ISRAEL TESTING LABORATORIES
Global Certifications You Can Trust

ACCREDITED
Certificate: 1152.01

Date: 27 October 2022

I.T.L. Product Testing Ltd.

FCC/IC Radio Test Report

for

Roseman Engineering Ltd.

Equipment under test:

Dual Nozzle Tag

Dual Mode

Tested by: _____
M. Zohar

Approved by: I. Mansky

pp. I. Cohen: _____

ISRAEL TESTING LABORATORIES
Global Certifications You Can Trust

ACCREDITED
Certificate: 1152.01

Measurement/Technical Report for

Roseman Engineering Ltd.

Dual Nozzle Tag

Dual Mode

FCC ID: JAKNR-G4G3

IC: 29097NR-G4G3

This report concerns:	Original Grant
Equipment type:	FCC: DSS Part 15 Spread Spectrum Transmitter IC: Spread Spectrum Digital Device (2400-2483.5 MHz)
Limits used:	47CFR15 Section 15.247 RSS-247, Issue 2, February 2017, Section 5 RSS-Gen, Issue 5, April 2018, Amendment 1 (March 2019), Amendment 2 (February 2021)

Measurement procedures used: FCC: KDB 558074 D01 v05, ANSI C63.10: 2020
IC: RSS-Gen, Issue 5, April 2018, Amendment 1 (March 2019), Amendment 2 (February 2021)

Prepared by:

R. Ezrah

I.T.L. Product Testing Ltd.

1 Bat Sheva St., Lod 7116002, Israel

Email: rame@itlglobal.org

Applicant:

Haim Kashi

Roseman Engineering Ltd.

Kiriat Atidim Bldg. 7, Tel Aviv 6158101, Israel

Email: haim@roseman.co.il,
Engineering-Group@roseman.co.il

Table of Contents

1. General Information

1.1 Administrative Information

Manufacturer:	Roseman Engineering Ltd.
Manufacturer's Address:	Kiriat Atidim Bldg. 7, Tel Aviv 6158101, Israel
	Tel: +972. 3.5731801
Manufacturer's Representative:	Haim Kashi
Equipment Under Test (E.U.T):	Dual Nozzle Tag
Equipment Serial No.:	Not designated
PMN/HVIN:	RID-DMR-07
	RID-DMR-09
Date of Receipt of E.U.T:	January 16, 2022
Start of Test:	January 16, 2022
End of Test:	January 30, 2022
Test Laboratory Location:	I.T.L (Product Testing) Ltd.
	1 Bat Sheva St., Lod 7120101
	ISRAEL
Test Specifications:	47CFR15 Section 15.247
	RSS-247, Issue 2 (February 2017), Section 5
	RSS-Gen, Issue 5, (April 2018), Amendment 2 (February 2021)

1.2 List of Accreditations

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), FCC Designation No. IL1005.
3. Department of Innovation, Science and Economic Development (ISED) Canada, CAB identifier: IL1002

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

1.3 Product Description

The Wireless Nozzle Reader (WNR) is an active stand-alone device fitted to the nozzle. The WNR is a robust system enclosed in rugged plastic, designed to operate in harsh fuel environments. It is easy to install and does not require any adaptations to the nozzle.
The nozzle is inserted into a vehicle fuel tank inlet. The WNR automatically reads the vehicle identification device data and transmits it to the Island Control Unit (ICU) via the Wireless Automated Fueling (WAF) unit to check the tag authentication and verification. Only then will authorization be approved, and fuel dispensed into the vehicle.
Throughout the course of fueling the WNR transmits refresh signals to the WAF unit showing that the fueling is in progress and will do so until the transaction is completed.
The nozzle tag contains a replaceable battery.

Type of Equipment							
☒	Stand Alone (Equipment with/without its own control provisions)						
☐	Combined (Equipment where radio part is fully integrated with another type of equipment)						
☐	Plug in card (Equipment intended for a variety of host systems)						
Intended Use		Condition of use					
☐	Fixed	Always of distance >2m from the people					
√	Mobile	distance of 10cm					
☐	Portable	Always of distance <20cm to human body					
Assigned frequency band		2400.0-2483.5MHz					
Operational frequencies		2401.0-2478M.0Hz FHSS					
Maximum rated output power		At transmitter 50Ω RF output connector [dBm]	+1dBm				
		Effective Radiated Power (for equipment without RF connector)					
Antenna Connection							
☐	Unique Coupling	☐	Standard Connection	☒	Integral	☒	With temporary RF connector
						☐	Without temporary RF connector
Antenna Gain		+2dBi					
Operating channel bandwidth		296KHz					
Type of modulation		MSK					
Bit rate		250Kbs					
Maximum transmitter duty cycle		98%					
Transmitter power source							
☐	AC	Nominal rated voltage					
☐	DC	Nominal rated voltage					
☒	Battery	Nominal rated voltage	3.6V				
FHSS/DTS equipment		16 channels FHSS					

1.4 Test Methodology

Radiated testing was performed according to the procedures in KDB 558074 D01 v05, ANSI C63.10: 2013 and RSS-Gen Issue 5 (2018). Radiated testing was performed at an antenna to EUT distance of three meters.

1.5 Test Facility

Emissions tests were performed at I.T.L.'s testing facility in Lod, Israel. I.T.L.'s EMC Laboratory is accredited by the A2LA, certificate No. 1152.01 and its FCC Designation Number is IL1005.

1.6 Measurement Uncertainty

Conducted Emission

Conducted Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4) 0.15 – 30 MHz:

Expanded Uncertainty (95% Confidence, K=2):

± 3.6 dB

Radiated Emission

Radiated Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4) for open site:
30-1000MHz:
Expanded Uncertainty (95% Confidence, K=2):
± 4.96 dB

1 GHz to 6 GHz
Expanded Uncertainty (95% Confidence, K=2):
±5.19 dB

>6 GHz
Expanded Uncertainty (95% Confidence, K=2):
±5.51 dB

2. System Test Configuration

2.1 Justification

1. The E.U.T is battery operated and contains a 16-channel hopping transceiver.

2. The unit was evaluated while transmitting at the low channel (2401MHz), the mid channel (2442MHz) and the high channel (2478MHz).

3. Final radiated emission test was performed after exploratory emission testing that was performed in 3 orthogonal polarities to determine the "worst case" radiation.

4. According to the below results the "worst case" was the Y axis

Orientation	Frequency	fundamental	2nd Harmonic	3rd Harmonic	Band Edge
	(MHz)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)
X axis	2401.0	90.7	48.2	44.2 (N.L)	59.8
	2442.0	88.1	50.0	45.0	-
	2478.0	86.8	47.6	44.0 (N.L)	58.8
Y axis	2401.0	92.0	50.1	46.5	61.8
	2442.0	93.0	50.7	46.3	-
	2478.0	89.4	47.5	44.7 (N.L)	59.3
Z axis	2401.0	91.2	49.8	46.0	60.3
	2442.0	92.1	48.3	47.1	-
	2478.0	88.0	47.1	44.0 (N.L)	59.0

*N.L.: noise level

Figure 1. Screening Results

5. Conducted emission tests were performed with the E.U.T. antenna terminal connected by a RF cable to the Spectrum Analyzer through a 30dB external attenuator.

2.2 EUT Exercise Software

No special exercise software was used.

2.3 Special Accessories

No special accessories were needed in order to achieve compliance.

2.4 Equipment Modifications

No modifications were needed in order to achieve compliance.

2.5 Configuration of Tested System

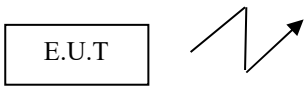


Figure 2. Configuration of Tested System – Radiated

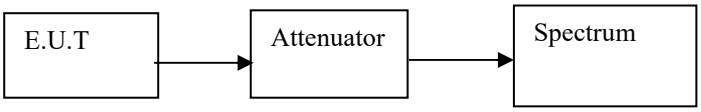


Figure 3. Configuration of Tested System - Conducted

3. Test Setup Photos

See a separate file.

4. 20dB Minimum Bandwidth

4.1 Test Specification

FCC, Part 15, Subpart C, Section 15.247(a)(1)
RSS-247, Issue 2, Section 5.1(b)

4.2 Test Procedure

(Temperature (19°C)/ Humidity (43%RH))
The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable. The transmitter unit operated with normal modulation.
The spectrum analyzer was set to the following parameters:
Span = ~ 2 to 3 times the 20 dB bandwidth,
RBW ≥ 1% of the 20 dB bandwidth
Detector Function: Peak, Trace: Maximum Hold.

4.3 Test Limit

N/A

4.4 Test Results

Operation Frequency (MHz)	Bandwidth Reading (kHz)
2401.0	375.2
2442.0	373.3
2478.0	371.3

Figure 4 Test Results

JUDGEMENT: Passed

For additional information see *Figure 5* to *Figure 7.*

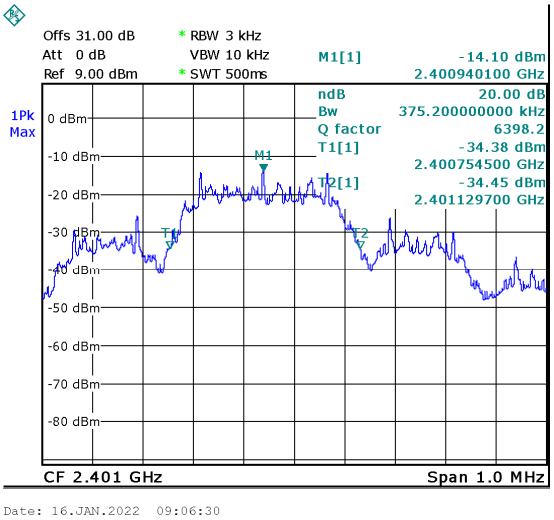


Figure 5. 2401MHz

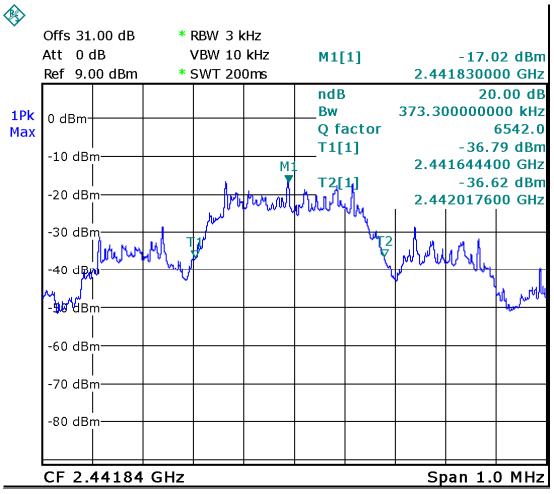


Figure 6. 2442MHz

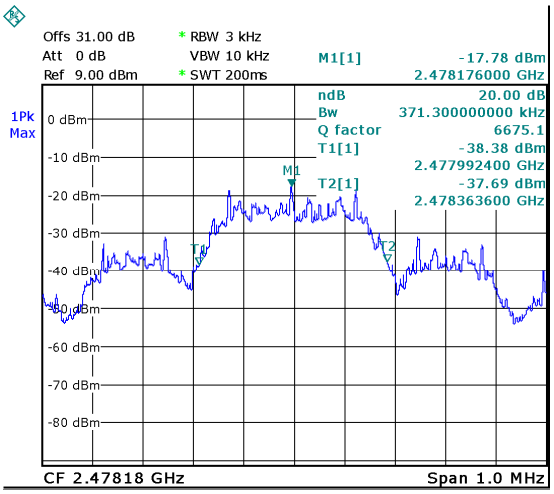


Figure 7. 2478MHz

4.5 Test Equipment Used

Instrument	Manufacturer	Model	Serial Number	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	20/02/2022	20/02/2023
30dB Attenuator	MCL	BW-S30W5	533	23/05/2021	23/05/2022
RF Cable	Huber Suhner	Sucofelex	28239/4PEA	23/05/2021	23/05/2022

Figure 8 Test Equipment Used, 20 dB Minimum Bandwidth

5. Occupied Bandwidth

5.1 Test Specification

FCC, Part 15, Subpart C, Section 2.1048

RSS-Gen, Issue 5: 2018, Section 6.6

5.2 Test Procedure

(Temperature (19°C)/ Humidity (43%RH))
The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable .
The spectrum analyzer was set to the following parameters:
Span = ~ 1.5 to 5 times the OBW
RBW = 1% to 5% of the 20 dB bandwidth
Detector Function: Peak, Trace: Maximum Hold.

5.3 Test Limit

N/A

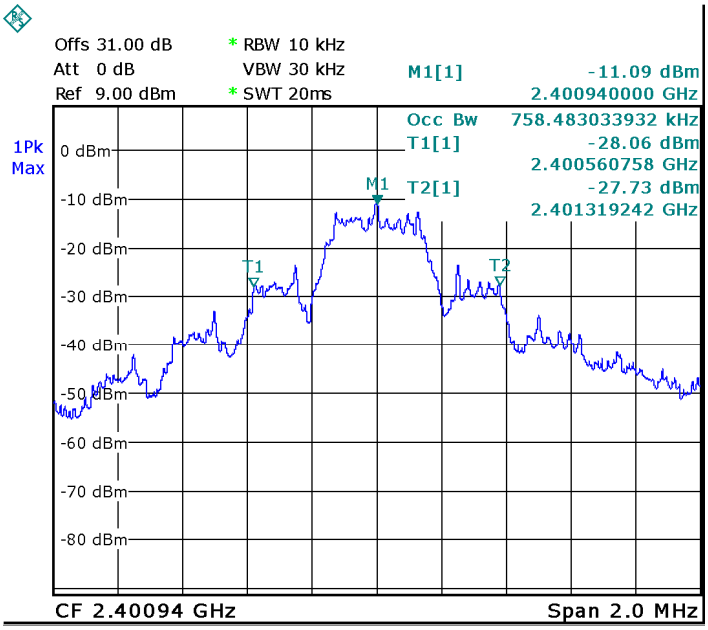
5.4 Test Results

Operation Frequency (MHz)	Bandwidth Reading (kHz)
2401.0	758.5
2442.0	770.4
2478.0	794.4

Figure 9 Test Results

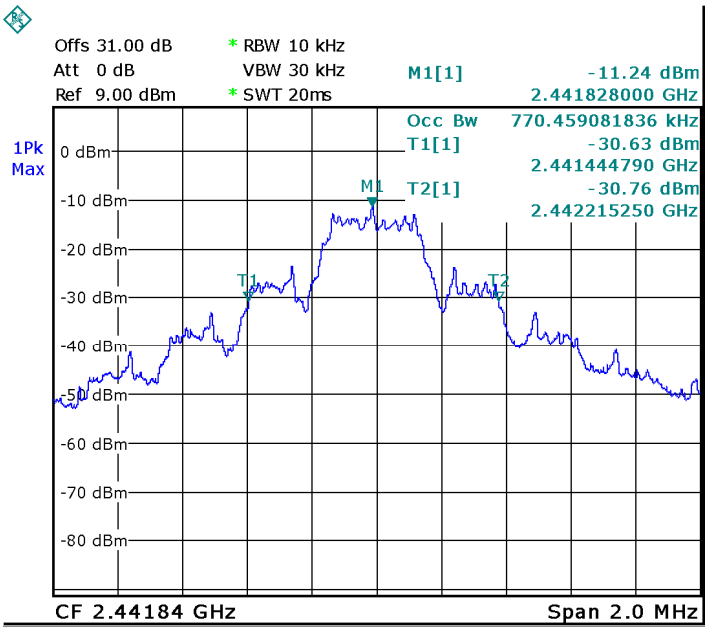
JUDGEMENT: Passed

For additional information see *Figure 10* to *Figure 12.*



Date: 16.JAN.2022 10:30:11

Figure 10. 2401MHz



Date: 16.JAN.2022 10:29:08

Figure 11. 2442MHz

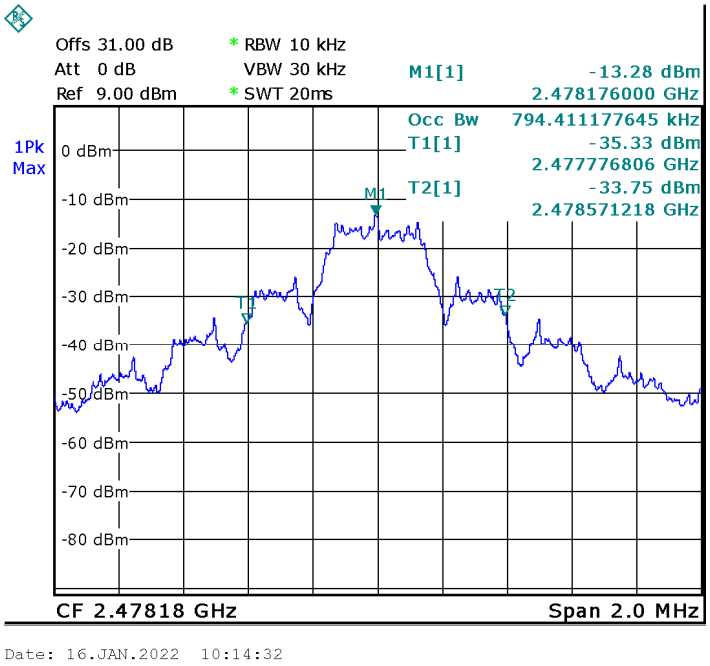


Figure 12. 2478MHz

5.5 Test Equipment Used

Instrument	Manufacturer	Model	Serial Number	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	20/02/2022	20/02/2023
30dB Attenuator	MCL	BW-S30W5	533	23/05/2021	23/05/2022
RF Cable	Huber Suhner	Sucofelex	28239/4PEA	23/05/2021	23/05/2022

Figure 13 Test Equipment Used, Occupied Bandwidth

6. Frequency Hopping

6.1 Test Specification

FCC, Part 15, Subpart C Section 15.247(a)(1)(iii)

RSS-247, Issue 2, Section 5.1(d)

6.2 Test Procedure

(Temperature (19°C)/ Humidity (48%RH))
The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable.

The E.U.T. was set to hopping mode.
The spectrum analyzer was set to the following parameters:

Band of Operation: 2400M-2483.5 MHz
RBW= VBW: 1MHz
Detector Function: Peak, Trace: Maximum Hold

6.3 Test Limit

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15/75 Channels.

6.4 Test Results

Number of Hopping Frequencies	Limit
16	≥15/75

Figure 14 Test Results

JUDGEMENT: Passed

For additional information see *Figure 15.*

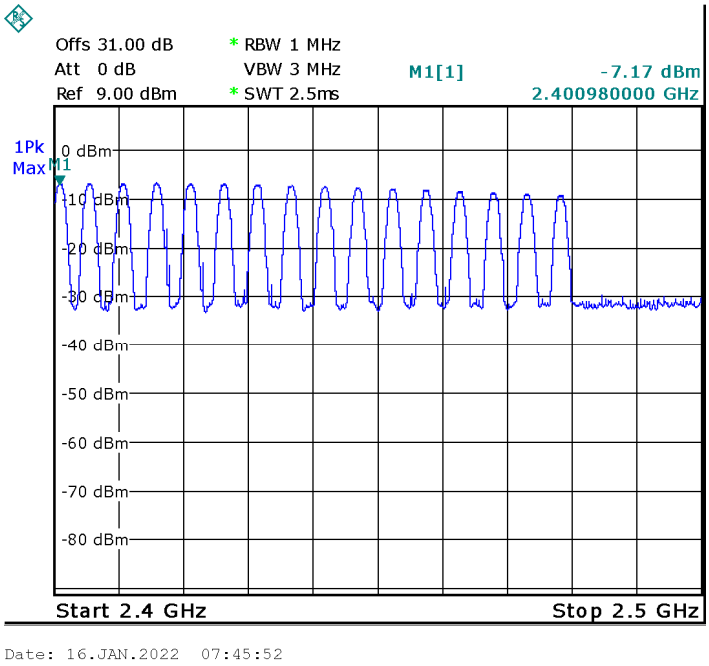


Figure 15. Number of Channels

6.5 Test Equipment Used

Instrument	Manufacturer	Model	Serial Number	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	20/02/2022	20/02/2023
30dB Attenuator	MCL	BW-S30W5	533	23/05/2021	23/05/2022
RF Cable	Huber Suhner	Sucofelex	28239/4PEA	23/05/2021	23/05/2022

Figure 16 Test Equipment Used, Frequency Hopping

7. Channel Frequency Separation

7.1 Test Specification

FCC Part 15, Subpart C, 15.247(a) (1)

RSS-247, Issue 2, Section 5.1(b)

7.2 Test Procedure

(Temperature (19°C)/ Humidity (48%RH))
The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable.

The E.U.T. was set to hopping mode.

The spectrum analyzer was set to the following parameters:
Span = wide enough to capture two adjacent channels, RBW≥ 1% of the span
Detector Function: Peak, Trace: Maximum Hold.

7.3 Test Limit

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.

7.4 Test Results

Channel Frequency Separation	Limit
(kHz)	(kHz)
5190.0	≥375.0

Figure 17 Test Results

JUDGEMENT: Passed by ___ kHz

For additional information see *Figure 18.*

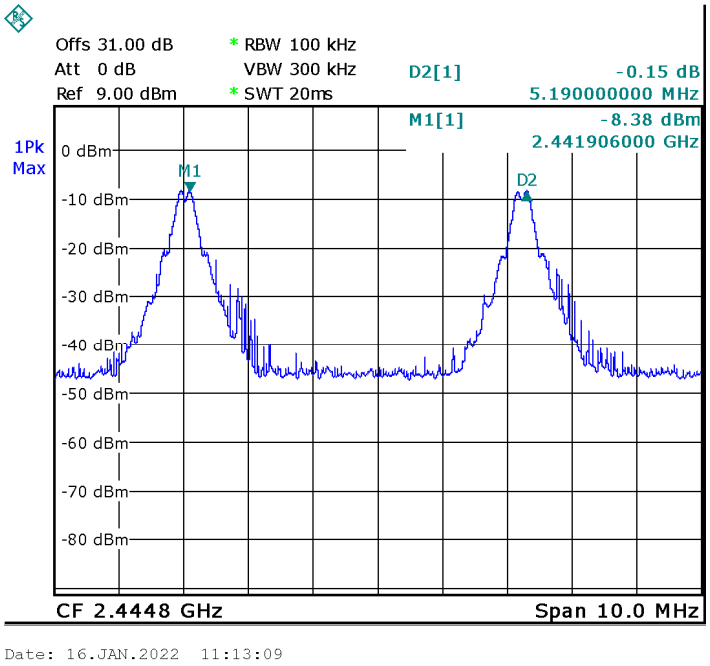


Figure 18. Channel Frequency Separation

7.5 Test Equipment Used

Instrument	Manufacturer	Model	Serial Number	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	20/02/2022	20/02/2023
30dB Attenuator	MCL	BW-S30W5	533	23/05/2021	23/05/2022
RF Cable	Huber Suhner	Sucofelex	28239/4PEA	23/05/2021	23/05/2022

Figure 19 Test Equipment Used, Channel Frequency Separation

8. Peak Output Power

8.1 Test Specification

FCC Part 15, Subpart C: section 15.247(b)(1)
RSS-247, Issue 2, Section 5.4(b)

8.2 Test Procedure

(Temperature (19°C)/ Humidity (48%RH))

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

The E.U.T was tested in the chamber and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of three meters.

