

FIELD STRENGTH OF SPURIOUS EMISSIONS (GREATER THAN 30 MHZ) - UNITY CS - PNEUMATIC RFID MODULE



TEST DESCRIPTION

The antennas to be used with the EUT were tested. The EUT was transmitting while set at the operating channel.

For each configuration, the spectrum was scanned throughout the specified range as part of the exploratory investigation of the emissions. These “pre-scans” are not included in the report. Final measurements on individual emissions were then made and included in this test report.

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis, and adjusting the measurement antenna height and polarization (per ANSI C63.10). A preamp and high pass filter (and notch filter) were used for this test in order to provide sufficient measurement sensitivity.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

- QP = Quasi-Peak Detector
- PK = Peak Detector
- AV = RMS Detector

Measurements were made to satisfy the specific requirements of the test specification for out of band emissions as well as the restricted band requirements.

If there are no detectable emissions above the noise floor, the data included may show noise floor measurements for reference only.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Antenna - Biconilog	EMCO	3142	AXB	2022-05-04	2024-05-04
Cable	ESM Cable Corp.	30-1GHz Cables	OCW	2023-01-23	2024-01-23
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	PAD	2023-01-23	2024-01-23
Filter - Low Pass	Micro-Tronics	LPM50004	HGK	2023-01-09	2024-01-09
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAV	2022-12-06	2023-12-06

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	4.7 dB	-4.7 dB

FREQUENCY RANGE INVESTIGATED

30 MHz TO 1000 MHz

POWER INVESTIGATED

120VAC/60Hz

CONFIGURATIONS INVESTIGATED

ALCO0426-2

MODES INVESTIGATED

Transmitting RFID 13.56 MHz. Pneumatic RFID Module, 1x port populated with probe and transmitting.

FIELD STRENGTH OF SPURIOUS EMISSIONS (GREATER THAN 30 MHz) - UNITY CS - PNEUMATIC RFID MODULE



EUT:	Unity CS	Work Order:	ALCO0426
Serial Number:	2301010901X	Date:	2023-11-10
Customer:	Alcon Research LLC	Temperature:	19.5°C
Attendees:	Hakan Gokdogan	Relative Humidity:	33%
Customer Project:	None	Bar. Pressure (PMSL):	1018 mb
Tested By:	Nolan De Ramos	Job Site:	OC07
Power:	120VAC/60Hz	Configuration:	ALCO0426-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.225:2023	ANSI C63.10:2013

TEST PARAMETERS

Run #:	19	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)
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COMMENTS

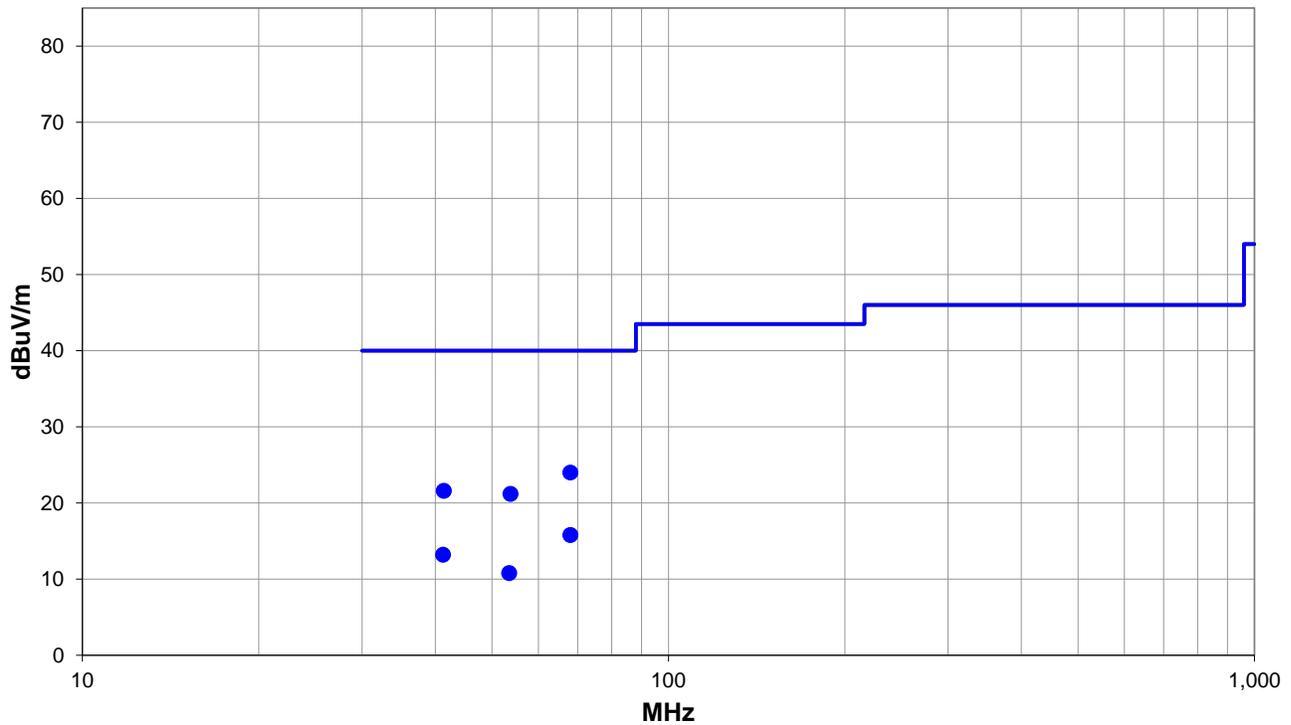
Unity CS only has 1x available port on the Pneumatic RFID Module

EUT OPERATING MODES

Transmitting RFID 13.56 MHz. Pneumatic RFID Module, 1x port populated with probe and transmitting.

