

ELECTROMAGNETIC COMPATIBILITY TEST REPORT

PREPARED FOR Intrinsyc Technologies Corporation
BY QAI LABORATORIES



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American Association for Laboratory Accreditation Certificate Number: 3657.02

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Applicable Test Standards:

CFR 47 FCC Part 15, Subpart C & E - Radio Frequency Devices – Intentional Radiators.

ICES-003 Issue 6 - Information Technology Equipment (including Digital Apparatus) – Limits and Methods of Measurement.

RSS-247 Issue 1 - Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

RSS-210 Issue 8 - Licence-Exempt Radio Apparatus: Category I Equipment



Equipment Tested: 802.11a/b/g/n/ac WiFi + BT
Model Number: ITCNFA324
Manufacturer: Intrinsyc Technologies Corporation

REVISION HISTORY

Date	Report Number	Revision	Description	Author
2016 Oct 15	EI0702-1609	1.0	Initial Release	BB
2016 Nov 16	EI0702-1609	1.1	Minor corrections	BB
2017 Jan 15	EI0702-1609	1.2	Revised for submission response	BB
2017 Jan 19	EI0702-1609	1.3	Revised for submission response	BB

All previous versions of this report have been superseded by the latest dated revision as listed in the above table.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 equipment ITCNFA324 802.11a/b/g/n/ac WiFi + BT¹ provided by Intrinsyc Technologies Corporation. Tests were performed on the sample equipment as requested by Intrinsyc Technologies Corporation for the purpose of demonstrating compliance with CFR 47 FCC Part 15, Subpart C & E, ICES-003 Issue 6, RSS-247 Issue 1, RSS-210 Issue 8 as agreed upon by Intrinsyc Technologies Corporation as per quotation I6SH05102. This report comprises a partial list of tests pursuant to a Class II Permissive Change.

Intrinsyc Technologies Corporation is responsible for the tested product configuration, continued product compliance, and for the appropriate auditing of subsequent products as required. This report may comprise a partial list of tests that are required for FCC, ISED and/or CE Mark Declaration of Conformity and can only be reproduced by the manufacturer.

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



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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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QAI EMC ACCREDITATION

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EMC Laboratory Location	FCC Designator	FCC Registration 3m SAC	FCC Registration 3m/10m OATS	IC Registration 3m SAC	A2LA Certificate
Burnaby, BC Canada	CA9543	9543A	9543C-1	21146-1	3657.02
Everett, WA USA	US1151	307482	9543C-1	11876A-1	3657.01



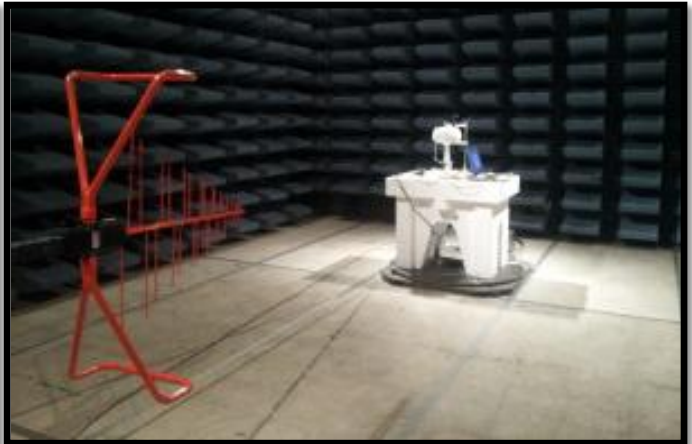
Corporate Headquarters & EMC Laboratory
Burnaby, BC



EMC Laboratory
Everett, WA



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



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



10m Open Area Test Site (OATS)
Malcom Knapp Research Forest, Maple Ridge, BC



3m Semi-Anechoic Chamber (SAC)
Everett, WA

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Section I: EXECUTIVE SUMMARY

1.1 Scope

This report demonstrates and documents compliance of 802.11a/b/g/n/ac WiFi + BT Model ITCNFA324 to the applicable standards listed below for Class II Permissive Change as described.

1.2 Applicable Standards

The information documented in this report is based on the test methods and levels as per quotation 16SH05102.

CFR 47 FCC Part 15, Subpart C & E Radio Frequency Devices – Intentional Radiators.

ICES-003 Issue 6 Information Technology Equipment (including Digital Apparatus) – Limits and Methods of Measurement.

RSS-247 Issue 1 Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

RSS-210 Issue 8 Licence-Exempt Radio Apparatus: Category I Equipment

1.3 Reference Standards

The following standards are included as a normative reference.

ANSI C63.10(2013) - American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

KD 558074 D01 v03r05 - Guidance for Performing Compliance Measurements on Digital Transmissions Systems (DTS) operating under §15.247

KDB 789033 D02 v01r03 - General UNII Test Procedures New Rules

1.4 Summary of Results

This report demonstrates and documents compliance of 802.11a/b/g/n/ac WiFi + BT ITCNFA324 manufactured by Intrinsyc Technologies Corporation to CFR 47 FCC Part 15, Subpart C & E, ICES-003 Issue 6 for a Class II Permissive Change regarding the addition of antennas to the original certification.

The following testing was performed pursuant to CFR 47 FCC Part 15, Subpart B - Emissions

Test or Measurement	Applicable Standard	Description	Result
Radiated Emissions Enclosure	15.109 Class B	Radiated emissions of the enclosure measured 30M - 1G Hz (quasi-peak) and 1G - 40G Hz (average) as applicable.	Complies

The following testing was performed pursuant to CFR 47 FCC Part 15, Subpart C - Emissions

Test or Measurement	Applicable Standard	Description	Result
Radiated Emissions Enclosure	15.209 Class B	Radiated emissions of the enclosure measured 30M - 1G Hz (quasi-peak) and 1G Hz - 10th harmonic of fundamental or 40G Hz (average) as applicable.	Complies
RF Peak Output Power	15.247(b)(3)	Maximum peak conducted output power shall not exceed 1 W. The e.i.r.p. shall not exceed 4 W.	Complies
Out of Band Emissions (Bandedge)	15.247(d), 15.205(c)	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 20dBc (peak) or 30dBc (rms). Radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a).	Complies
Conducted Spurious Emissions	15.247(d), 15.205, 15.209(a)	Conducted emissions requirements as stated in the Standard.	Complies
Radiated Spurious Emissions	15.247(d), 15.205, 15.209(a)	Radiated emissions requirements as stated in the Standard.	Complies
RF Exposure	1.131	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 CFR 47 FCC Part 15, Subpart E - Emissions

Test or Measurement	Applicable Standard	Description	Result
Radiated Emissions Enclosure	15.209 Class B	<i>Radiated emissions of the enclosure measured 30M - 1G Hz (quasi-peak) and 1G Hz - 10th harmonic of fundamental or 40G Hz (average) as applicable.</i>	Complies
RF Peak Output Power	15.407(a)(1)(2)(3)(4)	<i>For 5.15-5.25, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm 10 log B, where B is the 26 dB emission bandwidth in megahertz. For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.</i>	Complies
Out of Band Emissions (Bandedge)	15.407(b)(1)(2)(3)(4), 15.205(c)	<i>All emissions outside of the specified band shall not exceed an e.i.r.p. of -27 dBm/MHz or 68.2dBuV/m at 3m. For 15.407(b)(4) limit is -17dBm/MHz within 10MHz of band edge. Radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a).</i>	Complies
Conducted Spurious Emissions	15.407(b)(1)(2)(3)(4), 15.205, 15.209(a)	<i>Conducted emissions requirements as stated in the Standard.</i>	Complies
Radiated Spurious Emissions	15.407(b)(1)(2)(3)(4), 15.205, 15.209(a)	<i>Radiated emissions requirements as stated in the Standard.</i>	Complies
RF Exposure	1.131 (e)	<i>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</i>	Complies

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

Test or Measurement	Applicable Standard	Description	Result
Radiated Emissions Enclosure	ICES-003 Issue 6 Class B	<i>Radiated emissions of the enclosure measured 30M - 1G Hz (quasi-peak) and 1G - 6 GHz</i>	Complies

The following testing was performed pursuant to RSS-210 Issue 8 and RSS-247 Issue 1 - Emissions

Test or Measurement	Applicable Standard	Description	Result
Radiated Emissions Enclosure	RSS 210 Issue 8 Annex 8, RSS 247 Issue 1	<i>Radiated emissions of the enclosure measured 30M - 1G Hz (quasi-peak) and 1G Hz - 10th harmonic of fundamental or 40G Hz (average) as applicable.</i>	Complies
RF Peak Output Power	RSS 210 Issue 8 Annex 8, RSS 247 Issue 1	<i>Maximum peak conducted output power shall not exceed 1 W. The e.i.r.p. shall not exceed 4 W.</i>	Complies
Out of Band Emissions (Bandedge)	RSS 210 Issue 8 Annex 8, RSS 247	<i>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 -20dBc (peak) or -30dBc (rms). Radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a).</i>	Complies
Conducted Spurious Emissions	RSS 210 Issue 8 Annex 8, RSS 247	<i>Conducted emissions requirements as stated in the Standard.</i>	Complies
Radiated Spurious Emissions	RSS-210 Issue 8 Annex 2 Section A2.2 (b), RSS-Gen Issue 4	<i>Radiated emissions requirements as stated in the Standard.</i>	Complies
RF Exposure	RSS-102 Section 2.5.2	<i>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</i>	Complies

Section II: GENERAL INFORMATION

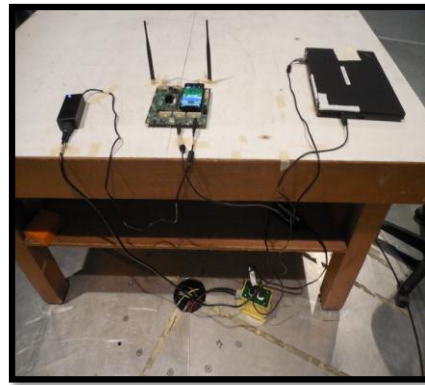
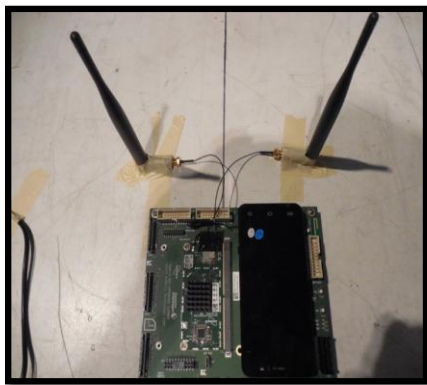
2.1 Product Description

The information provided in this section describes the Equipment Under Test (EUT) and the corresponding Auxiliary Equipment (AE) required to perform the tests as complete system.

EUT Information

Equipment	Manufacturer	Description	Model	Serial Number
EUT	Intrinsyc Technologies Corporation	802.11A/B/G/N/ACWiFi + Bluetooth Module	ITCNFA324	252 0201 041516 000696
EUT	Intrinsyc Technologies Corporation	Board Data File(configuration file)	eeeprom_ar6320_3p0_NF A324i_1_Rev0x16	
Auxiliary 1	Intrinsyc Technologies Corporation	Sytem Development Kit	Open-Q(TM) 820 SDK	252 0201 041516 000696
Auxiliary 2	IBM	Lenovo Notebook PC	2904-HDU	R9-C71XZ-11103
Auxiliary 3	Qualcomm	Qualcomm Radio Control Toolkit	3.0.00230	-

Figure 1: Equipment under Test



2.1.1 Test Configuration

The EUT was configured for 'normal operation' at maximum rate load unless other specified. All accessory cables were attached unless defined as 'craftsman' port used for diagnostic and configuration.

The EUT was configured for test using the internal test mode provided by the manufacturer to simulate data transmission. This utility includes all modulation modes, transmit frequencies and power levels and all other configuraiton options required for testing.

Refer to the original grant for additional details of modulation types, technology, applicable data transfer rates, channels and other information. Transmission for BT is TX0 only (no beamforming directional gain), transmission for WiFi modulations employs TX0 and TX 1 beamforming directional gain.

2.1.2 Modifications

No additional modifications were made to the EUT other than as described in the Class II Permissive Change cover letter.

2.1.4 Description of Antenna

The manufacturer's specified directional antenna gain in excess of 6dBi is used to reduce the overall conducted power limit as applicable in each specified frequency band. For WiFi, the transmit signals are assumed to be correlated and the number of independent spatial streams (Nss) is assumed to be 1.

Brand	Model	Gain	Antenna Type	Connector
Taoglas	GW.71.5153	3.8dBi(2.4-2.5GHz) 5.5dBi (4.9 to 5.8GHz)	Dipole	IPEX

2.1.5 Directional Gain

The manufacturer's specified directional antenna gain in excess of 6dBi is used to reduce the overall conducted power limit as applicable in each specified frequency band. For WiFi, the transmit signals are assumed to be correlated and the number of independent spatial streams (Nss) is assumed to be 1.

$$\text{Directional Gain} = G_{\text{max}} + 10 * \log (N_{\text{ant}}/N_{\text{ss}})$$

where: G_{max} is the maximum antenna gain in dBi

N_{ant} is the number of antennas

N_{ss} is number of independent spatial streams, assumed to be 1

Frequency Band MHz	2TX CDD Directional Gain (Beamforming) dB	2TX CDD Directional Gain (Beamforming) dB	Directional Gain Output Power Limit Reduction dB
2400 - 2483.5 (*1)	3.8	6.81	0.81
5150 - 5250	5.5	8.51	2.51
5250 - 5350	5.5	8.51	2.51
5470 - 5725	5.5	8.51	2.51
5725 - 5825	5.5	8.51	2.51

Notes: 1. Applicable to Wifi device only, does not apply to BT device(single antenna).

2.2 Environmental Conditions

The EUT was operated and tested under the following environmental conditions.

Parameter	Condition
Location	Indoors
Temperature	22 - 28 C
Relative Humidity	39.8 - 54.5%

2.3 Measurement Uncertainty

Parameter	Uncertainty
Radiated Emissions 30MHz-1GHz	±2.40 dB
Radiated Emissions 1GHz-40GHz	±2.48 dB
Radio Frequency	±15 Hz
Total RF Power Conducted	±1.36 dB
Spurious Emissions, Conducted	±1.36 dB
RF Power Density, Conducted	±1.36 dB
Temperature	±1 C
Humidity	±5 %
DC and low frequency voltages	±3 %

2.4 Worst Test Case

When appropriate during radiated emissions and/or other testing, worst-case orientation or configuration was determined during expolatory investigation phase. The final radiated emissions or other measurements were then performed in the worst-case orientation or configuration.

2.5 Sample Calculations of Emissions Data

Radiated and conducted emissions may be performed using automated measurement software. Correction factors for antenna factor, cable loss, amplifier gain, and other transducer factors are stored in the test templates used to perform measurements. Sample data generated from the automated software consisting of product details, emission plots and final data tables is shown below.

Sample Radiated Emission Table:

Frequency MHz	Quasi-Peak dBμV/m	Meas. Time ms	Bandwidth KHz	Antenna Height cm	Polarity	Turntable position deg	Correction dB	Margin dB	Limit dBμV/m
42.6639	33	1000	120	100	H	70	13.2	7.5	40.5

The Quasi-Peak/Average reading shown in the table above is corrected by the software using the correction factor shown. An amplifier may be used when required. The correction factor listed is calculated as:

$$\text{Correction(dB)} = \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The final Quasi-Peak/Average value for radiated emissions is calculated by the automated software using following equation:

$$\text{Corrected QuasiPeak/Average(dBμV/m)} = \text{Raw QuasiPeak/Average} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

Sample Conducted Emission Calculation:

Frequency MHz	Quasi-Peak dBμV	Meas. Time ms	Bandwidth KHz	Correction dB	Margin dB	Limit dBμV
0.15	44.3	1000	9	0.6	21.7	66

Frequency MHz	Average dBμV	Meas. Time ms	Bandwidth KHz	Correction dB	Margin dB	Limit dBμV
0.15	27.2	1000	9	0.6	28.8	56

The Quasi-Peak/Average reading shown in the table above is corrected by the software using the correction factor shown. The correction factor listed is calculated as:

$$\text{Correction(dB)} = \text{Transducer Factor} + \text{Cable Loss}$$

The final Quasi-Peak/Average value for radiated emissions is calculated by the automated software using following equation:

$$\text{Corrected QuasiPeak/Average(dBμV)} = \text{Raw QuasiPeak/Average} + \text{Transducer Factor} + \text{Cable Loss}$$

The margin, defined as the distance to the limit specified in the applicable standard is calculated as shown below for both radiated and conducted emissions.

$$\text{Margin(dB)} = \text{Limit} - \text{QuasiPeak/Average Measurement}$$

2.6 List of Test Equipment

The tables below list the equipment used by QAI Laboratories in performing the tests on the Equipment Under Test (EUT). The calibration interval is 3 years or less as defined in the Quality Manual.

