FCC PART 15C TEST REPORT

TESTING
CNAS L3572

Issued to

CONVERGENCE SYSTEMS LIMITED

For

RFID Reader

Model Name:	CS469-2
Trade Name:	CSL
Brand Name:	CSL
FCC ID:	UB4CS469C1GEN2
Standard:	47 CFR Part 15 Subpart C
Test date:	2013-11-20 to 2013-12-17
Issue date:	2013-12-31

by

Shenzhen Morlab Communications Technology Co., Ltd.
FL.3, Building A, FeiYang Science Park, No.8 LongChang Road,Block 67, BaoAn District,
ShenZhen, GuangDong Province, P. R. China 518101

Tested by	Nie Quan	*Approved by*	Zeng Dexin	*Reviewed by*	Peng Huarui
	Nie Quan (Test Engineer)		Zeng Dexin (Chief Engineer)		Peng Huarui (Dept. Manager)
Date	2013.12.31	*Date*	2013.12.31	*Date*	2013.12.31

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Change History		
Issue	Date	Reason for change
1.0	December 31, 2013	First edition

1. GENERAL INFORMATION

1.1. EUT Description

EUT Type.....:	RFID Reader
Serial No. .....:	(n.a, marked #1 by test site)
Hardware Version.....:	3.0
Software Version.....:	1.5.20
Applicant.....:	CONVERGENCE SYSTEMS LIMITED 20/F, Chung Nam Building, No.1 Lockhart Road, Wanchai, Hong Kong
Manufacturer .....:	DongGuan DongHongXingYe Electronics Science and Technology Limited 1 Jianxiang Street, Hanxishui, Chashan Town Dongguan, Guangdong, China
Frequency Range.....:	The frequency range used is 902MHz - 928MHz (50 channels, at intervals of 500kHz);
Modulation Type.....:	FHSS
Data Type .....:	DSB-ASK, PR-ASK
Antenna Type .....:	SMA Antenna
Antenna Gain.....:	5.0dBi

NOTE:

1. The EUT is a RFID Reader, it contains Radio Module operating at 900MHz ISM band; the frequencies allocated for the Radio Module is F(MHz)=902.25+0.5*n (1<=n<=50). The lowest, middle, highest channel numbers of the Radio Module used and tested in this report are separately 1 (902.75MHz), 26 (915.25MHz) and 50 (927.25MHz).

2. For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

3. EUT specification and Test Model:

Profile	Tari (µs)	Reader to Tag Forward Link Modulation	Pulse Width (µs)	Tag to Reader Link Frequency (kHz)	Tag to Reader Reverse Modulation
0	25.00	PR-ASK	12.50	120	Miller, M=4
1	12.50	DSB-ASK	6.25	160	Miller, M=2
2	25.00	PR-ASK	12.50	250	Miller, M=4
3	25.00	PR-ASK	12.50	300	Miller, M=4
4	6.25	DSB-ASK	3.13	400	FM0
5	25.00	PR-ASK	12.50	250	Miller, M=2

*:We just tested Profile 1, profile 2 and profile 4 for the different data mode in this report.

4. The EUT has 4 antenna ports, we test them all but only record the worst test case in this report.

1.2. Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart C (900 MHz ISM Band Frequency Hopping Spread Spectrum Transmitter) for the EUT FCC ID Certification:

No.	Identity	Document Title
1	47 CFR Part 15 (10-1-12 Edition)	Radio Frequency Devices

Test detailed items/section required by FCC rules and results are as below:

No.	Section in CFR 47	Description	Result
1	15.203	Antenna Requirement	**PASS**
2	15.247(a)	Number of Hopping Frequency	**PASS**
3	15.247(b)	Peak Output Power	**PASS**
4	15.247(a)	20dB Bandwidth	**PASS**
5	15.247(a)	Carrier Frequency Separation	**PASS**
6	15.247(a)	Time of Occupancy (Dwell time)	**PASS**
7	15.247(d)	Conducted Spurious Emission and Band Edge	**PASS**
8	15.207	Conducted Emission	**PASS**
9	15.209 15.247(d)	Radiated Emission	**PASS**
10	15.247(i),1.1307& 2.1091	RF exposure evaluation	**PASS**

NOTE:

The tests were performed according to the method of measurements prescribed in DA-00-705.

1.3. Facilities and Accreditations

1.3.1. Facilities

Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L3572.

All measurement facilities used to collect the measurement data are located at FL.1, Building A, FeiYang Science Park, Block 67, BaoAn District, Shenzhen, 518101 P. R. China. The test site is constructed in conformance with the requirements of ANSI C63.10 2009, ANSI C63.4 2009 and CISPR Publication 22; the FCC registration number is 695796.

The IC registration number is 7183A-2.

1.3.2. Test Environment Conditions

During the measurement, the environmental conditions were within the listed ranges:

Temperature (°C):	15 - 35
Relative Humidity (%):	30 -60
Atmospheric Pressure (kPa):	86-106

2. 47 CFR PART 15C REQUIREMENTS

2.1. Antenna requirement

2.1.1. Applicable Standard

According to FCC 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

2.1.2. Result: Compliant

The maximum gain of antenna was defined by manufacturer. The max gain is 5dBi.The antenna type is SMA Antenna. For more info, please refer to the user manual.

2.2. Number of Hopping Frequency

2.2.1. Requirement

According to FCC section 15.247(a)(1)(i), frequency hopping systems operating in the 902MHz to 928MHz bands shall use at least 50 hopping frequencies if the 20dB bandwidth of the hopping channel is less than 250KHz; or at least 25 hopping frequencies if the 20dB bandwidth of the hopping channel is 250KHz or greater.

2.2.2. Test Description

A. Test Setup:

The RFID Reader Module of the EUT, which is powered by the AC adapter, is coupled to the Spectrum Analyzer (SA) with Attenuators the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. During the measurement, the RFID Reader Module of the EUT is activated by the PC via Lan port.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer	Agilent	E7405A	US44210471	2013.05.12	2014.05.11
Attenuator	Resnet	10dB	(n.a.)	2013.05.12	2014.05.11

2.2.3. Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:
Span = the frequency band of operation
RBW ≥ 1% of the span
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
Allow the trace to stabilize

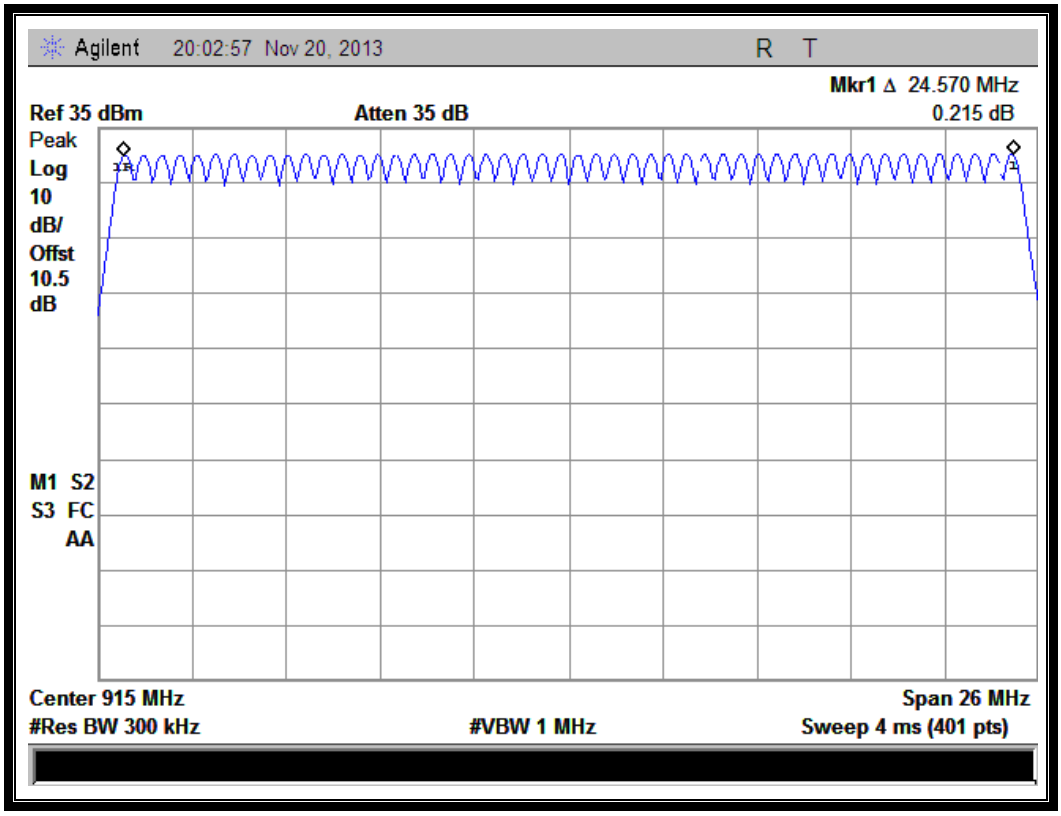
2.2.4. Test Result

The RFID Reader Module of the EUT operates at hopping-on test mode; the frequencies number employed is counted to verify the Module's using the number of hopping frequency.

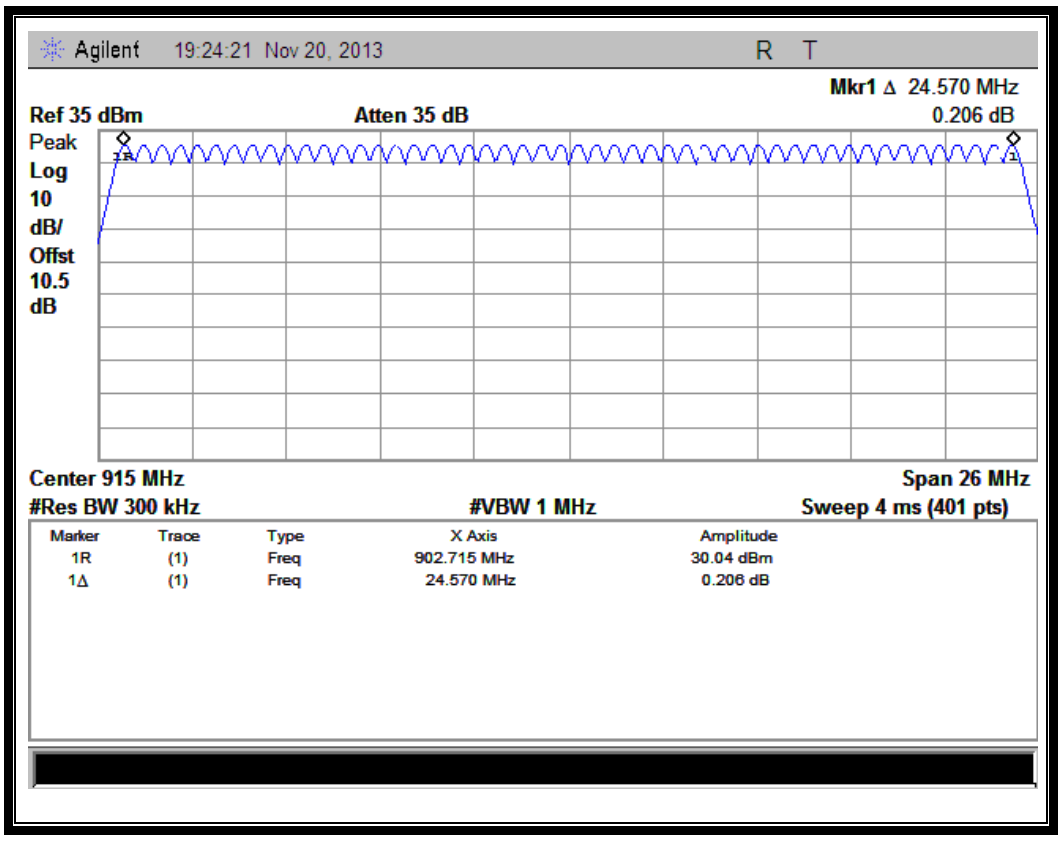
A. Test Verdict:

Profile	Frequency Block (MHz)	Measured Channel Numbers	Min. Limit	Refer to Plot	Verdict
1	902 - 928	50	50	Plot A	PASS
2	902 - 928	50	50	Plot B	PASS
4	902 - 928	50	25	Plot C	PASS

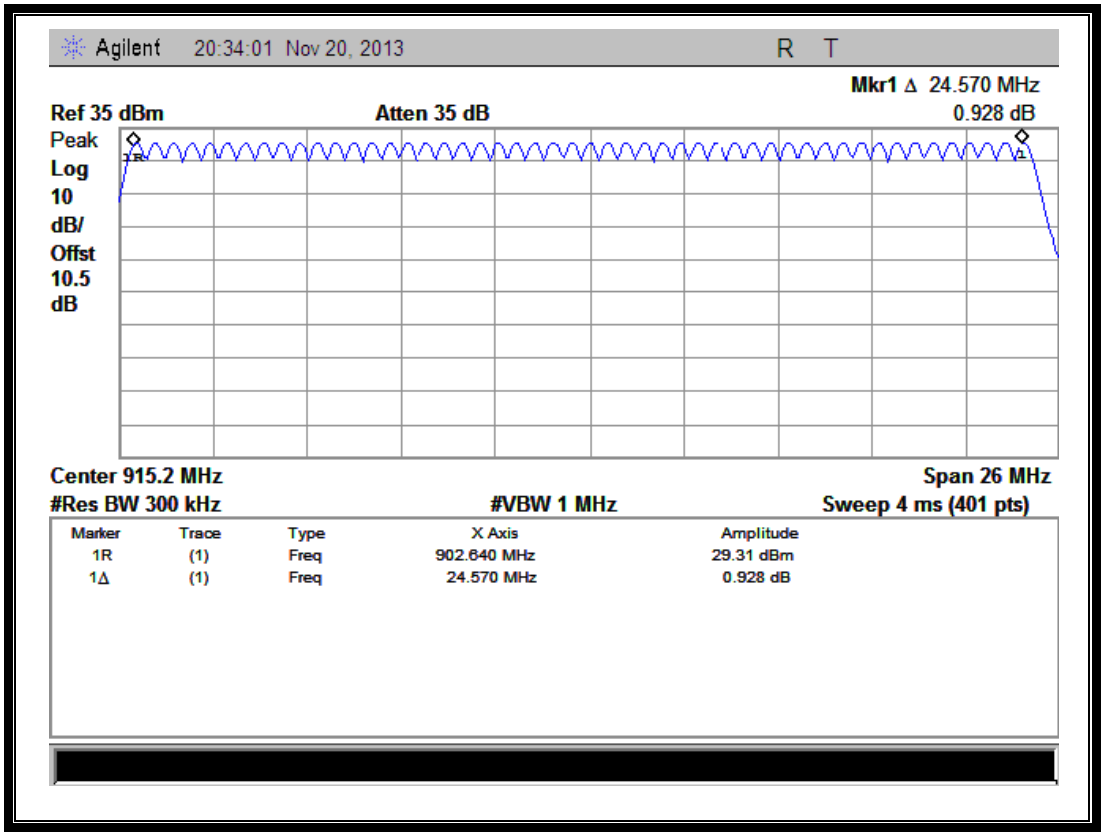
B. Test Plots:



(Plot A: Profile 1 902MHz to 928MHz)



(Plot B: Profile 2 902MHz to 928MHz)



(Plot C: Profile 4 902MHz to 928MHz)

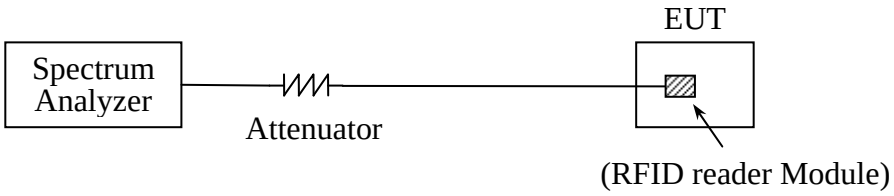
2.3. Peak Output Power

2.3.1. Requirement

According to FCC section 15.247(b)(2), for frequency hopping systems that operates in the 902MHz to 928MHz band employing at least 10 hopping channels, the maximum peak output power of the intentional radiator shall not exceed 1Watt. and 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels.

2.3.2. Test Description

A. Test Setup:



The RFID Reader Module of the EUT, which is powered by the AC adapter, is coupled to the Spectrum Analyzer (SA) with Attenuators the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. During the measurement, the RFID Reader Module of the EUT is activated by the PC via Lan port.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer	Agilent	E7405A	US44210471	2013.05.12	2014.05.11
Attenuator	Resnet	10dB	(n.a.)	2013.05.12	2014.05.11

2.3.3. Test Result

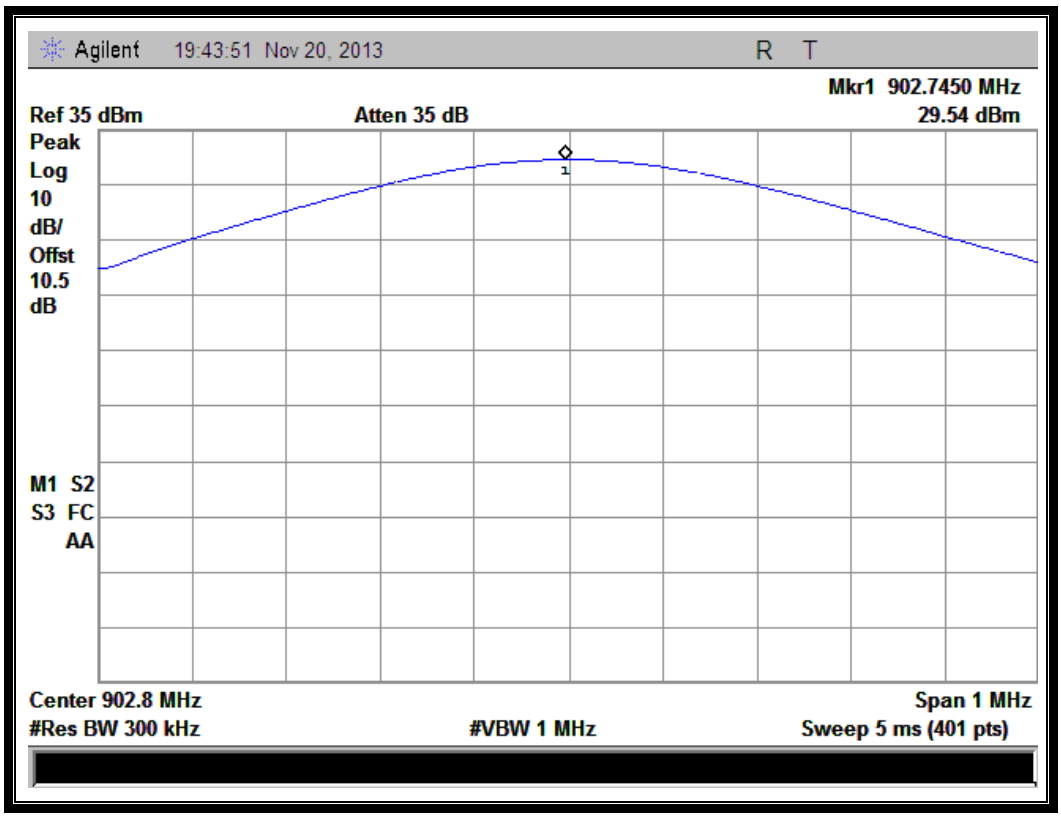
The RFID Reader Module operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the Module.

A. Test Verdict:

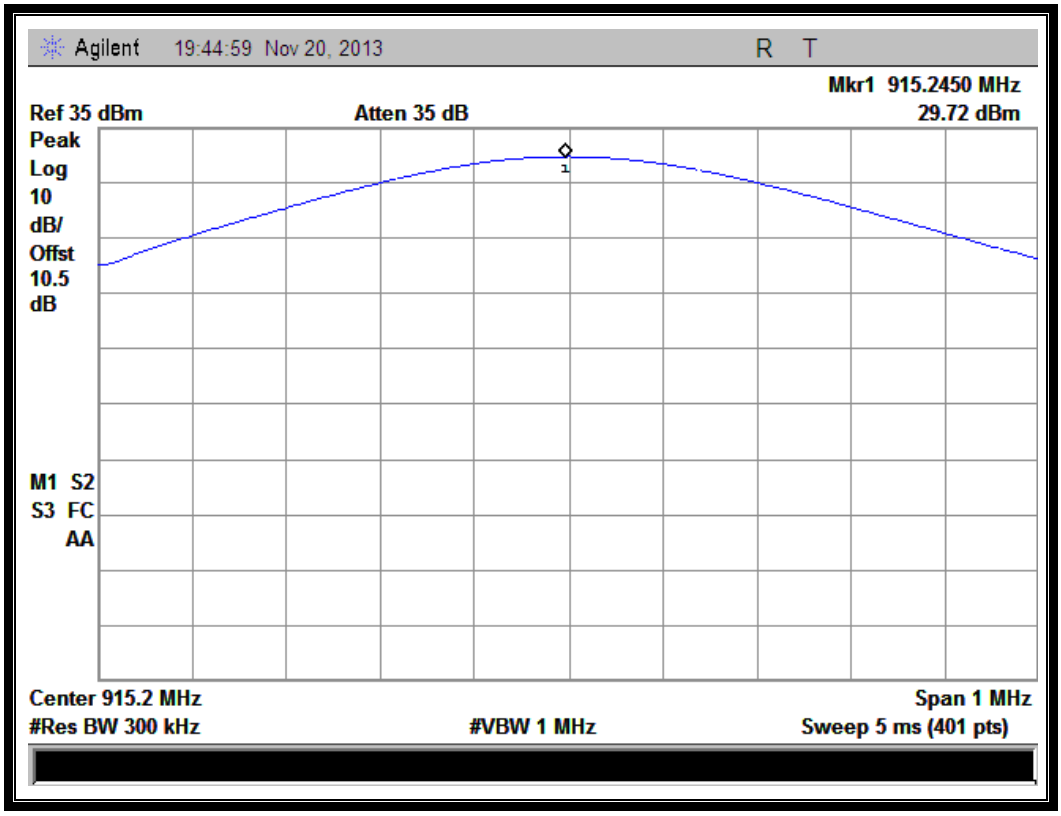
Profile	Channel	Frequency (MHz)	Measured Output Peak Power			Limit (W)	Verdict
			dBm	W	Refer to Plot		
1	1	902.75	29.54	0.899498	Plot A	1	PASS
	26	915.25	29.72	0.937562	Plot B		PASS

Profile	Channel	Frequency (MHz)	Measured Output Peak Power			Limit (W)	Verdict
			dBm	W	Refer to Plot		
	50	927.25	29.76	0.946237	Plot C		PASS
2	1	902.75	29.44	0.879023	Plot D	1	PASS
	26	915.25	29.84	0.963829	Plot E		PASS
	50	927.25	29.85	0.966051	Plot F		PASS
4	1	902.75	29.47	0.885116	Plot G	1	PASS
	26	915.25	29.66	0.924698	Plot H		PASS
	50	927.25	29.77	0.948418	Plot I		PASS

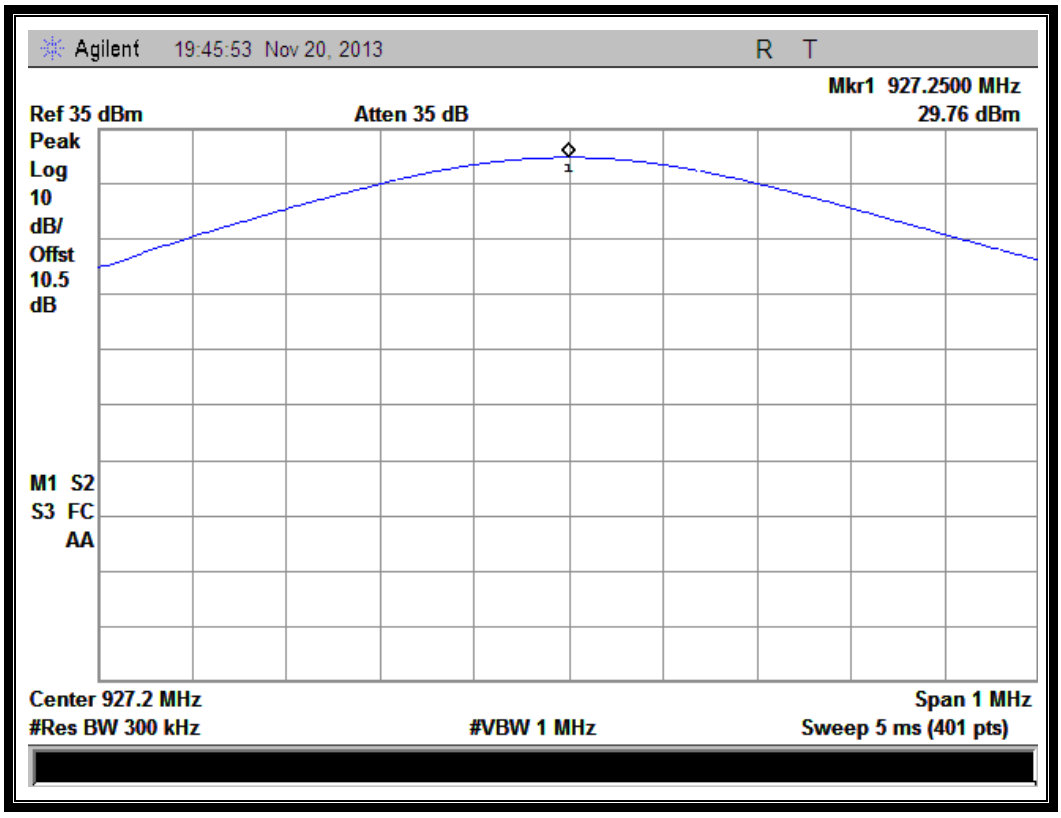
B. Test Plot:



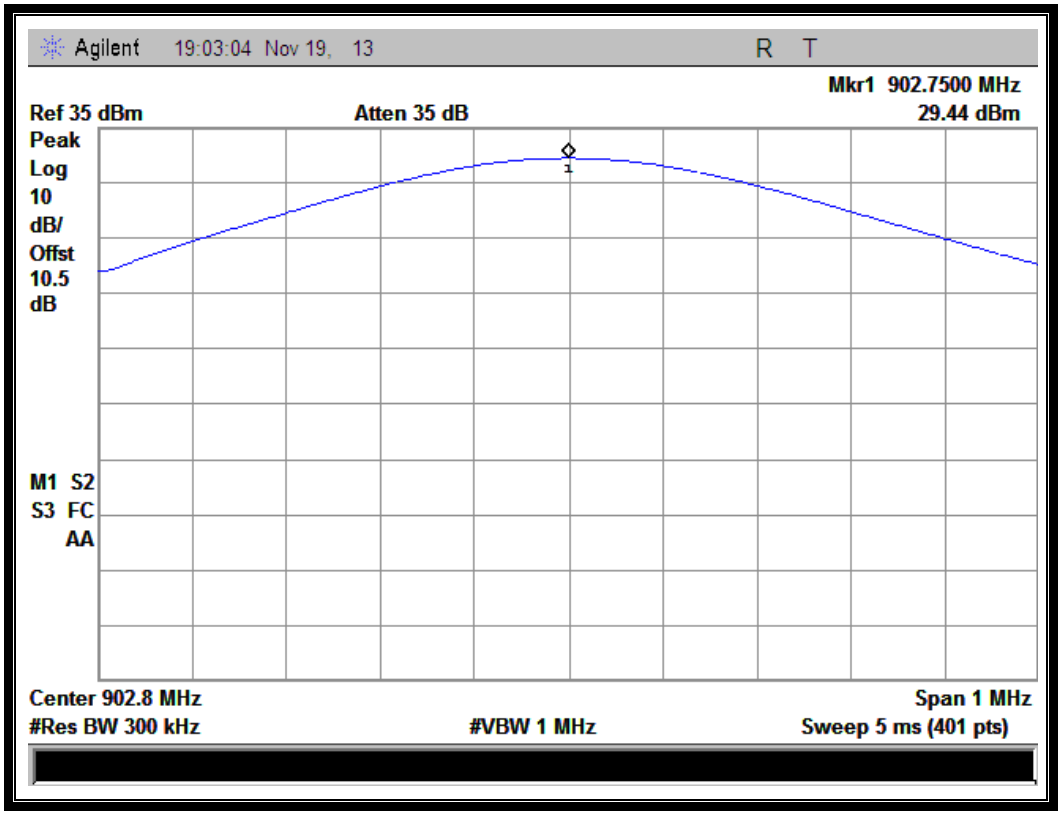
(Plot A: Profile 1 Channel = 1)



