Global EMC Inc. Labs

EMC & RF Test Report

As per

RSS 210 Issue 8:2010

&

FCC Part 15 Subpart C:2010
Unlicensed Intentional Radiators

on the

Ceridian DFTouch (WR)

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Testing produced for

CERIDIAN

See *Appendix A* for full customer & EUT details.

Industry Canada
LAB REGISTRATION #6844A-3

CE

FEDERAL COMMUNICATIONS COMMISSION · USA ·
FCC REGISTRATION #377448

A2LA ACCREDITED
Testing Laboratory
Certificate #2555.01

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Report Scope

This report addresses the EMC verification testing and test results of the Ceridian DFTouch (WR) device, 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:2014

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.

Client	CERIDIAN HCM
Product	DFTouch (WR)
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014

Summary

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

EUT FCC Certification #, FCC ID:	2AC2N-DFTOUCHWR
EUT Industry Canada Certification #, IC:	12286A-DFTOUCHWR
EUT Passed all tests performed.	Yes (see test results summary)
Tests conducted by	Raymond Lee Au

Client	CERIDIAN HCM
Product	DFTouch (WR)
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2014

Test Results Summary

Standard/Method	Description	Class/Limit	Result
FCC 15.203	Antenna Requirement	Unique	Pass See Justification
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**

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 '*'.

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 (RSS 210 section 5.5), the antennas in this device are all inside the unit's enclosure, and are not meant to be replicable by the user.

The EUT consists an approved modular transmitter (FCC ID: RYK-WUBR170GNM, IC: 6158A-WUBR170GNM) and a 15.209 transmitter designed to operate at 13.56 MHz, and 125 kHz.

The antenna of the modular transmitter (FCC ID: RYK-WUBR170GNM, IC: 6158A WUBR170GNM) has been changed via a Class I permissive change. The antenna gain of the new antenna is of the same type and less gain than that of the originally approved antenna.

For the Restricted Bands of operation, the 15.209 transmitters are designed to operate at 13.56 MHz, and 125 kHz.

The EUT was tested in the three orthogonal axes. The worst case results are obtained with the EUT upright, (screen facing sideways) in a wall hung position (which is its position during typical usage). Worst case results are presented.

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Applicable Standards, Specifications and Methods

ANSI C63.4:2009	- 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	- Code of Federal Regulations – Radio Frequency Devices
CISPR 22:2008	- Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement
FCC KDB 558074	- FCC KDB 558074 Digital Transmission Systems, measurements and procedures
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-GEN	General Requirements and Information for the Certification of Radio Apparatus
RSS 210:2010	- Issue 8: Spectrum Management and Telecommunications Policy. Radio Standards Specification Low Power Licence-Exempt Radiocommunication Devices

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 - October 9, 2014
Initial release.

Definitions and Acronyms

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

AE – Auxiallary Equipment.

BW – Bandwidth. Unless otherwise stated, this is 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

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.

Testing Environmental Conditions and Dates

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

Date	Test	Init.	Temperature (ºC)	Humidity (%)	Pressure (kPa)
Aug. 11 – 15, 2014	All	RA	20-25ºC	30-45%	100 -103kPa

Detailed Test Results Section

Radiated Emissions - Spurious

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

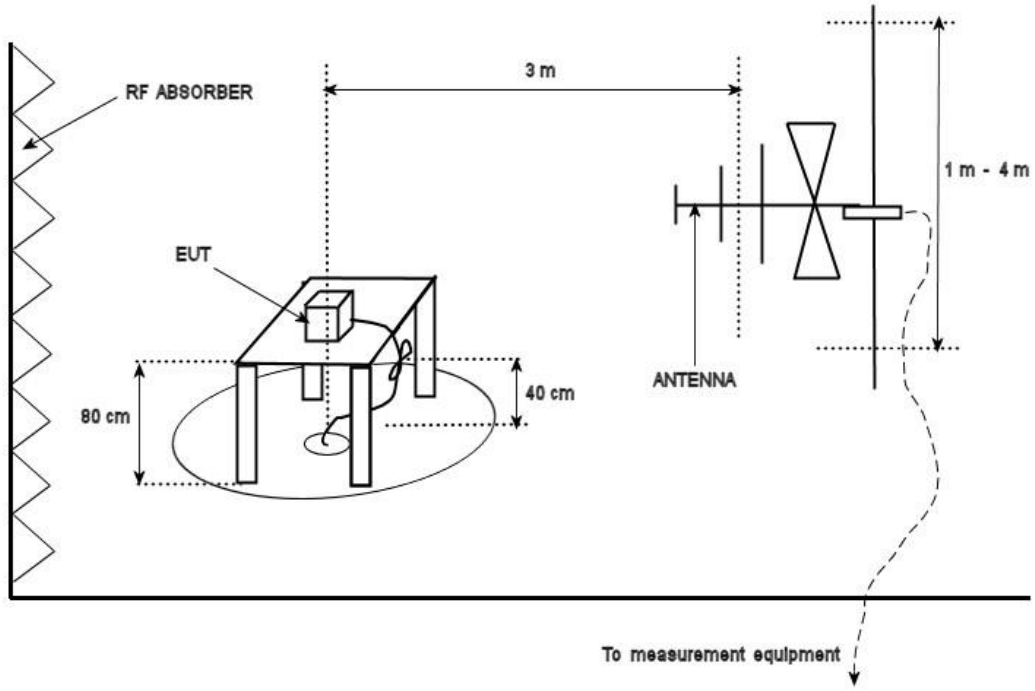
The method is as defined in ANSI C63.4:2003.
The limits are as defined in FCC Part 15, Section 15.209:

The limits, as defined in 15.247(d) for unintentional radiated emissions 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).

0.009 MHz – 0.490 MHz, 2400/F(kHz) uV/m at 300 m[1]
0.490 MHz – 1.705 MHz, 24000/F(kHz) uV/m at 30 m[1]
1.705 MHz – 30 MHz, 30 uV/m at 30 m[1]
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
Above 1000 MHz, 500 uV/m (74 dBuV/m[3]) at 3m

[1]Limit is with Quasi Peak detector with bandwidths as defined in CISPR-16-1-1.
[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.

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 or equal to, 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 the 10^{th} harmonic.

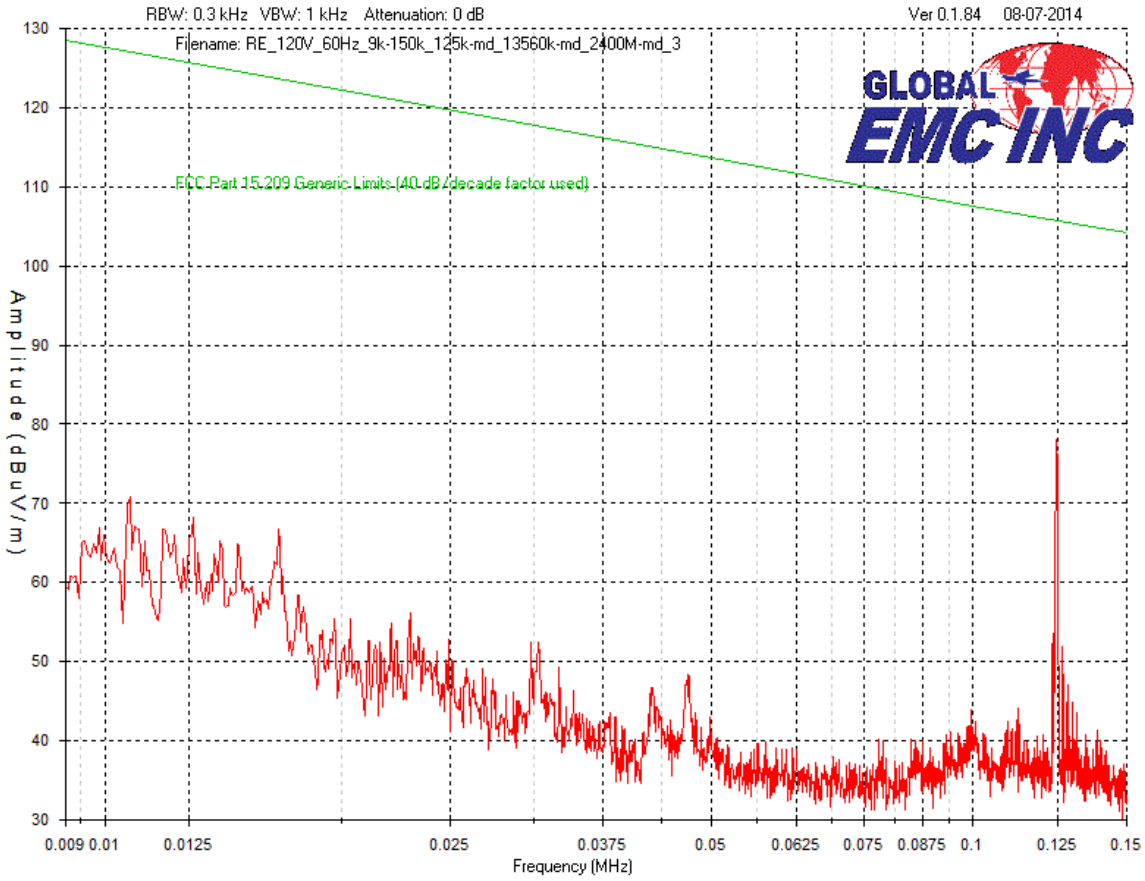
Devices scanned may be scanned at alternate test distances, and in accordance with FCC Part 15, Subpart A, Section 15.31, an extrapolation factor of 20 dB/decade was used above 30 MHz and 40 dB/decade below 30 MHz. For example for 1 meter measurements, an extrapolation factor 9.5 dB from 20 Log (1m/3m)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

The EUT was scanned with both the 15.247 and 15.209 transmitters on.

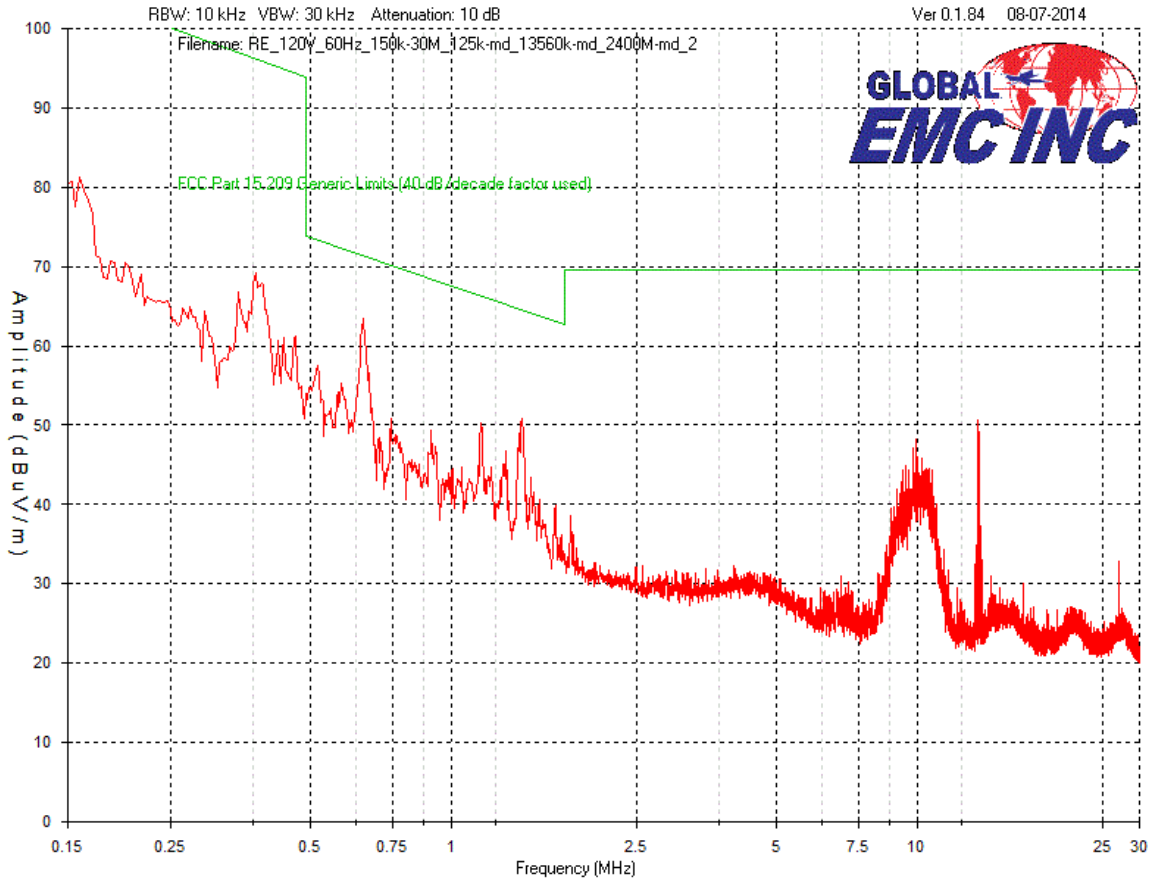
See final measurement section for all measurements.

Plots and measurements are made at a 3 meter distance.

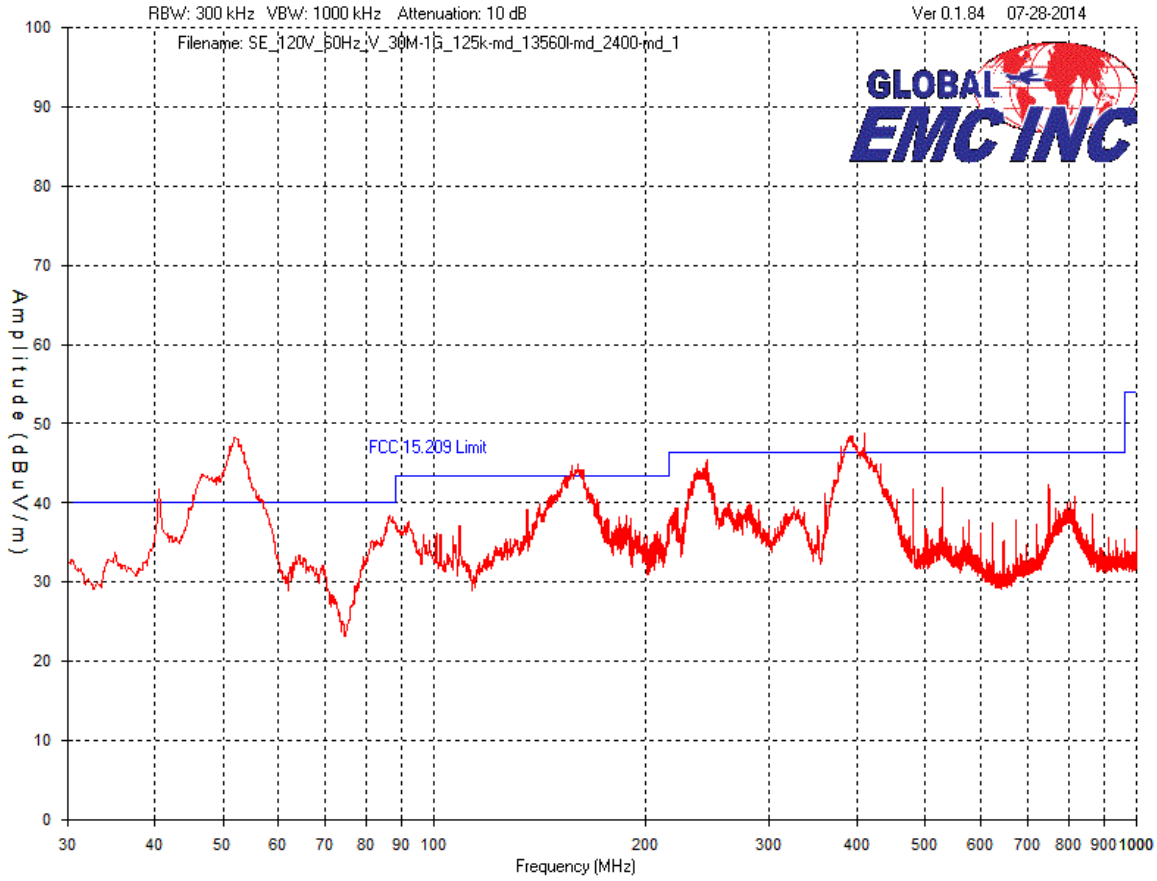
Peak Emissions Graph
9 kHz to 150 kHz
3 meter test distance



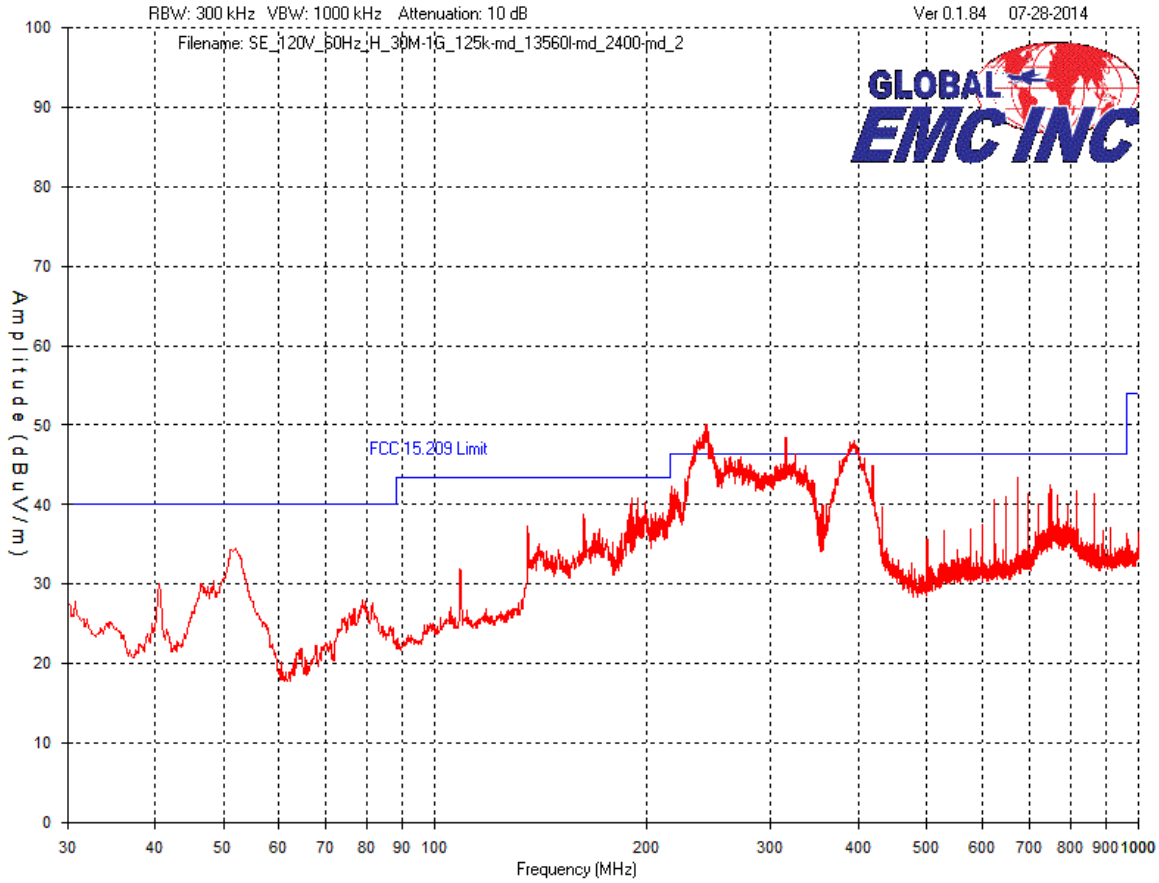
Peak Emissions Graph
150 kHz to 30 MHz
3 meter test distance



Peak Emissions Graph
Vertical Antenna Polarity
30 MHz to 1 GHz
3 meter test distance



Peak Emissions Graph
Horizontal Antenna Polarity
30 MHz to 1 GHz
3 meter test distance



Final Measurements

Radiated Emissions
Spurious measurements
3m test distance

Test Frequency (MHz)	Detection mode	Raw signal dB(µV)	Antenna factor dB	Cable loss dB + Pre-selector	Pre-Amp Gain dB	Received signal dB(µV/m)	Emission limit dB(µV/m)	Margin dB(µV)	Result
Vertical Antenna Polarity									
51.9	QP	54	8	0.6	-30	32.6	40	7.4	Pass
410.4	QP	45.1	15.6	1.5	-30.2	32	46.4	14.4	Pass
390.9	QP	44.7	15.3	1.5	-30.3	31.2	46.4	15.2	Pass
40.5	QP	54.4	10.8	0.5	-30	35.7	40	4.3	Pass
47.5	QP	41.8	8.6	0.6	-30	21	40	19	Pass
160.2	QP	56.5	9.9	1	-30	37.4	43.5	6.1	Pass
Horizontal Antenna Polarity									
242.9	QP	56.4	12.2	1.2	-30.3	39.5	46.4	6.9	Pass
271.2	QP	54.9	13.1	1.3	-30.2	39.1	46.4	7.3	Pass
315.1	QP	46.3	14.3	1.4	-30.3	31.7	46.4	14.7	Pass
393.5	QP	44.1	16.5	1.5	-30.3	31.8	46.4	14.6	Pass
318.7	QP	46.9	14.4	1.4	-30.3	32.4	46.4	14	Pass

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	85650A	HP	Jan. 23, 2013	Jan. 23, 2015	GEMC 170
Quasi-Peak Detector	8566B	HP	Jan. 22, 2013	Jan. 22, 2015	GEMC 169
Loop Antenna 30Hz – 1MHz	EM 6871	Electro-Metrics	Feb. 5, 2013	Feb. 5, 2015	GEMC 70
Loop Antenna 100kHz – 30MHz	EM 6872	Electro-Metrics	Feb. 5, 2013	Feb. 5, 2015	GEMC 71
BiLog Antenna	3142-C	ETS	Feb 4, 2013	Feb 4, 2015	GEMC 137
Chase Preamp 9kHz - 2 GHz	CPA9231A	Chase	Sept. 9, 2014	Sept. 9, 2016	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

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

Radiated Emissions – Fundamental

Purpose

The purpose of these tests 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 broadcast radio services such as television, FM radio, pagers, cellular telephones, emergency services, and so on, from unwanted interference. RF energy unintentionally emitted from the EUT, and the intentionally emitted fundamental and its harmonics, have limits as shown below.

Limit(s) and Method

The method is as defined in ANSI C63.4:2003 and as per applicable standards.

For the fundamental and harmonics, the limits are as defined in FCC Part 15, Section 15.209 (at 3m):

Fundamental frequency	Field strength limits	Field strength limit of fundamental
0.009-0.490 MHz[3,4]	2400/F(kHz) µV/m at 300m	At 125 kHz 105.66 dBµV/m at 3m
1.705-30.0 MHz[4]	30 µV/m at 30m	At 13.56 MHz 69.54 dBµV/m at 3m

For other spurious emissions, the limits are as defined in FCC Part 15, Section 15.209:
0.490 MHz – 1.705 MHz, 24000/F(kHz) uV/m[4] at 30 m
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 (46.4 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

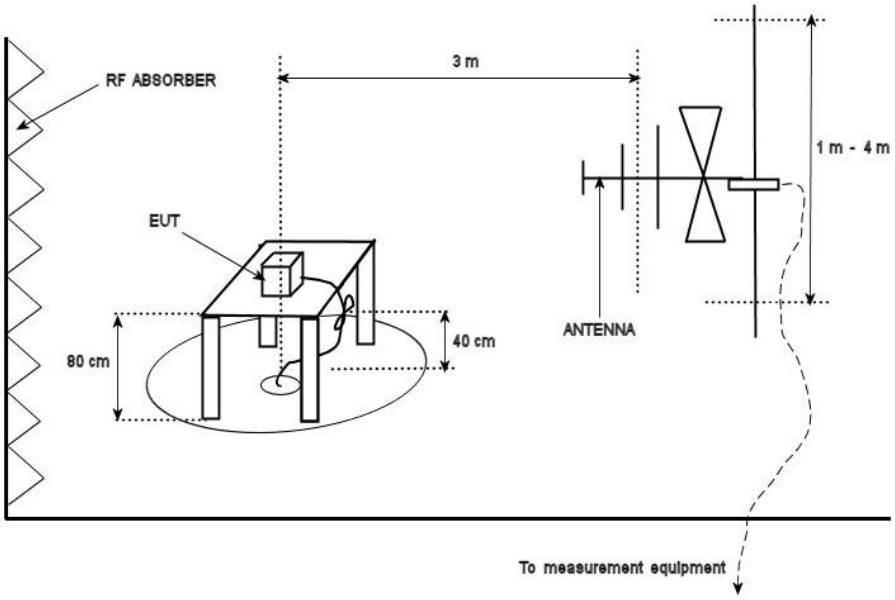
Peak field strengths are limited to be at most 20 dB above the average limits as defined above at the corresponding frequencies.

[1]Limit is with 120 kHz measurement bandwidth and a using a Quasi Peak detector.
[2]Limit is with 1 MHz measurement bandwidth and using an Average detector. A peak limit of 20 dB higher additionally applies.

[3]In the frequency bands 9 – 90 kHz, and 110 – 490 kHz, limit is defined using an Average detector. A peak limit of 20 dB higher additionally applies. Otherwise it is a using a Quasi Peak detector.

[4]In the frequency bands 9 – 150 kHz, and 150 kHz – 30 MHz, limit is defined with a 200 Hz and 9 kHz measurement bandwidths respectively.

