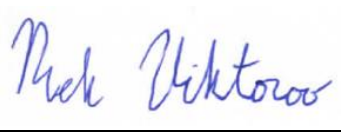
EMC Radiated Emissions Test Report
for
RD 4442 B30 (KRY 901 407/1)

Tested to: FCC Part 15 Subpart B
FCC Part 27

Approvals

Function	Name	Job title	Signature
Author	Nikolai Viktorov	Document Author	
Technical reviewer	Scott Drysdale	Document Reviewer	

Document number: 7169005116-EMC-000-R1

Release date: December 3, 2018

Prepared for: Ericsson

About this document

This document is written and distributed by TÜV SÜD Canada Inc. Whenever TÜV SÜD is mentioned in this document it shall be taken as referring to TÜV SÜD Canada Inc.

This test report does not imply product endorsement by any government, accreditation agency, or TÜV SÜD Canada Inc. Opinions or interpretations expressed in this report, if any, are outside the scope of the accreditations of TÜV SÜD Canada Inc. Any opinions expressed do not necessarily reflect the opinions of TÜV SÜD Canada Inc, unless otherwise stated.

Throughout this document:

- text in blue font is a clickable link
- text in italics is provided as-is from the customer

The release control record, document approvals, and laboratory Accreditations are as follows.

Release control record

This document is based on document template KG000347-TR-EMC-08-02.

Accreditations

The TÜV SÜD Canada Inc test facilities are accredited by the Standards Council of Canada (SCC) to ISO/IEC 17025 in accordance with the scope of accreditation outlined at the website palcan.scc.ca/Specs/PDF/95_e.pdf [11]. The SCC is a signatory of the APLAC [3] and ILAC [9] Mutual Recognition Arrangements. The SCC's Laboratory Accreditation Program has been evaluated and has demonstrated its competence to operate according to the requirements of ISO/IEC 17011.

The Canadian lab registration number associated with test facilities is 5248S-1.

Test lab information

Lab name	TÜV SÜD Canada Inc
Company name	TÜV SÜD Canada Inc
Mailing or shipping address	1280 Teron Road, Ottawa, Ontario, Canada, K2K 2C1
Primary technical contact	Stephen Tippet
Title	Lab Manager
Phone	613-668-5149

Customer information

Company name	Ericsson
Mailing address	349 Terry Fox Drive, Ottawa, ON, K2K 2V6
Primary contact	Denis Lalonde
Title	Developer RA Verification
Phone	+1 (613) 963-6496
E-mail	denis.lalonde@ericsson.com

Table of contents

List of figures

List of tables

1. Executive summary

This document reports the Electromagnetic Compatibility (EMC) testing performed on the product called RD 4442 B30 for Ericsson per project number 7169005116. The objective of the test activities is to demonstrate compliance of the product to the applicable EMC regulatory standards.

The RD 4442 B30 is verified to comply with the Class B Emissions requirements of these standards:

- FCC Part 15 Subpart B [7]
- FCC Part 27 [8]

Information about the test result summary and, the equipment under test (EUT) is in the sections:

- Compliance summary
- Details of the equipment under test
- Detailed test results of Emissions

1.1 Compliance summary

The test results in this report apply only to the tested components that are identified in the section Assessed hardware.

The following tables summarize the EMC test results for the test cases performed on the RD 4442 B30.

Table 1: Summary of test results for the USA; FCC Part 15 subpart B

FCC Section	Description	Specification/Method	Pass or Fail	Results in section
15.109	Radiated Emissions (RE)	FCC Part 15/ANSI C63.4	Pass	3.2
15.107	Conducted Emissions (CE) for AC Power	FCC Part 15/ANSI C63.4	Not applicable [1]	NA
Table notes				
1. The EUT is DC-powered; therefore, no AC port testing applies.				

Table 2: Summary of test results for the USA; FCC Part 27 subpart C

FCC Section	Description	Specification/Method	Pass or Fail	Results in section
27.53(a)(1) 2.1051	Transmitter Spurious Emissions (RE)	ANSI C63.26	Pass	3.2

2. Details of the equipment under test

This section describes the equipment under test (EUT).

2.1 Assessed hardware

The following table indicates the hardware components that were assessed during this test program.

Table 3: Assessed hardware

Hardware component	Part number
RD 4442 B30 (Remote Radio Unit)	KRY 901 407/1

2.2 Product overview

The RD 4442 30 (KRY 901 407/1) is a multi-standard Remote Radio Unit (RRU) forming part of the Ericsson Radio Base Station (RBS) equipment. The RD (Radio DOT) provides radio access for mobile and fixed devices and is intended for the indoor environment.

BS communications are supported via the RDI (Radio DOT Interface) cable providing power, control and an IF link between the RBS IRU (Indoor Radio Unit) and the RD 4442. The typical RDI for the RD 4442 is via a 100-meter CAT6 cable.

The RD 4442 B30 supports (4) Transmit/Receive ports for FDD operation at frequencies between:

- *2350 MHz to 2360 MHz for the B30 transmitter*
- *2305 MHz to 2315 MHz for the B30 receiver*

The radio supports the LTE Radio Access Standard (RATS) at transmit bandwidths up to 10MHz.
The radio operates in Single, Multi-Carrier, and MIMO transmission with a maximum rated RF Output of 50mW per port over an operational temperature of +5°C to +40°C. The unit is designed to be ceiling or wall mounted.

Figure 1: RD 4442 B30

2.3 Power and grounding requirements

Table 4 describes the power requirement of the system under test.

Table 4: Power requirements

Feed	Voltage	Current rating (as per regulatory label)
RDI	–48 V DC from PoE	0.45 A max

2.4 Clocks, oscillators, or switching frequencies

The maximum clock frequency used to determine the Radiated Emissions (RE) frequency range to test is 2.36 GHz.

2.5 Product port definition and EUT cable information

Table 5 identifies all the cables and ports on the EUT. The Environment of the cables is indoor.

Table 5: System port definition

Port or cable designation	Interface description	Port location	Permanent connection for operation?	Shielded cable?	Max cable length (m)	Max quantity
RDI	RJ45(CAT6)	NA	Yes	Yes	100	1

Table 6: Cable configuration for the EUT

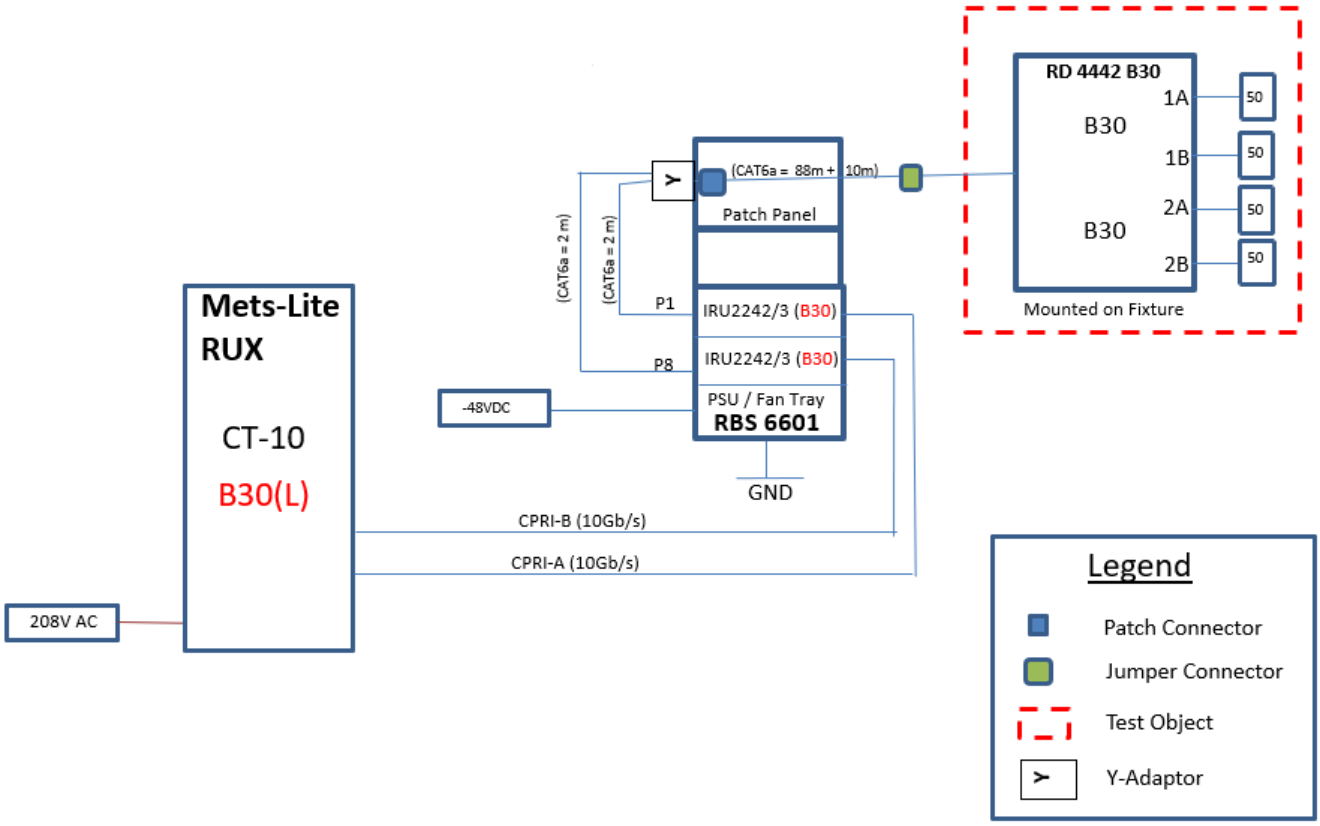
Port or cable designation	Qty	Cable length (m)	Termination during testing	Activity in signal cable during testing
RDI	1	100	RJ45 connector	POE power + signal

2.6 Configurations of the EUT

One configuration was used to evaluate EMC on the system.

The overall test setup is detailed in Figure 2.

Figure 2: Hardware Setup of the RD 4442 B30



2.7 Inventory of the EUT

The following table identifies the inventory of the RD 4442 B30.

Table 7: Inventory of the RD 4442 B30

Description	Part number	Revision	Serial number
RD 4442 B30	KRY 901 407/1	R1A	TD3T601990

2.8 Software and operations of the EUT

The software used to operate the system was representative of the latest production version. The software version number was:

CXP 901 3268/14 - Revision: R71HG

2.9 Support equipment

The customer support equipment that is used to enable operating the EUT for testing is as follows:

Table 8: Test support equipment

Description	Model number	R-State	Serial number
RBS-6601	BFL 901 009/4	R2A	BR83523705
IRU 2242	KRC 161 444/2	R2B	D822456537
IRU 2242	KRC 161 444/2	R2B	D822439694
CT-10	LPC102487/1	R1C	T01F295101
METS-Lite	n/a	n/a	n/a
Software Version: CXP 901 3268/14		Revision: R71HG	

3. Detailed test results of Emissions

Emissions from systems manifest themselves in two forms: conducted emissions on cables and radiated emissions from the entire system (i.e. electronic modules, hardware, and cables). Regulatory standards restrict these different forms of emissions generated by the system.

The temperature and humidity in the test facilities are controlled. The temperature is maintained between 20 ºC and 25 ºC, with a relative humidity between 30 % and 60 %. Levels are recorded and any exceptions are included in the detailed test results sections of this report.

3.1 Measurement instrumentation

The measurement instrumentation conforms to the relevant standards in this report: CISPR 16, CISPR 32. Calibration of the measurement instrumentation is maintained in accordance with the supplier's recommendations, or as necessary to ensure its accuracy.

