



Test Report Electromagnetic Compatibility

Product	IoT gateway for cellular connection and data communication from and to different type of devices
Name and address of the applicant	Telenor Connexion AB Box 3081, SE-169 03 Solna, Sweden
Name and address of the manufacturer	Telenor Connexion AB Box 3081, SE-169 03 Solna, Sweden
Model	STA02_B (same as ECB02_B with enclosure)
Rating	12 – 56VDC, max 6W
Trademark	Telenor
Additional information	/
Tested according to	FCC CFR 47 Subpart 15B ISED Canada ICES-003, Issue 7
Project number	467274
Tested in period	2022-11-29 to 2023-03-09
Issue date	2024-05-21
Name and address of the testing laboratory	Nemko Scandinavia AS Philip Pedersens vei 11, 1366 Lysaker, Norway An accredited technical test associated under the Newtonian accreditation schools.

An accredited technical test executed under the Norwegian accreditation scheme

Prepared by [Tore LøvlienDRAFT]

Approved by [Roy Uggerud]



REPORT REVISIONS

Report Edition	Date	Project	Description
REP006529	2023-06-21	467274	First issued
REP006529-4	2024-05-21	467274	Correction of model names
REP006529-4	2024-08-16	467274	Annex removed



THIS REPORT APPLIES ONLY TO THE ITEM(S) AND CONFIGURATION(S) TESTED.

It is the manufacturer's responsibility to assure the additional production units of this product are manufactured with identical electrical and mechanical components. The manufacturer is responsible to the authorities for any modifications made to the product, which result in non-compliance to the relevant regulations.

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Opinions expressed within this report regarding general assessments and qualifications for PASS or FAIL to the standards limits and requirements, are not part of the current accreditation. Neither is opinions expressed regarding model variants covered by the testing performed in this report.

Deviations from, additions to, or exclusions from the test specifications are described in "Test Report Summary".

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DESCRIPTION OF TESTED ITEM(S)

Product description:	The EUT is a multipurpose communication boards with cellular, WiFi, BLE/BT and GNSS technology. The EUT also har connection for RS232, RS485, Digital I/O, USB and CANbus. The EUT also has several onboard LEDs and sensors. During all testing, except Surge and ESD, the device has been connected to a laptop which has been	
	used to energize and supervise all interfaces via a proprietary LabVIEW program. For ESD and Surge, the EUT has been reprogrammed with a special FW, and been supervised via the onboard LEDs. The software allows for having either cellular or GNSS running, not both.	
Model/type:	STA02_B (Same as ECB02_B)	
Serial number:	Prototypes	
Operating voltage:	12 – 56 VDC	
Maximum power/current:	max 6W	
Insulation class:	III	
Highest clock frequency:	582MHz	
Hardware version:	ECB02_B V3	
Software version:	BIST_EBC02_B_0.3.6	
FCC id	2BAKCSTA02B	
Contains FCC id	XMR202005BG95M5 (BG95)	
	XPYMAYAW166 (WiFi)	
	XMR201909EG95NAX (EG95NAX)	
Mounting position:		
Woulding position	□	
	Floor standing equipment	
	☐ Handheld equipment	
	☐ Rack mounted equipment	
	☐ Console equipment	
	☐ Other:	

RF CHARACTERISTICS OF THE TRANSMITTER

See the following Nemko reports for full details on RF transmitters:

2.4GHz WiFi + BT and BLEREP004400According to EN 300 3285GHz WiFiREP004401According to EN 301 893LTEREP004402According to EN 301 908GNSSREP004403According to EN 303 413

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CRITICAL MODULES/PARTS

Description	Manufacturer	Туре
MCU	NXP	MIMXRT1061CVL5B
Modem	Quectel	BG95 M5
Modem	Quectel	EG95 EX
Modem	Quectel	EG95 NAX
MM Connector	Wurth	690367292676
WiFi Module	Ublox	MAYA-W166-00B-00
RJ45	Molex	955406888
Power Socket	Weidmuller	1874690000 alt. 1870500000
PCB	NCAB	/

ACCESSORIES USED DURING TEST

Description	Manufacturer	Туре
Laptop computer	Lenovo	Legion
CAN to USB adapter	Kvaser	U100
2x UART-USB adapters	-	-
POE Injector	Trendnet	TPE-115GI /EU
POE Switch	Zyxel	GS1900-10HP

MODEL VARIANTS

The following model variants have been inspected and are confirmed to be identical or believed to be less disposed with regard to electromagnetic compatibility.

Model/type	Comment	Tested
STA02_B (Same as ECB02_B)	Full test (Performed on ECB02_B)	\boxtimes

INPUT/OUTPUT PORTS

Port name and description	Cable		
	Longer than 3m	Attached during test	Shielded
DC	\boxtimes	\boxtimes	
Ethernet	\boxtimes	\boxtimes	
RS232		\boxtimes	
RS485	\boxtimes	\boxtimes	
USB		\boxtimes	\boxtimes
CANBUS	\boxtimes	\boxtimes	
Digital IO		\boxtimes	
Sensor Feed	\boxtimes	\boxtimes	
Power via Minimodule Connector	\boxtimes	\boxtimes	
Power via Power Terminal	\boxtimes	\boxtimes	

This equipment has been tested with certain cable types and cable configurations. Any changes to these parameters when installed may influence the EMC properties of this equipment.

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TEST REPORT REP006529-4 Report No.

OPERATING MODES

OP no.	Description		Applied for testing	
		Emissions	Immunity	
OP1	Active and communicating, wireless disabled			
OP2	Active and communicating, wireless enabled	\boxtimes		

POWER SUPPLY CONDITIONS					
The following nominal power supply conditions have been tested:					
PC no.	Voltage	Frequency	Туре	Ground terminal	
PC1	24 V	\square AC 50Hz / \square AC 60Hz / \boxtimes DC	☐ 3AC / ☐ 3ACN / ☐ PoE	\square PE / \boxtimes GND / \square None	
PC3	54 V	\square AC 50Hz / \square AC 60Hz / \boxtimes DC	☐ 3AC / ☐ 3ACN / ⊠ PoE	\square PE / \boxtimes GND / \square None	

All DC sources where supplied with 120V/60Hz AC.

DHOTOS AND DRAWINGS

PHOTOS AND DRAWINGS		
Copy of marking label::	/	
Photo of the test item:	See photos	
OTHER INFORMATION		
Modifications:	1	
Additional information:	Power source was supplied with 120V 60Hz.	

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TEST ENVIRONMENT

Test laboratory:	□	
	☐ LYSAKER (Philip Pedersens vei 11, N-1366 Lysaker, Norway)	
Laboratory accreditation:	Norsk Akkreditering – TEST 033 P06 – Electromagnetic Compatibility NORWEGIAN ACCREDITATION TEST 033	
Environmental conditions:	The climatic conditions during the tests are within limits specified by the manufacturer for the operation of the product and the test equipment. The climatic conditions during tests are within the following limits:	
	Ambient temperature: 15 – 35 °C Relative humidity: 25 – 75 %RH Atmospheric pressure: 86 – 106 kPa If explicitly required by the test standard, or the requirements are tighter than the above; the	
Calibration:	climatic conditions are recorded and documented separately in this test report. All instruments used in the tests of this test report are calibrated and traceable to national or international standards. Between calibrations test set-ups are controlled and verified on a regular basis by intermediate checks to ensure, with 95% confidence that the instruments remain within their calibrated levels. The instrumentation accuracy is within limits agreed by the IECEE/CTL and defined by Nemko.	
Measurement uncertainties:	Uncertainty in EMC emission measurements stated in this report are calculated from the standard measurement uncertainties multiplied by the coverage factor k=2. It was determined in accordance with CISPR 16-4-2. The true value is in the corresponding interval with a probability of 95%. Uncertainties for continuous immunity tests are calculated based on the same principles as for EMC emission uncertainties. For Harmonics and Flicker measurements the measurement uncertainty is calculated based on the same principles as for EMC emission uncertainties. Uncertainties for transient immunity are kept within the requirements of the relevant basic standard. Further information about measurement uncertainties is provided on request.	
Decision rules:	As specified by CISPR 16-4-2; if our measurement uncertainty U _{LAB} is less than or equal to U _{CISPR} , compliance is deemed to occur if no measured disturbance level exceeds the limit hence "PASS" is indicated, and non-compliance is deemed to occur if any measured disturbance level exceeds the limits hence "FAIL" is indicated. For continuous immunity tests, uncertainties are not considered when applying the calibrated test levels. Tests are performed at the test levels specified by the test standard. PASS and FAIL decisions are based on behaviour observations of the specimen. For transient immunity tests, uncertainties are not considered if the test equipment is kept within the requirements of the relevant basic standard. Tests are performed at the test levels specified by the test standard. PASS and FAIL decisions are based on behaviour observations of the specimen. For Harmonics and Flicker measurements the measurement uncertainty is considered, and measurements are marked if necessary. In doing so, the associated uncertainty of measurement has been considered. Further information about decision rules is provided on request.	

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TEST REPORT SUMMARY

APPLIED STANDARDS

Standards	Titles
FCC CFR 47 Subpart 15B	Digital devices - Unintentinal radiators, Class B Digital Device
ISED Canada ICES-003, Issue 7	Spectrum Management and Telecommunications Policy. Interference-Causing Equipment Standard. Information Technology Equipment (Including Digital Apparatus - Limits and Methods of Measurement (Issue 7, June 2020)

TEST SUMMARY

Requirements – Tests	Reference standards	Verdict
Conducted Emissions	FCC CFR 47 Subpart 15B:0 ISED Canada ICES-003, Issue 7:0 FCC Part 12.107 per ANSI C63.4-2014	PASS
Radiated Emissions (Below 1GHz)	FCC CFR 47 Subpart 15B:0 ISED Canada ICES-003, Issue 7:0 FCC Part 12.109 per ANSI C63.4-2014	PASS
Radiated Emissions (Above 1GHz)	FCC CFR 47 Subpart 15B:0 ISED Canada ICES-003, Issue 7:0 FCC Part 12.109 per ANSI C63.4-2014	PASS

PASS : Tested and complied with the requirements

FAIL : Tested and failed the requirements

N/A : Test not relevant to this specimen (evaluated by the test laboratory)

Test not performed (instructed by the applicant)

* : An asterisk (*) placed after the verdict in the Result column indicates test items that are not within Nemko's scope of accreditation

: A grid (#) placed after the verdict in the Result column indicates test items that are only partly covered by Nemko's scope of

accreditation. Further information is detailed in the test section $% \left(1\right) =\left(1\right) \left(1\right)$

ABOUT REFERENCE STANDARDS AND TEST LEVELS

Product standards with dated references to basic standards may have been performed according to the newest edition of the basic standard. This may impact the compliance criteria or technical performance of the test, still this is adequate if the test is expected to confirm compliance to the intention of the product standard. The table above lists the actual editions of the basic standards which have been used during testing.

The choice of immunity test levels could be higher than those specified by the reference standards when we consider the nature of the specimen and its intended use or based on customer requests.

NOTES

None

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Test Results

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CONDUCTED EMISSIONS

TEST DESCRIPTION

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The reference method for this test is listed in the table under clause TEST SU
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Set-up The measurement was performed at the power supply terminal of the specimen. Nominal supply voltage was provided.
The specimen was energized and in normal operating mode during the measurement.
\square The specimen and its cables were elevated 10 cm above a ground plane.
\square The specimen and its cables were elevated 40 cm above a ground plane.
☑ The specimen and its cables were placed 40 cm from a vertical ground plane, 80 cm over ground plane.
□ The specimen was mounted directly on, and bonded to a ground plane. Cables and auxiliary equipment were elevated by 1 cm
☑ The specimen was connected to an Artificial Mains Network (AMN) by its power supply cable, which was adjusted to 100cm length by folding.
☐ The specimen was connected to an Artificial Mains Network (AMN) by a 0.8 m shielded power supply cable directly connected to the AMN
Conditions
□ Frequency range was 9kHz – 30MHz.
□ Frequency range was 10kHz – 30MHz.
☑ Frequency range was 150kHz – 30MHz.

The measuring bandwidth is 200Hz in the frequency range 9 kHz - 150 kHz. Measurement was made with a 100 Hz step size and 100 ms dwell time.

The measuring bandwidth is 9 kHz in the frequency range 150 kHz - 30 MHz. Measurement was made with a 4.5 kHz step size and 20 ms dwell time.

Measurement uncertainty: \pm 3.7 dB (9 kHz - 150 kHz); \pm 3.3 dB (150 kHz - 30 MHz)

Instruments used during measurement

Instrument list: AMN: R&S / ENV216 (LR-1665) (11/2023)

EMI Receiver: R&S / ESCI 3 (N-4259) (12/2023)

AC Power Source: Agilent Technoligies / 6812B (LR-1515) (N/A)

Conformity

Verdict: PASS
Test engineer: GNS

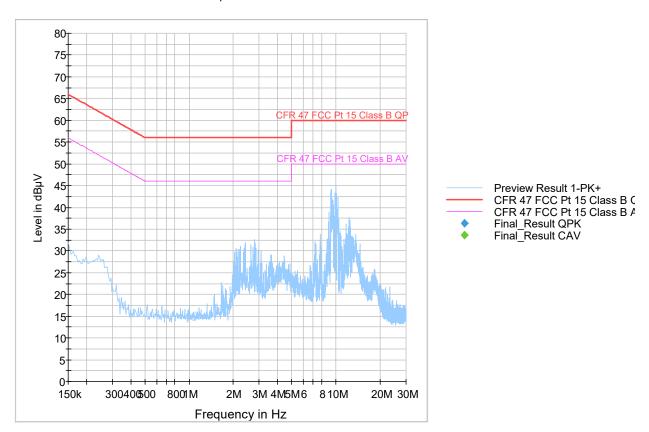
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ECB02B - PC1 - OP2

EMISSION SPECTRUM

Full Spectrum



MEASUREMENT DATA

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)	Comment
-	-	-			-					

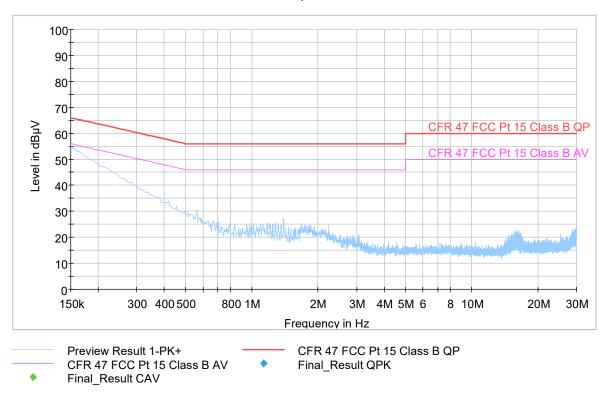
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ECB02B - PC3 - OP2

EMISSION SPECTRUM

Full Spectrum



MEASUREMENT DATA

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)	Comment
	-									

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Report No. REP006529-4

RADIATED EMISSIONS (BELOW 1GHZ)

TEST DESCRIPTION

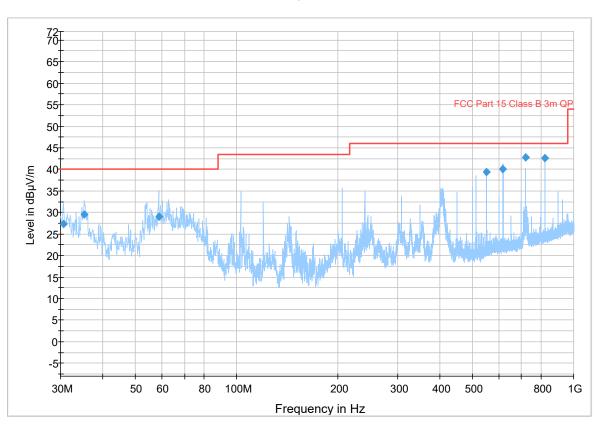
Method The reference method for th	nis test is listed in the table under cla	ause TEST SUMMARY.		
-	rformed in a semi-anechoic chambe I and in normal operating mode dur		vas pro	vided.
☐ The specimen and its cab	les were elevated 10 cm above the s les were placed on a table 80 cm ab D were applied to cables leaving the e power supply cable.	ove the site ground plane and pla		
Antenna type = Hybrid bilog Antenna elevation = 100-400 Specimen rotation = 0-360°.	cm above the ground reference pl	ane.		
\square Band-stop filter(s) was us	ed to suppress the wanted RF trans	mission band to protect the measi	ureme	nt equipment.
Frequency range: 30-300MHz 30-1000MHz Other:	Measurement distance: ☑ 3 m ☐ 5 m ☐ 10 m			
	120 kHz in the frequency range 30 sweep time of 20 ms (step size reso		eps wit	th RBW = 120 kHz and VBW
Measurement uncertainty: ±	\pm 4.9 dB (3m distance in SAC10); \pm 4.	6 dB (3m distance in SAC3); ± 4.6	dB (10	m distance in SAC10)
Instruments used during me	easurement			
Instrument list:	Antenna, Hybrid: Schwarzbeck / VL EMI Receiver: R&S / ESU40 (LR-163 Preamplifier: Sonoma / 310N (LR-1 AC Power Source: Agilent Technolig	9) (01/2024) 686) (08/2023)		
		Conformity		
		Verdict:		PASS
		Test engineer:		DGW

