



TEST REPORT

Report Number: 13131738-E2V2

Applicant : APPLE, INC.
1 APPLE PARK WAY
CUPERTINO, CA 95014, U.S.A

Model : A2410

FCC ID : BCG-E3549A

IC : 579C-E3549A

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:
October 02, 2020

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NVLAP Lab code: 200065-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	9/21/2020	Initial issue	Chin Pang
V2	10/2/2020	Updated Appendix A 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: A2410

SERIAL NUMBER: (Original) G6TCQ01TQ897, G6TCV00BQ88T
(Spot Check): G6TD401A06P9, G6TD401306P3

DATE TESTED: AUGUST 11 – 16, 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 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 Road
<input checked="" type="checkbox"/> Chamber A	<input type="checkbox"/> Chamber D	<input type="checkbox"/> Chamber I
<input type="checkbox"/> Chamber B	<input type="checkbox"/> Chamber E	<input checked="" type="checkbox"/> Chamber J
<input type="checkbox"/> Chamber C	<input type="checkbox"/> Chamber F	<input type="checkbox"/> Chamber K
	<input type="checkbox"/> Chamber G	<input type="checkbox"/> Chamber L
	<input type="checkbox"/> Chamber H	<input type="checkbox"/> Chamber M

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: 2324A.

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

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%.

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-E3548A, IC: 579C-E3548A to cover variant model BCG-E3549A, 579C-E3549A. 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. SPOT CHECK VERIFICATION RESULTS SUMMARY

Spot check verification has been done on device model A2410, FCC ID: BCG-E3549A, IC: 579C-E3549A for radiated spurious and radiated band-edge in accordance with the Test Plan that was approved via KDB inquiry.

BCG-E3549A, 579C-E3549A SPOT CHECK RESULTS										
Technology	Mode	Test Item	Channel	Measured	Original model		Spot check model		Delta (dB)	
					A2342		A2410			
					BCG-E3548A 579C-E3548A		BCG-E3549A 579C-E3549A			
				Frequency	Peak	Ave	Peak	Ave	Peak	Ave
BLE	1M	RBE	Low	2390.0MHz	49.09	38.45	48.49	38.88	0.6	-0.43
			High	2483.5MHz	51.24	39.60	50.64	38.66	0.6	0.94
	1M	RSE	Mid	4.88GHz	46.3	36.08	48.08	35.23	1.78	-0.85

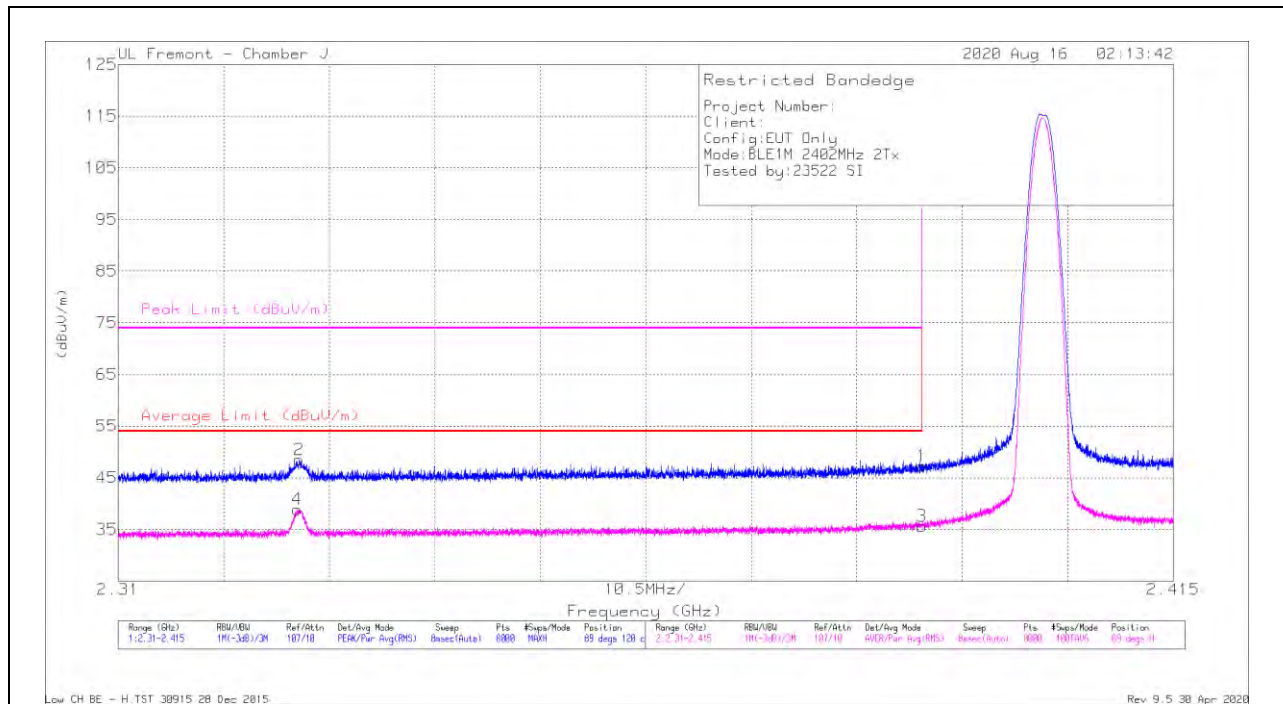
Comparison of the models, upper deviation is within 3dB range and all tests are under FCC Technical Limits. The test report for FCC ID: BCG-E3548A, IC: 579C-E3548A is therefore being used to support the application for certification for FCC ID: BCG-E3549A, IC: 579C-E3549A.

Note: The output powers were verified on model A2410 to match with model A2342 before radiated emissions spot check was performed.

SPOT CHECK DATA

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



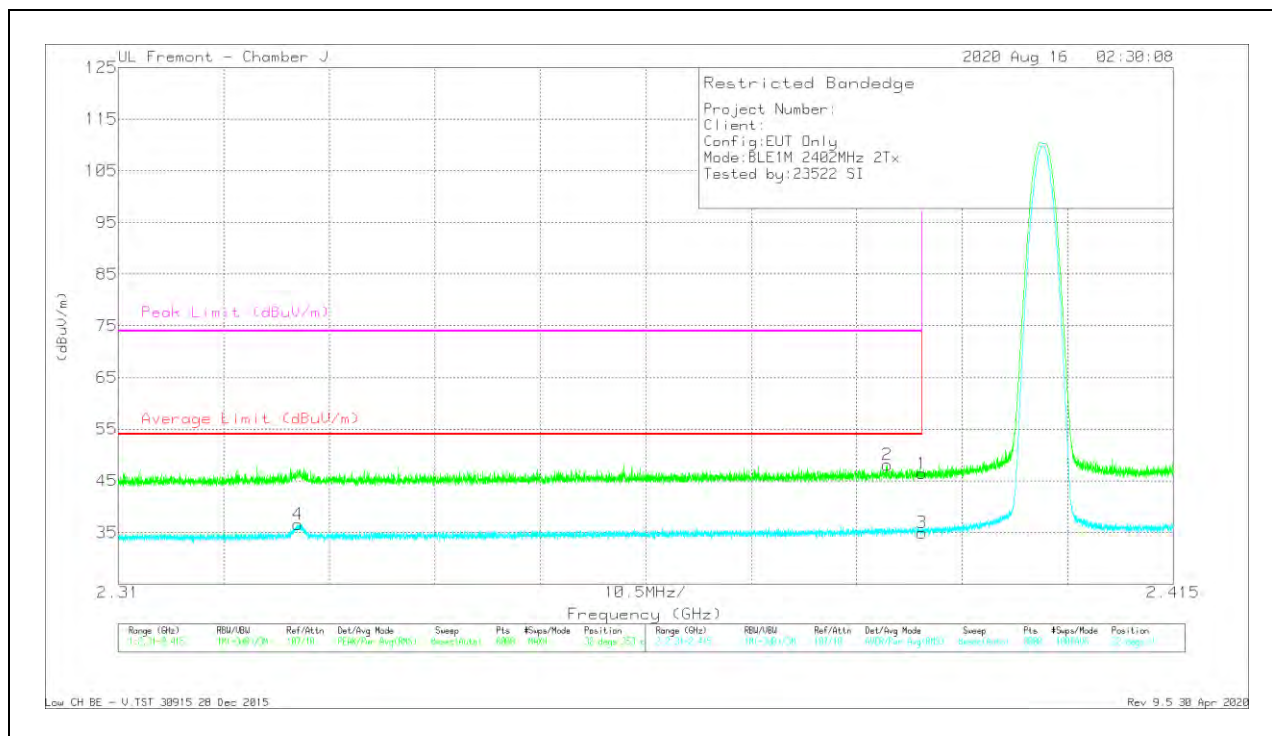
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T963 (dB/m)	Amp/Cbl/Fitr/Pa d (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	32.95	Pk	29	-14.7	47.25	-	-	74	-26.75	89	120	H
2	* 2.32802	34.49	Pk	28.9	-14.9	48.49	-	-	74	-25.51	89	120	H
3	* 2.39	21.29	RMS	29	-14.7	35.59	54	-18.41	-	-	89	120	H
4	* 2.32781	24.88	RMS	28.9	-14.9	38.88	54	-15.12	-	-	89	120	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

VERTICAL RESULT

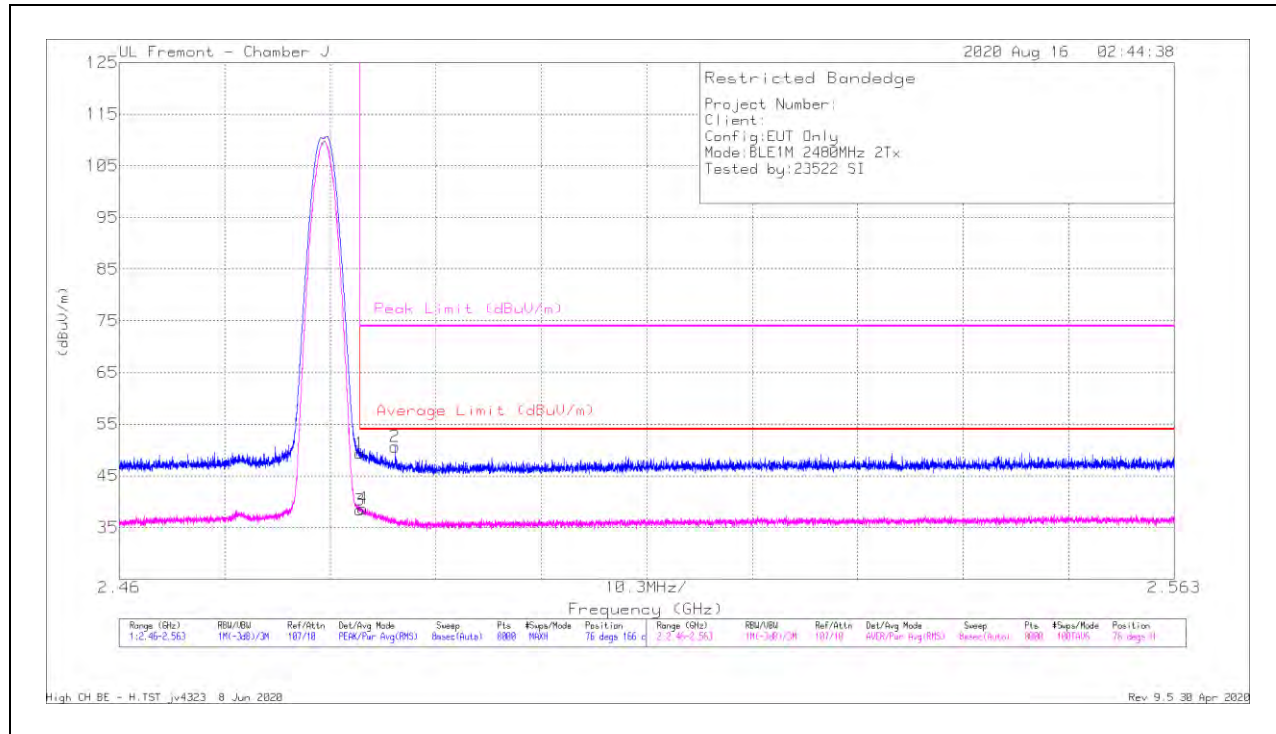


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T963 (dB/m)	Amp/Cbl/Ftr/Psd (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	32.1	Pk	29	-14.7	46.4	-	-	74	-27.6	32	353	V
2	* 2.38652	33.78	Pk	29	-14.7	48.08	-	-	74	-25.92	32	353	V
3	* 2.39	20.63	RMS	29	-14.7	34.93	54	-19.07	-	-	32	353	V
4	* 2.32789	22.56	RMS	28.9	-14.9	36.56	54	-17.44	-	-	32	353	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

BANDEDGE (HIGH CHANNEL)**HORIZONTAL RESULT**

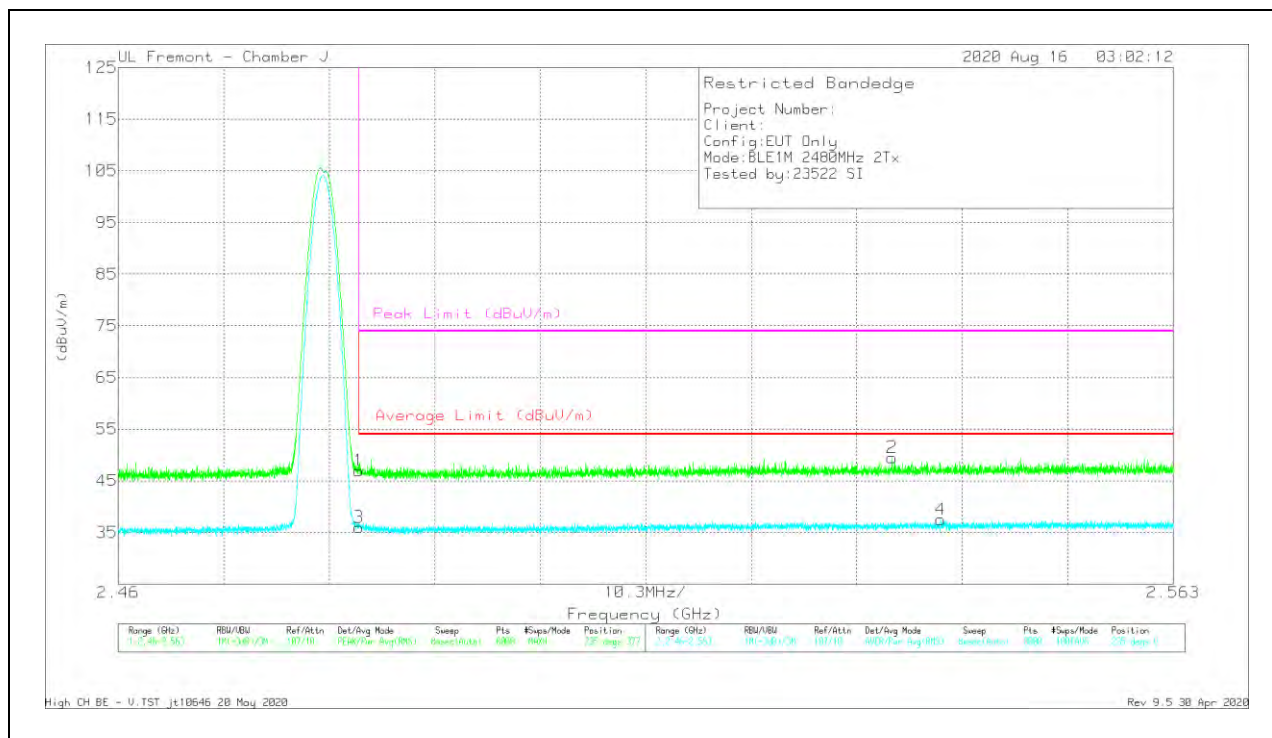
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T963 (dB/m)	Amp/Cb/Filt/Pa d (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.4835	34.42	Pk	29.5	-14.6	49.32	-	-	74	-24.68	76	166	H
2	* 2.48694	35.74	Pk	29.5	-14.6	50.64	-	-	74	-23.36	76	166	H
3	* 2.4835	23.47	RMS	29.5	-14.6	38.37	54	-15.63	-	-	76	166	H
4	* 2.48377	23.76	RMS	29.5	-14.6	38.66	54	-15.34	-	-	76	166	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T963 (dB/m)	Ampl/Cbl/Filtr/Pa d (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Dogs)	Height (cm)	Polarity
1	* 2.4835	32.07	Pk	29.5	-14.6	46.97	-	-	74	-27.03	235	377	V
2	2.5354	34.18	Pk	29.8	-14.5	49.48	-	-	74	-24.52	235	377	V
3	* 2.4835	21.05	RMS	29.5	-14.6	35.95	54	-18.05	-	-	235	377	V
4	2.54031	22.09	RMS	29.9	-14.5	37.49	54	-16.51	-	-	235	377	V

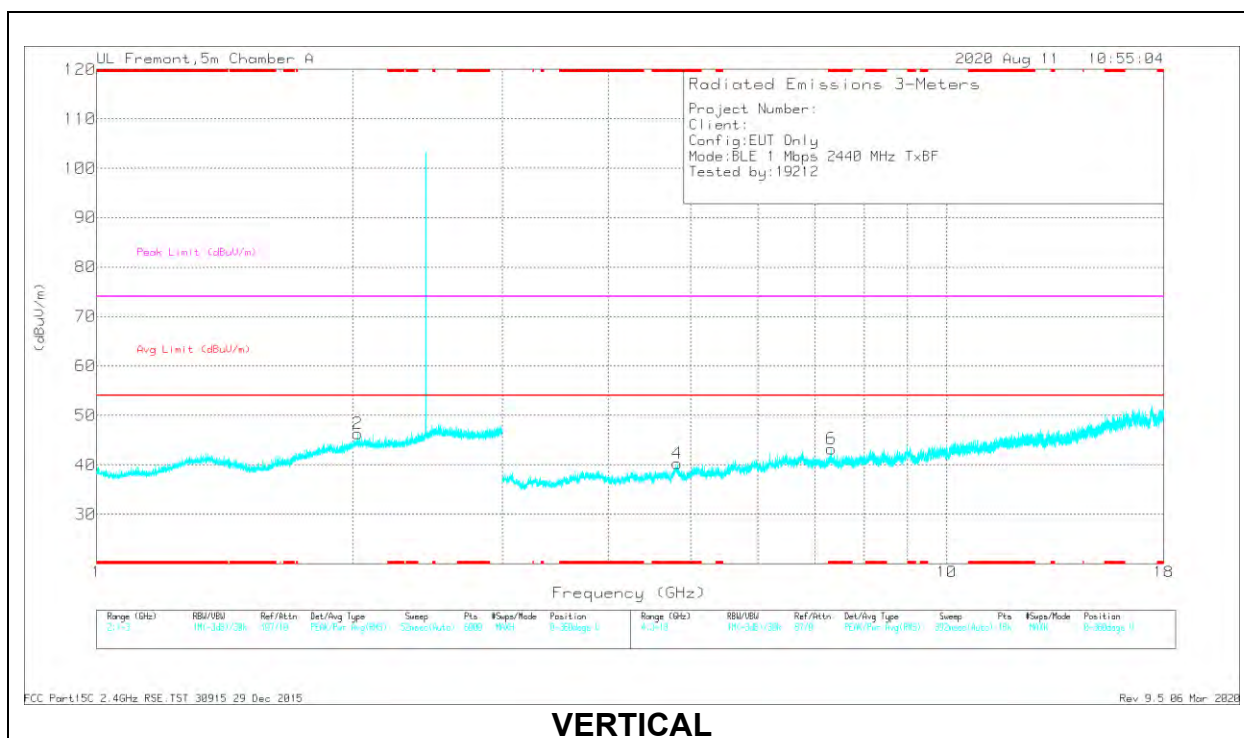
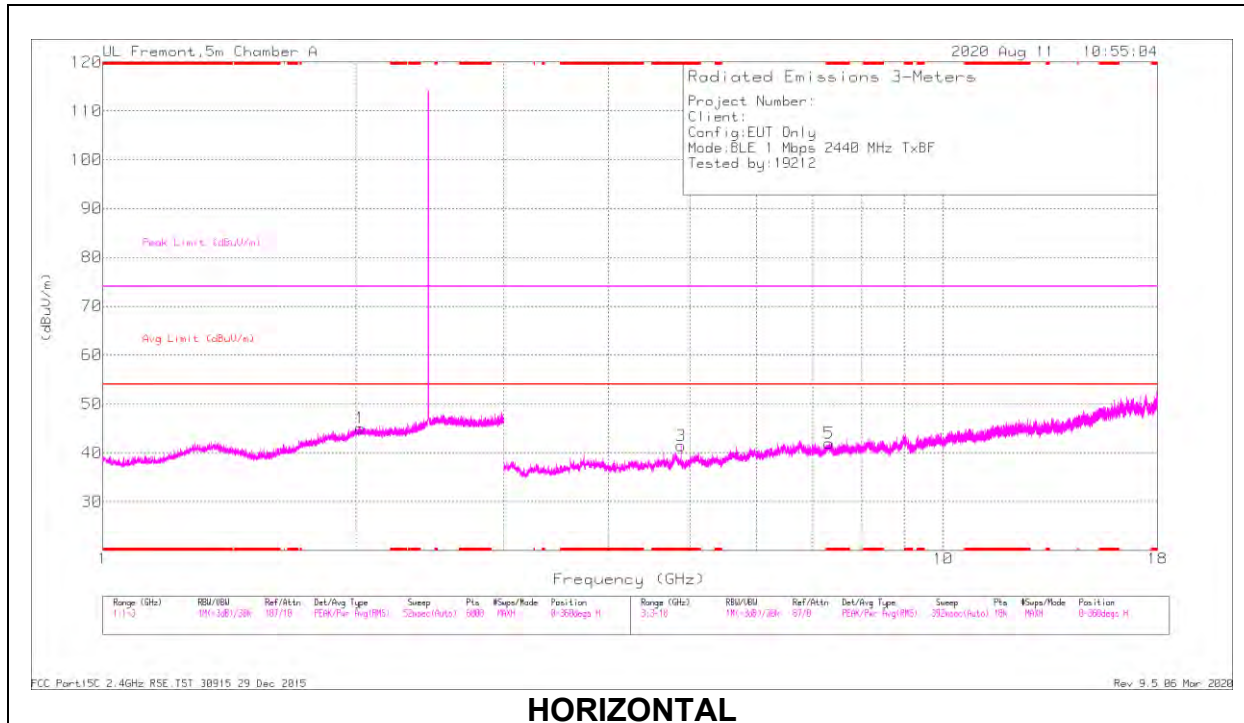
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

MID CHANNEL RESULTS



Radiated Emissions

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/Fitr/P ad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2.02643	42.98	PK2	32.4	-21.9	53.48	-	-	-	-	173	202	H
3	* 4.87819	38.75	PK2	34.1	-26.6	46.25	-	-	74	-27.75	170	110	H
	* 4.88021	26.09	MAv1	34.1	-26.7	33.49	54	-20.51	-	-	170	110	H
5	* 7.32038	35.14	PK2	36	-21.3	49.84	-	-	74	-24.16	278	237	H
	* 7.31957	22.43	MAv1	36	-21.3	37.13	54	-16.87	-	-	278	237	H
2	2.02885	42.16	PK2	32.3	-21.9	52.56	-	-	-	-	224	127	V
4	* 4.82375	39.28	PK2	34.2	-25.4	48.08	-	-	74	-25.92	336	294	V
	* 4.82376	26.43	MAv1	34.2	-25.4	35.23	54	-18.77	-	-	336	294	V
6	* 7.31917	34.8	PK2	36	-21.3	49.5	-	-	74	-24.5	214	115	V
	* 7.31833	22.48	MAv1	36	-21.3	37.18	54	-16.82	-	-	214	115	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

6.4. REFERENCE DETAIL

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

Equipment Class	Reference FCC ID & IC	Reference Report	Report Title/Section
DTS	BCG-E3548A 579C-E3548A	13335182-E2	FCC IC_BLE Report / All sections

6.5. DESCRIPTION OF AVAILABLE ANTENNAS

Frequency Range (GHz)	ANT 4 (dBi)	ANT 3 (dBi)
2.4	0.3	-1.7

6.6. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was 18.1.148.558

6.7. WORST-CASE CONFIGURATION AND MODE

Radiated band edge and spurious emissions from 1GHz to 18GHz were performed based on the Model A2342 worst case with the EUT set at highest power at 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.

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

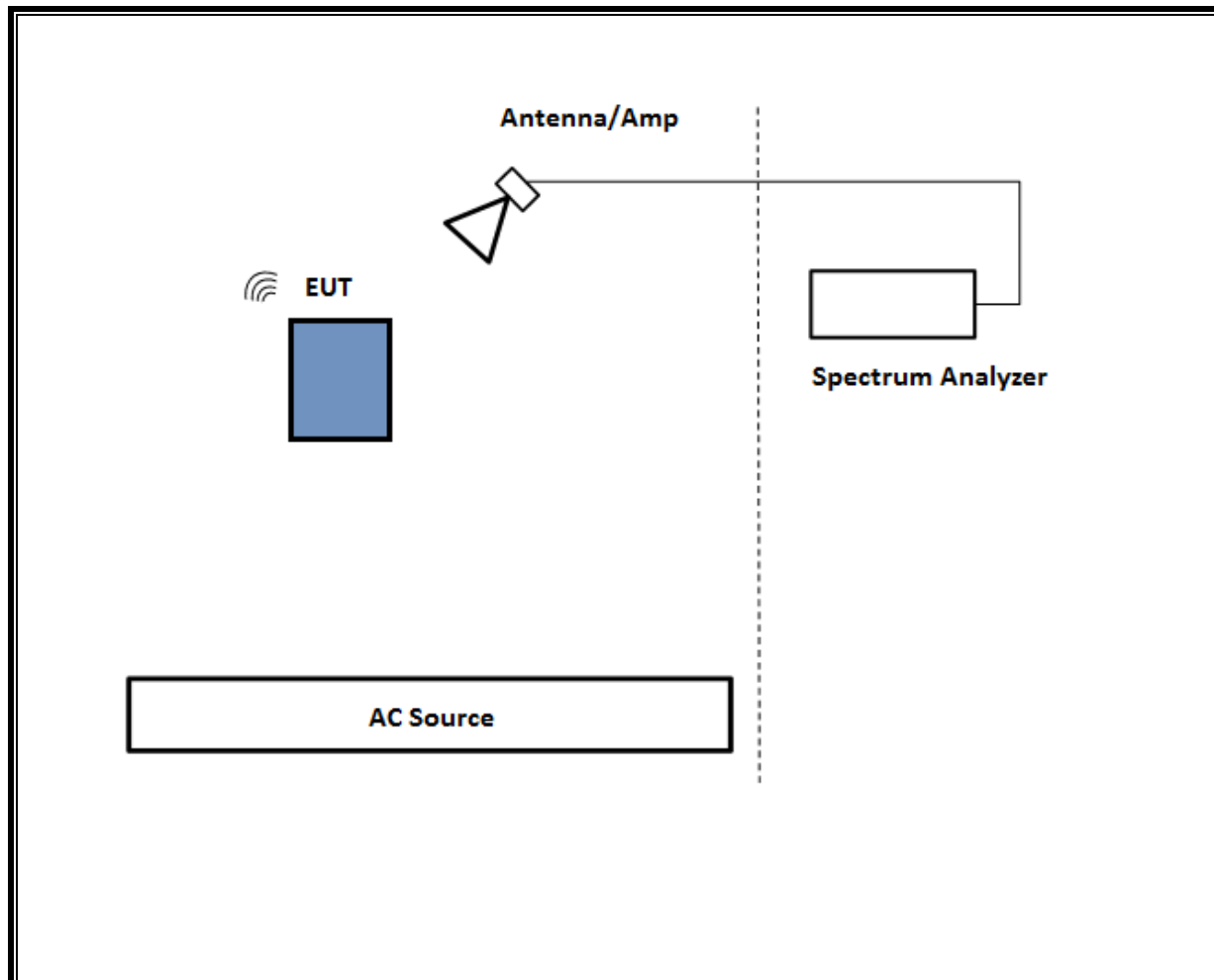
6.8. DESCRIPTION OF TEST SETUP

SUPPORT TEST EQUIPMENT						
Description		Manufacturer	Model	Serial Number		FCC ID/ DoC
Laptop		Apple	A1398	C02PM012G3QD		QDS-BRCM1069
Laptop AC/DC adapter		Liteon Technology	PA-1450-BA1	B123		N/A
EUT AC/DC adapter		Apple	A1385	D29325SM03XDHLHC9		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.