3.2 Radiated Emissions, E-field

This test verifies that the EUT does not produce excess amounts of E-field Radiated Emissions (RE) that could interfere with licensed radiators.

3.2.1 Test specification and limits

The testing requirements are as follows.

Table 9: RE test requirements

Requirement	Method	Country of application
FCC Part 15, Subpart B	ANSI C63.4	USA
FCC Part 27	ANSI C63.26	USA

The limits of the RE tests are as follows.

Table 10: RE limits at 10 m for Class B of FCC

Frequency range (MHz)	FCC Part 15 (dBμV/m)	Detector
30 to 88	29.5	Quasi Peak
88 to 216	33.0	Quasi Peak
216 to 960	35.5	Quasi Peak
960 to 1000	43.5	Quasi Peak
1000 to 40000	43.5[1]	Average
Table notes		
1. The peak level cannot exceed the limit by more than 20dB.		

Table 11: Emission limits for FCC Part 27

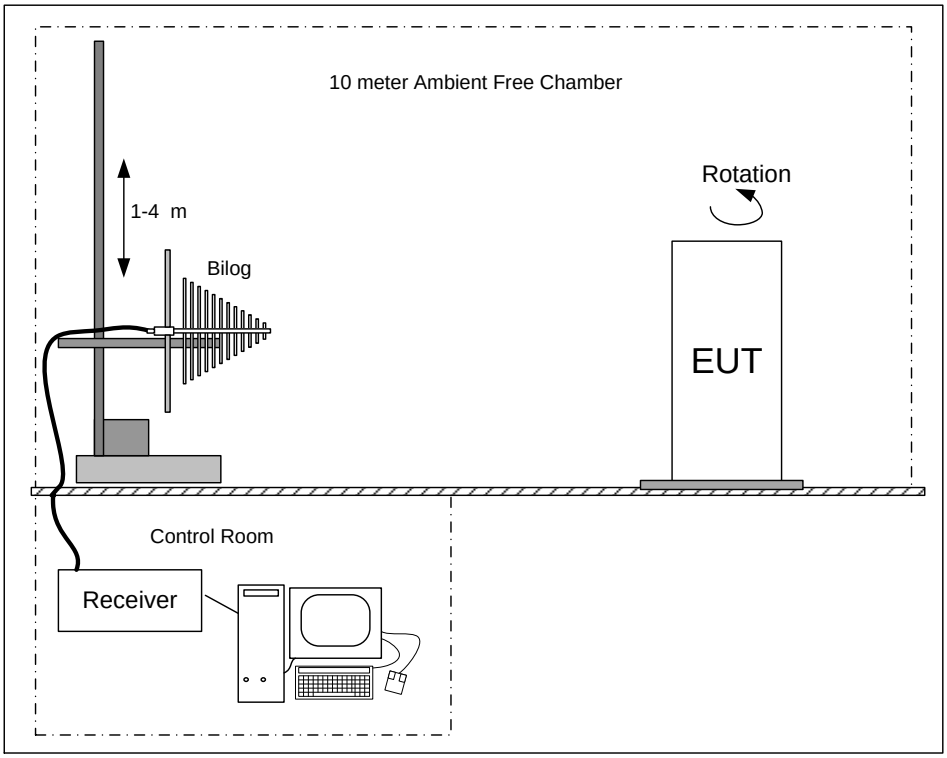
Frequency range (MHz)	FCC Part 27 EIRP Limit (dBm)
< 2285 MHz	-45 dBm
2285-2287.5 MHz	-42 dBm
2287.5-2300 MHz	-40 dBm
2305-2320 MHz	-13 dBm
2320-2345 MHz	-45 dBm
2345-2350 MHz	-13 dBm
2360-2362.5 MHz	-13 dBm
2362.5-2365 MHz	-25 dBm
2365-2367.5 MHz	-40 dBm
2367.5-2370 MHz	-42 dBm
2370 MHz <	-45 dBm

3.2.2 Test procedure

Verifications of the test equipment and AFC were performed before the installation of the EUT in accordance with the quality assurance procedures documented in the EMC test procedures document [5]. The test was performed according to the relevant procedures listed in Table 9.

- The EUT was placed on the turntable inside the AFC (configured for normal operation). The system and its cables were separated from the ground plane by an insulating support 10 mm in height.
- For tests between 30 MHz and 1 GHz the receive antenna (BiLog®) was placed 10 m away from the EUT. An initial scan was performed to find emissions/frequencies requiring detailed measurement. The pre-scan was performed by rotating the system 360 degrees while recording all emissions (frequency and amplitude). This procedure was repeated for antenna heights of 1 to 4 m, as well as both polarizations of the receiving antenna.
- For tests above 1 GHz the receive antenna (horn) was placed 3 m away from the EUT. Absorbing cones were placed on the floor between the antenna and the EUT. An initial scan was performed to find emissions/frequencies requiring detailed measurement. The pre-scan was performed by rotating the system 360 degrees while recording all emissions (frequency and amplitude). This procedure was repeated for antenna heights of 1 to 4 m, as well as both polarizations of the receiving antenna.
- For FCC Part 15 or ICES tests between 18 and 40 GHz the receive horn antenna was placed at a 1 m distance from the EUT with the absorbing cones placed on the floor. An initial scan was performed to find emissions/frequencies requiring detail measurement. The pre-scan was performed on all sides of the EUT, using both polarization of the receive antenna to find any system emissions.
- For all above frequency ranges, the pre-scan peak data was compared to the limits. Peaks with less than 6 dB of margin were maximized using the proper detector: the EUT was rotated in azimuth over 360 degrees to identify the direction of maximum emission, antenna height was then varied from 1 to 4 m to obtain maximum emission level.

Figure 3: Setup of Radiated Emissions



3.2.3 Calculation of the compliance margin

The following example shows the way in which the compliance margin is calculated in the "RE Test Results" tables.

The rows in these tables are defined as follows.

Meter Reading (dBµV) =	Voltage measured using the spectrum analyzer with the proper detector
Correction (dB) =	Cumulative gain or loss of pre-amplifier and cables used in the measurement path (dB) + Antenna Factor (dB)
Level (dBµV/m) =	Corrected value or field strength, that is, the parameter of interest that is compared to the limit
Margin (dB) =	Level with respect to the appropriate limit (a negative Margin indicates that the Level is below the limit and that the measurement is a PASS)

The values in the Level row are calculated as follows: Level = Meter Reading + Correction (dB)

The values in the Margin row are calculated as follows: Margin = Level – Limit

3.2.4 Measurement uncertainties

The expanded measurement instrumentation uncertainty with a 95 % level of confidence, calculated according to the method described in CISPR 16 is:

- ± 3.8 dB between 30 MHz and 1 GHz
- ± 4.7 dB between 1 GHz and 10 GHz
- ± 4.8 dB between 10 GHz and 18 GHz
- ± 4.6 dB between 18 GHz and 26.5 GHz

3.2.5 Test results of Radiated Emissions

Test location: 10-meter Ambient Free Chamber (AFC)

Date tested: 7-9 November 2018

Tested by: Scott Turner

Test configurations are identified in the section Configurations of the EUT.

For the following test results that have supporting data tables, negative margin values indicate a pass. While positive margin values indicate a failure to meet the requirement.

Figure 4: Plot of RE at 10 m for FCC from 30 to 1000 MHz, Low Channel – 5MHz BW

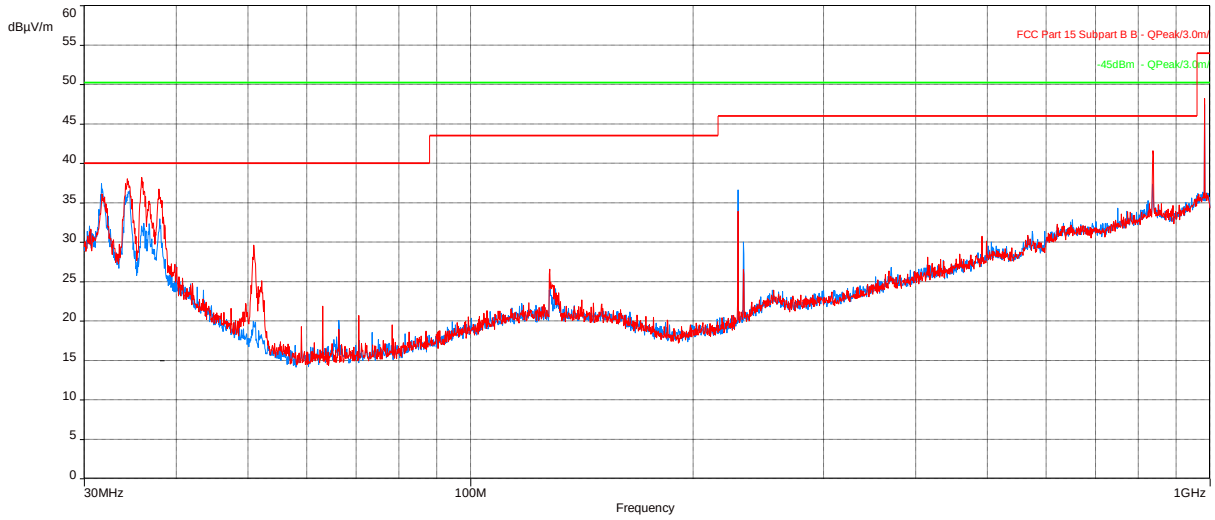


Table 12: RE test results for FCC Part 15 from 30 to 1000 MHz, Low Channel – 5MHz BW

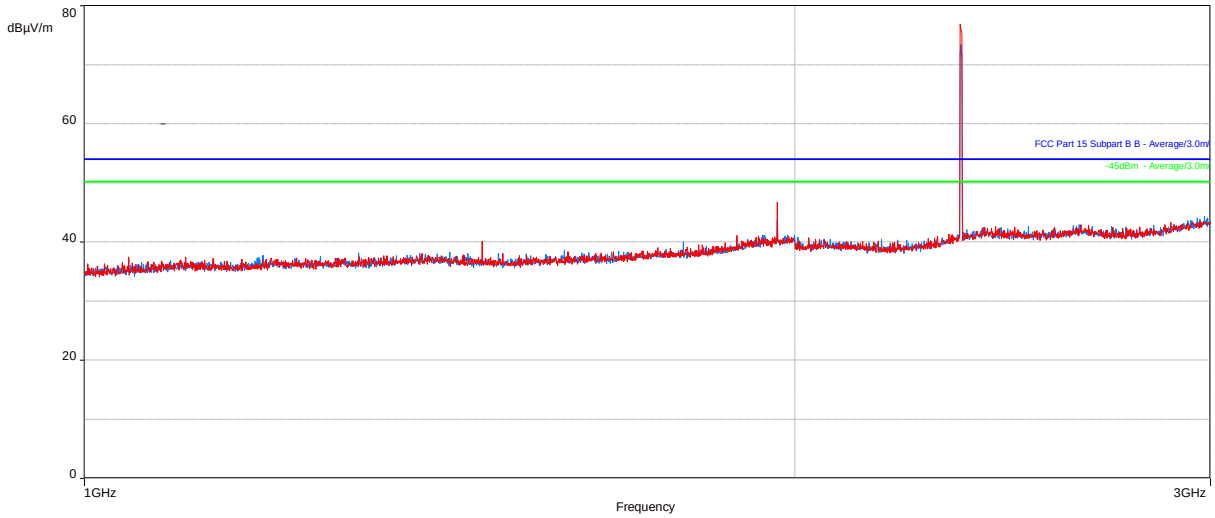
Frequency (MHz)	Level Quasi Peak (dBµV/m)	Height (m)	Azimuth (deg)	Polarization	Margin (dB)	Limit (dBµV/m)	Correction (dB)
34.32497469	35.28	1.00	175.00	Vertical	-4.72	40.00	23.15
35.84604521	35.26	1.00	291.75	Vertical	-4.74	40.00	22.27
37.91417274	34.14	1.00	360.00	Vertical	-5.86	40.00	22.13
983.0323718	47.87	1.98	75.25	Vertical	-6.11	53.98	29.17

Table 13: RE test results for FCC Part 27 from 30 to 1000 MHz, Low Channel – 5MHz BW

Frequency (MHz)	Level Quasi Peak (dBµV/m)	Height (m)	Azimuth (deg)	Polarization	Margin (dB)	Limit (dBµV/m)	Correction (dB)
34.32497469	35.28	1.00	175.00	Vertical	-14.95	50.23	23.15
35.84604521	35.26	1.00	291.75	Vertical	-14.97	50.23	22.27
37.91417274	34.14	1.00	360.00	Vertical	-16.09	50.23	22.13
983.0323718	47.87	1.98	75.25	Vertical	-2.36	50.23	29.17

Note: In the table above, no emissions exceed the Part 27 radiated spurious emissions limit when converted to dBuV/m. For final spurious emissions measurements to FCC Part 27, see antenna port conducted emissions in applicable test report.

