TEST REPORT

Report Number.: 13259319-E3V2

Applicant	:	APPLE, INC. 1 APPLE PARK WAY CUPERTINO, CA 95014, U.S.A.
Model	:	A2407, A2408, A2409
FCC ID	:	BCG-E3547A
IC	:	579C-E3547A
EUT Description	:	SMARTPHONE
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C ISED RSS-247 ISSUE 2 ISED RSS-GEN ISSUE 5

Date of Issue:
September 24, 2020

Prepared by:
UL Verification Services Inc.
47173 Benicia Street
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NVLAP TESTING
NVLAP Lab code: 200065-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	9/21/2020	Initial Issue	Chin Pang
V2	9/24/2020	Update the statement per TCB's question	Vien Tran

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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: A2407, A2408, A2409

SERIAL NUMBER: (Original)" G6TCP01UQ5R9, G6TCM020Q5T6
(Spot Check): G6TCN009Q5W0, G6TD20AR0RR

DATE TESTED: JULY 31, 2010 – AUGUST 03, 2020

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. 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 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
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2. TEST RESULTS SUMMARY

FCC Clause	ISED Clause	Requirement	Result	Comment
15.209, 15.205	RSS-GEN 8.9, 8.10	Radiated 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 662911, RSS-GEN Issue 5, and RSS-247 Issue 2.

4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, and 47658 Kato Road, 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	47658 Kato Rd.
☐ Chamber A (IC:2324B-1)	☐ Chamber D (IC:22541-1)	☐ Chamber I (IC: 2324A-5)
☐ Chamber B (IC:2324B-2)	☐ Chamber E (IC:22541-2)	☐ Chamber J (IC: 2324A-6)
☐ Chamber C (IC:2324B-3)	☐ Chamber F (IC:22541-3)	☒ Chamber K (IC: 2324A-1)
	☐ Chamber G (IC:22541-4)	☐ Chamber L (IC: 2324A-3)
	☐ Chamber H (IC:22541-5)	☐ Chamber M (IC: 2324A-2)

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers above are covered under Industry Canada company address and respective code.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0

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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.

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:

PARAMETER	U_{Lab}
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.39 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.07 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.52 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	4.88 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.24 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.37 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.17 dB

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

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6. INTRODUCTION OF TEST DATA REUSE

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, CDMA, IEEE 802.11a/b/g/n/ac/ax, Bluetooth, Ultra-Wideband, GPS, NFC and WPT. All models 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.

6.2. INTRODUCTION

This application for certification is leveraging the data reuse procedures from KDB 484596 D01 based on reference FCC ID: BCG-E3545A, IC: 579C-E3545A to cover variant model BCG-E3547A, 579C-E3547A. The major difference between the parent/reference model and the variant model is the depopulation in the variant model of the mmWave transmitter. All other circuitry and features are identical. The data reuse test plan was approved via manufacturer KDB inquiry.

6.3. DIFFERENCE IN MODEL NUMBER

Models A2407, A2408, and A2409 are electrically identical and the model numbers are allocated for marketing and logistic purposes only. Model A2407 was used for the spot check testing described in this report.

6.4. SPOT CHECK VERIFICATION RESULTS SUMMARY

Spot check verification has been done on device model A2407, FCC ID: BCG-E3547A, IC: 579C-E3547A for radiated spurious and radiated band-edge in accordance with the Test Plan that was approved via KDB inquiry.

BCG-E3547A, 579C-E3547A SPOT CHECK RESULTS										
Technology	Mode	Test Item	Channel	Measured	Original model		Spot check model		Delta (dB)	
					BCG-E3545A 579C-E3545A		BCG-E3547A 579C-E3547A			
					A2341		A2407, A2408, A2409			
				Frequency (MHz)	Peak	Ave	Peak	Ave	Peak	Ave
HDR	HDR4	RBE	Low	2390	54.49	41.92	54.37	42.59	-0.12	0.67
			High	2483.5	60.53	48.89	63.86	50.98	3.33	2.09
	HDR8	RSE	Mid	10739.5	49.48	38.64	NF	NF	NA	NA

Comparison of the models, upper deviation is within 3dB for the worst case measurements relative to the limit (note some peak values are more than 3dB higher but the corresponding average value, which has less margin relative to the average limit for emissions, is within 3dB of the reference model) and all measurements are under FCC/IC Technical Limits.

Note: The output powers were verified on model A2407 to match with model A2341 before radiated emissions spot check was performed.

Note: NF—Noise Floor

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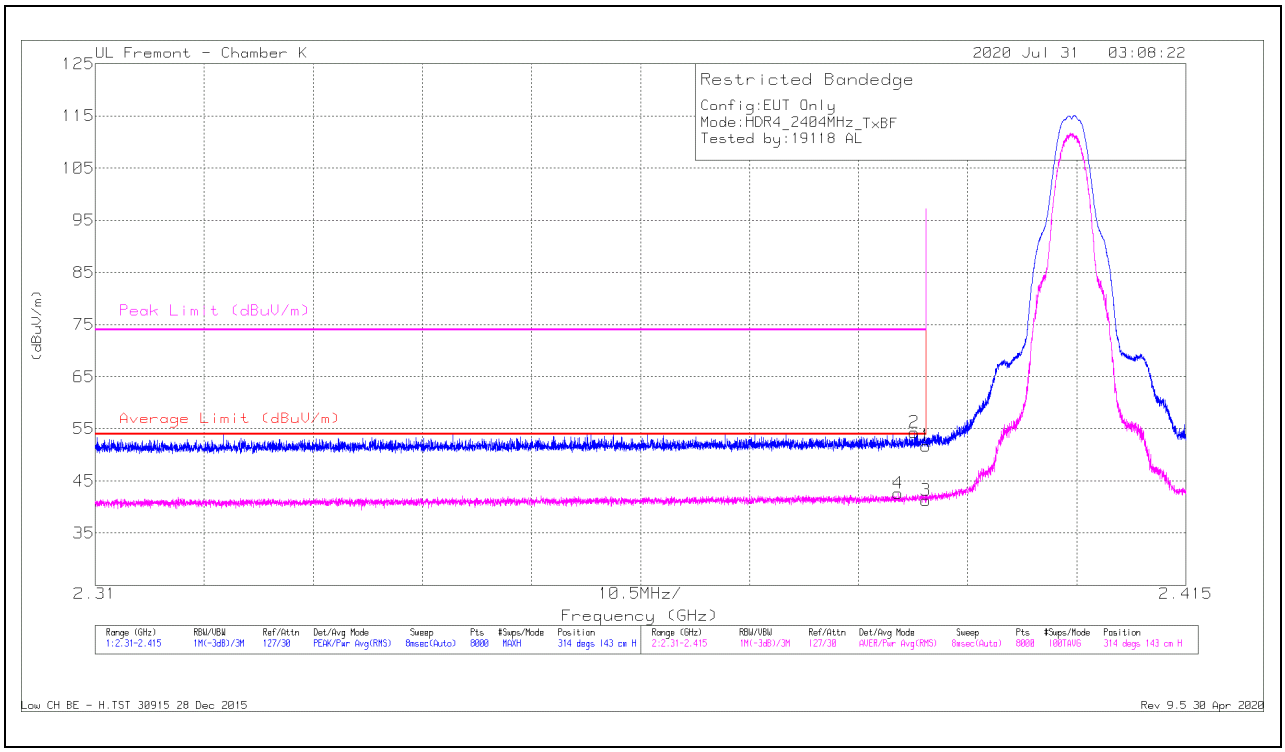
SPOT CHECK DATA

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	54.83	Pk	31.9	-35	51.73	-	-	74	-22.27	314	143	H
2	* 2.38884	57.47	Pk	31.9	-35	54.37	-	-	74	-19.63	314	143	H
3	* 2.39	44.39	RMS	31.9	-35	41.29	54	-12.71	-	-	314	143	H
4	* 2.3873	45.79	RMS	31.9	-35.1	42.59	54	-11.41	-	-	314	143	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
RMS - RMS detection

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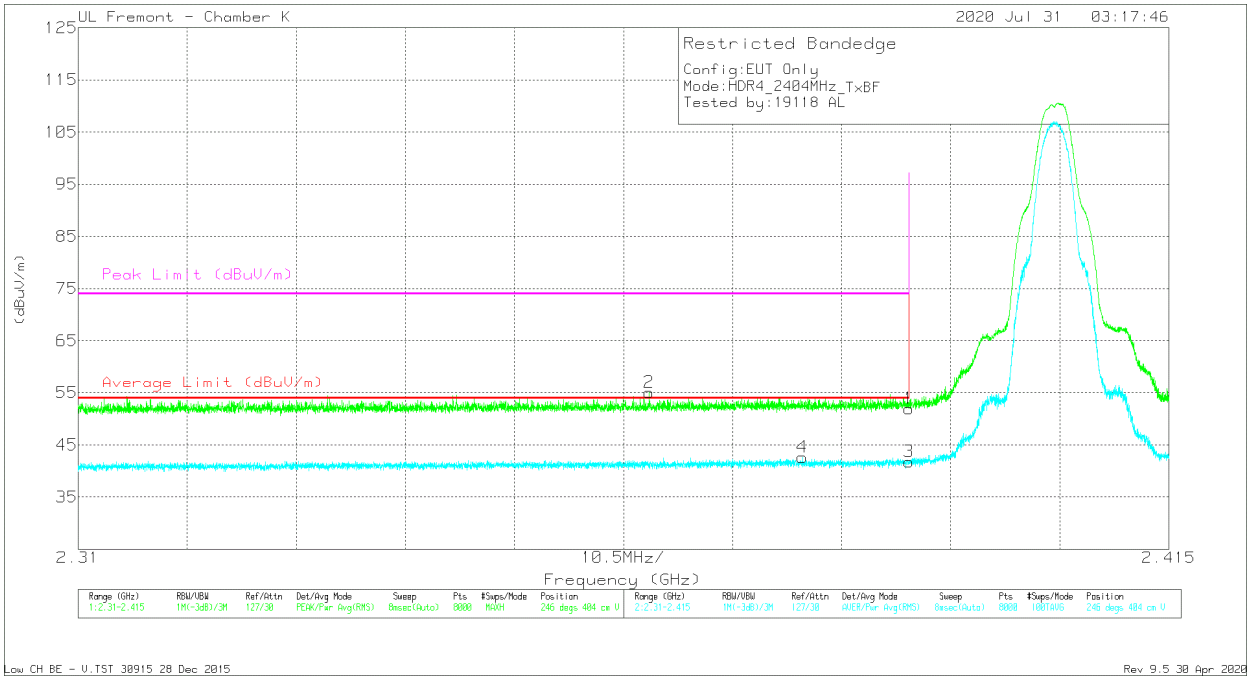
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	55.06	Pk	31.9	-35	51.96	-	-	74	-22.04	246	404	V
2	* 2.36495	58.4	Pk	31.8	-35.1	55.1	-	-	74	-18.9	246	404	V
3	* 2.39	44.88	RMS	31.9	-35	41.78	54	-12.22	-	-	246	404	V
4	* 2.37972	45.78	RMS	31.9	-35.1	42.58	54	-11.42	-	-	246	404	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
RMS - RMS detection

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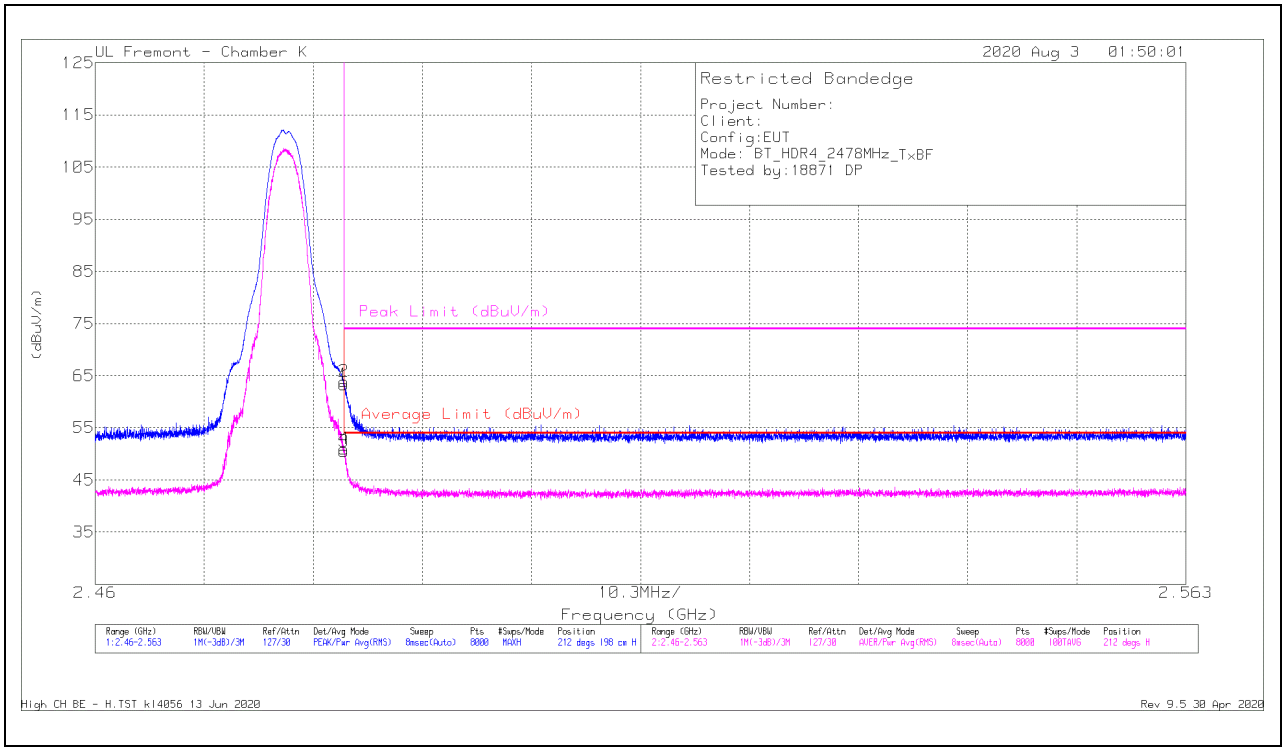
BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.4835	65.31	Pk	32.5	-34.6	63.21	-	-	74	-10.79	212	198	H
2	* 2.48351	65.96	Pk	32.5	-34.6	63.86	-	-	74	-10.14	212	198	H
3	* 2.4835	52.53	RMS	32.5	-34.6	50.43	54	-3.57	-	-	212	198	H
4	* 2.48353	53.08	RMS	32.5	-34.6	50.98	54	-3.02	-	-	212	198	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
RMS - RMS detection

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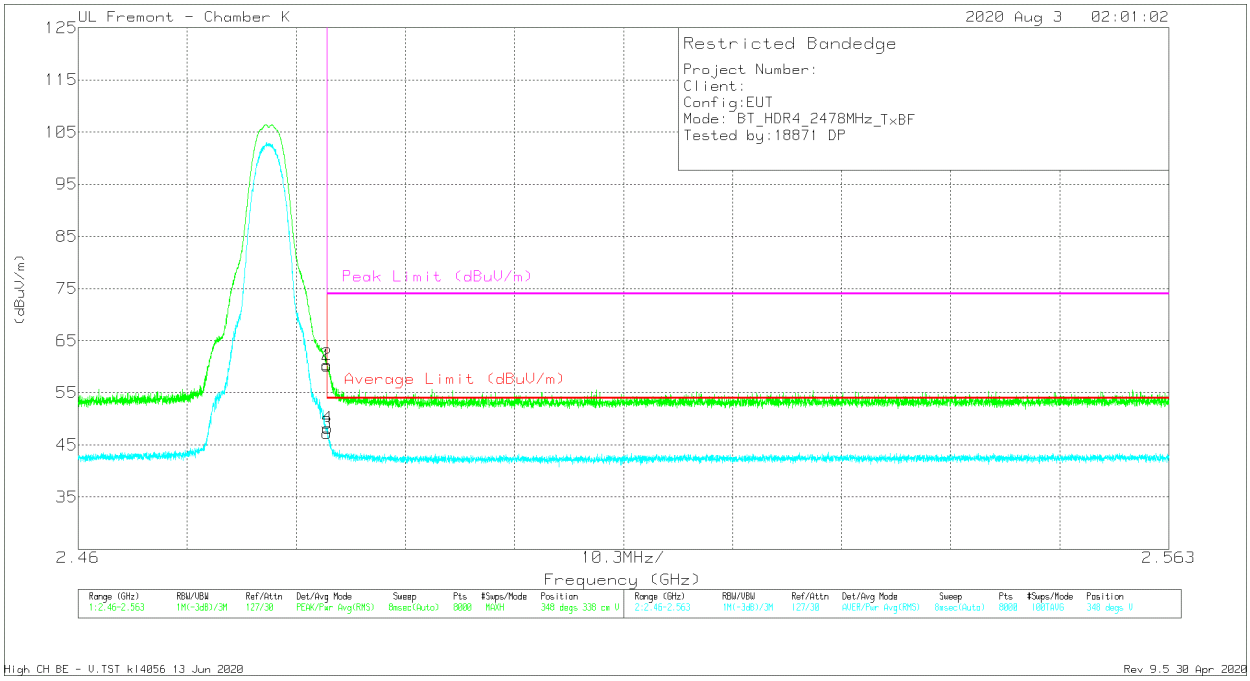
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.4835	62.29	Pk	32.5	-34.6	60.19	-	-	74	-13.81	348	338	V
2	* 2.48351	62.51	Pk	32.5	-34.6	60.41	-	-	74	-13.59	348	338	V
3	* 2.4835	49.35	RMS	32.5	-34.6	47.25	54	-6.75	-	-	348	338	V
4	* 2.48354	50.38	RMS	32.5	-34.6	48.28	54	-5.72	-	-	348	338	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
RMS - RMS detection

