

TÜV SÜD Canada Inc.

EMC & RF Test Report

As per

RSS 210 Issue 8

&

FCC Part 15 Subpart C

Unlicensed Intentional Radiators

on the

MRC 3040



Canada

Choose certainty.
Add value.

A handwritten signature in black ink, appearing to read "Ferhat".

Abderrahmane Ferhat, Eng.
Project Engineer
TÜV SÜD Canada Inc.
2972 Joseph-A-Bombardier
Laval, QC, H7P 6E3 CANADA
Ph: (450) 687- 4976

Testing produced for



See Appendix A for full customer & EUT details.





Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	

Table of Contents

Table of Contents	2
Report Scope	3
Summary	4
Test Results Summary	5
Justifications, Descriptions, or Deviations.....	6
Applicable Standards, Specifications and Methods.....	7
Sample calculation(s).....	8
Document Revision Status.....	9
Definitions and Acronyms	10
Testing Facility	11
Calibrations and Accreditations.....	11
Testing Environmental Conditions and Dates	12
Detailed Test Results Section	13
Power Line Conducted Emissions	14
Radiated Emissions	20
20 dB Bandwidth of Periodically Operated Transmitters.....	33
Appendix A – EUT Summary.....	36
Appendix B – EUT and Test Setup Photographs.....	37

Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	

Report Scope

This report addresses the EMC verification testing and test results of the MRC 3040, herein referred to as EUT (Equipment Under Test) performed at TÜV SÜD Canada Inc. Labs.

The EUT was tested for compliance against the following standards:


RSS 210 Issue 8
FCC Part 15 Subpart C 15

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 TÜV SÜD Canada Inc.


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

Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	

Summary

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


EUT FCC Certification #, FCC ID:	2AHE6-MRC3040
EUT Industry Canada Certification #, IC:	20485-MRC3040
EUT Passed all tests performed.	Yes (see test results summary)
Tests conducted by	Abderrahmane Ferhat

Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	

Test Results Summary

Standard/Method	Description	Class/Limit	Result
FCC 15.203	Antenna Requirement	—	Pass See Justification
FCC 15.205 RSS-Gen (Table 6)	Restricted Bands for intentional operation	Not allowed	Pass See Justification
FCC 15.207 RSS-Gen (Table 3)	Power line conducted emissions	QuasiPeak Average	Pass
FCC 15.209 RSS-Gen (Table 2, 4, and 5) FCC 15.231(e) RSS-210 (Table B)	Intentional / Spurious Radiated emissions	QuasiPeak Average	Pass
FCC 15.231(e) RSS-210 A1.1.5(2)	Automatic transmission Transmission time	< 1 seconds	Pass See Justification
FCC 15.231 (e) RSS-210 A1.1.5(2)	Transmission off time	> 30 x TX interval > 10 seconds	Pass See Justification
FCC 15.231 (c) RSS-210 A1.1.3	20 dB Bandwidth	< 0.25% of carrier	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 '*'.

Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	


Justifications, Descriptions, or Deviations

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

For the Antenna requirement specified in FCC 15.203, this device is designed with an SMA antenna connector and provided with a dipole antenna. The device is installed by a professional, which meets the requirements of FCC 15.203.


For the Restricted Bands of operation as specified in FCC 15.205 and RSS-Gen (Table 6), the EUT is designed to only operate at 450 MHz

For automatic transmission as specified in FCC 15.231 (e), RSS-210 A1.1.5 and RSS-210 A1.1.3, this device is activated automatically upon receipt of a signal from another device (Bracelet transmitter with manually activated buttons subject to a different application) and shall cease transmission within 0.250 seconds after activation and is not transmitting on periodically on regular bases. See MRC Networks Inc., declaration in document “**Attestation non periodic manual TX mrc networks.pdf**”.

Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	

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 of Procedures for Compliance Testing of Unlicensed Wireless Devices
CFR 47 FCC 15	- Code of Federal Regulations – Radio Frequency Devices
CISPR 22:2008	- Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement
ICES-003:2016	- Information Technology Equipment (Including Digital Apparatus) - Limits and Methods of Measurement
ISO 17025:2005	- General Requirements for the competence of testing and calibration laboratories
RSS 210:2015	- Issue 8: Spectrum Management and Telecommunications Policy. Radio Standards Specification Low Power Licence-Exempt Radio communication Devices

Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	

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/m + 2.5dB – 20dB)


Margin = 8.0 dB (pass)

Power Line Conducted Emission Test

Margin = Limit – (Received Signal + Attenuation Factor + Cable Loss + LISN Factor)

Margin = 73.0dB μ V – (50dB μ V + 10dB + 2.5dB + 0.5dB)


Margin = 10.0 dB (pass)

Client	MRC Networks Inc	 Canada
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	

Document Revision Status

Revision 0 - April 13, 2016. Initial release.

Revision 1 - April 20, 2016. FCC ID correction.

Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	

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


Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	

Testing Facility

Testing for EMC on the EUT was carried out at TÜV SÜD Canada testing lab in Montréal, Québec, Canada. The testing lab has a calibrated 3m semi-anechoic chamber which allows 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, 382292) and Industry Canada (IC, 6844B-1). This chamber was calibrated for Normalized Site Attenuation (NSA) using test procedures outlined in ANSI C63.4 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". The chamber is lined with ferrite tiles and absorption cones to minimize any undesired reflections. The NSA data is kept on file at TÜV SÜD Canada. For radiated susceptibility testing, a 16 point field calibration has been performed on the chamber. The field uniformity data is kept on file at TÜV SÜD Canada. TÜV SÜD Canada Inc is accredited to ISO 17025 by A2LA with Testing Certificate #2955.02. The laboratory's current scope of accreditation listing can be found as listed on the A2LA website. All measuring equipment is calibrated on an annual or bi-annual basis as listed for each respective test.

Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	


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)
2016.02.04 to 2016.02.09	All	AF	20-25°C	30-50%	100 -103kPa

Client	MRC Networks Inc	 Canada
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	

Detailed Test Results Section

Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	

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 & Method

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


Method is as defined in ANSI C64:2009

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

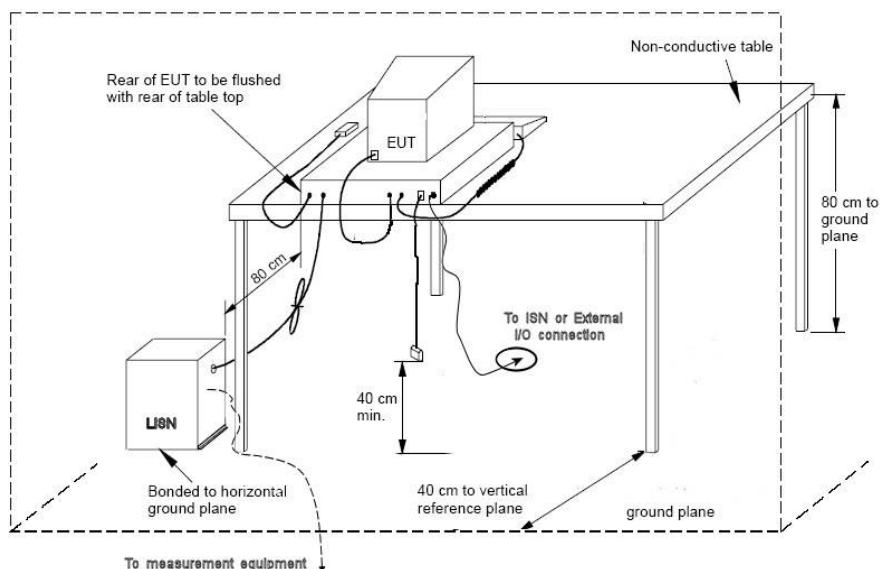
The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

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.

Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	

Typical Setup Diagram




Note: The vertical reference plane is optional as per ANSI C63.4 section 5.2.2

Measurement Uncertainty

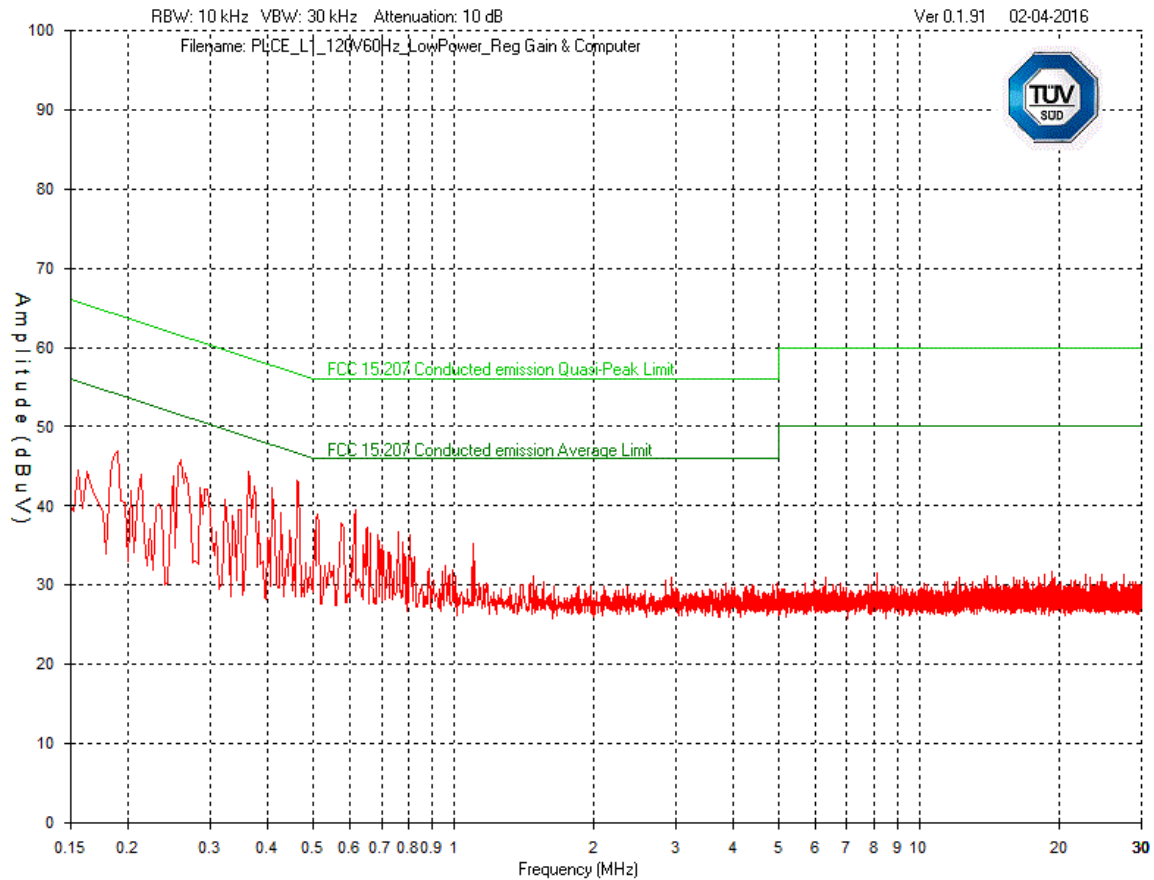
The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is ± 3.6 dB with a 'k=2' coverage factor and a 95% confidence level.


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 graph shown below is a peak measurement graph, 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.

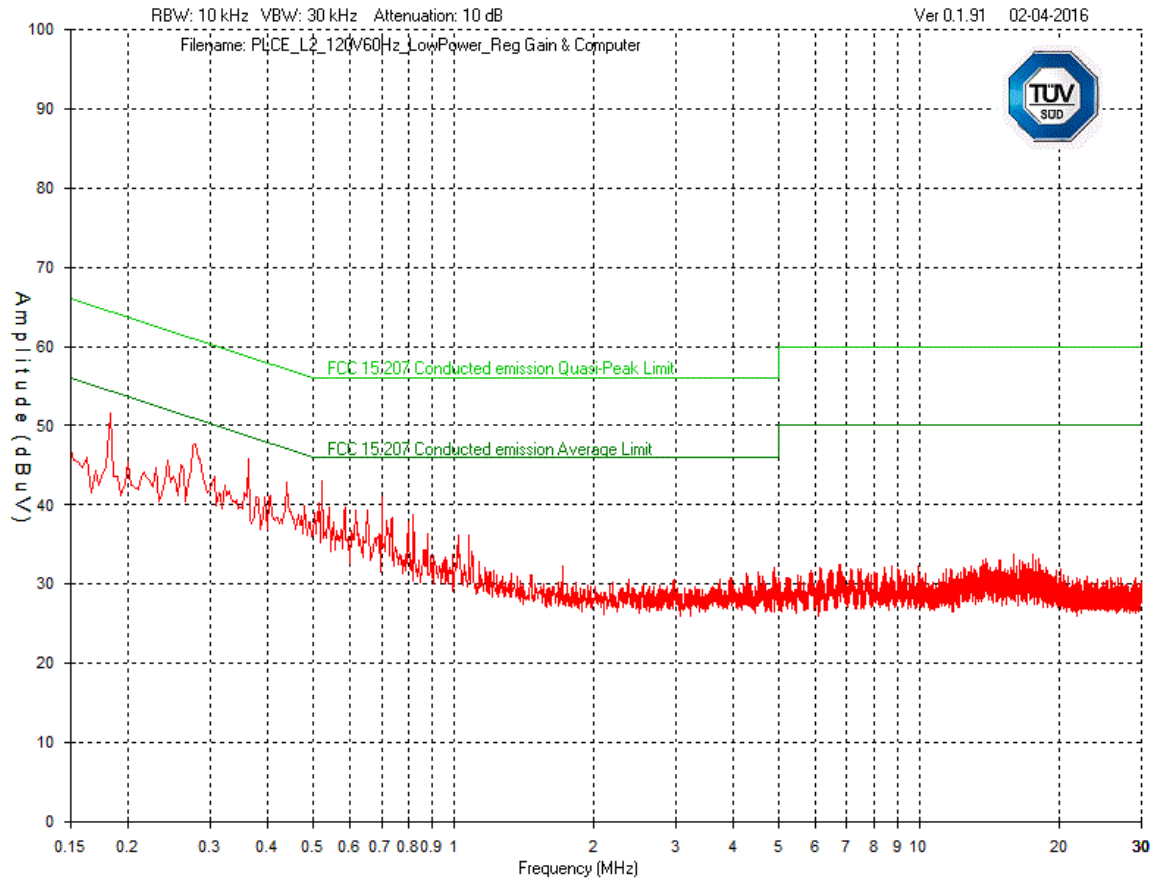
Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	


Phase – L1 – (Black/Brown) – Peak emissions graph



Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	

Neutral – L2 – (White/Blue) – Peak emissions graph



Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	

Final Measurements


Average Emission reading table – Line 1

Frequency (MHz)	Raw (dBuV)	Atten Factor (dB)	LISN Factor (dB)	Cable (dB)	Level (dBuV)	Limit (dB)	Margin (dB)	Pass/Fail
0.4618	17.1	10	0.2	0	27.3	46.7	19.4	Pass
0.3623	20.1	10	0.3	0	30.4	48.7	18.3	Pass
0.4087	17.2	10	0.2	0	27.4	47.7	20.3	Pass
0.2595	22.7	10	0.7	0	33.4	51.4	18.0	Pass
0.6143	16.3	10	0.2	0	26.5	46.0	19.5	Pass
0.5115	17.7	10	0.2	0	27.9	46.0	18.1	Pass

Average Emission reading table – Line 2

Frequency (MHz)	Raw (dBuV)	Atten Factor (dB)	LISN Factor (dB)	Cable (dB)	Level (dBuV)	Limit (dB)	Margin (dB)	Pass/Fail
0.1832	37.6	10	1.2	0	48.8	54.3	5.5	Pass
0.3623	24.2	10	0.3	0	34.5	48.7	14.2	Pass
0.5215	22.6	10	0.2	0	32.8	46.0	13.2	Pass
0.2655	33.2	10	0.6	0	43.8	50.8	7.0	Pass
0.7006	21.2	10	0.2	0	31.4	46.0	14.6	Pass
0.6541	21.2	10	0.2	0	31.4	46.0	14.6	Pass


Note: See ‘Appendix B – EUT & Test Setup Photographs’ for photos showing the test set-up for the highest line conducted emission

Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	

Test Equipment List Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date ¹	Next calibration due date ¹	Asset#
HP Spectrum Analyzer	8566B	HP	1-28-15	1-28-17	4169
Spectrum Analyzer Display	8566B	HP	1-28-15	1-28-17	4168
Quasi Peak Adapter	85650A	HP	1-28-15	1-28-17	4170
LISN	FCC-LISN-50/250-16-2-01	FCC	3-20-15	3-20-17	4005
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	1-28-15	1-28-17	4026
RF Cable 10m	LMR-400-10M-50OHM-MN-MN	LexTec	1-28-15	1-28-17	4025
Attenuator 10 dB	FP-50-10	Trilithic	1-28-15	1-28-17	4027
Emission software	0.1.91	Global EMC	1-28-15	1-28-17	58

1: For cables and attenuators, verification dates apply.

Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	

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

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

0.009 MHz – 0.490 MHz, 2400/F(kHz) uV/m at 300 m⁴

0.490 MHz – 1.705 MHz, 24000/F(kHz) uV/m at 30 m⁴

1.705 MHz – 30 MHz, 30 uV/m at 30 m⁴

30 MHz – 88 MHz, 100 uV/m (40.0 dBuV/m¹) at 3 m

88 MHz – 216 MHz, 150 uV/m (43.5 dBuV/m¹) at 3 m

216 MHz – 960 MHz, 200 uV/m (46.0 dBuV/m¹) at 3 m

Above 960 MHz, 500 uV/m (54.0 dBuV/m¹) at 3 m

Above 1000 MHz, 500 uV/m (54 dBuV/m²) at 3m


Above 1000 MHz, 5000 uV/m (74 dBuV/m³) at 3m

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

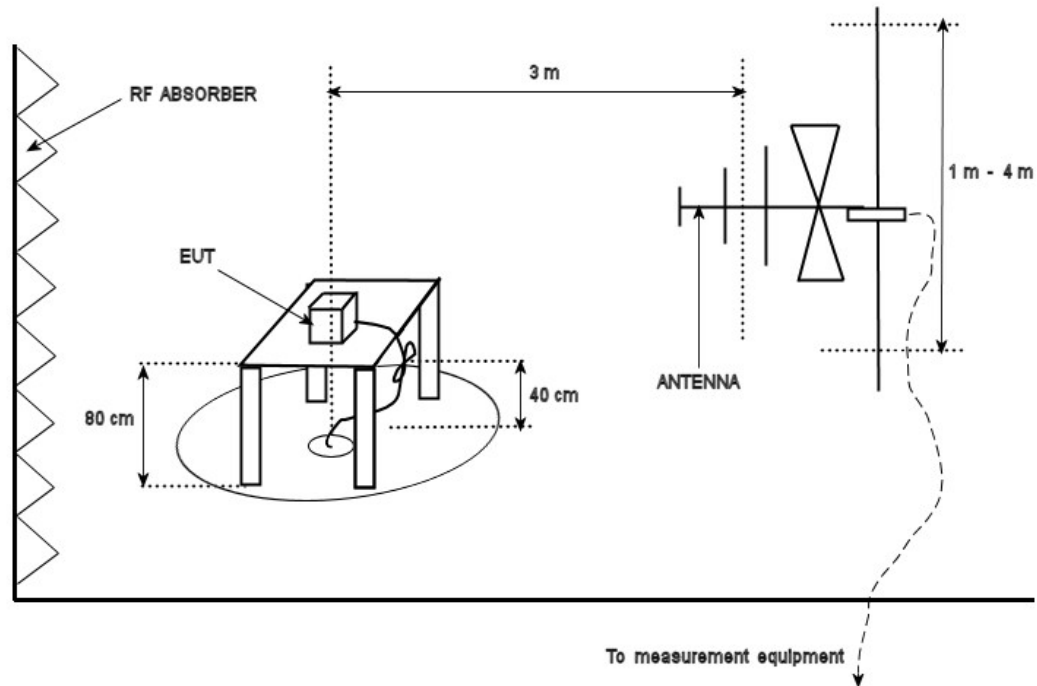
²Limit is with 1 MHz measurement bandwidth and using an Average detector


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

⁴Limit is with using a Quasi-peak detector with a bandwidth as defined in CISPR 16-1-1

Client	MRC Networks Inc	 Canada
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	

Typical Radiated Emissions Setup



Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	

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

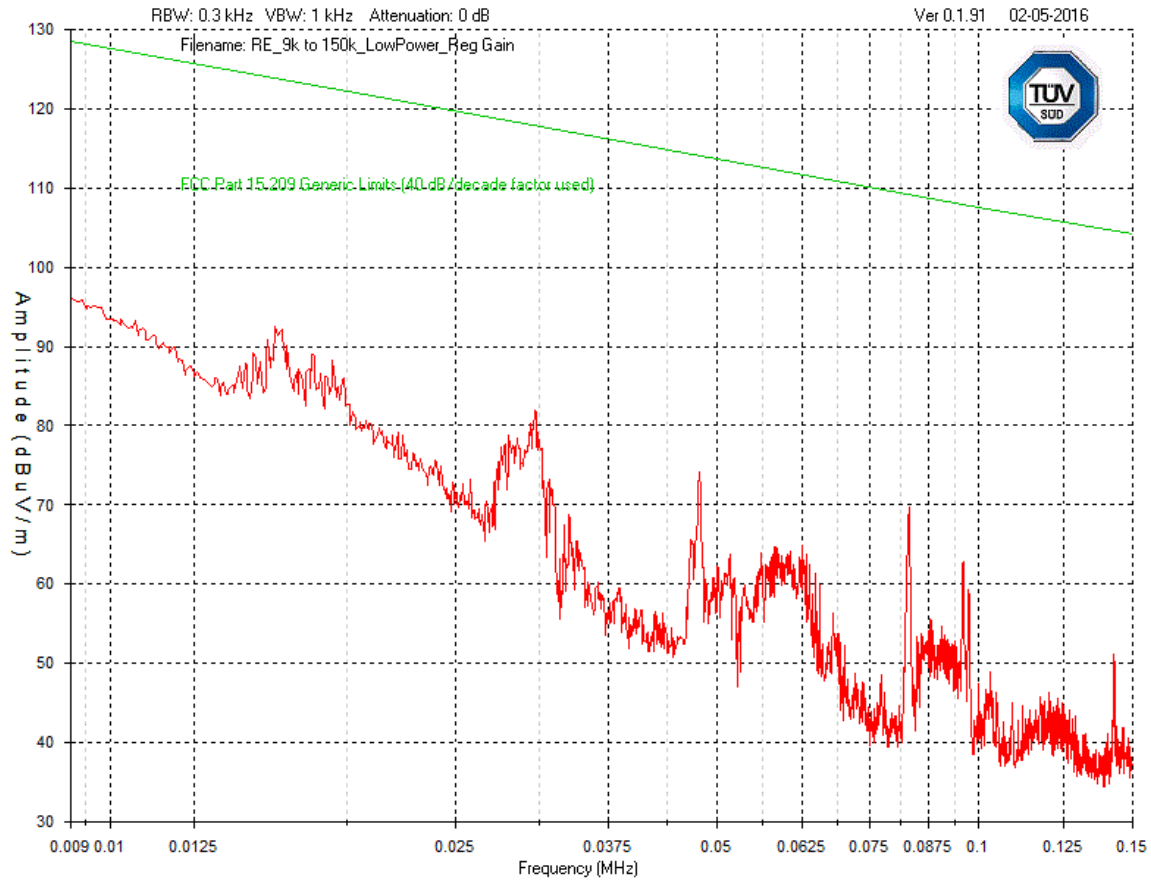
Note the graphs shown below are for graphical illustration only. For final measurements with the appropriate detector, please refer to the final measurement table where applicable. The graph shown below is a maximized peak measurement graph, measured with a resolution bandwidth greater than the final 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, the device was scanned to a minimum of a 1 GHz.

Devices scanned above 1GHz may be scanned at 1 meter test distance, and in accordance with FCC Part 15, Subpart A, Section 15.31, an extrapolation factor of 20 dB/decade was used. For example for 1 meter measurements, an extrapolation factor 9.5 dB from $20 \cdot \log(3\text{m} / 1\text{m})$ is applied.

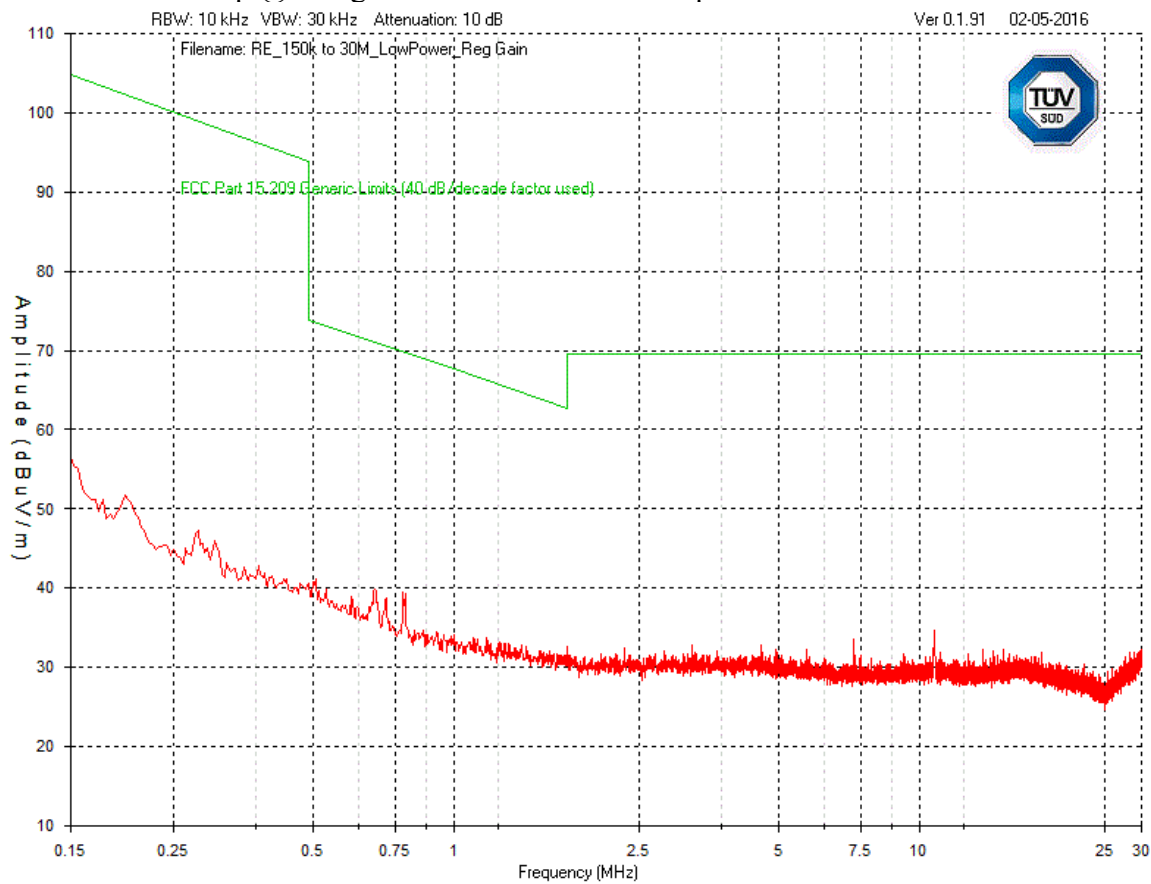
Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	


Loop @ 0 degree – Peak Emissions Graph– 9kHz to 150kHz



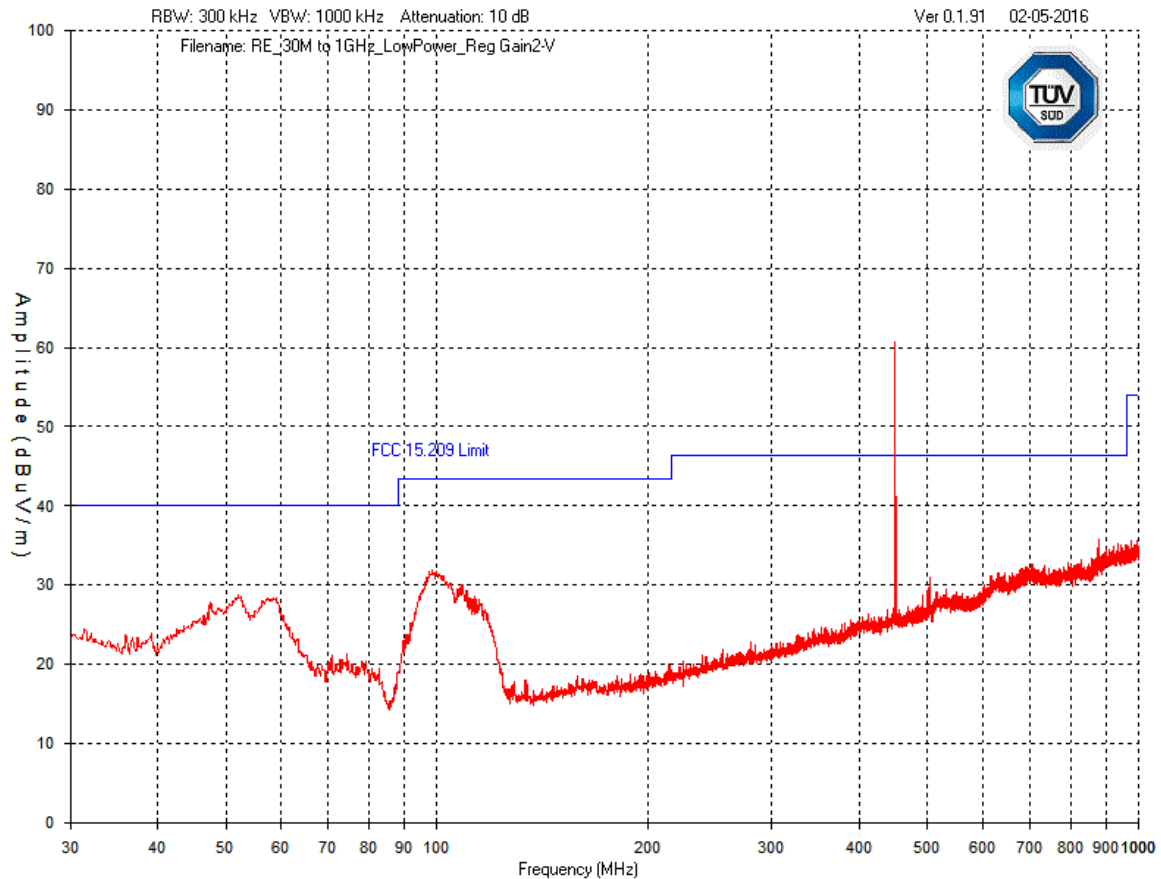
Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	


Loop @ 0 degree – Peak Emissions Graph – 150kHz to 30MHz



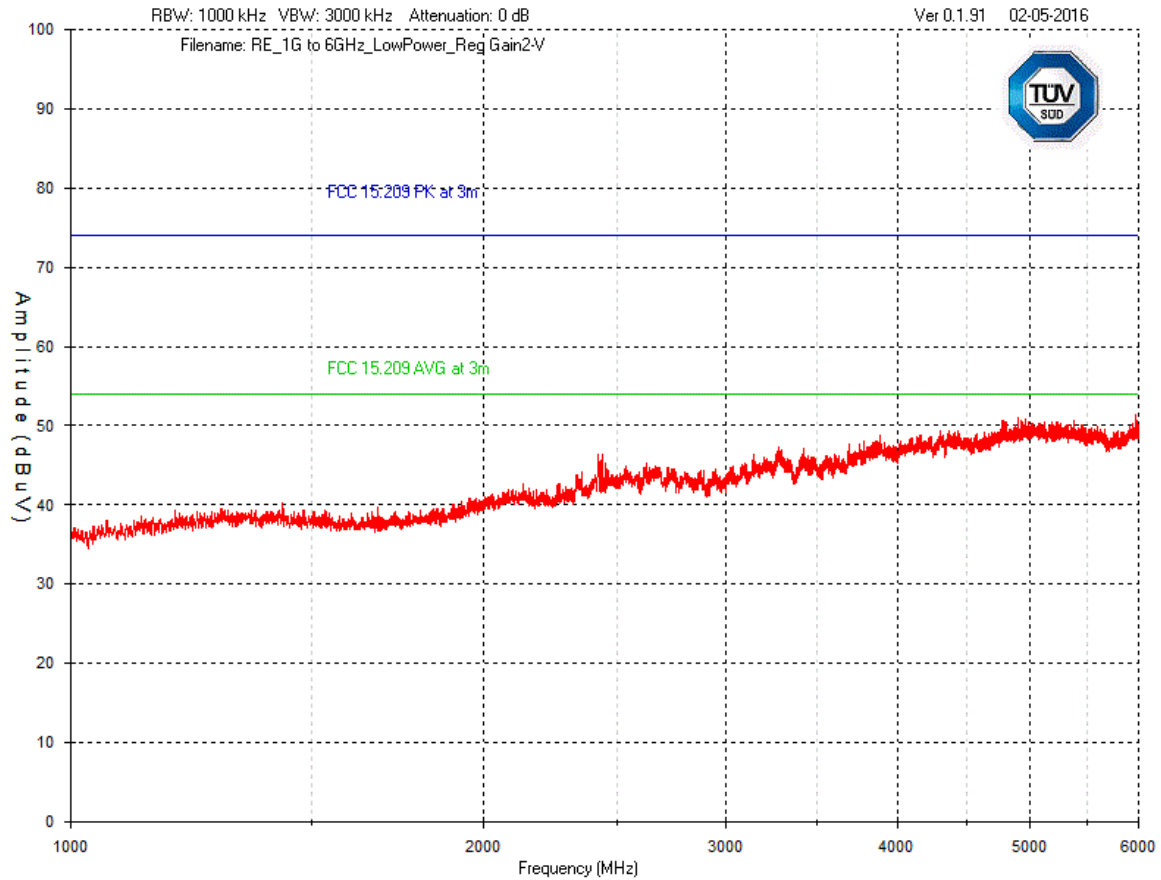
Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	


Vertical – Peak Emissions Graph – 30MHz to 1GHz



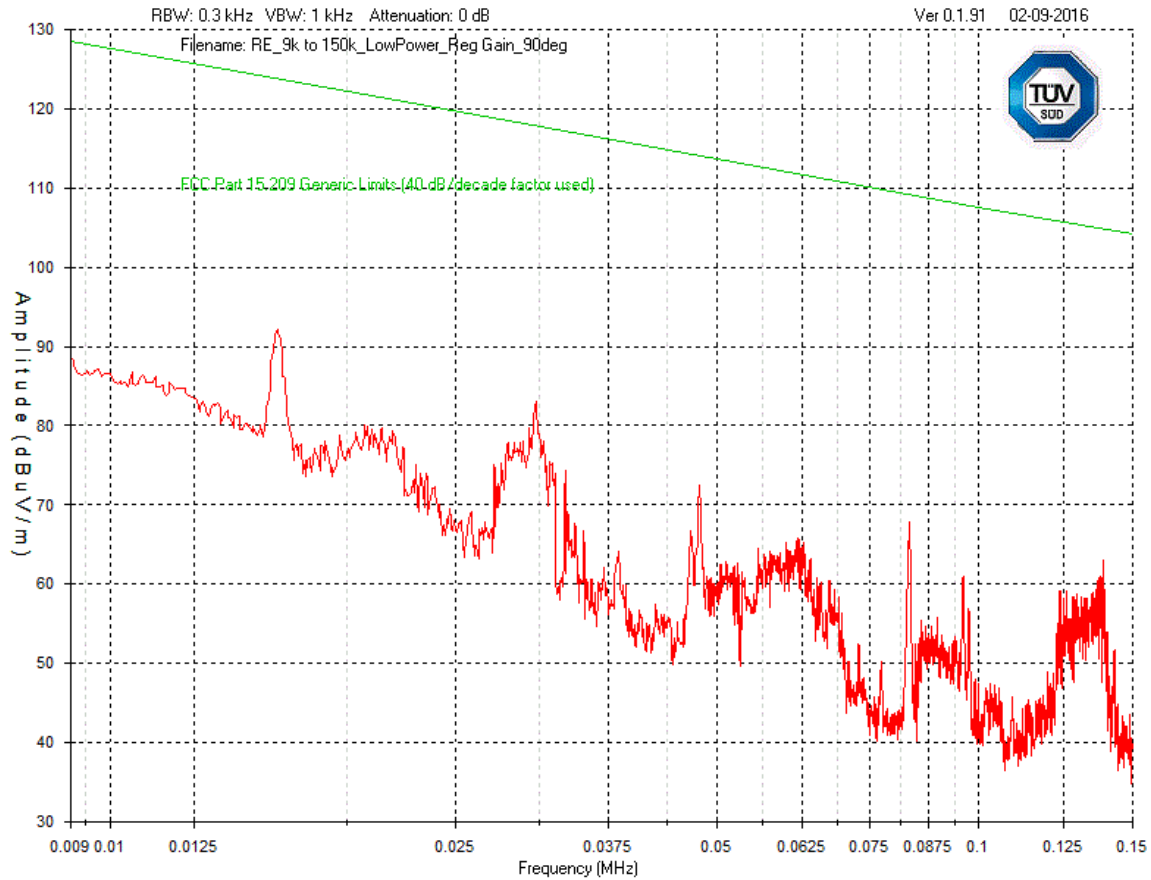
Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	


Vertical – Peak Emissions Graph – 1GHz to 6GHz



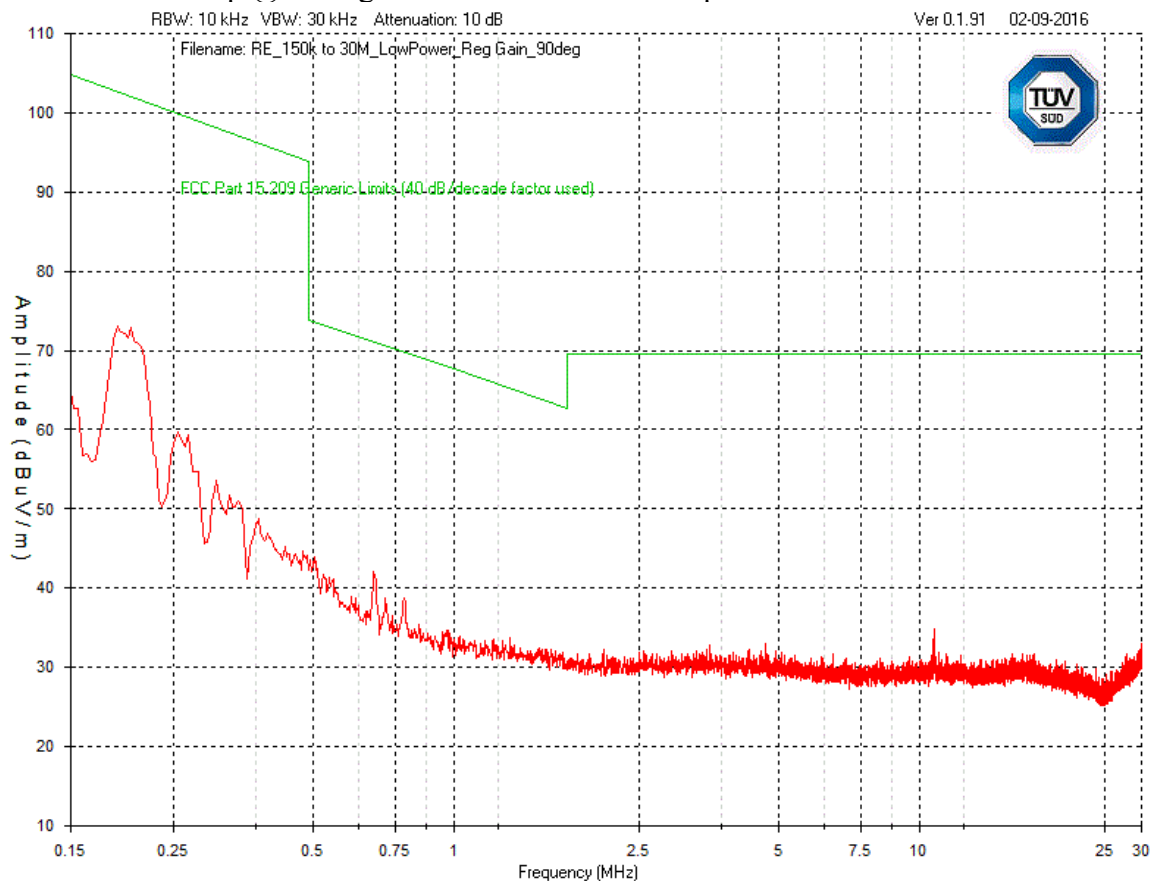
Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	


Loop @ 90 degree – Peak Emissions Graph – 9kHz to 150kHz



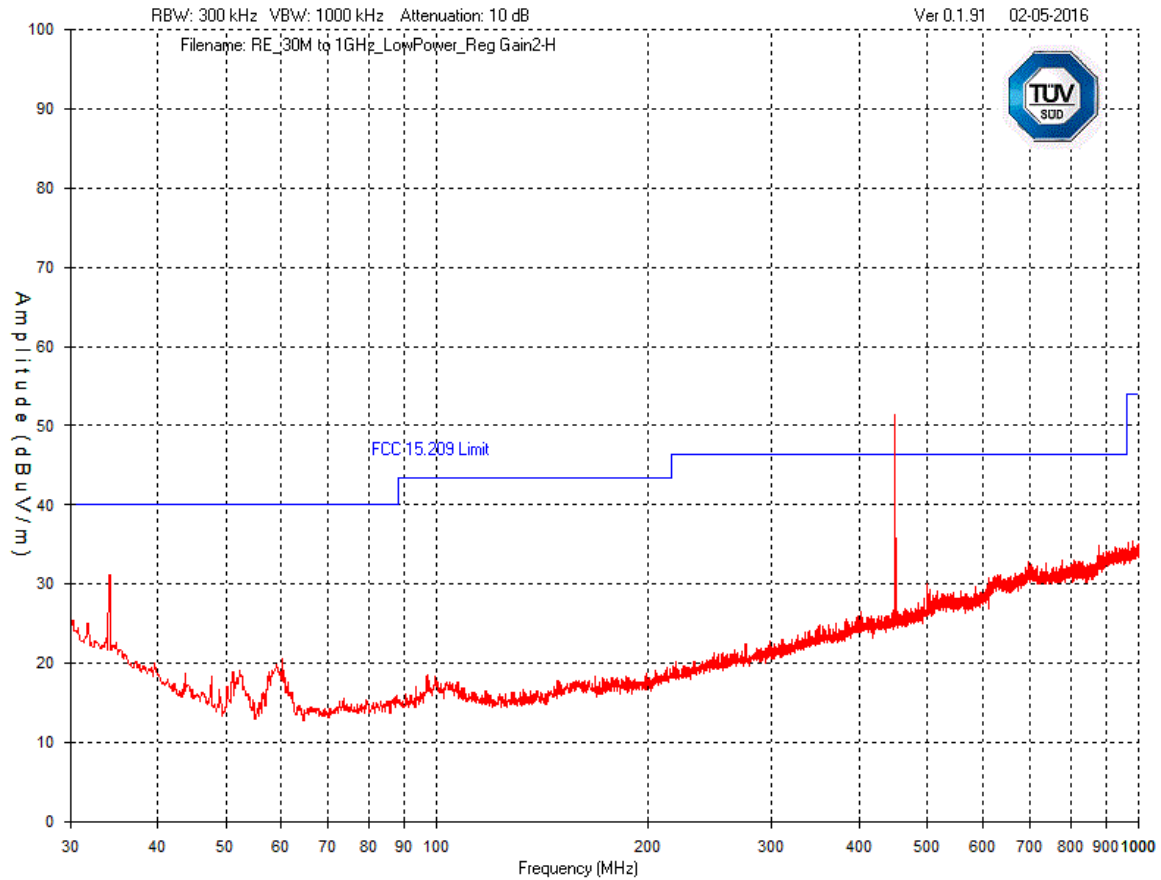
Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	


Loop @ 90 degree – Peak Emissions Graph – 150kHz to 30MHz



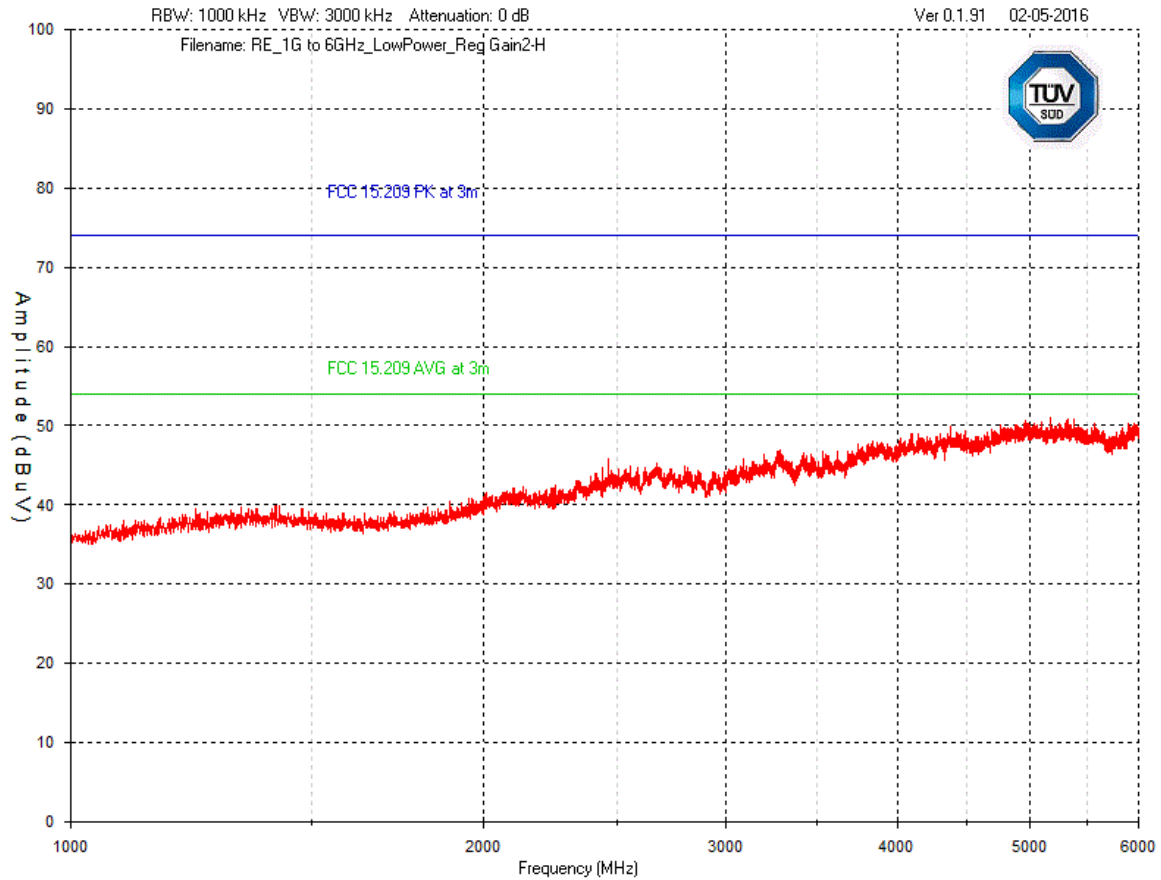
Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	


Horizontal – Peak Emissions Graph – 30MHz to 1GHz



Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	

Horizontal – Peak Emissions Graph – 1GHz to 6GHz



Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	

Final Measurements

Emission Reading Table – Vertical

Frequency (MHz)	Det. mode	Raw (dBuV)	Ant. (dB/m)	Att. (dB)	Cab. (dB)	Amp (dB)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass/Fail
449.428	Peak	71.5	17.4	3	2	-33.3	60.6	73.4	12.8	Pass
34.074	Peak	39.4	23.2	3	2.7	-32.5	35.8	46.4	10.6	Pass
978.563	Peak	51.4	6.9	3	0.7	-33.3	28.7	40	11.3	Pass
60.264	Peak	52.6	8.9	3	0.9	-33.5	31.9	43.5	11.6	Pass
52.31	Peak	40.5	18.6	3	2.1	-33.2	31	46.4	15.4	Pass
96.93	Peak	36.2	14.2	3	1.7	-33.3	21.8	46.4	24.6	Pass

Emission Reading Table – Horizontal


Frequency (MHz)	Det. mode	Raw (dBuV)	Ant. (dB/m)	Att. (dB)	Cab. (dB)	Amp (dB)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass/Fail
449.428	Peak	62.2	17.4	3	2	-33.3	51.3	73.4	22.1	Pass
34.074	Peak	45.2	15	3	0.6	-32.5	31.3	40	8.7	Pass
978.563	Peak	37.2	24.2	3	2.9	-31.9	35.4	54	18.6	Pass
60.264	Peak	43.3	6.8	3	0.8	-33.3	20.6	40	19.4	Pass
52.31	Peak	41.7	6.9	3	0.7	-33.3	19	40	21	Pass
96.93	Peak	39.3	8.8	3	0.9	-33.5	18.5	43.5	25	Pass

Note:

All emissions meet the limits of spurious emissions in 15.231 (b). According to 15.231 (b)(3), it may meet whichever limit of 15.231 (b) or 15.209 permits a higher field strength, and so complies with the requirements of this standard.

The fundamental was measured to be 60.6 dBuV/m at 3 meters.

Above 1GHz, no emissions were detected above the limits.


Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer Display	8566B	HP	1-28-15	1-28-17	4168
Spectrum Analyzer	8566B	HP	1-28-15	1-28-17	4169
Quasi Peak Adapter	85650A	HP	1-28-15	1-28-17	4170
Loop Antenna	EM-6872	Electro-Metrics	02-03-15	02-03-17	GEMC 11
Loop Antenna	EM-6871	Electro-Metrics	02-03-15	02-03-17	GEMC 70
BiLog Antenna	3142-C	ETS	9-8-14	9-8-16	GEMC 8
Attenuator 3 dB	FP-50-3	Trilithic	N/A	N/A	4028
9kHz-1GHz, 28dB preamp	LNA-1450	RF Bay Inc.	7-22-15	7-22-16	4036
Horn Antenna	ATH1G18G	AR	4-23-15	4-23-17	4003
1GHz-26.5GHz preamp	8449B	Agilent	9-9-14	9-9-16	6351
RF Cable 10m	LMR-400-10M-50OHM-MN-MN	LexTec	1-28-15	1-28-17	4025
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	1-28-15	1-28-17	4026
Emission software	0.1.91	Global EMC	1-28-15	1-28-17	58

1: For cables and attenuators, verification dates apply.

This report module is based on GEMC template "FCC - 15.209 - Radiated Emissions_Rev5.doc"

Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	

20 dB Bandwidth of Periodically Operated Transmitters

Purpose

The purpose of this test is to ensure that the bandwidth occupied does not exceed a stated minimum. This helps ensure the utilization of the frequency allocation is sufficiently narrow, and not occupying excessive spectrum. This also helps prevent accidentally interference of data by ensuring adequate data separation to distinguish the reception of the intended information by enabling the receiver to have a relatively narrow band response tuned to the transmitter's frequency.


Limits

The Limit is as specified in FCC Part 15 and RSS 210.

For periodic transmitters below 900 MHz, this should not exceed 0.25 % of the fundamental frequency. For periodic transmitters above 900 MHz, this should not exceed 0.5 % of the fundamental frequency. This should be measured with a RBW equal to approximately 1% of the 20 dB BW of the signal and a VBW > then the RBW.

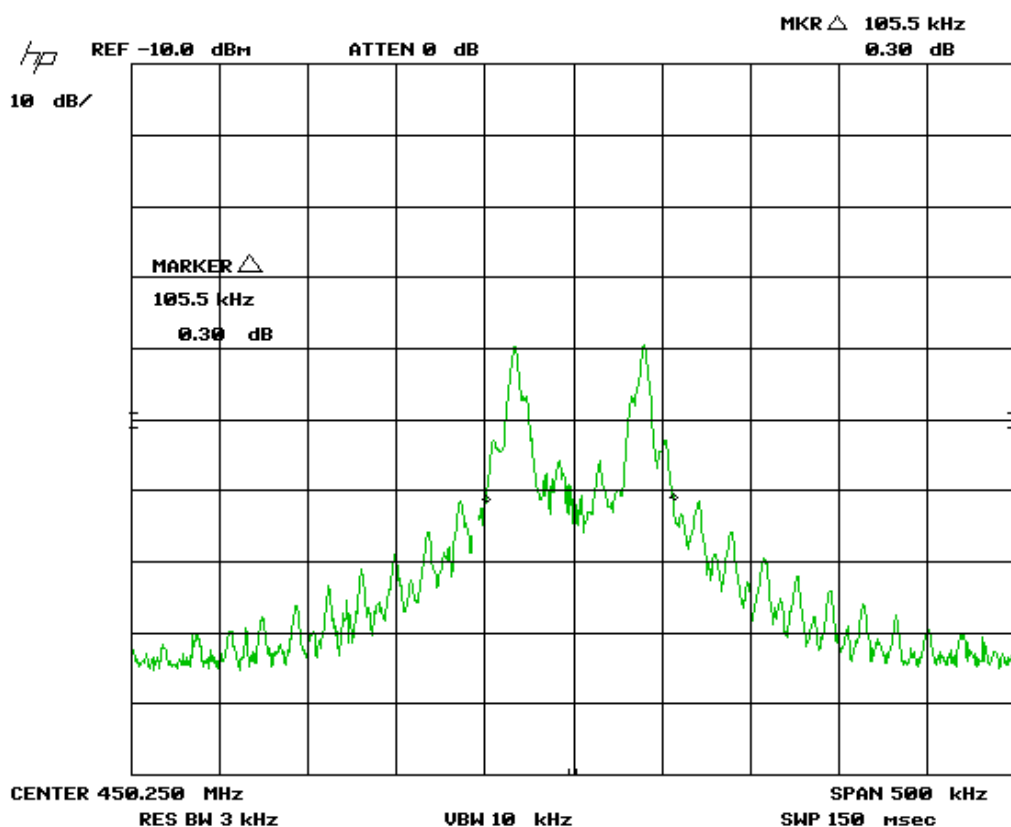
Results

The EUT passed. The 20 dB BW measured was 105.5 kHz and the requirement was that this be less than 1.125 MHz (0.25% of 450MHz)..


Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	

Graph(s)

The graphs shown below shows the channel spacing during the operation of the device. This is measured by a max hold on the spectrum analyzer and the highest resolution bandwidth that is approximately 1 % of the 20 dB BW during operation of the EUT. This measurement is a peak measurement. Max hold is performed for a duration of not less than 1 minute. Markers are set at 20 dB below peak.




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

Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer Display	8566B	HP	1-28-15	1-28-17	4168
Spectrum Analyzer	8566B	HP	1-28-15	1-28-17	4169
Quasi Peak Adapter	85650A	HP	1-28-15	1-28-17	4170
BiLog Antenna	3142-C	ETS	9-8-14	9-8-16	GEMC 8
Attenuator 3 dB	FP-50-3	Trilithic	N/A	N/A	4028
9kHz-1GHz, 28dB preamp	LNA-1450	RF Bay Inc.	7-22-15	7-22-16	4036
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	1-28-15	1-28-17	4026
RF Cable 10m	LMR-400-10M-50OHM-MN-MN	LexTec	1-28-15	1-28-17	4025

This report module is based on GEMC template "FCC - 15.231 - 20dB Bandwidth_Rev2.doc"

Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	

Appendix A – EUT Summary

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


General EUT Description

MRC 3040 is a wireless gateway that receives and transmits events. It operates within ISM band. It is intended for use as high-performance for robust frequency agile, half-duplex bi-directional RF links, and where stable and constant RF performance is required over the full operating range of the device.

The Gateway has three main modes of operation. It can function as:


- Terminal unit: the unit will receive the events and is normally connected to the computer/server that is used for processing the events.
- Receive/Transmit unit : the unit will receive the events from end user devices such as bracelet or pendant. It will communicate this event wirelessly to the the terminal unit or to an intermediate repeater unit.
- Repeater unit: It functions as the unit above but it will receive its event from another MRC 3040 gateway instead of end user devices.

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 & Test Setup Photographs’.

Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	


Appendix B – EUT and Test Setup Photographs

Note: These photos are for information purposes only. Also refer to PDF files that are separate from this test report.

Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	


EUT's Photo 1



Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	


EUT's Photo 2



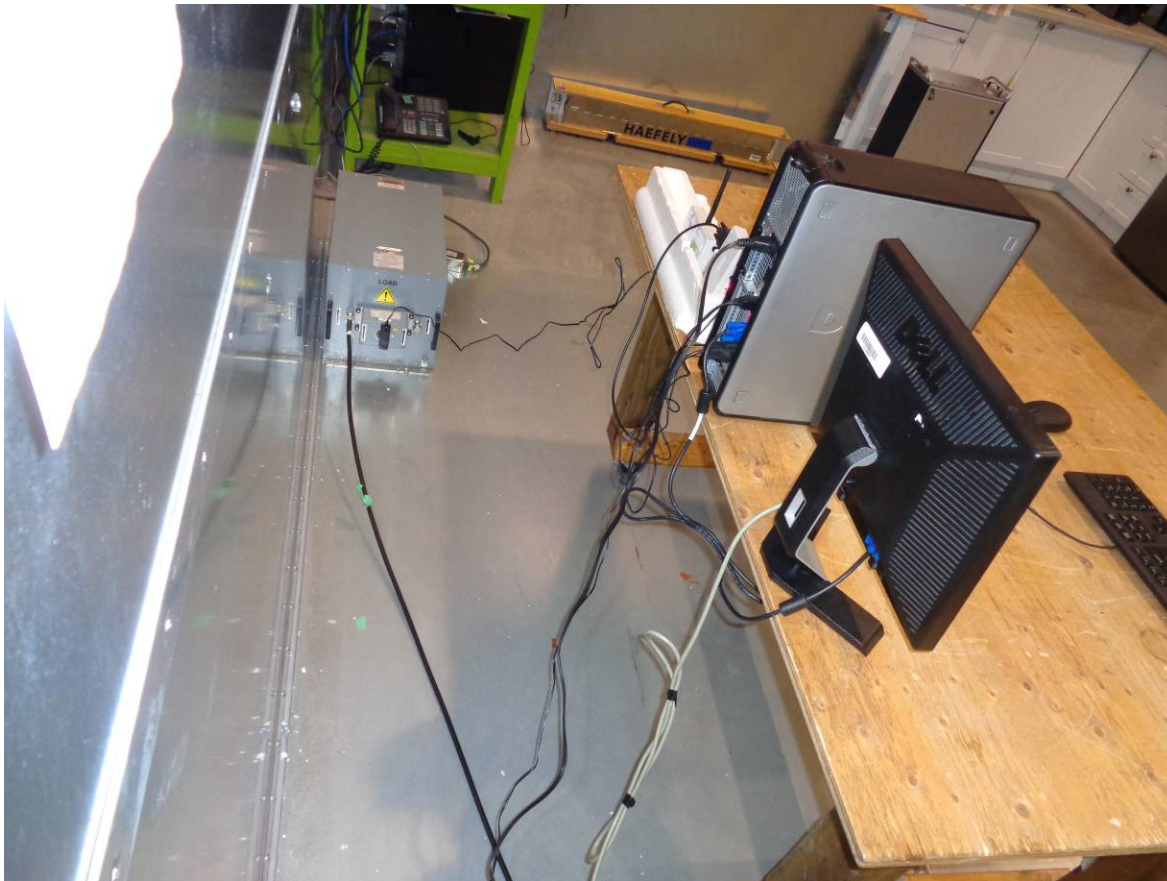
Client	MRC Networks Inc	 Canada
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	


Conducted emissions Photo 1



Client	MRC Networks Inc	 TÜV SÜD Canada
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	


Conducted emissions Photo 2



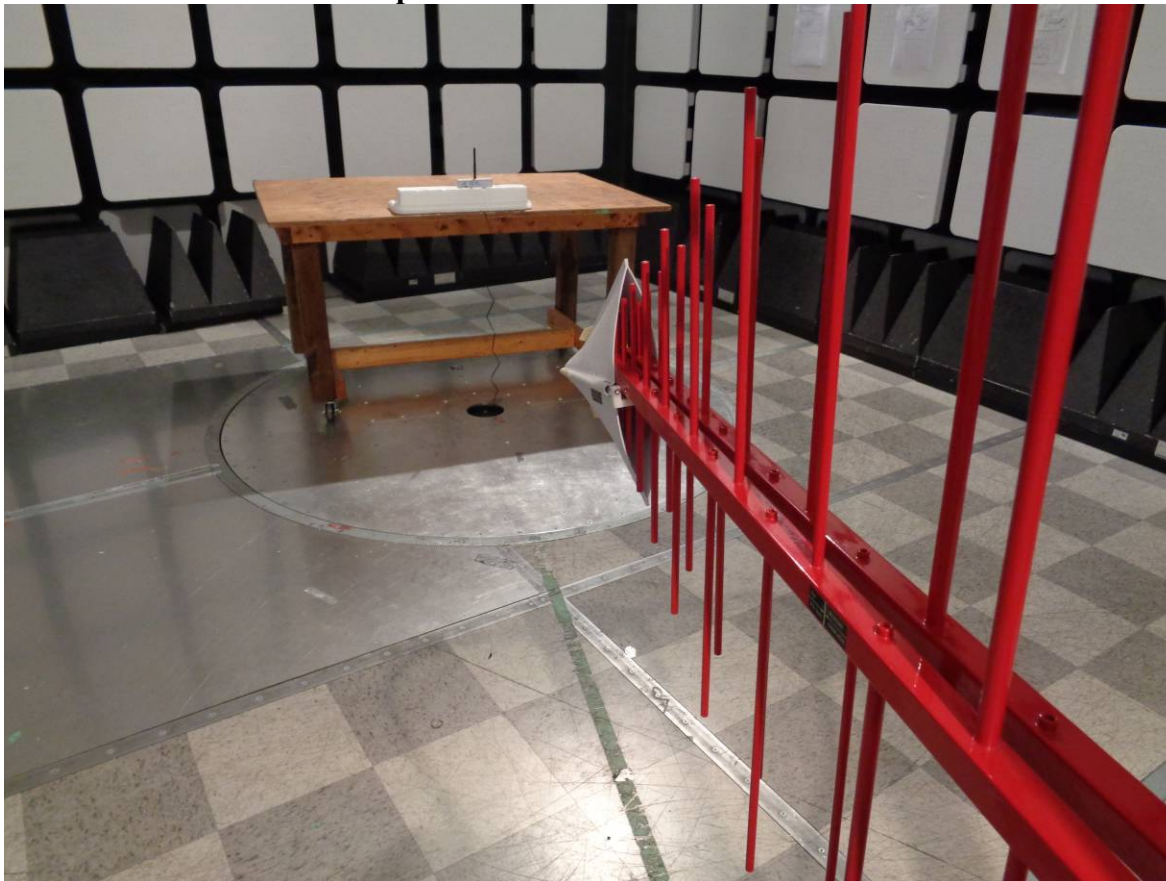
Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	


Radiated Emission Test Setup Photo #1:



Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	

Radiated Emission Test Setup Photo #2:



Client	MRC Networks Inc	
Product	MRC 3040	
Standard(s)	RSS 210 Issue 8/ FCC Part 15 Subpart C 15	

Radiated Emission Test Setup Photo #3:

