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ETC Report #: s01e21a303_FCC Release1 Date: December 13, 2021

Test Dates: November 26, 27, 30 & December 01, 06, 2021

EMC testing of the SMART Technologies ULC (Model: IDS675-3) - Panel in accordance with FCC Part 15.225.

FCC ID: QCIIDS675P1

Tested By: Imran Akram, Janet Mijares

Prepared for: SMART Technologies ULC

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REVISION RECORD

ISSUE	DATE	AUTHOR	REVISIONS
DRAFT 1	2021-12-06	I. Akram	Initial draft submitted for review.
Release1	2021-12-13	I. Akram	Sign Off

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1.0 INTRODUCTION

1.1 Scope

The purpose of this report is to present the results of compliance testing performed in accordance with FCC Part 15.225 to gain Class 2 Permissive Change for low-power License-Exempt transmitters. All test procedures, limits, criteria, and results described in this report apply only to the SMART Technologies ULC test sample IDS675-3, referred to herein as the EUT (Equipment Under Test).

The samples have been provided by the customer.

This report does not imply product endorsement by the Electronics Test Centre, A2LA, nor any Canadian Government agency.

1.2 Applicant

This test report has been prepared for SMART Technologies ULC, located in Calgary, Alberta, Canada.

1.3 Test Sample Description

As provided to ETC (Airdrie) by SMART Technologies ULC:

Product Name:	SMART board Interactive display
Frequency Band	13.110 - 14.010 MHz
Type of Modulation	ASK with Manchester Coding
Frequency	13.56MHz +/- 423.75 kHz
Associated Antenna	Non-Detachable, Loop
Model #	IDS675-3
Serial #	K080NW27B0019
FCC ID #	QCIIDS675P1
Associated Antenna Type / connection Type	Panel Antenna / Soldered, Integral
Power:	120 VAC / 60 Hz

Note: For more detailed description, refer to the manufacturer's specification or the user manual.

All 60 active antennas were investigated. Antenna with worst case radiation was configured for full test analysis.

KIB1_1 (East)															
Rx ANT POS	PK Value dBuV/m ANT-1	PK Value dBuV/m ANT-2	PK Value dBuV/m ANT-3	PK Value dBuV/m ANT-4	PK Value dBuV/m ANT-5	PK Value dBuV/m ANT-6	PK Value dBuV/m ANT-7	PK Value dBuV/m ANT-8	PK Value dBuV/m ANT-9	PK Value dBuV/m ANT-10	PK Value dBuV/m ANT-11	PK Value dBuV/m ANT-12	PK Value dBuV/m ANT-13	PK Value dBuV/m ANT-14	PK Value dBuV/m ANT-15
1st	53.86	50.35	50.31	43.74	45.34	45.87	43.81	49.53	44.69	44.11	43.38	41.53	44.42	44.44	47.77
2nd	52.78	50.71	51.1	47.46	46.74	51.7	47.21	54.28	50.8	48.57	48.19	47.97	49.3	49.86	49.93
KIB1_1 (West)															
1st	47.82	48.26	50.29	51.16	43.88	43.41	45.56	48.39	41.31	51.49	50.39	49.08	43	46.13	50.32
2nd	47.7	54.11	53	52.54	48.81	43.15	48.38	52.5	46.94	55.51	49.34	48.78	45.91	42.61	47.77
KIB2_1 (East)															
1st	52.05	52.47	50.8	48.86	45.03	52.38	44.79	50.98	52.58	52.12	52.34	51.99	48.68	49.42	45.43
2nd	51.48	58.2	56.29	50.64	49.22	55.69	50.3	48.78	53.8	52.54	51.81	51.95	49.08	52	47.44
KIB2_1 (West)															
1st	43.05	42.29	42.52	46.96	47.48	46.05	48.27	52.43	53.65	53.49	52.85	49.81	49.53	42.3	50.22
2nd	47.19	48.32	51.69	45.97	50.01	48.43	49.3	53.71	51.11	53.86	59.32	57.31	57.92	55.65	49.84
Note: KIB2_1 (West) antenna # 11 selected for detail analysis															

1.4 General Test Conditions

The EUT was set up and exercised using the configurations, modes of operation and arrangements defined in this report only. All inputs and outputs to and from other equipment associated with the EUT were adequately simulated.

Where relevant, the EUT was only tested using the monitoring methods and test criteria defined in this report.

The environmental conditions are recorded during each test, and are reported in the relevant sections of this document.

EUT Modification:

EUT modification detailed in exhibit# **QCIID675P1_Modification Letter**

1.5 Scope of Testing

Tests were performed in accordance with FCC Part 15.225 and ANSI C63.10-2013.

1.5.1 Test Methodology

Test methods are documented in the part of Section 2 of this report associated with each particular Test Case.

1.5.2 Variations in Test Methodology

Any variance in methodology or deviation from the reference Standard is documented in the part of Section 2 of this report associated with each particular Test Case.

1.5.3 Test Sample Verification, Configuration & Modifications

EUT setup, configuration, protocols for operation and monitoring of EUT functions, and any modifications performed in order to meet the requirements, are detailed in each Test Case of Section 2 of this report.

1.5.4 Uncertainty of Measurement:

The factors contributing to uncertainty of measurement are identified and calculated in accordance with CISPR 16-4.

This uncertainty estimate represents an expended uncertainty expressed at approximately 95% confidence using a coverage factor of k = 2.

Test Method	Frequency	Uncertainty
Conducted Emissions Level	150 kHz – 30 MHz	±3.4 dB
Radiated Emissions Level	30 MHz – 1 GHz	±5.8 dB

2.0 TEST CONCLUSION

STATEMENT OF COMPLIANCE

The customer equipment referred to in this report was found to comply with the requirements, as summarized below.

The measurement uncertainty is not accounted for determination of the statement of compliance. The statement of compliance is based only on the measurement value recorded.

The EUT was subjected to the following tests. Compliance status is reported as **compliant** or **Non-compliant**. **N/A** indicates the test was Not Applicable to the EUT.

> **Note:** Maintenance of compliance is the responsibility of the Manufacturer. Any modifications to the product should be assessed to determine their potential impact on the compliance status of the EUT with respect to the standards detailed in this test report.

The following table summarizes the tests performed in terms of the specification, class or performance criterion applied, and the EUT modification state.

Test Case	Test Type	Specification	Test Sample	Config.	Result
2.1	AC Conducted Emissions	FCC Part 15.207	IDS675-1	see § 2.1	**Compliant**
2.2	Radiated Spurious Emissions (out-of-band)	FCC Part 15.225(d), FCC15.209, FCC 15.205	IDS675-1	see § 2.2	**Compliant**
2.3	Radiated Emissions (Within the band)	FCC Part 15.225(a) – (c)	IDS675-1	see § 2.3	**Compliant**
2.4	20 dB Bandwidth	FCC Part 15.215 (c)	IDS675-1	see § 2.4	**Compliant**
2.5	Frequency Stability	FCC Part 15.225 (e)	IDS675-1	see § 2.5	**Compliant**

Refer to the test data for applicable test conditions.

2.1 AC Power Line Conducted Emissions:

Test Lab: Electronics Test Centre, Airdrie	**EUT: IDS675-1**
Test Personnel: Janet Mijares	**Standard: FCC Part 15.207**
Date:2021-11-30 (20.1° C, 18.4% RH)	**Basic Standard: ANSI C63.10-2013**

EUT status: Compliant

Specification: Part15-207

Frequency (MHz)	Quasi-Peak Limit (dBµV)	Average Limit (dBµV)
0.15 – 0.5	66 – 56	56 – 46
0.5 – 5	56	46
5 – 30	60	50

Criteria: The conducted emissions produced by a device shall not exceed the limits as specified.

2.1.1 Test Guidance: ANSI C63.4-2014, Clause 7.3.1 & ANSI C63.10: 2013

Before any testing is performed, the Ambient (measurement noise floor) is recorded, and a QC check is performed to show that the system is functioning correctly. Testing starts with a scan, performed under software control. After this is complete, the list of frequencies of interest is generated. These frequencies are then investigated for quasi-peak and average amplitude, as applicable. Emissions measured with a QP detector that fall below the Average limit are deemed to meet both requirements.

2.1.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

2.1.3 Test Equipment

Testing was performed with the following equipment:

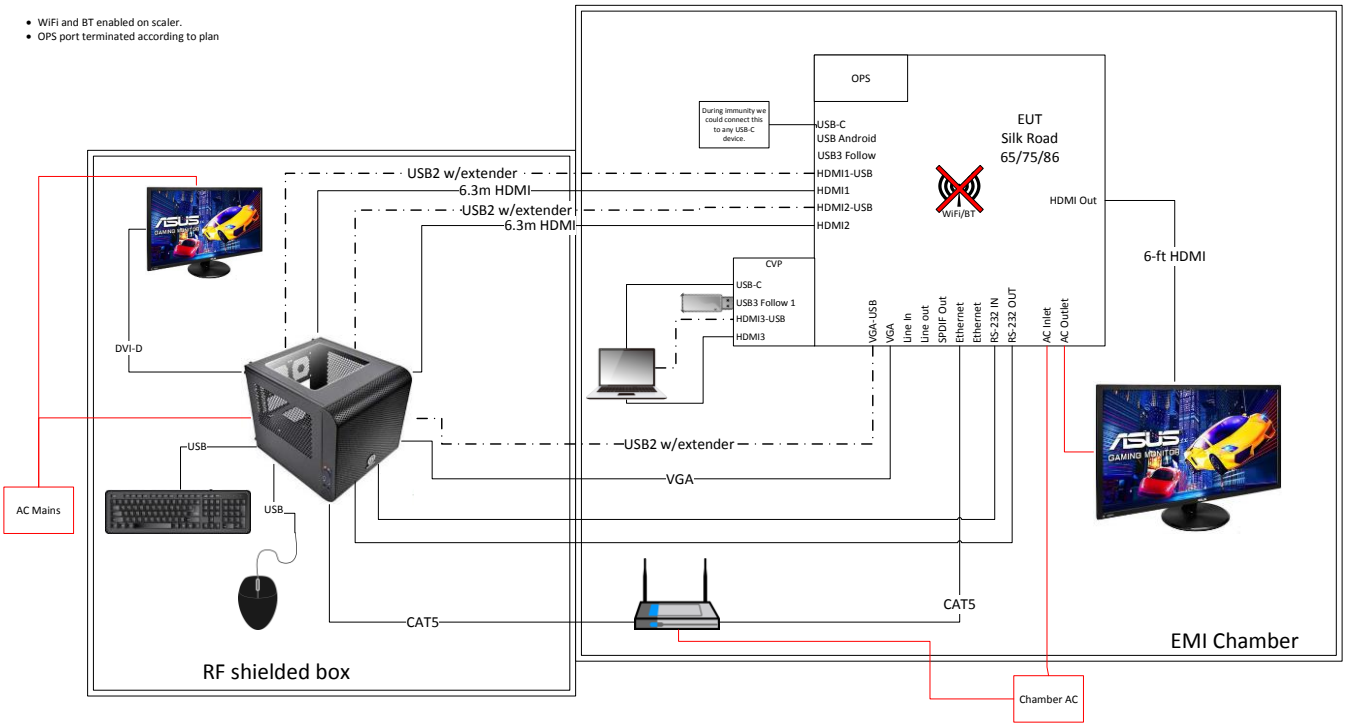
Equipment	Manufacturer	Model #	Asset #	Cal. Date (yyyy-mm-dd)	Cal. Due (yyyy-mm-dd)
EMC Software	UL	Ver. 9.5	ETC-SW-EMC 2.1	N/A	N/A
EMI receiver	Keysight Technologies Inc.	N9038A (FW A.25.05)	6130	2021-06-18	2022-06-18
LISN	Com-Power	LI-215A	6180	2020-06-30	2022-06-30
Temp/RH logger	Extech	42270	5892	2021-04-06	2022-04-06

2.1.4 Test Sample Verification, Configuration & Modifications

The EUT was set to selected channels with test-specific software. The output was modulated as in normal operation. Configuration in Tx mode.

The EUT met the requirements without modification.

EUT Test Configuration:



2.1.5 Conducted Emissions Data:

The emissions data is presented in tabular form, showing the uncorrected spectrum analyzer reading, the correction factors applied, the net result, the value(s) of limit at the frequency measured, and the Delta between the result and the limit.

Freq. Marker	Freq. (MHz)	Raw reading(dBµv)	Det.	LISN Factor (dB)	Cable Loss (dB)	Corrected Reading (dBµV)	FCC 15.207 AV Limit (dBµV)	Delta (dB)	L / N
1	0.36	39.89	AV	00	.1	39.99	48.79	-8.8	L
2	0.433	31.08	AV	0	.2	31.28	47.2	-15.92	L
3	0.597	37.43	AV	0	.2	37.63	46	-8.37	L
4	0.635	32.61	AV	0	.2	32.81	46	-13.19	L
5	0.675	34.87	AV	0	.2	35.07	46	-10.93	L
6	0.687	31.43	AV	0	.2	31.63	46	-14.37	L
7	0.733	32.66	AV	0	.2	32.86	46	-13.14	L
8	13.56	35.42	AV	0	.8	36.22	50	-13.78	L
1	0.238	47.07	AV	0	.1	47.17	52.16	-4.99	N
2	0.356	40.29	AV	0	.1	40.39	48.81	-8.42	N
3	0.450	34.03	AV	0	.2	34.23	46.87	-12.64	N
4	0.543	35.71	AV	0	.2	35.91	46	-10.09	N
5	0.597	37.54	AV	0	.2	37.74	46	-8.26	N
6	0.671	35.55	AV	0	.2	35.75	46	-10.25	N
7	0.708	36.99	AV	0	.2	37.19	46	-8.81	N
8	0.835	38.31	AV	0	.2	38.51	46	-749	N
9	13.09	36.96	AV	0	.8	37.76	50	-12.24	N
10	13.80	34.99	AV	0	.8	35.79	50	-14.21	N

AV = Average Detector

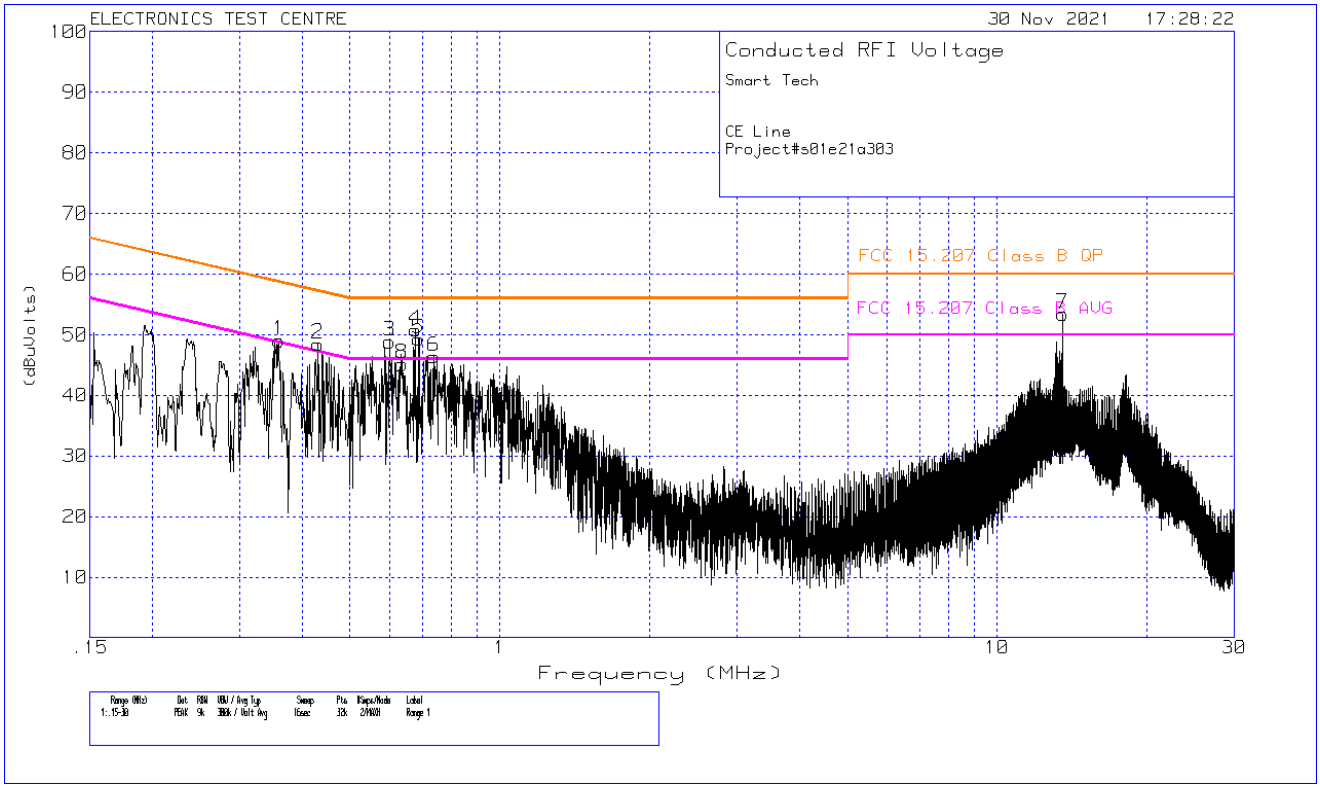
Raw Reading in dBµV + LISN Factor dB + Gain/Loss Factor in dB = Corrected Field Strength in dbµV.

Note: When a preamp is used, the resulting gain is compensated, producing a negative value for the Cable Loss.

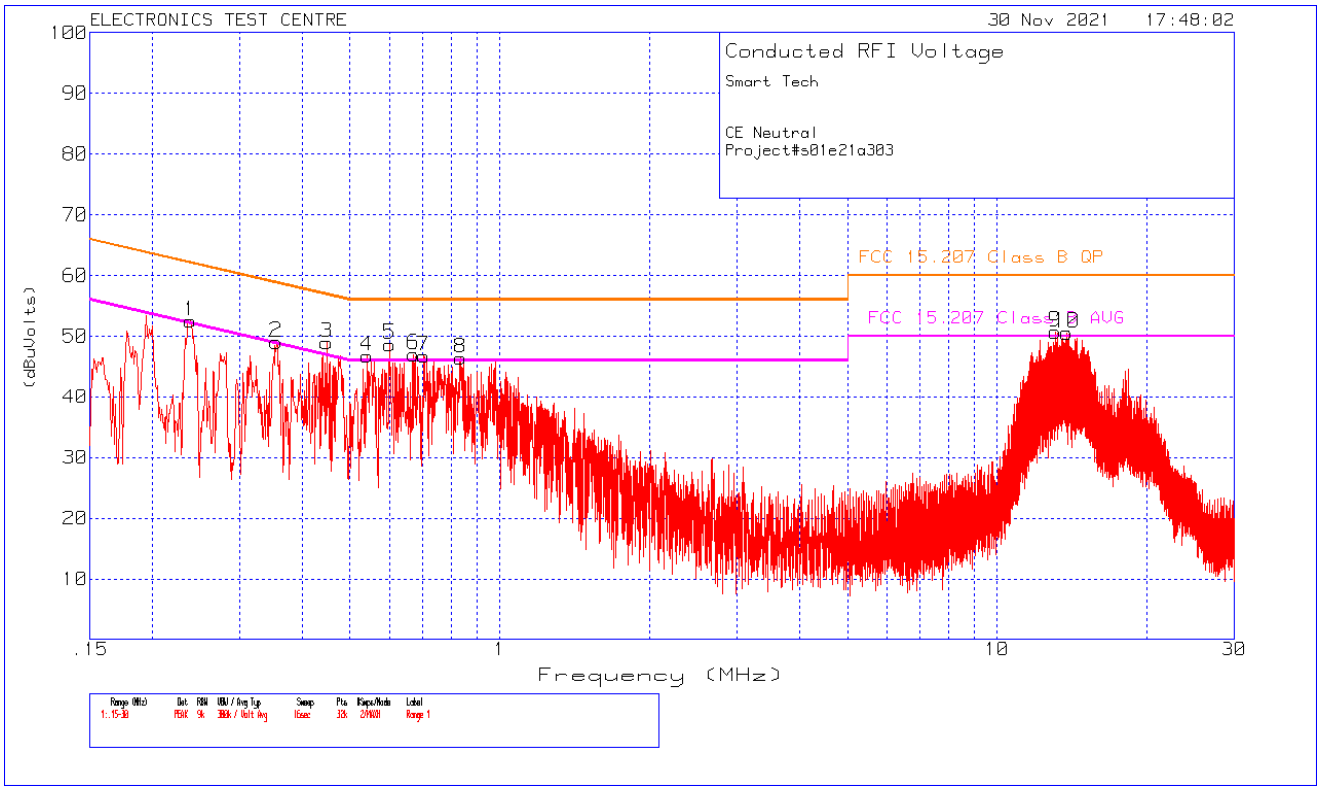
Negative values for Delta indicate compliance.

The Ground Bond was measured and found to be 1.25 mΩ.

Plot of Conducted Emissions: Line



Plot of Conducted Emissions: Neutral



2.2 Radiated Spurious Emissions (out-of-band)

Test Lab: Electronics Test Centre, Airdrie	**EUT: IDS675-1**
Test Personnel: Janet Mijares	**Standard: FCC Part 15.225**
Date:2021-11-26 (22.2°C,15. 3 % RH) 2021-12-06(20.5°C,9.1 % RH)	**Basic Standard: ANSI C63.10-2013**

EUT status: Compliant

Specification: FCC Part 15.225(d)

In addition to the provisions of §15.205, the field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

§15.209 Radiated emission limits; general requirements.

(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in this table

Frequency (MHz)	Field strength		Measurement distance (meters)	
	(µv/m)	(dBµv/m)		
0.009-0.490	2400/F(kHz)	128.5- 93.8	300	3
0.490-1.705	24000/F(kHz)	73.8 – 62.97	30	3
1.705-30.0	30	69.54	30	3
30-88	100**	40	3	3
88-216	150**	43.52	3	3
216-960	200**	46.02	3	3
Above 960	500	53.98	3	3

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §15.231 and §15.241.

Specification: ANSI C63.10-2013, Clause 5.9

An unlicensed wireless device shall be tested to demonstrate that any emissions within restricted frequency bands specified by the regulatory authority are spurious emissions only. Unless otherwise specifically authorized, the spurious emission shall meet prescribed limits and the fundamental transmit signal shall not fall within these frequency bands. Test reports shall provide measured data to demonstrate compliance with these regulatory requirements.

§15.205 Restricted bands of operation:

MHz	MHz	MHz	MHz	MHz	GHz	GHz
0.0900000 – 0.1100000	8.2910000 - 8.2940000	16.804250 - 16.804750	162.01250 - 167.17000 *	1660.0000 – 1710.0000	3.6000000 – 4.4000000	14.470000 – 14.500000
0.4950000 - 0.5050000 *	8.3620000 - 8.3660000	25.500000 - 25.670000	167.72000 - 173.20000 *	1718.8000 – 1722.2000	4.5000000 – 5.1500000	15.350000 – 16.200000
2.1735000 - 2.1905000	8.3762500 - 8.3867500	37.500000 - 38.250000	240.00000 – 285.00000	2200.0000 – 2300.0000	5.3500000 – 5.4600000	17.700000 – 21.400000
4.1250000 - 4.1280000	8.4142500 - 8.4147500	73.000000 - 74.600000	322.00000 - 335.40000	2310.0000 – 2390.0000	7.2500000 – 7.7500000	22.010000 – 23.120000
4.1772500 - 4.1777500	12.290000 - 12.293000	74.800000 - 75.200000	399.90000 – 410.00000	2483.5000 – 2500.0000 *	8.0250000 – 8.5000000	23.600000 – 24.000000
4.2072500 - 4.2077500	12.519750 - 12.520250	108.00000 - 121.94000 **	608.00000 – 614.00000	2655.0000 – 2900.0000	9.0000000 – 9.2000000	31.200000 – 31.800000
5.6770000 - 5.6830000	12.576750 - 12.577250	123.00000 - 138.00000 **	960.00000 – 1240.0000 ***	3260..0000 – 3267.0000	9.3000000 – 9.5000000	36.430000 – 36.500000
6.2150000 - 6.2180000	13.360000 - 13.410000	149.90000 - 150.05000 *	1300.0000 – 1427.0000 ***	3332.0000 – 3339.0000	10.600000 – 12.700000	Above 38.600000
6.2677500 - 6.2682500	16.420000 - 16.423000	156.52475- 156.52525	1435.0000 – 1626.5000	3345.8000 – 3358.0000	13.250000 – 13.400000	
6.3117500 - 6.3122500	16.694750 - 16.695250	156.70000 - 156.90000	1645.5000 – 1646.5000	3500.0000 – 3600.0000 ****		

* US only ** Canada 108 – 138 MHz *** Canada 960 – 1427 MHz **** Canada only

2.2.1 Test Methodology: ANSI C63.10-2013, Clause 6.6.4

From 9 kHz to 150 kHz (resolution bandwidth of 200 Hz) and from 150 kHz to 30 MHz (resolution bandwidth 9 kHz) measurements are performed with a loop antenna.

From 30 MHz to 1000 MHz, measurements are performed with a broadband biconilog antenna and a resolution bandwidth of 120 kHz.

The scan is performed at discreet increments of turntable azimuth and antenna height, which are selected in accordance with the applicable standard in order to assure capture of frequencies of interest. Optimization is performed based on the scan data.

Frequencies having peak emissions within 6 dB of the limits are optimized. The EUT is rotated in azimuth over 360 degrees and the direction of maximum emission is noted.

Antenna height is varied from 1 – 4 meters at this azimuth to obtain the maximum emission. Then the maximum level is measured with the appropriate detector and recorded. Up to 1 GHz, measurements are performed with a Quasi-Peak detector.

2.2.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

2.2.3 Test Equipment

Testing was performed with this equipment:

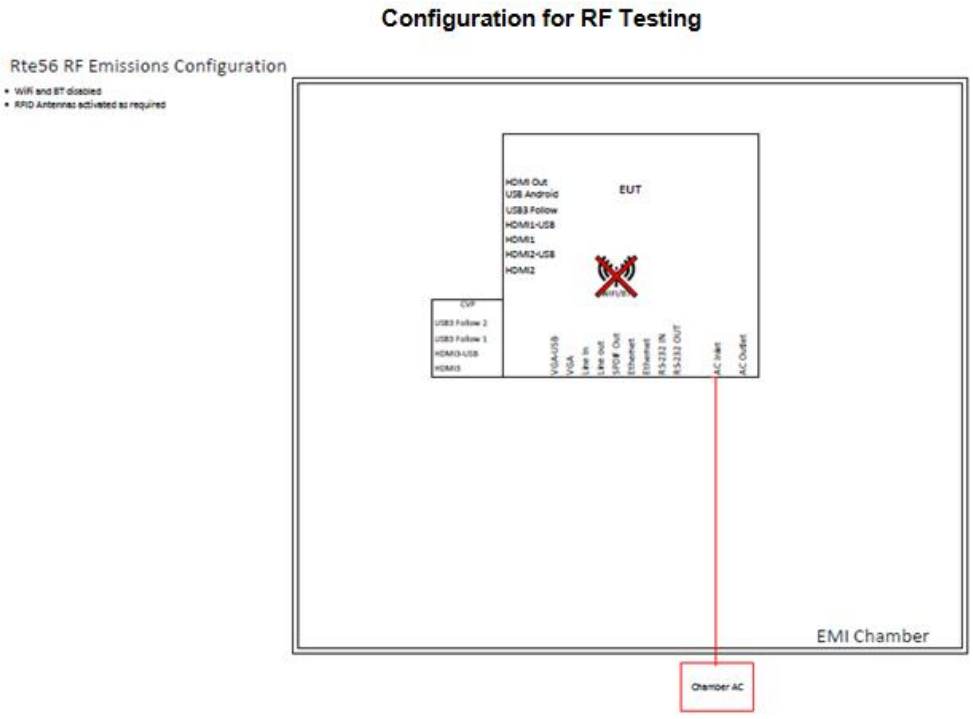
Equipment	Manufacturer	Model #	Asset #	Calibration Date (yyyy mm dd)	Calibration Due-Date (yyyy mm dd)
EMC Software	UL	Ver. 9.5	ETC-SW-EMC 2.1	N/A	N/A
EMI receiver	Keysight Technologies Inc.	N9038A (FW A.25.05)	6130	2021-06-18	2022-06-18
Loop Antenna	EMCO	6502	10868	2021-05-11	2023-05-11
Biconilog Antenna	SunAR RF Motion;	JB1	6905	2019-10-14	2021-10-14
T/H Logger	EXTECH Ins.	42270	5892	2021-04-06	2022-04-06
Emission Cable (30 – 1000 MHz)	IW	KPS-1501A-3600-KPS 01102006	4419	2021-03-03	2022-03-03
Emission Cable (1000 – 5000 MHz)	A.H. System Inc.	SAC-26G-8.23	6187	2021-03-03	2022-03-03
Pre- Amp	HP	8447D	9291	Monitored	

2.2.4 Test Sample Verification, Configuration & Modifications

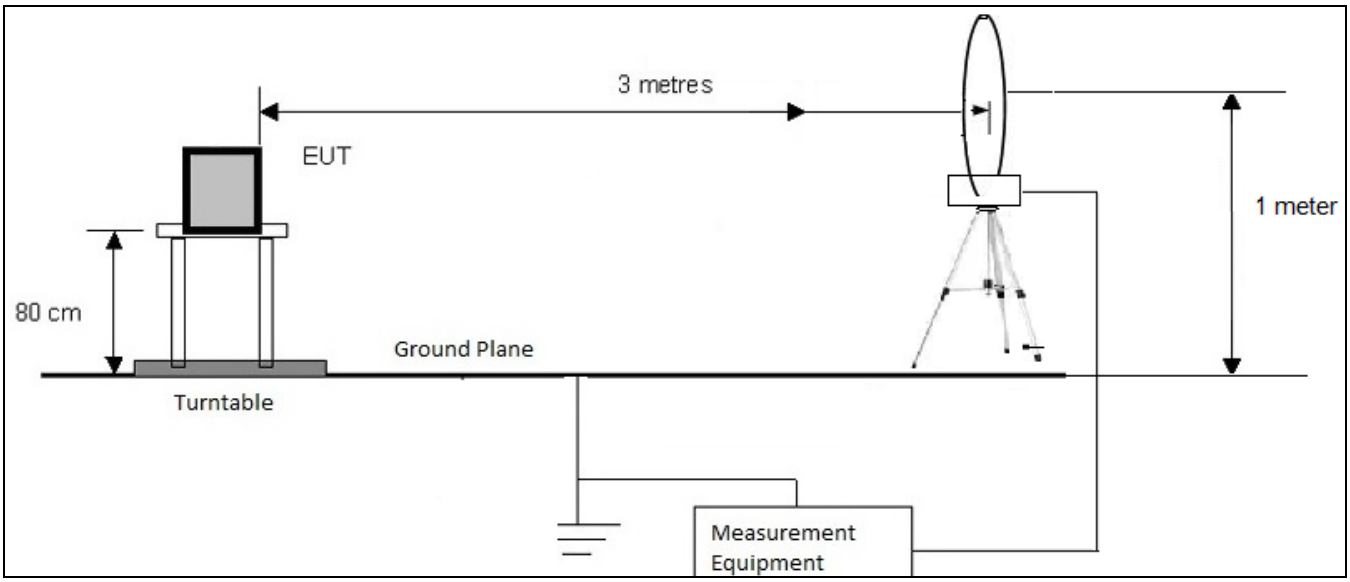
The EUT RFID radio was configured in transmitting mode via micro USB using the test software 1.1.4.99. The output was modulated as in normal operation.

The EUT met the requirements without modification.

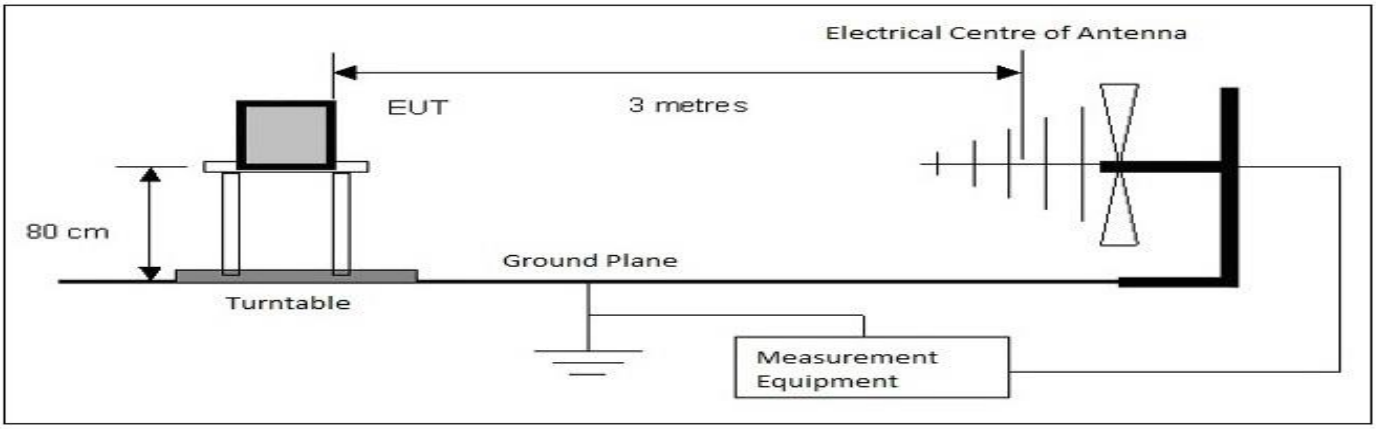
EUT configuration for Radiated Spurious Emissions testing:



Test setup for Radiated Spurious Emissions testing:



Below 30 MHz



Above 30 MHz.

2.2.5 Radiated Emissions Data:

The emissions data are presented in tabular form, showing turntable azimuth, antenna height and polarization, the uncorrected spectrum analyzer reading, the correction factors applied, the net result, the value of the limit at the frequency investigated, and the Delta between the result and the limit.

Meter Reading in dBμV + Antenna Factor in dB/m + Gain/Loss Factor in dB = Corrected Field Strength in dbμV/m.

Delta = Field Strength - Limit

Notes:

- When a preamp is used, the resulting gain is compensated, producing a negative value for the Cable Loss.
- Measurements reported are the result of adjusting the turntable azimuth and antenna height to obtain the maximum EUT emission. This may produce a different reading than the plot trace. The plot is a Peak Hold function obtained at discreet increments of height and azimuth, while the reported measurement is obtained with the appropriate Quasi Peak or Average detector after the height and azimuth have been adjusted for maximum emission.
- Scans were performed in Transmit mode at TX frequency = 13.56 MHz
- The EUT was assessed up to 1 GHz highest emission related to radio were maximized.

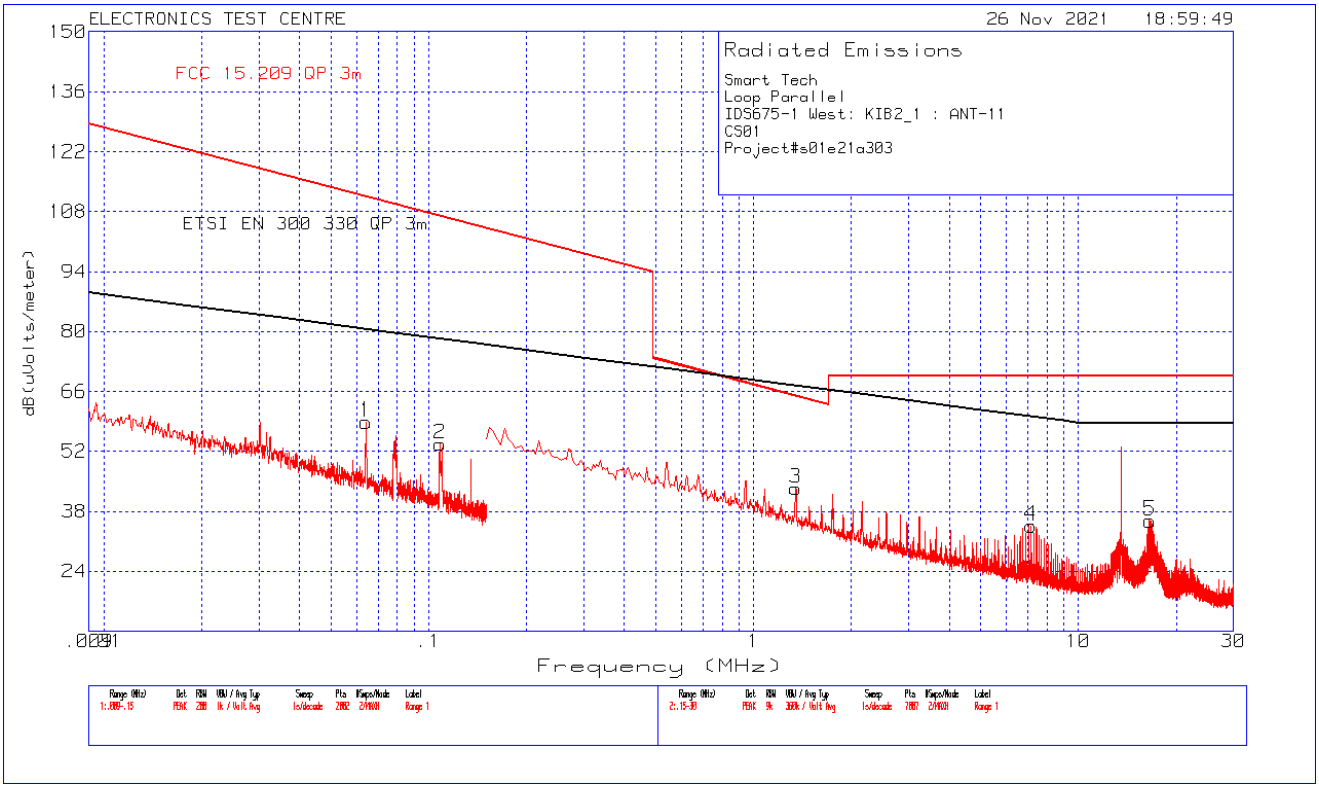
Field Strength of Spurious Emission test result

Marker#	Freq. (MHz)	Raw reading (dBμV)	Det	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Field Strength Reading (dBμV/m)	Strength 209 Limit (dBμV/m)	Margin [dB]	Azimuth (deg)	Height (cm)	Polarization
1	.06414	45.7	QP	11.2	.1	57.0	111.45	-54.45	99	100	Parallel
2	.10809	40.41	QP	10.5	.1	51.01	106.92	-55.91	113	100	Parallel
3	1.35084	32.0	QP	10.8	.2	43.0	64.98	-21.98	303	100	Parallel
4	7.15567	22.97	QP	10.8	.7	34.47	69.56	-35.09	79	100	Parallel
5	16.6063	23.04	QP	10.7	1	34.74	69.56	-34.82	0	100	Parallel
1	.07912	38.82	QP	10.8	.1	49.72	109.63	-59.91	181	100	Perpendicular
2	.10989	37.7	QP	10.5	.1	48.3	106.78	-58.48	162	100	Perpendicular
3	1.35204	29.54	QP	10.8	.2	40.54	64.97	-24.43	7	100	Perpendicular
4	7.15518	25.62	QP	10.8	.7	37.12	69.56	-32.44	357	100	Perpendicular
5	16.8744	29.29	QP	10.7	1	40.99	69.56	-28.57	40	100	Perpendicular
Above 30 MHz											
1	43.9309	44.38	QP	14.7	-24.7	34.38	40.01	-5.63	337	352	Horizontal
2	107.9996	47.03	QP	16.1	-23.8	39.33	43.53	-4.2	20	148	Horizontal
3	115.8445	48.28	QP	17.2	-23.7	41.78	43.53	-1.75	13	147	Horizontal
4	124.0911	45.42	QP	18	-23.6	39.82	43.53	-3.71	22	146	Horizontal
6	49.9104	46.22	QP	11.9	-24.6	33.52	40.01	-6.49	7	112	Vertical
7	108.0811	48.0	QP	16.2	-23.8	40.4	43.53	-3.13	360	244	Vertical
8	120.0043	46.47	QP	17.6	-23.6	40.47	43.53	-3.06	166	105	Vertical

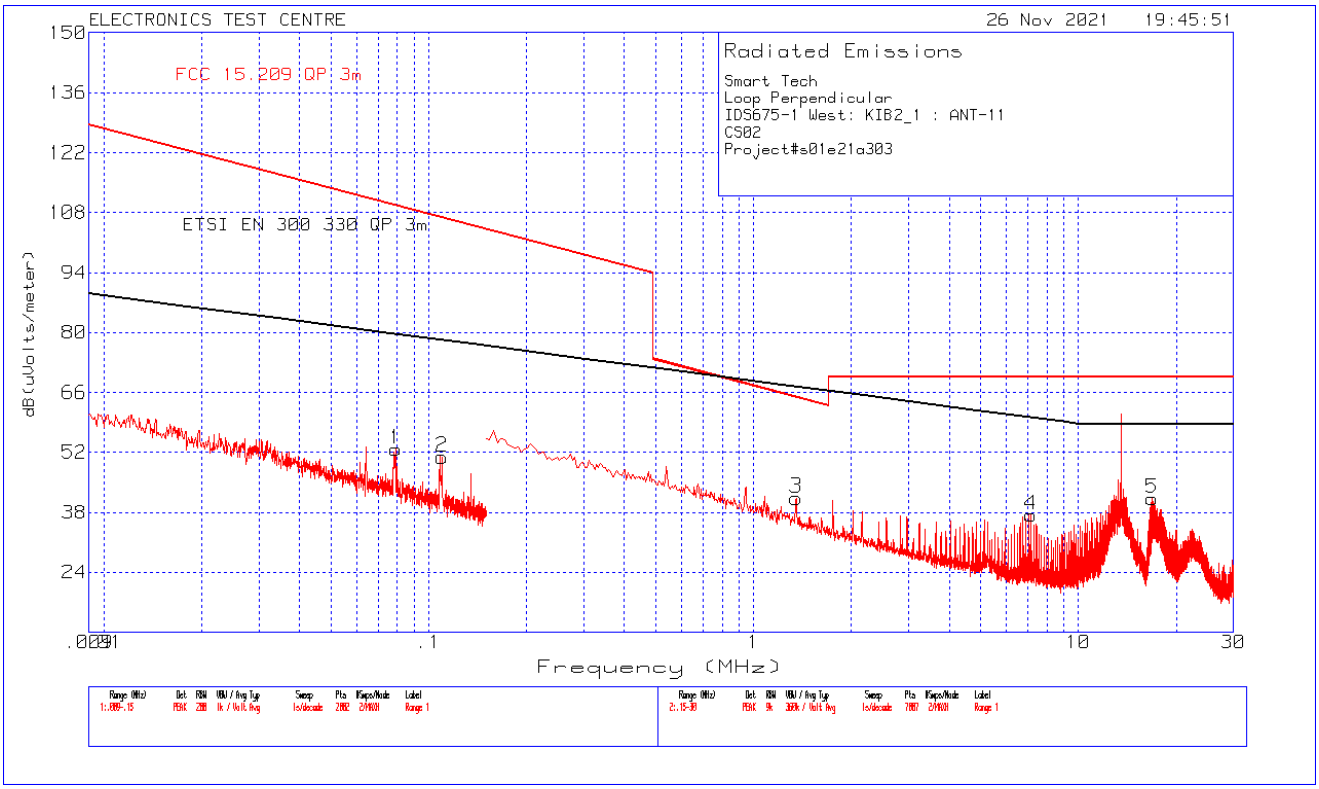
QP = Quasi-Peak Detector
Negative values for Delta indicate compliance.

Note: The peaks that are not maximized are from the digital circuitry which is reported separately under FCC Part 15 and ICES-003 unintentional radiator that is compliant to the Class A limit.

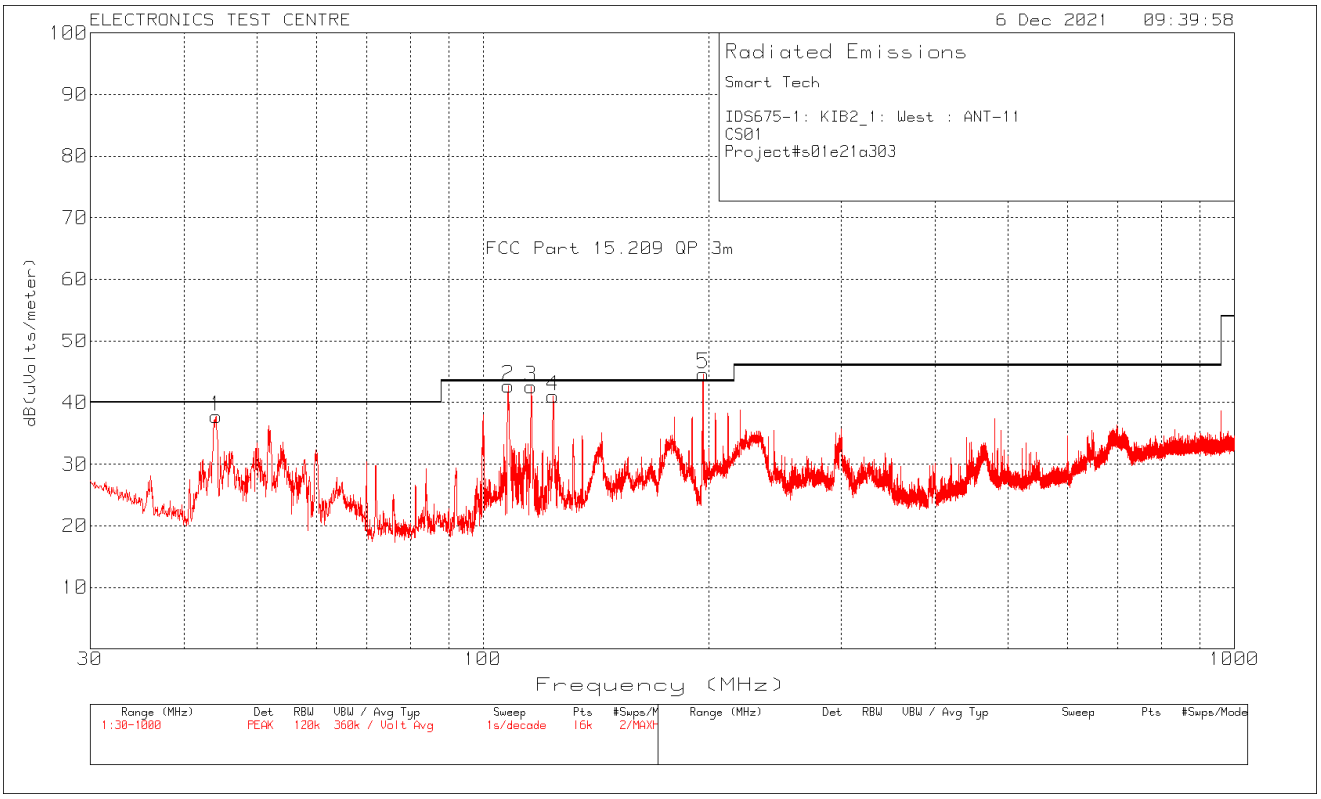
Plot of Radiated Emissions: Parallel



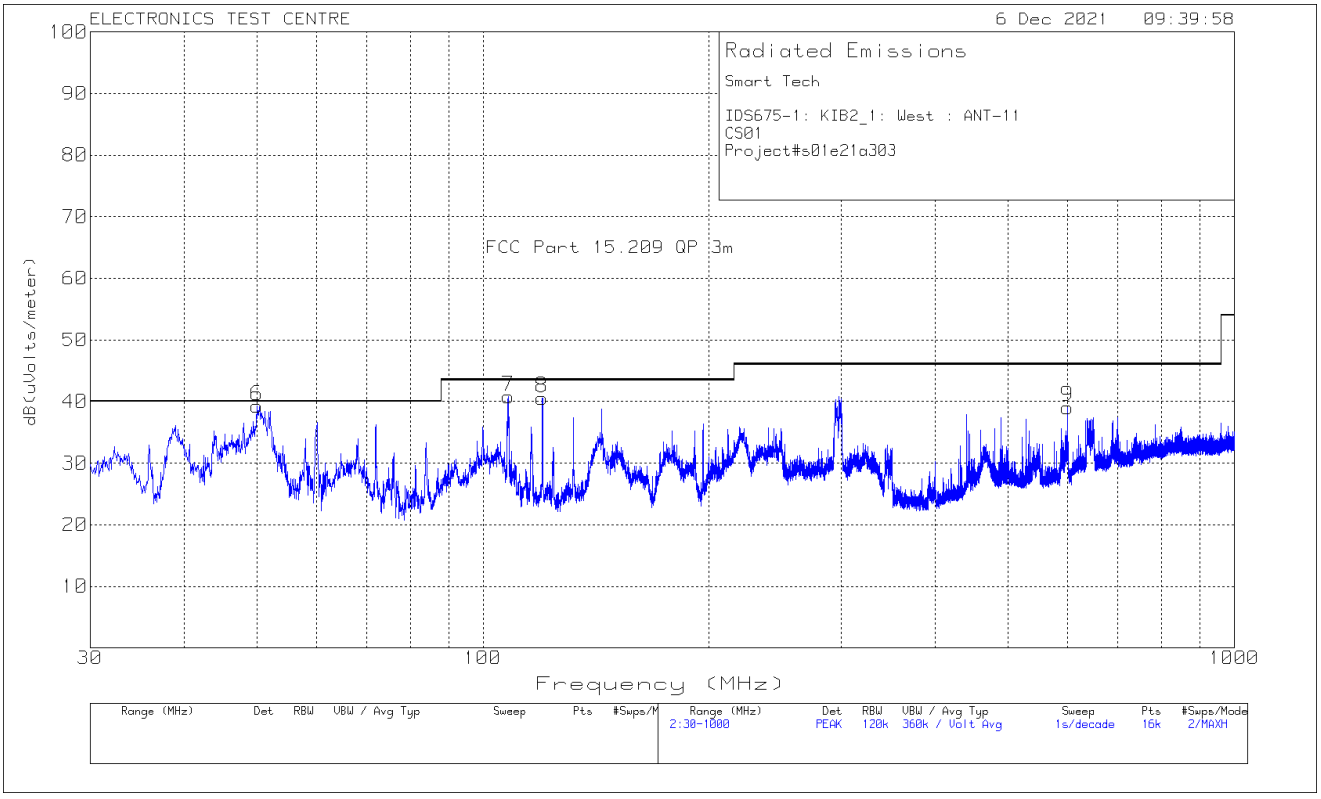
Plot of Radiated Emissions: Perpendicular



Plot of Radiated Emissions: Horizontal polarization (RFID TX)



Plot of Radiated Emissions: Vertical polarization (RFID TX)



2.3 Radiated Emissions ((Within the band)

Test Lab: Electronics Test Centre, Airdrie	**EUT: IDS675-1**
Test Personnel: Janet Mijares	**Standard: FCC Part 15.225**
Date: 2021-11-27(20.4°C,18.4 % RH)	**Basic Standard: ANSI C63.10-2013**

EUT status: Compliant

Specification: FCC Part 15.225 (a) – (c)

(a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter (84 dBµv/m) at 30 meters.

(b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter (50.5 dBµv/m) at 30 meters.

(c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter (40.51 dBµv/m) at 30 meters.

Clause	Frequency (MHz)	dBµv/m @ 3 meter
15.225(a)	13.553 – 13.567	124
15.225(a)	13.567 – 13.710	90.5
15.225(c)	13.710 – 14.010	80.51

Sample calculation

15,848 microvolts per meter at 30 m = 20*LOG10 (15848) dBuV/m at 30 m = 84.0 dBuV/m

Limit at 3m = Limit at 30m+40log (30/3)

124.0 dBuV/m = 84.0 dBuV/m +40 dB

2.3.1 Test Methodology: ANSI C63.10-2013, Clause 6.6.4

From 9 kHz to 150 kHz (resolution bandwidth of 200 Hz) and from 150 kHz to 30 MHz (resolution bandwidth 9 kHz) measurements are performed with a loop antenna.

The scan is performed at discreet increments of turntable azimuth and antenna height, which are selected in accordance with the applicable standard in order to assure capture of frequencies of interest. Optimization is performed based on the scan data.

Frequencies having peak emissions within 6 dB of the limits are optimized. The EUT is rotated in azimuth over 360 degrees and the direction of maximum emission is noted.

Antenna height is varied from 1 – 4 meters at this azimuth to obtain the maximum emission. Then the maximum level is measured with the appropriate detector and recorded. Up to 1 GHz, measurements are performed with a Quasi-Peak detector.

2.3.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

2.3.3 Test Equipment

Testing was performed with this equipment:

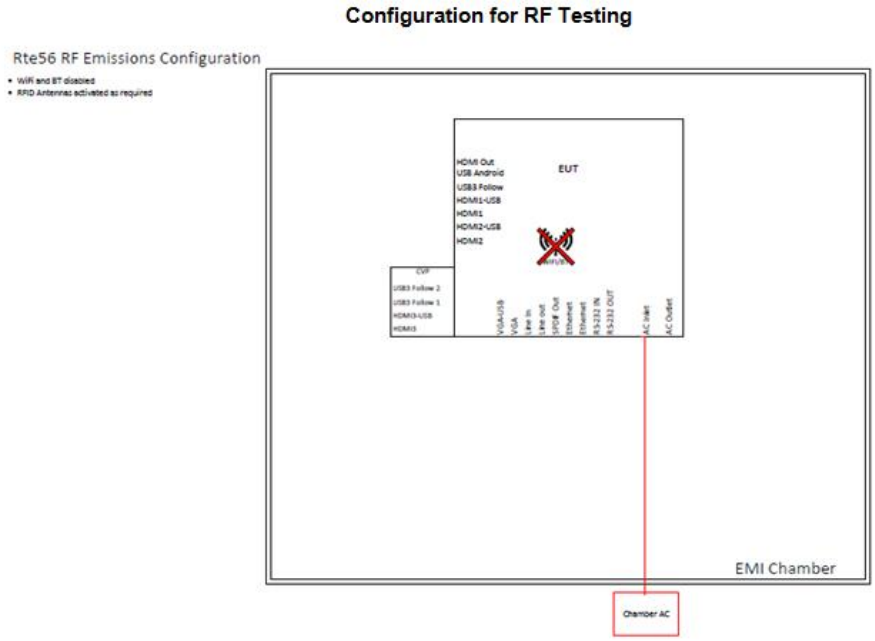
Equipment	Manufacturer	Model #	Asset #	Calibration Date (yyyy mm dd)	Calibration Due-Date (yyyy mm dd)
EMC Software	UL	Ver. 9.5	ETC-SW-EMC 2.1	N/A	N/A
EMI receiver	Keysight Technologies Inc.	N9038A (FW A.25.05)	6130	2021-06-18	2022-06-18
Loop Antenna	EMCO	6502	10868	2021-05-11	2023-05-11
Biconilog Antenna	SunAR RF Motion;	JB1	6905	2019-10-14	2021-10-14
T/H Logger	EXTECH Ins.	42270	5892	2021-04-06	2022-04-06
Emission Cable (30 – 1000 MHz)	IW	KPS-1501A-3600-KPS 01102006	4419	2021-03-03	2022-03-03
Emission Cable (1000 – 5000 MHz)	A.H. System Inc.	SAC-26G-8.23	6187	2021-03-03	2022-03-03
Pre- Amp	HP	8447D	9291	Monitored	

2.3.4 Test Sample Verification, Configuration & Modifications

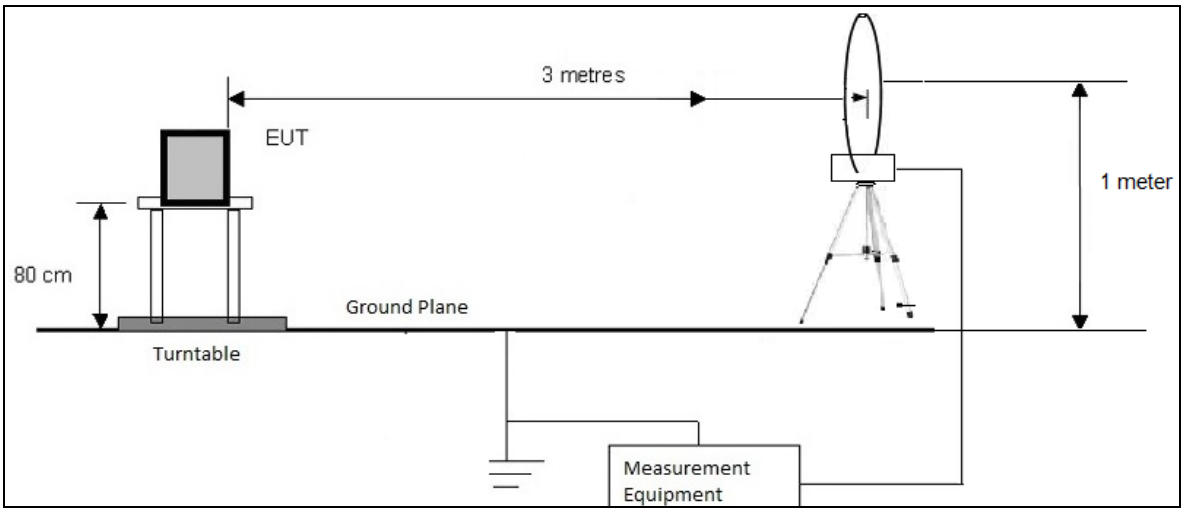
The EUT RFID radio was configured in transmitting mode via micro USB using the test software 1.1.4.99. The output was modulated as in normal operation.

The EUT met the requirements without modification.

EUT configuration for Radiated Spurious Emissions testing:



Test setup for Radiated Spurious Emissions testing:



2.3.5 Radiated Emissions Data:

The emissions data are presented in tabular form, showing turntable azimuth, antenna height and polarization, the uncorrected spectrum analyzer reading, the correction factors applied, the net result, the value of the limit at the frequency investigated, and the Delta between the result and the limit.

Meter Reading in dBμV + Antenna Factor in dB/m + Gain/Loss Factor in dB = Corrected Field Strength in dbμV/m.

Delta = Field Strength - Limit

Notes:

- When a preamp is used, the resulting gain is compensated, producing a negative value for the Cable Loss.
- Measurements reported are the result of adjusting the turntable azimuth and antenna height to obtain the maximum EUT emission. This may produce a different reading than the plot trace. The plot is a Peak Hold function obtained at discreet increments of height and azimuth, while the reported measurement is obtained with the appropriate Quasi Peak or Average detector after the height and azimuth have been adjusted for maximum emission.
- Preliminary scans were performed in Transmit mode.
- The EUT was assessed up to 1 GHz.

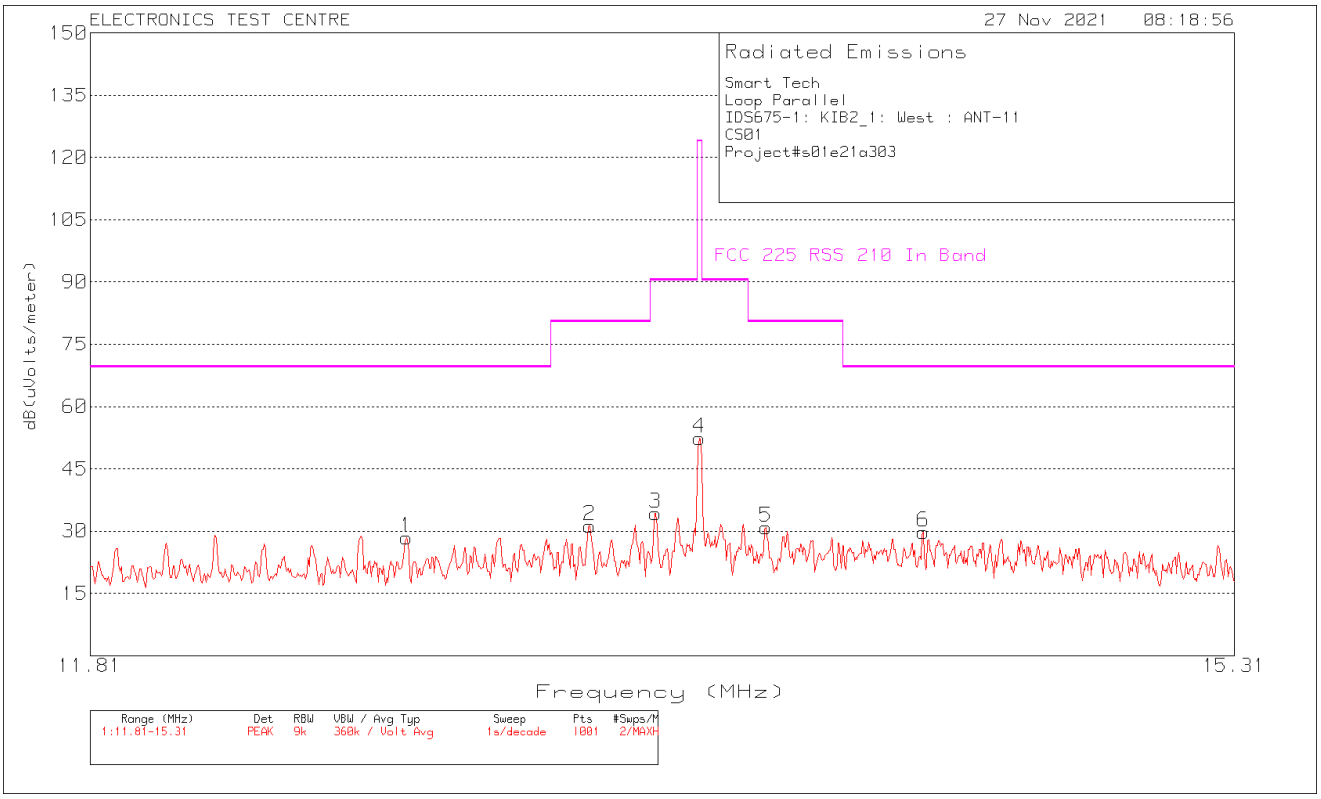
Field Strength of Spurious Emission test result

Marker#	Freq. (MHz)	Raw reading (dBμV)	Det	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Field Strength Reading (dBμV/m)	Strength 225 Limit (dBμV/m)	Margin [dB]	Azimuth (deg)	Height (cm)	Polarization
1	12.7495	12.44	QP	10.9	.9	24.24	69.56	-45.32	176	100	Parallel
2	13.2247	17.75	QP	10.9	.9	29.55	80.51	-50.96	148	100	Parallel
3	13.4269	22.03	QP	10.9	.9	33.83	90.51	-56.68	177	100	Parallel
4	13.5611	40.61	QP	10.9	.9	52.41	124	-71.59	280	100	Parallel
5	13.7677	16.14	QP	10.9	.9	27.94	80.51	-52.57	152	100	Parallel
6	14.2563	14.48	QP	10.9	.9	26.38	69.56	-43.18	187	100	Parallel
1	12.9589	27.32	QP	10.9	.9	39.12	69.56	-30.44	317	100	Perpendicular
2	13.2903	26.62	QP	10.9	.9	38.42	80.54	-42.12	172	100	Perpendicular
3	13.4264	31.96	QP	10.9	.9	43.76	90.54	-46.78	265	100	Perpendicular
4	13.5616	46.24	QP	10.9	.9	58.04	124	-65.96	228	100	Perpendicular
4	13.5616	47.88	PK	10.9	.9	59.68	124	-64.32	228	100	Perpendicular
5	13.6964	28.22	QP	10.9	.9	40.02	90.54	-50.52	235	100	Perpendicular
6	13.8312	24.87	QP	10.9	.9	36.67	80.54	-43.87	261	100	Perpendicular
7	14.0395	28.35	QP	10.9	1	40.25	69.56	-29.31	294	100	Perpendicular

QP = Quasi-Peak Detector
Negative values for Delta indicate compliance.

Note: The peaks that are not maximized are from the digital circuitry which is reported separately under FCC Part 15 and ICES-003 unintentional radiator that is compliant to the Class A limit.

Plot of Radiated Emissions: Parallel



Plot of Radiated Emissions: Perpendicular

2.4 Occupied Bandwidth: 20 dB Bandwidth

Test Lab: Electronics Test Centre, Airdrie	**EUT: IDS675-1**
Test Personnel: Janet Mijares	**Standard: FCC Part 15.215**
Date: 2021-12-01(22.0°C, 19.4% RH)	**Basic Standard: ANSI C63.10-2013**

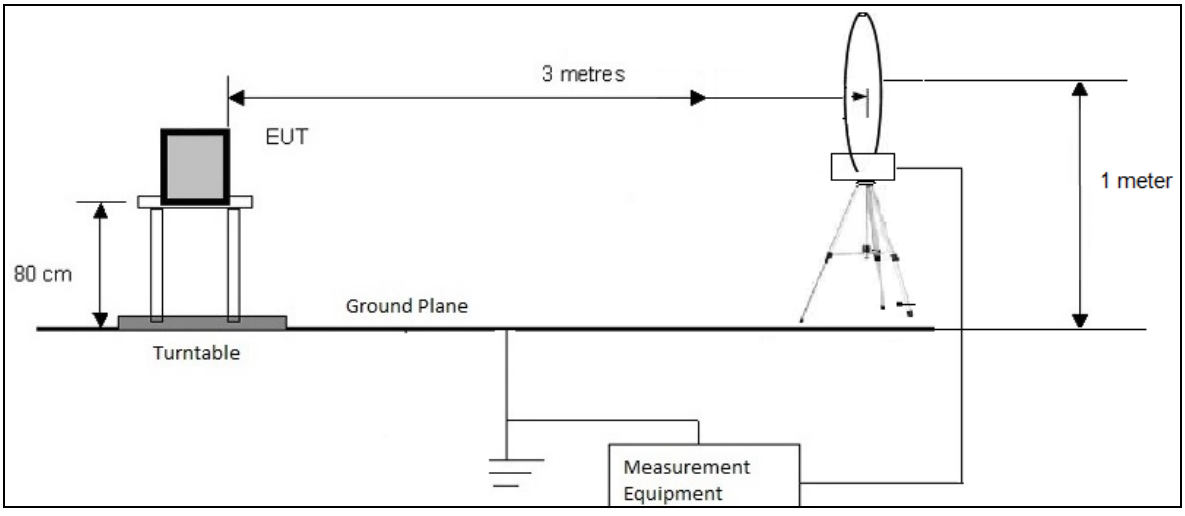
EUT status: Compliant

Specification: § 15.215 Additional provisions to the general radiated emission limitations.

(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 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.

2.4.1 Test Guidance: ANSI C63.10-2013, Clause 6.9.2, 6.9.3 & 7.8.7

The EUT RFID radio was configured in transmitting mode via micro USB using the test software 1.1.4.99. The output was modulated as in normal operation.

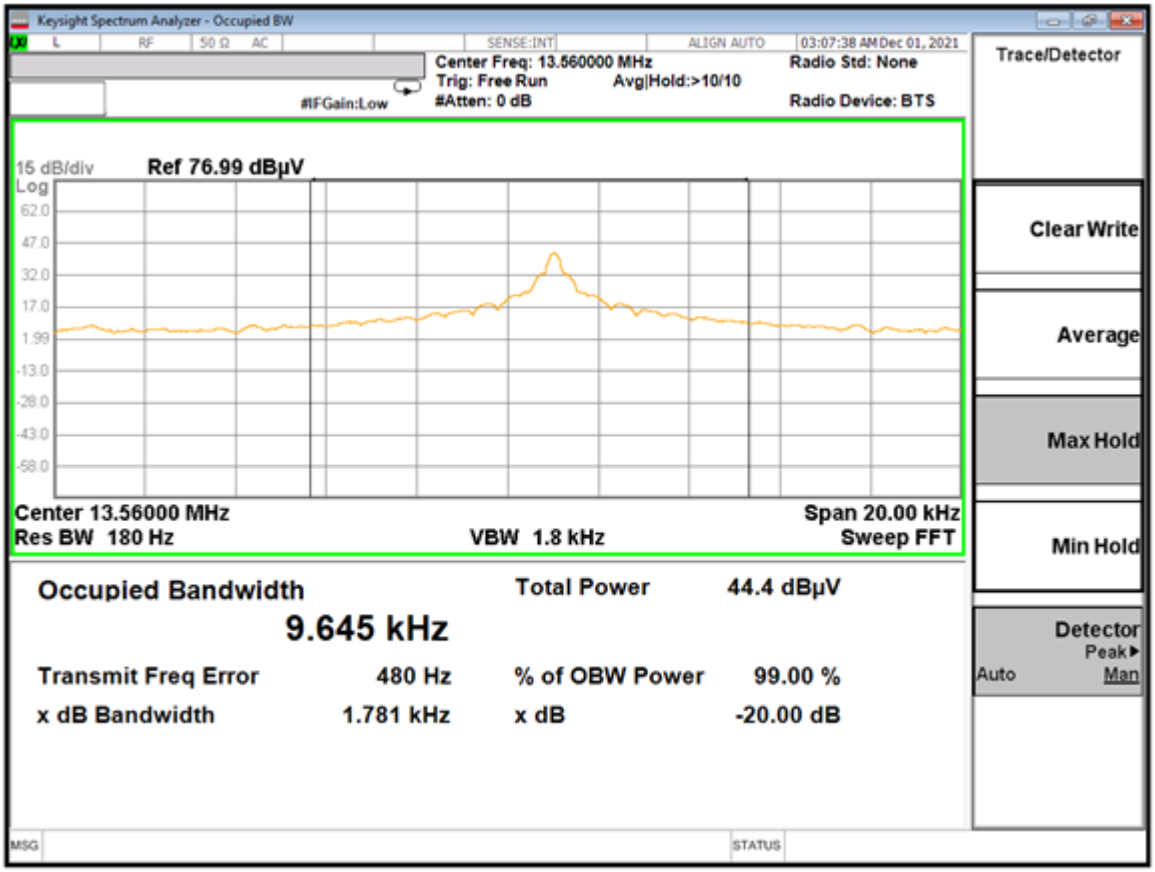


Use the following spectrum analyzer settings	
Span	Between two times and five times the channel center frequency OBW
RBW	1% to 5% of the OBW
VBW	Approximately three times RBW
Sweep	Auto
Detector function	Peak
Trace	Max hold
Allow the trace to stabilize. The automated 99% BW function of the spectrum analyzer is engaged, 20 dB OBW is measured with the x dB function.	

2.4.2 Test Equipment

Testing was performed with this equipment:

Equipment	Manufacturer	Model #	Asset #	Calibration Date (yyyy mm dd)	Calibration Due-Date (yyyy mm dd)
EMC Software	UL	Ver. 9.5	ETC-SW-EMC 2.1	N/A	N/A
EMI receiver	Keysight Technologies Inc.	N9038A (FW A.25.05)	6130	2021-06-18	2022-06-18
Loop Antenna	EMCO	6502	10868	2021-05-11	2023-05-11
Biconilog Antenna	SunAR RF Motion;	JB1	6905	2019-10-14	2021-10-14
T/H Logger	EXTECH Ins.	42270	5892	2021-04-06	2022-04-06
Emission Cable (30 – 1000 MHz)	IW	KPS-1501A-3600-KPS 01102006	4419	2021-03-03	2022-03-03
Emission Cable (1000 – 5000 MHz)	A.H. System Inc.	SAC-26G-8.23	6187	2021-03-03	2022-03-03
Pre- Amp	HP	8447D	9291	Monitored	


Keysight Spectrum Analyzer - Occupied BW
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
03:07:38 AM Dec 01, 2021
Center Freq: 13.560000 MHz
Trig: Free Run
Avg|Hold:>10/10
#IFGain:Low
#Atten: 0 dB
Radio Std: None
Radio Device: BTS
Trace/Detector
15 dB/div
Ref 76.99 dBµV
Log
62.0
47.0
32.0
17.0
1.99
-13.0
-28.0
-43.0
-58.0
Center 13.56000 MHz
Res BW 180 Hz
VBW 1.8 kHz
Span 20.00 kHz
Sweep FFT
Occupied Bandwidth
9.645 kHz
Total Power 44.4 dBµV
Transmit Freq Error 480 Hz
% of OBW Power 99.00 %
x dB Bandwidth 1.781 kHz
x dB -20.00 dB
Clear Write
Average
Max Hold
Min Hold
Detector
Peak
Auto
Man
MSG
STATUS

2.5 Carrier Frequency Stability

Test Lab: Electronics Test Centre, Airdrie	**EUT: IDS675-1**
Test Personnel: Janet Mijares /I. Akram	**Standard: FCC Part 15.215**
Date:2021-12-01 (22.0°C, 19.4% RH)	**Basic Standard: ANSI C63.10-2013**

EUT status: Compliant

Specification: § 15.225 (e)

(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.

2.5.1 Test Guidance: ANSI C63.10-2013, Clause 6.8

The EUT RFID radio was configured in transmitting mode via micro USB using the test software 1.1.4.99. The output was modulated as in normal operation.

Use the following spectrum analyzer settings	
Span	10KHz
RBW	1KHz
VBW	3KHz
Sweep	Auto
Detector function	Peak
The span, RBW, and VBW on the spectrum analyzer were adjusted to ensure significant accuracy when measuring the center frequency.	

2.5.2 Test Equipment

Testing was performed with this equipment:

Equipment	Manufacturer	Model #	Asset #	Calibration Date (yyyy mm dd)	Calibration Due-Date (yyyy mm dd)
Spectrum Analyzer	Keysight Technologies Inc.	8566B	9168	2020-12-17	2021-12-17
Loop Antenna	Electro-Metrics	ALP-70	3703	2018-12-18	2021-12-18
T/H Logger	EXTECH Ins.	42270	5892	2021-04-06	2022-04-06
Temperature/humidity chamber	Thermotron	WP-2000-TCHM4-25-25	5885	2021-01-05	2022-01-05
Power Supply	California Insts Corp.	5001IX	4378	2021-11-17	2023-11-17

Power Supply (rated voltage)	Recording time @ Constant temperature	Temperature (℃)	Measured Frequency (MHz)	Frequency Error (%)	15.225 (e) Limit
Carrier Frequency = 13.56 MHz					
120 VAC / 60Hz	startup	50	13.56103	0.00759587	± 0.01%
	2 minutes		13.56111	0.008185841	
	5 minutes		13.56108	0.007964602	
	10 minutes		13.56101	0.007448378	
	startup	40	13.56103	0.00759587	± 0.01%
	2 minutes		13.56098	0.007227139	
	5 minutes		13.56105	0.007743363	
	10 minutes		13.56103	0.00759587	
	startup	30	13.56101	0.007448378	± 0.01%
	2 minutes		13.56108	0.007964602	
	5 minutes		13.56103	0.00759587	
	10 minutes		13.56105	0.007743363	
	startup	20	13.56108	0.007964602	± 0.01%
	2 minutes		13.56108	0.007964602	
	5 minutes		13.56112	0.008259587	
	10 minutes		13.56107	0.007890855	
	startup	10	13.56118	0.008702065	± 0.01%
	2 minutes		13.56117	0.008628319	
	5 minutes		13.56105	0.007743363	
	10 minutes		13.56114	0.00840708	
	startup	0	13.56112	0.008259587	± 0.01%
	2 minutes		13.56119	0.008775811	
	5 minutes		13.56109	0.008038348	
	10 minutes		13.56114	0.00840708	
	startup	-10	13.56121	0.008923304	± 0.01%
	2 minutes		13.56108	0.007964602	
	5 minutes		13.56116	0.008554572	
	10 minutes		13.56109	0.008038348	
	startup	-20	13.56118	0.008702065	± 0.01%
	2 minutes		13.5612	0.008849558	
	5 minutes		13.56114	0.00840708	
	10 minutes		13.56107	0.007890855	
Variation in the primary voltage from 85% to 115 % of the rated supply voltage					
102 VAC (85%)	startup	20	13.56107	0.007890855	± 0.01%
	2 minutes		13.5611	0.008112094	
	5 minutes		13.5611	0.008112094	
	10 minutes		13.56109	0.008038348	
138 VAC (115%)	startup	20	13.56107	0.007890855	± 0.01%
	2 minutes		13.5612	0.008849558	
	5 minutes		13.56101	0.007448378	
	10 minutes		13.56108	0.007964602	

3.0 TEST FACILITY

3.1 Location

The IDS675-1 was tested at the Electronics Test Centre laboratory located in Airdrie, Alberta, Canada. The Radio Frequency Anechoic Chamber (RFAC), identified as Chamber 1, has a usable working space measuring 10.6 m long x 7.3 m wide x 6.5 m high.

Measurements taken at this site are accepted by Industry Canada as evidence of conformity per registration file # 2046A. This site is also listed with the FCC under Designation Number CA2046.

The floor, walls and ceiling consist of annealed steel panels. The walls and ceiling are covered with ferrite tile, augmented by RF absorbant foam material on the end wall nearest the turntable, and on the adjacent walls and the ceiling. The chamber floor supports a 15 cm high internal floor, constructed of annealed steel panels, that forms the ground plane, and is bonded to the chamber walls.

The 3-m diameter turntable is flush-mounted with the floor. A sub-floor cable-way is provided to route cables between the turntable pit and EUT support equipment located in the Control Room. Cables reach the EUT through an opening in the centre of the turntable.

Test instrumentation and EUT support equipment is located in the Control Room, consisting of two shielded vestibules joined together at the side of the main room. Cables are routed through bulkhead panels between the rooms and the test chamber as required. Power feeds are routed into the main room and vestibules through line filters providing at least 100 dB of attenuation between 10 kHz and 10 GHz.

Either floor mounted or table-top equipment can be tested at this facility.

3.2 Grounding Plan

The Panel was placed at the centre of the test chamber turntable mounted 80cm off the ground plane. There was no external ground strap connected to the EUT enclosure.

3.3 Power Supply

All EUT power was supplied by AC power Supply.

3.4 Emissions Profile

Ambient emission profiles were generated throughout the tests and are included in the test data.

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