



Canada

RF Test Report

As per

RSS-210 Issue 10:2019 & FCC Part 15 Subpart 15.249

Unlicensed Intentional Radiators

on the

Tag Programmer/Tester
T500/T600 Basic Unit
(Model: 800890)

Issued by: **TÜV SÜD Canada Inc.**
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Testing produced for
kapsch >>>
See Appendix A for full client &
EUT details.



Registration #
6844A-3



Testing Laboratory
Certificate #2955.02

Report Issued: 2/6/2024



R-14023, G-20072
C-14498, T-20060

Report File #: 7169014028RF-000



Registration #
CA6844

Client	Kapsch TrafficCom Canada Inc.	
Product	Tag Programmer/Tester T500/T600 Basic Unit	
Standard(s)	RSS 210 Issue 10:2019 FCC Part 15 Subpart 15.249	

Table of Contents

Table of Contents	2
Report Scope	3
Summary	4
Test Results Summary	5
Notes, Justifications, or Deviations	6
Sample Calculation(s).....	6
Applicable Standards, Specifications and Methods.....	7
Document Revision Status	8
Definitions and Acronyms	9
Testing Facility	10
Calibrations and Accreditations.....	10
Testing Environmental Conditions and Dates	11
Detailed Test Results Section	12
Maximum Output Power.....	13
Transmitter Spurious Radiated Emissions	16
Emission Bandwidth	28
Power Line Conducted Emissions	32
Appendix A – EUT Summary.....	37
Appendix B – EUT and Test Setup Photos.....	39

Client	Kapsch TrafficCom Canada Inc.	
Product	Tag Programmer/Tester T500/T600 Basic Unit	
Standard(s)	RSS 210 Issue 10:2019 FCC Part 15 Subpart 15.249	

Report Scope

This report addresses the EMC verification testing and test results of the **Tag Programmer/Tester T500/T600 Basic Unit** Model: **800890**, and is herein referred to as EUT (Equipment Under Test). The EUT was tested for compliance against the following standards:

RSS-210 Issue 10:2019

FCC Part 15 Subpart C 15.249

Test procedures, results, justifications, and engineering considerations, if any, follow later in this report.

This 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 TÜV SÜD Canada Inc. accreditations. Any opinions expressed do not necessarily reflect the opinions of TÜV SÜD Canada Inc., unless otherwise stated.

Client	Kapsch TrafficCom Canada Inc.	
Product	Tag Programmer/Tester T500/T600 Basic Unit	
Standard(s)	RSS 210 Issue 10:2019 FCC Part 15 Subpart 15.249	

Summary

The results contained in this report relate only to the item(s) tested.

EUT:	Tag Programmer/Tester T500/T600 Basic Unit (Model: 800890)
FCC Certification #, FCC ID:	JQU800890
ISED Certification #, IC:	2665A-800890
EUT passed all tests performed	Yes
Tests conducted by	Jadon Bull
Report reviewed by	Sanjiv Vyas

For testing dates, see "Testing Environmental Conditions and Dates".

Client	Kapsch TrafficCom Canada Inc.	
Product	Tag Programmer/Tester T500/T600 Basic Unit	
Standard(s)	RSS 210 Issue 10:2019 FCC Part 15 Subpart 15.249	

Test Results Summary

Standard/Method	Description	Class/Limit	Result
FCC 15.203	Antenna Requirement	Unique	Pass See Justification
FCC 15.205 RSS-GEN (Table 7)	Restricted Bands for Intentional Operation	QuasiPeak Average	Pass
FCC 15.207 RSS-GEN (Table 4)	Power Line Conducted Emissions	QuasiPeak Average	Pass
FCC 15.249(a) RSS-210 F.1(a)	Maximum Output Power	< 50 mV/m	Pass
FCC 15.249(d) RSS-210 F.1(e)	Transmitter Spurious Radiated Emissions	QuasiPeak Average	Pass
FCC 15.215 RSS-GEN 6.7	Emission Bandwidth	20dB BW 99% BW	Pass
Overall Result			Pass

If the product as tested or otherwise complies with the specification, the EUT is deemed to comply with the requirement and is deemed a 'PASS' grade. If not 'FAIL' grade will be issued. Note that 'PASS' / 'FAIL' grade is independent of any measurement uncertainties. A 'PASS' / 'FAIL' grade within measurement uncertainty is marked with a '*'.

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Notes, Justifications, or Deviations

The following notes, justifications for tests not performed or deviations from the above listed specifications apply:

The EUT is a Basic Unit used in 2 product models: T500 Tag Programmer and T600 Tag Tester.

For both product models the basic unit model is controlled by a host computer and requires an external AC to DC power adapter to operate, which is supplied with the unit. The models differ in the commands from the host computer and the control firmware inside the EUT.

The EUT was tested as a table-top device in the orientation of normal operation.

The EUT is powered by an off-the-shelf AC/DC adaptor (Model: PCM50UT05).

For the Antenna requirement specified in FCC 15.203, the unit uses a single patch antenna (Antenna Gain: -7dBi) that is fixed within the internal assembly of the EUT.

For the Restricted Bands of operation, the EUT is designed to only operate at a fixed frequency of 915MHz, within the designated band of operation of 908MHz-928MHz.

Sample Calculation(s)

Radiated Emission Test

E-Field Level = Received Signal + Antenna Factor + Cable Loss – Pre-Amp Gain

E-Field Level = 50dB μ V + 10dB/m + 2dB – 20dB

E-Field Level = 42dB μ V/m

Margin = Limit – E-Field Level

Margin = 50dB μ V/m – 42dB μ V/m

Margin = 8.0 dB (pass)

Power Line Conducted Emission Test

E-Field Level = Received Signal + Attenuation Factor + Cable Loss + LISN Factor

E-Field Level = 50dB μ V + 10dB + 2.5dB + 0.5dB

E-Field Level = 63dB μ V

Margin = Limit – E-Field Level

Margin = 73dB μ V – 63dB μ V

Margin = 10.0 dB (pass)

Client	Kapsch TrafficCom Canada Inc.	
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Standard(s)	RSS 210 Issue 10:2019 FCC Part 15 Subpart 15.249	

Applicable Standards, Specifications and Methods

- ANSI C63.4:2014 Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
- ANSI C63.10:2020 American National Standard For Testing Unlicensed Wireless Devices
- CFR 47 FCC 15 Subpart C Code of Federal Regulations – Radio Frequency Devices, Intentional Radiators
- RSS-210 Issue 10 2019 Licence-Exempt Radio Apparatus: Category I Equipment
- RSS-GEN Issue 5 2018 General Requirements and Information for the Certification of Radio Apparatus
- ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration Laboratories

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Document Revision Status

Revision	Date	Description	Initials
000	February 6 th , 2023	Initial Release	JB

Client	Kapsch TrafficCom Canada Inc.	
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Standard(s)	RSS 210 Issue 10:2019 FCC Part 15 Subpart 15.249	

Definitions and Acronyms

The following definitions and acronyms are applicable in this report.
See also ANSI C63.14.

DTS – Digital Transmission System
LISN – Line Impedance Stabilization Network
NCR – No Calibration Required
NSA – Normalized Site Attenuation
N/A – Not Applicable
RF – Radio Frequency

AE – Auxiliary Equipment. A digital accessory that feeds data into or receives data from another device (host) that in turn, controls its operation.

Antenna Port – Port, other than a broadcast receiver tuner port, for connection of an antenna used for intentional transmission and/or reception of radiated RF energy.

BW – Bandwidth. Unless otherwise stated, this refers to the 6 dB bandwidth.

EMC – Electro-Magnetic Compatibility. The ability of an equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment.

EMI – Electro-Magnetic Immunity. The ability to maintain a specified performance when the equipment is subjected to disturbance (unwanted) signals of specified levels.

EUT – Equipment Under Test. A device or system being evaluated for compliance that is representative of a product to be marketed.

ITE – Information Technology Equipment. Has a primary function of entry, storage, display, retrieval, transmission, processing, switching, or control of data and/or telecommunication messages and which may be equipped with one or more ports typically for information transfer.

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Testing Facility

Testing for EMC on the EUT was carried out at TÜV SÜD Canada testing lab near Toronto, Ontario. The testing lab has calibrated 3m semi-anechoic chambers which allow measurements on a EUT that has a maximum width or length of up to 2m and a height of up to 3m. The testing lab also has a calibrated 10m Open Area Test Site (OATS). The chambers are equipped with a turntable that is capable of testing devices up to 5000lb in weight and are equipped with a mast that controls the polarization and height of the antenna. Control of the mast occurs in the control room adjoining the shielded chamber. This facility is capable of testing products that are rated for single phase or 3-phase AC input and DC capability is also available. Radiated emission measurements are performed using a BiLog antenna and a Horn antenna where applicable. Conducted emissions, unless otherwise stated, are performed using a LISN and using the vertical ground plane if applicable.

Calibrations and Accreditations

The 3m semi-anechoic chamber is registered with Federal Communications Commission (FCC, CA6844), Innovation, Science and Economic Development Canada (ISED, 6844A-3) and Voluntary Control Council for Interference (VCCI, R-14023, G-20072, C-14498, and T-20060). This chamber was calibrated for Normalized Site Attenuation (NSA) using test procedures outlined in ANSI C63.4 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". The chamber is lined with ferrite tiles and absorption cones to minimize any undesired reflections. The NSA data is kept on file at TÜV SÜD Canada. For radiated susceptibility testing, a 16 point field calibration has been performed on the chamber. The field uniformity data is kept on file at TÜV SÜD Canada. TÜV SÜD Canada Inc. is accredited to ISO 17025 by A2LA with Testing Certificate #2955.02. The laboratory's current scope of accreditation listing can be found as listed on the A2LA website. All measuring equipment is calibrated on an annual or biennial basis as listed for each respective test.

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Testing Environmental Conditions and Dates

Following environmental conditions were recorded in the facility during time of testing

Date	Test	Initials	Temperature (°C)	Humidity (%)	Pressure (kPa)
12/20/2023	Power Line Conducted Emissions	JB	22.6	19	102.9
12/20/2023	Maximum Output Power	JB	22.6	19	102.9
12/20/2023	Transmitter Spurious Radiated Emissions	JB	22.6	19	102.9
12/20/2023	Emissions Bandwidth	JB	22.6	19	102.9

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Detailed Test Results Section

Client	Kapsch TrafficCom Canada Inc.	
Product	Tag Programmer/Tester T500/T600 Basic Unit	
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Maximum Output Power

Purpose

The purpose of this test is to ensure that the maximum equivalent isotropically radiated power does not exceed the limits specified.

Limits and Method

The limits are defined in FCC Part 15.249(a) and RSS-210 B.10(a). The method is given in ANSI C63.10 Section 6.3.3.

As per FCC 15.35(a) and RSS-210 B.10(a) The field strength shall be measured using a CISPR quasi-peak detector for the frequency range of 902-928MHz.

Fundamental Frequency	Field Strength of Fundamental	Field Strength of Harmonics
902 – 928MHz	50 mV/m (94 dBuV/m) at 3m	500 uV/m (54 dBuV/m) at 3m

Harmonics have been measured against Transmitter Spurious Radiated Emissions requirements as a worst-case scenario. Please see the Transmitter Spurious Radiated Emissions section for more details.

Results

The EUT passed with a worst-case margin of 2.9dB.

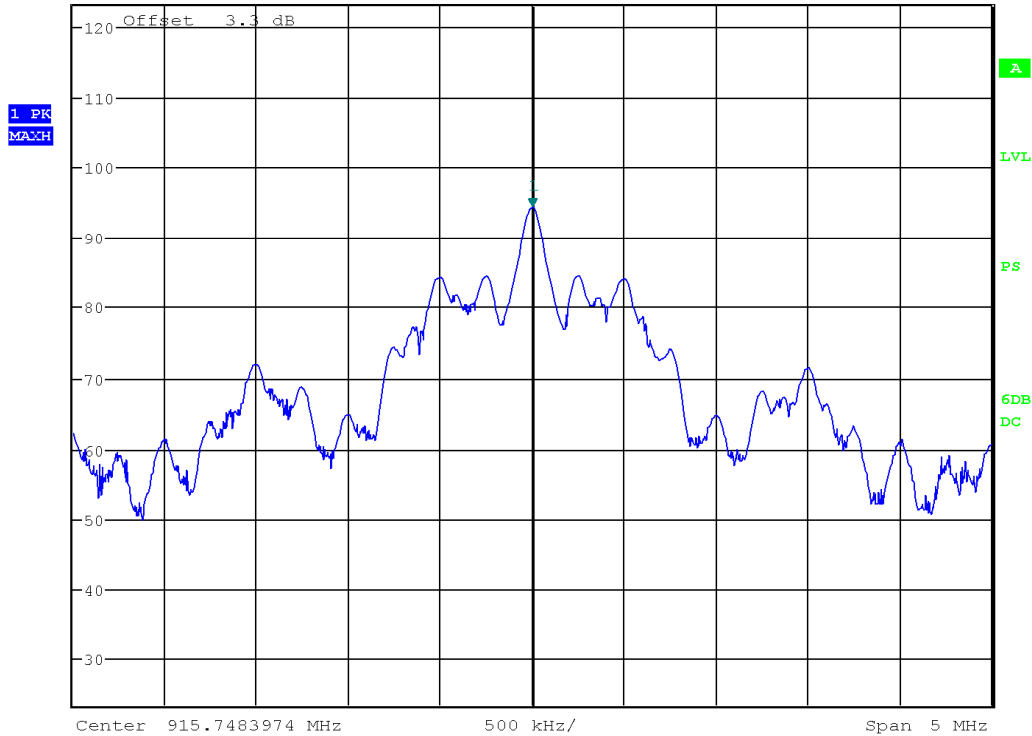
Frequency (MHz)	Antenna Polarization	Detector	Received Signal (dBµV)	Correction Factors (dB/m)	Level (dBµV/m)	QP Limit (dBµV/m)	Margin (dB)	Test Result
915.75	H	PEAK	89.4	3.3	92.7	--	--	--
915.75	V	QP	85.2	3.3	88.5	94.0	5.5	Pass
915.75	H	PEAK	91.6	3.3	94.9	--	--	--
915.75	V	QP	87.8	3.3	91.1	94.0	2.9	Pass

See 'Appendix B – EUT and Test Setup Photos' for photos showing the test set-up.

Client	Kapsch TrafficCom Canada Inc.	
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*RBW 120 kHz Marker 1 [T1]
 *VEW 500 kHz 94.44 dBµV
 *SWT 10 ms 915.744397436 MHz
 Ref 123.3 dBµV *Att 35 dB



Date: 20.DEC.2023 11:58:23

Maximum Peak Power Measurement Plot – Vertical Antenna Polarity

NOTE: The correction factors are considered as a reference level offset in the measurement receiver.

Client	Kapsch TrafficCom Canada Inc.	
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Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
EMI Receiver	ESU 40	Rohde & Schwarz	Feb. 11, 2022	Feb. 11, 2024	GEMC 233
BiLog Antenna	3142-C	ETS-Lindgren	Dec. 7, 2022	Dec. 7, 2024	GEMC 8
Attenuator 6 dB	6N5W-06	Inmet	NCR	NCR	GEMC 345
Pre-Amp 9 kHz – 1 GHz	LNA 6901	Teseq	Feb. 17, 2023	Feb. 17, 2025	GEMC 168
RF Cable <1GHz	LMR-400	LexTec	NCR	NCR	GEMC 274
RF Cable <1GHz	Sucoflex 104A	Huber+Suhner	NCR	NCR	GEMC 271
RF Cable >1GHz	EMC2	MegaPhase	NCR	NCR	GEMC 369

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Transmitter Spurious Radiated Emissions

Purpose

The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT does not exceed the limits listed below as defined in the applicable test standard, as measured from a receiving antenna. This helps protect broadcast radio services such as television, FM radio, pagers, cellular telephones, emergency services, and so on, from unwanted interference.

Limits and Method

The method is as defined in ANSI C63.10 Section 6.3.

The limits are defined in FCC Part 15.249(d) and RSS-210 B.10(b) for emissions radiated outside of the specified frequency bands. These emissions must comply with the radiated emission limits specified in FCC Part 15.209(a) and RSS-GEN 8.9 Tables 5 & 6.

Frequency	Field Strength Limit ($\mu\text{V/m}$)	Field Strength at 3m ($\text{dB}\mu\text{V/m}$)
0.009 MHz – 0.490 MHz	2400/F(kHz) ^a (at 300m)	128.5 to 93.8 ^a
0.490 MHz – 1.705 MHz	24000/F(kHz) ^a (at 30m)	73.8 to 63.0 ^a
1.705 MHz – 30 MHz	30 ^a (at 30m)	69.5 ^a
30 MHz – 88 MHz	100 ^a (at 3m)	40.0 ^a
88 MHz – 216 MHz	150 ^a (at 3m)	43.5 ^a
216 MHz – 960 MHz	200 ^a (at 3m)	46.0 ^a
Above 960 MHz	500 ^a (at 3m)	54.0 ^a
Above 1000 MHz	500 ^b (at 3m)	54.0 ^b
Above 1000 MHz	5 mV/m ^c (at 3m)	74.0 ^c

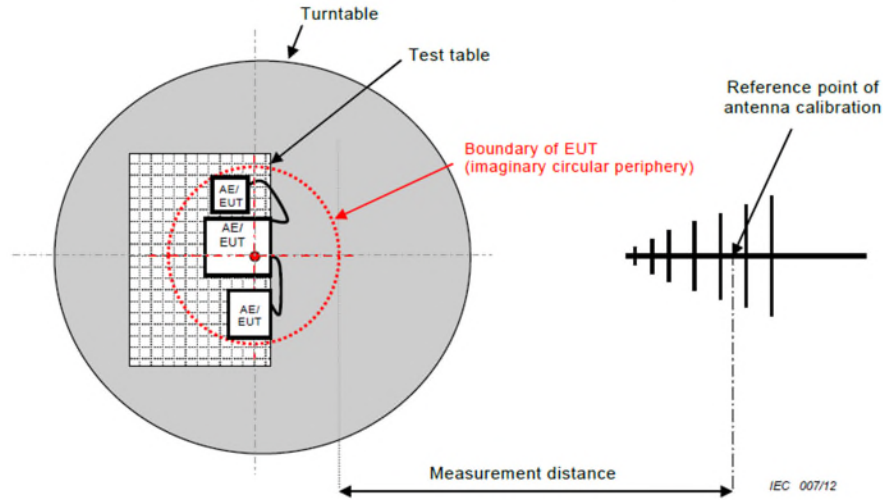
^aLimit is with Quasi Peak detector with bandwidths as defined in CISPR-16-1-1

^bLimit is with 1 MHz measurement bandwidth and using an Average detector

^cLimit is with 1 MHz measurement bandwidth and using a Peak detector

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Typical Radiated Emissions Setup



Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is $\pm 5.66\text{dB}$ for 30MHz – 1GHz and $\pm 4.68\text{dB}$ for 1GHz – 18GHz with a 'k=2' coverage factor and a 95% confidence level.

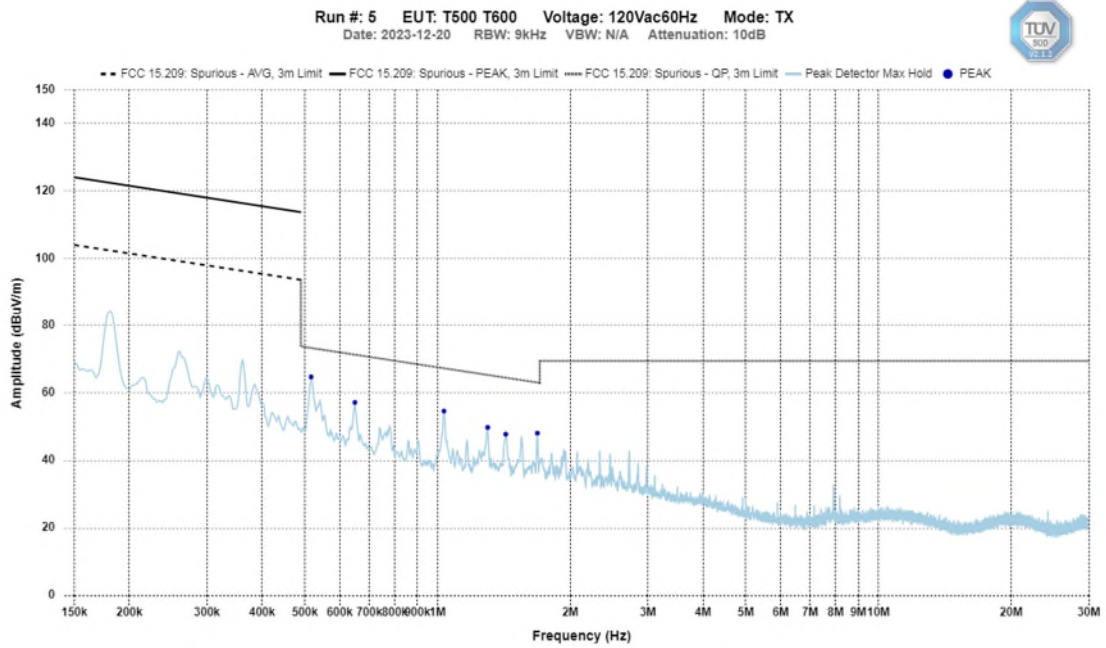
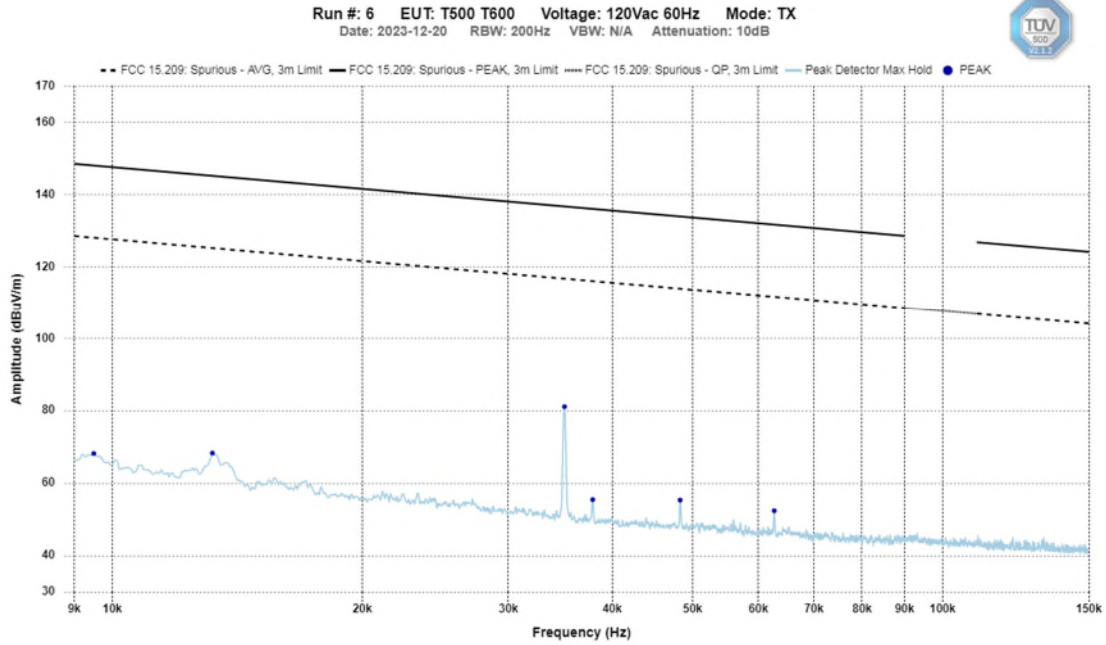
Preliminary Graphs

The graphs shown below are maximized peak measurement graphs measured with a resolution bandwidth greater than or equal to the final required detector over a full 0-360°. This peaking process is done as a worst-case measurement and enables the detection of frequencies of concern for final measurement. For final measurements with the appropriate detector, where applicable, please refer to the tables under Final Measurements.

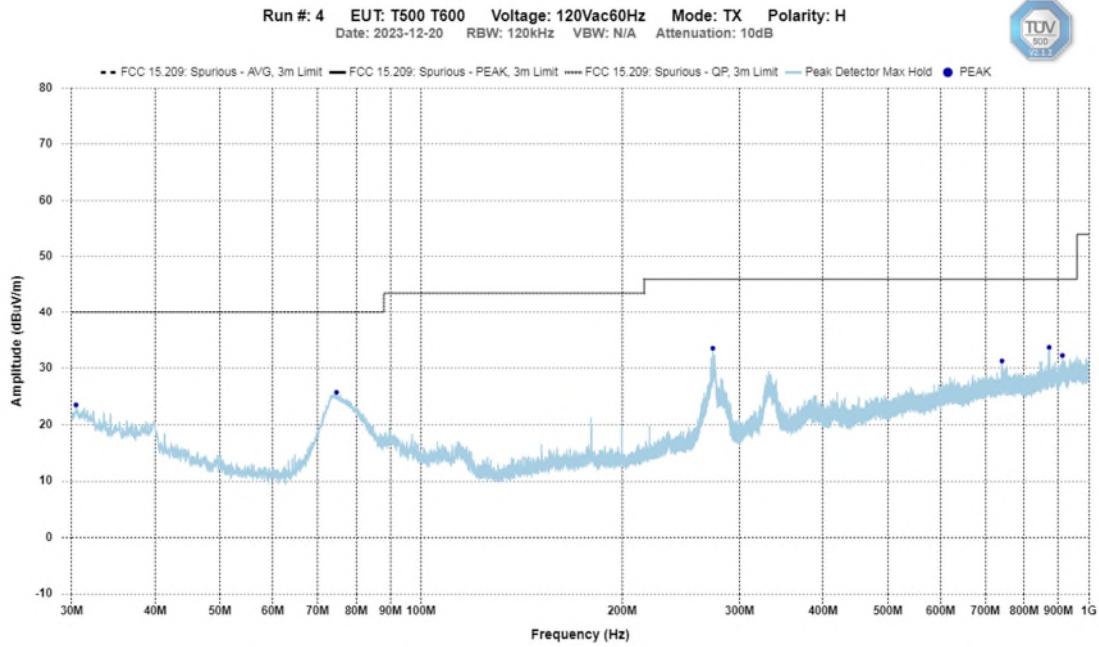
In accordance with FCC Part 15, Subpart A, Section 15.33, the device was scanned to the 10th harmonic (a minimum of 9150 MHz).

Devices scanned may be scanned at alternate test distances and in accordance with FCC Part 15, Subpart A, Section 15.31, an extrapolation factor of 20 dB/decade was used above 30 MHz and 40 dB/decade below 30 MHz. For example for 1 meter measurements, an extrapolation factor 9.5 dB from 20 Log (1m / 3m) is applied.

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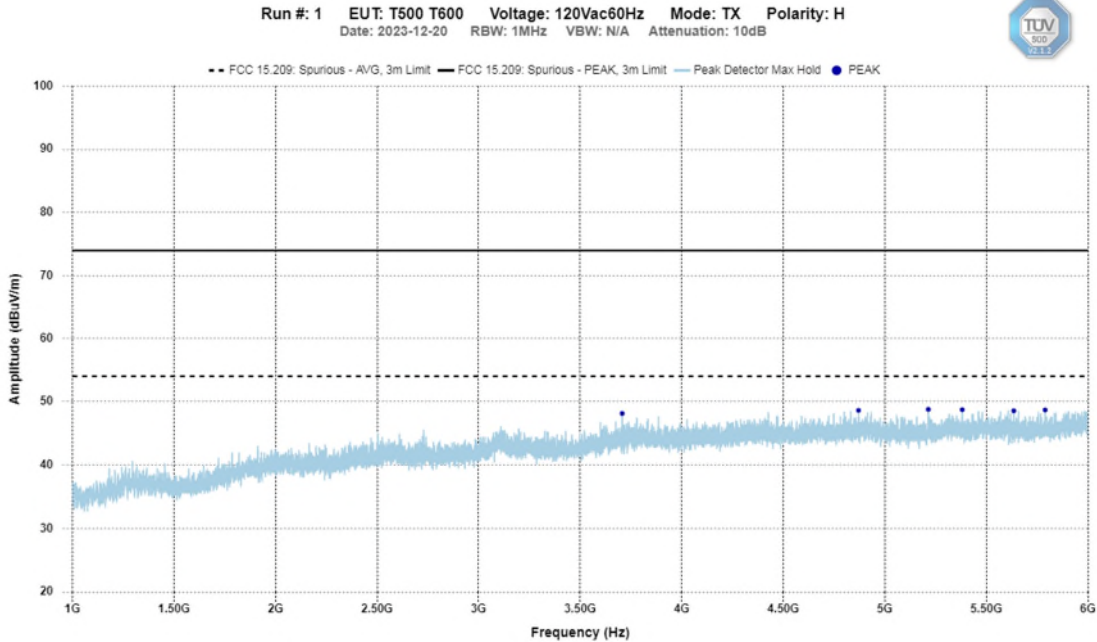
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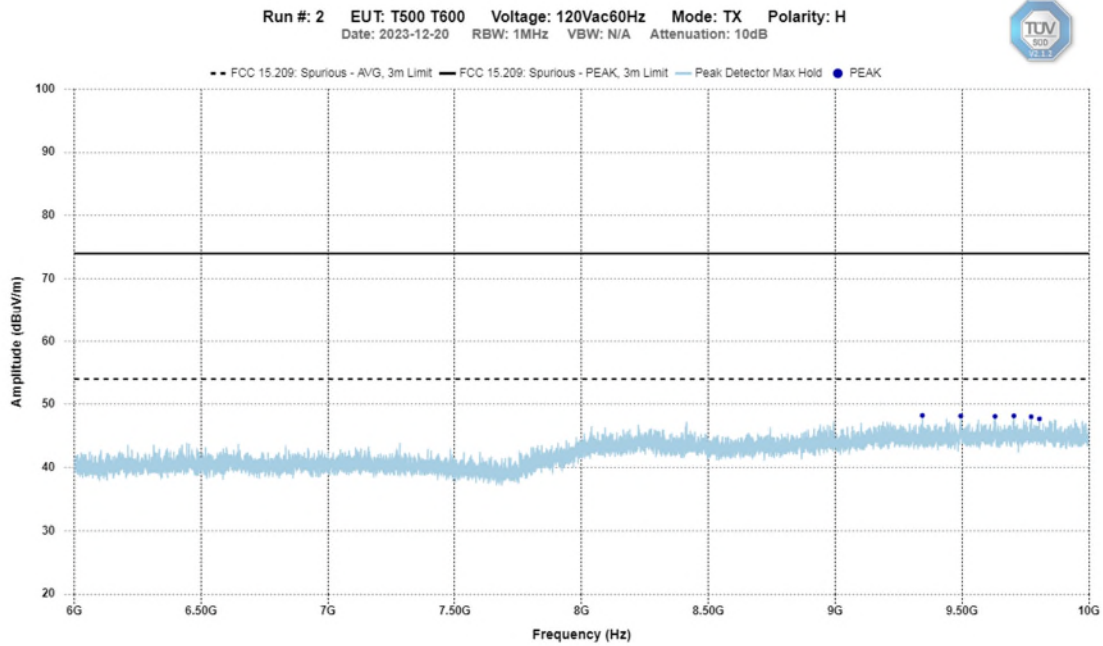
30 MHz – 1 GHz
Horizontal - Peak Emission Graph

NOTE: The fundamental frequency at 915MHz was filtered out during the measurement of spurious emissions to avoid overloading the measurement equipment.

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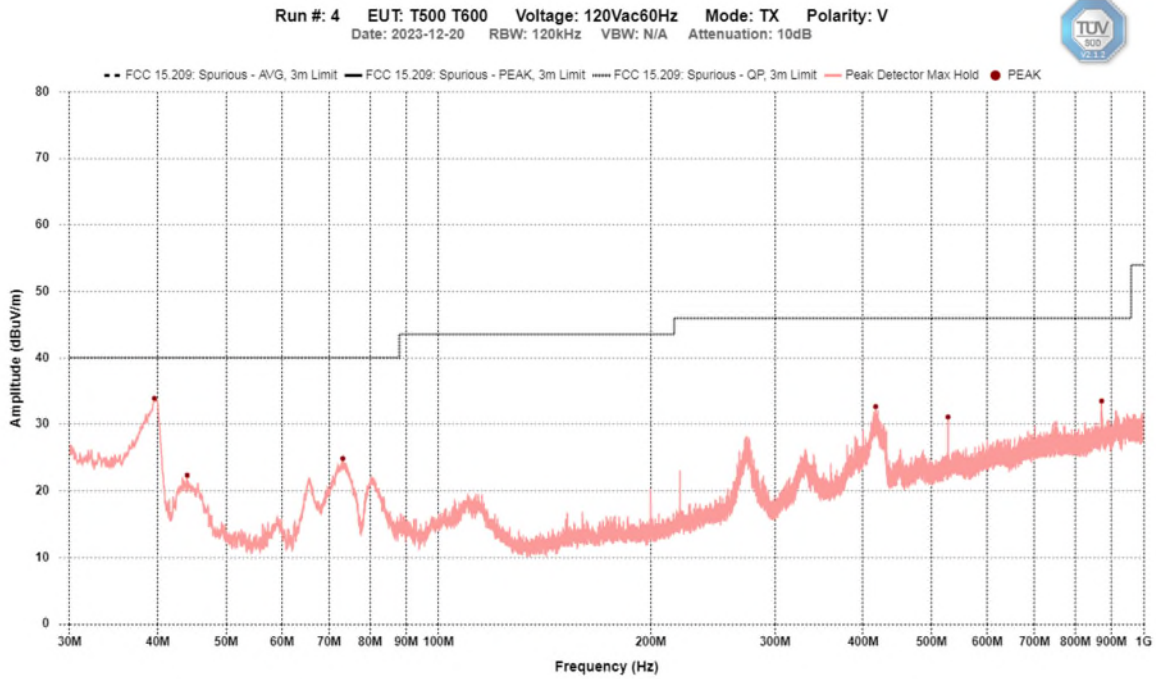


1 GHz – 6 GHz
Horizontal - Peak Emission Graph



6 GHz – 10 GHz
Horizontal - Peak Emission Graph

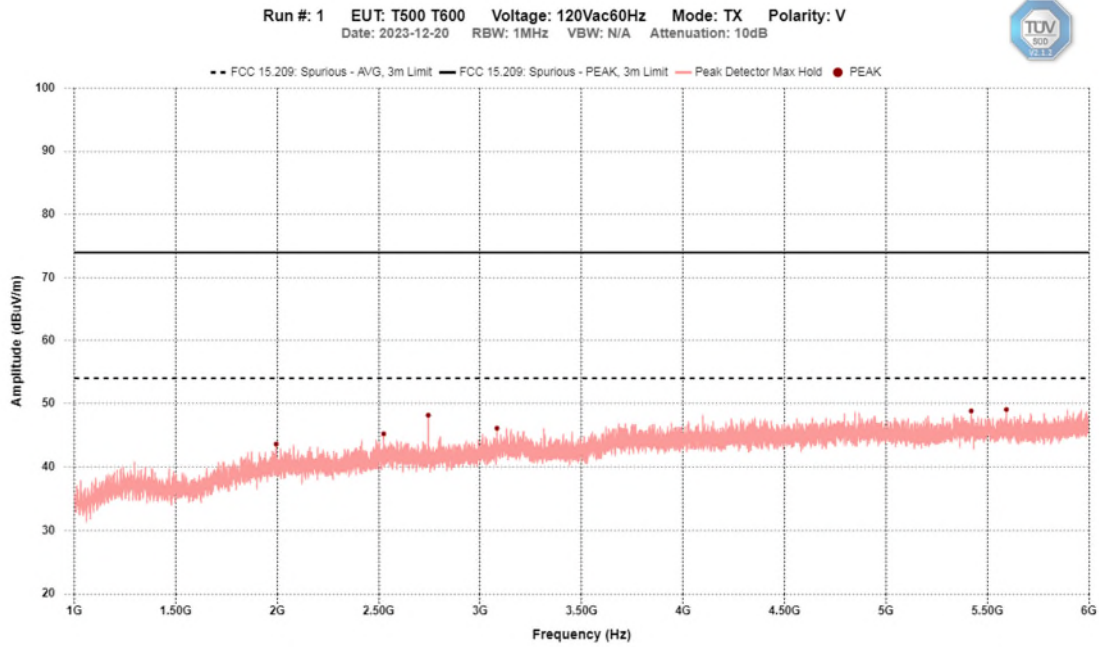
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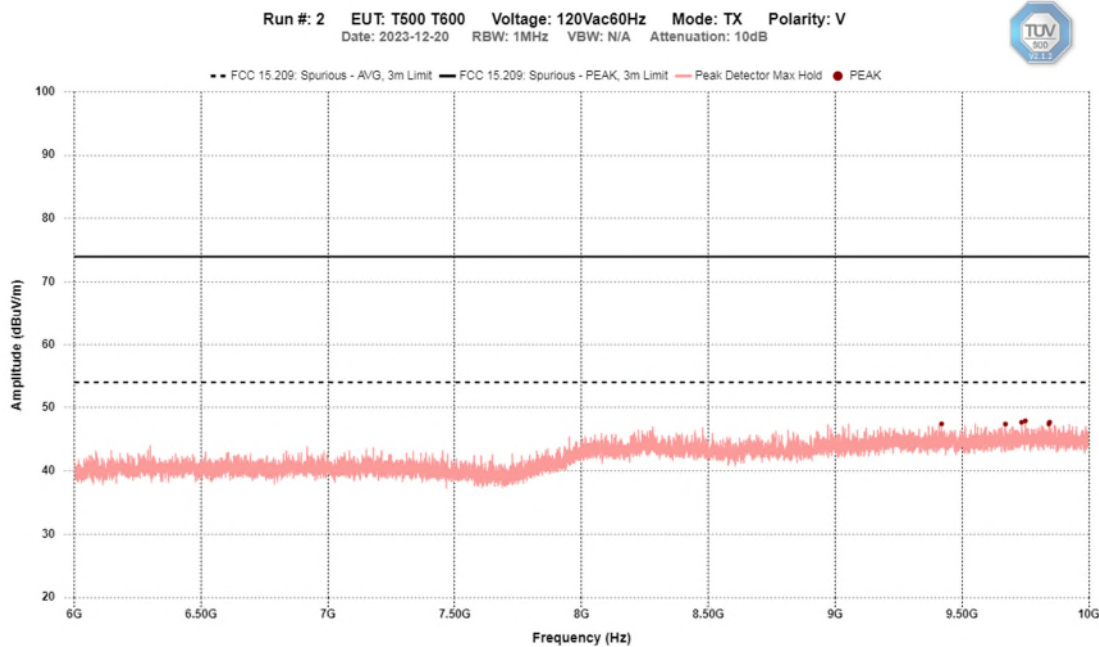
30 MHz – 1 GHz
Vertical - Peak Emission Graph

NOTE: The fundamental frequency at 915MHz was filtered out during the measurement of spurious emissions to avoid overloading the measurement equipment.

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1 GHz – 6 GHz
Vertical - Peak Emission Graph



6 GHz – 10 GHz
Vertical - Peak Emission Graph

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Final Measurements and Results

The EUT passed. As per ANSI C63.10 Clause 6.5.4, the frequency and amplitude of the six highest spurious emissions relative to the limit shall be recorded for each frequency range. Emissions more than 20dB below the limit do not need to be reported.

No emissions within 20dB of the limit were measured for the frequency range of 9kHz-150kHz.

EUT Name		T500 T600				
Limit		FCC 15.209, Spurious				
Power Supply		120Vac60Hz				
Frequency (Hz)	Detector	Correction Factor (dB/m)	Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dB)	Test Result
Loop Antenna						
516.75k	PEAK	23.5	64.8	73.3	8.6	Pass
1.0342M	PEAK	18.1	54.6	67.3	12.7	Pass
649.5k	PEAK	21.5	57.2	71.4	14.1	Pass
1.6845M	PEAK	14.9	48.1	63.1	15.0	Pass
1.2997M	PEAK	16.8	49.8	65.4	15.6	Pass
1.428M	PEAK	16.2	47.8	64.5	16.7	Pass

Quasi-Peak Emissions Table – 150kHz – 30MHz

Client	Kapsch TrafficCom Canada Inc.	
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Standard(s)	RSS 210 Issue 10:2019 FCC Part 15 Subpart 15.249	

EUT Name		T500 T600				
Limit		FCC 15.209, Spurious				
Power Supply		120Vac60Hz				
Frequency (Hz)	Detector	Correction Factor (dB/m)	Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dB)	Test Result
Horizontal						
872.31M	PEAK	2.6	33.7	46.0	12.3	Pass
273.63M	PEAK	-8.8	33.6	46.0	12.4	Pass
913.11M	PEAK	3.4	32.3	46.0	13.7	Pass
74.76M	PEAK	-15.7	25.7	40.0	14.3	Pass
741.45M	PEAK	1.2	31.3	46.0	14.7	Pass
30.45M	PEAK	-4.8	23.5	40.0	16.5	Pass
Vertical						
39.57M	PEAK	-10.0	33.9	40.0	6.1	Pass
871.74M	PEAK	2.6	33.5	46.0	12.5	Pass
416.88M	PEAK	-5.2	32.7	46.0	13.3	Pass
527.97M	PEAK	-2.0	31.1	46.0	14.9	Pass
73.2M	PEAK	-15.7	24.9	40.0	15.1	Pass
44.04M	PEAK	-11.9	22.4	40.0	17.6	Pass

Quasi-Peak Emissions Table – 30MHz – 1GHz

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EUT Name		T500 T600						
Limit		FCC 15.209, Spurious						
Power Supply		120Vac60Hz						
Frequency (Hz)	Detector	Correction Factor (dB/m)	Level (dBuV/m)	PEAK Limit (dBuV/m)	AVG Limit (dBuV/m)	PEAK Margin (dB)	AVG Margin (dB)	Test Result
Horizontal								
5.2148G	PEAK	8.7	48.8	74.0	54.0	25.2	5.2	Pass
3.7075G	PEAK	6.1	48.1	74.0	54.0	25.9	5.9	Pass
5.3818G	PEAK	9.1	48.7	74.0	54.0	25.3	5.3	Pass
5.79G	PEAK	9.3	48.7	74.0	54.0	25.3	5.3	Pass
4.871G	PEAK	8.5	48.6	74.0	54.0	25.4	5.4	Pass
5.6355G	PEAK	9.3	48.6	74.0	54.0	25.4	5.4	Pass
Vertical								
5.594G	PEAK	9.4	49.1	74.0	54.0	24.9	4.9	Pass
5.4207G	PEAK	9.2	48.8	74.0	54.0	25.2	5.2	Pass
2.7447G	PEAK	3.5	48.2	74.0	54.0	25.8	5.8	Pass
3.0833G	PEAK	5.1	46.1	74.0	54.0	27.9	7.9	Pass
2.5248G	PEAK	3.5	45.2	74.0	54.0	28.8	8.8	Pass
1.995G	PEAK	1.3	43.6	74.0	54.0	30.4	10.4	Pass

Quasi-Peak Emissions Table – 1GHz – 6GHz

NOTE: The emissions measured at 2.7447GHz are the 3rd harmonic of the fundamental frequency. These emissions passed the applicable Transmitter Spurious Radiated Emissions limits as a worst-case scenario. All other emissions were verified to be noise floor of the measuring equipment.

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EUT Name		T500 T600						
Limit		FCC 15.209, Spurious						
Power Supply		120Vac60Hz						
Frequency (Hz)	Detector	Correction Factor (dB/m)	Level (dBuV/m)	PEAK Limit (dBuV/m)	AVG Limit (dBuV/m)	PEAK Margin (dB)	AVG Margin (dB)	Test Result
Horizontal								
9.344G	PEAK	8.4	48.2	74.0	54.0	25.8	5.8	Pass
9.7048G	PEAK	8.8	48.2	74.0	54.0	25.8	5.8	Pass
9.4953G	PEAK	8.8	48.2	74.0	54.0	25.8	5.8	Pass
9.6305G	PEAK	8.9	48.1	74.0	54.0	25.9	5.9	Pass
9.773G	PEAK	8.8	48.0	74.0	54.0	26.0	6.0	Pass
9.8055G	PEAK	8.9	47.7	74.0	54.0	26.3	6.3	Pass
Vertical								
9.7502G	PEAK	8.5	47.9	74.0	54.0	26.1	6.1	Pass
9.8458G	PEAK	8.9	47.7	74.0	54.0	26.3	6.3	Pass
9.7353G	PEAK	8.5	47.7	74.0	54.0	26.3	6.3	Pass
9.4198G	PEAK	8.6	47.4	74.0	54.0	26.6	6.6	Pass
9.8428G	PEAK	8.9	47.4	74.0	54.0	26.6	6.6	Pass
9.6717G	PEAK	8.7	47.4	74.0	54.0	26.6	6.6	Pass

Quasi-Peak Emissions Table – 6GHz – 10GHz

NOTE: All emissions in this frequency range were verified to be noise floor of the measuring equipment.

Client	Kapsch TrafficCom Canada Inc.	
Product	Tag Programmer/Tester T500/T600 Basic Unit	
Standard(s)	RSS 210 Issue 10:2019 FCC Part 15 Subpart 15.249	

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
EMI Receiver	ESU 40	Rohde & Schwarz	Feb. 11, 2022	Feb. 11, 2024	GEMC 233
Loop Antenna	EM 6871	Electro-Metrics	Mar 13, 2023	Mar 13, 2025	GEMC 70
Loop Antenna	EM 6872	Electro-Metrics	Mar 13, 2023	Mar 13, 2025	GEMC 71
BiLog Antenna	3142-C	ETS-Lindgren	Dec. 7, 2022	Dec. 7, 2024	GEMC 8
Horn Antenna 2 – 18 GHz	WBH218HN	Q-par	June. 8, 2022	June. 8, 2024	GEMC 6375
Horn Antenna 1 – 18 GHz	3117	ETS-Lindgren	Mar. 11, 2022	Mar. 11, 2024	GEMC 340
Attenuator 6 dB	6N5W-06	Inmet	NCR	NCR	GEMC 345
Pre-Amp 9 kHz – 1 GHz	LNA 6901	Teseq	Feb. 17, 2023	Feb. 17, 2025	GEMC 168
Pre-Amp 1 – 26.5 GHz	HP 8449B	HP	Sept. 20, 2022	Sept. 20, 2024	GEMC 312
902MHz - 928MHz Notch Filter	BRC50722	Micro-Tronics	NCR	NCR	GEMC 186
RF Cable <1GHz	LMR-400	LexTec	NCR	NCR	GEMC 274
RF Cable <1GHz	Sucoflex 104A	Huber+Suhner	NCR	NCR	GEMC 271
RF Cable >1GHz	EMC2	MegaPhase	NCR	NCR	GEMC 369
Emissions Software	V2.1.4	TUV SUD Canada, Inc.	NCR	NCR	GEMC 361

Client	Kapsch TrafficCom Canada Inc.	
Product	Tag Programmer/Tester T500/T600 Basic Unit	
Standard(s)	RSS 210 Issue 10:2019 FCC Part 15 Subpart 15.249	

Emission Bandwidth

Purpose

The purpose of this test is to ensure that the upper and lower frequency limits of the transmitter bandwidth remain within the operating frequency limits at all times.

Limits and Method

There are no specific emissions bandwidth requirements within FCC Part 15.249. Therefore, the general requirement to ensure that the 20dB emissions bandwidth is contained within the designated frequency band, as per FCC Part 15.215, is the only applicable requirement. The method for measuring 20dB emissions bandwidth is given in ANSI C63.10 Section 6.9.2.

There are no specific emissions bandwidth requirements within RSS-210 B.10. Therefore, the general requirement to ensure that the 99% emissions bandwidth is contained within the designated frequency band, as per RSS-GEN 6.7, is the only applicable requirement. The method is given in ANSI C63.10 Section 6.9.3.

Results

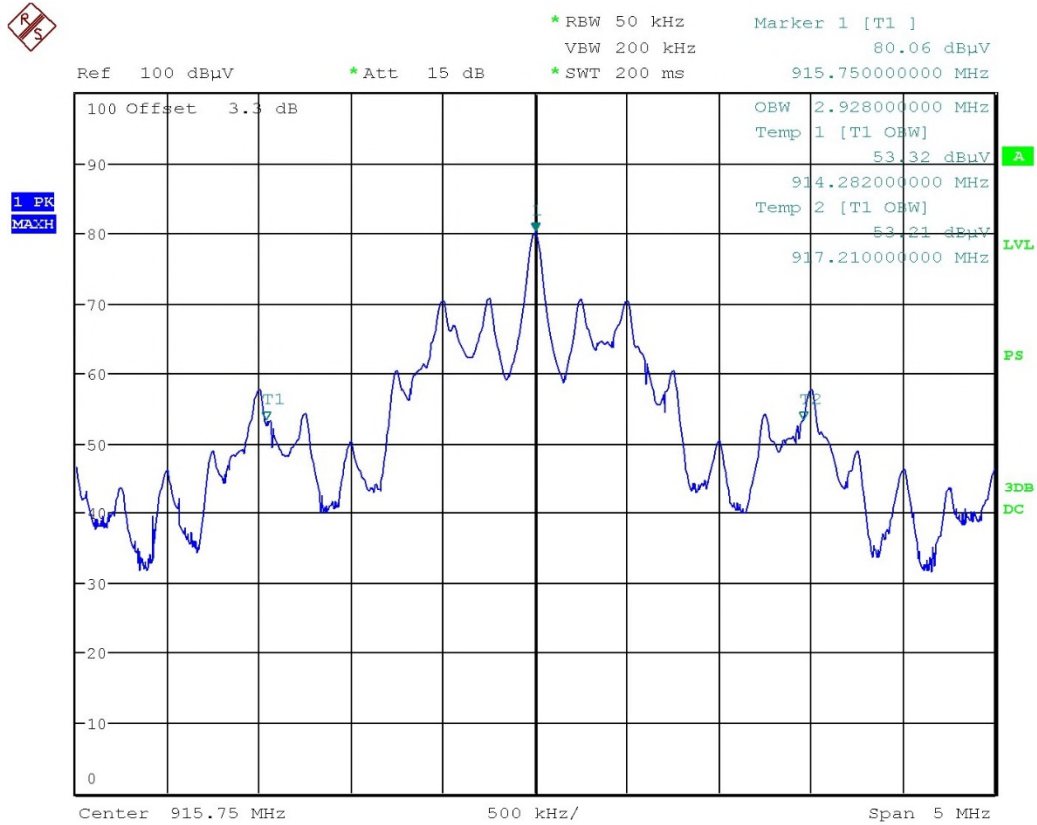
The EUT passed. The 99% bandwidth was measured using the 99% bandwidth function of the spectrum analyzer and the 20dB bandwidth measurement was measured manually using trace markers, both measured in a radiated test setup.

Frequency (MHz)	99% Bandwidth			Result
	F _{LOW} (MHz)	F _{HIGH} (MHz)	Occupied Bandwidth (MHz)	
915.75	912.82	918.68	2.93	Pass

Frequency (MHz)	20dB Bandwidth			Result
	F _{LOW} (MHz)	F _{HIGH} (MHz)	Occupied Bandwidth (MHz)	
915.75	914.23	917.27	1.52	Pass

Client	Kapsch TrafficCom Canada Inc.	
Product	Tag Programmer/Tester T500/T600 Basic Unit	
Standard(s)	RSS 210 Issue 10:2019 FCC Part 15 Subpart 15.249	

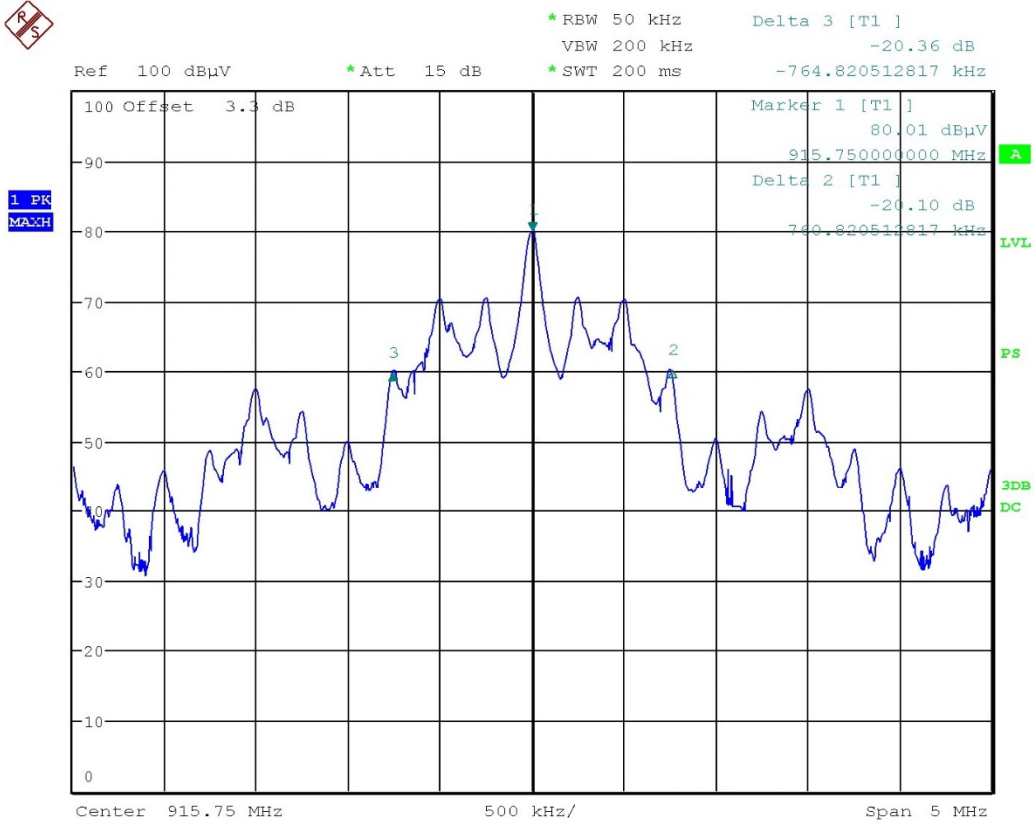
Graphs



Date: 20.DEC.2023 12:08:04

99% Bandwidth

Client	Kapsch TrafficCom Canada Inc.	
Product	Tag Programmer/Tester T500/T600 Basic Unit	
Standard(s)	RSS 210 Issue 10:2019 FCC Part 15 Subpart 15.249	



Date: 20.DEC.2023 12:06:47

20dB Bandwidth

Note: See 'Appendix B – EUT & Test Setup Photos' for photos showing the test set-up.

Client	Kapsch TrafficCom Canada Inc.	
Product	Tag Programmer/Tester T500/T600 Basic Unit	
Standard(s)	RSS 210 Issue 10:2019 FCC Part 15 Subpart 15.249	

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
EMI Receiver	ESU 40	Rohde & Schwarz	Feb. 11, 2022	Feb. 11, 2024	GEMC 233
BiLog Antenna	3142-C	ETS-Lindgren	Dec. 7, 2022	Dec. 7, 2024	GEMC 8
Attenuator 6 dB	6N5W-06	Inmet	NCR	NCR	GEMC 345
Pre-Amp 9 kHz – 1 GHz	LNA 6901	Teseq	Feb. 17, 2023	Feb. 17, 2025	GEMC 168
RF Cable <1GHz	LMR-400	LexTec	NCR	NCR	GEMC 274
RF Cable <1GHz	Sucoflex 104A	Huber+Suhner	NCR	NCR	GEMC 271
RF Cable >1GHz	EMC2	MegaPhase	NCR	NCR	GEMC 369

Client	Kapsch TrafficCom Canada Inc.	
Product	Tag Programmer/Tester T500/T600 Basic Unit	
Standard(s)	RSS 210 Issue 10:2019 FCC Part 15 Subpart 15.249	

Power Line Conducted Emissions

Purpose

The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT's power line does not exceed the limits listed below as defined in the applicable test standard and measured from a LISN. This helps protect lower frequency radio services such as AM radio, shortwave radio, amateur radio, maritime radio, CB radio, and so on, from unwanted interference.

Limits & Method

The method is as defined in ANSI C63.10 Clause 6.2. The limits are as defined in FCC Part 15 Section 15.207 and RSS-GEN Section 8.8:

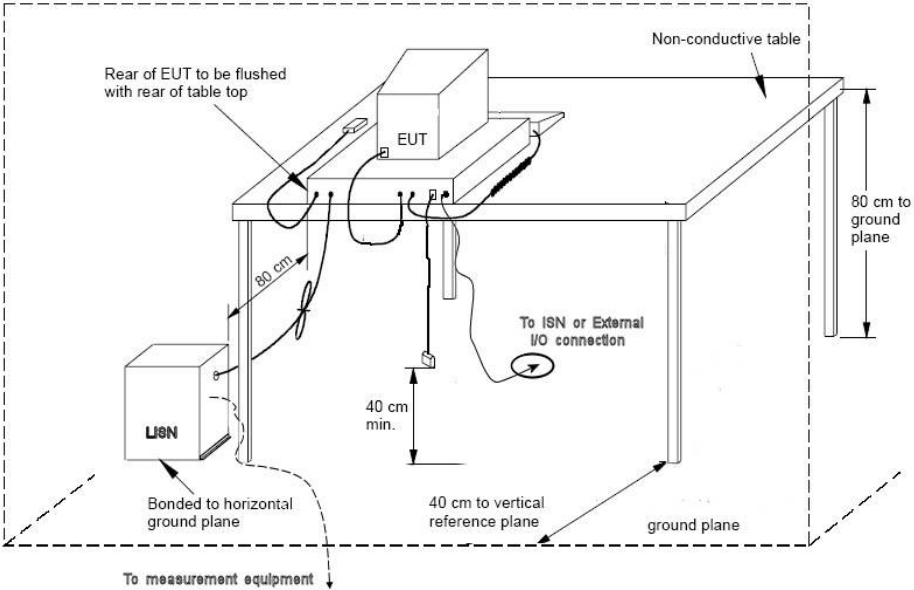
Average Limits		Quasi-Peak Limits	
150 kHz – 500 kHz	56 to 46* dB μ V	150 kHz – 500 kHz	66 to 56* dB μ V
500 kHz – 5 MHz	46 dB μ V	500 kHz – 5 MHz	56 dB μ V
5 MHz – 30 MHz	50 dB μ V	5 MHz – 30 MHz	60 dB μ V

* Decreases linearly with the logarithm of the frequency

Both Quasi-Peak and Average limits are applicable and each is specified as being measured with a resolution bandwidth of 9 kHz. For Quasi-Peak, a video bandwidth at least three times greater than the resolution bandwidth is used.

Client	Kapsch TrafficCom Canada Inc.	
Product	Tag Programmer/Tester T500/T600 Basic Unit	
Standard(s)	RSS 210 Issue 10:2019 FCC Part 15 Subpart 15.249	

Typical Setup Diagram



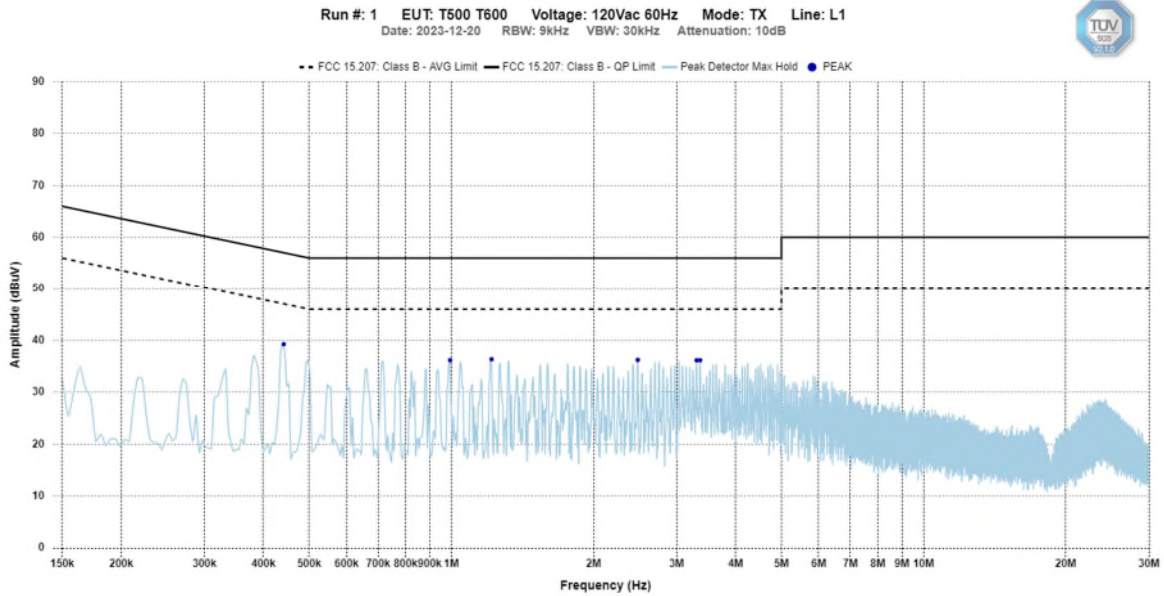
Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is $\pm 2.31\text{dB}$ with a 'k=2' coverage factor and a 95% confidence level.

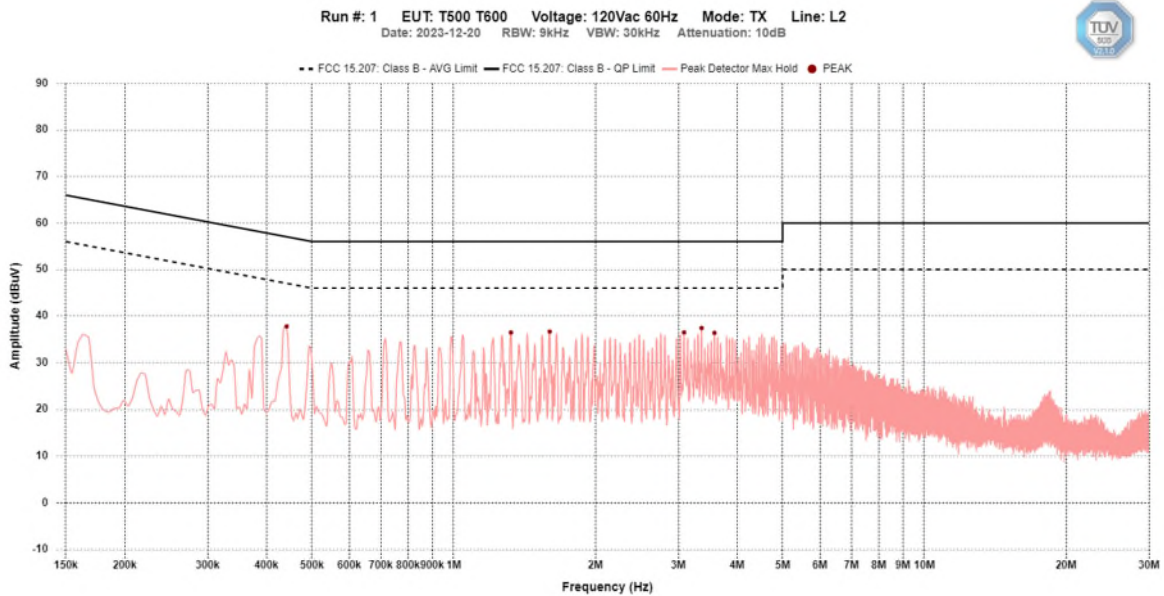
Preliminary Graphs

The graphs shown below are maximized peak measurement graphs measured with a resolution bandwidth greater than or equal to the final required detector. This peaking process is done as a worst case measurement and enables the detection of frequencies of concern for final measurement. For final measurements with the appropriate detector, where applicable, please refer to the tables under Final Measurements.

Client	Kapsch TrafficCom Canada Inc.	
Product	Tag Programmer/Tester T500/T600 Basic Unit	
Standard(s)	RSS 210 Issue 10:2019 FCC Part 15 Subpart 15.249	



Line (L) – 120Vac 60Hz



Neutral (N) – 120Vac 60Hz

Client	Kapsch TrafficCom Canada Inc.	
Product	Tag Programmer/Tester T500/T600 Basic Unit	
Standard(s)	RSS 210 Issue 10:2019 FCC Part 15 Subpart 15.249	

Final Measurements

EUT Name		T500 T600							
Limit		FCC 15.207, Class B							
Power Supply		120Vac 60Hz							
Frequency (Hz)	Detector	Correction Factor (dB)	Level (dBuV)	QP Limit (dBuV)	AVG Limit (dBuV)	QP Margin (dB)	AVG Margin (dB)	Test Result	
Line 1									
441.8k	PEAK	9.3	39.2	57.7	47.7	18.4	8.4	Pass	
1.2169M	PEAK	9.3	36.3	56.0	46.0	19.7	9.7	Pass	
2.482M	PEAK	9.4	36.2	56.0	46.0	19.8	9.8	Pass	
994.1k	PEAK	9.3	36.2	56.0	46.0	19.8	9.8	Pass	
3.364M	PEAK	9.4	36.2	56.0	46.0	19.8	9.8	Pass	
3.3061M	PEAK	9.4	36.1	56.0	46.0	19.9	9.9	Pass	
Line 2									
3.364M	PEAK	9.5	37.4	56.0	46.0	18.6	8.6	Pass	
441.8k	PEAK	9.3	37.7	57.7	47.7	19.9	9.9	Pass	
1.6M	PEAK	9.4	36.6	56.0	46.0	19.4	9.4	Pass	
3.0878M	PEAK	9.5	36.5	56.0	46.0	19.5	9.5	Pass	
1.3238M	PEAK	9.4	36.4	56.0	46.0	19.6	9.6	Pass	
3.5822M	PEAK	9.5	36.4	56.0	46.0	19.6	9.6	Pass	

Average and Quasi-Peak Emissions Table

Note:

- Peak = Peak measurement
- AVG = Average measurement
- QP = Quasi-Peak measurement

See 'Appendix B – EUT, Peripherals and Test Setup Photos' for photos showing the test set-up for the highest line conducted emission

Client	Kapsch TrafficCom Canada Inc.	
Product	Tag Programmer/Tester T500/T600 Basic Unit	
Standard(s)	RSS 210 Issue 10:2019 FCC Part 15 Subpart 15.249	

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
EMI Receiver	ESL 6	Rohde & Schwarz	Feb. 17, 2023	Feb. 17, 2025	GEMC 160
LISN	FCC-LISN-50/250-16-2-01	FCC	Feb. 23, 2023	Feb. 23, 2025	GEMC 303
RF Cable 3m	LMR-400-3M-50Ω-MN-MN	LexTec	NCR	NCR	GEMC 276
Attenuator 10 dB	6N10W-10	Inmet	NCR	NCR	GEMC 349
Emissions Software	V2.1.0	TUV SUD Canada, Inc.	NCR	NCR	GEMC 361

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Client	Kapsch TrafficCom Canada Inc.	
Product	Tag Programmer/Tester T500/T600 Basic Unit	
Standard(s)	RSS 210 Issue 10:2019 FCC Part 15 Subpart 15.249	

Appendix A – EUT Summary

Client	Kapsch TrafficCom Canada Inc.	
Product	Tag Programmer/Tester T500/T600 Basic Unit	
Standard(s)	RSS 210 Issue 10:2019 FCC Part 15 Subpart 15.249	

For further details for filing purposes, refer to filing package.

General EUT Description

Client Details	
Organization / Address	Kapsch TrafficCom Canada Inc. 6020 Ambler Drive, Mississauga, ON, Canada L4W 2P1
Contact	Alastair Malarky, Chief Engineer
Phone	416-451-0223
Email	alastair.malarky@kapsch.net
EUT (Equipment Under Test) Details	
EUT Name (for report title)	Tag Programmer/Tester T500/T600 Basic Unit
EUT Model / SN (if known)	Model #: 800890
EUT revision	New product
Software version	N/A
EUT is powered using	AC
Input voltage range(s) (V)	100-240
Frequency range(s) (Hz)	47-63
Rated input current (A)	1.35 (adapter)
Nominal power consumption (W)	30W
Number of power supplies in EUT	One
Frequency of all clocks present in EUT	48 MHz used for FPGA, 40 MHz reference for Synthesizer, 8 MHz for microcontroller, 3-4 MHz for power supplies
Dimensions of product	L 406 mm W 322.5 mm H 279.4 mm

Note the EUT is considered to have been received the date of the commencement of the first test, unless otherwise stated. For a close-up picture of the EUT, see 'Appendix B – EUT and Test Setup Photos'.

Client	Kapsch TrafficCom Canada Inc.	
Product	Tag Programmer/Tester T500/T600 Basic Unit	
Standard(s)	RSS 210 Issue 10:2019 FCC Part 15 Subpart 15.249	

Appendix B – EUT and Test Setup Photos

Refer to the files separate from this test report