Electromagnetic Compatibility Test Report

Tested to FCC Part 15, Subpart C and RSS-210 Issue 9

On

Active RFID

OMNI-P60 & OMNI-P65

Omni-ID®

1200 Ridgeway Avenue

Rochester NY 14615 USA

Prepared by:

TUV Rheinland of North America, Inc.

Manufacturer's statement - attestation

The manufacturer; OMNI-ID, as the responsible party for the equipment tested, hereby affirms:

a) That he has reviewed and concurs that the test shown in this report are reflective of the operational characteristics of the device for which certification is sought;

b) That the device in this test report will be representative of production units;

c) That all changes (in hardware and software/firmware) to the subject device will be reviewed.

d) That any changes impacting the attributes, functionality or operational characteristics documented in this report will be communicated to the body responsible for approving (certifying) the subject equipment.

Ed Nabrotzky	
Printed name of official	Signature of Official
OMNI-ID 1200 Ridgeway Avenue Rochester NY 14615 USA	09 September 2016
Address	Date
(585) 713-1007	ed.nabrotzky@omni-id.com
Telephone number	Email address of official

Client:	OMNI-ID 1200 Ridgeway Avenue Rochester NY 14615 USA	Ed Nabrotzky Ph: (585) 713-1007 Fax: ed.nabrotzky@omni-id.com	
Identification:	Active RFID	***Serial No.:***	Production Prototypes
Test item:	OMNI-P60 & OMNI-P65	***Date tested:***	19 August 2016
Testing location:	TUV Rheinland of North America 762 Park Avenue Youngsville, NC 27596-9470 U.S.A.	Tel: (919) 554-3668 Fax: (919) 554-3542	
Test specification:	**Emissions: FCC Part 15, Subpart C & RSS-210 Issue 9:** FCC Part 15.231 and RSS-210 Annex A, FCC Part 15.231(b) and RSS-210 A.1.2(a), FCC Parts 15.231(b), 15.209, RSS-210 A.1.2(b) and RSS-GEN A1.1, FCC part 15.231(a)(3) and RSS-210 A.1.1(c), FCC Part 15.207(a) and RSS-GEN 7.2.4, FCC Part 15.231(b) and RSS-210 A.1.2(a),		
Test Result	**The above product was found to be Compliant to the above test standard(s)**		

tested by: Mark Ryan	***reviewed by:*** Robert Richards
8 December 2016 ***Signature***	8 December 2016 ***Signature***
Other Aspects:	**None**

Abbreviations: OK, Pass, Compliant, Complies = passed
Fail, Not Compliant, Does Not Comply = failed
N/A = not applicable

		Industry Canada
90552 and 100881	**Testing Cert #3331.05**	**2932H-1 and 2932H-2**

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1 General Information

1.1 Scope

This report is intended to document the status of conformance with the requirements of the standard(s), based on the results of testing performed on 19 August 2016 on the Active RFID, Model No. OMNI-P60 & OMNI-P65, manufactured by OMNI-ID. This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle. All documentation will be included as a supplement.

1.2 Purpose

Testing was performed to evaluate the EMC performance of the EUT (Equipment Under Test) in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report.

1.3 Revision History

Revision	Date	Description of Revision
- -	11 Oct 2016	Initial Release
1	31 Oct 2016	Corrected typos
2	8 Dec 2016	Corrected typos in subpart references.

1.1 *Summary of Test Results*

Applicant	OMNI-ID 1200 Ridgeway Avenue Rochester NY 14615 USA	**Tel**	(585) 713-1007	**Contact**	Ed Nabrotzky
		Fax		**e-mail**	ed.nabrotzky@omni-id.com

Description	Active RFID	**Model**	OMNI-P60 & OMNI-P65
Serial Number	Production Prototypes	**Test Voltage/Freq.**	3 V DC Lithium Metal battery
Test Date Completed:	19 August 2016	**Test Engineer**	Mark Ryan

Standards	Description	Severity Level or Limit	Worst-case Values	Test Result
FCC Part 15, Subpart C Standard	Radio Frequency Devices-Subpart C: Intentional Radiators	See called out parts below	See Below	**Complies**
RSS-210 Issue 9 Standard	Low-Power Licence-exempt Radiocommunication Devices Category I Equipment	See called out parts below	See Below	**Complies**
FCC Part 15.231 and RSS-210 Annex A	Periodic operation in the band 40.66-40.70MHz and above 70 MHz.	See called out parts below	See Below	Complies
FCC Part 15.231(b) and RSS-210 A.1.2(a)	Radiated Output Power for Fundamental and Harmonic Frequencies	Fund: Shall not exceed 11 mV/m (80.83 dB µV/m) at 3m Harmonics: Shall not exceed 1100µV/m (60.83 dBµV/m) at 3m, (in unresticted bands)	79.84 dBµV /m All harmonics are below the restricted-band limits	Complies
FCC Parts 15.231(b), 15.209, RSS-210 A.1.2(b) and RSS-GEN A1.1	Out-of-Band Spurious Emissions and Band Edges (EUT in Transmit Mode)	Below the applicable limits	46.72 dBµV/m	Complies
FCC part 15.231(a)(3) and RSS-210 A.1.1(c)	Type of Momentayry Signal	Total transmission time shall not exceed two seconds per hour	1.44 seco /h r.	Complies
FCC Part 15.207(a) and RSS-GEN 7.2.4	Conducted Emissions on AC Mains	NA, The EUT is battery operated only	NA	NA
FCC Part 15.231(c) and RSS-210 A.1.3	Occupied Bandwidth	20 dB BW ≤ 0.5% of center freq. 99% BW ≤ 0.5% of center freq.	505.01 kHz 415.23 kHz	Complies

2 Laboratory Information

2.1 Accreditations

2.1.1 US Federal Communications Commission

TUV Rheinland of North America located at 762 Park Avenue, Youngsville, NC 27596-9470 is accredited by the commission for performing testing services for the general public on a fee basis. This laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (Registration No 90552 and 100881). The laboratory scope of accreditation includes: Title 47 CFR Part 15, and 18. The accreditation is updated every 3 years.

2.1.2 ILAC / A2LA

The laboratory has been assessed and accredited by A2LA in accordance with ISO Standard 17025:2005 (Certificate Number: 3331.05, Master Code: 134288). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

2.1.3 Innovation, Science and Economic Development Canada

Registration No.: 2932H-1 The OATS has been accepted by ISED to perform testing to 3 and to 10 meters, based on the test procedures described in ANSI C63.4:2014.

Registration No.: 2932H-2 The 5 meter chamber has been accepted by ISED to perform testing to 3 meters, based on the test procedures described in ANSI C63.4:2014.

2.1.4 Japan – VCCI

The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) is a group that consists of Information Technology Equipment (ITE) manufacturers and EMC test laboratories. The purpose of the Council is to take voluntary control measures against electromagnetic interference from Information Technology Equipment, and thereby contribute to the development of a socially beneficial and responsible state of affairs in the realm of Information Technology Equipment in Japan. TUV Rheinland at the 762 Park Ave. Youngsville, N.C 27596 address has been assessed and approved in accordance with the Regulations for Voluntary Control Measures. (Laboratory Registration No: A-0034).

2.1.5 Sample Calculation – radiated & conducted emissions

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

Field Strength (dBμV/m) = RAW - AMP + CBL + ACF

Where: RAW = Measured level before correction (dBμV)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

$$\mu V/m = 10^{\frac{dB\mu V/m}{20}}$$

Sample radiated emissions calculation @ 30 MHz

Measurement +Antenna Factor–Amplifier Gain+Cable loss=Radiated Emissions (dBuV/m)

25 dBuV/m + 17.5 dB – 20 dB + 1.0 dB = 23.5 dBuV/m

2.2 Measurement Uncertainty Emissions

Total uncertainty

Band 1 uncertainty

Symbol	Source of uncertainty	Uncertainty value		Distribution	divisor	Dependency	Unit conver'n	Std uncertainty	
		+x	-x			multiplier	divisor	+u(Hz)	-u(Hz)
Time base	Time base drift (1x10-9 = 0.001ppm)	0.05	0.05	Rectangular	1.73	1.00	1.00	0.03	0.03
Counter	Counter (±20pHz/Hz+0.6Hz)	0.60	0.60	Rectangular	1.73	1.00	1.00	0.35	0.35
Temp	Ambient temperature uncertainty	1.00	1.00	Rectangular	1.73	1.12	1.00	0.65	0.65
							Combined (RSS) Standard Uncertainty (U_c):	**0.73**	**0.73**
							Expanded Uncertainty (U_{95}):	**1.44**	**1.44**

Band 2 uncertainty

Symbol	Source of uncertainty	Uncertainty value		Distribution	divisor	Dependency	Unit conver'n	Std uncertainty	
		+x	-x			multiplier	divisor	+u(Hz)	-u(Hz)
Time base	Time base drift (1x10-9 = 0.001ppm)	0.92	0.92	Rectangular	1.73	1.00	1.00	0.53	0.53
Counter	Counter (±20pHz/Hz+0.6Hz)	0.62	0.62	Rectangular	1.73	1.00	1.00	0.36	0.36
Temp	Ambient temperature uncertainty	1.00	1.00	Rectangular	1.73	1.12	1.00	0.65	0.65
							Combined (RSS) Standard Uncertainty (U_c):	**0.91**	**0.91**
							Expanded Uncertainty (U_{95}):	**1.78**	**1.78**

Band 3 uncertainty

Symbol	Source of uncertainty	Uncertainty value		Distribution	divisor	Dependency	Unit conver'n	Std uncertainty	
		+x	-x			multiplier	divisor	+u(Hz)	-u(Hz)
Time base	Time base drift (1x10-9 = 0.001ppm)	2.45	2.45	Rectangular	1.73	1.00	1.00	1.41	1.41
Counter	Counter (±20pHz/Hz+0.6Hz)	0.65	0.65	Rectangular	1.73	1.00	1.00	0.37	0.37
Temp	Ambient temperature uncertainty	1.00	1.00	Rectangular	1.73	1.12	1.00	0.65	0.65
							Combined (RSS) Standard Uncertainty (U_c):	**1.60**	**1.60**
							Expanded Uncertainty (U_{95}):	**3.13**	**3.13**

Total uncertainty (all bands)	Combined (RSS) Standard Uncertainty (U_c):	**1.98**	**1.98**
	Expanded Uncertainty (U_{95}):	**3.88**	**3.88**

