



Canada

RF Test Report

As per

RSS-210 Issue 9:2016, Annex B & FCC Part 15 Subpart 15.225:2016

**Low Power Licence Exempt Radio
Communication Devices
Intentional Radiators**
on the

**UNT1422 RFID Module
13.56MHz**

Issued by:

TÜV SÜD Canada Inc.
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Testing produced for



Amir Emami,
Project Engineer

See Appendix A for full client &
EUT details.



**R-4023, G-506
C-4498, T-1246**





Client	ARCX Inc.	
Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	

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Client	ARCX Inc.	
Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	

Report Scope

This report addresses the EMC verification testing and test results of the **UNT1422 RFID Module (13.56MHz)**, and is herein referred to as EUT (Equipment Under Test). The EUT was tested for compliance against the following standards:


RSS-210 Issue 9:2016, Annex B

FCC Part 15 Subpart C 15.225:2016

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	ARCX Inc.	
Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	

Summary

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

EUT	UNT1422
FCC Certification #, FCC ID:	2AJLM-UNT1422
Industry Canada Certification #, IC:	21879-UNT1422
EUT passed all tests performed	Yes
Tests conducted by	Amir Emami


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

Client	ARCX Inc.	
Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	

Test Results Summary

Standard/Method	Description	Class/Limit	Result
FCC 15.203	Antenna Requirement	Unique	Pass See Justification
FCC 15.225 (a), (b), (c) RSS-210 B.6	Operation within the band 13.110-14.010 MHz (Field Strength)	--	Pass
FCC 15.225 (e) RSS-210 B.6	Operation within the band 13.110-14.010 MHz (Carrier Frequency Stability)	±0.01%	Pass
FCC 15.225 (d) FCC 15.209 RSS-GEN (Table 4)	Transmitter Spurious Radiated Emissions	Quasi-Peak	Pass
FCC 15.207 RSS-GEN (Table 3)	Power Line Conducted Emissions	Quasi-Peak, Average	N/A
FCC 15.215 (c) C63.10 Section 6.9	Occupied Bandwidth, Lower and Upper Band Edges	20dB OBW	Pass
RSS-GEN Section 6.6	Occupied Bandwidth	99% OBW	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:

For the antenna requirement specified in FCC 15.203, the unit used a custom loop antenna which is also not meant to be replaceable by the user. Refer to Figures 5 and 6 of the Internal Pictures document.

For the Restricted Bands of operation, the EUT is designed to only operate at 13.56 MHz and 125 kHz.

The EUT was mounted in three orthogonal axis. Worst case results were obtained with the EUT in the X-axis. Worst case results are presented. See Appendix B for axis details.

The EUT is a module that is powered at 5VDC from the host device it will be installed in. It does not connect to any AC mains directly and therefore, the conducted emission test is not applicable.

The EUT does not have an antenna port and a modified module was not provided. All measurements were performed using the radiated method.


Sample Calculation(s)

Radiated Emission Test

Margin = Limit – (Received Signal + Antenna Factor + Cable Loss – Pre-Amp Gain)


Margin = 50.5dB μ V/m – (50dB μ V + 10dB + 2.5dB – 20dB)

Margin = 8.0 dB (pass)

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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 C63.10:2013	American National Standard For Testing Unlicensed Wireless Devices
CFR 47 FCC 15 Subpart C:2016	Code of Federal Regulations – Radio Frequency Devices, Intentional Radiators
CISPR 22:2008	Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement
ICES-003 Issue 6 2016	Digital Apparatus - Spectrum Management and Telecommunications Policy Interference-Causing Equipment Standard
RSS-GEN Issue 4 2014	General Requirements and Information for the Certification of Radio Apparatus
RSS-210 Issue 9:2016	Licence-Exempt Radio Apparatus: Category I Equipment
ISO 17025:2005	General Requirements for the Competence of Testing and Calibration Laboratories

Client	ARCX Inc.	 Canada
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Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	

Document Revision Status

Revision 1 - September 26, 2016
Initial Release

Client	ARCX Inc.	
Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	

Definitions and Acronyms

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

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

BW – Bandwidth. Unless otherwise stated, this refers to the 20 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 with a primary function(s) of entry, storage, display, retrieval, transmission, processing, switching, or control, of data.

LISN – Line Impedance Stabilization Network

NCR – No Calibration Required

RF – Radio Frequency


Client	ARCX Inc.	
Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	

Testing Facility

Testing for EMC on the EUT was carried out at TÜV SÜD Canada labs near Toronto, Ontario. The testing lab consists of a 3m semi-anechoic chamber calibrated to be able to allow measurements on an EUT that has a maximum width or length of up to 2m and a height of up to 3m. The chamber is equipped with a turntable that is capable of testing devices up to 3300lb in weight. This facility is capable of testing products that are rated for 120Vac and 240Vac single phase, or devices that are rated for a 208Vac 3 phase input. DC capability is also available for testing. The chamber is 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. 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), Industry Canada (IC, 6844A-3) and Voluntary Control Council for Interference (VCCI, R-4023, G-506, C-4498, and T-1246). 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 #2555.01. 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 bi-annual 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)
June 20 – July 7, 2016	Radiated Emissions	AE	20 – 24	40 – 51	98.0 – 102.0
September 19, 2016	Co-Location Testing	AE	20 – 24	40 – 51	98.0 – 102.0

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Detailed Test Results Section

Client	ARCX Inc.	
Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	

Radiated Emission Field Strength

Purpose

The purpose of this test is to ensure that the RF energy 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 other devices which may be using the same spectrum allocations for similar or other purposes and also ensures the transmit range of the device is within the pre-determined suitable range. This also ensures public safety by not exceeding a level which has been deemed safe for human exposure.

Limits and Method

The limits are defined in FCC Part 15.225 (a), (b), (c) and RSS-210 B.6.


The field strength of any emissions within the bands given in the table below shall not exceed the limits specified. Method is using a loop antenna and converting to voltage based on the impedance of free space.

Frequency Range (MHz)	Limit (uV/m) ¹ at 30m	Limit (dBuV/m) ¹ at 3m
13.110 - 13.410	106	80.5
13.410 - 13.553	334	90.5
13.553 - 13.567	15,848	124.0
13.567 - 13.710	334	90.5
13.710 - 14.010	106	80.5

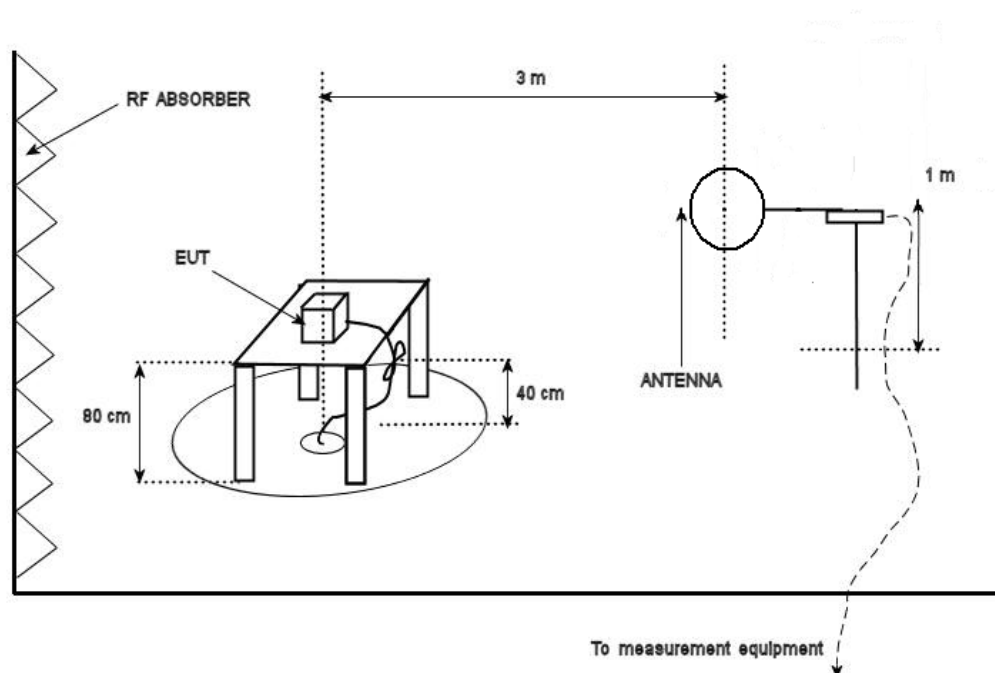
¹Limit is with a Quasi-Peak detector with bandwidths as defined in CISPR-16-1-1

Based on ANSI C63.4 Section 4.2, if the Peak detector measurements do not exceed the Quasi-Peak limits, where defined, then the EUT is deemed to have passed the requirements.

In accordance with FCC Part 15, section 15.31(f)(2), testing was performed at a 3 meter test distance and an extrapolation factor of 40 dB/decade was applied. For example, an extrapolation of 30m to 3m is $20\text{Log}(uV/m) + 40\text{Log}(30m/3m)$.

Client	ARCX Inc.	 Canada
Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	

Typical Radiated Emissions Setup




Measurement Uncertainty

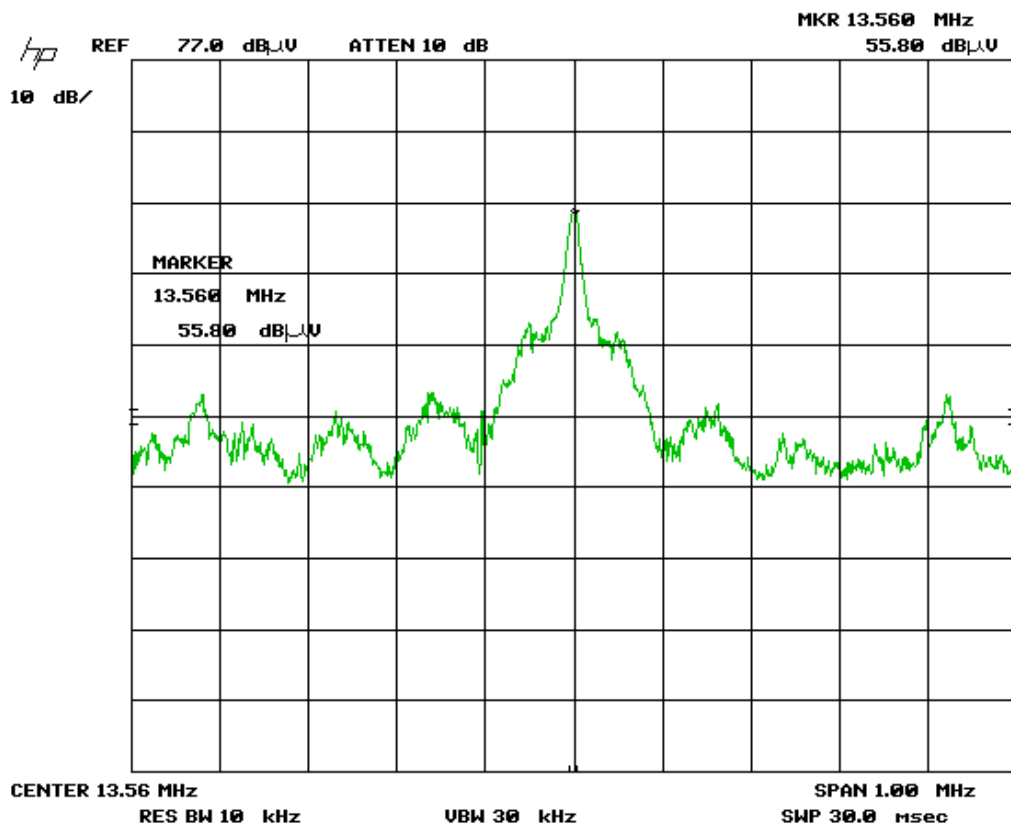
The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is $\pm 4.25\text{dB}$ for 30MHz – 1GHz and $\pm 4.93\text{dB}$ for 1GHz – 18GHz with a 'k=2' coverage factor and a 95% confidence level.


Preliminary Graphs

The graphs shown below are maximized peak measurement graphs over a full 0-360°. The loop was orientated at 0 degrees and 90 degrees and a maximized reading is shown. The marker shows the raw value. See the Final Measurements section below for corrected values.

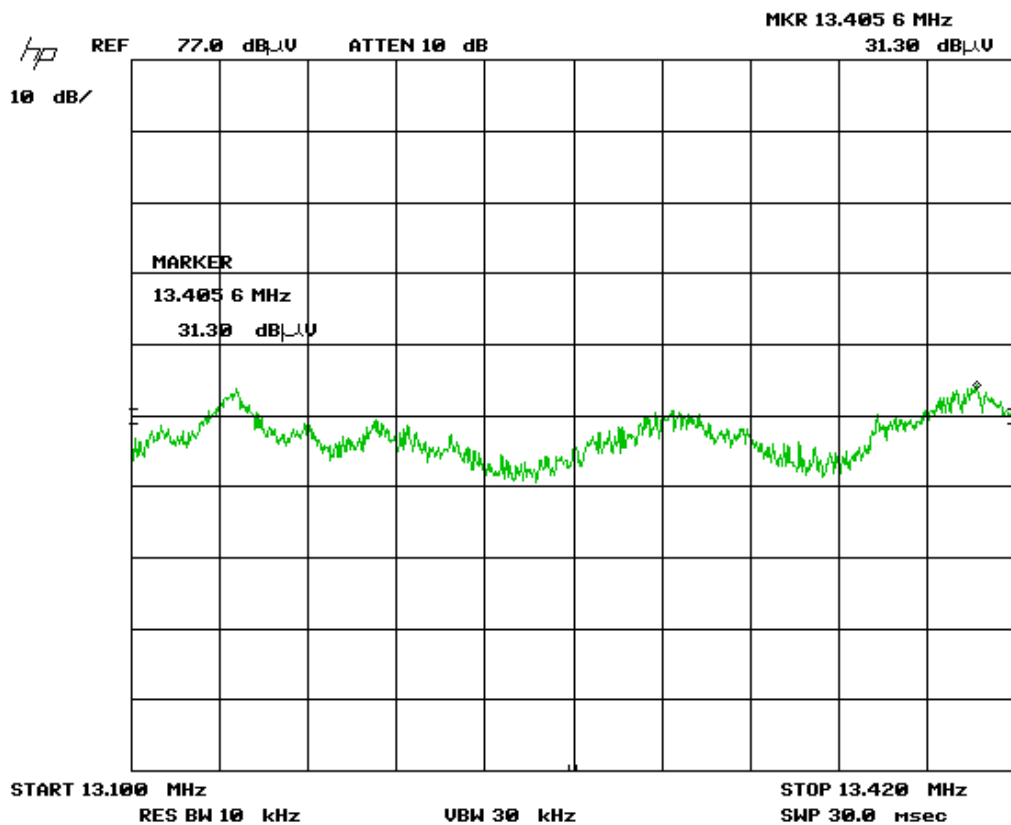
Client	ARCX Inc.	 TÜV SÜD Canada
Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	


Peak Emission at Carrier Frequency within Band: 13.553 - 13.567MHz



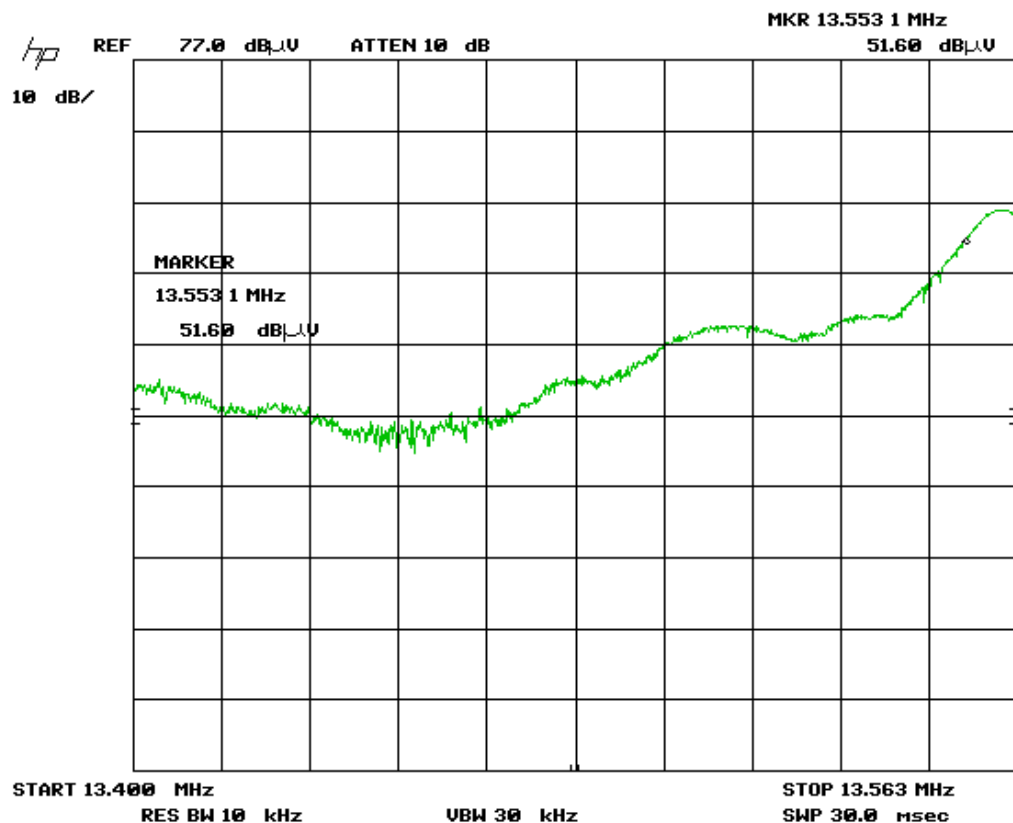
Client	ARCX Inc.	 Canada
Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	


Peak Emission within Band: 13.110 - 13.410 MHz



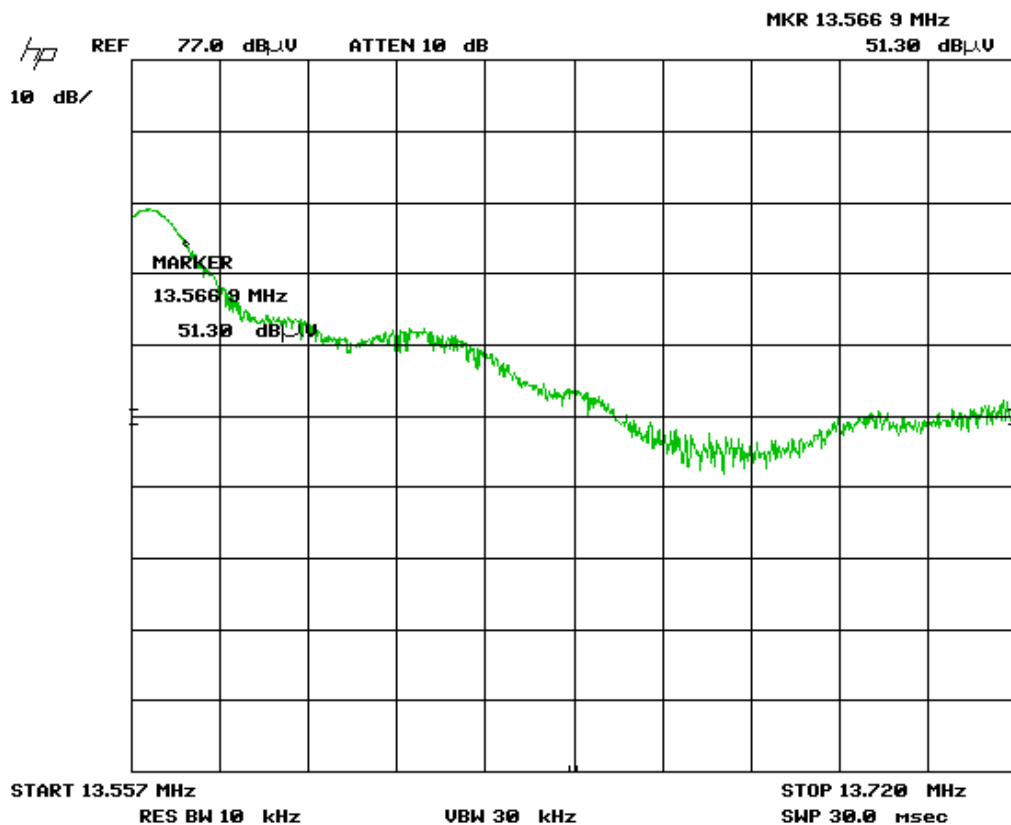
Client	ARCX Inc.	 Canada
Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	


Peak Emission within Band: 13.410 - 13.553 MHz



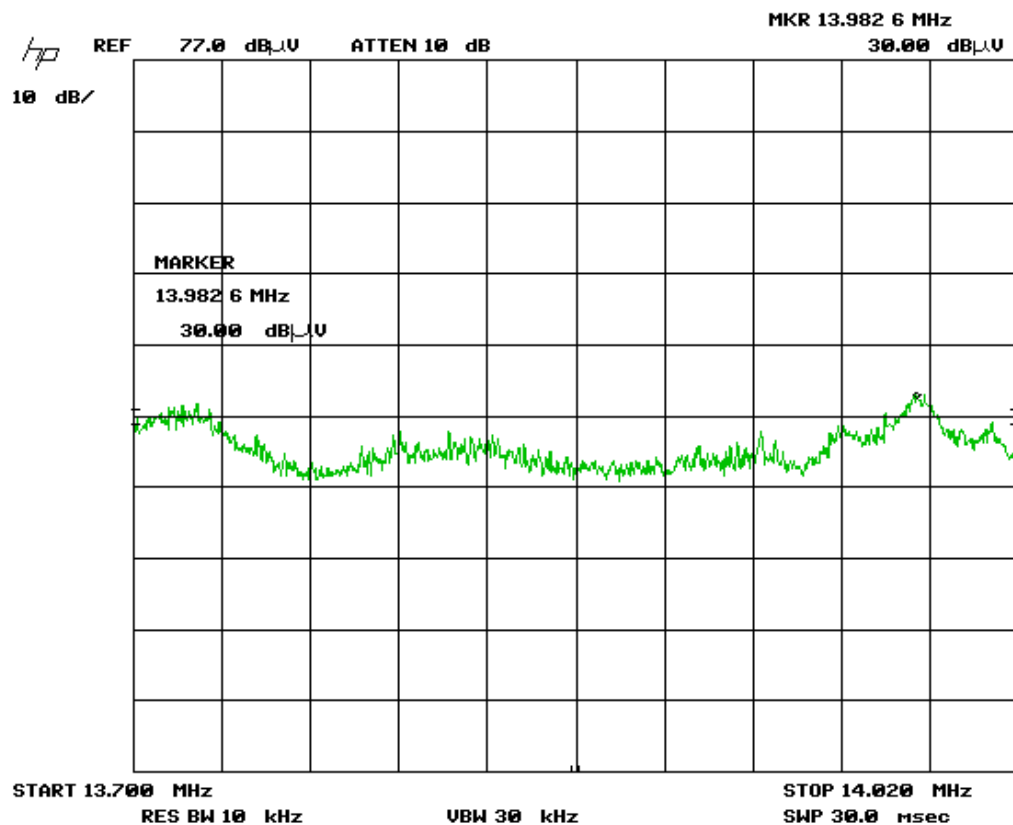
Client	ARCX Inc.	 Canada
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Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	


Peak Emission within Band: 13.567 - 13.710 MHz



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Peak Emission within Band: 13.710 - 14.010 MHz



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Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	

Final Measurements

Test Frequency (MHz)	Detector	EUT Axis	Received Signal (dBμV)	dBuA/dBuV Conv. Factor	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-Amp (dB)	Level (dBμV/m)	Emission Limit dB(μV/m)	Margin dB	Result
13.5600	Peak	Y	55.6	51.5	16.2	0.3	-33.1	90.5	124.0	33.5	Pass
13.5600	Peak	X	55.8	51.5	16.2	0.3	-33.1	90.7	124.0	33.3	Pass
13.5600	Peak	Z	46.9	51.5	16.2	0.3	-33.1	81.8	124.0	42.2	Pass
13.5530	Peak	X	51.6	51.5	16.2	0.3	-33.1	86.5	90.5	4.0	Pass
13.5670	Peak	X	51.3	51.5	16.2	0.3	-33.1	86.2	90.5	4.3	Pass
13.4056	Peak	X	31.3	51.5	16.2	0.3	-33.1	66.2	80.5	14.3	Pass
13.9826	Peak	X	30.0	51.5	16.2	0.3	-33.1	64.9	80.5	15.6	Pass

Emissions Table

Note:


Peak = Peak measurement

QP = Quasi-Peak measurement

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

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	8566B	HP	Nov 27, 2015	Nov 27, 2017	GEMC 190
Quasi-Peak Adapter	85650A	HP	Nov 27, 2015	Nov 27, 2017	GEMC 191
Pre-Amp 9 kHz – 1 GHz	CPA9231A	Chase	Sept 09, 2014	Sept 09, 2016	GEMC 6403
Loop Antenna	EM 6872	Electro-Metrics	Feb 3, 2015	Feb 3, 2017	GEMC 71
BiLog Antenna	3142-C	ETS	Sept 8, 2014	Sept 8, 2016	GEMC 8
RF Cable 7m	LMR-400-7M-50Ω-MN-MN	LexTec	June 16, 2016	June 16, 2017	GEMC 28
RF Cable 10m	LMR-400-10M-50Ω-MN-MN	LexTec	June 16, 2016	June 16, 2017	GEMC 27
RF Cable 0.5m	LMR-400-0.5M-50Ω-MN-MN	LexTec	June 16, 2016	June 16, 2017	GEMC 31

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Carrier Frequency Stability

Purpose

The purpose of this test is to ensure that the RF energy intentionally emitted from the EUT does not exceed the permitted bandwidth or level during extreme temperature variations. This helps protect radio broadcasts and receivers with spectrum nearby to the equipment under test from unwanted interference. This also helps ensure proper reception of the intended signal by ensuring the transmit frequency is correct over the expected temperature range.

Limits and Method


The limits are as defined in FCC Part 15, Section 15.225 (e) and RSS-210 B.6. The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20°C to $+50^{\circ}\text{C}$ at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

Results

The EUT passed the requirements. Carrier signal remained within $\pm 0.01\%$ of the operating frequency. Voltage variation was performed on the AC/DC USB adaptor that was used to power the EUT.

Temperature (°C)	Measured Frequency (MHz)	Deviation (MHz)	Deviation (%)	Result
Ambient (25)	13.560120			
-20	13.560160	0.000040	0.00029	Pass
-10	13.560040	0.000080	0.00059	Pass
0	13.560160	0.000040	0.00029	Pass
10	13.560160	0.000040	0.00029	Pass
20	13.560120	0.000000	0.00000	Pass
30	13.560120	0.000000	0.00000	Pass
40	13.560040	0.000080	0.00059	Pass
50	13.560160	0.000040	0.00029	Pass

Frequency Tolerance Table


Client	ARCX Inc.	
Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	

Vac	Measured Frequency (MHz)	Deviation (MHz)	Deviation (%)	Result
120	13.5601200			
102	13.5601200	0.000000	0.00000	Pass
138	13.5600000	0.000120	0.00088	Pass

Voltage Variation Table (Temperature 20°C)

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration / Verification Date	Next Calibration / Verification Date	Asset #
Spectrum Analyzer	ESL 6	Rohde & Schwarz	Nov. 25, 2015	Nov. 25, 2017	GEMC 160
Pre-Amp 9 kHz – 1 GHz	CPA9231A	Chase	Sept 09, 2014	Sept 09, 2016	GEMC 6403
Loop Antenna	EM 6872	Electro-Metrics	Feb 3, 2015	Feb 3, 2017	GEMC 71
Humidity and Temperature Transmitter	HMP233	Vaisala	Dec 15, 2015	Dec 15, 2016	CANE00043
Environmental Chamber	SM-32-7800	Thermotron	NCR	NCR	GEMC 153

Client	ARCX Inc.	
Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	

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 limits are as defined in FCC Part 15, Section 15.209(a) and 15.225(d). The method is as defined in ANSI C63.10.

The limits apply for those emissions that fall in the restricted bands, as defined in Section 15.205(a). These emissions must comply with the radiated emission limits specified in Section 15.209(a).


Frequency	Limit at 3m (dBuV/m)
0.009 MHz – 0.490 MHz	128.5 to 93.8 ¹
0.490 MHz – 1.705 MHz	73.8 to 63 ¹
1.705 MHz – 30 MHz	69.5 ¹
30 MHz – 88 MHz	40.0 ¹
88 MHz – 216 MHz	43.5 ¹
216 MHz – 960 MHz	46.0 ¹
Above 960 MHz	54.0 ¹
Above 1000 MHz	54.0 ²
Above 1000 MHz	74.0 ³

¹Limit is with a Quasi Peak detector with bandwidths as defined in CISPR-16-1-1 except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz where an Average detector is used.

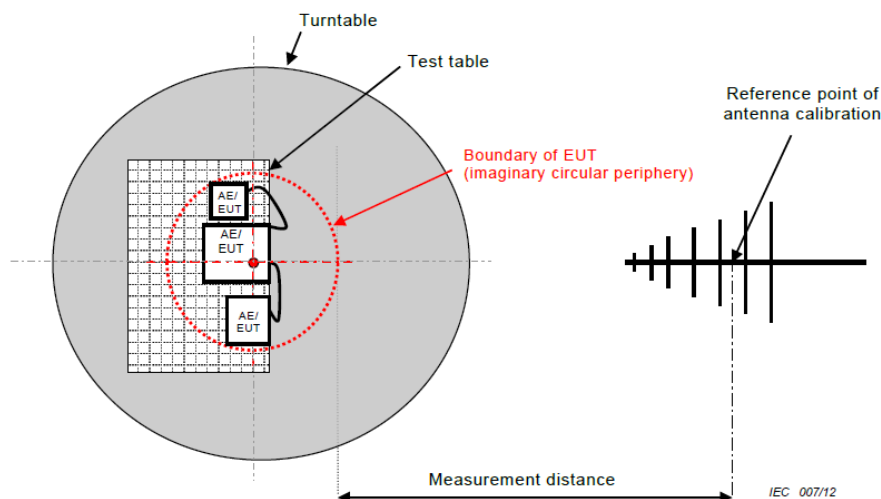
²Limit is with 1 MHz measurement bandwidth and using an Average detector

³Limit is with 1 MHz measurement bandwidth and using a Peak detector

Based on ANSI C63.4 Section 4.2, if the Peak detector measurements do not exceed the Quasi-Peak limits, where defined, then the EUT is deemed to have passed the requirements

Client	ARCX Inc.	
Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	

Typical Radiated Emissions Setup



Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is $\pm 4.25\text{dB}$ for 30MHz – 1GHz and $\pm 4.93\text{dB}$ for 1GHz – 18GHz with a 'k=2' coverage factor and a 95% confidence level.


Preliminary Graphs

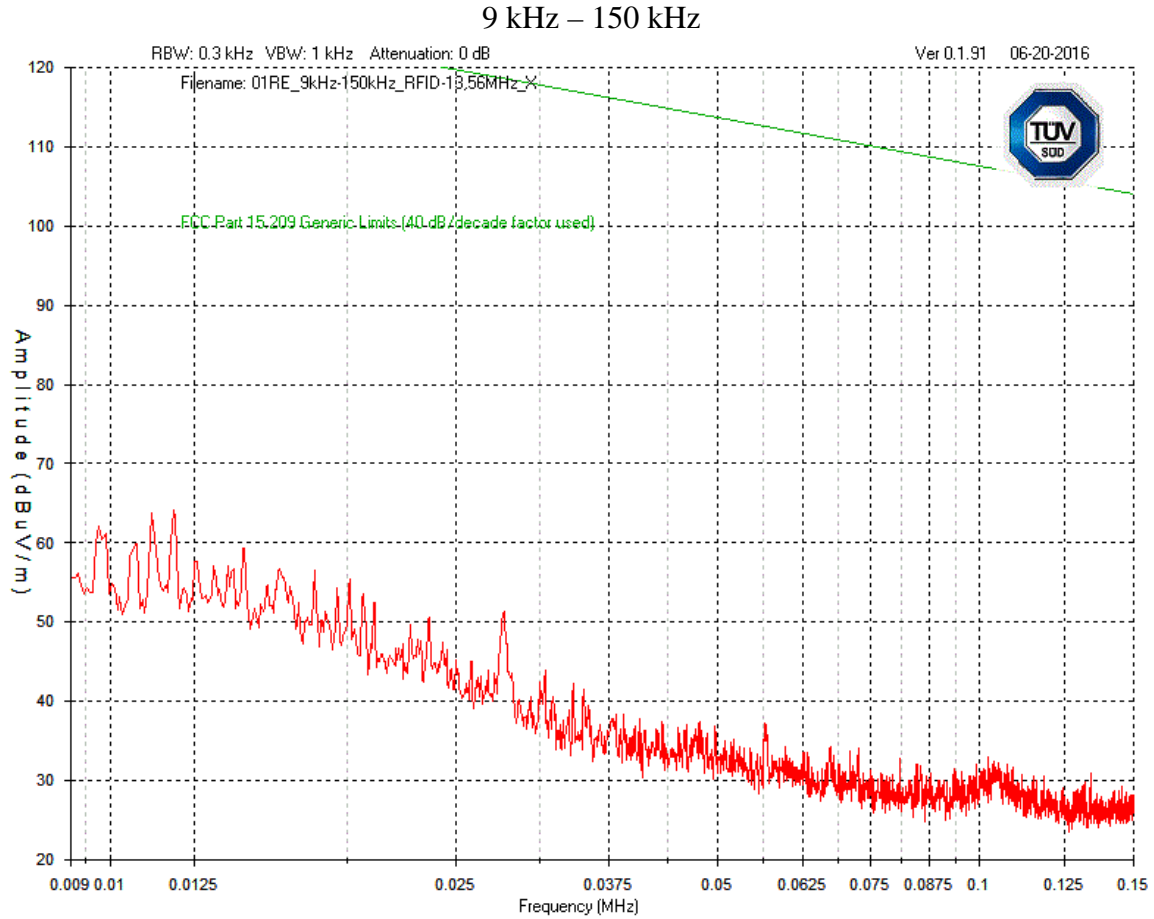
The graphs shown below are obtained at a 3m test distance and are maximized peak measurement graphs measured with a resolution bandwidth greater than or equal to the final required detector over a full 0-360°. This peaking process is done as a worst case measurement and enables the detection of frequencies 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(a), the device is scanned to at least the 10th harmonic (A minimum of 135.6 MHz).

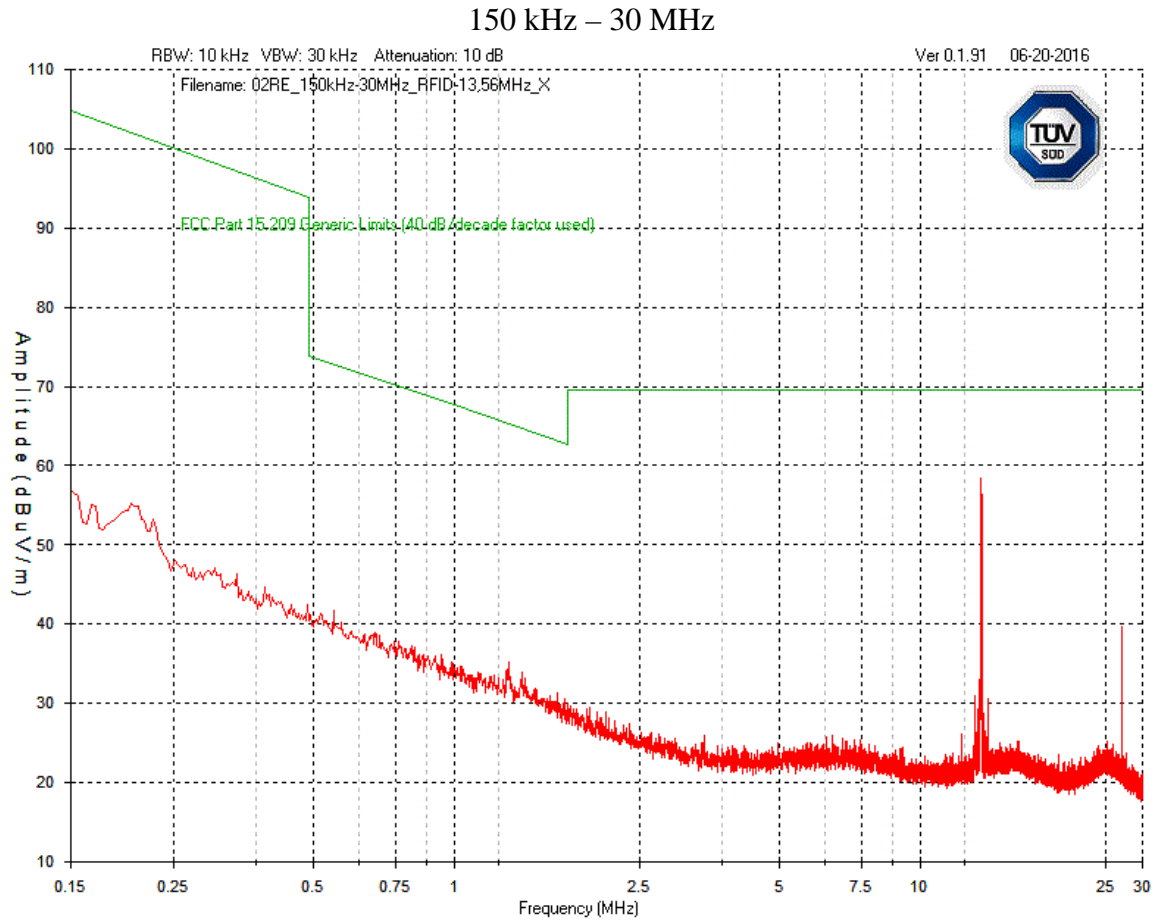
Devices scanned may be scanned at alternate test distances, and in accordance with FCC Part 15, Subpart A, Section 15.31(f), an extrapolation factor of 20 dB/decade was used above 30 MHz and 40 dB/decade below 30 MHz. For example, an extrapolation of 30m to 3m for frequencies below 30MHz is $20\text{Log}(uV/m) + 40\text{Log}(30m/3m)$.


The EUT was checked in three orthogonal axes. However, the worst case graphs are presented from the X-axis.

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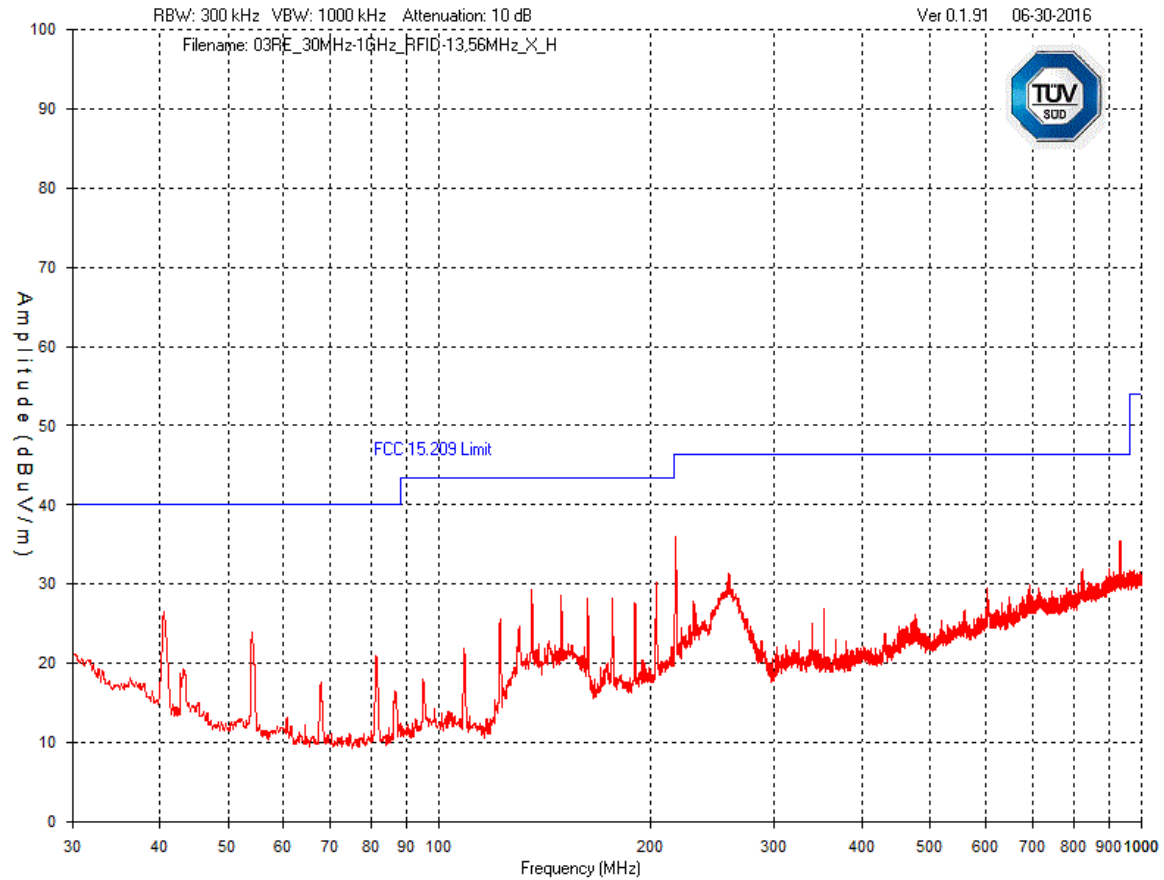



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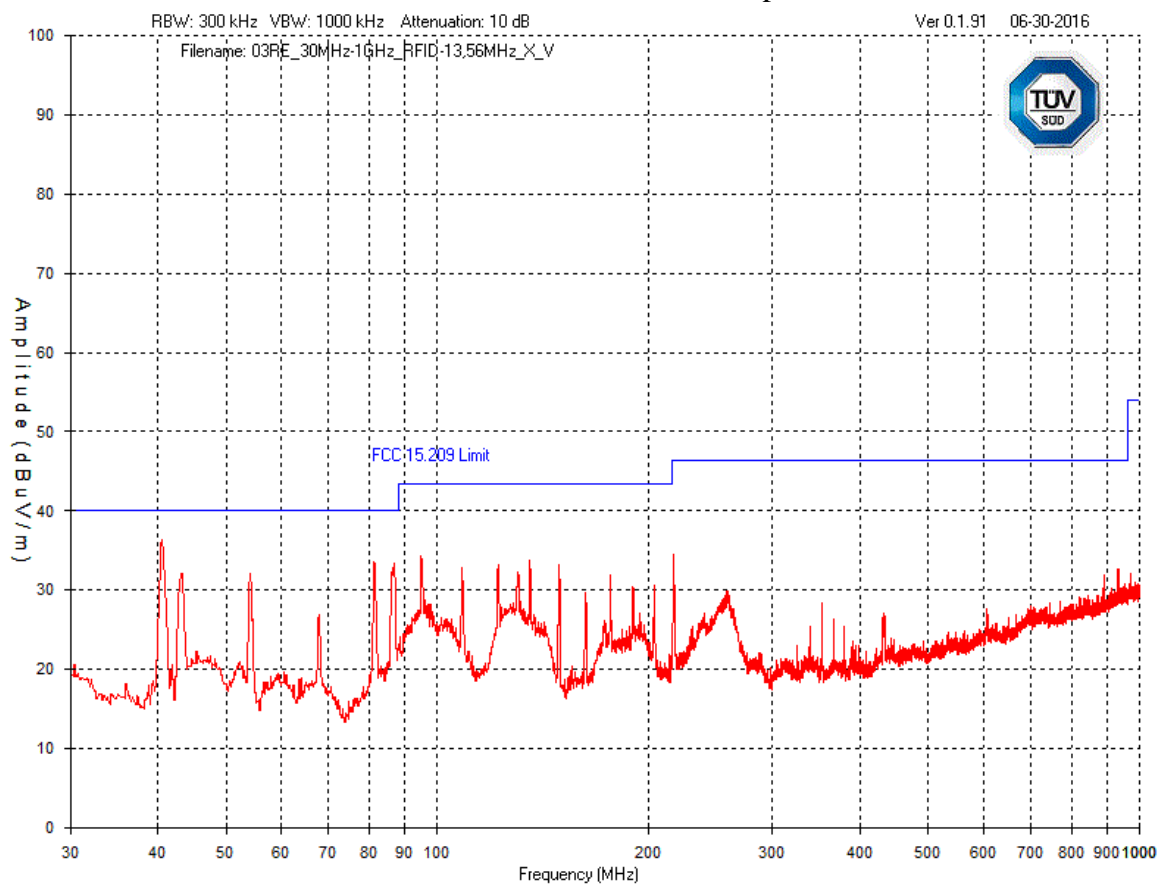
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30 MHz – 1 GHz Horizontal - Peak Emission Graph



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30 MHz – 1 GHz
Vertical - Peak Emission Graph



Client	ARCX Inc.	
Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	

Final Measurements

The EUT passed.

Product Category			Class B						
Frequency (MHz)	Detector Peak/QP	Received Signal (dBμV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-Amp (dB)	Level (dBμV/m)	QP Limit (dBμV/m)	QP Margin (dB)	Pass / Fail
Horizontal Antenna Polarization									
217.02	PEAK	57.3	11.2	1.0	-33.5	36.0	46.4	10.4	Pass
931.62	PEAK	40.7	23.9	2.6	-31.7	35.5	46.4	10.9	Pass
203.44	PEAK	52.2	10.5	1.0	-33.4	30.3	43.5	13.2	Pass
40.48	PEAK	47.1	12.1	0.5	-33.1	26.6	40.0	13.4	Pass
135.44	PEAK	54.3	7.4	0.9	-33.2	29.4	43.5	14.1	Pass
148.92	PEAK	52.2	8.8	0.9	-33.2	28.7	43.5	14.8	Pass
Vertical Antenna Polarization									
40.68	QP	58.7	10.2	0.5	-33.1	36.3	40.0	3.7	Pass
81.31	PEAK	59.5	6.6	0.7	-33.2	33.6	40.0	6.4	Pass
86.75	PEAK	57.9	7.9	0.7	-33.2	33.3	40.0	6.7	Pass
43.19	PEAK	55.3	9.5	0.5	-33.1	32.2	40.0	7.8	Pass
54.15	PEAK	57.2	7.5	0.5	-33.1	32.1	40.0	7.9	Pass
94.89	PEAK	57.7	9.0	0.8	-33.2	34.3	43.5	9.2	Pass


Quasi-Peak Emissions Table

Note:

Peak = Peak measurement

QP = Quasi-Peak measurement


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

Client	ARCX Inc.	
Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	8566B	HP	Nov 27, 2015	Nov 27, 2017	GEMC 190
Quasi-Peak Adapter	85650A	HP	Nov 27, 2015	Nov 27, 2017	GEMC 191
Pre-Amp 9 kHz – 1 GHz	CPA9231A	Chase	Sept 09, 2014	Sept 09, 2016	GEMC 6403
Loop Antenna	EM 6871	Electro-Metrics	Feb 3, 2015	Feb 3, 2017	GEMC 70
Loop Antenna	EM 6872	Electro-Metrics	Feb 3, 2015	Feb 3, 2017	GEMC 71
BiLog Antenna	3142-C	ETS	Sept 8, 2014	Sept 8, 2016	GEMC 8
RF Cable 7m	LMR-400-7M-50Ω-MN-MN	LexTec	June 16, 2016	June 16, 2017	GEMC 28
RF Cable 10m	LMR-400-10M-50Ω-MN-MN	LexTec	June 16, 2016	June 16, 2017	GEMC 27
RF Cable 0.5m	LMR-400-0.5M-50Ω-MN-MN	LexTec	June 16, 2016	June 16, 2017	GEMC 31
Emissions Software	0.1.91	Global EMC	NCR	NCR	GEMC 58

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Client	ARCX Inc.	
Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	

20dB and 99% Occupied Bandwidth

Purpose

The purpose of this test is to verify that intentional radiators operating under the alternative provisions to the general emission limits are designed to ensure the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. This helps ensure the utilization of the frequency allocation and prevent corruption of data by ensuring adequate data separation to distinguish the reception of the intended information.

Limits and Method


The limit is as specified in FCC Part 15.215(c) and RSS-GEN Section 6.6 and the method is given in ANSI C63.10.

Frequency Band: $F_{MIN} = 13.110\text{MHz}$ and $F_{MAX} = 14.010$

Results

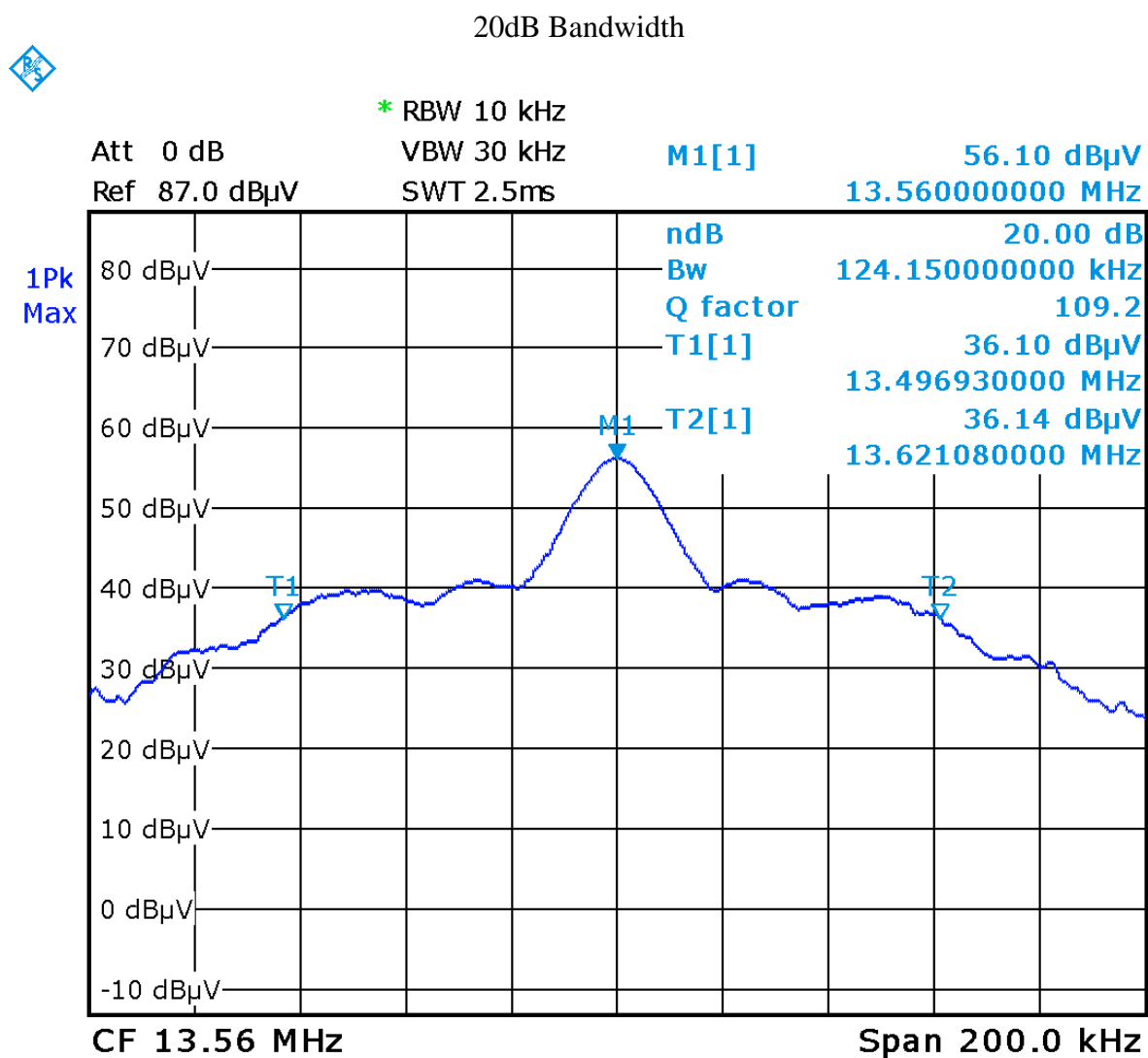
The EUT passed. The 20dB BW measured from F_{LOW} to F_{HIGH} was within the specified F_{MIN} and F_{MAX} . The 99% BW was measured using the 99% BW function of the spectrum analyzer.

Carrier Frequency (MHz)	20dB Bandwidth		99% Bandwidth (kHz)
	F_{LOW} (MHz)	F_{HIGH} (MHz)	
13.56	13.497	13.621	303.39


Client	ARCX Inc.	
Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	

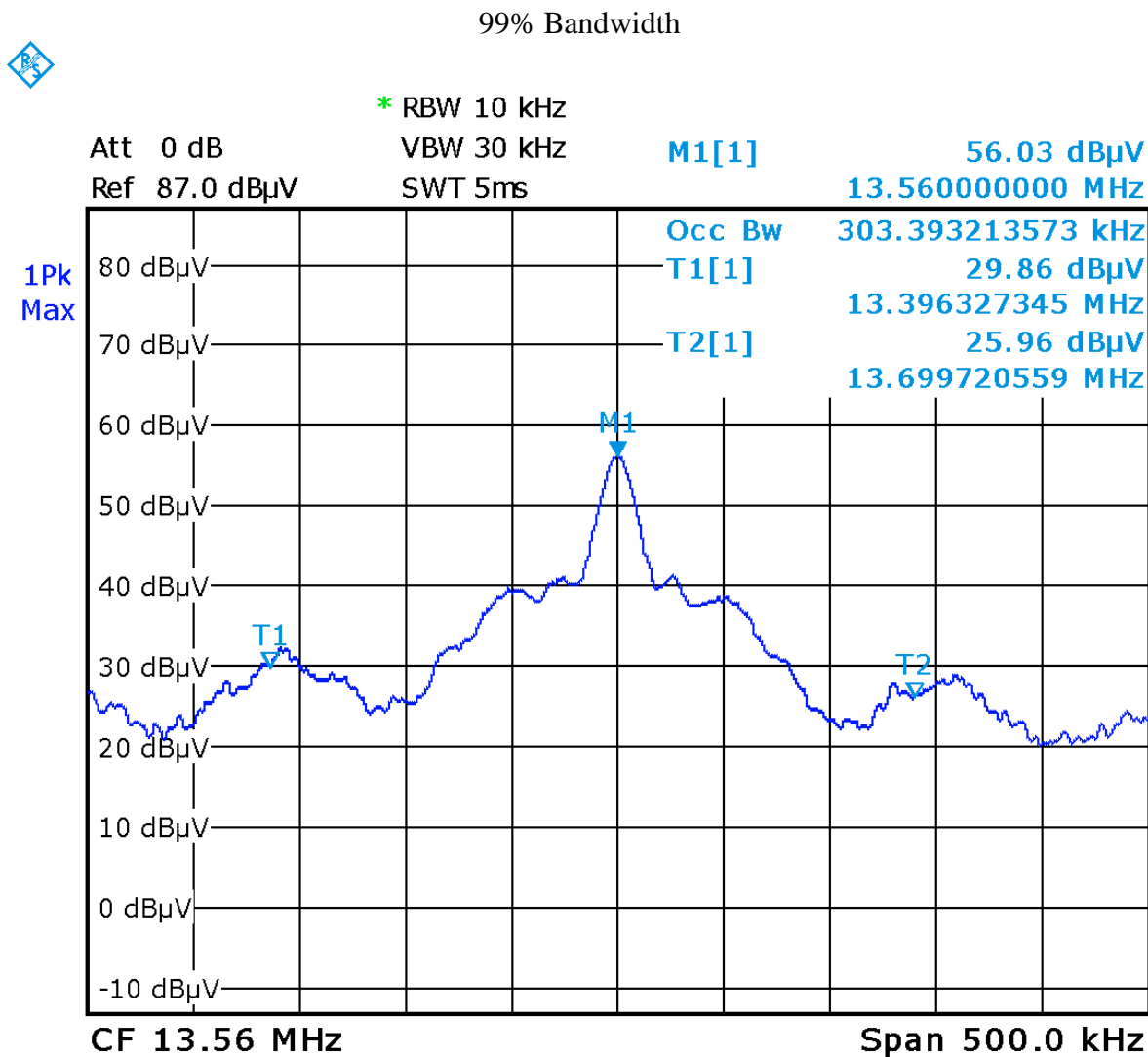
Graphs

The graphs showed below shows the OBW during the operation of the device. This is measured by a max hold on the spectrum analyzer and the highest resolution bandwidth that is sufficiently low to exhibit the bandwidth of the channel during operation of the EUT. Max hold is performed for a duration of not less than 1 minute.




Date: 7.JUL.2016 09:56:47

Client	ARCX Inc.	 TÜV SÜD Canada
Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	




Date: 7.JUL.2016 10:02:06

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

Client	ARCX Inc.	
Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	ESL 6	Rohde & Schwarz	Nov. 25, 2015	Nov. 25, 2017	GEMC 160
Pre-Amp 9 kHz – 1 GHz	CPA9231A	Chase	Sept 09, 2014	Sept 09, 2016	GEMC 6403
Loop Antenna	EM 6872	Electro-Metrics	Feb 3, 2015	Feb 3, 2017	GEMC 71
RF Cable 7m	LMR-400-7M- 50Ω-MN-MN	LexTec	June 16, 2016	June 16, 2017	GEMC 28
RF Cable 10m	LMR-400- 10M-50Ω-MN- MN	LexTec	June 16, 2016	June 16, 2017	GEMC 27
RF Cable 0.5m	LMR-400- 0.5M-50Ω-MN- MN	LexTec	June 16, 2016	June 16, 2017	GEMC 31

Client	ARCX Inc.	
Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	

Co-Located Transmitters 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 limits are as defined in FCC Part 15, Section 15.209(a). The method is as defined in ANSI C63.10.

The limits apply for those emissions that fall in the restricted bands, as defined in Section 15.205(a). These emissions must comply with the radiated emission limits specified in Section 15.209(a).


Frequency	Limit at 3m (dBuV/m)
0.009 MHz – 0.490 MHz	128.5 to 93.8 ¹
0.490 MHz – 1.705 MHz	73.8 to 63 ¹
1.705 MHz – 30 MHz	69.5 ¹
30 MHz – 88 MHz	40.0 ¹
88 MHz – 216 MHz	43.5 ¹
216 MHz – 960 MHz	46.0 ¹
Above 960 MHz	54.0 ¹
Above 1000 MHz	54.0 ²
Above 1000 MHz	74.0 ³

¹Limit is with a Quasi Peak detector with bandwidths as defined in CISPR-16-1-1 except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz where an Average detector is used.

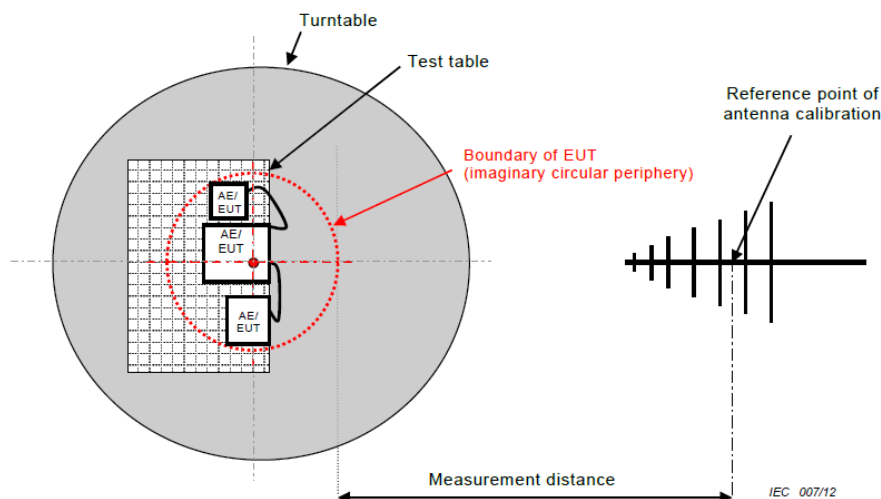
²Limit is with 1 MHz measurement bandwidth and using an Average detector

³Limit is with 1 MHz measurement bandwidth and using a Peak detector

Based on ANSI C63.4 Section 4.2, if the Peak detector measurements do not exceed the Quasi-Peak limits, where defined, then the EUT is deemed to have passed the requirements

Client	ARCX Inc.	
Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	

Typical Radiated Emissions Setup



Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is $\pm 4.25\text{dB}$ for 30MHz – 1GHz and $\pm 4.93\text{dB}$ for 1GHz – 18GHz with a 'k=2' coverage factor and a 95% confidence level.


Preliminary Graphs

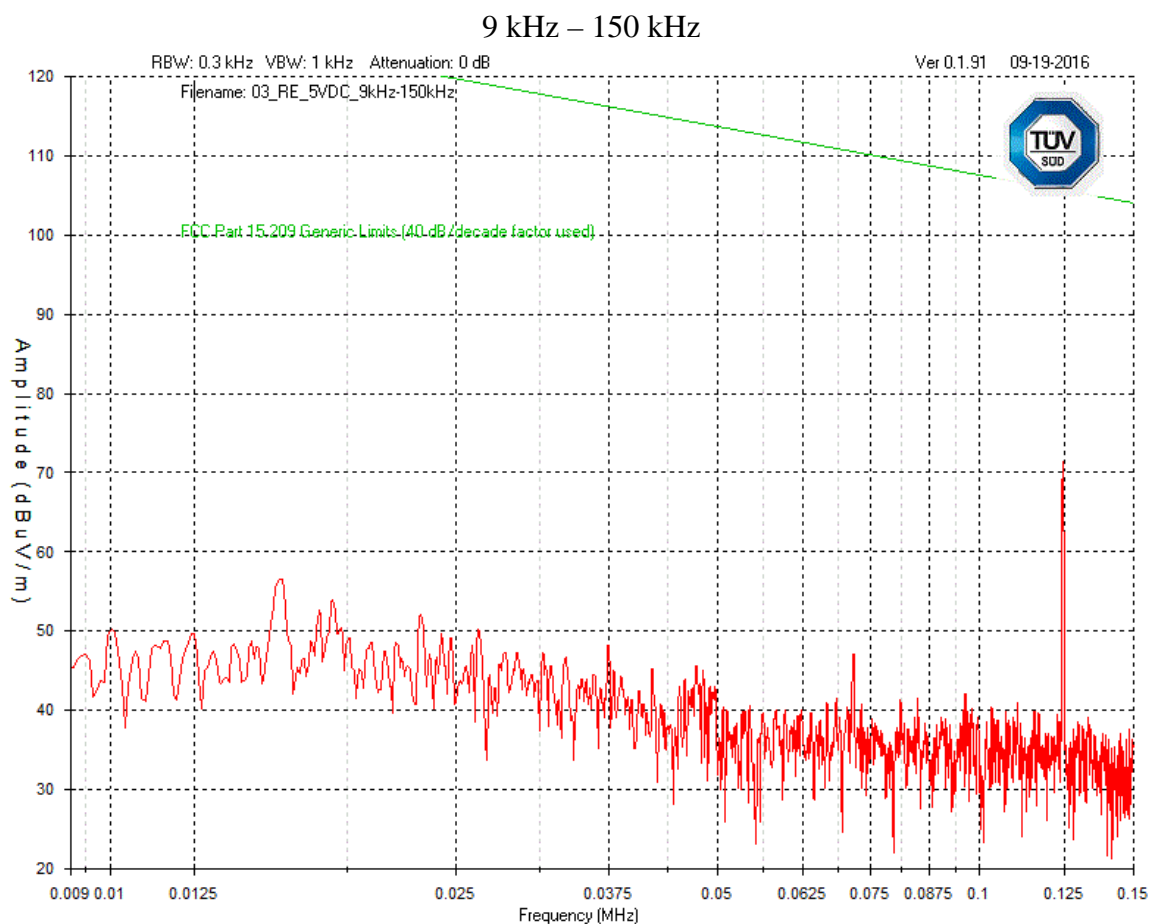
The graphs shown below are obtained at a 3m test distance and are maximized peak measurement graphs measured with a resolution bandwidth greater than or equal to the final required detector over a full 0-360°. This peaking process is done as a worst case measurement and enables the detection of frequencies 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(a), the device is scanned to at least the 10th harmonic (A minimum of 135.6 MHz).

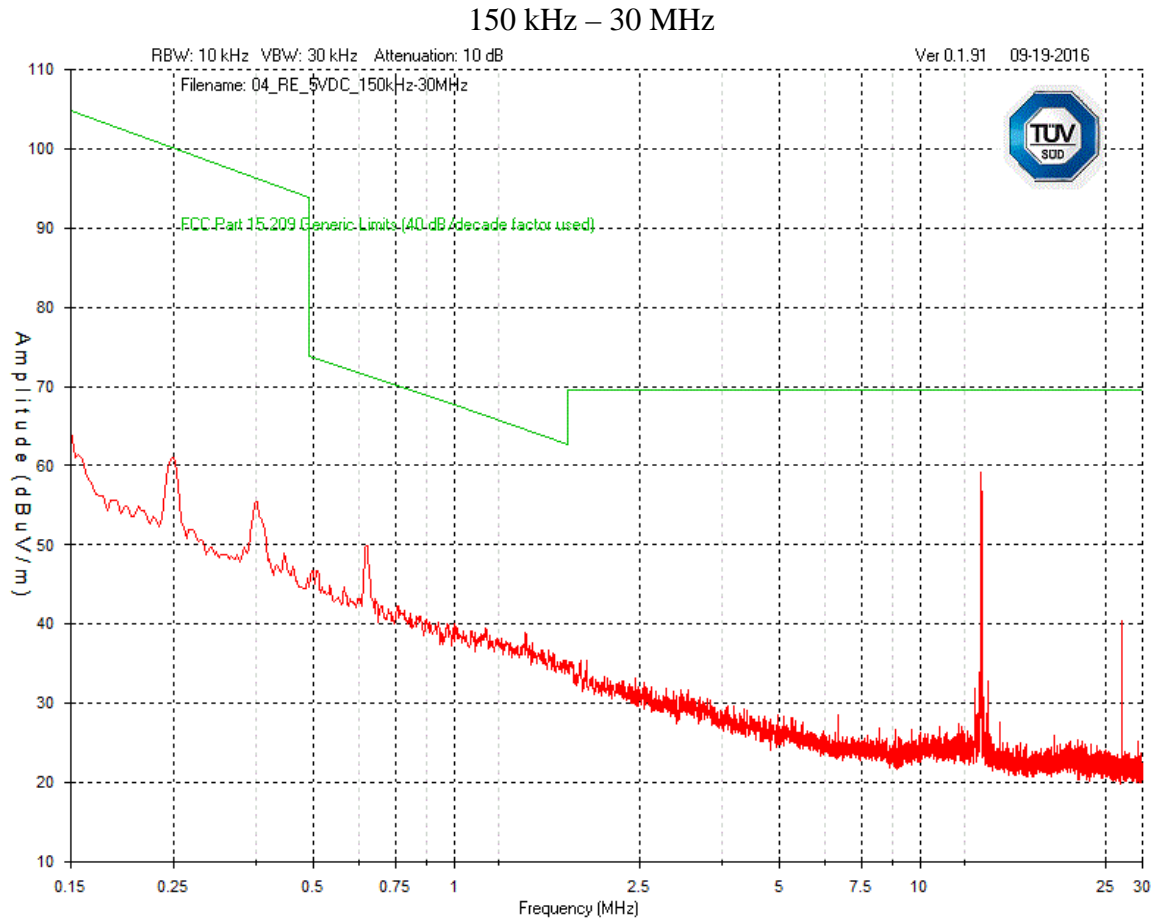
Devices scanned may be scanned at alternate test distances, and in accordance with FCC Part 15, Subpart A, Section 15.31(f), an extrapolation factor of 20 dB/decade was used above 30 MHz and 40 dB/decade below 30 MHz. For example, an extrapolation of 30m to 3m for frequencies below 30MHz is $20\text{Log}(uV/m) + 40\text{Log}(30m/3m)$.


The EUT was checked in three orthogonal axes. However, the worst case graphs are presented from the X-axis.

Client	ARCX Inc.	
Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	

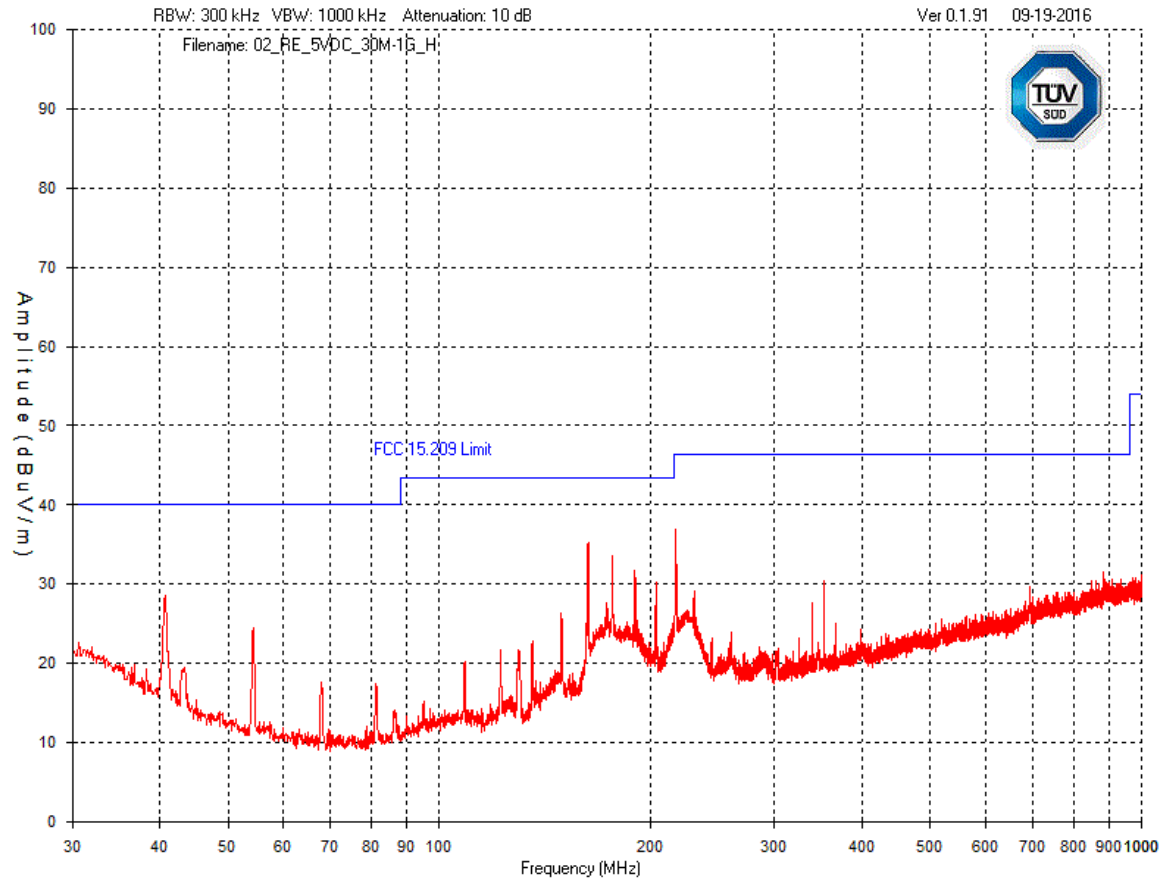



Client	ARCX Inc.	
Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	



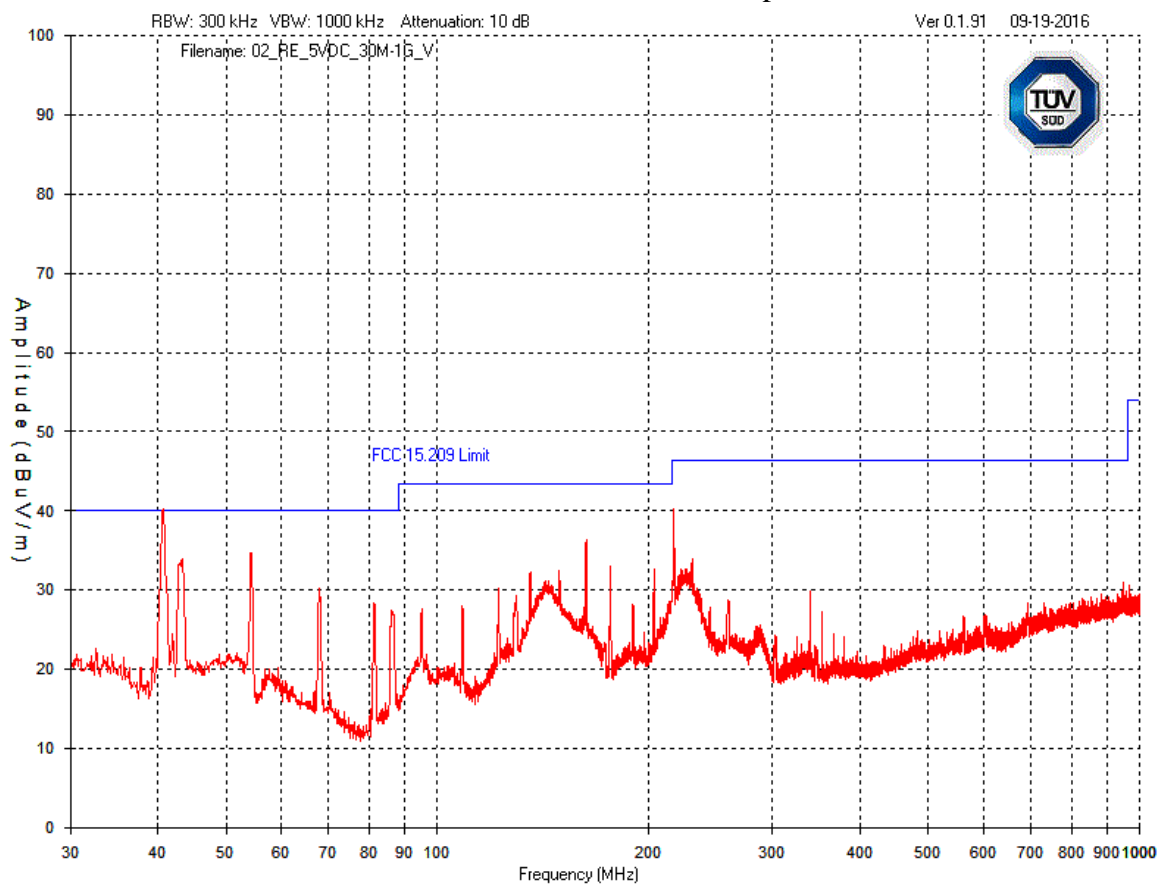
Client	ARCX Inc.	
Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	


30 MHz – 1 GHz Horizontal - Peak Emission Graph



Client	ARCX Inc.	
Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	

30 MHz – 1 GHz
Vertical - Peak Emission Graph



Client	ARCX Inc.	
Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	

Final Measurements

The EUT passed.

Product Category			Class B						
Co-Location			125kHz Transmitter and 13.56MHz Transmitter						
Frequency (MHz)	Detector Peak/QP	Received Signal (dBμV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-Amp (dB)	Level (dBμV/m)	QP Limit (dBμV/m)	QP Margin (dB)	Pass /Fail
Horizontal Antenna Polarization									
162.87	PEAK	53.9	9.2	0.9	-28.8	35.2	43.5	8.3	Pass
217.10	PEAK	53.3	11.3	1.0	-28.8	36.8	46.4	9.6	Pass
176.28	PEAK	52.0	9.4	1.0	-28.8	33.6	43.5	9.9	Pass
40.69	PEAK	44.2	12.7	0.5	-28.7	28.7	40.0	11.3	Pass
189.79	PEAK	48.8	10.9	1.0	-28.8	31.9	43.5	11.6	Pass
203.49	PEAK	47.3	10.7	1.0	-28.8	30.2	43.5	13.3	Pass
Vertical Antenna Polarization									
40.69	QP	57.3	10.5	0.5	-28.7	39.6	40.0	0.4	Pass
54.24	QP	54.7	7.8	0.5	-28.8	34.2	40.0	5.8	Pass
43.32	PEAK	52.5	9.7	0.5	-28.7	34.0	40.0	6.0	Pass
217.10	PEAK	56.9	11.2	1.0	-28.8	40.3	46.4	6.1	Pass
162.87	PEAK	54.4	9.8	0.9	-28.8	36.3	43.5	7.2	Pass
67.91	PEAK	51.9	6.5	0.6	-28.8	30.2	40.0	9.8	Pass


Quasi-Peak Emissions Table

Note:

Peak = Peak measurement

QP = Quasi-Peak measurement


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

Client	ARCX Inc.	
Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	


Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	8566B	HP	Nov 27, 2015	Nov 27, 2017	GEMC 190
Quasi-Peak Adapter	85650A	HP	Nov 27, 2015	Nov 27, 2017	GEMC 191
Pre-Amp 9 kHz – 1 GHz	LNA 6901	Teseq	Jan 30, 2015	Jan 30, 2017	GEMC 168
Loop Antenna	EM 6871	Electro-Metrics	Feb 3, 2015	Feb 3, 2017	GEMC 70
Loop Antenna	EM 6872	Electro-Metrics	Feb 3, 2015	Feb 3, 2017	GEMC 71
BiLog Antenna	3142-C	ETS	Feb 10, 2015	Feb 10, 2017	GEMC 137
RF Cable 7m	LMR-400-7M-50Ω-MN-MN	LexTec	June 16, 2016	June 16, 2017	GEMC 28
RF Cable 10m	LMR-400-10M-50Ω-MN-MN	LexTec	June 16, 2016	June 16, 2017	GEMC 27
RF Cable 0.5m	LMR-400-0.5M-50Ω-MN-MN	LexTec	June 16, 2016	June 16, 2017	GEMC 31
Emissions Software	0.1.91	Global EMC	NCR	NCR	GEMC 58

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Client	ARCX Inc.	 Canada
Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	

Appendix A – EUT Summary


Client	ARCX Inc.	
Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	

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

General EUT Description

Client	
Organization / Address	ARCX Inc. 151 Amber Street, Unit 16 Markham, Ontario L3R 3B3, Canada
Phone	905-513-9160
EUT Details	
EUT Name	UNT1422
Equipment Category	RFID Module
Basic EUT Functionality	RFID Module to allow contactless communication with RFID cards and tags.
Input Voltage and Frequency	5VDC (Tested with an AC/DC USB adaptor powered at 120Vac/60Hz)
Connectors available on EUT	None
Peripherals Required for Test	13.56MHz RFID card
Release type	Final
Intentional Radiator Frequency	125kHz and 13.56MHz for RFID applications
EUT Configuration	Wireless configured to transmit continuously at 100% duty cycle

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	ARCX Inc.	 Canada
Product	UNT1422	
Standard(s)	RSS-210 Issue 9:2016, Annex B FCC Part 15 Subpart 15.225:2016	

Appendix B – EUT and Test Setup Photos

See the PDF files which are separate from this test report.