INTENTIONAL RADIATOR TEST REPORT

CFR 47 Part 15, Subpart 2 - Intentional Radiators - 15.247 - DTS - 902-928MHz

Reference **E11085-1901-DTS4**

ID **2AUXY-ICX120/2AUXY-LAN2RF**

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Product	**900 MHz ISM Gateway System**
Model	**LAN2RF / ICX120**
Manufacturer	**IBC Technologies Inc.**

REVISION HISTORY

#NAME?

Date	Report Number	Revision	Description	By
2020 Apr 3	E11085-1901-DTS4	0.0-001	Draft release	BB

This report is applicable to the specific standards listed, current released revision for companion reports for devices with multiple applicable standards are listed here.

All previous versions of this report have been superseded by the latest dated revision as listed in the above table.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 LAN2RF / ICX120 - 900M Narrrowband gateway device provided by IBC Technologies Inc.. Tests were performed on the sample provided by IBC Technologies Inc. as requested for the purpose of demonstrating compliance with as agreed per quotation 19SH05281R2.

IBC Technologies 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 a partial list of tests that are required for FCC, ISED, & 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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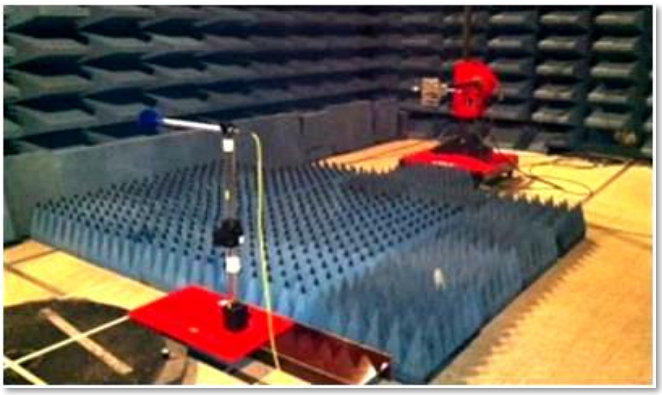

3m Semi-Anechoic Chamber (SAC1)
Burnaby, BC

3m Semi-Anechoic Chamber (SAC2)
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Section I: EXECUTIVE SUMMARY

1.1 Scope

#NAME?

This report demonstrates and documents compliance of 900 MHz ISM Gateway System, model LAN2RF / ICX120 manufacturered by IBC Technologies Inc. to the applicable standards listed below as described in 1.2 - 1.4.

1.2 Applicable Standards

The information documented in this report is based on the standards, test methods, limits and levels as per quotation 19SH05281R2.

CFR 47 FCC Part 15 Subpart C - 15.247	*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-247 - Issue 2	*Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices*

1.3 Reference Standards

The following standards are included as normative references.

ANSI C63.4:2014	*American National Standard For Methods Of Measurement Of Radio-Noise Emissions From Low-Voltage Electrical And Electronic Equipment In The Range Of 9 kHz To 40 GHz*
ANSI C63.10:2013	*American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices*
TR CISPR 16-4-3 IEC:2004€	*Specification for radio disturbance and immunity measuring apparatus and methods - Part 4-3: Uncertainties, statistics and limit modelling –Statistical considerations in the determination of EMC compliance of mass-produced products*
CISPR 16-1-1:2019	*Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-1: Radio disturbance and immunity measuring apparatus – Measuring apparatus*
CISPR 32 - Edition 1: IEC:2012	*Electromagnetic compatibility of multimedia equipment – Emission requirements*
FCC Part 1.310	*Radiofrequency radiation exposure limits*
FCC Part 2	*Frequency Allocations and Radio Treaty Matters; General Rules and Regulations*
FCC Part 15	*Radio Frequency Devices, Subpart B – Unintentional Radiators*
ICES-003 - Issue 6	*Information Technology Equipment (Including Digital Apparatus) — Limits and Methods of Measurement*
RSS-Gen - Issue 5	*General Requirements for Compliance of Radio Apparatus*
RSS-102 - Issue 5	*Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)*
KDB 447498 D01 v06	*RF Exposure Procedures and Equipment Authorization Policies for Mobile and Portable Devices.*

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1.4 Summary of Results

This report demonstrates and documents compliance of 900 MHz ISM Gateway System, within LAN2RF / ICX120 manufactured by IBC Technologies Inc. to CFR 47 FCC Part 15 Subpart C - 15.247, , RSS-247 - Issue 2 - DTS for digital transmissions system using narrowband digital modulation.

Table 1.4-1 **Test Summary - FCC 15.107, 15.109, 15.207, 15.209, 15.205, 15.247-DTS / ISED ICES-003, RSS-247-DTS - Emissions**

Test or Measurement	Applicable Standard	Description	Result
Radiated Emissions Enclosure	15.109 RSS-Gen 7.1, ICES-003	*§ Radiated emissions of the enclosure measured 30M - 1G Hz (quasi-peak) and 1G - 5G/6G Hz (peak/average) as defined by the applicable measurement frequency range.*	Complies
Radiated Emissions Enclosure	2.1053, 15.209, 15.205, 15.247(d) RSS-Gen 8.9, RSS 247 5.5	*§ Radiated emissions of the enclosure measured 30M - 1G Hz (quasi-peak) and 1G - 9G28 Hz (peak/average) as defined by the applicable measurement frequency range.*	Complies
Conducted Emissions AC Mains	15.107, ICES-003	*§ Conducted emissions measured on the AC power input (Mains), 150k - 30M Hz.*	Complies
Conducted Emissions AC Mains	15.207, RSS-Gen 7.2.2	*§ Conducted emissions measured on the AC power input (Mains), 150k - 30M Hz.*	Complies

Table 1.4-2 **Test Summary - FCC 15.247-DTS / ISED RSS-247-DTS - Emissions**

Test or Measurement	Applicable Standard	Description	Result
Antenna Requirement	15.203 RSS-Gen 7.1.2	*§ The manufacturer is required to ensure no other antenna, except as provided, shall be used.*	Complies
RF Conducted RMS Output Power	15.247(b)(3), 2.1046 RSS-247 5.4(b)	*§ For DTS equipment in the 902-928 MHz, band, 1 watt maximum conducted output power averaged (rms) across all symbols in the signaling alphabet, and with duty cycle correction applied to exclude intervals when the transmitter is off.*	Complies
EIRP	15.247(b)(3), 2.1046 RSS-247 5.4(b)	*§ For DTS equipment in the 902-928 MHz band, the EIRP shall not exceed 4 W or use antennas with gains greater than 6 dBi unless specified restrictions are observed..*	Complies
Power Spectral Density	15.247 (e) RSS-247 5.2(b)	*§ For DTS equipment, the transmitter power spectral density shall be less than +8 dBm in any 3 kHz bandwidth.*	Complies
Occupied Bandwidth DTS Bandwidth	2.1049, 15.247(a)(2) RSS-247 5.2(a), RSS-Gen 6.7	*§ Occupied bandwidth is a required measurement for DTS equipment.* *§ For DTS equipment, DTS Bandwidth defined as 100 kHz RBW (occupied) bandwdith shall be greater than 500 kHz.*	Complies
Emission Mask & Bandedge	15.247(d), 15.205(c) RSS-247 5.5, RSS-Gen 8.9	*§ For DTS equipment, transmitter unwanted emissions in the out-of-band domain - see 4.3.2.7.3. Out-of-band and emission mask conducted emission requirements are fulfilled by compliance with the occupied channel bandwidth requirement.*	Complies
Transmitter Spurious Conducted Emissions	15.247(d), 15.205, 15.209(a), 2.1051 RSS-247 5.5	*§ For DTS equipment, transmitter conducted spurious (unwanted) emissions; in any 100 kHz bandwidth, spurious emissions shall be at least 30 dB below the 100 kHz bandwidth containing the maximum conducted output averaged (rms) power. Attenuation below the general limits is not required.*	Complies
Transmitter Spurious Radiated Emissions	2.1053, 15.209, 15.205, 15.247(d) RSS-Gen 8.9, RSS 247 5.5	*§ For DTS equipment, transmitter radiated spurious (unwanted) emissions; in any 100 kHz bandwidth, spurious emissions shall be at least 30 dB below the 100 kHz bandwidth containing the maximum conducted output averaged (rms) power. Attenuation below the general limits is not required. Spurious radiated emissions which fall within restricted bands must comply with the general radiated emission limits.*	Complies
Frequency Stability	15.247, 2.1055 RSS-247 , RSS-Gen 8.11	*§ Frequency stability shall be measured with variation of ambient temperature over the manufacturer's specified temperature range and variation of +/-15% of primary supply voltage.*	Complies

Table 1.4-3 **RF Exposure/Maximum Permitted Exposure for Fixed Devices - FCC 1.130(d) / ISED RSS-102 2.5.1**

Requirement	Applicable Standard	Description	Result
RF Exposure	1.1310(d), RSS-102 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. SAR evaluation is not required.*	Complies

Section II: GENERAL INFORMATION

#######

The Equipment Under Test (EUT) and the corresponding Auxiliary Equipment (AE) required to perform the tests as complete system are described below. The client has provided a sample of each of the product listed for compliance testing. If applicable, evaluation testing was performed on individual EUT models within the product family as necessary to determine worst-case configuration and satisfy due diligence requirements. All of the products listed are considered within the scope of compliance testing.