SETUP DIAGRAM FOR RADIATED TESTS Above 1 GHz



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 -11.9.2.3.2 Measurement using gated average power meter.

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

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

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

NOTE: All conducted antenna port tests for Beamforming applied the same test procedures as BLE 1Mbps and BLE 2Mbps normal modes.

8. TEST AND MEASUREMENT EQUIPMENT

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

Description	Manufacturer	Model	ID Num	Cal Due	Last Cal
Antenna, Double Ridge Guide Horn Antenna 700MHz to 18GHz	A.H. Systems, Inc.	SAS-571	T963	01/25/2021	01/25/2020
Amplifier, 1 to 18GHz, 35dB	AMPLICAL	AMP1G18-35	T1571	08/20/2021	08/20/2020
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179372	02/22/2021	02/25/2020
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T136	07/07/2021	07/07/2020
RF Amplifier, 1-18GHz	MITEQ	AFS42-00101800-25-S-42	T1165	08/10/2021	08/10/2020
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight Technologies Inc	N9030A	T907	01/22/2021	01/22/2020
Power Sensor	Keysight	N1921A	T1226	02/13/2021	02/13/2020
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight Technologies Inc	N9030A	T908	05/05/2021	05/05/2020

UL AUTOMATION SOFTWARE

Radiated Software	UL	UL EMC	Ver 9.5, Mar 6, 2020
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9. SETUP PHOTOS

Please refer to 13335182-EP1 for setup photos.

END OF TEST REPORT

Appendix A – Reference Test Report

Attached is the test report (13335182-E2) containing the reference data from the parent model as detailed in section 6.4.



TEST REPORT

Report Number: 13335182-E2V3

Applicant : APPLE, INC.
1 APPLE PARK WAY
CUPERTINO, CA 95014, U.S.A

Model : A2342

FCC ID : BCG-E3548A

IC : 579C-E3548A

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 30, 2020

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NVLAP Lab code: 200065-0

REPORT REVISION HISTORY

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V1	9/21/2020	Initial Issue	Chin Pang
V2	9/25/2020	Address TCB's Questions	Chin Pang
V3	9/30/2020	Address TCB's Questions	Vien Tran

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12. SETUP PHOTOS128

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: APPLE, INC.
1 APPLE PARK WAY
CUPERTINO, CA 95014, U.S.A.

EUT DESCRIPTION: SMARTPHONE

MODEL: A2342

SERIAL NUMBER: G6TCQ01TQ897, G6TCQ02KQ897

DATE TESTED: MAY 06, 2020 to SEPTEMBER 05, 2020

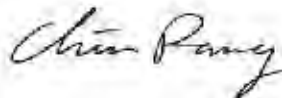
APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Complies
ISED RSS-247 Issue 2	Complies
ISED RSS-GEN Issue 5	Complies

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:



Chin Pang
Senior Engineer
Consumer Technology Division
UL Verification Services Inc.

Prepared By:



Francisco Guarnero
Test Engineer
Consumer Technology Division
UL Verification Services Inc.

2. TEST 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.
<input type="checkbox"/> Chamber A (IC:2324B-1)	<input type="checkbox"/> Chamber D (IC:22541-1)	<input type="checkbox"/> Chamber I (IC: 2324A-5)
<input type="checkbox"/> Chamber B (IC:2324B-2)	<input checked="" type="checkbox"/> Chamber E (IC:22541-2)	<input type="checkbox"/> Chamber J (IC: 2324A-6)
<input type="checkbox"/> Chamber C (IC:2324B-3)	<input type="checkbox"/> Chamber F (IC:22541-3)	<input type="checkbox"/> Chamber K (IC: 2324A-1)
	<input type="checkbox"/> Chamber G (IC:22541-4)	<input type="checkbox"/> Chamber L (IC: 2324A-3)
	<input checked="" type="checkbox"/> Chamber H (IC:22541-5)	<input type="checkbox"/> 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: 2324A.

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

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%.

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	Configuration	Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
ANT 4	High Power	2402 - 2480	BLE 1M	20.22	105.20
	Low Power			12.71	18.66
	High Power	2404 - 2478	BLE 2M	20.15	103.51
	Low Power			12.70	18.62
ANT 3	High Power	2402 - 2480	BLE 1M	20.21	104.95
	Low Power			12.80	19.05
	High Power	2404 - 2478	BLE 2M	20.23	105.44
	Low Power			12.79	19.01
BF, ANT 4 + ANT 3	High Power	2402 - 2480	BLE 1M	20.41	109.90
	Low Power			15.76	37.67
	High Power	2404 - 2478	BLE 2M	20.27	106.41
	Low Power			15.77	37.76

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

Frequency Range (GHz)	ANT 4 (dBi)	NT 3 (dBi)
2.4	0.3	-1.7

6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was 18.1.148.558.

6.5. WORST-CASE CONFIGURATION AND MODE

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

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 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 were performed with EUT 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 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.

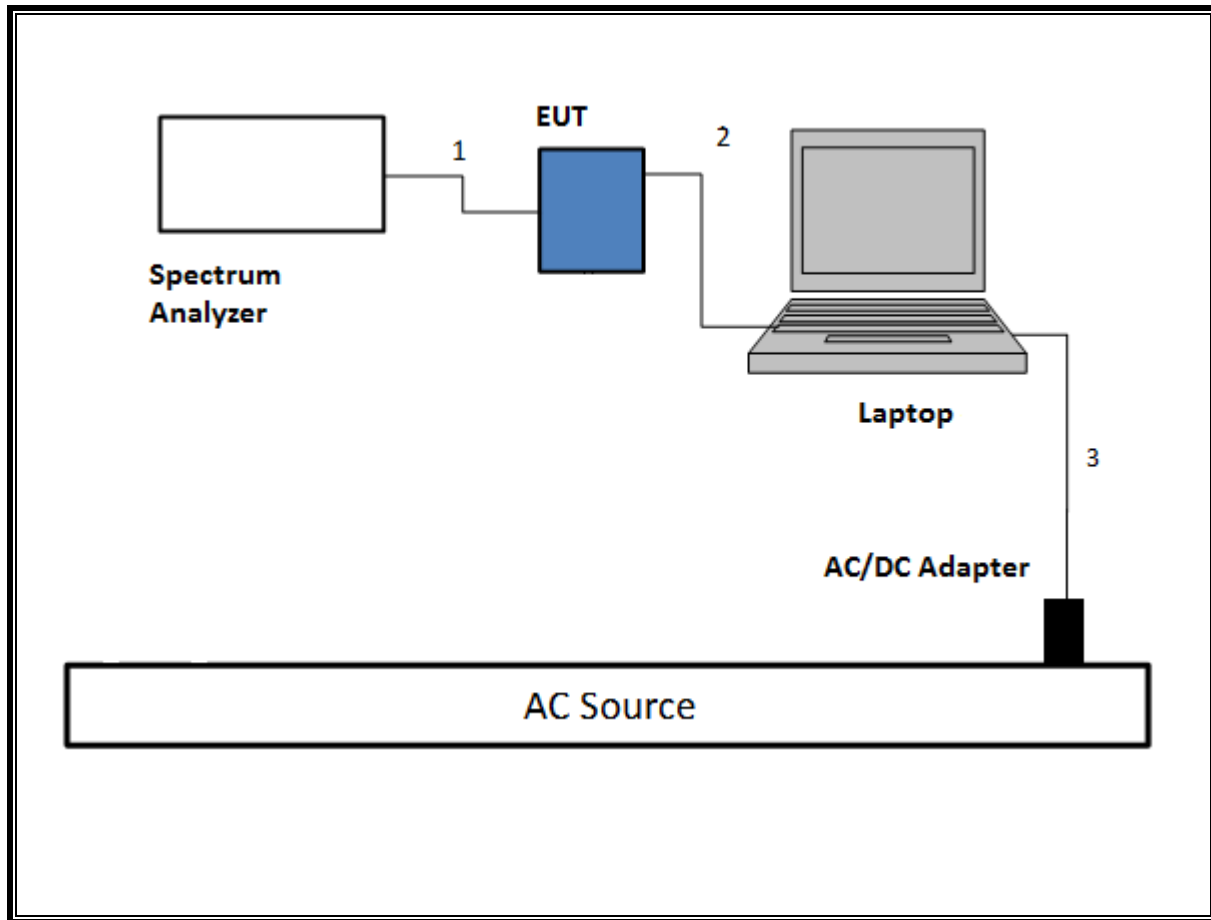
6.6. DESCRIPTION OF TEST SETUP

SUPPORT TEST EQUIPMENT						
Description		Manufacturer	Model	Serial Number		FCC ID/ DoC
Laptop		Apple	A1398	C02PM012G3QD		QDS-BRCM1069
Laptop AC/DC adapter		Liteon Technology	PA-1450-BA1	B123		N/A
EUT AC/DC adapter		Apple	A1385	D29325SM03XDHLHC9		N/A
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

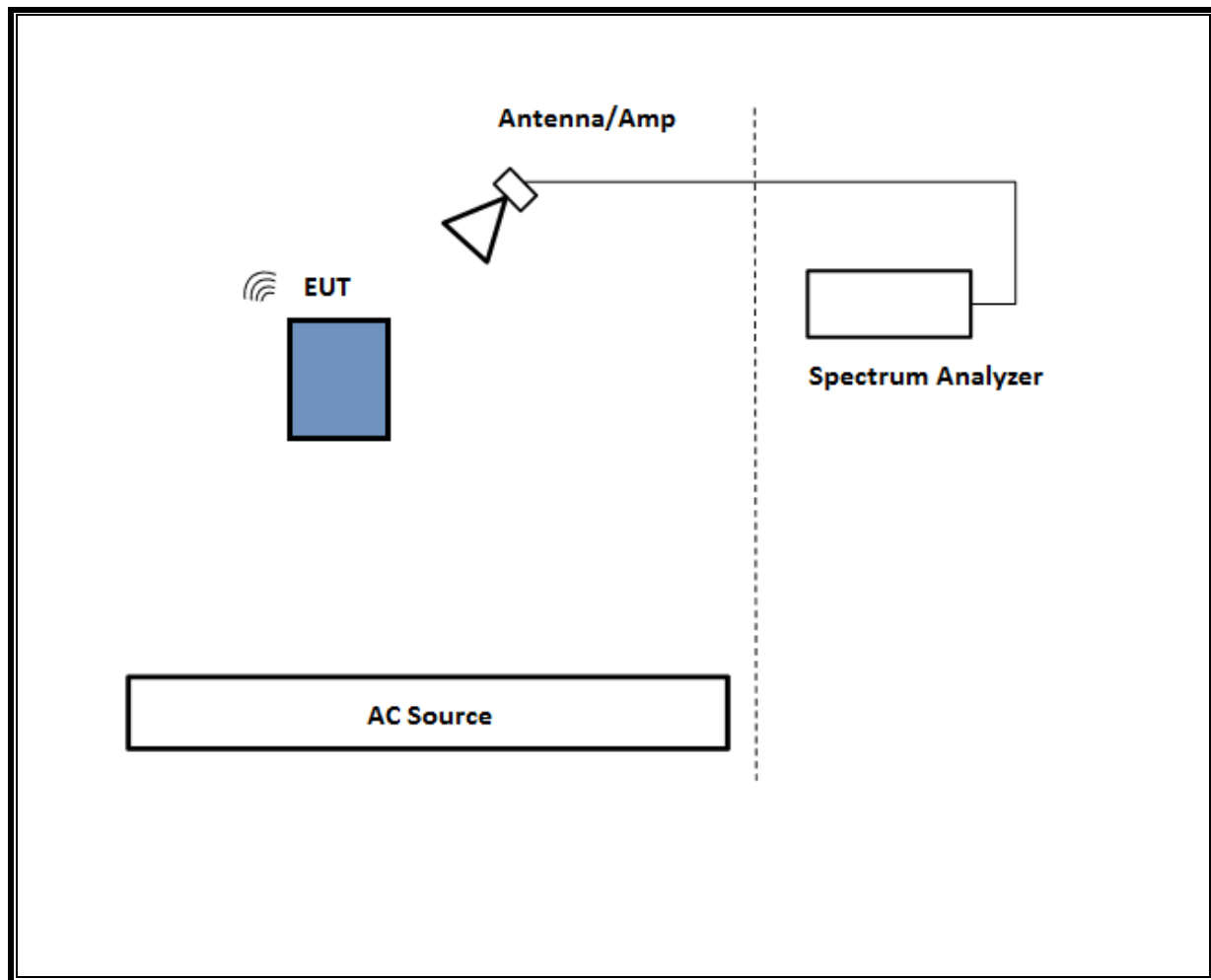
TEST SETUP

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

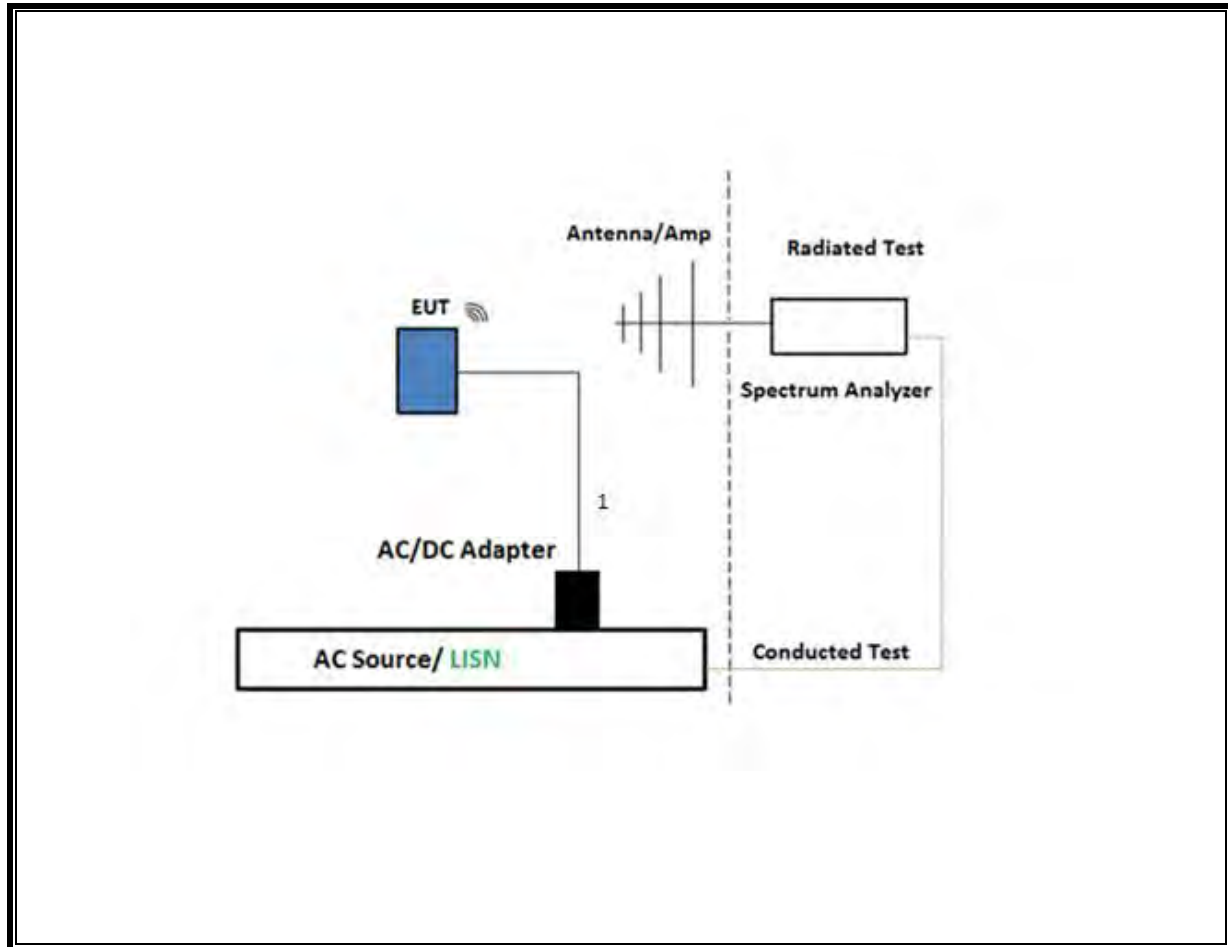
SETUP DIAGRAM FOR CONDUCTED TESTS



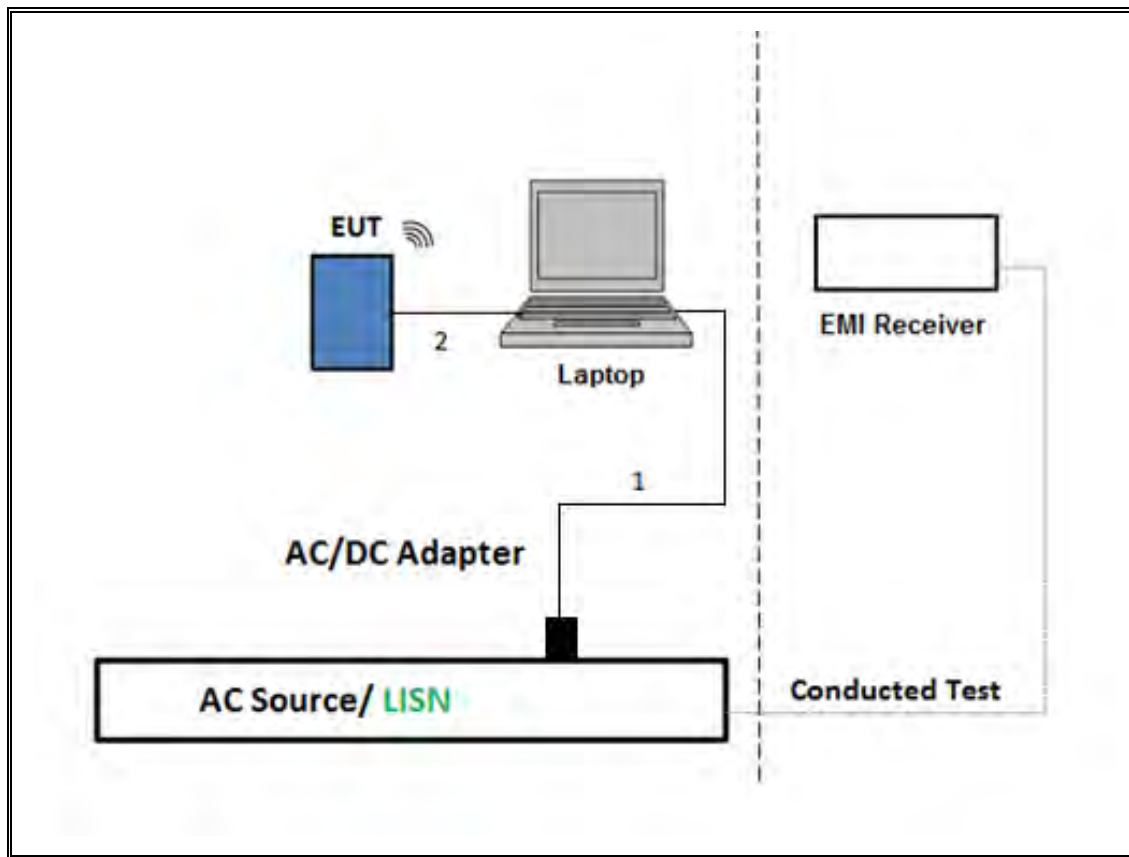
SETUP DIAGRAM FOR RADIATED TESTS Above 1 GHz



SETUP DIAGRAM FOR Below 1GHz and AC LINE CONDUCTED TEST



TEST SETUP- AC LINE CONDUCTED: LAPTOP CONFIGURATION



7. MEASUREMENT METHOD

On Time and Duty Cycle: KDB 558074 D01 v05r02, Section 6.

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

Occupied BW (99%): ANSI C63.10-2013 Section 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 -11.9.2.3.2 Measurement using gated average power meter.

PSD: ANSI C63.10 Subclause -11.10.2 Method PKPSD (peak PSD)

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, Section 6.2.

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

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

NOTE: All conducted antenna port tests for Beamforming applied the same test procedures as BLE 1Mbps and BLE 2Mbps normal modes.

8. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment were 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	T907	01/22/2021	01/22/2020
Antenna, Broadband Hybrid, 30-2000MHz	Sunol Sciences	JB1	T130	08/09/2020	08/09/2019
Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	T285	06/06/2020	06/06/2019
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T863	11/01/2020	11/01/2019
Amplifier, 1 to 18GHz, 35dB	Ampical	AFS42-00101800-25-S-42	T1567	01/24/2021	01/24/2020
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1210	01/21/2021	01/21/2020
Antenna, Double Ridge Guide Horn Antenna	A.H. Systems, Inc.	SAS-571	T963	01/25/2021	01/25/2020
Amplifier, 1 to 18GHz, 35dB	Ampical	AFS42-00101800-25-S-42	T1568	04/14/2021	04/14/2020
Pre-Amp 18-26GHz	Agilent Technology	8449B	T404	04/08/2021	04/08/2020
Antenna, Horn 18-26GHz	ARA	SWH-28	T125	04/17/2021	04/17/2020
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1454	01/23/2021	01/23/2020
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

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 6, 2020		
Conducted Software	UL	UL EMC	2020.2.26		
AC Line Conducted Software	UL	UL EMC	Ver 9.5, February 21, 2020		

*Testing was completed before equipment calibration date

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						
BLE, 1Mbps	17.1	17.1	1.00	100.0	0.00	0.010
BLE, 2Mbps	28.5	28.5	1.00	100.0	0.00	0.010
BLE, TXBF, 1Mbps	26.1	26.1	1.00	100.0	0.00	0.010
BLE, TXBF, 2Mbps	24.0	24.0	1.00	100.0	0.00	0.010

Note: Low power duty cycle is same as higher power

The figure consists of four sub-images, each showing a screenshot of a spectrum analyzer interface. The top two images are labeled 'BLE 1Mbps' and 'BLE 2Mbps', and the bottom two are labeled 'BLE TXBF 1Mbps' and 'BLE TXBF 2Mbps'. Each screenshot displays a frequency plot with a peak at 2.402000000 GHz. The left side of each plot shows a log scale from -10 dBm to 10 dBm. The right side shows a linear scale from 0 Hz to 100.0 ms. The bottom of each plot shows a table of measurement parameters. The top two images show the main measurement parameters, and the bottom two show the TXBF measurement parameters.

Measurement	BLE 1Mbps	BLE 2Mbps	BLE TXBF 1Mbps	BLE TXBF 2Mbps
Center Freq	2.402000000 GHz	2.404000000 GHz	2.402000000 GHz	2.404000000 GHz
Span	0 Hz	0 Hz	0 Hz	0 Hz
Res BW	8 MHz	8 MHz	8 MHz	8 MHz
CF Step	8.000000 MHz	8.000000 MHz	8.000000 MHz	8.000000 MHz
Auto Tune	Auto	Auto	Auto	Auto
Center Freq	2.402000000 GHz	2.404000000 GHz	2.402000000 GHz	2.404000000 GHz
Start Freq	2.402000000 GHz	2.404000000 GHz	2.402000000 GHz	2.404000000 GHz
Stop Freq	2.402000000 GHz	2.404000000 GHz	2.402000000 GHz	2.404000000 GHz
CF Step	8.000000 MHz	8.000000 MHz	8.000000 MHz	8.000000 MHz
Auto Tune	Auto	Auto	Auto	Auto
Center Freq	2.402000000 GHz	2.404000000 GHz	2.402000000 GHz	2.404000000 GHz
Start Freq	2.402000000 GHz	2.404000000 GHz	2.402000000 GHz	2.404000000 GHz
Stop Freq	2.402000000 GHz	2.404000000 GHz	2.402000000 GHz	2.404000000 GHz
CF Step	8.000000 MHz	8.000000 MHz	8.000000 MHz	8.000000 MHz
Auto Tune	Auto	Auto	Auto	Auto
Center Freq	2.402000000 GHz	2.404000000 GHz	2.402000000 GHz	2.404000000 GHz
Start Freq	2.402000000 GHz	2.404000000 GHz	2.402000000 GHz	2.404000000 GHz
Stop Freq	2.402000000 GHz	2.404000000 GHz	2.402000000 GHz	2.404000000 GHz
CF Step	8.000000 MHz	8.000000 MHz	8.000000 MHz	8.000000 MHz
Auto Tune	Auto	Auto	Auto	Auto
Center Freq	2.402000000 GHz	2.404000000 GHz	2.402000000 GHz	2.404000000 GHz
Start Freq	2.402000000 GHz	2.404000000 GHz	2.402000000 GHz	2.404000000 GHz
Stop Freq	2.402000000 GHz	2.404000000 GHz	2.402000000 GHz	2.404000000 GHz
CF Step	8.000000 MHz	8.000000 MHz	8.000000 MHz	8.000000 MHz
Auto Tune	Auto	Auto	Auto	Auto
Center Freq	2.402000000 GHz	2.404000000 GHz	2.402000000 GHz	2.404000000 GHz
Start Freq	2.402000000 GHz	2.404000000 GHz	2.402000000 GHz	2.404000000 GHz
Stop Freq	2.402000000 GHz	2.404000000 GHz	2.402000000 GHz	2.404000000 GHz
CF Step	8.000000 MHz	8.000000 MHz	8.000000 MHz	8.000000 MHz
Auto Tune	Auto	Auto	Auto	Auto
Center Freq	2.402000000 GHz	2.404000000 GHz	2.402000000 GHz	2.404000000 GHz
Start Freq	2.402000000 GHz	2.404000000 GHz	2.402000000 GHz	2.404000000 GHz
Stop Freq	2.402000000 GHz	2.404000000 GHz	2.402000000 GHz	2.404000000 GHz
CF Step	8.000000 MHz	8.000000 MHz	8.000000 MHz	8.000000 MHz
Auto Tune	Auto	Auto	Auto	Auto
Center Freq	2.402000000 GHz	2.404000000 GHz	2.402000000 GHz	2.404000000 GHz
Start Freq	2.402000000 GHz	2.404000000 GHz	2.402000000 GHz	2.404000000 GHz
Stop Freq	2.402000000 GHz	2.404000000 GHz	2.402000000 GHz	2.404000000 GHz
CF Step	8.000000 MHz	8.000000 MHz	8.000000 MHz	8.000000 MHz
Auto Tune	Auto	Auto	Auto	Auto
Center Freq	2.402000000 GHz	2.404000000 GHz	2.402000000 GHz	2.404000000 GHz
Start Freq	2.402000000 GHz	2.404000000 GHz	2.402000000 GHz	2.404000000 GHz
Stop Freq	2.402000000 GHz	2.404000000 GHz	2.402000000 GHz	2.404000000 GHz
CF Step	8.000000 MHz	8.000000 MHz	8.000000 MHz	8.000000 MHz
Auto Tune	Auto	Auto	Auto	Auto
Center Freq	2.402000000 GHz	2.404000000 GHz	2.402000000 GHz	2.404000000 GHz
Start Freq	2.402000000 GHz	2.404000000 GHz	2.402000000 GHz	2.404000000 GHz
Stop Freq	2.402000000 GHz	2.404000000 GHz	2.402000000 GHz	2.404000000 GHz
CF Step	8.000000 MHz	8.000000 MHz	8.000000 MHz	8.000000 MHz
Auto Tune	Auto	Auto	Auto	Auto
Center Freq	2.402000000 GHz	2.4040000		

9.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

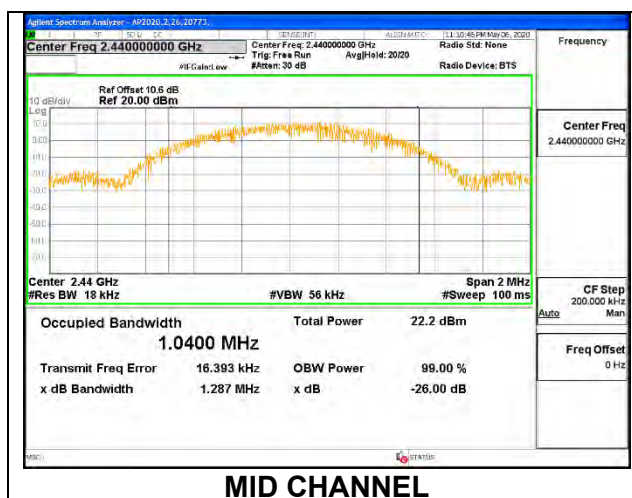
RESULTS

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.

