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TÜV SÜD

RF Test Report

As per

RSS 247 Issue 2:2017

&

FCC Part 15 Subpart C:2016

Unlicensed Intentional Radiators

on the

Zigbee Gen 2 Module

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Testing produced for

KABA®

See Appendix A for full customer & EUT details.

Industry Canada
REGISTRATION #6844B-1

FCC REGISTRATION #382292

ACCREDITED
Testing Laboratory
Certificate #2955.02

Table of Contents

Report Scope

This report addresses the EMC verification testing and test results of Zigbee Gen 2 Module Module Unit, herein referred to as EUT (Equipment Under Test) performed at TUV SUD Canada Labs.

The EUT was tested for compliance against the following standards:

RSS 247 Issue 2:2017 / FCC Part 15 Subpart C 15:2016

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 TUV SUD Canada Inc.

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

Client	Kaba Ilco Inc.
Product	Zigbee Gen 2 Module
Standard(s)	RSS 247 Issue 2/ FCC Part 15 Subpart C

Summary

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

EUT FCC Certification #, FCC ID:	Q8S515123
EUT Industry Canada Certification #, IC:	4562A-515123
EUT Passed all tests performed.	Yes (see test results summary)
Tests conducted by	Scott Drysdale

Client	Kaba Ilco Inc.
Product	Zigbee Gen 2 Module
Standard(s)	RSS 247 Issue 2/ FCC Part 15 Subpart C

Test Results Summary

Standard/Method	Description	Class/Limit	Result
FCC 15.203	Antenna Requirement	Unique	Pass See Justification
FCC 15.205 RSS-GEN	Restricted Bands for intentional operation	N/A	Pass
FCC 15.207 RSS-GEN	Power line conducted emissions	QuasiPeak Average	Pass See justification
FCC 15.209 RSS-247 5.5	Spurious Radiated emissions	QuasiPeak Average	Pass
FCC 15.247(a)2 RSS-247 5.2.1	6 dB Bandwidth	> 500 kHz	Pass
FCC 15.247(b)2 RSS-247 5.4.4	Max output power	< 1 Watt	Pass
FCC 15.247(b)(4) RSS-247 5.4.5	Antenna Gain	< 6 dBi	Pass See Justifications
FCC 15.247(d) RSS-247 5.5	Antenna conducted spurious	< 20 dBc	Pass
FCC 15.247(e) RSS-247 5.2.2	Spectral Density	< 8 dBm (3 kHz BW)	Pass
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 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 descriptions, or deviations from the above listed specifications apply:

The duty cycle of the EUT during measurement was greater than or equal to 98%. Note that this duty cycle is performed in this special mode for test purposes only. The customer's states maximum duty cycle during any 100 msecond operation is 66%.

For the Antenna requirement specified in FCC 15.203 (RSS 247), this device can be configured with the following antenna(s), and the antenna connector type(s), and antenna gain; chip antenna.

This module was tested in a representative host, and is covered under the provisions of limited module approval, where the grantee attests they verify each host the module is to be installed in. Installation is performed by grantee prior to sale.

The representative host used was:
Model name: Quantum RFID
Model number: QP1-11AAOAOLANA

For the Restricted Bands of operation, the EUT is designed to only operate between 2.4 GHz and 2.4835 GHz.

For the power line conducted emissions requirements, the EUT is DC powered, with no provisions for AC power, either direct or indirectly.

For the scope of this test report, radiated testing of the EUT host was pre-scanned in three orthogonal axis to maximize emissions. Additionally the antenna was scanned in each axis.

For maximum permissible exposure, this device operates at less than 1 Watt at 2.4GHz to 2.4835 GHz MHz and is designed to operate greater than 20 cm from personnel during normal operation. No testing is required, however worst case calculated exposure compliance is presented as separate exhibit.

A later revision of the standard may have been substituted in place of the previous dated referenced revision. The year of the specification used are listed under applicable standards. Using the later revision accomplishes the goal of ensuring compliance to the intent of the previous specification, while allowing the laboratory to incorporate the extensions and clarifications made available by a later revision.

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/IEC 17025:2005	- General Requirements for the competence of testing and calibration laboratories
RSS 247:2016	- Issue 2: Spectrum Management and Telecommunications Policy. Radio Standards Specification Low Power Licence-Exempt Radiocommunication 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

000 - 1st release – Nov 27, 2017

001 – Feb 6, 2018 Revisions as per TCB request to include representative host used.

002 – Mar 17, 2018 revisions to representative host module number to match label provided by client.

Definitions and Acronyms

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

AE – Auxiliary 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 TUV SUD Canada labs in Montréal (Laval), 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. Testing was performed under TUV SUD Canada was performed under accreditation by A2LA with a scope of accreditation listed under certificate number 2955.02.

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 6 – Nov 20, 2017	Radiated	SD	20ºC	30-45%	98 -103kPa
Nov 6 – Nov 20, 2017	Antenna Conducted	SD	23ºC	30-55%	98 -103kPa
Nov 6 – Nov 20, 2017	Powerline conducted emissions	SD	23ºC	30-55%	98 -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.

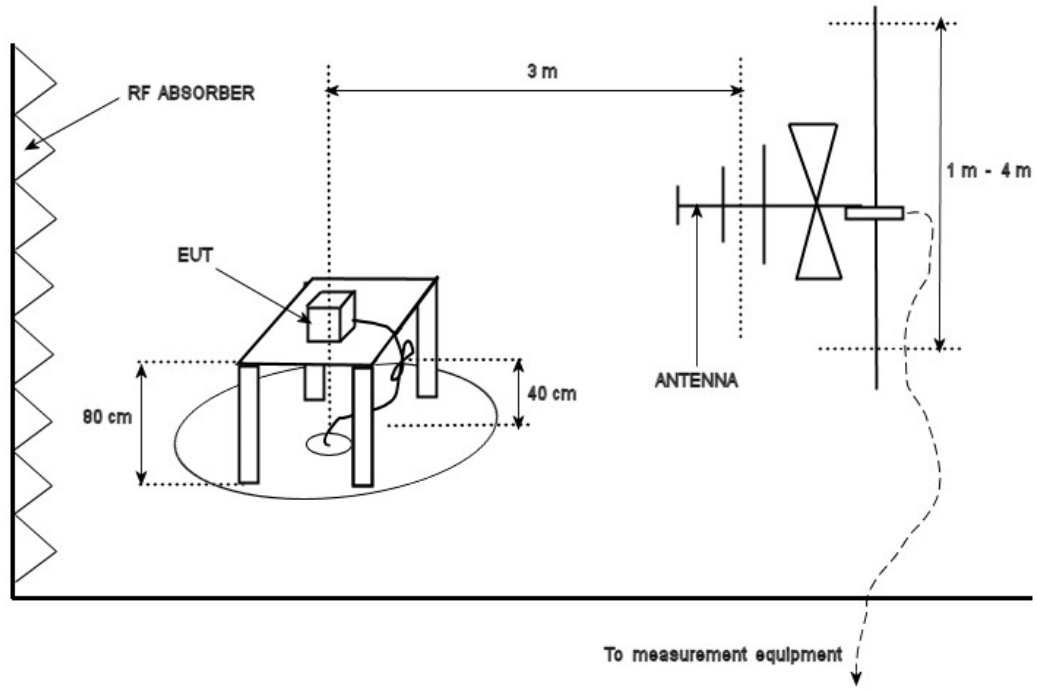
Limit(s) and Method

The method is as defined in ANSI C63.4.
The limits are as defined in FCC Part 15, Section 15.209:

0.009 MHz – 0.490 MHz, 2400/F(kHz) uV/m at 300 m[1]
0.490 MHz – 1.705 MHz, 24000/F(kHz) uV/m at 30 m[1]
1.705 MHz – 30 MHz, 30 uV/m at 30 m[1]
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 Quasi Peak detector with bandwidths as defined in CISPR-16-1-1
[2]Limit is with 1 MHz measurement bandwidth and using an Average detector
[3]Limit is with 1 MHz measurement bandwidth and using a Peak detector

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.

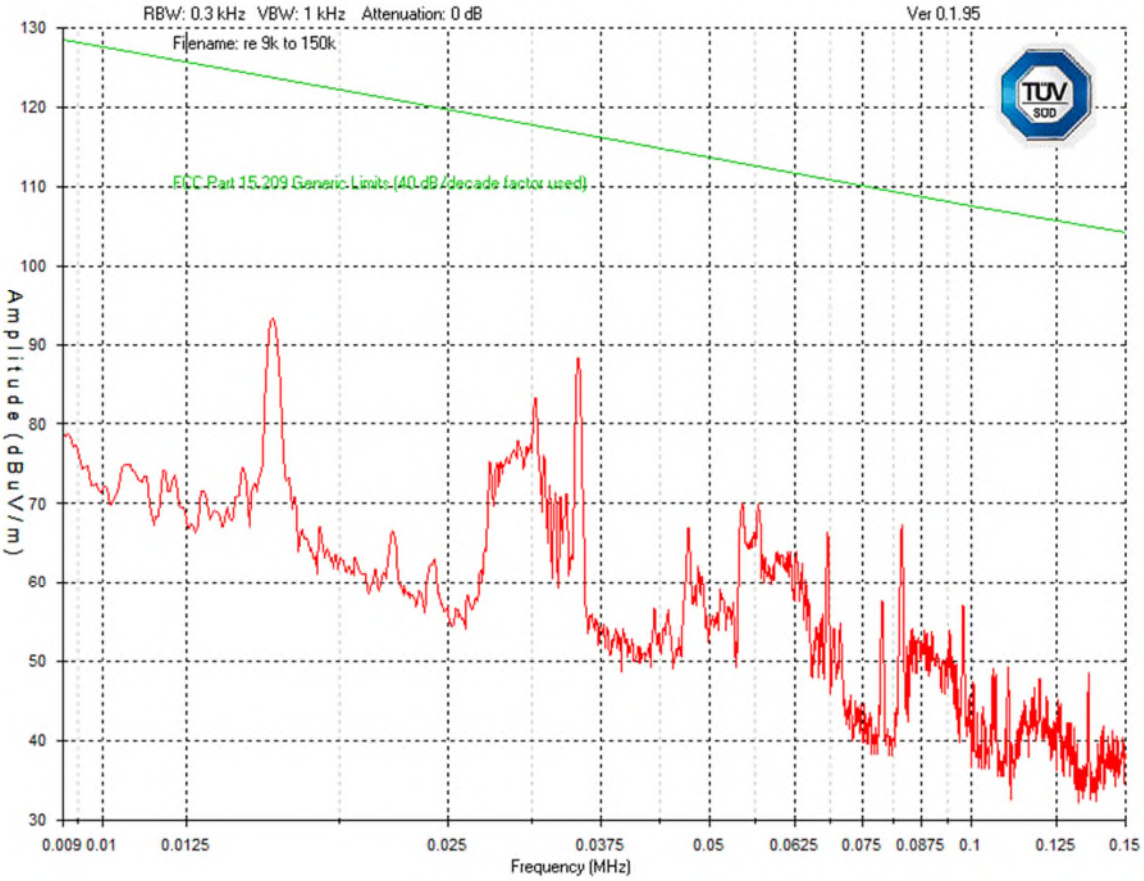
Preliminary Graphs

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 then 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.

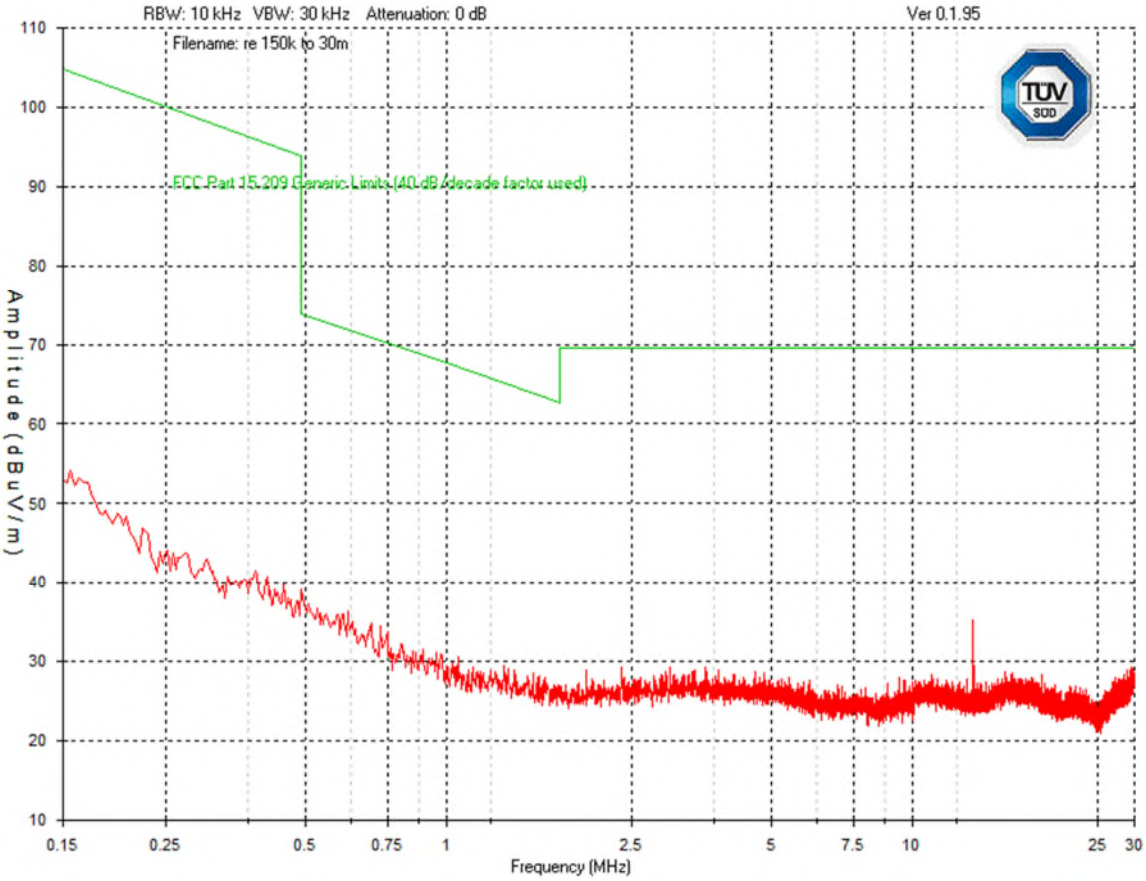
In accordance with FCC Part 15, Subpart A, Section 15.33, the device was scanned to the 10^{th} harmonic (a minimum of a 25 GHz).

Devices scanned may be scanned at alternate test distances, 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. For example for 1 meter measurements, an extrapolation factor 9.5 dB from 20 Log (1m / 3m) is applied.

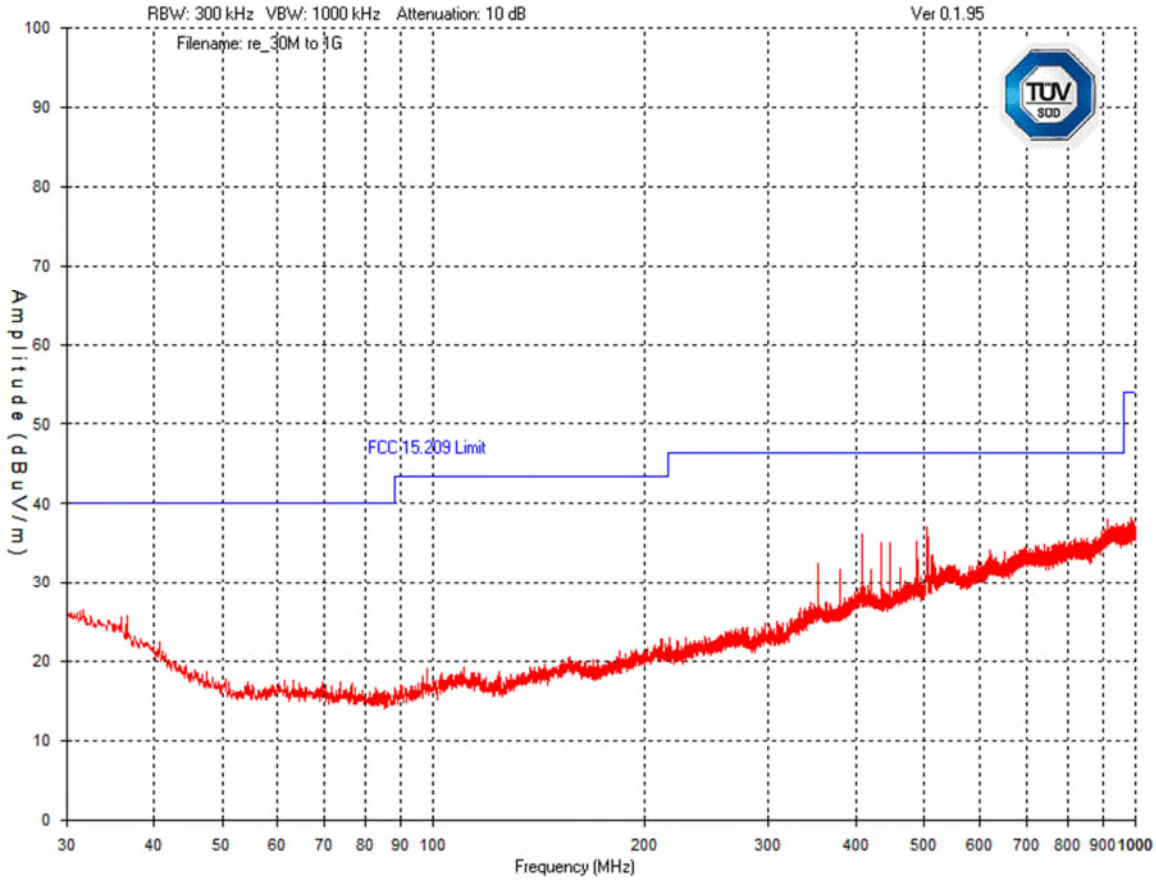
Peak emissions graph - 9 kHz to 150 KHz



Peak emissions graph - 150 kHz to 30 MHz

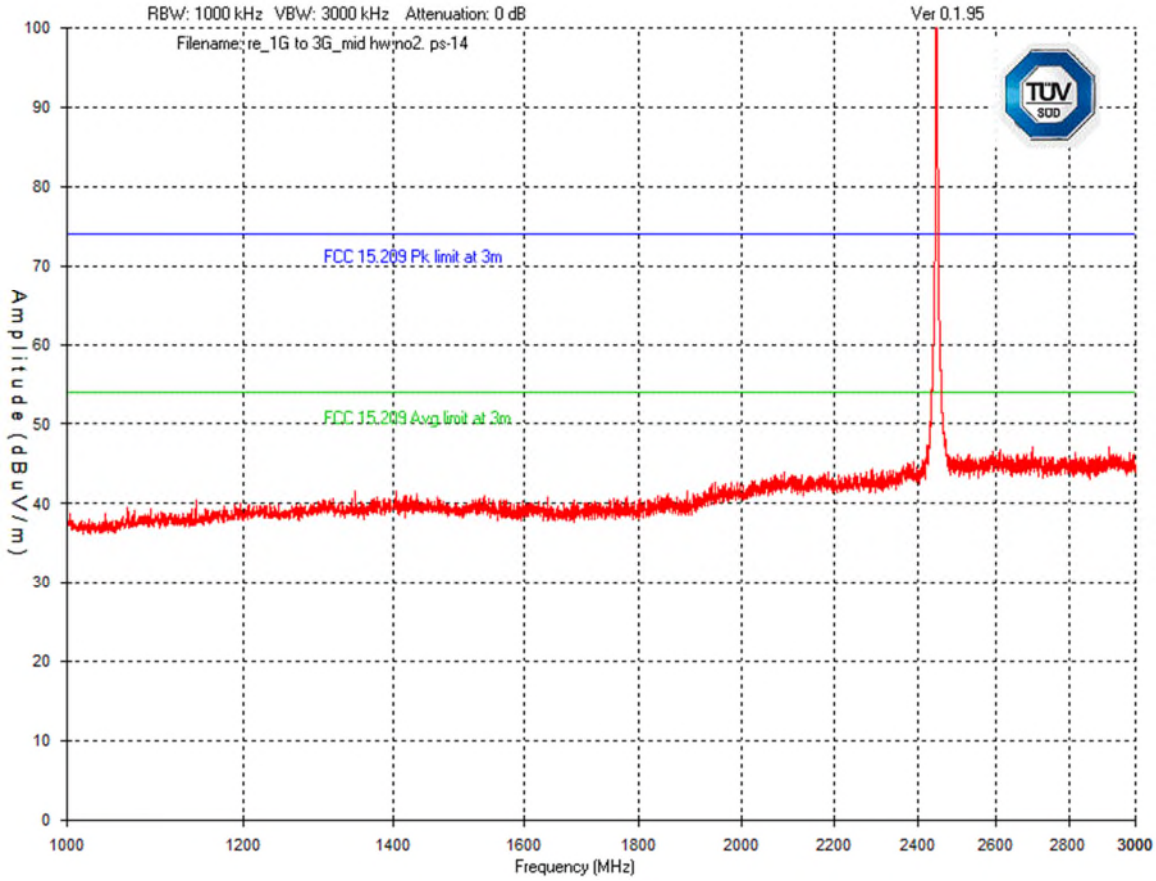


Vertical – Peak Emissions Graph – 30 MHz to 1 GHz

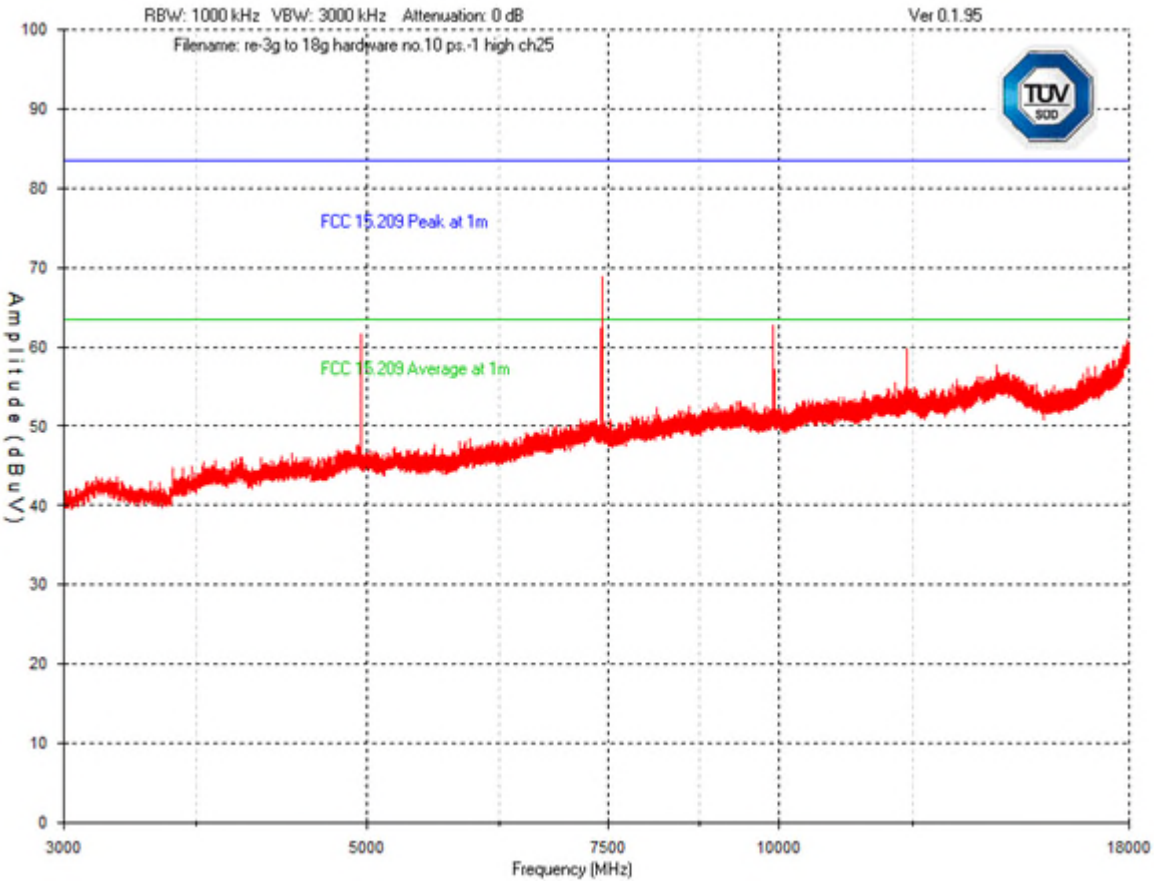


Low, Mid and High scanned, worst case or representative shown above.

Vertical – Peak emissions Graph – Above 1 GHz

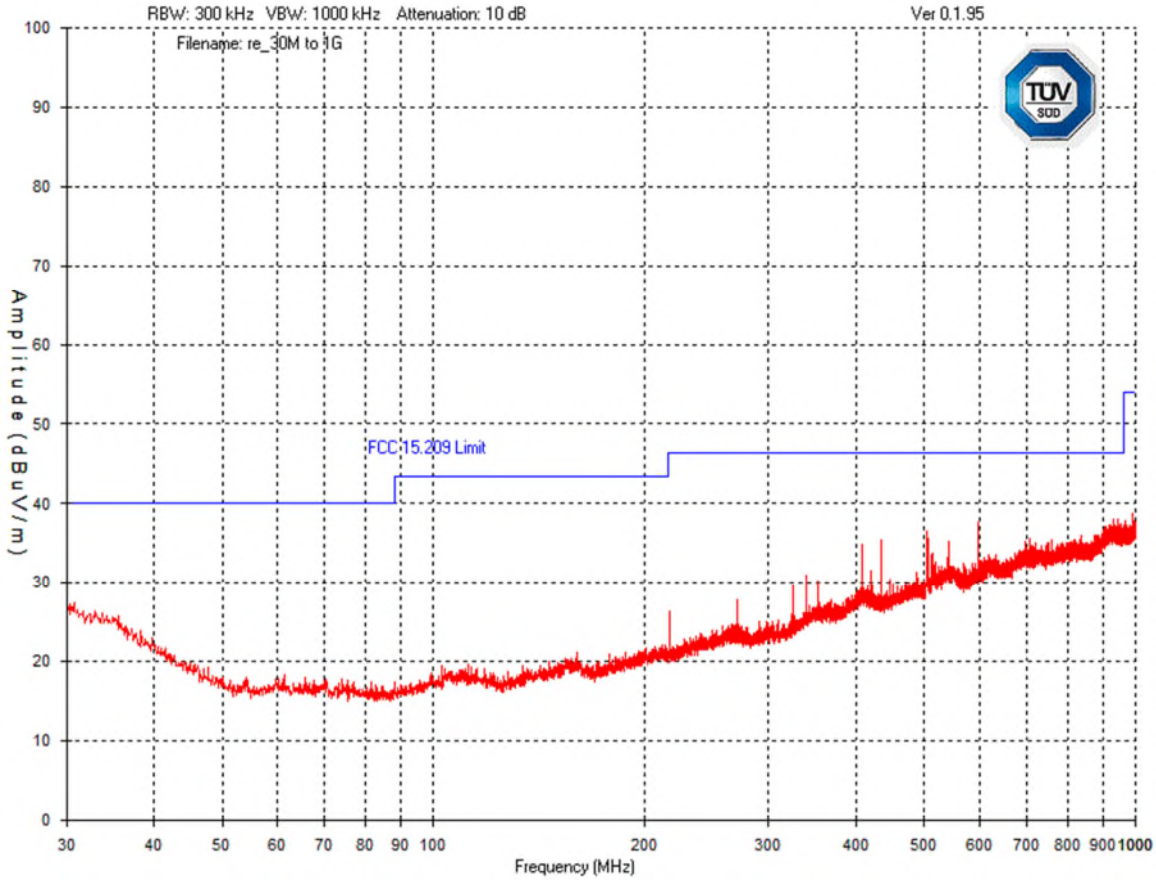


Mid-channel shown as worst case. See table for details.

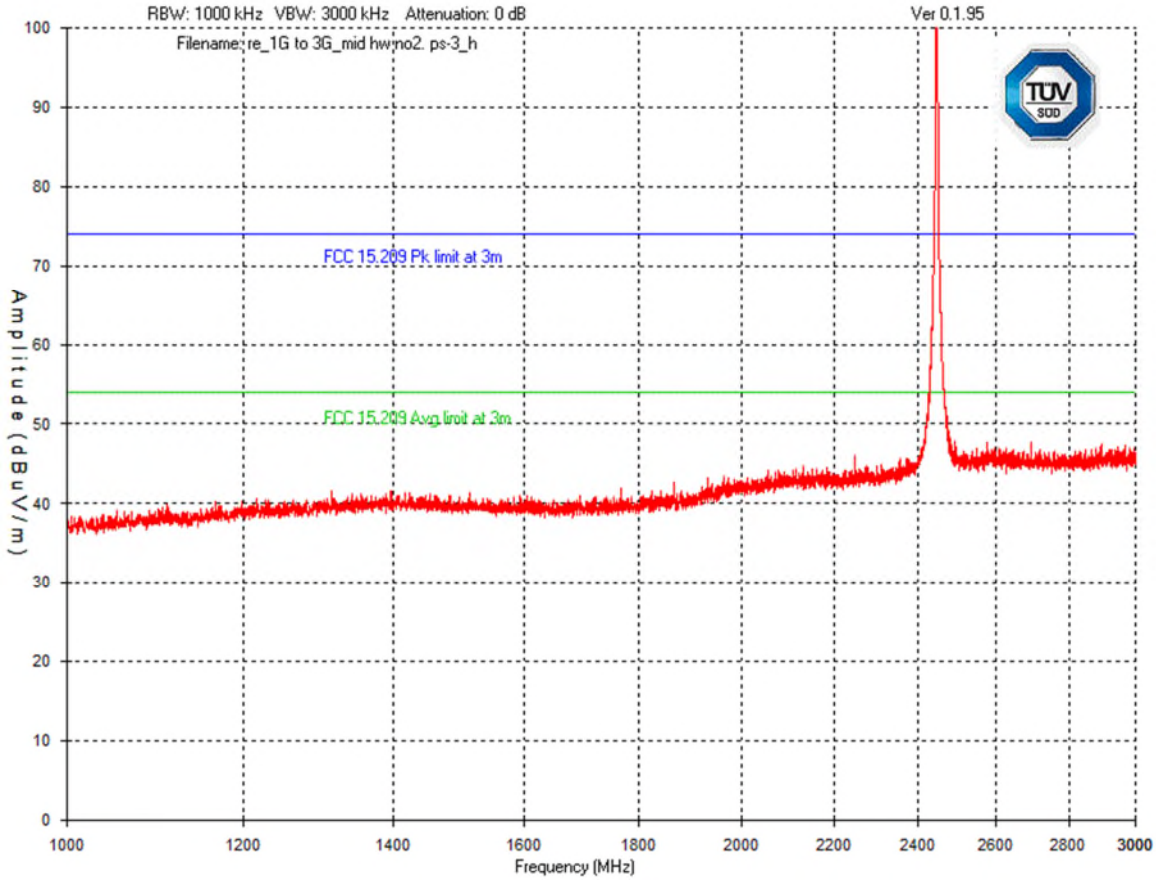


Note: Emissions were scanned to 25 GHz, and no emissions above 18 GHz were detected. The system noise floor was below the applicable limit.

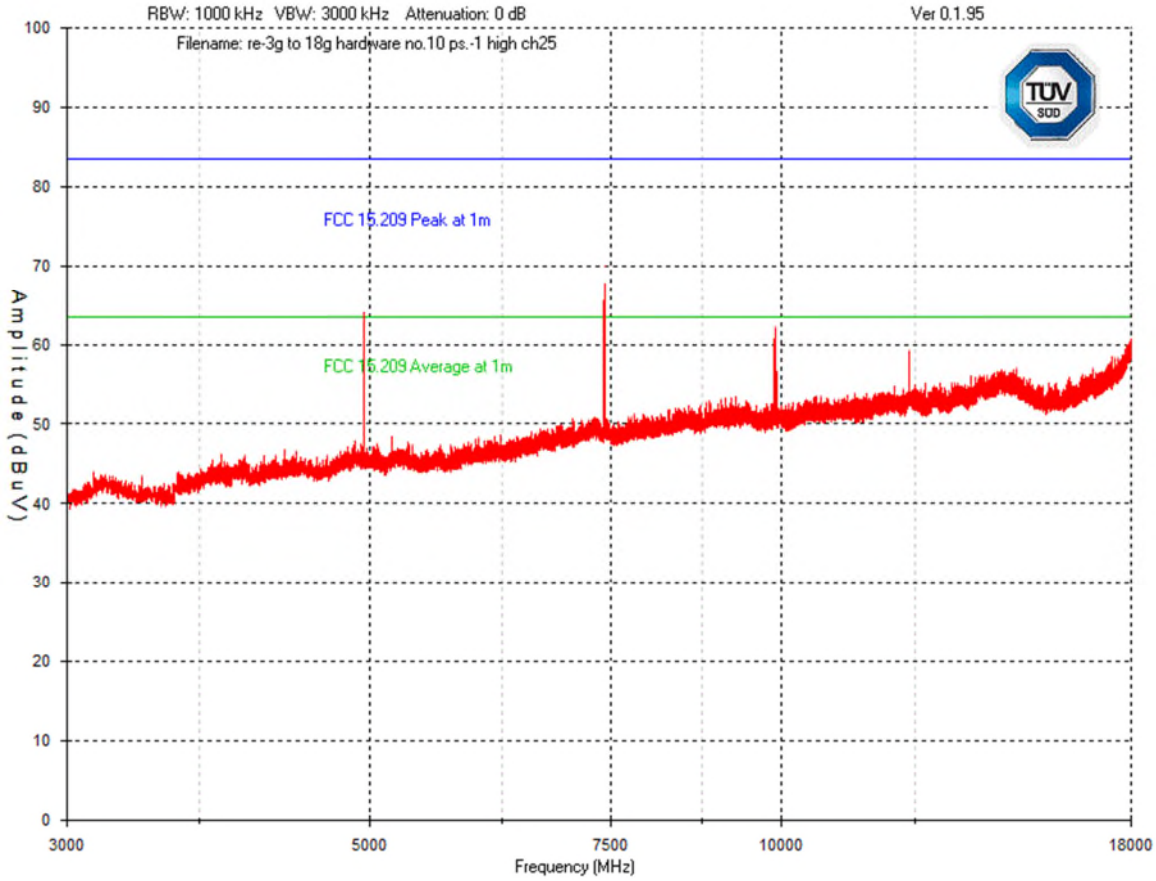
Horizontal – Peak Emissions Graph – 30 MHz to 1 GHz



Horizontal – Peak Emissions Graph – Above 1 GHz



Horizontal – Peak Emissions Graph – Above 1 GHz



Note: Emissions were scanned to 25 GHz, and no emissions were detected above 18- GHz and the system noise floor did not exceed the applicable limit

Final Measurements

Note: In accordance with 15.247(d), only frequencies exceeding the 15.209 limit that occur within the bands listed in 15.205, need to be verified with a final detector.

For information purposes, the fundamental was measured at 3 meters.

Note: Fundamental readings were obtained for informational purposes only.

Test Frequency (MHz)	Detection mode (Q-Peak)	Antenna polarity (Horz/Vert)	Raw signal dB(µV)	Antenna factor dB	Cable loss dB + Preselector	Attenuator dB	Pre-Amp Gain dB	Received signal dB(µV/m)	Emission limit dB(µV/m)	Margin dB(µV)	Result
Low Channel											
2405	Peak	Horz	113.1	30.6	5.2	0.0	33.0	115.9			PASS
2405	PEAK 3	Horz	114.2	30.6	5.2	0.0	33.0	117.0			PASS
2405	Peak	Vert	102.9	30.6	5.2	0.0	33.0	105.7			PASS
2405	PEAK 3	Vert	103.9	30.6	5.2	0.0	33.0	106.7			PASS
2405	Avg	Horz	104.7	30.6	5.2	0.0	33.0	107.5			PASS
2405	Avg	Vert	101.6	30.6	5.2	0.0	33.0	104.4			PASS
2390	Peak	Horz	46.1	30.6	5.2	0.0	33.0	48.9	74.0	25.1	PASS
2390	Avg	Horz	35.1	30.6	5.2	0.0	33.0	37.9	54.0	16.1	PASS
2390	Peak	Vert	45.1	30.6	5.2	0.0	33.0	47.9	74.0	26.1	PASS
2390	Avg	Vert	33.3	30.6	5.2	0.0	33.0	36.1	54.0	17.9	PASS
2400	Peak	Horz	60.9	30.6	5.2	0.0	33.0	63.7	95.9	32.2	PASS
2400	Avg	Horz	50.1	30.6	5.2	0.0	33.0	52.9	87.5	34.6	PASS
2400	Peak	Vert	58.1	30.6	5.2	0.0	33.0	60.9	85.7	24.8	PASS
2400	Avg	Vert	47.1	30.6	5.2	0.0	33.0	49.9	84.4	34.5	PASS
4810	Peak	Horz	53.1	33.7	2.9	0.0	35.7	54.0	74.0	20.0	PASS
4810	Avg	Horz	46.2	33.7	2.9	0.0	35.7	47.1	54.0	6.9	PASS
4810	Peak	Vert	51.9	33.7	2.9	0.0	35.7	52.8	74.0	21.2	PASS
4810	Avg	Vert		33.7	2.9	0.0	35.7	0.9	54.0	53.1	PASS
7215	Peak	Vert	53.0	37.9	4.3	0.0	35.9	59.3	74.0	14.7	PASS
7215	Avg	Vert	43.1	37.9	4.3	0.0	35.9	49.4	54.0	4.6	PASS
7215	Peak	Horz	52.6	37.9	4.3	0.0	35.9	58.9	74.0	15.1	PASS
7215	Avg	Horz	43.4	37.9	4.3	0.0	35.9	49.7	54.0	4.3	PASS
9620	Peak	Horz	41.9	39.2	5.8	0.0	35.9	51.0	74.0	23.0	PASS
9620	Avg	Horz		39.2	5.8	0.0	35.9	9.1	74.0	64.9	PASS
9620	Peak	Vert	43.9	39.2	5.8	0.0	35.9	53.0	74.0	21.0	PASS
9620	Avg	Vert		39.2	5.8	0.0	35.9	9.1	54.0	44.9	PASS
Mid channel											
2440	Peak	Horz	112.5	30.6	5.2	0.0	33.0	115.3			PASS
2440	Avg	Horz	103.1	30.6	5.2	0.0	33.0	105.9			PASS
2440	Peak	Vert	102.5	30.6	5.2	0.0	33.0	105.3			PASS
2440	Avg	Vert	93.1	30.6	5.2	0.0	33.0	95.9			PASS
4880	Peak	Horz	53.2	33.7	2.9	0.0	35.7	54.1	74.0	19.9	PASS
4880	Avg	Horz	46.4	33.7	2.9	0.0	35.7	47.3	54.0	6.7	PASS
4880	Peak	Vert	52.1	33.7	2.9	0.0	35.7	53.0	74.0	21.0	PASS

4880	Avg	Vert		33.7	2.9	0.0	35.7	0.9	54.0	53.1	PASS
7320	Peak	Vert	53.2	37.9	4.3	0.0	35.9	59.5	74.0	14.5	PASS
7320	Avg	Vert	43.2	37.9	4.3	0.0	35.9	49.5	54.0	4.5	PASS
7320	Peak	Horz	52.9	37.9	4.3	0.0	35.9	59.2	74.0	14.8	PASS
7320	Avg	Horz	43.6	37.9	4.3	0.0	35.9	49.9	54.0	4.1	PASS
9760	Peak	Horz	42.2	39.2	5.8	0.0	35.9	51.3	74.0	22.7	PASS
9760	Avg	Horz		39.2	5.8	0.0	35.9	9.1	74.0	64.9	PASS
9760	Peak	Vert	43.2	39.2	5.8	0.0	35.9	52.3	74.0	21.7	PASS
9760	Avg	Vert		39.2	5.8	0.0	35.9	9.1	54.0	44.9	PASS
High channel 25											
2475	Peak	Horz	112.8	30.6	5.2	0.0	33.0	115.6			PASS
2475	Peak3	Horz	113.9	30.6	5.2	0.0	33.0	116.7			PASS
2475	Avg	Horz	103.3	30.6	5.2	0.0	33.0	106.1			PASS
2475	Peak	Vert	102.4	30.6	5.2	0.0	33.0	105.2			PASS
2475	Peak3	Vert	103.4	30.6	5.2	0.0	33.0	106.2			PASS
2475	Avg	Vert	93.5	30.6	5.2	0.0	33.0	96.3			PASS
2483.5	Peak	Horz	64.7	30.6	5.2	0.0	33.0	67.5	74.0	6.5	PASS
2483.5	Avg	Horz	48.7	30.6	5.2	0.0	33.0	51.5	54.0	2.5	PASS
2483.5	Peak	Vert	54.7	30.6	5.2	0.0	33.0	57.5	74.0	16.5	PASS
2483.5	Avg	Vert	38.8	30.6	5.2	0.0	33.0	41.6	54.0	12.4	PASS
4950	Peak	Horz	53.3	33.7	2.9	0.0	35.7	54.2	74.0	19.8	PASS
4950	Avg	Horz	45.9	33.7	2.9	0.0	35.7	46.8	54.0	7.2	PASS
4950	Peak	Vert	52.1	33.7	2.9	0.0	35.7	53.0	74.0	21.0	PASS
4950	Avg	Vert		33.7	2.9	0.0	35.7	0.9	54.0	53.1	PASS
7425	Peak	Vert	53.2	37.9	4.3	0.0	35.9	59.5	74.0	14.5	PASS
7425	Avg	Vert	43.2	37.9	4.3	0.0	35.9	49.5	54.0	4.5	PASS
7425	Peak	Horz		37.9	4.3	0.0	35.9	6.3	74.0	67.7	PASS
7425	Avg	Horz		37.9	4.3	0.0	35.9	6.3	54.0	47.7	PASS
9900	Peak	Horz	42.2	39.2	5.8	0.0	35.9	51.3	74.0	22.7	PASS
9900	Avg	Horz		39.2	5.8	0.0	35.9	9.1	74.0	64.9	PASS
9900	Peak	Vert	43.2	39.2	5.8	0.0	35.9	52.3	74.0	21.7	PASS
9900	Avg	Vert		39.2	5.8	0.0	35.9	9.1	54.0	44.9	PASS

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration / Verification date	Next calibration/ Verification due date	Asset #
Spectrum Analyzer	ESU-40	R&S	2017-04-20	2019-04-20	4092
Loop Antenna	EM 6879	Electro-Metrics	4-19-17	4-19-19	4040
BiLog Antenna	3142-E	ETS	11-16-16	11-16-18	4002
Attenuator 10 dB	4779-10	Agilent	2-11-16	2-11-18	4096
RF bay	LNA 1450	RF Bay	7-22-17	7-22-19	4089
Horn Antenna	ATH1G18G	AR	4-25-17	4-25-19	4003
1-26G pre-amp	HP 8449B	HP	7-22-16	7-22-18	4006
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	N/A	N/A	4026
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	N/A	N/A	4039
RF Cable 0.5M	LMR-400-0.5M-50OHM-MN-MN	LexTec	N/A	N/A	4029

6dB Bandwidth of Digitally Modulated Systems

Purpose

The purpose of this test is to ensure that the bandwidth occupied exceeds a stated minimum. This helps ensure the utilization of the frequency allocation is sufficiently wide. This also helps prevent corruption of data by ensuring adequate data separation to distinguish the reception of the intended information.

Limits

The Limit is as specified in FCC Part 15 and RSS 247.

Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Method

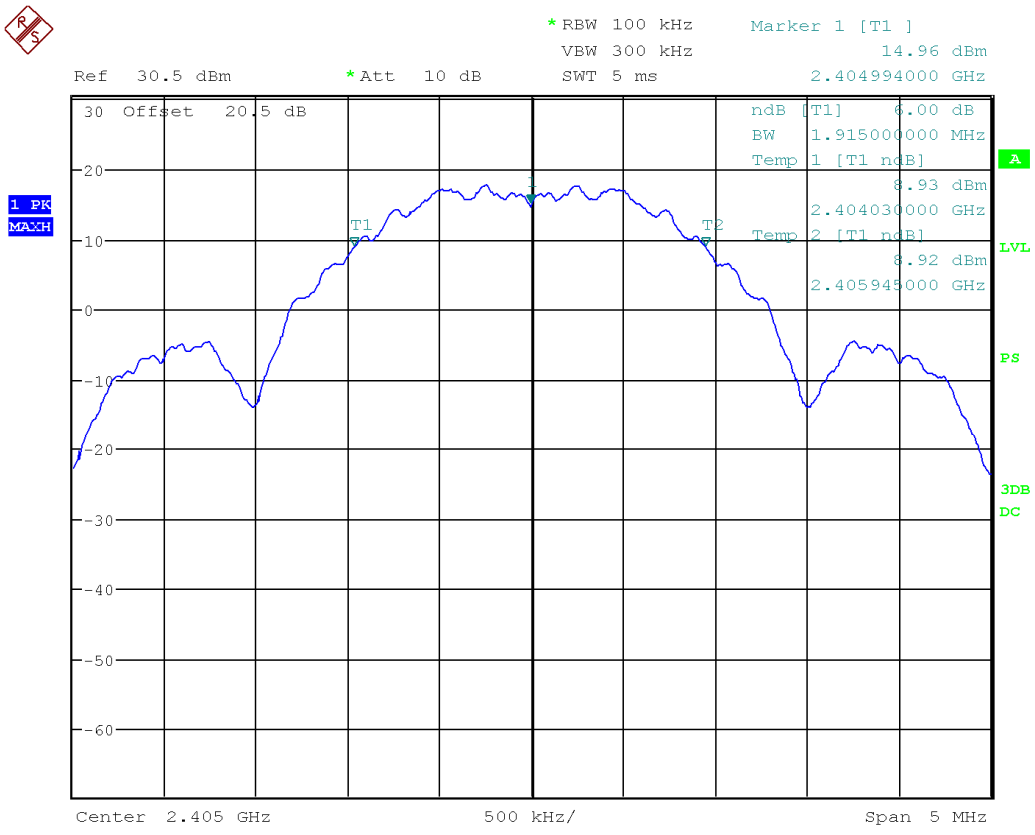
The DTS bandwidth method is as per FCC KDB 558074 Section 8.1 for the 6 dB BW. For the 20 dB BW, FCC KDB 558074, Section 2.0 references ANSI C63.10 for occupied bandwidth. ANSI C63.10 Section 6.9.1 was used for occupied bandwidth.

