NORTHWEST EMC

Walt Disney Parks and Resorts US, Inc.

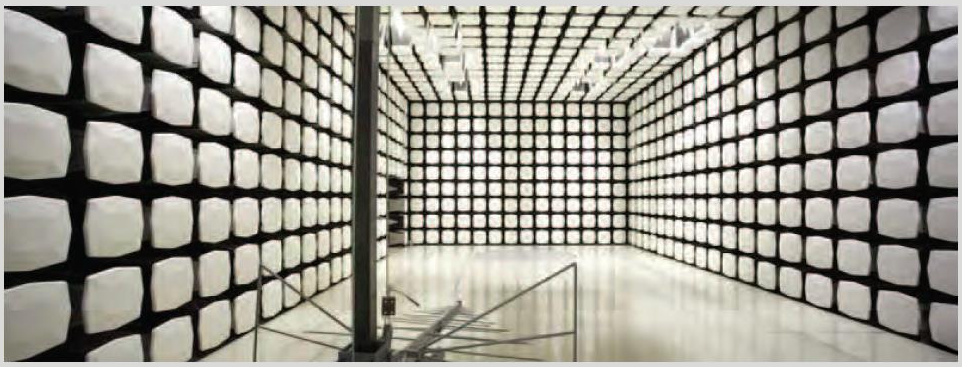
TPv2 (DAP 2)

FCC 15.207:2016

FCC 15.225:2016

13.56 MHz HF RFID Radio

Report # SYNA0194.10



NVLAP TESTING

NVLAP Lab Code: 200630-0

CERTIFICATE OF TEST

NORTHWEST EMC
2014-12-10

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

Radio Equipment Testing

Standards

Specification	Method
FCC 15.207:2016	ANSI C63.10:2013
FCC 15.225:2016	

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:

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

NORTHWEST EMC
REV 2014.10.14

Revision Number	Description	Date	Page Number
00	None		

ACCREDITATIONS AND AUTHORIZATIONS

NORTHWEST EMC
REV 2016.7.25

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:
http://www.nwemc.com/accreditations/
http://gsi.nist.gov/global/docs/cabs/designations.html

MEASUREMENT UNCERTAINTY

NORTHWEST EMC
TMU.2015.07.10

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.

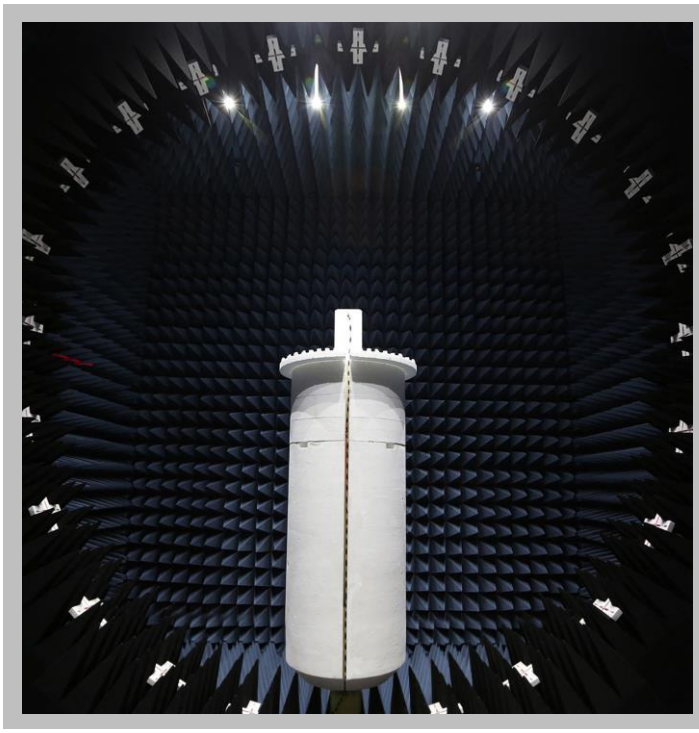
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

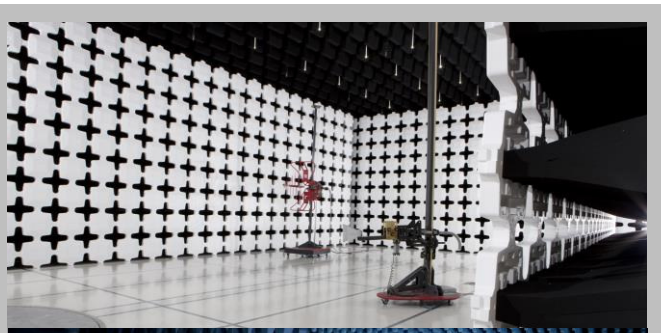
Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%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

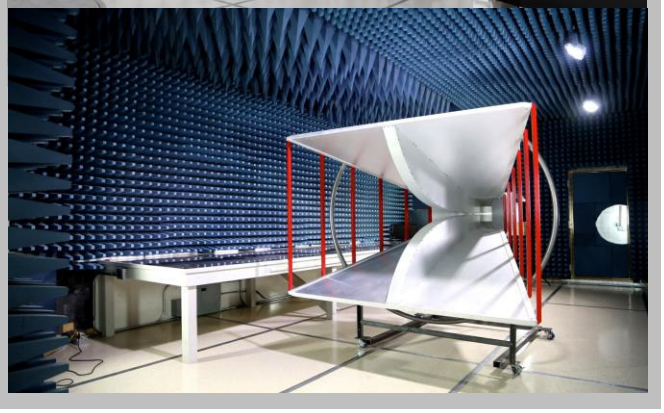
FACILITIES

NORTHWEST EMC
REV 2016.7.25

California	Minnesota	New York	Oregon	Texas	Washington
Labs OC01-13 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-08, MN10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 554-8214	Labs EV01-12 22975 NW Evergreen Pkwy Hillsboro, OR 97124 (503) 844-4066	Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Labs NC01-05 19201 120th Ave NE Bothell, WA 98011 (425)984-6600
NVLAP					
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
BSMI					
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

NORTHWEST EMC 2014-12-10

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

NORTHWEST EMC 2014-12-10

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

NORTHWEST EMC
2014-12-10

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.

AC – POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2016.05.18

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 50ohm measuring port is terminated by a 50ohm EMI meter or a 50ohm resistive load. All 50ohm measuring ports of the LISN are terminated by 50ohm. 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

AC – POWERLINE CONDUCTED EMISSIONS

EUT:	TPv2 (DAP 2)	Work Order:	SYNA0194
Serial Number:	850-1631004	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 SPECIFICATIONS

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

TEST PARAMETERS

Run #:	11	Line:	High Line	Add. Ext. Attenuation (dB):	0

COMMENTS

face plate # 3691-3605.

