022

Channel	Frequency	Output Power	Output Power	Total Power	Limit	Margin
		ANT 4	ANT 3			
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Low	2402	10.58	10.70	13.65	21	-7.35
Middle	2441	10.67	10.68	13.69	21	-7.31
High	2480	10.59	10.60	13.61	21	-7.39

Page 40 of 153

## 9.6.11. LOW POWER ENHANCED DATA RATE 8PSK MODULATION

## <u>ANT 4</u>

Tested By:	19172
Date:	5/31/2022

Channel	Frequency	Output Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	10.67	21	-10.33
Middle	2441	10.59	21	-10.41
High	2480	10.68	21	-10.32

#### <u>ANT 3</u>

Tested By:	19172
Date:	5/31/2022

Channel	Frequency	Output Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2402	10.76	21	-10.24
Middle	2441	10.70	21	-10.3
High	2480	10.66	21	-10.34

# 9.6.12. LOW POWER ENHANCED DATA RATE TXBF 8PSK MODULATION

## <u>ANT 4 + ANT 3</u>

Tested By:	19172
Date:	5/31/2022

Channel	Frequency	Output Power	Output Power	Total Power	Limit	Margin
		ANT 4	ANT 3			
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Low	2402	10.70	10.72	13.72	21	-7.28
Middle	2441	10.74	10.73	13.75	21	-7.25
High	2480	10.75	10.66	13.72	21	-7.28

Page 41 of 153

## 9.7. AVERAGE POWER

## **LIMITS**

None; for reporting purposes only

## TEST PROCEDURE

Measurements was performed using a power meter with wideband average power sensor.

The power output was measured on the EUT antenna port using SMA cable with 10dB attenuator connected to a power meter via wideband average power sensor. Gated average output power was read directly from power meter.

## **RESULTS**

Page 42 of 153

## 9.7.1. HIGH POWER BASIC DATA RATE GFSK MODULATION

## <u>ANT 4</u>

Tested By:	19172		
Date	5/31/2022		
Channel	Frequency	Average Power	
	(MHz)	(dBm)	
Low	2402	19.94	
Middle	2441	19.95	
High	2480	19.93	

## <u>ANT 3</u>

Tested By:	19172
Date	5/31/2022

Channel	Frequency	Average Power
	(MHz)	(dBm)
Low	2402	19.92
Middle	2441	19.88
High	2480	19.85

# 9.7.2. HIGH POWER BASIC DATA RATE TXBF GFSK MODULATION

Tested By:	19172
Date:	5/31/2022

Channel	Frequency	Average Power	Average Power	Total Power
		ANT 4	ANT 3	
	(MHz)	(dBm)	(dBm)	(dBm)
Low	2402	16.88	16.95	19.93
Middle	2441	16.91	16.94	19.94
High	2480	16.96	16.97	19.98

## 9.7.3. HIGH POWER ENHANCED DATA RATE QPSK MODULATION

## <u>ANT 4</u>

Tested By:	19172			
Date	5/31/2022			
Channel	Frequency	Average Power		
	(MHz)	(dBm)		
Low	2402	16.40		
Middle	2441	16.25		
High	2480	16.31		

## <u>ANT 3</u>

Tested By:	19172
Date	5/31/2022

Channel	Frequency	Average Power
	(MHz)	(dBm)
Low	2402	16.40
Middle	2441	16.32
High	2480	16.44

## 9.7.4. HIGH POWER BASIC DATA RATE TXBF QPSK MODULATION

## <u>ANT 4 + ANT 3</u>

Tested By:	19172
Date:	5/31/2022

Channel	Frequency	Average Power	Average Power	Total Power
		ANT 4	ANT 3	
	(MHz)	(dBm)	(dBm)	(dBm)
Low	2402	13.42	13.25	16.35
Middle	2441	13.43	13.44	16.45
High	2480	13.20	13.30	16.26

Page 44 of 153

# 9.7.5. HIGH POWER ENHANCED DATA RATE 8PSK MODULATION

## <u>ANT 4</u>

Tested By:	19172		
Date	5/31/2022		
Channel	Frequency	Average Power	
	(MHz)	(dBm)	