Figure 5: Plot of RE at 3 m for FCC from 1 to 3 GHz, Low Channel – 5MHz BW



Note: The emission exceeding the limit in the graph above was the emission of the fundamental from the 50-ohm loads.

Note 2: Between 2285 MHz and 2370 MHz, where not part of the certified band, the limits in Table 11 apply. Final measurements were performed in these bands via antenna port conducted emissions.

Table 14: RE test results for FCC Part 15 from 1 to 3 GHz, Low Channel – 5MHz BW

Frequency (MHz)	Average Level (dBµV/m)	Height (m)	Azimuth (deg)	Polarization	Margin (dB)	Limit (dBµV/m)	Correction (dB)
1966.064777	48.10	3.62	175.00	Vertical	-5.86	53.96	30.11
2350.635129	79.37	1.00	355.25	Vertical	25.41	53.96	31.33

Table 15: RE test results for FCC Part 27 from 1 to 3 GHz, Low Channel – 5MHz BW

Frequency (MHz)	Average Level (dBµV/m)	Height (m)	Azimuth (deg)	Polarization	Margin (dB)	Limit (dBµV/m)	Correction (dB)
1966.064777	48.10	3.62	175.00	Vertical	-2.13	50.23	30.11
2350.635129	79.37	1.00	355.25	Vertical	29.14	50.23	31.33

Note: In the table above, no emissions exceed the Part 27 radiated spurious emissions limit when converted to dBuV/m, except for the fundamental. For final spurious emissions measurements to FCC Part 27, see antenna port conducted emissions in applicable test report.

Figure 6: Plot of RE at 3 m for FCC from 3 to 10 GHz, Low Channel – 5MHz BW

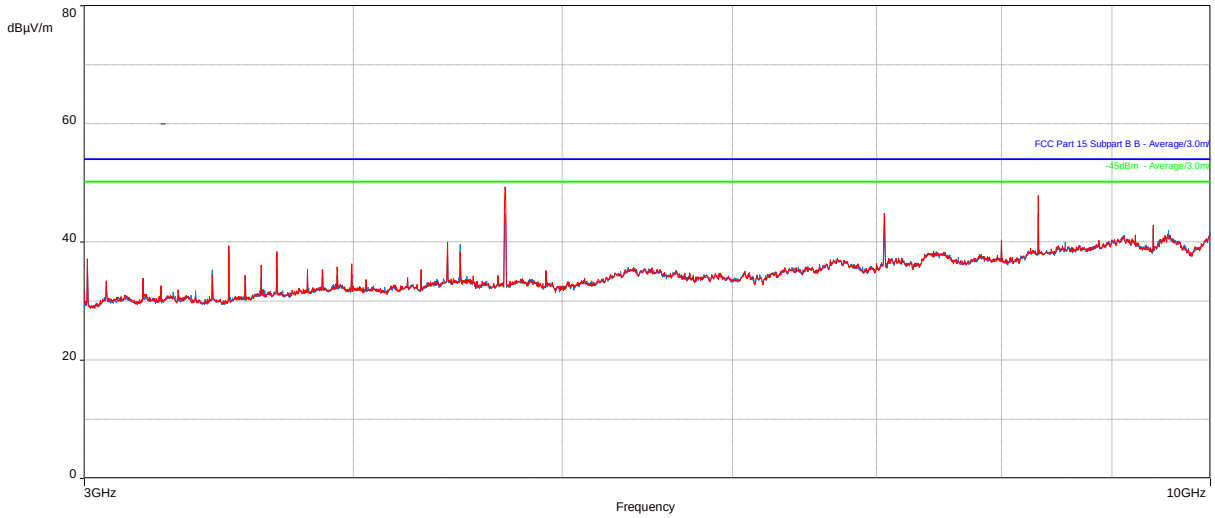


Table 16: RE test results for FCC Part 15 from 3 to 10 GHz, Low Channel – 5MHz BW

Frequency (MHz)	Average Level (dBµV/m)	Height (m)	Azimuth (deg)	Polarization	Margin (dB)	Limit (dBµV/m)	Correction (dB)
4705.818269	47.12	1.31	220.75	Vertical	-6.84	53.96	-2.61
7057.997082	43.90	1.11	270.25	Vertical	-10.06	53.96	3.67
8319.934295	45.48	3.15	182.25	Vertical	-8.48	53.96	3.31

Table 17: RE test results for FCC Part 27 from 3 to 10 GHz, Low Channel – 5MHz BW

Frequency (MHz)	Average Level (dBµV/m)	Height (m)	Azimuth (deg)	Polarization	Margin (dB)	Limit (dBµV/m)	Correction (dB)
4705.818269	47.12	1.31	220.75	Vertical	-3.11	50.23	-2.61
7057.997082	43.90	1.11	270.25	Vertical	-6.33	50.23	3.67
8319.934295	45.48	3.15	182.25	Vertical	-4.75	50.23	3.31

Note: In the table above, no emissions exceed the Part 27 radiated spurious emissions limit when converted to dBuV/m. For final spurious emissions measurements to FCC Part 27, see antenna port conducted emissions in applicable test report.

Figure 7: Plot of RE at 3 m for FCC from 10 to 17 GHz, Low Channel – 5MHz BW

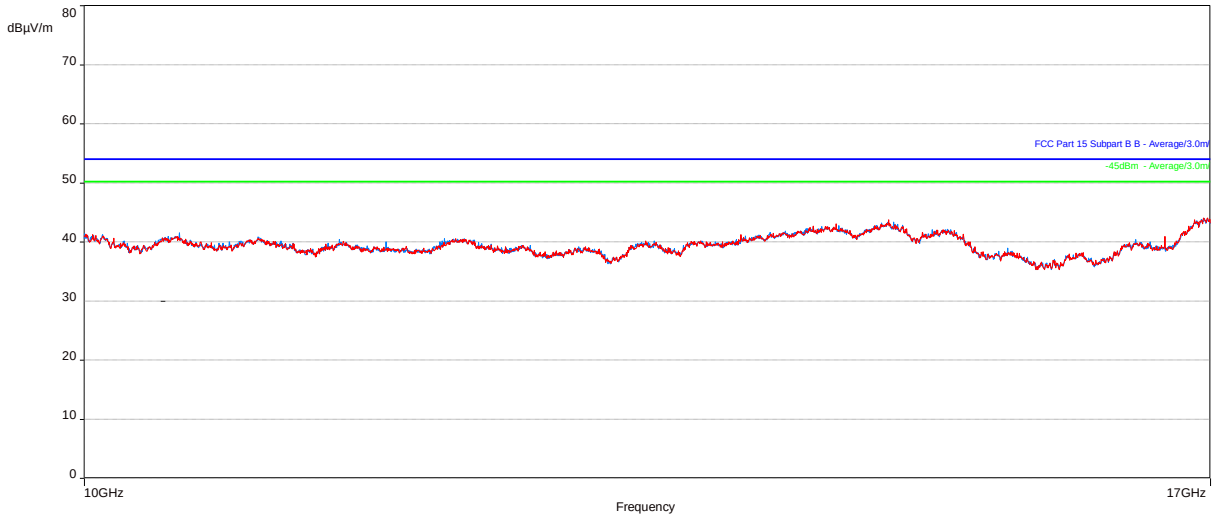


Table 18: RE test results for FCC Part 15 from 10 to 17 GHz, Low Channel – 5MHz BW

Frequency (MHz)	Average Level (dBµV/m)	Height (m)	Azimuth (deg)	Polarization	Margin (dB)	Limit (dBµV/m)	Correction (dB)
16639.9654	38.82	1.00	360.00	Vertical	-15.14	53.96	7.96
16946.32659	39.77	1.00	360.00	Vertical	-14.19	53.96	14.53

Table 19: RE test results for FCC Part 27 from 10 to 17 GHz, Low Channel – 5MHz BW

Frequency (MHz)	Average Level (dBµV/m)	Height (m)	Azimuth (deg)	Polarization	Margin (dB)	Limit (dBµV/m)	Correction (dB)
16639.9654	38.82	1.00	360.00	Vertical	-11.41	50.23	7.96
16946.32659	39.77	1.00	360.00	Vertical	-10.46	50.23	14.53

Note: In the table above, no emissions exceed the Part 27 radiated spurious emissions limit when converted to dBuV/m. For final spurious emissions measurements to FCC Part 27, see antenna port conducted emissions in applicable test report.

Figure 8: Plot of RE at 3 m for FCC from 17 to 18 GHz, Low Channel – 5MHz BW

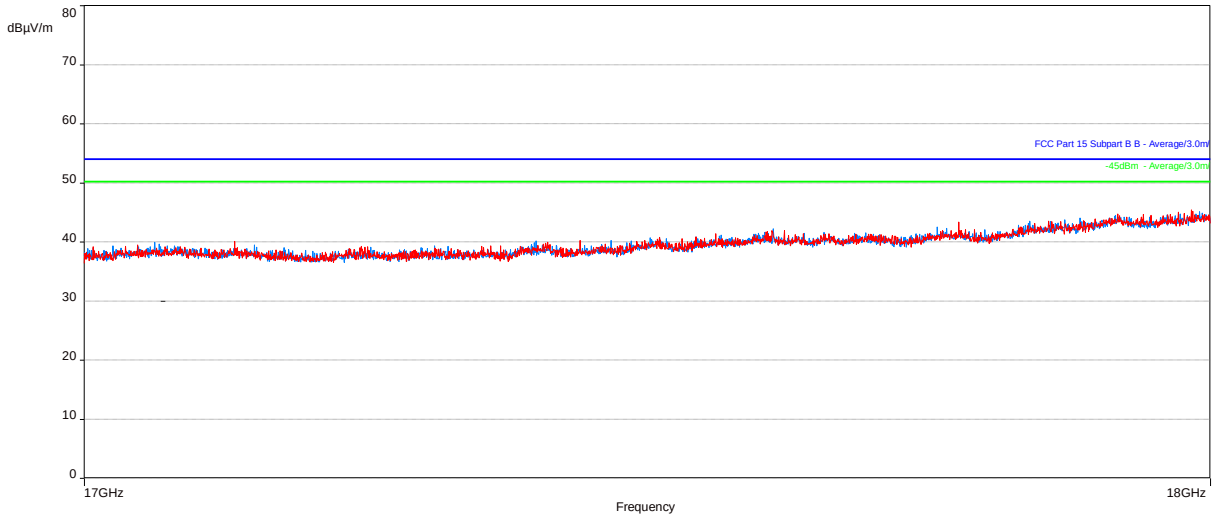


Table 20: RE test results for FCC Part 15 from 17 to 18 GHz, Low Channel – 5MHz BW

Frequency (MHz)	Average Level (dBµV/m)	Height (m)	Azimuth (deg)	Polarization	Margin (dB)	Limit (dBµV/m)	Correction (dB)
17771.60673	42.90	1.96	360.00	Vertical	-11.06	53.96	15.73

Table 21: RE test results for FCC Part 27 from 17 to 18 GHz, Low Channel – 5MHz BW

Frequency (MHz)	Average Level (dBµV/m)	Height (m)	Azimuth (deg)	Polarization	Margin (dB)	Limit (dBµV/m)	Correction (dB)
17771.60673	42.90	1.96	360.00	Vertical	-7.33	50.23	15.73

Note: In the table above, no emissions exceed the Part 27 radiated spurious emissions limit when converted to dBuV/m. For final spurious emissions measurements to FCC Part 27, see antenna port conducted emissions in applicable test report.

