



Test report

REP013204-1R1TRFWL

Date of issue: August 18, 2023

Applicant:

Motorola Solutions, Inc.

Product description:

DH300

Model:

DHS1100BMPAA

Product marketing name(s):

DH300

FCC ID:

AZ499FT7177


ISED certification number:

109U-99FT7177

Specifications:

- ◆ **FCC 47 CFR Part 15, Subpart C – §15.247**
Operation within the bands 902 – 928 MHz, 2400 – 2483.5 MHz, 5727 – 5850 MHz
- ◆ **Industry Canada RSS-247, Issue 2**
Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

Lab and test locations

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FCC Site Number	Test Firm Registration Number: 392943; Designation Number: US5058
ISED Test Site	2040B-3
Tested by	Chenhao Ma, Wireless Test Technician
Reviewed by	James Cunningham, EMC/WL Manager
Review date	August 16, 2023
Reviewer signature	

Limits of responsibility

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 contain in this report are within Nemko USA's ISO/IEC 17025 accreditation.

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Section 1 Report summary

1.1 Test specifications

FCC 47 CFR Part 15, Subpart C – §15.247	Operation within the bands 902 – 928 MHz, 2400 – 2483.5 MHz, 5727 – 5850 MHz
Industry Canada RSS-247, Issue 2	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

1.2 Exclusions

None.

1.3 Statement of compliance

Testing was performed against all relevant requirements of the test standard(s).

Results obtained indicate that the product under test complies in full with the tested requirements.

The test results relate only to the item(s) tested.

See “Section 2 Summary of test results” for full details.

1.4 Test report revision history

Table 1.4-1: Test report revision history

Revision #	Issue Date	Details of changes made to test report
REP013204-TRFEMC	August 9, 2023	Original report issued
REP013204-1R1TRFEMC	August 18, 2023	Updated measurement results

Section 2 Summary of test results

2.1 Sample information

Receipt date	07-Jul-23
Nemko sample ID number	REP013204

2.2 Testing period

Test start date	15-Aug-23
Test end date	18-Aug-23

2.3 Test results

Table 2.3-1: FCC 47 CFR Part 15, Subpart B & C, general requirements

Part	Test description	Verdict
§15.207(a)	Conducted limits	Pass ¹
§15.31(e)	Variation of power source	Pass
§15.203	Antenna requirement	Pass
§15.215(c)	20 dB bandwidth	Pass

Notes: ¹ EUT is directly or indirectly powered via AC mains

Table 2.3-2: FCC 47 CFR Part 15, Subpart C, §15.247 requirements

Part	Test description	Verdict
§15.247(a)(1)(i)	Frequency hopping systems operating in the 902–928 MHz band	Pass
§15.247(a)(1)(ii)	Frequency hopping systems operating in the 5725–5850 MHz band	Not applicable
§15.247(a)(1)(iii)	Frequency hopping systems operating in the 2400–2483.5 MHz band	Not applicable
§15.247(a)(2)	Minimum 6 dB bandwidth for systems using digital modulation techniques	Not applicable
§15.247(b)(1)	Maximum peak output power of frequency hopping systems operating in the 2400–2483.5 MHz band and 5725–5850 MHz band	Pass
§15.247(b)(2)	Maximum peak output power of Frequency hopping systems operating in the 902–928 MHz band	Not applicable
§15.247(b)(3)	Maximum peak output power of systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands	Not applicable
§15.247(b)(4)	Transmitting antennas of directional gain greater than 6 dBi	Not applicable
§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
§15.247(d)	Spurious emissions	Pass
§15.247(e)	Power spectral density for digitally modulated devices	Not applicable
§15.247(f)	Time of occupancy for hybrid systems	Not applicable

Table 2.3-3: ISSED RSS-247 requirements

Part	Test description	Verdict
5.1 (a)	Bandwidth of a frequency hopping channel	Pass
5.1 (b)	Minimum channel spacing for frequency hopping systems	Pass
5.1 (c)	Frequency hopping systems operating in the 902–928 MHz band	Pass
5.1 (d)	Frequency hopping systems operating in the 2400–2483.5 MHz band	Not applicable
5.1 (e)	Frequency hopping systems operating in the 5725–5850 MHz band	Not applicable
5.2 (a)	Minimum 6 dB bandwidth	Not applicable
5.2 (b)	Maximum power spectral density	Not applicable
5.3 (a)	Digital modulation turned off	Not applicable
5.3 (b)	Frequency hopping turned off	Not applicable
5.4 (a)	Frequency hopping systems operating in the 902–928 MHz band	Pass
5.4 (b)	Frequency hopping systems operating in the 2400–2483.5 MHz band	Not applicable
5.4 (c)	Frequency hopping systems operating in the 5725–5850 MHz	Not applicable
5.4 (d)	Systems employing digital modulation techniques	Not applicable
5.4 (e)	Point-to-point systems in 2400–2483.5 MHz and 5725–5850 MHz band	Not applicable
5.4 (f)	Transmitters which operate in the 2400–2483.5 MHz band with multiple directional beams	Not applicable
5.5	Out-of-band emissions	Pass

Table 2.3-4: ISSED RSS-GEN requirements

Part	Test description	Verdict
6.7	Occupied bandwidth (99%)	Pass
7.3	Receiver radiated emission limits	Not applicable ¹
7.4	Receiver conducted emission limits	Not applicable ¹
8.8	Power Line Conducted Emissions Limits for Licence-Exempt Radio Apparatus	Pass

Notes: ¹ Only applicable to scanner receivers or stand-alone receivers operating in the band 30-960 MHz

Section 3 Equipment under test (EUT) details

3.1 Disclaimer

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 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.

3.2 Applicant

Company name	Motorola Solutions, Inc.
Address	8000 W Sunrise Blvd
City	Plantation
State	FL
Postal/Zip code	33322
Country	United States

3.3 Manufacturer

Company name	Indyme
Address	8295 Aero Place Suite260
City	San Diego
State	CA
Postal/Zip code	92123
Country	United States

3.4 EUT information

Product name	DH300
Model	DHS1100BMPAA
Variant(s)	None
Serial number	None
Part number	None
Power requirements	100-2400 Vac, 50/60 Hz
Description/theory of operation	DH300 Curve Digital Hub 1W 900 MHz (BRUS/BRCAN)
Operational frequencies	902 - 928 MHz operating band
Software details	1.3.0

3.5 Transmitter Information

Frequency band	<input checked="" type="checkbox"/> 902 – 928 MHz <input type="checkbox"/> 2400 – 2483.5MHz <input type="checkbox"/> 5725 – 5850 MHz
Transmitter type	<input checked="" type="checkbox"/> Frequency hopping spread spectrum (FHSS) <input type="checkbox"/> Digital transmission system (DTS) <input type="checkbox"/> Hybrid FHSS / DTS
Minimum frequency (MHz)	902.525
Maximum frequency (MHz)	927.525
Tested frequencies	902.525 MHz (low), 915.525 MHz (middle), and 927.525 MHz (high)

3.6 EUT setup details

Table 3.6-1: EUT sub assemblies

Description	Brand name	Model/Part number	Serial number	Rev.
AC adaptor	Motorola	NU50-9120400-I3 / HKPN4011A	N/A	N/A

Table 3.6-2: EUT interface ports

Description	Qty.
Ethernet	1
USB	4

Table 3.6-3: Support equipment

Description	Brand name	Model/Part number	Serial number	Rev.
Laptop PC				

Table 3.6-4: Inter-connection cables

Cable description	From	To	Length (m)
Ethernet	EUT	Unterminated	> 3

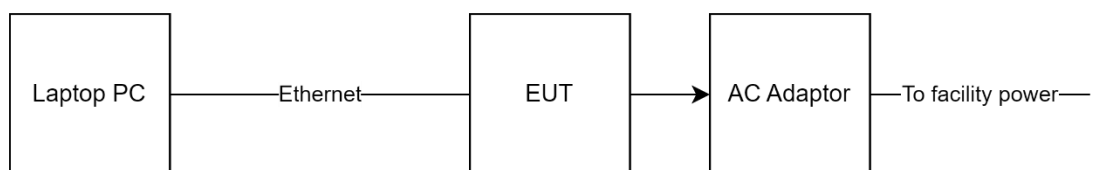


Figure 3.6-1: Test setup diagram

Section 4 Engineering considerations

4.1 Modifications incorporated in the EUT

None.

4.2 Technical judgement

None.

4.3 Deviations from laboratory test procedures

None.

Section 5 Test conditions

5.1 Atmospheric conditions

Temperature	15–30 °C
Relative humidity	20–75 %
Air pressure	86–106 kPa

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.

5.2 Power supply range

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 ± 5 %, for which the equipment was designed.

Section 6 Measurement uncertainty

6.1 Uncertainty of measurement

Nemko USA Inc. has calculated measurement uncertainty and is documented in EMC/MUC/001 "Uncertainty in EMC measurements." Measurement uncertainty was calculated using the methods described in CISPR 16-4-2 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics, and limit modelling – Measurement instrumentation uncertainty. The expression of Uncertainty in EMC testing. Measurement uncertainty calculations assume a coverage factor of K=2 with 95% certainty.

Table 6.1-1: Measurement uncertainty calculations

Measurement		U_{cispr} dB	U_{lab} dB
Conducted disturbance at AC mains and other port power using a V-AMN	9 kHz to 150 kHz	3.8	2.9
	150 kHz to 30 MHz	3.4	2.3
Conducted disturbance at telecommunication port using AAN	150 kHz to 30 MHz	5.0	4.3
Conducted disturbance at telecommunication port using CVP	150 kHz to 30 MHz	3.9	2.9
Conducted disturbance at telecommunication port using CP	150 kHz to 30 MHz	2.9	1.4
Conducted disturbance at telecommunication port using CP and CVP	150 kHz to 30 MHz	4.0	3.1
Radiated disturbance (electric field strength in a SAC)	30 MHz to 1 GHz	6.3	5.5
Radiated disturbance (electric field strength in a FAR)	1 GHz to 6 GHz	5.2	4.7
Radiated disturbance (electric field strength in a FAR)	6 GHz to 18 GHz	5.5	5.0

- Notes:
- Compliance assessment:
 - If U_{lab} is less than or equal to U_{cispr} then:
 - compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
 - non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit
 - If U_{lab} is greater than U_{cispr} then:
 - compliance is deemed to occur if no measured disturbance level, increased by $(U_{\text{lab}} - U_{\text{cispr}})$, exceeds the disturbance limit;
 - non-compliance is deemed to occur if any measured disturbance level, increased by $(U_{\text{lab}} - U_{\text{cispr}})$, exceeds the disturbance limit

V-AMN: V type artificial mains network
 AAN: Asymmetric artificial network
 CP: Current probe
 CVP: Capacitive voltage probe
 SAC: Semi-anechoic chamber
 FAR: Fully anechoic room

Section 7 Test equipment

7.1 Test equipment list

Table 7.1-1: Test Equipment List

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Signal Generator	Rohde & Schwarz	SMR27	E1338	1 year	08-29-2023
Variable Attenuator	API Weinschel	AF9009-9-31	E1164	N/A	N/A
EMC Test Receiver	Rohde & Schwarz	ESU 40	E1121	1 year	08-31-2023
System controller	Sunol Sciences	SC104V	E1191	NCR	NCR
Bilog Antenna	Schaffner-Chase	CBL 6111D	1763	2 years	04-01-2024
Horn antenna with preamplifier	ETS-Lindgren	3115-PB	EW100	2 years	18-Apr-2024
Signal and spectrum analyzer	Rohde & Schwarz	FSW43	E1302	1 year	20-Oct-2023
Signal and spectrum analyzer	Rohde & Schwarz	FSV3030	E1321	1 year	26-Apr-2024

Notes: NCR: no calibration required
VBU: verify before use

7.2 Test software list

Table 7.2-1: Test Software

Manufacturer	Details
Rohde & Schwarz	EMC 32 V10.60.10 (AC conducted emissions)
Rohde & Schwarz	EMC 32 V10.60.15 (radiated emissions)

Section 8 Testing data

8.1 Conducted limits / power line conducted emissions limits for licence-exempt radio apparatus

8.1.1 References and limits

- FCC 47 CFR Part 15, Subpart C: §15.207(a)
- ISSED: RSS-GEN §8.8
- Test method: ANSI C63.10-2020 §6.2

Table 8.1-1: Conducted emissions limit

Frequency of emission, MHz	Quasi-peak	Conducted limit, dBµV	Average
0.15–0.5	66 to 56*		56 to 46*
0.5–5	56		46
5–30	60		50

Note: * Decreases with the logarithm of the frequency.

