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

EDGE-MMUL

Issued by: **TÜV SÜD Canada Inc.**
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Testing produced for

See Appendix A for full client & EUT details.

Industry Canada
Registration # 6844A-3

Testing Laboratory
Certificate #2955.02

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

Registration # CA6844

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Report Scope

This report addresses the EMC verification testing and test results of the **EDGE-MMUL**, 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

The EUT have two transmitters that are covered by the two referenced standards. This report covers the 13.56 MHz RFID.

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.

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Summary

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

EUT	EDGE-MMUL
FCC Certification #, FCC ID:	Z89-EDGEMMUL
Industry Canada Certification #, IC:	1812A-EDGEMMUL
EUT passed all tests performed	Yes
Tests conducted by	Min Xie

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

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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	Pass
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.

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

Voltage variation was not performed as the EUT was powered from a regulated switch mode power supply with a rated input of 100 Vac to 240 Vac. The DC output does not vary with change in input.

The EUT is a print management and an accounting device to be used in conjunction with a multifunction printer. The EUT contains Class A digital devices. As per FCC 15.31 and 15.209 unintentional emissions emanating from the EUT cabinet (rather than the antenna port) shall comply with the applicable limits. This allowance was applied between 30 MHz and 1 GHz. The EUT were tested with the transmitter disabled and then transmitting. No new emissions where found when the transmitter is transmitting.

The EUT have three co-located transmitters. The 13.56 MHz transmitter was tested for all applicable requirements by itself and simultaneous transmission of all three were investigated for radiated emissions. Other than the fundamental transmission frequency, no new emissions were found.

For the Restricted Bands of operation, the transmitter cover in this report is designed to only operate at 13.56 MHz.

Power line conducted emissions were performed with all three transmitters operating.

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Sample Calculation(s)

Radiated Emission Test

Margin = Limit – (Received Signal + Antenna Factor + Cable Loss – Pre-Amp Gain)
Margin = 50.5dBµV/m – (50dBµV + 10dB + 2.5dB – 20dB)
Margin = 8.0 dB (pass)

Power Line Conducted Emission Test

Margin = Limit – (Received Signal + Attenuation Factor + Cable Loss + LISN Factor)
Margin = 73.0dBµV – (50dBµV + 10dB + 2.5dB + 0.5dB)
Margin = 10.0 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:2015	Code of Federal Regulations – Radio Frequency Devices, Intentional Radiators
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

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Document Revision Status

Revision 000 - Aug 23, 2017
Initial Release

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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 is 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

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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 (ºC)	Humidity (%)	Pressure (kPa)
2017/05/29 to 2017/06/05	Radiated Emissions	AE	20 – 24	40 – 51	98.0 – 102.0
2017/08/04	Power Line Conducted Emissions	MX	20 - 25	30 - 45	99 - 101

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Detailed Test Results Section

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Emission Mask

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

[1]Limit 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 20Log(uV/m) + 40Log(30m/3m).

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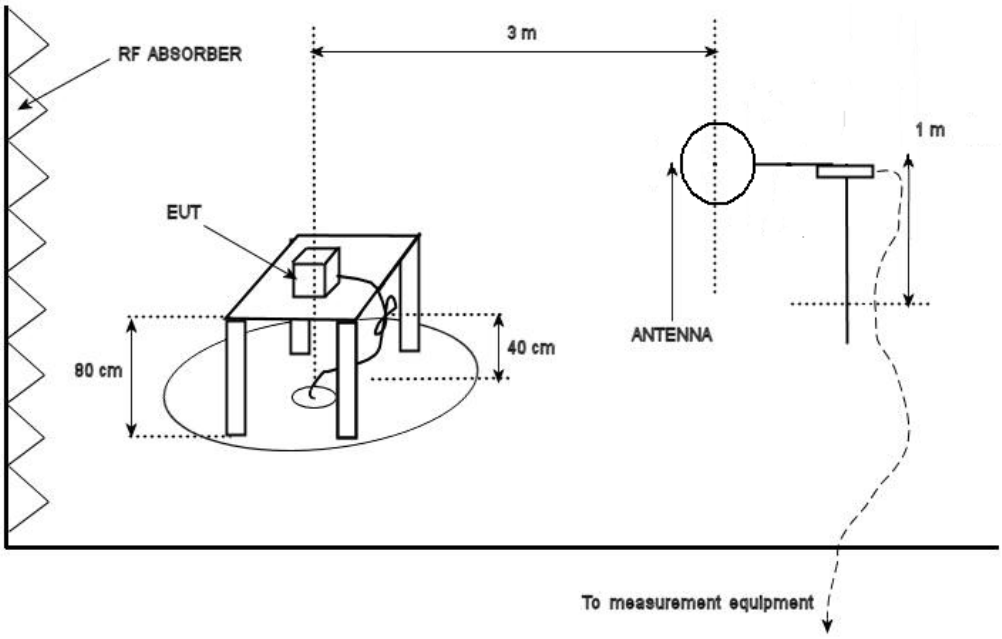
Typical Radiated Emissions Setup



Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is ±4.25dB for 30MHz – 1GHz and ±4.93dB 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.

To obtain the maximum emission, the loop antenna is positioned with its plane vertical and rotated about its vertical axis at the maximum azimuth position. This is then repeated with its plane horizontal, and rotated about the horizontal axis. The maximum obtained emission is presented.

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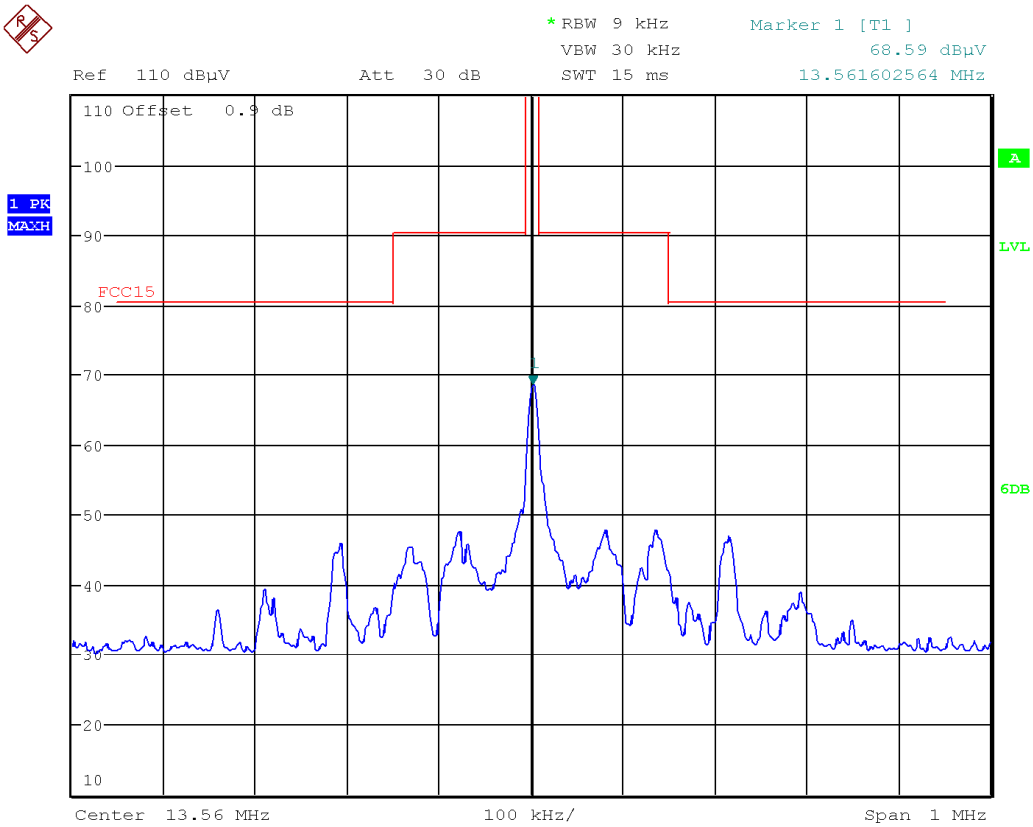
Peak Emission Mask



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Final Measurements

Test Frequency (MHz)	Detector Peak/QP	Received Signal (dBµV)	dBuA=>dBuV conversion 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	67.7	51.5	-16.3	0.2	-34.5	68.6	124.0	55.4	Pass
13.5530	Peak	56.0	51.5	-16.3	0.2	-34.5	56.9	90.5	33.6	Pass
13.5670	Peak	65.9	51.5	-16.3	0.2	-34.5	66.8	90.5	23.7	Pass
13.3523	Peak	44.6	51.5	-16.3	0.2	-34.5	45.5	80.5	35.0	Pass
13.7705	Peak	44.9	51.5	-16.3	0.2	-34.5	45.8	80.5	34.8	Pass

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 / Verification Date	Next Calibration / Verification Date	Asset #
Spectrum Analyzer	ESU 40	Rohde & Schwarz	Jan. 06, 2016	Jan. 06, 2018	GEMC 233
Pre-Amp 9 kHz – 1 GHz	CPA9231A	Chase	Oct. 12, 2016	Oct. 12, 2018	GEMC 6403
Loop Antenna	EM 6872	Electro-Metrics	Feb. 13, 2017	Feb. 13, 2019	GEMC 71
RF Cable 10m	LMR-400-10M-50Ω-MN-MN	LexTec	Feb. 20, 2017	Feb. 20, 2018	GEMC 274
RF Cable 2m	Sucoflex 104A	Huber+Suhner	Feb. 20, 2017	Feb. 20, 2018	GEMC 272

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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 ±0.01% of the operating frequency over a temperature variation of −20°C to +50°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 ±0.01% of the operating frequency.

Temperature (°C)	Measured Frequency (MHz)	Deviation (MHz)	Deviation (%)	Result
Ambient (25)	13.560433			
-20	13.560048	0.000385	0.00284	Pass
-10	13.560473	0.000040	0.00030	Pass
0	13.560449	0.000016	0.00012	Pass
10	13.560433	0.000000	0.00000	Pass
20	13.560425	0.000008	0.00006	Pass
30	13.560433	0.000000	0.00000	Pass
40	13.560433	0.000000	0.00000	Pass
50	13.560433	0.000000	0.00000	Pass

Frequency Tolerance Table

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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	Jan 24, 2017	Jan 24, 2018	CANE00043
Environmental Chamber	SM-32-8200	Thermotron	Jun 2, 2016	Jun 2, 2018	CANE00169

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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 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.

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]

[1]Limit 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.
[2]Limit is with 1 MHz measurement bandwidth and using an Average detector
[3]Limit 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

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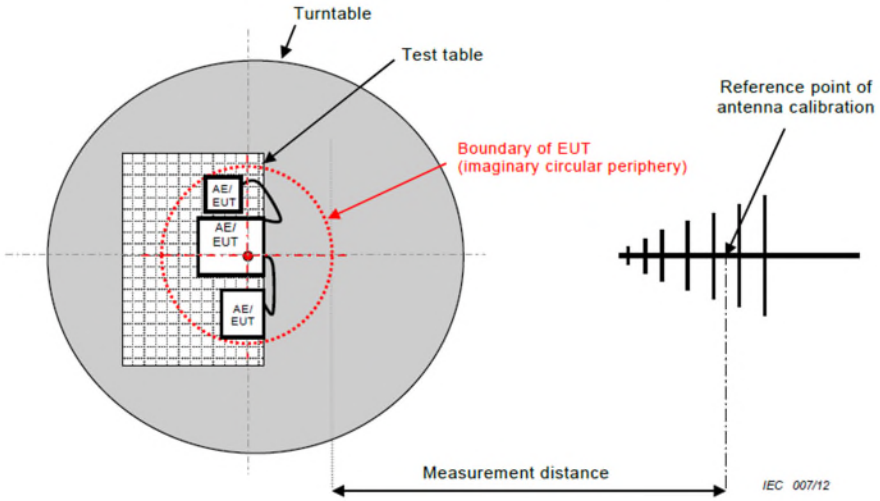
Typical Radiated Emissions Setup



Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is ±4.25dB for 30MHz – 1GHz and ±4.93dB 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 20Log(uV/m) + 40Log(30m/3m).