Typical Radiated Emissions Setup



Measurement Uncertainty

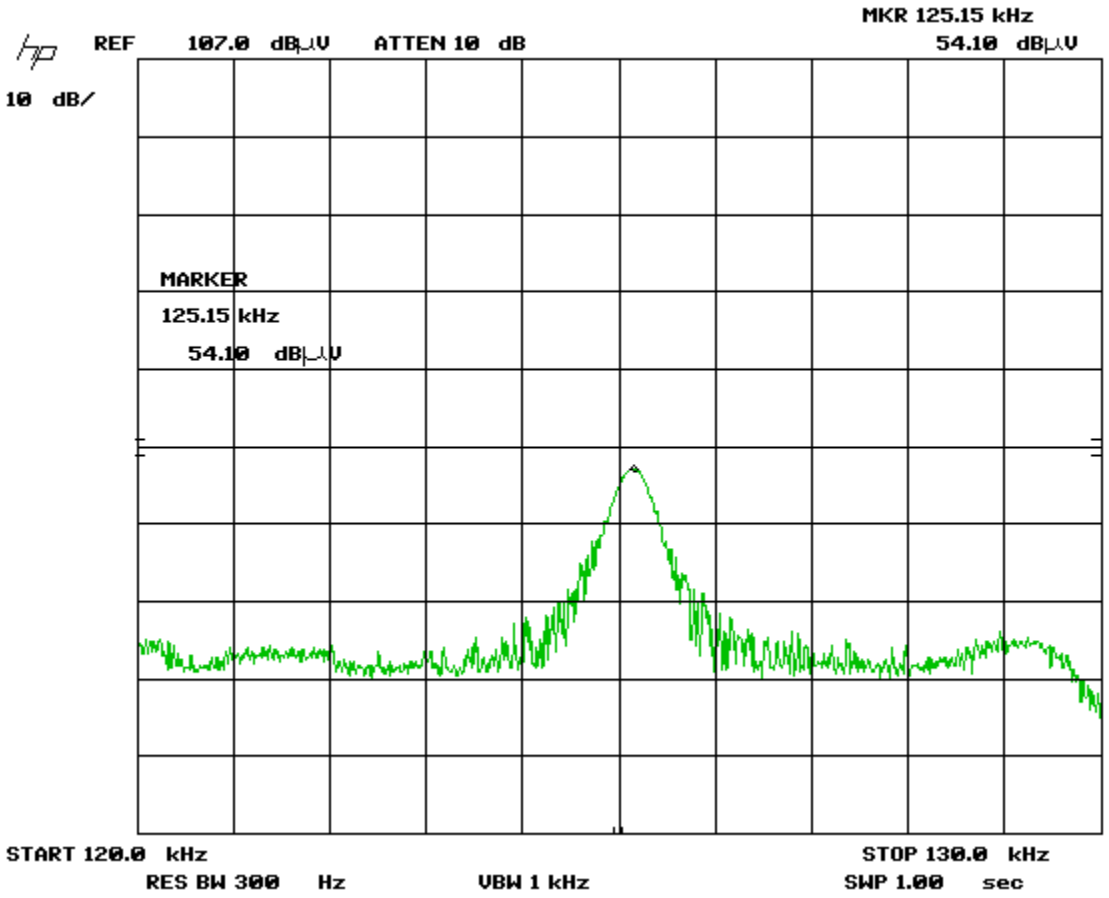
The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is +/-4.4 dB with a 'k=2' coverage factor and a 95% confidence level.

Preliminary Graphs

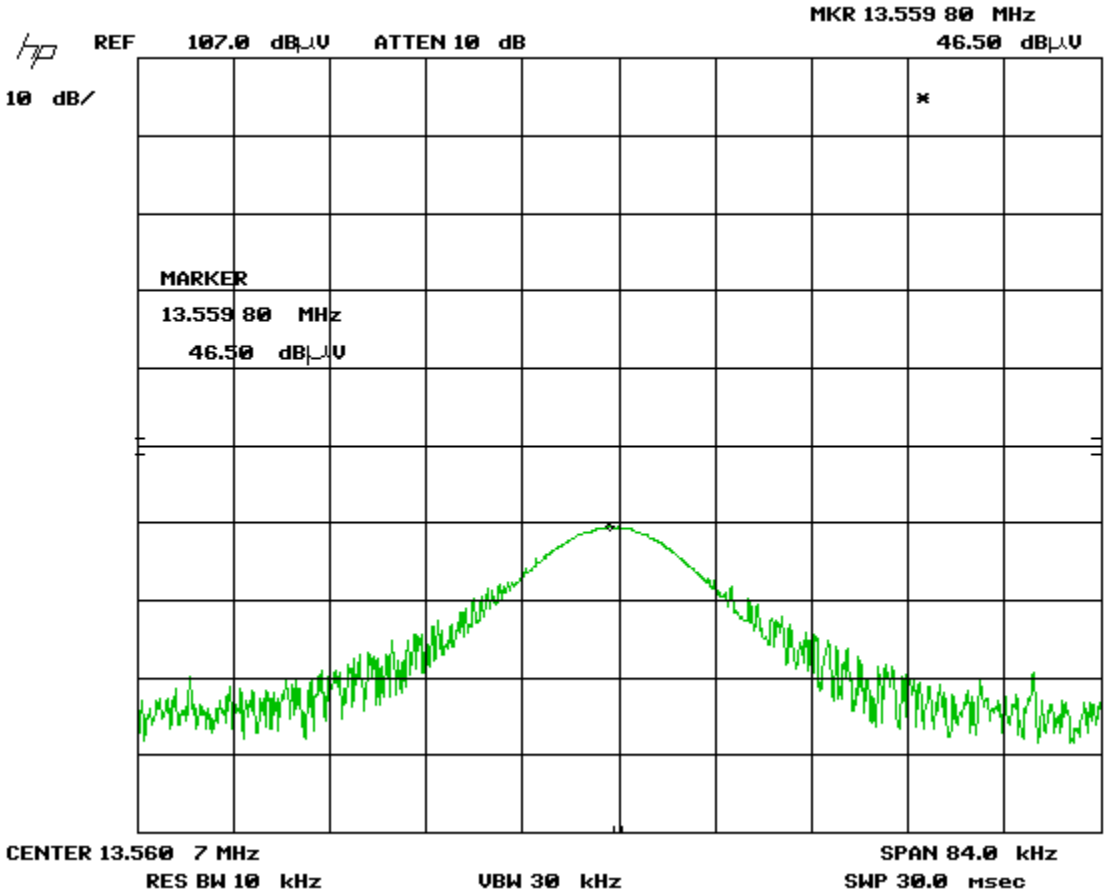
The graphs shown below are peak scans for graphical illustration only. For final measurements with the appropriate detector, please refer to the final measurement table where applicable. The graph shown below is a maximized peak measurement graph, measured with a resolution bandwidth greater than or equal to, 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 at least the 10th harmonic.

Peak Emissions Plot
125 kHz



Peak Emissions Plot
13.56 MHz



Final Measurements

Radiated Emissions - 15.209 - Table 4

Test Frequency (MHz)	Detection mode	Raw signal dB(µA)	dBuA to dBuV conversion factor	Antenna factor dB	Cable loss dB + Preselecor	Chase Pre-Amp Gain dB	Received signal dB(µV/m)	Emission limit dB(µV/m)	Margin dB(µV)	Result
0.125	Peak	54.1	51.5	3.6	0.1	30.2	79.1	105.6	26.5	Pass
13.56	Peak	46.5	51.5	-17.2	0.3	30.0	51.1	69.5	18.4	Pass

See *Radiated Emissions – Spurious* section in this report for spurious emissions test results.

Peak emissions meet the general emission limit requirements.

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	85650A	HP	Jan. 23, 2013	Jan. 23, 2015	GEMC 170
Quasi-Peak Detector	8566B	HP	Jan. 22, 2013	Jan. 22, 2015	GEMC 169
Loop Antenna 30Hz – 1MHz	EM 6871	Electro-Metrics	Feb. 5, 2013	Feb. 5, 2015	GEMC 70
Loop Antenna 100kHz – 30MHz	EM 6872	Electro-Metrics	Feb. 5, 2013	Feb. 5, 2015	GEMC 71
Chase Preamp 9kHz - 2 GHz	CPA9231A	Chase	Sept. 9, 2014	Sept. 9, 2016	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

99% Bandwidth

Purpose

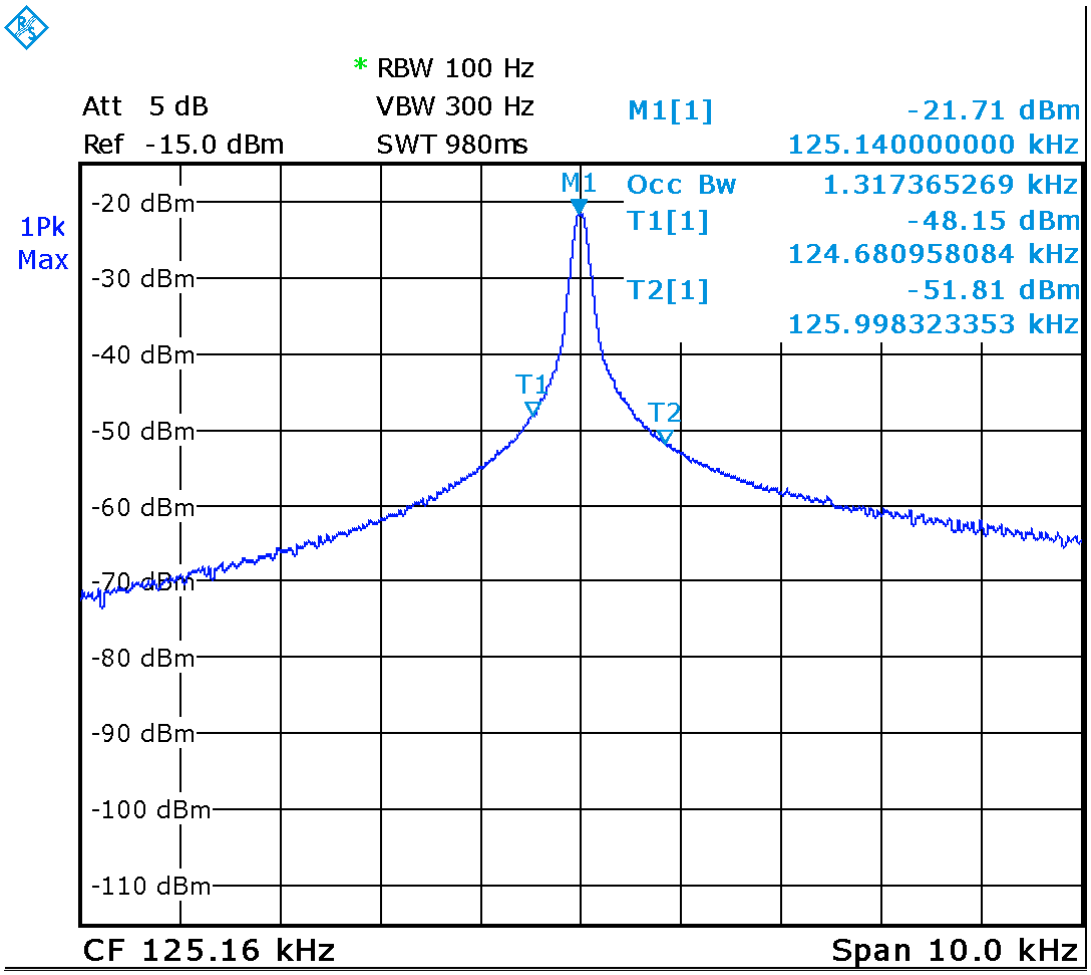
The purpose of this test is to find the 99% occupied bandwidth of the emission. This bandwidth contains 99% of the power of the transmitted spectrum.

Limit(s) and Method

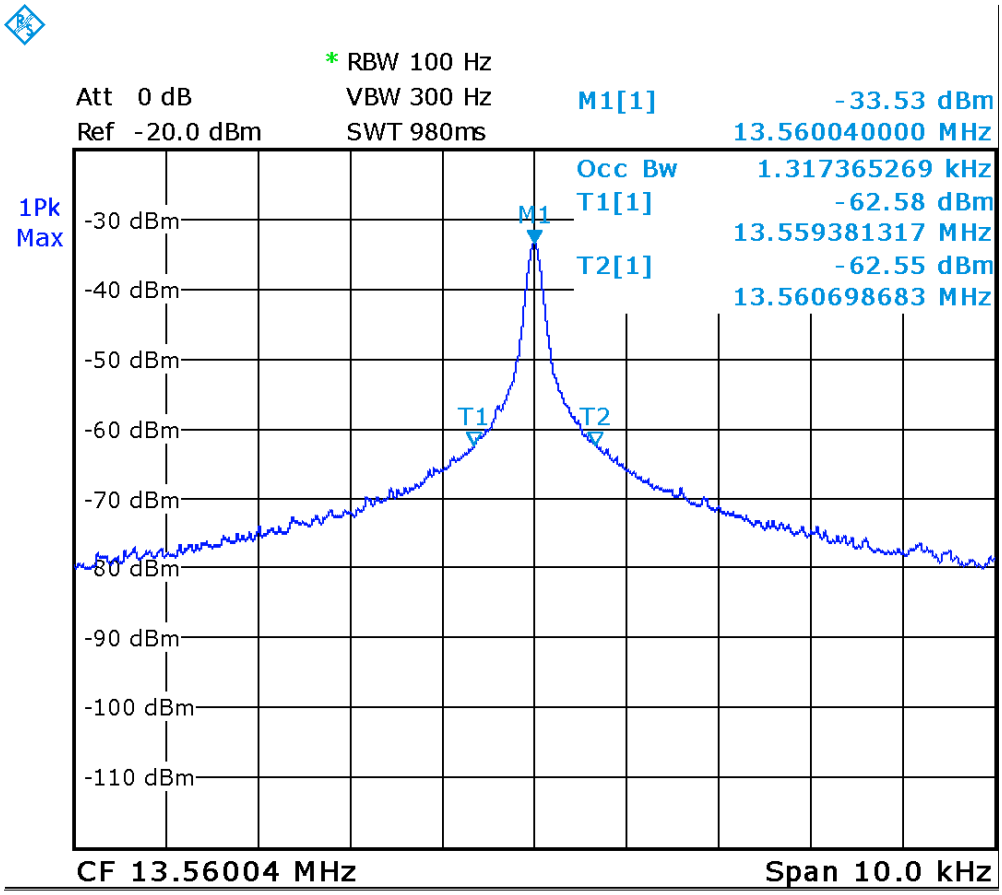
The method is as defined in RSS-Gen.
There are no applicable limits for this test. Its results are for informational purposes only.

Preliminary Graphs

99% Bandwidth for 125 kHz Transmission



99% Bandwidth for 13.56 MHz Transmission



Results

The 99% occupied bandwidth for the 125 kHz transmission is 1.32 kHz.
The 99% occupied bandwidth for the 13.56 MHz transmission is 1.32 kHz.

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	ESL6	Rohde & Schwarz	Nov. 15, 2013	Nov. 15, 2015	GMEC 160
Loop Antenna 30Hz – 1MHz	EM 6871	Electro-Metrics	Feb. 5, 2013	Feb. 5, 2015	GEMC 70
Loop Antenna 100kHz – 30MHz	EM 6872	Electro-Metrics	Feb. 5, 2013	Feb. 5, 2015	GEMC 71
Chase Preamp 9kHz - 2 GHz	CPA9231A	Chase	Sept. 9, 2014	Sept. 9, 2016	GEMC 6403

Radiated Emissions – Modularly Approved Transmitter Verification

Purpose

The purpose of this test is to verify the emissions of the modularly approved 15.247 transmitter remain within required limits while operating in the EUT with a different antenna.

Limit(s) and Method

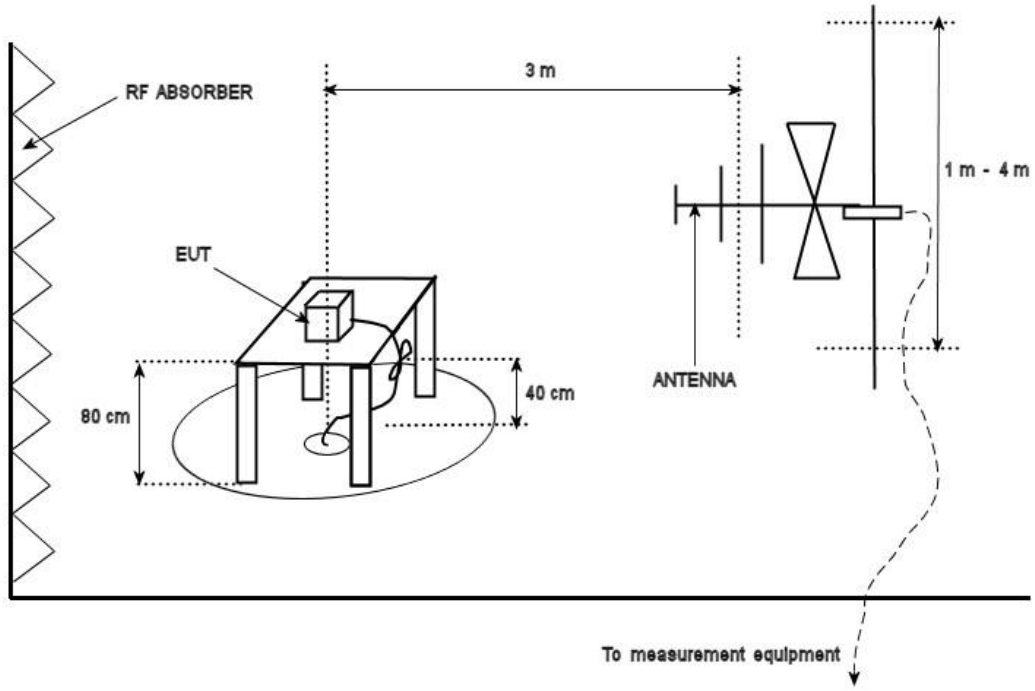
The method is as defined in ANSI C63.4:2003.
The limits are as defined in FCC Part 15, Section 15.209:

The limits, as defined in 15.247(d) for unintentional radiated emissions 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).

0.009 MHz – 0.490 MHz, 2400/F(kHz) uV/m at 300 m[1]
0.490 MHz – 1.705 MHz, 24000/F(kHz) uV/m at 30 m[1]
1.705 MHz – 30 MHz, 30 uV/m at 30 m[1]
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
Above 1000 MHz, 500 uV/m (74 dBuV/m[3]) at 3m

[1]Limit is with Quasi Peak detector with bandwidths as defined in CISPR-16-1-1.
[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.

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 or equal to, 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 the 10^{th} harmonic.

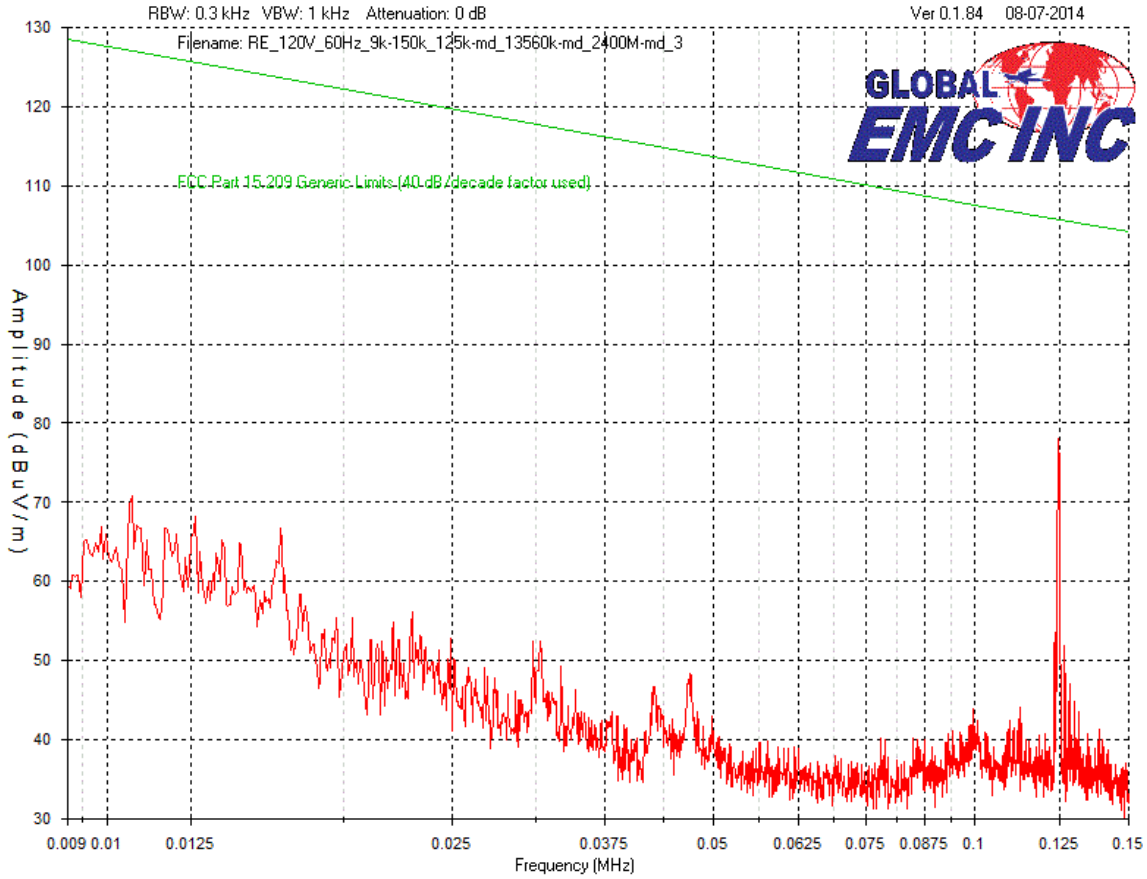
Devices scanned may be scanned at alternate test distances, and in accordance with FCC Part 15, Subpart A, Section 15.31, an extrapolation factor of 20 dB/decade was used above 30 MHz and 40 dB/decade below 30 MHz. For example for 1 meter measurements, an extrapolation factor 9.5 dB from 20 Log (1m/3m)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

The EUT was scanned with both the 15.247 and 15.209 transmitters on.

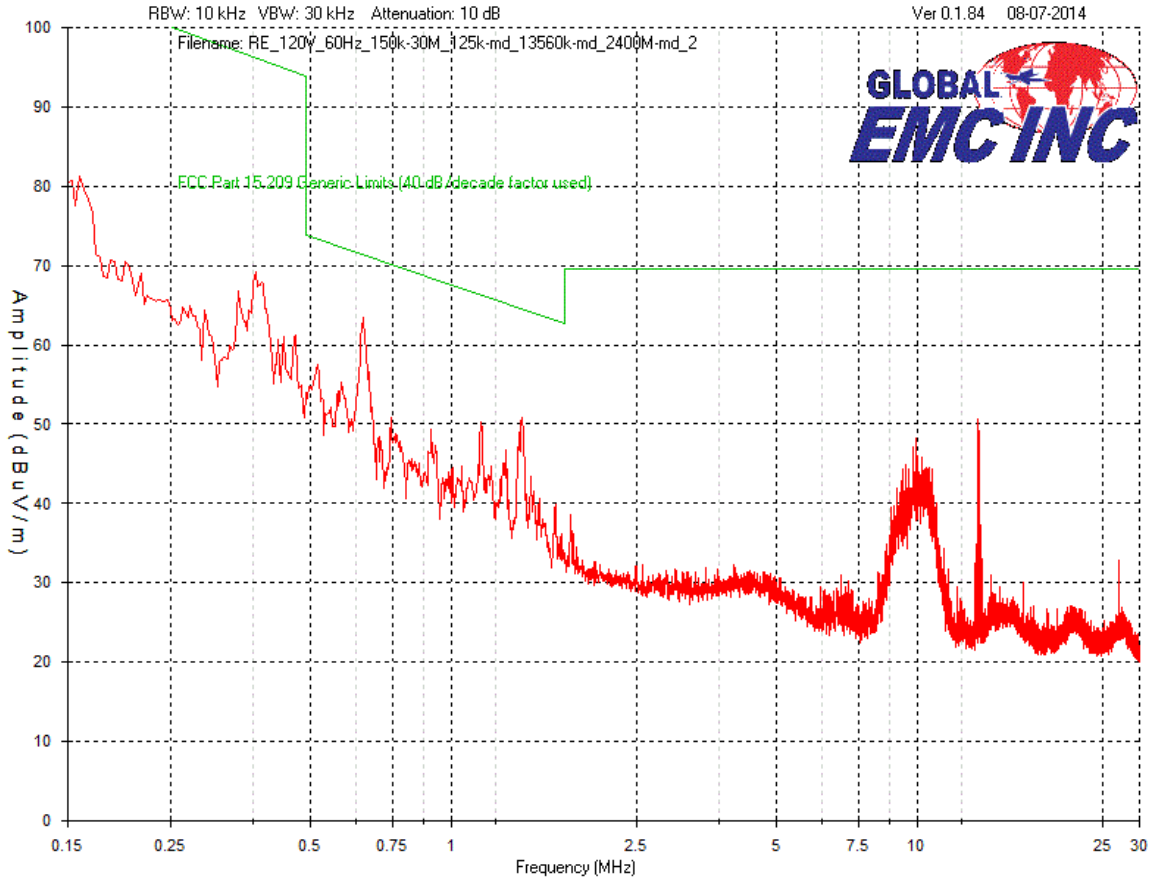
See final measurement section for all measurements.

Low, middle, and high channels were scanned in the worst case configuration. The worst case is presented.

