EMC TEST REPORT

NVLAP Lab Code 200033-0

Standard(s):

47 CFR FCC Part 15.247:2013
RSS 210, Issue 8, 2010
FCC ID: M4Z1000
IC ID: 3637B-4100

Product: **3M Compact RFID Reader**
Model: **1000-001**
3M Division: TSSD

Report Number: **RE1301030-1**
Report Issue Date: **October 15, 2014**

Report Prepared By:

Signature:

Yuriy Litvinov
Lead EMC Engineer

Tested By:
3M Regulatory Engineering
EMC Laboratory
410 E. Fillmore Avenue, Building 76-01-1
St. Paul, Minnesota 55107-1000

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1.0 Test Summary

Based on the results of our investigation, we have concluded the product tested complies with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested.

No	Standard	Test Requirements	Result	Comments
4.1	15.107/15.207/RSS-Gen	Conducted Emissions	pass	
4.2	15.109/15.209/RSS-Gen	Radiated Emissions	pass	
4.3	15.247(a)(1)/A8.1(b)	Carrier Frequency Separation	pass	
4.4	15.247(a)(1)/A8.1(d)	Number of Hopping Frequencies	pass	
4.5	15.247(a)(1)/A8.1(d)	Time of Occupancy (Dwell Time)	pass	
4.6	15.247(a)(1)/A8.1(a)	20dB Bandwidth	pass	
4.7	15.247(b)(3)/A8.4	Band-edge Compliance	pass	
4.8	15.247(c)/A8.5)	Conducted Output Power	pass	
4.9	15.247(c)/A8.5	Spurious Conducted and Radiated Emissions	pass	
4.10	15.247(2)(h)(i)/RSS102	RF Exposure Compliance	pass	

Note:	

1.1 Measurement Uncertainty

The measured value related to the corresponding limit will be used to decide whether the equipment meets the requirements. The measurement uncertainty figures were calculated and correspond to a coverage factor of k=2, providing a confidence level of respectively 95.45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian).

Radiated emissions	5.20 dB
Conducted emissions	3.60 dB
Harmonics and Flicker	3.32 dB

2.0 Equipment Description

2.1	Equipment Under Test		
Description:	3M Model 1000 is a multi protocol four-Port Compact RFID Reader which can support up to four mono-static or two bi-static antennas. All antenna ports operate sequentially with only one port transmitting at the time from a single transmit source (RF path is switched between selected ports). One RF Section and one antenna multiplexing at the time. Antenna path is identical.		
Model(s):	1000-001		
Serial number:	N/A		
Client Contact:	**Name:**	**Phone:**	
	Dave Missimer Randal D. Roebuck Aaron Mills	919-281-1559 512- 984 5688 651- 736-3323	
3M Division:	Traffic Safety and Security		
Modifications:	None		
Frequency Range (MHz) :	902 – 928MHz		
Modulation Type:	FHSS	DB-ASK, PR-ASK	
Channel No.:	50		
Maximum Output Power:	30.0dBm		
Antenna Type :	MT–262006/TRH/A – 6dBi Dual Polarized Dipole (7dBi max) MT–242048/NRH – 4.5dBi Dual Polarized Dipole		
Equipment Category:	☒ General ☐ Portable ☐ Indoor Use		
Rated Input Power:	Voltage: ☒ 120VAC ☐ 230VAC ☐ VDC Frequency: ☐ 50Hz ☒ 60Hz Current: ☒ 3.75A		
Test Dates:	05/19-06/20/2014		
Received Date:	04/26/2014		
Received Conditions:	☐ Poor ☒ Good ☐ Prototype ☒ Production		

3.0 EUT Configuration

3.1 Support Equipment

No.	Product Type	Manufacturer	Model	Comments
1	24 VDC Power Supply	Mean Well	p/n GS90A24-P1M	100-240VAC, 50/60Hz
2				

3.2 Cables/Ports

No.	Name	Type	Length	Shielding	Comments
1	Ethernet	RG45	2m	Yes	Digital I/O Connection
2	USB	USB	2m	No	
3	Serial	RS232	2m	No	

3.3 Operating Condition of EUT

	Operation Modes
☐	Stand by
☒	Continuous Monitored Operation
☐	Continuous Unmonitored Operation
☒	RFID reader was programmed for FHSS operation using RTS RFID software via Command Line Interface.
☒	FCC Dense mode – 902.75-927.250MHz with 500KHz channels
☒	FCC Band A - 902.75-912.100MHz with 200KHz channels
☒	FCC Band B - 910.100-919.900MHz with 200KHz channels
☒	FCC Band C - 917.900-927.700MHz with 200KHz channels

3.4 Exercising of EUT

No.	Description of EUT Exercising
1	Transmitting at lowest, middle and highest channels of operation with un-modulated carrier
2	Transmitting with hopping channels enabled
3	Transmitting un-modulated carrier at maximum rated RF output power

4.0 Test Conditions and Results

4.1	**Conducted Emissions Data**
Method:	The AMN was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane. This distance was between the closest points of the AMN and the EUT. All other units of the EUT and associated equipment were at least 0.8 m from the AMN. All power was connected to the system through Artificial Mains Network (AMN). Conducted voltage measurements on mains lines were made at the output of the AMN.

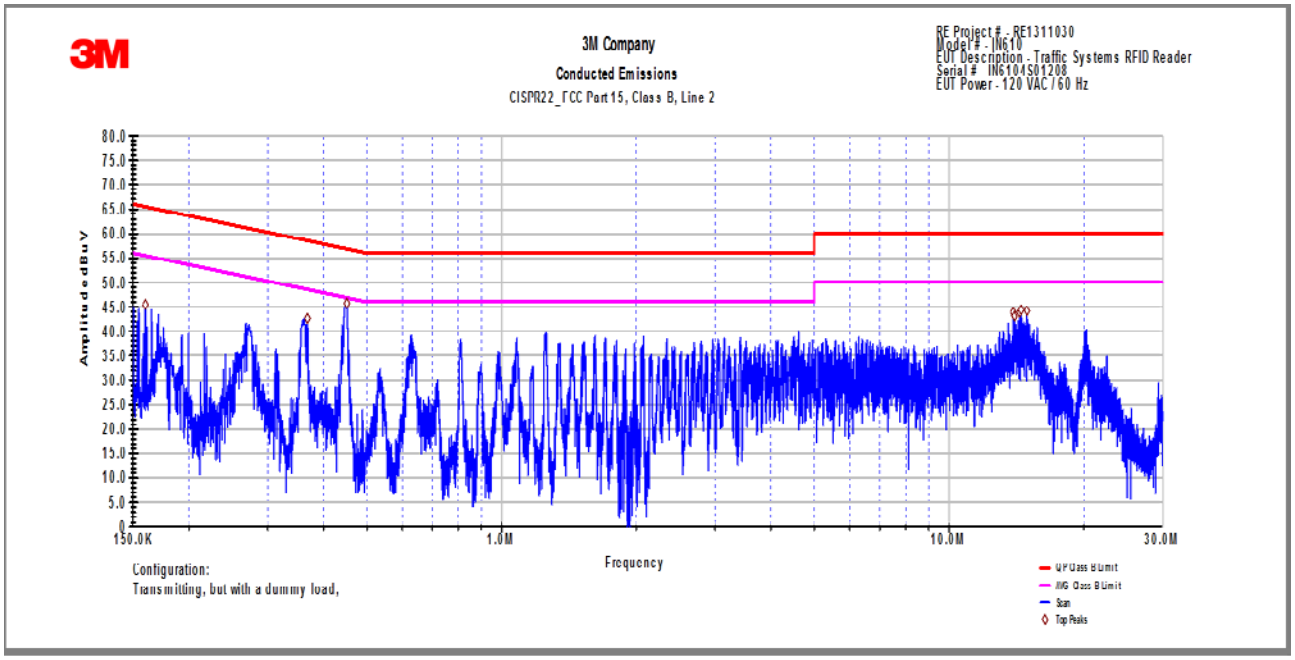
Test Verification: ☒	Laboratory Ambient Temperature	21°C
	Relative Humidity	35%
Reference Standard:	☐ ANSI C63.4:2003 ☒ ANSI C63.4:2009 ☐ ANSI C63.10:2009 ☒ FCC Part 15.207/RSS Gen ☐ FCC Part 15.247/RSS 210 ☐	**Measurement Point** ☒ Mains ☐ Telecommunication ports ☐
Frequency Range:	☒ 150KHz to 30KHz ☐	
Nominal Voltage:	☒ 120VAC ☐ 230VAC ☐	
Tested By:	Mike Schultz MS	**Date:** 05/22/2014

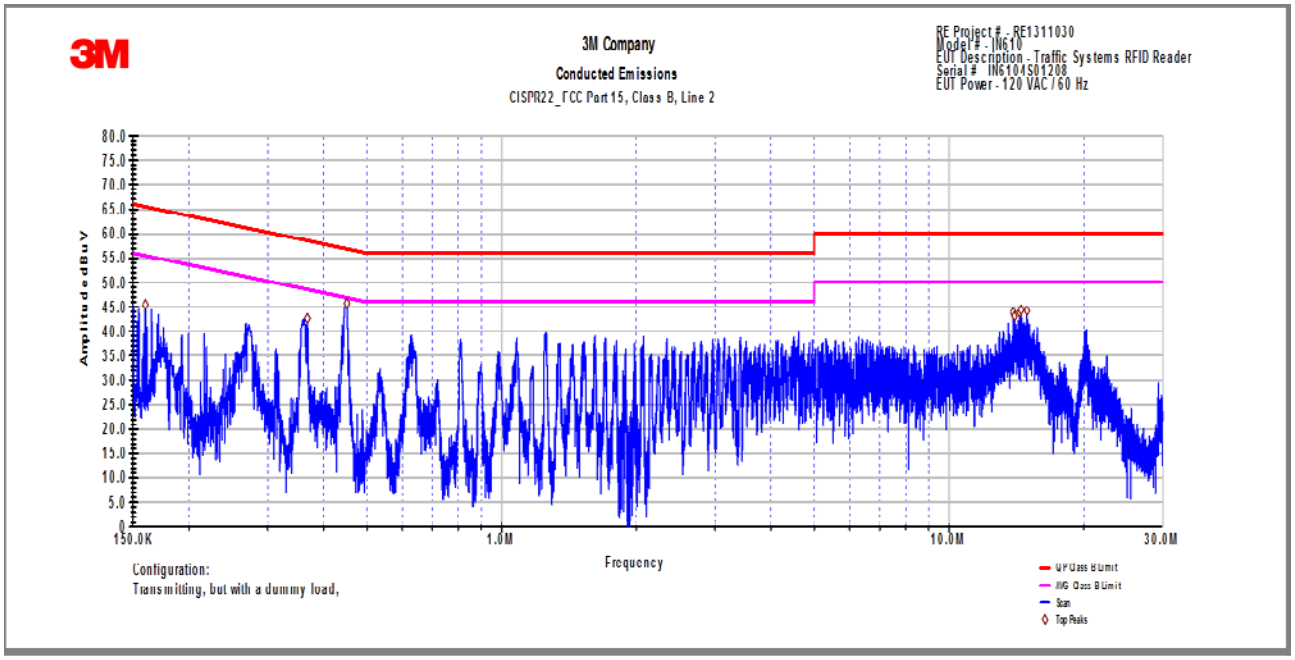
Limits

Frequency (MHz)	Limit dB (µV)			
	Quasi-Peak	Average	Result	Comments
0.15 to 0.50	66 to 56	56 to 46	**pass**	
0.50 to 5	56	46	**pass**	
5 to 30	60	50	**pass**	

Modifications:	
Note:	

Frequency (MHz)	QP Line 1 dB (µV)	AVG Line 1 dB (µV)	QP Limit dB (µV)	AVG Limit dB (µV)	QP Margin dB	AVG Margin dB
0.17	42.23	36.78	64.92	54.92	-22.70	-18.14
0.27	42.50	38.23	61.07	51.07	-18.57	-12.84
0.36	43.97	42.54	58.70	48.70	-14.73	-6.16
0.45	47.02	45.74	56.89	46.89	-9.87	-1.15
0.63	40.94	35.81	56.00	46.00	-15.06	-10.19
14.39	39.15	32.09	60.00	50.00	-20.85	-17.91
14.59	41.08	32.14	60.00	50.00	-18.92	-17.86
15.06	38.83	30.78	60.00	50.00	-21.17	-19.22
Frequency (MHz)	**QP Line 2 dB (µV)**	**AVG Line 2 dB (µV)**	**QP Limit dB (µV)**	**AVG Limit dB (µV)**	**QP Margin dB**	**AVG Margin dB**
0.16	37.98	24.25	65.47	55.47	-27.49	-31.22
0.37	37.35	30.81	58.54	48.54	-21.19	-17.73
0.44	42.10	35.26	57.03	47.03	-14.93	-11.77
14.14	40.08	32.12	60.00	50.00	-19.92	-17.88
14.14	38.68	30.98	60.00	50.00	-21.32	-19.02
14.37	39.24	31.03	60.00	50.00	-20.76	-18.97
14.48	41.46	32.75	60.00	50.00	-18.54	-17.25
14.74	40.09	31.78	60.00	50.00	-19.91	-18.22
Voltage		☒ 120VAC ☐ 230VAC ☐				
Notes						


3M Company
Conducted Emissions
CISPR22_FCC Part15, Class B, Line 2
RE Project # - RE1311030
Model # - IN610
EUT Description - Traffic Systems RFID Reader
Serial # IN6104S01208
EUT Power - 120 VAC / 60 Hz
Amplitude dBuV
80.0
75.0
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0
150.0K
1.0M
10.0M
30.0M
Frequency
Configuration:
Transmitting, but with a dummy load,
QP Class B Limit
AVG Class B Limit
Scan
Top Peaks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30.0
25.0
20.0
15.0
10.0
5.0
0
150.0K
1.0M
10.0M
30.0M
Frequency
Configuration:
Transmitting, but with a dummy load,
QP Class B Limit
AVG Class B Limit
Scan
Top Peaks

Test Set Up Photo

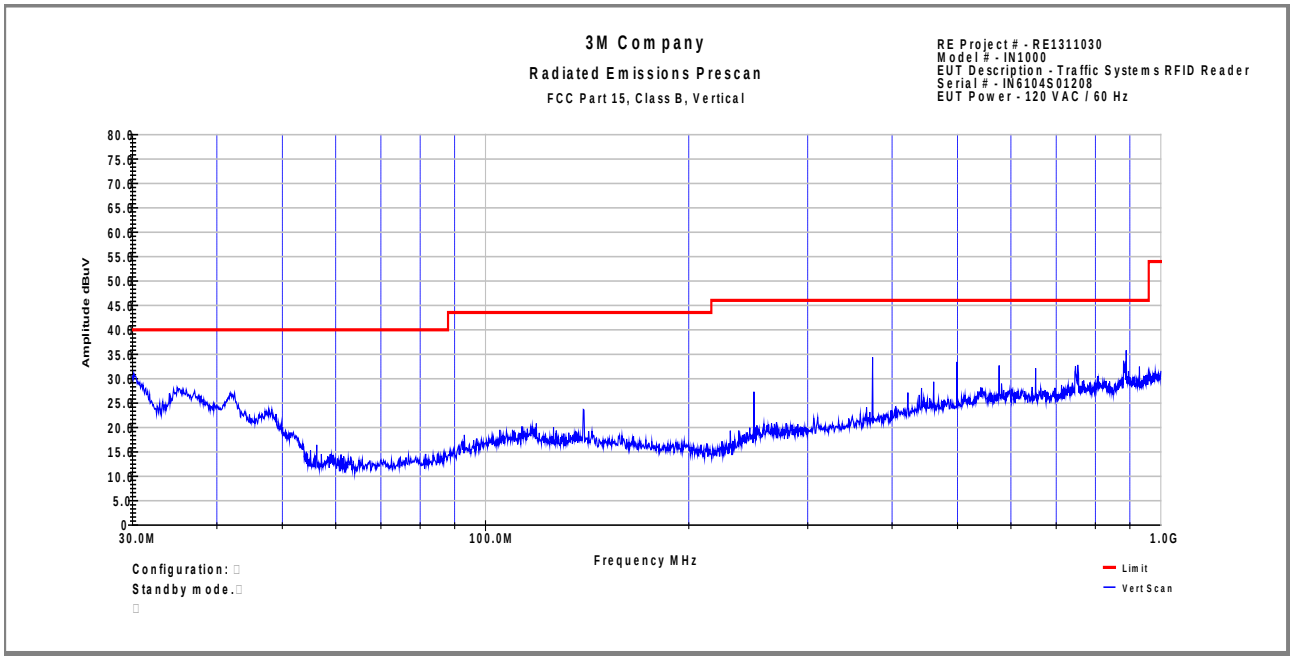
4.2	**Radiated Emissions Data**		
Method:	Measurements were made in a 3-meter semi-anechoic chamber that complies to CISPR 16. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in horizontal and vertical polarities. Final measurements (quasi-peak) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4 m. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.		
Test Verification: ☒	Laboratory Ambient Temperature	23°C	
	Relative Humidity	35%	
Reference Standard:	☐ ANSI C63.4:2003 ☒ ANSI C63.4:2009 ☐ ANSI C63.10:2009 ☒ FCC Part 15.109/ICES 003 ☐ FCC Part 15.247/RSS 210 ☒ FCC Part 15.209	**Measurement Distance**	☒ 3 Meters ☐
Frequency Range:	☒ 30 MHz TO 10GHz ☐		
Nominal Voltage:	☒ 120VAC ☐ 230VAC ☐		
Tested By:	Mike Schultz MS	**Date:** 05/28/2014	

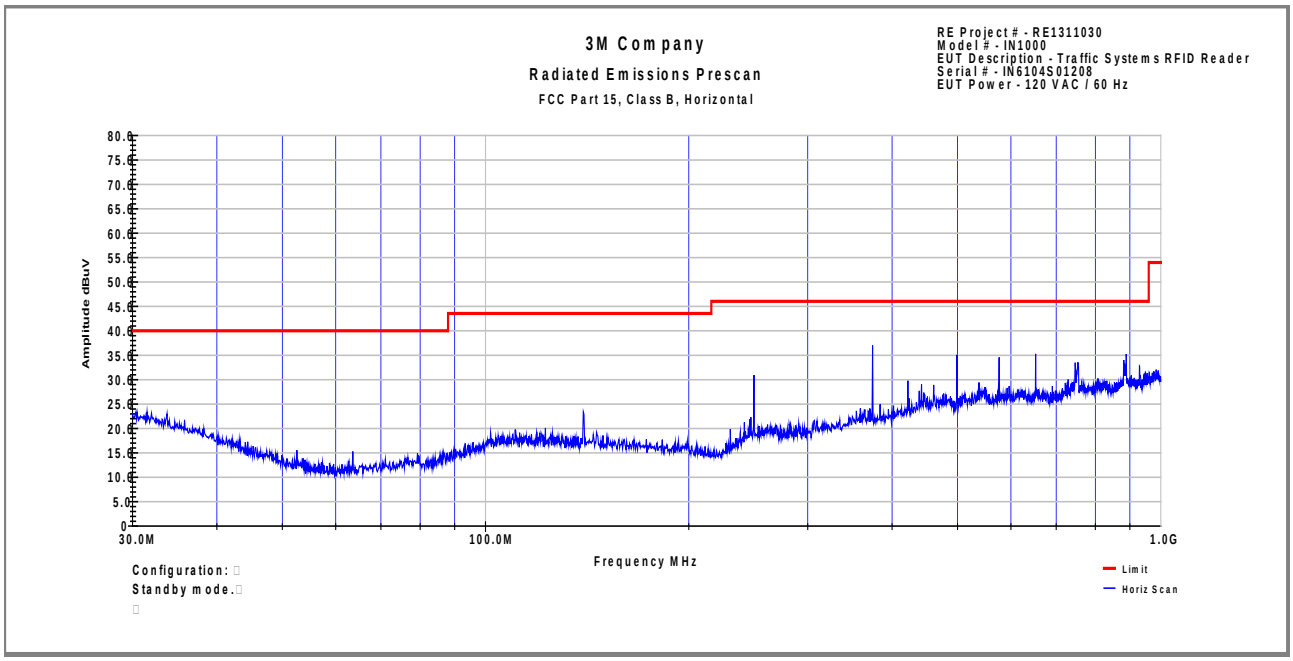
Limits

Frequency (MHz)	Limit dB (µV/m)			
	Quasi-Peak	Average	Distance	Results
0.009-0.490		2400/F(KHz)	300	**N/A**
0.490-1.705	24000/F(KHz)		30	**N/A**
1.705-30	29.5		30	**N/A**
30 to 88	40		3	**pass**
88-216	43.5		3	**pass**
216-960	46		3	**pass**
Above 960		54	3	**pass**

Modifications:	
Note:	For emission in the restricted bands, the limit of 15.209 was used.

Frequency (MHz)	Pol.	QP Reading dBµV/m	Total CF dB	Net at 3 m dBµV/m	Limit (dBµV/m)	Margin dB
249.60	H	13.90	15.39	29.29	47.00	-17.71
374.00	H	7.69	19.12	26.81	47.00	-20.19
500.00	H	8.59	21.71	30.30	47.00	-16.70
576.00	H	11.94	23.27	35.21	47.00	-11.79
652.00	H	8.92	23.74	32.66	47.00	-14.34
249.60	H	13.90	15.39	29.29	47.00	-17.71
Notes	Total CF = Antenna Factor + Cable Factor - AMP Gain					


3M Company
Radiated Emissions Prescan
FCC Part 15, Class B, Vertical
RE Project # - RE1311030
Model # - IN1000
EUT Description - Traffic Systems RFID Reader
Serial # - IN6104S01208
EUT Power - 120 VAC / 60 Hz
Amplitude dBuV
80.0
75.0
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0
30.0M
100.0M
1.0G
Frequency MHz
Configuration:
Standby mode.
Limit
Vert Scan


3M Company
Radiated Emissions Prescan
FCC Part 15, Class B, Horizontal
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Model # - IN1000
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Serial # - IN6104S01208
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65.0
60.0
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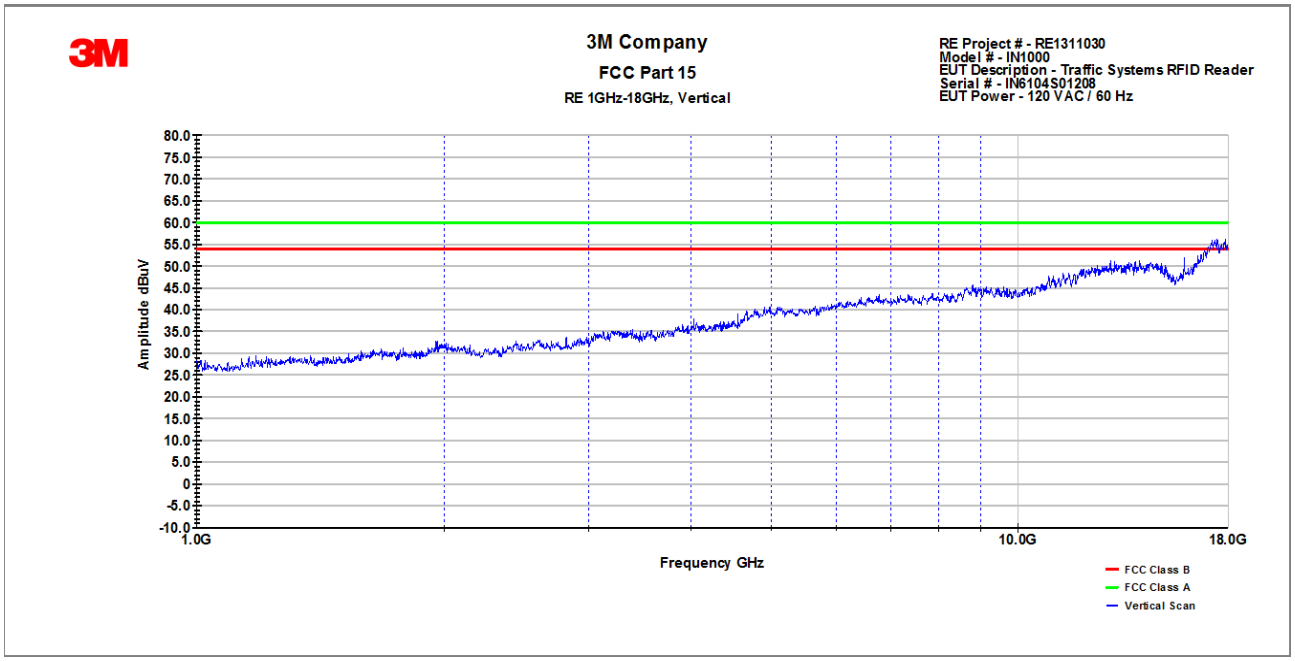
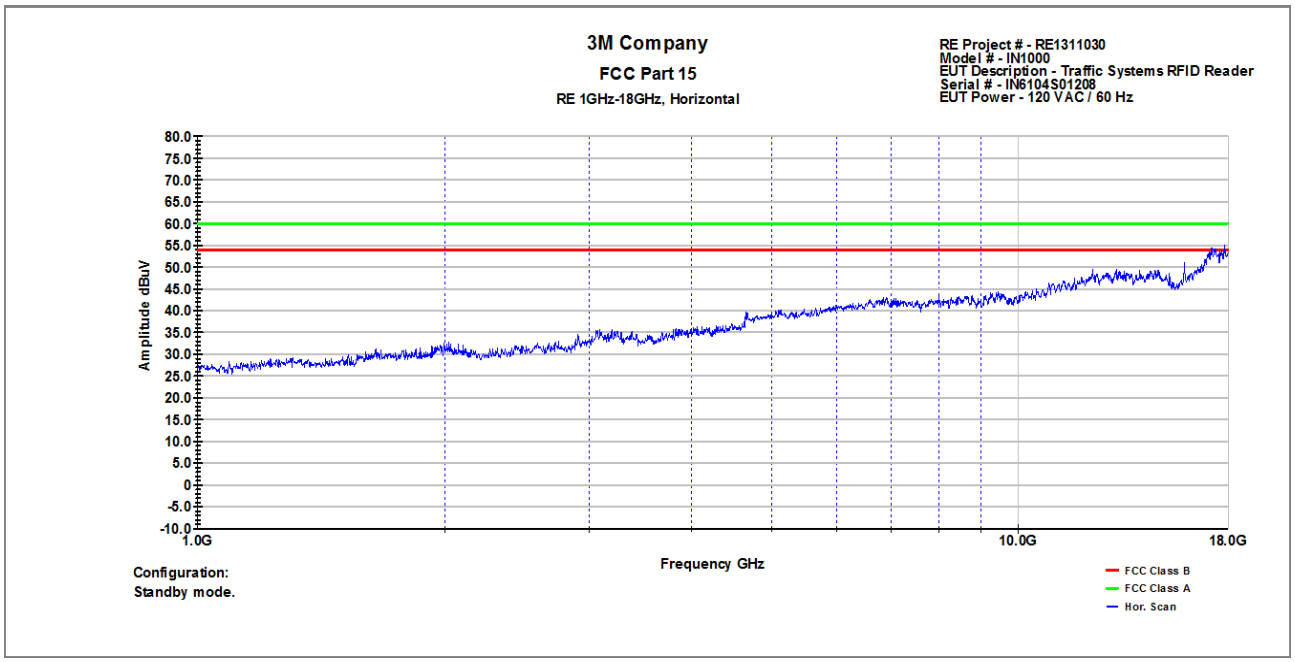
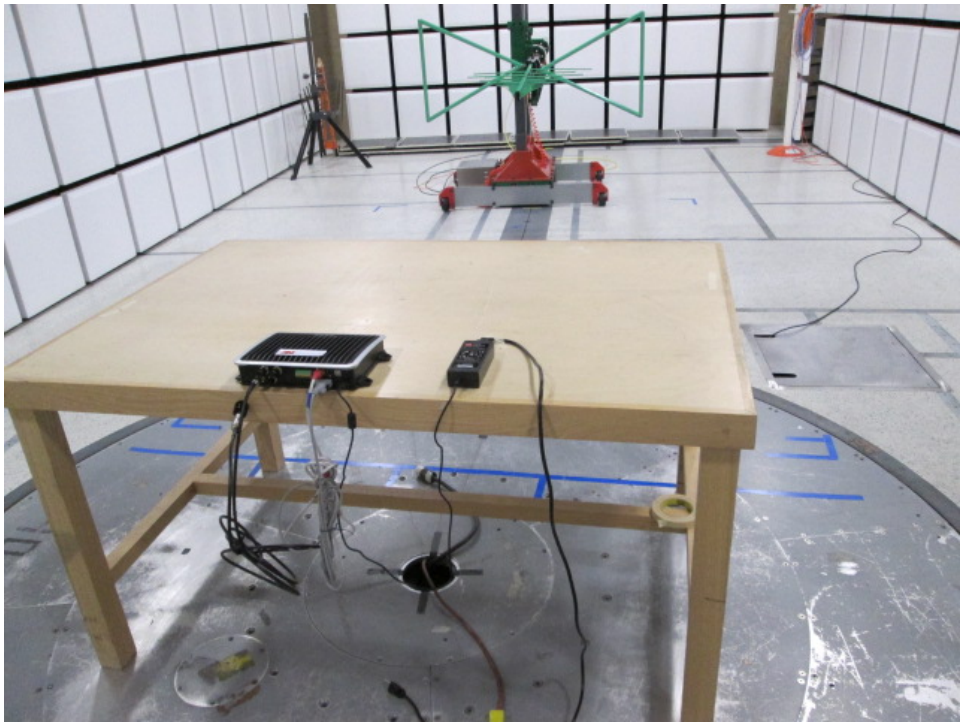
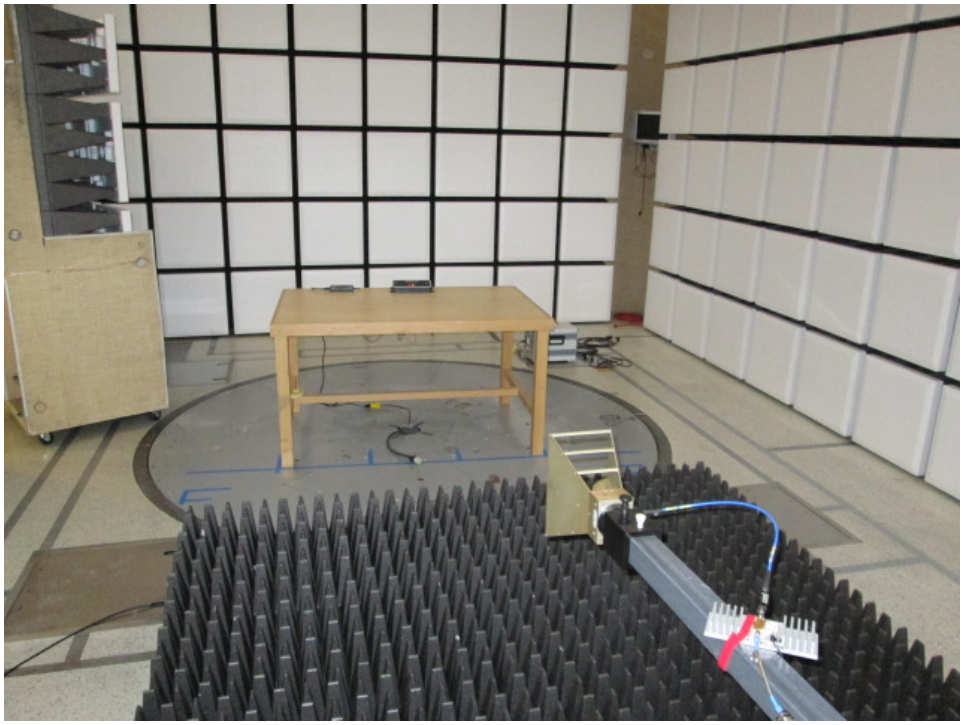
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0
30.0M
100.0M
1.0G
Frequency MHz
Configuration:
Standby mode.
Limit
Horiz Scan


3M Company
FCC Part 15
RE 1GHz-18GHz, Vertical
RE Project # - RE1311030
Model # - IN1000
EUT Description - Traffic Systems RFID Reader
Serial # - IN6104S01208
EUT Power - 120 VAC / 60 Hz
Amplitude dBuV
80.0
75.0
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0
-5.0
-10.0
1.0G
10.0G
18.0G
Frequency GHz
FCC Class B
FCC Class A
Vertical Scan


3M Company
FCC Part 15
RE 1GHz-18GHz, Horizontal
RE Project # - RE1311030
Model # - IN1000
EUT Description - Traffic Systems RFID Reader
Serial # - IN6104S01208
EUT Power - 120 VAC / 60 Hz
Amplitude dBuV
80.0
75.0
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0
-5.0
-10.0
1.0G
10.0G
18.0G
Frequency GHz
Configuration:
Standby mode.
FCC Class B
FCC Class A
Hor. Scan



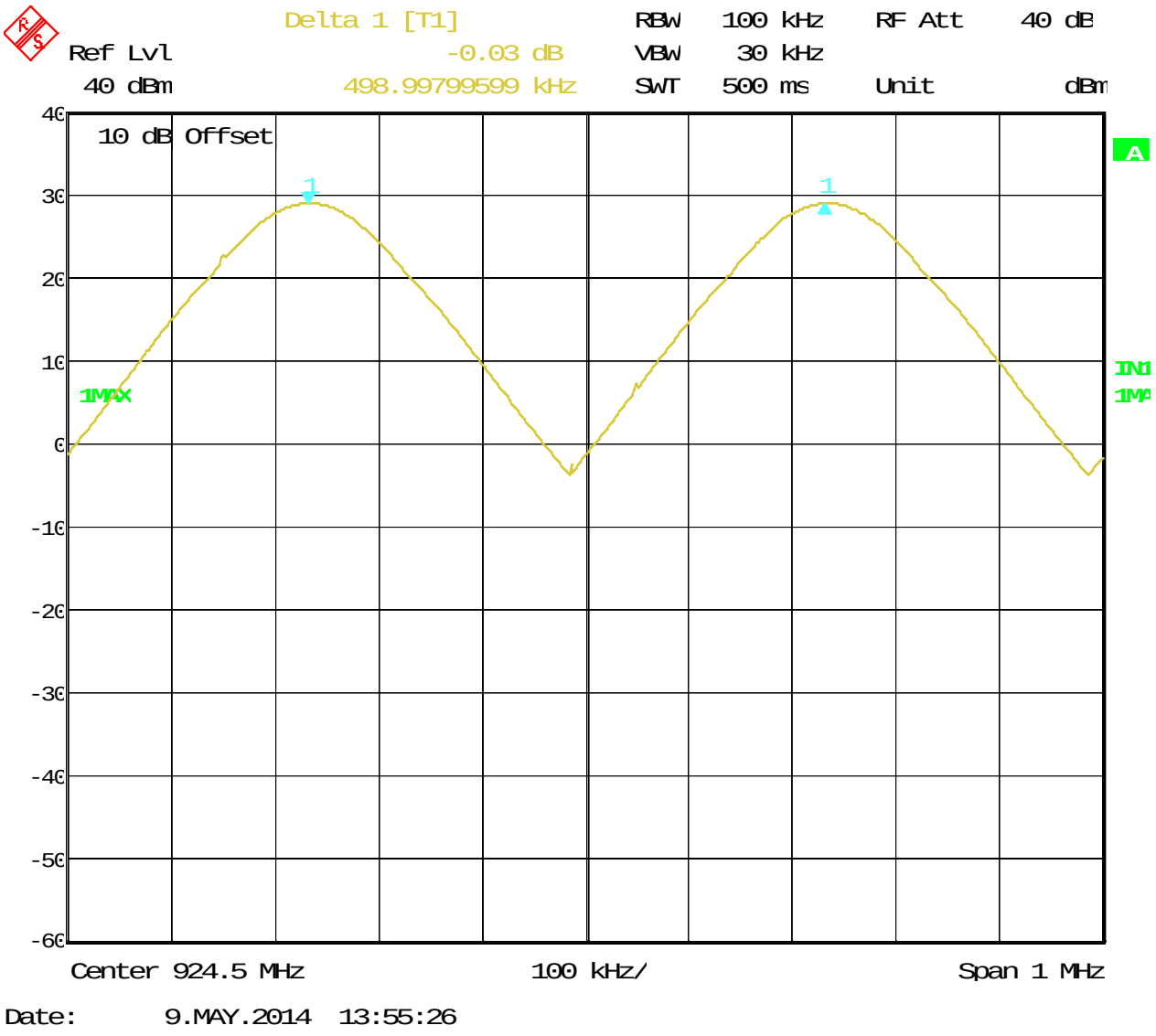
Test Set Up Photo



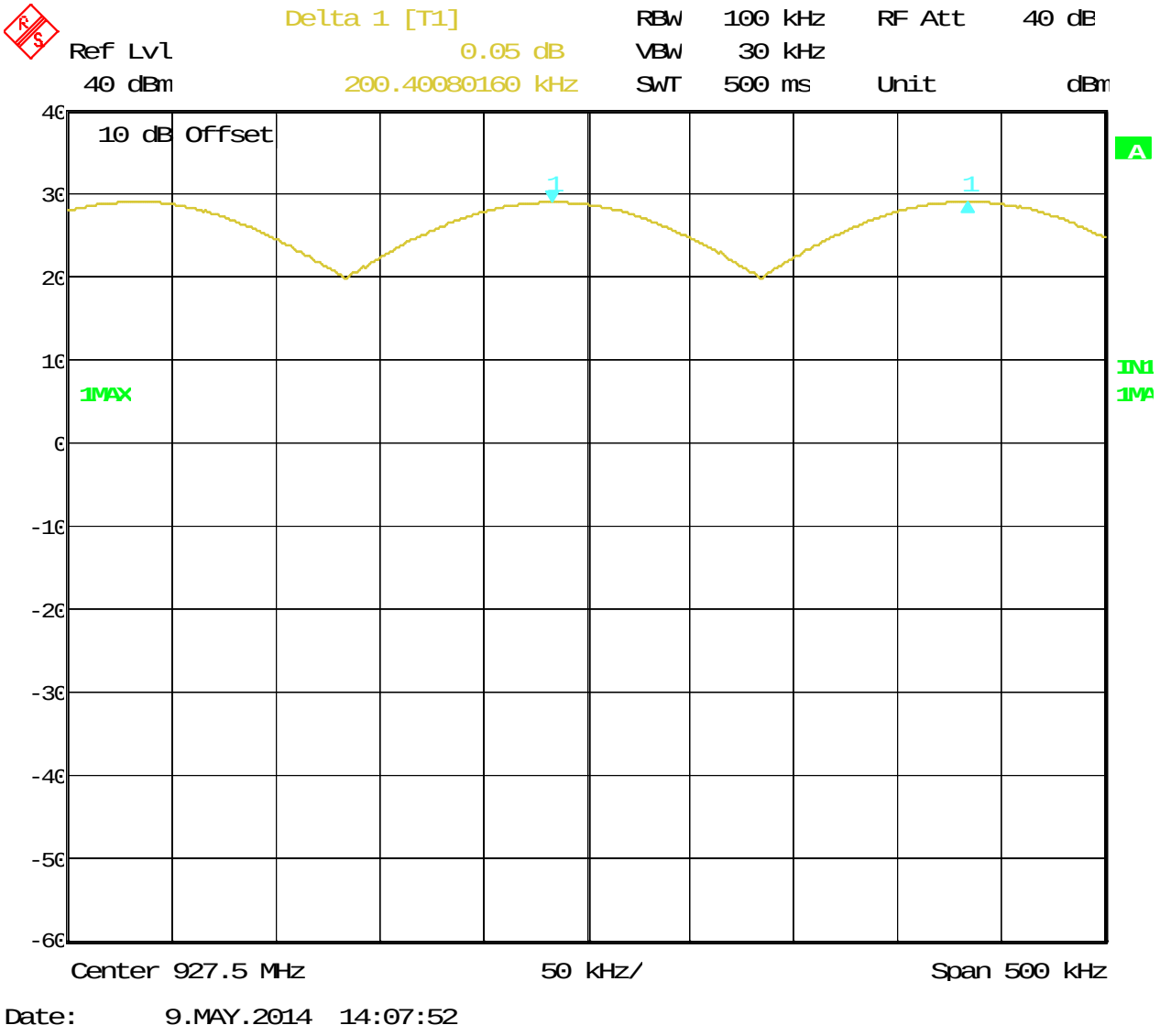
Test Set Up Photo

4.3	**Carrier Frequency Separation**				
Method:	The measurements were made with transmitter set to transmit a continuously with hopping function enabled. The EUT antenna was removed and the cable was connected directly into the spectrum analyzer via 10dB attenuator.				
	Laboratory Ambient Temperature	23°C			
	Relative Humidity	35%			
Reference Standard:	☐ ANSI C63.4:2003 ☐ ANSI C63.4:2009 ☒ ANSI C63.10:2009 ☐ FCC Part 15.109/ICES 003 ☒ FCC Part 15.247/RSS 210 ☐ FCC Part 15.209	**Measurement Point** ☒ Conducted ☐ Radiated ☐			
Frequency Range:	☒ 902.3-927.75MHz				
Antenna Gain:	☒ 6dBi	**Result**			
Limit	☐ >25KHz				
	☒ >20dB Bandwidth (110 KHz)	Dense	Band A	Band B	Band C
		499KHz	200KHz	200KHz	200KHz
Nominal Voltage:	☒ 120VAC ☐ VDC				
Tested By:	Yuriy Litvinov	**Date:** 05/09/2014			

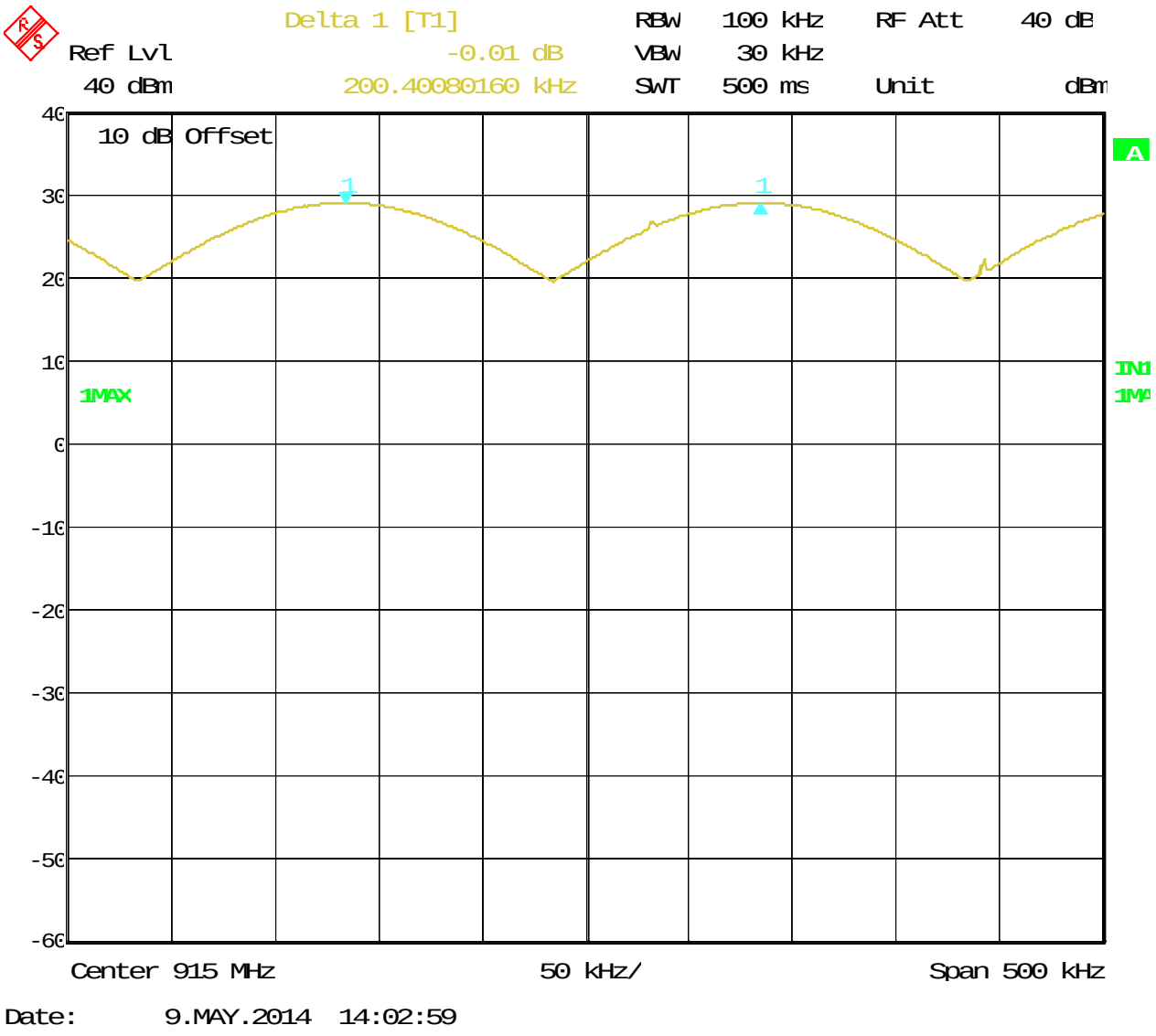
Note:	The channel spacing was verified to be nominally 200KHz in Bands A, B and C. The dense mode utilizes 50 channels and the channel spacing in this mode was measured to be 500KHz.



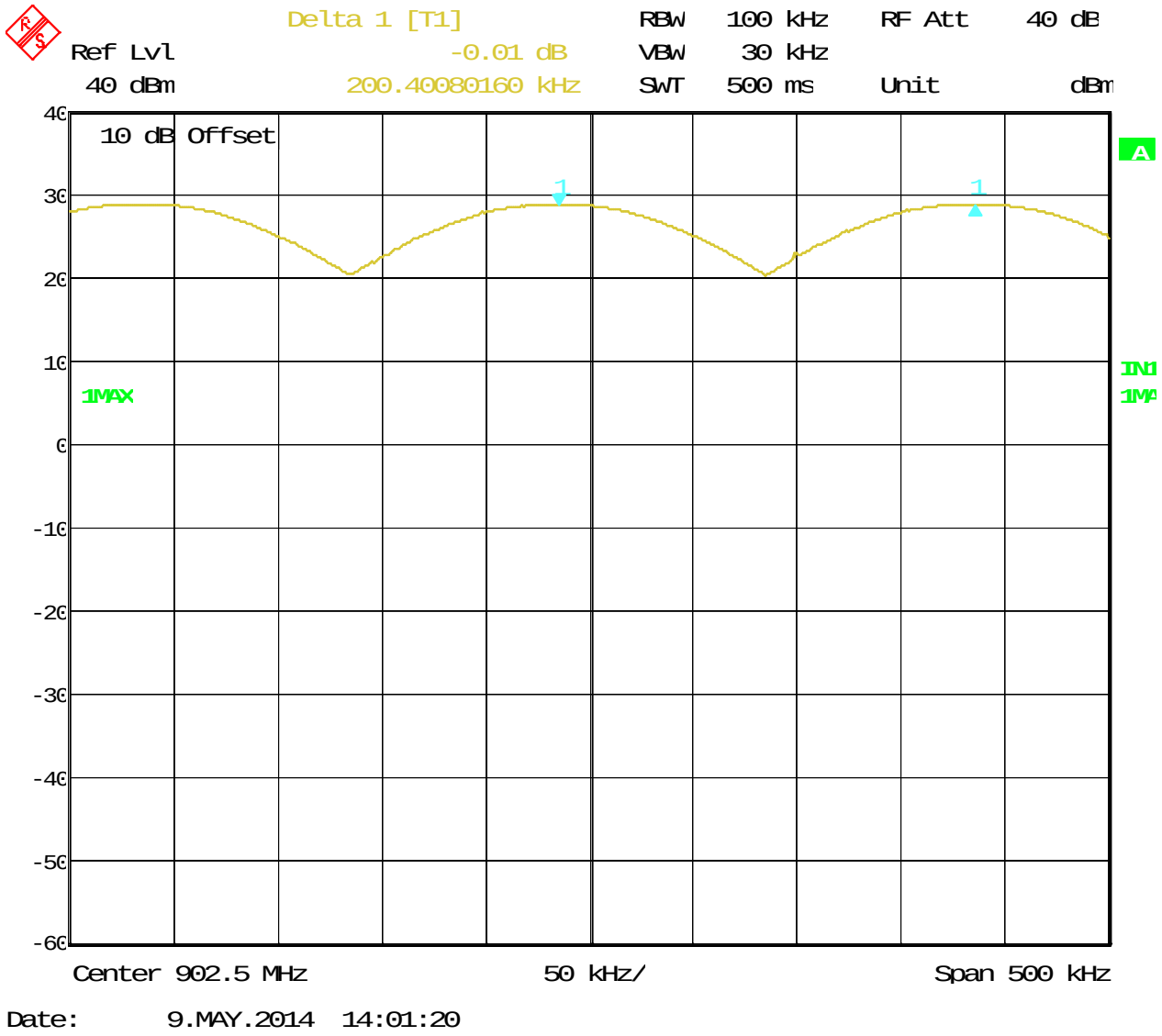
Carrier Frequency Separation – Dense Mode



Carrier Frequency Separation – Band C



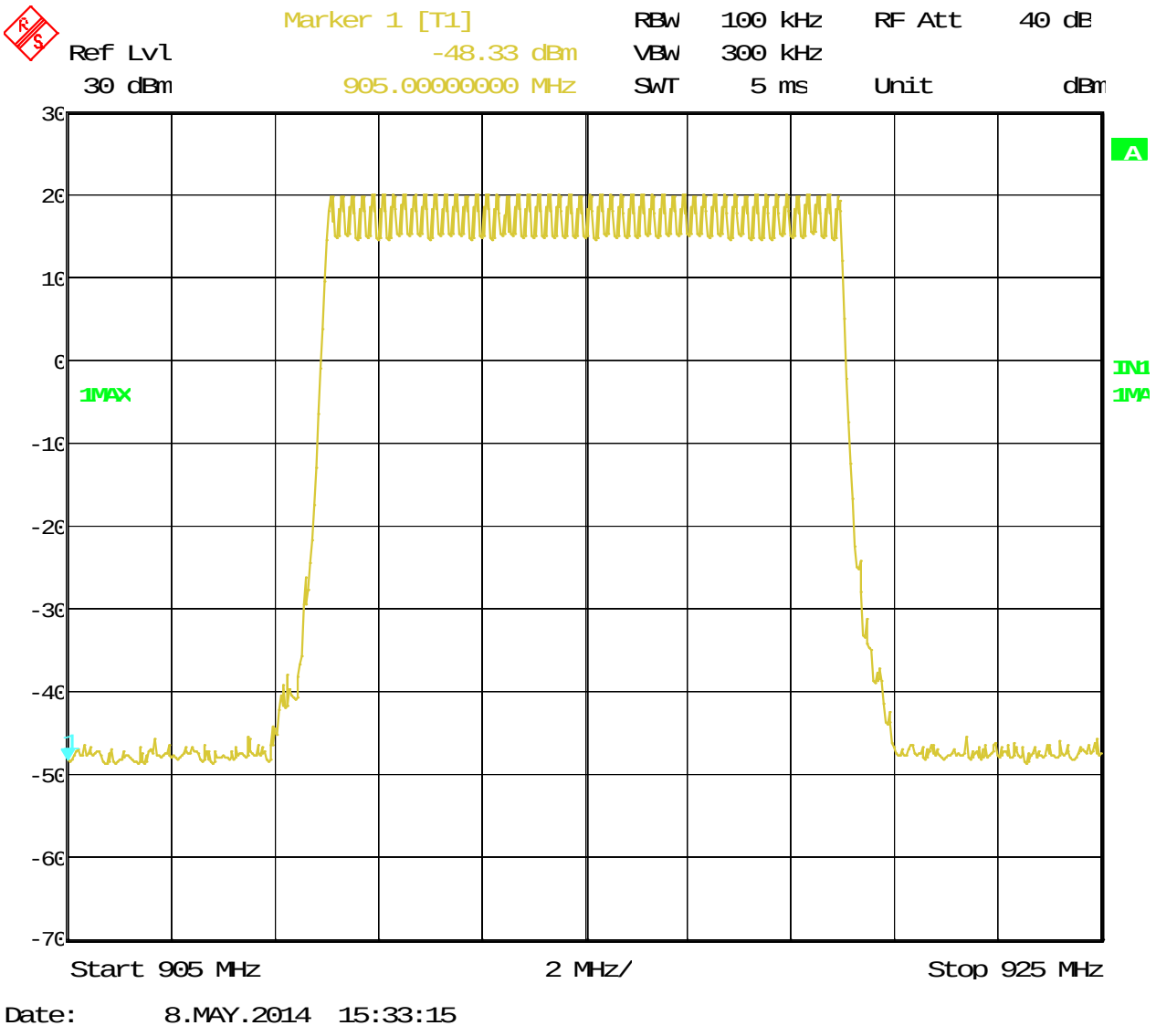
Carrier Frequency Separation – Band B



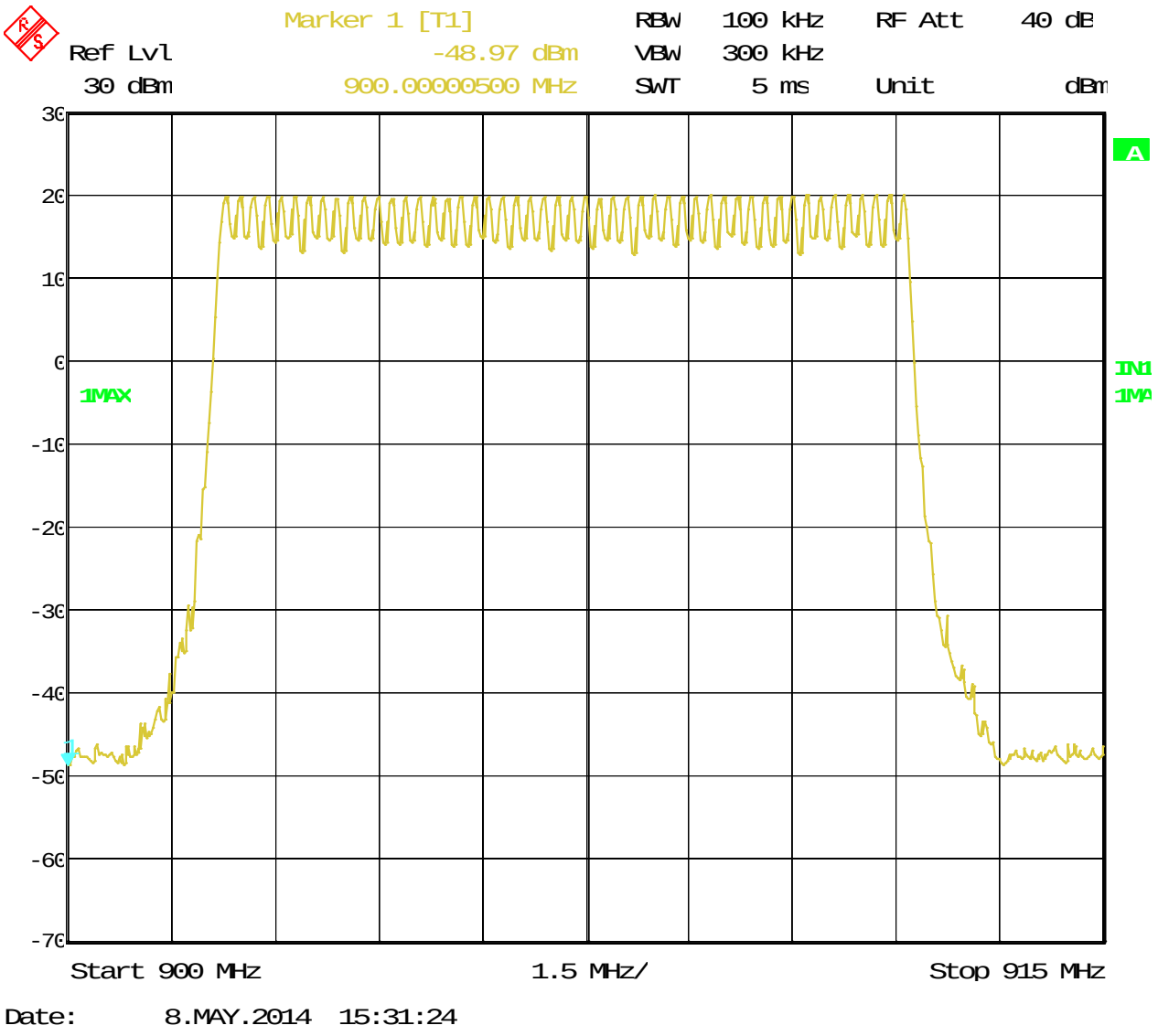
Carrier Frequency Separation – Band A

4.4	Number of Hopping Frequencies		
Method:	The measurements were made with transmitter set to transmit a continuously with hopping function enabled. The EUT antenna was removed and the cable was connected directly into the spectrum analyzer via 10dB attenuator.		
	Laboratory Ambient Temperature	23°C	
	Relative Humidity	35%	
Reference Standard:	☐ ANSI C63.4:2003 ☐ ANSI C63.4:2009 ☒ ANSI C63.10:2009 ☐ FCC Part 15.109/ICES 003 ☒ FCC Part 15.247/RSS 210 ☐ FCC Part 15.209	**Measurement Point** ☒ Conducted ☐ Radiated ☐	
Frequency Range:	☒ 902.3-927.75MHz		
Antenna Gain:	☒ 6dBi	**Number of Channels**	**Result**
Limit	☒ > 50 Hopping Channels, BW <250KHz	50	**Pass**
	☒ >25 Hopping Channels, BW >250KHz		
Nominal Voltage:	☒ 120VAC ☐ VDC		
Tested By:	Yuriy Litvinov	**Date:** 05/08/2014	

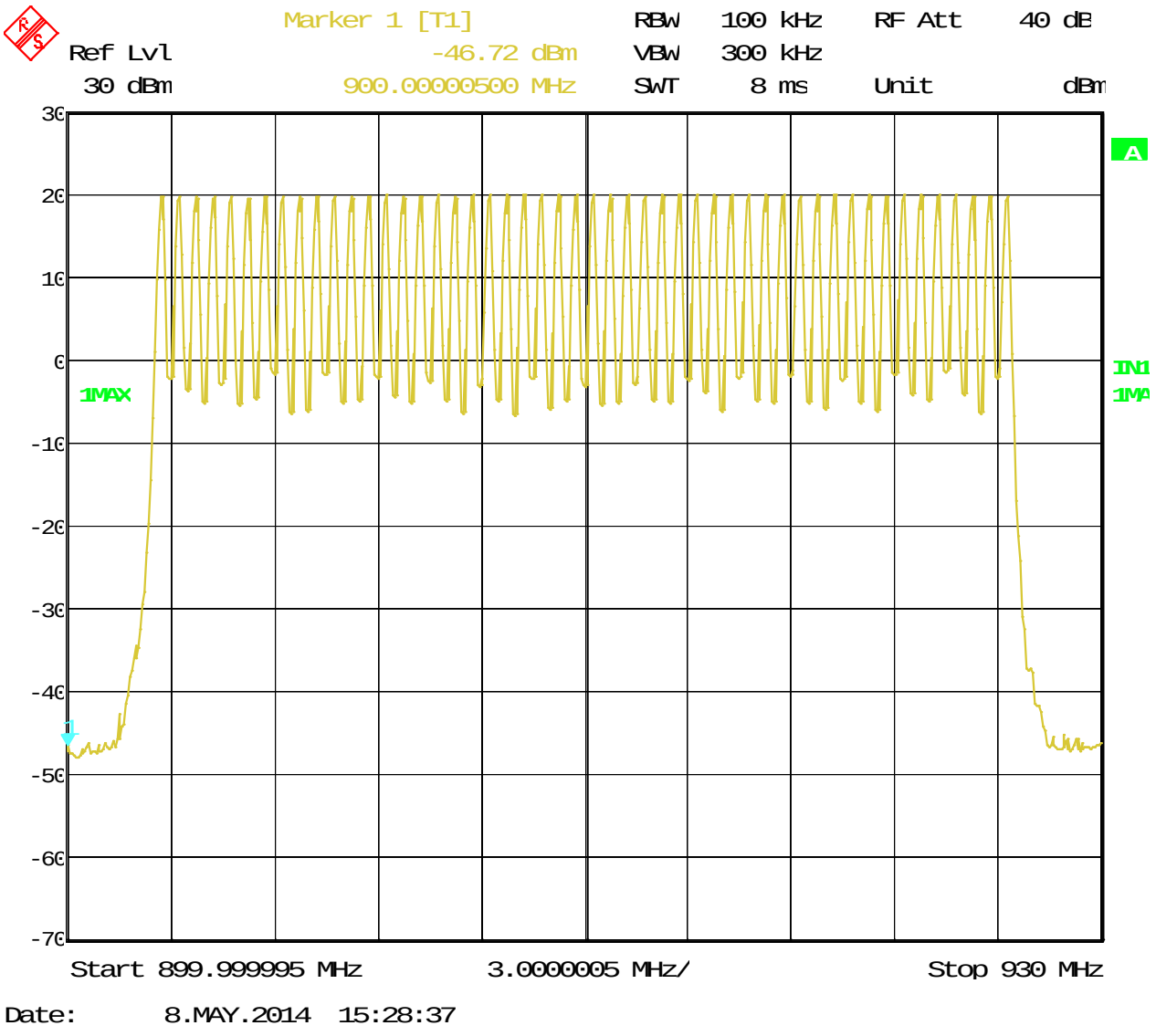
Note:	



Number of Channels – Band B



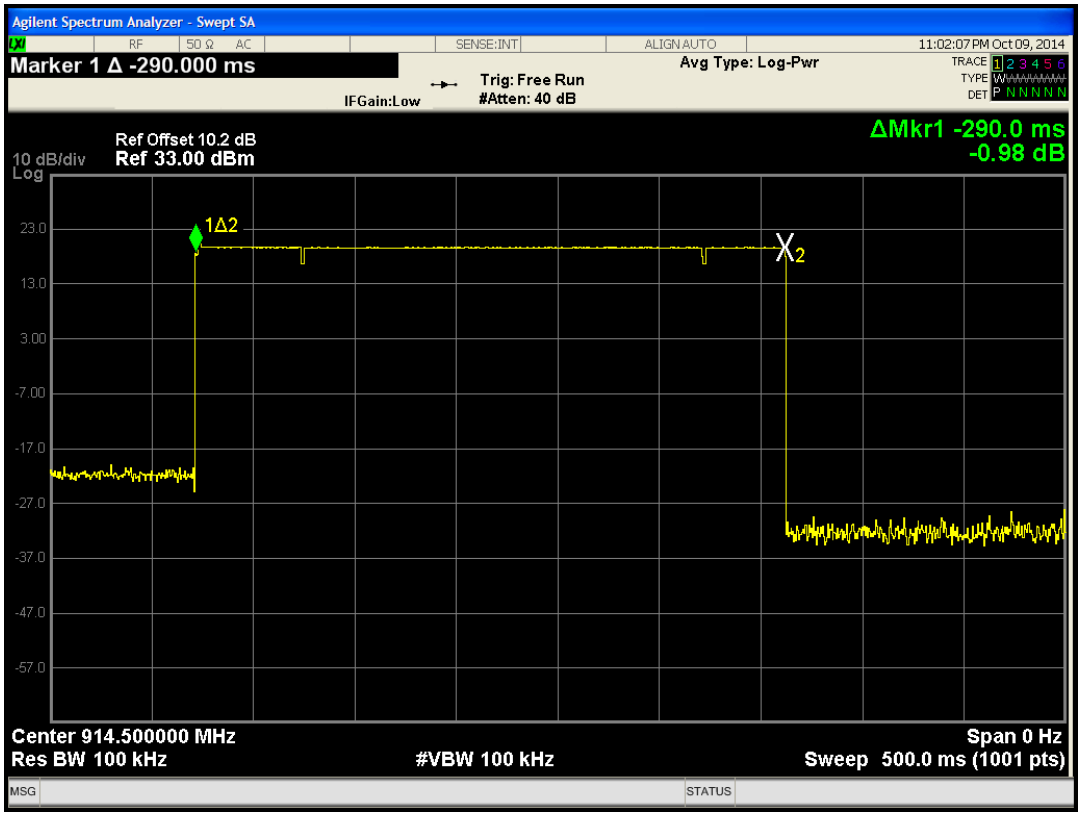
Number of Channels – Band A



Number of Channels – Dense Mode

4.5	Time of Occupancy		
Method:	The measurements were made with transmitter set to transmit continuously with hopping function enabled. The EUT antenna was removed and the cable was connected directly into the spectrum analyzer via 10dB attenuator.		
	Laboratory Ambient Temperature	23°C	
	Relative Humidity	35%	
Reference Standard:	☐ ANSI C63.4:2003 ☐ ANSI C63.4:2009 ☒ DA 00-705 ☐ FCC Part 15.109/ICES 003 ☒ FCC Part 15.247/RSS 210 ☐ FCC Part 15.209	**Measurement Point** ☒ Conducted ☐ Radiated ☐	
Frequency Range:	☒ 902.3-927.25MHz		
Antenna Gain:	☐		**Results**
Limit (dwell time):	☒ 20dB<250KHz	☒ <0.4 sec within a period of 20s	290.00ms
	☒ 20dB>250KHz	☒ <0.4 sec within a period of 10s	
Nominal Voltage:	☒ 120VAC ☐ VDC		
Tested By:	Yuriy Litvinov		**Date:** 10/09/2014

Note:	Tested worst case using PR-ASK/DSB/ASK protocols. Single pulse duration is 290.0ms in a 10s/20s sweep period 1 pulse occurs, and therefore the total on time is 290.0 ms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50 Ω AC
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ALIGN AUTO
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Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE W
DET P N N N N N
IFGain:Low
Trig: Free Run
#Atten: 40 dB
Ref Offset 10.2 dB
10 dB/div
Log
Ref 33.00 dBm
ΔMkr1 -290.0 ms
-0.98 dB
23.0
13.0
3.00
-7.00
-17.0
-27.0
-37.0
-47.0
-57.0
1Δ2
X2
Center 914.500000 MHz
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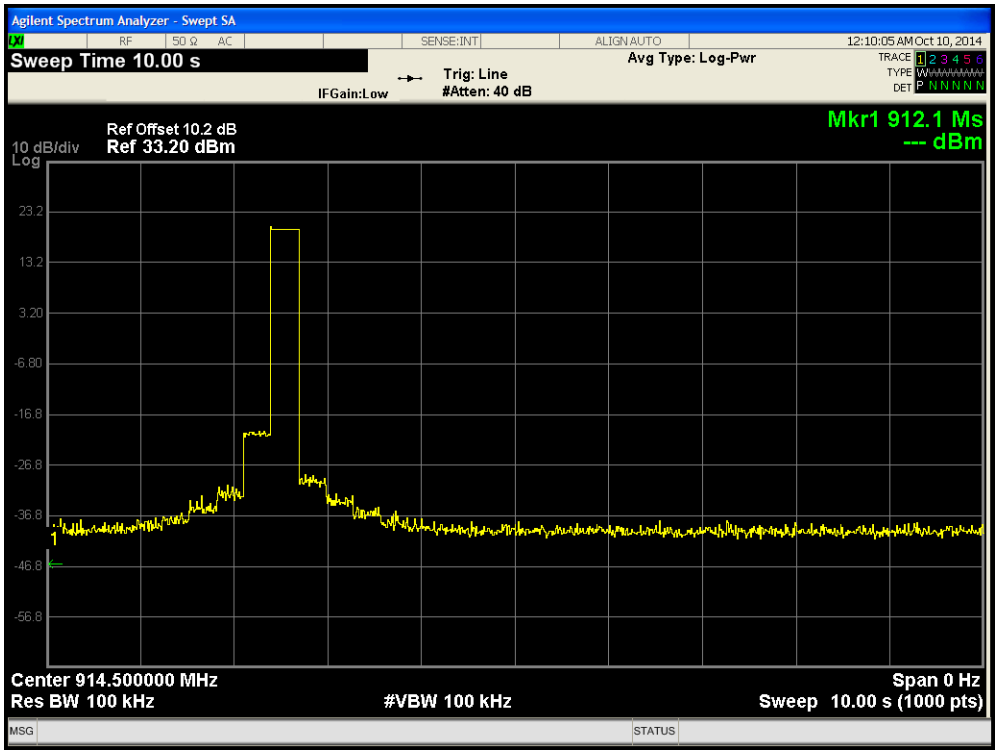
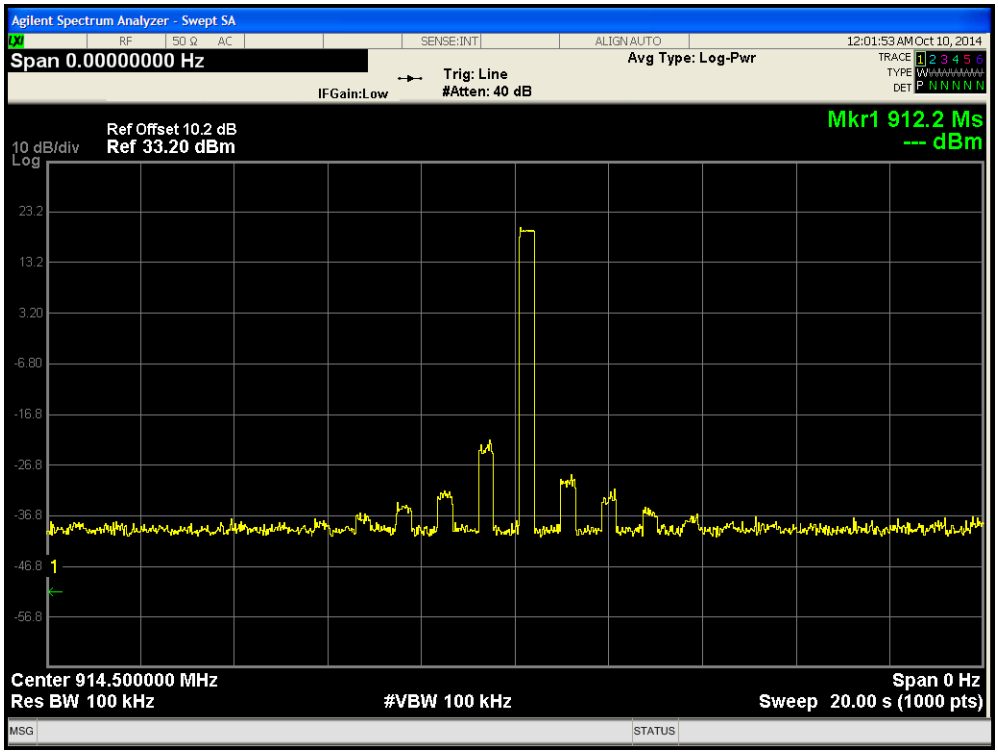
#VBW 100 kHz
Span 0 Hz
Sweep 500.0 ms (1001 pts)
MSG
STATUS

Duty Cycle



Total on Time – 20dB >250KHz



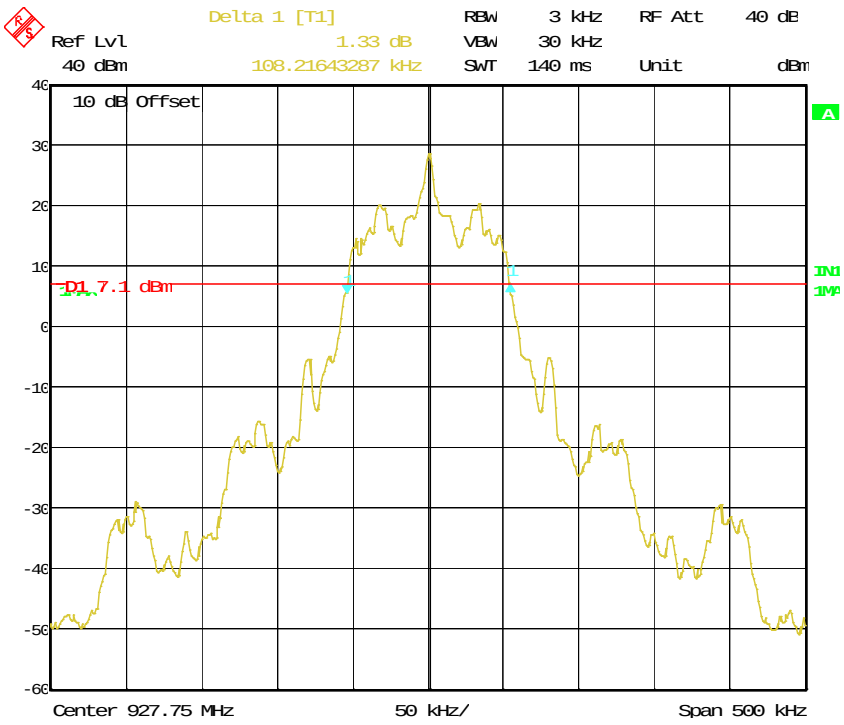
Total on Time – 20dB <250KHz

4.6	20dB Bandwidth	
Method:	The measurements were made with transmitter set to transmit continuously modulated signal at low, mid and high channels. The marker delta method was used to determine the 20dB bandwidth.	
	Laboratory Ambient Temperature	23°C
	Relative Humidity	35%
Reference Standard:	☐ ANSI C63.4:2003 ☐ ANSI C63.4:2009 ☒ DA 00-705 ☐ FCC Part 15.109/ICES 003 ☒ FCC Part 15.247/RSS 210 ☐ FCC Part 15.209	Measurement Point ☒ Conducted ☐ Radiated ☐
Frequency Range:	☒ 902.3-927.75MHz	
Antenna Gain:	☐	RBW ≥ 1% of the 20 dB bandwidth VBW ≥ RBW
Nominal Voltage:	☒ 120VAC ☐ VDC	
Tested By:	Yuriy Litvinov	Date: 10/09/2014

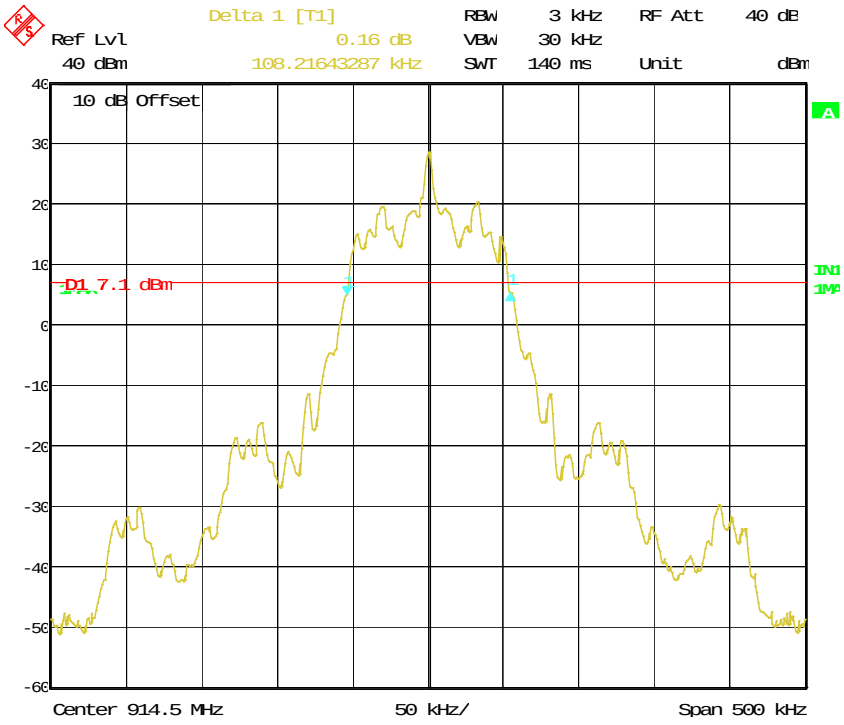
Note:	The worst case modulations used by the device have been reported.

Frequency (MHz) (PR-ASK)	20 dB Bandwidth (KHz)	Limit (KHz)	Results
902.3	110.7	500	pass
914.5	108.2	500	pass
927.75	108.2	500	pass

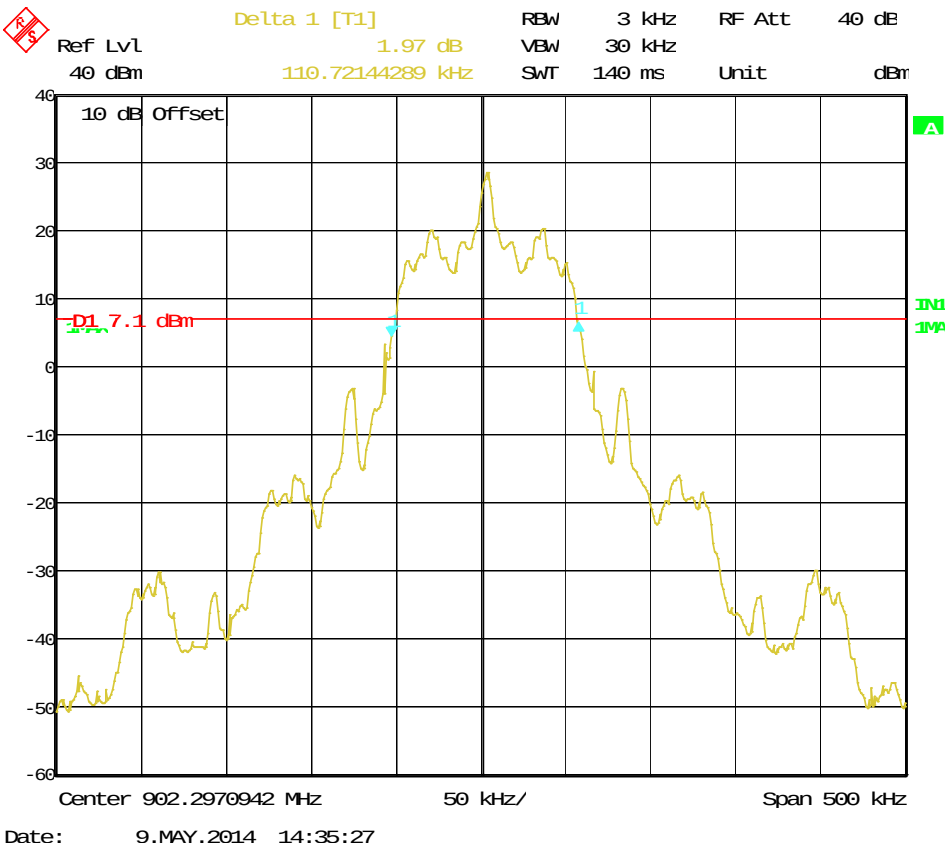
Frequency (MHz) (DSB-ASK)	20 dB Bandwidth (KHz)	Limit (KHz)	Results
902.3	282	500	pass
914.5	282	500	pass
927.75	282	500	pass



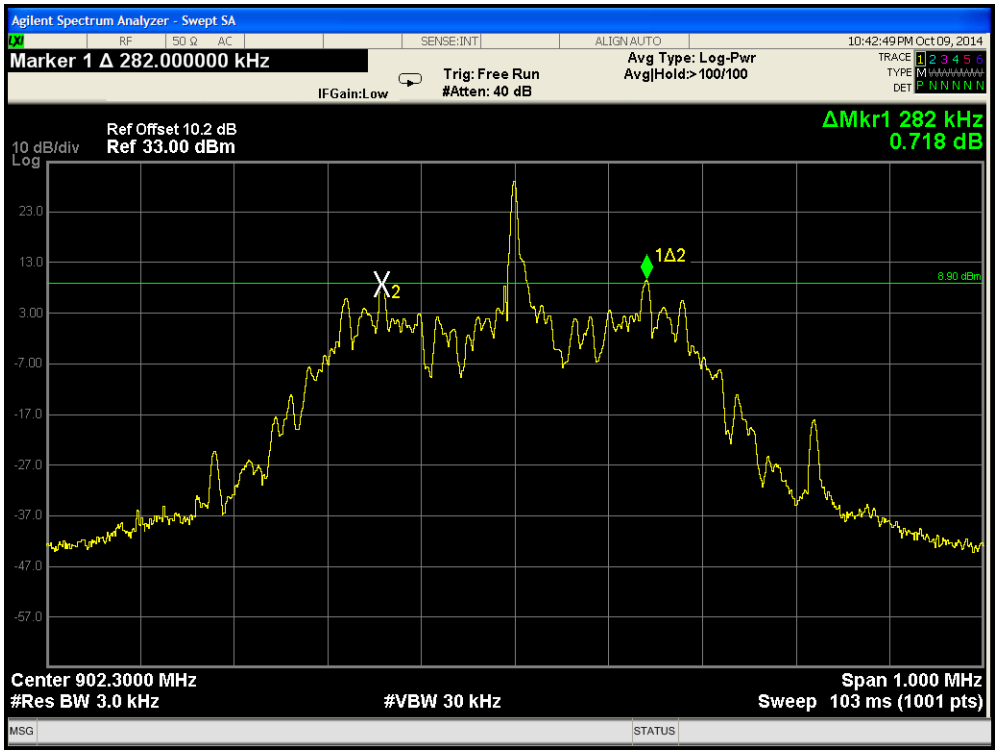
20dB BW Low Channel



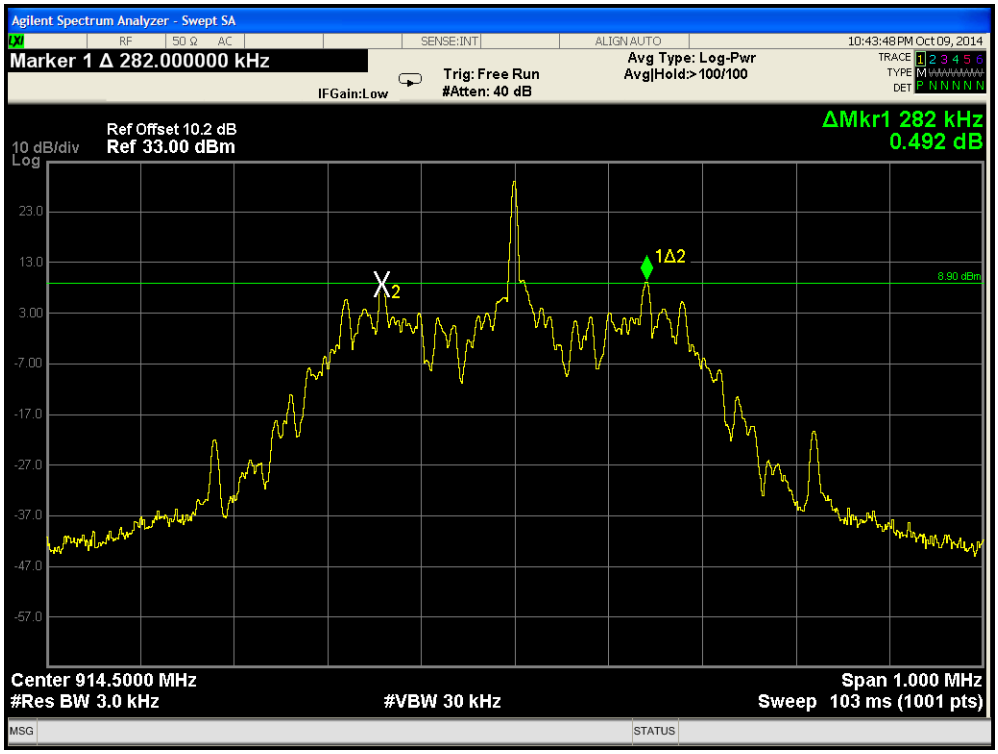
20dB BW Mid Channel



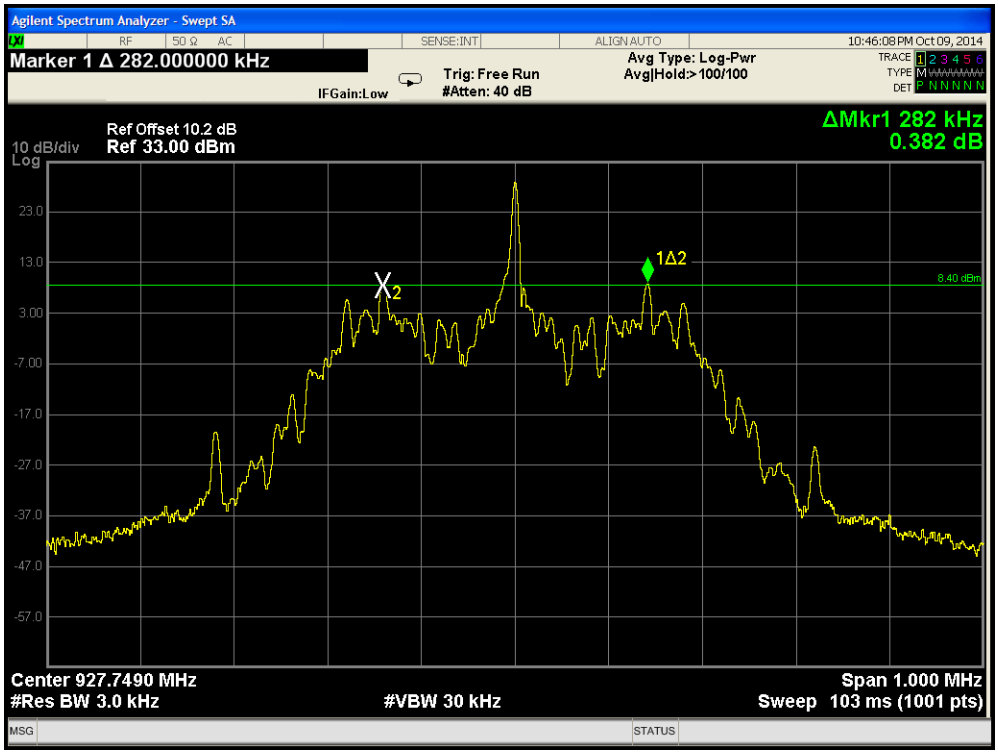
20dB BW High Channel



20dB BW Low Channel



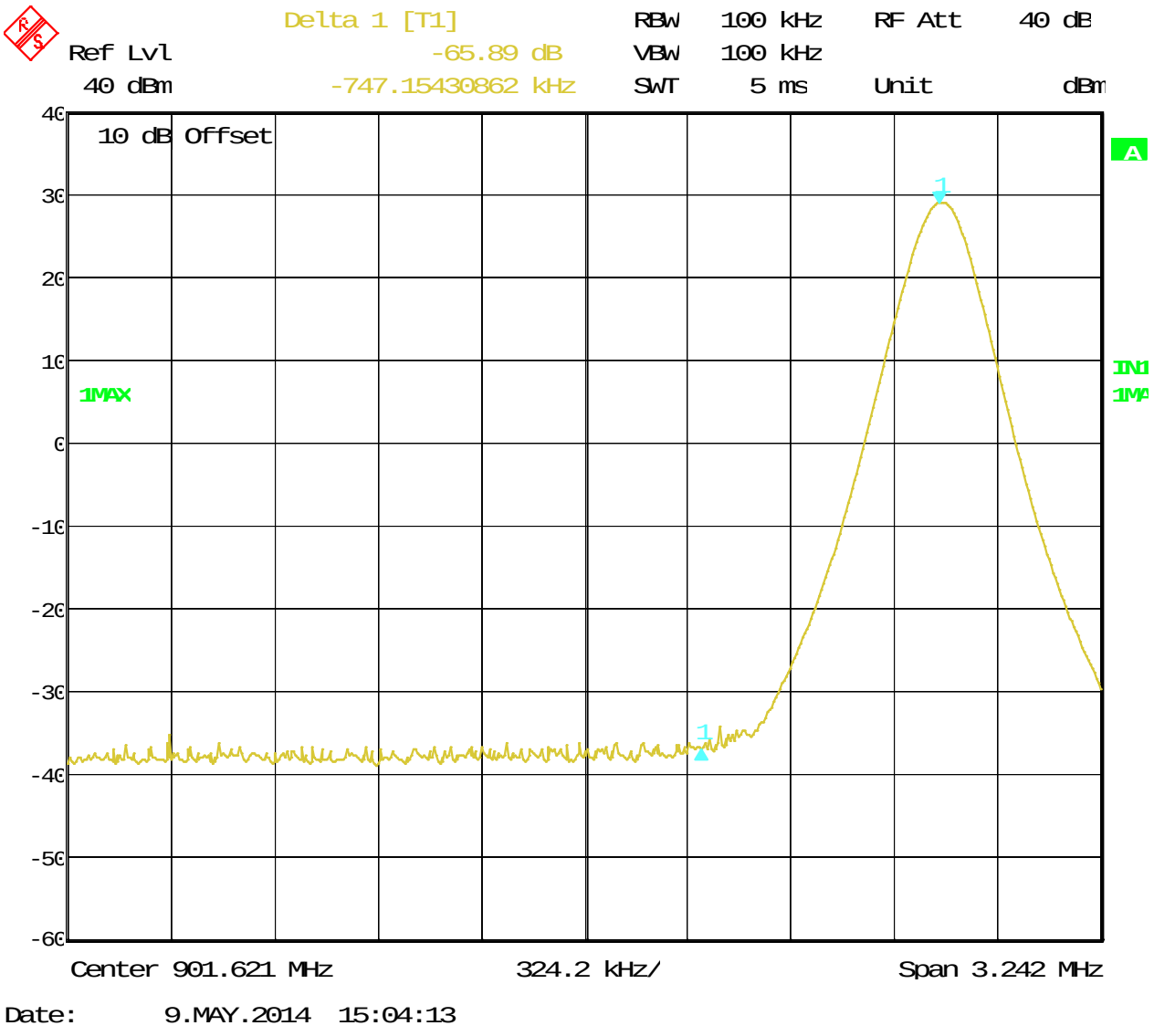
20dB BW Mid Channel

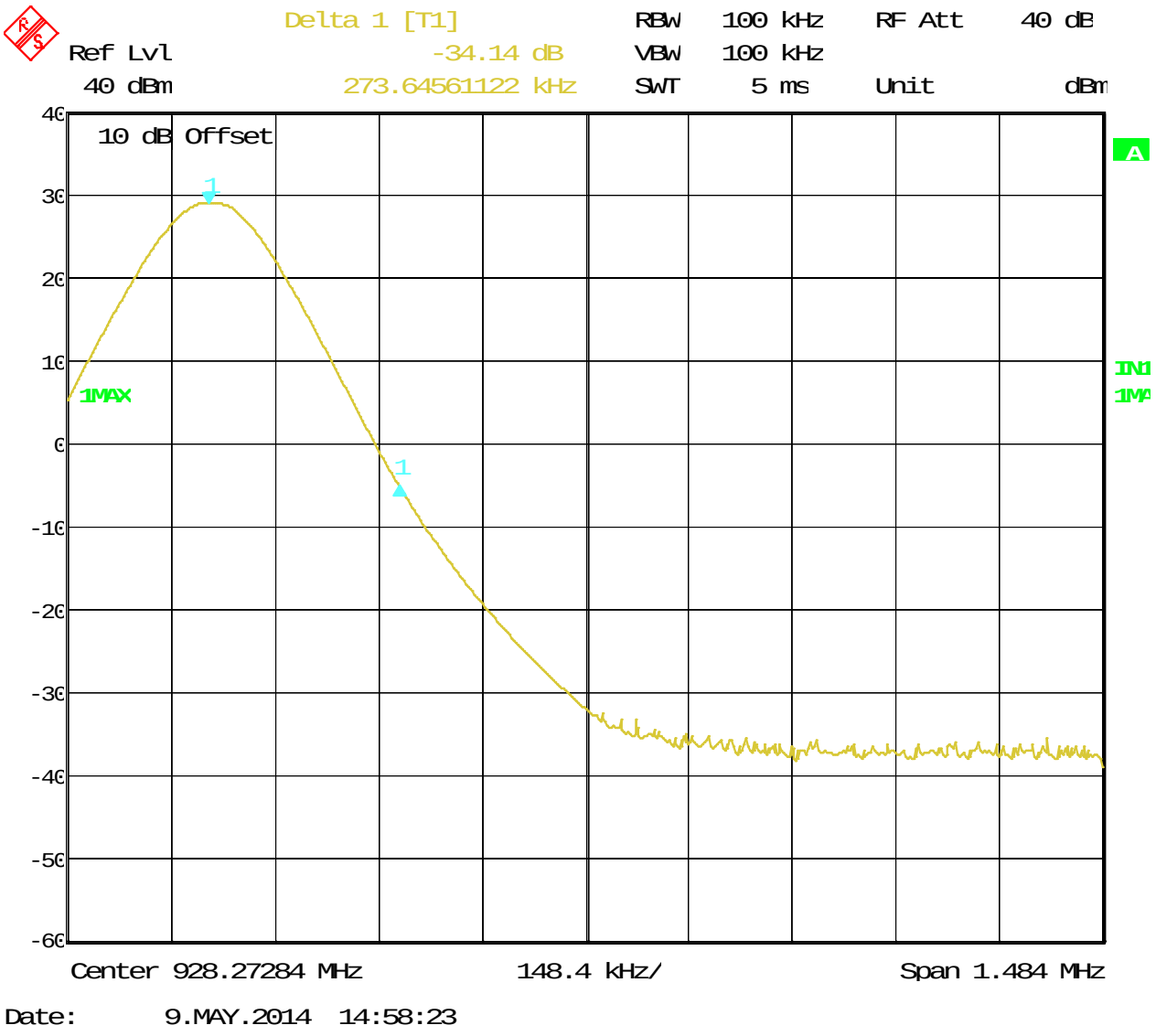


20dB BW High Channel

4.7	**Band-Edge Compliance**	
Method:	The measurements were made with transmitter set to transmit continuously with un-modulated signal and hopping enabled at low and high channels. The marker delta method was used to determine band-edge compliance.	
	Laboratory Ambient Temperature	23°C
	Relative Humidity	35%
Reference Standard:	☐ ANSI C63.4:2003 ☐ ANSI C63.4:2009 ☒ DA 00-705 ☐ FCC Part 15.109/ICES 003 ☒ FCC Part 15.247/RSS 210 ☐ FCC Part 15.209	**Measurement Point** ☒ Conducted ☐ Radiated ☐
Frequency Range:	☒ 902.3-927.75MHz	
Antenna Gain:	☒ 6dBi	**Results**
Limit	☒ >20dBc ☐ FCC Part 15.209	➢ 34dBc
Nominal Voltage:	☒ 120VAC ☐ VDC	
Tested By:	Yuriy Litvinov	**Date:** 05/09/2014

Note:	


Delta 1 [T1]
-65.89 dB
-747.15430862 kHz
RBW 100 kHz
VBW 100 kHz
SWT 5 ms
RF Att 40 dB
Unit dBm
Ref Lvl
40 dBm
10 dB Offset
1MAX
A
Center 901.621 MHz
324.2 kHz/
Span 3.242 MHz
Date: 9.MAY.2014 15:04:13


Delta 1 [T1]
RBW 100 kHz
RF Att 40 dB
Ref Lvl
-34.14 dB
VBW 100 kHz
40 dBm
273.64561122 kHz
SWT 5 ms
Unit dBm
10 dB Offset
1MAX
Center 928.27284 MHz
148.4 kHz/
Span 1.484 MHz
Date: 9.MAY.2014 14:58:23

4.8	Conducted Output Power	
Method:	Measurements was performed with an un-modulated carrier at the highest power level at which the transmitter is intended to operate. The transmitter was configured to operate lowest, middle and highest power channels and connected to an antenna port. The carrier or mean power delivered to antenna was measured under normal test conditions. The analyzer offset was adjusted to compensate for the attenuator and other losses. The RF Power output listed in the table is the power delivered to the antenna.	
	Laboratory Ambient Temperature	23°C
	Relative Humidity	55%
Reference Standard:	☐ ANSI C63.4:2003 ☐ ANSI C63.4:2009 ☒ ANSI C63.10:2009 ☒ FCC Part 15.247/RSS 210 ☐ FCC Part 15.209	**Measurement Point** ☒ Conducted ☐ Radiated ☐
Frequency Range:	☒ 902.3-927.75MHz	
Antenna Gain:	☐	
Limit	≥50 Hopping Channels	>25 Hopping Channels <50
	☒ 30dBm ☐	☐ 24dBm ☐
Nominal Voltage:	☒ 120VAC ☐ VDC	
Tested By:	Yuriy Litvinov	**Date:** 05/08/2014

Antenna Port	Channels Frequency (MHz)	Power Output Conducted (dBm)	Limit (dBm)	Results
1	902.3	29.35	30	**pass**
	914.5	29.55	30	**pass**
	927.7	29.45	30	**pass**
2	902.3	29.40	30	**pass**
	914.5	29.54	30	**pass**
	927.7	29.51	30	**pass**
3	902.3	29.40	30	**pass**
	914.5	29.42	30	**pass**
	927.7	29.55	30	**pass**
4	902.3	29.51	30	**pass**
	914.5	29.47	30	**pass**
	927.7	29.43	30	**pass**

Note:	Worst case modulation used by the device. **EIRPmax= Pmax(dBm) +Antenna Gain(dBi) = 29.55dBm+6dBi=35.55dBm** **KDB 594280 -** Professional installation. Authorized service personnel is required to configure radio parameters of RFID Reader using the software for adjusting total EIRP power at local installation to ensure compliance with FCC Rules.

4.9	**Transmitter spurious emissions**
Method:	The measurements were made with transmitter set to transmit continuously with un-modulated signal and hopping enabled at low, mid and high channels. The level of spurious emissions was measured as conducted spurious emission and radiated power that falls in a restricted band. EUT was rotated through three orthogonal axes to determine which attitude (orientation) and arrangement produces the highest emission relative to the limit; the attitude and headset arrangement that produces the highest emission relative to the limit was used in making final radiated emission measurements. EUT was rotated 360 deg and radiated emissions was measured while the headset situated in three orthogonal planes with the measurement antenna set up in vertical and horizontal polarization. Spurious Radiated emissions measurements ware performed with external preamp and a high pass filter.

	Laboratory Ambient Temperature	23°C
	Relative Humidity	35%
Reference Standard:	☐ ANSI C63.4:2003 ☒ ANSI C63.4:2009 ☒ DA 00-705 ☐ FCC Part 15.109/ICES 003 ☒ FCC Part 15.247/RSS 210 ☒ FCC Part 15.209	**Measurement Point** ☒ Conducted ☒ Radiated
Frequency Range:	☒ 902.3-927.75Mhz	
Limit	☒ >20dBc	**Restricted Band**
	☒ FCC Part 15.209	☒ 15.205
Nominal Voltage:	☒ 120VAC ☐ VDC	
Tested By:	Mike Schultz MS	**Date:** 05/28/2014

Limits

Frequency (MHz)	Limit dB (µV/m)			
	Quasi-Peak	Average	Distance	Results
0.009-0.490		2400/F(KHz)	300	**N/A**
0.490-1.705	24000/F(KHz)		30	**N/A**
1.705-30	29.5		30	**N/A**
30 to 88	40		3	**pass**
88-216	43.5		3	**pass**
216-960	46		3	**pass**
Above 960		54	3	**pass**

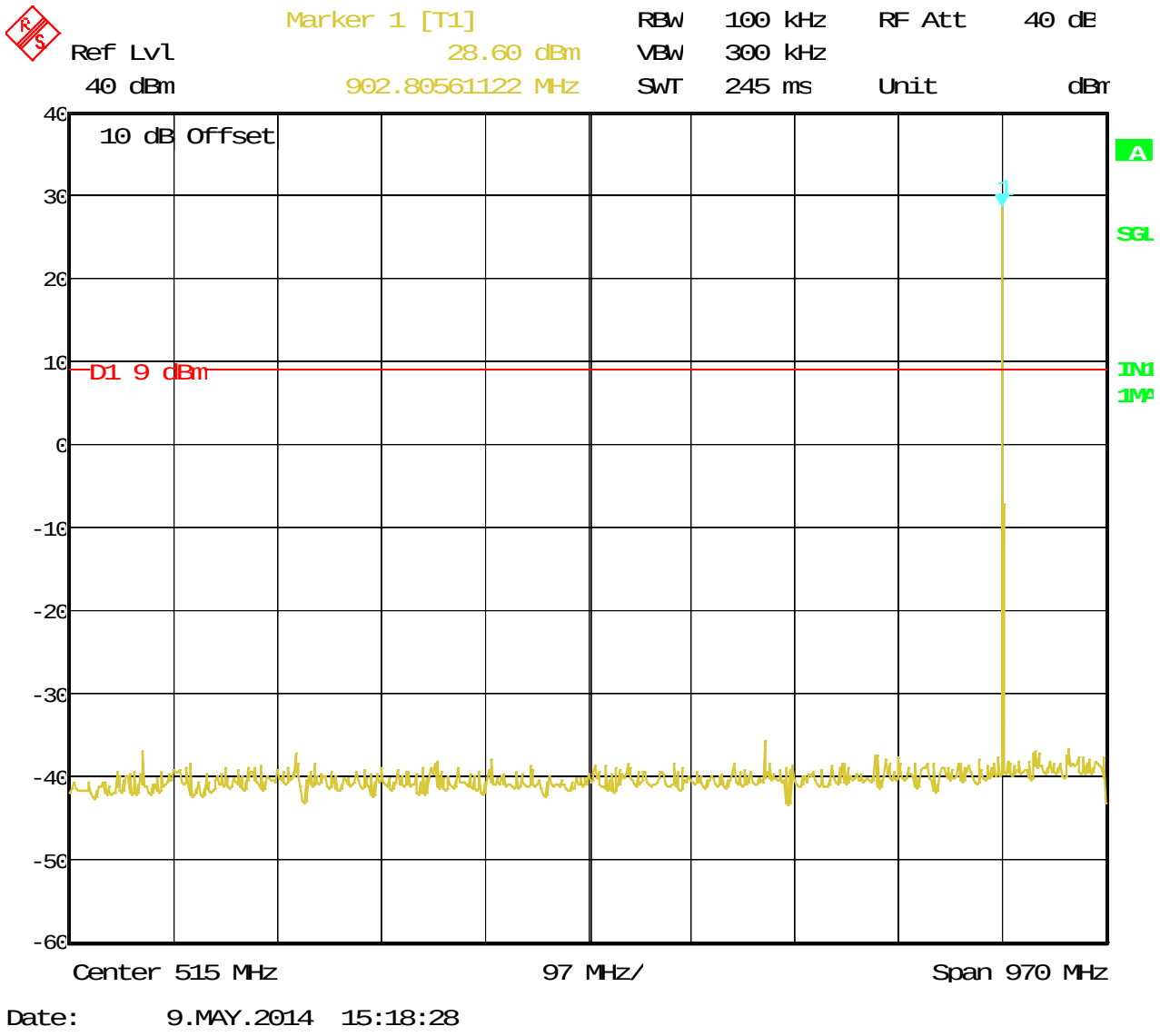
Note:	No spurious emissions were detected in the frequency range above 5GHz. All antenna ports operate sequentially with only one port transmitting at the time from a single transmit source (RF path is switched between selected ports). One RF Section and one antenna multiplexing at the time. Antenna path is identical.

Pol.	Frequency (MHz)	Reading dBµV/m	Total CF dB	Net at 3 m dBµV/m.	Limit dBµV/m	Margin dB	Comments	
V	2708.00	49.7	-13.0	36.7	74	-37.3	PK	
V	2708.00	36.5	-13.0	23.5	54	-30.5	AV	
H	2708.00	48.5	-13.0	35.5	74	-38.5	PK	
H	2708.00	36.5	-13.0	23.5	54	-30.5	AV	
V	3610.00	48.5	-11.0	37.5	74	-36.5	PK	
V	3610.00	33.8	-11.0	22.8	54	-31.2	AV	
H	3610.00	48.2	-11.0	37.2	74	-36.8	PK	
H	3610.00	33.9	-11.0	22.9	54	-31.1	AV	
Notes		Total CF = Antenna Factor + Cable Factor - AMP Gain						
		Low Channel. Average readings obtained with the 10Hz VBW						

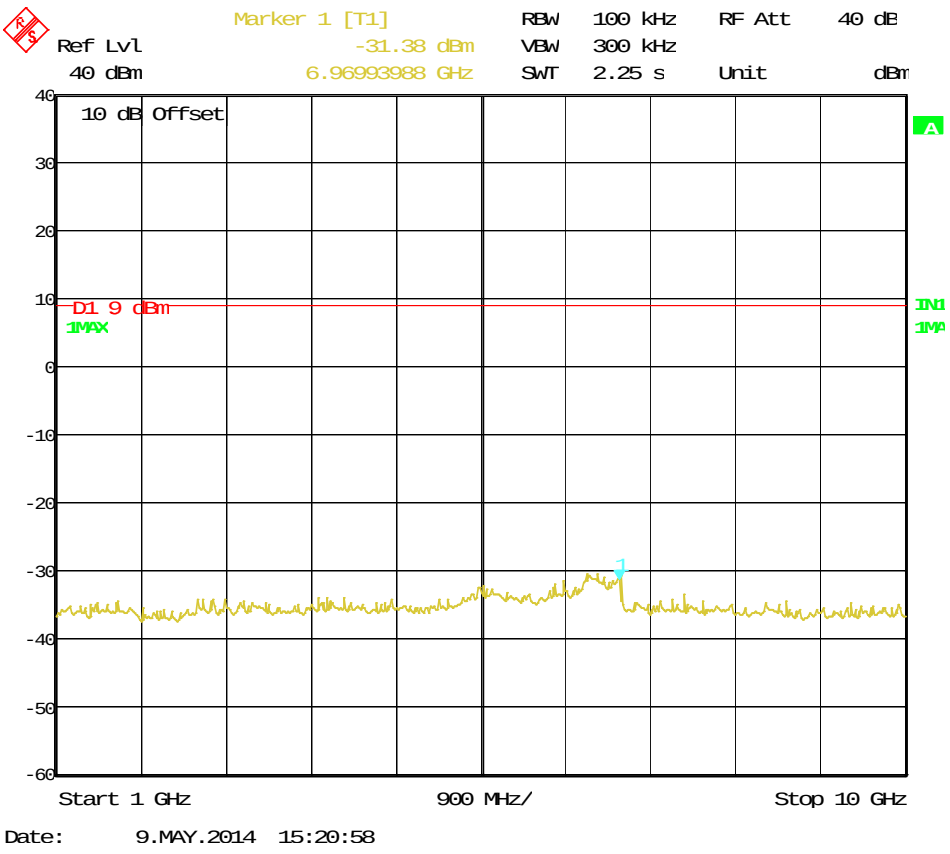
Pol.	Frequency (MHz)	Reading dBµV/m	Total CF dB	Net at 3 m dBµV/m.	Limit dBµV/m	Margin dB	Comments	
V	2744.00	49.9	-12.0	37.9	74	-36.1	PK	
V	2744.00	37.1	-12.0	25.1	54	-28.9	AV	
H	2744.00	49.5	-12.0	37.5	74	-36.5	PK	
H	2744.00	36.2	-12.0	24.2	54	-29.8	AV	
V	3658.0	48.6	-10.7	37.9	74	-36.1	PK	
V	3658.0	34.1	-10.7	23.4	54	-30.6	AV	
H	3658.0	45.6	-10.7	34.9	74	-39.1	PK	
H	3658.0	34.0	-10.7	23.3	54	-30.7	AV	
Notes		Total CF = Antenna Factor + Cable Factor - AMP Gain						
		Mid Channel. Average readings obtained with the 10Hz VBW						

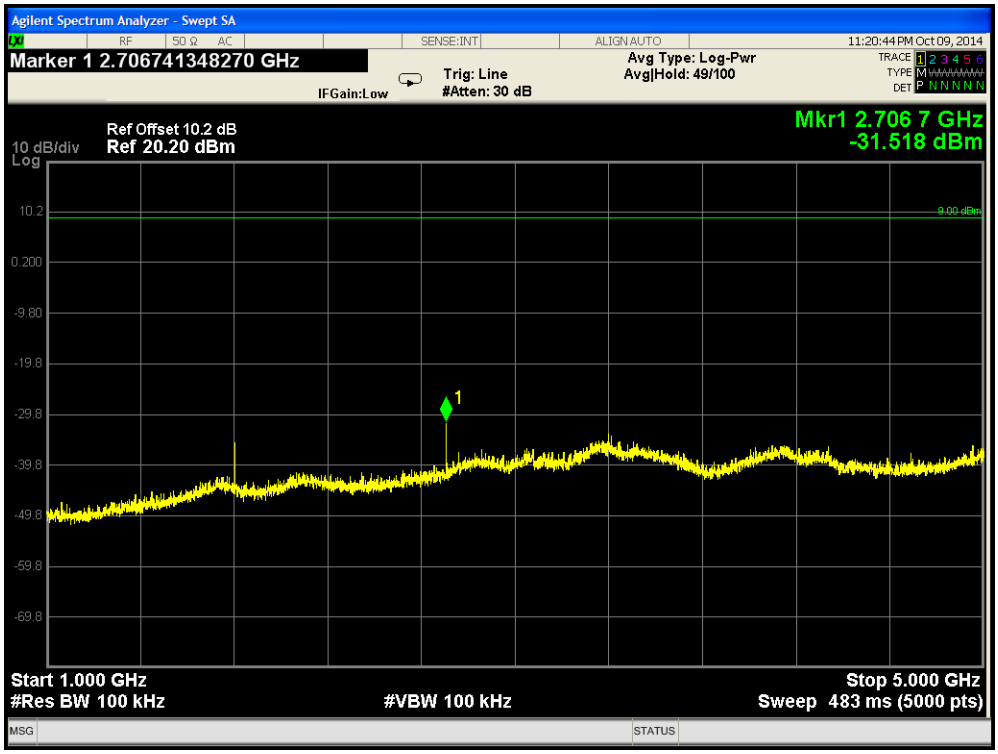
Pol.	Frequency (MHz)	Reading dBµV/m	Total CF dB	Net at 3 m dBµV/m.	Limit dBµV/m	Margin dB	Comments	
V	2783.0	48.5	-12.0	36.5	74	-37.5	PK	
V	2783.0	33.5	-12.0	21.5	54	-32.5	AV	
H	2783.0	48.4	-12.0	36.4	74	-37.6	PK	
H	2783.0	33.4	-12.0	21.4	54	-32.6	AV	
V	3712.0	46.9	-10.0	36.9	74	-37.1	PK	
V	3712.0	33.7	-10.0	23.7	54	-30.3	AV	
H	3712.0	47.6	-10.0	37.6	74	-36.4	PK	
H	3712.0	33.7	-10.0	23.7	54	-30.3	AV	
Notes		Total CF = Antenna Factor + Cable Factor - AMP Gain						
		High Channel. Average readings obtained with the 10Hz VBW						

Test Set Up Photo

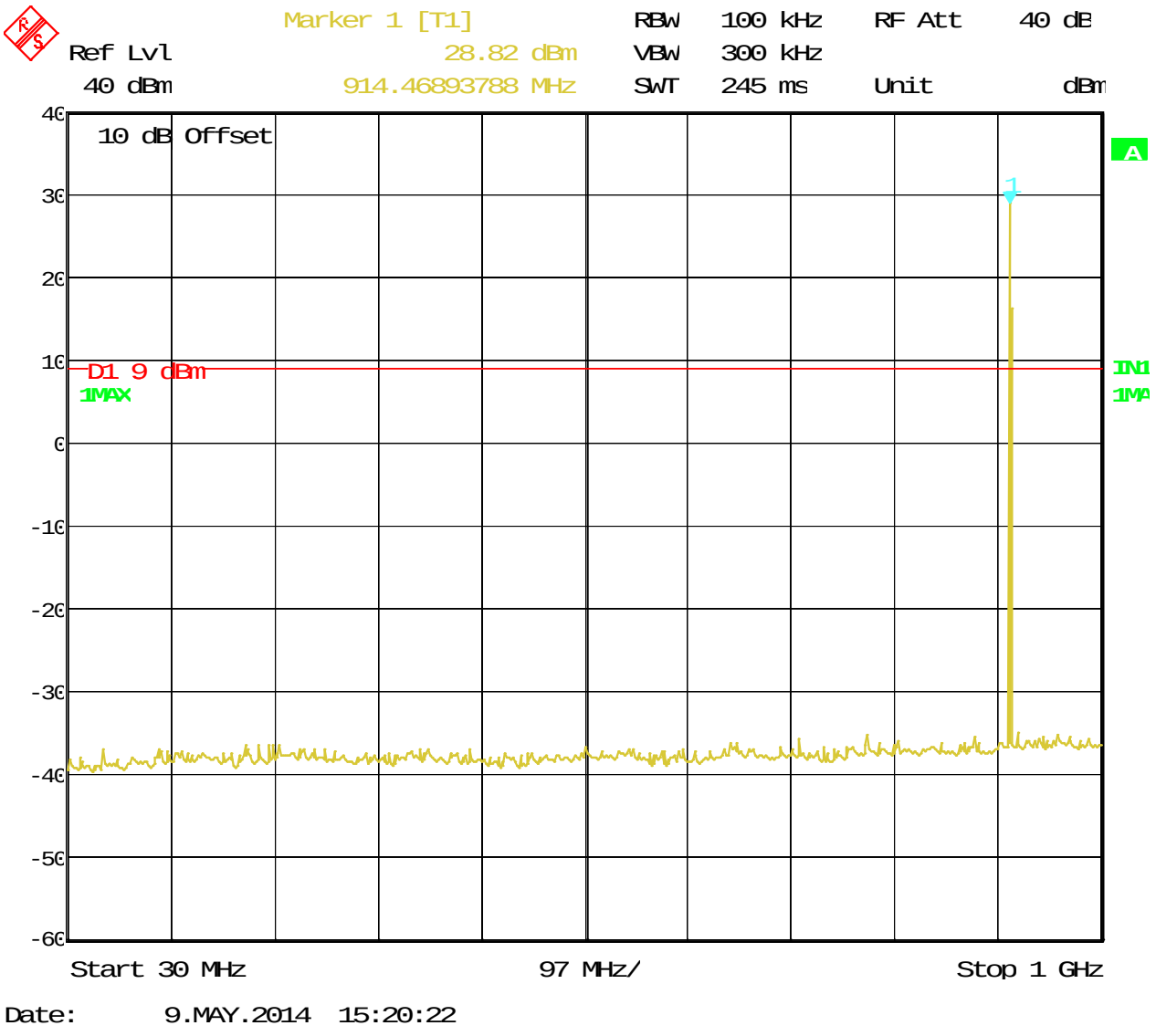


Conducted Spurious Emissions Low channel

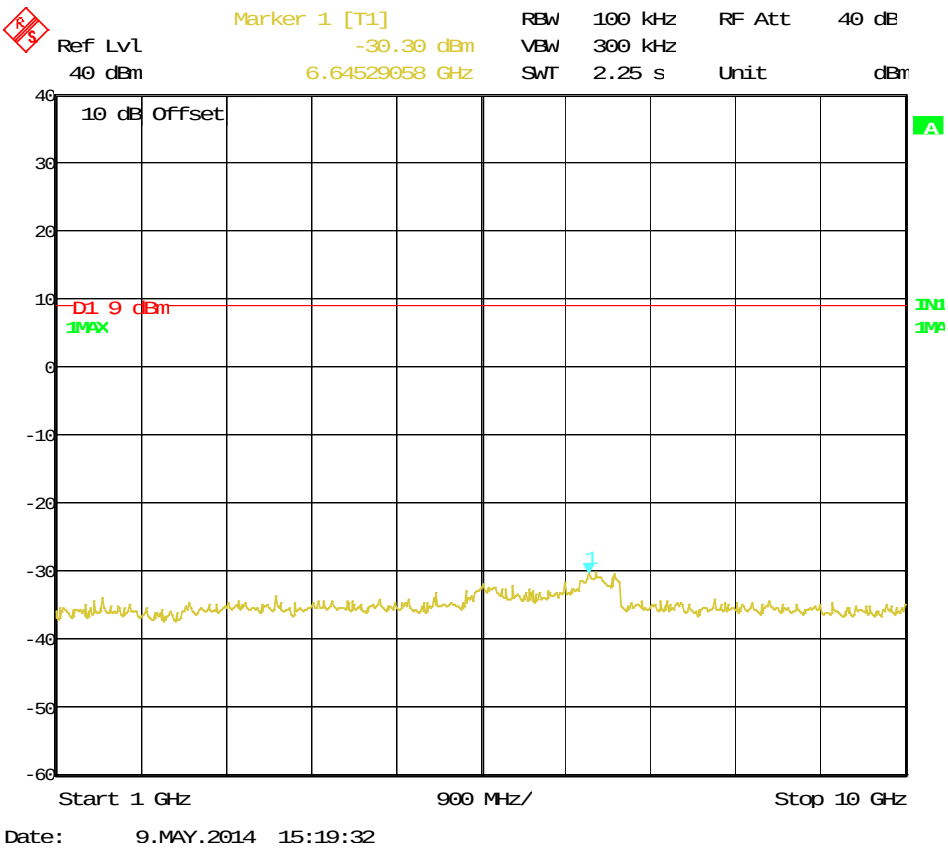


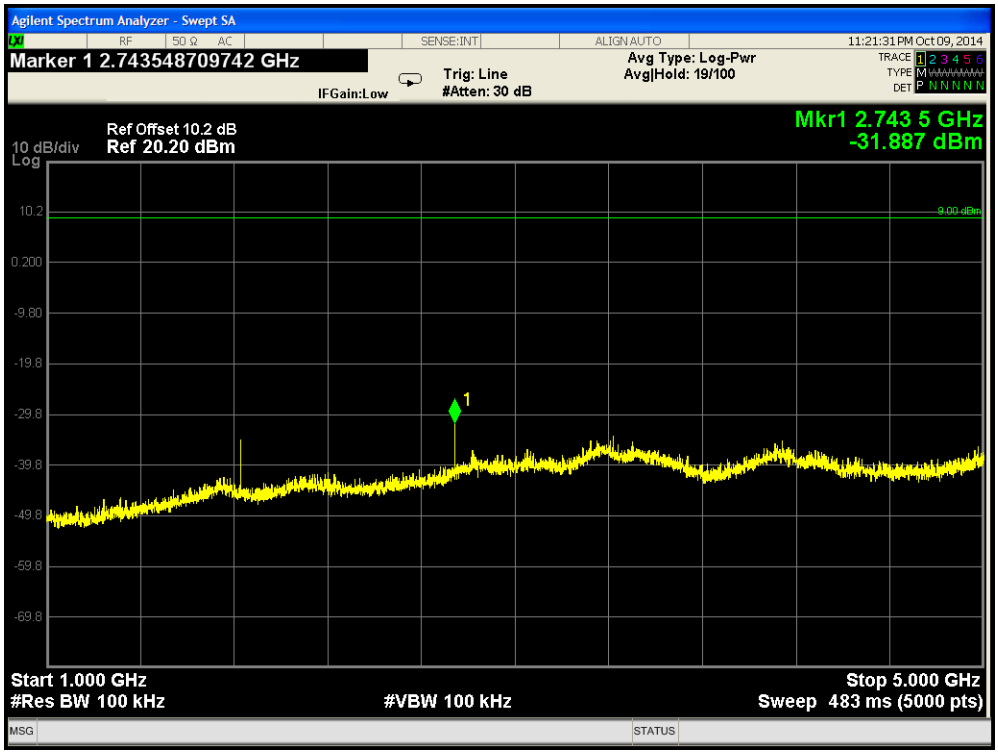


Conducted Spurious Emissions Low channel

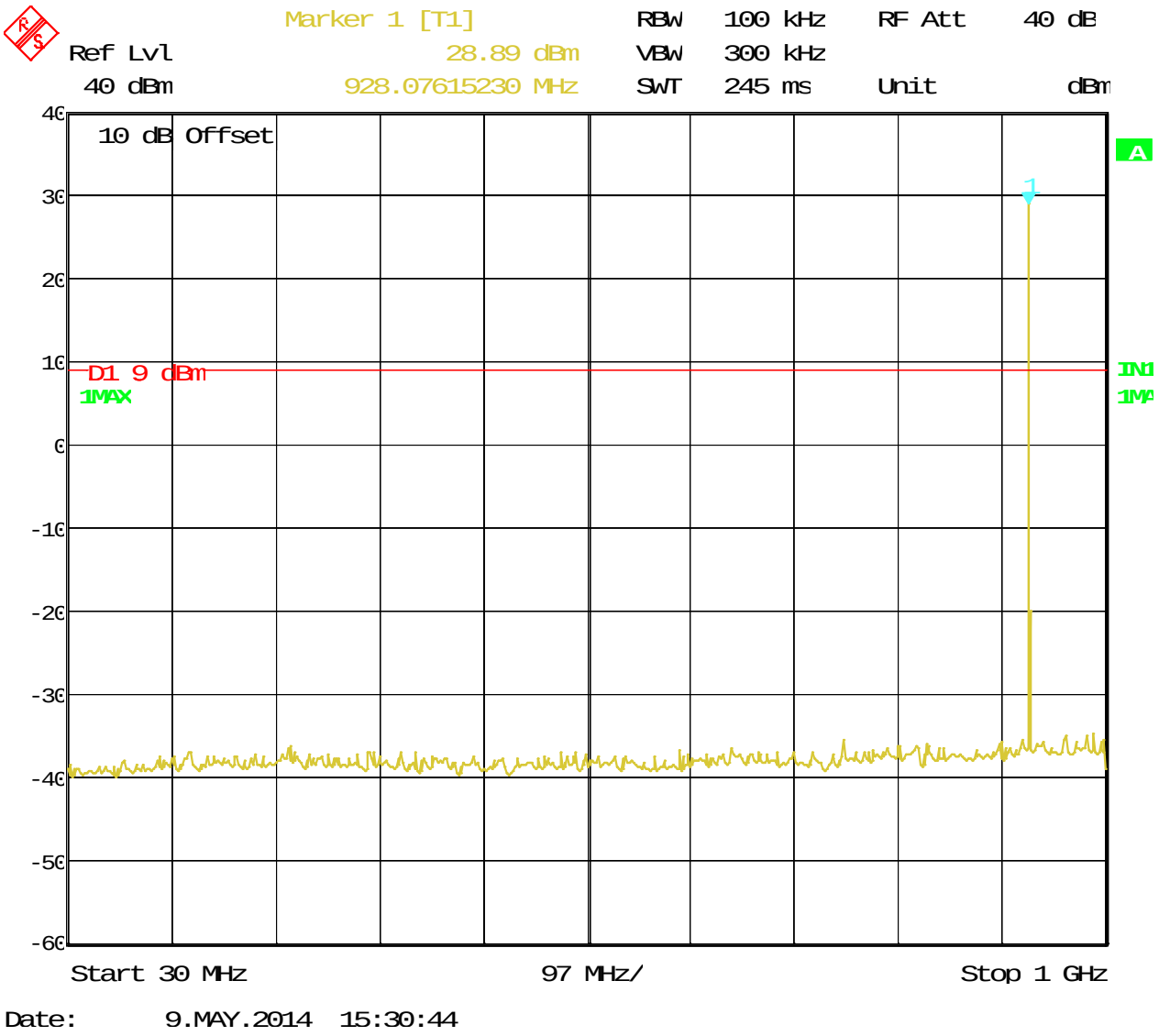


Conducted Spurious Emissions Mid channel

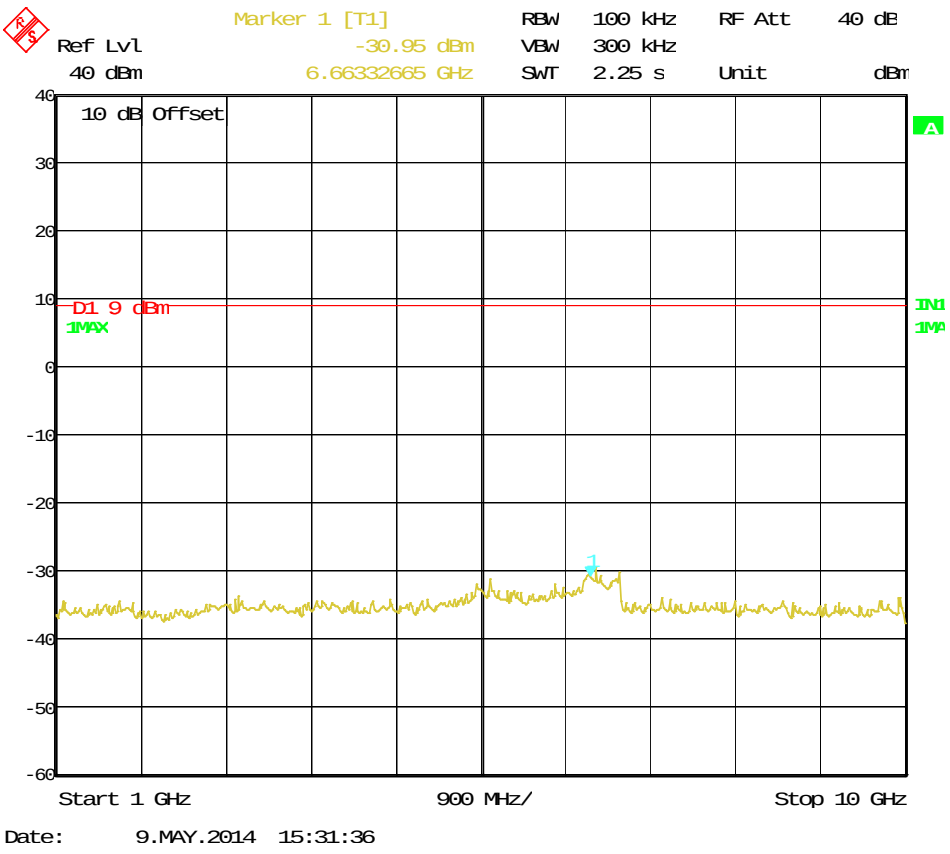


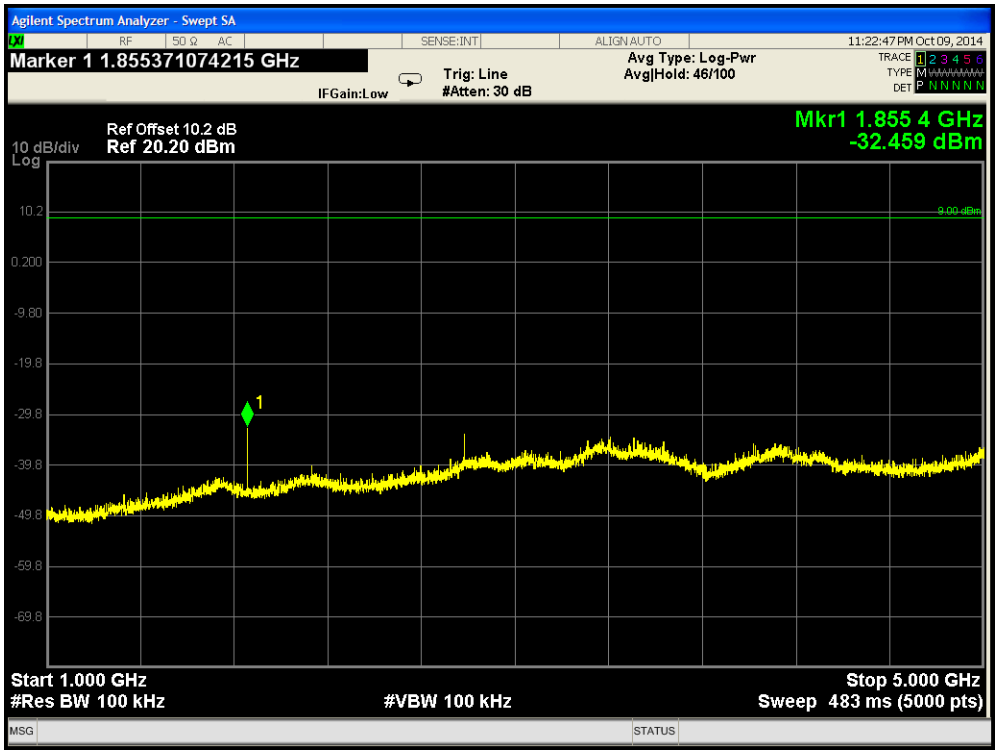


Conducted Spurious Emissions Mid channel



Conducted Spurious Emissions High channel





Conducted Spurious Emissions High channel

4.10	RF Exposure Compliance	
Reference Standard:	☒ IEEE Std 1528a ☒ RSS 102, Issue 4 ☒ KDB 447498 ☐ KDB ☒ FCC Parts 2.1091 and 2.1093 ☐ OET 65	☒ MPE ☐ SAR Evaluation
Frequency Range:	☒ 902-928MHz	
Antenna Separation Distance	>100cm	
Antenna Gain (maximum)	7dBi (5.01 numeric gain)	
Maximum Output Power at antenna terminal	29dBm (794mW)	
Power Density	0.032 mW/cm^2	
GENERAL POPULATION/UNCONTROLLED LIMIT		
FCC/RSS102	0.610 mW/cm^2 at 915MHz	

Note:	The highest RF output power of the unit was measured and recorded. According to §1.1310 of the FCC rules, the power density limit for General population/Uncontrolled Exposure is 0.610 mW/cm2. The MPE shall be calculated at 20cm to show compliance with the power density limit. The following formula was used to calculate the Power Density: $S=PG/4\pi R^2$

5.0 Test Equipment

Test Equipment Used

Description	Manufacturer	Model	Identifier	Cal. Due	Check
Biconilog Antenna	Schaffner	CBL6112B	27491	10/2014	☒
Horn Antenna	AH Systems	SAS 571	1010	10/2014	☒
Loop Antenna	EMCO	ALR25M	1011	10/2014	☐
EMI Receiver	Rohde & Schwarz	ESIB 40	100235	10/2014	☐
EMI Receiver	Agilent	E4448A	1530975	09/2014	☒
Signal Analyzer	Agilent	N9000A	MY53031040	05/2015	☒
LISN	TESEQ	NNB51	1130	10/2014	☒
Harmonic/Flicker Source	Cal. Instruments	C4-5001iX	57162	10/2014	☐
Amplifier	AR	250W1000AM	14354	10/2014	☐
Amplifier	AR	25S1G4A	4003	10/2014	☐
Signal Generator	HP	8656A	2326A05125	10/2014	☐
Signal Generator	Agilent	E8257D	160895	10/2014	☐
Field Probe	AR	FL7006	25019	10/2014	☐
Field Monitor	AR	FM2000	14292	10/2014	☐
AC CDN	Schaffner	M316,	21937	10/2014	☐
AC CDN	Teseq	M016,	26131	10/2014	☐
ISN	Teseq	T4	25652	10/2014	☐
Current Injection Coil	A.H. Systems	ICP-200/521	149	10/2014	☐
RF Conducted System	TESEQ	NSG 4070-75	1141	10/2014	☐
ESD Generator	KeyTek	MZ-15/EC	609325	10/2014	☐
EFT/Surge Generator	ThermoFisher	EMC Pro Plus	1146	10/2014	☐
EMF Meter	NARDA	ELT400	1139	10/2014	☐
Absorbing Clamp	Rhode & Schwarz	MDS-21	1001	10/2014	☐
EMF Test Generator	FCC	F-1000-4-8-G	9940	NCR	☐
AC Power System	Titan	MAC-03	6619921	NCR	☐
EMC Software	ETS-Lindgren	TILE 6		10/2014	☒
Oscilloscope	Tektronix	DPO4104	1550	03/2015	☐

6.0 Report revision history

Revision Level	Date	Report Number	Notes
0	10/15/2014	RE1311030-1	Original Issue

Certificate of Conformity

3M EMC Laboratory

SEMS Global Regulatory Engineering
Building 76-01-01
St. Paul, MN 55144-1000, USA

MANUFACTURER'S NAME	**3M COMPANY**
NAME OF EQUIPMENT	**COMPACT RFID READER**
MODEL NUMBER(S)	**1000-001**
TEST REPORT NUMBER	**RE1311030-1**
DATE OF ISSUE	**October 15, 2014**

Referring to the performance criteria and operating mode during the tests specified in this report the equipment complies with the essential requirements herein specified:

47 CFR Part 15 – Subpart C – Intentional Radiator	**FCC Part 15.247**
License-exempt Radio Apparatus (All Frequency Bands): Category I Equipment	**RSS 210, Issue 8, 2010**
Emissions	**47 CFR:2013, FCC Parts 15.107 and 15.109** **ICES-003, Issue 5, 2012**

Comments:

NVLAP Lab Code 200033-0

Yuriy Litvinov

Yuriy Litvinov
Lead EMC Engineer