Intertek
731 Enterprise Drive
Lexington, KY 40510

Tel 859 226 1000
Fax 859 226 1040

www.intertek.com

Haier US Appliance Solutions Inc. DBA GE Appliances
TEST REPORT

SCOPE OF WORK
EMC TESTING – RFID MODULE

REPORT NUMBER
104073059LEX-001

ISSUE DATE

10/2/2019

PAGES
30

DOCUMENT CONTROL NUMBER
Non-Specific EMC Report Shell Rev. December 2017

EMC TEST REPORT

(FULL COMPLIANCE)

Report Number: 104073059LEX-001
Project Number: G104073059

Report Issue Date: 10/2/2019

Model(s) Tested: RFID Module

Standards: FCC Part 15B
FCC Part 15.225
FCC Part 15.215
RSS-210 Issue 9
ICES-003 Issue 6

Tested by:
Intertek Testing Services NA, Inc.
731 Enterprise Dr.
Lexington, KY 40510
USA

Client:
Haier US Appliance Solutions Inc. DBA GE Appliances
Appliance Park
AP2-121
Louisville KY 40225
USA

Report prepared by

Bryan Taylor, Team Leader

Report reviewed by

Brian Lackey, Staff Engineer

Table of Contents

1 Introduction and Conclusion 4
2 Test Summary 4
3 Client Information 5
4 Description of Equipment under Test and Variant Models 6
5 System Setup and Method 7
6 Radiated Emissions 8
7 Radiated Emissions (RFID) 12
8 Conducted Emissions 18
9 Frequency Stability 24
10 Occupied Bandwidth 26
11 Antenna Requirement 29
12 Revision History 30

1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

2 Test Summary

Section	Test full name	Result
6	Radiated Emissions (Transmitters Idle) (ANSI C63.4:2014)	Pass
7	Radiated Spurious Emissions (Transmitters Active) (ANSI C63.10:2013, RSS-210 Issue 9)	Pass
8	Conducted Emissions (ANSI C63.10:2013, ANSI C63.4:2014)	Pass
9	Frequency Stability (ANSI C63.10:2013, RSS-210-Issue 9)	Pass
10	Occupied Bandwidth (ANSI C63.10:2013, RSS-Gen Issue 5)	Pass
11	Antenna Requirement (FCC Part 15.203, RSS-Gen Issue 5)	Pass

3 Client Information

This product was tested at the request of the following:

Client Information	
Client Name:	Haier US Appliance Solutions Inc. DBA GE Appliances
Address:	Appliance Park AP2-121 Louisville KY 40225 USA
Contact:	Brad Gasior
Email:	Bradford.gasior@geappliances.com
Manufacturer Information	
Manufacturer Name:	Haier US Appliance Solutions Inc. DBA GE Appliances
Manufacturer Address:	Appliance Park AP2-121 Louisville KY 40225 USA

4 Description of Equipment under Test and Variant Models

Equipment Under Test	
Product Name	RFID Module
Model Number	RFID Module
Serial Number	Test Sample 1
Receive Date	9/9/2019
Test Start Date	9/9/2019
Test End Date	9/13/2019
Device Received Condition	Good
Test Sample Type	Production
Power Ratings	12VDC
Transmit Frequency	13.56MHz
Description of Equipment Under Test (provided by client)	
The product under test was an RFID module with an onboard antenna.	

4.1 Variant Models:

There were no variant models covered by this evaluation.

5 System Setup and Method

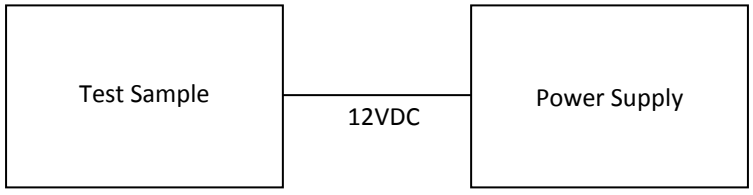
5.1 Method:

Configuration as required by ANSI C63.4:2014 and ANSI C63.10:2013.

No.	Descriptions of EUT Exercising
1	During the testing the RFID Module was transmitting a 13.56MHz RFID signal with a tag present.
2	Idle mode with the RFID radio not transmitting.

Cables					
Qty	Description	Length (m)	Shielding	Ferrites	Termination
1	12VDC	2m	None	None	Power Supply

5.2 EUT Block Diagram:



6 Radiated Emissions

6.1 Method

Tests are performed in accordance with ANSI C63.4:2014.

TEST SITE: 10m ALSE

Site Designation: 10m Chamber

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	3.9dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	4.0dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.7dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	4.7dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	4.7dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	4.7dB	5.5 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required.

6.2 Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG
Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

6.3 Test Equipment Used:

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	3900	Rohde & Schwarz	ESU40	9/18/2018	9/18/2019
Bilog Antenna	7088	SunAR	JB6	8/8/2019	8/8/2020
System Controller	3957	Sunol Sciences	SC99V	Verify at Time of Use	Verify at Time of Use
Coaxial Cable	3339			11/26/2018	11/26/2019
Coaxial Cable	2593			11/26/2018	11/26/2019
Coaxial Cable	2592			11/26/2018	11/26/2019