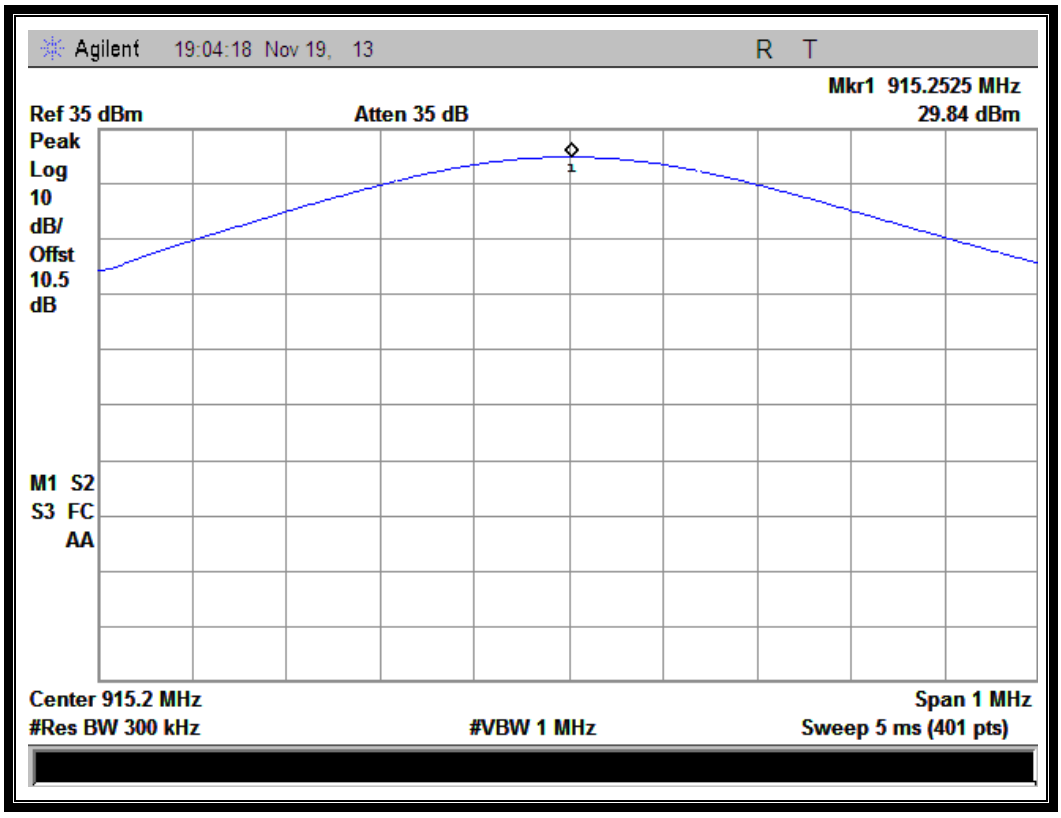
(Plot B: Profile 1 Channel = 26)



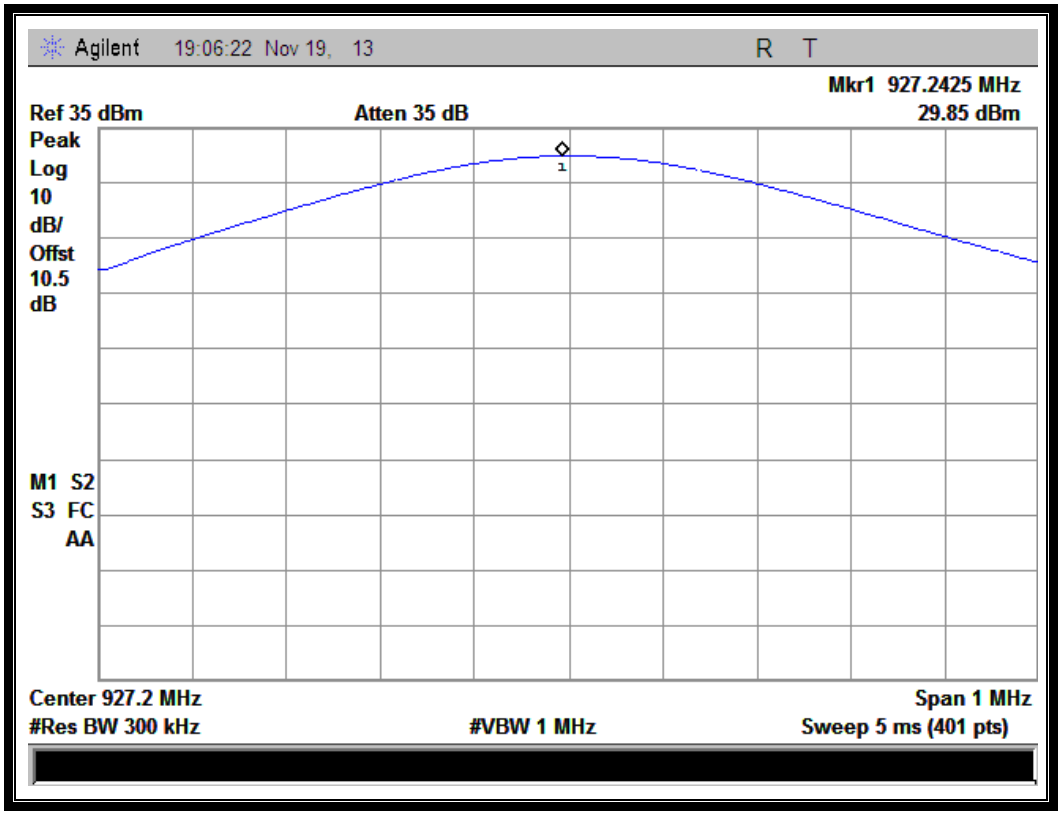
(Plot C: Profile 1 Channel = 50)



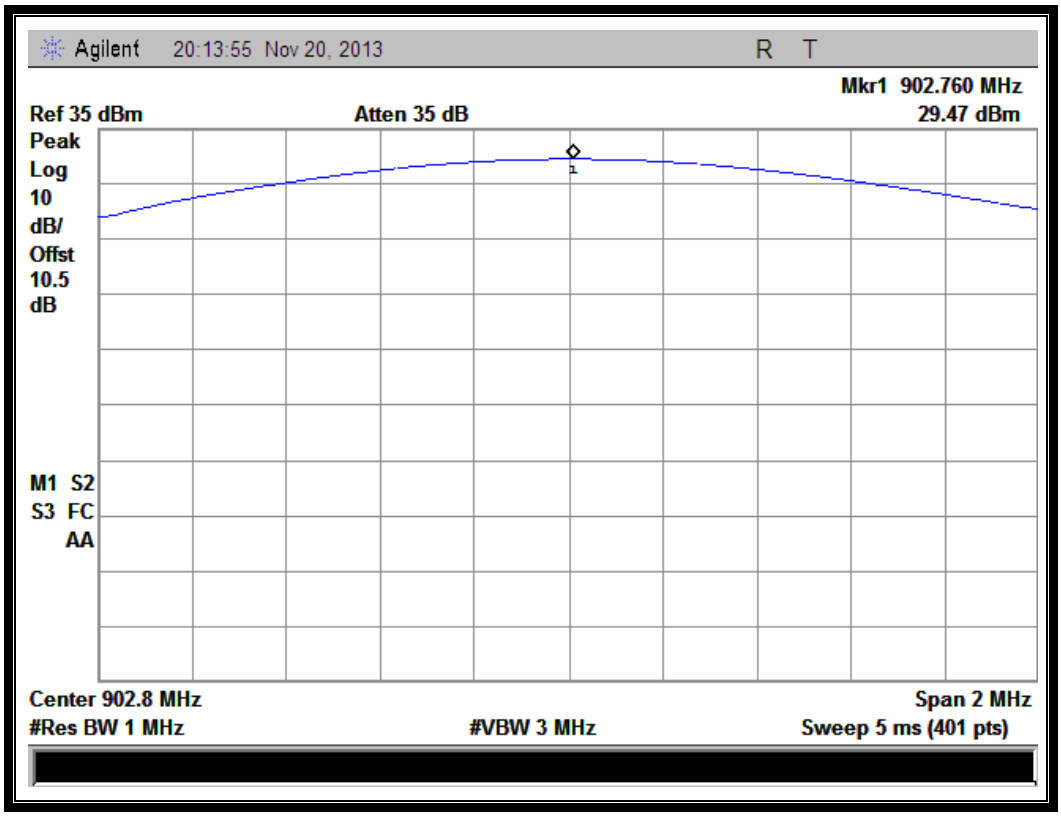
(Plot D: Profile 2 Channel = 1)



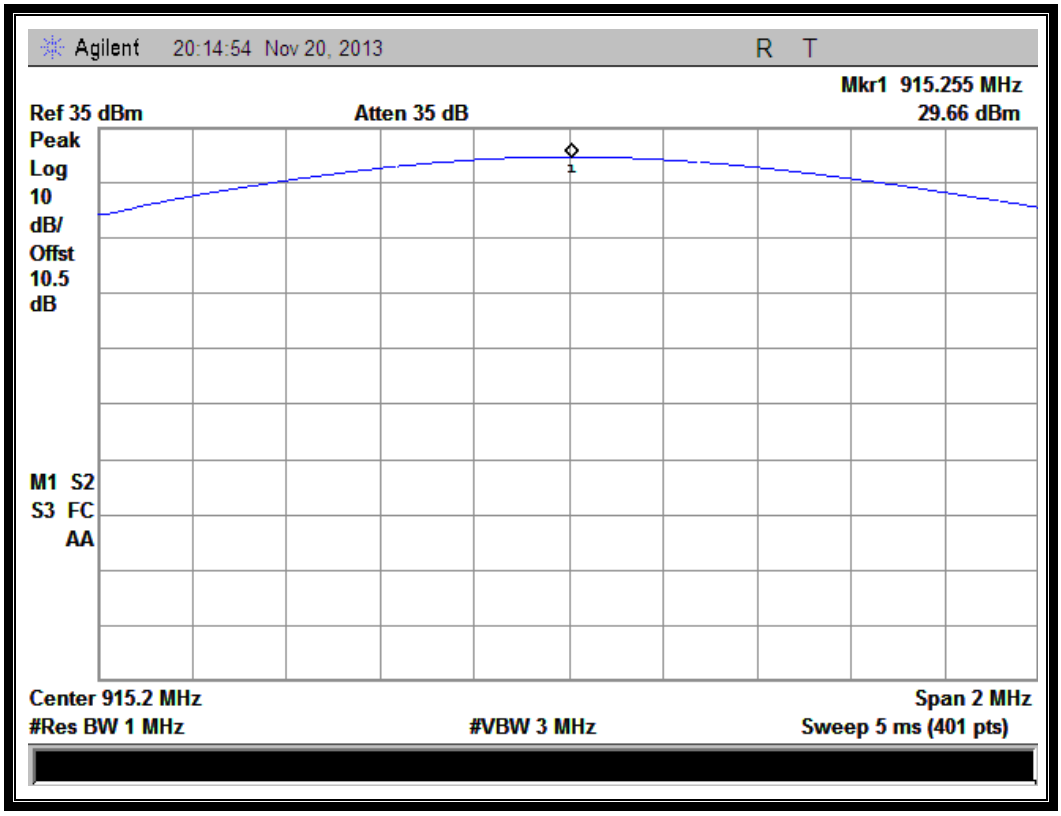
(Plot E: Profile 2 Channel = 26)



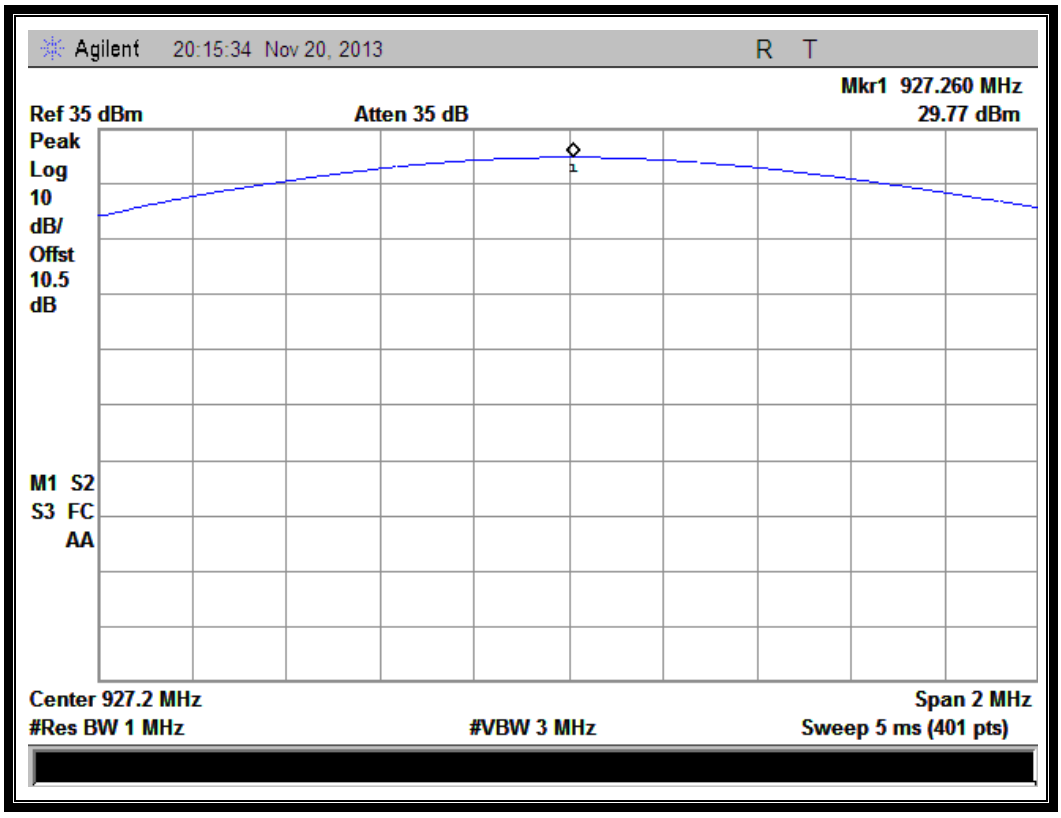
(Plot F: Profile 2 Channel = 50)



(Plot G: Profile 4 Channel = 1)



(Plot H: Profile 4 Channel = 26)



(Plot I: Profile 4 Channel = 50)

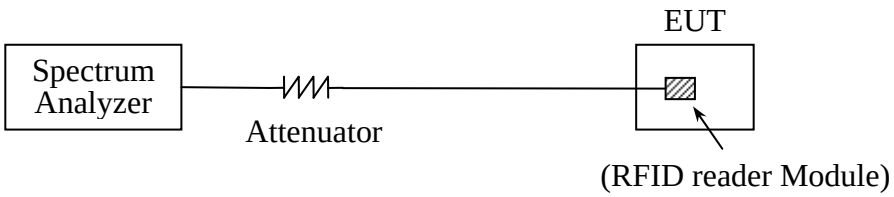
2.4. 20dB Bandwidth

2.4.1. Definition

According to FCC §15.247(a)(1), the 20dB bandwidth is known as the 99% emission bandwidth, or 20dB bandwidth (10*log1% = 20dB) taking the total RF output power.

2.4.2. Test Description

A. Test Setup:



The RFID Reader Module of the EUT, which is powered by the AC adapter, is coupled to the Spectrum Analyzer (SA) with Attenuators the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. During the measurement, the RFID Reader Module of the EUT is activated by the PC via Lan port.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer	Agilent	E7405A	US44210471	2013.05.12	2014.05.11
Attenuator	Resnet	10dB	(n.a.)	2013.05.12	2014.05.11

2.4.3. Test Procedure

Use the following spectrum analyzer settings:
Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
RBW ≥ 1% of the 20 dB bandwidth
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

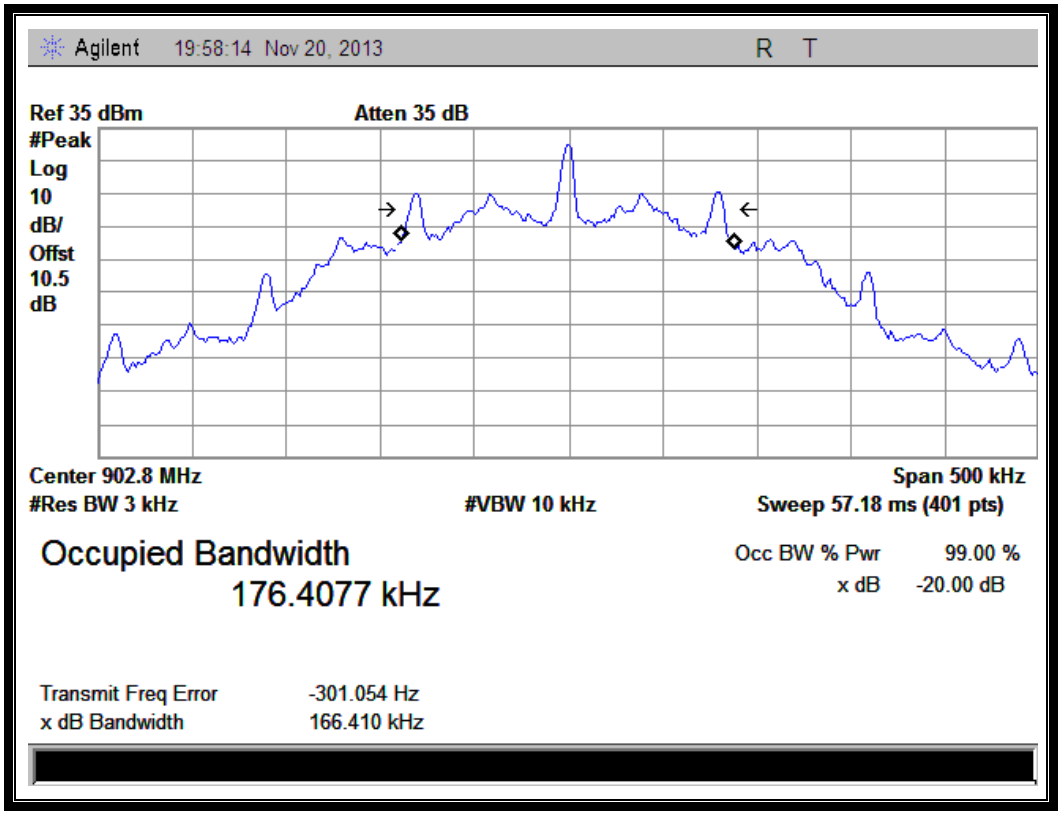
2.4.4. Test Result

The RFID Reader Module operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to record the 20dB bandwidth of the Module.

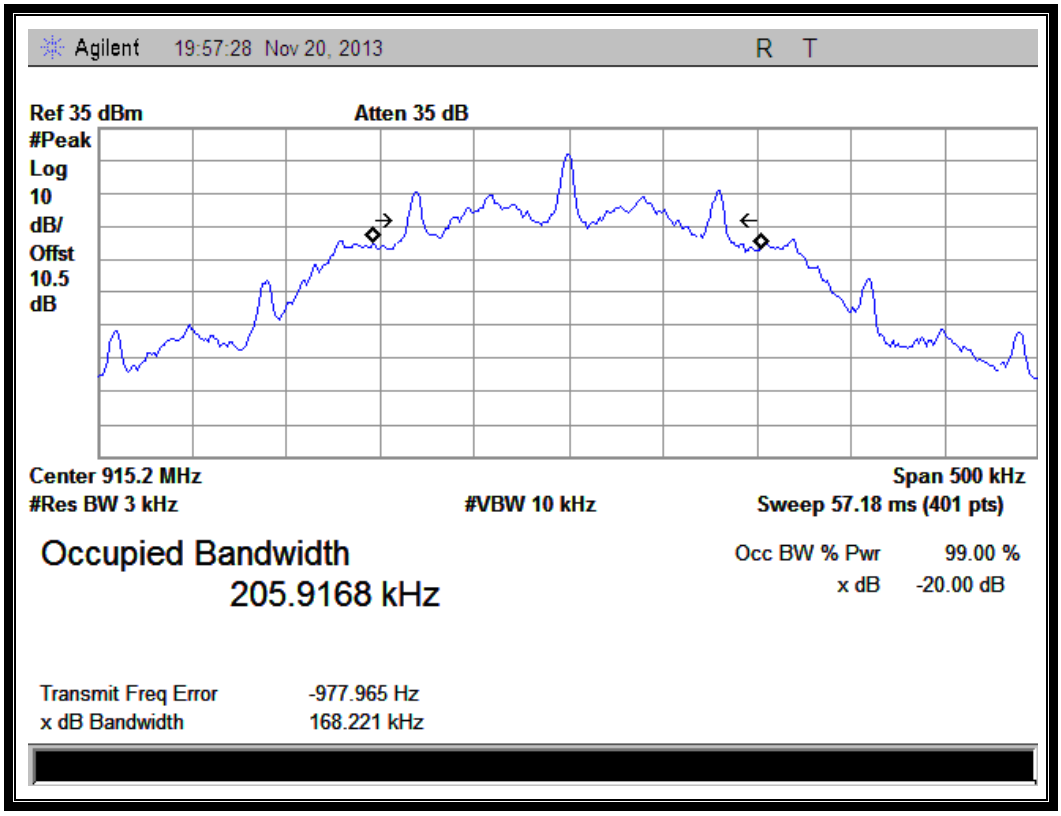
A. Test Verdict:

Profile	Channel	Frequency (MHz)	20dB Bandwidth (KHz)	Refer to Plot
1	1	902.75	166.410	Plot A
	26	915.25	168.221	Plot B
	50	927.25	168.194	Plot C
2	1	902.75	86.688	Plot D
	26	915.25	85.586	Plot E
	50	927.25	85.754	Plot F
4	1	902.75	437.030	Plot G
	26	915.25	436.103	Plot H
	50	927.25	436.882	Plot I

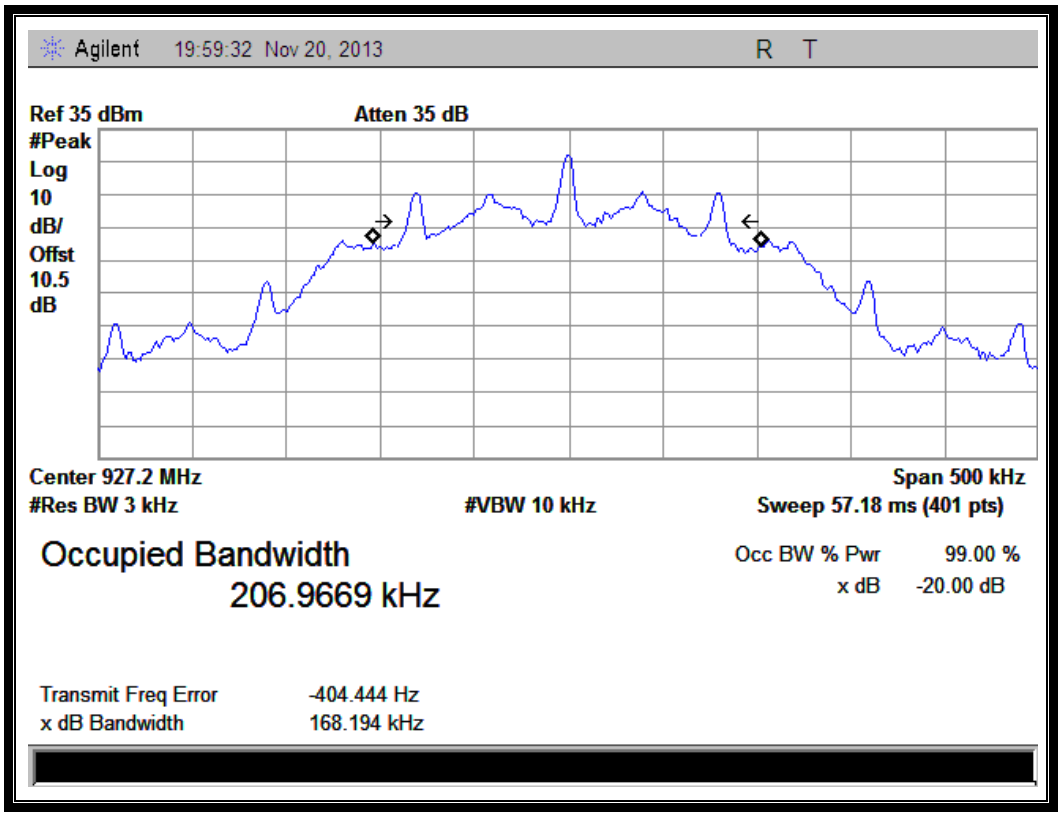
B. Test Plots:



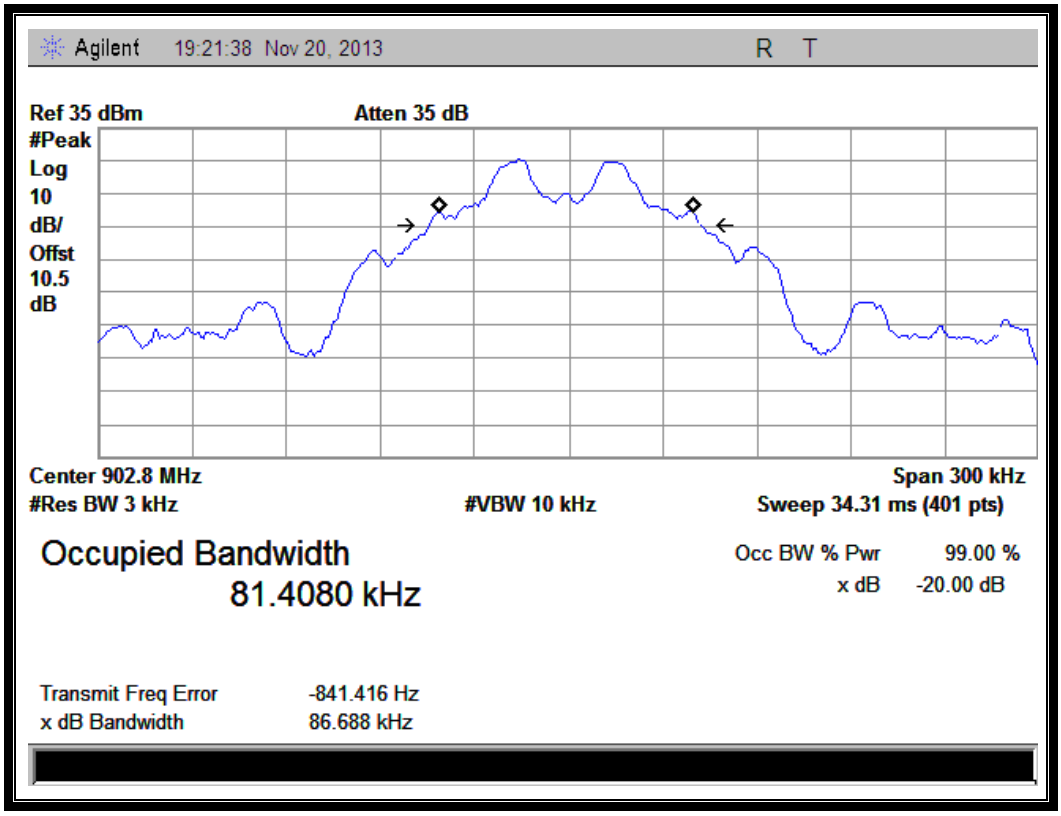
(Plot A: Profile 1 Channel = 1)



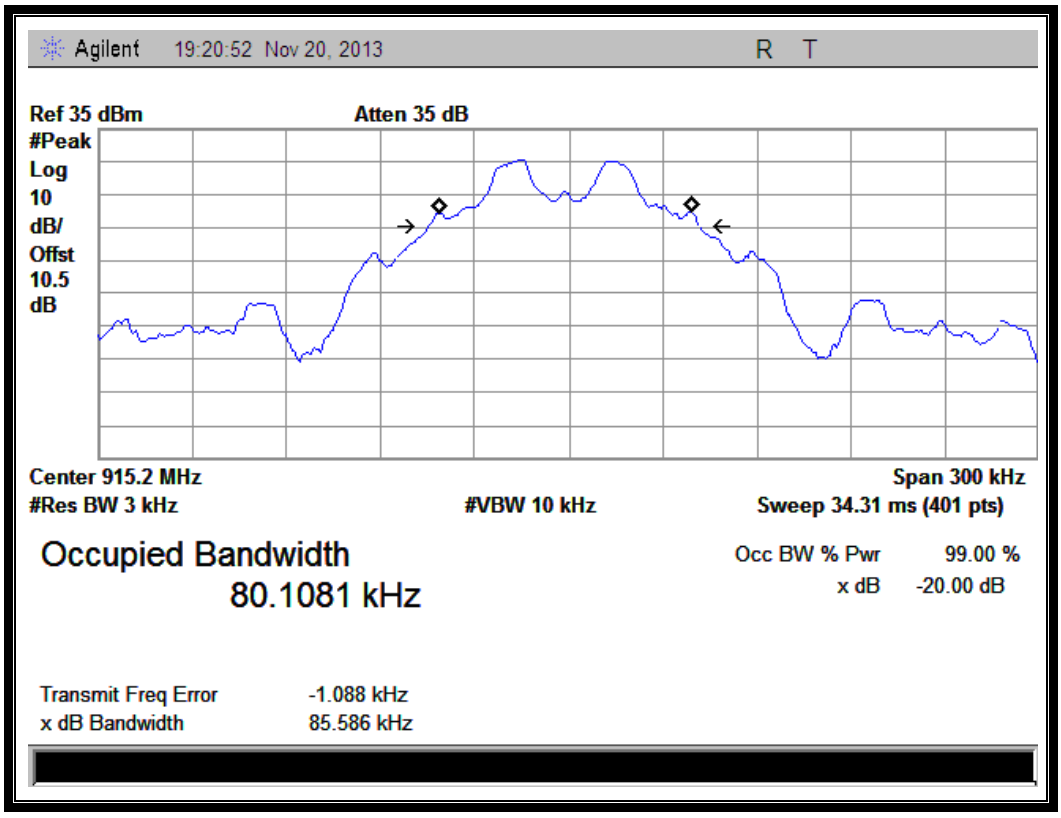
(Plot B: Profile 1 Channel = 26)



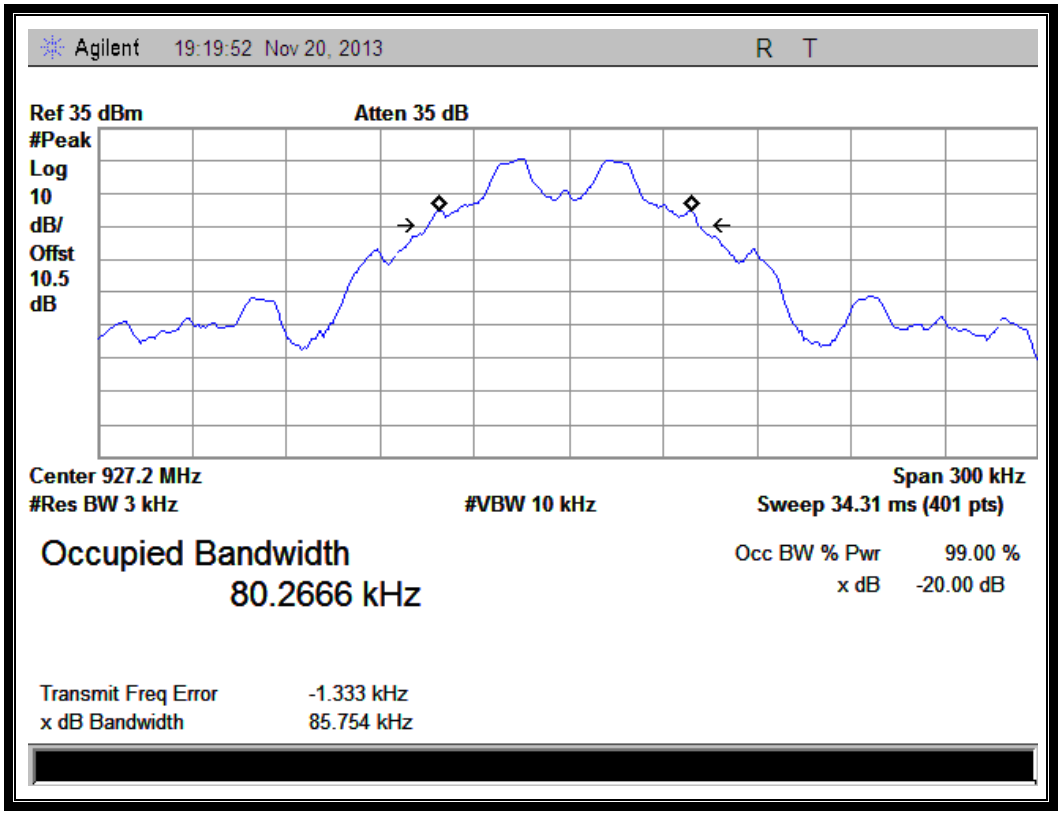
(Plot C: Profile 1 Channel = 50)



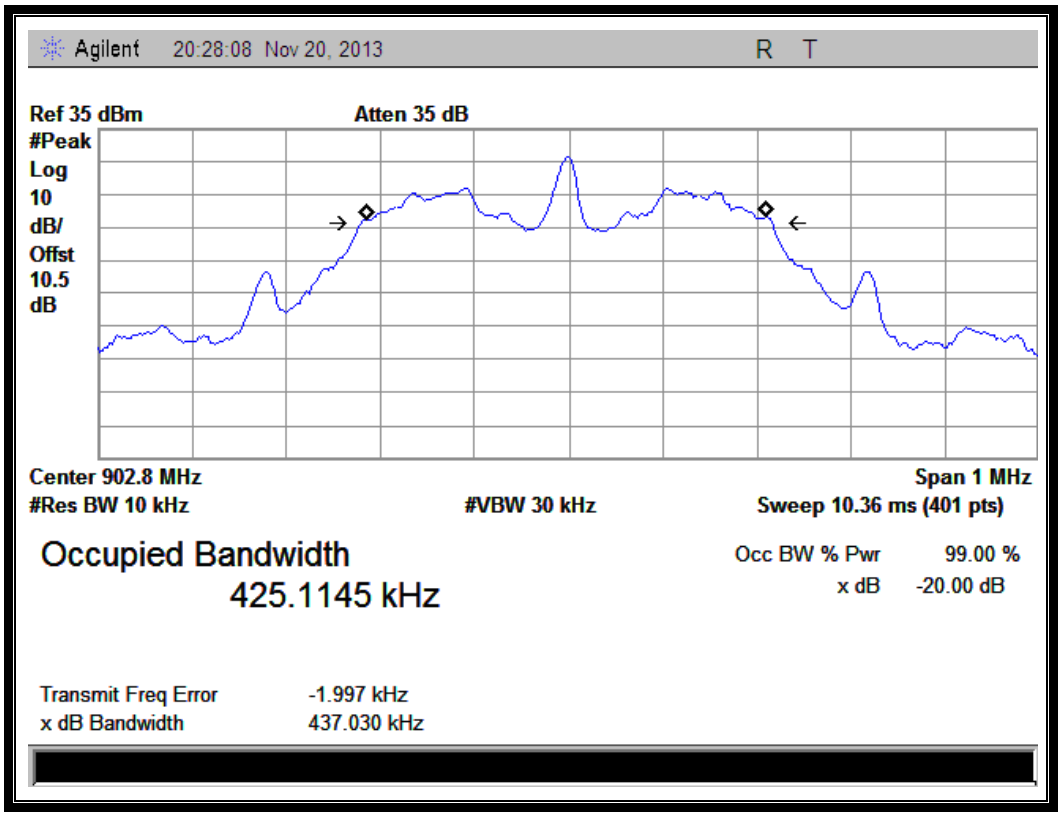
(Plot D: Profile 2 Channel = 1)



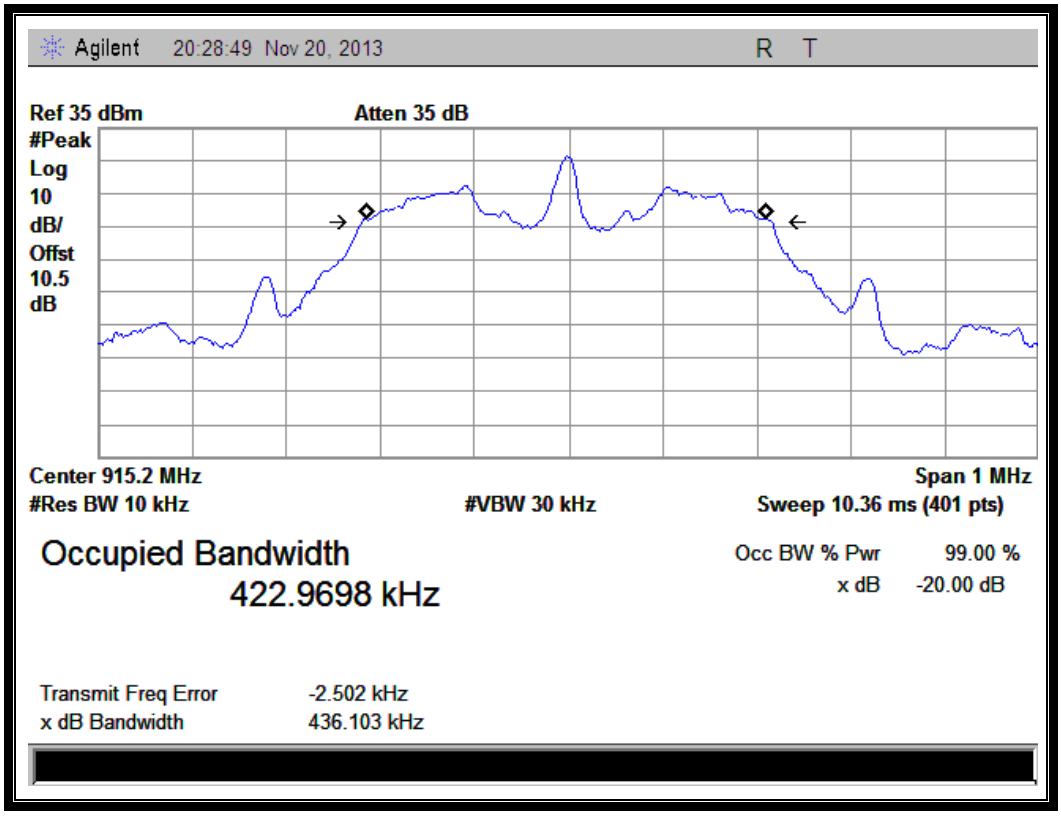
(Plot E: Profile 2 Channel = 26)



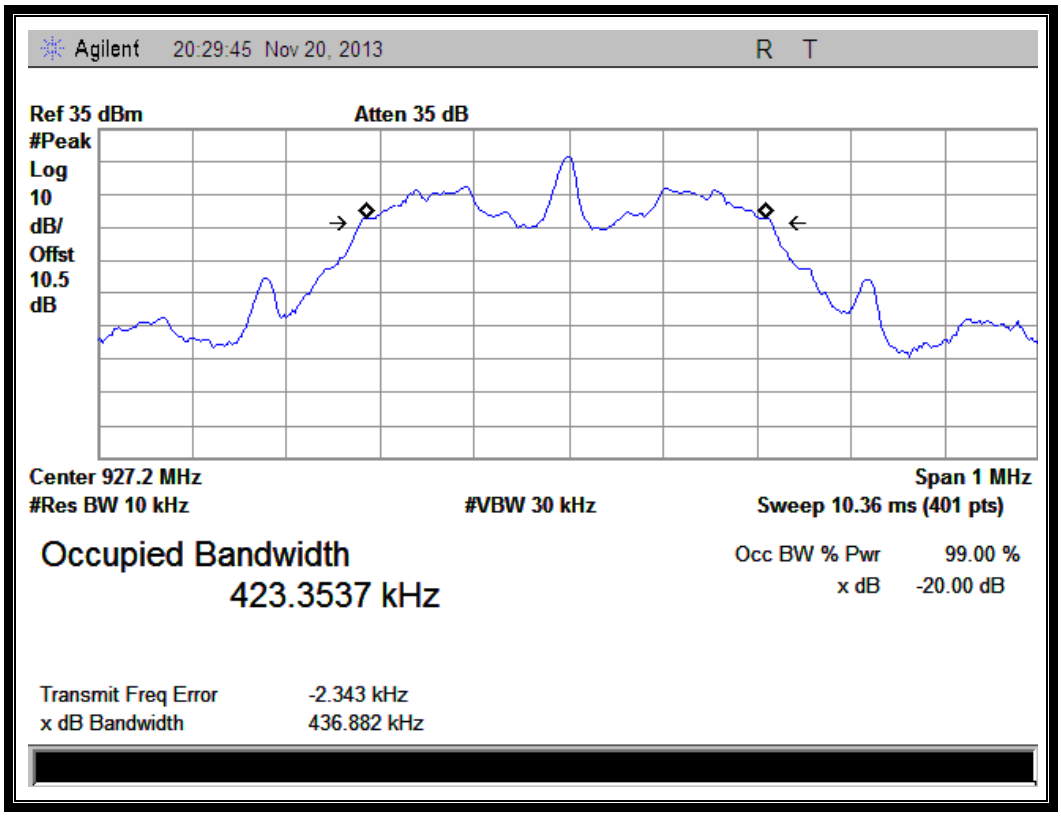
(Plot F: Profile 2 Channel = 50)



(Plot G: Profile 4 Channel = 1)



(Plot H: Profile 4 Channel = 26)



(Plot I: Profile 4 Channel = 50)

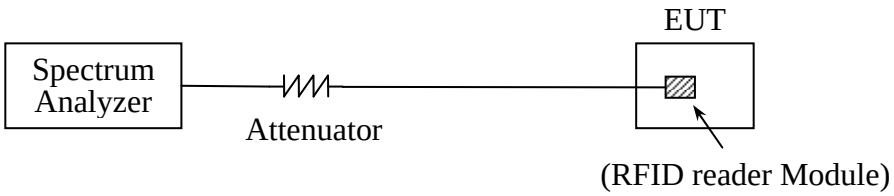
2.5. Carried Frequency Separation

2.5.1. Definition

According to FCC section 15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.

2.5.2. Test Description

A. Test Setup:



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B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer	Agilent	E7405A	US44210471	2013.05.12	2014.05.11
Attenuator	Resnet	10dB	(n.a.)	2013.05.12	2014.05.11

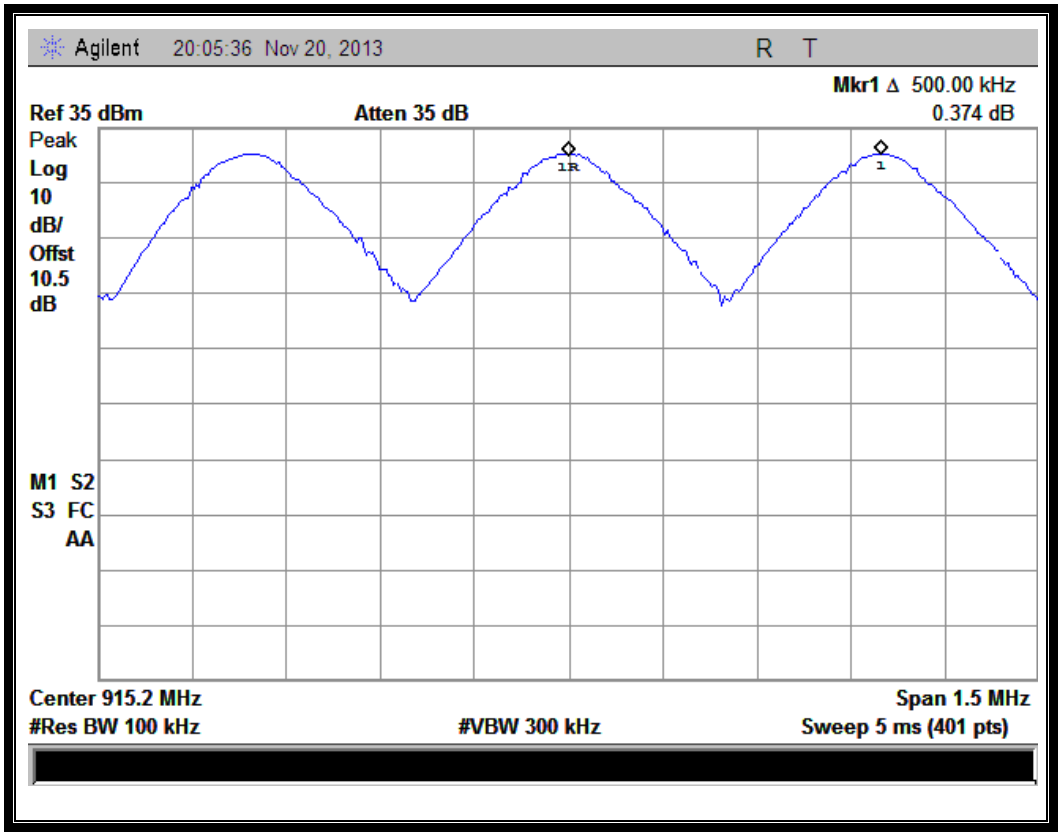
2.5.3. Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:
Span = wide enough to capture the peaks of two adjacent channels
Resolution (or IF) Bandwidth (RBW) ≥ 1% of the span
Video (or Average) Bandwidth (VBW) ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

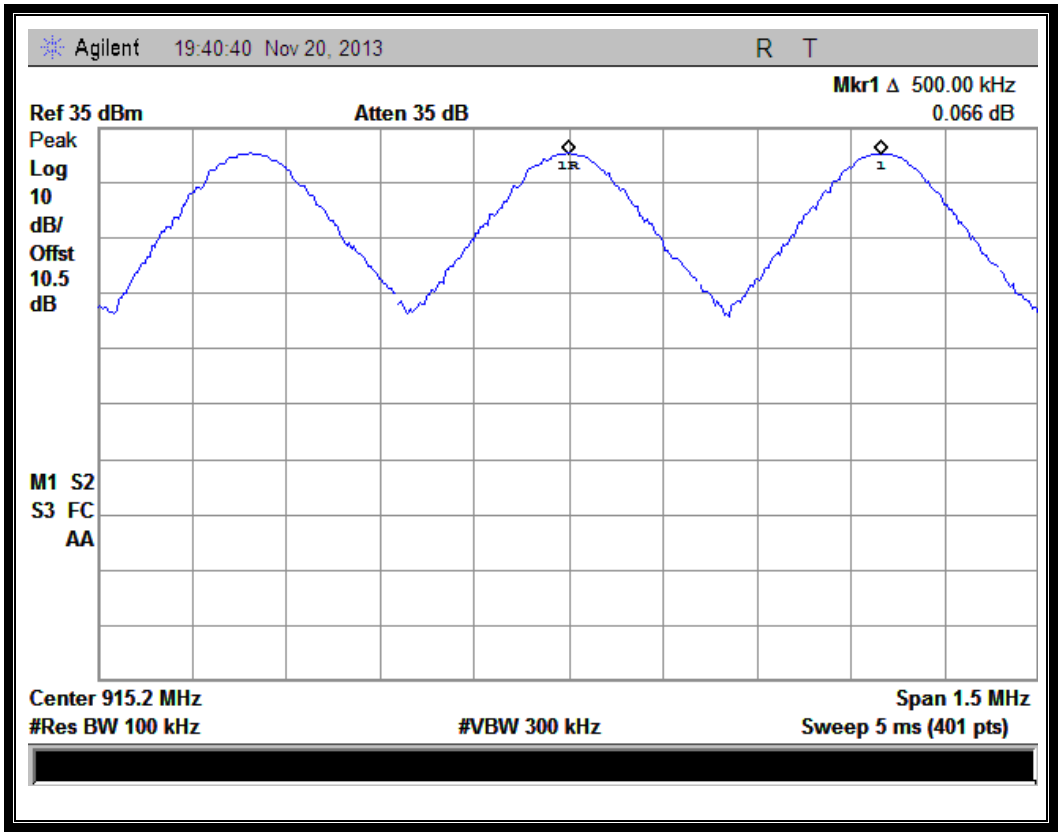
2.5.4. Test Result

The RFID Reader Module of the EUT operates at hopping-on test mode.

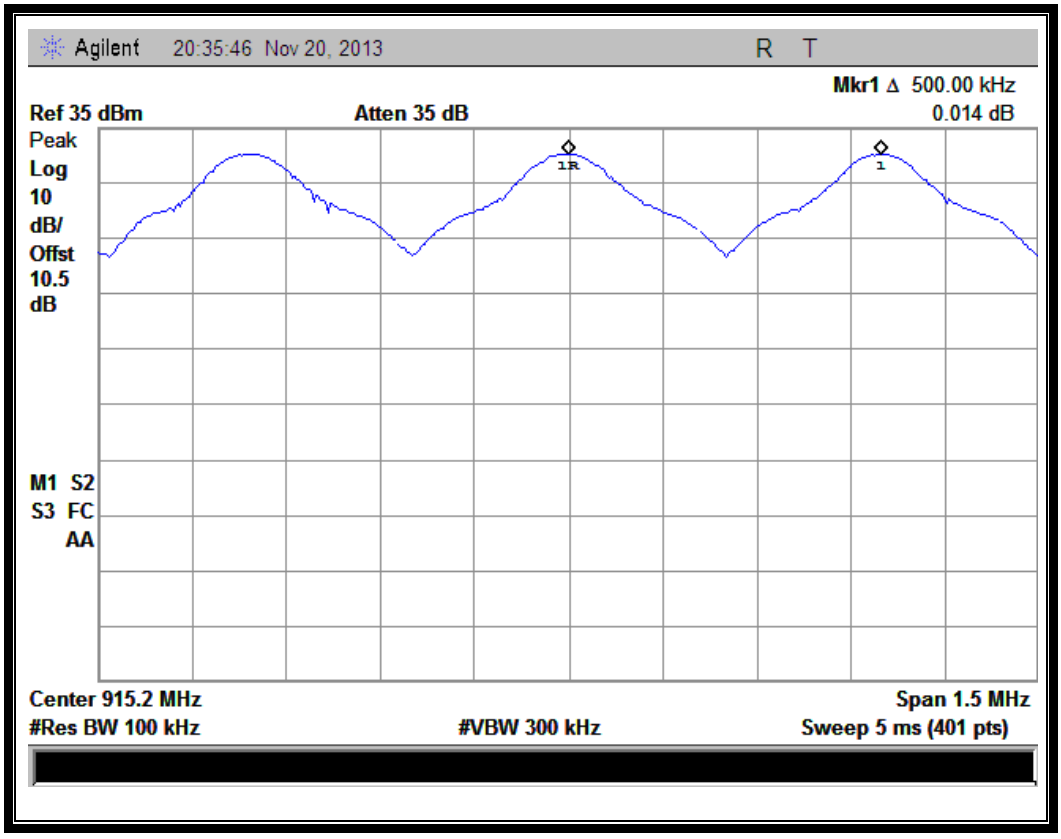
For any adjacent channels (e.g. the channel 26 and 27 as showed in the Plot A), the Module does have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater. So, the verdict is PASSING



(Plot A: Profile 1 Carried Frequency Separation)



(Plot B: Profile 2 Carried Frequency Separation)



(Plot C: Profile 4 Carried Frequency Separation)

2.6. Time of Occupancy (Dwell time)

2.6.1. Requirement

According to FCC section 15.247(a)(1)(i), frequency hopping systems in the 902 - 928MHz band shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.

2.6.2. Test Description

A. Test Setup:

The RFID Reader Module of the EUT, which is powered by the AC adapter, is coupled to the Spectrum Analyzer (SA) with Attenuators the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. During the measurement, the RFID Reader Module of the EUT is activated by the PC via Lan port.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer	Agilent	E7405A	US44210471	2013.05.12	2014.05.11
Attenuator	Resnet	10dB	(n.a.)	2013.05.12	2014.05.11

2.6.3. Test Procedure

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 10/20 second scan, to enable resolution of each occurrence.

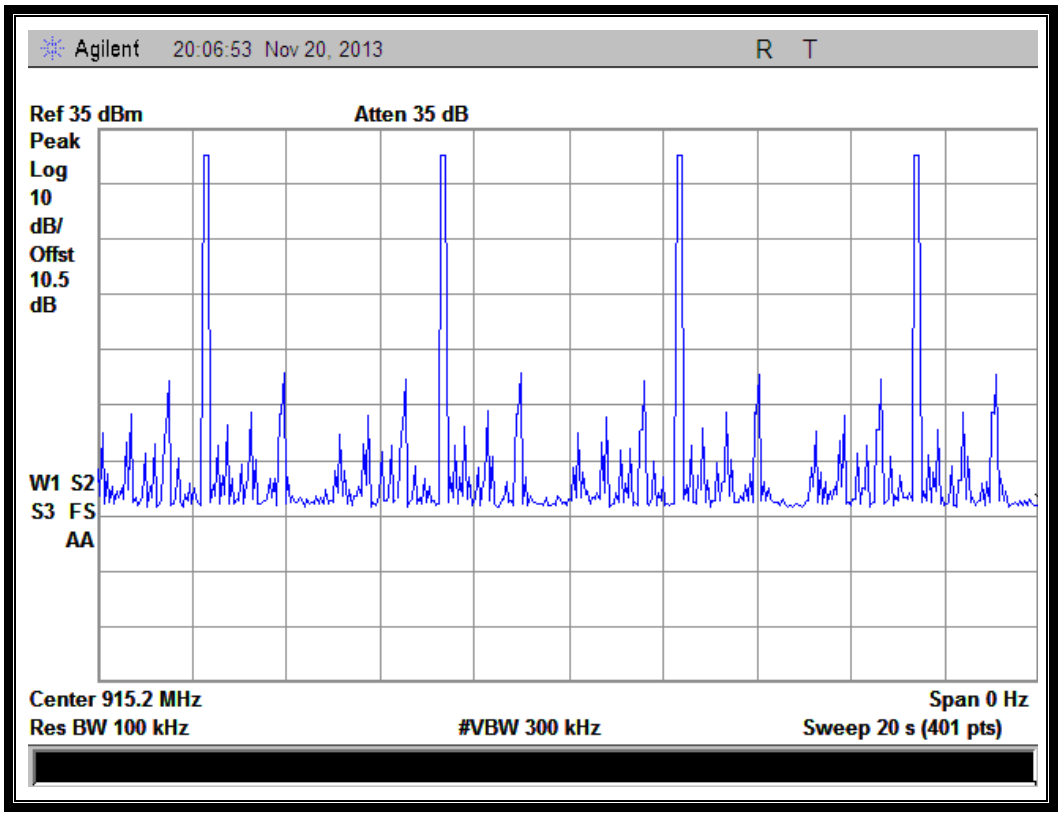
The average time of occupancy in the specified 10/20 second period is equal to (# of pulses in 10/20s) * pulse width.

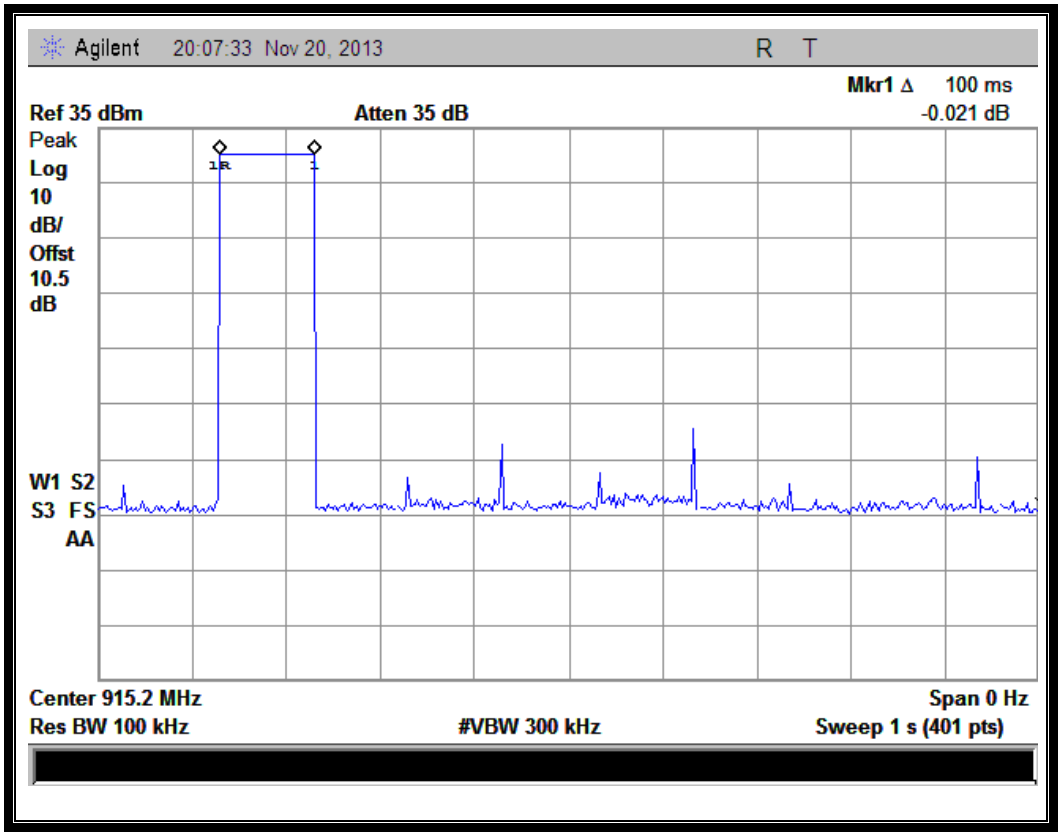
2.6.4. Test Result

A. Test Verdict:

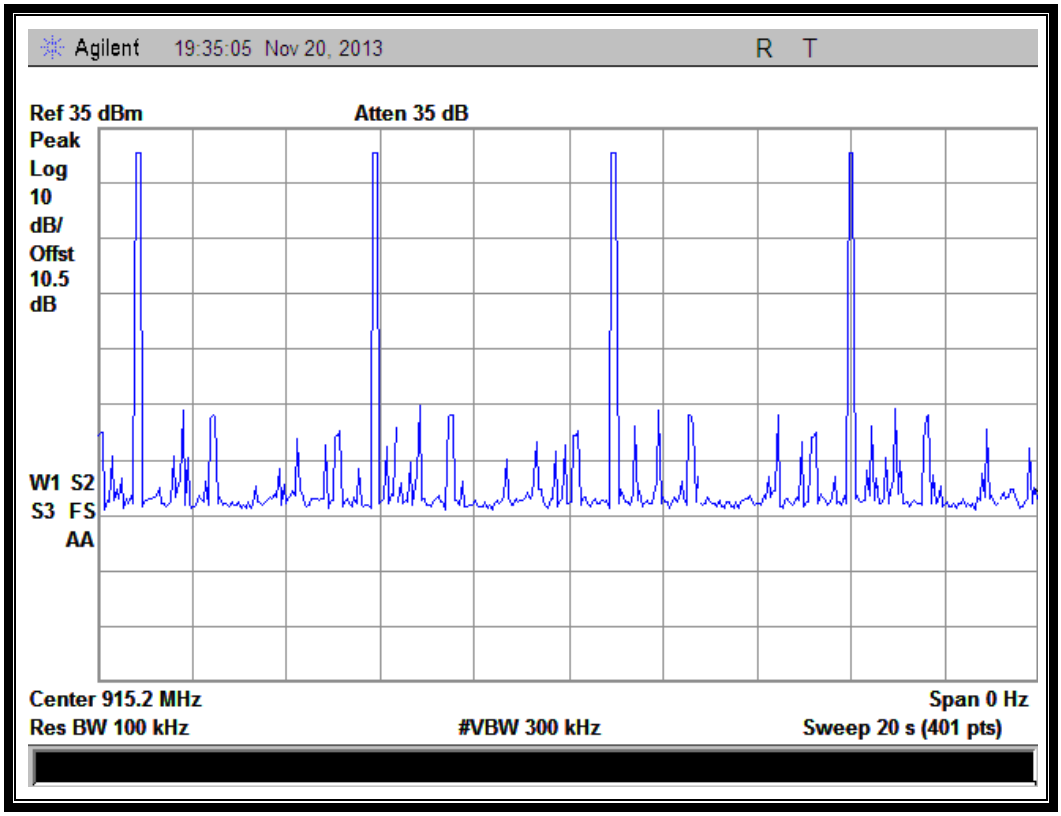
Profile	Pulse Width (msec)	Number of pulse in 10/20 seconds	Refer to Plot	Average Time of Occupancy (sec)	Limit (sec)	Verdict
1	100	4/20	Plot A	0.4	0.4	PASS
2	100	4/20	Plot B	0.4		PASS
4	97.5	2/10	Plot C	0.195		PASS

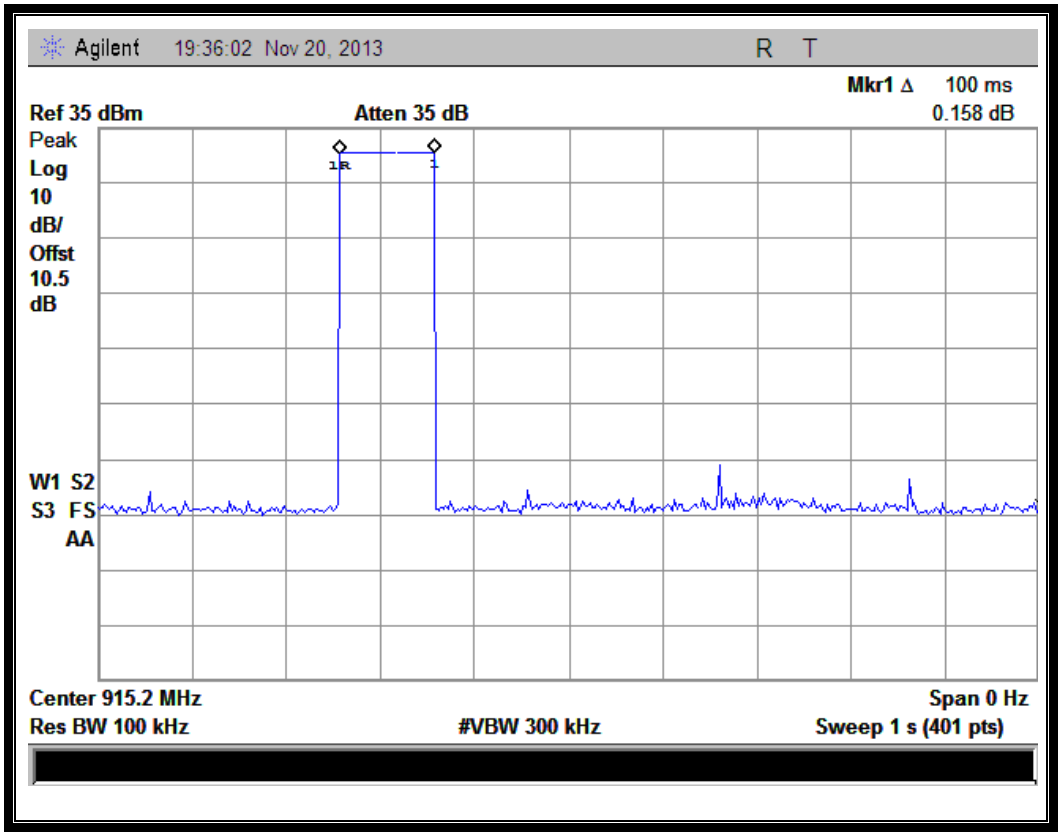
B. Test Plots:



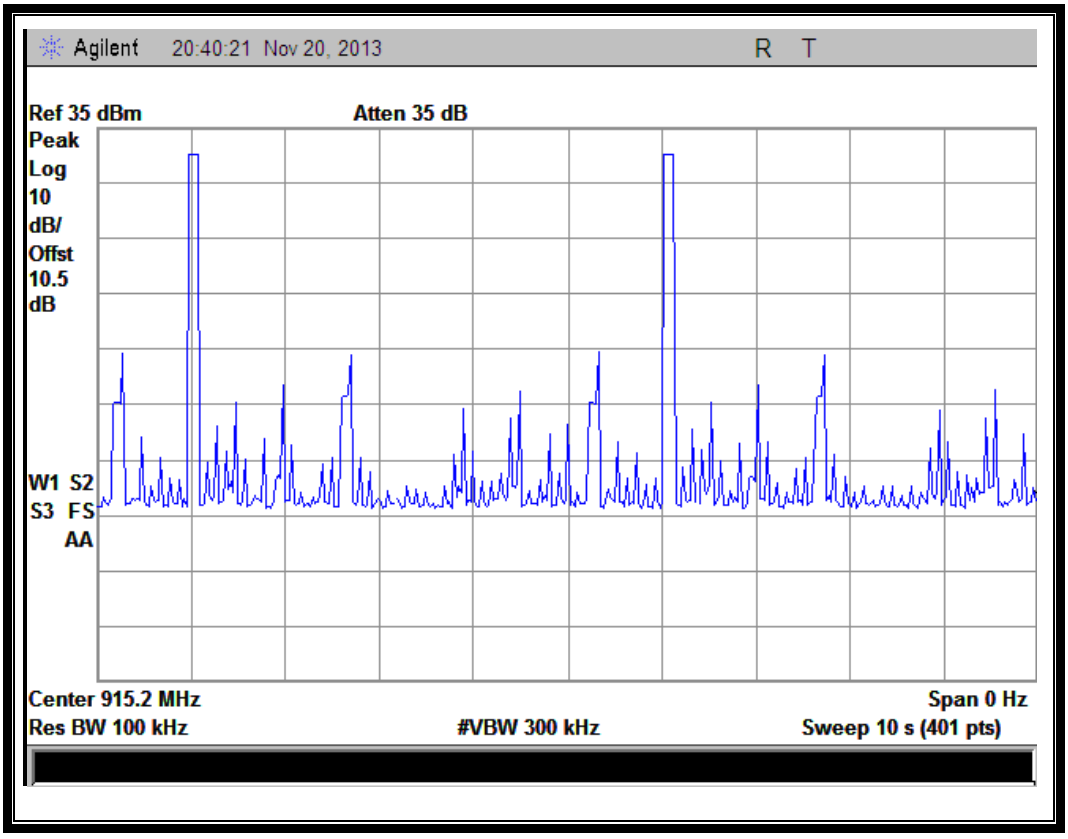


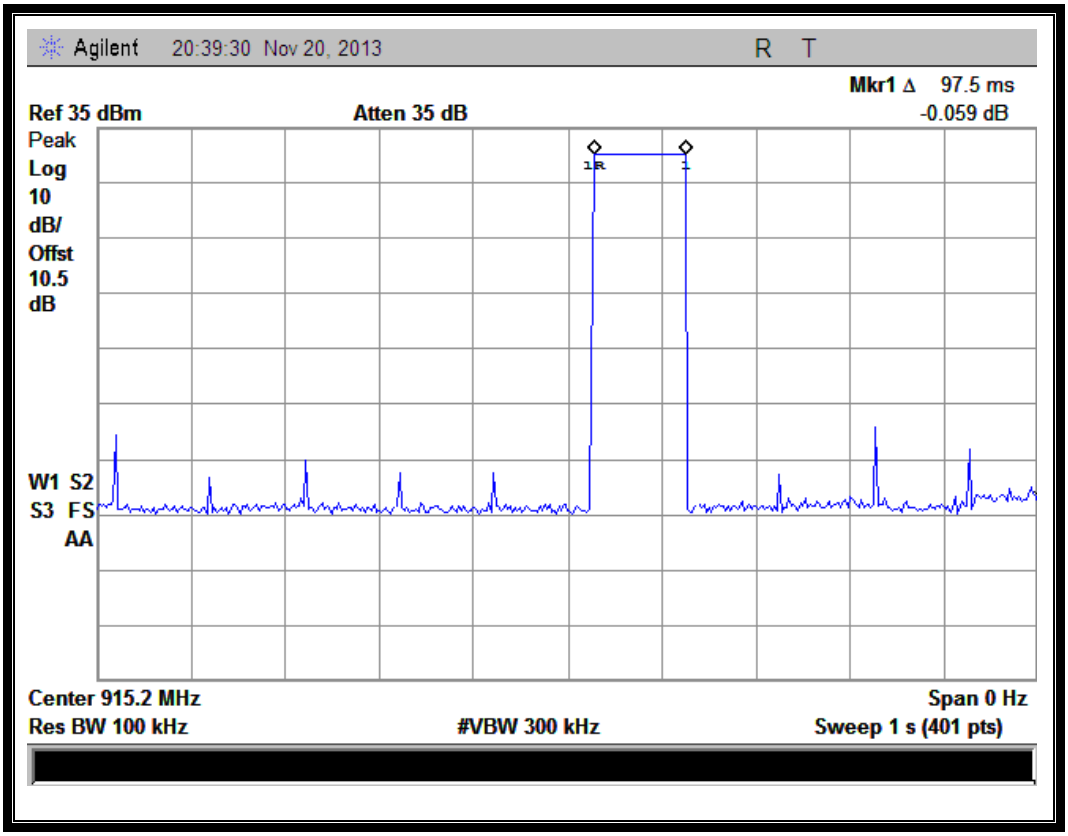
(Plot A: Profile 1)





(Plot B: Profile 2)





(Plot C: Profile 4)

2.7. Conducted Spurious Emissions and Band Edge

2.7.1. Requirement

According to FCC §15.247(d), in any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

2.7.2. Test Description

A. Test Setup:

The RFID Reader Module of the EUT, which is powered by the AC adapter, is coupled to the Spectrum Analyzer (SA) with Attenuators the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. During the measurement, the RFID Reader Module of the EUT is activated by the PC via Lan port.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer	Agilent	E7405A	US44210471	2013.05.12	2014.05.11
Attenuator	Resnet	10dB	(n.a.)	2013.05.12	2014.05.11

2.7.3. Test Procedure

Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
RBW = 100 kHz
VBW ≥ RBW
Sweep = auto
Detector function = peak

Trace = max hold
Allow the trace to stabilize.

2.7.4. Test Result

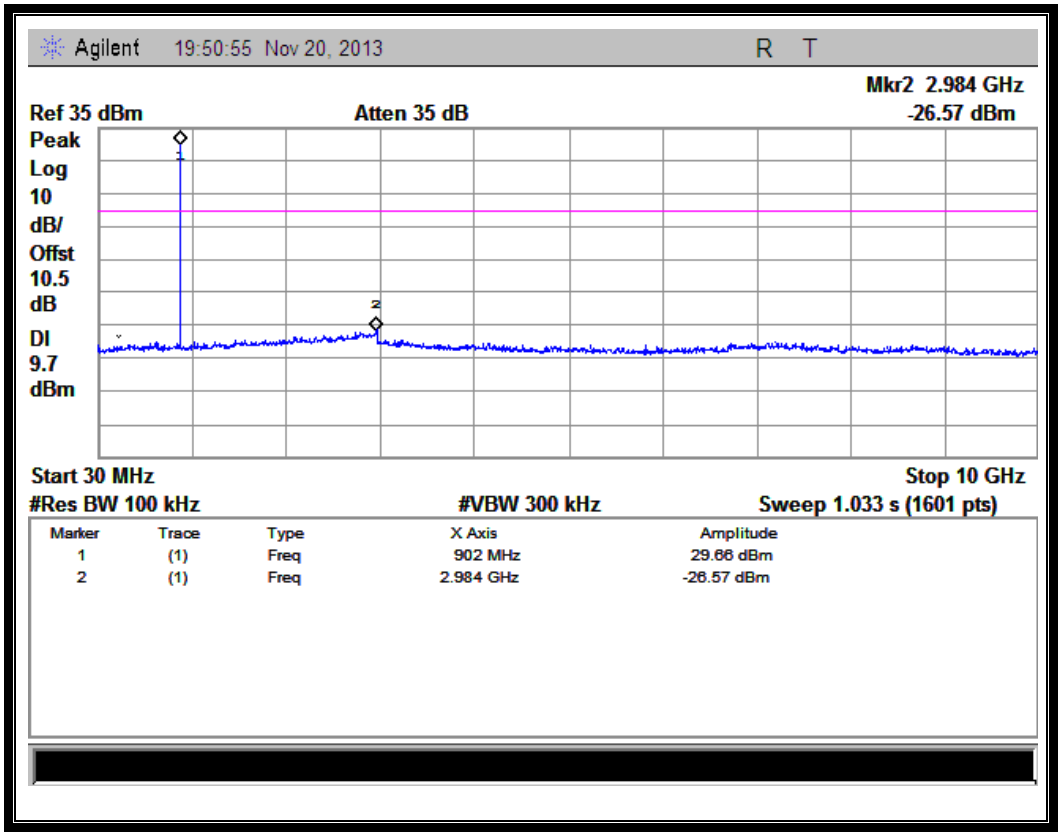
The RFID Reader Module of the EUT operates at hopping-off test mode. The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions.

A. Test Verdict:

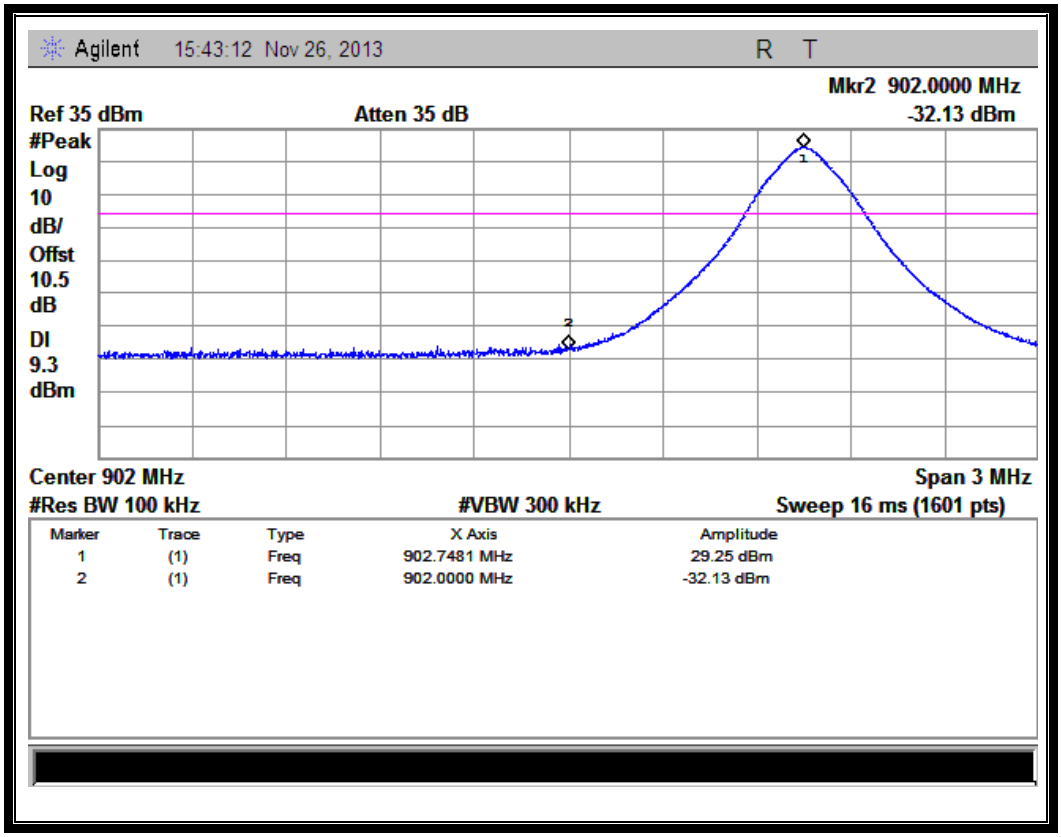
Profile	Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Plot	Limit (dBm)		Verdict
					Carrier Level	Calculated -20dBc Limit	
1	1	902.75	-26.57	Plot A	29.66	9.7	PASS
	26	915.25	-25.66	Plot B	29.58	9.6	PASS
	50	927.25	-26.88	Plot C	29.61	9.6	PASS
2	1	902.75	-26.85	Plot D	29.77	9.8	PASS
	26	915.25	-28.12	Plot E	29.81	9.8	PASS
	50	927.25	-26.61	Plot F	29.92	9.9	PASS
4	1	902.75	-25.70	Plot G	27.52	7.5	PASS
	26	915.25	-26.55	Plot H	27.59	7.6	PASS
	50	927.25	-26.46	Plot I	27.93	7.9	PASS

B. Test Plots:

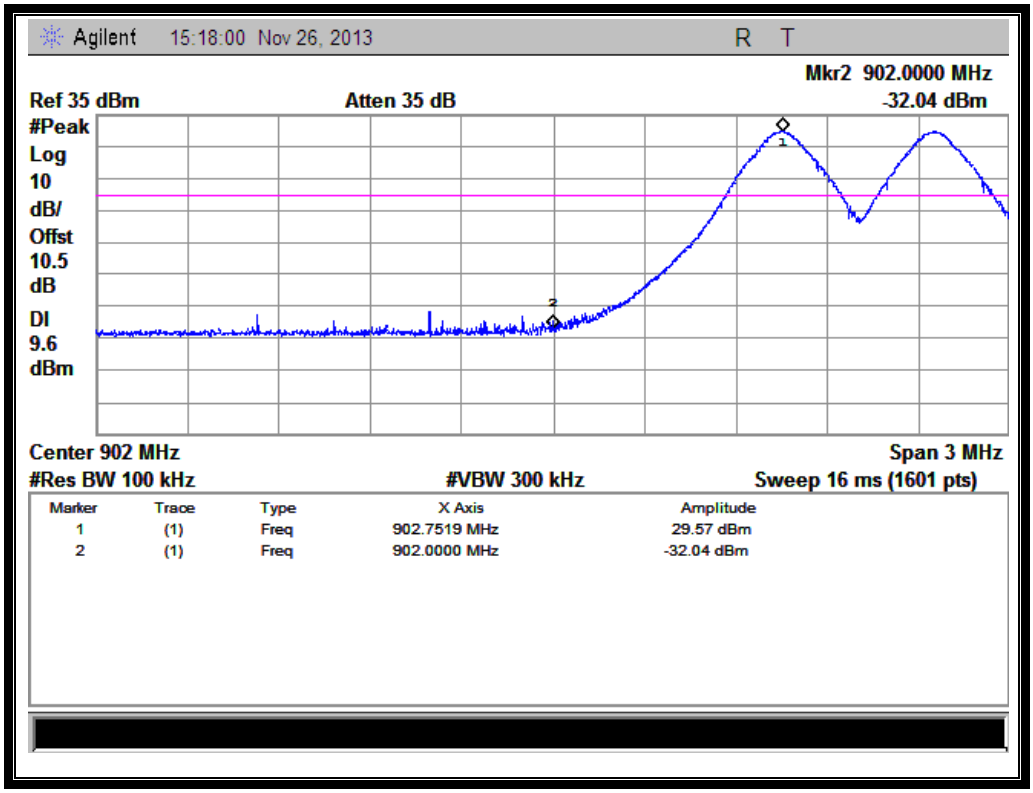
Note: the power of the Module transmitting frequency should be ignored.



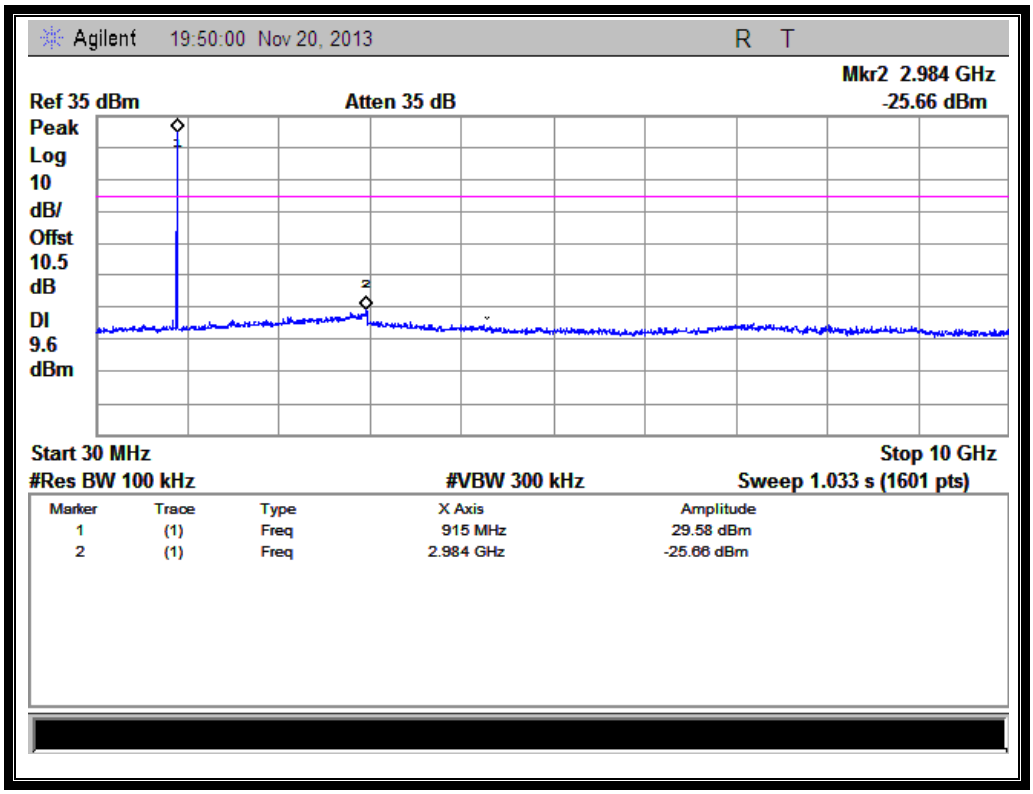
(Plot A.1: Channel = 1, 30MHz to 10GHz @ Profile 1)



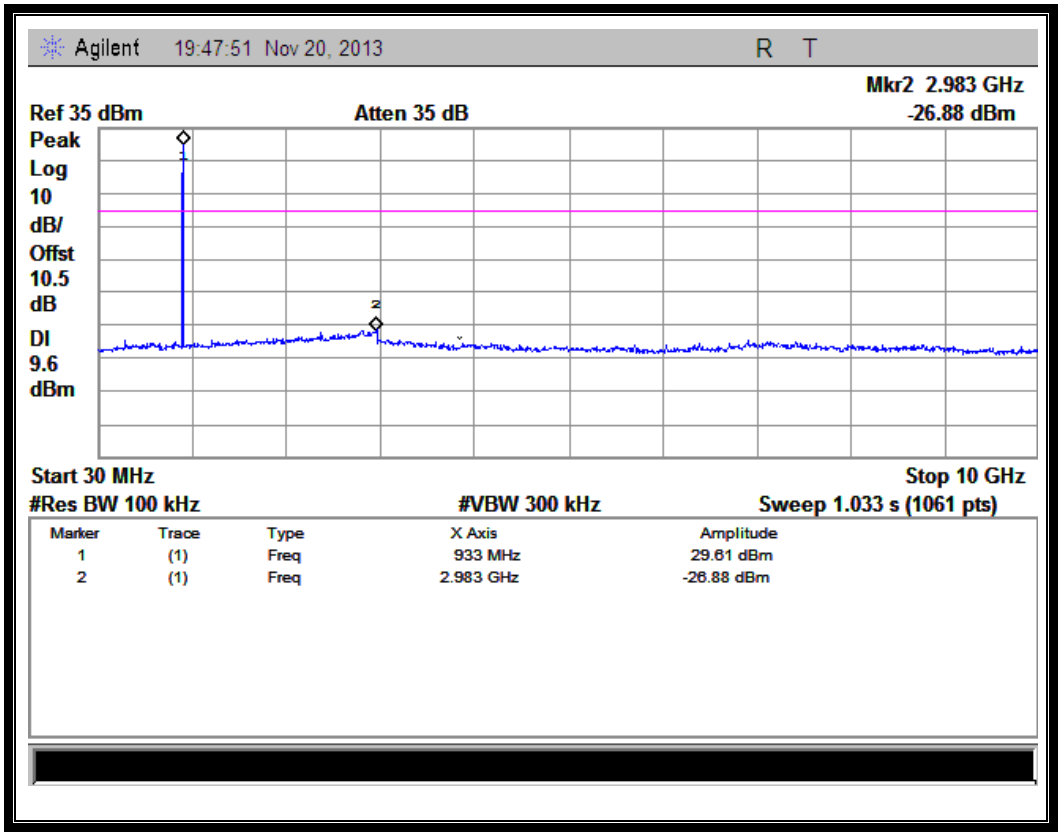
(Channel = 1, Band edge @ Profile 1)



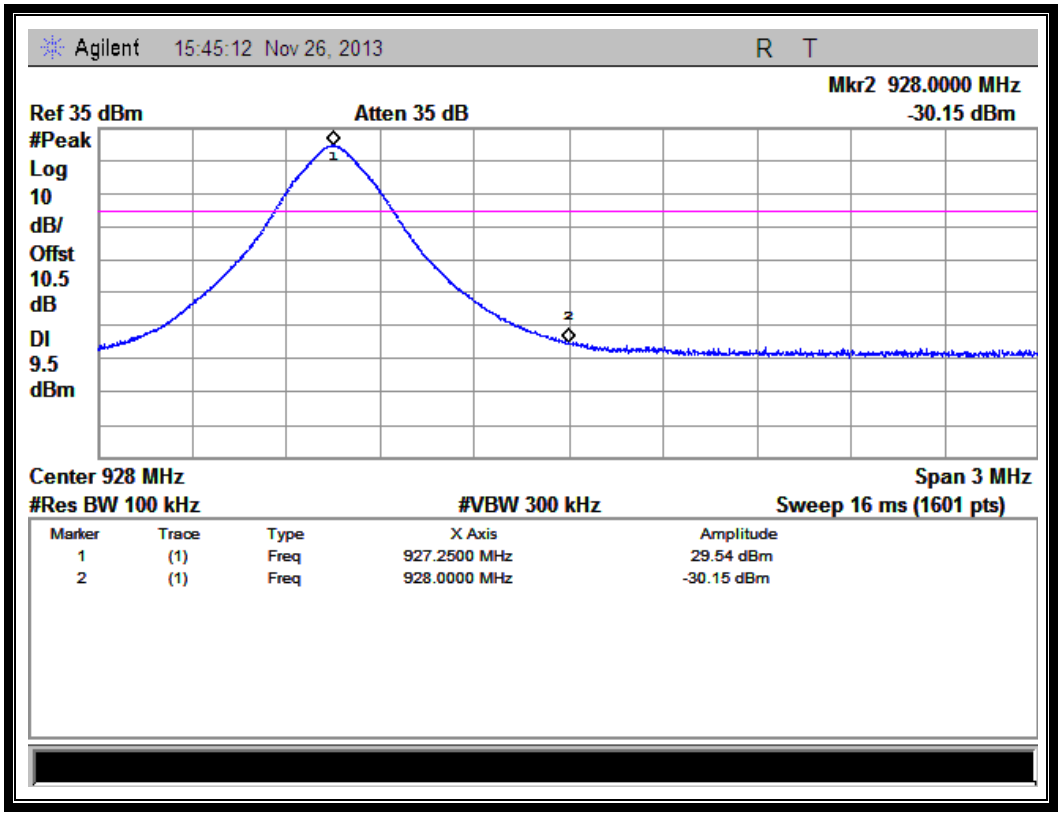
(Channel = 1, Band edge with hopping on Profile 1)



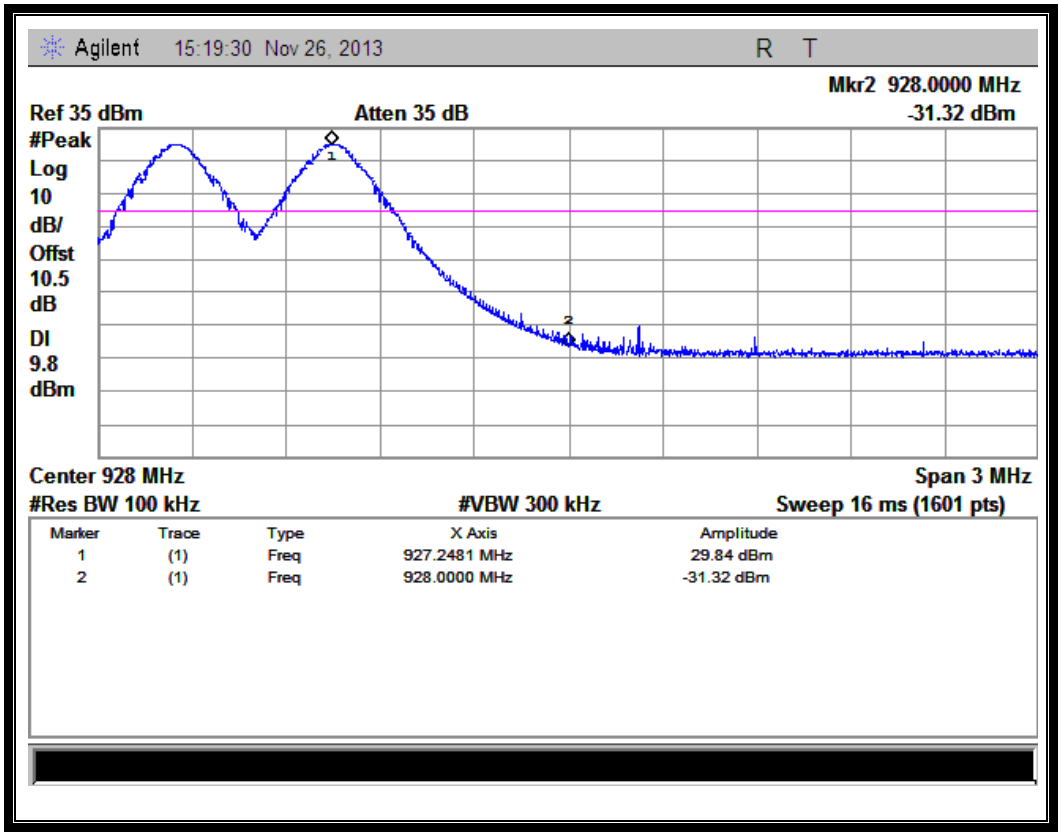
(Plot B.1: Channel = 26, 30MHz to 10GHz @ Profile 1)



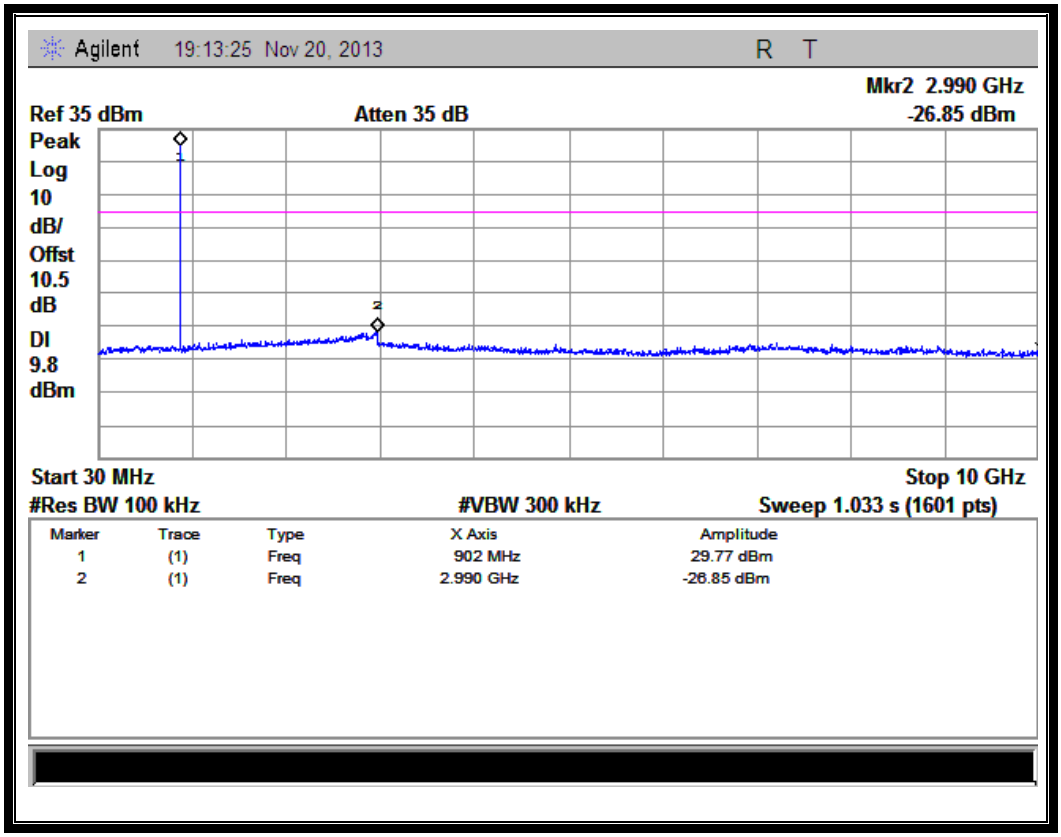
(Plot C.1: Channel = 50, 30MHz to 10GHz @ Profile 1)



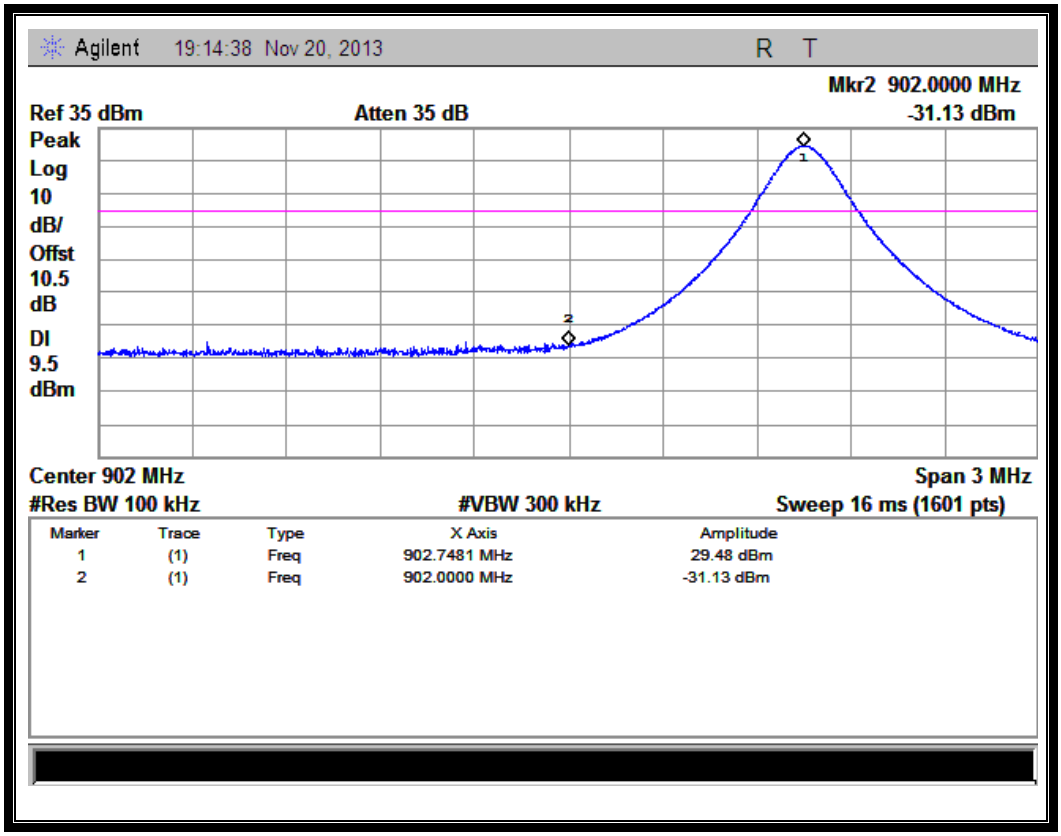
(Channel = 50, Band edge @ Profile 1)



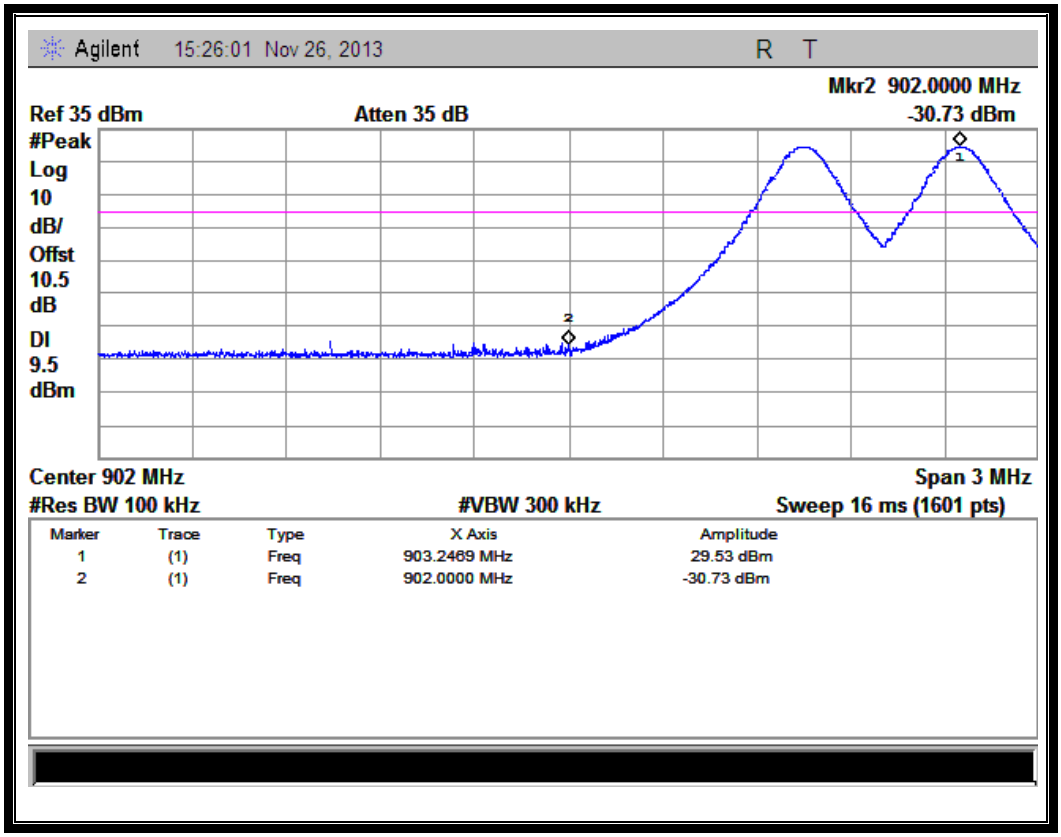
(Channel = 50, Band edge with hopping on @ Profile 1)



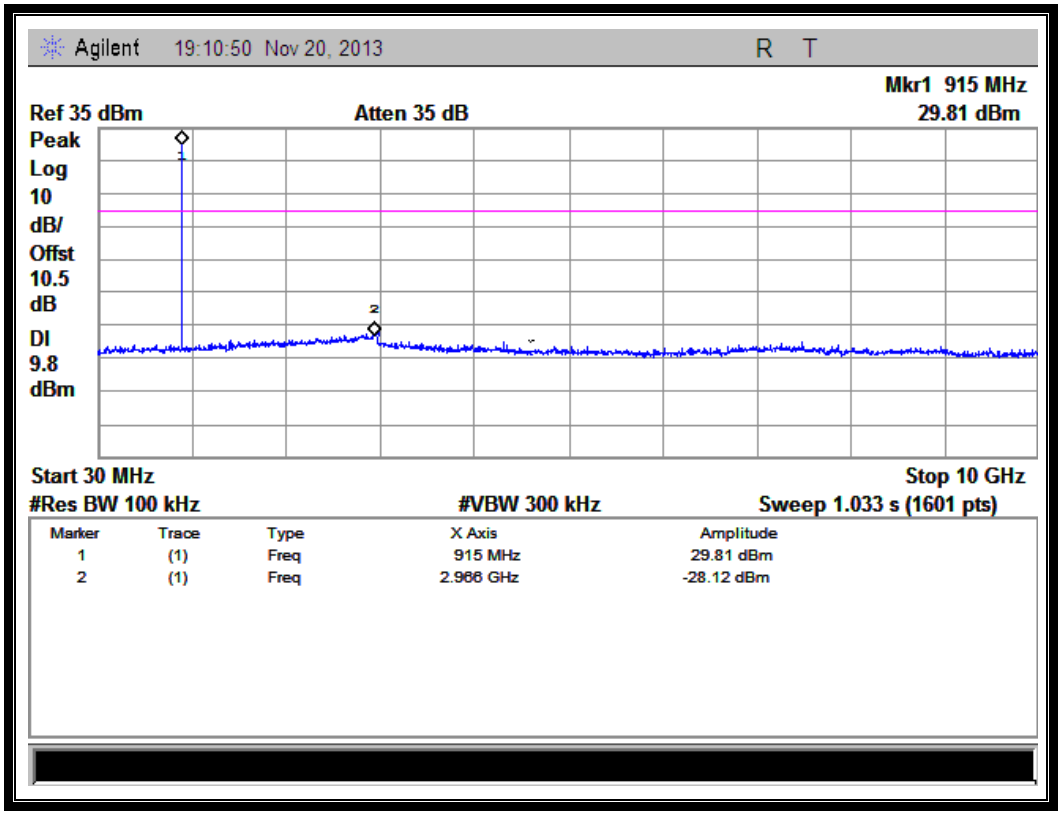
(Plot D.1: Channel = 1, 30MHz to 10GHz @ Profile 2)



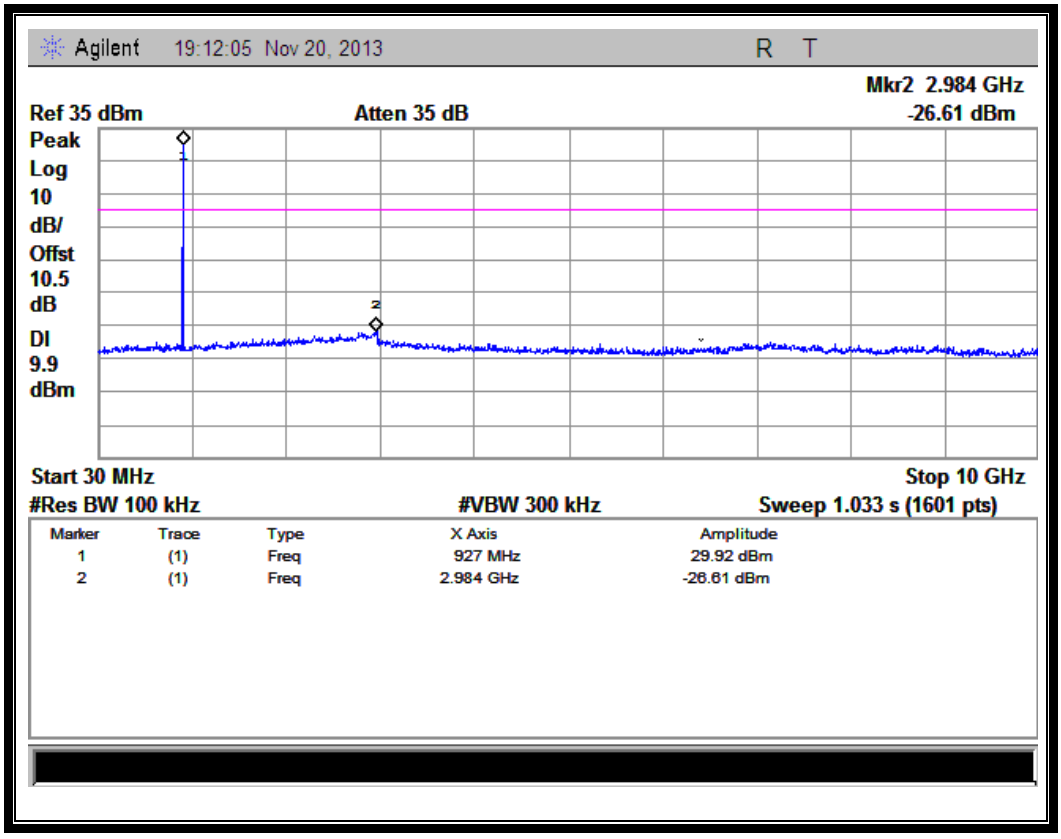
(Channel = 1, Band edge @ Profile 2)



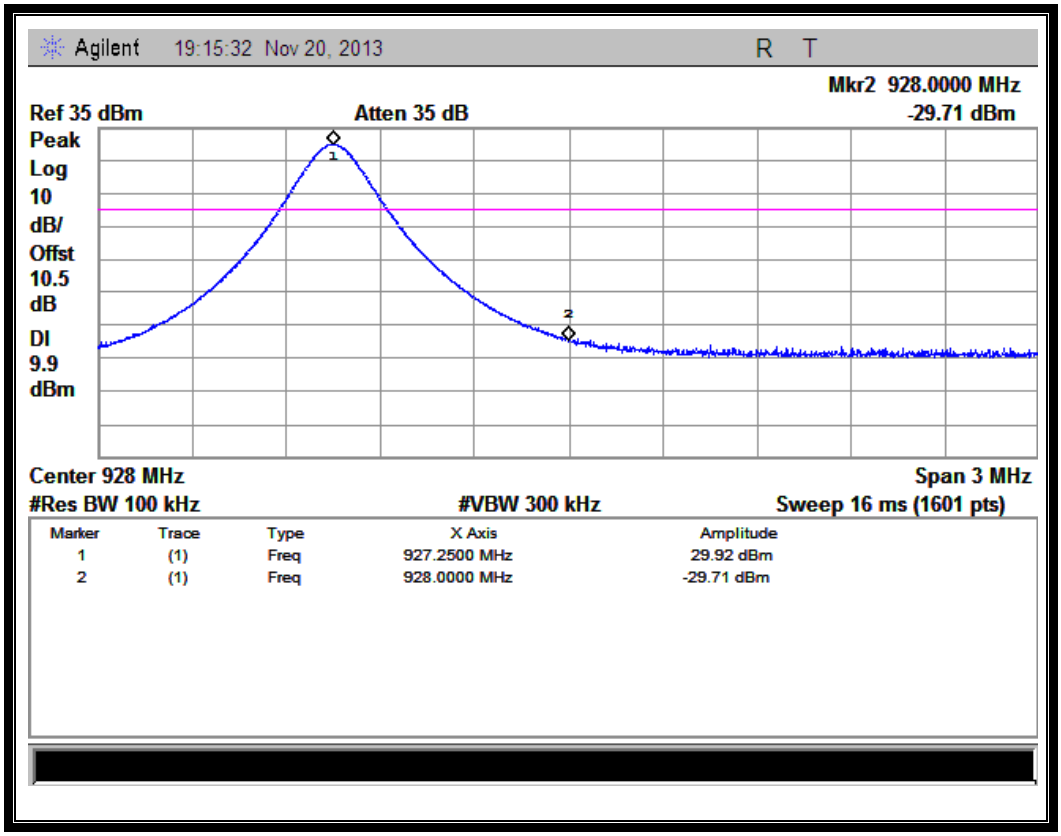
(Channel = 1, Band edge with hopping on @ Profile 2)



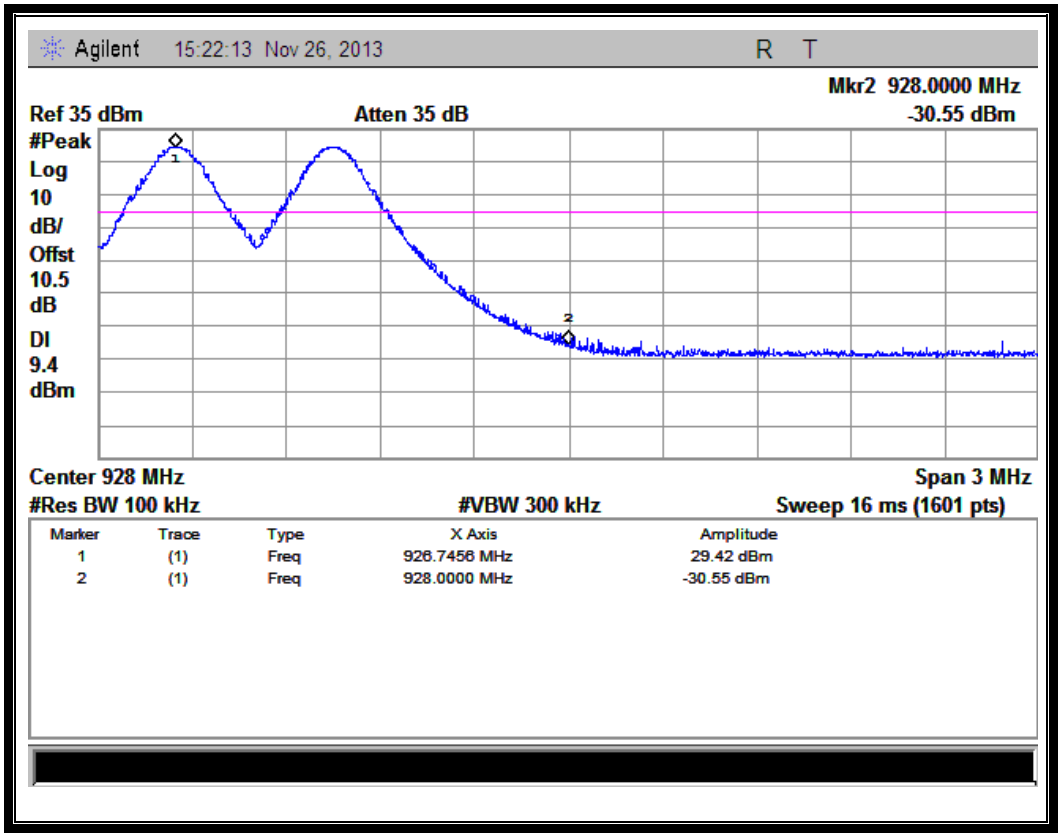
(Plot E.1: Channel = 26, 30MHz to 10GHz @ Profile 2)



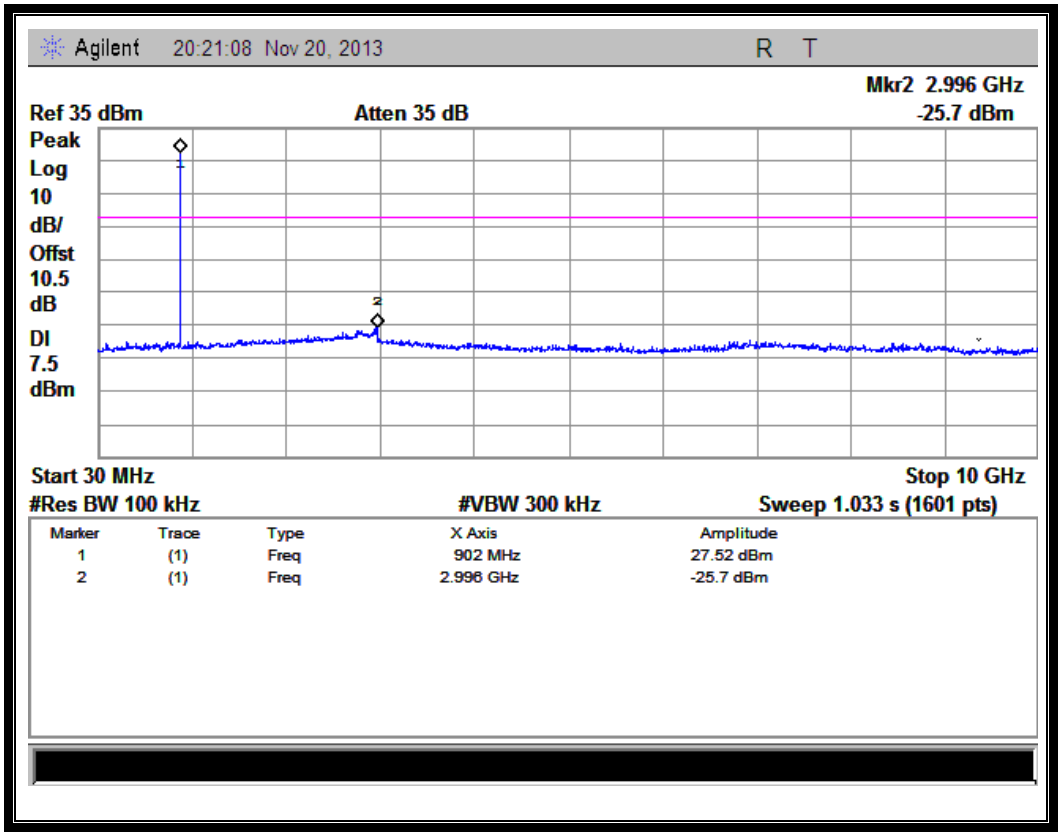
(Plot F.1: Channel = 50, 30MHz to 10GHz @ Profile 2)



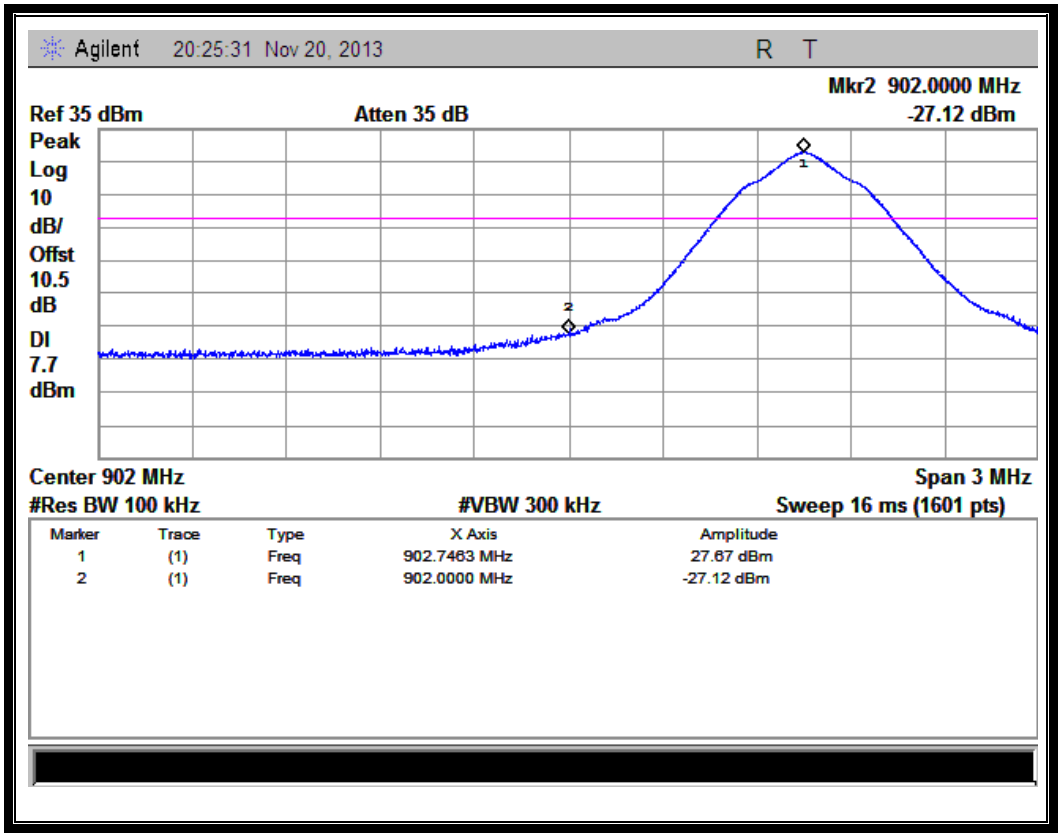
(Channel = 50, Band edge @ Profile 2)



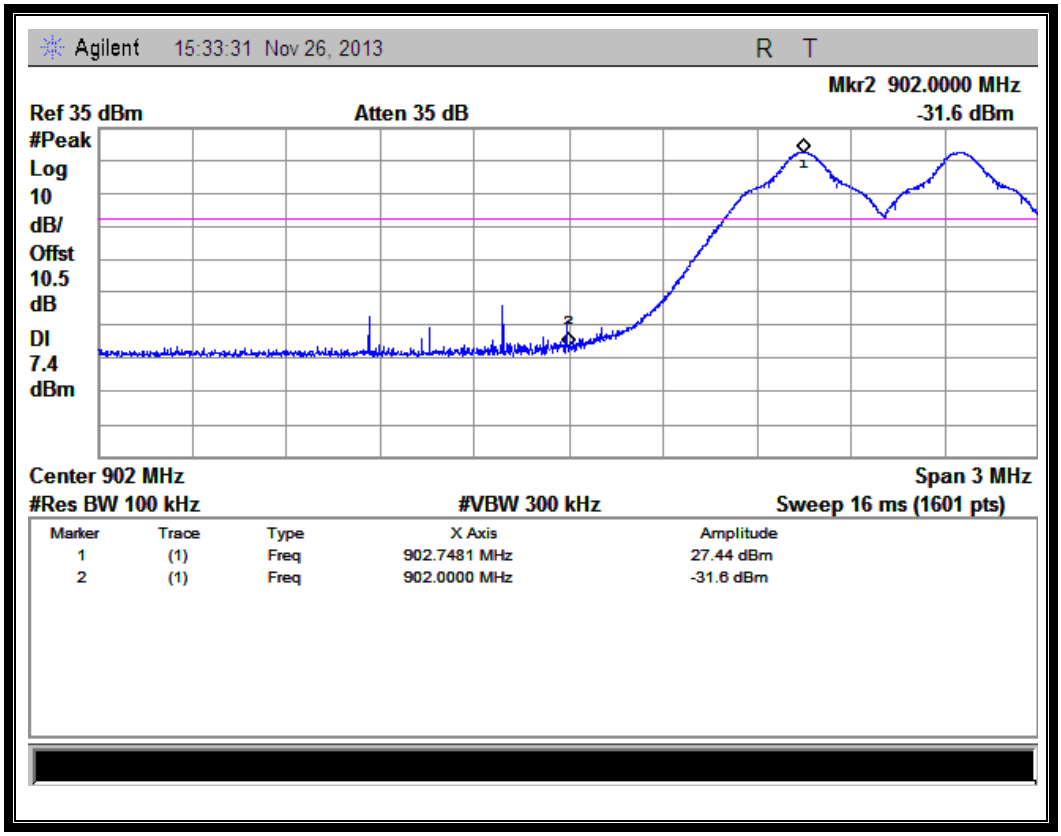
(Channel = 50, Band edge with hopping on @ Profile 2)



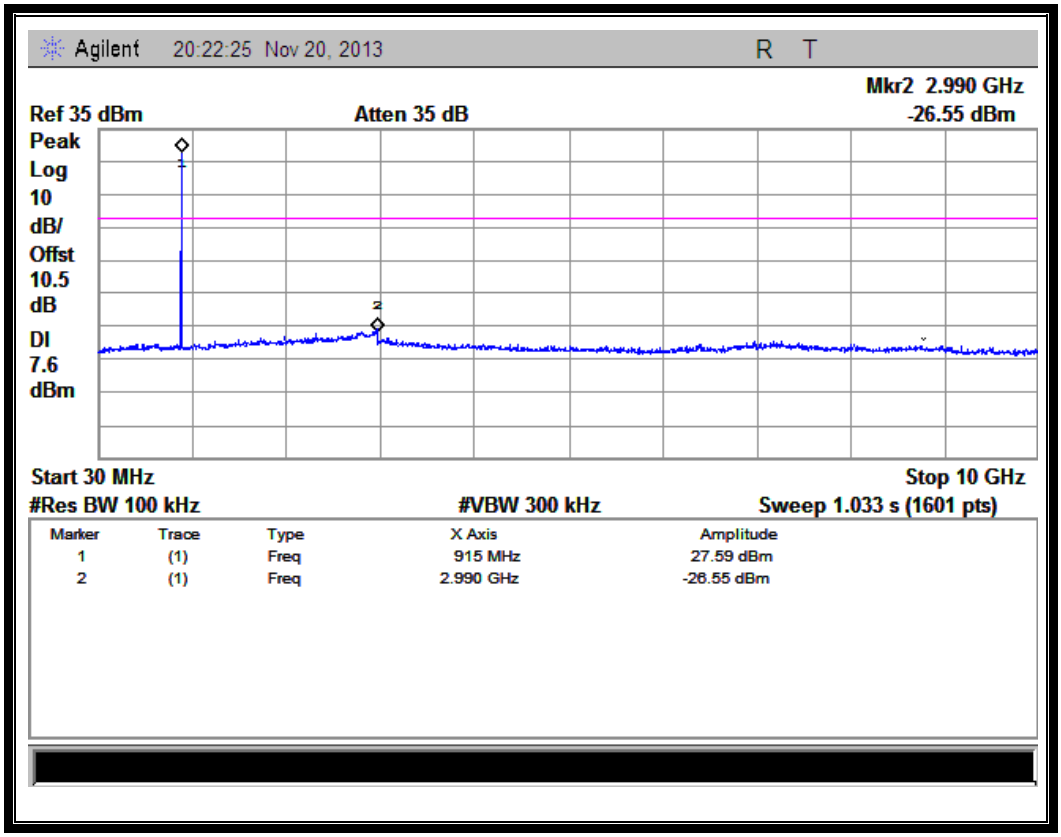
(Plot G.1: Channel = 1, 30MHz to 10GHz @ Profile 4)



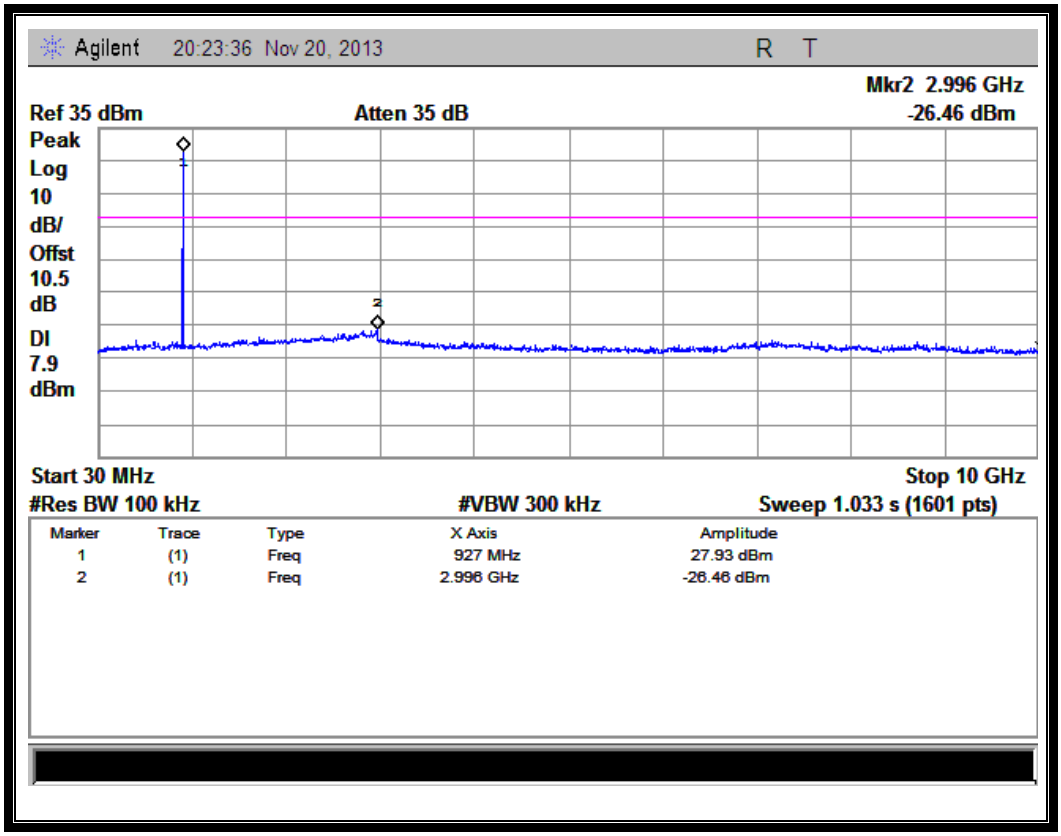
(Channel = 1, Band edge @ Profile 4)



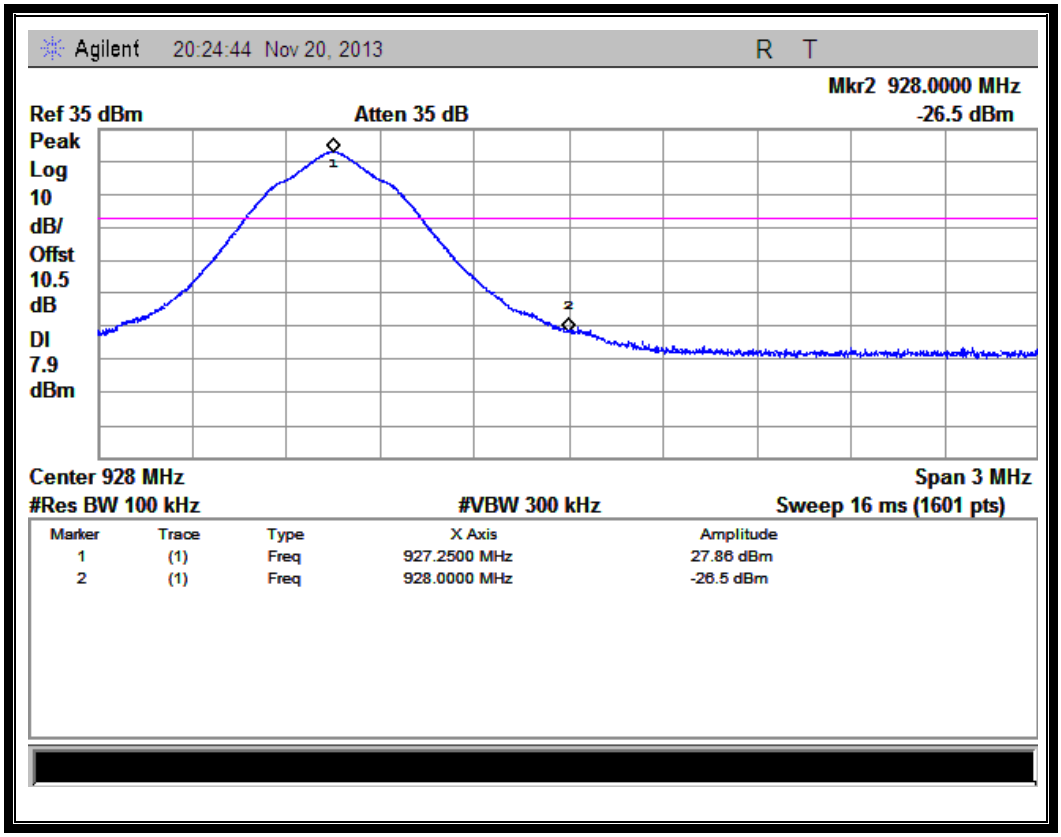
(Channel = 1, Band edge with hopping on @ Profile 4)



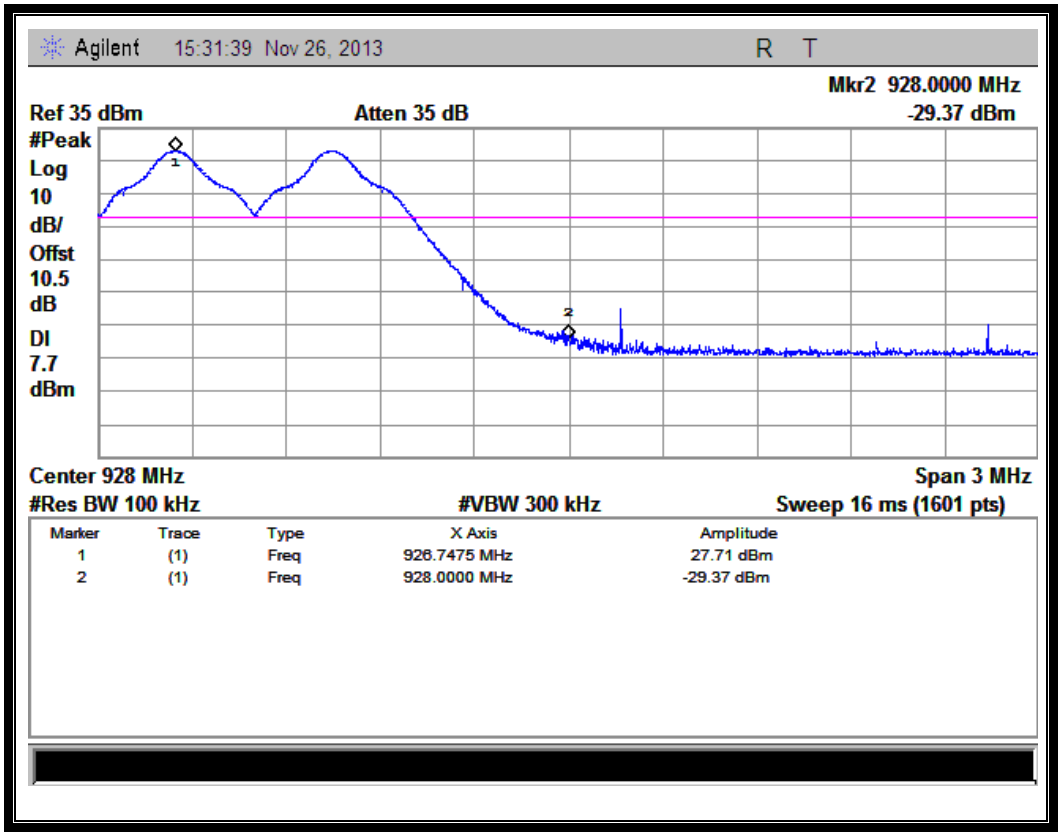
(Plot H.1: Channel = 26, 30MHz to 10GHz @ Profile 4)



(Plot I.1:Channel = 50, 30MHz to 10GHz @ Profile 4)



(Plot I.1:Channel = 50, Band edge @ Profile 4)



(Plot I.1: Channel = 50, Band edge with hopping on @ Profile 4)

2.8. Conducted Emission

2.8.1. Requirement

According to FCC section 15.207, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dBμV)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5- 30	60	50

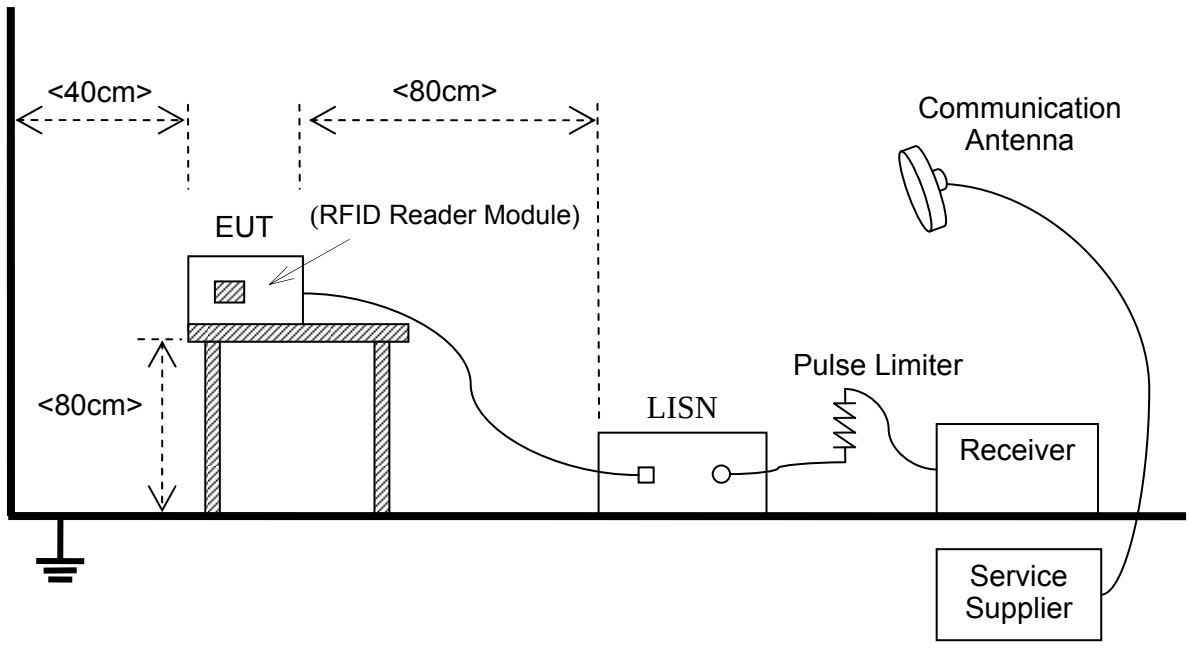
NOTE:

(a) The lower limit shall apply at the band edges.

(b) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

2.8.2. Test Description

A. Test Setup:



The Table-top EUT was placed upon a non-metallic table 0.8m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference Ground Plane. EUT was 80cm from LISN. The set-up and test methods were according to ANSI C63.4:2009

The RFID Reader is powered by the AC adapter.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Receiver	Agilent	E7405A	US44210471	2013.05.12	2014.05.11
LISN	Schwarzbeck	NSLK 8127	812744	2013.05.12	2014.05.11
Service Supplier	R&S	CMU200	100448	2013.05.12	2014.05.11
Pulse Limiter (20dB)	Schwarzbeck	VTSD 9561-D	9391	2013.05.12	2014.05.11

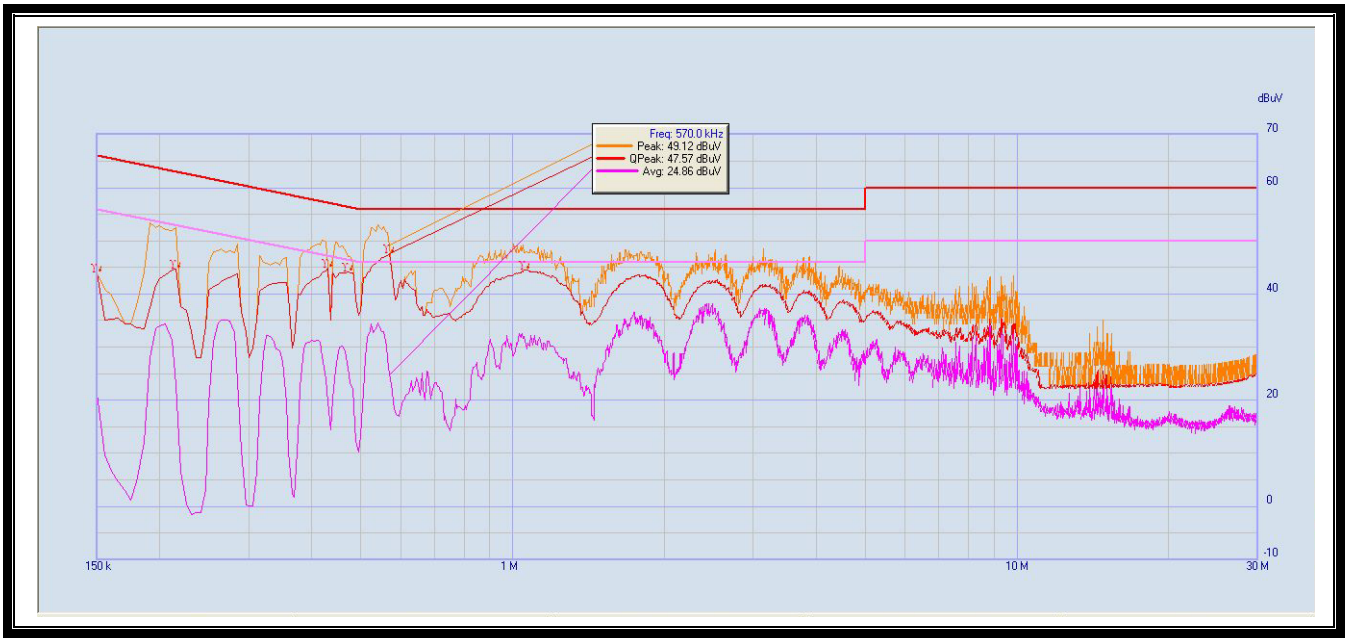
2.8.3. Test Result

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Refer to recorded points and plots below.

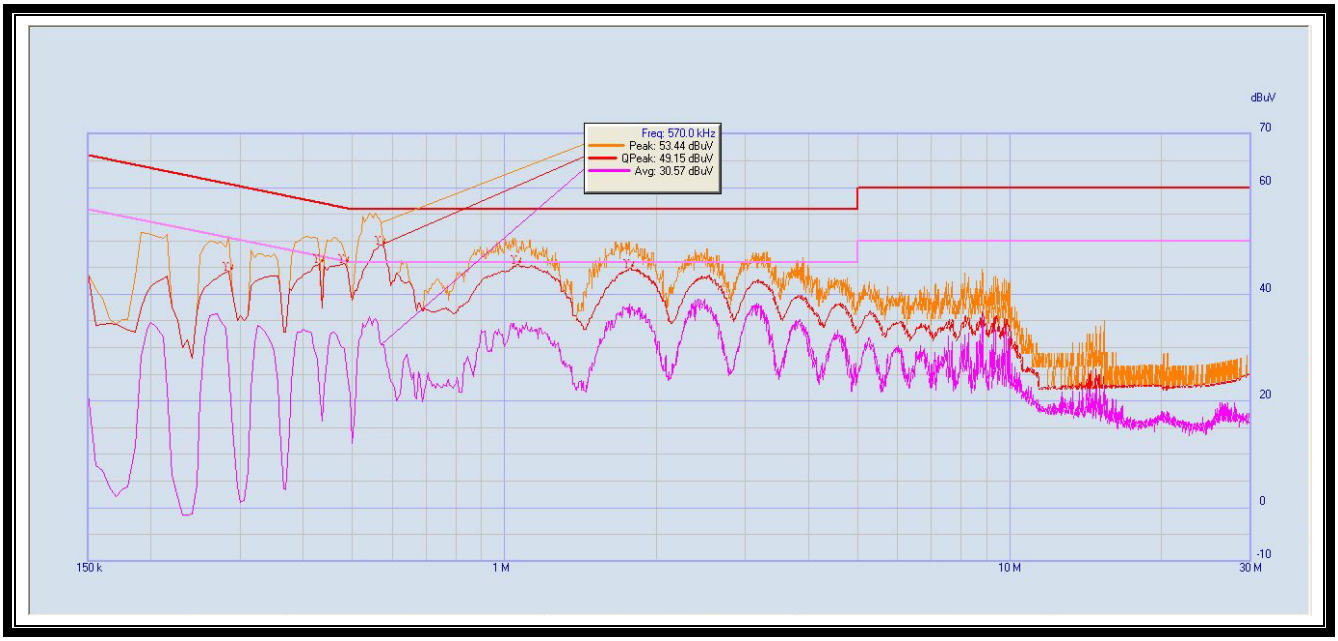
A. Test setup:

The EUT configuration of the emission tests is EUT + Link.

B. Test Plots:



(Plot A: L Phase)



(Plot B: N Phase)

2.9. Radiated Emission

2.9.1. Requirement

According to FCC section 15.247(d) and RSS-A8.5, radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).
According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

Note:

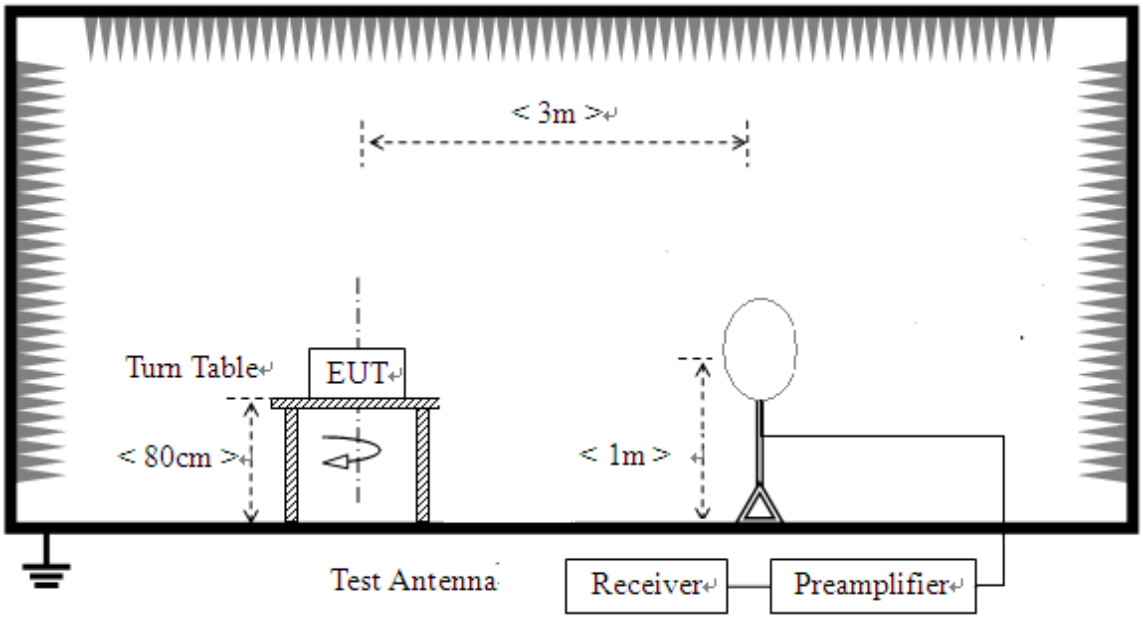
1. For Above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
2. For above 1000MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK)

In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), also should comply with the radiated emission limits specified in Section 15.209(a)(above table)

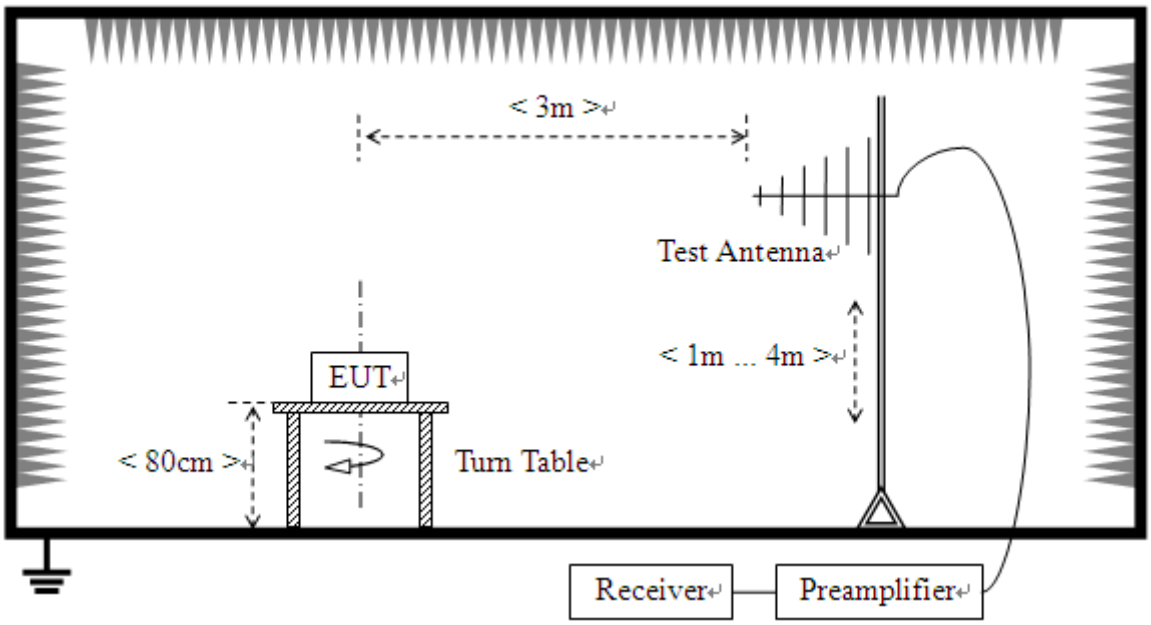
2.9.2. Test Description

A. Test Setup:

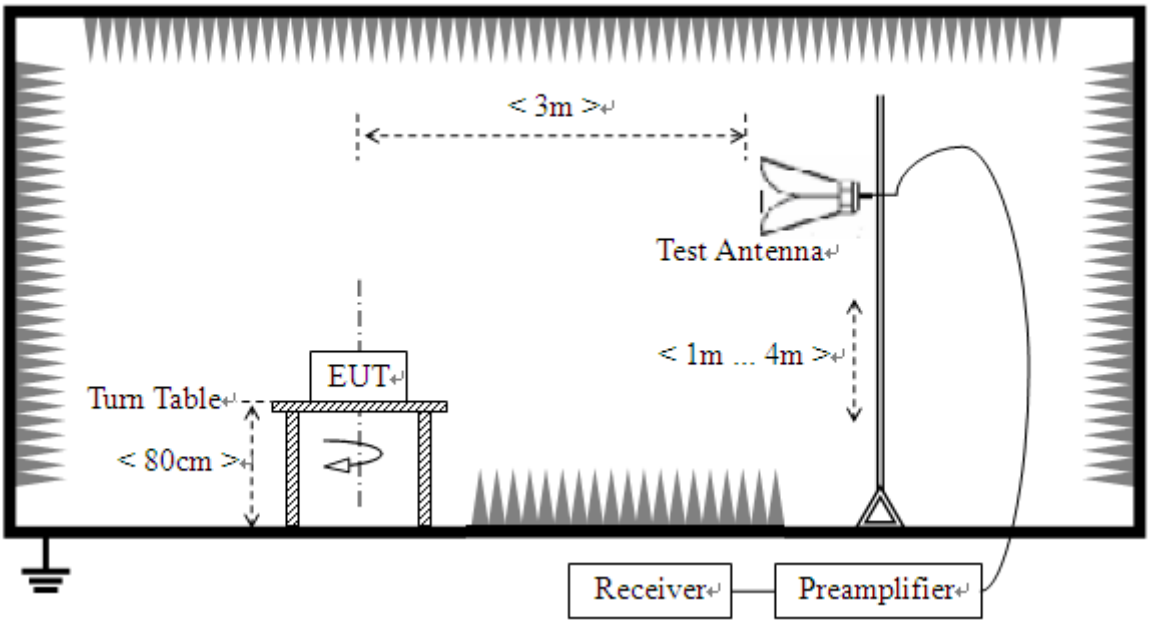
1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to1GHz



3) For radiated emissions above 1GHz



The test site semi-anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSI C63.4 (2009). The EUT was set-up on insulator 80cm above the Ground Plane. The set-up and test methods were according to ANSI C63.4.

The RFID Reader Module of the EUT is powered by the AC Adapter. The Module is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading. During the measurement, the RFID Reader Module of the EUT is activated by the PC via Lan port.

For the Test Antenna:

(a) In the frequency range of 9kHz to 30MHz, magnetic field is measured with Loop Test Antenna. The Test Antenna is positioned with its plane vertical at 1m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
(b) In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 2GHz) and Horn Test Antenna (above 2GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength. The emission levels at both horizontal and vertical polarizations should be tested.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
System Simulator	R&S	CMU200	100448	2013.05.12	2014.05.11
Receiver	Agilent	E7405A	US44210471	2013.05.12	2014.05.11
Full-Anechoic Chamber	Albatross	9m*6m*6m	(n.a.)	2013.05.12	2014.05.11
Test Antenna - Bi-Log	Schwarzbeck	VULB 9163	9163-274	2013.05.12	2014.05.11
Test Antenna - Horn	Schwarzbeck	BBHA 9120D	9120D-963	2013.05.12	2014.05.11
Test Antenna - Horn	R&S	HL050S7	71688	2013.05.12	2014.05.11
Test Antenna - Loop	Schwarzbeck	FMZB 1519	1519-022	2013.05.12	2014.05.11

2.9.3. Test Procedure

Use the following spectrum analyzer settings:
Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

2.9.4. Test Result

According to ANSI C63.4 selection 4.2.2, because of peak detection will yield amplitudes equal to or greater than amplitudes measured with the quasi-peak (or average) detector, the measurement data from a spectrum analyzer peak detector will represent the worst-case results, if the peak measured value complies with the quasi-peak limit, it is unnecessary to perform an quasi-peak measurement.

The measurement results are obtained as below:

$E\ [dB\mu V/m] = U_R + A_T + A_{Factor}\ [dB]$; $A_T = L_{Cable\ loss}\ [dB] - G_{preamp}\ [dB]$

A_T: Total correction Factor except Antenna

U_R: Receiver Reading

G_{preamp}: Preamplifier Gain

A_{Factor}: Antenna Factor at 3m

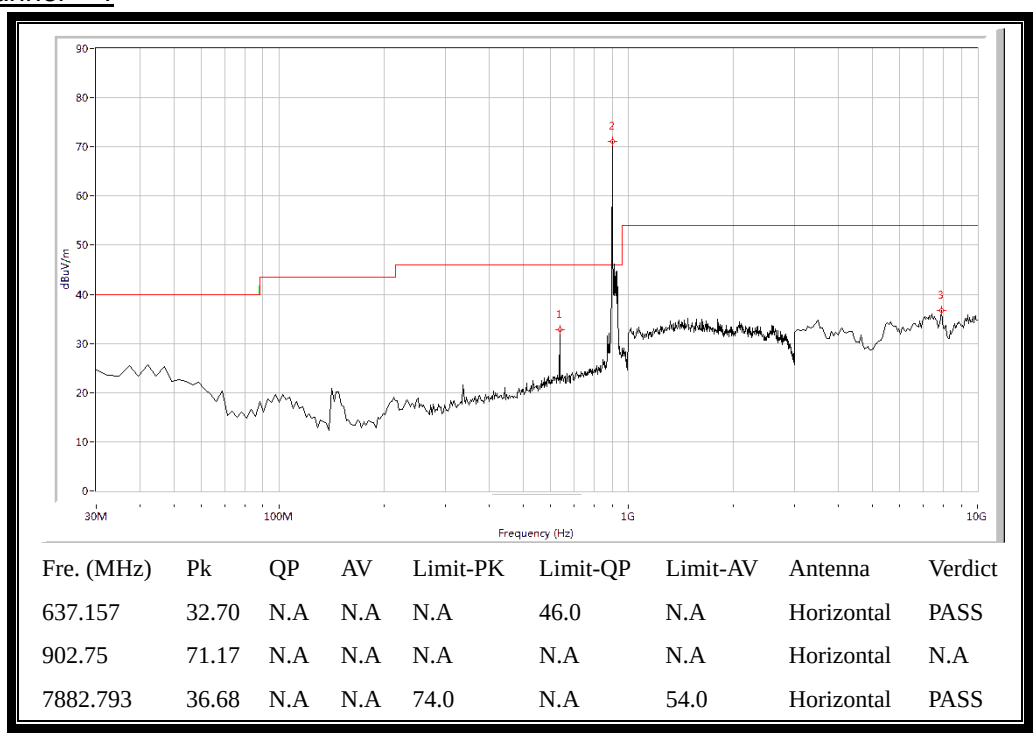
During the test, the total correction Factor AT and A_{Factor} were built in test software.

Note: All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

2.9.4.1. Profile 1 Mode：

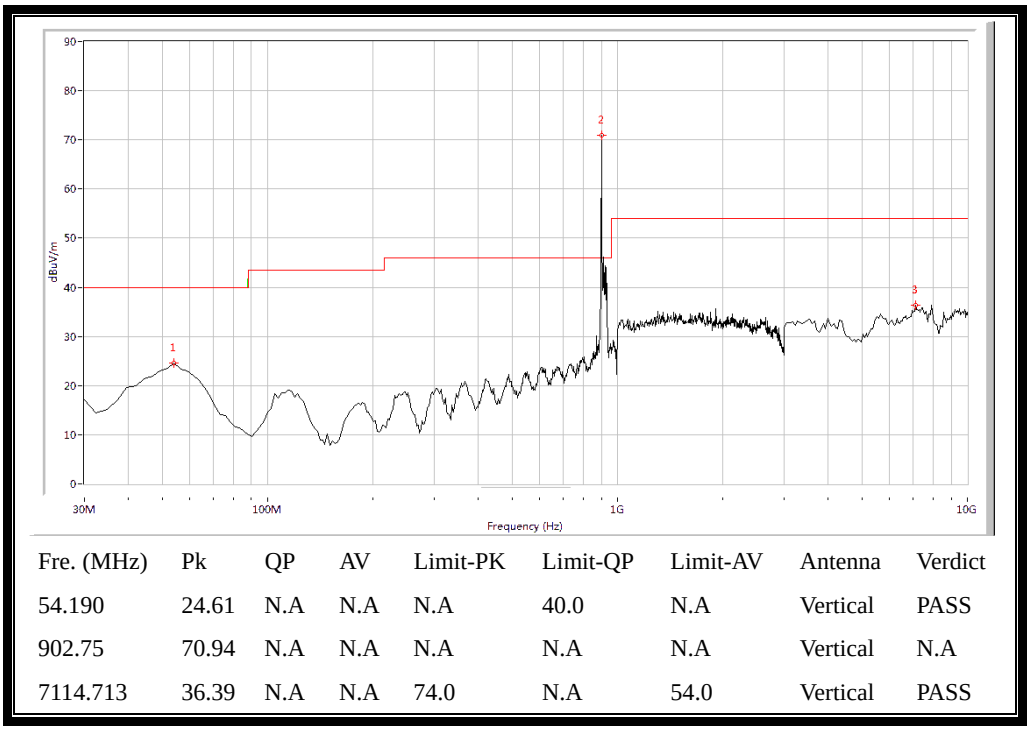
A. Test Plots for the Whole Measurement Frequency Range:

Plots for Channel = 1



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
637.157	32.70	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
902.75	71.17	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
7882.793	36.68	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

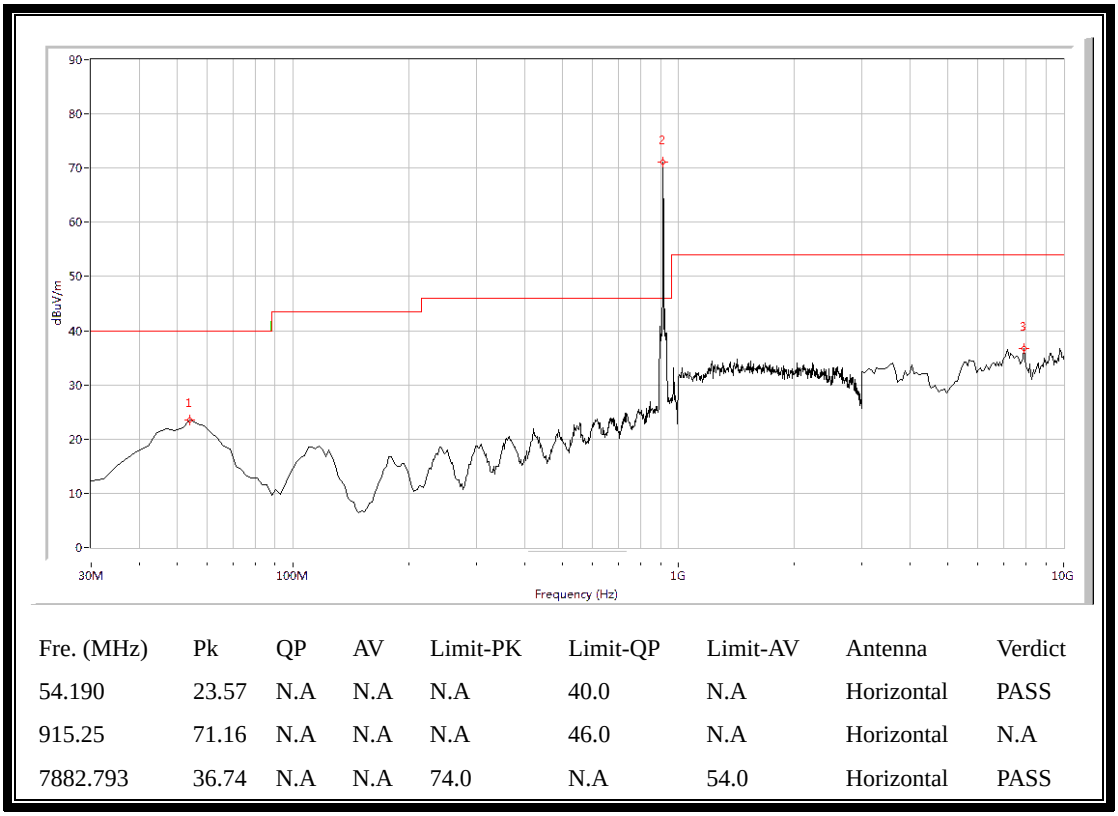
(Plot A.1: 30MHz to 10GHz, Antenna Horizontal @ Profile 1, channel 1)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
54.190	24.61	N.A	N.A	N.A	40.0	N.A	Vertical	PASS
902.75	70.94	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
7114.713	36.39	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

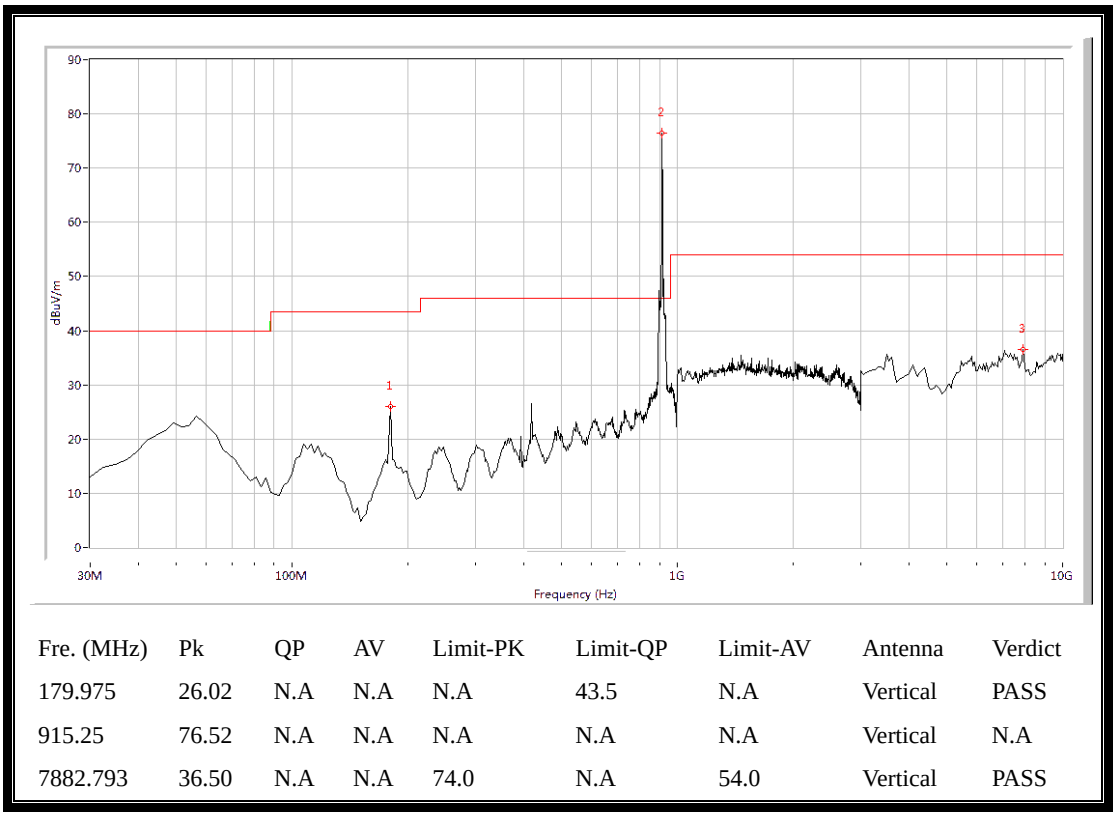
(Plot A.2: 30MHz to 10GHz, Antenna Vertical @ Profile 1, channel 1)

Plot for Channel = 26



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
54.190	23.57	N.A	N.A	N.A	40.0	N.A	Horizontal	PASS
915.25	71.16	N.A	N.A	N.A	46.0	N.A	Horizontal	N.A
7882.793	36.74	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

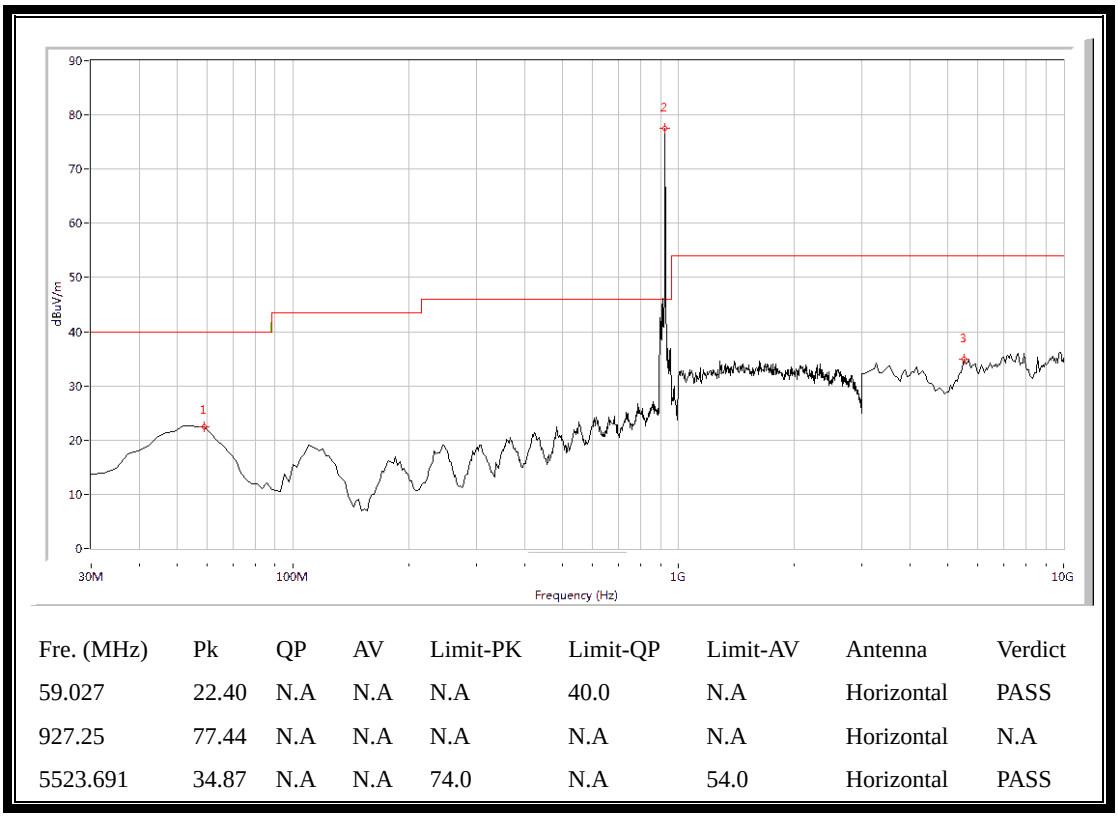
(Plot B.1: 30MHz to 10GHz, Antenna Horizontal @ Profile 1, channel 26)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
179.975	26.02	N.A	N.A	N.A	43.5	N.A	Vertical	PASS
915.25	76.52	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
7882.793	36.50	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

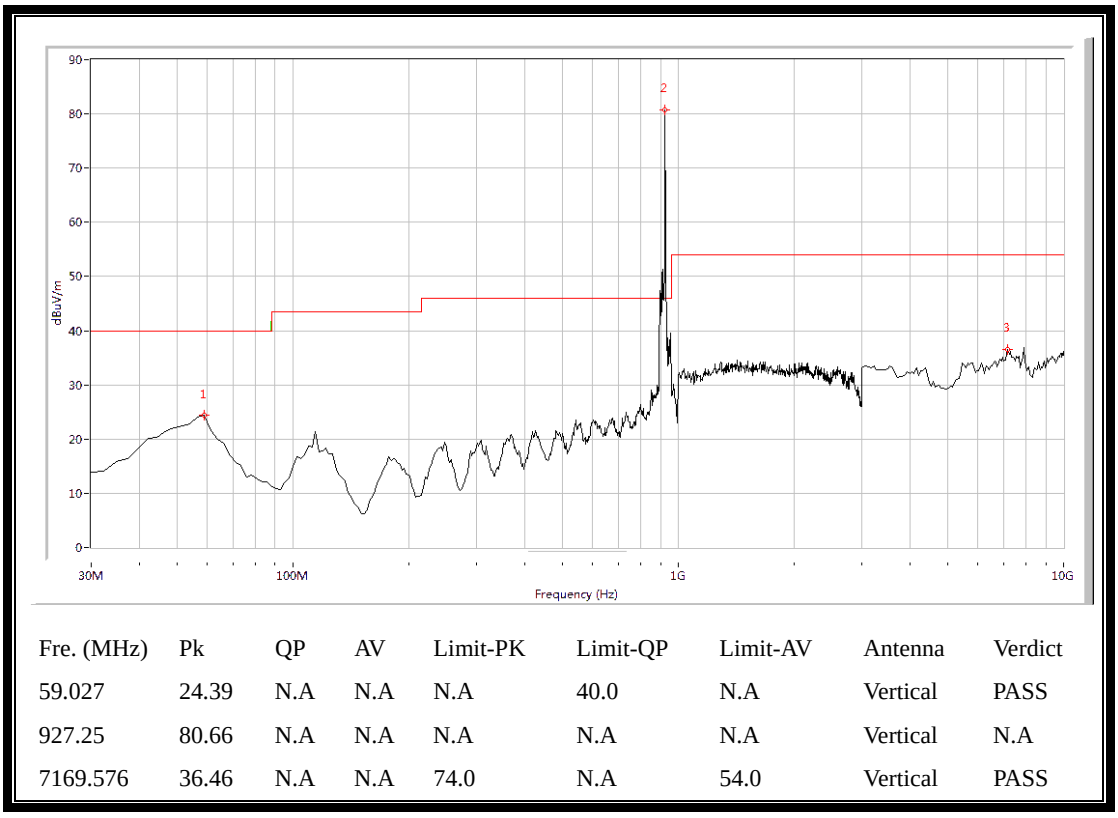
(Plot B.2: 30MHz to 10GHz, Antenna Vertical @ Profile 1, channel 26)

Plot for Channel = 50



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
59.027	22.40	N.A	N.A	N.A	40.0	N.A	Horizontal	PASS
927.25	77.44	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
5523.691	34.87	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

(Plot C.1: 30MHz to 10GHz, Antenna Horizontal @ Profile 1, channel 50)



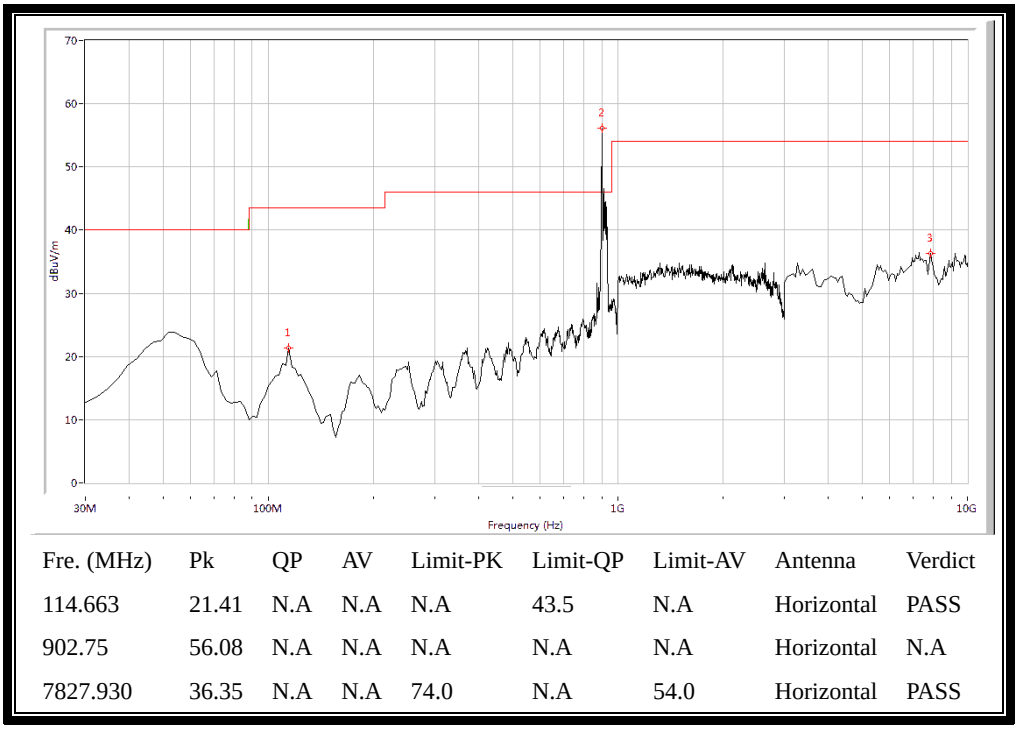
Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
59.027	24.39	N.A	N.A	N.A	40.0	N.A	Vertical	PASS
927.25	80.66	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
7169.576	36.46	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

(Plot C.2: 30MHz to 10GHz, Antenna Vertical @ Profile 1, channel 50)

2.9.4.2. Profile 2 Mode：

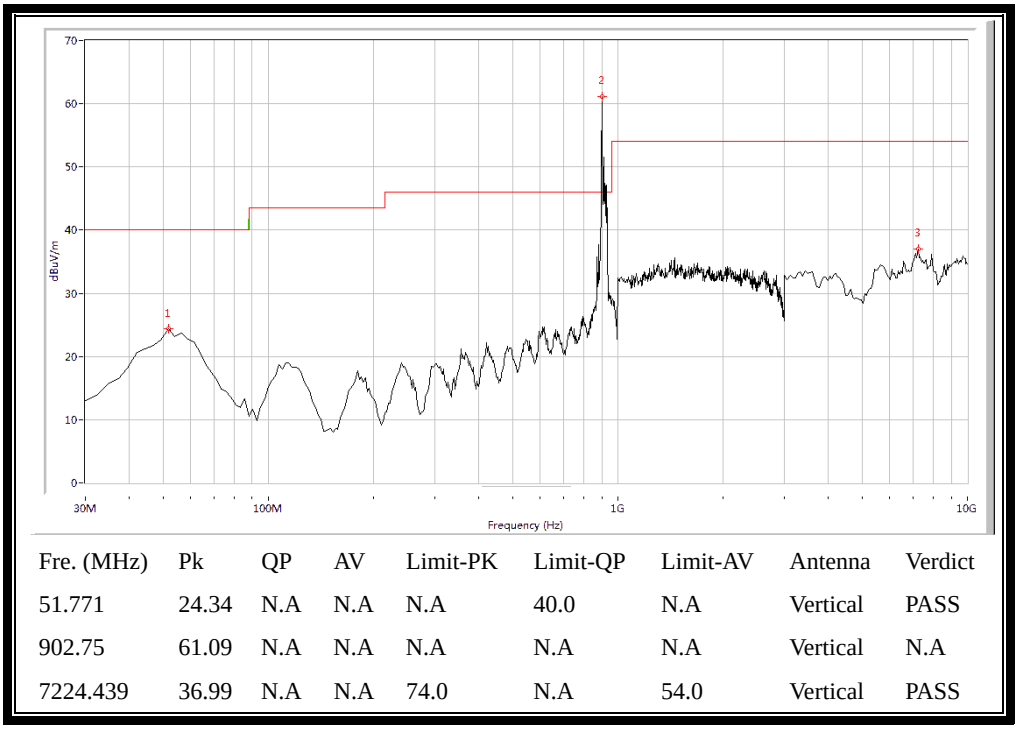
A. Test Plots for the Whole Measurement Frequency Range:

Plots for Channel = 1



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
114.663	21.41	N.A	N.A	N.A	43.5	N.A	Horizontal	PASS
902.75	56.08	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
7827.930	36.35	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

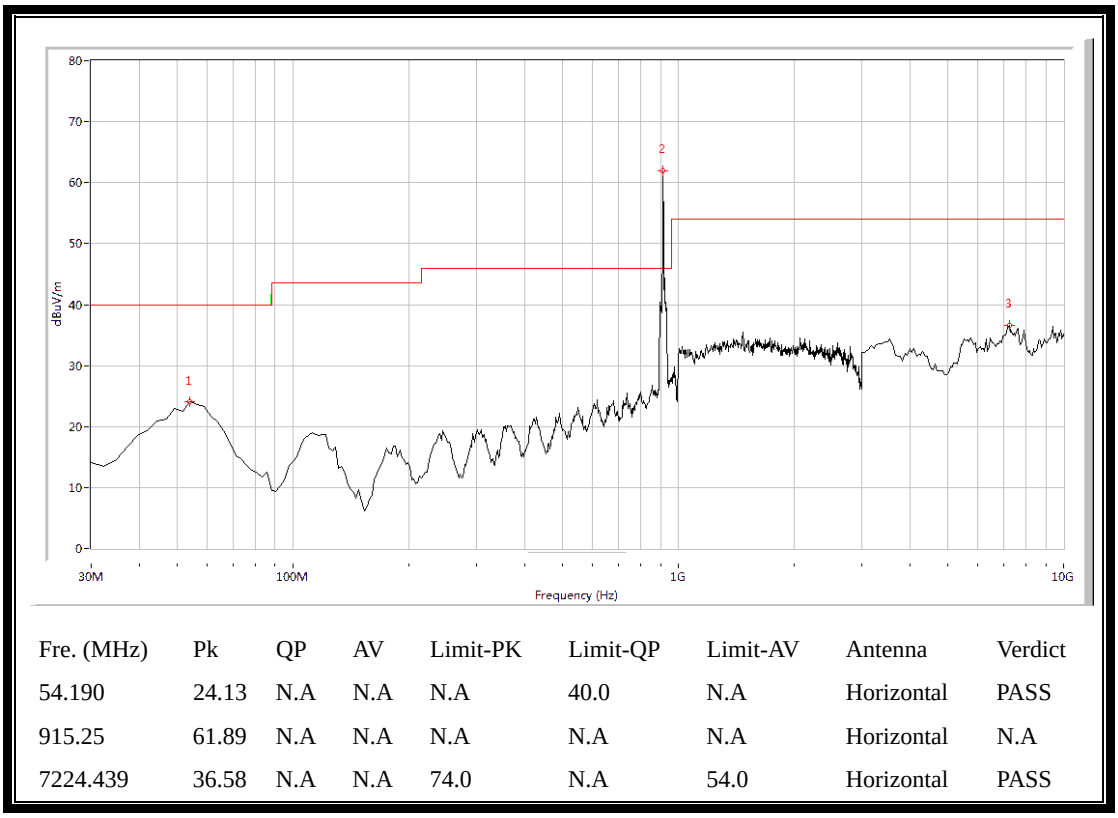
(Plot A.1: 30MHz to 10GHz, Antenna Horizontal @ Profile 2, channel 1)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
51.771	24.34	N.A	N.A	N.A	40.0	N.A	Vertical	PASS
902.75	61.09	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
7224.439	36.99	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

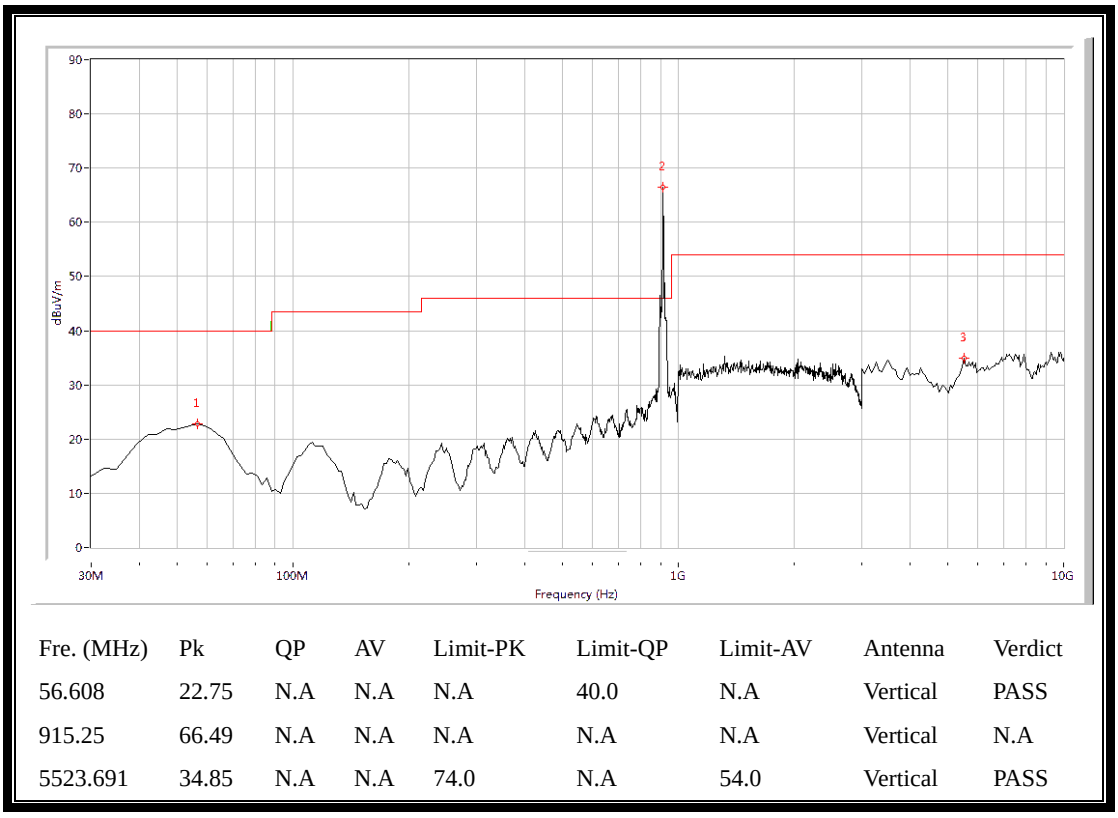
(Plot A.2: 30MHz to 10GHz, Antenna Vertical @ Profile 2, channel 1)

Plot for Channel = 26



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
54.190	24.13	N.A	N.A	N.A	40.0	N.A	Horizontal	PASS
915.25	61.89	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
7224.439	36.58	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

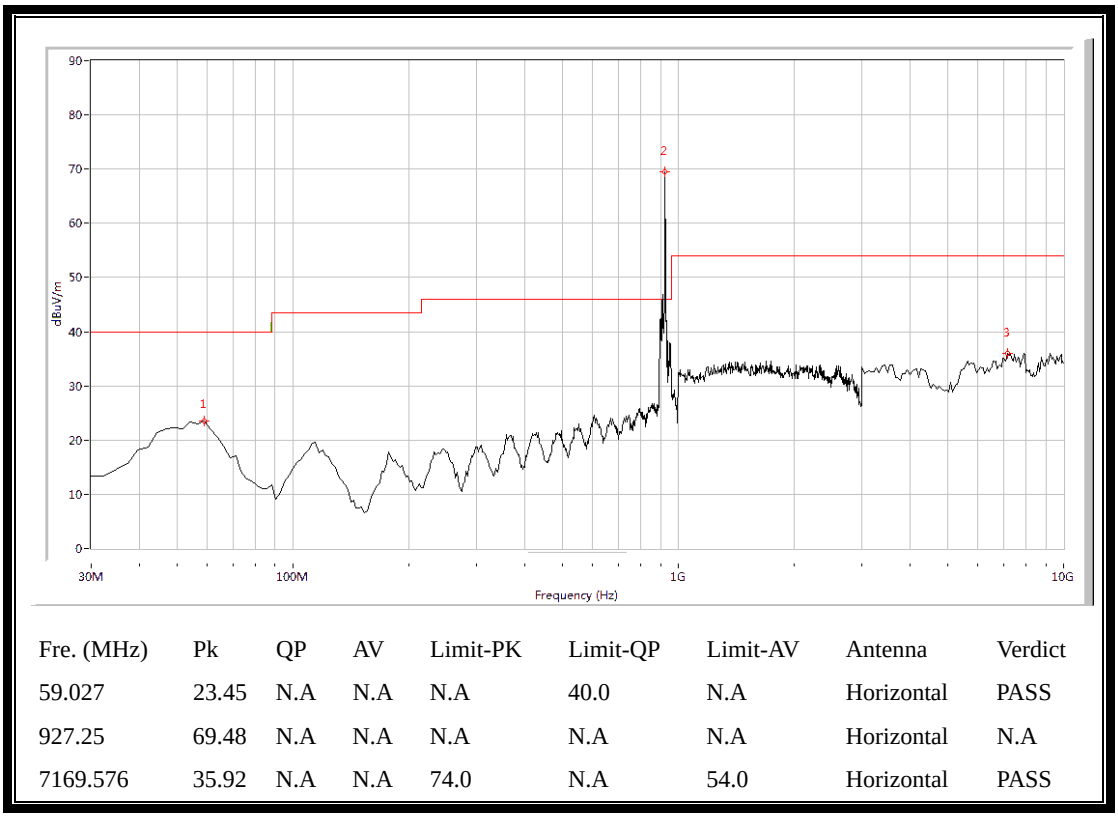
(Plot B.1: 30MHz to 10GHz, Antenna Horizontal @ Profile 2, channel 26)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
56.608	22.75	N.A	N.A	N.A	40.0	N.A	Vertical	PASS
915.25	66.49	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
5523.691	34.85	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

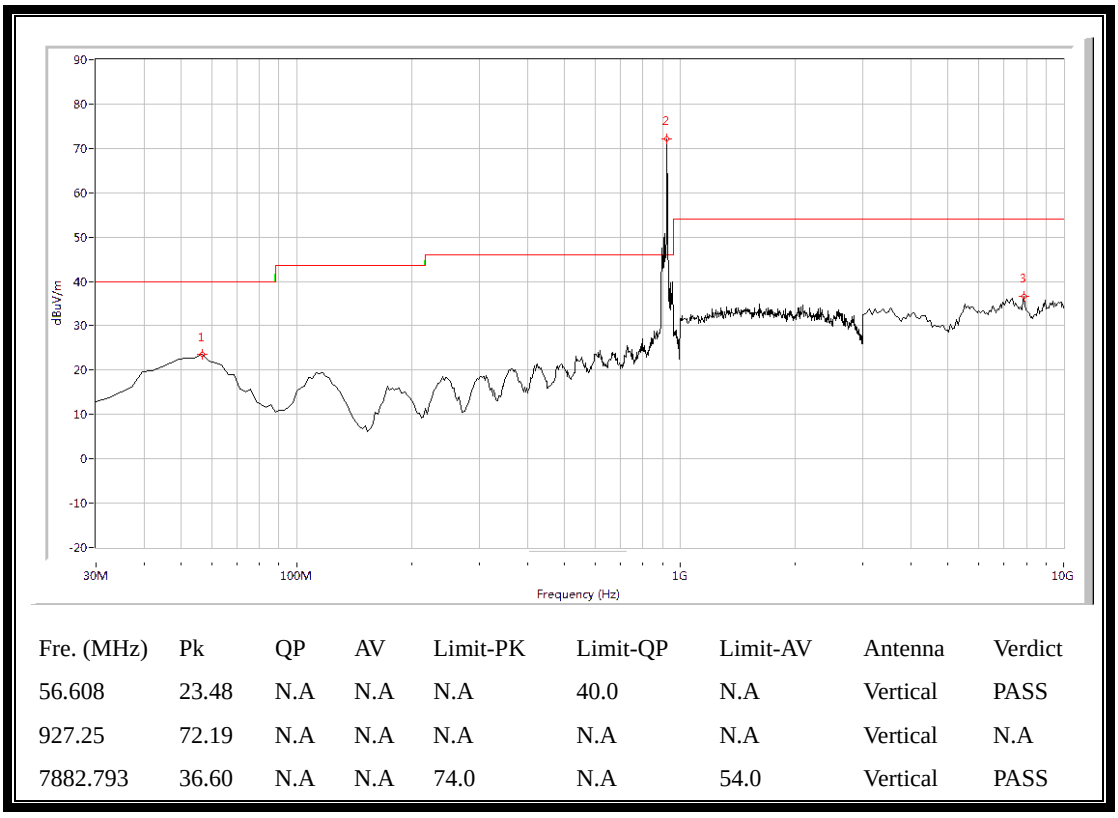
(Plot B.2: 30MHz to 10GHz, Antenna Vertical @ Profile 2, channel 26)

Plot for Channel = 50



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
59.027	23.45	N.A	N.A	N.A	40.0	N.A	Horizontal	PASS
927.25	69.48	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
7169.576	35.92	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

(Plot C.1: 30MHz to 10GHz, Antenna Horizontal @ Profile 2, channel 50)



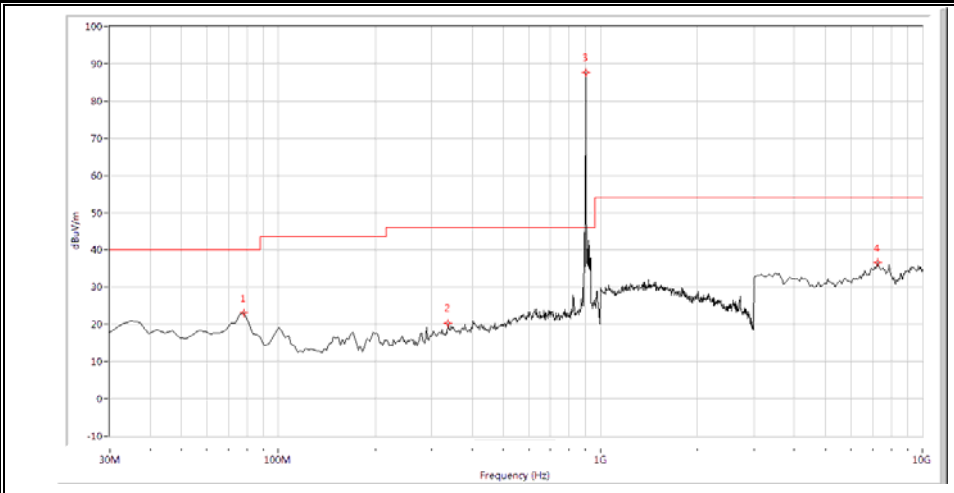
Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
56.608	23.48	N.A	N.A	N.A	40.0	N.A	Vertical	PASS
927.25	72.19	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
7882.793	36.60	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

(Plot C.2: 30MHz to 10GHz, Antenna Vertical @ Profile 2, channel 50)

2.9.4.3. Profile 4 Mode：

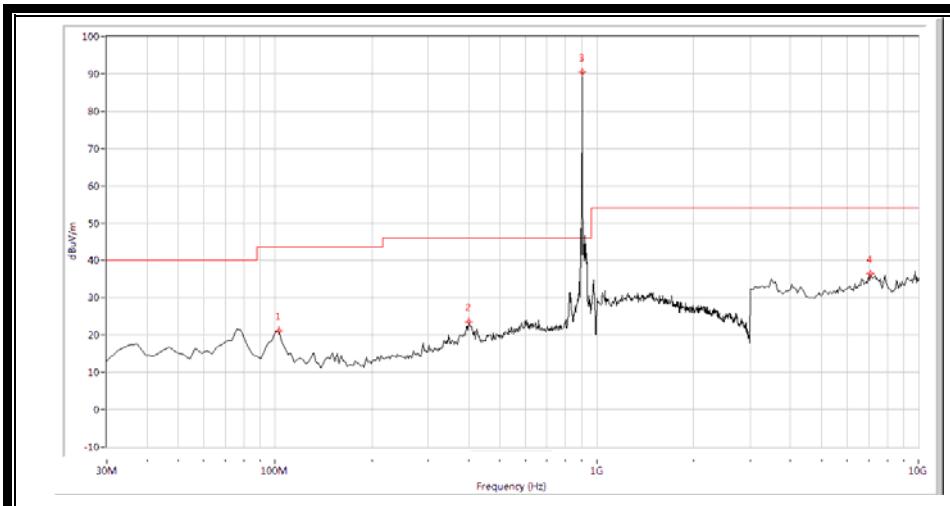
A. Test Plots for the Whole Measurement Frequency Range:

Plots for Channel = 1



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
78.379	23.17	N.A	N.A	N.A	40.0	N.A	Horizontal	PASS
337.207	20.23	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
902.750	87.58	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
7279.302	36.53	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

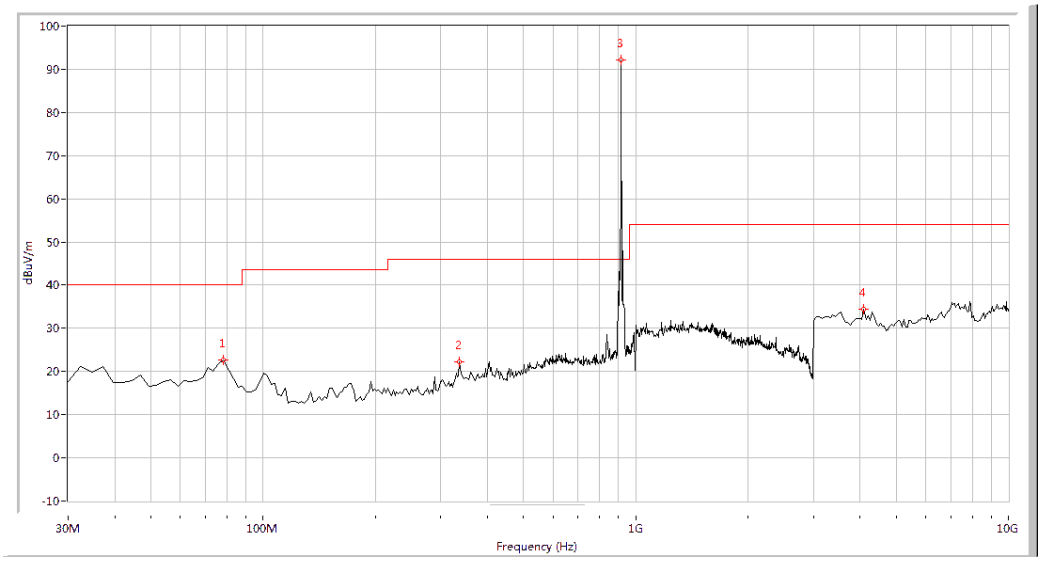
(Plot A.1: 30MHz to 10GHz, Antenna Horizontal @Profile 4, channel 1)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
102.569	21.21	N.A	N.A	N.A	43.5	N.A	Vertical	PASS
400.100	23.49	N.A	N.A	N.A	46.0	N.A	Vertical	PASS
902.750	90.44	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
7114.713	36.36	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

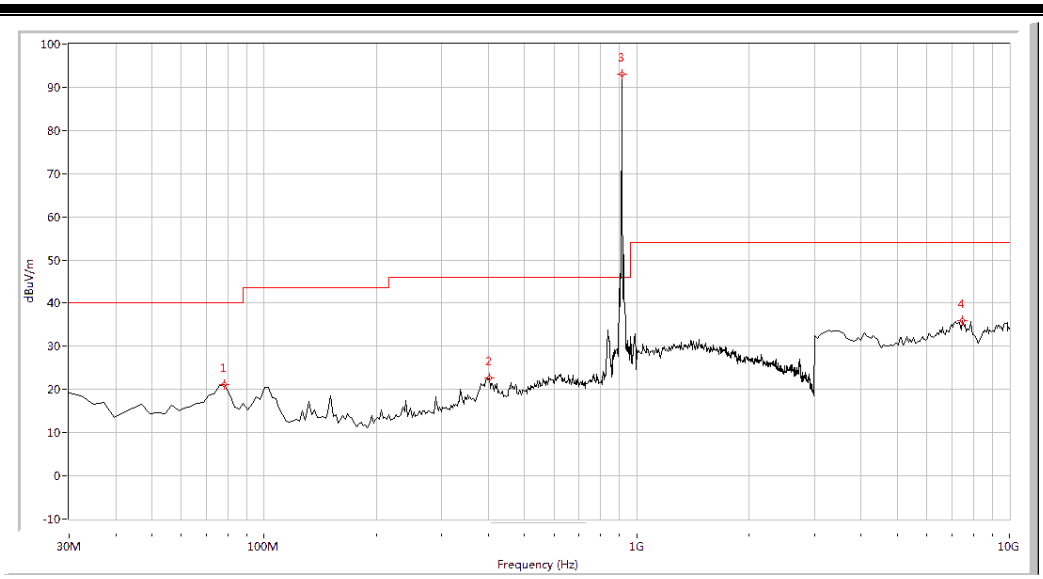
(Plot A.2: 30MHz to 10GHz, Antenna Vertical @Profile 4, channel 1)

Plot for Channel = 26



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
78.379	22.68	N.A	N.A	N.A	40.0	N.A	Horizontal	PASS
337.207	22.16	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
915.250	92.15	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
4097.257	34.33	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

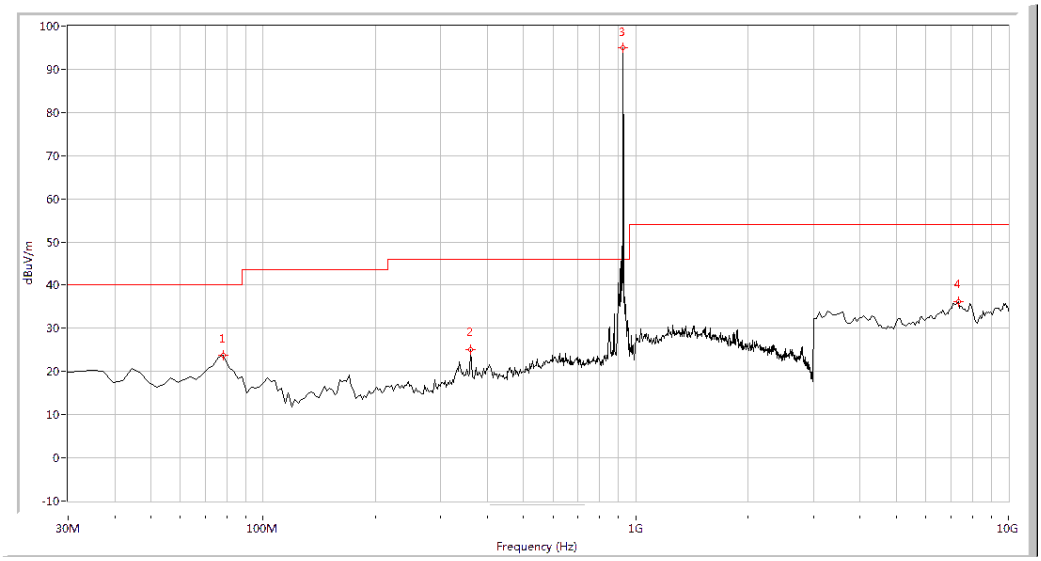
(Plot B.1: 30MHz to 10GHz, Antenna Horizontal @Profile 4, channel 26)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
78.379	21.21	N.A	N.A	N.A	40.0	N.A	Vertical	PASS
402.59	22.73	N.A	N.A	N.A	46.0	N.A	Vertical	PASS
915.250	92.97	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
7498.753	35.85	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

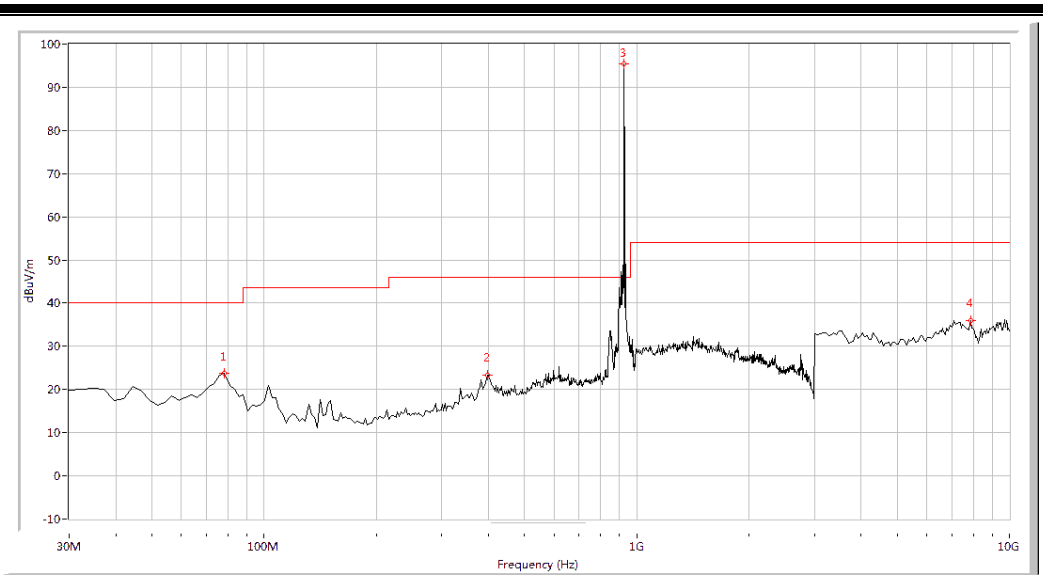
(Plot B.2: 30MHz to 10GHz, Antenna Vertical @Profile 4, channel 26)

Plot for Channel = 50



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
78.379	23.81	N.A	N.A	N.A	40.0	N.A	Horizontal	PASS
361.397	24.97	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
927.250	95.04	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
7334.165	36.19	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

(Plot C.1: 30MHz to 10GHz, Antenna Horizontal @Profile 4, channel 50)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
78.379	23.81	N.A	N.A	N.A	40.0	N.A	Vertical	PASS
397.681	23.40	N.A	N.A	N.A	46.0	N.A	Vertical	PASS
927.250	95.37	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
7882.793	35.96	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

(Plot C.2: 30MHz to 10GHz, Antenna Vertical @Profile 4, channel 50)

2.10. RF exposure evaluation

Equation from page 18 of OET Bulletin 65, Edition 97-01

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

Where:

S = power density

P = power input to the antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

2.10.1. Limits for Maximum Permissible Exposure

According to FCC Part 1.1307, systems operating under the provisions of this section shall be operated in a manner the ensures that the public is not exposed to radio frequency energy level in excess of the commission's guidelines.

According to FCC Part 1.1310 RF exposure is calculated.

Limits for General Population/ Uncontrolled Exposure			
Frequency Range (MHz)	Electric Field Strength(E)(V/m)	Magnetic Field Strength (H)(A/m)	Power Density (S)(mW/cm2)
0.3-1.34	614	1.63	(100)*
1.34-30	824/f	2.19/f	(180/f2)*
30-300	27.5	0.073	0.2
300-1500			f/1500
1500-100,000			1.0

2.10.2. Test result

Maximum peak output power at antenna input terminal(dBm):	29.85
Maximum peak output power at antenna input terminal(mW):	966.051
Source-based time-averaged output power:	--
Prediction distance(cm):	20
Predication frequency(MHz):	927.25
Antenna Gain (typical) (dBi):	5
Power density at predication frequency at 20 cm(mW/cm^2):	0.607757
MPE limit for RF exposure at prediction frequency(mW/cm^2):	0.618

2.10.3. Conclusion

Since the test result is passed, the SAR measurement is not required.

** END OF REPORT **