Equipment Under Test (EUT) Information

PN	Manufacturer/Description	Reference	Model	Description
	IBC Technologies Inc.		LAN2RF / ICX120	*System*
2AUXY-LAN2RF	IBC Technologies Inc.	EUT-A	LAN2RF	*Boiler interface*
2AUXY-ICX120	IBC Technologies Inc.	EUT-B	ICX120	*Internet gateway*

Figure 2.1-1: Equipment Under Test

900 MHz ISM Gateway System

2AUXY-LAN2RF

2AUXY-ICX120

Information for Contained Approved Radio Equipment (pre-approved radio modules)

Pre-approved Radio	Manufacturer	Description	FCC ID
-	-	-	-

EUT Power

Input Power		Manufacturer	Model	Specification
AC Mains	ICX120	-	-	*Linecord*
USB	LAN2RF		SIMSLKAN	*AC/DC Adapter - USB*

2.1.1 Test Configuration

The EUT was configured for 'normal operation' at maximum rate load unless specified otherwise. All accessory cables were attached unless defined as 'craftsman' port used for diagnostic and configuration. Auxiliary Equipment (AE) (notebook computer and USB cable) may be present within test volume or contained within an external auxiliary RF shielded room or box during compliance testing .

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 configuration options required for testing excluding tests which are performed in "normal" mode of operation.

Refer to manufacturers documentation for additional details of modulation types, technology, applicable data transfer rates, channels and other information. Multiple antenna output (beamforming) does not apply.

Test Modes

	TX0			
Test Mode	**Modulation Class**	**Channel Frequency MHz**	**Modulation**	
Normal Operation	custom	902.3, 915, 927.7	2-GFSK	Single transmit packet
Continuous Operation	custom	902.3, 915, 927.7	2-GFSK	Duty cycle > 94%
Continuous CW	custom	902.3, 915, 927.7	CW	Duty cycle > 94%

Notes:
1. *Device is classified as narrowband digital transmission system (DTS) with occupied bandwidth of less than 100 kHz.*
2. *Device operated in continuous transmit and normal (single packet transmission) modes.*
3. *Device may be operated in CW mode where applicable.*

Modulations

Product operates with single modulation mode.

2.1.2 Modifications

No modifications were made to the EUT.

2.1.3 List of Ports

Craftsman ports are defined by the manufacturer and used for diagnostic and configuration by the manufacturer or installer.

Special test mode(s) provided by the manufacturer was used to perform specific tests for hardware parameters via LAN port or custom firmware for mode configuration and operation.

2.1.4 Description of Antenna

Product utilizes an integral antenna. A modified unit with an external SMA connector was provided for antenna port conducted emissions.

2.1.5 Directional Gain (Beamforming)

Beamforming (directional) antenna gain does not apply to EUT.

2.1.6 Temperature Extremes

The manufacturer has declared a temperature range of:

Declared Temperature Range	0 C	+55 C

2.1.7 Declared RF Output Power

Sufficient margin to allow for production tolerance of RF output power and other parameters is required to ensure continued product compliance. EUT was tested at maximum possible declared RF output power including tune-up tolerance. Other specifications may constrain rated RF output power, specifically power spectral density (PSD) specification may reduce maximum compliant power for some modulations. The 'As Tested' power level operates the EUT at the maximum permissable emission levels assuming a detuned unit at the upper limit of the declared tune-up tolerance.

Table 2.1.7-1: Maximum Conducted RF Output Power

Frequency Band MHz	Manufacturer Declared Tune-up Tolerance dB	Rated Output Power dBm	Antenna Gain dBi	As Tested Maximum Output Power (incl. tune-up tolerance) dBm (*2,*3)	Output Power Limit dBm	EIRP Limit dBm (*4)
902.3-927.7	1.25	**8.0**	0.30	9.6	30.0	36.0

Notes: 1. This table represents the maximum applicable test condition.
2. Sufficient margin as determined by manufacturer is required for production variance of product, see CISPR 16-4-3 for guidance.
3. Manufacturer tune-up tolerance derating is required to include production variation of product and/or tuning.
4. Operation with antenna gains greater than 6 dBi permitted in some cases, see 15.247(c) and RSS-247 5.4(f) for guidance.

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%
Atmospheric Pressure	100.5 - 102.5 kPa

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-Case

When appropriate during radiated emissions and/or other testing, worst-case orientation or configuration was determined during exploratory 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 msec	Resolution Bandwidth kHz	Antenna Height cm	Polarity	Turntable position deg	Correction dB	Margin dB	Limit dBµV/m
42.6639	33.4	1000	120	104	HORZ	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:

Correction(dB) = Antenna Factor + Cable Loss - Amplifier Gain

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

Corrected Quasi-Peak/Average(dBµV/m) = Raw Quasi-Peak/Average + Correction(dB)

Sample Conducted Emission Calculation:

Frequency MHz	Quasi-Peak dBµV/m	Meas. Time msec	Bandwidth kHz	Correction dB	Margin dB	Limit dBµV/m
0.15162	44.3	1000	9	0.6	21.7	66

Frequency MHz	Average dBµV/m	Meas. Time msec	Bandwidth kHz	Correction dB	Margin dB	Limit dBµV/m
0.15162	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:

Correction(dB) = Transducer Factor + Cable Loss

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

Corrected Quasi-Peak/Average(dBµV) = Raw Quasi-Peak/Average + Correction (dB)

Margin, defined as the distance to the limit specified in the applicable standard is calculated as shown below for both radiated and conducted emissions. By definition, negative margin is non-compliant (failure).

Margin(dB) = Limit – Quasi-Peak/Average Measurement

0

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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. / Asset	Calibration Due Date
Sunol Sciences	SM46C	Turntable	051204-2	N/A
Sunol Sciences	TWR95	Mast	TREML0001	N/A
Sunol Sciences	JB3	Biconilog Antenna 30M–3G Hz	A120106	2020 Aug 16
ETS Lindgren	2165	Turntable	43677	N/A
ETS Lindgren	2125	Mast	77487	N/A
Rohde & Schwarz	ESU40	EMI Receiver	100011	2019 Dec 1
Rohde & Schwarz	FSU40	EMI Spectrum Analyzer	101388	2022 Jan 24
Rohde & Schwarz	NRP/NRP-Z22	RF Power Sensor (Meter)	100272	2022 Oct 22
Fischer Custom Communications	FCC-LISN-50-25-2-08	LISN 150k-30M Hz	2041	2020 Nov 19
ETS Lindgren	S201	3-meter Semi-Anechoic Chamber	1030	N/A
ETS Lindgren	DRH 3117	Horn Antenna 1G-18G Hz	75944	2022 Mar 9
HP	8449B	Amplifier 1G-18G Hz	1179	Conditional Use

Measurement Software

Manufacturer	Model	Description	Serial No.
Rhode & Schwarz	EMC 32	Emissions Measurement	6.20.0

Section III - REQUIREMENTS

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3.1 - Conducted Emissions, AC Mains

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 Class B of 15.107, ICES-003 and 15.207, RSS-Gen 7.2.2. This prevents the EUT from causing unwanted interference to other electronic devices.

A Line Impedance Stabilizing Network (LISN) was used. Measurements were made by using instrumentation with 9 kHz measurement resolution bandwidth, CISPR quasi-peak and average detector capabilities; measurement instrumentation requirements, including the measurement bandwidths used, as specified in CISPR 16-1-1.

The EUT was operated in transmit, standby, & receive mode of operation as described in Radiated Spurious Emissions and EUT Configuration. Specialized custom software may have been used. The EUT was operated in at least three tranmsit frequencies, and tranmsit, standby, and receive modes and worst-case data reported.

Table 3.1-1 FCC 15.107/15.207 / RSS-247/ICES-003 - Class B - AC Mains Conducted Emission Limits - RX/TX

EN 55032 Class B	Frequency Hz	Quasi-Peak Limit dBµV	Average Limit dBµV
CEAC 150K30M	150k - 500k	66 - 56 *	56 - 46 *
	500k - 5M	56	46
	5M - 30M	60	50
Notes:	*1. The lower limit shall apply at the transition frequencies.*		
	2. Decreases linearly with the logarithm of frequency.		

The EUT was tested without modification on March 13, 2020 and complies with Class B of 15.107, ICES-003 and 15.207, RSS-Gen 7.2.2.

Refer to Appendix A for AC Mains Conducted Emissions data.

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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, Class B of 15.109, RSS-Gen 7.1, ICES-003 and 15.209, 15.205, 15.247(d), RSS-Gen 8.9, RSS 247 5.5 for systems employing narrowband digital modulation techniques operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz.. This prevents the EUT from causing unwanted interference to other electronic devices.

This test was performed using method in accordance with ANSI C63.10 and ANSI C63.4. The EUT was operated at AC Mains while in 'Continuous Mode' of operation. The battery was at nominal full charge. The measurement frequency range was determined in accordance with CISPR 32. Where applicable, the EUT was operated with a transmit duty cycle exceeding 94%.

Measurements were made by using instrumentation with measurement bandwidth, CISPR quasi-peak and average detector capabilities; measurement instrumentation requirements, including the measurement bandwidths used, as specified in CISPR 16-1-1.

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 for Class A digital devices.

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 signals, measurements may be performed at a closer distance and the emission limit adjusted using the equation below to ensure compliance.

20 * Log (d1/d2)

Where d1 = Measurement distance
d2 = Specified distance (refer to applicablc standard)

Devices incorporating an "ancilliary device" have applicable ancilliary mode limits. Ancilliary device circuitry requires compliance to Class A or Class B limits as appropriate.