8.1.2 Test summary

Verdict	Pass		
Test date	August 18, 2023	Temperature	22.6 °C
Test engineer	Chenhao Ma, Wireless Test Technician	Air pressure	1001 mbar
Test location	<input type="checkbox"/> 10m semi anechoic chamber <input type="checkbox"/> 3m semi anechoic chamber <input checked="" type="checkbox"/> Other: Ground Plane	Relative humidity	64.4 %

8.1.3 Notes

Testing was performed with the transmitter operating on a fixed channel (lowest, middle, and highest channels; hopping disabled) at maximum output power.

The spectral plots within this section have been corrected with all relevant transducer factors.

For EUT's supporting multiple modulation schemes and/or data rates, testing is performed with the modulation and data rate that produces the highest transmitter output power.

8.1.4 Setup details

Port under test	AC mains input
EUT power input during test	120 VAC / 60 Hz
EUT setup configuration	<input checked="" type="checkbox"/> Table-top <input type="checkbox"/> Floor standing <input type="checkbox"/> Other:
Measurement details	A preview measurement was generated with the receiver in continuous scan mode. Emissions detected within 6 dB or above limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

Receiver settings:

Resolution bandwidth	9 kHz
Video bandwidth	30 kHz
Detector mode	– Peak (Preview measurement) – Quasi-peak and CAverage (Final measurement)
Trace mode	Max Hold
Measurement time	– 100 ms (Peak and Average preview measurement) – 5000 ms (Quasi-peak final measurement) – 5000 ms (CAverage final measurement)

8.1.5 Test data

Full Spectrum

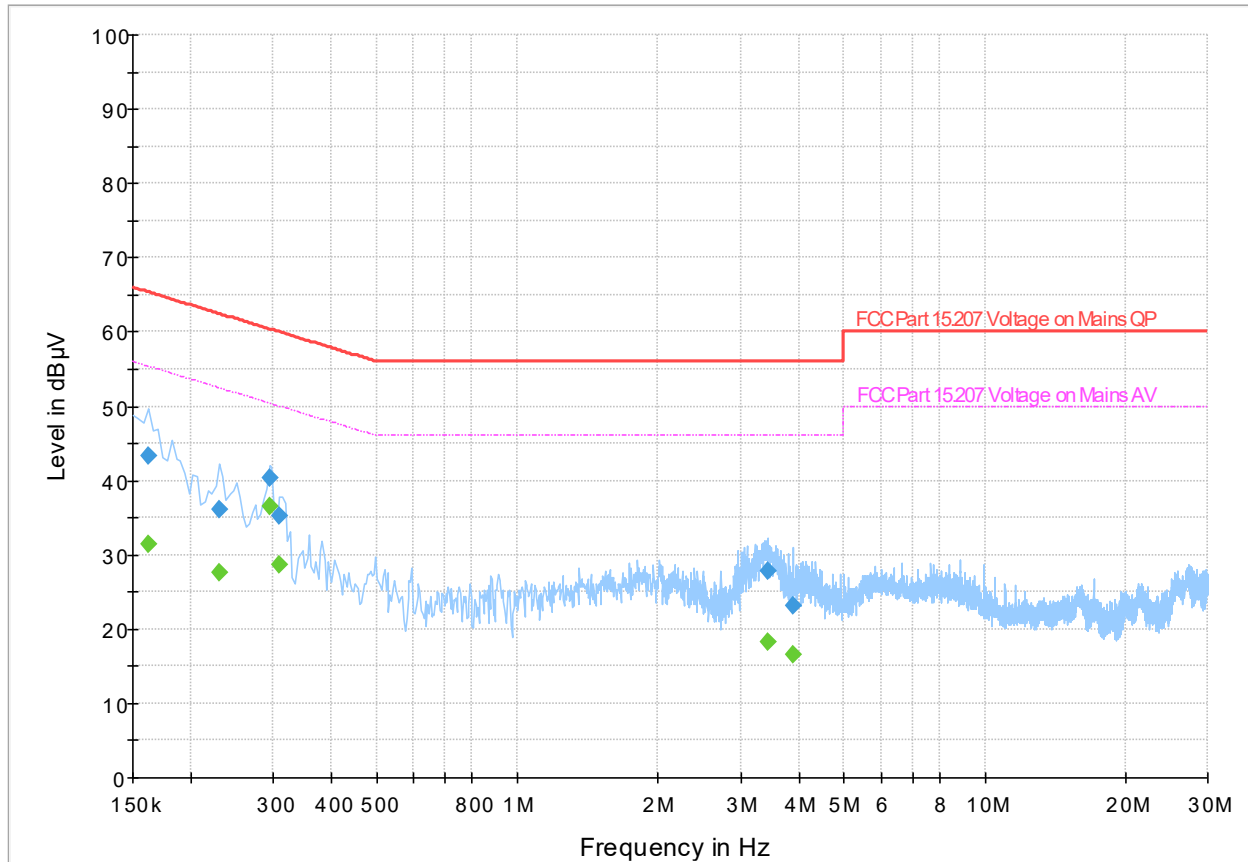


Figure 8.1-1: Conducted emissions at mains port spectral plot (150 kHz - 30 MHz) low channel

Table 8.1-2: Conducted emissions at mains port results

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.162000	---	31.40	55.36	23.96	5000.0	9.000	L1	ON	19.5
0.162000	43.40	---	65.36	21.96	5000.0	9.000	L1	ON	19.5
0.230000	---	27.68	52.45	24.77	5000.0	9.000	N	ON	19.4
0.230000	36.17	---	62.45	26.28	5000.0	9.000	N	ON	19.4
0.294000	40.32	---	60.41	20.09	5000.0	9.000	N	ON	19.4
0.294000	---	36.45	50.41	13.96	5000.0	9.000	N	ON	19.4
0.310000	35.22	---	59.97	24.75	5000.0	9.000	L1	ON	19.4
0.310000	---	28.71	49.97	21.26	5000.0	9.000	L1	ON	19.4
3.422000	---	18.18	46.00	27.83	5000.0	9.000	L1	ON	19.4
3.422000	27.88	---	56.00	28.12	5000.0	9.000	L1	ON	19.4
3.894000	---	16.60	46.00	29.40	5000.0	9.000	L1	ON	19.5
3.894000	23.20	---	56.00	32.80	5000.0	9.000	L1	ON	19.5

Notes:

¹ Result (dBµV) = receiver analyzer value (dBµV) + correction factor (dB).

² Correction factors = LISN factor IL (dB) + cable loss (dB) + transient limiter (dB)

³ 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.

Full Spectrum

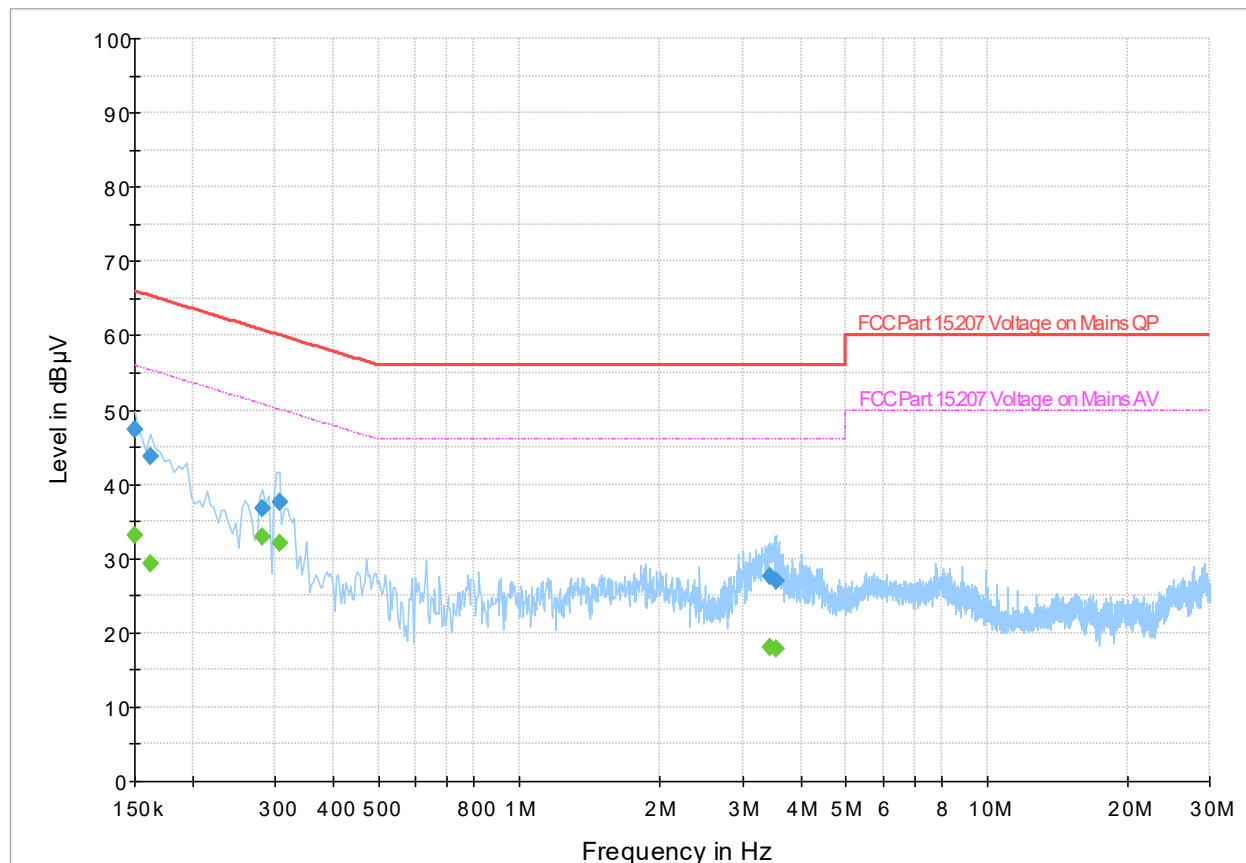


Figure 8.1-2: Conducted emissions at mains port spectral plot (150 kHz - 30 MHz) mid channel

Table 8.1-3: Conducted emissions at mains port results

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.150000	---	33.14	56.00	22.86	5000.0	9.000	L1	ON	19.5
0.150000	47.41	---	66.00	18.59	5000.0	9.000	L1	ON	19.5
0.162000	---	29.34	55.36	26.02	5000.0	9.000	L1	ON	19.5
0.162000	43.78	---	65.36	21.58	5000.0	9.000	L1	ON	19.5
0.282000	---	32.84	50.76	17.92	5000.0	9.000	N	ON	19.4
0.282000	36.65	---	60.76	24.11	5000.0	9.000	N	ON	19.4
0.306000	---	32.01	50.08	18.07	5000.0	9.000	N	ON	19.4
0.306000	37.60	---	60.08	22.48	5000.0	9.000	N	ON	19.4
3.422000	---	18.00	46.00	28.01	5000.0	9.000	L1	ON	19.4
3.422000	27.70	---	56.00	28.30	5000.0	9.000	L1	ON	19.4
3.538000	---	17.78	46.00	28.22	5000.0	9.000	L1	ON	19.4
3.538000	27.07	---	56.00	28.93	5000.0	9.000	L1	ON	19.4

Notes:

¹ Result (dBµV) = receiver analyzer value (dBµV) + correction factor (dB).

² Correction factors = LISN factor IL (dB) + cable loss (dB) + transient limiter (dB)

³ 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.

Full Spectrum

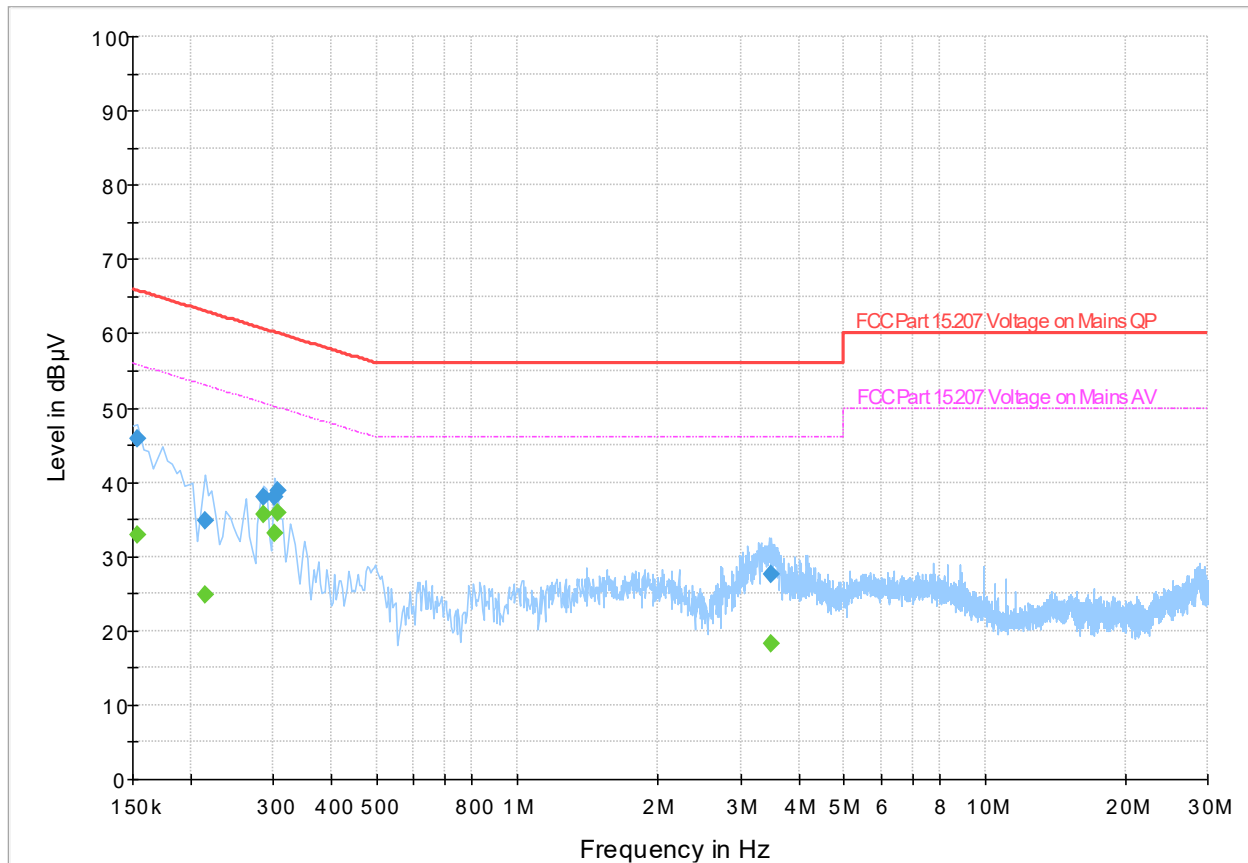


Figure 8.1-3: Conducted emissions at mains port spectral plot (150 kHz - 30 MHz) high channel

Table 8.1-4: Conducted emissions at mains port results

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.154000	45.96	---	65.78	19.82	5000.0	9.000	N	ON	19.5
0.154000	---	33.01	55.78	22.77	5000.0	9.000	N	ON	19.5
0.214000	---	24.78	53.05	28.27	5000.0	9.000	L1	ON	19.5
0.214000	34.83	---	63.05	28.22	5000.0	9.000	L1	ON	19.5
0.286000	---	35.75	50.64	14.89	5000.0	9.000	N	ON	19.4
0.286000	37.90	---	60.64	22.74	5000.0	9.000	N	ON	19.4
0.302000	37.97	---	60.19	22.22	5000.0	9.000	N	ON	19.4
0.302000	---	33.16	50.19	17.02	5000.0	9.000	N	ON	19.4
0.306000	38.87	---	60.08	21.21	5000.0	9.000	N	ON	19.4
0.306000	---	35.98	50.08	14.09	5000.0	9.000	N	ON	19.4
3.498000	27.61	---	56.00	28.39	5000.0	9.000	L1	ON	19.4
3.498000	---	18.18	46.00	27.82	5000.0	9.000	L1	ON	19.4

Notes:

¹ Result (dBµV) = receiver analyzer value (dBµV) + correction factor (dB).

² Correction factors = LISN factor IL (dB) + cable loss (dB) + transient limiter (dB)

³ 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.

8.2 Variation of power source

8.2.1 References and limits

- FCC 47 CFR Part 15, Subpart A: §15.31(e)
- Test method: ANSI C63.10-2020 §5.13

§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.

8.2.2 Test summary

Verdict	Pass		
Test date	August 15, 2023	Temperature	21 °C
Test engineer	Chenhao Ma, Wireless Test Technician	Air pressure	1004 mbar
Test location	<input checked="" type="checkbox"/> Wireless bench <input type="checkbox"/> Other:	Relative humidity	46 %

8.2.3 Notes

Testing was performed with the transmitter operating on a fixed channel (middle) at maximum output power.

8.2.4 Setup details

EUT power input during test	120 VAC / 60 Hz (varied from 85% to 115%)
-----------------------------	---

8.2.5 Test data

<input type="checkbox"/>	EUT is battery operated. Therefore, all tests performed with a new fully charged battery
<input checked="" type="checkbox"/>	EUT power supply voltage varied across supported range. No variation in transmitter output power observed therefore all tests performed at nominal power supply voltage.
<input type="checkbox"/>	EUT power supply voltage varied across supported range. Transmitter output power variation was observed. All tests performed with the EUT operated at the worst case operating voltage with respect to transmitter output power: V.

8.3 Antenna requirement

8.3.1 References and limits

- FCC 47 CFR Part 15, Subpart C: §15.203

§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. Test summary

Verdict	Pass		
Test date	August 15, 2023	Temperature	21 °C
Test engineer	Chenhao Ma, Wireless Test Technician	Air pressure	1004 mbar
Test location	<input checked="" type="checkbox"/> Wireless bench <input type="checkbox"/> Other:	Relative humidity	46 %

8.3.2 Notes

None

8.3.3 Test data

Antenna part number:	ANT-915-NUB-RPS
Technical description:	915 MHz LPWA whip antenna with RP-SMA plug (female socket) connector
Peak gain (dBi):	3.9 dBi
Source of gain data:	<input type="checkbox"/> Declared by client
	<input checked="" type="checkbox"/> Antenna data sheet or specification. Document name: ANTENNA ISM 915 MHz RP-SMA LPWA WHIP by LINX
	<input type="checkbox"/> Antenna gain test report. Document name:

8.4 20 dB bandwidth (902 – 928 MHz band)

8.4.1 References and limits

- FCC 47 CFR Part 15, Subpart C: §15.247(a)(1)(i)
- RSS-247 5.1(c)
- Test method: ANSI C63.4-2020: §6.9.2

§15.247(a)(1)(i) and RSS-247 5.1(c):

The maximum 20 dB bandwidth of the hopping channel shall be 500 kHz.

8.4.2 Test summary

Verdict	Pass		
Test date	August 15, 2023	Temperature	21 °C
Test engineer	Chenhao Ma, Wireless Test Technician	Air pressure	1004 mbar
Test location	<input checked="" type="checkbox"/> Wireless bench <input type="checkbox"/> Other:	Relative humidity	46 %

8.4.3 Notes

Testing was performed with the transmitter operating on a fixed channel (lowest, middle, and highest; frequency hopping disabled) at maximum output power.

The spectral plots within this section have been corrected with all relevant transducer factors.

8.4.4 Setup details

EUT power input during test	120 VAC / 60 Hz
EUT setup configuration	<input checked="" type="checkbox"/> Table-top <input type="checkbox"/> Floor standing <input type="checkbox"/> Other:

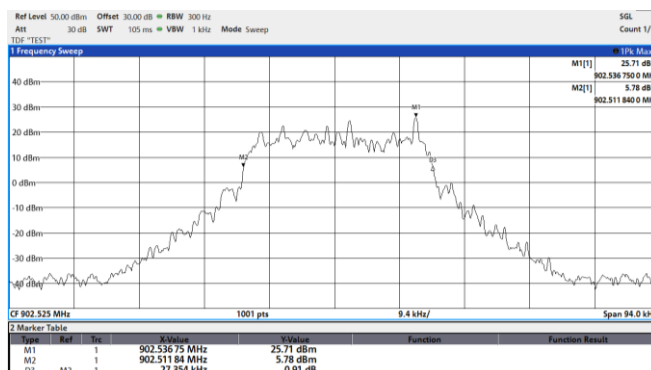
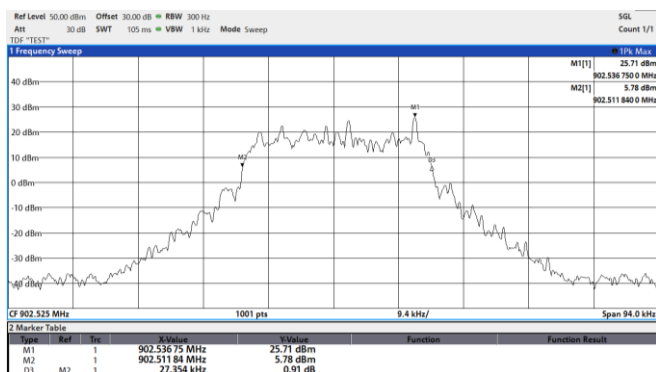
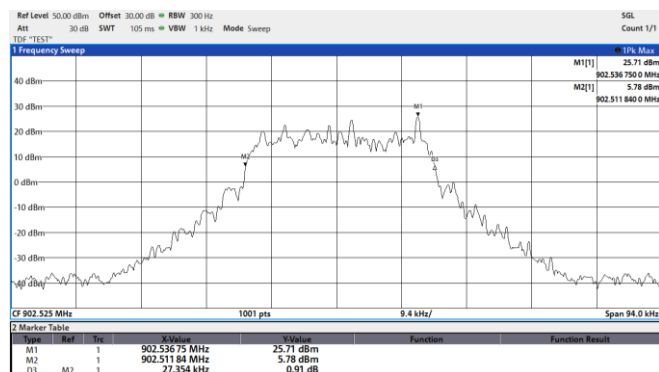
Receiver/spectrum analyzer settings:

Resolution bandwidth	300 Hz
Video bandwidth	1 kHz
Detector mode	Peak
Trace mode	Max Hold
Measurement time	Long enough for trace to stabilize

8.4.5 Test data

Table 8.4-1: 20 dB bandwidth (902 – 928 MHz band) test data

Test frequency (MHz)	Bandwidth (MHz)	Limit	Verdict
902.525	0.027	≤ 0.5 MHz	PASS
915.525	0.027	≤ 0.5 MHz	PASS
927.525	0.027	≤ 0.5 MHz	PASS



8.5 Channel separation

8.5.1 References and limits

- FCC 47 CFR Part 15, Subpart C: §15.247(a)(1)
- ISSED: RSS 247 5.1(b)
- Test method: ANSI C63.4-2020: §6.9.2

§15.247(a)(1), RSS-247 5.1(b):

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.

8.5.2 Test summary

Verdict	Pass		
Test date	August 15, 2023	Temperature	21 °C
Test engineer	Chenhao Ma, Wireless Test Technician	Air pressure	1004 mbar
Test location	<input checked="" type="checkbox"/> Wireless bench <input type="checkbox"/> Other:	Relative humidity	46 %

8.5.3 Notes

Testing was performed with the frequency hopping operation.

The spectral plots within this section have been corrected with all relevant transducer factors.

8.5.4 Setup details

EUT power input during test	120 VAC / 60 Hz
EUT setup configuration	<input checked="" type="checkbox"/> Table-top <input type="checkbox"/> Floor standing <input type="checkbox"/> Other:

Receiver/spectrum analyzer settings:

Resolution bandwidth	5 kHz
Video bandwidth	20 kHz
Detector mode	Peak
Trace mode	Max Hold
Measurement time	Long enough for trace to stabilize

8.5.5 Test data

Table 8.5-1: Channel separation results

Channel Separation (kHz)	Limit	Verdict
489 kHz	≥ 25 kHz or 20 dB bandwidth (whichever is greater)	PASS

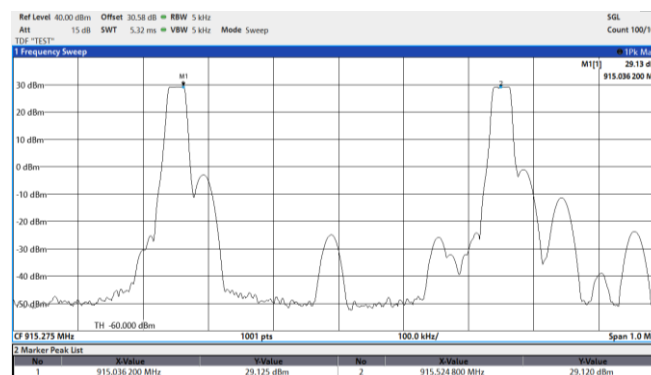


Figure 8.5-1: Channel separation

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Test name
Specification(s)

Testing data
Channel separation
FCC 15.247 & RSS-247



8.6 Number of hopping channels (902 – 928 MHz band)

8.6.1 References and limits

- FCC 47 CFR Part 15, Subpart C: §15.247(a)(1)(i)
- ISSED: RSS-247 5.1(c)
- Test method: ANSI C63.4-2020: §6.9.2

§15.247(a)(1)(i) and RSS-247 5.1(c):

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.

8.6.2 Test summary

Verdict	Pass		
Test date	August 15, 2023	Temperature	21 °C
Test engineer	Chenhao Ma, Wireless Test Technician	Air pressure	1004 mbar
Test location	<input checked="" type="checkbox"/> Wireless bench <input type="checkbox"/> Other:	Relative humidity	46 %

8.6.3 Notes

Testing was performed with the frequency hopping mode enabled.

The spectral plots within this section have been corrected with all relevant transducer factors.

8.6.4 Setup details

EUT power input during test	120 VAC / 60 Hz
EUT setup configuration	<input checked="" type="checkbox"/> Table-top <input type="checkbox"/> Floor standing <input type="checkbox"/> Other:

Receiver settings:

Resolution bandwidth	5 kHz
Video bandwidth	5 kHz
Detector mode	Peak
Trace mode	Max Hold
Measurement time	Long enough for trace to stabilize

8.6.5 Test Data

Table 8.6-1: Number of hopping channels (902 – 928 MHz band) results

Number of hopping channels (902 – 928 MHz band)	Limit	Verdict
50	≥ 50	PASS

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Test name

Specification(s)

Testing data

Number of hopping channels (902 – 928 MHz band)

FCC 15.247 & RSS-247

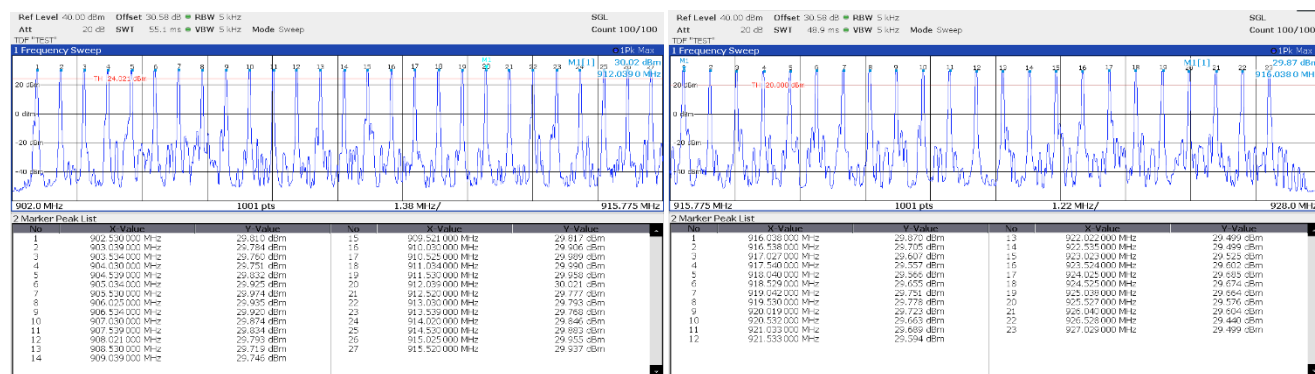


Figure 8.6-1: Number of hopping channels (902 – 928 MHz band)

8.7 Dwell time (902 – 928 MHz band)

8.7.1 References and limits

- FCC 47 CFR Part 15, Subpart C: §15.247(a)(1)(i)
- ISSED: RSS-247 5.1(c)
- Test method: ANSI C63.4-2020: §6.9.2

§15.247(a)(1)(i) and RSS-247 5.1(c):

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.

8.7.2 Test summary

Verdict	Pass		
Test date	July 12, 2023	Temperature	23.6 °C
Test engineer	Chenhao Ma, Wireless Test Technician	Air pressure	100.4 mbar
Test location	<input checked="" type="checkbox"/> Wireless bench <input type="checkbox"/> Other:	Relative humidity	48.6 %

8.7.3 Notes

Testing was performed with the frequency hopping mode enabled.

The spectral plots within this section have been corrected with all relevant transducer factors.

8.7.4 Setup details

EUT power input during test	120 VAC / 60 Hz
EUT setup configuration	<input checked="" type="checkbox"/> Table-top <input type="checkbox"/> Floor standing <input type="checkbox"/> Other:

Receiver settings:

Resolution bandwidth	100 kHz
Video bandwidth	100 kHz
Detector mode	Peak

8.7.5 Test Data

Table 8.7-1: Dwell time (902 – 928 MHz band) results

Measurement period	10 seconds
Pulse width	80 ms
Number of pulses in measurement period	2
Total time of occupancy in measurement period	2 x 80 ms = 160 ms
Limit	≤ 400 ms in 10 second measurement period

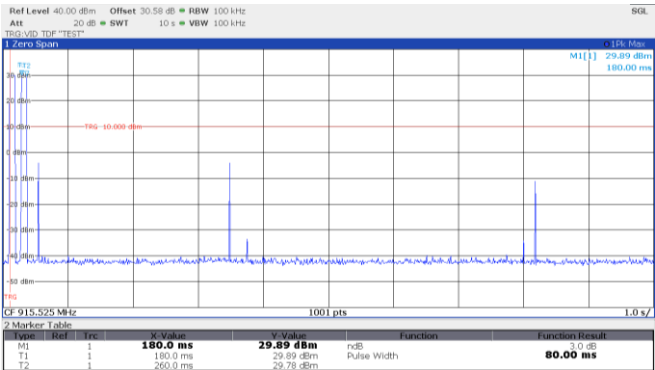


Figure 8.7-1: Dwell time (902 – 928 MHz band)

8.8 Maximum peak output power (902 – 928 MHz band)

8.8.1 References and limits

- FCC 47 CFR Part 15, Subpart C: §15.247(b)(2)
- ISSED: RSS-247 5.4(a)
- Test method: ANSI C63.10-2020 §7.8.5

§15.247:

(b) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

- (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.

RSS-247:

5.4 Devices shall comply with the following requirements, where applicable:

- (d) For FHSs 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.

8.8.2 Test summary

Verdict	Pass		
Test date	August 15, 2023	Temperature	21 °C
Test engineer	Chenhao Ma, Wireless Test Technician	Air pressure	1004 mbar
Test location	<input checked="" type="checkbox"/> Wireless bench <input type="checkbox"/> Other:	Relative humidity	46 %

8.8.3 Notes

Testing was performed with the transmitter operating on a fixed channel (lowest, middle, and highest; frequency hopping disabled) at maximum output power.

The spectral plots within this section have been corrected with all relevant transducer factors.

8.8.4 Setup details

EUT power input during test	120 VAC / 60 Hz
EUT setup configuration	<input checked="" type="checkbox"/> Table-top <input type="checkbox"/> Floor standing <input type="checkbox"/> Other:

Receiver/spectrum analyzer settings:

Resolution bandwidth	30 kHz
Video bandwidth	30 kHz
Detector mode	Peak
Trace mode	Max Hold
Measurement time	Long enough for trace to stabilize

8.8.5 Test data

Table 8.8-1: Maximum peak output power (902 – 928 MHz band) test data

Test Frequency (MHz)	Conducted Power (dBm)	Conducted Power Limit (dBm)	Margin (dB)	Antenna Gain (dBi)	EIRP (dBm) ¹	EIRP (Watts) ²	EIRP Limit (Watts) ³	Margin (Watts)
902.525	29.08	≤ 30	3.81	3.9	32.98	1.99	4.00	2.01
915.525	29.03	≤ 30	3.70	3.9	32.93	1.96	4.00	2.04
927.525	28.83	≤ 30	3.52	3.9	32.73	1.87	4.00	2.13

- Note:
1. EIRP = Conducted Power (dBm) + Antenna Gain (dBi)
 2. EIRP (Watts) = $10^{((\text{EIRP (dBm)} - 30)/10)}$
 2. EIRP Limit per ISSED RSS-247 Clause 5.4(a)