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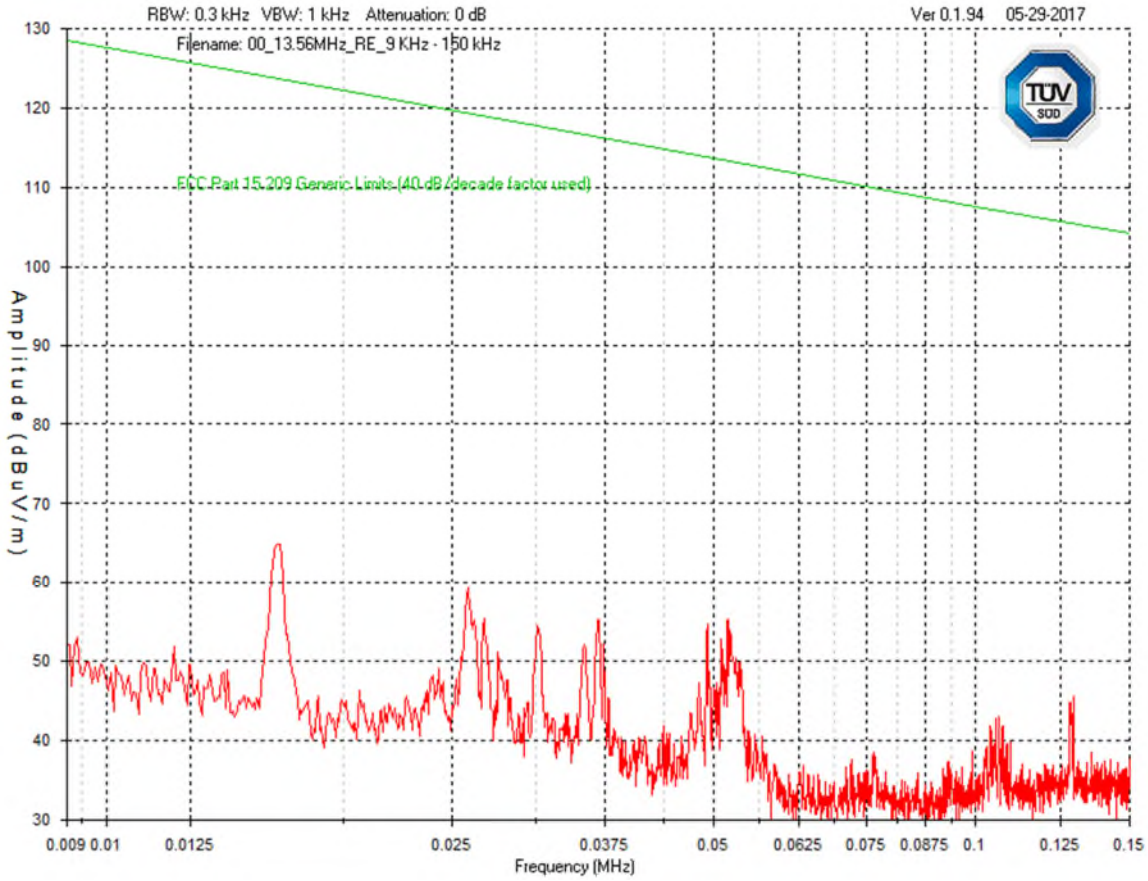
9 kHz – 150 kHz



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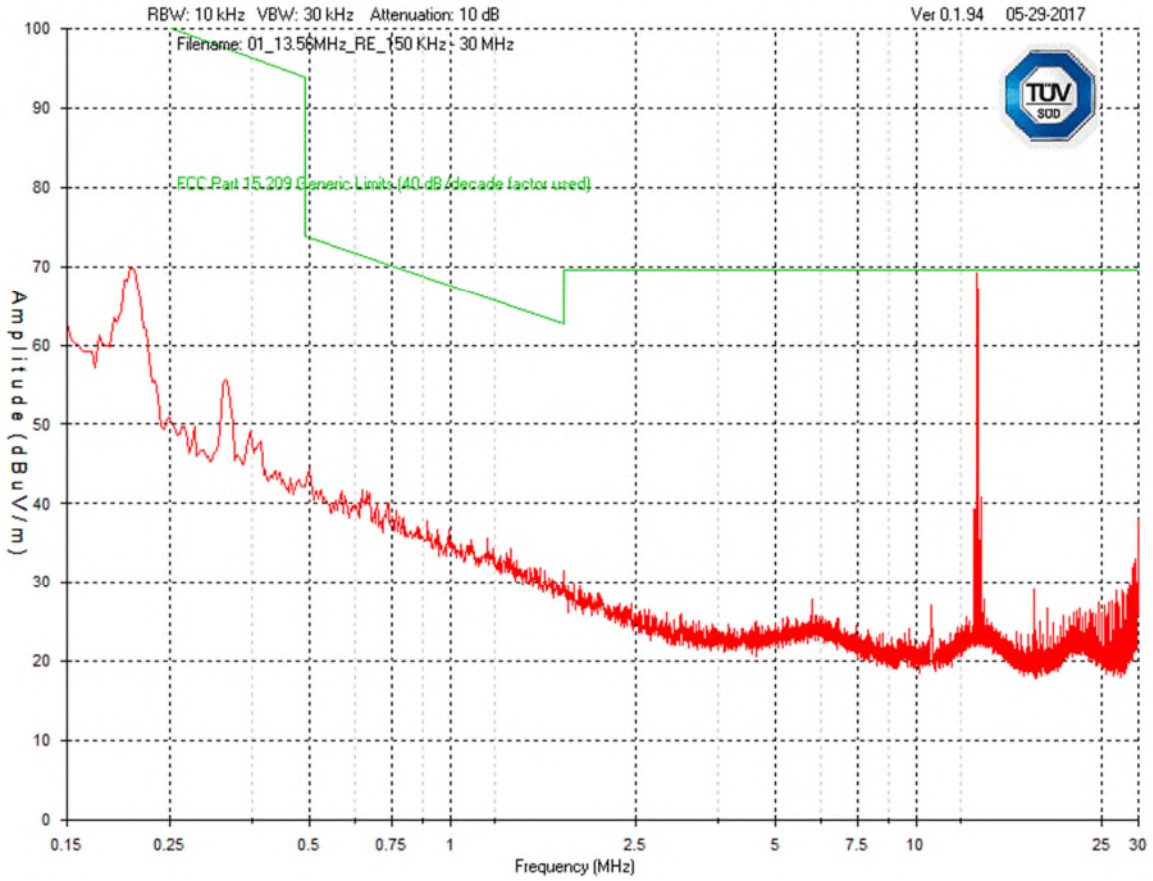
150 kHz – 30 MHz



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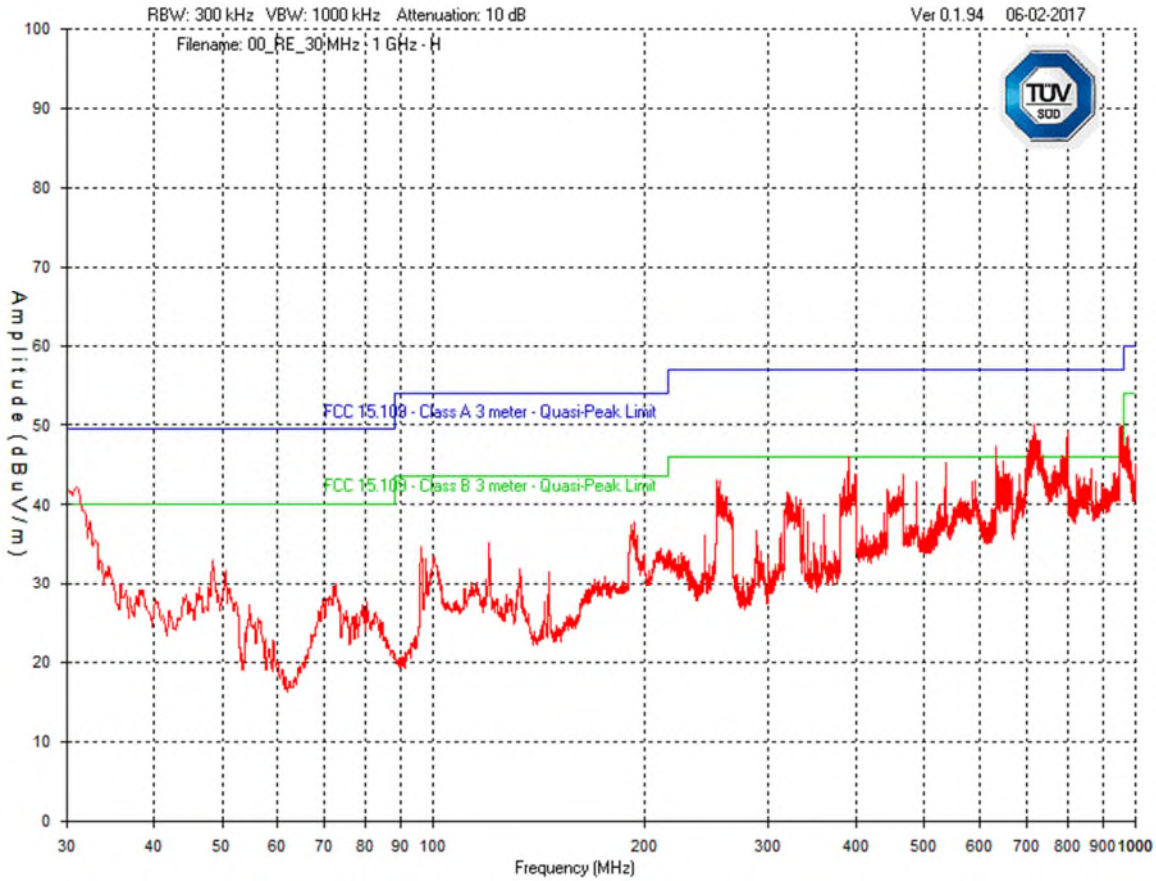
30 MHz – 1 GHz
Horizontal - Peak Emission Graph



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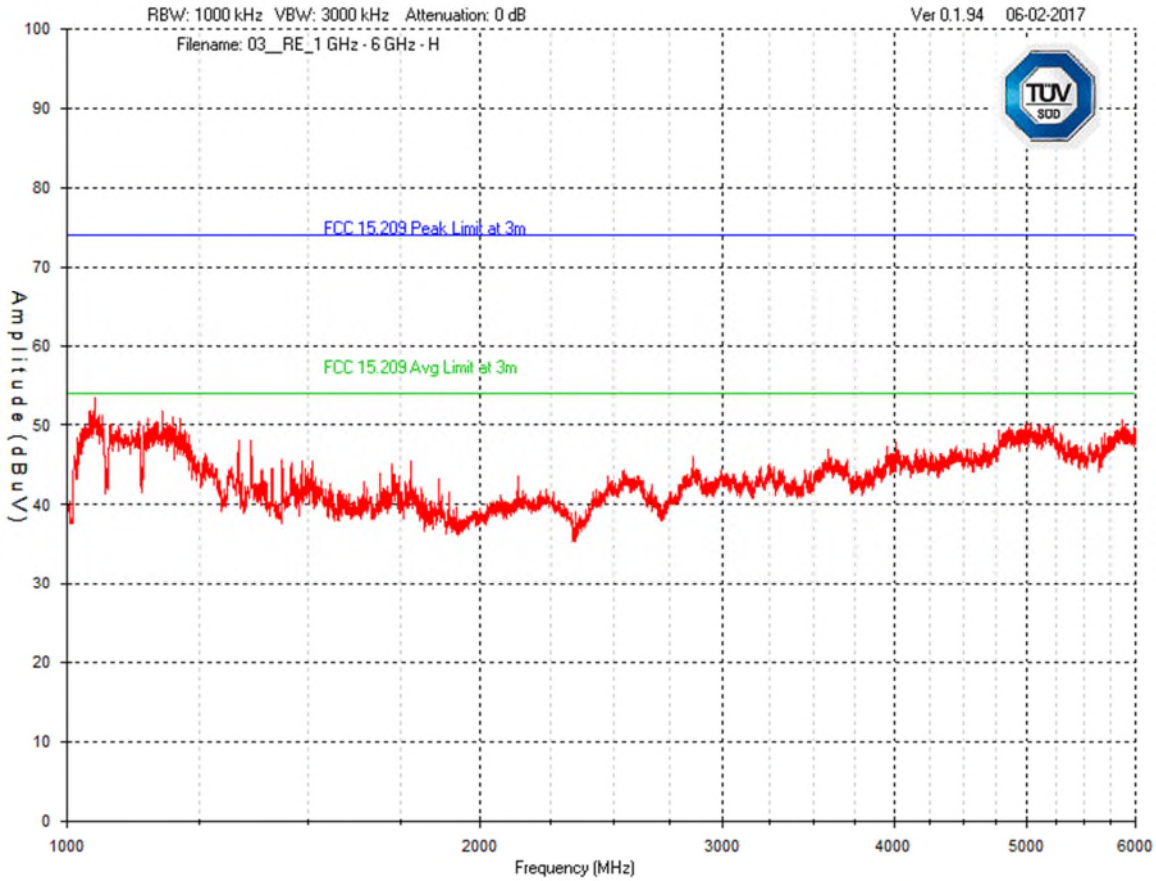
1 GHz – 6 GHz
Horizontal - Peak Emission Graph



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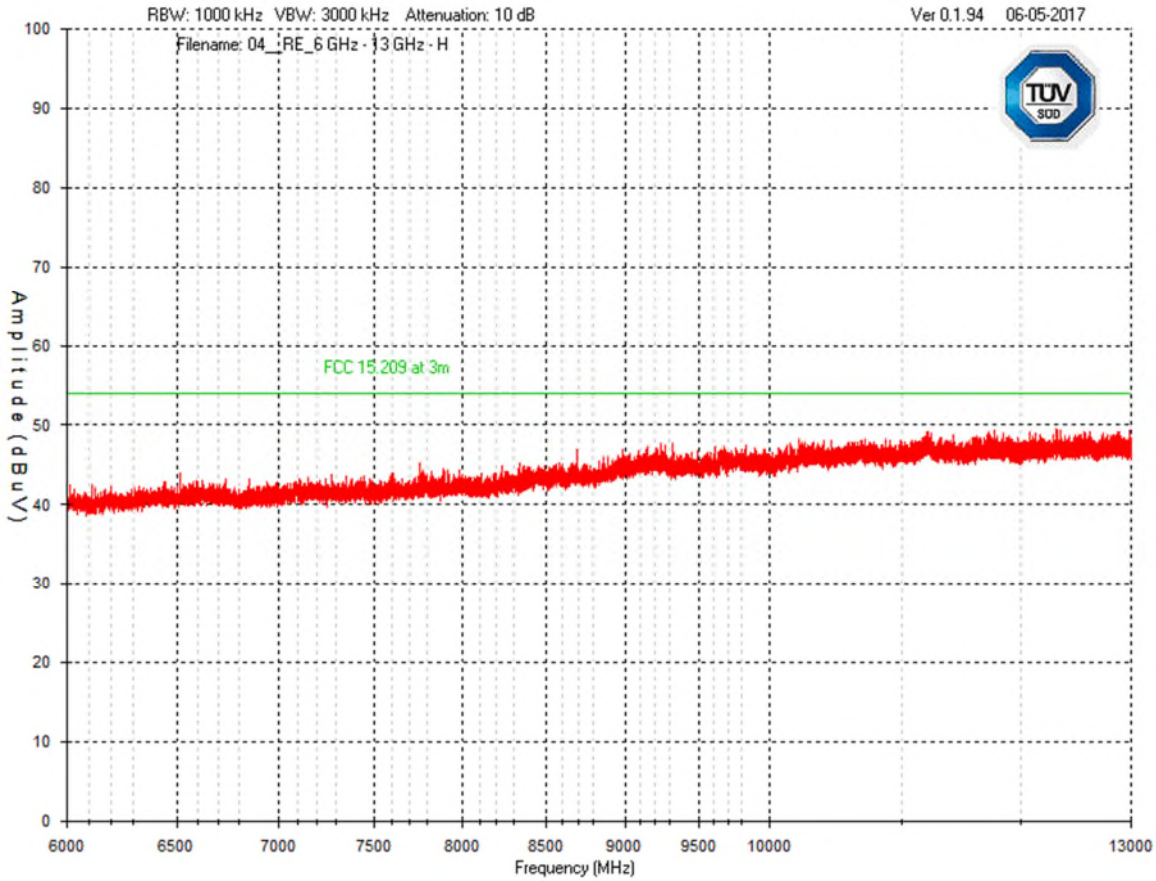
6 GHz – 13 GHz
Horizontal - Peak Emission Graph



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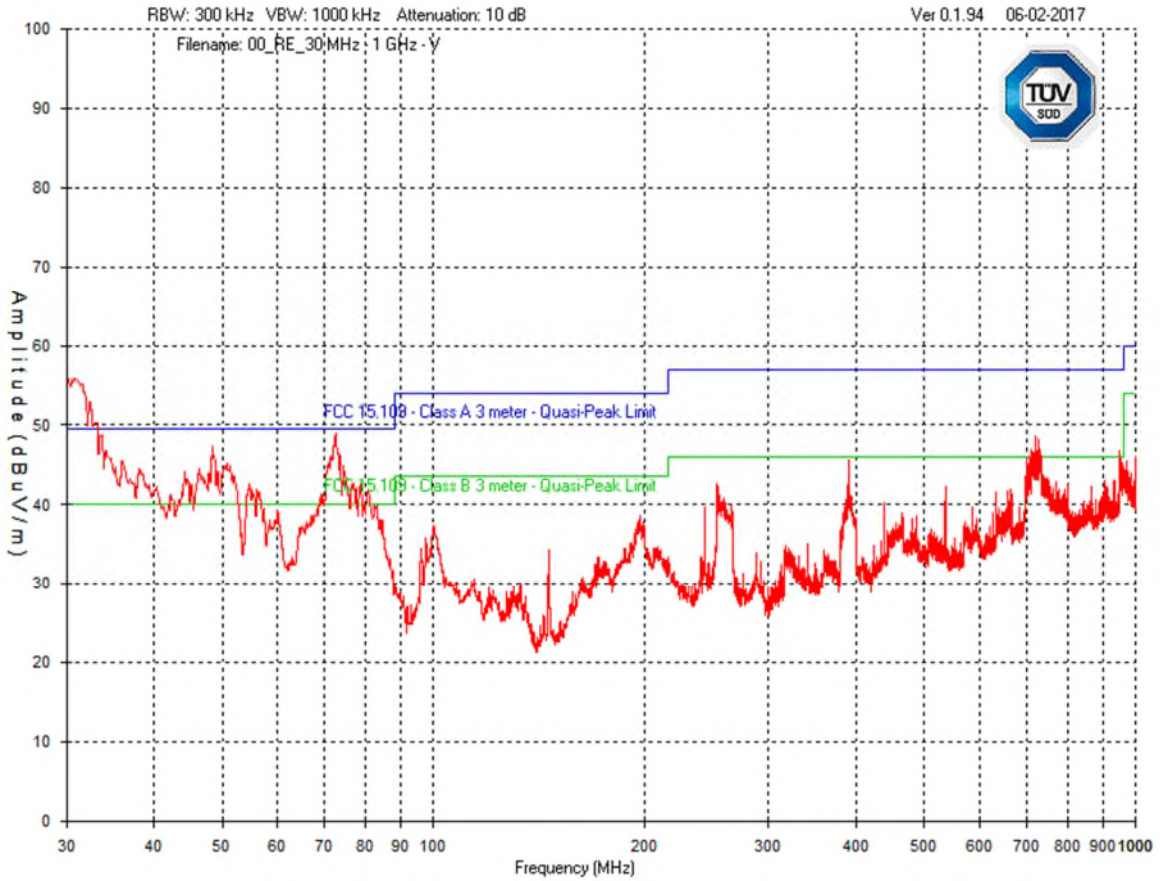
30 MHz – 1 GHz
Vertical - Peak Emission Graph



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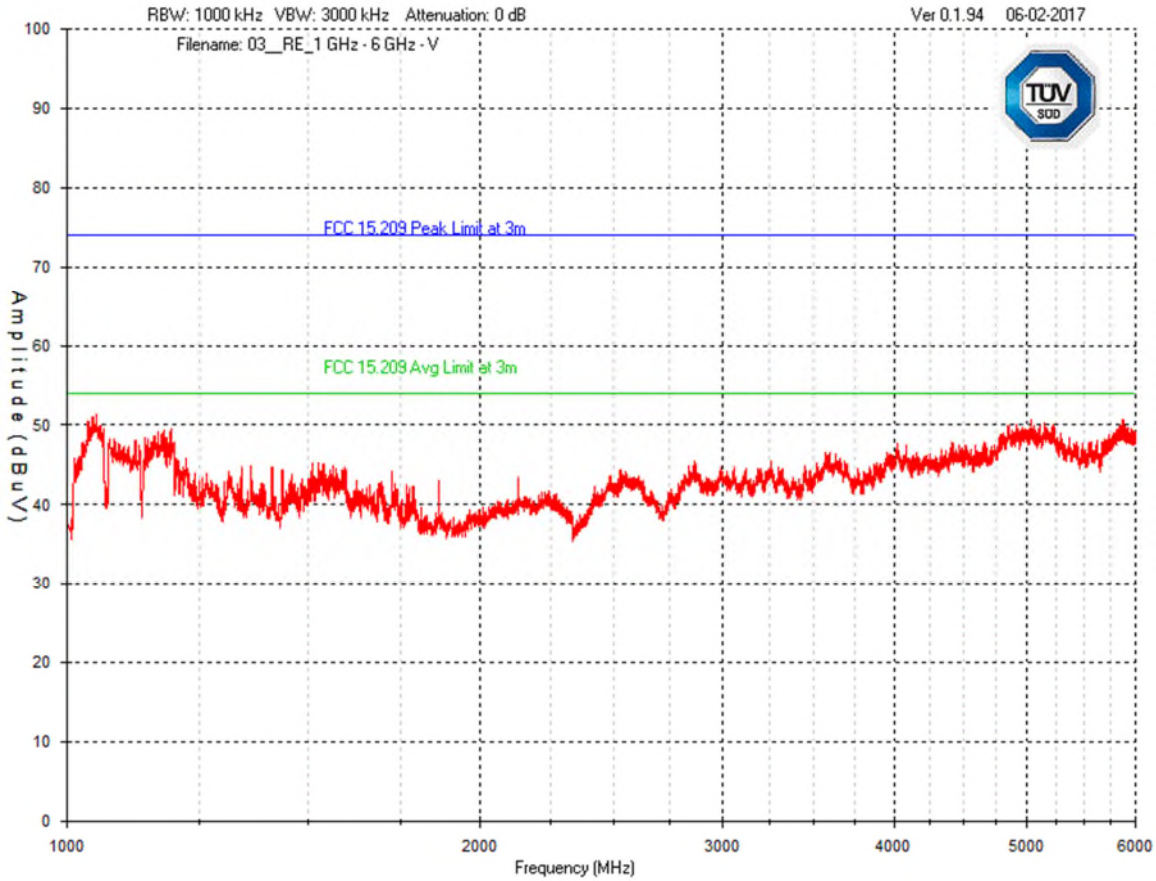
1 GHz – 6 GHz
Vertical - Peak Emission Graph