9.2.1. HIGH POWER BLE (1Mbps)

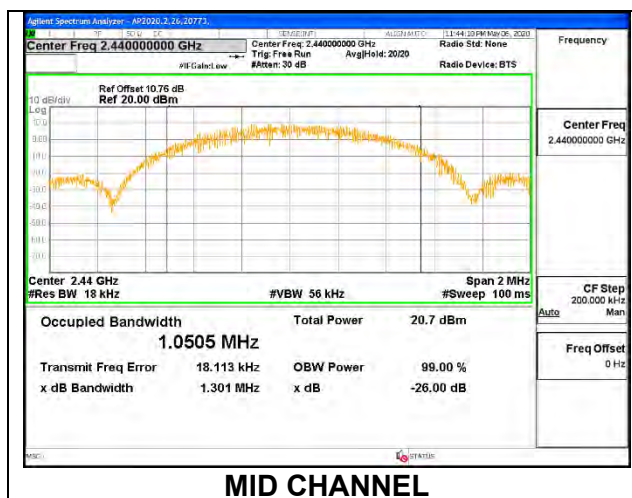
ANT 4

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.056
Middle	2440	1.040
High	2480	1.051



ANT 3

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.051
Middle	2440	1.051
High	2480	1.043



9.2.2. HIGH POWER BLE TXBF (1Mbps)

Channel	Frequency (MHz)	99% Bandwidth ANT 4 (MHz)	99% Bandwidth ANT 3 (MHz)
Low	2402	1.036	1.038
Mid	2440	1.042	1.048
High	2480	1.041	1.041

Note: Test procedures and setting are same as BLE normal mode.



MID CHANNEL ANT 4

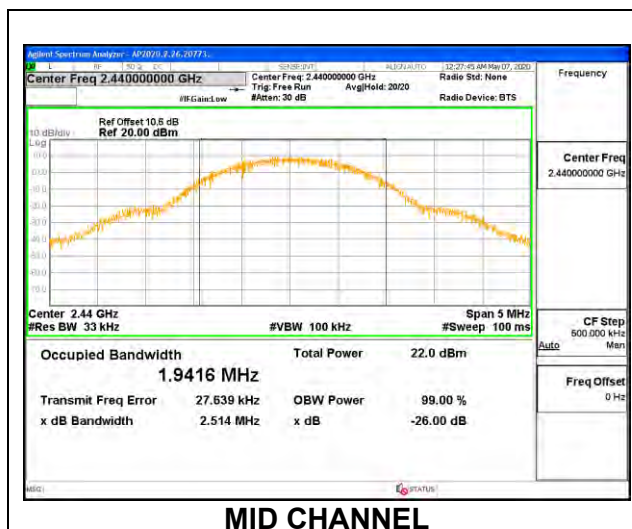


MID CHANNEL ANT 3

9.2.3. HIGH POWER BLE (2Mbps)

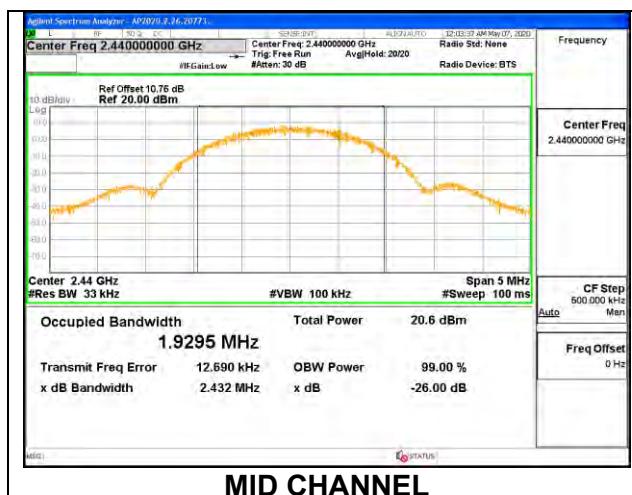
ANT 4

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2404	1.921
Middle	2440	1.942
High	2478	1.937



ANT 3

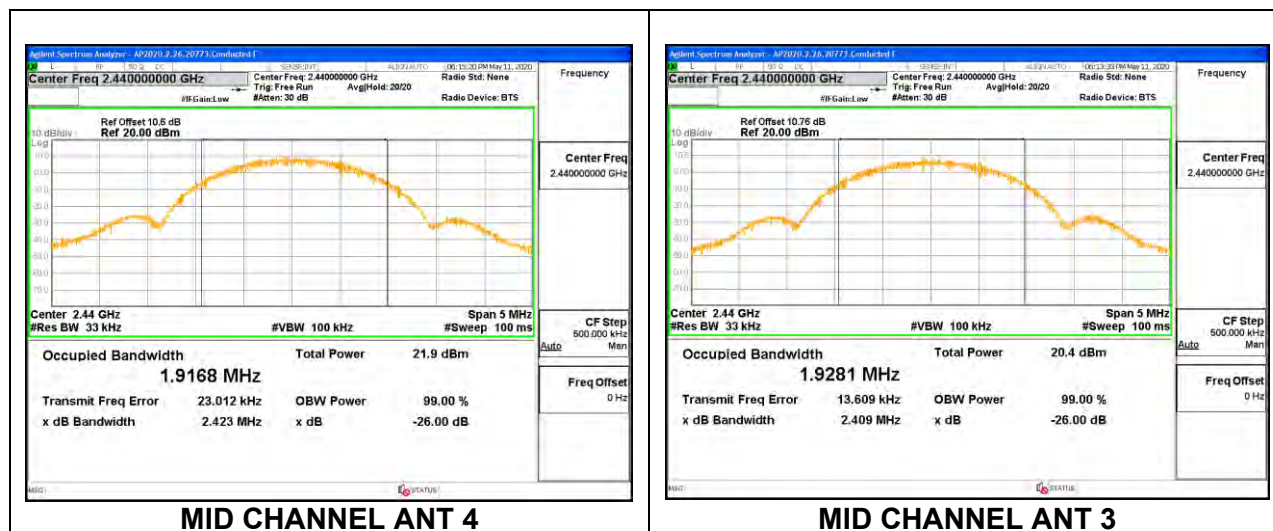
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.921
Middle	2440	1.930
High	2480	1.928



9.2.4. HIGH POWER BLE TXBF (2Mbps)

Channel	Frequency (MHz)	99% Bandwidth ANT 4 (MHz)	99% Bandwidth ANT 3 (MHz)
Low	2404	1.909	1.918
Mid	2440	1.917	1.928
High	2478	1.914	1.925

Note: Test procedures and setting are same as BLE normal mode.



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

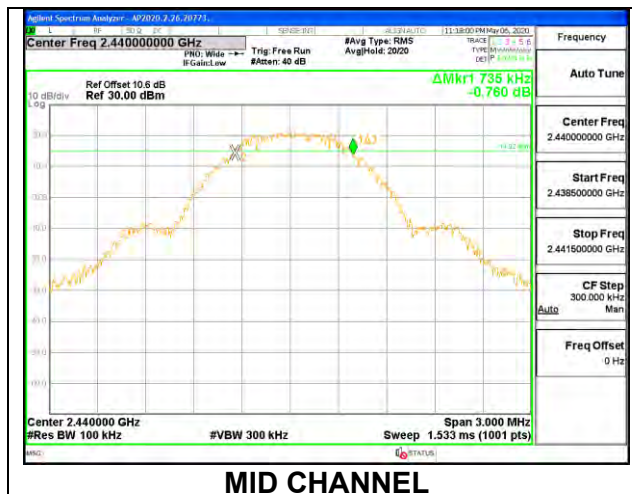
The 6dB bandwidth was measured for the 1Mbps mode, high power, to demonstrate compliance with the minimum required bandwidth of 500 kHz. Other modes were not tested as their bandwidth is greater than the 1Mbps mode, as demonstrated by the 99% bandwidth measurements performed on all modes.

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

9.3.1. HIGH POWER BLE (1Mbps)

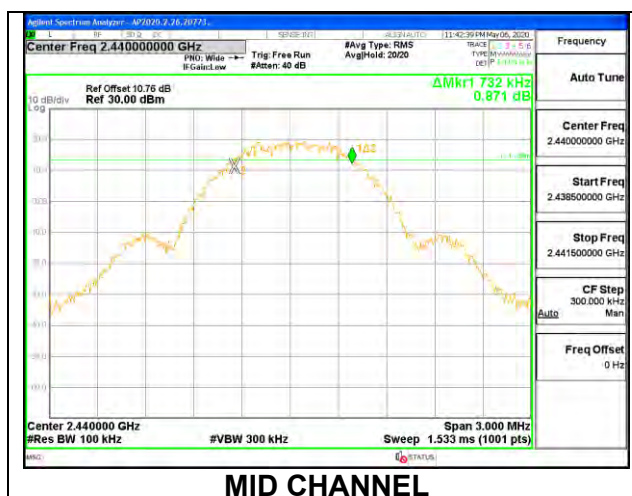
ANT 4

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.696	0.5
Middle	2440	0.735	0.5
High	2480	0.654	0.5



ANT 3

Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
2402	0.717	0.5
2440	0.732	0.5
2480	0.699	0.5



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

Measurement was performed using a power meter with wideband 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 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 2TX:

Tx chains are correlated for power and PSD due to the device supporting Beamforming mode. 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	0.30	-1.70	-0.59	2.37

RESULTS

9.4.1. HIGH POWER BLE (1Mbps)

ANT 4

Tested By:	39472
Date:	9/2/2020

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	20.18	30	-9.82
Middle	2440	20.22	30	-9.78
High	2480	20.19	30	-9.81

ANT 3

Tested By:	39472
Date:	9/2/2020

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	20.14	30	-9.86
Middle	2440	20.21	30	-9.79
High	2480	20.20	30	-9.80

9.4.2. HIGH POWER BLE TXBF (1Mbps)

ANT 4 + ANT 3

Tested By:	39472
Date:	9/2/2020

Channel	Frequency (MHz)	Output Power ANT 4 (dBm)	Output Power ANT 3 (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	17.39	17.40	20.41	30	-9.59
Middle	2440	17.36	17.32	20.35	30	-9.65
High	2480	17.32	17.31	20.33	30	-9.67

9.4.3. HIGH POWER BLE (2Mbps)

ANT 4

Tested By:	39472
Date:	9/2/2020

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	20.13	30	-9.87
Middle	2440	20.09	30	-9.91
High	2480	20.15	30	-9.85

ANT 3

Tested By:	39472
Date:	9/2/2020

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	20.09	30	-9.91
Middle	2440	20.12	30	-9.88
High	2480	20.23	30	-9.77

9.4.4. HIGH POWER BLE TXBF (2Mbps)

ANT 4 + ANT 3

Tested By:	39472
Date:	9/2/2020

Channel	Frequency (MHz)	Output Power Ant 4 (dBm)	Output Power Ant 3 (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	17.10	17.18	20.15	30	-9.85
Middle	2440	17.21	17.11	20.17	30	-9.83
High	2480	17.31	17.21	20.27	30	-9.73

9.4.5. LOW POWER BLE (1Mbps)

ANT 4

Tested By:	39472
Date:	9/2/2020

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	12.69	30	-17.31
Middle	2440	12.59	30	-17.41
High	2480	12.71	30	-17.29

ANT 3

Tested By:	39472
Date:	9/2/2020

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	12.66	30	-17.34
Middle	2440	12.74	30	-17.26
High	2480	12.80	30	-17.20

9.4.6. LOW POWER BLE TXBF (1Mbps)

ANT 4 + ANT 3

Tested By:	39472
Date:	9/2/2020

Channel	Frequency (MHz)	Output Power ANT 4 (dBm)	Output Power ANT 3 (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	12.71	12.52	15.63	30	-14.37
Middle	2440	12.76	12.74	15.76	30	-14.24
High	2480	12.66	12.77	15.73	30	-14.27

9.4.7. LOW POWER BLE (2Mbps)

ANT 4

Tested By:	39472
Date:	9/2/2020

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	12.59	30	-17.41
Middle	2440	12.66	30	-17.34
High	2480	12.70	30	-17.30

ANT 3

Tested By:	39472
Date:	9/2/2020

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	12.68	30	-17.32
Middle	2440	12.79	30	-17.21
High	2480	12.77	30	-17.23

9.4.8. LOW POWER BLE TXBF (2Mbps)

ANT 4 + ANT 3

Tested By:	39472
Date:	9/2/2020

Channel	Frequency (MHz)	Output Power ANT 4 (dBm)	Output Power ANT 3 (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	12.62	12.71	15.68	30	-14.32
Middle	2440	12.75	12.76	15.77	30	-14.23
High	2480	12.79	12.66	15.74	30	-14.26

9.5. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

Measurement was performed using a power meter with gated wideband 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

9.5.1. HIGH POWER BLE (1Mbps)

ANT 4

Tested By:	39472
Date:	9/2/2020

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	19.68
Middle	2440	19.81
High	2480	19.72

ANT 3

Tested By:	39472
Date:	9/2/2020

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	19.74
Middle	2440	19.88
High	2480	19.76

9.5.2. HIGH POWER BLE TXBF (1Mbps)

ANT 4 + ANT 3

Tested By:	39472
Date:	9/2/2020

Channel	Frequency (MHz)	Average Power ANT 4 (dBm)	Average Power ANT 3 (dBm)	Total Power (dBm)
Low	2402	16.83	16.92	19.89
Middle	2440	16.91	16.86	19.90
High	2480	16.89	16.85	19.88

9.5.3. HIGH POWER BLE (2Mbps)

ANT 4

Tested By:	39472
Date:	9/2/2020

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	19.66
Middle	2440	19.79
High	2480	19.77

ANT 3

Tested By:	39472
Date:	9/2/2020

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	19.68
Middle	2440	19.79
High	2480	19.80

9.5.4. HIGH POWER BLE TXBF (2Mbps)

ANT 4 + ANT 3

Tested By:	39472
Date:	9/2/2020

Channel	Frequency (MHz)	Average Power ANT 4 (dBm)	Average Power ANT 3 (dBm)	Total Power (dBm)
Low	2402	16.71	16.69	19.71
Middle	2440	16.83	16.78	19.82
High	2480	16.89	16.80	19.86

9.5.5. LOW POWER BLE (1Mbps)

ANT 4

Tested By:	39472
Date:	9/2/2020

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	12.20
Middle	2440	12.19
High	2480	12.29

ANT 3

Tested By:	39472
Date:	9/2/2020

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	12.17
Middle	2440	12.29
High	2480	12.31

9.5.6. LOW POWER BLE TXBF (1Mbps)

ANT 4 + ANT 3

Tested By:	39472
Date:	9/2/2020

Channel	Frequency (MHz)	Average Power ANT 4 (dBm)	Average Power ANT 3 (dBm)	Total Power (dBm)
Low	2402	12.22	12.16	15.20
Middle	2440	12.32	12.34	15.34
High	2480	12.19	12.31	15.26

9.5.7. LOW POWER BLE (2Mbps)

ANT 4

Tested By:	39472
Date:	9/2/2020

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	12.19
Middle	2440	12.29
High	2480	12.28

ANT 3

Tested By:	39472
Date:	9/2/2020

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	12.29
Middle	2440	12.33
High	2480	12.39

9.5.8. LOW POWER BLE TXBF (2Mbps)

ANT 4 + ANT 3

Tested By:	39472
Date:	9/2/2020

Channel	Frequency (MHz)	Average Power Ant 4 (dBm)	Average Power Ant 3 (dBm)	Total Power (dBm)
Low	2402	12.22	12.29	15.27
Middle	2440	12.31	12.34	15.34
High	2480	12.39	12.20	15.31

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.

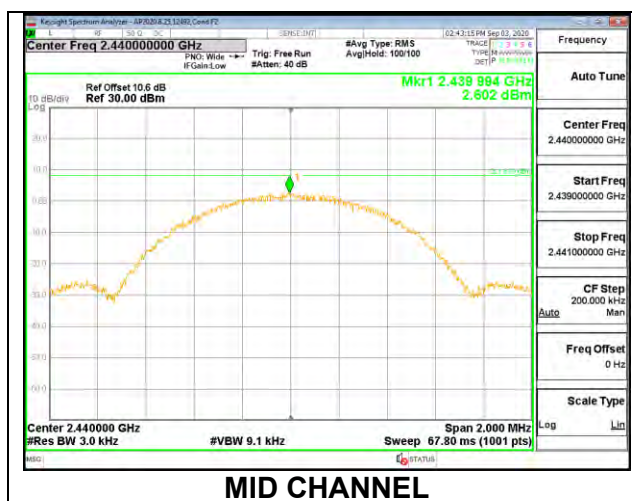
RESULTS

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

9.6.1. HIGH POWER BLE (1Mbps)

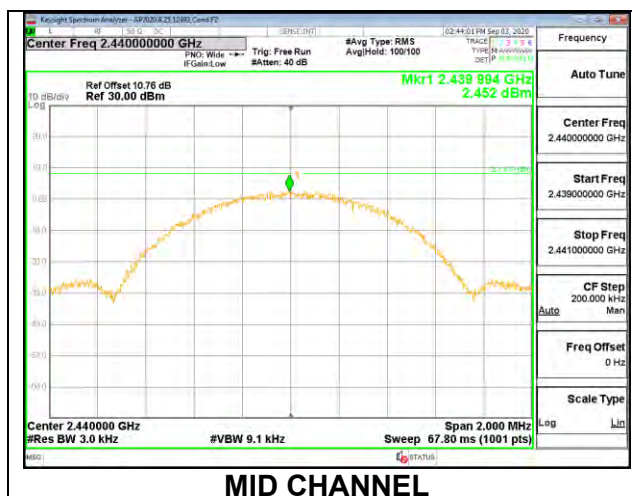
ANT 4

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	2.576	8	-5.42
Middle	2440	2.602	8	-5.40
High	2480	1.513	8	-6.49



ANT 3

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	2.584	8	-5.42
Middle	2440	2.452	8	-5.55
High	2480	1.666	8	-6.33

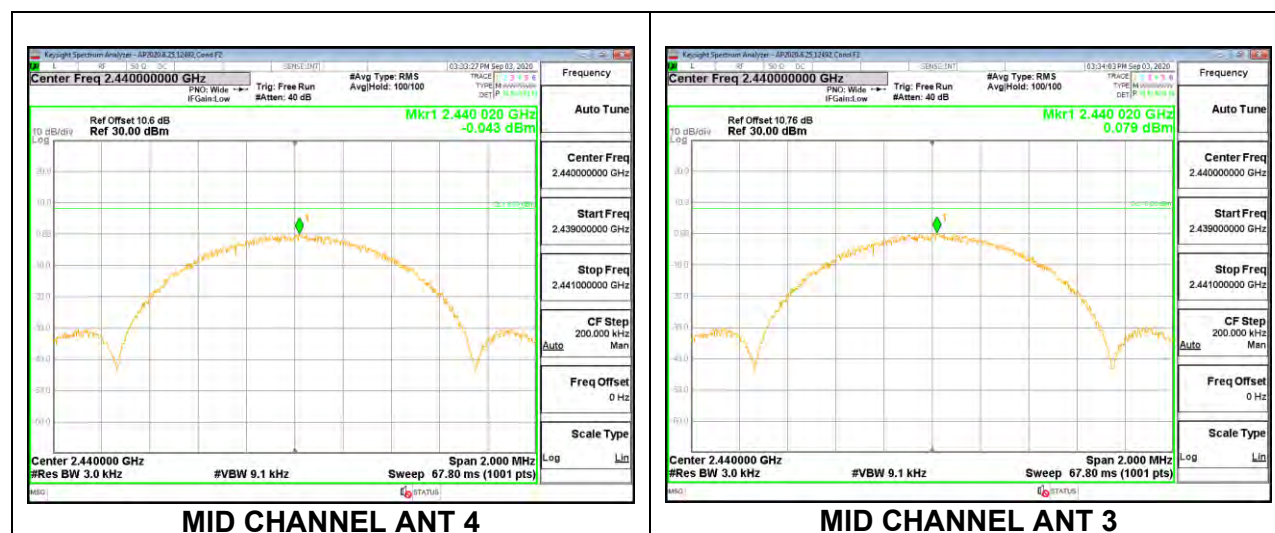


9.6.2. HIGH POWER BLE TXBF (1Mbps)

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	2402	-0.608	-0.108	2.66	8.0	-5.3
Mid	2440	-0.043	0.079	3.03	8.0	-5.0
Hjigh	2480	0.162	-0.196	3.00	8.0	-5.0

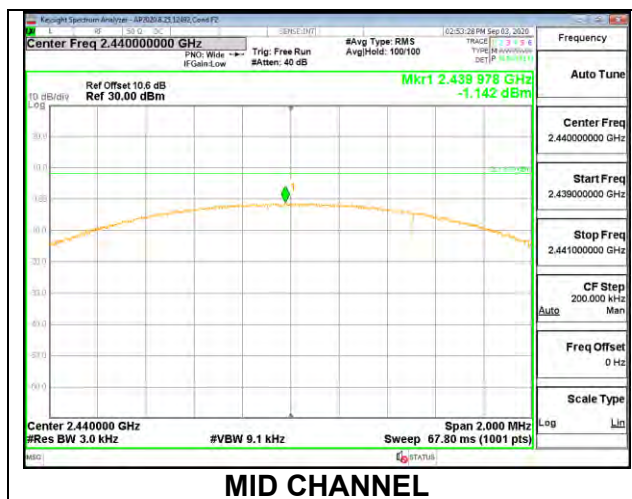
Note: Test procedures and setting are same as BLE normal mode.



9.6.3. HIGH POWER BLE (2Mbps)

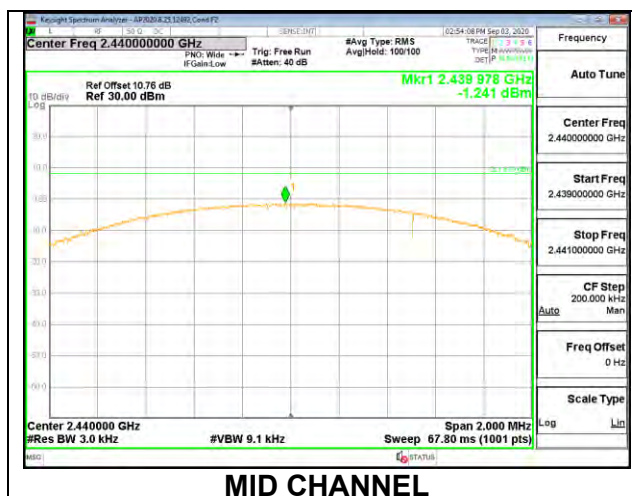
ANT 4

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2404	-1.843	8	-9.84
Middle	2440	-1.142	8	-9.14
High	2478	-2.558	8	-10.56



ANT 3

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2404	-1.730	8	-9.73
Middle	2440	-1.241	8	-9.24
High	2478	-2.452	8	-10.45

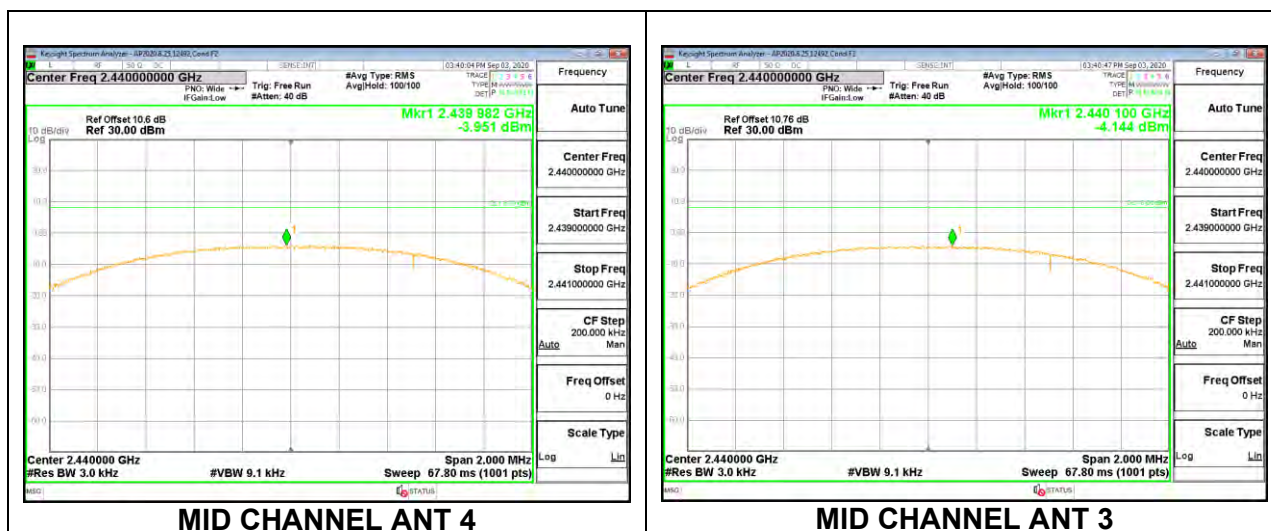


9.6.4. HIGH POWER BLE TXBF (2Mbps)

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	-4.403	-4.221	-1.30	8.0	-9.3
Mid	2440	-3.951	-4.144	-1.04	8.0	-9.0
Hjgh	2478	-3.890	-3.696	-0.78	8.0	-8.8

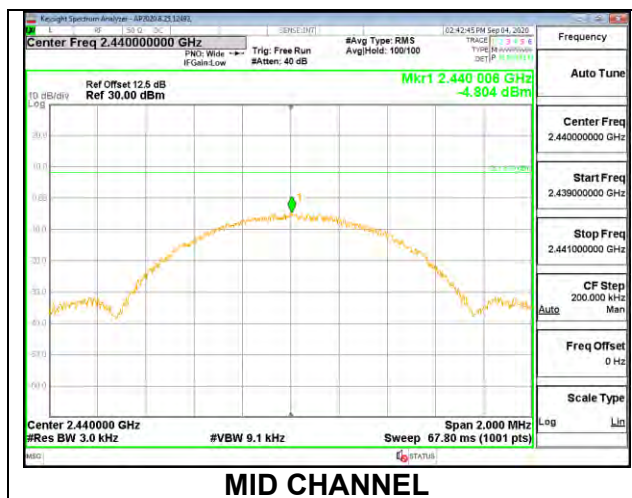
Note: Test procedures and setting are same as BLE normal mode.



9.6.5. LOW POWER BLE (1Mbps)

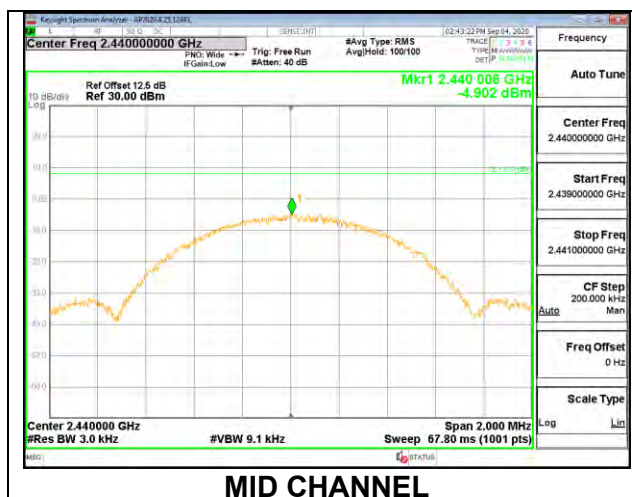
ANT 4

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-5.425	8	-13.43
Middle	2440	-4.804	8	-12.80
High	2480	-6.300	8	-14.30



ANT 3

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-5.077	8	-13.08
Middle	2440	-4.902	8	-12.90
High	2480	-6.418	8	-14.42

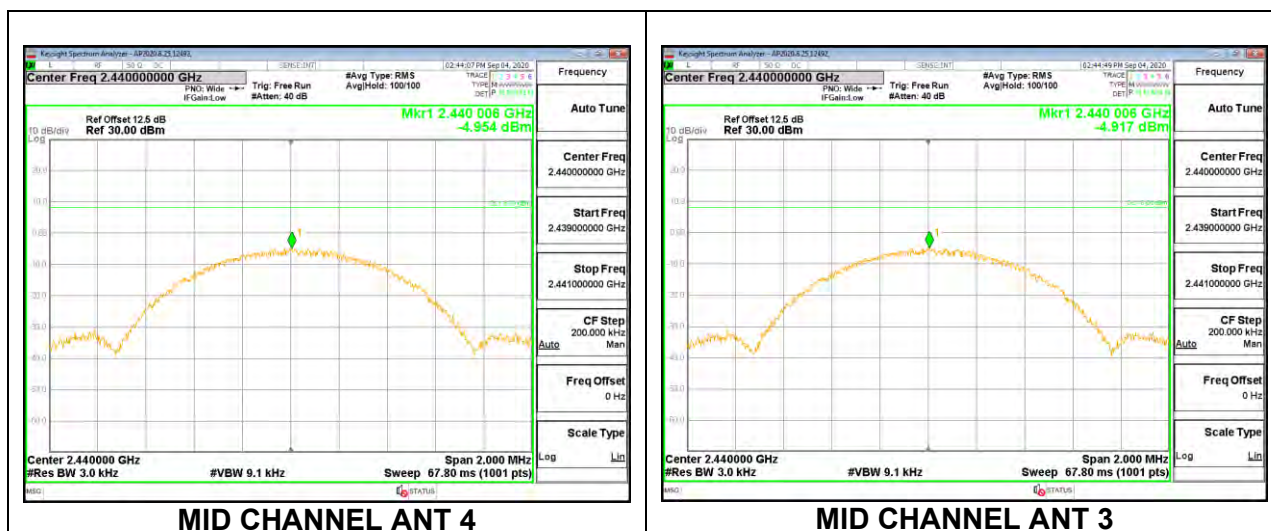


9.6.6. LOW POWER BLE TXBF (1Mbps)

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	2402	-5.147	-5.215	-2.17	8.0	-10.2
Mid	2440	-4.954	-4.917	-1.93	8.0	-9.9
Hjgh	2480	-6.348	-6.400	-3.36	8.0	-11.4

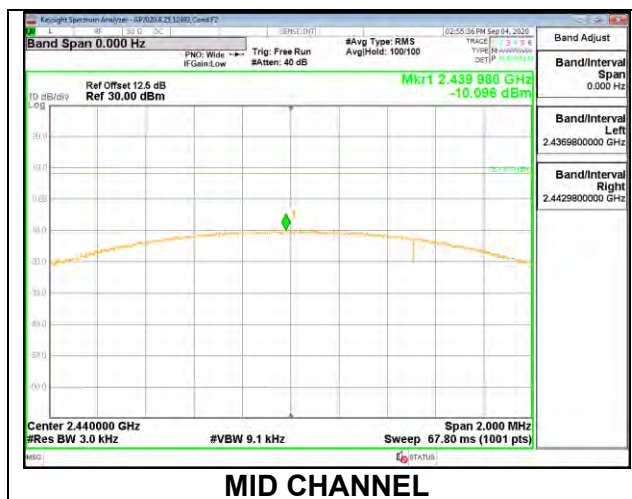
Note: Test procedures and setting are same as BLE normal mode.



9.6.7. LOW POWER BLE (2Mbps)

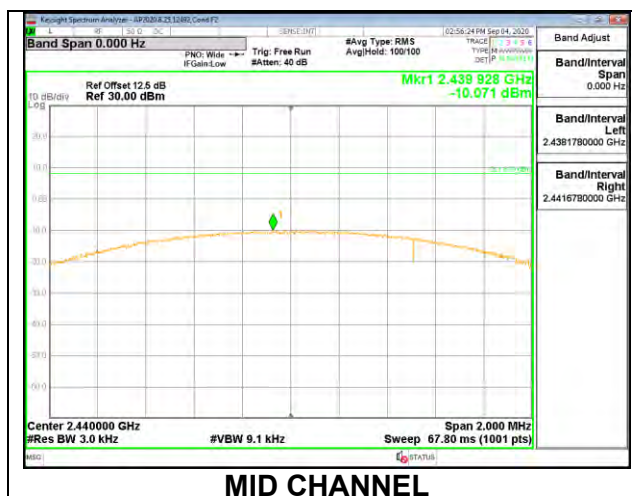
ANT 4

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2404	-10.368	8	-18.37
Middle	2440	-10.096	8	-18.10
High	2478	-10.979	8	-18.98



ANT 3

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2404	-10.525	8	-18.53
Middle	2440	-10.071	8	-18.07
High	2478	-11.309	8	-19.31

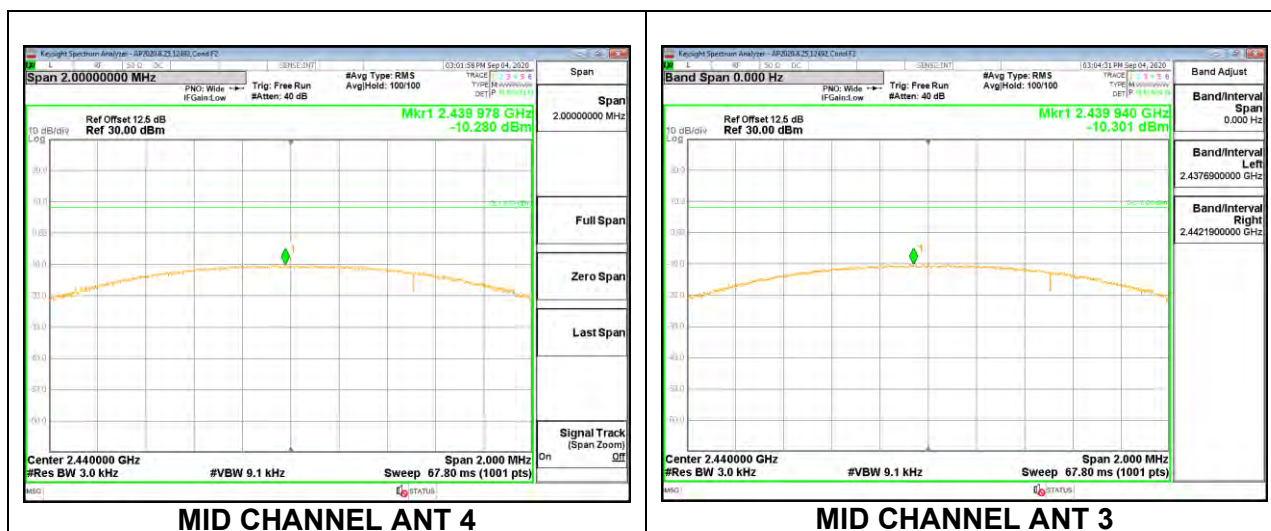


9.6.8. LOW POWER BLE TXBF (2Mbps)

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	-10.548	-10.535	-7.53	8.0	-15.5
Mid	2440	-10.280	-10.301	-7.28	8.0	-15.3
Hjigh	2478	-11.061	-11.080	-8.06	8.0	-16.1

Note: Test procedures and setting are same as BLE normal mode.



9.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

RSS-247 5.5

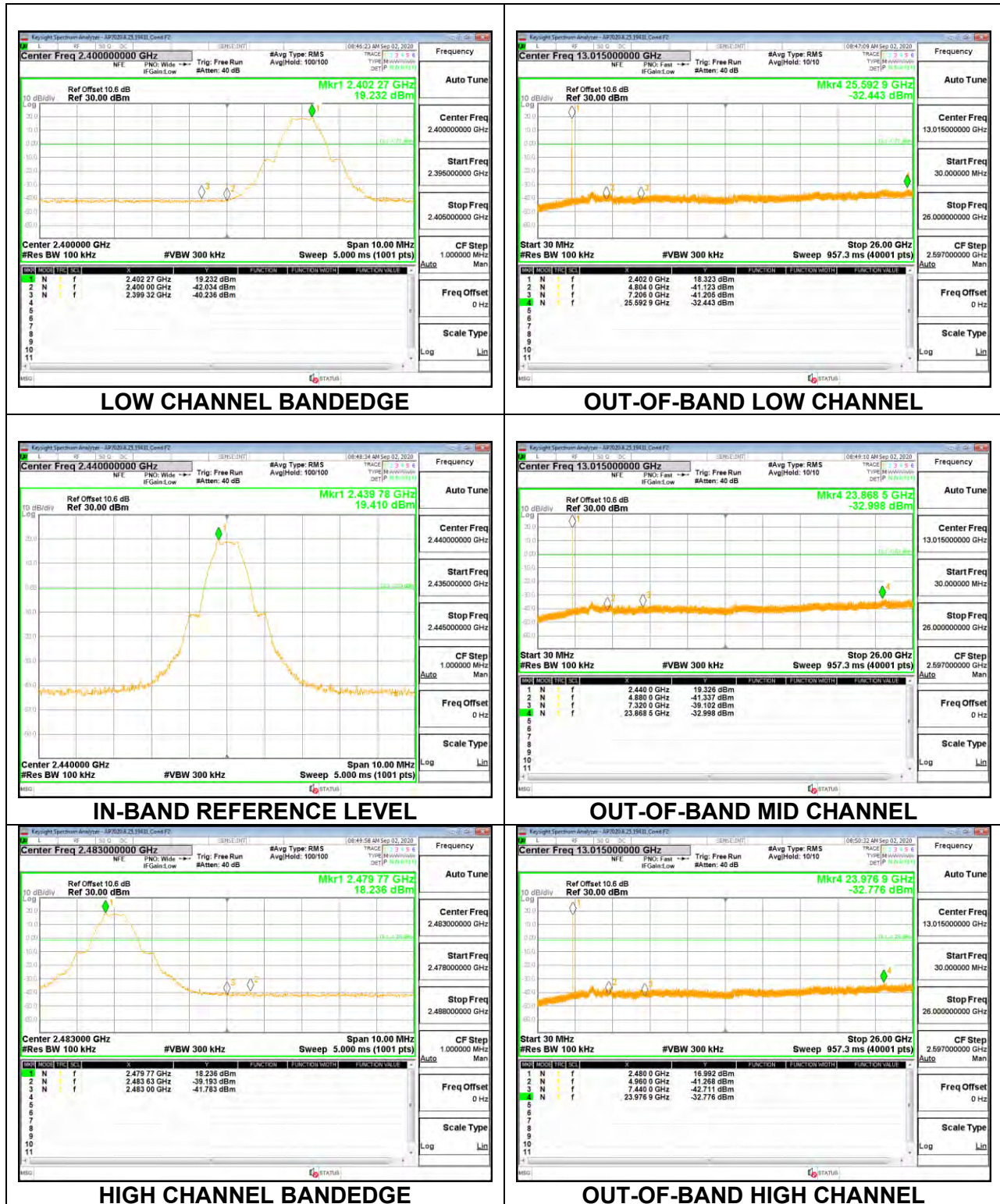
Output power was measured based on the use of a peak measurement; the required attenuation is 20 dB; therefore, spurious emissions are required to be 20dBc.

Note: Test procedures and setting are same as BLE normal mode.

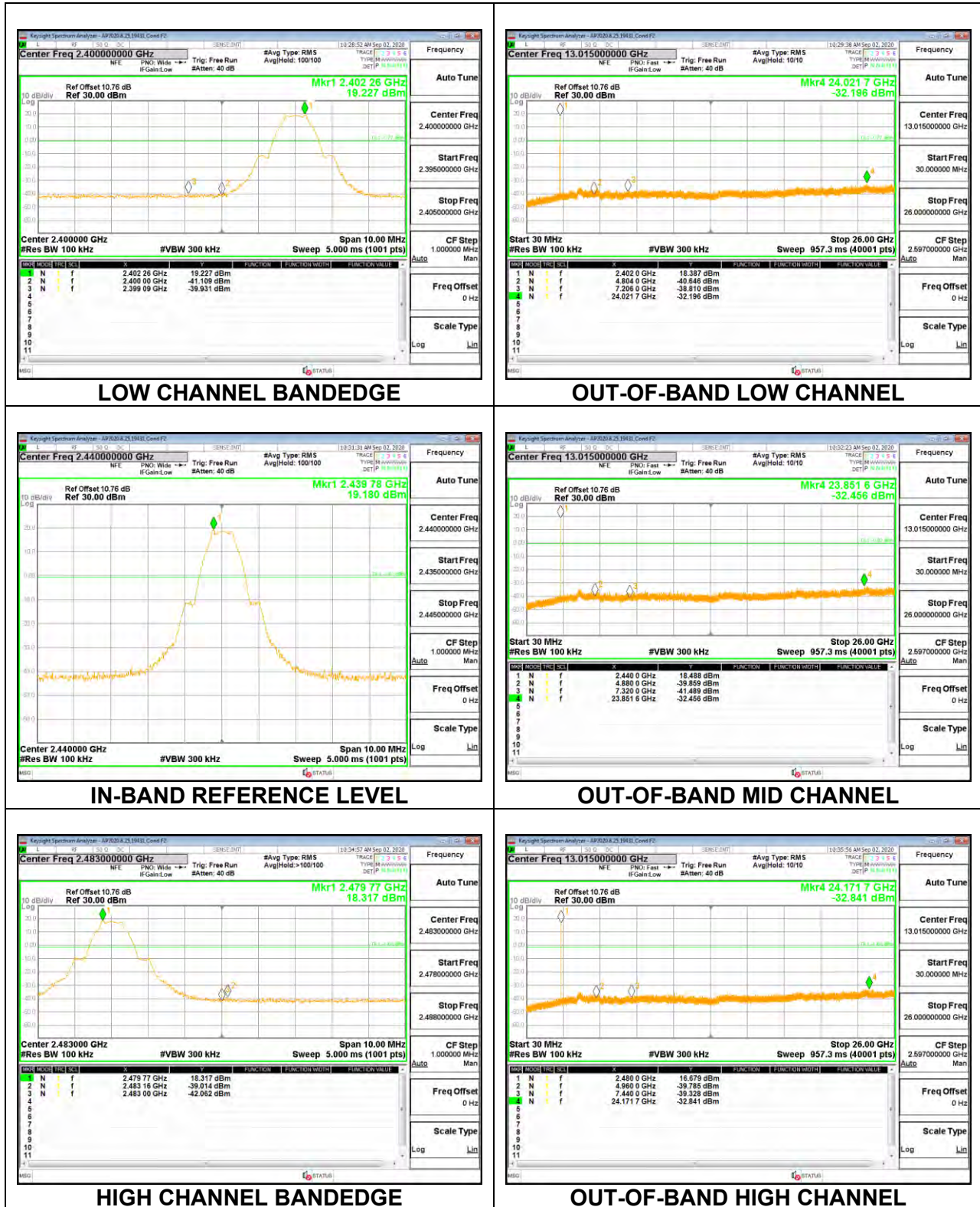
RESULTS

9.7.1. HIGH POWER BLE (1Mbps)

ANT 4

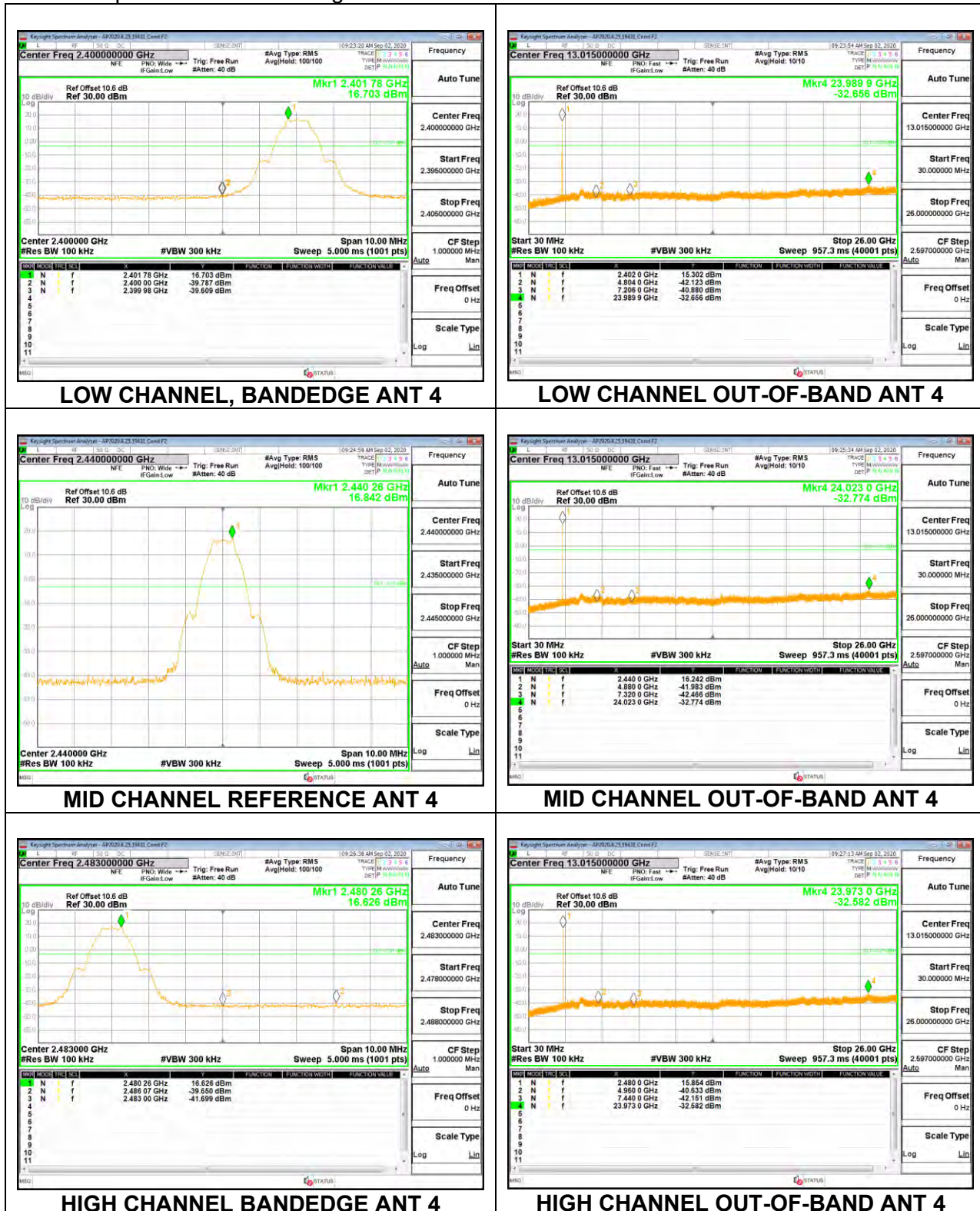


ANT 3

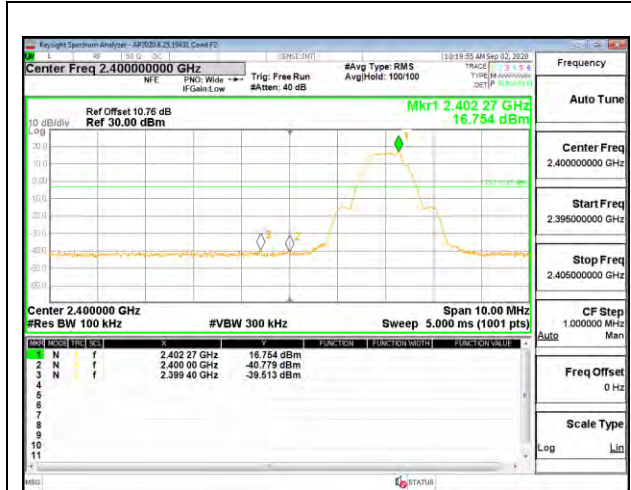


9.7.2. HIGH POWER BLE TXBF (1Mbps)

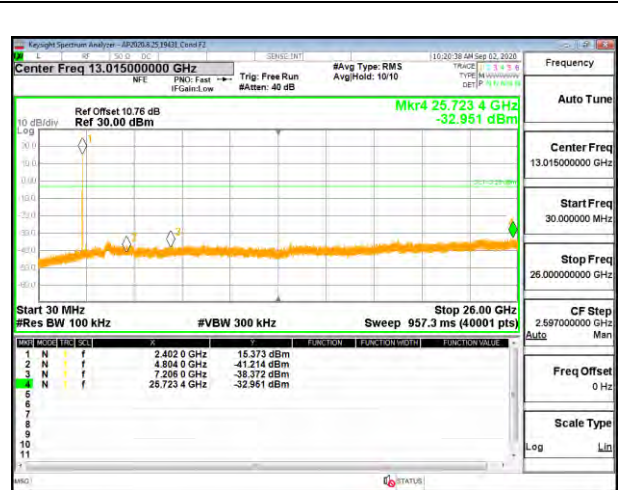
Note: Test procedures and setting are same as BLE normal mode.



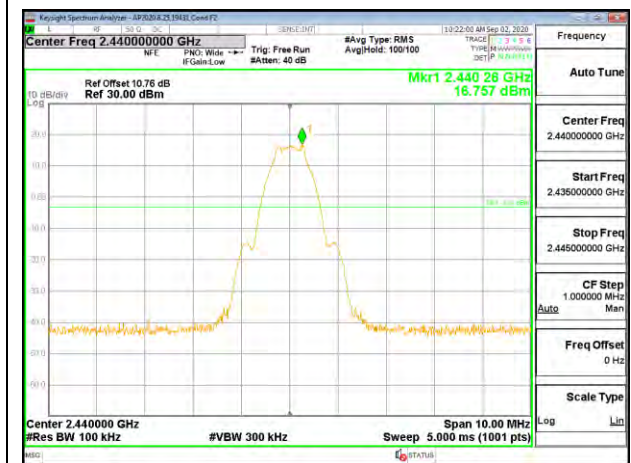
HIGH POWER (1Mbps)



