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Module Compliance Verification Report

EUT Name: Toll RFID Reader

Model No.: 6204

47 CFR FCC Part 90, Subpart M: 2019 and RSS 137, Issue 2, 2009

Prepared for:

Neology, Inc.
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Prepared by:

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Report/Issue Date:	April 20, 2020
Job #	234121453
Report Number:	32061086.001

Revisions

Revision No.	Date MM/DD/YYYY	Reason for Change	Author
0	4/1/20	Original Document	NA
1	4/3/20	TCB Review	OC
1.1	4/7/20	Change of customer address	OC
1.2	4/14/20	TCB Review	OC
1.3	4/16/20	TCB Review	OC
1.4	4/20/20	TCB Review	OC

Note: Latest revision report will replace all previous reports.

Statement of Compliance

Manufacturer:	Neology, Inc. 12760 Danielson Court Suite A Poway, CA. 92064
Requester / Applicant:	Neology, Inc.
Name of Equipment:	Toll RFID Reader
Model No.	6204
Type of Equipment:	Intentional Radiator
Application of Regulations:	47 CFR FCC Part 90, Subpart M: 2019 and RSS 137, Issue 2, 2009
Test Dates:	March 11, 2020 to March 16, 2020

Guidance Documents:

Emissions: ANSI C63.26-2015, 47 CFR FCC Part 90, Subpart M: 2019 and RSS 137, Issue 2, 2009

Test Methods:

Emissions: ANSI C63.26-2015, 47 CFR FCC Part 90, Subpart M: 2019 and RSS 137, Issue 2, 2009

The electromagnetic compatibility test and documented data described in this report has been performed and recorded by TUV Rheinland, in accordance with the standards and procedures listed herein. As the responsible authorized agent of the EMC laboratory, I hereby declare that the equipment described above has been shown to be compliant with the EMC requirements of the stated regulations and standards based on these results. If any special accessories and/or modifications were required for compliance, they are listed in the Executive Summary of this report.

The applied New Modulation Type Compliance Verification Testing documented in this report did not reveal any non-compliance.

This report must not be used to claim product endorsement by A2LA or any agency of the U.S. Government. This report shall not be reproduced except in full, without the written authorization of TUV Rheinland of North America.

Osvaldo Casorla		Rachana Khanduri	
Test Engineer	Date April 20, 2020	A2LA Signatory	Date April 20, 2020

Testing Cert #3331.02 **US1131** **2932D**

1 Executive Summary

1.1 Scope

This report is intended to document the status of conformance with the requirements of the 47 CFR FCC Part 90, Subpart M: 2019 and RSS 137, Issue 2, 2009 based on the results of testing performed on March 11, 2020 to March 16, 2020 on the Toll RFID Reader Model 6204 manufactured by Neology, Inc.. This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle. All documentation will be included as a supplement.

1.2 Purpose

Testing was performed to evaluate the EMC performance of the EUT in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report. The 902 MHz to 928 MHz frequency band for RFID is covered in this document.

We have verified that all testing and results leveraged from the test reports of the addition of new modulation type are still valid and not impacted from updates to relevant rule parts or test stands since then.

Original test report number RE1407019-2 with FCC ID: M4Z6204, IC ID: 458C-6204.

1.3 Summary of Test Results

Table 1: Summary of Test Results

Test	Test Method ANSI C63.26	Worse Case (Measured)	Result
Maximum Output Power	CFR47 90.205, RSS 137 Sect. 6.4	2.38 W @ 915.75MHz Channel	**Complied**
Occupied Bandwidth	CFR47 90.210, RSS 137 Sect. 6.1	1.39 MHz @ 914.25 MHz Channel	**Complied**
Spurious Emissions at Antenna terminals	CFR47 Part 90.210/RSS137, 6.5	-30.96 dBm @ 915.75 MHz Channel	**Complied**
Transmitter Spurious Emissions	CFR47 90.210, RSS 137 Sect. 6.5	19.61 dB Margin @ 17754.75 MHz, MaxPeak	**Complied**
Frequency Stability	CFR47 Part 90.213/RSS137, 6.3	Refer to Note 3	**Note 3**

Note 1: This test report covers 902 MHz to 928 MHz band. .

Note 2: Class B limits were applied where applicable.

Note 3: Covered by Test report Number RE1407019-2 with FCC ID: M4Z6204, IC ID: 458C-6204 Issued on November 13, 2014.

1.4 Special Accessories

No special accessories were necessary in order to achieve compliance.

1.5 Equipment Modifications

None

2 Laboratory Information

2.1 Accreditations & Endorsements

2.1.1 US Federal Communications Commission

TUV Rheinland of North America EMC test facilities located at 1279 Quarry Lane, Ste. A, Pleasanton, CA, 94566, and 5015 Brandin Ct, Fremont, CA 94538, are recognized by the Commission for performing testing services for the general public on a fee basis. These laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (Registration No. US1131). The laboratory Scopes of Accreditation include Title 47 CFR Parts 15, 18 and 90. The accreditations are updated every three years.

2.1.2 NIST / A2LA

TUV Rheinland of North America is accredited by the National Voluntary Laboratory Accreditation Program, which is administered under the auspices of the National Institute of Standards and Technology. The laboratory has been assessed and accredited in accordance with ISO Guide 17025:2017. The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

2.1.3 Canada – Industry Canada

Industry Canada Industrie Canada

The Pleasanton 5-meter Semi-Anechoic Chamber, Registration No. 2932M-1, has been accepted by Industry Canada to perform testing to 3 and 5 meters based on the test procedures described in ANSI C63.4-2014. The Fremont 10-meter Semi-Anechoic Chamber, Registration No. 2932D-1, has been accepted by Industry Canada to perform testing to 3 and 10 meters based on the test procedures described in ANSI C63.4-2014.

2.1.4 Japan – VCCI

The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) is a group that consists of Information Technology Equipment (ITE) manufacturers and EMC test laboratories. The purpose of the Council is to take voluntary control measures against electromagnetic interference from Information Technology Equipment, and thereby contribute to the development of a socially beneficial and responsible state of affairs in the realm of Information Technology Equipment in Japan. TUV Rheinland of North America EMC test facilities located at 1279 Quarry Lane, Ste. A, Pleasanton, CA, 94566, and 5015 Brandin Ct, Fremont, CA 94538, have been assessed and approved in accordance with the Regulations for Voluntary Control Measures.

VCCI Registration No. for Pleasanton: A-0326

VCCI Registration No. for Fremont: A-0327

2.1.5 Acceptance by Mutual Recognition Arrangement

The United States has an established agreement with specific countries under the Asia Pacific Laboratory Accreditation Corporation (APLAC) Mutual Recognition Arrangement. Under this agreement, all TUV Rheinland at 1279 Quarry Ln, Pleasanton, CA 94566 test results and test reports within the scope of the laboratory NIST / A2LA accreditation will be accepted by each member country.

2.2 Test Facilities

Test facilities are located at 5015 Brandin Ct, Fremont, California, 94538, USA and 1279 Quarry Lane, Pleasanton, California 94566, USA (Fremont is the Pleasanton Annex).

2.2.1 Emission Test Facility

The Semi-Anechoic Chambers and AC Line Conducted measurement facilities used to collect radiated and conducted emissions data have been constructed in accordance with ANSI C63.7:1992. The Fremont 10 meter semi-anechoic chamber has been measured in accordance with and verified to comply with the theoretical volumetric normalized site attenuation of ANSI C63.4:2014 and SVSWR requirements of CISPR 16-1-4 Consol. Ed. 3.0 (2010-04), at test distances of 3 and 10 meters. This site has been described in reports dated November 1st, 2006, submitted to the FCC, and accepted by letter dated November 28, 2006. The site is listed with the FCC and accredited by A2LA (Testing Certificate #3331.02). The Pleasanton 5 meter semi-anechoic chamber has been verified to comply with the theoretical volumetric normalized site attenuation of ANSI C63.4:2009 and SVSWR requirements of CISPR 16-1-4 Consol. Ed. 3.0 (2010-04) at a test distance of 3 meters. This site has been described in reports dated November 1st, 2006, submitted to the FCC, and accepted by letter dated November 28, 2006. The site is listed with the FCC and accredited by A2LA (Testing Certificate #3331.02).

2.3 Measurement Uncertainty

Two types of measurement uncertainty are expressed in this report, per *ISO Guide To The Expression Of Uncertainty In Measurement*, 1st Edition, 1995.

The Combined Standard Uncertainty is the standard uncertainty of the result of a measurement when that result is obtained from the values of a number of other quantities; it is equal to the positive square root of the sum of the variances or co-variances of these other quantities, weighted according to how the measurement result varies with changes in these quantities. The term *standard uncertainty* is the result of a measurement expressed as a standard deviation.

The Expanded Uncertainty defines an interval about the result of a measurement that may be expected to encompass a large fraction of the distribution of values that could reasonably be attributed to the measurement and the fraction may be viewed as the coverage probability or level of confidence of the interval.

2.3.1 Sample Calculation – radiated & conducted emissions

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

Field Strength (dBμV/m) = RAW - AMP + CBL + ACF

Where: RAW = Measured level before correction (dBμV)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

$$\mu V/m = 10^{\frac{dB\mu V/m}{20}}$$

Sample radiated emissions calculation @ 30 MHz

Measurement +Antenna Factor–Amplifier Gain+Cable loss=Radiated Emissions (dBuV/m)

25 dBuV/m + 17.5 dB – 20 dB + 1.0 dB = 23.5 dBuV/m

2.3.2 Measurement Uncertainty

Per CISPR 16-4-2	**U_{lab}**	**U_{cispr}**
Radiated Disturbance @ 10 meters		
30 – 1,000 MHz	2.25 dB	4.51 dB
Radiated Disturbance @ 3 meters		
30 – 1,000 MHz	2.26 dB	4.52 dB
1 – 6 GHz	2.12 dB	4.25 dB
6 – 18 GHz	2.47 dB	4.93 dB
Conducted Disturbance @ Mains Terminals		
150 kHz – 30 MHz	1.09 dB	2.18 dB
Disturbance Power		
30 MHz – 300 MHz	3.92 dB	4.3 dB

2.4 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Standard 17025:2017. Equipment calibration records are kept on file at the test facility.

3 Product Information

3.1 Product Description

The Model 6204 is a Toll RFID Reader utilizing RFID. The EUT will be in compliance with regulatory standards of regions it will be operating in.

3.2 Equipment Configuration

A description of the equipment configuration is given in the Test Plan Section. The EUT was tested as called for in the test standard and was configured and operated in a manner consistent with its intended use. The EUT was connected to rated power and allowed to reach intended operating conditions. The placement of the EUT system components was guided by the test standard and selected to represent typical installation conditions.

In the case of an EUT that can operate in more than one configuration, preliminary testing was performed to determine the configuration that produced maximum radiation.

The final configuration was selected to produce the worst case radiation for emissions testing and to place the EUT in the most susceptible state for immunity testing.

3.3 Operating Mode

A description of the operation mode is given in the Test Plan Section. In the case of an EUT that can operate in more than one state, preliminary testing was performed to determine the operating mode that produced maximum radiation.

The final operating mode was selected to produce the worst case radiation for emissions testing.

3.4 Duty Cycle

Duty cycles were measured by the spectrum analyzer used for measurements in section 4.1 of this report.

Mode	Measured Duty Cycle	Duty Cycle Correction Factor (dB)
RFID	33%	4.81

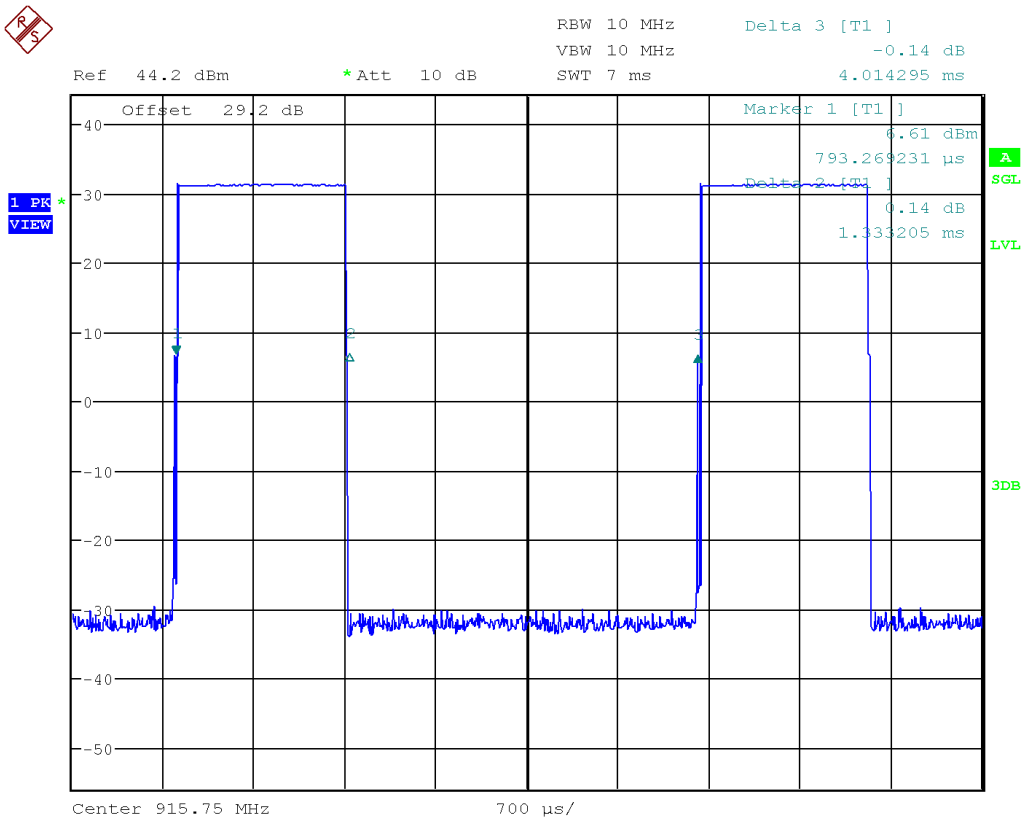


Figure 1: Duty Cycle

4 Emissions

Testing was performed in accordance with CFR 47 Part 15.247: 2019 and RSS 247: 2017. These test methods are listed under the laboratory's A2LA Scope of Accreditation. This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices. Procedures described in section 8 of the standard were used.

4.1 Output Power Requirements

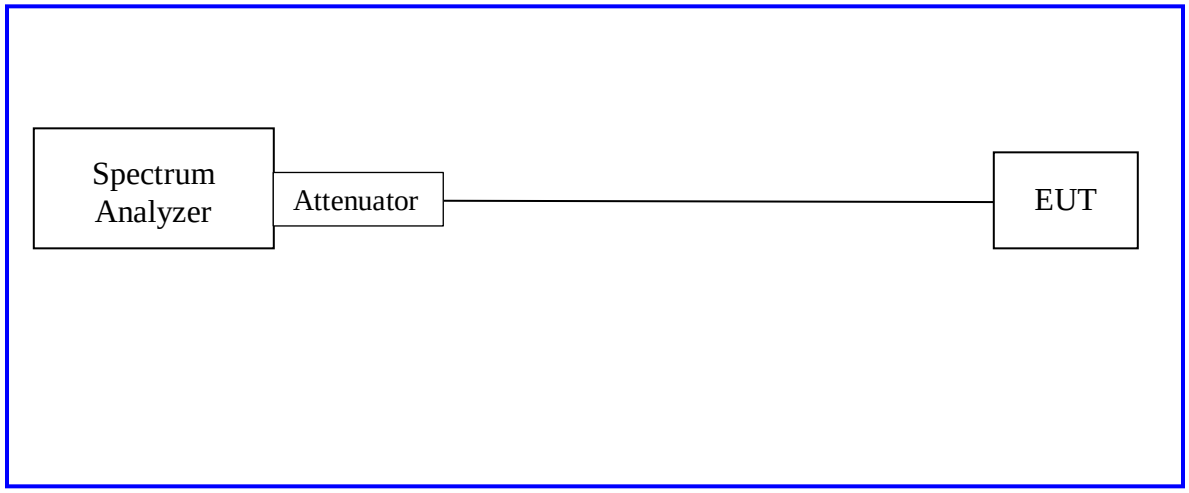
The maximum output power requirement is the maximum equivalent isotropic radiated power delivering at the transmitting antenna under specified conditions of measurements in the presence of modulation.

90.205 (3)(l) 902-928 MHz. LMS systems operating pursuant to subpart M of this part in the 902-927.25 MHz band will be authorized a maximum of 30 watts ERP.

4.1.1 Test Method

Conducted method was used to measure the channel power output. The worst findings were conducted on 4 channels in each operating range per CFR47 *90.205 (3) (l)* and RSS 137 Sect. 6.4; 902-928 MHz. Conditions applied based on ANSI C63.26 section 5.2.4.3.3. The worst mode results indicated below.

Test Setup:

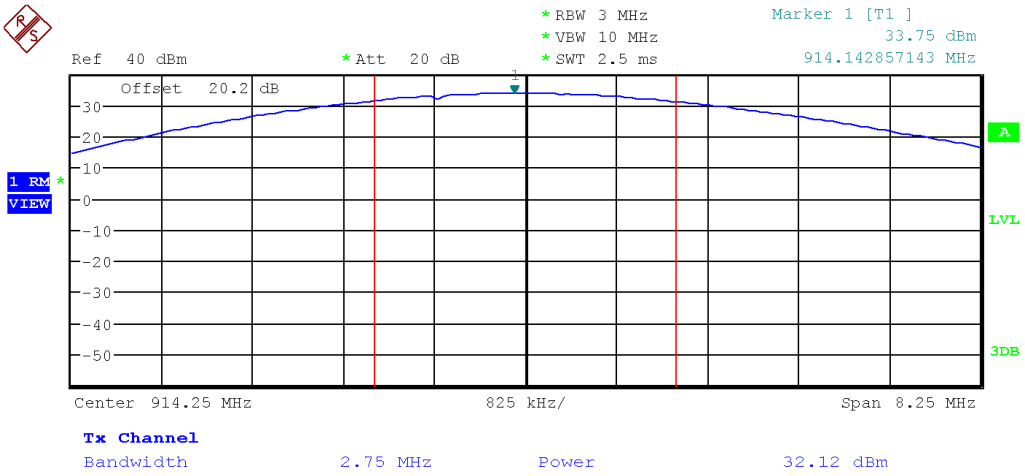


4.1.3 Results

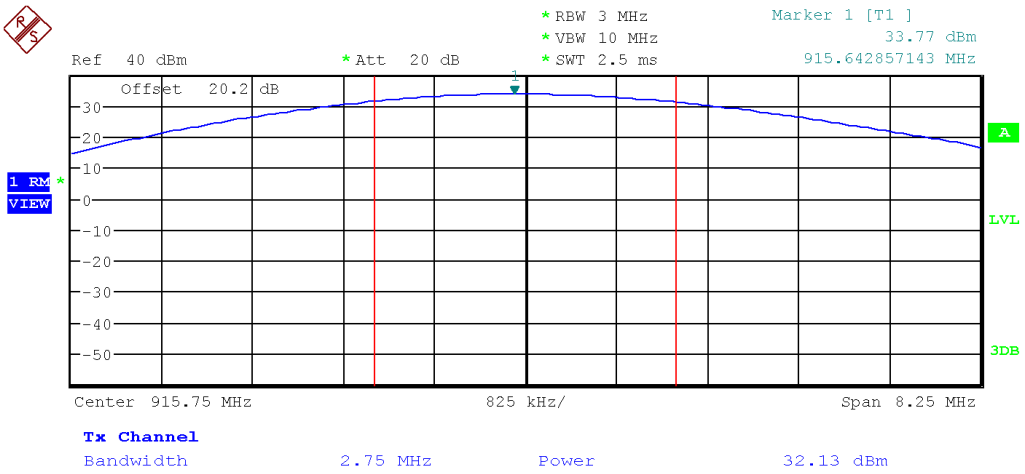
As originally tested, the EUT was found to be compliant to the requirements of the test standard(s). Worse case data for each mode reported below. Plots of highest power included for low, medium, and high channels.

Table 2: RF Output Power at the Antenna Port – Test Results

Test Conditions: Conducted Measurement, Normal Temperature						
Antenna Type: Patch, linear polarized						
Max. Antenna Gain: 16 dBi						
Operating Channel (MHz)	**Mode**	**ERP Limit (W)**	**Power Port 1 (W)**	**Power Port 2 (W)**	**Power Port 3 (W)**	**Power Port 4 (W)**
914.25	ASTMv6	30	2.25	2.30	2.37	2.24
915.75	ASTMv6	30	2.21	2.28	2.38	2.31
Note 1: Duty Cycle Correction Factor [10 log (1/duty cycle)], not required for ANSI C63.26 section 5.2.4.3.3.						



Plot 1. Maximum Conducted Power, 914.25MHz



Plot 2. Maximum Conducted Power, 915.75MHz

4.2 26 Bandwidth and Occupied Bandwidth

The occupied bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency.

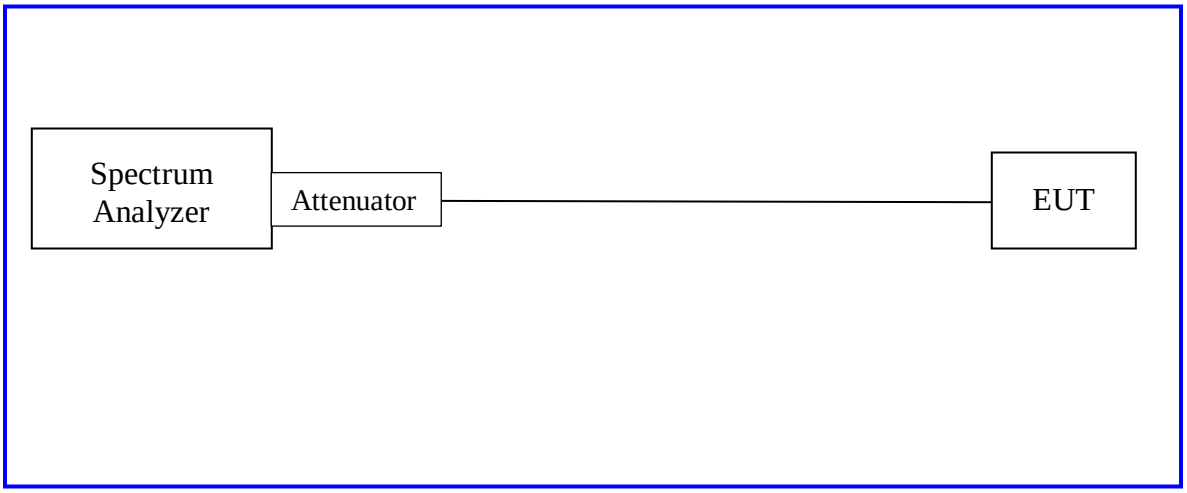
The 99% bandwidth is the bandwidth in which 99% of the transmitted power occupied.

The maximum bandwidth shall be less than 2 MHz for the frequency range 902 – 904 MHz, and less than 12 MHz for the frequency range 909.75 – 921.75.

4.2.1 Test Method

The conducted method was used to measure the occupied bandwidth according to ANSI C63.26:2015 Section A.2.9.6. The measurement was performed with modulation per CFR47 90.209 (b) (5) (4) and RSS 137 Sect. 6.1.2. Measurements were performed on the low, middle and high channels of the operating frequency range; 902-928 MHz.

Test Setup:

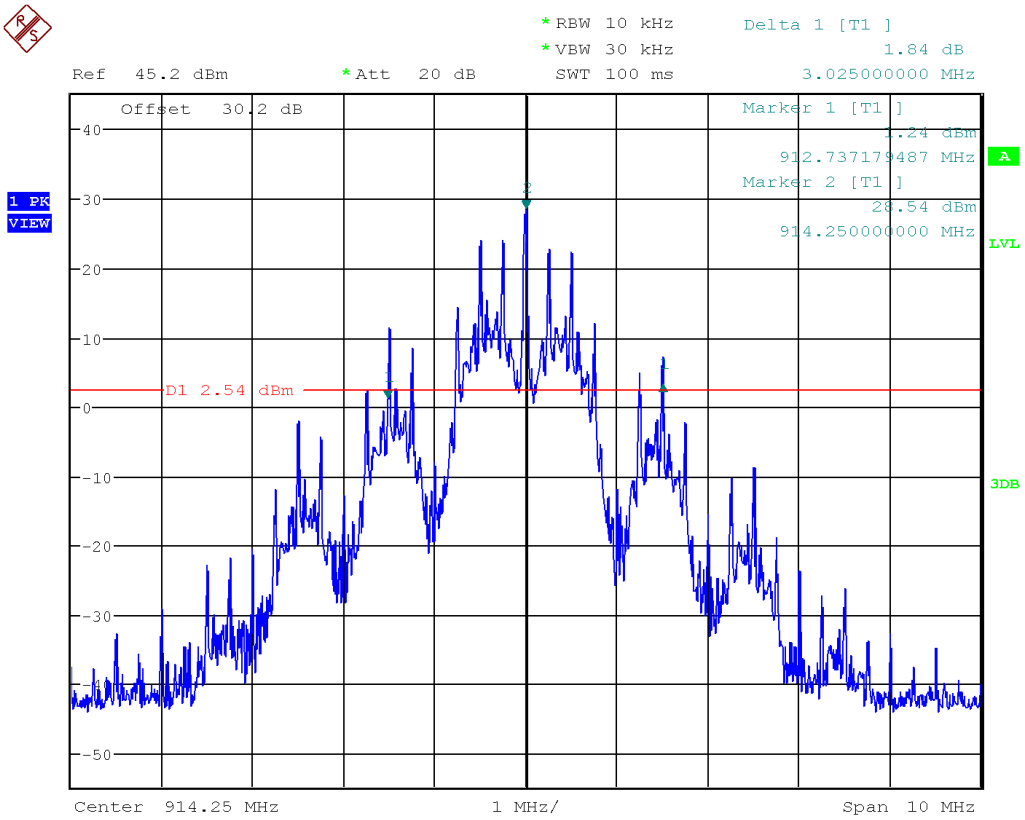


Results
As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

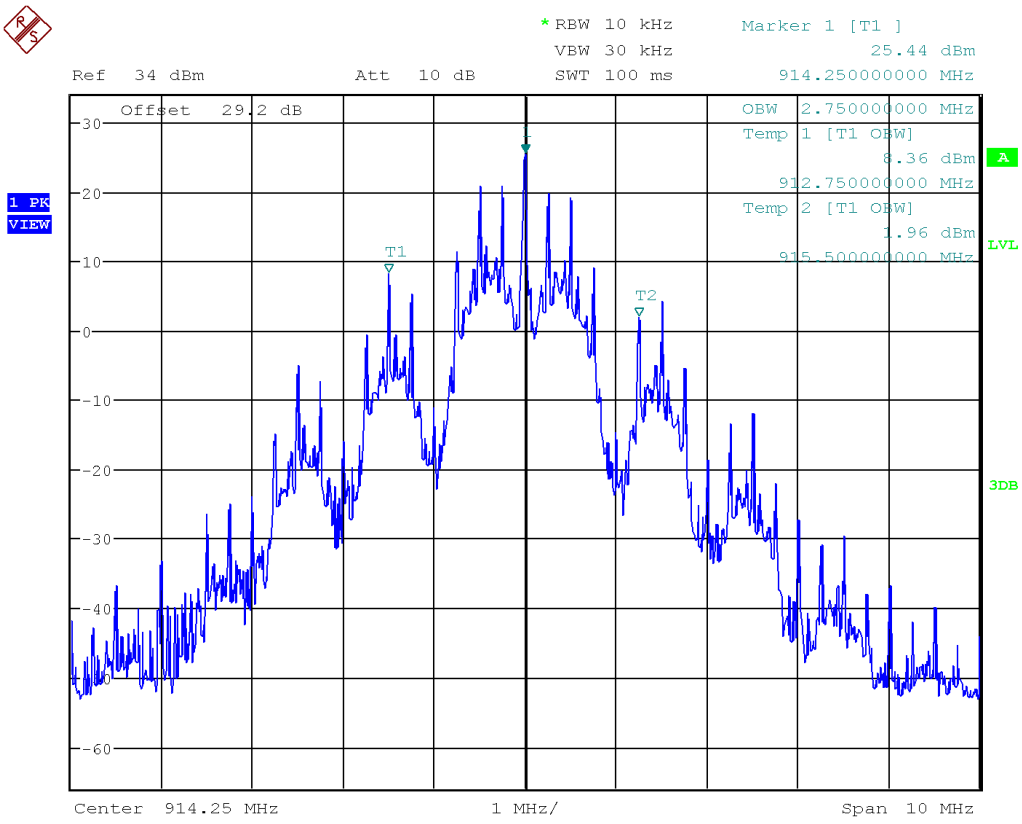
4.2.2 Results

Table 3: Occupied Bandwidth – Test Results

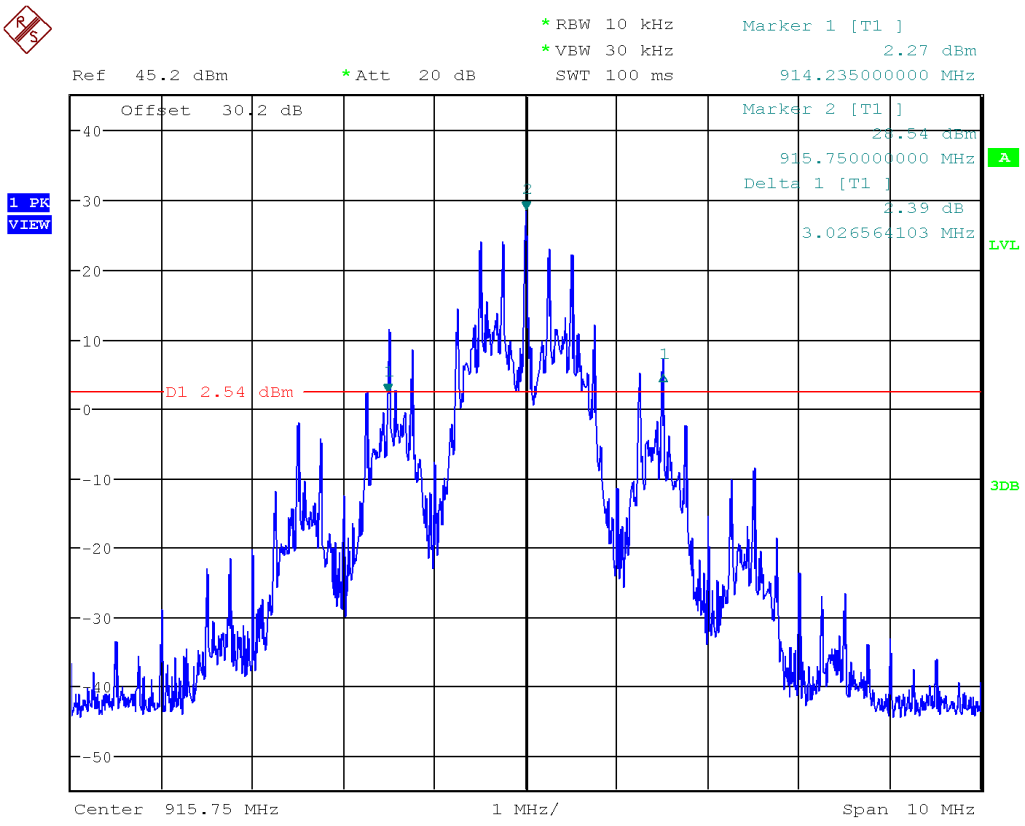
Test Conditions: Conducted Measurement, Normal Temperature		
Bandwidth		
Freq. (MHz)	**99% Bandwidth (MHz)**	**26dB Bandwidth (MHz)**
914.25	2.75	3.03
915.75	2.75	3.03
Note: None		