Emissions Test Equipment

Manufacturer	Model	Description	Serial No. or Asset No.	Calibration Due Date
ETS Lindgren	2165	Turntable	None	NCR
Hewlett Packard	85662A	SA Display Unit	1181	05 02 2019
Hewlett Packard	85660B	Spectrum Analyzer	1182	05 02 2019
Hewlett Packard	85650A	QP adapter	1008	05 02 2019
Hewlett Packard	85685A	RF Preselector	1011	05 02 2019
Sunol Sciences	TWR-MB/99	Mast	051204-3	NCR
EMCO	93110B	Biconical Antenna	1110	07 May 17
EMCO	93146	Log Periodic Antenna	1116	08 Sep 17
EMCO	6502	Loop Antenna	2016	21 Aug 17
Sunol Sciences	DRH-118	DRG	1403	21 Aug 17
Hewlett Packard	8447F	Dual Amplifier 0.1 to 1000MHz	1238	06 Mar 18
Rohde & Schwarz	FSP 40	Spectrum Analyzer	100184	03 Nov 17
Hewlett Packard	85662A	SA Display Unit	1181	05 02 2019
Hewlett Packard	85660B	Spectrum Analyzer	1182	05 02 2019
Hewlett Packard	85650A	QP adapter	1008	05 02 2019
Hewlett Packard	85685A	RF Preselector	1011	05 02 2019
Rohde & Schwarz	NRVS/1020.1809.02	Power Meter Display Unit	834432/074	10 Nov 18
FCC	FCC-LISN-50-25-2-08	LISN 150K-30M Hz	1057	18 Nov 18
Solar	7930-8.0	High Pass Filter	1286	01 Apr 17
Fischer	FCC-450B-2.4N	RF Fuse	1288	01 Apr 17
California Instruments	PACS-1	Power Analyzer & Conditioning System	1136	18 Jul 18
California Instruments	OMNI 1-18i	Impedance Network	1137	18 Jul 18
California Instruments	300lix	3 kVA Programmable Power Source	1138	18 Jul 18

Measurement Software

Manufacturer	Model	Description	Serial No.
Rhode & Schwarz	EMC 32	Emissions Measurement	6.20.0
VI Automation	Via RCI Executive	Radiated and Conducted Immunity	1.0.308
TILE	7	Emissions Measurement	7.1
California Instruments	CTS-1	Harmonics and Flicker	3.3.0.25

Section III: REQUIREMENTS FOR THE US MARKET (FCC) & THE CANADIAN MARKET (IC)

3.1 AC Mains Conducted Emissions

This test ensures unintentional RF energy from the Equipment Under Test (EUT) conducted to its power source does not exceed the limits defined in the table below as specified in 15.107, Class B. This prevents the EUT from causing unwanted interference to other electronic devices.

This test is performed in accordance with ANSI C63.10(2013). A Line Impedance Stabilizing Network (LISN) was used to make conducted emissions measurements. Measurements were made by using instrumentation with 9 kHz measurement bandwidth, CISPR quasi-peak and average detector capabilities; measurement instrumentation requirements, including the measurement bandwidths used, are specified in CISPR 16-1-1.

The EUT was operated 120V/60Hz while in 'Continuous Mode' of operation.

Conducted Emissions Limits for FCC CFR 47 Part 15, Subpart C, 15.207

FCC CFR 47 Part 15, Subpart C - Radio Frequency Devices, Subpart C - Intentional Radiators.

Frequency Hz	Limit	
	Quasi-Peak dBμV	Average dBμV
150K - 500K	66 - 56 *	56 - 46 *
500K - 5M	56	46
5M - 30M	60	50
<i>Notes: The lower limit shall apply at the transition frequencies. *Decreases linearly with the logarithm of the frequency.</i>		

Conducted Emissions Limits for FCC CFR 47 Part 15, Subpart B, 15.107 Class B

FCC CFR 47 Part 15, Subpart B - Radio Frequency Devices, Subpart B - Unintentional Radiators.

Frequency Hz	Limit	
	Quasi-Peak dBμV	Average dBμV
150K - 500K	66 - 56 *	56 - 46 *
500K - 5M	56	46
5M - 30M	60	50
<i>Notes: The lower limit shall apply at the transition frequencies. *Decreases linearly with the logarithm of the frequency.</i>		

The EUT was tested on October 3, 2016 and complies with Class B of 15.107.

Refer to Appendix A for AC Mains Conducted Emissions data.

3.2 Radiated Spurious Emissions

This test ensures the unintentional RF energy emitted (radiated) from the Equipment Under Test (EUT) does not exceed the limits defined in the table below as specified in 15.109, Class B. This prevents the EUT from causing unwanted interference to

This test is performed in accordance with ANSI C63.10(2013).

The EUT was operated at 120V/60Hz while in 'Continuous Mode' of operation. All cables over 1 meter length were bundled and retained from the floor. Preliminary measurements were performed in the 3m Semi Anechoic Chamber (SAC) while final measurements were performed at the 10m Open Air Test Site (OATS) if required.

The device incorporates a 'digital device' and applicable receive mode (RX) limits also apply.

The device includes co-location of transmitters, transmit mode (TX) limits are applicable while all transmitters are operating unless RF transmission of each device is exclusive. Preliminary investigation of intermodulation of transmitters to determine worst-case has been performed and final measurements for transmit mode have been performed independently and during simultaneous worst-case transmission of all devices.

Radiated Emissions Limits - TX

Frequency MHz	Field Strength Limit at 3m	
	Quasi-Peak $\mu\text{V/m}$	Quasi-Peak $\text{dB}\mu\text{V/m}$
0.009 - 0.490	$2400/F(\text{kHz}) \cdot *1$	128.5 - 93.8
0.490 - 1.705	$24000/F(\text{kHz}) \cdot *1$	73.8 - 63.0
1.705 - 30	$30 \cdot *2$	69.5
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

Notes:
1. Measurement distance of 300m.
2. Measurement distance of 30m.
3. The lower limit shall apply at the transition frequencies.
4. The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector of 200Hz for 9k - 150k Hz, 9kHz for 150k - 30M Hz, and 120kHz for 30M - 1G Hz except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector. CISPR average detector of 300Hz for 9k - 150k Hz, and 30kHz for 150k - 30M Hz, 300kHz for above 1GHz

Radiated Emissions Limits - RX (Digital Device)

Frequency MHz	Field Strength Limit at 3m	
	Quasi-Peak $\mu\text{V/m}$	Quasi-Peak $\text{dB}\mu\text{V/m}$
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

Notes: The lower limit shall apply at the transition frequencies.

Emissions in both horizontal and vertical planes (polarizations) were measured while rotating the EUT on the turntable to maximize signal strength. In the case of high ambient noises, the measurements are performed at a closer distance and the limit is adjusted using the equation below to ensure compliance.

$$20 \log (d1/d2);$$

Where d1 = New distance
d2 = Required distance

The EUT was tested on October 3, 2016 and complies.

Refer to Appendix B for Radiated Spurious Emissions data.

3.3 Conducted Spurious Emissions

This test ensures the RF peak power output of the Equipment Under Test (EUT) does not exceed the limits as specified in 15.247(b)(3), 15.407(a)(1)(2)(3)(4), ICES-003 Issue 6 for systems employing digital modulation techniques operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz, and unlicensed National Information Infrastructure (U-NII) devices operating in the 5.15-5.35 GHz, 5.47-5.725 GHz and 5.725-5.850 GHz bands.

The EUT was operated at 120V/60Hz while in 'continuous transmit mode'. The test was performed as defined by the standards above with the antenna port of the EUT directly connected to a spectrum analyzer or power meter.

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. The Equivalent Isotropically Radiated Power (EIRP) shall not exceed 4 W unless otherwise specified in the standard.

The device includes co-location of transmitters and transmit mode (TX) limits are applicable while all transmitters are operating unless RF transmission of each device is exclusive. Preliminary investigation of intermodulation of transmitters to determine worst-case has been performed and final measurements for transmit mode have been performed independently and during simultaneous worst-case transmission of all devices.

The EUT was tested on October 3, 2016 and complies.

Refer to Appendix C for Conducted Spurious Emissions data.

3.5 RF Peak Power Output

This test ensures the RF peak power output of the Equipment Under Test (EUT) does not exceed the limits as specified in 15.247(b)(3), 15.407(a)(1)(2)(3)(4), ICES-003 Issue 6 for systems employing digital modulation techniques operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz, and unlicensed National Information Infrastructure (U-NII) devices operating in the 5.15-5.35 GHz, 5.47-5.725 GHz and 5.725-5.850 GHz bands.

The EUT was operated at 120V/60Hz while in 'continuous transmit mode'. The test was performed as defined by the standards above with the antenna port of the EUT directly connected to a spectrum analyzer or power meter. If necessary duty cycle plots are used to establish correction for non-continuous operation.

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. The Equivalent Isotropically Radiated Power (EIRP) shall not exceed 4 W unless otherwise specified in the standard.

For systems operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power.

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm $10 \log B$, where B is the 26 dB emission bandwidth in megahertz. For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

The RF peak output power or EIRP is calculated using the maximum conducted output power increased by the directional antenna gain. The conducted RF peak output power is also corrected for duty cycle to provide the maximum transmit power.

Directional Antenna Gain (beamforming) reduces the power limit for directional antenna gains over 6dB.

Frequency Band MHz	Power Limit dBm	2TX CDD (*1) Directional Gain (Beamforming) dB	Adjusted Power Limit dBm
2400 - 2483.5	30	0.81	29.2
2400 - 2483.5 (*4)	30	0.00	30.0
5150 - 5250	24	2.51	21.5
5250 - 5350	24	2.51	21.5
5470 - 5725	24	2.51	21.5
5470 - 5725 (*2)	23.2	2.51	20.7
5470 - 5725 (*3)	22.8	2.51	20.3
5725 - 5825	30	2.51	27.5
Notes: 1. See Antenna Directional Gain calculation. 2. Applicable to 802.11a modulations only. 3. Applicable to VHT20 modulation only. 4. Applicable limit for BT device (does not use 2TX CDD).			

For U-NII bands employing a limit of 11 dBm + $10 \log B$, it is shown in the original report the fixed limit is applicable for all modulations except U-NII 2C operation with VHT20 or 802.11a modulation.

The EUT was tested on October 5, 2016 and complies with 15.247(b)(3), 15.407(a)(1)(2)(3)(4), RSS 210 Issue 8 Annex 8, RSS 247 Issue 1, ICES-003 Issue 6.

Refer to Appendix D for RF Peak Power Output data.

Refer to Appendix E for Duty Cycle Correction data.

3.8 Out-of-Band Emissions (Band Edge)

This test ensures the RF peak power output of the Equipment Under Test (EUT) does not exceed the limits as specified in 15.247(b)(3), 15.407(a)(1)(2)(3)(4), ICES-003 Issue 6 for systems employing digital modulation techniques operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz, and unlicensed National Information Infrastructure (U-NII) devices operating in the 5.15-5.35 GHz, 5.47-5.725 GHz and 5.725-5.850 GHz bands.

The EUT was operated at 120V/60Hz while in 'continuous transmit mode'. The test was performed as defined by the standards above with the antenna port of the EUT directly connected to a spectrum analyzer or power meter.

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, the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified is not required. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits specified.

For conducted measurements above 1000 MHz within the restricted bands, the EIRP[dBm] shall be measured and then field strength $E[\text{dB}\mu\text{V}/\text{m}]$ shall be calculated (see KDB Publication 789033 D02).

$$E[\text{dB}\mu\text{V}/\text{m}] = \text{EIRP}[\text{dBm}] - 20 \log(d[\text{meters}]) + 104.77 + A[\text{dB}]$$

where: E = field strength

d = distance at which field strength limit is specified in the rules

A[dB] = 2TX CDD Directional Gain (Beamforming) in excess of 6 dBi

The EUT was tested on October 5, 2016 and complies with 15.247(b)(3), 15.407(a)(1)(2)(3)(4), RSS 210 Issue 8 Annex 8, RSS 247 Issue 1, ICES-003 Issue 6.

Refer to Appendix F for Out-of-Band Emissions (Bandedge) data.

3.10 RF Exposure Evaluation

This requirement ensures the Equipment Under Test (EUT) complies with the RF exposure requirements of CFR 47 FCC Part 1.131, RSS-102 Section 2.5.2.

CFR 47 FCC 1.1310 defines radio frequency radiation exposure limits for General Population/Uncontrolled Exposure within frequency range 1500 - 100,000 MHz: as 1.0 mW/cm².

RSS-102 Section 2.5.2 defines RF exposure evaluation as 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 at or above 300 MHz and below 6 GHz. The source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834} \text{ W}$ (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.

RF Exposure Limits

Band	Worst-Case (Lowest) Frequency in Band MHz	RSS-102-2.5.2 Power Density Limit at 20 cm mW/cm ²	CFR 47 FCC 1.1310 Power Density Limit at 20 cm mW/cm ²
2G4	2400	2.7	1.0
UNII-1	5150	4.5	1.0
UNII-2A	5250	4.6	1.0
UNII-2C	5470	4.7	1.0
UNII-3	5725	4.8	1.0

RF Exposure Evaluation

$$\text{Power Density (mW/cm}^2\text{)} = \text{EIRP(mW)} / (4 * \pi * r^2)$$

Frequency MHz	Highest Measured Conducted Power dBm	Antenna Gain dBi	EIRP mW	Power Density at 20 cm mW/cm ²
2412	18.4	3.8	165.96	0.03302
5150	12.8	5.5	67.61	0.01345
5250	12.4	5.5	61.66	0.01227
5725	10.4	5.5	38.90	0.00774

In all cases, the Power Density reported is significantly less than the applicable limits.

The measurements and calculations for RF Exposure were performed on October 4, 2016 and the EUT complies with CFR 47 FCC Part 1.131 and RSS-102 Section 2.5.2.

Appendix A: CONDUCTED EMISSIONS DATA

Figure A1: AC Mains Conducted Emissions for FCC/ICES 120V/60H - RX - LI

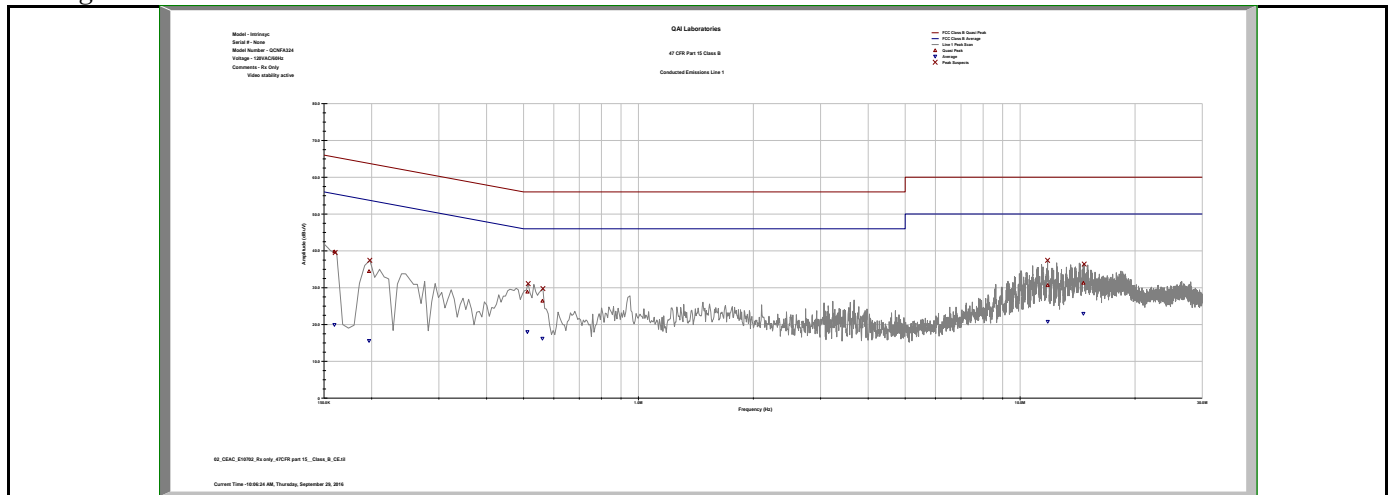


Table A1-1: Quasi Peak Data AC Mains Conducted Emissions for FCC/ICES 120V/60H - RX - LI

Frequency MHz	Quasi-Peak dBμV	Meas. Time ms	Bandwidth KHz	Line	Correction dB	Margin dB	Limit dBμV
0.160	39.8	1000	9	L1	0.14	25.7	65.5
0.197	34.4	1000	9	L1	0.10	29.3	63.7
0.512	28.9	1000	9	L1	0.05	27.1	56.0
0.560	26.4	1000	9	L1	0.10	29.6	56.0
11.812	30.7	1000	9	L1	0.40	29.3	60.0
14.646	31.3	1000	9	L1	0.58	28.7	60.0

Table A1-2: Average Data AC Mains Conducted Emissions for FCC/ICES 120V/60H - RX - LI

Frequency MHz	Average dBμV	Meas. Time ms	Bandwidth KHz	Line	Correction dB	Margin dB	Limit dBμV
0.160	19.9	1000	9	L1	0.14	35.5	55.5
0.197	15.6	1000	9	L1	0.10	38.2	53.7
0.512	18.0	1000	9	L1	0.05	28.0	46.0
0.560	16.2	1000	9	L1	0.10	29.8	46.0
11.812	20.8	1000	9	L1	0.40	29.2	50.0
14.646	23.0	1000	9	L1	0.58	27.0	50.0

Figure A2: AC Mains Conducted Emissions for FCC/ICES 120V/60H - RX - L2

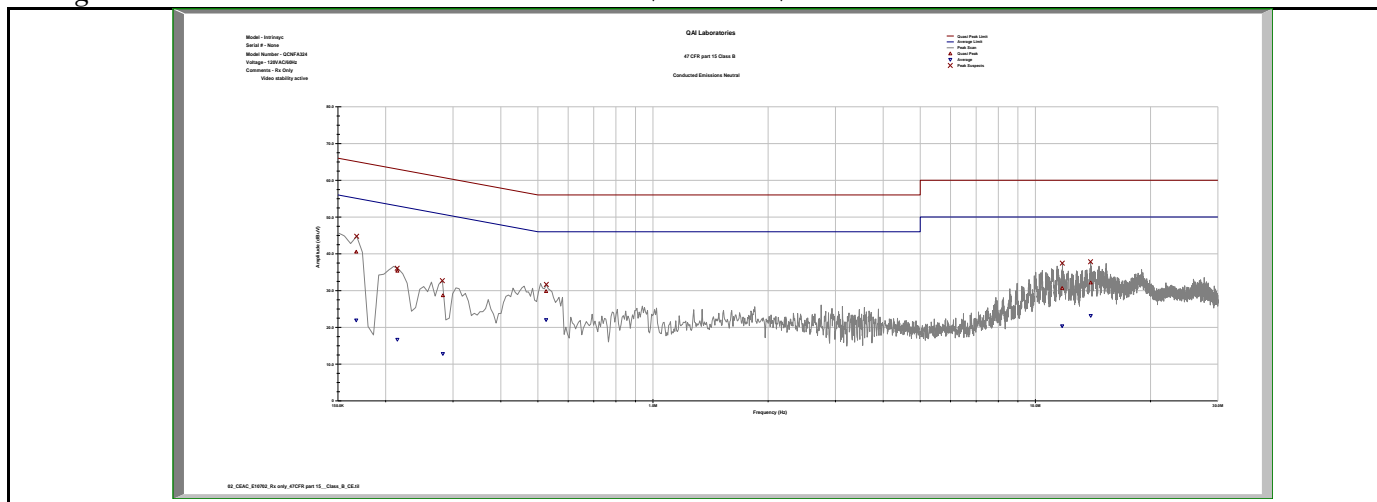


Table A2-1: Quasi Peak Data AC Mains Conducted Emissions for FCC/ICES 120V/60H - RX - L2

Frequency MHz	Quasi-Peak dBμV	Meas. Time ms	Bandwidth KHz	Line	Correction dB	Quasi Peak Margin dB	Quasi Peak Limit dBμV
0.167	40.5	1000	9	L2	0.10	24.6	65.1
0.215	35.3	1000	9	L2	0.13	27.7	63.0
0.282	28.7	1000	9	L2	0.10	32.1	60.8
0.525	29.8	1000	9	L2	0.00	26.2	56.0
11.749	30.6	1000	9	L2	0.40	29.4	60.0
13.952	32.1	1000	9	L2	0.60	27.9	60.0

Table A2-2: Average Data AC Mains Conducted Emissions for FCC/ICES 120V/60H - RX - L2

Frequency MHz	Average dBμV	Meas. Time ms	Bandwidth KHz	Line	Correction dB	Average Margin dB	Average Limit dBμV
0.167	21.9	1000	9	L2	0.10	33.1	55.1
0.215	16.7	1000	9	L2	0.13	36.3	53.0
0.282	12.8	1000	9	L2	0.10	37.9	50.8
0.525	22.0	1000	9	L2	0.00	24.0	46.0
11.749	20.4	1000	9	L2	0.40	29.6	50.0
13.952	23.2	1000	9	L2	0.60	26.8	50.0

Figure A3: AC Mains Conducted Emissions for FCC/ICES 120V/60H - TX- Worst-Case - L1

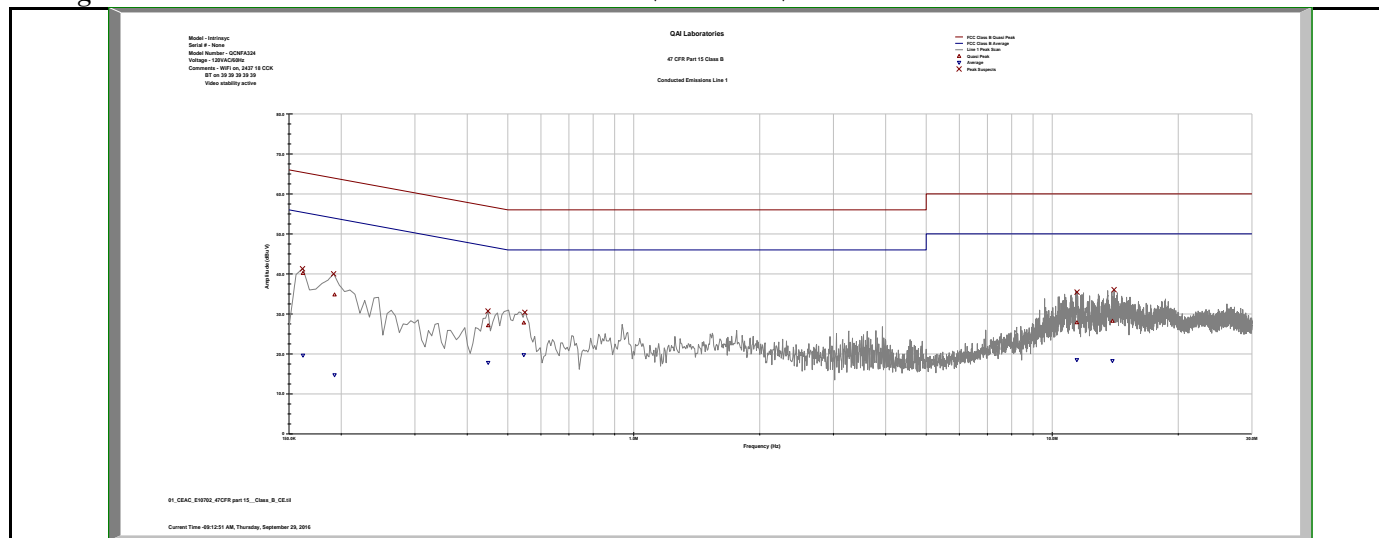


Table A3-1: Quasi Peak Data AC Mains Conducted Emissions for FCC/ICES 120V/60H - TX Worst-Case - L1

Frequency MHz	Quasi-Peak dBμV	Meas. Time ms	Bandwidth KHz	Line	Correction dB	Quasi Peak Margin dB	Quasi Peak Limit dBμV
0.162	40.2	1000	9	L1	0.11	25.2	65.4
0.193	34.8	1000	9	L1	0.10	29.1	63.9
0.449	27.1	1000	9	L1	0.08	29.8	56.9
0.546	27.8	1000	9	L1	0.08	28.2	56.0
11.454	27.8	1000	9	L1	0.40	32.2	60.0
13.929	28.2	1000	9	L1	0.60	31.8	60.0

Table A3-2: Average Data AC Mains Conducted Emissions for FCC/ICES 120V/60H - TX Worst-Case - L1

Frequency MHz	Average dBμV	Meas. Time ms	Bandwidth KHz	Line	Correction dB	Average Margin dB	Average Limit dBμV
0.162	19.6	1000	9	L1	0.11	35.7	55.4
0.193	14.7	1000	9	L1	0.10	39.2	53.9
0.449	17.8	1000	9	L1	0.08	29.1	46.9
0.546	19.7	1000	9	L1	0.08	26.3	46.0
11.454	18.5	1000	9	L1	0.40	31.5	50.0
13.929	18.3	1000	9	L1	0.60	31.7	50.0

Figure A4: AC Mains Conducted Emissions for FCC/ICES 120V/60H - TX Worst-Case - L2

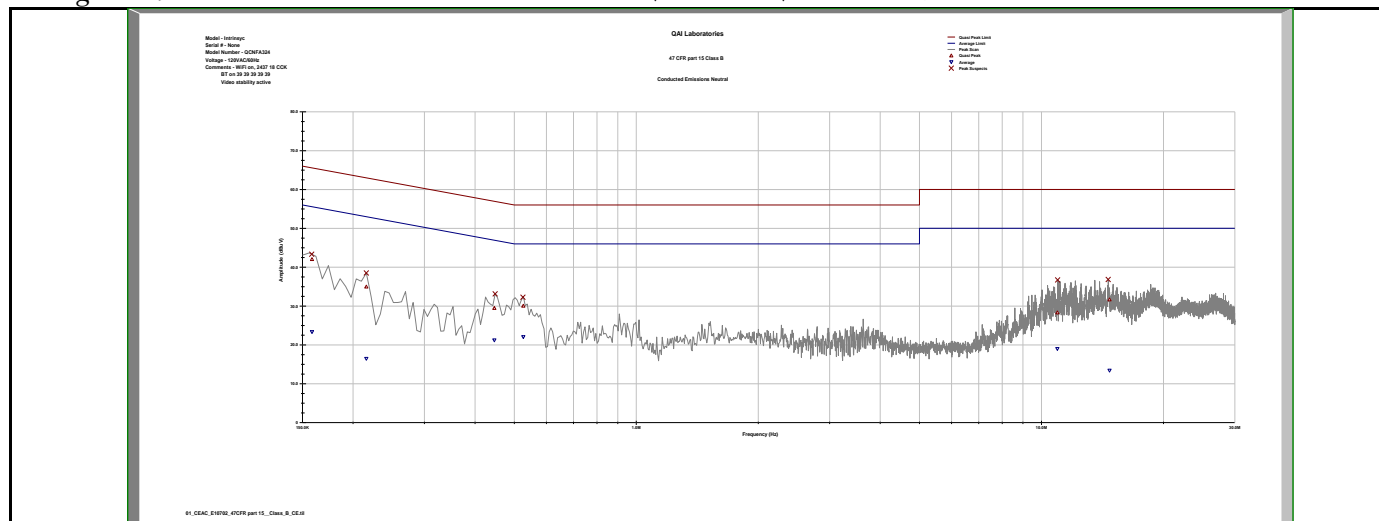


Table A4-1: Quasi Peak Data AC Mains Conducted Emissions for FCC/ICES 120V/60H - TX Worst-Case - L2

Frequency MHz	Quasi-Peak dBuV	Meas. Time ms	Bandwidth KHz	Line	Correction dB	Quasi Peak Margin dB	Quasi Peak Limit dBuV
0.158	42.0	1000	9	L2	0.16	23.5	65.6
0.216	34.9	1000	9	L2	0.15	28.0	63.0
0.446	29.5	1000	9	L2	0.07	27.5	56.9
0.526	30.0	1000	9	L2	0.00	26.0	56.0
10.944	28.3	1000	9	L2	0.48	31.7	60.0
14.721	31.6	1000	9	L2	0.57	28.4	60.0

Table A4-2: Average Data AC Mains Conducted Emissions for FCC 220V/60H - RF ON - L2

Frequency MHz	Average dBuV	Meas. Time ms	Bandwidth KHz	Line	Correction dB	Average Margin dB	Average Limit dBuV
0.158	23.3	1000	9	L2	0.16	32.2	55.6
0.216	16.5	1000	9	L2	0.15	36.5	53.0
0.446	21.2	1000	9	L2	0.07	25.7	46.9
0.526	22.1	1000	9	L2	0.00	23.9	46.0
10.944	19.0	1000	9	L2	0.48	31.0	50.0
14.721	13.4	1000	9	L2	0.57	36.6	50.0

Appendix B: RADIATED EMISSIONS DATA

Figure B1: Radiated Emissions 30M-1G Hz for FCC/IC - RX

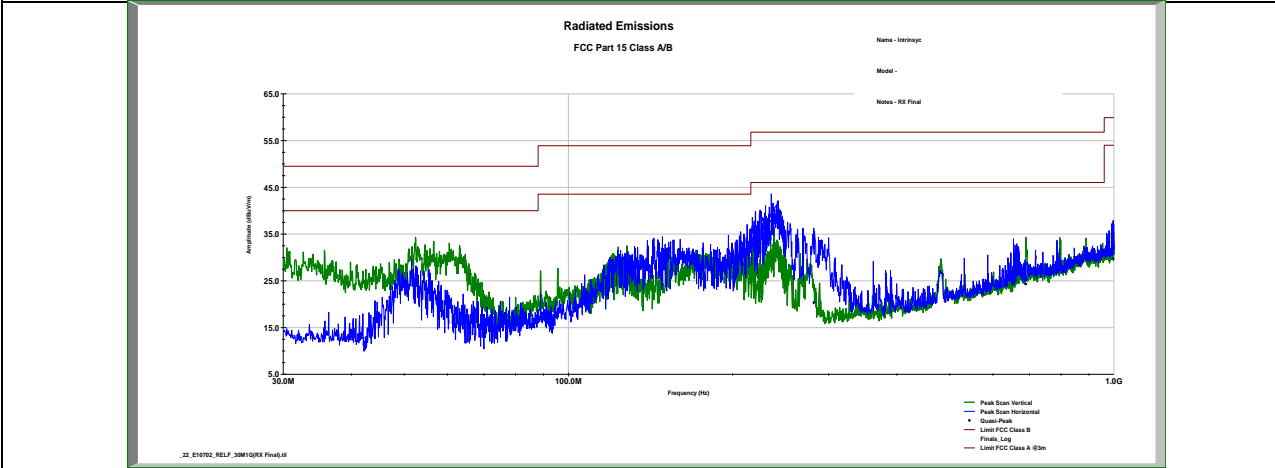


Table B1-1: Radiated Emissions 30M-1G Hz Data for FCC/IC - RX

Frequency MHz	Quasi-Peak dBµV	Meas. Time ms	Bandwidth KHz	Polarity	Correction dB	Margin dB	Limit dBµV/m		
52.627	24.5	1000	120	VERT	-15.1	15.5	40.0		
124.041	31.7	1000	120	VERT	-11.7	11.8	43.5		
148.215	25.3	1000	120	VERT	-10.5	18.2	43.5		
229.015	33.9	1000	120	HORZ	-5.4	12.1	46.0		
235.415	37.8	1000	120	HORZ	-4.9	8.2	46.0		
689.815	24.3	1000	120	VERT	4.7	21.7	46.0		
758.891	25.5	1000	120	VERT	5.6	20.5	46.0		
Notes: 1. Peak data may be compared to quasi-peak limit.									

Figure B2: Radiated Emissions IG-6G Hz for FCC/IC - RX

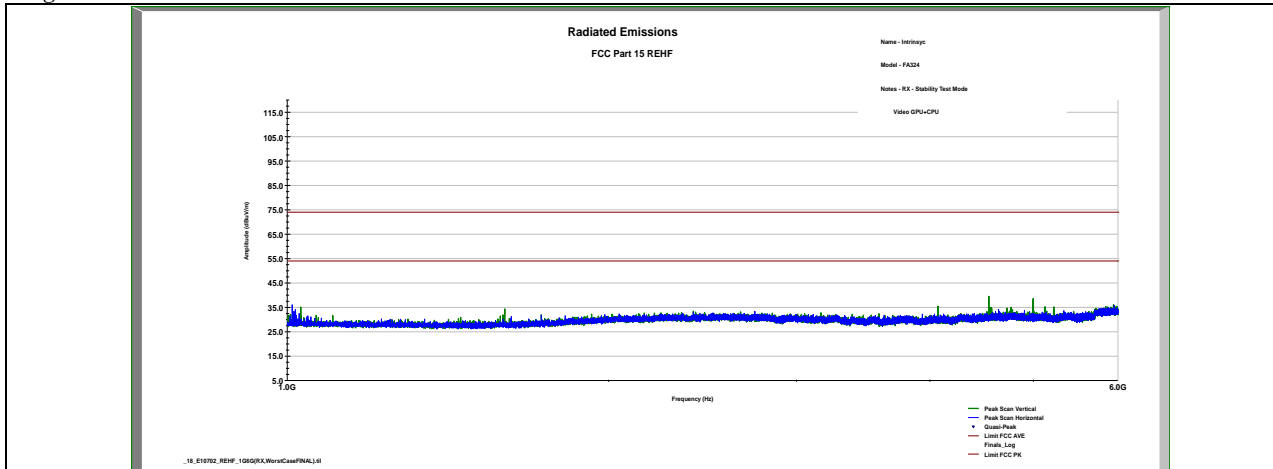


Table B2-1: Radiated Emissions IG-6G Hz Data for FCC/IC - RX

Frequency MHz	Average dBμV	Meas. Time ms	Bandwidth KHz	Polarity	Correction dB	Margin dB	Limit dBμV/m
1590.256	38.1	1000	120	V	-9.9	15.9	54
4543.256	36.1	1000	120	V	-7.5	17.9	54
4991.256	34.6	1000	120	V	-7.7	19.4	54

Notes: 1. Peak data may be compared to average limit.

Colocation Worst-Case: The worst-case mode for colocated transmitters was determined to be Bluetooth (TX0) and 802.11B CCK (TX1).

Figure B3: Radiated Emissions 30M-1G Hz for FCC/IC - TX Worst-Case (BT/11BCCK)

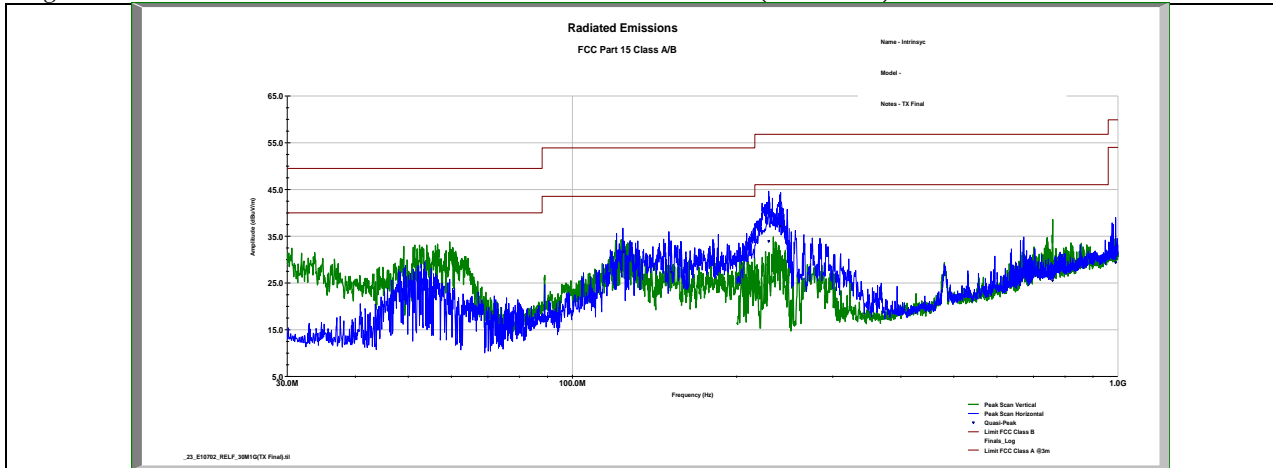


Table B3-1: Radiated Emissions 30M-1G Hz Data for FCC/IC - TX Worst-Case (BT/11BCCK)

Frequency MHz	Quasi-Peak dBμV	Meas. Time ms	Bandwidth KHz	Polarity	Correction dB	Margin dB	Limit dBμV/m		
124.041	31.7	1000	120	VERT	-11.7	11.8	43.5		
151.694	27.3	1000	120	VERT	-10.4	16.2	43.5		
229.015	33.9	1000	120	HORZ	-5.4	12.1	46.0		
240.405	37.1	1000	120	HORZ	-4.9	8.9	46.0		
758.891	25.5	1000	120	VERT	5.7	20.5	46.0		

Notes 1. Peak data may be compared to quasi-peak limit unless noted.

Figure B4: Radiated Emissions 1G-18G Hz for FCC/IC - TX Worst-Case (BT/IIBCCCK)

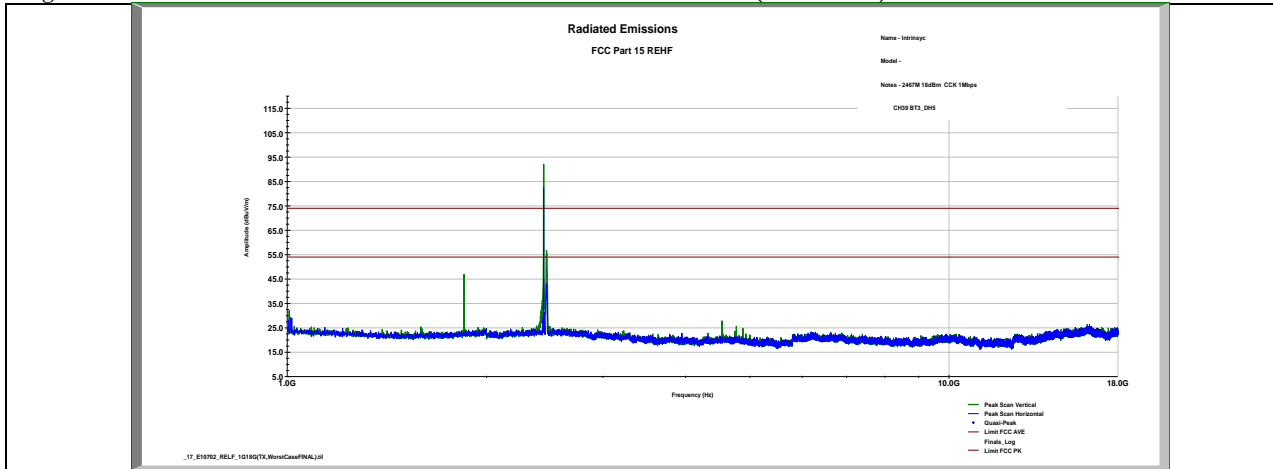


Table B4-1: Radiated Emissions 1G-18G Hz Data for FCC/IC - TX Worst-Case (BT/IIBCCCK)

Frequency MHz	Average dBμV	Meas. Time ms	Bandwidth KHz	Polarity	Correction dB	Margin dB	Limit dBμV/m	Note
2440		1000	120	V	2.1			Fundamental
1007.256	36.8	1000	120	V	-5.1	17.2	54	
1850.547	46.5	1000	120	V	0.5	7.5	54	
4540.159	38.7	1000	120	V	3.3	15.3	54	
Notes: 1. Peak data may be compared to average limit.								

Figure B5: Radiated Emissions 9K-30M Hz for FCC/IC - TX Worst-Case (BT/IIBCCCK)

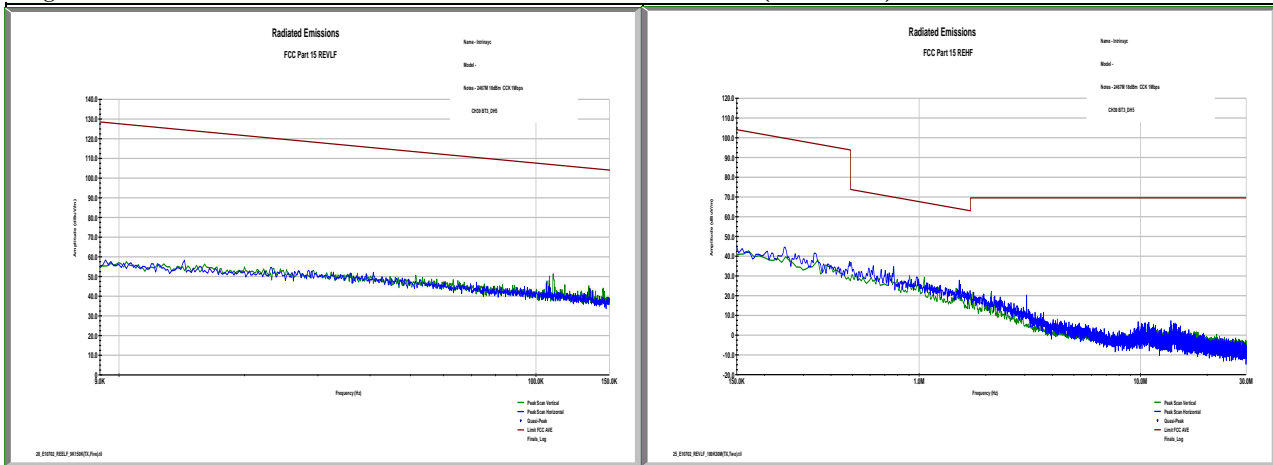


Table B5-1: Radiated Emissions 9K-30M Hz Data for FCC/IC - TX Worst-Case (BT/IIBCCCK)

Frequency MHz	Quasi-Peak dBμV	Meas. Time ms	Bandwidth KHz	Antenna Height cm	Turntable Position deg	Polarity	Correction dB	Margin dB	Limit dBμV/m
Notes: 1. No emissions within 20dB of limit were found.									

Appendix C: SPURIOUS CONDUCTED EMISSIONS DATA

Figure C1: Spurious Conducted Emissions for FCC/ICES - TX 2G4 Worst-Case (IIB/IIG)

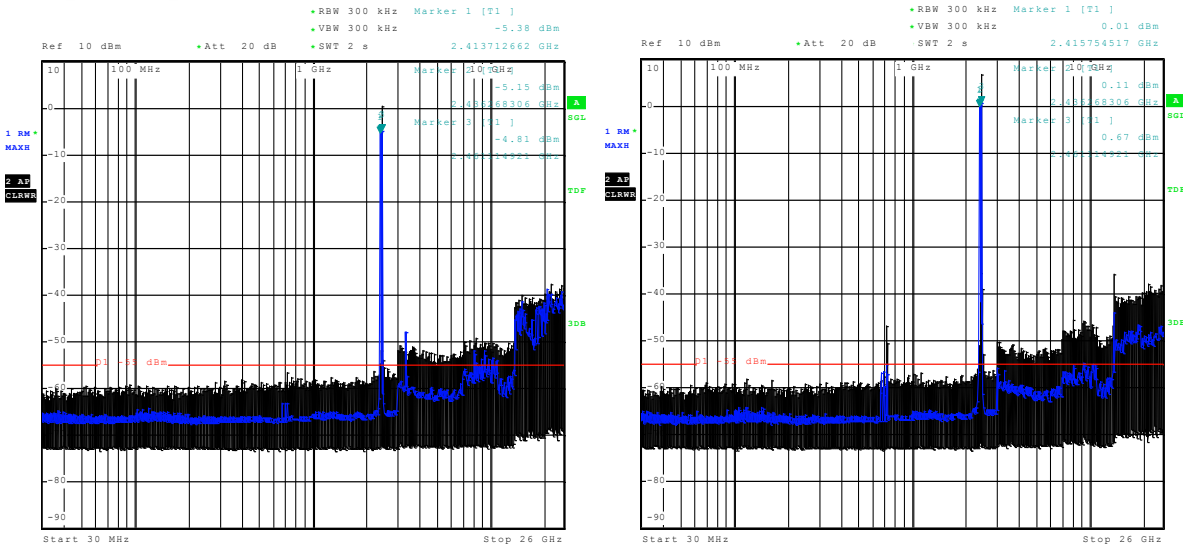


Table C1: Spurious Conducted Emissions for FCC/ICES - TX 2G4 Worst-Case (IIB/IIG)

Frequency MHz	Average dBm or dBuV/m	Meas. Time ms	Bandwidth KHz	Correction dB	Limit dBc or dBuV/m	Margin dB	Note
2467	-4.81	1000	300	0.0	-	-	TX Worst-Case
672.664	-61.9	1000	300	1.0	-34.8	27.1	Restr N/A
725.288	-60.8	1000	300	2.0	-34.8	26.0	Restr N/A
3368.156	39.4	1000	1000	3.0	54.0	14.6	Restricted
13615.259	-43.7	1000	300	4.0	-34.8	8.9	Restr N/A
24500	-39.7	1000	300	4.0	-34.8	4.9	Restr N/A
2409	0.67	1000	300	0.0	-	-	TX Worst-Case
694.042	-56.4	1000	300	1.0	-29.3	27.1	Restr N/A
724.628	-54.8	1000	300	2.0	-29.3	25.5	Restr N/A
3025.156	-55.8	1000	300	3.0	-29.3	26.5	Restr N/A
13615.259	-43.9	1000	300	4.0	-29.3	14.6	Restr N/A
24500	-46.7	1000	300	4.0	-29.3	17.4	Restr N/A

Notes: 1. Spurious emissions are required to attenuated by 30dB (RMS method) or 20dB (PK method) unless emissions are within restricted bands.
2. Unless noted.
3. Restricted band emissions are compared to 54 dBuV/m using EIRP calculation.

Figure C2: Spurious Conducted Emissions for FCC/ICES - TX 2G4 Worst-Case (IIN/BT)

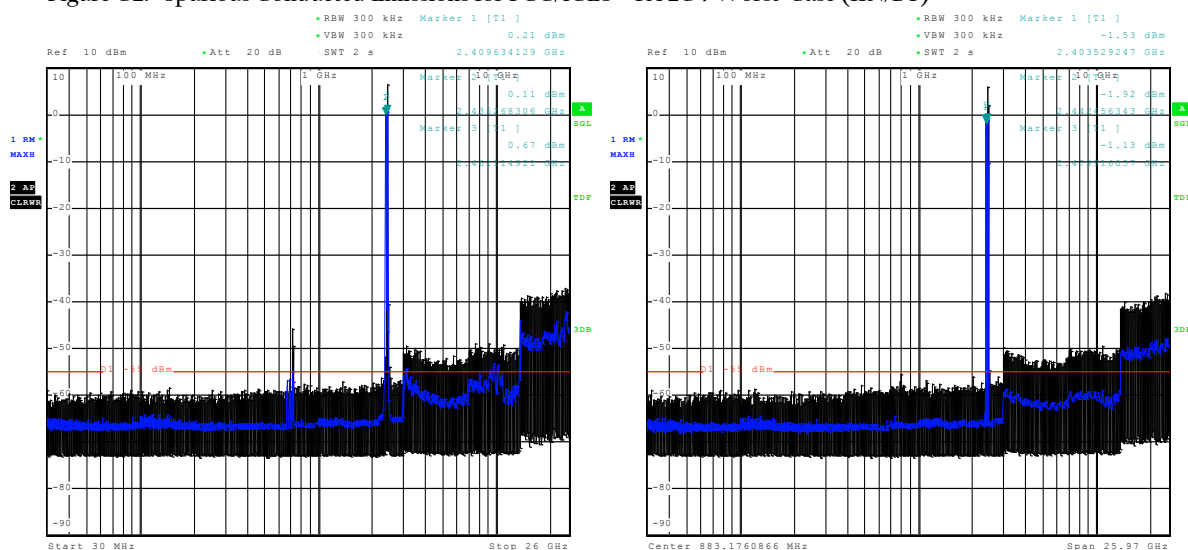


Table C2: Spurious Conducted Emissions for FCC/ICES - TX 2G4 Worst-Case (IIN/BT)

Frequency MHz	Average dBm or dBuV/m	Meas. Time ms	Bandwidth KHz	Correction dB	Limit dBc or dBuV/m	Margin dB	Note
2461	0.67	1000	300	0.0	-	-	TX Worst-Case
672.665	-56.8	1000	300	1.0	-29.3	27.5	Restr N/A
724.628	-54.8	1000	300	1.0	-29.3	25.5	Restr N/A
3161.105	-54.1	1000	300	1.0	-29.3	24.8	Restr N/A
9774.318	-53.1	1000	300	1.0	-29.3	23.8	Restr N/A
10351.316	-53.5	1000	300	1.0	-29.3	24.2	Restr N/A
13615.739	-43.9	1000	300	2.0	-29.3	14.6	Restr N/A
24944.741	-42.2	1000	300	2.0	-29.3	12.9	Restr N/A
2409	-1.13	1000	300	0.0	-	-	TX Worst-Case
24500	-48.0	1000	300	0.0	-31.1	16.9	

Notes: 1. Spurious emissions are required to attenuated by 30dB (RMS method) or 20dB (PK method) unless emissions are within restricted bands.
2. Unless noted.
3. Restricted band emissions are compared to 54 dBuV/m using EIRP calculation.

Figure C3: Spurious Conducted Emissions for FCC/ICES - TX 5G Worst-Case (UNII)

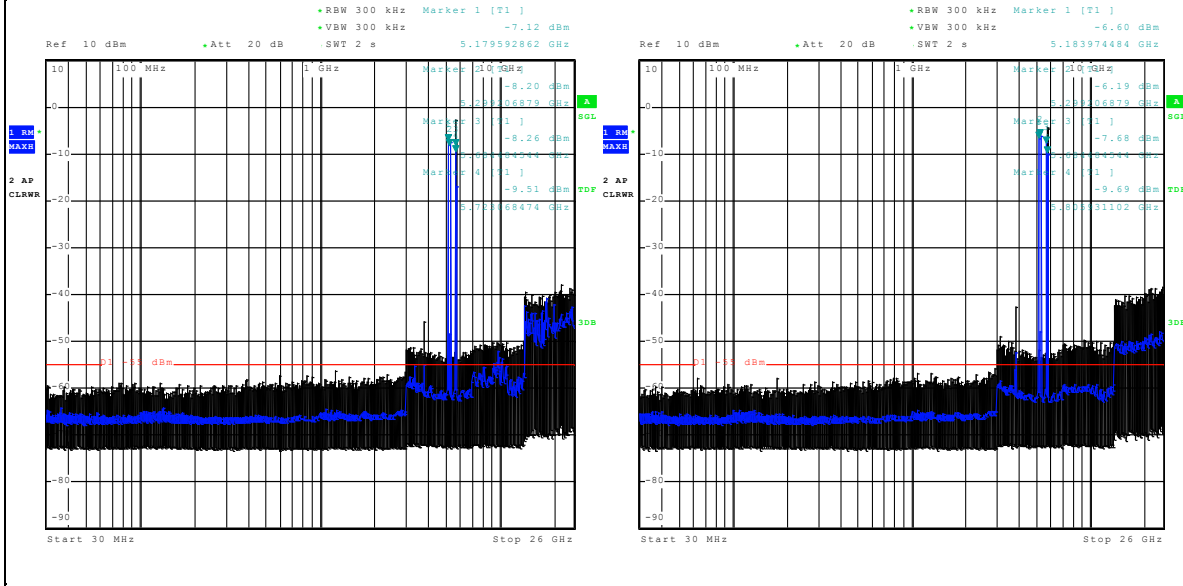


Table C3: Spurious Conducted Emissions for FCC/ICES - TX 5G Worst-Case (UNII)

Frequency MHz	Average dBm or dBuV/m	Meas. Time ms	Bandwidth KHz	Correction dB	Limit dBc or dBuV/m	Margin dB	Note
5180	-7.12	1000	300	0.0	-	-	TX Worst-Case
3351.590	-55.1	1000	300	1.0	-37.1	18.0	Restr N/A
3813.359	-54.9	1000	300	1.0	-37.1	17.8	Restr N/A
9745.157	-52.2	1000	300	1.0	-37.1	15.1	Restr N/A
13664.258	-42.5	1000	300	1.0	-37.1	5.4	Restr N/A
18054.942	52.4	1000	1000	1.0	54.0	1.6	Restricted
24500	-43.0	1000	300	0.0	-31.1	11.9	Restr N/A
5184	-6.60	1000	300	0.0	-	-	TX Worst-Case
3870.105	-52.3	1000	300	1.0	-36.6	15.7	Restr N/A
24500	-48.0	1000	300	0.0	-36.6	11.4	
Notes: 1. Spurious emissions are required to attenuated by 30dB (RMS method) or 20dB (PK method) unless emissions are within restricted bands. 2. Unless noted.							

Figure C4: Spurious Conducted Emissions for FCC/ICES - TX 5G Worst-Case (UNII VHT)

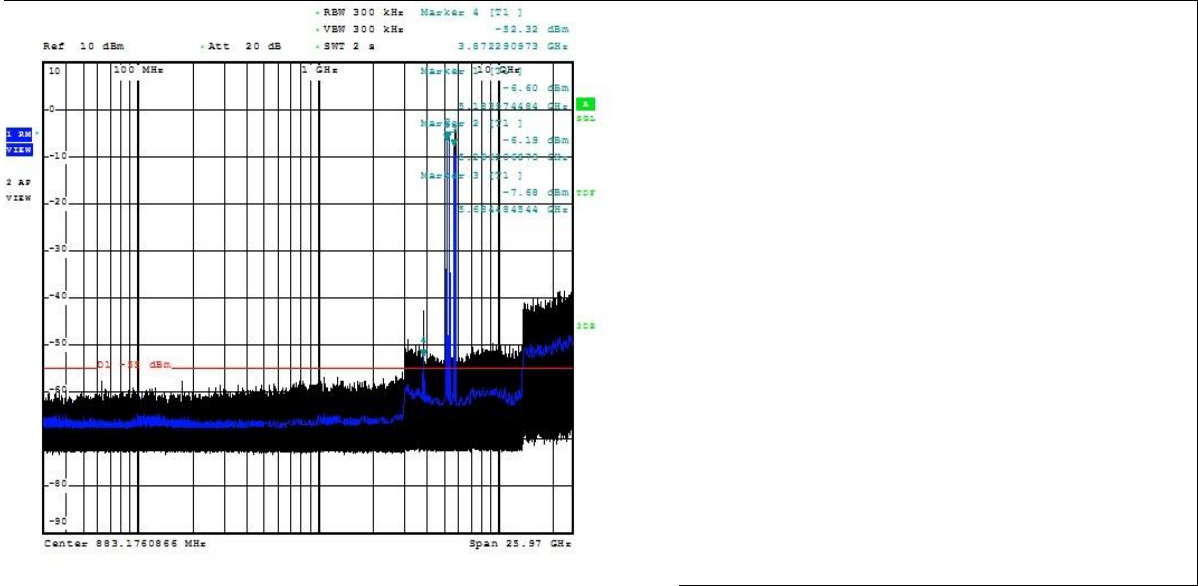


Table C4: Spurious Conducted Emissions for FCC/ICES - TX 5G Worst-Case (UNII VHT)

Frequency MHz	Average dBm or dBuV/m	Meas. Time ms	Bandwidth KHz	Correction dB	Limit dBc or dBuV/m	Margin dB	Note
5262	-6.19	1000	300	0.0	-	-	TX Worst-Case
3872.290	42.9	1000	300	0.0	54.0	11.1	Restricted
24500	-47.9	1000	300	1.0	-36.2	11.7	Restr N/A
Notes: 1. Spurious emissions are required to attenuated by 30dB (RMS method) or 20dB (PK method) unless emissions are within restricted bands. 2. Unless noted.							

Appendix D: CONDUCTED RF OUTPUT POWER DATA

Table D1: RF Output Power Worst Case, corrected for Duty Cycle - FCC/ICES

						Limit (*2) dBm	Worst Case Margin (*1)	Directional Antenna Gain dBi	EIRP dBm	EIRP mW
Bluetooth Low Energy	BLE	9	2402	2440	2480					
RATE	BT DHS	Measured	-1.3	-0.6	-0.8					
Duty Cycle Correction (dB)	0.42	Corrected	-0.9	-0.2	-0.4	30.0	30.2	3.80	3.62	2.3
Bluetooth	BT	9	2402	2440	2480					
RATE	BT DHS	Measured	8.3	8.7	8.6					
Duty Cycle Correction (dB)	0.44	Corrected	8.7	9.1	9.0	30.0	20.9	3.80	12.94	19.7
802.11b	CCK	18	2412	2437	2462					
RATE	1M (L)	Measured	16.8	17.3	17.9					
Duty Cycle / 2TX CDD	0.48	Corrected	17.3	17.8	18.4	29.2	10.8	6.81	25.19	330.4
802.11g	NoHT	18	2412	2432	2452					
RATE	6M	Measured	16.8	16.5	16.7					
Duty Cycle / 2TX CDD	0.53	Corrected	17.3	17.0	17.2	29.2	11.9	6.81	24.14	259.4
802.11n	HT20	18	2412	2432	2452					
RATE	MCS 0	Measured	15.9	16.1	16.6					
Duty Cycle / 2TX CDD	0.44	Corrected	16.3	16.5	17.0	29.2	12.2	6.81	23.85	242.7
UNII-1	VHT20	12.5	5180	5200	5240					
RATE	MCS 0	Measured	10.1	10.6	11.0					
Duty Cycle / 2TX CDD	0.45	Corrected	10.6	11.1	11.5	21.5	10.1	8.51	19.96	99.1
UNII-2A	VHT20	12.5	5260	5300	5320					
RATE	MCS 0	Measured	10.9	10.1	9.8					
Duty Cycle / 2TX CDD	0.93	Corrected	11.8	11.0	10.7	21.5	9.7	8.51	20.34	108.1
UNII-2C	VHT20	12.5	5500	5680	5720					
RATE	MCS 0	Measured	8.7	10.1	9.3					
Duty Cycle / 2TX CDD	0.45	Corrected	9.2	10.6	9.8	21.5	11.0	8.51	19.06	80.5
UNII-3	VHT20	12.5	5720	5785	5805					
RATE	MCS 0	Measured	9.5	8.6	8.3					
Duty Cycle / 2TX CDD	0.93	Corrected	10.4	9.5	9.2	20.7	10.3	8.51	18.94	78.3
UNII-1	NoHT	13	5180	5200	5240					
RATE	6M	Measured	10.7	11	11.9					
Duty Cycle / 2TX CDD	0.86	Corrected	11.6	11.9	12.8	21.5	8.7	8.51	21.27	134.0
UNII-2A	NoHT	13	5260	5300	5320					
RATE	6M	Measured	11.5	10.8	10.3					
Duty Cycle / 2TX CDD	0.86	Corrected	12.4	11.7	11.2	21.5	9.1	8.51	20.87	122.2
UNII-2C	NoHT	13	5500	5680	5720					
RATE	12M	Measured	8.9	10.7	9.5					
Duty Cycle / 2TX CDD	0.86	Corrected	9.8	11.6	10.4	21.5	9.9	8.51	20.07	101.6
UNII-3	NoHT	13	5720	5785	5805					
RATE	6M	Measured	9.5	8.8	8.2					
Duty Cycle / 2TX CDD	0.86	Corrected	10.4	9.7	9.1	27.5	17.1	8.51	18.87	77.1
Notes: 1. Limit is based on table provided in requirements correcting for directional gain and emission bandwidth. 2. Reported data for WiFi includes directional gain of Tx0 and Tx1 chains, BT data is Tx0 chain only.										

Table D2: RF Output Power for Class II Permissive Change compared to original certification

Mode	FLo MHz	FHi MHz	Original Certification		Class II Permissive Change	
			mW	dBm	dBm	mW
BLE	2402	2480	2.0	3.0	-0.2	0.95
BT	2402	2480	15	11.8	9.1	8.1
802.11b/g	2412	2462	485	26.9	18.4	69.2
802.11n	2422	2452	205	23.1	15.3	33.9
UNII-1	5180	5240	80	19.0	12.8	19.1
UNII-2A	5260	5320	75	18.8	12.4	17.4
UNII-2C	5500	5720	51	17.1	11.6	14.5
UNII-3	5745	5825	68	18.3	10.4	11.0

Table D3: Uncorrected RF Output Power for FCC/ICES

	BLE		2402	2440	2480
RATE	BLE	-	-1.3	-0.6	-0.8
	BT	9	2402	2440	2480
RATE	BT DHS	9	8.3	8.7	8.6
RATE	BT2 DHS	9	5.5	5.8	5.6
RATE	BT3 DHS	9	5.4	5.8	5.5
802.11b	CCK	18	2412	2437	2462
RATE	1M (L)	18	16.8	17.3	17.9
RATE	2M (L)	18	16.8	17.1	17.7
RATE	2M (S)	18	16.7	17.2	17.7
RATE	5.5M (L)	18	16.9	17.1	17.6
RATE	5.5M (S)	18	16.9	17.0	17.8
RATE	11M (L)	18	16.6	17.1	17.6
RATE	11M (S)	18	16.6	17.1	17.6
802.11g	NoHT	18	2412	2432	2462
RATE	6M	18	16.8	16.5	16.7
RATE	12M	18	15.9	16.3	16.6
RATE	18M	18	15.9	16.2	16.6
RATE	24M	18	15.3	15.7	16.2
802.11n	HT20	18	2412	2432	2462
RATE	MCS 0	18	15.9	16.1	16.6
RATE	MCS1	18	15.5	15.8	16.3
RATE	MCS 2	18	15.6	15.9	16.3
RATE	MCS10	18	15.2	15.5	16.0
RATE	MCS11	18	14.9	15.1	15.6
RATE	MCS12	18	14.9	14.5	15.1
802.11n	HT40+	17	2422		
RATE	MCS 0	17	14.8		
RATE	MCS1	17	14.4		
RATE	MCS 2	17	14.1		
802.11n	HT40-	17	2422		
RATE	MCS 0	17	14.6		
RATE	MCS1	17	14.3		
RATE	MCS 2	17	14		
UNII-1	VHT80	10.5	5210		
RATE	MCS 0	10.5	7.4		
RATE	MCS1	10.5	6.9		
RATE	MCS 2	10.5	6.4		
RATE	MCS 3	10.5	6.1		
RATE	MCS 4	10.5	5.5		
UNII-1	VHT40+	11.5	5190	5230	
RATE	MCS 0	11.5	8.3	9.6	
RATE	MCS1	11.5	8	9.2	
RATE	MCS 2	11.5	7.5	8.8	
RATE	MCS 3	11.5	7.3	8.4	
RATE	MCS 4	11.5	6.9	8.1	
UNII-1	VHT40-	11.5	5190	5230	
RATE	MCS 0	11.5	8.4	9.4	
RATE	MCS1	11.5	7.8	9.1	
RATE	MCS 2	11.5	7	8.8	
RATE	MCS 3	11.5	7	8.6	
RATE	MCS 4	11.5	6.7	8.1	
UNII-1	VHT20	12.5	5180	5200	5240
RATE	MCS 0	12.5	10.1	10.6	11
RATE	MCS1	12.5	9.5	9.9	10.8
RATE	MCS 2	12.5	9.8	10	10.8
RATE	MCS10	12.5	9.9	10.2	10.8
RATE	MCS11	12.5	9.5	9.9	10.7
RATE	MCS12	12.5	9.2	9.6	10.6

UNII-2A	VHT80	10.5	5290		
RATE	MCS 0	10.5	7		
RATE	MCS1	10.5	6.7		
RATE	MCS 2	10.5	6.2		
RATE	MCS 3	10.5	5.9		
RATE	MCS 4	10.5	5.3		
UNII-2A	VHT40+	11.5	5270	5310	
RATE	MCS 0	11.5	9.1	7.9	
RATE	MCS1	11.5	8.8	7.7	
RATE	MCS 2	11.5	8.5	7.3	
RATE	MCS 3	11.5	8.1	6.8	
RATE	MCS 4	11.5	7.7	6.5	
UNII-2A	VHT40-	11.5	5270	5310	
RATE	MCS 0	11.5	9.3	8.2	
RATE	MCS1	11.5	9	7.8	
RATE	MCS 2	11.5	8.8	7.6	
RATE	MCS 3	11.5	8.2	7.1	
RATE	MCS 4	11.5	7.9	6.7	
UNII-2A	VHT20	12.5	5260	5300	5320
RATE	MCS 0	12.5	10.9	10.1	9.8
RATE	MCS1	12.5	10.7	9.8	9.5
RATE	MCS 2	12.5	10.7	9.7	9.5
RATE	MCS10	12.5	9.6	10	9.8
RATE	MCS11	12.5	10.5	9.7	9.6
RATE	MCS12	12.5	10.1	9.5	9.2

UNII-2C	VHT80	10.5	5530	5610	5690
RATE	MCS 0	10.5	6.2	7.7	7.4
RATE	MCS1	10.5	5.8	7.4	6.9
RATE	MCS 2	10.5	5.3	6.9	6.5
RATE	MCS 3	10.5	5.1	6.6	6.2
RATE	MCS 4	10.5	4.5	6	5.7
UNII-2C	VHT40+	11.5	5510	5670	5710
RATE	MCS 0	11.5	7.5	9.2	8.5
RATE	MCS1	11.5	7.3	8.8	8.1
RATE	MCS 2	11.5	7	8.4	7.9
RATE	MCS 3	11.5	6.6	8	7.4
RATE	MCS 4	11.5	6.1	7.8	7.1
UNII-2C	VHT40-	11.5	5510	5670	5710
RATE	MCS 0	11.5	7.5	9.3	8.6
RATE	MCS1	11.5	7.3	8.6	8.1
RATE	MCS 2	11.5	7	8.5	7.9
RATE	MCS 3	11.5	6.6	8	7.5
RATE	MCS 4	11.5	6.2	7.6	7
UNII-2C	VHT20	12.5	5500	5680	5720
RATE	MCS 0	12.5	8.7	10.1	9.3
RATE	MCS1	12.5	8.4	9.8	8.9
RATE	MCS 2	12.5	8.4	9.8	9
RATE	MCS10	12.5	8.5	9.7	8.6
RATE	MCS11	12.5	8.1	9.4	8.6
RATE	MCS12	12.5	8	9.1	8.2
UNII-3	VHT80	10.5	5690	5775	
RATE	MCS 0	10.5	7.5	6.1	
RATE	MCS1	10.5	6.9	5.7	
RATE	MCS 2	10.5	6.5	5.3	
RATE	MCS 3	10.5	6.3	5.1	
RATE	MCS 4	10.5	5.6	4.6	
UNII-3	VHT40+	11.5	5710	5755	5795
RATE	MCS 0	11.5	8.5	8.5	7.9
RATE	MCS1	11.5	8.2	8	7.1
RATE	MCS 2	11.5	7.9	7.8	6.8
RATE	MCS 3	11.5	7.6	7.3	6.4
RATE	MCS 4	11.5	7.1	6.9	6.1

UNII-3	VHT40-	11.5	5710	5755	5795
RATE	MCS 0	11.5	8.6	8.4	7.4
RATE	MCS1	11.5	8.3	8.1	7.1
RATE	MCS 2	11.5	8	7.8	6.8
RATE	MCS 3	11.5	7.5	7.4	6.5
RATE	MCS 4	11.5	7.1	7	6.1
UNII-3	VHT20	12.5	5720	5785	5805
RATE	MCS 0	12.5	9.5	8.6	8.3
RATE	MCS1	12.5	9.1	8.3	8
RATE	MCS 2	12.5	9.2	8.5	8
RATE	MCS 10	12.5	9.3	8.6	8.2
RATE	MCS 11	12.5	9	8.3	7.8
RATE	MCS 12	12.5	8.7	8	7.6
UNII-1	NoHT	13	5180	5200	5240
RATE	6M	13	10.7	11	11.9
RATE	12M	13	10.4	10.8	11.7
RATE	18M	13	10.3	10.8	11.6
RATE	24M	13	9.7	10.1	11.1
RATE	36M	13	9.2	9.8	10.7
UNII-2A	NoHT	13	5260	5300	5320
RATE	6M	13	11.5	10.8	10.3
RATE	12M	13	11.3	10.6	10.1
RATE	18M	13	11.2	10.5	9.8
RATE	24M	13	10.6	9.8	9.4
RATE	36M	13	10.3	9.6	9
UNII-2C	NoHT	13	5500	5680	5720
RATE	6M	13	9.1	10.5	9.3
RATE	12M	13	8.9	10.7	9.5
RATE	18M	13	9.1	10.4	9.3
RATE	24M	13	8.4	9.7	8.7
RATE	36M	13	8.1	9.1	8.4
UNII-3	NoHT	13	5720	5785	5805
RATE	6M	13	9.5	8.8	8.2

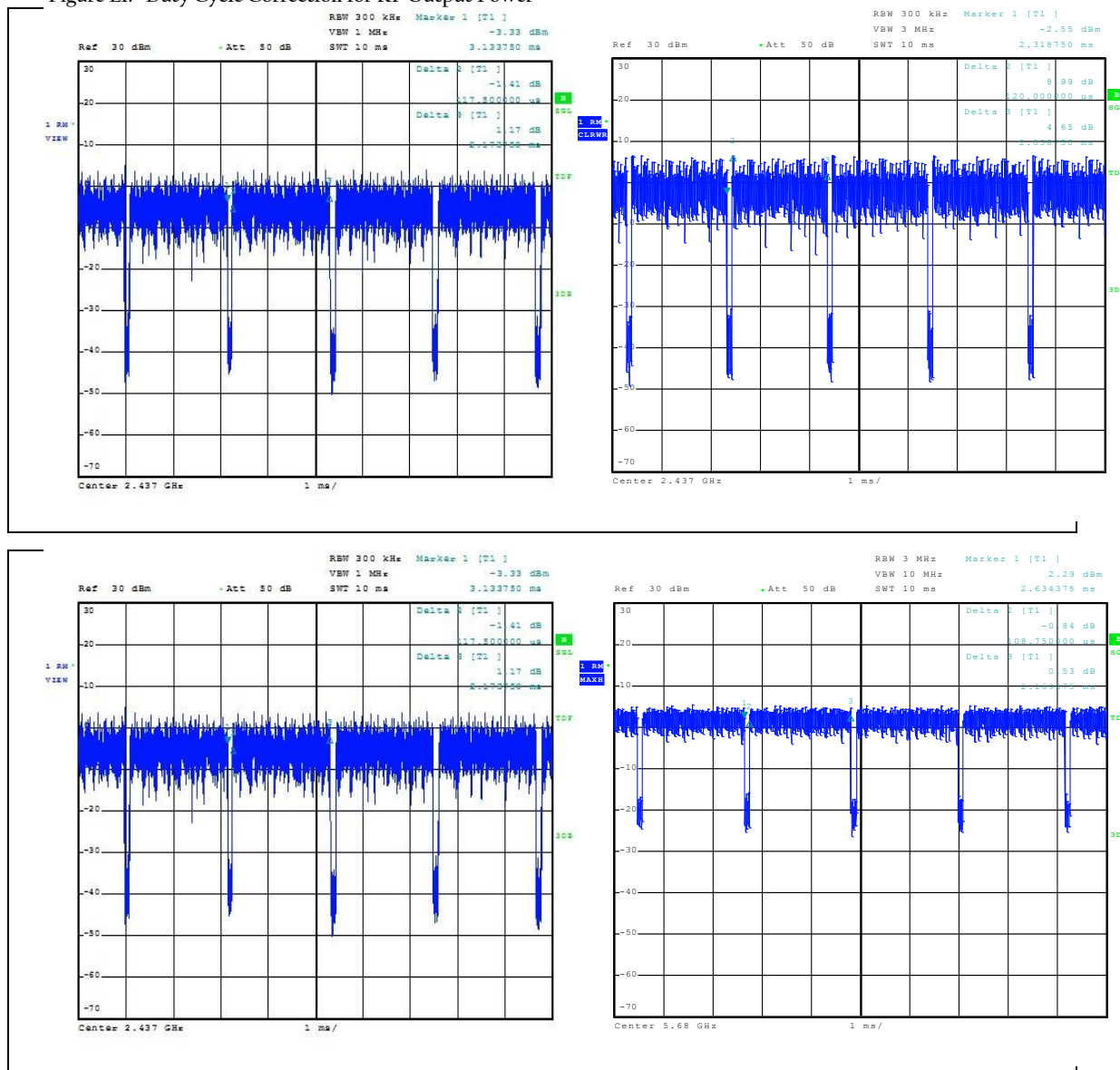
Appendix E: DUTY CYCLE CORRECTION DATA

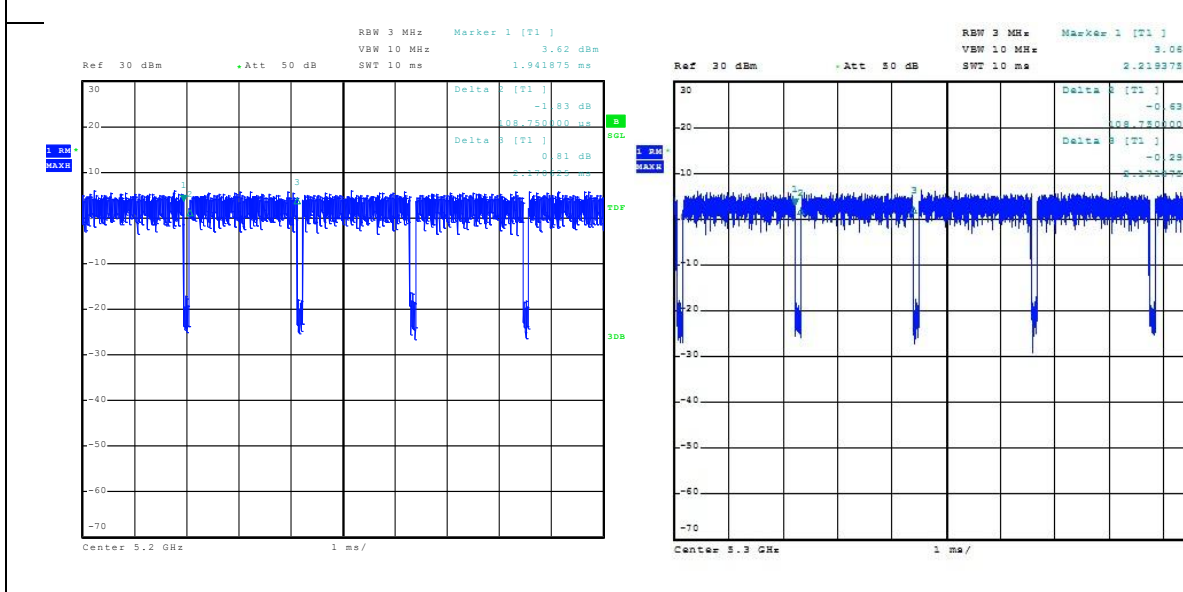
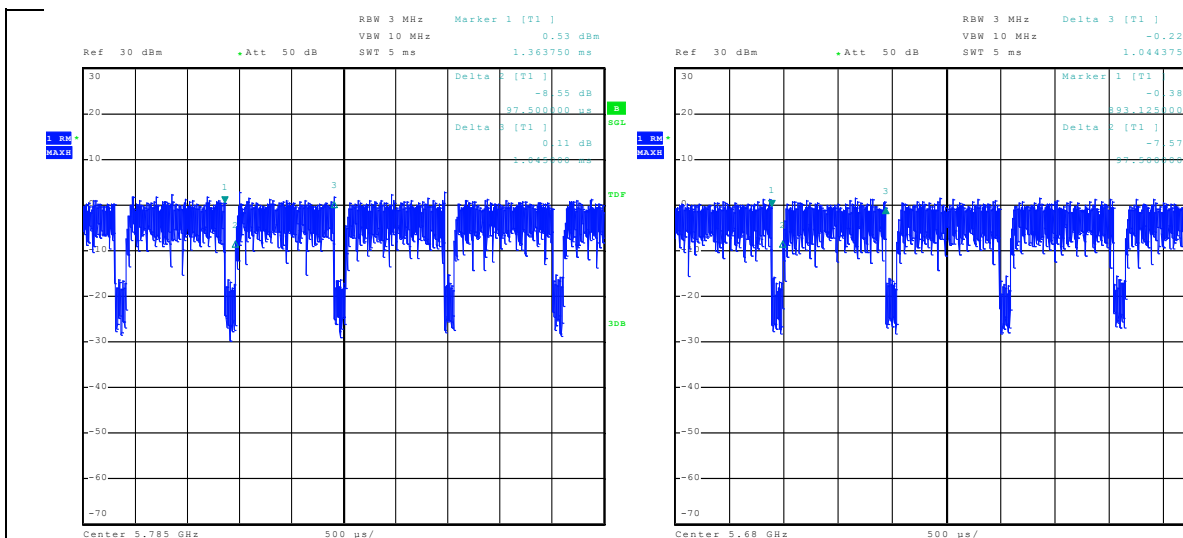
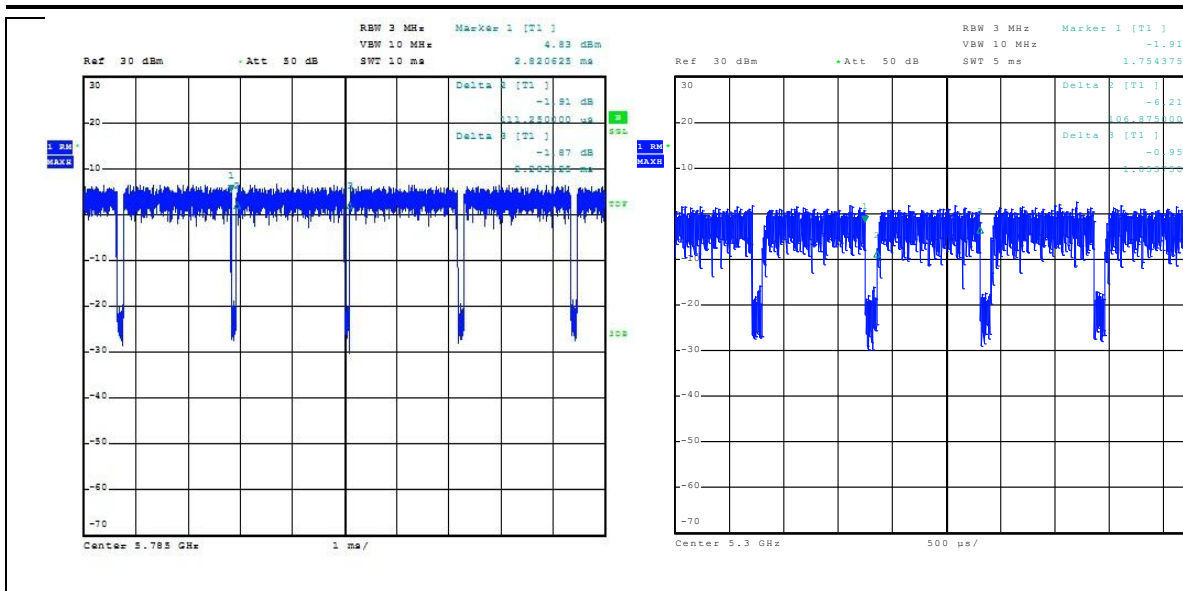
Table E1: Duty Cycle Correction for RF Output Power

Frequency MHz	Modulation	Rate	T2 (OFF) usec	T1 (ON+OFF) usec	Duty Cycle dB	Location	
2437	BT	BT DH5	117	2174	0.48	L1	
2437	802.11b	CCK 1M(L)	117	2174	0.48	R1	
2437	802.11g	NoHT 6M	120	2038	0.53	L2	
5680	802.11n	HT20 MCS 0	108	2169	0.44	R2	
5785	UNII-2A	VHT20 MCS 1	111	2203	0.45	L3	
5300	UNII-3	VHT20 MCS 2	107	1053	0.93	R3	
5785	UNII-1	NoHT 6M	97	1045	0.85	L4	
5680	UNII-2A	NoHT 6M	98	1044	0.86	R4	
5200	UNII-2C	NoHT 12M	98	1044	0.86	L5	
5300	UNII-3	NoHT 6M	98	1044	0.86	R5	

Notes: L:

Figure E1: Duty Cycle Correction for RF Output Power





Appendix F: OUT-OF-BAND EMISSIONS (BAND EDGE) DATA

Figure F1: Out-of-Band (Band Edge) Emissions for FCC/ICES - TX 2G4 Worst-Case (IIB)

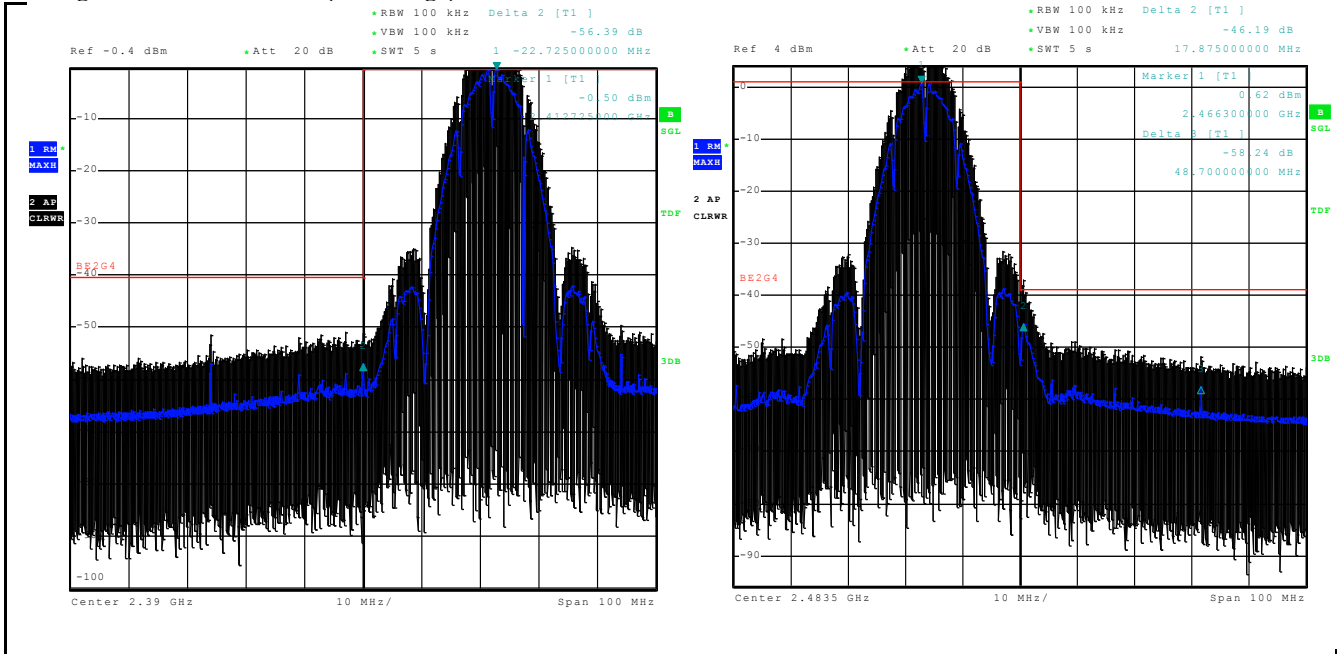


Table F1: Out-of-Band (Band Edge) Emissions for FCC/ICES - TX 2G4 Worst-Case (IIB)

Frequency MHz	Average dBm or dBuV/m	Meas. Time ms	Bandwidth KHz	Correction dB	Limit dBc or dBuV/m	Margin dB	Note
2412	-0.5	1000	100	0.0	-	-	TX Worst-Case
2390	-56.4	1000	100	0.0	-30.0	26.4	Restricted
2390 (*3)	39.1	1000	100	0.0	54.0	14.9	Restricted
2365	-55.9	1000	100	0.0	-30.0	25.9	Restricted
2365 (*3)	39.6	1000	100	0.0	54.0	14.4	Restricted
2466	0.6	1000	100	0.0	-	-	TX Worst-Case
2483.5	-46.2	1000	100	0.0	-30.0	16.2	Restricted
2483.5 (*3)	50.4	1000	100	0.0	54.0	3.6	Restricted
2515	-58.2	1000	100	0.0	-30.0	28.2	Restricted
2515 (*3)	38.4	1000	100	0.0	54.0	15.6	Restricted
Notes: 1. Spurious emissions are required to attenuated by 30dB (RMS method) or 20dB (PK method) unless emissions are within restricted bands. 2. Unless noted. 3. Conducted emission converted to field reading in accordance with KDB 789033 D02							

Figure F2: Out-of-Band (Band Edge) Emissions for FCC/ICES - TX 2G4 Worst-Case (IIG)

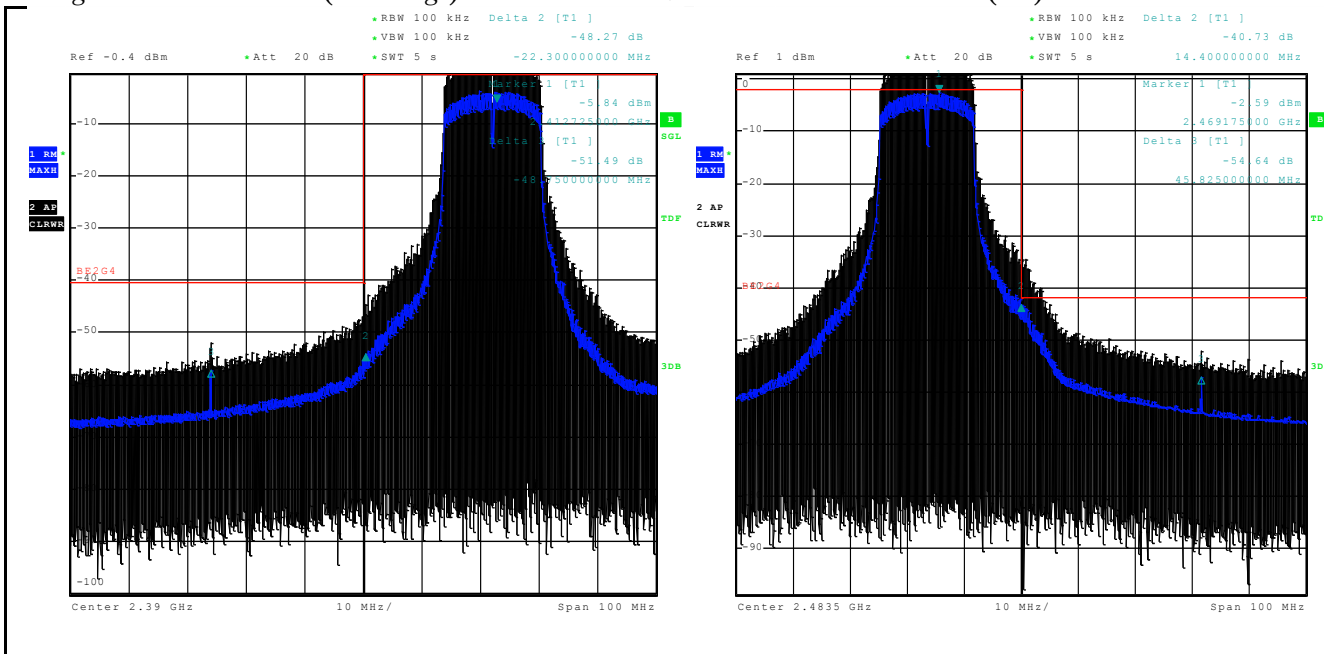


Table F2: Out-of-Band (Band Edge) Emissions for FCC/ICES - TX 2G4 Worst-Case (IIG)

Frequency MHz	Average dBm or dBuV/m	Meas. Time ms	Bandwidth KHz	Correction dB	Limit dBc or dBuV/m	Margin dB	Note
2413	-5.8	1000	100	0.0	-	-	TX Worst-Case
2390	-48.3	1000	100	0.0	-30.0	18.3	Restricted
2390 (*3)	41.9	1000	100	0.0	54.0	12.1	Restricted
2365	-52.0	1000	100	0.0	-30.0	22.0	Restricted
2365 (*3)	38.2	1000	100	0.0	54.0	15.8	Restricted
2469	-2.6	1000	100	0.0	-	-	TX Worst-Case
2483.5	-40.7	1000	100	0.0	-30.0	10.7	Restricted
2483.5 (*3)	52.7	1000	100	0.0	54.0	1.3	Restricted
2514	-54.6	1000	100	0.0	-30.0	24.6	Restricted
2514 (*3)	38.8	1000	100	0.0	54.0	15.2	Restricted
Notes: 1. Spurious emissions are required to attenuated by 30dB (RMS method) or 20dB (PK method) unless emissions are within restricted bands. 2. Unless noted. 3. Conducted emission converted to field reading in accordance with KDB 789033 D02							

Figure F3: Out-of-Band (Band Edge) Emissions for FCC/ICES - TX 2G4 Worst-Case (IIN)

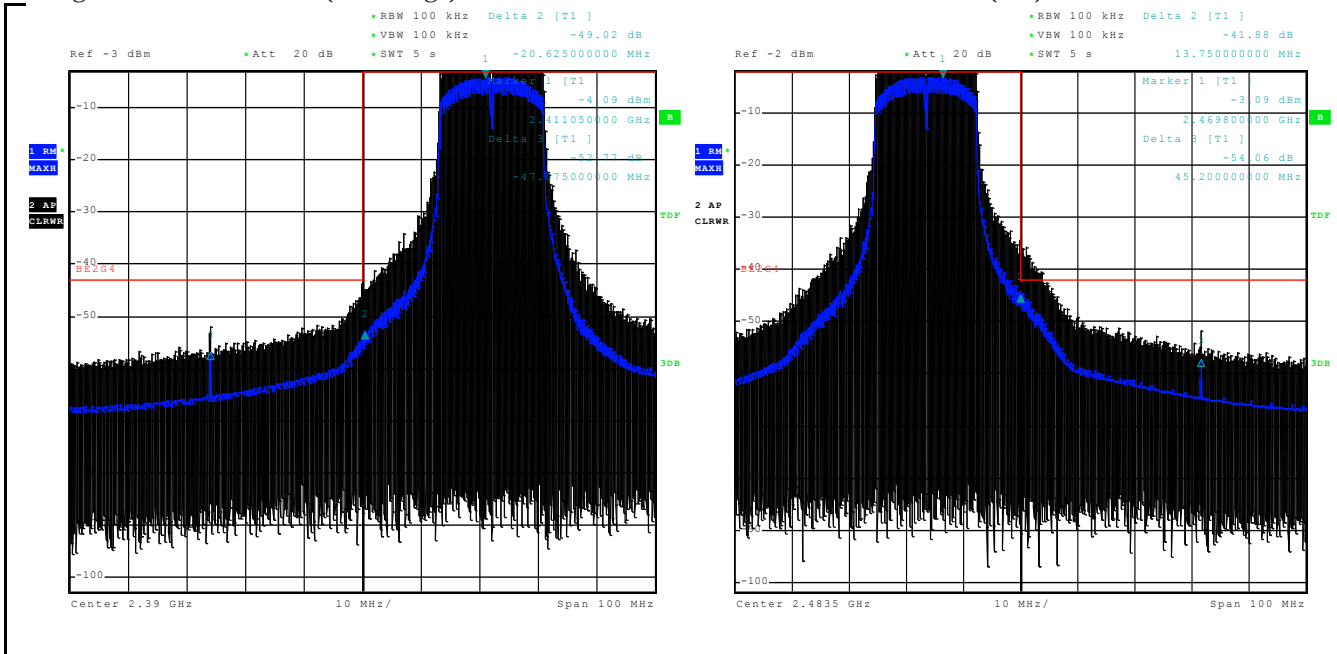


Table F3: Out-of-Band (Band Edge) Emissions for FCC/ICES - TX 2G4 Worst-Case (IIN)

Frequency MHz	Average dBm or dBuV/m	Meas. Time ms	Bandwidth KHz	Correction dB	Limit dBc or dBuV/m	Margin dB	Note
2411	-4.1	1000	100	0.0	-	-	TX Worst-Case
2390	-49.0	1000	100	0.0	-30.0	19.0	Restricted
2390 (*3)	42.9	1000	100	0.0	54.0	11.1	Restricted
2364	-52.8	1000	100	0.0	-30.0	22.8	Restricted
2364 (*3)	39.1	1000	100	0.0	54.0	14.9	Restricted
2470	-3.1	1000	100	0.0	-	-	TX Worst-Case
2483.5	-41.9	1000	100	0.0	-30.0	11.9	Restricted
2483.5 (*3)	51.0	1000	100	0.0	54.0	3.0	Restricted
2515	-54.1	1000	100	0.0	-30.0	24.1	Restricted
2515 (*3)	38.9	1000	100	0.0	54.0	15.1	Restricted

Notes: 1. Spurious emissions are required to attenuated by 30dB (RMS method) or 20dB (PK method) unless emissions are within restricted bands.
2. Unless noted.
3. Conducted emission converted to field reading in accordance with KDB 789033 D02

Figure F4: Out-of-Band (Band Edge) Emissions for FCC/ICES - TX 2G4 Worst-Case (BT)

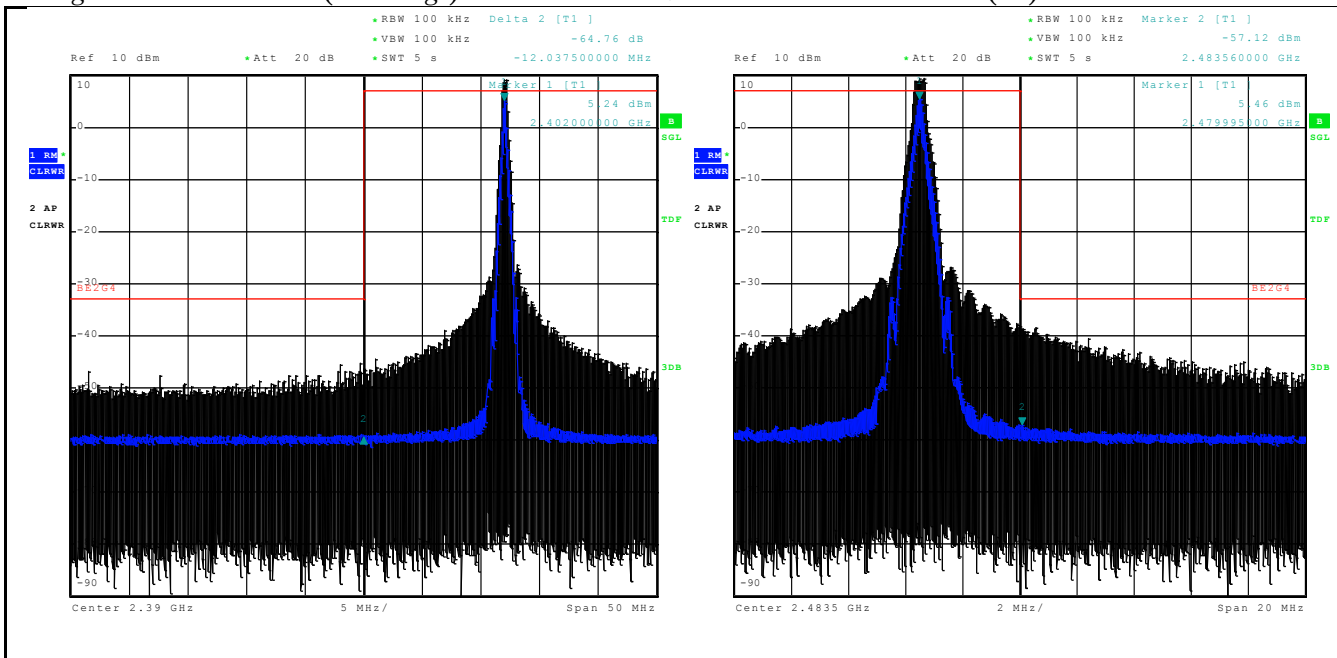


Table F4: Out-of-Band (Band Edge) Emissions for FCC/ICES - TX 2G4 Worst-Case (BT)

Frequency MHz	Average dBm or dBuV/m	Meas. Time ms	Bandwidth KHz	Correction dB	Limit dBc or dBuV/m	Margin dB	Note
2402	5.24	1000	100	0.0	-	-	TX Worst-Case
2390	-64.8	1000	100	0.0	-30.0	34.8	Restricted
2390 (*3)	36.5	1000	100	0.0	54.0	17.5	Restricted
2480	5.5	1000	100	0.0	-	-	TX Worst-Case
2483.5	-51.7	1000	100	0.0	-30.0	21.7	Restricted
2483.5 (*3)	49.8	1000	100	0.0	54.0	4.2	Restricted
Notes: 1. Spurious emissions are required to attenuated by 30dB (RMS method) or 20dB (PK method) unless emissions are within restricted bands. 2. Unless noted. 3. Conducted emission converted to field reading in accordance with KDB 789033 D02							

Figure F5: Out-of-Band (Band Edge) Emissions for FCC/ICES - TX UNII-1/2A Worst-Case (NoHT 6M)

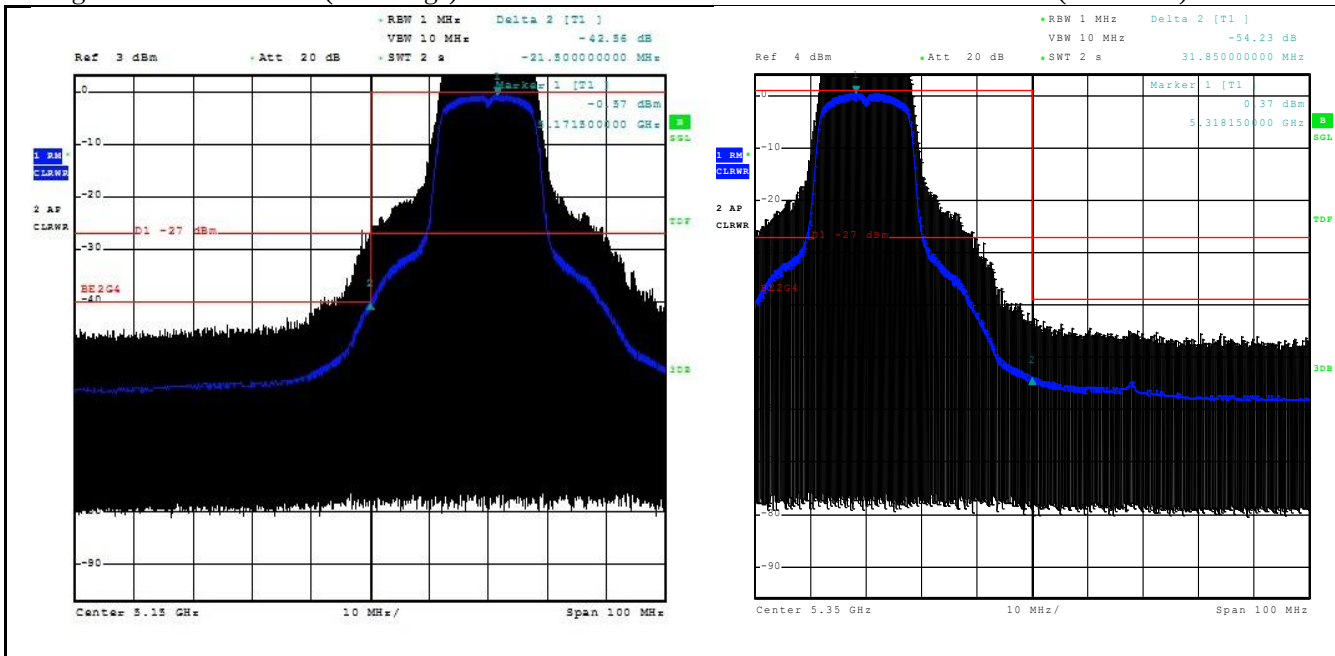


Table F5: Out-of-Band (Band Edge) Emissions for FCC/ICES - TX UNII-1/2A Worst-Case (NoHT 6M)

Frequency MHz	Average dBm or dBuV/m	Meas. Time ms	Bandwidth KHz	Correction dB	Limit dBc or dBuV/m	Margin dB	Note
5171	-0.6	1000	1000	0.0	-	-	TX Worst-Case
5150	-42.4	1000	1000	0.0	-30.0	12.4	Restricted
5150 (*3)	54.8	1000	1000	0.0	54.0	-0.8	Restricted
5320	0.4	1000	1000	0.0	-	-	TX Worst-Case
5350.0	-54.2	1000	1000	0.0	-30.0	24.2	Restricted
5350 (*3)	43.9	1000	1000	0.0	54.0	10.2	Restricted
Notes: 1. Spurious emissions are required to attenuated by 30dB (RMS method) or 20dB (PK method) unless emissions are within restricted bands. 2. Unless noted. 3. Conducted emission converted to field reading in accordance with KDB 789033 D02							

Figure F6: Out-of-Band (Band Edge) Emissions for FCC/ICES - TX UNII-2C/3 Worst-Case (NoHT 6M)

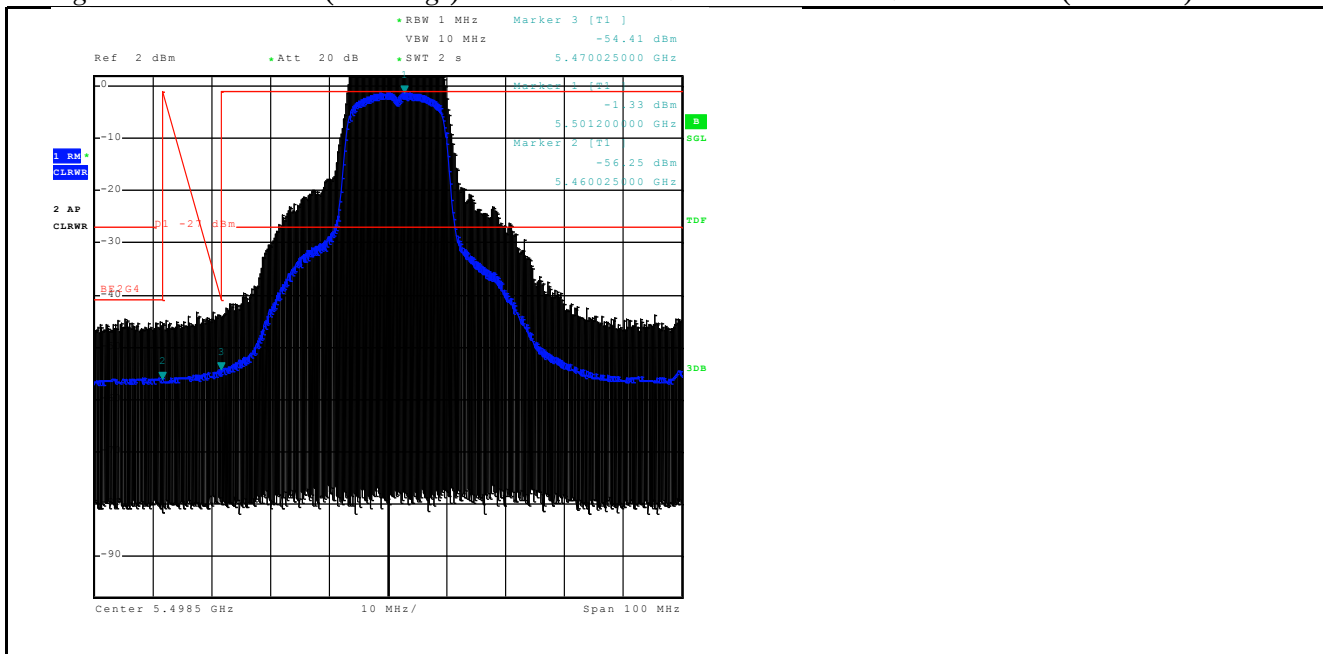


Table F6: Out-of-Band (Band Edge) Emissions for FCC/ICES - TX UNII-2C/3 Worst-Case (NoHT 6M)

Frequency MHz	Average dBm or dBuV/m	Meas. Time ms	Bandwidth KHz	Correction dB	Limit dBc or dBuV/m	Margin dB	Note
5501	-1.33	1000	1000	0.0	-	-	TX Worst-Case
5470	-55.7	1000	1000	0.0	-30.0	25.7	Band Edge
5460	-57.6	1000	1000	0.0	-30.0	27.6	Restricted
5460 (*3)	40.6	1000	1000	0.0	54.0	13.4	Restricted
Notes: 1. Spurious emissions are required to attenuated by 30dB (RMS method) or 20dB (PK method) unless emissions are within restricted bands. 2. Unless noted. 3. Conducted emission converted to field reading in accordance with KDB 789033 D02							

Appendix R: TEST SETUP PHOTOS

Figure R1: EUT Radiated Emissions Cable Layout

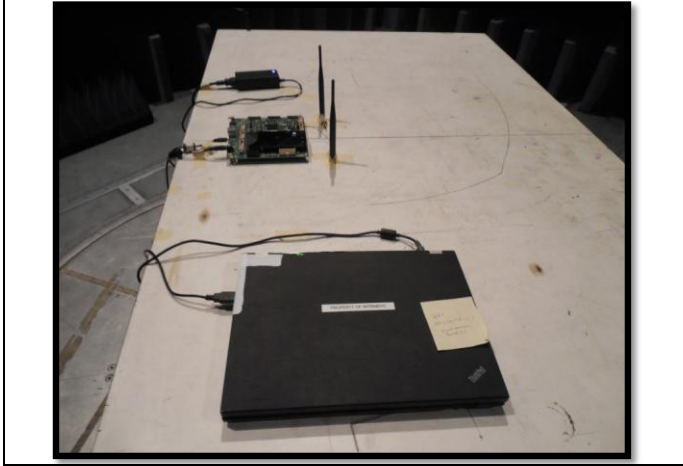


Figure R2: Harmonic Emissions and Flicker Test Setup



Figure R3: Radiated Emissions 30M-200M Hz Test Setup

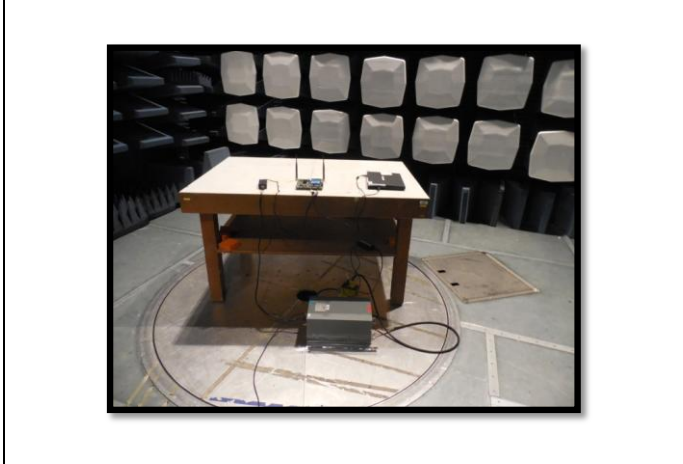


Figure R4: Radiated Emissions 200M-1G Hz Test Setup

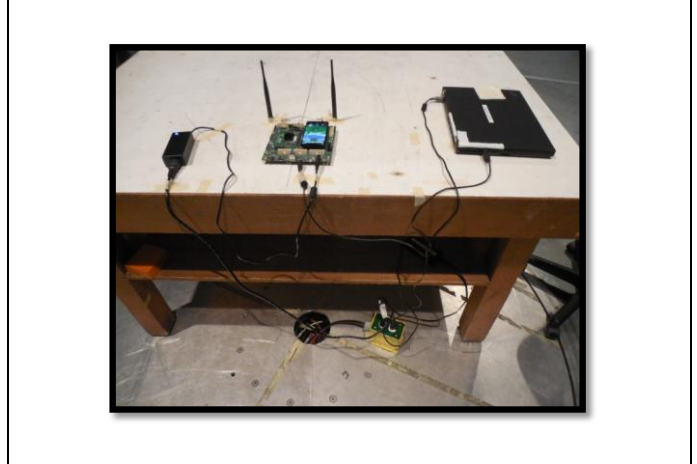


Figure R5: Radiated Emissions 30M-200M Hz Test Setup



Figure R6: Radiated Emissions 200M-1G Hz Test Setup

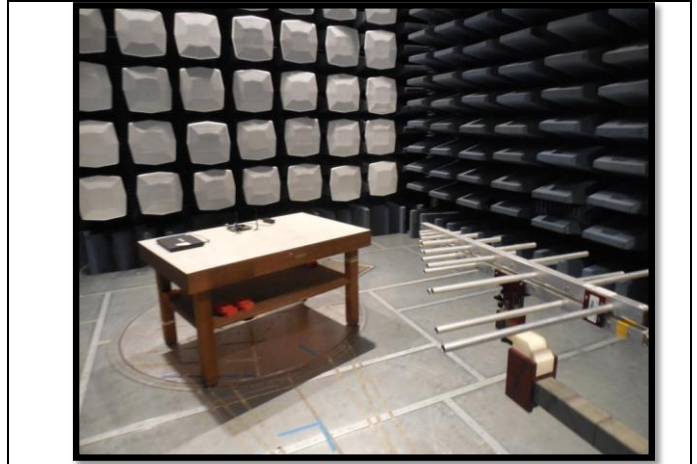


Figure R7: AC Mains Conducted Emissions Test Setup

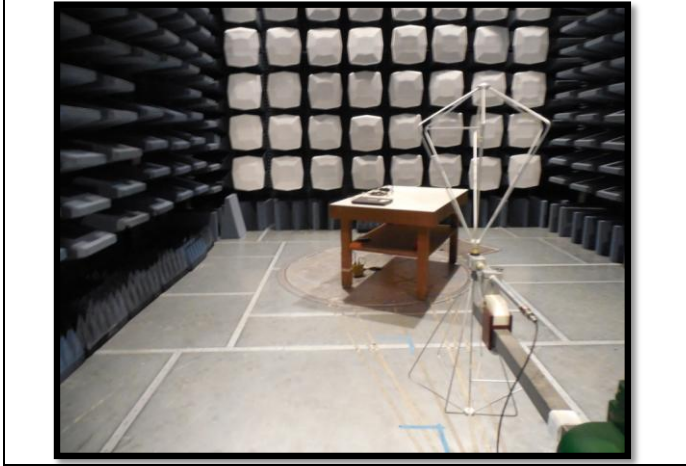


Figure R8: Radiated Emissions Test Setup Cable Layout



Figure R9: Radiated Emissions 30M-200M Hz Test Setup

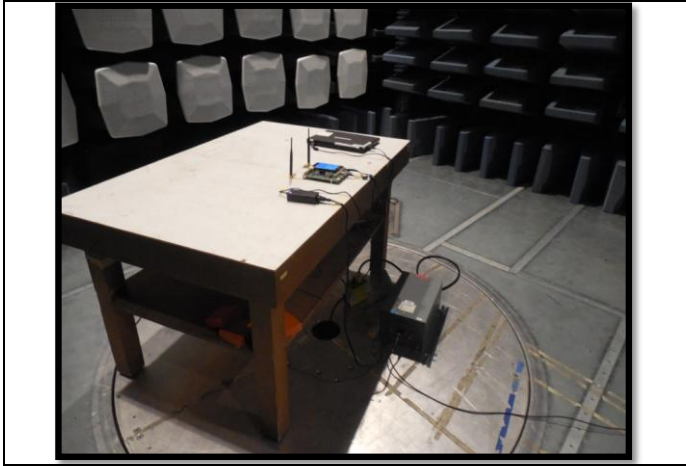


Figure R10: Radiated Emissions 200M-1G Hz Test Setup



Appendix S: ABBREVIATIONS

Abbreviation	Definition
AC	Alternating Current
CDN	Coupling/Decoupling Network
CE	European Conformity
CISPR	Comité International Spécial des Perturbations Radioélectriques
DC	Direct Current
EFT	Electrical Fast Transient
EMC	Electro-Magnetic Compatibility
EMI	Electro-Magnetic Interference
ESD	Electro-Static 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

[END OF REPORT]