DEVIATIONS FROM TEST STANDARD

None



Run #: 19

PK AV QP

FIELD STRENGTH OF SPURIOUS EMISSIONS (GREATER THAN 30 MHZ) - UNITY CS - PNEUMATIC RFID MODULE



RESULTS - Run #19

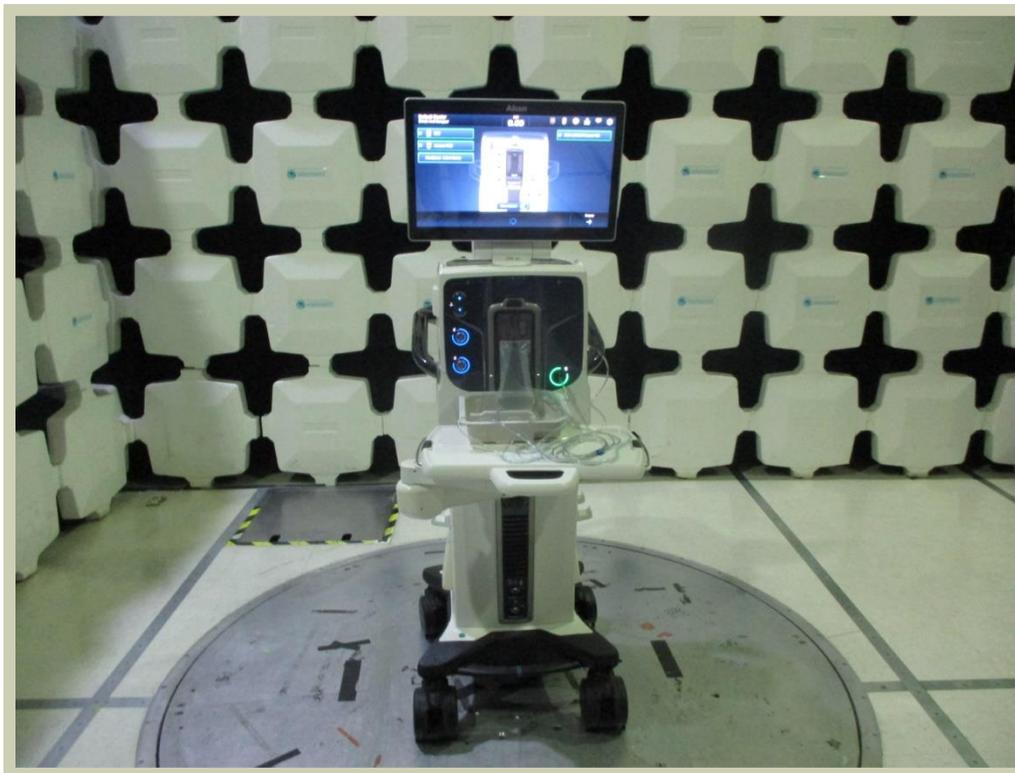
Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)
68.018	34.7	-10.7	1.36	163.0	3.0	0.0	Vert	QP	0.0	24.0	40.0	-16.0
41.362	26.8	-5.2	1.0	178.0	3.0	0.0	Vert	QP	0.0	21.6	40.0	-18.4
53.749	30.6	-9.4	1.47	135.0	3.0	0.0	Vert	QP	0.0	21.2	40.0	-18.8
68.011	26.5	-10.7	1.0	82.0	3.0	0.0	Horz	QP	0.0	15.8	40.0	-24.2
41.241	18.3	-5.1	3.23	264.0	3.0	0.0	Horz	QP	0.0	13.2	40.0	-26.8
53.484	20.1	-9.3	1.0	109.0	3.0	0.0	Horz	QP	0.0	10.8	40.0	-29.2

CONCLUSION

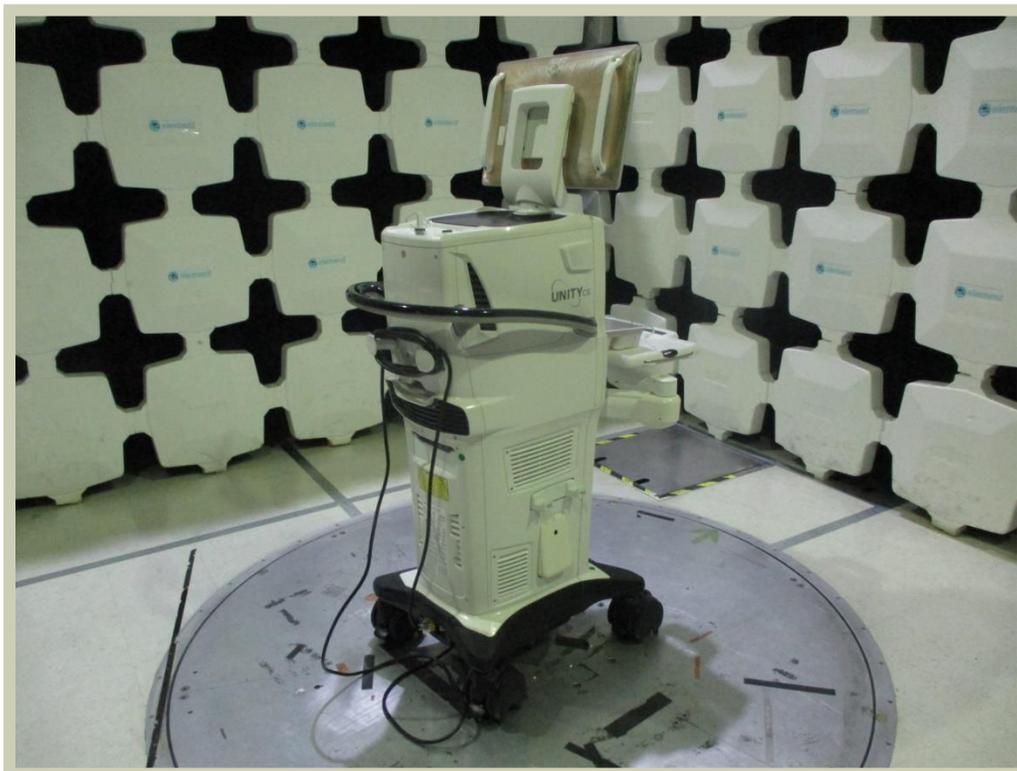
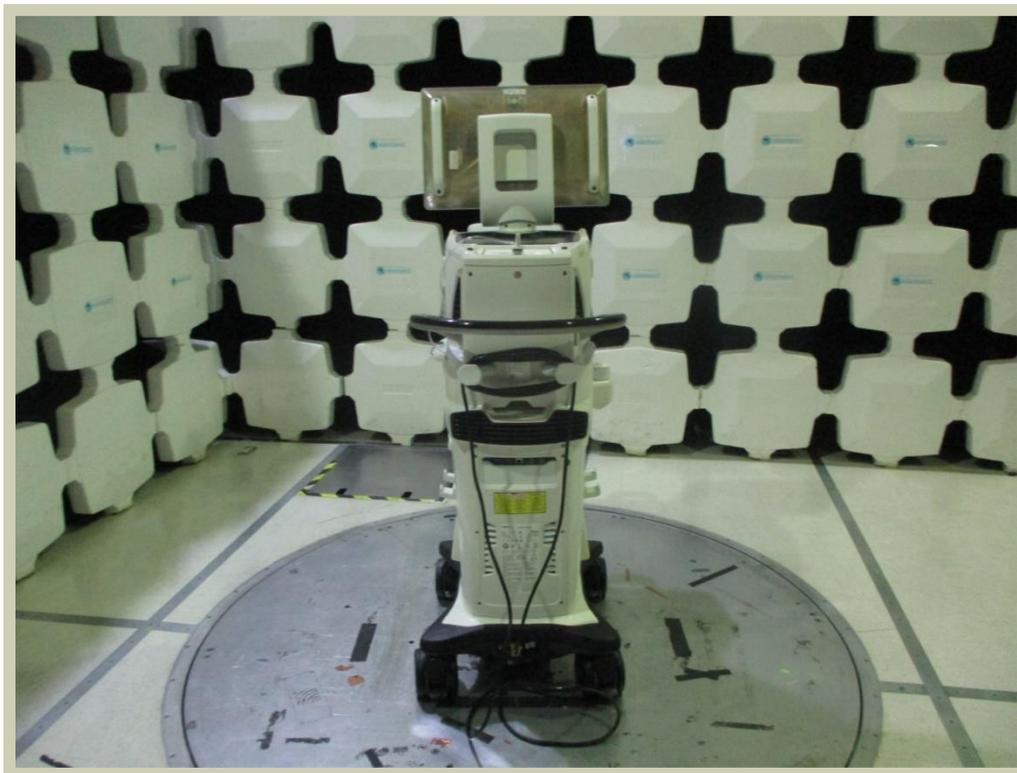
Pass

Tested By

FIELD STRENGTH OF SPURIOUS EMISSIONS (GREATER THAN 30 MHZ) - UNITY CS - PNEUMATIC RFID MODULE



FIELD STRENGTH OF SPURIOUS EMISSIONS (GREATER THAN 30 MHZ) - UNITY CS - PNEUMATIC RFID MODULE



FREQUENCY STABILITY



TEST DESCRIPTION

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

The spectrum analyzer is equipped with a precision frequency reference that exceeds the stability requirement of the EUT.

Measurements were made on the single transmit frequency as called out on the data sheets. Testing was done while the EUT was continuously polling.

The primary supply voltage was varied from 85 % to 115% of the nominal voltage while at ambient temperature. Using a temperature chamber, the transmit frequency was recorded at the extremes of the specified temperature range of -20 ° to +50° C and at 10°C intervals.

The requirement of a frequency tolerance of ±0.01% is equivalent to 100 ppm
The formula to check for compliance is:

$$\text{ppm} = (\text{Measured Frequency} / \text{Measured Nominal Frequency} - 1) * 1,000,000$$

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFA	2022-10-21	2023-10-21
Block - DC	Aeroflex	INMET 8535	AMO	2023-01-30	2024-01-30
Attenuator	Fairview Microwave	SA18H-20	UAZ	2023-03-22	2024-03-22
Cable	Element	None	OC5	2023-01-30	2024-01-30
Chamber - Temperature/Humidity	Cincinnati Sub Zero (CSZ)	ZPHS-32-3.5-SCT/AC	TBE	NCR	NCR
Meter - Temperature/Humidity	Omega Engineering, Inc.	HH414	DVB	2023-03-16	2024-03-16
Meter - Multimeter	Fluke	107	MBF	2023-04-13	2024-04-13
Probe - Near Field Set	EMCO	7405	IPI	NCR	NCR

FREQUENCY STABILITY



EUT:	Unity VCS	Work Order:	ALCO0421
Serial Number:	2301157201X	Date:	2023-09-19
Customer:	Alcon Research LLC	Temperature:	25.6°C
Attendees:	Hakan Gokdogan, Nathan Gass	Relative Humidity:	47.2%
Customer Project:	None	Bar. Pressure (PMSL):	1014 mbar
Tested By:	Nolan De Ramos	Job Site:	OC13
Power:	120VAC/60Hz	Configuration:	ALCO0421-3

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.225:2023	ANSI C63.10:2013

COMMENTS

Transmitting RFID 13.56 MHz. Illuminator RFID Module. Middle port populated and transmitting. All RFID radios included in the UNITY VCS and UNITY CS are identical. This data is representative of all other RFID radios in the system.

DEVIATIONS FROM TEST STANDARD

None

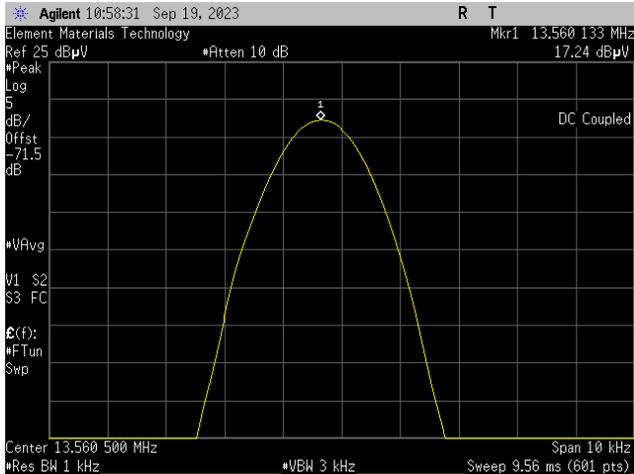
TESTED BY

Nolan De Ramos

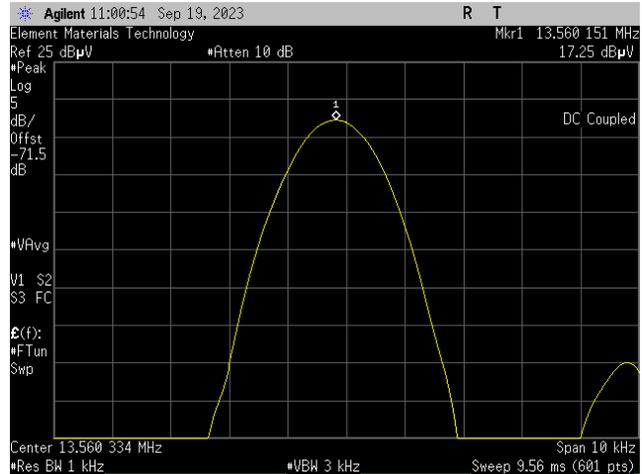
TEST RESULTS

	Measured Value (MHz)	Nominal Value (MHz)	Error (ppm)	Limit (ppm)	Results
13.56 MHz RFID, ISO/IEC 15693					
Normal Conditions	13.560133	13.560133	0.00	100	Pass
Extreme Voltage 115%	13.560151	13.560133	1.33	100	Pass
Extreme Voltage 85%	13.560150	13.560133	1.25	100	Pass
Extreme Temperature +50°C	13.560067	13.560133	4.87	100	Pass
Extreme Temperature +40°C	13.560101	13.560133	2.36	100	Pass
Extreme Temperature +30°C	13.560150	13.560133	1.25	100	Pass
Extreme Temperature +20°C	13.560216	13.560133	6.12	100	Pass
Extreme Temperature +10°C	13.560267	13.560133	9.88	100	Pass
Extreme Temperature +0°C	13.560317	13.560133	13.57	100	Pass
Extreme Temperature -10°C	13.560350	13.560133	16.00	100	Pass
Extreme Temperature -20°C	13.560350	13.560133	16.00	100	Pass

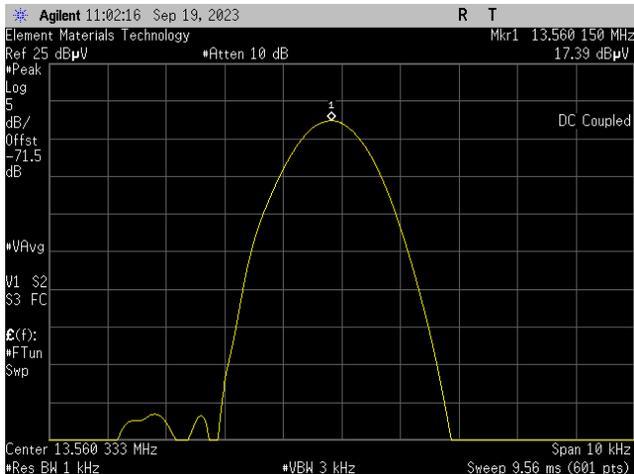
FREQUENCY STABILITY



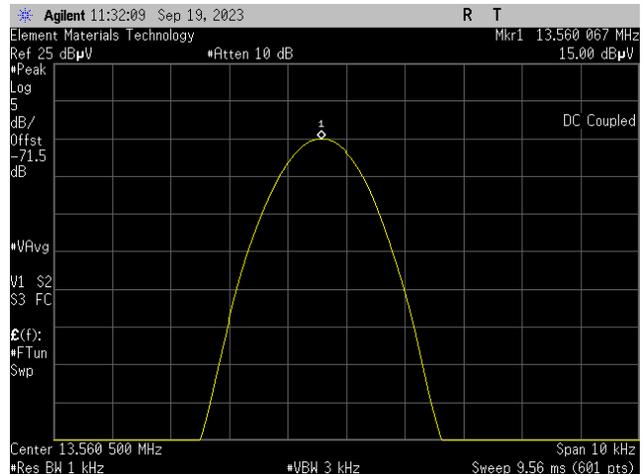
13.56 MHz RFID, ISO/IEC 15693 | Normal Conditions



13.56 MHz RFID, ISO/IEC 15693 | Extreme Voltage 115%

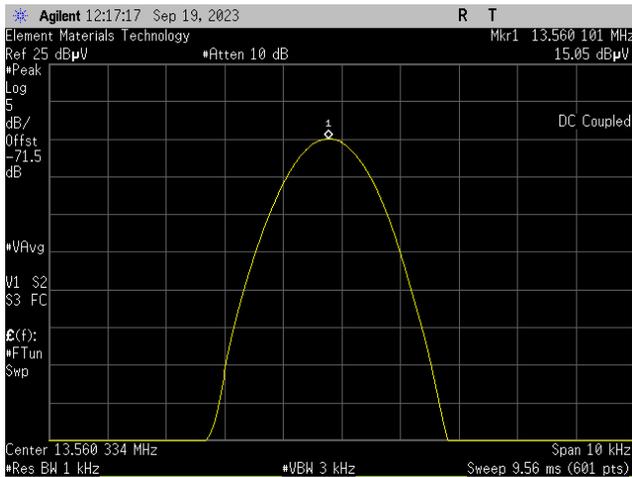


13.56 MHz RFID, ISO/IEC 15693 | Extreme Voltage 85%

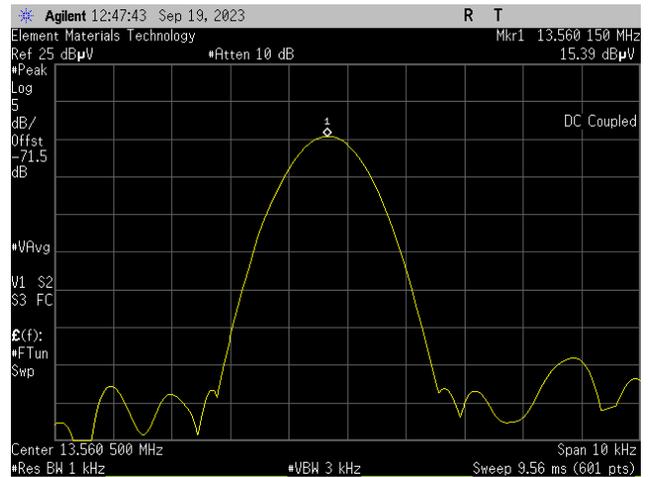


13.56 MHz RFID, ISO/IEC 15693 | Extreme Temperature +50°C

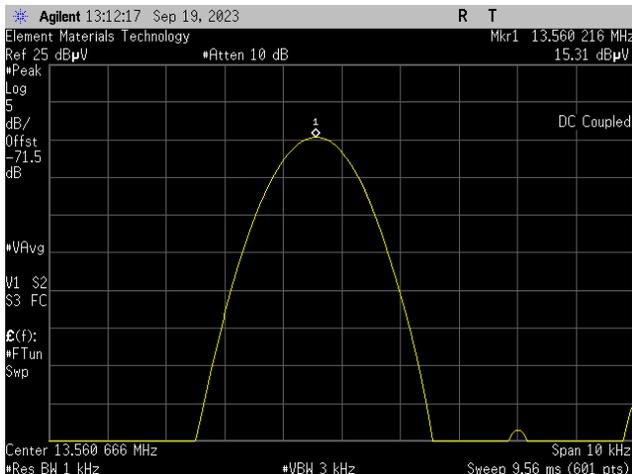
FREQUENCY STABILITY



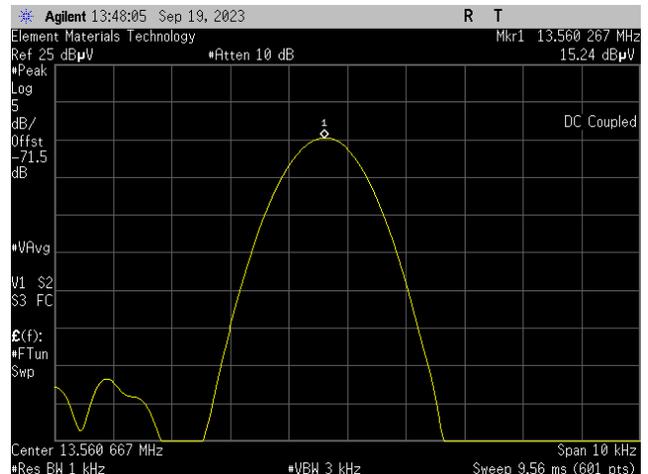
13.56 MHz RFID, ISO/IEC 15693 | Extreme Temperature +40°C



13.56 MHz RFID, ISO/IEC 15693 | Extreme Temperature +30°C

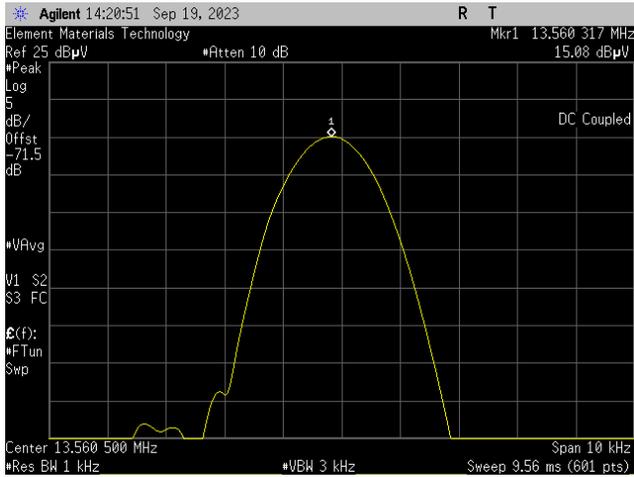


13.56 MHz RFID, ISO/IEC 15693 | Extreme Temperature +20°C

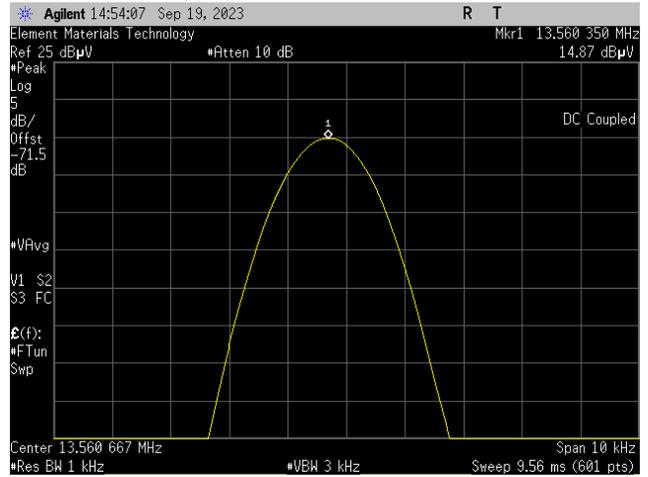


13.56 MHz RFID, ISO/IEC 15693 | Extreme Temperature +10°C

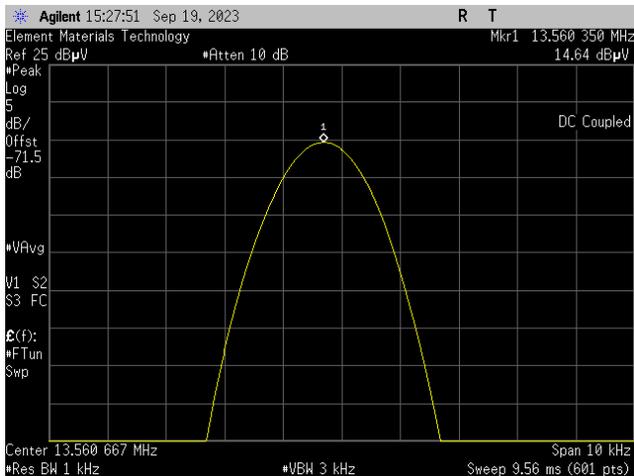
FREQUENCY STABILITY



13.56 MHz RFID, ISO/IEC 15693 | Extreme Temperature +0°C

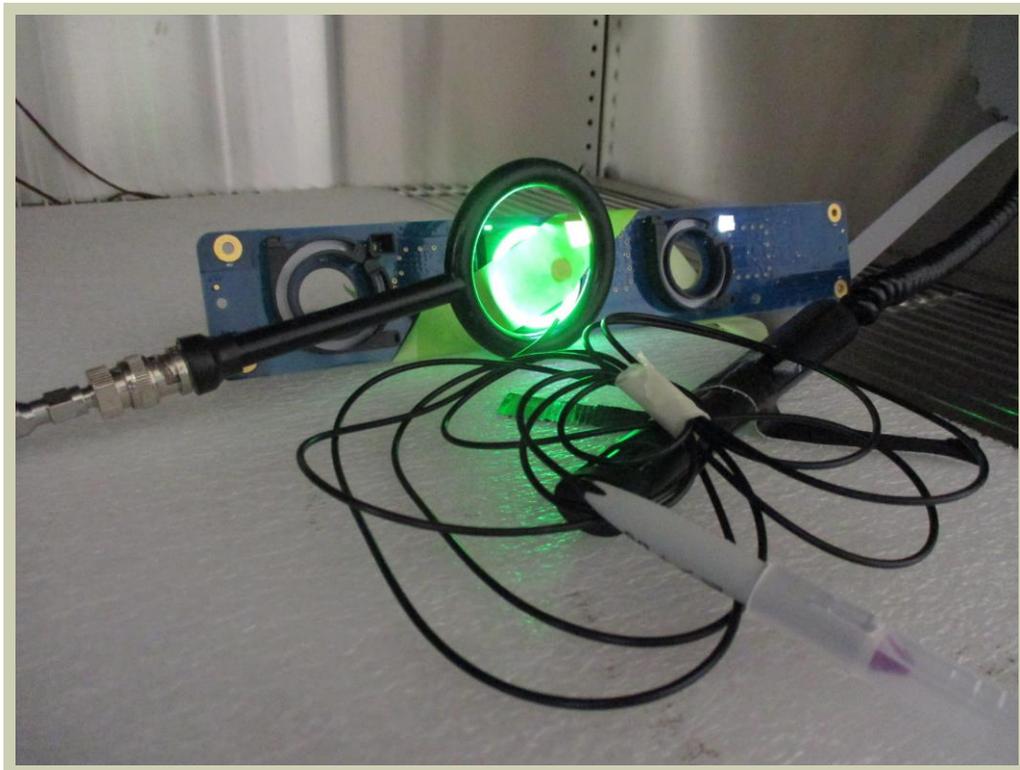


13.56 MHz RFID, ISO/IEC 15693 | Extreme Temperature -10°C



13.56 MHz RFID, ISO/IEC 15693 | Extreme Temperature -20°C

FREQUENCY STABILITY



FREQUENCY STABILITY



EMISSIONS BANDWIDTH (20 DB) ILLUMINATOR RFID MODULE



TEST DESCRIPTION

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

As defined in FCC 15.215 Part (c), intentional radiators 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 designed in the rule section under which the equipment is operated.

The 20 dB bandwidth must be contained within the band 13.110-14.010 MHz. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.

The resolution bandwidth (RBW) of the spectrum analyzer was set to the range of 1% to 5% of the emissions bandwidth (EBW) and video bandwidth (VBW) bandwidth was set to at least 3 times the resolution bandwidth. The analyzer sweep time was set to auto and a peak detector was used.

The spectrum analyzer bandwidth measurement function was used to measure the 20 dB bandwidth.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Antenna - Loop	EMCO	6502	AZB	2023-09-06	2025-09-06
Cable	ESM Cable Corp.	30-1GHz Cables	OCW	2023-01-23	2024-01-23
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAY	2022-12-06	2023-12-06

EMISSIONS BANDWIDTH (20 DB) ILLUMINATOR RFID MODULE



EUT:	Unity VCS/CS	Work Order:	ALCO0426
Serial Number:	2202329401X	Date:	2023-11-10
Customer:	Alcon Research LLC	Temperature:	19.7°C
Attendees:	Hakan Gokdogan	Relative Humidity:	36.9%
Customer Project:	None	Bar. Pressure (PMSL):	1016 mbar
Tested By:	Nolan De Ramos	Job Site:	OC06
Power:	120VAC/60Hz	Configuration:	ALCO0426-3
Signature:			

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.225:2023	ANSI C63.10:2013

COMMENTS

Transmitting RFID 13.56 MHz. Illuminator RFID Module, all 2x ports populated with probes and transmitting

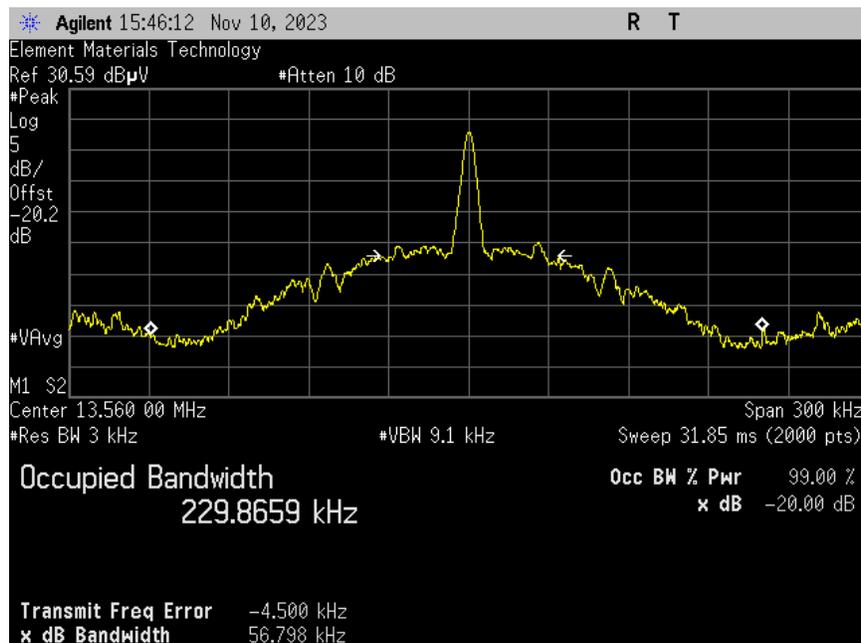
DEVIATIONS FROM TEST STANDARD

None

TEST RESULTS

	Value	Limit	Result
		$13.110 \leq f \leq 14.010$	
13.56 MHz RFID			
Normal Conditions	56.798 kHz	Within	Pass

EMISSIONS BANDWIDTH (20 DB) ILLUMINATOR RFID MODULE



13.56 MHz RFID
Normal Conditions

EMISSIONS BANDWIDTH (20 DB) LASER RFID MODULE



TEST DESCRIPTION

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

As defined in FCC 15.215 Part (c), intentional radiators 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 designed in the rule section under which the equipment is operated.

The 20 dB bandwidth must be contained within the band 13.110-14.010 MHz. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.

The resolution bandwidth (RBW) of the spectrum analyzer was set to the range of 1% to 5% of the emissions bandwidth (EBW) and video bandwidth (VBW) bandwidth was set to at least 3 times the resolution bandwidth. The analyzer sweep time was set to auto and a peak detector was used.

The spectrum analyzer bandwidth measurement function was used to measure the 20 dB bandwidth.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Antenna - Loop	EMCO	6502	AZB	2023-09-06	2025-09-06
Cable	ESM Cable Corp.	30-1GHz Cables	OCW	2023-01-23	2024-01-23
Filter - Low Pass	Micro-Tronics	LPM50004	HGK	2023-01-09	2024-01-09
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAY	2022-12-06	2023-12-06

EMISSIONS BANDWIDTH (20 DB) LASER RFID MODULE



EUT:	Unity VCS/CS	Work Order:	ALCO0426
Serial Number:	2301157201X	Date:	2023-11-13
Customer:	Alcon Research LLC	Temperature:	19.6°C
Attendees:	Hakan Gokdogan	Relative Humidity:	36.8%
Customer Project:	None	Bar. Pressure (PMSL):	1017 mbar
Tested By:	Nolan De Ramos	Job Site:	OC07
Power:	120VAC/60Hz	Configuration:	ALCO0426-1
Signature:			

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.225:2023	ANSI C63.10:2013

COMMENTS

Transmitting RFID 13.56 MHz. Laser RFID Module, all 2x ports populated with probes and transmitting

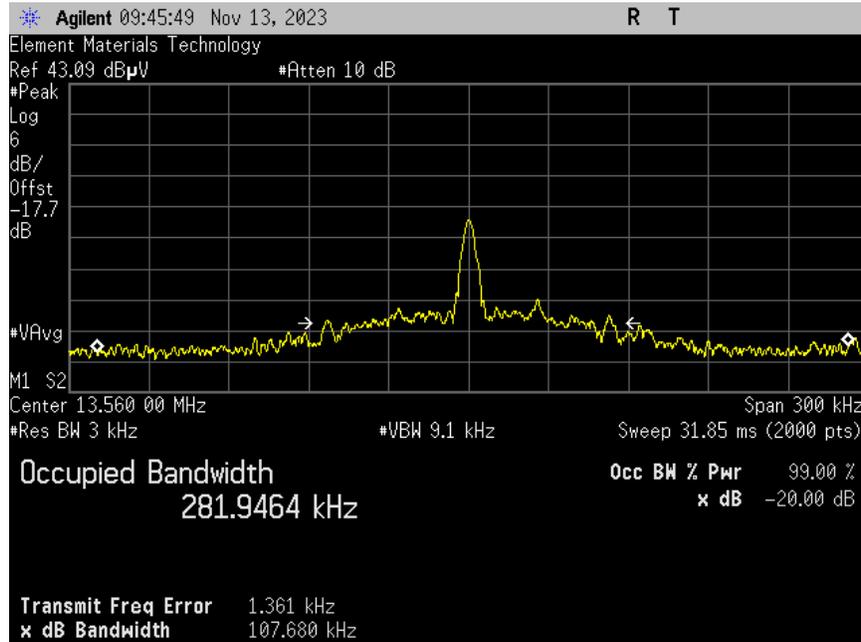
DEVIATIONS FROM TEST STANDARD

None

TEST RESULTS

	Value	Limit	Result
		$13.110 \leq f \leq 14.010$	
13.56 MHz RFID			
Normal Conditions	107.683 kHz	Within	Pass

EMISSIONS BANDWIDTH (20 DB) LASER RFID MODULE



13.56 MHz RFID
Normal Conditions

EMISSIONS BANDWIDTH (20 DB) PNEUMATIC RFID MODULE



TEST DESCRIPTION

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

As defined in FCC 15.215 Part (c), intentional radiators 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 designed in the rule section under which the equipment is operated.

The 20 dB bandwidth must be contained within the band 13.110-14.010 MHz. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.

The resolution bandwidth (RBW) of the spectrum analyzer was set to the range of 1% to 5% of the emissions bandwidth (EBW) and video bandwidth (VBW) bandwidth was set to at least 3 times the resolution bandwidth. The analyzer sweep time was set to auto and a peak detector was used.

The spectrum analyzer bandwidth measurement function was used to measure the 20 dB bandwidth.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Antenna - Loop	EMCO	6502	AZB	2023-09-06	2025-09-06
Cable	ESM Cable Corp.	30-1GHz Cables	OCW	2023-01-23	2024-01-23
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAY	2022-12-06	2023-12-06

EMISSIONS BANDWIDTH (20 DB) PNEUMATIC RFID MODULE



EUT:	Unity VCS/CS	Work Order:	ALCO0426
Serial Number:	2301157201X	Date:	2023-11-10
Customer:	Alcon Research LLC	Temperature:	19.6°C
Attendees:	Hakan Gokdogan	Relative Humidity:	36.8%
Customer Project:	None	Bar. Pressure (PMSL):	1017 mbar
Tested By:	Nolan De Ramos	Job Site:	OC07
Power:	120VAC/60Hz	Configuration:	ALCO0426-1
Signature:			

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.225:2023	ANSI C63.10:2013

COMMENTS

Transmitting RFID 13.56 MHz. Pneumatic RFID Module, all 5x ports populated with probes and transmitting

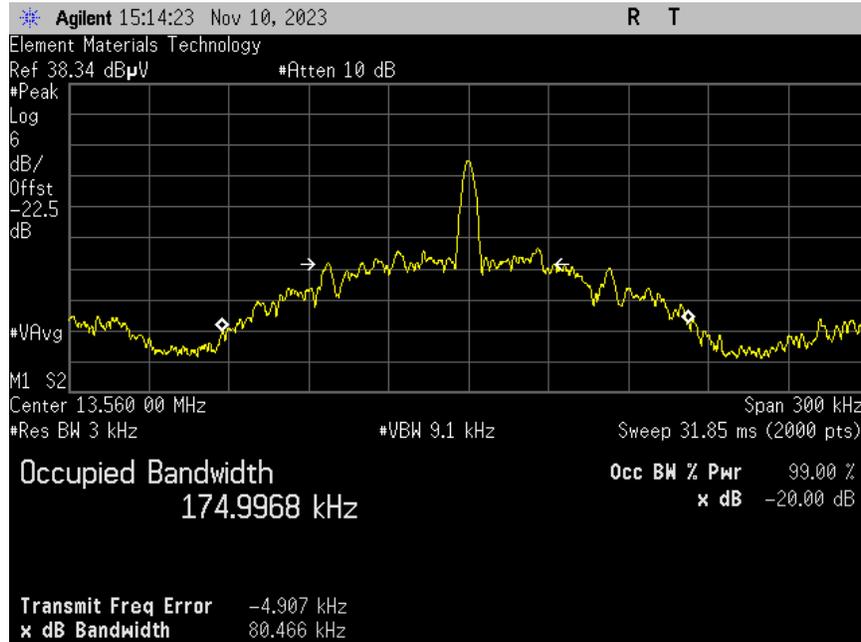
DEVIATIONS FROM TEST STANDARD

None

TEST RESULTS

	Value	Limit	Result
		$13.110 \leq f \leq 14.010$	
13.56 MHz RFID			
Normal Conditions	80.373 kHz	Within	Pass

EMISSIONS BANDWIDTH (20 DB) PNEUMATIC RFID MODULE



13.56 MHz RFID
Normal Conditions

EMISSIONS BANDWIDTH (20 DB) UNITY CS PNEUMATIC RFID MODULE



TEST DESCRIPTION

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The 20 dB bandwidth must be contained within the band 13.110-14.010 MHz. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.

The resolution bandwidth (RBW) of the spectrum analyzer was set to the range of 1% to 5% of the emissions bandwidth (EBW) and video bandwidth (VBW) bandwidth was set to at least 3 times the resolution bandwidth. The analyzer sweep time was set to auto and a peak detector was used.

The spectrum analyzer bandwidth measurement function was used to measure the 20 dB bandwidth.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Antenna - Loop	EMCO	6502	AZB	2023-09-06	2025-09-06
Cable	ESM Cable Corp.	30-1GHz Cables	OCW	2023-01-23	2024-01-23
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAY	2022-12-06	2023-12-06

EMISSIONS BANDWIDTH (20 DB) UNITY CS PNEUMATIC RFID MODULE



EUT:	Unity VCS/CS	Work Order:	ALCO0426
Serial Number:	2301010901X	Date:	2023-11-10
Customer:	Alcon Research LLC	Temperature:	19.7°C
Attendees:	Hakan Gokdogan	Relative Humidity:	37%
Customer Project:	None	Bar. Pressure (PMSL):	1016 mbar
Tested By:	Nolan De Ramos	Job Site:	OC07
Power:	120VAC/60Hz	Configuration:	ALCO0426-2
Signature:			

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.225:2023	ANSI C63.10:2013

COMMENTS

Transmitting RFID 13.56 MHz. Pneumatic RFID Module, 1x port populated with probe and transmitting. Unity CS only has 1x available port on the Pneumatic RFID Module

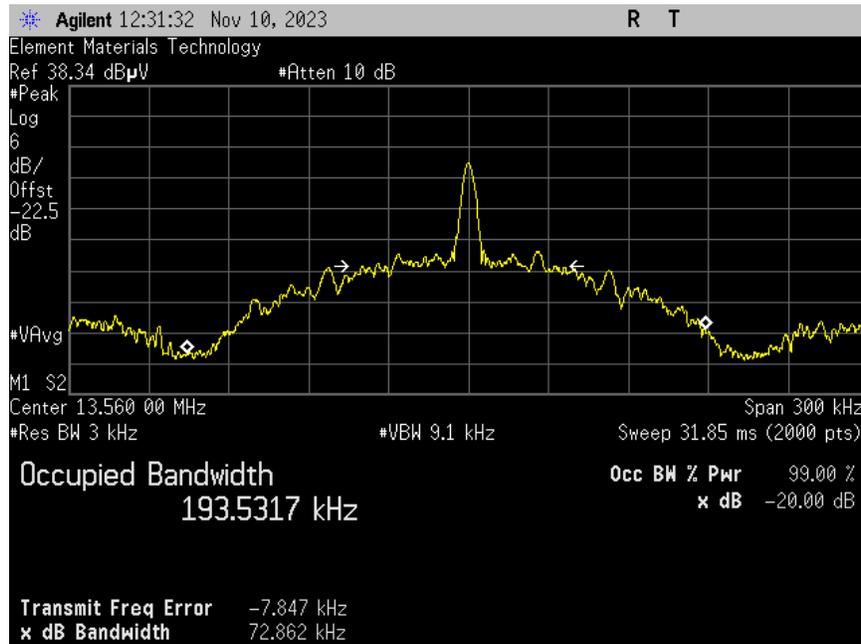
DEVIATIONS FROM TEST STANDARD

None

TEST RESULTS

	Value	Limit	Result
		$13.110 \leq f \leq 14.010$	
13.56 MHz RFID			
Normal Conditions	72.789 kHz	Within	Pass

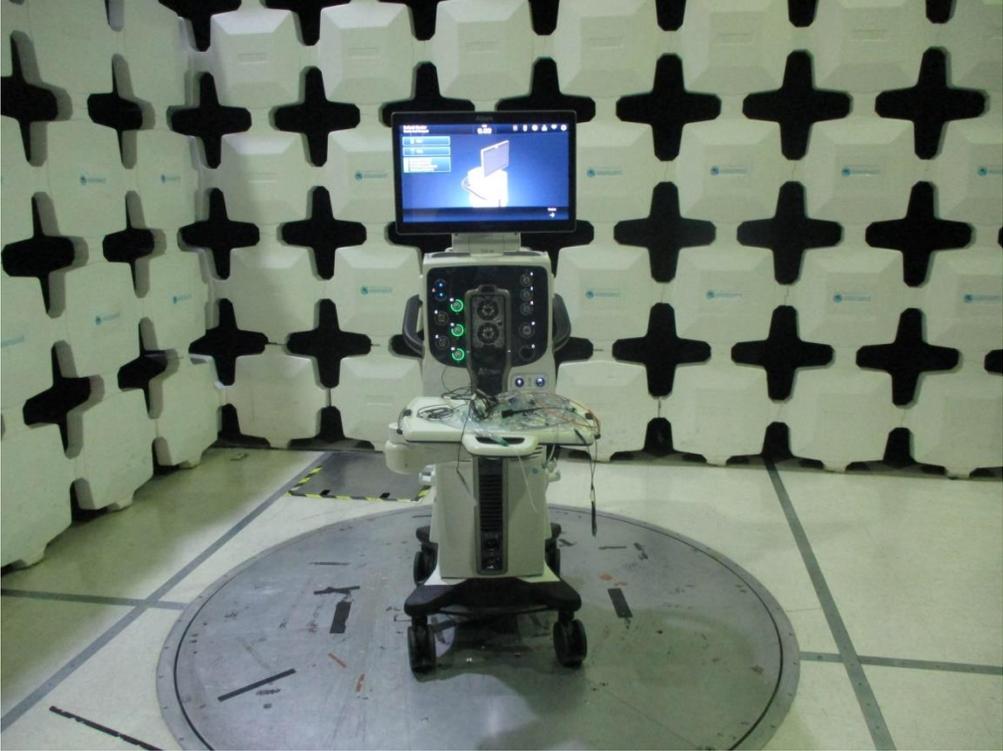
EMISSIONS BANDWIDTH (20 DB) UNITY CS PNEUMATIC RFID MODULE



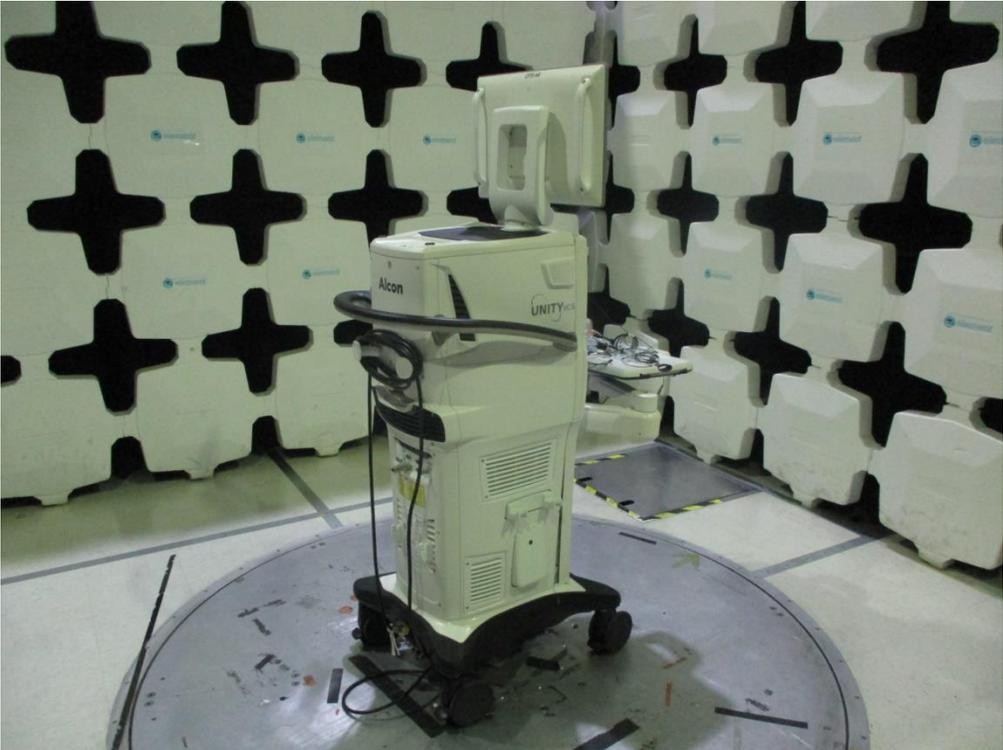
13.56 MHz RFID
Normal Conditions

Test Setup Photos

Emissions Bandwidth (20 dB)



Test Setup Photos



Test Setup Photos

Emissions Bandwidth (20 dB)



Test Setup Photos

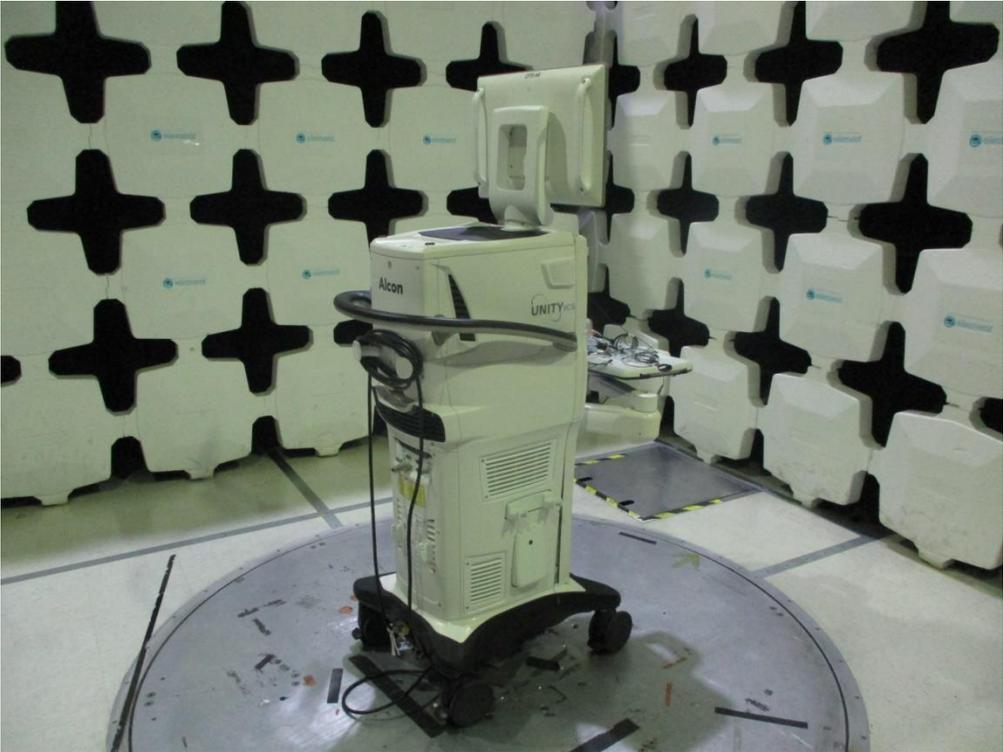


Test Setup Photos

Emissions Bandwidth (20 dB)



Test Setup Photos



Test Setup Photos

Emissions Bandwidth (20 dB)



Test Setup Photos



End of Test Report