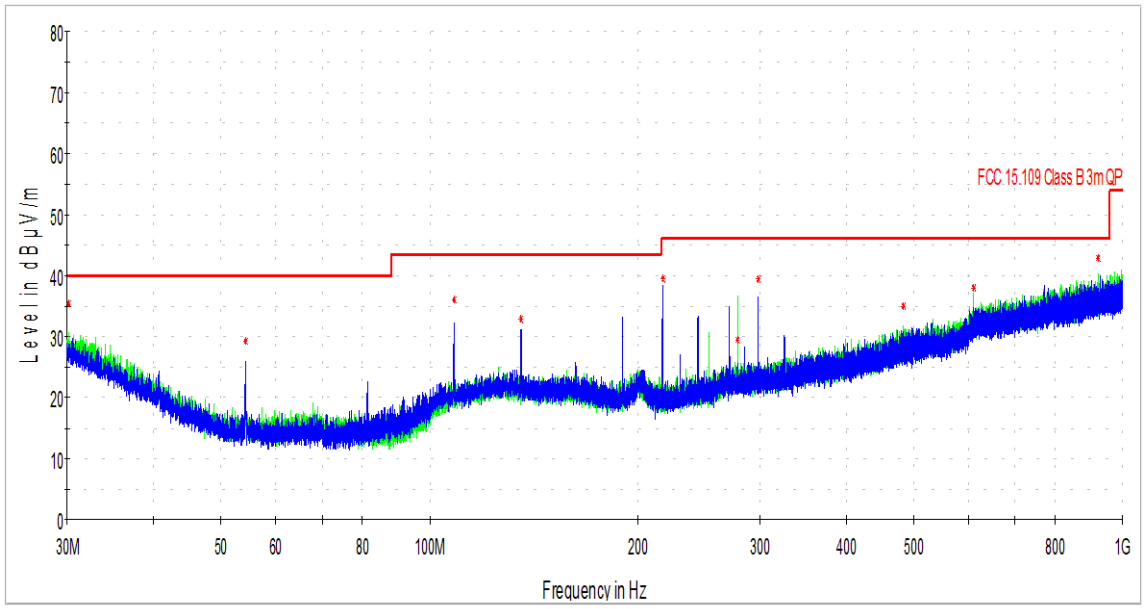
6.4 Software Utilized:

Name	Manufacturer	Version
EMC32	Rohde & Schwarz	Version 9.15.02

6.5 Results:

The sample tested was found to Comply.

6.6 Plots/Data: Radiated Emissions, 30MHz – 1GHz (Transmitter Idle)



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.168000	35.41	40.00	4.59	120.000	359.0	H	8.0	28.6
54.248000	29.14	40.00	10.86	120.000	100.0	V	210.0	14.8
108.480000	35.99	43.52	7.53	120.000	105.1	V	222.0	20.6
135.600000	32.92	43.52	10.60	120.000	100.2	V	128.0	21.7
216.980000	39.49	46.02	6.53	120.000	99.9	V	218.0	19.7
278.200000	29.46	46.02	16.56	120.000	141.4	H	135.0	22.7
298.340000	39.38	46.02	6.64	120.000	153.6	V	136.0	22.7
482.740000	35.00	46.02	11.02	120.000	153.4	H	10.0	27.8
610.220000	38.08	46.02	7.94	120.000	331.8	H	199.0	30.2
921.720000	42.85	46.02	3.17	120.000	118.0	H	0.0	34.4

Test Personnel:	Bryan Taylor	Test Date:	9/9/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	FCC Part 15.209
Product Standard:	FCC Part 15B, ICES-003 Issue 6	Ambient Temperature:	26.9C °C
Input Voltage:	12VDC	Relative Humidity:	41.3 %
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	987.3 mbar

Deviations, Additions, or Exclusions: None

7 Radiated Emissions (RFID)

7.1 Method

Tests are performed in accordance with ANSI C63.10:2013.

TEST SITE: 10m ALSE

Site Designation: 10m Chamber

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	3.9dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	4.0dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.7dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	4.7dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	4.7dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	4.7dB	5.5 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required.

7.2 Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG

Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

7.3 Test Equipment Used:

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	3900	Rohde & Schwarz	ESU40	9/18/2018	9/18/2019
Magnetic Loop Antenna	2366	ETS	6502	6/11/2019	6/11/2020
Bilog Antenna	7088	SunAR	JB6	8/8/2019	8/8/2020
System Controller	3957	Sunol Sciences	SC99V	Verify at Time of Use	Verify at Time of Use
Coaxial Cable	3339			11/26/2018	11/26/2019
Coaxial Cable	2593			11/26/2018	11/26/2019
Coaxial Cable	2592			11/26/2018	11/26/2019

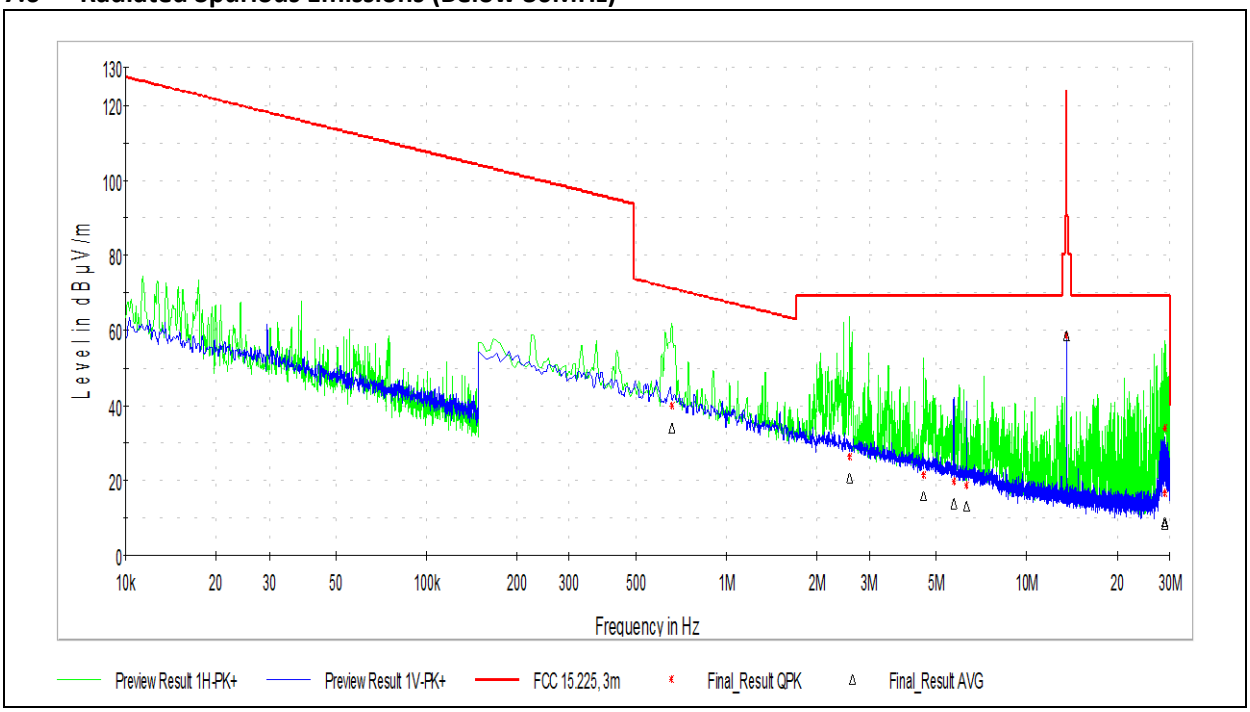
7.4 Software Utilized:

Name	Manufacturer	Version
EMC32	Rohde & Schwarz	Version 9.15.02

7.5 Results:

The sample tested was found to Comply.

7.6 Radiated Spurious Emissions (Below 30MHz)



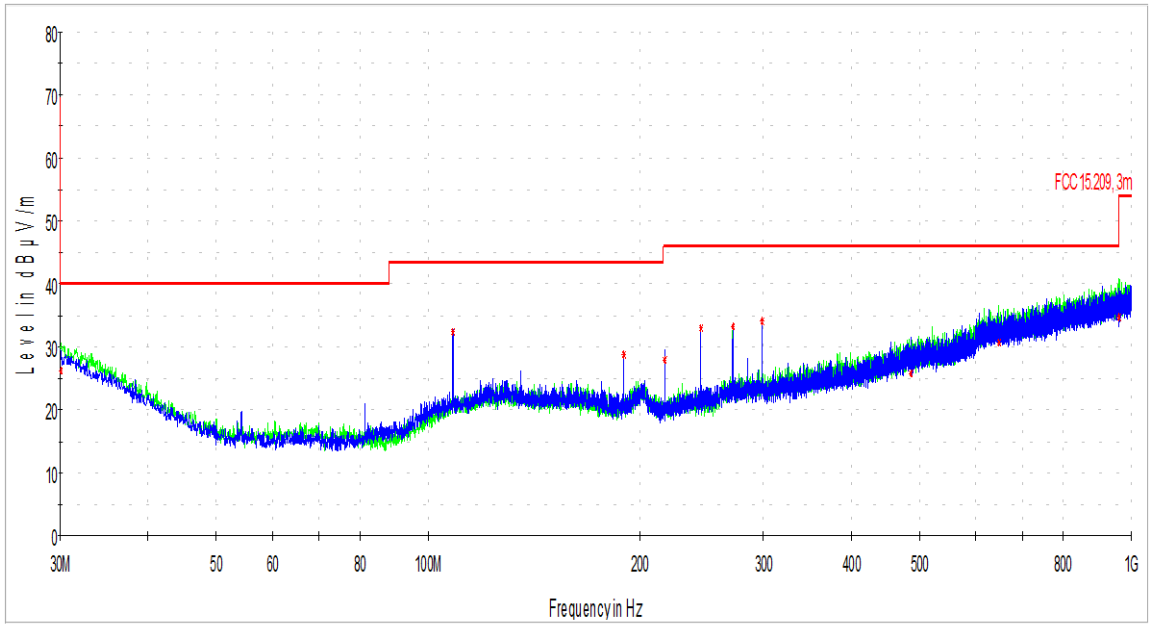
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Azimuth (deg)	Corr. (dB)
0.659206	39.79	71.23	31.44	9.000	0.0	12.6
2.564338	26.35	69.50	43.15	9.000	0.0	12.3
4.539706	21.61	69.50	47.89	9.000	156.0	12.1
5.707368	19.65	69.50	49.85	9.000	58.0	11.9
6.304368	18.88	69.50	50.62	9.000	126.0	11.9
13.560552	58.63	124.00	65.37	9.000	338.0	11.5
28.762103	33.85	69.50	35.65	9.000	292.0	9.3
28.841118	16.60	69.50	52.9	9.000	308.0	9.3

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Azimuth (deg)	Corr. (dB)
0.659206	34.10	71.23	37.13	9.000	0.0	12.6
2.564338	20.68	69.50	48.82	9.000	0.0	12.3
4.539706	15.84	69.50	53.66	9.000	156.0	12.1
5.707368	13.98	69.50	55.52	9.000	58.0	11.9
6.304368	13.17	69.50	56.33	9.000	126.0	11.9
13.560552	58.68	124.00	65.32	9.000	338.0	11.5
28.762103	8.93	69.50	60.57	9.000	292.0	9.3
28.841118	8.21	69.50	61.29	9.000	308.0	9.3

Test Personnel:	Bryan Taylor	Test Date:	9/9/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	FCC Part 15.225
Product Standard:	FCC Part 15C RSS-210 Issue 9	Ambient Temperature:	26.9C °C
Input Voltage:	12VDC	Relative Humidity:	41.3 %
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	987.3 mbar

Deviations, Additions, or Exclusions: Bluetooth radio was transmitting during this test as well.