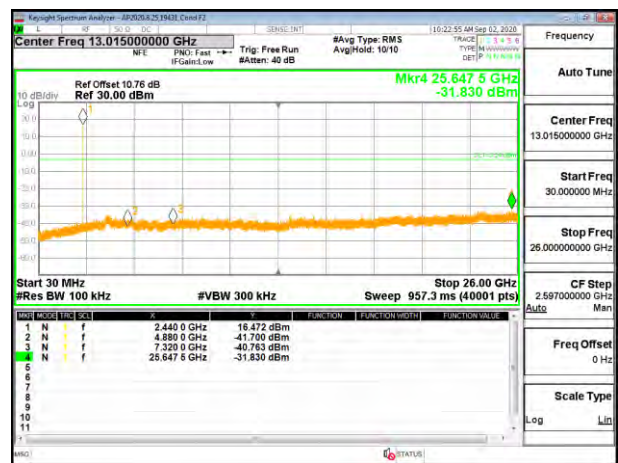
LOW CHANNEL , BANDEDGE ANT 3



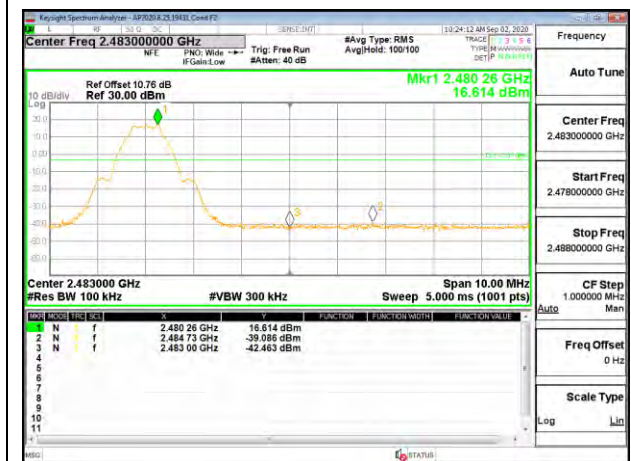
LOW CHANNEL OUT-OF-BAND ANT 3



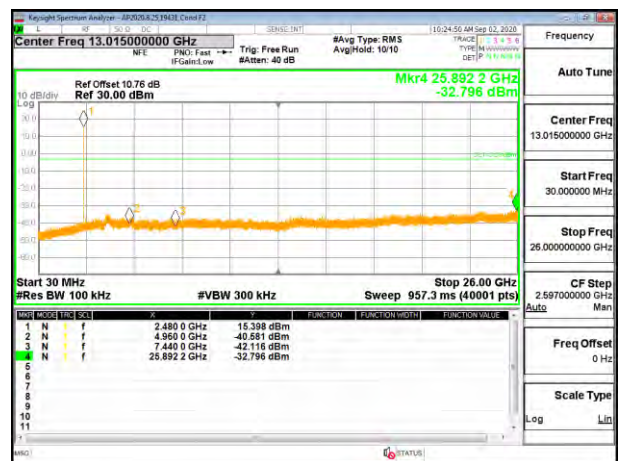
MID CHANNEL REFERENCE ANT 3



MID CHANNEL OUT-OF-BAND ANT 3



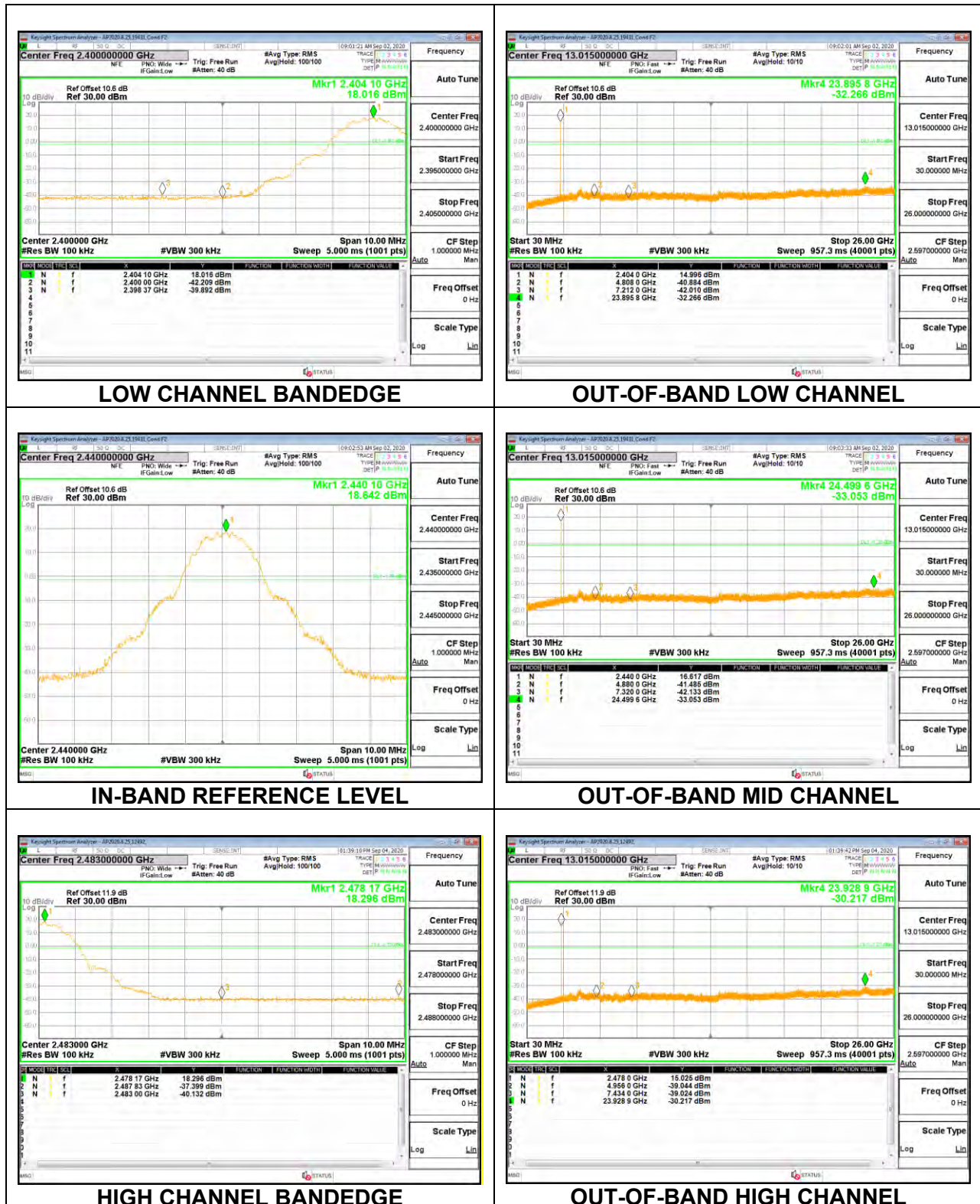
HIGH CHANNEL BANDEDGE ANT 3



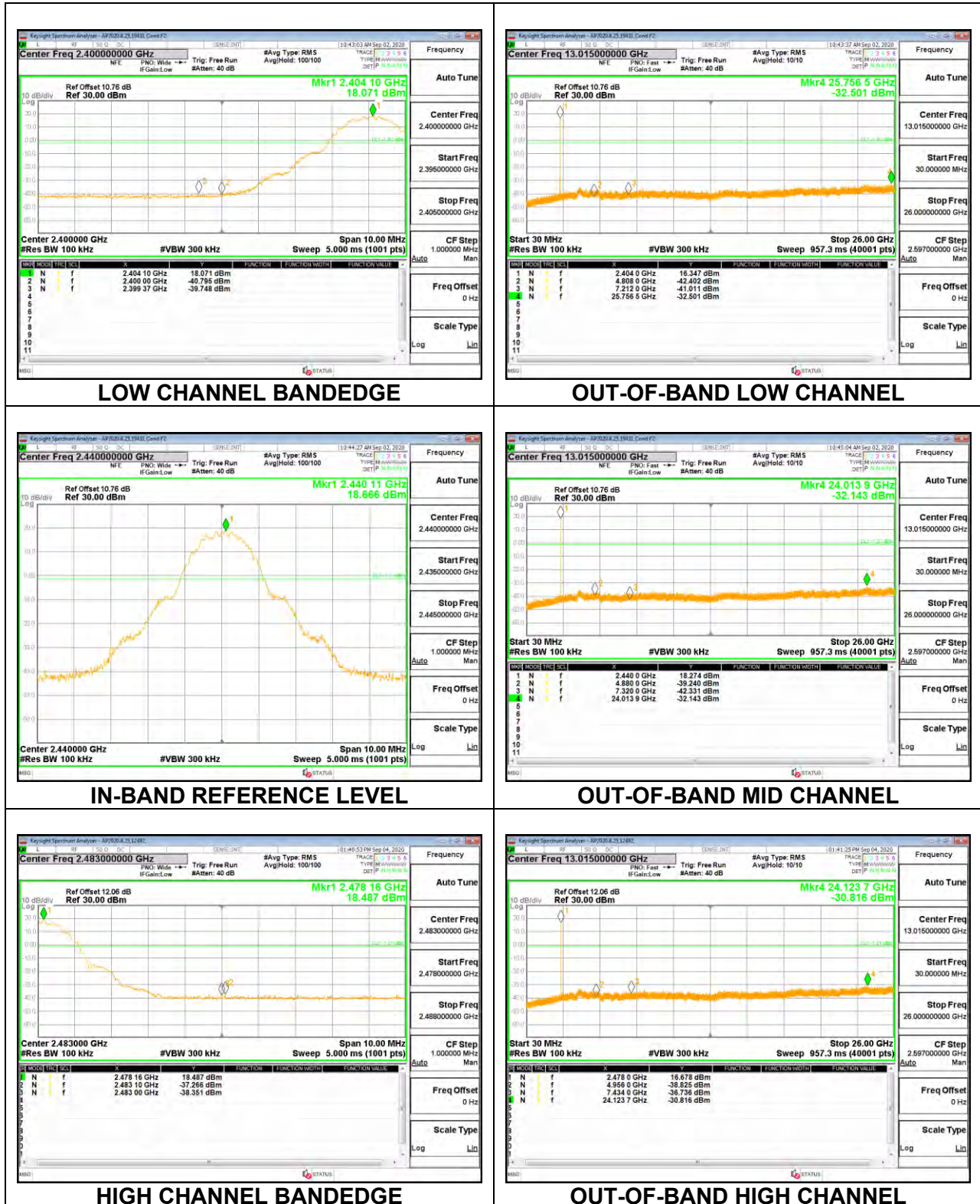
HIGH CHANNEL OUT-OF-BAND ANT 3

9.7.3. HIGH POWER BLE (2Mbps)

ANT 4

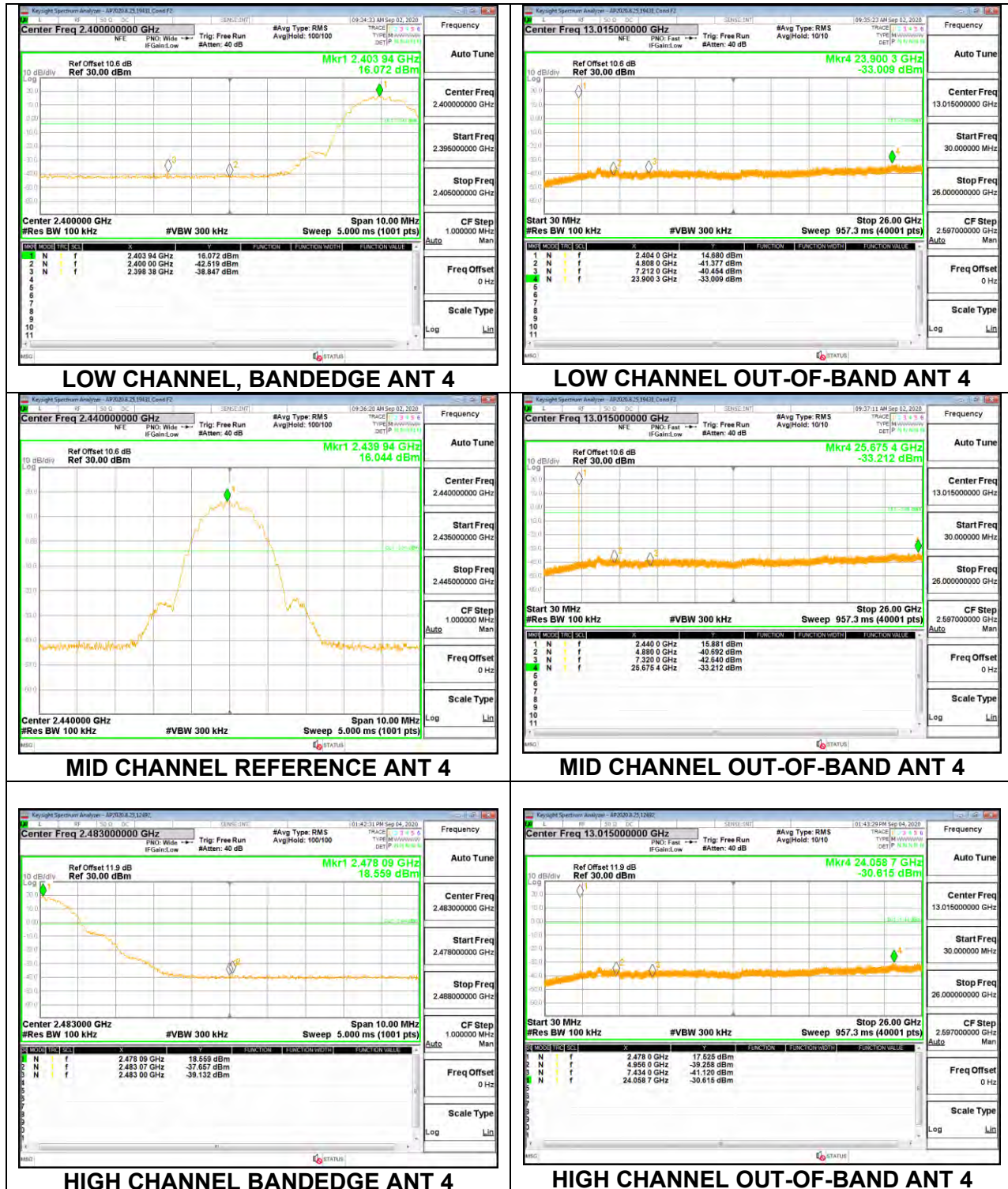


ANT 3

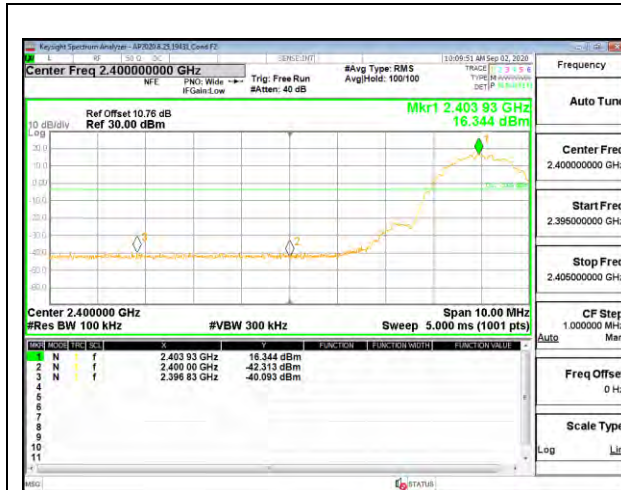


9.7.4. HIGH POWER BLE TXBF (2Mbps)

Note: Test procedures and setting are same as BLE normal mode.



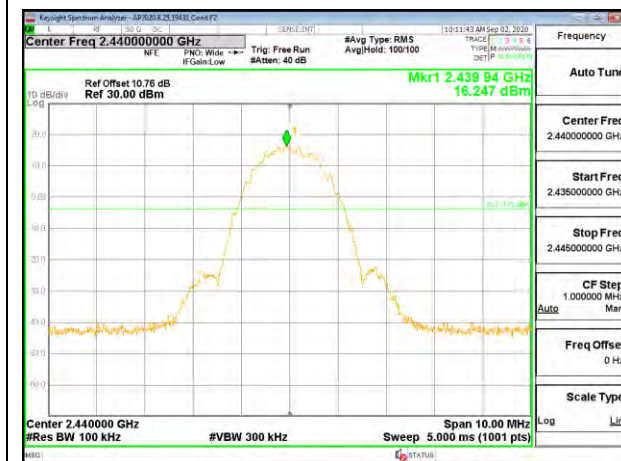
HIGH POWER (2Mbps)



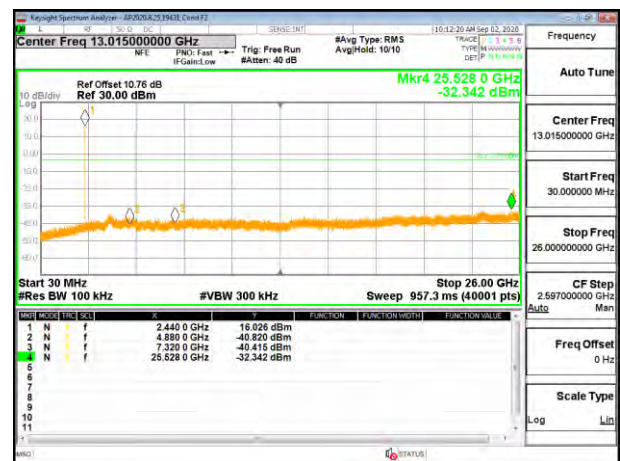
LOW CHANNEL , BANDEDGE ANT 3



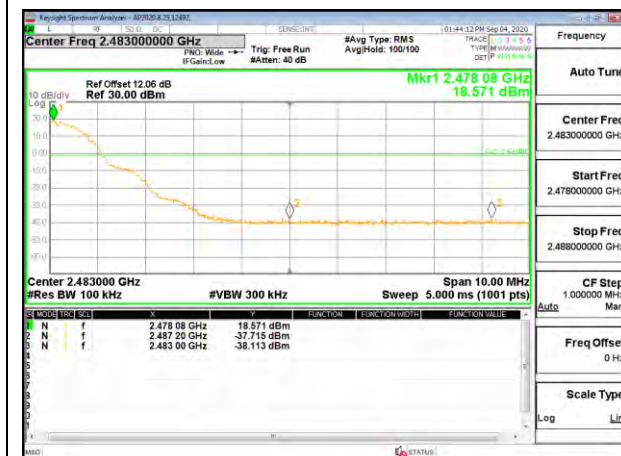
LOW CHANNEL OUT-OF-BAND ANT 3



MID CHANNEL REFERENCE ANT 3



MID CHANNEL OUT-OF-BAND ANT 3



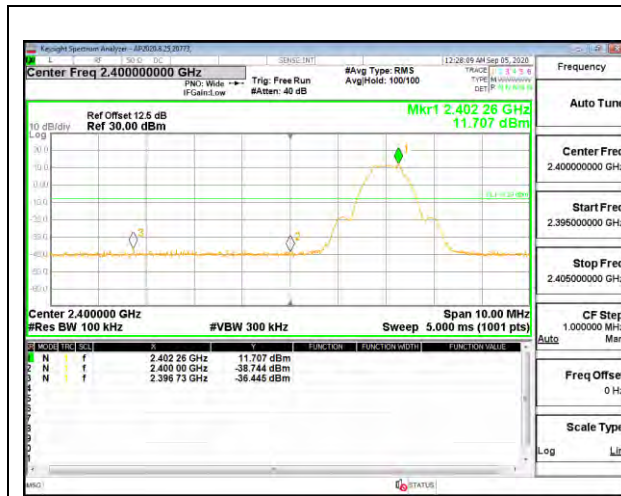
HIGH CHANNEL BANDEDGE ANT 3



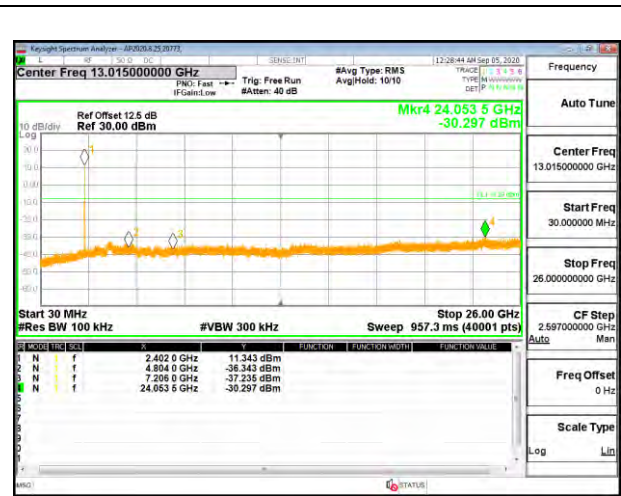
HIGH CHANNEL OUT-OF-BAND ANT 3

9.7.5. LOW POWER BLE (1Mbps)

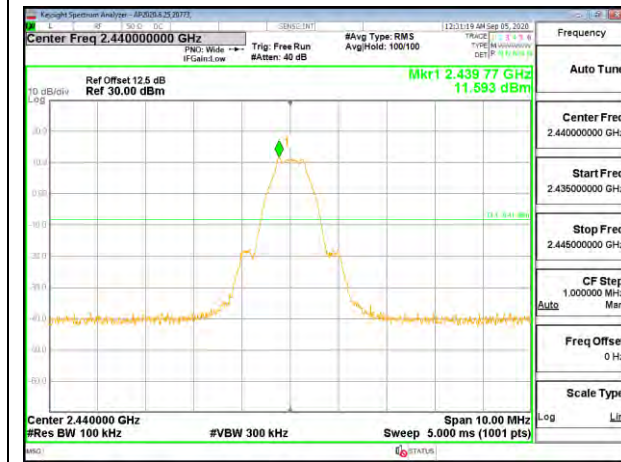
ANT 4



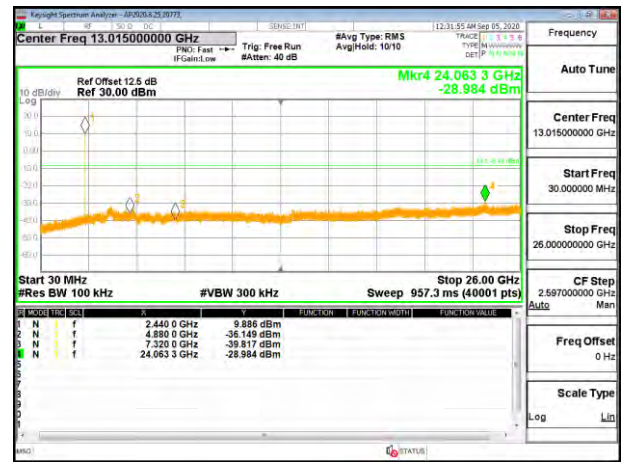
LOW CHANNEL BANDEDGE



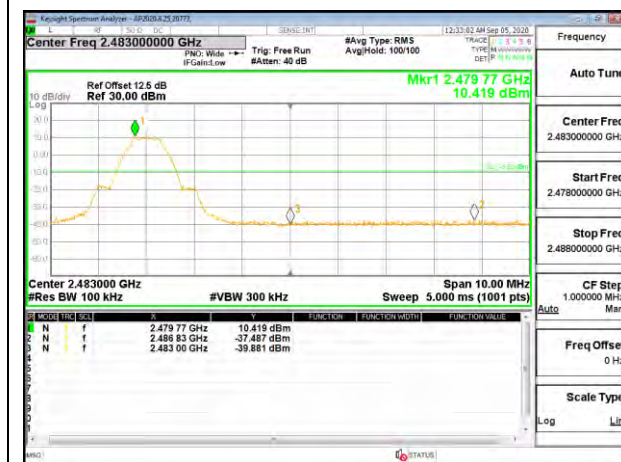
OUT-OF-BAND LOW CHANNEL



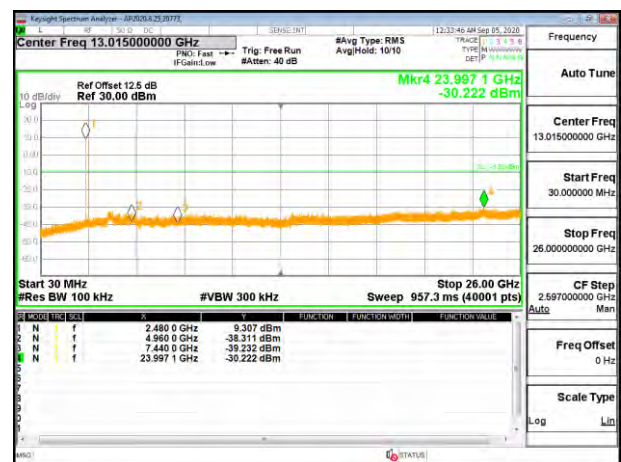
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL

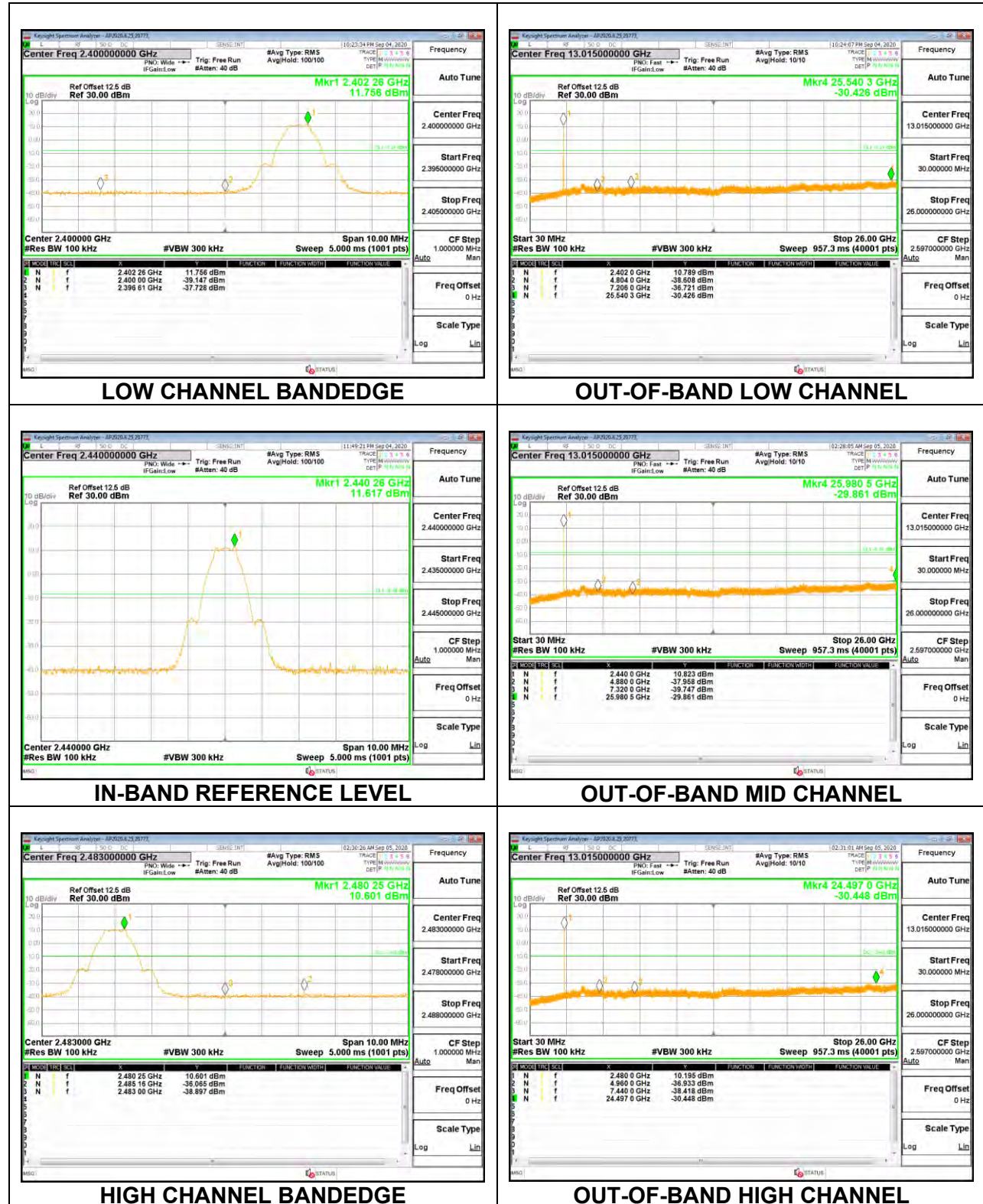


HIGH CHANNEL BANDEDGE



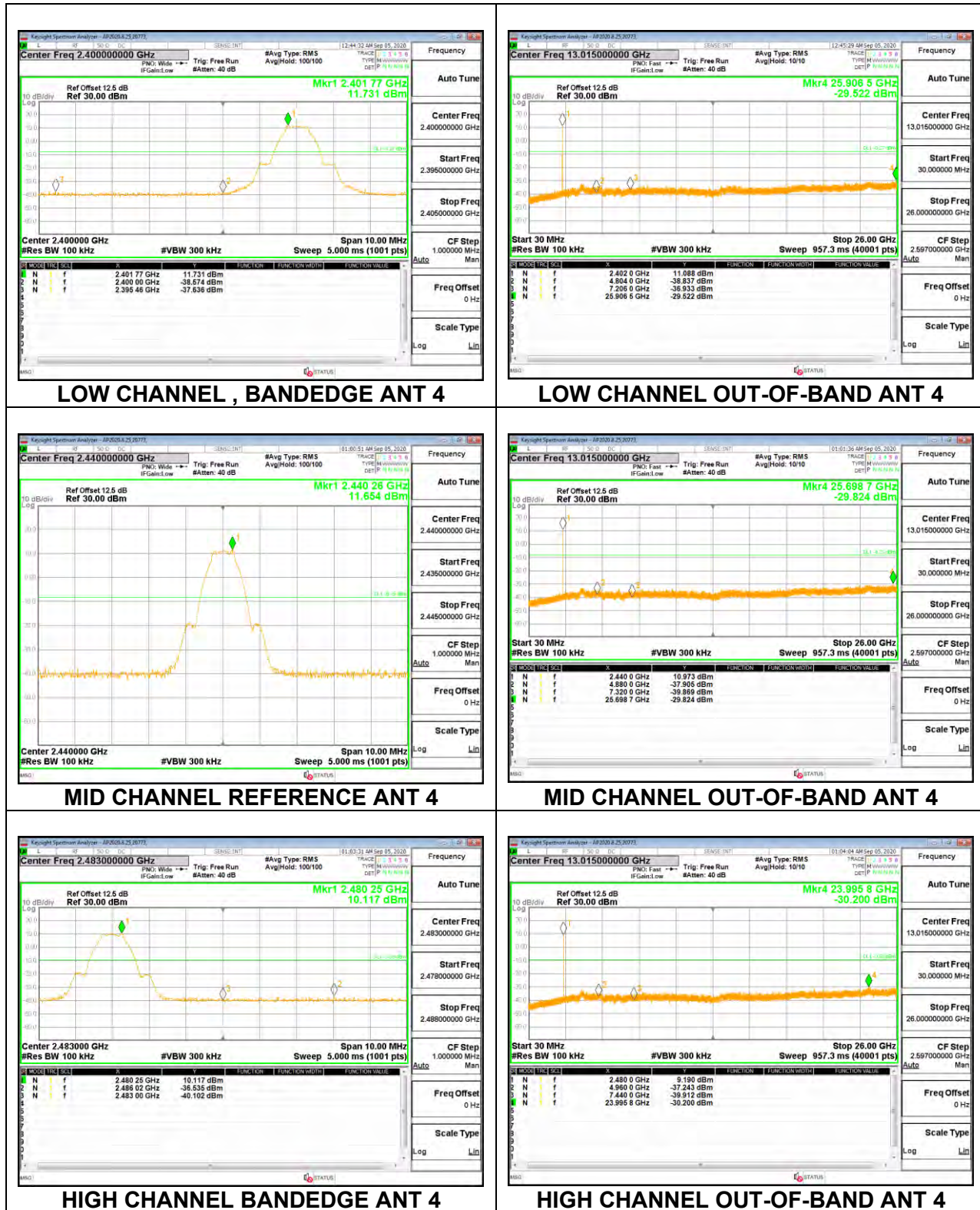
OUT-OF-BAND HIGH CHANNEL

ANT 3

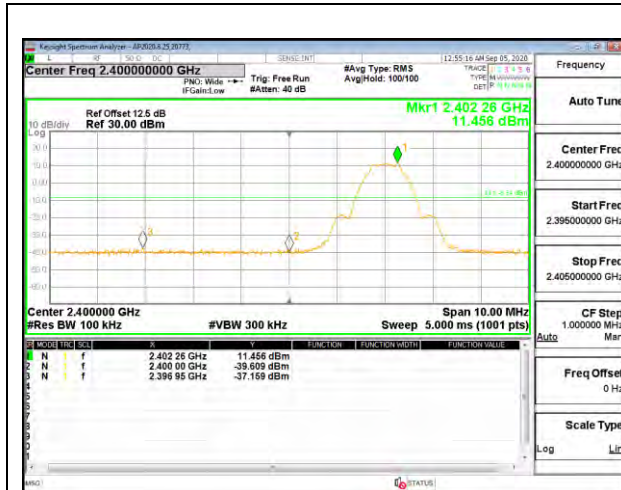


9.7.6. LOW POWER BLE TXBF (1Mbps)

Note: Test procedures and setting are same as BLE normal mode.