Figure 9: Plot of RE at 1 m for FCC from 18 to 26.5 GHz, Low Channel – 5MHz BW

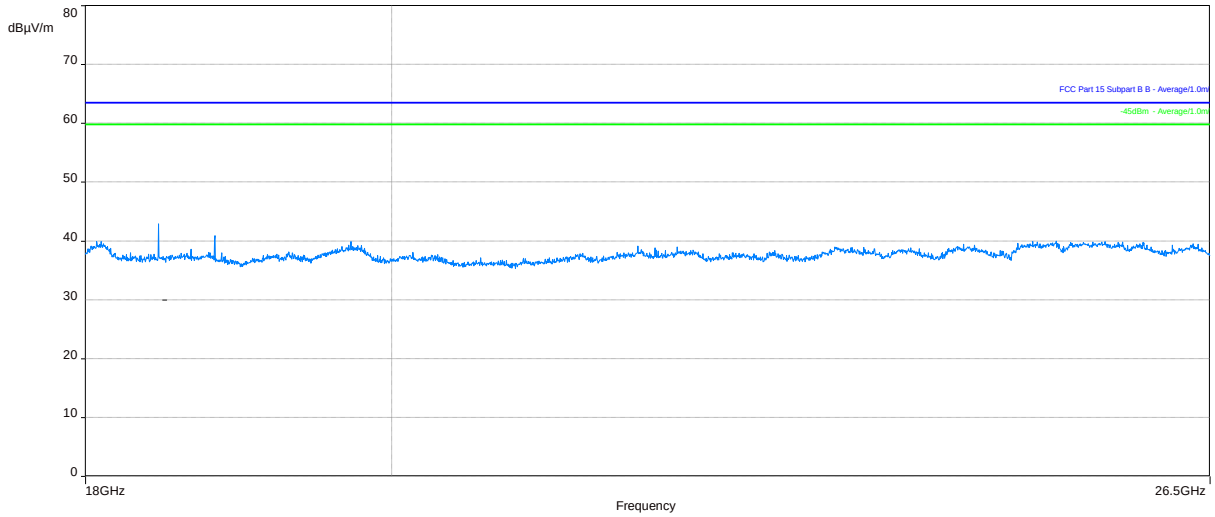


Table 22: RE test results for FCC Part 15 from 18 to 26.5 GHz, Low Channel – 5MHz BW

Frequency (MHz)	Average Level (dBµV/m)	Margin (dB)	Limit (dBµV/m)	Correction (dB)
18459.85561	46.93	-16.59	63.52	-12.43

Table 23: RE test results for FCC Part 27 from 18 to 26.5 GHz, Low Channel – 5MHz BW

Frequency (MHz)	Average Level (dBµV/m)	Margin (dB)	Limit (dBµV/m)	Correction (dB)
18459.85561	46.93	-12.84	59.77	-12.43

Note: In the table above, no emissions exceed the Part 27 radiated spurious emissions limit when converted to dBuV/m. For final spurious emissions measurements to FCC Part 27, see antenna port conducted emissions in applicable test report.

Figure 10: Plot of RE at 10 m for FCC from 30 to 1000 MHz, Mid Channel – 5MHz BW

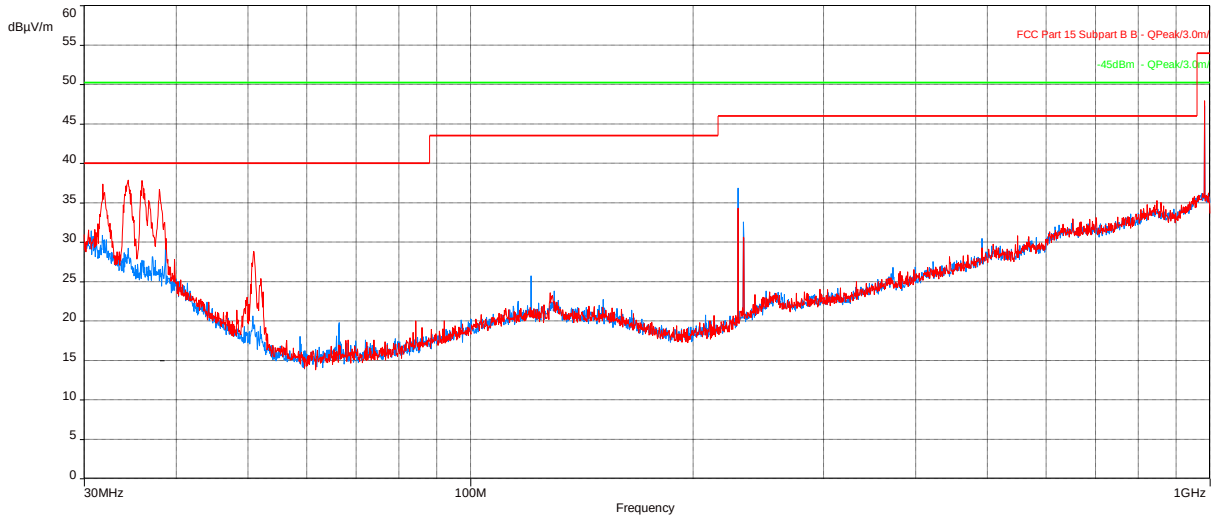


Table 24: RE test results for FCC Part 15 from 30 to 1000 MHz, Mid Channel – 5MHz BW

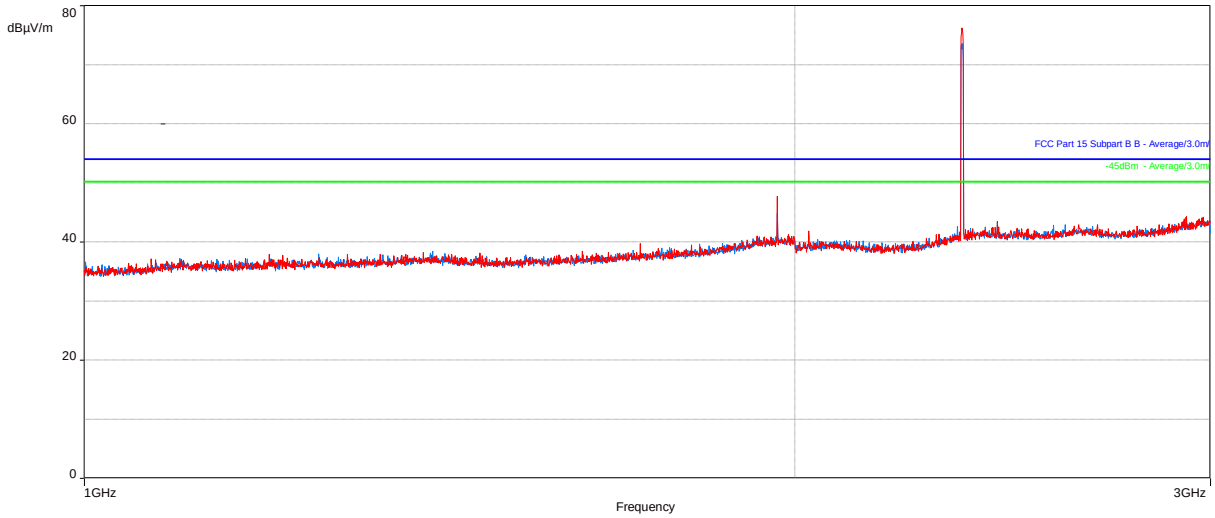
Frequency (MHz)	Level Quasi Peak (dBµV/m)	Height (m)	Azimuth (deg)	Polarization	Margin (dB)	Limit (dBµV/m)	Correction (dB)
31.80105162	32.50	1.00	253.25	Vertical	-7.50	40.00	24.71
34.42473685	36.14	1.00	327.00	Vertical	-3.86	40.00	23.06
35.95466026	35.73	1.00	360.00	Vertical	-4.27	40.00	22.24
37.91573751	33.88	1.00	359.25	Vertical	-6.12	40.00	22.13
983.0321697	47.99	1.97	75.25	Vertical	-5.99	53.98	29.17

Table 25: RE test results for FCC Part 27 from 30 to 1000 MHz, Mid Channel – 5MHz BW

Frequency (MHz)	Level Quasi Peak (dBµV/m)	Height (m)	Azimuth (deg)	Polarization	Margin (dB)	Limit (dBµV/m)	Correction (dB)
31.80105162	32.50	1.00	253.25	Vertical	-17.73	50.23	24.71
34.42473685	36.14	1.00	327.00	Vertical	-14.09	50.23	23.06
35.95466026	35.73	1.00	360.00	Vertical	-14.50	50.23	22.24
37.91573751	33.88	1.00	359.25	Vertical	-16.35	50.23	22.13
983.0321697	47.99	1.97	75.25	Vertical	-2.24	50.23	29.17

Note: In the table above, no emissions exceed the Part 27 radiated spurious emissions limit when converted to dBuV/m. For final spurious emissions measurements to FCC Part 27, see antenna port conducted emissions in applicable test report.

Figure 11: Plot of RE at 3 m for FCC from 1 to 3 GHz, Mid Channel – 5MHz BW



Note: The emission exceeding the limit in the graph above was the emission of the fundamental from the 50-ohm loads.

Note 2: Between 2285 MHz and 2370 MHz, where not part of the certified band, the limits in Table 11 apply. Final measurements were performed in these bands via antenna port conducted emissions.

Table 26: RE test results for FCC Part 15 from 1 to 3 GHz, Mid Channel – 5MHz BW

Frequency (MHz)	Average Level (dBµV/m)	Height (m)	Azimuth (deg)	Polarization	Margin (dB)	Limit (dBµV/m)	Correction (dB)
1966.064456	47.76	2.81	125.00	Vertical	-6.20	53.96	30.11
2354.513909	80.95	2.53	334.50	Vertical	26.99	53.96	31.34

Table 27: RE test results for FCC Part 27 from 1 to 3 GHz, Mid Channel – 5MHz BW

Frequency (MHz)	Average Level (dBµV/m)	Height (m)	Azimuth (deg)	Polarization	Margin (dB)	Limit (dBµV/m)	Correction (dB)
1966.064456	47.76	2.81	125.00	Vertical	-2.47	50.23	30.11
2354.513909	80.95	2.53	334.50	Vertical	30.72	50.23	31.34

Note: In the table above, no emissions exceed the Part 27 radiated spurious emissions limit when converted to dBuV/m, except for the fundamental. For final spurious emissions measurements to FCC Part 27, see antenna port conducted emissions in applicable test report.

