



CERTIFICATION TEST REPORT

Report Number. : 12935947-E1V2

Applicant : Microsoft Corporation
One Microsoft Way
Redmond, WA 98052-6399
USA

Model : 1872

FCC ID : C3K1872

IC : 3048A-1872

EUT Description : Portable Computing Device

Test Standard(s) : FCC 47 CFR PART 15 SUBPART C
ISED RSS-247 ISSUE 2
ISED RSS-GEN ISSUE 5

Date Of Issue:
September 10, 2019

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



NVLAP Lab code: 200065-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	8/29/2019	Initial Issue	--
V2	9/9/2019	Section 8.2: 99% OBW updated Section 11: Statement added, Setup photos Removed	Jose Martinez

TABLE OF CONTENTS

REPORT REVISION HISTORY	2
TABLE OF CONTENTS	3
1. ATTESTATION OF TEST RESULTS	5
2. TEST METHODOLOGY	7
3. FACILITIES AND ACCREDITATION	7
4. CALIBRATION AND UNCERTAINTY	8
4.1. MEASURING INSTRUMENT CALIBRATION	8
4.2. SAMPLE CALCULATION	8
4.3. MEASUREMENT UNCERTAINTY	8
5. EQUIPMENT UNDER TEST	9
5.1. EUT DESCRIPTION	9
5.2. MAXIMUM OUTPUT POWER	9
5.3. DESCRIPTION OF AVAILABLE ANTENNAS	9
5.4. SOFTWARE AND FIRMWARE	9
5.5. WORST-CASE CONFIGURATION AND MODE	9
5.6. DESCRIPTION OF TEST SETUP	10
6. TEST AND MEASUREMENT EQUIPMENT	13
7. MEASUREMENT METHOD	14
8. ANTENNA PORT TEST RESULTS	15
8.1. ON TIME AND DUTY CYCLE	15
8.2. 99% BANDWIDTH	17
8.2.1. BLE (125Kbps)	18
8.2.2. BLE (500Kbps)	19
8.2.3. BLE (1Mbps)	20
8.2.4. BLE (2Mbps)	21
8.3. 6 dB BANDWIDTH	22
8.3.1. BLE (125Kbps)	23
8.3.2. BLE (500Kbps)	24
8.3.3. BLE (1Mbps)	25
8.3.4. BLE (2Mbps)	26
8.4. OUTPUT POWER	27
8.4.1. BLE (125Kbps)	28
8.4.2. BLE (500Kbps)	28
8.4.3. BLE (1Mbps)	28

8.4.4.	BLE (2Mbps).....	28
8.5.	<i>AVERAGE POWER</i>	29
8.5.1.	BLE (125Kbps)	30
8.5.1.	BLE (500Kbps)	30
8.5.1.	BLE (1Mbps).....	30
8.5.2.	BLE (2Mbps).....	31
8.6.	<i>POWER SPECTRAL DENSITY</i>	32
8.6.1.	BLE (125Kbps)	33
8.6.2.	BLE (500Kbps)	34
8.6.3.	BLE (1Mbps).....	35
8.6.4.	BLE (2Mbps).....	36
8.7.	<i>CONDUCTED SPURIOUS EMISSIONS</i>	37
8.7.1.	BLE (125Kbps)	38
8.7.2.	BLE (500Kbps)	39
8.7.3.	BLE (1Mbps).....	40
8.7.4.	BLE (2Mbps).....	41
9.	RADIATED TEST RESULTS	42
9.1.	<i>LIMITS AND PROCEDURE</i>	42
9.2.	<i>TRANSMITTER ABOVE 1 GHz</i>	44
9.2.1.	BLE (125Kbps)	44
9.2.1.	BLE (500Kbps)	54
9.2.2.	BLE (1Mbps).....	64
9.2.3.	BLE (2Mbps).....	74
9.3.	<i>SPURIOUS EMISSIONS FOR COLLOCATION</i>	84
9.4.	<i>WORST CASE BELOW 30MHZ</i>	85
9.5.	<i>WORST CASE BELOW 1 GHZ</i>	87
9.6.	<i>WORST CASE 18-26 GHZ</i>	89
10.	AC POWER LINE CONDUCTED EMISSIONS	91
10.1.1.	AC Power Line Norm.....	92
11.	SETUP PHOTOS	94

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Microsoft Corporation
One Microsoft Way
Redmond, WA 98052-6399
USA

EUT DESCRIPTION: Portable Computing Device

MODEL: 1872

SERIAL NUMBER: 006404792757(Conducted)
013880192757(Conducted)
013885392757(Radiated)
014813492757(Radiated)

DATE TESTED: July 17, 2019 –September 9, 2019

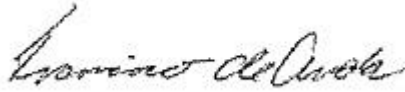
APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Complies
ISED RSS-247 Issue 2	Complies
ISED RSS-GEN Issue 5	Complies

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:



Francisco DeAnda
OPERATIONS LEAD
Consumer Technology Division
UL Verification Services Inc.

Prepared By:



Eric Yu
TEST ENGINEER
Consumer Technology Division
UL Verification Services Inc.

Reviewed By:



Henry Lau
PROJECT ENGINEER
Consumer Technology Division
UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, KDB 558074 D01 15.247 Meas Guidance v05r02, RSS-GEN Issue 5, and RSS-247 Issue 2.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, 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 type="checkbox"/> Chamber A	<input type="checkbox"/> Chamber D	<input checked="" type="checkbox"/> Chamber I
<input type="checkbox"/> Chamber B	<input type="checkbox"/> Chamber E	<input type="checkbox"/> Chamber J
<input type="checkbox"/> Chamber C	<input type="checkbox"/> Chamber F	<input checked="" 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

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:

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

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.
 $36.5 \text{ dBuV} + 0 \text{ dB} + 10.1 \text{ dB} + 0 \text{ dB} = 46.6 \text{ dBuV}$

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.84 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	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%.

5. EQUIPMENT UNDER TEST

5.1. EUT DESCRIPTION

The EUT is a Portable Computing Device.

5.2. MAXIMUM OUTPUT POWER

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

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2402 - 2480	BLE	2.29	1.69

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PIFA antenna, with a maximum gain of -2.2 dBi.

5.4. SOFTWARE AND FIRMWARE

The operating system installed on the EUT is MTEOS 1.652.0.

The Bluetooth Driver installed on the EUT is version 21.0.19157.20088.

The test utility software used during testing was version 11.1916.0-09531

5.5. WORST-CASE CONFIGURATION AND MODE

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

Band edge and radiated emissions between 1GHz and 18GHz were performed with the EUT set to transmit at the highest power on low, middle and high channels.

The EUT has one intended orientations, X; therefore, all final radiated testing was performed with the EUT in X orientation.

Data rates provided by the client were:

BLE mode: 125kbps
BLE mode: 500kbps
BLE mode: 1Mbps
BLE mode: 2Mbps

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
AC DC Adapter	Microsoft	1706	0C130J02T8396	DoC
USB Mouse	Microsoft	1113	X821908-002	DoC
USB Type C to Audio Jack	SONY	A1-0231	N/A	DoC
Earphone	SONY	AG1100	N/A	DoC
Earphone	SONY	AG1100	N/A	DoC

I/O CABLES (CONDUCTED TEST)

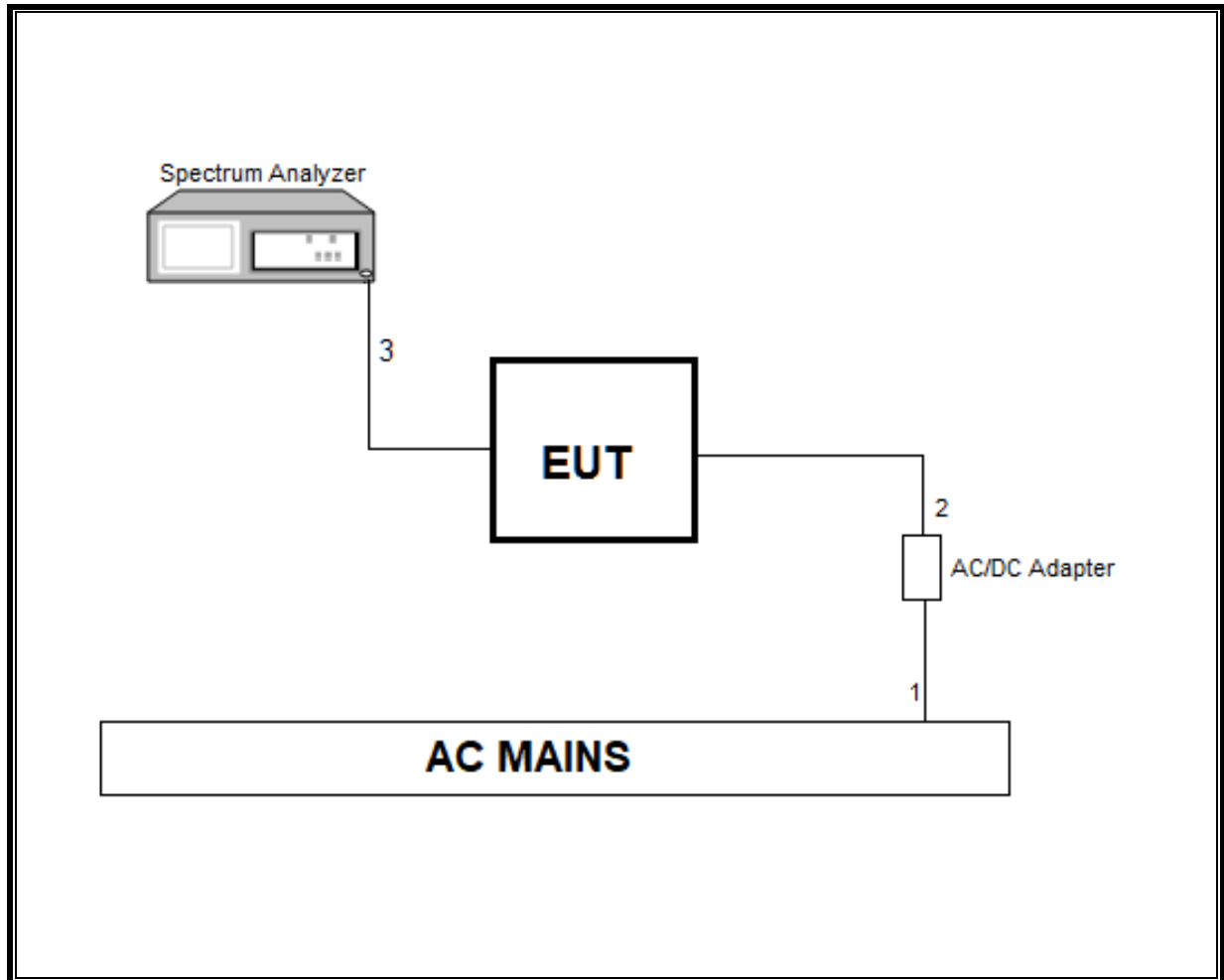
I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	AC	Un-Shielded	0.2	to AC/DC Adaptor
2	DC	1	DC	Shielded	1	to Laptop, to EUT
3	Antenna	1	SMA	Un-Shielded	0.2	to Analyzer

I/O CABLES (RADIATED AND CONDUCTED EMISSIONS)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	Type C	Un-shielded	0.2	to AC/DC Adapter
2	DC	1	DC	Shielded	1	to EUT
3	USB	1	Type A	Shielded	1.5	EUT TO Mouse
4	USB	1	Type C	Shielded	0.1	EUT to earphone AUX
5	earphone	1	3.5mm	Un-shielded	1	EUT to earphone

TEST SETUP

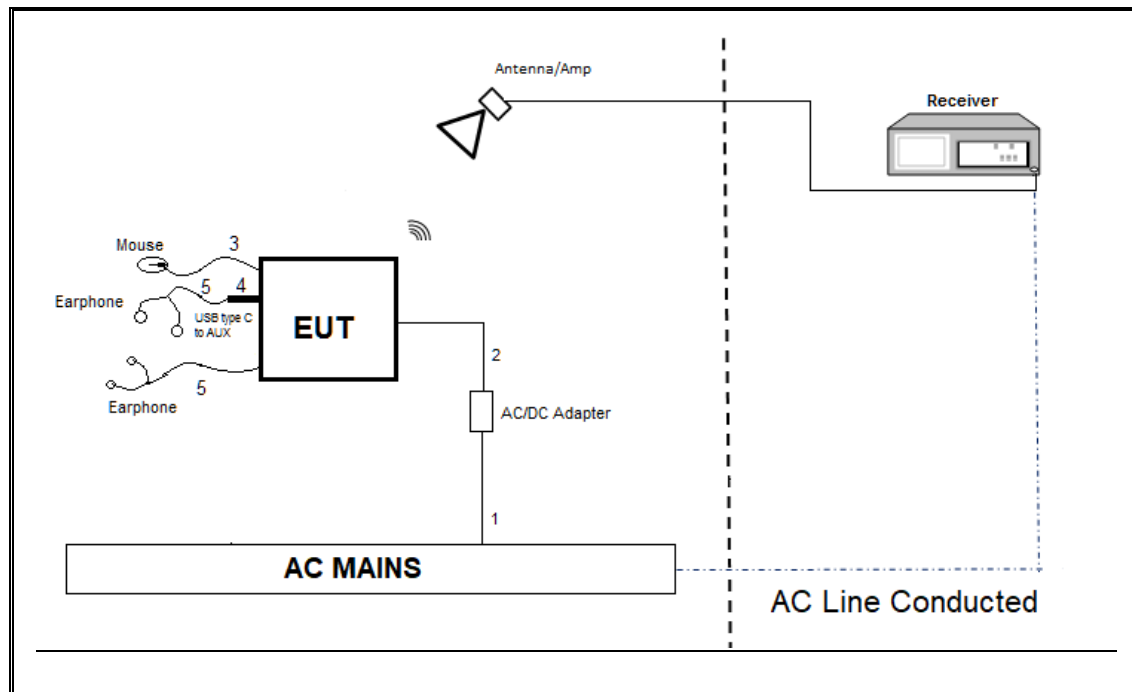
CONDUCTED TEST SETUP DIAGRAM



TEST SETUP

For conducted tests, the test software exercises the radio.

RADIATED AND AC LINE CONDUCTED EMISSIONS SETUP DIAGRAM



TEST SETUP

For radiated tests: EUT is connected to all support equipment. The test software exercises the radio.

6. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST					
Description	Manufacturer	Model	ID Num	Cal Due	Last Cal
Antenna, Passive Loop 30Hz to 1MHz	ELETRO METRICS	EM-6871	PRE0179465	05/31/2020	05/31/2019
Antenna, Passive Loop 100kHz to 30MHz	ELETRO METRICS	EM-6872	PRE0179467	05/31/2020	05/31/2019
Amplifier, 9kHz to 1GHz, 32dB	Sonoma Instrument	310	PRE01886650	12/13/2019	12/13/2018
Hybrid Antenna, 30MHz to 3GHz	Sunol Sciences Corp	JB3	PRE0184971	11/13/2019	11/13/2018
Amplifier, 9kHz to 1GHz, 32 dB	Sonoma Instrument	310	PRE0180175	06/29/2020	06/29/2019
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	EMC4294	06/14/2020	06/14/2019
Amplifier, 1 to 18GHz, 35dB	AMPLICAL	AMP1G18-35	T1569	06/04/2020	06/04/2019
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T862	06/05/2020	06/05/2019
Amplifier, 1 to 18GHz	MITEQ	AFS42-00101800-25-S-42	PRE018078	08/01/2019	08/01/2018
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826/B	PRE0182188	08/29/2019	08/29/2018
Rf Amplifier, 18-26.5GHz, 60dB gain	Amplical	AMP18G26.5-60	PRE0181238	05/01/2020	05/01/2019
Power Meter, P-series single channel	Agilent (Keysight) Technologies	N1911A	T1265	01/29/2020	01/29/2019
Power Sensor, P-series, 50MHz to 18GHz, Wideband	Agilent (Keysight) Technologies	N1921A	T1227	02/05/2020	02/05/2019
EMI Test Receiver	Rohde & Schwarz	ESW44	PRE0179367	05/16/2020	05/16/2019
EMI Test Receiver	Rohde & Schwarz	ESW44	PRE0179372	02/16/2020	02/16/2019
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T908	01/23/2020	01/23/2019
AC Line Conducted					
EMI Receiver	Rohde & Schwarz	ESR	T1436	02/14/2020	02/14/2019
LISN for Conducted Emissions CISPR-16	FCC INC.	FCC LISN 50/250	T1310	01/24/2020	01/24/2019
Test Software List					
Radiated Software	UL	UL EMC	Ver 9.5, June 22, 2018 & Jan 11, 2019		
Antenna Port Software	UL	UL RF	Ver 9.9, June 05, 2019		
AC Line Conducted Software	UL	UL EMC	Ver 9.5, May 26, 2015		

NOTES:

- Equipment listed above that calibrated during the testing period was set for test after the calibration.
- Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.

7. MEASUREMENT METHOD

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

6 dB BW: ANSI C63.10 Subclause -11.8.1

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 Method AVGPM-G (Measurement using a gated RF average-reading 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

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

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

Band-edge: ANSI C63.10 Subclause -11.13.3.4 Integration method -Trace averaging across ON and OFF times DC correction

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

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

8. ANTENNA PORT TEST RESULTS

8.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

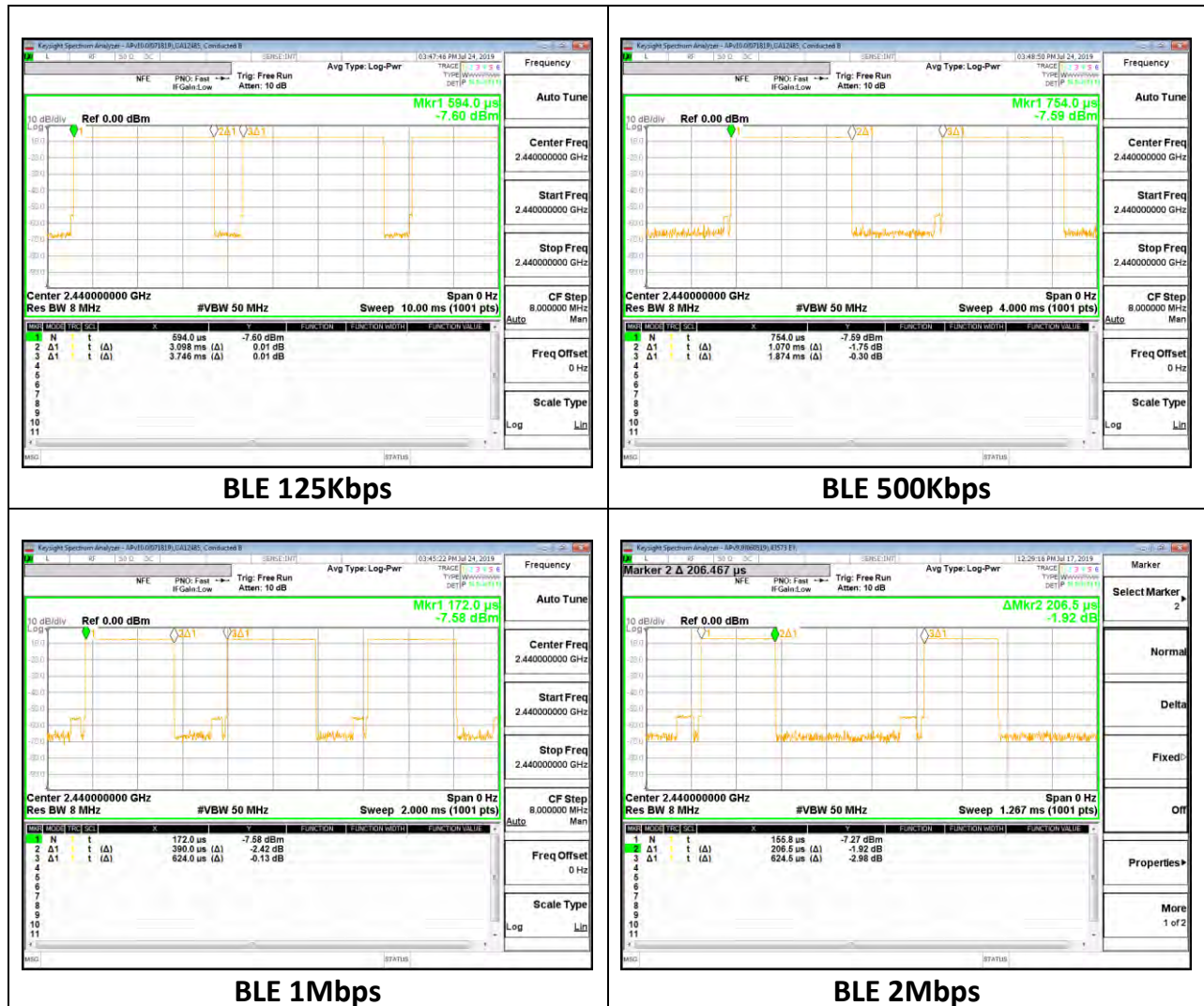
PROCEDURE

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 125Kbps	3.098	3.746	0.827	82.70%	0.82	0.323
BLE 500Kbps	1.070	1.874	0.571	57.10%	2.43	0.935
BLE 1Mbps	0.390	0.624	0.625	62.52%	2.04	2.563
BLE 2Mbps	0.207	0.625	0.331	33.07%	4.81	4.843

DUTY CYCLE PLOTS



8.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

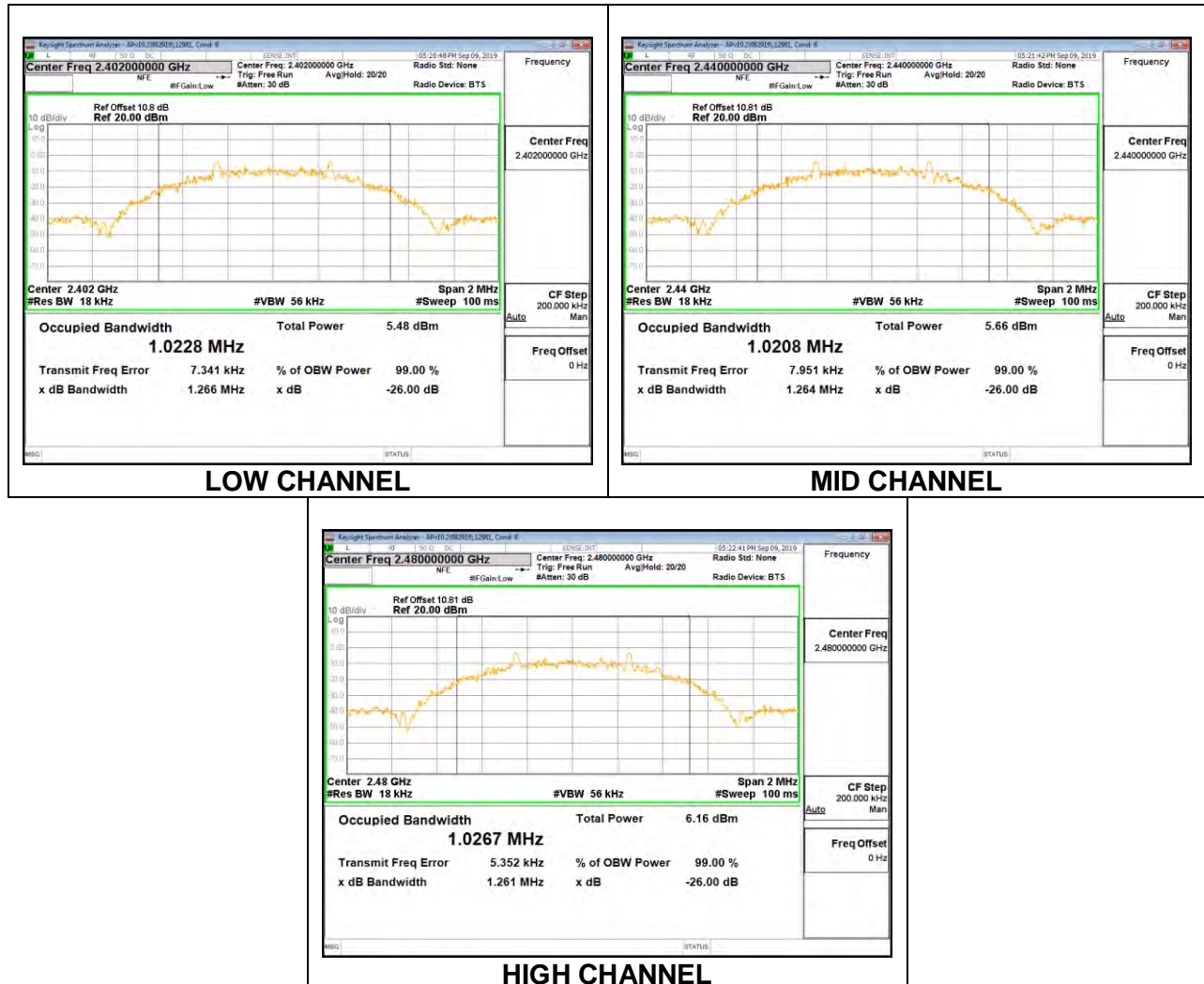
8.2.1. BLE (125Kbps)

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0556
Middle	2440	1.0514
High	2480	1.0531



8.2.2. BLE (500Kbps)

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0228
Middle	2440	1.0208
High	2480	1.0267



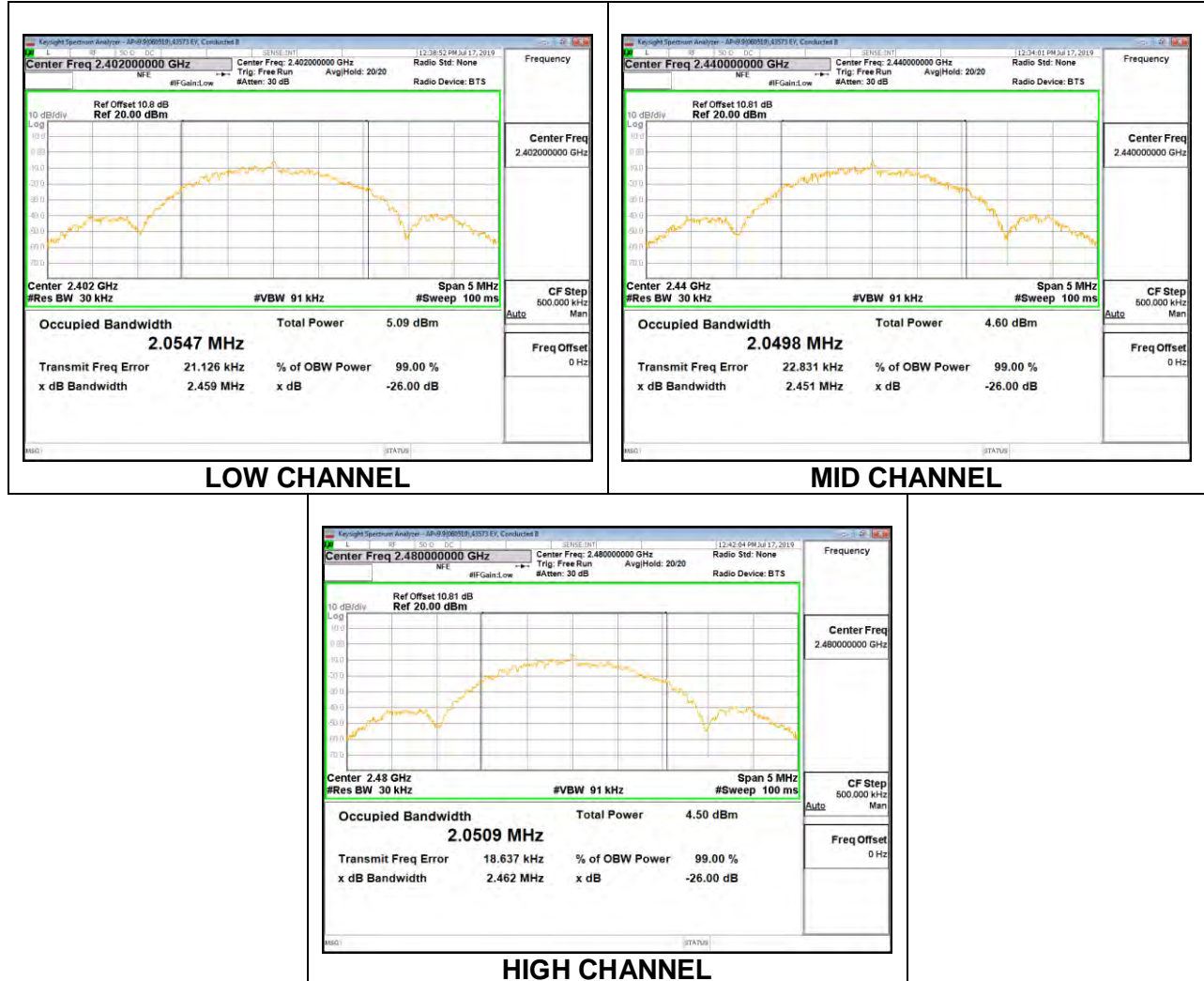
8.2.3. BLE (1Mbps)

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0424
Middle	2440	1.0410
High	2480	1.0412



8.2.4. BLE (2Mbps)

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	2.0547
Middle	2440	2.0498
High	2480	2.0509



8.3. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

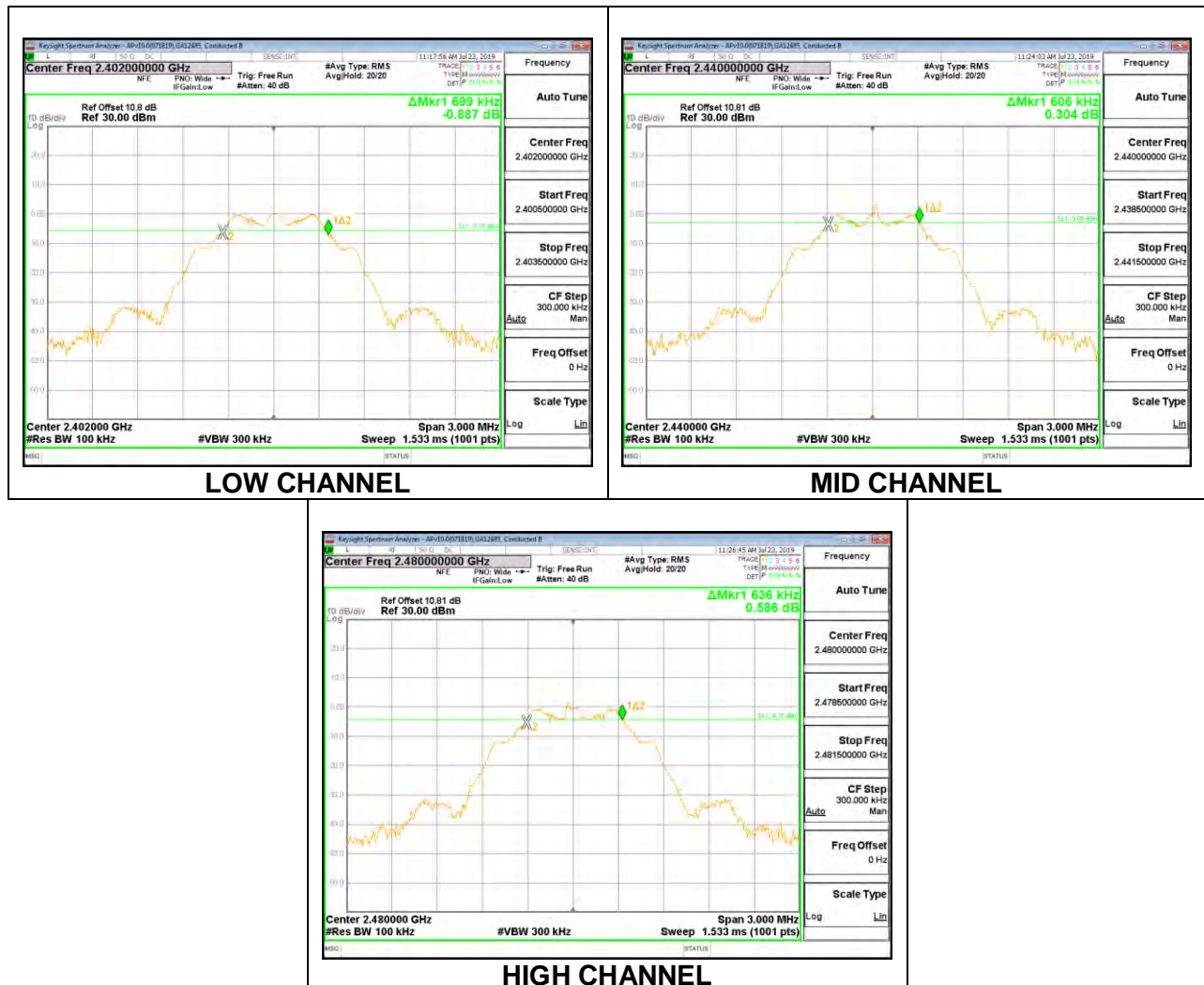
RSS-247 5.2 (a)

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

RESULTS

8.3.1. BLE (125Kbps)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.6990	0.5
Middle	2440	0.6060	0.5
High	2480	0.6360	0.5



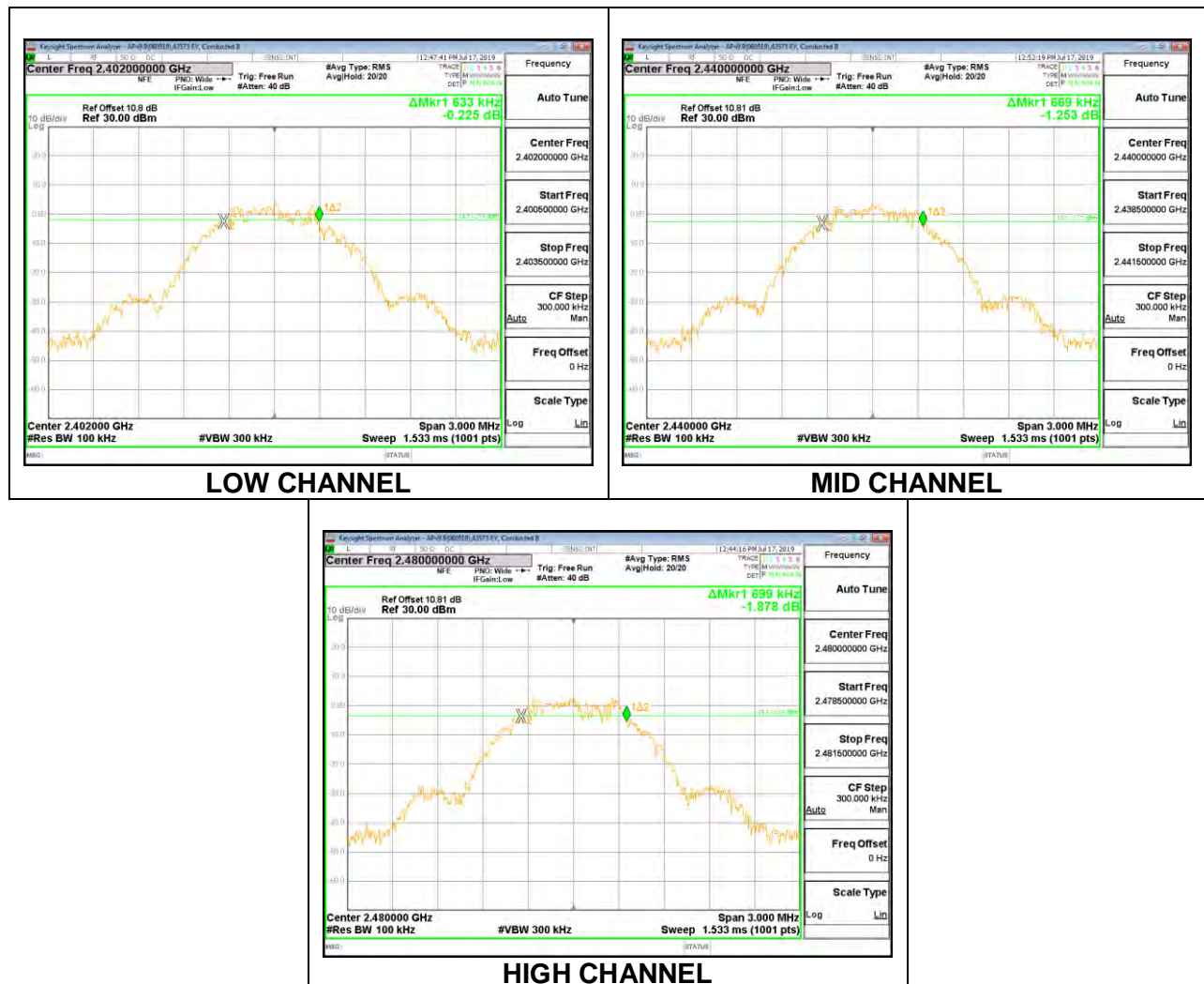
8.3.2. BLE (500Kbps)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.6420	0.5
Middle	2440	0.6240	0.5
High	2480	0.6360	0.5



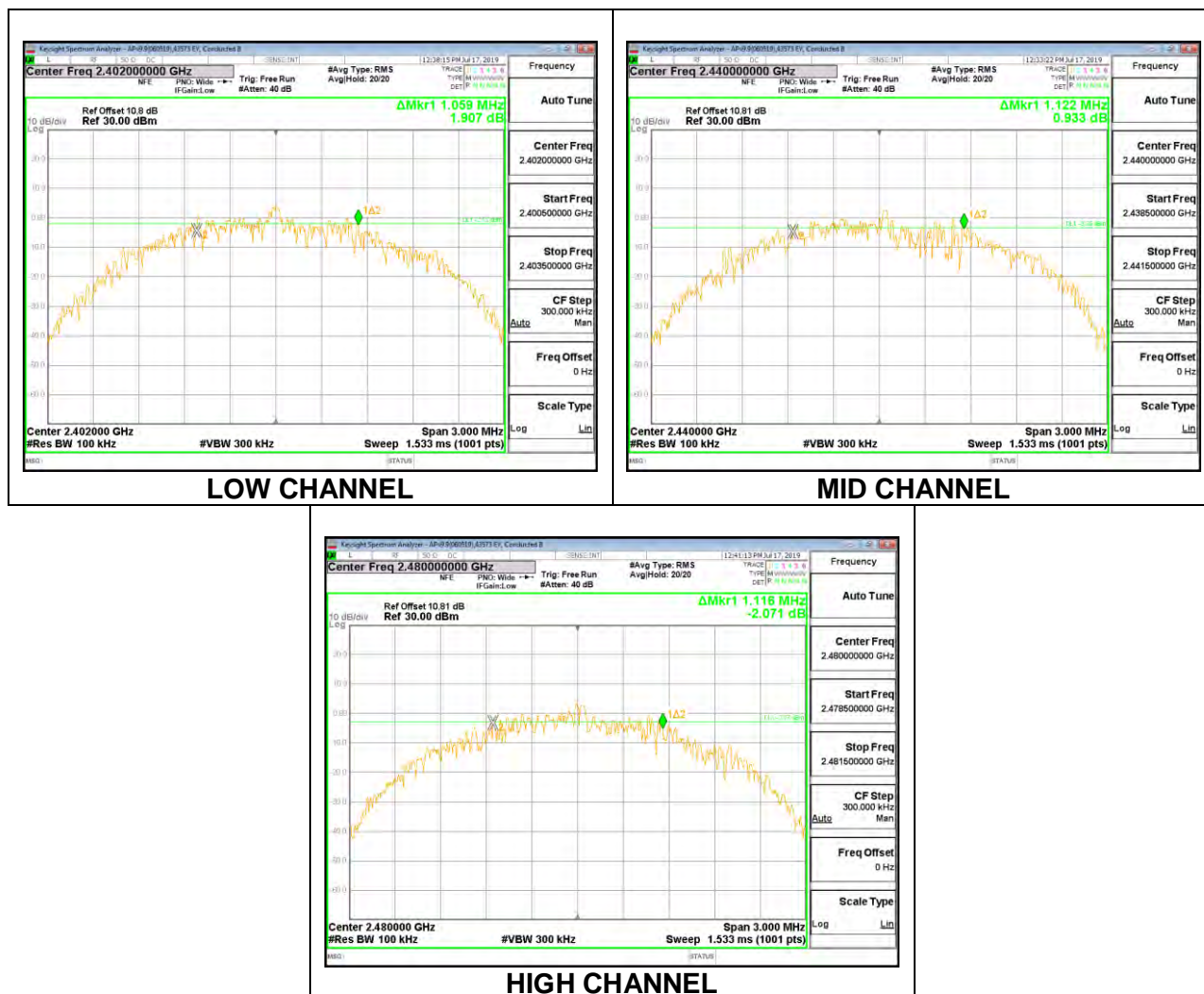
8.3.3. BLE (1Mbps)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.6330	0.5
Middle	2440	0.6690	0.5
High	2480	0.6990	0.5



8.3.4. BLE (2Mbps)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	1.0590	0.5
Middle	2440	1.1220	0.5
High	2480	1.1160	0.5



8.4. 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.

The cable assembly insertion loss was entered as an offset in the power meter to allow for a peak reading of power.

RESULTS

8.4.1. BLE (125Kbps)

Tested By:	10649 JR
Date:	8/22/2019

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	2.11	30	-27.890
Middle	2440	2.06	30	-27.940
High	2480	2.29	30	-27.710

8.4.2. BLE (500Kbps)

Tested By:	10649 JR
Date:	8/22/2019

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	2.16	30	-27.840
Middle	2440	2.10	30	-27.900
High	2480	2.25	30	-27.750

8.4.3. BLE (1Mbps)

Tested By:	10649 JR
Date:	8/22/2019

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	2.20	30	-27.800
Middle	2440	2.07	30	-27.930
High	2480	2.26	30	-27.740

8.4.4. BLE (2Mbps)

Tested By:	10649 JR
Date:	8/22/2019

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	2.15	30	-27.850
Middle	2440	2.08	30	-27.920
High	2480	2.23	30	-27.770

8.5. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss was entered as an offset in the power meter to allow for a gated average reading of power.

RESULTS

8.5.1. BLE (125Kbps)

Tested By:	10649 JR
Date:	8/22/2019

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	1.97
Middle	2440	1.93
High	2480	2.1

8.5.1. BLE (500Kbps)

Tested By:	10649 JR
Date:	8/22/2019

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	1.98
Middle	2440	1.94
High	2480	2.11

8.5.1. BLE (1Mbps)

Tested By:	10649 JR
Date:	8/22/2019

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	2.01
Middle	2440	1.93
High	2480	2.10

8.5.2. BLE (2Mbps)

Tested By:	10649 JR
Date:	8/22/2019

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	1.98
Middle	2440	1.93
High	2480	2.1

8.6. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

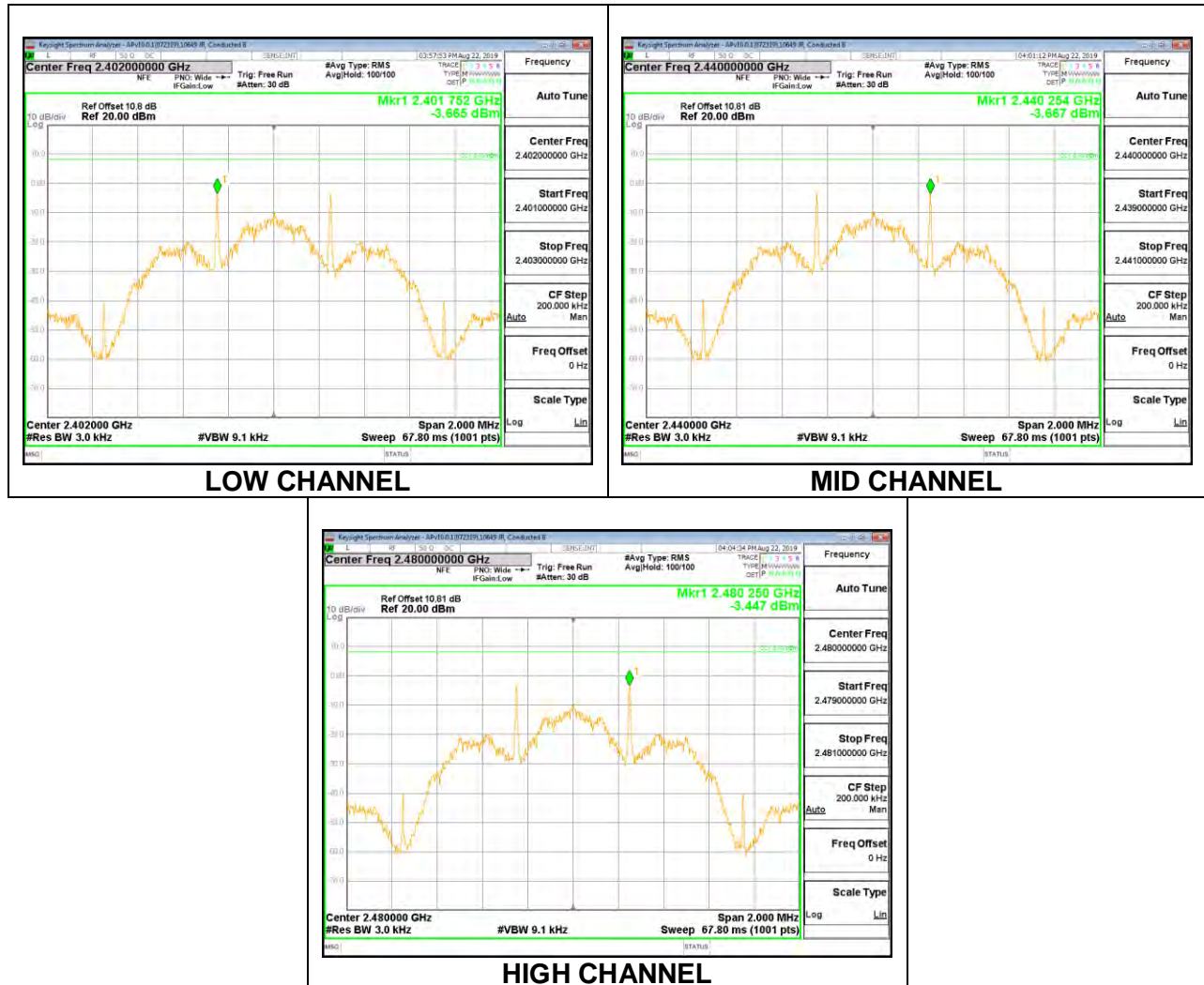
RSS-247 (5.2) (b)

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

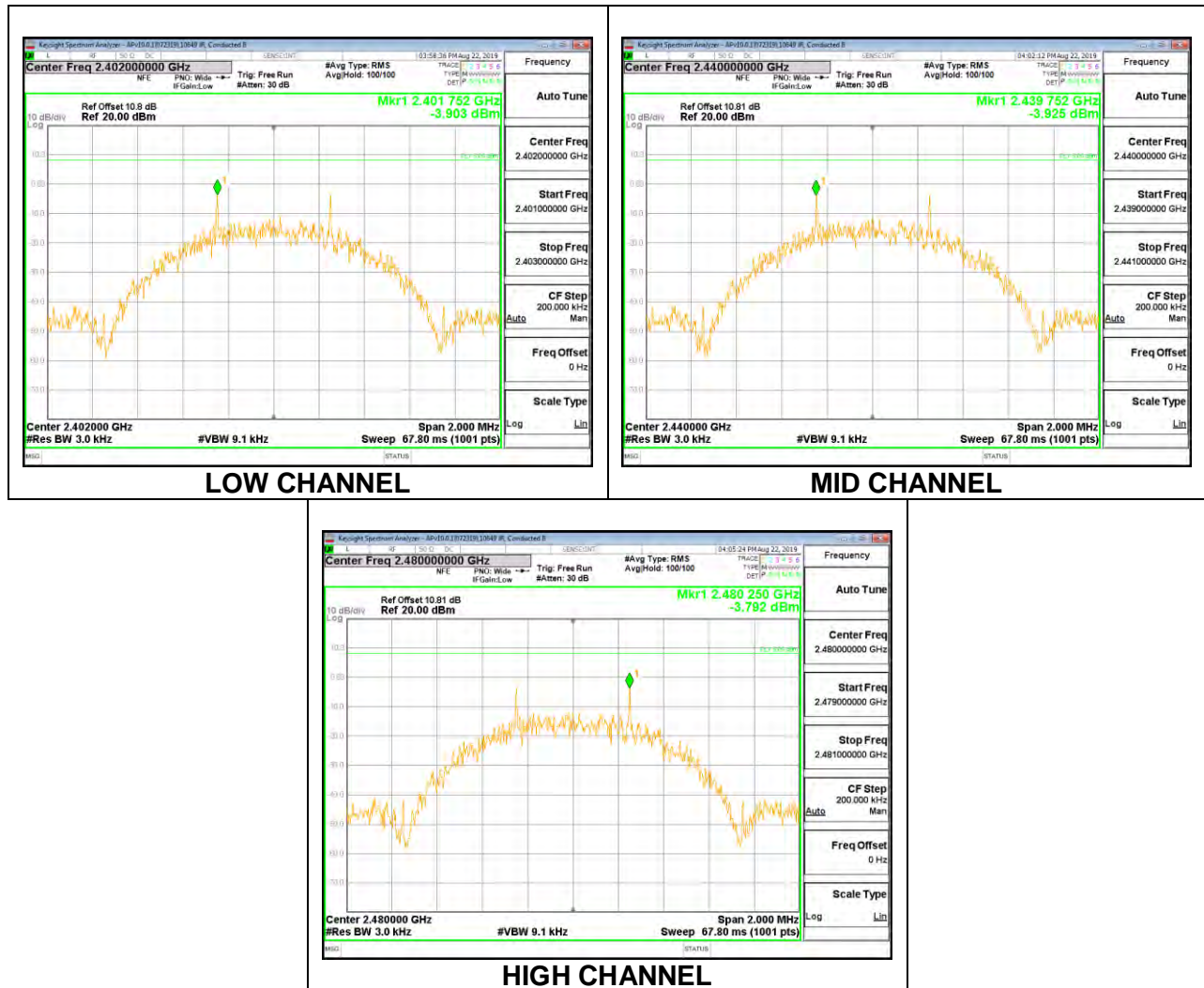
8.6.1. BLE (125Kbps)

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-3.67	8	-11.67
Middle	2440	-3.67	8	-11.67
High	2480	-3.45	8	-11.45



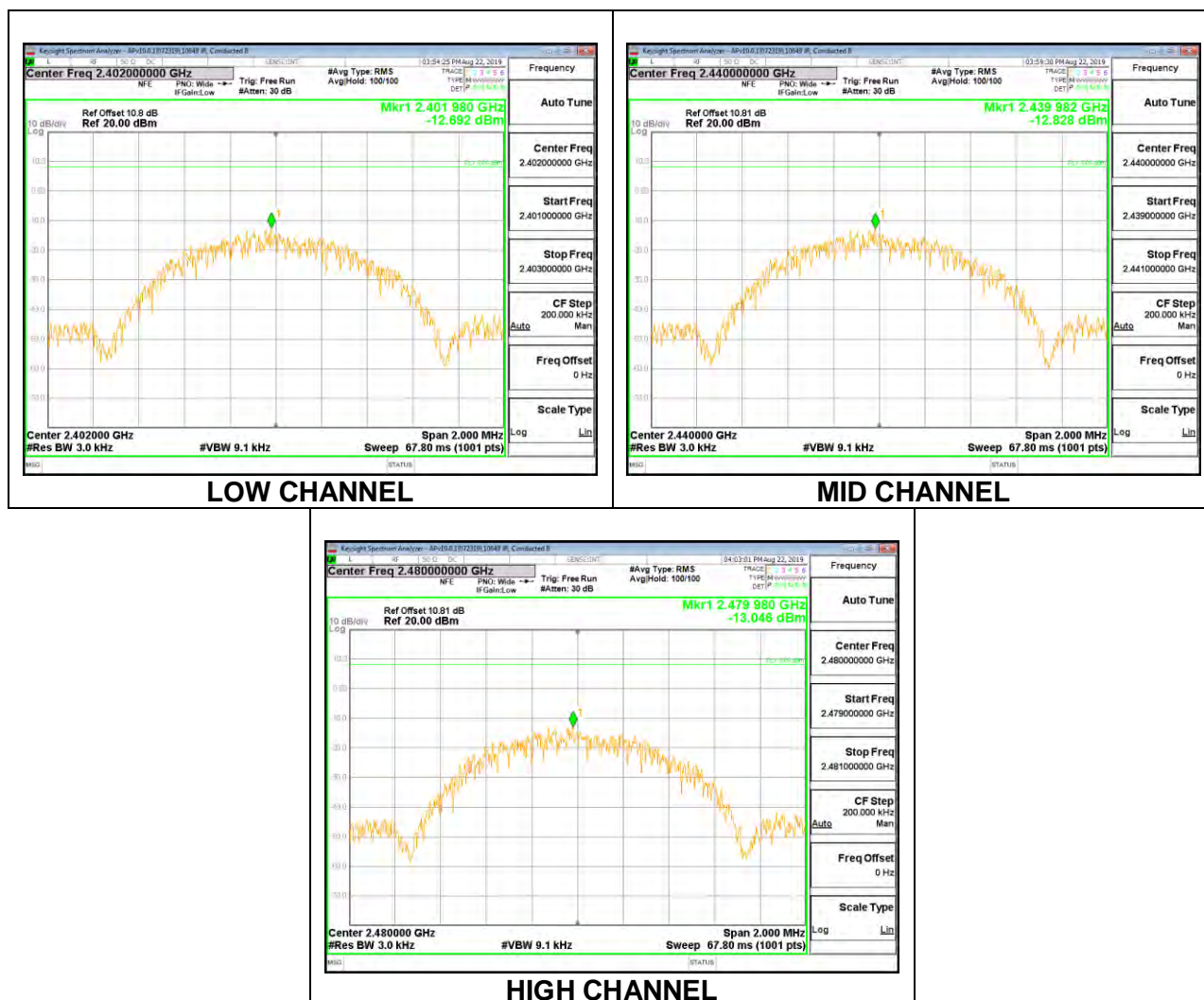
8.6.2. BLE (500Kbps)

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-3.99	8	-11.99
Middle	2440	-3.93	8	-11.93
High	2480	-3.79	8	-11.79



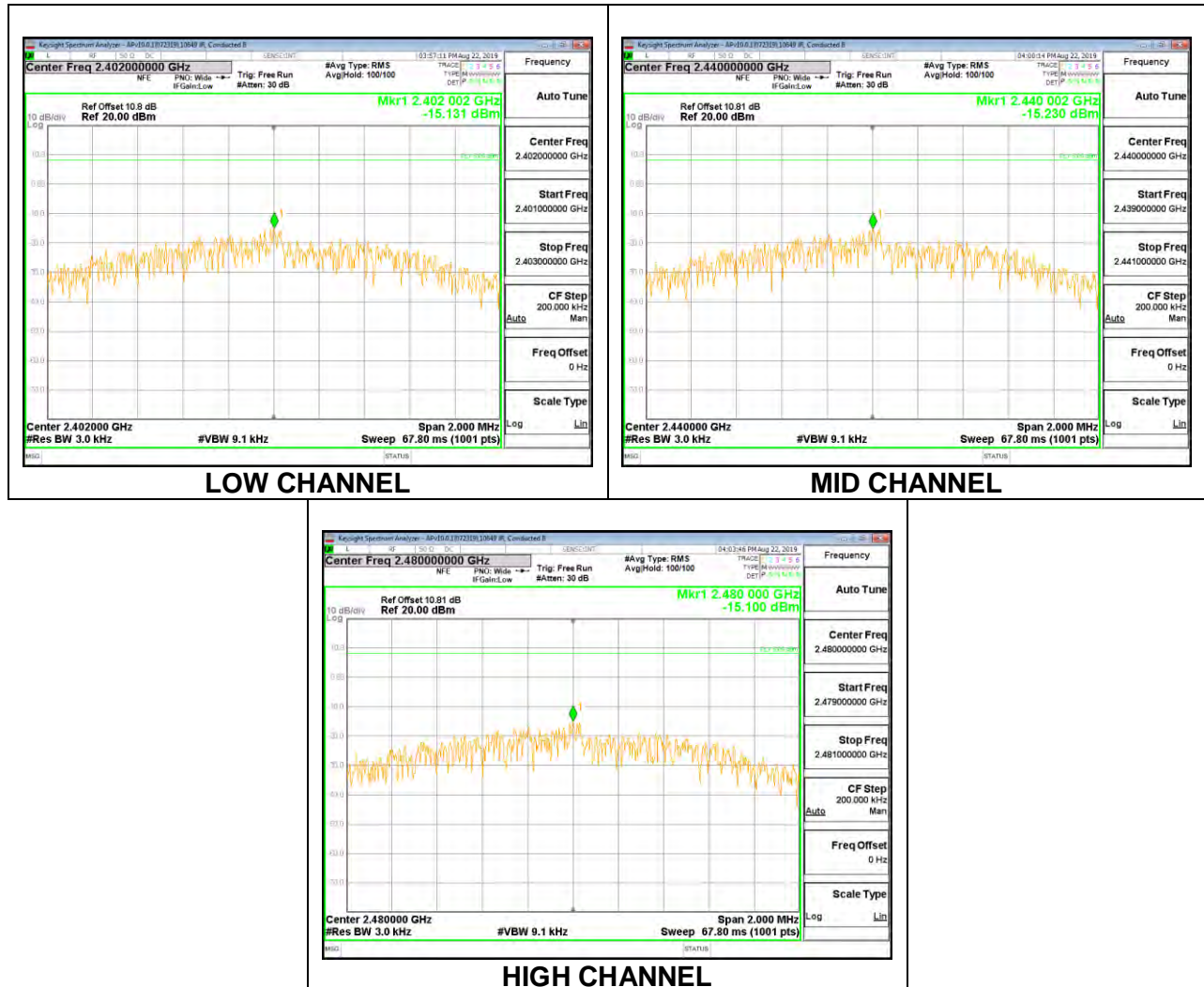
8.6.3. BLE (1Mbps)

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-12.69	8	-20.69
Middle	2440	-12.83	8	-20.83
High	2480	-13.05	8	-21.05



8.6.4. BLE (2Mbps)

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-15.13	8	-23.13
Middle	2440	-15.23	8	-23.23
High	2480	-15.10	8	-23.10



8.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

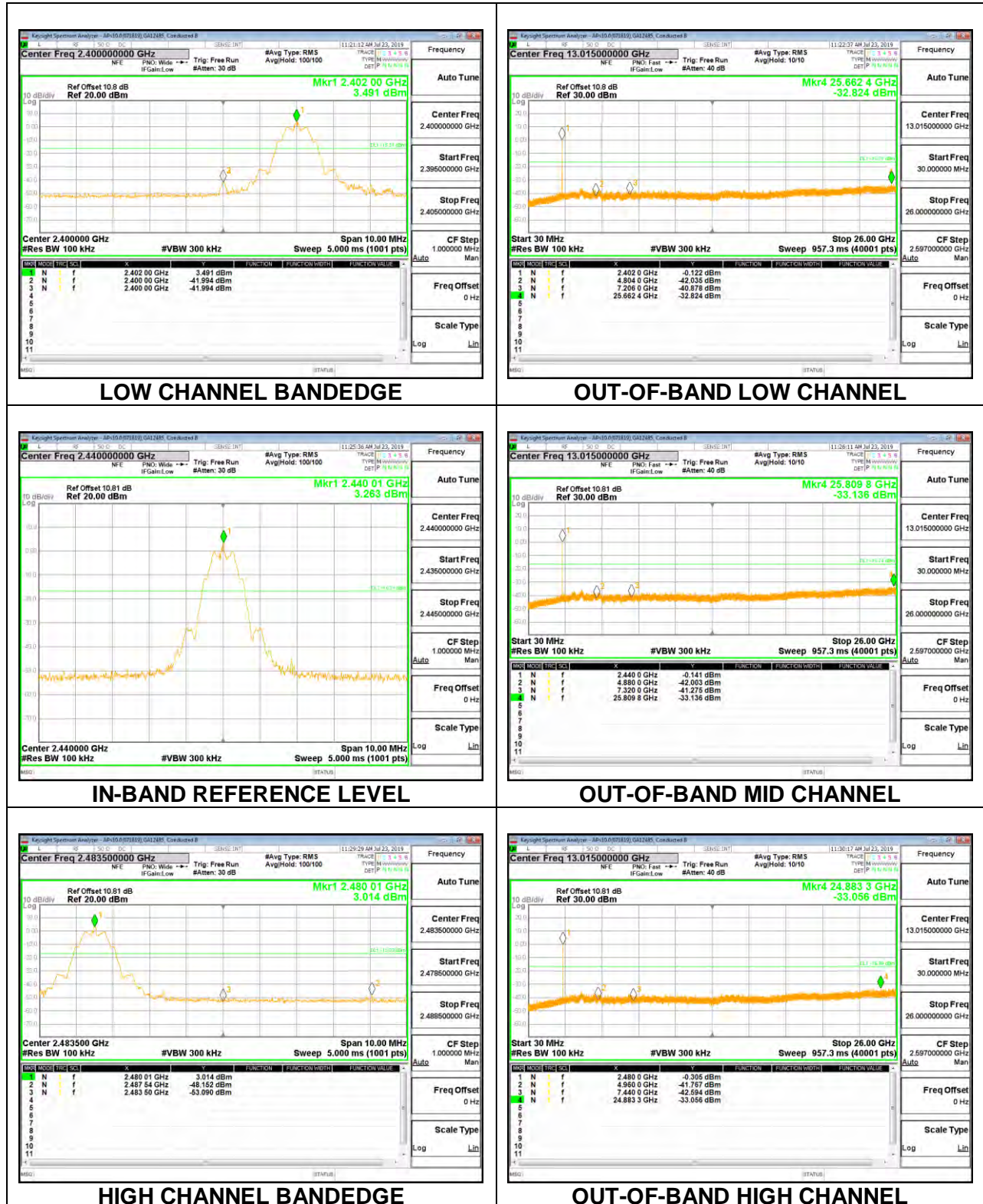
FCC §15.247 (d)

RSS-247 5.5

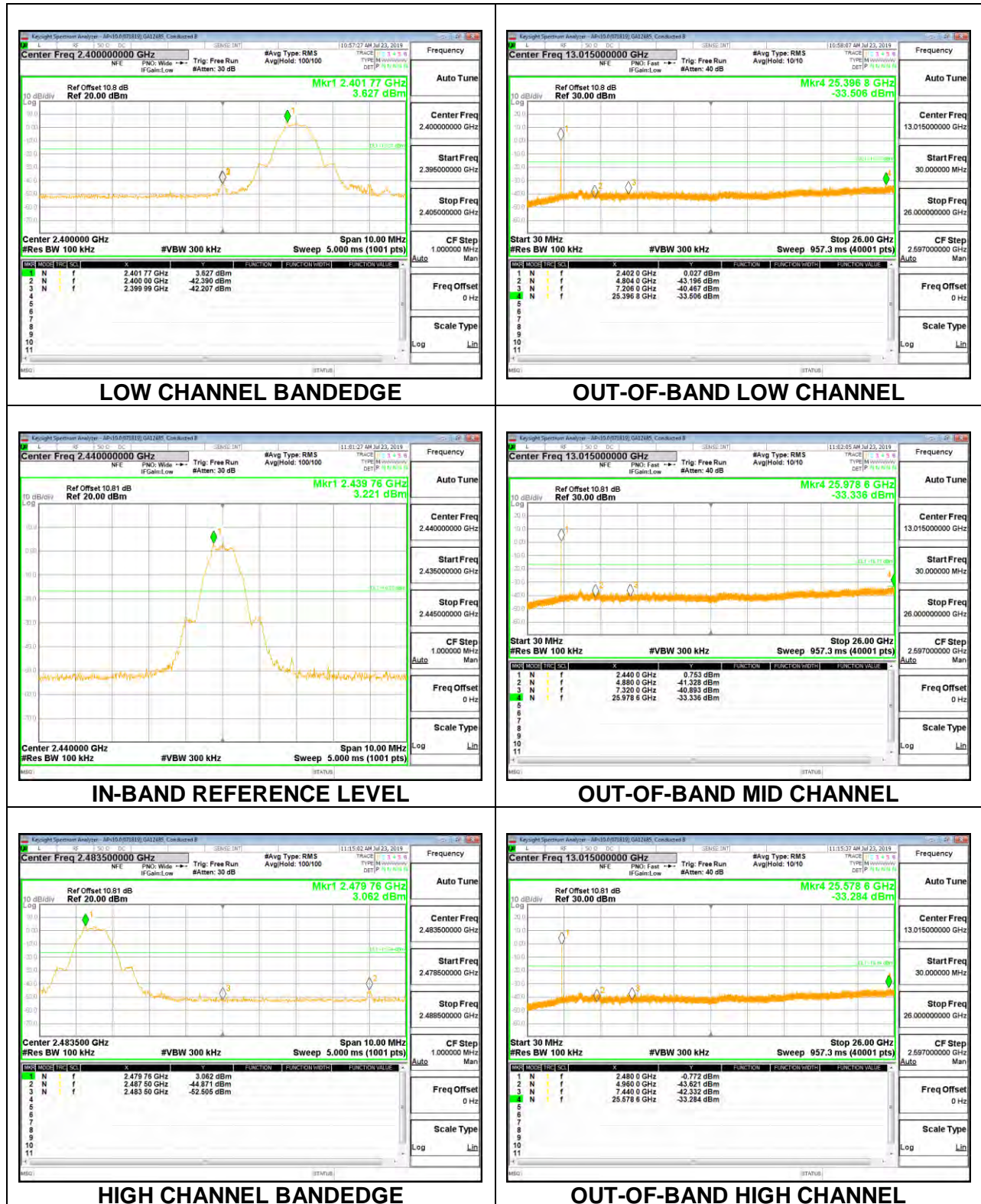
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

RESULTS

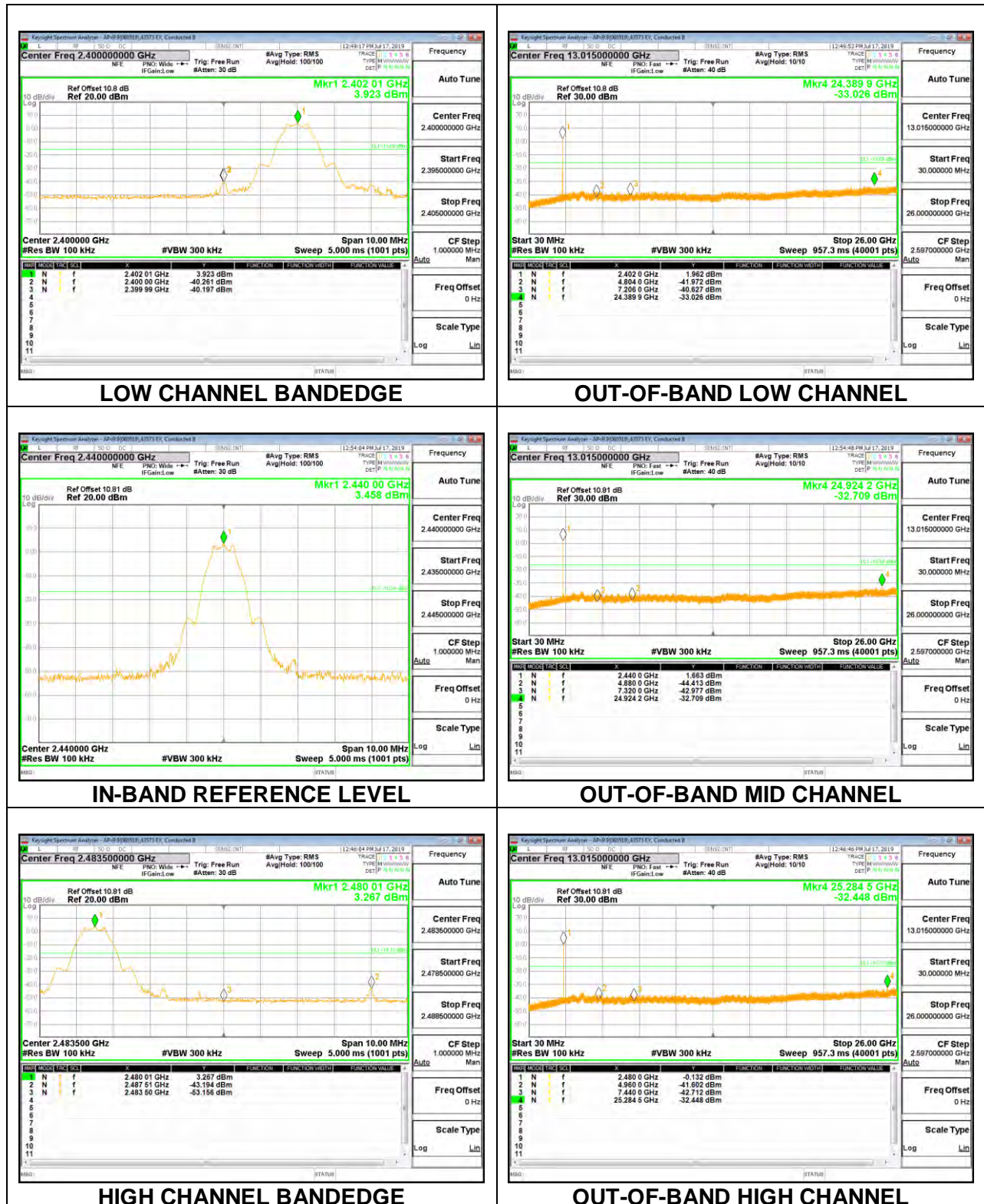
8.7.1. BLE (125Kbps)



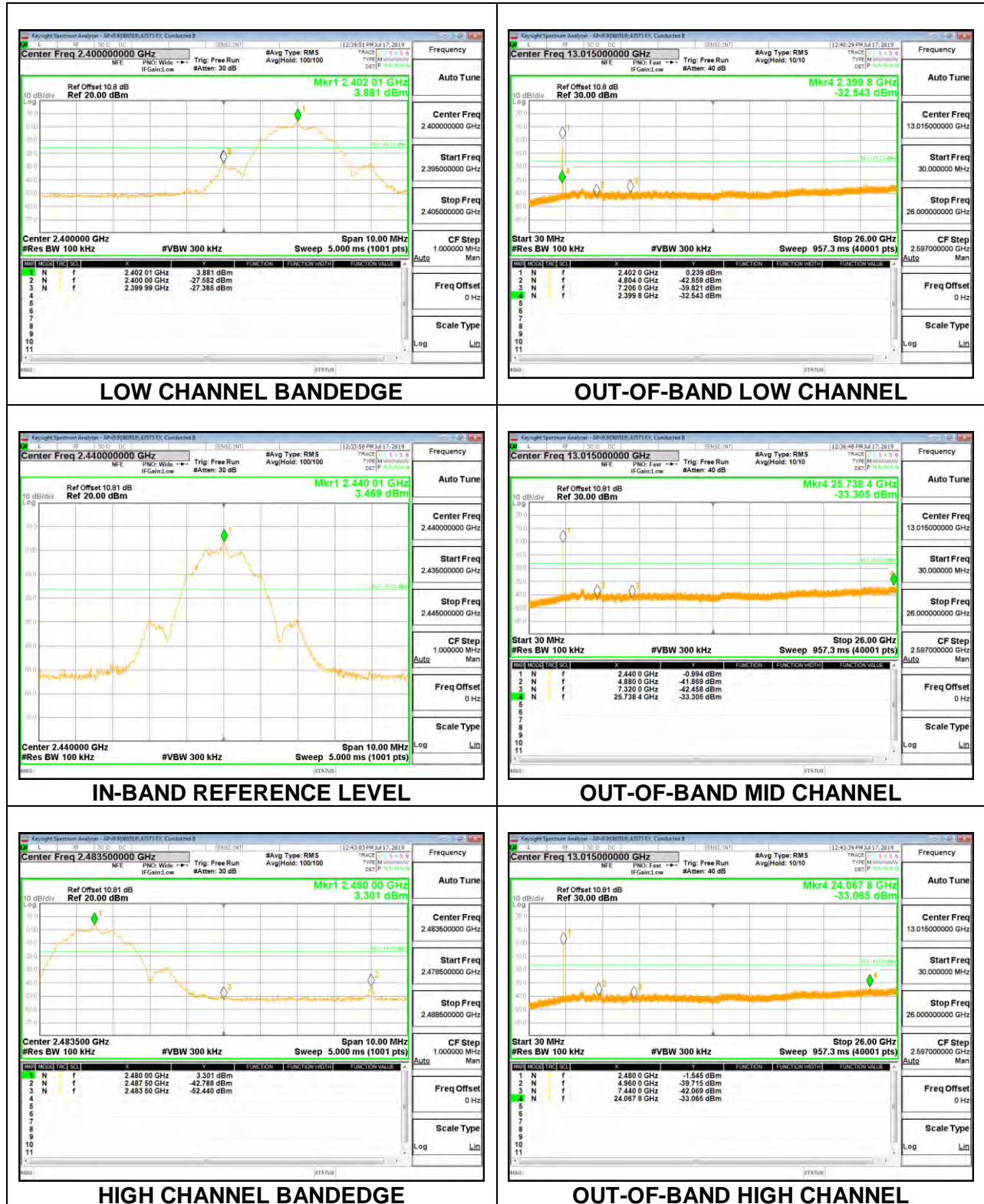
8.7.2. BLE (500Kbps)



8.7.3. BLE (1Mbps)



8.7.4. BLE (2Mbps)



9. RADIATED TEST RESULTS

9.1. 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 30MHz, 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.

2D antenna use - 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.

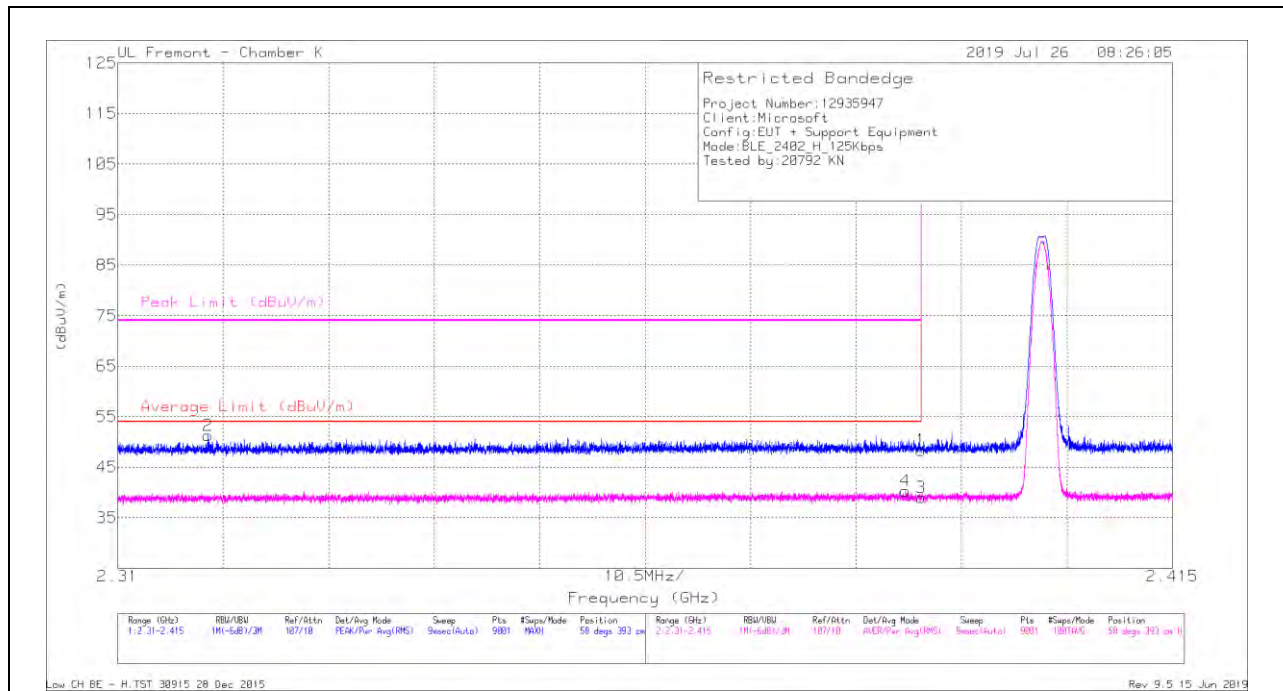
OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

9.2. TRANSMITTER ABOVE 1 GHz

9.2.1. BLE (125Kbps)

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



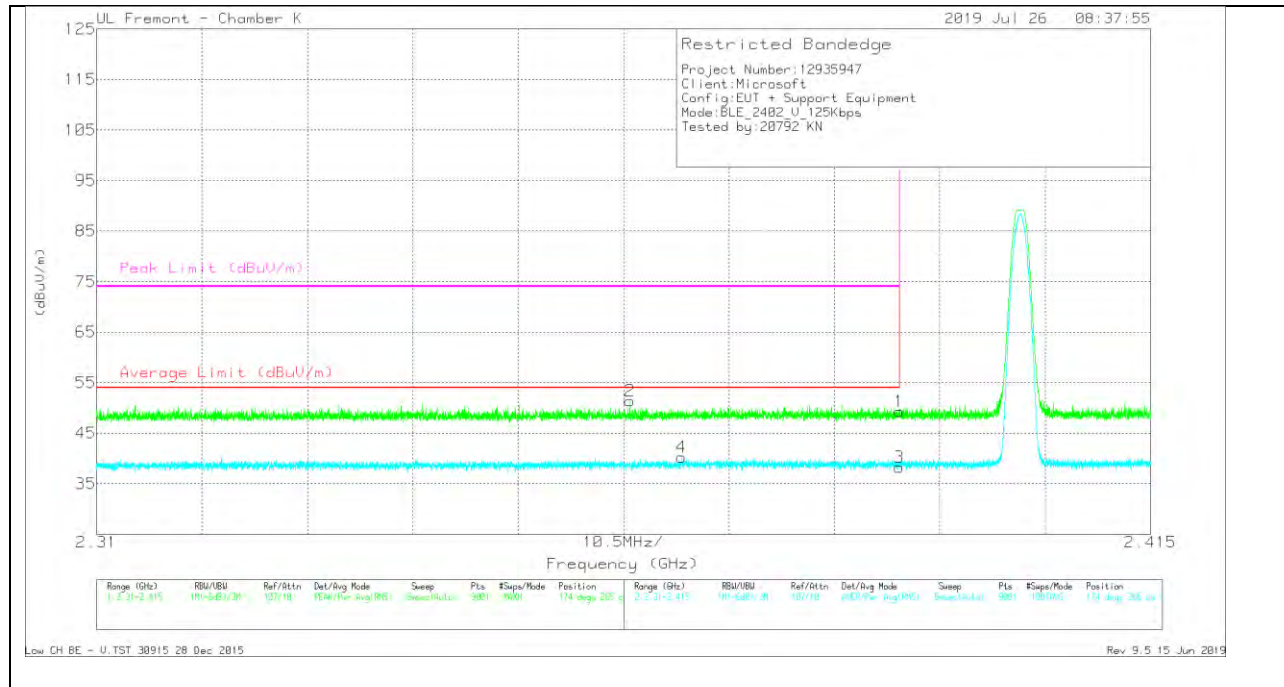
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (dBm)	Amp/Cb/Filt/Pa d (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.38999	41.17	Pk	31.9	-24.7	0	48.37	-	-	74	-25.63	58	393	H
2	* 2.319	44.27	Pk	31.6	-24.6	0	51.27	-	-	74	-22.73	58	393	H
3	* 2.38999	30.94	RMS	31.9	-24.7	.82	38.97	54	-15.03	-	-	58	393	H
4	* 2.38845	32.17	RMS	31.9	-24.6	.82	40.3	54	-13.7	-	-	58	393	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 EMC4294 (dBm)	Ant/Ch/Filt/Pad (dB)	DC Corr (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	42.09	Pk	31.9	-24.7	0	49.29	-	-	74	-24.71	174	265	V
2	* 2.36312	44.18	Pk	31.8	-24.6	0	51.38	-	-	74	-22.62	174	265	V
3	* 2.38999	30.18	RMS	31.9	-24.7	.82	38.21	54	-15.79	-	-	174	265	V
4	* 2.36827	32.22	RMS	31.8	-24.6	.82	40.25	54	-13.75	-	-	174	265	V

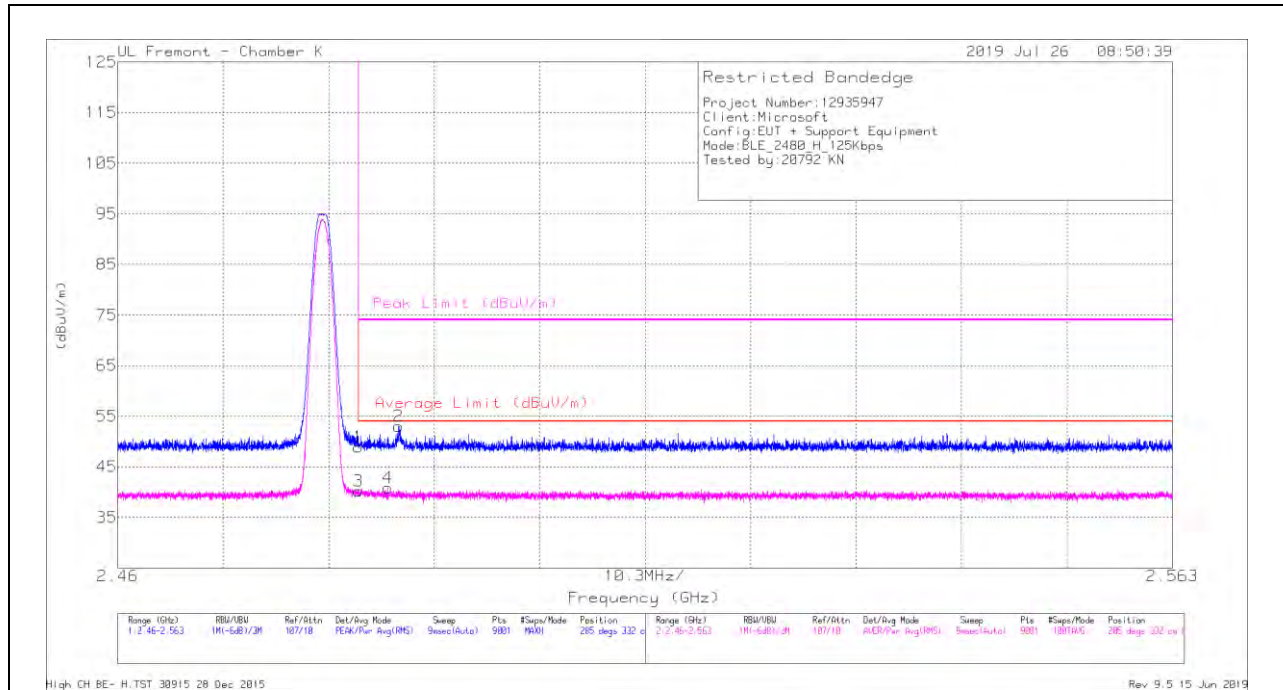
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



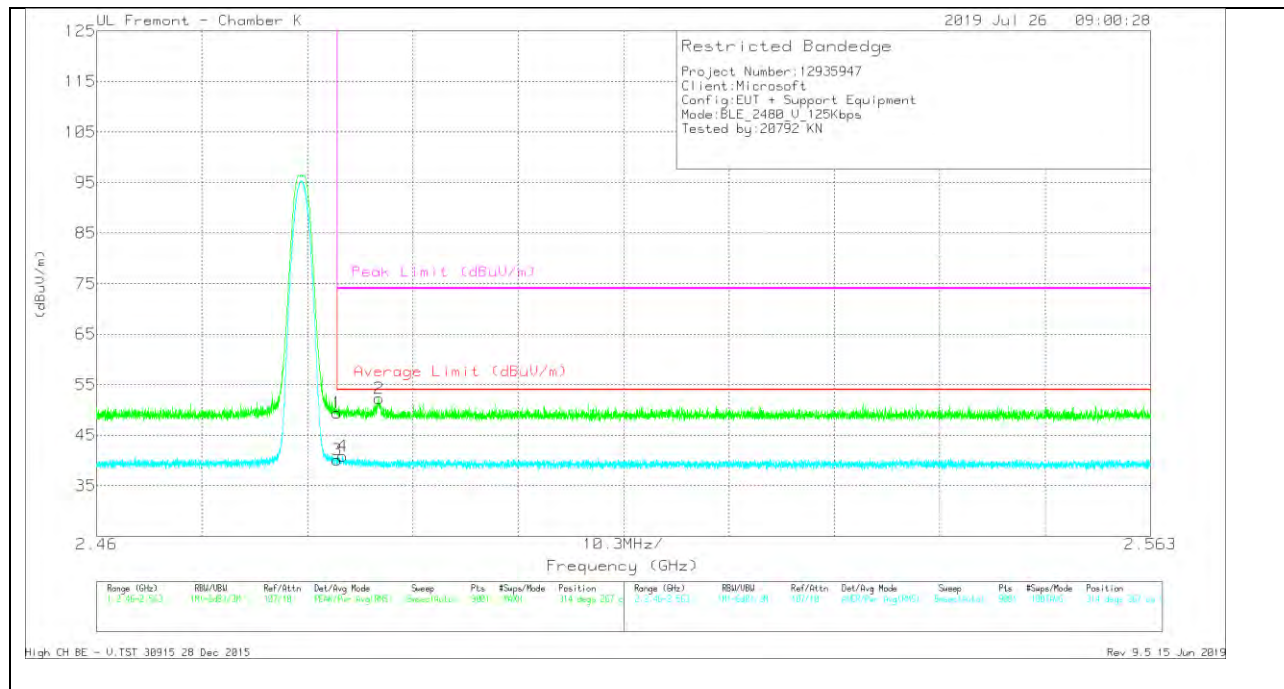
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (dBm)	Amp/Cb/Filt/Pa d (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*2.48351	41.19	Pk	32.5	-24.8	0	48.89	-	-	74	-25.11	285	332	H
2	*2.48743	45.32	Pk	32.5	-24.8	0	53.02	-	-	74	-20.98	285	332	H
3	*2.48351	31.75	RMS	32.5	-24.8	.82	40.28	54	-13.72	-	-	285	332	H
4	*2.48638	32.35	RMS	32.5	-24.8	.82	40.88	54	-13.12	-	-	285	332	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	AP EMC4294 (dBm)	Antp/Ch/Filt/Pa d (dB)	DC Corr (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	41.71	Pk	32.5	-24.8	0	49.41	-	-	74	-24.59	314	267	V
2	* 2.4876	44.54	Pk	32.5	-24.8	0	52.24	-	-	74	-21.76	314	267	V
3	* 2.48351	31.62	RMS	32.5	-24.8	.82	40.15	54	-13.85	-	-	314	267	V
4	* 2.48404	32.28	RMS	32.5	-24.8	.82	40.81	54	-13.19	-	-	314	267	V

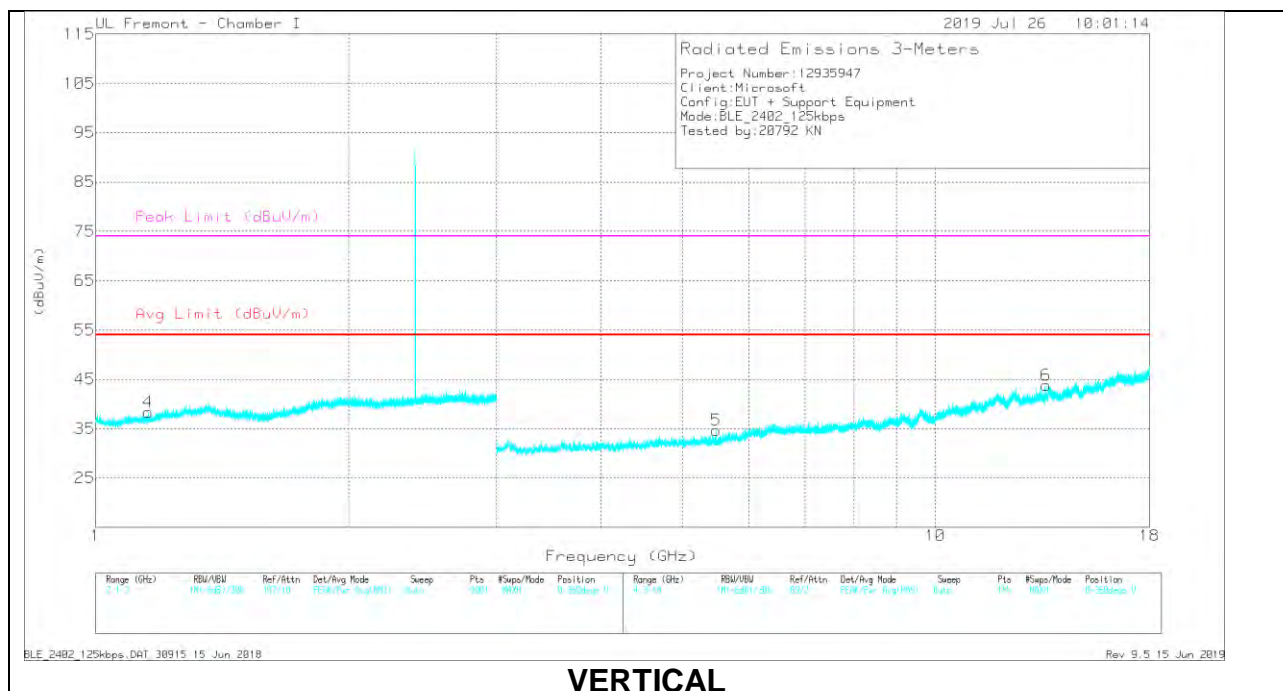
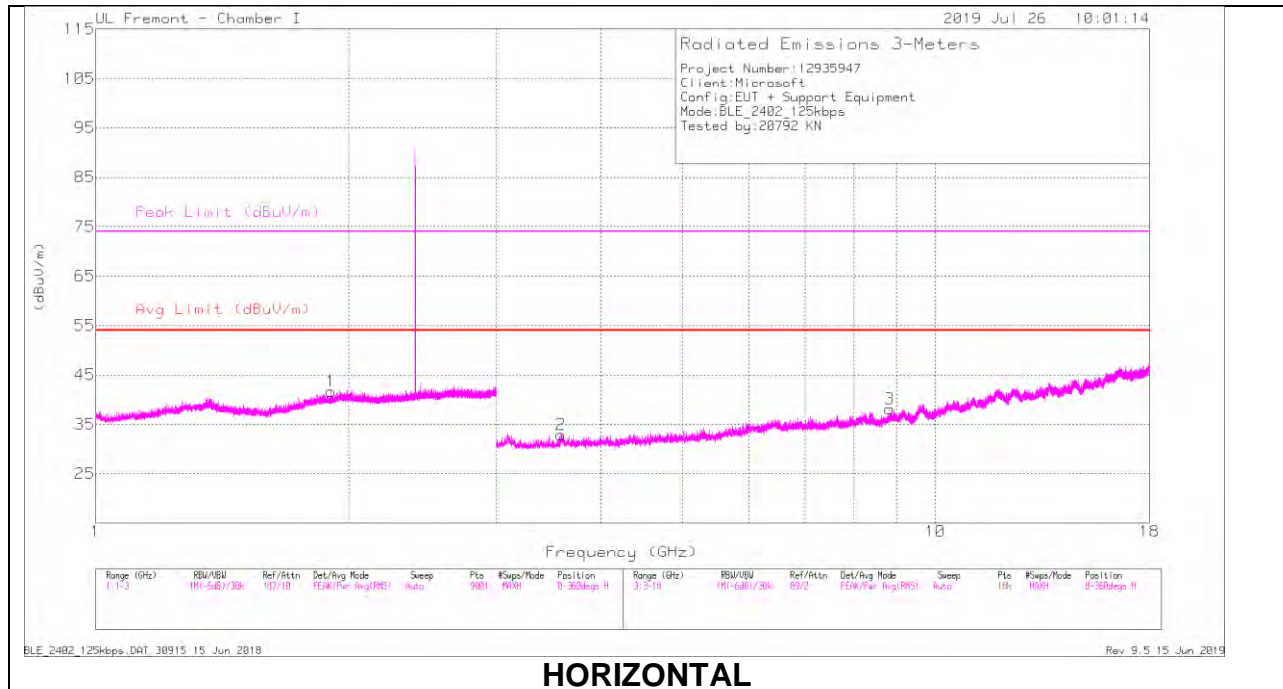
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.90488	38.92	PK2	31	-24.3	0	45.62	-	-	-	-	149	256	H
4	* 1.15527	39.88	PK2	27.7	-23.9	0	43.68	-	-	74	-30.32	229	182	V
	* 1.15536	29.87	MAv1	27.6	-23.9	.82	34.39	54	-19.61	-	-	229	182	V
2	* 3.58148	35.68	PK2	33.6	-32.3	0	36.98	-	-	74	-37.02	308	239	H
	* 3.57859	25.67	MAv1	33.5	-32.2	.82	27.79	54	-26.21	-	-	308	239	H
3	8.82532	33.15	PK2	36.1	-24	0	45.25	-	-	-	-	308	210	H
5	5.48605	32.72	PK2	34.5	-29.4	0	37.82	-	-	-	-	161	265	V
6	13.54472	30.1	PK2	38.8	-19	0	49.9	-	-	-	-	303	251	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