Applicable to emissions radiated by the cabinet or emissions radiated by integral antenna equipment without antenna connectors. These limits are ERP for emissions up to 1 GHz and EIRP for emissions above 1 GHz. In case of equipment with antenna connectors, these limits apply to emissions at the antenna port (conducted), see Conducted Spurious Emisisons.

Table 3.2-1: FCC 15.109 - Radiated Emission Limits - Ancilliary Device (Cabinet) - Class B

FCC 15.109 / ICES-003 Class B	Frequency MHz	Quasi-Peak - QP dBµV/m @3m	Peak Limit - PK dBµV/m @3m	Average Limit - AV dBµV/m @3m
RELF(30M1G)	30 - 88	40.0	-	-
	88 - 216	43.5	-	-
	216 - 960	46.0	-	-
	960 - 1000	54.0	-	-
REHF(1G6G)	1000 - 5000	-	74	54
Notes:	*1. The lower limit shall apply at the transition frequencies.*			
	2. The frequency range of interest extends to the intentional radiator frequency of interest.			

Table 3.2-2 15.209 - Radiated Spurious (Cabinet) Emission Limits - TX

15.247 TX	Frequency MHz	Quasi-Peak - QP dBµV/m @3m	Peak Limit - PK dBµV/m @3m	Average Limit - AV dBµV/m @3m
RELF(30M1G)	30 - 88	40.0	-	-
	88 - 216	43.5	-	-
	216 - 960	46.0	-	-
	960 - 1000	54.0	-	-
REHF(1G40G)	1G - 40G	-	74	54
Notes:	*1. These limits apply within restricted bands 15.205/RSS-247 when the transmitter is active.*			
	2. The lower limit shall apply at the transition frequencies.			
	3. The frequency range of interest extends to the tenth multiple of intentional radiator fundamental frequency			
	4. used or generated.			
	5. Spurious emissions outside of restricted bands subject to other spurious requirements.			
	Limit is EIRP below 1 GHz, EIRP above 1 GHz			

The EUT was tested without modification on March 13, 2020 and complies with Class B of 15.109, RSS-Gen 7.1, ICES-003 and 15.209, 15.205, 15.247(d), RSS-Gen 8.9, RSS 247 5.5.

Refer to Appendix B for Radiated Spurious Emissions data.

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3.3 - Conducted Spurious Emissions

This test ensures the conducted spurious emissions of the Equipment Under Test (EUT) does not exceed the limits as specified in 15.247(d), 15.205, 15.209(a), 2.1051 for systems employing narrowband digital modulation techniques operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz..

The EUT was operated in continuous transmit mode with a duty cycle exceeding normal operation or greater than 94% as applicable. The test was performed as defined by the standards above with the antenna port of the EUT directly connected to a spectrum analyzer.

For equipment with antenna connectors, these limits are applicable emissions at the antenna port (conducted). For emissions radiated by the cabinet (see Radiated Spurious Emissions) or emissions radiated by integral antenna equipment, these limits are ERP for emissions up to 1 GHz and EIRP for emissions above 1 GHz.

The highest frequency of interest extends to at least the tenth harmonic of the the highest frequency used or generated within the device or 40 GHz.. The lowest frequency of interest is at least 10% lower than the lowest clock or other frequency within the device or 9 kHz paying particular interest to real-time clock crystals.

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.

The EUT was tested without modification on March 16, 2020 and complies with 15.247(d), 15.205, 15.209(a), 2.1051, and RSS-

Refer to Appendix C for Conducted Spurious Emissions data.

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3.4 - Antenna Requirements

This requirement ensures no other antenna except as provided by the manufacturer shall be used with the Equipment Under Test (EUT) as defined in FCC 15.203.

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 a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of § 15.211, 15.213, 15.217, 15.219, 15.221, or § 15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

The manufacturer declares the device(s) contain integral trace antennas and declare compliance on March 22, 2020 .

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3.5 - RF Output Power & EIRP

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), 2.1046 for systems employing narrowband digital modulation techniques operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz..

The EUT was operated in continuous transmit mode with a duty cycle exceeding normal operation or greater than 94% as applicable. 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 conducted RF peak output power was examined and output power measurement data corrected for duty cycle as necessary to report the maximum permitted transmit power.

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

The RF peak output power or EIRP is calculated using the maximum conducted output power increased by the directional antenna gain. For conducted measurements above 1000 MHz , the EIRP[dBm] shall be measured and then field strength E[dBuV/m} shall be calculated using:

$$E[dB\mu V/m] = EIRP[dBm] - 20 \log (d[meters]) + 104.77 + G[dBi]$$

where: E = field strength
d = distance specified in the applicable standard
G[dBi] = Antenna gain

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 1 Watt. The use of antennas with directional gains exceeding 6 dBi is permitted within restrictions as specified in the standard. The EIRP shall not exceed 4 W, except as provided for in the standard.

The EUT was tested without modification on March 12, 2020 and complies with 15.247(b)(3), 2.1046, and RSS-247 5.4(b).

Refer to Appendix D for RF Peak Power Output data.
Refer to Appendix E for Duty Cycle Correction data.

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3.6 - Power (Spectral) Density

This test ensures the power spectral density of the Equipment Under Test (EUT) does not exceed the limits as specified in 15.247 (e) for systems employing narrowband digital modulation techniques operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz.

The EUT was operated in 'continuous transmit mode with a duty cycle exceeding normal operation or greater than 94% as applicable. 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 antenna port conducted power spectral density shall not be greater than +8 dBm in any 3 kHz band during any time interval of continuous transmission. The same method of determining the conducted output power shall be used to determine the power spectral density.

The EUT was tested without modification on March 15, 2020 and complies with 15.247 (e) and RSS-247 5.2(b).

Refer to Appendix F for Power Spectral Density data.

QAI Laboratories
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Burnaby, BC V5J 5K5 Canada

3.7 - Occupied Bandwidth

This test ensures the occupied bandwidth of the Equipment Under Test (EUT) does not exceed the limits as specified in 15.247(a)(2), 2.1049, and RSS-247 5.2(a), RSS-Gen-6.6 for systems employing digital modulation techniques operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz.

The test was conducted in accordance with ANSI C63.10(6.9, 11.8). The antenna port of the EUT is connected directly to the spectrum analyzer with max peak detection and using max hold. The EUT was operated at its maximum power under normal test conditions. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.

For generic occupied bandwidth measurements, the resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be at least 3x RBW. For the DTS or 6dB bandwidth measurement, the resolution bandwidth (RBW) shall be 100 kHz and video bandwidth (VBW) shall be at least 3x RBW.

The minimum 6 dB (DTS) bandwidth shall be 500 kHz. The 20 dB or 99% bandwidth shall be measured and may also be used to demonstrate compliance.

The EUT was tested without modification on March 13, 2020 and complies with 2.1049, 15.247(a)(2) and RSS-247 5.2(a), RSS-Gen 6.7.

Refer to Appendix F for Occupied Bandwidth data.

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3.8 - Mask/In-Band, Out-of-Band & Bandedge Emissions

This test ensures the out-of -band emissions (mask/bandedge) of the Equipment Under Test (EUT) does not exceed the limits as specified in 15.247(d), 15.205(c) and RSS-247 5.5, RSS-Gen 8.9 for systems employing digital modulation techniques operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz.

The EUT was operated in 'continuous transmit mode with a duty cycle exceeding normal operation or greater than 94% as applicable. The test was performed as defined by the standards above with the antenna port of the EUT directly connected to a spectrum analyzer.

For conducted measurements above 1000 MHz, the EIRP (dBm) shall be measured and then field strength E (dBuV/m) shall be calculated. Below 1000 MHz, ERP (dBm) instead of EIRP shall be used, where ERP = EIRP + 2.15 dB (gain of ideal dipole).

$$E(dB\mu V/m) = EIRP(dBm) - 20 \log (d(meters)) + 104.8 + G(dBi)$$

where: E (dBuV/m) = field strength
d = Measurement distance specified in the applicable standard
G (dBi) = Antenna gain

The EUT was tested without modification on March 14, 2020 and complies with 15.247(d), 15.205(c) and RSS-247 5.5, RSS-Gen 8.9.

Refer to Appendix F for occupied bandwidth, emission mask and bandedge data.

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Burnaby, BC V5J 5K5 Canada

3.10 - Duty-Cycle

Measurement of the duty cycle of the fundamental emission of the Equipment Under Test (EUT) is required to ensure rms averaging power meter measurement of conducted RF output power is corrected for periodic transmissions in excess of 100 msec and the document fundamental transmission modes.

Duty-cycle correction may be applied to reduce peak emissions directly related to the fundamental transmission in terms of radiated spurious emissions reported in dBuV/m at distance m and/or peak emissions corrected to equivalent conducted rms output power (dBm) and/or measurement of rms conducted average power (dBm).

The duty cycle of the fundamental transmissions was measured with a modified unit to provide an antenna port conducted data on March 22, 2020.

Refer to Appendix E for Duty-Cycle data.

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Burnaby, BC V5J 5K5 Canada

3.11 - Frequency Stability

This measurement is required as a general requirement of the Equipment Under Test (EUT) as specified in 15.247, 2.1055 and RSS-247 , RSS-Gen 8.11 for unlicensed transmitters.

The frequency stability shall be measured with variation of ambient temperature from −30C to + 50C or over the manufacturer's specified temperature range. Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10° centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement.

The frequency stability shall be measured with variation of primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment. For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer. The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided.

