

Walt Disney Parks and Resorts US, Inc.

TPv2 (DAP 2) FCC 15.207:2016 FCC 15.225:2016 13.56 MHz HF RFID Radio

Report # SYNA0194.10



TESTING

NVLAP Lab Code: 200630-0

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Last Date of Test: September 12, 2016 Walt Disney Parks and Resorts US, Inc. Model: TPv2 (DAP 2)

Radio Equipment Testing

Standards Method Specification Method FCC 15.207:2016 ANSI C63.10:2013

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	AC - Powerline Conducted Emissions	Yes	Pass	
6.4	Field Strength of Fundamental	Yes	Pass	
6.4	Field Strength of Spurious Emissions Less Than 30 MHz	Yes	Pass	
6.5	Field Strength of Spurious Emissions Greater Than 30 MHz	Yes	Pass	
6.8	Frequency Stability	Yes	Pass	

Deviations From Test Standards

None

Approved By:

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Rod Munro, Operations Manager

Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information.

REVISION HISTORY



Revision Number	Description	Date	Page Number
00	None		

ACCREDITATIONS AND AUTHORIZATIONS



United States

FCC - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

A2LA - Accredited by A2LA to ISO / IEC 17065 as a product certifier. This allows Northwest EMC to certify transmitters to FCC and IC specifications.

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

ISED - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB). Certification chambers and Open Area Test Sites are filed with ISED.

European Union

European Commission – Validated by the European Commission as a Notified Body under the R&TTE Directive.

Australia/New Zealand

ACMA - Recognized by ACMA as a CAB for the acceptance of test data.

Korea

MSIP / RRA - Recognized by KCC's RRA as a CAB for the acceptance of test data.

Japan

VCCI - Associate Member of the VCCI. Conducted and radiated measurement facilities are registered.

Taiwan

BSMI – Recognized by BSMI as a CAB for the acceptance of test data.

NCC - Recognized by NCC as a CAB for the acceptance of test data.

Singapore

IDA – Recognized by IDA as a CAB for the acceptance of test data.

Israel

MOC – Recognized by MOC as a CAB for the acceptance of test data.

Hong Kong

OFCA – Recognized by OFCA as a CAB for the acceptance of test data.

Vietnam

MIC – Recognized by MIC as a CAB for the acceptance of test data.

SCOPE

For details on the Scopes of our Accreditations, please visit: <u>http://www.nwemc.com/accreditations/</u> http://gsi.nist.gov/global/docs/cabs/designations.html

MEASUREMENT UNCERTAINTY



Measurement Uncertainty

When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement uncertainty is a statistical expression of measurement error qualified by a probability distribution.

A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable test description page. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-2 as applicable), and are available upon request.

The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.2 dB	-5.2 dB
AC Powerline Conducted Emissions (dB)	2.4 dB	-2.4 dB

FACILITIES





California	Minnesota	New York	Oregon	Texas	Washington	
Labs OC01-13	Labs MN01-08, MN10	Labs NY01-04	Labs EV01-12	Labs TX01-09	Labs NC01-05	
41 Tesla	9349 W Broadway Ave.	4939 Jordan Rd.	22975 NW Evergreen Pkwy	3801 E Plano Pkwy	19201 120 th Ave NE	
Irvine, CA 92618	Brooklyn Park, MN 55445	Elbridge, NY 13060	Hillsboro, OR 97124	Plano, TX 75074	Bothell, WA 98011	
(949) 861-8918	(612)-638-5136	(315) 554-8214	(503) 844-4066	(469) 304-5255	(425)984-6600	
		NV	LAP			
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200761-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code:201049-0	NVLAP Lab Code: 200629-0	
Innovation, Science and Economic Development Canada						
2834B-1, 2834B-3	2834E-1	N/A	2834D-1, 2834D-2	2834G-1	2834F-1	
		BS	МІ			
SL2-IN-E-1154R	SL2-IN-E-1152R	N/A	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R	
VCCI						
A-0029	A-0109	N/A	A-0108	A-0201	A-0110	
	Recognized Phase I CAB for ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA					
US0158	US0175	N/A	US0017	US0191	US0157	



PRODUCT DESCRIPTION



Client and Equipment Under Test (EUT) Information

Company Name:	Walt Disney Parks and Resorts US, Inc.
Address:	PO Box 10000
City, State, Zip:	Lake Buena Vista, FL 32830
Test Requested By:	Brian Piquette of Synapse Product Development LLC
Model:	TPv2 (DAP 2)
First Date of Test:	August 31, 2016
Last Date of Test:	September 12, 2016
Receipt Date of Samples:	August 31, 2016
Equipment Design Stage:	Production
Equipment Condition:	No Damage

Information Provided by the Party Requesting the Test

Functional Description of the EUT:

Multi-ticket media reader with Ethernet network interface Device containing an HF RFID reader (ISO 14443), UHF RFID Reader (ISO 18000), BT/BLE Radio, and proprietary 2.4GHz DTS radio.

Testing Objective:

To demonstrate compliance of the 13.56 MHz HF RFID radio to FCC Part 15.225 specifications.

CONFIGURATIONS



Configuration SYNA0194-1

Software/Firmware Running during test			
Description	Version		
LRR Firmware (2.4 GHz)	0.10F		

EUT					
Description	Manufacturer	Model/Part Number	Serial Number		
Access Point	Walt Disney Parks and Resorts US, Inc.	TPv2	850-1631035		

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
DC Power Cable	No	.5m	No	Access Point	DC Power Supply

Configuration SYNA0194-2

Software/Firmware Running during test			
Description Version			
RFIDTest (13.56 MHz)	27B5248		

EUT					
Description	Manufacturer	Model/Part Number	Serial Number		
Access Point	Walt Disney Parks and Resorts US, Inc.	TPv2	850-1631028		

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
DC Power Cable	No	.5m	No	Access Point	DC Power Supply

Configuration SYNA0194-3

Software/Firmware Running during test		
Description	Version	
RFIDTest (13.56 MHz)	27B5248	

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Access Point	Walt Disney Parks and Resorts US, Inc.	TPv2	850-1631035

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
DC Power Cable	No	.5m	No	Access Point	DC Power Supply

CONFIGURATIONS



Configuration SYNA0194-6

Software/Firmware Running during test				
Description	Version			
LRR Firmware (2.4 GHz)	0.10F			

EUT					
Description	Manufacturer	Model/Part Number	Serial Number		
Access Point	Walt Disney Parks and Resorts US, Inc.	TPv2	850-1631028		

Peripherals in test setup boundary							
Description	Manufacturer	Model/Part Number	Serial Number				
Access Point Fixture	Walt Disney Parks and Resorts US, Inc.	310-019778-Rev-01	No				
Scanner	Zebra	SE4710	Unknown				

Remote Equipment Outside of Test Setup Boundary							
Description Manufacturer Model/Part Number Serial Number							
POE Injector	Unknown	Unknown	Unknown				
Laptop	Apple	Macbook Air	C02NP2WDG5RQ				

Cables							
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2		
Ethernet Cable	No	6m	No	Access Point	POE Injector		
USB Cable	Yes	1m	No	Access Point	Scanner		
Ethernet Cable	No	1m	No	POE Injector	Laptop		

MODIFICATIONS



Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	8/31/2016	Frequency Stability	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
2	9/1/2016	Field Strength of Fundamental	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
3	9/1/2016	Field Strength of Spurious Emissions Less Than 30 MHz	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
4	9/12/2016	Field Strength of Spurious Emissions Greater Than 30 MHz	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
5	9/12/2016	AC - Powerline Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.



TEST DESCRIPTION

Using the mode of operation and configuration noted within this report, conducted emissions tests were performed. The frequency range investigated (scanned), is also noted in this report. Conducted power line measurements are made, unless otherwise specified, over the frequency range from 150 kHz to 30 MHz to determine the line-to-ground radio-noise voltage that is conducted from the EUT power-input terminals that are directly (or indirectly via separate transformer or power supplies) connected to a public power network. Per the standard, an insulating material was also added to ground plane between the EUT's power and remote I/O cables. Equipment is tested with power cords that are normally used or that have electrical or shielding characteristics that are the same as those cords normally used. Typically those measurements are made using a LISN (Line Impedance Stabilization Network), the 500hm measuring port is terminated by a 500hm EMI meter or a 500hm resistive load. All 500hm measuring ports of the LISN are terminated by 500hm. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Cable - Conducted Cable Assembly	Northwest EMC	EVG, HHD, RKA	EVGA	5/10/2016	5/10/2017
LISN	Solar Electronics	9252-50-R-24-BNC	LIP	1/27/2015	1/27/2017
Receiver	Rohde & Schwarz	ESCI	ARH	3/21/2016	3/21/2017
Power Supply - DC	Topward	TPS-2000	TPD	NCR	NCR

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	2.4 dB	-2.4 dB

CONFIGURATIONS INVESTIGATED

SYNA0194-6

MODES INVESTIGATED

Transmit, RFID 13.56 MHz



EUT:	TPv2 (DAP 2	2)			Work Order:	SYNA0194	
Serial Number:	850-1631004	850-1631004				09/12/2016	
Customer:	Walt Disney	Parks and	Resorts US, Inc.		Temperature:	23.3°C	
Attendees:	None				Relative Humidity:	40.5%	
Customer Proje	ct: None				Bar. Pressure:	1022 mb	
Tested By:	Jared Ison				Job Site:	EV07	
Power:	24 VDC				Configuration:	SYNA0194-6	
TEST SPECIFICATIONS							
Specification:			Method:	Method:			
FCC 15.207:20	16			ANSI C63.10:2013			
TEST PARA	METERS						
Run #:	1	Line:	High Line	A	Add. Ext. Attenuation (dB): 0		
COMMENTS							
face plate # 3691-3605.							
EUT OPERATING MODES							
I ransmit, RFID	Transmit, RFID 13.56 MHz						
DEVIATIONS FROM TEST STANDARD							

None.









RESULTS - Run #11

Qı	Quasi Peak Data - vs - Quasi Peak Limit							
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)			
13.561	28.4	20.4	48.8	60.0	-11.2			
18.243	17.8	20.6	38.4	60.0	-21.6			
17.694	17.0	20.6	37.6	60.0	-22.4			
16.228	16.7	20.4	37.1	60.0	-22.9			
18.304	16.4	20.6	37.0	60.0	-23.0			
18.364	15.3	20.7	36.0	60.0	-24.0			
16.166	15.1	20.4	35.5	60.0	-24.5			

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
13.561	28.7	20.4	49.1	50.0	-0.9
18.243	17.6	20.6	38.2	50.0	-11.8
17.694	16.7	20.6	37.3	50.0	-12.7
16.228	16.3	20.4	36.7	50.0	-13.3
18.304	16.1	20.6	36.7	50.0	-13.3
18.364	14.9	20.7	35.6	50.0	-14.4
16.166	14.6	20.4	35.0	50.0	-15.0

CONCLUSION

Pass



Tested By



EUT:	TPv2 (DAP 2	2)			Work Order:	SYNA0194
Serial Number:	850-163100	4			Date:	09/12/2016
Customer:	Walt Disney	Parks and	Resorts US, Inc.		Temperature:	23.3°C
Attendees:	None				Relative Humidity:	40.5%
Customer Project	: None				Bar. Pressure:	1022 mb
Tested By:	Jared Ison				Job Site:	EV07
Power:	24 VDC				Configuration:	SYNA0194-6
TEST SPECIF	ICATIONS					
Specification:				Method:		
FCC 15.207:2016	6			ANSI C63.10	0:2013	
TEST PARAM	IETERS					
Run #: 13		Line:	Neutral	A	dd. Ext. Attenuation (dB)): 0
COMMENTS						
face plate # 3691	-3605.					
EUT OPERAT	ING MODES					
Transmit, RFID 1	3.56 MHz					
DEVIATIONS	FROM TEST	STAND	ARD			

100

None.