Figure 12: Plot of RE at 3 m for FCC from 3 to 8 GHz, Mid Channel – 5MHz BW

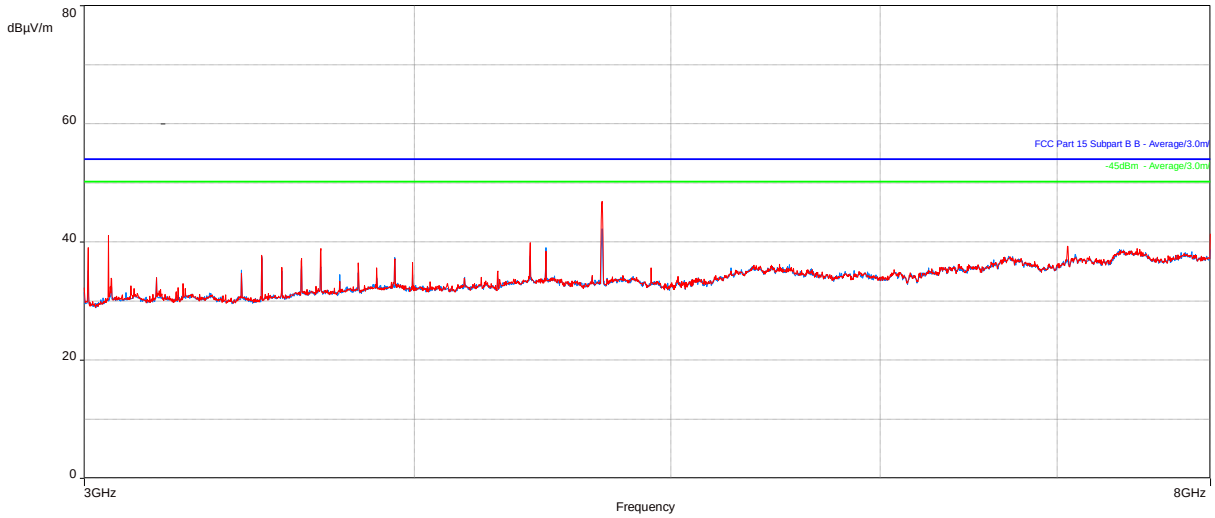


Table 28: RE test results for FCC Part 15 from 3 to 8 GHz, Mid Channel – 5MHz BW

Frequency (MHz)	Peak Level (dBµV/m)	Height (m)	Azimuth (deg)	Polarization	Margin (dB)	Limit (dBµV/m)	Correction (dB)
3064.333333	41.03	1.01	89.25	Vertical	-12.93	53.96	-5.69
4423.666667	39.84	1.50	68.50	Vertical	-14.12	53.96	-2.86
4709.833333	42.24	3.49	278.00	Horizontal	-11.72	53.96	-2.57
4710.166667	46.81	1.50	214.75	Vertical	-7.15	53.96	-2.57
7065.5	39.27	2.50	278.50	Vertical	-14.69	53.96	3.73

Table 29: RE test results for FCC Part 27 from 3 to 8 GHz, Mid Channel – 5MHz BW

Frequency (MHz)	Peak Level (dBµV/m)	Height (m)	Azimuth (deg)	Polarization	Margin (dB)	Limit (dBµV/m)	Correction (dB)
3064.333333	41.03	1.01	89.25	Vertical	-9.20	50.23	-5.69
4423.666667	39.84	1.50	68.50	Vertical	-10.39	50.23	-2.86
4709.833333	42.24	3.49	278.00	Horizontal	-7.99	50.23	-2.57
4710.166667	46.81	1.50	214.75	Vertical	-3.42	50.23	-2.57
7065.5	39.27	2.50	278.50	Vertical	-10.96	50.23	3.73

Note: In the table above, no emissions exceed the Part 27 radiated spurious emissions limit when converted to dBuV/m. For final spurious emissions measurements to FCC Part 27, see antenna port conducted emissions in applicable test report.

Figure 13: Plot of RE at 3 m for FCC Part 15 from 8 to 10 GHz, Mid Channel – 5MHz BW

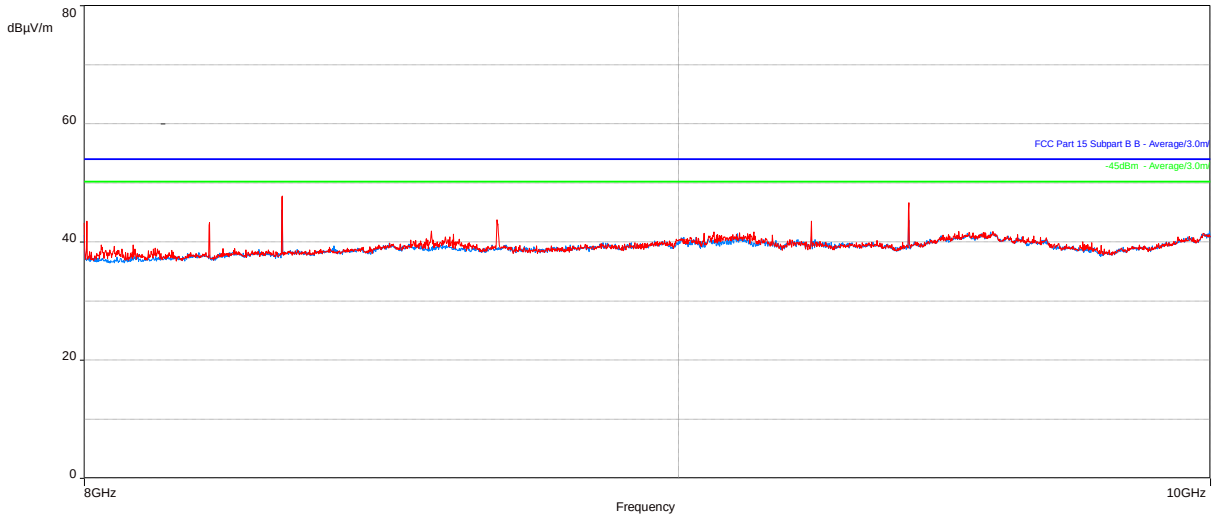


Table 30: RE test results for FCC Part 15 from 8 to 10 GHz, Mid Channel – 5MHz BW

Frequency (MHz)	Average Level (dBµV/m)	Height (m)	Azimuth (deg)	Polarization	Margin (dB)	Limit (dBµV/m)	Correction (dB)
8319.934295	45.77	2.81	182.00	Vertical	-8.19	53.96	3.31
9419.927597	45.56	1.00	75.25	Vertical	-8.40	53.96	5.05

Table 31: RE test results for FCC Part 27 from 8 to 10 GHz, Mid Channel – 5MHz BW

Frequency (MHz)	Average Level (dBµV/m)	Height (m)	Azimuth (deg)	Polarization	Margin (dB)	Limit (dBµV/m)	Correction (dB)
8319.934295	45.77	2.81	182.00	Vertical	-4.46	50.23	3.31
9419.927597	45.56	1.00	75.25	Vertical	-4.67	50.23	5.05

Note: In the table above, no emissions exceed the Part 27 radiated spurious emissions limit when converted to dBuV/m. For final spurious emissions measurements to FCC Part 27, see antenna port conducted emissions in applicable test report.

Figure 14: Plot of RE at 3 m for FCC from 10 to 18 GHz, Mid Channel – 5MHz BW

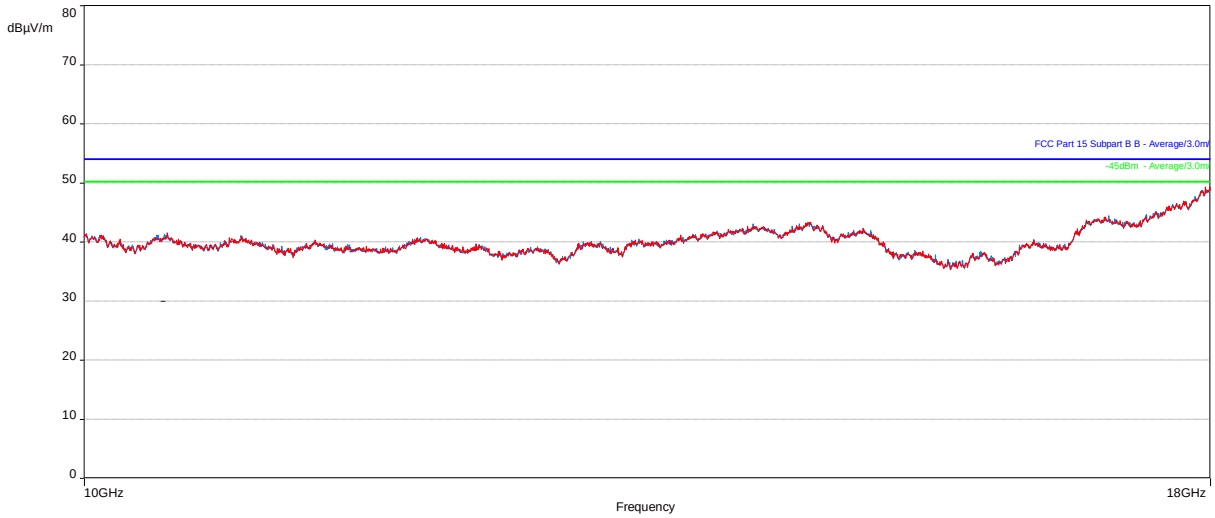


Table 32: RE test results for FCC Part 15 from 10 to 18 GHz, Mid Channel – 5MHz BW

Frequency (MHz)	Average Level (dBµV/m)	Height (m)	Azimuth (deg)	Polarization	Margin (dB)	Limit (dBµV/m)	Correction (dB)
16872.78061	39.41	1.00	360.00	Vertical	-14.55	53.96	13.50

Table 33: RE test results for FCC Part 27 from 10 to 18 GHz, Mid Channel – 5MHz BW

Frequency (MHz)	Average Level (dBµV/m)	Height (m)	Azimuth (deg)	Polarization	Margin (dB)	Limit (dBµV/m)	Correction (dB)
16872.78061	39.41	1.00	360.00	Vertical	-10.82	50.23	13.50

Note: In the table above, no emissions exceed the Part 27 radiated spurious emissions limit when converted to dBuV/m. For final spurious emissions measurements to FCC Part 27, see antenna port conducted emissions in applicable test report.