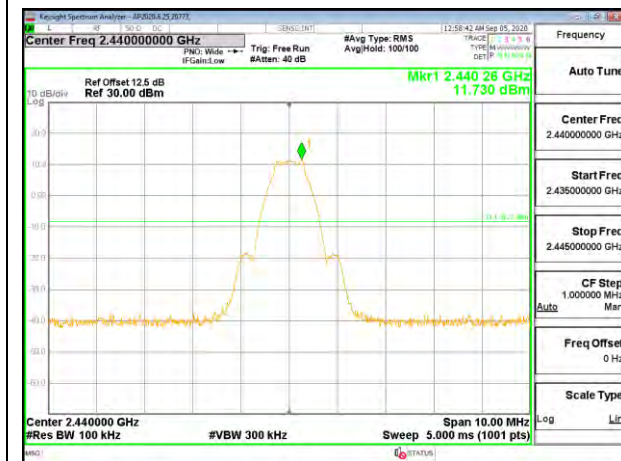
LOW POWER (1Mbps)



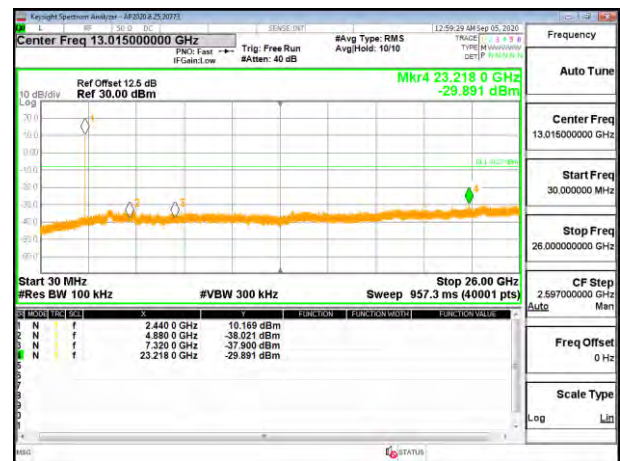
LOW CHANNEL , BANDEDGE ANT 3



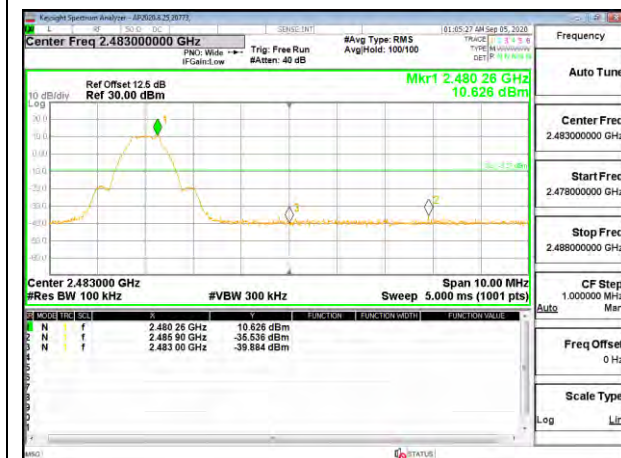
LOW CHANNEL OUT-OF-BAND ANT 3



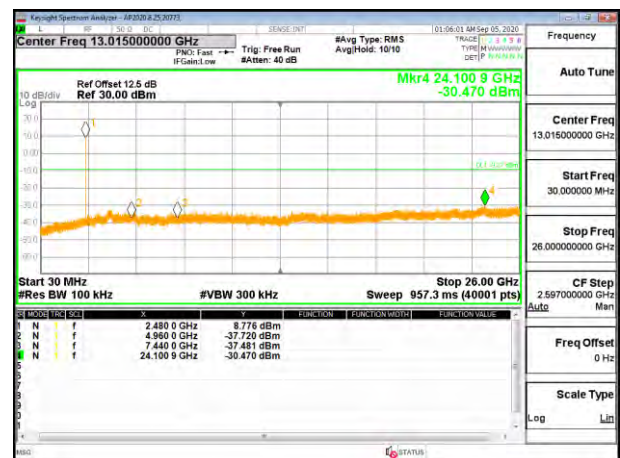
MID CHANNEL REFERENCE ANT 3



MID CHANNEL OUT-OF-BAND ANT 3



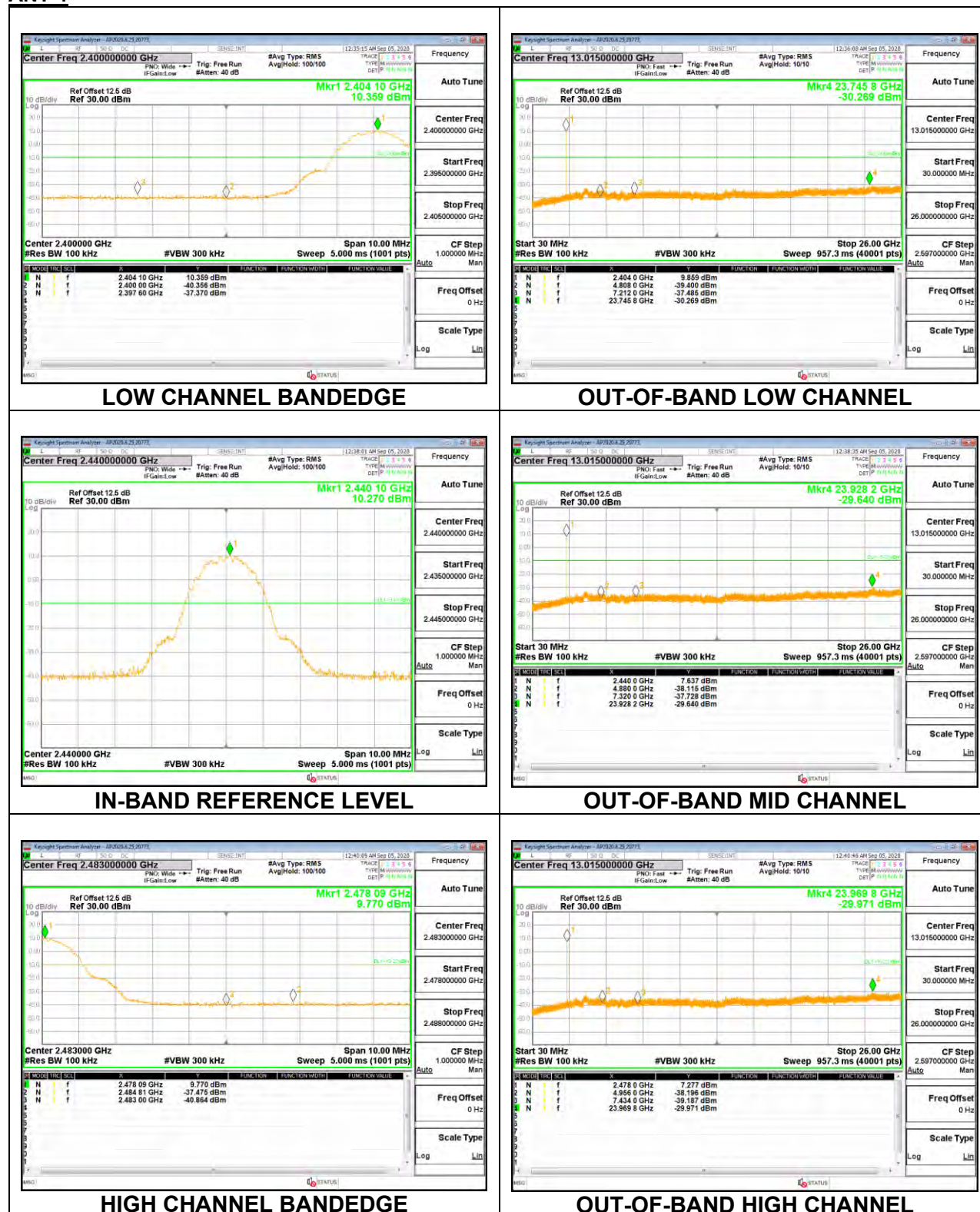
HIGH CHANNEL BANDEDGE ANT 3



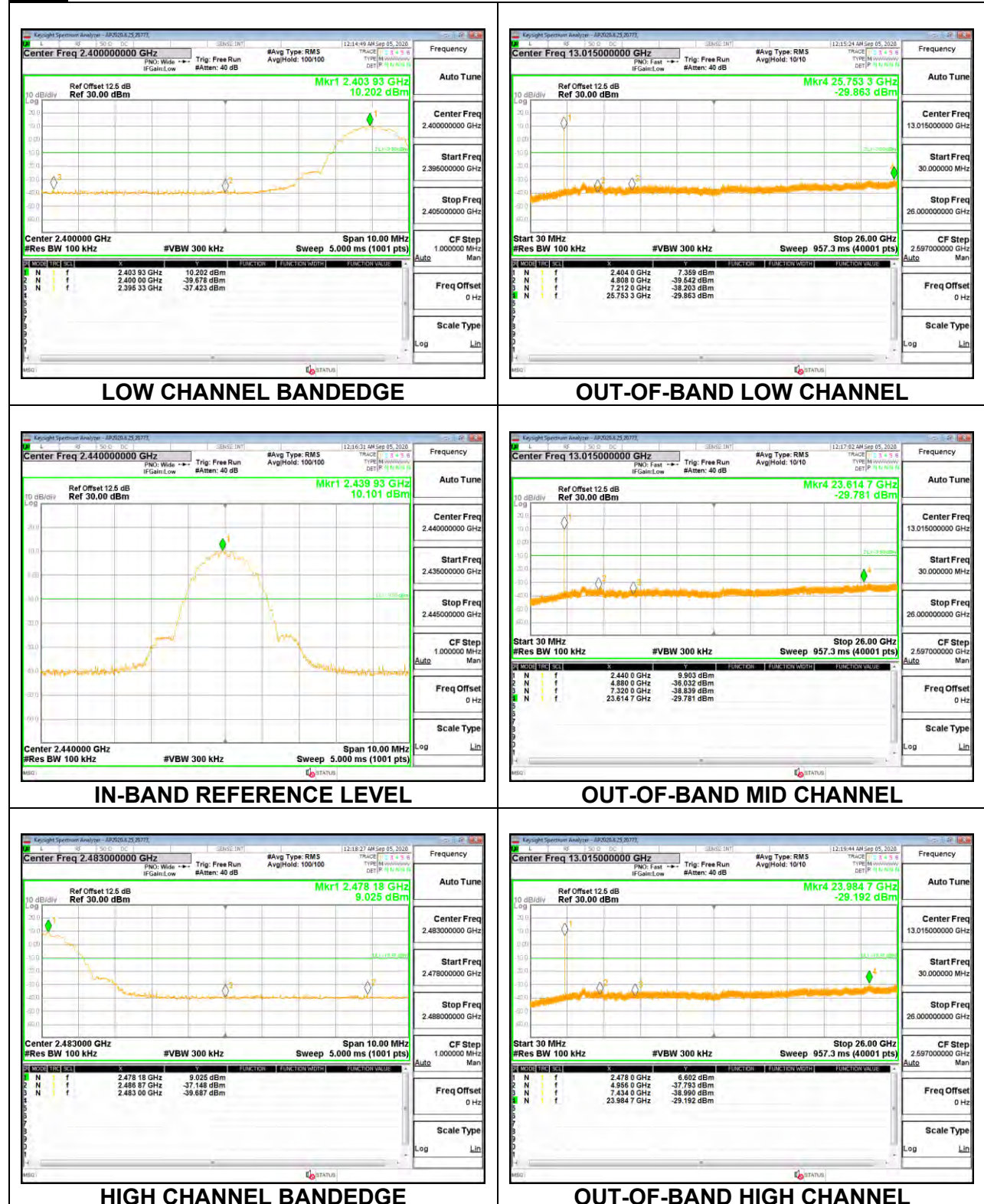
HIGH CHANNEL OUT-OF-BAND ANT 3

9.7.7. LOW POWER BLE (2Mbps)

ANT 4

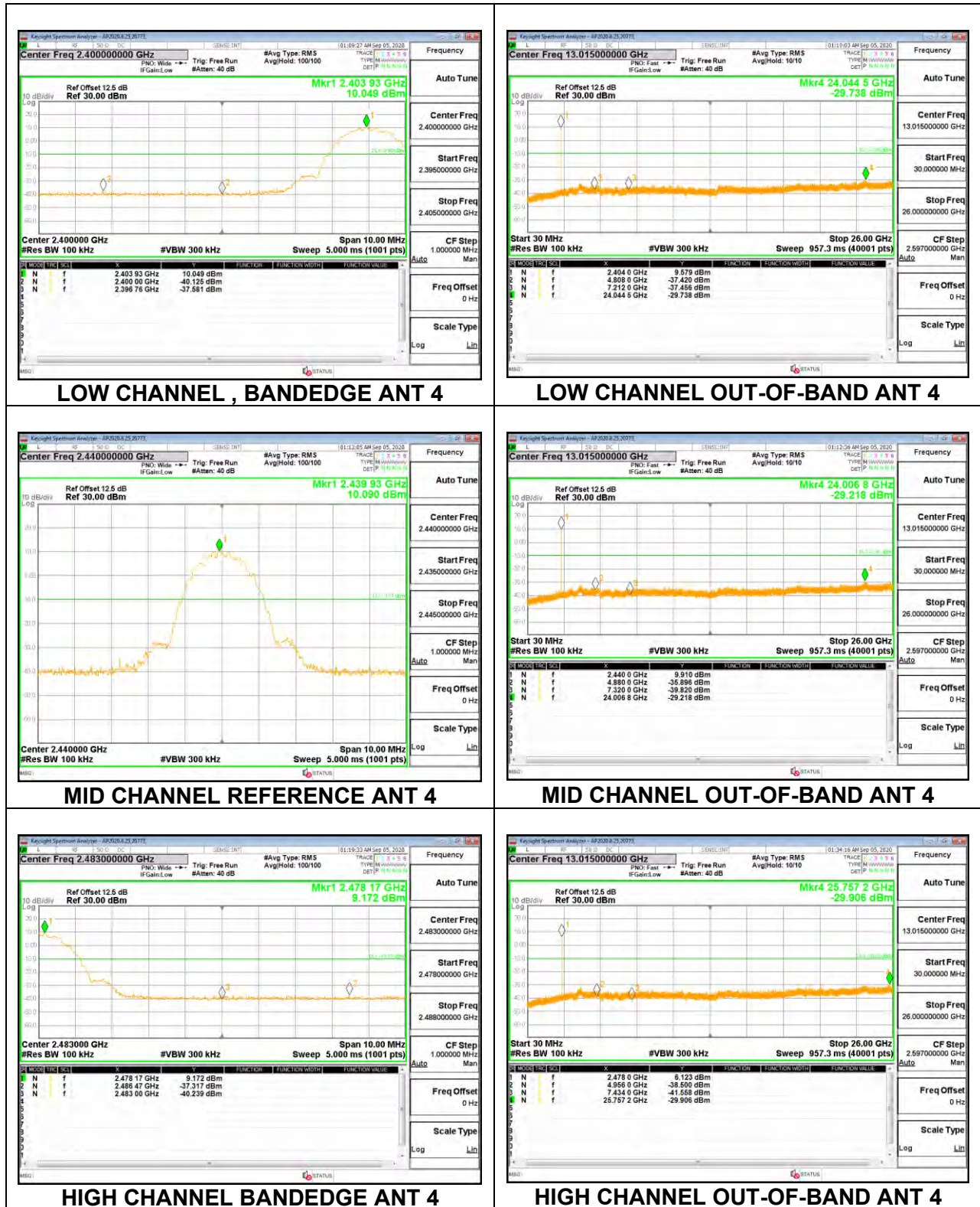


ANT 3

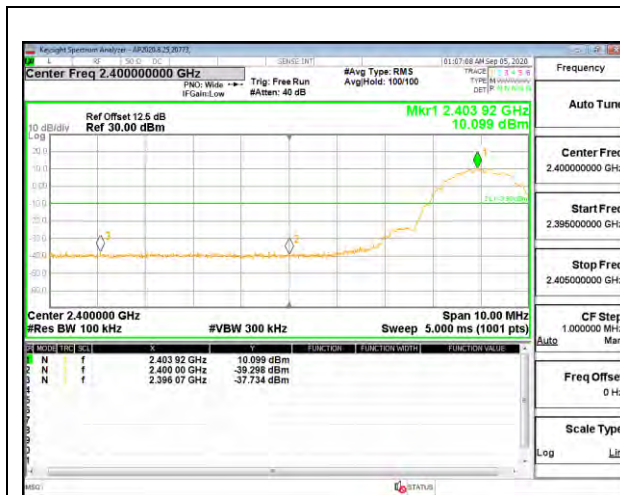


9.7.8. LOW POWER BLE TXBF (2Mbps)

Note: Test procedures and setting are same as BLE normal mode.



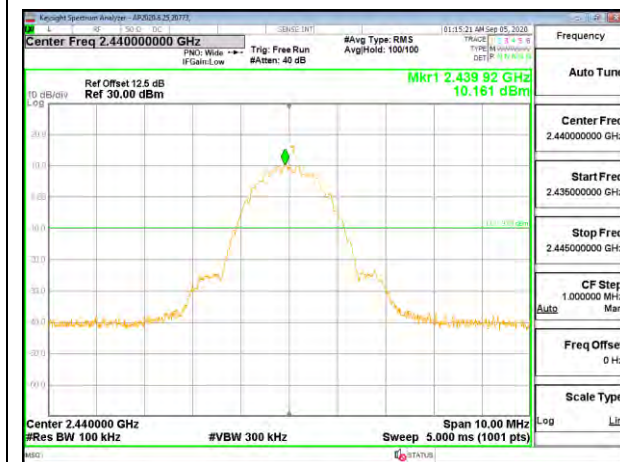
LOW POWER (2Mbps)



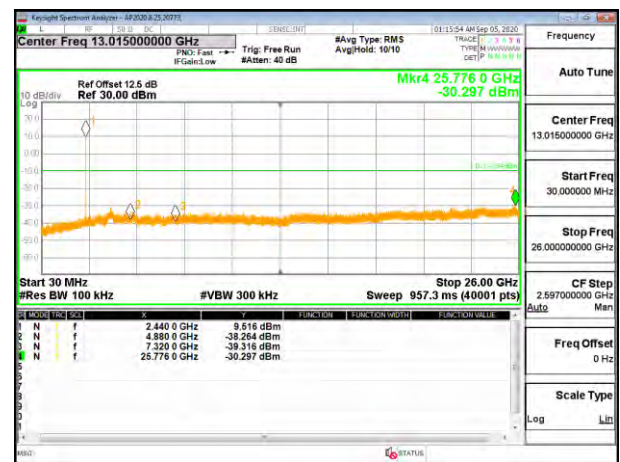
LOW CHANNEL, BANDEDGE ANT 3



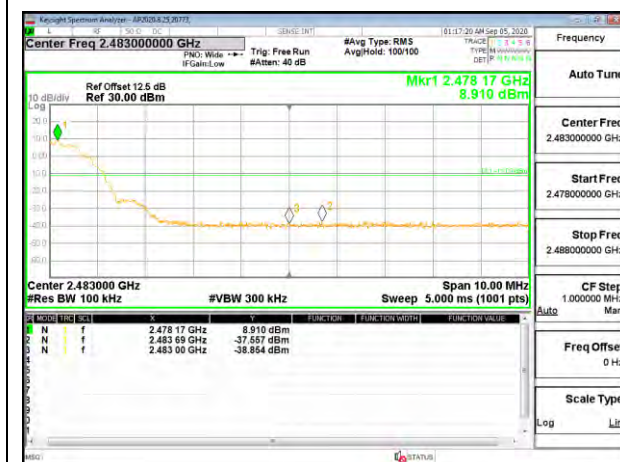
LOW CHANNEL OUT-OF-BAND ANT 3



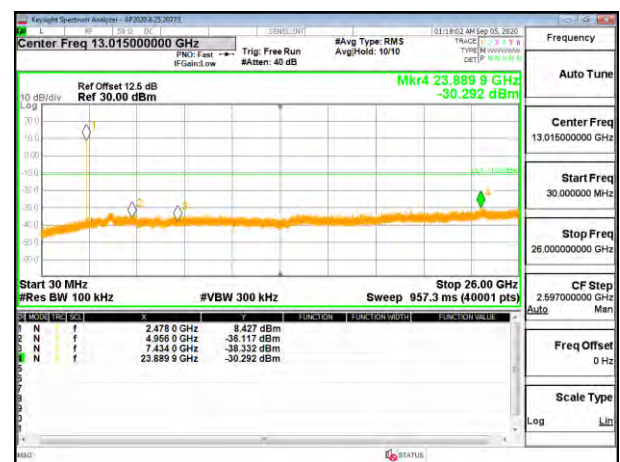
MID CHANNEL REFERENCE ANT 3



MID CHANNEL OUT-OF-BAND ANT 3



HIGH CHANNEL BANDEDGE ANT 3



HIGH CHANNEL OUT-OF-BAND ANT 3

10. RADIATED TEST RESULTS

10.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

RSS-GEN, Section 8.9 and 8.10.

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
0.009-0.490	2400/F(kHz) @ 300 m	-
0.490-1.705	24000/F(kHz) @ 30 m	-
1.705 - 30	30 @ 30m	-
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1GHz; 1.5 m above the ground plane for measurement above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For pre-scans above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 KHz for peak measurements.

For final measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements and as applicable for average measurements.

The spectrum from 1 GHz to 18 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band. Below 1GHz and above 18GHz emissions, the channel with the highest output power was tested.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel), parallel and perpendicular are the worst orientations, therefore testing was performed on these two orientations only.

KDB 414788 Open Field Site(OFS) and Chamber Correlation Justification

Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

OFS and chamber correlation testing had been performed and chamber measured test result is the worst-case test result.

Compliance with radiated spurious emissions limits in the restricted bands closest to the allocated 2402 – 2480 MHz band were performed on all modes for the low and high channels. Additional measurements on adjacent channels to the low and/or high channels were limited to cases where the edge channels have a significantly lower rated power than the adjacent channels.

Compliance with radiated spurious emissions limits in the restricted bands between 1GHz and 18GHz (except as explained for the band edge) the operating band were performed on the low, middle and high channel for 2Mbps mode. As this mode has the highest output power and highest power spectral density it is considered worst case for spurious emissions across all modes. For these tests both transmit chains were operating simultaneously and set to the maximum power per chain to cover both TXBF mode. The spurious emissions for frequencies below 1GHz and above 18GHz were limited to the center channel as preliminary testing indicated that changing the operating frequency had no significant impact on the emissions in those frequency bands.

RESULTS

High Power Beamforming BLE 1Mbps mode is set to maximum power per chain to cover both SISO and MIMO modes to comply with radiated spurious emissions limits in the restricted bands between 1GHz and 18GHz low/mid/high channels (except the band edge).

Spurious emissions for frequencies below 1GHz and above 18GHz were limited to the middle channel as preliminary testing indicated that changing the operating frequency had no significant impact on the emissions in those frequency bands.

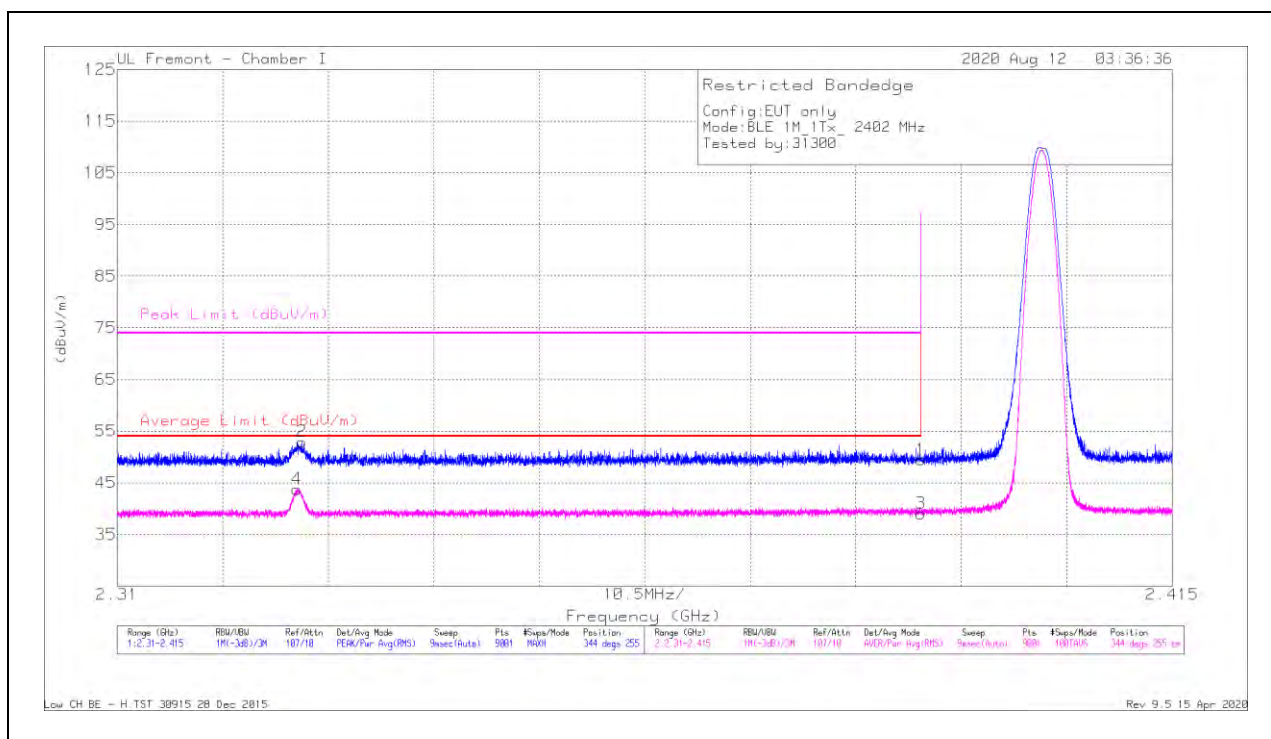
10.2. TRANSMITTER ABOVE 1 GHz

10.2.1. HIGH POWER BLE (1Mbps)

ANT 4

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



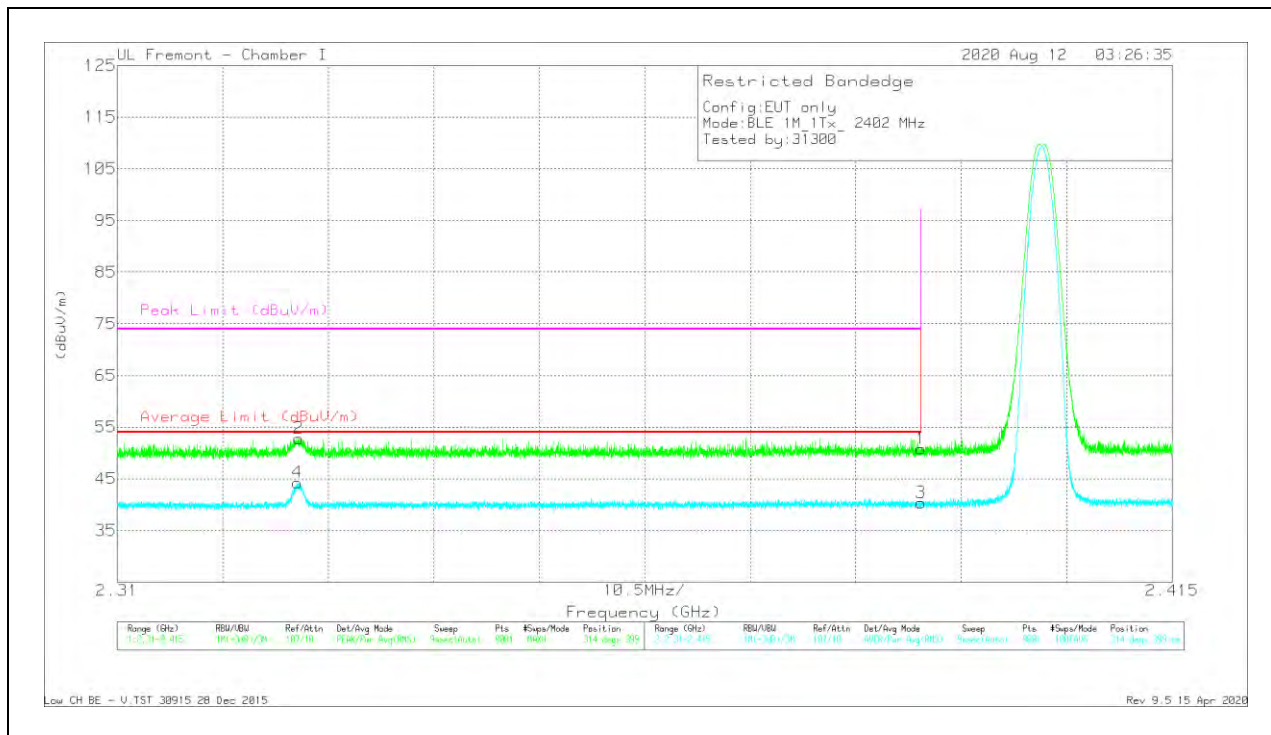
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (dB/m)	Amp/Cbl/Filt/Pa d (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.38999	34.74	Pk	32	-17.3	49.44	-	-	74	-24.56	344	255	H
2	* 2.32838	38.44	Pk	31.7	-17.2	52.94	-	-	74	-21.06	344	255	H
3	* 2.38999	24.37	RMS	32	-17.3	39.07	54	-14.93	-	-	344	255	H
4	* 2.32787	29.26	RMS	31.7	-17.2	43.76	54	-10.24	-	-	344	255	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (dB/m)	Amp/Cbl/Filt/Psd (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.38999	36.09	Pk	32	-17.3	50.79	-	-	74	-23.21	314	399	V
2	* 2.32805	38.31	Pk	31.7	-17.2	52.81	-	-	74	-21.19	314	399	V
3	* 2.38999	25.68	RMS	32	-17.3	40.38	54	-13.62	-	-	314	399	V
4	* 2.32792	29.79	RMS	31.7	-17.2	44.29	54	-9.71	-	-	314	399	V