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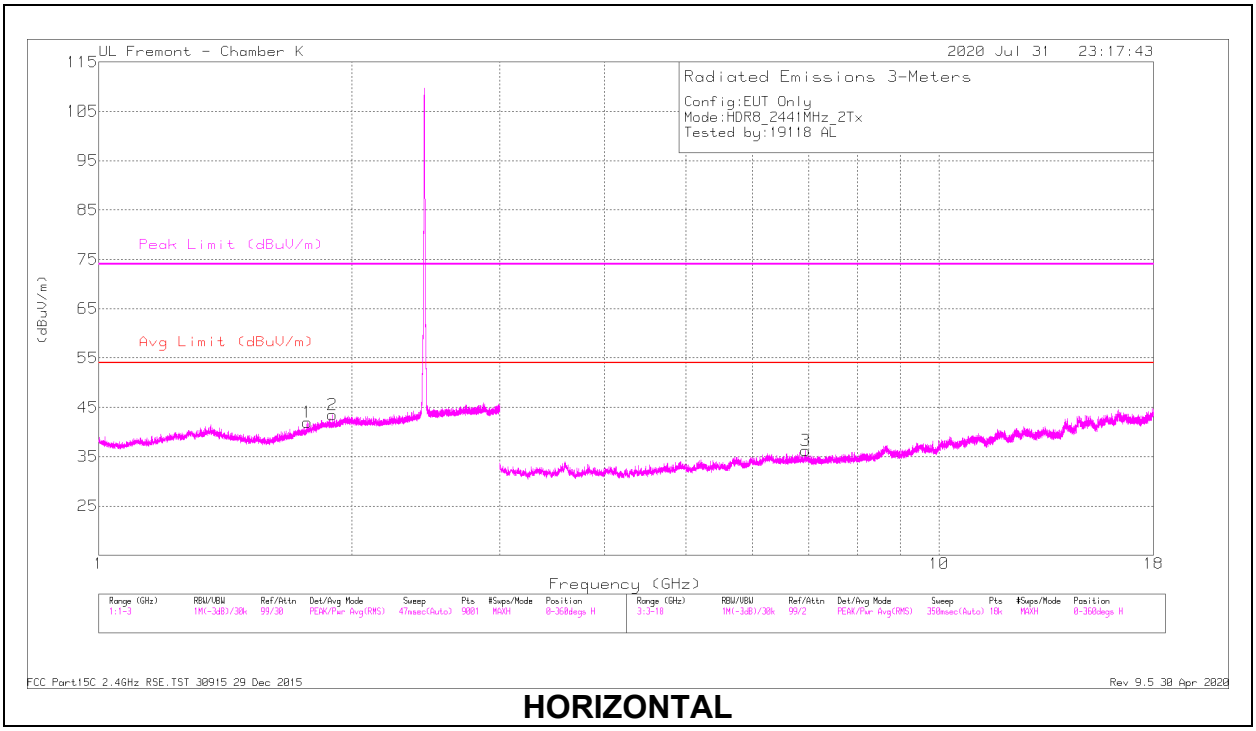
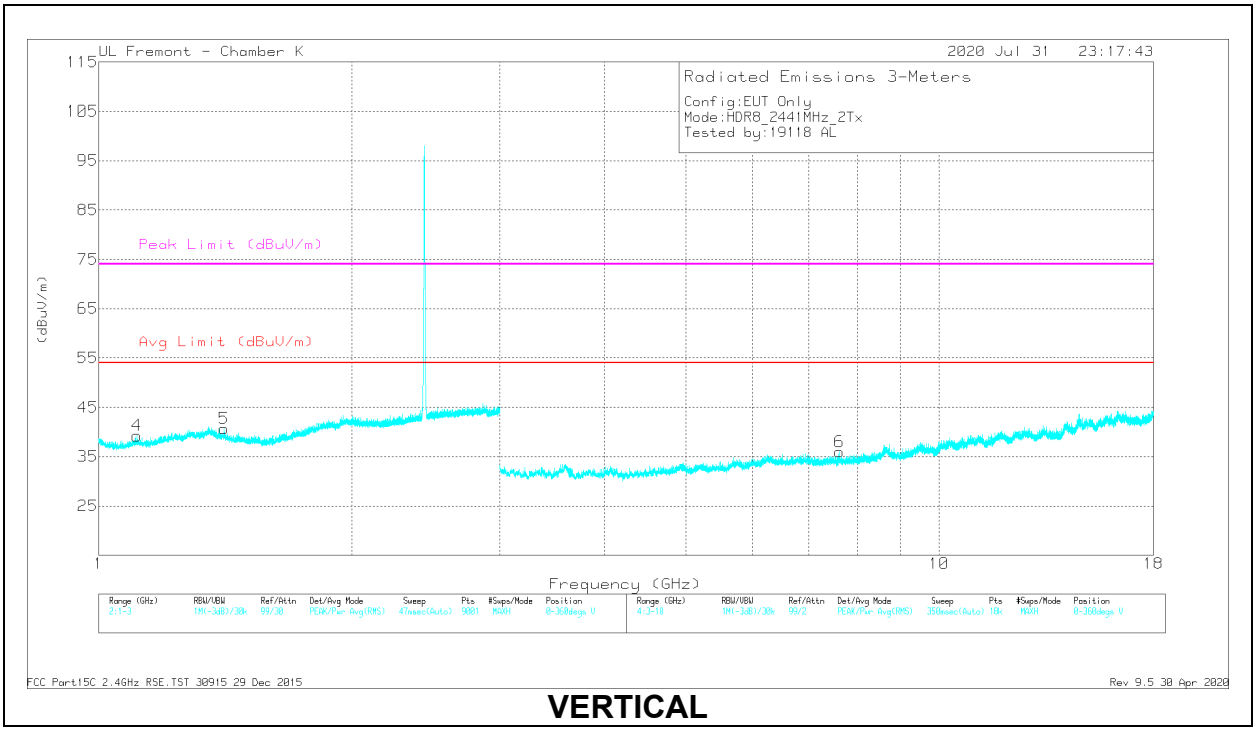
HARMONICS AND SPURIOUS EMISSIONS

MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.7722	54.95	PK2	29.8	-36.5	48.25	-	-	-	-	308	346	H
2	1.89852	55.77	PK2	30.9	-36.2	50.47	-	-	-	-	244	339	H
4	* 1.1125	56.17	PK2	27.7	-37.3	46.57	-	-	74	-27.43	233	213	V
	* 1.11326	46.14	MAv1	27.7	-37.3	36.54	54	-17.46	-	-	233	213	V
5	* 1.408	55.28	PK2	28.8	-36.5	47.58	-	-	74	-26.42	20	300	V
	* 1.40695	45.55	MAv1	28.8	-36.4	37.95	54	-16.05	-	-	20	300	V
3	6.9353	47.39	PK2	35.8	-38.4	44.79	-	-	-	-	228	359	H
6	* 7.61504	48.21	PK2	35.7	-38.2	45.71	-	-	74	-28.29	148	252	V
	* 7.61809	36.35	MAv1	35.7	-38.2	33.85	54	-20.15	-	-	148	252	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - KDB558074 Method: Maximum Peak
MAv1 - KDB558074 Option 1 Maximum RMS Average

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6.5. REFERENCE DETAIL

Reference application that contains the reused reference data which is attached to this report in Appendix A.

Equipment Class	Reference FCC ID & IC	Reference Report	Report Title/Section
DTS	BCG-E3545A 579C-E3545A	13259315-E3	FCC IC_HDR Report / All sections

6.6. DESCRIPTION OF AVAILABLE ANTENNAS

Frequency Range (GHz)	ANT 4 (Core 0) (dBi)	ANT 3 (Core 1) (dBi)
2.4	-1.9	0.4

6.7. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was 18.1.148.558

6.8. WORST-CASE CONFIGURATION AND MODE

Radiated band edge and spurious emissions from 1GHz to 18GHz were performed based on Model A2341 worst case with the EUT set to transmit at highest power on Low/Middle/High channels.

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.

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6.9. DESCRIPTION OF TEST SETUP

SUPPORT TEST EQUIPMENT				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID/ DoC**
Laptop	Apple	A1502	HRP003436	QDS-BRCM1080
Laptop AC/DC adapter	Liteon Technology	PA-1450-BA1	B123	NA
EUT AC/DC adapter	Apple	A1385	D29325SM03XDHLHC9	NA

I/O CABLES (RF RADIATED 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	Un-shielded	1	N/A

TEST SETUP

The EUT is connected to a test laptop during the tests. Test software exercised the radio card.

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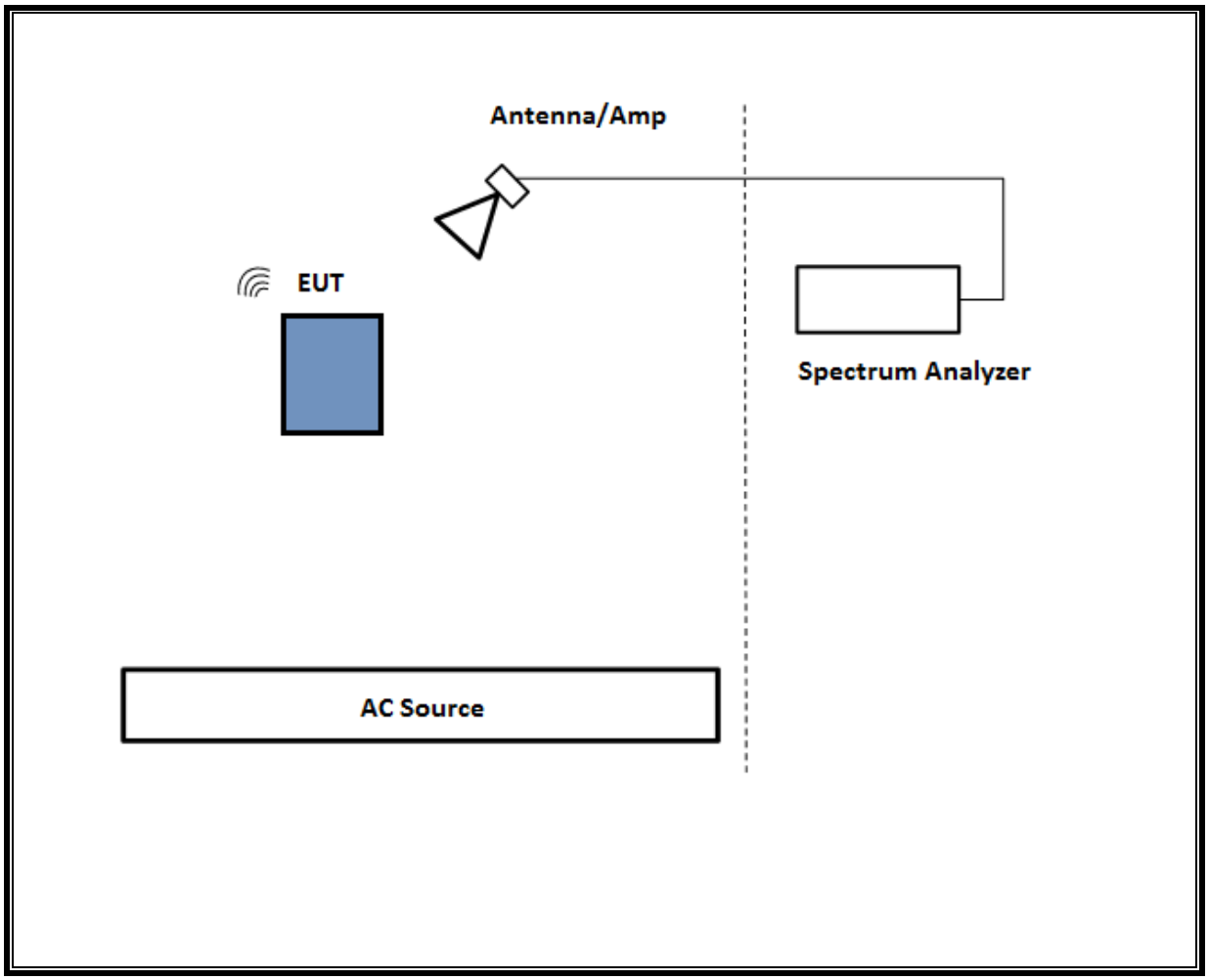
SETUP DIAGRAM FOR RADIATED TESTS Above 1 GHz



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7. MEASUREMENT METHOD

Output Power: ANSI C63.10 Subclause -11.9.1.3 Method PKPM1 Peak-reading power meter

Output Power: ANSI C63.10 Subclause -11.9.2.3.1 Measurement using average gated power meter
Radiated emissions non-restricted frequency bands: ANSI C63.10 Subclause -11.11 & Clause 13

Radiated emissions restricted frequency bands: ANSI C63.10 Subclause -11.12.1 & Clause 13

Band-edge: ANSI C63.10 Subclause -11.13.3.2 & Clause 13 Integration method -Peak detection

Band-edge: ANSI C63.10 Subclause -11.13.3.3 & Clause 13 Integration method -Trace averaging with continuous transmission at full power

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8. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST					
Description	**Manufacturer**	**Model**	**ID Num**	**Cal Due**	**Last Cal**
Antenna, Horn 1-18GHz	ETS Lindgren	3117	EMC4294	11/01/2020	11/01/2019
Amplifier, 1 to 18GHz, 35dB	AMPLICAL	AMP1G18-35	T1569	01/30/2021	01/30/2020
Spectrum Analyzer, PXA 3Hz to 44GHz	Keysight	N9030A	T1466	01/23/2021	01/23/2020
EMI Test Receiver	Rohde & Schwarz	ESW44	Pre0179522	02/20/2021	02/20/2020
Power Meter, P-series single channel	Keysight	N1911A	PRE0177682	01/21/2021	01/21/2020
Power Sensor	Keysight	N1921A	T1228	04/13/2021	04/13/2020

UL AUTOMATION SOFTWARE			
Radiated Software	UL	UL EMC	Ver 9.5, Mar 6, 2020

*Testing is completed before equipment expiration date.

9. SETUP PHOTOS

Please refer to 13259315-EP1 for setup photos

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Appendix A – Reference Test Report

Attached is the test report (13259315-E3) containing the reference data from the parent model as detailed in section 6.5.

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TEST REPORT

Report Number. : 13259315-E3V3

Applicant	:	APPLE, INC. 1 APPLE PARK WAY CUPERTINO, CA 95014, U.S.A.
Model	:	A2341
FCC ID	:	BCG-E3545A
IC	:	579C-E3545A
EUT Description	:	SMARTPHONE
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C ISED RSS-247 ISSUE 2 ISED RSS-GEN ISSUE 5

Date of Issue:
September 21, 2020

Prepared by:
UL Verification Services Inc.
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NVLAP Lab code: 200065-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	8/26/2020	Initial Issue	Chin Pang
V2	9/18/2020	Address TCB's Questions	Chin Pang
V3	9/21/2020	Address TCB's Questions	Chin Pang

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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: A2341

SERIAL NUMBER: G6TCP01UQ5R9, G6TCM020Q5T6

DATE TESTED: MARCH 12, 2010 – JULY 30, 2020

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. 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 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:

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Senior Engineer
Consumer Technology Division
UL Verification Services Inc.

Prepared By:

Jingang Li
Test Engineer
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2. TEST RESULTS SUMMARY

FCC Clause	ISED Clause	Requirement	Result	Comment
See Comment		Duty Cycle	Reporting purposes only	ANSI C63.10 Section 11.6.
-	RSS-GEN 6.7	99% OBW	Reporting purposes only	ANSI C63.10 Section 6.9.3.
15.247 (a) (2)	RSS-247 5.2 (a)	6dB BW	Complies	None.
15.247 (b) (3)	RSS-247 5.4 (d)	Output Power	Complies	None.
See Comment		Average power	Reporting purposes only	Per ANSI C63.10, Section 11.9.2.3.2.
15.247 (e)	RSS-247 5.2 (b)	PSD	Complies	None.
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 662911, RSS-GEN Issue 5, and RSS-247 Issue 2.

4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, and 47658 Kato Road, 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	47658 Kato Rd.
☒ Chamber A (IC:2324B-1)	☐ Chamber D (IC:22541-1)	☒ Chamber I (IC: 2324A-5)
☐ Chamber B (IC:2324B-2)	☒ Chamber E (IC:22541-2)	☐ Chamber J (IC: 2324A-6)
☐ Chamber C (IC:2324B-3)	☐ Chamber F (IC:22541-3)	☐ Chamber K (IC: 2324A-1)
	☐ Chamber G (IC:22541-4)	☐ Chamber L (IC: 2324A-3)
	☐ Chamber H (IC:22541-5)	☐ Chamber M (IC: 2324A-2)

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers above are covered under Industry Canada company address and respective code.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0

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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.

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:

PARAMETER	U_{Lab}
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.39 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.07 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.52 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	4.88 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.24 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.37 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.17 dB

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

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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, CDMA, IEEE 802.11a/b/g/n/ac/ax, Bluetooth, Ultra-Wideband, GPS, NFC and WPT. All models 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.

6.2. MAXIMUM OUTPUT POWER

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

Antenna	Frequency Range (MHz)	Mode	Configuration	Output Power (dBm)	Output Power (mW)
ANT 4	2404 - 2478	HDR4	High Power	14.45	27.86
			Low Power	8.74	7.48
		HDR8	High Power	15.41	34.75
			Low Power	9.73	9.40
ANT 3	2404 - 2478	HDR4	High Power	14.40	27.54
			Low Power	8.66	7.35
		HDR8	High Power	15.43	34.91
			Low Power	9.72	9.38
BF, ANT 4 + ANT 3	2404 - 2478	HDR4	High Power	17.16	52.00
			Low Power	11.66	14.66
		HDR8	High Power	18.16	65.46
			Low Power	11.63	14.55

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

Frequency Range (GHz)	ANT 4 (Core 0) (dBi)	ANT 3 (Core 1) (dBi)
2.4	-1.9	0.4

6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was 18.1.148.558

The test utility software used during testing was QRCT v3.0.264.0.

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6.5. WORST-CASE CONFIGURATION AND MODE

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

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

Radiated emissions below 1GHz, 18-26GHz and AC power line conducted emissions were performed with the EUT transmitting 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 were performed with EUT connected to AC power adapter as the worst case and for above 1GHz, tests were performed with EUT only. For AC power line conducted emission, tests were investigated with AC power adapter and with laptop.
For below 30MHz testing, investigation was done on three antenna orientations: RX antenna Face-on, Face-off and horizontal (parallel to ground). The worst-case configurations were determined on RX antenna Face-on and Face-off; therefore, all final tests were performed using these two orientations.

For simultaneous transmission of multiple channels in the 2.4GHz BLE and 5GHz bands. No noticeable emission was found.

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.

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6.6. DESCRIPTION OF TEST SETUP

SUPPORT TEST EQUIPMENT						
Description		**Manufacturer**	**Model**	**Serial Number**		**FCC ID/ DoC**
Laptop		Apple	Apple	A1989		C02YL3ZMJHC8
Laptop AC/DC adapter		Liteon Technology	Liteon Technology	A1718		C4N711404U3GN8RAW
EUT AC/DC adapter		Apple	Apple	A2305		C4H951700S7PF4F4F
I/O CABLES (RF CONDUCTED 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 (RF RADIATED 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	Un-shielded	1	N/A

TEST SETUP

The EUT is connected to a test laptop during the tests. Test software exercised the radio card.

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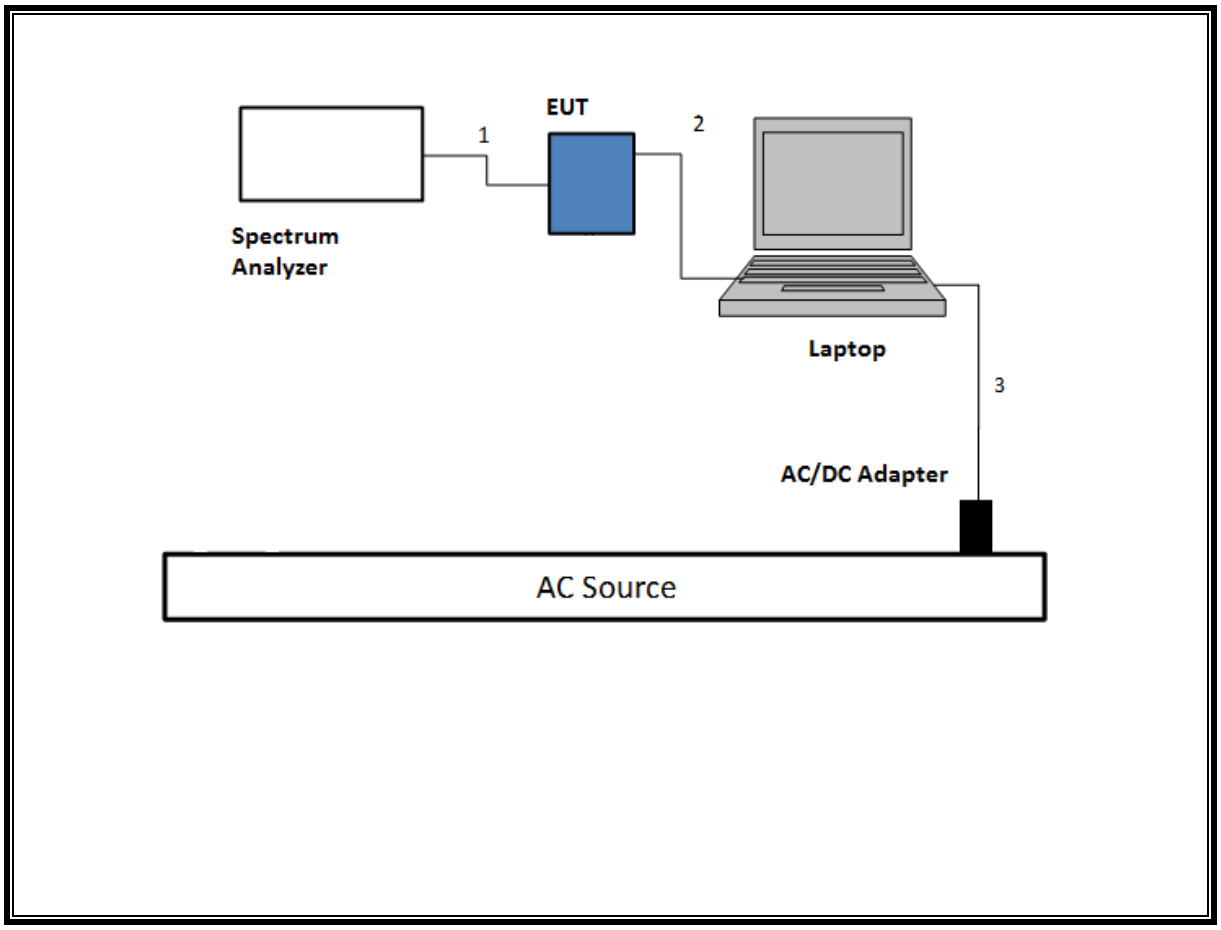
SETUP DIAGRAM FOR CONDUCTED TESTS



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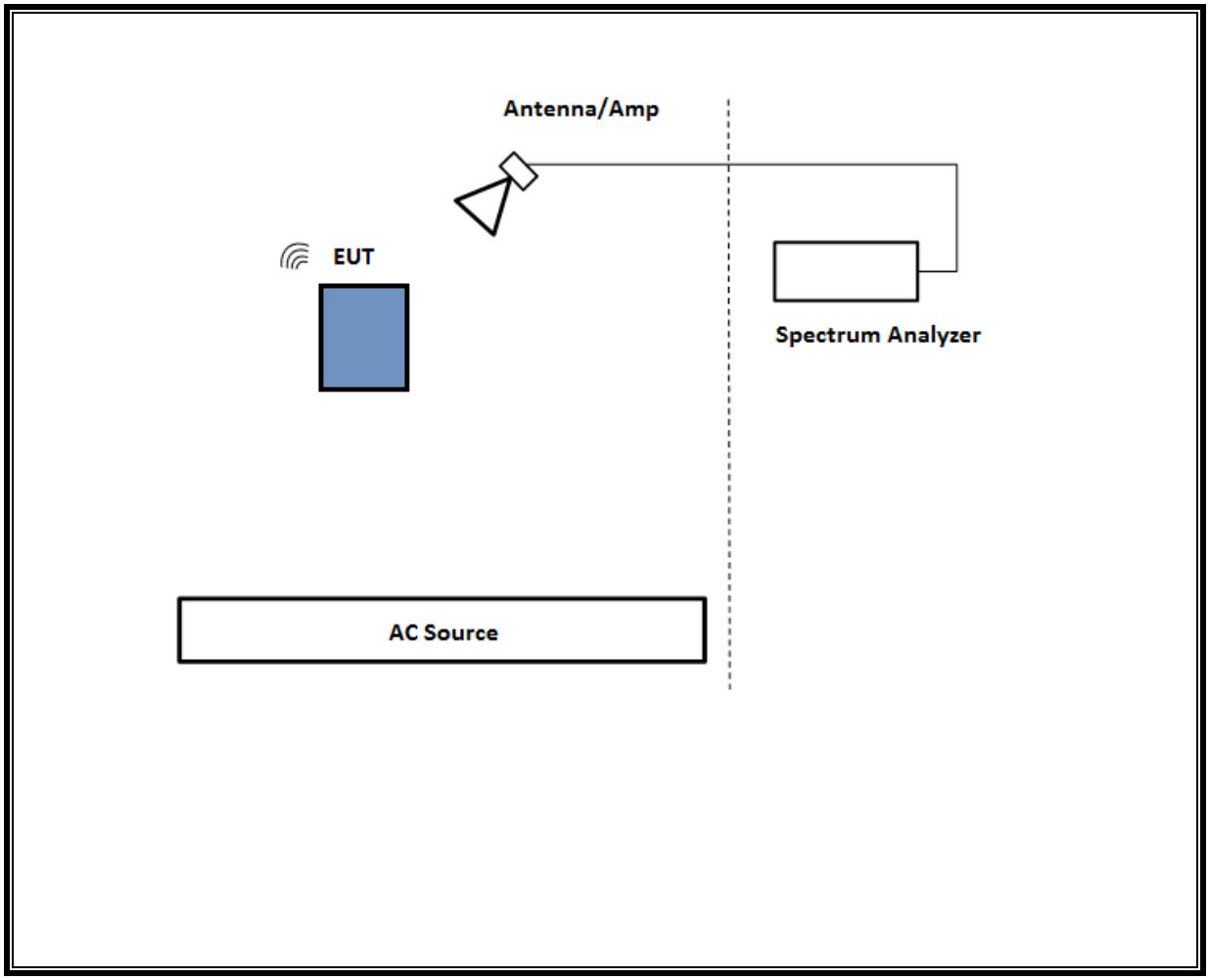
SETUP DIAGRAM FOR RADIATED TESTS Above 1 GHz



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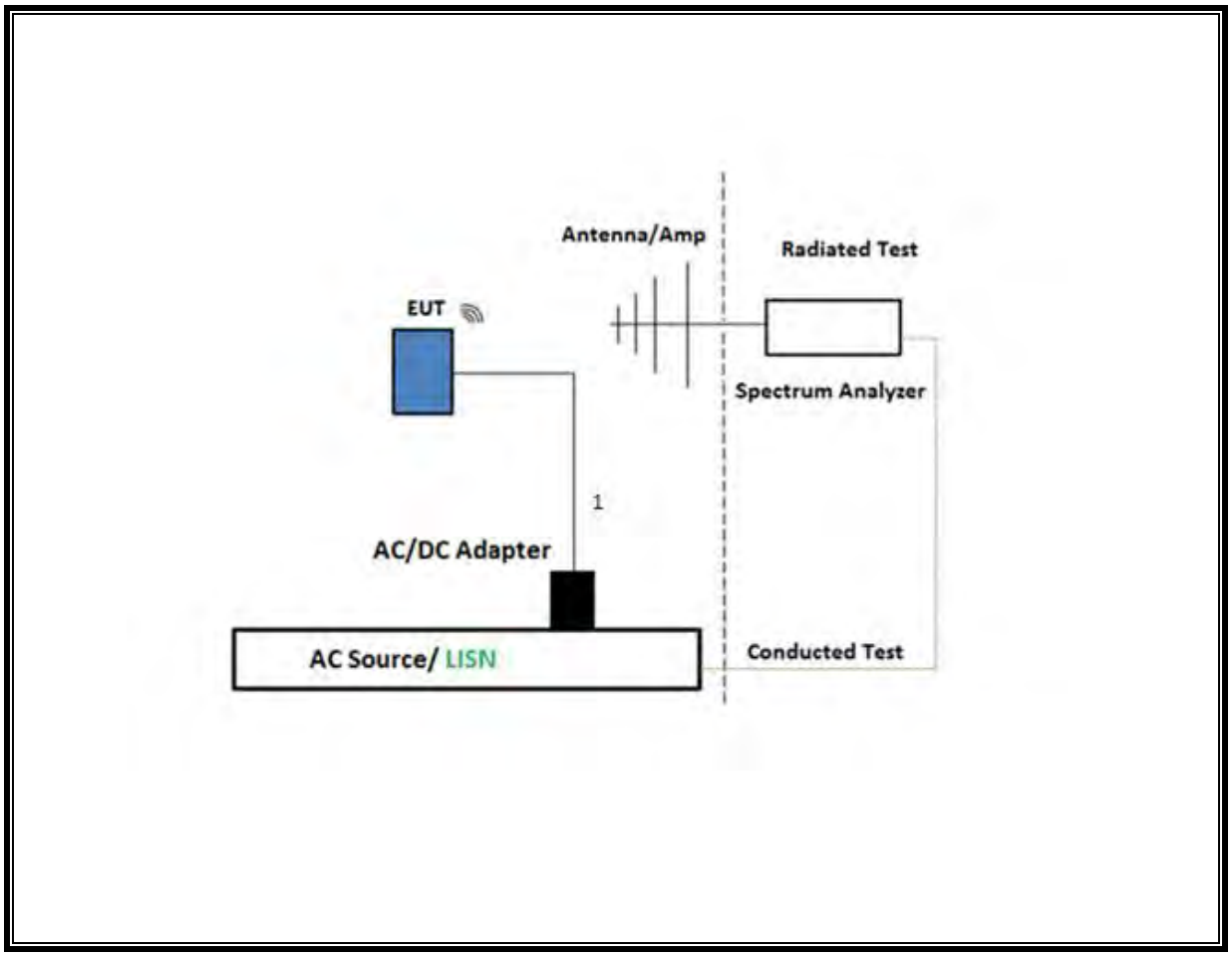
SETUP DIAGRAM FOR Below 1GHz and AC LINE CONDUCTED TEST



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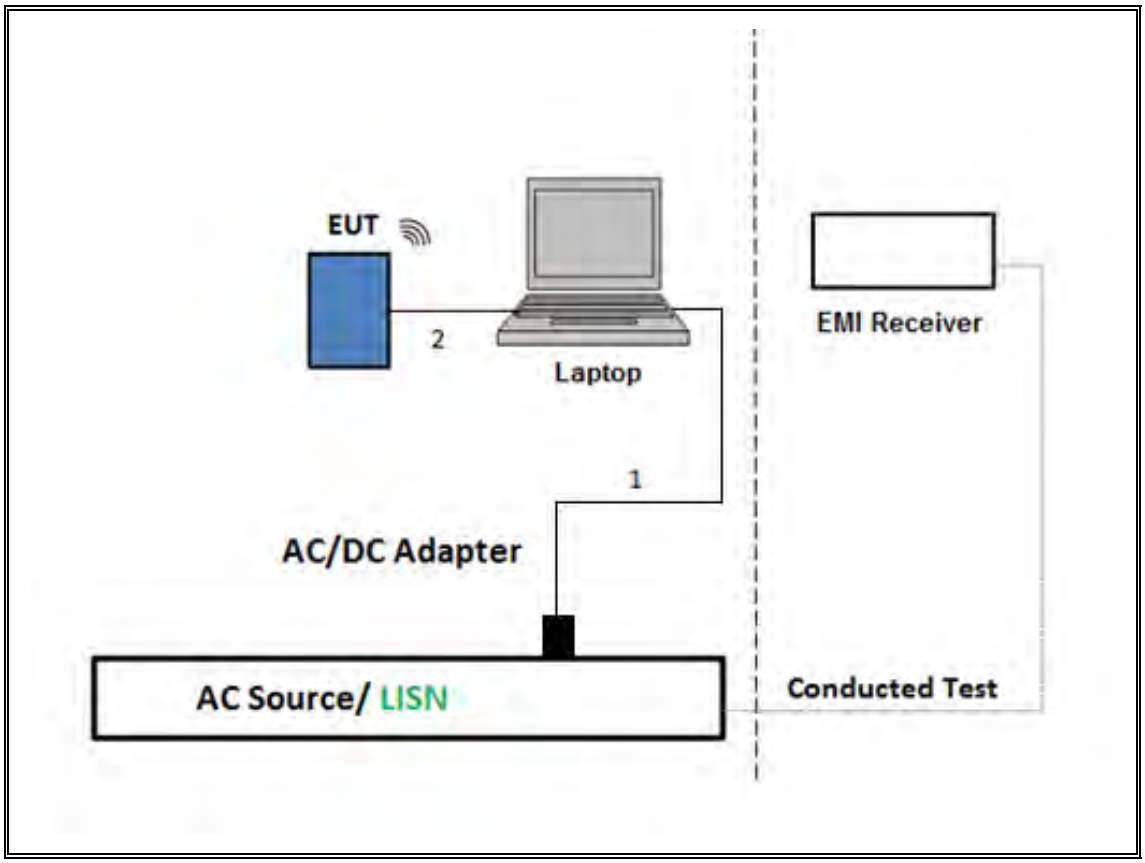
TEST SETUP- AC LINE CONDUCTED: LAPTOP CONFIGURATION



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7. MEASUREMENT METHOD

6 dB BW: ANSI C63.10 Subclause -11.8.1 RBW ≥ DTS BW

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

Output Power: ANSI C63.10 Subclause -11.9.1.3 Method PKPM1 Peak-reading power meter

Output Power: ANSI C63.10 Subclause -11.9.2.3.1 Measurement using average gated power meter
PSD: ANSI C63.10 Subclause -11.10.2 Method PKPSD (peak PSD)

Radiated emissions non-restricted frequency bands: ANSI C63.10 Subclause -11.11 & Clause 13

Radiated emissions restricted frequency bands: ANSI C63.10 Subclause -11.12.1 & Clause 13

Conducted emissions in restricted frequency bands: ANSI C63.10 Subclause -11.12.2

Band-edge: ANSI C63.10 Subclause -11.13.3.2 & Clause 13 Integration method -Peak detection

Band-edge: ANSI C63.10 Subclause -11.13.3.3 & Clause 13 Integration method -Trace averaging with continuous transmission at full power

AC Power Line Conducted Emissions: ANSI C63.10-2013, Clause 6.2.

Radiated Spurious Emissions Below 30MHz: ANSI C63.10-2013 Clause 6.4 & Clause 13

NOTE: Test procedures and settings for HDR beamforming mode are the same as HDR normal mode.

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8. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST					
Description	**Manufacturer**	**Model**	**ID Num**	**Cal Due**	**Last Cal**
*Antenna, Horn 1-18GHz	ETS Lindgren	3117	T862	08/20/2020	08/20/2019
Amplifier, 1 to 18GHz, 35dB	Amplical	AFS42-00101800-25-S-42	T1567	01/24/2021	01/24/2020
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T712	03/09/2021	03/09/2020
RF Amplifier, 1-18GHz	MITEQ	AFS42-00101800-25-S-42	171460	08/24/2020	08/24/2019
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1210	01/21/2021	01/21/2020
Spectrum Analyzer, PXA 3Hz to 44GHz	Keysight	N9030A	T1466	01/23/2021	01/23/2020
Antenna, Broadband Hybrid, 30MHz to 3000MHz	Sun AR rf motion	JB3	Pre0181575	09/05/2020	09/05/2019
*Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	Pre0180089	07/06/2020	07/06/2019
Antenna Horn, 18 to 26GHz	ARA	SWH-28	T125	04/17/2021	04/17/2020
Pre-Amp 18-26GHz	Agilent Technology	8449B	T404	04/08/2021	04/08/2020
Antenna, Active Loop 9KHz to 30MHz	ETS-Lindgren	6502	T757	10/01/2020	10/01/2019
Power Meter, P-series single channel	Keysight	N1911A	PRE0177682	01/21/2021	01/21/2020
Power Sensor	Keysight	N1921A	T1226	02/13/2021	02/13/2020
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1454	01/23/2021	01/23/2020

AC Line Conducted					
Description	**Manufacturer**	**Model**	**ID Num**	**Cal Due**	**Last Cal**
EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESR	T1436	02/20/2021	02/20/2020
Power Cable, Line Conducted Emissions	UL	PR1	T861	10/27/2020	10/27/2019
LISN for Conducted Emissions CISPR-16	FISCHER CUSTOM COMMUNICATIONS	FCC-LISN-50/250-25-2-01	PRE0186446	01/23/2021	01/23/2020
UL AUTOMATION SOFTWARE					
Radiated Software	UL	UL EMC	Ver 9.5, Mar 06, 2020		
Conducted Software	UL	UL EMC	2020.2.26		
AC Line Conducted Software	UL	UL EMC	Ver 9.5, February 21, 2020		

*Testing is completed before equipment expiration date.