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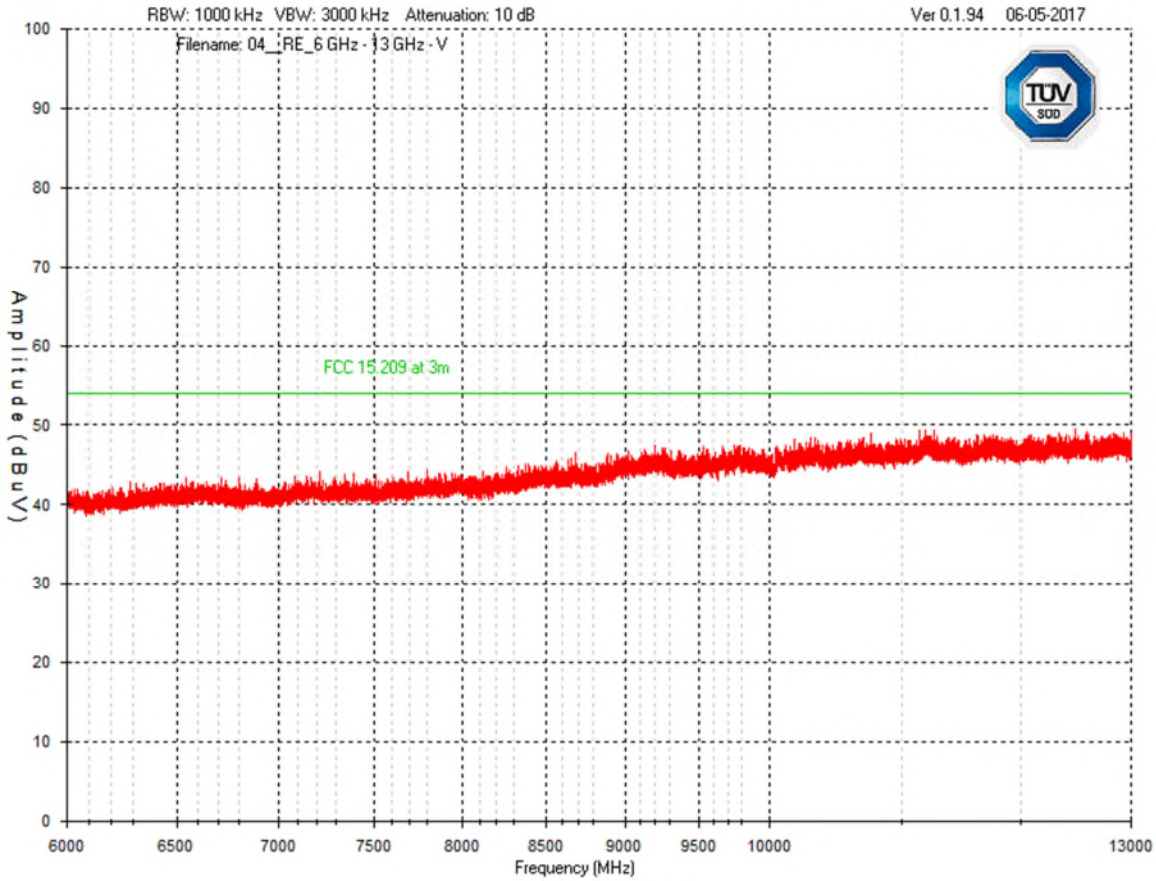
6 GHz – 13 GHz
Vertical - Peak Emission Graph



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Final Measurements

The EUT passed.

Product Category		FCC 15.109 Class A					
Supply		120 Vac 60 Hz					
Vertical Emission Table							
Frequency (MHz)	Detector	Raw (dBuV)	Correction Factors (dB)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass/Fail
30.097	QP	55.1	-10.3	44.8	49.6	4.8	Pass
72.486	QP	60.8	-21.6	39.2	49.6	10.4	Pass
48.43	QP	63.6	-19.3	44.3	49.6	5.3	Pass
54.638	QP	54.4	-20.5	33.9	49.6	15.7	Pass
37.5	QP	44.2	-14.6	29.6	49.6	20	Pass
73.0	QP	59.2	-21.7	37.5	49.6	12.1	Pass
Horizontal Emission Table							
717.633	PEAK	52.9	-2.8	50.1	56.9	6.8	Pass
954.895	PEAK	47.6	2.4	50.0	56.9	6.9	Pass
30.97	PEAK	53.2	-11.1	42.1	49.6	7.5	Pass
798.725	PEAK	50.2	-1.1	49.1	56.9	7.8	Pass
633.146	PEAK	52.3	-5.0	47.3	56.9	9.6	Pass
389.482	PEAK	56.9	-10.9	46.0	56.9	10.9	Pass
960	PEAK	42.3	2.4	44.7	60.0	15.3	Pass
1049	AVG	57.5	-8.7	48.8	54.0	5.2	Pass
1175.33	AVG	53.2	-7.6	45.6	54.0	8.4	Pass

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.

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Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration / Verification Date	Next Calibration / Verification Date	Asset #
Spectrum Analyzer	ESU 40	Rohde & Schwarz	Jan. 06, 2016	Jan. 06, 2018	GEMC 233
Pre-Amp 1 – 26.5 GHz	HP 8449B	HP	Oct. 12, 2016	Oct. 12, 2018	GEMC 6351
Pre-Amp 9 kHz – 1 GHz	CPA9231A	Chase	Oct. 12, 2016	Oct. 12, 2018	GEMC 6403
Loop Antenna	EM 6871	Electro-Metrics	Feb. 13, 2017	Feb. 13, 2019	GEMC 70
Loop Antenna	EM 6872	Electro-Metrics	Feb. 13, 2017	Feb. 13, 2019	GEMC 71
BiLog Antenna	3142-C	ETS	Feb. 22, 2017	Feb. 22, 2019	GEMC 137
Double Ridge Guide Horn Antenna 1-18 GHz	AH-118	Com-Power Corporation	Jul-01, 2015	Jul-01, 2017	GEMC 214
Horn Antenna 2 – 18 GHz	WBH218HN	Q-par	Feb. 12, 2016	Feb. 12, 2018	GEMC 6375
RF Cable 10m	LMR-400-10M-50Ω-MN-MN	LexTec	Feb. 20, 2017	Feb. 20, 2018	GEMC 274
RF Cable 2m	Sucoflex 104A	Huber+Suhner	Feb. 20, 2017	Feb. 20, 2018	GEMC 272
Emissions Software	0.1.94	Global EMC	NCR	NCR	GEMC 58

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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 MHz and F_{MAX} = 14.010 MHz

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)	20dB Bandwidth (kHz)	
13.56	13.481	13.695	213.14	427.88

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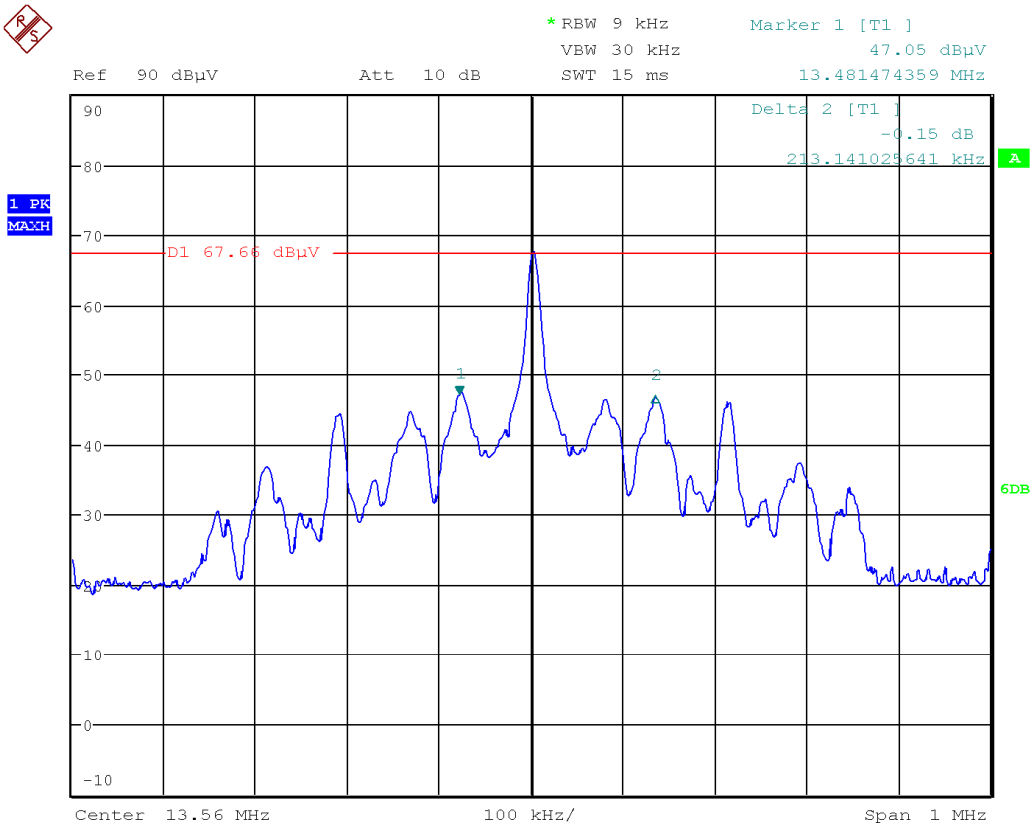
Graphs

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.

20dB Bandwidth



Date: 29.MAY.2017 17:49:13

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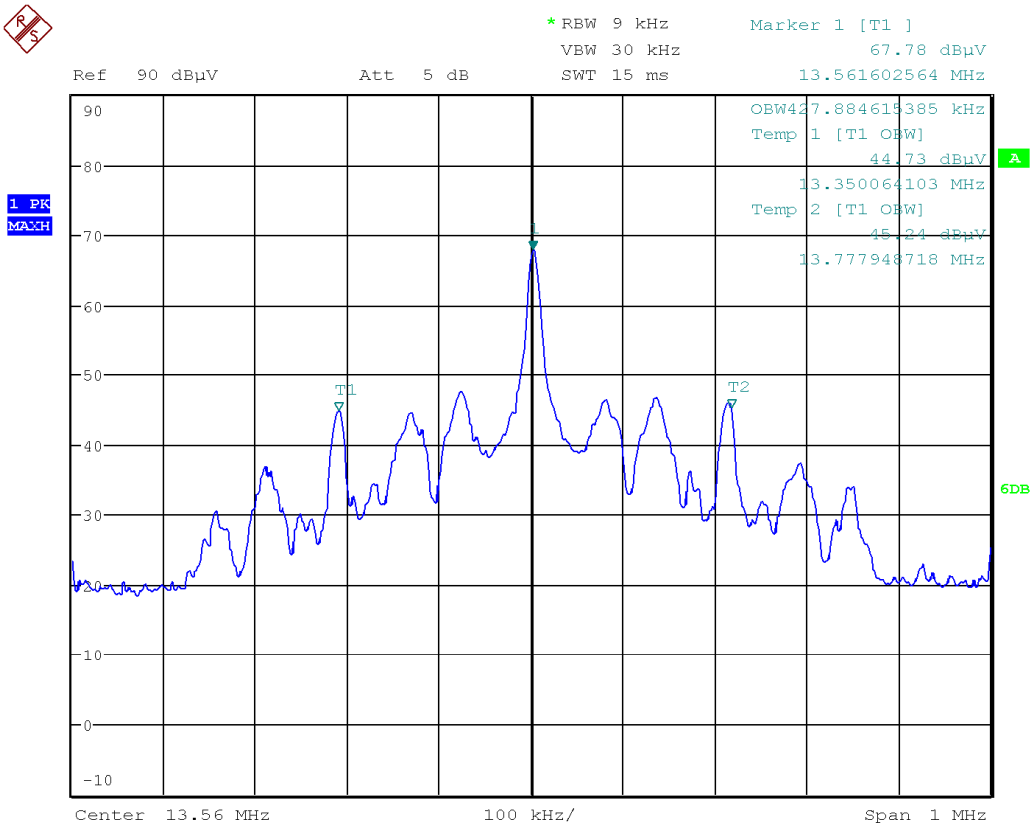
99% Bandwidth



Date: 29.MAY.2017 18:01:23

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

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Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration / Verification Date	Next Calibration / Verification Date	Asset #
Spectrum Analyzer	ESU 40	Rohde & Schwarz	Jan. 06, 2016	Jan. 06, 2018	GEMC 233
Pre-Amp 9 kHz – 1 GHz	CPA9231A	Chase	Oct. 12, 2016	Oct. 12, 2018	GEMC 6403
Loop Antenna	EM 6872	Electro-Metrics	Feb. 13, 2017	Feb. 13, 2019	GEMC 71
RF Cable 10m	LMR-400-10M-50Ω-MN-MN	LexTec	Feb. 20, 2017	Feb. 20, 2018	GEMC 274
RF Cable 2m	Sucoflex 104A	Huber+Suhner	Feb. 20, 2017	Feb. 20, 2018	GEMC 272

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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]

[1]Limit 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.
[2]Limit is with 1 MHz measurement bandwidth and using an Average detector
[3]Limit 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

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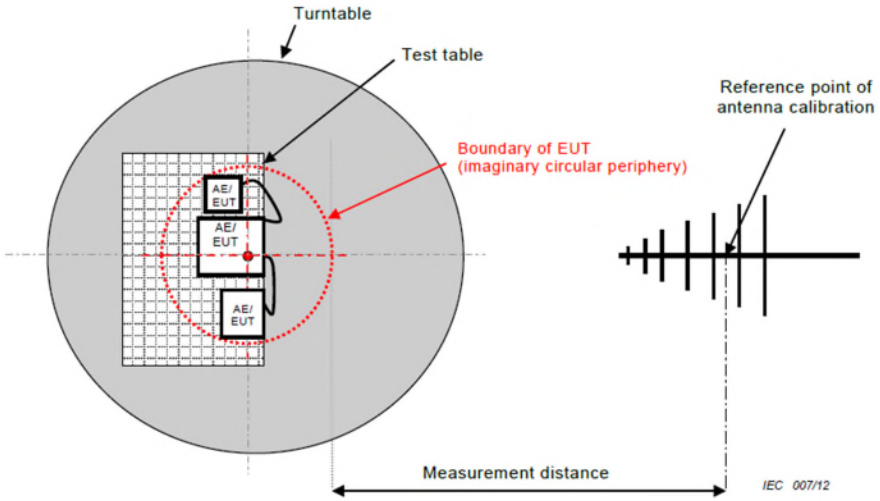
Typical Radiated Emissions Setup



Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is ±4.25dB for 30MHz – 1GHz and ±4.93dB 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 20Log(uV/m) + 40Log(30m/3m).