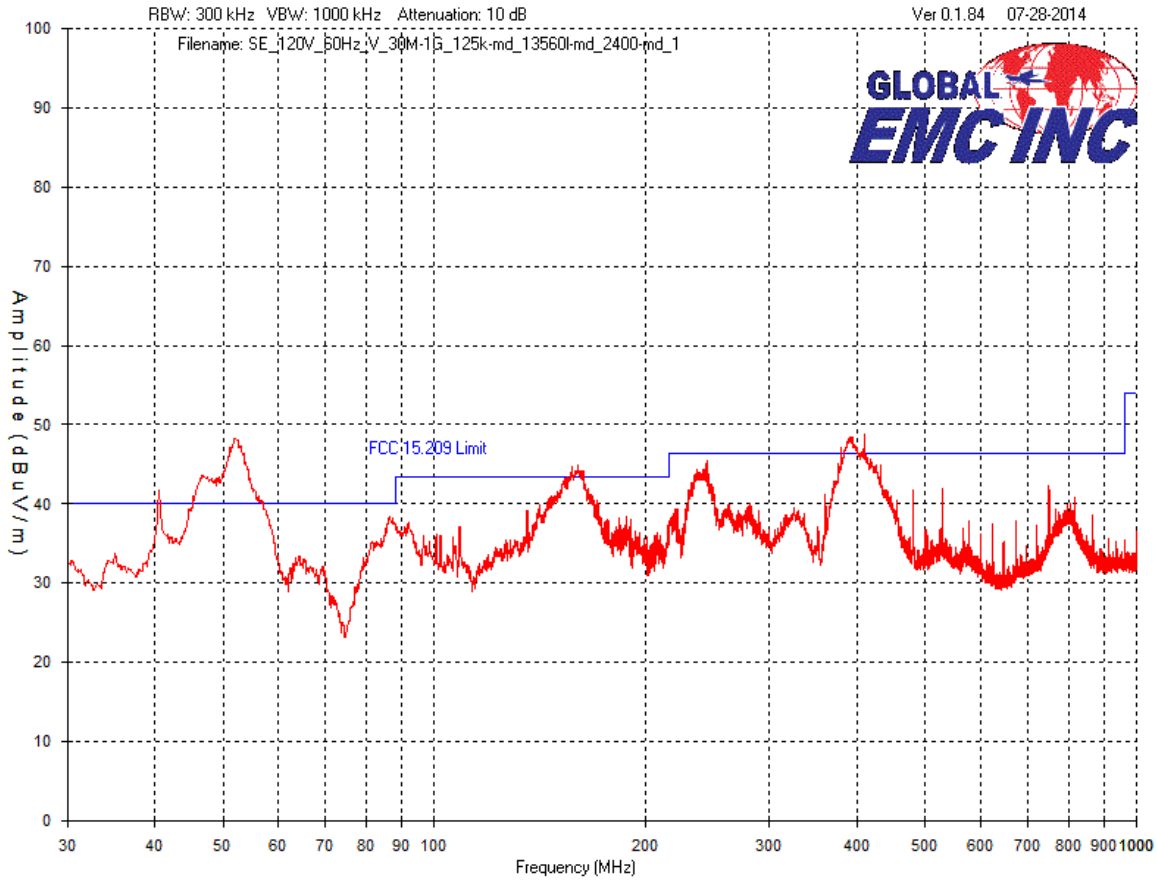
Peak Emissions Graph
9 kHz to 150 kHz



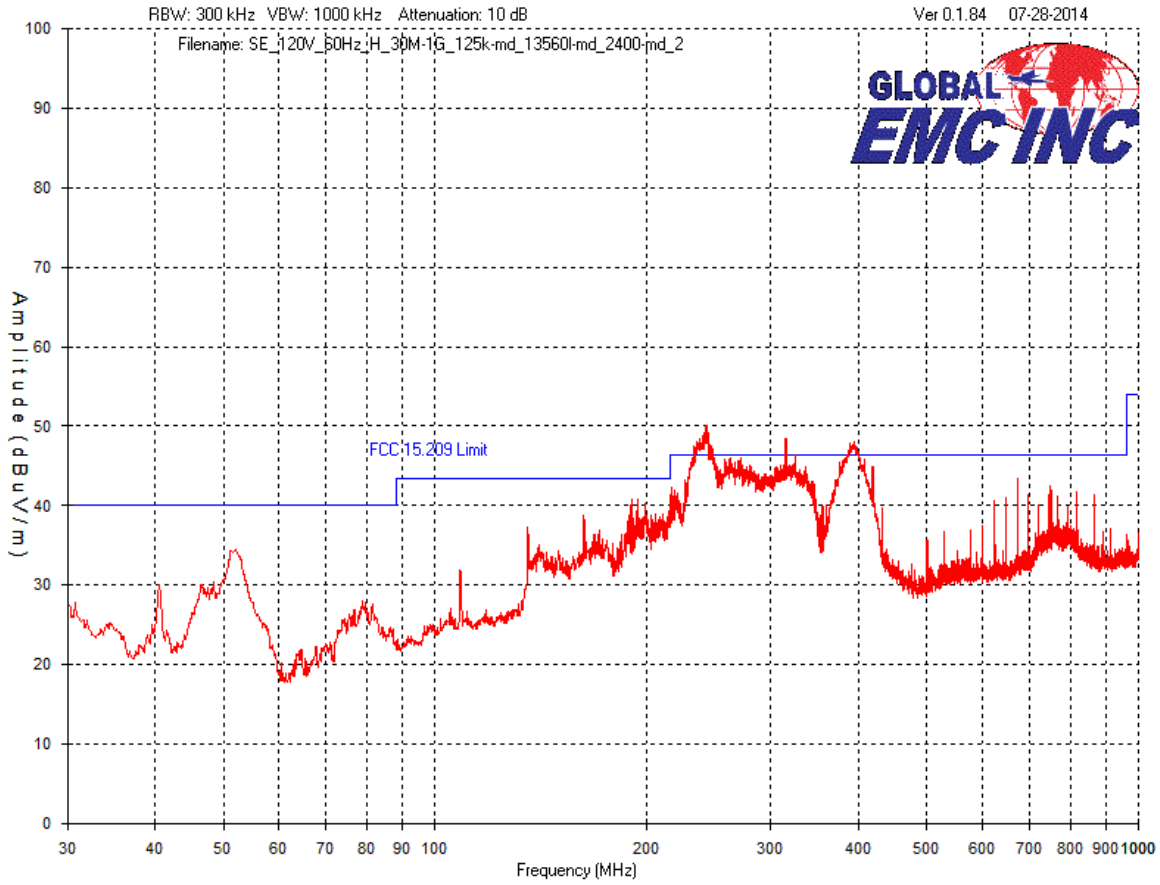
Peak Emissions Graph
150 kHz to 30 MHz



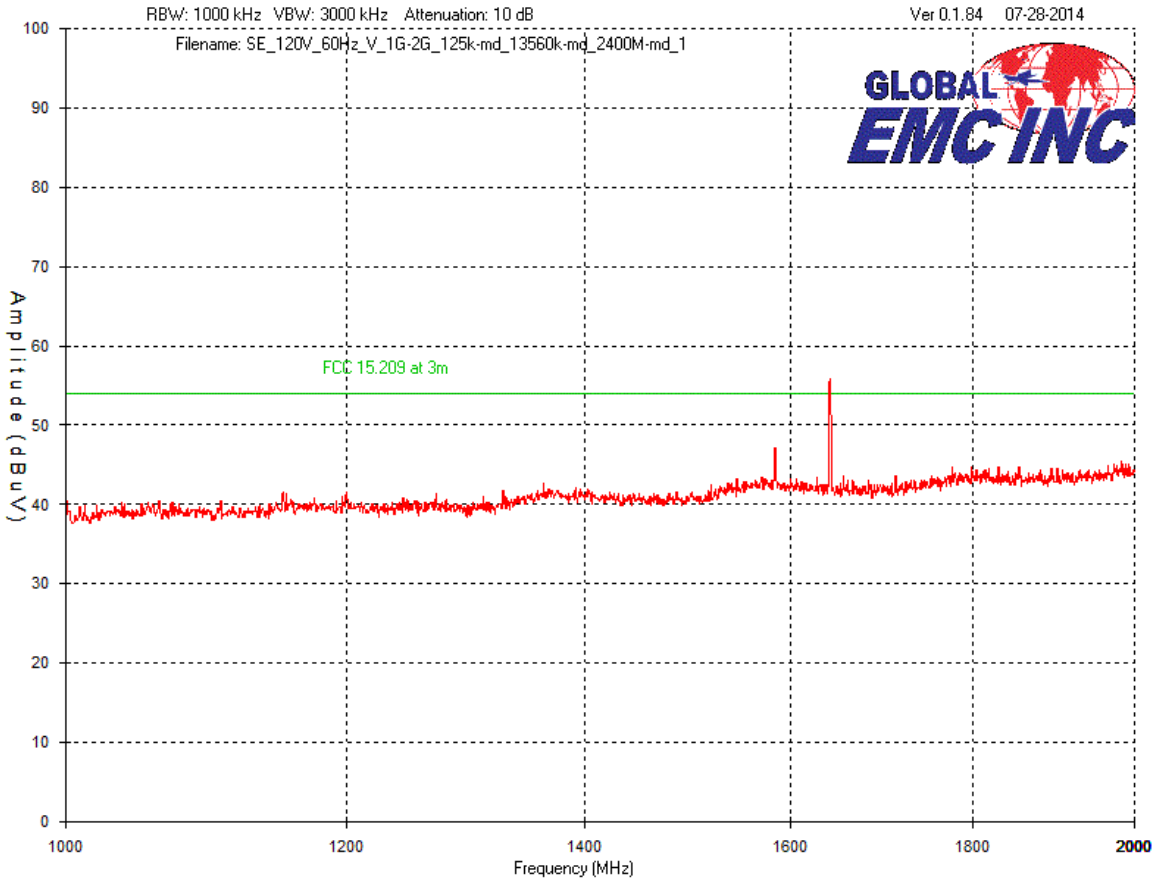
Peak Emissions Graph
Vertical Antenna Polarity
30 MHz to 1 GHz



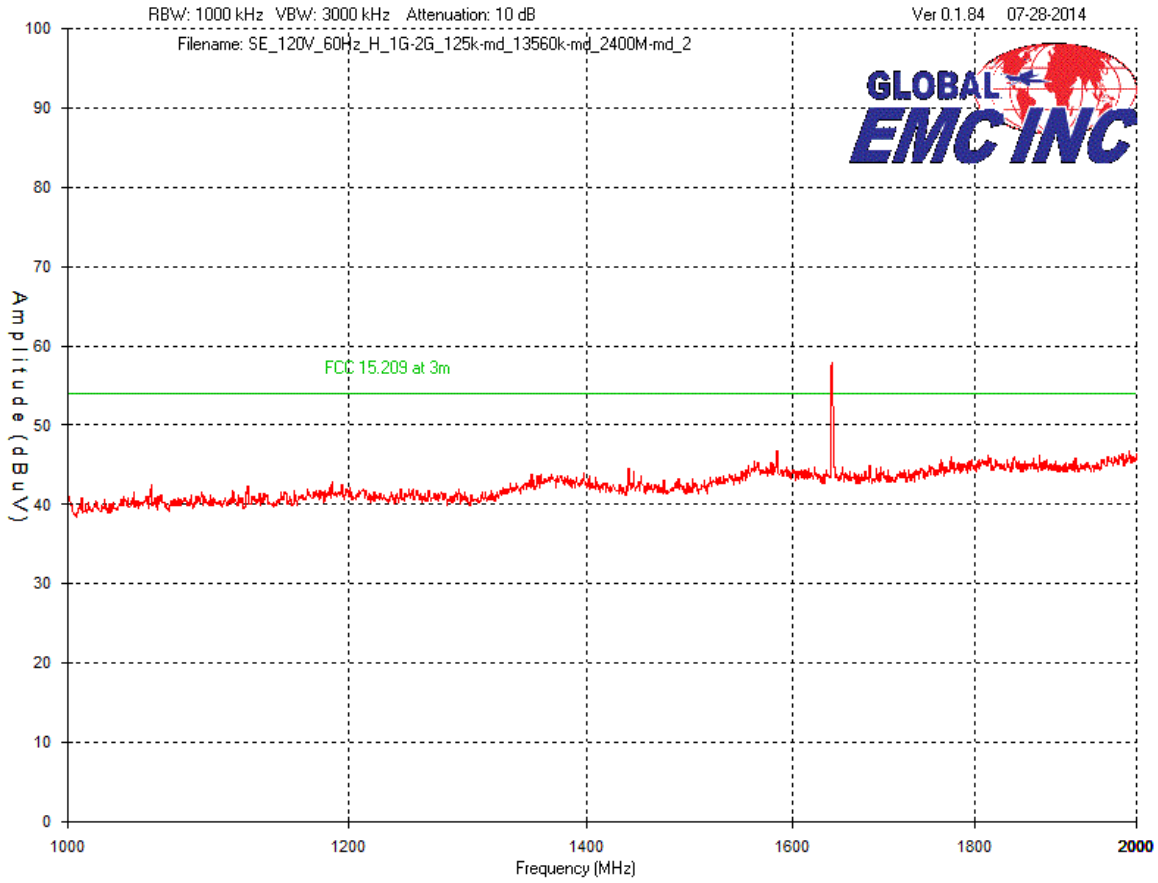
Peak Emissions Graph
Horizontal Antenna Polarity
30 MHz to 1 GHz



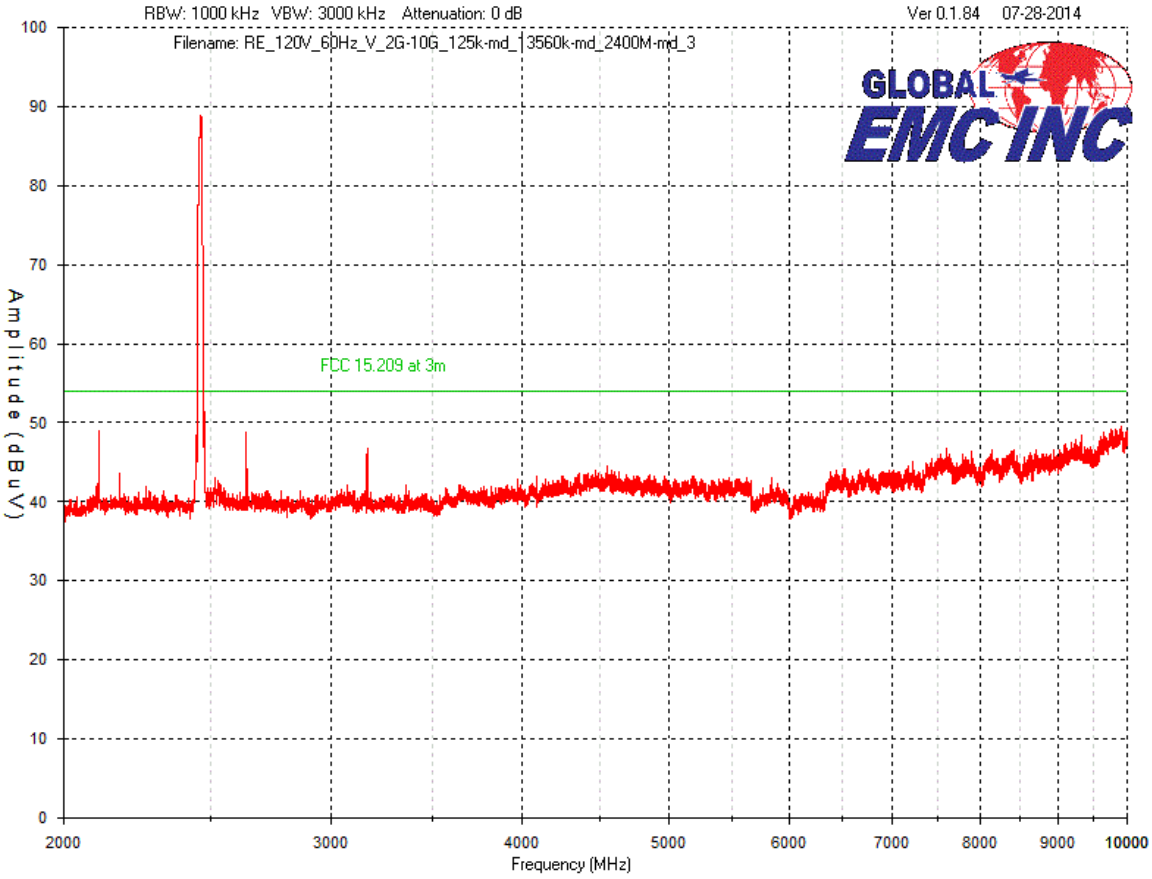
Peak Emissions Graph
Vertical Antenna Polarity
1 GHz to 2 GHz



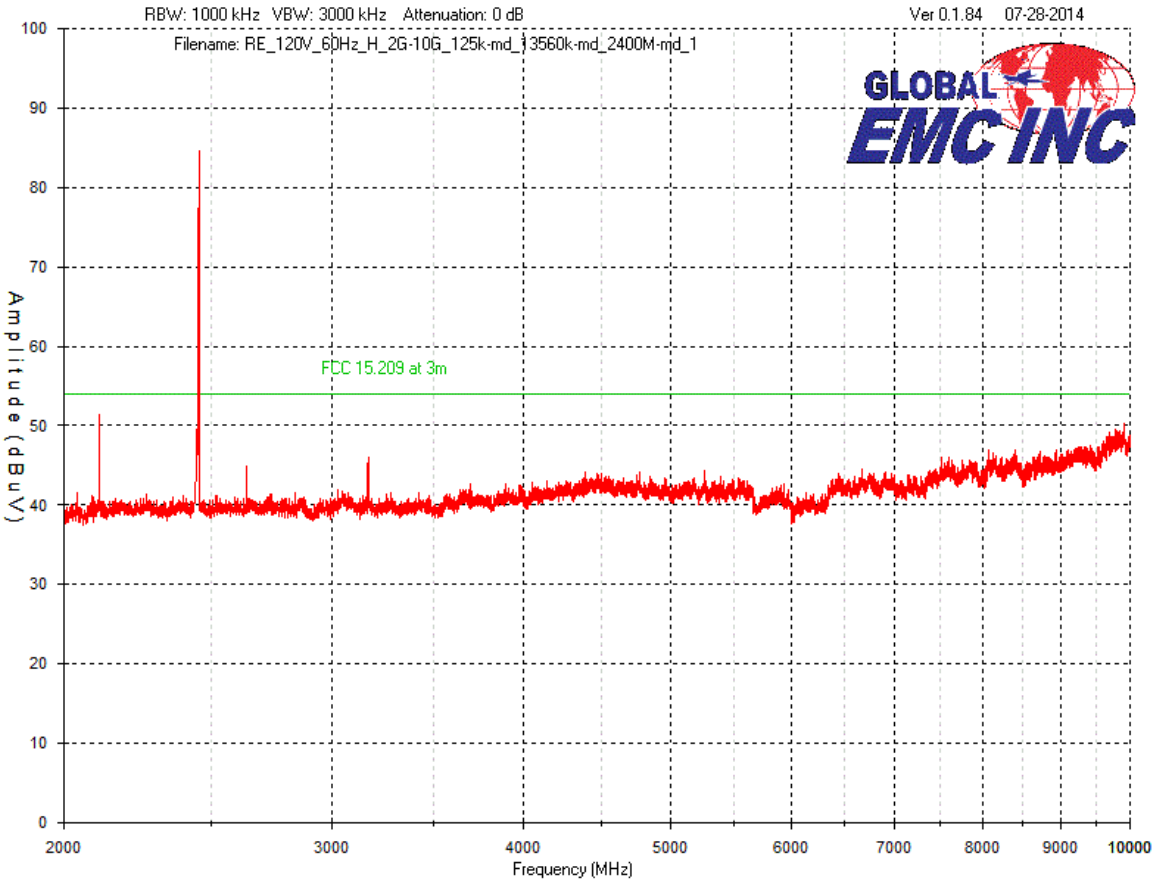
Peak Emissions Graph
Horizontal Antenna Polarity
1 GHz to 2 GHz



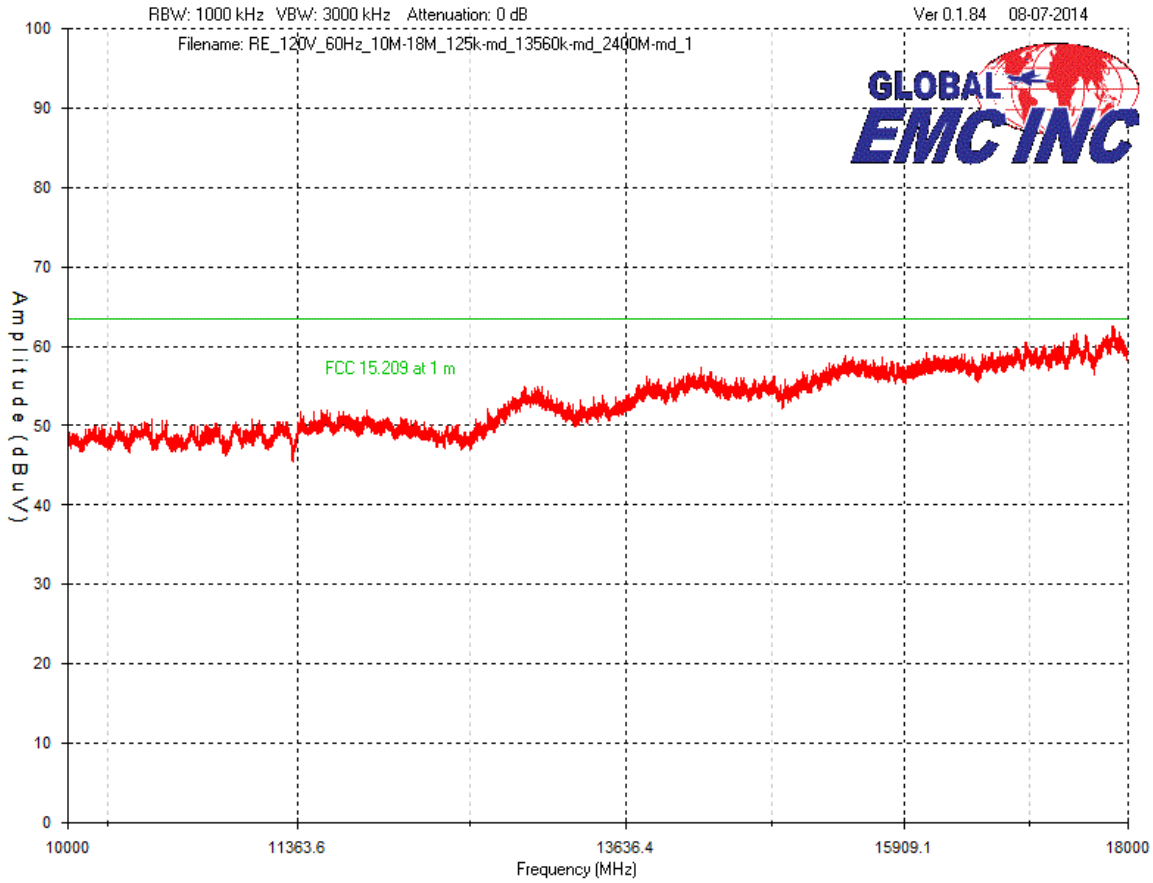
Peak Emissions Graph
Vertical Antenna Polarity
2 GHz to 10 GHz



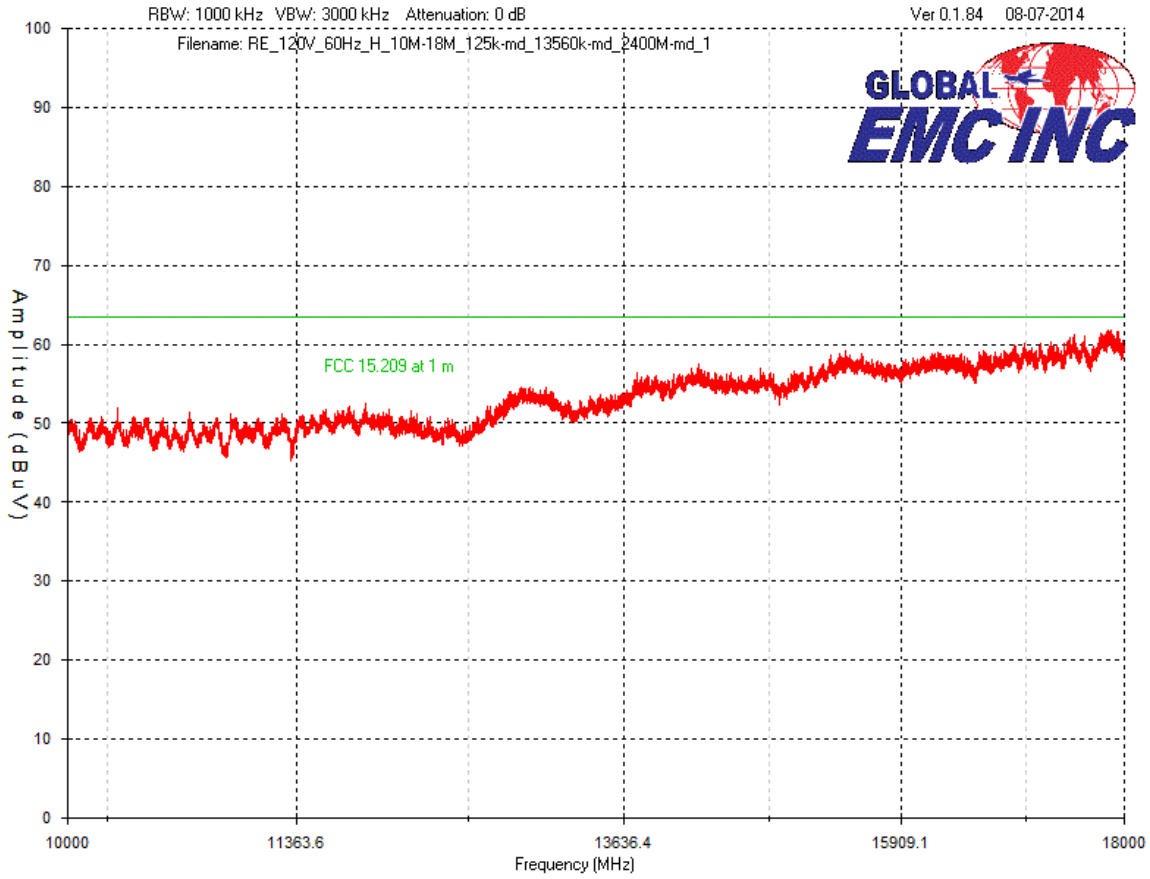
Peak Emissions Graph
Horizontal Antenna Polarity
2 GHz to 10 GHz



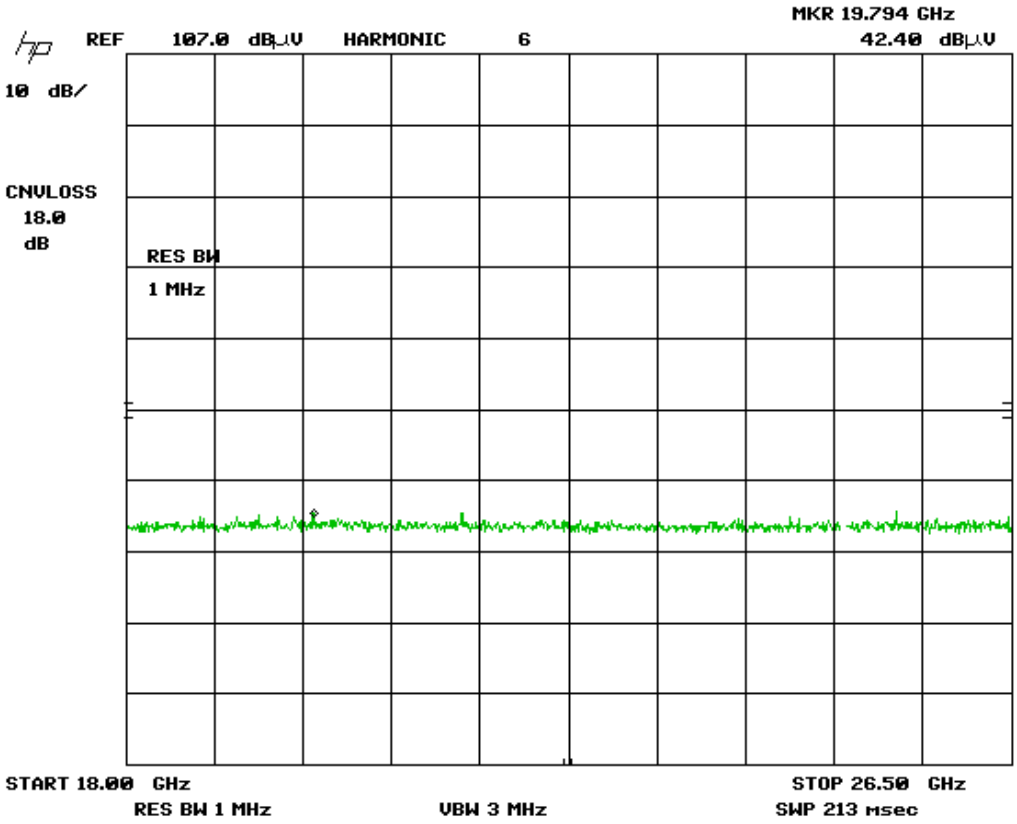
Peak Emissions Graph
Vertical Antenna Polarity
10 GHz to 18 GHz



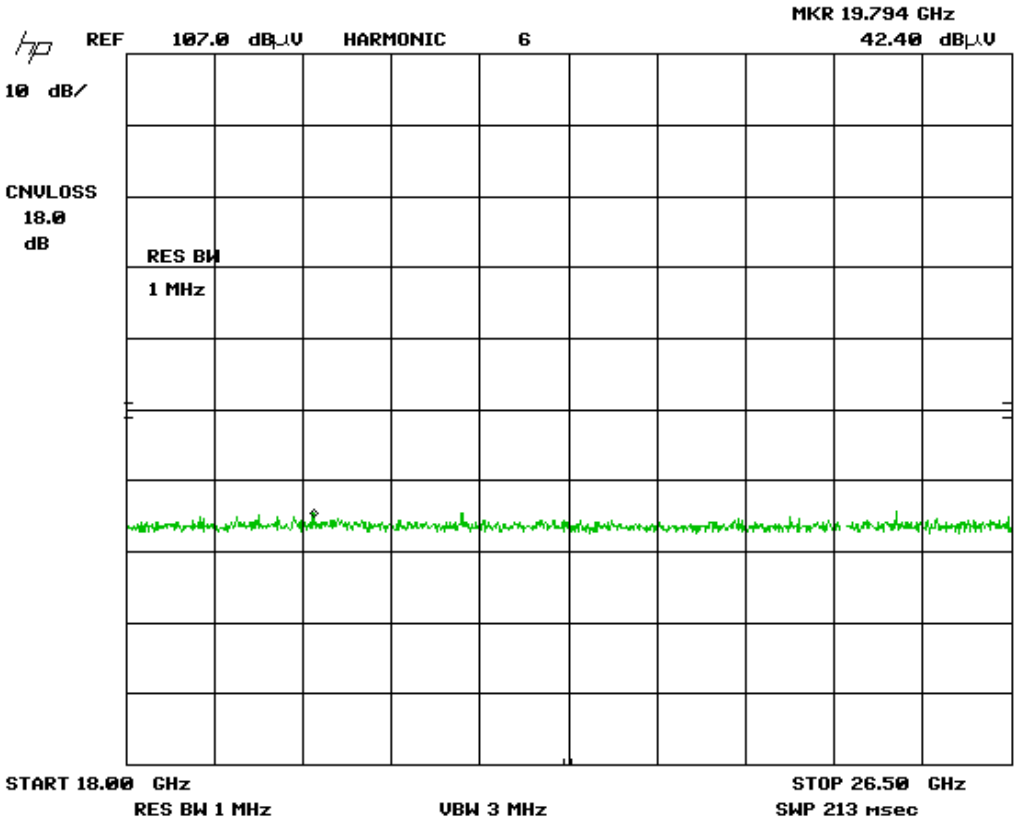
Peak Emissions Graph
Horizontal Antenna Polarity
10 GHz to 18 GHz



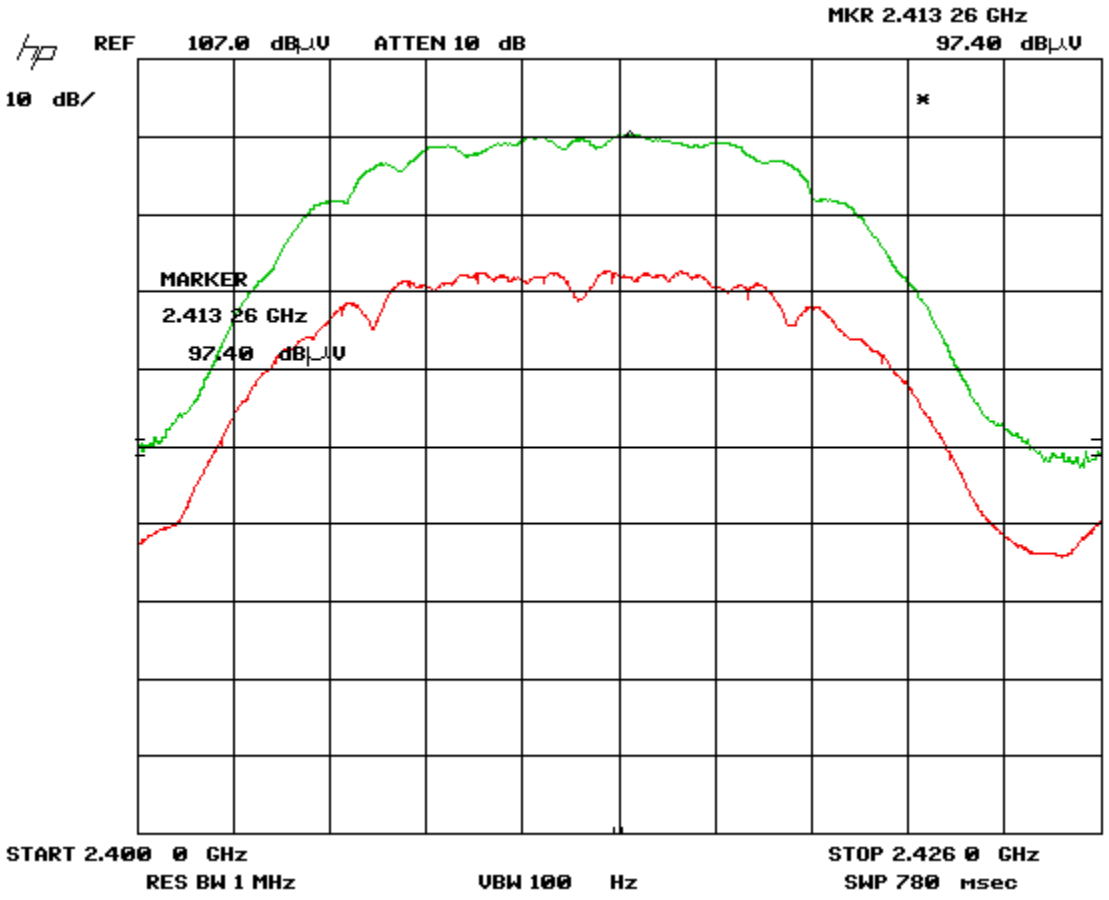
Peak Emissions Graph
Vertical Antenna Polarity
18 GHz to 26.5 GHz



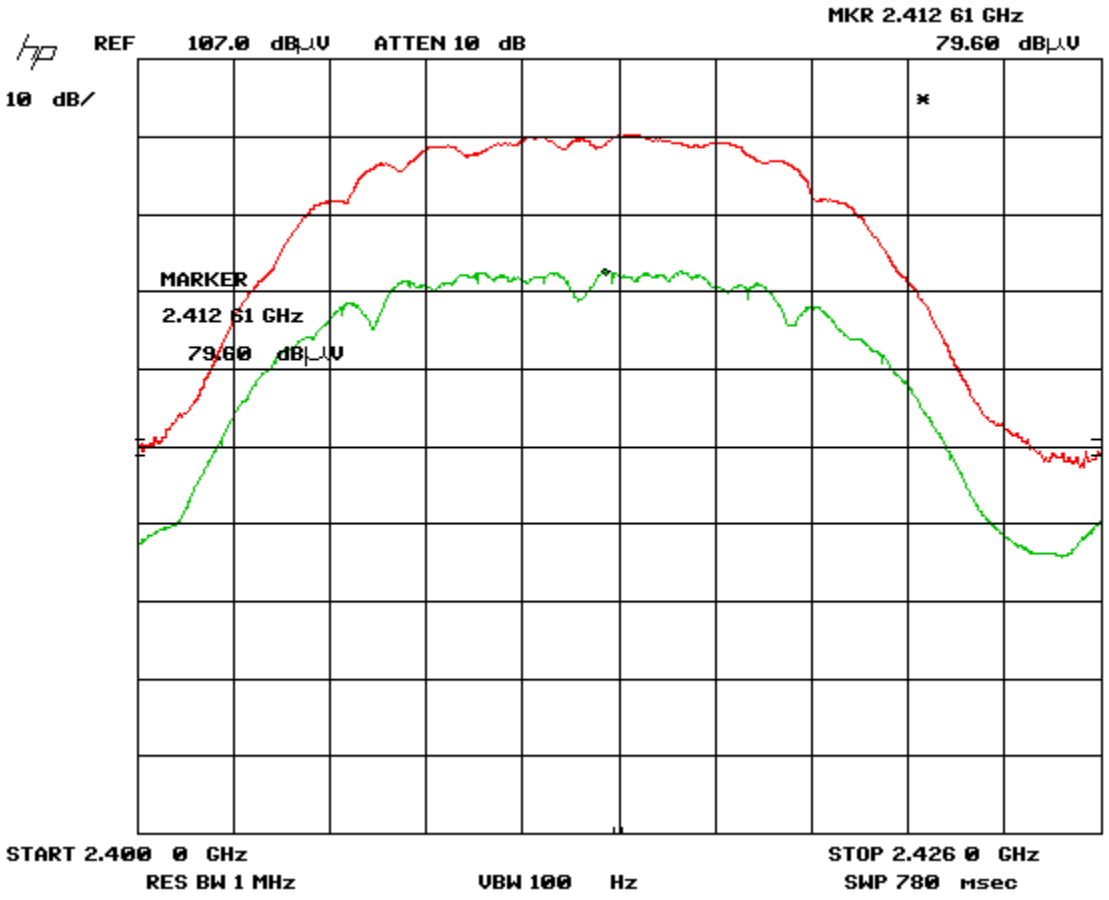
Peak Emissions Graph
Horizontal Antenna Polarity
18 GHz to 26.5 GHz



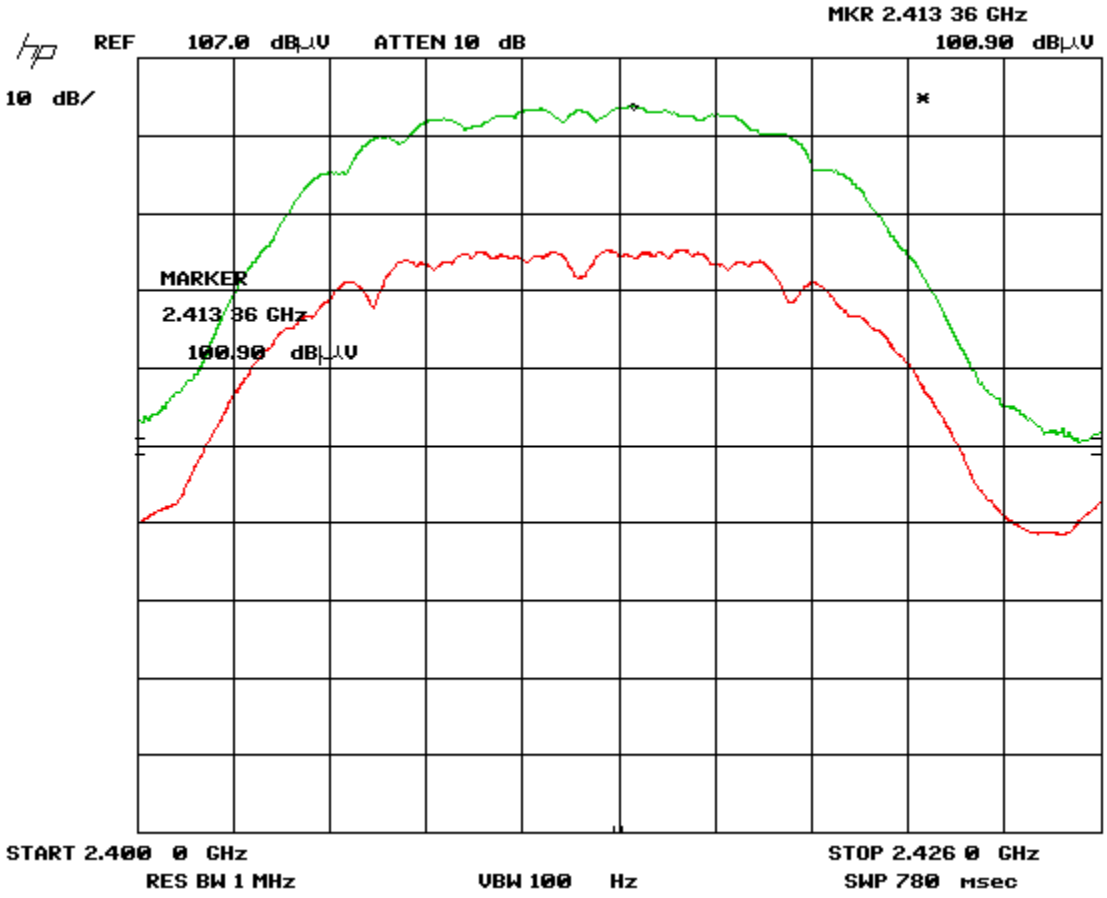
Peak Emissions Graph, Horizontal Antenna Polarity
Peak & Average Plot 1
EUT Output: Low Channe1



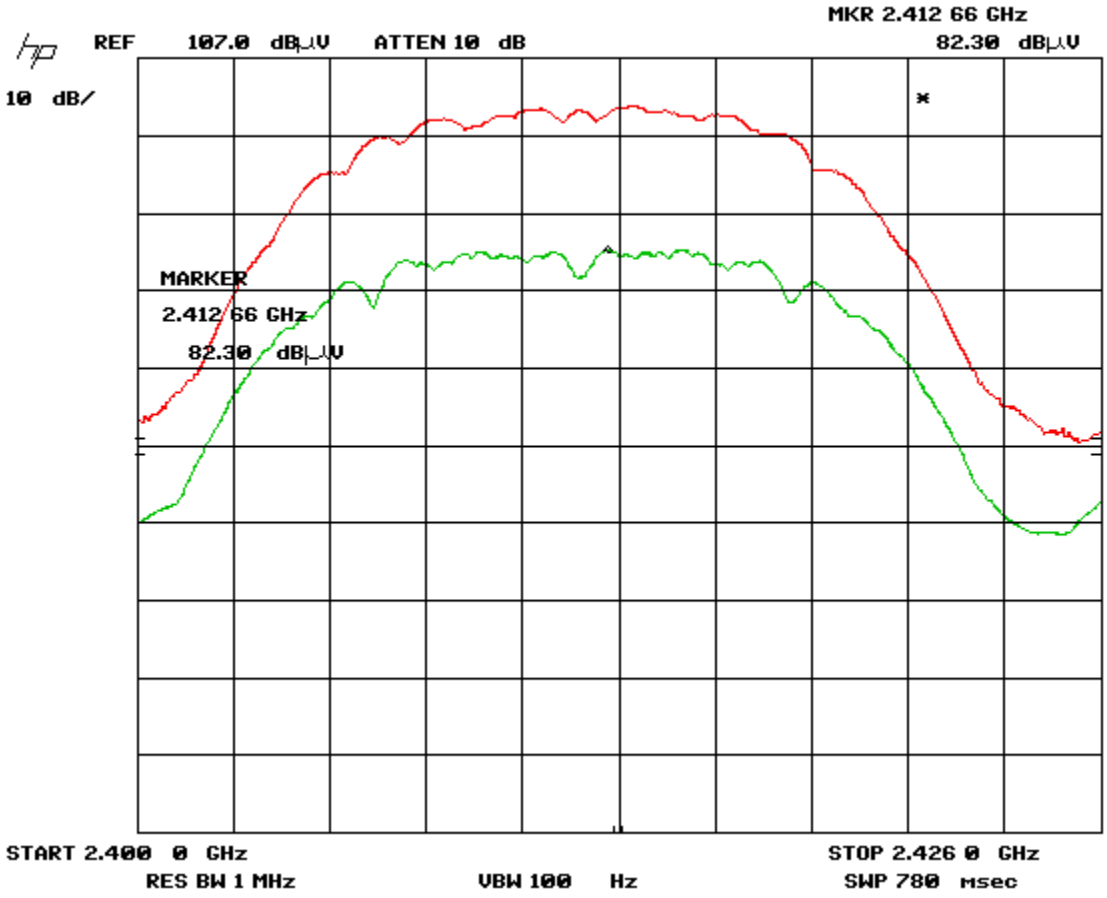
Peak Emissions Graph, Horizontal Antenna Polarity
Peak & Average Plot 2
EUT Output: Low Channe1



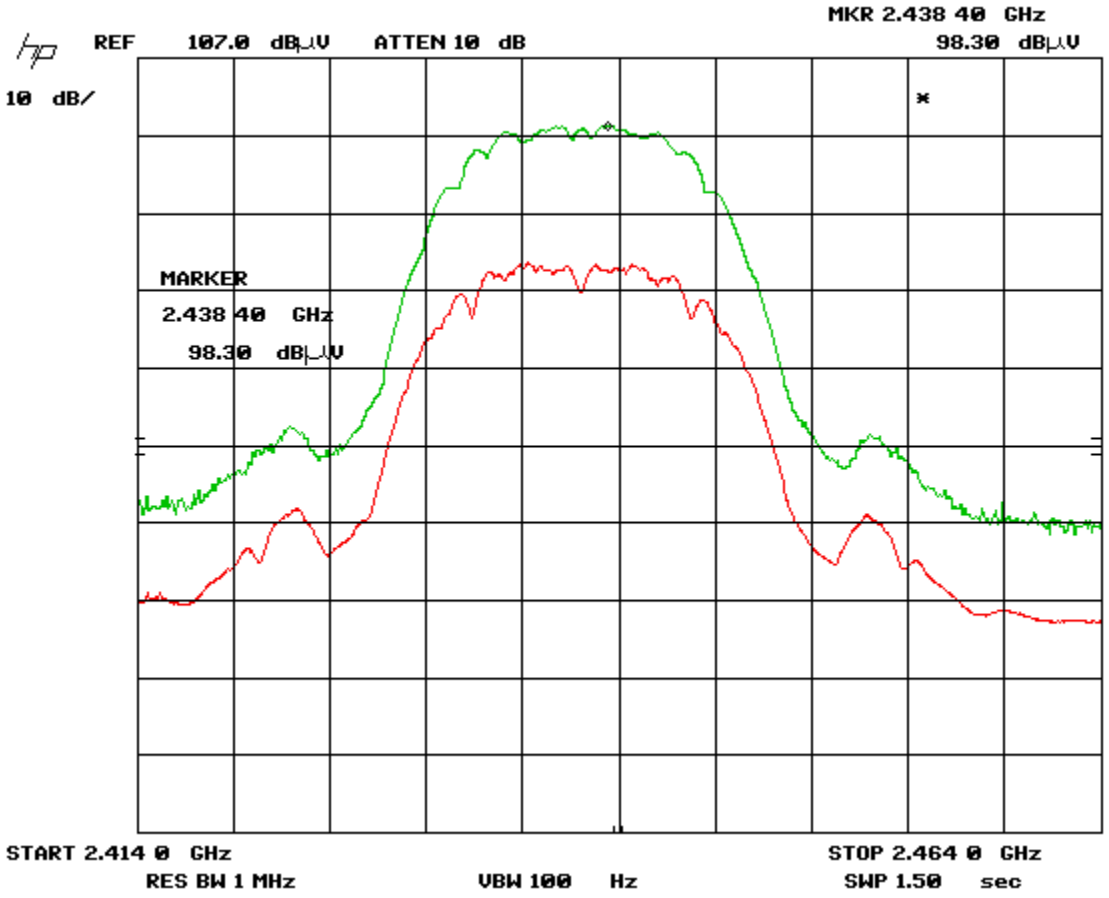
Peak Emissions Graph, Vertical Antenna Polarity
Peak & Average Plot 1
EUT Output: Low Channe1



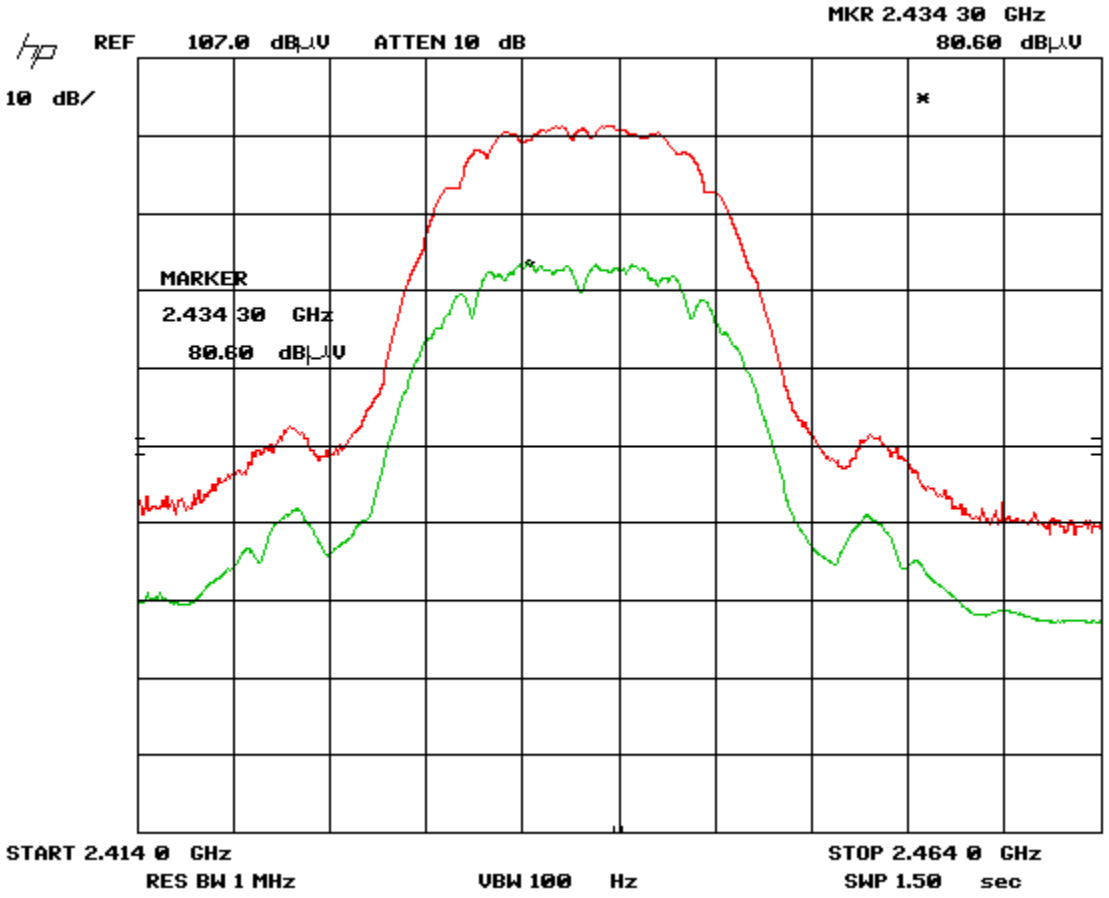
Peak Emissions Graph, Vertical Antenna Polarity
Peak & Average Plot 2
EUT Output: Low Channe1



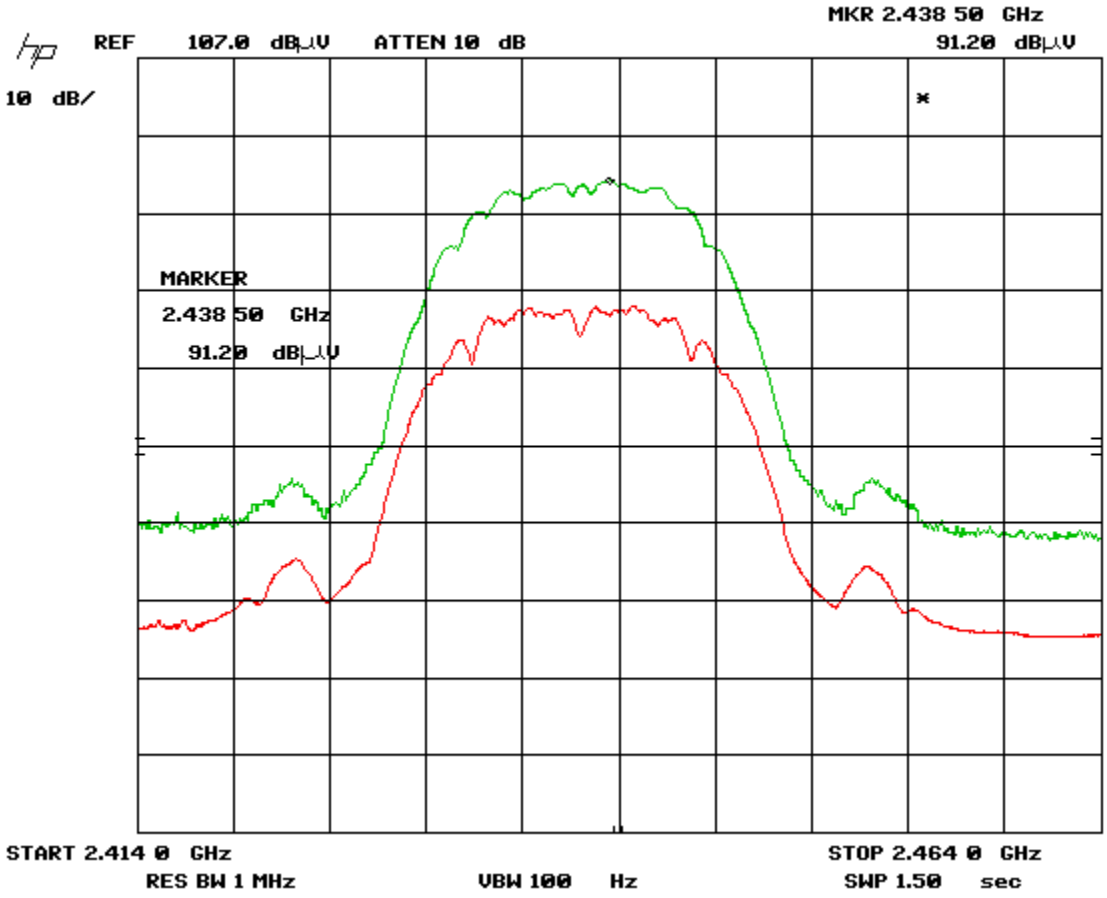
Peak Emissions Graph, Vertical Antenna Polarity
Peak & Average Plot 1
EUT Output: Middle Channe1



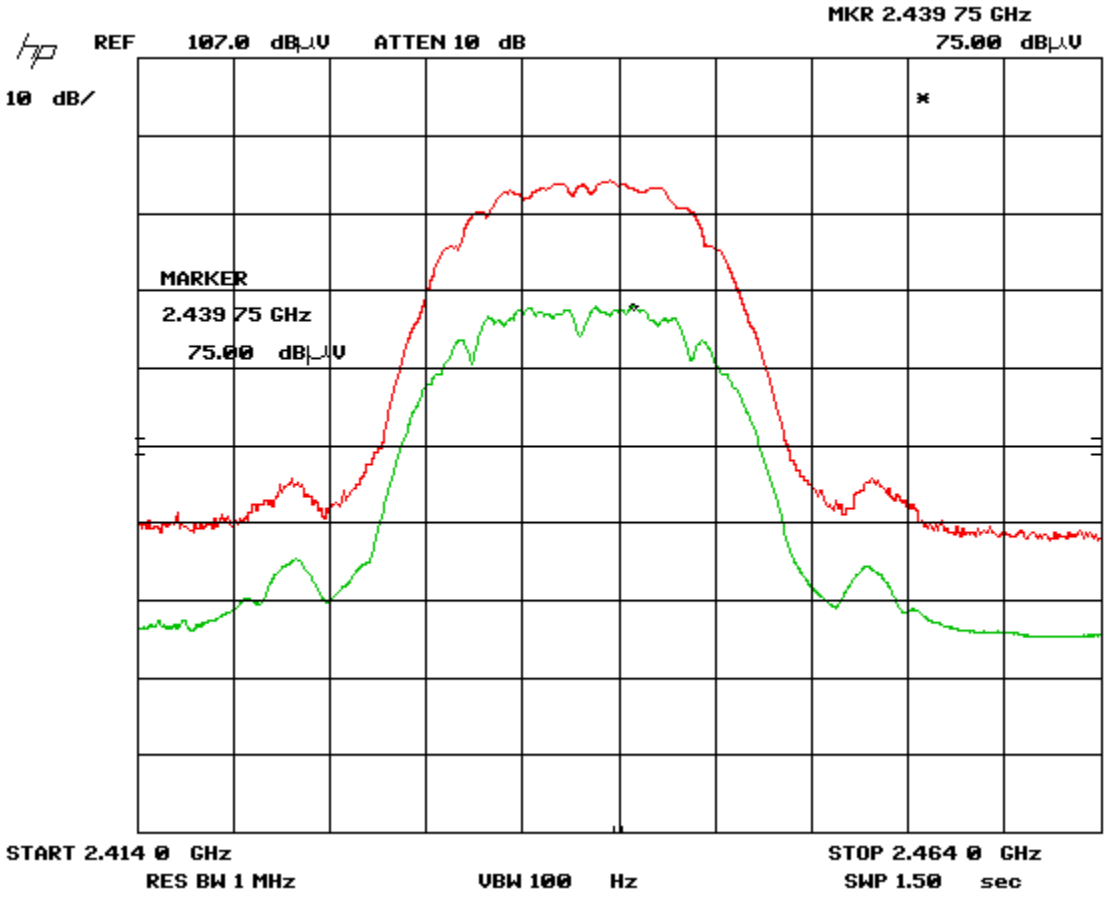
Peak Emissions Graph, Vertical Antenna Polarity
Peak & Average Plot 2
EUT Output: Middle Channe1



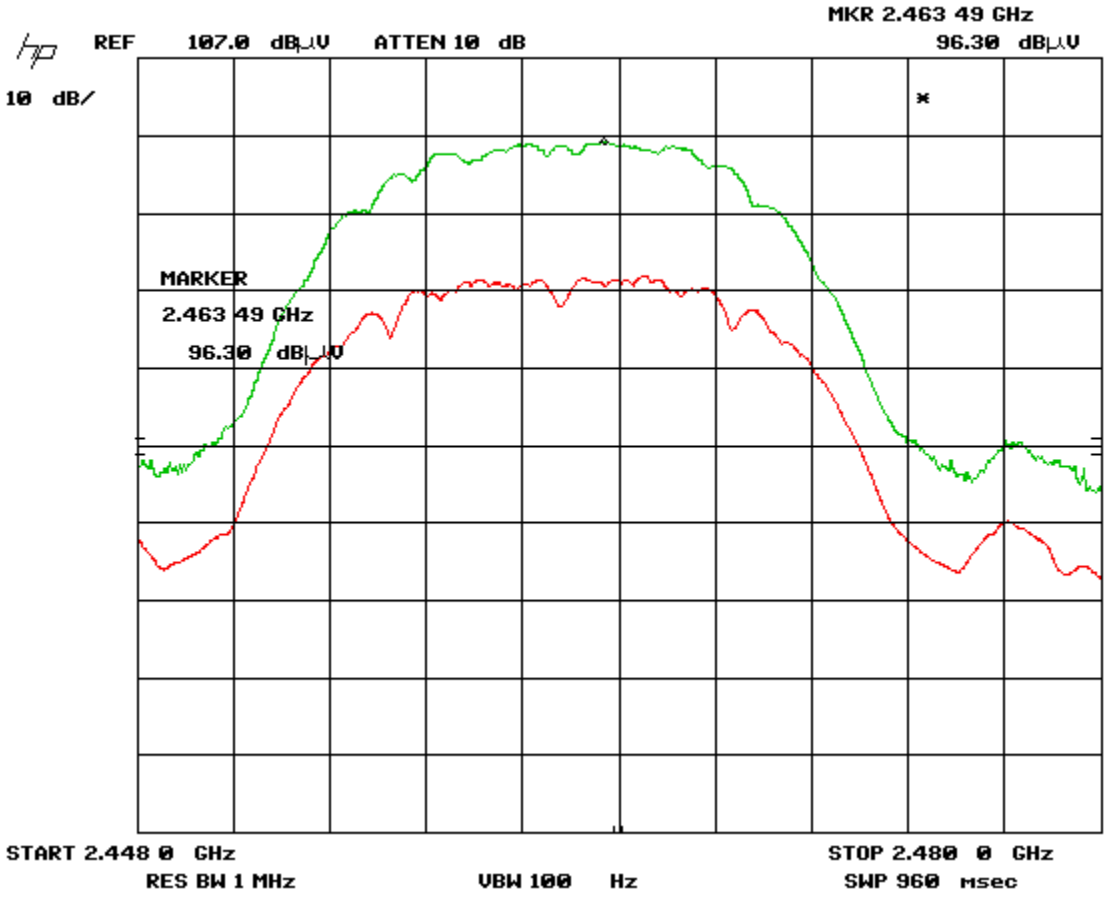
Peak Emissions Graph, Horizontal Antenna Polarity
Peak & Average Plot 1
EUT Output: Middle Channe1



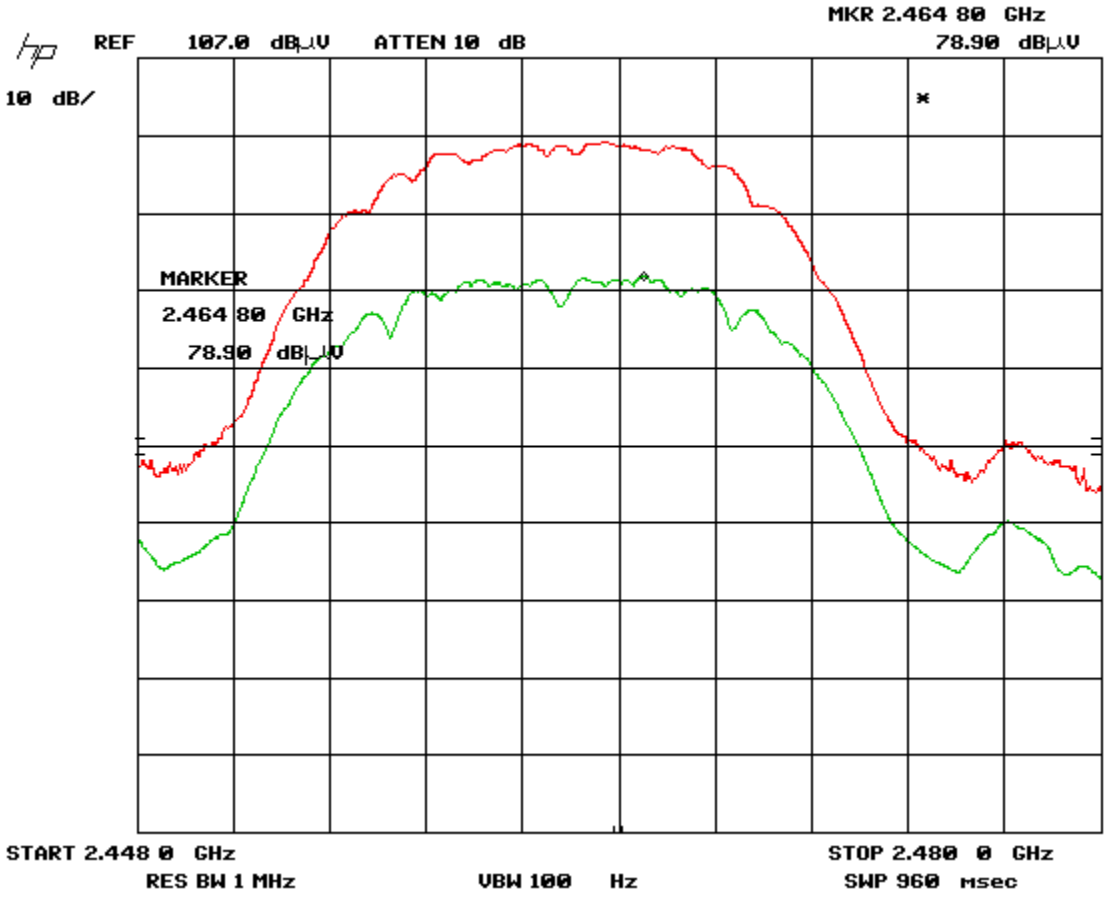
Peak Emissions Graph, Horizontal Antenna Polarity
Peak & Average Plot 2
EUT Output: Middle Channe1



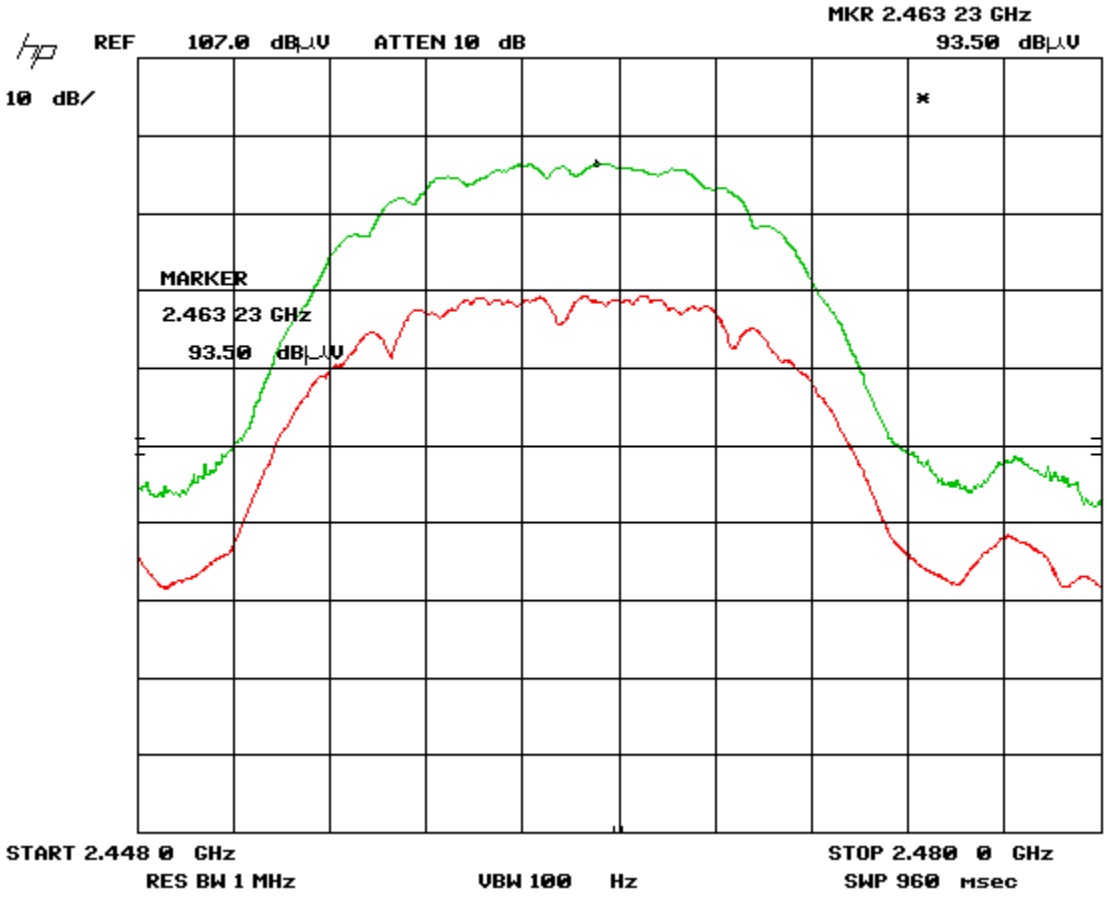
Peak Emissions Graph, Vertical Antenna Polarity
Peak & Average Plot 1
EUT Output: High Channe1



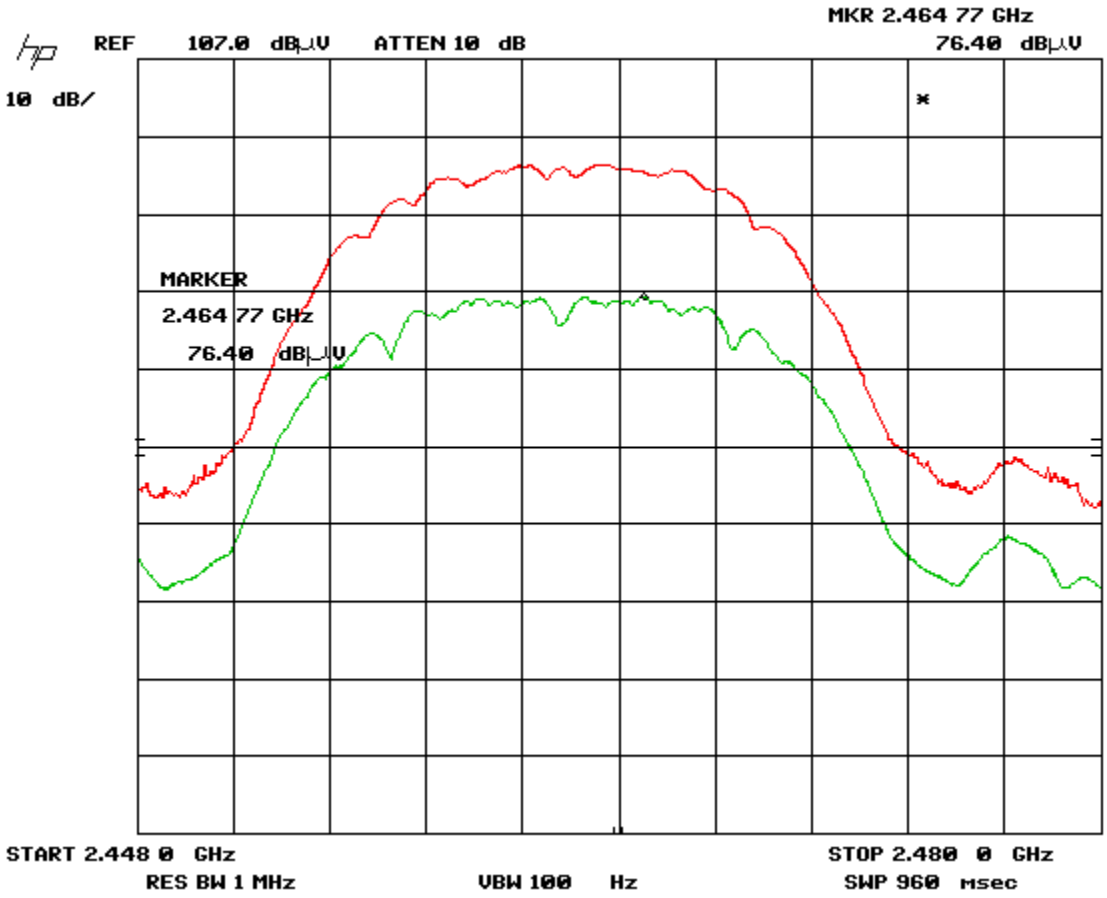
Peak Emissions Graph, Vertical Antenna Polarity
Peak & Average Plot 2
EUT Output: High Channe1



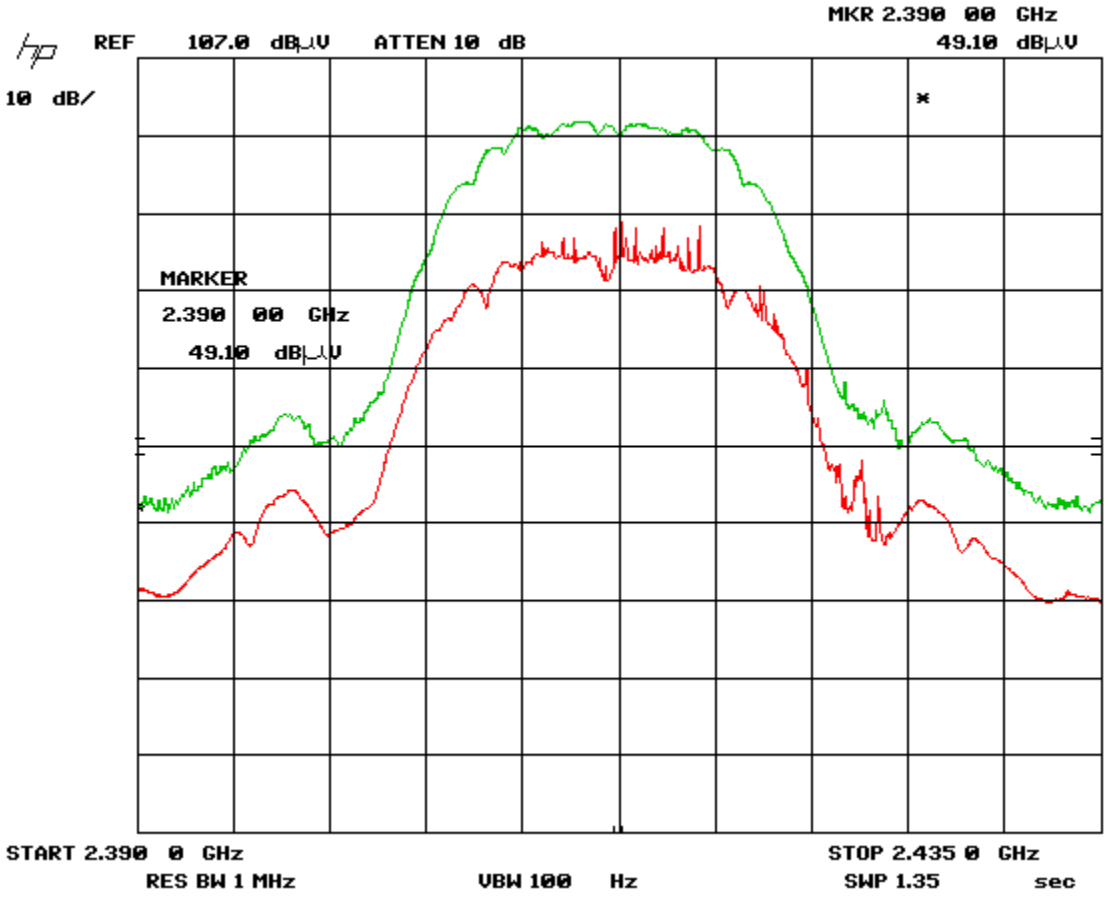
Peak Emissions Graph, Horizontal Antenna Polarity
Peak & Average Plot 1
EUT Output: High Channe1



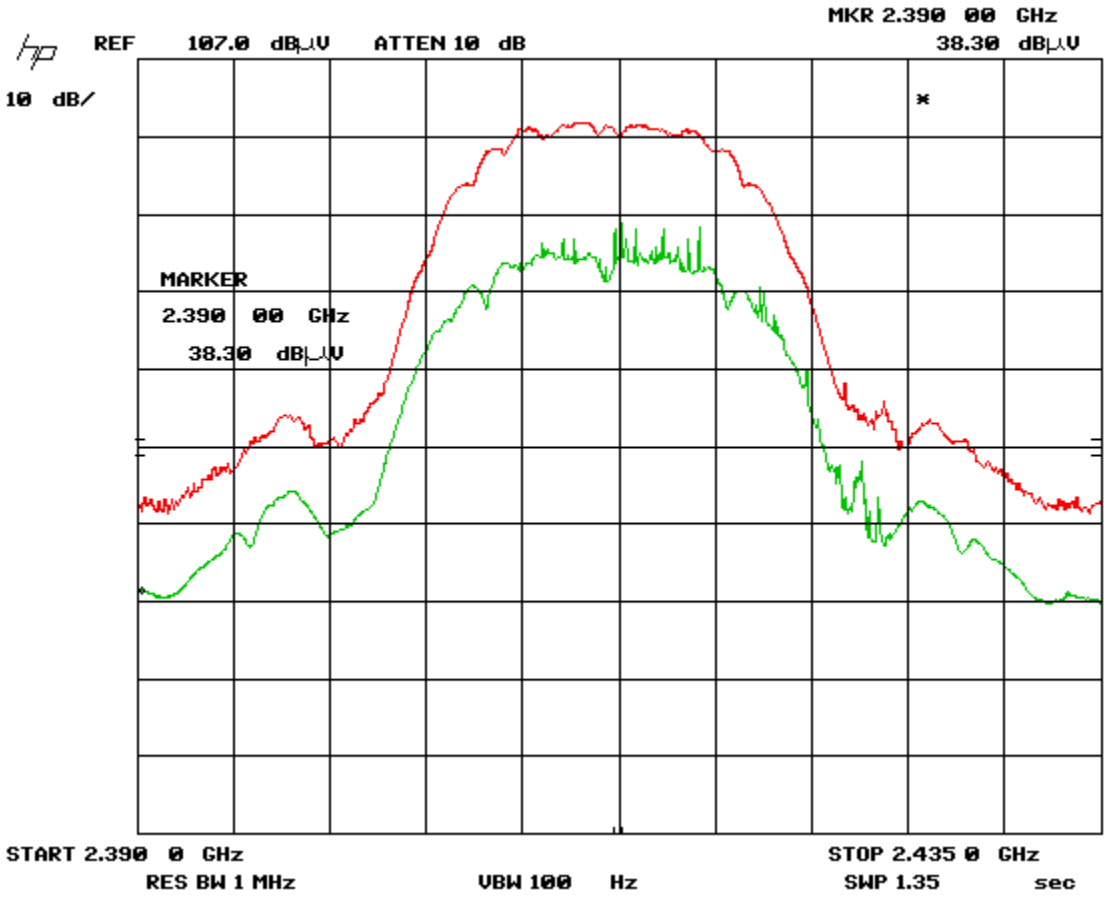
Peak Emissions Graph, Horizontal Antenna Polarity
Peak & Average Plot 2
EUT Output: High Channe1



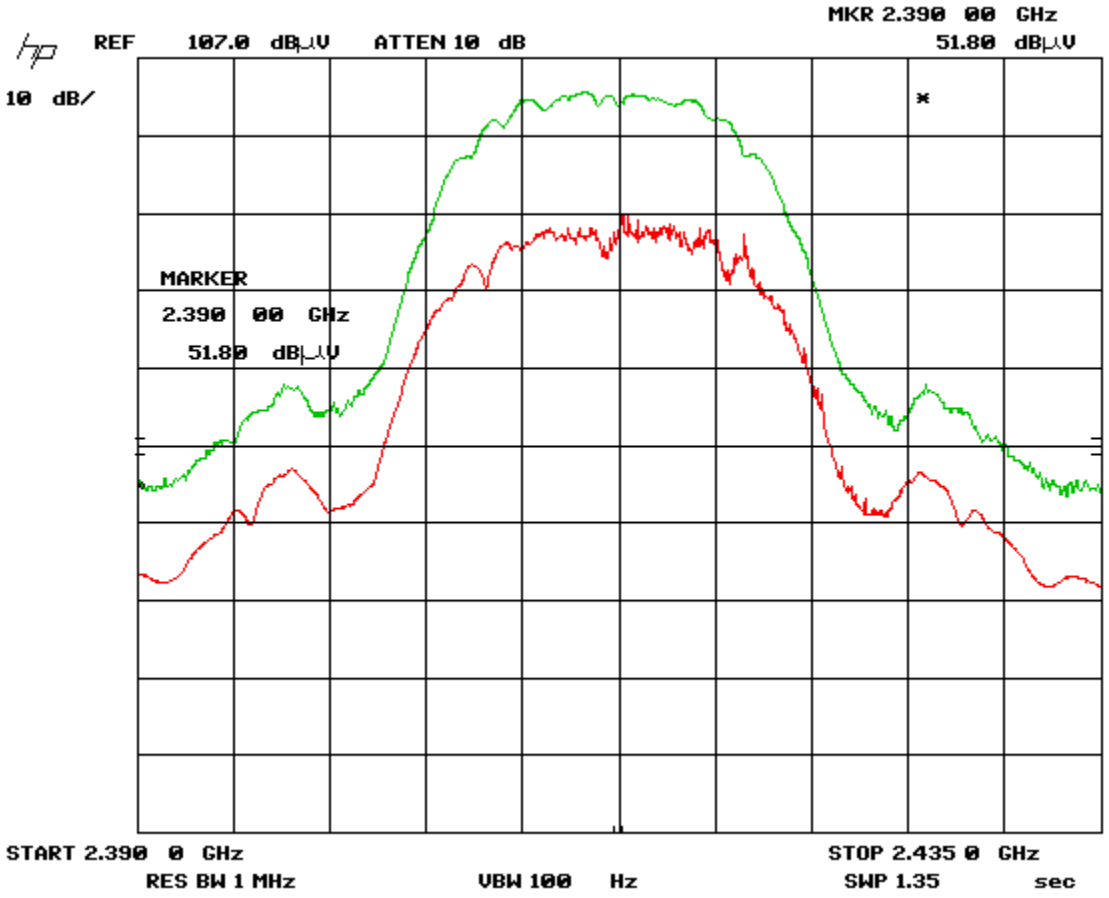
Restricted Band Edges Emissions Graph (Peak)
At 2.390 GHz, Horizontal Antenna Polarity
EUT Output: Channe1 1 (2412 MHz)



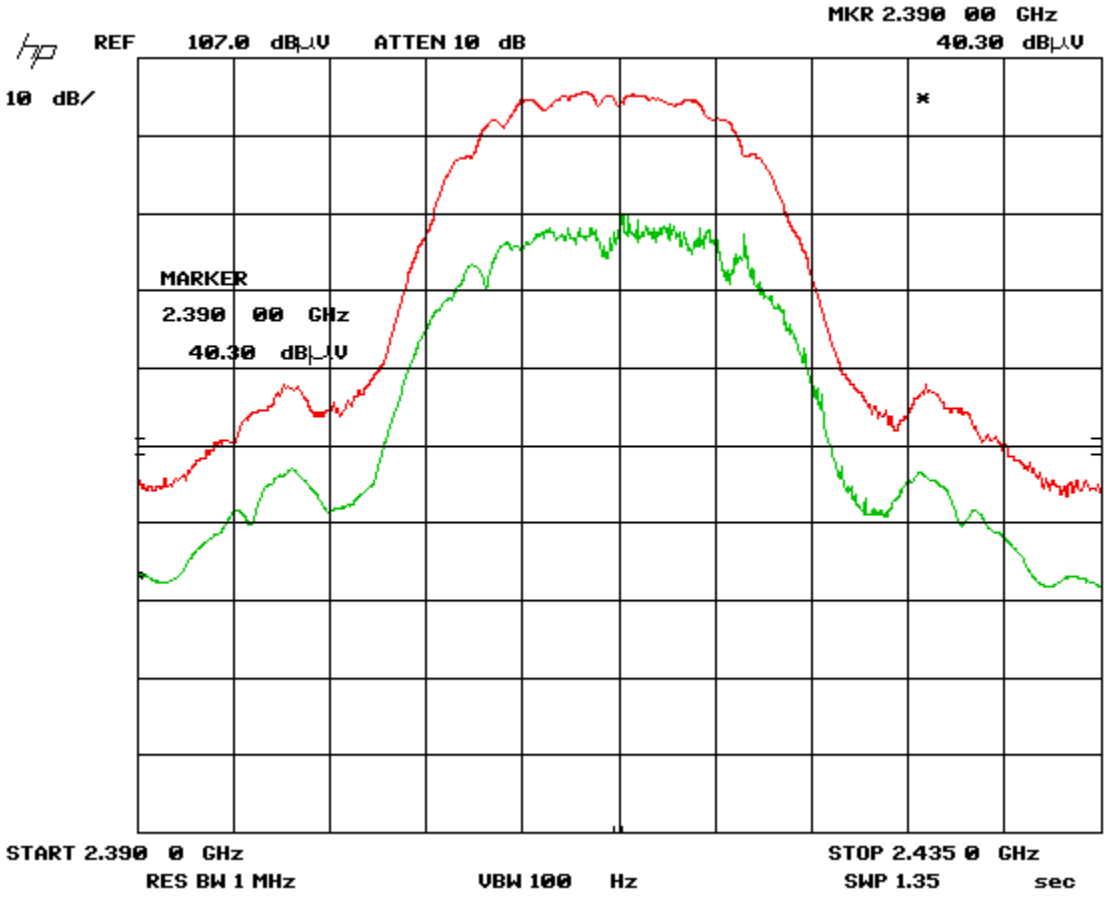
Restricted Band Edges Emissions Graph (Average)
At 2.390 GHz, Horizontal Antenna Polarity
EUT Output: Channe1 1 (2412 MHz)



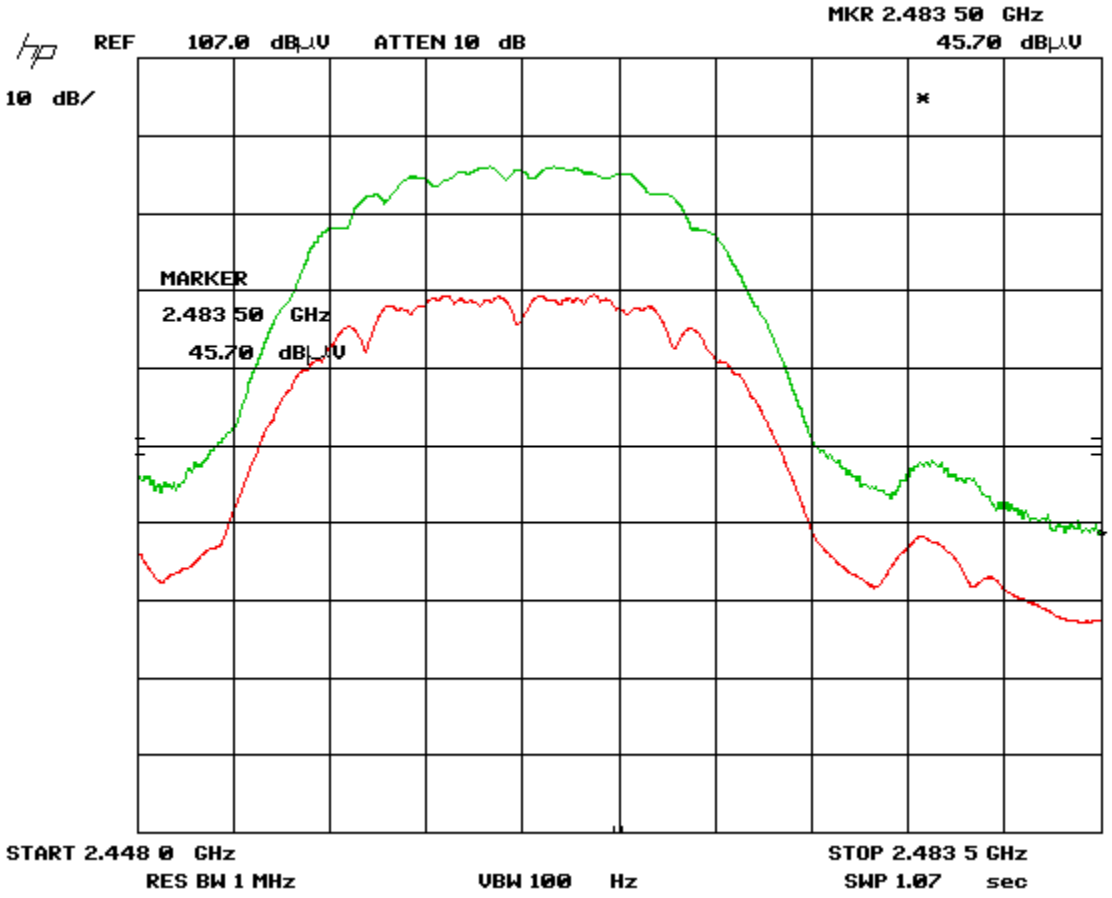
Restricted Band Edges Emissions Graph (Peak)
At 2.390 GHz, Vertical Antenna Polarity
EUT Output: Channe1 1 (2412 MHz)



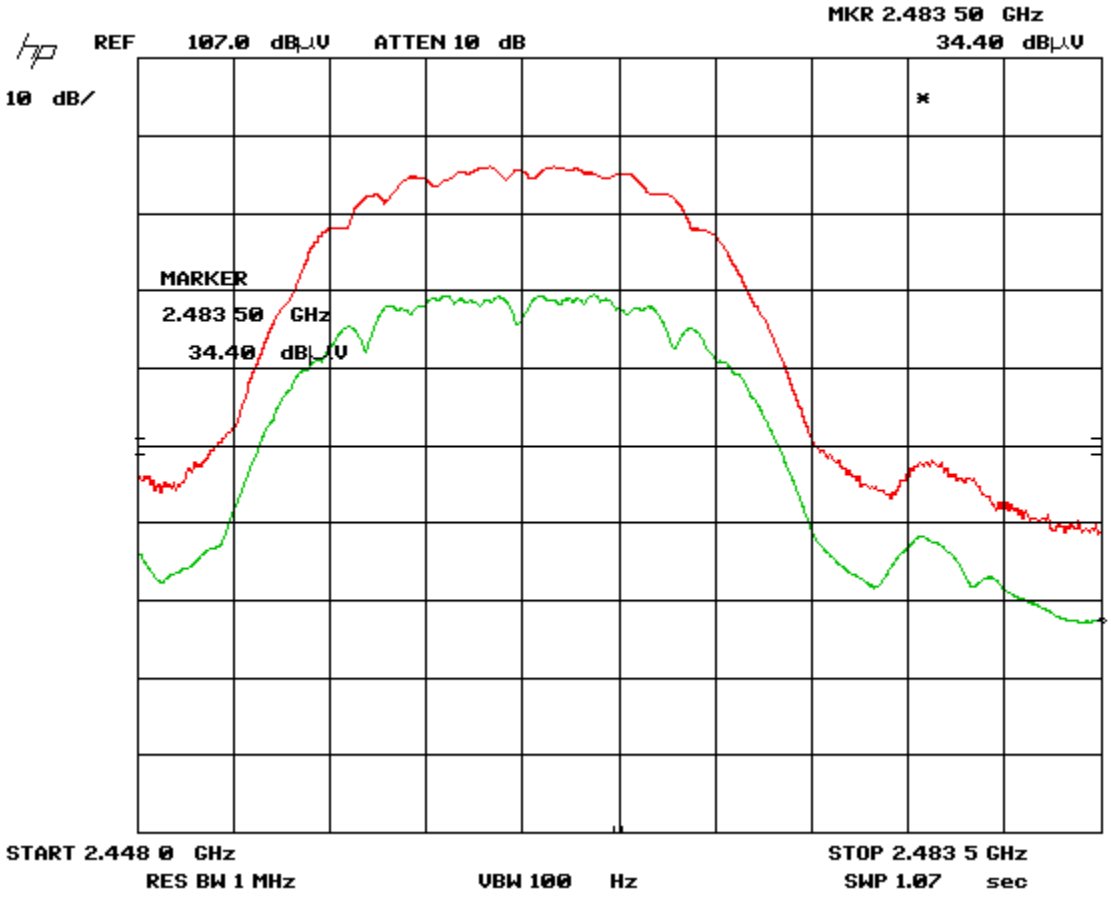
Restricted Band Edges Emissions Graph (Average)
At 2.390 GHz, Vertical Antenna Polarity
EUT Output: Channe1 1 (2412 MHz)



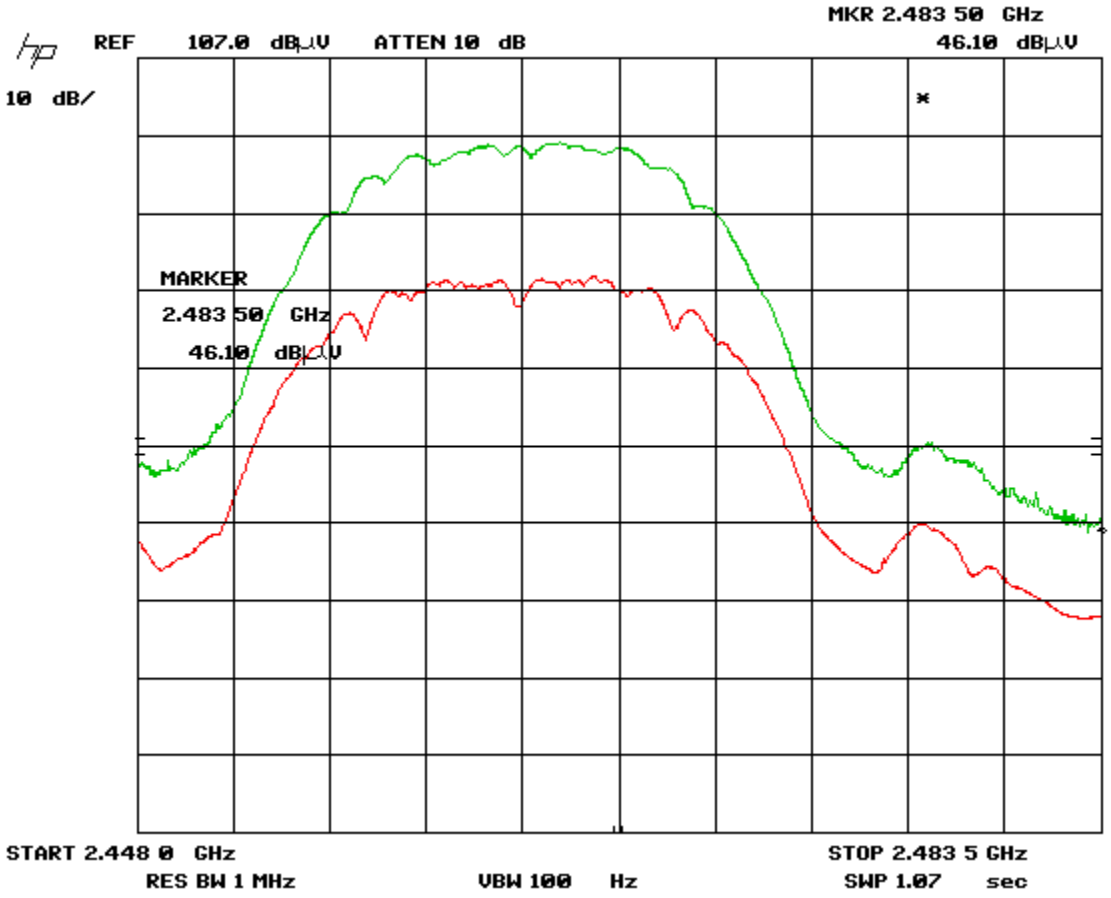
Restricted Band Edges Emissions Graph (Peak)
At 2.4835 GHz, Horizontal Antenna Polarity
EUT Output: Channe1 11 (2483.5 MHz)



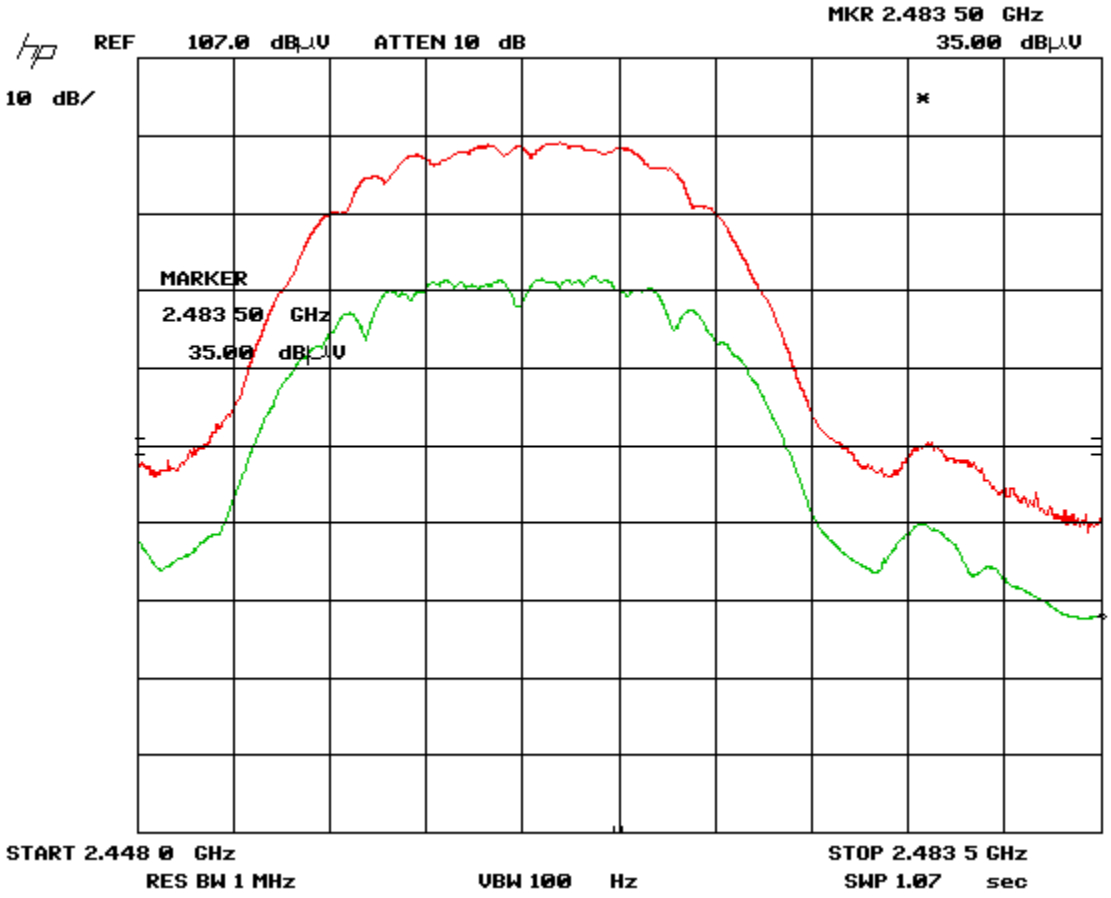
Restricted Band Edges Emissions Graph (Average)
At 2.4835 GHz, Horizontal Antenna Polarity
EUT Output: Channe1 11 (2483.5 MHz)



Restricted Band Edges Emissions Graph (Peak)
At 2.4835 GHz, Vertical Antenna Polarity
EUT Output: Channe1 11 (2483.5 MHz)



Restricted Band Edges Emissions Graph (Average)
At 2.4835 GHz, Vertical Antenna Polarity
EUT Output: Channe1 11 (2483.5 MHz)



Final Measurements

Radiated Emissions - 15.247 - Table 1
Fundamental & Harmonics
3m measurement distance

Test Frequency (MHz)	Detection mode	Antenna polarity (Horz/Vert)	Raw signal dB(µV)	Antenna factor dB	Cable loss dB + Pre-selector	Attenuator dB	Pre-Amp Gain dB	Received signal dB(µV/m)	Emission limit dB(µV/m)	Margin dB(µV)	Result
Low Channel											
2412	Peak	Horz	97.4	30.6	2.2	0.0	36.1	94.1	125.20	31.1	Pass. Fundamental emission.
2412	Peak	Vert	100.9	30.8	2.2	0.0	36.1	97.8	125.20	27.4	
4824	Peak	Horz	noise floor	33.7	2.9	0.0	35.7	< 73.97	73.97	---	Pass. Harmonics at and above the 2nd harmonic are under the noise floor
4824	Avg	Horz	noise floor	33.7	2.9	0.0	35.7	< 53.97	53.97	---	
4824	Peak	Vert	noise floor	33.7	2.9	0.0	35.7	< 73.97	73.97	---	
4824	Avg	Vert	noise floor	33.7	2.9	0.0	35.7	< 53.97	53.97	---	
Mid channel											
2437	Peak	Horz	91.2	30.6	2.2	0.0	36.1	87.9	125.20	37.3	Pass. Fundamental emission.
2437	Peak	Vert	98.3	30.6	2.2	0.0	36.1	95.0	125.20	30.2	
4874	Peak	Horz	noise floor	33.7	2.9	0.0	35.7	< 73.97	73.97	---	Pass. Harmonics at and above the 2nd harmonic are under the noise floor
4874	Avg	Horz	noise floor	33.7	2.9	0.0	35.7	< 53.97	53.97	---	
4874	Peak	Vert	noise floor	33.7	2.9	0.0	35.7	< 73.97	73.97	---	
4874	Avg	Vert	noise floor	33.7	2.9	0.0	35.7	< 53.97	53.97	---	
High channel											
2464	Peak	Horz	93.5	30.6	2.2	0.0	36.1	90.2	113.97	23.8	Pass. Fundamental emission.
2464	Peak	Vert	96.3	30.6	2.2	0.0	36.1	93.0	113.97	21.0	
4928	Peak	Horz	noise floor	33.7	2.9	0.0	35.7	< 73.97	73.97	---	Pass. Harmonics at and above the 2nd harmonic are under the noise floor
4928	Avg	Horz	noise floor	33.7	2.9	0.0	35.7	< 53.97	53.97	---	
4928	Peak	Vert	noise floor	33.7	2.9	0.0	35.7	< 73.97	73.97	---	
4928	Avg	Vert	noise floor	33.7	2.9	0.0	35.7	< 53.97	53.97	---	

Radiated Emissions - 15.247 - Table 2
Band Edges
3m measurement distance

Test Frequency (MHz)	Detection mode	Antenna polarity (Horz/ Vert)	Raw signal dB(µV)	Antenna factor dB	Cable loss dB + Pre-selector	Pre-Amp Gain dB	Received signal dB(µV/m)	Emission limit dB(µV/m)	Margin dB	Result
Low Channel Bandedges										
2390	Peak	Horz	49.1	30.6	2.2	36.1	45.8	74.00	28.2	Pass
2390	Avg	Horz	38.3	30.6	2.2	36.1	35.0	53.97	19.0	Pass
2390	Peak	Vert	51.8	30.7	2.2	36.1	48.6	74.00	25.4	Pass
2390	Avg	Vert	40.3	30.7	2.2	36.1	37.1	53.97	16.9	Pass
High channel Bandedges										
2483.5	Peak	Horz	45.7	30.8	2.2	36.1	42.6	74.0	31.4	Pass
2483.5	Avg	Horz	34.4	30.8	2.2	36.1	31.3	54.0	22.7	Pass
2483.5	Peak	Vert	46.1	30.9	2.2	36.1	43.1	74.0	30.9	Pass
2483.5	Avg	Vert	35.0	30.9	2.2	36.1	32.0	54.0	22.0	Pass

Radiated Emissions - 15.247 - Table 3
Other spurious measurements
3m measurement distance

Test Frequency (MHz)	Detection mode	Raw signal dB(µV)	Antenna factor dB	Cable loss dB + Pre-selector	Pre-Amp Gain dB	Received signal dB(µV/m)	Emission limit dB(µV/m)	Margin dB(µV)	Result
Vertical Antenna Polarity									
51.9	QP	54	8	0.6	-30	32.6	40	7.4	Pass
410.4	QP	45.1	15.6	1.5	-30.2	32	46.4	14.4	Pass
390.9	QP	44.7	15.3	1.5	-30.3	31.2	46.4	15.2	Pass
40.5	QP	54.4	10.8	0.5	-30	35.7	40	4.3	Pass
47.5	QP	41.8	8.6	0.6	-30	21	40	19	Pass
160.2	QP	56.5	9.9	1	-30	37.4	43.5	6.1	Pass
1641.3	Peak	58.9	26.9	4.2	-34.2	55.8	74	18.2	Pass
1641.3	Avg	53.5	26.9	4.2	-34.2	50.4	54	3.6	Pass
Horizontal Antenna Polarity									
242.9	QP	56.4	12.2	1.2	-30.3	39.5	46.4	6.9	Pass
271.2	QP	54.9	13.1	1.3	-30.2	39.1	46.4	7.3	Pass
315.1	QP	46.3	14.3	1.4	-30.3	31.7	46.4	14.7	Pass
393.5	QP	44.1	16.5	1.5	-30.3	31.8	46.4	14.6	Pass
318.7	QP	46.9	14.4	1.4	-30.3	32.4	46.4	14	Pass
1641.3	Peak	59.4	28.4	4.2	-34.2	57.8	74	16.2	Pass
1641.3	Avg	54.2	28.4	4.2	-34.2	52.6	54	1.4	Pass

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	85650A	HP	Jan. 23, 2013	Jan. 23, 2015	GEMC 170
Quasi-Peak Detector	8566B	HP	Jan. 22, 2013	Jan. 22, 2015	GEMC 169
Loop Antenna 30Hz – 1MHz	EM 6871	Electro-Metrics	Feb. 5, 2013	Feb. 5, 2015	GEMC 70
Loop Antenna 100kHz – 30MHz	EM 6872	Electro-Metrics	Feb. 5, 2013	Feb. 5, 2015	GEMC 71
BiLog Antenna	3142-C	ETS	Feb 4, 2013	Feb 4, 2015	GEMC 137
Q-Par Horn 1.5GHz -18 GHz	6878/24	Q-par	Sept. 10, 2014	Sept. 10, 2016	GEMC 6365
Horn Antenna 18 GHz - 26.5 GHz	SAS-572	A.H. Systems	Sept. 9, 2014	Sept. 9, 2016	GEMC 6371
18.0-26.5 GHz Harmonic Mixer	11970K	HP	Jan 28, 2014	Jan 28, 2016	GEMC 158
Chase Preamp 9kHz - 2 GHz	CPA9231A	Chase	Sept. 9, 2014	Sept. 9, 2016	GEMC 6403
Pre-amp 1-26GHz	HP 8449B	HP	Sept. 9, 2014	Sept. 9, 2016	GEMC 6351
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

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

Antenna Gain – Modularly Approved Transmitter Verification

Purpose

The purpose of this test is to verify the antenna gain of the modularly approved 15.247 transmitter is ≤ the gain of its approved antenna.

Limits

The gain of the new antenna of the approved module must be ≤ 2dBi, which is the gain of the antenna approved with original filing.

Results

The table below shows the measured peak power output of the device during the antenna conducted measurements. Peak measurements were made with a 1 MHz resolution bandwidth, during transmit operation of the EUT with continuous modulated data (>98%).

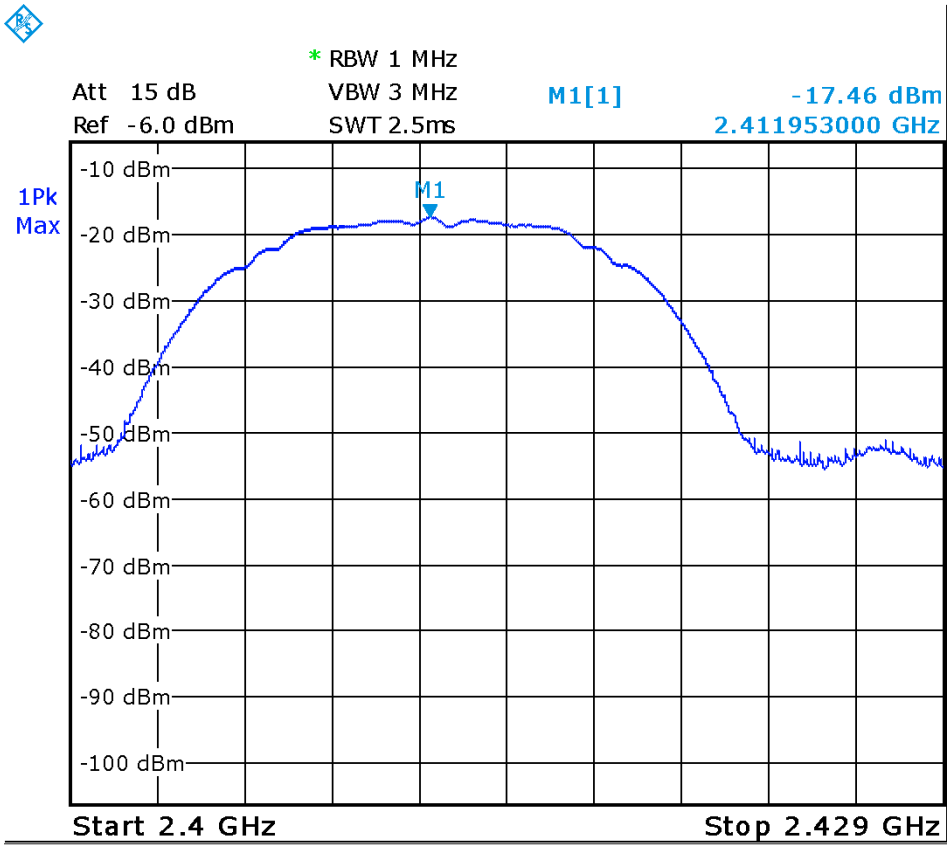
Maximum Peak Conducted Power – Table 1

Band	Channel	Frequency (GHz)	Received Reading (dBm)	External Attenuation (dB)	Output Power (dBm)
Low	1	2.412	-17.5	20	2.5
Middle	6	2.437	-17.6	20	2.4
High	11	2.462	-17.1	20	2.0

As per the previous section, *Radiated Emissions – Modularly Approved Transmitter Verification* the max radiated emission is 97.9 dBuV/m at a 3m distance. 97.9 -95.2 = 2.6 dBm emitted power.