Figure 15: Plot of RE at 1 m for FCC Part 15 from 18 to 26.5 GHz, Mid Channel – 5MHz BW

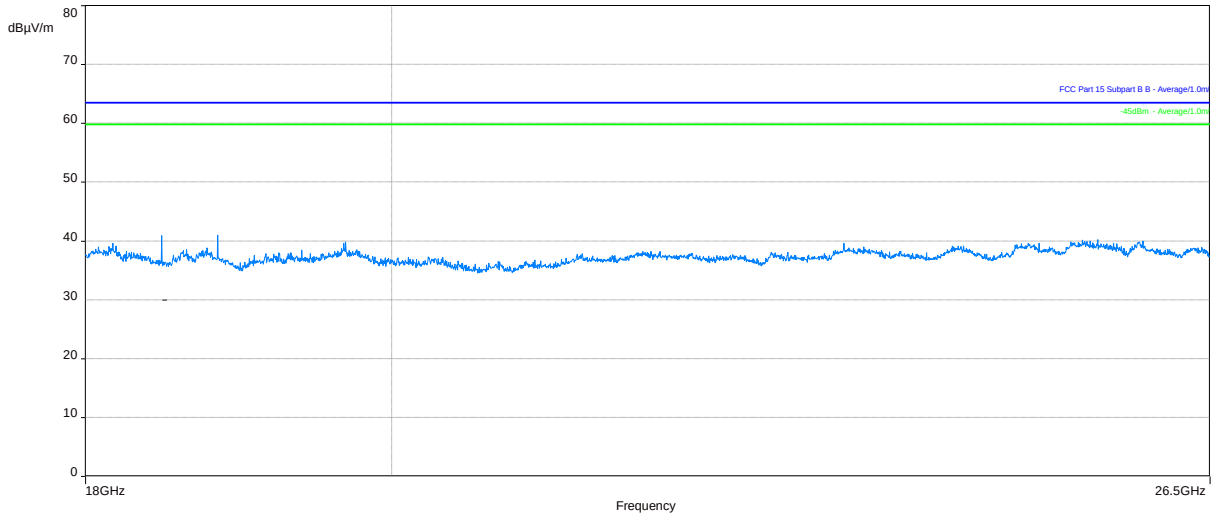


Table 34: RE test results for FCC Part 15 from 18 to 26.5 GHz, Mid Channel – 5MHz BW

Frequency (MHz)	Average Level (dBµV/m)	Margin (dB)	Limit (dBµV/m)	Correction (dB)
18839.84183	40.06	-23.46	63.52	-11.20

Table 35: RE test results for FCC Part 27 from 18 to 26.5 GHz, Mid Channel – 5MHz BW

Frequency (MHz)	Average Level (dBµV/m)	Margin (dB)	Limit (dBµV/m)	Correction (dB)
18839.84183	40.06	-19.71	59.77	-11.20

Note: In the table above, no emissions exceed the Part 27 radiated spurious emissions limit when converted to dBuV/m. For final spurious emissions measurements to FCC Part 27, see antenna port conducted emissions in applicable test report.

Figure 16: Plot of RE at 10 m for FCC from 30 to 1000 MHz, High Channel – 5MHz BW

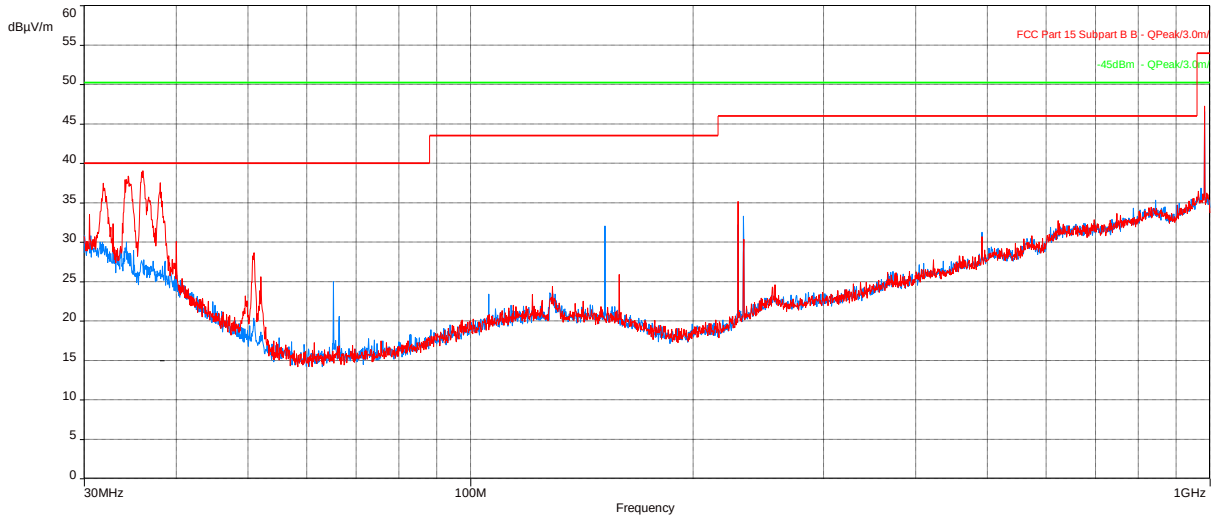


Table 36: RE test results for FCC Part 15 from 30 to 1000 MHz, High Channel – 5MHz BW

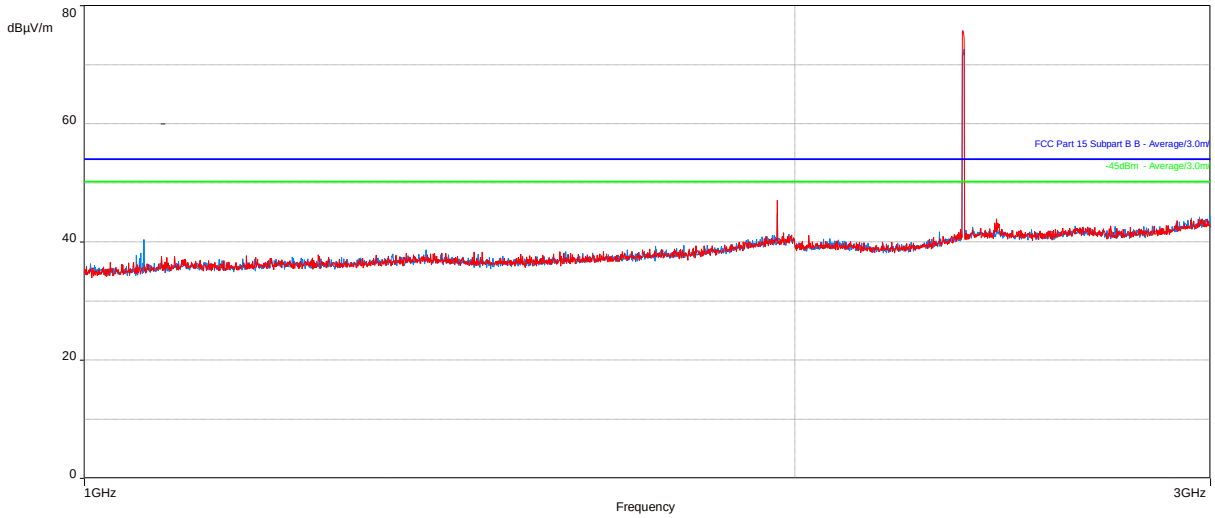
Frequency (MHz)	Level Quasi Peak (dBµV/m)	Height (m)	Azimuth (deg)	Polarization	Margin (dB)	Limit (dBµV/m)	Correction (dB)
36.04028205	35.33	1.00	360.00	Vertical	-4.67	40.00	22.23
229.9478877	36.23	3.94	295.75	Vertical	-9.79	46.02	15.77
983.0321697	47.53	1.97	75.25	Vertical	-6.45	53.98	29.17
151.8444582	14.89	2.66	139.25	Horizontal	-28.63	43.52	16.29

Table 37: RE test results for FCC Part 27 from 30 to 1000 MHz, High Channel – 5MHz BW

Frequency (MHz)	Level Quasi Peak (dBµV/m)	Height (m)	Azimuth (deg)	Polarization	Margin (dB)	Limit (dBµV/m)	Correction (dB)
36.04028205	35.33	1.00	360.00	Vertical	-14.90	50.23	22.23
229.9478877	36.23	3.94	295.75	Vertical	-14.00	50.23	15.77
983.0321697	47.53	1.97	75.25	Vertical	-2.70	50.23	29.17
151.8444582	14.89	2.66	139.25	Horizontal	-35.34	50.23	16.29

Note: In the table above, no emissions exceed the Part 27 radiated spurious emissions limit when converted to dBuV/m. For final spurious emissions measurements to FCC Part 27, see antenna port conducted emissions in applicable test report.

Figure 17: Plot of RE at 3 m for FCC Part 15 from 1 to 3 GHz, High Channel – 5MHz BW



Note: The emission exceeding the limit in the graph above was the emission of the fundamental from the 50-ohm loads.

Note 2: Between 2285 MHz and 2370 MHz, where not part of the certified band, the limits in Table 11 apply. Final measurements were performed in these bands via antenna port conducted emissions.

Table 38: RE test results for FCC Part 15 from 1 to 3 GHz, High Channel – 5MHz BW

Frequency (MHz)	Average Level (dBµV/m)	Height (m)	Azimuth (deg)	Polarization	Margin (dB)	Limit (dBµV/m)	Correction (dB)
1966.064617	47.69	2.95	153.50	Vertical	-6.27	53.96	30.11
2356.002404	81.15	2.46	338.50	Vertical	27.19	53.96	31.35
1060.274873	38.56	3.83	93.00	Horizontal	-15.40	53.96	26.77

Table 39: RE test results for FCC Part 27 from 1 to 3 GHz, High Channel – 5MHz BW

Frequency (MHz)	Average Level (dBµV/m)	Height (m)	Azimuth (deg)	Polarization	Margin (dB)	Limit (dBµV/m)	Correction (dB)
1966.064617	47.69	2.95	153.50	Vertical	-2.54	50.23	30.11
2356.002404	81.15	2.46	338.50	Vertical	30.92	50.23	31.35
1060.274873	38.56	3.83	93.00	Horizontal	-11.67	50.23	26.77

Note: In the table above, no emissions exceed the Part 27 radiated spurious emissions limit when converted to dBuV/m, except for the fundamental. For final spurious emissions measurements to FCC Part 27, see antenna port conducted emissions in applicable test report.

Figure 18: Plot of RE at 3 m for FCC from 3 to 10 GHz, High Channel – 5MHz BW

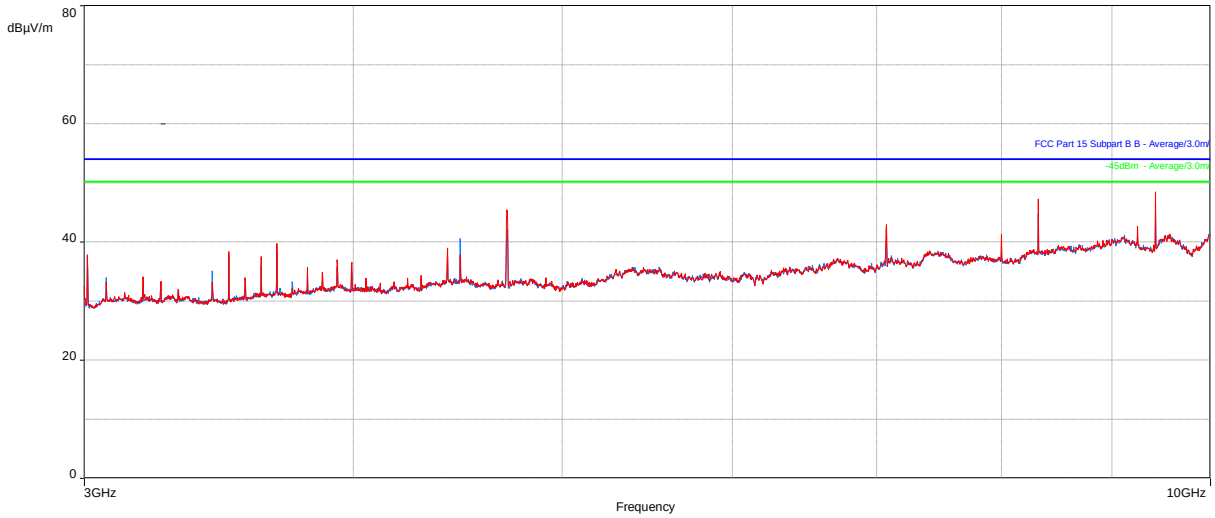


Table 40: RE test results for FCC Part 15 from 3 to 10 GHz, High Channel – 5MHz BW

Frequency (MHz)	Average Level (dBµV/m)	Height (m)	Azimuth (deg)	Polarization	Margin (dB)	Limit (dBµV/m)	Correction (dB)
4714.676603	43.99	2.88	327.25	Vertical	-9.97	53.96	-2.53
9429.926636	48.36	1.00	277.50	Vertical	-5.60	53.96	5.40
8319.934295	44.05	3.49	185.25	Horizontal	-9.91	53.96	3.31

Table 41: RE test results for FCC Part 27 from 3 to 10 GHz, High Channel – 5MHz BW

Frequency (MHz)	Average Level (dBµV/m)	Height (m)	Azimuth (deg)	Polarization	Margin (dB)	Limit (dBµV/m)	Correction (dB)
4714.676603	43.99	2.88	327.25	Vertical	-6.24	50.23	-2.53
9429.926636	48.36	1.00	277.50	Vertical	-1.87	50.23	5.40
8319.934295	44.05	3.49	185.25	Horizontal	-6.18	50.23	3.31

Note: In the table above, no emissions exceed the Part 27 radiated spurious emissions limit when converted to dBuV/m. For final spurious emissions measurements to FCC Part 27, see antenna port conducted emissions in applicable test report.

