EMC TEST REPORT

NVLAP Lab Code 200033-0

Standard(s):

47 CFR FCC Part 15.247
47 CFR FCC Parts 15.107 and 15.109
RSS 210, Issue 8, 2010
FCC ID: M4Z6204
IC ID: 458C-6204

Class II Permissive Change

Product: Toll RFID READER
Model: 6204
3M Division: TSSD

Report Number: RE1407019-3
Report Issue Date: January 16, 2015

Report Prepared By:

Signature:

Yuriy Litvinov
Lead EMC Engineer

Tested By:
3M 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.

	Section FCC 15C/RSS 210	Scope of Test	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:	The four-port Toll RFID Reader 6204 is a multi-protocol, multi-regional Radio Frequency Identification (RFID) System that operates in the 902-928 MHz UHF band. All antenna ports operate sequentially with only one port transmitting at the time from a single transmit source Antenna path is identical. Optional 3M's Reader Redundancy Switch (RRS) can be used where the peripheral component interfaces with two RFID Readers and associated antenna systems to provide antenna change without operational disturbance and hardware replacement in event of reader failure. This peripheral was tested in FCC Part 90 test report RE1407019-2.		
Model(s):	6204		
Serial number:	ID6204000021		
Firmware:	Version # 1.4.25483		
Client Contact:	**Name:**	**Phone:**	
	Dave Missimer Randal D. Roebuck Jason Bram	919-281-1559 512-984-5688 512-984-5431	
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 :	N/A	MT – 262043	Linear 22^0 ,16 (max 17)dBi
	3M SKU#78-0060-1048-8	NA	Linear 36^0 , 13.5dBi
	3M SKU#7800601053-8	MT- 262044	Linear 30^0 , 15dBi
	3M SKU#78-0060-1044-7	MT-263006	Linear 42^0 , 12.5dBi
	3M SKU# 78-0060-1045-4	MT–262006	6dBi, RHCP (max 7dBi)
	N/A	MT–242048	4.5dBi, RHCP
Rated Input Power:	Voltage: ☒ 120VAC ☐ 230VAC ☐ VDC Frequency: ☐ 50Hz ☒ 60Hz Current: ☒ 2.0A		
Test Dates:	08/04-11/12/2014 – Original Certifications 01/12/2015 – Class II PC		
Received Date:	06/26/2014		
Received Conditions:	☐ Poor ☒ Good ☐ Prototype ☒ Production		

3.0 EUT Configuration

3.1 Support Equipment

No.	Product Type	Manufacturer	Model	Comments
1	Power Supply	TDK-Lambda	DSP100-24	24VDC/4.4A
2				

3.2 Cables/Ports

No.	Name	Type	Length	Shielding	Comments
1	RS232/Ethernet Interface	Wire Harness	13m	Unshielded	Digital I/O Connection
2					

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

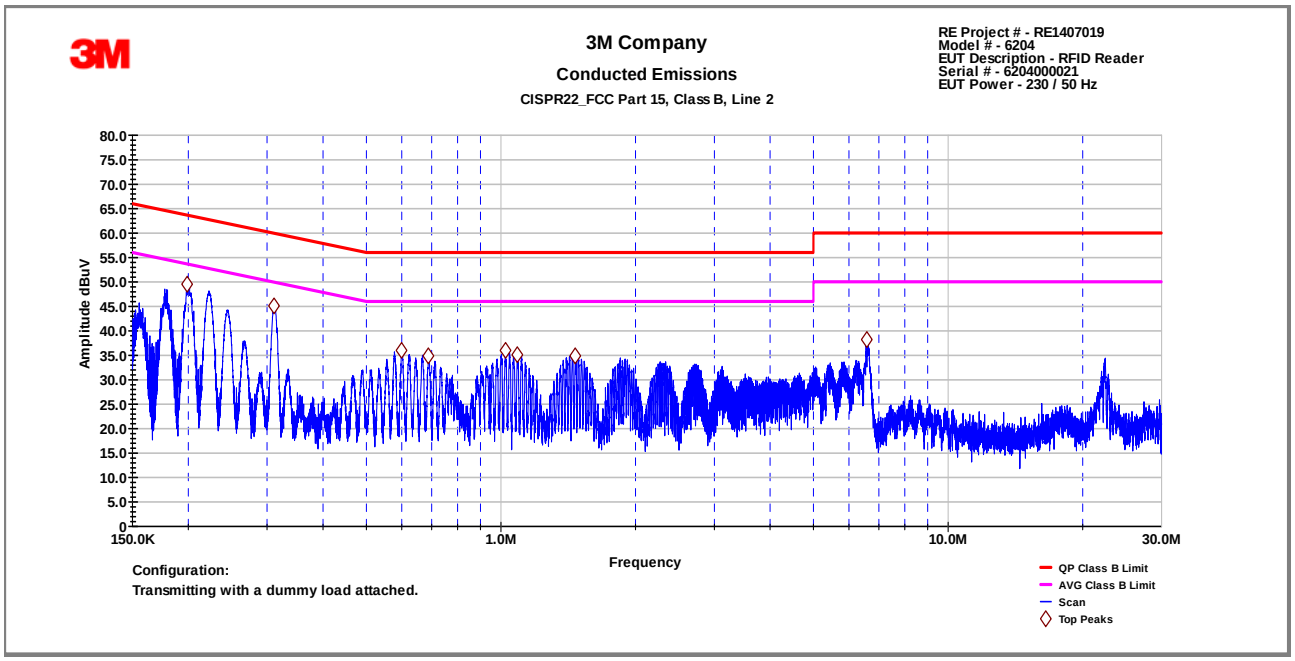
4.1	**Conducted Emissions Data**		
Method:	The AMN was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane. This distance was between the closest points of the AMN and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the AMN. 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	45%
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 30MHz ☐	
Nominal Voltage:		☒ 120VAC ☐ 230VAC ☐	
Tested By:		Mike Schultz MS	**Date: 08/12/2014**

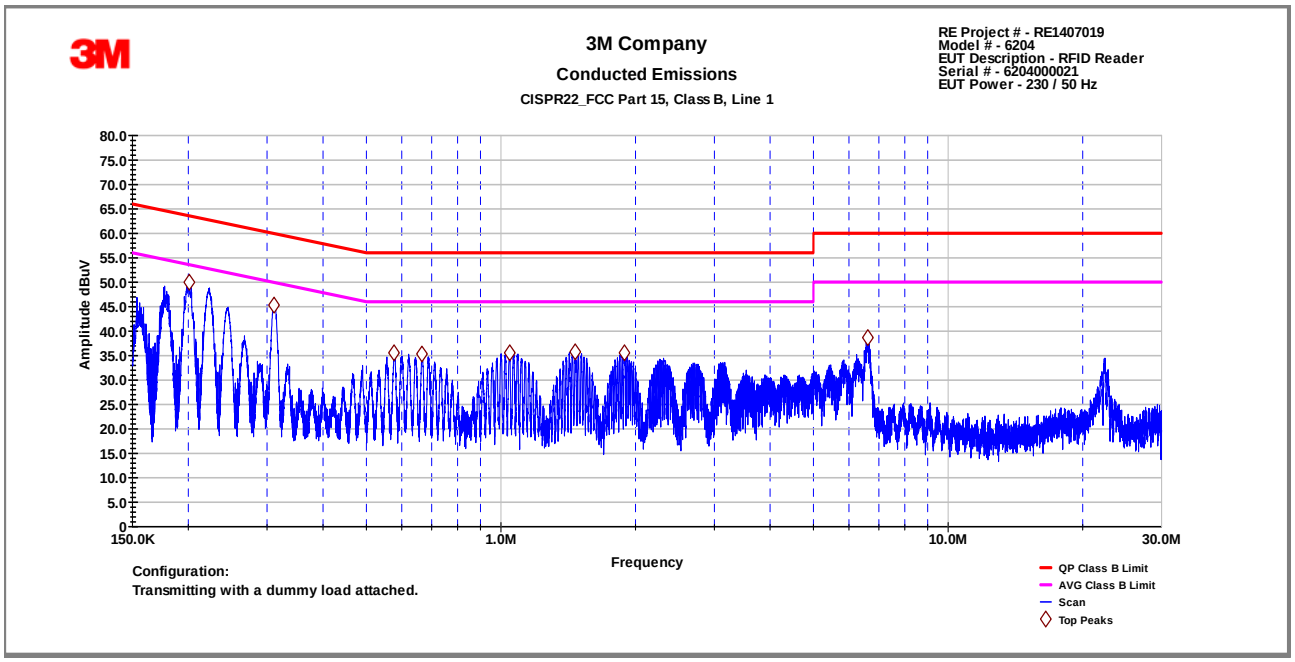
Limits

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
0.201	49.45	48.29	63.56	53.56	-14.12	-5.27
0.312	45.45	44.41	59.93	49.93	-14.48	-5.52
0.579	34.94	33.73	56	46	-21.06	-12.27
0.668	34.73	33.44	56	46	-21.27	-12.56
1.046	34.87	33.49	56	46	-21.13	-12.51
1.472	35.4	34.36	56	46	-20.6	-11.64
1.896	35.06	33.91	56	46	-20.94	-12.09
6.598	36.75	31.21	60	50	-23.25	-18.79
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**
0.201	49.34	48.12	63.58	53.58	-14.24	-5.46
0.313	45.16	44.65	59.9	49.9	-14.74	-5.25
0.603	35.39	34.26	56	46	-20.61	-11.74
0.7	22.87	16.55	56	46	-33.13	-29.45
1.028	35.17	34.05	56	46	-20.83	-11.95
1.095	34.92	33.82	56	46	-21.08	-12.18
1.452	34.95	33.76	56	46	-21.05	-12.24
6.615	36.09	45.51	60	50	-23.91	-4.49
Voltage		☒ 120VAC ☐ 230VAC ☐				
Notes						


3M Company
Conducted Emissions
CISPR22_FCC Part 15, Class B, Line 2
RE Project # - RE1407019
Model # - 6204
EUT Description - RFID Reader
Serial # - 6204000021
EUT Power - 230 / 50 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 with a dummy load attached.
QP Class B Limit
AVG Class B Limit
Scan
Top Peaks


3M Company
Conducted Emissions
CISPR22_FCC Part 15, Class B, Line 1
RE Project # - RE1407019
Model # - 6204
EUT Description - RFID Reader
Serial # - 6204000021
EUT Power - 230 / 50 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 with a dummy load attached.
QP Class B Limit
AVG Class B Limit
Scan
Top Peaks

Test Set Up Photo

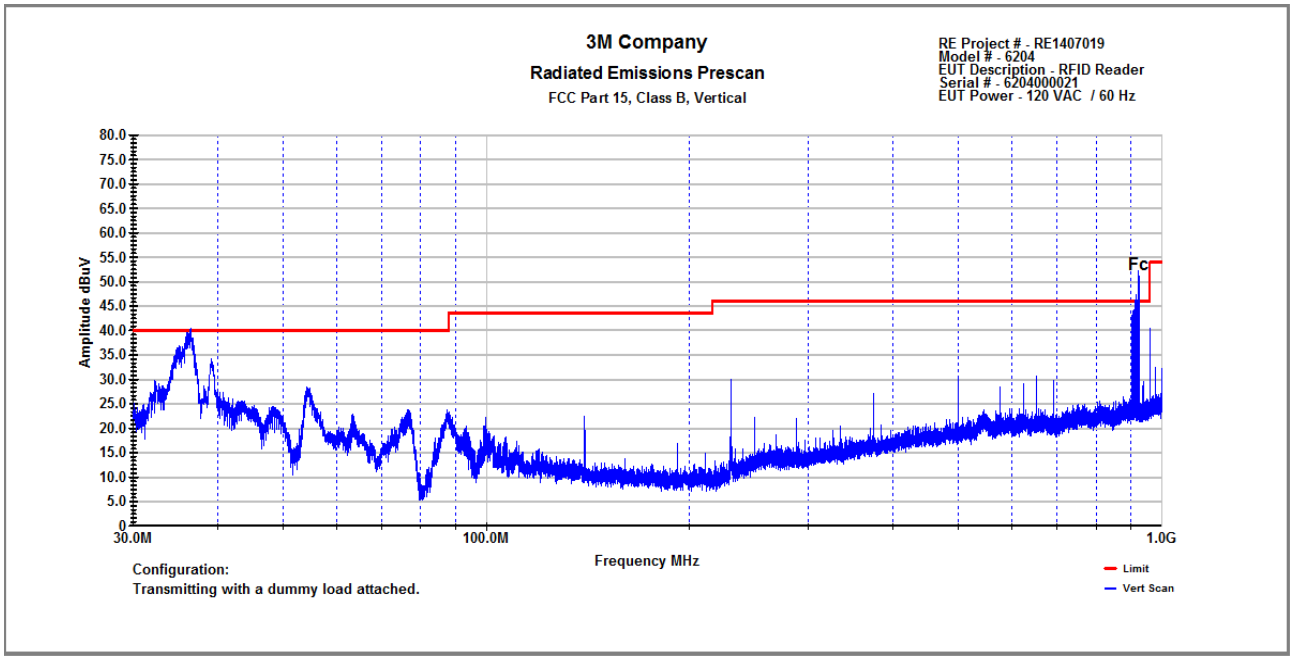
4.2	**Radiated Emissions Data**		
Method:	Measurements were made in a 3-meter semi-anechoic chamber that complies to CISPR 16. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in horizontal and vertical polarities. Final measurements (quasi-peak) were then 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: 08/11/2014**	

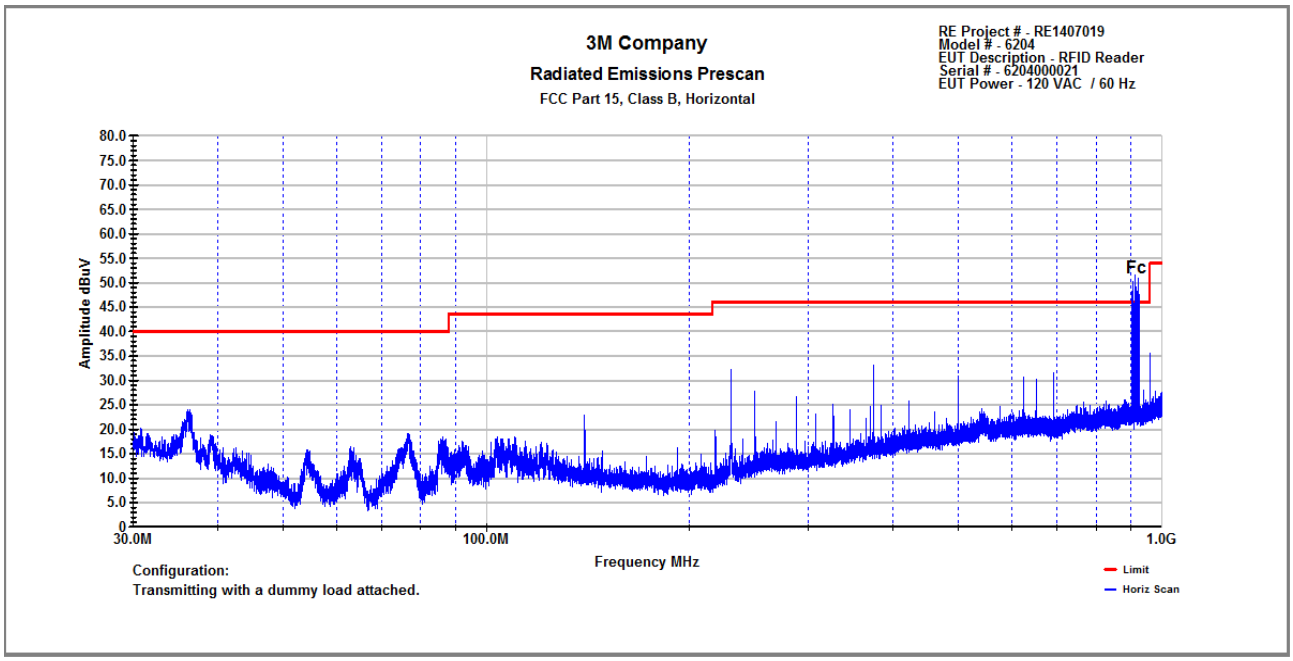
Limits

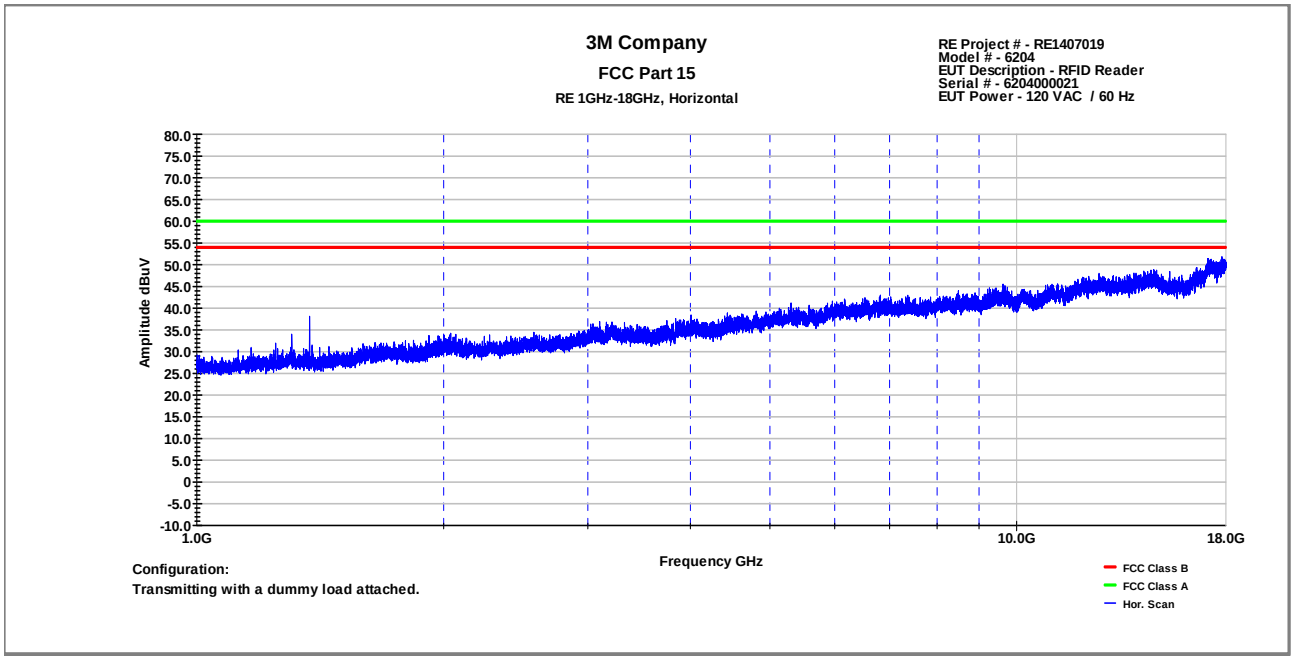
Frequency (MHz)	Limit dB (µV/m)			
	Quasi-Peak	Average	Distance	Results
0.009-0.490		2400/F(KHz)	300	**N/A**
0.490-1.705	24000/F(KHz)		30	**N/A**
1.705-30	29.5		30	**N/A**
30 to 88	40		3	**pass**
88-216	43.5		3	**pass**
216-960	46		3	**pass**
Above 960		54	3	**pass**

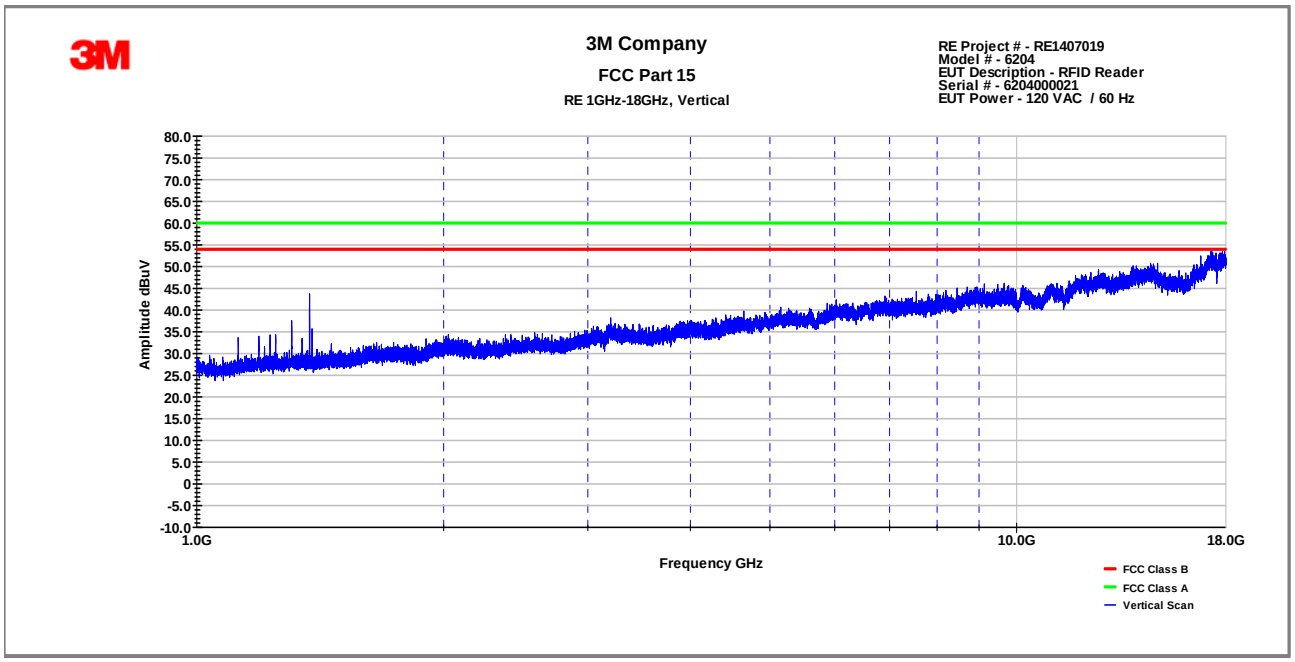
Modifications:	
Note:	For emission in the restricted bands, the limit of 15.209 was used.

Frequency (MHz)	Pol.	QP Reading dBµV/m	Total CF dB	Net at 3 m dBµV/m	Limit (dBµV/m)	Margin dB
36.15	V	16.36	18.42	34.78	40	-5.22
39.068	V	11.1	16.92	28.02	40	-11.98
54.5	V	13.83	10.38	24.21	40	-15.79
76.27	V	9.33	10.52	19.85	40	-20.15
913.734	H	-5.01	25.57	20.56	46.02	-25.46
921.647	V	3.62	25.29	28.91	46.02	-17.11
Notes		Total CF = Antenna Factor + Cable Factor - AMP Gain				


3M Company
Radiated Emissions Prescan
FCC Part 15, Class B, Vertical
RE Project # - RE1407019
Model # - 6204
EUT Description - RFID Reader
Serial # - 6204000021
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
Fc
30.0M
100.0M
1.0G
Frequency MHz
Configuration:
Transmitting with a dummy load attached.
Limit
Vert Scan


3M Company
Radiated Emissions Prescan
FCC Part 15, Class B, Horizontal
RE Project # - RE1407019
Model # - 6204
EUT Description - RFID Reader
Serial # - 6204000021
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
Fc
30.0M
100.0M
1.0G
Frequency MHz
Configuration:
Transmitting with a dummy load attached.
Limit
Horiz Scan


3M Company
FCC Part 15
RE 1GHz-18GHz, Horizontal
RE Project # - RE1407019
Model # - 6204
EUT Description - RFID Reader
Serial # - 6204000021
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:
Transmitting with a dummy load attached.
FCC Class B
FCC Class A
Hor. Scan

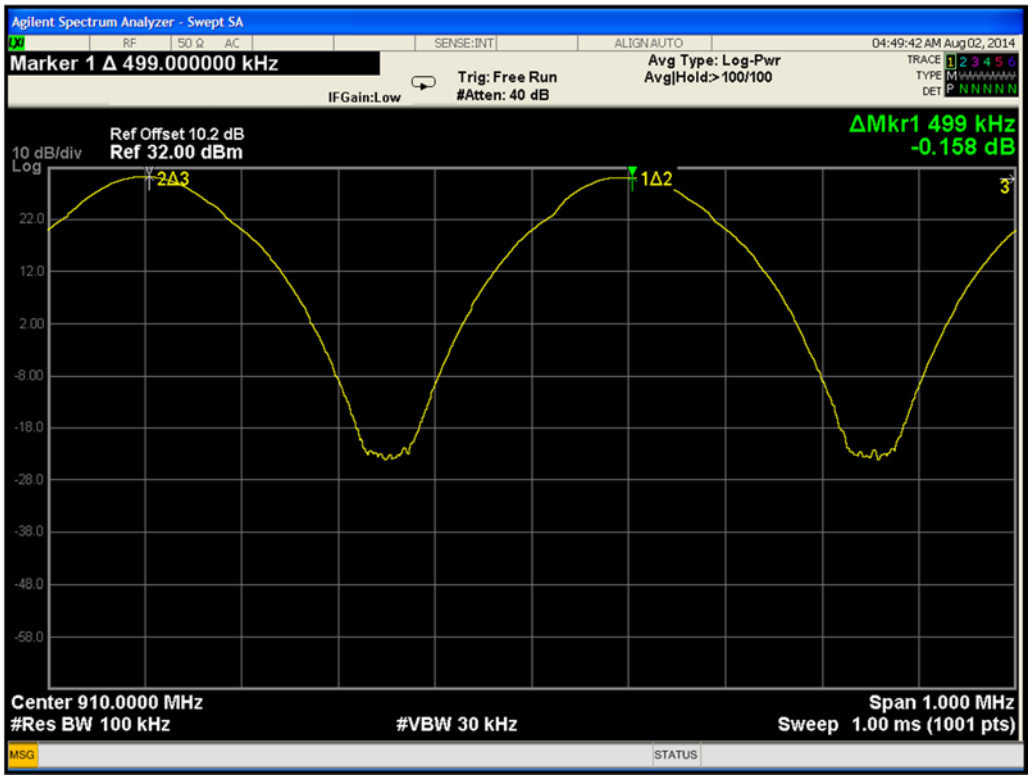

3M Company
FCC Part 15
RE 1GHz-18GHz, Vertical
RE Project # - RE1407019
Model # - 6204
EUT Description - RFID Reader
Serial # - 6204000021
EUT Power - 120 VAC / 60 Hz
Amplitude dBuV
80.0
75.0
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0
-5.0
-10.0
1.0G
10.0G
18.0G
Frequency GHz
FCC Class B
FCC Class A
Vertical Scan

Test Set Up Photo

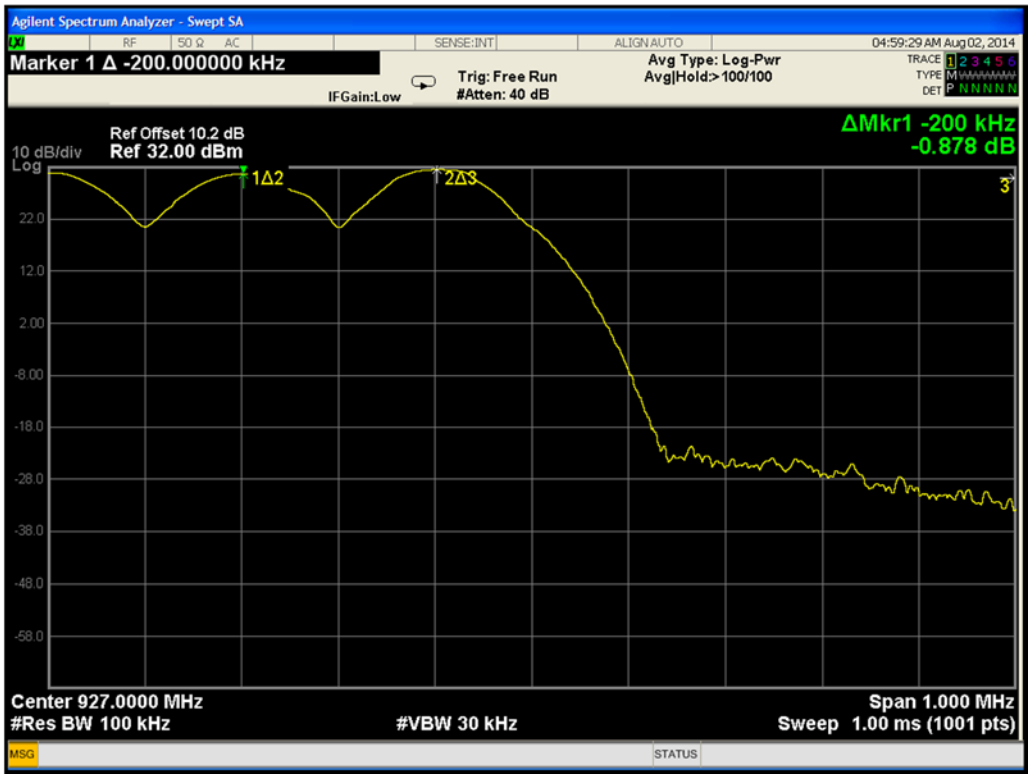
Test Set Up Photo

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	45%			
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				
		Result			
Limit	☐ >25KHz	**Pass**			
	☒ >20dB Bandwidth (110 KHz)	Dense	Band A	Band B	Band C
		499KHz	200KHz	200KHz	200KHz
Nominal Voltage:	☒ 120VAC ☐ VDC				
Tested By:	Yuriy Litvinov	**Date:** 08/02/2014			

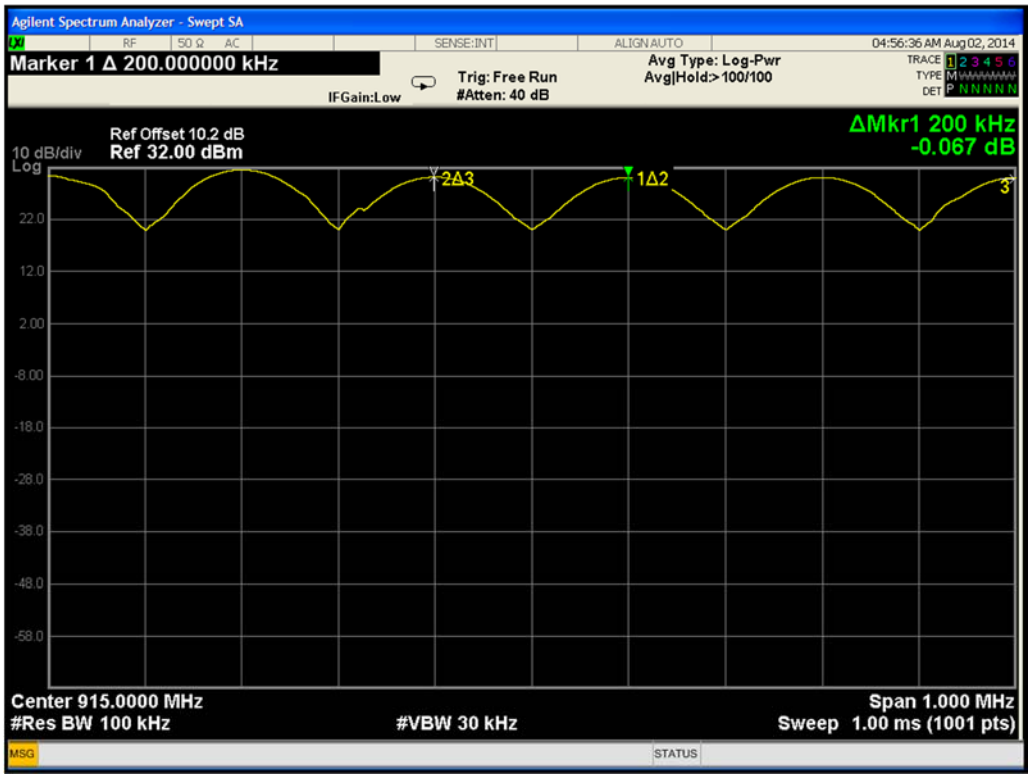
Note:	The channel spacing was verified to be nominally 200KHz in Bands A, B and C. The dense mode utilizes 50 channels and the channel spacing in this mode was measured to be 500KHz.



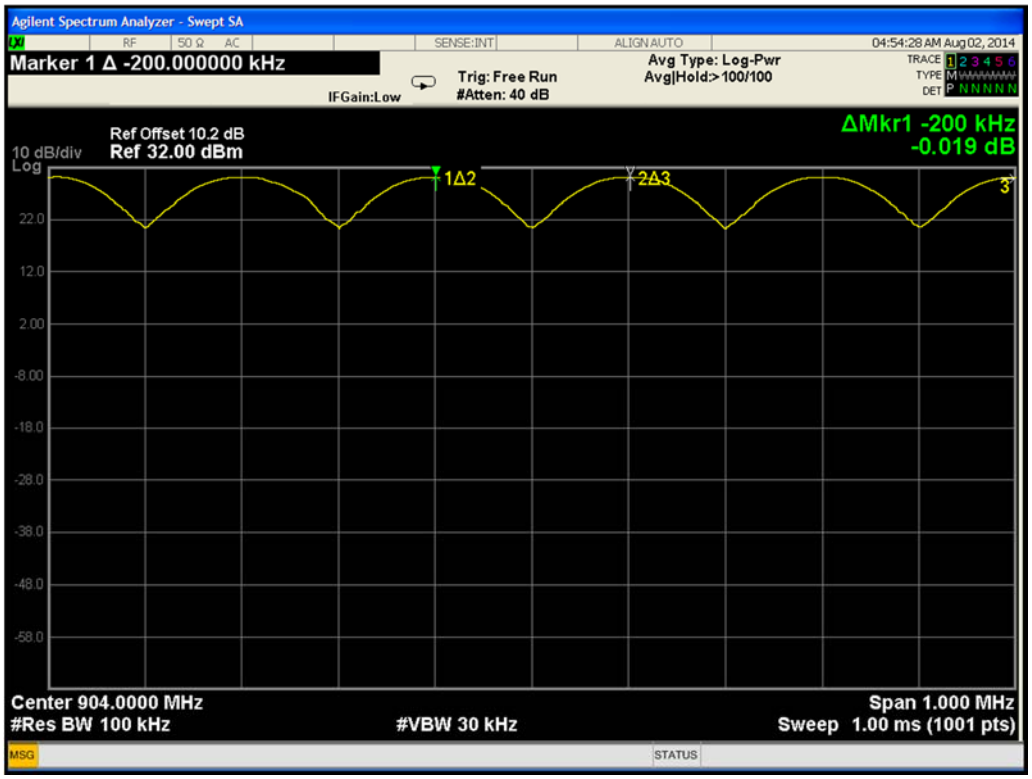
Carrier Frequency Separation – Dense Mode



Carrier Frequency Separation – Band C



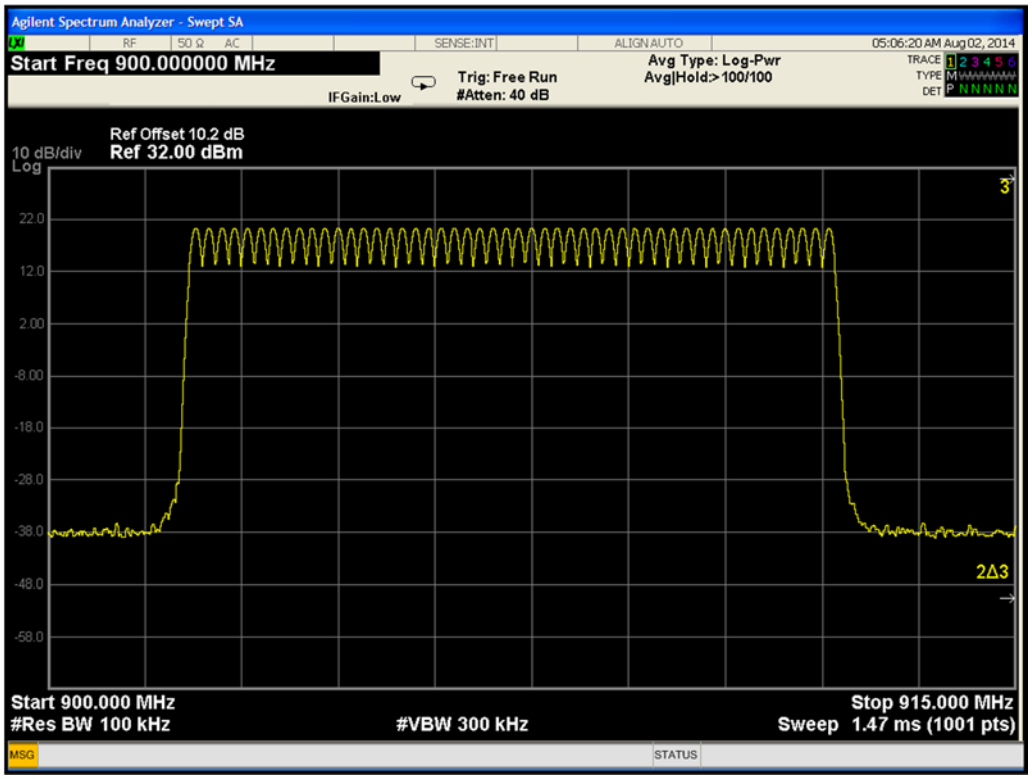
Carrier Frequency Separation – Band B



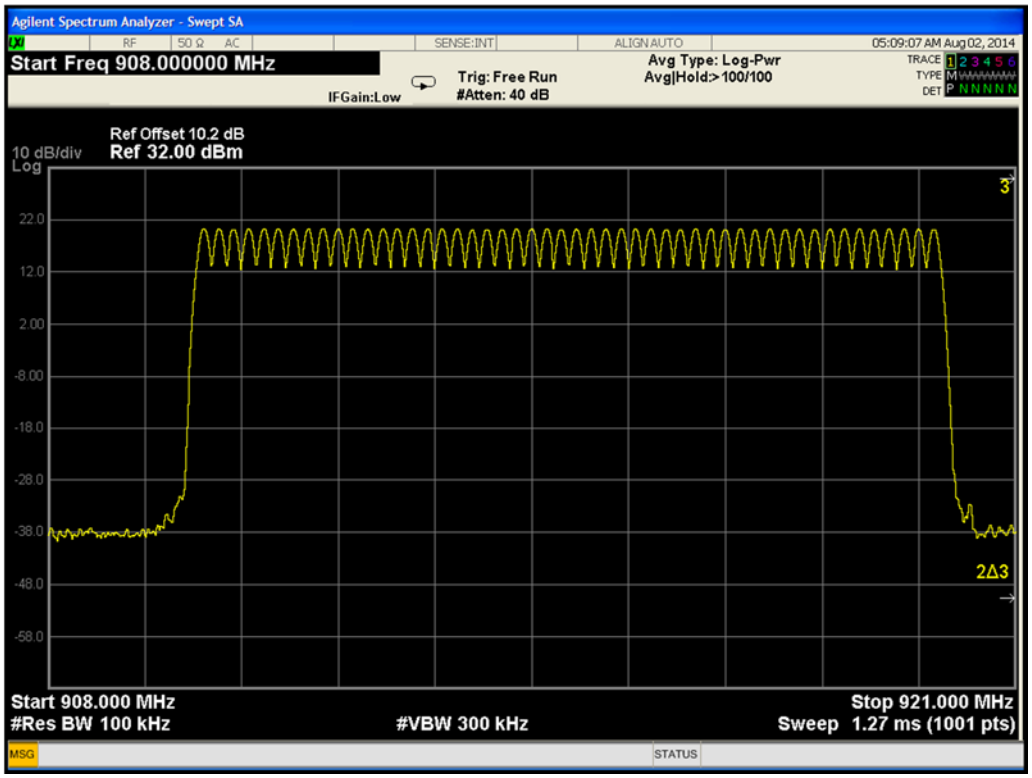
Carrier Frequency Separation – Band A

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	45%	
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:	☐	**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:** 08/02/2014	

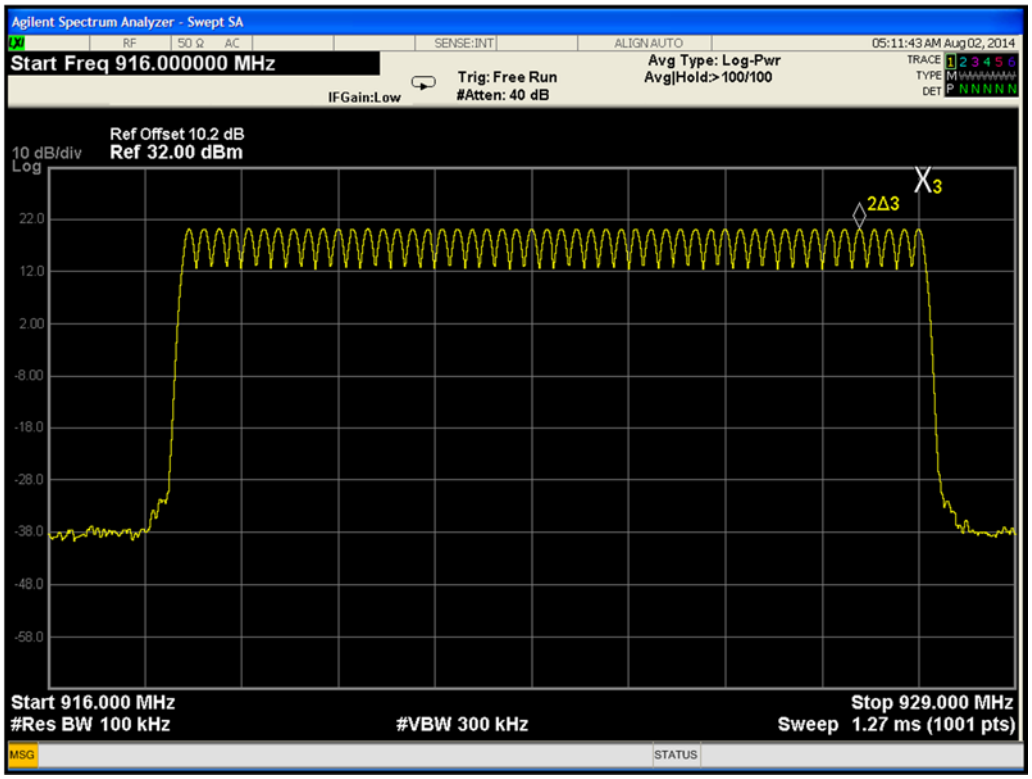
Note:	



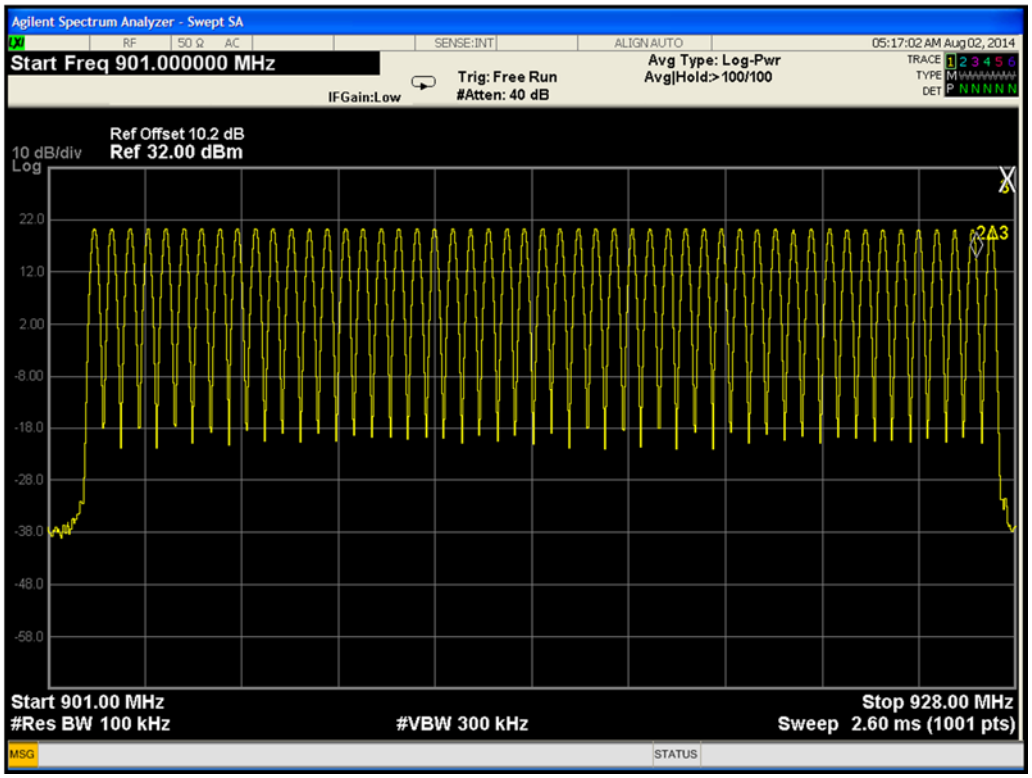
Number of Channels – Band A



Number of Channels – Band B



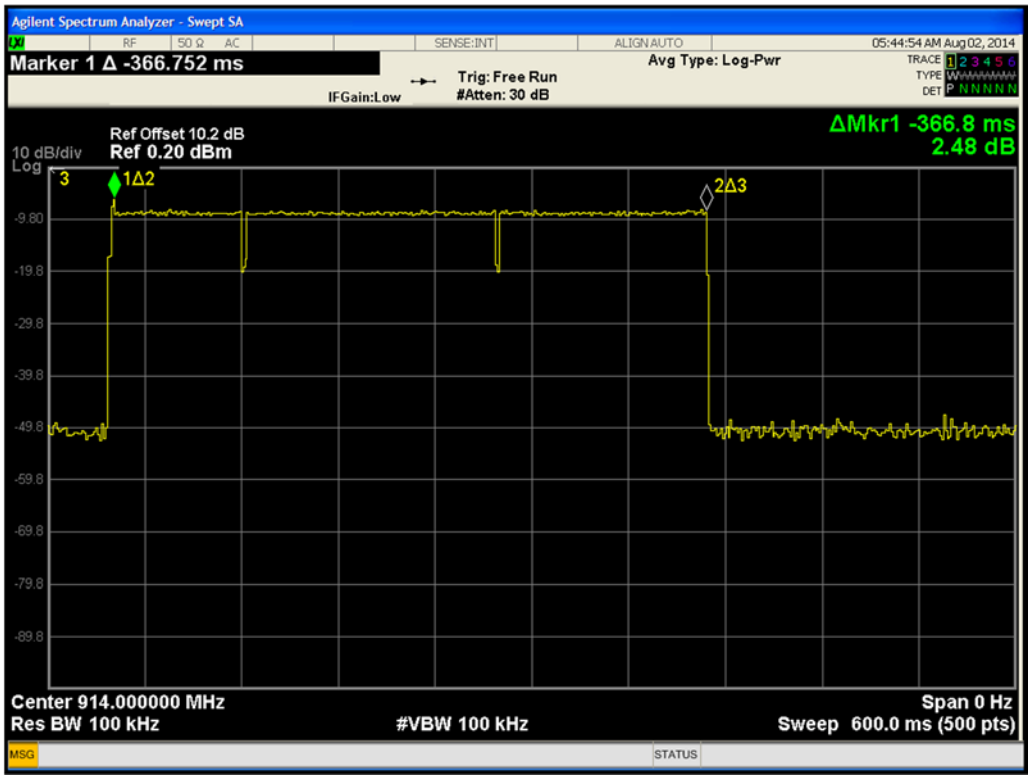
Number of Channels – Band C



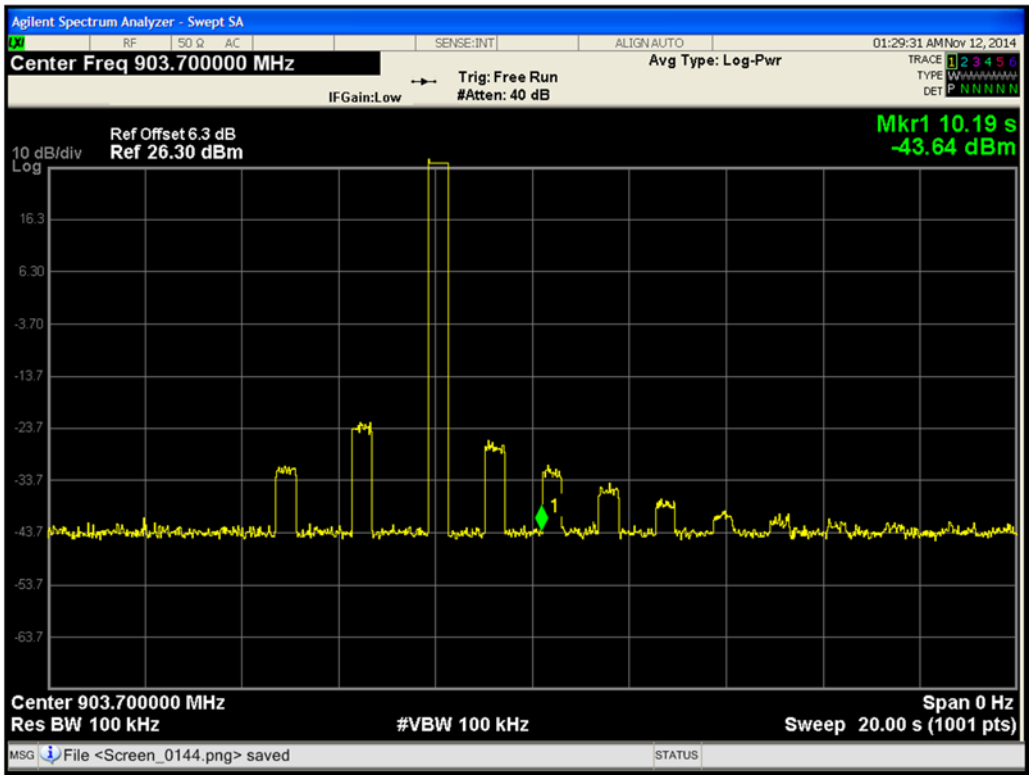
Number of Channels – Dense Mode

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	366.8ms
	☐ 20dB>250KHz	☐ <0.4 sec within a period of 10s	
Nominal Voltage:	☒ 120VAC ☐ VDC		
Tested By:	Yuriy Litvinov		**Date:** 05/09/2104

Note:	Single pulse duration is 366.8ms in a 20s sweep period 1 pulse occurs, and therefore the total on time is 366.8.6ms



Duty Cycle



Total on Time

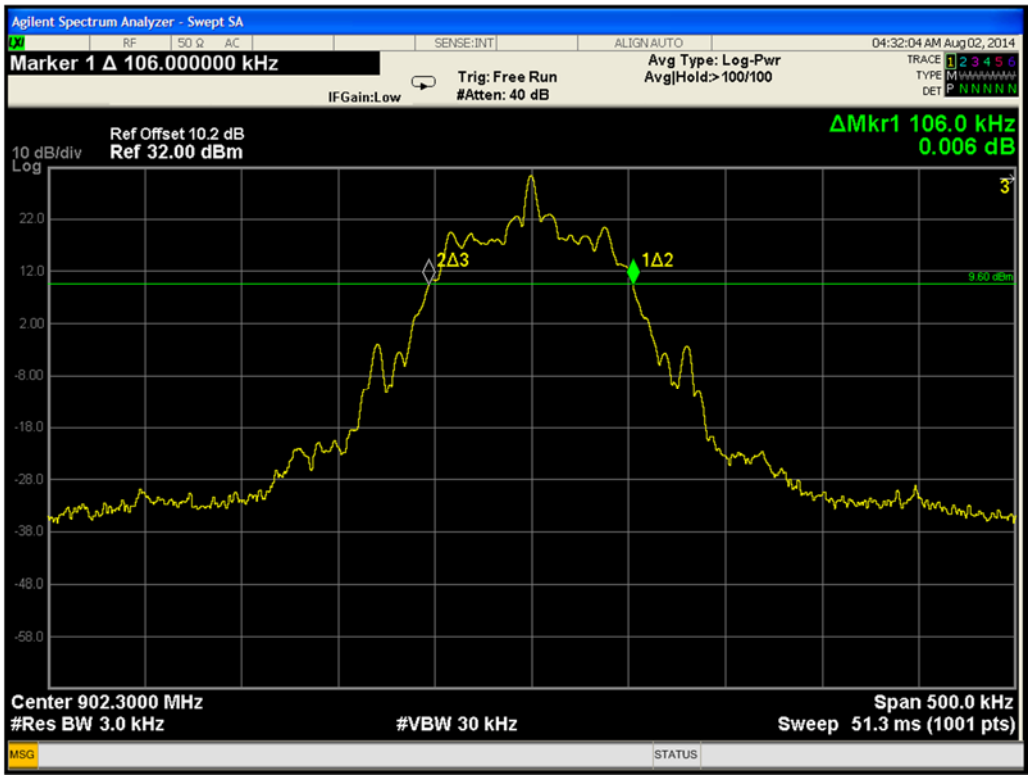
4.6	20dB Bandwidth	
Method:	The measurements were made with transmitter set to transmit continuously modulated signal at low, mid and high channels. The marker delta method was used to determine the 20dB bandwidth.	
	Laboratory Ambient Temperature	23°C
	Relative Humidity	45%
Reference Standard:	☐ ANSI 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:	☐ dBi	RBW ≥ 1% of the 20 dB bandwidth VBW ≥ RBW
Nominal Voltage:	☒ 120VAC ☐ VDC	
Tested By:	Yuriy Litvinov	Date: 08/02/2014

Note:	Occupied Bandwidth for the various modes available. The worst case modulations used by the device have been reported.

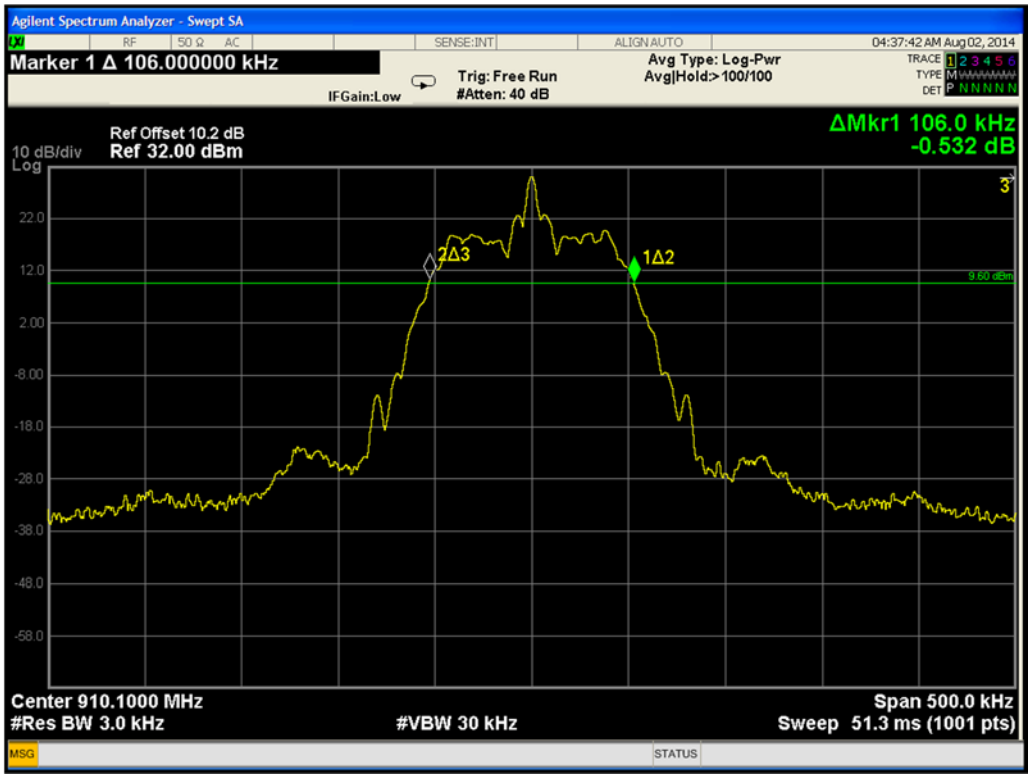
Channels Frequency (MHz)	20 dB Bandwidth (KHz)	Limit (KHz)	Results
Low Band A: 902.3	106.0	500	pass
Mid Band B: 910.1	106.0	500	pass
High Band C: 927.75	106.0	500	pass

Frequency (MHz) (lower data rate dense mode)	20 dB Bandwidth (KHz)	Limit (KHz)	Results
Dense Mode Low: 902.3	106.0	500	pass
Dense Mode Mid: 914.5	106.5	500	pass
Dense Mode High: 927.75	106.0	500	pass

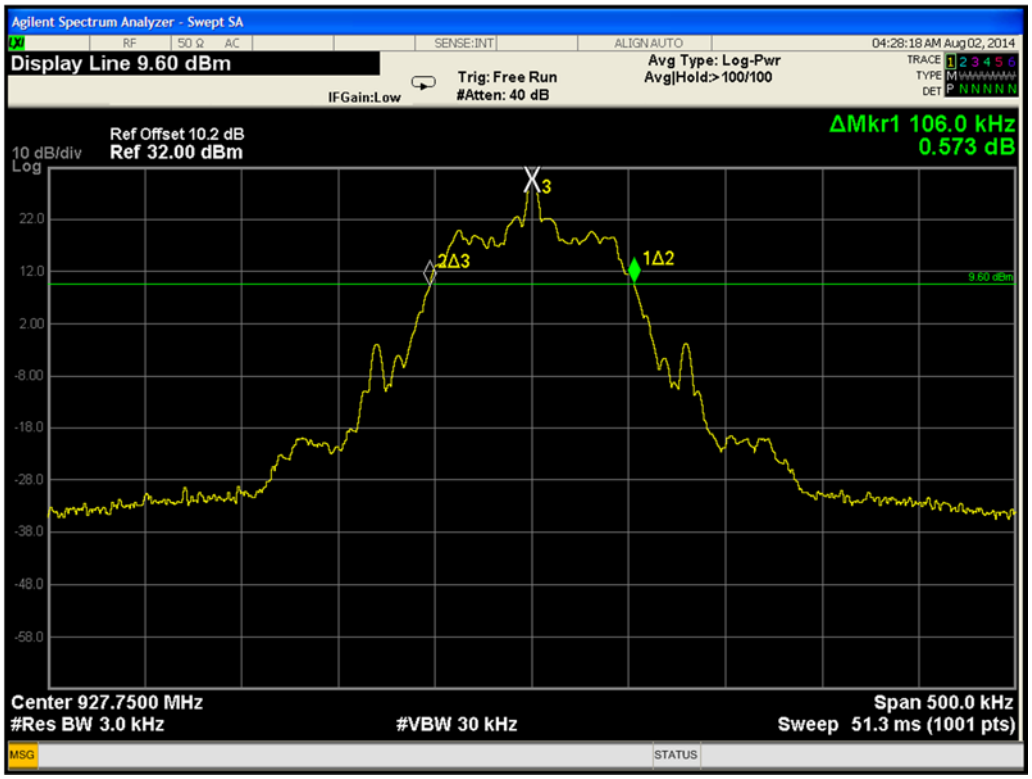
Frequency (MHz) (higher data rate dense mode)	20 dB Bandwidth (KHz)	Limit (KHz)	Results
Dense Mode Low: 902.3	190.8	500	pass
Dense Mode Mid: 914.5	185.3	500	pass
Dense Mode High: 927.75	185.2	500	pass



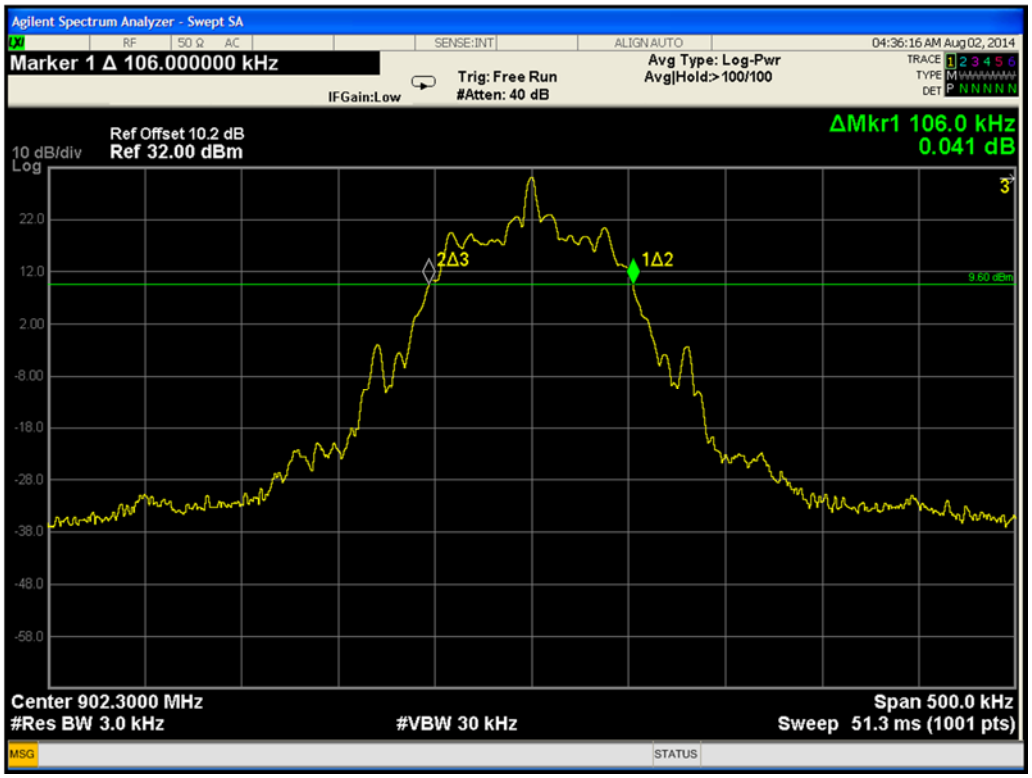
Occupied Bandwidth – Band A



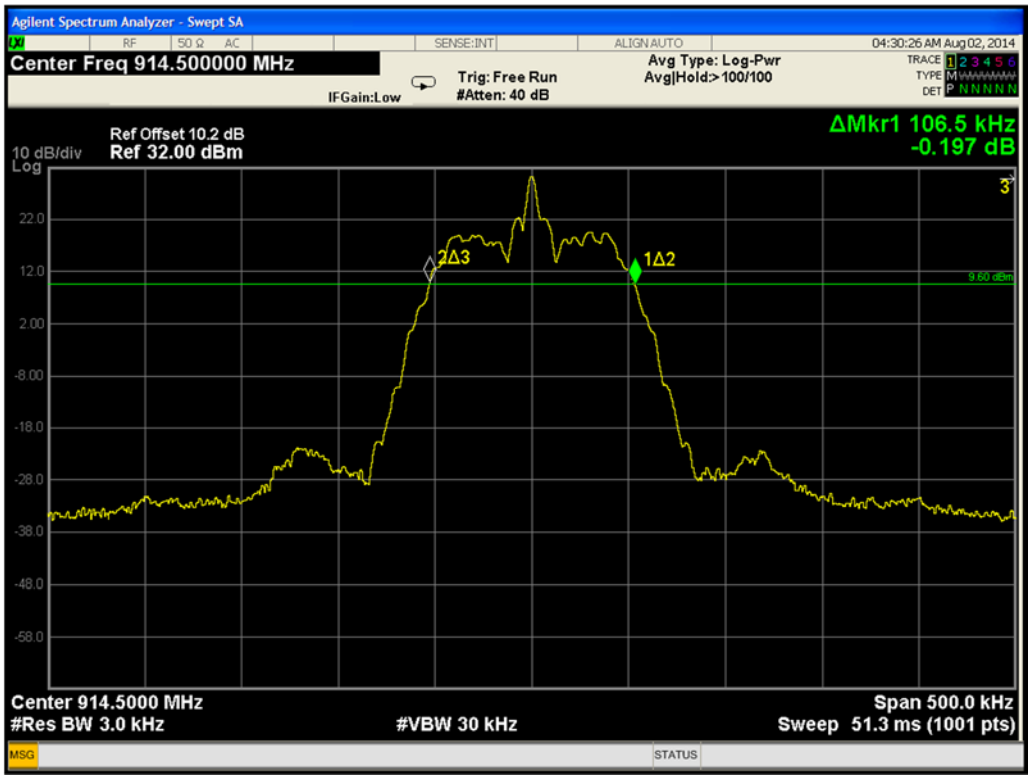
Occupied Bandwidth – Band B



Occupied Bandwidth – Band C

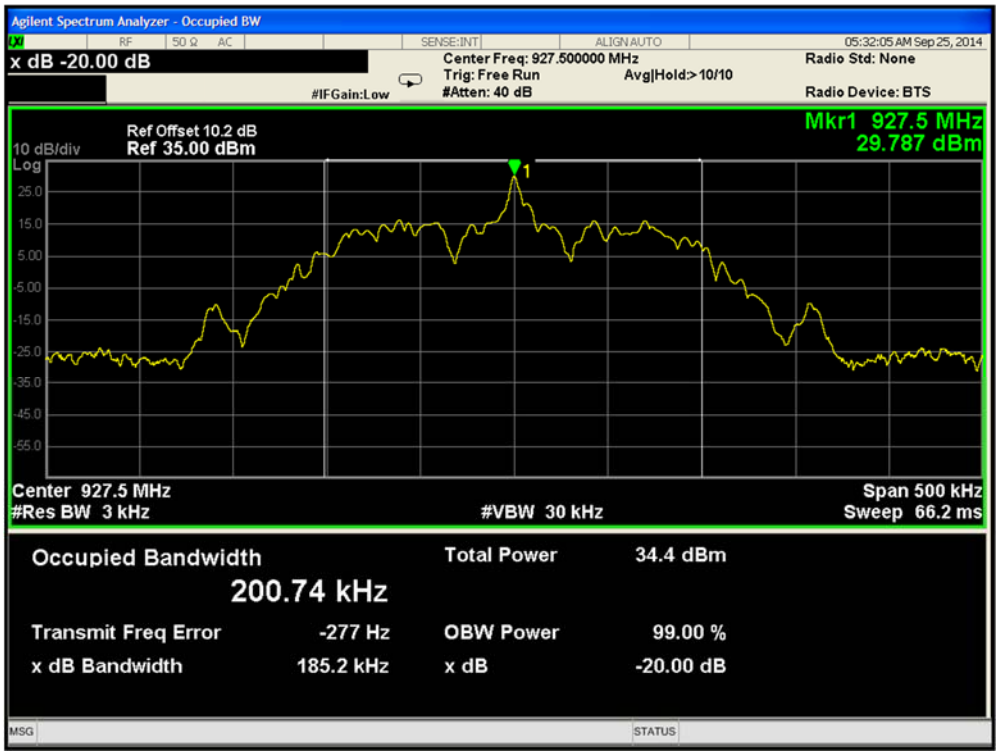


Occupied Bandwidth – Dense Mode Low

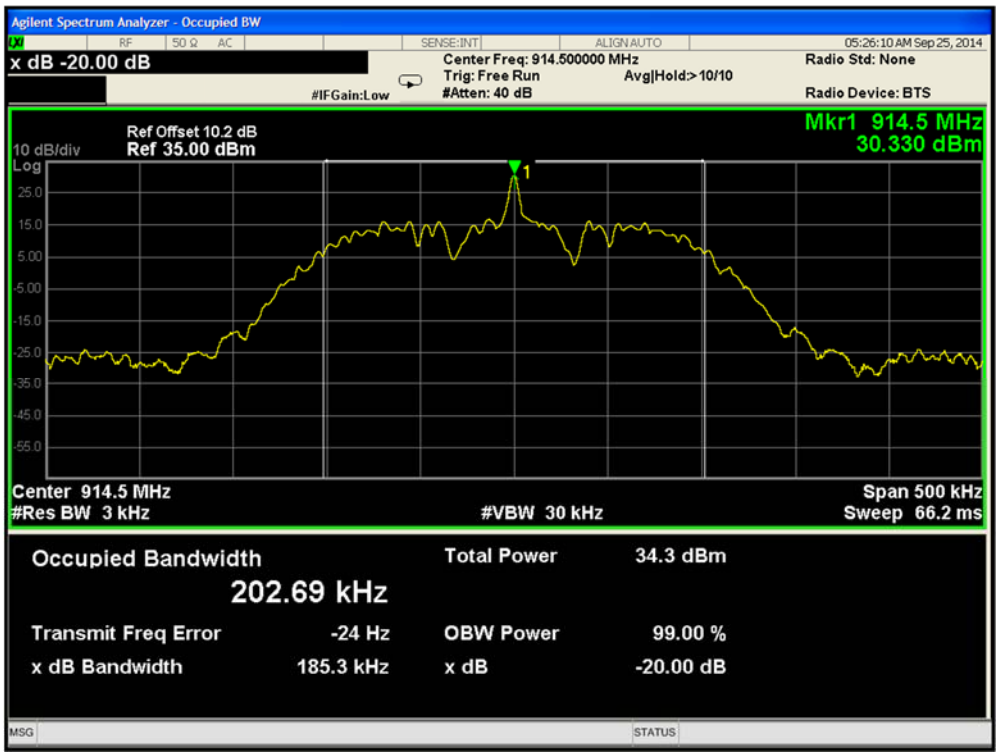


Occupied Bandwidth – Dense Mode Mid

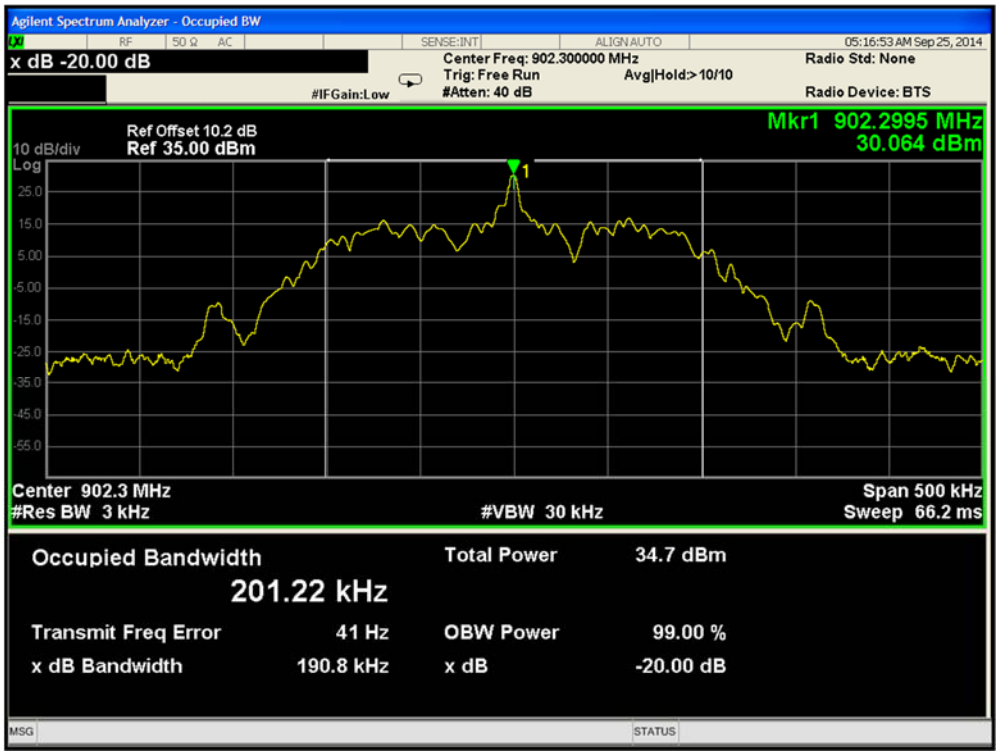
Occupied Bandwidth – Dense Mode High



Occupied Bandwidth – Dense Mode High (higher data rate)



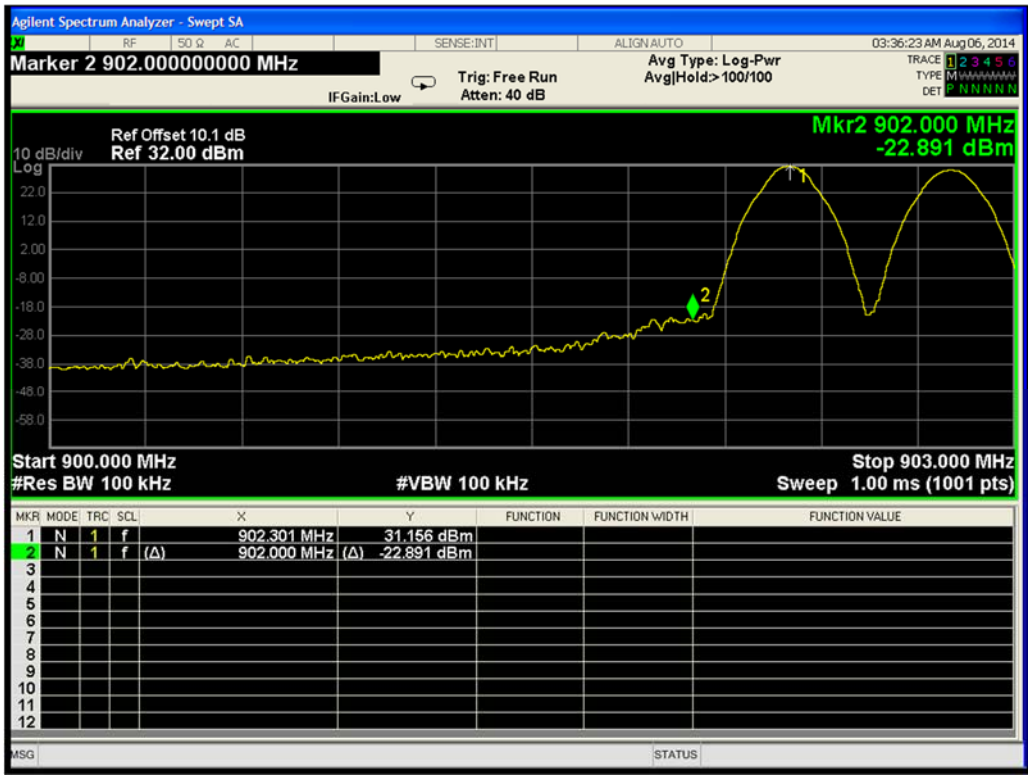
Occupied Bandwidth – Dense Mode Mid (higher data rate)

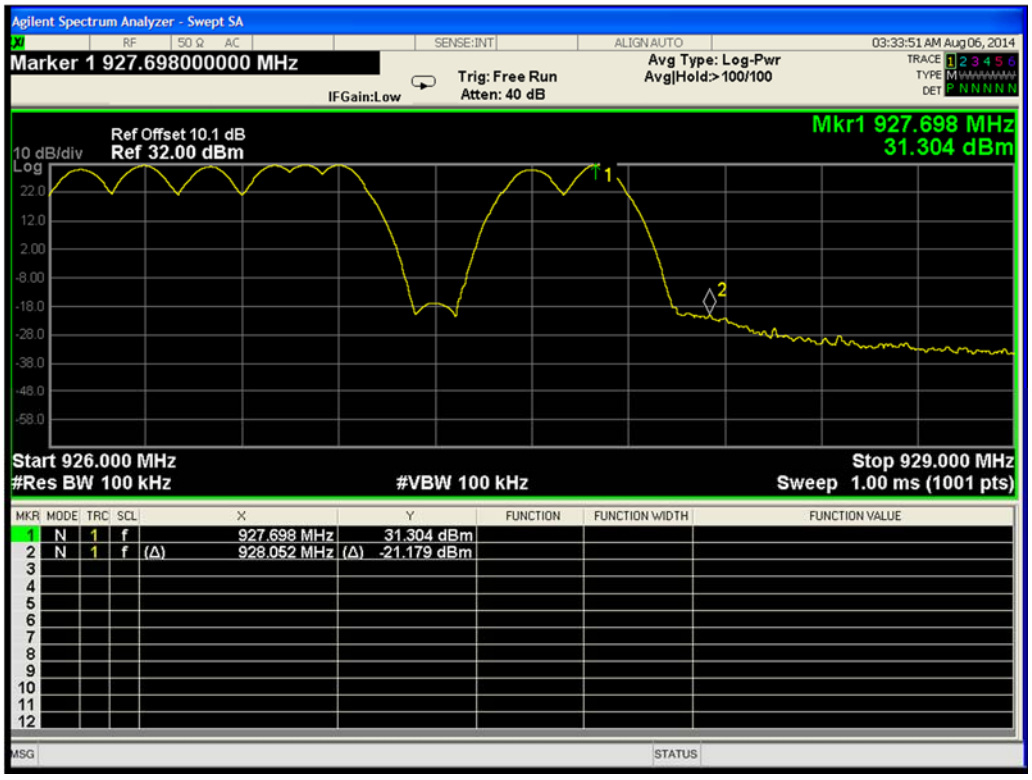


Occupied Bandwidth – Dense Mode Low (higher data rate)

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:	☐	**Results**
Limit	☒ >20dBc ☐ FCC Part 15.209	➢ 53dBc
Nominal Voltage:	☒ 120VAC ☐ VDC	
Tested By:	Yuriy Litvinov	**Date:** 08/09/2014

Note:	

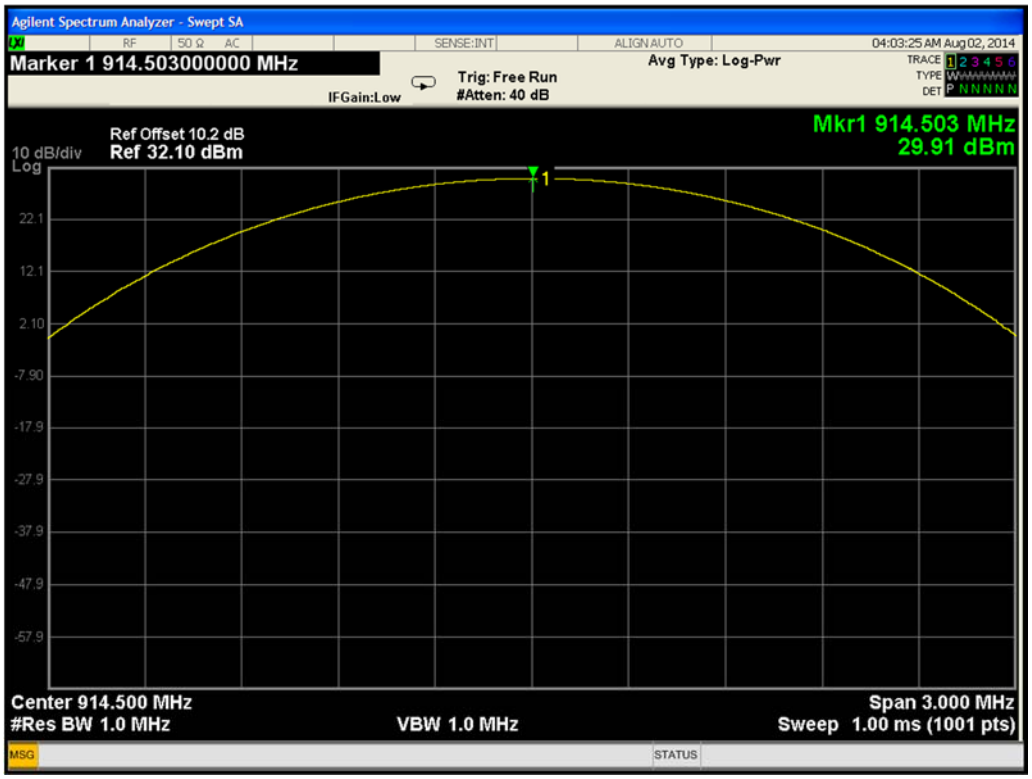

Agilent Spectrum Analyzer - Swept SA
Marker 2 902.000000000 MHz
IFGain:Low
Trig: Free Run
Atten: 40 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
03:36:23 AM Aug 06, 2014
Ref Offset 10.1 dB
10 dB/div
Ref 32.00 dBm
Log
Mkr2 902.000 MHz
-22.891 dBm
Start 900.000 MHz
#Res BW 100 kHz
#VBW 100 kHz
Stop 903.000 MHz
Sweep 1.00 ms (1001 pts)
1 N 1 f 902.301 MHz 31.156 dBm
2 N 1 f (Δ) 902.000 MHz (Δ) -22.891 dBm


Agilent Spectrum Analyzer - Swept SA
Marker 1 927.698000000 MHz
IFGain:Low
Trig: Free Run
Atten: 40 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
03:33:51 AM Aug 06, 2014
Ref Offset 10.1 dB
10 dB/div
Ref 32.00 dBm
Log
Mkr1 927.698 MHz
31.304 dBm
Start 926.000 MHz
#Res BW 100 kHz
#VBW 100 kHz
Stop 929.000 MHz
Sweep 1.00 ms (1001 pts)
1 N 1 f 927.698 MHz 31.304 dBm
2 N 1 f (Δ) 928.052 MHz (Δ) -21.179 dBm

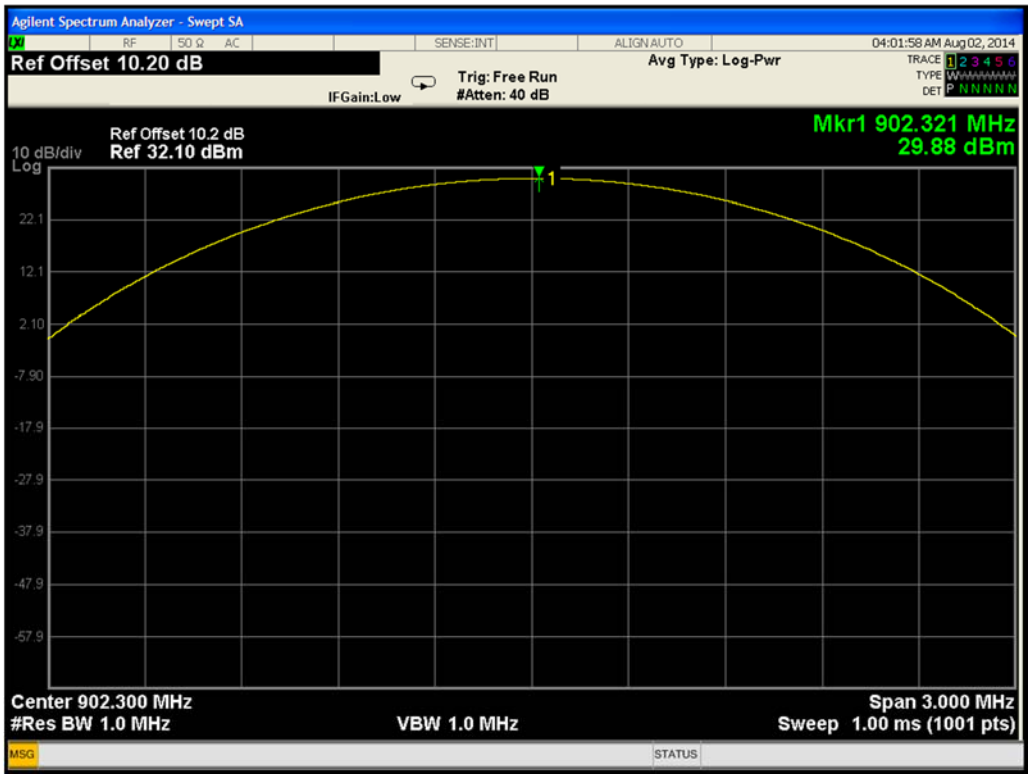
4.8	**Conducted Output Power**	
Method:	Measurements was performed with an un-modulated carrier at the highest power level at which the transmitter is intended to operate. The transmitter was configured to operate lowest, middle and highest power channels and connected to an antenna port. The carrier 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	45%
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	
Limit	≥50 Hopping Channels	>25 Hopping Channels <50
	☒ 30dBm ☐	☐ 24dBm ☐
Nominal Voltage:	☒ 120VAC ☐ VDC	
Tested By:	Yuriy Litvinov	**Date:** 08/02/2014

Antenna Port	Channels Frequency (MHz)	RF Power Output (dBm)	Limit (dBm)	Results
1	902.3	29.88	30	**pass**
	914.5	29.81	30	**pass**
	927.7	29.71	30	**pass**
2	902.3	29.75	30	**pass**
	914.5	29.85	30	**pass**
	927.7	29.89	30	**pass**
3	902.3	29.85	30	**pass**
	914.5	29.88	30	**pass**
	927.7	29.88	30	**pass**
4	902.3	29.88	30	**pass**
	914.5	29.85	30	**pass**
	927.7	29.75	30	**pass**

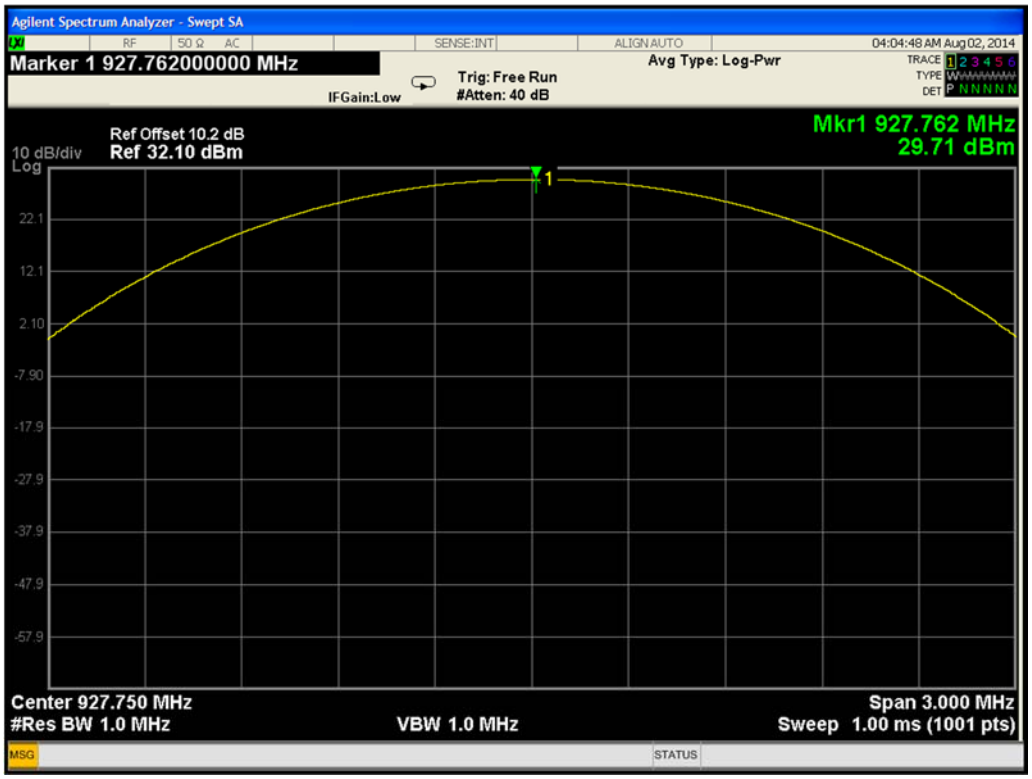
Note:	Worst case modulation used by the device. KDB 594280. Professional installation or authorized service personnel is required to configure radio parameters of the transmitter using the software for adjusting total EIRP (36dBm) power at local installation to ensure compliance with FCC Rules.



Peak Power-Low Channel



Peak Power-Mid Channel



Peak Power-High Channel

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 15.247/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
Antenna	MT–262006/N – 7dBi (RHCP) MT- 262044/NH,15dBi MT–263006,12.5dBi	
	MT–262043, 16dBi	**Class II PC**
Nominal Voltage:	☒ 120VAC ☐ VDC	
Tested By:	Mike Schultz MS	**Date: 01/12/2015**

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 (conducted &radiated) were detected in the frequency range above 5GHz. Test was performed with the highest gain of each type of antenna proposed for use with the EUT.

Pol.	Frequency (MHz)	Reading dBµV/m	Total CF dB	Net at 3 m dBµV/m.	Limit dBµV/m	Margin dB	Comments	
V	2707.00	51.6	-13.0	38.6	74	-35.4	PK	
V	2707.00	42.0	-13.0	29.0	54	-25.0	AV	
H	2707.00	52.0	-13.0	39.0	74	-35.0	PK	
H	2707.00	43.7	-13.0	30.7	54	-23.3	AV	
V	3609.00	46.3	-11.0	35.3	74	-38.7	PK	
V	3609.00	33.4	-11.0	22.4	54	-31.6	AV	
H	3609.00	46.6	-11.0	35.6	74	-38.4	PP	
H	3609.00	34.5	-11.0	23.5	54	-30.5	AV	
V	4511.00	44.1	-6.7	37.4	74	-36.6	PK	
V	4511.00	31.8	-6.7	25.1	54	-28.9	AV	
H	4511.00	44.3	-6.7	37.6	74	-36.4	PK	
H	4511.00	32.3	-6.7	25.6	54	-28.4	AV	
Notes		Total CF = Antenna Factor + Cable Factor - AMP Gain						
		MT- 262044/NH,15dBi **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	2743.50	46.8	-12.0	34.8	74	-39.2	Pk	
V	2743.50	34.4	-12.0	22.4	54	-31.6	AV	
H	2743.50	46.7	-12.0	34.7	74	-39.3	Pk	
H	2743.50	34.2	-12.0	22.2	54	-31.8	AV	
V	3658.0	45.4	-10.7	34.7	74	-39.3	Pk	
V	3658.0	33.1	-10.7	22.4	54	-31.6	AV	
H	3658.0	46.1	-10.7	35.4	74	-38.6	PK	
H	3658.0	34.4	-10.7	23.7	54	-30.3	AV	
V	4572.5	44.9	-5.2	39.7	74	-34.3	Pk	
V	4572.5	32.8	-5.2	27.6	54	-26.4	AV	
H	4572.5	45.9	-5.2	40.7	74	-33.3	PK	
H	4572.5	33.3	-5.2	28.1	54	-25.9	AV	
Notes		Total CF = Antenna Factor + Cable Factor - AMP Gain						
		MT- 262044/NH,15dBi **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	46.0	-12.0	34.0	74	-40.0	PK	
V	2783.0	33.7	-12.0	21.7	54	-32.3	AV	
H	2783.0	60.8	-12.0	48.8	74	-25.2	PK	
H	2783.0	50.6	-12.0	38.6	54	-15.5	AV	
V	3710.8	45.9	-10.0	35.9	74	-38.1	PK	
V	3710.8	33.5	-10.0	23.5	54	-30.5	AV	
H	3710.8	46.7	-10.0	36.7	74	-37.3	PK	
H	3710.8	34.8	-10.0	24.8	54	-29.2	AV	
V	4638.515	44.3	-5.8	38.5	74	-35.5	PK	
V	4638.515	31.5	-5.8	25.7	54	-28.3	AV	
H	4638.515	44.2	-5.8	38.4	74	-35.6	PK	
H	4638.515	31.9	-5.8	26.1	54	-27.9	AV	
Notes		Total CF = Antenna Factor + Cable Factor - AMP Gain						
		MT- 262044/NH,15dBi High Channel. Average readings obtained with the 10Hz VBW						

Test Set Up Photo

Pol.	Frequency (MHz)	Reading dBµV/m	Total CF dB	Net at 3 m dBµV/m.	Limit dBµV/m	Margin dB	Comments	
V	2707.00	51.3	-13.0	38.3	74	-35.7	PK	
V	2707.00	42.2	-13.0	29.2	54	-24.8	AV	
H	2707.00	47.7	-13.0	34.7	74	-39.3	PK	
H	2707.00	41.2	-13.0	28.2	54	-25.8	AV	
V	3609.00	47.1	-11.0	36.1	74	-37.9	Pk	
V	3609.00	34.0	-11.0	23.0	54	-31.0	AV	
H	3609.00	46.8	-11.0	35.8	74	-38.2	Pk	
H	3609.00	34.2	-11.0	23.2	54	-30.8	AV	
V	4511.00	45.2	-6.7	38.5	74	-35.5	Pk	
V	4511.00	32.5	-6.7	25.8	54	-28.2	AV	
H	4511.00	45.1	-6.7	38.4	74	-35.6	Pk	
H	4511.00	33.3	-6.7	26.6	54	-27.4	AV	
Notes		Total CF = Antenna Factor + Cable Factor - AMP Gain						
		Antenna MT–263006, 12.5dBi 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	2743.51	48.3	-12.0	36.3	74	-37.7	Pk	
V	2743.51	37.7	-12.0	25.7	54	-28.3	AV	
H	2743.51	48.5	-12.0	36.5	74	-37.5	Pk	
H	2743.51	38.0	-12.0	26.0	54	-28.0	AV	
V	3658.0	46.6	-10.7	35.9	74	-38.1	Pk	
V	3658.0	34.4	-10.7	23.7	54	-30.3	AV	
H	3658.0	47.6	-10.7	36.9	74	-37.1	PK	
H	3658.0	34.7	-10.7	24.0	54	-30.0	AV	
Notes		Total CF = Antenna Factor + Cable Factor - AMP Gain						
		Antenna MT–263006, 12.5dBi 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	47.3	-12.0	35.3	74	-38.7	PK	
V	2783.0	36.8	-12.0	24.8	54	-29.2	AV	
H	2783.0	51.8	-12.0	39.8	74	-34.2	PK	
H	2783.0	46.9	-12.0	34.9	54	-19.1	AV	
V	3710.8	46.2	-10.0	36.2	74	-37.8	PK	
V	3710.8	33.7	-10.0	23.7	54	-30.3	AV	
H	3710.8	45.7	-10.0	35.7	74	-38.3	PK	
H	3710.8	33.7	-10.0	23.7	54	-30.3	AV	
Notes		Total CF = Antenna Factor + Cable Factor - AMP Gain						
		Antenna MT–263006, 12.5dBi High Channel. Average readings obtained with the 10Hz VBW						

Test Set Up Photo

Pol.	Frequency (MHz)	Reading dBµV/m	Total CF dB	Net at 3 m dBµV/m.	Limit dBµV/m	Margin dB	Comments	
V	2707.00	71.4	-13.0	58.4	74	-15.6	PK	
V	2707.00	62.6	-13.0	49.6	54	-4.5	AV	
H	2707.00	67.0	-13.0	54.0	74	-20.0	PK	
H	2707.00	58.0	-13.0	45.0	54	-9.0	AV	
V	3609.00	50.7	-11.0	39.7	74	-34.4	Pk	
V	3609.00	39.5	-11.0	28.5	54	-25.5	AV	
H	3609.00	53.1	-11.0	42.1	74	-31.9	Pk	
H	3609.00	42.3	-11.0	31.3	54	-22.7	AV	
V	4511.00	46.4	-6.7	39.7	74	-34.4	Pk	
V	4511.00	33.1	-6.7	26.4	54	-27.6	AV	
H	4511.00	45.4	-6.7	38.7	74	-35.3	Pk	
H	4511.00	33.1	-6.7	26.4	54	-27.6	AV	
Notes		Total CF = Antenna Factor + Cable Factor - AMP Gain						
		MT–262006/N, 7dBi 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	2743.51	49.2	-12.0	37.2	74	-36.8	Pk	
V	2743.51	37.3	-12.0	25.3	54	-28.7	AV	
H	2743.51	49.5	-12.0	37.5	74	-36.5	Pk	
H	2743.51	36.2	-12.0	24.2	54	-29.8	AV	
V	3658.0	47.3	-10.7	36.6	74	-37.4	Pk	
V	3658.0	35.6	-10.7	24.9	54	-29.1	AV	
H	3658.0	52.2	-10.7	41.5	74	-32.5	PK	
H	3658.0	42.9	-10.7	32.2	54	-21.9	AV	
Notes		Total CF = Antenna Factor + Cable Factor - AMP Gain						
		MT–262006/N, 7dBi 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	56.2	-12.0	44.2	74	-29.8	PK	
V	2783.0	46.1	-12.0	34.1	54	-19.9	AV	
H	2783.0	52.3	-12.0	40.3	74	-33.7	PK	
H	2783.0	42.2	-12.0	30.2	54	-23.8	AV	
V	3712.0	46.4	-10.0	36.4	74	-37.6	PK	
V	3712.0	34.1	-10.0	24.1	54	-29.9	AV	
H	3712.0	46.7	-10.0	36.7	74	-37.3	PK	
H	3712.0	34.2	-10.0	24.2	54	-29.8	AV	
Notes		Total CF = Antenna Factor + Cable Factor - AMP Gain						
		MT–262006/N, 7dBi High Channel. Average readings obtained with the 10Hz VBW						

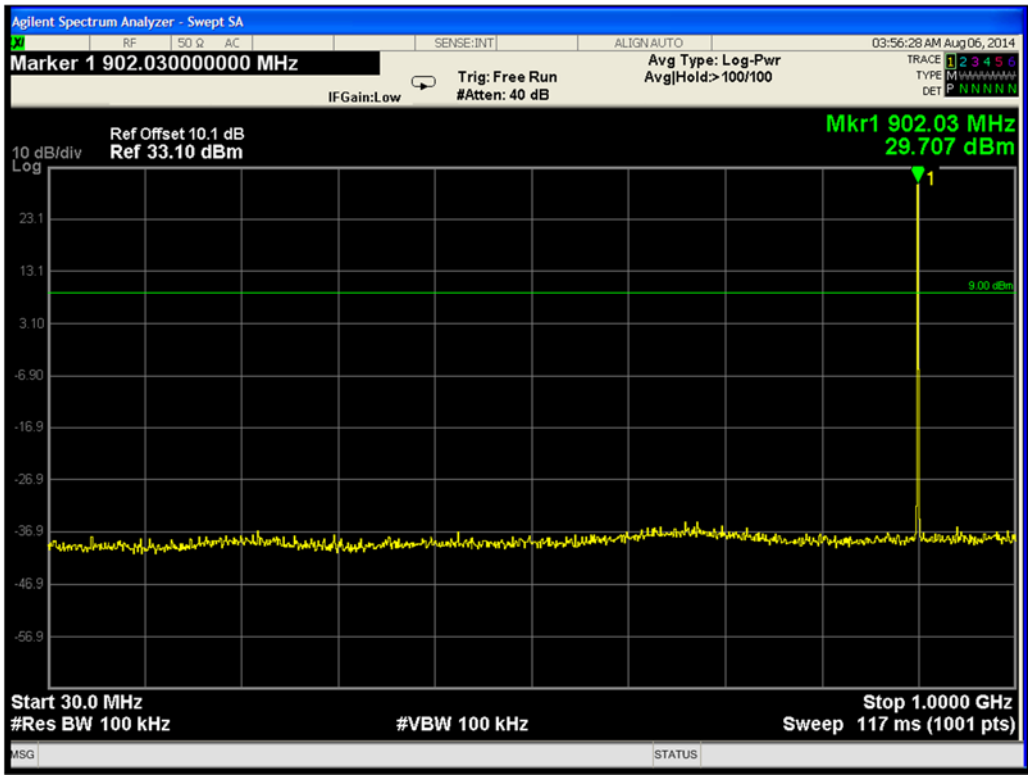
Test Set Up Photo

Pol.	Frequency (MHz)	Reading dBµV/m	Total CF dB	Net at 3 m dBµV/m.	Limit dBµV/m	Margin dB	Comments
V	2708.25	51.6	-13.0	38.6	74	-35.4	PK
V	2708.25	35.5	-13.0	22.5	54	-31.5	AV
H	2708.25	47.4	-13.0	34.4	74	-39.6	PK
H	2708.25	34.7	-13.0	21.7	54	-32.3	AV
V	3611.00	46.5	-11.0	35.5	74	-38.5	Pk
V	3611.00	34.2	-11.0	23.2	54	-30.8	AV
H	3611.00	46.9	-11.0	35.9	74	-38.1	Pk
H	3611.00	34.4	-11.0	23.4	54	-30.6	AV
V	4513.75	43.7	-6.7	37.0	74	-37.0	Pk
V	4513.75	31.5	-6.7	24.8	54	-29.2	AV
H	4513.75	44.5	-6.7	37.8	74	-36.2	Pk
H	4513.75	31.5	-6.7	24.8	54	-29.2	AV
Notes	Total CF = Antenna Factor + Cable Factor - AMP Gain						
	MT–262043, 16dBi 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	2743.50	47.4	-12.0	35.4	74	-38.6	Pk
V	2743.50	34.4	-12.0	22.4	54	-31.6	AV
H	2743.50	46.7	-12.0	34.7	74	-39.3	Pk
H	2743.50	34.3	-12.0	22.3	54	-31.7	AV
V	3658.0	46.1	-10.7	35.4	74	-38.6	Pk
V	3658.0	34.1	-10.7	23.4	54	-30.6	AV
H	3658.0	46.9	-10.7	36.2	74	-37.8	PK
H	3658.0	34.7	-10.7	24.0	54	-30.0	AV
V	4572.5	44.6	-5.2	39.4	74	-34.6	Pk
V	4572.5	32.3	-5.2	27.1	54	-26.9	AV
H	4572.5	44.3	-5.2	39.1	74	-34.9	Pk
H	4572.5	32.2	-5.2	27	54	-27	AV
Notes	Total CF = Antenna Factor + Cable Factor - AMP Gain						
	MT–262043, 16dBi Mid Channel. Average readings obtained with the 10Hz VBW						

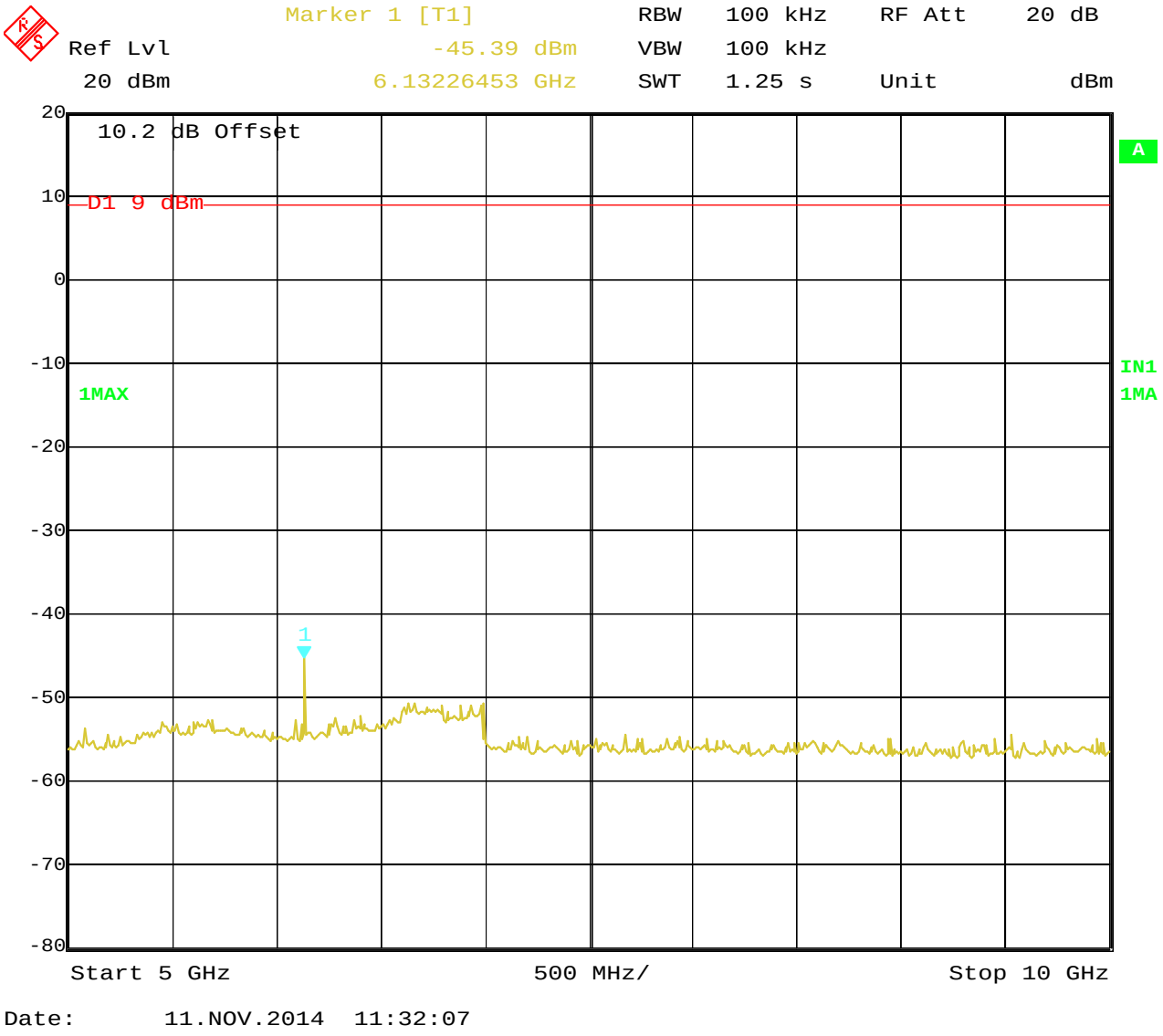
Pol.	Frequency (MHz)	Reading dBµV/m	Total CF dB	Net at 3 m dBµV/m.	Limit dBµV/m	Margin dB	Comments	
V	2783.0	46.1	-12.0	34.1	74	-39.9	PK	
V	2783.0	34.1	-12.0	22.1	54	-31.9	AV	
H	2783.0	47.1	-12.0	35.1	74	-38.9	PK	
H	2783.0	33.9	-12.0	21.9	54	-32.1	AV	
V	3710.8	46.4	-10.0	36.4	74	-37.6	PK	
V	3710.8	33.9	-10.0	23.9	54	-30.1	AV	
H	3710.8	46.2	-10.0	36.2	74	-37.8	PK	
H	3710.8	33.9	-10.0	23.9	54	-30.1	AV	
V	4638.515	43.6	-5.8	37.8	74	-36.2	PK	
V	4638.515	31.2	-5.8	25.4	54	-28.6	AV	
H	4638.515	43.7	-5.8	37.9	74	-36.1	PK	
H	4638.515	31.1	-5.8	25.3	54	-28.7	AV	
Notes		Total CF = Antenna Factor + Cable Factor - AMP Gain						
		MT–262043, 16dBi High Channel. Average readings obtained with the 10Hz VBW						

Test Set Up Photo

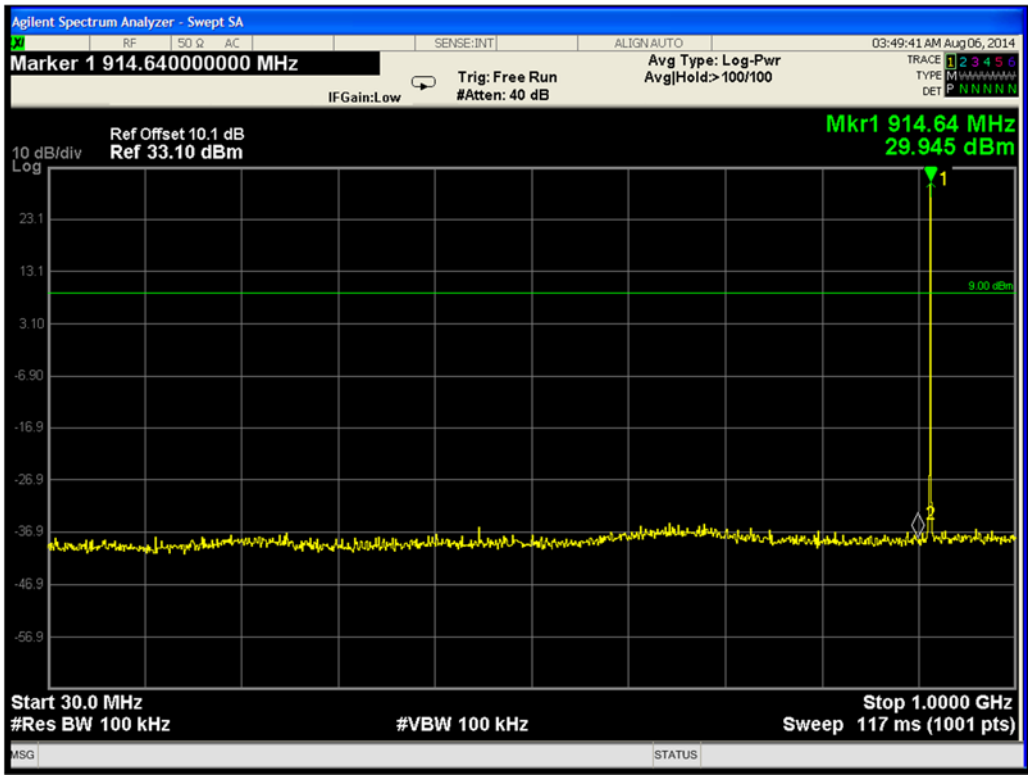


Conducted Spurious Emissions Low channel

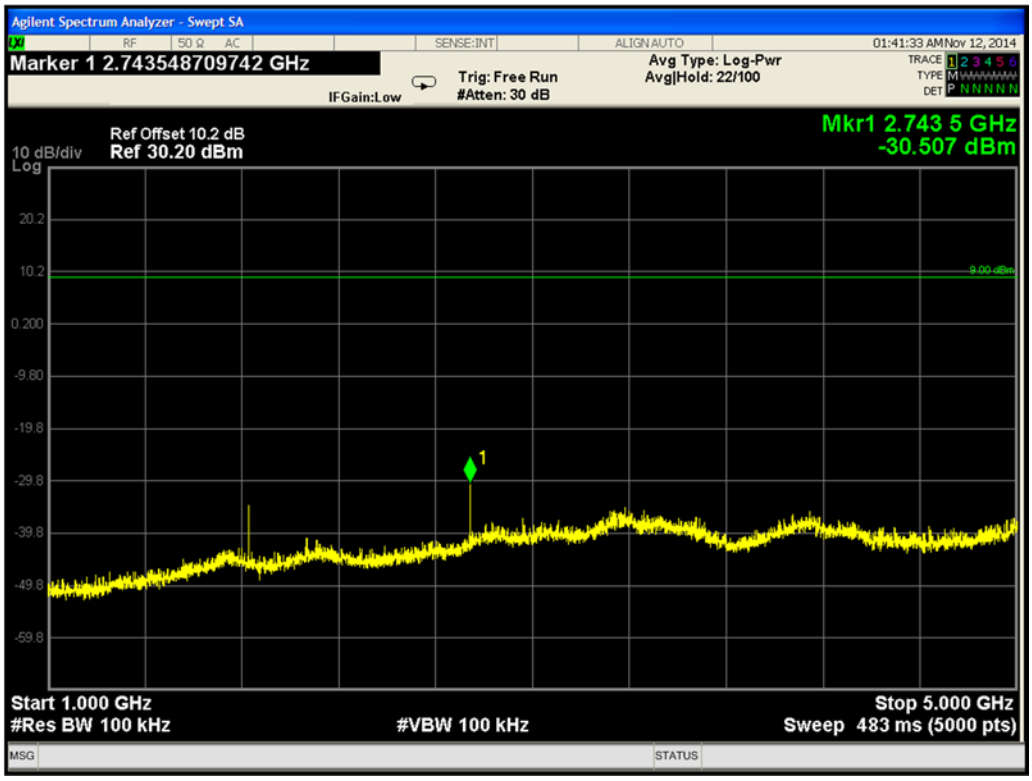
Conducted Spurious Emissions Low channel



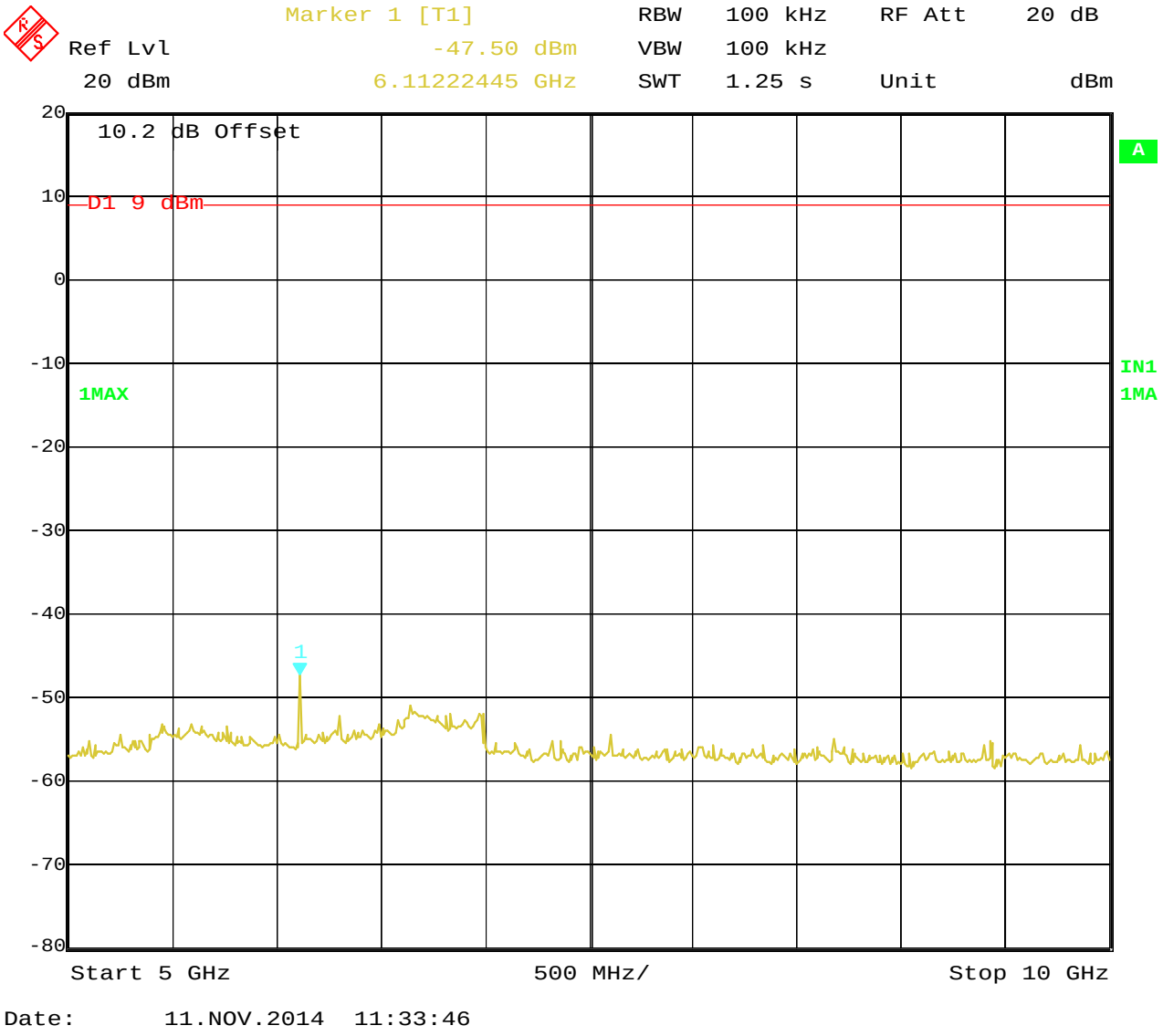
Conducted Spurious Emissions Low channel



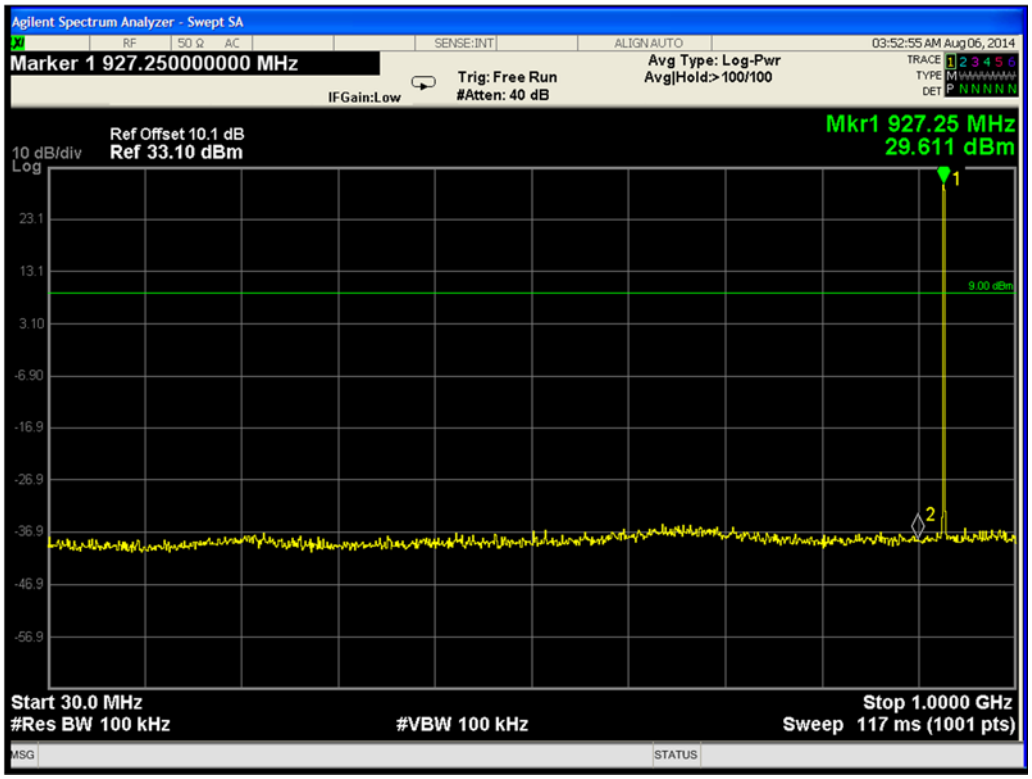
Conducted Spurious Emissions Mid channel



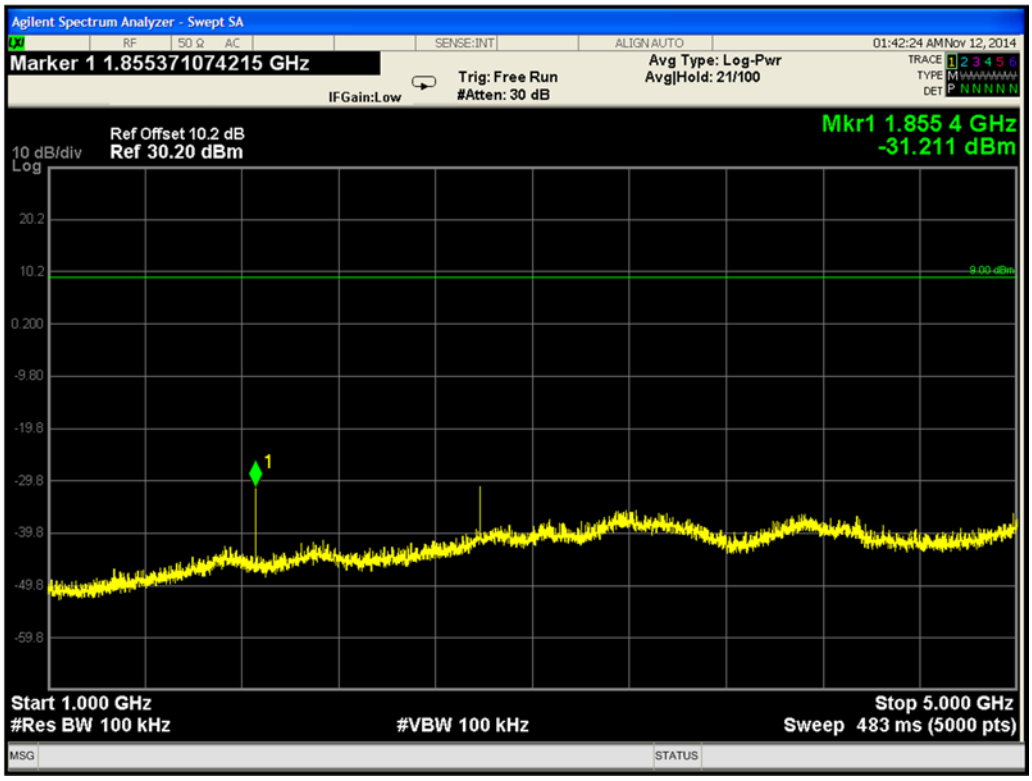
Conducted Spurious Emissions Mid channel



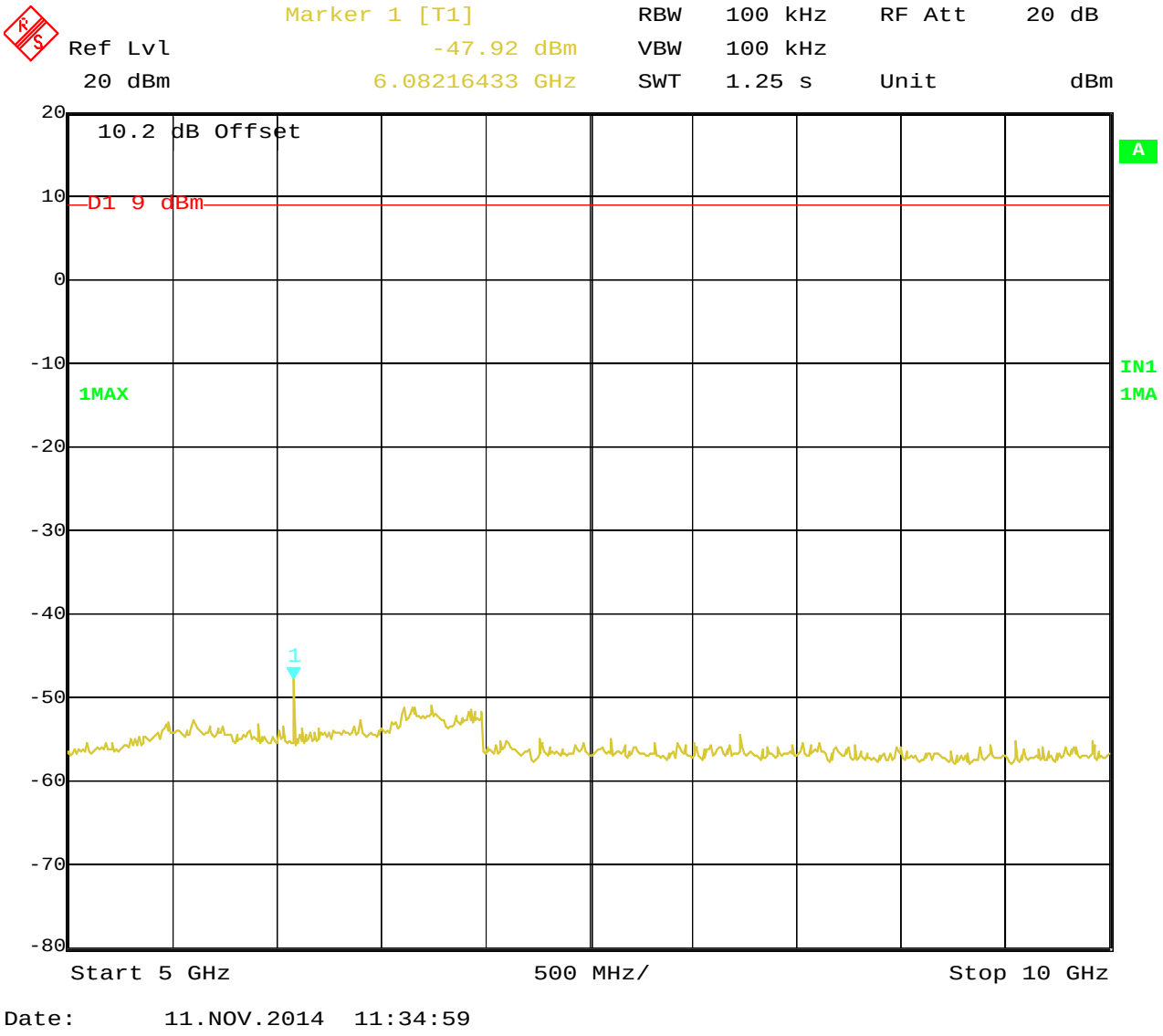
Conducted Spurious Emissions Mid channel



Conducted Spurious Emissions High 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 ☒ FCC Parts 2.1091 and 2.1093 ☐ OET 65	☒ MPE ☐ SAR Evaluation
Frequency Range:	☒ 902-928MHz	
Antenna Separation Distance	>100cm	
Antenna Gain (maximum)	17dBi (50.1 numeric gain)	
Maximum Output Power at antenna terminal	19dBm (79.4mW)	
Power Density	0.032 mW/cm^2	
GENERAL POPULATION/UNCONTROLLED LIMIT		
FCC/RSS102	0.610 mW/cm^2	

Note:	**The device doesn't transmitting simultaneously in multiple frequency bands or different FCC Parts. Frequency management is configured by the factory to comply with applicable radio regulations.** The highest RF output power of the unit was measured and recorded. According to §1.1310 of the FCC rules. The MPE was calculated at 120cm 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	10/2015	☒
Horn Antenna	AH Systems	SAS 571	1010	10/2015	☒
Loop Antenna	EMCO	ALR25M	1011	10/2015	☐
EMI Receiver	Rohde & Schwarz	ESIB 40	100235	10/2015	☐
EMI Receiver	Agilent	E4448A	1530975	10/2015	☒
Signal Analyzer	Agilent	N9000A	MY53031040	10/2015	☒
LISN	TESEQ	NNB51	1130	10/2015	☒
Harmonic/Flicker Source	Cal. Instruments	C4-5001iX	57162	10/2015	☐
Amplifier	AR	250W1000AM	14354	10/2015	☐
Amplifier	AR	25S1G4A	4003	10/2015	☐
Signal Generator	HP	8656A	2326A05125	10/2015	☐
Signal Generator	Agilent	E8257D	160895	10/2015	☐
Field Probe	AR	FL7006	25019	10/2015	☐
Field Monitor	AR	FM2000	14292	10/2015	☐
AC CDN	Schaffner	M316,	21937	10/2015	☐
AC CDN	Teseq	M016,	26131	10/2015	☐
ISN	Teseq	T4	25652	10/2015	☐
Current Injection Coil	A.H. Systems	ICP-200/521	149	10/2015	☐
RF Conducted System	TESEQ	NSG 4070-75	1141	10/2015	☐
ESD Generator	KeyTek	MZ-15/EC	609325	10/2015	☐
EFT/Surge Generator	ThermoFisher	EMC Pro Plus	1146	10/2015	☐
EMF Meter	NARDA	ELT400	1139	10/2015	☐
Absorbing Clamp	Rhode & Schwarz	MDS-21	1001	10/2015	☐
EMF Test Generator	FCC	F-1000-4-8-G	9940	10/2015	☐
AC Power System	Titan	MAC-03	6619921	10/2015	☐
EMC Software	ETS-Lindgren	TILE 6		10/2015	☒
Oscilloscope	Tektronix	DPO4104	1550	03/2015	☐

6.0 Report revision history

Revision Level	Date	Report Number	Notes
0	11/11/2014	RE1407019-1	Original Issue
1	01/15/2015	RE1407019-3	Class II PC – new Antenna

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	**Toll RFID READER**
MODEL NUMBER(S)	**6204**
TEST REPORT NUMBER	**RE1407019-3**
DATE OF ISSUE	**January 16, 2015**

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: Class II Permissive Change

NVLAP®
NVLAP Lab Code 200033-0

Yuriy Litvinov

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Lead EMC Engineer