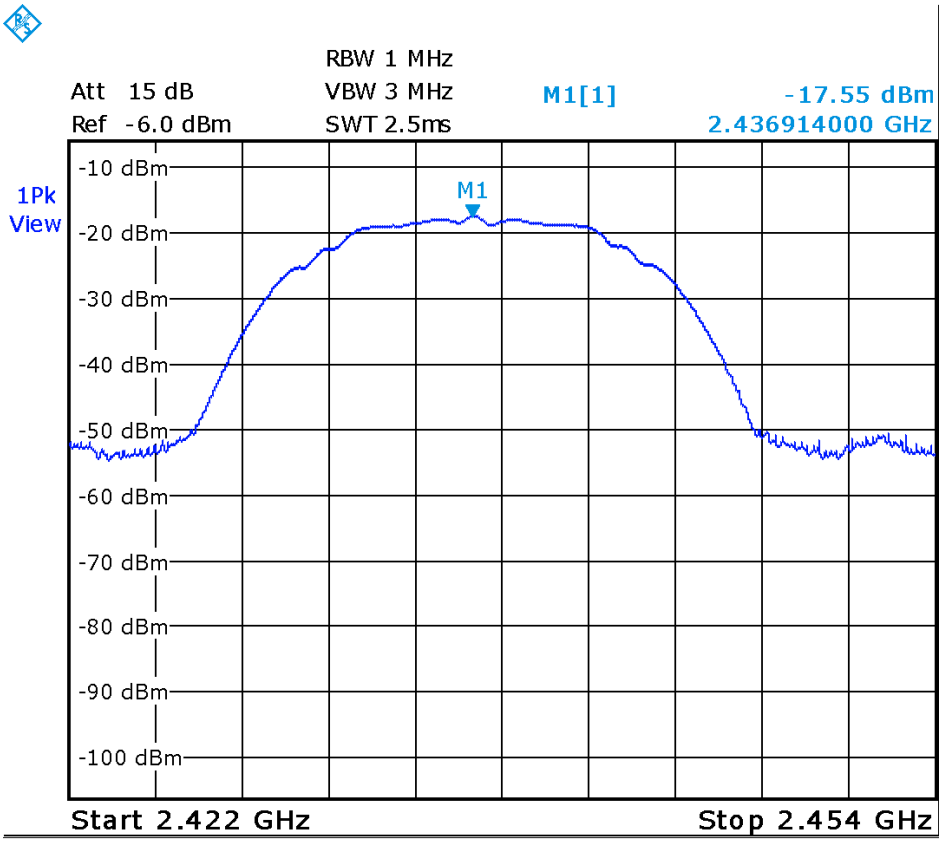
Antenna gain = radiated power – output power = 2.6 – 2.5 = 0.1 dBi.

The gain of the new antenna is < the gain of the antenna approved with the transmitter module.



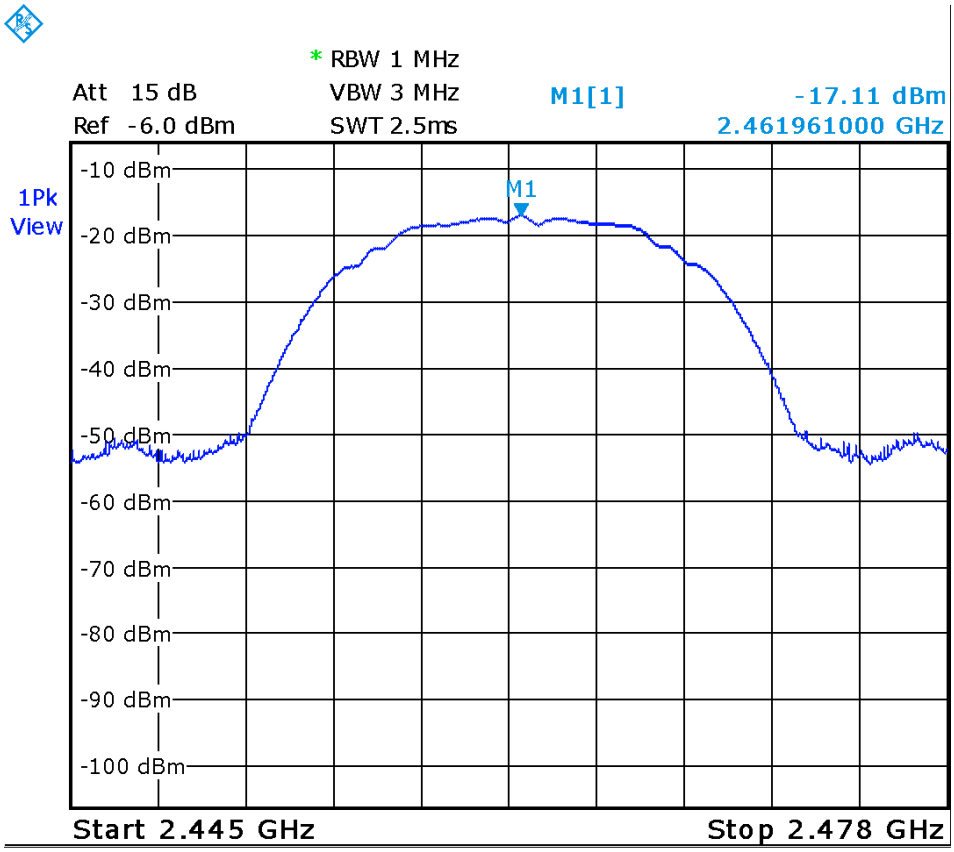
Low Channel

Note: 20 dB for external attenuation losses added to value shown above.



Mid Channel

Note: 20 dB for external attenuation losses added to value shown above.



High Channel

Note: 20 dB for external attenuation losses added to value shown above.

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

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Power Head	PH 2000	AR	2013-02-07	2015-02-07	GEMC 15
Power meter	PM 2002	AR	2013-02-07	2015-02-07	GEMC 16
Spectrum Analyzer	ESL6	Rohde & Schwarz	2013-11-15	2015-11-15	GMEC 160
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29

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

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 C64:2003

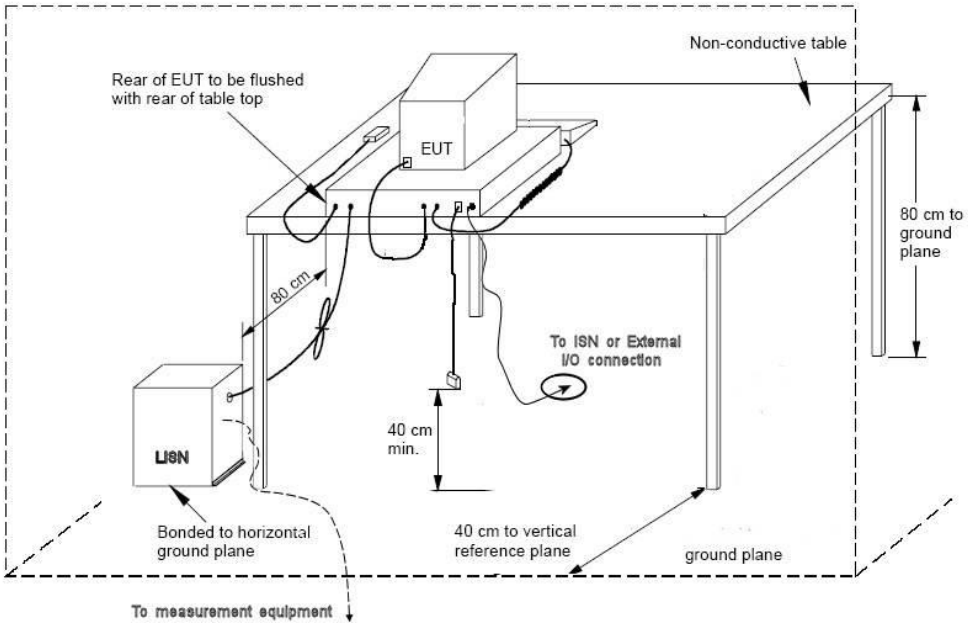
Average Limits		QuasiPeak Limits	
150 kHz – 500 kHz	56 to 46 dBuV	150 kHz – 500 kHz	66 to 56 dBuV
500 kHz – 5 MHz	46 dBuV	500 kHz – 5 MHz	56 dBuV
5 MHz – 30 MHz	50 dBuV	500 kHz – 30 MHz	60 dBuV

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.

Typical Setup Diagram



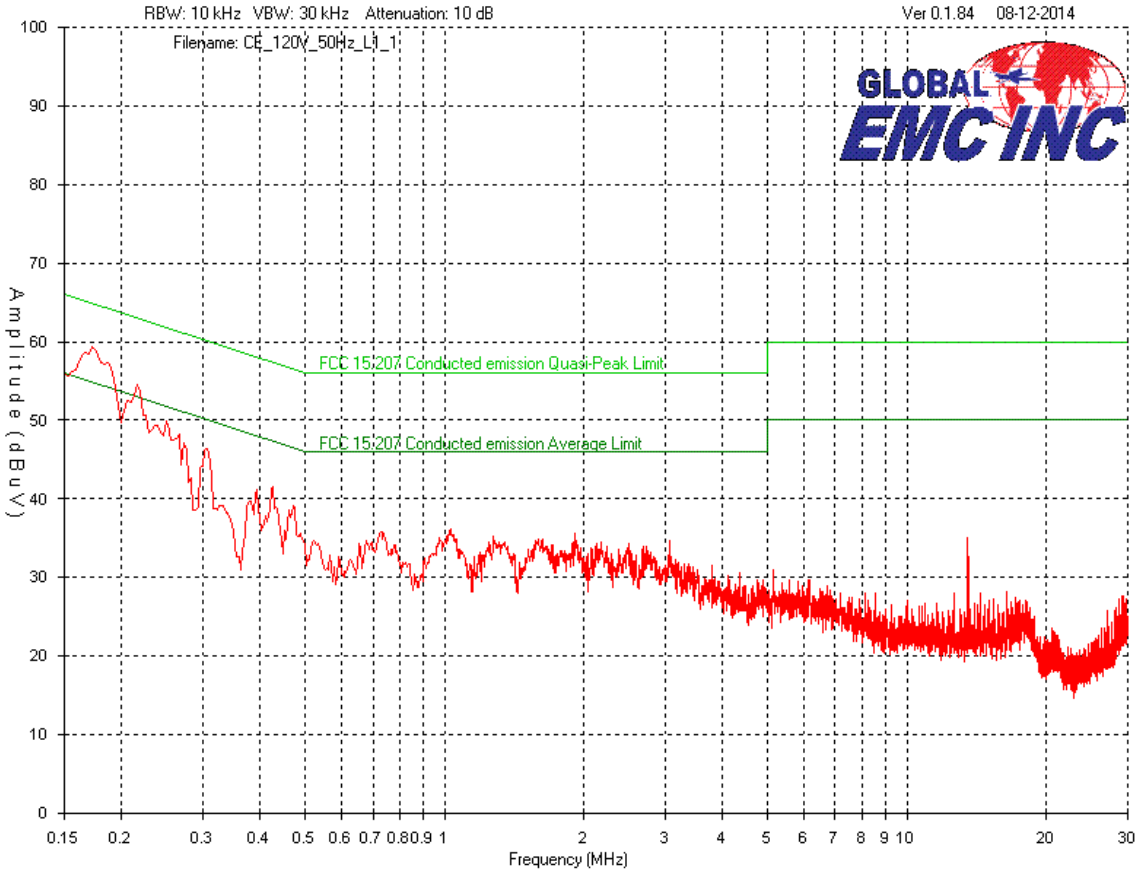
Measurement Uncertainty

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.

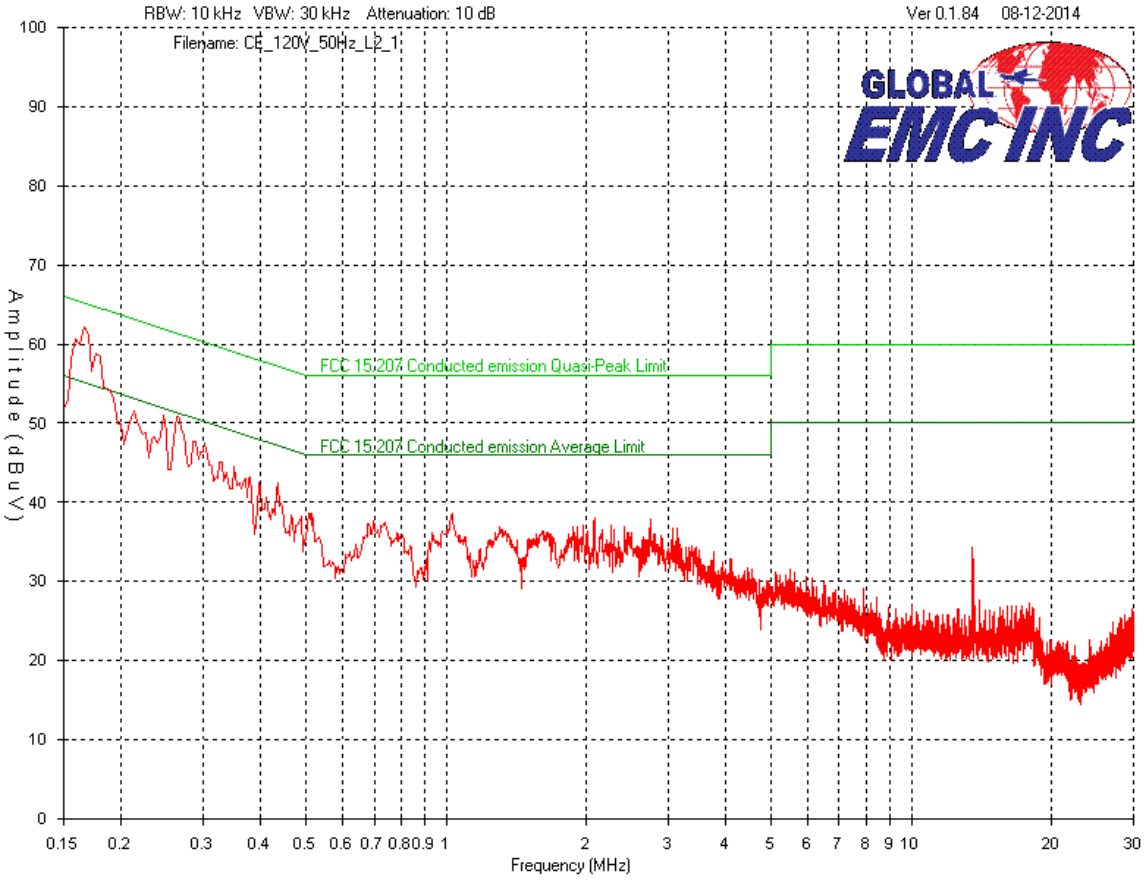
Preliminary Graphs

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. Power line conducted emissions were performed with all transmitters transmitting with constant modulated data at maximum power.

Peak Emissions Graph - Line 1
$120V_{AC}$, 60Hz



Peak Emissions Graph - Line 2
$120V_{AC}$, 60Hz



Final Measurements

Emissions Table
$120V_{AC}$, 60Hz

Test Frequency (MHz)	Detector	Received signal (dBµV)	Attenuator (dB)	Cable loss (dB)	LISN factor (dB)	Emission Level (dBµV)	Quasi-Peak Emission limit (dBµV)	Average Emission limit (dBµV)	Quasi-Peak Margin (dB)	Average Margin (dB)	Result
Phase Line											
0.173	Peak	49.2	10	0.1	0.1	59.4	64.8	---	5.4	---	Pass
0.173	Avg.	31.18	10	0.1	0.1	41.38	---	54.8	---	13.42	Pass
0.166	Peak	48.38	10	0.1	0.1	58.58	64.8	---	6.22	---	Pass
0.166	Avg.	32.07	10	0.1	0.1	42.27	---	54.8	---	12.53	Pass
0.192	Peak	46.6	10	0.1	0.1	56.8	64.8	---	8	---	Pass
0.192	Avg.	32.23	10	0.1	0.1	42.43	---	54.8	---	12.37	Pass
0.179	Peak	47.2	10	0.1	0.1	57.4	64.8	---	7.4	---	Pass
0.179	Avg.	33.29	10	0.1	0.1	43.49	---	54.8	---	11.31	Pass
0.217	Peak	44.6	10	0.1	0.1	54.8	64.8	---	10	---	Pass
0.217	Avg.	29.8	10	0.1	0.1	40	---	54.8	---	14.8	Pass
0.306	Peak	36.3	10	0.1	0.1	46.5	60.1	50.1	13.6	3.6	Pass
Neutral Line											
0.167	Peak	51.9	10	0.1	0.1	62.1	65.1	---	3	---	Pass
0.167	Avg.	25.91	10	0.1	0.1	36.11	---	55.1	---	18.99	Pass
0.190	Peak	43.7	10	0.1	0.1	53.9	65.1	---	11.2	---	Pass
0.190	Avg.	29.02	10	0.1	0.1	39.22	---	55.1	---	15.88	Pass
0.174	Peak	46.4	10	0.1	0.1	56.6	65.1	---	8.5	---	Pass
0.174	Avg.	28.77	10	0.1	0.1	38.97	---	55.1	---	16.13	Pass
0.165	Peak	51.9	10	0.1	0.1	62.1	65.1	---	3	---	Pass
0.165	Avg.	27.51	10	0.1	0.1	37.71	---	55.1	---	17.39	Pass
0.151	Peak	41.7	10	0.1	0.1	51.9	65.1	---	13.2	---	Pass
0.151	Avg.	29.42	10	0.1	0.1	39.62	---	55.1	---	15.48	Pass
0.263	Peak	40.7	10	0.1	0.1	50.9	61.3	---	10.4	---	Pass
0.263	Avg.	23.32	10	0.1	0.1	33.52	---	51.3	---	17.78	Pass
0.298	Peak	36.2	10	0.1	0.1	46.4	61.3	---	14.9	---	Pass
0.298	Avg.	29.8	10	0.1	0.1	40	---	51.3	---	11.3	Pass

See ‘Appendix B – EUT & Test Setup Photographs’ for photos showing the test set-up.

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	ESL 6	Rohde & Schwarz	2013-11-15	2015-11-15	GEMC 160
LISN	FCC-LISN-50/250-16-2-01	FCC	2013-02-06	2015-02-06	GEMC 65
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 28

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

Appendix A – EUT Summary

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

General EUT Description

Client Details	
Organization / Address	CERIDIAN HCM 4110 Yonge Street Suite 4110 Toronto, ON. Canada, M2P 2B7
Contact	Martin Ossip
Phone	(416) 987-2987 x2211
Email	mossip@dayforce.com
EUT (Equipment Under Test) Details	
EUT Name / Model	DFTouch (WR)
Mains input voltage range(s)	120-240V, 50-60Hz
Rated input current	1.5 A max
Transmit Frequencies	125 kHz, 13.56 MHz, 2.4 GHz
Basic EUT functionality description	EUT is a Time & Attendance device mounted on the wall allowing users to swipe in using an integrated badge or finger print reader. Device runs the Android operating system and has a battery backup for power interruption recovery.
Modes of operation	On mode. Unit is typically always on after installation.
Frequency of all clocks present in EUT	OSC: 24.0MHz, 25.0MHz CPU: 792MHz – 1GHz, 528MHz, 33.26MHz, 132MHz
Available connectors on EUT	RJ45 USB
Dimensions of product	L: 290mm W: 140mm H: 60mm
Separation distance from operator	20cm

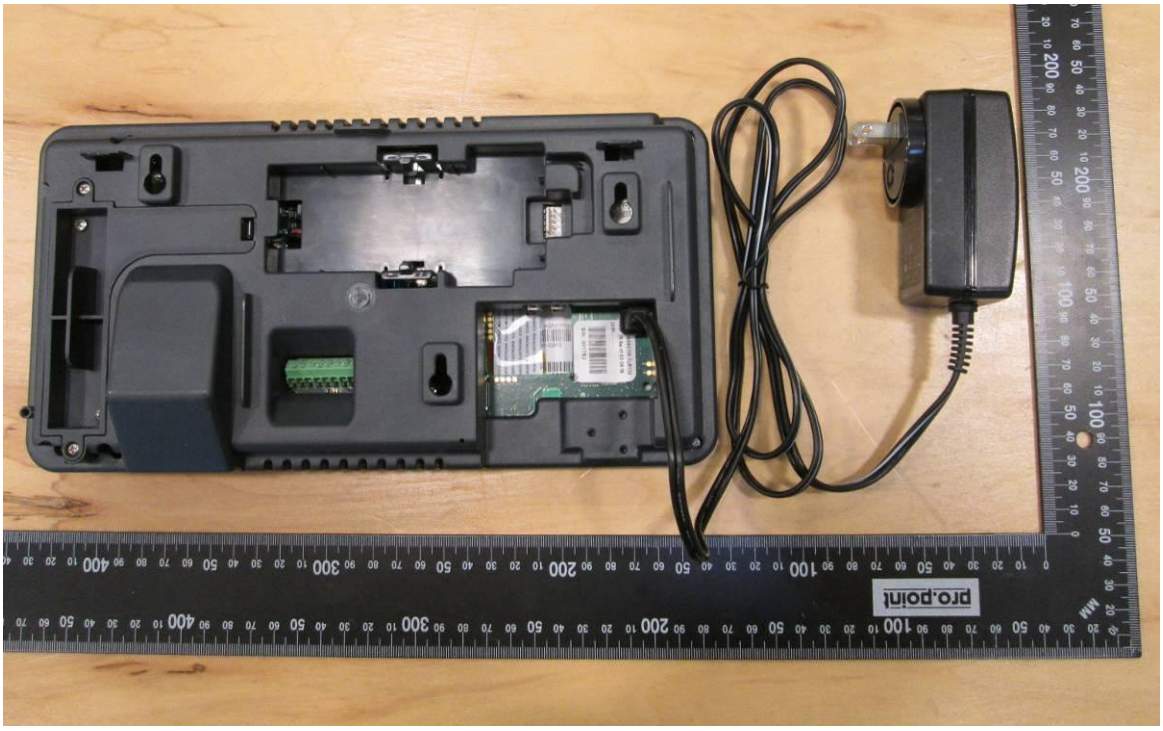
Note the EUT is considered to have been received the date of the commencement of the first test, unless otherwise stated. For a close-up picture of the EUT, see 'Appendix B – EUT & Test Setup Photographs'.

Appendix B – EUT and Test Setup Photographs

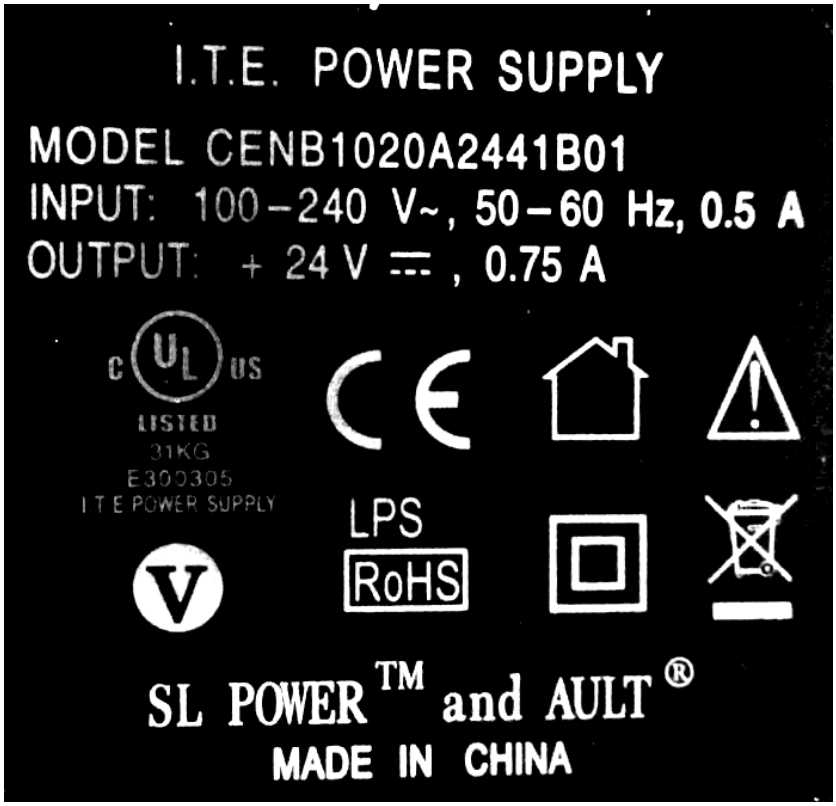
Note: These photos are for information purposes only.
Also refer to .PDF files that are separate from this test report.

EUT – External view, side 1
(With power supply)

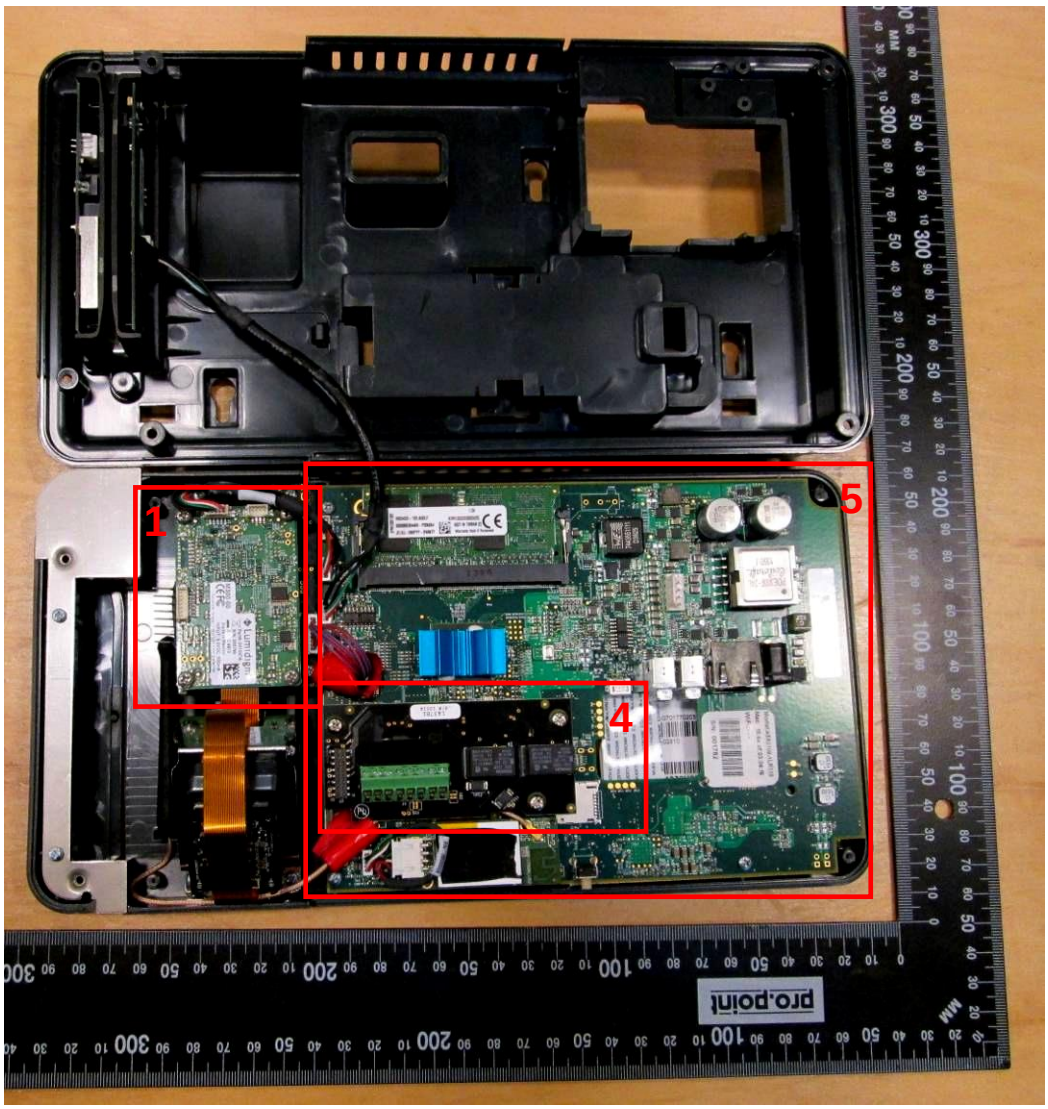
EUT – External view, side 2
(With power supply)



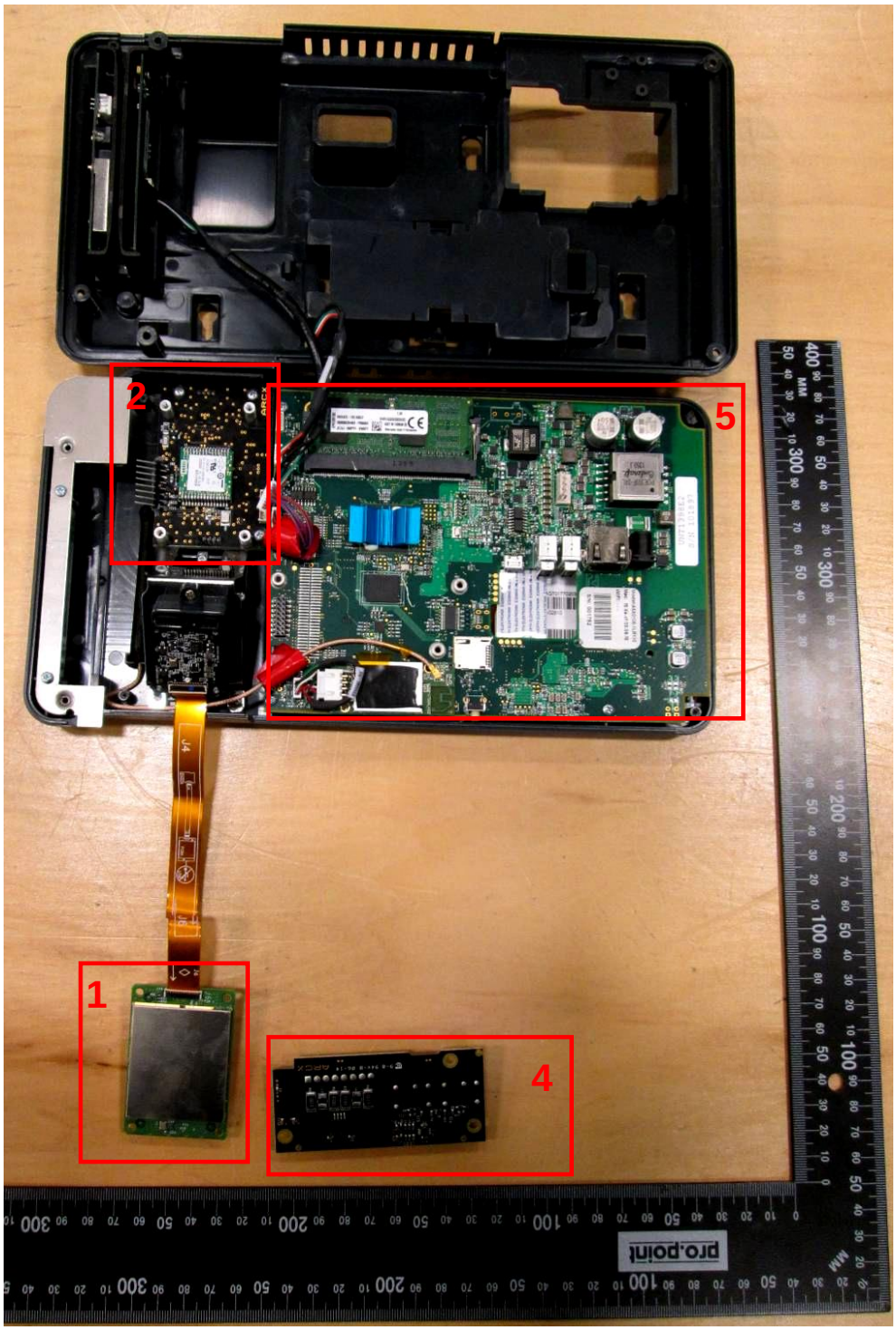
EUT – External view
Power supply label



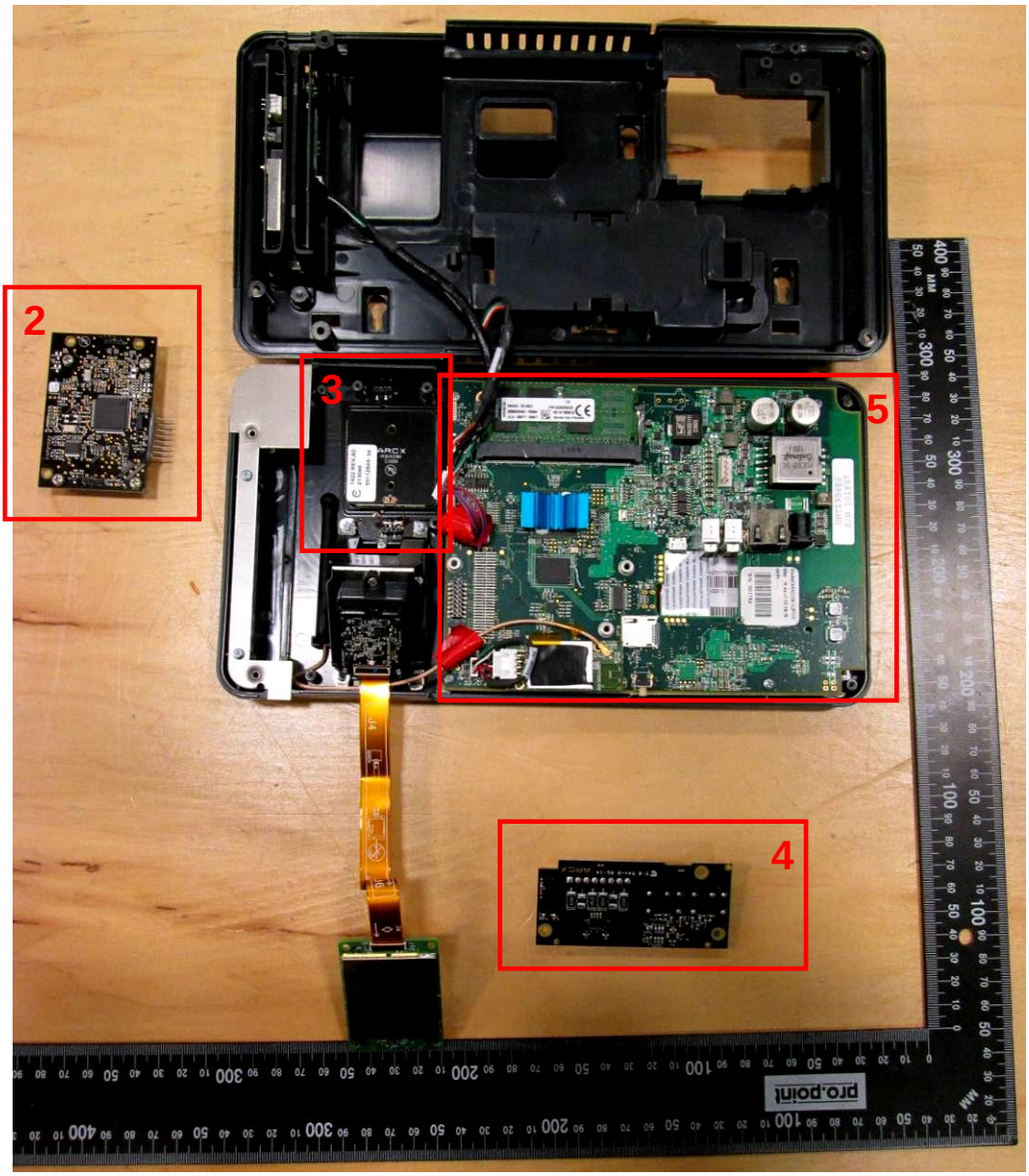
EUT – Internal view 1



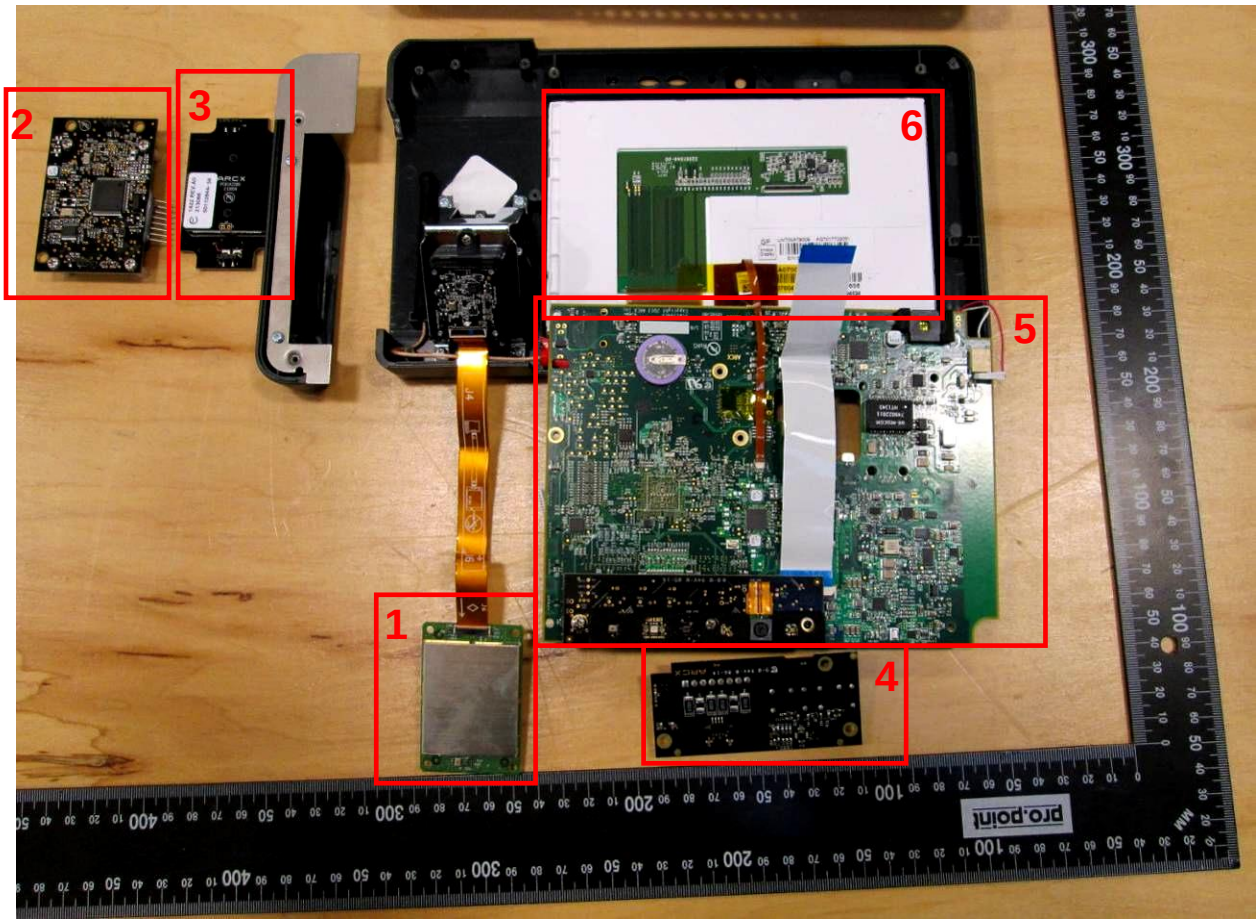
EUT – Internal view 2



EUT – Internal view 3



EUT – Internal view 4



Board #1 as seen in photos *EUT – Internal view 1-4*
Side 1

Board #1 as seen in photos *EUT – Internal view 1-4*
Side 2

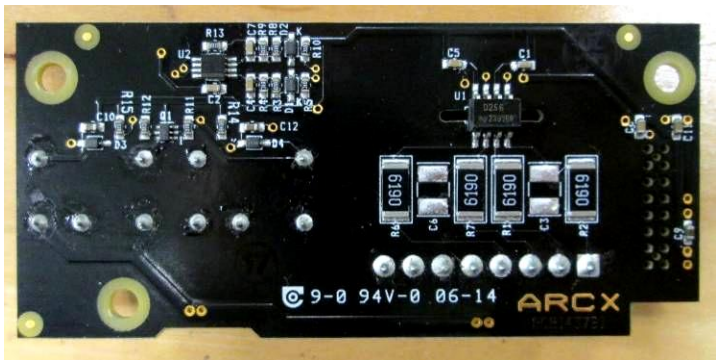
Board #2 as seen in photos *EUT – Internal view 2-4*
Side 1

Board #2 as seen in photos *EUT – Internal view 2-4*
Side 2

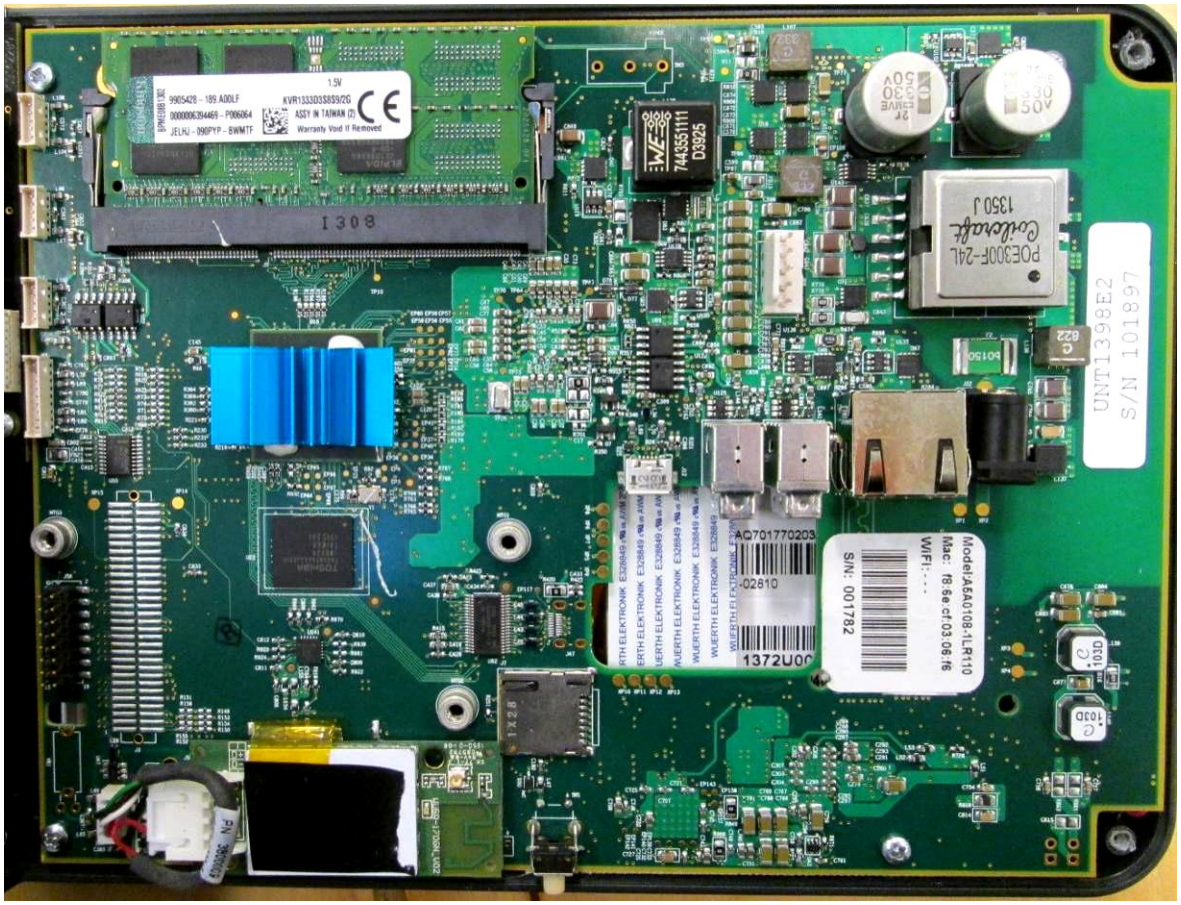
Board #3 as seen in photos *EUT – Internal view 3-4*
Side 1

Board #3 as seen in photos *EUT – Internal view 3-4*
Side 1

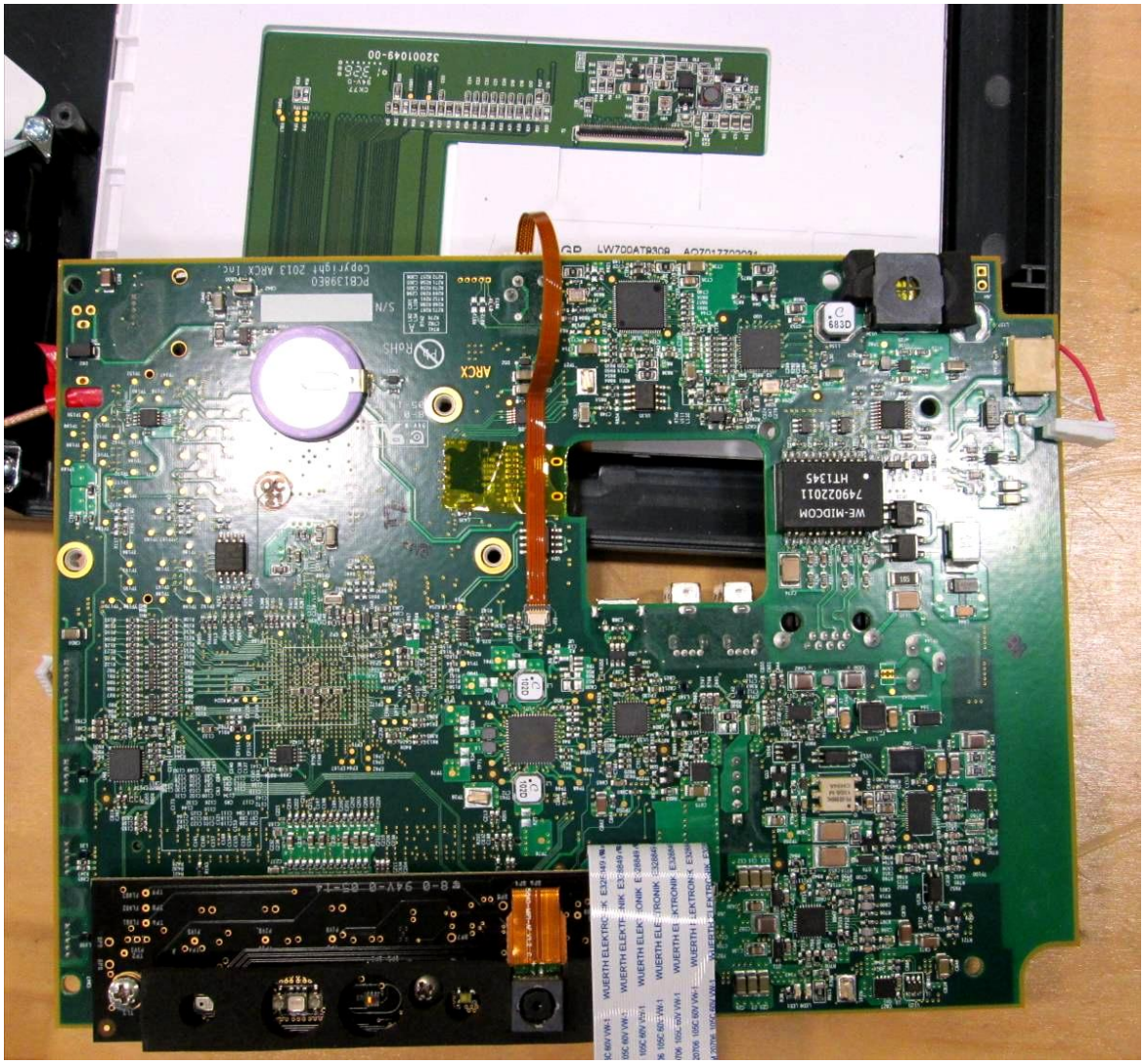
Board #4 as seen in photos *EUT – Internal view 1-4*
Side 1



Board #4 as seen in photos *EUT – Internal view 1-4*
Side 2



Board #5 as seen in photos *EUT – Internal view 1-4*
Side 1



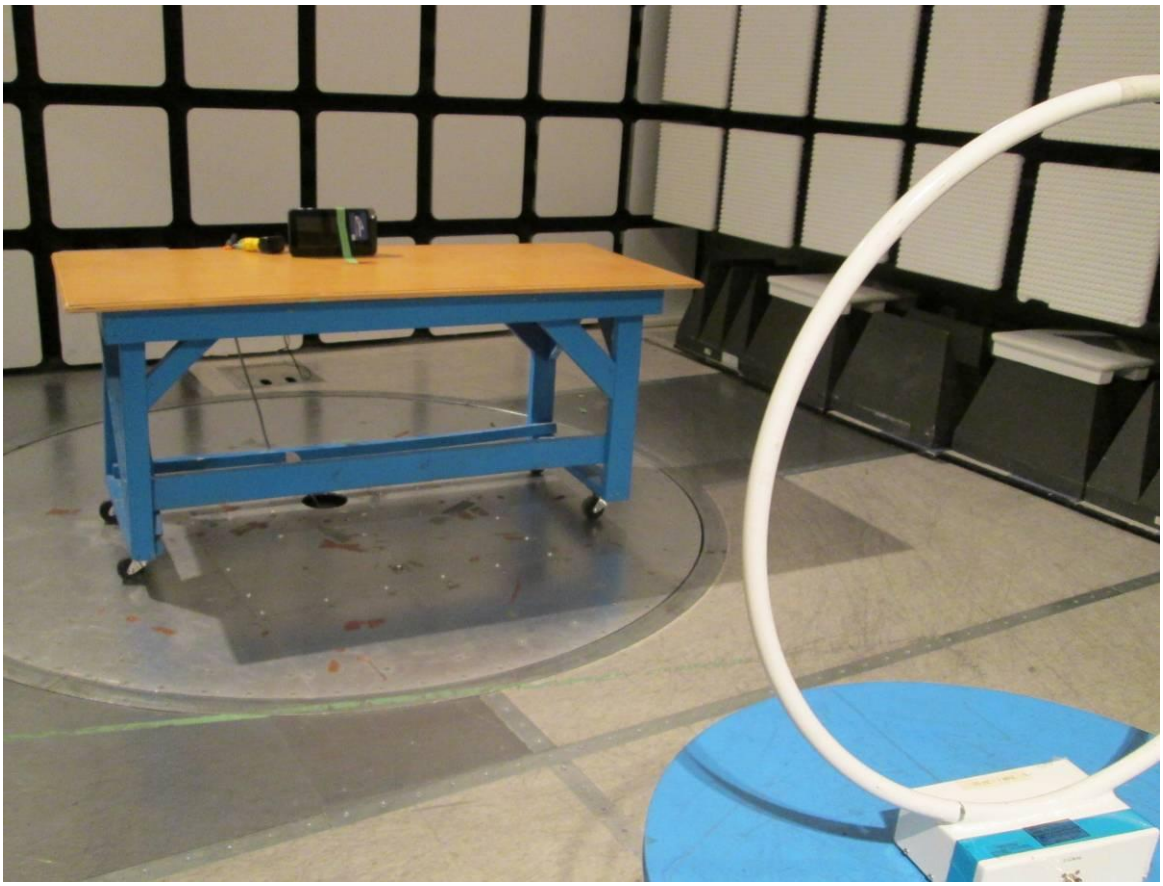
Board #5 as seen in photos *EUT – Internal view 1-4*
Side 2

Board #6 as seen in photos *EUT – Internal view 4*, is the back of the LCD panel.

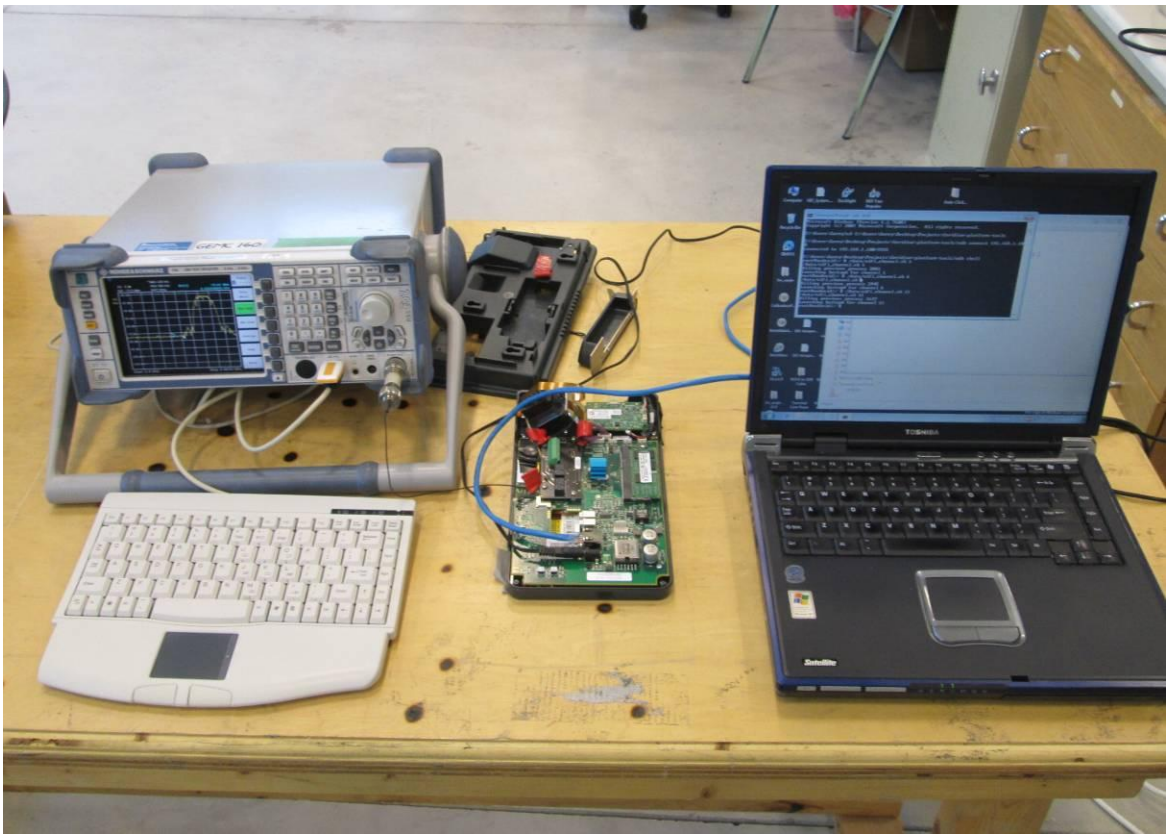
Radiated Emissions

Radiated Emissions 2

Radiated Emissions 3



Conducted Measurements



Power Line Conducted Emissions