Results

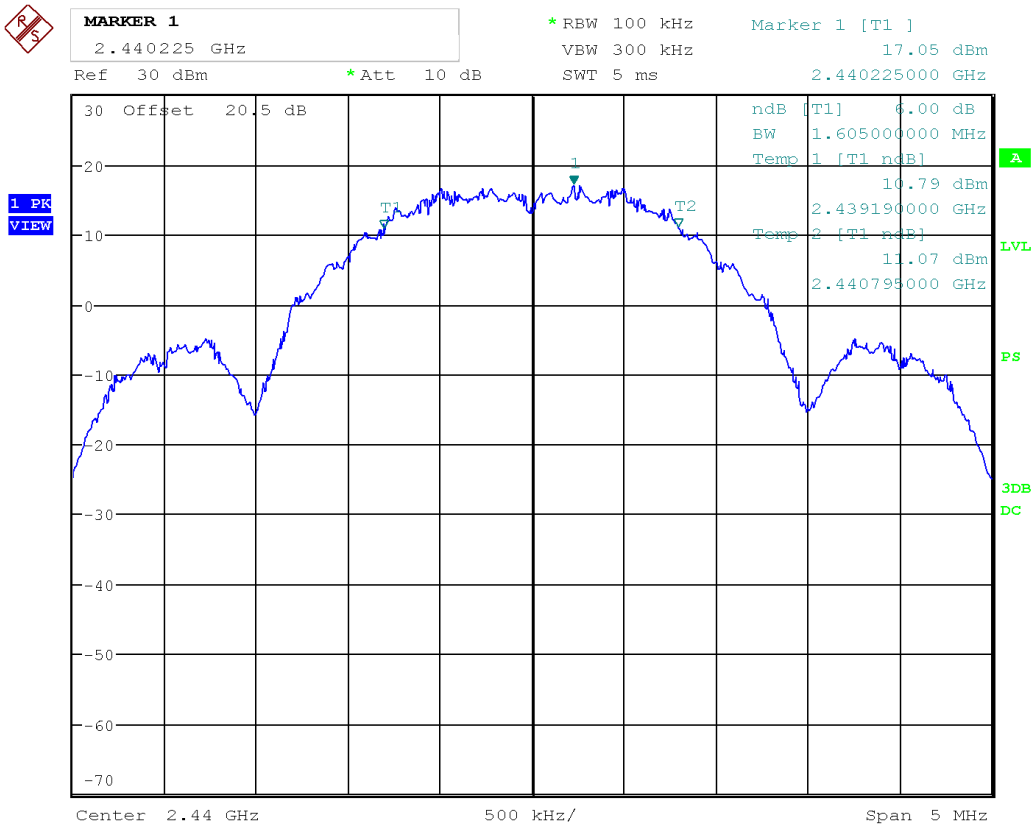
The EUT passed. The minimum 6 dB BW measured was 1.585 MHz. For information purposes, the 99% occupied BW was measured to be 2.435 MHz

Graph(s)

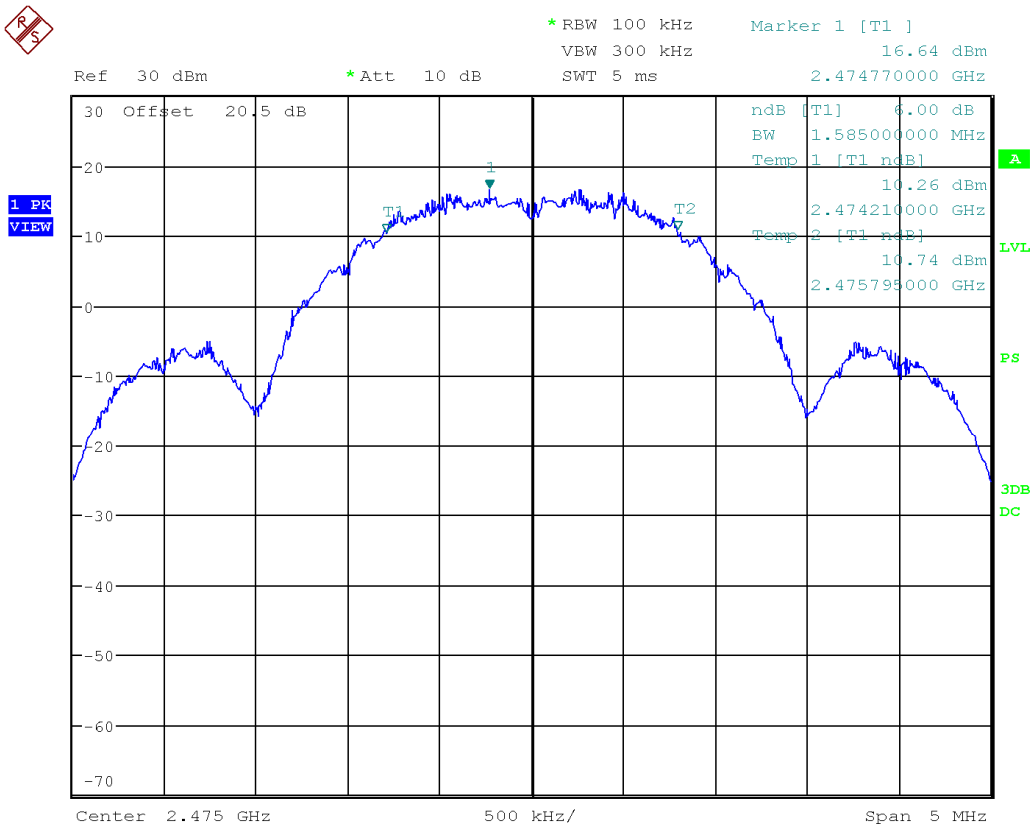
The graphs shown below shows the channel spacing during the operation of the device. This is measured by a max hold on the spectrum analyzer and the highest resolution bandwidth that is sufficiently low to exhibit the 6 dB bandwidth of a channel during operation of the EUT. This measurement is a peak measurement. Max hold is performed for a duration of not less than 1 minute.