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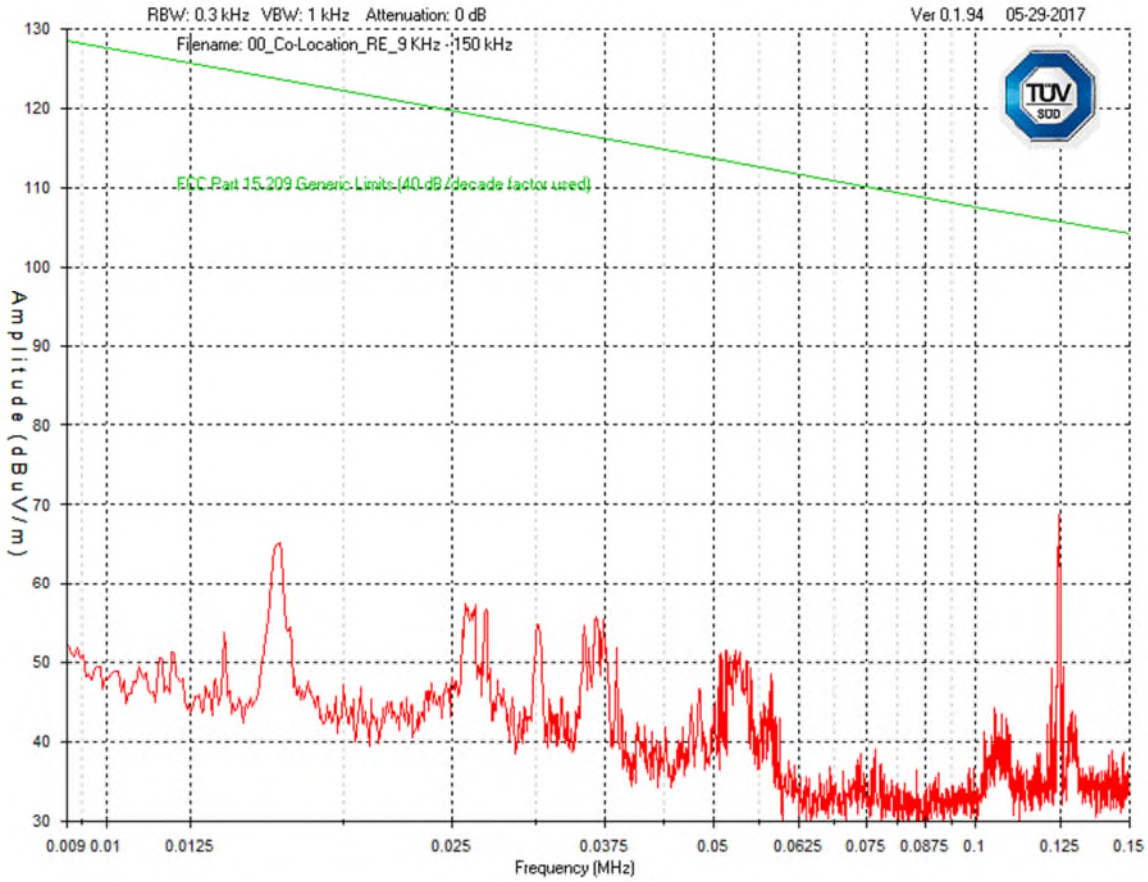
9 kHz – 150 kHz
Peak Emission Graph



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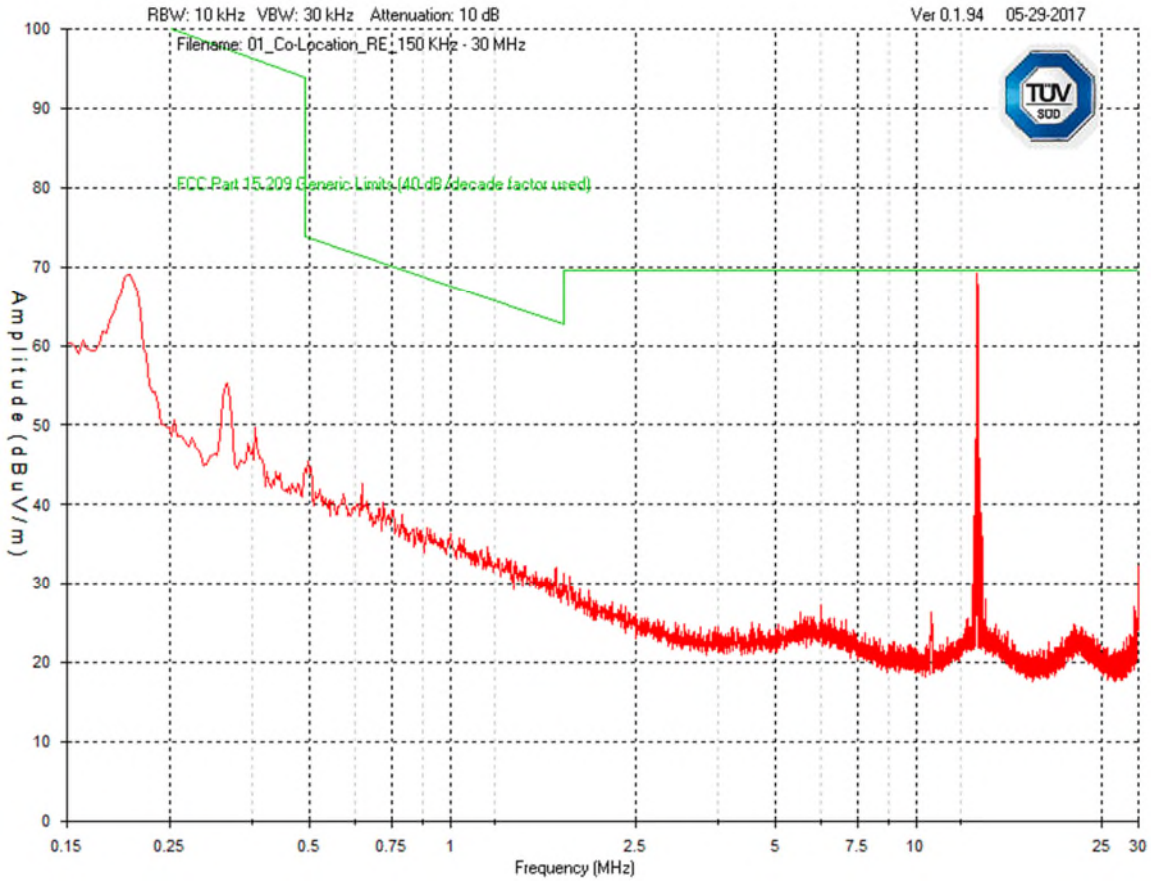
150 kHz – 30 MHz
Peak Emission Graph



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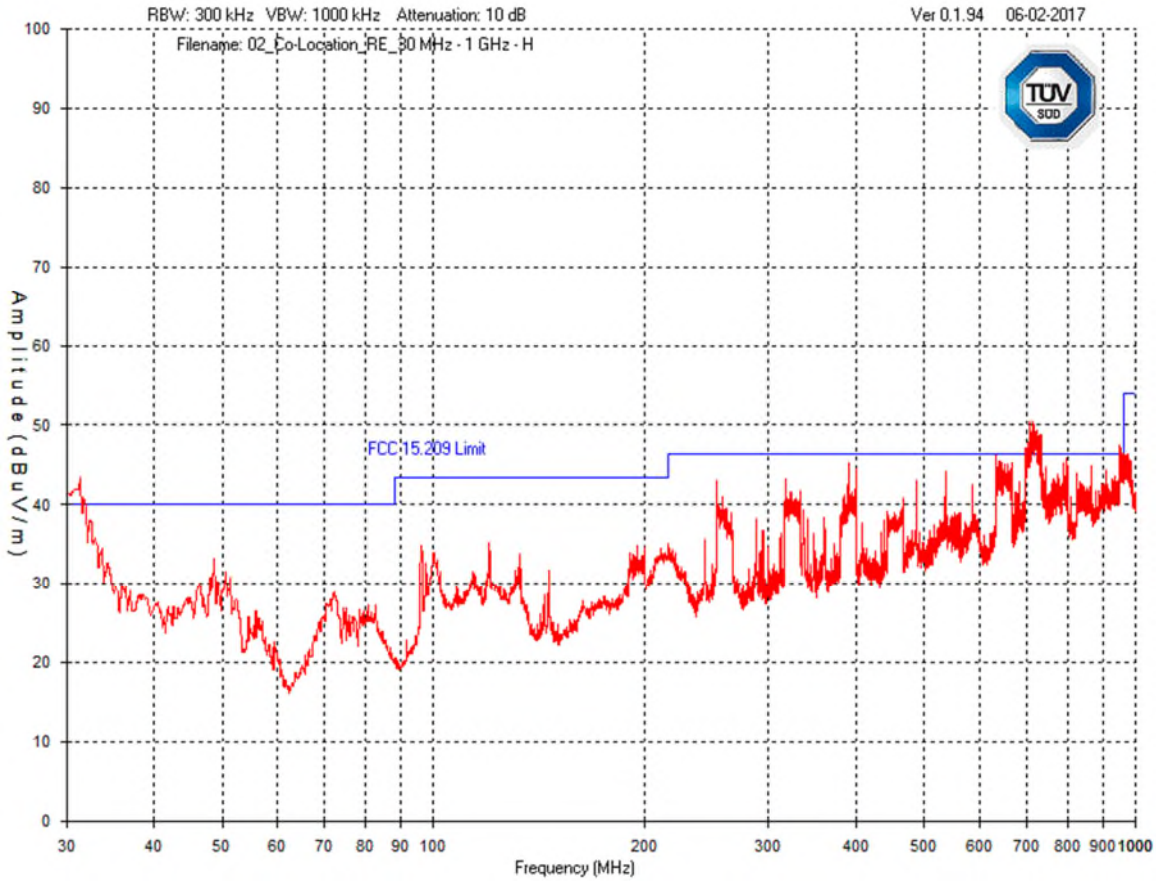
30 MHz – 1 GHz
Horizontal - Peak Emission Graph



