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DATE: 05 October 2016

I.T.L. (PRODUCT TESTING) LTD.

FCC Radio Test Report

for

Risco Ltd.

Equipment under test:

915MHz/916MHz RF Module

RWDTR9S916VA-40 (consisting of RWTRSS10915A-40 and RWTRSS10916A-40)

Tested by: _____
N. Levi

Approved by: _____
D. Shidlowsky

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Measurement/Technical Report for
Risco Ltd.

Equipment under test:

915MHz/916MHz RF Module

RWDTR9S916VA-40 (consisting of RWTRSS10915A-40 and RWTRSS10916A-40)

FCC ID: JE4STAMP915-916

This report concerns:	Original Grant: X Class I change: Class II change:
Equipment type:	DXT – Part 15 Low Power Transceiver, Rx Verified
Limits used:	47CFR15 Section 15.249

Measurement procedure used is ANSI C63.10-2013

Application for Certification prepared by:
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1. General Information

1.1 Administrative Information

Manufacturer:	Risco Ltd.
Manufacturer's Address:	14 Hachoma St. Rishon Le T'zion 75655 Israel Tel: +972-3-963-7777 Fax: +972-3-961-6584
Manufacturer's Representative:	Motti Barad
Equipment Under Test (E.U.T):	915MHz/916MHz RF Module
Equipment Model No.:	RWDTR9S916VA-40 (consisting of RWTRSS10915A-40 and RWTRSS10916A-40)
Equipment Serial No.:	Not designated
Date of Receipt of E.U.T:	July 03, 2016
Start of Test:	July 03, 2016, October 5, 2016*
End of Test:	July 11, 2016, October 5, 2016*
Test Laboratory Location:	I.T.L (Product Testing) Ltd. 1 Batsheva St., Lod ISRAEL 7120101
Test Specifications:	FCC Part 15, Subpart C, Section 15.249

*Conducted Emissions on AC Power Lines was performed on October 5, 2016.

1.2 List of Accreditations

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), FCC Designation Number IL1005.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-3006, R-2729, T-1877, G-245.
5. Industry Canada (Canada), IC File No.: 46405-4025; Site No. IC 4025A-1, 4025A-2.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

1.3 Product Description

The RWDTR9S916VA-40 is RF module that consisting of two "Stamps", One 915 Mhz "Stamp" model RWTRSS10915A-40 and Second 916Mhz "Stamp" model RWTRSS10916A-40.

The Transceiver Si4432 is by Silicon Laboratories' highly integrated, single chip wireless ISM. It includes a complete line of transmitters, receivers, and transceivers allowing the RF system designer to choose the optimal wireless part for their application.

The Si4432 offers advanced radio features including continuous frequency coverage from 240–930 MHz. The Si4432's high level of integration offers reduced BOM cost while simplifying the

overall system design. Additional system features such as an automatic wake-up timer, low battery detector, 64 byte TX/RX FIFOs, automatic packet handling, and preamble detection reduce overall current consumption and allow the use of lower-cost system MCUs. An integrated temperature sensor, general purpose ADC, poweron- reset (POR), and GPIOs further reduce overall system cost and size.

The Si4432's digital receive architecture features a high-performance ADC and DSP based modem which performs demodulation, filtering, and packet handling for increased flexibility and performance. This digital architecture simplifies system design while allowing for the use of lower-end MCUs. The direct digital transmit modulation and automatic PA power ramping ensure precise transmit modulation and reduced spectral spreading ensuring compliance with FCC and ETSI regulations.

Model name	RWDTR9S916VA-40 (consisting of RWTRSS10915A-40 and RWTRSS10916A-40)
Working voltage	n/a
Mode of operation	Transmitter
Modulations	915MHz –OOK 916MHz –GFSK
Assigned Frequency Range	915MHz, 916MHz
Operation frequency	915MHz, 916MHz
Transmit power	915MHz: 8dbm 916MHz: 5dbm
Antenna Gain	+3.0dBi

1.4 Test Methodology

Radiated testing were performed according to the procedures in ANSI C63.10-2013. Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.5 Test Facility

Radiated emissions tests were performed at I.T.L.'s testing facility in Lod, Israel. I.T.L.'s EMC Laboratory is accredited by A2LA, certificate No. 1152.01 and its FCC Designation Number is IL1005.

1.6 Measurement Uncertainty

Radiated Emission

Radiated Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4) for open site 30-1000MHz:

Expanded Uncertainty (95% Confidence, K=2):

± 4.96 dB

Conducted Emission

Conducted Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4)
0.15 – 30 MHz:
Expanded Uncertainty (95% Confidence, K=2):

± 3.44 dB

1.7 Ambient conditions

Temperature (32ºC- 22.7 ºC)/humidity (35.6%-41.1%)

2. System Test Configuration

2.1 Justification

The module was evaluated operating while transmitting modulated signal at 915MHz and 916MHz separately. Additional evaluation was done while both transmitters 915MHz and 916MHz were activated for intermodulation products.

The module was assembled on an evaluation board with a DC board. The DC board was connected to an AC/DC adapter.

2.2 EUT Exercise Software

No special exercise software was needed to achieve compliance.

2.3 Special Accessories

No special exercise software was needed to achieve compliance

2.4 Equipment Modifications

No equipment modifications were needed to achieve compliance.

2.5 Configuration of Tested System

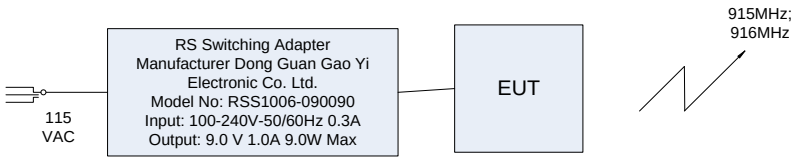

Figure 1. Configuration of Tested System

3. Conducted & Radiated Measurement Test Set-Up Photos

Figure 2. Conducted Emission Test

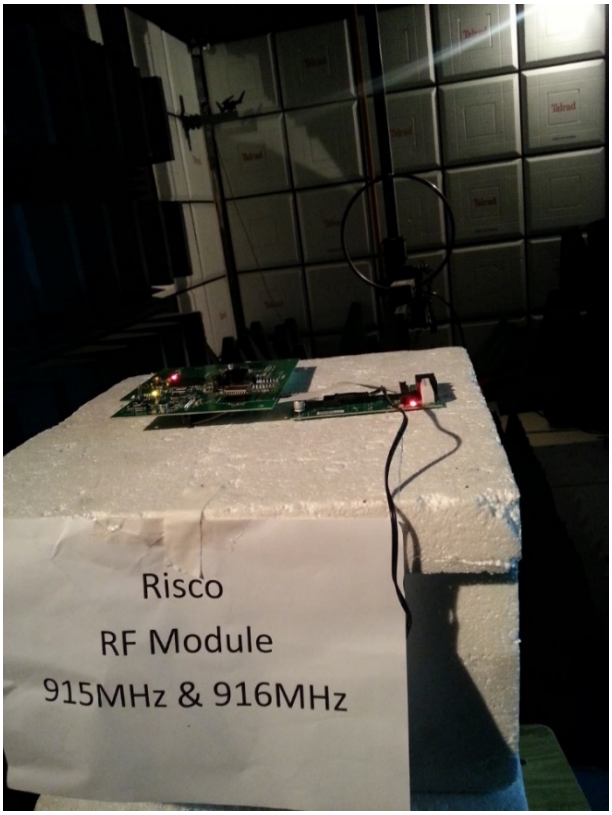

Figure 3. Field Strength of Fundamental Test

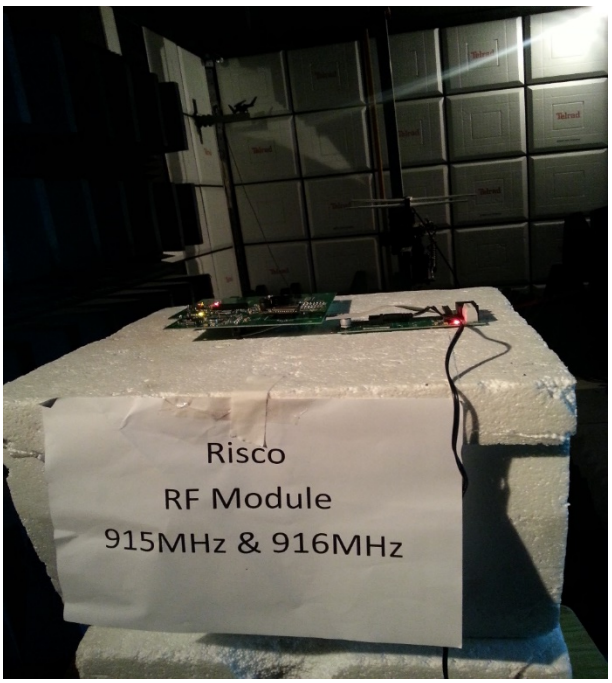

Figure 4. Radiated Emission Test

Figure 5. Radiated Emission Test

Figure 6. Radiated Emission Test

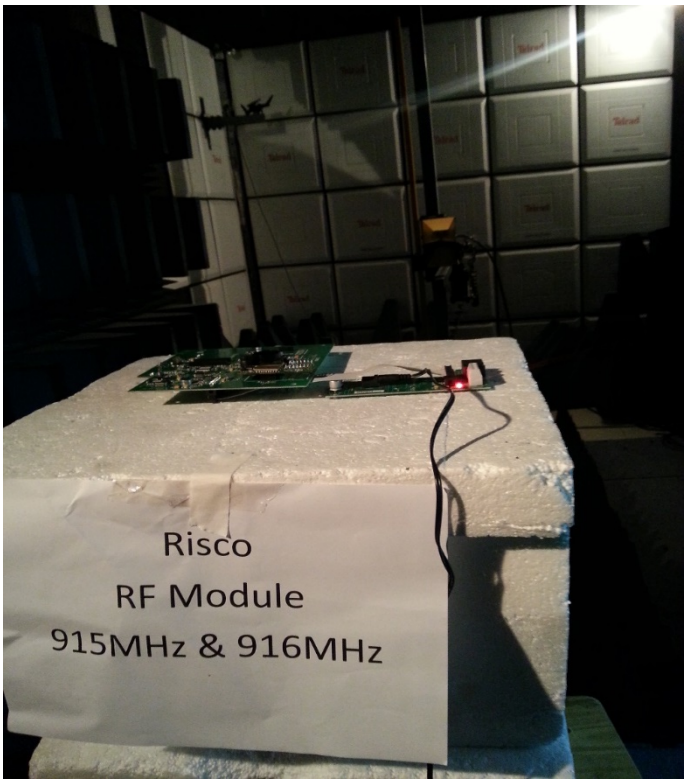

Figure 7. Radiated Emission Test

4. Conducted Emission From AC Mains

4.1 Test Specification

FCC Part 15, Subpart C, Section 15.207

4.2 Test Procedure

(Temperature (23°C)/ Humidity (65%RH))

The E.U.T operation mode and test setup are as described in Section 2 of this report. In order to minimize background noise interference, the conducted emission testing was performed inside a shielded room, with the E.U.T placed on a 0.8 meter high wooden table, 0.4 meter from the room's vertical wall. In the case of a floor-standing E.U.T., it was placed on the horizontal ground plane.

The E.U.T was powered from 115 V AC / 60 Hz via 50 Ohm / 50 µHn Line Impedance Stabilization Network (LISN) on the phase and neutral lines. The LISN's were grounded to the shielded room ground plane (floor), and were kept at least 0.8 meters from the nearest boundary of the E.U.T

The center of the E.U.T.'s AC cable was folded back and forth, in order to form a bundle less than 0.40 meters and a total cable length of 1 meter.

The effect of varying the position of the cables was investigated to find the configuration that produces maximum emission. The configuration tested is shown in the photograph, *Figure 2. Conducted Emission Test.*

The emission voltages at the LISN's outputs were measured using a computerized receiver, complying with CISPR 16 requirements. The specification limits are loaded to the receiver and are displayed on the receiver's spectrum display.

The E.U.T was tested while transmitting simultaneously at 915MHz and 916MHz

A frequency scan between 0.15 and 30 MHz was performed at 9 kHz I.F. band width, using peak detection.

The spectral components having the highest level on each line were measured using a quasi-peak and average detector.

4.3 Test Limit

Frequency of emission (MHz)	**Conducted limit (dBµV)**	
	Quasi-peak	Average
0.15-0.5	66.0 to 56.0*	56.0 to 46.0*
0.5-5.0	56.0	46.0
5.0-30.0	60.0	50.0

* Decreases with the logarithm of the frequency.