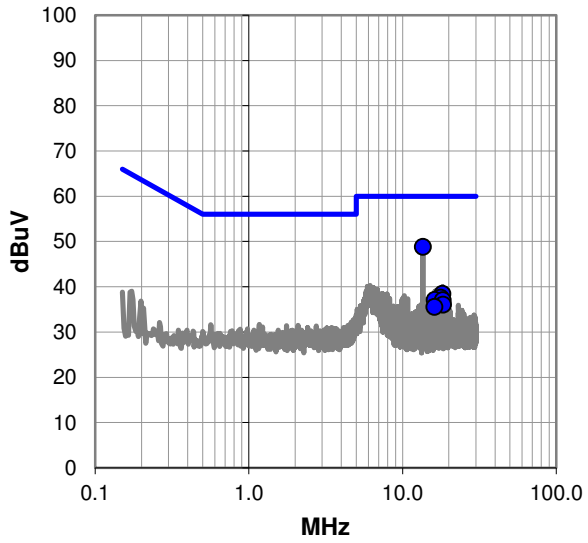
EUT OPERATING MODES

Transmit, RFID 13.56 MHz

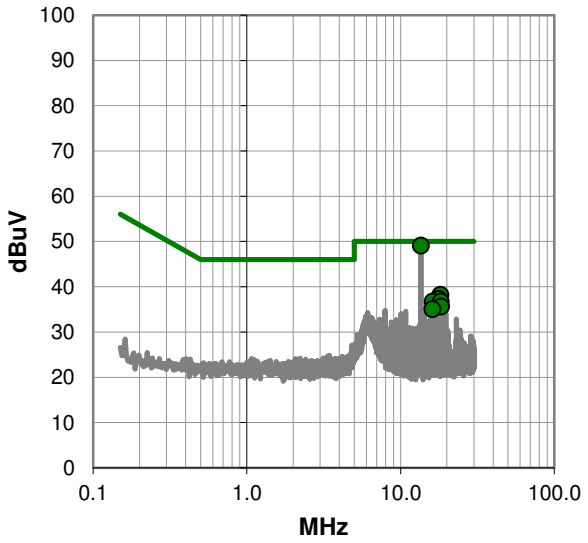
DEVIATIONS FROM TEST STANDARD

None.

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



AC – POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2016.05.18

RESULTS - Run #11

Quasi Peak Data - vs - Quasi Peak Limit

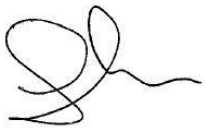
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
13.561	28.4	20.4	48.8	60.0	-11.2
18.243	17.8	20.6	38.4	60.0	-21.6
17.694	17.0	20.6	37.6	60.0	-22.4
16.228	16.7	20.4	37.1	60.0	-22.9
18.304	16.4	20.6	37.0	60.0	-23.0
18.364	15.3	20.7	36.0	60.0	-24.0
16.166	15.1	20.4	35.5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

AC – POWERLINE CONDUCTED EMISSIONS

EUT:	TPv2 (DAP 2)	Work Order:	SYNA0194
Serial Number:	850-1631004	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 SPECIFICATIONS

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

TEST PARAMETERS

Run #:	13	Line:	Neutral	Add. Ext. Attenuation (dB):	0

COMMENTS

face plate # 3691-3605.

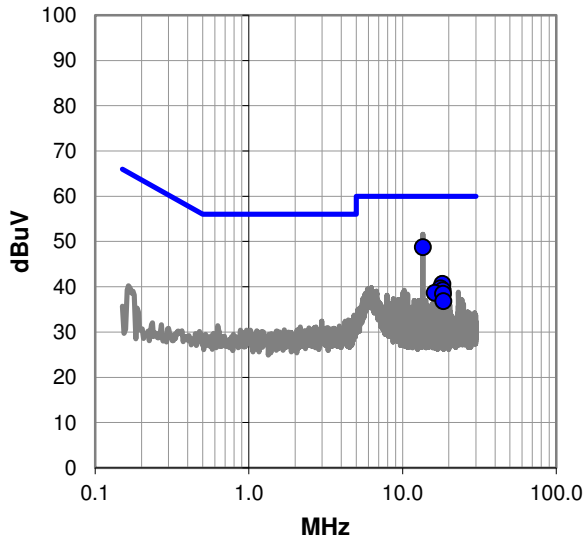
EUT OPERATING MODES

Transmit, RFID 13.56 MHz

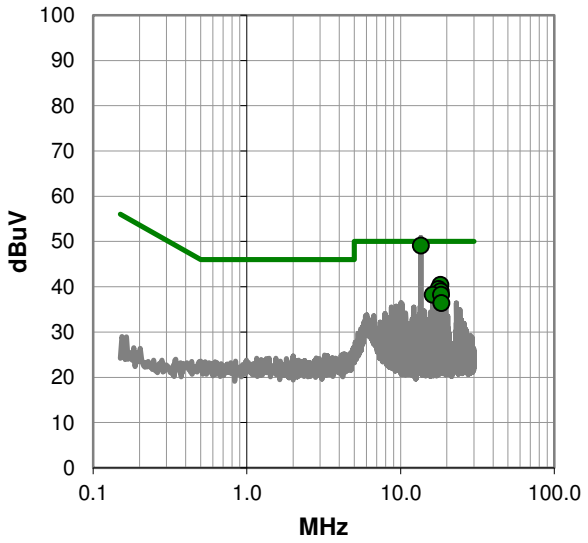
DEVIATIONS FROM TEST STANDARD

None.