2.2.1 Total Carrier Power Measurement Uncertainty

Total uncertainty

Power meter & sensor

Symbol	Source of uncertainty	Uncertainty value		Distribution	divisor	Dependency multiplier	Unit conver'n divisor	Std uncertainty	
		+x	-x					+u(dB)	-u(dB)
Meter ref	Power meter reference level	1.500	1.500	Rectangular	1.732	1.000	23.000	0.038	0.038
Cal fact	Cal factor uncert	2.300	2.300	Rectangular	1.732	1.000	23.000	0.058	0.058
Range err	Range to range change error	0.500	0.500	Rectangular	1.732	1.000	23.000	0.013	0.013
Meter lin	Power meter linearity	0.500	0.500	Rectangular	1.732	1.000	23.000	0.013	0.013
	Mismatch when calibrating	0.022	0.022		1.000	1.000	1.000	0.022	0.022
					1.000	1.000	1.000	0.000	0.000
							Combined (RSS) Standard Uncertainty (u_{c1}):	**0.074**	**0.074**

Uncertainty when measuring atten/cable

Symbol	Source of uncertainty	Uncertainty value		Distribution	divisor	Dependency multiplier	Unit conver'n divisor	Std uncertainty	
		+x	-x					+u(dB)	-u(dB)
	measurement	0.175	0.175		1.000	1.000	1.000	0.175	0.175
Range err	Range to range change error	0.500	0.500	Rectangular	1.732	1.000	23.000	0.013	0.013
Meter lin	Power meter linearity	0.500	0.500	Rectangular	1.732	1.000	23.000	0.013	0.013
							Combined (RSS) Standard Uncertainty (U_{c2}):	**0.175**	**0.175**

Carrier power measurement

Symbol	Source of uncertainty	Uncertainty value		Distribution	divisor	Dependency multiplier	Unit conver'n divisor	Std uncertainty	
		+x	-x					+u(dB)	-u(dB)
	Mismatch during power measurement	0.643	0.643		1.000	1.000	1.000	0.643	0.643
Atten PI	Attenuator power influence	0.750	0.750	Rectangular	1.732	1.000	1.000	0.433	0.433
Temp	Temperature uncertainty	1.000	1.000	Rectangular	1.732	4.176	23.000	0.105	0.105
Supply	Supply uncertainty	0.100	0.100	Rectangular	1.732	10.440	23.000	0.026	0.026
Random	Random uncertainty (see note in section 6.4.7 , Part 1)	0.010	0.010	Normal	1.000	1.000	1.000	0.010	0.010
Time duty	Time duty cycle	2.000	2.000	Normal	1.000	1.000	23.000	0.087	0.087
					1.000	1.000	1.000	0.000	0.000
							Combined (RSS) Standard Uncertainty (U_{c3}):	**0.788**	**0.788**

Total uncertainty

Symbol	Source of uncertainty	Uncertainty value		Distribution	divisor	Dependency multiplier	Unit conver'n divisor	Std uncertainty	
		+u or x	-u or x					+u(dB)	-u(dB)
Uc1	Power meter & sensor	0.074	0.074		1.000	1.000	1.000	0.074	0.074
Uc2	Uncertainty when measuring atten/cable	0.175	0.175		1.000	1.000	1.000	0.175	0.175
Uc3	Carrier power measurement	0.788	0.788		1.000	1.000	1.000	0.788	0.788
					1.000	1.000	1.000	0.000	0.000
							Combined (RSS) Standard Uncertainty (U_c):	**0.810**	**0.810**
							Expanded Uncertainty (U_{95}):	**1.588**	**1.588**

2.2.2 Total Adjacent channel power Measurement Uncertainty

Total uncertainty

Total relative RF level uncertainty

Symbol	Source of uncertainty	Uncertainty value		Distribution divisor		Dependency multiplier	Unit conver'n divisor	Std uncertainty	
		+x	-x					+u(dB)	-u(dB)
Filter pwr bw	Filter power bw	0.200	0.200	Rectangular	1.732	1.000	1.000	0.115	0.115
Relative acc	Relative accuracy	0.500	0.500	Rectangular	1.732	1.000	1.000	0.289	0.289
Random	Random uncertainty (see note in section 6.4.7 , Part 1)	0.110	0.110	Normal	1.000	1.000	1.000	0.110	0.110
Deviation	Deviation uncertainty	30.000	30.000	Rectangular	1.732	0.054	23.000	0.041	0.041
6dB pt unc	Uncertainty of 6dB point	0.075	0.075	Rectangular	1.732	15.524	1.000	0.672	0.672
					1.000	0.000	23.000	0.000	0.000
					1.000	1.000	1.000	0.000	0.000
					1.000	1.000	1.000	0.000	0.000
					1.000	1.000	1.000	0.000	0.000
							Combined (RSS) Standard Uncertainty (u_c):	**0.750**	**0.750**
							Expanded Uncertainty (U_{95}):	**1.470**	**1.470**

2.2.3 Total Conducted Spurious Emissions Measurement Uncertainty

Total uncertainty

Total uncertainty

Symbol	Source of uncertainty	Uncertainty value		Distribution divisor		Dependency multiplier	Unit conversion divisor	Std uncertainty	
		+x	-x					+u(dB)	-u(dB)
	Total Mismatch EUT to Spectrum Anal.	1.01	1.01		1.00	1.00	1.00	1.01	1.01
	Total Mismatch cal of Spectrum Analyzer	0.30	0.30		1.00	1.00	1.00	0.30	0.30
SA Cal ref	Spec. Ana. Cal output reference level	0.30	0.30	Rectangular	1.73	1.00	1.00	0.17	0.17
SA freq res.	Spec. Ana. frequency response	2.50	2.50	Rectangular	1.73	1.00	1.00	1.44	1.44
SA BW Sw	Spec. Ana. Bandwidth switching	0.50	0.50	Rectangular	1.73	1.00	1.00	0.29	0.29
SA Log Fid	Spec. Ana. Log fidelity	1.50	1.50	Rectangular	1.73	1.00	1.00	0.87	0.87
Supply Volt	Supply voltage uncertainty	0.10	0.10	Rectangular	1.73	10.44	23.00	0.03	0.03
Fltr loss unc	Filter loss uncertainty	0.15	0.15	Rectangular	1.73	1.00	1.00	0.09	0.09
Atten unc	Attenuator loss uncertainty	0.15	0.15	Rectangular	1.73	1.00	1.00	0.09	0.09
SA i/p att sw	SA atten switching uncertainty	0.20	0.20	Rectangular	1.73	1.00	1.00	0.12	0.12
Att pwr coef	Attenuator power coefficient	0.30	0.30	Rectangular	1.73	1.00	1.00	0.17	0.17
Cable	Measurement cable loss uncert	0.20	0.20	Normal	1.00	1.00	1.00	0.20	0.20
Rnd	Random contribution (see note in section 6.4.7 , Part 1)	0.20	0.20	Normal	1.00	1.00	1.00	0.20	0.20
							Combined (RSS) Standard Uncertainty (u_c):	**2.05**	**2.05**
							Expanded Uncertainty (U_{95}):	**4.01**	**4.01**

2.2.4 Total Frequency Deviation Measurement Uncertainty

Total uncertainty

Total deviation uncertainty

Symbol	Source of uncertainty	Uncertainty value		Distribution		Dependency	Unit conver'n	Std uncertainty	
		+x	-x	divisor		multiplier	divider	+u(%)	-u(%)
Dev Unc	Deviation uncertainty	1.00	1.00	Rectangular	1.73	1.00	1.00	0.58	0.58
Last Digit	+/- last digit of deviation meter display	0.25	0.25	Rectangular	1.73	1.00	1.00	0.14	0.14
Res mod	Residual modulation	0.50	0.50	Rectangular	1.73	1.00	1.00	0.29	0.29
Rand unc	Random uncertainty (see note in section 6.4.7 , Part 1)	0.00	0.00	Normal	1.00	1.00	1.00	0.00	0.00
						Combined (RSS) Standard Uncertainty (u_c):		**0.66**	**0.66**
						Expanded Uncertainty (U_{95}):		**1.30**	**1.30**

2.2.5 Total Response Measurement Uncertainty

Deviation uncertainty

Symbol	Source of uncertainty	Uncertainty value		Distribution		Dependency	Unit conver'n	Std uncertainty	
		+x	-x	divisor		multiplier	divider	+u(%)	-u(%)
Dev Unc	Deviation uncertainty	1.00	1.00	Rectangular	1.732	1.00	1.00	0.58	0.58
AF Osc	AF oscillator uncertainty	0.70	0.70	Rectangular	1.732	1.00	1.00	0.40	0.40
AC volt mtr	AC Volt meter uncertainty	4.00	4.00	Rectangular	1.732	1.00	1.00	2.31	2.31
AF gain unc	AF gain uncertainty	2.00	2.00	Rectangular	1.732	1.00	1.00	1.15	1.15
Rand unc	Random uncertainty (see note in section 6.4.7 , Part 1)	0.00	0.00	Normal	1.000	1.00	1.00	0.00	0.00
						Combined (RSS) Standard Uncertainty (u_{c1}):		**2.68**	**2.68**

Total uncertainty

Symbol	Source of uncertainty	Uncertainty value		Distribution		Dependency	Unit conver'n	Std uncertainty	
		+u or x	-u or x	divisor		multiplier	divider	+u(dB)	-u(dB)
Uc1	Deviation uncertainty	2.68	2.68		1.000	1.00	11.50	0.23	0.23
					1.000	1.00	1.00	0.00	0.00
					1.000	1.00	1.00	0.00	0.00
					1.000	1.00	1.00	0.00	0.00
						Combined (RSS) Standard Uncertainty (U_c):		**0.23**	**0.23**
						Expanded Uncertainty (U_{95}):		**0.46**	**0.46**

2.3 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Standard 17025:2005. Equipment calibration records are kept on file at the test facility.

2.4 Measurement Equipment Used

Equipment	Manufacturer	Model #	Serial/Inst #	Last Cal dd/mm/yy	Next Cal dd/mm/yy
Radiated Emissions (5 Meter Chamber)					
Receiver, EMI	Rohde & Schwarz	ESIB40	100043	16-Aug-16	16-Aug-17
Receiver, EMI	Rohde & Schwarz	ESCI 7	100917	16-Aug-16	16-Aug-17
Spectrum Analyzer	Agilent Tec.	E7405A	US39440161	16-Aug-16	16-Aug-17
Amplifier, preamp	Agilent Technologies	8449B	3008A01480	20-Aug-15	20-Aug-17
Antenna Loop	EMCO	6502	3336	17-Dec-15	17-Dec-17
Ant. BiconiLog	Chase	CBL6140A	1108	06-Oct-15	06-Oct-17
Antenna Horn 1-18GHz	EMCO	3115	2236	18-Nov-15	18-Nov-17
Antenna Horn 18-26.5 GHz	ATM	42-442-6/cal	G181104-01	31-Dec-14	31-Dec-16
Cable, Coax	MicroCaox	MKR300C-0-0-1200-500500	002	17-Aug-16	17-Aug-17
Cable, Coax	MicroCaox	MKR300C-0-1968-500310	005	17-Aug-16	17-Aug-17
Cable, Coax	MicroCaox	UFB29C-1-5905-50U-50U	009	17-Aug-16	17-Aug-17
Cable, Coax	Andrew	FSJ1-50A	045	20-Aug-15	20-Aug-16
General Laboratory Equipment					
Meter, Multi	Fluke	179	90580752	15-Aug-16	15-Aug-17
Meter, Temp/Humid/Barom	ExTech	SD700	Q677933	21-Dec-15	21-Dec-17
Meter, Temp/Humid/Barom	ExTech	SD700	Q677942	21-Dec-15	21-Dec-17

Note: The test equipment used was calibrated in mid-August. There were no discrepancies issued from the previous calibration.

3 Product Information

3.1 Product Description

The model is OMNI-P60 and OMNI-P65 tag is powered by a 3V Lithium Metal primary battery and is designed to tag materials and equipment in the industrial, oil & gas and manufacturing industries. The usage environments are industrial factories, warehouses and commercial locations. The transmitter will communicate with a gateway device to exchange presence and location information between the tag and the back end process control system.

The EUT operates on one channel of a thirteen channel band. Three sets of each the EUT were provided for testing; one each for the low medium and high frequencies used. Test samples of both modulations used by the EUT (OMNI and 802.15.4F protocols) were also supplied. The transmissions are non-periodic that will have less than 2 seconds of transmissions time per hour. Fresh batteries were installed.

The EUT model is available in two part numbers:

Model Table

Model	FCC-ID	Part Number	Protocol	-20dBc BW	UID
OMNI-P60	N74-OMNIP60	CP11564	**OMNI**	~ 270 kHz	D9AE1E00xxxxxxxx
OMNI-P65	N74-OMNIP60	CP11565	**802.15.4F**	~ 510 kHz	9C611D0200xxxxxx

OMNI-P60 & OMNI-P65

The hardware for CP11564 and CP11565 are identical. The only difference is the firmware loaded into the microcontroller to provide the **Proview** and **802.15.4F** protocols.

The Active tag operates with an internal 3.0 DC Lithium Metal battery only, on one of the thirteen channels from 433.272 to 434.568 MHz and transmits an average of once every 3 seconds, or when the button is pushed, for duration of 1.2ms or 1.3ms for button push. (See section 4.2 of this report).

3.2 Equipment Modifications

No modifications were needed to bring product into compliance.

3.3 Test Plan

The EUT product information, test configuration, mode of operation, test types, test procedures, test levels, pass/failure criteria, in this report were carried out per the product test plan located in appendix A of this report.

4 Radiated Emissions in Transmit mode

4.1 Radiated emissions - FCC Parts 15.231, RSS-210 A1.1

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following limits:
Fundamental Frequency range: 260 to 470 MHz – 3750 to 12500 mV/m (Linear interpolation) at 3m.
Harmonic Frequencies: 375 to 1250 µV/m (Linear interpolation) at 3m.
Spurious Emissions: To the limits of FCC Part 15.209 and RSS-GEN 7.2.1.

4.1.1 Over View of Test

Results	**Complies** (as tested per this report)				**Date**	9 August 2016	
Standard	FCC Parts 15.205, 15.209, 15.215(c), 15.231(b), RSS-210 A.1, and RSS-GEN						
Product Model	OMNI-P60 & OMNI-P65			**Serial#**	Production Prototypes		
Test Set-up	Tested in a 5m Semi Anechoic chamber, placed on a non-conductive foam table.						
EUT Powered By	3.0 V DC Lithium Metal battery	**Temp**	77º F	**Humidity**	42%	**Pressure**	1005 mbar
Perf. Criteria	(Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Mark Ryan		

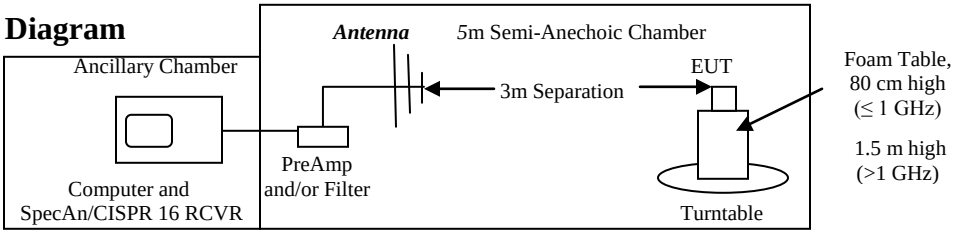
4.1.2 Test Procedure

Testing was performed in accordance with 47 CFR Part 15, ANSI C63.10:2013, RSS-GEN Issue 4. These test methods are listed under the laboratory's A2LA Scope of Accreditation. This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

4.1.3 Deviations

Since all emissions outside the band are within the limits of FCC Part 15.209 and RSS-GEN 7.2.1, the emissions shown below are also compliant with FCC Parts 15.205, 15.209, 15.215(c), 15.231(b), RSS-210 A1, and RSS-GEN 7.2.1.

4.1.4 Test Setup Block Diagram



4.1.5 Final Test

All final radiated spurious emissions measurements were below (in compliance) the limits.

The worst –case emissions are shown below. All other emissions are on file at TUV Rheinland.

4.1.5.1 Worst Case Emissions inside the Frequency Band

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBµV/m)	Magin to Limit (dBµV/m)
Orientation A:										
433.88	H	1.2	186	41.24	0	2.39	20.9	64.53	80.83	-16.30
433.88	H	1.2	186	45.24	0	2.39	20.9	68.53	100.83	-32.30
433.88	V	1	0	54.84	0	2.39	20.9	78.13	80.83	-2.70
433.88	V	1	0	58.71	0	2.39	20.9	82	100.83	-18.83
Orientation B:										
433.88	H	2.2	178	55.85	0	2.39	20.9	79.14	80.83	-1.69
433.88	H	2.2	178	59.75	0	2.39	20.9	83.04	100.83	-17.79
433.88	V	2	841	45.94	0	2.39	20.9	69.23	80.83	-11.60
433.88	V	2	81	49.89	0	2.39	20.9	73.18	100.83	-27.65
Orientation C:										
433.88	H	1.8	176	56.55	0	2.39	20.9	79.84	80.83	-0.99
433.88	H	1.8	176	60.56	0	2.39	20.9	83.85	100.83	-16.98
433.88	V	1.9	279	47.33	0	2.39	20.9	70.62	80.83	-10.21
433.88	V	1.9	279	51.36	0	2.39	20.9	74.65	100.83	-26.18

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor

Notes: **GREEN = Average Detector, Blue = Peak Detector**
The Limit using the Peak Detector is 20dB higher than the Average Detector limit.
The Spec limit has been converted from µV/m to dBµV/m for this table.
All other data is on file at TUV Rheinland.

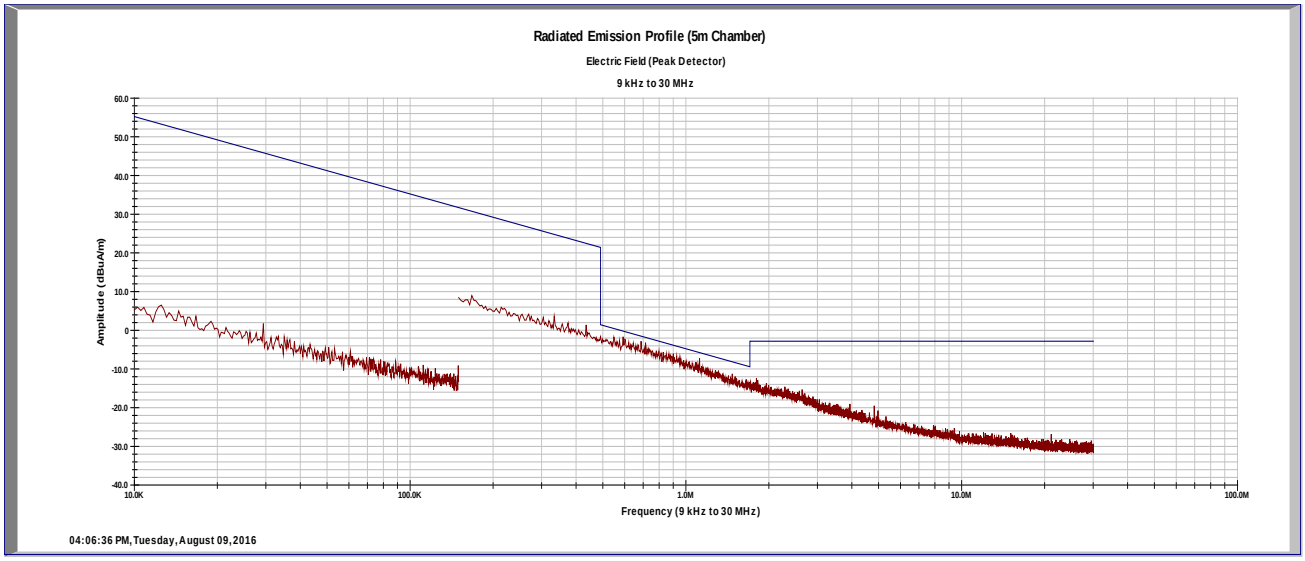
This highlighted frequency and orientation was Highest Emission (Orientation C).

4.1.5.2 Maximum Time-weighted Emission:

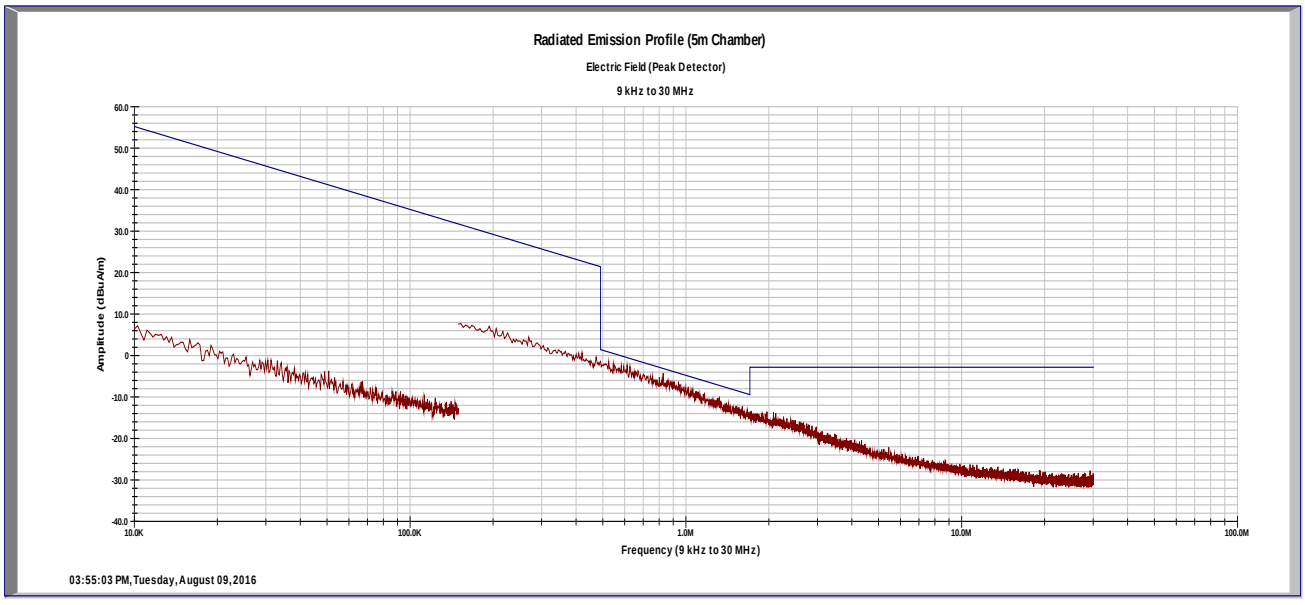
The firmware of the EUT was modified to transmit continuously at 100% Duty cycle. This is considered to be the worst-case scenario.

4.1.5.3 Emissions Outside the Frequency Band:

9kHz to 30 MHz Parallel:



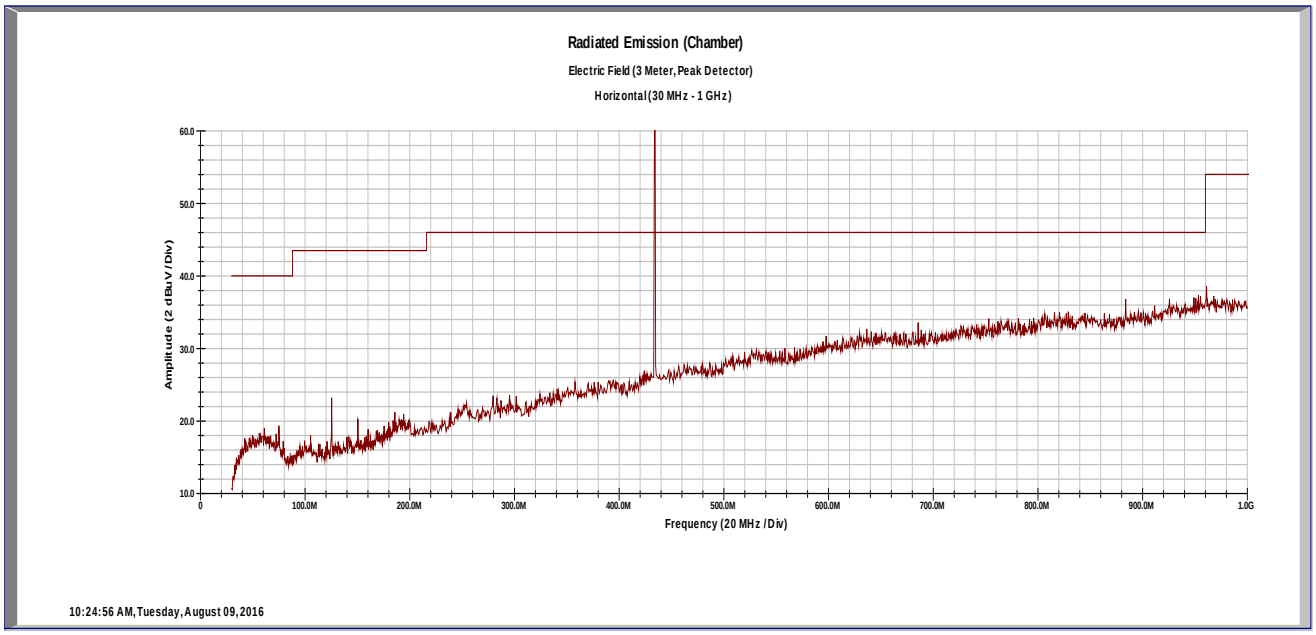
9kHz to 30 MHz Perpendicular:



Note: No measurable emissions found.

Radiated Emissions – 30 MHz to 1000 MHz

Horizontal



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor

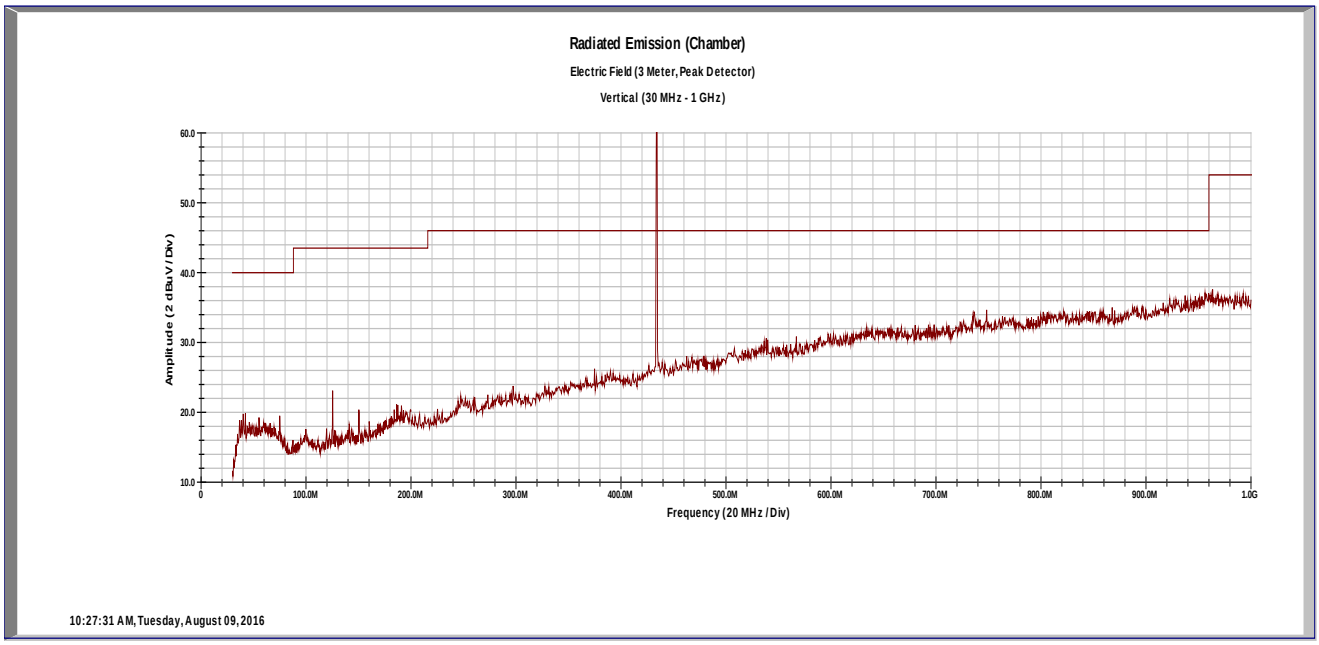
Notes: Emission shown is the fundamental of the RFID transmitter.
Otherwise no measurable frequencies were found.

The spikes shown around 100 MHz are anomalies of the preamp in the analyzer.

The low / high frequencies with both modulations yielded similar results.

Radiated Emissions – 30 MHz to 1000 MHz

Vertical



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor

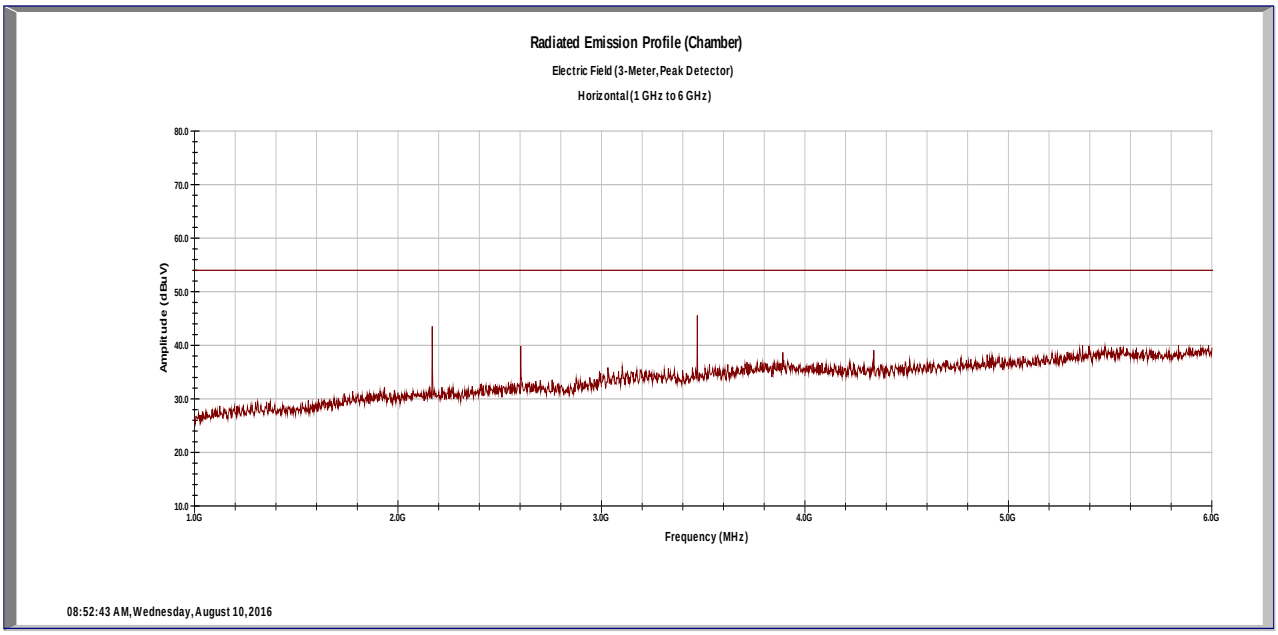
Notes: Emission shown is the fundamental of the RFID transmitter.
Otherwise no measurable frequencies were found.

The spikes shown around 100 MHz are anomalies of the preamp in the analyzer.

The low / high frequencies with both modulations yielded similar results.

Radiated Emissions – 1 GHz to 6 GHz

Horizontal



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
1301.60	H	1	158	38.95	34.81	6.12	25.50	35.76	54.00	-18.24
1301.60	H	1	158	46.81	34.81	6.12	25.50	43.62	74.00	-30.38

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor

Notes: **GREEN = Average Detector, Blue = Peak Detector**

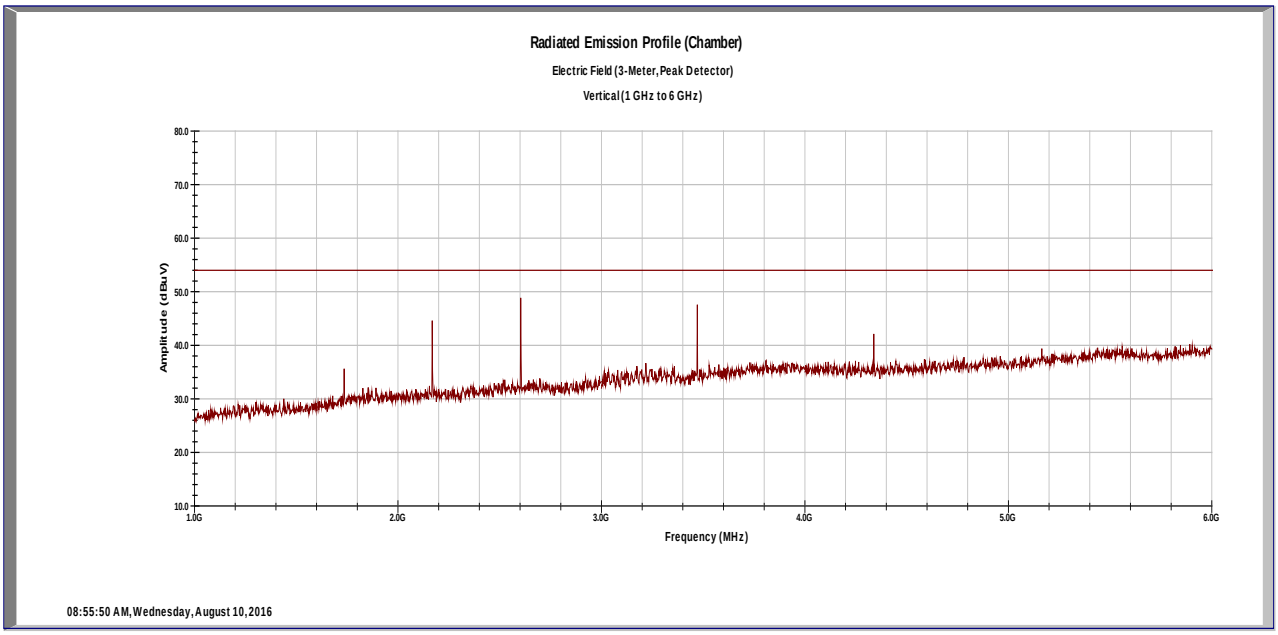
The Limit using the Peak Detector is 20dB higher than the Average Detector limit.

Other worst-case emissions are on the Vertical polarity (see next page)

The low/mid/high frequencies show similar results. All plots are on file at TUV Rheinland.

Radiated Emissions Radiated Emissions – 1 GHz to 6 GHz

Vertical



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
2169.20	V	1.3	0	39.72	34.28	7.84	27.84	41.12	54.00	-12.88
2169.20	V	1.3	0	47.44	34.28	7.84	27.84	48.84	74.00	-25.16
2603.20	V	1.3	0	43.28	34.15	8.55	29.04	46.72	54.00	-7.28
2603.20	V	1.3	0	49.41	34.15	8.55	29.04	52.85	74.00	-21.15
3471.20	V	1.7	103	38.27	34.13	9.91	31.42	45.47	54.00	-8.53
3471.20	V	1.7	103	45.67	34.13	9.91	31.42	52.87	74.00	-21.13

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor

Notes: **GREEN = Average Detector, Blue = Peak Detector**

The Limit using the Peak Detector is 20dB higher than the Average Detector limit.

The low/mid/high frequencies show similar results. All plots are on file at TUV Rheinland.

4.2 Conducted Emissions on AC Mains – FCC 15.207(a) and RSS-GEN 7.2.4

This test measures the electromagnet levels of spurious signals generated by the EUT on the AC power line that may affect the performance of other nearby electronic equipment.

4.2.1 Over View of Test

Results	**NA** EUT is battery operated only				**Date**	NA	
Standard	FCC Part 15.207(a) and RSS-GEN 7.2.4						
Product Model	OMNI-P60 & OMNI-P65			**Serial#**	NA		
Test Set-up	Tested in shielded room. EUT placed on table, see test plans for details						
EUT Powered By	3.0 V DC Lithium Metal battery	**Temp**	NA	**Humidity**	NA	**Pressure**	NA
Frequency Range	NA						
Perf. Criteria	(Below Limit)	**Perf. Verification**	Readings Under Limit for L1 & Neutral				
Mod. to EUT	None	**Test Performed By**	NA				

4.2.2 Test Procedure

Conducted emissions tests were performed using the procedures of ANSI C64.4: 2014, including methods for signal maximizations and EUT configuration. The photos included with the report show the EUT in its maximized configuration.

4.2.3 Deviations

The Test sample is battery operated only. It does not have provision for external power of any kind.

4.2.4 Final Test

This test is not applicable for the device submitted for testing.

4.3 Periodic operation – FCC 15.231(a)(3) and RSS-210 A1.1.1

The EUT utilizes a non-predetermined interval of transmissions that averages a 1.2 ms burst every three seconds. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

4.3.1 Over View of Test

Results	**Complies** EUT is battery operated only					**Date**	10 August 2016
Standard	FCC part 15.231(a)(3) and RSS-210 A.1.1(c)						
Product Model	OMNI-P60 & OMNI-P65			**Serial#**	Production Prototypes		
Test Set-up	Tested in shielded room. EUT placed on table, see test plans for details						
EUT Powered By	3.0 V DC Lithium Metal battery	**Temp**	75º F	**Humidity**	40%	**Pressure**	1000 mbar
Frequency Range	150 kHz – 30 MHz						
Perf. Criteria	(Below Limit)	**Perf. Verification**	Readings Under Limit for L1 & Neutral				
Mod. to EUT	None	**Test Performed By**	Mark Ryan				

4.3.2 Test Procedure

Measure the number of pulses in a one minute period. Measure the pulse width of the transmission. Multiply: number of pulses/minutes * 60 minutes * pulse width. The product must be less than 2 seconds.

4.3.3 Deviations

The Test sample is battery operated only. It does not have provision for external power of any kind.

4.3.4 Final Test

The low/mid/high frequencies with both modulations show similar results.

All plots are on file at TUV Rheinland.

Number of Pulses/hour = 20 pulses per minute * 60 minutes = 1200 pulses per hour.

1200 pulses * 1.2 ms/ pulse = 1440 ms / hour or 1.44 seconds per hour.

When the ID button on the EUT is pushed a one-time 1.3 ms pulse will be sent on the next transmission.

Note: The ID button on the EUT would have to be pushed at least 430 times in one hour before it would become non-compliant with the rules of this section.

4.3.1 Final Data

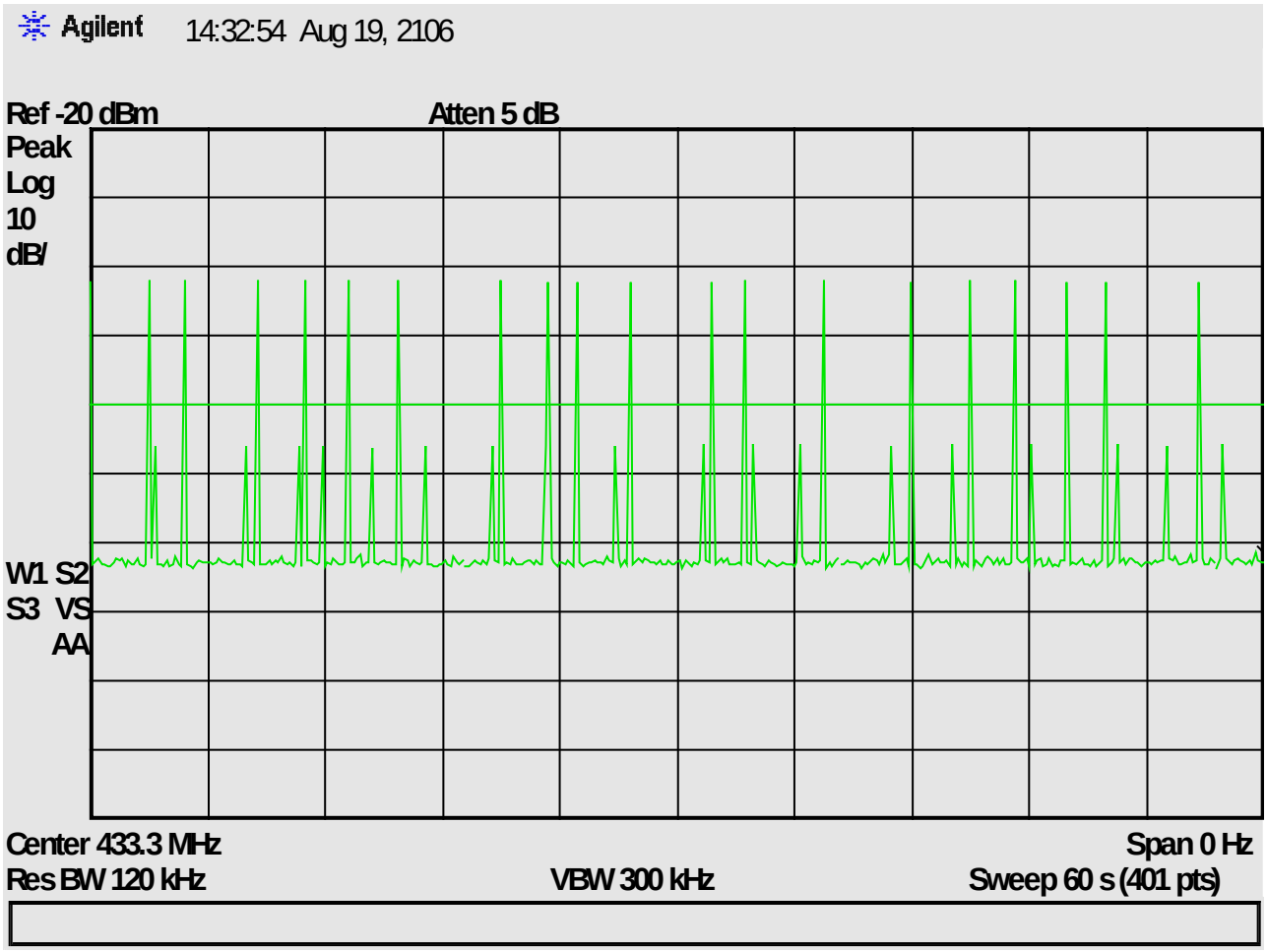


Figure 1 – 20 non-periodic pulses in 60 second

Span = 0, RBW = 120 kHz VBW = 300 kHz (≥ 3x RBW), Sweep = 60 s

Note: The lower peaks were from another apparatus placed on the other side of the chamber and are to be ignored.

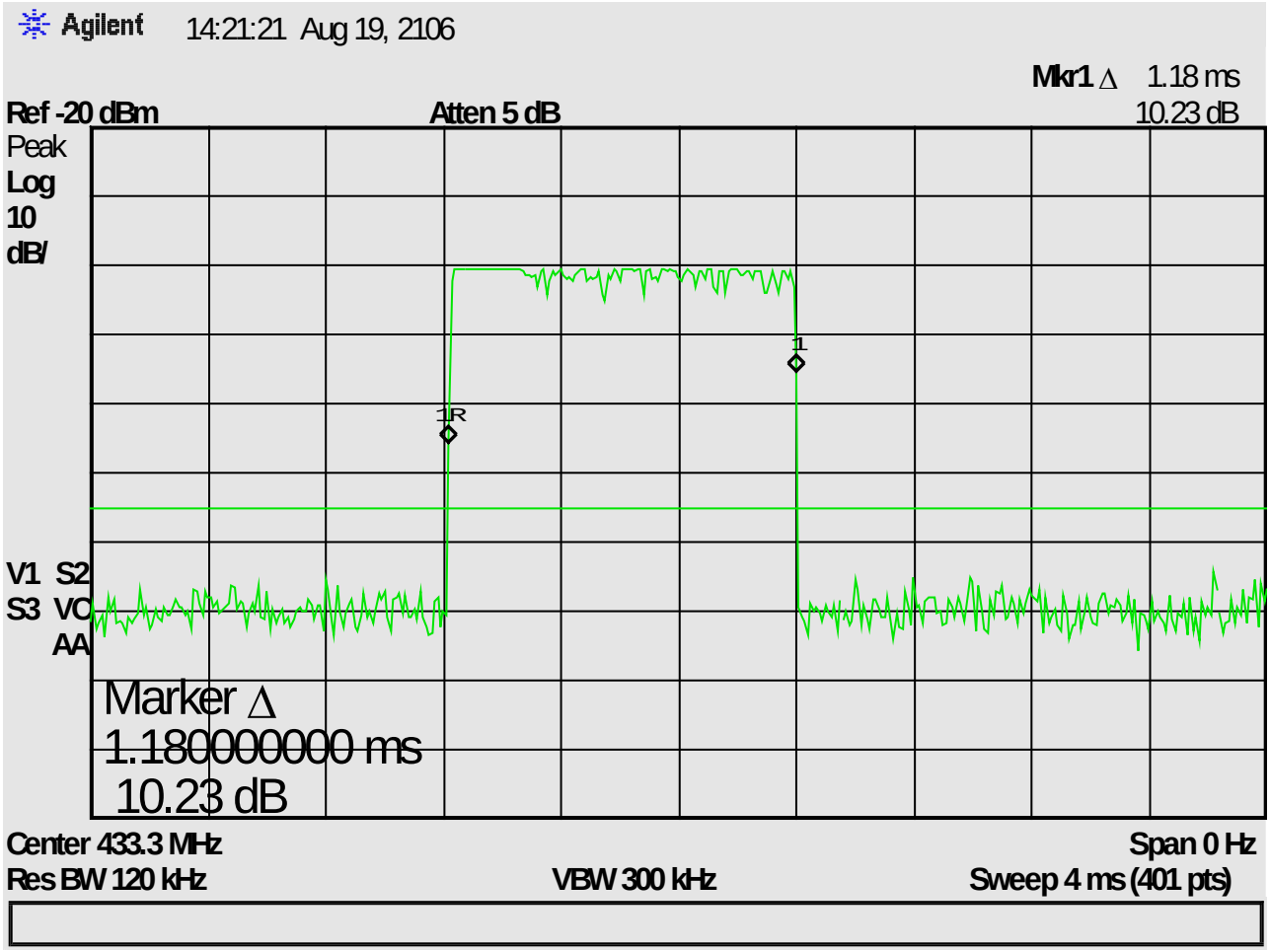


Figure 2 – Pulse duration = 1.2 ms (Normal Operation)

Span = 0, RBW = 120 kHz VBW = 300 kHz (≥ 3x RBW), Sweep = 4 ms

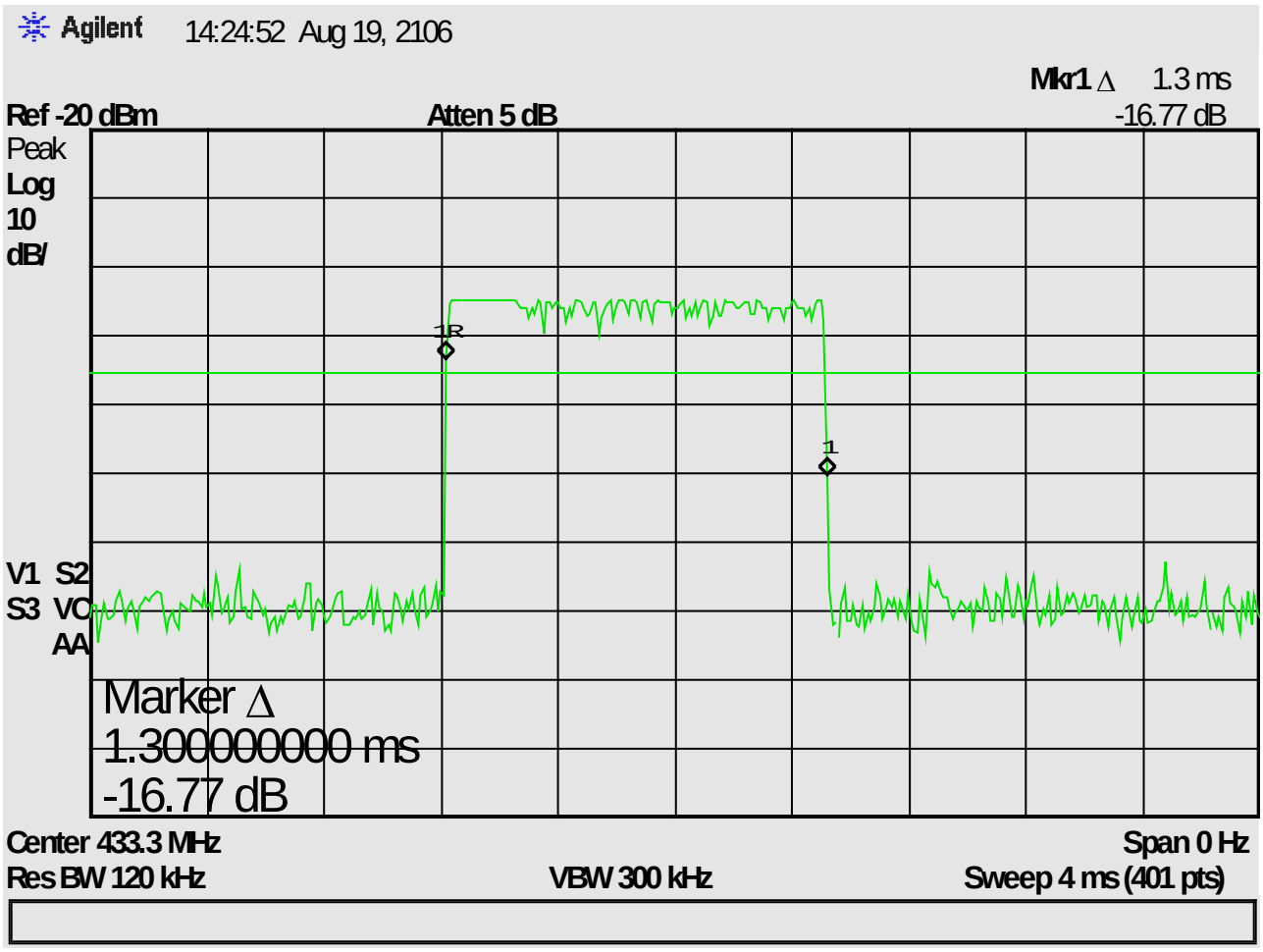


Figure 3 – Pulse duration = 1.3 ms (Normal Operation)

Span = 0, RBW = 120 kHz VBW = 300 kHz (≥ 3x RBW), Sweep = 4 ms

Note: when the button on the EUT is pushed, an identifier will be transmitted added to the next normal RFID data packet.

Note: The ID button on the EUT would have to be pushed more than 430 times in one hour before it would become non-compliant with the rules of this section

4.4 20dB Bandwidth

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. The Bandwidth is determined at the points 20dB down from the modulated carrier. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. This device operates below 900 MHz.

4.4.1 Test Over View

Results	**Complies** (as tested per this report)					**Date**	9 August 2016
Standard	FCC Part 15.231(c)						
Product Model	OMNI-P60 & OMNI-P65			**Serial#**	Production Prototypes		
Test Set-up	Direct Measurement from antenna port						
EUT Powered By	3 V DC Lithium Metal battery	**Temp**	73º F	**Humidity**	35%	**Pressure**	998 mbar
Perf. Criteria	(Below Limit)			**Perf. Verification**	Readings Under Limit		
Mod. to EUT	None			**Test Performed By**	Mark Ryan		

4.4.2 Test Procedure

For the purpose of part 15.231(c), the -20dB bandwidth shall be no wider than .25% of the center frequency for devices operating between 70 MHz to 900 MHz.

4.4.3 Deviations

The firmware of the EUT can utilize two different types of modulations. The 802.15.4F protocol modulation was chosen (worst case) as it is about twice the bandwidth of the OMNI Protocol (269kHz - 20dBc BW). Otherwise, there were no deviations from the test methodology.

The plot(s) for the -20dBc Bandwidths are on file at TUV Rheinland.

4.4.4 Final Results

The measured -20dB bandwidth is 511.42 kHz, which is well below the 1.083 MHz limit.

The EUT is compliant with the standards.

Frequency (MHz)	-20dB BW (kHz)	Limit (kHz)	Margin (kHz)	Modulation used	Part Number #
433.27	505.01	1083.18	-578.17	802.15.4F	CP11565
433.92	272.55	1084.80	-812.25	OMNI	CP11564
434.58	436.07	1086.45	-650.38	802.15.4F	CP11565

-20dBc Bandwidth.

4.4.5 Final Data

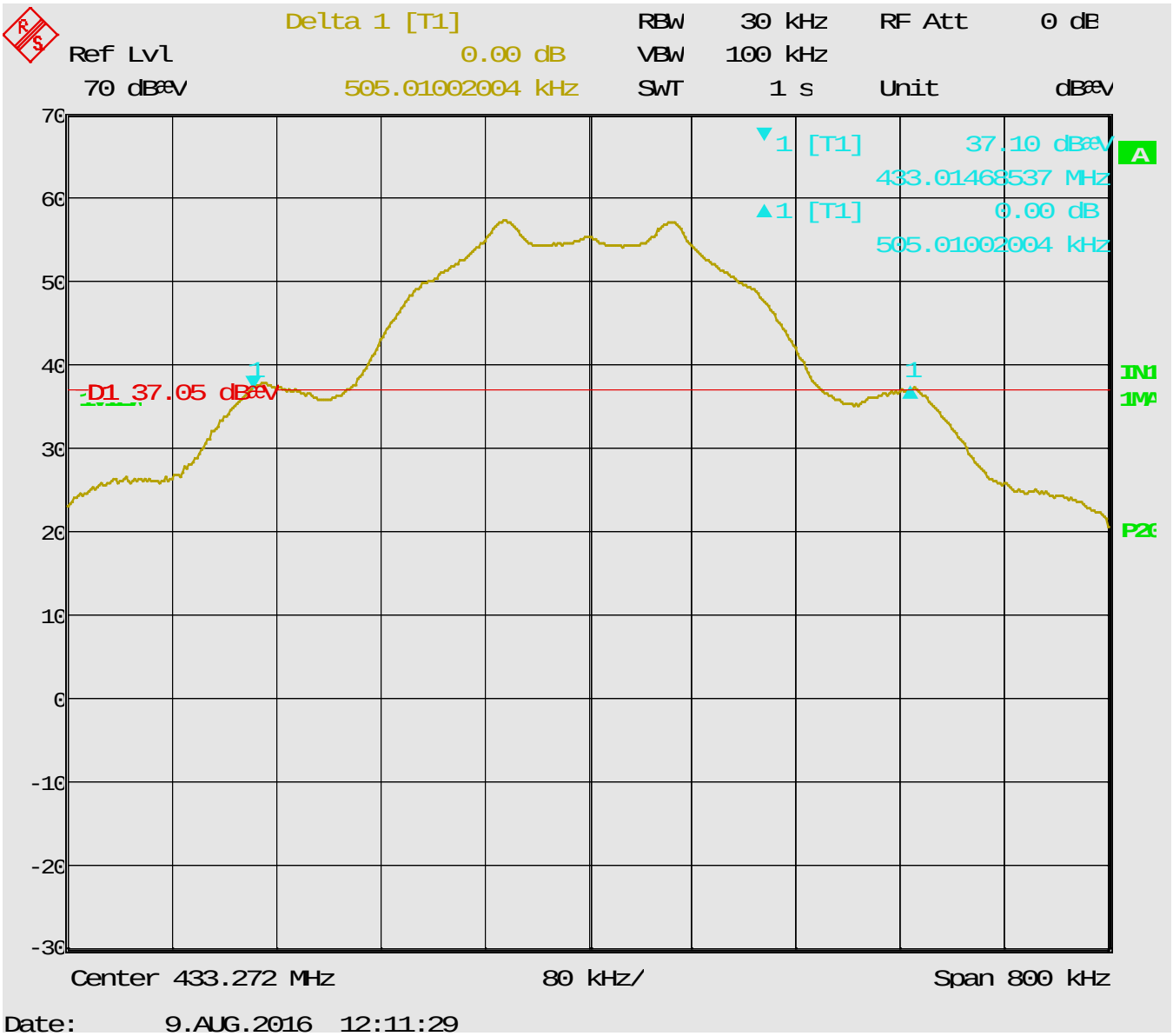


Figure 4 – The -20dB Bandwidth (802.15.4F Protocol) = 511.12 kHz. The Worst-Case is shown.

Span = 800 kHz, RBW = 30 kHz (4% of Span), VBW = 100 kHz (≥ 3x RBW)

Note; no correction factors were applied to plot as this is only a BW measurement.

The EUT is compliant to the requirements of FCC Part 15.231(c).

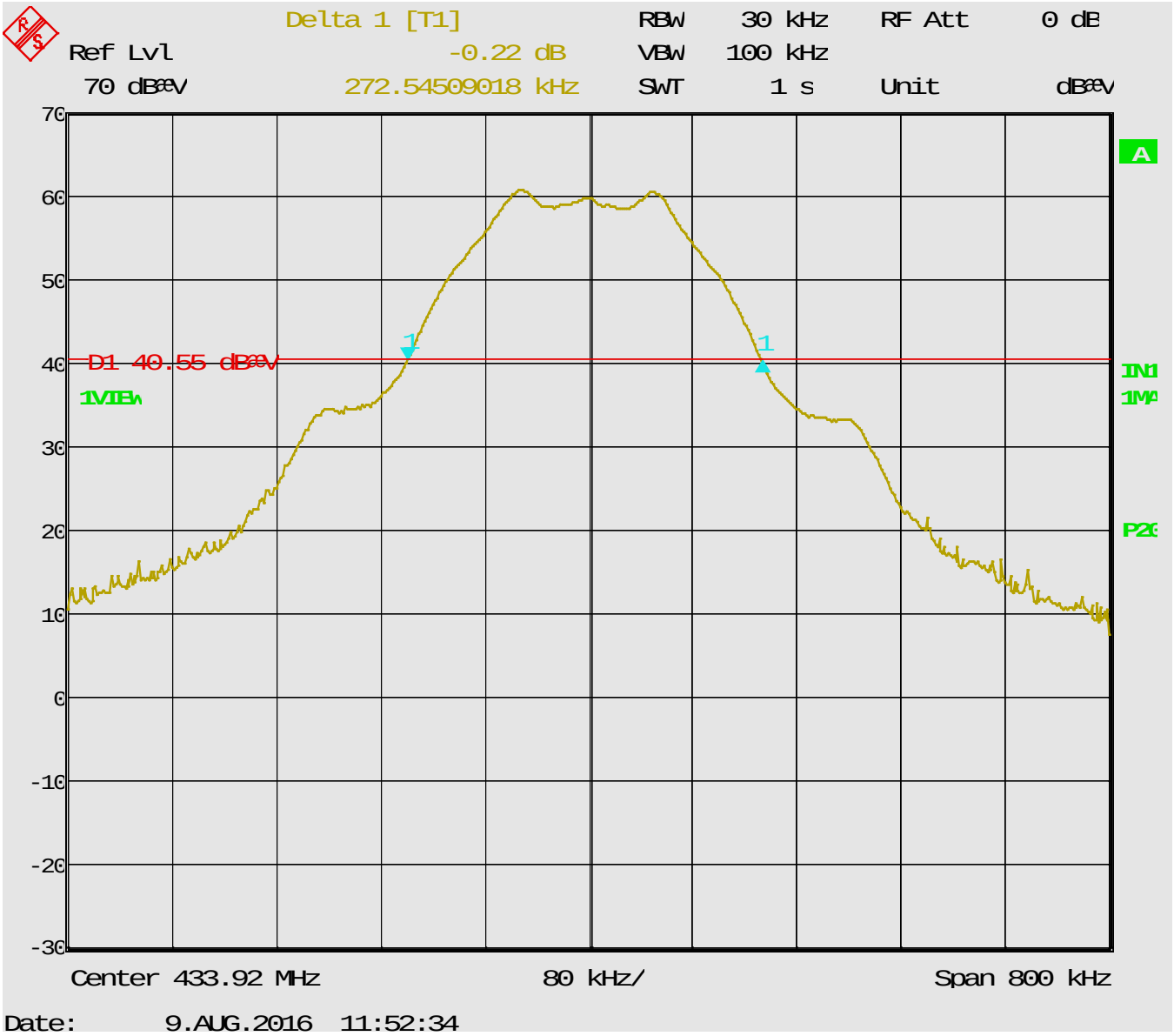


Figure 5 – The -20dB Bandwidth (OMNI protocol) = 269.34 kHz. The Worst-Case is shown.

Span = 800 kHz, RBW = 30 kHz (4% of Span), VBW = 100 kHz (≥ 3x RBW)

Note; no correction factors were applied to plot as this is only a BW measurement.

The EUT is compliant to the requirements of FCC Part 15.231(c).

4.5 99% Power Bandwidth

For the purpose of Section A1.1, the 99% bandwidth shall be no wider than .25% of the center frequency for devices operating between 70-900MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. This device operates below 900 MHz.

4.5.1 Test Over View

Results	**Complies** (as tested per this report)					**Date**	1 February 2016
Standard	RSS-210 Section A.1.3						
Product Model	OMNI-P60 & OMNI-P65			**Serial#**	Production Prototypes		
Test Set-up	Direct Measurement from antenna port						
EUT Powered By	3 V DC Lithium Metal battery	**Temp**	73º F	**Humidity**	35%	**Pressure**	998 mbar
Perf. Criteria	(Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Mark Ryan		

4.5.2 Test Procedure

For the purpose of Section A1.1, the 99% bandwidth shall be no wider that 0.25% of the center frequency for devices operating between 70 MHz and 900 MHz.

4.5.3 Deviations

The firmware of the EUT can utilize two different types of modulations. The 802.15.4F protocol modulation was chosen (worst case) as it is about twice the bandwidth of the OMNI Protocol (237 kHz 99% BW). Otherwise, there were no deviations from the test methodology.

The plot(s) for the 99% Bandwidths are on file at TUV Rheinland.

4.5.4 Final Results

The measured 99% bandwidth is 1083.18 kHz, which is well below the 1.083 MHz limit.

The EUT is compliant with the standards.

Freq. (MHz)	Meas BW (kHz)	BW Limit (kHz)	Margin (kHz)	Modulation used	Model of EUT
433.27	415.23	1083.18	-667.95	802.15.4F	CP11565
433.92	238.88	1084.80	-845.92	OMNI	CP11564
434.58	410.42	1086.45	-676.03	802.15.4F	CP11565

99% Bandwidth.

4.5.5 Final Data

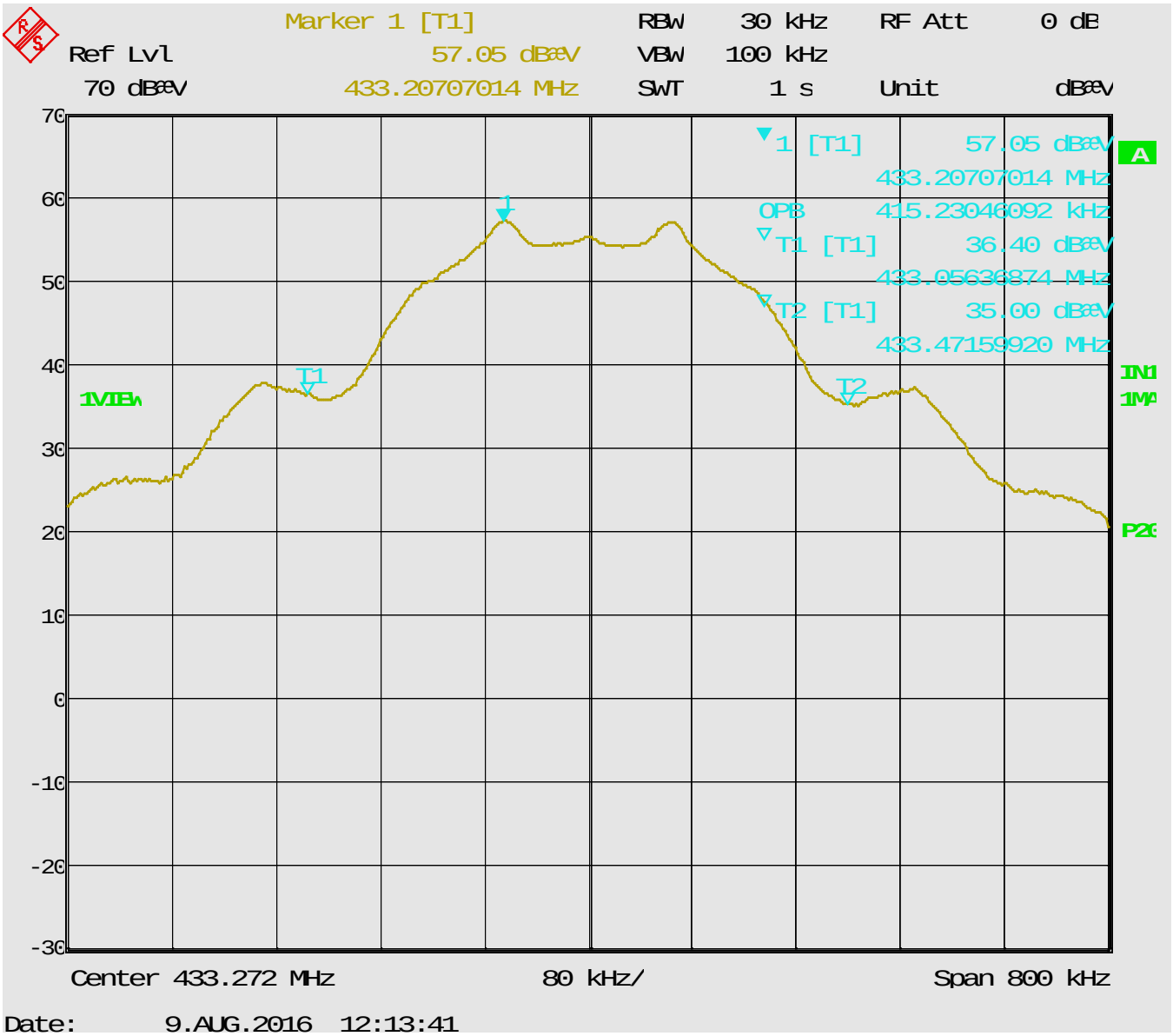


Figure 6 – 99% Power Bandwidth (802.15.4F Protocol) = 410.42 kHz. The Worst-Case shown.

Span = 800 kHz, RBW = 30 kHz (4% of Span), VBW = 100 kHz (≥ 3x RBW)

Note; no correction factors were applied to plot as this is only a BW measurement.

The EUT is compliant to the requirements of RSS-210 A1.1.3

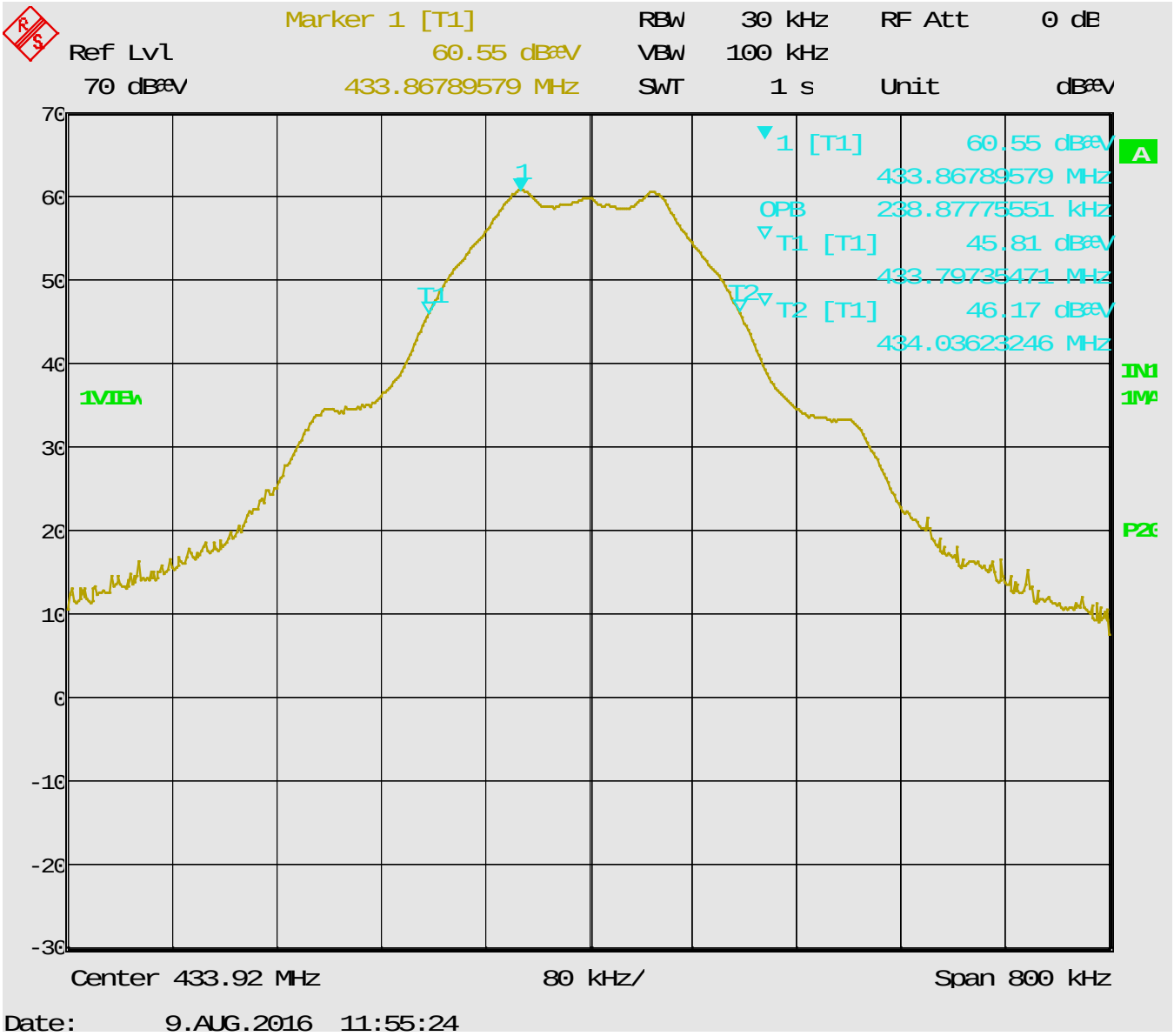


Figure 7 – 99% Power Bandwidth (OMNI Protocol) = 237.32 kHz. The Worst-Case shown.

Span = 800 kHz, RBW = 30 kHz (4% of Span), VBW = 100 kHz (≥ 3x RBW)

Note; no correction factors were applied to plot as this is only a BW measurement.

The EUT is compliant to the requirements of RSS-210 A1.1.3