

Global EMC Inc. Labs

RF Test Report

As per

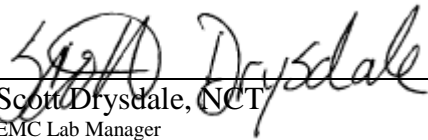
RSS 197 Issue 1:2010

&

FCC Part 90 Subpart Z

on the

**X100 Hub Module and X100
Remote Backhaul Module**



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Testing produced for



See Appendix A for full customer & EUT details.



LAB REGISTRATION #6844A-3



FCC
REGISTRATION
#612361



Client	Blinq Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

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Client	Blinq Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

Report Scope

This report addresses the EMC verification testing and test results of the <EUT>, herein referred to as EUT (Equipment Under Test) performed at Global EMC Labs.

The EUT was tested for compliance against the following standards:

RSS 197 Issue 1:2010


FCC Part 90 Subpart Z

Test procedures, results, justifications, and engineering considerations, if any, follow later in this report.

The results contained in this report relate only to the item(s) tested.

This report does not imply product endorsement by A2LA or any other accreditation agency, any government, or Global EMC Inc.


Opinions/interpretations expressed in this report, if any, are outside the scope of Global EMC Inc accreditation. Any opinions expressed do not necessarily reflect the opinions of Global EMC Inc, unless otherwise stated.

Client	Blinq Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

Summary


The results contained in this report relate only to the item(s) tested.

EUT FCC Certification #, FCC ID:	ROR00000001
EUT Industry Canada Certification #, IC:	10794A-00000001
EUT Passed all tests performed.	Yes (see test results summary)
Tests conducted by	Scott Drysdale

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

Test Results Summary

Standard/Method	Description	Requirement	Result
FCC Section 90.205 FCC Section 90.1321	Maximum power output	10W/10MHz or 40dBm per 10 MHz	Pass
FCC Section 90.1321 RSS 197 Section 5.6	Peak EIRP power density	30 dBm per 1 MHz	Pass
FCC Section 90.209	Occupied Bandwidth	N/A	Pass
FCC Section 90.210(b)	Emission Mask	Mask B	Pass
FCC Section 9.1323	Conducted Spurious Emissions	dBc \geq -43 + 10log(P)	Pass
FCC Section 9.1323	Radiated Spurious Emissions	82.2 dBuV/m (-13 dBm EIRP)	Pass
FCC Section 90.213	Frequency Stability	N/A	Pass
FCC 2.1091 FCC 90.1335 IC Safety code 6	Maximum Permissible Exposure	> 20 cm separation. (30 cm required)	Pass See justifications and MPE Exhibit
Overall Result			PASS

Client	Bling Networks	
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Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

All tests were performed by Scott Drysdale.

If the product as tested or otherwise complies with the specification, the EUT is deemed to comply with the requirement and is deemed a 'PASS' grade. If not 'FAIL' grade will be issued. Note that 'PASS' / 'FAIL' grade is independent of any measurement uncertainties. A 'PASS' / 'FAIL' grade within measurement uncertainty is marked with a '*'.

Justifications, Descriptions, or Deviations


The following justifications for tests not performed or deviations from the above listed specifications apply:

For Power spectral density and peak power, this devices output signals are completely uncorrelated as defined in FCC KDB 662911 D01. Therefore, each of the two EIRPs or ERPs (total or spectral density) for ANT1 and ANT2 were measured individually to be below the limit.

The power measurements were equal or worst case with ANT1 port as compared to ANT2 port. The ANT1 port results are presented in this report as representative.


From an RF perspective, the X100 Hub Module and X100 Remote Backhaul Module are identical. The physical difference are two bulkhead N connectors placed in the chassis are not present on the remote backhaul module. The Remote Backhaul module uses internal antennas with an equal gain to the Hub module of 17 dBi. The Hub Module was tested as representative of both units.

For maximum permissible exposure, this device operates is designed to operate at fixed installations greater then 30 cm from personnel during normal operation,, as per instructions provided in end user documentation. A separate MPE exhibit is presented.

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

Applicable Standards, Specifications and Methods

- ANSI C63.4:2003 - Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
- ANSI C63.2: 1996 - American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
- ANSI/TIA/EIA-603-C:2004 Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
- CFR 47 FCC 15 - Code of Federal Regulations – Radio Frequency Devices
- CFR 47 FCC 90Z - Subpart Z—Wireless Broadband Services in the 3650–3700 MHz Band
- CISPR 22:1997 - Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement
- ICES-003:2004 - Digital Apparatus - Spectrum Management and Telecommunications Policy Interference-Causing Equipment Standard
- ISO 17025:2005 - General Requirements for the competence of testing and calibration laboratories
- RSS 197:2010 - Wireless Broadband Access Equipment Operating in the Band 3650-3700 MHz
- RSS-Gen:2010 General Requirements and Information for the Certification of Radio Apparatus

Client	Blinq Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
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Sample calculation(s)

Margin = limit – (received signal + antenna factor + cable loss – pre-amp gain)

Margin = 50.5dBuV/m – (50dBuV + 10dB + 2.5dB – 20dB)

Margin = 8.5 dB

Document Revision Status

Draft 1 - Feb 13, 2013

Draft released to client – subject to change

Revision 1 - Feb 19, 2013


First revision – minor corrections as per client instruction

Revision 2 - April 11, 2013

Second revision – added additional graphs for power spectral density for other modulation schemes as per FCC request.

Revision 3 - April 12, 2013

Added limits to the graphs on page 19 through 22 as per FCC request.

Client	Blinq Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

Definitions and Acronyms

The following definitions and acronyms are applicable in this report.
See also ANSI C63.14.

AE – Auxillary Equipment.

BW – Bandwidth. Unless otherwise stated, this is refers to the 6 dB bandwidth.

EMC – Electro-Magnetic Compatibility

EMI – Electro-Magnetic Immunity

EUT – Equipment Under Test

ITE – Information Technology Equipment with a primary function(s) of entry, storage, display, retrieval, transmission, processing, switching, or control, of data.

LISN – Line impedance stabilization network

NCR – No Calibration Required

RF – Radio Frequency


Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

Testing Facility

Testing for EMC on the EUT was carried out at Global EMC labs in Toronto, Ontario, Canada. The testing lab consists of a 3m semi-anechoic chamber calibrated to be able to allow measurements on an EUT with a maximum width or length of up to 2m and height up to 3m. The chamber is equipped with a turn table that is capable of testing devices up to 3300lb in weight. This facility is capable of testing products that are rated for 120 Vac and 240Vac single phase, or 208 Vac 3 phase input. DC capability is also available. The chamber is equipped with an antenna mast that controls polarization and height from the control room adjoining the shielded chamber. Radiated emissions measurements are performed using a Bilog, and Horn antenna where applicable. Conducted emissions, unless otherwise stated, are performed using a LISN.

Calibrations and Accreditations


The measurement site used is registered with Federal Communications Commission (FCC) and Industry Canada (IC). This site is calibrated for Normalized Site Attenuation (NSA) using test procedures outlined in ANSI C63.4 “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz”. The semi-anechoic chamber is lined with ferrite tiles and absorption cones to minimize any undesired reflections. All measuring equipment is calibrated on an annual or bi-annual basis as listed for each respective test. Global EMC is an ISO 17025 Accredited facility, with A2LA Certificate #2555.01, however the testing in this report is not covered under the scope of accreditation.

Client	Bling Networks	
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Testing Dates and Environmental Conditions

Following were the environmental conditions in the facility during time of testing –

Date	Test	Init.	Temperature (°C)	Humidity (%)	Pressure (kPa)
Jan 1 - 30, 2013	Maximum power output	SD	20-25°C	30-45%	100 -103kPa
Jan 1 - 30, 2013	Peak EIRP power density	SD	20-25°C	30-45%	100 -103kPa
Jan 1 - 30, 2013	Occupied Bandwidth	SD	20-25°C	30-45%	100 -103kPa
Jan 1 - 30, 2013	Emission Mask	SD	20-25°C	30-45%	100 -103kPa
Jan 1 - 30, 2013	Conducted Spurious Emissions	SD	20-25°C	30-45%	100 -103kPa
Jan 1 - 30, 2013 Feb 13, 2013	Radiated Spurious Emissions	SD	20-25°C	30-45%	100 -103kPa
Jan 1 - 30, 2013	Frequency Stability	SD	20-25°C	30-45%	100 -103kPa

Client	Blinq Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

Detailed Test Results Section

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

Maximum Conducted Power

Purpose


The purpose of this test is to ensure that the maximum power conducted to the radiating element does not exceed the limits specified.

Limits

The limits are defined in FCC Part 90, Section 90.205 and 90.1321. This is 10W per 10 MHz, or 40 dBm EIRP. The test procedure is as per 47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1.

Results

The EUT passed. The maximum power measured was 38.96 dBm (7.87 Watts) including antenna gain, in a 10 MHz channel.


Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

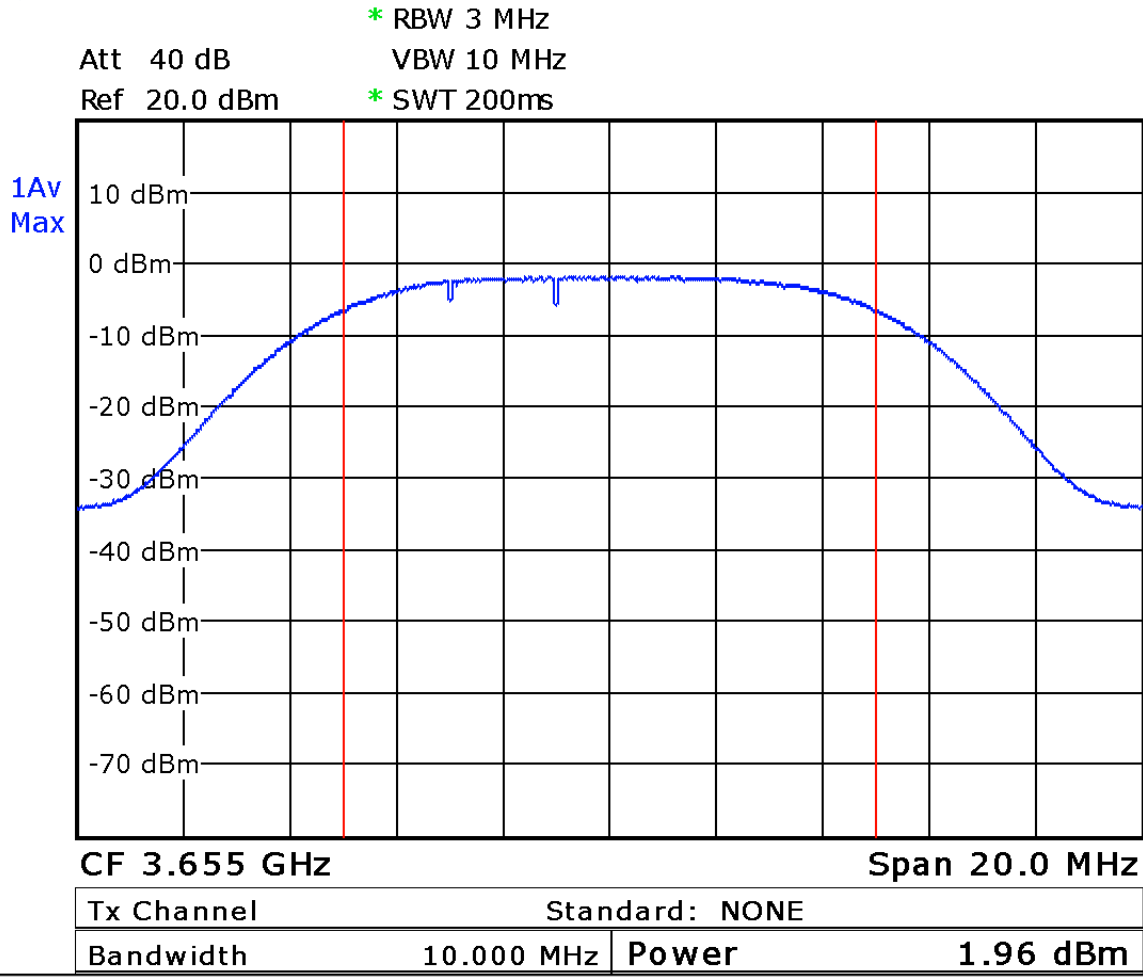
Table(s)

The table shown below shows the peak power output of the device during the antenna conducted measurement during transmit operation of the EUT.

Modulation	Channel Freq (MHz)	Raw (dBm)	Att.(dB)	Ant gain (dBi)	Power (dBm)	Limit (dBm)	Margin (dB)
QPSK	3655	1.91	20	17	38.91	40	1.09
	3675	1.48	20	17	38.48	40	1.52
	3695	0.91	20	17	37.91	40	2.09
16 QAM	3655	1.44	20	17	38.44	40	1.56
	3675	1.53	20	17	38.53	40	1.47
	3695	0.51	20	17	37.51	40	2.49
64QAM	3655	1.91	20	17	38.91	40	1.09
	3675	1.62	20	17	38.62	40	1.38
	3695	0.99	20	17	37.99	40	2.01
256 QAM	3655	1.96	20	17	38.96	40	1.04
	3675	1.42	20	17	38.42	40	1.58
	3695	1.25	20	17	38.25	40	1.75

Worst case highlighted in green above.


Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	



Date: 2.JAN.2013 18:00:56

N

ote: See 'Appendix B – EUT & Test Setup Photographs' for photos showing the test set-up.


Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

Test Equipment List

Testing was performed on January 14-18th, 2013.

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Power Head	PH 2000	AR	2011-01-31	2013-01-31	GEMC 15
Power meter	PM 2002	AR	2011-01-31	2013-01-31	GEMC 16
Spectrum Analyzer	ESL 6	Rohde & Schwarz	Oct-06, 2011	Oct-06, 2013	GEMC 160
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
Power Attenuator 20 dB	25-A-FFN-20	Bird / Hutton	NCR	NCR	GEMC 49

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B_Rev1"

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

Power Spectral Density - DM

Purpose

The purpose of this test is to ensure that the maximum power spectral density to the radiating element does not exceed the limits specified. This ensures that the modulation is significantly wide enough, or low enough in power that it will allow for co-operation of other wireless devices operating within this frequency allocation.

Limits

The limits are defined in FCC Section 90.1321 and RSS 197 Section 5.6

The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 30 dBm in any 1 MHz band during any time interval of continuous transmission.

Results

The EUT passed. Each mode was tested at low, medium, and high band. The worst case value is 29.76 dBm, or 946 mW, as measured with the following settings


Operating frequency range: 3650.0 – 3700.0 MHz

Detector used: average (rms)

Resolution bandwidth: 100 kHz with integration over a 1 MHz slice of spectrum

Video bandwidth: 300 kHz (or greater)


Antenna gain: 17 dBi.

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

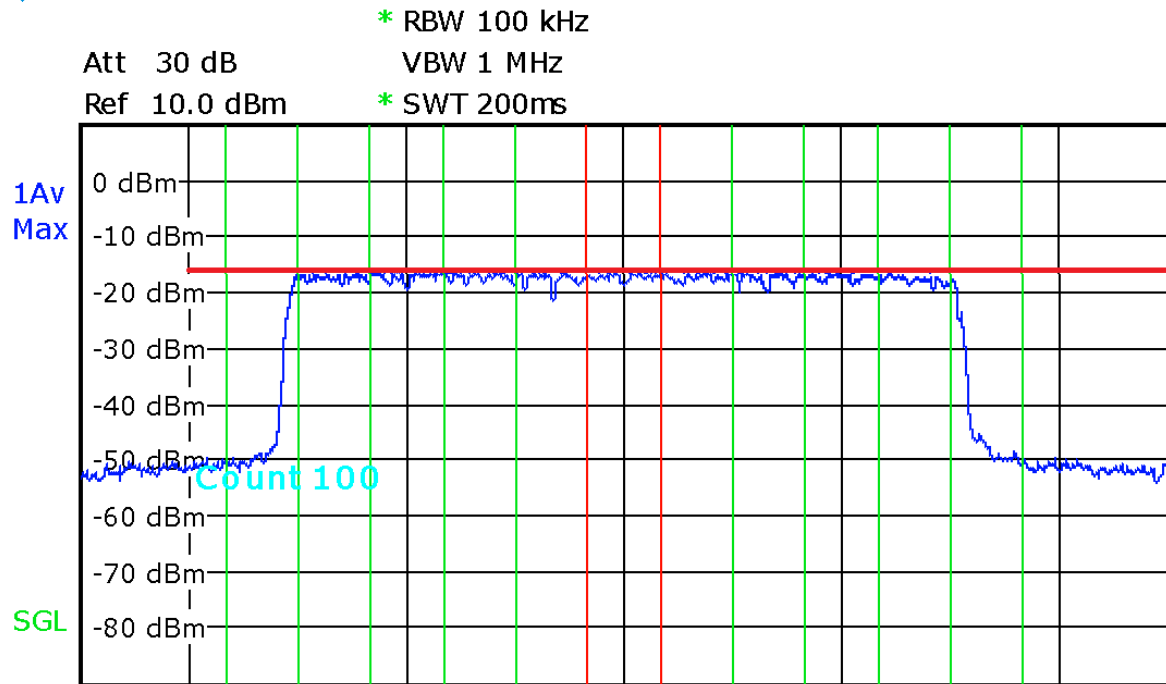
Final Measurement Tables

Modulation	EUT Channel Freq (MHz)	Raw (dBm)	Att.(dB)	Ant gain (dBi)	Power (dBm)	Limit (dBm)	Margin (dB)
QPSK	3655	-7.58	20	17	29.42	30	0.58
	3675	-7.99	20	17	29.01	30	0.99
	3695	-8.71	20	17	28.29	30	1.71
16 QAM	3655	-7.47	20	17	29.53	30	0.47
	3675	-8.28	20	17	28.72	30	1.28
	3695	-8.94	20	17	28.06	30	1.94
64QAM	3655	-7.46	20	17	29.54	30	0.46
	3675	-7.75	20	17	29.25	30	0.75
	3695	-8.73	20	17	28.27	30	1.73
256 QAM	3655	-7.24	20	17	29.76	30	0.24
	3675	-7.75	20	17	29.25	30	0.75
	3695	-8.51	20	17	28.49	30	1.51

Note: Power = Raw + Att (attenuation) + Ant Gain. Worst case is highlighted in green above.

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

QPSK Worst Case Graph (Low channel)




CF 3.655 GHz Span 15.0 MHz

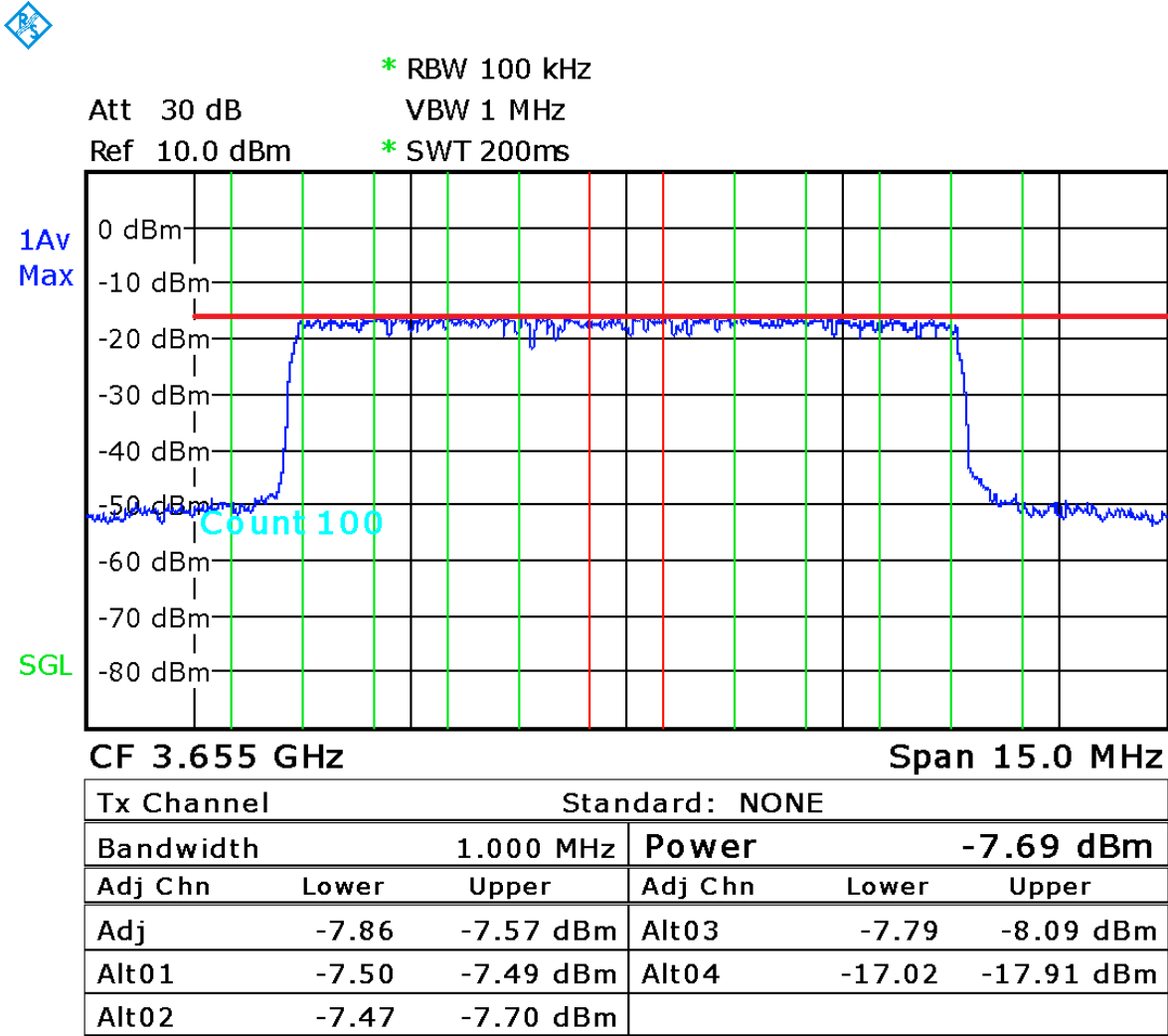
Tx Channel		Standard: NONE			
Bandwidth		1.000 MHz	Power		-7.64 dBm
Adj Chn	Lower	Upper	Adj Chn	Lower	Upper
Adj	-7.82	-7.71 dBm	Alt03	-7.80	-8.16 dBm
Alt01	-7.57	-7.88 dBm	Alt04	-17.12	-18.49 dBm
Alt02	-7.58	-7.76 dBm			

Date: 21.DEC.2012 12:27:47

Note: Limit is 30 dBm. Accounting for a 17 dBi antenna gain and an external 20 dB attenuator, the 1 MHz limit is -7 dBm raw. The approximate 100 kHz limit would be -17 dBm based on a 10 dB, or $20 \log(\text{bandwidth}_1/\text{bandwidth}_2)$ factor as shown in the graph above. However, this measurement was made at 100 kHz and integrated over a 1 MHz spectrum as shown in the table above for each of the 10 upper and lower adjacent 1 MHz bandwidths. For EUT in low, middle and high frequency band measurements, taking into account all applicable factors see table on page 18.


Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

16 QAM – Worst Case Graph

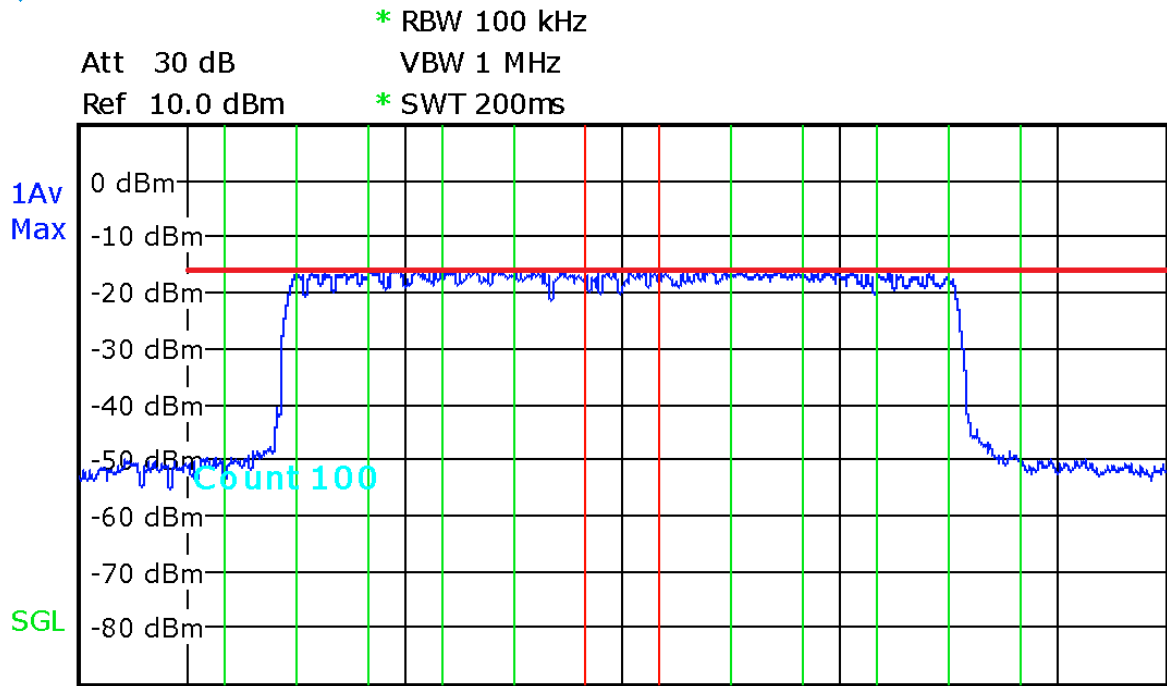


Date: 21.DEC.2012 15:37:11

Note: Limit is 30 dBm. Accounting for a 17 dBi antenna gain and an external 20 dB attenuator, the 1 MHz limit is -7 dBm raw. The approximate 100 kHz limit would be -17 dBm based on a 10 dB, or $20 \log(\text{bandwidth}_1/\text{bandwidth}_2)$ factor as shown in the graph above. However, this measurement was made at 100 kHz and integrated over a 1 MHz spectrum as shown in the table above for each of the 10 upper and lower adjacent 1 MHz bandwidths. For EUT in low, middle and high frequency band measurements, taking into account all applicable factors see table on page 18.

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

64 QAM - Worst Case Graph




CF 3.655 GHz Span 15.0 MHz

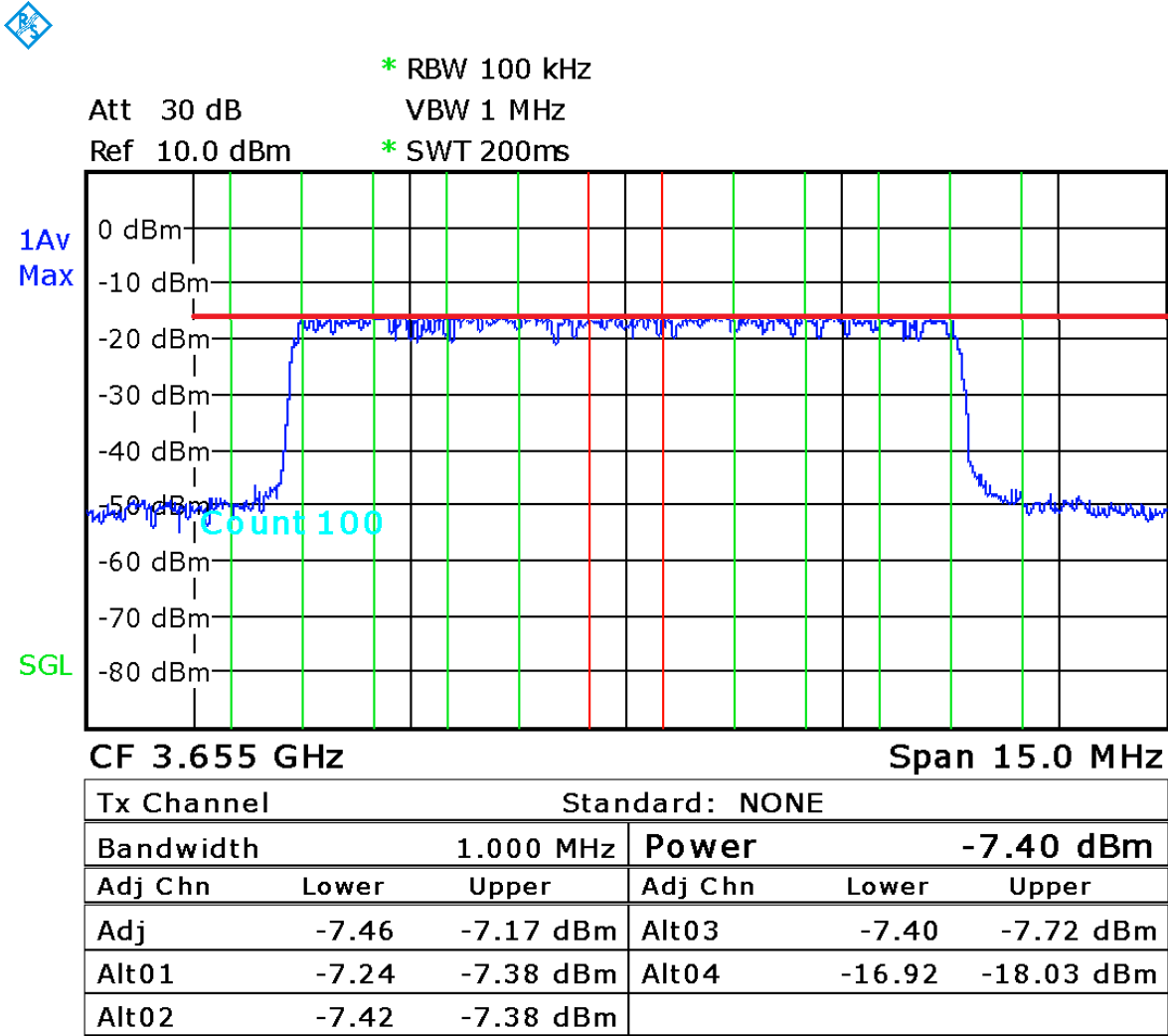
Tx Channel		Standard: NONE			
Bandwidth		1.000 MHz	Power		-7.82 dBm
Adj Chn	Lower	Upper	Adj Chn	Lower	Upper
Adj	-7.75	-7.66 dBm	Alt03	-7.77	-8.13 dBm
Alt01	-7.46	-7.42 dBm	Alt04	-17.15	-17.84 dBm
Alt02	-7.55	-7.77 dBm			

Date: 2.JAN.2013 15:03:11

Note: Limit is 30 dBm. Accounting for a 17 dBi antenna gain and an external 20 dB attenuator, the 1 MHz limit is -7 dBm raw. The approximate 100 kHz limit would be -17 dBm based on a 10 dB, or $20 \log(\text{bandwidth}_1/\text{bandwidth}_2)$ factor as shown in the graph above. However, this measurement was made at 100 kHz and integrated over a 1 MHz spectrum as shown in the table above for each of the 10 upper and lower adjacent 1 MHz bandwidths. For EUT in low, middle and high frequency band measurements, taking into account all applicable factors see table on page 18.


Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

256 QAM Worst Case Graph



Date: 2.JAN.2013 19:53:55

Note: Limit is 30 dBm. Accounting for a 17 dBi antenna gain and an external 20 dB attenuator, the 1 MHz limit is -7 dBm raw. The approximate 100 kHz limit would be -17 dBm based on a 10 dB, or $20 \log(\text{bandwidth}_1/\text{bandwidth}_2)$ factor as shown in the graph above. However, this measurement was made at 100 kHz and integrated over a 1 MHz spectrum as shown in the table above for each of the 10 upper and lower adjacent 1 MHz bandwidths. For EUT in low, middle and high frequency band measurements, taking into account all applicable factors see table on page 18.


Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

Test Equipment List

Note: Tested on December 21 2012 and January 15, 2013

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	ESL 6	Rohde & Schwarz	Oct-06, 2011	Oct-06, 2013	GEMC 160
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
Power Attenuator 20 dB	25-A-FFN-20	Bird / Hutton	NCR	NCR	GEMC 49

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B_Rev1"

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

Occupied Bandwidth (99 % or 20 dB)

Purpose

The purpose of this test is to ensure that the bandwidth is correctly reported. This helps ensure the frequency allocation.

Limits


A 10 MHz Limit applies as per FCC 90.209. Test procedure is as per 47 CFR, Section 2.1049

Results

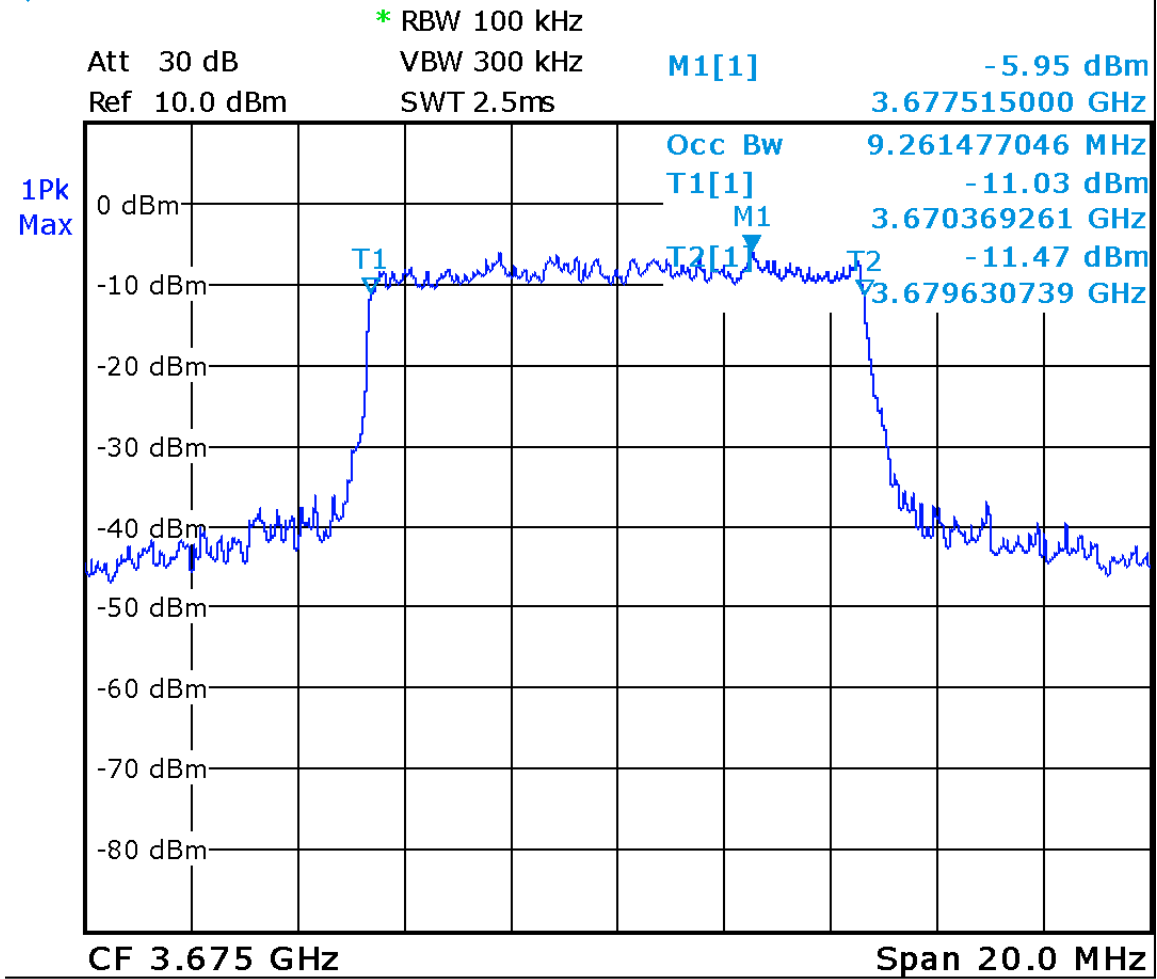
The maximum 20 dB BW measured was 9.26 MHz.

Table

Modulation	Channel (MHz)	Bandwidth (MHz)
QPSK	3655	9.18
	3675	9.18
	3695	9.18
16 QAM	3655	9.22
	3675	9.22
	3695	9.22
64QAM	3655	9.18
	3675	9.26
	3695	9.18
256 QAM	3655	9.22
	3675	9.18
	3695	9.18


Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

Graph(s)



Date: 3.JAN.2013 15:12:19


Maximum bandwidth graph shown above.

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Attenuator 20 dB	FP-50-20	Trilithic	NCR	NCR	GEMC 43
Spectrum Analyzer	ESL 6	Rohde & Schwarz	Oct-06, 2011	Oct-06, 2013	GEMC 160
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
Power Attenuator 20 dB	25-A-FFN-20	Bird / Hutton	NCR	NCR	GEMC 49

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B_Rev1"

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

Emission Mask

Purpose

The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT does not exceed the limits listed below as defined in the applicable test standard. This helps protect other broadcast radio services from unwanted interference.


Limit(s) and Method

The limits are as defined in 90.210(b), emission mask B. Method is as per 47 CFR, Sections 2.1051, 2.1047, 90.210; TIA/EIA-603-C, Section 2.2.13

Frequency (from center channel)	dBc (relative to peak of in band)
0 to 5 MHz	N/A
5 MHz to 10 MHz	- 25 dBc
10 MHz to 25 MHz	- 35 dBc

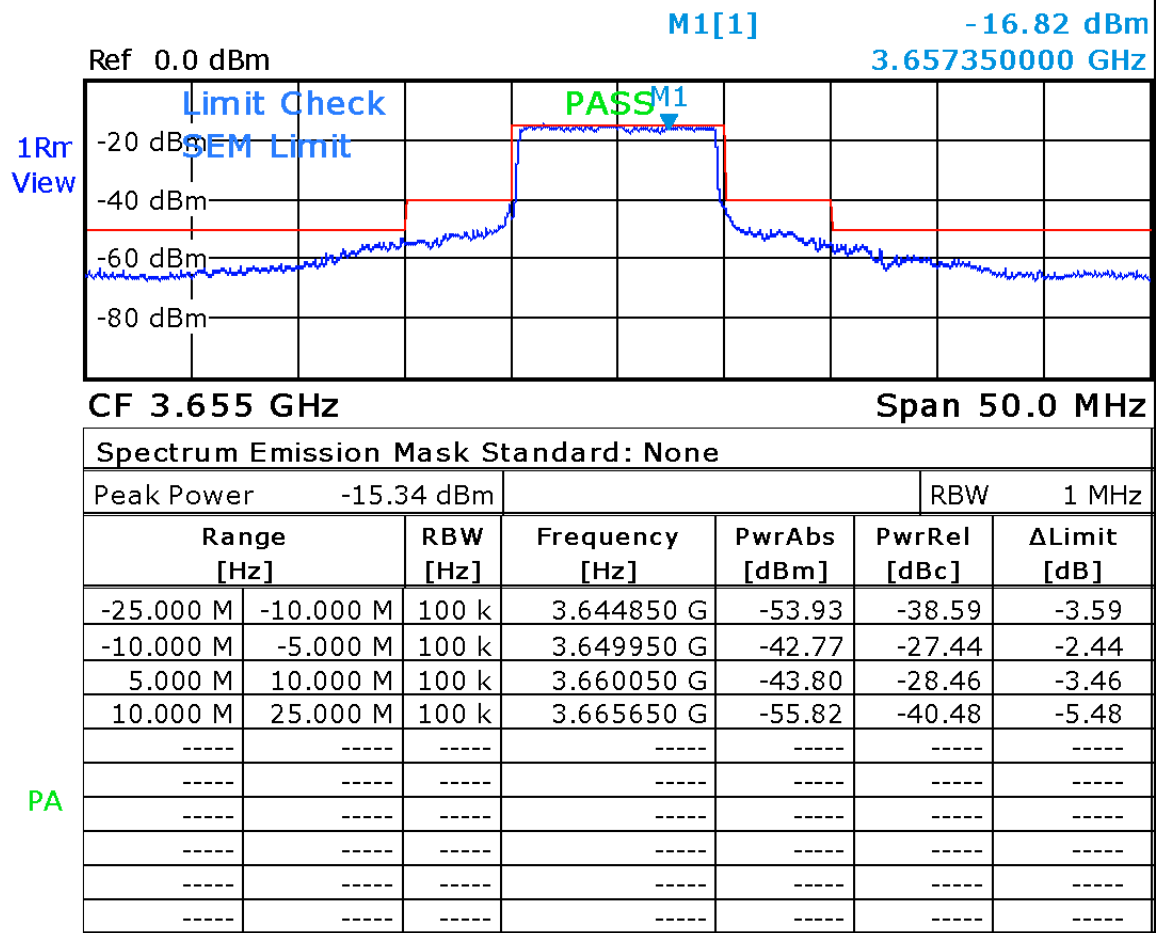
Result

The device met the requirements. See graphs for details.

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	


Graphs


Low Frequency (16 QAM shown as worst case)



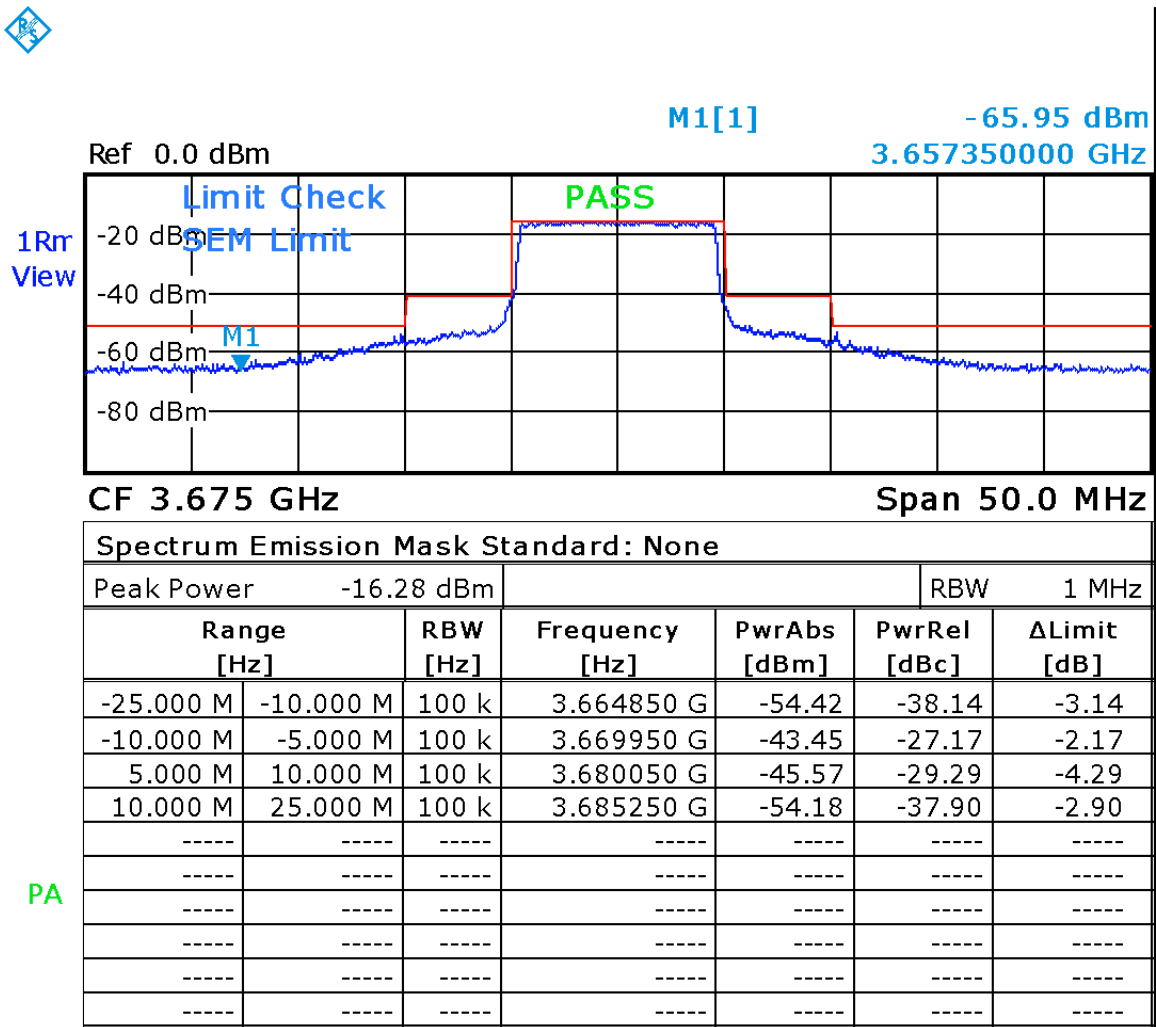
Date: 21.JAN.2013 15:30:15

Note: QPSK, 16 QAM, 64 QAM and 254 QAM were evaluated, and the worst case graph is shown above.

Client	Blinq Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	


Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

Mid Frequency (worst case 16 QAM)

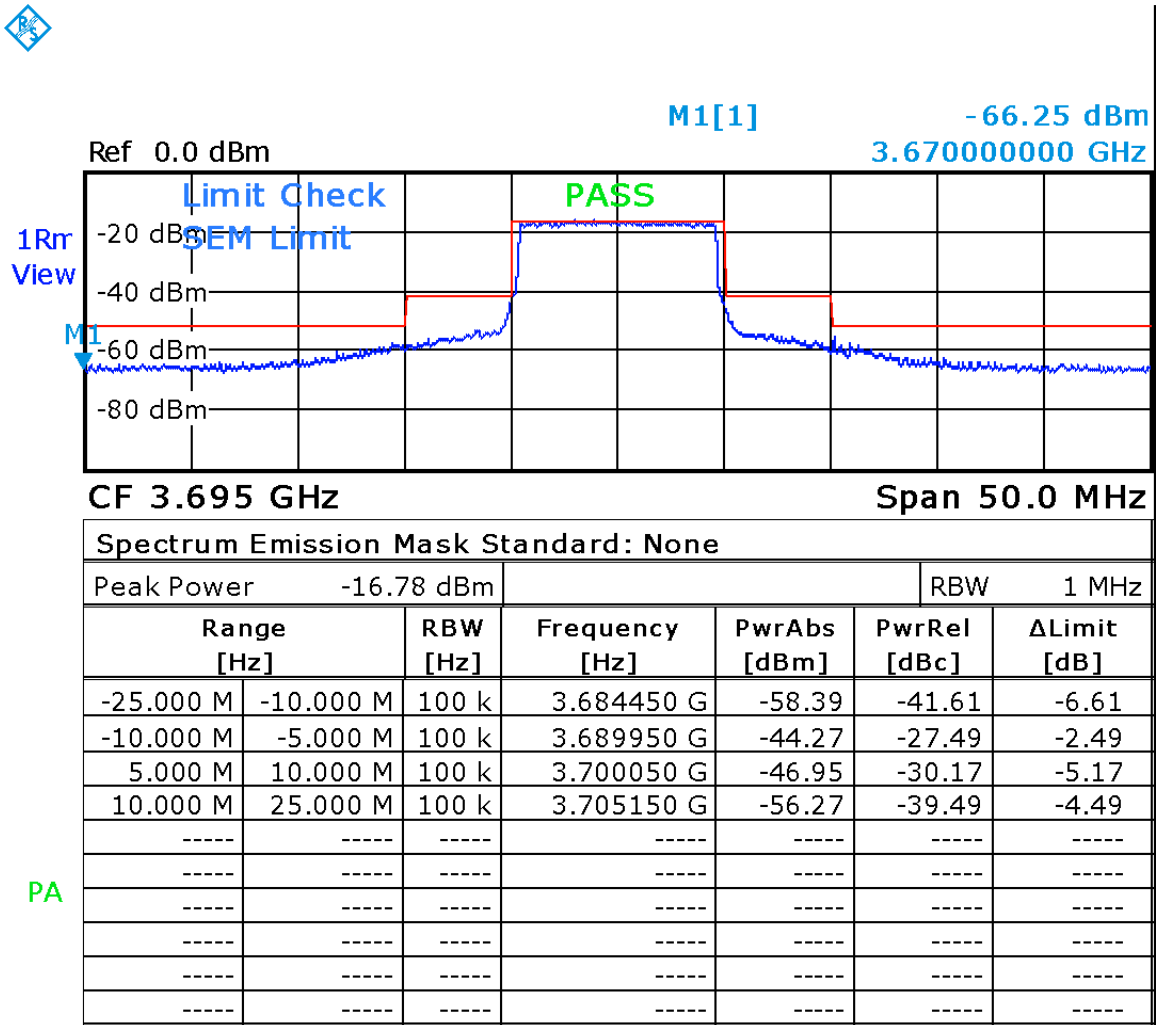


Date: 21.JAN.2013 15:37:23


Note: QPSK, 16 QAM, 64 QAM and 254 QAM were evaluated, and the worst case graph is shown above.

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

High (worst case 16 QAM)




Date: 21.JAN.2013 15:44:08

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	ESL 6	Rohde & Schwarz	Oct-06, 2011	Oct-06, 2013	GEMC 160
Attenuator 3 dB	FP-50-3	Trilithic	NCR	NCR	GEMC 40
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 28
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
RF Cable 0.5M	LMR-400-0.5M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 31

This report module is based on GEMC template "FCC - 15.225 - RFID Emissions Mask_Rev1.doc"

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

Spurious Conducted Emissions

Purpose

The purpose of this test is to ensure that the maximum power conducted to the radiating element at frequencies outside of the authorized spectrum does not exceed the limits specified. This ensures that the only the intended signal is delivered to the radiating element.


Limits

The limits are defined in 47 CFR, FCC 90.1323. The spurious must be attenuated by $43\log(P)$, or to -13 dBm EiRP. The method is as per 47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13. Spurious Conducted emissions are to be evaluated up to the 10th harmonic. Spurious emission limits do not apply to the in band emission within $\pm 250\%$ of the authorized bandwidth from the carrier; investigated in course of emission mask testing.

Note: P is transmitter output power in Watts

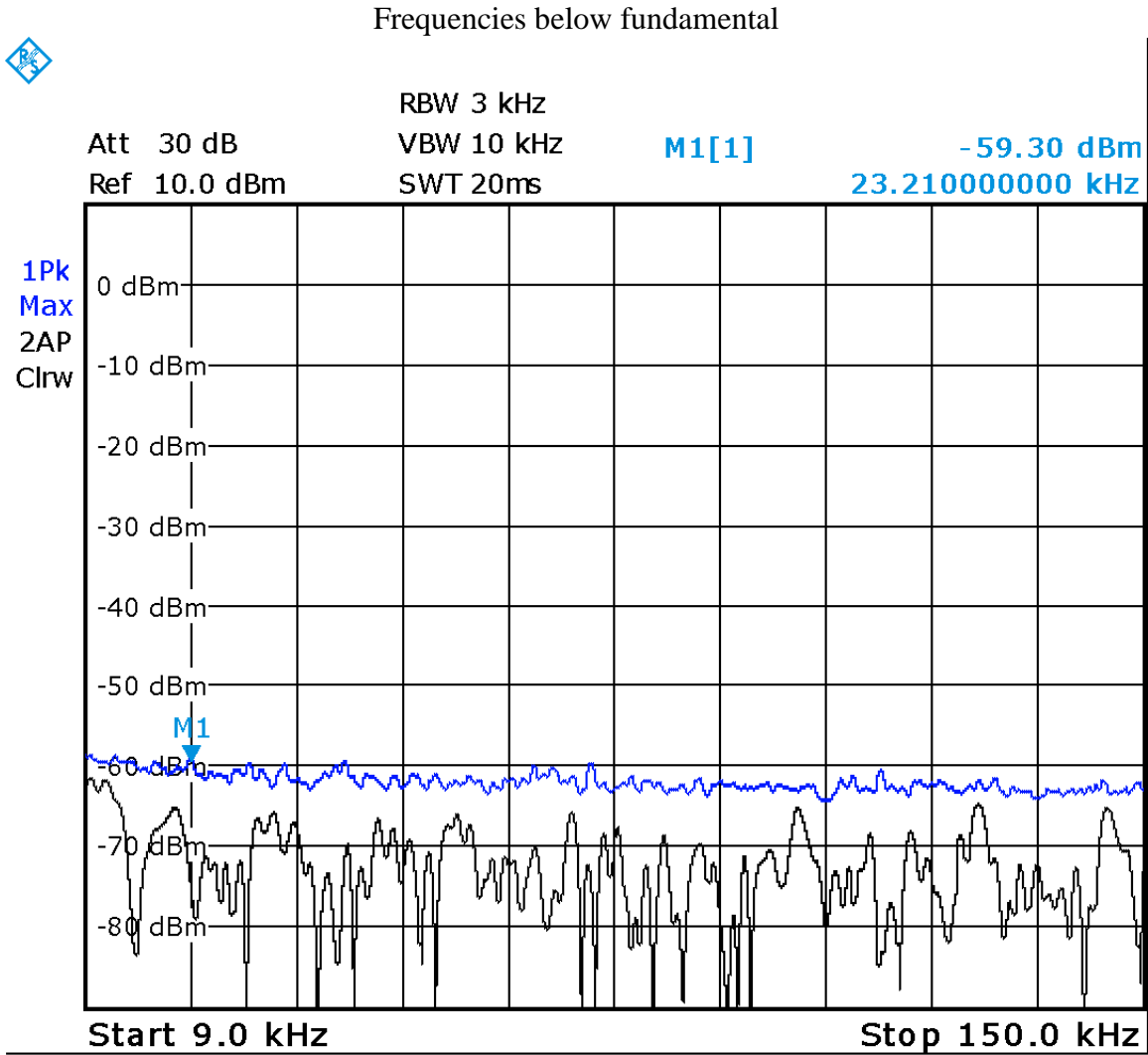
Results

The EUT passed. Low, middle and high band was measured for each mode, and the worst case results are presented.

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	


Graph(s)

The graphs shown below shows the peak power output of the device during the antenna conducted measurement during transmit operation of the EUT.




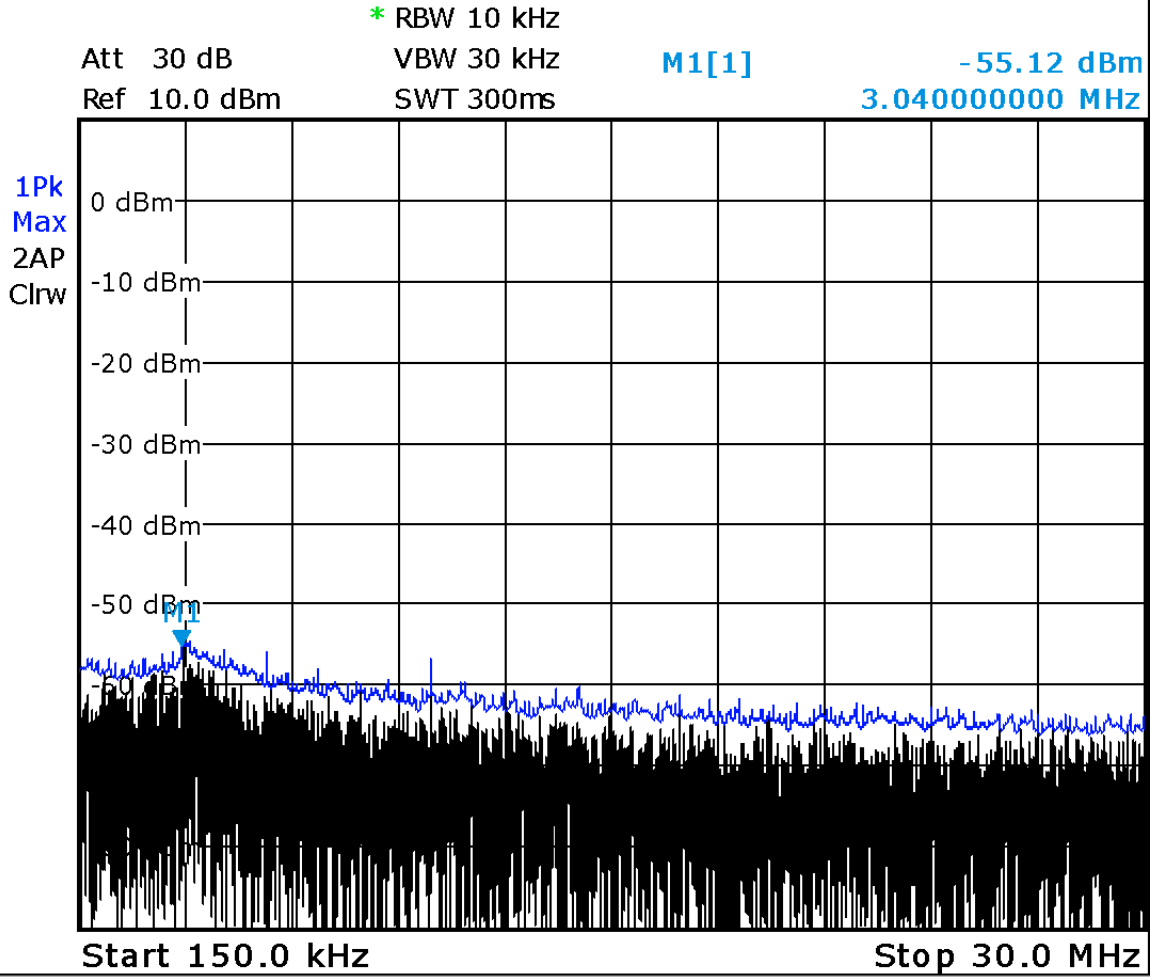
Date: 21.JAN.2013 16:22:28

Note there was 20 dB of external attenuation taken during this measurement.

Client	Blinq Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

Limit is $-13 \text{ dBm} - 20 \text{ dB} - 17 \text{ dBi} = -50 \text{ dBm}$.


Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

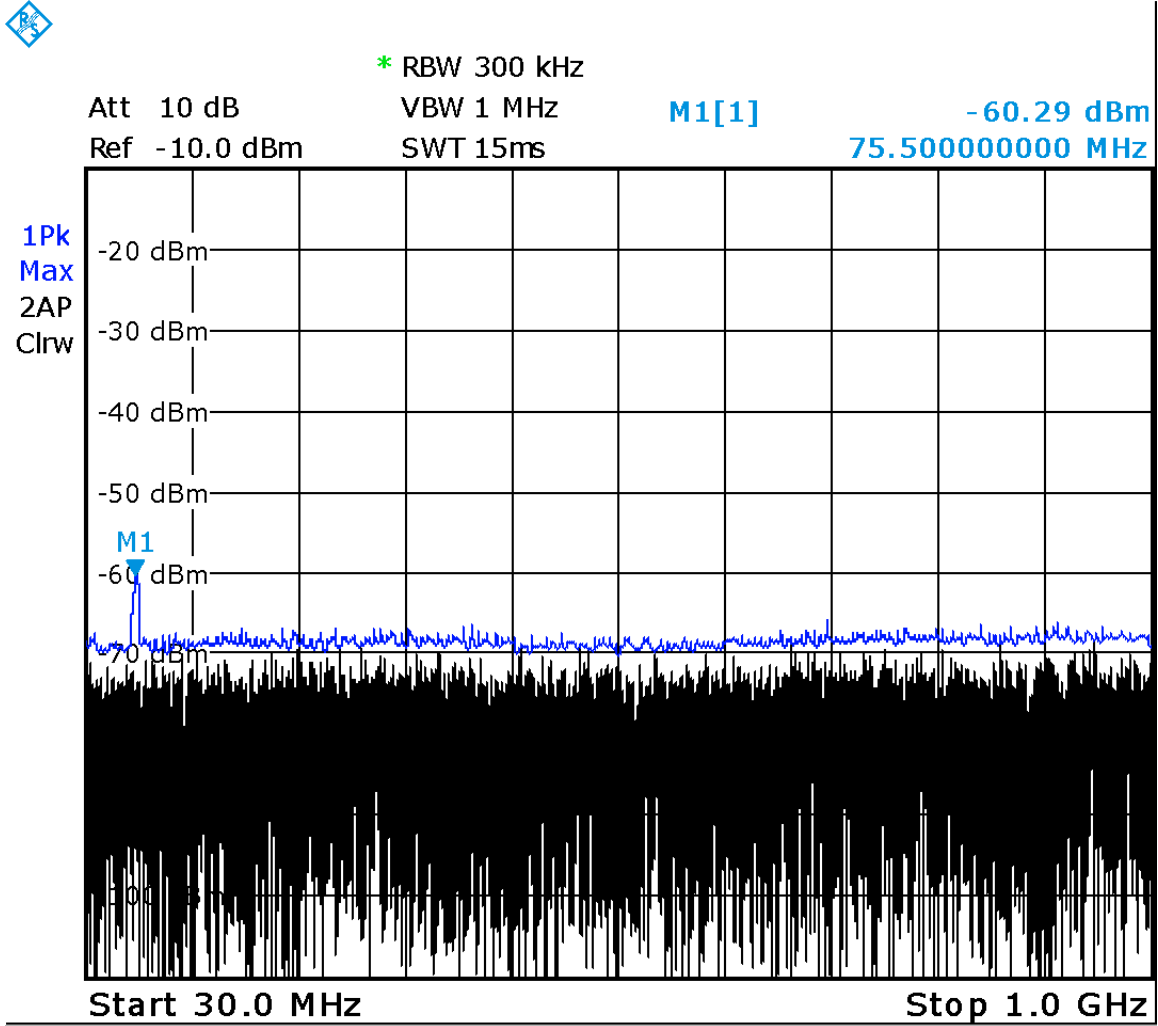


Date: 21.JAN.2013 16:23:44

Note there was 20 dB of external attenuation taken during this measurement.

Limit is $-13 \text{ dBm} - 20 \text{ dB} - 17 \text{ dBi} = -50 \text{ dBm}$.


Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

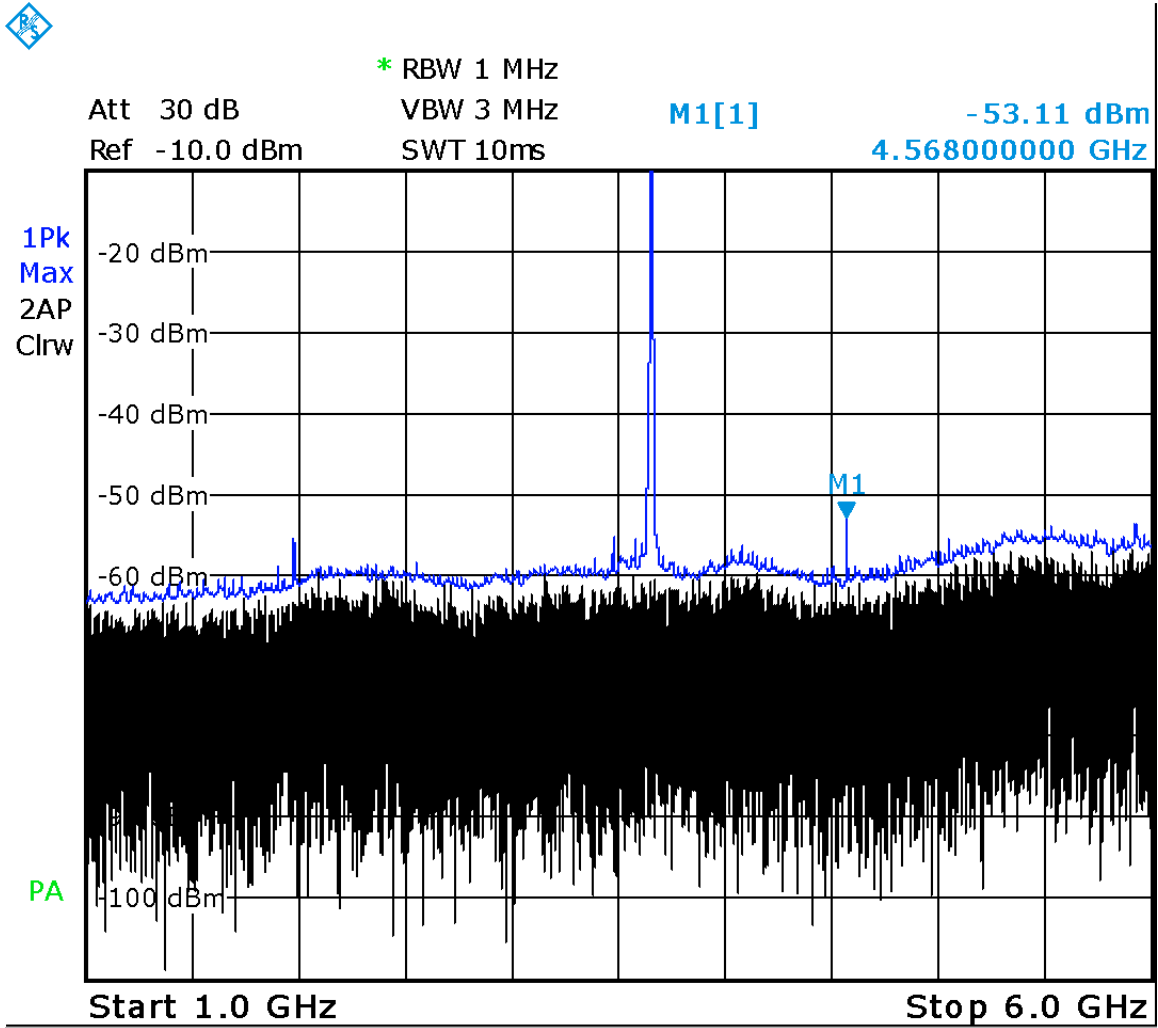


Date: 21.JAN.2013 16:28:03

Note there was 20 dB of external attenuation taken during this measurement.

Limit is $-13 \text{ dBm} - 20 \text{ dB} - 17 \text{ dBi} = -50 \text{ dBm}$.


Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

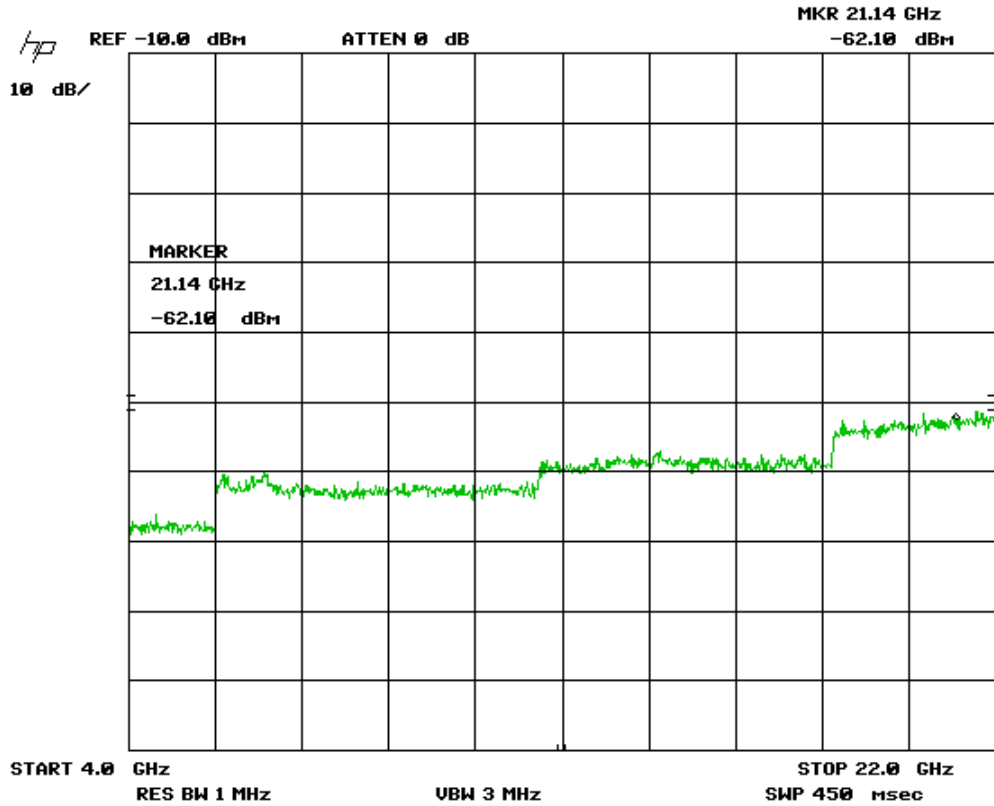


Date: 21.JAN.2013 16:32:32

Note: Center frequency 16 QAM shown above as representative. Note there was 20 dB of external attenuation taken during this measurement.


Limit is $-13 \text{ dBm} - 20 \text{ dB} - 17 \text{ dBi} = -50 \text{ dBm}$.

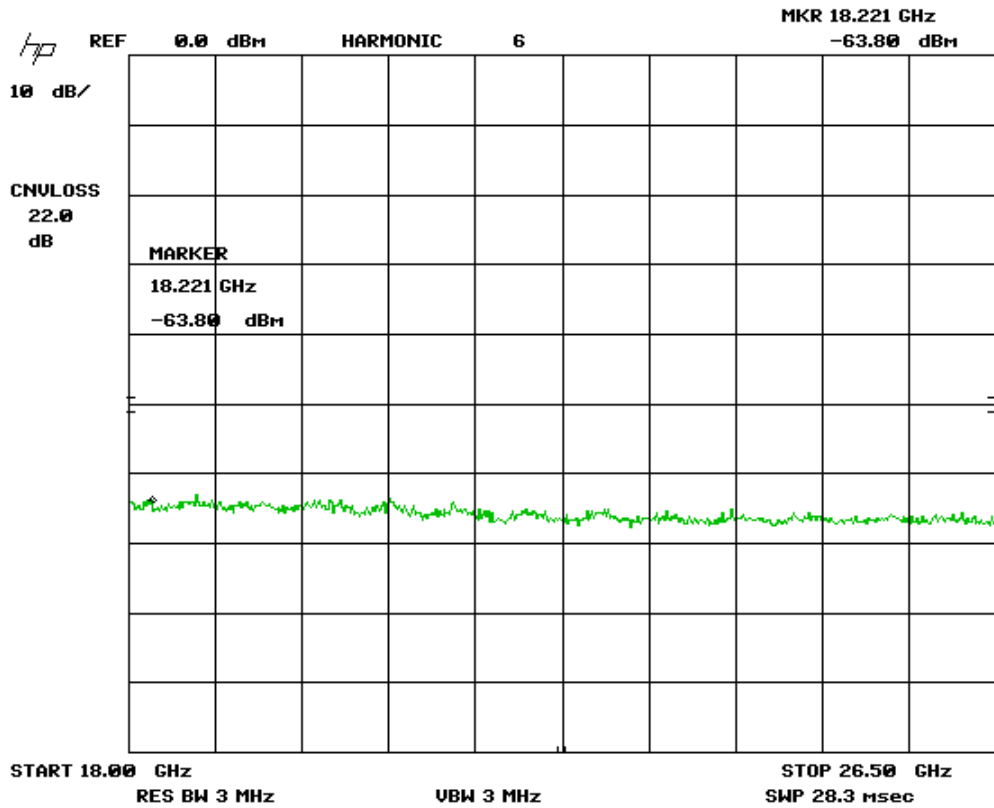
Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	



Note there was 20 dB of external attenuation taken during this measurement.


Limit is $-13 \text{ dBm} - 20 \text{ dB} - 17 \text{ dBi} = -50 \text{ dBm}$.

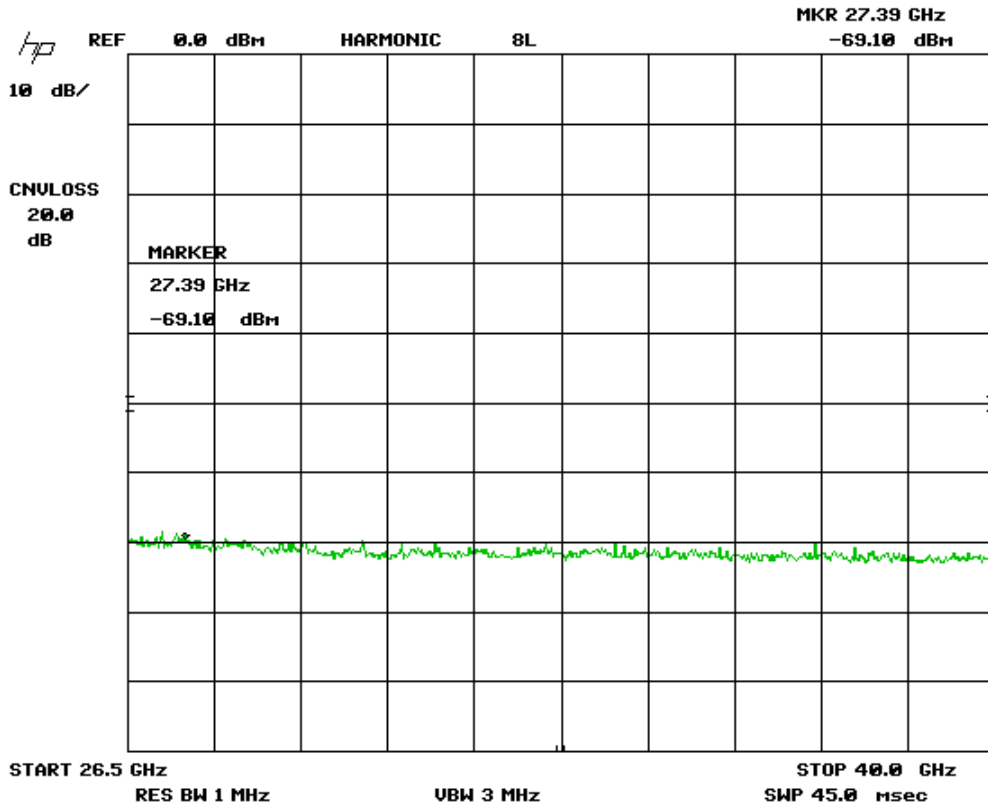
Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	



Note there was worst case 9 dB of offset to be applied to this measurement due to harmonic mixer used.

Limit is $-13 \text{ dBm} - 9 \text{ dB} - 17 \text{ dBi} = -39 \text{ dBm}$.


Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	



Note there was worst case 8 dB of offset to be applied to this measurement due to harmonic mixer used.

Limit is $-13 \text{ dBm} - 8 \text{ dB} - 17 \text{ dBi} = -38 \text{ dBm}$.


See 'Appendix B – EUT & Test Setup Photographs' for photos showing the test set-up.

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	8566B	HP	12/21/ 2011	12/21/2013	GEMC 141
Spectrum Analyzer	ESL 6	Rohde & Schwarz	Oct-06, 2011	Oct-06, 2013	GEMC 160
Attenuator 3 dB	FP-50-3	Trilithic	NCR	NCR	GEMC 40
18.0-26.5 GHz Harmonic Mixer	11970K	HP	21-Dec-11	21-Dec-13	GEMC 158
26G to 40 GHz Harmonic Mixer	11970A	HP	On file	21-Dec-13	GEMC 165
1-26G pre-amp	HP 8449B	HP	8/22/2012	8/22/2014	GEMC 6351
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 28
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
RF Cable 0.5M	LMR-400-0.5M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 31

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B_Rev1"

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

Spurious Radiated Emissions

Purpose

The purpose of this test is to ensure that the maximum power radiating from the device radiating element at frequencies outside of the authorized spectrum does not exceed the limits specified.


Limits

The limits are defined in 47 CFR, FCC 90.1323. The spurious must be attenuated by $43\log(P)$, or to -13 dBm EIRP. The method is as per 47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12. Spurious radiated emissions are to be evaluated up to the 10th harmonic. Spurious emission limits do not apply to the in band emission within ± 250 % of the authorized bandwidth from the carrier; investigated in course of emission mask testing.

Note: P is transmitter output power in Watts

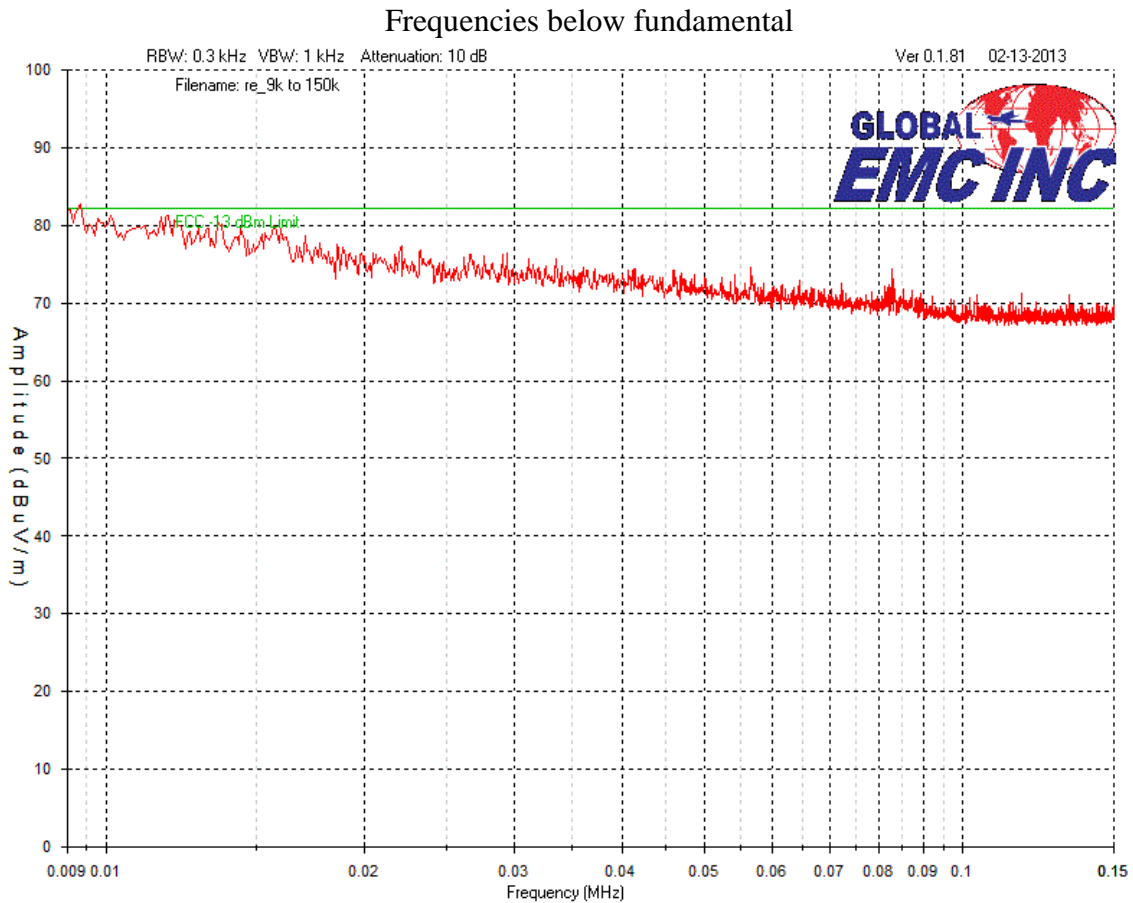
Results

The EUT passed. Low, middle and high band was measured for each mode, and the worst case or representative results for QPSK mode are presented.


Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

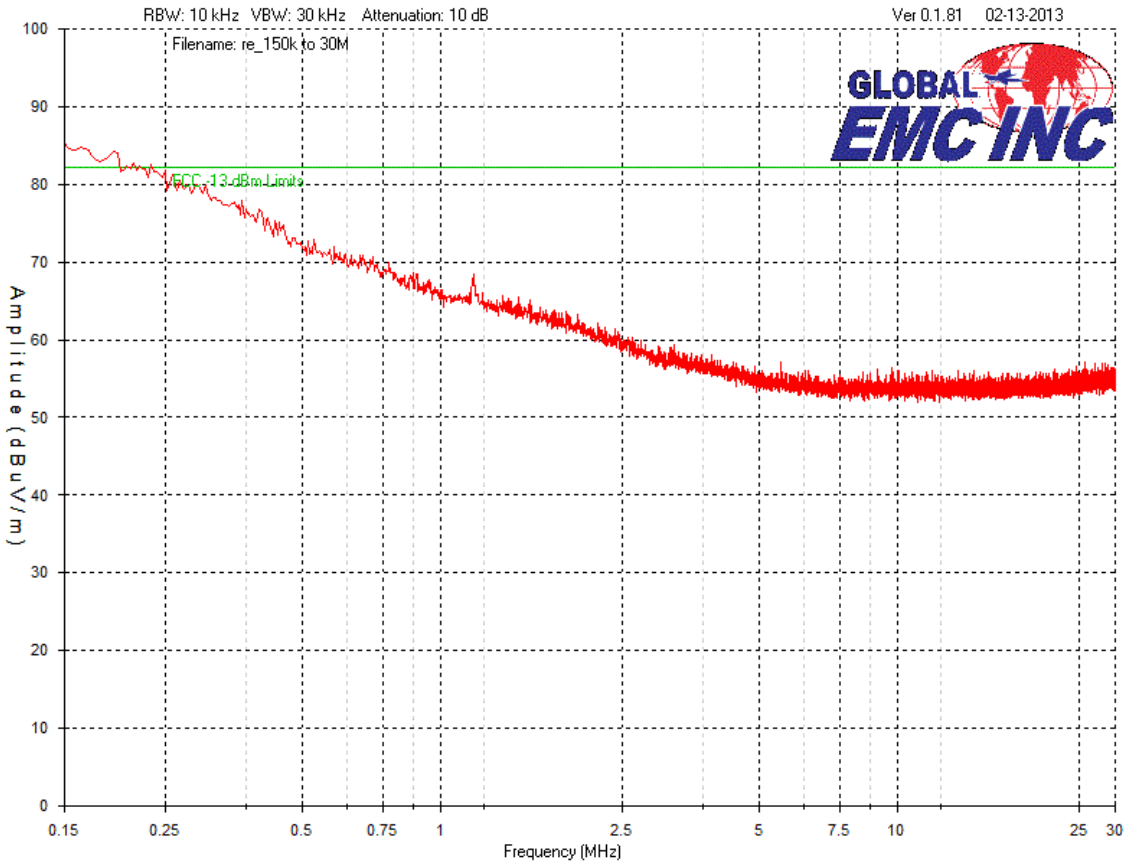
Graph(s)

The graphs shown below shows the peak power output of the device during the antenna conducted measurement during transmit operation of the EUT.




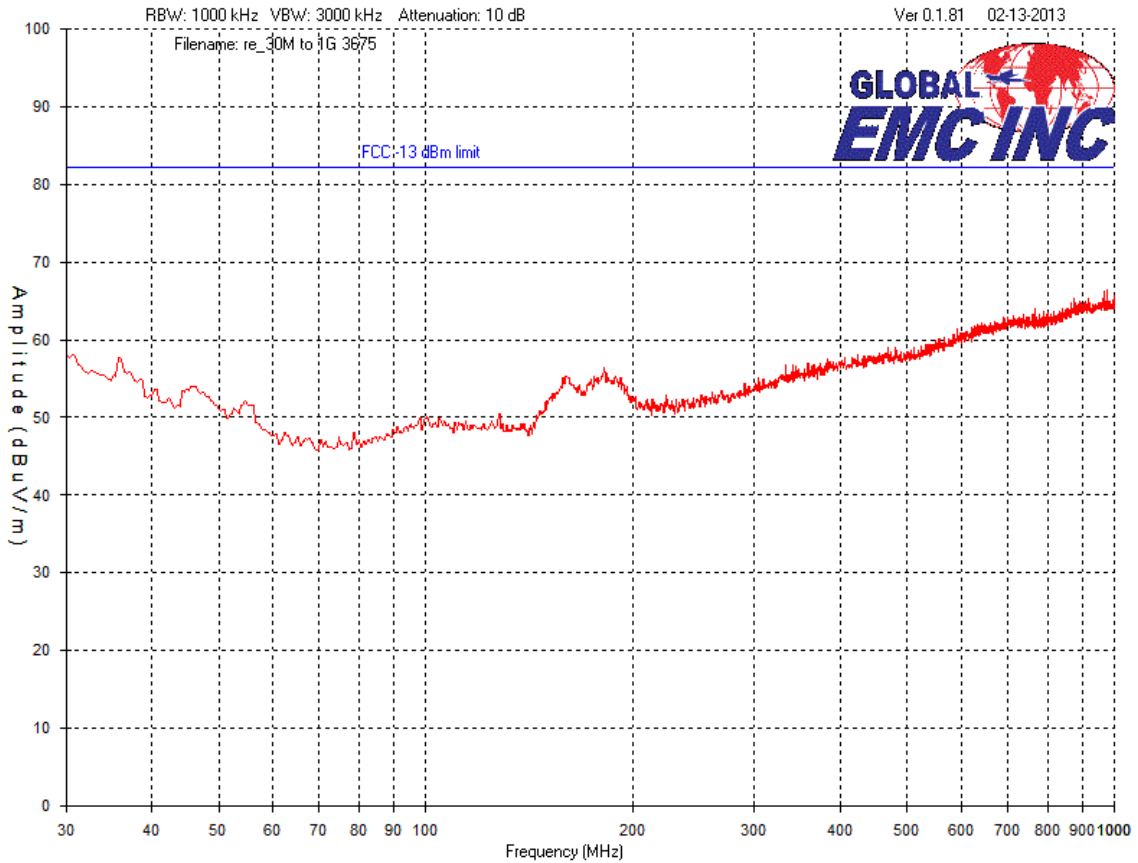
Note: No emissions from the EUT were detected in this frequency range

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	




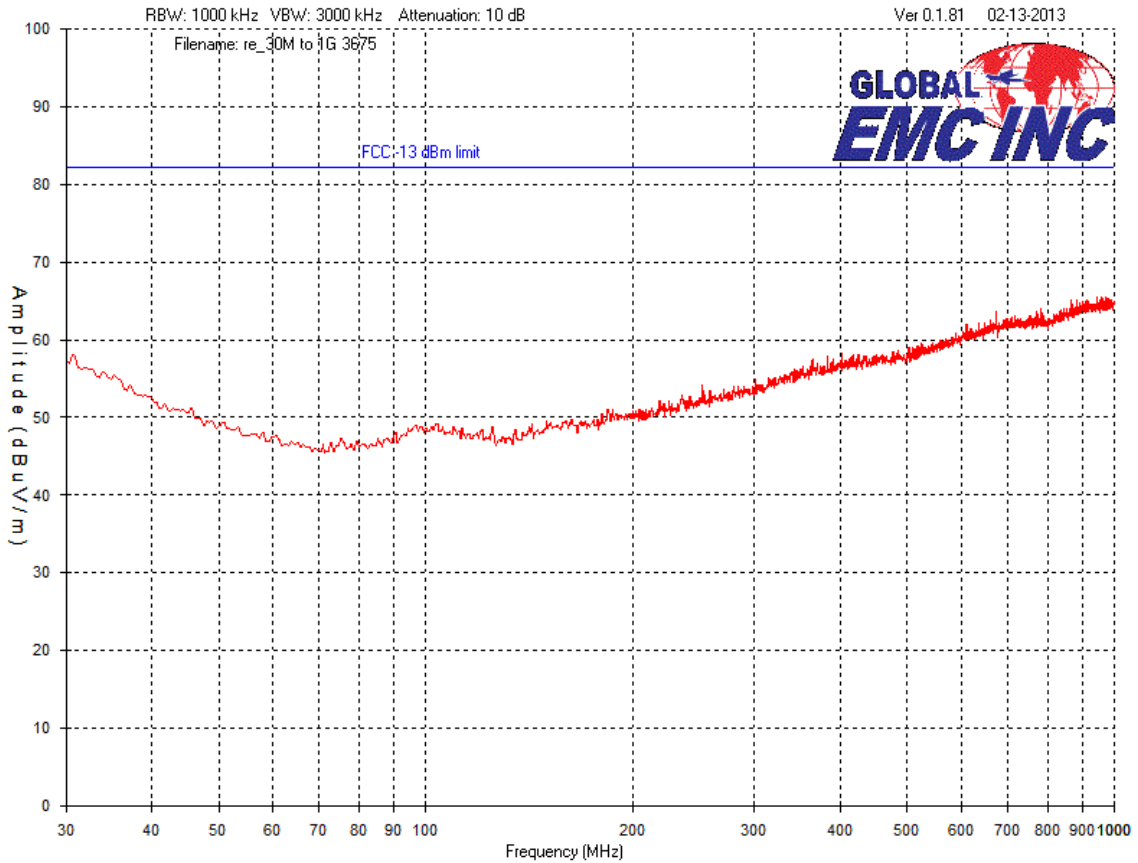
Note: No emissions from the EUT were detected in this frequency range.

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	




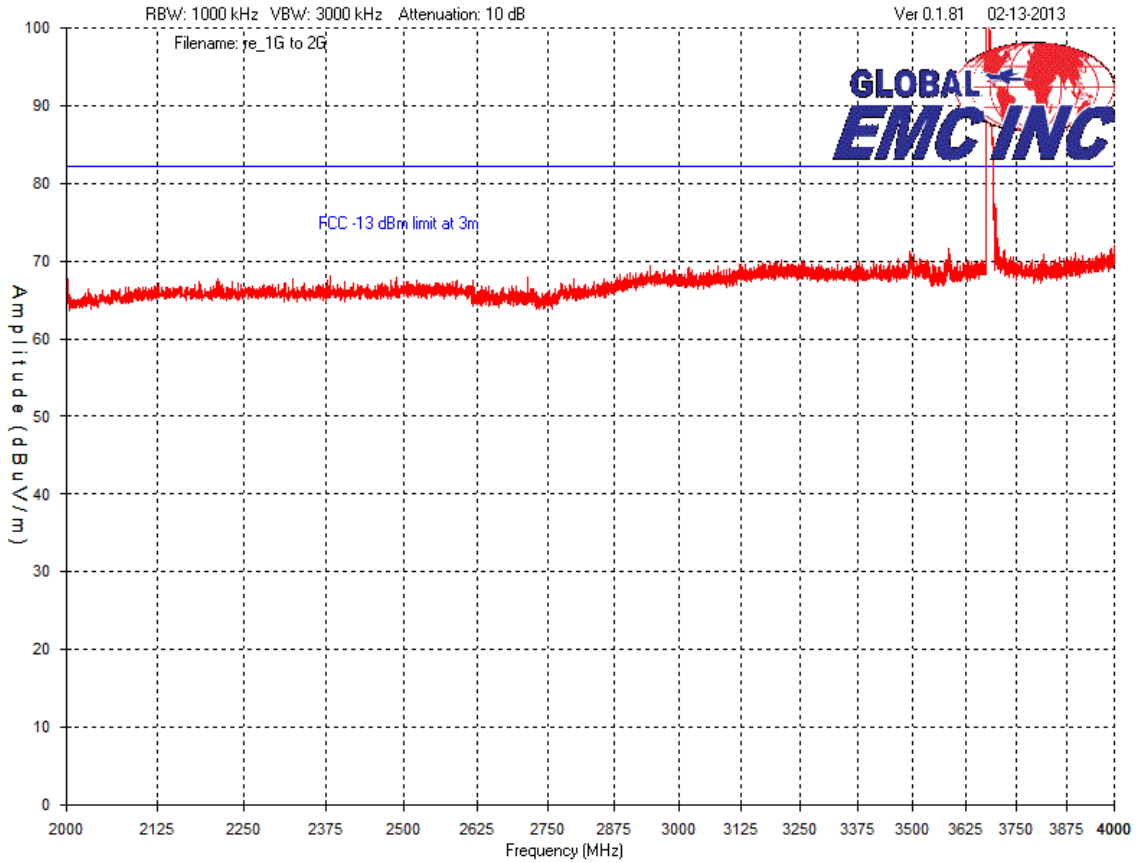
Vertical

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	




Horizontal

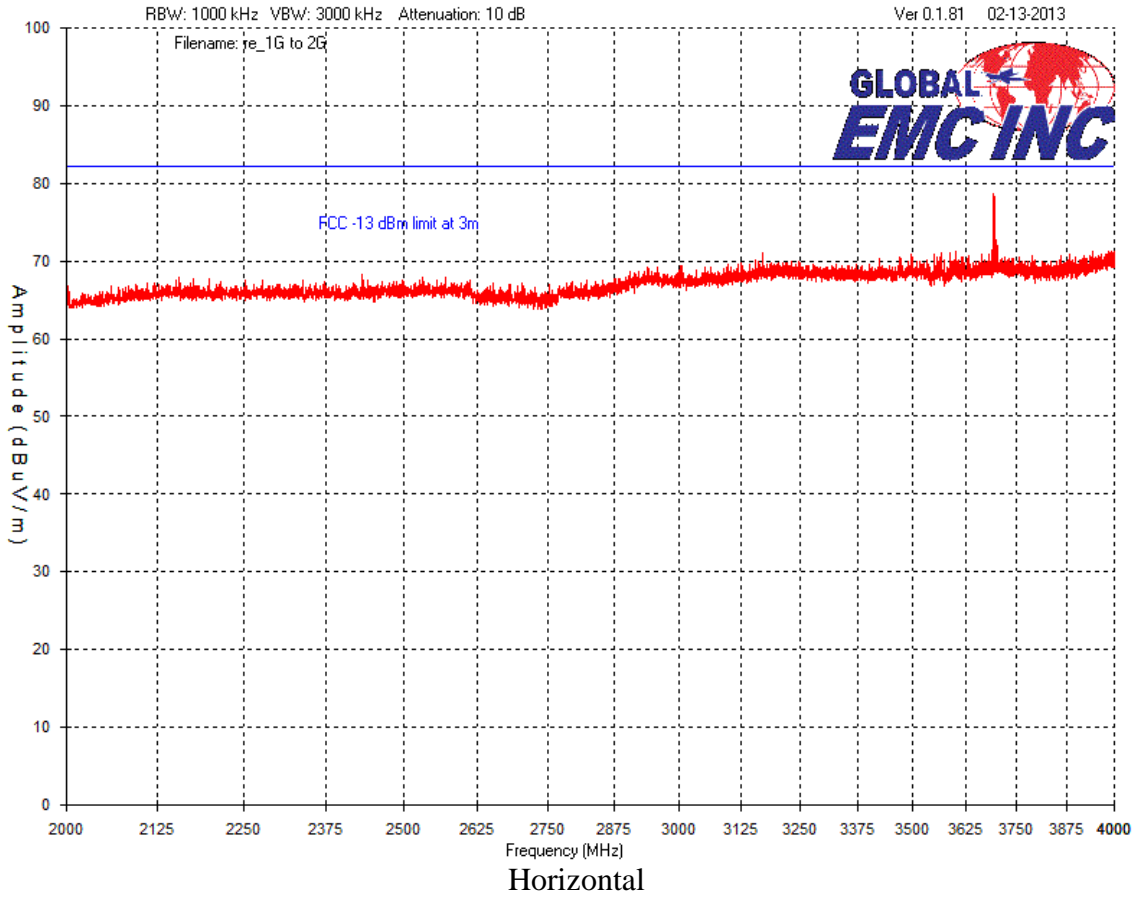
Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	




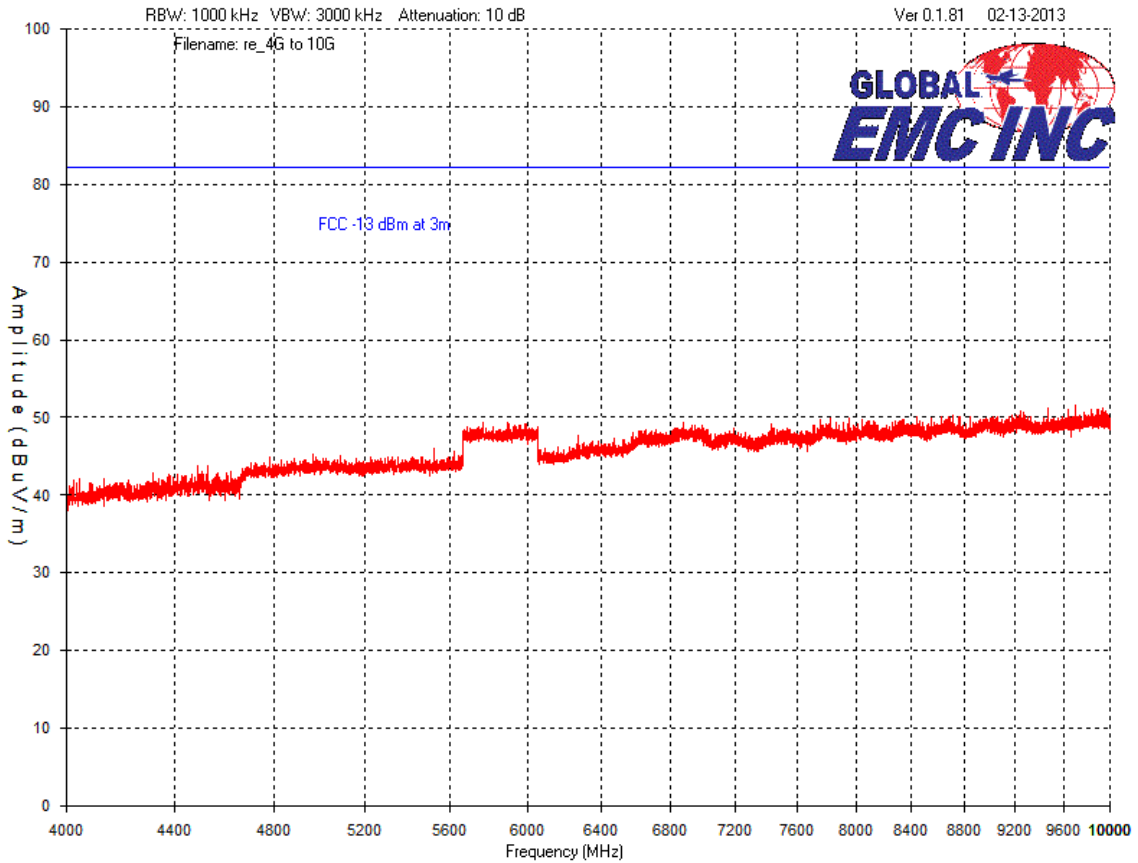
Vertical.

Note: no emissions were detected outside of $\pm 250\%$ of the authorized bandwidth from the carrier.


Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

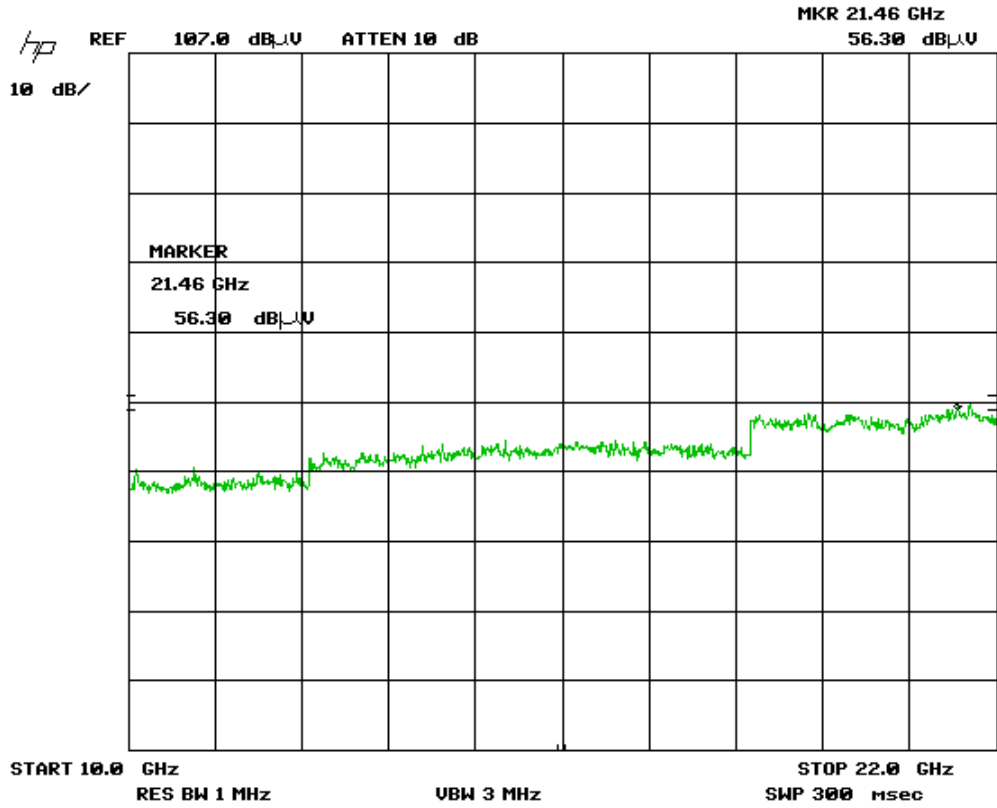


Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	




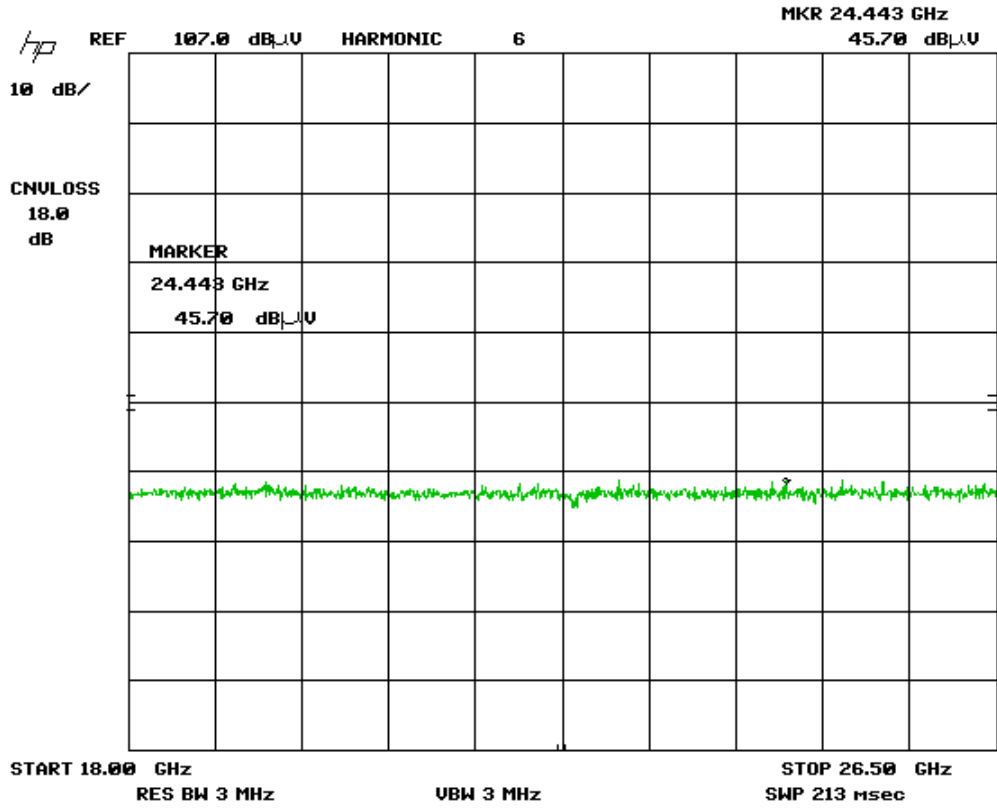
Vertical

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	




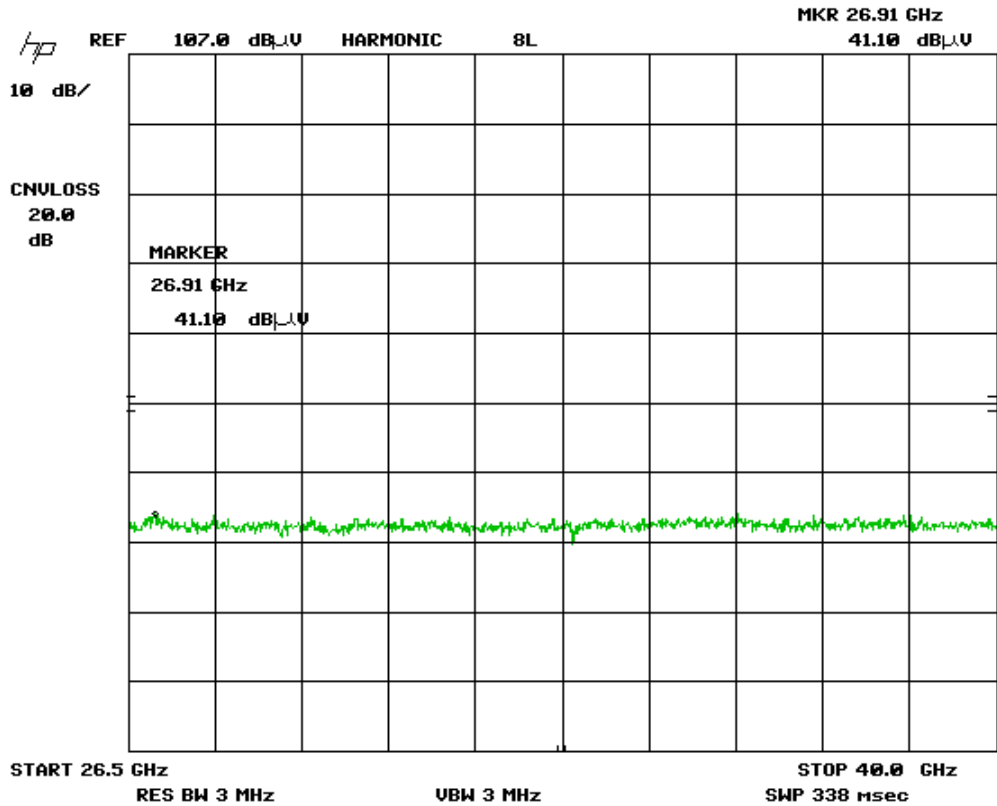
10 GHz to 22 GHz maximized vertical and horizontal, measured at 1 meter. No emissions were detected.

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	




18 GHz to 26 GHz maximized vertical and horizontal, measured at 1 meter. No emissions were detected.

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	




26 GHz to 40 GHz maximized vertical and horizontal, measured at 1 meter. No emissions were detected.

See ‘Appendix B – EUT & Test Setup Photographs’ for photos showing the test set-up.

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	


Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	8566B	HP	12/21/ 2011	12/21/2013	GEMC 141
Quasi Peak Adapter	85650A	HP	12/21/ 2011	12/21/2013	GEMC 7
Spectrum Analyzer	ESL 6	Rohde & Schwarz	Oct-06, 2011	Oct-06, 2013	GEMC 160
Loop Antenna	EM 6871	Electro-Metrics	Jan 31, 2011	Jan 31, 2013	GEMC 70
Loop Antenna	EM 6872	Electro-Metrics	Jan 31, 2011	Jan 31, 2013	GEMC 71
Loop Antenna	EM 6871	Electro-Metrics	Feb 5, 2013	Feb 5, 2015	GEMC 70
Loop Antenna	EM 6872	Electro-Metrics	Feb 5, 2013	Feb 5, 2015	GEMC 71
BiLog Antenna	3142-C	ETS	Jan 17, 2011	Jan 17, 2013	GEMC 137
BiLog Antenna	3142-C	ETS	Feb 4, 2013	Feb 4, 2015	GEMC 137
BiLog Antenna	3142-C	ETS	Aug 28, 2012	Aug 28, 2014	GEMC 8
Attenuator 3 dB	FP-50-3	Trilithic	NCR	NCR	GEMC 40
Chase Preamp 9kHz - 2 GHz	CPA9231A	Chase	8/29/2012	8/29/2014	GEMC 6403
Q-Par 1.5-18 GHz Horn	6878/24	Q-par	8/23/2012	8/23/2014	GEMC 6365
Horn Antenna 18 GHz - 26.5 GHz	SAS-572	A.H. Systems	8/27/2012	8/27/2014	GEMC 6371
Horn Antenna 26 GHz to 40 GHz	H Flange 3/4" Square	Radar Systems	NCR	8/27/2014	GEMC 6376
18.0-26.5 GHz Harmonic Mixer	11970K	HP	21-Dec-11	21-Dec-13	GEMC 158
26G to 40 GHz Harmonic Mixer	11970A	HP	NCR	21-Dec-13	GEMC 165
1-26G pre-amp	HP 8449B	HP	8/22/2012	8/22/2014	GEMC 6351
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 28
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

RF Cable 0.5M	LMR-400-0.5M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 31
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This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B_Rev1"

Client	Blinq Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

Temperature Frequency Stability


Purpose

The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT does not exceed the permitted allocation during extreme temperature variations. This helps ensure channel allocation during extreme temp. This also helps ensure proper reception of the intended signal by ensuring the transmit frequency is correct in any temperature.

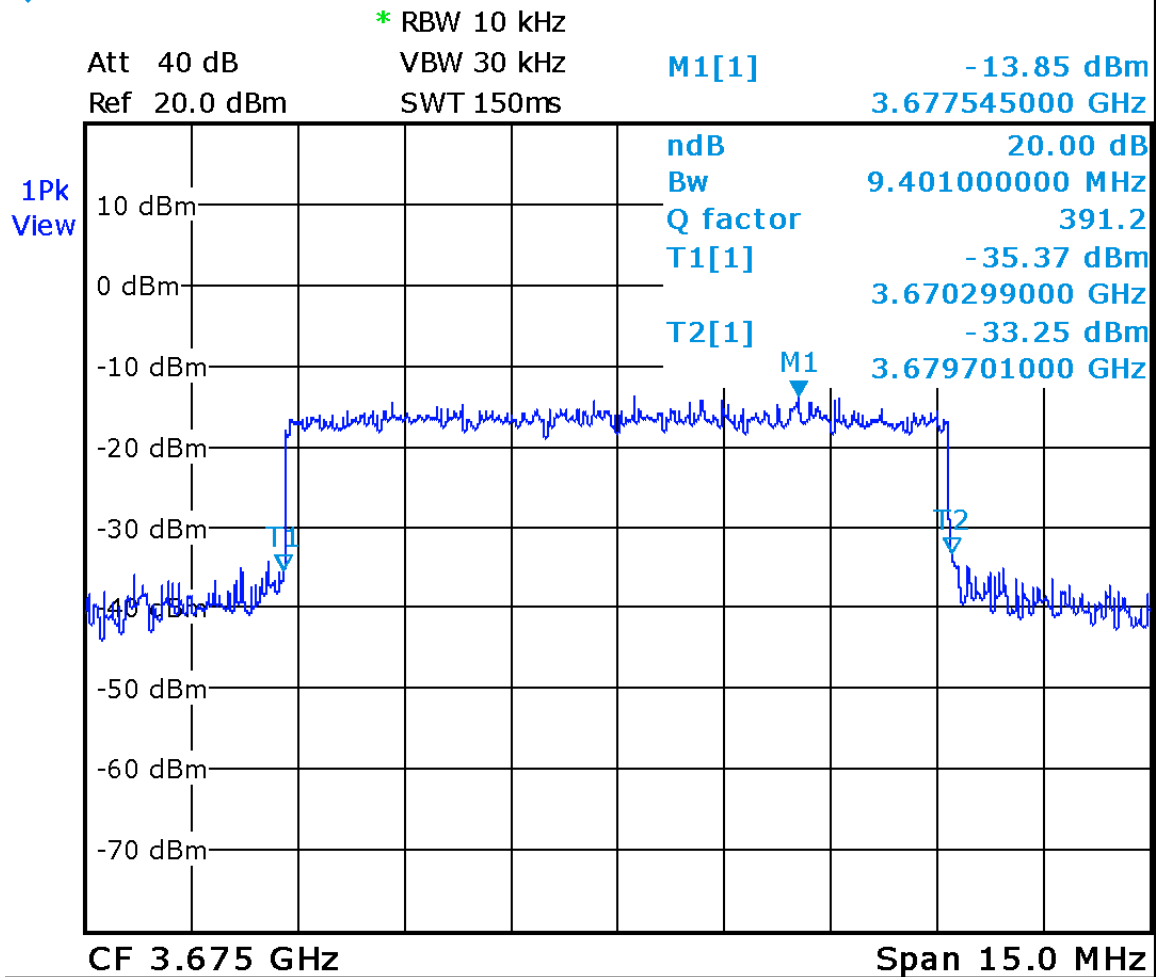
Limit(s) and Method

As no limits are specified, this was performed for information purposes. A worst case application of the maximum frequency drift was applied to the room temperature


Frequency must be maintained from -20 C to +50 C. For information purposes, the EUT was additionally tested at -30C. The EUT is monitored at each 10 degree increment. At each temperature, the device is checked after a stabilization period required for the device to reach the temperature.

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

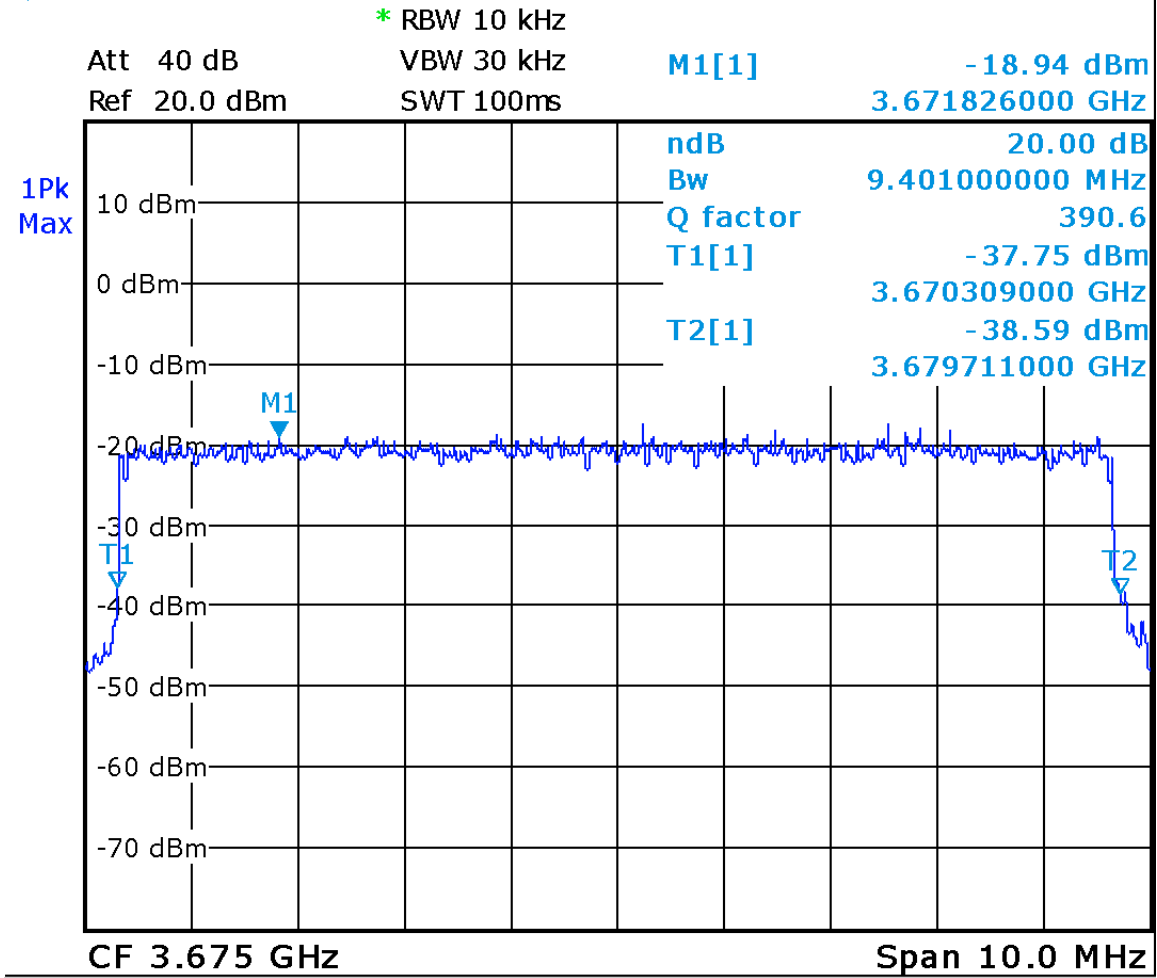
Cold: - 30C




Date: 18.DEC.2012 17:56:19

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

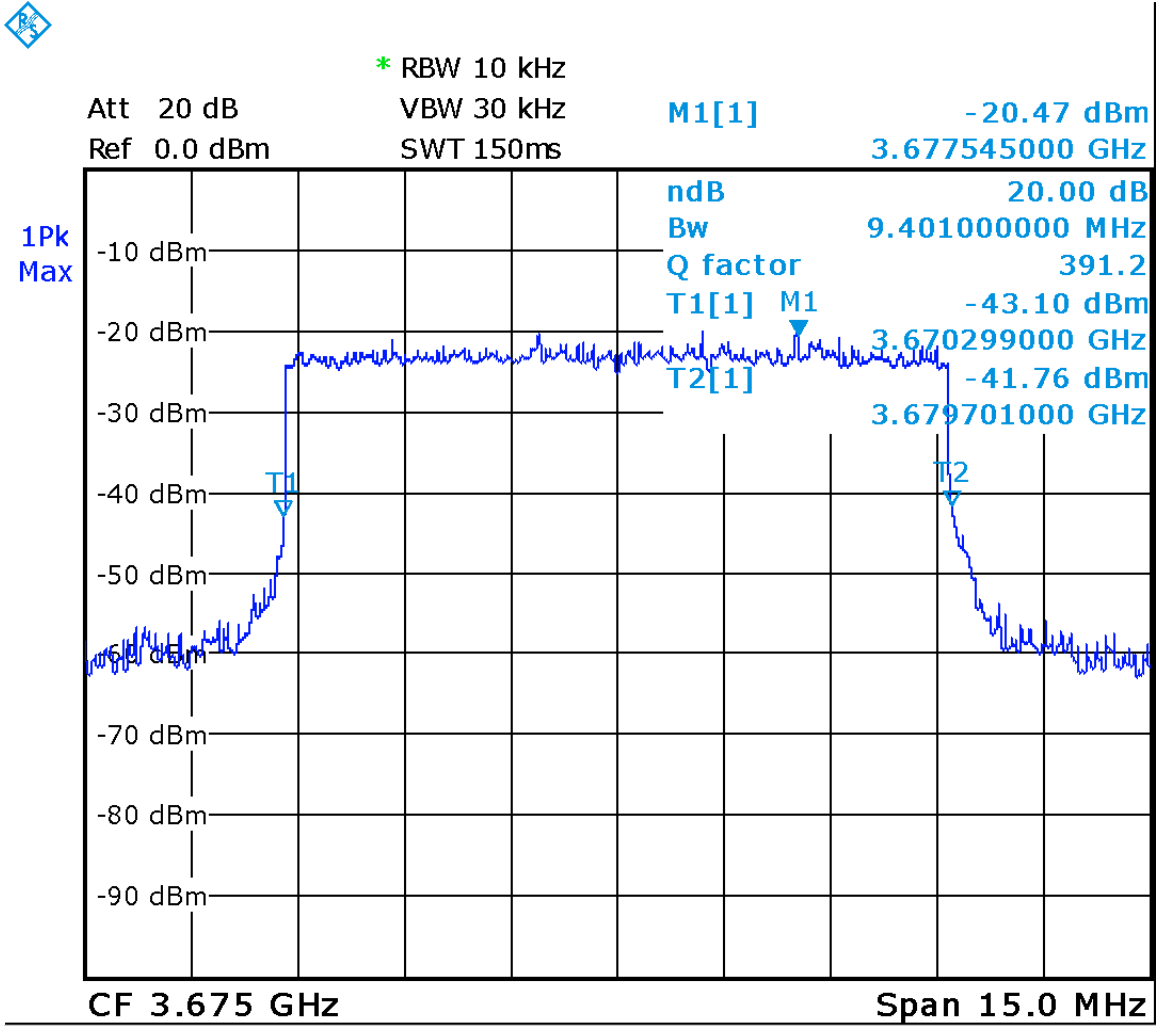
Room temperature: 23C




Date: 18.DEC.2012 18:41:40

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

Heat: +50 C




Date: 18.DEC.2012 19:09:23

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

Measurement Table


Modulation	Channel	Temp C	Low edge	High edge	Mid
QPSK	3655	-30	3650.299	3659.76	3655.0295
	3655	20	3650.299	3659.701	3655
	3655	50	3650.299	3659.701	3655
	3675	-30	3670.299	3679.701	3675
	3675	20	3670.299	3679.701	3675
	3675	50	3670.299	3679.701	3675
	3695	-30	3690.299	3699.701	3695
	3695	20	3690.299	3699.701	3695
	3695	50	3690.299	3699.701	3695

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	8566B	HP	12/21/ 2011	12/21/2013	GEMC 141
Attenuator 20 dB	FP-50-20	Trilithic	NCR	NCR	GEMC 43
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 28

This report module is based on GEMC template "FCC - 15.225 - RFID Freq Stab_Rev1.doc"

Client	Blinq Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	


Appendix A – EUT Summary

For further details for filing purposes, refer to filing package.

General EUT Description


Client Details	
Organization / Address	Blinq Wireless Inc. 400 March Road, Suite 240, Kanata, ON K2K 3H4, Canada www.blinqnetworks.com
EUT (Equipment Under Test) Details	
EUT Name (for report title)	X100 Hub Module and X100 Remote Backhaul Module
EUT Model / SN (if known)	HX1-3650-E and RX1-3650-I
EUT revision	New product
Software version	Release 1.1
EUT is powered using	-48VDC
Input voltage range(s) (V)	-36VDC to-60VDC
Frequency range(s) (Hz)	N/A
Rated input current (A)	2 A
Nominal power consumption (W)	65 W
Number of power supplies in EUT	1
Transmits RF energy? (describe)	Yes

Note the EUT is considered to have been received the date of the commencement of the first test, unless otherwise stated. For a close-up picture of the EUT, see ‘Appendix B – EUT & Test Setup Photographs’.

Client	Blinq Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	


Appendix B – EUT and Test Setup Photographs

Note: These photos are for information purposes only. Also refer to PDF files that are separate from this test report.

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	




Equipment under test.

Client	Blinq Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	




Antenna conducted setup.

Client	Bling Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	


Radiated Emissions 9k to 30M



Client	Blinq Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

Radiated Emissions 30M to 2G



Client	Blinq Networks	
Product	X100 Hub Module and X100 Remote Backhaul Module	
Standard(s)	RSS 197 Issue 1:2010 & FCC Part 90 Subpart Z	

Radiated Emissions 2G to 18G

