Global EMC Inc. Labs

EMC & RF Test Report

As per

RSS 247 Issue 1

&

FCC Part 15 Subpart C

Unlicensed Intentional Radiators

on the

C003

Yong Huang, Project Specialist
Global EMC Inc. Laval
2972 Joseph-A-Bombardier
Laval, QC, H7P 6E3 CANADA
Ph: (450) 687- 4976

Testing produced for

See Appendix A for full customer & EUT details.

LAB REGISTRATION #6844A-2

FCC REGISTRATION #612361

Testing Laboratory Certificate #2555.01

Table of Contents

Report Scope

This report addresses the EMC verification testing and test results of the C003, herein referred to as EUT (Equipment Under Test) performed at Global EMC Labs.

The EUT was tested for compliance against the following standards:

RSS -247 Issue 1/ FCC Part 15 Subpart C 15

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.

Summary

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

EUT FCC Certification #, FCC ID:	2ADQFC003
EUT Industry Canada Certification #, IC:	12649A-C003
EUT Passed all tests performed.	Yes (see test results summary)
Tests conducted by	Yong Huang

Client	**Otodata Wireless Network Inc.**
Product	C003
Standard(s)	RSS -247 Issue18/ FCC Part 15 Subpart C 15

Test Results Summary

Standard/Method	Description	Class/Limit	Result
FCC 15.203 RSS-247	Antenna Requirement	Unique	Pass See Justification
FCC 15.205 RSS-247	Restricted Bands for intentional operation	None within chart	Pass See description
FCC 15.207 RSS-247	Power line conducted emissions	QuasiPeak Average	Pass See Justification
FCC 15.209 RSS-247	Radiated emissions	QuasiPeak Average	Pass
FCC 15.247(a)(1) RSS-247	Channel Separation	> 25 kHz	Pass
FCC 15.247(a)(1)(i) RSS-247	Number of channels	> 50	Pass
FCC 15.247(a)(1)(i) RSS-247	Time of occupancy	< 400 mSec in 20 sec period	Pass
FCC 15.247(b) RSS-247	Max output power	< 1 Watt	Pass
FCC 15.247(b)(4) RSS-247	Antenna Gain	< 6 dBi	Pass See Justification
FCC 15.247(d) RSS-247	Antenna conducted spurious	> 20 dBc	Pass
FCC 15.247(h)	FHSS Intelligence	No coordination	Pass See Justification
FCC 15.247(i) IC Safety code 6	Maximum Permissible Exposure	> 20 cm separation.	Pass See justification and calculations
Overall Result			**PASS**

All tests were performed by Yong Huang.

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 the Antenna requirement specified in FCC 15.203 (RSS-247), this device is designed with an integral antenna or proprietary antenna connector which meets the requirements of FCC 15.203.

For the Restricted Bands of operation, the EUT is designed to only operate between 902 to 928 MHz.

For the scope of this test report, radiated testing of the EUT was pre-scanned in three orthogonal axis to maximize emissions. Maximum emissions were found in the vertical EUT polarization. This setup was used for all testing in this report.

For the power line conducted emissions requirements, the EUT is DC powered via battery, with no provisions for direct or indirect connection to mains and this test does not apply.

For the Antenna gain, the radiated measurement of the fundamental compared to the conducted measurement of the fundamental show a gain of less than 6 dB. As per client's instruction, the antenna gain is 2.14dBi.

For maximum permissible exposure, this device operates at less than 1 Watt at 902-928 MHz and is designed to operate greater then 20 cm from personnel during normal operation. No testing is required.

EUT was investigated with all terminal block on populated, and it was found for compliance with FCC Part B subpart B, records were kept on Global EMC Inc.

Applicable Standards, Specifications and Methods

ANSI C63.4:2014	- Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10:2013	- American national standard for testing unlicensed wireless devices
CFR 47 FCC 15	- Code of Federal Regulations – Radio Frequency Devices
CISPR 22:2008	- Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement
ICES-003:2012	- 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 210:2010	- Issue 8: Spectrum Management and Telecommunications Policy. Radio Standards Specification Low Power Licence-Exempt Radiocommunication Devices
RSS-247:2015	- Issue 1: Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

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

Revision 1 - Issue on the 23rd , Apr. 2015

Revision 2 - Revised on the 22nd , Sep. 2015, as per TCB's request.

Revision 3 - Revised on the 30th , Sep. 2015, Reference to RSS-247, as per TCB's request.

Definitions and Acronyms

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

AE – Auxiallary 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

Testing Facility

Testing for EMC on the EUT was carried out at Global EMC labs in Montréal, Québec, 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’s is accredited by A2LA with a scope of accreditation listed under certificate number 2555.01.

Testing Environmental Conditions and Dates

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

Date	Test	Init.	Temperature (ºC)	Humidity (%)	Pressure (kPa)
Nov. 18-Dec.23, 2014	All	YH	20-25ºC	30-45%	100 -103kPa

Detailed Test Results Section

Radiated Emissions

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, as measured from a receiving antenna. This helps protect broadcast radio services such as television, FM radio, pagers, cellular telephones, emergency services, and so on, from unwanted interference.

Limit(s) and Method

The method is as defined in ANSI C63.4:2014 for tests below 1GHz, and ANSI C63.10:2013 for tests above 1GHz.

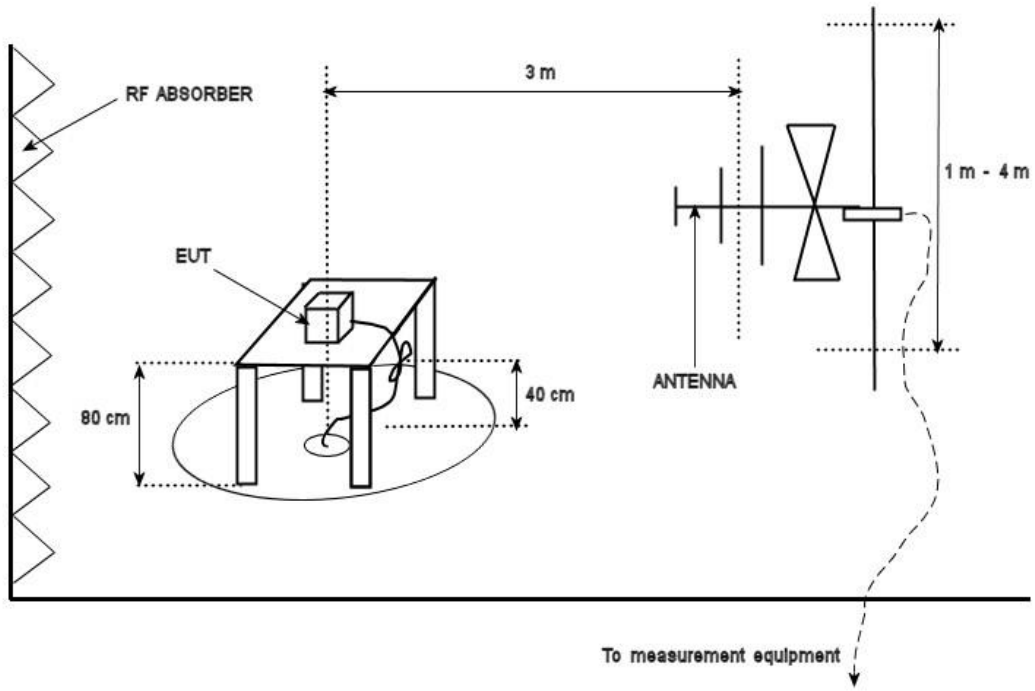
The limits, as defined in 15.247(d) for unintentional radiated emissions apply for those emissions that fall in the restricted bands, as defined in Section 15.205(a). These emissions must comply with the radiated emission limits specified in Section 15.209(a).

All unintentional emissions (including band edge) must also meet the requirements of -20 dBc or greater

0.009 MHz – 0.490 MHz, 2400/F(kHz) uV/m at 300 m[4]
0.490 MHz – 1.705 MHz, 24000/F(kHz) uV/m at 30 m[4]
1.705 MHz – 30 MHz, 30 uV/m at 30 m[4]
30 MHz – 88 MHz, 100 uV/m (40.0 dBuV/m[1]) at 3 m
88 MHz – 216 MHz, 150 uV/m (43.5 dBuV/m[1]) at 3 m
216 MHz – 960 MHz, 200 uV/m (46.0 dBuV/m[1]) at 3 m
Above 960 MHz, 500 uV/m (54.0 dBuV/m[1]) at 3 m
Above 1000 MHz, 500 uV/m (54 dBuV/m[2]) at 3m
Above 1000 MHz, 5000 uV/m (74 dBuV/m[3]) at 3m

[1]Limit is with 120 kHz measurement bandwidth and a using a Quasi Peak detector.
[2]Limit is with 1 MHz measurement bandwidth and using an Average detector
[3]Limit is with 1 MHz measurement bandwidth and using an Peak detector
[4]Limit is with using a Quasi-peak detector with a bandwidth as defined in CISPR 16-1-1

Typical Radiated Emissions Setup



Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is +/-4.4 dB with a 'k=2' coverage factor and a 95% confidence level.

Results

The EUT passed the limits. Low, middle and high band was measured. The worst case for each mode is presented as a graph for the spectrum.

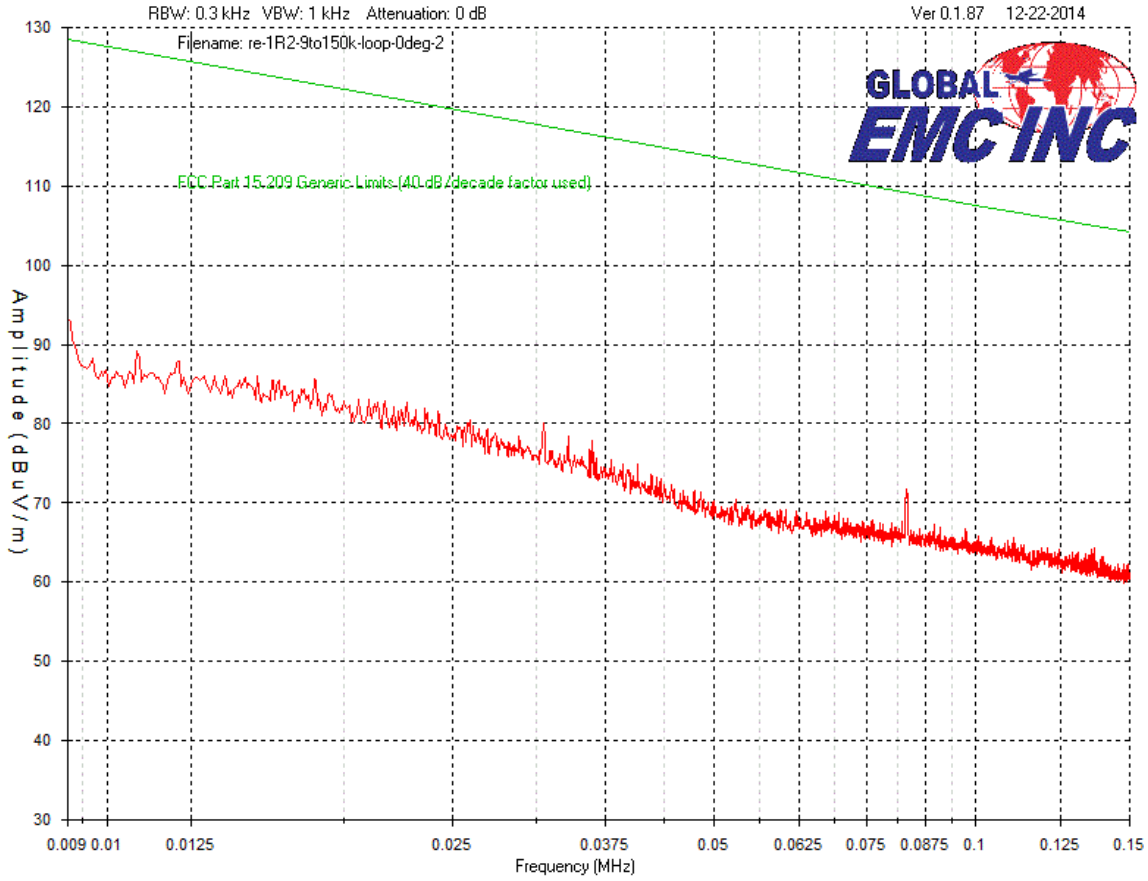
Preliminary Graphs

Note the graphs shown below are for graphical illustration only. For final measurements with the appropriate detector, please refer to the final measurement table where applicable. The graph shown below is a maximized peak measurement graph, measured with a resolution bandwidth greater than the final required detector and over a full 0-360 rotation. This peaking process is done as a worst case measurement. This process enables the detection of frequencies of concern for final measurement, and provides considerable time savings. Final measurements are performed over a full 0-360 degrees rotation and 1 – 4 meter height of measurement antenna.

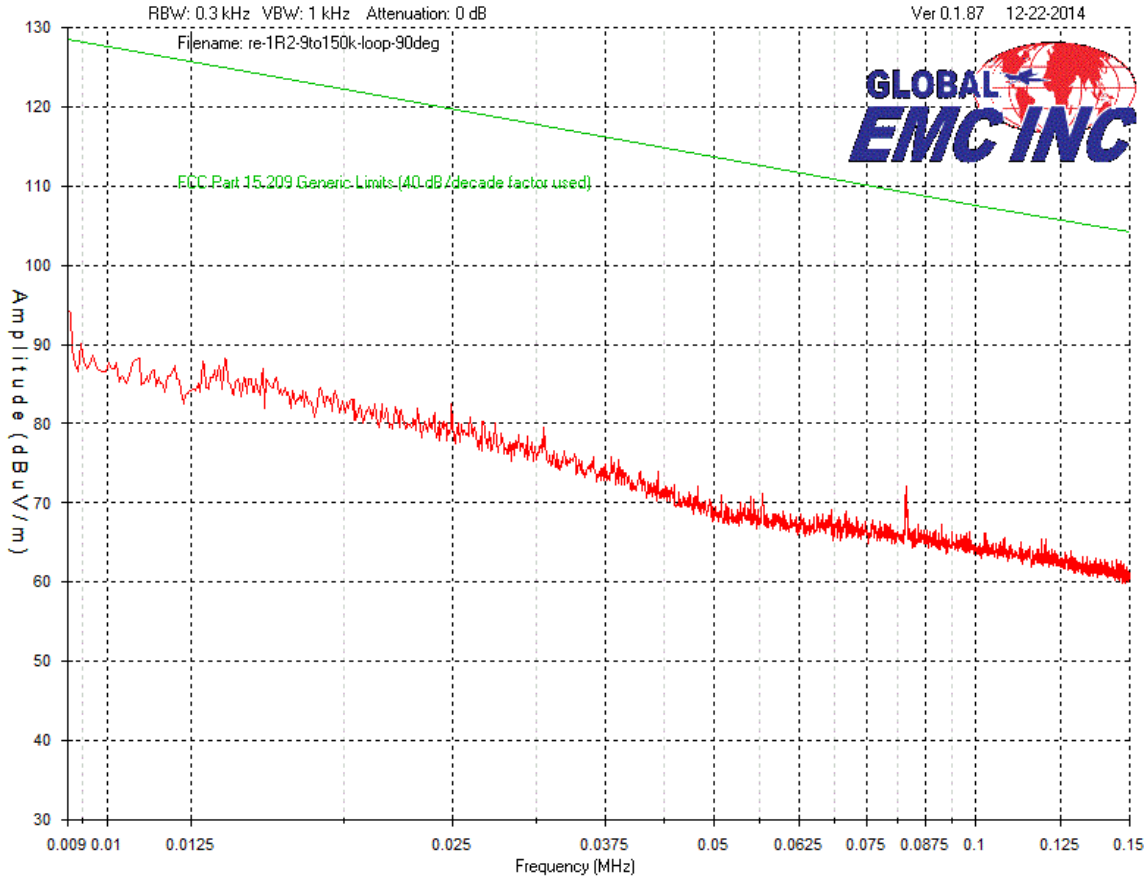
In accordance with FCC Part 15, Subpart A, Section 15.33, the device was scanned to the 10^{th} harmonic (a minimum of a 1 GHz).

Devices scanned above 1GHz may be scanned at a closer test distance, and in accordance with FCC Part 15, Subpart A, Section 15.31, an extrapolation factor of 20 dB/decade was used above 30 MHz, and 40 dB/decade below 30 MHz.

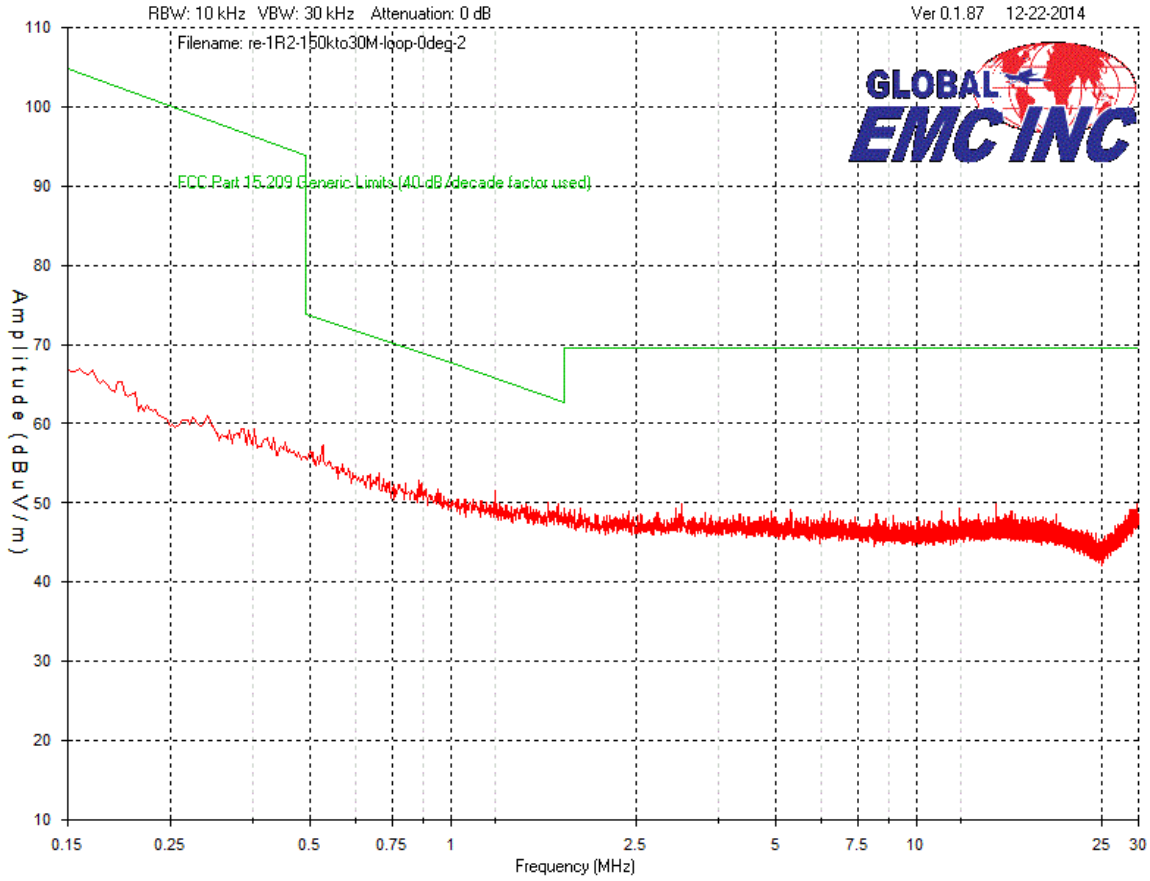
9 kHz to 150 kHz – Loop @ 0 degree



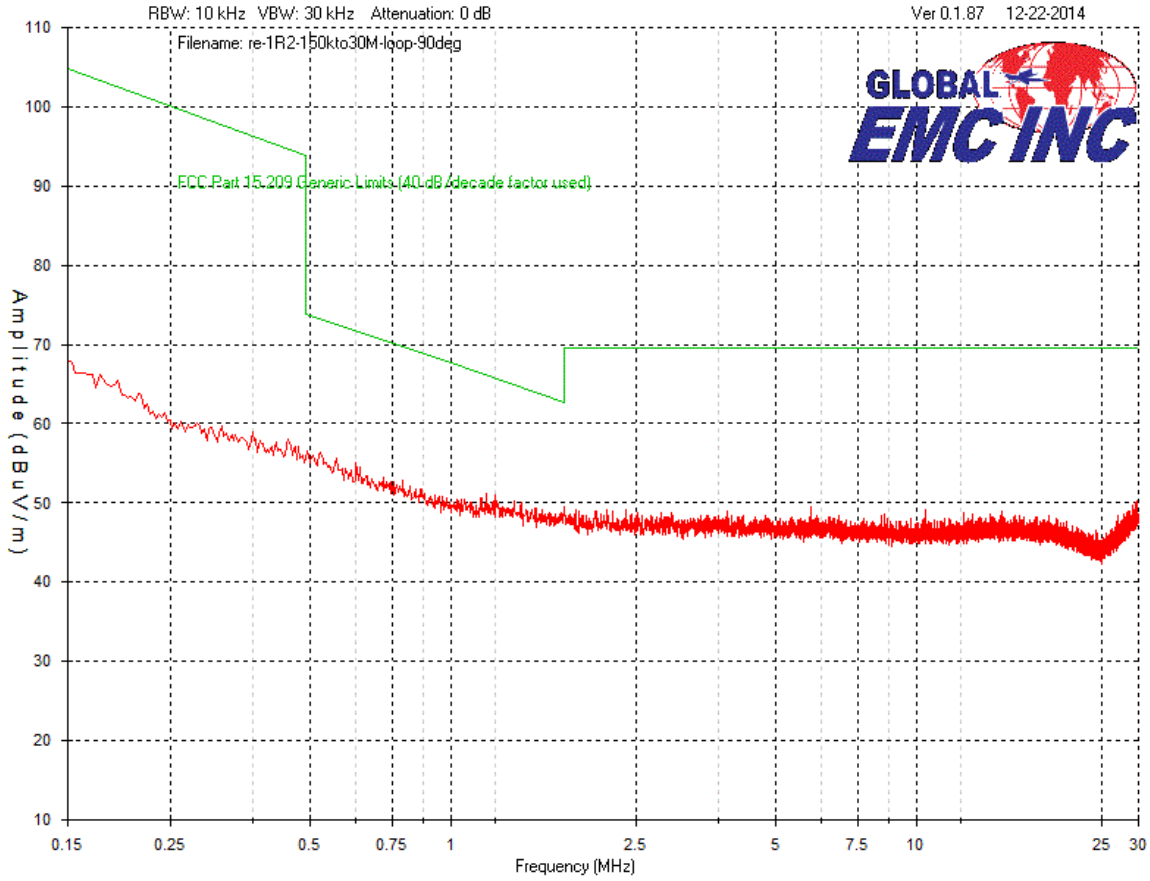
9 kHz to 150 kHz – Loop @ 90 degree



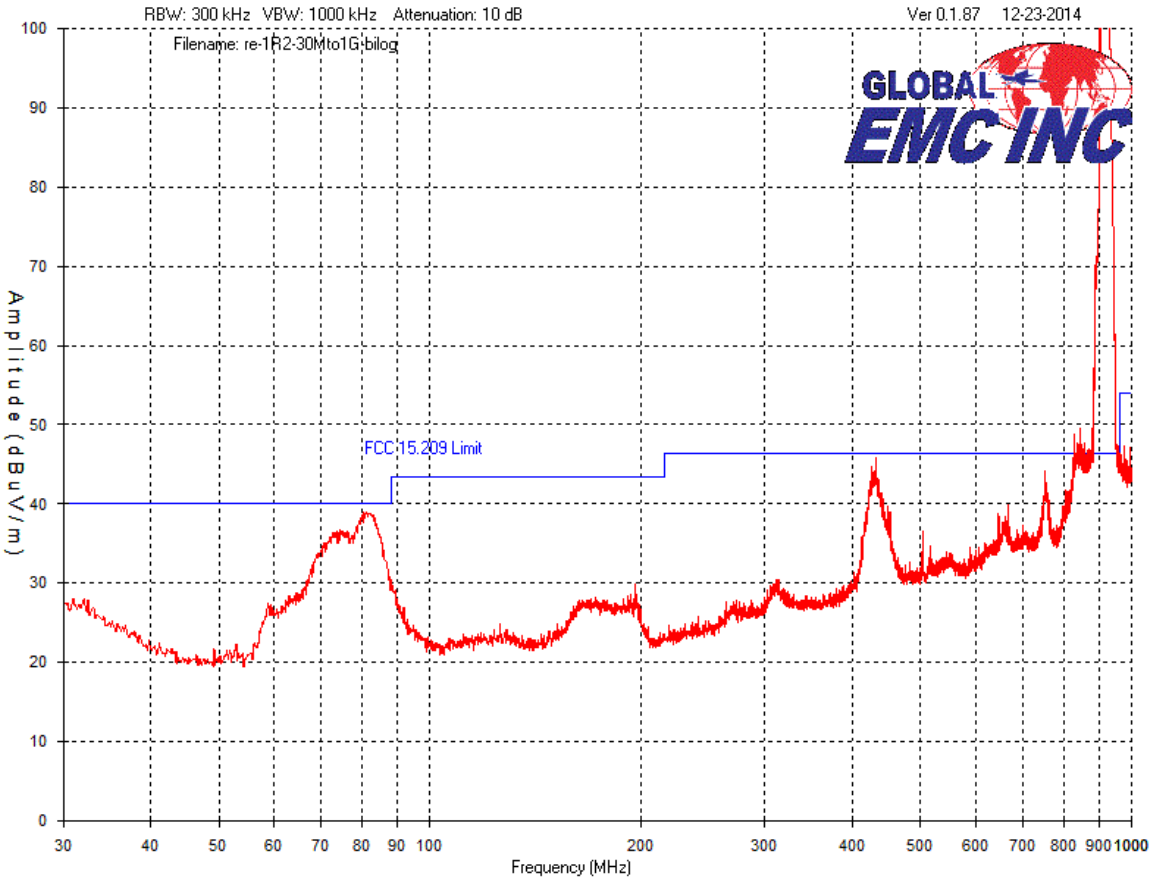
150 kHz to 30 MHz - Loop @ 0 degree

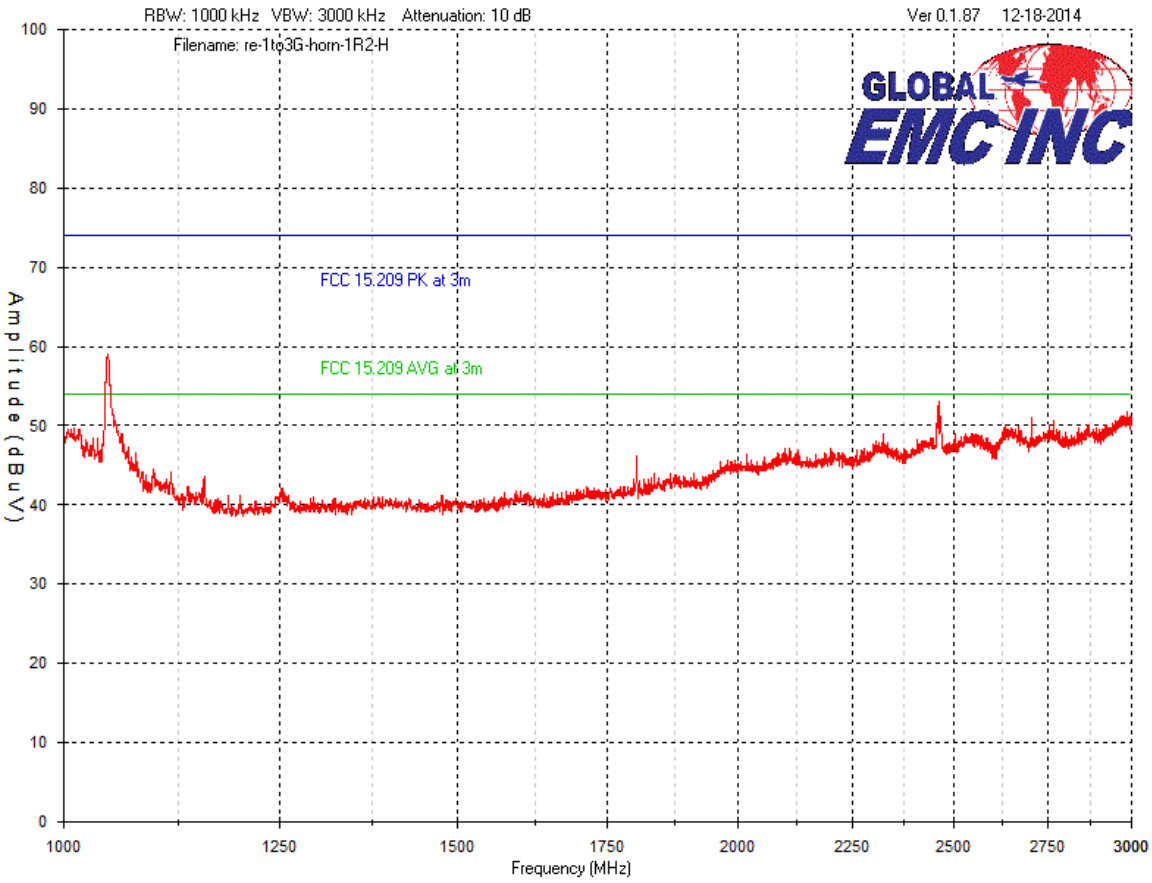


150 kHz to 30 MHz - Loop @ 90 degree

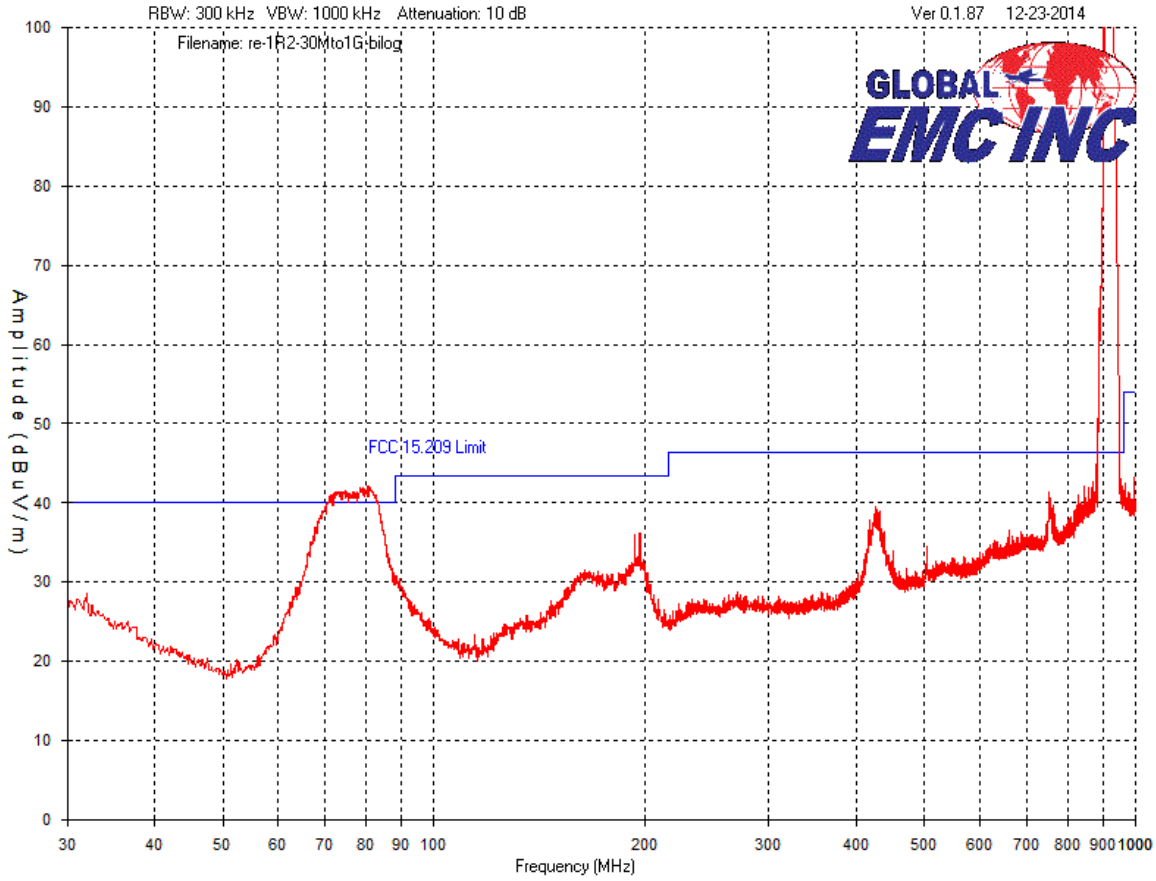


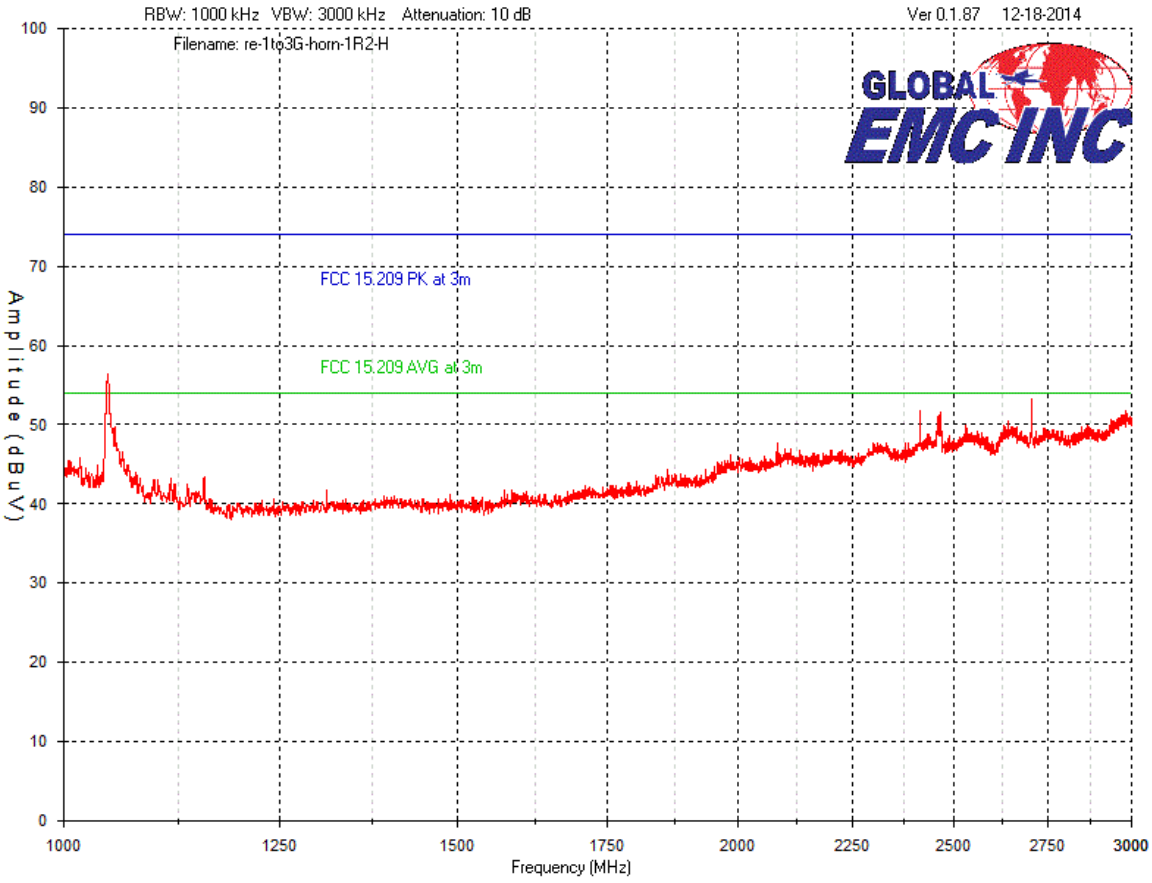
Vertical – Peak Emissions Graph





Horizontal – Peak Emissions Graph





Final Measurements

The following measurements were made at the harmonics.

Test Freq. (MHz)	Det. mode	Ant. Pol. (H/V)	Raw signal dB(µV)	Ant. factor dB	Cable loss dB	Pre-Amp Gain dB	Pre-sel /atten. dB	Received signal dB(µV/m)	Emission limit dB(µV/m)	Margin dB(µV)	Result
Low Channel											
902.25	Peak	H	95.6	24.0	2.8	0	0	122.4	n/a	n/a	
902.25	Peak	V	103.1	24.0	2.8	0	0	129.9	n/a	n/a	
1804.0	Peak	H	51.6	25.2	4.1	-33.1	1.9	49.6	102.4	52.8	PASS
2706.0	Peak	H	51.8	28.9	5.3	-33.1	3.3	56.2	74.0	17.8	PASS
3608.0	Peak	H	48.1	30.2	6.6	-32.9	6.0	58.0	74.0	16.0	PASS
4510.0	Peak	H	43.9	32.1	6.9	-32.9	6.0	56.0	74.0	18.0	PASS
1804.0	Peak	V	54.5	25.2	4.1	-33.1	1.9	52.5	109.9	55.4	PASS
2706.0	Peak	V	49.3	28.9	5.3	-33.1	3.3	53.7	74.0	20.3	PASS
3608.0	Peak	V	46.2	30.2	6.6	-32.9	6.0	56.1	74.0	17.9	PASS
4510.0	Peak	V	44.1	32.1	6.9	-32.9	6.0	56.2	74.0	17.8	PASS
1804.0	Avg	H	45.4	25.2	4.1	-33.1	1.9	43.4	n/a	n/a	
2706.0	Avg	H	48.4	28.9	5.3	-33.1	3.3	52.8	54.0	1.2	PASS
3608.0	Avg	H	37.5	30.2	6.6	-32.9	6.0	47.4	54.0	6.6	PASS
4510.0	Avg	H	29.3	32.1	6.9	-32.9	6.0	41.4	54.0	12.6	PASS
1804.0	Avg	V	52.5	25.2	4.1	-33.1	1.9	50.5	n/a	n/a	
2706.0	Avg	V	43.2	28.9	5.3	-33.1	3.3	47.6	54.0	6.4	PASS
3608.0	Avg	V	39.1	30.2	6.6	-32.9	6.0	49.0	54.0	5.0	PASS
4510.0	Avg	V	30.1	32.1	6.9	-32.9	6.0	42.2	54.0	11.8	PASS
Mid channel											
915.0	Peak	H	94.6	24.0	2.8	0	0	121.4	n/a	n/a	
915.0	Peak	V	103.7	24.0	2.8	0	0	130.5	n/a	n/a	
1830.0	Peak	H	50.2	25.2	4.1	-33.1	1.9	48.2	101.4	53.2	PASS
2745.0	Peak	H	51.9	28.9	5.3	-33.1	3.3	56.3	74.0	17.7	PASS
3660.0	Peak	H	45.8	30.2	6.6	-32.9	6.0	55.7	74.0	18.3	PASS
4575.0	Peak	H	45.2	32.1	6.9	-32.9	6.0	57.3	74.0	16.7	PASS
1830.0	Peak	V	54.5	25.2	4.1	-33.1	1.9	52.5	110.5	58.0	PASS
2745.0	Peak	V	50.1	28.9	5.3	-33.1	3.3	54.5	74.0	19.5	PASS
3660.0	Peak	V	46.1	30.2	6.6	-32.9	6.0	56.0	74.0	18.0	PASS
4575.0	Peak	V	45.2	32.1	6.9	-32.9	6.0	57.3	74.0	16.7	PASS
1830.0	Avg	H	45.5	25.2	4.1	-33.1	1.9	43.5	n/a	n/a	

2745.0	Avg	H	48.1	28.9	5.3	-33.1	3.3	52.5	54.0	1.5	PASS
3660.0	Avg	H	36.9	30.2	6.6	-32.9	6.0	46.8	54.0	7.2	PASS
4575.0	Avg	H	32.8	32.1	6.9	-32.9	6.0	44.9	54.0	9.1	PASS
1830.0	Avg	V	51.6	25.2	4.1	-33.1	1.9	49.6	n/a	n/a	
2745.0	Avg	V	44.3	28.9	5.3	-33.1	3.3	48.7	54.0	5.3	PASS
3660.0	Avg	V	37.1	30.2	6.6	-32.9	6.0	47.0	54.0	7.0	PASS
4575.0	Avg	V	30.1	32.1	6.9	-32.9	6.0	42.2	54.0	11.8	PASS
High channel											
927.75	Peak	H	96.1	24.0	2.8	0	0	122.9	n/a	n/a	
927.75	Peak	V	135.4	24.0	2.8	0	0	132.2	n/a	n/a	
1855.0	Peak	H	49.2	25.2	4.1	-33.1	1.9	47.2	102.9	55.7	PASS
2782.5	Peak	H	51.5	28.9	5.3	-33.1	3.3	55.9	74.0	18.1	PASS
3710.0	Peak	H	45.4	30.2	6.6	-32.9	6.0	55.3	74.0	18.7	PASS
4637.5	Peak	H	35.8	32.1	6.9	-32.9	6.0	47.9	74.0	26.1	PASS
1855.0	Peak	V	51.4	25.2	4.1	-33.1	1.9	49.4	112.2	62.8	PASS
2782.5	Peak	V	49.4	28.9	5.3	-33.1	3.3	53.8	74.0	20.2	PASS
3710.0	Peak	V	44.7	30.2	6.6	-32.9	6.0	54.6	74.0	19.4	PASS
4637.5	Peak	V	35.8	32.1	6.9	-32.9	6.0	47.9	74.0	26.1	PASS
1855.0	Avg	H	43.1	25.2	4.1	-33.1	1.9	41.1	n/a	n/a	
2782.5	Avg	H	47.4	28.9	5.3	-33.1	3.3	51.8	54.0	2.2	PASS
3710.0	Avg	H	33.1	30.2	6.6	-32.9	6.0	43.0	54.0	11.0	PASS
4637.5	Avg	H	23.1	32.1	6.9	-32.9	6.0	35.2	54.0	18.8	PASS
1855.0	Avg	V	48.1	25.2	4.1	-33.1	1.9	46.1	n/a	n/a	
2782.5	Avg	V	46.4	28.9	5.3	-33.1	3.3	50.8	54.0	3.2	PASS
3710.0	Avg	V	33.1	30.2	6.6	-32.9	6.0	43.0	54.0	11.0	PASS
4637.5	Avg	V	22.2	32.1	6.9	-32.9	6.0	34.3	54.0	19.7	PASS

Note: In accordance with 15.247(d), only radiated emissions exceeding the 15.209 limit that occur within the bands listed in 15.205, need to be verified with a quasi-peak detector or an average detector.

The frequency shown on the peak graph does not fall within a restricted band as listed in FCC 15.205 and does not need to be verified. In case the peak emissions exceeding the average limits, average detector emission measurements were made to ensure compliance.

Up to the 10^{th} harmonics were measured on all three channels, no emissions were detected above the 5^{rd} harmonic at 3 meter. The noise floor is lower than the limits.

The fundamental was measured for information purpose, and none of the unintentional radiated emissions that fall outside of the restricted bands exceeded the -20dBc requirement. See 'Spurious Conducted' measurements for further details.

Note: During the tests, EUT was operating in a continuous transmit mode in which it is transmitting at a 100% duty cycle.

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	8566B	HP	1/22/13	1/22/15	4169
Quasi Peak Adapter	85650A	HP	1/23/13	1/23/15	4170
Loop Antenna	EM 6879	Electro-Metrics	10-11-13	10-11-15	4040
BiLog Antenna	3142-C	ETS	4/25/13	4/25/15	4002
Attenuator 3 dB	FP-50-3	Trilithic	Verified 2013-04-02	2015-04-02	4028
9kHz-1GHz, 28dB preamp	LNA 6901	Teseq	8-6-13	8-6-15	4036
Horn Antenna	ATH1G18G	AR	4/3/13	4/3/15	4003
1GHz-26.5GHz preamp	HP 8449B	HP	4/25/13	4/25/15	4006
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	Verified 2013-04-02	2015-04-02	4026
RF Cable 1M	LMR-400-1M-50OHM-MN-MN	LexTec	Verified 2013-04-02	2015-04-02	4039
RF Cable 10m	LMR-400-10M-50OHM-MN-MN	LexTec	Verified 2013-04-02	2015-04-02	4025
Hewlett Packard Preselector	8445B	HP	NCR	NCR	6364
Notch Filter	BRC50722	MICRO-TRONICS	Verified 2013-04-02	2015-04-02	186
Emission software	0.1.87	Global EMC	NCR	NCR	58

This report module is based on GEMC template "FCC - 15.209 - Radiated Emissions_Rev5.doc"

Spurious Conducted Emissions

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 15.247(d).
In any 100 kHz band, the peak spurious harmonics emissions must be at least 20 dB below the fundamental.

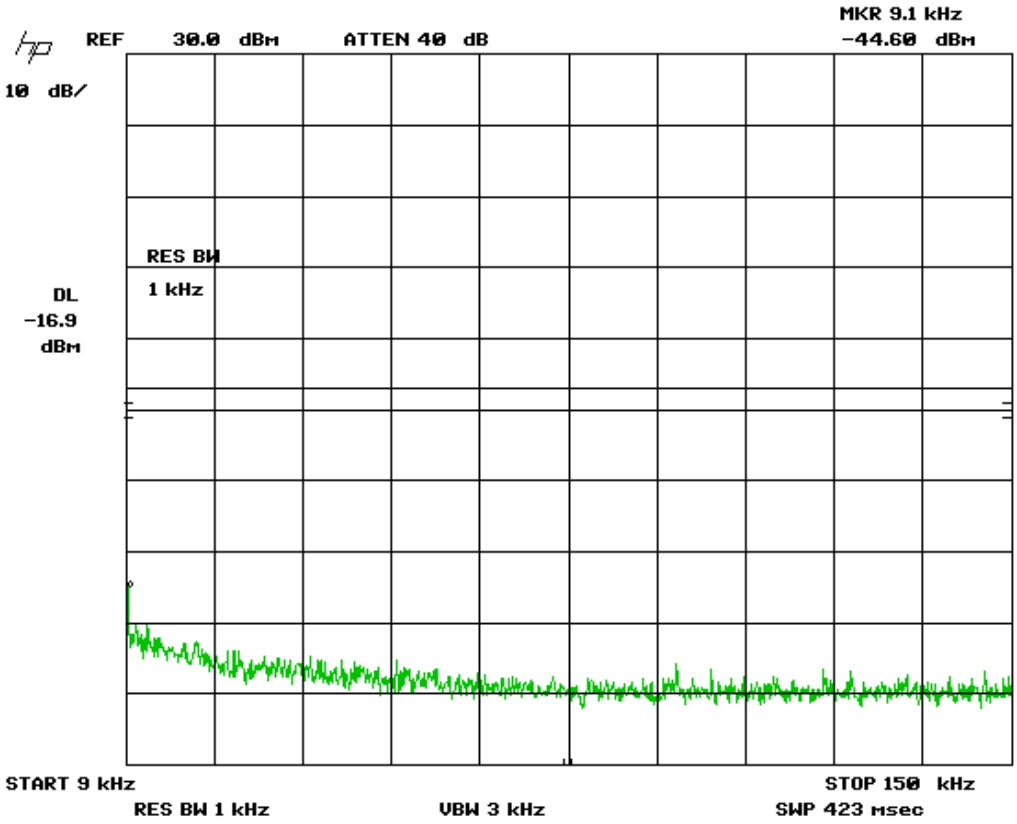
Results

The EUT passed. The peak power measured was 29.8 dBm (955 mW). The worst case instrument noise floor was below -60 dBc under this configuration (or -30 dBm) and no harmonics were observed.

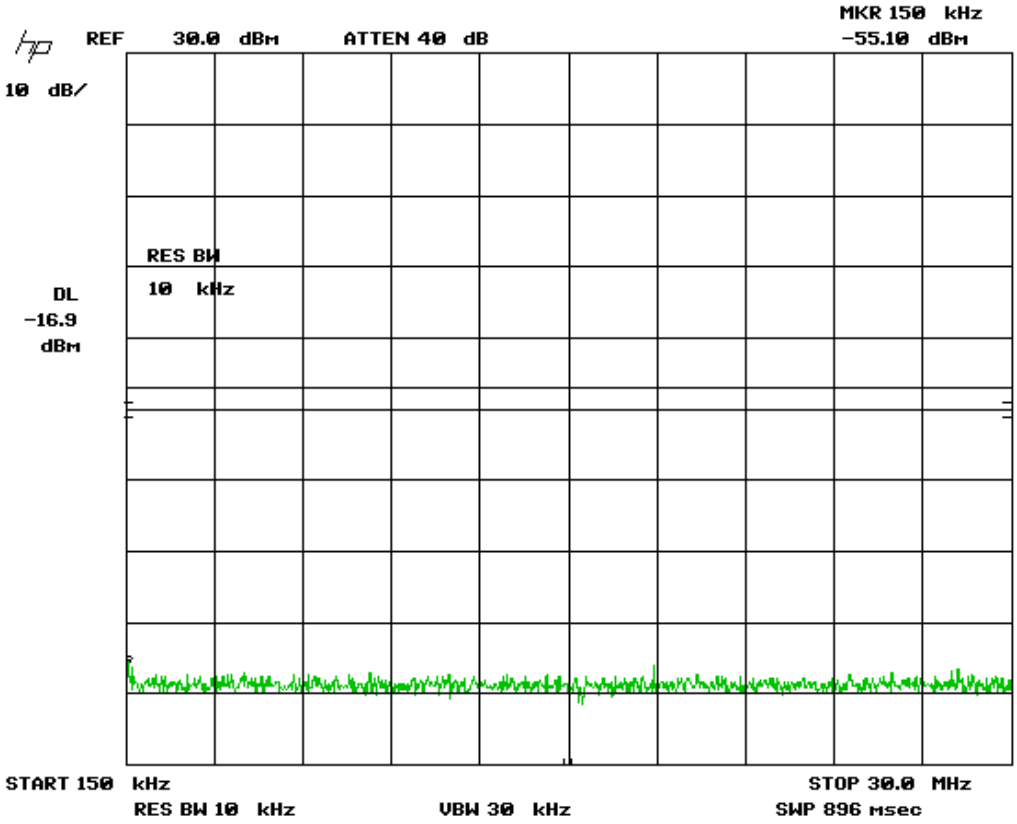
Graph(s)

The graphs shown below shows the peak power output of the device during the antenna conducted measurement during transmit operation of the EUT. Note there was 20 dB (or 26dB) of external attenuation taken during this measurement. The -20 dBc requirement is shown for the lower band edge at 902MHz in the low channel. The -20 dBc requirement is also shown for the higher band edge at 928MHz in the high channel.

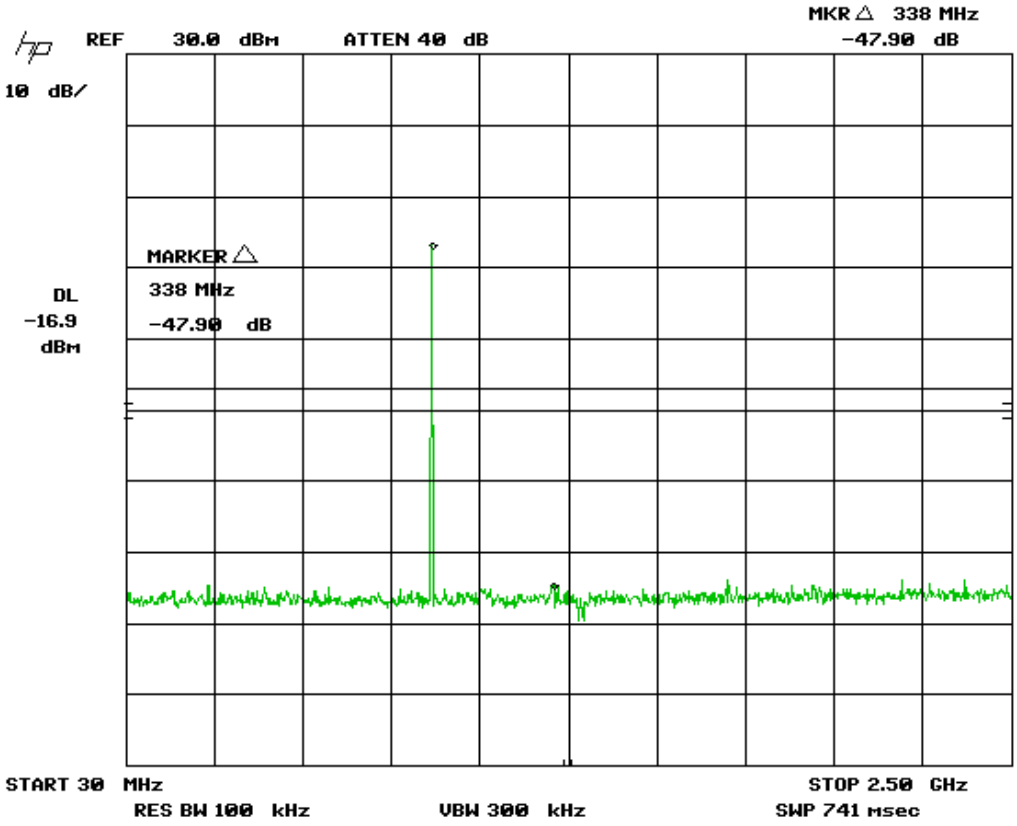
9kHz to 150kHz (26dB attenuation)



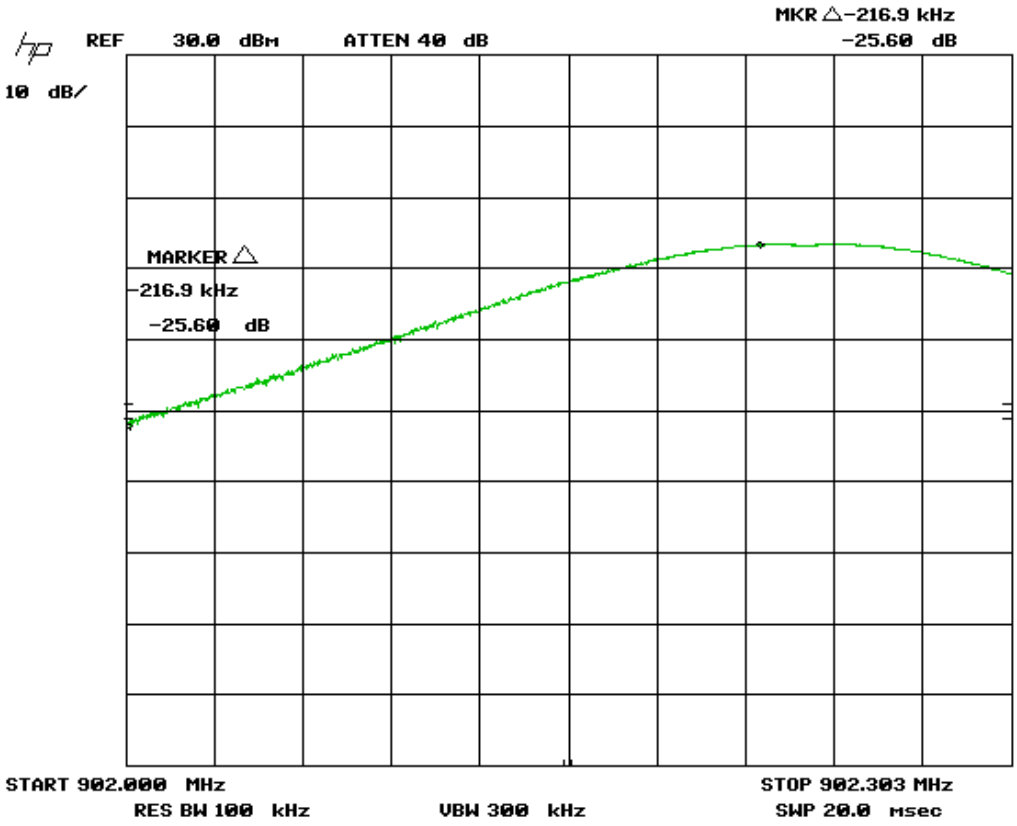
150kHz to 30MHz(26dB attenuation)



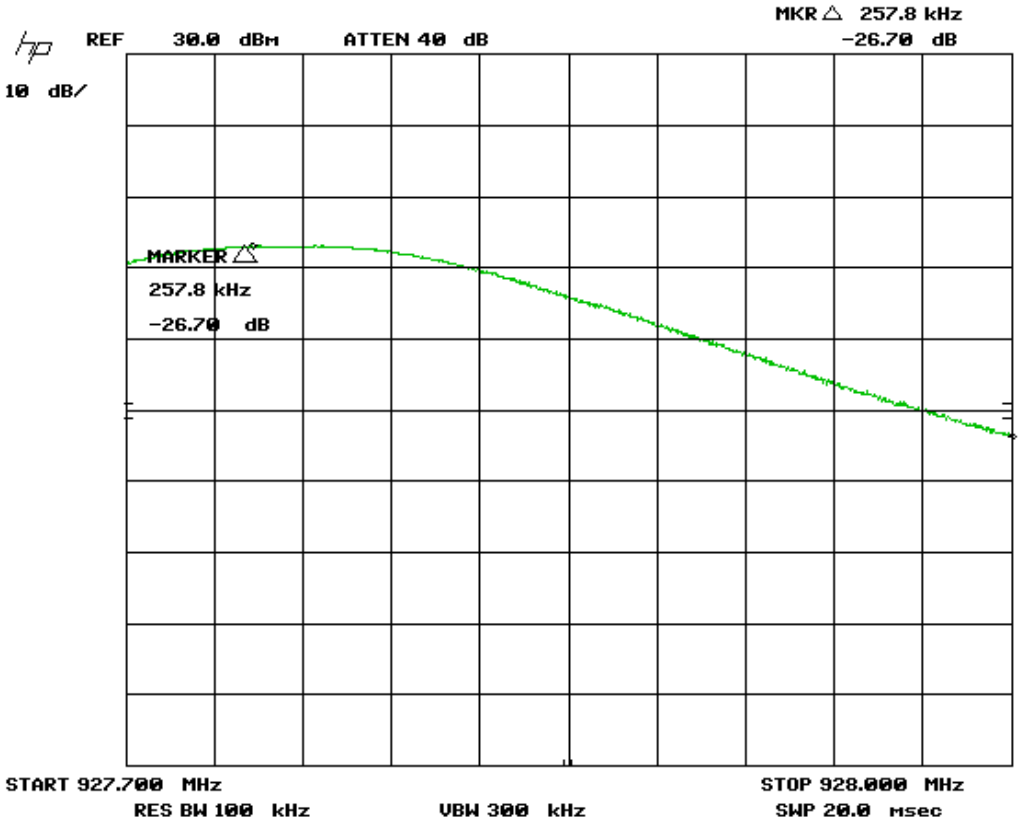
30MHz to 2.5GHz(26dB attenuation)



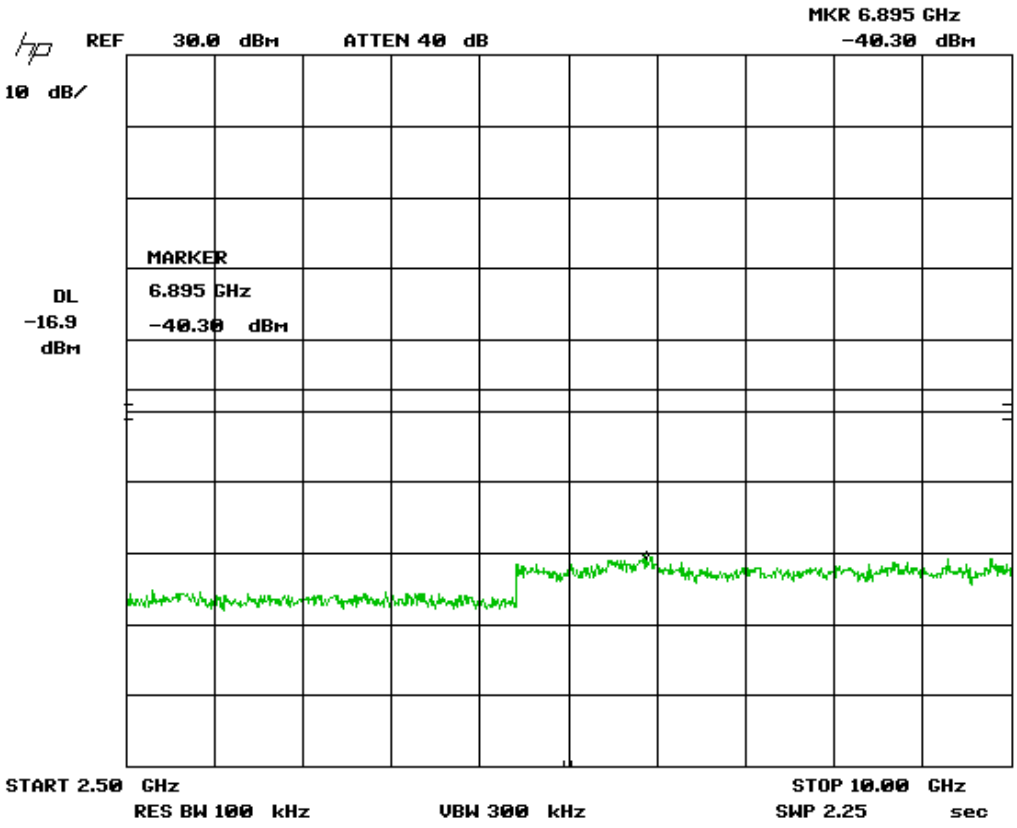
902MHz to 902.5MHz
(Band edge, low channel with 26dB attenuation)



927.5MHz to 928MHz
(Band edge, High Channel, with 26dB attenuation)



2.5GHz to 10GHz(26dB attenuation)



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

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Attenuator 20 dB	FP-50-20	Trilithic	Verified 2013-04-02	2015-04-02	4038
Power Attenuator 6 dB	100-A-MFN-06	Bird	Verified 2013-04-02	2015-04-02	4010
Spectrum Analyzer Display	8566B	HP	2013-01-22	2015-01-22	4168
Spectrum Analyzer	8566B	HP	2013-01-22	2015-01-22	4169
RF Cable 0.5M	LMR-400-0.5M-50OHM-MN-MN	LexTec	Verified 2013-04-02	2015-04-02	4029
Screen Capture software	Version 1.3.1	John Miles, KE5FX	NCR	NCR	59

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

Maximum Peak Envelope 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 15.247(b).
For frequency hopping systems operating in the 902-928 MHz band employing more than 50 hopping channels, the peak limit is 1 watt.

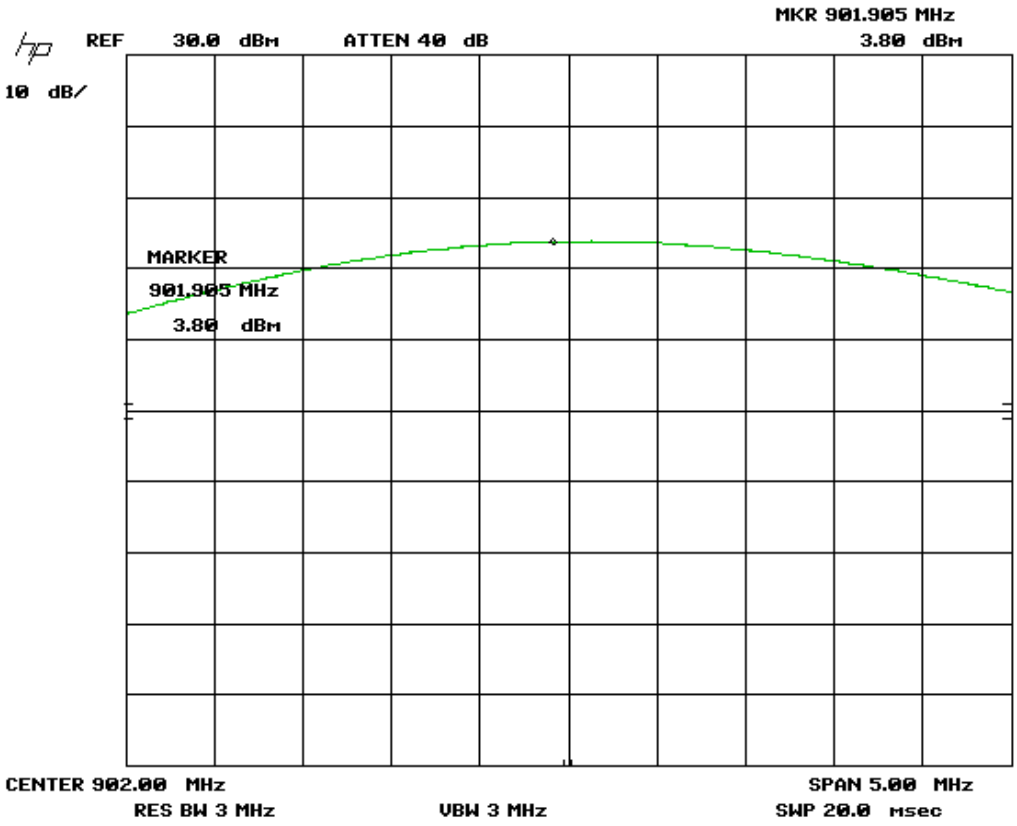
Results

The EUT passed. The peak power measured was 29.8 dBm (955 mW).

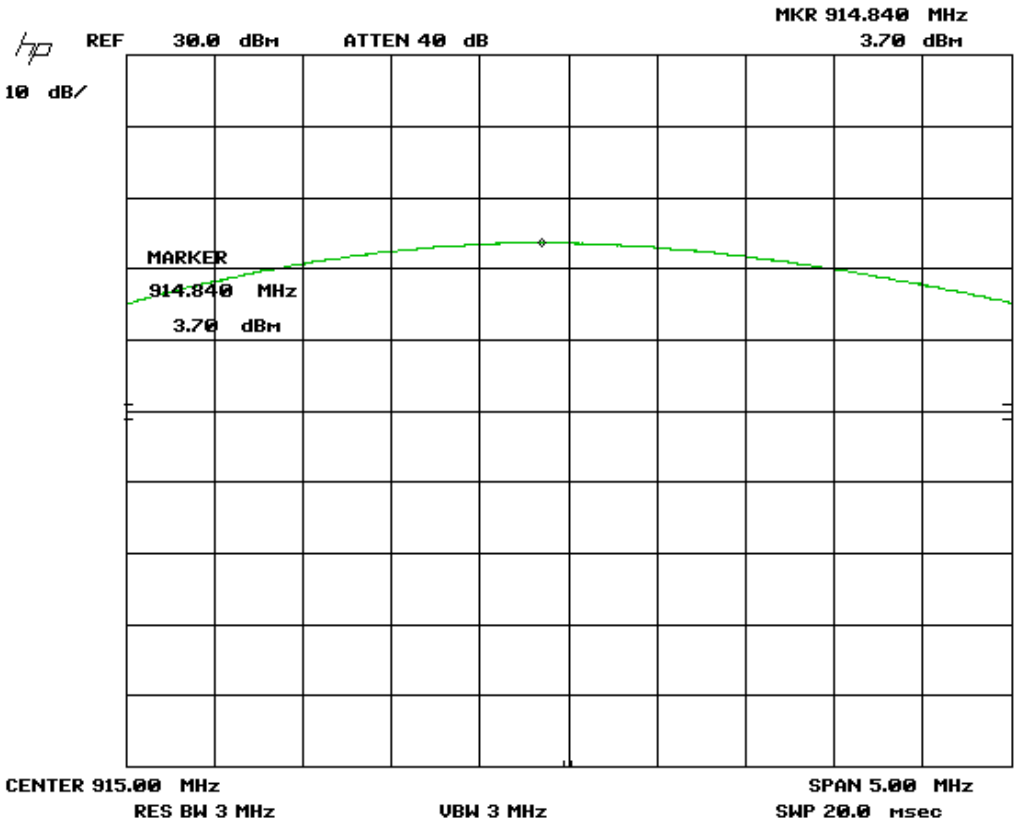
Graph(s)

The graphs shown below shows the peak power output of the device during the antenna conducted measurement during transmit operation of the EUT. Note there was 26dB of external attenuation taken during this measurement.

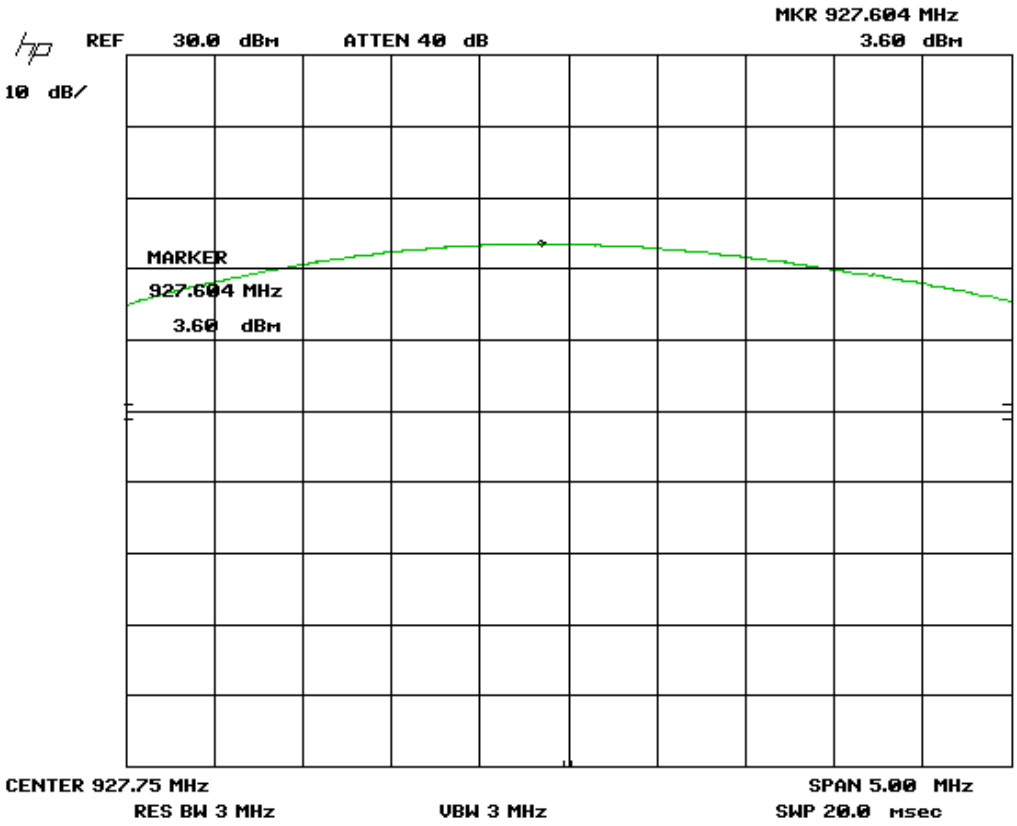
Low Channel



Mid Channel



High Channel



The calculated value is:
3.8 dBm + 26 dB (attenuator) = 29.8 dBm or 955 mW.

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

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Attenuator 20 dB	FP-50-20	Trilithic	Verified 2013-04-02	2015-04-02	4038
Power Attenuator 6 dB	100-A-MFN-06	Bird	Verified 2013-04-02	2015-04-02	4010
Spectrum Analyzer Display	8566B	HP	2013-01-22	2015-01-22	4168
Spectrum Analyzer	8566B	HP	2013-01-22	2015-01-22	4169
RF Cable 0.5M	LMR-400-0.5M-50OHM-MN-MN	LexTec	Verified 2013-04-02	2015-04-02	4029
Screen Capture software	Version 1.3.1	John Miles, KE5FX	NCR	NCR	59

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

Channel Carrier Bandwidth of Frequency Hopping Systems

Purpose

The purpose of this test is to allow for results that is used to help establish other limits. Although there is not specific limit for this requirement, the derived limits dependant on this information helps allow for other spread spectrum devices to co-exist in the same frequency spectrum.. This also helps prevent corruption of data by ensuring adequate channel separation to distinguish the reception of the intended information.

Limits

As per FCC part 15.247, The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

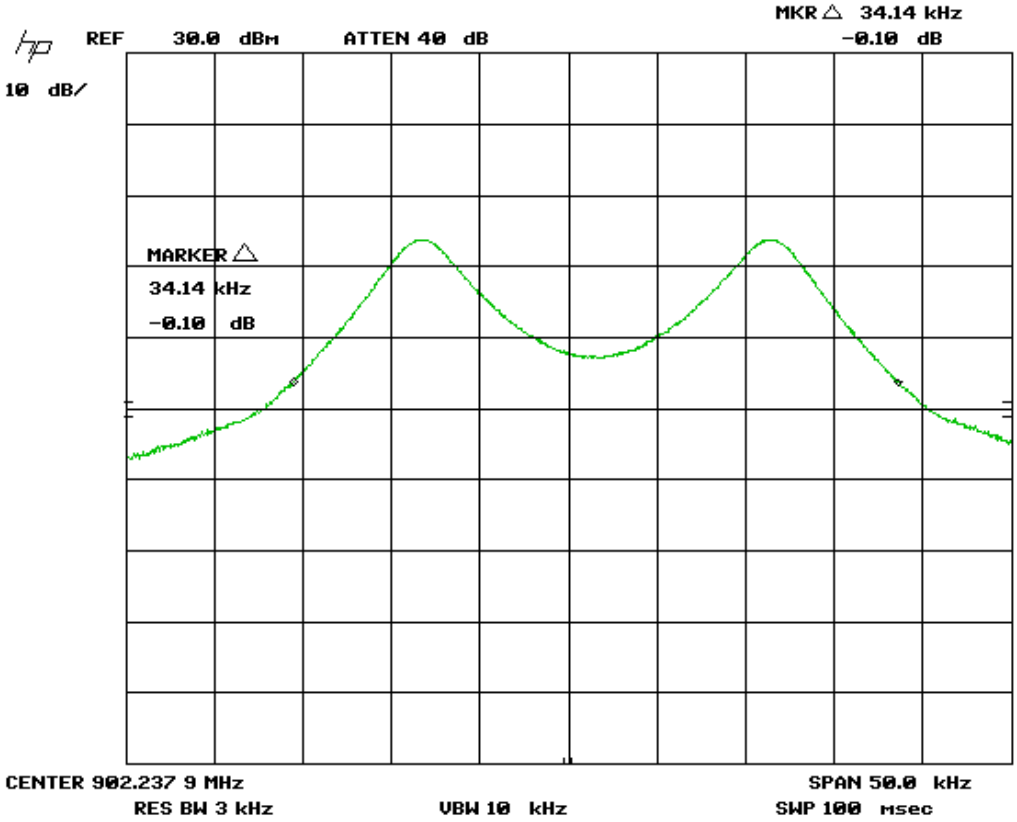
Results

The EUT passed. The 20 dB BW measured was 34.3 kHz.

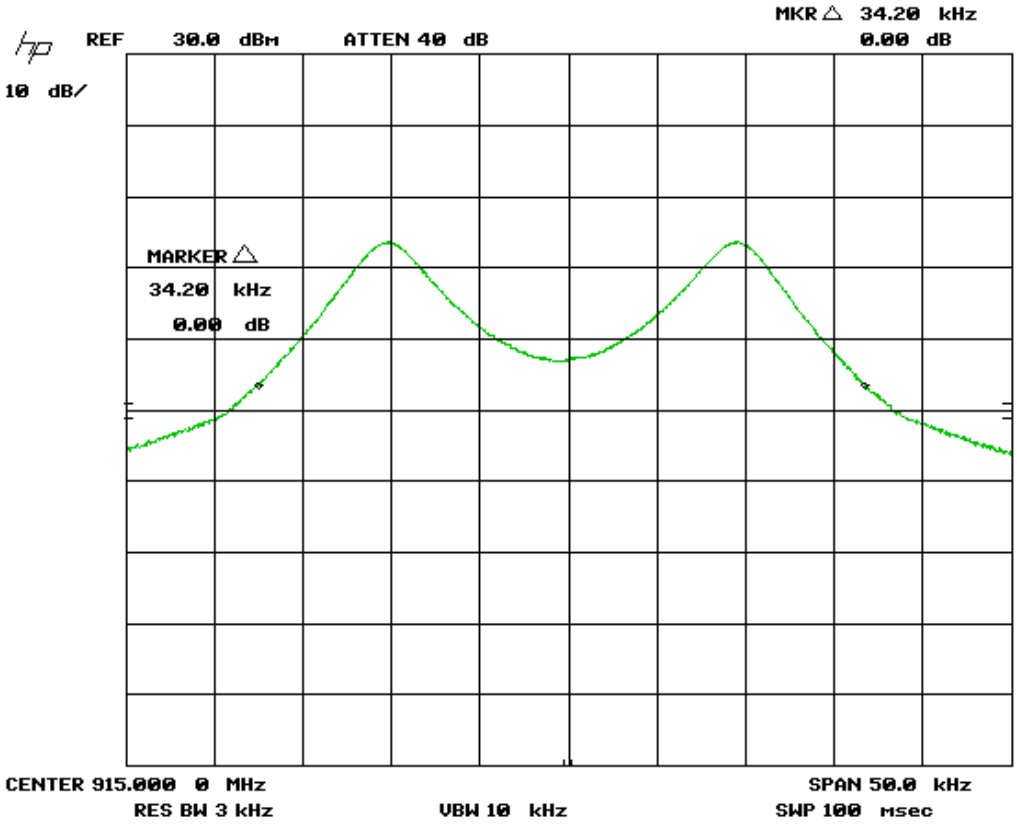
Graph(s)

The graphs shown below shows the channel spacing during the operation of the device. This is measured by a max hold on the spectrum analyzer and the highest resolution bandwidth that is sufficiently low to exhibit the 20 dB bandwidth of a channel during operation of the EUT. This measurement is a peak measurement. Max hold is performed for a duration of not less than 1 minute.

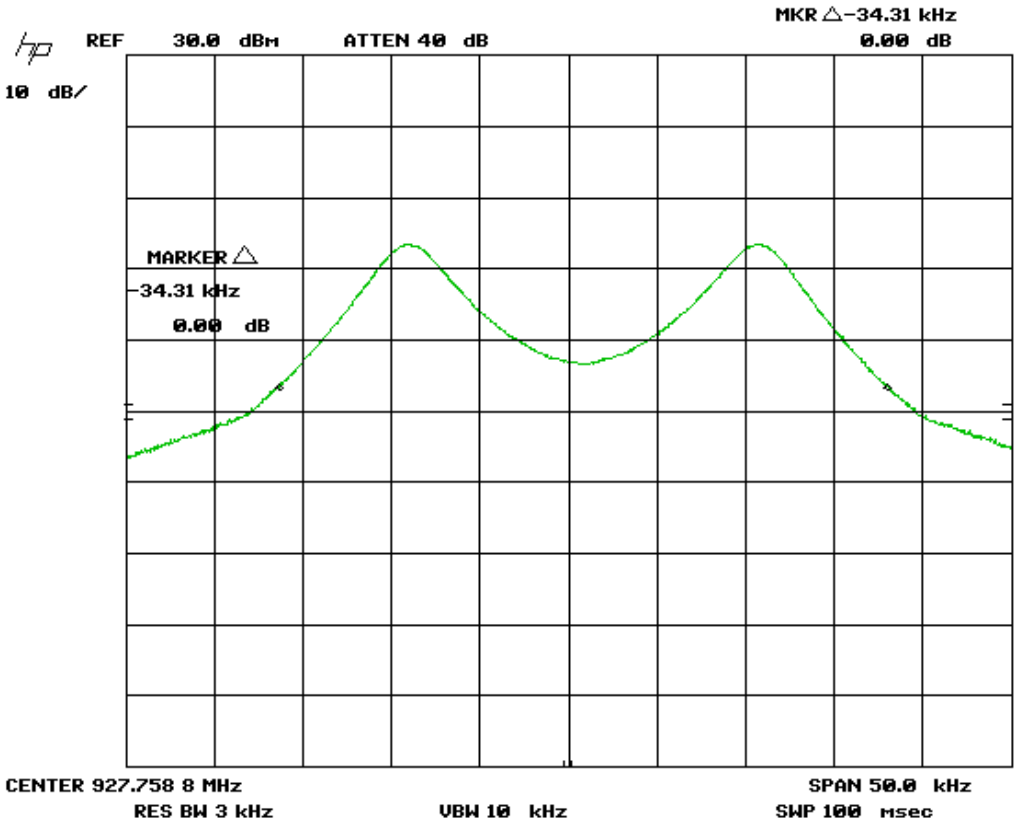
Low channel



Mid channel



High channel



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

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Attenuator 20 dB	FP-50-20	Trilithic	Verified 2013-04-02	2015-04-02	4038
Power Attenuator 6 dB	100-A-MFN-06	Bird	Verified 2013-04-02	2015-04-02	4010
Spectrum Analyzer Display	8566B	HP	2013-01-22	2015-01-22	4168
Spectrum Analyzer	8566B	HP	2013-01-22	2015-01-22	4169
RF Cable 0.5M	LMR-400-0.5M-50OHM-MN-MN	LexTec	Verified 2013-04-02	2015-04-02	4029
Screen Capture software	Version 1.3.1	John Miles, KE5FX	NCR	NCR	59

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

Number of Channels for Frequency Hopping Systems

Purpose

The purpose of this test is to ensure that the RF energy of frequency hopping systems is sufficiently spread over a spectrum and that the radio energy is not overly dense. This limit helps allow for other spread spectrum devices to co-exist in the same frequency spectrum. This also helps prevent corruption of data by ensuring adequate channel separation to distinguish the reception of the intended information.

Limits

The limits are as defined in 47 CFR FCC Part 15 Section 15.247(a)(1)

	902 to 928 MHz	2.4 to 2.4835 GHz	5.275 to 5.85 GHz
No conditions	>= 50 channels	>= 15 channels	>= 75 channels
20 dB BW exceeds 250 kHz	>= 25 channels	>= 15 channels	>= 75 channels

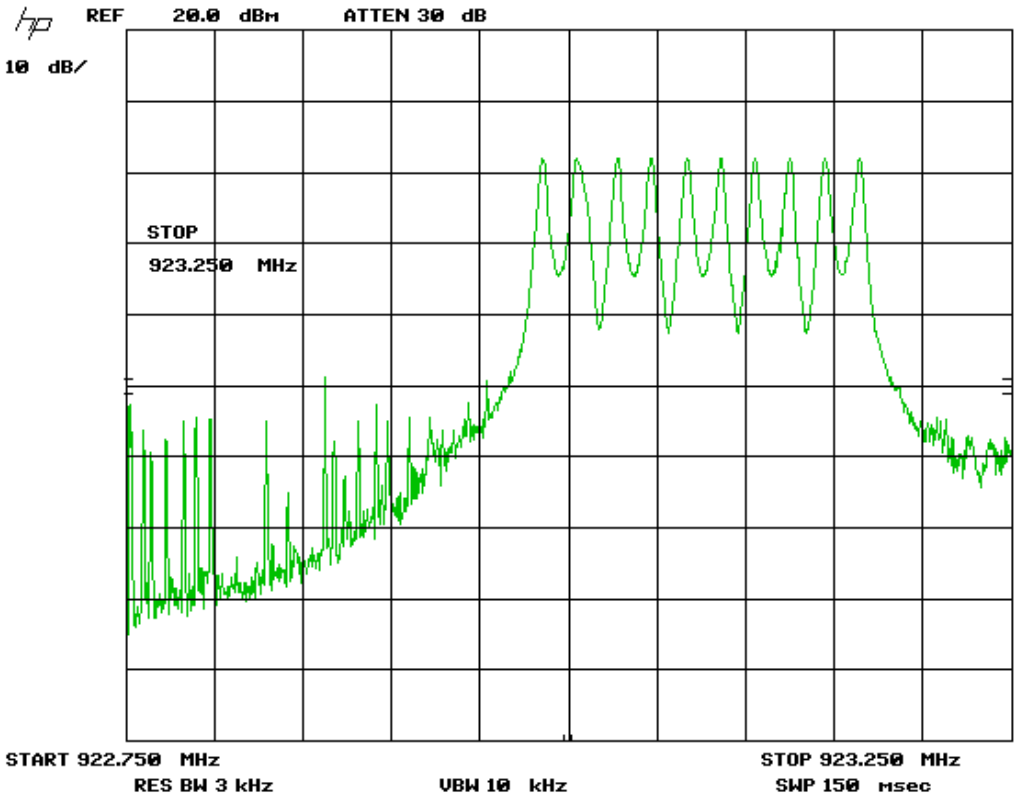
Results

The EUT passed the requirements of the number of channels. The number of channels the device occupies is 53 channels in the allocation band of 902 to 928 MHz.

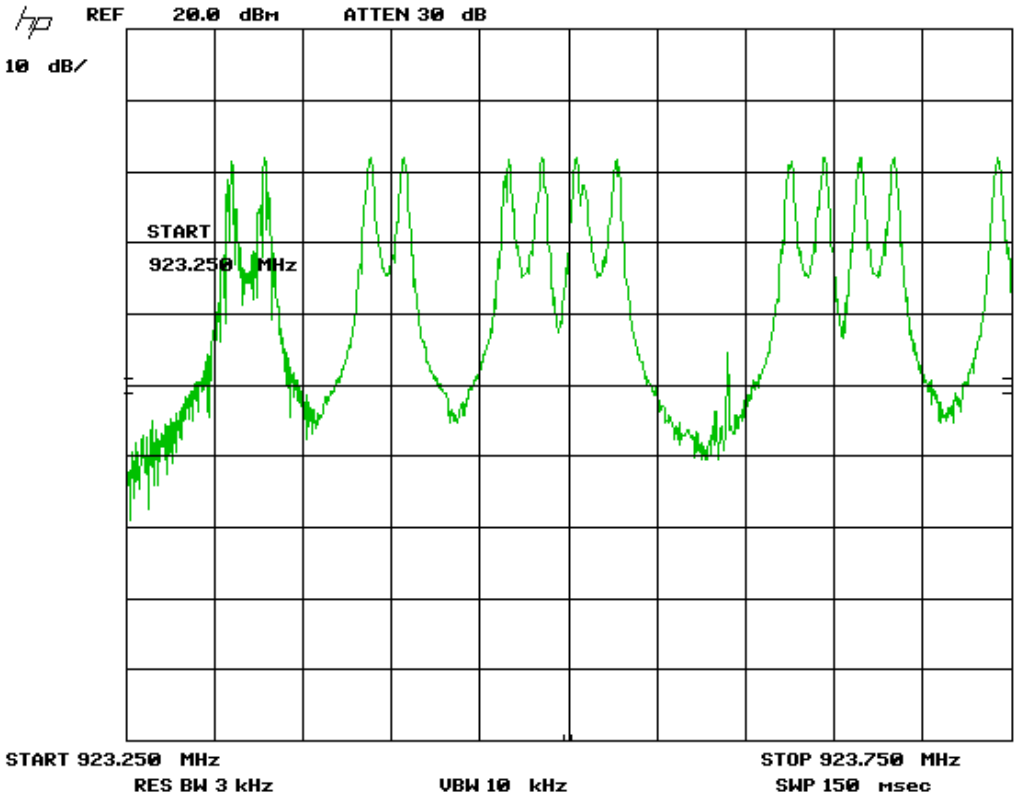
Graph(s)

The graphs shown below shows the number of occupied channels during the operation of the device. This is measured by a max hold on the spectrum analyzer and the highest resolution bandwidth that is sufficiently low to exhibit the channel spacing of the signal being measured. This measurement is a peak measurement. Max hold is performed for a duration of not less than 10 minutes, or as sufficient to capture the channels occupied.

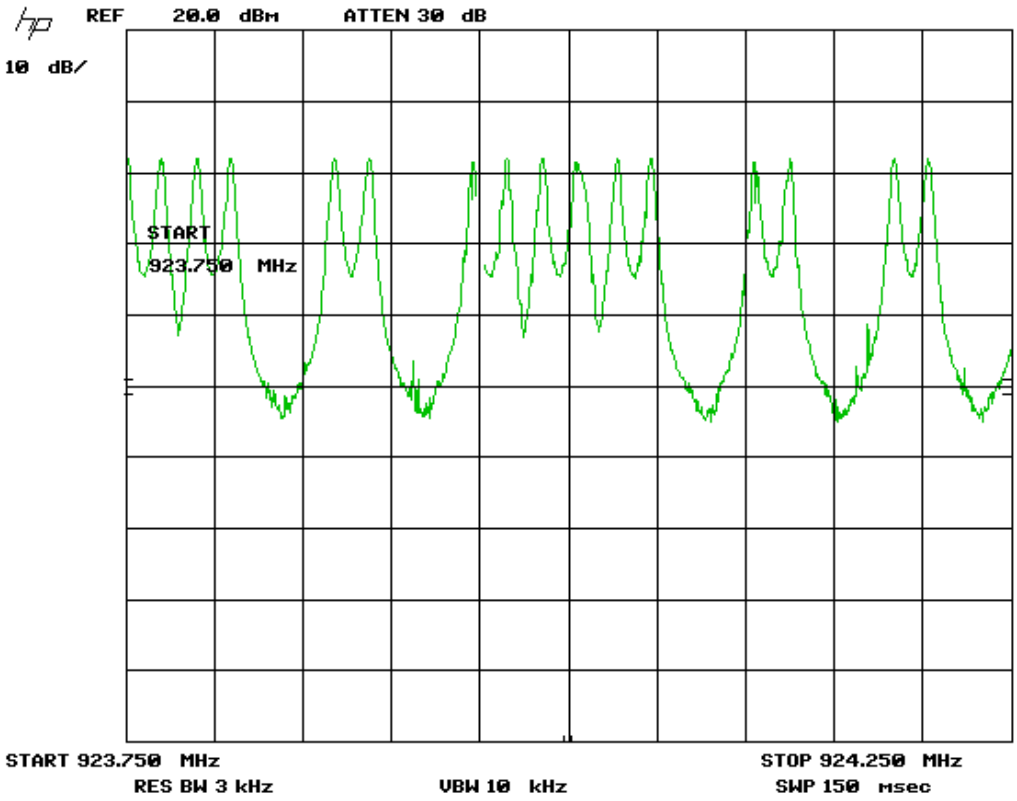
The number of channels from 922.75MHz to 923.25MHz: 5



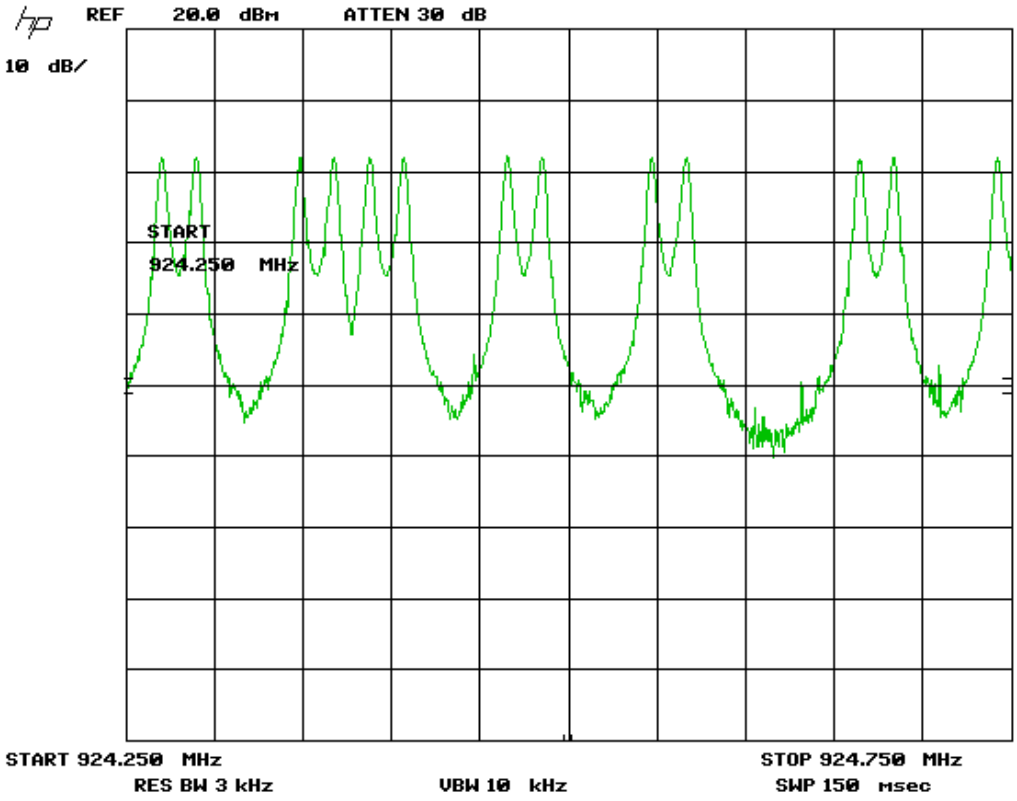
The number of channels from 923.25MHz to 923.75MHz: 6



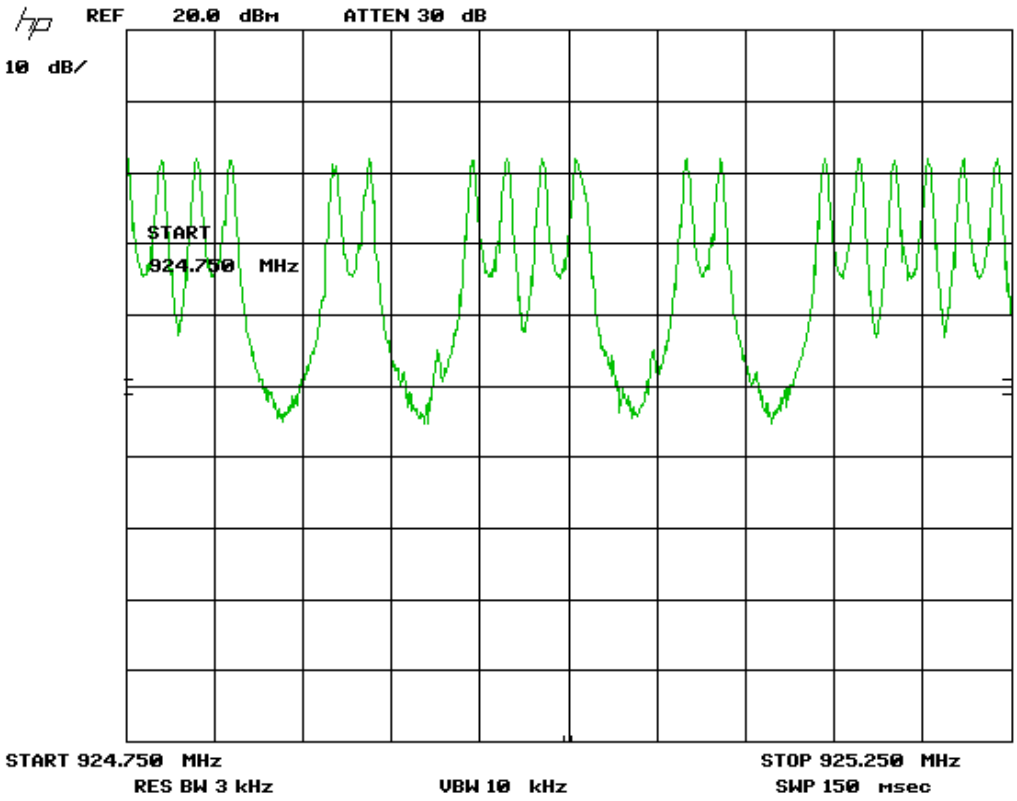
The number of channels from 923.75MHz to 924.25MHz: 8



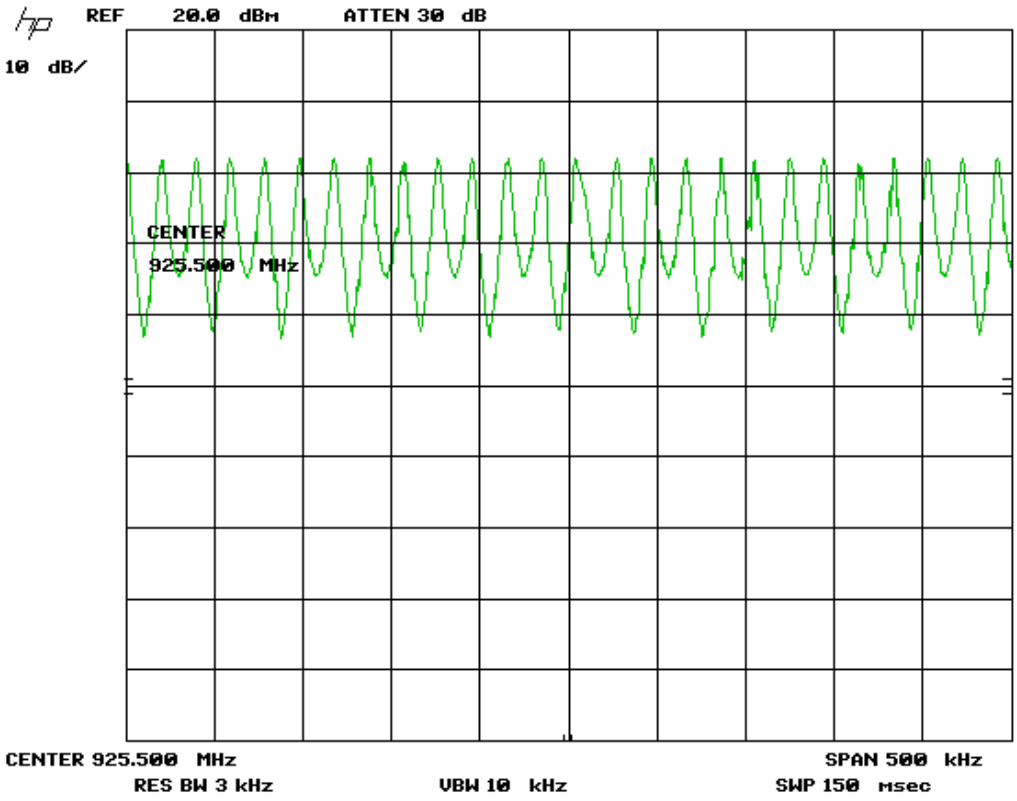
The number of channels from 924.25MHz to 924.75MHz: 6



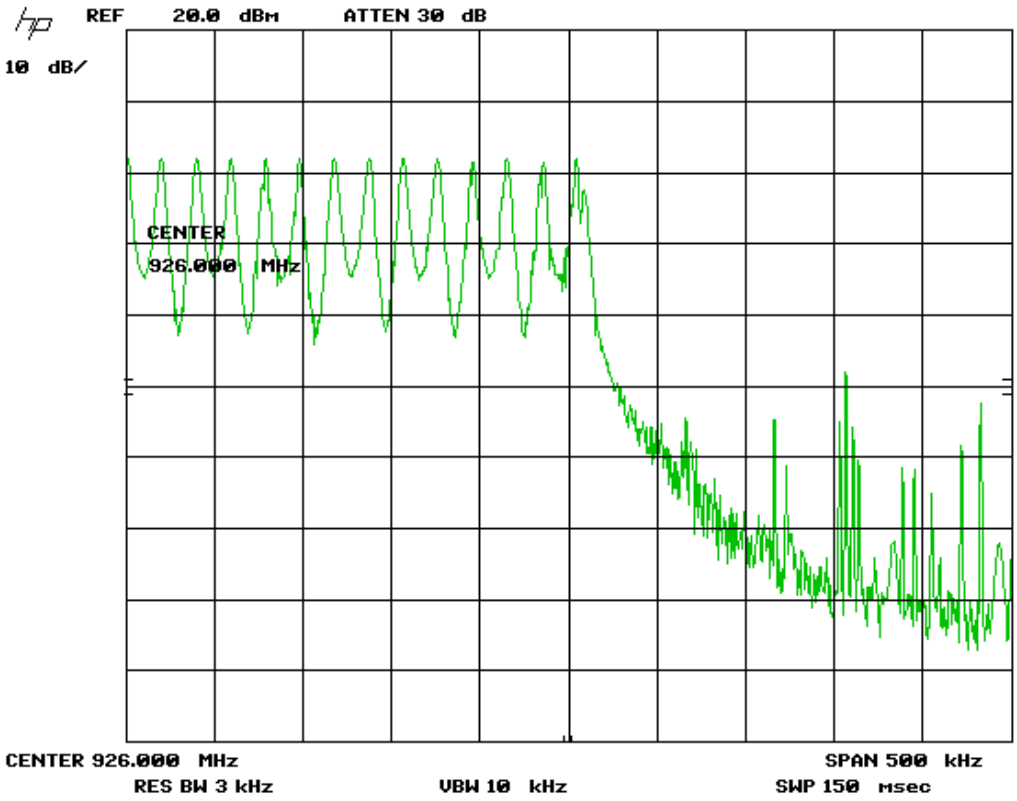
The number of channels from 924.75MHz to 925.25MHz: 9



The number of channels from 925.25MHz to 925.75MHz: 12



The number of channels from 922.75MHz to 923.25MHz: 7



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

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Attenuator 20 dB	FP-50-20	Trilithic	Verified 2013-04-02	2015-04-02	4038
Power Attenuator 6 dB	100-A-MFN-06	Bird	Verified 2013-04-02	2015-04-02	4010
Spectrum Analyzer Display	8566B	HP	2013-01-22	2015-01-22	4168
Spectrum Analyzer	8566B	HP	2013-01-22	2015-01-22	4169
RF Cable 0.5M	LMR-400-0.5M-50OHM-MN-MN	LexTec	Verified 2013-04-02	2015-04-02	4029
Screen Capture software	Version 1.3.1	John Miles, KE5FX	NCR	NCR	59

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

Channel Carrier Separation for Frequency Hopping Systems

Purpose

The purpose of this test is to ensure that the RF energy of frequency hopping systems is sufficiently spread over a spectrum and that the radio energy is not overly dense. This limit helps allow for other spread spectrum devices to co-exist in the same frequency spectrum. This also helps prevent corruption of data by ensuring adequate channel separation to distinguish the reception of the intended information.

Limits

The limits are as defined in 47 CFR FCC Part 15 Section 15.247(a)(1)

	902 to 928 MHz	2.4 to 2.4835 GHz	5.275 to 5.85 GHz
No conditions	25 kHz or 20 dB BW[1]	25 kHz or 20 dB BW[1]	25 kHz or 20 dB BW[1]
< 125 mW	25 kHz or 20 dB BW[1]	25 kHz or 2/3 of 20 dB BW[1]	25 kHz or 20 dB BW[1]

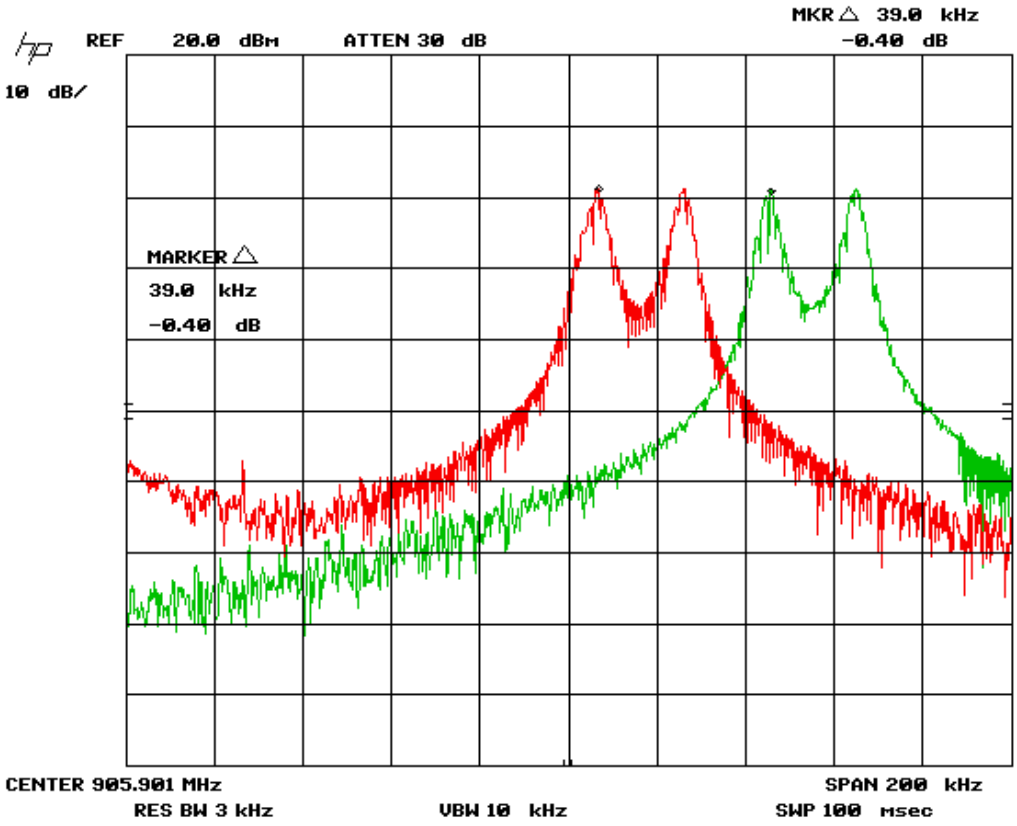
Note 1: Whichever is greater. The 20 dB BW of the system was measured to be 35 kHz, so a limit of 35 kHz applies.

Results

The EUT passed the requirements of channel carrier spacing exceeding the measured 20 dB BW of the EUT. The 20 dB BW previously measured was 34.3 kHz, and the device had a channel spacing of 39.0 kHz.

Graph(s)

The graphs shown below shows the channel spacing during the operation of the device. This is measured by a max hold on the spectrum analyzer and the highest resolution bandwidth that is sufficiently low to exhibit the channel spacing of the signal being measured. This measurement is a peak measurement. Max hold is performed for a duration of not less than 1 minute.



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

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Attenuator 20 dB	FP-50-20	Trilithic	Verified 2013-04-02	2015-04-02	4038
Power Attenuator 6 dB	100-A-MFN-06	Bird	Verified 2013-04-02	2015-04-02	4010
Spectrum Analyzer Display	8566B	HP	2013-01-22	2015-01-22	4168
Spectrum Analyzer	8566B	HP	2013-01-22	2015-01-22	4169
RF Cable 0.5M	LMR-400-0.5M-50OHM-MN-MN	LexTec	Verified 2013-04-02	2015-04-02	4029
Screen Capture software	Version 1.3.1	John Miles, KE5FX	NCR	NCR	59

Frequency Occupancy for Frequency Hopping Systems

Purpose

The purpose of this test is to ensure that the RF energy of frequency hopping systems is hopping at a minimum defined rate. This helps ensure sufficient time off to enable other frequency hopping devices to co-operate within this allocated band.

Limits

For 902 to 928 MHz systems, the limits are as defined in 47 CFR FCC Part 15 Section 15.247(a)(1)(i).

For systems with greater then a 20 dB BW of a hopping channel, and greater than 50 hopping channels, such as this EUT, the average time of occupancy on any frequency shall not be greater then 0.4 seconds within a 20 second period.

Results

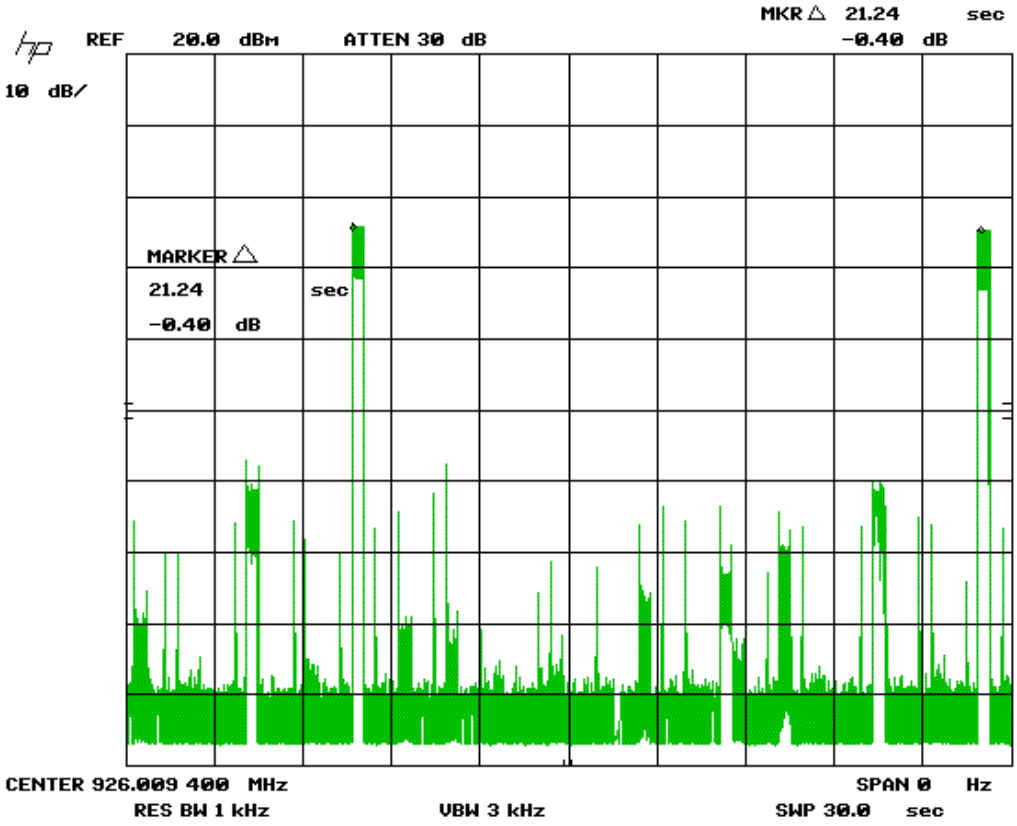
The EUT passed the requirements. The EUT cycles through its list of hopping frequencies every 21.24 seconds. The on time duration of each hop is 396 msec.

Thus the EUT achieves an worst case occupancy of 396 msec within a 20 second period. This is under the 400 msec limit.

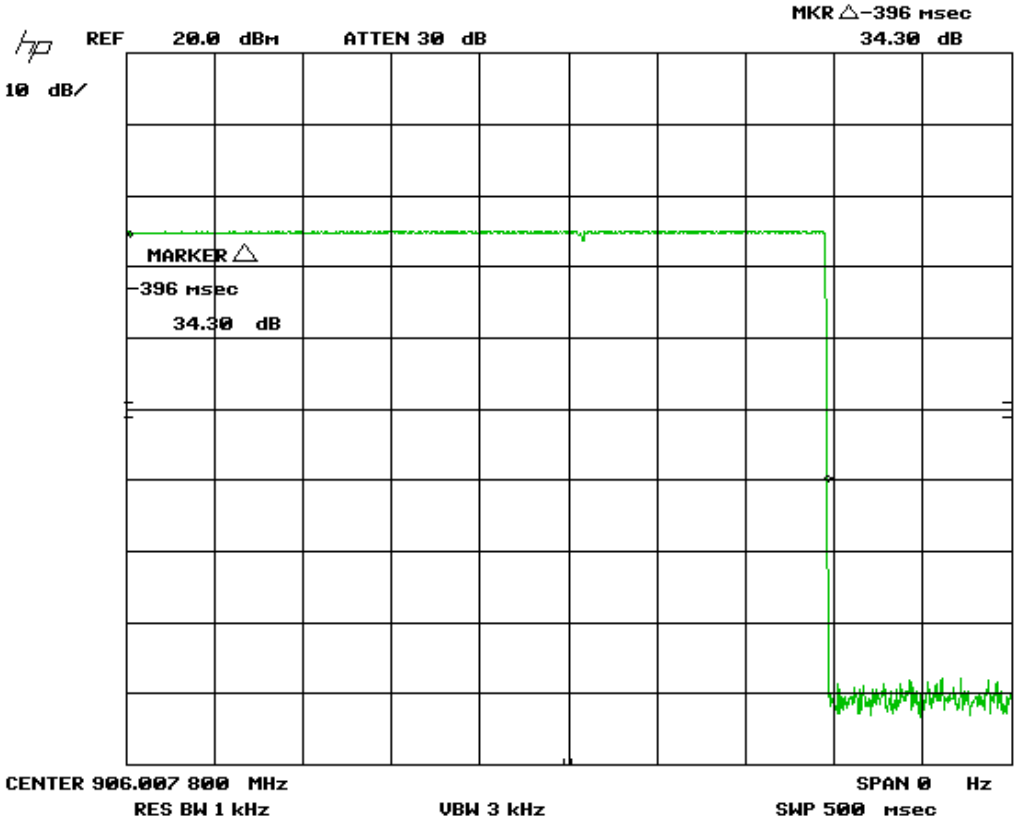
Graph(s)

The first graph shown below shows the repeat time of the pseudorandom generated hopping list. This graph was taken over a period of 120 seconds. The second graph shows the on time over a 500 msec period. Note that in the first graph, the peak represents the 'on' of the frequency being measured. The lower signals are artifacts of nearby channels due to the wide resolution BW used.

Hopping List repeat rate



On time during each channel



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

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Attenuator 20 dB	FP-50-20	Trilithic	Verified 2013-04-02	2015-04-02	4038
Power Attenuator 6 dB	100-A-MFN-06	Bird	Verified 2013-04-02	2015-04-02	4010
Spectrum Analyzer Display	8566B	HP	2013-01-22	2015-01-22	4168
Spectrum Analyzer	8566B	HP	2013-01-22	2015-01-22	4169
RF Cable 0.5M	LMR-400-0.5M-50OHM-MN-MN	LexTec	Verified 2013-04-02	2015-04-02	4029
Screen Capture software	Version 1.3.1	John Miles, KE5FX	NCR	NCR	59

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

Appendix A – EUT Summary

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

General EUT Description

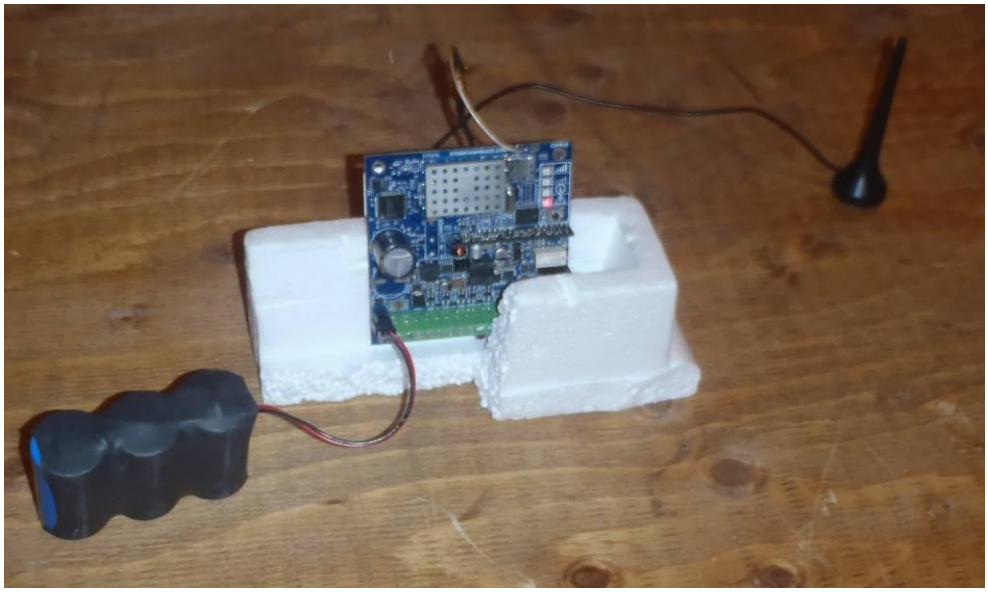
Client Details	
Organization / Address	Otodata Wireless Network Inc. 9280 L'Acadie Boulevard, Montreal, QC. Canada H4N 3C5
Contact	Jason M Gallovich - Executive Vice-President
Phone	P: 514-673-0244
Email	jmgallovich@otodata.ca
EUT (Equipment Under Test) Details	
EUT Name (for report title)	C003
EUT Model / SN (if known)	C003
EUT revision	1R2
Software version	0.1.80
Equipment category	Transceiver
Input voltage range(s) (V)	5v-16v
Frequency range(s) (Hz)	902-928 MHz ISM
Rated input current (A)	1 A Max
Nominal power consumption (W)	3 W
Number of power supplies in EUT	1 Battery
Transmits RF energy? (describe)	Click here... 30 dBm
Basic EUT functionality description	Wireless alarm panel interface module
High level block diagram of EUT (attachment)	C003
Modes of operation	FHSS
Frequency of all clocks present in EUT	32.768KHz, 19.68MHz
Dimensions of product	L 100mm W 100mm H 25mm

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'.

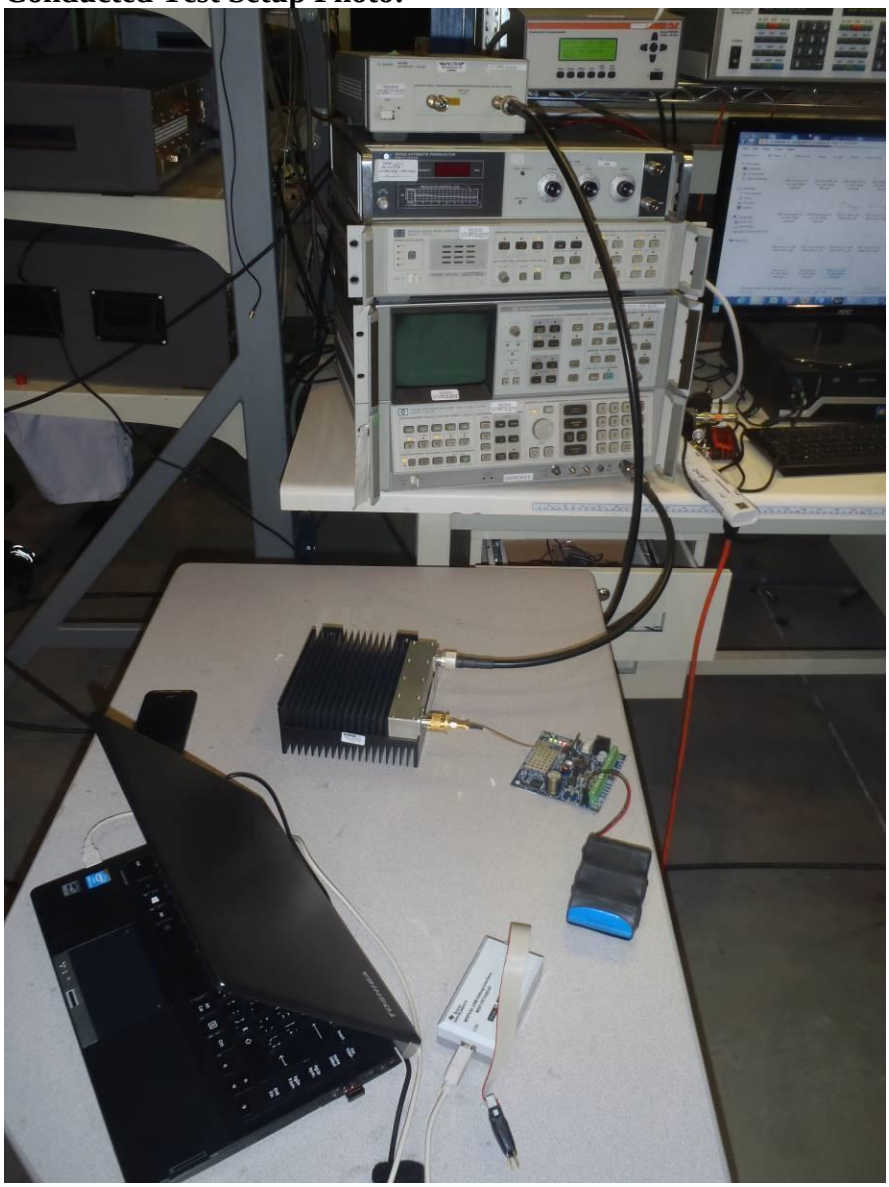
Appendix B – EUT and Test Setup Photographs

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

EUT's Photo:



Conducted Test Setup Photo:



Radiated Emission Test Setup Photo#1:

Radiated Emission Test Setup Photo#2: