TYCO SAFETY PRODUCTS
SENSORMATIC ELECTRONICS, LLC.
EMC TEST REPORT

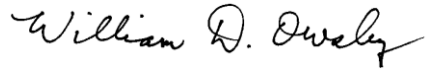
Model:
IDX-8000-NA
IDX-4000-NA
IDX-2000-NA

Type: IDX8000NA

FCC ID: BVCIDX8000NA
IC: 3506A-IDX8000NA

Intentional Radiator

FCC and IC
47 CFR, Part 15, Subpart B, and Subpart C
Industry Canada
ICES-003e, RSS GENi3, RSS-210i8



EMC Engineer

6600 Congress Ave.
Boca Raton, FL. 33487
USA

Revision Level	Reason	Date
Rev. A	Initial	May 17, 2012

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1 Summary Of Results

FCC 47 CFR Part 15. Subpart C.	Test Requirement	Test Limit	Comments
15,15 (b)	User Accessible Controls	Cannot change output power above limit.	The product contains no user accessible controls that increase transmission power above permitted levels.
15.31 (e)	Vary Input AC Mains Power	Does not increase the output power above the limit.	AC Mains Input was varied from 102 to 138 VAC. Input power to antenna was measured. Complies.
13.33 (a)	Frequency range of radiated measurements	General Limits of 15.209, 9kHz to 10 GHz.	H-field and E-field measurements comply
15.107	AC Mains Conducted Emissions Requirements	See Table 15.107. Unintentional digital emissions subject to Class B limits.	Digital emissions determined by turning transmitter off. Complies [Verification].
15.109	Radiated Emissions Requirements	See Table 15.109. Unintentional digital emissions subject to Class B limits.	Digital emissions determined by turning transmitter off. Complies [Verification].
15.203	Antenna Connector	Permanently attached or unique coupling.	The radio to antenna connectors are MMX to RP SMA connectors. Complies.
15.204(b)(c)	System and Antennas	Marketed as a system with authorized antenna types	System is complete radio with list of patch type antennas. Complies
15.207 (a) (b)	AC Mains Conducted Emissions	General Limits.	Conducted emissions on AC side of DC supply. . Complies.
15.205 (a) (b) 15.209 (a) (c)	Radiated Emission	Must comply with limits specified in 15.209 (a). No intentional emissions in the restricted bands of 15.205	The radiated emissions in the comply with the general emission limits.
15.247 (a) (1)	Carrier Frequency Separation	Separated by minimum of 25 kHz or 20 dB BW of the hopping channel, whichever is greater.	The carrier frequencies of the hopping channel are separated by 500 kHz. Complies.
15.247 (a) (1) (i)	Number of Hopping Frequencies .	If 20 dB BW is less than 250 kHz, then shall use at least 50 hopping channels, using frequencies in a pseudo random list.	The EUT has 50 hopping channels and complies with the requirement.
15.247 (a) (1) (i)	Dwell Time – Number of Hopping Frequencies > 25	< 0.4 sec within a 20 second period	The EUT complies with the requirement.
15.247 (b) (2) (3)	Output Power 902-928 MHz Tx	Maximum 1 W – frequency hopping with 50+ channels	The EUT complies with the requirement.
15.247 (b) (4)	Maximum Antenna Gain	If directional gain of transmitting antenna greater than 6 dBi, the peak output power of the device shall be reduced below the stated values by the amount in dB exceeding 6 dBi.	Permanently attached attenuators on each antenna ensure compliance to 6 dBi.
15.247 (b) (5)	RF Exposure	Must ensure that RF MPE to the public falls within Commission Guidelines	See RF Exposure Section.
These results are deemed satisfactory evidence of compliance with Industry Canada Interference-Causing Equipment Standard ICES-003 and Radio Standards RSS Gen and RSS-210, RSS-101.			

2 General Information

This report is part of the application for Certification of a RFID reader operating in the 902-928 MHz bands under the rules provided for frequency-hopping transmitters found in 47 CFR 15.247. The digital portion of the radio was evaluated according to the DoC procedures. The product covered by this report is the Sensormatic IDX-x000-NA Reader. (The x can be any number to represent other models with fewer output ports.)

The EUT is a RFID radio transceiver with 30 dBm maximum output power and 2-8 ports that are used one at a time.

The EUT can accommodate up to 8 transmit antennas on 8 electrically identical transmit ports. However, only one port, and therefore one antenna, can be active at a time. Under no circumstances can more than one transmitter port be on at a time.

2.1 Test Procedures

Both conducted and radiated emissions testing were performed according to the procedures in ANSI C63.4-2003, as required by 47 CFR Part 15 Subpart A Section 15.31(a)(3), 15.107, 15.109, 15.207, 15.209.

15.247 requirements were measured per FCC document DA 00-705, "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems", released March 30, 2000.

Accessory Equipment used to terminate ports and communicate are all FCC DoC products. This includes ITE power supplies, PC's, network switches.

2.2 Test Site Registration

The Tyco Safety Products / Sensormatic Electronics, LLC OATS located at 6600 Congress Ave. Boca Raton, FL. 33487 is registered with the FCC, number – 889978 and 616407, and with Industry Canada, number – 3506A-1.

2.3 Sample Calculation – Radiated & Conducted Emissions

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

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

Where:
RAW = Measured level before correction (dBμV)
AMP = Amplifier Gain (dB)
CBL = Cable Loss (dB)
ACF = Antenna Correction Factor (dB/m)

dBμV/m = 20 * log * μV/m

Margin to Limit is calculated by subtracting corrected measurement from Limit.
Positive margin indicates compliance. Negative margin indicates non-compliance

To convert dBμV/m to dBμA/m,
Reduce reading in dBμV/m by 51.5 dB to convert to dBμA/m.

IC RSS GEN
The following formula may be used to convert field strength (FS) in volts/metre to transmitter output power (TP) in watts:
$TP = (FS \times D) / (30 \times G)^2$
Where D is the distance in metres between the two antennas and G is the antenna numerical gain referenced to isotropic gain. (**Note:** In an open-area test measurement, the effect due to the metal ground plane should be subtracted

$FS = TP \times (30 \times G)^2 / D$

Radiated Power, e.r.p dBm
By using PC = Pe.r.p. −GIC + 5,15 + CL dBm and re-arranging to Perp = PC + GIC - 5,15 – CL.
Where the highest reading was 30.28 dBm.
Antenna gain = 6 dBi = 9 dBic
Cable loss = 2.1 dB

Maximum e.r.p. is 29.1 = 30.3 + 6 – 5.15 – 2.1

Effective Radiated Power is converted to Field Strength by the following:

The Friis transmission equation governs the interaction between two antennas in the far field:

$$P_r = \frac{P_t G_t G_r \lambda^2}{(4\pi r)^2}, \quad (5)$$

where Pr is the power measured at the receive antenna output port;
Pt is the power measured at the transmit antenna input port;
Gt is the gain of the transmit antenna;
Gr is the gain of the receive antenna;
l is the wavelength; and
r is the separation between the two antennas (the range length).

The electric field generated at a point in the far field as a function of the transmitted power is given by

$$E = \frac{\sqrt{30 P_t G_t(\theta,\phi)}}{r}, \quad (12)$$

where E is the electric field generated at the distance r from the transmit antenna,
Pt is the power measured at the transmit antenna input port,
Gt (q, f) is the angle-dependent gain of the transmit antenna, and
r is the distance from the transmit antenna to the test point (the range length)

Info: http://www.ce-mag.com/archive/02/Spring/fogelle2.html

Note:
power levels into a dipole results in an E-field at a distance according to power: (V^2) / R = P

power flux density: s = PG / (4*pi*r^2), where pi = 3.14 and r = distance

Field strength: e = sqrt (120 * pi * s) = sqrt (30 * P) / r

A half-wave dipole has a 1.64 gain in its equatorial plane, therefore:
e = sqrt (1.64*30*P) /r = 7*sqrt (P) / r

Field strength e = (7.02*sqrt (ERP)) / d. ERP in Watts, d in meters.
Or Source Radiating (ERP) -> ERP = (e*d / 7.02)^2 in Watts, Volts/meter, meters

Conversion to dBuV from http://www.compeng.com.au/emc_conversion_tables_rf_calculator2.aspx

2.4 Uncertainty of Measurements

Combined Standard Uncertainty and Expanded Uncertainty using an expansion factor of 2. (estimated)		CISPR 16-4-2 Uncertainty Limits
Radiated Emissions = ± 1.56 dB	Expanded Uncertainty = 3.12 dB	5.2 dB
Conducted Emissions = ± 1.12 dB	Expanded Uncertainty = 2.24 dB	3.6 dB
Harmonic Current and Flicker = ± 2.6 %	Expanded Uncertainty = 5.12 %	
Radiated Immunity = ± 2.15 dB	Expanded Uncertainty = 4.3 dB	
ESD Immunity = 4.15 %	Expanded Uncertainty = 8.3 %	
EFT - Fast Transient Immunity = ± 2.82 %	Expanded Uncertainty = 5.64 %	
Conducted Immunity = ± 1.83 dB	Expanded Uncertainty = 2.24 dB	
Voltage Variation and Interruption = ± 1.7 %	Expanded Uncertainty = 3.4 %	
Surge Immunity = ± 3.1 %	Expanded Uncertainty = 6.2 %	

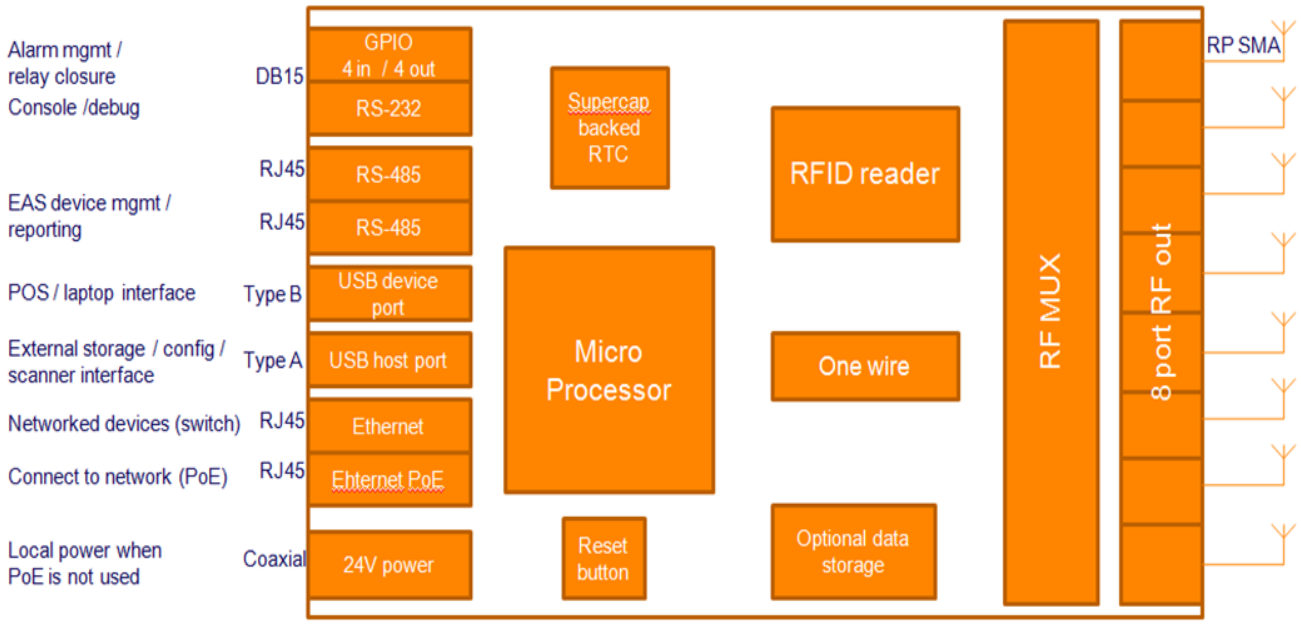
Uncertainty values were calculated based on methods in ETSI TR 100 028.

Per EN 302 208-1, Clause 7, the value of the measurement uncertainty for each measurement, shall be equal to or lower than the figures given below.

Parameter Uncertainty

RF frequency	+/-1 × 10-7
RF power, conducted	+/-0,75 dB
RF power, radiated, valid up to 12,75 GHz	+/-6 dB
Maximum frequency deviation for FM	+/-5 %
Two-signal measurements	+/-4 dB
Time	+/-5 %
Temperature	+/-1 K
Humidity	+/-5 %

3 Test Set-Up Block Diagram



3.1 List Of Ports

Cable	Signal or Power	Max Length	Type	Load
GPIO	Signal	>3m	shielded	Alarms/Relays
RS-232	Signal	>3m	shielded	Console/Debug
RS-485 x 2	Signal	>3m	Un-shielded	EAS Device Mgmt
USB-Type B	Signal	>3m	shielded	POS/Computer
USB-Type A	Signal	>3m	shielded	Ext Storage/Scanner I/F
Ethernet Cat-5	Signal	>3m	Un-shielded	Network devices
Ethernet PoE-Cat-5	Signal and DC Power	>3m	Un-shielded	Network Connect/PoE
24 VDC	DC Power	<3m	coax	AC-DC Power Supply
RF Coax x 8	Signal	<3m	50 ohm Coax	RFID Antenna

3.2 Ancillary Equipment Used During Testing

RFID Tag or label
UHF patch antenna

Accessory Equipment Declaration of Conformity

All accessory equipment used during testing is commercially available off-the-shelf (COTS) FCC DoC or Verified devices.
Laptop Computer for USB and Ethernet communication
LDM CBC-4055 for RS-485 termination

3.2.1 List of Power Supplies evaluated for worst case:

Any LPS rated independently approved power supply such as,
Sensormatic p/n 5606-0091-01
GlobTek, Inc.
PN: TR9KI170760BKN-(RVB)
Model: GT-41083-4042-T2
Input: 100-240Vac, 50/60Hz, 1.0A
Output: 24Vdc, 1.7A

Any LPS rated independently rated Power over Ethernet supply such as,
PoE Injector Power Supply, Phihong PSA16U-480(POE), PowerDsine 7001G

3.2.2 List of Antennas that can be used with the EUT:

Manufacturer	Model Number	Polarization	Composite Gain
Sensormatic	IDA-1000-US	RHCP	3.3dBiL
Sensormatic	IDA-2100-US	RHCP	6.0dBiL
Sensormatic	IDA-2400-US	RHCP	6.0dBiL
Sensormatic	IDKM-1000 / IDKM-1010	near field	–8.5dBiL
Motorola (Symbol)	AN480-CL66100WR	LHCP	6.0dBiL
Motorola (Symbol)	AN480-CR66100WR	RHCP	6.0dBiL

All antennas were evaluated to determine worst case emissions

All ports were evaluated for worst case emissions

EUT was tested with modulation and without modulation for worst case

Radiated evaluations were performed in a pre-screen environment and the worst case was tested on the OATS. Multiple orientations of antenna and radio were evaluated to determine worst case.

Maximum conducted transmit power was measured at the antenna end of the supplied antenna cable.

3.3 RF Exposure Compliance Requirements per 15.247 (b) (5)

Operating Band Center Frequency = 915 MHz, Range 902-928
EUT Max Output Power = 30 dBm
Antenna Gain = 6 dBi => Numeric Gain = 4
Power Density Limit for General Population is S = f(MHz) / 1500 = 0.61 mW / cm^2 or 6.100 W/m^2
(CFR 47 Part 1.1310, Table 1)

Minimum MPE safe distance (using equation below) = 23 cm

Calculations:
Power Density Pd = (Pt*G)/(4*pi*d^2)
Solve for d
d^2 = (Pt*G)/(4*pi*Pd)
d = SqrRoot((Pt*G)/(4*pi*Pd))
d = SqrRoot((1watt*4gain)/(4*pi*6.100watt/m^2)
d = SqrRoot((1/pi*6.100)m^2)
d = SqrRoot(1/pi*6.100)m
d = 0.228meters = 23 cm

Where
E = Field Strength in Volts/meter
Pt= Transmit Power In Watts
G = Numeric Antenna Gain
d = Distance in Meters
Pd = Power Density in W / square m

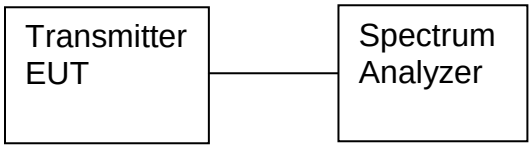
Per IC: RSS-102i4, 4.2.
Power Density Limit for General Population is S = f(MHz) / 150 = 06.1 mW / cm^2 or 61.00 W/m^2
From above;
d = SqrRoot(1/pi*61.0)m
d = 0.072meters = 7.2 cm

3.4 Input Voltage Variation, 15.31(e).

Measured using a connector adapter short cable, MCX to N.
The required cable is longer and has more loss.
Output power set to Maximum, 30 dBm.

Frequency	Voltage	Peak Signal Level
902.74	120	30.02
902.75	+15% (138V)	30.00
902.75	-15% (102V)	30.05
915.25	120	29.93
914.25	+15% (138V)	29.93
915.25	-15% (102V)	29.92
927.25	120	30.07
927.25	+15% (138V)	30.12
927.25	-15% (102V)	30.07

Setup:



3.5 Temperature Variation, 15.215(c).

Freq	-20 C	25 C	55 C
138 V	902.74	902.74	902.74
120 V	902.75	902.75	902.74
102 V	902.75	902.75	902.74

Freq	-20 C	25 C	55 C
138 V	916.25	914.25	914.24
120 V	915.25	915.25	915.24
102 V	915.25	915.25	915.25

Freq	-20 C	25 C	55 C
138 V	927.25	927.25	927.24
120 V	927.25	927.25	927.25
102 V	927.25	927.25	927.25

3.6 AC Conducted Emissions, 15.207 And 15.107, Class B.

Port : AC Mains
Equipment operation : Transmitting modulated. Communicating with accessories.
AC Mains : 120V / 60 Hz
Ambient temperature : 23.1 °C
Relative humidity : 53.1 % RH
Equipment list asset numbers : 1, 37, 104, 10.

Test method is according to ANSI C63.4-2003.

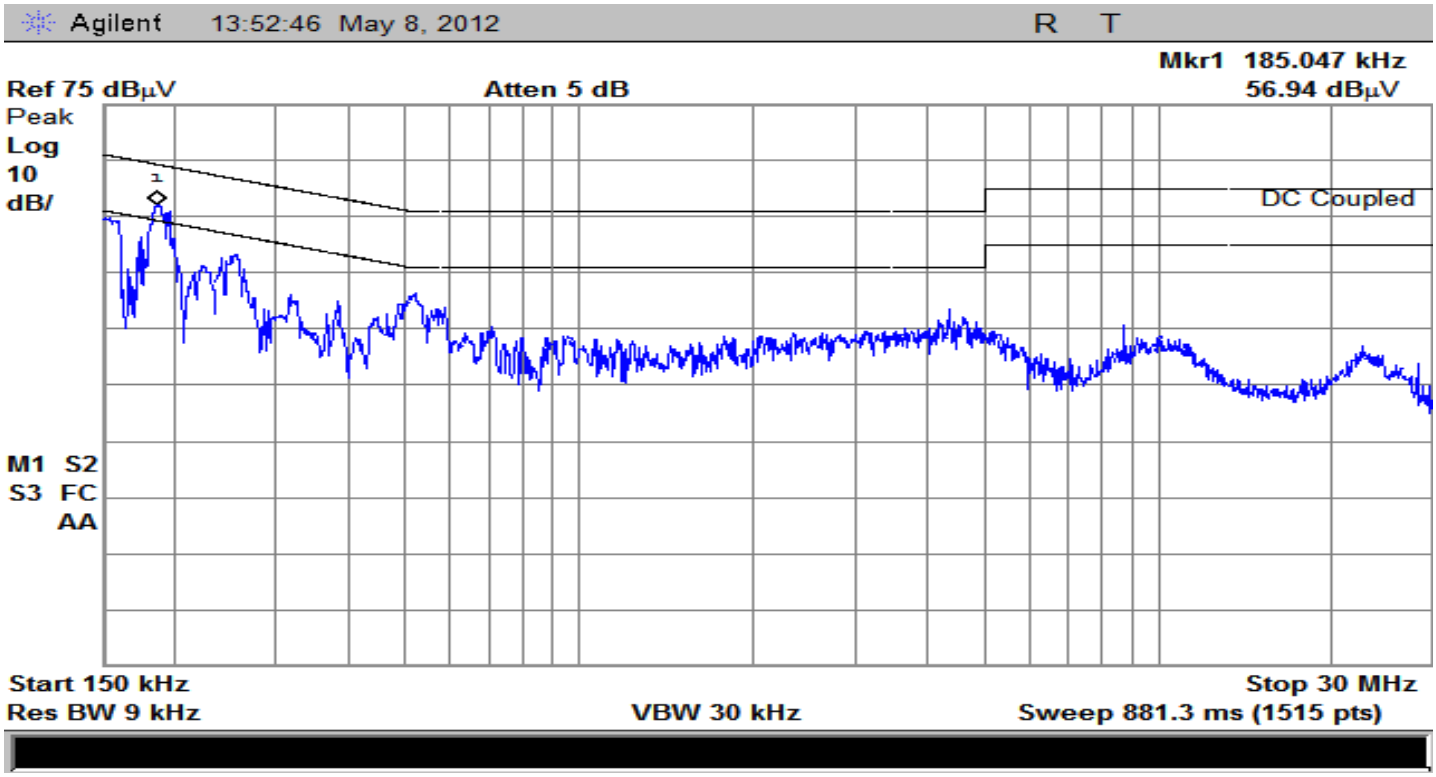
FCC 15.107 - Class B digital device**, and 15.207 - General limits**

Frequency range	Quasi-peak (dBuV)	Average (dBuV)
0,15 - 0,50	66 - 56	56 - 46
0,50 - 5	56	46
5 - 30	60	50

		Reading		Limit	
Freq (MHz)		dbUv	Line	Class B	Margin
0.19	QP	54.84	L1	64.04	9.20
	Avg	36.59	L1	54.04	17.45
0.19	QP	53.36	L2	64.04	10.68
	Avg	35.03	L2	54.04	19.01
0.525	QP	36.59	L1	56.00	19.41
	Avg	29.19	L1	46.00	16.81
0.525	Qp	38.78	L2	56.00	17.22
	Avg	29.17	L2	46.00	16.83
0.154	Qp	50.41	L1	66.00	15.59
	Avg	23.23	L1	56.00	32.77
0.315	Qp	37.8	L2	59.97	22.17
	Avg	23.53	L2	49.97	26.44

GlobTek power supply

Line 1



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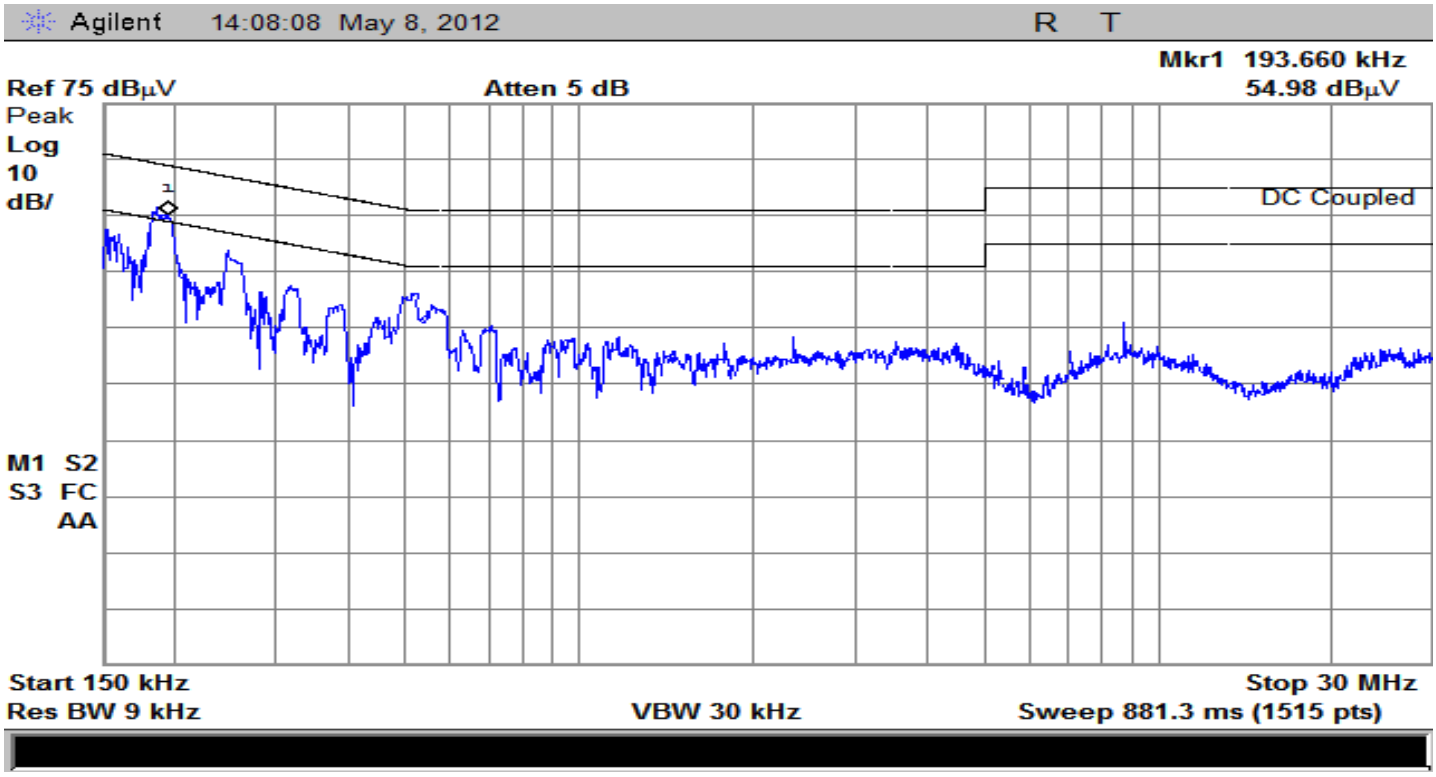
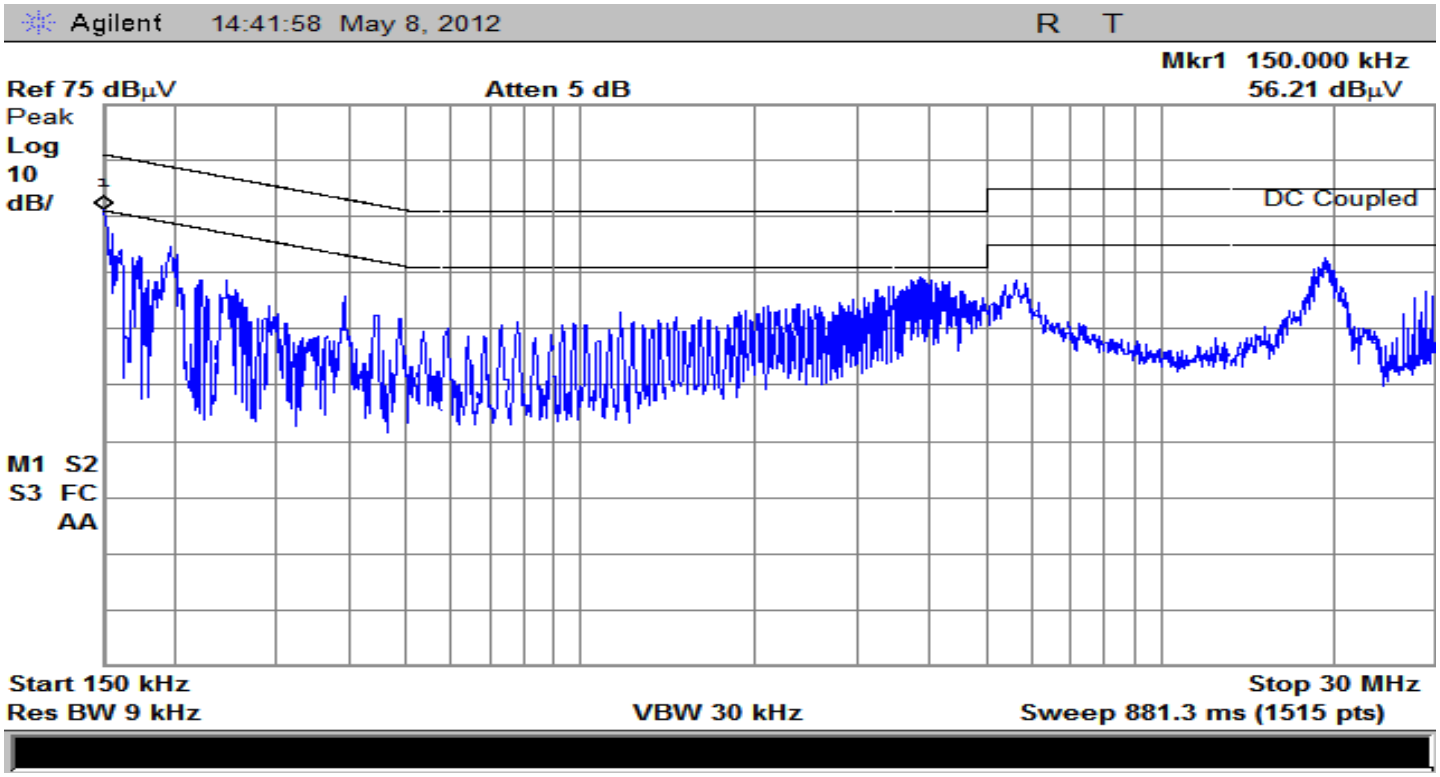
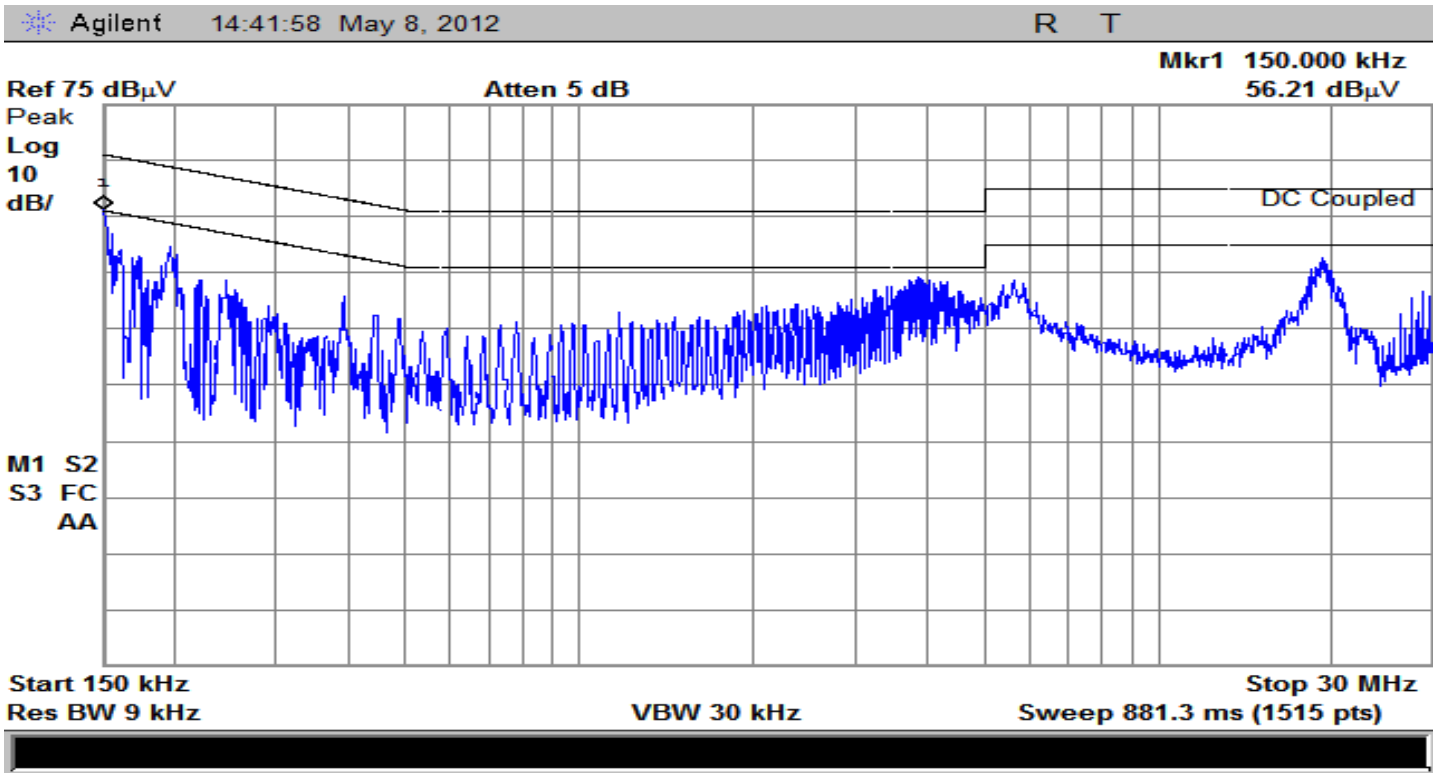


Line 1


Agilent 14:41:58 May 8, 2012
R T
Mkr1 150.000 kHz
56.21 dBµV
Ref 75 dBµV
Atten 5 dB
Peak
Log
10
dB/
DC Coupled
M1 S2
S3 FC
AA
Start 150 kHz
Res BW 9 kHz
VBW 30 kHz
Stop 30 MHz
Sweep 881.3 ms (1515 pts)

Line 2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R T
Mkr1 150.000 kHz
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Ref 75 dBµV
Atten 5 dB
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Log
10
dB/
DC Coupled
M1 S2
S3 FC
AA
Start 150 kHz
Res BW 9 kHz
VBW 30 kHz
Stop 30 MHz
Sweep 881.3 ms (1515 pts)

3.7 Frequency Hopping Requirement, 15.247

Section 15.247 (a)
The EUT contains a transmitter that modulates a carrier with data, changes carrier frequency in a pseudo-random pattern with a dwell time, channel separation, and hop count that meets the requirements of 15.247. In addition, the receiver tracks the transmitter's pseudo-random hopping sequence and demodulates the signal. The order of channels in the hop sequence is pseudo random list.
Frequency-hopping proceeds in order through the list.

Equal Hopping Frequency Use [Section 15.247 (g)]
Each Frequency is specified only once in the list and the list is completed before looping back to the beginning.

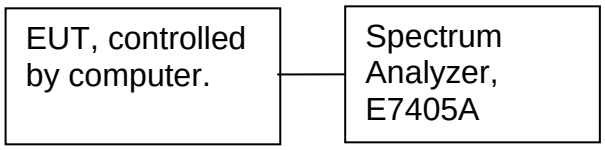
System Receiver Input Bandwidth
The received signal is demodulated by a balanced mixer. The output of this mixer is filter by a fixed 5Mhz low pass 5th order anti-aliasing filter. The output of the anti-aliasing filter is sampled by the ADC – where the samples are passed to the DSP for selective filtering. Depending on the protocol used, the signal is further digitally filtered (by the DSP) as required by the tag protocol.

System Receiver Hopping Capability
Each RF radio module carrier starts from a Synthesizer with an 8 MHz input clock. The synthesizer output (carrier) is passed through a preliminary RF chain of filters and pre-amplifiers. Through a power splitter, the Carrier is sent into two directions—one for the transmit path and the other for the receive path. Through the transmit path, the carrier is further filtered and amplified before passing through an isolator before passing through a 4 port switch—where the signal can be multiplexed onto one of four external antenna ports. The portion of the transmitter split off into the receive path is used to demodulate the received signal from the selected output port—thereby assuring that the demodulation reference is exactly equal to the transmit carrier frequency. The carrier may hop to one of 50 different frequencies and the receive path will always be in synchronization with it.

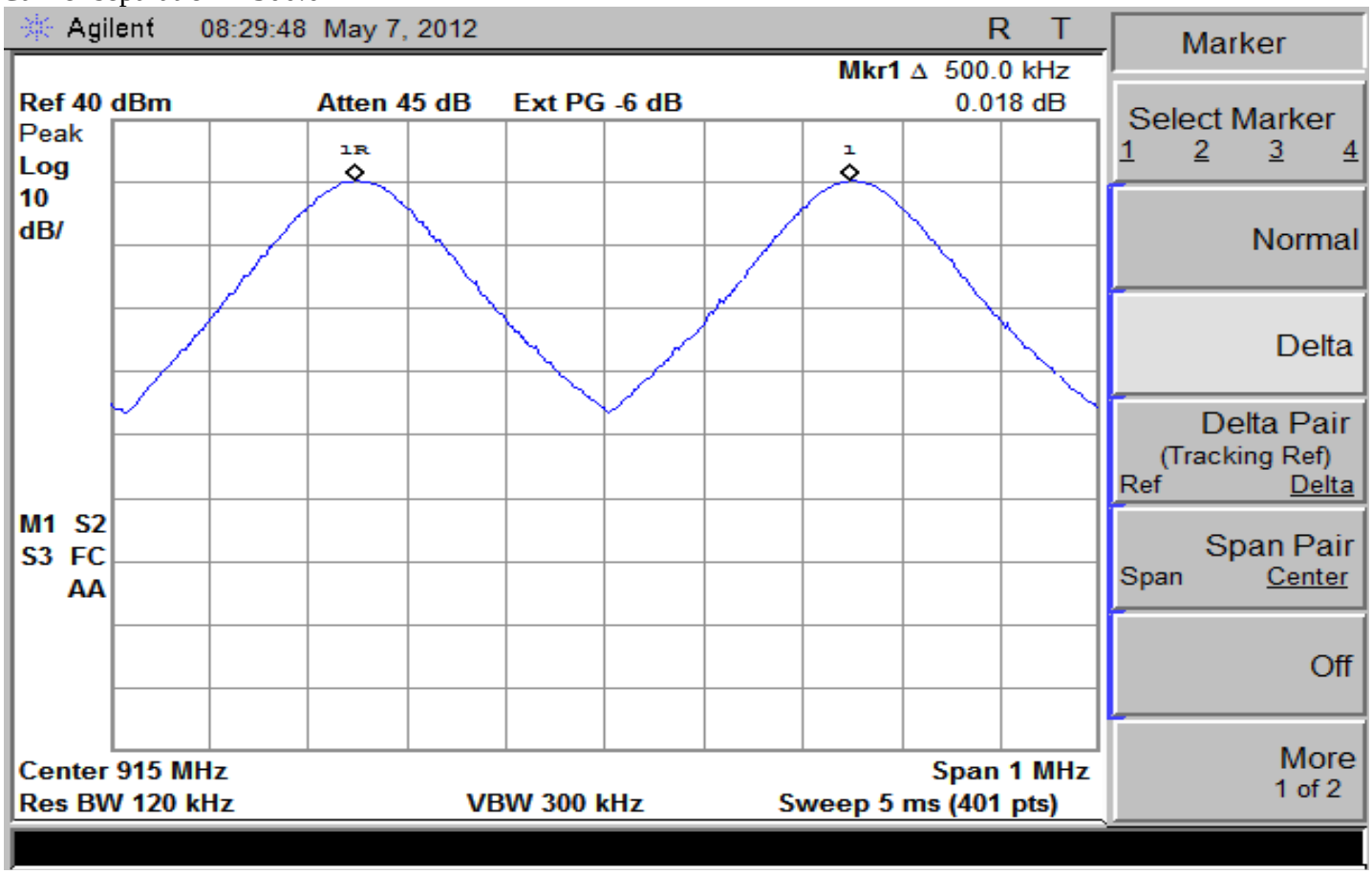
Section 15.247 (h)
Since the device is programmed to follow a set hopping sequence, regardless of potential interference and it is not programmed to scan the channels for interference, it does not have the ability to coordinate with other FHSS systems in an effort to avoid the simultaneous occupancy of individual frequencies.

3.8 Carrier Frequency Separation, 15.247 (a)(1)

Setup used for the following tests.

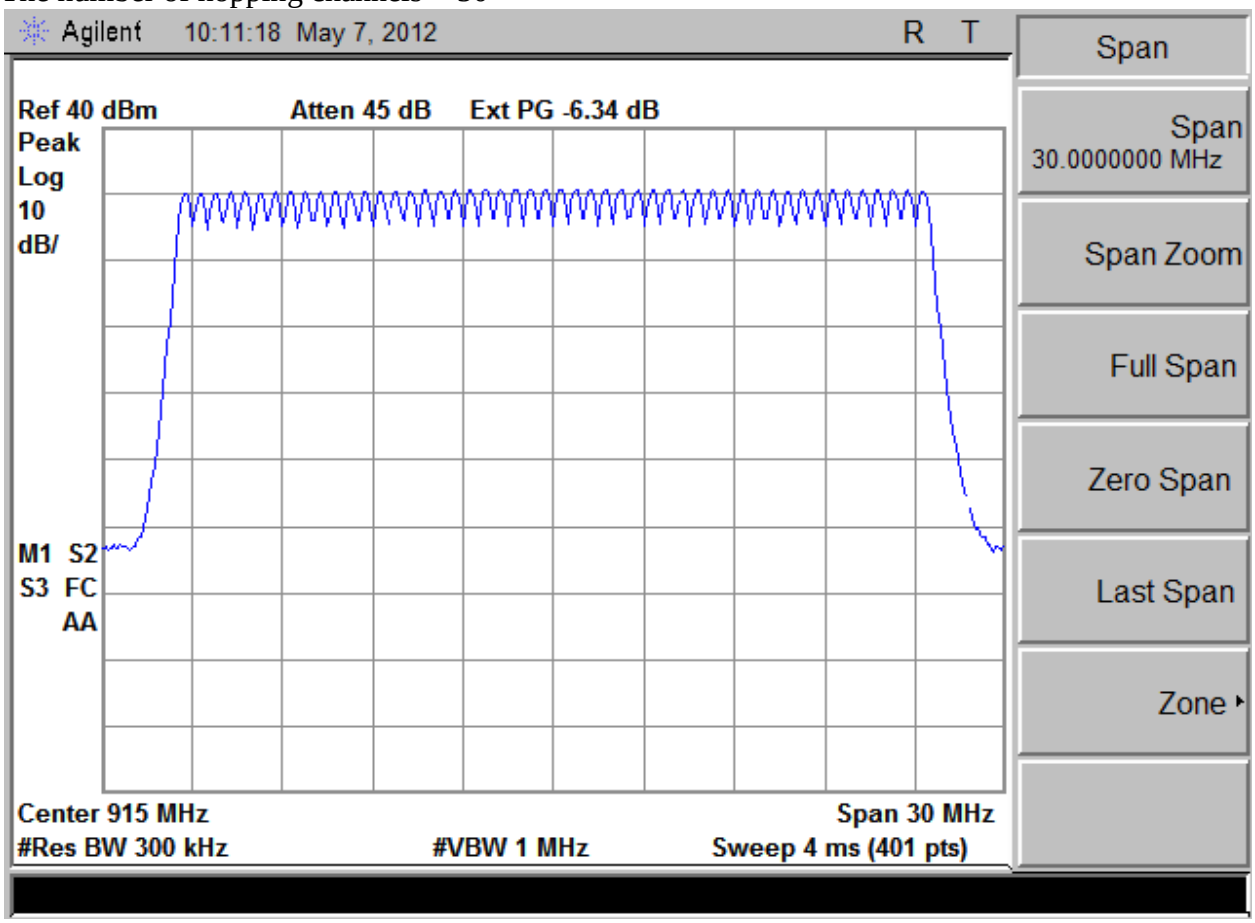


Carrier separation = 500.0 kHz



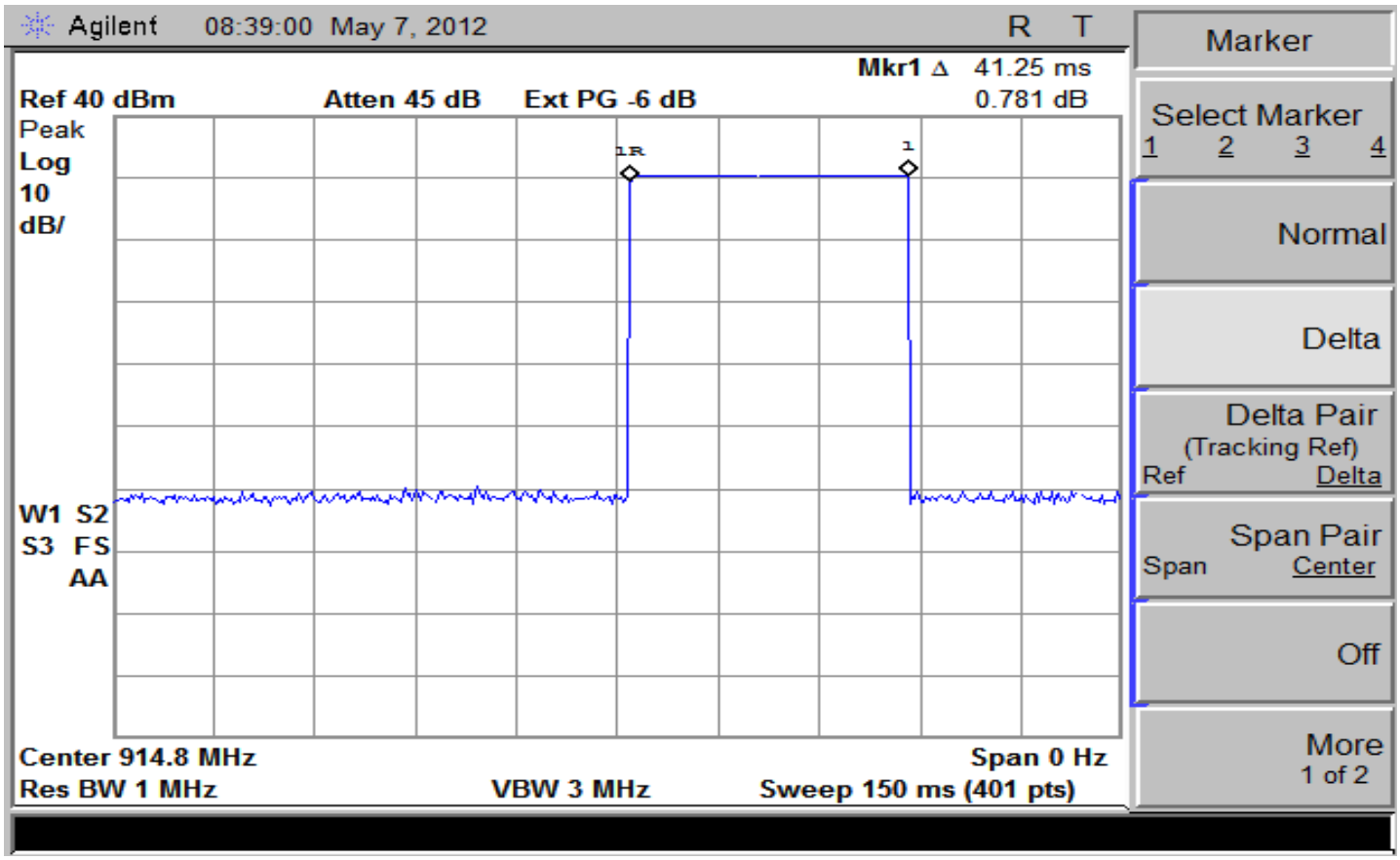
3.9 Number Of Hopping Channels, 15.247 (a)(1)(i)

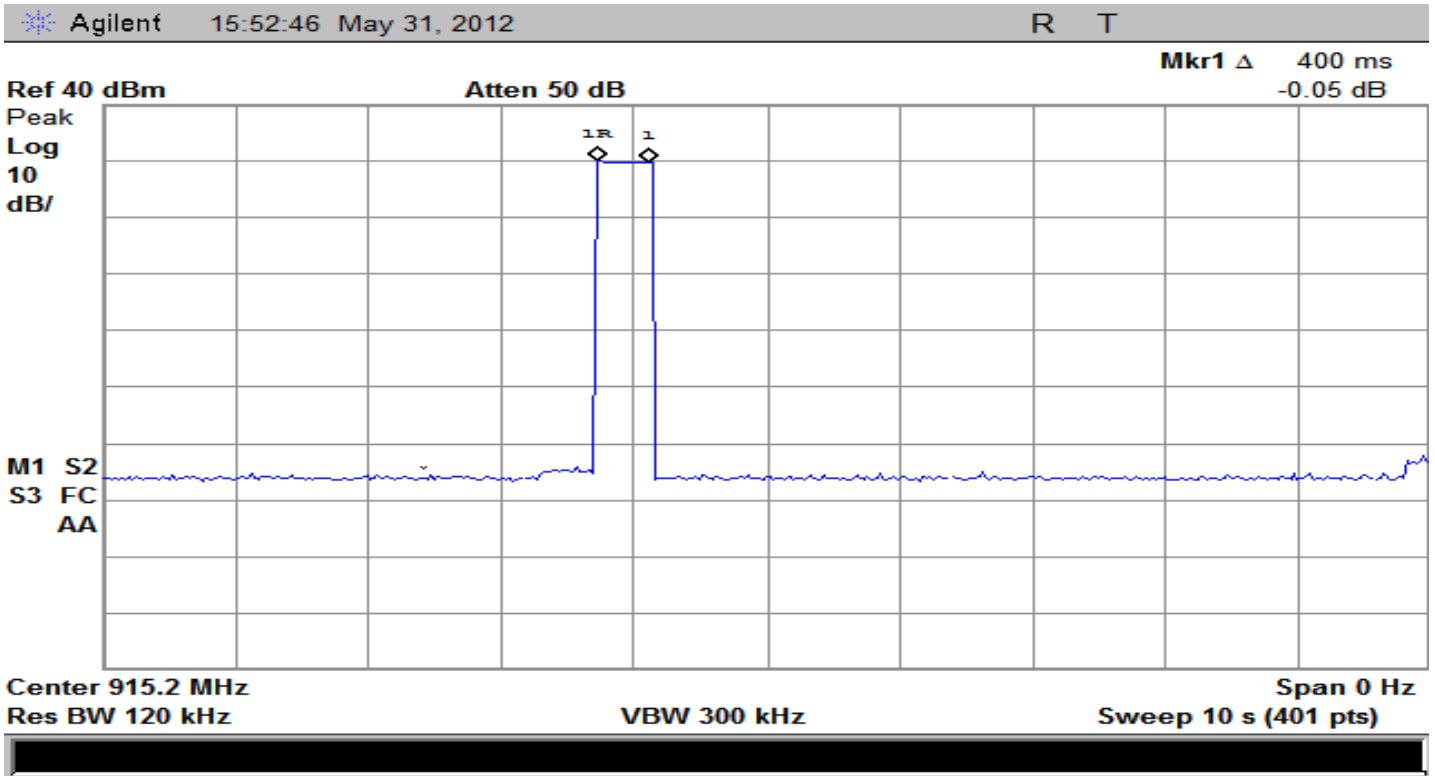
The number of hopping channels = 50

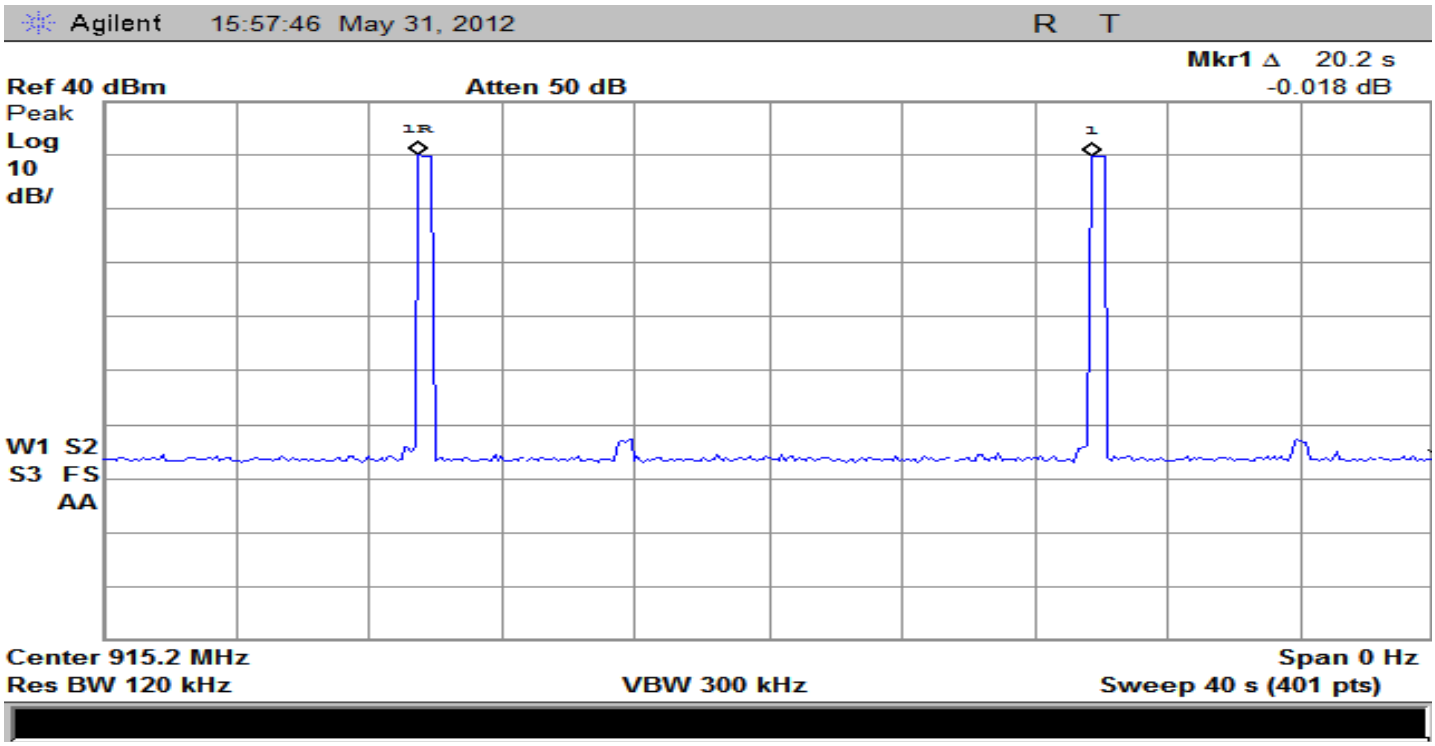


3.10 Time Of Occupancy (Dwell Time), 15.247 (a)(1)(i)

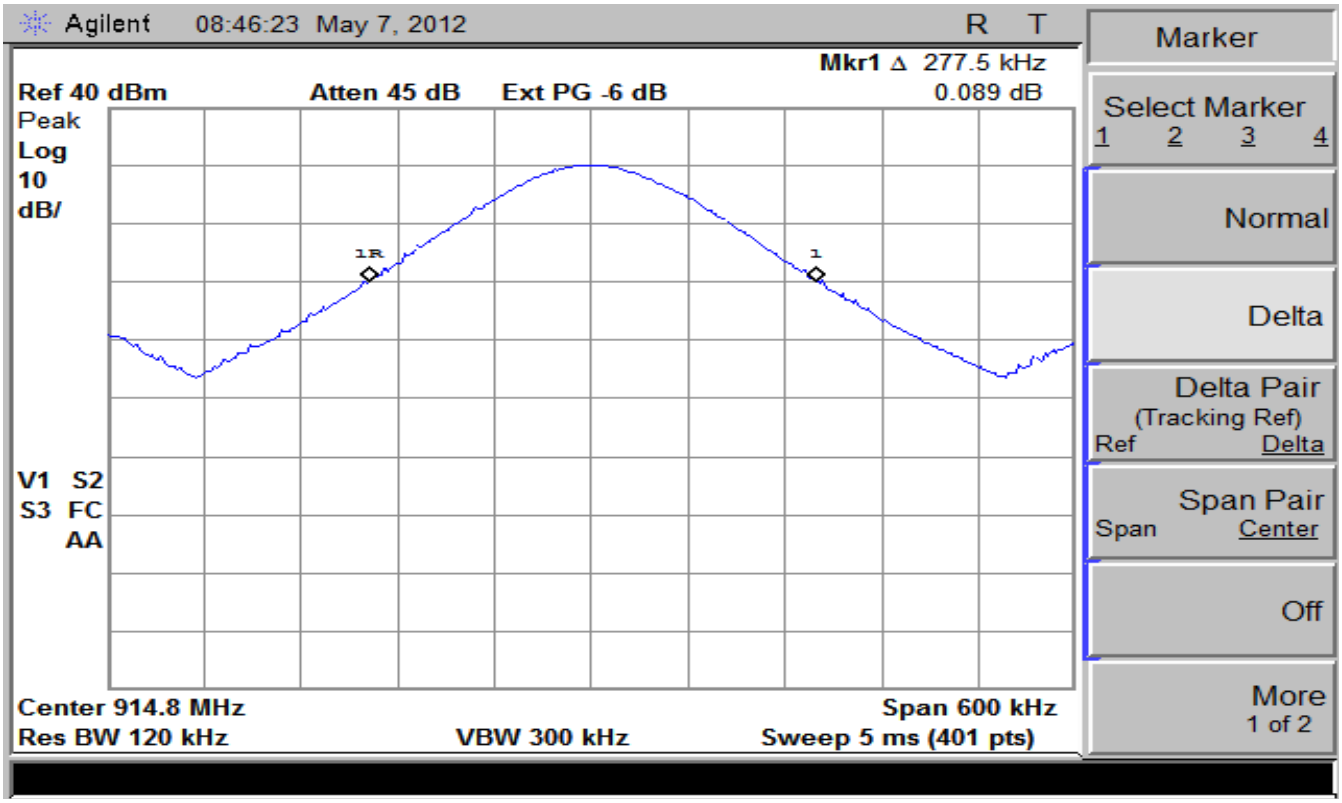
Limit = 400 ms.






Agilent 15:57:46 May 31, 2012
R T
Mkr1 Δ 20.2 s
-0.018 dB
Ref 40 dBm
Atten 50 dB
Peak
Log
10
dB/
1R
1
W1 S2
S3 FS
AA
Center 915.2 MHz
Res BW 120 kHz
VBW 300 kHz
Span 0 Hz
Sweep 40 s (401 pts)

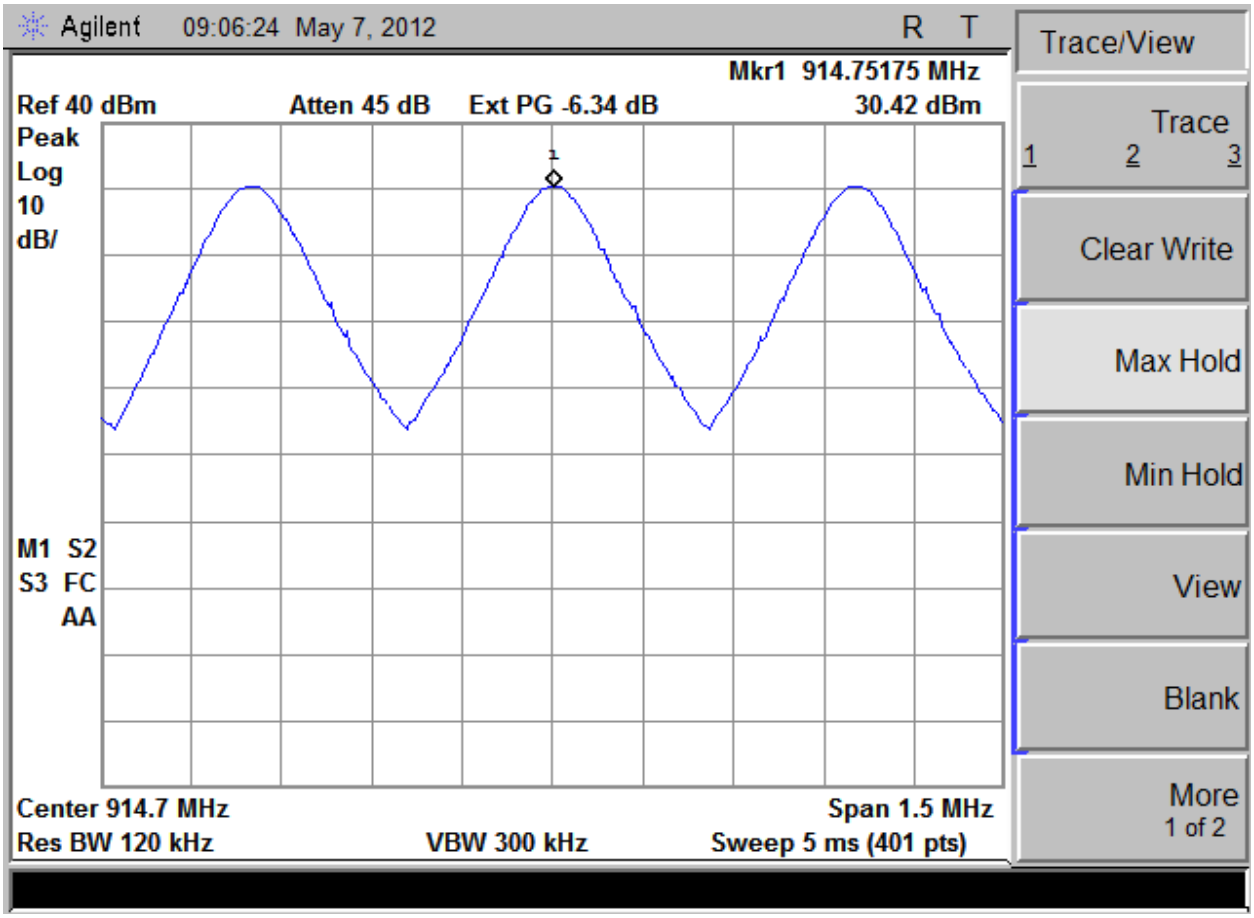
3.11 20 dB Bandwidth, 15.247 (a)(1)(i)



3.12 Peak Power Output, 15.247 (b)

On the transmitter ports, the maximum output power is set at 30 dBm.
The worst case peak conducted power is reported here and is measured at 30.42 dBm.
A 6 dB attenuator was used to prevent damage to the spectrum analyzer front end and the loss with short connecting cable was measured at 6.34 dB. This factor was added into the spectrum analyzer.

The EUT complies with the limit.
The intended use for the EUT is detection of nearby tags. Therefore, maximum output of 30 dBm is not needed at the antennas. Cable loss provides acceptable performance for detecting tags. Thus there is no need to define cable parameters to meet the limit.



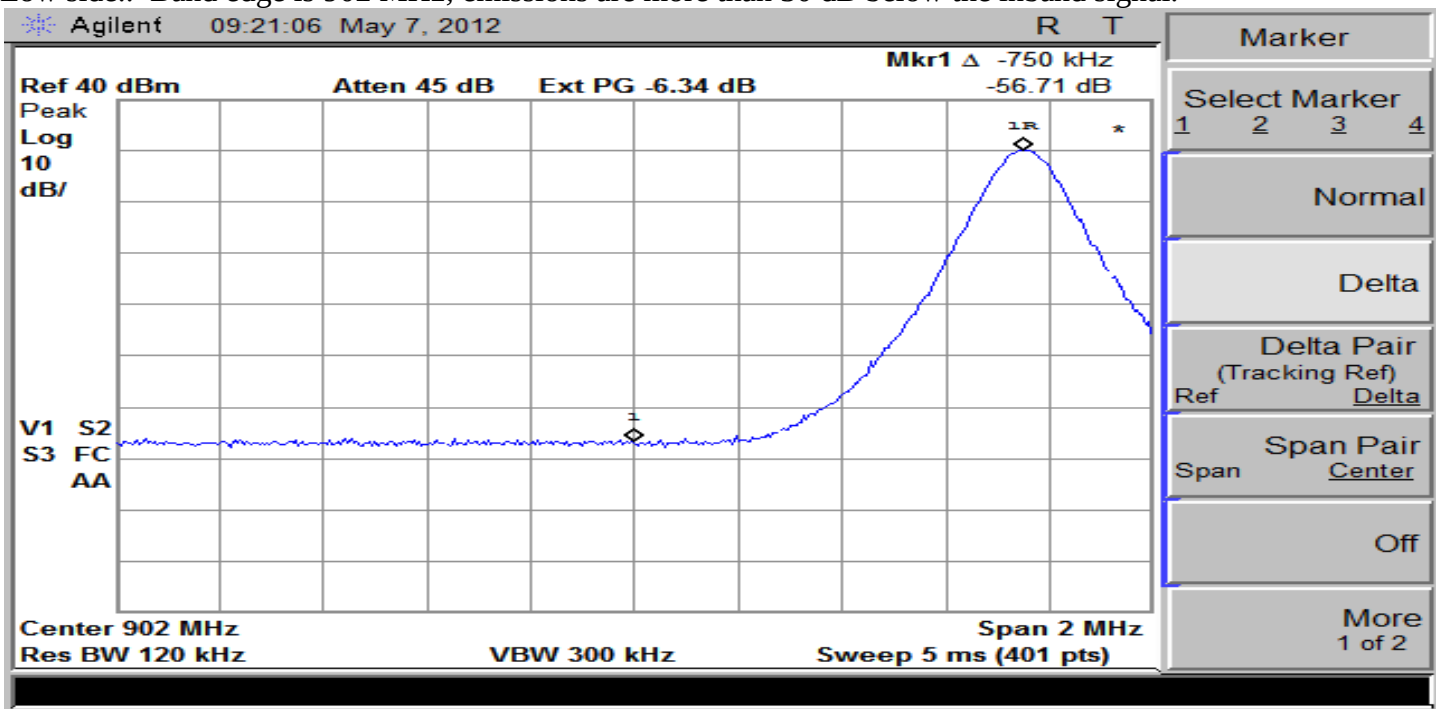
Radiated Power, e.r.p dBm
By using PC = Pe.r.p. −GIC + 5,15 + CL dBm and re-arranging to Perp = PC + GIC - 5,15 – CL.
Where the highest reading was 30.28.
Antenna gain = 6 dBi = 9 dBic
Cable loss = 2.1 dB

Maximum e.r.p. is 29.1 = 30.3 + 6 – 5.15 – 2.1

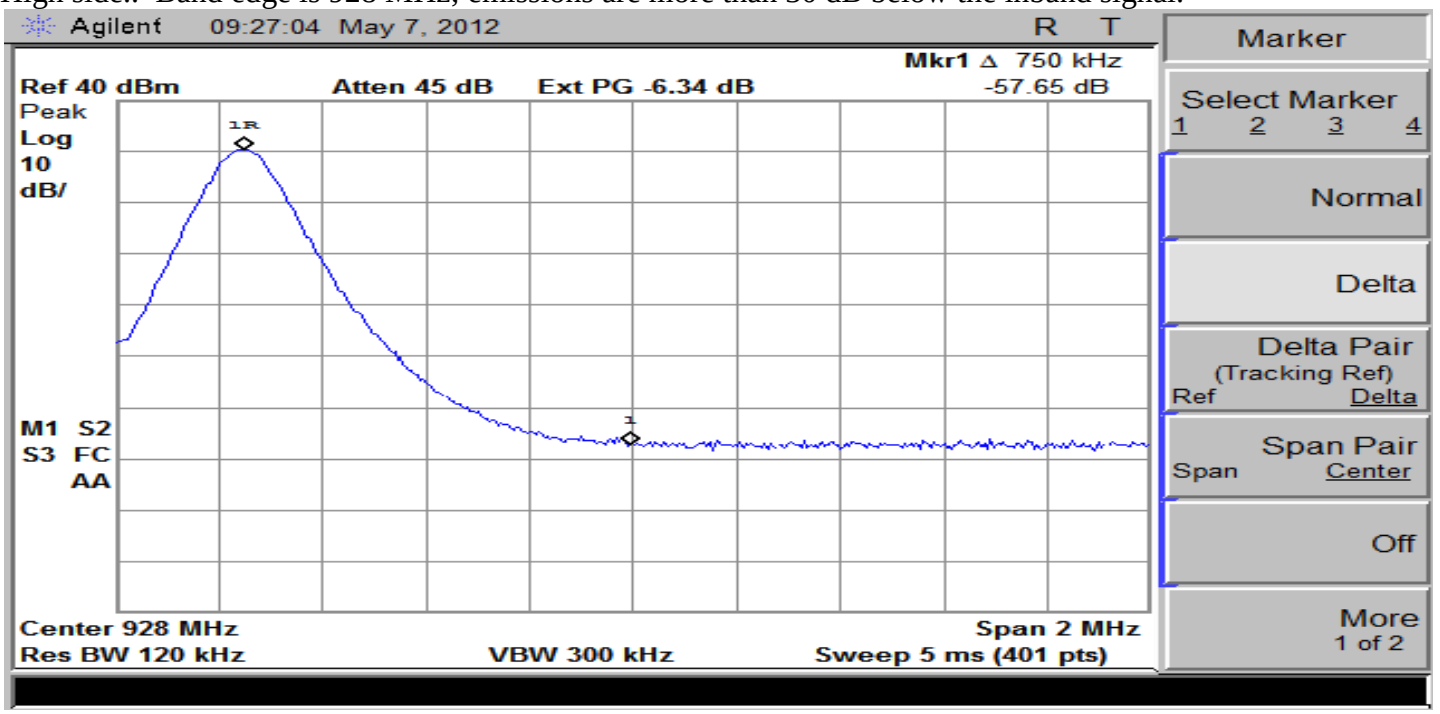
3.13 Band-Edge Compliance Of RF Conducted Emissions, 15.247 (c)

Limit: > 20 dB below highest inband signal.

Low side.. Band edge is 902 MHz; emissions are more than 30 dB below the inband signal.



High side.. Band edge is 928 MHz; emissions are more than 30 dB below the inband signal.

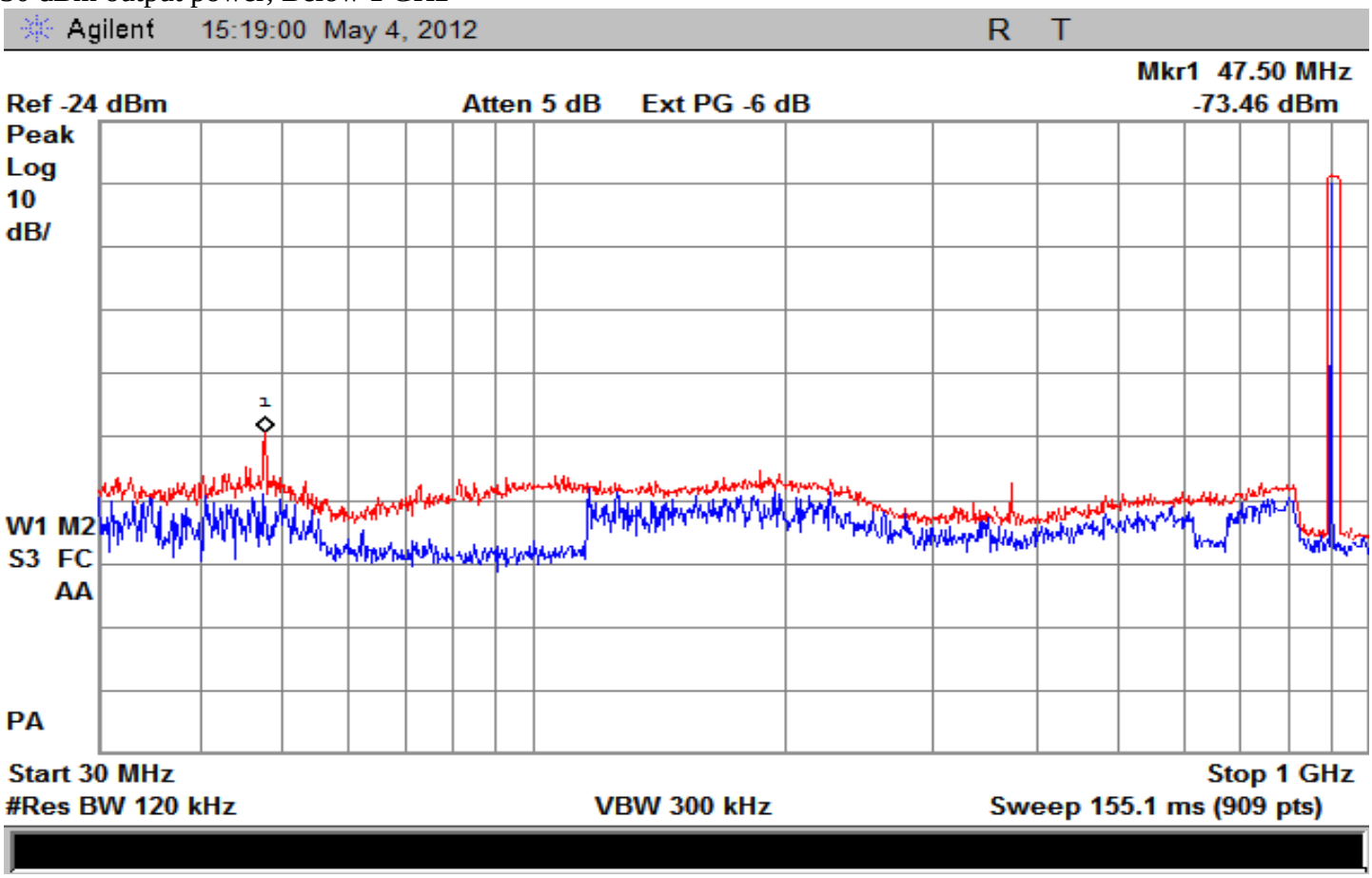


3.14 Spurious RF Conducted Emissions, 15.247 (d)

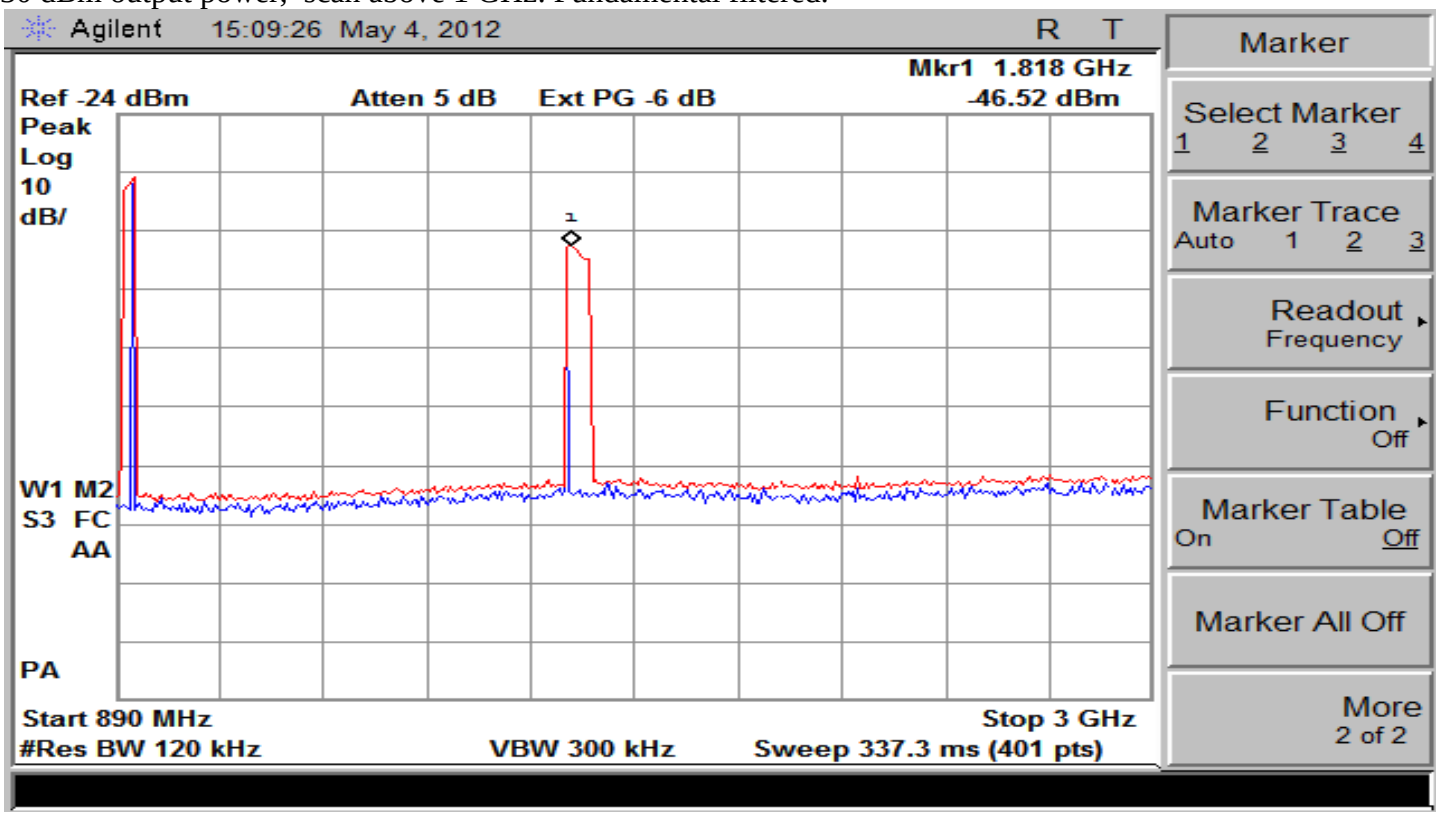
(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, 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)).

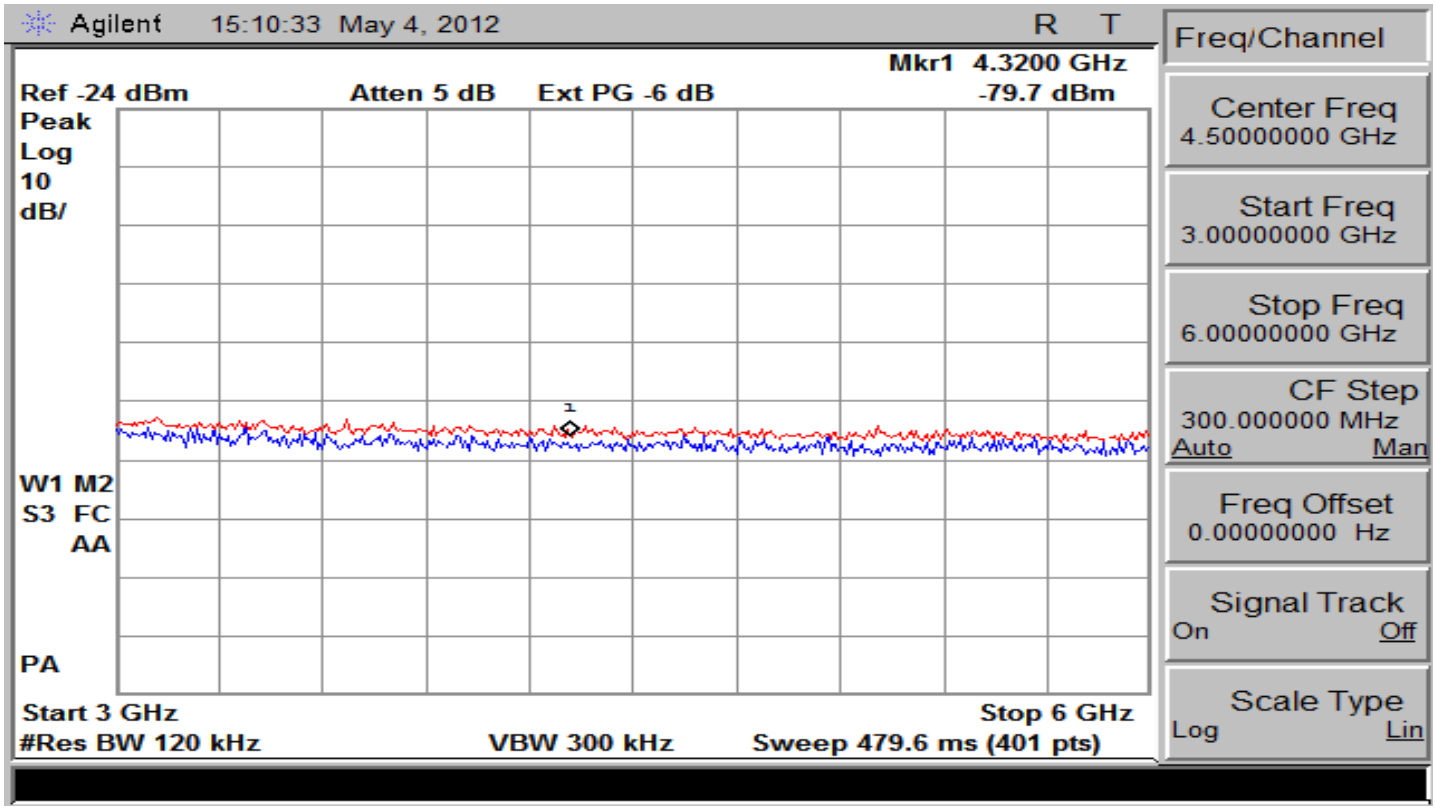
The following plots shows that there are no emissions within 20 dB of the inband signal in any 100 kHz band from 30 MHz all the way to the 10th harmonic.
RF output goes to 6 dB attenuator then either a low pass or high pass filter to reduce the fundamental in order increase the dynamic range.

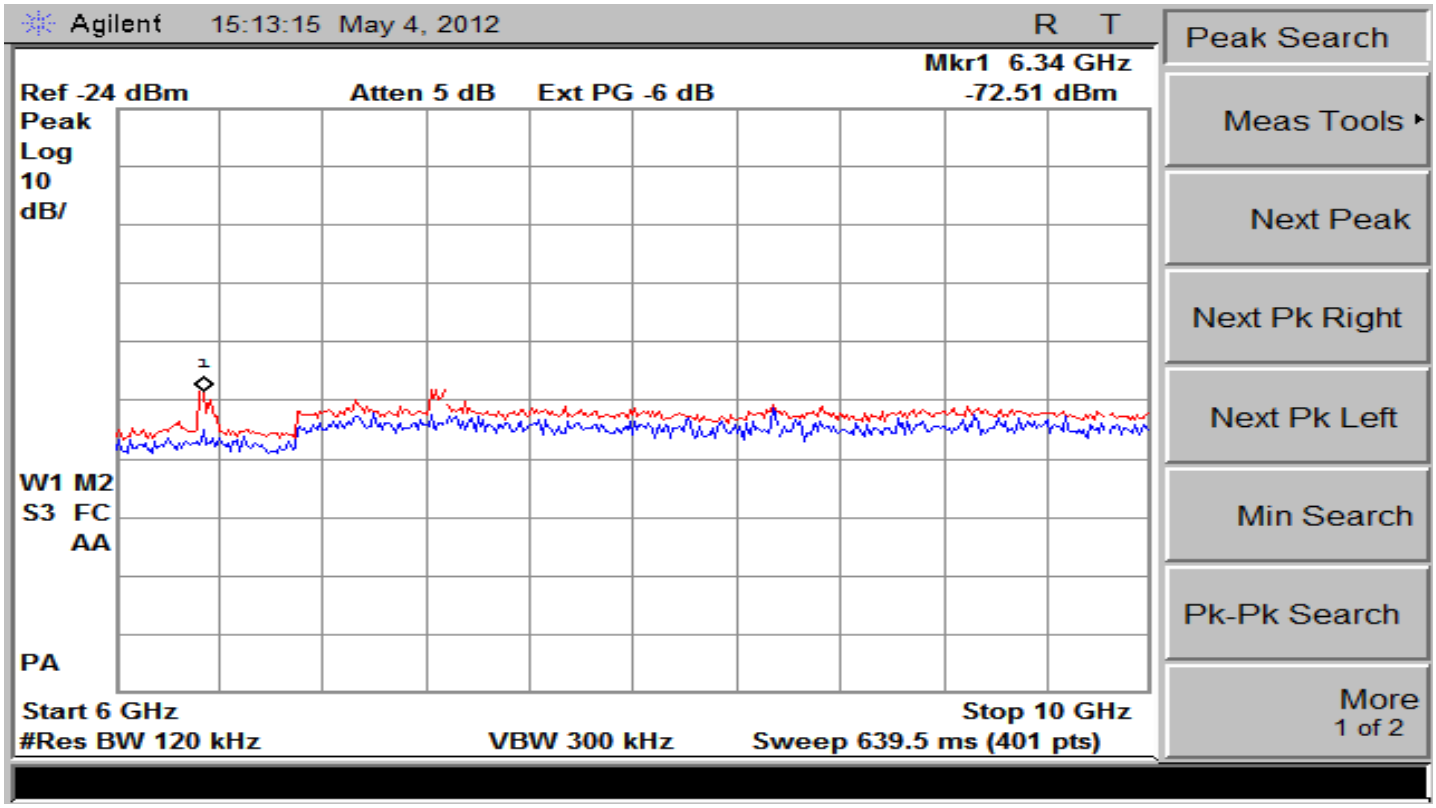
30 dBm output power, Below 1 GHz



30 dBm output power, scan above 1 GHz. Fundamental filtered.






Agilent 15:13:15 May 4, 2012
R T
Mkr1 6.34 GHz
Ref -24 dBm
Atten 5 dB
Ext PG -6 dB
-72.51 dBm
Peak
Log
10
dB/
W1 M2
S3 FC
AA
PA
Start 6 GHz
Stop 10 GHz
#Res BW 120 kHz
VBW 300 kHz
Sweep 639.5 ms (401 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

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3.15 Spurious Radiated Emissions, 15.247 (d), 15.205, 15.209

The EUT was prescreened in the semi-anechoic chamber at Sensormatic per the guidelines in ANSI C63.4-2003. Each port was compared to determine which had the worst case emissions.
In addition, each antenna type was compared in prescreens to determine the worst case antenna for measurement.

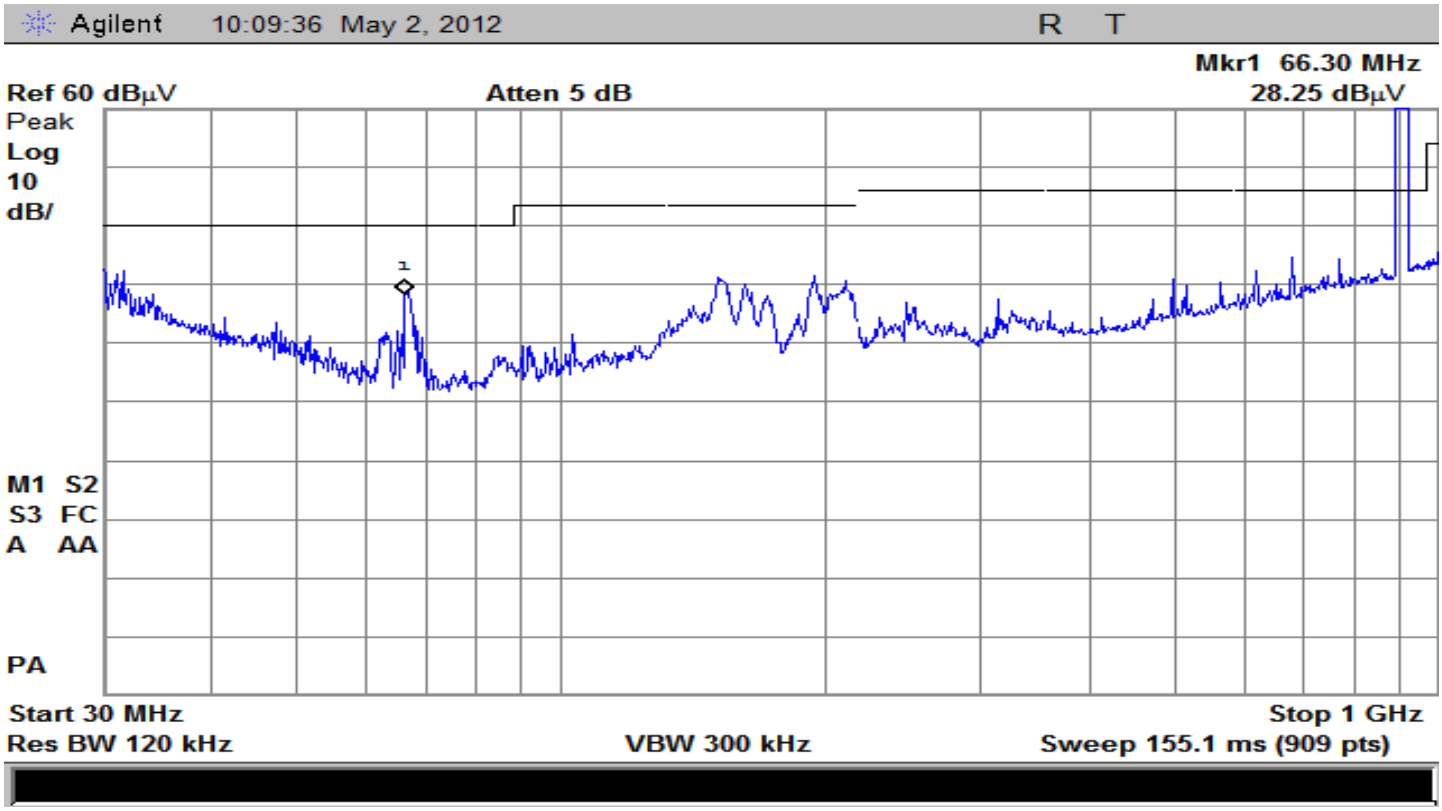
Equipment list asset numbers: 6, 8, 5, 156, 41, 12, 37, 104, 107.

OATS measurements

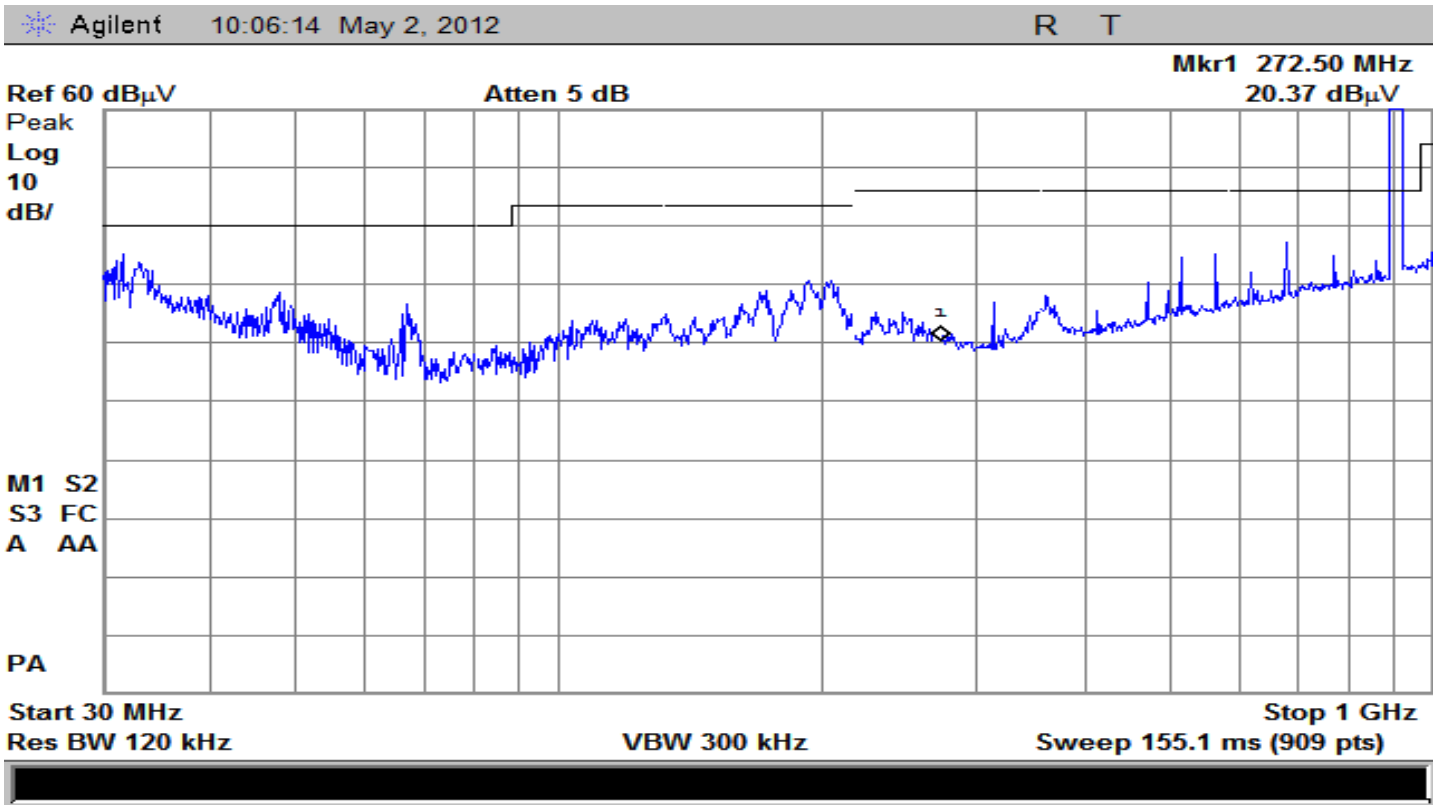
Freq (MHz)	QP (dBuV)	Antenna	Polarity	ant fac	cable fac	PA	Corrected	Class B	Margin
163.9	13.9	Bi-con #1	Horz	12.96	2.31	0	29.17	43.50	14.33
163.9	13.28	Bi-con #1	Vert	12.82	2.31	0	28.41	43.50	15.09
64.8	12.4	Bi-con #1	Vert	9.41	1.28	0	23.09	40.00	16.91
64.8	7.9	Bi-con #1	Horz	9.10	1.28	0	18.28	40.00	21.72
200	9.1	Bi-con #1	Horz	14.86	2.67	0	26.63	43.50	16.87
200	6.4	Bi-con #1	Vert	15.21	2.67	0	24.28	43.50	19.22
1844	21.9	EMCO Horn	Horz	25.09	12.76	-28.57	31.17	54.00	22.83

Pre-compliance scans in chamber.

Horizontal

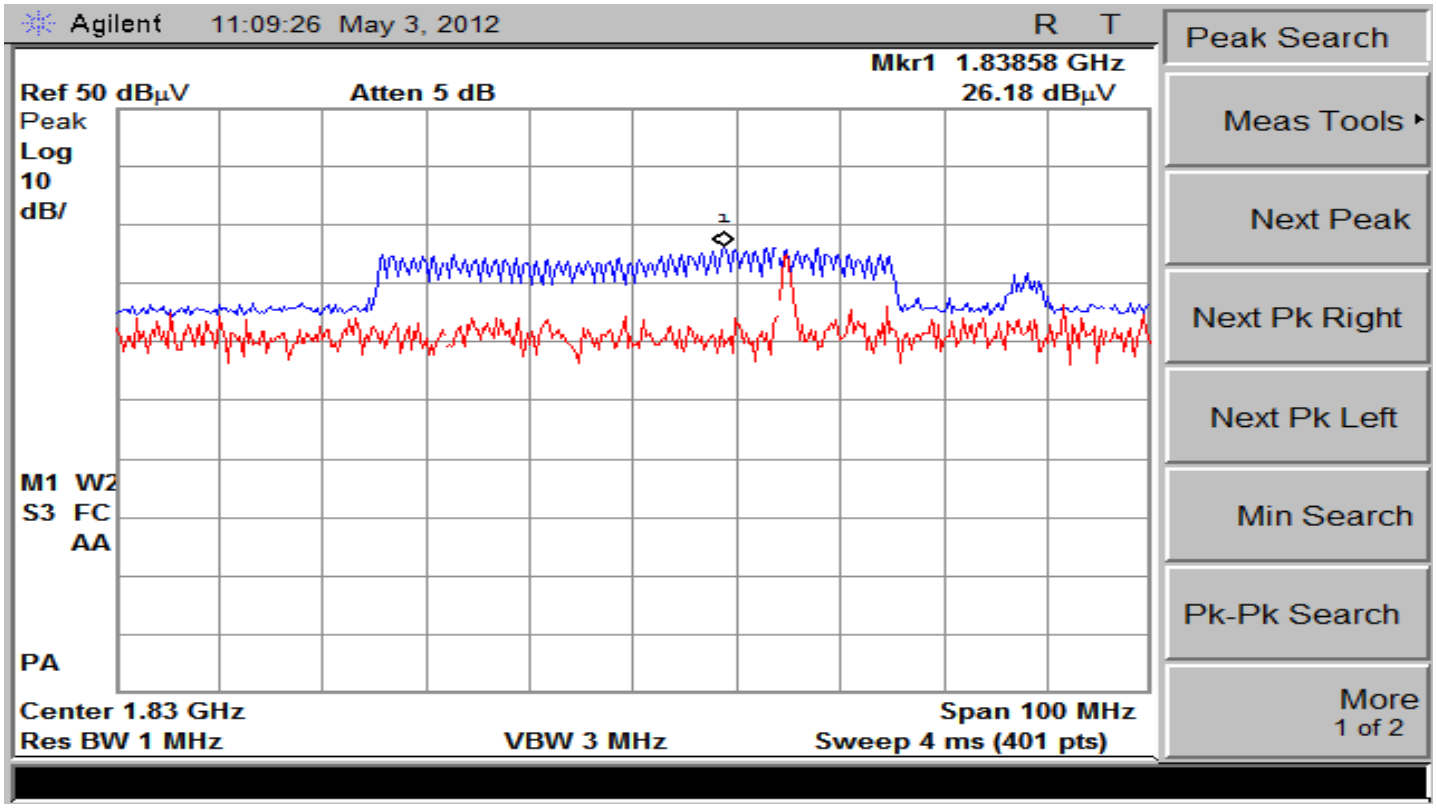


Vertical

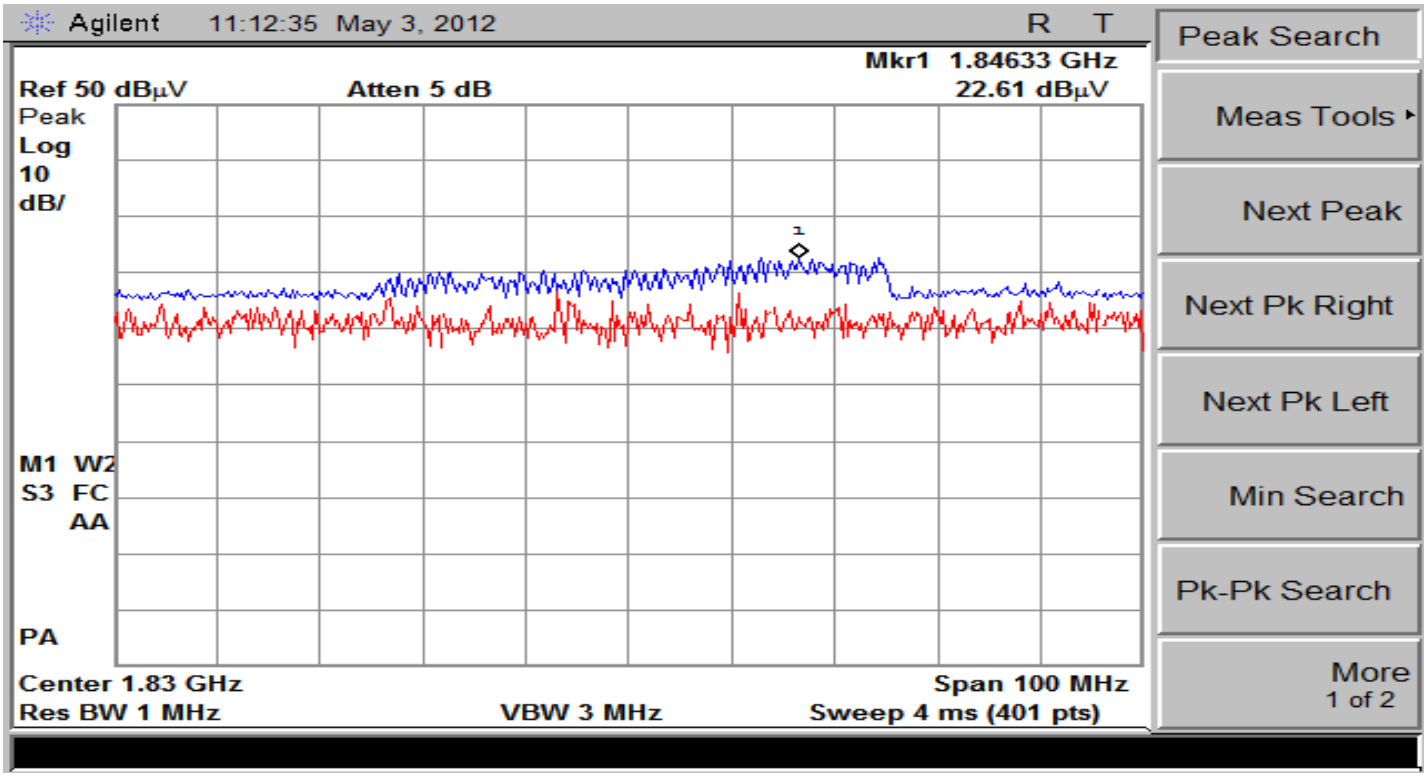


Above 1 GHz the only detectable emission is the 2nd harmonic.

Horizontal

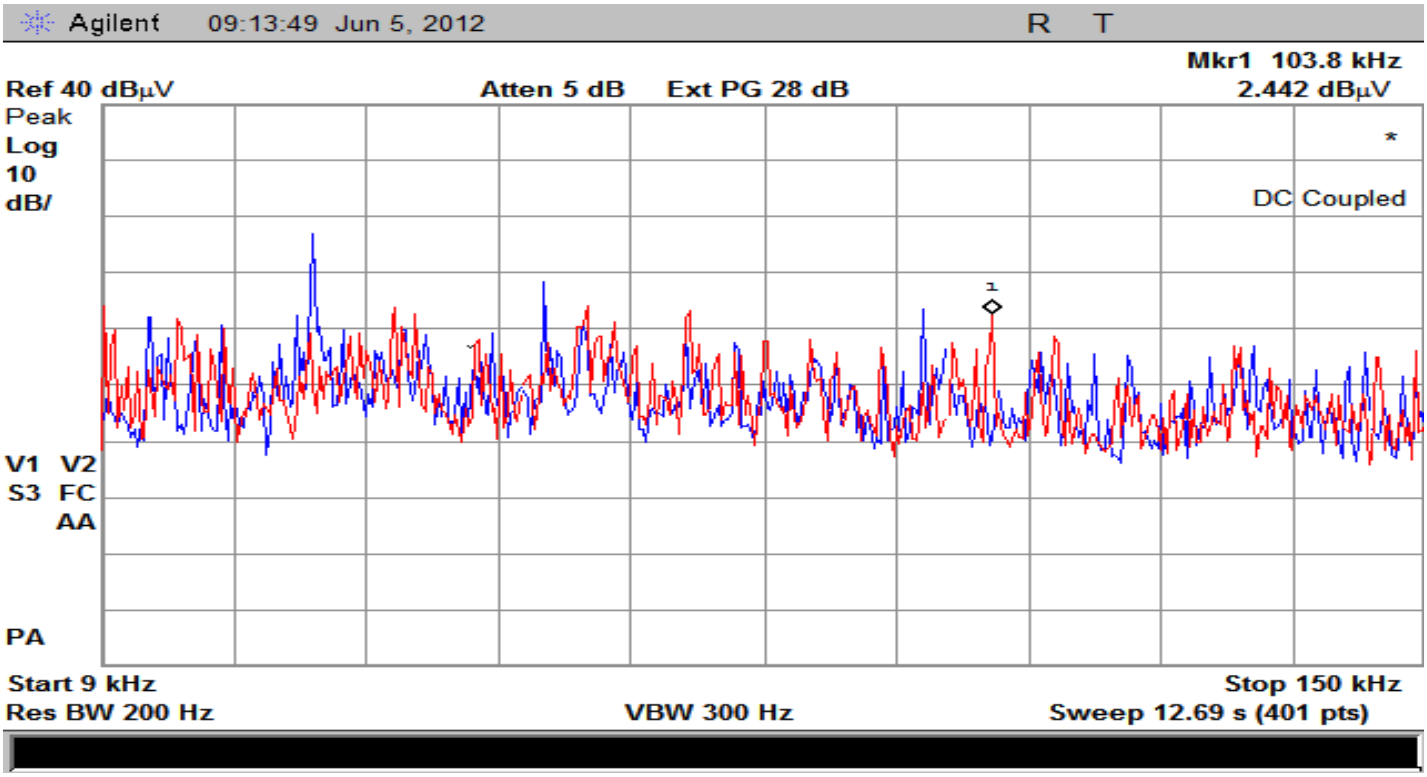


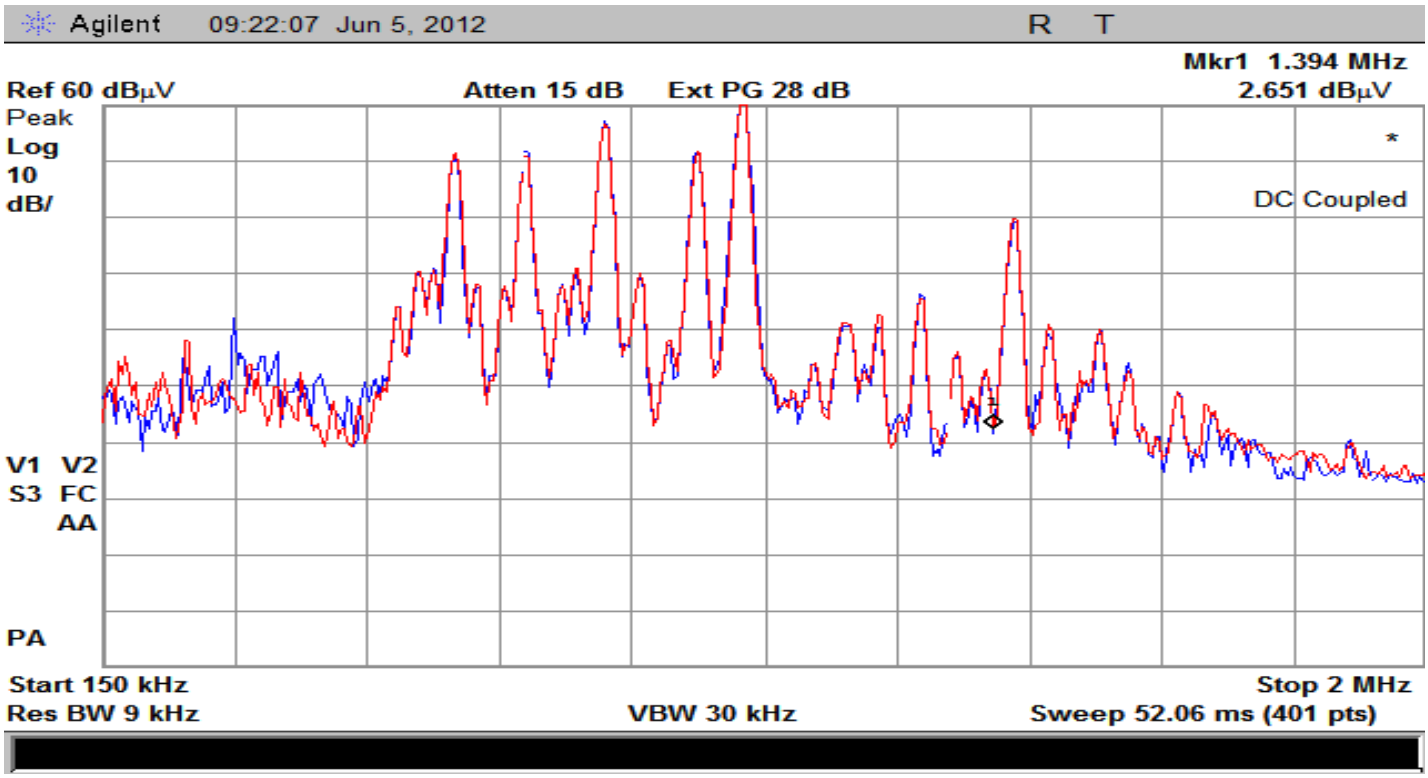
Vertical



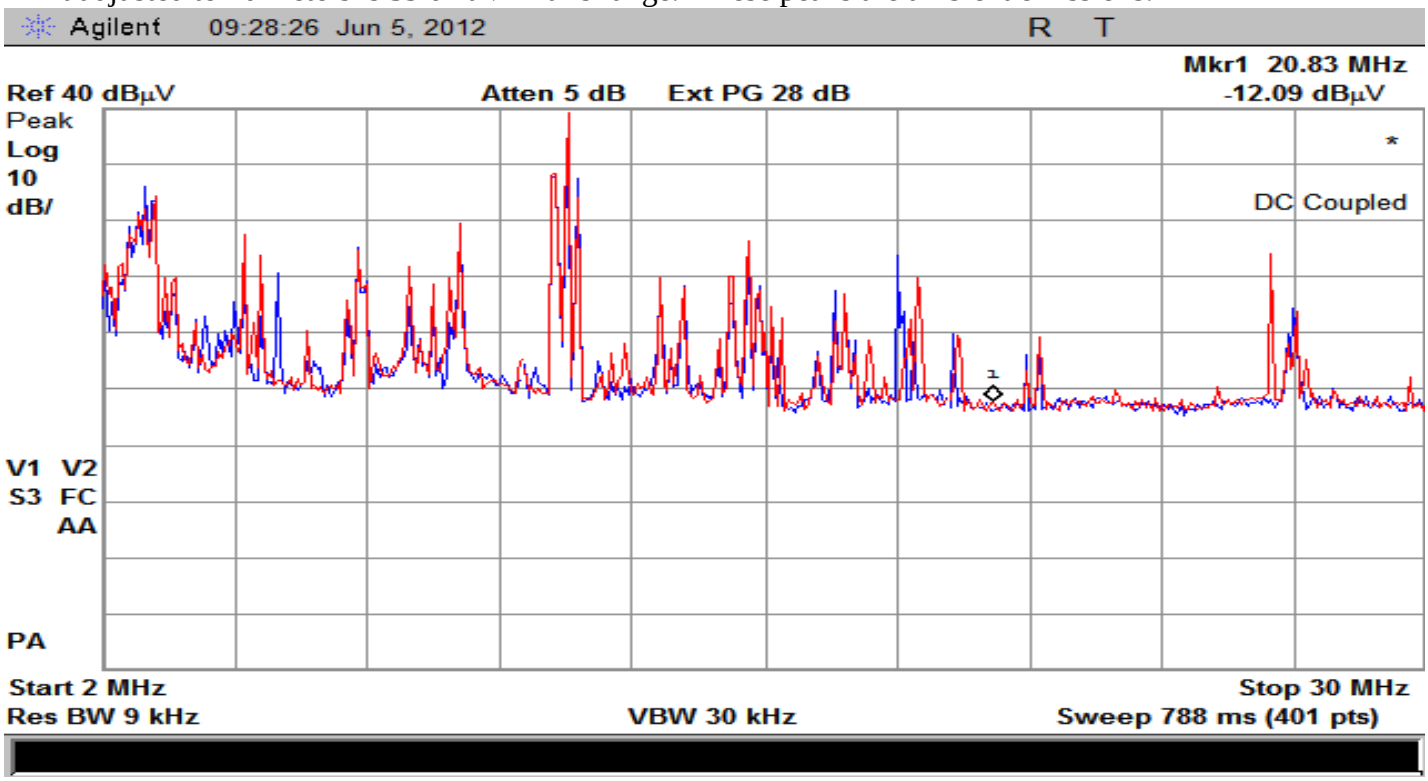
3.15.1 Spurious Radiated Emissions below 30 MHz – H-field.

Blue is ambient – EUT off. Red is EUT on. No Emissions could be correlated to EUT.
EUT emissions were more than 20 dB below the limits of 15.209.





Limit adjusted to 10 meters is 39 dBuV in this range. These peaks are ambient emissions.



4 Test Equipment List

Asset	Description	Manufacturer	Model	Serial #	Last Cal	DueDate
1	5kv VA AC Power Source	California Inst.	5001ix	54328	10-Dec-11	10-Dec-12
2	Power Analyzer & Cond System	California Inst.	PACS-1	72376	10-Dec-11	10-Dec-12
4	58 kHz Filter	In House	unique	N/A	30-Aug-11	30-Aug-12
5	Double-Ridge Waveguide Horn	EMCO	3115	3006	31-Mar-11	30-Mar-13
6	Biconical Antenna	Electro Metrics	3110B	1017	18-May-12	18-May-14
7	Biconical Antenna	ETS	3110B	3380	31-Aug-11	30-Aug-12
8	Log Periodic Antenna	EMCO	3146	3909	31-Aug-11	30-Aug-12
9	Log Periodic Antenna	EMCO	3146	4731	18-May-12	18-May-14
10	Transient Limiter	Electro Metrics	EM 7600	187	13-Jan-12	12-Jan-13
11	Line Imp Stable Network	EMCO	3816/2NM	1018	08-Feb-12	07-Feb-13
12	Loop Antenna	Electro Metrics	ALP -70	163	30-Aug-11	29-Aug-12
13	Directional Coupler	Werlatone	C3910	6706	13-Jan-12	12-Jan-13
14	RF Power Meter	Boonton	4231-30	53701	21-Mar-12	21-Mar-13
16	Directional Coupler	Werlatone	C5673	11481	13-Jan-12	12-Jan-13
17	Radiation Meter	Narda	EMR-200	AN-0055	21-Jan-11	21-Jan-12
18	EFT Generator	Haefely Trench	PEFT Junior	083 180-16	08-Feb-12	07-Feb-15
19	RF Absorbing Clamp	FCC	F-201	174	09-Jun-09	08-Jun-12
20	Coupling Decoupling Netwk	FCC	FCC-801-M3-16	58	08-Feb-12	07-Feb-13
21	Coupling Decoupling Netwk	FCC	FCC-801-M3-16	59	08-Feb-12	07-Feb-13
22	RF Current Probe	FCC	F-33-1	304	24-Nov-11	24-Nov-12
24	RF Injection Clamp	FCC	F-20311	30	24-Nov-11	24-Nov-12
27	Surge Coupler/Decoupler	Key Tek	CE50	9507535	27-Jul-11	26-Jul-12
29	Log Periodic Antenna	EMCO	3146	3576	29-Apr-10	28-Apr-15
30	Spectrum Analyzer	HP	8562A	2712A00534	29-Jul-11	28-Jul-12
32	Spectrum Analyzer	HP	8591EM	3649A01066	26-Jul-11	25-Jul-12
36	Coupling Decoupling Netwk	FCC	FCC-801-M3-16A	2036	08-Feb-12	07-Feb-13
37	Line Imp Stable Network	EMCO	3816/2NM	1064	08-Feb-12	07-Feb-13
38	Coupling Decoupling Netwk	FCC	FCC-801-M3-16A	2037	08-Feb-12	07-Feb-13
39	Biconical Antenna	EMCO	3104C	4334	03-Apr-10	02-Apr-12
40	Spectrum Analyzer	HP	E7401A	US39110103	08-Feb-12	07-Feb-13
41	Pre-Amp .009-1300MHz	HP	8447F	2805A03473	08-Feb-12	07-Feb-13
42	Pre-Amp .009-1300MHz	HP	8447F	3113A06072	29-Jul-11	28-Jul-12
43	BiLog Antenna (Immunity)	Schaffner Chase	CBL6141	4112	26-Aug-98	25-Aug-03
44	Loop Antenna (Immunity)	Solar Elect	7334-1	73626	02-Jan-08	31-Dec-12
104	Spectrum Analyzer	Agilent	E7405A	MYY49510099	28-Jul-11	27-Jul-12
105	Spectrum Analyzer	Agilent	E7405A	MYY49510320	08-Jun-11	07-Jun-12
107	AC Power Source	Pacific	120ASX	1513_05894	26-May-10	25-May-12
121	ESD Generator	NoiseKen	ESS-2000	170053	02-Oct-12	02-Oct-13
152	Dipole Antenna	EMCO	3121C	9701-1262	28-Dec-11	28-Dec-12
153	Signal Generator	Agilent	N5183A	MY50140589	08-Feb-12	07-Feb-13
154	Horn Antenna	ETS Lindgren	3115	00135941	11-Apr-11	10-Apr-12
155	Horn Antenna	ETS Lindgren	3116B	00122502	03-Feb-11	03-Feb-12
156	Loop Antenna	ETS Lindgren	6512	00123860	22-Nov-11	22-Nov-12
157	Antenna	Teseq	T800	28620	10-Jun-11	09-Jun-12
175	EMI Power Sensor	Boonton Electronics	51011-EMC	35804	21-Mar-12	21-Mar-13

5 Antenna Factors.

Customer Name: Tyco Safety Products - Sensormatic
Antenna Manufacturer: Electro-Metrics
Antenna Model: ALP-70 Loop
Antenna Serial No.: 163
Temperature (Deg C): 21.0
Humidity (%): 50.0
Measurement Distance in Meters = 1.0
NOTES: ACF valid to 10 meters per NIST methods.
CAL CERT #: 2009042912

Freq (MHz)	E-field ACF (dB)	H-field ACF (dB)
0.01	75.6	24.1
0.02	71.6	20.2
0.03	68.3	16.9
0.04	65.5	14.0
0.05	63.6	12.2
0.06	61.1	9.7
0.07	59.6	8.2
0.08	58.5	7.0
0.09	57.8	6.4
0.10	56.8	5.4
0.20	51.8	0.4
0.30	48.5	-3.0
0.40	46.3	-5.1
0.50	45.0	-6.5
0.60	43.6	-7.8
0.70	42.8	-8.6
0.80	41.6	-9.8
0.90	41.1	-10.3
1.00	40.5	-11.0
2.00	38.2	-13.3
3.00	37.2	-14.3
4.00	37.0	-14.4
5.00	36.7	-14.8
6.00	37.6	-13.8
7.00	37.7	-13.8
8.00	37.7	-13.7
9.00	37.6	-13.9
10.00	37.6	-13.8
15.00	37.4	-14.0
20.00	37.2	-14.2
25.00	36.2	-15.2
30.00	37.4	-14.1

Customer Name: Tyco Safety Products - Sensormatic
Antenna Manufacturer: EMCO
Antenna Model: 3104C Biconical
Antenna Serial No.: 9009-4334
Temperature (Deg C). 3
Humidity (%). 65
Measurement Distance in Meters = 3
Antenna Polarization = VERT / HORZ
CAL CERT #: 2009033120

Freq	Vert ACF	Horz ACF
(MHz)	(dB)	(dB)
20.0	17.7	20.6
21.0	17.4	20.0
22.0	16.4	18.6
23.0	16.1	18.1
24.0	15.3	16.9
25.0	14.9	16.4
26.0	14.2	15.5
27.0	13.6	15.0
28.0	13.0	14.3
29.0	12.3	13.7
30.0	11.9	13.3
31.0	11.3	12.7
32.0	11.0	12.4
33.0	10.5	11.9
34.0	10.3	11.7
35.0	9.9	11.3
36.0	9.8	11.3
37.0	9.6	11.0
38.0	9.6	11.0
39.0	9.5	10.8
40.0	9.5	10.7
40.0	9.5	10.7
41.0	9.6	10.7
42.0	9.7	10.7
43.0	9.9	10.6
44.0	10.0	10.6
45.0	10.2	10.7
46.0	10.4	10.7
47.0	10.5	10.7
48.0	10.7	10.7
49.0	11.0	10.8
50.0	11.2	10.8
51.0	11.4	10.8
52.0	11.6	10.8
53.0	11.9	10.9
54.0	12.0	10.9
55.0	12.1	11.0
56.0	11.9	10.9
57.0	11.9	11.0
58.0	11.4	10.9
59.0	11.2	10.9
60.0	10.8	10.8
61.0	10.5	10.8
62.0	10.0	10.5
63.0	9.7	10.4
64.0	9.2	10.1
65.0	8.9	9.9
66.0	8.5	9.5
67.0	8.2	9.3
68.0	7.8	8.9
69.0	7.6	8.6
70.0	7.3	8.2
71.0	7.2	7.9
72.0	7.0	7.5
73.0	7.0	7.3
74.0	6.8	7.0
75.0	6.8	6.8
75.0	6.8	6.8
76.0	6.7	6.5
77.0	6.7	6.4
78.0	6.6	6.3
79.0	6.7	6.3
80.0	6.7	6.3
81.0	6.9	6.3
82.0	7.2	6.4
83.0	7.4	6.5
84.0	7.6	6.7
85.0	7.9	6.8
86.0	8.2	7.1
87.0	8.3	7.2
88.0	8.7	7.6
89.0	8.8	7.7
90.0	9.1	8.0
91.0	9.2	8.1
92.0	9.5	8.5
93.0	9.5	8.6
94.0	9.8	8.9
95.0	9.9	9.0
96.0	10.2	9.4
97.0	10.6	9.9
98.0	11.4	11.2
99.0	11.7	12.0
100.0	11.7	11.7
101.0	11.4	11.3
102.0	11.6	11.4
103.0	11.5	11.2
104.0	11.8	11.5
105.0	11.9	11.5
106.0	12.1	11.8
107.0	12.2	11.8
108.0	12.5	12.1
109.0	12.6	12.2
110.0	12.9	12.6
111.0	13.1	12.7
112.0	13.5	13.2
113.0	13.8	13.5
114.0	14.3	14.2
115.0	14.8	14.9
116.0	15.6	15.7
117.0	16.3	15.8
118.0	16.3	15.3
119.0	15.6	14.5
120.0	15.0	14.1
121.0	14.3	13.6
122.0	14.1	13.5
123.0	13.8	13.3
124.0	13.6	13.3
125.0	13.4	13.2
126.0	13.4	13.3
127.0	13.2	13.1
128.0	13.1	13.2
129.0	12.9	13.0
130.0	13.0	13.2
131.0	12.8	13.0
132.0	12.8	13.2
133.0	12.7	13.0
134.0	12.8	13.1
135.0	12.7	13.0
136.0	12.8	13.0
137.0	12.8	13.0
138.0	12.8	13.1
139.0	12.8	13.0
140.0	12.8	13.0
141.0	12.8	13.0
142.0	12.9	13.1
143.0	13.0	13.1
144.0	13.0	13.2
145.0	13.2	13.3
146.0	13.3	13.4
147.0	13.5	13.6
148.0	13.7	13.8
149.0	14.0	14.1
150.0	14.2	14.2
151.0	14.4	14.3
152.0	14.3	14.2
153.0	14.5	14.1
154.0	14.5	13.9
155.0	14.6	13.9
156.0	14.7	13.8
157.0	14.8	13.8
158.0	14.7	13.7
159.0	14.8	13.8
160.0	14.8	13.8
161.0	15.0	14.0
162.0	15.1	14.0
163.0	15.3	14.2
164.0	15.4	14.2
165.0	15.7	14.4
166.0	15.7	14.4
167.0	16.0	14.7
168.0	15.9	14.7
169.0	16.1	14.9
170.0	16.1	15.0
171.0	16.1	15.2
172.0	16.1	15.2
173.0	16.2	15.4
174.0	16.3	15.5
175.0	16.4	15.7
176.0	16.5	15.8
177.0	16.7	16.0
178.0	16.8	16.1
179.0	16.9	16.3
180.0	17.0	16.4
181.0	17.1	16.6
182.0	17.1	16.7
183.0	17.2	16.9
184.0	17.2	17.0
185.0	17.3	17.1
186.0	17.3	17.2
187.0	17.5	17.3
188.0	17.6	17.5
189.0	17.8	17.6
190.0	17.8	17.7
191.0	17.9	17.7
192.0	17.8	17.5
193.0	17.8	17.5
194.0	17.7	17.3
195.0	17.8	17.4
196.0	17.7	17.4
197.0	17.9	17.5
198.0	17.8	17.4
199.0	17.7	17.5
200.0	17.6	17.3
201.0	17.7	17.4
202.0	17.6	17.3
203.0	17.5	17.3
204.0	17.4	17.3
205.0	17.4	17.3
206.0	17.2	17.2
207.0	17.2	17.2
208.0	17.2	17.2
209.0	17.2	17.2
210.0	17.1	17.1

211.0	17.0	17.2
212.0	16.9	17.0
213.0	16.9	17.0
214.0	16.8	16.9
215.0	16.7	16.9
216.0	16.6	16.8
217.0	16.5	16.7
218.0	16.5	16.7
219.0	16.4	16.5
220.0	16.5	16.4
221.0	16.5	16.3
222.0	16.4	16.2
223.0	16.4	16.1
224.0	16.2	16.1
225.0	16.2	15.9
226.0	16.0	16.0
227.0	16.1	16.0
228.0	16.1	15.9
229.0	16.0	15.8
230.0	16.1	15.7
231.0	16.1	15.7
232.0	16.2	15.7
233.0	16.2	15.6

234.0	16.3	15.7
235.0	16.3	15.6
236.0	16.5	15.7
237.0	16.6	15.7
238.0	16.6	15.7
239.0	16.6	15.7
240.0	16.7	15.7
241.0	16.7	15.8
242.0	16.8	15.9
243.0	16.8	15.9
244.0	16.9	16.0
245.0	17.0	16.0
246.0	17.0	16.1
247.0	17.2	16.2
248.0	17.2	16.3
249.0	17.4	16.4
250.0	17.4	16.5
251.0	17.5	16.6
252.0	17.5	16.7
253.0	17.5	16.8
254.0	17.5	17.0
255.0	17.5	17.1
256.0	17.6	17.3

257.0	17.7	17.4
258.0	17.9	17.5
259.0	18.1	17.6
260.0	18.2	17.7
261.0	18.4	17.9
262.0	18.5	18.0
263.0	18.5	18.1
264.0	18.6	18.3
265.0	18.6	18.4
266.0	18.6	18.6
267.0	18.7	18.7
268.0	18.7	18.8
269.0	18.7	19.0
270.0	18.8	19.1
271.0	18.9	19.2
272.0	18.9	19.3
273.0	19.1	19.4
274.0	19.2	19.5
275.0	19.3	19.5
276.0	19.4	19.6
277.0	19.5	19.7
278.0	19.6	19.7
279.0	19.8	19.8

280.0	19.9	19.9
281.0	20.1	20.0
282.0	20.1	20.1
283.0	20.1	20.2
284.0	20.1	20.3
285.0	20.1	20.4
286.0	20.2	20.6
287.0	20.2	20.7
288.0	20.3	21.0
289.0	20.3	21.2
290.0	20.5	21.3
291.0	20.6	21.5
292.0	20.6	21.7
293.0	20.6	21.8
294.0	20.7	21.8
295.0	20.6	21.9
296.0	20.6	22.0
297.0	20.7	22.1
298.0	20.7	22.2
299.0	20.8	22.3
300.0	20.8	22.4

Customer Name: Tyco Safety Products - Sensormatic
Antenna Manufacturer: EMCO
Antenna Model: 3146 – Log periodic
Antenna Serial No.: 9303-3576
Temperature (Deg C). 3
Humidity (%). 65
Measurement Distance in Meters = 3
Antenna Polarization = VERT / HORZ
CAL CERT #: 2009033116

Freq	Vert ACF	Horz ACF
(MHz)	(dB)	(dB)
200.0	11.7	12.1
205.0	11.6	12.1
210.0	11.7	11.9
215.0	11.6	11.7
220.0	11.5	11.5
225.0	11.2	11.4
230.0	11.1	11.4
235.0	11.5	11.6
240.0	11.8	11.9
245.0	12.2	12.1
250.0	12.6	12.4
255.0	12.6	12.6
260.0	12.8	13.0
265.0	12.9	13.2
270.0	13.0	13.5
275.0	13.3	13.6
280.0	13.6	13.7
285.0	13.9	13.8
290.0	14.1	14.0
295.0	14.1	14.1
300.0	14.2	14.3
305.0	14.5	14.8
310.0	14.8	15.2
315.0	14.8	15.1
320.0	14.7	14.8
325.0	14.7	14.6
330.0	14.6	14.6
335.0	14.3	14.7
340.0	14.1	14.9
345.0	14.2	14.9
350.0	14.5	14.9
355.0	14.8	14.8
360.0	15.0	14.9
365.0	15.3	15.0
370.0	15.2	15.1
375.0	15.1	15.2
380.0	15.0	15.3
385.0	15.4	15.5
390.0	15.7	15.8
395.0	15.5	15.9
400.0	15.4	16.1
405.0	15.5	16.0
410.0	15.7	15.9
415.0	16.0	16.1
420.0	16.0	16.2
425.0	15.9	16.4
430.0	15.8	16.5
435.0	15.9	16.5
440.0	16.1	16.4
445.0	16.4	16.5
450.0	16.7	16.7
455.0	16.9	16.9
460.0	16.9	17.2
465.0	16.9	17.3
470.0	16.9	17.3
475.0	17.1	17.4
480.0	17.2	17.4
485.0	17.5	17.5
490.0	17.7	17.6
495.0	17.9	17.9
500.0	17.9	17.9
505.0	18.0	18.2
510.0	18.3	18.6
515.0	18.5	19.0
520.0	18.3	18.8
525.0	18.0	18.6
530.0	17.7	18.5
535.0	17.6	18.6
540.0	17.6	18.4
545.0	17.9	18.3
550.0	18.2	18.3
555.0	18.3	18.6
560.0	18.2	18.7
565.0	18.1	18.8
570.0	18.0	18.9
575.0	18.2	18.7
580.0	18.4	18.6
585.0	18.7	18.8
590.0	18.8	19.1
595.0	18.7	19.2
600.0	18.7	19.2
605.0	18.7	19.1
610.0	18.8	19.3
615.0	19.0	19.5
620.0	19.2	19.4
625.0	19.4	19.4
630.0	19.2	19.4
635.0	19.2	19.4
640.0	19.5	19.7
645.0	19.7	19.9
650.0	19.9	20.0
655.0	20.1	20.1
660.0	20.3	20.3
665.0	20.4	20.4
670.0	20.5	20.6
675.0	20.5	20.7
680.0	20.5	20.9
685.0	20.4	20.9
690.0	20.4	21.1
695.0	20.4	21.0
700.0	20.5	21.0
705.0	20.6	21.0
710.0	20.5	21.0
715.0	20.5	21.0
720.0	20.5	21.2
725.0	20.7	21.3
730.0	20.7	21.2
735.0	20.7	21.2
740.0	20.6	21.1
745.0	20.6	21.2
750.0	20.6	21.4
755.0	20.6	21.4
760.0	20.7	21.3
765.0	20.7	21.4
770.0	20.7	21.4
775.0	20.7	21.4
780.0	20.7	21.4
785.0	20.7	21.4
790.0	20.8	21.5
795.0	20.9	21.6
800.0	21.1	21.6
805.0	21.0	21.7
810.0	21.1	21.7
815.0	21.1	21.8
820.0	21.3	22.0
825.0	21.4	22.1
830.0	21.5	22.1
835.0	21.6	22.2
840.0	21.7	22.3
845.0	21.7	22.4
850.0	21.8	22.4
855.0	21.9	22.5
860.0	22.2	22.7
865.0	22.4	22.9
870.0	22.5	23.0
875.0	22.6	23.1
880.0	22.6	23.1
885.0	22.5	23.2
890.0	22.6	23.1
895.0	22.6	23.1
900.0	22.7	23.3
905.0	22.7	23.3
910.0	22.8	23.3
915.0	22.8	23.2
920.0	22.6	23.3
925.0	22.6	23.4
930.0	22.6	23.4
935.0	22.7	23.4
940.0	22.7	23.5
945.0	22.7	23.6
950.0	22.6	23.5
955.0	22.7	23.6
960.0	22.9	23.7
965.0	22.9	23.9
970.0	23.1	23.8
975.0	23.1	23.8
980.0	23.1	23.9
985.0	23.2	23.9
990.0	23.3	24.1
995.0	23.5	24.4
1000.0	23.6	24.4

Customer Name: Tyco Safety Products - Sensormatic
Antenna Manufacturer: EMCO
Antenna Model: 3115 Horn
Antenna Serial No.: 3006
Temperature (Deg C): 20.0
Humidity (%): 37.0
Measurement Distance in Meters = 3.0
Antenna Polarization = VERT / HORZ
NOTES: Observed Pin Depth: -0.0003" from typical.
CAL CERT #: 2009033119

Freq	Vert ACF	Horz ACF
(MHz)	(dB)	(dB)
1000.0	23.377	23.524
1500.0	25.067	25.087
2000.0	27.357	27.365
2500.0	29.000	29.024
3000.0	30.277	30.385
3500.0	31.557	31.512
4000.0	32.827	32.580
4500.0	32.593	32.499
5000.0	33.481	33.288
5500.0	34.467	34.421
6000.0	34.894	34.639
6500.0	34.730	34.612
7000.0	35.473	35.489
7500.0	36.832	36.780
8000.0	37.271	37.207
8500.0	37.649	37.600
9000.0	37.956	37.940
9500.0	37.858	37.743
10000.0	38.517	38.433
10500.0	38.992	39.004
11000.0	40.566	40.541
11500.0	39.704	39.684
12000.0	39.424	39.396
12500.0	38.797	38.822
13000.0	39.622	39.615
13500.0	40.408	40.394
14000.0	41.209	41.203
14500.0	41.665	41.584
15000.0	40.325	40.233
15500.0	38.024	38.049
16000.0	37.320	37.358
16500.0	38.400	38.340
17000.0	41.136	40.903
17500.0	42.866	42.522
18000.0	44.717	44.269