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



AC – POWERLINE CONDUCTED EMISSIONS

NORTHWEST EMC
WTD.2016.05.18

RESULTS - Run #13

Quasi Peak Data - vs - Quasi Peak Limit

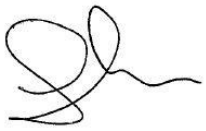
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
13.561	28.3	20.4	48.7	60.0	-11.3
18.243	20.0	20.6	40.6	60.0	-19.4
17.693	19.0	20.6	39.6	60.0	-20.4
18.304	18.6	20.6	39.2	60.0	-20.8
16.228	18.2	20.4	38.6	60.0	-21.4
18.365	17.7	20.7	38.4	60.0	-21.6
18.487	16.1	20.7	36.8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

PSA-ESCI 2016.07.22

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

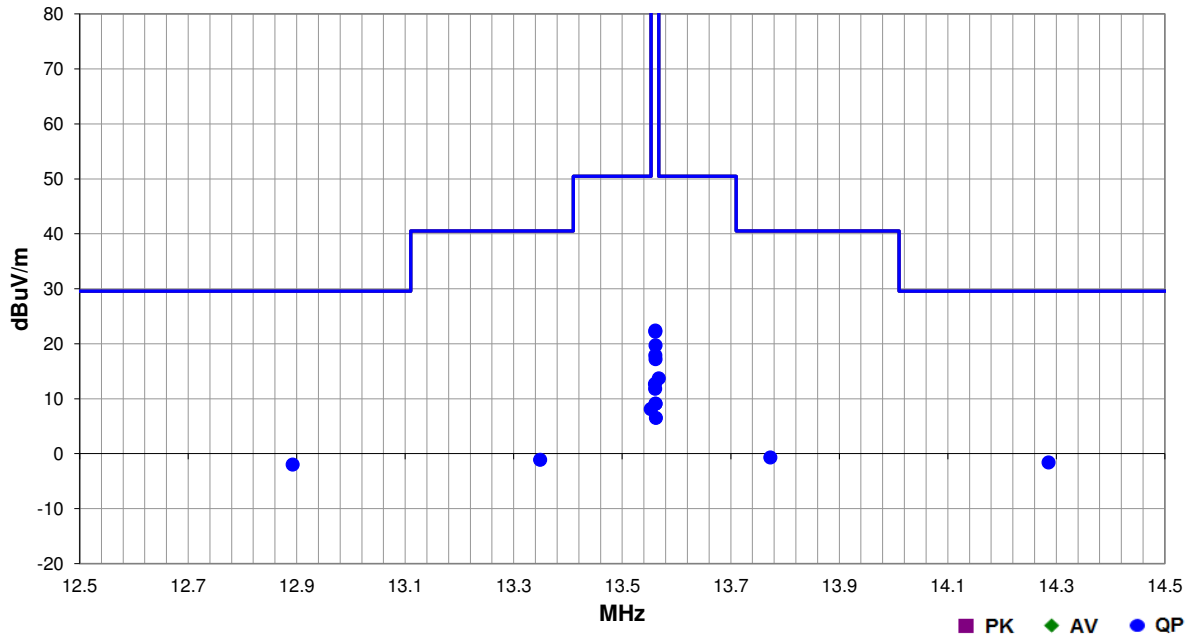
NORTHWEST EMC

PSA-ESCI 2016.07.22
EmiR5 2016.07.22.1

Work Order:	SYNA0194	**Date:**	09/01/16		
Project:	None	**Temperature:**	22.8 °C		
Job Site:	EV11	**Humidity:**	38.6% RH		
Serial Number:	850-1631035	**Barometric Pres.:**	1019 mbar	**Tested by:**	Jared Ison
EUT:	TPv2 (DAP 2)				
Configuration:	1				
Customer:	Walt Disney Parks and Resorts US, Inc.				
Attendees:	Hattie Spetla				
EUT Power:	24 VDC				
Operating Mode:	Transmit. 13.56 MHz				
Deviations:	None				
Comments:	None				

Test Specifications	**Test Method**
FCC 15.225:2016	ANSI C63.10:2013

Run #	0	**Test Distance (m)**	10	**Antenna Height(s)**	1(m)	**Results**	Pass



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

NORTHWEST EMC

PSA-ESCI 2016.07.22

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

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 (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.

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

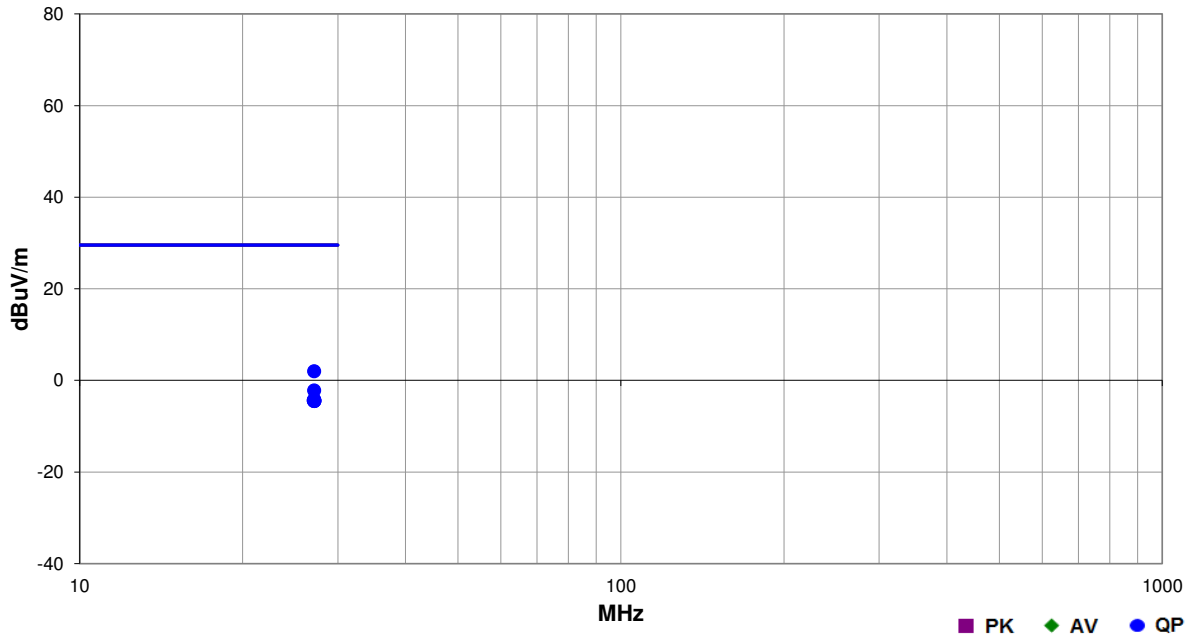
NORTHWEST EMC

PSA-ESCI 2016.07.22
EmiR5 2016.07.22.1

Work Order:	SYNA0194	**Date:**	09/01/16		
Project:	None	**Temperature:**	22.7 °C		
Job Site:	EV11	**Humidity:**	38.4% RH		
Serial Number:	850-1631035	**Barometric Pres.:**	1019 mbar	**Tested by:**	Jared Ison
EUT:	TPv2 (DAP 2)				
Configuration:	1				
Customer:	Walt Disney Parks and Resorts US, Inc.				
Attendees:	Hattie Spetla				
EUT Power:	24 VDC				
Operating Mode:	Transmit. 13.56 MHz				
Deviations:	None				
Comments:	None				

Test Specifications	**Test Method**
FCC 15.225:2016	ANSI C63.10:2013

Run #	13	**Test Distance (m)**	10	**Antenna Height(s)**	1(m)	**Results**	Pass



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
27.122	11.9	9.2	1.0	323.0	10.0	0.0	Perp to GND	QP	-19.1	2.0	29.5	-27.5	48 VDC, EUT On Side
27.122	7.7	9.2	1.0	92.0	10.0	0.0	Perp to GND	QP	-19.1	-2.2	29.5	-31.7	POE, EUT Side
27.121	5.7	9.2	1.0	194.0	10.0	0.0	Perp to GND	QP	-19.1	-4.2	29.5	-33.7	48 VDC, EUT Horz
27.123	5.6	9.2	1.0	317.0	10.0	0.0	Para to GND	QP	-19.1	-4.3	29.5	-33.8	48 VDC, EUT On Side
27.138	5.5	9.2	1.0	27.0	10.0	0.0	Para to EUT	QP	-19.1	-4.4	29.5	-33.9	48 VDC, EUT Vert
27.076	5.5	9.2	1.8	235.0	10.0	0.0	Perp to GND	QP	-19.1	-4.4	29.5	-33.9	48 VDC, EUT Vert
27.063	5.5	9.2	1.0	127.0	10.0	0.0	Para to GND	QP	-19.1	-4.4	29.5	-33.9	48 VDC, EUT Horz
27.144	5.4	9.2	1.0	216.0	10.0	0.0	Para to EUT	QP	-19.1	-4.5	29.5	-34.0	48 VDC, EUT On Side
27.106	5.4	9.2	1.0	74.0	10.0	0.0	Para to GND	QP	-19.1	-4.5	29.5	-34.0	48 VDC, EUT Vert
27.125	5.4	9.2	1.0	307.0	10.0	0.0	Para to EUT	QP	-19.1	-4.5	29.5	-34.0	48 VDC, EUT Horz

FIELD STRENGTH OF SPURIOUS EMISSIONS GREATER THAN 30 MHZ

NORTHWEST EMC

PSA-ESCI 2016.07.22

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

Start Frequency	30 MHz	Stop Frequency	140 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
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 (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 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.

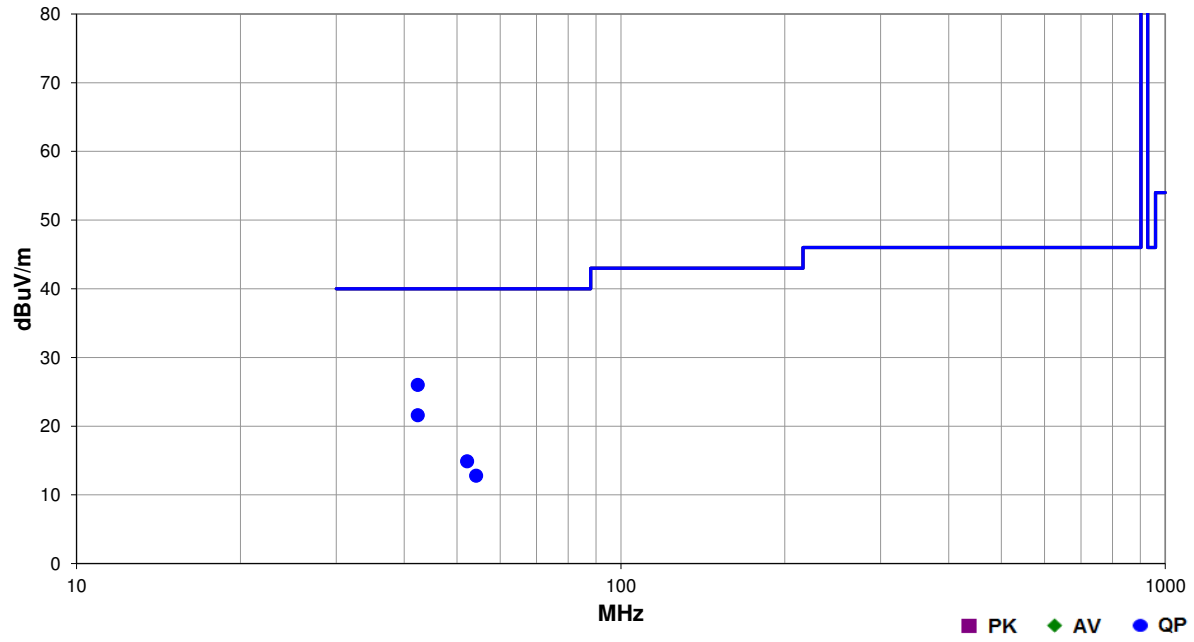
FIELD STRENGTH OF SPURIOUS EMISSIONS GREATER THAN 30 MHZ

PSA-ESCI 2016.07.22
EmiR5 2016.07.22.1

Work Order:	SYNA0194	**Date:**	09/12/16		
Project:	None	**Temperature:**	22.8 °C		
Job Site:	EV01	**Humidity:**	41.6% RH		
Serial Number:	850-1631004	**Barometric Pres.:**	1023 mbar	**Tested by:**	Jared Ison
EUT:	TPv2 (DAP 2)				
Configuration:	3				
Customer:	Walt Disney Parks and Resorts US, Inc.				
Attendees:	None				
EUT Power:	24 VDC				
Operating Mode:	Transmit.				
Deviations:	None				
Comments:	face plate # 3691-3605.				

Test Specifications	**Test Method**
FCC 15.225:2016	ANSI C63.10:2013

Run #	71	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



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
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

FREQUENCY STABILITY

NORTHWEST EMC

XMit 2016.05.06

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 ±0.01% is equivalent to 100 ppm
The formula to check for compliance is:

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

FREQUENCY STABILITY

NORTHWEST EMC

XMit 2016.05.06

EUT:	TPv2 (DAP 2)			**Work Order:**	SYNA0194
Serial Number:	850-1631035			**Date:**	08/31/16
Customer:	Walt Disney Parks and Resorts 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 SPECIFICATIONS	Test Method
FCC 15.225:2016	ANSI C63.10:2013

COMMENTS

None

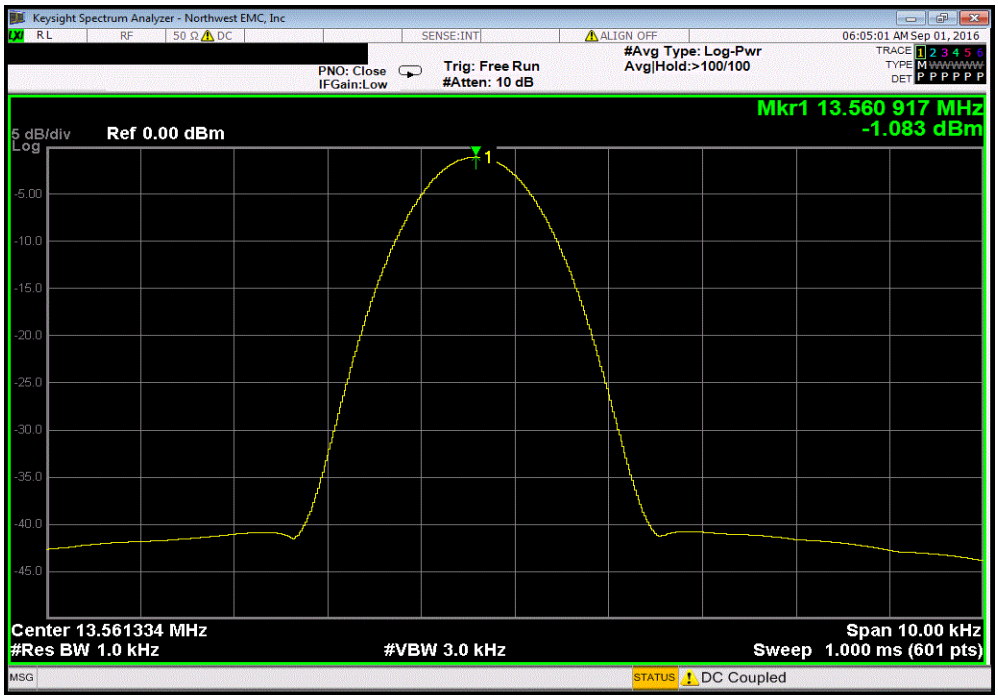
DEVIATIONS FROM TEST STANDARD

None

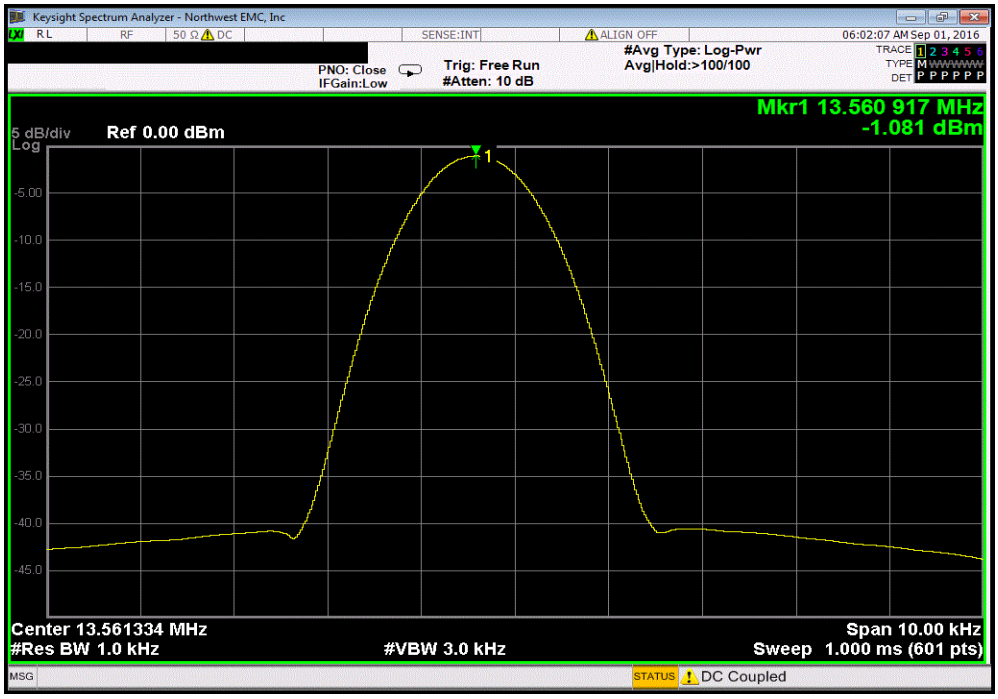
Configuration #	1	Signature

	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
RFID 13.56 MHz					
Voltage: 115%	13.56091733	13.56	67.7	100	Pass
Voltage: 100%	13.56091733	13.56	67.7	100	Pass
Voltage: 85%	13.56091733	13.56	67.7	100	Pass
Temperature: +50°	13.56091733	13.56	67.7	100	Pass
Temperature: +40°	13.56090067	13.56	66.4	100	Pass
Temperature: +30°	13.56091667	13.56	67.6	100	Pass
Temperature: +20°	13.56095	13.56	70.1	100	Pass
Temperature: +10°	13.56096633	13.56	71.3	100	Pass
Temperature: 0°	13.561	13.56	73.8	100	Pass
Temperature: -10°	13.56101667	13.56	75	100	Pass
Temperature: -20°	13.56098333	13.56	72.5	100	Pass
Temperature: -30°	13.56096667	13.56	71.3	100	Pass

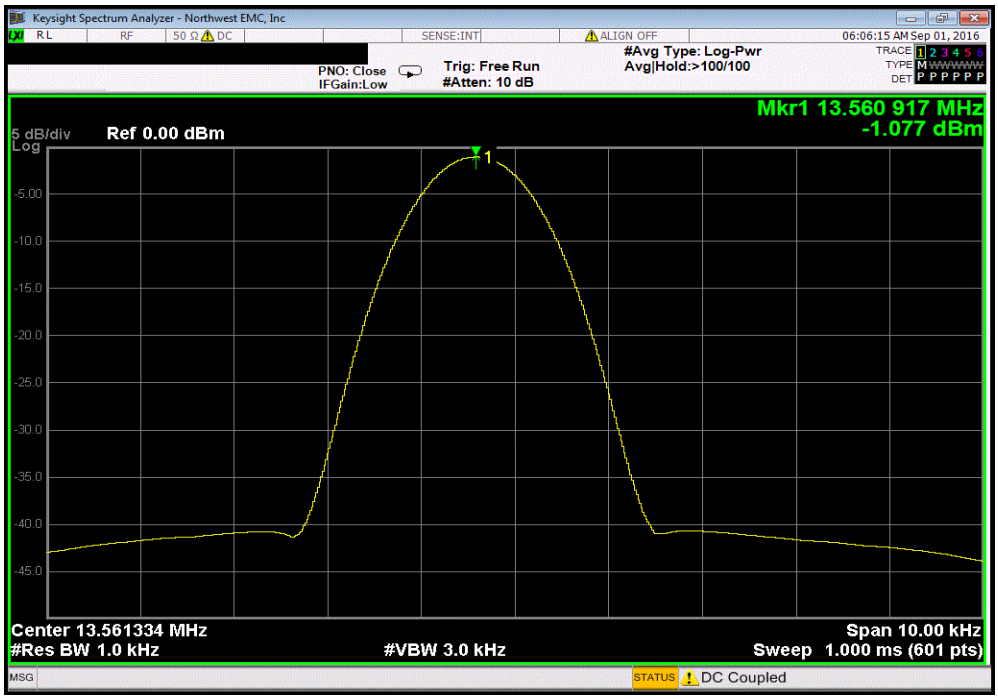
RFID 13.56 MHz, Voltage: 115%						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.56091733	13.56	67.7	100	Pass



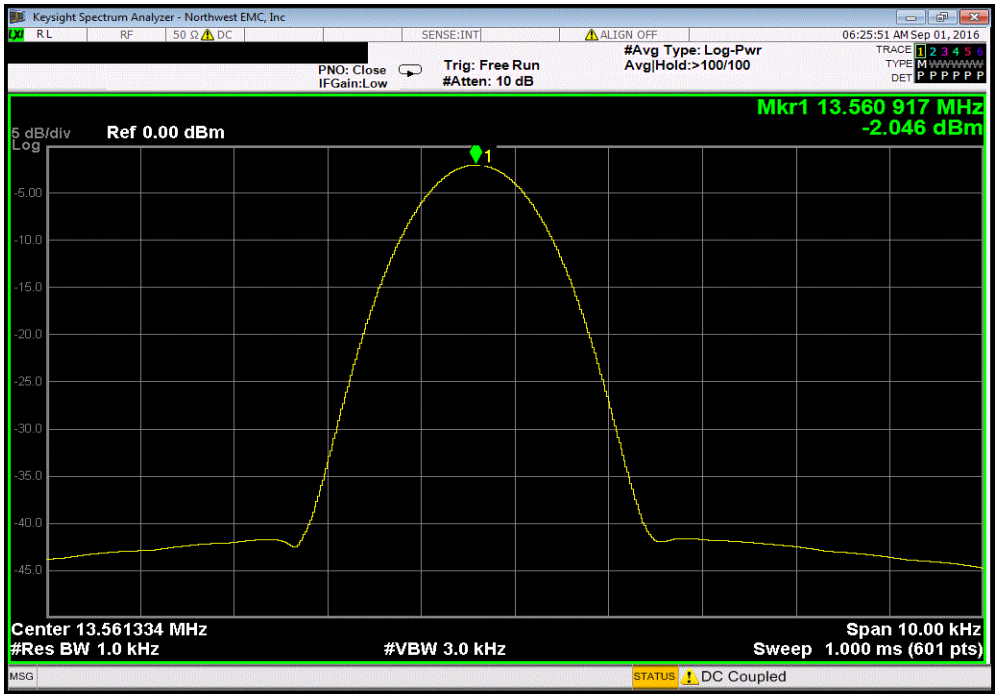
RFID 13.56 MHz, Voltage: 100%						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.56091733	13.56	67.7	100	Pass



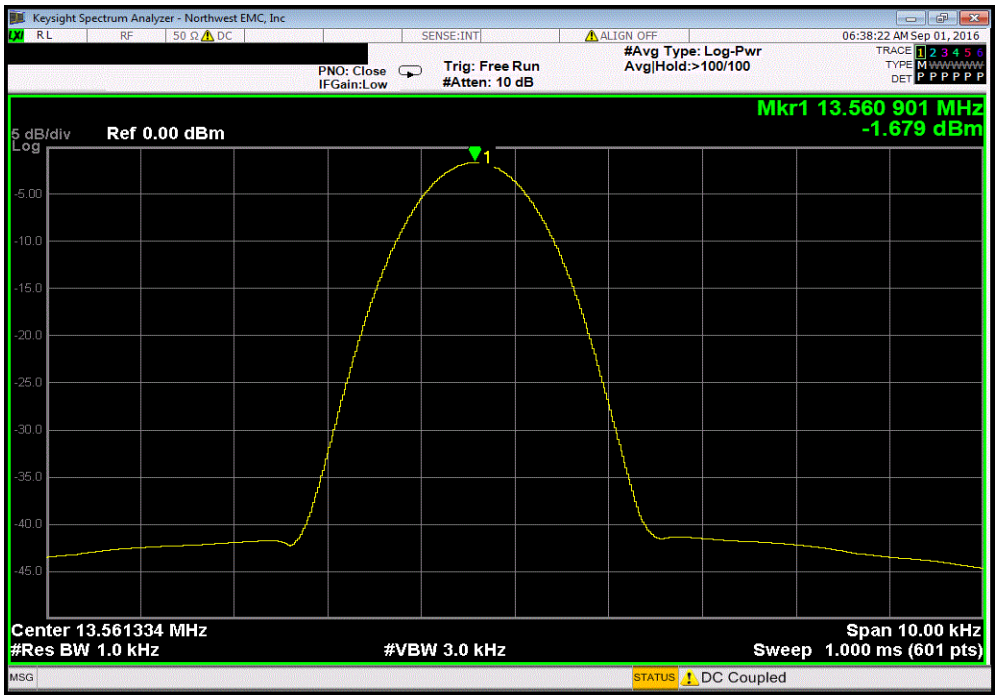
RFID 13.56 MHz, Voltage: 85%						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.56091733	13.56	67.7	100	Pass



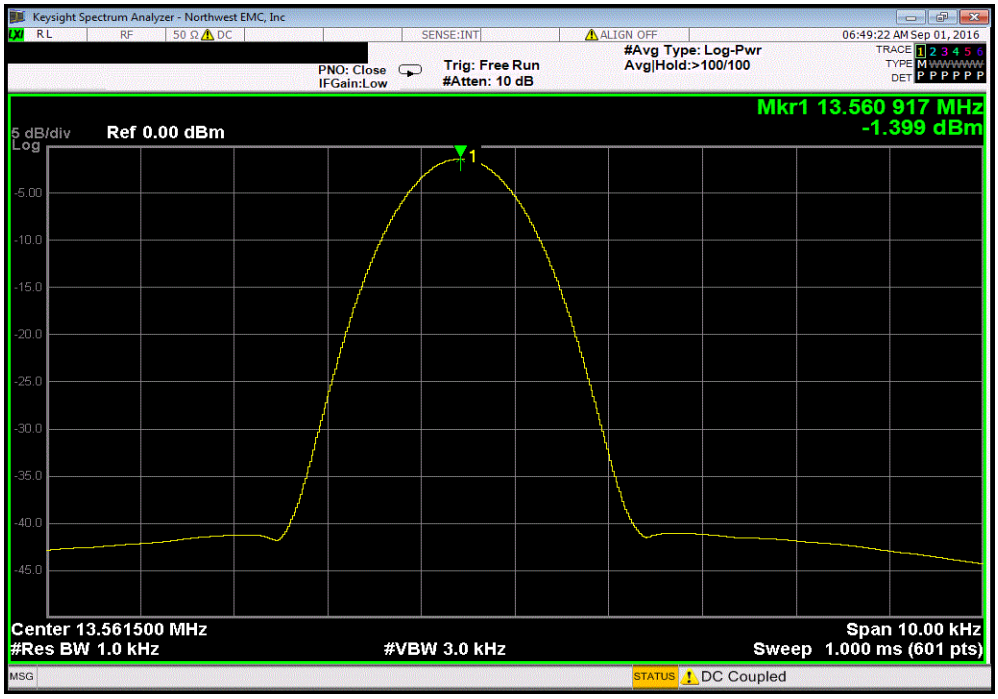
RFID 13.56 MHz, Temperature: +50°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.56091733	13.56	67.7	100	Pass



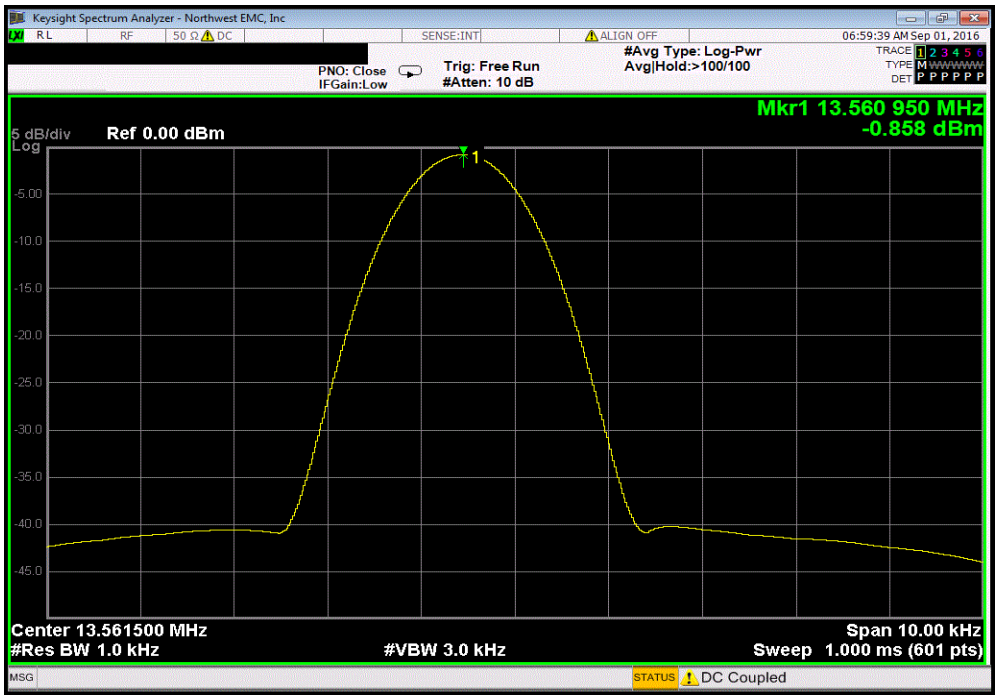
RFID 13.56 MHz, Temperature: +40°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.56090067	13.56	66.4	100	Pass



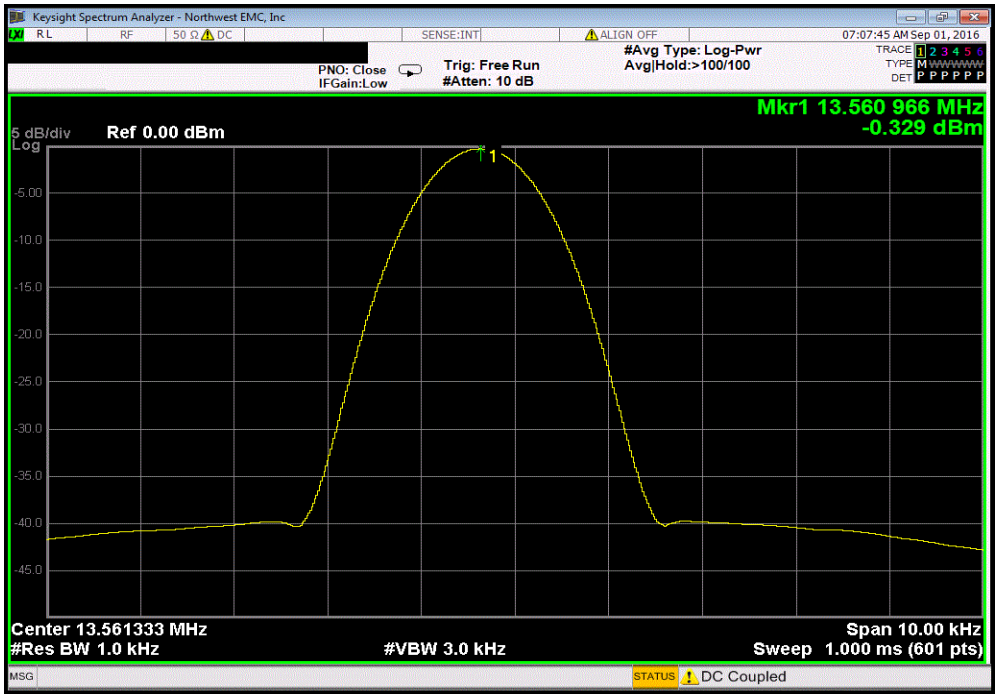
RFID 13.56 MHz, Temperature: +30°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.56091667	13.56	67.6	100	Pass



RFID 13.56 MHz, Temperature: +20°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.56095	13.56	70.1	100	Pass



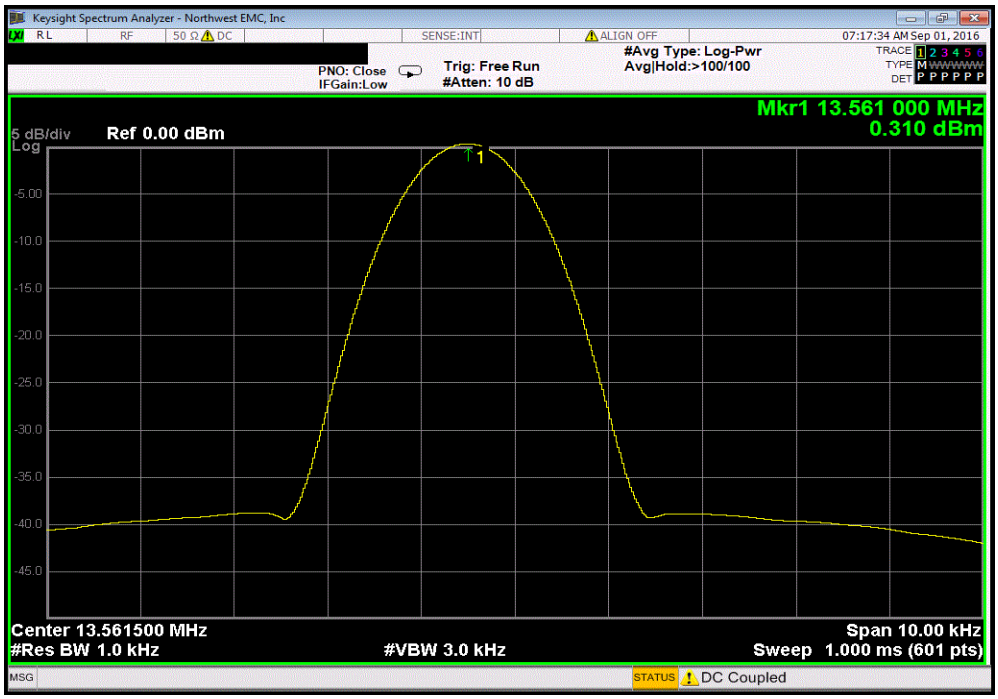
RFID 13.56 MHz, Temperature: +10°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.56096633	13.56	71.3	100	Pass



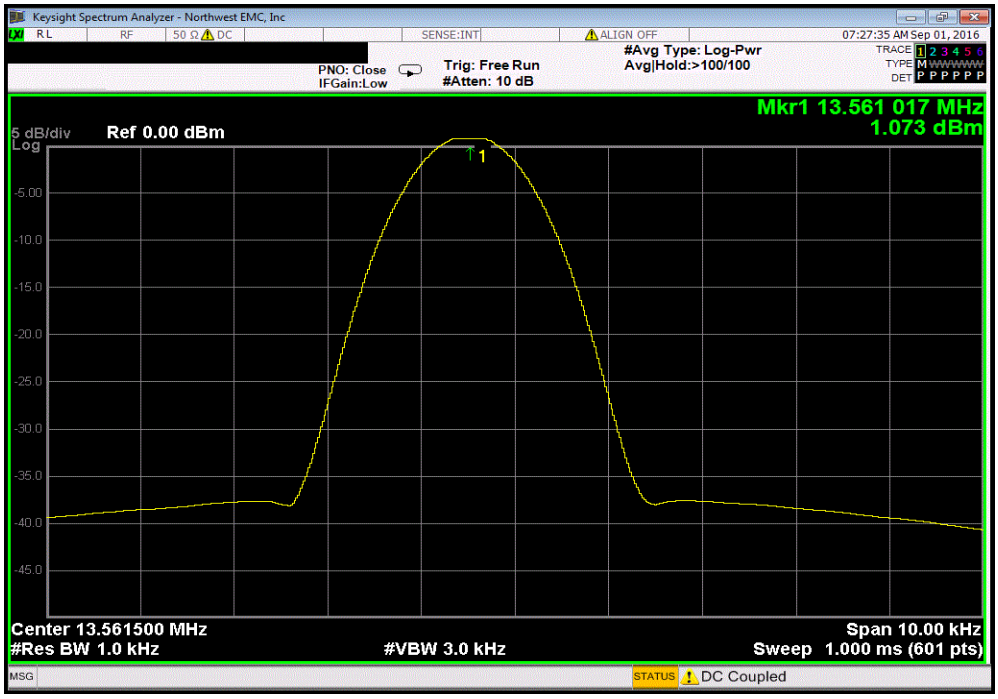
FREQUENCY STABILITY

XMit 2016.05.06

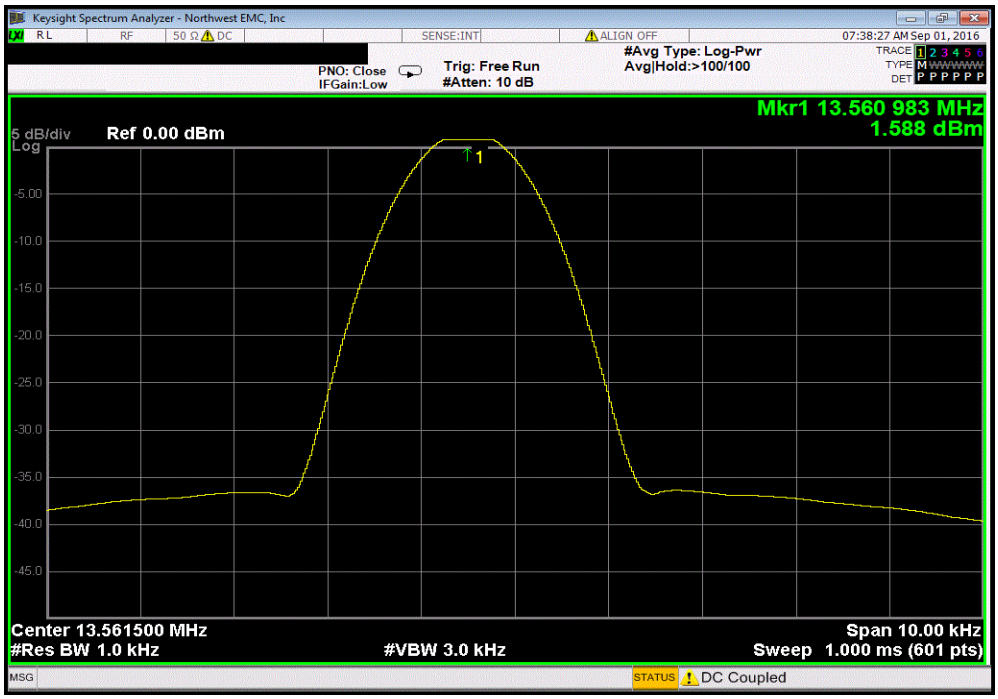
RFID 13.56 MHz, Temperature: 0°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.561	13.56	73.8	100	Pass



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



RFID 13.56 MHz, Temperature: -20°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.56098333	13.56	72.5	100	Pass



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