	(MHz)	(dBm)
Low	2402	16.30
Middle	2441	16.45
High	2480	16.35

## <u>ANT 3</u>

Tested By:	19172
Date	5/31/2022

Channel	Frequency	Average Power
	(MHz)	(dBm)
Low	2402	16.46
Middle	2441	16.45
High	2480	16.47

# 9.7.6. HIGH POWER BASIC DATA RATE TXBF 8PSK MODULATION

Tested By:	19172
Date:	5/31/2022

Channel	Frequency	Average Power	Average Power	Total Power
		ANT 4	ANT 3	
	(MHz)	(dBm)	(dBm)	(dBm)
Low	2402	13.48	13.45	16.48
Middle	2441	13.47	13.48	16.49
High	2480	13.46	13.47	16.48

# 9.7.7. LOW POWER BASIC DATA RATE GFSK MODULATION

## <u>ANT 4</u>

Tested By:	19172
Date	5/31/2022

Channel	Frequency	Average Power
	(MHz)	(dBm)
Low	2402	10.96
Middle	2441	10.97
High	2480	10.92

## <u>ANT 3</u>

Tested By:	19172
Date	5/31/2022

Channel	Frequency	Average Power
	(MHz)	(dBm)
Low	2402	10.92
Middle	2441	10.88
High	2480	10.77

## 9.7.8. LOW POWER BASIC DATA RATE TXBF GFSK MODULATION

Tested By:	19172
Date:	5/31/2022

Channel	Frequency	Average Power	Average Power	Total Power
		ANT 4	ANT 3	
	(MHz)	(dBm)	(dBm)	(dBm)
Low	2402	10.93	10.92	13.94
Middle	2441	10.96	10.95	13.97
High	2480	10.94	10.95	13.96

# 9.7.9. LOW POWER ENHANCED DATA RATE QPSK MODULATION

## <u>ANT 4</u>

Tested By:	19172
Date	5/31/2022

Channel	Frequency	Average Power
	(MHz)	(dBm)
Low	2402	8.34
Middle	2441	8.27
High	2480	8.32

## <u>ANT 3</u>

Tested By:	19172
Date	5/31/2022

Channel	Frequency	Average Power
	(MHz)	(dBm)
Low	2402	8.44
Middle	2441	8.41
High	2480	8.40

# 9.7.10. LOW POWER BASIC DATA RATE TXBF QPSK MODULATION

Tested By:	19172
Date:	5/31/2022

Channel	Frequency	Average Power	Average Power	Total Power
		ANT 4	ANT 3	
	(MHz)	(dBm)	(dBm)	(dBm)
Low	2402	8.38	8.42	11.41
Middle	2441	8.40	8.40	11.41
High	2480	8.36	8.39	11.39

## 9.7.11. LOW POWER ENHANCED DATA RATE 8PSK MODULATION

## <u>ANT 4</u>

Tested By:	19172
Date	5/31/2022

Channel	Frequency	Average Power
	(MHz)	(dBm)
Low	2402	8.40
Middle	2441	8.35
High	2480	8.42

## <u>ANT 3</u>

Tested By:	19172
Date	5/31/2022

Channel	Frequency	Average Power
	(MHz)	(dBm)
Low	2402	8.47
Middle	2441	8.46
High	2480	8.44

## 9.7.12. LOW POWER BASIC DATA RATE TXBF 8PSK MODULATION

## <u>ANT 4 + ANT 3</u>

Tested By:	19172
Date:	5/31/2022

Channel	Frequency	Average Power	Average Power	Total Power
		ANT 4	ANT 3	
	(MHz)	(dBm)	(dBm)	(dBm)
Low	2402	8.42	8.46	11.45
Middle	2441	8.45	8.45	11.46
High	2480	8.45	8.44	11.46

Page 48 of 153

# 9.8. CONDUCTED SPURIOUS EMISSIONS

## <u>LIMITS</u>

FCC §15.247 (d)

RSS-247 5.5

Limit = -20 dBc

## 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 band edges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

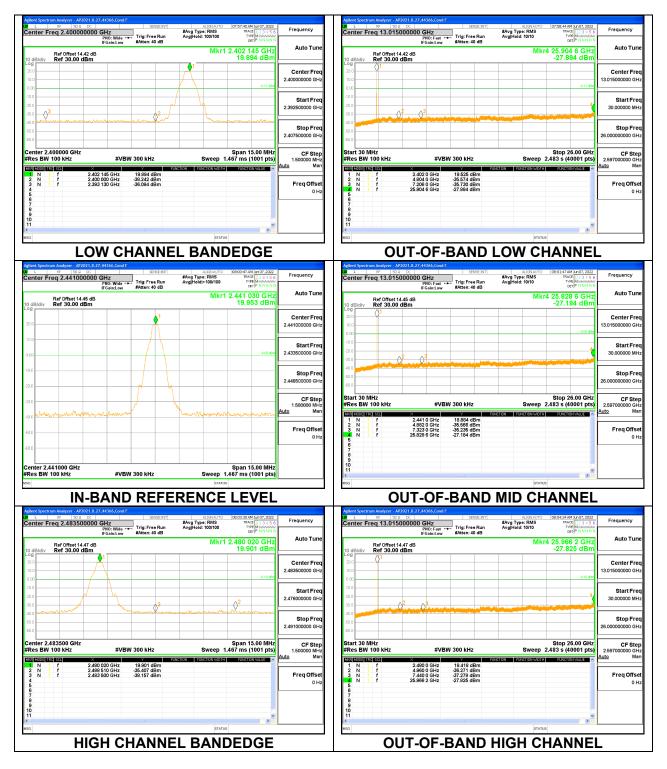
Note: Test procedure on Beamforming mode is same as BT BDR and EDR mode.

## **RESULTS**

Page 49 of 153

## 9.8.1. HIGH POWER BASIC DATA RATE GFSK MODULATION

## ANT 4 SPURIOUS EMISSIONS, NON-HOPPING



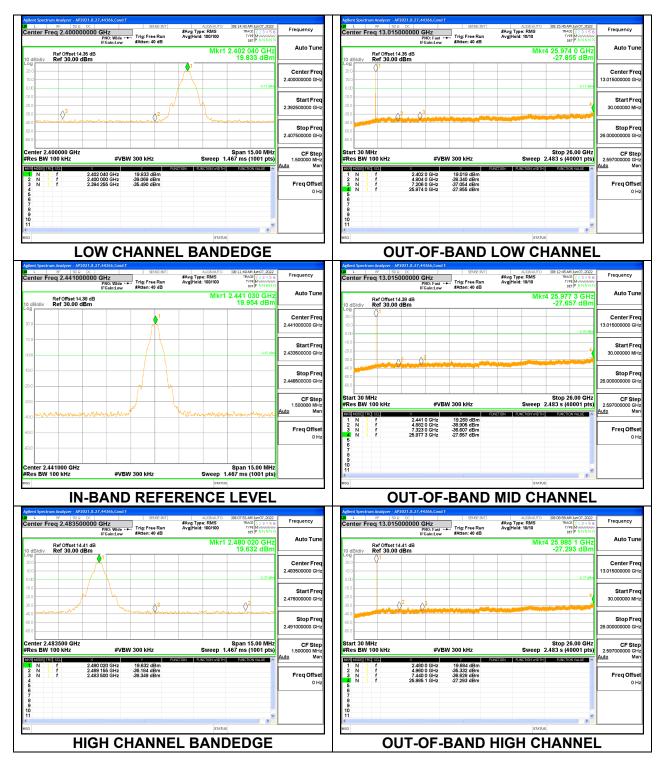
Page 50 of 153

#### ANT 4 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

Agilent Spectrum Analyzer - Swept SA VI L RF SO R DC Center Freq 2.400000000		ALIGNAUTO #Avg Type: RMS	06:38:20 AM Dec 26, 2021 TRACE 1 2 3 4 5 6	Frequency	Center Freq 2.483500000 GHz #Avg Type: RMS	18:41:38 AM Dec 28, 2021 TRACE 1 2 3 4 5 6 TYPE M WWWWWW
Ref Offset 14.54 dB	PNO: Wide ++ Trig: Free Run IFGain:Low #Atten: 40 dB	AvgiHoid: 100/100 Mkr1	2.403 000 GHz 21.697 dBm	Auto Turre	Ref Offset 1454 dB  Mkr1 2.    10 dB/dlv  Ref 30.00 dBm	476 855 GHz 21.664 dBm
20.0 10.0		MM	M Ma	Center Freq 2.400000000 GHz		2.483500000 GHz
-10.0	3			Start Freq 2.392500000 GHz		Start Freq 2.476000000 GHz
-40.0 -50.0 -60.0	and have a second and			Stop Freq 2.407500000 GHz		Stop Freq 2.491000000 GHz
Center 2.400000 GHz #Res BW 100 kHz		Sweep 1	Span 15.00 MHz .467 ms (1001 pts)	CF Step 1.500000 MHz Auto Man	#Res BW 100 kHz #VBW 300 kHz Sweep 1.46	Span 15.00 MHz 7 ms (1001 pts) Auto Man
2 N 1 f 2.400	3 000 GHz 21.697 dBm 0 000 GHz -36.602 dBm 7 000 GHz -34.534 dBm			Freq Offset 0 Hz	N  f  2.476 855 GHz  21.664 dBm    2  N  1  f  2.485 466 GHz  34.060 dBm    3  N  1  2.483 560 GHz  -36.509 dBm    6  5  5  5  5	Freq Offset 0 Hz
8 9 10 11					/s 9 10 11	×
MSG	LOW BA	NDEDG				

Page 51 of 153

#### ANT 3 SPURIOUS EMISSIONS, NON-HOPPING



Page 52 of 153