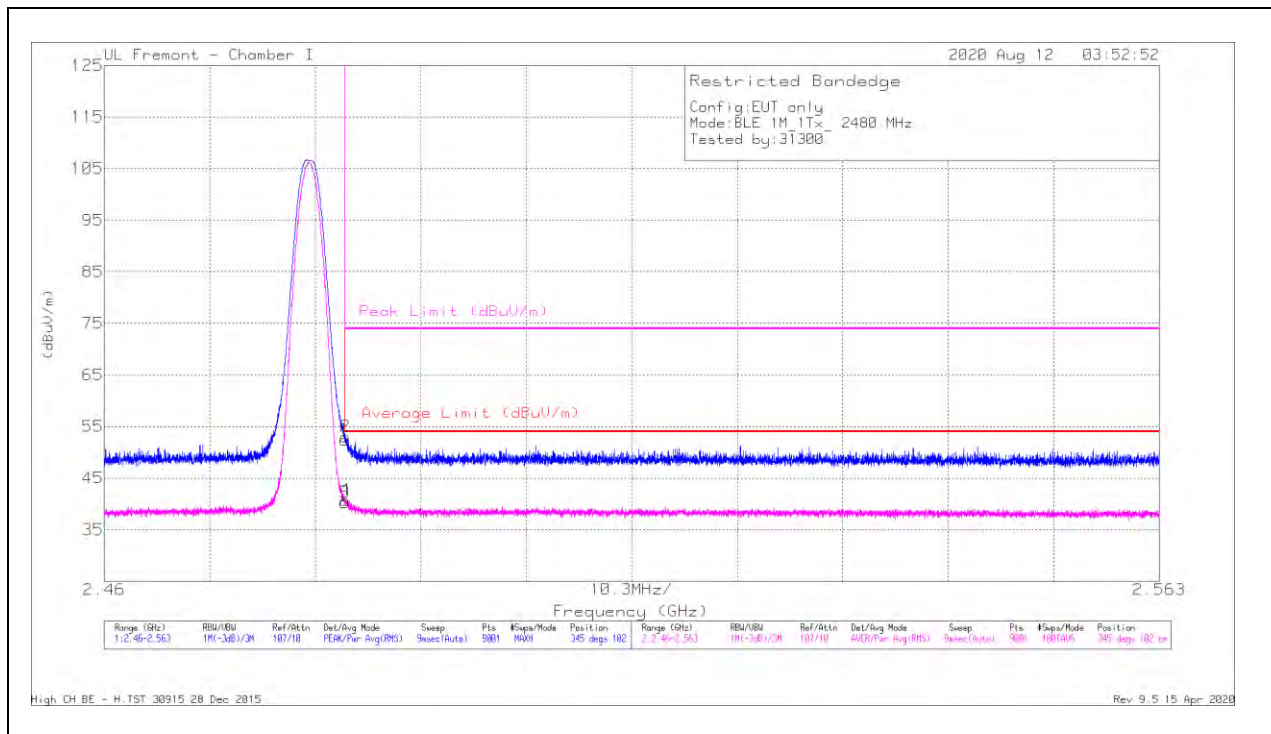
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



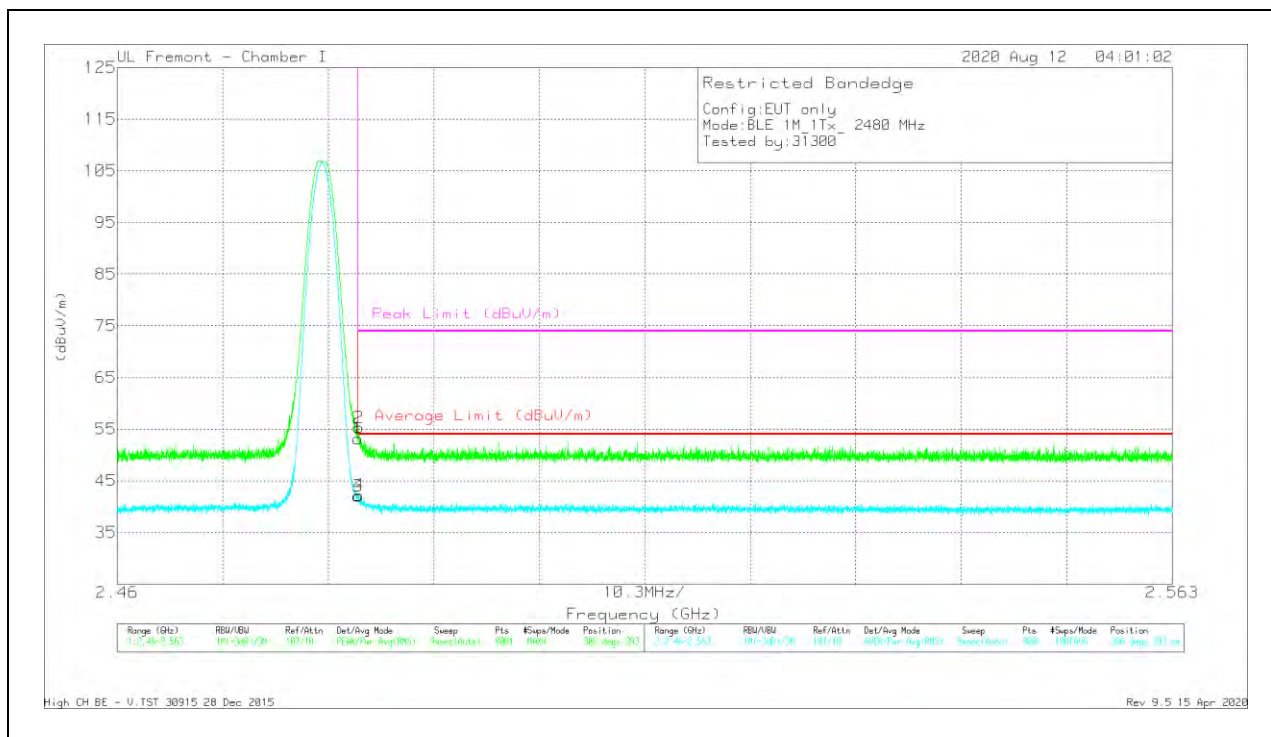
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (dB/m)	Amp/Cbl/Fitr/Pa d (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.48351	37.74	Pk	32.4	-17.7	52.44	-	-	74	-21.56	345	102	H
2	* 2.48353	38.35	Pk	32.4	-17.7	53.05	-	-	74	-20.95	345	102	H
3	* 2.48351	25.58	RMS	32.4	-17.7	40.28	54	-13.72	-	-	345	102	H
4	* 2.48353	26.06	RMS	32.4	-17.7	40.76	54	-13.24	-	-	345	102	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (dB/m)	Amp/Cbl/Fitr/Psd (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.48351	38.48	Pk	32.4	-17.7	53.18	-	-	74	-20.82	306	393	V
2	* 2.48357	40.61	Pk	32.4	-17.7	55.31	-	-	74	-18.69	306	393	V
3	* 2.48351	27.33	RMS	32.4	-17.7	42.03	54	-11.97	-	-	306	393	V
4	* 2.48357	27.47	RMS	32.4	-17.7	42.17	54	-11.83	-	-	306	393	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

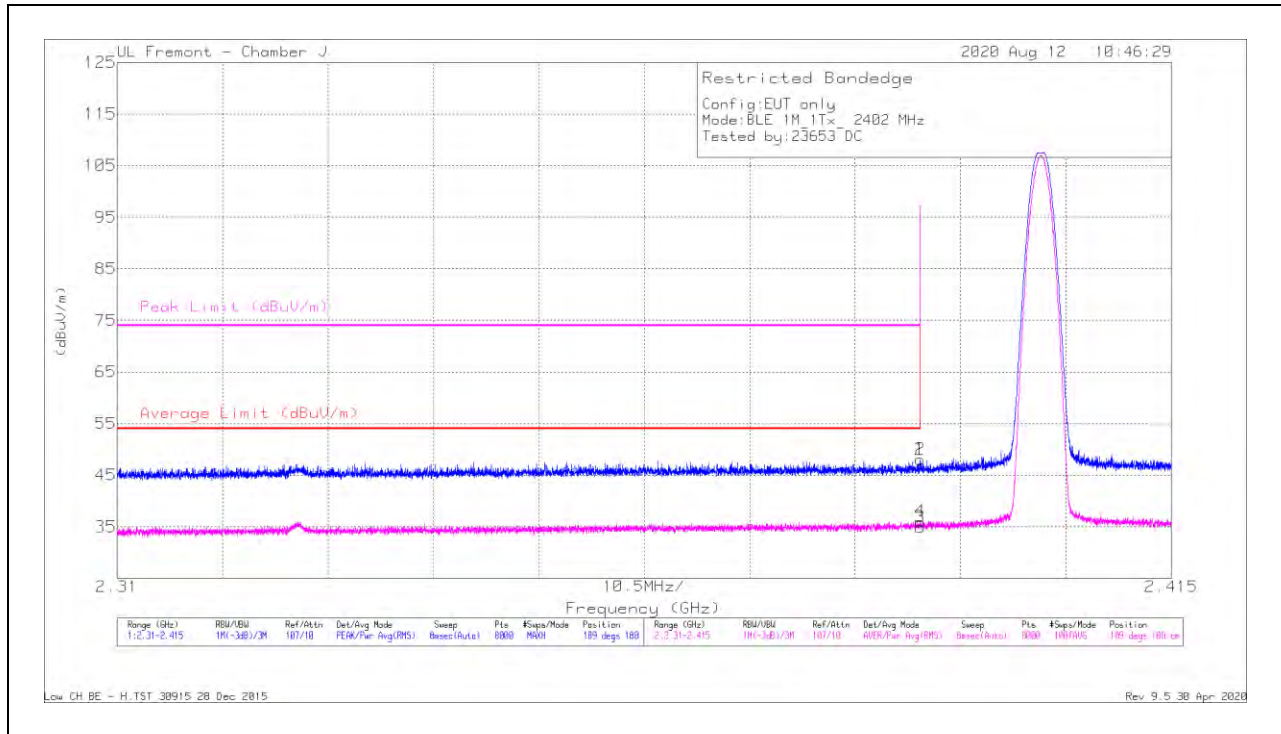
Pk - Peak detector

RMS - RMS detection

ANT 3

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T963 (dB/m)	Amp/Cbl/Filt/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	33.72	Pk	29	-14.7	48.02	-	-	74	-25.98	189	188	H
2	* 2.38998	33.74	Pk	29	-14.7	48.04	-	-	74	-25.96	189	188	H
3	* 2.39	20.62	RMS	29	-14.7	34.92	54	-19.08	-	-	189	188	H
4	* 2.38998	21.69	RMS	29	-14.7	35.99	54	-18.01	-	-	189	188	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

UL Fremont - Chamber J

2020 Aug 12 11:00:07

Restricted Bandedge

Config: EUT only

Mode: BLE 1M 1Tx 2402 MHz

Tested by: 23653 DC

Peak Limit (dBuV/m)

Average Limit (dBuV/m)

2.31 10.5MHz 2.415

Frequency (GHz)

Range (GHz)	RBW/ABW	Ref/Attn	Det/Avg Mode	Sweep	Pls	#Swept/Mode	Position	Range (GHz)	RBW/ABW	Ref/Attn	Det/Avg Mode	Sweep	Pls	#Swept/Mode	Position
2.31 to 2.415	100 kHz/300 kHz	100 dB	ENB/Power Avg (RMS)	Power (dBm)	2000	1000	2.40 sweep 20	2.31 to 2.415	100 kHz/300 kHz	100 dB	ENB/Power Avg (RMS)	Power (dBm)	2000	1000	2.40 sweep 20

Low CH BE - U.TST_30915 20 Dec 2015

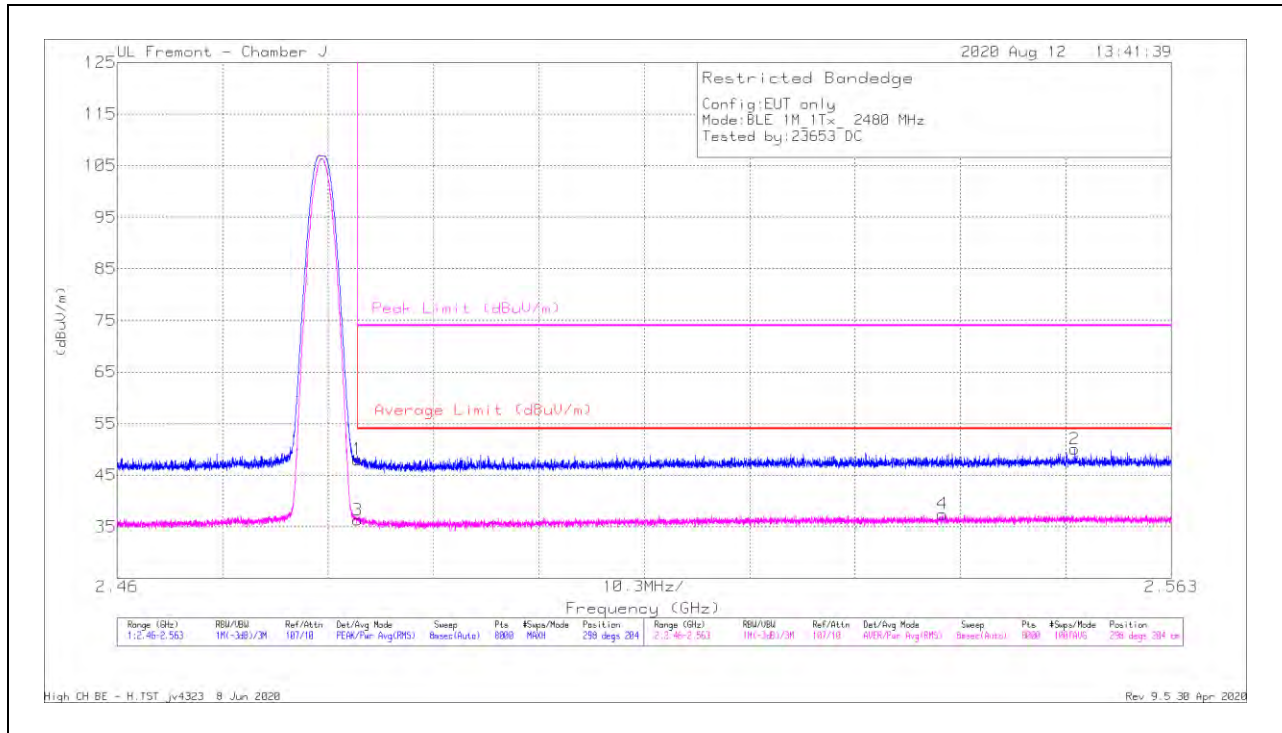
Rev 9.5 30 Apr 2020

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF 1963 (dB/m)	Amp/CuI/Fitr/Pa d (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	31.81	Pk	29	-14.7	46.11	-	-	74	-27.89	249	295	V
2	* 2.3801	34.23	Pk	29	-14.7	48.53	-	-	74	-25.47	249	295	V
3	* 2.39	19.79	RMS	29	-14.7	34.09	54	-19.91	-	-	249	295	V
4	* 2.38737	21.29	RMS	29	-14.7	35.59	54	-18.41	-	-	249	295	V

RMS - RMS detection

BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



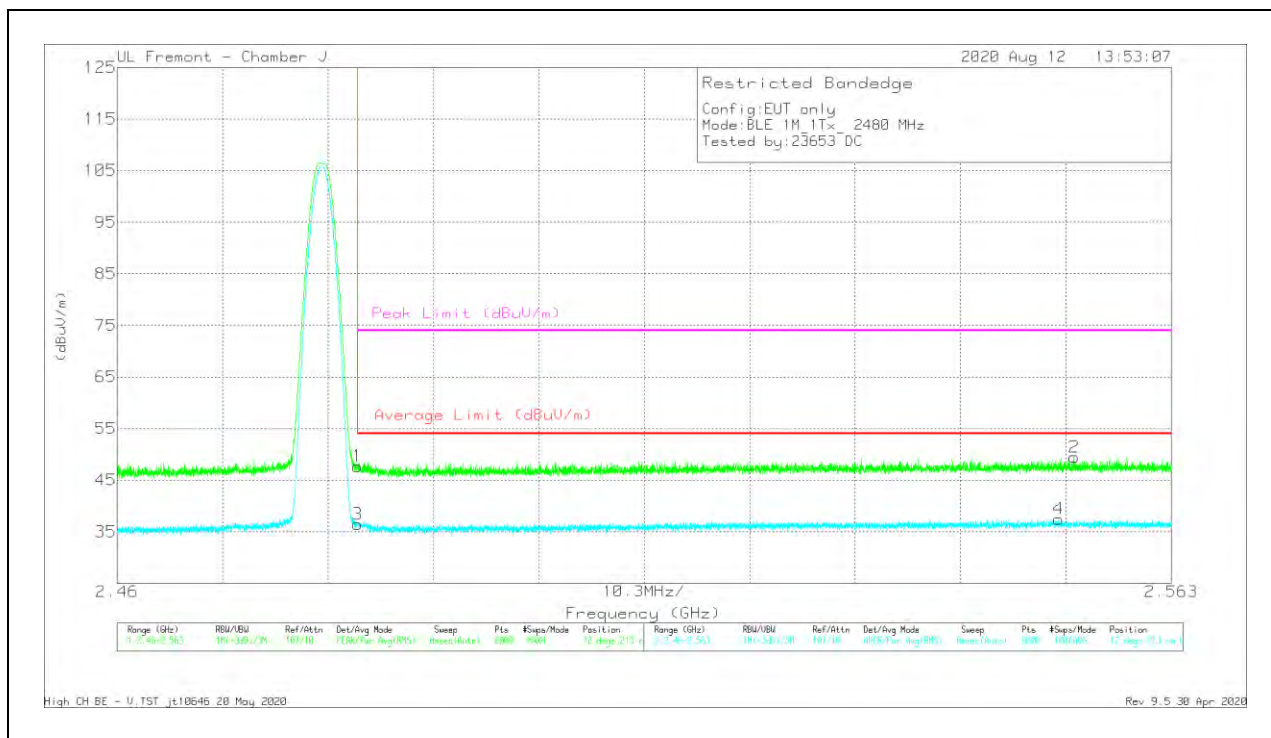
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T963 (dB/m)	Amp/Cbll/Filt/Pa d (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.4835	33.12	Pk	29.5	-14.6	48.02	-	-	74	-25.98	298	204	H
2	2.55354	34.57	Pk	29.9	-14.4	50.07	-	-	74	-23.93	298	204	H
3	* 2.4835	21.39	RMS	29.5	-14.6	36.29	54	-17.71	-	-	298	204	H
4	2.54064	22.17	RMS	29.8	-14.5	37.47	54	-16.53	-	-	298	204	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK - Peak detector

RMS - RMS detection

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T963 (dB/m)	Amp/Cbl/Filt/Pa d (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	32.79	Pk	29.5	-14.6	47.69	-	-	74	-26.31	12	213	V
2	2.55351	33.97	Pk	29.9	-14.4	49.47	-	-	74	-24.53	12	213	V
3	* 2.4835	21.54	RMS	29.5	-14.6	36.44	54	-17.56	-	-	12	213	V
4	2.55198	21.96	RMS	29.9	-14.4	37.46	54	-16.54	-	-	12	213	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

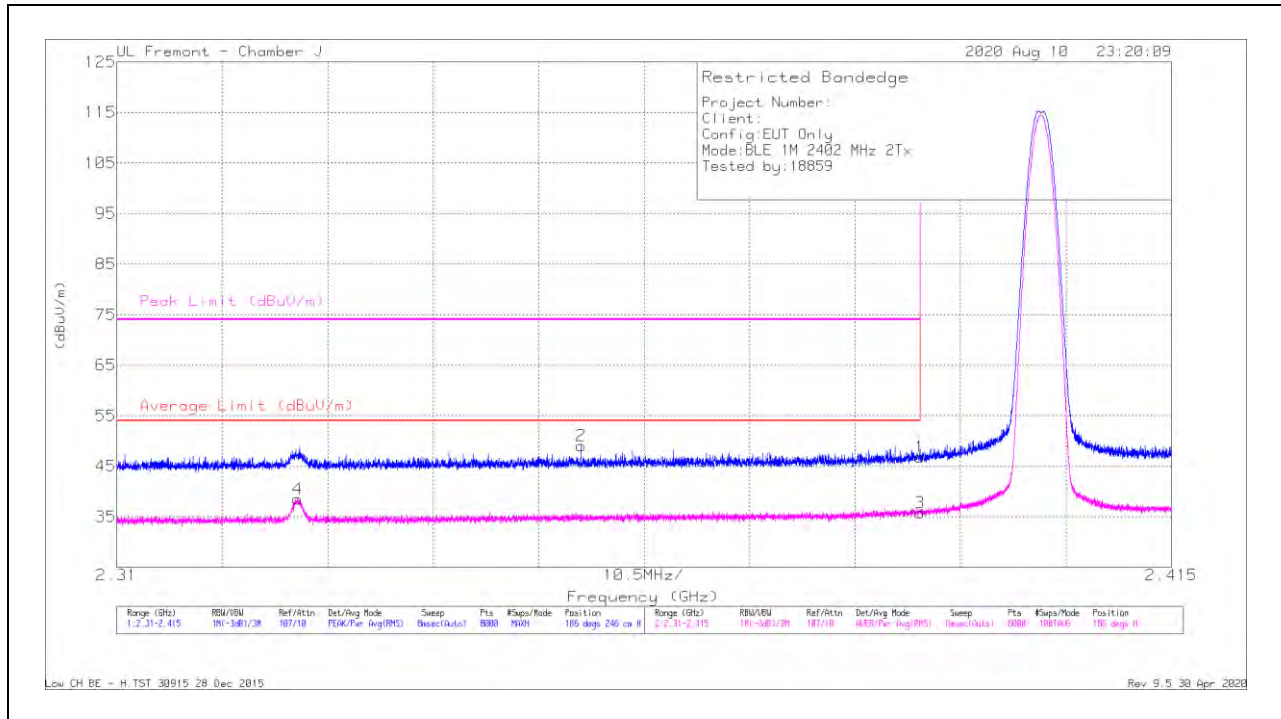
Pk - Peak detector

RMS - RMS detection

10.2.2. HIGH POWER BLE TXBF (1Mbps)

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



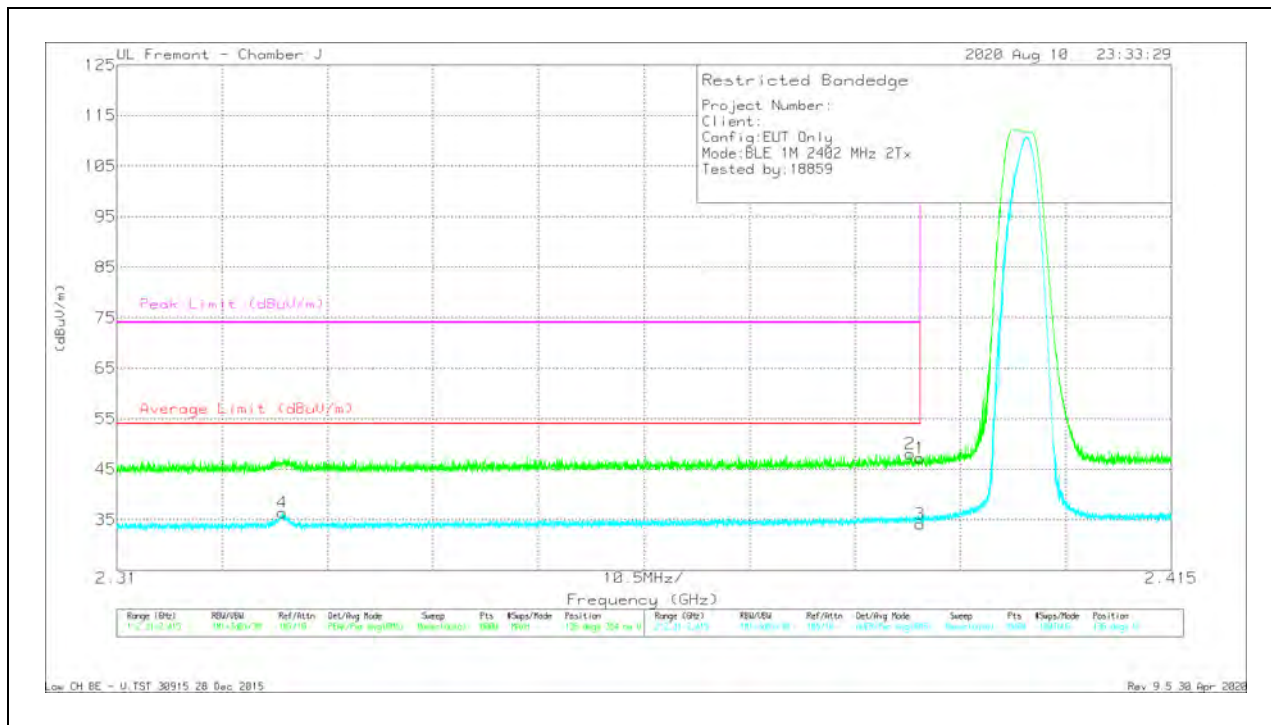
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T963 (dB/m)	Amp/Cbl/Filt/Pa d (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	32.51	Pk	29	-14.7	46.81	-	-	74	-27.19	186	246	H
2	* 2.35621	34.99	Pk	29	-14.9	49.09	-	-	74	-24.91	186	246	H
3	* 2.39	21.46	RMS	29	-14.7	35.76	54	-18.24	-	-	186	246	H
4	* 2.32805	24.45	RMS	28.9	-14.9	38.45	54	-15.55	-	-	186	246	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T963 (dB/m)	Amp/Cbl/Filt/Pa d (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	32.89	Pk	29	-14.7	47.19	-	-	74	-26.81	136	354	V
2	* 2.389	33.7	Pk	29	-14.7	48	-	-	74	-26	136	354	V
3	* 2.39	19.88	RMS	29	-14.7	34.18	54	-19.82	-	-	136	354	V
4	* 2.32646	22.45	RMS	28.8	-14.9	36.35	54	-17.65	-	-	136	354	V