Radiated output power levels were measured at selected operation frequencies and the results were converted to power level according to the formula as shown below:

$$P = \frac{(E_{V/m} \times d)^2}{(30 \times G)} \text{ [W]}$$

E - Field Strength (V/m)
d – Distance from transmitter (m)
G – Antenna gain
P – Peak power (W)

8.3 Test Limit

The maximum peak conducted output power of the intentional radiator shall not exceed the following: For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels: 1 watt.
For all other frequency hopping systems in the 2400-2483.5 MHz band:
0.125 Watts. (The limits above applies to antenna gain until 6dBi).

8.4 Test Results

Operation Frequency	Pol.	Field Strength	EIRP	Antenna Gain	Power	Power	Limit	Margin
(MHz)	(V/H)	(dBuV/m)	(dBm)	(dBi)	(dBm)	(mW)	(mW)	(mW)
2401.0	V	92.0	-3.2	2.0	-5.2	0.3	125.0	-124.7
	H	89.8	-5.4	2.0	-7.4	0.2	125.0	-124.8
2442.0	V	93.1	-2.1	2.0	-4.1	0.4	125.0	-124.6
	H	88.9	-6.3	2.0	-8.3	0.1	125.0	-124.9
2478.0	V	89.4	-5.8	2.0	-7.8	0.2	125.0	-124.8
	H	88.6	-6.6	2.0	-8.6	0.1	125.0	-124.9

Figure 20 Radiated Power Output Test Results

JUDGEMENT: Passed by -124.6 mW

For additional information see Figure 21 to Figure 26.

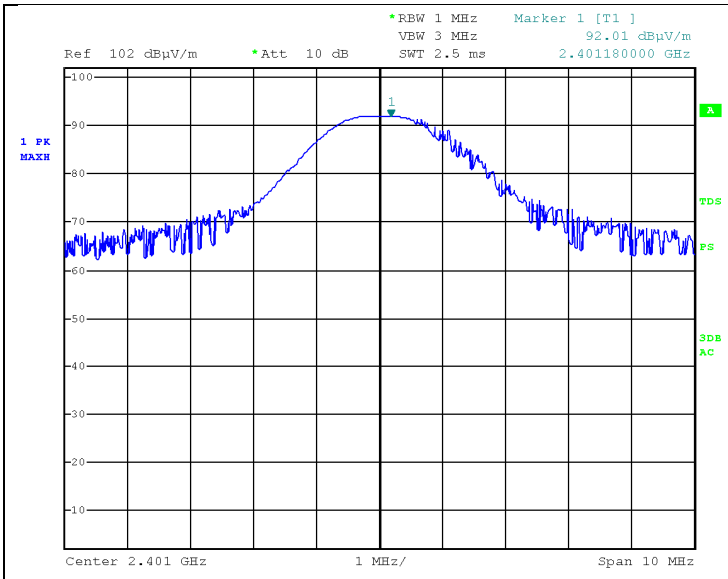


Figure 21 2401MHz, Vertical

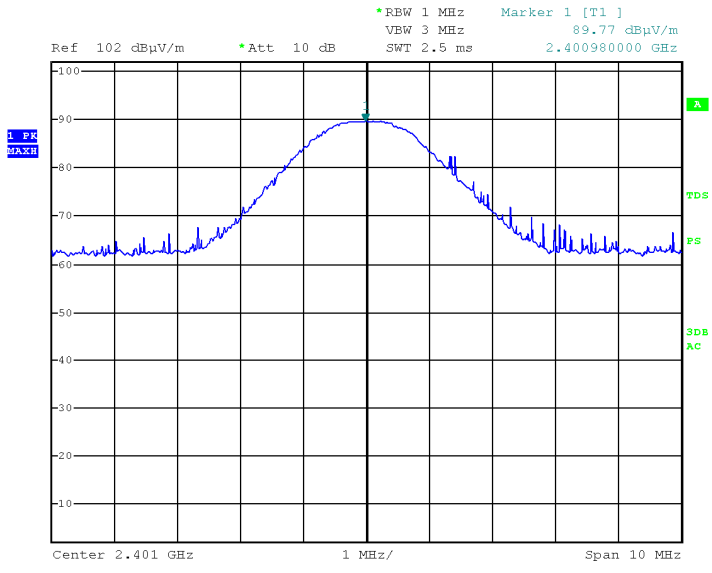


Figure 22 2401MHz, Horizontal

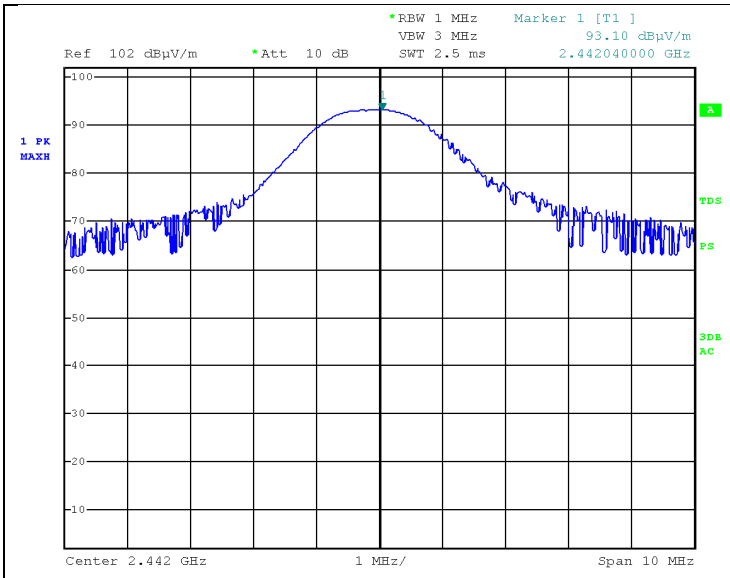


Figure 23 2442MHz, Vertical

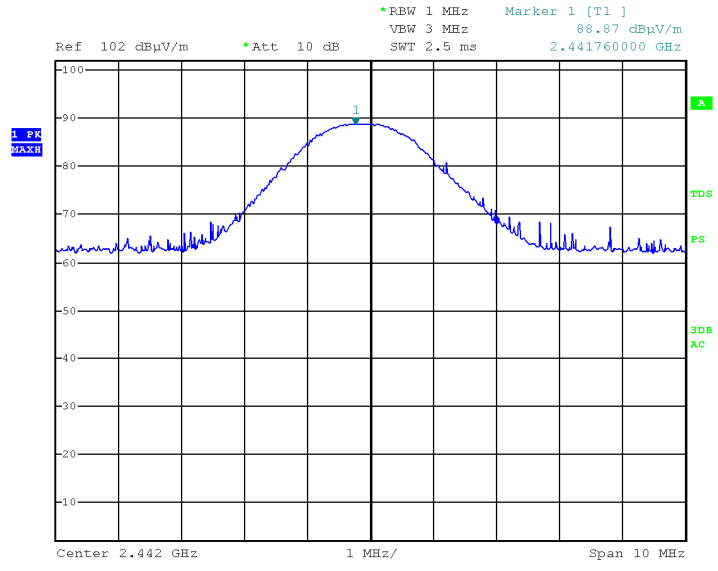


Figure 24 2442MHz, Horizontal

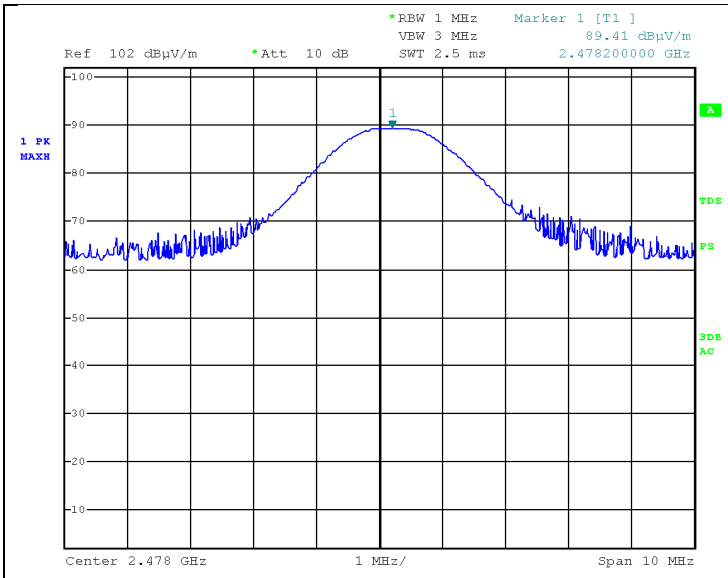


Figure 25 2478MHz, Vertical

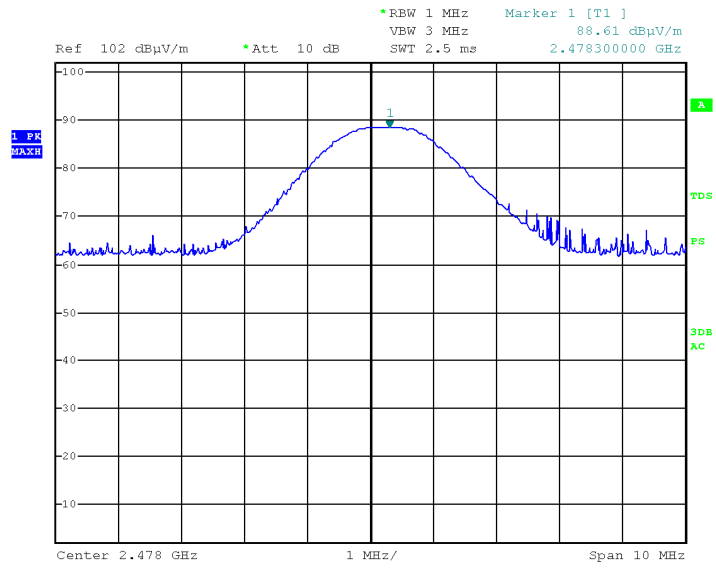


Figure 26 2478MHz, Horizontal

8.5 Test Equipment Used, Peak Output Power

Instrument	Manufacturer	Model	Serial Number	Last Calibration Date	Next Calibration Due

EMI Receiver	HP (Agilent)	8542E	3906A00276	22/02/2021	22/02/2022
Horn Antenna	ETS	3115	29845	25/05/2021	25/05/2024
Full Anechoic Civil Chamber	ETS	S81	SL 11643	NCR	NCR
RF Cable Chamber	Commscope ORS	0623 WBC-400	G020132	25/05/2021	25/05/2022

Figure 27 Test Equipment Used

9. Dwell Time on Each Channel

9.1 Test Specification

FCC Part 15, Part C, Section 15.247(a)(1)(iii)

RSS-247, Issue 2, Section 5.1(d)

9.2 Test Procedure

(Temperature (19°C)/ Humidity (48%RH))
The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable.
The spectrum analyzer was set to the following parameters:
Span = zero span, centered on a hopping channel, RBW≥ 1MHz
Detector Function: Peak, Trace: Maximum Hold

9.3 Test Limit

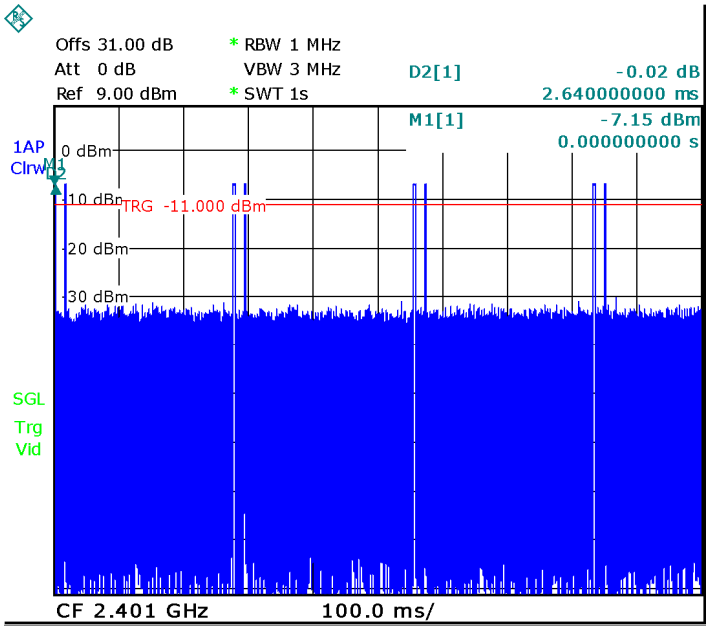
The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed(0.4*16=6.4 sec)

9.4 Test Results

JUDGEMENT: Passed

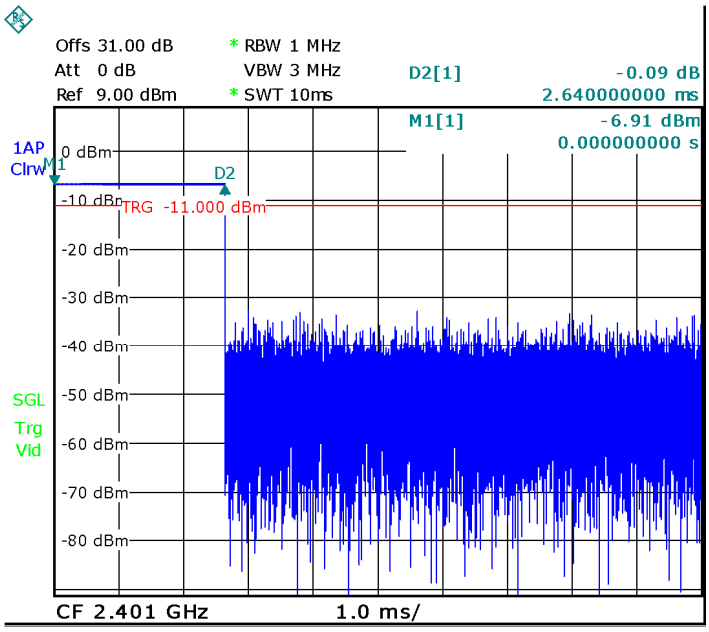
The E.U.T met the requirements of the FCC Part 15, Section 15.247(d) and RSS, Issue 2, Section 5.1(d)

Additional information of the results is given in *Figure 28* to *Figure 29*.



Date: 16.JAN.2022 07:43:55

Figure 28 Number of Bursts in 1 sec=8



Date: 16.JAN.2022 07:43:22

Figure 29 Burst Duration =2.64msec

DWELL TIME (6.4*8)*2.64m= 135.1msec<400msec

9.5 Test Equipment Used

Instrument	Manufacturer	Model	Serial Number	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	20/02/2022	20/02/2023
30dB Attenuator	MCL	BW-S30W5	533	23/05/2021	23/05/2022
RF Cable	Huber Suhner	Sucofelex	28239/4PEA	23/05/2021	23/05/2022

Figure 30 Test Equipment Used, Dwell Time on Each Channel

10. Band Edge

10.1 Test Specification

FCC Part 15, Section 15.247(d)

RSS-247, Issue 2, Section 5.5

10.2 Test Procedure

(Temperature (19°C)/ Humidity (48%RH))
The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable.
The transmitter unit operated in 2 modes: hopping enabled and hopping disabled.
The RBW was set to 100 kHz.

10.3 Test Limit

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.

10.4 Test Results

Mode	Operation Frequency	Band Edge Frequency	Spectrum Level	Limit	Margin
	(MHz)	(MHz)	(dBm)	(dBm)	(dB)
Hopping	2401-2478	2400.0	-40.6	-28.0	-12.6
		2483.5	-45.0	-32.3	-12.7
Non- Hopping	2401.0	2400.0	-41.2	-28.0	-13.2
	2478.0	2483.5	-44.5	-32.0	-12.5

Figure 31 Band Edge Test Results

JUDGEMENT: Passed by __-12.5 dB

For additional information see *Figure 32* to *Figure 35.*

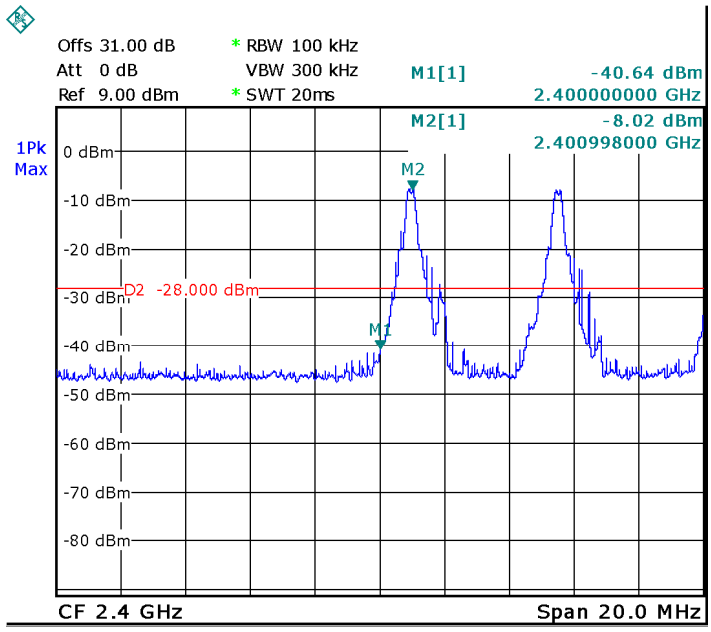


Figure 32 Hopping, Band Edge Low

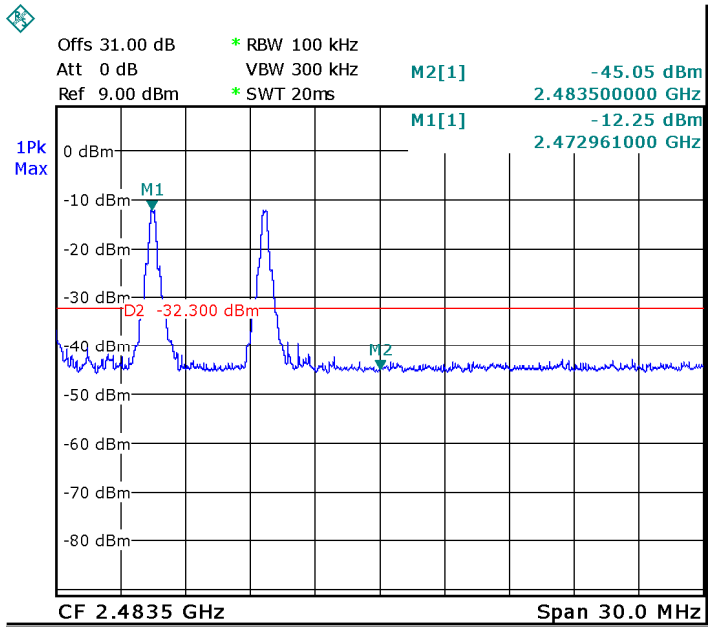


Figure 33 Hopping, Band Edge High

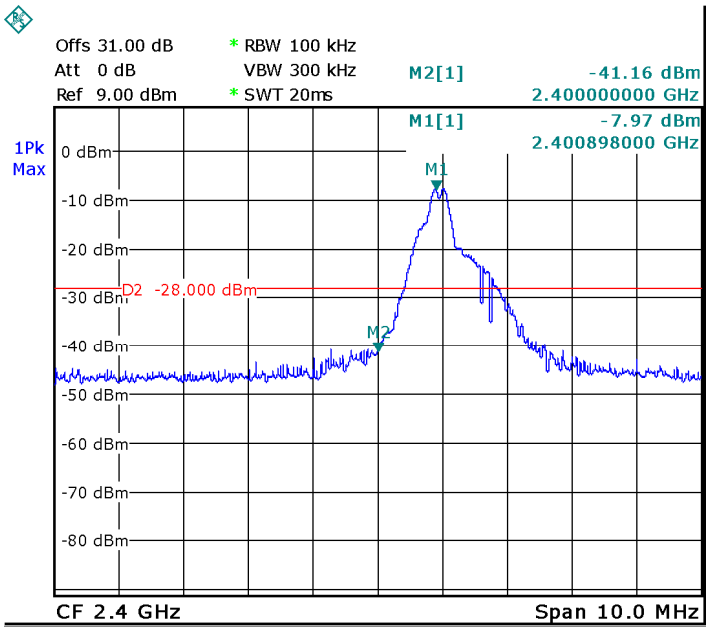


Figure 34 Non-Hopping, Band Edge Low

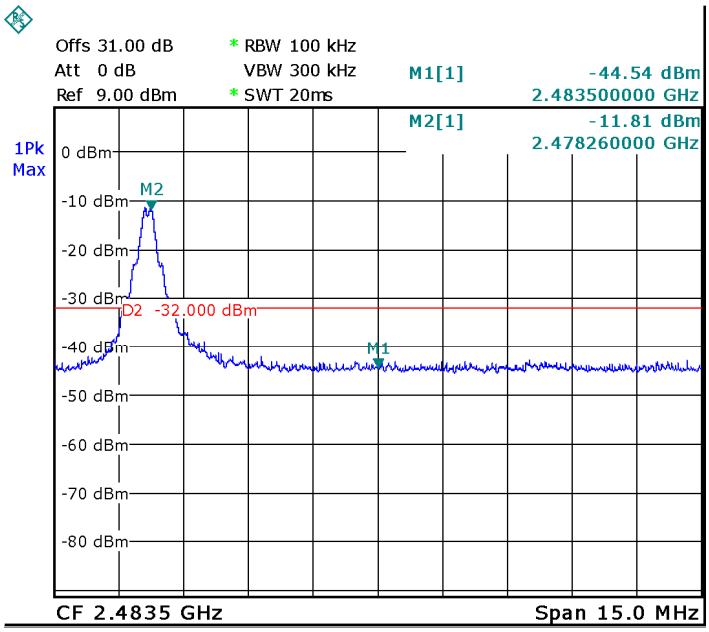


Figure 35 Non-Hopping, Band Edge High

10.5 Test Equipment Used

Instrument	Manufacturer	Model	Serial Number	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	20/02/2022	20/02/2023
30dB Attenuator	MCL	BW-S30W5	533	23/05/2021	23/05/2022
RF Cable	Huber Suhner	Sucofelex	28239/4PEA	23/05/2021	23/05/2022

Figure 36 Test Equipment Used, Band Edge

11. Emissions in Non-Restricted Frequency Bands

11.1 Test Specification

FCC, Part 15, Subpart C, Section 247(d)

RSS-247, Issue 2, Section 5.5

11.2 Test Procedure

(Temperature (20°C)/ Humidity (49%RH))
The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable.
RBW was set to 100 kHz, detector set to max peak and trace to “max hold”.\

11.3 Test Limit

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.

11.4 Test Results

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 247 (d) and RSS-247, Issue 2, Section 5.5 specification.