### ANT 3 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

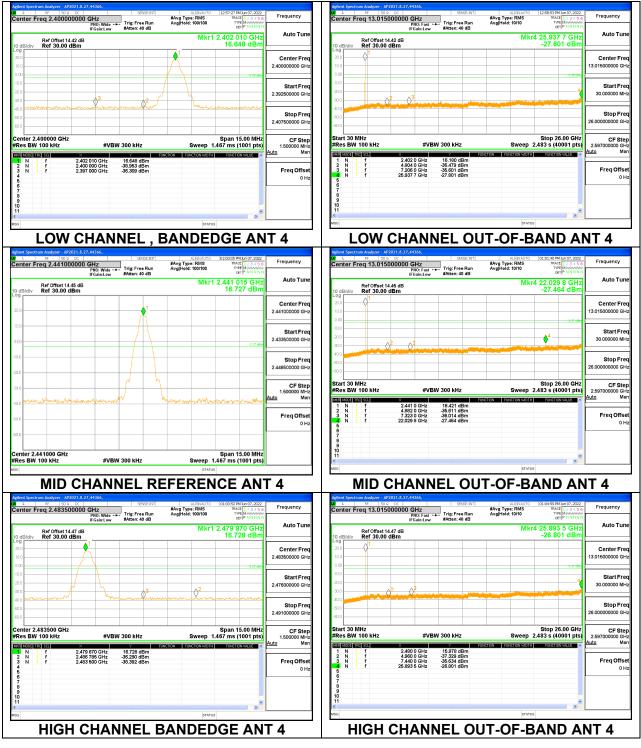
Agilent Spectrum Analyzer - AP2021.8.27, L RF 50 Q DC Center Freg 2.400000000 C	SENSEINT	ALIGNAUTO	02:32:36 PM Jan 20, 2022 TRACE 1 2 3 4 5 6	Frequency		P2021.8.27,19172,Cond F Ω □C     500000 GHz	SENSE:IP	#Avg T	ALIGNAUTO /pe: RMS	02:33:59 PM Jan 20, 2022 TRACE 1 2 3 4 5 6	Frequency
Ref Offset 14.24 dB 10 dB/div Ref 30.00 dBm	PNO: Wide + Trig: Free Run IFGain:Low #Atten: 40 dB	AvgjHold: 100/100 Mkr1	2.406 855 GHz 20.040 dBm	Auto Tune	Ref Offset 10 dB/div Ref 30.00	PNO: Wide - IFGain:Low 14.24 dB 0 dBm	#Atten: 40 dB	n Avg Ho	ia: 100/100 Mkr1	2.478 010 GHz 18.588 dBm	Auto Tur
0 g 20.0 10.0				Center Freq 2.40000000 GHz						-1.41.400	Center Fre 2.483500000 GH
10.0 20.0 30.0 0 3	02 M	1		Start Freq 2.392500000 GHz	-10.0 -20.0 -30.0		3			<sup>2</sup>	Start Fre 2.476000000 GF
40.0 <b></b>	we was not the second second			Stop Freq 2.407500000 GHz	-40.0 -50.0 -60.0		man and the second	er, , , , , , , , , , , , , , , , , , ,		and states and	Stop Fro 2.491000000 G
enter 2.400000 GHz Res BW 100 kHz		Sweep 1	Span 15.00 MHz .467 ms (1001 pts) 	CF Step 1.500000 MHz Auto Man	Center 2.483500 GH #Res BW 100 kHz	- #VB	№ 300 kHz	Function F		Span 15.00 MHz .467 ms (1001 pts) 	CF Ste 1.500000 M Auto M
2 N 1 f 2.400	855 GHz 20.040 dBm 000 GHz -36.926 dBm 755 GHz -35.932 dBm			Freq Offset 0 Hz	1 N 1 f 2 N 1 f 3 N 1 f 4 5 6	2.478 010 GHz 2.488 495 GHz 2.483 500 GHz	18.588 dBm -35.467 dBm -37.698 dBm			2	Freq Offs 0
7 8 9 00 11			×		7 8 9 10 11		-1			×	
96	LOW BA				MSG	HI	GH B		STATU: EDG		