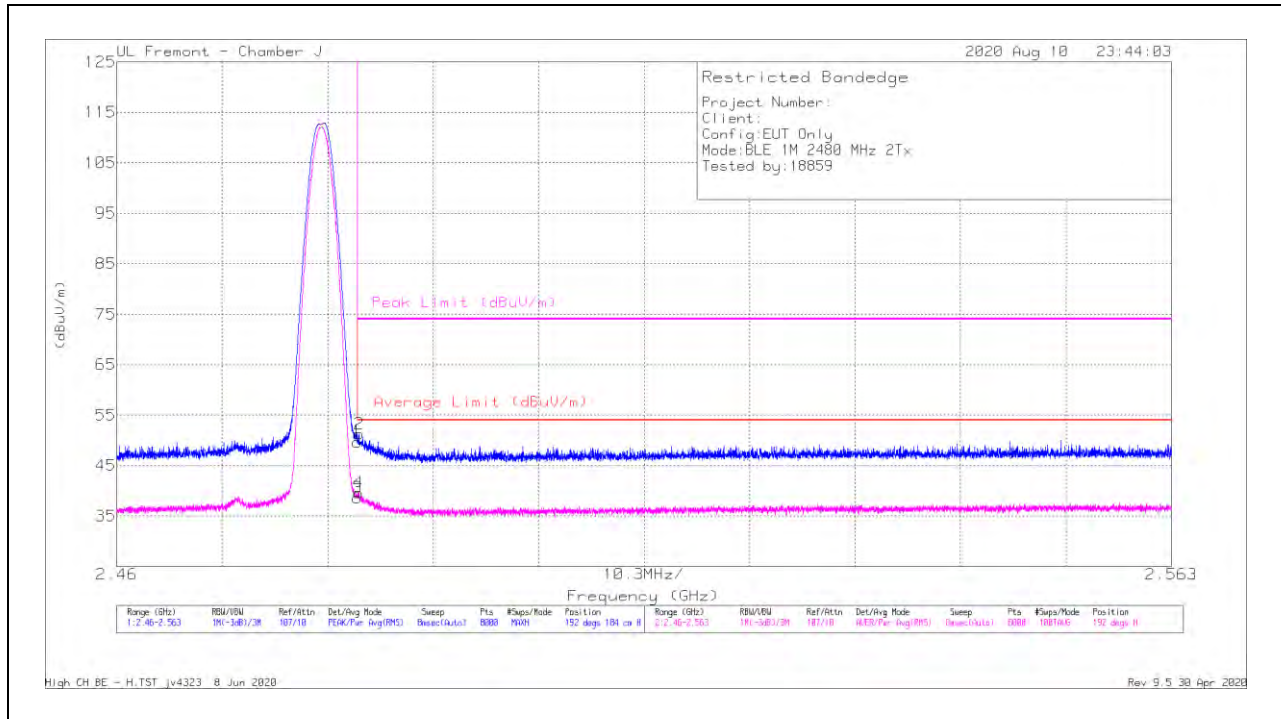
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



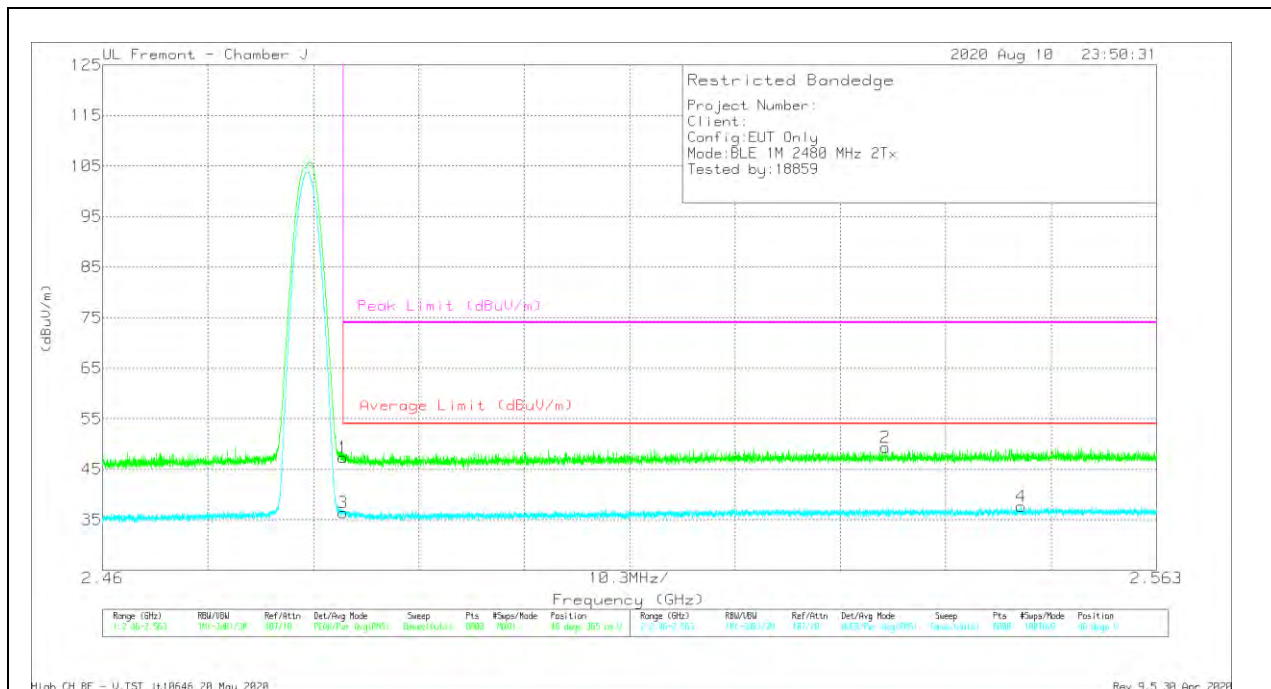
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T963 (dB/m)	Amp/Cbl/Filt/Pa d (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.4835	34.83	Pk	29.5	-14.6	49.73	-	-	74	-24.27	192	184	H
2	* 2.48366	36.34	Pk	29.5	-14.6	51.24	-	-	74	-22.76	192	184	H
3	* 2.4835	23.77	RMS	29.5	-14.6	38.67	54	-15.33	-	-	192	184	H
4	* 2.48363	24.7	RMS	29.5	-14.6	39.6	54	-14.4	-	-	192	184	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T963 (dB/m)	Amp/Cbl/Filt/Psd (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	32.41	Pk	29.5	-14.6	47.31	-	-	74	-26.69	46	365	V
2	2.5365	33.95	Pk	29.8	-14.5	49.25	-	-	74	-24.75	46	365	V
3	* 2.4835	21.53	RMS	29.5	-14.6	36.43	54	-17.57	-	-	46	365	V
4	2.5498	22.27	RMS	29.9	-14.5	37.67	54	-16.33	-	-	46	365	V

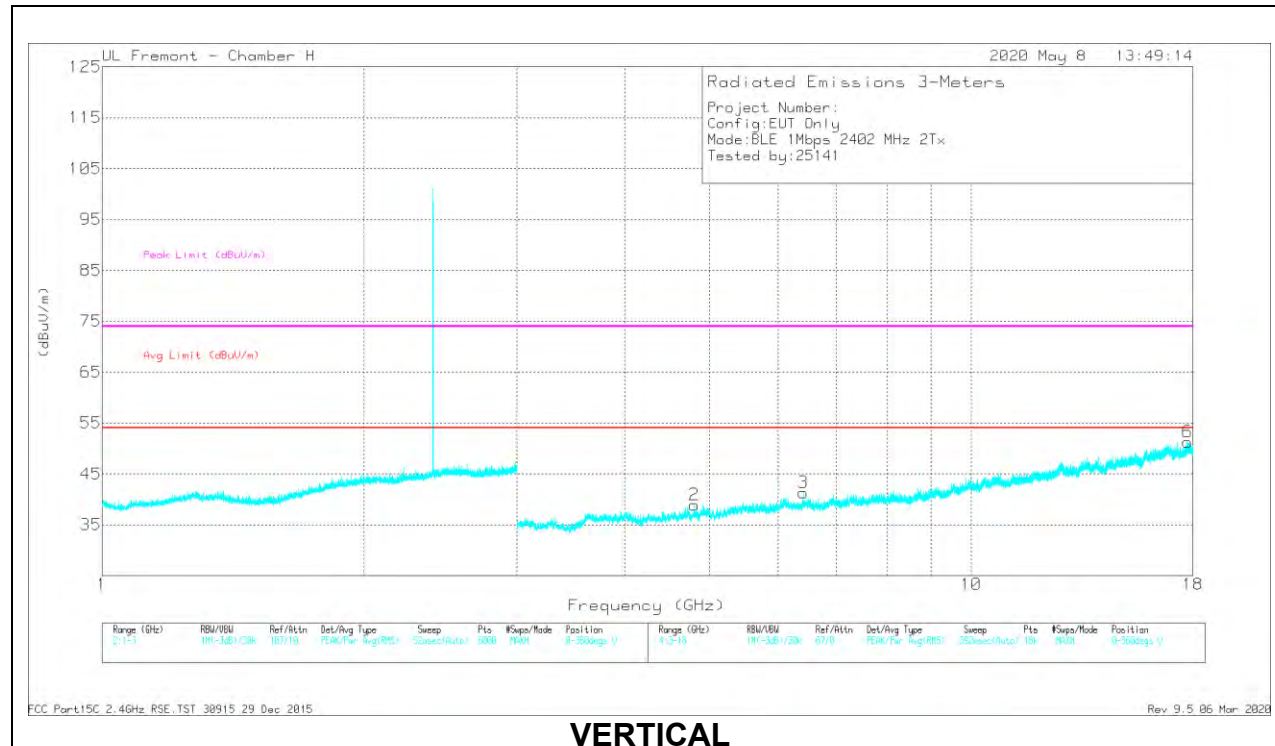
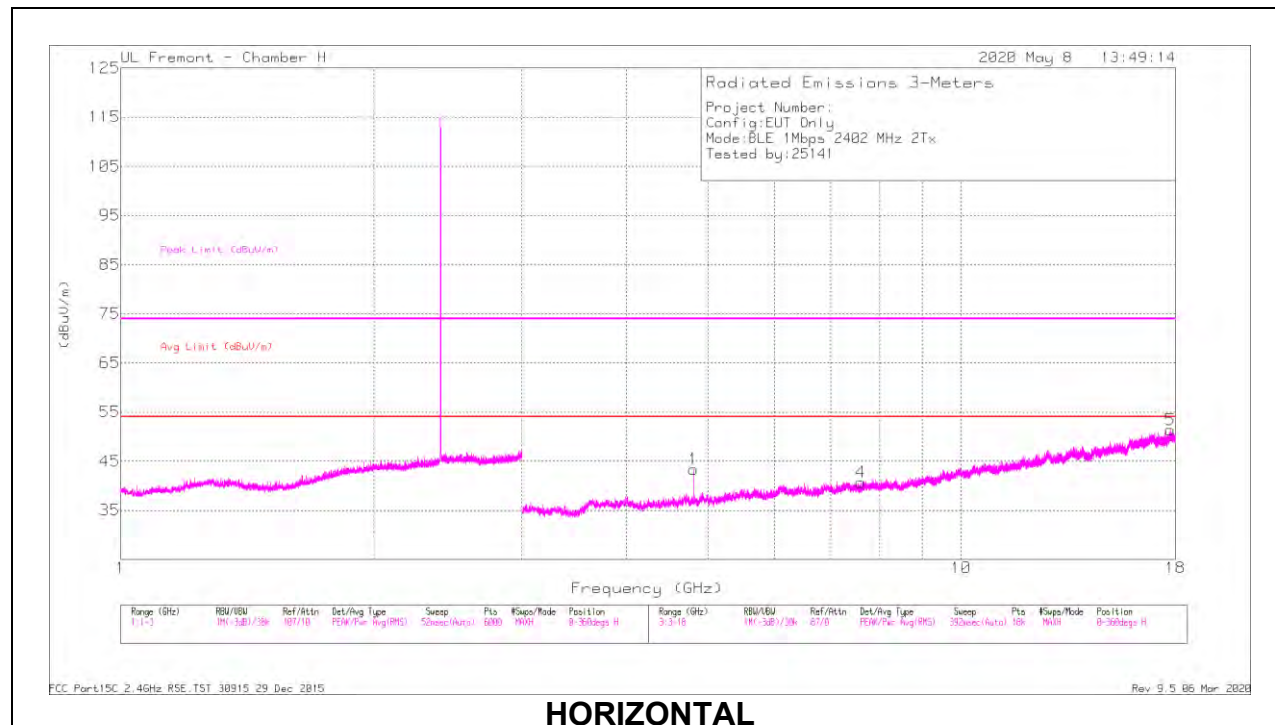
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



RADIATED EMISSIONS

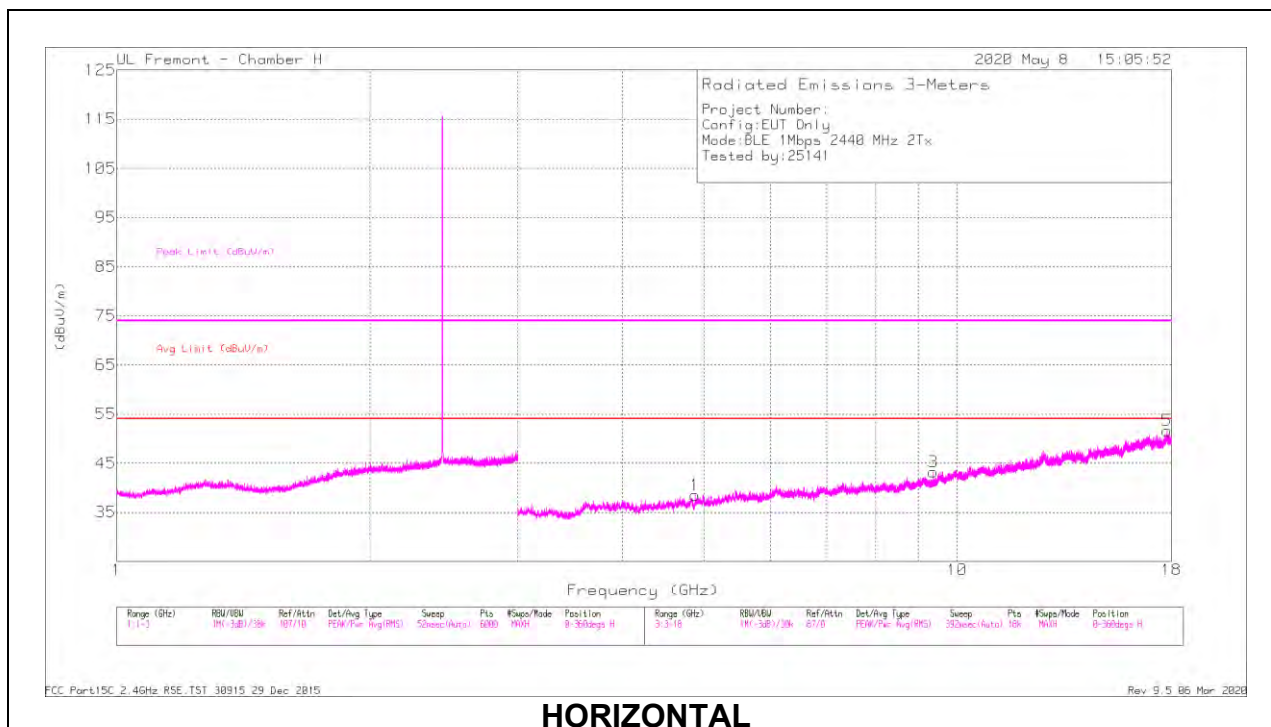
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Fitr/P ad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.80114	46.91	PK2	34.4	-31.5	49.81	-	-	74	-24.19	300	109	H
1	* 4.80342	38.05	MAv1	34.4	-31.5	40.95	54	-13.05	-	-	300	109	H
2	* 4.80066	45.42	PK2	34.4	-31.5	48.32	-	-	74	-25.68	263	378	V
2	* 4.80271	34.51	MAv1	34.4	-31.5	37.41	54	-16.59	-	-	263	378	V
3	6.41007	40.79	PK2	35.7	-29.5	46.99	-	-	-	-	0	246	V
3	6.40929	29.15	MAv1	35.7	-29.5	35.35	-	-	-	-	0	246	V
4	* 7.5986	39.52	PK2	36.2	-28.2	47.52	-	-	74	-26.48	206	110	H
4	* 7.59506	27.61	MAv1	36.2	-28.3	35.51	54	-18.49	-	-	206	110	H
5	* 17.75814	35.96	PK2	41.4	-19.5	57.86	-	-	74	-16.14	92	216	H
5	* 17.75762	24.49	MAv1	41.4	-19.5	46.39	54	-7.61	-	-	92	216	H
6	* 17.7539	36.6	PK2	41.4	-19.6	58.4	-	-	74	-15.6	60	156	V
6	* 17.75363	24.58	MAv1	41.4	-19.6	46.38	54	-7.62	-	-	60	156	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

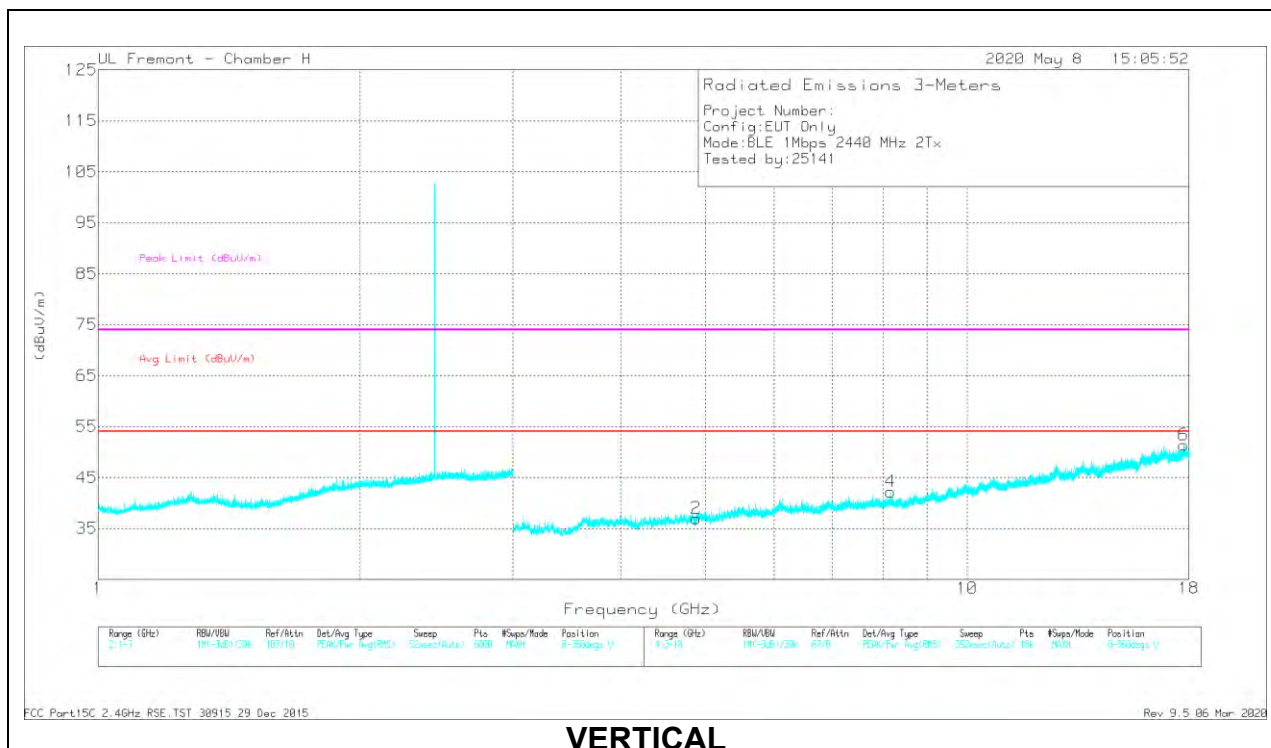
PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

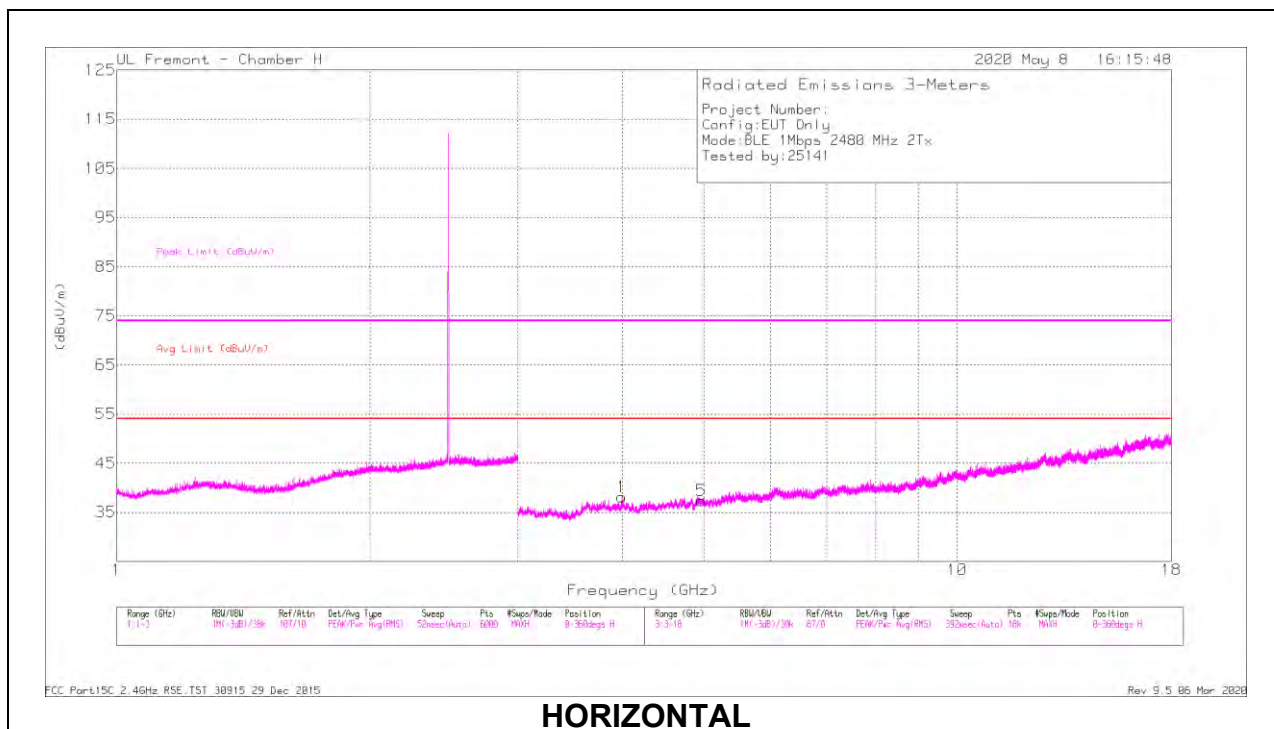
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtr/P ad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.88012	43.19	PK2	34.3	-31.4	46.09	-	-	74	-27.91	9	101	H
1	* 4.88013	32.75	MAv1	34.3	-31.4	35.65	54	-18.35	-	-	9	101	H
2	* 4.88019	43.4	PK2	34.3	-31.4	46.3	-	-	74	-27.7	356	347	V
2	* 4.87996	33.18	MAv1	34.3	-31.4	36.08	54	-17.92	-	-	356	347	V
3	* 9.37466	38.11	PK2	36.5	-25.2	49.41	-	-	74	-24.59	0	204	H
3	* 9.37295	25.76	MAv1	36.5	-25.3	36.96	54	-17.04	-	-	0	204	H
4	* 8.16579	38.08	PK2	36	-26.4	47.68	-	-	74	-26.32	49	255	V
4	* 8.16402	26.54	MAv1	36	-26.4	36.14	54	-17.86	-	-	49	255	V
5	* 17.77363	36.08	PK2	41.4	-19.4	58.08	-	-	74	-15.92	19	217	H
5	* 17.77129	24.36	MAv1	41.3	-19.4	46.26	54	-7.74	-	-	19	217	H
6	* 17.76131	35.36	PK2	41.4	-19.4	57.36	-	-	74	-16.64	257	126	V
6	* 17.76071	24.44	MAv1	41.4	-19.4	46.44	54	-7.56	-	-	257	126	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

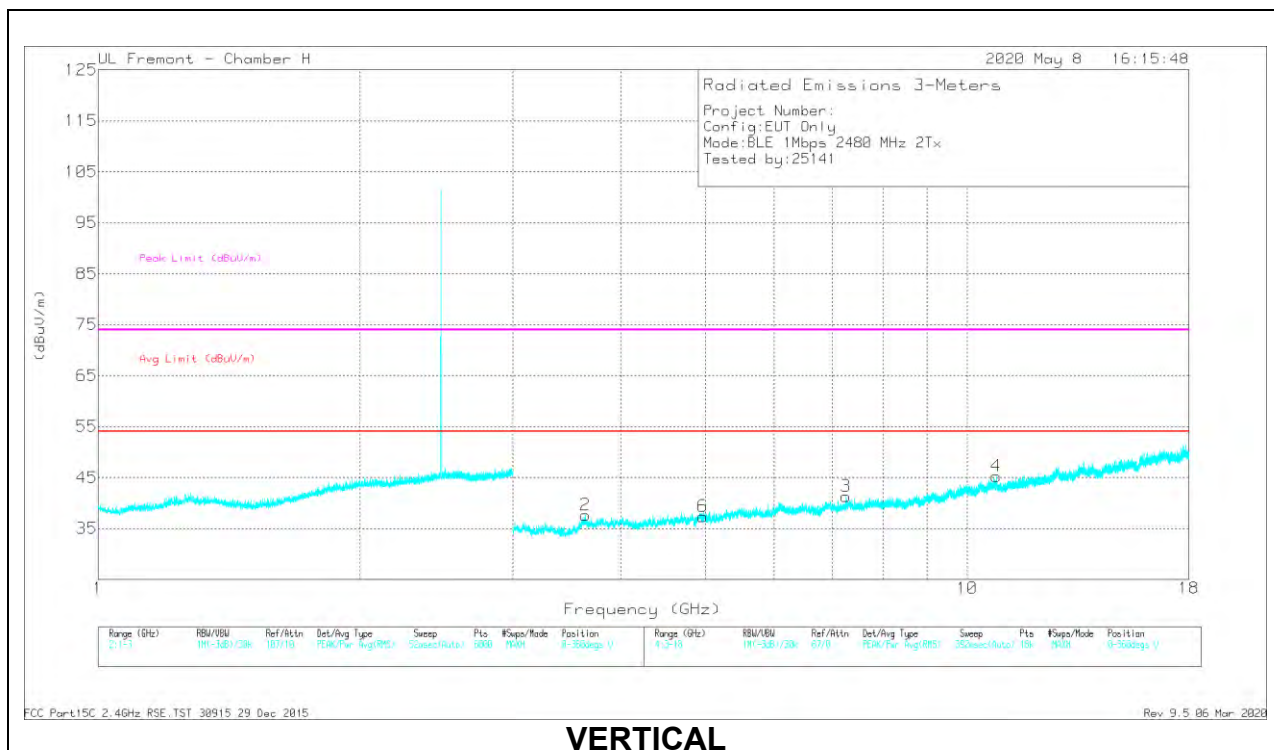
PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL