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ELECTROMAGNETIC COMPATIBILITY TEST REPORT

PREPARED FOR CARMANAH SIGNS INC.
BY QAI LABORATORIES

Report Reference Number:	E10786-1601-Carmanah Rev 3.0
Total Number of Pages:	51
Date of Issue:	August 5, 2016

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American Association for Laboratory Accreditation Certificate Number: 3657.02

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Applicable Test Standards:	FCC Title 47 Part 15 Subpart C & Subpart B, RSS-210 Issue 8, RSS-Gen Issue 4 & ICES-003 Issue 6

Equipment Tested	Stand-Alone Radio Module
Model Number:	2-14231
FCC ID:	2AIQM-214231
IC Certification Number:	21436-214231
Manufacturer:	Carmanah Signs Inc.

REVISION HISTORY

Date	Report Number	Rev #	Details	Author's Initials
July 15, 2016	E10786-1601-Carmanah	0.0	Draft Test Report	MT
July 25, 2016	E10786-1601-Carmanah	1.0	Final Test Report	MT
August 2, 2016	E10786-1601-Carmanah	2.0	Updated as per Filing Requirements	MT
August 5, 2016	E10786-1601-Carmanah	3.0	RF Exposure Updated	MT
All previous versions of this report have been superseded by the latest dated revision as listed in the above table. Please dispose of all previous electronic and paper printed revisions accordingly.				

REPORT AUTHORIZATION

The data documented in this report is for the test equipment provided by Carmanah Signs Inc. Tests were conducted on the sample equipment as requested by Carmanah Signs Inc. for the purpose of demonstrating compliance with FCC Title 47 Part 15 Subpart C & Subpart B, RSS-210 Issue 8, RSS-Gen Issue 4 & ICES-003 Issue 6 as agreed upon by Carmanah Signs Inc. as per Quote SH-2015-032702.

Carmanah Signs Inc. is responsible for the tested product configuration, continued product compliance, and for the appropriate auditing of subsequent products as required. This report may comprise partial list of tests that are required for FCC or IC Declaration of Conformity and can only be produced by the manufacturer.

This is to certify that the following report is true and correct to the best of our knowledge.

Written by Maurice Torio
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Reviewed by Parminder Singh
Director for the EMC Department

QAI FACILITIES

Founded in 1994 by a group of experienced certification and testing experts, QAI is an independent third-party testing, inspection and certification organization which serves the building industry, government and individuals with cost effective solutions through our in-house capabilities / services, and an established world-wide network of qualified affiliates. To help get your product to market, trust the provider that many leading global manufacturers do: QAI.

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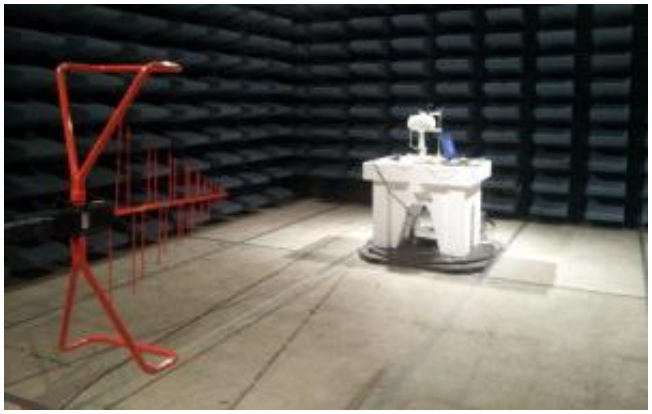
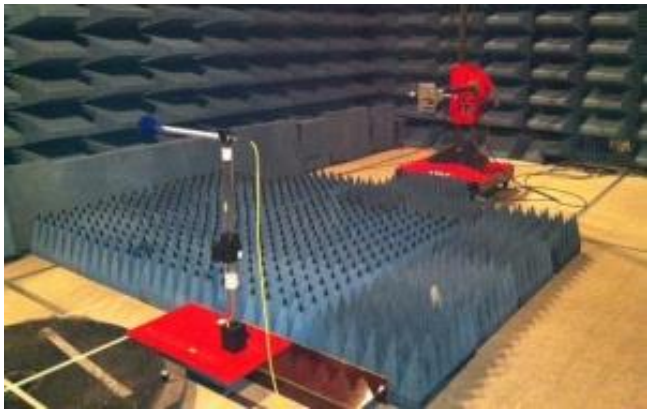
EMC Laboratory Location	FCC Designation (3m SAC)	IC Registration (3m SAC)	A2LA Certificate
Burnaby, BC Canada	CA9543	21146-1	3657.02
Everett, Washington USA	307482	11876A-1	3657.02

Headquarters & EMC Laboratory in Burnaby, BC

EMC Laboratory in Everett, Washington



3 m Semi-Anechoic Chamber (SAC) in Burnaby, BC



3 m Semi-Anechoic Chamber (SAC) in Burnaby, BC

10 m Open Area Test Site (OATS) in British Columbia, Canada

5 m Semi-Anechoic Chamber (SAC) in Everett, Washington

5 m Semi-Anechoic Chamber (SAC) in Everett, Washington

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Section I: EXECUTIVE SUMMARY

1.1 Purpose

The purpose of this report is to demonstrate and document the compliance of "2-14231 Stand-Alone Radio Module" as per Sections 1.2 & 1.3.

1.2 Scope

The information documented in this report is based on the test methods and levels as per Quote SH-2015-032702:

- **FCC Title 47 Part 15 –** Radio Frequency Devices, Subpart C – Intentional Radiators. 15.205 Restricted Bands of Operation
- **FCC Title 47 Part 15 –** Radio Frequency Devices, Subpart C – Intentional Radiators. 15.207 Conducted Limits
- **FCC Title 47 Part 15 –** Radio Frequency Devices, Subpart C – Intentional Radiators. 15.209 Radiated Emissions Limits: General Requirements
- **FCC Title 47 Part 15 –** Radio Frequency Devices, Subpart C – Intentional Radiators. 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz
- **RSS-210 Issue 8 –** License Exempt Radio Apparatus (All Frequency Bands): Category 1 Equipment
- **RSS-Gen Issue 4 –** General Requirements and Information for the Certification of Radio Apparatus – Section 3.2 Modular Approvals for Category I Equipment or Category II Equipment
- **ICES-003 Issue 5 –** Digital Apparatus Spectrum - Information Technologies and Telecommunications
- **CFR Title 47 FCC Part 15 –** Radio Frequency Devices, Subpart B – Unintentional Radiators

The tests documented in this report were performed in accordance with ANSI C63.4-2014, ANSI C63.10-2013, RSS-Gen Issue 4 and FCC KDB 558074 D01 DTS Meas Guidance v03r05.

1.3 Summary of Results

The following tests demonstrate the testimony to "FCC, IC & CE" Mark Electromagnetic compatibility testing for "2-14231 Stand-Alone Radio Module" manufactured by Carmanah Signs Inc.

The following testing was performed pursuant to FCC Title 47 Part 15 Subpart B & Subpart C

Test or Measurement	Applicable FCC Rule Parts	Description	Performance Criteria
Antenna Requirement	FCC 47 CFR Part 15.203	Soldered, non-replaceable antenna	Complies
RF Peak Power Output	FCC Part 15.247 (b)(3)	Maximum peak conducted output power shall not exceed 1 W. Except as provided in Section RSS 210 A8.4 (5), the e.i.r.p. shall not exceed 4 W.	Complies
Occupied Bandwidth (6dB Bandwidth)	FCC Part 15.247 (a)(2)	The minimum -6 dB bandwidth shall be at least 500 kHz.	Complies
Power Spectral Density	FCC Part 15.247 (e)	The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission	Complies
Out-of-Band Emissions (Band Edge)	FCC Part 15.247 (d)	In any 100 kHz bandwidth outside the frequency band in which the digitally modulated device is operating, the RF power that is produced shall be at least 20dB.	Complies
Conducted Spurious Emissions	FCC Part 15.247 (d), FCC Part 15.207, FCC Part 15.209 (a)	In any 100 kHz bandwidth outside the frequency band in which the digitally modulated device is operating, the RF power that is produced shall be at least 20dB.	Complies

Radiated Spurious Emissions – Transmit Mode	FCC Part 15.247 (d), FCC Part 15.209 (a), FCC Part 15.205	Radiated emissions requirements as stated in the Standards.	Complies
Radiated Spurious Emissions – Receive Mode	FCC Part 15.247 (d), FCC Part 15.209 (a)	Radiated emissions requirements as stated in the Standards	Complies
Frequency Stability	FCC Part 15.255(f)	Ensure the normal functionality despite temperature fluctuations	Complies
RF Exposure	FCC 47 CFR §1.1310	RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm	Complies

The following testing was performed pursuant to Industry Canada ICES-003 Issue 6

Test or Measurement	Applicable Industry Canada Rule Parts	Description	Performance Criteria
Antenna Requirement	RSS-Gen Issue 4	Soldered, non-replaceable antenna	Complies
RF Peak Power Output	RSS 210 Issue 8 Annex 8, RSS 247	Maximum peak conducted output power shall not exceed 1 W. Except as provided in Section RSS 210 A8.4 (5), the e.i.r.p. shall not exceed 4 W.	Complies
Occupied Bandwidth (6dB Bandwidth)	RSS 210 Issue 8 Annex 8, RSS 247	The minimum -6 dB bandwidth shall be at least 500 kHz.	Complies
Power Spectral Density	RSS 210 Issue 8 Annex 8, RSS 247	The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission	Complies
Out-of-Band Emissions (Band Edge)	RSS 210 Issue 8 Annex 8, RSS 247	In any 100 kHz bandwidth outside the frequency band in which the digitally modulated device is operating, the RF power that is produced shall be at least 20dB.	Complies
Conducted Spurious Emissions	RSS 210 Issue 8 Annex 8, RSS 247	In any 100 kHz bandwidth outside the frequency band in which the digitally modulated device is operating, the RF power that is produced shall be at least 20dB.	Complies
Radiated Spurious Emissions – Transmit Mode	RSS-210 Issue 8 Annex 2 Section A2.2 (b), RSS-Gen Issue 4	Radiated emissions requirements as stated in the Standards.	Complies
Radiated Spurious Emissions – Receive Mode	RSS-210 Issue 8 Annex 2 Section A2.2 (b), ICES-003 Issue 6	Radiated emissions requirements as stated in the Standards	Complies
Frequency Stability	RSS-Gen Issue 4	Ensure the normal functionality despite temperature fluctuations	Complies
RF Exposure	RSS-102 Section 2.5.2	RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm	Complies

Section II: GENERAL INFORMATION

2.1 Product Description

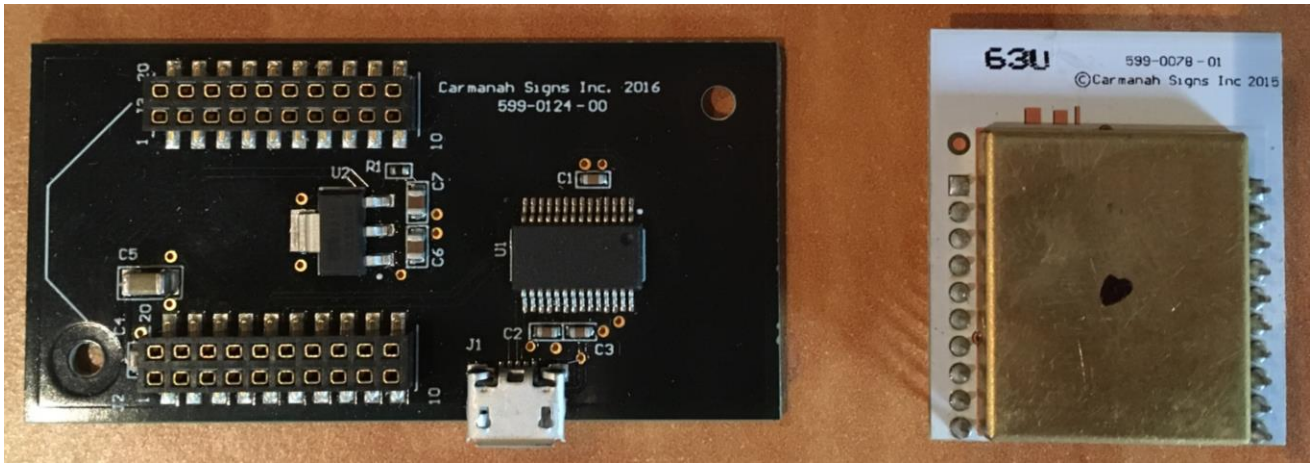
The information provided in this section is for the Equipment Under Test (EUT) and the corresponding Auxiliary Equipment needed to perform the tests as complete system.

Equipment Under Test (EUT) Information

EUT	Stand-Alone Radio Module
Functional Description	The radio module is designed to be installed on a host device which will use the radio module to communicate with remote devices.
Operational Description	The host device will provide power to the radio module according to the specifications in the User Manual. Communication with the radio module is conducted through a UART bus. On-board the radio module is two (2) microchips to control serial and RF communications.
FRN	0025542697
FCC ID	2AIQM-214231
IC Certification Number	21436-214231
Manufacturer	Carmanah Signs Inc.
Model No.	2-14231
Serial No.	00002
Transmitter Type	Zigbee
Frequency Band	2402-2480MHz
Transmit Power	3 dBm
Modulation	GFSK
Number of Channels	16
Test Channels	2405, 2440 and 2480MHz
Antenna Description	Printed circuit board antenna (Inverted "F")
Antenna Gain	3.3 dBi
Voltage Ratings	5Vdc USB
Software and Firmware	0102
Received Date	April 28, 2016
Received by	Aman Jathaul
Sample Log	QAI Product Control Log (QM 1305 - Sample Inventory)

Auxiliary Equipment Information

Equipment	Manufacturer	Product Description	Model No.
Auxiliary 1	Toshiba	Laptop	PSLB8C-0HH01X
Auxiliary 2	PuTTY	Software	Release 0.64



2-14231 Stand-Alone Radio Module

2.2 Environmental Conditions

The equipment under test was operated and tested under the following environmental conditions:

Parameter	Conditions
Location	Indoors
Temperature	22-28ºC
Relative Humidity	39.7 - 54.4%

2.3 Measurement Uncertainty

Parameter	Uncertainty
Radiated Emissions, 30MHz-1GHz	± 2.40 dB
Radiated Emissions, 1GHz-40GHz	± 2.48 dB
Radio Frequency	±1,5 x 10-5 MHz
Total RF Power Conducted	±1.36 dB
Spurious Emissions, Conducted	±1.36 dB
RF Power Density, Conducted	±1.36 dB
Temperature	±1ºC
Humidity	±5 %
DC and low frequency voltages	±3 %

2.4 Worst Test Case

Worst-case orientation was determined during the preliminary testing. The final radiated emissions were performed in the worst-case orientation.

2.5 Sample Calculations of Emissions Data

Radiated and conducted emissions were performed using EMC32 software developed by Rohdes & Schwarz. Transducer factors like Antenna factors, Cable Losses and Amplifier gains were stored in the test templates which are used to perform the emissions measurements. After test is finished, data is generated from the EMC32 consisting of product details, emission plots and final data tables as shown below.

Frequency (MHz)	Quasi-Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
42.663900	33.0	1000.000	120.000	100.0	H	70.0	13.2	7.5	40.5

Quasi Peak reading shown in the table above is already corrected by the software using correction factor shown in column “Corr.” The correction factor listed under “Corr.” table calculated as:

Corr.(dB) = Antenna factor + Cable loss

Or

Corr.(dB) = Antenna factor + Cable Loss - Amp gain (if pre-amplifier was used)

The final Quasi peak reading shown in the data is calculated by the software using following equation:

Corrected Quasi Peak(dBµV/m) = Raw Quasi Peak Reading + Antenna factor + Cable loss

To obtain the final Quasi-Peak or Average reading during power line conducted emissions, transducer factors are included in the final measurement as shown below.

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150	44.3	1000.000	9.000	0.6	21.7	66.0

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150	27.2	1000.000	9.000	0.6	28.8	56.0

Quasi Peak or Average reading shown in above table is already corrected by the software using the correction factor shown in column "Corr." The correction factor listed under "Corr." table calculated as:

Corr.(dB) = Antenna factor + Cable loss

The final Quasi peak or Average reading shown in the data is calculated by the software using following equation:

Corr. Quasi Peak/Average Reading (dBµV) = Raw Quasi Peak/Average Reading + Antenna factor + Cable loss

The allowable margin from the limits, as per the standards, were calculated for both radiated and conducted emissions:

Margin(dB) = Limit – Quasi-Peak or Average reading

2.6 Test Equipment List

The tables below contain all the equipment used by QAI Laboratories in conducting all tests on the Equipment Under Test (EUT) as per Section 1.3.

Emissions Test Equipment

Manufacturer	Model	Description	Serial No.	Calibration Due Date
Sunol Sciences	SM46C	Turntable	051204-2	N/A
Sunol Sciences	TWR95	Mast	TREML0001	N/A
Sunol Sciences	JB3	Biconilog Antenna 30MHz – 3GHz	A120106	24-Sep-2017
ETS Lindgren	2165	Turntable	00043677	N/A
ETS Lindgren	2125	Mast	00077487	N/A
Rohde & Schwarz	ESU40	EMI Receiver	100011	20-Nov-2017
Fischer	FCC-LISN-50-25-2-08	LISN (150kHz-30MHz)	2041	19-Nov-2018
ETS Lindgren	S201	5-meter Semi-Anechoic Chamber	1030	N/A
ETS Lindgren	3117	Horn Antenna 1GHz-18GHz	00075944	29-Aug-2016
AH Systems	PAM118	Amplifier 10KHz-18GHz	189	Conditional Use
California Instruments	PACS-1	Harmonics and flicker analyzer	72569	18 July 2018
California Instruments	OMNI 1-18 I	Programmable Impedance Flicker test	N/A	18 July 2018
California Instruments	3001ix	Power supply	HK52117	18 July 2018
Mini Circuit	8400+	High Pass Filter	N/A	N/A
Mini Circuit	2700A+	High Pass Filter	N/A	N/A
EMCO	3160-09	Standard gain Horn Antenna	9701-1071	30 August 2016
EMCO	6502	Loop Antenna	2178	21 August 2017
A.H. Systems Inc.	PAM-1840VH	Pre-Amp	152	14 June 2016

Immunity Testing Equipment

Manufacturer	Model	Description	Serial No.	Calibration Due Date
Ophir	5048FE	RF Amplifier 0.15-230 MHz	1035	N/A
Ophir	5125FE	RF Amplifier 20-1000 MHz	1030	N/A
Ophir	5163FE	RF Amplifier 0.8-4.2 GHz	1044	N/A
Amplifier Research	FP2080	Isotropic Field Probe, 80 MHz to 40 GHz	17905/120024 93-1/2	11-Oct-2018
Chase	emCELL	RF Immunity Chamber	1016	N/A
ETS Lindgren	S201	5-meter Semi-Anechoic Chamber	1030	N/A
HP	8648C	Signal Generator	3623A03622	17-Feb-2019
ThermoScientific	MiniZap	ESD Simulator:	0402265	07-Oct-2017
EMC Partner	CN-EFT1000	Capacitive Clamp	#408	29- jan-2018
FCC	F-120-9A	Bulk Injection Clamp	399	N/A

Teseq	NSG 3060	EMC multifunction Generator - 6kV with CDN and INA	184	14-May-2018
Teseq	CDN 3061	Surge CDN	184	14-May-2018
Teseq	INA 6502-CIB	Step up Transformer	124	14-May-2018

Measurement Software List

Manufacturer	Model	Version	Description
Rhode & Schwarz	EMC 32	6.20.0	Emissions Pre-scan Test Software
VI Automation	Via EMC Immunity Executive	1.0.308	Radiated and Conducted Immunity Test Program
TESEQ	WIN 3000	1.2.0	Surge, EFT & Voltage Dips Immunity Test Program
Thurlby Thandar Instruments	HA-PC Link Version	2.02	Harmonics and Flicker Test Program

Section III: REQUIREMENTS FOR THE US MARKET (FCC) & THE CANADIAN MARKET (IC) – Exigences pour le Marché Canadien

3.1 Antenna Requirements

The purpose of this requirement is to make certain that no other antenna, except for that provided by the responsible party, shall be used with the Equipment-Under-Test (EUT) as defined in FCC 47 CFR Part 15.203 & RSS-Gen Issue 4:

> "An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited." … "the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded."

The EUT meets the antenna requirement. The printed circuit board Inverted F antenna was soldered to the circuit board and was not accessible to the end-user.

3.2 RF Peak Power Output

The purpose of this test is to make certain that for systems employing digital modulation techniques operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz does not exceed the maximum conducted output power as per the standards, FCC Part 15.247 (b)(3), RSS 247 & RSS 210 Issue 8 Annex 8.

The test was conducted as defined by the standards above with the antenna port of the EUT directly connected to a spectrum analyzer. The maximum peak conducted power for systems employing digital modulation techniques operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz shall not exceed 1W. Except as provided in RSS 247 Section 5.4, the Equivalent Isotropically Radiated Power (E.I.R.P.) shall not exceed 4 W.

The EUT was tested without any modifications and was deemed compliant to the standards on May 16, 2016

Please refer to Appendix A of this report for the RF Peak Power Output Data.

3.3 Occupied Bandwidth (6dB Bandwidth)

The purpose of this test is to make certain that the 6dB bandwidth of the Equipment-Under-Test (EUT) is within the limits as per the standards, FCC Part 15.247 (a)(2), RSS 247 & RSS 210 Issue 8 Annex 8.

The test was conducted as defined by the standards above with the antenna port of the EUT directly connected to a spectrum analyzer. The minimum 6dB bandwidth of the EUT, as per the standards, shall be at least 500kHz.

The EUT was tested without any modifications and was deemed compliant to the standards on May 16, 2016

Please refer to Appendix B of this report for the Occupied Bandwidth (6dB Bandwidth) data.

3.4 Power Spectral Density

The purpose of this test is to make certain that the transmitter power spectral density conducted to the antenna is within the limits as per the standards, FCC Part 15.247 (e), RSS 247 & RSS 210 Issue 8 Annex 8.

The test was conducted as defined by the standards above with the antenna port of the EUT directly connected to a spectrum analyzer. The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission. The power spectral density was determined using the same method as is used to determine the conducted output power.

The EUT was tested without any modifications and was deemed compliant to the standards on May 16, 2016

Please refer to Appendix C of this report for the Power Spectral Density data.

3.5 Out-of-Band Emissions (Band Edge)

The purpose of this test is to make certain that Out-of-Band Emissions (Band Edge) from the Equipment Under Test (EUT) does not exceed the limits as per the standards, FCC Part 15.247 (d), RSS 247 & RSS 210 Issue 8 Annex 8.

The test was conducted as defined by the standards above. In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under RSS 247 Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen Issue 4 is not required.

The EUT was tested without any modifications and was deemed compliant to the standards on May 16, 2016.

Please refer to Appendix D of this report for the Out-of-Band Emissions (Band Edge) data.

3.6 Conducted Spurious Emissions

The purpose of this test is to make certain that the conducted spurious emissions from the Equipment Under Test (EUT) does not exceed the limits as per the standards, FCC Part 15.247 (d), FCC Part 15.207, FCC Part 15.209 (a), RSS 247 & RSS 210 Issue 8 Annex 8.

The test was conducted as defined by the standards above. In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits.

The EUT was tested without any modifications and was deemed compliant to the standards on May 16, 2016

Please refer to Appendix E of this report for the Conducted Spurious Emissions data.

3.7 AC Mains Conducted Emissions

The purpose of this test is to make certain that the unintentional emitted RF energy from the Equipment Under Test (EUT) to its power source does not exceed the limits defined in the table below as per the standards, ICES-003 Issue 6 & FCC CFR47 Part 15 Subpart B, for Class B equipment. This will prevent the EUT from causing any unwanted interference to other electronic devices.

Frequency (MHz)	**Conducted Limit (dBµV)**	
	Quasi-Peak	**Average**
0.15 – 0.50	66 to 56	56 to 46
0.50 – 5	56	46
5 – 30	60	50

Note 1: *The lower limit shall apply at the transition frequencies.*
Note 2: *The limit decreases linearly with the logarithm of the frequency in the 0.15 to 0.50 MHz*

The test was conducted as defined by the standards above. The Line Impedance Stabilizing Network (LISN) was used to make conducted emissions measurements. The equipment was operated and tested at 120Vac 60Hz while in “Continuous Mode” of operation. Measurements were made by using an EMI test receiver with 9 kHz bandwidth, CISPR Quasi-Peak and Average detector capabilities. Test receiver requirements, including the bandwidths used, for the test receiver are those specified in CISPR 16-1-1.

The EUT was tested without any modifications and was deemed compliant to Class B standards on June 16, 2016.

Please refer to Appendix F of this report for the AC Mains Conducted Emissions data.

3.8 Radiated Spurious Emissions – Transmit Mode

The purpose of this test is to make certain that the radiated spurious emissions from the Equipment Under Test (EUT) while in transmit mode does not exceed the limits as per the standards, FCC Part 15.247 (d), FCC Part 15.209 (a), FCC Part 15.205, IC RSS-210 Issue 8 Annex 2 Section (A2.2) (b), RSS-Gen Issue 4.

The test was conducted as defined by the standards above. The EUT was positioned in the center of the turntable in the SAC and was connected to a 3Vdc battery. The transmitter was set for continuous transmission. The lowest, middle and highest channels in the 2400-2483.5 MHz band were measured for all radiated emissions 10kHz to 18 GHz.

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20 dB below the level of the fundamental or to the general field strength limits listed in RSS-Gen Issue 4, whichever is less stringent. In measuring unwanted emissions, the spectrum shall be investigated from 30 MHz or the lowest radio frequency signal generated in the equipment, whichever is lower, without going below 9 kHz, up to at least the frequency if the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower. Unwanted emissions falling into restricted bands of shall comply with the limits specified below.

Frequency (MHz)	Field Strength	
	uV/m @ 3-m	Calculated dBµV/m at 3m
30 – 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
960 - 1000	500	54.0

For frequencies below 30 MHz, an active loop antenna was used to make measurements. There were no significant emission levels detected during the test. Thus, the said results were not included in this report.

FCC PART 15.205 – Restricted Bands of Operation:

(a) Except as shown in paragraph (d) of FCC PART 15.205, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
1 0.495-0.505*	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(2)
13.36-13.41			

Note 1: **FCC-specific*
Note 2: *Canada-specific frequency ranges - 3.020-3.026, 5.677–5.683, 121.94-123.0. 149.9-150.05, 162.0125-167.17, 167.72-173.2, 1300-1427, 2483.5-2500, 3500-3600,*
Note 3: *(2) Above 38,6 GHz*

(b) Except as provided in paragraphs (d) and (e) FCC PART 15.205, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in § 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in § 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in § 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in § 15.35 apply to these measurements.

RESTRICTED FREQUENCY BANDS (RSS-GEN ISSUE 4)

MHz
0.090-0.110
2.1735-2.1905
3.020-3.026
4.125-4.128
4.17725-4.17775
4.20725-4.20775
5.677-5.683
6.215-6.218
6.26775-6.26825
6.31175-6.31225
8.291-8.294
8.362-8.366
8.37625-8.38675
8.41425-8.41475
12.29-12.293
12.51975-12.52025
12.57675-12.57725
13.36-13.41
16.42-16.423
16.69475-16.69525
16.80425-16.80475
25.5-25.67
37.5-38.25
73-74.6
74.8-75.2
108-138
156.52475-156.52525
156.7-156.9

MHz
240-285
322-335.4
399.9-410
608-614
960-1427
1435-1626.5
1645.5-1646.5
1660-1710
1718.8-1722.2
2200-2300
2310-2390
2655-2900
3260-3267
3332-3339
3345.8-3358
3500-4400
4500-5150
5350-5460
7250-7750
8025-8500

GHz
9.0-9.2
9.3-9.5
10.6-12.7
13.25-13.4
14.47-14.5
15.35-16.2
17.7-21.4
22.01-23.12
23.6-24.0
31.2-31.8
36.43-36.5
Above 38.6

Note: Certain frequency bands listed in Table 3 and in bands above 38.6 GHz are designated for licence-exempt applications. These frequency bands and the requirements that apply to the devices are set out in the 200– and 300– series RSSs, such as RSS-210 and RSS-310, which contain the requirements that apply to licence-exempt radio apparatus.

Measurements were made by using a spectrum analyzer, receiver, 200Hz RBW average detector for the frequency range 9-150KHz, 9kHz RBW average detector for the Frequency range 150kHz to 30MHz, 120kHz RBW quasi-peak detector using the appropriate antennas, amplifiers and filters. The measurement results are obtained as described below:

E [dBµV/m] = Un-Corrected Value + ATOT Where ATOT = total correction factor including cable loss, antenna factor and preamplifier gain (ATOT = LCABLES + AF - AMP).

Radiated spurious emissions was measured up to 10th harmonics of fundamental frequency using the procedures described in ANSI C63.4:2014 and ANSI C63.10:2013 but no radiated emissions were found and reported other than in Figure 27 of Appendix G.

The EUT was tested without any modifications and was deemed compliant to the standards on April 28, 2016.

Please refer to Appendix G of this report for the Radiated Spurious Emissions – Transmit Mode data.

3.9 Radiated Spurious Emissions – Receive Mode

The purpose of this test is to make certain that the radiated spurious emissions by the Equipment Under Test (EUT) while in receive mode does not exceed the limits as per the standards, FCC Part 15.247 (d), FCC Part 15.209 (a), RSS-210 Issue 8 Annex 2 Section A2.2 (b), & ICES-003 Issue 6.

The test was conducted as defined by the standards above. The EUT was positioned in the center of the turntable in the SAC and was connected to a 3Vdc battery. The transmitter was set for continuous transmission. The lowest, middle and highest channels in the 2400-2483.5 MHz band were measured for all radiated emissions 10kHz to 18 GHz.

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20 dB below the level of the fundamental or to the general field strength limits listed in RSS-Gen Issue 4, whichever is less stringent.

In measuring unwanted emissions, the spectrum shall be investigated from 30 MHz or the lowest radio frequency signal generated in the equipment, whichever is lower, without going below 9 kHz, up to at least the frequency … if the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower. Unwanted emissions falling into restricted bands of shall comply with the limits specified below.

Frequency (MHz)	Field Strength	
	uV/m @ 3-m	Calculated dBµV/m at 3m
30 – 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
960 - 1000	500	54.0

Measurements were made by using a spectrum analyzer, receiver, 200Hz RBW average detector for the frequency range 9-150KHz, 9kHz RBW average detector for the Frequency range 150kHz to 30MHz, 120kHz RBW quasi-peak detector using the appropriate antennas, amplifiers and filters. The measurement results are obtained as described below:

E [dBµV/m] = Un-Corrected Value + ATOT Where ATOT = total correction factor including cable loss, antenna factor and preamplifier gain (ATOT = LCABLES + AF - AMP).

The EUT was tested without any modifications and was deemed compliant to the standards on April 28, 2016.

Please refer to Appendix H of this report for the Radiated Spurious Emissions – Receive Mode data.

3.10 Frequency Stability

The purpose of this test is to make certain that the Frequency Stability of the Equipment Under Test (EUT) is maintained as per the standards, FCC Part 15.255(f), RSS-Gen Issue 4.

RSS-Gen Issue 4 Section 6.11

"With the transmitter installed in an environment test chamber, the unmodulated carrier frequency shall be measured under the conditions specified below:"

(a) at temperatures of -30°C, +20°C and +50°C, at the manufacturer's rated supply voltage
(b) at a temperature of +20°C and at ±15 percent of the manufacturer's rated supply voltage.

"*Transmitter frequency stability for licence-exempt radio apparatus shall be measured in accordance with Section 6.11. For licence-exempt radio apparatus, the frequency stability shall be measured at temperatures of -20°C (-4°F), +20°C (+68°F) and +50°C (+122°F) instead of at the temperatures specified in Section 6.11."*

"If the frequency stability of the licence-exempt radio apparatus is not specified in the applicable standard (RSS), measurement of the frequency stability is not required provided that the occupied bandwidth of the licence-exempt radio apparatus lies entirely outside the restricted bands and the prohibited TV bands of 54-72 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz and 614-806 MHz".

FCC Part 15.255 (f)

"Fundamental emissions must be contained within the frequency bands specified in this section during all conditions of operation. Equipment is presumed to operate over the temperature range −20 to + 50 degrees Celsius with an input voltage variation of 85% to 115% of rated input voltage, unless justification is presented to demonstrate otherwise."

The test was conducted as defined by the standards above. The EUT was bench tested in the temperature chamber. Measurements were made using a Spectrum Analyzer with 120kHz RBW Average detector while directly connected to the EUT through the antenna port.

The EUT was tested without any modifications and was deemed compliant to the standards on June 3, 2016.

Please refer to Appendix I of this report for the Radiated Spurious Emissions – Receive Mode data.

3.11 RF Exposure Evaluation

The purpose of this test is to make certain that the Equipment Under Test (EUT) complies with the RF exposure requirements as per the standards, RSS-102 Section 2.5.2 & FCC 47 CFR §1.1310

RSS-102 Section 2.5.2

"RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- *at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1.31 x 10-2 f^0.6834 W (adjusted for tune-up tolerance), where f is in MHz*

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived."

FCC 47 CFR §1.1310

"Radiofrequency radiation exposure limits for General Population/Uncontrolled Exposure at Frequency range 1500 - 100000 MHz: 1.0 mW/cm^2"

Exposure Evaluation:

1.) The highest conducted power measured was 2.97dBm when the EUT was operated at 2405 MHz
2.) The Antenna gain: 3.3dBi.
3.) E.I.R.P = 2.97dBm + 3.3dBi = 6.27dBm = 4.24mW
4.) Power Density at 20cm distance = 4.24mW/(4X3.14X20X20 cm^2) = 0.0008mW/cm^2

The radiated emissions of the EUT is far below the exemption limit 2.7W as per RSS-102 Section 2.5.2. The maximum power density at 20 cm distance is 0.0008mW/cm2 and is far below the limit 1.0 mW/cm^2 as per FCC 47 CFR §2.1091 & §1.1310.

The EUT was deemed compliant to the standards based on these measurements and calculations.

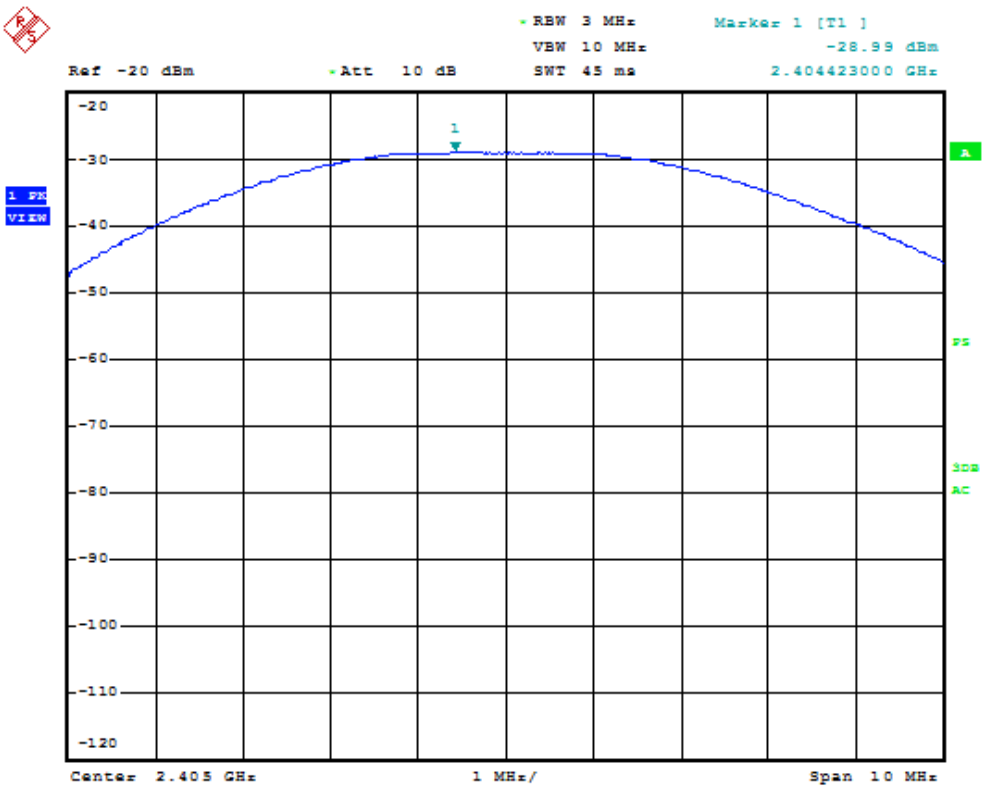
Appendix A: RF PEAK POWER OUTPUT DATA & PLOTS

Table 1: Conducted output power measurements

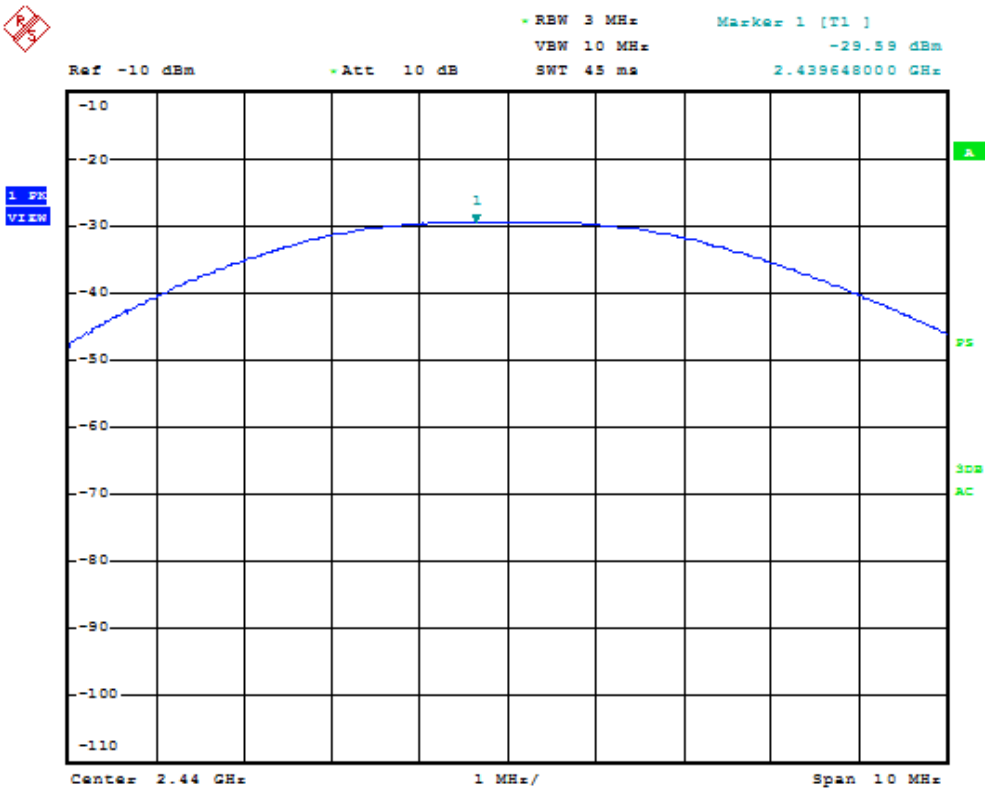
Channel	Frequency (MHz)	Measured Peak Output Power (dBm)	Cable Loss with 30dB Attenuator (dB)	Corrected Peak Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2405	-28.99	31.96	2.97	30	27.03
Middle	2440	-29.59	32	2.41	30	27.59
High	2480	-30.11	31.98	1.87	30	28.13

Table 2: E.I.R.P. measurements

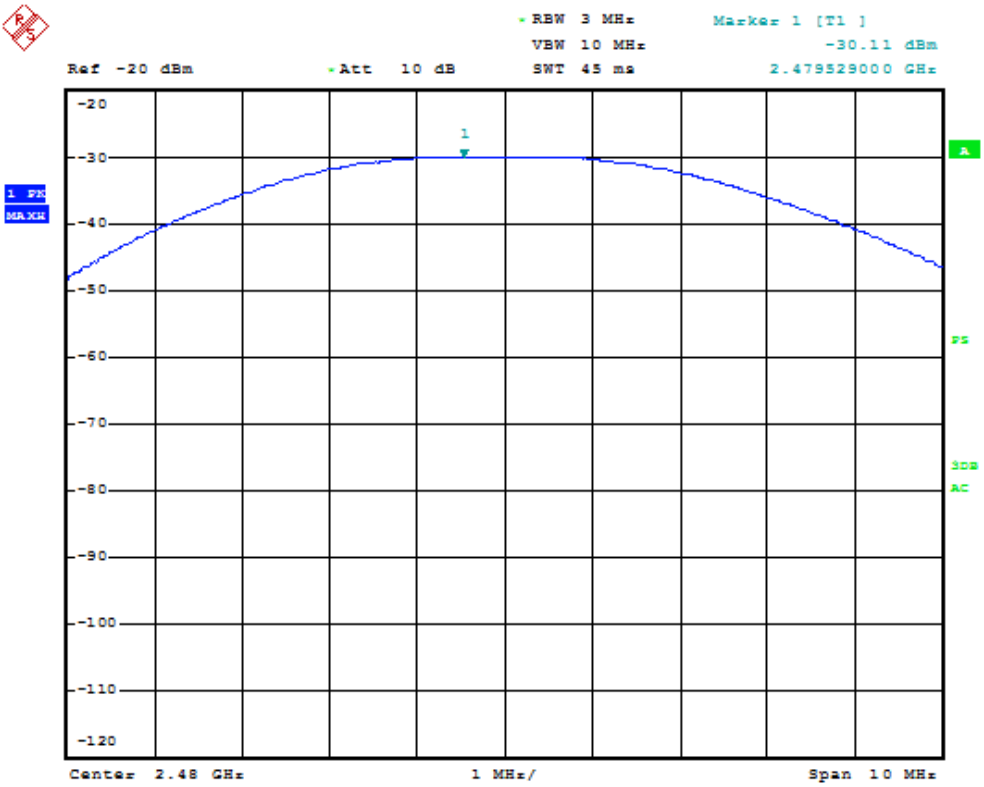
Channel	Frequency (MHz)	Corrected Peak at 3m (dBuV/m)	3m EIRP (dBm)
Low	2405	98.62	3.36
Middle	2440	98	2.74
High	2480	97.51	2.25



Plot 1: Peak Output Power – Low Channel



Plot 2: Peak Output Power – Mid Channel

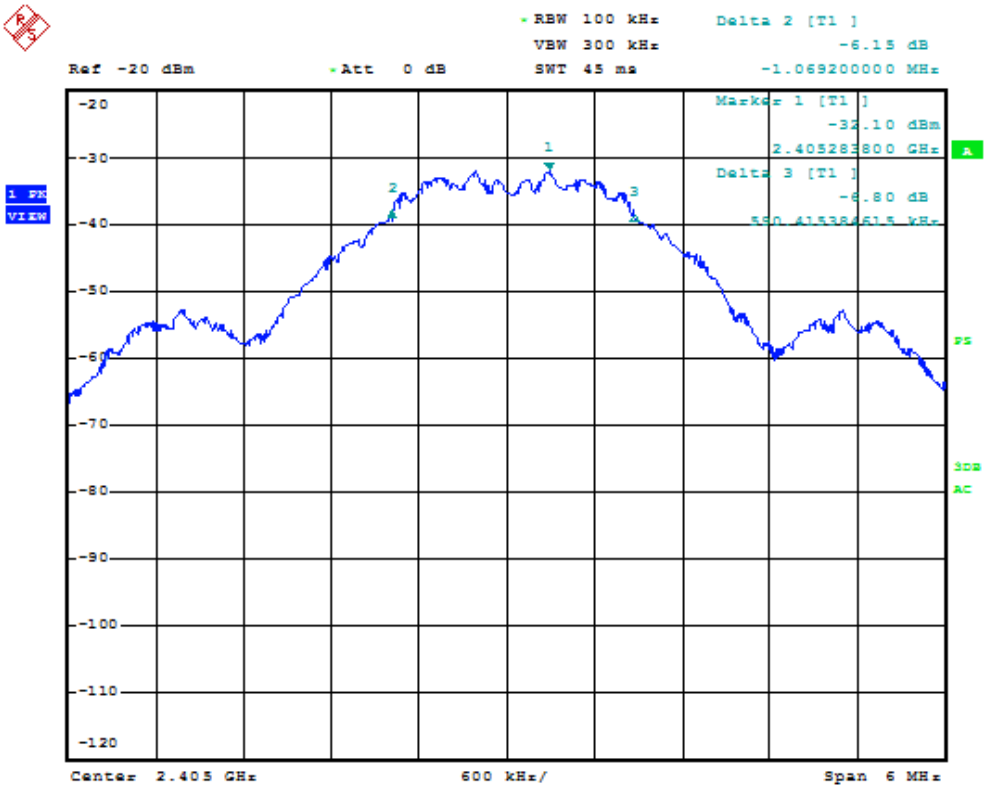


Plot 3: Peak Output Power – High Channel

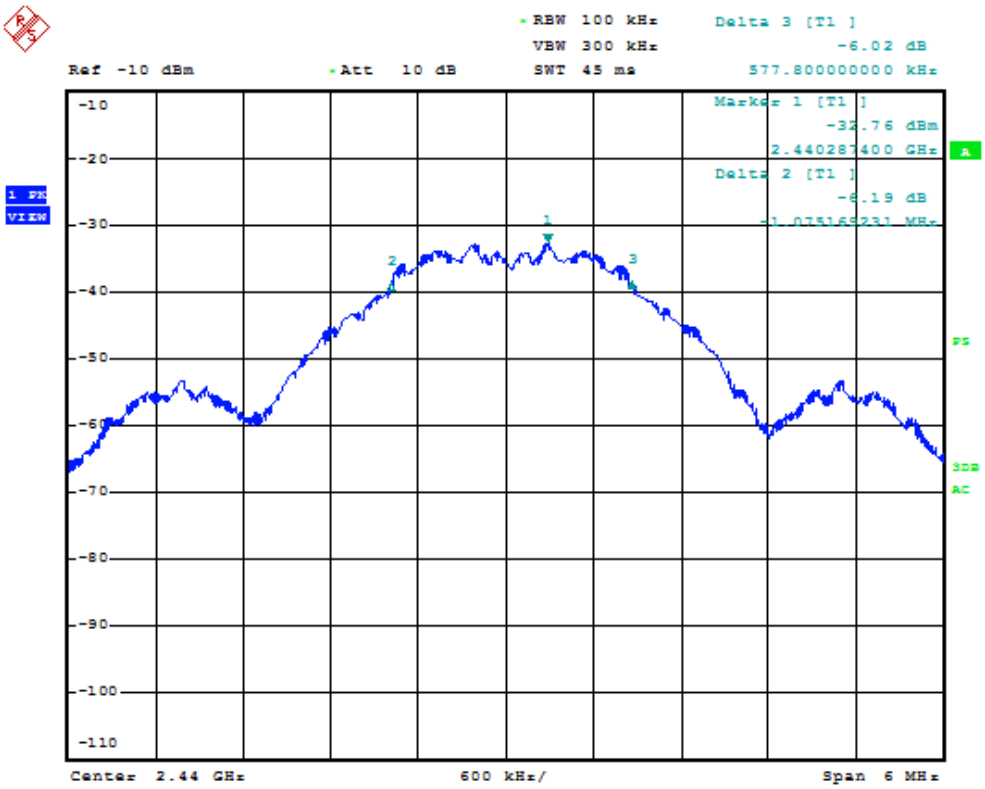
Appendix B: OCCUPIED BANDWIDTH (6dB BANDWIDTH) DATA & PLOTS

Table 3: Occupied Bandwidth (6dB Bandwidth) Data

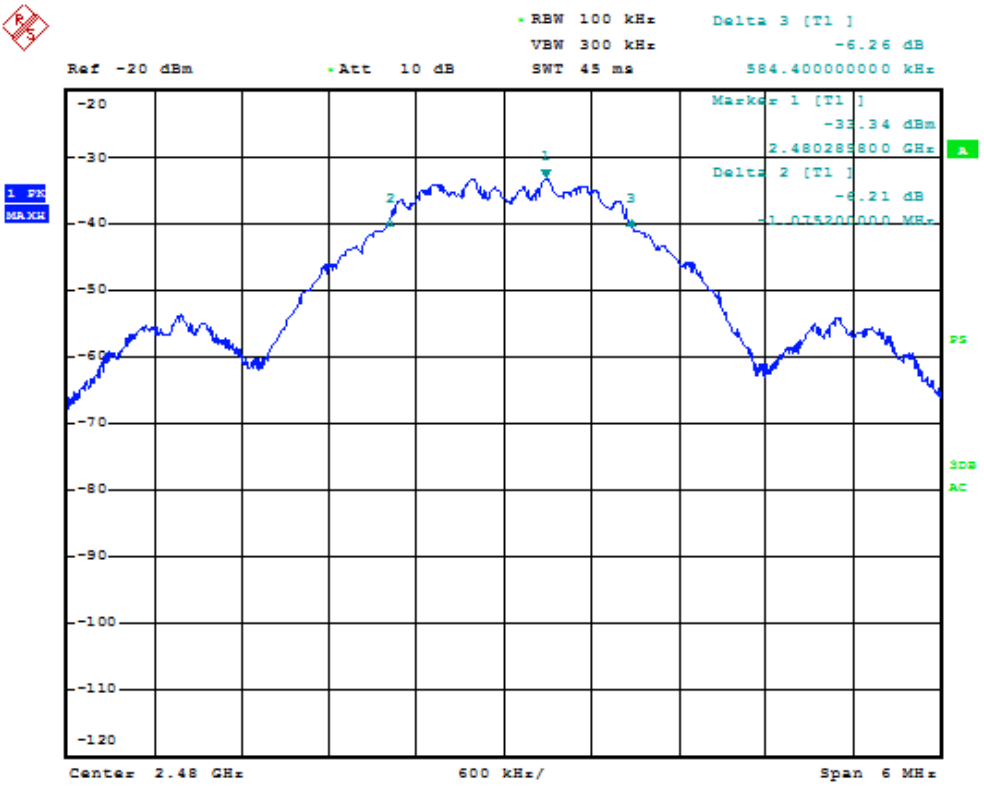
Channel	Frequency (MHz)	6dB Bandwidth (kHz)	Minimum Bandwidth (kHz)
Low	2405	1659.62	500
Middle	2440	1652.19	500
High	2480	1659.92	500



Plot 4: 6dB Occupied Bandwidth – Low Channel



Plot 5: 6dB Occupied Bandwidth – Middle Channel

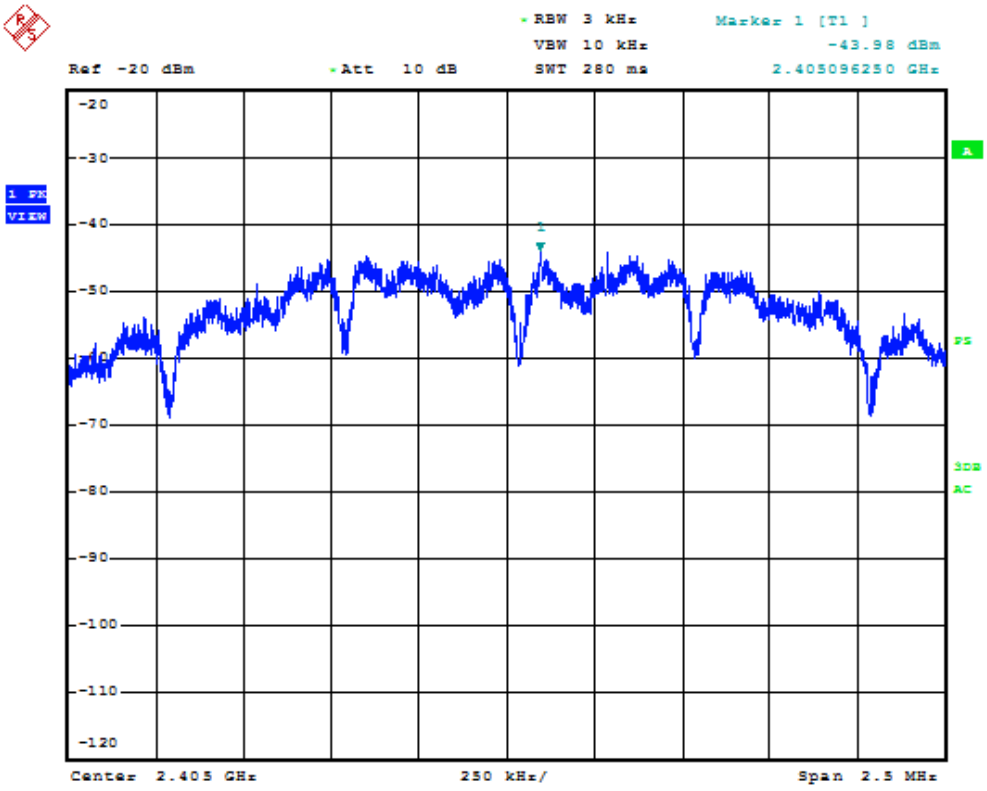


Plot 6: 6dB Occupied Bandwidth – High Channel

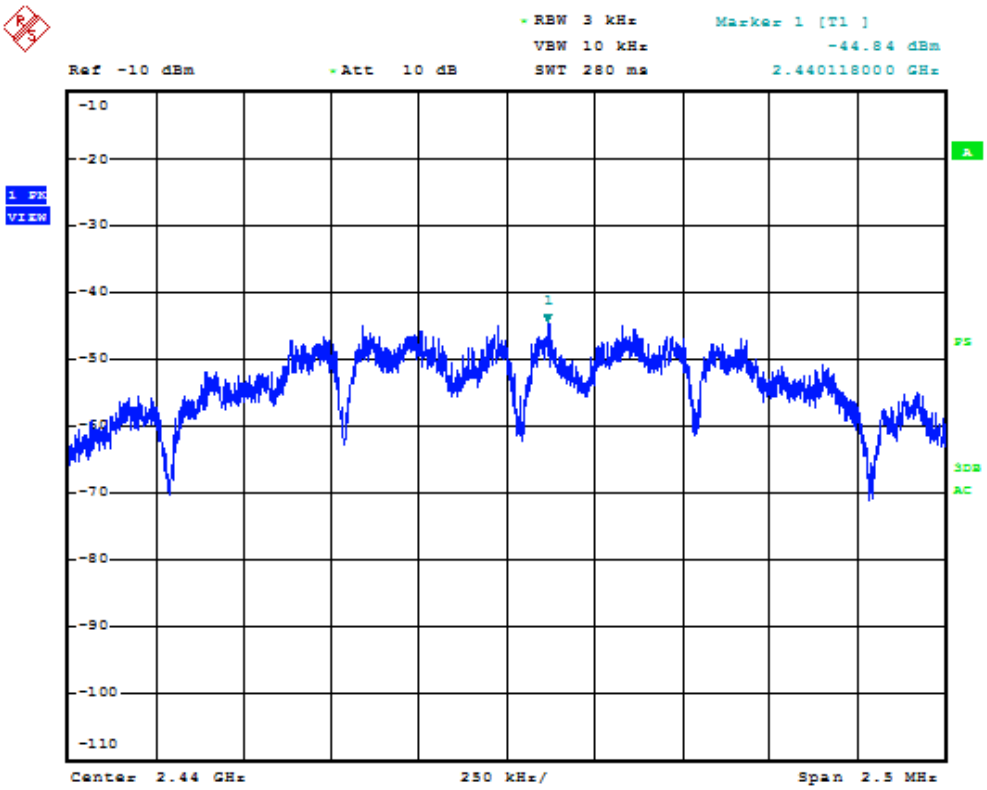
Appendix C: POWER SPECTRAL DENSITY DATA & PLOTS

Table 4: Power Spectral Density (PSD) Data

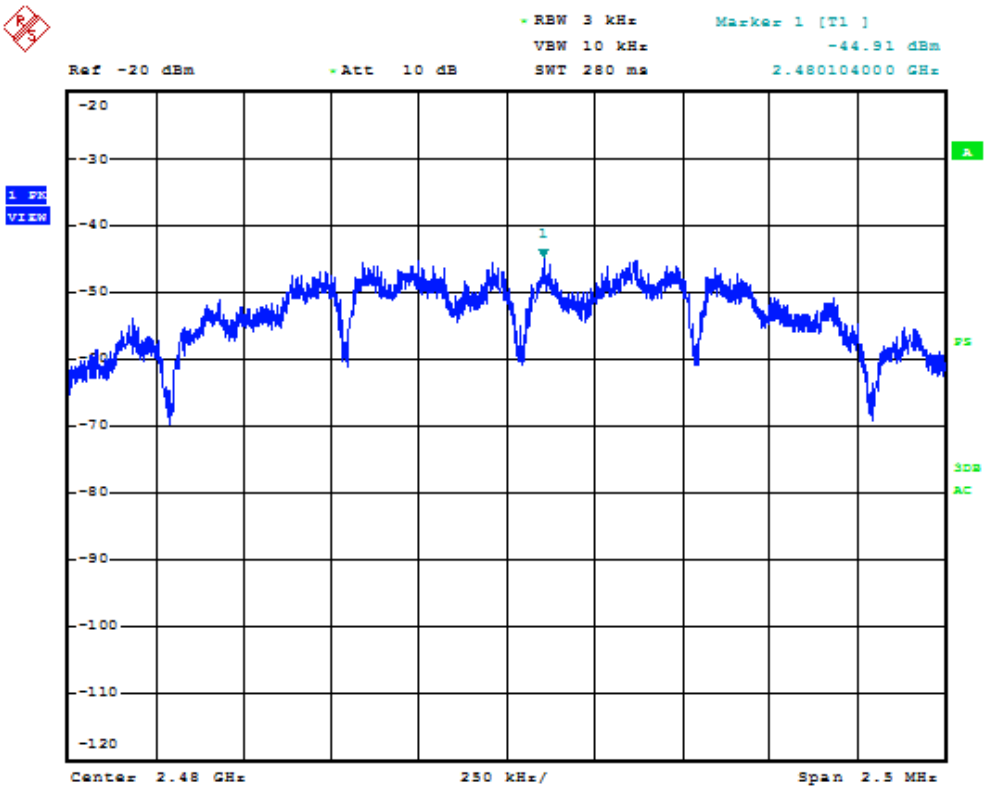
Channel	Frequency (MHz)	Measured PSD (dBm)	Cable Loss with 30dB Attenuator (dB)	Corrected PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2405	-43.98	31.96	-12.02	8	20.02
Middle	2440	-44.84	32	-12.84	8	20.84
High	2480	-44.91	31.98	-12.93	8	20.93



Plot 7: Power Spectral Density – Low Channel



Plot 8: Power Spectral Density – Middle Channel

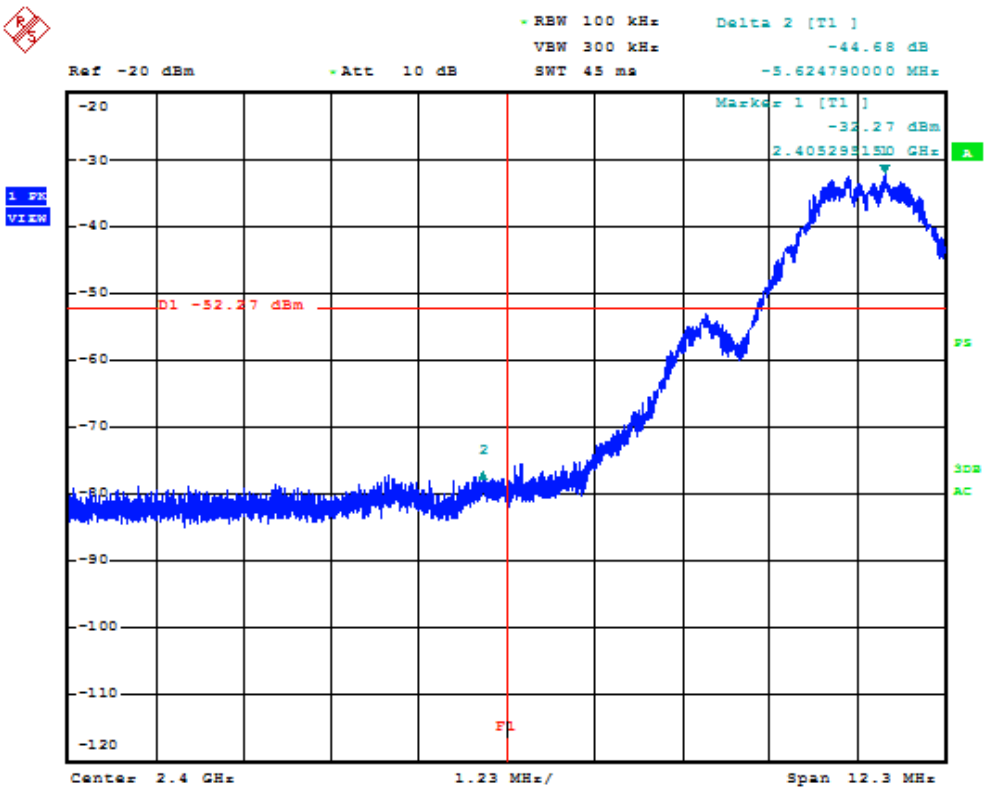


Plot 9: Power Spectral Density – High Channel

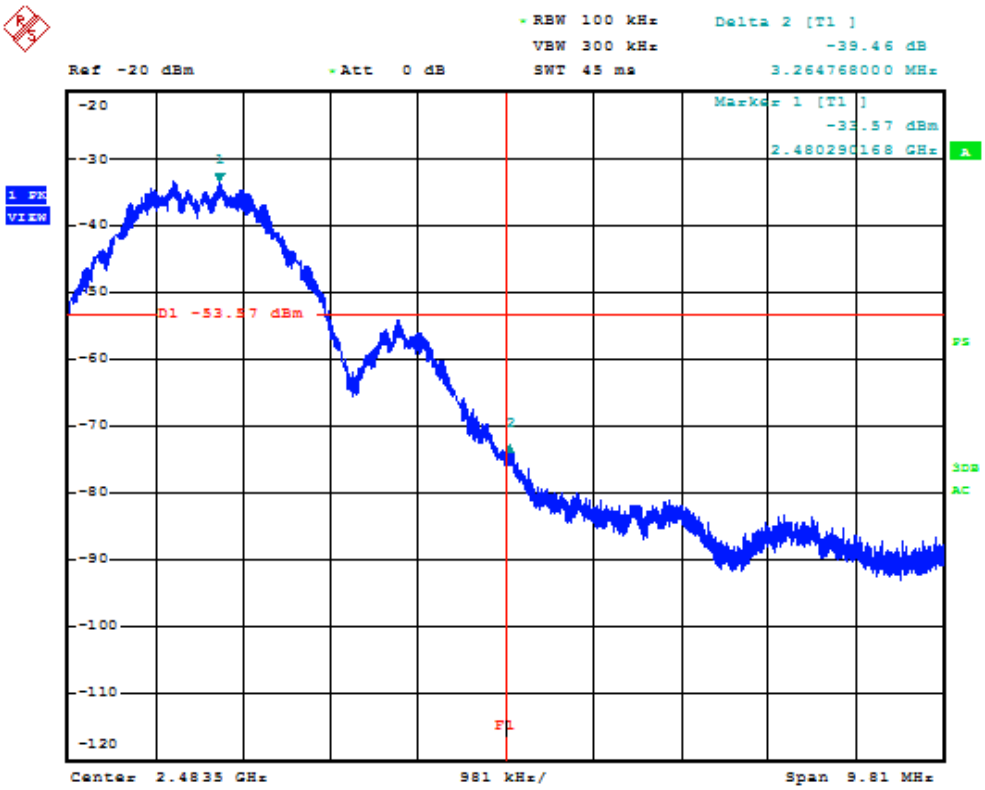
Appendix D: OUT-OF-BAND EMISSIONS (BAND EDGE) DATA & PLOTS

Table 5: Out-of-Band Emissions Data

Frequency (MHz)	Out-of-Band Emissions Level (dBc)	Minimum Limit (dBc)
2400	44.68	20
2483.5	39.46	20



Plot 10: Out-of-Band Emissions – Low Channel



Plot 11: Power Spectral Density – High Channel

Appendix E: CONDUCTED SPURIOUS EMISSIONS DATA

Table 6: Conducted Spurious Emissions Data – Low Channel

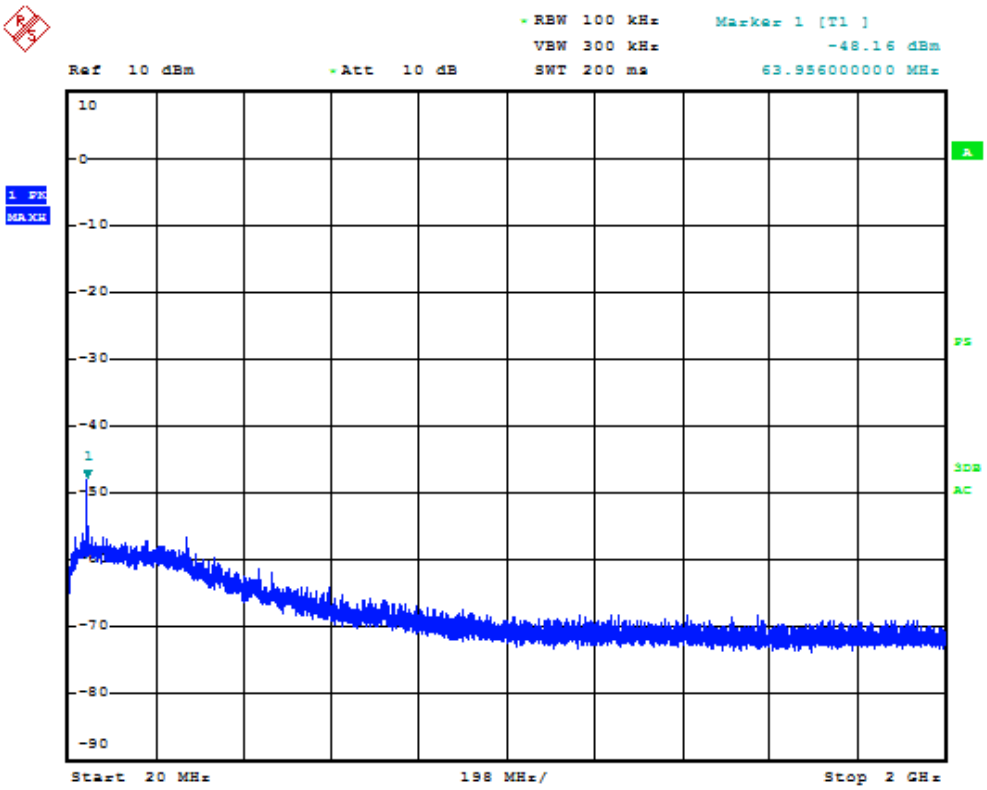
Frequency (MHz)	Measured Peak Emission (dBm)	Loss (dB)	Corrected Peak Emission (dBm)	Limit (dBm)	Margin (dB)
4810	-48.19	2.26	-45.93	-20.27	25.66
7215	-55.73	2.44	-53.29	-20.27	33.02
9620	-56.98	3.91	-53.07	-20.27	32.8
12025	-72.71	4.74	-67.97	-20.27	47.7
63.98	-48.15	1.78	-46.37	-20.27	26.1

Table 7: Conducted Spurious Emissions Data – Middle Channel

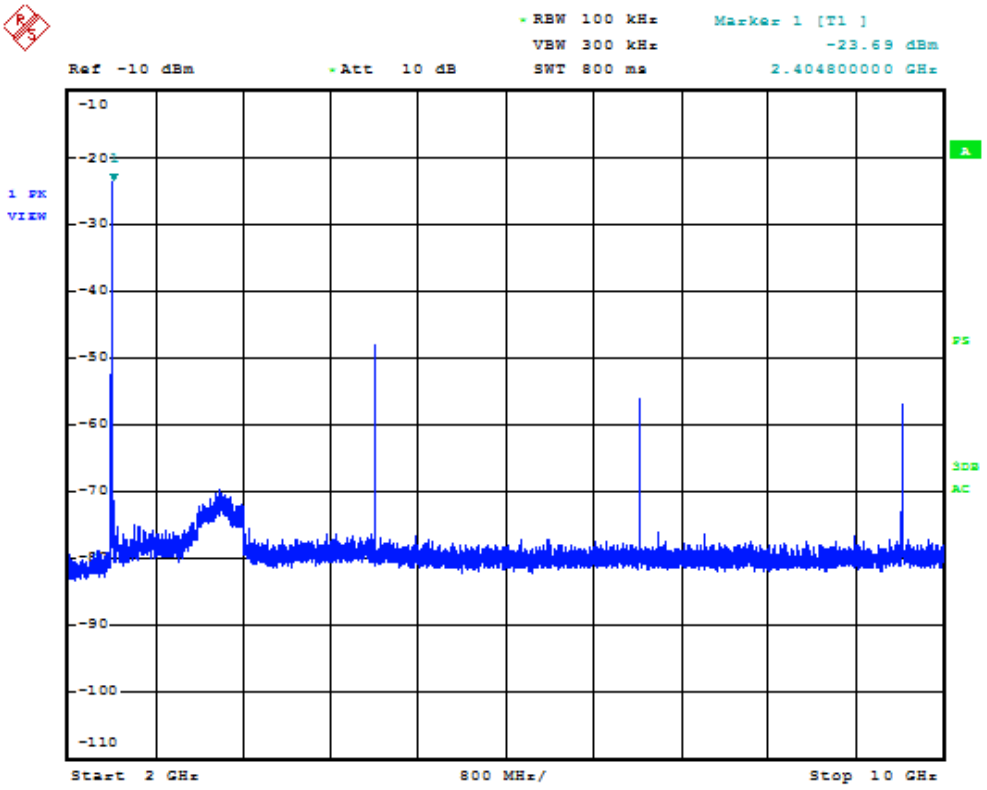
Frequency (MHz)	Measured Peak Emission (dBm)	Loss (dB)	Corrected Peak Emission (dBm)	Limit (dBm)	Margin (dB)
4880	-49.36	2.84	-46.52	-20.82	25.7
7320	-58.73	3.12	-55.61	-20.82	34.79
9760	-60.9	4.73	-56.17	-20.82	35.35
12200	-76.58	4.69	-71.89	-20.82	51.07
63.9	-47.13	1.78	-45.35	-20.82	24.53

Table 8: Conducted Spurious Emissions Data – High Channel

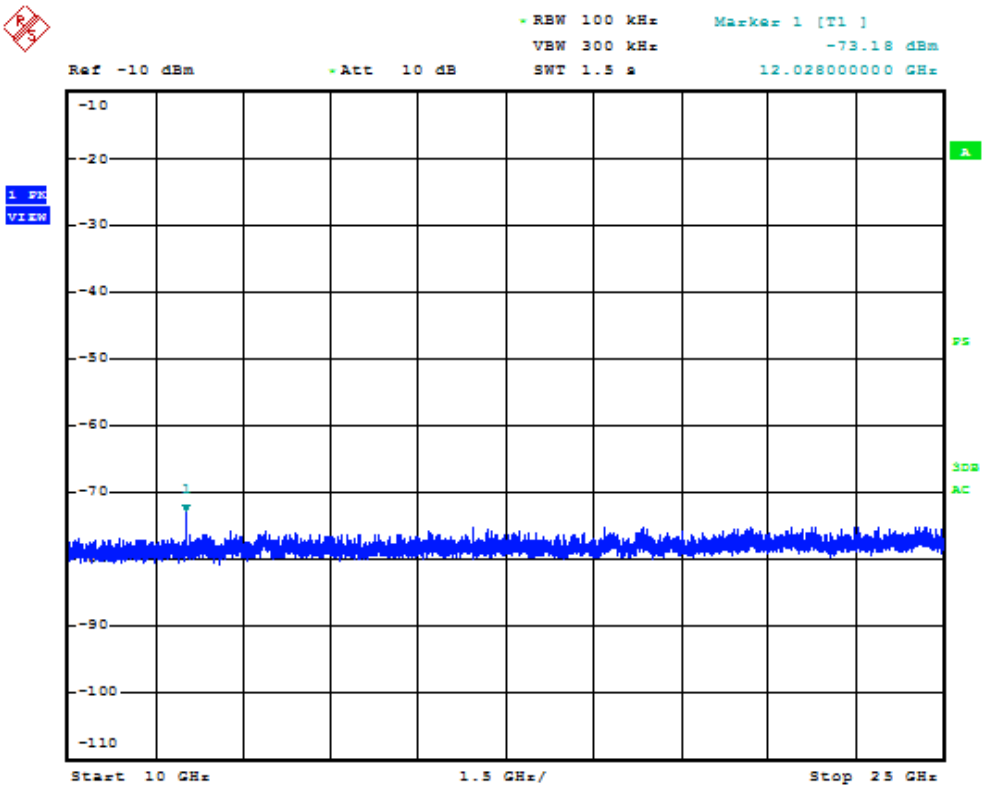
Frequency (MHz)	Measured Peak Emission (dBm)	Loss (dB)	Corrected Peak Emission (dBm)	Limit (dBm)	Margin (dB)
4960	-50.2	2.23	-47.97	-21.3	26.67
7440	-59.28	3.15	-56.13	-21.3	34.83
9920	-61.86	4.46	-57.4	-21.3	36.1
63.8	-47.31	1.78	-45.53	-21.3	24.23



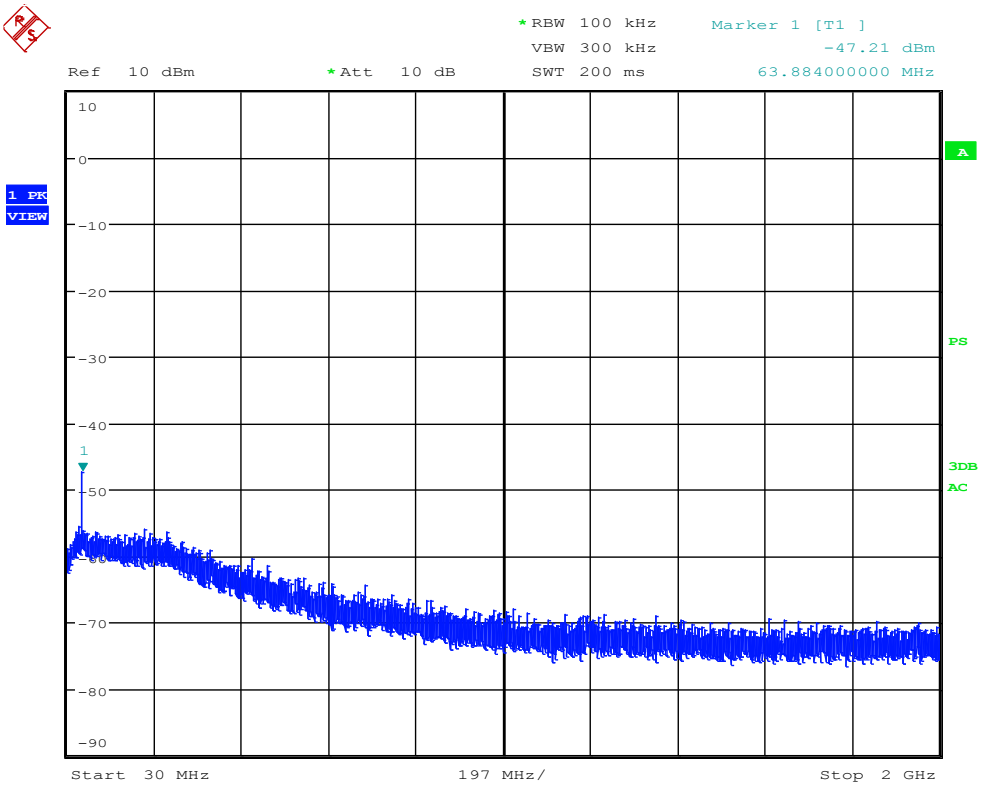
Plot 12: Conducted Spurious Emissions Data from 30MHz to 2GHz – Low Channel



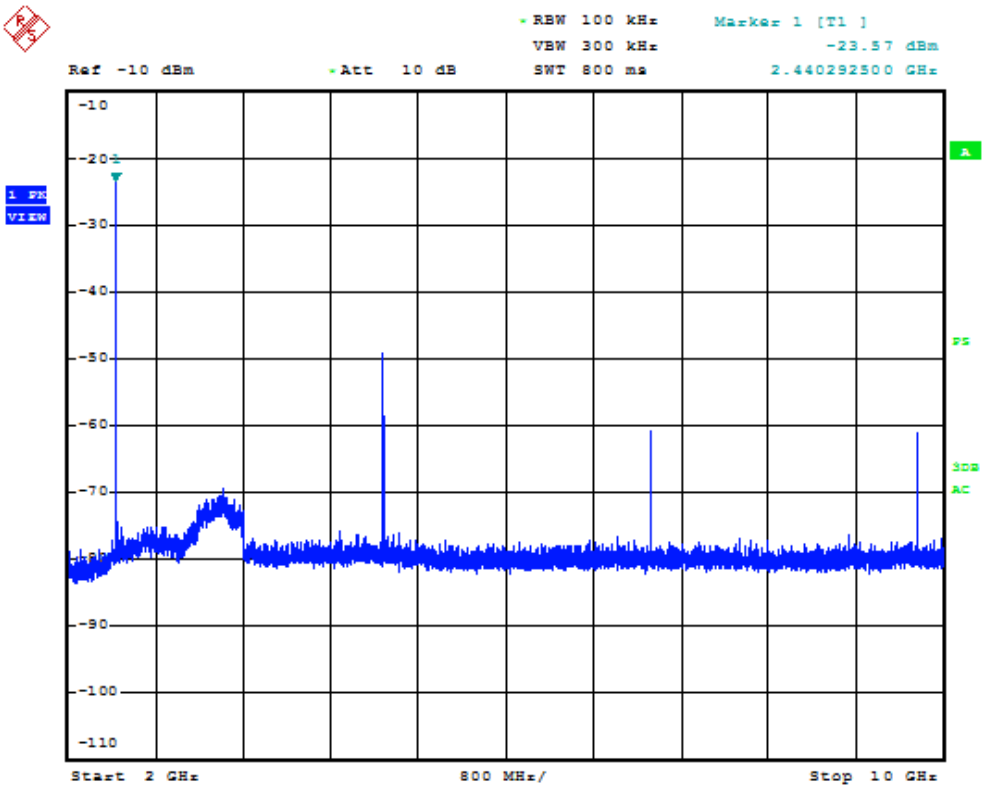
Plot 13: Conducted Spurious Emissions Data from 2GHz to 10GHz – Low Channel



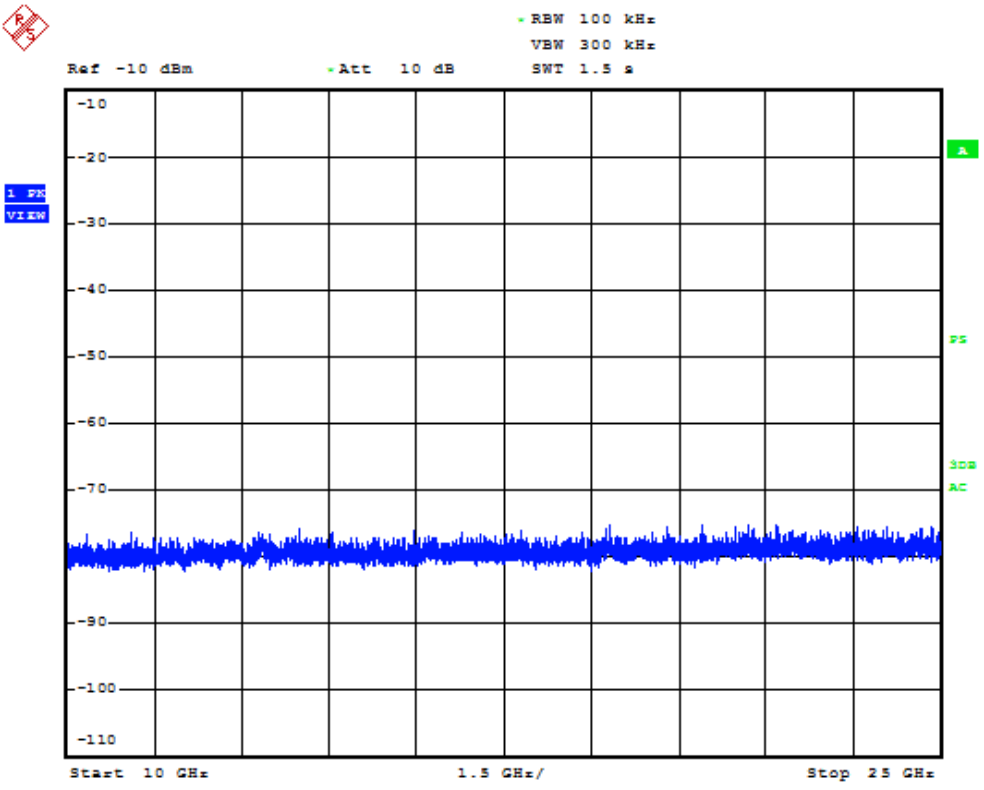
Plot 14: Conducted Spurious Emissions Data from 10GHz to 25GHz – Low Channel



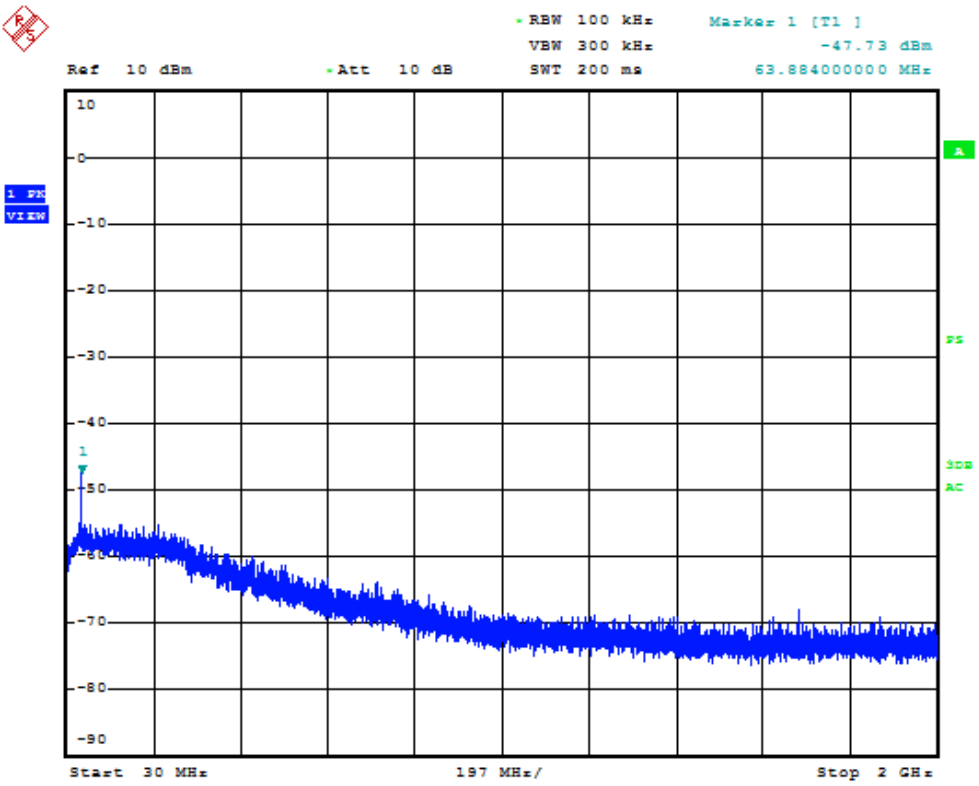
Plot 15: Conducted Spurious Emissions Data from 30MHz to 2GHz – Middle Channel



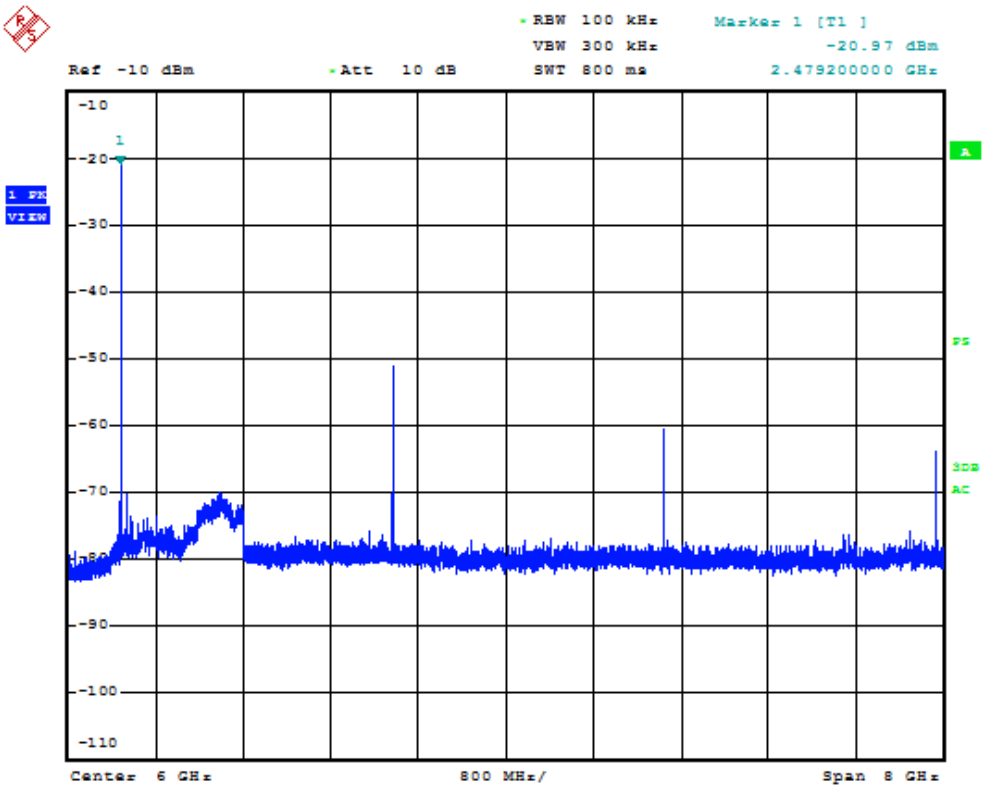
Plot 16: Conducted Spurious Emissions Data from 2GHz to 10GHz – Middle Channel



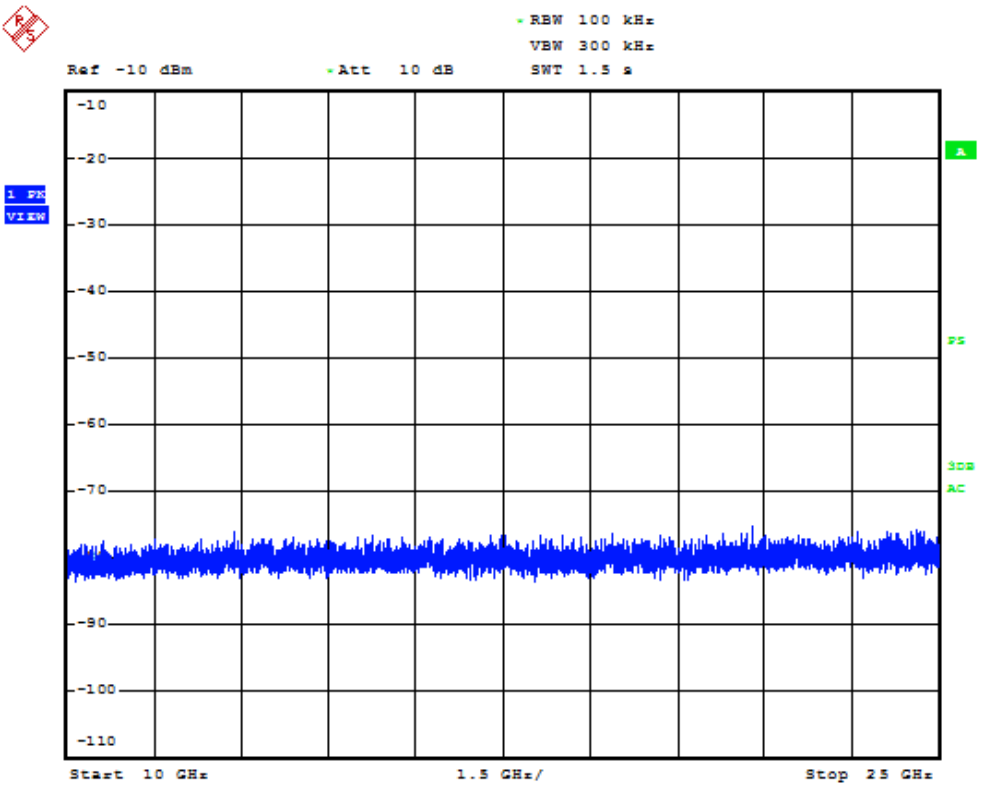
Plot 17: Conducted Spurious Emissions Data from 10GHz to 25GHz – Middle Channel



Plot 18: Conducted Spurious Emissions Data from 30MHz to 2GHz – High Channel

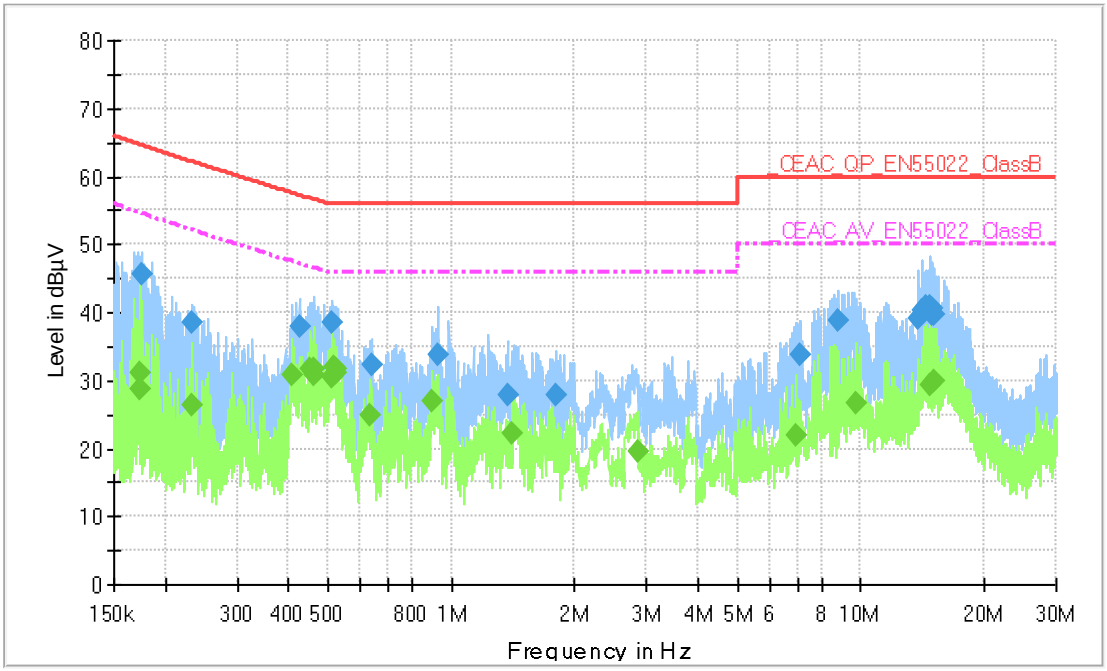


Plot 19: Conducted Spurious Emissions Data from 2GHz to 10GHz – High Channel



Plot 20: Conducted Spurious Emissions Data from 10GHz to 25GHz – High Channel

Appendix F: AC MAINS CONDUCTED EMISSIONS DATA & PLOTS



Plot 21: AC Mains Conducted Emissions for FCC/IC Class B Line 1 120Vac/60Hz

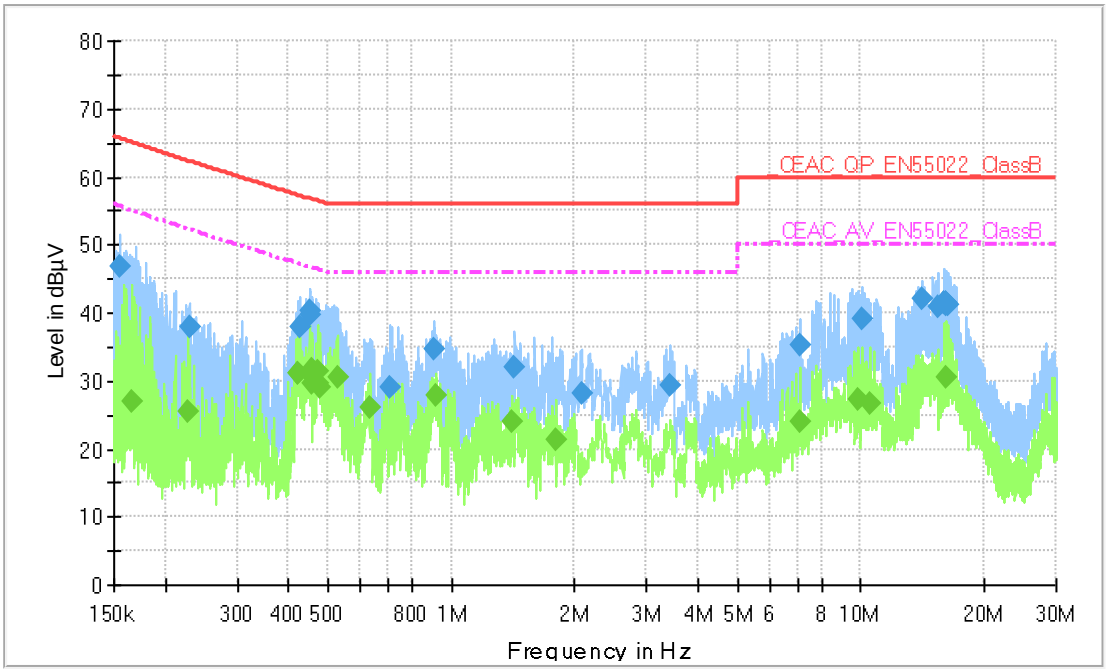
Table 9: Quasi-Peak data AC Mains Conducted Emissions for FCC/IC Class B Line 1 120Vac/60Hz

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.175837	45.6	1000.000	9.000	GND	0.5	19.0	64.6
0.231926	38.5	1000.000	9.000	GND	0.4	23.7	62.2
0.425011	38.0	1000.000	9.000	GND	0.4	19.3	57.3
0.509803	38.6	1000.000	9.000	GND	0.4	17.4	56.0
0.637091	32.3	1000.000	9.000	GND	0.4	23.7	56.0
0.925862	33.9	1000.000	9.000	GND	0.4	22.1	56.0
1.368581	27.9	1000.000	9.000	GND	0.4	28.1	56.0
1.806942	27.9	1000.000	9.000	GND	0.5	28.1	56.0
7.087250	33.8	1000.000	9.000	GND	0.6	26.2	60.0
8.786000	38.7	1000.000	9.000	GND	0.6	21.3	60.0
13.871000	39.2	1000.000	9.000	GND	0.6	20.8	60.0
14.071250	40.3	1000.000	9.000	GND	0.6	19.7	60.0
14.426750	40.9	1000.000	9.000	GND	0.6	19.1	60.0
14.550500	40.7	1000.000	9.000	GND	0.6	19.3	60.0
14.703500	40.8	1000.000	9.000	GND	0.6	19.2	60.0
14.762000	40.6	1000.000	9.000	GND	0.6	19.4	60.0
14.818250	40.3	1000.000	9.000	GND	0.7	19.7	60.0
14.903750	39.8	1000.000	9.000	GND	0.7	20.2	60.0

14.966750	40.6	1000.000	9.000	GND	0.7	19.4	60.0
15.038750	39.7	1000.000	9.000	GND	0.7	20.3	60.0

Table 10: Average data AC Mains Conducted Emissions for FCC/IC Class B Line 1 120Vac/60Hz

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.173047	28.7	1000.000	9.000	GND	0.5	26.0	54.7
0.174436	31.2	1000.000	9.000	GND	0.5	23.4	54.6
0.231926	26.5	1000.000	9.000	GND	0.4	25.7	52.2
0.409580	30.9	1000.000	9.000	GND	0.4	16.6	47.5
0.453993	31.7	1000.000	9.000	GND	0.4	15.0	46.7
0.459471	31.8	1000.000	9.000	GND	0.4	14.8	46.6
0.462697	30.9	1000.000	9.000	GND	0.4	15.7	46.6
0.509803	30.7	1000.000	9.000	GND	0.4	15.3	46.0
0.512869	30.5	1000.000	9.000	GND	0.4	15.5	46.0
0.519058	31.9	1000.000	9.000	GND	0.4	14.1	46.0
0.521137	31.7	1000.000	9.000	GND	0.4	14.3	46.0
0.523225	31.1	1000.000	9.000	GND	0.4	14.9	46.0
0.636454	25.0	1000.000	9.000	GND	0.4	21.0	46.0
0.900310	27.0	1000.000	9.000	GND	0.4	19.0	46.0
1.407424	22.1	1000.000	9.000	GND	0.4	23.9	46.0
2.861750	19.6	1000.000	9.000	GND	0.5	26.4	46.0
6.972500	21.8	1000.000	9.000	GND	0.6	28.2	50.0
9.755750	26.7	1000.000	9.000	GND	0.6	23.3	50.0
14.759750	29.5	1000.000	9.000	GND	0.6	20.5	50.0
15.088250	29.8	1000.000	9.000	GND	0.7	20.2	50.0



Plot 22: AC Mains Conducted Emissions for FCC/IC Class B Line 2 120Vac/60Hz

Table 11: Quasi-Peak data AC Mains Conducted Emissions for FCC/IC Class B Line 2 120Vac/60Hz

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.155496	46.9	1000.000	9.000	GND	0.5	18.8	65.7
0.228932	37.9	1000.000	9.000	GND	0.4	24.4	62.3
0.426713	37.9	1000.000	9.000	GND	0.4	19.3	57.2
0.449478	39.7	1000.000	9.000	GND	0.4	17.1	56.8
0.452634	40.2	1000.000	9.000	GND	0.4	16.6	56.8
0.705468	28.9	1000.000	9.000	GND	0.4	27.1	56.0
0.910263	34.7	1000.000	9.000	GND	0.4	21.3	56.0
1.430112	32.1	1000.000	9.000	GND	0.4	23.9	56.0
2.074250	28.1	1000.000	9.000	GND	0.5	27.9	56.0
3.415250	29.3	1000.000	9.000	GND	0.5	26.7	56.0
7.123250	35.2	1000.000	9.000	GND	0.6	24.8	60.0
10.041500	39.3	1000.000	9.000	GND	0.6	20.7	60.0
14.190500	42.0	1000.000	9.000	GND	0.6	18.0	60.0
15.394250	40.9	1000.000	9.000	GND	0.7	19.1	60.0
15.902750	41.4	1000.000	9.000	GND	0.6	18.6	60.0
15.981500	41.5	1000.000	9.000	GND	0.6	18.5	60.0
16.087250	41.5	1000.000	9.000	GND	0.6	18.5	60.0
16.163750	41.1	1000.000	9.000	GND	0.6	18.9	60.0
16.213250	41.4	1000.000	9.000	GND	0.6	18.6	60.0
16.271750	41.2	1000.000	9.000	GND	0.6	18.8	60.0

Table 12: Average data AC Mains Conducted Emissions for FCC/IC Class B Line 2 120Vac/60Hz

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.166099	27.0	1000.000	9.000	GND	0.5	28.1	55.1
0.227109	25.6	1000.000	9.000	GND	0.4	26.7	52.3
0.422048	31.2	1000.000	9.000	GND	0.4	16.1	47.3
0.423315	31.2	1000.000	9.000	GND	0.4	16.1	47.3
0.449478	31.1	1000.000	9.000	GND	0.4	15.7	46.8
0.451730	31.1	1000.000	9.000	GND	0.4	15.7	46.8
0.454901	31.8	1000.000	9.000	GND	0.4	14.9	46.7
0.456267	29.8	1000.000	9.000	GND	0.4	16.9	46.7
0.470156	29.8	1000.000	9.000	GND	0.4	16.7	46.5
0.472511	31.4	1000.000	9.000	GND	0.4	15.0	46.4
0.477735	29.0	1000.000	9.000	GND	0.4	17.3	46.3
0.525846	30.5	1000.000	9.000	GND	0.4	15.5	46.0
0.634549	26.1	1000.000	9.000	GND	0.4	19.9	46.0
0.919407	28.0	1000.000	9.000	GND	0.4	18.0	46.0
1.408831	23.9	1000.000	9.000	GND	0.4	22.1	46.0
1.794344	21.4	1000.000	9.000	GND	0.5	24.6	46.0
7.123250	23.9	1000.000	9.000	GND	0.6	26.1	50.0
9.845750	27.4	1000.000	9.000	GND	0.6	22.6	50.0
10.554500	26.6	1000.000	9.000	GND	0.6	23.4	50.0
16.213250	30.6	1000.000	9.000	GND	0.6	19.4	50.0

Appendix G: RADIATED SPURIOUS EMISSIONS – TRANSMIT MODE DATA

Table 13: Peak Radiated Spurious Emissions data – Low Channel

Frequency (MHz)	Measured Peak (dBuV/m)	Polarization	Antenna Height (cm)	Angle (degrees)	Gain/Loss (dB)	Antenna Factor (dBm)	Corrected Peak (dBuV/m)	Peak Limit (dB)	Peak Margin (dB)
4810	41.76	V	100	10	-26.14	34.1	49.72	74	24.28
4810	43.13	H	100	273	-26.14	34.1	51.09	74	22.91
7215	39.74	V	100	20	-22.97	35.6	52.37	74	21.63
7215	38.77	H	204	18	-22.97	35.6	51.4	74	22.6

Table 14: Average Radiated Spurious Emissions data – Low Channel

Frequency (MHz)	Measured Average (dBuV/m)	Polarization	Antenna Height (cm)	Angle (degrees)	Gain/Loss (dB)	Antenna Factor (dBm)	Corrected Average (dBuV/m)	Average Limit (dB)	Average Margin (dB)
4810	35.56	V	100	10	-26.14	34.1	43.52	54	10.48
4810	39.14	H	100	273	-26.14	34.1	47.1	54	6.9
7215	31.24	V	100	20	-22.97	35.6	43.87	54	10.13
7215	29.59	H	204	18	-22.97	35.6	42.22	54	11.78

Table 15: Peak Radiated Spurious Emissions data – Middle Channel

Frequency (MHz)	Measured Peak (dBuV/m)	Polarization	Antenna Height (cm)	Angle (degrees)	Gain/Loss (dB)	Antenna Factor (dBm)	Corrected Peak (dBuV/m)	Peak Limit (dB)	Peak Margin (dB)
4880	41.33	V	140	0	-26.15	34.1	49.28	74	24.72
4880	41.07	H	225	327	-26.15	34.1	49.02	74	24.98
7320	40.4	V	118	21	-22.53	35.6	53.47	74	20.53
7320	38.8	H	184	17	-22.53	35.6	51.87	74	22.13

Table 16: Average Radiated Spurious Emissions data – Middle Channel

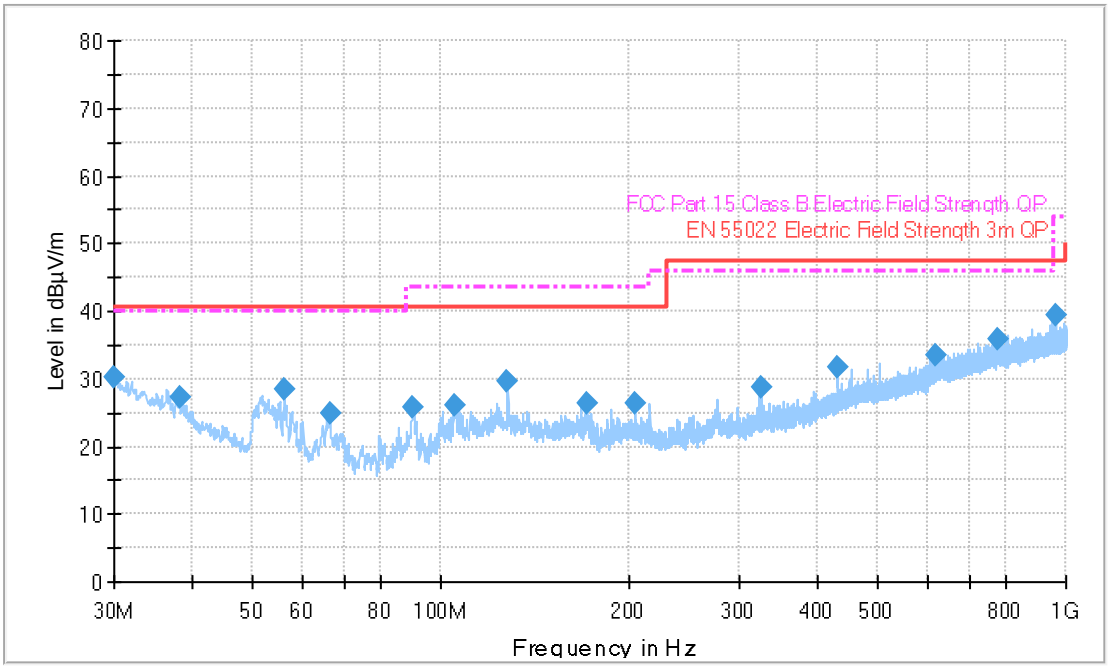
Frequency (MHz)	Measured Average (dBuV/m)	Polarization	Antenna Height (cm)	Angle (degrees)	Gain/Loss (dB)	Antenna Factor (dBm)	Corrected Average (dBuV/m)	Average Limit (dB)	Average Margin (dB)
4880	35.29	V	140	0	-26.15	34.1	43.24	54	10.76
4880	35.5	H	225	327	-26.15	34.1	43.45	54	10.55
7320	31.84	V	118	21	-22.53	35.6	44.91	54	9.09
7320	30.02	H	184	17	-22.53	35.6	43.09	54	10.91

Table 17: Peak Radiated Spurious Emissions data – High Channel

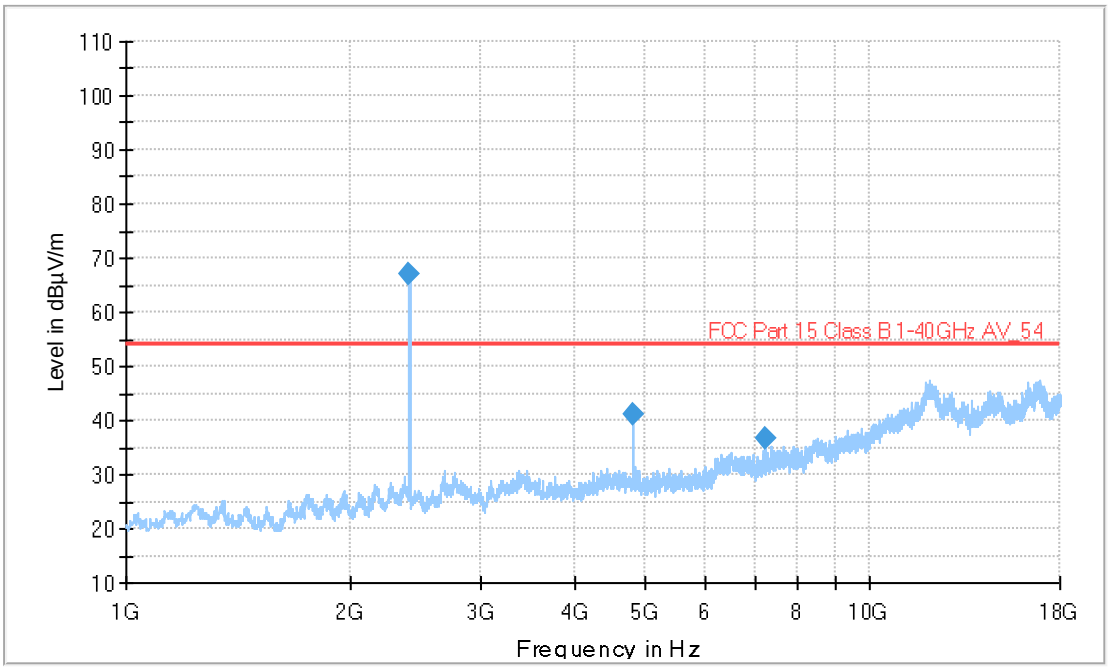
Frequency (MHz)	Measured Peak (dBuV/m)	Polarization	Antenna Height (cm)	Angle (degrees)	Gain/Loss (dB)	Antenna Factor (dBm)	Corrected Peak (dBuV/m)	Peak Limit (dB)	Peak Margin (dB)
4960	42.06	V	100	360	-26.93	34.1	49.23	74	24.77
4960	40.36	H	226	34.8	-26.93	34.1	47.53	74	26.47
7440	40.08	V	100	22	-21.43	35.6	54.25	74	19.75
7440	38.57	H	184	17	-21.43	35.6	52.74	74	21.26
9920	28.7	H	183	20	-15.66	37.7	50.74	74	23.26

Table 18: Average Radiated Spurious Emissions data – High Channel

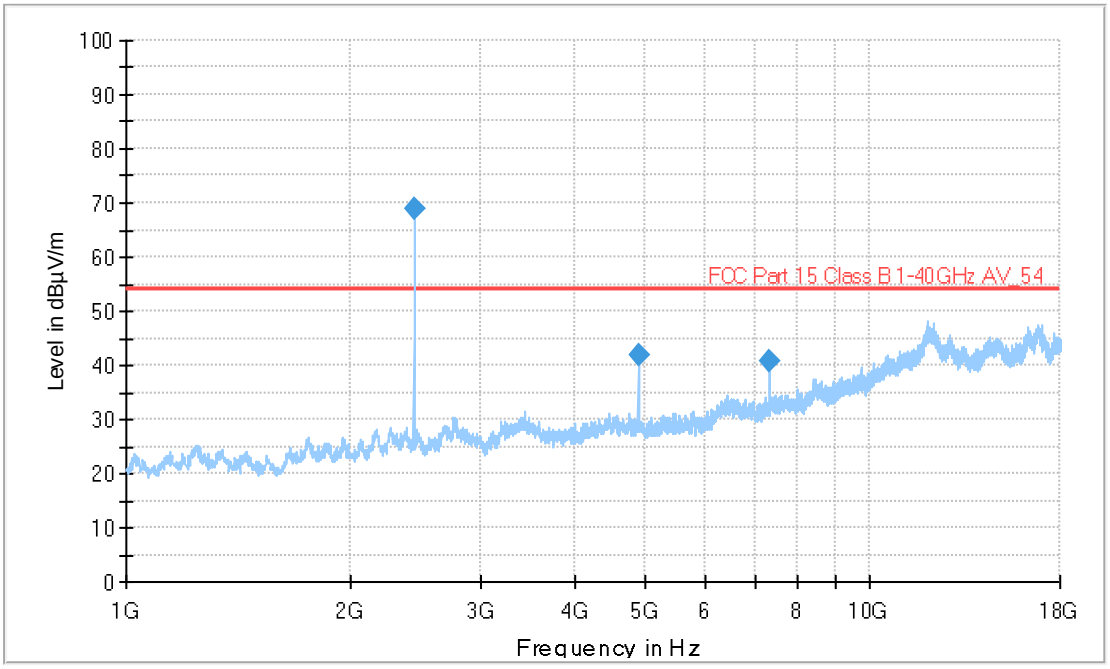
Frequency (MHz)	Measured Average (dBuV/m)	Polarization	Antenna Height (cm)	Angle (degrees)	Gain/Loss (dB)	Antenna Factor (dBm)	Corrected Average (dBuV/m)	Average Limit (dB)	Average Margin (dB)
4960	37.52	V	100	360	-26.93	34.1	44.69	54	9.31
4960	35.25	H	226	34.8	-26.93	34.1	42.42	54	11.58
7440	30.95	V	100	22	-21.43	35.6	45.12	54	8.88
7440	29.63	H	184	17	-21.43	35.6	43.8	54	10.2
9920	17.35	H	183	20	-15.66	37.7	39.39	54	14.61



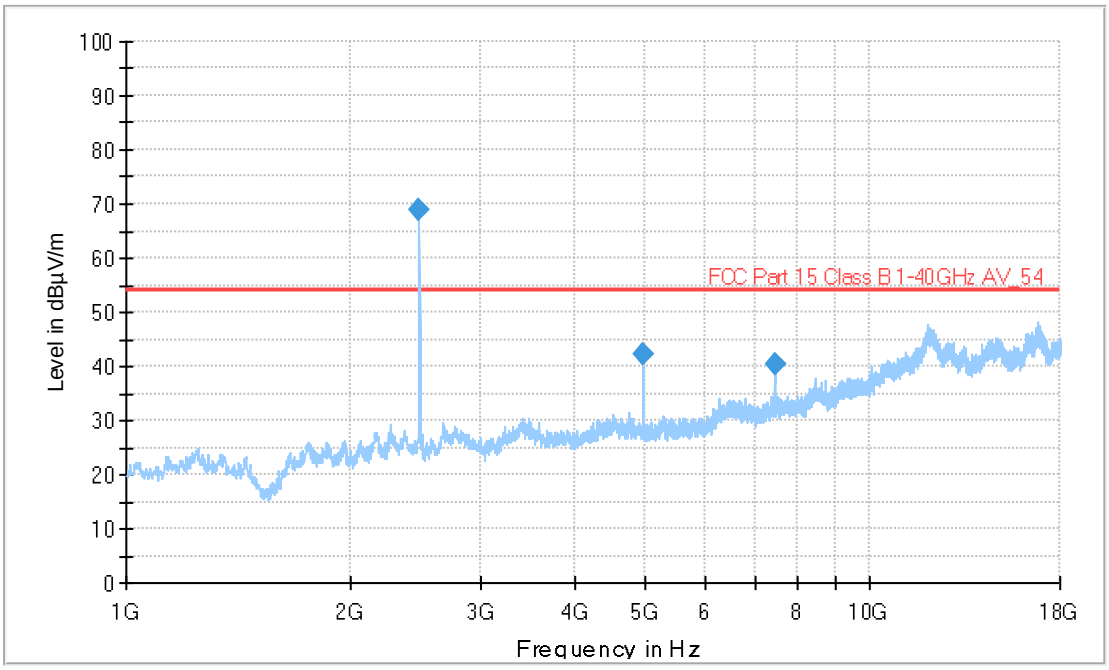
Plot 23: Radiated Spurious Emissions Data from 30MHz to 1GHz – Low Channel



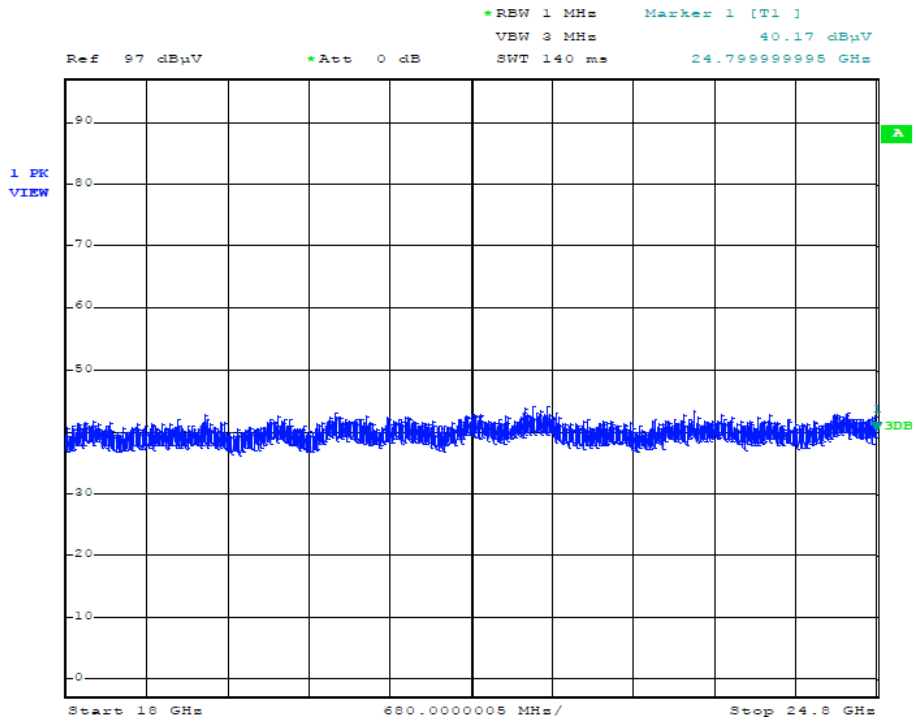
Plot 24: Radiated Spurious Emissions Data from 1GHz to 18GHz – Low Channel



Plot 25: Radiated Spurious Emissions Data from 1GHz to 18GHz – Middle Channel



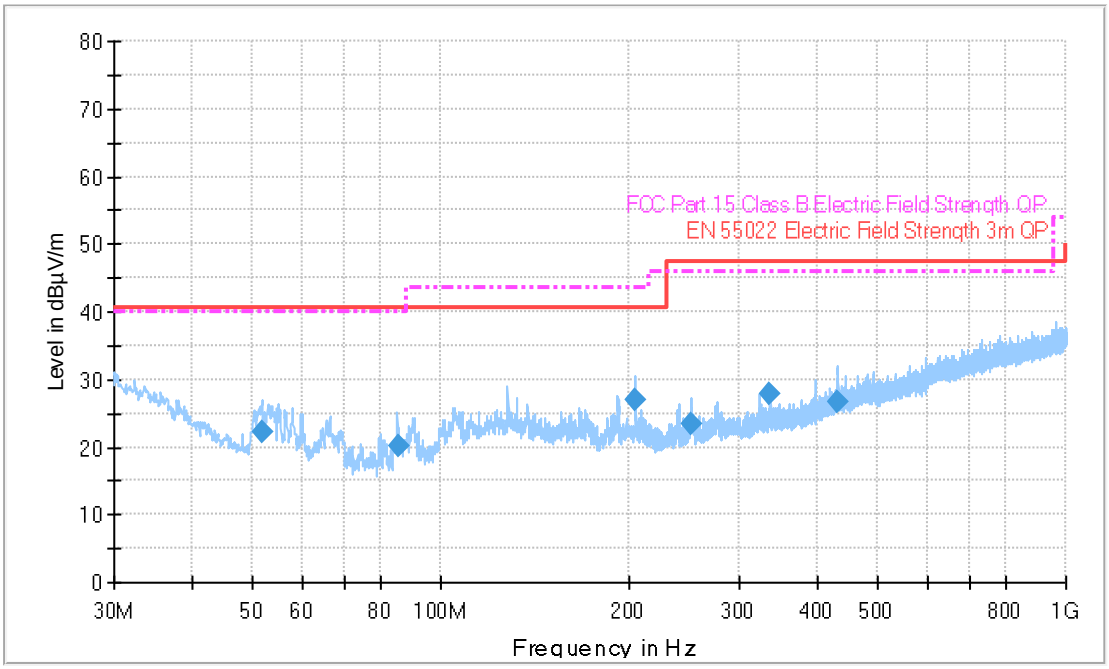
Plot 26: Radiated Spurious Emissions Data from 1GHz to 18GHz – High Channel



Plot 27: Radiated Spurious Emissions Data from 18GHz to 24.8GHz – High Channel

Note: *Radiated spurious emissions was measured up to 10th harmonics of fundamental frequency using the procedures described in ANSI C63.4:2014 and ANSI C63.10:2013 but no radiated emissions were found and reported other than in Plot 27.*

Appendix H: RADIATED SPURIOUS EMISSIONS – RECEIVE MODE DATA



Plot 28: Radiated Spurious Emissions Data from 30MHz to 1GHz – Receive Mode

Appendix I: FREQUENCY STABILITY DATA

Table 19: Frequency Stability measurements

Temperature	Channel	Frequency (MHz)	Offset (MHz)	PPM
20	Low	2405.080	-	-
	Middle	2440.000	-	-
	High	2480.000	-	-
-40	Low	2405.040	-0.040	-40000
	Middle	2440.040	0.040	40000
	High	2480.040	0.040	40000
+85	Low	2405.040	-0.040	-40000
	Middle	2440.040	0.040	40000
	High	2480.040	0.040	40000

Appendix J: TEST SETUP PICTURES

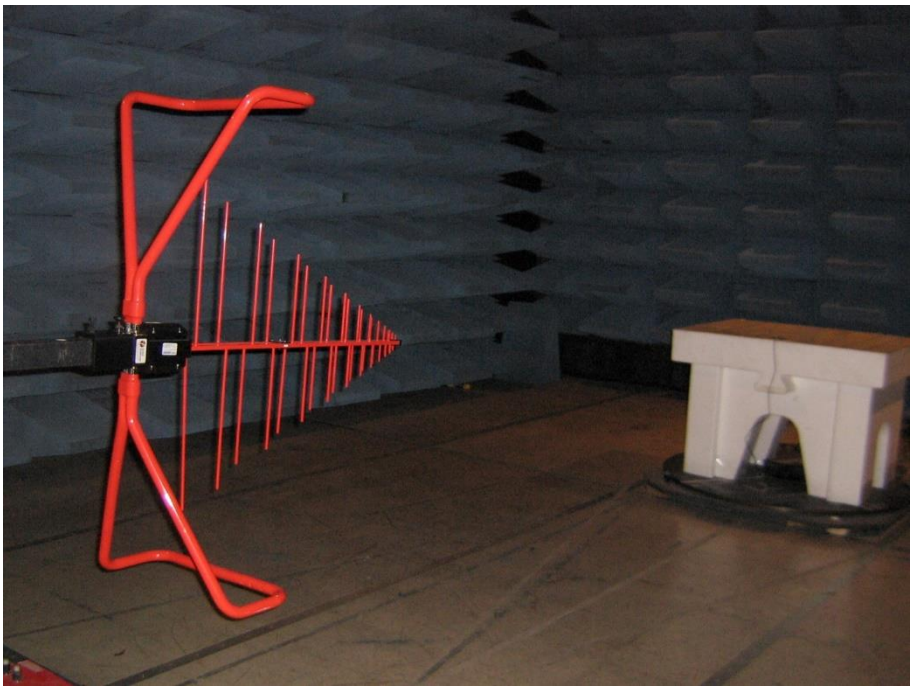


Figure 1: Radiated Spurious Emissions Test Setup (Transmit Mode) at SAC – Flat on the table top

Figure 2: Radiated Spurious Emissions Test Setup (Transmit Mode) at SAC – Flat on the table top

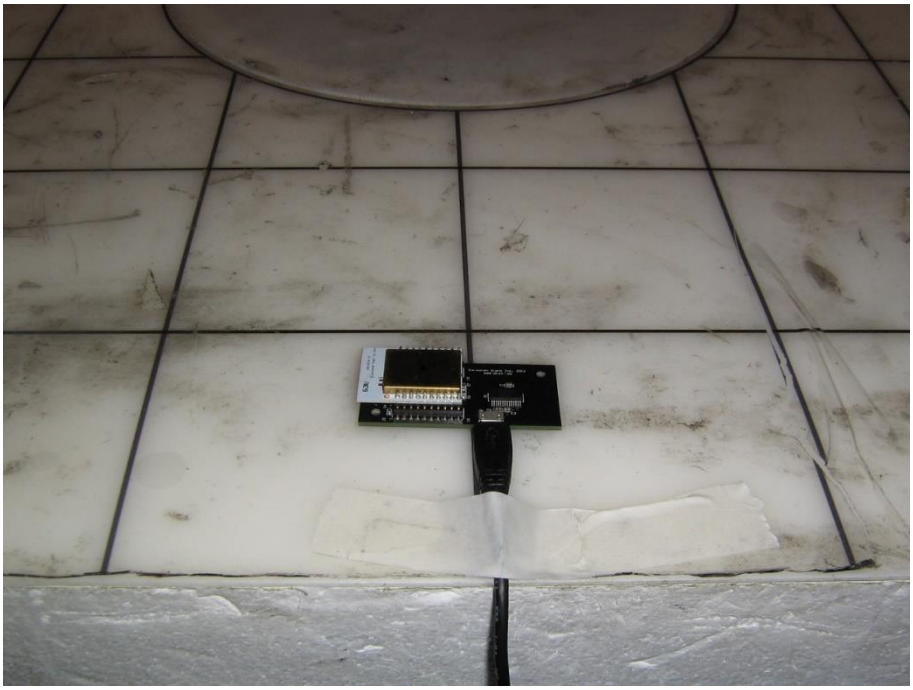


Figure 3: Radiated Spurious Emissions Test Setup (Transmit Mode) at SAC – Flat on the table top

Figure 4: Radiated Spurious Emissions Test Setup (Transmit Mode) at SAC – Vertical on the table top

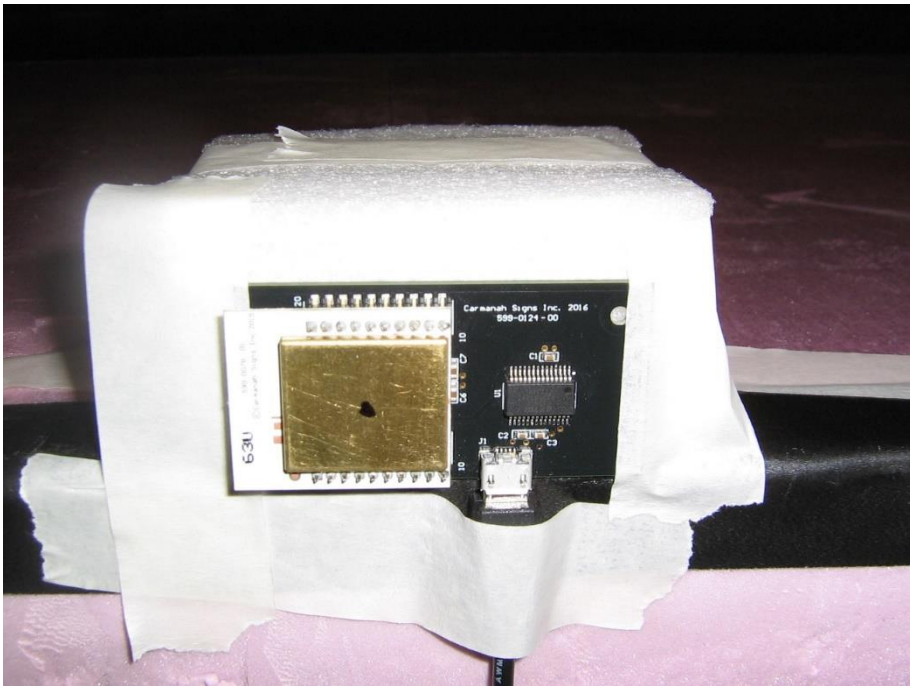


Figure 5: Radiated Spurious Emissions Test Setup (Transmit Mode) at SAC – Vertical and sideways on the table top

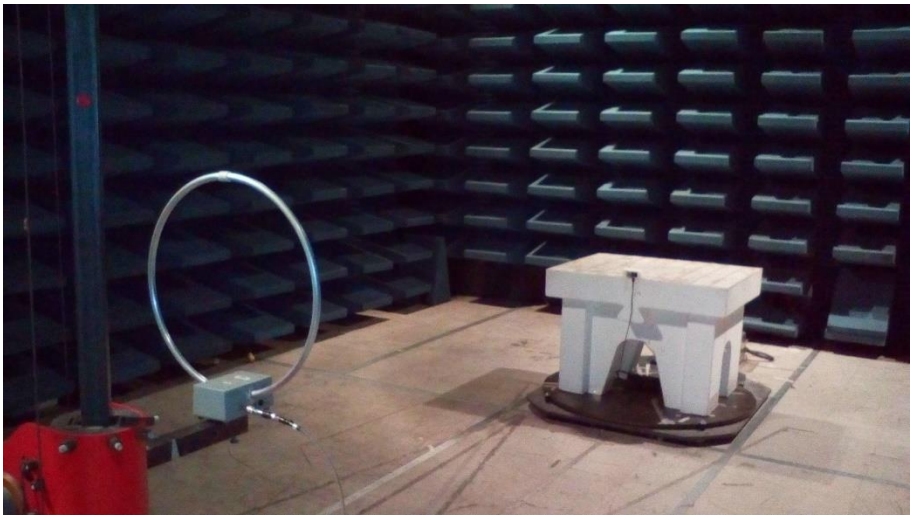


Figure 6: Radiated Spurious Emissions (Transmit Mode) Test Setup at SAC with Loop Antenna

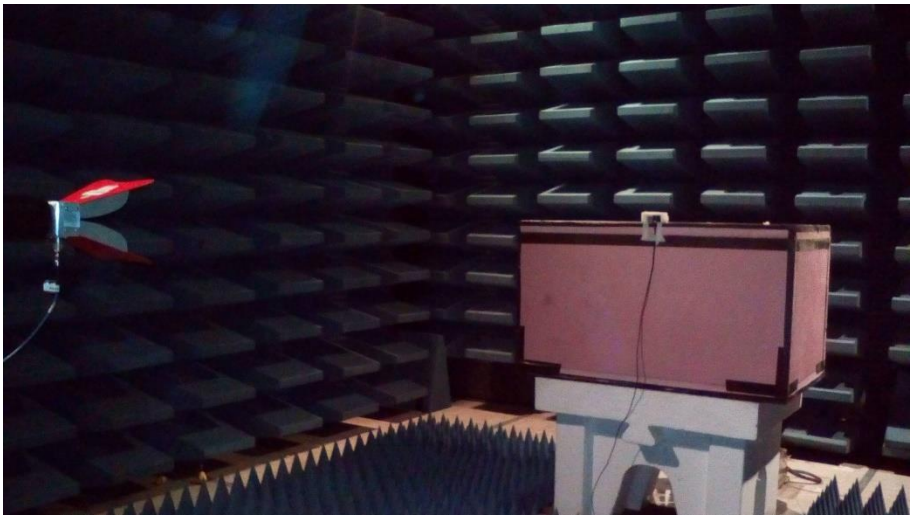


Figure 7: Radiated Spurious Emissions Test Setup (Transmit Mode) from 1-18 GHz at SAC

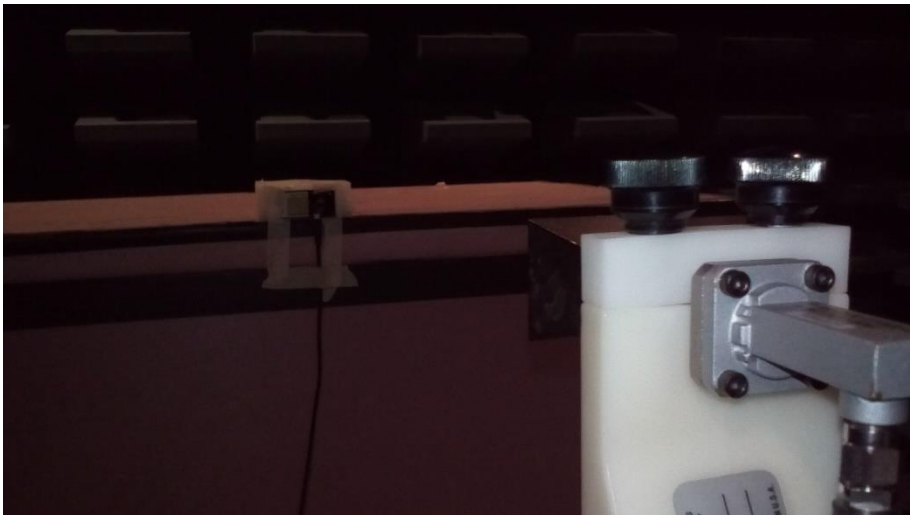


Figure 8: Radiated Spurious Emissions Test Setup (Transmit Mode) from 18-25 GHz at SAC

Figure 9: Radiated Spurious Emissions Test Setup (Transmit Mode) from 18-25 GHz at SAC

Appendix K: ABBREVIATIONS

Abbreviation	Definition
AC	Alternating Current
CE	European Conformity
CISPR	Comité International Spécial des Perturbations Radioélectriques
DC	Direct Current
EFT	Electrical Fast Transient
E.I.R.P.	Equivalent Isotropically Radiated Power
EMC	ElectroMagnetic Compatibility
EMI	ElectroMagnetic Interference
ESD	ElectroStatic Discharge
EUT	Equipment Under Test
FCC	Federal Communications Commission
IC	Industry Canada
ICES	Interference-Causing Equipment Standard
LISN	Line Impedance Stabilizing Network
OATS	Open Area Test Site
RF	Radio Frequency
RMS	Root-Mean-Square
SAC	Semi-Anechoic Chamber

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END OF REPORT