4.4 Test Results

JUDGEMENT: Passed by 5.46 dB

The margin between the emission levels and the specification limit is, in the worst case, 5.73dB for the phase line at 0.154 MHz and 5.46 dB at 0.154 MHz for the neutral line.

The EUT met the F.C.C. Part 15, Subpart C specification requirements.

The details of the highest emissions are given in *Figure 8* to *Figure 11*.

Conducted Emission

E.U.T Description	915MHz/916MHz RF Module
Type	RWDTR9S916VA-40 (consisting of RWTRSS10915A-40 and RWTRSS10916A-40)
Serial Number:	Not designated

Specification:	FCC Part 15, Subpart C
Lead:	Phase
Detectors: :	Quasi-peak, Average

EDIT PEAK LIST (Final Measurement Results)

Trace1: CE22BQP
Trace2: CE22BAP
Trace3: ---

	TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1	Quasi Peak	154 kHz	60.04	-5.73
2	Average	158 kHz	41.32	-14.24
1	Quasi Peak	262 kHz	47.20	-14.16
2	Average	350 kHz	26.84	-22.11
2	Average	454 kHz	30.91	-15.88
1	Quasi Peak	458 kHz	39.55	-17.17
2	Average	750 kHz	20.94	-25.05
1	Quasi Peak	774 kHz	30.27	-25.72
1	Quasi Peak	1.274 MHz	28.87	-27.12
2	Average	1.602 MHz	20.48	-25.51
2	Average	3.042 MHz	20.18	-25.81
1	Quasi Peak	3.138 MHz	29.82	-26.17
1	Quasi Peak	4.474 MHz	27.77	-28.22
2	Average	4.494 MHz	18.12	-27.87
1	Quasi Peak	6.458 MHz	24.92	-35.07
2	Average	7.582 MHz	15.41	-34.58
1	Quasi Peak	10.606 MHz	20.03	-39.96
2	Average	12.522 MHz	14.20	-35.79
2	Average	26.67 MHz	20.18	-29.81
1	Quasi Peak	27.606 MHz	25.12	-34.87

Date: 5.OCT.2016 12:11:46

Figure 8. Detectors: Peak, Quasi-peak, Average

Note: QP Delta/Av Delta refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Conducted Emission

E.U.T Description	915MHz/916MHz RF Module
Type	RWDTR9S916VA-40 (consisting of RWTRSS10915A-40 and RWTRSS10916A-40)
Serial Number:	Not designated

Specification:	FCC Part 15, Subpart C
Lead:	Phase
Detectors:	Peak, Average

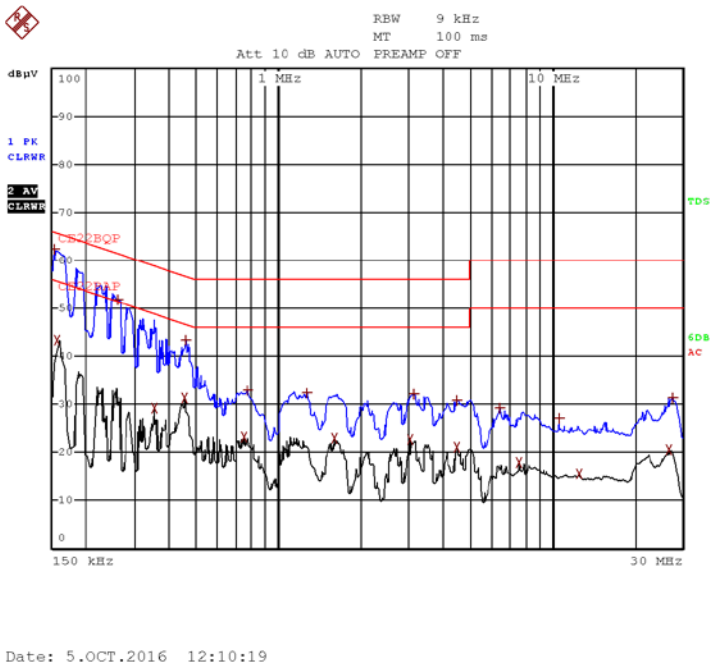

Figure 9. Detectors: Peak, Quasi-peak, Average

Conducted Emission

E.U.T Description	915MHz/916MHz RF Module
Type	RWDTR9S916VA-40 (consisting of RWTRSS10915A-40 and RWTRSS10916A-40)
Serial Number:	Not designated

Specification:	FCC Part 15, Subpart C
Lead:	Neutral
Detectors:	Quasi-peak, Average

EDIT PEAK LIST (Final Measurement Results)

Trace1: CE22BQP
Trace2: CE22BAP
Trace3: ---

	TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1	Quasi Peak	154 kHz	60.31	-5.46
2	Average	154 kHz	40.06	-15.71
1	Quasi Peak	258 kHz	49.37	-12.11
2	Average	422 kHz	25.86	-21.54
2	Average	454 kHz	30.95	-15.84
1	Quasi Peak	462 kHz	39.05	-17.59
1	Quasi Peak	774 kHz	30.27	-25.72
2	Average	774 kHz	22.63	-23.36
2	Average	1.594 MHz	21.77	-24.22
1	Quasi Peak	1.67 MHz	29.40	-26.59
1	Quasi Peak	3.018 MHz	29.27	-26.72
2	Average	3.138 MHz	21.14	-24.86
1	Quasi Peak	4.938 MHz	28.80	-27.19
2	Average	4.954 MHz	19.61	-26.38
2	Average	6.374 MHz	16.38	-33.61
1	Quasi Peak	7.73 MHz	23.55	-36.44
2	Average	12.242 MHz	15.31	-34.69
1	Quasi Peak	15.93 MHz	20.83	-39.16
1	Quasi Peak	27.134 MHz	28.14	-31.85
2	Average	27.602 MHz	22.43	-27.56

Date: 5.OCT.2016 12:05:27

Figure 10. Detectors: Peak, Quasi-peak, Average

Note: QP Delta/Av Delta refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Conducted Emission

E.U.T Description	915MHz/916MHz RF Module
Type	RWDTR9S916VA-40 (consisting of RWTRSS10915A-40 and RWTRSS10916A-40)
Serial Number:	Not designated

Specification:	FCC Part 15, Subpart C
Lead:	Neutral
Detectors:	Peak, Average

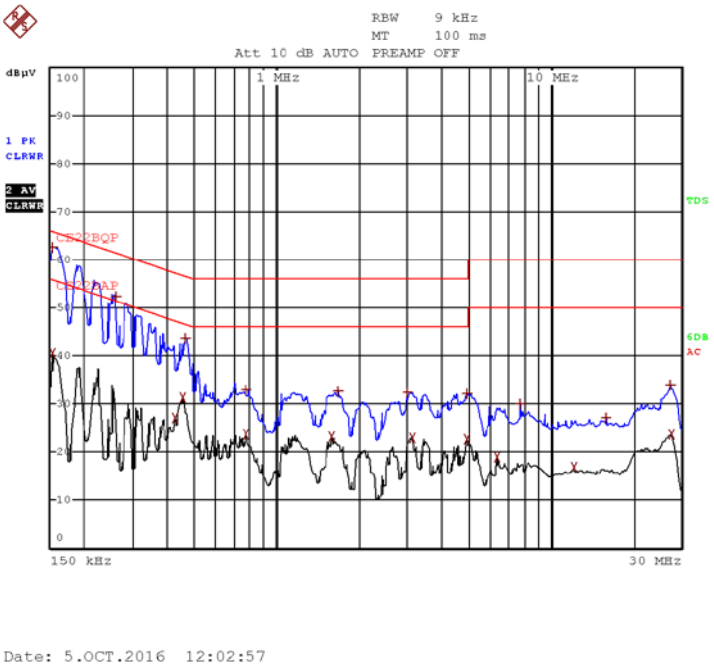

Figure 11 Detectors: Peak, Quasi-peak, Average

4.5 Test Equipment Used; Conducted Emission

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
LISN	Fischer	FCC-LISN-25A	127	June 23, 2016	June 23, 2017
Transient Limiter	HP	11947A	3107A03041	June 15, 2016	June 15, 2017
EMI Receiver	Rohde & Schwarz	ESCI7	100724	February 29, 2016	March 1, 2017

Figure 12 Test Equipment Used

5. Field Strength of Fundamental

5.1 Test Specification

F.C.C., Part 15, Subpart C, Section 15.249(a)

5.2 Test Procedure

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

The E.U.T was tested in the chamber, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The configuration tested is shown in *Figure 1*.

The E.U.T was evaluated in the following operational frequencies: 915.0MHz and 916MHz.
The readings were maximized by adjusting the turntable azimuth between 0-360°, and the antenna polarization.

5.3 Test Limits

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of fundamental (dBuV/m)
902.0-928.0 MHz	50.0	94.0
2400-2483.5 MHz	50.0	94.0
5725.0-5875.0 MHz	50.0	94.0
24.0-24.25 GHz	250.0	108.0

*Field strength limits are specified at a distance of 3 meters
** for frequencies above 1000 MHz, the field strength limits of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

5.4 Test Results

JUDGEMENT: Passed by 1.7dB

The EUT met the FCC Part 15, Subpart C, Section 15.249(a) specification requirements.

The details of the highest emissions are given in *Figure 13* to *Figure 22.*

Field Strength of Fundamental

E.U.T Description	915MHz/916MHz RF Module
Model Number	RWDTR9S916VA-40 (consisting of RWTRSS10915A-40 and RWTRSS10916A-40)
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C 15.249(a)

Antenna Polarization: Horizontal/Vertical
Operation Frequency: 915MHz
Test Distance: 3 meters
Detector: Peak, Quasi-peak

Freq. (MHz)	Axis	Pol. (V/H)	Peak Reading (dBµV/m)	QP reading (dBµV/m)	Correction factor* (dBµV/m)	Total reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)
915.0	X	H	67.5	67.1	25.0	92.1	94.0	-1.9
915.0		V	58.2	58.0	25.0	83.0	94.0	-11.0
915.0	Y	H	63.8	63.5	25.0	88.5	94.0	-5.5
915.0		V	66.6	66.3	25.0	91.3	94.0	-2.7
915.0	Z	H	65.3	65.2	25.0	90.2	94.0	-3.8
915.0		V	59.7	59.5	25.0	84.5	94.0	-9.5

Figure 13. Field Strength of Fundamental. Antenna Polarization: HORIZONTAL/VERTICAL. Detector: Peak – 915MHz Operation Frequency

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

* "Correction Factors" = Antenna Correction Factor + Cable Loss.

Field Strength of Fundamental

E.U.T Description	915MHz/916MHz RF Module
Model Number	RWDTR9S916VA-40 (consisting of RWTRSS10915A-40 and RWTRSS10916A-40)
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C 15.249(a)

Antenna Polarization: Horizontal/Vertical Operation Frequency: 916MHz

Test Distance: 3 meters Detector: Peak, Q.peak

Freq.	Axis	Pol.	Peak Reading	Q.peak reading	Correction factor*	Total reading	Limit	Margin
(MHz)		(V/H)	(dBµV/m)	(dBµV/m)	(dBµV/m)	(dBµV/m)	(dBµV/m)	(dB)
916.0	X	H	67.4	67.3	25	92.3	94.0	-1.7
916.0		V	58.8	58.6	25	83.6	94.0	-10.4
916.0	Y	H	63.8	63.7	25	88.7	94.0	-5.3
916.0		V	66.6	66.5	25	91.5	94.0	-2.5
916.0	Z	H	63.8	63.7	25	88.7	94.0	-5.3
916.0		V	56.6	56.4	25	81.4	94.0	-12.6

Figure 14. Field Strength of Fundamental. Antenna Polarization: HORIZONTAL/VERTICAL. Detector: Peak – 916MHz Operation Frequency

Note: Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

* "Correction Factors" = Antenna Correction Factor + Cable Loss.

Field Strength of Fundamental

E.U.T Description	915MHz/916MHz RF Module
Model Number	RWDTR9S916VA-40 (consisting of RWTRSS10915A-40 and RWTRSS10916A-40)
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C 15.249(a)

Antenna Polarization: Horizontal/Vertical
Operation Frequency: 915.0MHz
Test Distance: 3 meters
Detector: Peak

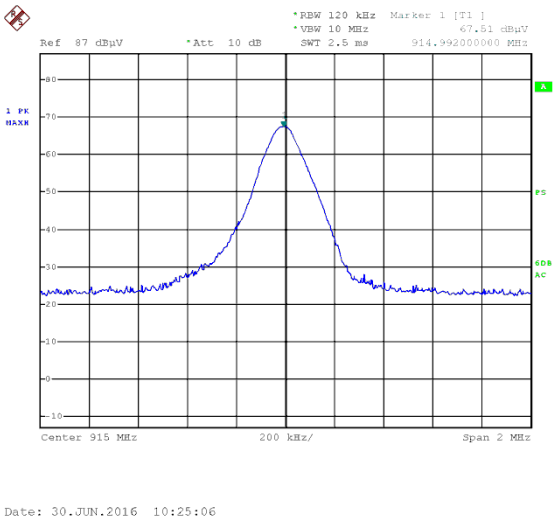

Figure 15. Field Strength of Fundamental 915MHz. - Antenna Polarization: HORIZONTAL

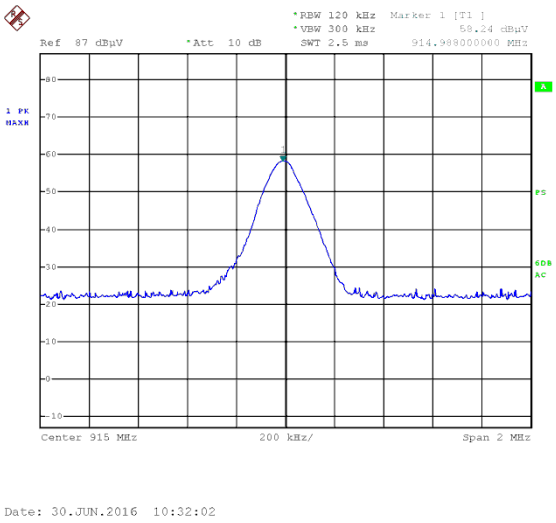

Figure 16. Field Strength of Fundamental 915MHz. - Antenna Polarization: VERTICAL

Field Strength of Fundamental

E.U.T Description	915MHz/916MHz RF Module
Model Number	RWDTR9S916VA-40 (consisting of RWTRSS10915A-40 and RWTRSS10916A-40)
Serial Number:	Not designated

Specification: F.C.C., Part 15, Subpart C 15.249(a)

Antenna Polarization: Horizontal/Vertical
Operation Frequency: 916.0MHz
Test Distance: 3 meters
Detector: Peak

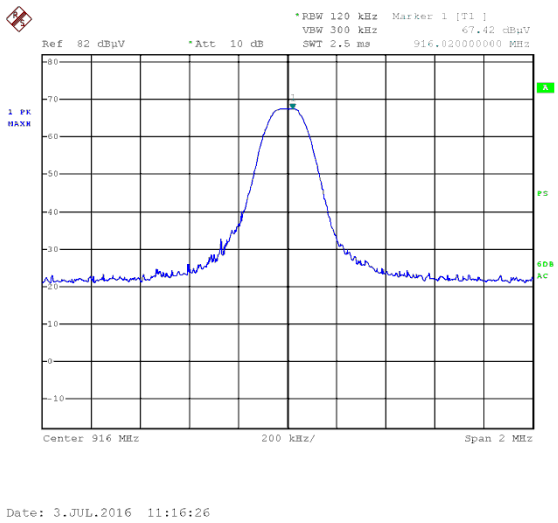

Figure 17.Field Strength of Fundamental 916MHz. - Antenna Polarization: HORIZONTAL

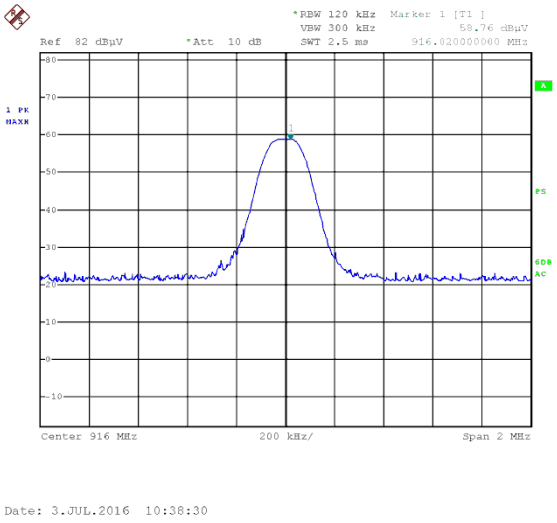

Figure 18. Field Strength of Fundamental 916MHz. - Antenna Polarization: VERTICAL

5.5 Test Instrumentation Used; Field Strength of Fundamental

Instrument	Manufacturer	Model	Serial Number	Last Calibration Date	Next Calibration Date
EMI Receiver	R&S	ESCI7	100724	February 29, 2016	March 1, 2017
Log Periodic Antenna	EMCO	3146	9107-3158	March 24, 2016	March 24, 2017
Semi Anechoic Chamber	ETS	S81	SL 11643	N/A	N/A

Figure 19 Test Equipment Used

6. Field Strength of Harmonics

6.1 Test Specification

FCC, Part 15, Subpart C, Section 249(a)

6.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 2 of this report.

The E.U.T was placed in the chamber and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The configuration tested is shown in *Figure 1*.
The frequency range 1000.0MHz-10,000MHz was scanned. RBW was set to 1000 kHz. The readings were maximized by adjusting the turntable azimuth between 0-360°, and the antenna polarization.
The testing was performed at a distance of 3 meters.

6.3 Test Limits

Fundamental frequency (MHz)	Field strength of harmonics (microvolts/meter)	Field strength of harmonics (dBuV/m)
902.0-928.0 MHz	500.0	54.0
2400-2483.5 MHz	500.0	54.0
5725.0-5875.0 MHz	500.0	54.0
24.0-24.25 GHz	2500.0	68.0

* for frequencies above 1000 MHz, the field strength limits of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

6.4 Test Results

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 15.209 specification.

Field Strength of Harmonics

E.U.T Description	915MHz/916MHz RF Module
Type	RWDTR9S916VA-40 (consisting of RWTRSS10915A-40 and RWTRSS10916A-40)
Serial Number:	Not designated

Specification: FCC Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Frequency Range: 30 MHz to 10.0 GHz
Test Distance: 3 meters
Detector: Average
Operation Frequency: 915.0MHz

Freq. (MHz)	Polarity (H/V)	Avg (dBµV/m)			Limit (dBµV/m)	Margin (dB)
		X	Y	Z		
1829.9	H	35.1	35.3	**35.4**	54.0	-18.6
1829.9	V	36.2	**36.5**	36.0	54.0	-17.5
2745.3	H	37.4	37.6	**37.7**	54.0	-16.3
2744.9	V	36.8	37.0	**37.3**	54.0	-16.7
5490.0	H	39.2	**39.7**	39.5	54.0	-14.3
5489.5	V	40.3	40.8	**40.9**	54.0	-13.1

Figure 20. Field Strength of Harmonics- Antenna Polarization: AVG -HORIZONTAL / VERTICAL. – 915MHz

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Amp" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

Field Strength of Harmonics

E.U.T Description	915MHz/916MHz RF Module
Type	RWDTR9S916VA-40 (consisting of RWTRSS10915A-40 and RWTRSS10916A-40)
Serial Number:	Not designated

Specification: FCC Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Frequency Range: 30 MHz to 10.0 GHz
Test Distance: 3 meters
Detector: Peak
Operation Frequency: 915.0MHz

Freq. (MHz)	Polarity (H/V)	Peak (dBµV/m)			Limit (dBµV/m)	Margin (dB)
		X	Y	Z		
1829.9	H	41.3	**41.4**	41.0	74.0	-32.6
1829.9	V	42.2	42.5	**42.7**	74.0	-31.3
2745.3	H	43.7	44.2	**44.7**	74.0	-29.3
2744.9	V	44.1	44.5	**44.8**	74.0	-29.2
5490.0	H	50.1	**50.3**	49.7	74.0	-23.7
5489.5	V	50.2	49.6	**50.3**	74.0	-23.7

Figure 21. Field Strength of Harmonics- Antenna Polarization: Peak -HORIZONTAL / VERTICAL. – 915MHz

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Amp" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

Field Strength of Harmonics

E.U.T Description	915MHz/916MHz RF Module
Type	RWDTR9S916VA-40 (consisting of RWTRSS10915A-40 and RWTRSS10916A-40)
Serial Number:	Not designated

Specification: FCC Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Frequency Range: 30 MHz to 10.0 GHz
Test Distance: 3 meters
Detector: Average
Operation Frequency: 916.0MHz

Freq. (MHz)	**Polarity** (H/V)	**Avg** (dBµV/m)			**Limit** (dBµV/m)	**Margin** (dB)
		X	Y	Z		
1832.2	H	**38.5**	38.5	37.5	54.0	-15.5
1832.4	V	**39.5**	38.6	38.1	54.0	-14.5
2748.6	H	44.0	**44.2**	43.2	54.0	-9.8
2748.1	V	**44.8**	44.3	43.9	54.0	-9.2
3664.3	H	43.5	42.6	**44.4**	54.0	-9.6
3664.5	V	**46.5**	46.2	45.4	54.0	-7.5

Figure 22. Field Strength of Harmonics. Antenna Polarization: AVG - HORIZONTAL / VERTICAL. 916MHz

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Amp" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

Field Strength of Harmonics

E.U.T Description	915MHz/916MHz RF Module
Type	RWDTR9S916VA-40 (consisting of RWTRSS10915A-40 and RWTRSS10916A-40)
Serial Number:	Not designated

Specification: FCC Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Frequency Range: 30 MHz to 10.0 GHz
Test Distance: 3 meters
Detector: Peak
Operation Frequency: 916.0MHz

Freq. (MHz)	**Polarity** (H/V)	**Peak** (dBµV/m)			**Limit** (dBµV/m)	**Margin** (dB)
		X	Y	Z		
1832.5	H	45.6	**45.8**	43.2	74.0	-28.2
1832.1	V	44.2	44.8	**45.1**	74.0	-28.9
2748.1	H	46.2	**46.3**	45.9	74.0	-27.7
2748.4	V	50.1	**50.2**	47.7	74.0	-23.8
3664.6	H	48.5	47.0	**50.8**	74.0	-23.2
3664.2	V	**51.2**	50.8	50.6	74.0	-22.8

Figure 23. Field Strength of Harmonics. Antenna Polarization: Peak - HORIZONTAL / VERTICAL. 916MHz

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Amp" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

6.5 Test Instrumentation Used; Field Strength of Harmonics

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Last Calibration Date
EMI Receiver	R&S	ESCI7	100724	February 29, 2016	March 1, 2017
Spectrum Analyzer	HP	8592L	3826A01204	March 13, 2016	March 13, 2017
Active Loop Antenna	EMCO	6502	9506-2950	November 5, 2015	November 30, 2016
Biconical Antenna	EMCO	3110B	9912-3337	March 24, 2016	March 24, 2018
Log Periodic Antenna	EMCO	3146	9505-4081	April 23, 2016	April 23, 2017
1G-18GHz Horn Antenna	ETS	3115	29845	May 19, 2015	May 19, 2018
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9908-1456	N/A	N/A

Figure 24 Test Equipment Used

6.6 Field Strength Calculation

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$FS = RA + AF + CF$$

FS: Field Strength [dBµv/m]
RA: Receiver Amplitude [dBµv]
AF: Receiving Antenna Correction Factor [dB/m]
CF: Cable Attenuation Factor [dB]

Example: FS = 30.7 dBµV (RA) + 14.0 dB (AF) + 0.9 dB (CF) = 45.6 dBµV

No external pre-amplifiers are used.

7. Radiated Emission

7.1 Test Specification

Part 15, Subpart C, Section 15.249(d)

7.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 2 of this report.

For measurements between 0.009MHz -30.0MHz:

The E.U.T was tested inside the shielded room and placed on a non-metallic table, 1.5 meters above the ground. The frequency range 0.009MHz-30.0MHz was scanned. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.

For 30.0MHz-1000.0MHz range:

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in *Figure 1*.
The frequency range 0.009 MHz-1000 MHz was scanned.
RBW was set to 100 kHz.
The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

For 1000.0MHz-10,000.0MHz range:

The E.U.T was placed in the chamber and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The configuration tested is shown in *Figure 1*.
The frequency range 1000.0MHz-10,000MHz was scanned. RBW was set to 1000 kHz. The readings were maximized by adjusting the turntable azimuth between 0-360°, and the antenna polarization.

For all final evaluations the distance was 3 meters.

7.3 Test Limits

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

7.4 Test Results

JUDGEMENT: Passed

The margin between the emission level and the specification limit was 4.5dB in the worst case at the frequency of 64.8 MHz, vertical polarization.

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 15.249 specification.

Radiated Emission

E.U.T Description	915MHz/916MHz RF Module
Type	RWDTR9S916VA-40 (consisting of RWTRSS10915A-40 and RWTRSS10916A-40)
Serial Number:	Not designated

Specification: FCC Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Frequency range: 30 MHz to 10.0 GHz
Test Distance: 3 meters
Detector: Peak, Quasi Peak
Operation Frequency: 915.0MHz

Freq. (MHz)	Polarity (H/V)	Peak (dBµV/m)	Q.Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)
64.8	H	26.6	20.3	40.0	-13.4
64.8	V	35.5	25.7	40.0	-4.5
125.7	H	29.1	22.7	43.5	-14.4
125.7	V	32.2	25.3	43.5	-11.3
159.6	H	33.3	26.9	43.5	-10.2
159.6	V	32.2	25.2	43.5	-11.3

Figure 25. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Peak/QPeak – 915MHz

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Amp" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

Radiated Emission

E.U.T Description	915MHz/916MHz RF Module
Type	RWDTR9S916VA-40 (consisting of RWTRSS10915A-40 and RWTRSS10916A-40)
Serial Number:	Not designated

Specification: FCC Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical
Frequency range: 30 MHz to 10.0 GHz
Test Distance: 3 meters
Detector: Peak, Quasi Peak
Operation Frequency: 916.0MHz

Freq. (MHz)	Polarity (H/V)	Peak (dBµV/m)	Q.Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)
64.8	H	26.3	20.4	40.0	-13.7
64.8	V	35.2	25.4	40.0	-4.8
125.7	H	29.5	22.8	43.5	-14.0
125.7	V	31.4	24.1	43.5	-12.1
159.6	H	32.5	26.2	43.5	-11.0
159.6	V	30.6	24.9	43.5	-12.9

Figure 26. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Peak/QPeak – 916MHz

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Amp" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

7.5 Test Instrumentation Used; Radiated Emission

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Date
EMI Receiver	R&S	ESCI7	100724	February 29, 2016	March 1, 2017
Spectrum Analyzer	HP	8592L	3826A01204	March 13, 2016	March 13, 2017
Active Loop Antenna	EMCO	6502	9506-2950	November 5, 2015	November 30, 2016
Biconical Antenna	EMCO	3110B	9912-3337	March 24, 2016	March 24, 2018
Log Periodic Antenna	EMCO	3146	9505-4081	April 23, 2016	April 23, 2017
1G-18GHz Horn Antenna	ETS	3115	29845	May 19, 2015	May 19, 2018
Antenna Mast	ETS	2070-2	9608-1497	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 27 Test Equipment Used

7.6 Field Strength Calculation

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$[dB\mu v/m]\ FS = RA + AF + CF$$

FS: Field Strength [dBμv/m]
RA: Receiver Amplitude [dBμv]
AF: Receiving Antenna Correction Factor [dB/m]
CF: Cable Attenuation Factor [dB]

8. Intermodulation Radiated

8.1 Test Procedure

The module is transmitting at two frequencies: 915MHz and 916MHz and the intermodulation of these two frequencies was tested. The test was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The E.U.T was placed on a remote-controlled turntable 1.5 meters above the ground. The configuration tested is shown in *Figure 1.*

The emissions were measured using a computerized EMI receiver complying with CISPR 16 requirements.

The readings were maximized by adjusting the antenna height between 1.5 meters, the turntable azimuth between 0-360°, and the antenna polarization.

The E.U.T was placed in the chamber and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The configuration tested is shown in *Figure 1*

The readings were maximized by adjusting the turntable azimuth between 0-360°, and the antenna polarization.

During average measurements, the IF bandwidth was 1 MHz and the video bandwidth was 100Hz. During peak measurements, the IF bandwidth was 1 MHz and the video bandwidth was 3 MHz.

For all final evaluations, the distance was 3 meters.

The E.U.T. was operated in transmitting mode simultaneously at 915MHz and 916MHz.

8.2 Test Limits

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.
Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)	Field strength* (dBµV/m)	Field strength* (dBµV/m)@3m
0.009-0.490	2400/F(kHz)	300	48.5-13.8	128.5-73.8
0.490-1.705	24000/F(kHz)	30	33.8-23.0	73.8-63.0
1.705-30.0	30	30	29.5	69.5
30-88	100	3	40.0	40.0
88-216	150	3	43.5	43.5
216-960	200	3	46.0	46.0
Above 960	500	3	54.0	54.0

*The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector. For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

Figure 28 Table of Limits

8.3 Test Results

JUDGEMENT: Passed

Freq. (MHz)	Polarity (H/V)	QPeak Reading (dBµV/m)	QPeak Specification (dB µV/m)	Margin (dB)
914.0	H	45.8	46.0	-0.2
	V	42.4	46.0	-3.6
917.0	H	41.8	46.0	-4.2
	V	40.9	46.0	-5.1
913.0	H	40.7	46.0	-5.3
	V	40.7	46.0	-5.3
918.0	H	41.5	46.0	-4.5
	V	40.9	46.0	-5.1
912.0	H	41.6	46.0	-4.4
	V	40.7	46.0	-5.3
919.0	H	40.8	46.0	-5.2
	V	40.6	46.0	-5.4
911.0	H	40.6	46.0	-5.4
	V	40.6	46.0	-5.4
920.0	H	40.2	46.0	-5.8
	V	40.5	46.0	-5.5

Figure 29 Intermodulation Radiated Results

8.4 Test Instrumentation Used, Intermodulation Measurements

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Last Calibration Date
EMI Receiver	HP	8593EM	3536A00120ADI	March 10, 2016	March 10, 2017
Log Periodic Antenna	EMCO	3146	9107-3158	March 24, 2016	March 24, 2017
Semi Anechoic Chamber	ETS	S81	SL 11643	N/A	N/A

Figure 30 Test Equipment Used

8.5 Field Strength Calculation

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$[dB\mu v/m]\ FS = RA + AF + CF$$

FS: Field Strength [dBμv/m]
RA: Receiver Amplitude [dBμv]
AF: Receiving Antenna Correction Factor [dB/m]
CF: Cable Attenuation Factor [dB]

Example: FS = 30.7 dBμV (RA) + 14.0 dB (AF) + 0.9 dB (CF) = 45.6 dBμV

No external pre-amplifiers are used.

9. Antenna Gain/Data

+3dBi

RFAR
RF & Antenna Resource

P/N: ANT868-2S-CHETH
Rev-D

Specification

Frequency: 868.65 MHz Gain: Max +3dbi

10. R.F Exposure/Safety

Typical use of the E.U.T. is as a module in alarm system units.
The typical placement of the E.U.T. is in alarm detectors, control panels, keypads.

The typical distance between the E.U.T. and the user is greater than 20 cm.

Calculation of Maximum Permissible Exposure (MPE)
Based on Section 1.1310 Requirements

(a) FCC limits at 915 MHz is: (f/1500)$\frac{mW}{cm^2}$ = 915/1500=.61$\frac{mW}{cm^2}$

Using table 1 of Section 1.1310 limit for general population/uncontrolled exposures, the above level is an average over 30 minutes.

(b) The power density produced by the E.U.T. is

P_t- Transmitted Power 92.1dBuV/m (Peak) = -3.1dBm = 0.49mW

$$S = \frac{P_t G_t}{4\pi R^2}$$

(testing performed conducted, power calculation contains antenna gain)
G_T- Antenna Gain, +3.0dBi
R- Distance from Transmitter using 20cm

(c) The peak power density is:

$$S_p = \frac{0.49}{4\pi(20)^2} = 9.75x10^{-5}\frac{mW}{cm^2}$$

(d) This is below the FCC limit.

11. APPENDIX A - CORRECTION FACTORS

11.1 Correction factors for CABLE

from EMI receiver to test antenna at 3 meter range.

Frequency (MHz)	Cable Loss (dB)	Frequency (MHz)	Cable Loss (dB)
0.010	0.4	50.00	1.2
0.015	0.2	100.00	0.7
0.020	0.2	150.00	2.1
0.030	0.3	200.00	2.3
0.050	0.3	300.00	2.9
0.075	0.3	500.00	3.8
0.100	0.2	750.00	4.8
0.150	0.2	1000.00	5.4
0.200	0.3	1500.00	6.7
0.500	0.4	2000.00	9.0
1.00	0.4	2500.00	9.4
1.50	0.5	3000.00	9.9
2.00	0.5	3500.00	10.2
5.00	0.6	4000.00	11.2
10.00	0.8	4500.00	12.1
15.00	0.9	5000.00	13.1
20.00	0.8	5500.00	13.5
		6000.00	14.5

NOTES:

1. The cable type is SPUMA400 RF-11N(X2) and 39m long

2. The cable is manufactured by Huber + Suhner

11.2 Correction factors for CABLE

**from EMI receiver
to test antenna
at 3 meter range (chamber).**

Frequency (GHz)	**Cable Loss** (dB)	**Frequency** (MHz)	**Cable Loss** (dB)
1.0	-1.5	11.0	-6.1
2.0	-2.1	12.0	-6.1
3.0	-2.7	13.0	-6.2
4.0	-3.1	14.0	-6.7
5.0	-3.5	15.0	-7.4
6.0	-4.1	16.0	-7.5
7.0	-4.6	17.0	-7.9
8.0	-4.9	18.0	-8.1
9.0	-5.7	19.0	-8.8
10.0	-5.7	20.0	-9.1

NOTES:

1. The cable type is 0623 WBC-400 and 39m long

2. The cable is manufactured by COMMSCOPE

11.3 Correction factors for CABLE

from EMI receiver to test antenna at 3 meter range additional cable(chamber).

Frequency (GHz)	**Cable Loss** (dB)	**Frequency** (MHz)	**Cable Loss** (dB)
1.0	-0.3	10.0	-0.1
2.0	-0.5	11.0	-2.0
3.0	-0.7	12.0	-0.4
4.0	-0.7	13.0	-2.9
5.0	-0.7	14.0	-3.3
6.0	-1.0	15.0	-1.6
7.0	-0.3	16.0	-2.6
8.0	-0.4	17.0	-1.4
9.0	-0.7	18.0	-1.4

NOTES:

1. The cable type is 705A009301 EIM and 1m long

2. The cable is manufactured by Huber Zhuner

11.4 Correction factors for LOG PERIODIC ANTENNA

Model: 3146

Antenna serial number: 9505-4081

3 meter range

Frequency [MHz]	AF [dB/m]
200.0	11.47
250.0	12.06
300.0	14.77
400.0	15.77
500.0	18.01
600.0	18.84
700.0	20.93
800.0	21.27
900.0	22.44
1000.0	24.10

11.5 Correction factors for Biconical ANTENNA

Model: EMCO 3110B
serial number: 9912-3337
3 meter range

Frequency [MHz]	AF [dB/m]
30.0	14.18
35.0	13.95
40.0	12.84
45.0	11.23
50.0	11.10
60.0	10.39
70.0	9.34
80.0	9.02
90.0	9.31
100.0	8.95
120.0	11.53
140.0	12.20
160.0	12.56
180.0	13.49
200.0	15.27

11.6 Correction factors for Horn ANTENNA

Model: 3115
Antenna serial number: 29845
10 meter range

FREQUENCY (MHz)	AFE (dB/m)	FREQUENCY (MHz)	AFE (dB/m)
1000	22.4	10000	36.1
2000	25.2	11000	37.0
3000	31.1	12000	41.3
4000	30.2	13000	38.1
5000	34.2	14000	41.7
6000	31.6	15000	39.0
7000	34.7	16000	38.8
8000	34.8	17000	43.2
9000	36.2	18000	43.7

11.7 Correction factors for Active Loop Antenna Model 6502 S/N 9506-2950

FREQUENCY	Magnetic Antenna Factor	Electric Antenna Factor
(MHz)	(dB)	(dB)
.009	-35.1	16.4
.010	-35.7	15.8
.020	-38.5	13.0
.050	-39.6	11.9
.075	-39.8	11.8
.100	-40.0	11.6
.150	-40.0	11.5
.250	-40.0	11.6
.500	-40.0	11.5
.750	-40.1	11.5
1.000	-39.9	11.7
2.000	-39.5	12.0
3.000	-39.4	12.1
4.000	-39.7	11.9
5.000	-39.7	11.8
10.000	40.2	11.3
15.000	-40.7	10.8
20.000	-40.5	11.0
25.000	-41.3	10.2
30.000	-42.3	9.2