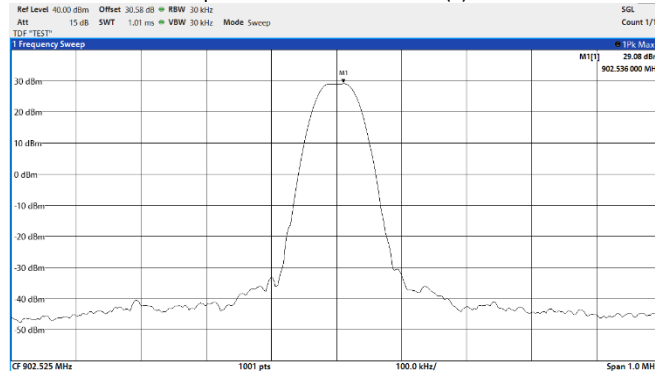


Figure 8.8-1: Maximum peak output power (902 – 928 MHz band), 902.525 MHz

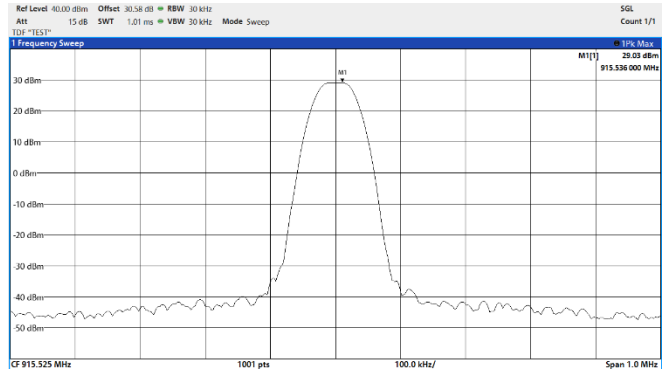


Figure 8.8-2: Maximum peak output power (902 – 928 MHz band), 915.525 MHz

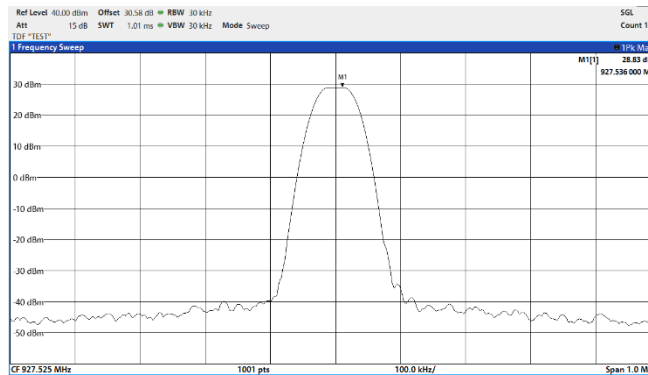


Figure 8.8-3: Maximum peak output power (902 – 928 MHz band), 927.525 MHz

8.9 Spurious emissions

8.9.1 References and limits

- FCC 47 CFR Part 15, Subpart C: §15.247(d)
- RSS-247: §5.5
- Test method: ANSI C63.10-2020 §6.10.4 (authorized band edge)
- Test method: ANSI C63.10-2020 §11.11 (antenna port conducted spurious emissions)
- Test method: ANSI C63.10-2020 §11.12.3 (radiated restricted band edge)
- Test method: ANSI C63.10-2020 §6.5, 6.6 (radiated emissions in restricted bands)

§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:

- 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.

Table 8.9-1: FCC §15.209 / RSS-GEN §8.9– Radiated emission limits

Frequency, MHz	Field strength of emissions		Measurement distance, m
	μV/m	dBμV/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.

Table 8.9-2: 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			

Table 8.9-3: ISSED RSS-GEN restricted frequency bands

MHz	MHz	GHz
090 - 0.110	149.9 - 150.05	9.0 - 9.2
0.495 - 0.505	156.52475 - 156.52525	9.3 - 9.5
2.1735 - 2.1905	156.7 - 156.9	10.6 - 12.7
3.020 - 3.026	162.0125 - 167.17	13.25 - 13.4
4.125 - 4.128	167.72 - 173.2	14.47 - 14.5
4.17725 - 4.17775	240 - 285	15.35 - 16.2
4.20725 - 4.20775	322 - 335.4	17.7 - 21.4
5.677 - 5.683	399.9 - 410	22.01 - 23.12
6.215 - 6.218	608 - 614	23.6 - 24.0
6.26775 - 6.26825	960 - 1427	31.2 - 31.8
6.31175 - 6.31225	1435 - 1626.5	36.43 - 36.5
8.291 - 8.294	1645.5 - 1646.5	Above 38.6
8.362 - 8.366	1660 - 1710	
8.37625 - 8.38675	1718.8 - 1722.2	
8.41425 - 8.41475	2200 - 2300	
12.29 - 12.293	2310 - 2390	
12.51975 - 12.52025	2483.5 - 2500	
12.57675 - 12.57725	2655 - 2900	
13.36 - 13.41	3260 - 3267	
16.42 - 16.423	3332 - 3339	
16.69475 - 16.69525	3345.8 - 3358	
16.80425 - 16.80475	3500 - 4400	
25.5 - 25.67	4500 - 5150	
37.5 - 38.25	5350 - 5460	
73 - 74.6	7250 - 7750	
74.8 - 75.2	8025 - 8500	
108 - 138		

8.9.2 Test summary

Verdict	Pass		
Test date	August 16, 2023	Temperature	19 °C
Test engineer	Chenhao Ma, Wireless Test Technician	Air pressure	1004 mbar
Test location	<input checked="" type="checkbox"/> Wireless bench (conducted tests) <input type="checkbox"/> 10 m semi-anechoic chamber (radiated tests) <input checked="" type="checkbox"/> 3 m semi-anechoic chamber (radiated tests) <input type="checkbox"/> Other:	Relative humidity	45 %

8.9.3 Notes

Testing was performed with the transmitter operating on a fixed channel at full power. Low, middle, and high channels were tested. The spectrum was searched from 30 MHz to above the 10th harmonic of the highest transmit frequency.

For radiated measurements, the EUT was investigated to identify the worst case orientation with respect to the fundamental transmitter power. All measurements were performed with the EUT in that worst-case orientation.

The spectral plots within this section have been corrected with all relevant transducer factors.

Radiated emissions are reported for the modulation / data rate settings that produced the highest transmitter output power as a worst-case. For this EUT, the worst case modulation / data rate setting used was: .

8.9.4 Setup details

EUT power input during test	120 VAC / 60 Hz
EUT setup configuration	<input checked="" type="checkbox"/> Table-top <input type="checkbox"/> Floor standing <input type="checkbox"/> Other:

Spectrum analyzer settings (conducted emissions):

Resolution bandwidth	100 kHz
Video bandwidth	300 kHz
Detector mode	Peak
Trace mode	Max Hold
Measurement time	Long enough for trace to stabilize

Receiver settings for radiated measurements within restricted bands below 1 GHz:

Resolution bandwidth	120 kHz
Video bandwidth	300 kHz
Detector mode	Peak (preview measurements) Quasi-Peak (final measurements)

Receiver settings for radiated measurements within restricted bands above 1 GHz:

Resolution bandwidth	1 MHz
Video bandwidth	3 MHz
Detector mode	Peak (preview measurements) Peak and average (final measurements)

8.9.5 Test data

Antenna port conducted spurious emissions:

- Authorized band edge:

Table 8.9-4: Authorized band edge conducted emissions (antenna port)

Test Frequency (MHz)	Frequency of highest emission (MHz)	Amplitude (dBc)	Limit (dBc)	Margin (dB)
902.525	901.935	67.38	≥ 20	47.38
927.525	928.010	66.80	≥ 20	46.80
Hopping (low edge)	901.560	53.94	≥ 20	33.94
Hopping (high edge)	928.004	52.94	≥ 20	32.94

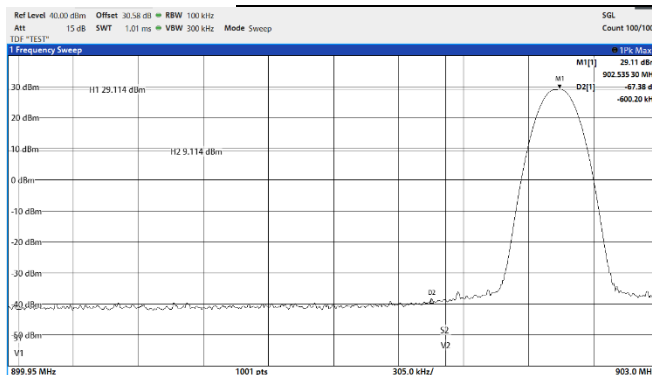


Figure 8.9-1: Authorized band-edge emissions, 902.525 MHz

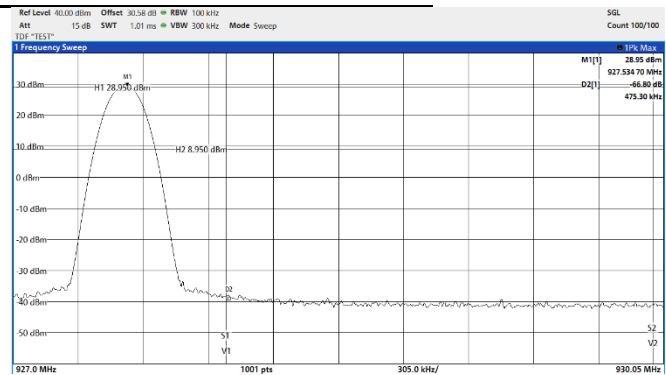


Figure 8.9-2: Authorized band-edge emissions, 927.525 MHz

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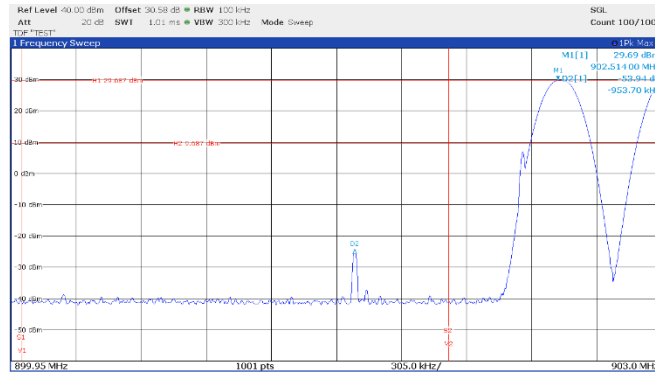


Figure 8.9-3: Authorized band-edge emissions, hopping mode, low band edge

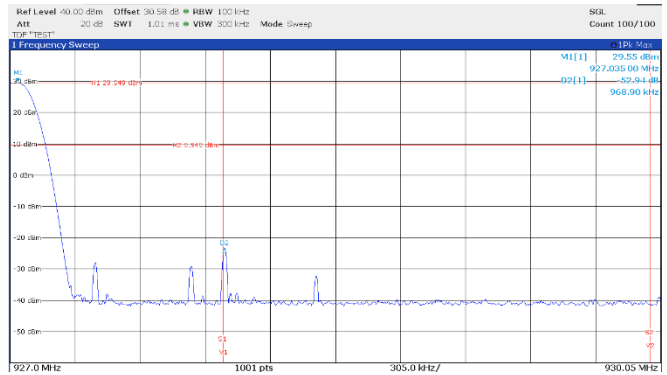


Figure 8.9-4: Authorized band-edge emissions, hopping mode, high band edge

Antenna port conducted spurious emissions:

Table 8.9-5: Antenna port conducted spurious emissions

Test Frequency (MHz)	Frequency of highest emission (MHz)	Amplitude (dBc)	Limit (dBc)	Margin (dB)
902.525	No significant emissions		≥ 20	---
915.525	No significant emissions		≥ 20	---
927.525	No significant emissions		≥ 20	---

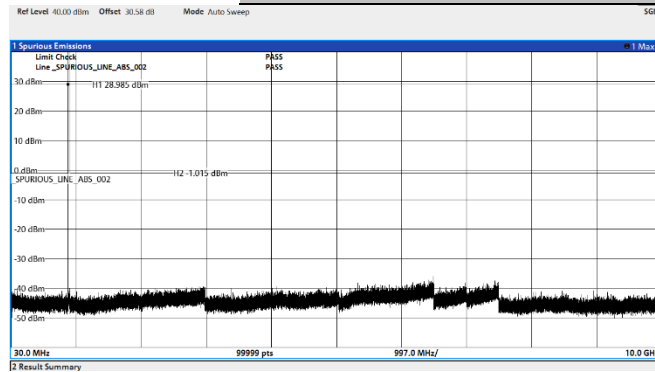


Figure 8.9-5: Antenna port conducted spurious emissions, 902.525 MHz

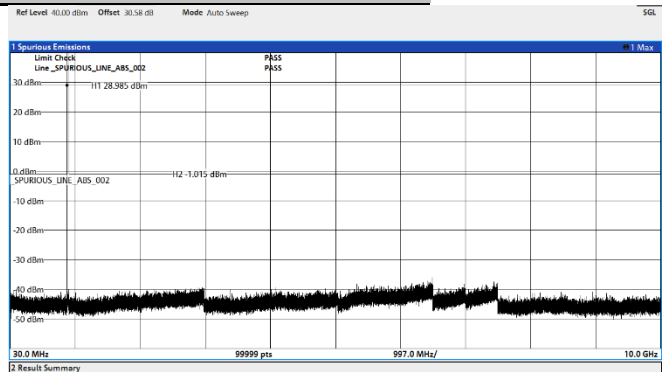


Figure 8.9-6: Antenna port conducted spurious emissions, 915.525 MHz

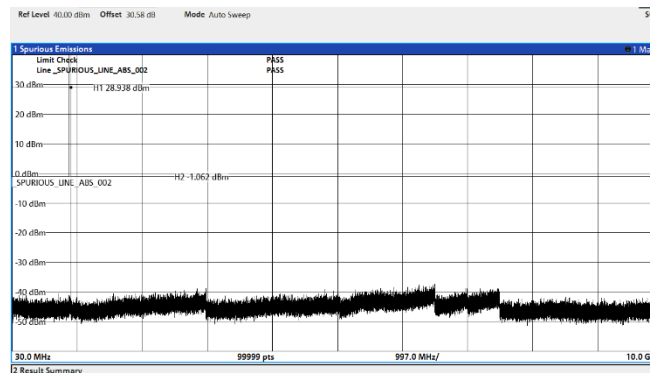


Figure 8.9-7: Antenna port conducted spurious emissions, 927.525 MHz

Radiated spurious emissions:

- Radiated spurious emissions, restricted bands:

Full Spectrum

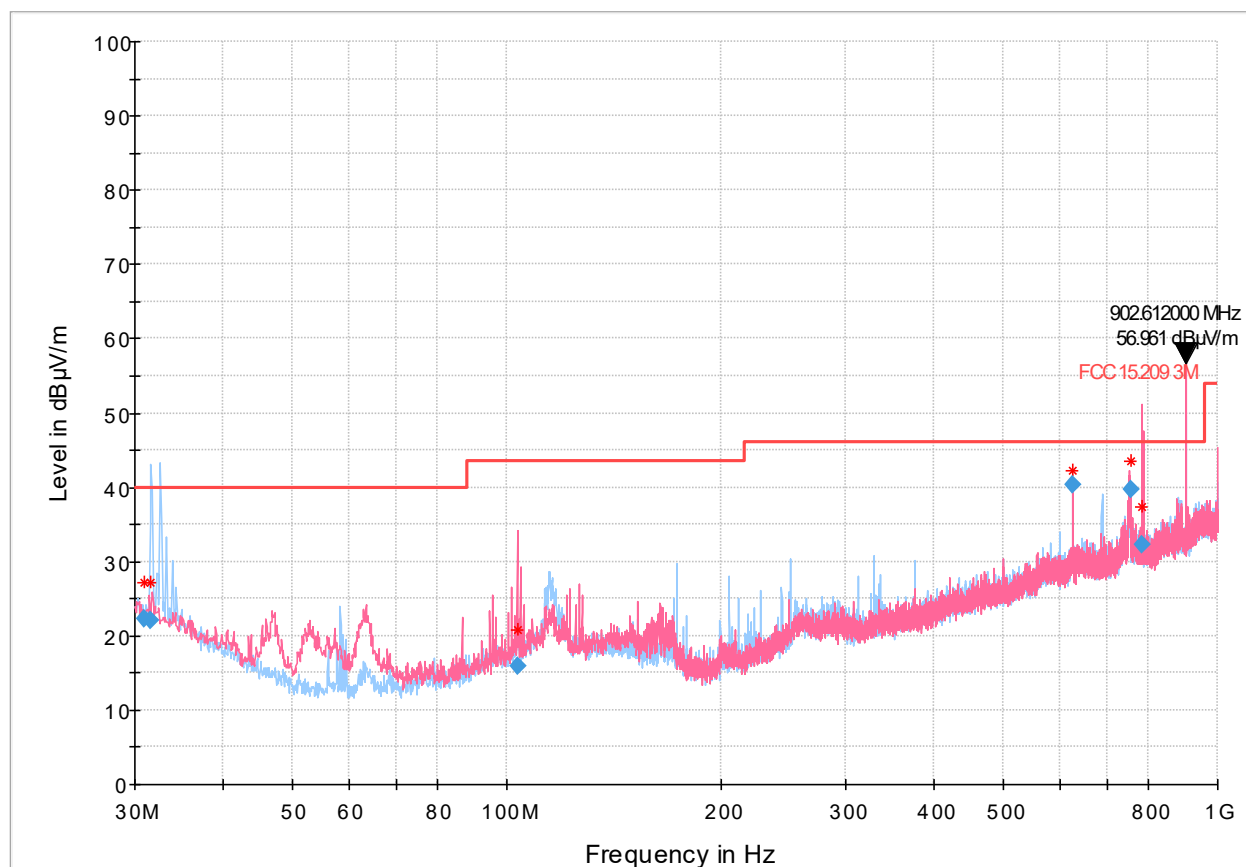


Figure 8.9-8: Radiated emissions spectral plot (30 MHz - 1 GHz) low channel

Table 8.9-6: Radiated emissions results

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
30.969000	22.28	40.00	17.72	5000.0	120.000	270.0	H	20.0	24.7
31.499000	22.00	40.00	18.00	5000.0	120.000	378.0	H	112.0	24.4
103.526000	15.92	43.50	27.58	5000.0	120.000	300.0	V	170.0	17.6
625.015000	40.32	46.00	5.68	5000.0	120.000	181.0	V	88.0	30.0
753.422000	39.71	46.00	6.29	5000.0	120.000	236.0	V	134.0	32.2
783.844000	32.32	46.00	13.68	5000.0	120.000	334.0	V	242.0	32.0

Notes: ¹ Field strength (dB V/m) = receiver/spectrum analyzer value (dB V) + correction factor (dB)

² Correction factors = antenna factor ACF (dB) + cable loss (dB)

³ 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.

Full Spectrum

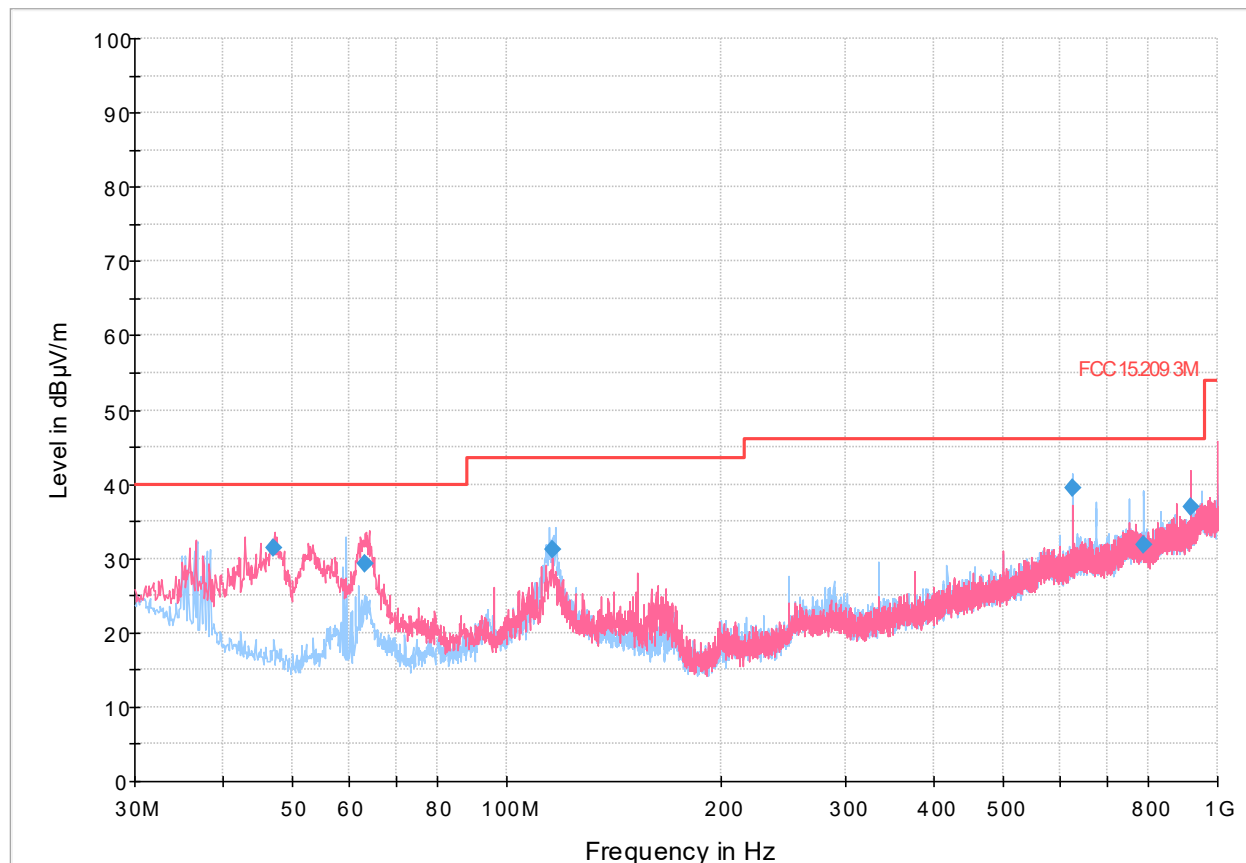


Figure 8.9-9: Radiated emissions spectral plot (30 MHz - 1 GHz) mid channel

Table 8.9-7: Radiated emissions results

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
47.129000	31.32	40.00	8.68	5000.0	120.000	104.0	V	320.0	15.6
63.287000	29.32	40.00	10.68	5000.0	120.000	110.0	V	238.0	12.2
116.195000	31.20	43.50	12.30	5000.0	120.000	260.0	H	246.0	18.5
624.998000	39.55	46.00	6.45	5000.0	120.000	314.0	H	138.0	30.0
786.727000	31.92	46.00	14.08	5000.0	120.000	222.0	H	11.0	32.0
915.250000	36.92	46.00	9.08	5000.0	120.000	323.0	V	182.0	33.8

Notes: ¹ Field strength (dB V/m) = receiver/spectrum analyzer value (dB V) + correction factor (dB)

² Correction factors = antenna factor ACF (dB) + cable loss (dB)

³ 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.

Full Spectrum

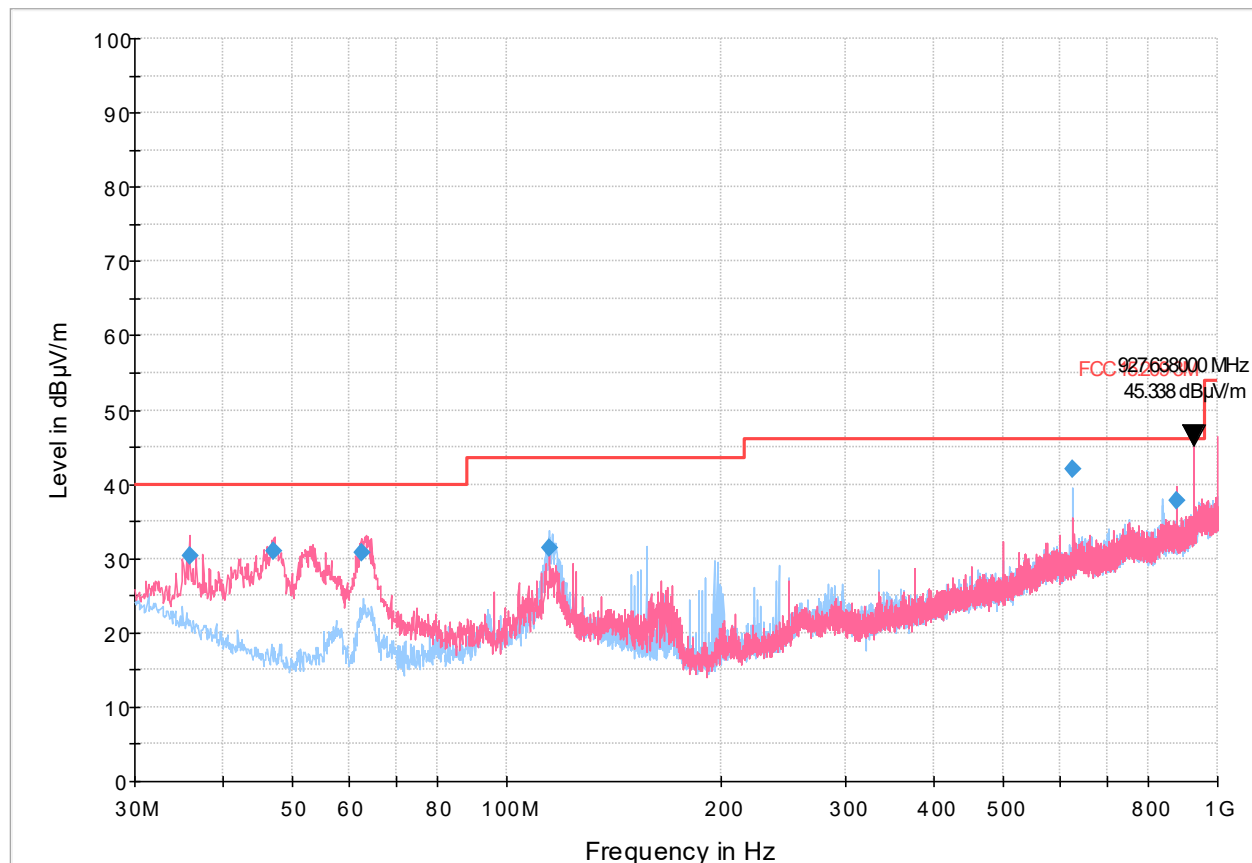


Figure 8.9-10: Radiated emissions spectral plot (30 MHz - 1 GHz) high channel

Table 8.9-8: Radiated emissions results

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
35.900000	30.44	40.00	9.56	5000.0	120.000	113.0	V	202.0	21.7
47.089000	31.07	40.00	8.93	5000.0	120.000	100.0	V	334.0	15.6
62.488000	30.78	40.00	9.22	5000.0	120.000	131.0	V	192.0	12.2
115.075000	31.38	43.50	12.12	5000.0	120.000	289.0	H	262.0	18.4
624.998000	42.12	46.00	3.88	5000.0	120.000	127.0	H	135.0	30.0
874.984000	37.81	46.00	8.19	5000.0	120.000	174.0	V	42.0	33.2

Notes: ¹ Field strength (dB V/m) = receiver/spectrum analyzer value (dB V) + correction factor (dB)
² Correction factors = antenna factor ACF (dB) + cable loss (dB)
³ 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.

Full Spectrum

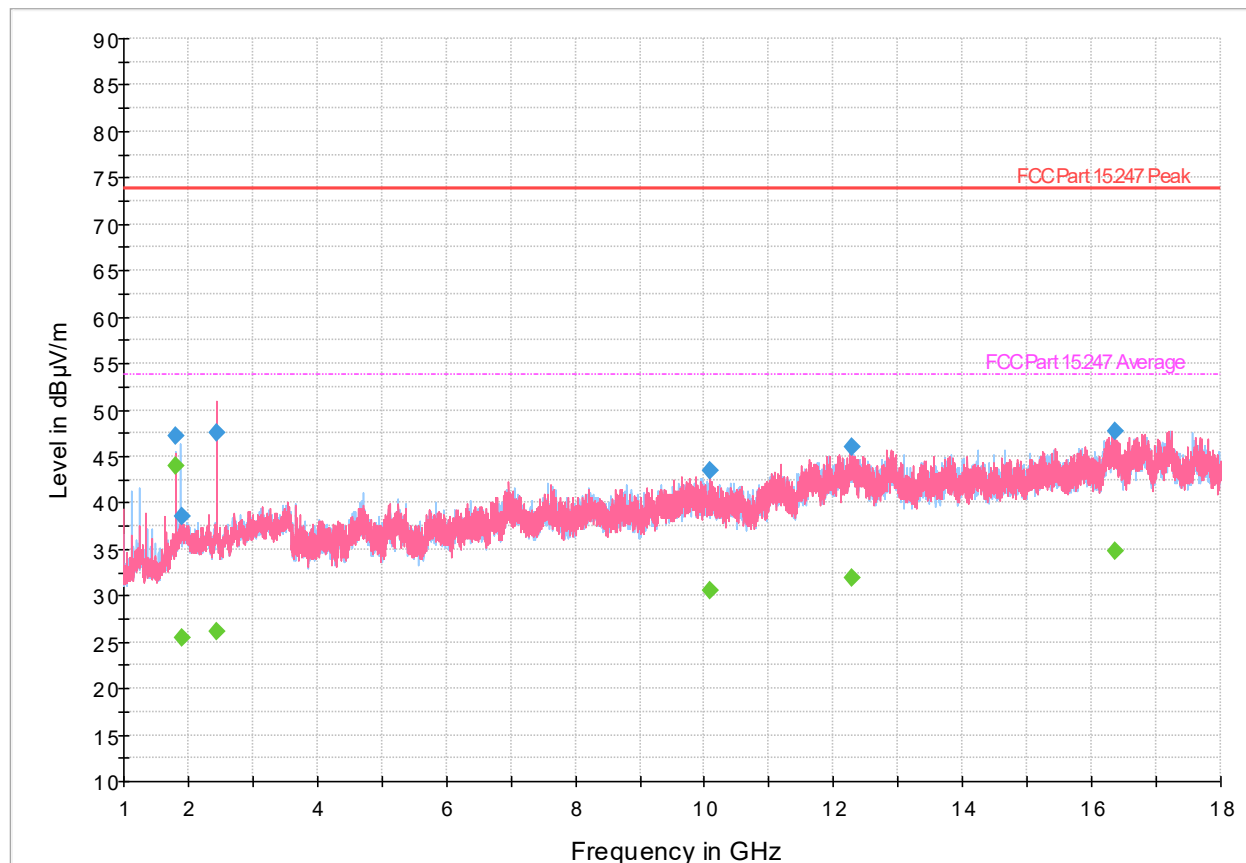


Figure 8.9-11: Radiated emissions spectral plot (1 GHz - 18 GHz) low channel

Table 8.9-9: Radiated emissions results

Frequency (MHz)	MaxPeak (dBμV/m)	CAverage (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1805.066667	---	44.05	53.90	9.85	5000.0	1000.000	328.0	H	221.0	-12.1
1805.066667	47.22	---	73.90	26.68	5000.0	1000.000	328.0	H	221.0	-12.1
1896.977778	---	25.42	53.90	28.48	5000.0	1000.000	169.0	H	186.0	-10.8
1896.977778	38.45	---	73.90	35.45	5000.0	1000.000	169.0	H	186.0	-10.8
2437.955556	47.54	---	73.90	26.36	5000.0	1000.000	391.0	V	267.0	-9.8
2437.955556	---	26.17	53.90	27.73	5000.0	1000.000	391.0	V	267.0	-9.8
10095.400000	---	30.54	53.90	23.36	5000.0	1000.000	371.0	H	196.0	3.9
10095.400000	43.51	---	73.90	30.39	5000.0	1000.000	371.0	H	196.0	3.9
12277.533333	---	31.84	53.90	22.06	5000.0	1000.000	104.0	V	313.0	7.1
12277.533333	45.96	---	73.90	27.94	5000.0	1000.000	104.0	V	313.0	7.1
16365.200000	47.76	---	73.90	26.14	5000.0	1000.000	177.0	H	44.0	12.9
16365.200000	---	34.76	53.90	19.14	5000.0	1000.000	177.0	H	44.0	12.9

Notes: ¹ Field strength (dB V/m) = receiver/spectrum analyzer value (dB V) + correction factor (dB)

² Correction factors = antenna factor ACF (dB) + cable loss (dB)

³ 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.

Full Spectrum

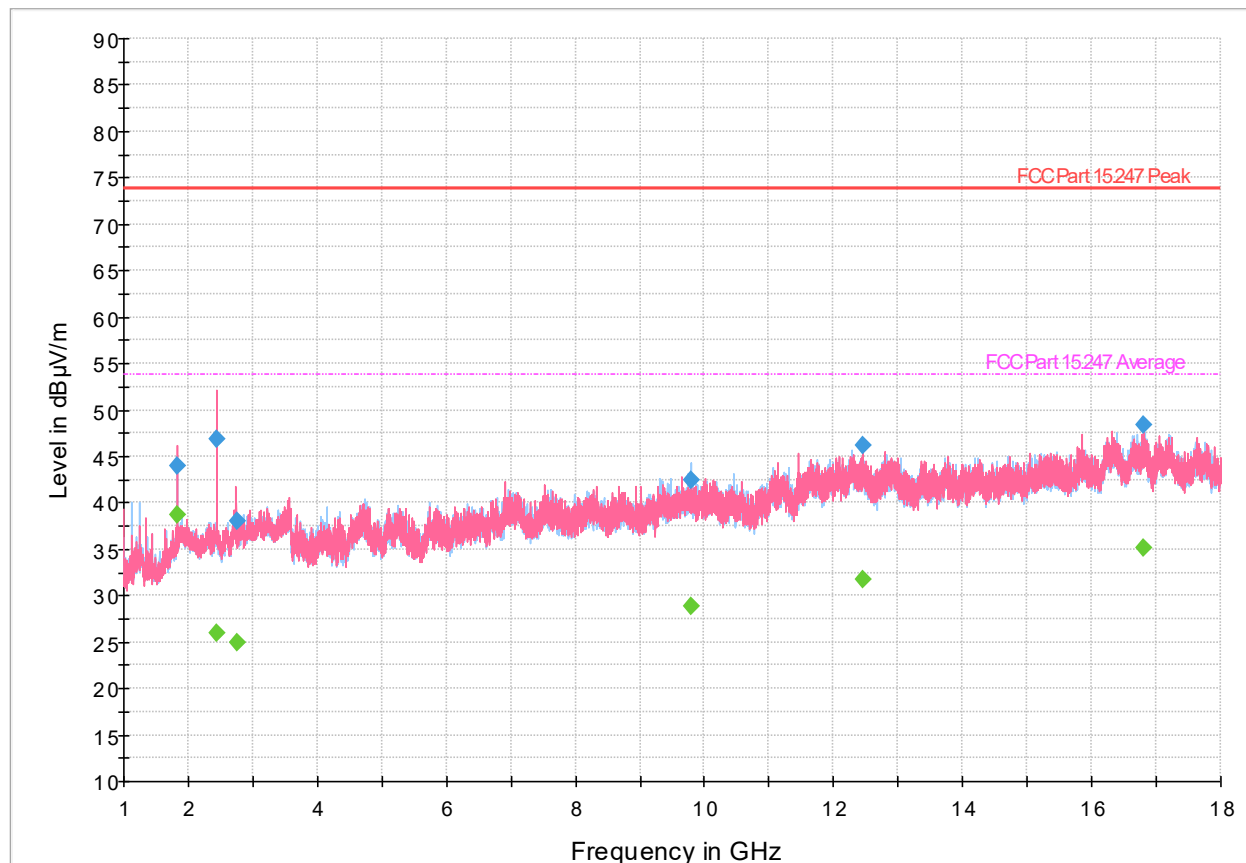


Figure 8.9-12: Radiated emissions spectral plot (1 GHz - 18 GHz) mid channel

Table 8.9-10: Radiated emissions results

Frequency (MHz)	MaxPeak (dBμV/m)	CAverage (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1831.111111	43.96	---	73.90	29.94	5000.0	1000.000	175.0	V	331.0	-11.6
1831.111111	---	38.74	53.90	15.16	5000.0	1000.000	175.0	V	331.0	-11.6
2435.555556	---	25.95	53.90	27.95	5000.0	1000.000	373.0	V	302.0	-9.8
2435.555556	46.91	---	73.90	26.99	5000.0	1000.000	373.0	V	302.0	-9.8
2749.477778	---	25.03	53.90	28.87	5000.0	1000.000	364.0	V	43.0	-8.6
2749.477778	38.07	---	73.90	35.83	5000.0	1000.000	364.0	V	43.0	-8.6
9781.588889	42.48	---	73.90	31.42	5000.0	1000.000	139.0	H	0.0	3.6
9781.588889	---	28.91	53.90	24.99	5000.0	1000.000	139.0	H	0.0	3.6
12452.555556	46.11	---	73.90	27.79	5000.0	1000.000	243.0	V	86.0	7.4
12452.555556	---	31.76	53.90	22.14	5000.0	1000.000	243.0	V	86.0	7.4
16809.311111	48.36	---	73.90	25.54	5000.0	1000.000	240.0	V	264.0	14.3
16809.311111	---	35.09	53.90	18.81	5000.0	1000.000	240.0	V	264.0	14.3

Notes: ¹ Field strength (dB V/m) = receiver/spectrum analyzer value (dB V) + correction factor (dB)

² Correction factors = antenna factor ACF (dB) + cable loss (dB)

³ 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.

Full Spectrum

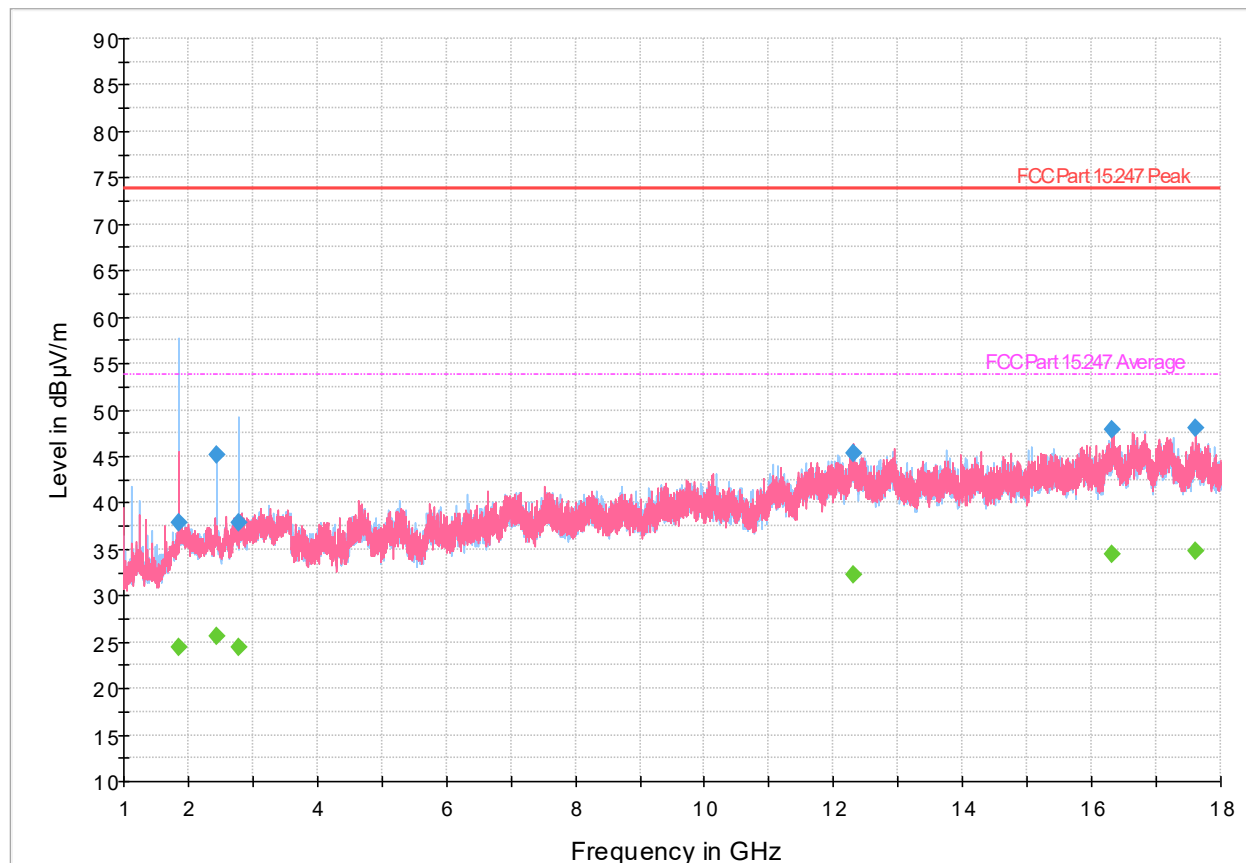


Figure 8.9-13: Radiated emissions spectral plot (1 GHz - 18 GHz) high channel

Table 8.9-11: Radiated emissions results

Frequency (MHz)	MaxPeak (dBμV/m)	CAverage (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1855.522222	---	24.51	53.90	29.39	5000.0	1000.000	144.0	H	143.0	-11.2
1855.522222	37.87	---	73.90	36.03	5000.0	1000.000	144.0	H	143.0	-11.2
2435.700000	45.19	---	73.90	28.71	5000.0	1000.000	163.0	H	312.0	-9.8
2435.700000	---	25.70	53.90	28.20	5000.0	1000.000	163.0	H	312.0	-9.8
2780.566667	37.92	---	73.90	35.98	5000.0	1000.000	180.0	H	20.0	-8.6
2780.566667	---	24.50	53.90	29.40	5000.0	1000.000	180.0	H	20.0	-8.6
12299.366667	45.32	---	73.90	28.58	5000.0	1000.000	275.0	V	301.0	7.1
12299.366667	---	32.18	53.90	21.72	5000.0	1000.000	275.0	V	301.0	7.1
16321.433333	---	34.38	53.90	19.52	5000.0	1000.000	379.0	V	351.0	13.3
16321.433333	47.87	---	73.90	26.03	5000.0	1000.000	379.0	V	351.0	13.3
17615.788889	48.13	---	73.90	25.77	5000.0	1000.000	328.0	V	0.0	13.4
17615.788889	---	34.77	53.90	19.13	5000.0	1000.000	328.0	V	0.0	13.4

Notes: ¹ Field strength (dB V/m) = receiver/spectrum analyzer value (dB V) + correction factor (dB)

² Correction factors = antenna factor ACF (dB) + cable loss (dB)

³ 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.

8.10 99% occupied bandwidth

8.10.1 References and limits

- ISED: RSS-Gen: §6.7
- Test method: ANSI C63.4-2020: §6.9.2

RSS-GEN:

6.7 The occupied bandwidth or the “99% emission bandwidth” is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

8.10.2 Test summary

Verdict	Pass		
Test date	August 15, 2023	Temperature	21 °C
Test engineer	Chenhao Ma, Wireless Test Technician	Air pressure	1004 mbar
Test location	<input checked="" type="checkbox"/> Wireless bench <input type="checkbox"/> Other:	Relative humidity	46 %

8.10.3 Notes

Testing was performed with the transmitter operating on a fixed channel (lowest, middle, and highest) at maximum output power.

The spectral plots within this section have been corrected with all relevant transducer factors.

8.10.4 Setup details

EUT power input during test	120 VAC / 60 Hz
EUT setup configuration	<input checked="" type="checkbox"/> Table-top <input type="checkbox"/> Floor standing <input type="checkbox"/> Other:

Receiver settings:

Resolution bandwidth	300 Hz
Video bandwidth	1 kHz
Detector mode	Peak
Trace mode	Max Hold
Measurement time	Long enough for trace to stabilize

8.10.5 Test data

Table 8.10-1: 99% occupied bandwidth test data

Test Frequency (MHz)	99% BW (MHz)	f _l (MHz)	f _h (MHz)	Limit	Verdict
902.525	0.026	902.513	902.539	f _h and f _l within 902 - 928MHz	PASS
915.525	0.026	915.513	915.539	f _h and f _l within 902 - 928MHz	PASS
927.525	0.026	927.512	927.539	f _h and f _l within 902 - 928MHz	PASS

Section 8

Test name

Specification(s)

Testing data

99% occupied bandwidth

FCC 15.247 & RSS-247

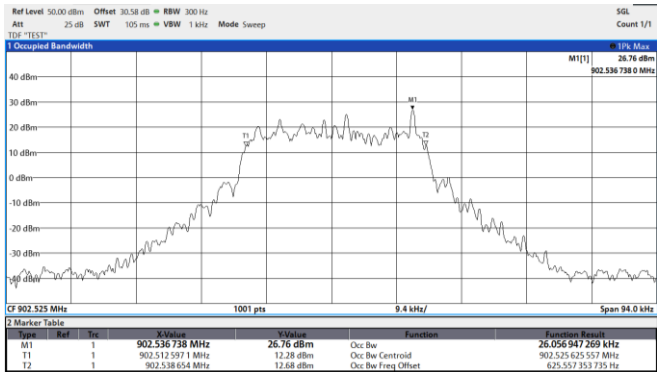


Figure 8.10-1: 99% occupied bandwidth, 902.525 MHz

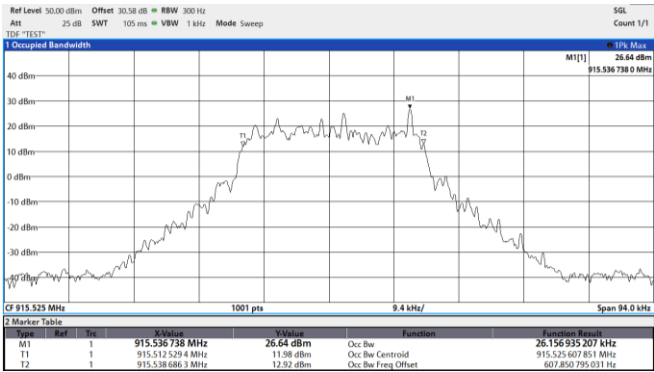


Figure 8.10-2: 99% occupied bandwidth, 915.525 MHz

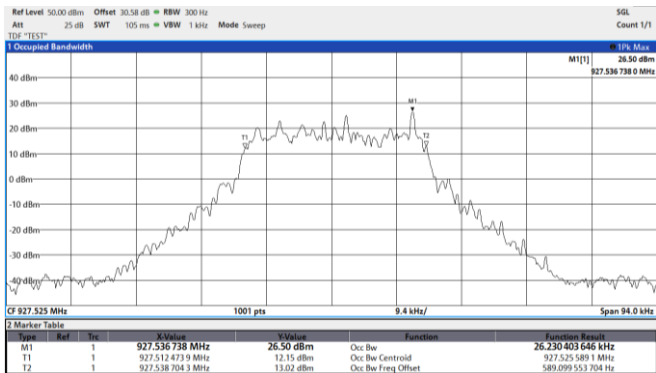


Figure 8.10-3: 99% occupied bandwidth, 927.525 MHz

End of test report