7.7 Radiated Spurious Emissions (30MHz – 1GHz)



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.053889	26.27	40.00	13.73	120.000	399.9	H	-1.0	28.7
108.462222	32.31	43.50	11.19	120.000	100.2	V	246.0	20.6
189.834445	28.76	43.50	14.74	120.000	252.3	V	340.0	19.9
216.940556	27.89	46.00	18.11	120.000	100.2	V	210.0	19.7
244.100556	33.03	46.00	12.97	120.000	100.2	V	176.0	21.0
271.206667	33.17	46.00	12.83	120.000	100.2	H	82.0	22.6
298.312778	34.07	46.00	11.93	120.000	99.8	H	65.0	23.0
485.684444	25.75	46.00	20.25	120.000	320.4	V	93.0	27.5
648.644444	30.66	46.00	15.34	120.000	189.4	H	283.0	30.7
959.152222	34.75	46.00	11.25	120.000	296.5	H	36.0	34.8

Test Personnel:	Bryan Taylor	Test Date:	9/9/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	FCC Part 15.209
Product Standard:	FCC Part 15C RSS-210 Issue 9	Ambient Temperature:	26.9C °C
Input Voltage:	12VDC	Relative Humidity:	41.3 %
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	987.3 mbar

Deviations, Additions, or Exclusions: None

8 Conducted Emissions

8.1 Method

Tests are performed in accordance with ANSI C63.4:2014 and ANSI C63.10: 2013.

TEST SITE: Ground Plane

Site Designation: Ground Plane

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
AC Line Conducted Emissions	150 kHz - 30 MHz	3.1dB	3.4dB

As shown in the table above our conducted emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required.

8.2 Sample Calculations

The following is how net line-conducted readings were determined:

NF = RF + LF + CF + AF
Where NF = Net Reading in dBμV
RF = Reading from receiver in dBμV
LF = LISN or ISN Correction Factor in dB
CF = Cable Correction Factor in dB
AF = Attenuator Loss Factor in dB

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 dBμV
$UF = 10^{(49.1\ dB\mu V / 20)}$ = 285.1 μV/m

8.3 Test Equipment Used:

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	3900	Rohde & Schwarz	ESU40	9/18/2018	9/18/2019
LISN	3333	Teseq	NNB52	4/16/2019	4/16/2020
Coaxial Cable (COND 3)	7024			11/26/2018	11/26/2019

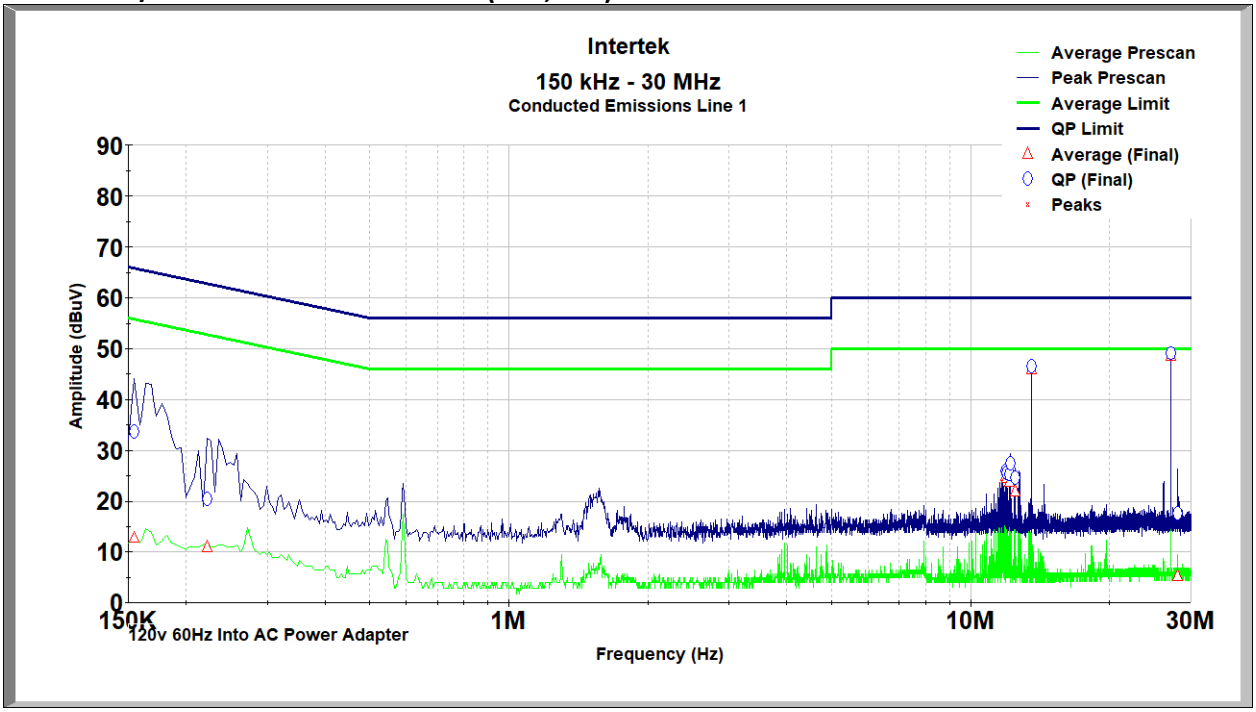
8.4 Software Utilized:

Name	Manufacturer	Version
TILE	ETS Lindgren	V7.0.6.545

8.5 Results:

The sample tested was found to Comply.

