

Global EMC Inc. Labs

EMC & RF Test Report

As per
RSS 210 Issue 8:2010
&
FCC Part 15 Subpart C:2011
Unlicensed Intentional Radiators
on the
M333688D001 RFID Module



Raymond Lee Au
Project Engineer
Global EMC Inc.
11 Gordon Collins Dr.
Gormley, ON
L0H 1G0, Canada
Ph: (905) 883-8189

Testing produced for



See Appendix A for full customer & EUT details.

 **Industry
Canada**
LAB REGISTRATION
#6844A-3




FCC REGISTRATION
#377448


ACCREDITED
Testing
Laboratory
Certificate
#2555.01

Client	Medtronic Inc.	
Product	M333688D001	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	

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Client	Medtronic Inc.	
Product	M333688D001	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	

Report Scope

This report addresses the EMC verification testing and test results of the M333688D001 RFID module from Medtronic Inc. This unit is herein referred to as EUT (Equipment Under Test). Testing is performed at Global EMC Labs.

The EUT was tested for compliance against the following standards:

RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011

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

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

This report does not imply product endorsement by A2LA or any other accreditation agency, any government, or Global EMC Inc.

Opinions/interpretations expressed in this report, if any, are outside the scope of Global EMC Inc accreditation. Any opinions expressed do not necessarily reflect the opinions of Global EMC Inc, unless otherwise stated.

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Product	M333688D001	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	

Summary

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

EUT FCC Certification #, FCC ID:	LF5-M333688D001
EUT Industry Canada Certification #, IC:	3408D-M333688D001
EUT Passed all tests performed.	Yes (see test results summary)
Tests conducted by	Raymond Lee Au

Test Results Summary

Standard/Method	Description	Class/Limit	Result
FCC 15.203	Antenna Requirement	Unique	Pass See Test Notes
FCC 15.205 RSS 210 (Table 1)	Restricted Bands for intentional operation	QuasiPeak Average	Pass
FCC 15.207	Power line conducted emissions	QuasiPeak Average	Pass
FCC 15.209 RSS-210 (Table 2)	Spurious Radiated emissions	QuasiPeak Average	Pass
Overall Result			PASS

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All tests were performed by Raymond Lee Au.

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 '*'.

Test Notes

This section contains notes regarding testing, procedures, justifications, deviations, or other general notes. Also see sections on individual tests in the *Detailed Test Result Section* for more details.

For the Antenna requirement specified in FCC 15.203 (RSS 210 section 5.5), this device will only be used in other products made by the manufacturer. This unit is professionally installed by the manufacturer in their own products. Therefore, the installer has complete responsibility and control over its use to ensure that the proper antenna is used so that the limits are not exceeded. Furthermore, the manufacturer will ensure that this entire device is only used in products where it is completely enclosed within the enclosure, including the module, its antenna, and all connections between them. The entirety of this device will not be accessible by the end user, who will not be able to easily access, change, or otherwise tamper with, the antenna. Therefore, the objectives of this clause are met.

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

The intentional emission does not fall within restricted bands as shown in FCC 15.205.

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Applicable Standards, Specifications and Methods

- ANSI C63.4:2003 - Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
- ANSI C63.10:2009 - American national standard for testing unlicensed wireless devices
- CFR 47 FCC 15:2011 - Code of Federal Regulations – Radio Frequency Devices
- CISPR 22:2008 - Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement
- ICES-003:2012 - Digital Apparatus - Spectrum Management and Telecommunications Policy Interference-Causing Equipment Standard
- ISO 17025:2005 - General Requirements for the competence of testing and calibration laboratories
- RSS 210:2010 - Issue 8: Spectrum Management and Telecommunications Policy. Radio Standards Specification Low Power Licence-Exempt Radiocommunication Devices

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Sample calculation(s)

Margin = limit – (received signal + antenna factor + cable loss – pre-amp gain)

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

Margin = 8 dB

Document Revision Status

Release 1 - September 16, 2013
 - First release issued.

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Definitions and Acronyms

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

AE – Auxillary Equipment.

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

EMC – Electro-Magnetic Compatibility

EMI – Electro-Magnetic Immunity

EUT – Equipment Under Test

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 Global EMC labs in Toronto, Ontario, Canada. The testing lab consists of a 3m semi-anechoic chamber calibrated to be able to allow measurements on an EUT with a maximum width or length of up to 2m and height up to 3m. The chamber is equipped with a turn table that is capable of testing devices up to 3300lb in weight. This facility is capable of testing products that are rated for 120 Vac and 240Vac single phase, or 208 Vac 3 phase input. DC capability is also available. The chamber is equipped with an antenna mast that controls polarization and height from the control room adjoining the shielded chamber. Radiated emissions measurements are performed using a Bilog, and Horn antenna where applicable. Conducted emissions, unless otherwise stated, are performed using a LISN.

Calibrations and Accreditations

The measurement site used is registered with Federal Communications Commission (FCC) and Industry Canada (IC). This site is 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 semi-anechoic chamber is lined with ferrite tiles and absorption cones to minimize any undesired reflections. 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 were the environmental conditions in the facility during time of testing –

Date	Test	Init.	Temperature (°C)	Humidity (%)	Pressure (kPa)
April 9-10, 2013	RE	RA	20-25°C	30-45%	100 -103kPa
April 11, 2013	CE	RA	20-25°C	30-45%	100 -103kPa

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Detailed Test Results Section

Client	Medtronic Inc.	
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Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	

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.

Limit(s) and Method

The method is as defined in ANSI C63.4:2003.

The limits are as defined in FCC Part 15, Section 15.209:

0.009 MHz – 0.490 MHz:	2400/ F uV/m ($67.6-20\log F$ dBuV/m) at 300 m ($147.6-20\log(F)$ at 3 m)
0.490 MHz – 1.705 MHz:	24000/ F uV/m ($87.6-20\log(F)$ dBuV/m) at 30 m, ($127.6-20\log(F)$ at 3 m)
1.705 MHz – 30.0 MHz:	30 uV/m (29.5 dBuV/m) at 30 m, (69.5 dBuV/m at 3m)
30 MHz – 88 MHz:	100 uV/m (40.0 dBuV/m^1) at 3 m
88 MHz – 216 MHz:	150 uV/m (43.5 dBuV/m^1) at 3 m
216 MHz – 960 MHz:	200 uV/m (46.0 dBuV/m^1) at 3 m
Above 960 MHz:	500 uV/m (54.0 dBuV/m^1) at 3 m
Above 1000 MHz:	500 uV/m (54 dBuV/m^2) at 3m

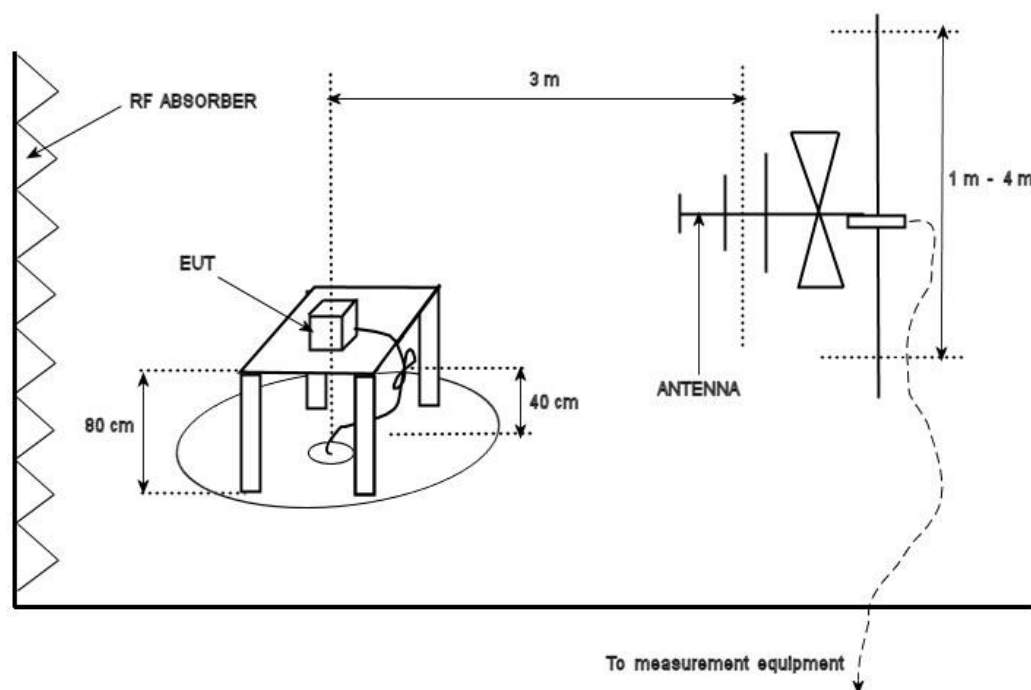
F = frequency in kHz

¹Limit is with 120 kHz measurement bandwidth and a using a Quasi Peak detector.

²Limit is with 1 MHz measurement bandwidth and using an Average 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 ± 4.4 dB with a 'k=2' coverage factor and a 95% confidence level.

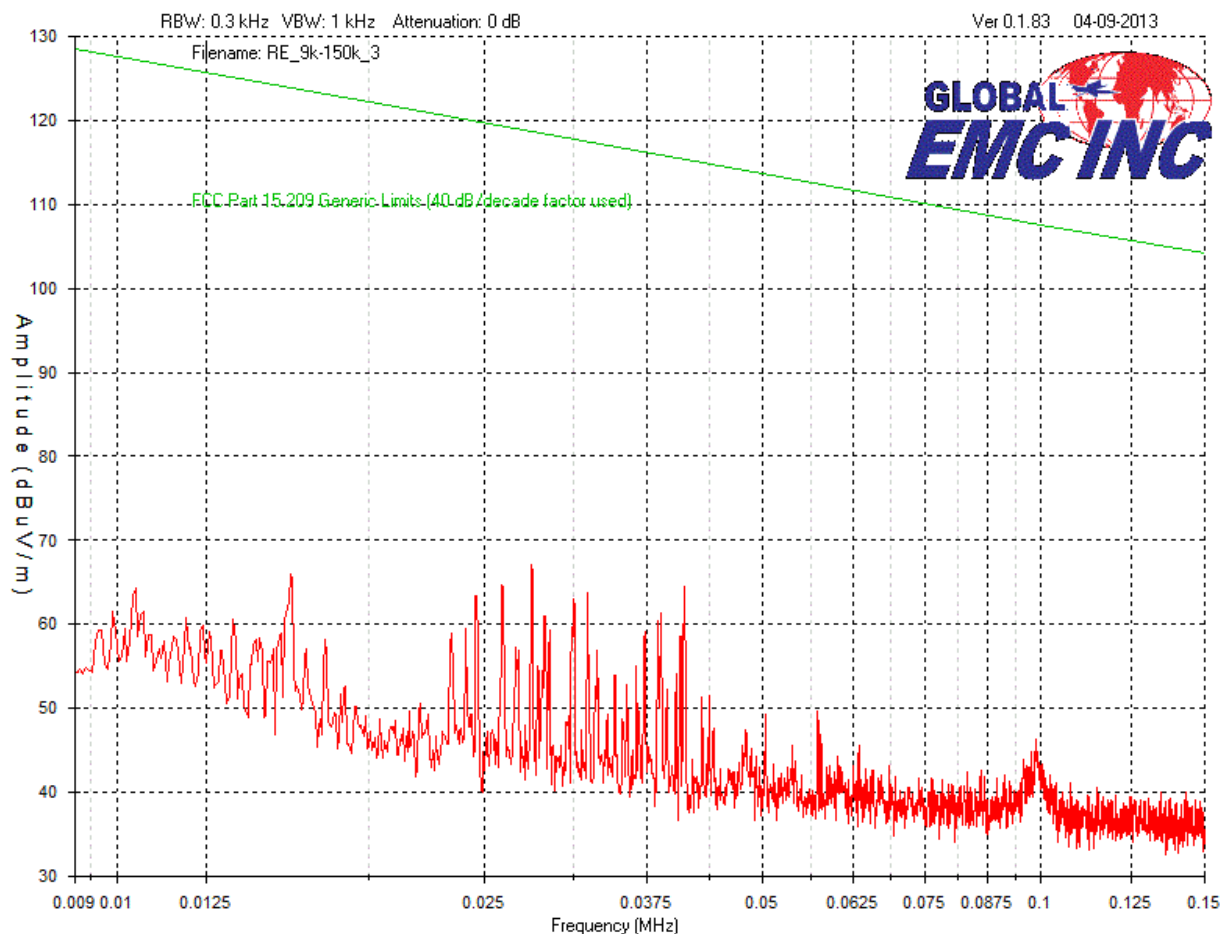
Preliminary Graphs

Note the graphs shown below are for graphical illustration only. For final measurements with the appropriate detector, please refer to the final measurement table where applicable. The graphs shown below are maximized peak measurement graphs, measured with a resolution bandwidth greater than the final required detector and over a full 0-360° rotation. This peaking process is done as a worst case measurement. This process enables the detection of frequencies of concern for final measurement, and provides considerable time savings.

In accordance with FCC Part 15, Subpart A, Section 15.33(a), the device was scanned to the 10th harmonic (a minimum of a 1 GHz).