Figure 19: Plot of RE at 3 m for FCC from 10 to 17 GHz, High Channel – 5MHz BW

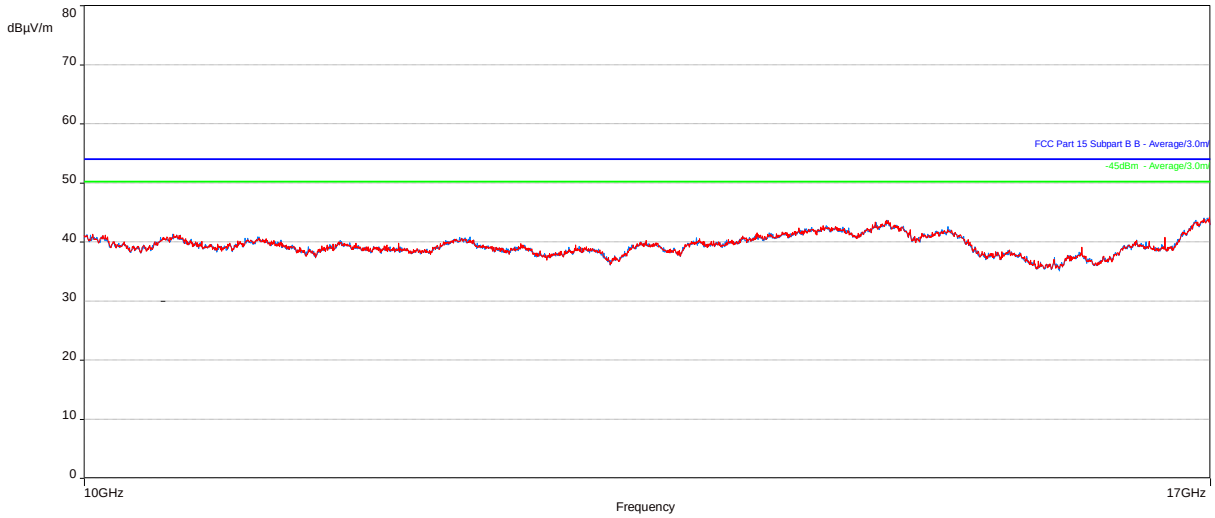


Table 42: RE test results for FCC Part 15 from 10 to 17 GHz, High Channel – 5MHz BW

Frequency (MHz)	Average Level (dBµV/m)	Height (m)	Azimuth (deg)	Polarization	Margin (dB)	Limit (dBµV/m)	Correction (dB)
16950.30272	40.07	4.00	360.00	Horizontal	-13.89	53.96	14.56

Table 43: RE test results for FCC Part 27 from 10 to 17 GHz, High Channel – 5MHz BW

Frequency (MHz)	Average Level (dBµV/m)	Height (m)	Azimuth (deg)	Polarization	Margin (dB)	Limit (dBµV/m)	Correction (dB)
16950.30272	40.07	4.00	360.00	Horizontal	-10.16	50.23	14.56

Note: In the table above, no emissions exceed the Part 27 radiated spurious emissions limit when converted to dBuV/m. For final spurious emissions measurements to FCC Part 27, see antenna port conducted emissions in applicable test report.

Figure 20: Plot of RE at 3 m for FCC from 17 to 18 GHz, High Channel – 5MHz BW

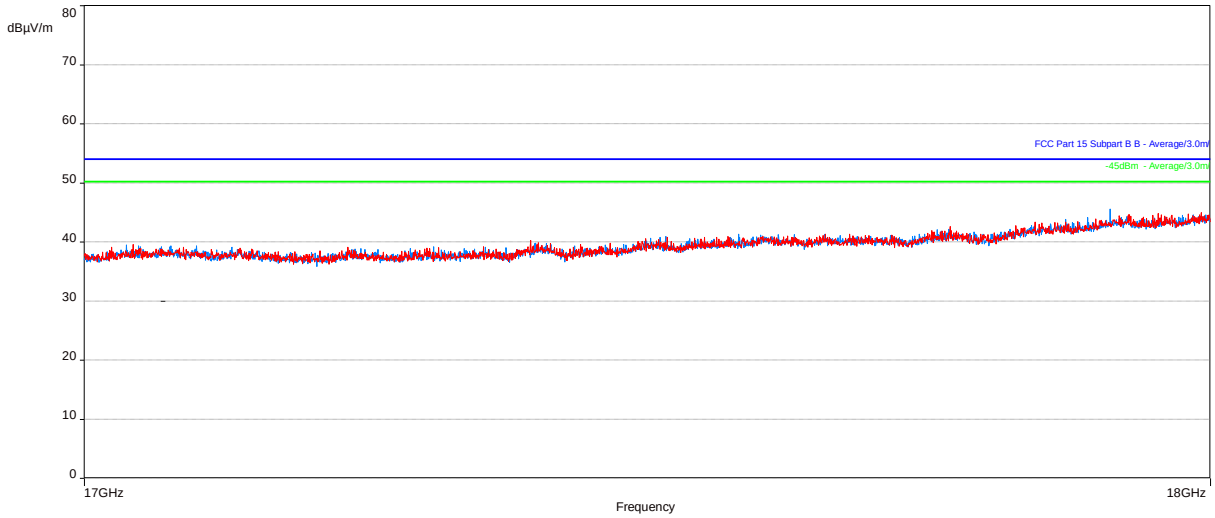


Table 44: RE test results for FCC Part 15 from 17 to 18 GHz, High Channel – 5MHz BW

Frequency (MHz)	Average Level (dBµV/m)	Height (m)	Azimuth (deg)	Polarization	Margin (dB)	Limit (dBµV/m)	Correction (dB)
17908.7662	45.44	1.00	360.00	Horizontal	-8.52	53.96	19.03

Table 45: RE test results for FCC Part 27 from 17 to 18 GHz, High Channel – 5MHz BW

Frequency (MHz)	Average Level (dBµV/m)	Height (m)	Azimuth (deg)	Polarization	Margin (dB)	Limit (dBµV/m)	Correction (dB)
17908.7662	45.44	1.00	360.00	Horizontal	-4.79	50.23	19.03

Note: In the table above, no emissions exceed the Part 27 radiated spurious emissions limit when converted to dBuV/m. For final spurious emissions measurements to FCC Part 27, see antenna port conducted emissions in applicable test report.

Figure 21: Plot of RE at 1 m for FCC from 18 to 26.5 GHz, High Channel – 5MHz BW

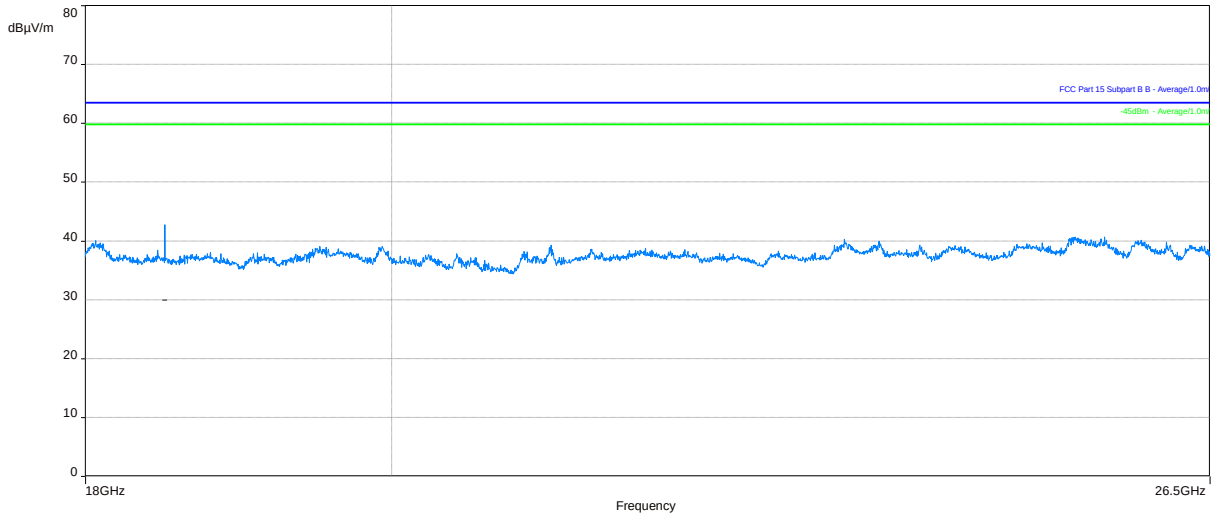


Table 46: RE test results for FCC Part 15 from 18 to 26.5 GHz, High Channel – 5MHz BW

Frequency (MHz)	Average Level (dBµV/m)	Margin (dB)	Limit (dBµV/m)	Correction (dB)
18499.84455	42.95	-20.57	63.52	-12.77

Table 47: RE test results for FCC Part 27 from 18 to 26.5 GHz, High Channel – 5MHz BW

Frequency (MHz)	Average Level (dBµV/m)	Margin (dB)	Limit (dBµV/m)	Correction (dB)
18499.84455	42.95	-16.82	59.77	-12.77

Note: In the table above, no emissions exceed the Part 27 radiated spurious emissions limit when converted to dBuV/m. For final spurious emissions measurements to FCC Part 27, see antenna port conducted emissions in applicable test report.