Page 53 of 153

# 9.8.2. HIGH POWER BASIC DATA RATE TXBF GFSK MODULATION

Note: Test procedure on beamforming mode is same as BT basic and EDR mode





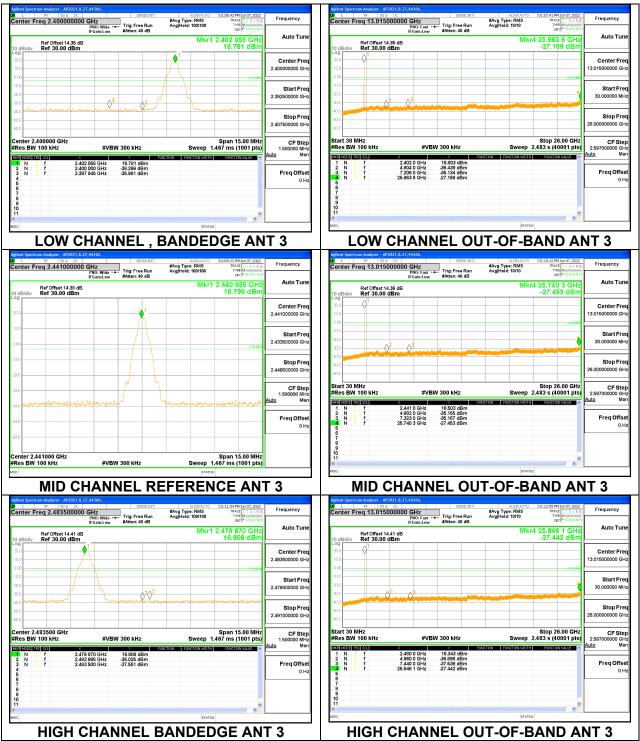
Page 54 of 153

#### ANT 4 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

Agilent Spectrum Analyzer - AP2021.8.2	SENSE:INT	ALIGNAUTO	09:05:57 AM Dec 28, 2021	Frequency	L RF SC	AP2021.8.27,12492,Cond F	1 SENSE:INT	ALIGNAUTO	09:07:27 AM Dec 28, 2021	Frequency
Center Freq 2.400000000	GHz PNO: Wide ++ Trig: Free Run IFGain:Low #Atten: 40 dB	#Avg Type: RMS Avg Hold>100/100	TRACE 1 2 3 4 5 6 TYPE MWWWWW DET PINNNN		Center Freq 2.483	500000 GHz PNO: Wide + IFGain:Low	➡ Trig: Free Run #Atten: 40 dB	#Avg Type: RMS Avg Hold: 100/100	TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P NNNNN	
Ref Offset 14.54 dB IO dB/div Ref 30.00 dBm		Mkr1	2.407 155 GHz 22.035 dBm	Auto Tune	Ref Offset 10 dB/div Ref 30.0	14.54 dB 0 dBm		Mkr1	2.476 060 GHz 21.537 dBm	Auto Tur
0 g 20.0 10.0				Center Freq 2.400000000 GHz	20.0 10.0				1.54 dBn	Center Fre 2.483500000 GH
000 200 200	^2 /			Start Freq 2.392500000 GHz	-10.0 -20.0 -30.0	h	3			Start Fre 2.476000000 GF
40.0	on der handen ander a			Stop Freq 2.407500000 GHz	-40.0 -50.0 -60.0			www.www.www.		Stop Fre 2.491000000 GF
enter 2.400000 GHz Res BW 100 kHz	#VBW 300 kHz	Sweep 1	Span 15.00 MHz 467 ms (1001 pts)	CF Step 1.500000 MHz Auto Man	Center 2.483500 GH #Res BW 100 kHz		W 300 kHz	Sweep 1	Span 15.00 MHz 1.467 ms (1001 pts)	CF Sto 1.500000 M Auto M
1 N 1 f 2.407 2 N 1 f 2.400	7 155 GHz 22.035 dBm 0 000 GHz -37.180 dBm 4 690 GHz -35.705 dBm		2	Freq Offset 0 Hz	1 N 1 f 2 N 1 f 3 N 1 f 4 5 6	2.476 060 GHz 2.486 860 GHz 2.483 500 GHz	21.537 dBm -35.223 dBm -37.758 dBm			Freq Offs 0 H
7 8 9 10 11			×		7 8 9 10 11				×	
96		STATUS			MSG			STATU		
	LOW BA	NDEDG	E			HI	GH BA	NDEDG	E	

Page 55 of 153

#### ANT 3 SPURIOUS EMISSIONS, NON-HOPPING



Page 56 of 153

## ANT 3 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

DA L	m Analyzer - AP2021.8.27,1 RF 50 Q DC eq 2.400000000 G	HZ Trig: Free	SE:INT ALIGNA #Avg Type: RMS Run Avg[Hold: 100/10	TRACE 1 2 3 4 5 (	Frequency	1.04		PNO: W	ide Trig:	SENSE: INT	#Avg Type Avg Hold:	ALIGNAUTO E: RMS 100/100	TRAC	MMay 13, 2022 CE 12 3 4 5 6 PE NUMMUM	Frequency
10 dB/div	Ref Offset 12.02 dB Ref 30.00 dBm	FGain:Low #Atten: 40	dB	kr1 2.405 940 GHz 21.331 dBm	Auto Tune		B/div Ref 30.	IFGain:L et 12.02 dB .00 dBm	.ow #Atte	en: 40 dB		Mkr1	2.476 0	945 GHz 34 dBm	Auto Tune
20.0					Center Freq 2.400000000 GHz	21 11	KAM							0.83 oEm	Center Freq 2.483500000 GHz
-20.0			M		Start Freq 2.392500000 GHz	-10 -20 -30		h		2.42					Start Freq 2.476000000 GHz
-40.0		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	22		Stop Freq 2.407500000 GHz	-40 -50 -50			haman			mme	- and a star	Yanna ya yili yada ya	Stop Freq 2.491000000 GHz
Center 2.40 #Res BW 1	100 kHz	#VBW 300 kHz	Swee	Span 15.00 MHz p 1.000 ms (1001 pts)	CF Step 1.500000 MHz Auto Man	#F	nter 2.483500 G es BW 100 kHz		≠VBW 300 I		S NETION PUN		.000 ms (	5.00 MHz (1001 pts)	CF Step 1.500000 MHz Auto Man
1 N 1 2 N 1 3 N 1 4 5 6	f 2.405 9 f 2.400 0 f 2.395 7	00 GHz -41.000 dB	lm m		Freq Offset 0 Hz		N 1 f	2.476 045 GH 2.484 280 GH 2.483 500 GH	z -38.21	34 dBm 17 dBm 18 dBm	NCTUN PUN		PUNUT		Freq Offset
7 8 9 10 11		U				10								~	
MSG		LOW E		GE		MSC		F	IIGH	BA	NDE	DG			

Page 57 of 153