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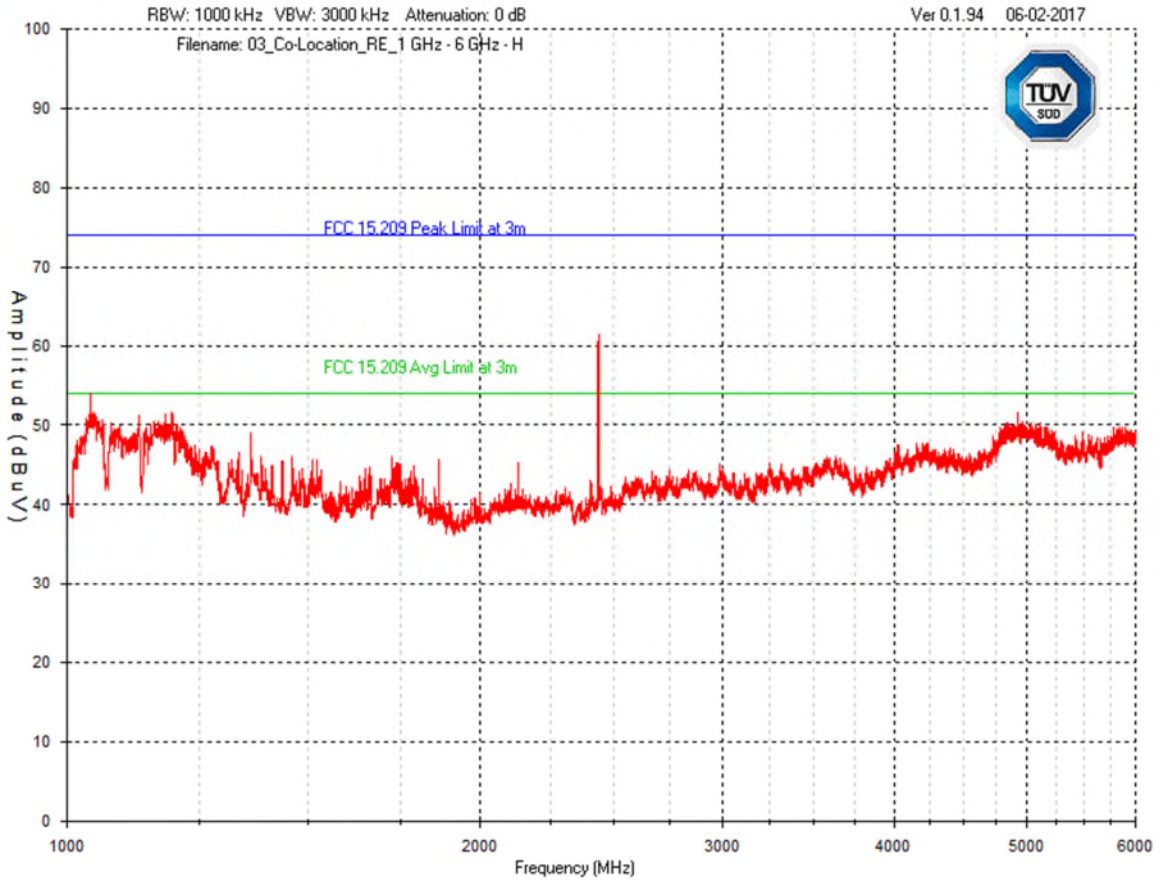
1 GHz – 6 GHz
Horizontal - Peak Emission Graph



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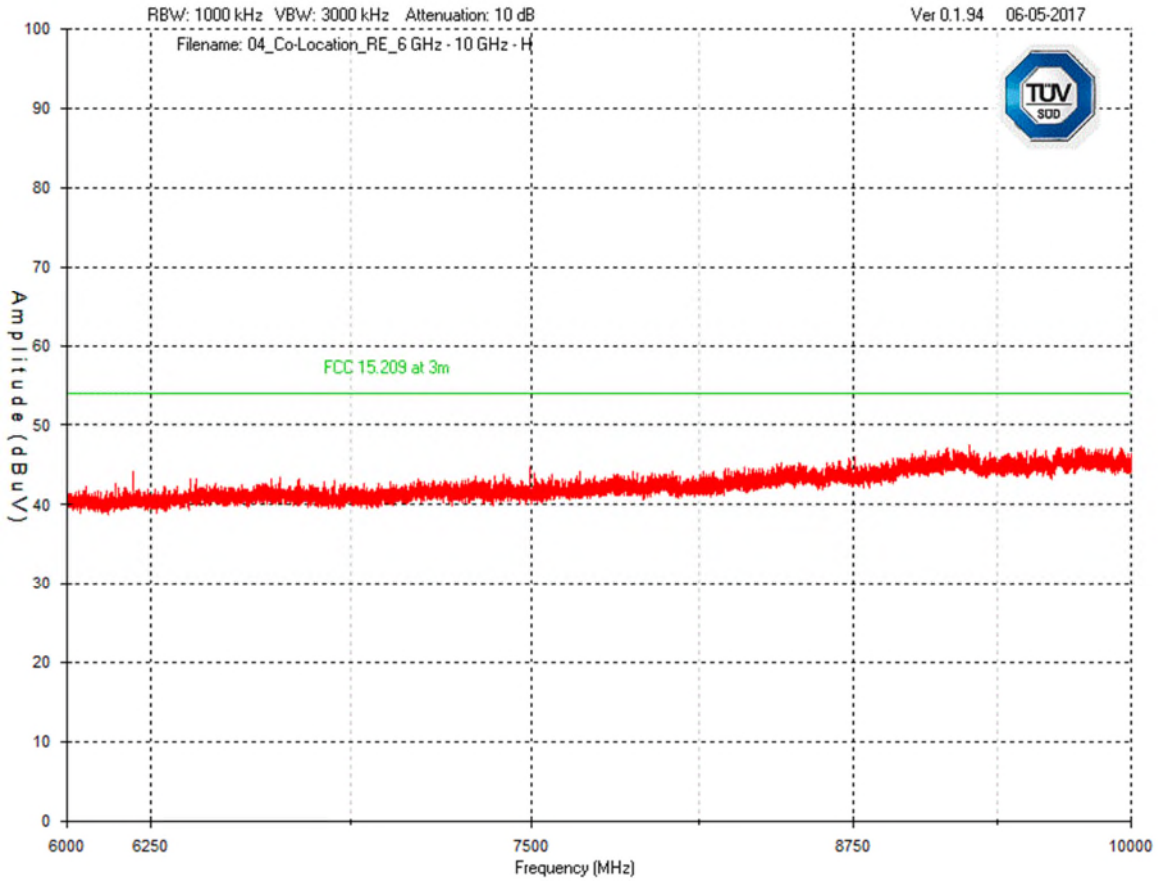
6 GHz – 10 GHz
Horizontal - Peak Emission Graph



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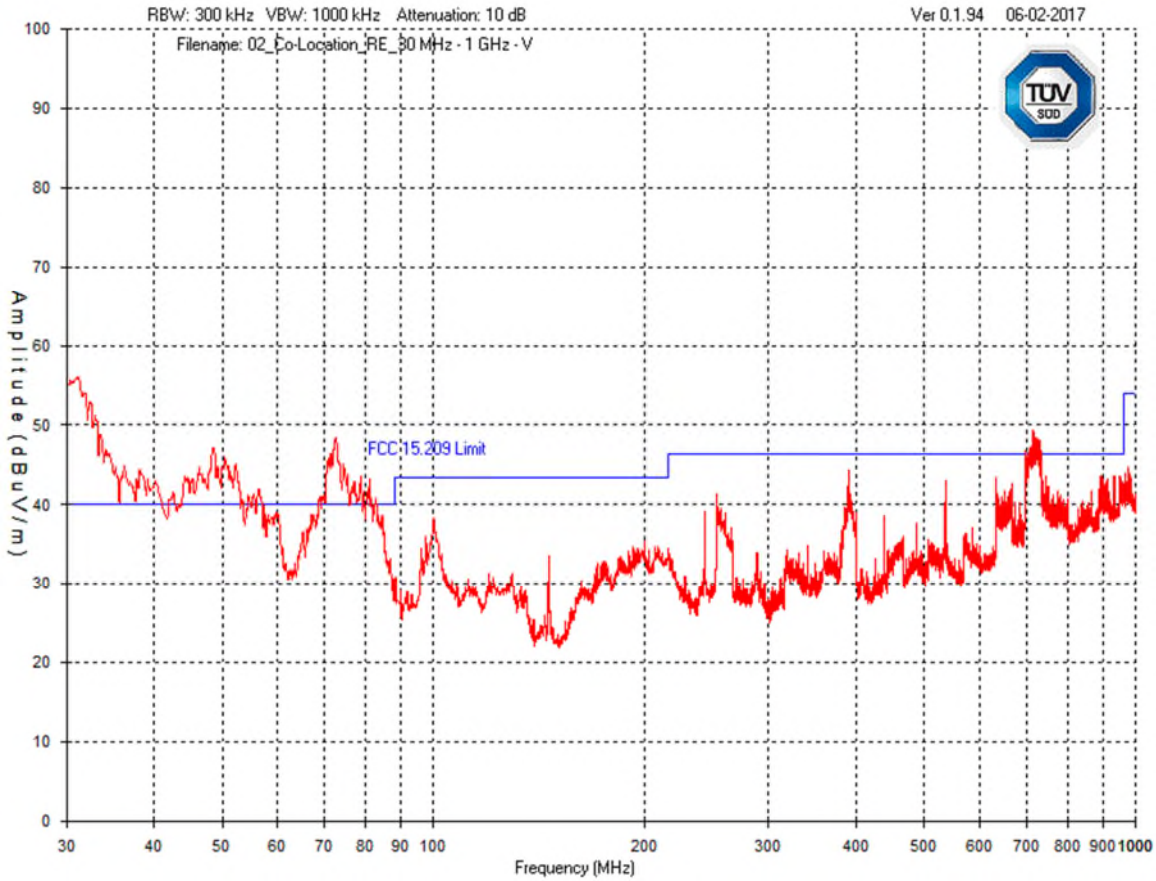
30 MHz – 1 GHz
Vertical - Peak Emission Graph



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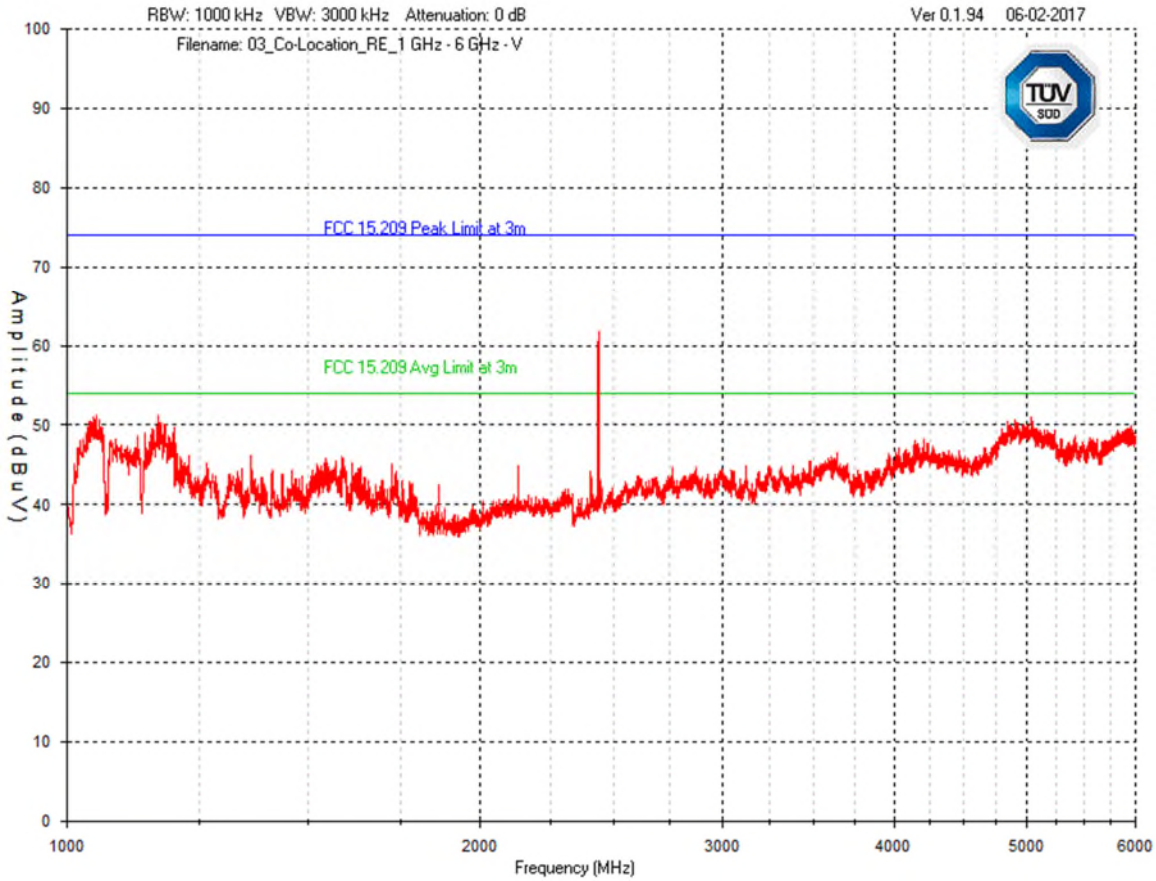
1 GHz – 6 GHz
Vertical - Peak Emission Graph



