

# RADIO TEST REPORT

Report ID:

**REP051835**

Project number:

**PRJ0061410**

Type of assessment:

**Original testing, Limited Modular Approval**

Type of radio equipment:

**Spread Spectrum/Digital Device (902–928 MHz)**

Equipment class:

**DSS**

Applicant:

**Xtract One Technologies Inc**

Description of product:

**RF SYNC module**

Model/HVIN:

**C02-XOG-02000**

Product marketing name (PMN):

**X1-SYNC**

FCC identifier:

**FCC ID: 2BH2H-C02XOG02000**

ISED certification number:

**IC: 32822-C02XOG02000**

Specifications:

- ◆ **FCC 47 CFR Part 15 Subpart C, §15.247**
- ◆ **RSS-247, Issue 3, August 2023, Section 5**

Date of issue: August 29, 2024

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**Fahar Abdul Sukkoor, EMC/RF Specialist**

Tested by



Signature

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Reviewed by



Signature

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ANAB File Number: AT-3195 (Ottawa); AT-3193 (Pointe-Claire); AT-3194 (Cambridge)



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Lab locations

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Test site identifier	<b>Organization</b>	<b>Ottawa</b>	<b>Montreal</b>
	FCC:	CA2040	CA2041
	ISED:	2040A-4	2040G-5
Website	<a href="http://www.nemko.com">www.nemko.com</a>		

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Limits of responsibility

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Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contained in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

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## Section 1 Report summary

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### 1.1 Test specifications

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FCC 47 CFR Part 15, Subpart C, Clause 15.247	Operation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–585 MHz
RSS-247, Issue 3, August 2023, Section 5	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

### 1.2 Test methods

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558074 D01 15.247 Meas Guidance v05r02 (April 2, 2019)	Guidance for compliance measurements on digital transmission system, frequency hopping spread spectrum system, and hybrid system devices operating under section 15.247 of the FCC rules.
DA 00-705, Released March 30, 2000	Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems
RSS-Gen, Issue 5, April 2018	General Requirements for Compliance of Radio Apparatus
ANSI C63.10 v2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

### 1.3 Exclusions

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None

### 1.4 Statement of compliance

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In the configuration tested, the EUT was found compliant.

Testing was performed against all relevant requirements of the test standard except as noted in section 1.3 above. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

Determining compliance is based on the results of the compliance measurement, not taking into account measurement uncertainty, in accordance with section 1.3 of ANSI C63.10 v2013.

See "Summary of test results" for full details.

### 1.5 Test report revision history

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**Table 1.5-1: Test report revision history**

Revision #	Date of issue	Details of changes made to test report
REP051835	August 29, 2024	Original report issued

## Section 2 Engineering considerations

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### 2.1 Modifications incorporated in the EUT for compliance

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There were no modifications performed to the EUT during this assessment.

### 2.2 Technical judgment

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None

### 2.3 Model variant declaration

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There were no model variants declared by the applicant.

### 2.4 Deviations from laboratory tests procedures

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No deviations were made from laboratory procedures.

## Section 3 Test conditions

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### 3.1 Atmospheric conditions

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Temperature	15 °C – 35 °C
Relative humidity	20 % – 75 %
Air pressure	86 kPa (860 mbar) – 106 kPa (1060 mbar)

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

### 3.2 Power supply range

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The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages  $\pm 5\%$ , for which the equipment was designed.

## Section 4 Information provided by the applicant

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### 4.1 Disclaimer

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This section contains information provided by the applicant and has been utilized to support the test plan. Inaccurate information provided by the applicant can affect the validity of the results contained within this test report. Nemko accepts no responsibility for the information contained within this section and the impact it may have on the test plan and resulting measurements.

### 4.2 Applicant / Manufacturer

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Applicant name	Xtract One Technologies Inc
Applicant address	257 Adelaide St W, Suite 400, Toronto, ON M5H 1X9
Manufacturer name	Same as applicant
Manufacturer address	Same as applicant

### 4.3 EUT information

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Product description	RF SYNC module
Model / HVIN	C02-XOG-02000
PMN:	X1-SYNC
HMN:	S00-XOG-02000
Serial number	230317340005
Power supply requirements	AC: 120-240 V, 50/60 Hz power cord
Product description and theory of operation	The EUT is intended to be a low power RF unit to operate in the sub-GHz ISM band range of frequencies. Intended use is to provide a PING/SYNC signal that other RF units will receive to all stay IN-SYNC with each other. This custom product will be inserted for use inside security gateway pillars.

#### 4.4 Radio technical information

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Category of Wideband Data Transmission equipment	<input checked="" type="checkbox"/> Frequency Hopping Spread Spectrum (FHSS) equipment <input type="checkbox"/> Other types of Wideband Data Transmission equipment (e.g. DSSS, OFDM, etc.).		
Frequency band	902–928 MHz		
Frequency Min	902.325 MHz		
Frequency Max	927.675 MHz		
Number of hopping channels	25		
RF power Max (W), Conducted	0.0804 W and (19.05 dBm)		
Measured BW (kHz), 99% OBW	388.97 kHz		
Type of modulation	2GFSK		
Emission classification	F1D		
Transmitter spurious, dB $\mu$ V/m @ 3 m	70.81(pk) & 41.61 (avg) @2746 MHz (mid channel)		
Antenna information	Manufacturer:	RF Solutions	Quectel
	Antenna type:	Rugged Puck Antenna	Puck Antenna
	Model:	ANT-GSMPUKS-IP67	YB0010AA
	Gain:	3 dBi	2.94 dBi
			2.8 dBi

#### 4.5 EUT setup details

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##### 4.5.1 Radio exercise details

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Operating conditions	EUT set transmit at max. input signal. EUT is made to transmit on (low, mid, and high) channels with hopping OFF and Frequency hopping mode (25 channels) for measurements. For receiver testing, EUT set to receiver mode for measurements.
Transmitter state	Transmitter set into continuous mode.
Receiver state	Transmitter set into receiver mode

## 4.5.2 EUT setup configuration

**Table 4.5-1: EUT interface ports**

Description	Qty.
AC power port	1
USB port (factory)	1

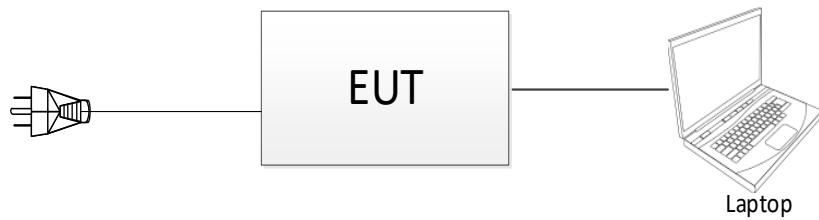
**Table 4.5-2: Support equipment**

Description	Brand name	Model, Part number, Serial number, Revision level
Laptop	Lenovo	PN: SL11B97086, SN: PF-3F45G3

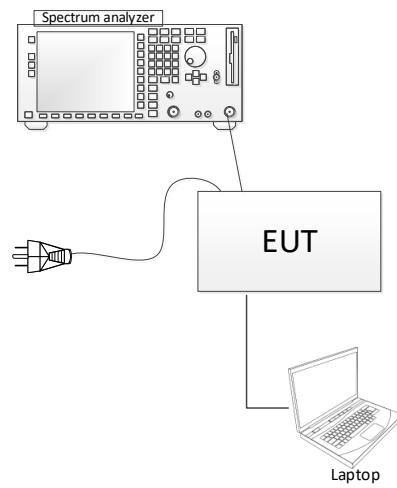
**Table 4.5-3: Inter-connection cables**

Cable description	From	To	Length (m)
AC power cable	EUT	AC mains	>3
USB cable	EUT	laptop	>3

EUT setup configuration, continued



**Figure 4.5-1: Radiated testing block diagram.**



**Figure 4.5-2: Antenna port testing block diagram.**

## Section 5 Summary of test results

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### 5.1 Testing period

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Test start date	July 16, 2024	Test end date	July 19, 2024
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### 5.2 Sample information

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Receipt date	July 16, 2024	Nemko sample ID number(s)	PRJ00614100001
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### 5.3 FCC test results

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**Table 5.3-1: FCC requirements results**

Part	Test description	Verdict
<b>Generic requirements</b>		
§15.207(a)	Conducted limits <sup>1</sup>	Pass
§15.31(e)	Variation of power source	Pass
§15.31(m)	Number of tested frequencies	Pass
§15.203	Antenna requirement	Pass
§15.247(c)(1)	Fixed point-to-point operation with directional antenna gains greater than 6 dBi	Not applicable
§15.247(c)(2)	Transmitters operating in the 2400–2483.5 MHz band that emit multiple directional beams	Not applicable <sup>2</sup>
2§15.247(d)	Spurious emissions	Pass
§15.247(f)	Time of occupancy for hybrid systems	Not applicable <sup>2</sup>
<b>FHSS specific requirements<sup>2</sup></b>		
§15.247(a)(1)(i)	Requirements for operation in the 902–928 MHz band	Pass
§15.247(b)(1)	Maximum peak output power in the 2400–2483.5 MHz band and 5725–5850 MHz band	Not applicable
§15.247(b)(2)	Maximum peak output power in the 902–928 MHz band	Pass
<b>DTS specific requirements<sup>2</sup></b>		
§15.247(a)(2)	Minimum 6 dB bandwidth	Not applicable
§15.247(b)(3)	Maximum peak output power	Not applicable
§15.247(e)	Power spectral density	Not applicable

Notes: <sup>1</sup>EUT is an AC powered device.

<sup>2</sup> EUT transmits FHSS signal at 902-928 MHz.