For additional information see *Figure 37* to *Figure 39.*

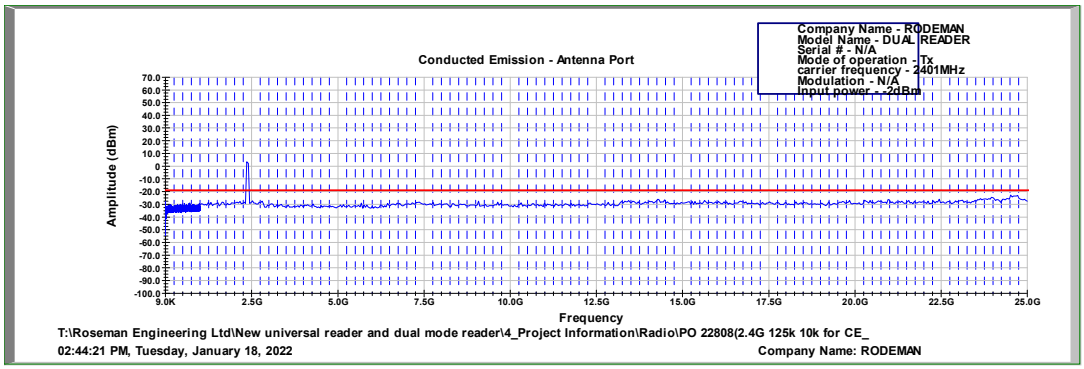


Figure 37 Conducted Spurious Emission, 2401MHz

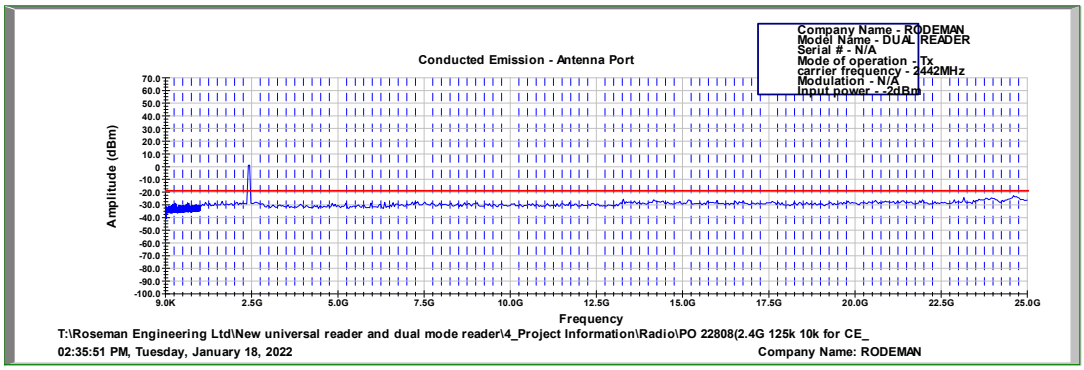


Figure 38 Conducted Spurious Emission, 2442MHz

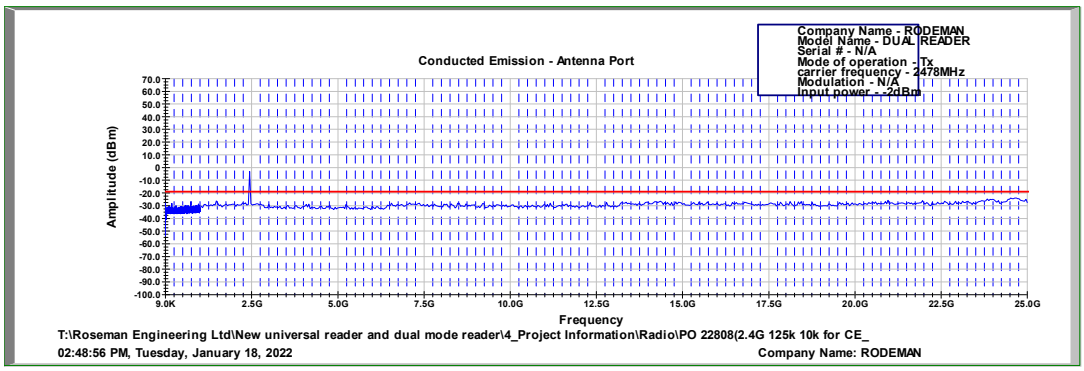


Figure 39 Conducted Spurious Emission, 2478MHz

11.5 Test Equipment Used,

Instrument	Manufacturer	Model	Serial Number	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	Rodhe & Schwarz	FSL6	100194	20/02/2022	20/02/2023
30dB Attenuator	MCL	BW-S30W5	533	23/05/2021	23/05/2022
RF Cable	Huber Suhner	Sucofelex	28239/4PEA	23/05/2021	23/05/2022

Figure 40 Test Equipment Used, Emissions in Non-Restricted Frequency Bands

12. Emissions in Restricted Frequency Bands

12.1 Test Specification

FCC, Part 15, Subpart C, Sections 247(d), 15.205, 15.209

RSS-247, Issue 2, Section 3.3

RSS-Gen, Issue 5, Section 8.10

12.2 Test Procedure

(Temperature (20°C)/ Humidity (53%RH))
The E.U.T. operation mode and test set-up are as described in Section 2.

For measurements between 0.009MHz-30MHz:

The E.U.T was tested inside the shielded room at a distance of 3 meters and the E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The frequency range 0.009MHz-30MHz was scanned. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

For measurements between 30.0MHz-1.0GHz:
A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The frequency range 30.0MHz -1.0GHz was scanned and the list of the highest emissions was verified and updated accordingly.
The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

For measurements between 1.0GHz-25.0GHz:

The E.U.T was tested inside the shielded room at a distance of 3 meters and the E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The frequency range 1.0GHz -25.0GHz was scanned. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

12.3 FCC Test Limit

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)).

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)	Field strength* (dBµV/m)	Field strength* (dBµV/m)@3m
0.009-0.490	2400/F(kHz)	300	48.5-13.8	128.5-73.8
0.490-1.705	24000/F(kHz)	30	33.8-23.0	73.8-63.0
1.705-30.0	30	30	29.5	69.5
30-88	100	3	40.0	40.0
88-216	150	3	43.5	43.5

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)	Field strength* (dBµV/m)	Field strength* (dBµV/m)@3m
216-960	200	3	46.0	46.0
Above 960	500	3	54.0	54.0

*The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz.

Radiated emission limits in these three bands are based on measurements employing an average detector. For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

Figure 41 FCC Table of Limits

12.4 IC Test Limit

The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Magnetic Field strength (microampere/meter)	Measurement distance (meters)	Magnetic Field strength (dBµA/m)	Magnetic Field strength* (dBµA/m)@3m
0.009-0.490	6.37/F(kHz)	300	-3.0-(-37.7)	77.0-42.2
0.490-1.705	63.7/F(kHz)	30	-17.7-(-28.5)	22.3-11.4
1.705-30.0	0.08	30	-21.9	18.0
Frequency (MHz)	**Field strength (microvolts/meter)**	**Measurement distance (meters)**	**Field strength (dBµV/m)**	**Field strength* (dBµV/m)@3m**
30-88	100	3	40.0	40.0
88-216	150	3	43.5	43.5
216-960	200	3	46.0	46.0
Above 960	500	3	54.0	54.0

* The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz.

Radiated emission limits in these three bands are based on measurements employing an average detector. For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

Figure 42 IC Table of Limits

12.5 Test Results

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 209 specification.

For additional information see *Figure 43.*

Radiated Emission

E.U.T Description: Dual Nozzle Tag
Type: Dual Mode
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C, Sections 15.209, 15.205, 15.247(d); RSS-Gen, Issue 5, Section 8.10

Antenna Polarization: Horizontal/ Vertical

Frequency Range: 9 kHz to 25.0 GHz

Detector: Peak, Average

Operation Frequency	Freq.	Pol.	Peak Reading	Peak Limit	Peak Margin	Average Reading	Average Limit	Average Margin
(MHz)	(MHz)	(H/V)	(dBµV/m)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV/m)	(dB)
2401.0	2390.0	V	61.8	74.0	-12.2	43.5	54.0	-10.5
	2390.0	H	60.8	74.0	-13.2	42.7	54.0	-11.3
	4802.0	V	50.0	74.0	-24.0	-	54.0	-
	4802.0	H	49.8	74.0	-24.2	-	54.0	-
2442.0	4884.0	V	50.7	74.0	-23.3	-	54.0	-
	4884.0	H	50.2	74.0	-23.8	-	54.0	-
2478.0	4956.0	V	47.5	74.0	-26.5	-	54.0	-
	4956.0	H	47.6	74.0	-26.4	-	54.0	-
	2483.5	V	59.3	74.0	-14.7	40.9	54.0	-13.1
	2483.5	H	57.8	74.0	-16.2	43.5	54.0	-10.5

Figure 43. Radiated Emission Results

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Amp" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

