FCC / ISED Test Report

For:
Trimble Inc.

Model Number:
R580

Product Description:
GNSS receiver with an integrated Wi-Fi/BT modem with TDL450i (Rx-only)

FCC ID: JUP-R580
IC: 1756A-R580

Applied Rules and Standards:
47 CFR Part 15.247 (DSS)
RSS-247 Issue 2 (DSSs) & RSS-Gen Issue 5

REPORT #: EMC_TRIMB_163_22001_FCC_15_247_BT_Rev1

DATE: 2023-07-25

A2LA Accredited

IC recognized #
3462B-1

***CETECOM* Inc.**
411 Dixon Landing Road ◆ Milpitas, CA 95035 ◆ U.S.A.
Phone: + 1 (408) 586 6200 ◆ Fax: + 1 (408) 586 6299 ◆ E-mail: contact@cetecom.com ◆ http://www.cetecom.com
CETECOM Inc. is a Delaware Corporation with Corporation number: 2905571

TABLE OF CONTENTS

1 Assessment

The following device was evaluated against the applicable criteria specified in FCC rules Parts 15.247 of Title 47 of the Code of Federal Regulations and the relevant ISED Canada standard RSS-247.

No deviations were ascertained.

Company	Description	Model #
Trimble Inc.	GNSS receiver with an integrated Wi-Fi/BT modem with TDL450i (Rx-only)	R580

Responsible for Testing Laboratory:

Date	Section	Name	Signature
2023-07-25	Compliance	Arndt Stoecker (Director of Regulatory Services)	Arndt Stoecker Digitally signed by: Arndt Stoecker DN: CN = Arndt Stoecker email = arndt.stoecker@cetecom.com C = US O = CETECOM Inc Date: 2023.07.25 14:46:28 -07'00'

Responsible for the Report:

Date	Section	Name	Signature
2023-07-25	Compliance	Cheng Song (EMC Engineer)	cheng.song@cetecom.com Digitally signed by: cheng.song@cetecom.com DN: CN = cheng.song@cetecom.com Date: 2023.07.25 14:10:02 -07'00'

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the EMC Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Street Address:	411 Dixon Landing Road
City/Zip Code	Milpitas, CA 95035
Country	USA
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
Director of Regulatory Services:	Arndt Stoecker
Responsible Project Leader:	Phillip Quintal

2.2 Identification of the Client

Client's Name:	Trimble Inc.
Street Address:	935 Stewart Drive
City/Zip Code	Sunnyvale, CA 94085
Country	USA

2.3 Identification of the Manufacturer

Manufacturer's Name:	Same as Client
Manufacturers Address:	
City/Zip Code	
Country	

3 Equipment Under Test (EUT)

3.1 EUT Specifications

Model No:	R580
HW Version :	125761-A
SW Version :	5.6x
FCC-ID :	JUP-R580
IC:	1756A-R580
PMN:	R580
Product Description:	GNSS receiver with an integrated Wi-Fi/BT modem with TDL450i (Rx-only)
Radio Information:	**Bluetooth:** • Module: Trimble R580 • FCC ID: JUP-R580, IC: 1756A-R580 • BDR/EDR
Antenna Information as declared:	WLAN/BT max gain: +6.6 dBi
Power Supply/ Rated Operating Voltage Range:	USB Power
Operating Temperature Range	-20 °C to +55 °C
Other Radios included in the device:	**WiFi:** • Module: Trimble R580 • FCC ID: JUP-R580, IC: 1756A-R580 • Technologies: 802.11b/g/n 2.4GHz
Sample Revision	☐Prototype Unit; ■Production Unit; ☐Pre-Production

3.2 EUT Sample details

EUT #	Model Number	HW Version	SW Version	Notes/Comments
1	R580	125761-A	5.6x	Radiated Emissions

3.3 Accessory Equipment (AE) details

AE #	Type	Model	Manufacturer	Serial Number
1				

3.4 Test Sample Configuration

EUT Set-up #	Combination of AE used for test set up	Comments
1	EUT#1	The radio of the EUT was configured to a fixed channel transmission with highest possible duty cycle using software that is not available to the end user. The internal antenna was connected.

3.5 Mode of Operation

Operating Mode#	Note
Op. 1	During the testing process, the EUT was tested with transmitter sets on Bluetooth EDR 3Mbps on low, mid and high channels, and highest possible duty cycle. For radiated measurements, all data in this report shows the worst case between horizontal and vertical antenna polarizations and for all orientations of the EUT.

4 Subject of Investigation

The objective of the measurements done by CETECOM Inc. was to assess the performance of the EUT according to the relevant requirements specified in FCC rules Part 15.247 of Title 47 of the Code of Federal Regulations and Radio Standard Specification RSS-247 of ISED Canada.

5 Measurement Results Summary

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	NA	NP	Result
§15.247(b)(1) RSS-247 5.4(b)	Maximum Peak Conducted Output Power	Nominal		☐	☐	■	Note 2
§15.247(d) RSS-247 5.5 RSS-Gen 8.10	Band Edge Compliance	Nominal		☐	☐	■	Note 3
§15.247(a)(1) RSS-247 5.1(b)	Spectrum Bandwidth	Nominal		☐	☐	■	Note 4
§15.247(a)(1) RSS-247 5.1(b)	Carrier Frequency Separation	Nominal		☐	☐	■	Note 5
§15.247(a)(1) RSS-247 5.1(d)	Number of Hopping Channels	Nominal		☐	☐	■	Note 6
§15.247(a)(1)(iii) RSS-247 5.1(d)	Time of occupancy	Nominal		☐	☐	■	Note 7
§15.247(d) §15.209 (a) RSS-Gen 6.13	TX Spurious emissions-Radiated	Nominal	Op. 1	■	☐	☐	Complies
§15.207(a) RSS-Gen 8.8	AC Conducted Emissions	Nominal		☐	☐	■	Note 8

Note 1: NA= Not Applicable; NP= Not Performed.
Note 2: Leveraged from module report: FR1O0407AD Rev. 01 under FCC ID: SQG-LWBPLUS, section 3.4
Note 3: Leveraged from module report: FR1O0407AD Rev. 01 under FCC ID: SQG-LWBPLUS, section 3.2, section 3.3
Note 4: Leveraged from module report: FR1O0407AD Rev. 01 under FCC ID: SQG-LWBPLUS, section 3.6
Note 5: Leveraged from module report: FR1O0407AD Rev. 01 under FCC ID: SQG-LWBPLUS, section 3.7
Note 6: Leveraged from module report: FR1O0407AD Rev. 01 under FCC ID: SQG-LWBPLUS, section 3.5
Note 7: Leveraged from module report: FR1O0407AD Rev. 01 under FCC ID: SQG-LWBPLUS, section 3.8
Note 8: The device does not draw power from public mains.

6 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus, with 95% confidence interval (in dB delta to result), based on a coverage factor k=2.

Measurement System	EMC 1	EMC 2
Conducted Emissions (mains port)	1.12 dB	0.46 dB
Radiated Emissions		
(<30 MHz)	3.66 dB	3.88 dB
(30 MHz – 1 GHz)	3.17 dB	3.34 dB
(1 GHz – 3 GHz)	5.01 dB	4.45 dB
(> 3 GHz)	4.0 dB	4.79 dB

6.1 Environmental Conditions During Testing:

The following environmental conditions were maintained during the course of testing:

- Ambient Temperature: 20-25° C
- Relative humidity: 40-60%

6.2 Dates of Testing:

03/17/2023

6.3 Decision Rule:

Cetecom advanced follows ILAC G8:2019 chapter 4.2.1 (Simple Acceptance Rule).

Only the measured values related to their corresponding limits will be used to decide whether the equipment under test meets the requirements of the test standards listed in chapter 3. The measurement uncertainty is mentioned in this test report, See chapter 9, but is not taken into account – neither to the limits nor to the measurement results. Measurement results with a smaller margin to the corresponding limits than the measurement uncertainty have a potential risk of more than 5% that the decision might be wrong.