## 5.4 ISED test results

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**Table 5.4-1: ISED requirements results**

Part	Test description	Verdict
<b>Generic requirements</b>		
RSS-Gen, 7.3	Receiver radiated emission limits	Pass <sup>1</sup>
RSS-Gen, 7.4	Receiver conducted emission limits	Pass <sup>1</sup>
RSS-Gen, 6.9	Operating bands and selection of test frequencies	Pass
RSS-Gen, 8.8	AC powerline conducted emissions limits	Pass <sup>2</sup>
RSS-247, 5.5	Unwanted emissions	Pass
RSS-247, 5.3	Hybrid Systems	
RSS-247, 5.3 (a)	Digital modulation turned off	Not applicable
RSS-247, 5.3 (b)	Frequency hopping turned off	Not applicable
<b>FHSS specific requirements</b>		
RSS-247, 5.1 (b)	Minimum channel spacing	Pass
RSS-247, 5.1 (c)	Number of hopping channels, dwell time and occupied channel bandwidth in the 902–928 MHz band	Pass
RSS-247, 5.4 (a)	Transmitter output power and e.i.r.p. requirements in the 902–928 MHz band	Pass
RSS-247, 5.4 (e)	Transmitter e.i.r.p. requirements for point-to-point systems in 2400–2483.5 MHz and 5725–5850 MHz band	Not applicable <sup>3</sup>
RSS-247, 5.4 (f)	Transmitter requirements for operation in the 2400–2483.5 MHz band with multiple directional beams	Not applicable <sup>3</sup>
<b>DTS specific requirements <sup>3</sup></b>		
2RSS-247, 5.2 (a)	Minimum 6 dB bandwidth	Not applicable
RSS-247, 5.2 (b)	Maximum power spectral density	Not applicable
RSS-247, 5.4 (d)	Transmitter output power and e.i.r.p. requirements for systems employing digital modulation techniques	Not applicable
RSS-247, 5.4 (e)	Transmitter e.i.r.p. requirements for point-to-point systems in 2400–2483.5 MHz and 5725–5850 MHz band	Not applicable
RSS-247, 5.4 (f)	Transmitter requirements for operation in the 2400–2483.5 MHz band with multiple directional beams	Not applicable

Notes:

<sup>1</sup>According to sections 5.2 and 5.3 of RSS-Gen, Issue 5 the EUT have a stand-alone receiver

<sup>2</sup>EUT is an AC powered device.

<sup>3</sup>EUT transmits FHSS signal at 902- 928 MHz signal

## Section 6 Test equipment

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### 6.1 Test equipment list

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**Table 6.1-1: Equipment list**

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Receiver/spectrum analyzer	Rohde & Schwarz	ESR26	FA002969	1 year	May 17, 2025
50 Ω coax cable	Rohde & Schwarz	None	FA003074	1 year	July 27, 2024
Two-line v-network	Rohde & Schwarz	ENV216	FA002965	1 year	November 30, 2024
3 m EMI test chamber	TDK	SAC-3	FA003012	1 year	January 22, 2025
Spectrum analyzer	Rohde & Schwarz	FSW43	FA002971	1 year	November 30, 2024
Horn antenna (1–18 GHz)	ETS Lindgren	3117	FA002911	1 year	May 16, 2025
Preamp (1–18 GHz)	ETS Lindgren	124334	FA002956	1 year	April 2, 2025
Bilog antenna (30–2000 MHz)	SUNAR	JB1	FA003010	1 year	August 13, 2024
50 Ω coax cable	Huber + Suhner	None	FA003046	1 year	July 27, 2024
50 Ω coax cable	Huber + Suhner	None	FA003402	1 year	July 27, 2024
Signal Generator	Rohde & Schwarz	SMW200A	FA002970	1 year	Dec 08, 2024

Note:

All equipment related to the contribution of measurement has been included in this list. Such items include, but are not limited to, cables, attenuators, directional couplers, and pre-amps.

**Table 6.1-2: Automation software details**

Test description	Manufacturer of Software	Details
Radiated emissions	Rohde & Schwarz	EMC32, Software for EMC Measurements, Version 10.60.00
Conducted emissions	Rohde & Schwarz	RS Commander Version 2.4.2
AC powerline conducted emissions	Rohde & Schwarz	EMC32, Software for EMC Measurements, Version 10.60.00

**Table 6.1-3: Measurement uncertainty calculations based on equipment list**

Measurement	Measurement uncertainty, ±dB
AC power line conducted emissions	3.01
Radiated spurious emissions (30 MHz to 1 GHz)	4.27
Radiated spurious emissions (1 GHz to 6 GHz)	4.74
Radiated spurious emissions (6 GHz to 18 GHz)	5.04
RF Output power measurement using Spectrum Analyzer <sup>1</sup>	0.71
Conducted spurious emissions	0.90
Other antenna port measurements	0.81
Notes:	UKAS Lab 34, TIA-603 and ETSI TR 100 028-1&2 have been used as guidance for measurement uncertainty reasonable estimations with regards to previous experience and validation of data. Nemko Canada Inc. follows these test methods in order to satisfy ISO/IEC 17025 requirements for estimation of uncertainty of measurement for wireless products. Measurement uncertainty calculations assume a coverage factor of K = 2 with 95% certainty.



## Section 7 Testing data

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### 7.1 Variation of power source

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#### 7.1.1 References, definitions and limits

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##### FCC §15.31 (e):

For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

#### 7.1.2 Test summary

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Verdict	Pass		
Test date	July 16, 2024	Temperature	23 °C
Tested by	Fahar Abdul Sukkoor	Air pressure	1010 mbar
Test location	Cambridge	Relative humidity	40 %

#### 7.1.3 Observations, settings and special notes

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The testing was performed as per ANSI C63.10 Section 5.13.

- a) Where the device is intended to be powered from an external power adapter, the voltage variations shall be applied to the input of the adapter provided with the device at the time of sale. If the device is not marketed or sold with a specific adapter, then a typical power adapter shall be used.
- b) For devices, where operating at a supply voltage deviating  $\pm 15\%$  from the nominal rated value may cause damages or loss of intended function, test to minimum and maximum allowable voltage per manufacturer's specification and document in the report.
- c) For devices with wide range of rated supply voltage, test at 15% below the lowest and 15% above the highest declared nominal rated supply voltage.
- d) For devices obtaining power from an input/output (I/O) port (USB, firewire, etc.), a test jig is necessary to apply voltage variation to the device from a support power supply, while maintaining the functionalities of the device.
- e) For battery-operated equipment, the equipment tests shall be performed using a variable power supply.

#### 7.1.4 Test data

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EUT Power requirements:

If EUT is an AC or a DC powered, was the noticeable output power variation observed?

AC  DC  Battery

YES  NO  N/A

If EUT is battery operated, was the testing performed using fresh batteries?

YES  NO  N/A

If EUT is rechargeable battery operated, was the testing performed using fully charged batteries?

YES  NO  N/A

## 7.2 Number of frequencies

### 7.2.1 References, definitions and limits

#### FCC §15.31:

(m) Measurements on intentional radiators or receivers shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table.

#### RSS-Gen, Clause 6.9:

Except where otherwise specified, measurements shall be performed for each frequency band of operation for which the radio apparatus is to be certified, with the device operating at the frequencies in each band of operation shown in table below. The frequencies selected for measurements shall be reported in the test report.

*Table 7.2-1: Frequency Range of Operation*

Frequency range over which the device operates (in each band)	Number of test frequencies required	Location of measurement frequency inside the operating frequency range
1 MHz or less	1	Center (middle of the band)
1–10 MHz	2	1 near high end, 1 near low end
Greater than 10 MHz	3	1 near high end, 1 near center and 1 near low end

Notes: "near" means as close as possible to or at the centre / low end / high end of the frequency range over which the device operates.

### 7.2.2 Test summary

Verdict	Pass		
Test date	July 16, 2024	Temperature	23 °C
Tested by	Fahar Abdul Sukkoor	Air pressure	1010 mbar
Test location	Cambridge	Relative humidity	40 %

### 7.2.3 Observations, settings and special notes

#### ANSI C63.10, Clause 5.6.2.1:

The number of channels tested can be reduced by measuring the center channel bandwidth first and then applying the following relaxations as appropriate:

- For each operating mode, if the measured channel bandwidth on the middle channel is at least 150% of the minimum permitted bandwidth, then it is not necessary to measure the bandwidth on the high and low channels.
- For multiple-input multiple-output (MIMO) systems, if the measured channel bandwidth on testing the middle channel exceeds the minimum permitted bandwidth by more than 50% on one transmit chain, then it is not necessary to repeat testing on the other chains.
- If the measured channel bandwidth on the middle channel is less than 50% of the maximum permitted bandwidth, then it is not necessary to measure the bandwidth on the high and low channels.

#### ANSI C63.10, Clause 5.6.2.2:

For devices with multiple operating modes, measurements on the middle channel can be used to determine the worst-case mode(s). The worst-case modes are as follows:

- Band edge requirements—Measurements on the mode with the widest bandwidth can be used to cover the same channel (center frequency) on modes with narrower bandwidth that have the same or lower output power for each modulation family (e.g., OFDM and direct sequence spread spectrum).
- Spurious emissions—Measure the mode with the highest output power and the mode with the highest output power spectral density for each modulation family (e.g., OFDM and direct sequence spread spectrum).
- In-band PSD—Measurements on the mode with the narrowest bandwidth can be used to cover all modes within the same modulation family of an equal or lower output power provided the result is less than 50% of the limit.

#### 7.2.4 Test data

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**Table 7.2-2: Test channels selection**

<b>Start of Frequency range, MHz</b>	<b>End of Frequency range, MHz</b>	<b>Frequency range bandwidth, MHz</b>	<b>Low channel, MHz</b>	<b>Mid channel, MHz</b>	<b>High channel, MHz</b>
902	928	26	902.325	915.325	927.675

## 7.3 Antenna requirement

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### 7.3.1 References, definitions, and limits

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#### 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 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.