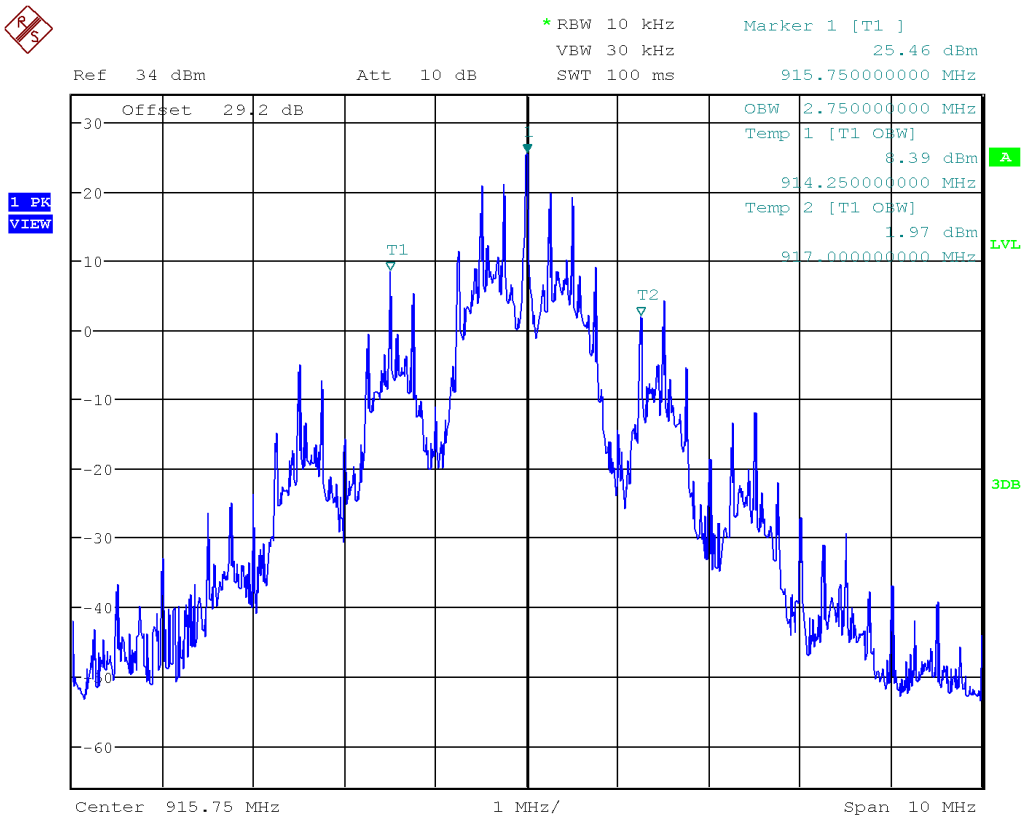
Plot 3. 914.25MHz, 26dB Bandwidth



Plot 4. 914.25MHz, 99% Bandwidth



Plot 5. 915.75MHz, 26dB Bandwidth



Plot 6. 915.75MHz, 99% Bandwidth

4.3 Transmitter Spurious Emissions

Transmitter spurious emissions are emissions outside the frequency range of the equipment when the equipment is in transmit mode; per requirement of CFR47 90.210 (k) (3) (ii), RSS 137 Sect.6.5.3.

4.3.1 Test Methodology

4.3.1.1 Preliminary Test

A test program that controls instrumentation and data logging was used to automate the preliminary RF emission test procedure. The frequency range of interest was divided into sub-ranges to yield a frequency resolution of approximately 120 kHz and provide a reading at each frequency for no more than 12° of turntable rotation. For each frequency sub-range the turntable was rotated 360° while peak emission data was recorded and plotted over the frequency range of interest in horizontal and vertical antenna polarization's.

Preliminary emission profile testing was performed inside the anechoic chamber. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm (<1 GHz) and 150cm (>1 GHz) above the floor. The EUT was positioned as shown in the setup photographs. The receiving antenna was placed at a distance of 3m at a fixed height of 1m. Measurement equipment was located outside of the chamber. A video camera was placed inside the chamber to view the EUT.

Pre-scans were performed to determine the worst data rate / chains.

4.3.1.2 Final Test

For each frequency measured, the peak emission was maximized by manipulating the receiving antenna from 1 to 4 meters above the ground plane and placing it at the position that produced the maximum signal strength reading. The turntable was then rotated through 360° while observing the peak signal and placing the EUT at the position that produced maximum radiation. The six highest emissions relative to the limit were measured unless such emissions were more than 20 dB below the limit. If less than six emissions are within 20 dB of the limit, than the noise level of the receiver is measured at frequencies where emissions are expected. Multiples of all oscillator and microprocessor frequencies were also checked.

Final testing was performed on an NSA compliant test site. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm (<1 GHz) and 150cm (>1 GHz) above the ground plane. The placement of EUT and cables were the same as for preliminary testing and is shown in the setup photographs.

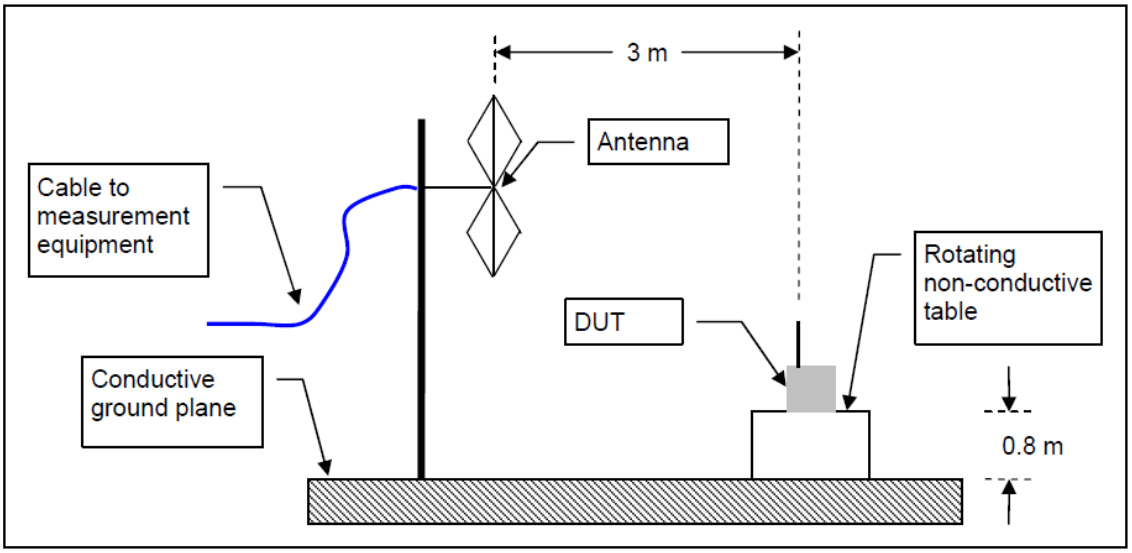
4.3.1.3 Deviations

None.

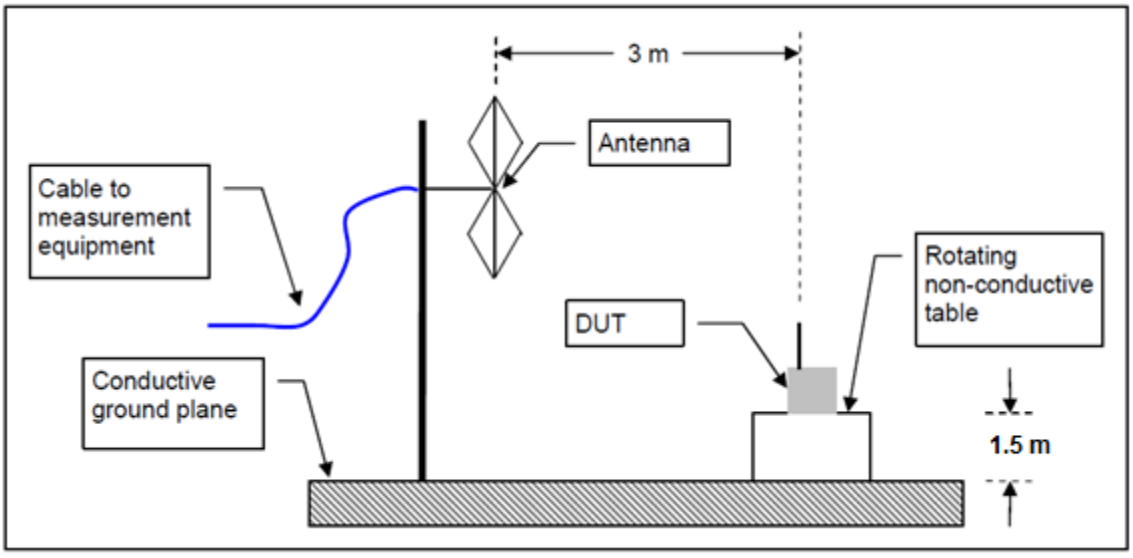
4.3.2 Test Setup:

All tests were conducted at full power on low, middle, and high channels. The DUT was stimulated by manufacturer provided test software that is not available to the end user.

30MHz-1GHz



>1GHz



4.3.3 Transmitter Spurious Emission Limit

The spurious emissions of the transmitter shall not exceed the values in CFR47 90.210 (k) (3) (ii), RSS 137 Sect.6.5.3.

The power of any emission outside the equipment operating sub-band edge shall be attenuated below the maximum permitted output power Pmax by at least 55 + 10 log (P) dB = (-) 25 dBm or 70.26 dBuV/m at 3 meter distance, where (P) is the highest emission (watts) of the transmitter inside the licensee's sub-band.

Resolution bandwidth (RBW) = 120 kHz for spurious emission below 1 GHz, and 1 MHz for spurious emissions above 1 GHz.
Video bandwidth (VBW) = 300 kHz for spurious emission below 1 GHz, and 3 MHz for spurious emissions above 1 GHz.

4.3.4 Test Results

The final measurement data was taken under the worst case operating modes, configurations, and/or cable positions. It also reflects the results including any modifications and/or special accessories listed in Sections 1.4 and test plan.

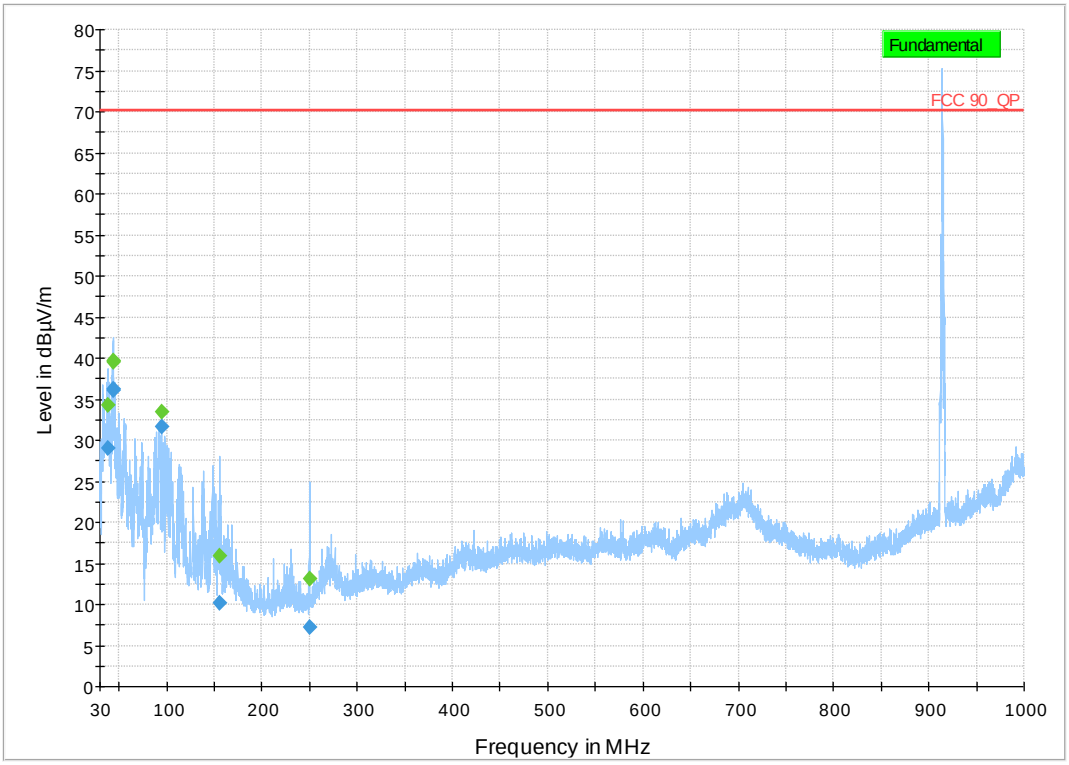
As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Note: Below 30 MHz was investigated and no emissions was found above noise floor.