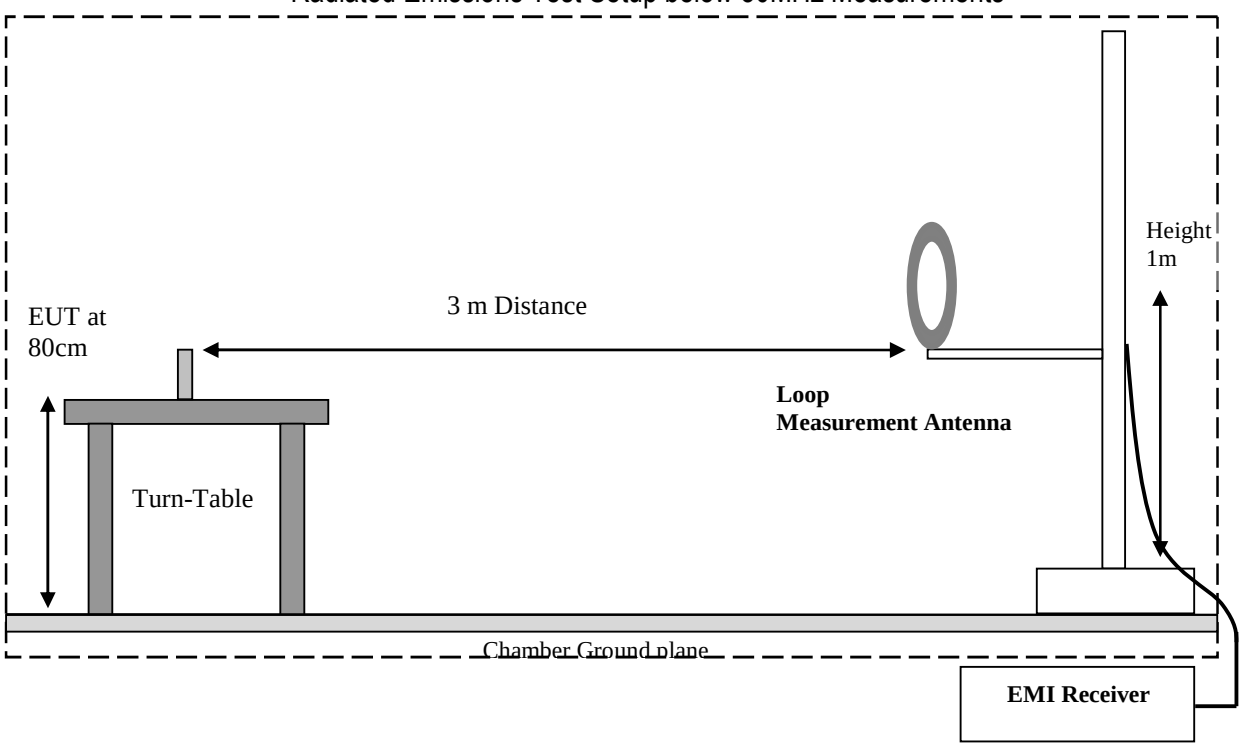
7 Measurement Procedures

7.1 Radiated Measurement

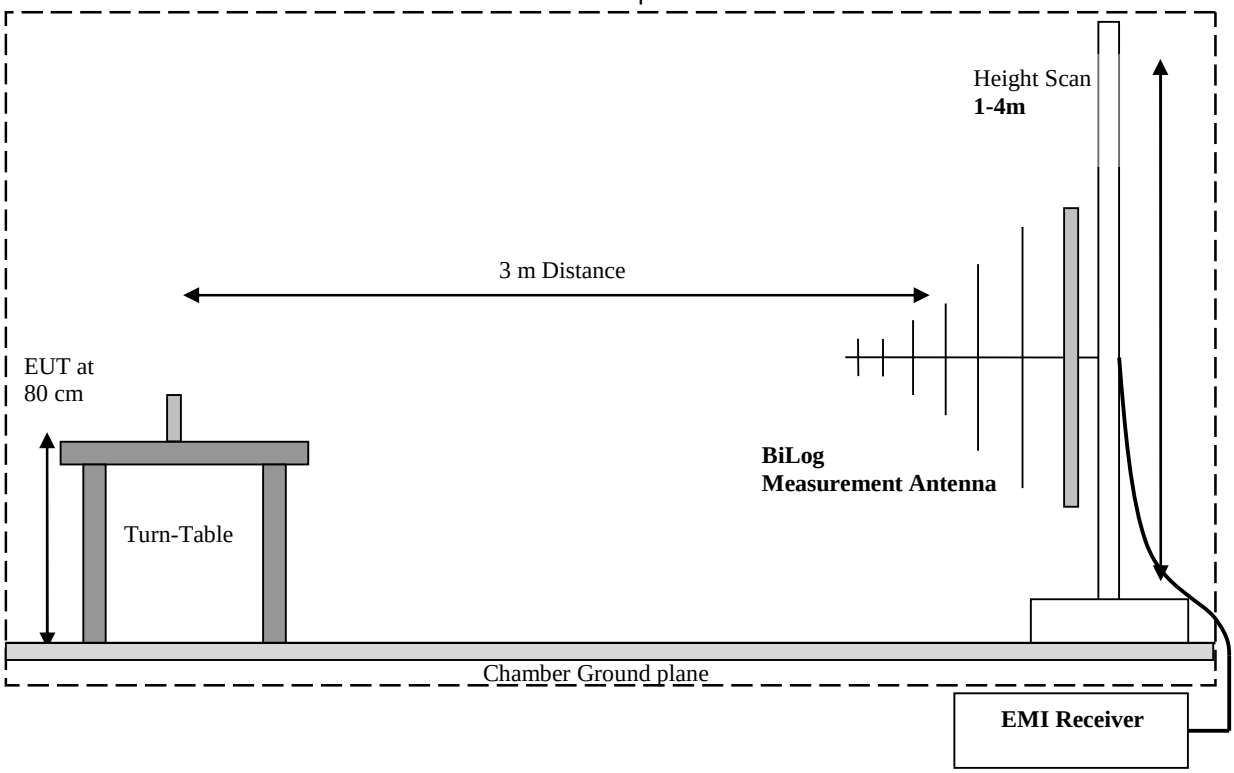
The radiated measurement is performed according to ANSI C63.10 (2013)

- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 4 positions of the turntable, two orthogonal positions of the EUT and both antenna polarizations. This procedure exceeds the requirement of the above standards to cover the 3 orthogonal axis of the EUT. A max peak detector is utilized during the exploratory measurement. The Test-SW creates an overall maximum trace for all 12 sweeps and saves the settings for each point of this trace. The maximum trace is part of the test report.
- The 10 highest emissions are selected with an automatic algorithm of EMC32 searching for peaks in the noise floor and ensuring that broadband signals are not selected multiple times.
- The maxima are then put through the final measurement and again maximized in a 90deg range of the turntable, fine search in frequency domain and height scan between 1m and 4m.
- The above procedure is repeated for all possible ways of power supply to EUT and for all supported modulations.
- In case there are no emissions above noise floor level only the maximum trace is reported as described above.
- The results are split up into up to 4 frequency ranges due to antenna bandwidth restrictions. A magnetic loop is used from 9 kHz to 30 MHz, a Biconilog antenna is used from 30 MHz to 1 GHz, and two different horn antennas are used to cover frequencies up to 40 GHz.