#### FCC §15.247:

- (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:
- (4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### RSS-Gen, Clause 6.8:

The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report.

### 7.3.2 Test summary

---

Verdict	Pass		
Test date	July 16, 2024	Temperature	23 °C
Tested by	Fahar Abdul Sukkoor	Air pressure	1010 mbar
Test location	Cambridge	Relative humidity	40 %

### 7.3.3 Observations, settings and special notes

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The antenna is installed and sealed inside the host gateway system. Only XtractOne Field Service Engineers would be able to access it, as customers do not have access to the interior of the end product, which would void the warranty.

#### 7.3.4 Test data

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Must the EUT be professionally installed?  YES  NO

Does the EUT have detachable antenna(s)?  YES  NO

If detachable, is the antenna connector(s) non-standard?  YES  NO  N/A

**Table 7.3-1: Antenna information**

Antenna type	Manufacturer	Model number	Maximum gain	Connector type
GSM Rugged Puck Antenna	RF Solutions	ANT-GSMPUKS-IP67	3.00 dBi	SMA male
Puck Antenna	Quectel	YB0010AA	2.94 dBi	SMA male
Adhesive mount	2J	2J5515P	2.80 dBi	SMA male

## 7.4 AC power line conducted emissions limits

### 7.4.1 References, definitions and limits

#### FCC §15.207:

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50  $\Omega$  line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

#### ANSI C63.10, Clause 6.2:

If the EUT normally receives power from another device that in turn connects to the public utility ac power lines, measurements shall be made on that device with the EUT in operation to demonstrate that the device continues to comply with the appropriate limits while providing the EUT with power. If the EUT is operated only from internal or dedicated batteries, with no provisions for connection to the public utility ac power lines (600 VAC or less) to operate the EUT (such as an adapter), then ac power-line conducted measurements are not required.

For direct current (dc) powered devices where the ac power adapter is not supplied with the device, an "off-the-shelf" unmodified ac power adapter shall be used. If the device is supposed to be installed in a host (e.g., the device is a module or PC card), then it is tested in a typical compliant host.

#### RSS-Gen, Clause 8.8:

A radio apparatus that is designed to be connected to the public utility (AC) power line shall ensure that the radio frequency voltage, which is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz, shall not exceed the limits in table below.

Unless the requirements applicable to a given device state otherwise, for any radio apparatus equipped to operate from the public utility AC power supply either directly or indirectly (such as with a battery charger), the radio frequency voltage of emissions conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in table below. The more stringent limit applies at the frequency range boundaries.

**Table 7.4-1: Conducted emissions limit**

Frequency of emission, MHz	Conducted emissions limit, dB $\mu$ V	
	Quasi-peak	Average**
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

Notes: \* - The level decreases linearly with the logarithm of the frequency.

\*\* - A linear average detector is required.

### 7.4.2 Test summary

Verdict	Pass		
Test date	July 19, 2024	Temperature	23 °C
Tested by	Fahar Abdul Sukkoor	Air pressure	1010 mbar
Test location	Cambridge	Relative humidity	40 %

#### 7.4.3 Observations, settings and special notes

Port under test – Coupling device	AC power port – Artificial Mains Network (AMN)
EUT power input during test	120 V <sub>AC</sub> , 60 Hz
EUT setup configuration	Table top
Measurement details	A preview measurement was generated with the receiver in continuous scan mode. Emissions detected within 10 dB or above the limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.
Additional notes:	<ul style="list-style-type: none"> <li>– The EUT was set up as tabletop configuration per ANSI C63.10-2013 measurement procedure.</li> <li>– The spectral scan has been corrected with transducer factors (i.e. cable loss, LISN factors, and attenuators) for determination of compliance. Correction factor (dB) = LISN factor IL (dB) + cable loss (dB) + attenuator (dB)</li> <li>– Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.</li> <li>– EUT is tested in both transmit and receive mode. The worst case plots are shown in test data below.</li> </ul>

#### Receiver settings:

Resolution bandwidth	9 kHz
Video bandwidth	30 kHz
Detector mode	Peak and Average (Preview), Quasi-peak and CAverage (Final)
Trace mode	Max Hold
Measurement time	100 ms (Preview), 160 ms (Final)

#### 7.4.4 Test data

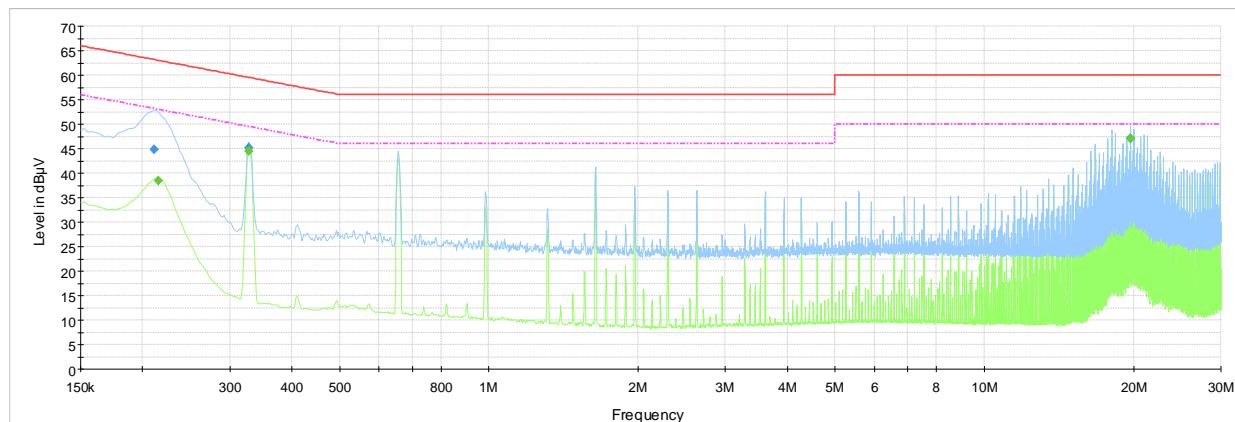
**Table 7.4-2: Conducted emissions results on phase line.**

Frequency, MHz	CAverage result, dB $\mu$ V	CAverage limit, dB $\mu$ V	CAverage margin, dB	Correction factor, dB
0.33	44.4	49.5	5.1	15.4
19.70	47.0	50.0	3.0	15.8

**Table 7.4-3: Conducted emissions results on neutral line.**

Frequency, MHz	CAverage result, dB $\mu$ V	CAverage limit, dB $\mu$ V	CAverage margin, dB	Correction factor, dB
0.33	44.2	49.5	5.3	15.4
19.70	46.9	50.0	3.1	15.8

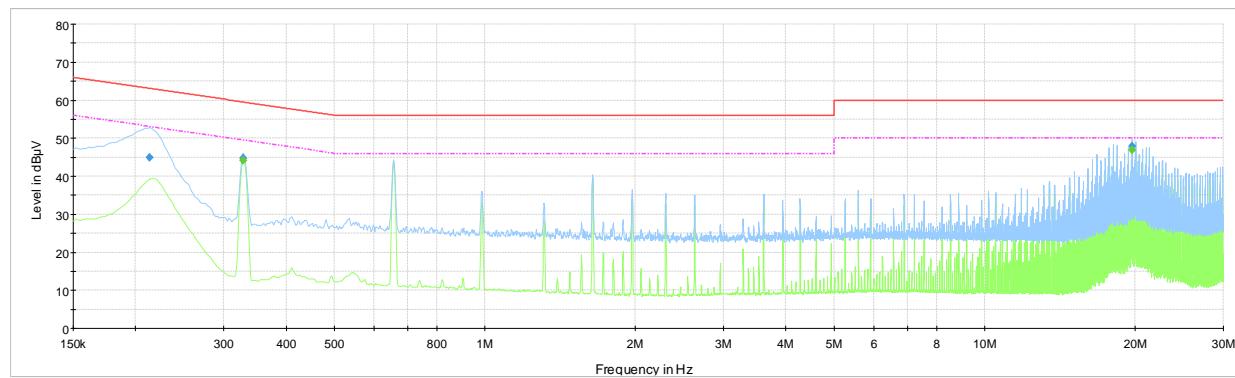
Test data, continued



PRJ0061410 CE 150 kHz - 30 MHz 120 Vac 60 Hz phase

— Preview Result 2-AVG  
— Preview Result 1-PK+  
— CISPR 32 Limit - Class B, Mains (Quasi-Peak)  
— CISPR 32 Limit - Class B, Mains (Average)  
◆ Final\_Result QPK  
◆ Final\_Result CAV

**Plot 7.4-1: Conducted emissions on phase line**



PRJ0061410 CE 150 kHz - 30 MHz 120 Vac 60 Hz neutral

— Preview Result 2-AVG  
— Preview Result 1-PK+  
— CISPR 32 Limit - Class B, Mains (Quasi-Peak)  
— CISPR 32 Limit - Class B, Mains (Average)  
◆ Final\_Result QPK  
◆ Final\_Result CAV

**Plot 7.4-2: Conducted emissions on neutral line**

## 7.5 Frequency Hopping Systems requirements, 900 MHz operation

### 7.5.1 References, definitions and limits

#### FCC §15.247:

- (a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:
  - (1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.
  - (i) For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.
  - (f) For the purposes of this section, hybrid systems are those that employ a combination of both frequency hopping and digital modulation techniques. The frequency hopping operation of the hybrid system, with the direct sequence or digital modulation operation turned-off, shall have an average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4. The power spectral density conducted from the intentional radiator to the antenna due to the digital modulation operation of the hybrid system, with the frequency hopping operation turned off, shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

