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DATE: 28 May 2015

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

FCC Radio Test Report

for

Herd MOOnitor Ltd.

Equipment under test:

CattleCare

150I

Tested: _____

I. Siboni, Test Engineer

Approved by: _____

D. Shidlowsky

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This report relates only to items tested.

Measurement/Technical Report for
Herd MOOnitor Ltd.

CattleCare

150I

FCC ID: 2AEOR-CC150I

This report concerns:	Original Grant: X Class I Change: Class II Change:
Equipment type:	Digital Transmission System
Limits used:	47CFR15 Section 15.247

Measurement procedures used are KDB 558074 D01 v03r02 and ANSI C63.4: 2003.

Application for Certification prepared by:

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Applicant for this device: (different from "prepared by")

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TABLE OF CONTENTS

1. General Information

1.1 *Administrative Information*

Manufacturer:	Herd MOOnitor Ltd.
Manufacturer's Address:	8 Micha St. Tel Aviv, 63111 Tel Aviv, Israel Tel: +972-54-5506412 Fax +972-9-742-2181
Manufacturer's Representative:	Menachem Tipris
Equipment Under Test (E.U.T):	CattleCare
Equipment Model No.:	150I
Equipment Serial No.:	Not designated
Date of Receipt of E.U.T:	05.04.2015
Start of Test:	05.04.2015
End of Test:	14.04.2015
Test Laboratory Location:	I.T.L (Product Testing) Ltd. 1 Batsheva St., Lod ISRAEL 7120101
Test Specifications:	FCC Part 15, Subpart C

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 No. US1004.
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-1350, R-1285.
5. Industry Canada (Canada), IC File No.: 46405-4025; Site No. IC 4025A-1.

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 CattleCare 150I is a free grazing cows solar powered activity and location tracking collar. The CattleCare 150I transmits a burst of the cow's activities summary via a satellite simplex modem once a day. The collar is also equipped with a 915MHz ISM band transceiver for remote control, maintenance and data download purposes. The collar operates under a very strict power regime and budget therefore the ISM transceiver is only turned on periodically for brief periods of time in receive mode typically for example: every two minutes for only a brief 10 seconds. An additional mode of operation of the ISM transceiver is a periodic burst transmission of the cow's activity at two predefined intervals of four seconds or five minutes. The ISM module is a low cost, high performance transceiver operating in the 915 MHz band. It features LoRa digital modulation at a 500KHz RF bandwidth small size, high output power of up to 100mW driving a---1dBi maximum gain on board chip antenna, high sensitivity, long transmission distance. Provides a generic UART interface.
The collar operation is supervised by a very low power CPU chip that continuously collects cow's activities, processes, compacts and transmits it to a server. The charging and power supply module harvests the solar energy from two solar panels, charges a lithium ion battery and converts it to the appropriate operating voltages. The GPS power is turned on at predefined times of day to obtain and record the cow's location. The satellite simplex modem power is turned on once a day to transmit the daily summary to the system's central server. The 915 MHz band ISM transceiver power is turned on periodically for brief periods of time expecting any remote control commands. The ISM transceiver can transmit periodic activity burst messages to a nearby computer running a dedicated application.
The E.U.T. contains an FCC approved 1611.25-1618.75 MHz modular transmitter under FCC ID: L2V-STX3. It does not transmit simultaneously with the 915 MHz transmitter.

1.4 *Test Methodology*

Radiated testing was performed according to the procedures in KDB 558074 D01 v03r02 and ANSI C63.4: 2003. 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 US1004.

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

2. System Test Configuration

2.1 *Justification*

Preliminary tests were performed on the E.U.T. to determine the worst case orientation which was the y axis. See *Figure 1* below for further details and photograph *Figure 3. Preliminary Radiated Emission Test (G-TEM).*

Orientation Position	Screening Result (dBuv/m)
X axis	82.0
Y axis	91.3
Z axis	90.2

Figure 1. Preliminary Screening

2.2 *EUT Exercise Software*

No exercise software was used.

2.3 *Special Accessories*

No special accessories were needed in order to achieve compliance.

2.4 *Equipment Modifications*

No modifications were needed in order to achieve compliance.

2.5 *Configuration of Tested System*

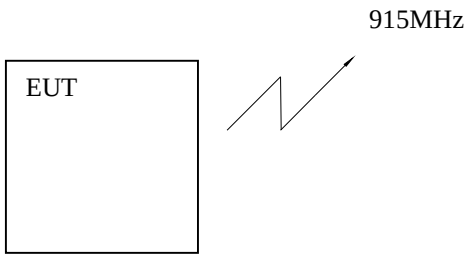


Figure 2. Configuration of Tested System

3. Radiated Measurement Test Set-up Photos

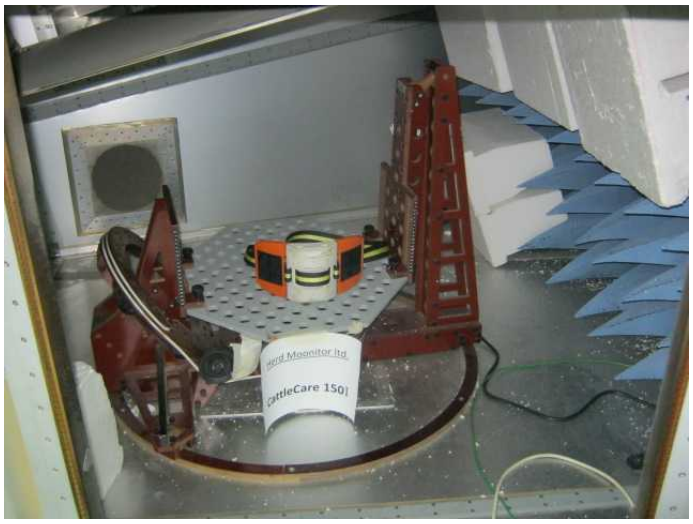


Figure 3. Preliminary Radiated Emission Test (G-TEM)

Figure 4. Radiated Emission Test

Figure 5. Radiated Emission Test

Figure 6. Radiated Emission Test

4. 6dB Minimum Bandwidth

4.1 *Test Specification*

F.C.C. Part 15, Subpart C: 15.247(a)(1)(i)

4.2 *Test Procedure*

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters.
The transmitter unit operated with normal modulation. The spectrum analyzer was set to 120 kHz resolution BW. The spectrum bandwidth of the transmitter unit was measured and recorded. The test was performed to measure the transmitter occupied bandwidth. The EUT was set up as shown in *Figure* 2, and its proper operation was checked. The transmitter occupied bandwidth was measured with the EMI receiver as frequency delta between reference points on modulation envelope.
The E.U.T. was tested at Low (915.00 MHz) and High (922.50 MHz) channels.

4.3 *Test Results*

Operation Frequency (MHz)	Bandwidth Reading (kHz)	Specification (kHz)
915.00	725	>500
922.50	680	>500

Figure 7 — 6 dB Minimum Bandwidth Test Results Table

JUDGEMENT: Passed

For additional information see
Figure 8 *to Figure 9.*

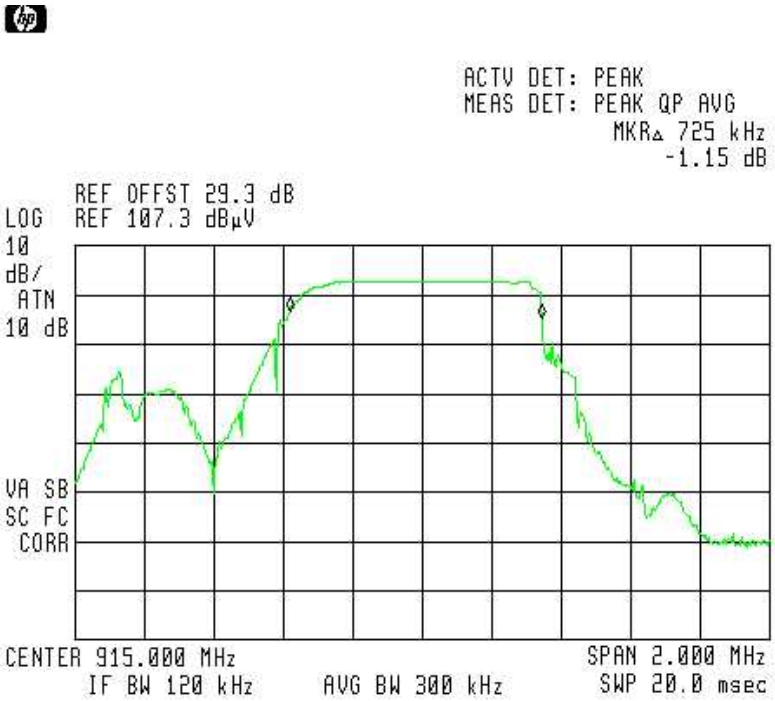


Figure 8. — 915.0 MHz

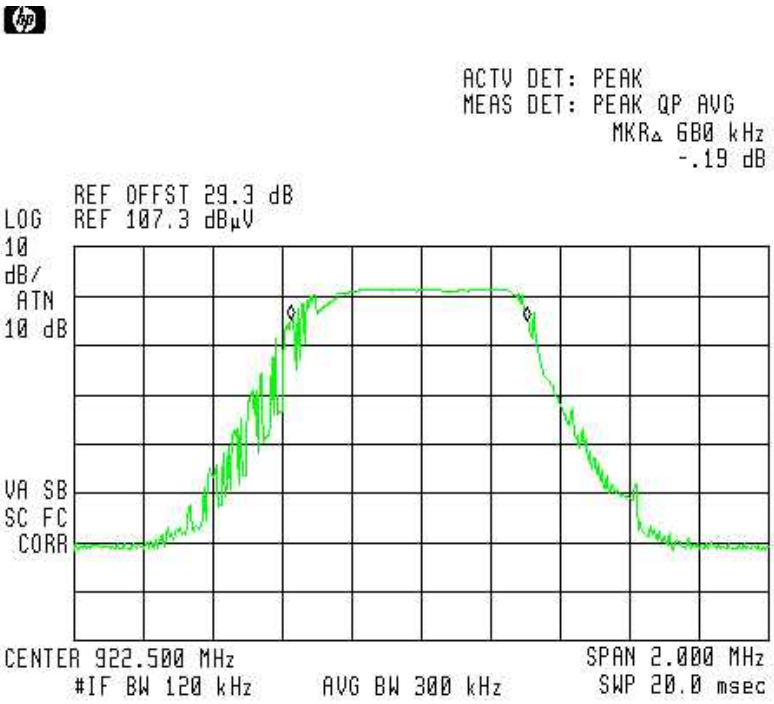


Figure 9. — 922.5 MHz

4.4 *Test Equipment Used, 6 dB Minimum Bandwidth*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	March 19, 2015	1 year
RF Section	HP	85420E	3705A00248	March 19, 2015	1 year
Biconilog Antenna	EMCO	3142B	1250	May 22, 2014	2 years
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 10 Test Equipment Used

5. 26dB Minimum Bandwidth

5.1 *Test Specification*

F.C.C. Part 15, Subpart C: 15.247(a)(1)(i)

5.2 *Test Procedure*

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters.
The transmitter unit operated with normal modulation. The spectrum analyzer was set to 120 kHz resolution BW. The spectrum bandwidth of the transmitter unit was measured and recorded. The test was performed to measure the transmitter occupied bandwidth. The EUT was set up as shown in *Figure* 2, and its proper operation was checked. The transmitter occupied bandwidth was measured with the EMI receiver as frequency delta between reference points on modulation envelope.
The E.U.T. was tested at Low (915.00 MHz) and High (922.50 MHz) channels.

5.3 *Test Results*

Operation Frequency (MHz)	Bandwidth Reading (kHz)
915.0	940
922.5	935

Figure 11 — 26 dB Minimum Bandwidth Test Results Table

JUDGEMENT: Passed

For additional information see *Figure 12* to *Figure 13.*

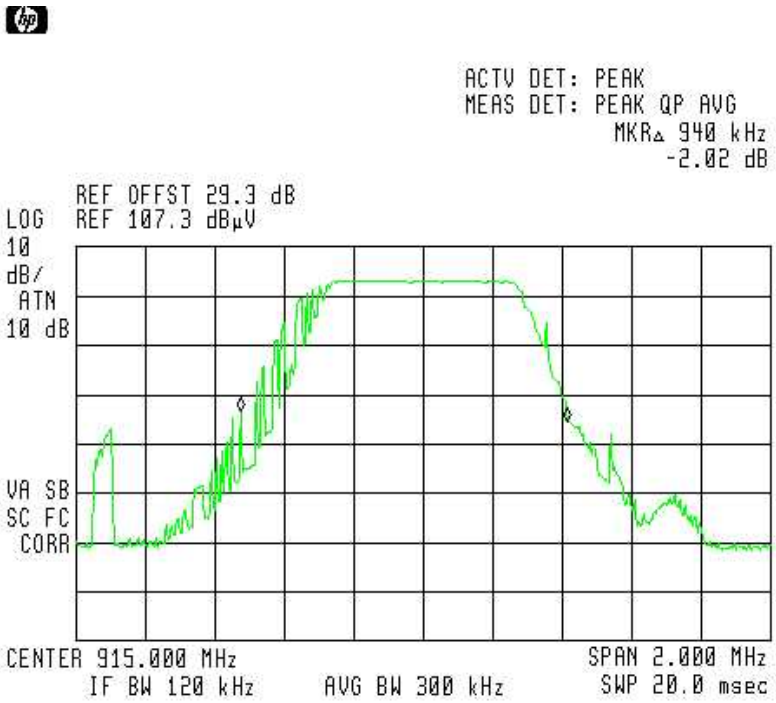


Figure 12. — 915.0 MHz

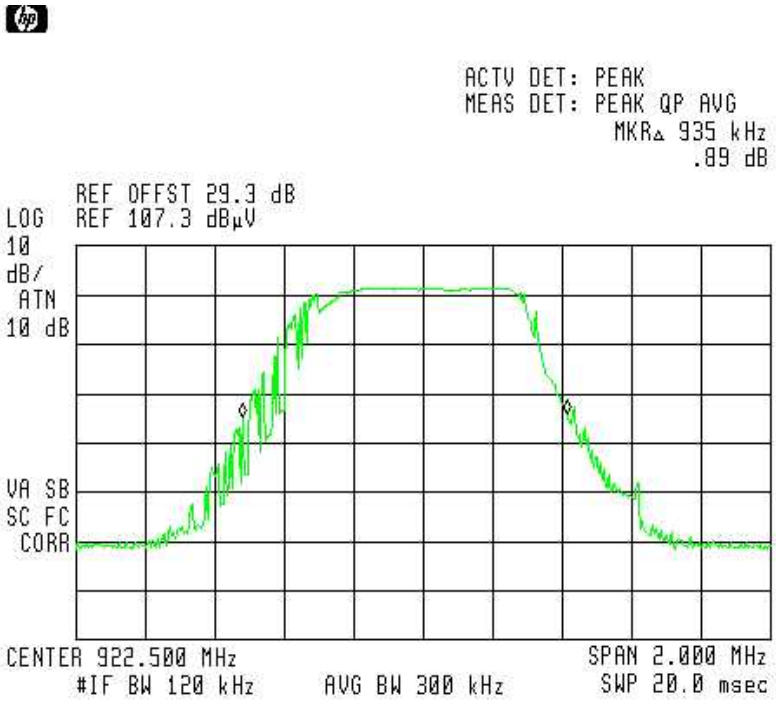


Figure 13. — 922.5 MHz

5.4 *Test Equipment Used, 26 dB Minimum Bandwidth*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	March 19, 2015	1 year
RF Section	HP	85420E	3705A00248	March 19, 2015	1 year
Biconilog Antenna	EMCO	3142B	1250	May 22, 2014	2 years
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 14 Test Equipment Used

6. Radiated Maximum Power Output

6.1 *Test Specification*

F.C.C. Part 15, Subpart C: 15.247(b)(2)

6.2 *Test Procedure*

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters. The transmitter unit operated with normal modulation. The EMI receiver was set to 100 kHz resolution BW. The EUT was set up as shown in *Figure* 2, and its proper operation was checked.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization/

The worst case emission were measured vertically.

Radiated output power levels were measured at selected operation frequencies and the results were converted to power level according to the formula as shown below:

$$P = \frac{(E_{V/m} \times d)^2}{(30 \times G)} \text{ [W]}$$

The E.U.T. was tested at the Low (915.00 MHz) and High (922.50 MHz) channels with modulation.

6.3 *Test Results*

Frequency	Pol	Field	Power Results	Power Results	Limit	Margin
(MHz)		(dbµV/m)	(dBm)	(mW)	(mW)	(mW)
915.0	V	90.3	-7.51	0.18	1000	-999.82
915.0	H	100.4	2.33	1.71	1000	-998.29
922.5	V	93.2	-4.61	0.36	1000	-999.65
922.5	H	98.5	0.43	1.10	1000	-998.90

Figure 15 Radiated Power Output Test Results Table

JUDGEMENT: Passed by 998.29 mW

For additional information see *Figure 16* to *Figure 19.*

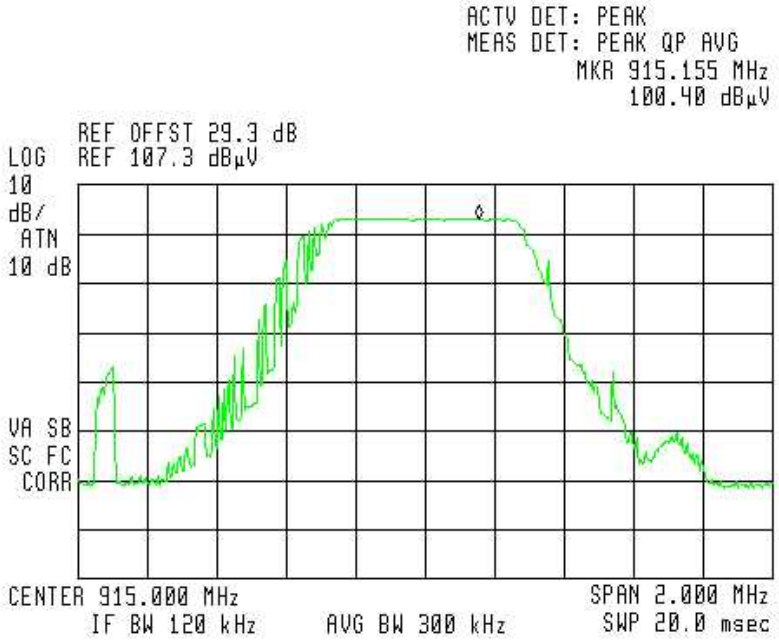


Figure 16 — 915.0 MHz-Horizontal

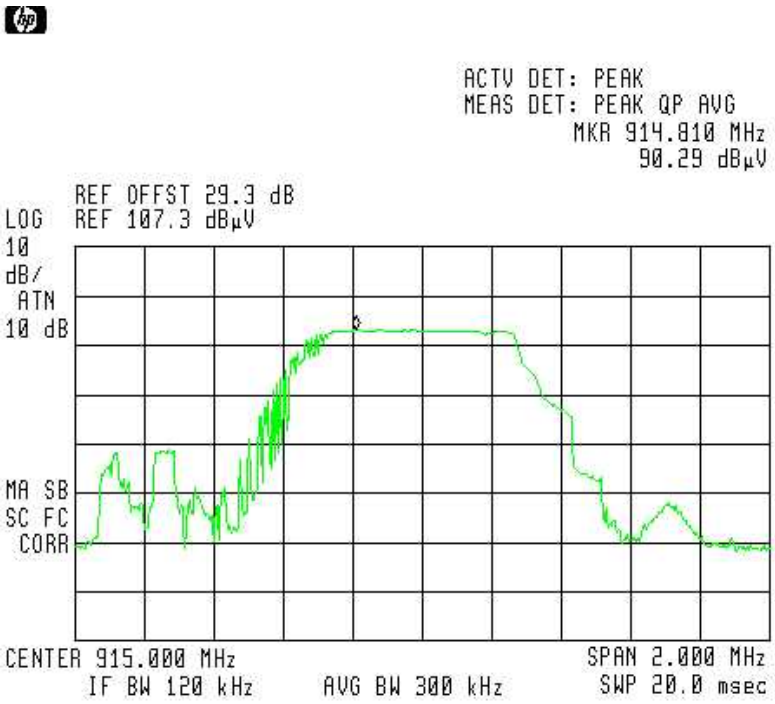


Figure 17 — 915.0 MHz-Vertical

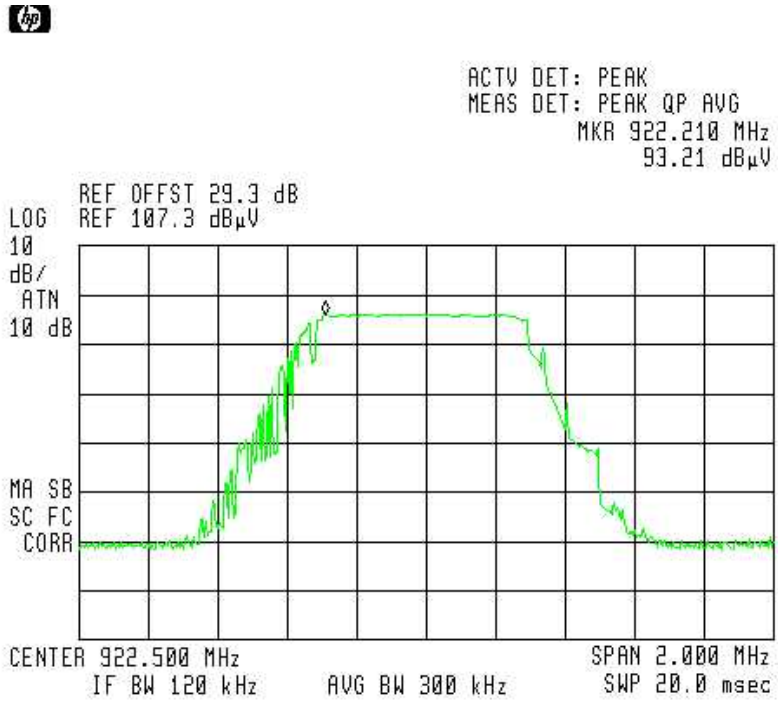


Figure 18 — 922.5 MHz Vertical

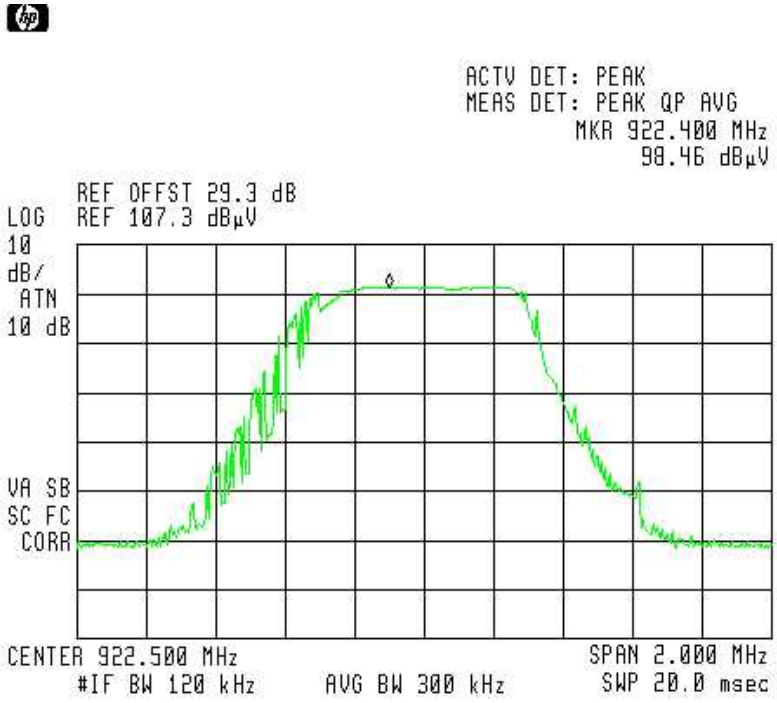


Figure 19 — 922.5 MHz Horizontal

6.4 *Test Equipment Used, Radiated Maximum Power Output*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	March 19, 2015	1 year
RF Section	HP	85420E	3705A00248	March 19, 2015	1 year
Biconilog Antenna	EMCO	3142B	1250	May 22, 2014	2 years
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 20 Test Equipment Used

7. Band Edge

7.1 *Test Specification*

FCC Part 15, Section 15.247(d)

7.2 *Test Procedure*

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters. The transmitter unit operated with normal modulation. The EMI receiver was set to 120 kHz resolution BW. The EUT was set up as shown in *Figure* 2, and its proper operation was checked.

The EMI receiver was adjusted to the transmission channel at the maximum radiated level. The display line was set to 20 dBc and the EMC analyzer was set to the band edge frequencies.

The E.U.T. was tested at the lower and the upper channels.

7.3 *Test Results*

Operation Frequency (MHz)	**Band Edge Frequency** (MHz)	**Spectrum Level** (dBuV/m)	**Specification** (dBuV/m)
Low	902.0	44.8	80.4
High	928.0	44.8	78.5

Figure 21 Band Edge Test Results Table

JUDGEMENT: Passed

For additional information see *Figure 22* to *Figure 23.*

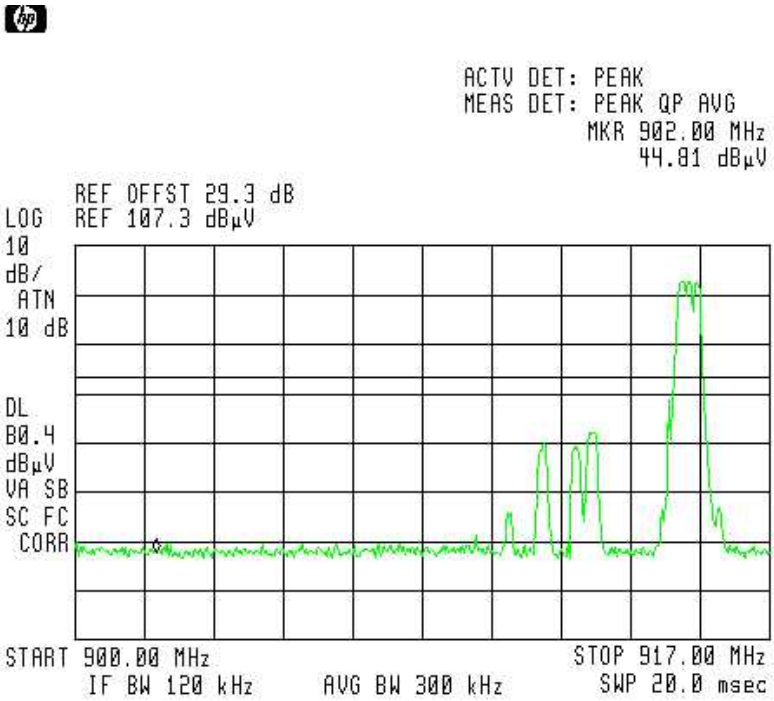


Figure 22 — 915.0 MHz Horizontal

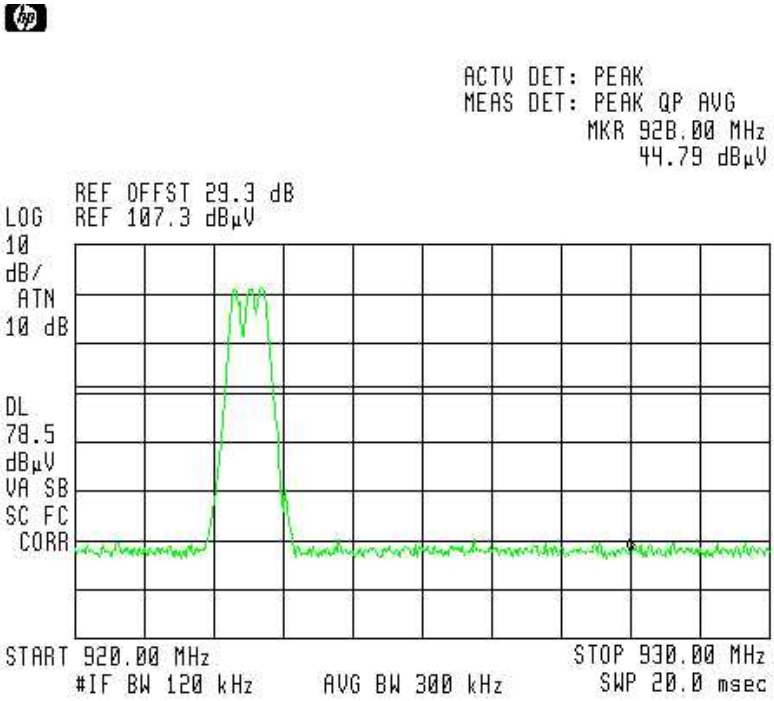


Figure 23 — 922.5 MHz Horizontal

7.4 *Test Equipment Used, Band Edge Spectrum*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	March 19, 2015	1 year
RF Section	HP	85420E	3705A00248	March 19, 2015	1 year
Biconilog Antenna	EMCO	3142B	1250	May 22, 2014	2 years
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 24 Test Equipment Used

8. Spurious Radiated Emission, 9 kHz – 30 MHz

8.1 *Test Specification*

9 kHz-30 MHz, FCC, Part 15, Subpart C, Section 209

8.2 *Test Procedure*

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

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 2.

The frequency range 9 kHz-30 MHz was scanned.

The emissions were measured using a computerized EMI receiver complying with CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

In the frequency range 9 kHz-30MHz, the loop antenna was rotated on its vertical axis. The antenna height (center of loop) was 1 meter at a distance of 3 meters.

The E.U.T. was operated at the frequencies of 915.0 and 922.5 MHz. These frequencies were measured using a peak detector.

8.3 *Test Results*

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 209 specification.

The results for the operating frequencies were the same.

No signals were detected in the frequency range of 9 kHz – 30 MHz.

8.4 *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.

8.5 *Test Equipment Used, Spurious Radiated Emission 9 kHz – 30 MHz*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	R&S	ESBI7	100120	January 1, 2015	1 year
Active Loop Antenna	EMCO	6502	2950	November 4, 2014	1 year
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 25 Test Equipment Used

9. Spurious Radiated Emission 30 MHz – 10 GHz

9.1 *Test Specification*

30 MHz- 10 GHz, F.C.C., Part 15, Subpart C

9.2 *Test Procedure*

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

See Section 2.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.

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 frequency range 30 MHz-10 GHz was scanned and the list of the highest emissions was verified and updated accordingly.

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.

In the frequency range of 30 MHz – 2.9 GHz, the emissions were measured using a computerized EMI receiver complying with CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

In the frequency range 2.9-10.0 GHz, a spectrum analyzer including a low noise amplifier was used. During average measurements, the IF bandwidth was 1 MHz and the video bandwidth was 100 Hz. During peak measurements, the IF bandwidth was 1 MHz and the video bandwidth was 3 MHz.
The test distance was 3 meters.
The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.
Verification of the E.U.T emissions was based on the following methods: turning the E.U.T on and off; using a frequency span less than 10 MHz; observation of the signal level during turntable rotation. (Background noise is not affected by the rotation of the E.U.T.)

The E.U.T. was tested in 2 operating frequencies:
915.0 MHz and 922.5 MHz.

9.3 *Test Data*

JUDGEMENT: Passed

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

For the operation frequency 915.0 MHz, the margin between the emission level and the specification limit is 4.8dB in the worst case at the frequency of 2745.0 MHz, horizontal and vertical polarization.

For the operation frequency 922.5 MHz, the margin between the emission level and the specification limit is 3.8 dB in the worst case at the frequency of 1845.0 MHz, vertical polarization.

Radiated Emission

E.U.T Description	CattleCare
Type	150I
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 (MHz)	Freq. (MHz)	Polarity (H/V)	Peak Reading (dBµV/m)	Peak Specification (dB µV/m)	Peak Margin (dB)
915.0	1830.0	H	57.4	74.0	-16.6
915.0	1830.0	V	57.9	74.0	-16.1
922.5	1845.0	H	56.9	74.0	-17.1
922.5	1845.0	V	60.4	74.0	-13.6
915.0	2745.0	H	61.3	74.0	-12.7
915.0	2745.0	V	62.7	74.0	-11.3
922.5	2767.5	H	61.3	74.0	-12.7
922.5	2767.5	V	61.2	74.0	-12.8

Figure 26. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Peak

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 Reading" includes correction factor.

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

Radiated Emission

E.U.T Description	CattleCare
Type	150I
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 (MHz)	Freq. (MHz)	Polarity (H/V)	Average Reading (dBµV/m)	Average Specification (dB µV/m)	Average Margin (dB)
915.0	1830.0	H	44.9	54.0	-9.1
915.0	1830.0	V	44.9	54.0	-9.1
922.5	1845.0	H	45.2	54.0	-8.8
922.5	1845.0	V	50.2	54.0	-3.8
915.0	2745.0	H	49.2	54.0	-4.8
915.0	2745.0	V	49.2	54.0	-4.8
922.5	2767.5	H	49.2	54.0	-4.8
922.5	2767.5	V	49.2	54.0	-4.8

Figure 27. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL. Detector: Average

Notes:

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 Reading" includes correction factor.

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

9.4 *Field Strength Calculation 30 – 1000 MHz*

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.

9.5 *Test Equipment Used, Spurious Radiated Emission 30 MHz – 10 GHz*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	R&S	ESIB7	100120	December 15, 2014	1 year
Spectrum Analyzer	R&S	FSL6	100194	January 1, 2015	1 year
Active Loop Antenna	EMCO	6502	9506-2950	November 4, 2014	1 year
Biconilog Antenna	EMCO	3142B	1250	May 22, 2014	2 years
Horn Antenna	ETS	3115	6142	March 14, 2012	3 years*
Horn Antenna	ARA	SWH-28	1007	March 30, 2014	3 years
Spectrum Analyzer	HP	8592L	3826A01204	March 4, 2015	1 year
Spectrum Analyzer	HP	8564E	3442A00275	March 11, 2015	1 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	August 22, 2014	1 year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 29, 2014	1 year
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

*Note – Extended to May 19, 2015

Figure 28 Test Equipment Used

10. Radiated Power Spectral Density

[In accordance with section 15.247(d)]

10.1 *Test Procedure*

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters.
The transmitter unit operated with normal modulation. The EMI receiver was set to 1 MHz resolution BW. The EUT was set up as shown in Figure 1, and its proper operation was checked.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.
The E.U.T. was tested in two operating frequencies 915.00 MHz and 922.5 MHz.

Then the EMI receiver was set to 3 kHz resolution BW, span of 5MHz, and automatic sweep time. The spectrum peaks were located at each of the 2 operating frequencies.

Radiated peak output power levels were converted to power level

10.2 *Test Results*

Operation Frequency (MHz)	Field Result (dBuV/m)	Spectral Density Result (dBm)	Specification (dBm)	Margin (dB)
915.00	95.7	-2.37	8.0	-10.37
922.50	94.7	-3.37	8.0	-11.37

Figure 29 Radiated Power Spectral Density Test Results

JUDGEMENT: Passed

For additional information see *Figure 30* and *Figure 31*.

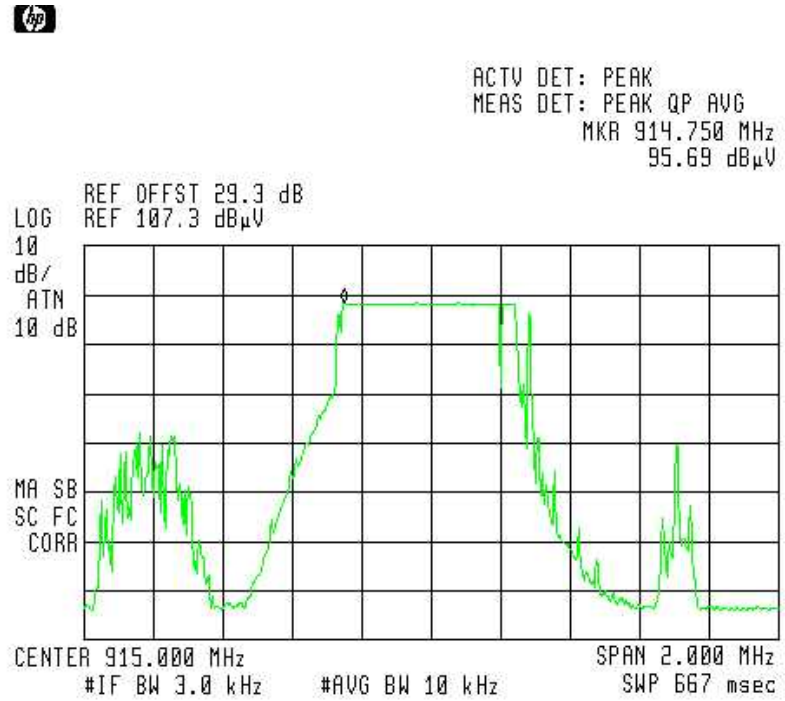


Figure 30 — 915MHz

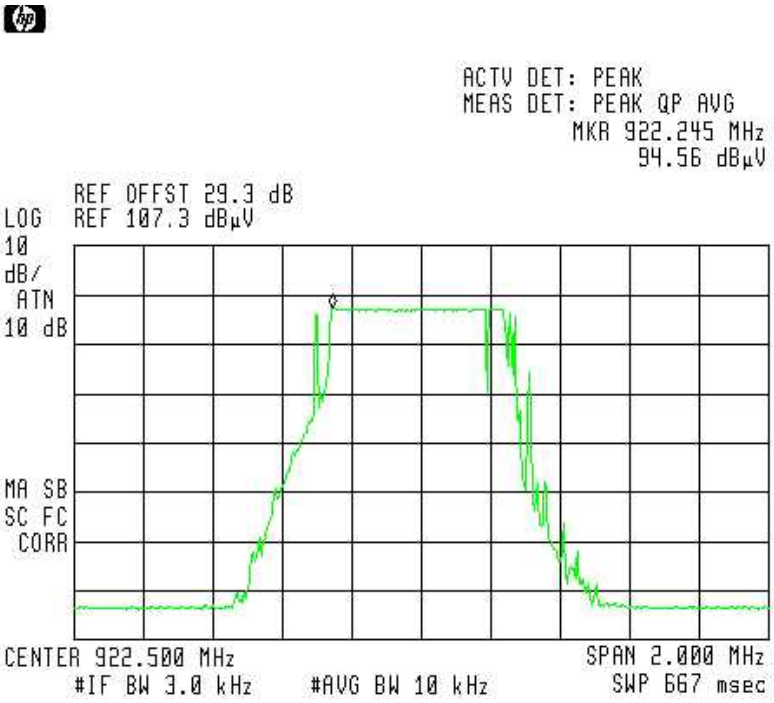


Figure 31 — 922.5MHz

10.1 *Test Equipment Used, Power Spectral Density*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	March 19, 2015	1 year
RF Section	HP	85420E	3705A00248	March 19, 2015	1 year
Biconilog Antenna	EMCO	3142B	1250	May 22, 2014	2 years
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 32 Test Equipment Used

11. Antenna Gain/Information

The antenna gain is -1 dBi.

"High Frequency Ceramic Solutions"

915 MHz Antenna — P/N 0915AT43A0026
Detail Specification: 4/10/2013 — Page 1 of 3

Recommended Application ISM

General Specifications

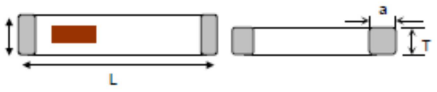
Part Number	0915AT43A0026	Input Power	2W max. (CW)
Frequency (MHz)	902 - 928 Mhz	Operating Temperature	-40 to +85°C
Peak Gain (XZ-total)	-1.0 dBi typ.	Recommended Storage Conditions	+5 to +35°C, Humidity 45~75%RH
Average Gain (XZ-total)	-4.0 dBi typ.		
Return Loss	8.5 dB min.	Reel Quanity	1,000

Part Number Explanation

P/N Suffix	Packing Style	Bulk (loose)	Suffix = S	eg. 0915AT43A0026S
		T & R	Suffix = E	eg. 0915AT43A0026E
		100% Tin	Suffix = E or S	eg. 0915AT43A0026(E or S)
	Termination style	Tin / Lead	Please Consult Factory	

Mechanical Dimensions

	In	mm
L	0.276 ± 0.008	7.00 ± 0.20
W	0.079 ± 0.008	2.00 ± 0.20
T	0.031 ± +.004/-.008	0.80 ± +0.1/-0.2
a	0.020 ± 0.012	0.50 ± 0.30



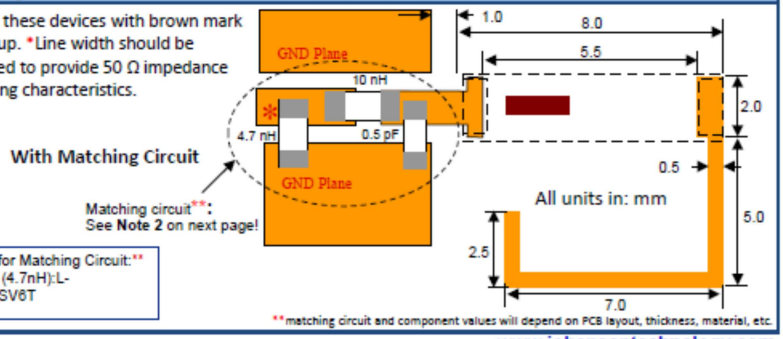
Terminal Configuration

No.	Function
1	Feeding Point
2	NC*

*This terminal must be soldered for anchoring and functionality purposes

Mounting Considerations I

Mount these devices with brown mark facing up. *Line width should be designed to provide 50 Ω impedance matching characteristics.



JTI P/N for Matching Circuit:**
Inductor (4.7nH):L-07C4N7SV6T

**matching circuit and component values will depend on PCB layout, thickness, material, etc.

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12. R.F Exposure/Safety

The typical placement of the E.U.T. is on the neck/back of a cow. The typical distance between the E.U.T. and the user is 20 cm.

Calculation of Maximum Permissible Exposure (MPE)
Based on 47CFR1 Section1.1310 Requirements

(a) FCC Limit at 915.0 MHz is: $\frac{f}{1500} = 0.61 \frac{mW}{cm^2}$

Using Table 1 of 47CFR1 Section 1.1310 limit for general population/uncontrolled exposures, the above levels are an average over 30 minutes.

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

$$S = \frac{P_t G_t}{4®R^2}$$

P_t = 100.4 dBuV/m = 1.71 mW (Calculated Transmitted Power (includes G_t))
G_t = Antenna Gain -1.0 dBi
R = Distance From Transmitter 20cm

(c) The peak power density produced by the E.U.T. is:

$$S_p = \frac{1.71}{4®(20)^2} = 3.4 \times 10^{-4} \frac{mW}{cm^2}$$

(d) This value is below the FCC limit.

13. APPENDIX A - CORRECTION FACTORS

13.1 *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	20.1
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

13.2 *Correction factors for CABLE* from EMI receiver to test antenna at 3 meter range.

FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.2
2.0	1.6
3.0	2.0
4.0	2.4
5.0	3.0
6.0	3.4
7.0	3.8
8.0	4.2
9.0	4.6
10.0	5.0
12.0	5.8

NOTES:

1. The cable type is RG-8.

2. The overall length of the cable is 10 meters.

13.3 *Correction factors for CABLE*

from spectrum analyzer to test antenna above 2.9 GHz

FREQUENCY (GHz)	CORRECTION FACTOR (dB)	FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.9	14.0	9.1
2.0	2.7	15.0	9.5
3.0	3.5	16.0	9.9
4.0	4.2	17.0	10.2
5.0	4.9	18.0	10.4
6.0	5.5	19.0	10.7
7.0	6.0	20.0	10.9
8.0	6.5	21.0	11.2
9.0	7.0	22.0	11.6
10.0	7.5	23.0	11.9
11.0	7.9	24.0	12.3
12.0	8.3	25.0	12.6
13.0	8.7	26.0	13.0

NOTES:

1. The cable type is SUCOFLEX 104 E manufactured by SUHNER.

2. The cable is used for measurements above 2.9 GHz.

3. The overall length of the cable is 10 meters.

13.4 *Correction factors for Bilog ANTENNA*

Model: 3142
Antenna serial number: 1250
3 meter range

FREQUENCY (MHz)	AFE (dB/m)	FREQUENCY (MHz)	AFE (dB/m)
30	18.4	1100	25
40	13.7	1200	24.9
50	9.9	1300	26
60	8.1	1400	26.1
70	7.4	1500	27.1
80	7.2	1600	27.2
90	7.5	1700	28.3
100	8.5	1800	28.1
120	7.8	1900	28.5
140	8.5	2000	28.9
160	10.8		
180	10.4		
200	10.5		
250	12.7		
300	14.3		
400	17		
500	18.6		
600	19.6		
700	21.1		
800	21.4		
900	23.5		
1000	24.3		

13.5 *Correction factors for Horn ANTENNA*

Model: 3115
Antenna serial number: 6142
3 meter range

FREQUENCY (MHz)	Antenna Factor (dB/m)	FREQUENCY (MHz)	Antenna Factor (dB/m)
1000	23.9	10500	38.4
1500	25.4	11000	38.5
2000	27.3	11500	39.4
2500	28.5	12000	39.2
3000	30.4	12500	39.4
3500	31.6	13000	40.7
4000	33	14000	42.1
4500	32.7	15000	40.1
5000	34.1	16000	38.2
5500	34.5	17000	41.7
6000	34.9	17500	45.7
6500	35.1	18000	47.7
7000	35.9		
7500	37.5		
8000	37.6		
8500	38.3		
9000	38.5		
9500	38.1		
10000	38.6		

13.6 *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

13.7 *Correction factors for* *Horn Antenna*

Model: SWH-28
at 1 meter range.

FREQUENCY (GHz)	AFE (dB /m)	Gain (dB1)
18.0	40.3	16.1
19.0	40.3	16.3
20.0	40.3	16.1
21.0	40.3	16.3
22.0	40.4	16.8
23.0	40.5	16.4
24.0	40.5	16.6
25.0	40.5	16.7
26.0	40.6	16.4