1.915 MHz

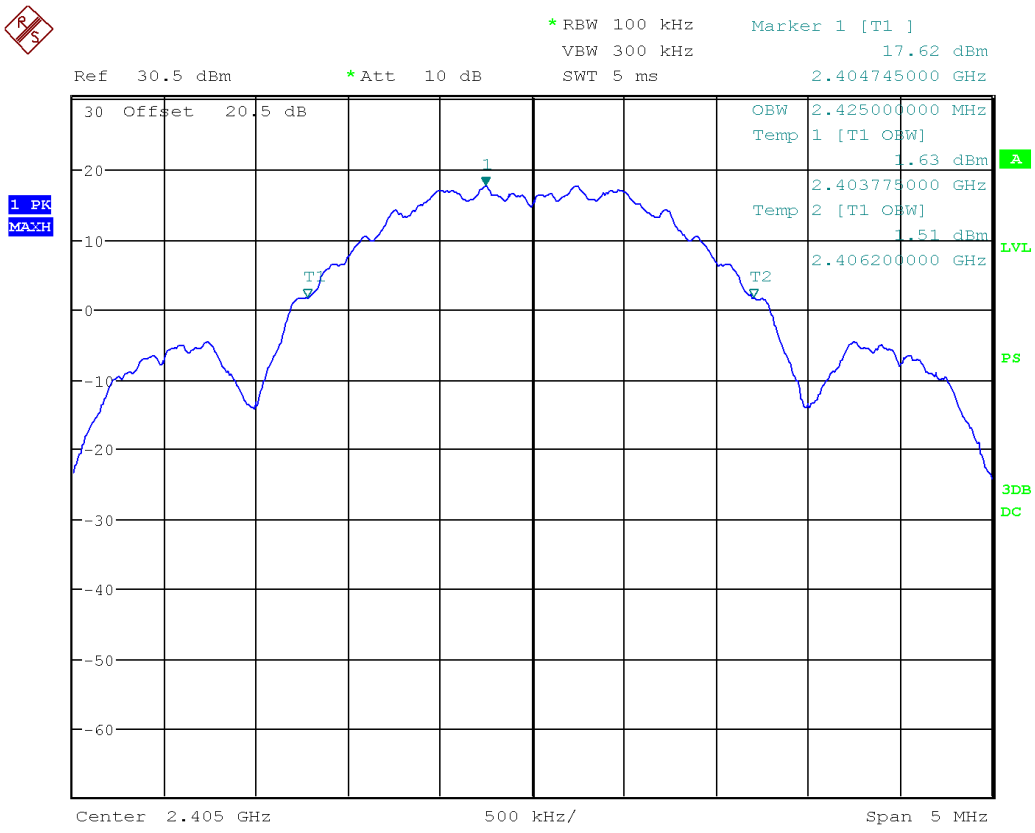


1.605 MHz

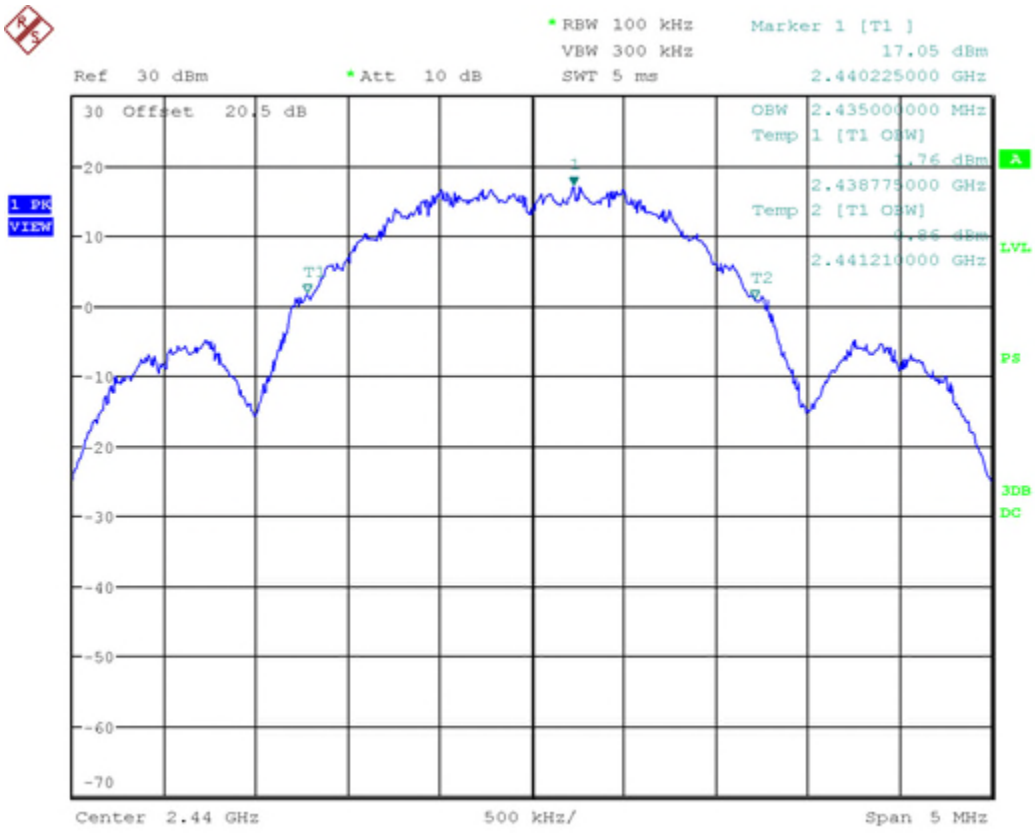


1.585 MHz

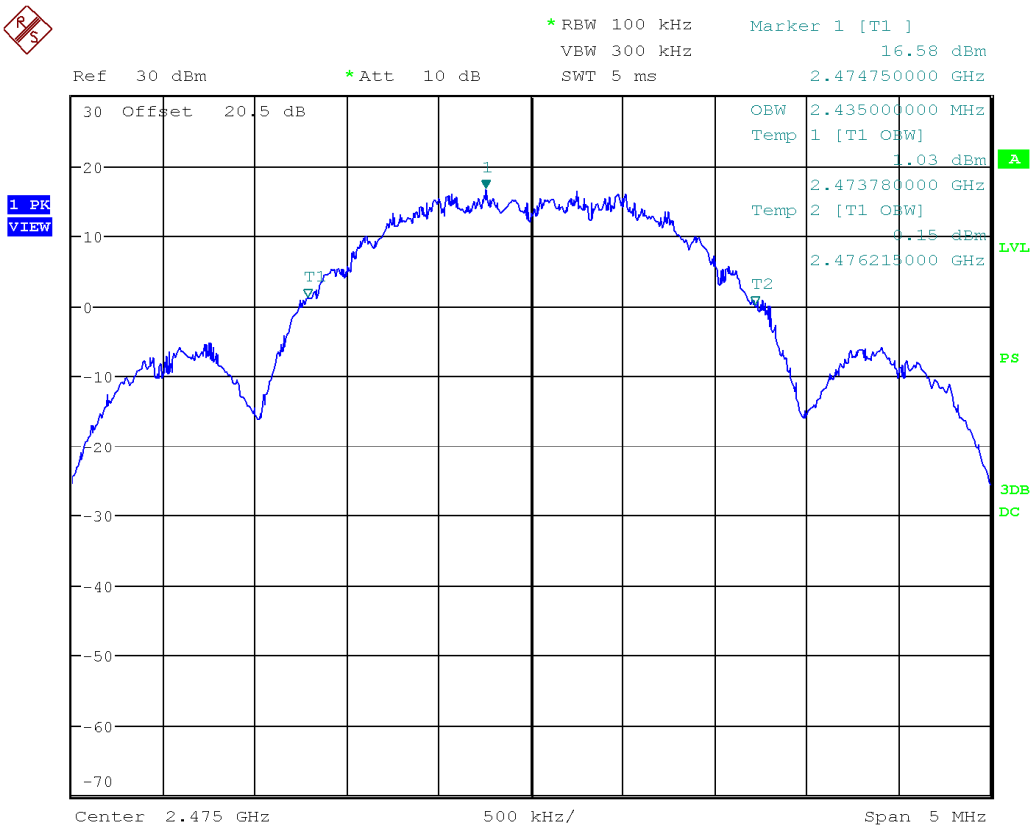
6 dB BW Low = 1.9 MHz
6 dB BW Mid = 1.605 MHz
6 dB BW High = 1.585 MHz



2.425 MHz



2.435 MHz



2.435 MHz

Occupied bw low = 2.425 MHz
Occupied bw mid = 2.435 MHz
Occupued bw high = 2.435 MHz

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	1-28-16	1-28-18	4038
Spectrum Analyzer	ESU-40	R&S	2017-04-20	2019-04-20	4092
RF Cable 0.5M	LMR-400-0.5M-50OHM-MN-MN	LexTec	1-28-16	1-28-18	4029

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

Maximum conducted output 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. This ensures that if the end-user replaces the antenna, that the maximum power does not exceed an amount which may create an excessive power level.

Limits

The limits are defined in FCC Part 15.247(b) and RSS 247.
For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands, the peak limit is 1 watt.

Method

Method was as per ANSI C63.10.

Results

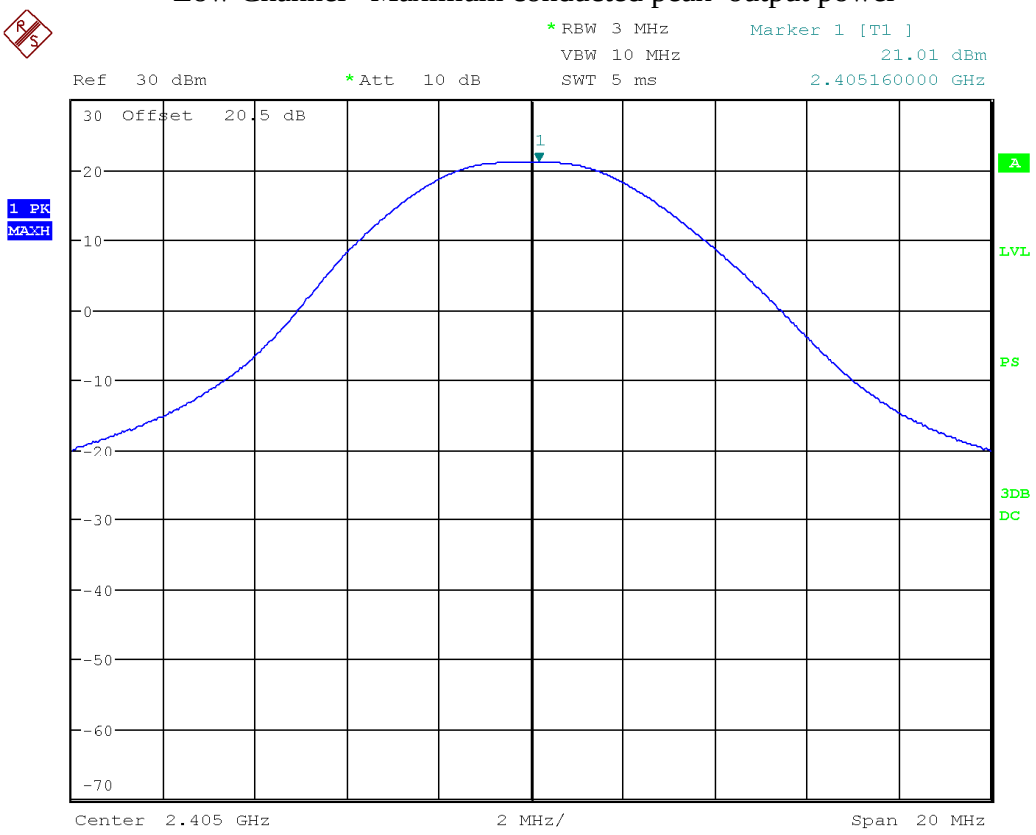
The EUT passed. The maximum conducted (peak) output power measured was 21.0 dBm

Table(s)

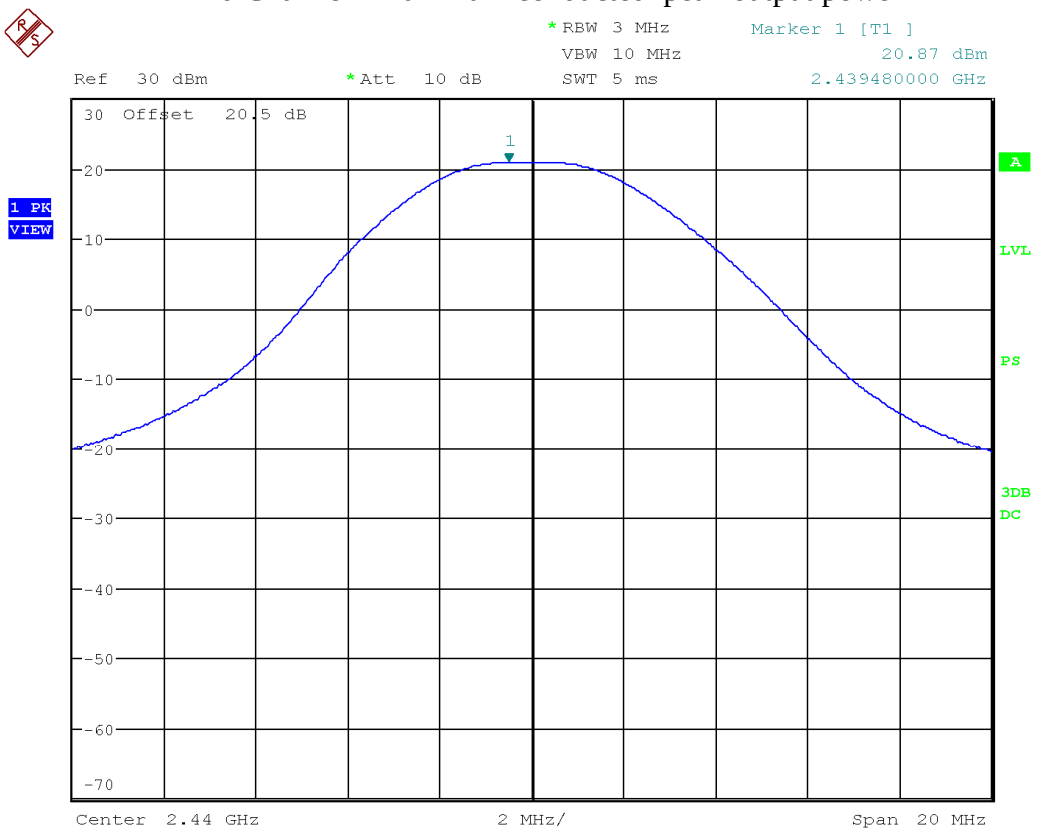
The tables shown below shows the Maximum conducted (peak) output power output of the device during the antenna conducted measurement during transmit operation of the EUT.