*Table 7.5-1: Summary of the basic requirements*

$P_{\max-pk} \leq 1 \text{ W}$	$P_{\max-pk} \leq 0.25 \text{ W}$
$N_{ch} \geq 50$	$25 \leq N_{ch} < 50$
$\Delta f \geq \text{MAX} \{25 \text{ kHz}, \text{BW20 dB}\}$	$\Delta f \geq \text{MAX} \{25 \text{ kHz}, \text{BW20 dB}\}$
$\text{BW20 dB} \leq 250 \text{ kHz}$	$250 \text{ kHz} < \text{BW20 dB} \leq 500 \text{ kHz}$
$T_{ch} \leq 0.4 \text{ s for } T = 20 \text{ s}$	$T_{ch} \leq 0.4 \text{ s for } T = 10 \text{ s}$

Note:  $t_{ch}$  = average time of occupancy;  $T$  = period;  $N_{ch}$  = # hopping frequencies;  $BW$  = bandwidth;  $\Delta f$  = hopping channel carrier frequency separation

#### RSS-247, Clause 5.1:

- a. The bandwidth of a frequency hopping channel is the 20 dB emission bandwidth, measured with the hopping stopped. The system's radio frequency (RF) bandwidth is equal to the channel bandwidth multiplied by the number of channels in the hopset. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.
- b. FHSs shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.
- c. For FHSs in the band 902–928 MHz: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 20-second period. If the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 10-second period. The maximum 20 dB bandwidth of the hopping channel shall be 500 kHz.

#### RSS-247, Clause 5.3:

Hybrid systems employ a combination of both frequency hopping and digital transmission techniques and shall comply with the following:

- a. With the digital transmission operation of the hybrid system turned off, the frequency hopping operation shall have an average time of occupancy on any frequency not exceeding 0.4 seconds within a duration in seconds equal to the number of hopping frequencies multiplied by 0.4.

### 7.5.2 Test summary

Verdict	Pass		
Test date	July 17, 2024	Temperature	23 °C
Tested by	Fahar Abdul Sukkoor	Air pressure	1010 mbar
Test location	Cambridge	Relative humidity	40 %

### 7.5.3 Observations, settings and special notes

Carrier frequency separation was tested per ANSI C63.10 subclause 7.8.2. Spectrum analyser settings:

Resolution bandwidth	Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
Video bandwidth	$\geq$ RBW
Frequency span	Wide enough to capture the peaks of two adjacent channels
Detector mode	Peak
Trace mode	Max Hold

Number of hopping frequencies was tested per ANSI C63.10 subclause 7.8.3. Spectrum analyser settings:

Resolution bandwidth	To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
Video bandwidth	$\geq$ RBW
Frequency span	The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
Detector mode	Peak
Trace mode	Max Hold

Time of occupancy (dwell time) was tested per ANSI C63.10 subclause 7.8.4. Spectrum analyser settings:

Resolution bandwidth	shall be $\leq$ channel spacing and where possible RBW should be set $\gg 1 / T$ , where T is the expected dwell time per channel.
Video bandwidth	$\geq$ RBW
Frequency span	Zero span, centered on a hopping channel.
Detector mode	Peak
Trace mode	Max Hold

20 dB bandwidth was tested per ANSI C63.10 subclause 6.9.2. Spectrum analyser settings:

Resolution bandwidth	$\geq$ 1–5% of the 20 dB bandwidth
Video bandwidth	$\geq$ RBW
Frequency span	approximately 2 to 5 times the 20 dB bandwidth, centered on a hopping channel
Detector mode	Peak
Trace mode	Max Hold

### 7.5.4 Test data

**Table 7.5-2: 20 dB bandwidth results**

Frequency, MHz	20 dB bandwidth, kHz
902.325	310.50
915.325	296.25
927.675	307.50

Notes: 20dB bandwidth limit should be between 250 kHz to 500 kHz

Test data, continued

**Table 7.5-3: 99% occupied bandwidth results**

Frequency, MHz	99% occupied bandwidth, kHz
902.325	388.97
915.325	384.99
927.675	371.82

Notes: There is no 99% occupied bandwidth limit in the standard's requirements the measurement results provided for information purposes only.

**Table 7.5-4: Carrier frequency separation results**

Carrier frequency separation, kHz	Minimum limit, kHz	Margin, kHz
651.0	310.50	340.5

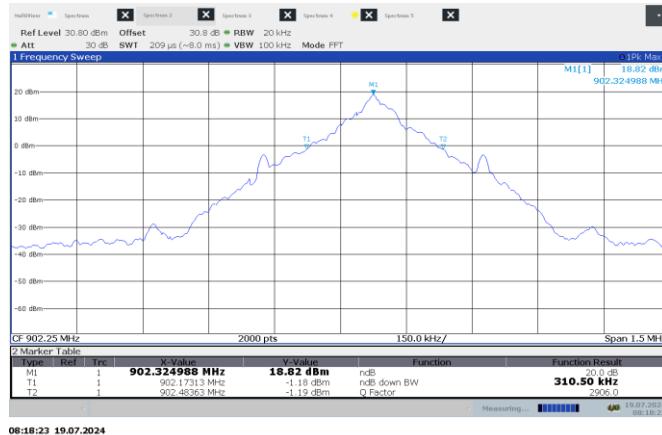
**Table 7.5-5: Number of hopping frequencies results**

Number of hopping frequencies	Minimum limit
25	25

**Table 7.5-6: Average time of occupancy results**

Dwell time of each pulse, ms	Number of pulses within period	Total dwell time within period, ms	Limit, ms	Margin, ms
0.3	6	1.8	400	398

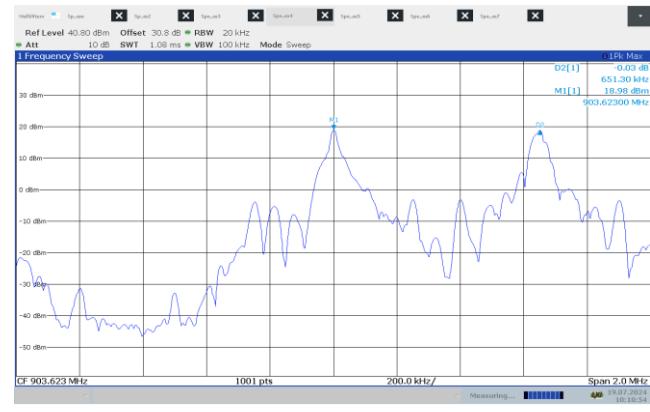
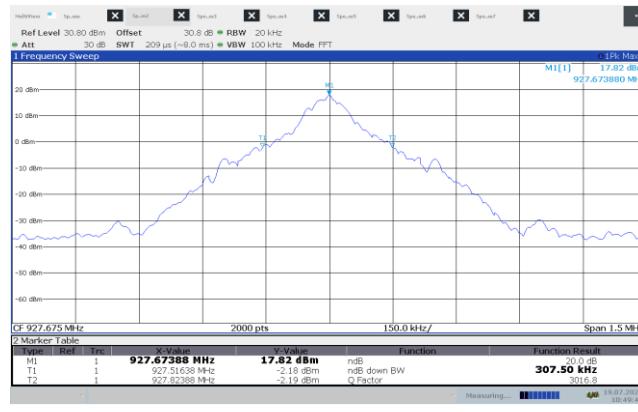
Notes: Measurement Period is 10 s



**Figure 7.5-1: 20 dB bandwidth on low channel**

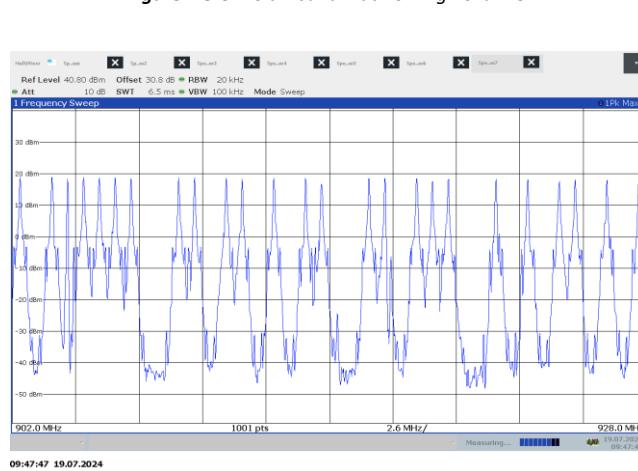


**Figure 7.5-2: 20 dB bandwidth on mid channel**

**Test data, continued**


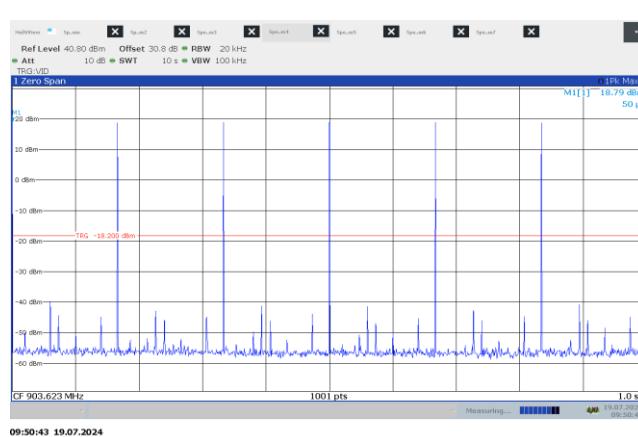
10:49:48 19.07.2024

10:10:55 19.07.2024



09:47:47 19.07.2024

10:21:31 19.07.2024



09:50:43 19.07.2024

08:17:49 19.07.2024

## 7.6 Transmitter output power and e.i.r.p. requirements for FHSS 900 MHz

### 7.6.1 References, definitions and limits

#### FCC §15.247:

(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:

(2) For frequency hopping systems operating in the 902–928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### RSS-247, Clause 5.4:

Devices shall comply with the following requirements, where applicable:

a. For FHSSs operating in the band 902–928 MHz, the maximum peak conducted output power shall not exceed 1.0 W, and the e.i.r.p. shall not exceed 4 W if the hopset uses 50 or more hopping channels; the maximum peak conducted output power shall not exceed 0.25 W and the e.i.r.p. shall not exceed 1 W if the hopset uses less than 50 hopping channels.

### 7.6.2 Test summary

Verdict	Pass		
Test date	July 19, 2024	Temperature	23 °C
Tested by	Fahar Abdul Sukkoor	Air pressure	1010 mbar
Test location	Cambridge	Relative humidity	40 %

### 7.6.3 Observations, settings and special notes

Conducted output power was tested per ANSI C63.10 subclause 7.8.5. The hopping shall be disabled for this test. Spectrum analyser settings:

Resolution bandwidth	> 20 dB bandwidth of the emission being measured
Video bandwidth	≥ RBW
Frequency span	approximately 5 times the 20 dB bandwidth, centered on a hopping channel
Detector mode	Peak
Trace mode	Max Hold

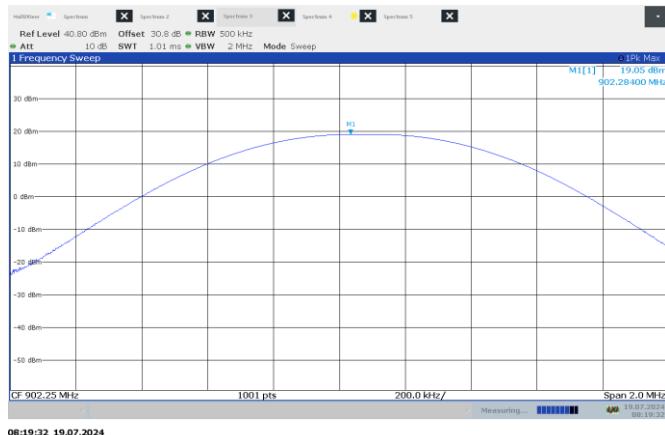
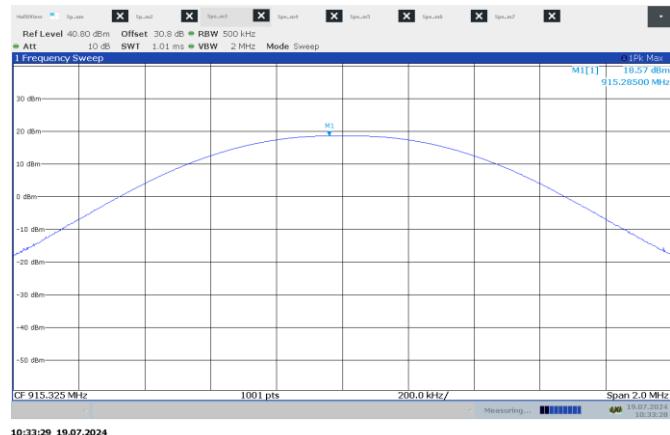
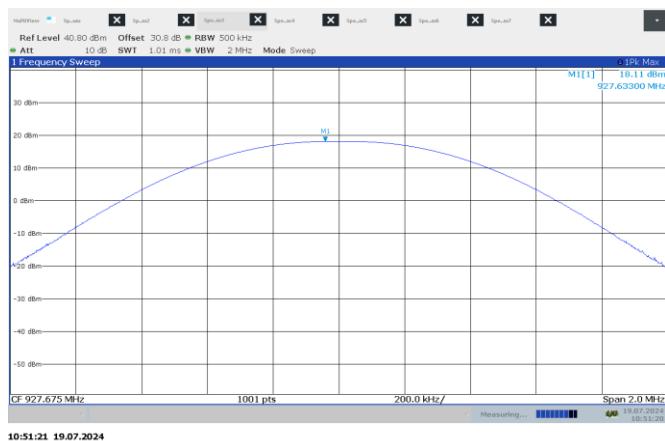
### 7.6.4 Test data

**Table 7.6-1: Output power and EIRP results**

Frequency, MHz	Output power, dBm	Output power limit, dBm	Margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
902.325	19.05	24.00	4.95	3.00	22.05	30.00	7.95
915.325	18.57	24.00	5.43	3.00	21.57	30.00	8.43
927.675	18.11	24.00	5.89	3.00	21.11	30.00	8.89

Notes: EIRP = Output power + Antenna gain.

Note, worst case antenna gain was used for EIRP calculation.

**Test data, continued**

**Figure 7.6-1: Output power on low channel**

**Figure 7.6-2: Output power on mid channel**

**Figure 7.6-3: Output power on high channel**

## 7.7 Spurious (out-of-band) unwanted emissions

### 7.7.1 References, definitions and limits

#### FCC §15.247:

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator 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 the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, 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) (see §15.205(c)).

#### RSS-247, Clause 5.5:

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

#### RSS-Gen:

8.9 Except where otherwise indicated in the applicable RSS, radiated emissions shall comply with the field strength limits shown in table below.

8.10 Restricted frequency bands are designated primarily for safety-of-life services (distress calling and certain aeronautical activities), certain satellite downlinks, radio astronomy and some government uses. The following conditions related to the restricted frequency bands apply:

- a The transmit frequency, including fundamental components of modulation, of licence-exempt radio apparatus shall not fall within the restricted frequency bands.
- b Unwanted emissions that fall into restricted frequency bands listed in table 7 shall comply with the limits specified in table below.
- c Unwanted emissions that do not fall within the restricted frequency bands shall comply either with the limits specified in the applicable RSS or with those specified in table below.

**Table 7.7-1: FCC §15.209 and RSS-Gen – Radiated emission limits**

Field strength of emissions			
Frequency, MHz	µV/m	dBµV/m	Measurement distance, m
0.009–0.490	2400/F	$67.6 - 20 \times \log_{10}(F)$	300
0.490–1.705	24000/F	$87.6 - 20 \times \log_{10}(F)$	30
1.705–30.0	30	29.5	30
30–88	100	40.0	3
88–216	150	43.5	3
216–960	200	46.0	3
above 960	500	54.0	3

Notes: In the emission table above, the tighter limit applies at the band edges.

For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.

References, definitions and limits, continued

**Table 7.7-2: ISED restricted frequency bands**

MHz	MHz	MHz	GHz
0.090–0.110	12.57675–12.57725	399.9–410	7.25–7.75
0.495–0.505	13.36–13.41	608–614	8.025–8.5
2.1735–2.1905	16.42–16.423	960–1427	9.0–9.2
3.020–3.026	16.69475–16.69525	1435–1626.5	9.3–9.5
4.125–4.128	16.80425–16.80475	1645.5–1646.5	10.6–12.7
4.17725–4.17775	25.5–25.67	1660–1710	13.25–13.4
4.20725–4.20775	37.5–38.25	1718.8–1722.2	14.47–14.5
5.677–5.683	73–74.6	2200–2300	15.35–16.2
6.215–6.218	74.8–75.2	2310–2390	17.7–21.4
6.26775–6.26825	108–138	2483.5–2500	22.01–23.12
6.31175–6.31225	149.9–150.05	2655–2900	23.6–24.0
8.291–8.294	156.52475–156.52525	3260–3267	31.2–31.8
8.362–8.366	156.7–156.9	3332–3339	36.43–36.5
8.37625–8.38675	162.0125–167.17	3345.8–3358	
8.41425–8.41475	167.72–173.2	3500–4400	Above 38.6
12.29–12.293	240–285	4500–5150	
12.51975–12.52025	322–335.4	5350–5460	

Note: Certain frequency bands listed in Table 7.7-2 and above 38.6 GHz are designated for licence-exempt applications. These frequency bands and the requirements that apply to related devices are set out in the 200 and 300 series of RSSs.

**Table 7.7-3: FCC restricted frequency bands**

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	Above 38.6
13.36–13.41			

**7.7.2 Test summary**

Verdict	Pass		
Test date	July 16, 2024	Temperature	23 °C
Tested by	Fahar Abdul Sukkoor	Air pressure	1010 mbar
Test location	Cambridge	Relative humidity	40 %

### 7.7.3 Observations, settings and special notes

- As part of the current assessment, the test range of 9 kHz to 10<sup>th</sup> harmonic has been fully considered and compared to the actual frequencies utilized within the EUT. Since the EUT contains a transmitter in the GHz range, the EUT has been deemed compliant without formal testing in the 9 kHz to 30 MHz test range, therefore formal test results (tabular data and/or plots) are not provided within this test report.
- Radiated measurements were performed at a distance of 3 m.
- The testing is performed on each distinct type of antenna, and only the worst-case test results are provided.
- FHSS emissions in non-restricted frequency bands test was performed with reference to ANSI C63.10 subclause 11.11.
- Since fundamental power was tested using the maximum peak conducted output power procedure to demonstrate compliance, the spurious emissions limit is -20 dBc/100 kHz.
- FHSS band-edge emission measurements test was performed in hopping off and on modes with reference to ANSI C63.10 subclause 11.13.
- Average was calculated from peak results using duty cycle correction factor (DCCF).
- As per customer declaration, worst case duty cycle is less than 1%. DCCF is -40 dB. The average emissions for these pulsed emissions will be well below its limits.

Spectrum analyser settings for radiated measurements within restricted bands below 1 GHz:

Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyser settings for peak radiated measurements within restricted bands above 1 GHz:

Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyser settings for average radiated measurements within restricted bands above 1 GHz:

Resolution bandwidth:	1 MHz
Video bandwidth:	10 Hz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyser settings for conducted spurious emissions measurements:

Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Detector mode:	Peak
Trace mode:	Max Hold

### 7.7.4 Test data

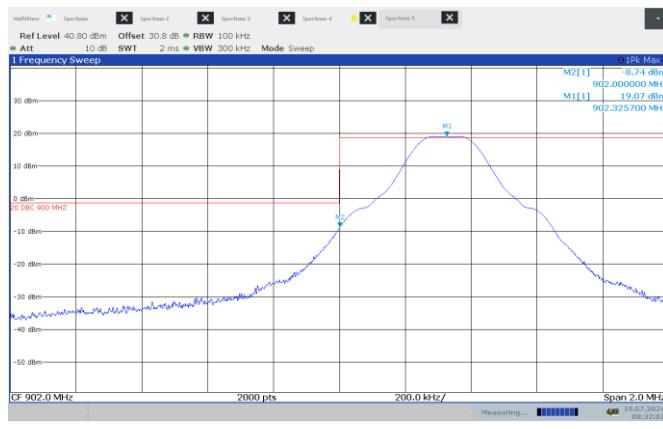


Figure 7.7-1: Conducted Band edge spurious emissions at 902 MHz

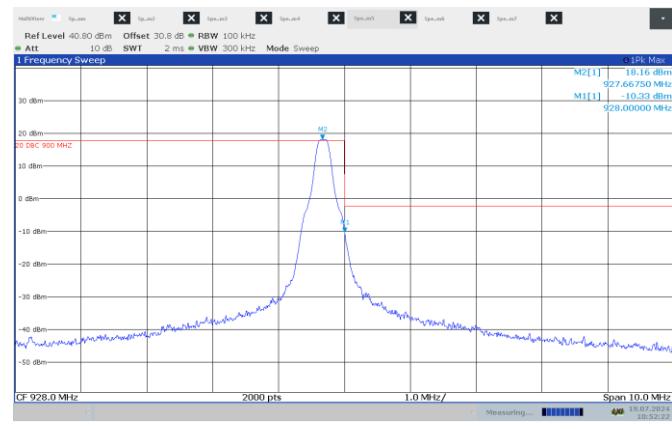


Figure 7.7-2: Conducted Band edge spurious emissions at 928 MHz

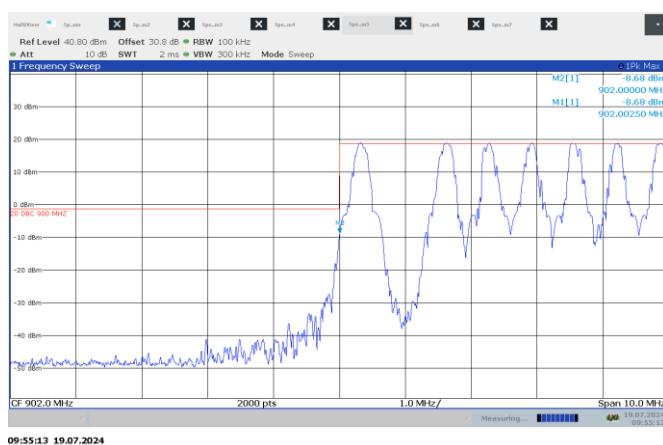


Figure 7.7-3: Conducted Band edge emissions at 902 MHz hopping ON

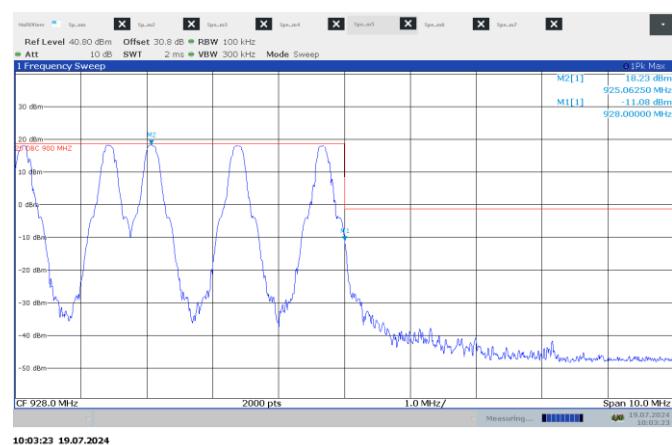
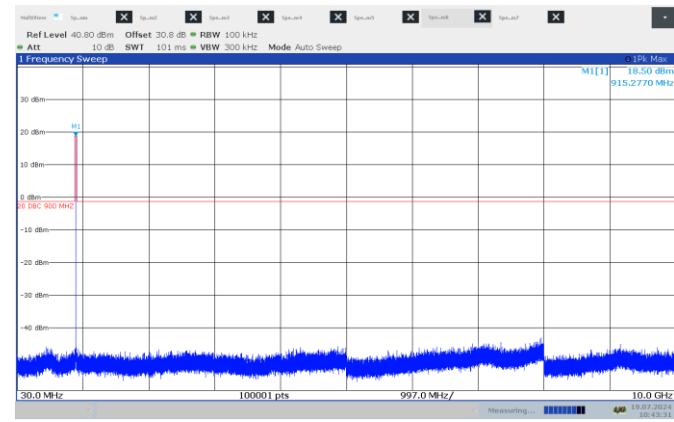
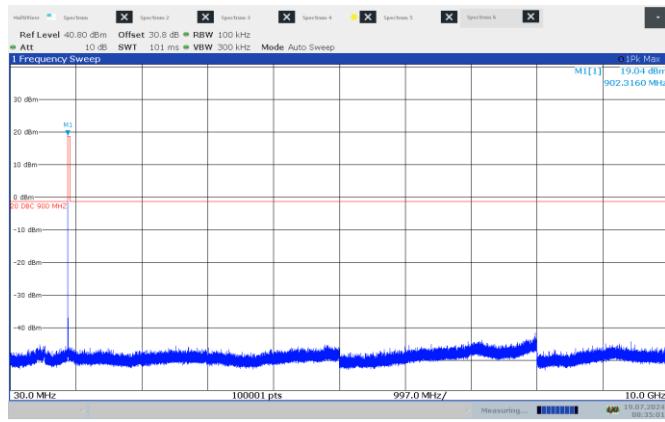


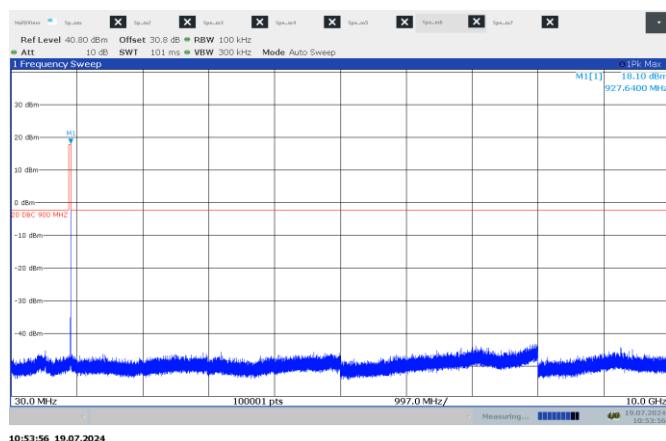
Figure 7.7-4: Conducted Band edge emissions at 928 MHz hopping ON

Test data, continued



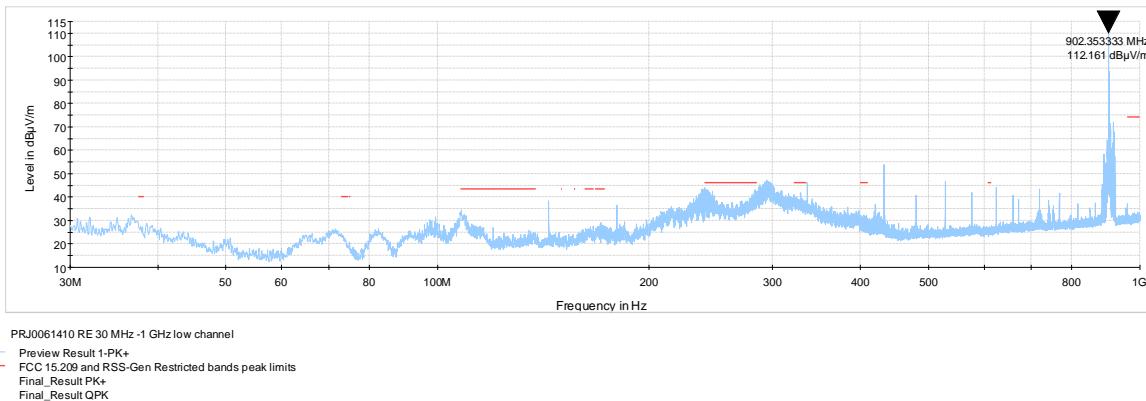
**Figure 7.7-5: Conducted spurious emissions on low channel**

**Figure 7.7-6: Conducted spurious emissions on mid channel**

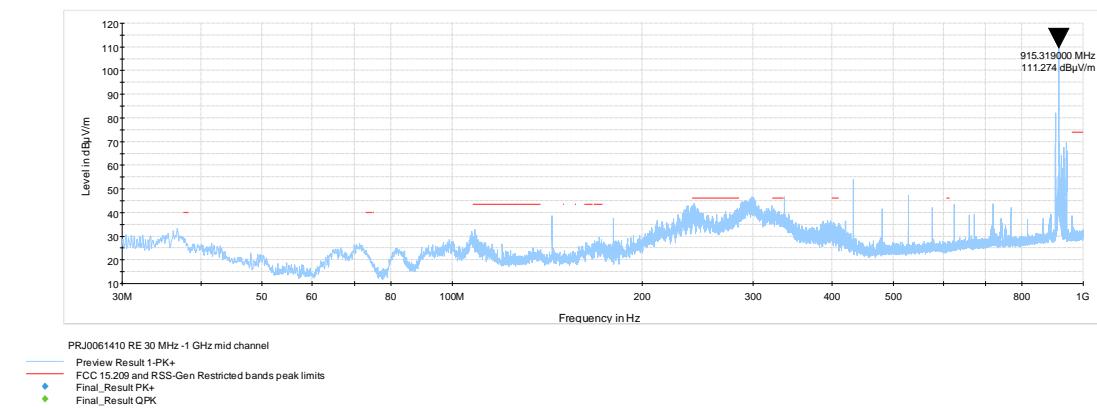


**Figure 7.7-7: Conducted spurious emissions on high channel**

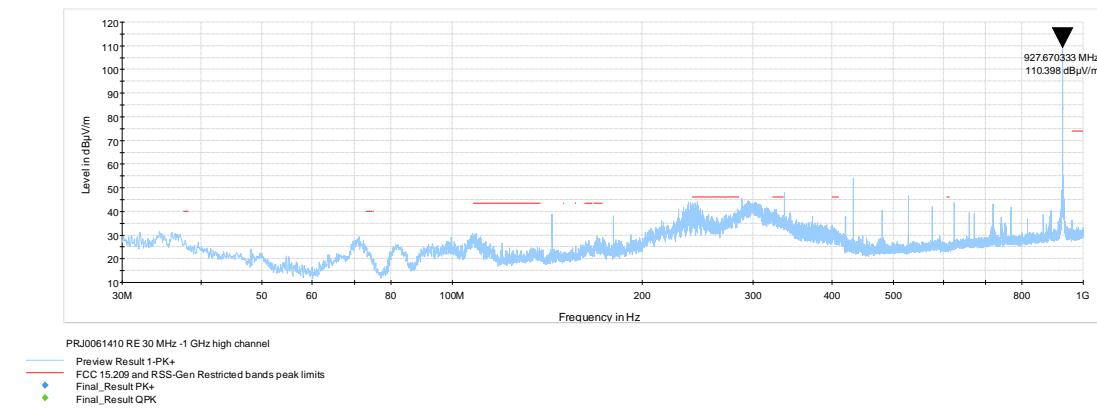
Test data, continued



**Figure 7.7-1: Radiated spurious emissions (30 to 1000 MHz) low channel.**



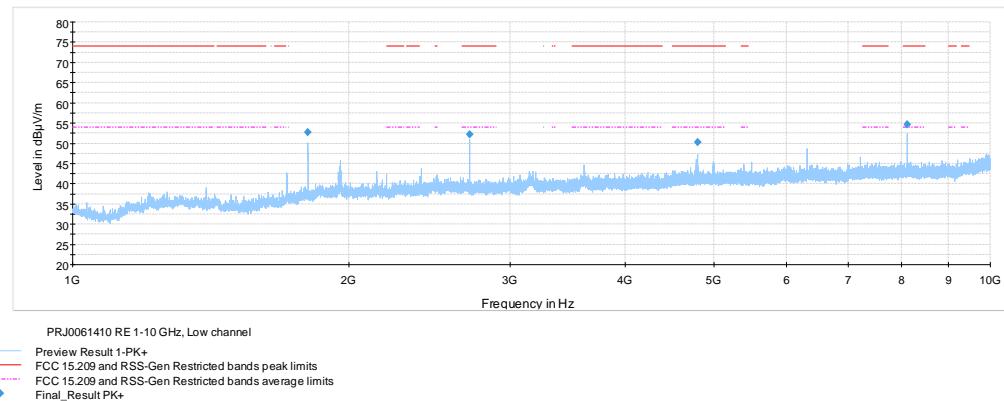
**Figure 7.7-2: Radiated spurious emissions (30 to 1000 MHz) mid channel.**



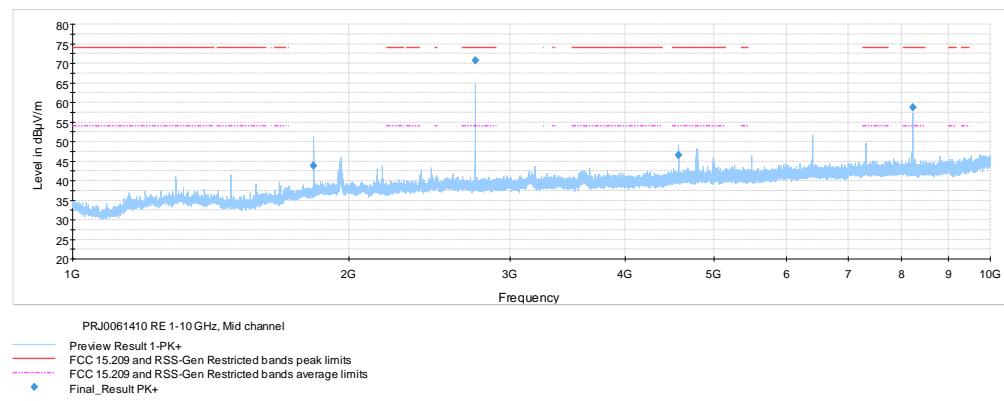
**Figure 7.7-3: Radiated spurious emissions (30 to 1000 MHz) high channel.**

*Note: All emissions exceeding the limit lines were verified to be digital emissions from the host and are unrelated to the transmitter board.*

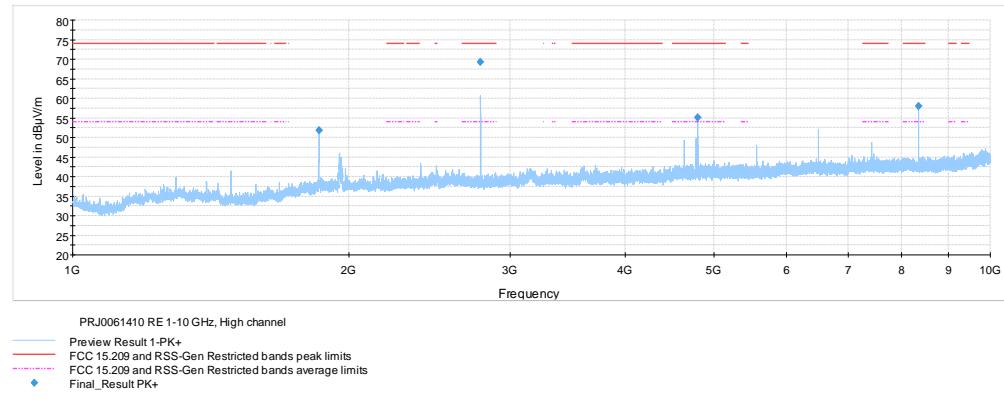
Test data, continued



**Figure 7.7-4:** Radiated spurious emissions (1 to 10 GHz) low channel.



**Figure 7.7-5:** Radiated spurious emissions (1 to 10 GHz) mid channel.



**Figure 7.7-6:** Radiated spurious emissions (1 to 10 GHz) high channel.



Test data, continued

**Table 7.7-4: Radiated field strength measurement results**

Channel	Frequency, MHz	Peak Field strength, dB $\mu$ V/m	Margin, dB
		Measured	Limit
Low	8121.2	54.7	74.0
Mid	2746.3	70.8	74.0
High	2783.0	69.4	74.0

Notes: Field strength includes correction factor of antenna, cable loss, amplifier, and attenuators where applicable.

As DCCF for average emissions is -40 dB, peak-to-average calculated emissions are well below the average limit of 54 dB $\mu$ V/m. Worst case calculated average emission is 30.8 dB $\mu$ V/m.

## 7.8 Receiver emissions

### 7.8.1 References, definition and limits

#### RSS-Gen:

7.3 Radiated emission measurements shall be performed with the receiver antenna connected to the receiver antenna ports. The search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver (e.g. local oscillator, intermediate or carrier frequency), or 30 MHz, whichever is higher, to at least five times the highest tunable or local oscillator frequency, whichever is higher, without exceeding 40 GHz.

Spurious emissions from receivers shall not exceed the radiated emissions limits shown in table 3.

**Table 7.8-1: RSS-Gen – Radiated emission limits**

Frequency, MHz	Field strength of emissions		Measurement distance, m
	µV/m	dBµV/m	
30–88	100	40.0	3
88–216	150	43.5	3
216–960	200	46.0	3
above 960	500	54.0	3

Notes: In the emission table above, the tighter limit applies at the band edges.

For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.

7.4 If the receiver has a detachable antenna of known impedance, an antenna-conducted spurious emissions measurement is permitted as an alternative to radiated measurement. However, the radiated method of section 7.3 is preferred.

The antenna-conducted test shall be performed with the antenna disconnected and with the receiver antenna port connected to a measuring instrument having equal input impedance to that specified for the antenna. The RF cable connecting the receiver under test to the measuring instrument shall also have the same impedance to that specified for the receiver's antenna.

The spurious emissions from the receiver at any discrete frequency, measured at the antenna port by the antenna-conducted method, shall not exceed 2 nW in the frequency range 30–1000 MHz and 5 nW above 1 GHz.

Audit testing performed by ISED to confirm compliance will use the radiated method for measuring receiver-spurious emissions. If the radiated limits are exceeded or, as a result of an interference complaint, it is determined that the device's spurious emissions cause harmful interference to other authorized users of the spectrum, ISED may require the party responsible for compliance to take corrective action. Therefore, it is recommended that the radiated method be employed.

### 7.8.2 Test summary

Verdict	Pass		
Test date	July 22, 2024	Temperature	23 °C
Tested by	Fahar Abdul Sukkoor	Air pressure	1010 mbar
Test location	Cambridge	Relative humidity	40 %

### 7.8.3 Observations, settings and special notes

- EUT is set in receive mode and tested through conducted measurements.