12.6 Test Equipment Used

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	R&S	ESCI7	100724	February 23, 2021	February 23, 2022
EMI Receiver	HP	8542E	3906A00276	February 24, 2021	February 24, 2022
RF Filter Section	HP	85420E	3705A00248	February 24, 2021	February 24, 2022
Spectrum Analyzer	HP	8593EM	3536A00120 ADI	February 28, 2021	February 28, 2022
Active Loop Antenna	EMCO	6502	9506-2950	May 3, 2021	May 3, 2022
Biconical Antenna	EMCO	3110B	9912-3337	April 27, 2021	April 27, 2024
Log Periodic Antenna	EMCO	3146	9505-4081	April 27, 2021	April 27, 2024
Horn Antenna	ETS	3115	29845	May 25, 2021	May 25, 2024
Horn Antenna	ARA	SWH-28	1007	02/11/2021	02/11/2024
RF Cable Chamber	Commscope ORS	0623 WBC-400	G020132	25/05/2021	25/05/2022
Wideband RF Amplifier 100Khz-26.5GHz	OSR	-	N.A	24/05/2021	24/05/2022
Filter Band Pass 4-20 GHz	Meuro	MFL040120 H50	902252	24/05/2021	24/05/2022
Full Anechoic Civil Chamber	ETS	S81	SL 11643	NCR	NCR
Antenna Mast	ETS	2070-2	9608-1497	NCR	NCR
Turntable	ETS	2087	-	NCR	NCR
Mast & Table Controller	ETS/EMCO	2090	9608-1456	NCR	NCR

Figure 44 Test Equipment Used, Emissions in Restricted Frequency Bands

13. Antenna Gain/Information

The antenna gain is +2dBi dBi, type: integral.

14. RF Exposure/Safety

See a separate report.

15. APPENDIX A - CORRECTION FACTORS

15.1 For ITL #1911 OATS RF Cable

Frequency (MHz)	Cable Loss (dB)		Frequency (MHz)	Cable Loss (dB)
1.0	0.5		450.00	5.83
10.00	1.0		500.00	6.33
20.00	1.34		550.00	6.67
30.00	1.5		600.00	6.83
50.00	1.83		650.00	7.17
100.00	2.67		700.00	7.66
150.00	3.17		750.00	7.83
200.00	3.83		800.00	8.16
250.00	4.17		850.00	8.5
300.00	4.5		900.00	8.83
350.00	5.17		950.00	8.84
400.00	5.5		1000.00	9.0

15.2 For ITL #1840 Anechoic Chamber RF Cable

Frequency (MHz)	Cable Loss (dB)		Frequency (MHz)	Cable Loss (dB)
1000.0	-1.4		10000.0	-6.0
1500.0	-1.7		10500.0	-6.2
2000.0	-2.0		11000.0	-6.2
2500.0	-2.3		11500.0	-6.0
3000.0	-2.6		12000.0	-6.0
3500.0	-2.8		12500.0	-6.1
4000.0	-3.1		13000.0	-6.3
4500.0	-3.3		13500.0	-6.5
5000.0	-3.6		14000.0	-6.7
5500.0	-3.7		14500.0	-7.0
6000.0	-4.0		15000.0	-7.3
6500.0	-4.4		15500.0	-7.5
7000.0	-4.7		16000.0	-7.6
7500.0	-4.8		16500.0	-8.0
8000.0	-5.0		17000.0	-8.0
8500.0	-5.1		17500.0	-8.1
9000.0	-5.6		18000.0	-8.2
9500.0	-5.8			

15.3 For ITL # 1075 Active Loop Antenna

Frequency (MHz)	MAF (dBs/m)	AF (dB/m)
0.01	-33.1	18.4
0.02	-37.2	14.3
0.03	-38.2	13.3
0.05	-39.8	11.7
0.1	-40.1	11.4
0.2	-40.3	11.2
0.3	-40.3	11.2
0.5	-40.3	11.2
0.7	-40.3	11.2
1	-40.1	11.4
2	-40.0	11.5
3	-40.0	11.5
4	-40.1	11.4
5	-40.2	11.3
6	-40.4	11.1
7	-40.4	11.1
8	-40.4	11.1
9	-40.5	11.0
10	-40.5	11.0
20	-41.5	10.0
30	-43.5	8.0

15.4 For ITL #1356 Biconical Antenna

Frequency (MHz)	AF (dB/m)
30	13.00
35	10.89
40	10.59
45	10.63
50	10.12
60	9.26
70	7.74
80	6.63
90	8.23
100	11.12
120	13.16
140	13.07
160	14.80
180	16.95
200	17.17

15.5 For ITL # 1349 Log Periodic Antenna

Frequency (MHz)	AF (dB/m)
200	11.58
250	12.04
300	14.76
400	15.55
500	17.85
600	18.66

700	20.87
800	21.15
900	22.32
1000	24.22

15.6 For ITL # 1352 1-18 Horn Antenna

Frequency (GHz)	AF (dB/m)		Frequency (GHz)	AF (dB/m)
0.75	25		9.5	38
1.0	23.5		10.0	38.5
1.5	26.0		10.5	38.5
2.0	29.0		11.0	38.5
2.5	27.5		11.5	38.5
3.0	30.0		12.0	38.0
3.5	31.5		12.5	38.5
4.0	32.5		13.0	40.0
4.5	32.5		13.5	41.0
5.0	33.0		14.0	40.0
5.5	35.0		14.5	39.0
6.0	36.5		15.0	38.0
6.5	36.5		15.5	37.5
7.0	37.5		16.0	37.5
7.5	37.5		16.5	39.0
8.0	37.5		17.0	40.0
8.5	38.0		17.5	42.0
9.0	37.5		18.0	42.5

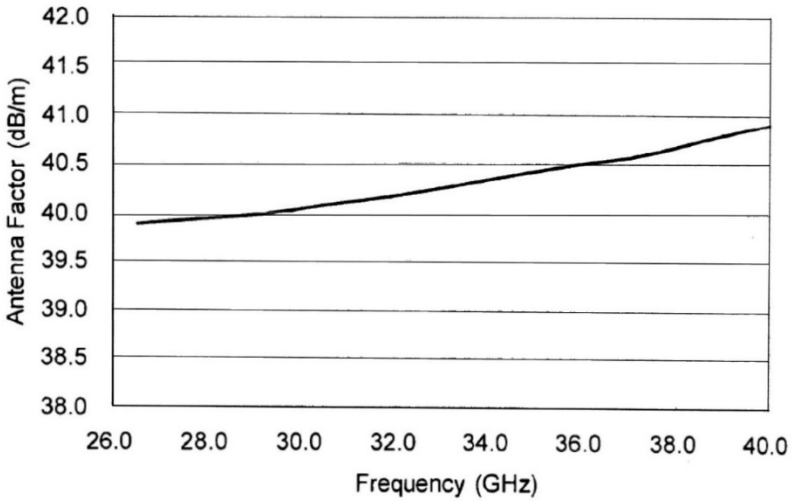
15.7 For ITL # 1353 18-26.5 GHz Horn Antenna

Frequency (MHz)	Measured antenna factor dB/m
18000	32.4
18500	32.0
19000	32.3
19500	32.4
20000	32.3
20500	32.8
21000	32.8
21500	32.7
22000	33.1
22500	33.0

Frequency (MHz)	Measured antenna factor dB/m
23000	33.1
23500	33.8
24000	33.5
24500	33.5
25000	33.8
25500	33.9
26000	34.2
26500	34.7

The antenna factor shall be added to the receiver reading in dBµV to obtain field strength in dBµ V/m.

15.8 For ITL # 1777 26.5-40 GHz Horn Antenna



15.9 For Horn Antenna Model: SWH-28

CALIBRATION DATA

3 m distance

Frequency MHZ	Measured antenna factor dB/m
18000	32.4
18500	32.0
19000	32.3
19500	32.4
20000	32.3
20500	32.8
21000	32.8
21500	32.7
22000	33.1
22500	33.0
23000	33.1
23500	33.8
24000	33.5
24500	33.5
25000	33.8
25500	33.9
26000	34.2
26500	34.7

[1] The antenna factor shall be added to receiver reading in dBµV to obtain field strength in dBµV/m.

End of Test Report