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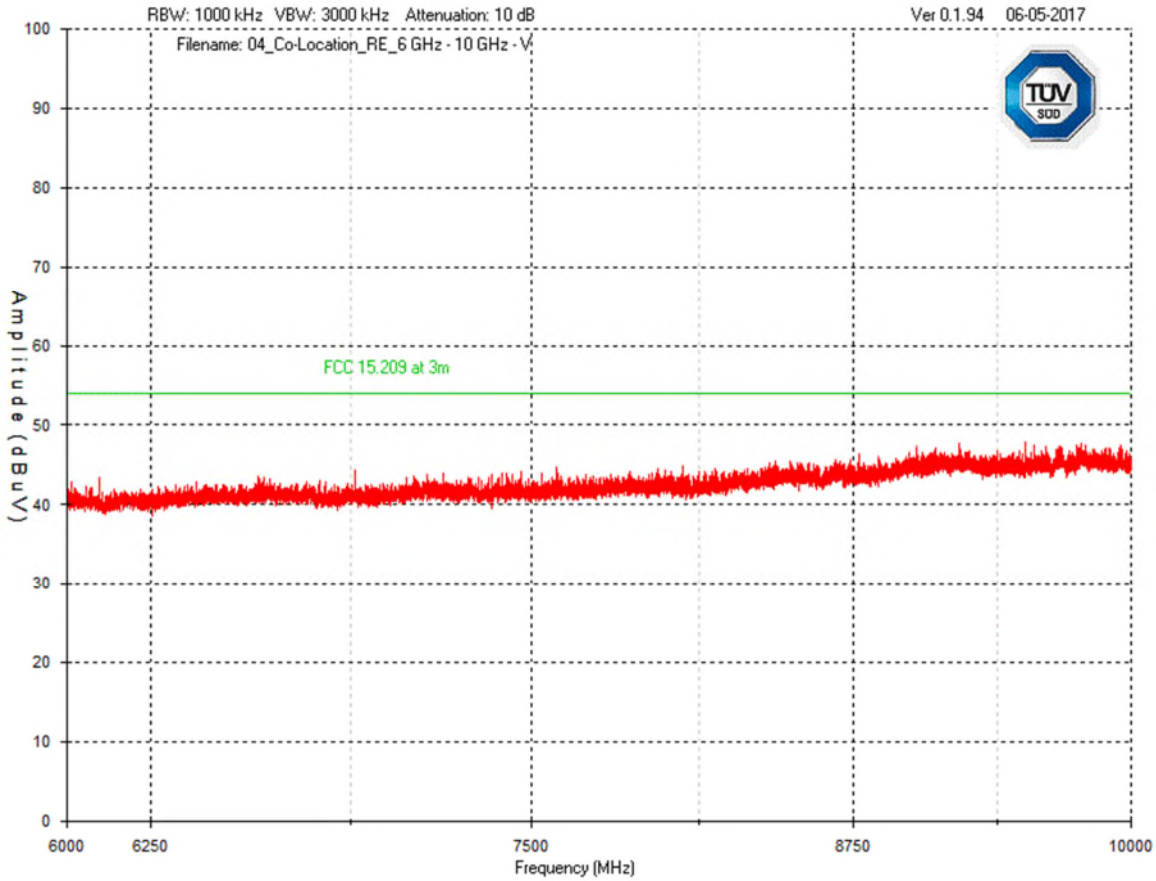
6 GHz – 10 GHz
Vertical - Peak Emission Graph



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Final Measurements

The EUT passed. See Notes, Justification, or Deviations section for further details.

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.

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration / Verification Date	Next Calibration / Verification Date	Asset #
Spectrum Analyzer	ESU 40	Rohde & Schwarz	Jan. 06, 2016	Jan. 06, 2018	GEMC 233
Pre-Amp 1 – 26.5 GHz	HP 8449B	HP	Oct. 12, 2016	Oct. 12, 2018	GEMC 6351
Pre-Amp 9 kHz – 1 GHz	CPA9231A	Chase	Oct. 12, 2016	Oct. 12, 2018	GEMC 6403
Loop Antenna	EM 6871	Electro-Metrics	Feb. 13, 2017	Feb. 13, 2019	GEMC 70
Loop Antenna	EM 6872	Electro-Metrics	Feb. 13, 2017	Feb. 13, 2019	GEMC 71
BiLog Antenna	3142-C	ETS	Feb. 22, 2017	Feb. 22, 2019	GEMC 137
Double Ridge Guide Horn Antenna 1-18 GHz	AH-118	Com-Power Corporation	Jul-01, 2015	Jul-01, 2017	GEMC 214
Horn Antenna 2 – 18 GHz	WBH218HN	Q-par	Feb. 12, 2016	Feb. 12, 2018	GEMC 6375
RF Cable 10m	LMR-400-10M-50Ω-MN-MN	LexTec	Feb. 20, 2017	Feb. 20, 2018	GEMC 274
RF Cable 2m	Sucoflex 104A	Huber+Suhner	Feb. 20, 2017	Feb. 20, 2018	GEMC 272
Emissions Software	0.1.94	Global EMC	NCR	NCR	GEMC 58

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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, as measured from a LISN. This helps protect lower frequency radio services such as AM radio, shortwave radio, amateur radio operators, maritime radio, CB radio, and so on, from unwanted interference.

Limits and Method

The limits are as defined in 47 CFR FCC Part 15 Section 15.207
Method is as defined in ANSI C63.4

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

* 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.

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

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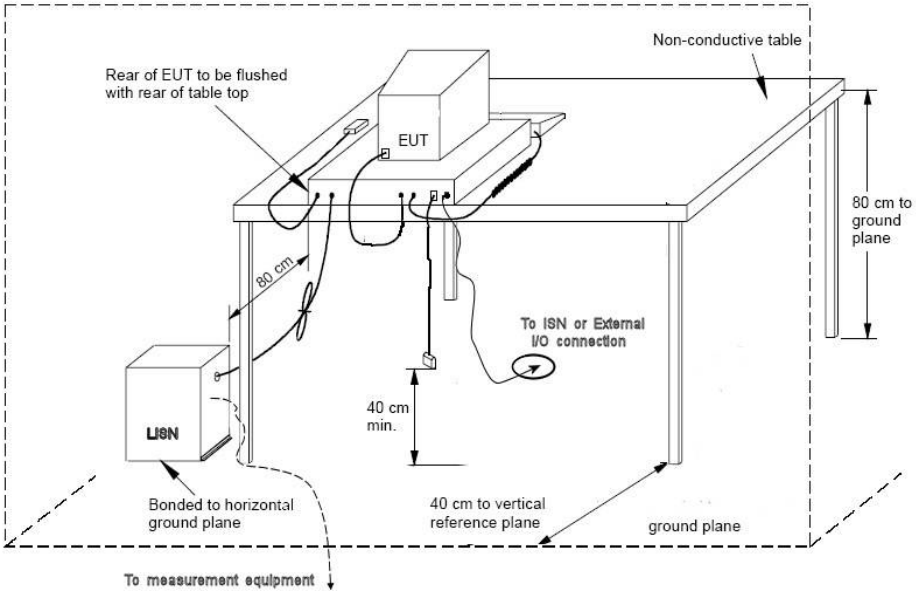
Typical Setup Diagram



Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is ±2.91dB 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.

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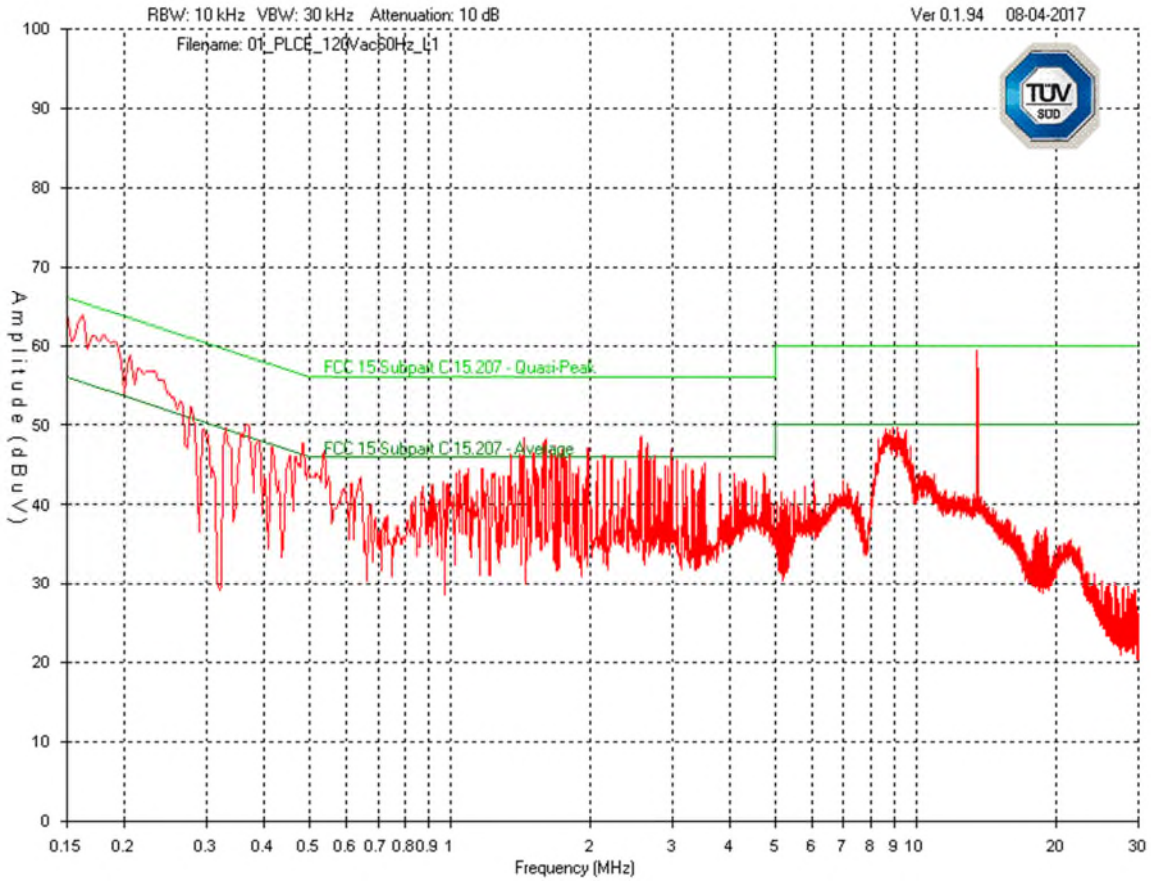
Line 1 (L1) – 120Vac 60Hz
Peak



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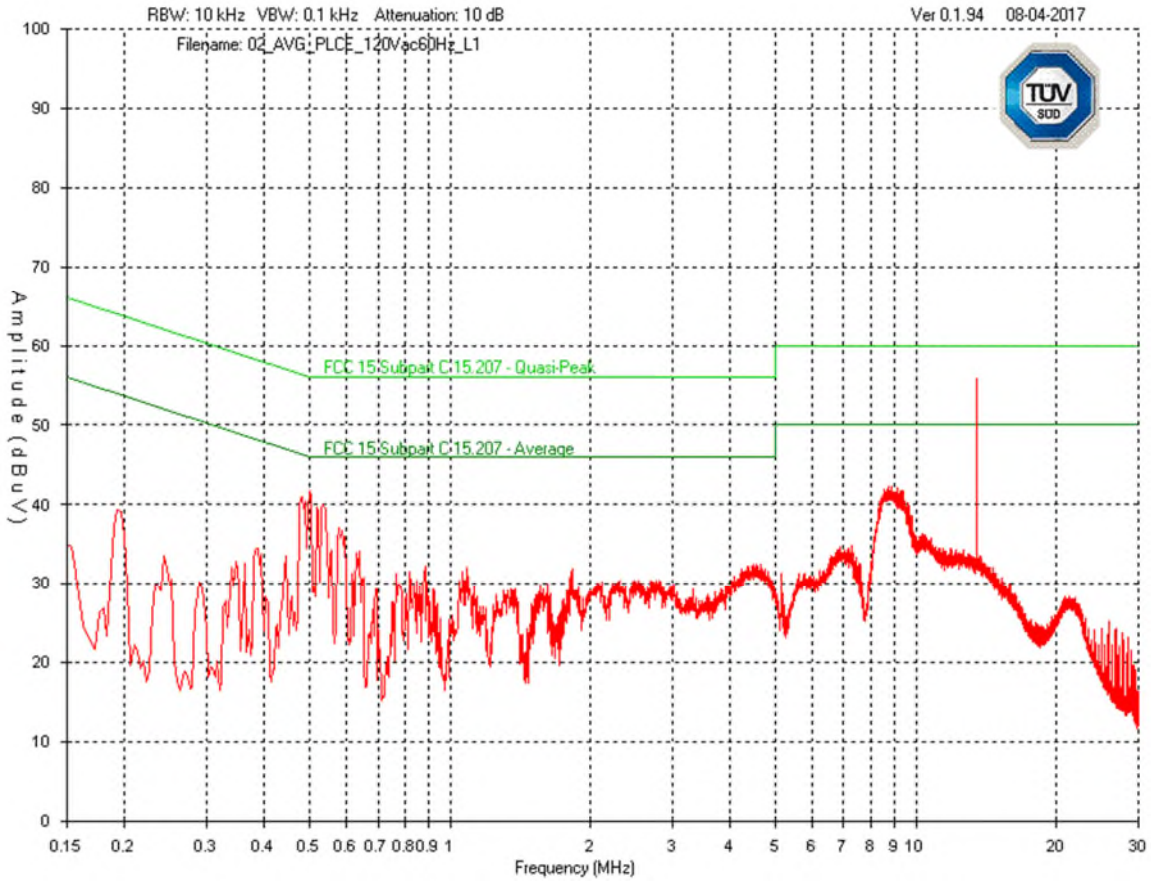
Line 1 (L1) – 120Vac 60Hz
Average