Note: The 0.9 GHz notch filter used for below 1 GHz scans and 1 GHz High Pass Filter for above 1GHz scans to protect the front end of the pre-amp.

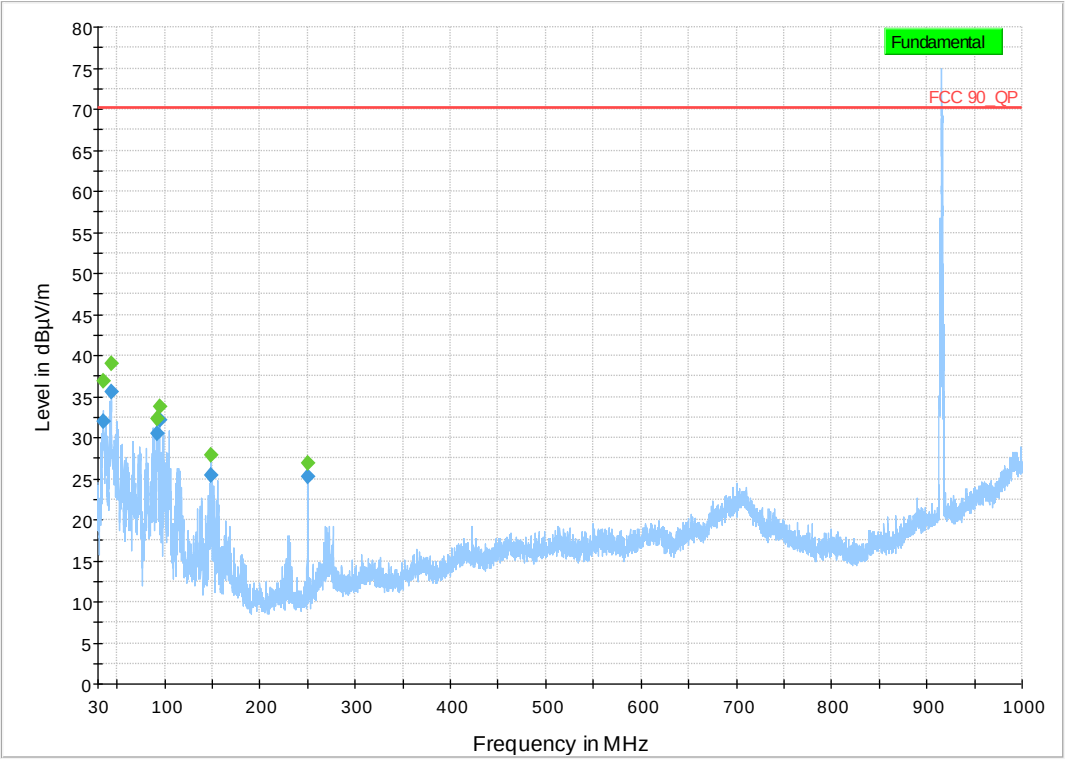
4.3.4.1 Plots

Frequency (MHz)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
38.83	28.98	---	70.23	41.25	1000.00	120.00	101.00	V	44.00	-12.80	
38.83	---	34.25	---	---	1000.00	120.00	101.00	V	44.00	-12.80	
43.81	36.29	---	70.23	33.94	1000.00	120.00	101.00	V	143.00	-15.80	
43.81	---	39.74	---	---	1000.00	120.00	101.00	V	143.00	-15.80	
43.81	36.11	---	70.23	34.12	1000.00	120.00	101.00	V	125.00	-15.80	
43.81	---	39.46	---	---	1000.00	120.00	101.00	V	125.00	-15.80	
94.38	31.69	---	70.23	38.54	1000.00	120.00	101.00	V	125.00	-18.30	
94.38	---	33.44	---	---	1000.00	120.00	101.00	V	125.00	-18.30	
155.64	---	15.84	---	---	1000.00	120.00	350.00	H	-141.00	-14.10	
155.64	10.12	---	70.23	60.11	1000.00	120.00	350.00	H	-141.00	-14.10	
250.31	---	13.12	---	---	1000.00	120.00	101.00	H	-74.00	-14.60	
250.31	7.24	---	70.23	62.99	1000.00	120.00	101.00	H	-74.00	-14.60	
914.35	---	75.23	---	---	1000.00	120.00	100.00	H	-1.00	-1.40	Fundamental



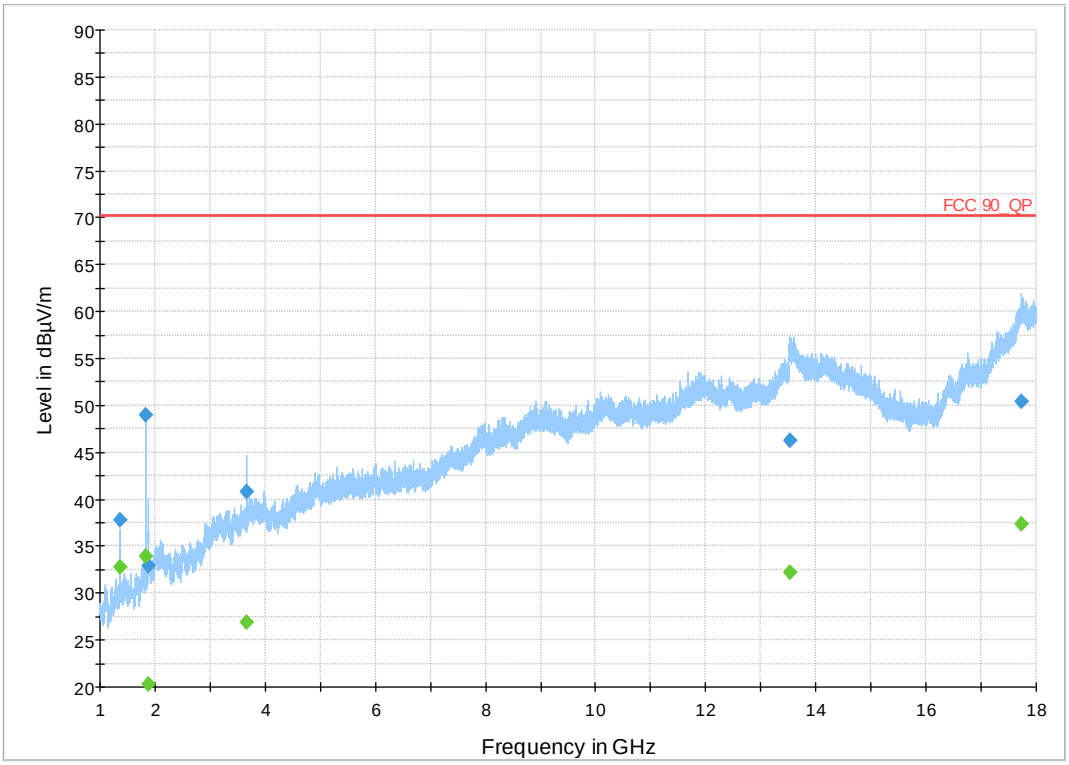
Plot 7. 30MHz-1GHz, 914.25MHz

Frequency (MHz)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
35.33	32.04	---	70.23	38.19	1000.00	120.00	101.00	V	59.00	-10.50	
35.33	---	36.93	---	---	1000.00	120.00	101.00	V	59.00	-10.50	
43.79	35.56	---	70.23	34.67	1000.00	120.00	101.00	V	-180.00	-15.70	
43.79	---	38.98	---	---	1000.00	120.00	101.00	V	-180.00	-15.70	
92.41	30.57	---	70.23	39.66	1000.00	120.00	252.00	H	112.00	-18.90	
92.41	---	32.27	---	---	1000.00	120.00	252.00	H	112.00	-18.90	
94.39	32.06	---	70.23	38.17	1000.00	120.00	101.00	V	151.00	-18.30	
94.39	---	33.73	---	---	1000.00	120.00	101.00	V	151.00	-18.30	
148.12	---	27.90	---	---	1000.00	120.00	101.00	V	-40.00	-14.40	
148.12	25.42	---	70.23	44.81	1000.00	120.00	101.00	V	-40.00	-14.40	
250.00	---	26.87	---	---	1000.00	120.00	101.00	H	-67.00	-14.60	
250.00	25.17	---	70.23	45.06	1000.00	120.00	101.00	H	-67.00	-14.60	
915.80	---	74.85	---	---	1000.00	120.00	200.00	H	-6.00	-1.39	Fundamental



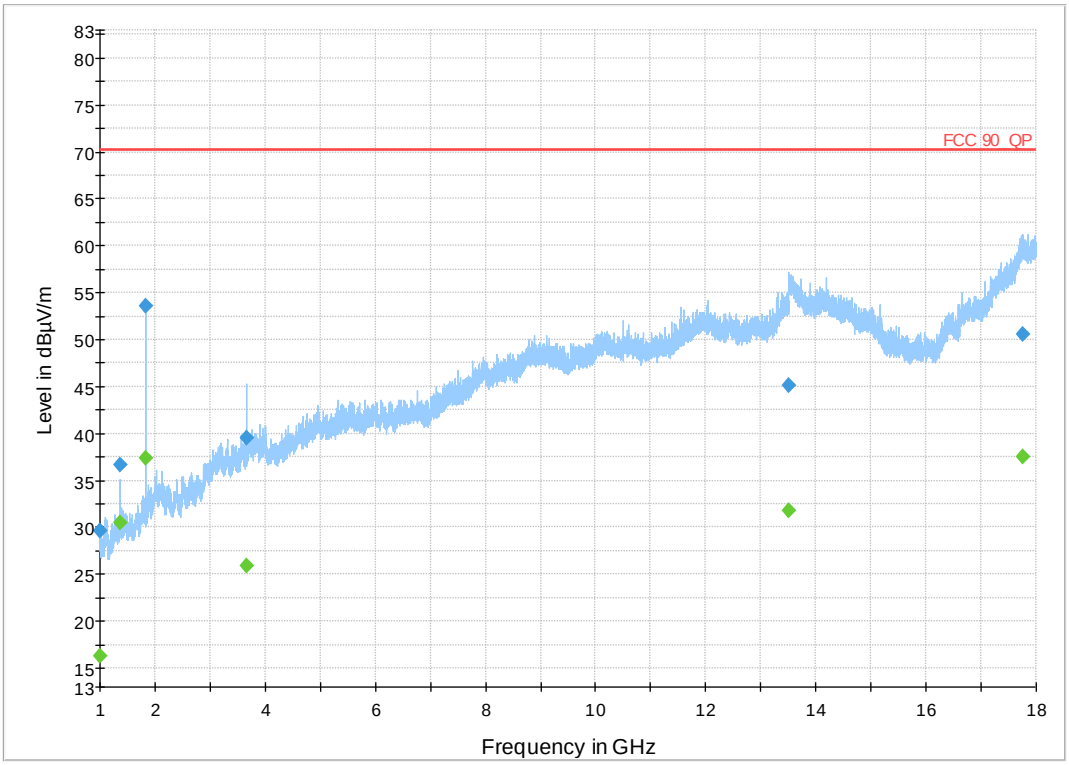
Plot 8. 30MHz-1GHz, 915.75MHz

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
1372.82	37.8	70.23	32.43	1000	1000	200	H	80	-35.2	
1827.9	49.01	70.23	21.22	1000	1000	101	H	-160	-32.7	
1877.53	32.97	70.23	37.26	1000	1000	202	V	-20	-32.4	
3656.99	40.84	70.23	29.39	1000	1000	202	H	155	-26.4	
13520.4	46.3	70.23	23.93	1000	1000	201	H	-125	-12.2	
17733.91	50.46	70.23	19.77	1000	1000	150	V	180	-7.1	



Plot 9. 1-18GHz, 914.25MHz

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
1004.55	29.62	70.23	40.61	1000	1000	150	H	-180	-36	
1372.75	36.62	70.23	33.61	1000	1000	101	H	-53	-35.2	
1831.49	53.66	70.23	16.57	1000	1000	201	H	-162	-32.6	
3663.05	39.58	70.23	30.65	1000	1000	202	H	150	-26.3	
13506.73	45.14	70.23	25.09	1000	1000	151	H	180	-12.2	
17754.75	50.62	70.23	19.61	1000	1000	101	H	-180	-6.9	



Plot 10. 1-18GHz, 915.75MHz

4.4 Spurious Emissions at Antenna Terminals

Transmitter spurious emissions are emissions outside the frequency range of the equipment when the equipment is in transmit mode; per requirement of CFR47 90.210 (k) (3) (ii), RSS 137 Sect.6.5.3.

4.4.1 Test Methodology

The RF output of the transceiver was connected to a spectrum analyzer and simulator through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz for below 1GHz and 1 MHz for above 1GHz. Band emissions are measured up to 10th harmonic

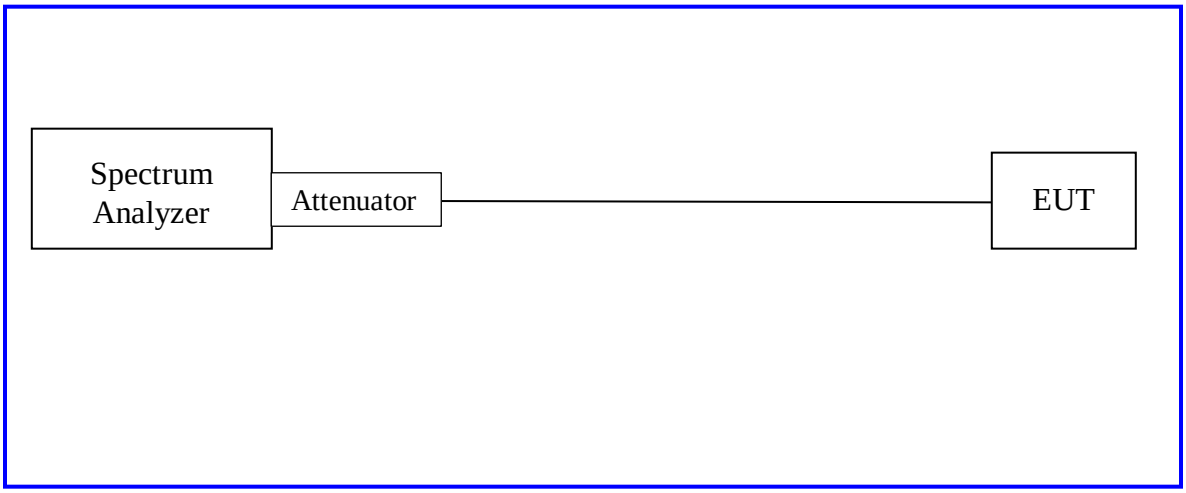
4.4.1.1 Deviations

None.

4.4.2 Test Setup:

All tests were conducted at full power on low, middle, and high channels. The DUT was stimulated by manufacturer provided test software that is not available to the end user.

Test Setup:



4.4.3 Transmitter Spurious Emission Limit

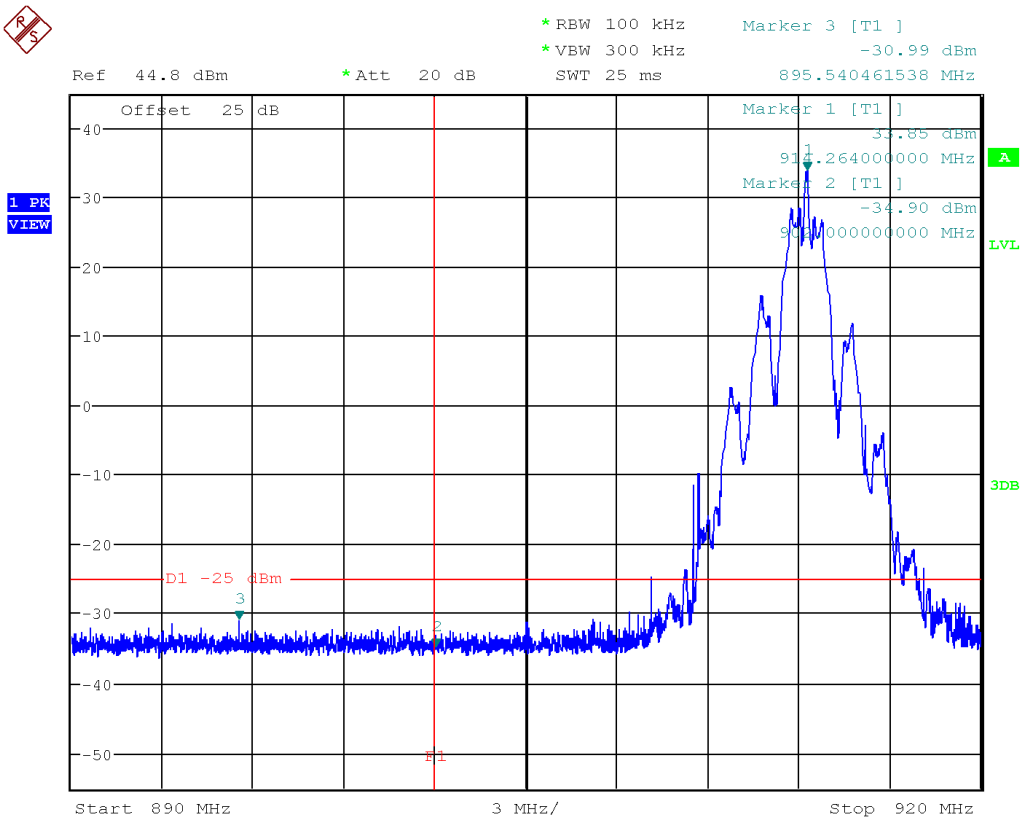
The spurious emissions of the transmitter shall not exceed the values in CFR47 90.210 (k) (3) (ii), RSS 137 Sect.6.5.3.

The power of any emission outside the equipment operating sub-band edge shall be attenuated below the maximum permitted output power Pmax by at least 55 + 10 log (P) dB = (-) 25 dBm, where (P) is the highest emission (watts) of the transmitter inside the licensee's sub-band.

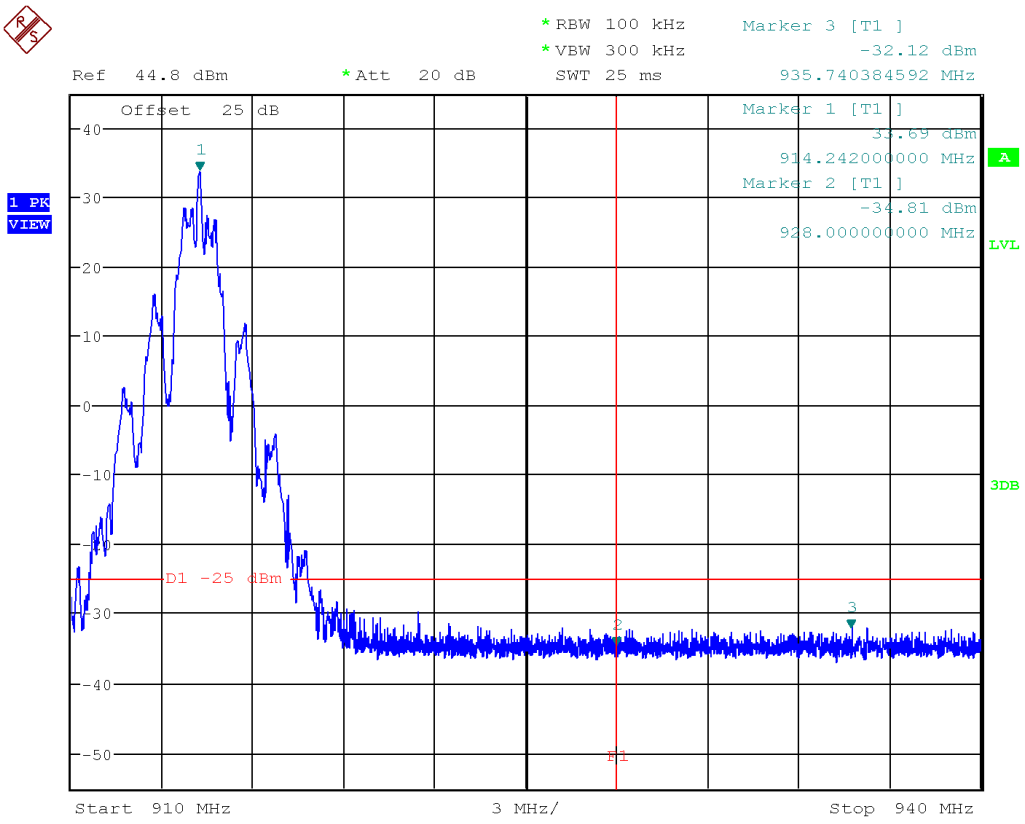
4.4.4 Test Results

Table 4: Emissions at the Band-Edge – Test Results

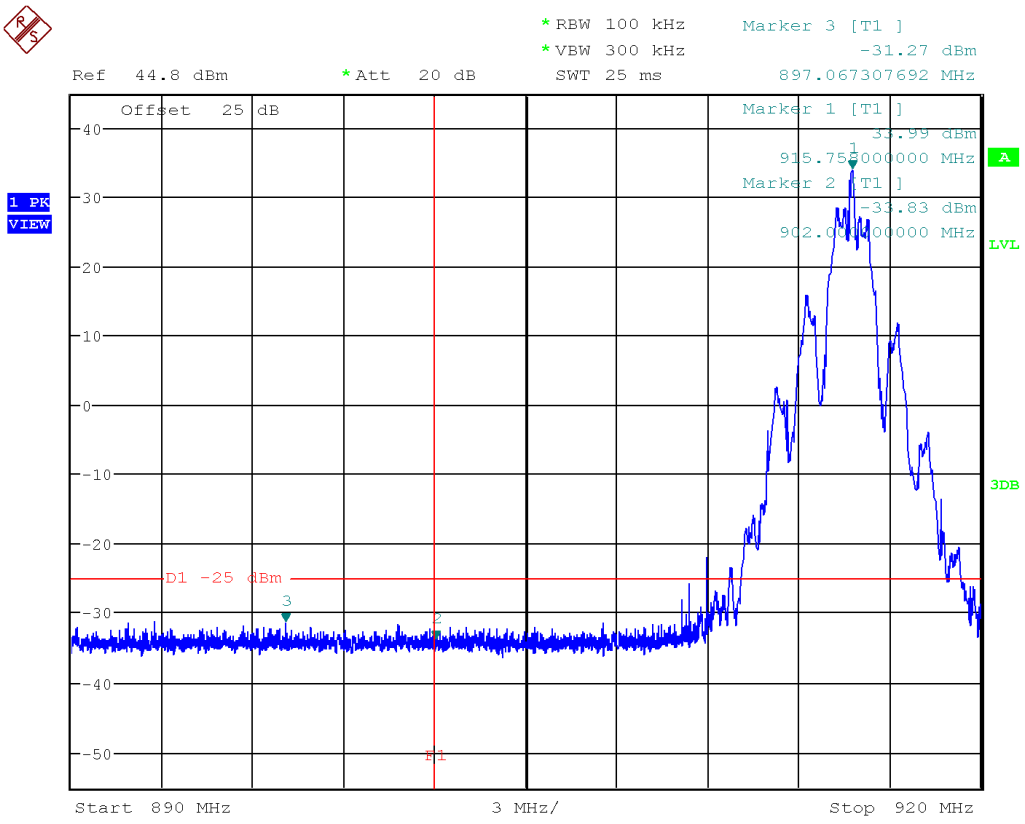
Test Conditions: Conducted Measurement, Normal Temperature and Voltage only					
Frequency Band Edge Emissions – Worse Case					
Band Edge	**Center Freq. (MHz)**	**Measured (dBm)**	**Limit (dBm)**	**Freq. (MHz)**	**Results**
Low	914.25	-30.99	-25	895.5	Pass
High	914.25	-34.81	-25	935.7	Pass
Low	915.75	-31.27	-25	897.1	Pass
High	915.75	-32.07	-25	935.9	Pass
Note:					



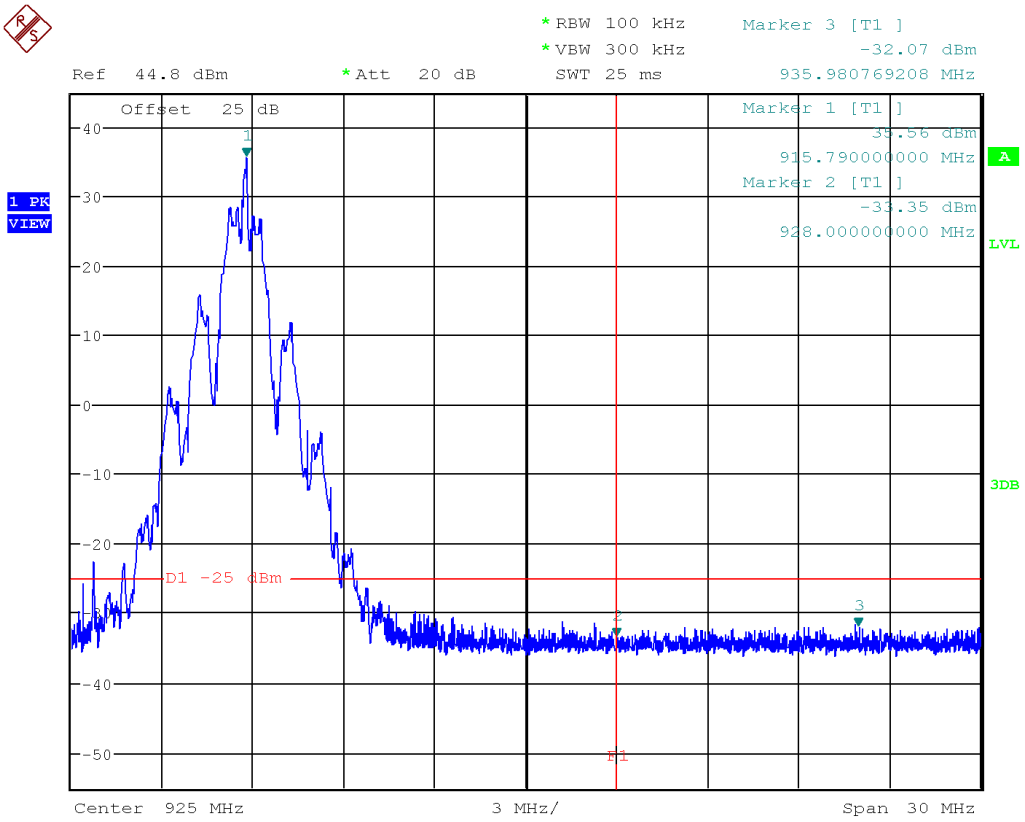
Plot 11. Low Bandedge, 914.25 MHz



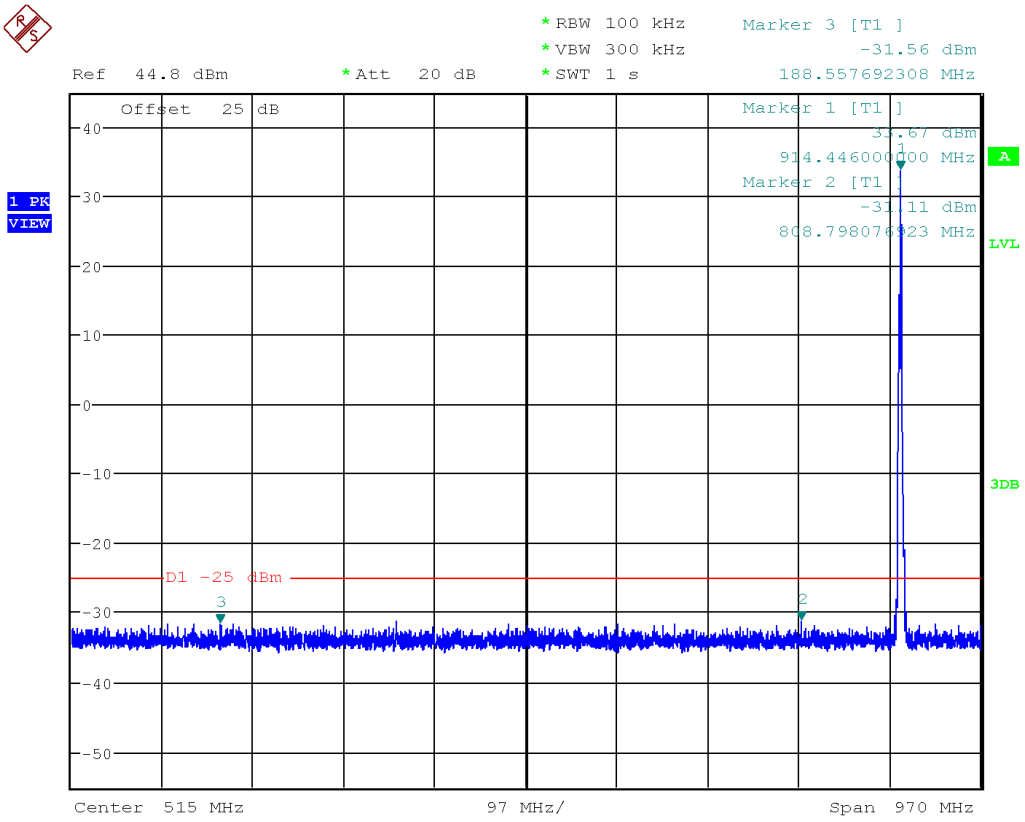
Plot 12. High Bandedge, 914.25 MHz



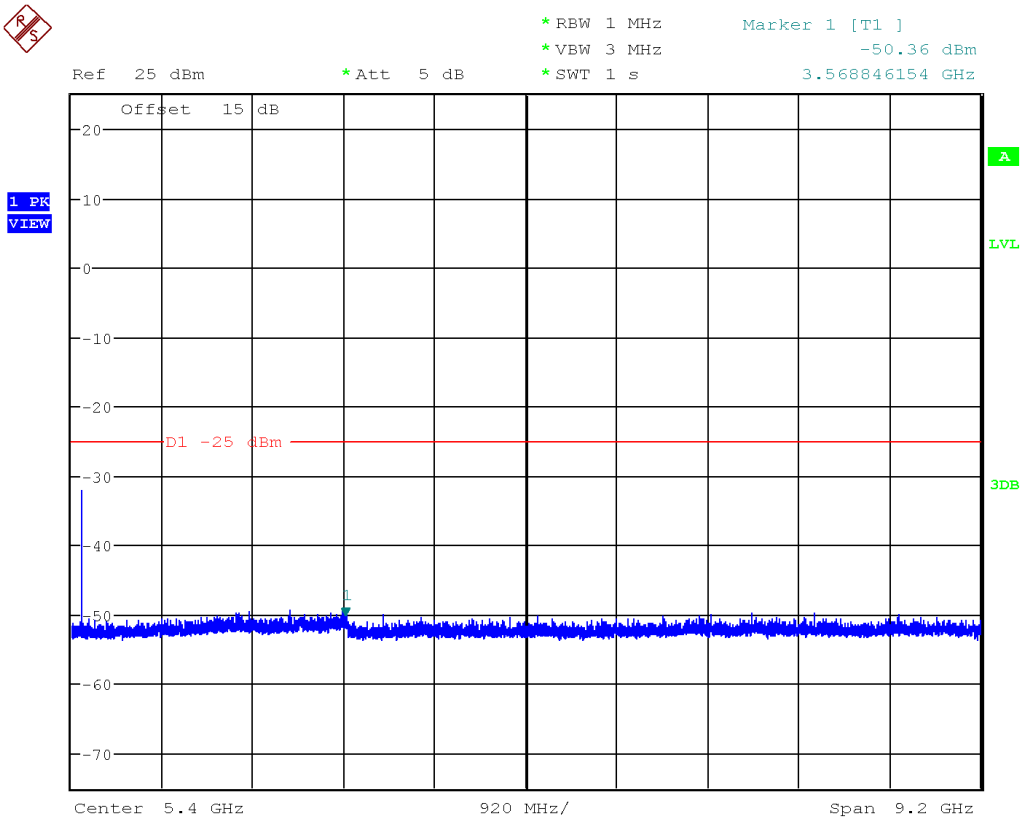
Plot 13. Low Bandedge, 915.75 MHz



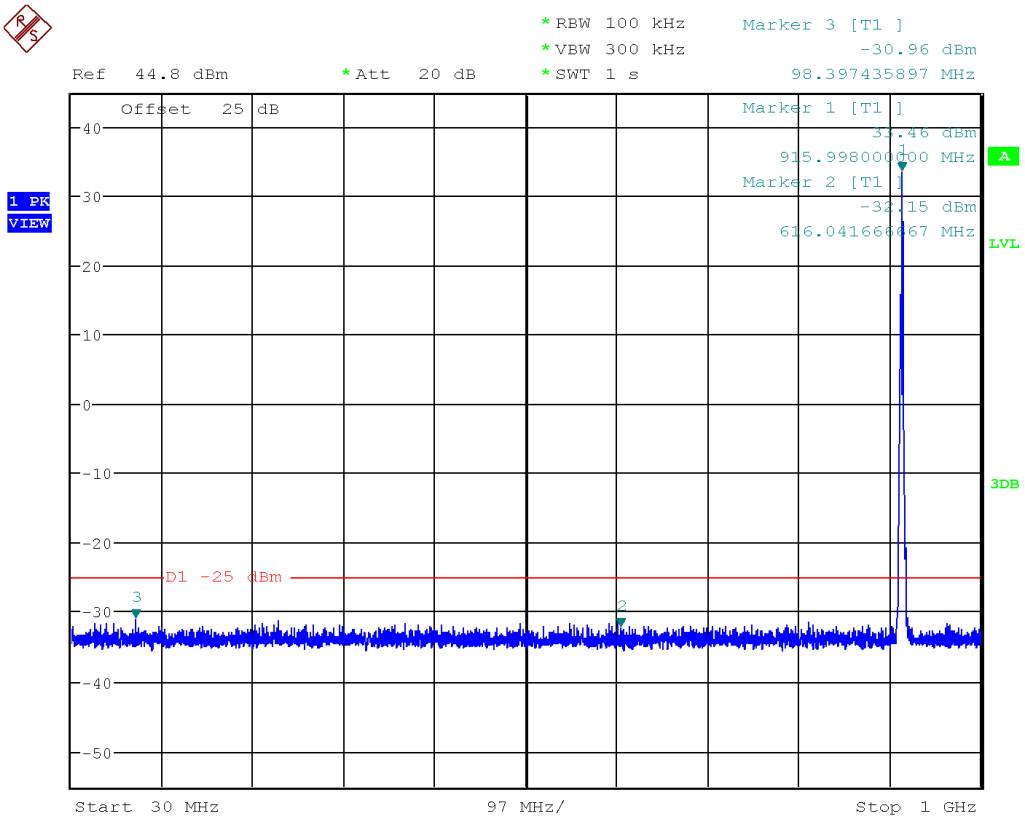
Plot 14. High Bandedge, 915.75 MHz



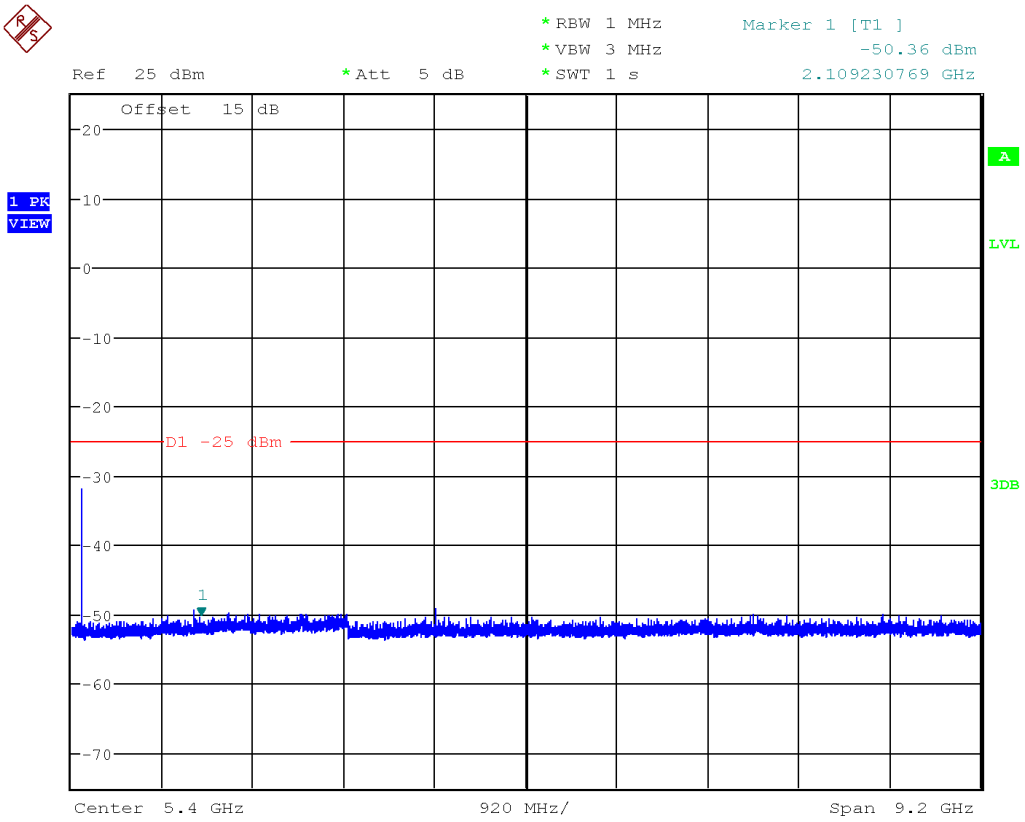
Plot 15. 30-1000 MHz, 914.25 MHz



Plot 16. 1000-10,000 MHz, 914.25 MHz, Notched



Plot 17. 30-1000 MHz, 915.75 MHz



Plot 18. 1000-10,000 MHz, 915.75 MHz, Notched

5 Test Equipment List

5.1 Equipment List

Equipment	Manufacturer	Model #	Serial/Inst #	Last Cal mm/dd/yyyy	Next Cal mm/dd/yyyy
EMI Receiver	Rohde & Schwarz	ESIB40	100180	05/31/2018	05/31/2021
L.I.S.N.	Com-Power	LI-215	192000	01/16/2019	01/16/2021
Transient Limiter	Com-Power	LIT-930	531582	01/16/2019	01/16/2021
EMI Receiver	Agilent	MXE N9038A	MY51210195	01/16/2019	01/16/2021
Preamplifier, 9 kHz – 1 GHz	Sonoma	310N	213221	01/16/2019	01/16/2021
Bilog Antenna	Sunol Sciences	JB3	A060502	05/27/2018	05/27/2021
Amplifier	Miteq	TTA1800-30-HG	1842452	01/16/2019	01/16/2021
Horn Antenna	Sunol Sciences	DRH-118	A040806	03/05/2019	03/05/2021
1 GHz High Pass Filter	Micro-Tronics	HPM50115	-	N/A (See Note)	
1.6 GHz Low Pass Filter	K&L Microwave	8L120-X1600-0/09135-0249	UA691-35	N/A (See Note)	
3.5 GHz High Pass Filter	Hewlett Packard	84300-80038	820004	N/A (See Note)	
2.4 GHz Notch Filter	Micro-Tronics	BRM50702	009	N/A (See Note)	

Note: Equipment is characterized before use.

6 EMC Test Plan

6.1 Introduction

This section provides a description of the Equipment Under Test (EUT), configurations, operating conditions, and performance acceptance criteria. It is an overview of information provided by the manufacturer so that the test laboratory may perform the requested testing.

6.2 Customer

Table 5: Customer Information

Company Name	Neology, Inc.
Address	12760 Danielson Court Suite A
City, State, Zip	Poway, CA. 92064
Country	USA

Table 6: Technical Contact Information

Name	David Missimer
E-mail	dmissimer@neology.net

6.3 Equipment Under Test (EUT)

The information provided in the following table should be listed as it should appear in the final report. For those products that have only a model name, list the model number as *non-applicable* and vice-versa.

Table 7: EUT Designation

Product Name	Toll RFID Reader
Model Number	6204
System Name	Toll RFID Reader
Product Description	The four-port Toll RFID Reader 6204 is a multi-protocol, multi-regional Radio Frequency Identification (RFID) System that operates in the 902-928 MHz UHF band. All antenna ports operate sequentially with only one port transmitting at the time from a single transmit source Antenna path is identical.

6.4 Product Specifications

Table 8: EUT Specifications

EUT Specifications	
AC, DC Input	24VDC, 1.5A max, 36W During normal operation, device is 1A max. However, during internal heater which activates below approximately -20C. At -40C (lowest spec), product can draw up to 3.5A but under this high current condition, such as start up from cold soak, product is not transmitting RF. During transmission of RF, 1.5A.
Environment	Outdoor
Operating Temperature Range	-40 to 55C
Multiple Feeds:	Yes and how many 4 There is a single power amplifier which is time division multiplexed to up to the 4 antenna ports
Product Marketing Name (PMN)	Toll RFID Reader
Hardware Version Identification Number (HVIN)	Rev.A
Firmware Version Identification Number (FVIN)	2.0
RF Test Software Version	Reader Startup Tool (RST) version 7.1.27610.28249
Operating Modes	ASTMv6
Transmitter Frequency Band	902-928 MHz
Power Setting @ Operating Channel	340
Modulation	Amplitude Shift Keying (ASK)
TX/RX Chain (s)	4
Type of Equipment	Table Top Wall-mount Floor standing cabinet Other:
Note: EUT will be on / transmitted at all times with the highest power levels and antenna gains per channel. Power level is installation site specific. Worse case is full power.	

Table 9: Antenna Information

Number	Antenna Type	Description	Max Gain (dBi)
Antenna 0	Patch, linear polarized	Linear 22°, Antenna 023 - 22° degree S/N: 00587	16

Table 10: Interface Specifications

Interface Type	Cabled with what type of cable?	Is the cable shielded?	Maximum potential length of the cable?	Metallic (M), Coax (C), Fiber (F), or Not Applicable?
RS232/Ethernet /Power Interface	RS232/Ethernet/Power Interface	No	13m	M
Ethernet/TTL Interface	Ethernet/TTL Interface	No	2m	M

Table 11: Accessory Equipment

Equipment	Manufacturer	Model	Serial	Comment
Power Supply	TDK-Lambda	DSP100-24	N/A	24VDC/4.4A

Table 12: Ancillary Equipment (used for test purposes only)

Equipment	Manufacturer	Model	Serial	Used for
Laptop	Dell	Precision 5510	N/A	Setup EUT operating modes/ channels via a USB connection to pins in EUT
Note: None.				

Table 13: Description of Sample used for Testing

Sample Number	Device	Serial Number	Configuration	Used For
1	6204	ID6204006072	Radiated/ Conducted Sample	TX Spurious Emissions, All other conducted Measurments
Note: None.				

Table 14: Description of Test Configuration used for Radiated Measurement.

Device	Antenna	Mode	Setup Photo (X-Axis)	Setup Photo (Y-Axis)	Setup Photo (Z-Axis)
6204	0	Transmit	EUT upright	N/A	N/A
Note:					

6.5 Test Specifications

Table 15: Test Specifications

Emissions	
Standard	**Requirement**
47 CFR FCC Part 90, Subpart M: 2019	All
RSS 137, Issue 2, 2009	All

END OF REPORT