Spectrum analyser settings for radiated measurements within restricted bands below 1 GHz:

Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyser settings for peak radiated measurements within restricted bands above 1 GHz:

Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Detector mode:	Peak
Trace mode:	Max Hold

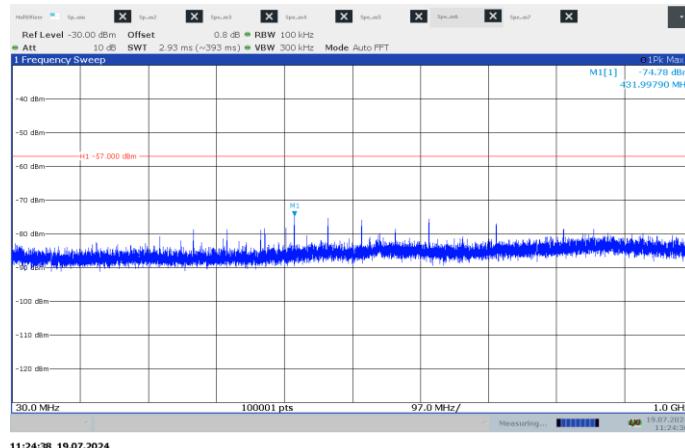
Spectrum analyser settings for average radiated measurements within restricted bands above 1 GHz:

Resolution bandwidth:	1 MHz
Video bandwidth:	10 Hz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyser settings for conducted spurious emissions measurements:

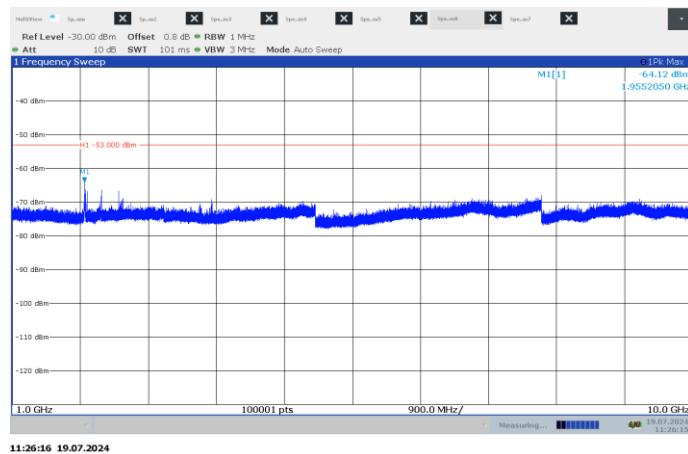
Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Detector mode:	Peak
Trace mode:	Max Hold

### 7.8.1 Test data



**Figure 7.8-1: Conducted spurious emissions (30 — 1000 MHz)**

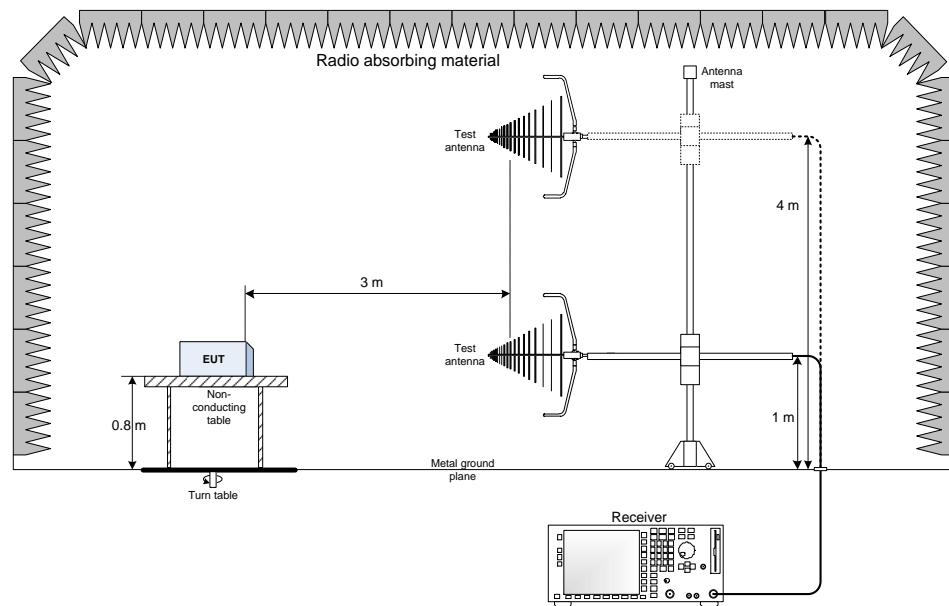
Test data, continued



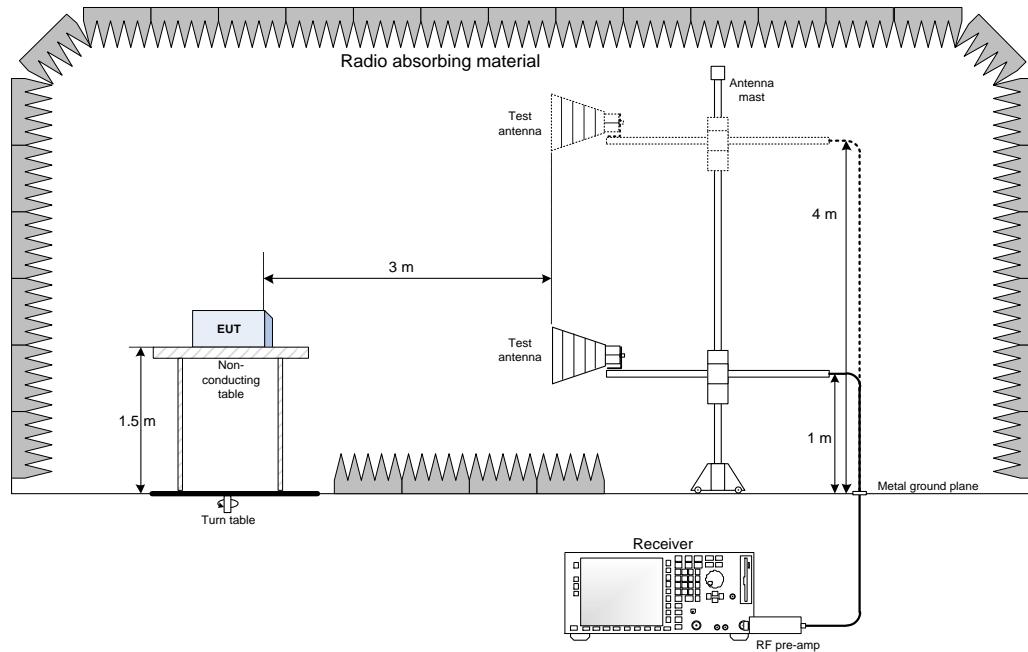
**Figure 7.8-2: Conducted spurious emissions (1— 10 GHz)**

## Section 8 Test setup diagrams

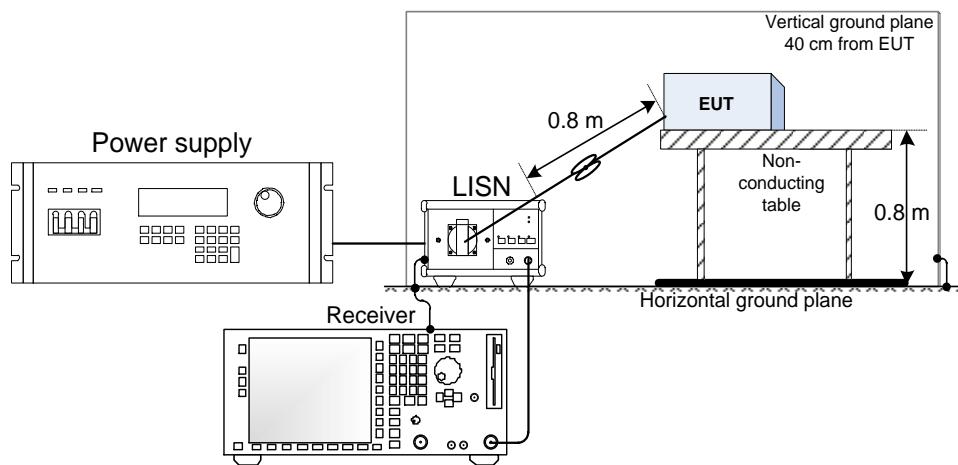
### 8.1 Radiated emissions set-up for frequencies below 1 GHz



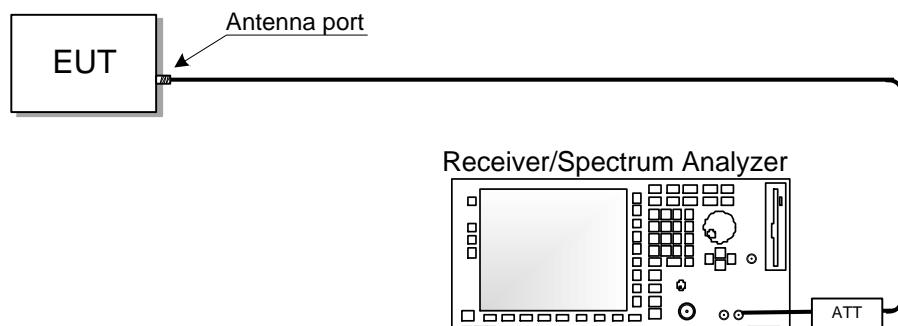
### 8.2 Radiated emissions set-up for frequencies above 1 GHz



### 8.3 AC mains conducted emissions set-up



### 8.4 Antenna port set-up



End of the test report