Band	Frequency (GHz)	Raw Peak Reading (dBm)	Atten.+Cable Factor(dB)	Maximum conducted (peak) output power (dBm)
Low	2.405	0.5	20.5	21.0
Medium	2.440	0.4	20.5	20.9
High	2.475	-0.2	20.5	20.3

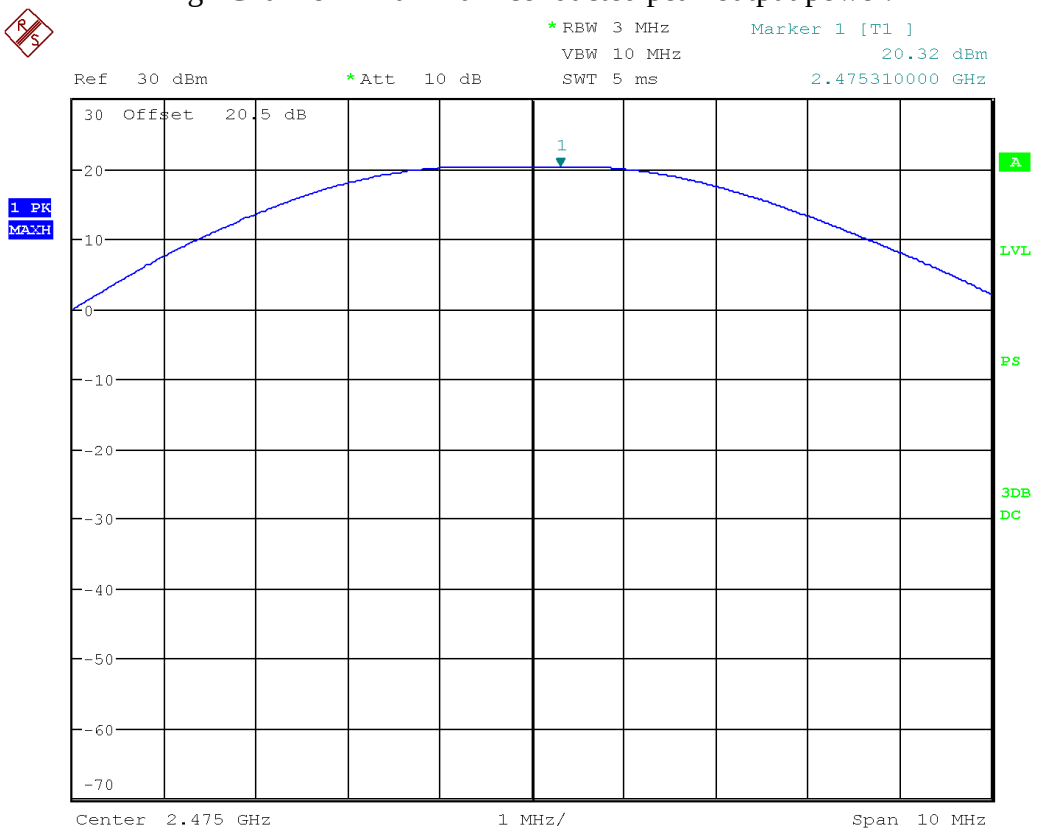
Low Channel– Maximum conducted peak output power



Mid Channel– Maximum conducted peak output power



High Channel – Maximum conducted peak output power.



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 30 dB	FP-50-30	Trilithic	1-28-16	1-28-18	4041
Spectrum Analyzer	ESU-40	R&S	2017-04-20	2019-04-20	4092
RF Cable 0.5m	LMR-400-0.5M-50OHM-MN-MN	LexTec	1-28-16	1-28-18	4029

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

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 15.247(d). As peak power was used, in any 100 kHz band, the peak spurious harmonics emissions must be at least 20 dB below the fundamental. Spurious Conducted emissions are to be evaluated up to the 10^{th} harmonic. This -20 dBc requirement also applies at the 'band edge' or 2.4 GHz and 2.4835 GHz.

Method

Method was as per Ansi C 63.4.

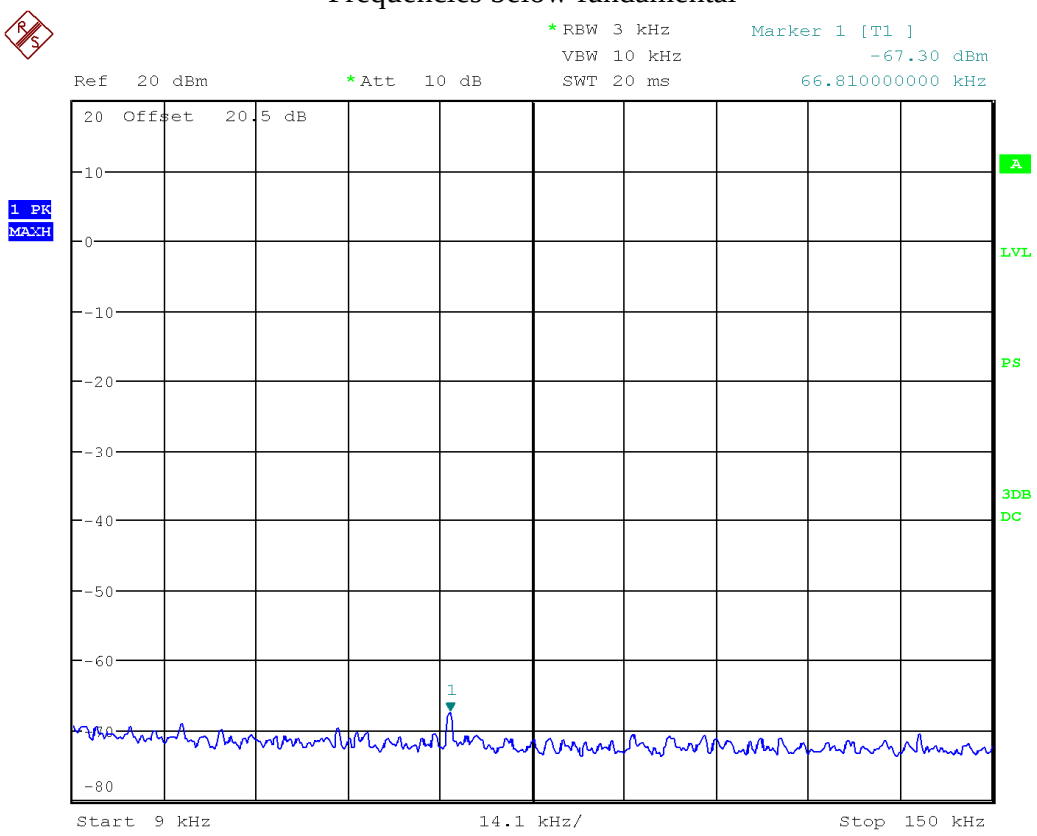
Results

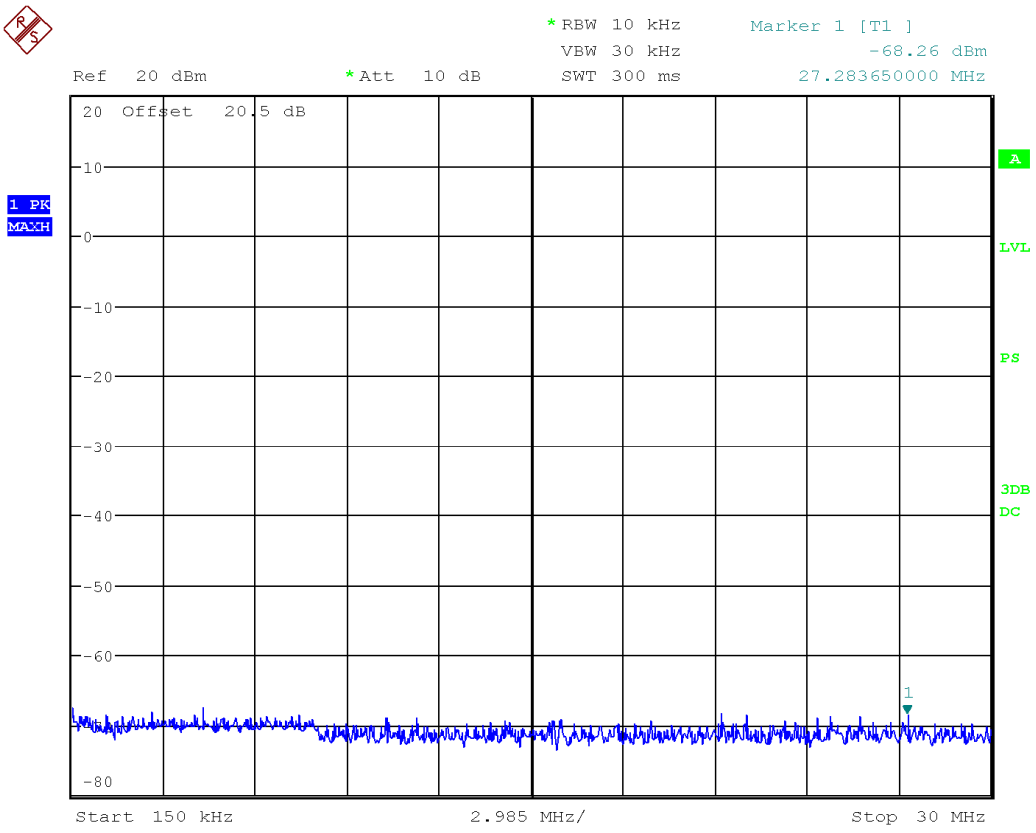
The EUT pass. Low, middle and high band was measured. The worst case for each mode is presented as a graph for the spectrum. The -20 dBc requirement is shown for the lower band edge at 2.4 GHz in the low band. The -20 dBc requirement is also shown for the higher band edge at 2.4835 GHz in the high band.

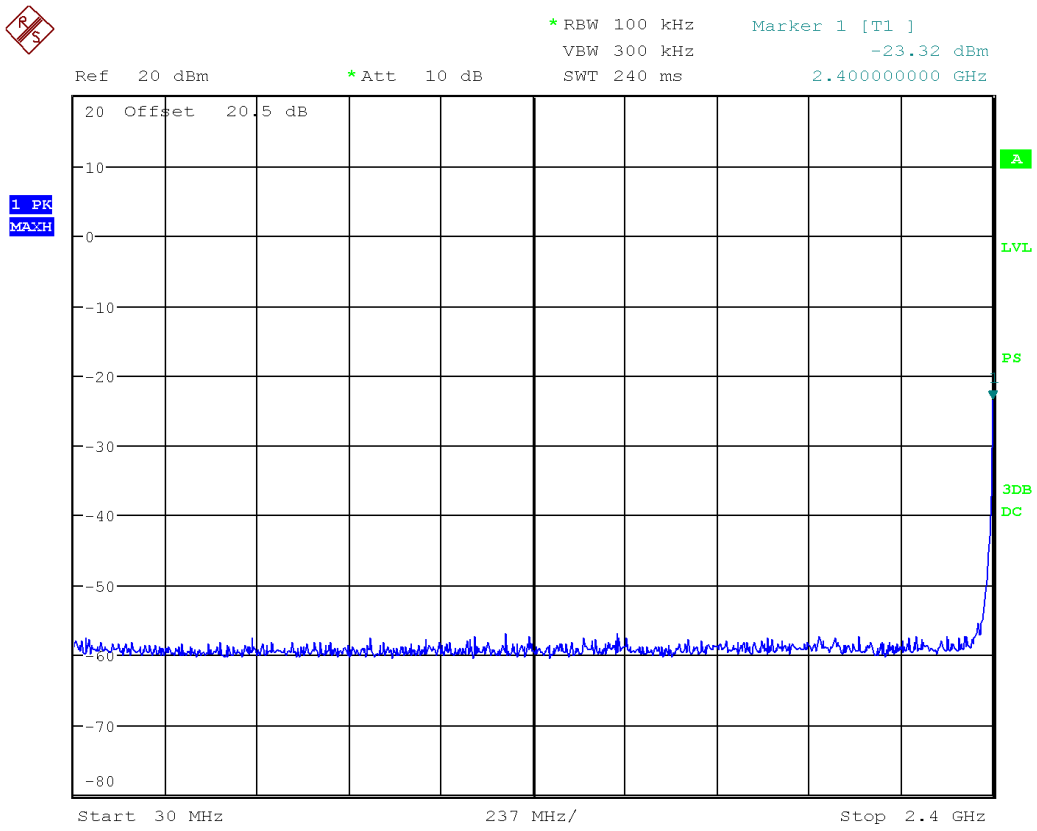
Graph(s)