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ECB02B - PC1 - OP1 EMISSION SPECTRUM

Full Spectrum



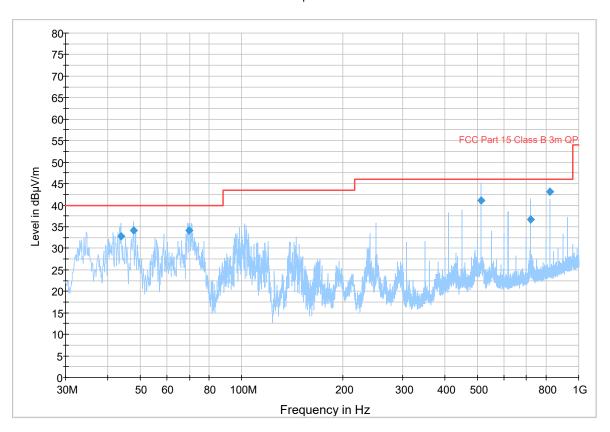
MEASUREMENTS DATA

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBuV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
30.638950	27.36	40.00	12.64	15000.0	120.000	123.0	V	20.0	-15.9
35.342092	29.52	40.00	10.48	15000.0	120.000	116.0	V	70.0	-14.6
58.699186	28.99	40.00	11.01	15000.0	120.000	121.0	V	8.0	-13.5
550.016838	39.33	46.00	6.67	15000.0	120.000	102.0	V	6.0	-4.6
617.159216	40.15	46.00	5.85	15000.0	120.000	239.0	V	317.0	-3.4
720.019084	42.71	46.00	3.29	15000.0	120.000	100.0	Н	246.0	-2.3
822.883094	42.54	46.00	3.46	15000.0	120.000	102.0	Н	174.0	-0.5

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Full Spectrum



MEASUREMENTS DATA

_									_
Frequency	QuasiPeak	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.
(MHz)	(dBµV/m)	(dBµV/m)	(dB)	(ms)	(kHz)	(cm)		(deg)	(dB/m)
43.768744	32.73	40.00	7.27	15000.0	120.000	102.0	V	33.0	-13.5
47.798916	34.12	40.00	5.88	15000.0	120.000	104.0	V	280.0	-13.5
69.692710	34.20	40.00	5.80	15000.0	120.000	113.0	V	94.0	-16.2
514.296610	41.14	46.00	4.86	15000.0	120.000	210.0	Н	1.0	-5.5
720.019984	36.76	46.00	9.24	15000.0	120.000	241.0	V	7.0	-2.3
822.876020	43.15	46.00	2.85	15000.0	120.000	104.0	Н	77.0	-0.5

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Report No. REP006529-4

RADIATED EMISSIONS (ABOVE 1GHZ)

TEST DESCRIPTION

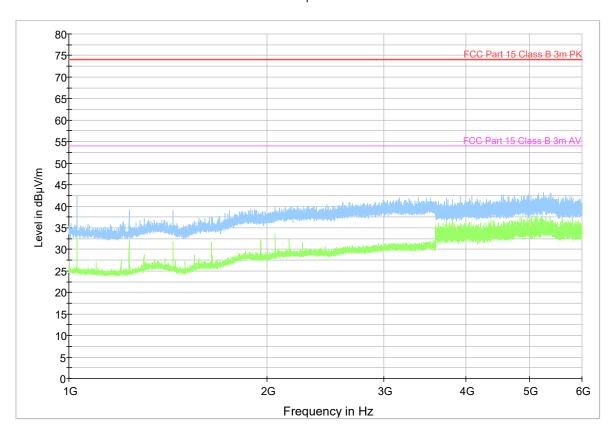
Method The reference method for the	his test is list	ted in the table under clause	TEST SUMMARY.	
Set-up Nominal supply voltage was	s provided. T	he specimen was energized	and in normal operating mode du	ring the measurement.
·			r and placed in the centre of the tu the floor and placed in the centre	
	nber (SAC10)	with extra floor absorbers*	alibrated volume: D=2.0m / H=2.0 (calibrated volume: D=1.5m / H=: 1.0m).	
* The reference ground plane was o	overed with fer	rite absorbers in the reflecting area	between the specimen and the measuring a	antenna.
Measurement distance = ⊠ Antenna elevation = fixed a Specimen rotation = 0-360º Measurements were perfor	t centre of sp	pecimen height. double-ridged guide horn ar	itenna.	
☐ Band-stop filter(s) was us	sed to suppr	ess the wanted RF transmiss	sion band to protect the measurer	nent equipment.
Frequency range: ☐ 1-2GHz ☐ 1-5GHz ☑ 1-6GHz ☑ 1-12GHz		Highest internal frequency Below 108MHz Between 108MHz and 50 Between 500MHz and 10 Above 1000MHz	DOMHz DOOMHz	
			requency sweeps with RBW = 1 M requency range was applied to obt	
Measurement uncertainty:	± 5.1 dB			
Instruments used during m Instrument list:	Antenna, H EMI Receiv Preamplifie	: lorn: ETS / 3117 (LR-1717) (1 er: R&S / ESU40 (LR-1639) (i er: ETS / 3117-PA (LR-1757) (Gource: Agilent Technoligies	01/2024) (08/2023)	
			Conformity	
			Verdict:	PASS
			Test engineer:	DGW

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ECB02B - PC1 - OP1 EMISSION SPECTRUM (HORIZONTAL POLARIZATION)

Full Spectrum



MEASUREMENTS DATA

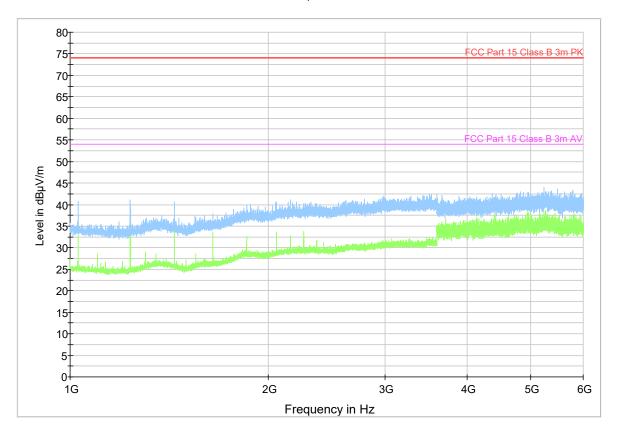
Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)

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EMISSION SPECTRUM (VERTICAL POLARIZATION)

Full Spectrum



MEASUREMENTS DATA

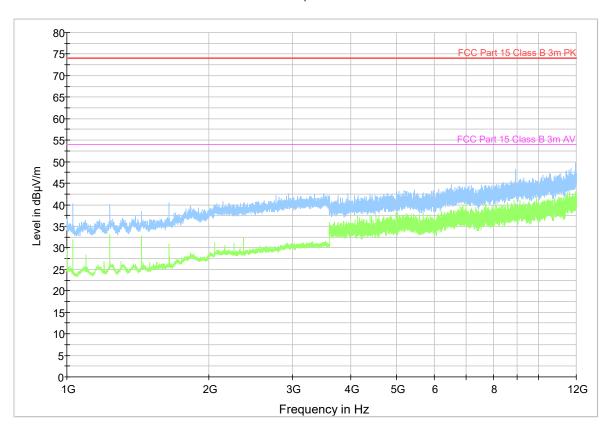
Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)

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ECB02B - PC3 - OP1
EMISSION SPECTRUM (HORIZONTAL POLARIZATION)

Full Spectrum



MEASUREMENTS DATA

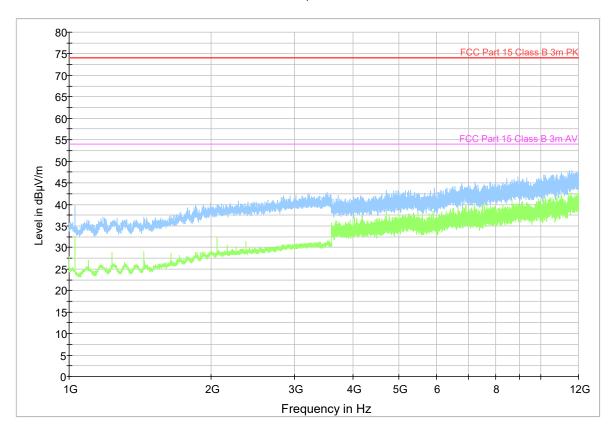
Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)

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EMISSION SPECTRUM (VERTICAL POLARIZATION)

Full Spectrum



MEASUREMENTS DATA

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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