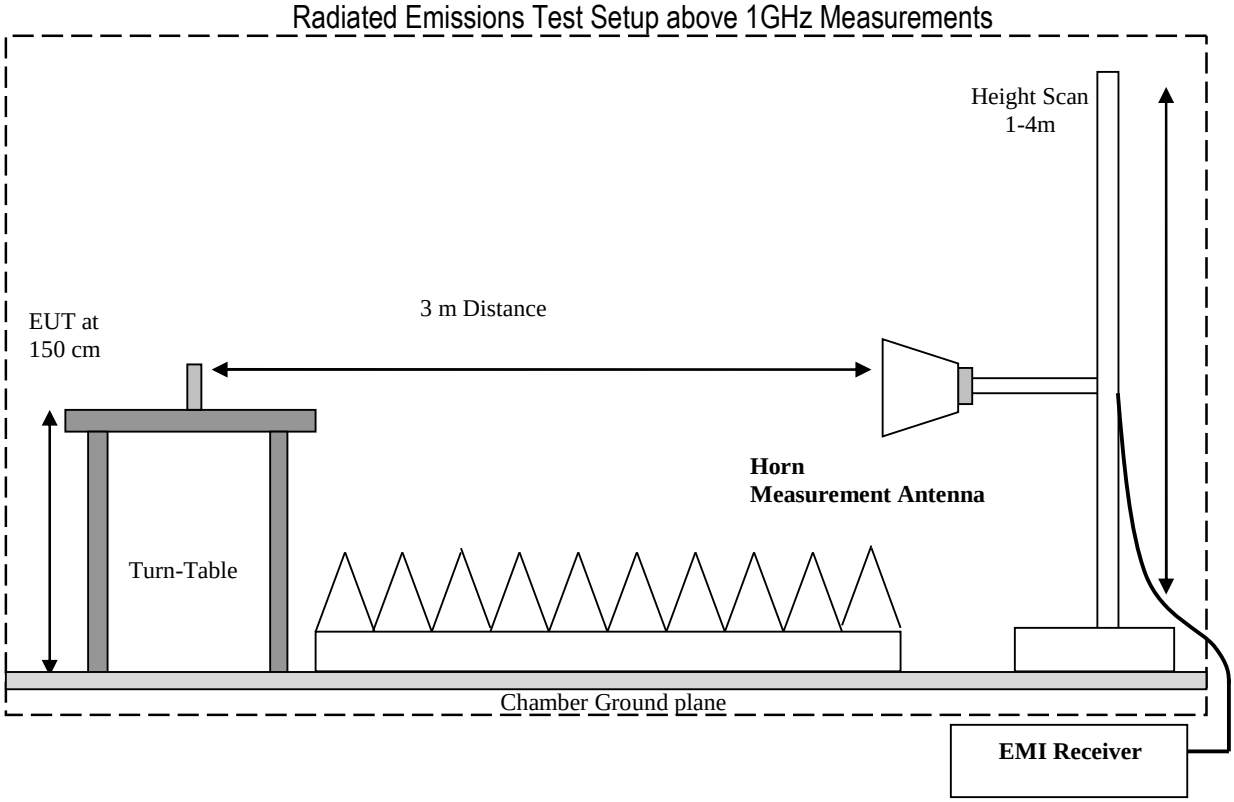
Radiated Emissions Test Setup below 30MHz Measurements



Radiated Emissions Test Setup 30MHz-1GHz Measurements



Radiated Emissions Test Setup above 1GHz Measurements



7.1.1 Sample Calculations for Field Strength Measurements

Field Strength is calculated from the Spectrum Analyzer/ Receiver readings, taking into account the following parameters:

1. Measured reading in dBµV
2. Cable Loss between the receiving antenna and SA in dB and
3. Antenna Factor in dB/m

All radiated measurement plots in this report are taken from a test SW that calculates the Field Strength based on the following equation:

FS (dBµV/m) = Measured Value on SA (dBµV) + Cable Loss (dB) + Antenna Factor (dB/m)

Example:

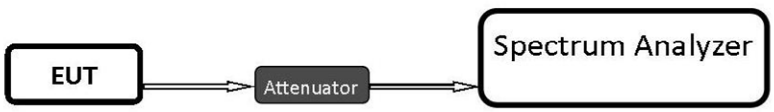
Frequency (MHz)	Measured SA (dBµV)	Cable Loss (dB)	Antenna Factor Correction (dB)	Field Strength Result (dBµV/m)
1000	80.5	3.5	14	98.0

7.2 Power Line Conducted Measurement Procedure

AC Power Line conducted emissions measurements performed according to: ANSI C63.4 (2014)

7.3 RF Conducted Measurement Procedure

Testing procedures are based on 558074 D01 15.247 Meas Guidance v05r02 – "GUIDANCE FOR COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEM, FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM, AND HYBRID SYSTEM DEVICES OPERATING UNDER SECTION 15.247 OF THE FCC RULES" - April 2, 2019, by the Federal Communications Commission, Office of Engineering and Technology, Laboratory Division.



- Connect the equipment as shown in the above diagram.
- Adjust the settings of the SA (Rohde-Schwarz Spectrum Analyzer) to connect the EUT at the required mode of test.
- Measurements are to be performed with the EUT set to the low, middle and high channels and for worst case modulation schemes.

8 Test Result Data

8.1 Radiated Transmitter Spurious Emissions and Restricted Bands

8.1.1 Measurement according to ANSI C63.10 (2013)

Spectrum Analyzer Settings:

- Frequency = 9 KHz – 30 MHz
- RBW = 9 KHz
- Detector: Peak

- Frequency = 30 MHz – 1 GHz
- Detector = Peak / Quasi-Peak
- RBW= 120 KHz (<1GHz)

- Frequency > 1 GHz
- Detector = Peak / Average
- RBW = 1 MHz

- Radiated spurious emissions shall be measured for the transmit frequencies, transmit power, and data rate for the lowest, middle and highest channel in each frequency band of operation and for the highest gain antenna for each antenna type, and using the appropriate parameters and test requirements.
- The highest (or worst-case) data rate shall be recorded for each measurement.
- For testing frequencies below 30 MHz at distance other than the specified in the standard, the limit conversion is calculated by using the FCC materials for the ANSI 63 committee issued on January, 27 1991.

8.1.2 Limits:

FCC §15.247

- In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

FCC §15.209 & RSS-Gen 8.9

- Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency of emission (MHz)	Field strength (µV/m)	Measurement Distance (m)	Field strength @ 3m (dBµV/m)
0.009–0.490	2400/F(kHz) / ---------	300	-
0.490–1.705	24000/F(kHz) / --------	30	-
1.705–30.0	30 / (29.5)	30	-
30–88	100	3	40 dBµV/m
88–216	150	3	43.5 dBµV/m
216–960	200	3	46 dBµV/m
Above 960	500	3	54 dBµV/m

FCC §15.205 & RSS-Gen 8.10

- Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
[1]0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

- Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).
  *PEAK LIMIT= 74 dBµV/m
  *AVG. LIMIT= 54 dBµV/m

8.1.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
22° C	1	Op. 1	USB Power

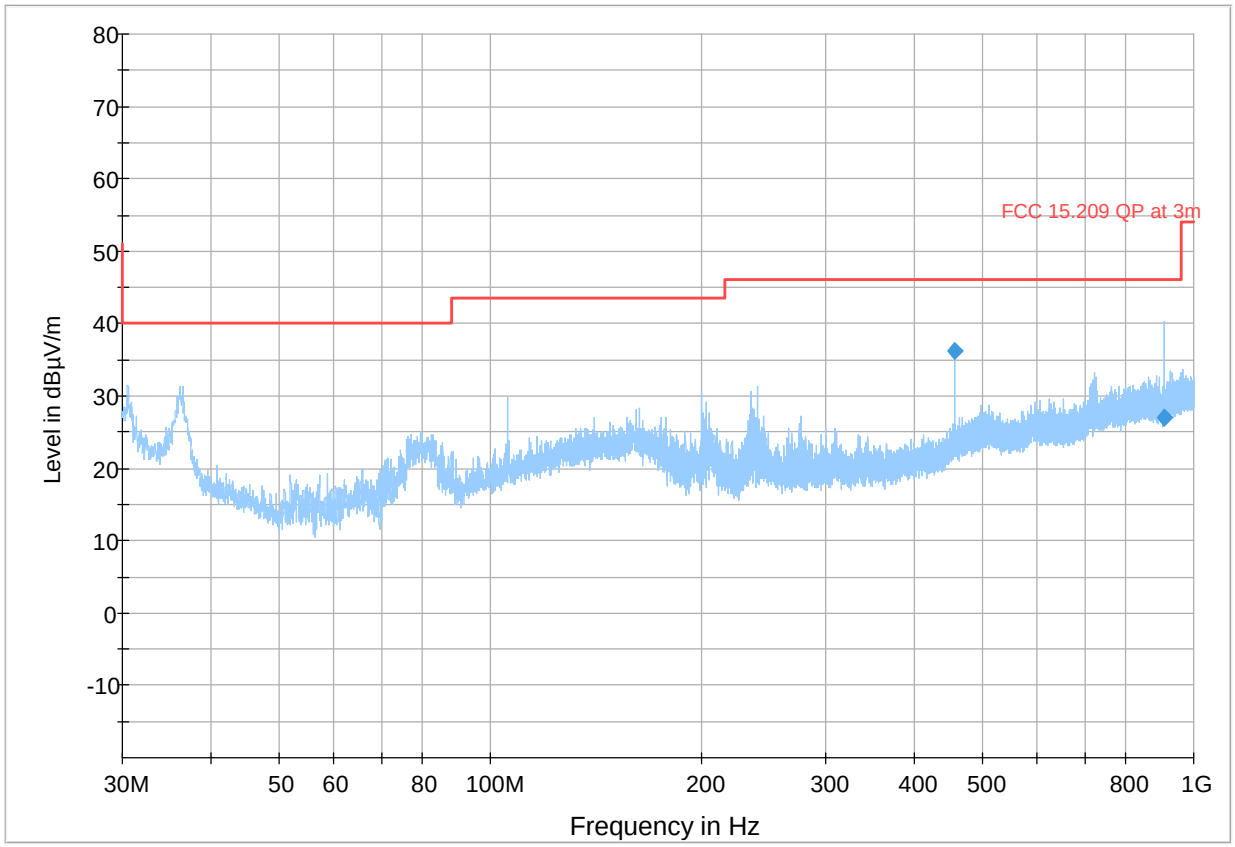
8.1.4 Measurement result:

Plot #	Channel #	Scan Frequency	Limit	Result
1-3	Low	30 MHz – 18 GHz	See section 8.1.2	Pass
4-8	Mid	9 kHz – 26 GHz	See section 8.1.2	Pass
9-11	High	30 MHz – 18 GHz	See section 8.1.2	Pass

8.1.5 Measurement Plots:

Plot # 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
457.48	36.14	46.02	9.88	500.0	120.0	133.0	V	-5.0	25.0
905.86	27.10	46.02	18.92	500.0	120.0	142.0	V	40.0	31.5



Plot # 2

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
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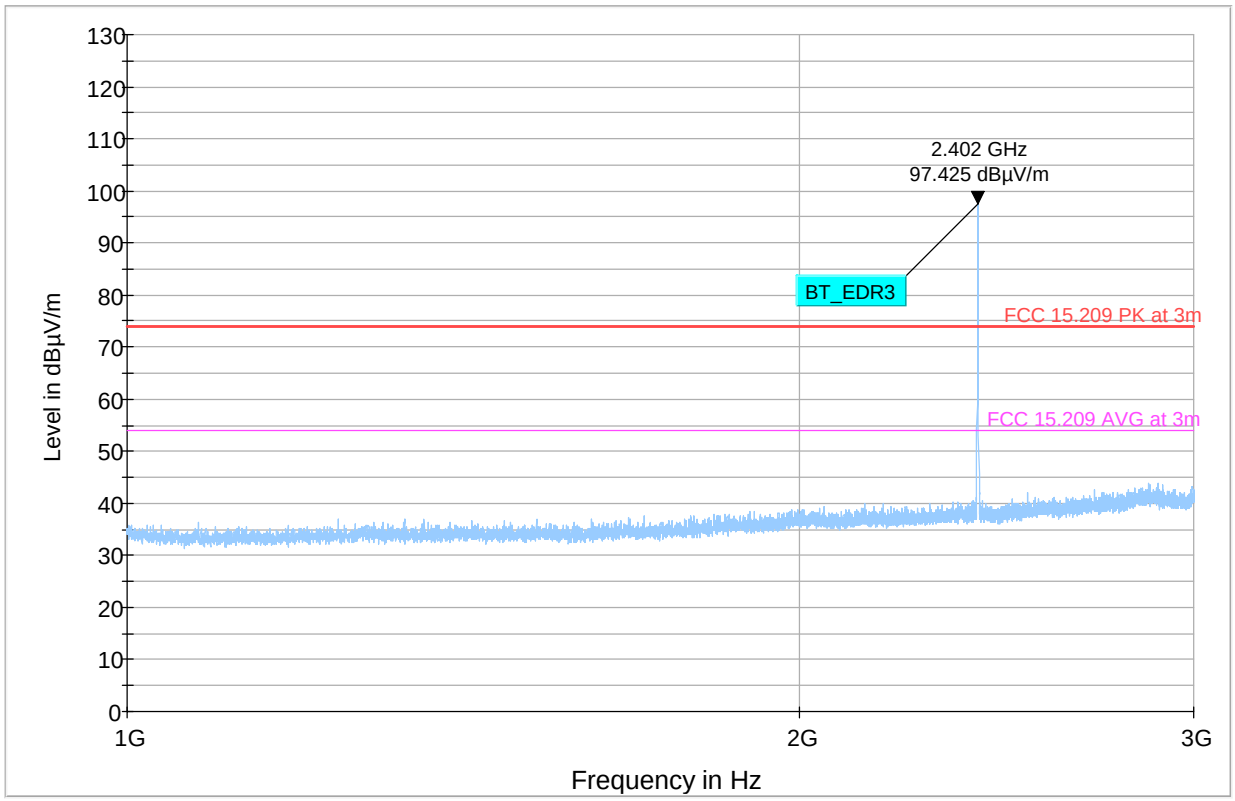
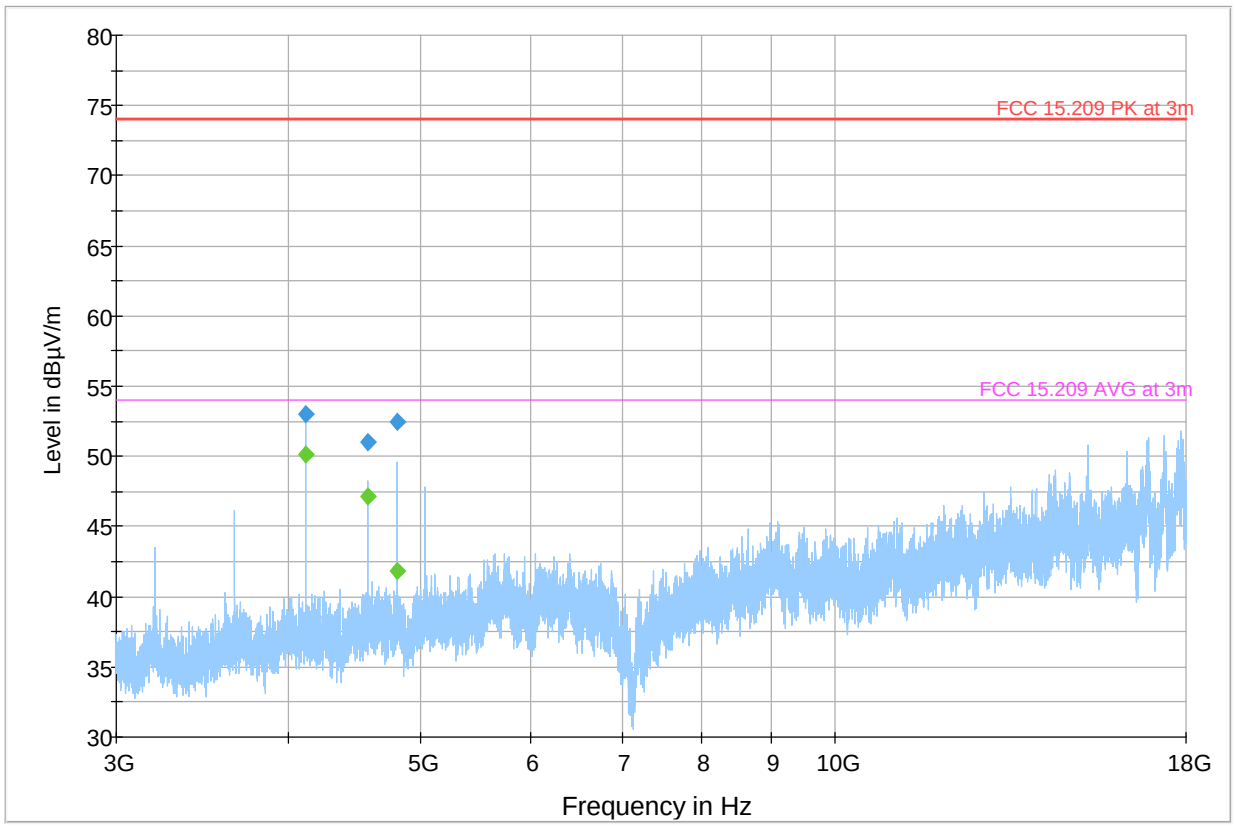


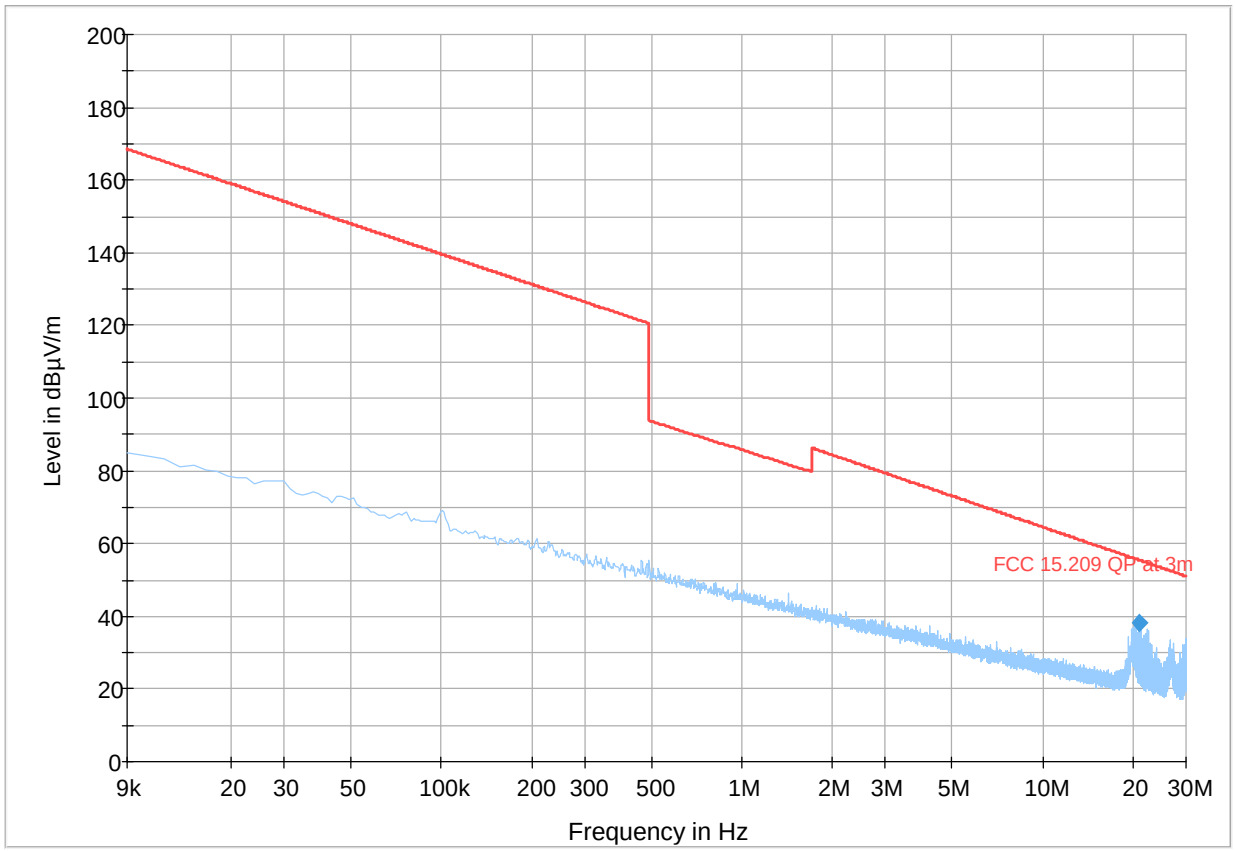
Plot # 3

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4117.25	53.04	---	73.98	20.94	500.0	1000.0	135.0	V	54.0	-4.4
4117.25	---	50.11	53.98	3.87	500.0	1000.0	135.0	V	54.0	-4.4
4575.00	---	47.19	53.98	6.79	500.0	1000.0	121.0	V	51.0	-3.5
4575.00	51.03	---	73.98	22.95	500.0	1000.0	121.0	V	51.0	-3.5
4804.00	52.48	---	73.98	21.50	500.0	1000.0	175.0	H	192.0	-3.3
4804.00	---	41.83	53.98	12.14	500.0	1000.0	175.0	H	192.0	-3.3



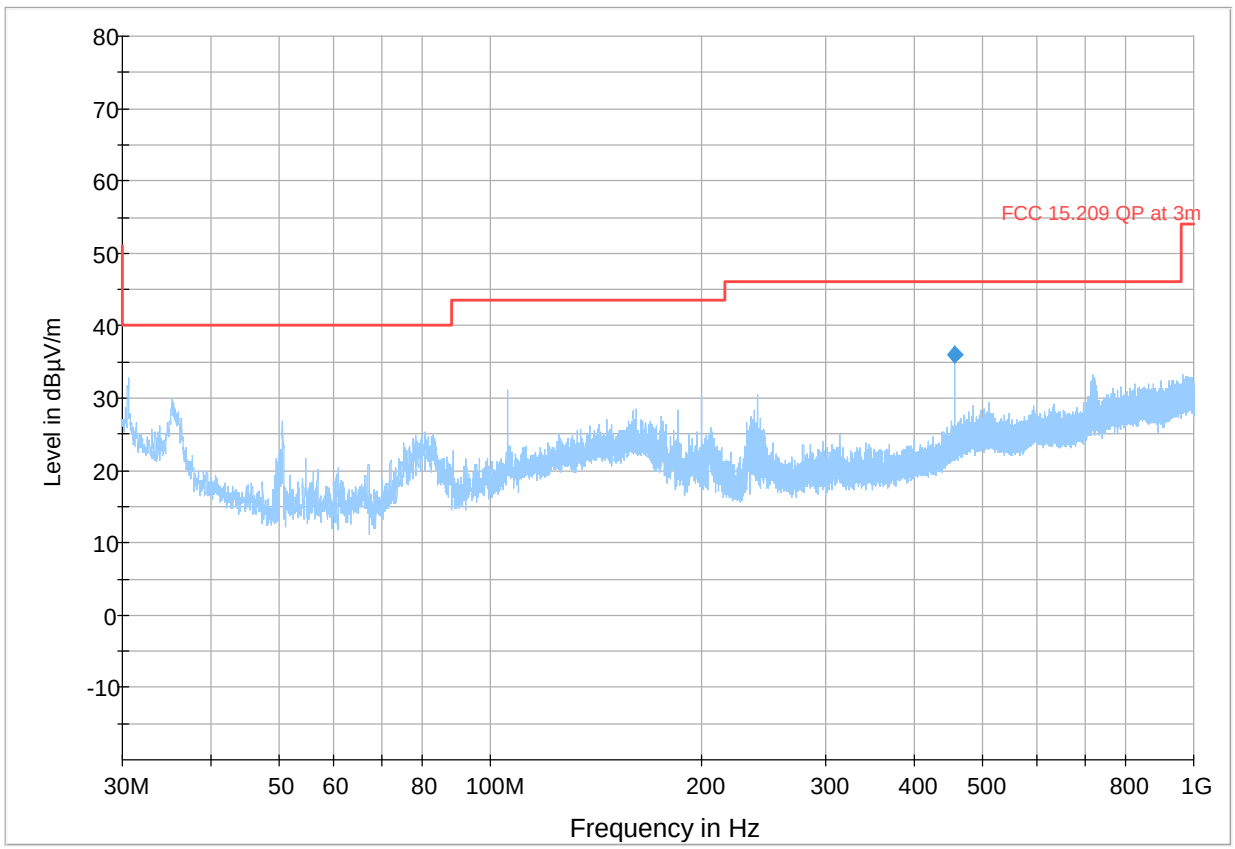
Plot # 4

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
20.99	38.08	55.44	17.36	500.0	9.0	100.0	V	194.0	16.4



Plot # 5

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
457.48	36.07	46.02	9.95	500.0	120.0	107.0	V	23.0	25.0



Plot # 6

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
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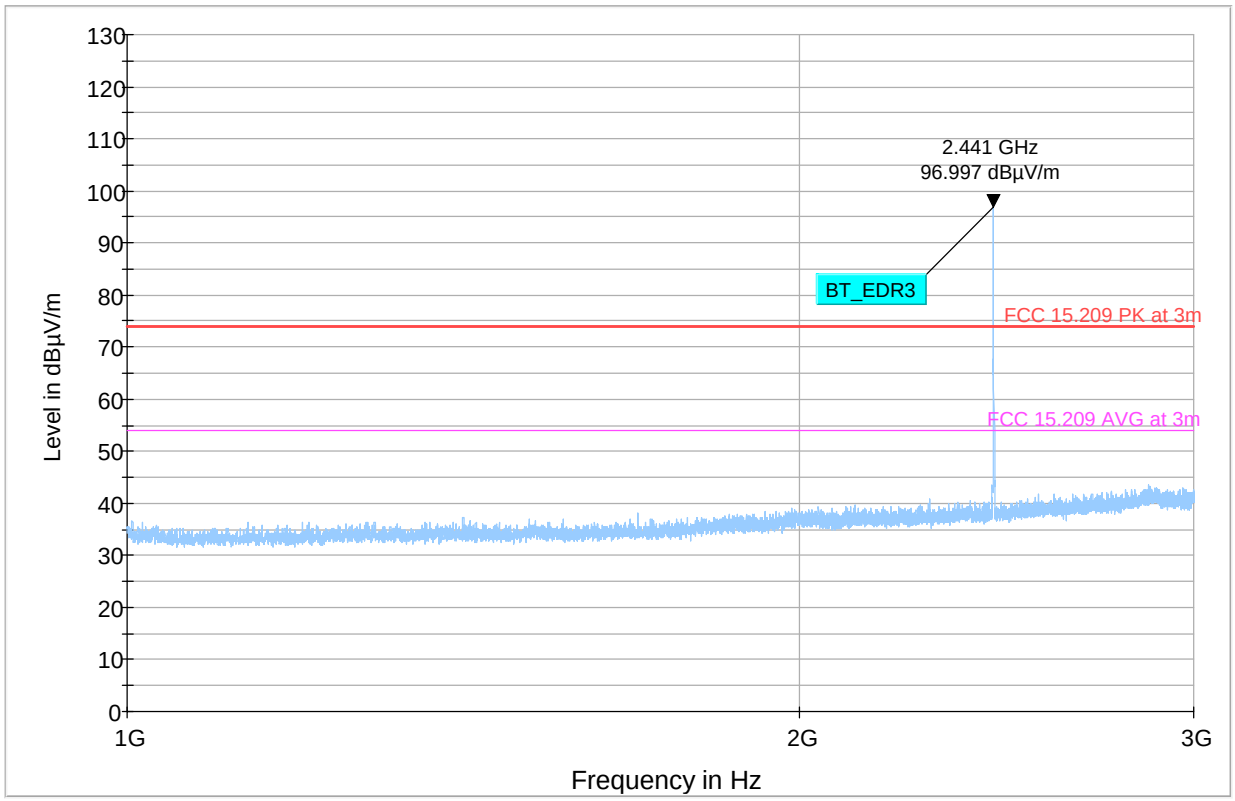
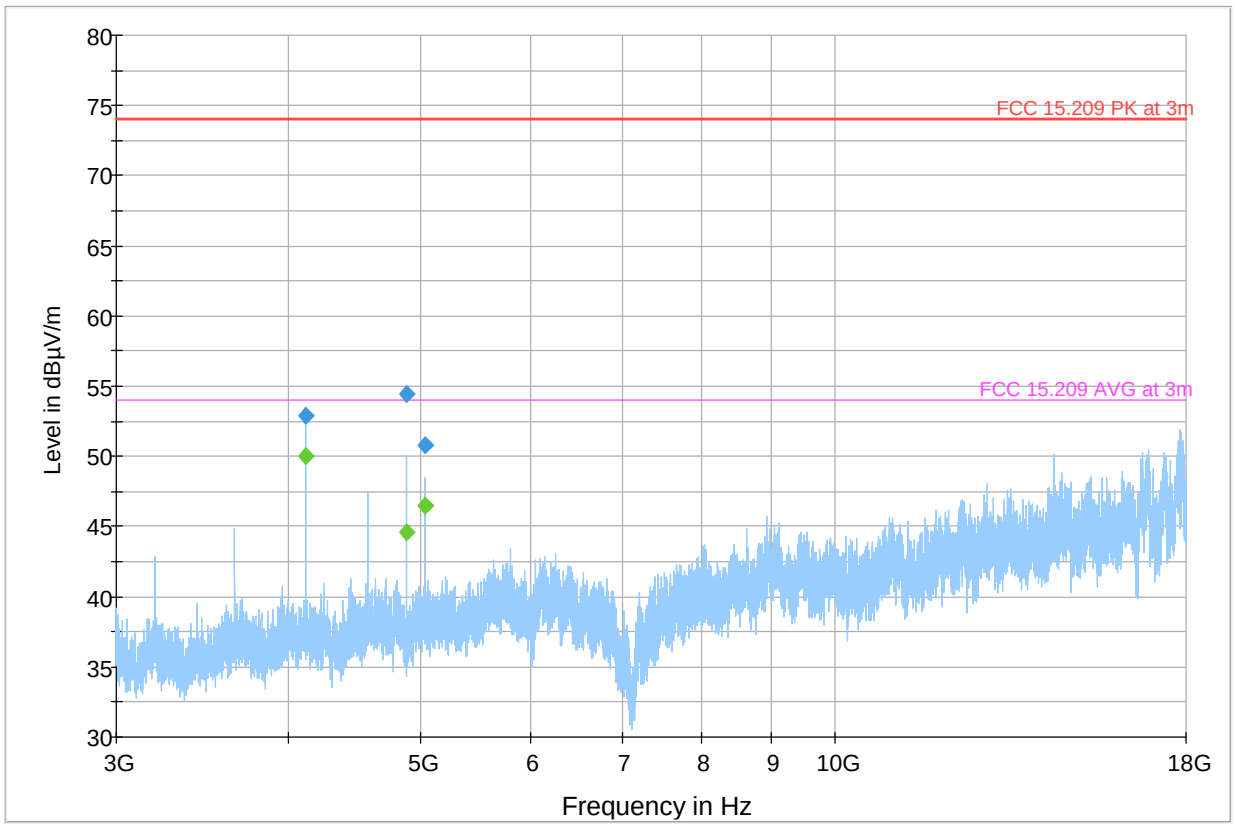


Plot # 7

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4117.25	52.85	---	73.98	21.13	500.0	1000.0	135.0	V	52.0	-4.4
4117.25	---	50.02	53.98	3.96	500.0	1000.0	135.0	V	52.0	-4.4
4882.00	54.45	---	73.98	19.53	500.0	1000.0	159.0	H	186.0	-3.8
4882.00	---	44.62	53.98	9.36	500.0	1000.0	159.0	H	186.0	-3.8
5032.25	---	46.47	53.98	7.51	500.0	1000.0	107.0	V	112.0	-3.1
5032.25	50.84	---	73.98	23.13	500.0	1000.0	107.0	V	112.0	-3.1



Plot # 8

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
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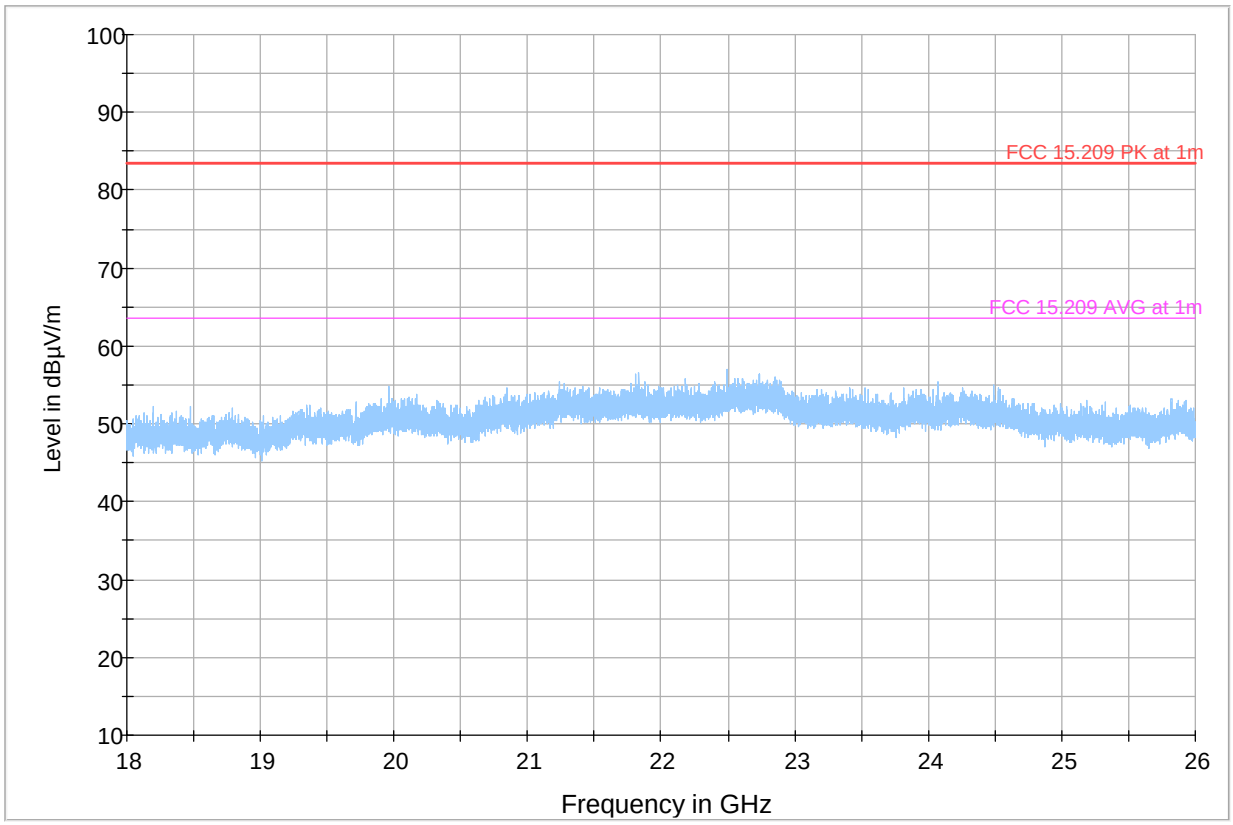
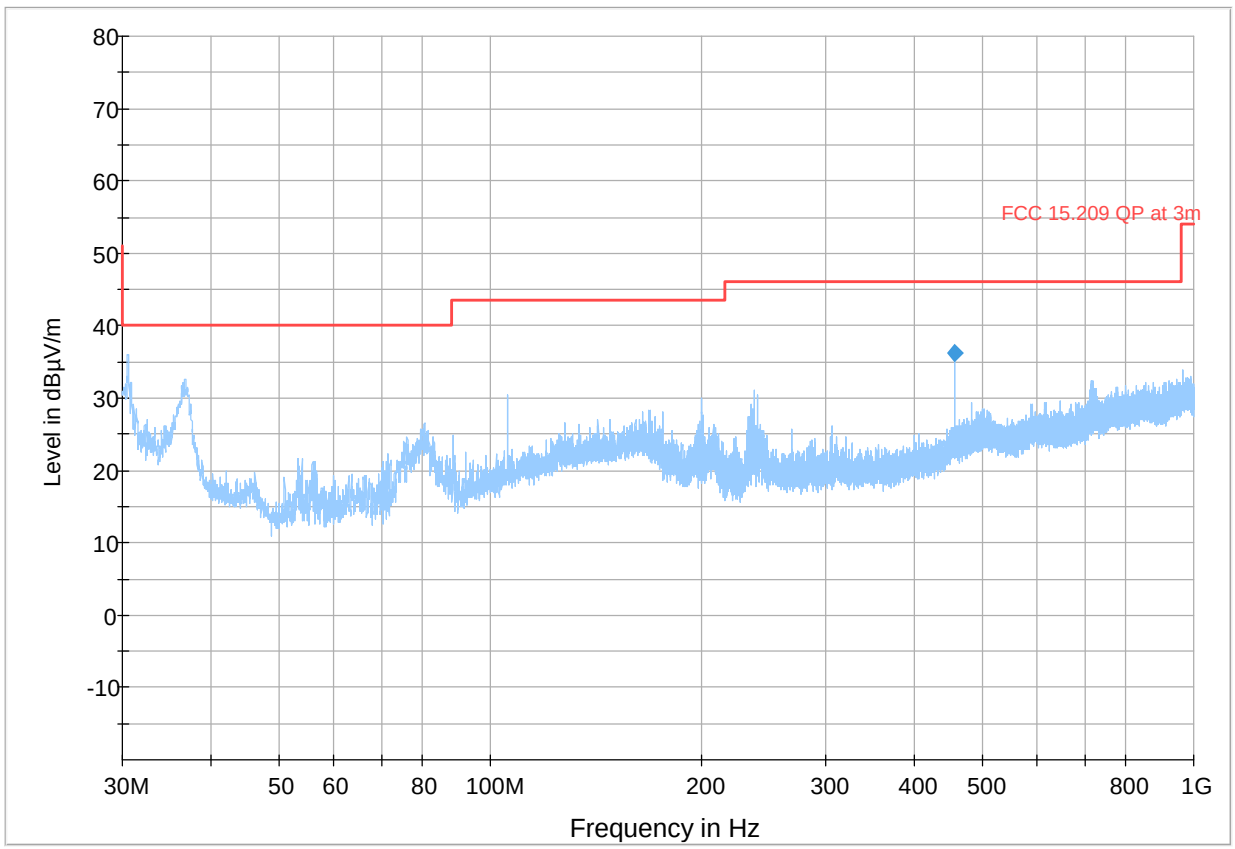


Plot # 9

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
457.48	36.26	46.02	9.76	500.0	120.0	107.0	V	-17.0	25.0



Plot # 10

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
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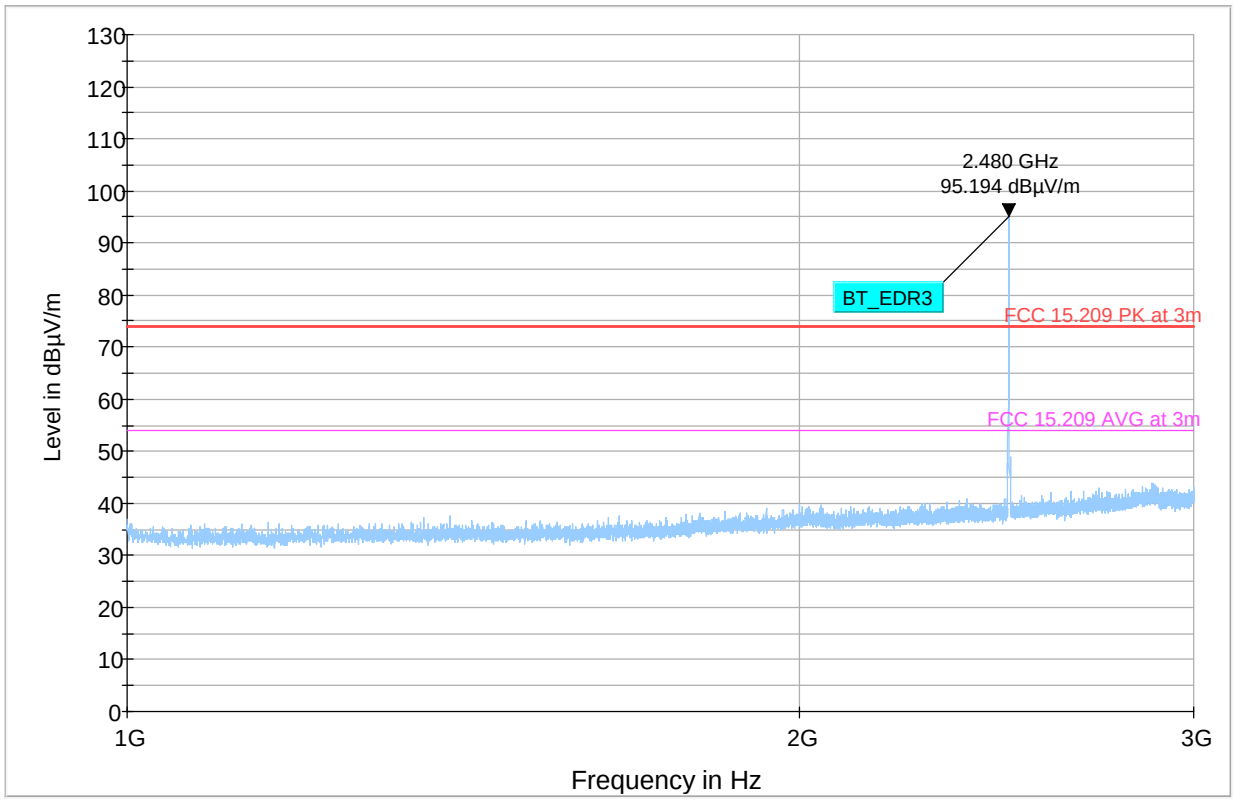
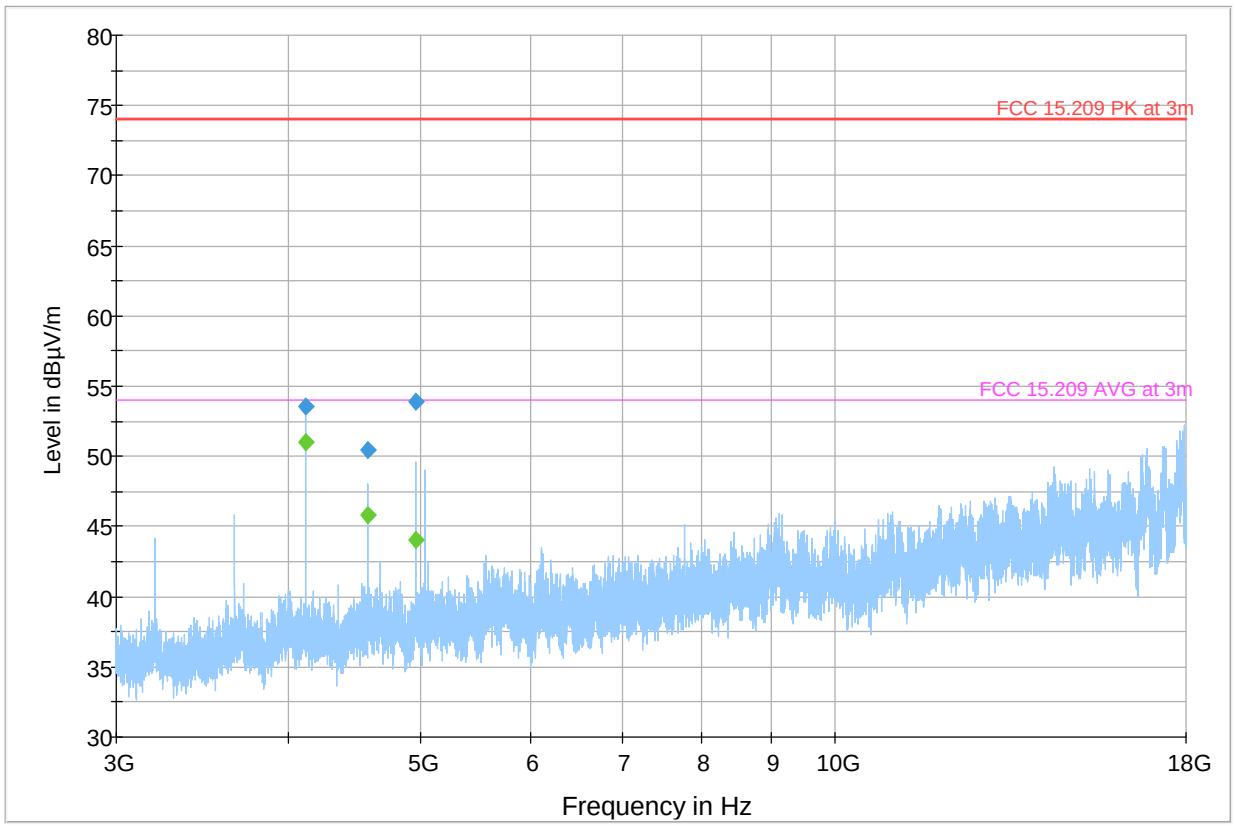


Plot # 11

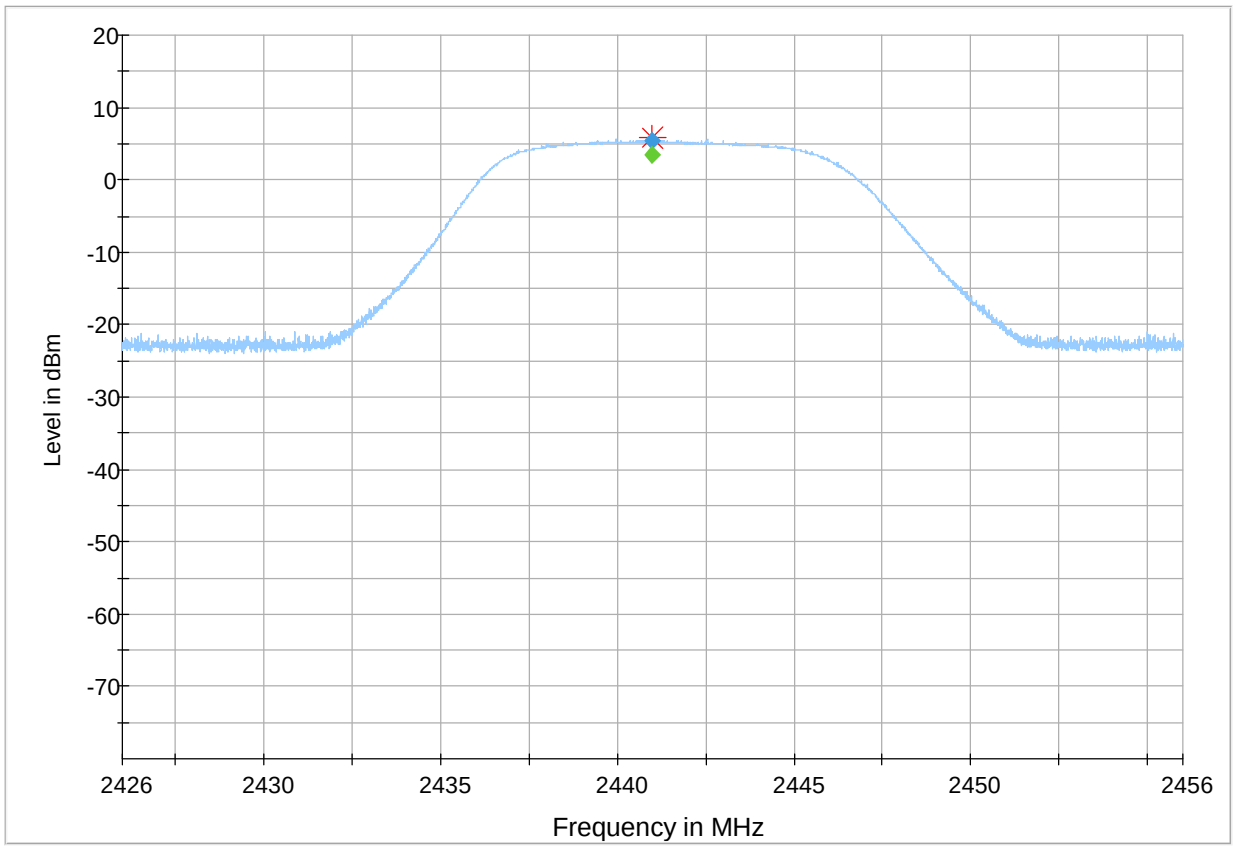
Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4117.25	53.53	---	73.98	20.45	500.0	1000.0	142.0	V	54.0	-4.4
4117.25	---	50.99	53.98	2.99	500.0	1000.0	142.0	V	54.0	-4.4
4574.75	50.45	---	73.98	23.53	500.0	1000.0	118.0	V	52.0	-3.5
4574.75	---	45.80	53.98	8.18	500.0	1000.0	118.0	V	52.0	-3.5
4960.00	---	44.03	53.98	9.95	500.0	1000.0	142.0	H	183.0	-3.2
4960.00	53.89	---	73.98	20.09	500.0	1000.0	142.0	H	183.0	-3.2



8.2 EIRP

BT EDR 3Mbps

Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
2440.98	---	3.58	---	---	500.0	10000.0	151.0	V	192.0	-60.34	
2440.98	5.49	---	---	---	500.0	10000.0	151.0	V	192.0	-60.34	



9 Test setup photos

Setup photos are included in supporting file name: “EMC_TRIMB_163_22001_FCC_15_247_Setup_Photos”

10 Test Equipment And Ancillaries Used For Testing

Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
ACTIVE LOOP ANTENNA	ETS LINDGREN	6507	00161344	3 YEARS	10/30/2020
BILOG ANTENNA	ETS.LINDGREN	3142E	00166067	3 YEARS	10/21/2021
HORN ANTENNA	EMCO	3115	00035111	3 YEARS	09/30/2021
HORN ANTENNA	ETS.LINDGREN	3117	00215984	3 YEARS	01/31/2021
HORN ANTENNA	ETS.LINDGREN	3116	00070497	3 YEARS	11/23/2020
TEST RECEIVER	R&S	ESU40	100251	3 YEARS	09/13/2021
DIGITAL THRMOMETER	CONTROL COMPANY	36934-164	181230565	3 YEARS	10/20/2021

Note: Equipment used meets the measurement uncertainty requirements as required per applicable standards for 95% confidence levels.
Calibration due dates, unless defined specifically, falls on the last day of the month. Items indicated “N/A” for cal status either do not specifically require calibration or is internally characterized before use.

11 History

Date	Report Name	Changes to report	Prepared by
2023-06-13	EMC_TRIMB_163_22001_FCC_15_247_BT	Initial Version	Cheng Song
2023-07-25	EMC_TRIMB_163_22001_FCC_15_247_BT_Rev1	Updated section 3.1	Cheng Song

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