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9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4GHz Band						
HDR4	1.000	1.000	1.000	100.00%	0.00	0.010
HDR8	1.000	1.000	1.000	100.00%	0.00	0.010
HDR4 TxBF	1.000	1.000	1.000	100.00%	0.00	0.010
HDR8 TxBF	1.000	1.000	1.000	100.00%	0.00	0.010

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DUTY CYCLE PLOTS

HDR 4

HDR 8

HDR 4 TxBF

HDR 8 TxBF

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9.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

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.

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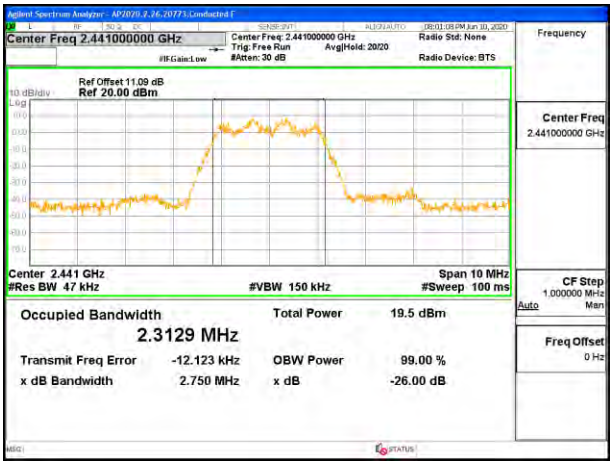
9.2.1. HIGH POWER HDR (HDR4)

ANT 4

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2404	2.3123
Middle	2441	2.3129
High	2478	2.3424



MID CHANNEL

ANT 3

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2404	2.3314
Middle	2441	2.3317
High	2478	2.3184

MID CHANNEL

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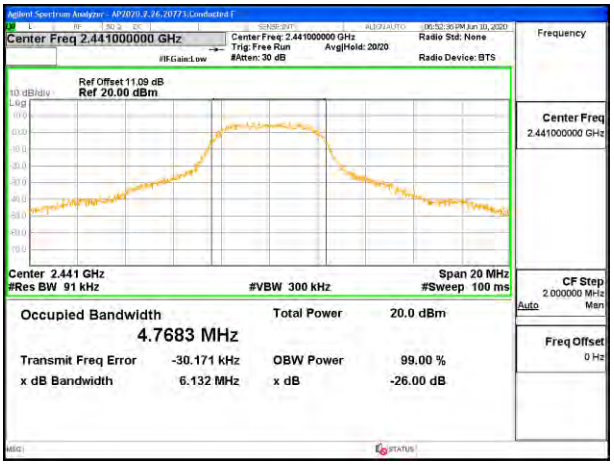
9.2.2. HIGH POWER HDR (HDR8)

ANT 4

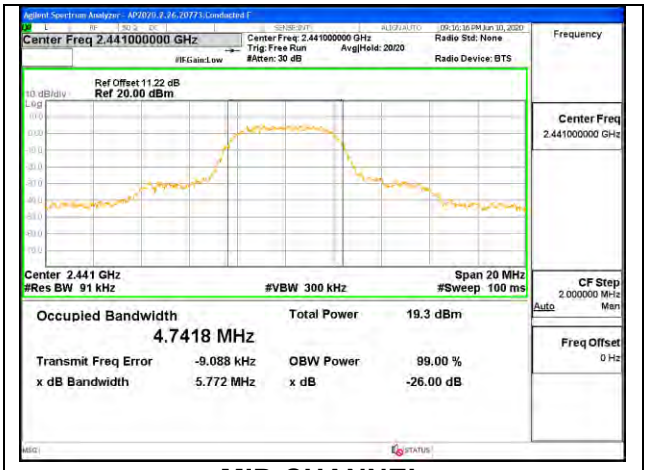
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2404	4.6887
Middle	2441	4.7683
High	2478	4.7902



MID CHANNEL

ANT 3

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2404	4.7286
Middle	2441	4.7418
High	2478	4.7103



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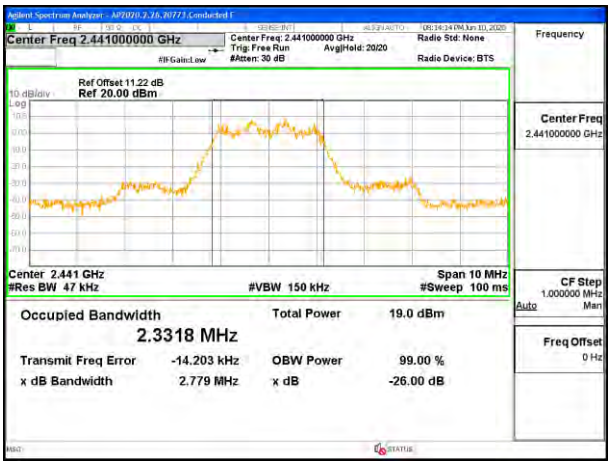
9.2.3. HIGH POWER HDR TXBF (HDR4)

Channel	Frequency (MHz)	99% Bandwidth ANT 4 (MHz)	99% Bandwidth ANT 3 (MHz)
Low	2404	2.3375	2.3297
Mid	2441	2.3217	2.3318
High	2478	2.3207	2.3191

MID CHANNEL ANT 4



MID CHANNEL ANT 3

Note: Test procedures and setting on beamforming are same as HDR normal mode

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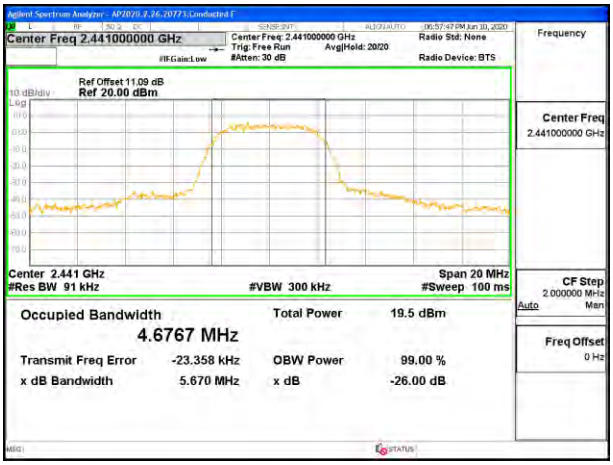
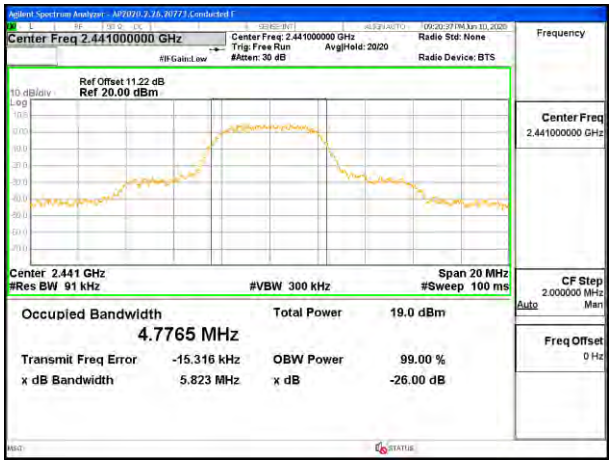
9.2.4. HIGH POWER HDR TXBF (HDR8)

Channel	Frequency (MHz)	99% Bandwidth ANT 4 (MHz)	99% Bandwidth ANT 3 (MHz)
Low	2404	4.7238	4.7586
Mid	2441	4.6767	4.7765
High	2478	4.6990	4.7055



MID CHANNEL ANT 4



MID CHANNEL ANT 3

Note: Test procedures and setting on beamforming are same as HDR normal mode

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9.3. 6 dB BANDWIDTH

LIMITS

FCC §15.407 (e)

RSS-247 5.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS

The 6dB bandwidth was measured for the narrowest bandwidth mode, High Power HDR4, to demonstrate compliance with the minimum required bandwidth of 500 kHz. Other modes were not tested as their bandwidth is greater than the High Power HDR4 mode, as demonstrated by the 99% bandwidth measurements performed on all modes.

Only Mid channel plot is reported to show setting parameter complies with testing method/procedure.

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9.3.1. HIGH POWER HDR (HDR4)

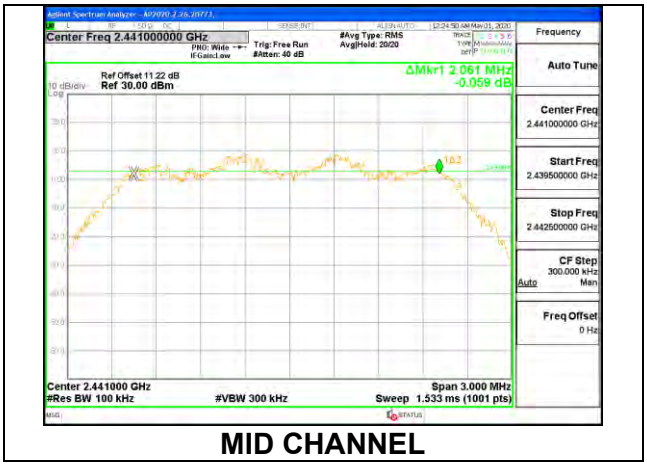
ANT 4

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2404	2.079	0.5
Middle	2441	2.067	0.5
High	2478	2.097	0.5

MID CHANNEL

ANT 3

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2404	2.055	0.5
Middle	2441	2.061	0.5
High	2478	2.082	0.5



MID CHANNEL

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9.4. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)

RSS-247 5.4 (d)

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

TEST PROCEDURE

The transmitter output is connected to a power meter with wideband power sensor.

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 peak reading of power.

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:

Band (GHz)	ANT 4 Antenna Gain (dBi)	ANT 3 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)	Correlated Chains Directional Gain (dBi)
2.4	-1.90	0.40	-0.60	2.34

RESULTS

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9.4.1. HIGH POWER HDR (HDR4)

ANT 4

Tested By:	20773
Date:	7/25/2020

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2404	14.41	30	-15.59
Middle	2441	14.45	30	-15.55
High	2478	14.39	30	-15.61

ANT 3

Tested By:	20773
Date:	7/25/2020

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2404	14.32	30	-15.68
Middle	2441	14.40	30	-15.60
High	2478	14.34	30	-15.66

9.4.2. HIGH POWER HDR (HDR8)

ANT 4

Tested By:	20773
Date:	7/25/2020

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2404	15.27	30	-14.73
Middle	2441	15.33	30	-14.67
High	2478	15.41	30	-14.59

ANT 3

Tested By:	20773
Date:	7/25/2020

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2404	15.43	30	-14.57
Middle	2441	15.37	30	-14.63
High	2478	15.24	30	-14.76

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9.4.3. LOW POWER HDR (HDR4)

ANT 4

Tested By:	20773
Date:	7/25/2020

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2404	8.62	30	-21.38
Middle	2441	8.67	30	-21.33
High	2478	8.74	30	-21.26

ANT 3

Tested By:	20773
Date:	7/25/2020

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2404	8.65	30	-21.4
Middle	2441	8.52	30	-21.5
High	2478	8.66	30	-21.3

9.4.4. LOW POWER HDR (HDR8)

ANT 4

Tested By:	20773
Date:	7/25/2020

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2404	9.73	30	-20.27
Middle	2441	9.68	30	-20.32
High	2478	9.60	30	-20.40

ANT 3

Tested By:	20773
Date:	7/25/2020

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2404	9.72	30	-20.28
Middle	2441	9.70	30	-20.30
High	2478	9.63	30	-20.37

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9.4.5. HIGH POWER HDR TXBF (HDR4)

ANT 4 + ANT 3

Tested By:	20773
Date:	7/25/2020

Channel	Frequency (MHz)	Output Power ANT 4 (dBm)	Output Power ANT 3 (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2404	14.04	14.11	17.09	30	-12.91
Middle	2441	14.2	14.09	17.16	30	-12.84
High	2478	14.04	14.13	17.10	30	-12.90

9.4.6. HIGH POWER HDR TXBF (HDR8)

ANT 4 + ANT 3

Tested By:	20773
Date:	7/25/2020

Channel	Frequency (MHz)	Output Power ANT 4 (dBm)	Output Power ANT 3 (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2404	15.03	15.12	18.09	30	-11.91
Middle	2441	15.19	15.11	18.16	30	-11.84
High	2478	15.04	15.1	18.08	30	-11.92

9.4.7. LOW POWER HDR TXBF (HDR4)

ANT 4 + ANT 3

Tested By:	20773
Date:	7/25/2020

Channel	Frequency (MHz)	Output Power ANT 4 (dBm)	Output Power ANT 3 (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2404	8.73	8.51	11.63	30	-18.37
Middle	2441	8.64	8.66	11.66	30	-18.34
High	2478	8.68	8.6	11.65	30	-18.35

9.4.8. LOW POWER HDR TXBF (HDR8)

ANT 4 + ANT 3

Tested By:	20773
Date:	7/25/2020

Channel	Frequency (MHz)	Output Power ANT 4 (dBm)	Output Power ANT 3 (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2404	8.57	8.66	11.63	30	-18.37
Middle	2441	8.51	8.72	11.63	30	-18.37
High	2478	8.69	8.55	11.63	30	-18.37

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9.5. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter with wideband power sensor

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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9.5.1. HIGH POWER HDR (HDR4)

ANT 4

Tested By:	20773
Date:	7/25/2020

Channel	Frequency (MHz)	AV power (dBm)
Low	2404	11.65
Middle	2441	11.68
High	2478	11.60

ANT 3

Tested By:	20773
Date:	7/25/2020

Channel	Frequency (MHz)	AV power (dBm)
Low	2404	11.54
Middle	2441	11.63
High	2478	11.60

9.5.2. HIGH POWER HDR (HDR8)

ANT 4

Tested By:	20773
Date:	7/25/2020

Channel	Frequency (MHz)	AV power (dBm)
Low	2404	11.59
Middle	2441	11.66
High	2478	11.74

ANT 3

Tested By:	20773
Date:	7/25/2020

Channel	Frequency (MHz)	AV power (dBm)
Low	2404	11.72
Middle	2441	11.64
High	2478	11.55

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9.5.3. LOW POWER HDR (HDR4)

ANT 4

Tested By:	20773
Date:	7/25/2020

Channel	Frequency (MHz)	AV power (dBm)
Low	2404	6.10
Middle	2441	6.13
High	2478	6.21

ANT 3

Tested By:	20773
Date:	7/25/2020

Channel	Frequency (MHz)	AV power (dBm)
Low	2404	6.11
Middle	2441	6.04
High	2478	6.13

9.5.4. LOW POWER HDR (HDR8)

ANT 4

Tested By:	20773
Date:	7/25/2020

Channel	Frequency (MHz)	AV power (dBm)
Low	2404	6.21
Middle	2441	6.19
High	2478	6.15

ANT 3

Tested By:	20773
Date:	7/25/2020

Channel	Frequency (MHz)	AV power (dBm)
Low	2404	6.12
Middle	2441	6.06
High	2478	6.15

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9.5.5. HIGH POWER HDR TXBF (HDR4)

ANT 4 + ANT 3

Tested By:	20773
Date:	7/25/2020

Channel	Frequency (MHz)	Average Power ANT 4 (dBm)	Average Power ANT 3 (dBm)	Total Power (dBm)
Low	2404	11.55	11.63	14.60
Middle	2441	11.71	11.60	14.67
High	2478	11.54	11.64	14.60

9.5.6. HIGH POWER HDR TXBF (HDR8)

ANT 4 + ANT 3

Tested By:	20773
Date:	7/25/2020

Channel	Frequency (MHz)	Average Power ANT 4 (dBm)	Average Power ANT 3 (dBm)	Total Power (dBm)
Low	2404	11.56	11.63	14.61
Middle	2441	11.69	11.52	14.62
High	2478	11.67	11.70	14.70

9.5.7. LOW POWER HDR TXBF (HDR4)

ANT 4 + ANT 3

Tested By:	20773
Date:	7/25/2020

Channel	Frequency (MHz)	Average Power ANT 4 (dBm)	Average Power ANT 3 (dBm)	Total Power (dBm)
Low	2404	6.22	6.04	9.14
Middle	2441	6.13	6.15	9.15
High	2478	6.15	6.10	9.14

9.5.8. LOW POWER HDR TXBF (HDR8)

ANT 4 + ANT 3

Tested By:	20773
Date:	7/25/2020

Channel	Frequency (MHz)	Average Power ANT 4 (dBm)	Average Power ANT 3 (dBm)	Total Power (dBm)
Low	2404	6.03	6.11	9.08
Middle	2441	6.02	6.20	9.12
High	2478	6.18	6.08	9.14

Note: Test procedures and setting on beamforming are same as HDR normal mode

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9.6. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

RSS-247 (5.2) (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

RESULTS

Only Mid channel plot is reported to show setting parameter complies with testing method/procedure.

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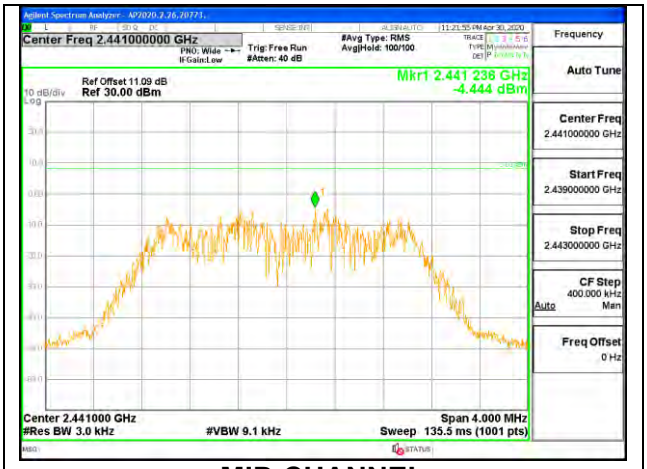
9.6.1. HIGH POWER HDR (HDR4)

ANT 4

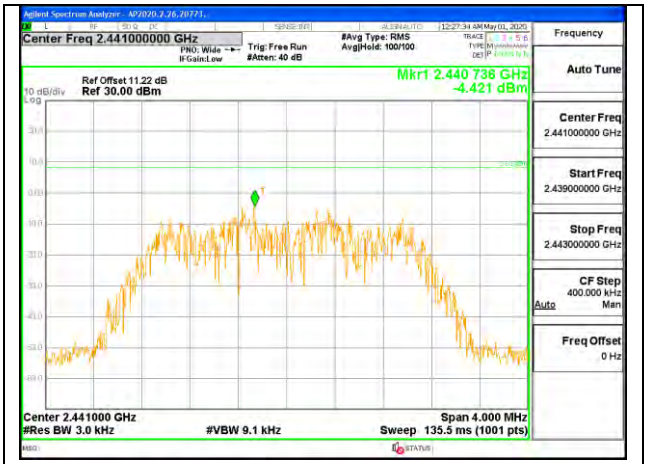
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2404	-4.523	8	-12.52
Middle	2441	-4.444	8	-12.44
High	2478	-4.780	8	-12.78



MID CHANNEL

ANT 3

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2404	-4.700	8	-12.70
Middle	2441	-4.421	8	-12.42
High	2478	-4.589	8	-12.59



MID **CHANNEL**

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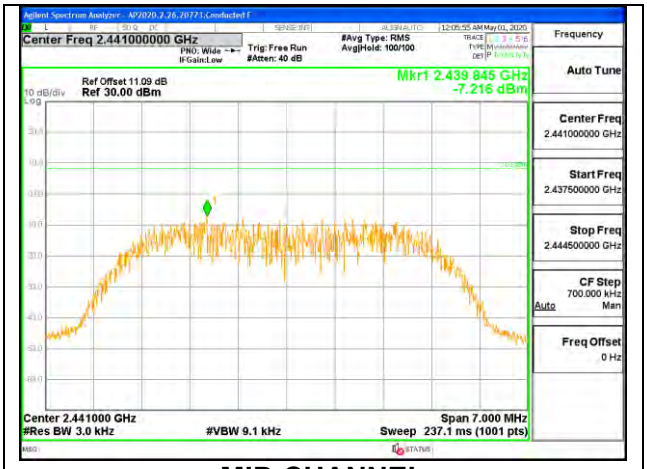
9.6.2. HIGH POWER HDR (HDR8)

ANT 4

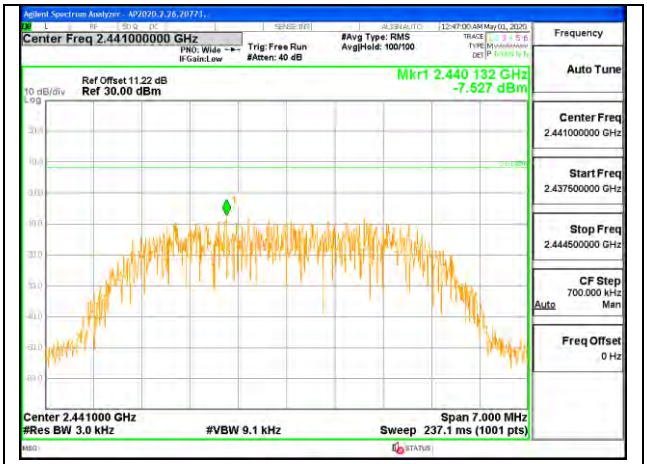
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2404	-7.295	8	-15.30
Middle	2441	-7.216	8	-15.22
High	2478	-7.129	8	-15.13



MID CHANNEL

ANT 3

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2404	-7.306	8	-15.31
Middle	2441	-7.527	8	-15.53
High	2478	-7.661	8	-15.66



MID CHANNEL

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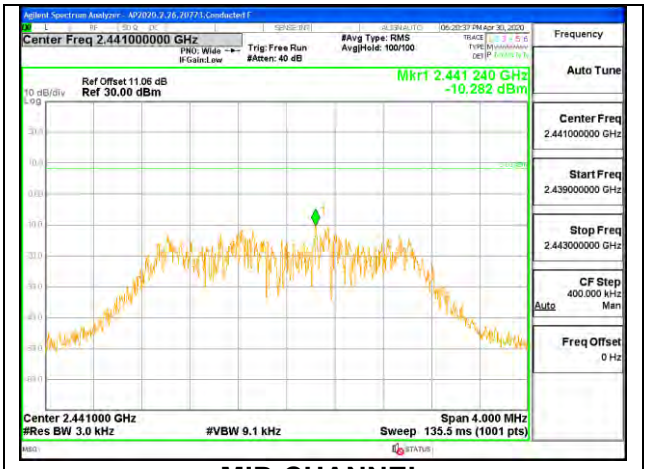
9.6.3. LOW POWER HDR (HDR4)

ANT 4

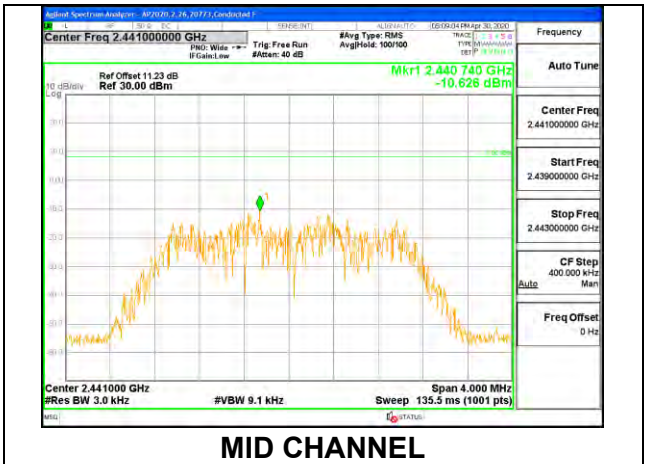
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2404	-10.480	8	-18.48
Middle	2441	-10.282	8	-18.28
High	2478	-9.887	8	-17.89



MID CHANNEL

ANT 3

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2404	-10.352	8	-18.35
Middle	2441	-10.626	8	-18.63
High	2478	-10.228	8	-18.23



MID CHANNEL

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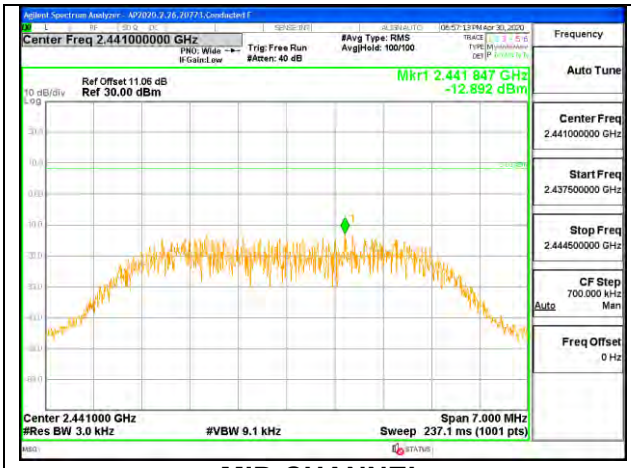
9.6.4. LOW POWER HDR (HDR8)

ANT 4

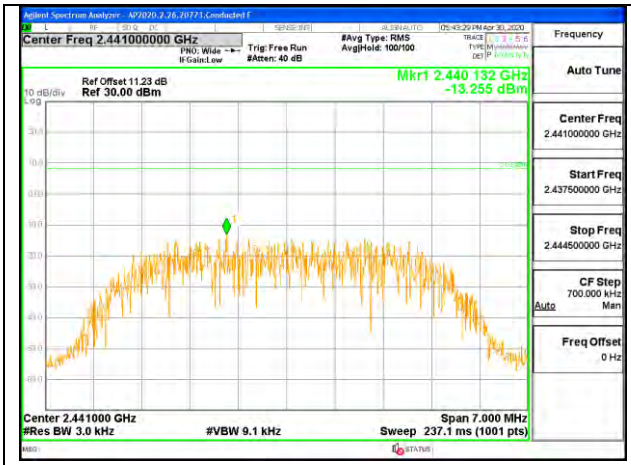
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2404	-12.79	8	-20.79
Middle	2441	-12.89	8	-20.89
High	2478	-13.17	8	-21.17



MID CHANNEL

ANT 3

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2404	-13.062	8	-21.06
Middle	2441	-13.255	8	-21.26
High	2478	-12.868	8	-20.87



MID CHANNEL

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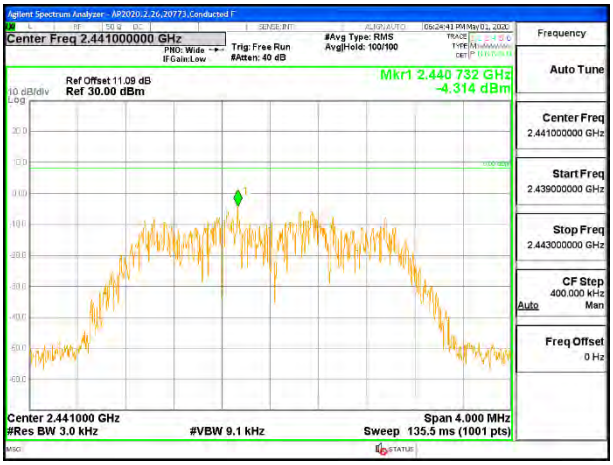
9.6.5. HIGH POWER HDR TXBF (HDR4)

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD

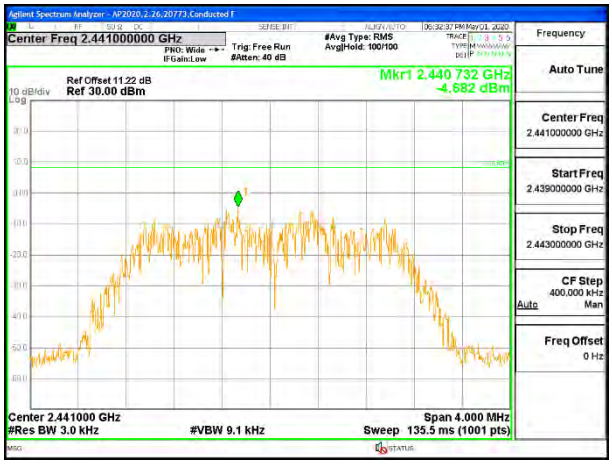
PSD Results

Channel	Frequency (MHz)	ANT 4 Meas (dBm/ 3kHz)	ANT 3 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low	2404	-4.862	-4.647	-1.74	8.0	-9.7
Mid	2441	-4.314	-4.682	-1.48	8.0	-9.5
Hjigh	2478	-4.871	-4.614	-1.73	8.0	-9.7

Note: Test procedures and setting on beamforming are same as HDR normal mode



MID CHANNEL ANT 4



MID CHANNEL ANT 3

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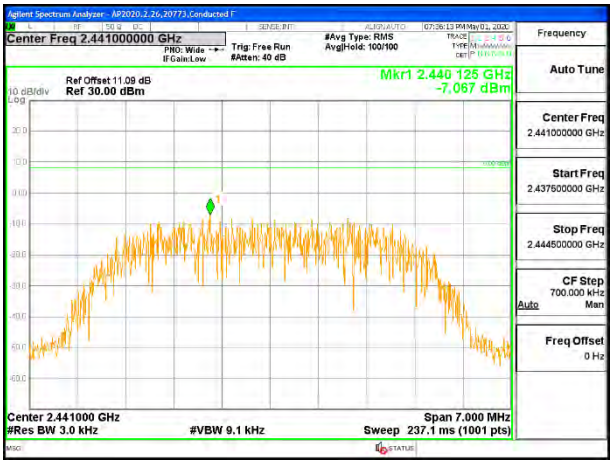
9.6.6. HIGH POWER HDR TXBF (HDR8)

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD

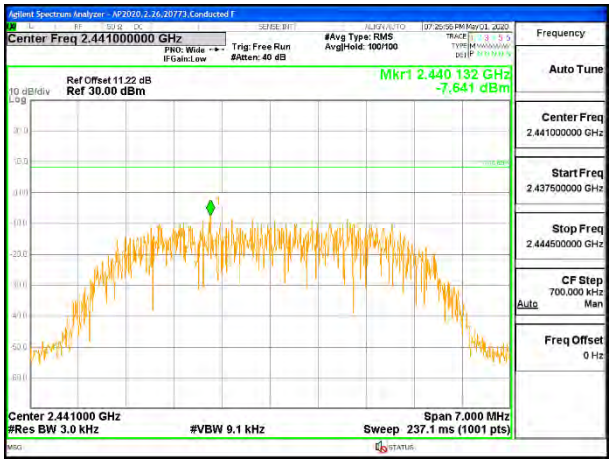
PSD Results

Channel	Frequency (MHz)	ANT 4 Meas (dBm/ 3kHz)	ANT 3 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low	2404	-7.589	-7.376	-4.47	8.0	-12.5
Mid	2441	-7.067	-7.641	-4.33	8.0	-12.3
Hjigh	2478	-7.116	-6.983	-4.04	8.0	-12.0

Note: Test procedures and setting on beamforming are same as HDR normal mode



MID CHANNEL ANT 4



MID CHANNEL ANT 3

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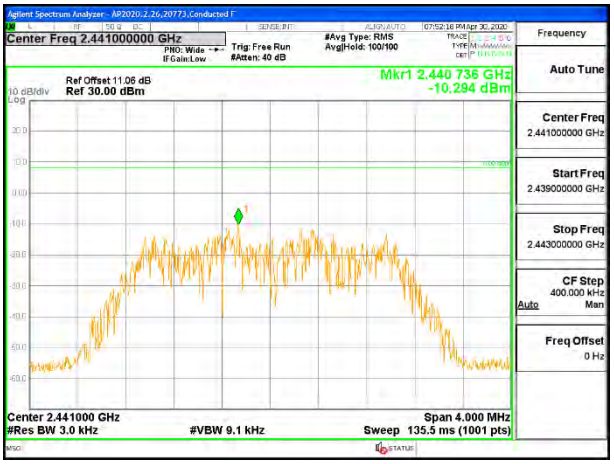
9.6.7. LOW POWER HDR TXBF (HDR4)

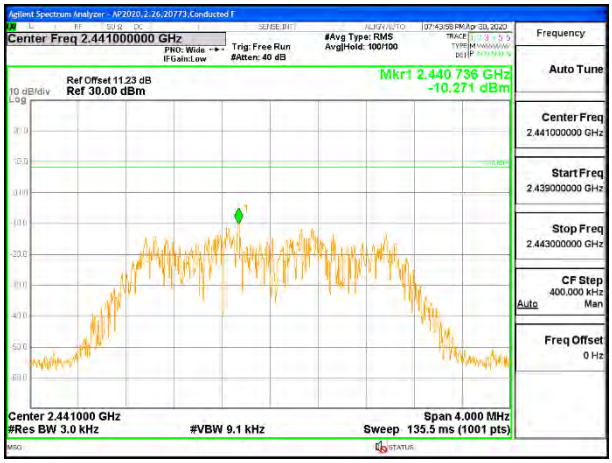
Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD

PSD Results

Channel	Frequency (MHz)	ANT 4 Meas (dBm/ 3kHz)	ANT 3 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low	2404	-9.911	-10.542	-7.20	8.0	-15.2
Mid	2441	-10.294	-10.271	-7.27	8.0	-15.3
Hjigh	2478	-10.245	-10.373	-7.30	8.0	-15.3



MID CHANNEL ANT 4



MID CHANNEL ANT 3

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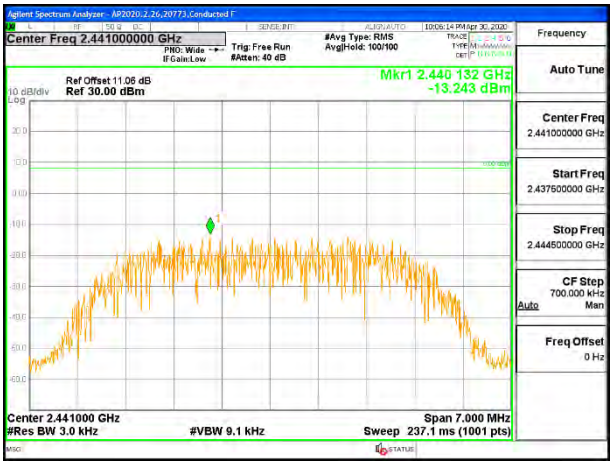
9.6.8. LOW POWER HDR TXBF (HDR8)

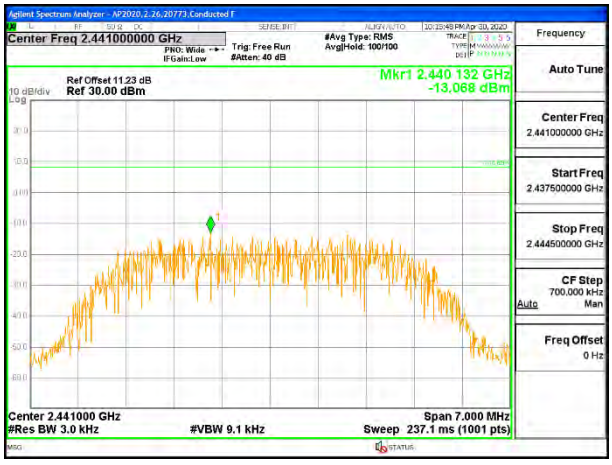
Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD

PSD Results

Channel	Frequency (MHz)	ANT 4 Meas (dBm/ 3kHz)	ANT 3 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low	2404	-13.231	-13.161	-10.19	8.0	-18.2
Mid	2441	-13.243	-13.068	-10.14	8.0	-18.1
Hjigh	2478	-13.122	-13.177	-10.14	8.0	-18.1



MID CHANNEL ANT 4



MID CHANNEL ANT 3

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9.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

RSS-247 5.5

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

RESULTS

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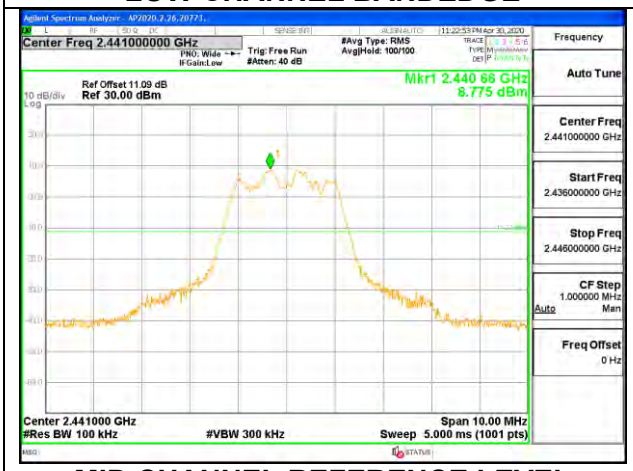
9.7.1. HIGH POWER HDR (HDR4)

ANT 4

LOW CHANNEL BANDEDGE

OUT-OF-BAND LOW CHANNEL



MID CHANNEL REFERENCE LEVEL

OUT-OF-BAND MID CHANNEL

HIGH CHANNEL BANDEDGE

OUT-OF-BAND HIGH CHANNEL

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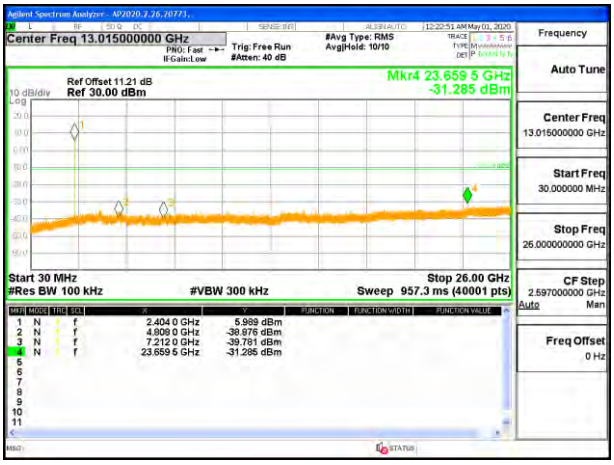
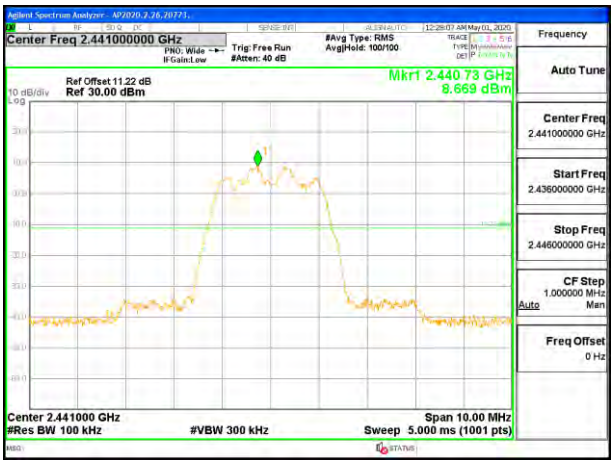
ANT 3

LOW CHANNEL BANDEDGE



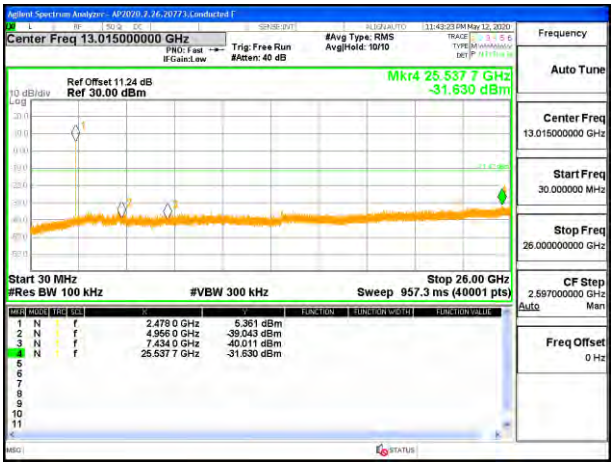
OUT-OF-BAND LOW CHANNEL



MID CHANNEL REFERENCE LEVEL

OUT-OF-BAND MID CHANNEL

HIGH CHANNEL BANDEDGE



OUT-OF-BAND HIGH CHANNEL

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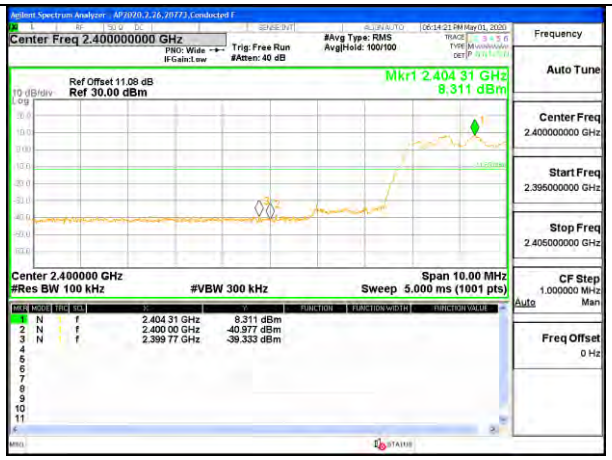
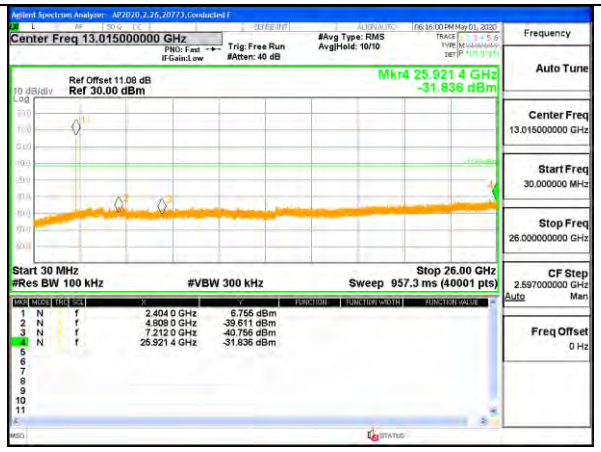
9.7.2. HIGH POWER HDR TXBF (HDR4)

ANT 4

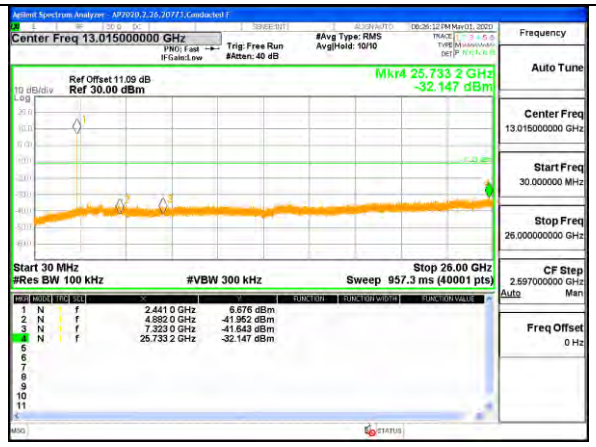


LOW CHANNEL , BANDEDGE ANT 4

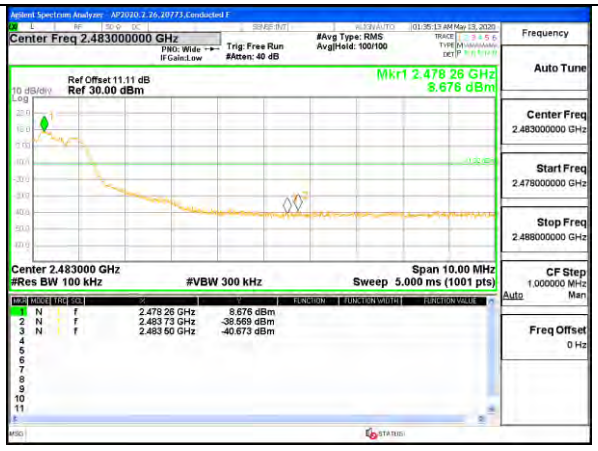


LOW CHANNEL OUT-OF-BAND ANT 4

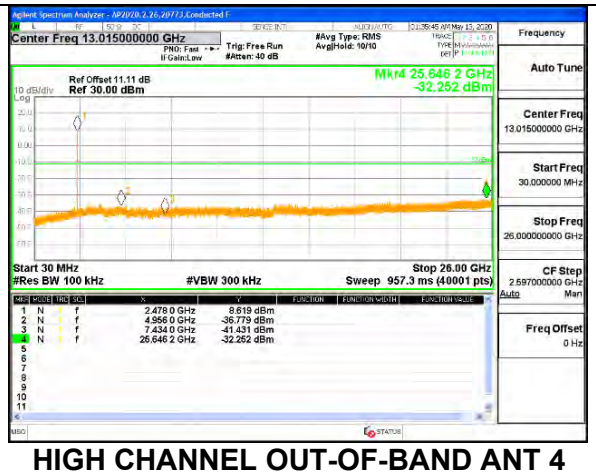
MID CHANNEL REFERENCE ANT 4



MID CHANNEL OUT-OF-BAND ANT 4



HIGH CHANNEL BANDEDGE ANT 4



HIGH CHANNEL OUT-OF-BAND ANT 4

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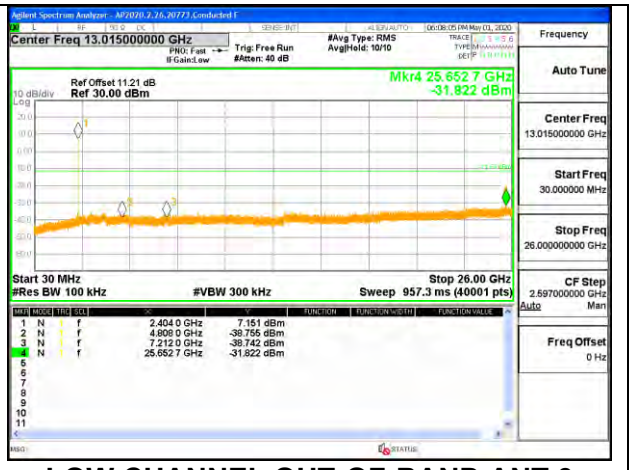
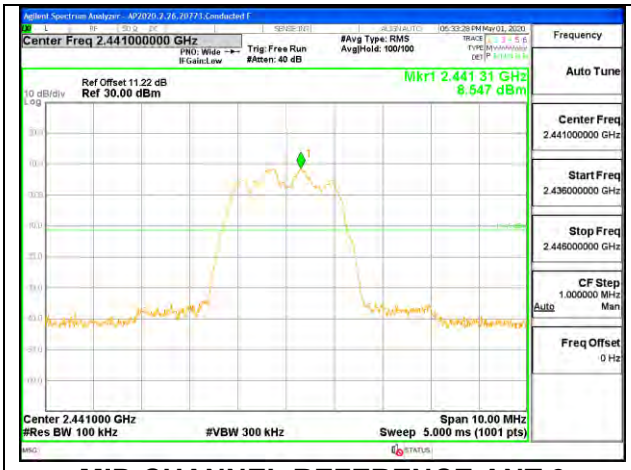
ANT 3

LOW CHANNEL , BANDEDGE ANT 3



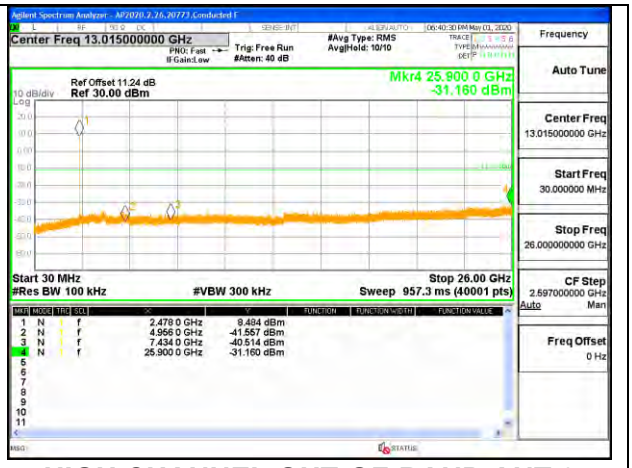
LOW CHANNEL OUT-OF-BAND ANT 3



MID CHANNEL REFERENCE ANT 3

MID CHANNEL OUT-OF-BAND ANT 3

HIGH CHANNEL BANDEDGE ANT 3



HIGH CHANNEL OUT-OF-BAND ANT 3

Note: Test procedures and setting on beamforming are same as HDR normal mode

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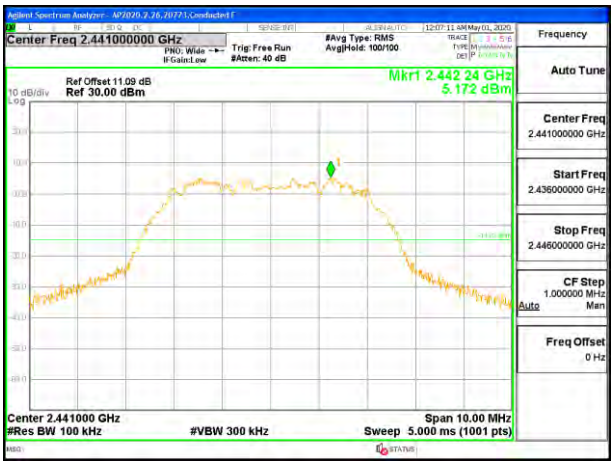
9.7.3. HIGH POWER HDR (HDR8)

ANT 4

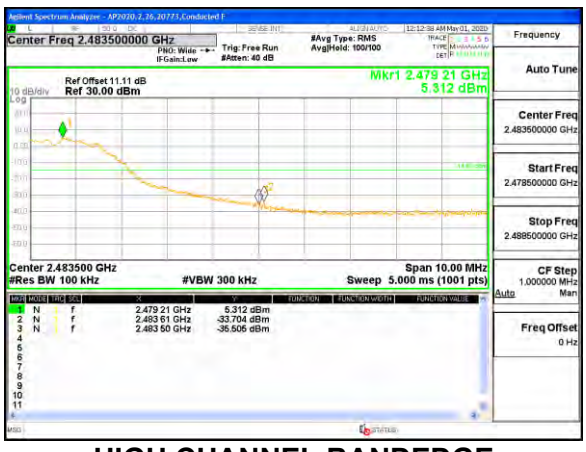
LOW CHANNEL BANDEDGE

OUT-OF-BAND LOW CHANNEL

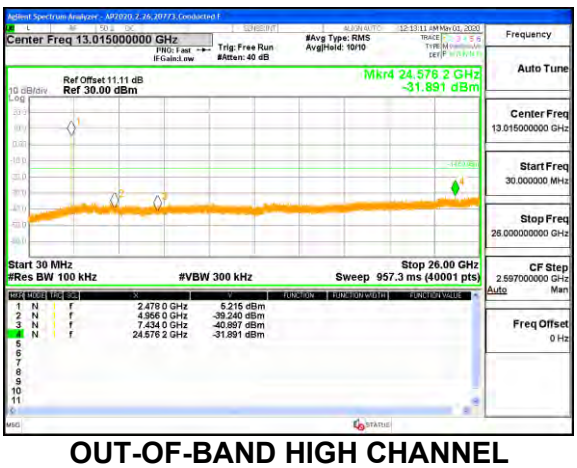


MID CHANNEL REFERENCE LEVEL

OUT-OF-BAND MID CHANNEL



HIGH CHANNEL BANDEDGE



OUT-OF-BAND HIGH CHANNEL

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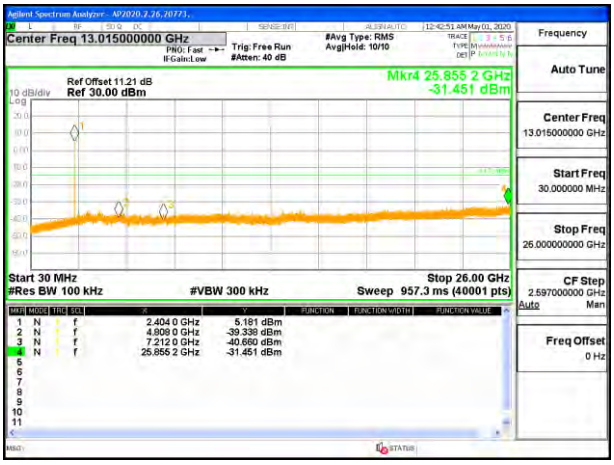
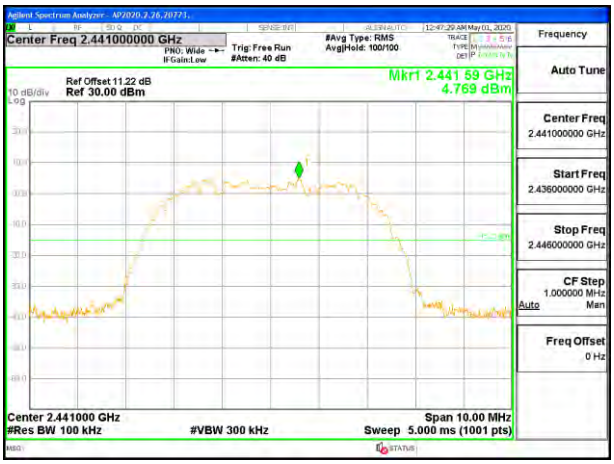
ANT 3