8.6 Plots/Data: Conducted Emissions (Line, Idle)

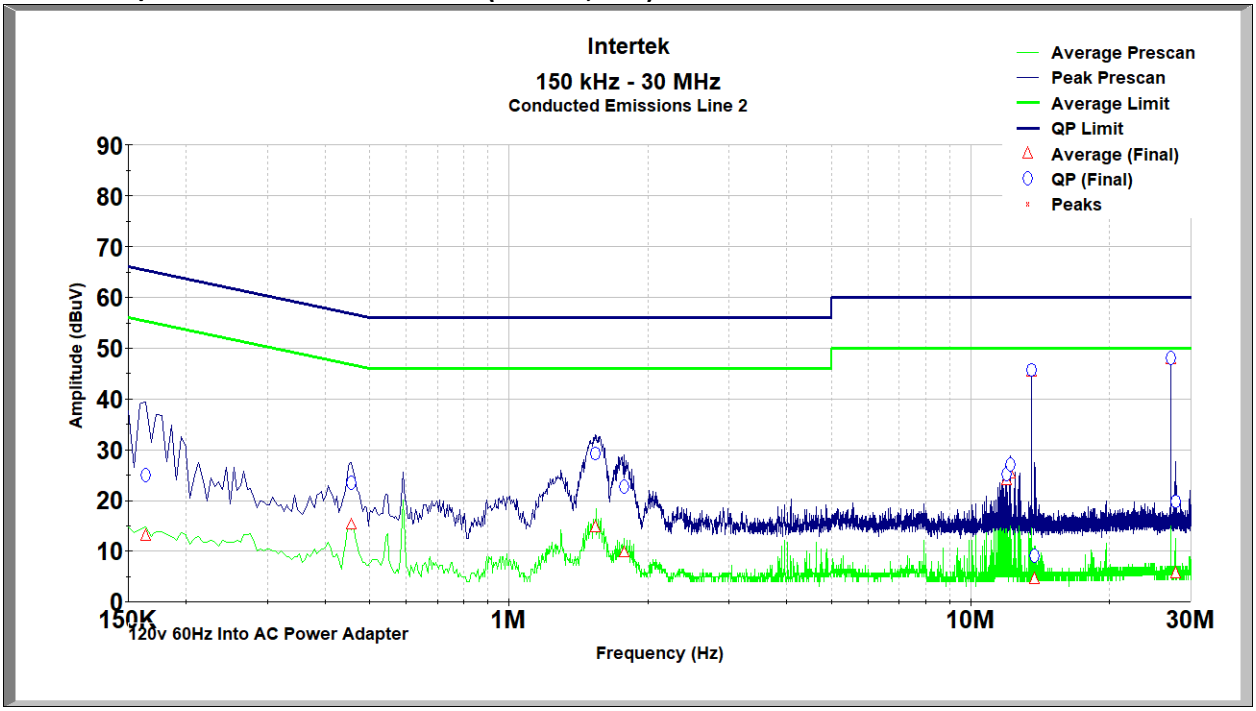


Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Margin (dB)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)
0.155	33.726	65.871	32.146	12.893	55.871	42.979
0.222	20.475	63.943	43.468	11.073	53.943	42.870
11.892	25.951	60.000	34.049	24.920	50.000	25.080
11.955	25.629	60.000	34.371	24.575	50.000	25.425
12.140	25.376	60.000	34.624	23.954	50.000	26.046
12.198	27.506	60.000	32.494	25.998	50.000	24.002
12.504	24.623	60.000	35.377	21.945	50.000	28.055
13.562	46.575	60.000	13.425	46.048	50.000	3.952
27.123	49.153	60.000	10.847	48.687	50.000	1.313
28.041	17.580	60.000	42.420	5.271	50.000	44.729

Test Personnel:	Bryan Taylor	Test Date:	9/13/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	Class B
Product Standard:	FCC Part 15B ICES-003 Issue 6	Ambient Temperature:	23.3 °C
Input Voltage:	120VAC / 60Hz into power adapter powering the device	Relative Humidity:	42.2 %
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	988.4 mbar

Deviations, Additions, or Exclusions: None

8.7 Plots/Data: Conducted Emissions (Neutral, Idle)

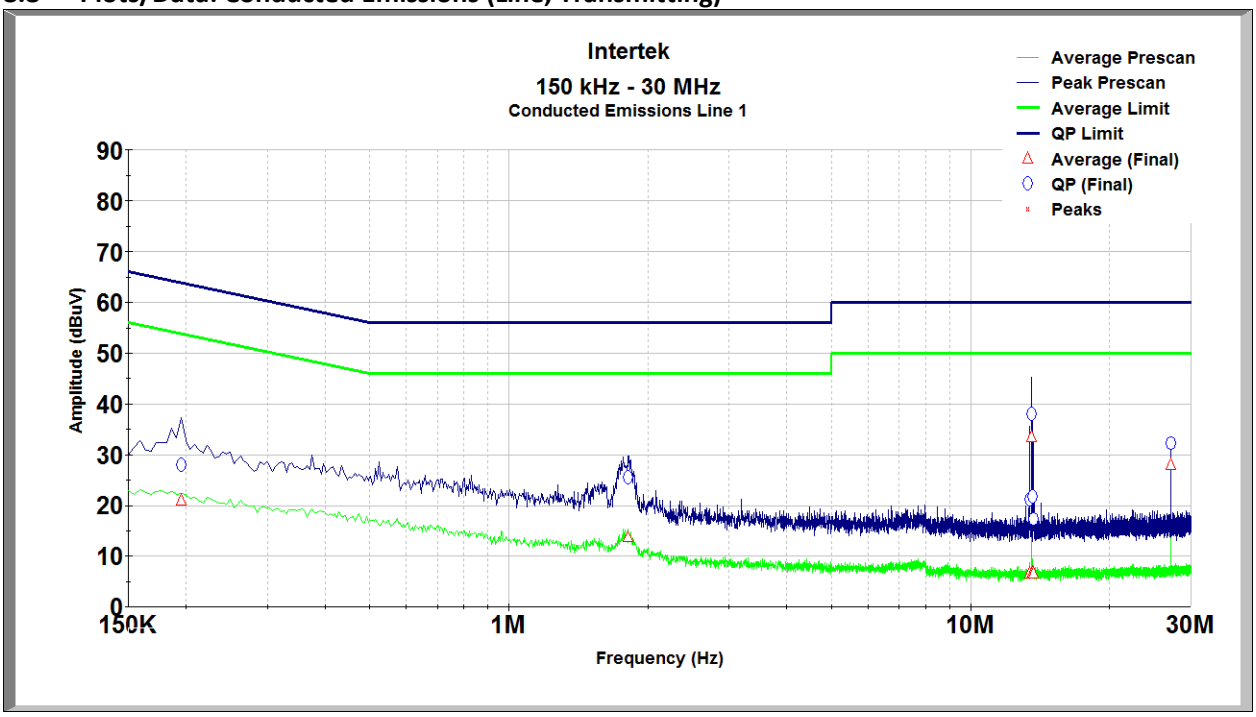


Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Margin (dB)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)
0.164	25.068	65.614	40.546	13.009	55.614	42.605
0.456	23.485	57.257	33.772	15.340	47.257	31.917
1.536	29.250	56.000	26.750	14.869	46.000	31.131
1.775	22.744	56.000	33.256	9.904	46.000	36.096
11.955	25.248	60.000	34.752	24.056	50.000	25.944
12.198	27.001	60.000	32.999	25.424	50.000	24.576
13.562	45.851	60.000	14.149	45.384	50.000	4.616
13.769	9.105	60.000	50.895	4.601	50.000	45.399
27.123	48.114	60.000	11.886	47.815	50.000	2.185
27.758	19.851	60.000	40.149	5.661	50.000	44.339