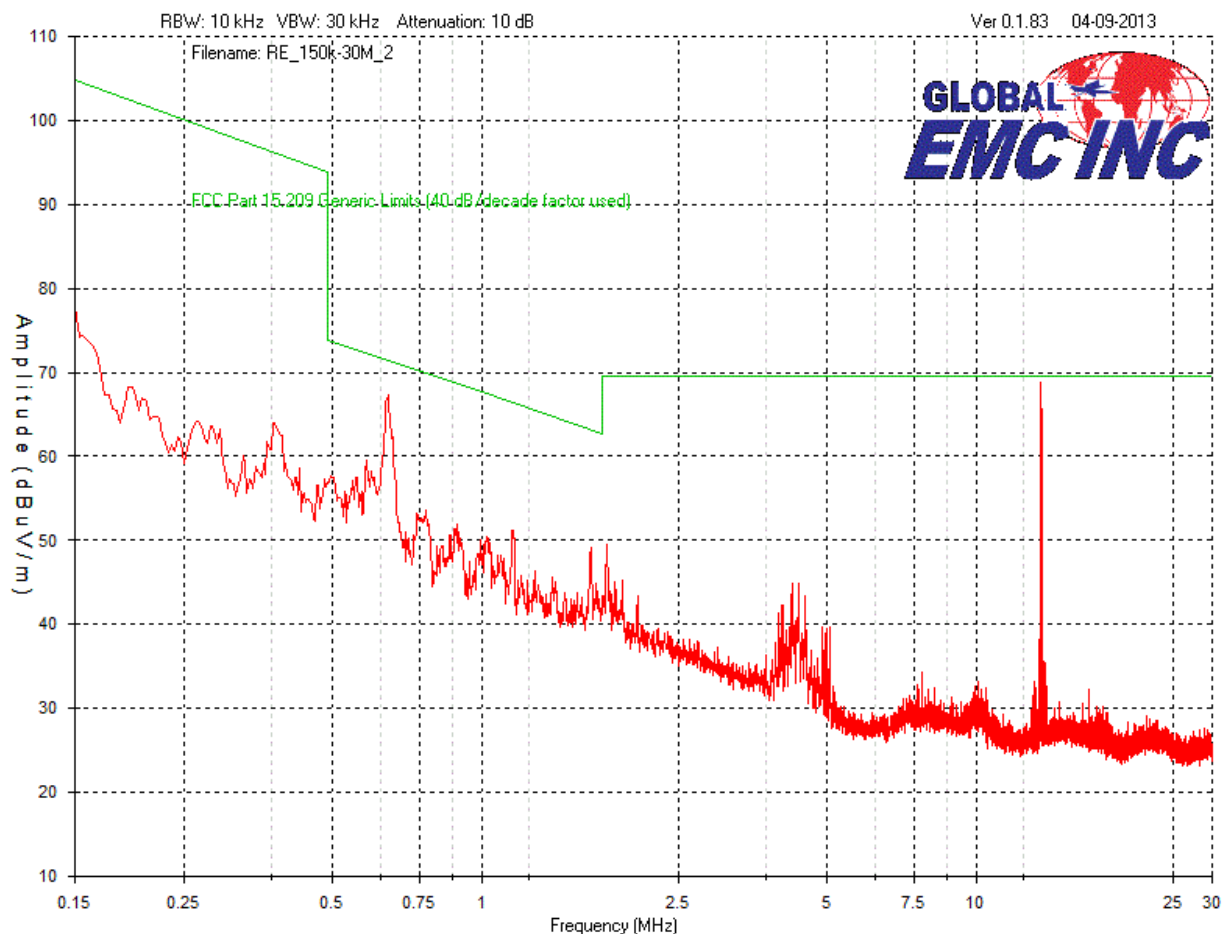
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Peak Emissions Graph
9kHz – 150kHz



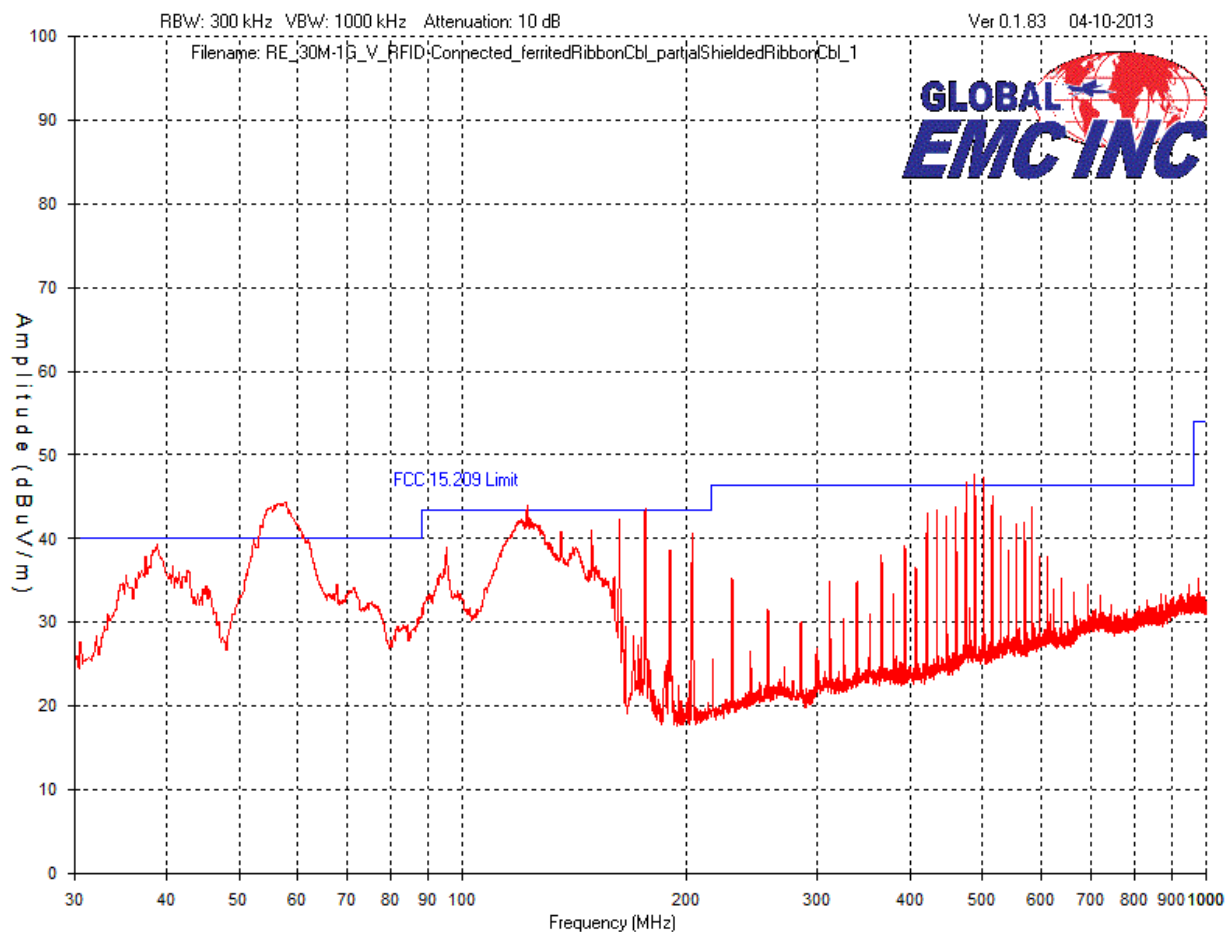
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Peak Emissions Graph 150kHz – 30MHz



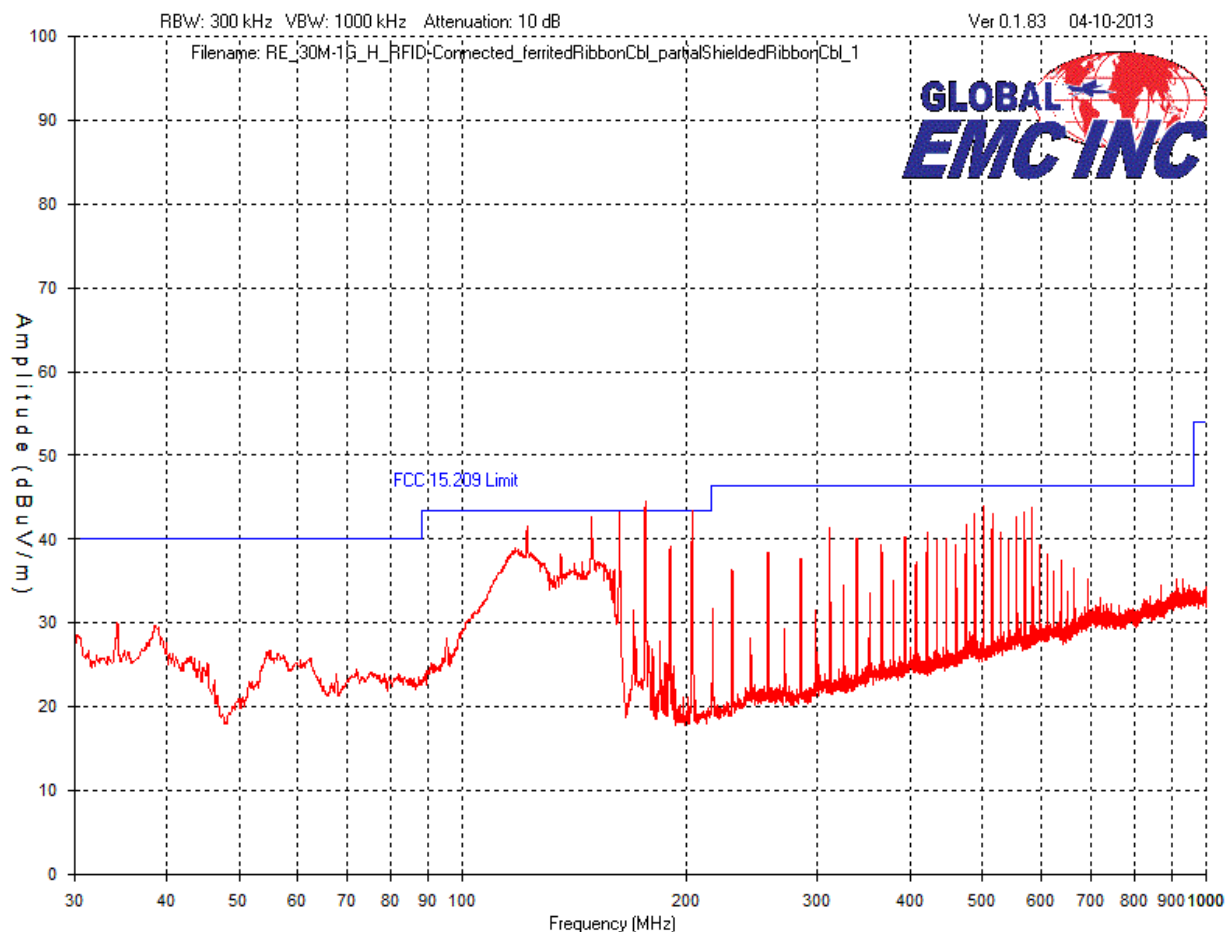
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Peak Emissions Graph
30MHz – 1GHz, Vertical



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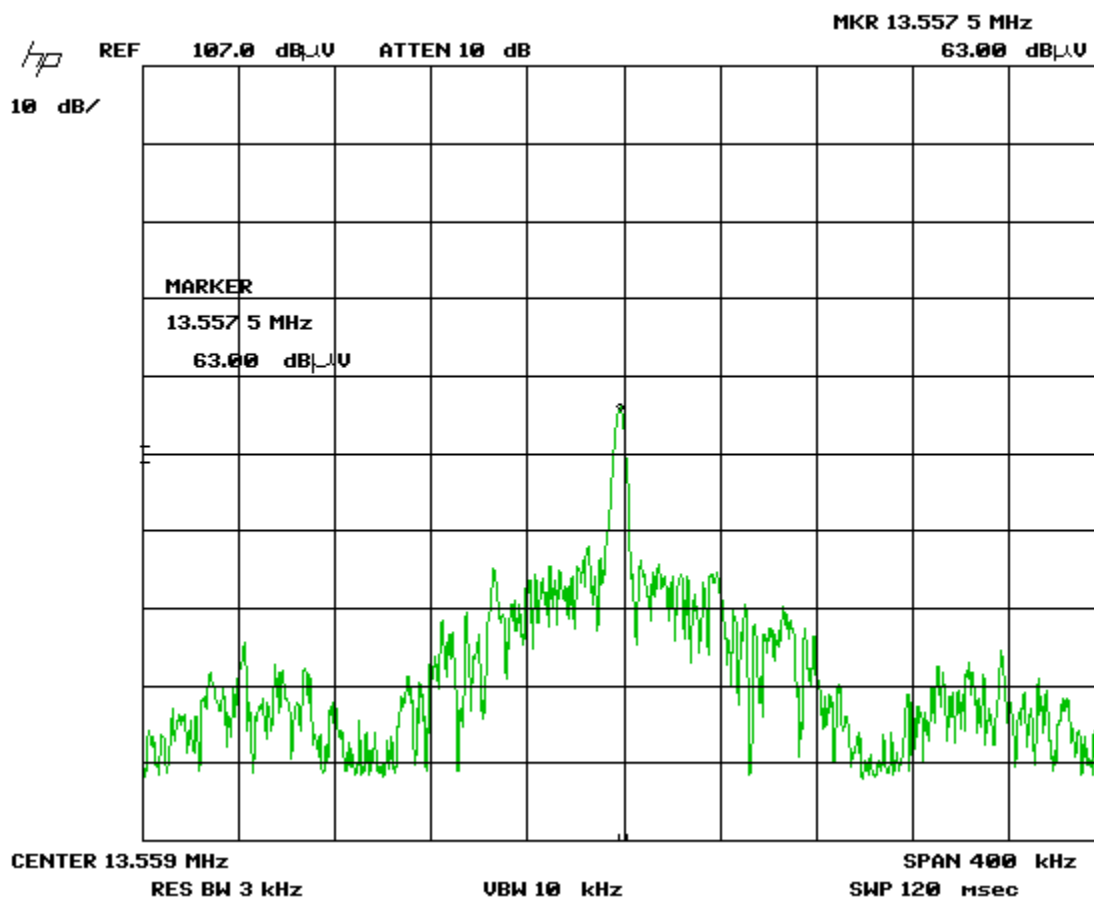
Peak Emissions Graph
30MHz –1GHz, Horizontal



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Bandwidth

For informational purposes, the 20dB bandwidth can be seen from the following screen capture. The 20dB bandwidth is 28kHz.



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Final Measurements

For informational purposes, the fundamental was measured to be 69.0 dBuV/m at 3 meters. Results from the worst case EUT orientation are shown (with module board parallel to ground, and antenna perpendicular).

Fundamental Emissions Table

Frequency (MHz)	Raw (dBuV)	Current to Voltage Factor (dB)	Antenna (dB/m)	Cable Factor (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit (dB)	Margin (dB)	Pass/Fail
13.56	63.1	51.5	-17.2	0.3	28.7	69.0	69.5	0.5	Pass ^α
13.56	63.1	51.5	-17.2	0.3	28.7	69.0	124.0	53.8	Pass ^β

^α The fundamental emission is compared with the general limits of 15.209 in this row.

^β For informational purposes, the fundamental emission is compared with the limit of 15.225 in this row.

Spurious Emissions Table

Frequency (MHz)	Detector	Raw (dBuV)	Antenna factor (dB/m)	Cable RE Factor	Preamplifier (dB)	Level (dBuV/m)	Limit (dB)	Margin (dB)	Pass/Fail
Vertical Antenna Polarity									
57.8	QP	57.2	8.8	0.6	-28.7	37.9	40	2.1	Pass
488.1	QP	54.6	17.8	1.7	-28.9	45.2	46.4	1.2	Pass
501.6	QP	55.1	17.6	1.7	-28.9	45.5	46.4	0.9	Pass
122.0	QP	55.6	7.8	0.9	-28.7	35.6	43.5	7.9	Pass
474.7	QP	54.62	18	1.7	-28.9	45.42	46.4	0.98	Pass
175.9	QP	50.3	9.9	1	-28.7	32.5	43.5	11	Pass
38.7	QP	41.52	11.4	0.5	-28.7	24.72	40	15.28	Pass
Horizontal Antenna Polarity									
175.9	QP	61.39	9.5	1	-28.7	43.19	43.5	0.31	Pass
203.3	QP	58.91	10.6	1.1	-28.7	41.91	43.5	1.59	Pass
162.4	QP	59.55	9.2	1	-28.7	41.05	43.5	2.45	Pass
149.0	Peak	61.7	8.8	0.9	-28.7	42.7	43.5	0.8	Pass
122.1	Peak	61.8	7.5	0.9	-28.7	41.5	43.5	2	Pass
501.6	Peak	53.2	18	1.7	-28.9	44	46.4	2.4	Pass

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Notes:

Peak = Peak detector used

QP = Quasi-Peak detector used

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	ESL 6	Rohde & Schwarz	Oct-06, 2011	Oct-06, 2013	GEMC 160
BiLog Antenna	3142-C	ETS	Feb. 4, 2013	Feb. 4, 2015	GEMC 137
Pre-Amp 9 kHz - 2 GHz	CPA9231A	Chase	Aug. 29, 2012	Aug. 29, 2014	GEMC 6403
RF Cable 7m	LMR-400-7M- 50OHM-MN- MN	LexTec	NCR	NCR	GEMC 28
RF Cable 1m	LMR-400-1M- 50OHM-MN- MN	LexTec	NCR	NCR	GEMC 29
RF Cable 0.5M	LMR-400- 0.5M- 50OHM-MN- MN	LexTec	NCR	NCR	GEMC 31
Loop Antenna	EM 6871	Electro-Metrics	Feb. 5, 2013	Feb. 5, 2015	GEMC 70
Loop Antenna	EM 6872	Electro-Metrics	Feb. 5, 2013	Feb. 5, 2015	GEMC 71

This report module is based on GEMC template "FCC - 15.209 - Radiated Emissions_Rev1.doc"

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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 when connected 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 & Method

The limits are as defined in 47 CFR FCC Part 15 Section 15.207

Method is as defined in ANSI C64:2003

Average Limits		QuasiPeak Limits	
150 kHz – 500 kHz	56 to 46 dBuV	150 kHz – 500 kHz	66 to 56 dBuV
500 kHz – 5 MHz	46 dBuV	500 kHz – 5 MHz	56 dBuV
5 MHz – 30 MHz	50 dBuV	500 kHz – 30 MHz	60 dBuV

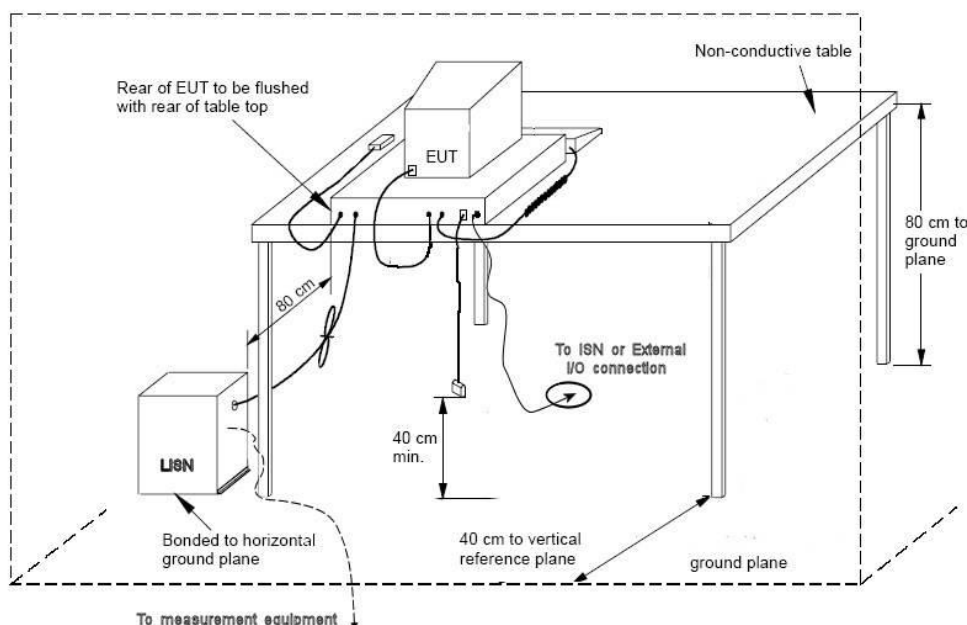
The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

Note: If the Peak or Quasi Peak detector measurements do not exceed the Average limits, then the EUT is deemed to have passed the requirements.

Both limits are applicable, and each is specified as being measured with a 9 kHz measurement bandwidth.

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Typical Setup Diagram



Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is ± 3.6 dB with a 'k=2' coverage factor and a 95% confidence level.

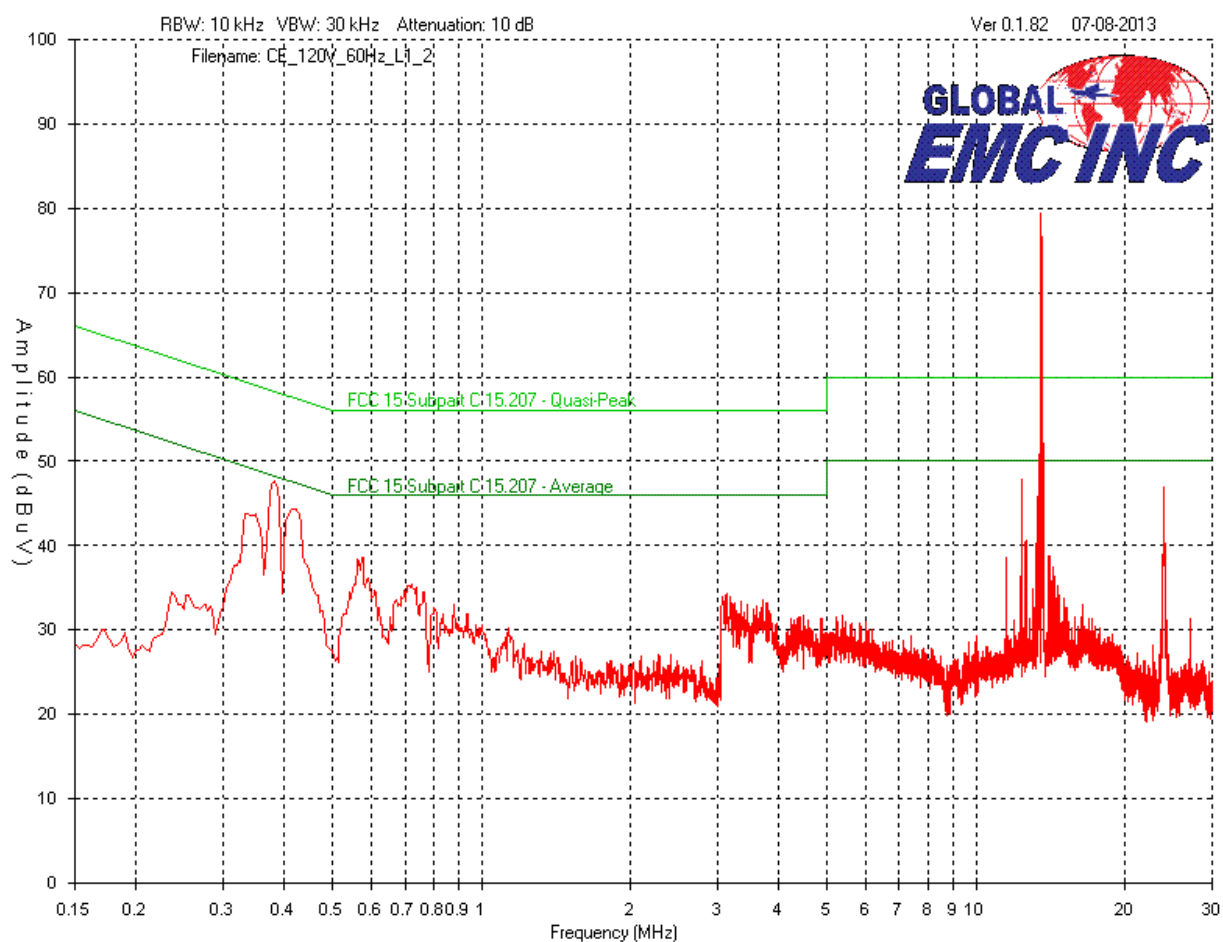
Preliminary Graphs

Note the graphs shown below are for graphical illustration only. For final measurements with the appropriate detector where applicable, please refer to the table. The graphs shown below are peak measurement graphs, measured with a resolution bandwidth greater than or equal to the final required detector. These graphs are performed as a worst case measurement to enable the detection of frequencies of concern and for considerable time savings.

This module operates below 30 MHz. As per FCC KDB publication number 174176, a dummy load (50Ω resistor) is used to replace the antenna when performing this test within the transmitter's fundamental emission band. When testing outside the emission band, the proper antenna is connected.

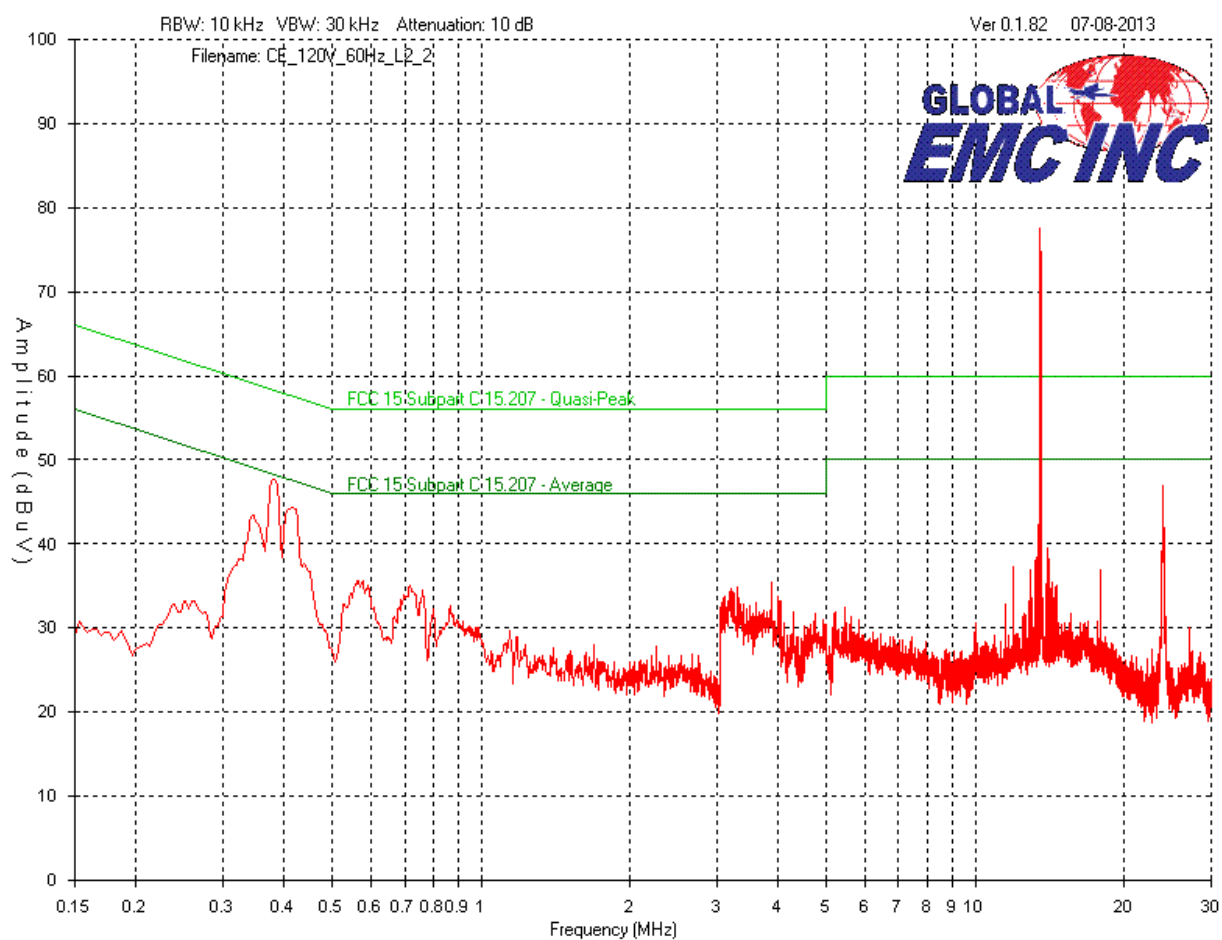
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Phase Line
120V, 60Hz
With antenna connected



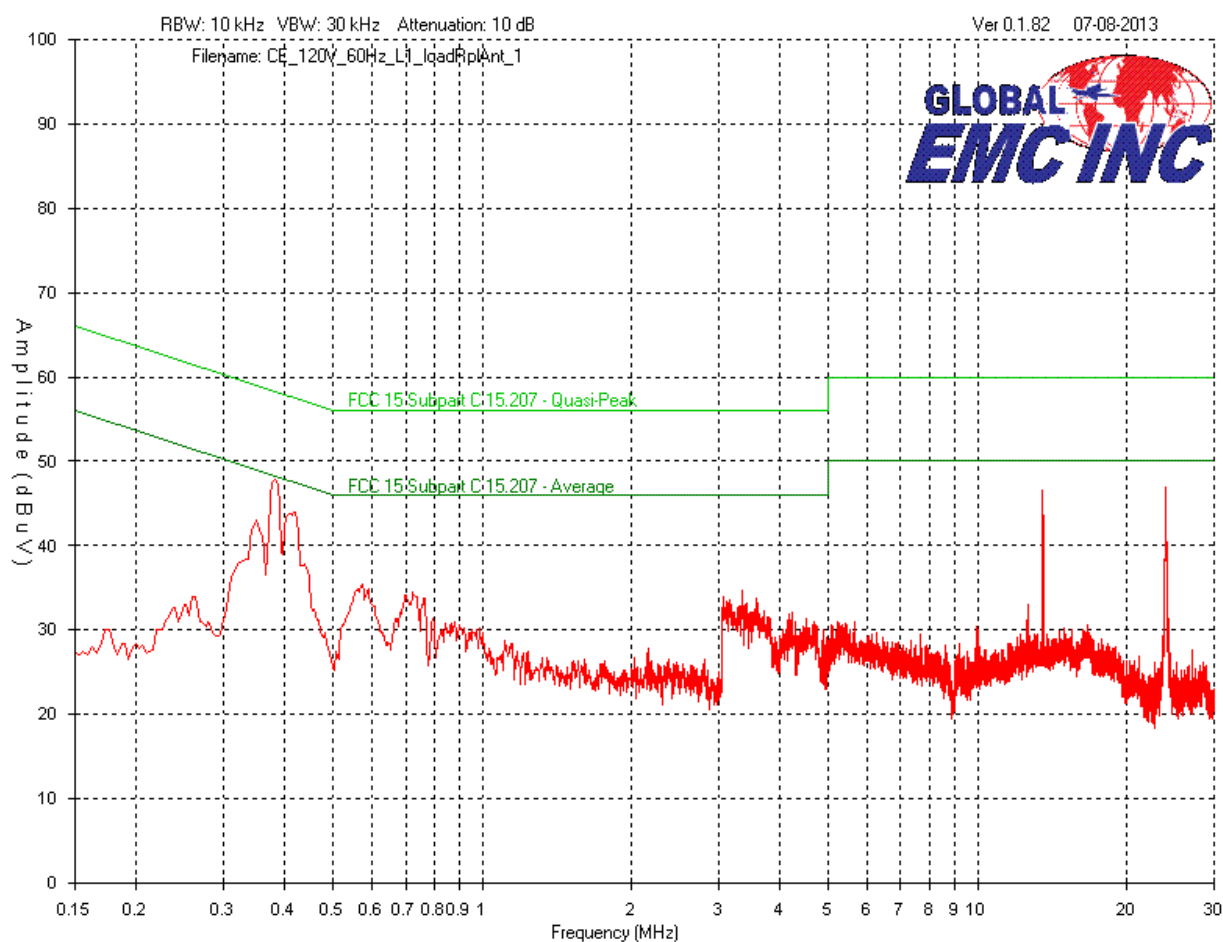
Client	Medtronic Inc.	
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Neutral Line
120V, 60Hz
With antenna connected



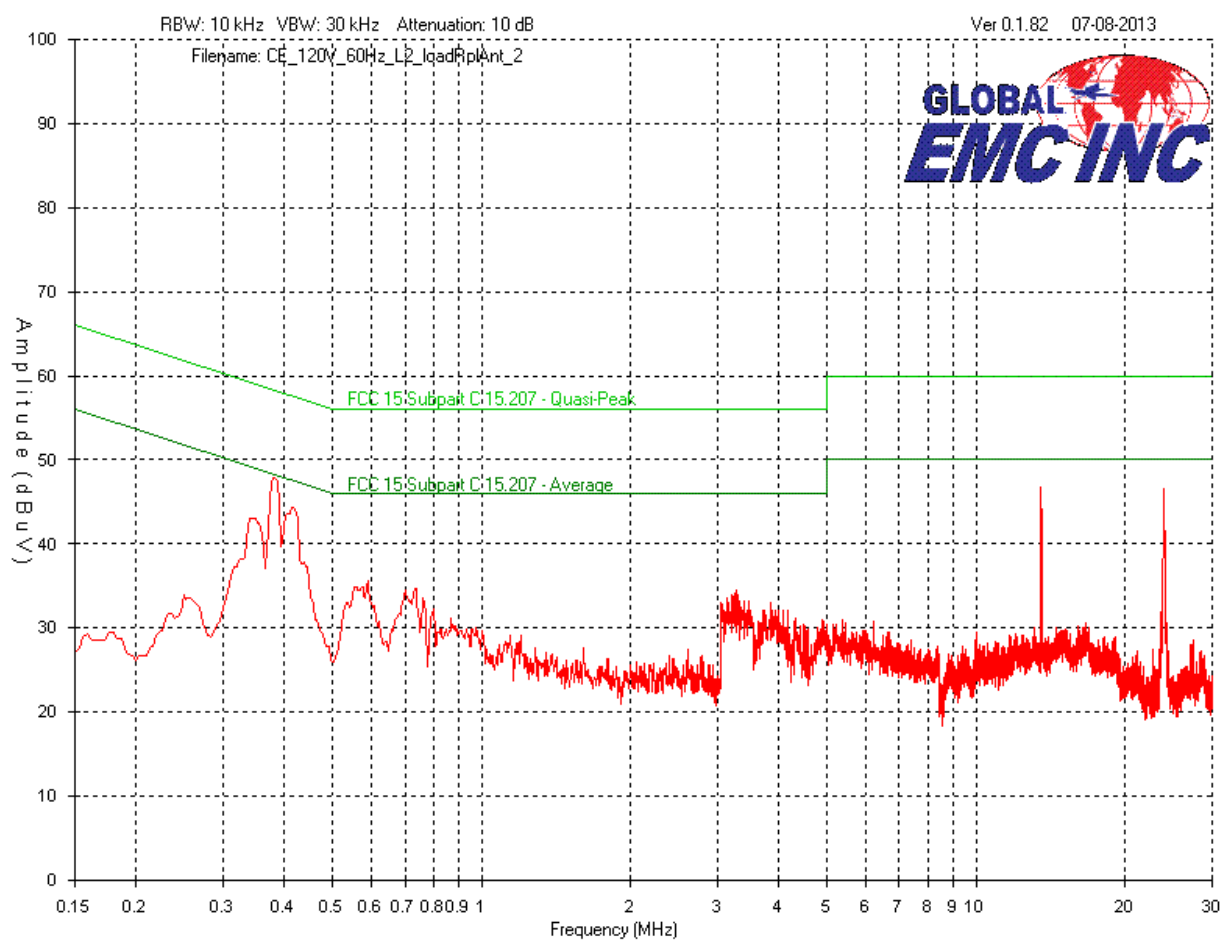
Client	Medtronic Inc.	
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Phase Line
120V, 60Hz
Antenna replaced with dummy load



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Neutral Line
120V, 60Hz
Antenna replaced with dummy load



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Final Measurements

Emissions Table Antenna Connected Emission Band Edges

Test Frequency (MHz)	Detector	Received signal (dBμV)	Attenuator (dB)	Cable loss (dB)	LISN Voltage factor (dB)	Emission Level (dBμV)	Emission limit (dBμV) Quasi-Peak	Emission limit (dBμV) Average	Margin (dB) Quasi-Peak	Margin (dB) Average	Result
Phase Line											
13.553	QP	49.37	10	0.2	0.1	59.67	60	---	0.33	---	Pass
13.553	Avg.	16.79	10	0.2	0.1	27.09	---	50	---	22.91	Pass
13.567	QP	47.01	10	0.2	0.1	57.31	60	---	2.69	---	Pass
13.567	Avg	16.72	10	0.2	0.1	27.02	---	50	---	22.98	Pass
Neutral Line											
13.553	QP	47.81	10	0.2	0.1	58.11	60	---	1.89	---	Pass
13.553	Avg	16.57	10	0.2	0.1	26.87	---	50	---	23.13	Pass
13.567	QP	45.25	10	0.2	0.1	55.55	60	---	4.45	---	Pass
13.567	Avg	16.36	10	0.2	0.1	26.66	---	50	---	23.34	Pass

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Emissions Table
Antenna Connected
Top 6 measurements

Test Frequency (MHz)	Detector	Received signal (dBμV)	Attenuator (dB)	Cable loss (dB)	LISN Voltage factor (dB)	Emission Level (dBμV)	Emission limit (dBμV) Quasi-Peak	Emission limit (dBμV) Average	Margin (dB) Quasi-Peak	Margin (dB) Average	Result
Phase Line											
0.383	Peak	37.4	10	0.1	0.1	47.6	58.2	---	10.6	---	Pass
0.383	Avg.	36.69	10	0.1	0.1	46.89	---	48.2	---	1.31	Pass
12.4	Peak	37.6	10	0.2	0.1	47.9	60	50	12.1	2.1	Pass
0.423	Peak	34.2	10	0.1	0.1	44.4	57.4	47.4	13	3	Pass
24.0	Peak	36.5	10	0.2	0.2	46.9	60	50	13.1	3.1	Pass
0.336	Peak	33.7	10	0.1	0.1	43.9	59.3	49.3	15.4	5.4	Pass
0.572	Peak	28.4	10	0.1	0.1	38.6	56	46	17.4	7.4	Pass
Neutral Line											
0.383	Peak	37.6	10	0.1	0.1	47.8	58.2	---	10.4	---	Pass
0.383	Avg.	36.97	10	0.1	0.1	47.17	---	48.2	---	1.03	Pass
0.416	Peak	34.3	10	0.1	0.1	44.5	57.5	47.5	13	3	Pass
24.0	Peak	36.5	10	0.2	0.2	46.9	60	50	13.1	3.1	Pass
0.562	Peak	25.5	10	0.1	0.1	35.7	56	46	20.3	10.3	Pass
14.0	Peak	29.2	10	0.2	0.1	39.5	60	50	20.5	10.5	Pass
3.88	Peak	25.2	10	0.1	0.1	35.4	56	46	20.6	10.6	Pass

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Antenna Replaced With Dummy Load
Top 6 Measurements

Test Frequency (MHz)	Detector	Received signal (dBμV)	Attenuator (dB)	Cable loss (dB)	LISN Voltage factor (dB)	Emission Level (dBμV)	Emission limit (dBμV) Quasi-Peak	Emission limit (dBμV) Average	Margin (dB) Quasi-Peak	Margin (dB) Average	Result
Phase Line											
0.383	Peak	37.6	10	0.1	0.1	47.8	58.2	---	10.4	---	Pass
0.383	Avg.	36.7	10	0.1	0.1	46.9	---	48.2	---	1.3	Pass
24.0	Peak	36.6	10	0.2	0.1	46.9	60	50	13.1	3.1	Pass
13.6	Peak	36.2	10	0.2	0.1	46.5	60	50	13.5	3.5	Pass
0.349	Peak	32.9	10	0.1	0.1	43.1	59	49	15.9	5.9	Pass
0.572	Peak	25.3	10	0.1	0.1	35.5	56	46	20.5	10.5	Pass
3.34	Peak	24.4	10	0.1	0.1	34.6	56	46	21.4	11.4	Pass
Neutral Line											
0.383	Peak	37.7	10	0.1	0.1	47.9	58.2	48.2	10.3	0.3	Pass
0.383	Avg.	36.89	10	0.1	0.1	47.09	58.2	48.2	11.11	1.11	Pass
13.6	Peak	36.5	10	0.2	0.1	46.8	60	50	13.2	3.2	Pass
24.0	Peak	36.1	10	0.2	0.2	46.5	60	50	13.5	3.5	Pass
0.589	Peak	25.5	10	0.1	0.1	35.7	56	46	20.3	10.3	Pass
0.735	Peak	24.5	10	0.1	0.1	34.7	56	46	21.3	11.3	Pass
3.27	Peak	24.3	10	0.1	0.1	34.5	56	46	21.5	11.5	Pass

Notes:

Where peak readings are under quasi-peak and/or average limits, the EUT passes the respective requirements.

Peak = Peak reading

Avg. = Average reading

QP = Quasi-Peak reading

Client	Medtronic Inc.	
Product	M333688D001	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	ESL 6	Rohde & Schwarz	Oct. 06, 2011	Oct. 06, 2013	GEMC 160
LISN	FCC-LISN-50/250-16-2-01	FCC	Feb 06, 2013	Feb 06, 2015	GEMC 65
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 28
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
Attenuator 10 dB	FP-50-10	Trilithic	NCR	NCR	GEMC 42

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B_Rev1"

Client	Medtronic Inc.	
Product	M333688D001	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	

Appendix A – EUT Summary

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

Client	Medtronic Inc.	
Product	M333688D001	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	

General EUT Description

Client/Manufacturer Details	
Organization / Address	Medtronic, Inc. 710 Medtronic Parkway Minneapolis, MN 55432
Contact	Bijan Nafea
Phone	707-591-2531
Email	bijan.nafea@medtronic.com
EUT (Equipment Under Test) Details	
EUT Name	Symlicity G3™ RFID Module
FCC ID	LF5-M333688D001
IC #	3408D-M333688D001
EUT Model Number	M333688D001
Equipment category	RFID Module
Input voltage range(s) (V)	5 Vdc
Frequency range(s) (Hz)	DC
Transmits RF energy?	Yes, 13.56MHz
Basic EUT functionality description	The RFID Module is designed for exclusive use in Medtronic's products to identify valid attachments.
Modes of operation	ON
Frequency of all clocks present in EUT	13.56MHz
I/O cable/connector description Specify length and type	None. Through-hole PCB mounted
Peripherals required to exercise EUT Ex. Signal generator	Modified Symlicity G3™ unit to supply power and commands to EUT. Laptop PC with USB to serial adapter.
Dimensions of product (approx. max dimensions)	Module: 4cm (L) x 2cm (W) x 2cm (H) Antenna: 5.5cm (L) x 5cm (W) x 1cm (H) Interconnecting cable: 30cm (L)

Note the EUT is considered to have been received the date of the commencement of the first test, unless otherwise stated.