If a CW signal is not available, a normally modulated signal may be used with a narrow resolution measurement bandwidth to demonstrate compliance.

The EUT was tested without modification on March 19, 2020 and complies with 15.247, 2.1055 and RSS-247 , RSS-Gen 8.11.

Refer to Appendix G for Frequency Stability data.

3.100 - RF Exposure Evaluation

#NAME?

If the device output power is less than Pmax' then the device is deemed to comply with the basic restrictions.

RF exposure, (power density) is calculated using the following formula.

Power Density (mW/cm^2) = EIRP(mW) / (4 * PI * r^2)

*

Table 3.50-1: RF Exposure Limits - Pmax

Guideline/Standard	I SAR limit SARmax W/kg	Averaging Mass g	Pmax mW	Exposure Tier	Region of Body
ICNIRP (*1)	2	10	20	*General public*	*Head and trunk*
ICNIRP	4	10	40	*General public*	*Limbs*
ICNIRP	10	10	100	*Occupational*	*Head and trunk*
ICNIRP	20	10	200	*Occupational*	*Limbs*
IEEE:1999 (*2)	1.6	1	2	*Uncontrolled*	*Head, trunk, arms, legs*
IEEE	4	10	40	*Uncontrolled*	*Hands, wrists, feet, ankles*
IEEE	8	1	8	*Controlled environment*	*Head, trunk, arms, legs*
IEEE	20	10	200	*Controlled environment*	*Hands, wrists, feet, ankles*
IEEE:2005 (*3)	2	10	20	*Action Level*	*Body except extremities, pinnae*
IEEE	4	10	40	*Action Level*	*Extremities, pinnae*
IEEE	10	10	100	*Controlled environment*	*Body except extremities, pinnae*
IEEE	20	10	200	*Controlled environment*	*Extremities, pinnae*

Notes:
1. International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for limiting exposure in time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz). Health Physics, 1998, vol. 74, pp. 494-522
2. IEEE Std C95.1-2005, IEEE standard for safety levels with respect to human exposure to radio frequency electromagnetic fields, 3 kHz to 300 GHz
3. IEEE Std C95.1-2005, IEEE standard for safety levels with respect to human exposure to radio frequency

Table 3.50-2: Typical Alternate RF Exposure Suggested Limits - P'max

Frequency MHz	Example	P'max (alternate) mW			
		distance = 5 mm		distance = 25 mm	
		m=1g	m=10g	m=1g	m=10g
915	2-GFSK	7.3	32	120	328

Table 3.50-3: RF Exposure RF Evaluation

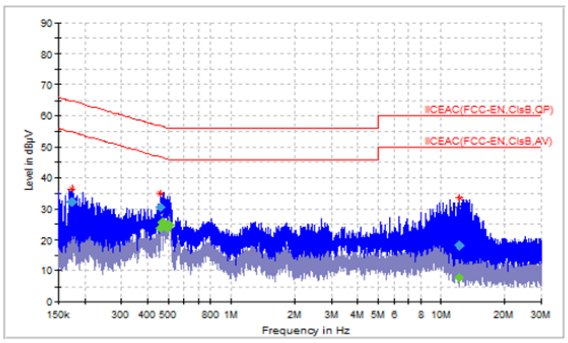
Band MHz	Measured Conducted Power dBm	Antenna Gain dBi	EIRP mW	Power Density at 20 cm mW/cm^2	Power Density Limit at 20 cm mW/cm^2
902-928 (ISM)	**9.3**	0.30	9.1	0.002	1.0

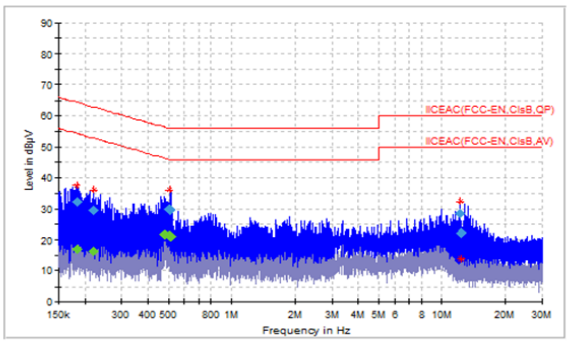
In all cases, the power density reported is significantly less than the applicable limits when located 20 cm from human body.

The measurements and calculations for RF Exposure were performed on March 28, 2019 and the EUT is exempt from requirements for SAR evaluation.

Appendix A: CONDUCTED EMISSIONS DATA

Figure A1-1/A1-2 FCC 15.107 / ISED ICES-003 - AC Mains Conducted Emissions - 120V/60H - RX - L1/L2





Notes: 1. Series inductor in L1 path causes differential in data from L1 to L2 (N).

Table A1-1 Quasi-Peak/Average Data AC Mains Conducted Emissions - 120V/60H - RX - L1

Frequency MHz	Quasi-Peak dBµV	Meas.Time msec	Bandwidth kHz	Line	Correction dB	Limit dBµV	Margin dB	
0.173900	**32.2**	1000	9	L1	**10.8**	64.8	32.6	PASS
0.462800	**30.7**	1000	9	L1	**10.7**	56.6	25.9	PASS
12.217100	**18.1**	1000	9	L1	**10.8**	60.0	41.9	PASS
							0.0	PASS
Frequency MHz	**Average dBµV**	**Meas.Time msec**	**Bandwidth kHz**	**Line**	**Correction dB**	**Limit dBµV**	**Margin dB**	
0.459600	**23.7**	1000	9	L1	**10.7**	46.7	23.0	PASS
0.469200	**25.7**	1000	9	L1	**10.7**	46.5	20.8	PASS
0.477000	**25.4**	1000	9	L1	**10.7**	46.4	21.0	PASS
0.495900	**23.9**	1000	9	L1	**10.7**	46.1	22.2	PASS

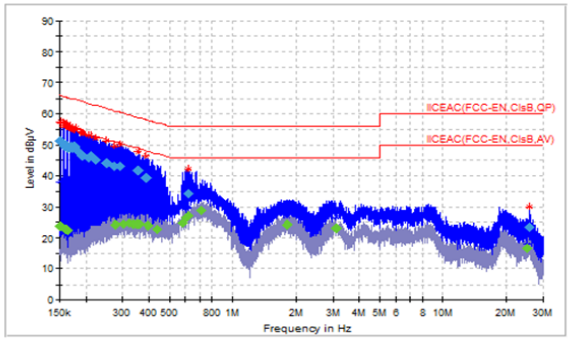
Notes: 1. Peak data may be compared to quasi-peak or average limit.
2. Emissions above noise floor or within 20dB of limit are reported.
3. The four data points with the least margin within 6dB of limit or all data within 6dB of limit are reported.

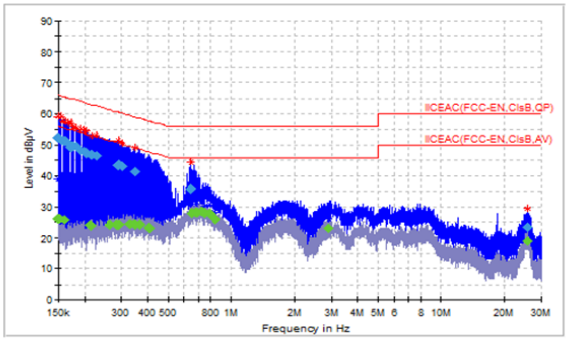
Table A1-2 Quasi-Peak/Average Data AC Mains Conducted Emissions - 120V/60H - RX - L2

Frequency MHz	Quasi-Peak dBµV	Meas.Time msec	Bandwidth kHz	Line	Correction dB	Limit dBµV	Margin dB	
0.183500	**32.2**	1000	9	L2	**10.8**	64.3	32.1	PASS
0.220200	**29.5**	1000	9	L2	**10.8**	62.8	33.3	PASS
0.505500	**29.7**	1000	9	L2	**10.7**	56.0	26.3	PASS
12.311600	**28.6**	1000	9	L2	**10.8**	60.0	31.4	PASS
Frequency MHz	**Average dBµV**	**Meas.Time msec**	**Bandwidth kHz**	**Line**	**Correction dB**	**Limit dBµV**	**Margin dB**	
0.482000	**21.8**	1000	9	L2	**10.7**	46.3	24.5	PASS
0.220200	**16.1**	1000	9	L2	**10.8**	52.8	36.7	PASS
0.183500	**17.1**	1000	9	L2	**10.8**	54.3	37.2	PASS
0.505500	**21.5**	1000	9	L2	**10.7**	46.0	24.5	PASS

Notes: 1. Peak data may be compared to quasi-peak or average limit.
2. Emissions above noise floor or within 20dB of limit are reported.
3. The four data points with the least margin within 6dB of limit or all data within 6dB of limit are reported.

Figure A2-1/A2-2 FCC 15.207 / ISED ICES-003 - AC Mains Conducted Emissions - 120V/60H - TX - L1/L2





Notes: 1. Series inductor in L1 path causes differential in data from L1 to L2 (N).

Table A2-1 Quasi-Peak/Average Data AC Mains Conducted Emissions - 120V/60H - TX Worst-Case - L1

Frequency MHz	Quasi-Peak dBµV	Meas.Time msec	Bandwidth kHz	Line	Correction dB	Limit dBµV	Margin dB	
0.151400	**51.4**	1000	9	L1	**10.9**	65.9	14.5	PASS
0.153900	**51.0**	1000	9	L1	**10.9**	65.8	14.8	PASS
0.177800	**49.2**	1000	9	L1	**10.8**	64.6	15.4	PASS
0.355200	**41.7**	1000	9	L1	**10.7**	58.8	17.1	PASS
Frequency MHz	**Average dBµV**	**Meas.Time msec**	**Bandwidth kHz**	**Line**	**Correction dB**	**Limit dBµV**	**Margin dB**	
0.602400	**26.4**	1000	9	L1	**10.6**	46.0	19.6	PASS
0.616700	**27.0**	1000	9	L1	**10.6**	46.0	19.0	PASS
0.707200	**28.9**	1000	9	L1	**10.6**	46.0	17.1	PASS
		1000	9	L1			0.0	PASS

Notes: 1. Peak data may be compared to quasi-peak or average limit.
2. Emissions above noise floor or within 20dB of limit are reported.
3. The four data points with the least margin within 6dB of limit or all data within 6dB of limit are reported.

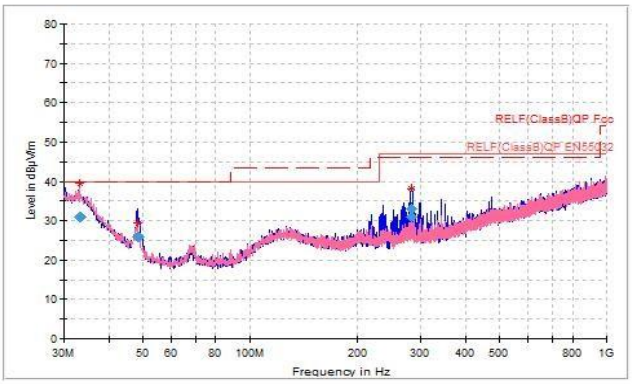
Table A2-2 Quasi-Peak/Average Data AC Mains Conducted Emissions - 120V/60H - TX Worst-Case - L2

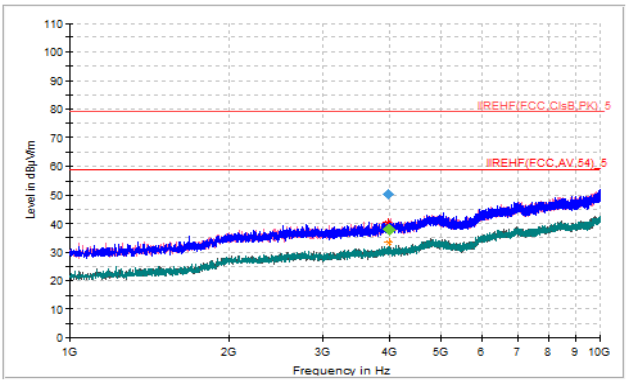
Frequency MHz	Quasi-Peak dBµV	Meas.Time msec	Bandwidth kHz	Line	Correction dB	Limit dBµV	Margin dB	
0.150400	**52.2**	1000	9	L2	**10.9**	66.0	13.8	PASS
0.157500	**51.4**	1000	9	L2	**10.8**	65.6	14.2	PASS
0.289700	**43.6**	1000	9	L2	**10.7**	60.5	16.9	PASS
0.349100	**41.2**	1000	9	L2	**10.7**	59.0	17.8	PASS
Frequency MHz	**Average dBµV**	**Meas.Time msec**	**Bandwidth kHz**	**Line**	**Correction dB**	**Limit dBµV**	**Margin dB**	
0.150400	**26.3**	1000	9	L2	**10.9**	56.0	29.7	PASS
0.344500	**24.4**	1000	9	L2	**10.7**	49.1	24.7	PASS
0.411100	**23.2**	1000	9	L2	**10.7**	47.6	24.4	PASS
0.726100	**28.5**	1000	9	L2	**10.6**	46.0	17.5	PASS
0.790900	**27.7**	1000	9	L2	**10.6**	46.0	18.3	PASS
		1000	9	L2		60.0	60.0	PASS

Notes: 1. Peak data may be compared to quasi-peak or average limit.
2. Emissions above noise floor or within 20dB of limit are reported.
3. The four data points with the least margin within 6dB of limit or all data within 6dB of limit are reported.

Appendix B - RADIATED EMISSIONS DATA

Figure B1 **15.109/ICES003 - 902-928 MHz DTS - Radiated (Spurious) Emissions - RX**





Notes: 1. Receiver mode of operation examined.

Table B1-1 **15.109/ICES003 - 902-928 MHz DTS - Radiated (Spurious) Emissions below 1 GHz - RX**

Frequency MHz	Quasi-Peak dBµV/m at 3m	Meas. Time msec	Resolution Bandwidth RBW- kHz	Polarity	Correction dB	Limit dBµV/m at 3m	Margin dB	FCC 15.109 / ICES-003 RELF.RX
30.226	**34.3**	1000	120	VERT		40.0	5.7	PASS
75.002	**31.9**	1000	120	VERT		40.0	8.1	PASS
200.001	**32.1**	1000	120	HORZ		40.0	7.9	PASS

Notes: 1. Peak data may be compared to quasi-peak/average limit.
2. The four data points with the least margin within 6dB of limit or all data above the noise floor within 6dB of limit are reported.

Observations:	
Notes:	**Receiver mode of operation examined.**

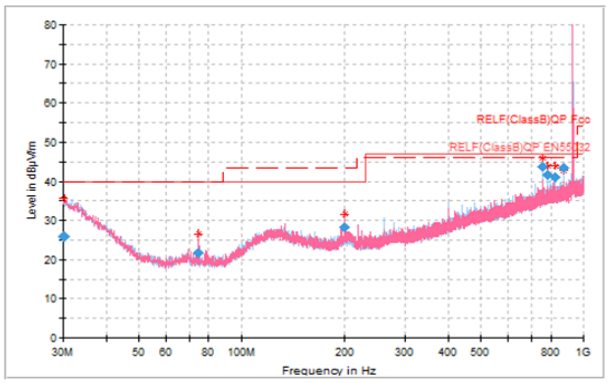
Table B1-2 **15.109/ICES003 - 902-928 MHz DTS - Radiated (Spurious) Emissions above 1 GHz - RX**

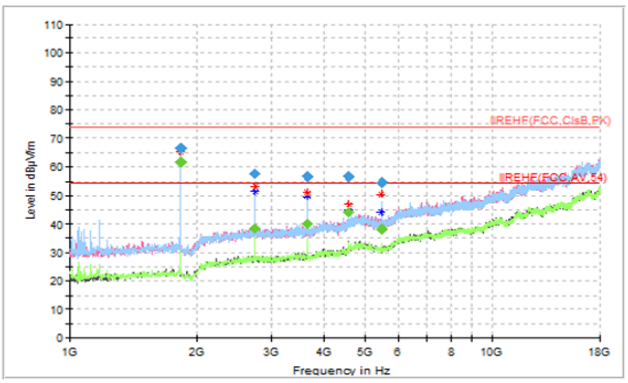
Frequency MHz	Max Peak dBµV/m at 3m	Average dBµV/m at 3m	Meas. Time msec	Resolution Bandwidth RBW - kHz	Polarity	Correction dB	Limit dBµV/m at 3m	Margin dB	FCC 15.109 / ICES-003 RELF.RX
4008.295	**45.9**	-	1000	1000	HORZ		74.0	28.1	PASS
4008.295	-	**32.8**	1000	1000	HORZ		54.0	21.2	PASS

No emissions found within 20 dB of limit.

Notes: 1. Peak data may be compared to max peak or average limit.
2. The four data points with the least margin within 6dB of limit or all data above the noise floor within 6dB of limit are reported.

Figure B2 **15.209/15.205/15.247.DTS & ICES003/RSS-247 - Radiated Spurious Emissions - TX - Worst-case**





Notes:	*1. Plots are worst-case, multiple modulation modes and at least three transmit frequencies examined.* *2. Radiated emissions frequency range of interest 30M-9.28G Hz (required).* *3. Fundmental transmission at 902-928 MHz shown.* *4. Limit line shown are applicable for all spurious emissions not directly associated with transmission.* *5. Emissions directly associated with transmission must comply with restricted band requirements, antennuation to general limits is not required.*

Observations:	**Some emissions directly associated with transmission are listed below for convenience; this list is not considered exhaustive. Frequencies identified may or may not depend on fundamental transmission frequency and may shift with fundamental transmission frequency. All frequencies associated with transmissionwithin 6 dB of limit were examined.** **746M 759M 772M 785M 797M 811M 837M 852M 863M 876M 952M**
Notes:	**1. Transmit mode of operation examined at least three frequencies.** **2. Single mode of modulation examined.**

Table B2-1 **15.209/15.205/15.247.DTS & ICES003/RSS-247 - Radiated Spurious Emissions below 1 GHz - TX - Worst-case**

Frequency MHz	Quasi-Peak dBµV/m at 3m	Meas. Time msec	Resolution Bandwidth RBW- kHz	Polarity	Correction dB	Limit dBµV/m at 3m	Margin dB	FCC 15.209 / RSS-247 RELF.TX
30.226	25.9	1000	120	VERT	27.6	40.0	14.1	PASS
75.002	26.6	1000	120	VERT	13.0	40.0	13.4	PASS
200.001	33.4	1000	120	HORZ	18.0	40.0	6.6	PASS

Notes: 1. Peak data may be compared to quasi-peak/average limit.
2. Data points with the least margin within 6dB of limit or all data above the noise floor within 6dB of limit are reported.
3. Notch filter may be used to suppress fundamental.
4. Transmit mode emission sweeps including co-location if applicable were performed using test configuration matrix to determine worst case.

Observations:

Notes: 1. Transmit mode of operation examined at least three frequencies.
2. Single mode of modulation examined.

Table B2-2 **15.209/15.205/15.247.DTS & ICES003/RSS-247 - Radiated Spurious Emissions above 1 GHz - TX - Worst-case**

Frequency MHz	Max Peak dBµV/m at 3m	Average dBµV/m at 3m	Meas. Time msec	Resolution Bandwidth RBW - kHz	Polarity	Correction dB	Limit dBµV/m at 3m	Margin dB	*3, *4
902.7	*Fundamental*								
1805.4	*30 dBc rms*	**55.8**	1000	1000	HORZ	-2.5	*Harmonic subject to 30 dBc criteria only.*		
2708.1	*Restricted*	**32.6**	1000	1000	HORZ	1.5	54.0	21.4	PASS
3610.8	*Restricted*	**34.0**	1000	1000	HORZ	3.1	54.0	20.1	PASS
4513.5	*Restricted*	**38.0**	1000	1000	HORZ	6.0	54.0	16.0	PASS
5412.0	*Restricted*	**32.2**	1000	1000	HORZ	6.9	54.0	21.8	PASS
1805.4	**60.5**	*30 dBc rms*	1000	1000	VERT	-2.5	*Harmonic subject to 30 dBc criteria only.*		
2708.1	**51.7**	*Restricted*	1000	1000	VERT	1.5	74.0	22.3	PASS
3610.8	**50.6**	*Restricted*	1000	1000	HORZ	3.1	74.0	23.4	PASS
4513.5	**50.6**	*Restricted*	1000	1000	VERT	6.0	74.0	23.5	PASS
5412.0	**48.3**	*Restricted*	1000	1000	VERT	6.9	74.0	25.7	PASS

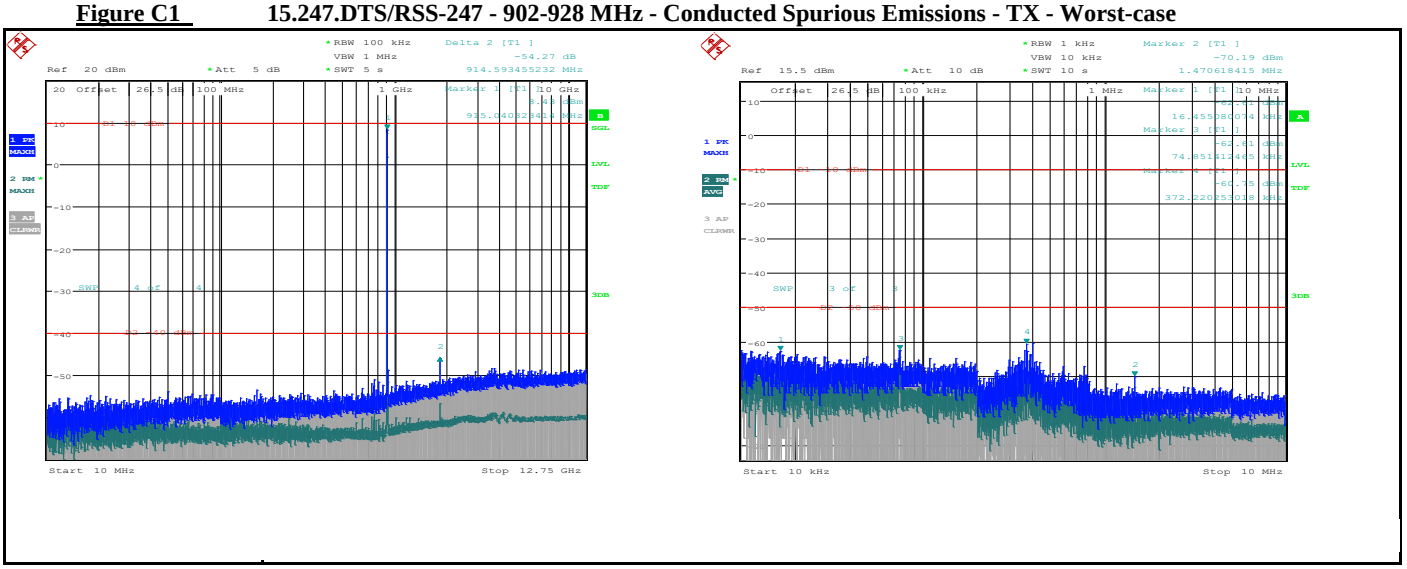
Notes: 1. Four data points with the least margin within 6dB of limit or all data above the noise floor within 6dB of limit are reported.
2. Notch filter or direct attenuation may be used to suppress fundamental to avoid saturation.
3. Radiated harmonic emissions within restricted bands compared to 74PK/54AV limit.
4. Non-restricted band harmonic emissions subject to 30 dBc, see conducted harmonic emissons.
5. Transmit mode emissions inclding co-location if applicable were performed using test configuration matrix to

Observations:

Notes: 1. Transmit mode of operation examined at least three frequencies.
2. Single mode of modulation examined.

Appendix C - CONDUCTED SPURIOUS & HARMONIC EMISSIONS DATA

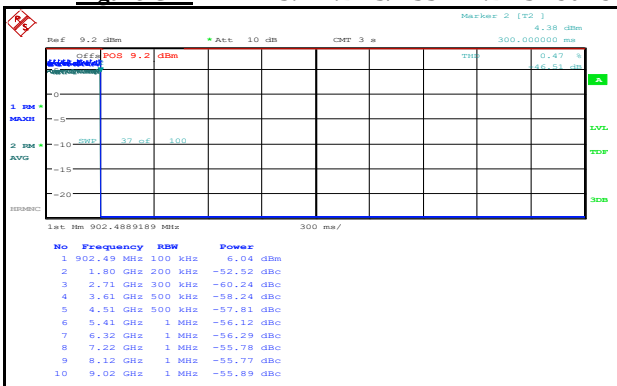
Figure C1 **15.247.DTS/RSS-247 - 902-928 MHz - Conducted Spurious Emissions - TX - Worst-case**



Notes: *1.*	*Plots shown are cumulative or worst-case, multiple modulation/transmit frequencies examined.*
2.	*No significant emissions found above noise floor, all emissions greater than 30 dBc using rms or average detector and greater than 20 dBc max peak detector.*

Observations:	**No significant emissions found above noise floor, all emissions greater than 30 dBc using rms or average detector and greater than 20 dBc using max peak detector.**
Notes: 1.	**Transmit mode of operation examined at least three frequencies**
2.	**Single modulation mode examined to determine worst-case.**

Figure C2 **15.247.DTS/RSS-247.DTS - 902-928 MHz - Conducted Harmonic Emissions - TX - Typical**



Notes:	*1. Plots shown are cumulative or worst-case, multiple modulation/transmit frequencies examined.* *2. No significant emissions found above noise floor, all emissions greater than 30 dBc using rms or average detector and greater than 20 dBc max peak detector.*

Observations:	
Notes:	**1. Transmit mode of operation examined at least three frequencies** **2. Single modulation mode examined to determine worst-case.**

Table C1 **15.247.DTS/RSS-247.DTS - 902-928 MHz - Conducted Harmonic Emissions - TX**

Frequency MHz	H2 dBc	H3 dBc	H4 dBc	H5 dBc	H6 dBc	H7 dBc	H8 dBc	H9 dBc	H10 dBc	Modulation
902.3	52	60	58	57	55	56	56	55	55	2-GFSK
915.0	54	61	60	58	56	56	57	56	55	2-GFSK
927.7	53	60	60	59	55	56	55	56	55	2-GFSK

Notes:	*1. All harmonic emissions are greater than 30 dBc using rms or average detector.*
Observations:	**No significant emissions found above noise floor, all emissions greater than 30 dBc using rms or average detector and greater than 20 dBc using max peak detector.**
Notes:	**1. Transmit mode of operation examined at least three frequencies** **2. Single modulation mode examined to determine worst-case.**

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Appendix D - RF OUTPUT POWER & EIRP DATA

Table D1 **15.247/RSS-247 - 900M - DTS RF Conducted Output Power Maximum (Worst-case)**

Band	Channel Frequency LO/HI MHz		Output Power Watt	Antenna Gain dBi	Antenna Gain Limit dBm	Margin dB	Output Power mW	Output Power dBm	Output Power Limit dBm	Margin dB	
ISM	902.3	927.7	0.00600	0.30	6.0	5.7	1.0	0.0	30.0	30.0	PASS

EUT	Channel Frequency MHz	Modulation	As Tested Output Power dBm (rms)	Max Output Power dBm (rms)	Tune-up Tolerance dB	Antenna Gin dBi	Rated *3 Output Power incl. tune-up tolerance dBm (rms)	
EUT-A	902.3	2-GFSK	**9.3**	**9.6**	**1.3**	**0.3**	**8.1**	
	915.0	2-GFSK	**9.5**					
	927.7	2-GFSK	**9.1**					
EUT-B	902.3	2-GFSK	**9.4**					
	915.0	2-GFSK	**9.6**					
	927.7	2-GFSK	**9.3**					

Notes: 1. Reported output power dBm includes duty cycle correction (Appendix E) for specific modulation to be determined as worst-case.
2. Sufficient margin as determined by manufacturer is required for production variance of product, see CISPR 16-4-3 for guidance.
3. Manufacturer tune-up tolerance derating is required to include production variation of product and/or tuning.

Observations:	
Notes: 1.	**A modified EUT was provided with an external antenna port connector for conducted output power measurements.**

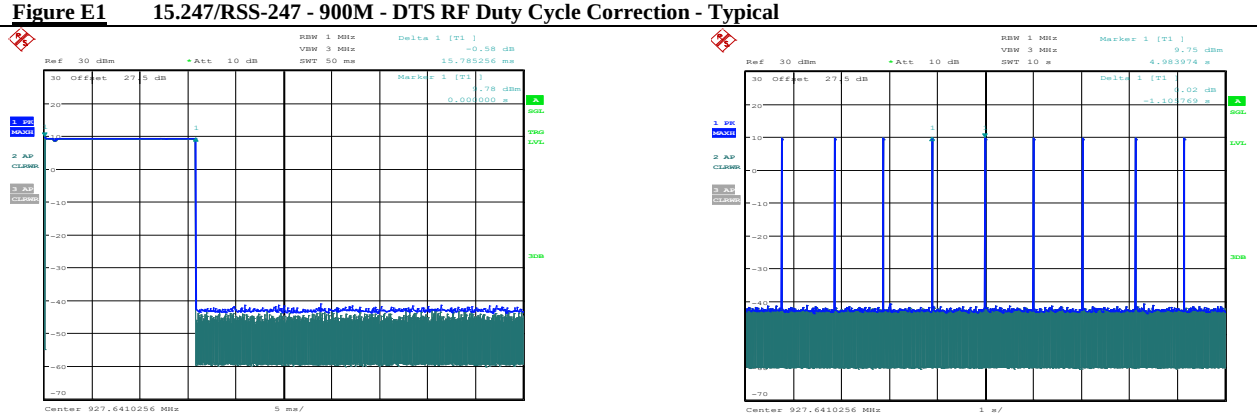
Appendix E - DUTY CYCLE CORRECTION DATA

Table E1 **15.247/RSS-247 - 900M - DTS - Fundamental Emission Duty Cycle Correction**

Equipment Category	Modulation	Frequency MHz	T2 TON msec	T1 TON+TOFF *1 msec	Duty Cycle dB	Duty Cycle %
DTS	2-GFSK	915	15.8	100	8.0	15.80
Notes: 1.	*For periodic transmissions with repetition rate greater than 100 msec, transmission period is considered to be 100 msec.*					

Observations:	**Manufacturer has declared periodic transmission with a single transmission from each device occurring with a period greater than 100 msec.**
Notes: 1.	**The devices transmit with a "handshake operation" occurring approximately once per second.**

Figure E1 **15.247/RSS-247 - 900M - DTS RF Duty Cycle Correction - Typical**



Observations:	**Manufacturer has declared periodic transmission with a single transmission from each device occurring with a period greater than 100 msec.**
Notes: 1.	**The devices transmit with a "handshake operation" occurring approximately once per second.**

Appendix F: OBW, PSD, MASK & BANDEDGE, PSD DATA

Table F1 **15.247/RSS-247 - 900M(DTS) -Occupied & DTS Bandwidth**

Mode	Frequency MHz	Modulation	99% Occupied Bandwidth kHz (*2)				DTS Bandwidth kHz (*1)	Limit - DTS Bandwidth >500 kHz
NORM	902.3	2-GFSK	**410**				**573.0**	PASS
NORM	915.0	2-GFSK	**407**				**572.0**	PASS
NORM	927.7	2-GFSK	**409**				**574.0**	PASS

Notes: 1. DTS Bandwidth specifies a 100 kHz resolution bandwidth RBW.
2. 99% occupied bandwidth specifies a ratio of resolution bandwidth RBW to measured occupied bandwidth OBW of approximately 1/100 or 1% , interrate until condition meet

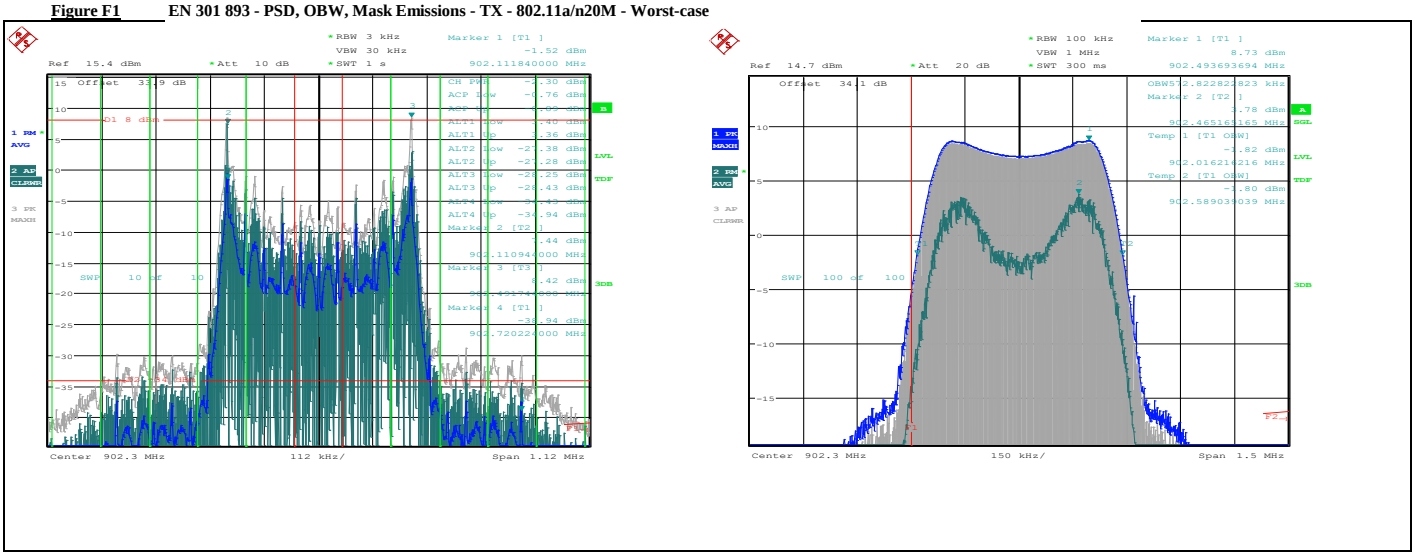
Observations:	
Notes: 1.	**Worst-case data shown includes evaluation of EUT-A & EUT-B at least three frequencies.**

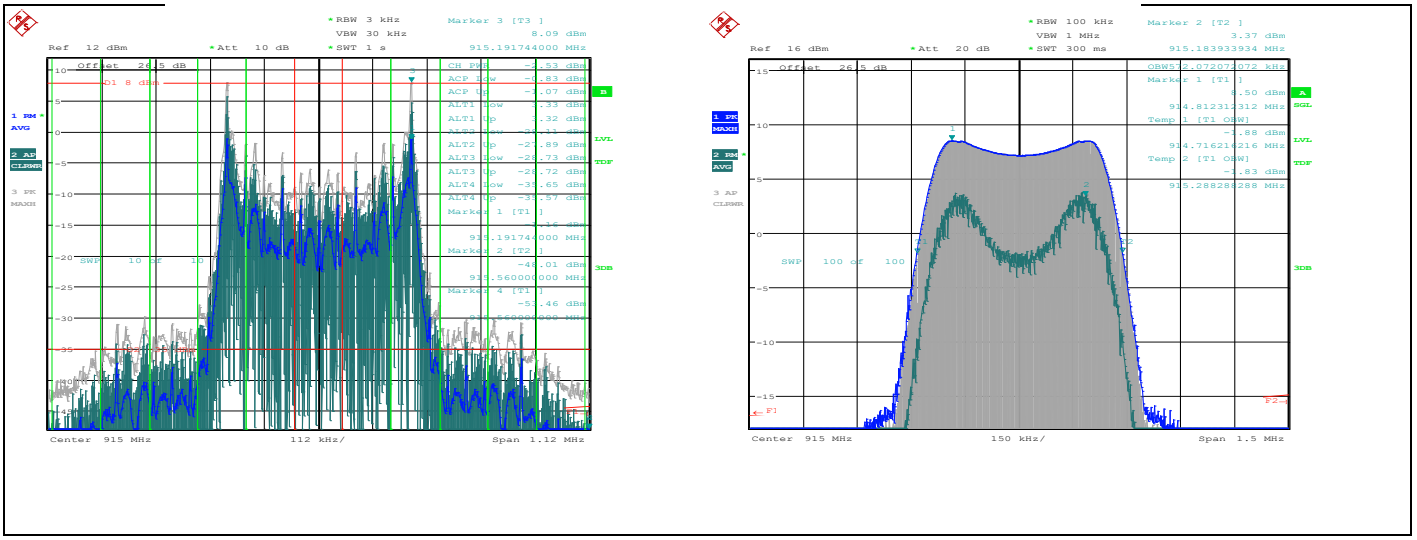
Table F2 **15.247/RSS-247 - 900M - DTS - Power Spectral Density & Bandedge Emissions**

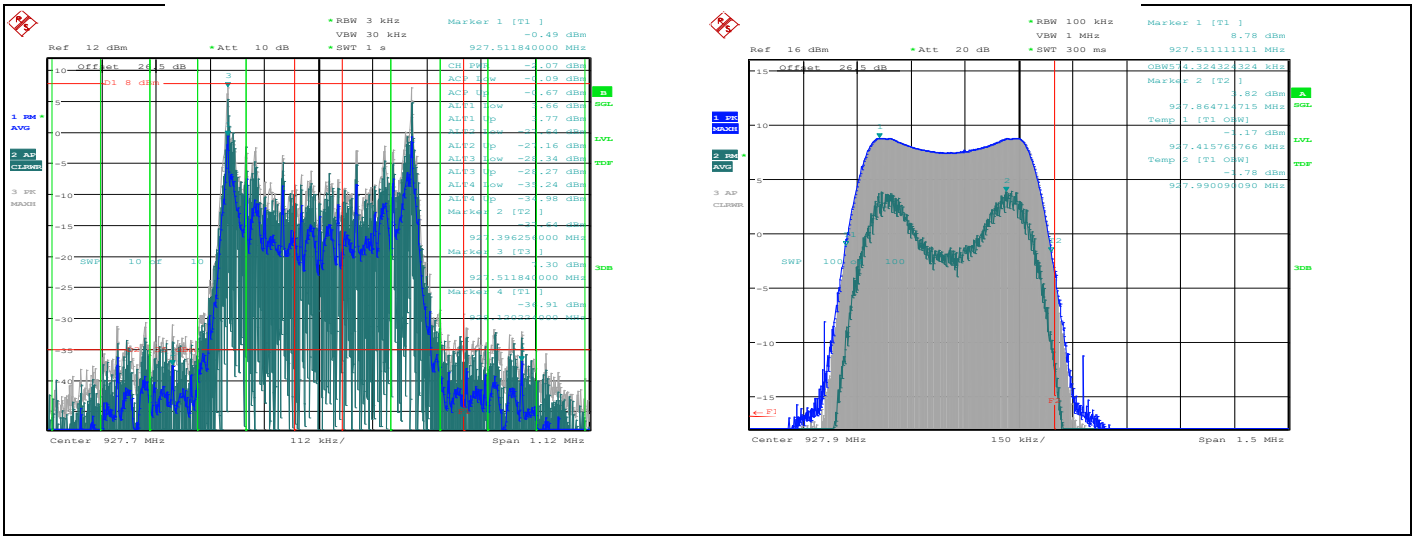
Mode	Frequency MHz	Modulation	Average PSD dBm/3kHz	Spurious & Bandedge dBc/100kHz	PSD Limit dBm/3kHz	Spurious Limit dBc/100kHz	Margin dB	
EUT-A/B	902.3	2-GFSK	**-1.5**		8.0		9.5	PASS
EUT-A/B	915.0	2-GFSK	**-1.2**		8.0		9.2	PASS
EUT-A/B	927.7	2-GFSK	**-0.5**		8.0		8.5	PASS
EUT-A/B	902.3	2-GFSK		**31.4**		30.0	1.4	PASS
EUT-A/B	915.0	2-GFSK		**30.8**		30.0	0.8	PASS
EUT-A/B	927.7	2-GFSK		**31.5**		30.0	1.5	PASS

Notes: 1.
2.
3.

Figure F1 **EN 301 893 - PSD, OBW, Mask Emissions - TX - 802.11a/n20M - Worst-case**







Observations:	
Notes:	**Worst-case data shown includes evaluation of EUT-A & EUT-B at least three frequencies.**

Appendix G: FREQUENCY STABILITY DATA

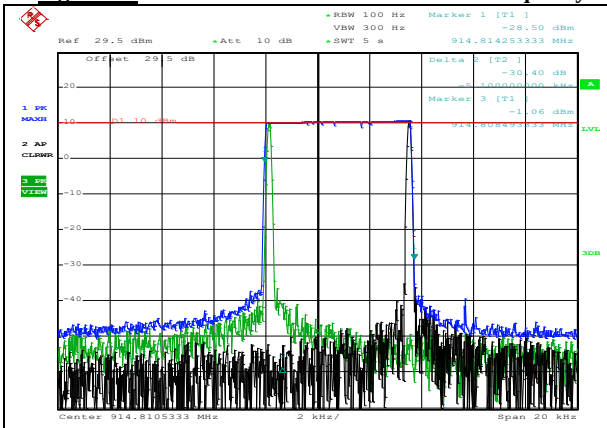
Table G1 15.247/RSS-247 - 900M - DTS - Frequency Stability Data

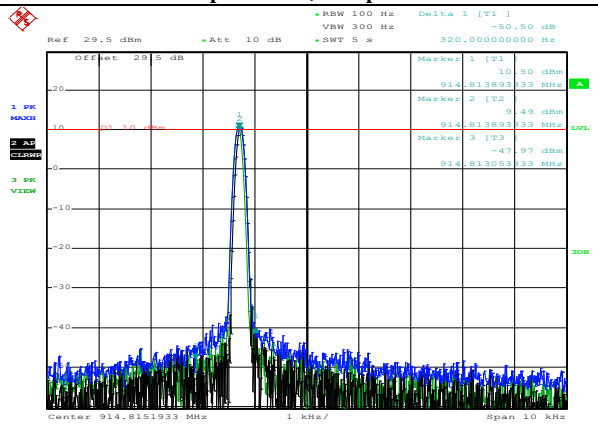
Procedure	Reference Frequency MHz		Deviation Hz	Deviation ppm	
Input voltage variation	**915.0**		**320**	**0.35**	
Temperature variation	**915.0**		**5109**	**5.58**	

Notes:
1. *Frequency stability performed with CW signal or modulated signal and is assumed to represent all TX modes.*
2. *Variation over input voltage range of 85 - 115% of AC or manufacturer specified DC input range..*
3. *Variation over temperature or manufacturer declared temperature range or -20C - +50C.*
4. *EUT monitored continuously using maxhold or average to record frequency deviation envelope.*
5. *Certification of CC devices (multiple rule parts) may comply based on frequency stability data of an alternate band unless manufacturer declaration of multiple oscillators used for reference.*

Observations:	
Notes:	

Figure G1 15.247/RSS-247 - 900M - DTS - Frequency Stability Data - Variation over Input Power, Temperature



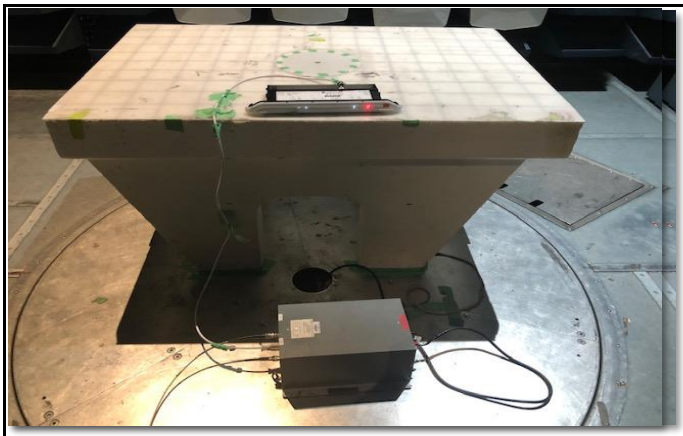


Appendix R: TEST SETUP PHOTOS

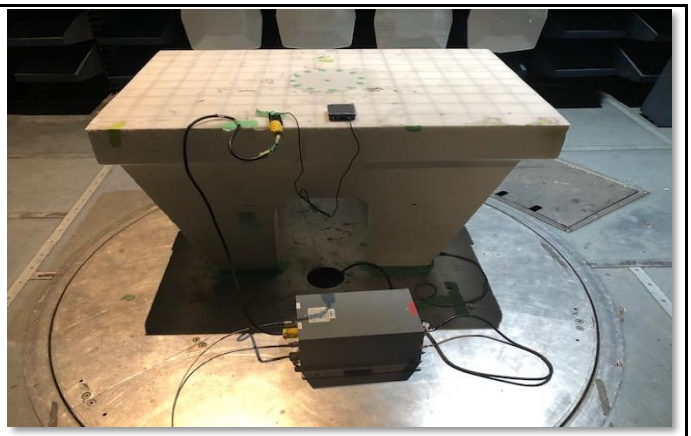
Figures R1-R8

EUT-A: LAN2RF

EUT-B: ICX120



CEAC - Conducted Emissions - EUT-B



CEAC - Conducted Emissions - EUT-A

STAB - Frequency Stability

STAB - Frequency Stability

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Appendix S: ABBREVIATIONS

Abbreviation	Definition
AC	Alternating Current
AFH	Adaptive Frequency Hopping (equipment)
NAFH	Non-Adaptive Frequency Hopping (equipment)
AE	Auxiliary Equipment
CDN	Coupling/Decoupling Network
CE	European Conformity
CISPR	Comité International Spécial des Perturbations Radioélectriques
DC	Direct Current
DTS	Digitial Transmission System (equipment utilizing wide band modulations other than FHSS)
EFT	Electrical Fast Transient
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EIRP	Equivalent Isotropic Radiated Power
ESD	Electrostatic Discharge
EUT	Equipment Under Test
FCC	Federal Communications Commission
FHS	Frequency Hopping System (or FHSS)
FHSS	Frequency Hopping Spread Spectrum (or FHS)
ICES	Interference Causing Equipment Standard (Canada)
ISED	Innovation, Science and Economic Development (Canada)
LISN	Line Impedance Stabilizing Network
OATS	Open Area Test Site
RF	Radio Frequency
RMS	Root Mean Square
RX	Receiver or receive mode of operation
SAC	Semi-Anechoic Chamber
TX	Transmitter or transmit mode of operation
UNII	Unlicensed National Information Infrastructure

[END OF REPORT]