Test Personnel:	Bryan Taylor	Test Date:	9/13/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	Class B
Product Standard:	FCC Part 15B ICES-003 Issue 6	Ambient Temperature:	23.3 °C
Input Voltage:	120VAC / 60Hz into power adapter powering the device	Relative Humidity:	42.2 %
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	988.4 mbar

Deviations, Additions, or Exclusions: None

8.8 Plots/Data: Conducted Emissions (Line, Transmitting)

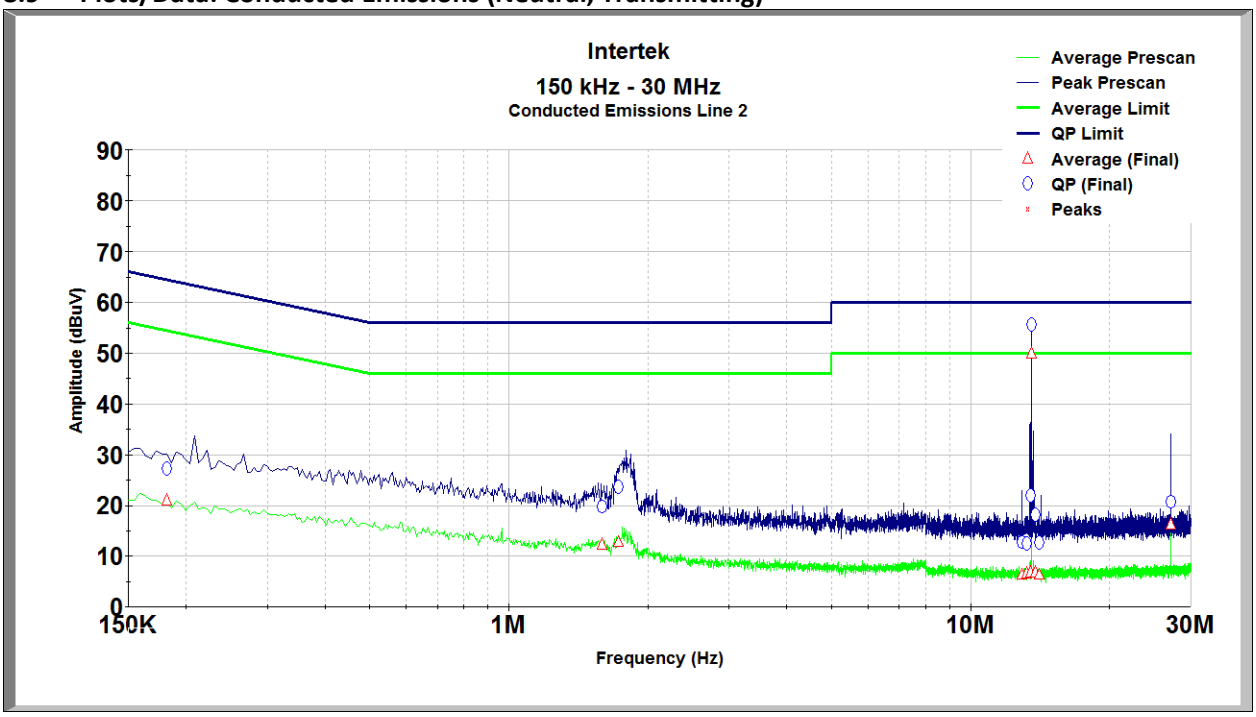


Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Margin (dB)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)
0.195	28.082	64.714	36.633	21.048	54.714	33.666
1.815	25.619	56.000	30.381	13.748	46.000	32.252
13.427	21.111	60.000	38.889	6.639	50.000	43.361
13.553	38.123	60.000	21.877	33.546	50.000	16.454
13.638	21.799	60.000	38.201	6.914	50.000	43.086
13.701	17.437	60.000	42.563	6.692	50.000	43.308
27.123	32.290	60.000	27.710	28.026	50.000	21.974

Test Personnel:	Bryan Taylor	Test Date:	9/13/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	15.207
Product Standard:	FCC Part 15C RSS-Gen Issue 5	Ambient Temperature:	23.3 °C
Input Voltage:	120VAC / 60Hz into power adapter powering the device	Relative Humidity:	42.2 %
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	988.4 mbar

Deviations, Additions, or Exclusions: None

8.9 Plots/Data: Conducted Emissions (Neutral, Transmitting)



Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Margin (dB)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)
0.181	27.241	65.100	37.859	21.030	55.100	34.070
1.595	19.907	56.000	36.093	12.254	46.000	33.746
1.730	23.602	56.000	32.398	12.864	46.000	33.136
12.927	12.938	60.000	47.062	6.503	50.000	43.497
13.256	12.497	60.000	47.503	6.568	50.000	43.432
13.485	21.875	60.000	38.125	6.859	50.000	43.141
13.562	55.695	60.000	4.305	49.880	50.000	0.120
13.778	18.096	60.000	41.904	6.735	50.000	43.265
14.066	12.597	60.000	47.403	6.515	50.000	43.485
27.114	20.868	60.000	39.132	16.305	50.000	33.695

Test Personnel:	Bryan Taylor	Test Date:	9/13/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	15.207
Product Standard:	FCC Part 15C RSS-Gen Issue 5	Ambient Temperature:	23.3 °C
Input Voltage:	120VAC / 60Hz into power adapter powering the device	Relative Humidity:	42.2 %
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	988.4 mbar

Deviations, Additions, or Exclusions: None

9 Frequency Stability

9.1 Test Limits

FCC Part 15.225:

> (e) The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of −20 degrees to + 50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

RSS-210 Issue 9 § B.6:

> Carrier frequency stability shall be maintained to ±0.01% (±100 ppm).

9.2 Test Method

Tests are performed in accordance with ANSI C63.10:2013.

9.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
Spectrum Analyzer	3099	Rohde & Schwarz	FSP7	9/20/2018	9/20/2019
Environmental Chamber	3949	Test Equity	115A	1/4/2019	1/4/2020

9.4 Test Results

The sample tested was found to be **compliant**.

9.5 Test Data

Voltage %	Voltage (VDC)	Temp (°C)	Measured Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	Limit (%)
100%	12	-30	13,560,408	-97	-0.0007	0.01
100%	12	-20	13,560,427	-78	-0.0006	0.01
100%	12	-10	13,560,477	-28	-0.0002	0.01
100%	12	0	13,560,515	10	0.0001	0.01
100%	12	10	13,560,523	18	0.0001	0.01
100%	12	20	13,560,505	0	0.0000	0.01
100%	12	30	13,560,477	-28	-0.0002	0.01
100%	12	40	13,560,451	-54	-0.0004	0.01
100%	12	50	13,560,436	-69	-0.0005	0.01
115%	13.8	20	13,560,442	-63	-0.0005	0.01
85%	10.2	20	13,560,484	-21	-0.0002	0.01

Test Personnel:	Bryan Taylor	Test Date:	9/11/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.225 RSS-210 Issue 9	Ambient Temperature:	22.5C
Input Voltage:	12VDC	Relative Humidity:	41.1%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	984.6mbar

Deviations, Additions, or Exclusions: None

10 Occupied Bandwidth

10.1 Test Limits

15.215(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. In the case of intentional radiators operating under the provisions of subpart E, the emission bandwidth may span across multiple contiguous frequency bands identified in that subpart. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

10.2 Test Method

Tests are performed in accordance with ANSI C63.10:2013.

10.3 Test Equipment Used

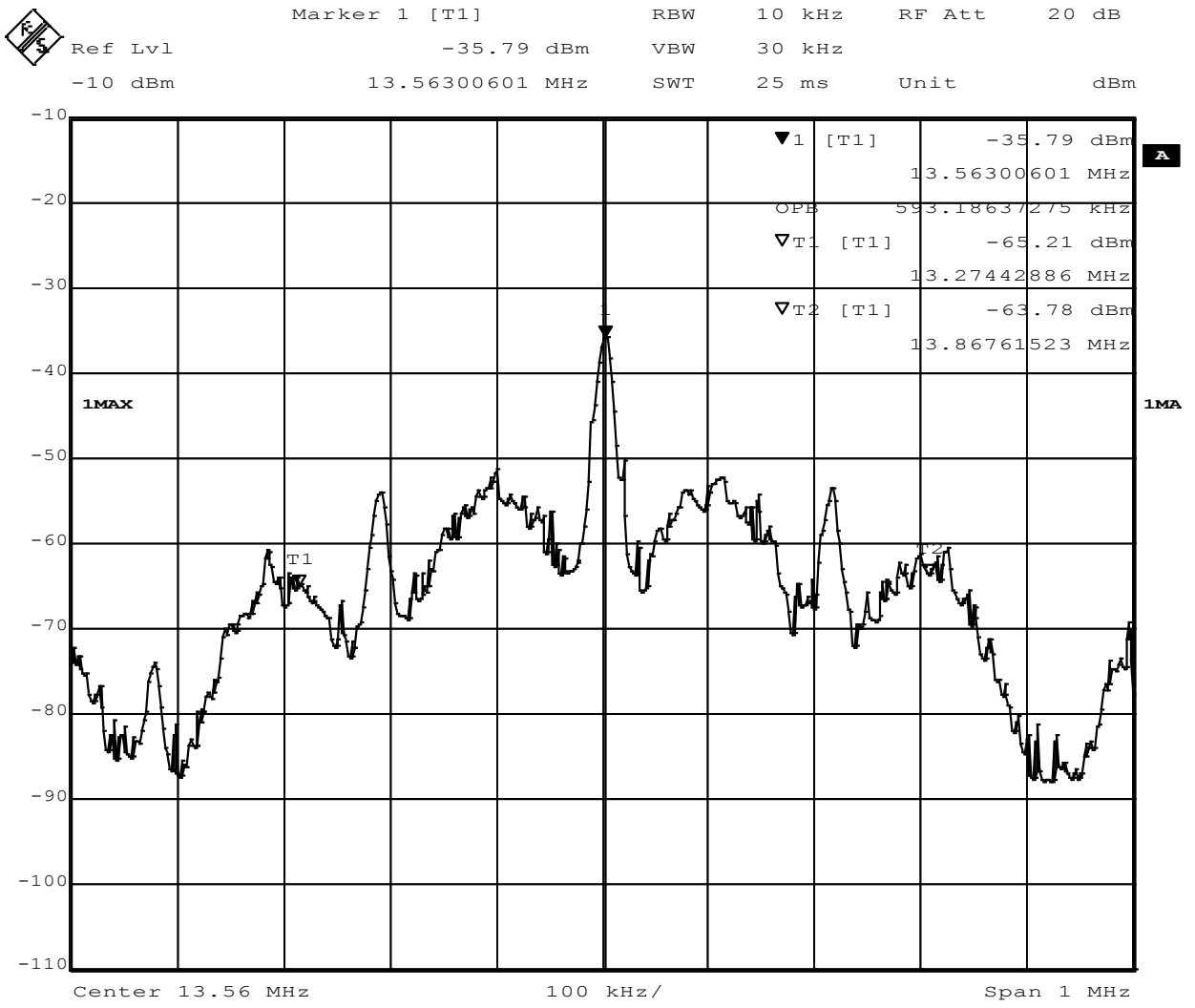
Description	Asset	Manufacturer	Model	Cal Date	Cal Due
Spectrum Analyzer	3720	Rohde & Schwarz	FSEK	9/20/2018	9/20/2019

10.4 Test Results

The sample tested was found to be **compliant**. The 99% power bandwidth was measured as was the 20dB down bandwidth. The 20dB bandwidth was entirely within the transmit band 13.11MHz – 14.01MHz as required by FCC Part 15.215.

10.5 Test Data

RBW	VBW	99% BW
10kHz	30kHz	593.18kHz

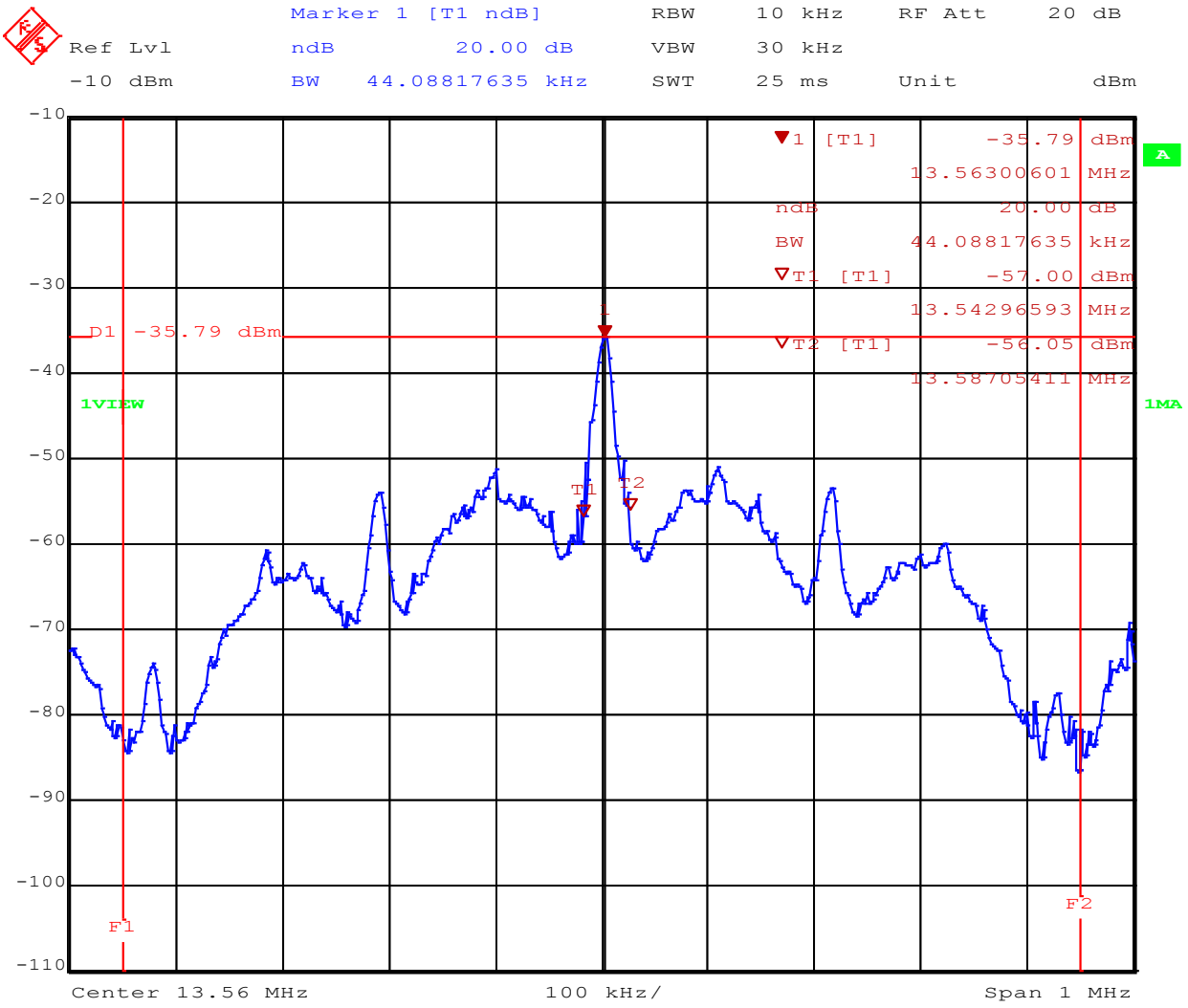


99% Occupied Bandwidth

Test Personnel:	Bryan Taylor	Test Date:	9/12/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	RSS-210 Issue 9	Ambient Temperature:	24.7 °C
Input Voltage:	12VDC	Relative Humidity:	45.9 %
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	978.6 mbar

Deviations, Additions, or Exclusions: None

RBW	VBW	20dB BW
10kHz	30kHz	44.08kHz



20dB Bandwidth

Test Personnel:	Bryan Taylor	Test Date:	9/12/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.215c	Ambient Temperature:	24.7 °C
Input Voltage:	12VDC	Relative Humidity:	45.9 %
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	978.6 mbar

Deviations, Additions, or Exclusions: None

11 Antenna Requirement

11.1 Test Limits

FCC Part 15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

RSS-Gen Issue 5 § 6.8:

The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the license-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.

License-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the license-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of license-exempt transmitter and antenna type, with the transmitter output power set at the maximum level. When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

This radio transmitter (identify the device by certification number) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi).

11.2 Test Results

The device was found to be **compliant**. The device has permanent antenna designed into the PCB.

12 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	10/2/2019	104073059LEX-001	BCT	BL	Original Issue