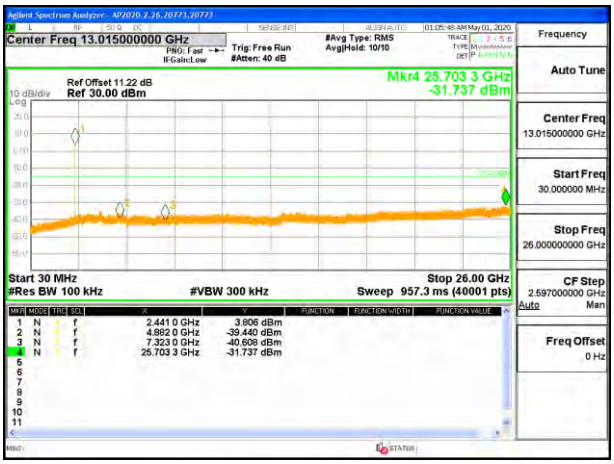
LOW CHANNEL BANDEDGE



OUT-OF-BAND LOW CHANNEL



MID CHANNEL REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL

HIGH CHANNEL BANDEDGE

OUT-OF-BAND HIGH CHANNEL

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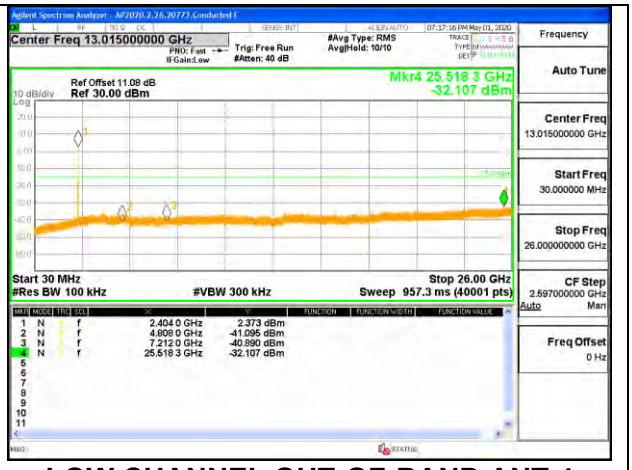
9.7.4. HIGH POWER HDR TXBF (HDR8)

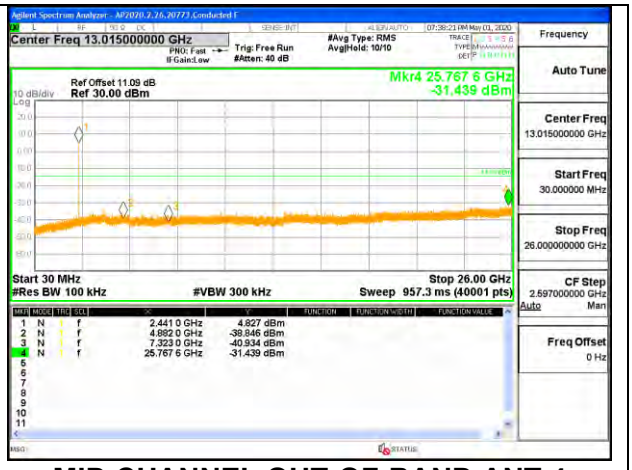
ANT 4

LOW CHANNEL , BANDEDGE ANT 4

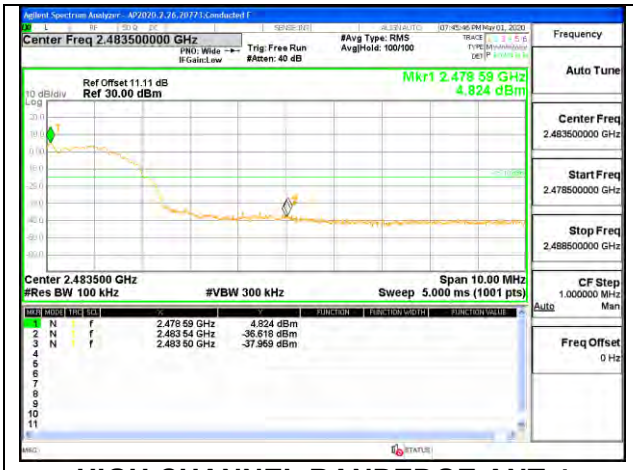


LOW CHANNEL OUT-OF-BAND ANT 4

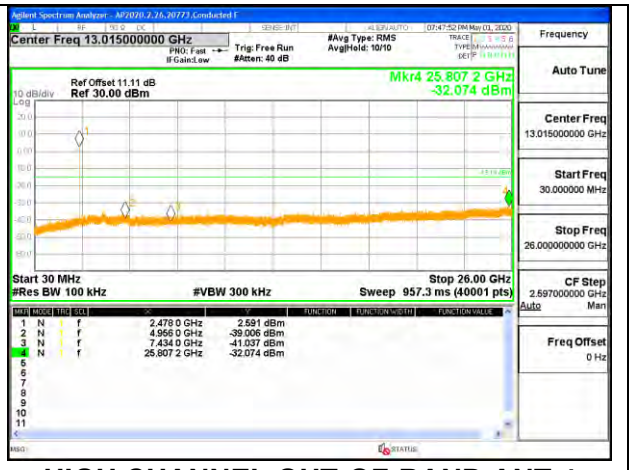
MID CHANNEL REFERENCE ANT 4



MID CHANNEL OUT-OF-BAND ANT 4



HIGH CHANNEL BANDEDGE ANT 4



HIGH CHANNEL OUT-OF-BAND ANT 4

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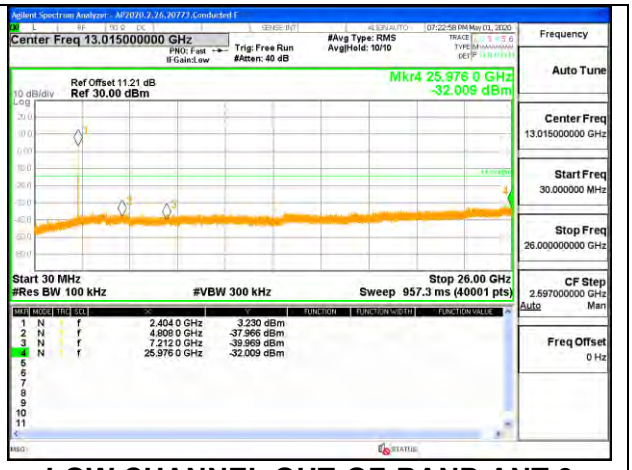
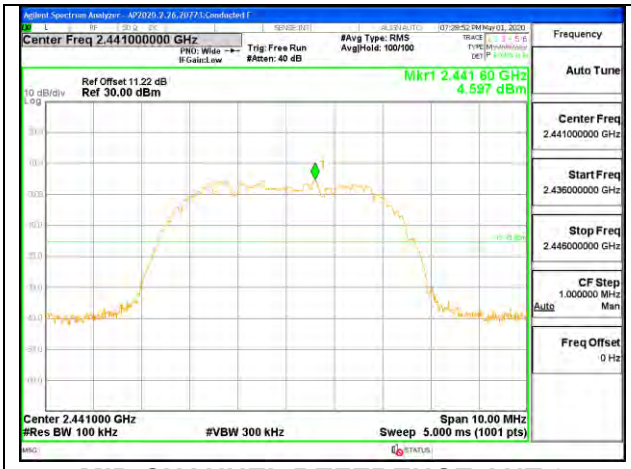
ANT 3

LOW CHANNEL BANDEDGE ANT 3

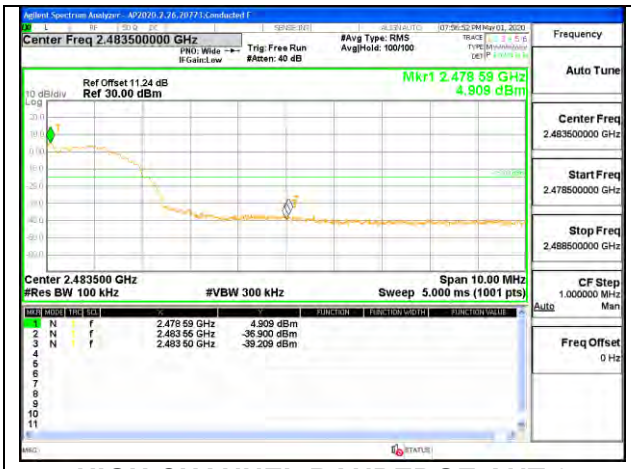


LOW CHANNEL OUT-OF-BAND ANT 3



MID CHANNEL REFERENCE ANT 3

MID CHANNEL OUT-OF-BAND ANT 3



HIGH CHANNEL BANDEDGE ANT 3

HIGH CHANNEL OUT-OF-BAND ANT 3

Note: Test procedures and setting on beamforming are same as HDR normal mode

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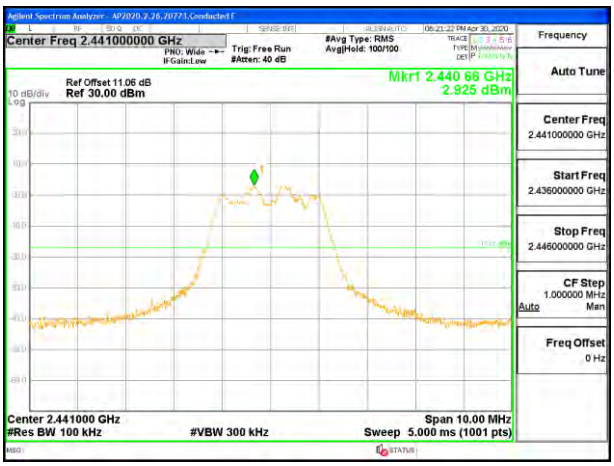
9.7.5. LOW POWER HDR (HDR4)

ANT 4

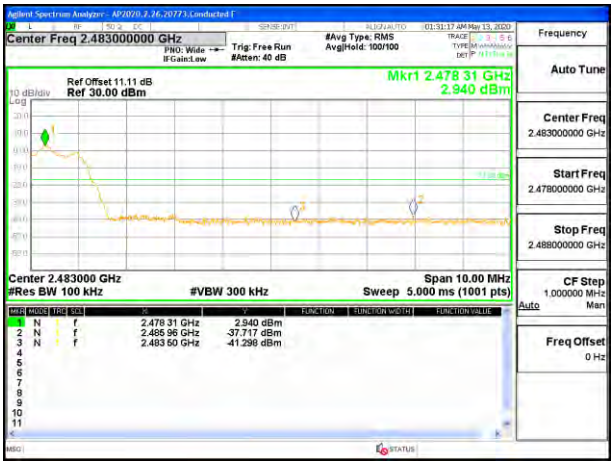
LOW CHANNEL BANDEDGE

OUT-OF-BAND LOW CHANNEL

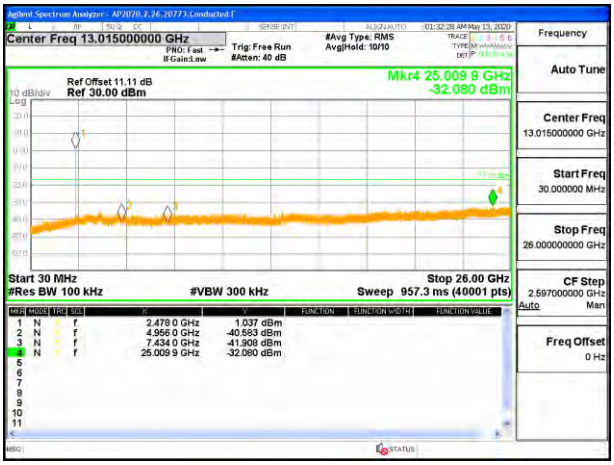


MID CHANNEL REFERENCE LEVEL

OUT-OF-BAND MID CHANNEL



HIGH CHANNEL BANDEDGE



OUT-OF-BAND HIGH CHANNEL

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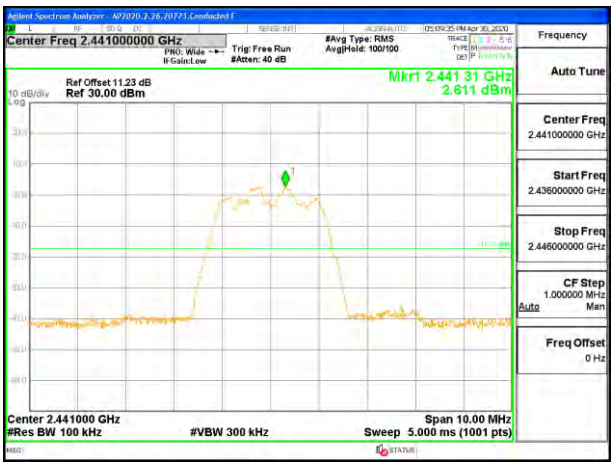
ANT 3

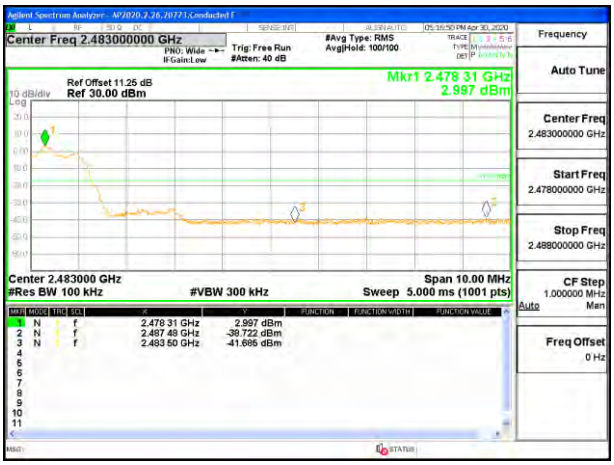
LOW CHANNEL BANDEDGE

OUT-OF-BAND LOW CHANNEL



MID CHANNEL REFERENCE LEVEL

OUT-OF-BAND MID CHANNEL



HIGH CHANNEL BANDEDGE

OUT-OF-BAND HIGH CHANNEL

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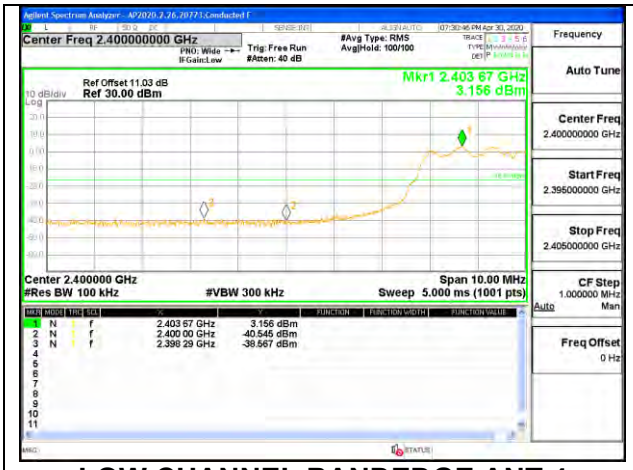
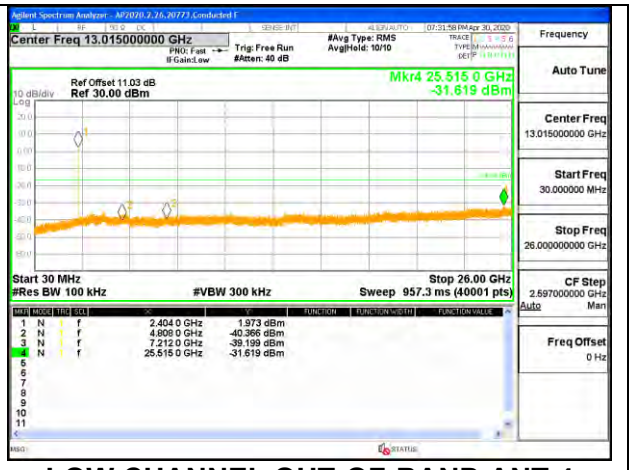
9.7.6. LOW POWER HDR TXBF (HDR4)

ANT 4

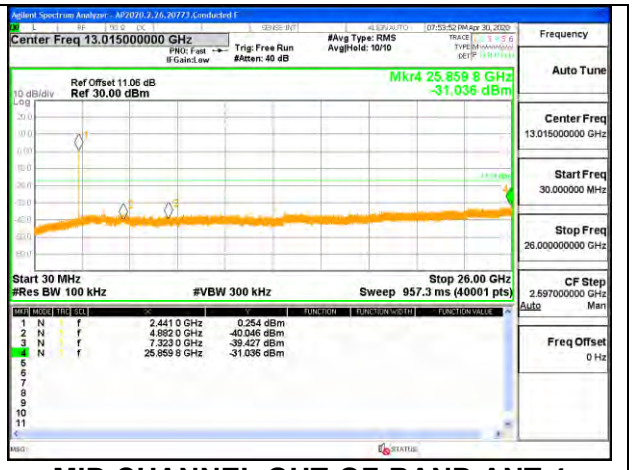


LOW CHANNEL BANDEDGE ANT 4

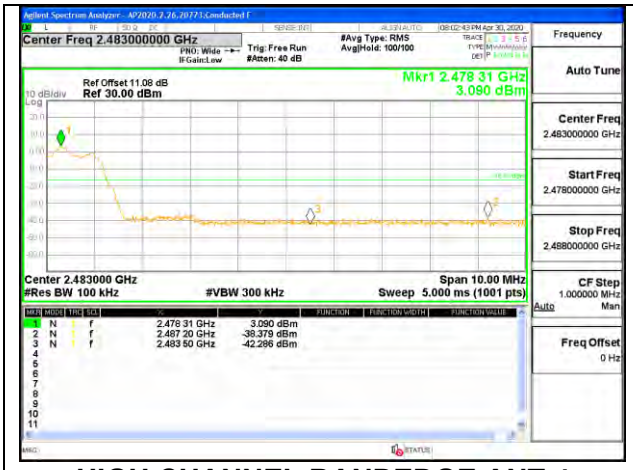


LOW CHANNEL OUT-OF-BAND ANT 4

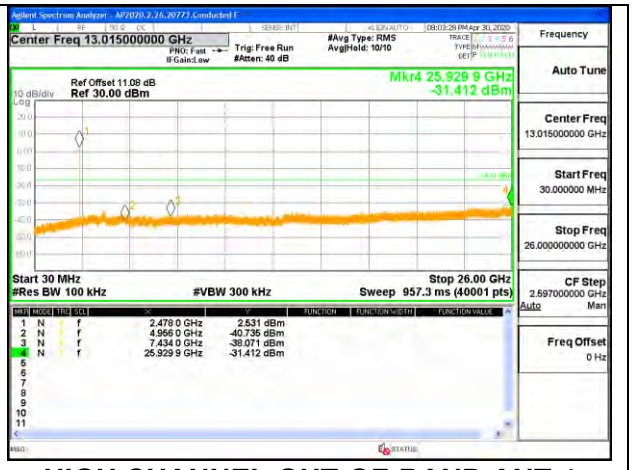
MID CHANNEL REFERENCE ANT 4



MID CHANNEL OUT-OF-BAND ANT 4



HIGH CHANNEL BANDEDGE ANT 4



HIGH CHANNEL OUT-OF-BAND ANT 4

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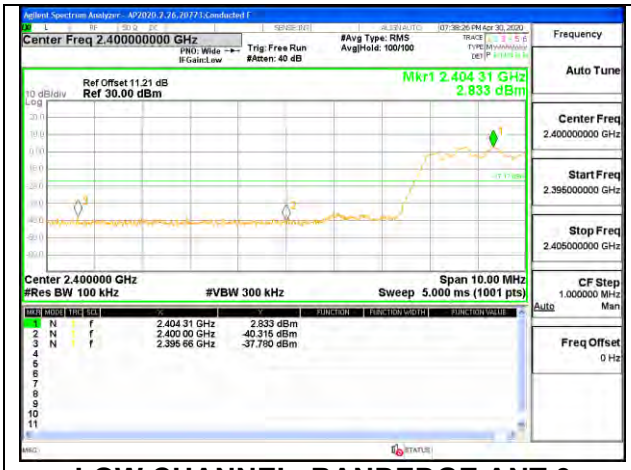
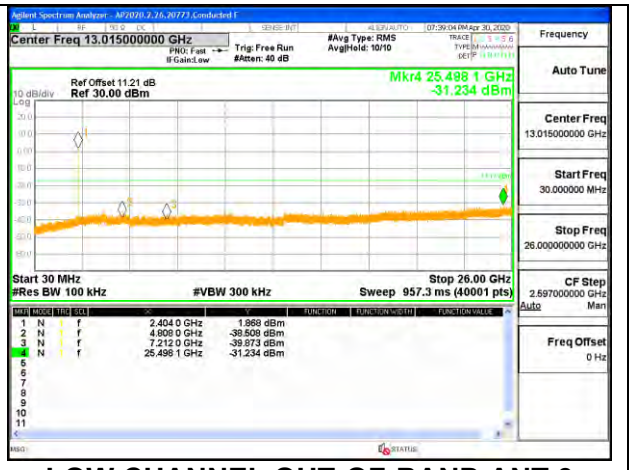
ANT 3

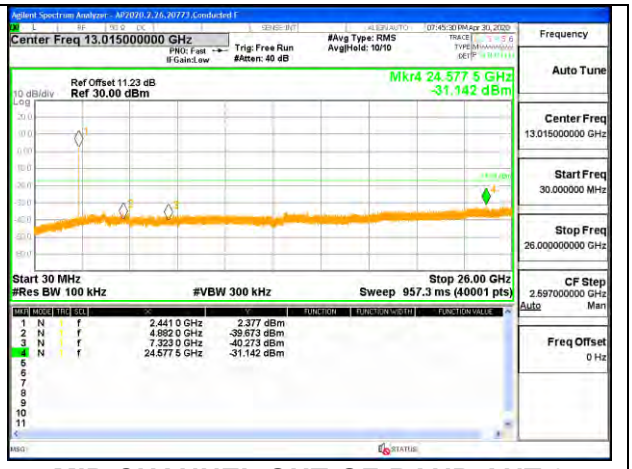


LOW CHANNEL BANDEDGE ANT 3



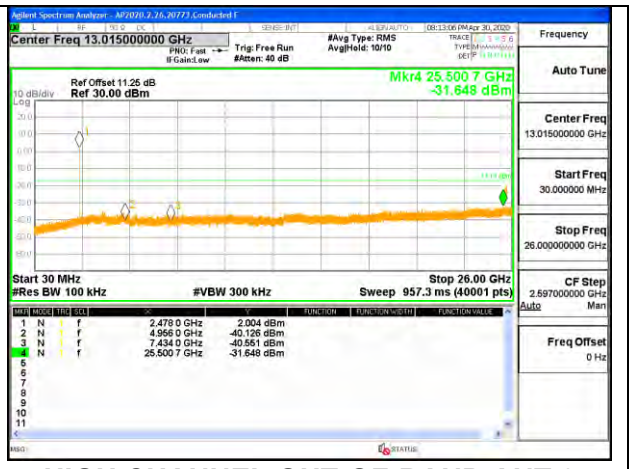
LOW CHANNEL OUT-OF-BAND ANT 3

MID CHANNEL REFERENCE ANT 3



MID CHANNEL OUT-OF-BAND ANT 3

HIGH CHANNEL BANDEDGE ANT 3



HIGH CHANNEL OUT-OF-BAND ANT 3

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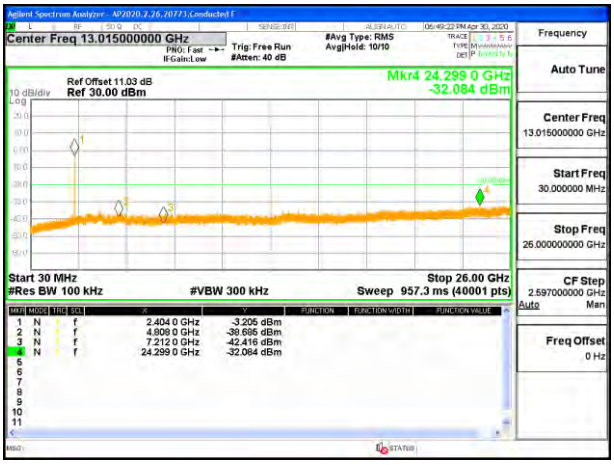
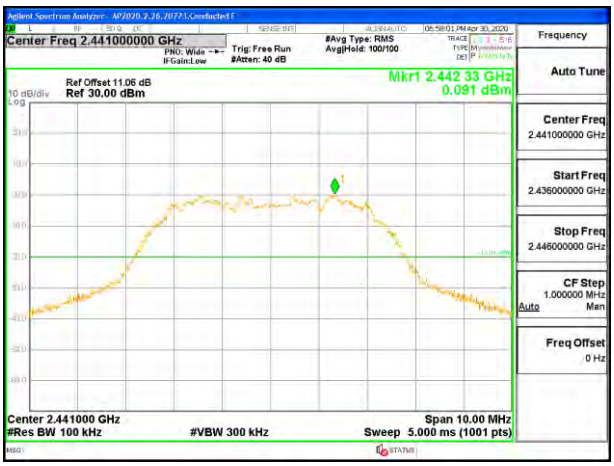
9.7.7. LOW POWER HDR (HDR8)

ANT 4

LOW CHANNEL BANDEDGE



OUT-OF-BAND LOW CHANNEL



MID CHANNEL REFERENCE LEVEL

OUT-OF-BAND MID CHANNEL

HIGH CHANNEL BANDEDGE

OUT-OF-BAND HIGH CHANNEL

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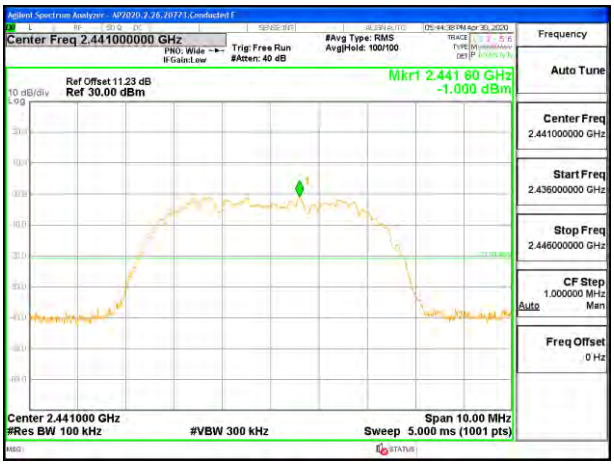
ANT 3

LOW CHANNEL BANDEDGE

OUT-OF-BAND LOW CHANNEL



MID CHANNEL REFERENCE LEVEL

OUT-OF-BAND MID CHANNEL

HIGH CHANNEL BANDEDGE

OUT-OF-BAND HIGH CHANNEL

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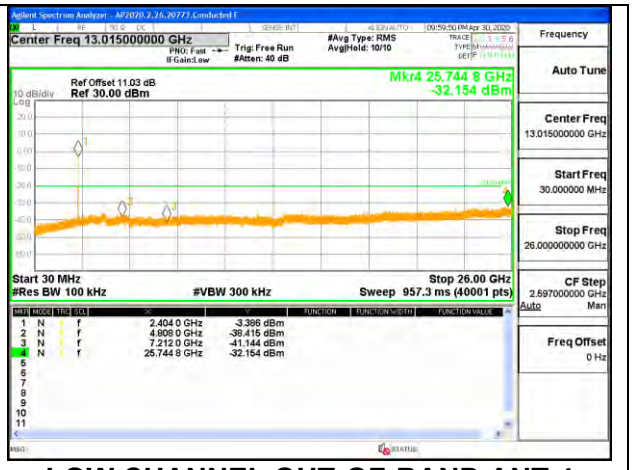
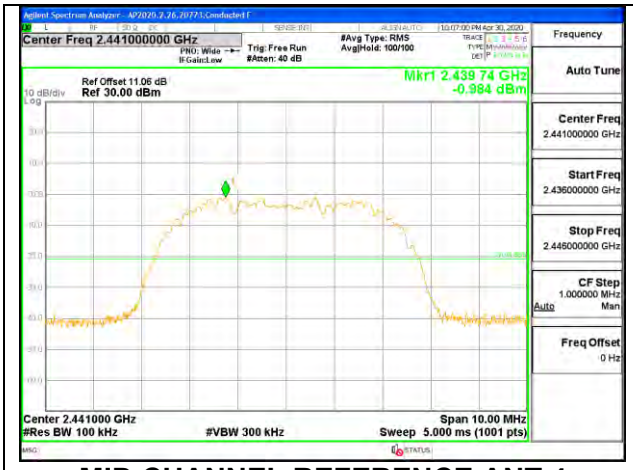
9.7.8. LOW POWER HDR TXBF (HDR8)

ANT 4

LOW CHANNEL BANDEDGE ANT 4



LOW CHANNEL OUT-OF-BAND ANT 4



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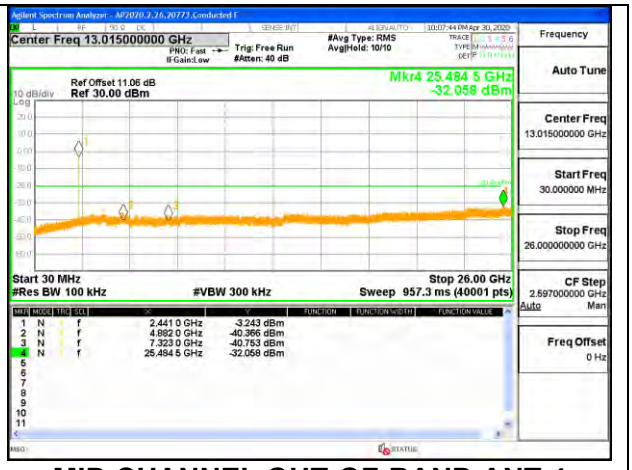

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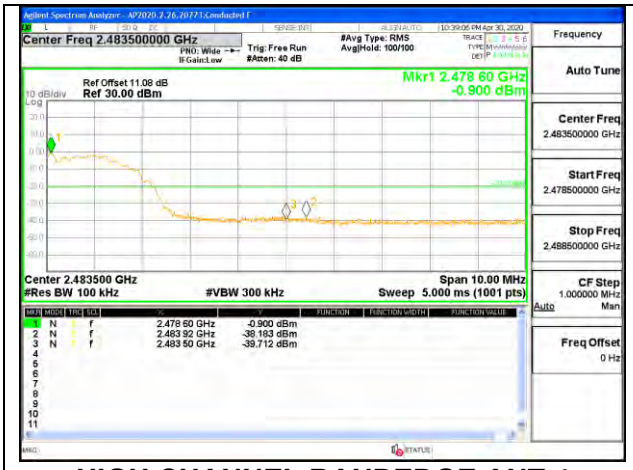
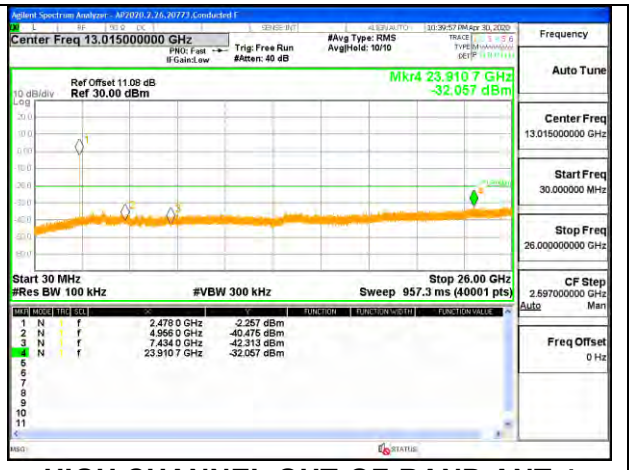


HIGH CHANNEL BANDEDGE ANT 4



HIGH CHANNEL OUT-OF-BAND ANT 4

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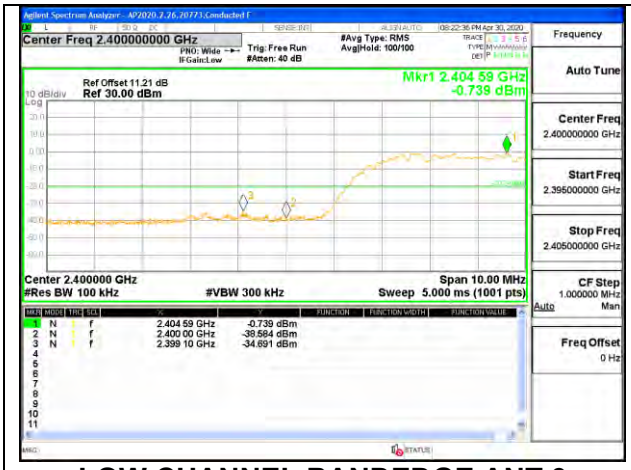
ANT 3



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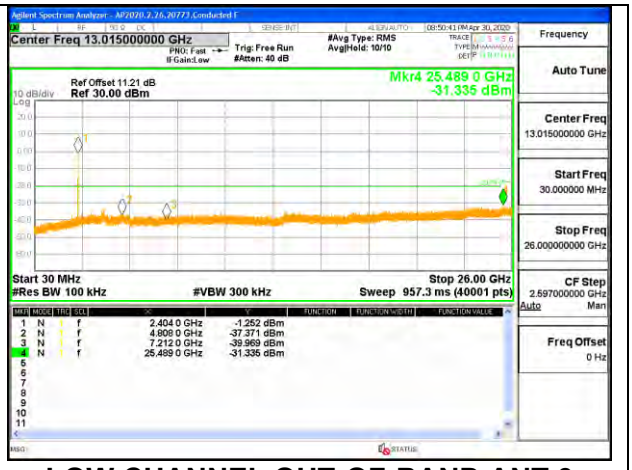
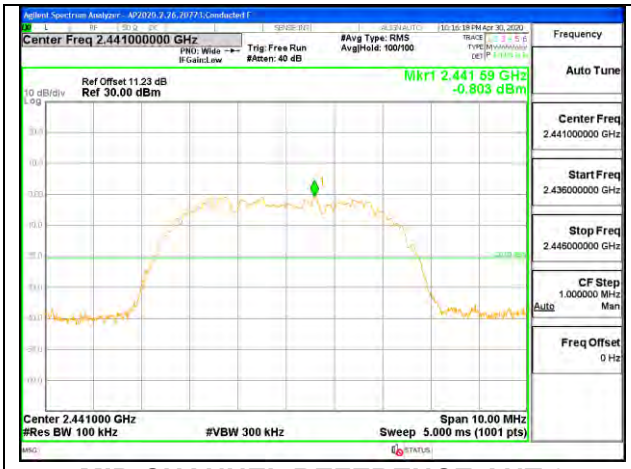
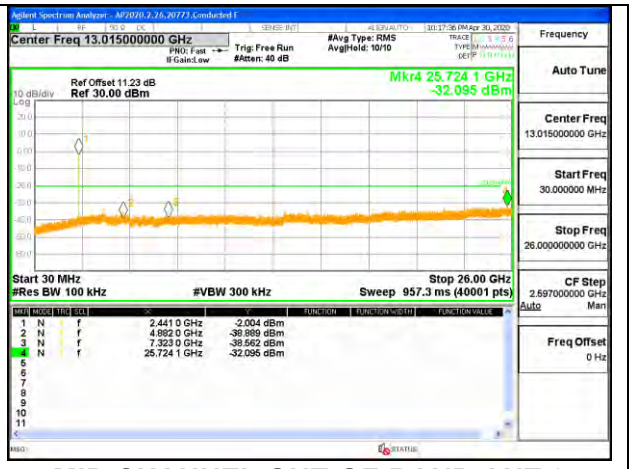


LOW CHANNEL OUT-OF-BAND ANT 3



MID CHANNEL REFERENCE ANT 3



MID CHANNEL OUT-OF-BAND ANT 3

HIGH CHANNEL BANDEDGE ANT 3

HIGH CHANNEL OUT-OF-BAND ANT 3

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