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DATE: 19 August 2014

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

FCC Radio Test Report

for

SuperCom Ltd.

Equipment under test:

PureTag v1.5

EM Wrist Tag: PRF-PURET15EM
Asset Tag: PRF-PURET15AT

Written by: _____
R. Pinchuck, Documentation

Approved by: _____
M. Zohar, Test Engineer

Approved by: _____
I. Raz, EMC Laboratory Manager

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Measurement/Technical Report for SuperCom Ltd.

PureTag v1.5

EM Wrist Tag: PRF-PURET15EM

Asset Tag: PRF-PURET15AT

FCC ID: W5P-PRF-PURET15

This report concerns:	Original Grant:	x
	Class I change:	
	Class II change:	

Equipment type: Part 15 Security/Remote Control Transmitter

Limits used: 47CFR15 Section 15.231 (a-d)

Measurement procedure used is ANSI C63.4-2003.

Application for Certification prepared by:

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1. General Information

1.1 Administrative Information

Manufacturer:	SuperCom Ltd.
Manufacturer's Address:	1 Arie Shenkar St. Herzeliya, 4672501 Israel Tel: 972-9-889-0800 Fax: 972-9-889-0814
Manufacturer's Representative:	Ehud Bachman
Equipment Under Test (E.U.T):	PureTag v1.5
Equipment Model No.:	EM Wrist Tag: PRF-PURET15EM Asset Tag: PRF-PURET15AT
Equipment Serial No.:	Not Designated
Date of Receipt of E.U.T:	23.07.2014
Start of Test:	23.07.2014
End of Test:	06.08.2014
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
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.), Registration No. 90715.
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 4025B-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 PureTag is SuperCom's next generation mini RFID tags, with a mission to be integrated in application like Electronic Monitoring systems and asset management systems.

Electronic Monitoring - Typically used by ministries of justice, departments of correction, probation offices, etc., the offender-monitoring suite consists of House Arrest and/or geographical monitoring based on a home unit, offender tag, and a GPS-enabled device. Supercom brings vast experience and proven record of accomplishment within the governmental sector, along with enhanced technology and most important – genuine understanding of the EM market.
Asset management - SuperCom's Tracking and Monitoring division specializes in smart solutions for various applications needing supervision of subjects.
By using a well-established Radio Frequency Identification technology, a reliable and secured solution can be fitted to nearly every need.
The wide range of solutions is based on our proven track record technology that makes use of active RFID platforms.
By using its RFID technology, SuperCom is able to track and monitor the tagged assets within the installed facility.
The facility is covered with RFID readers, which allow relatively high accuracy in determining where the subjects are.
It is also possible to increase the resolution and reach location by room.
Furthermore, real-time counts and an accurate time-stamped log is provided in order to allow the ultimate tracking solution.

1.4 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4: 2003. Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.5 Test Facility

The radiated emissions tests were performed at I.T.L.'s testing facility at Kfar Bin-Nun, Israel. This site is a FCC listed test laboratory (FCC Registration No. 90715, date of listing November 21, 2012).
I.T.L.'s EMC Laboratory is also accredited by A2LA, certificate No. 1152.01.

1.6 Measurement Uncertainty

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

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

Both models incorporate the same PCB with different plastic enclosure only.

The antenna is similar in both models.

Both models have 2 optional modulation modes: ASK and FSK.

Testing was done for each configuration mode after radiated emission screening was performed in 3 orthogonal orientations. The worst case orientation was the vertical position.

2.2 EUT Exercise Software

No special exercise software was used.

2.3 Special Accessories

No special accessories were needed.

2.4 Equipment Modifications

No modifications were needed in order to achieve compliance

2.5 Configuration of Tested System

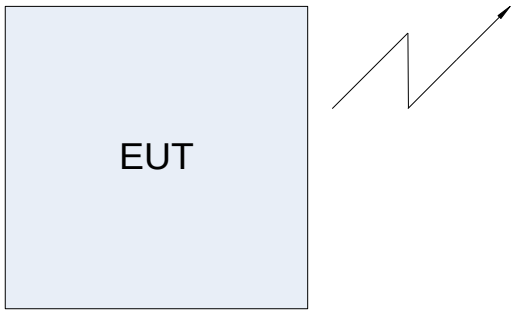

Figure 1. Configuration of Tested System

3. Radiated Measurement Test Set-up Photo

Figure 2. Radiated Emission Test

Figure 3. Radiated Emission Test

Figure 4. Radiated Emission Test

Figure 5. Radiated Emission Test

Figure 6. Radiated Emission Test

Figure 7. Radiated Emission Test

Figure 8. Radiated Emission Test

Figure 9. Radiated Emission Test

4. Average Factor Calculation

1. Transmission pulse duration = n/a
2. Transmission pulse period = n/a
3. Burst duration = 11.75 msec
4. Time between bursts = 303msec , >100ms
5. $$\text{Average Factor} = 20\log\left[\frac{\text{Pulse duration}}{\text{Pulse period}} \times \frac{\text{burst duration}}{100\text{msec}} \times \text{Num of burst within } 100\text{msec}\right]$$

$$\text{Average Factor} = 20\log\left[1 \times \frac{11.75}{100} \times 1\right] = -18.5dB$$

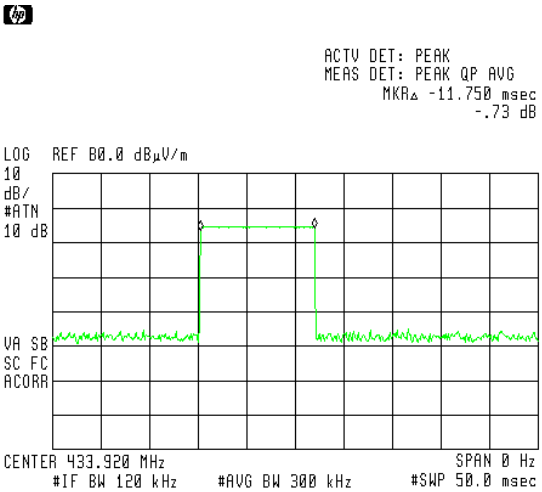

Figure 10. Burst duration = 11.75msec

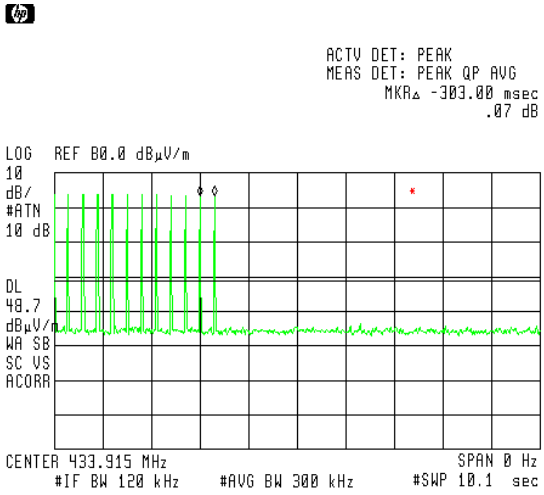

Figure 11. Time between bursts = 303msec>100ms

4.1 Test Instrumentation Used; Average Factor Calculation

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 year
Antenna Biconical	EMCO	3104	2606	August 30, 2014	2 years
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 2, 2014	2 years
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A

Figure 12. Test Equipment Used

5. Periodic Operation

5.1 Specification

F.C.C., Part 15, Subpart C, Section 15.231(a)

5.2 Requirements

Requirement	Rationale	Verdict
Continuous transmissions are not permitted.	N/A	Complies
A manually operated transmitter shall be deactivated within not more than 5 seconds after releasing the switch.	N/A	Complies
An automatically operated transmitter shall cease operation within 5 seconds after activation.	See Figure 15 (Wrist Tag) and Figure 18 (Asset Tag)	Complies
Periodic transmissions at regular predetermined intervals are not permitted.	N/A	Complies
Polling or supervised transmissions to determine system integrity of transmitter used in security or safety applications shall not exceed more than 2 seconds per hour.	See Figures 13 and 14 (Wrist Tag) and Figures 16 and 17 (Asset Tag)	Complies

5.3 Results

JUDGEMENT: Passed

The EUT met the FCC Part 15, Subpart C, Section 15.231(a) specification requirements.

TEST PERSONNEL:

Tester Signature:  Date: 26.08.14

Typed/Printed Name: M. Zohar

Periodic Operation

E.U.T Description	PureTag v1.5
Type	EM Wrist Tag: PRF-PURET15EM Asset Tag: PRF-PURET15AT
Serial Number:	Not Designated

Specification: F.C.C., Part 15, Subpart C, 15.231(a)

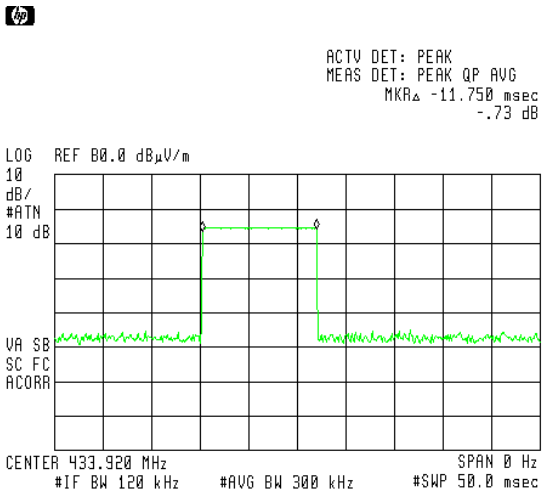

Figure 13. Wrist Tag - Supervision Mode Burst Time

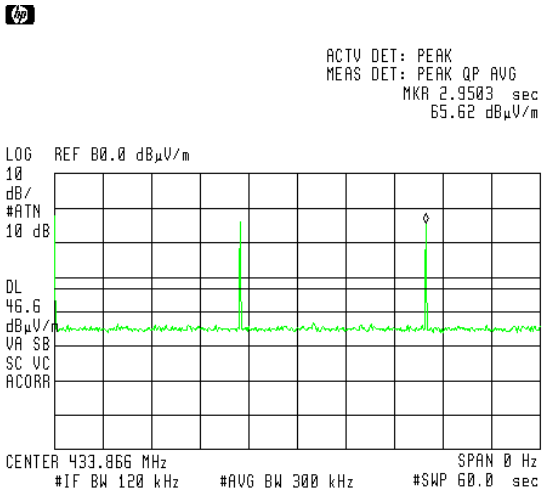

Figure 14. Wrist Tag - Supervision Mode Time Between Bursts

(11.75msec X 163 [once every 22sec] = 1922msec < 2000msec per hour)

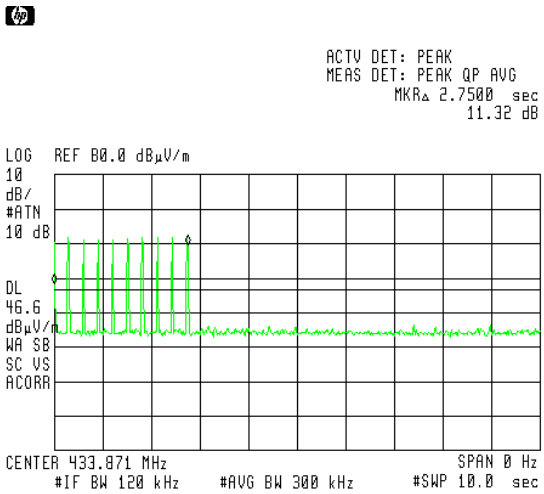

Figure 15. Wrist Tag - Automatic Transmission,Time Between Bursts

Periodic Operation

E.U.T Description	PureTag v1.5
Type	EM Wrist Tag: PRF-PURET15EM Asset Tag: PRF-PURET15AT
Serial Number:	Not Designated

Specification: F.C.C., Part 15, Subpart C, 15.231(a)

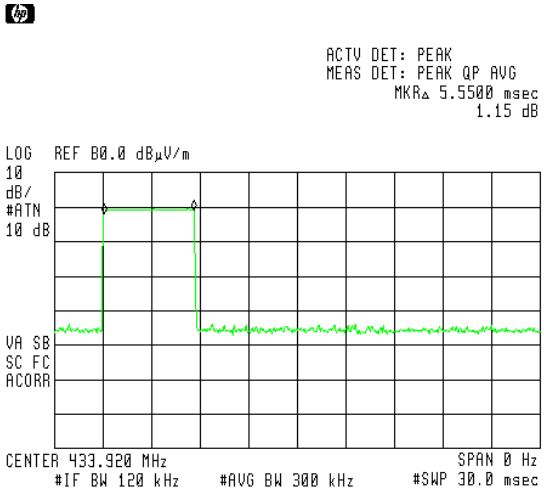

Figure 16. Asset Tag – Supervision Mode Burst Time

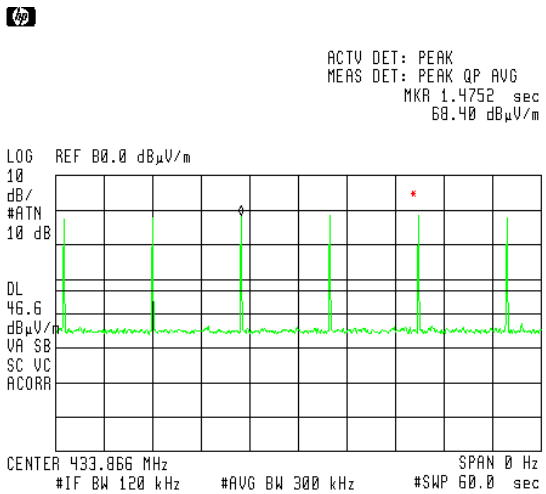

Figure 17. Asset Tag- Supervision Mode Time Between Bursts

(5.55msec X300 [once every 12sec] = 1650msec < 2000msec per hour)

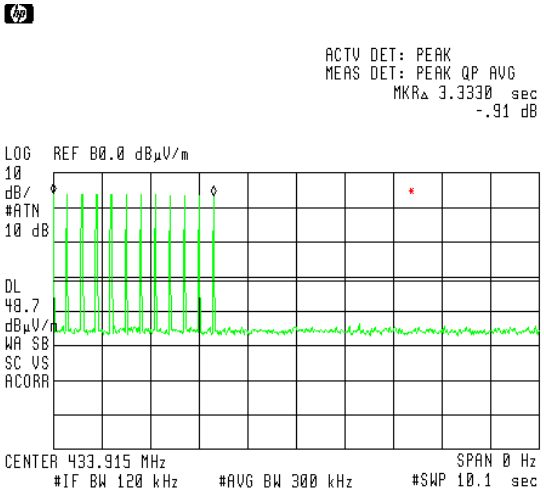

Figure 18. Asset Tag - Automatic Transmission, Time Between Bursts

5.4 Test Instrumentation Used; Periodic Operation

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	January 15, 2014	1 year
RF Section	HP	85420E	3705A00248	January 15, 2014	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	2 years
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

Figure 19 Test Equipment Used

6. Field Strength of Fundamental

6.1 Test Specification

F.C.C., Part 15, Subpart C, Section 15.231(b)

6.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3.

The E.U.T. was placed on a non-conductive table, 0.8 meters above the O.A.T.S. ground plane.
The EMI receiver was set to the E.U.T. Fundamental Frequency and Peak Detection.
The turntable and antenna mast were adjusted for maximum level reading on the EMI receiver.
The measurement was performed for vertical and horizontal polarizations of the test antenna.

The test was performed for 2 TAG types: Asset Tag and EM Wrist Tag.

Each Tag was tested in 2 modulation modes: ASK and FSK.

The average result is:

Peak Level (dBµV/m) + E.U.T. Duty Cycle Factor in 100msec time window (dB)

6.3 Measured Data

JUDGEMENT: Passed by 16.0 dB

The EUT met the FCC Part 15, Subpart C, Section 15.231(b) specification requirements.

The details of the highest emissions are given in *Figure 20* to *Figure 28*.

TEST PERSONNEL:

Tester Signature: _____ Date: 26.08.14

Typed/Printed Name: M. Zohar

Field Strength of Fundamental

E.U.T Description	PureTag v1.5
Type	EM Wrist Tag: PRF-PURET15EM Asset Tag: PRF-PURET15AT
Serial Number:	Not Designated

Specification: F.C.C., Part 15, Subpart C, 15.231(b)

Antenna Polarization: Horizontal/Vertical

Test Distance: 3 meters Detector: Peak

TAG	Modulation	Freq. (MHz)	Pol. V/H	Peak Reading (dBµV/m)	Average Factor (dB)	AVG Result (dBµV/m)	AVG Specification (dBµV/m)	Margin (dB)
ASSET TAG	FSK	433.92	H	78.4	-18.5	59.9	80.8	-20.9
	FSK	433.92	V	83.1	-18.5	64.6	80.8	-16.2
	ASK	433.92	H	76.6	-18.5	58.1	80.8	-22.7
	ASK	433.92	V	83.2	-18.5	64.7	80.8	-16.1
EM WRIST TAG	FSK	433.92	H	75.3	-18.5	56.8	80.8	-24.0
	FSK	433.92	V	83.3	-18.5	64.8	80.8	-16.0
	ASK	433.92	H	74.8	-18.5	56.3	80.8	-24.5
	ASK	433.92	V	82.7	-18.5	64.2	80.8	-16.6

Figure 20. AVG Test Results - Field Strength of Fundamental

Notes:

1. 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.
2. "Peak Reading." (dBµV/m) included the "Correction Factors".
3. "Correction Factors" (dB) = Test Antenna Correction Factor(dB) + Cable Loss.
4. "Average Factor = 20 log [(burst duration/100msec)*Num of burst within 100msec)]= 20 log [(11.75/100)*1)]=-18.5
5. "Average Result" (dBµV/m)=Peak Reading (dBµV/m)+D.C.F. (dB)

Field Strength of Fundamental

E.U.T Description	PureTag v1.5
Type	EM Wrist Tag: PRF-PURET15EM Asset Tag: PRF-PURET15AT
Serial Number:	Not Designated

Specification: F.C.C., Part 15, Subpart C, 15.231(b)

Antenna Polarization: Horizontal
Test Distance: 3 meters Detector: Peak

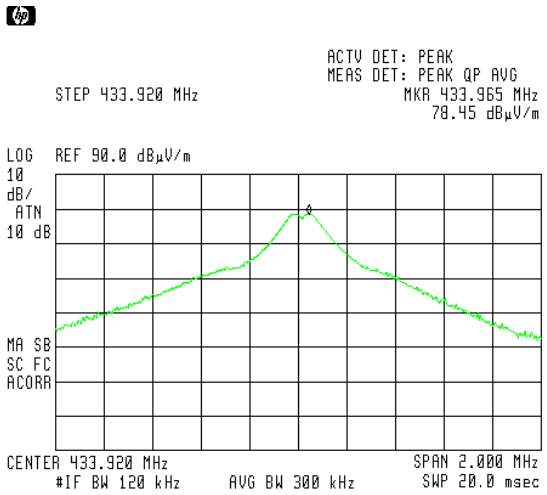

Figure 21. Asset Tag - Field Strength of Fundamental; Antenna Polarization: HORIZONTAL. Detector: Peak (FSK MODULATION)

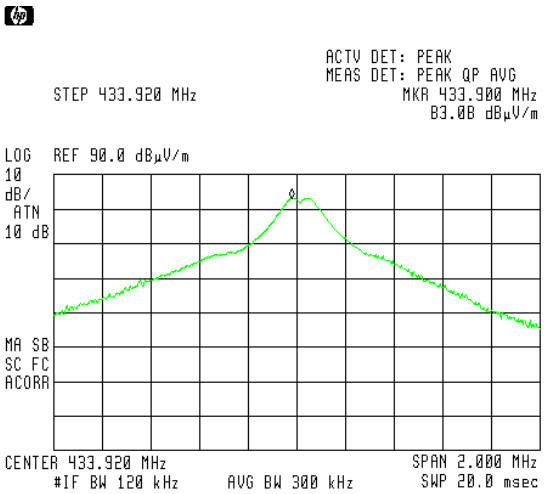

Figure 22. Asset Tag - Field Strength of Fundamental. Antenna Polarization: VERTICAL. Detector: Peak (FSK MODULATION)

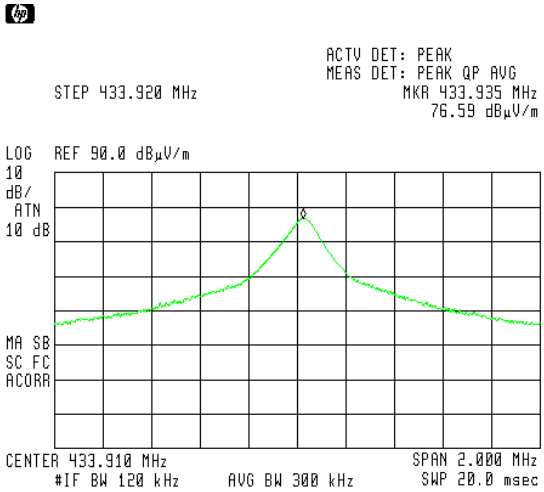

Figure 23. Asset Tag - Field Strength of Fundamental. Antenna Polarization: HORIZONTAL. Detector: Peak (ASK MODULATION)

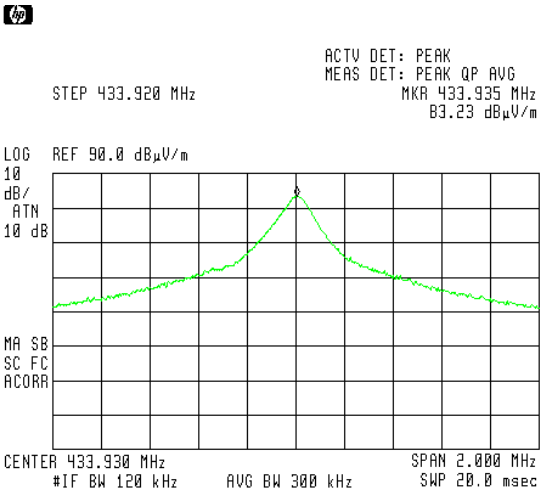

Figure 24. Asset Tag - Field Strength of Fundamental. Antenna Polarization: VERTICAL. Detector: Peak (ASK MODULATION)

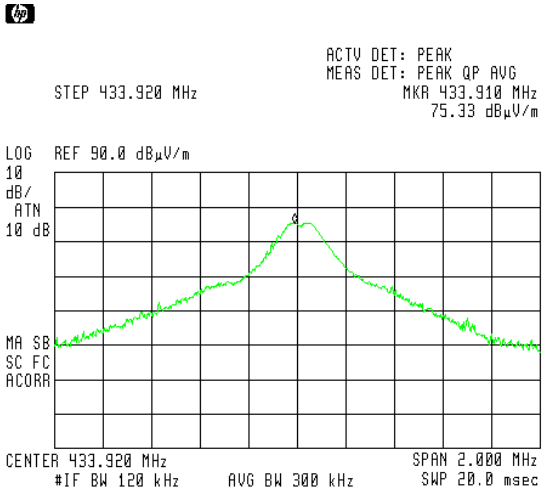

Figure 25. EM Wrist Tag - Field Strength of Fundamental. Antenna Polarization: HORIZONTAL. Detector: Peak (FSK MODULATION)

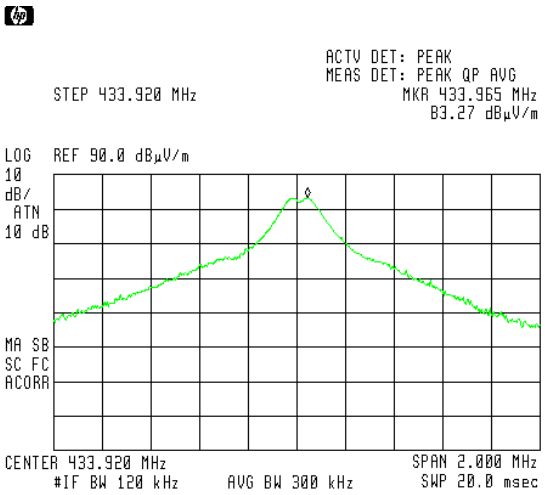

Figure 26. EM Wrist Tag - Field Strength of Fundamental. Antenna Polarization: VERTICAL. Detector: Peak (FSK MODULATION)

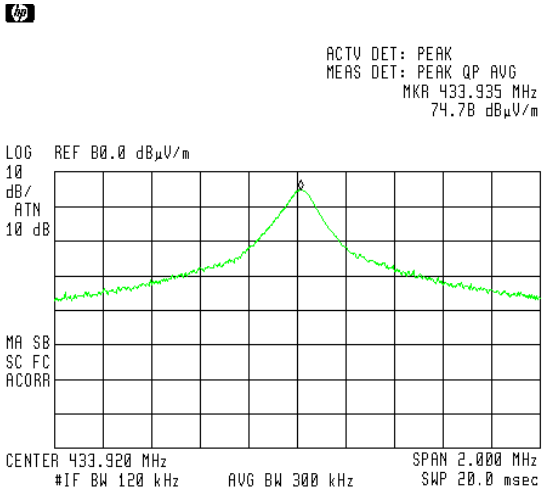

Figure 27. EM Wrist Tag - Field Strength of Fundamental. Antenna Polarization: HORIZONTAL. Detector: Peak (ASK MODULATION)

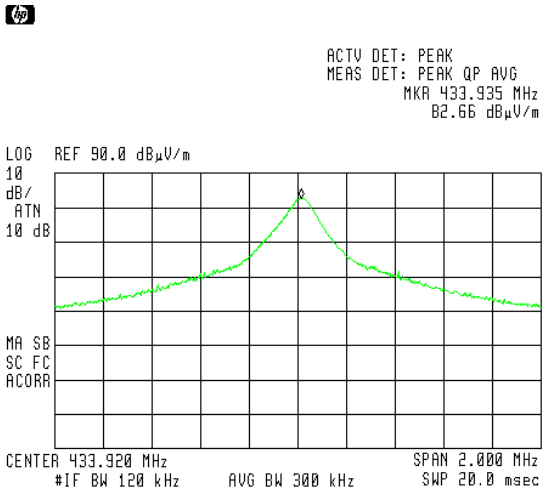

Figure 28. EM Wrist Tag - Field Strength of Fundamental. Antenna Polarization: VERTICAL. Detector: Peak (ASK MODULATION)

6.4 Test Instrumentation Used, Field Strength of Fundamental

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	January 15, 2014	1 year
RF Section	HP	85420E	3705A00248	January 15, 2014	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	2 years
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

Figure 29 Test Equipment Used

7. Radiated Emission, 9 kHz – 30 MHz

7.1 Test Specification

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

7.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3.

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 3.1.

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.
Two models of the EUT were tested: Asset Tag and EM Wrist Tag.
The E.U.T. was operated at the frequency of 433.92 kHz. This frequency was measured using a peak detector.

7.3 Measured Data

JUDGEMENT: Passed

No unwanted emission spurious was detected in frequency range 9 kHz-30 MHz

The EUT was tested and it met the requirements of the FCC Part 15, Subpart C specification.

TEST PERSONNEL:

Tester Signature: _____ Date: 26.08.14

Typed/Printed Name: M. Zohar

7.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	January 15, 2014	1 year
RF Section	HP	85420E	3705A00248	January 15, 2014	1 year
Active Loop Antenna	EMCO	6502	9506-2950	November 4, 2013	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A

Figure 30 Test Equipment Used

7.5 Field Strength Calculation

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

$$FS = RA + AF + CF$$

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. Radiated Emission 30 MHz -4.5GHZ

8.1 Test Specification

30 MHz – 4.5 GHz, F.C.C., Part 15, Subpart C

8.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3.
See Section 3.1 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 configuration tested is shown in *Figure 1*.

The signals from the list of the highest emissions were verified and the list was 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.

The frequency range 30 MHz to 4.5 GHz was scanned and the list of the highest emissions was verified and updated accordingly.

The emissions in the frequency range 30 MHz -1000 MHz 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 2.9GHz – 4.5GHz, a spectrum analyzer including a low noise amplifier was used. The test distance was 3 meters. During peak measurements, the I.F. bandwidth was 1 MHz, and video bandwidth 3 MHz. During average measurements, the I.F. bandwidth was 1 MHz and video bandwidth was 100 Hz.

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 emissions were measured at a distance of 3 meters.
Two E.U.T models were tested: Asset Tag and EM Wrist Tag.
The E.U.T.s were operated at the frequency of 433.92 kHz.

8.3 Test Data

JUDGEMENT: Passed by 42.7 dB

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

The margin between the emission level and the specification limit was 42.7 dB in the worst case at the frequency of 1301.7 MHz, vertical polarization.

For additional information see Figure 31.

TEST PERSONNEL:

Tester Signature: _____ Date: 26.08.14

Typed/Printed Name: M. Zohar

Radiated Emission

E.U.T Description	PureTag v1.5
Type	EM Wrist Tag: PRF-PURET15EM Asset Tag: PRF-PURET15AT
Serial Number:	Not Designated

Specification: FCC Part 15, Subpart C

Antenna Polarization: Vertical
ntenna: 3 meters distance

Frequency range: 30 MHz to 4.5 GHz
Detectors: Peak

TAG	Frequency	Pol.	Peak Reading	Average Factor	AVG Result	AVG Specification	Margin
	MHz		(dBµV/m)	(dB)	(dBµV/m)	(dBµV/m)	(dB)
Asset Tag	867.8	V	56.4	-18.5	37.9	80.8	-42.9
	1301.7	V	55.6	-18.5	37.1	80.8	-42.7
EM Wrist Tag	867.8	V	54.5	-18.5	36.0	80.8	-44.8
	1301.7	V	52.9	-18.5	34.4	80.8	-46.4

Figure 31. Radiated Emission. Antenna Polarization: VERTICAL. Detectors: Peak

Notes:

1. 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.
2. "Peak Reading." (dBµV/m) included the "Correction Factors".
3. "Correction Factors" (dB) = Test Antenna Correction Factor (dB) + Cable Loss.
4. "Average Result" (dBµV/m)=Peak Reading (dBµV/m)+ Average Factor (dB)

8.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	January 15, 2014	1 year
RF Section	HP	85420E	3705A00248	January 15, 2014	1 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	August 21, 2013	1 year
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 year
Antenna Biconical	EMCO	3104	2606	August 30, 2012	2 years
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	2 years
Double Ridged Waveguide Horn Antenna	EMCO	3115	29845	March 14, 2012	3 years
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

Figure 32 Test Equipment Used

9. 20dB Bandwidth

9.1 Test procedure

The transmitter unit operated with normal modulation. The spectrum analyzer was set to 30 kHz resolution BW and center frequency of the transmitter fundamental. The spectrum bandwidth of the transmitter unit was measured and recorded. The BW was measured at 20 dBc points.

The EUT was set up as shown in Figure 1, and its proper operation was checked. The transmitter occupied bandwidth was measured with the EMI receiver as frequency delta between reference points on the modulation envelope.
The E.U.T was tested in 2 modulation modes: ASK and FSK.

9.2 Results Table

E.U.T Description: PureTag v1.5
Model: EM Wrist Tag: PRF-PURET15EM
Asset Tag: PRF-PURET15AT
Serial Number: Not Designated
Specification: F.C.C. Part 15, Subpart C: (15.231(c))

Modulation	Bandwidth Reading (kHz)	Specification (kHz)	Margin (kHz)
FSK	295	<1084	-789
ASK	220	<1084	-864

Figure 33 20dB Bandwidth

JUDGEMENT: Passed by 789 kHz

TEST PERSONNEL:

Tester Signature: _____ Date: 26.08.14

Typed/Printed Name: M. Zohar

(1) 0.25% of the E.U.T. fundamental frequency, Section 15.231(c).

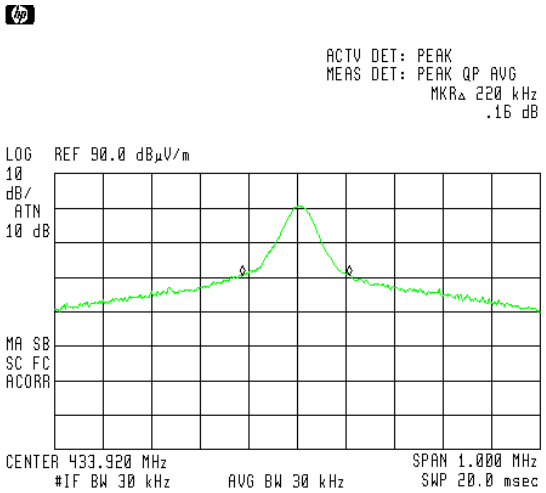

Figure 34 20dB ASK MODULUTION

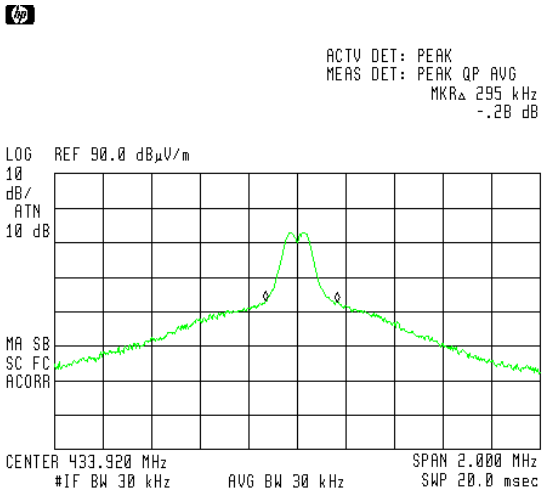

Figure 35 20dB FSK MODULUTION

9.3 Test Equipment Used; 20dB Bandwidth

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	January 15, 2014	1 year
RF Section	HP	85420E	3705A00248	January 15, 2014	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	2 years
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

Figure 36 Test Equipment Used

10. 26dB Bandwidth

10.1 Test procedure

The transmitter unit operated with normal modulation. The spectrum analyzer was set to 30 kHz resolution BW and center frequency of the transmitter fundamental. The spectrum bandwidth of the transmitter unit was measured and recorded. The BW was measured at 26 dBc points.

The EUT was set up as shown in Figure 1 and its proper operation was checked. The transmitter occupied bandwidth was measured with the EMI receiver as frequency delta between reference points on the modulation envelope.
The E.U.T was tested in 2 modulation modes: ASK and FSK.

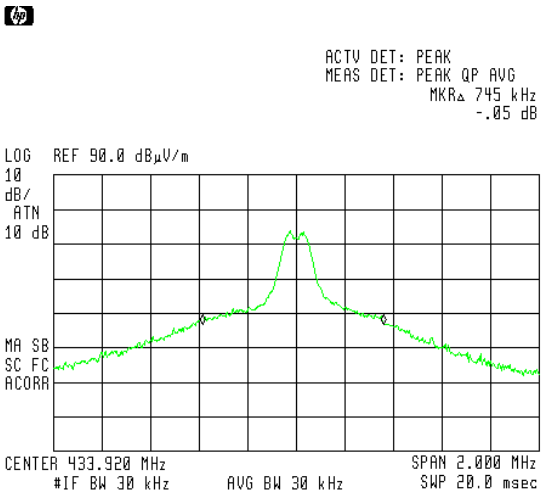

Figure 37 26dB FSK Modulation

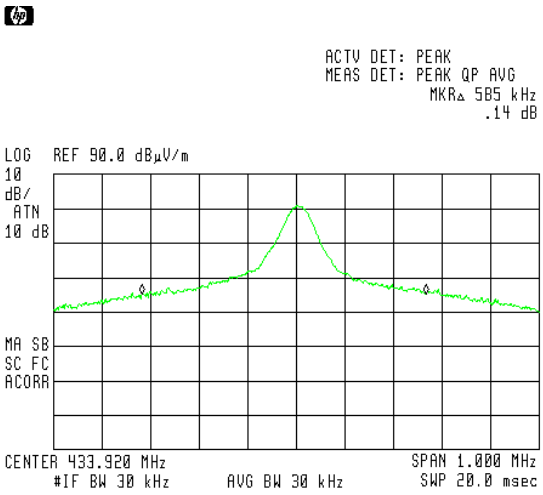

Figure 38 26dB ASK Modulation

10.2 Results Table

E.U.T Description: PureTag v1.5
Model: EM Wrist Tag: PRF-PURET15EM
Asset Tag: PRF-PURET15AT
Serial Number: Not Designated
Specification: F.C.C. Part 15, Subpart C: (15.231(c))

Modulation	Bandwidth Reading (kHz)
FSK	745
ASK	585

Figure 39 26dB Test Results

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____ Date: 26.08.14

Typed/Printed Name: M. Zohar

(1) 0.25% of the E.U.T. fundamental frequency, Section 15.231(c).

10.3 Test Equipment Used; 26 dB Bandwidth

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	January 15, 2014	1 year
RF Section	HP	85420E	3705A00248	January 15, 2014	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	2 years
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

Figure 40 Test Equipment Used

11. R.F Exposure/Safety

The typical placement of the E.U.T. is as a personal tag. The typical distance between the E.U.T. and the user is 0.5 cm.

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

(a) FCC Limit at 433.92 MHz is:

$$\frac{f}{1500} = 0.289 \frac{mW}{cm^2}$$

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:

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

P_t = Calculated Transmitted Power (includes G_t) = 9.12×10^{-4}

G_t = Antenna Gain dBi = dBi

R = Distance From Transmitter = 0.5cm

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

$$S_p = \frac{9.12x10^{-4}}{4\pi(0.5)^2} = 2.9x10^{-4} \frac{mW}{cm^2}$$

(d) This value is below the FCC limit.

12. APPENDIX A - CORRECTION FACTORS

12.1 Correction factors for CABLE

from EMI receiver to test antenna at 3 meter range.

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3
20.0	0.6
30.0	0.8
40.0	0.9
50.0	1.1
60.0	1.2
70.0	1.3
80.0	1.4
90.0	1.6
100.0	1.7
150.0	2.0
200.0	2.3
250.0	2.7
300.0	3.1
350.0	3.4
400.0	3.7
450.0	4.0
500.0	4.3
600.0	4.7
700.0	5.3
800.0	5.9
900.0	6.3
1000.0	6.7

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
1200.0	7.3
1400.0	7.8
1600.0	8.4
1800.0	9.1
2000.0	9.9
2300.0	11.2
2600.0	12.2
2900.0	13.0

NOTES:

1. The cable type is RG-214.

2. The overall length of the cable is 27 meters.

3. The above data is located in file 27MO3MO.CBL on the disk marked "Radiated Emission Tests EMI Receiver".

12.2 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.

12.3 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.

12.4 Correction factors for LOG PERIODIC ANTENNA

Type LPD 2010/A
at 3 and 10 meter ranges.

Distance of 3 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.1
250.0	10.2
300.0	12.5
400.0	15.4
500.0	16.1
600.0	19.2
700.0	19.4
800.0	19.9
900.0	21.2
1000.0	23.5

Distance of 10 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.0
250.0	10.1
300.0	11.8
400.0	15.3
500.0	15.6
600.0	18.7
700.0	19.1
800.0	20.2
900.0	21.1
1000.0	23.2

NOTES:

1. *Antenna serial number is 1038.*
2. *The above lists are located in file number 38M3O.ANT for a 3 meter range, and file number 38M100.ANT for a 10 meter range.*
3. *The files mentioned above are located on the disk marked "Radiated Emission Test EMI Receiver".*

12.5 Correction factors for LOG PERIODIC ANTENNA

Type SAS-200/511
at 3 meter range.

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
1.0	24.9
1.5	27.8
2.0	29.9
2.5	31.2
3.0	32.8
3.5	33.6
4.0	34.3
4.5	35.2
5.0	36.2
5.5	36.7
6.0	37.2
6.5	38.1

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
7.0	38.6
7.5	39.2
8.0	39.9
8.5	40.4
9.0	40.8
9.5	41.1
10.0	41.7
10.5	42.4
11.0	42.5
11.5	43.1
12.0	43.4
12.5	44.4
13.0	44.6

NOTES:

1. *Antenna serial number is 253.*
2. *The above lists are located in file number SAS3M0.ANT for a 3 meter range.*
3. *The files mentioned above are located on the disk marked "Antenna Factors".*

12.6 Correction factors for BICONICAL ANTENNA

Type BCD-235/B, at 3 meter range

FREQUENCY (MHz)	AFE (dB/m)
20.0	19.4
30.0	14.8
40.0	11.9
50.0	10.2
60.0	9.1
70.0	8.5
80.0	8.9
90.0	9.6
100.0	10.3
110.0	11.0
120.0	11.5
130.0	11.7
140.0	12.1
150.0	12.6
160.0	12.8
170.0	13.0
180.0	13.5
190.0	14.0
200.0	14.8
210.0	15.3
220.0	15.8
230.0	16.2
240.0	16.6
250.0	17.6
260.0	18.2
270.0	18.4
280.0	18.7
290.0	19.2
300.0	19.9
310	20.7
320	21.9
330	23.4
340	25.1
350	27.0

NOTES:

1. Antenna serial number is 1041.

2. The above list is located in file 19BC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver".

12.7 Correction factors for Double-Ridged Waveguide Horn

Model: 3115, S/N 29845
at 3 meter range.

FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (dBi)	FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (dBi)
1.0	24.8	5.4	10.0	38.8	11.4
1.5	26.1	7.6	10.5	38.9	11.8
2.0	28.6	7.7	11.0	39.0	12.1
2.5	29.8	8.4	11.5	39.6	11.8
3.0	31.4	8.4	12.0	39.8	12.0
3.5	32.4	8.7	12.5	39.6	12.5
4.0	33.7	8.6	13.0	40.0	12.5
4.5	33.4	9.9	13.5	39.8	13.0
5.0	34.5	9.7	14.0	40.2	13.0
5.5	35.1	9.9	14.5	40.6	12.9
6.0	35.4	10.4	15.0	41.3	12.4
6.5	35.6	10.8	15.5	39.5	14.6
7.0	36.2	10.9	16.0	38.8	15.5
7.5	37.3	10.4	16.5	40.0	14.6
8.0	37.7	10.6	17.0	41.4	13.4
8.5	38.3	10.5	17.5	44.8	10.3
9.0	38.5	10.8	18.0	47.2	8.1
9.5	38.7	11.1			

12.9 Correction factors for ACTIVE LOOP ANTENNA

Model 6502
S/N 9506-2950

FREQUENCY (MHz)	Magnetic Antenna Factor (dB)	Electric Antenna Factor (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