RESULTS - Run #13

Qı	uasi Peak	Data - vs	- Quasi P	eak Limit	
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
13.561	28.3	20.4	48.7	60.0	-11.3
18.243	20.0	20.6	40.6	60.0	-19.4
17.693	19.0	20.6	39.6	60.0	-20.4
18.304	18.6	20.6	39.2	60.0	-20.8
16.228	18.2	20.4	38.6	60.0	-21.4
18.365	17.7	20.7	38.4	60.0	-21.6
18.487	16.1	20.7	36.8	60.0	-23.2

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
13.561	28.7	20.4	49.1	50.0	-0.9
18.243	19.8	20.6	40.4	50.0	-9.6
17.693	18.9	20.6	39.5	50.0	-10.5
18.304	18.4	20.6	39.0	50.0	-11.0
16.228	17.8	20.4	38.2	50.0	-11.8
18.365	17.5	20.7	38.2	50.0	-11.8
18.487	15.7	20.7	36.4	50.0	-13.6

CONCLUSION

Pass



Tested By

FIELD STRENGTH OF FUNDAMENTAL



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 test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

Transmit. 13.56 MHz

POWER SETTINGS INVESTIGATED

24 VDC

POE

CONFIGURATIONS INVESTIGATED

SYNA0194 - 2

FREQUENCY RANGE INVESTIGATED

Start Frequency 12.5 MHz

Stop Frequency 14.5 MHz

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Cable	None	10m Test Distance Cable	EVL	5/12/2016	12 mo
Antenna	EMCO	6502	AOA	7/6/2016	24 mo
Analyzer - Spectrum Analyzer	Agilent	E4443A	AFB	5/17/2016	12 mo

MEASUREMENT BANDWIDTHS

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

TEST DESCRIPTION

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

The fundamental carrier of the EUT was 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 calibrated active loop antenna was used for this test in order to provide sufficient measurement sensitivity. The center of the loop antenna was maintained at 1m above the ground plane during the testing.

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

As outlined in 15.209(e), 15.31(f)(2), and RSS-GEN, 6.4, measurements may be performed at a distance closer than what is specified with the limit. The limit at the specified distance is shown on the data sheet. Measurements are made at a closer distance and the data is adjusted using a distance correction factor of 40dB/decade for comparison to the limit.

FIELD STRENGTH OF FUNDAMENTAL



								EmiR5 2016.07.2
Wo	rk Order:	SYNA0194		Date: 09	/01/16		\cap	
	Project:	None	Tem	perature: 22	2.8 °C		>>	
	Job Site:	EV11		Humidity: 38.	6% RH		5	
Serial	Number:	850-1631035	Baromet	ric Pres.: 101	9 mbar	Tested by:	Jared Ison	
	FUT	TPv2 (DAP 2)						
Confi	auration:	1						
	guration.	I Walt Dianay Darka ar	d Decerte II	C Inc				
U	ustomer:	Walt Disney Parks ar	la Resolts U	5, IIIC.				-
At	ttendees:	Hattie Spetia						
EU	T Power:	24 VDC						
Operatin	ng Mode:	Transmit. 13.56 MHz						
De	eviations:	None						
Co	omments:	None						
est Snecif	fications				Test Method			
CC 15 225	5.2016				ANSI C63 10:201	3		
Dun #	0	Tost Distance (m)	10	Antonno Hoight/a	1 4/m	<u>)</u>	Populie	Doop
nun #	U	rest distance (m)	10	Antenna neight(s	9 I (M)	nesults	F 855
70 60 50 40 w/Angp 20								
10								
10		•		•				•
10 - 0 - -10 -		•		•				•
10 0 -10 -20 12.5	5	12.7 12.9	13.1	13.3 13.1 MI	5 13.7	13.9	14.1	• 14.3 14.5

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	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)	Comments
14.286	6.4	11.1	1.0	130.0	10.0	0.0	Perp to GND	QP	-19.1	-1.6	29.5	-31.1	48 VDC, EUT On Side
12.893	6.0	11.1	1.0	191.0	10.0	0.0	Perp to GND	QP	-19.1	-2.0	29.5	-31.5	48 VDC, EUT On Side
13.567	21.7	11.1	1.0	158.0	10.0	0.0	Perp to GND	QP	-19.1	13.7	50.5	-36.8	48 VDC, EUT On Side
13.773	7.3	11.1	1.0	325.0	10.0	0.0	Perp to GND	QP	-19.1	-0.7	40.5	-41.2	48 VDC, EUT On Side
13.349	6.9	11.1	1.0	226.0	10.0	0.0	Perp to GND	QP	-19.1	-1.1	40.5	-41.6	48 VDC, EUT On Side
13.553	16.1	11.1	1.0	173.0	10.0	0.0	Perp to GND	QP	-19.1	8.1	50.5	-42.4	48 VDC, EUT On Side
13.561	30.4	11.1	1.0	27.0	10.0	0.0	Perp to GND	QP	-19.1	22.4	84.0	-61.6	48 VDC, EUT On Side
13.561	30.2	11.1	1.0	273.0	10.0	0.0	Perp to GND	QP	-19.1	22.2	84.0	-61.8	48 VDC, EUT Vert
13.561	27.7	11.1	1.0	64.0	10.0	0.0	Perp to GND	QP	-19.1	19.7	84.0	-64.3	POE, EUT On Side
13.561	25.9	11.1	1.0	296.0	10.0	0.0	Para to EUT	QP	-19.1	17.9	84.0	-66.1	48 VDC, EUT On Side
13.562	25.2	11.1	1.0	223.0	10.0	0.0	Perp to EUT	QP	-19.1	17.2	84.0	-66.8	48 VDC, EUT Vert
13.560	20.7	11.1	1.0	365.0	10.0	0.0	Para to GND	QP	-19.1	12.7	84.0	-71.3	48 VDC, EUT On Side
13.561	19.8	11.1	1.0	118.0	10.0	0.0	Para to GND	QP	-19.1	11.8	84.0	-72.2	48 VDC, EUT Vert
13.562	17.1	11.1	1.0	309.0	10.0	0.0	Para to EUT	QP	-19.1	9.1	84.0	-74.9	48 VDC, EUT Horz
13.562	17.1	11.1	1.0	36.0	10.0	0.0	Perp to GND	QP	-19.1	9.1	84.0	-74.9	48 VDC, EUT Horz
13.562	14.5	11.1	1.0	173.0	10.0	0.0	Para to GND	QP	-19.1	6.5	84.0	-77.5	48 VDC, EUT Horz

FIELD STRENGTH OF SPURIOUS EMISSIONS LESS THAN 30 MHZ



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 test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

Transmit. 13.56 MHz

POWER SETTINGS INVESTIGATED

24 VDC

CONFIGURATIONS INVESTIGATED

SYNA0194 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency 10 kHz Stop Frequency	30 MHz
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SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Antenna	EMCO	6502	AOA	7/6/2016	24 mo
Cable	None	10m Test Distance Cable	EVL	5/12/2016	12 mo
Analyzer - Spectrum Analyzer	Agilent	E4443A	AFB	5/17/2016	12 mo

MEASUREMENT BANDWIDTHS

Frequency Range	Peak Data	Quasi-Peak Data	Average Data
(MHz)	(kHz)	(kHz)	(kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

TEST DESCRIPTION

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

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 if required, and adjusting the measurement antenna height and polarization (per ANSI C63.10). An active loop antenna was 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

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

Measurements at the edges of the allowable band may be presented in an alternative method as provided for in the ANSI C63.10 Marker-Delta method. This method involves performing an in-band fundamental measurement followed by a screen capture of the fundamental and out-of-band emission using reduced measurement instrumentation bandwidths. The amplitude delta measured on this screen capture is applied to the fundamental emission value to show the out-of-band emission level as applied to the limit.

As outlined in 15.209(e), 15.31(f)(2), and RSS-GEN, 6.4, measurements may be performed at a distance closer than what is specified with the limit. The limit at the specified distance is shown on the data sheet. Measurements are made at a closer distance and the data is adjusted using a distance correction factor of 40dB/decade for comparison to the limit.

FIELD STRENGTH OF SPURIOUS EMISSIONS **LESS THAN 30 MHZ**



	Work O	der:	SYNA0194		Date:	09/0	01/16			-0-	88				
	Pro	iect:	None	Te	emperature:	22.	7 °C	5		>>				_	
	Job	Site:	EV11		Humidity:	38.4	% RH			5					
S	erial Num	ber: 8	50-1631035	Baron	etric Pres.:	1019) mbar		Tested by:	Jared Iso	ı				-
		UT TPv2	(DAP 2)						j-						-
	Configura	ion: 1													-
`	Custo	nor: Walt	Disnov Parks	and Pocorte	LIS Inc										-
	Attend		Distiey raiks	and nesons	03, 110.										-
	Attend	ees: Hatti	e Spella												_
	EUT PO	wer: 24 V	JC												_
On	erating M	Tran	smit. 13.56 MI	Ηz											
Op	cruting m	Juc.													_
	Dovieti	None	•												
	Deviati	5115.													
		None)												-
	Comme	nts:													
Test S	pecificati	ons					Test Metho	d							-
FCC 1	5.225:201	5					ANSI C63.1	0:2013							
D···	up #) –	ot Diotomos (m) 10	Antonio		1	1/m)		Decult		-	2002		-
Ru	in#		st Distance (m) 10	Antenna	a Height(s)		1 (m)		Results	6	F	ass		-
8	80													1	
4	60														
	00														
	40 1														
4	40													-	
4	40													-	
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، ۳	40													-	
m//m	20													-	
BuV/m	20													-	
dBuV/m	20													-	
dBuV/m	20													-	
dBuV/m	20													-	
dBuV/m	20													-	
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dBuV/m	20													-	
dBuV/m	20													-	
dBuV/m	20 0 20													-	
dBuV/m	20													-	
dBuV/m	20 0 20													-	
dBuV/m			8												
dBuV/m	20 0 20 40 10					100							10		
dBuV/m	20 0 20 40 10					100 MHz									
dBuV/m	20 0 20 40 10					100 MHz				PK	•	AV	10		
dBuV/m	20 0 20 40 10					100 MHz	Polarity/			PK	•			000 000	
dBuV/m	20 0 20 40 10					100 MHz External	Polarity/ Transducer		Distance	PK	•	AV			
Errec	20 0 20 40 10	ude Fa	tor Antenna He	sight Azimuth	Test Distance	100 MHz Attenuation	Polarity/ Transducer Type	Detector	Distance	PK	\$	AV c. Limit	10 Comrs	pared to Spec.	
E M M M B Free (MHz	20 20 20 20 40 10 Ampli (dBi	ude Fa V) (c	ctor B) Antenna He (meters	pight Azimuth (degrees)	Test Distance (meters)	100 MHz Atternal Atternation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spe (dB	AV c. Limit III	10 Com <u>s</u>	- 0000 000 000 000 000 000	Commonia
ш//ляр 	20 20 20 20 40 10 20 40 10 20 40 10	ude Fa V) (c	tor Antenna He (meters		Test Distance (meters)	100 MHz External Attenuation (dB)	Polarity/ Transducer Type Parn to CNID	Detector	Distance Adjustment (dB)	PK	Spe	AV c. Limit uV/m)	10 Comm 5	0000 Opened to Speec. (dB)	Comments
E/\ngp 	40 20 0 20 40 10 40 10 40 10 40 10 40 10 40 10 40 10 40 10 40 10 40 10 40 10 40 10 40 10 10 10 10 10 10 10 10 10 1	ude Fa V) (c 9 9 9	Antenna He (meters 2 1.0	bight Azimuth (degrees) 323.0 92.0	Test Distance (meters) 10.0	100 MHz External Attenuation (dB) 0.0	Polarity/ Transducer Type Perp to GND Perr to GND	Detector	Distance Adjustment (dB) -19.1	Adjusted (dBuV/m) 2.0	Spe (dB	AV c. Limit iu//m) 29.5		0000 000 000 000 000 000 000 000 000 0	Comments 48 VDC, EUT On S POE FLIT Side
Errec (MHz 27.12 27.12 27.12 27.12	40 20 0 20 40 10 22 11 22 11 22 7. 21 5	ude Fa V) 9 9 7 9 7 9	tor B) Antenna He (meters 2 1.0 2 1.0 2 1.0	sight Azimuth (degrees) 323.0 92.0 194.0	Test Distance (meters) 10.0 10.0	100 MHz Attenuation (dB)	Polarity/ Transducer Type Perp to GND Perp to GND Perp to GND	Detector	Distance Adjustment (dB) -19.1 -19.1	Adjusted (dBuV/m) 2.0 -2.2 -4.2	Spe (dB	AV c. Limiti 99.5 192.5			Comments 48 VDC, EUT On S POE, EUT SIde
Errec (MHz 27.12 27.12 27.12 27.12 27.12 27.12	40 20 0 20 40 10 22 11 22 11 22 7 23 5 5	ude Fa V) (c 9 9 9 7 9 6 9	Ctor B) Antenna He (meters .2 1.0 .2 1.0 .2 1.0 .2 1.0	bight Azimuth (degrees) 323.0 92.0 194.0 317.0	Test Distance (meters) 10.0 10.0 10.0 10.0	100 MHz 0.0 0.0 0.0 0.0	Polarity/ Transducer Type Perp to GND Perp to GND Perp to GND Para to GND	Detector	Distance Adjustment (dB) -19.1 -19.1 -19.1 -19.1	Adjusted (dBuV/m) 2.0 -2.2 -4.2	Spe (dB	AV c. Limit I 29.5 29.5 29.5			Comments 48 VDC, EUT On S POE, EUT Side 48 VDC, EUT HOT 48 VDC, EUT HOT
E(Ango 27.12 27.12 27.12 27.12 27.12 27.12 27.12 27.12	20 20 20 20 40 10 22 40 10 22 11 22 11 22 12 23 53 38 5	ude Fa V) 9 9 7 9 7 9 5 9	tor B) Antenna He (meters 2.2 1.0 .2 1.0 .2 1.0 .2 1.0 .2 1.0 .2 1.0	Azimuth (degrees) 323.0 92.0 194.0 317.0 27.0	Test Distance (meters) 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.	100 MHz External Attenuation (dB) 0.0 0.0 0.0 0.0	Polarity/ Transducer Type Perp to GND Perp to GND Perp to GND Para to EUT Para to EUT	Detector QP QP QP QP	Distance Adjustment (dB) -19.1 -19.1 -19.1 -19.1	■ PK Adjusted (dBuV/m) 2.0 -2.2 -4.2 -4.2 -4.4	Spe (dB	AV c. Limit uv/m) 29.5 29.5 29.5		0000 000 000 000 000 000 000 000 000 0	Comments 48 VDC, EUT On S POE, EUT Side 48 VDC, EUT Horz 48 VDC, EUT Vert 48 VDC, EUT Vert
E/Angp 	40 20 0 20 40 10 10 10 10 10 10 10 10 10 1	ude Fa V) (c 9 9 9 7 9 7 9 6 9 5 9 5 9	tor B) Antenna He (meters) 2 1.0 2 1.0 2 1.0 2 1.0 2 1.0 2 1.0 2 1.0 2 1.0	bight Azimuth (degrees) 92.0 194.0 317.0 235.0	Test Distance (meters) 10.0 10.0 10.0 10.0 10.0 10.0	100 External Attenuation (dB) 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	Polarity/ Transducer Type Perp to GND Perp to GND Perp to GND Para to GND Para to EUT Perp to GND	Detector QP QP QP QP QP	Distance Adjustment (dB) -19.1 -19.1 -19.1 -19.1 -19.1	Adjusted (dBuV/m) 2.0 -2.2 -4.2 -4.3 -4.4	Specific Spe	AV c. Limit 99.5 199.5 199.5 199.5		pared to base. (dB) 27.5 33.7 33.8 33.9 33.9	Comments 48 VDC, EUT On S POE, EUT Side 48 VDC, EUT Horz 48 VDC, EUT Horz 48 VDC, EUT Vert 48 VDC, EUT Vert
Errec (MHz 27.12 27.12 27.13 27.77 27.06	40 20 0 20 40 10 22 11 22 11 22 11 22 12 21 52 35 55 55 55 55 55 55 55 55 55	ude Fa V) 9 9 7 9 7 9 5 9 5 9 5 9	Antenna Heg (meters) 22 1.0 .2 1.0	Azimuth (degrees) 323.0 92.0 194.0 317.0 27.0 235.0 127.0	Test Distance (meters) 10.0 10.0 10.0 10.0 10.0 10.0	100 MHz 100 MHz 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	Polarity/ Transducer Type Perp to GND Perp to GND Perp to GND Para to GND Para to GND Para to GND Para to GND	Detector QP QP QP QP QP QP QP	Distance Adjustment (dB) -19.1 -19.1 -19.1 -19.1 -19.1 -19.1	Adjusted (dBuV/m) 2.0 -2.2 -4.2 -4.3 -4.4 -4.4	Spe (dB) 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	AV c. Limit 99.5 199.5 199.5 199.5		pared to pared to par	Comments 48 VDC, EUT On 1 48 VDC, EUT Side 48 VDC, EUT Hora 48 VDC, EUT Vert 48 VDC, EUT Vert 48 VDC, EUT Hora 48 VDC, EUT Hora
W/\/ngp 	20 20 20 20 40 10 22 40 10 22 40 10 22 11 22 7. 23 5. 38 5. 53 5. 53 5. 53 5. 53 5. 53 5. 5. 5. 5. 5. 5. 5. 5. 5. 5.	ude Fa V) (c 9 9 9 7 9 5 9 5 9 5 9 4 9	Antenna He (meters) 22 1.0 22 1.0 221	bight Azimuth (degrees) 323.0 92.0 194.0 317.0 27.0 235.0 127.0 2416.0	Test Distance (meters) 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.	100 MHz 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	Polarity/ Transducer Type Perp to GND Perp to GND Perp to GND Para to GND	Detector QP QP QP QP QP QP QP QP	Distance Adjustment (dB) -19.1 -19.1 -19.1 -19.1 -19.1 -19.1 -19.1	Adjusted (dBuV/m) 2.0 -2.2 -4.2 -4.3 -4.4 -4.4 -4.4 -4.5	Spe (dB)	AV c. Limit 29.5 29.5 29.5 29.5 29.5 29.5		0000 000 000 000 000 000 000 000 000 0	Comments 48 VDC, EUT On S POE, EUT Side 48 VDC, EUT Horz 48 VDC, EUT Vert 48 VDC, EUT Vert 48 VDC, EUT Vert 48 VDC, EUT Horz 48 VDC, EUT Horz
Erec (MHz 27.12 27.12 27.12 27.13 27.06 27.14 27.14 27.16	20 20 20 20 40 10 22 40 10 22 11 22 11 22 12 27 21 5. 38 5. 38 5. 53 5. 54 5. 53 5. 54 5. 5. 5. 5. 5. 5. 5. 5. 5. 5.	ude Fa V) Fa (c 99 9 7 9 7 9 5 9 5 9 5 9 5 9 5 9 4 9 4 9	tor B) Antenna He (meters 2 1.0 2 1.	sight Azimuth (degrees) 323.0 92.0 194.0 317.0 27.0 235.0 127.0 235.0 127.0 216.0 74.0	Test Distance (meters) 10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.	100 MHz 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	Polarity/ Transducer Type Perp to GND Perp to GND Para to GND Para to GND Para to GND Para to GND Para to GND Para to GND	Detector QP QP QP QP QP QP QP QP QP QP	Distance Adjustment (dB) -19.1 -19.1 -19.1 -19.1 -19.1 -19.1 -19.1	■ PK Adjusted (dBuV/m) 2.0 -2.2 -4.2 -4.3 -4.4 -4.4 -4.4 -4.4 -4.5	Spe (dB 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	AV c. Limiti uv/m) 99.5 99.5 99.5 99.5 99.5 99.5		0000 0000 000 000 000 000 000 000 000	Comments 48 VDC, EUT On S POE, EUT Side 48 VDC, EUT Horz 48 VDC, EUT Vert 48 VDC, EUT Vert 48 VDC, EUT Vert 48 VDC, EUT Nors 48 VDC, EUT On S

FIELD STRENGTH OF SPURIOUS EMISSIONS GREATER THAN 30 MHZ



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 test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

Transmit. RFID 13.56 MHz

POWER SETTINGS INVESTIGATED

24 VDC

CONFIGURATIONS INVESTIGATED

SYNA0194 - 3

FREQUENCY RANGE INVESTIGATED

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AOL	3/11/2016	12 mo
Cable	N/A	Bilog Cables	EVA	3/11/2016	12 mo
Antenna - Biconilog	Teseq	CBL 6141B	AXR	6/30/2016	24 mo
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAQ	4/22/2016	12 mo

MEASUREMENT BANDWIDTHS

Frequency Range	Peak Data	Quasi-Peak Data	Average Data
(MHz)	(kHz)	(kHz)	(kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

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.

Measurements at the edges of the allowable band may be presented in an alternative method as provided for in the ANSI C63.10 Marker-Delta method. This method involves performing an in-band fundamental measurement followed by a screen capture of the fundamental and out-of-band emission using reduced measurement instrumentation bandwidths. The amplitude delta measured on this screen capture is applied to the fundamental emission value to show the out-of-band emission level as applied to the limit.

FIELD STRENGTH OF SPURIOUS EMISSIONS **GREATER THAN 30 MHZ**



											Emi	R5 2016.07.22.1	-
W	ork Order:	SYN	A0194		Date:	09/1	12/16	-		\sim			
	Project:	N	one	Ter	mperature:	22.	8 °C			>>			
	Job Site:	E	V01		Humidity:	41.6	% RH			>			
Seria	al Number:	850-1	631004	Barom	etric Pres.:	1023	mbar	-	Tested by:	Jared Ison	l		
	EUT:	TPv2 (DA	P 2)										_
Con	figuration:	3											_
	Customer:	Walt Disn	ey Parks ar	nd Resorts	US, Inc.								_
	Attendees:	None	,										-
E	UT Power:	24 VDC											-
		Transmit											-
Opera	ting Mode:												
		None											-
E	Deviations:	None											
-		face plate	# 2601 260	5									-
~	Commonto:	lace plate	# 3091-300	5.									
Ļ	Joniments.												
-													-
Test Spec	cifications						Test Meth	od					_
FCC 15.22	25:2016						ANSI C63	10:2013					_
D	71	Test D		0	Amtown	I laiwht/a)		1 + = 4(Desults	D.		_
Run #	F / I	Test Di	istance (m)	3	Antenna	Height(S)		1 to 4(m)		Results	Pa	ass	-
r 80													
70 -													
60													
00]													
50													
50 -													
E													
1													
5 40													
8													
•													
30 -													
				•									
20 -				-									
10 -					-								
-													
0													
1	0					100						1000	
	•					NALI-						1000	
										PK	AV	o QP	
			-	1									
						External	Polarity/		Distance			Compared to	
Freq	Amplitude	Factor	Antenna Height	Azimuth	Test Distance	Attenuation	Type	Detector	Adjustment	Adjusted	Spec. Limit	Spec.	
(MHz)	(dBuV)	(dB)	(meters)	(degrees)	(meters)	(dB)			(dB)	(dBuV/m)	(dBuV/m)	(dB)	
()													Comments
42.363	26.1	-0.1	2.2	0.0	3.0	0.0	Horz	QP	0.0	26.0	40.0	-14.0	EUT On Side
42.348	21.7	-0.1	3.2	272.0	3.0	0.0	Vert	QP	0.0	21.6	40.0	-18.4	EUT On Side
52.190	19.2	-4.3	1.0	358.0	3.0	0.0	Vert	QP	0.0	14.9	40.0	-25.1	EUT On Side
54.207	17.7	-4.9	3.0	360.0	3.0	0.0	Horz	QP	0.0	12.8	40.0	-27.2	EUT On Side



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.

TEST EQUIPMENT					
Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Cable	ESM Cable Corp.	TT	EV1	NCR	NCR
Generator - Signal	Keysight	N5182B	TFU	10/27/2015	10/27/2018
Power Supply - DC	Topward	TPS-2000	TPD	NCR	NCR
Meter - Multimeter	Tektronix	DMM912	MMH	2/17/2016	2/17/2019
Thermometer	Omegaette	HH311	DTY	1/21/2015	1/21/2018
Attenuator	S.M. Electronics	SA26B-20	AUY	6/27/2016	6/27/2017
Block - DC	Pasternack	PE8210	AME	10/1/2015	10/1/2016
Chamber - Temperature/Humidity	Cincinnati Sub Zero (CSZ)	ZPH-8-2-SCT/AC	TBI	NCR	NCR
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFP	8/10/2016	8/10/2017

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The spectrum analyzer is equipped with a precision frequency reference that exceeds the stability requirement of the EUT. 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 $\pm 0.01\%$ is equivalent to 100 ppm The formula to check for compliance is:

ppm = (Measured Frequency / Measured Nominal Frequency - 1) * 1,000,000

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	XMi	2016.05.06

EUT:	TPv2 (DAP 2)					Work Order:	SYNA0194	
Serial Number:	850-1631035					Date:	08/31/16	
Customer:	Walt Disney Parks and R	esorts US, Inc.				Temperature:	23.5 °C	
Attendees:	Hattie Spetla					Humidity:	44.9% RH	
Project:	None					Barometric Pres.:	1018 mbar	
Tested by:	Jared Ison		Power: 24 VDC			Job Site:	EV06	
TEST SPECIFICATI	IONS		Test Method					
FCC 15.225:2016			ANSI C63.10:2013					
COMMENTS								
None								
DEVIATIONS FROM	M TEST STANDARD							
None								
Configuration #	1	<						
		Signature						
		Signature		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
RFID 13.56 MHz		Signature		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
RFID 13.56 MHz	Voltage: 115%	Signature		Measured Value (MHz) 13.56091733	Assigned Value (MHz) 13.56	Error (ppm) 67.7	Limit (ppm) 100	Results Pass
RFID 13.56 MHz	Voltage: 115% Voltage: 100%	Signature		Measured Value (MHz) 13.56091733 13.56091733	Assigned Value (MHz) 13.56 13.56	Error (ppm) 67.7 67.7	Limit (ppm) 100 100	Results Pass Pass
RFID 13.56 MHz	Voltage: 115% Voltage: 100% Voltage: 85%	Signature		Measured Value (MHz) 13.56091733 13.56091733 13.56091733	Assigned Value (MHz) 13.56 13.56 13.56	Error (ppm) 67.7 67.7 67.7	Limit (ppm) 100 100 100	Results Pass Pass Pass
RFID 13.56 MHz	Voltage: 115% Voltage: 100% Voltage: 85% Temperature: +50°	Signature		Measured Value (MHz) 13.56091733 13.56091733 13.56091733 13.56091733	Assigned Value (MHz) 13.56 13.56 13.56 13.56 13.56	Error (ppm) 67.7 67.7 67.7 67.7 67.7	Limit (ppm) 100 100 100 100	Results Pass Pass Pass Pass Pass
RFID 13.56 MHz	Voltage: 115% Voltage: 100% Voltage: 85% Temperature: +50° Temperature: +40°	Signature		Measured Value (MHz) 13.56091733 13.56091733 13.56091733 13.56091733 13.56090067	Assigned Value (MHz) 13.56 13.56 13.56 13.56 13.56 13.56	Error (ppm) 67.7 67.7 67.7 67.7 67.7 66.4	Limit (ppm) 100 100 100 100 100	Results Pass Pass Pass Pass Pass
RFID 13.56 MHz	Voltage: 115% Voltage: 100% Voltage: 85% Temperature: +50° Temperature: +40° Temperature: +30°	Signature		Measured Value (MHz) 13.56091733 13.56091733 13.56091733 13.56091733 13.56090067 13.56091667	Assigned Value (MHz) 13.56 13.56 13.56 13.56 13.56 13.56 13.56	Error (ppm) 67.7 67.7 67.7 67.7 66.4 67.6	Limit (ppm) 100 100 100 100 100 100	Results Pass Pass Pass Pass Pass Pass
RFID 13.56 MHz	Voltage: 115% Voltage: 100% Voltage: 85% Temperature: +50° Temperature: +30° Temperature: +20°	Signature -		Measured Value (MHz) 13.56091733 13.56091733 13.56091733 13.56091667 13.56091667 13.56095	Assigned Value (MHz) 13.56 13.56 13.56 13.56 13.56 13.56 13.56 13.56	Error (ppm) 67.7 67.7 67.7 67.7 66.4 67.6 70.1	Limit (ppm) 100 100 100 100 100 100 100	Results Pass Pass Pass Pass Pass Pass Pass
RFID 13.56 MHz	Voltage: 115% Voltage: 100% Voltage: 85% Temperature: +50° Temperature: +40° Temperature: +20° Temperature: +20°	Signature		Measured Value (MHz) 13.56091733 13.56091733 13.56091733 13.56091667 13.56095 13.56095 13.56095	Assigned Value (MHz) 13.56 13.56 13.56 13.56 13.56 13.56 13.56 13.56 13.56	Error (ppm) 67.7 67.7 67.7 67.7 66.4 67.6 70.1 71.3	Limit (ppm) 100 100 100 100 100 100 100 100	Results Pass Pass Pass Pass Pass Pass Pass Pa
RFID 13.56 MHz	Voltage: 115% Voltage: 100% Voltage: 85% Temperature: +50° Temperature: +40° Temperature: +20° Temperature: +10° Temperature: 0°	Signature		Measured Value (MHz) 13.56091733 13.56091733 13.56091733 13.5609067 13.56091667 13.56095 13.56095633 13.561	Assigned Value (MHz) 13.56 13.56 13.56 13.56 13.56 13.56 13.56 13.56 13.56 13.56	Error (ppm) 67.7 67.7 67.7 66.4 67.6 70.1 71.3 73.8 73.8	Limit (ppm) 100 100 100 100 100 100 100 100 100	Results Pass Pass Pass Pass Pass Pass Pass Pa
RFID 13.56 MHz	Voltage: 115% Voltage: 100% Voltage: 85% Temperature: +50° Temperature: +40° Temperature: +20° Temperature: +20° Temperature: 0° Temperature: 0°	Signature		Measured Value (MHz) 13.56091733 13.56091733 13.56091733 13.56091733 13.56091667 13.56096633 13.561 13.56101667	Assigned Value (MHz) 13.56 13.56 13.56 13.56 13.56 13.56 13.56 13.56 13.56 13.56 13.56 13.56	Error (ppm) 67.7 67.7 67.7 67.7 66.4 67.6 70.1 71.3 73.8 75	Limit (ppm) 100 100 100 100 100 100 100 100 100 10	Results Pass Pass Pass Pass Pass Pass Pass Pa
RFID 13.56 MHz	Voltage: 115% Voltage: 100% Voltage: 85% Temperature: +50° Temperature: +40° Temperature: +20° Temperature: +20° Temperature: -10° Temperature: -10° Temperature: -20°	Signature		Measured Value (MHz) 13.56091733 13.56091733 13.56091733 13.5609067 13.56090667 13.56096633 13.561 13.5611667 13.56098333	Assigned Value (MHz) 13.56 13.56 13.56 13.56 13.56 13.56 13.56 13.56 13.56 13.56 13.56 13.56 13.56	Error (ppm) 67.7 67.7 67.7 66.4 67.6 70.1 71.3 73.8 75 72.5	Limit (ppm) 100 100 100 100 100 100 100 100 100 10	Results Pass Pass Pass Pass Pass Pass Pass Pa





	RFID 13	3.56 MHz, Voltag	e: 100%		
	Measured	Assigned	Error	Limit	
	Value (MHz)	Value (MHz)	(ppm)	(ppm)	Results
	13.56091733	13.56	67.7	100	Pass

RL RF 50 Ω Λ DC		SENSE:INT	ALIGN OFF	06:02:07 AM Sep 01,
	PNO: Close G	Trig: Free Run #Atten: 10 dB	#Avg Type: Log- Avg Hold:>100/1	Pwr TRACE 1 2 3 00 TYPE MWW DET P P P
B/div Ref 0.00 dBm				Mkr1 13.560 917 N -1.081 d
, 				
	/			
hter 13.561334 MHz es BW 1.0 kHz	#VB	W 3.0 kHz		Span 10.00 Sweep 1.000 ms (601





	RFID 13.5	6 MHz, Tempera	ture: +50°		
	Measured	Assigned	Error	Limit	
	Value (MHz)	Value (MHz)	(ppm)	(ppm)	Results
	13.56091733	13.56	67.7	100	Pass

RI	RE 50.0 A DC		SENSEIINT	ALIGN OFF	06:25:51 AM Sep 01 20
	N SCHABE	PNO: Close G IFGain:Low	Trig: Free Run #Atten: 10 dB	#Avg Type: Log-Pwr Avg Hold:>100/100	TRACE 2 3 4 5 TYPE M WWW DET P P P P
lB/div	Ref 0.00 dBm			M	kr1 13.560 917 MF -2.046 dBi
.0		/	$\left[\right]$		
.0					
o ———					
0					
nter 13	3.561334 MHz				Span 10.00 k
es BW	1.0 kHz	#VE	3W 3.0 kHz	Sv	/eep 1.000 ms (601 p





	RFID 13.5	6 MHz, Tempera	ture: +30°		
	Measured	Assigned	Error	Limit	
	Value (MHz)	Value (MHz)	(ppm)	(ppm)	Results
	13.56091667	13.56	67.6	100	Pass

Keysight Spectrum Analyzer - Northwest EMC, Ir	nc						
	PNO: Close 🖵	Trig: Free Run #Atten: 10 dB	ALI	#Avg Type: Avg Hold:>	Log-Pwr 100/100	06:49:22 TR T	AM Sep 01, 2016 ACE 1 2 3 4 5 6 YPE M WWWWW DET P P P P P P
5 dB/div Ref 0.00 dBm					Mkr	1 13.560 -1.3	917 MHz 399 dBm
-5.00							
-10.0							
-15.0							
-20.0							
-25.0							
-30.0			۲				
-35.0			ľ	\			
-40.0				\			
-45.0							
Center 13.561500 MHz #Res BW 1.0 kHz	#VB	W 3.0 kHz			Swee	Span p 1.000 <u>m</u>	10.00 kHz s (601 pt <u>s</u>)
MSG				STATUS 🥂	DC Coupled		





RFID 13.56 MHz, Temperature: +10°									
			Measured	Assigned	Error	Limit			
			Value (MHz)	Value (MHz)	(ppm)	(ppm)	Results		
			13.56096633	13.56	71.3	100	Pass	1	

RL RF	50 Ω \Lambda DC	and the second	SENSE:INT	AL AL	IGN OFF		07:07:45	AM Sep 01, 20
		PNO: Close 🕞 IFGain:Low	 Trig: Free Run #Atten: 10 dB 		#Avg Type: I Avg Hold:>1	_og-Pwr 00/100	TR4 T	ACE 1 2 3 4 YPE M WWW DET P P P P
B/div Ref 0.00) dBm					Mkr1	13.560 -0.3	966 MH 329 dB
n								
0		/						
n				L L				
				le la				
		/		·				
1								
nter 13.561333 I es BW 1.0 kHz	MHz	#VE	3W 3.0 kHz			Swee	Span 0 1.000 <u>m</u>	10.00 k s (601 p





RFID 13.56 MHz, Temperature: -10°										
			Measured	Assigned	Error	Limit				
			Value (MHz)	Value (MHz)	(ppm)	(ppm)	Results			
			13.56101667	13.56	75	100	Pass			

🇾 Keysight Spec	trum Analyzer - Northwest EN	MC, Inc						
CXX RL	RF 50 Ω ▲ DC	PNO: Close 🕞 IFGain:Low	Trig: Free Run #Atten: 10 dB	ALI	#Avg Type: Avg Hold:>	Log-Pwr 100/100	07:27:35 TR/ T	AM Sep 01, 2016 ACE 1 2 3 4 5 6 YPE M WWWWW DET P P P P P P
5 dB/div	Ref 0.00 dBm					Mkr1	13.561 1.(017 MHz)73 dBm
-5.00		/						
-10.0				\				
-15.0		/						
-20.0		/						
-25.0		/		\ \				
-30.0					\			
-35.0								
-40.0								
-45.0								
Center 13. #Res BW	561500 MHz 1.0 kHz	#VB	W 3.0 kHz			Sweep	Span 5 1.000 m	10.00 kHz s (601 pts)
MSG					STATUS !	DC Coupled		



	Measured	Assigned	Error	Limit	
	Value (MHz)	Value (MHz)	(mag)	(mag)	Results
	13.56098333	13.56	72.5	100	Pass
RL RE 50.0 DC	, Inc	INSEITINT	ALIGN OFF		07:38:27 AM Sep 01, 2016
			#Avg Type	: Log-Pwr	TRACE 1 2 3 4 5 (
	PNO: Close	Trig: Free Run #Atten: 10 dB	Avg Hold:	>100/100	DET P P P P P
production of the second se	IFGail.Low	"rtten. To ub		Miler	12 560 002 MU
				IVIKI I	1 588 dBm
Log					1.000 abii
-5.00		\			
	/				
-10.0		\			
	/	1	4		
-15.0					
10.0			X I		
-20.0			l l		
-20.0	/		L.		
25.0	1		X		
-20.0			l.		
20.0	1		1		
-50.0			ł		
25.0			N.		
-35(0					
(0.0					
-40.0					
150					
-45.0					
Center 13.561500 MHz					Span 10.00 kHz
#Res BW 1.0 kHz	#VBV	/ 3.0 kHz		Sweep	1.000 ms (601 pts)
MSG			STATUS	DC Counled	

RFID 13.56 MHz, Temperature: -30°									
Measured Assigned Error									
			Value (MHz)	Value (MHz)	(ppm)	(ppm)	Results		
			13.56096667	13.56	71.3	100	Pass		

📕 Keysight Sp	ectrum Analyzer - Northwest E	MC, Inc	SCHOL THIT		1	
		PNO: Close 🖵 IFGain:Low	Trig: Free Run #Atten: 10 dB	#Avg Typ Avg Hold	be: Log-Pwr I:>100/100	07:48:50 AM SEP 01, 2016 TRACE 1 2 3 4 5 6 TYPE MWWWW DET P P P P P P
5 dB/div	Ref 0.00 dBm				Mkr	1 13.560 967 MHz 2.100 dBm
-5.00		/	1			
-10.0			\	\		
-15.0				<u> </u>		
-20.0		/				
-25.0				\		
-30.0				\		
-35.0						
-40.0						
-45.0						
Center 13 #Res BW	.561500 MHz 1.0 kHz	#VB	W 3.0 kHz		Swee	Span 10.00 kHz p 1.000 ms (601 pts)
MSG				STATUS	DC Coupled	