Figure 22: Setup for RE tests for 30 MHz to 1 GHz

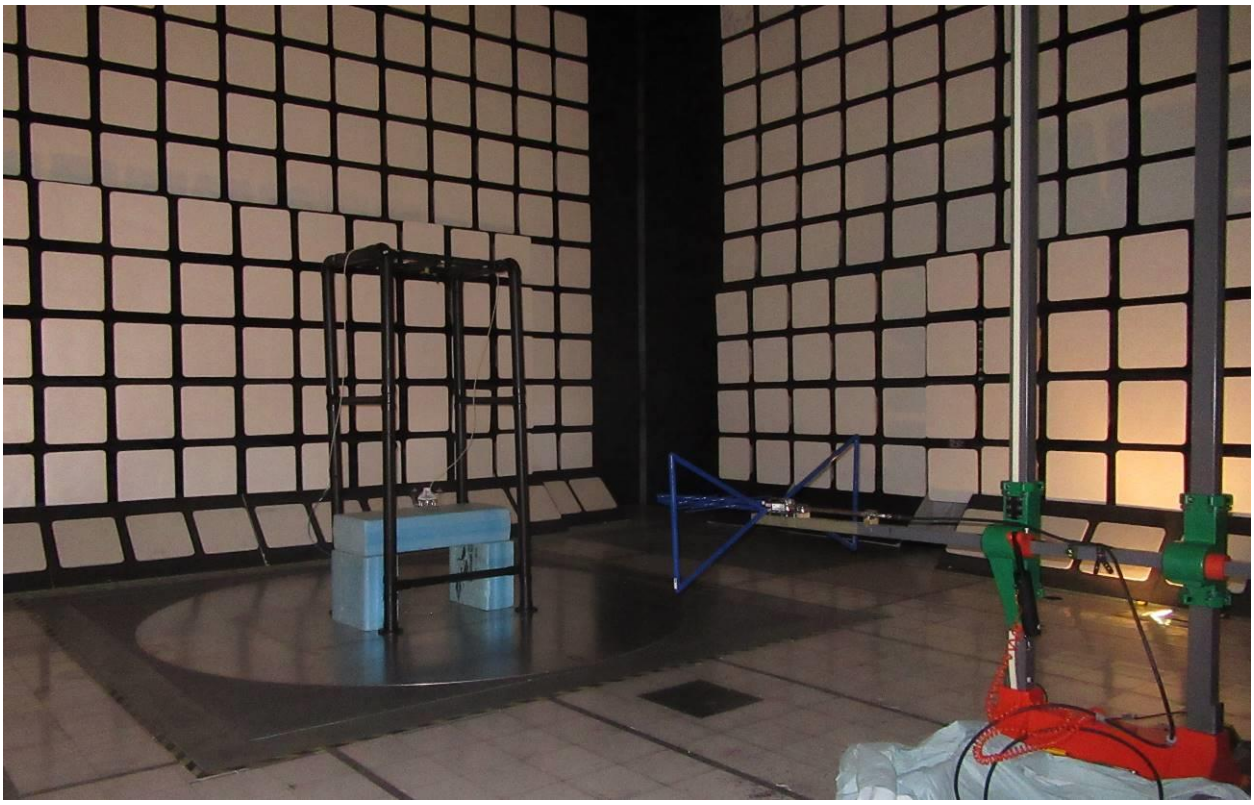
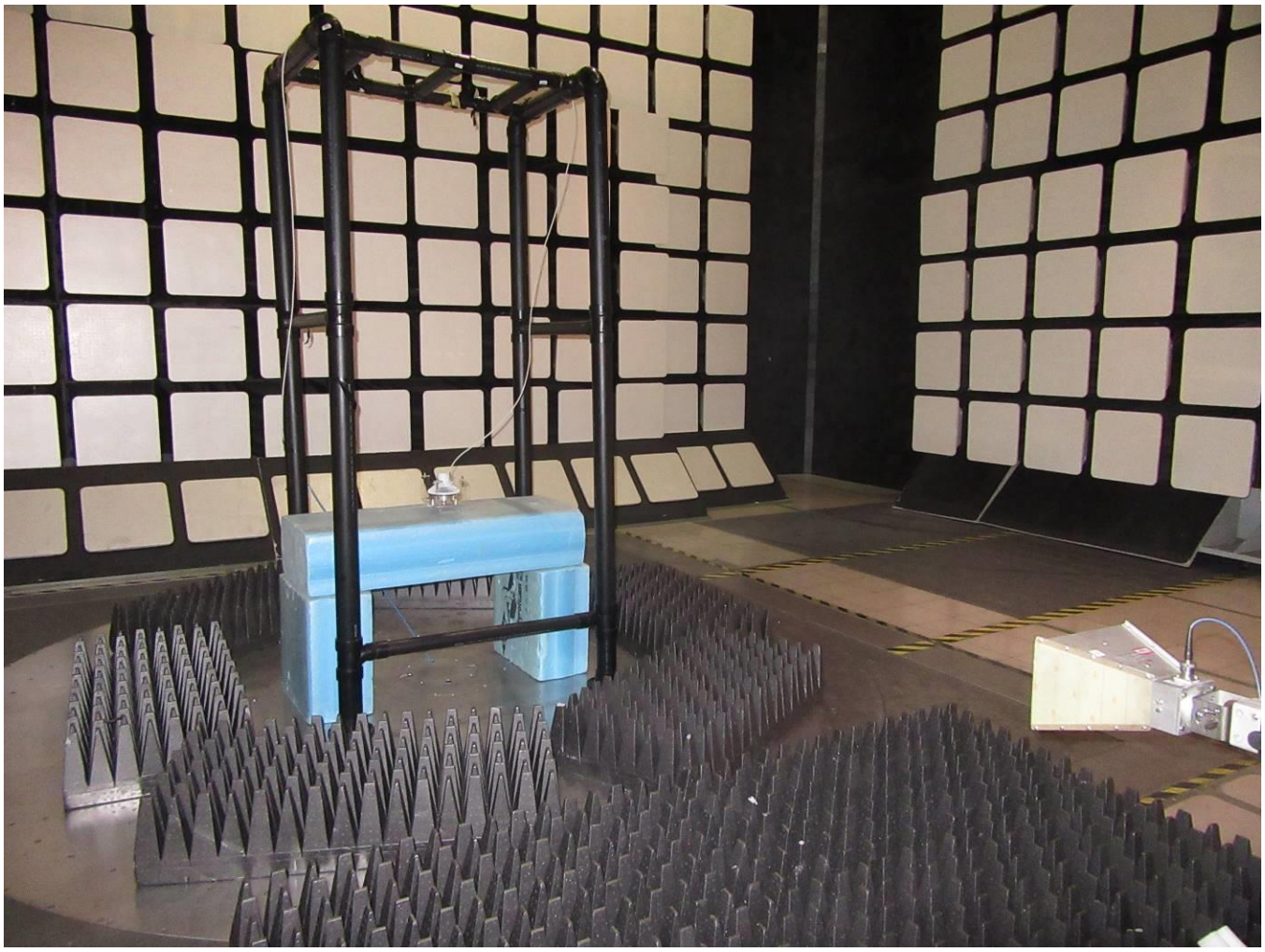


Figure 23: Setup for RE tests for above 1 GHz



3.2.6 Test equipment

The equipment used for E-field RE testing was as follows.

Table 48: Test equipment used for RE

Description	Make	Model number	Asset ID	Calibration date	Calibration due
EMI Receiver	Rohde & Schwarz	ESU40	SSG013672	2017-11-28	2018-11-28
EMI Receiver	Rohde & Schwarz	ESU26	SSG013729	2018-02-13	2019-02-13
Coaxial Cable	Huber & Suhner	106A	SSG012455	2018-01-05	2019-01-06
Coaxial Cable	Huber & Suhner	106A	SSG013841	2018-01-05	2019-01-06
Coaxial Cable	Huber & Suhner	104PEA	SSG012041	2018-01-05	2019-01-06
Bilog Antenna	Chase	CBL6111	SSG012564	2018-02-01	2019-02-01
Double Ridged Horn Antenna	Emco	3115	SSG012508	2017-12-21	2018-12-21
Pre-Amplifier	BNR	LNA	SSG012594	2018-04-04	2019-04-04
RF Filter: High Pass	Microwave Circuits inc.	H3G02G1	SSG012728	2018-01-08	2019-01-09
Coaxial Cable	Huber & Suhner	ST18/Nm/Nm/36	SSG012786	2018-01-05	2019-01-06
Coaxial Cable	Huber & Suhner	101 PEA	SSG013785	2018-10-03	2019-10-03
Horn Antenna (18 - 26.5 GHz)	Emco	3160-09	SSG012292	2018-01-02	2019-01-02

3.2.7 Test conclusion

The RD 4442 B30 has passed the E-field Radiated Emission (RE) tests with respect to the Class B limits of FCC Part 15 Subpart B.

For the FCC Part 15 limit, the worst-case margin was -3.86 dB at 34.42473685 MHz, while operating on Mid Channel.

For the converted FCC Part 27 limit, the worst-case margin was -1.87 dB at 9429.926636 MHz, while operating on High Channel. For final spurious emissions measurements to FCC Part 27, see antenna port conducted emissions in applicable test report.

4. References

The documents, regulations, and standards that are referenced throughout this test report are listed alphabetically as follows.

1. ANSI C63.2-2009, American National Standard for Electromagnetic Noise and Field Strength Instrumentation, 10 Hz to 40 GHz – Specifications.
2. ANSI C63.4-2014, Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
3. APLAC, Asia Pacific Laboratory Accreditation Cooperation, at the website aplac.org.
4. CISPR 16 Publications (all parts and sections), Specification for Radio Disturbance and Immunity Measuring Apparatus and Methods - Part 1: Radio Disturbance and Immunity Measuring Apparatus.
5. EMC General Lab Test Procedure, KP000270-LP-EMC-01.
6. FCC Rules for Radio Frequency Devices, Title 47 of the Code of Federal Regulations, Part 2 – Frequency Allocations and Radio Treaty Matters; General Rules and Regulations, U.S. Federal Communications Commission.
7. FCC Rules for Radio Frequency Devices, Title 47 of the Code of Federal Regulations, Part 15 – Radio Frequency Devices, U.S. Federal Communications Commission.
8. FCC Rules for Radio Frequency Devices, Title 47 of the Code of Federal Regulations, Part 27 - Miscellaneous Wireless Communications Services, U.S. Federal Communications Commission.
9. ILAC, International Laboratory Accreditation Cooperation, at the website ilac.org.
10. Lab34 Edition 1 (2002 August), “The Expression of Uncertainty in EMC Testing”, UKAS.
11. Standards Council of Canada, Scope of Accreditation for TÜV SÜD Canada Inc outlined at the website palcan.scc.ca/Specs/PDF/95_e.pdf

4.1 Appendix A: Abbreviations

The abbreviations of terms used in this document are as follows.

Term	Definition
A	6 dB Coaxial Attenuator (conducted immunity)
AAN	Asymmetric Artificial Network (ISN)
AE	Auxiliary equipment
AFC	Ambient Free Chamber
ANSI	American National Standards Institute
AVG	Average detector
BiLog	Biconical Log-Periodic Hybrid antenna (a registered trademark of Schaffner-Chase EMC Limited, 1993)
CE	Conducted Emissions
CI	Conducted Immunity
CISPR	Comité International Spécial Perturbation Radioélectrique (International Special Committee on Radio Interference)
CP	RF Current Probe
CPE	Customer Premises Equipment
CSA	Canadian Standards Association
DI	Direct Injection
DN/P	Decoupling / Protection Network
DP	High Voltage Differential Probe
EFT	Electrical Fast Transient
EFT/B	Electrical Fast Transient / Burst Generator
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EN	European Normative
ENR	Evaluation Not Requested
ESD	Electrostatic Discharge
ETSI	European Telecommunications Standards Institute
EUT	Equipment Under Test
FCC	Federal Communications Commission, USA
GND	Ground
h/w	hardware
IC	Industry Canada

Term	Definition
ICES	Canadian Specification: ICES-003, Issue 3, “Spectrum Management: Interference-causing equipment standard (Digital Apparatus)
IEC	International Electro Technical Association
ISN	Impedance Stabilization Network
LISN	Line Impedance Stabilization Network
ms	millisecond, unless otherwise specified
NA, na	not applicable
NAMAS	National Measurement Accreditation Service
PK	Peak Detector
PPS	Programmable Power Supply
PS	Power Supply
QP	Quasi-peak Detector
QPA	Quasi-peak Adapter (for the Spectrum Analyzer)
R	100-ohm Injection Resistor (conducted immunity)
RBW	Resolution Bandwidth
RE	Radiated Emissions
s/w	software
SA	Spectrum Analyzer, the CISPR 16, ANSI C63.2 Compliant EMI meter
SCC	Standards Council of Canada
STP	Shielded Twisted Pair
VBW	Video Bandwidth

TÜV SÜD Canada Inc

EMC Radiated Emissions Test Report

End of Document