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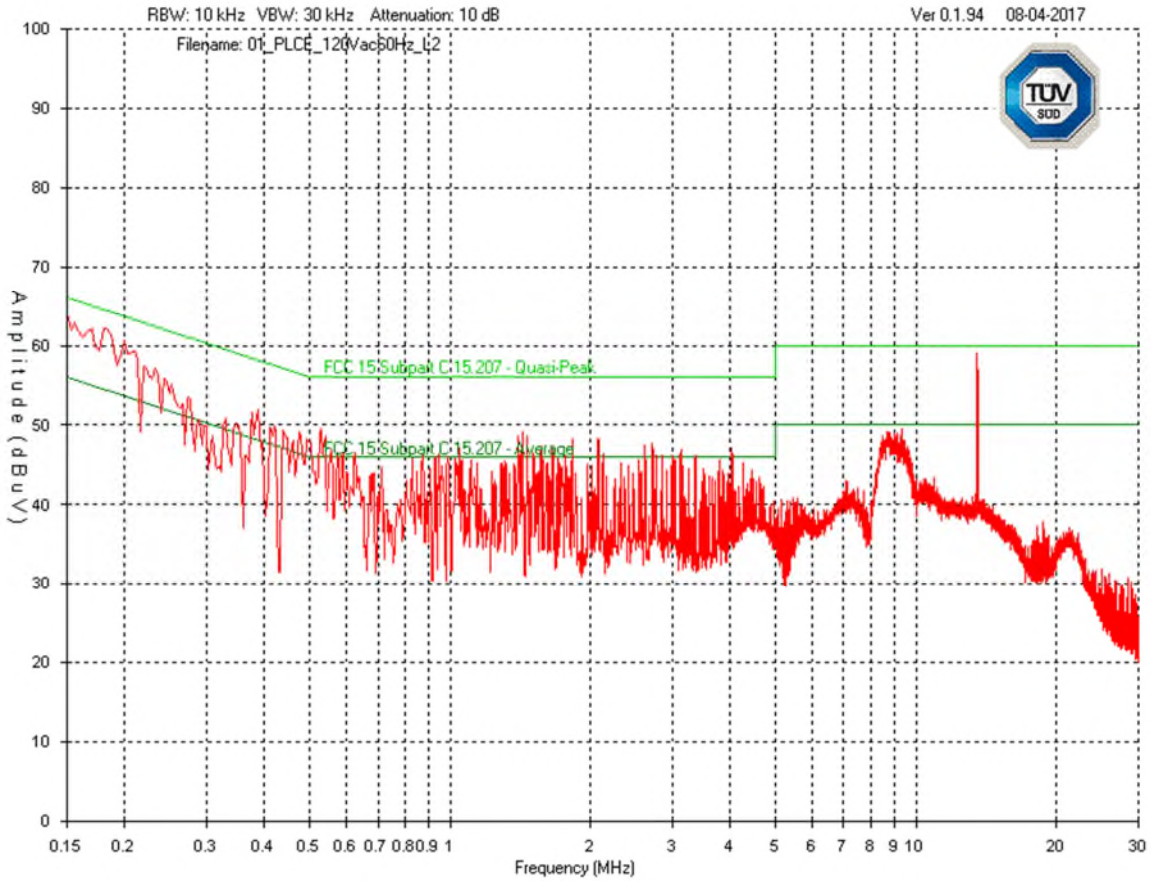
Line 2 (L2) – 120Vac 60Hz
Peak



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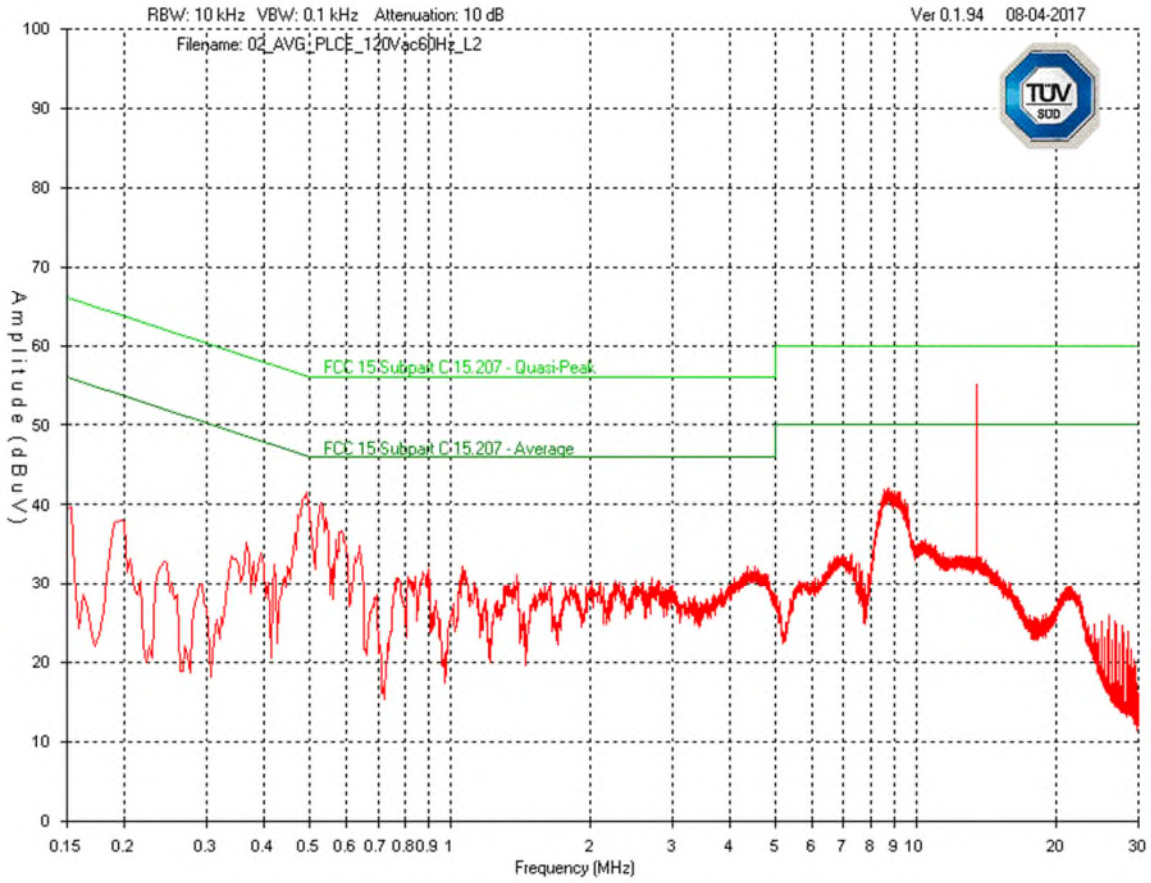
Line 2 (L2) – 120Vac 60Hz
Average



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Final Measurements

Supply	120 Vac 60 Hz						
Line Emission Table							
Frequency (MHz)	Detector	Raw (dBuV)	Factors (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Pass/Fail
13.5596	PEAK	49.1	10.2	59.3	60.0	0.7	Pass
0.1633	PEAK	53.5	10.2	63.7	65.3	1.6	Pass
2.5727	PEAK	38.4	10.2	48.6	56.0	7.4	Pass
1.4428	PEAK	38.1	10.2	48.3	56.0	7.7	Pass
1.6056	PEAK	38.0	10.2	48.2	56.0	7.8	Pass
2.6491	PEAK	37.5	10.2	47.7	56.0	8.3	Pass
13.5529	AVG	29.4	10.2	39.6	50.0	10.4	Pass
0.499	AVG	31.6	10.2	41.8	46.0	4.2	Pass
0.4823	AVG	30.8	10.2	41.0	46.3	5.3	Pass
0.5322	AVG	29.9	10.2	40.1	46.0	5.9	Pass
0.5189	AVG	29.6	10.2	39.8	46.0	6.2	Pass
Neutral Emission Table							
13.5596	PEAK	48.8	10.2	59.0	60.0	1.0	Pass
0.1567	PEAK	52.7	10.2	62.9	65.6	2.7	Pass
0.2198	PEAK	47.1	10.1	57.2	62.8	5.6	Pass
0.386	PEAK	41.8	10.2	52.0	58.1	6.1	Pass
0.5289	PEAK	39.4	10.2	49.6	56.0	6.4	Pass
1.4295	PEAK	38.9	10.2	49.1	56.0	6.9	Pass
13.5529	AVG	27.1	10.2	37.3	50.0	12.7	Pass
0.4923	AVG	31.3	10.2	41.5	46.1	4.6	Pass
0.5289	AVG	30.0	10.2	40.2	46.0	5.8	Pass
8.7707	AVG	32.0	10.2	42.2	50.0	7.8	Pass
0.5854	AVG	26.5	10.2	36.7	46.0	9.3	Pass
0.6385	AVG	24.6	10.2	34.8	46.0	11.2	Pass

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

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Average emission at 13.56 MHz was measured with a CISPR Average detector and emissions at other frequencies were measured with reduced VBW.

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

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
100A LISN	FCC-LISN-50-100-1-02-MS461F	FCC	Feb 5, 2016	Feb 5, 2018	GEMC 121
100A LISN	FCC-LISN-50-100-1-02-MS461F	FCC	Feb 5, 2016	Feb 5, 2018	GEMC 122
RF Cable 3m	LMR-400-3M-50Ω-MN-MN	LexTec	Feb 20, 2017	Feb 20, 2018	GEMC 276
Attenuator 10 dB	612-10-1	Meca Electronics, Inc	Feb 20, 2017	Feb 20, 2018	GEMC 223
Emissions Software	0.1.94	Global EMC	NCR	NCR	GEMC 58

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Appendix A – EUT Summary

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

General EUT Description

Client Details	
Organization / Address	460 Philip Street Waterloo, ON, N2L5J2
Contact	Dan Hooper
Phone	519-880-7441
Email	daniel.hooper@nuance.com
EUT (Equipment Under Test) Details	
EUT Name (for report title)	Nuance Edge for Copitrak
EUT Model / SN (if known)	EDGE, EDGE-MMUL
Equipment category	ITE/Radio
EUT is powered using	Click here...
Input voltage range(s) (V)	100-240
Frequency range(s) (Hz)	50/60Hz
Rated input current (A)	1.7A
Nominal power consumption (W)	60W
Number of power supplies in EUT	1
Transmits RF energy? (describe)	Yes 125kHz and 13.56MHz for RFID applications 2.4 GHz Bluetooth Low Energy
Basic EUT functionality description	Print management and an accoutning device to be used in conjunction with a multifunction printer.
Frequency of all clocks present in EUT	1.6GHz, 100MHz, 48MHz, 25MHz, 20MHz, 14.318MHz 12MHz, 6Mhz, 65kHz
Available connectors on EUT	5 USB, 2 Ethernet, 2 Display port Custom USB/
Method of monitoring EUT and description of failure for immunity.	Onscreen burn-in suite software, with cmd window pinging www.nuance.com, external jig for copy interface.

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’.

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Appendix B – EUT and Test Setup Photos

Refer to Test Setup exhibit for EUT and Test Setup photos.

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