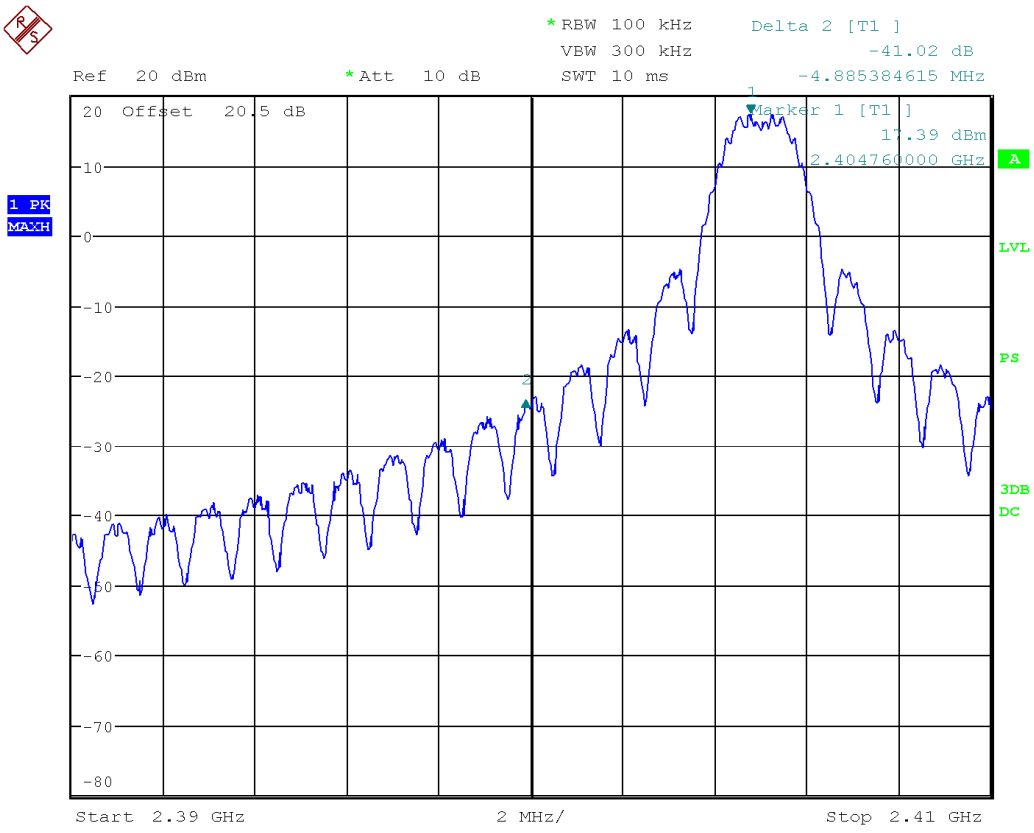
The graphs shown below shows the peak power output of the device during the antenna conducted measurement during transmit operation of the EUT. Note there was 20 dB of external attenuation taken during this measurement.

Frequencies below fundamental

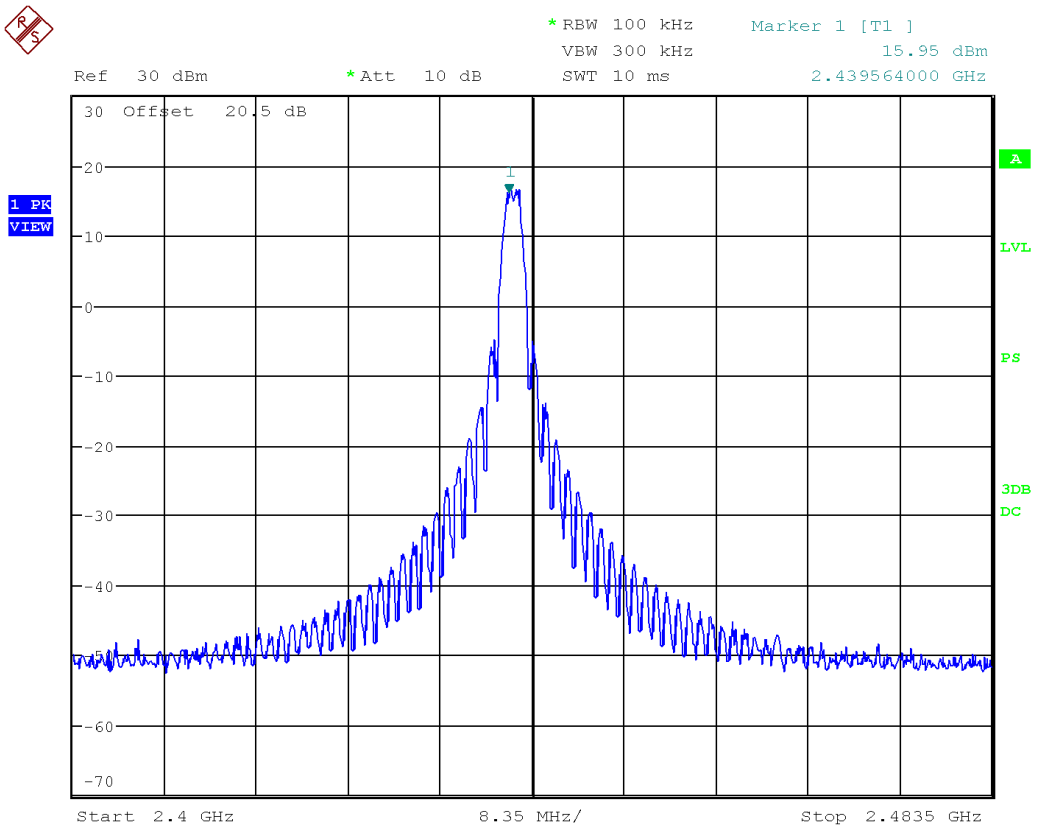




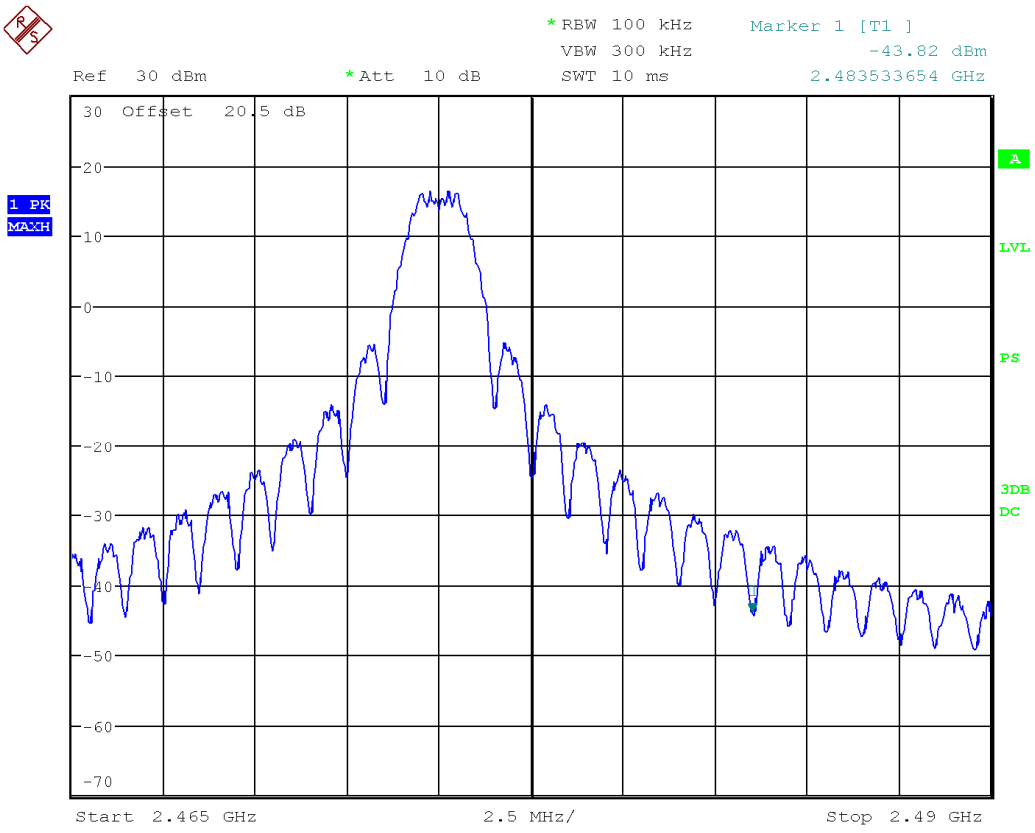




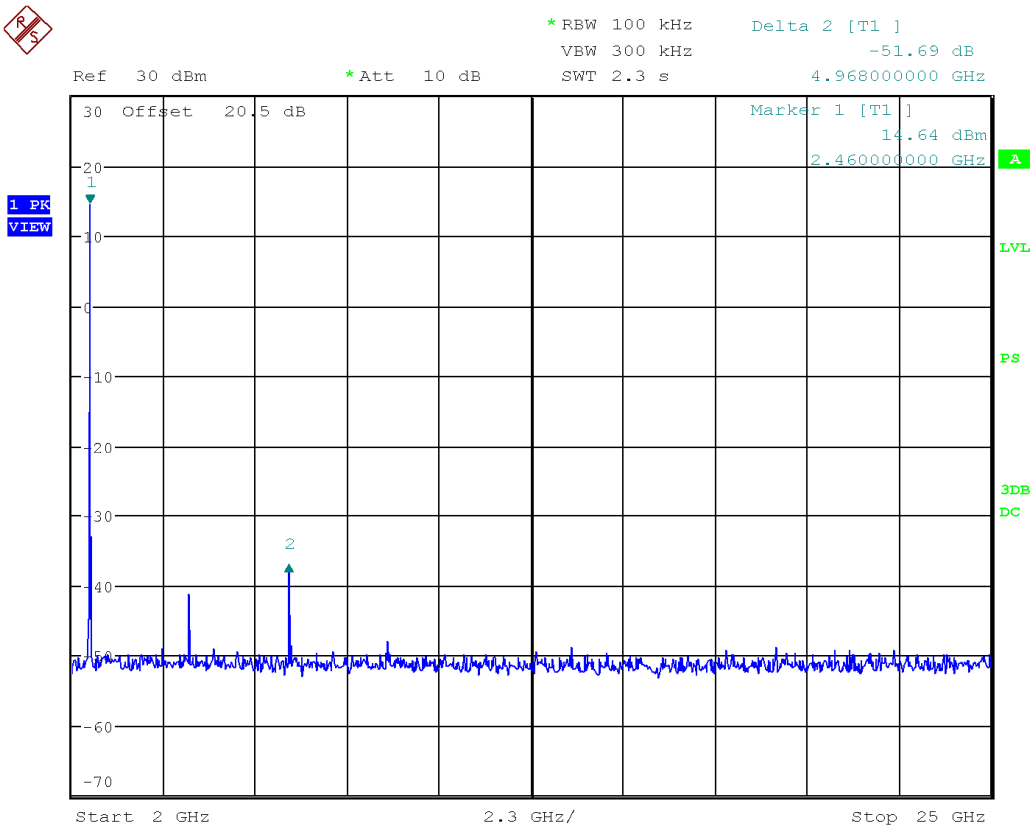
Worst case shown with low channel setting.



Mid channel shown above



Worst case high channel shown above.



Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	ESU-40	R&S	2017-04-20	2019-04-20	4092
RF Cable 0.5m	LMR-400-0.5M-50OHM-MN-MN	LexTec	1-28-16	1-28-18	4029

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 15.247(e).

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Method

Method was as per ANSI C63.10

Results

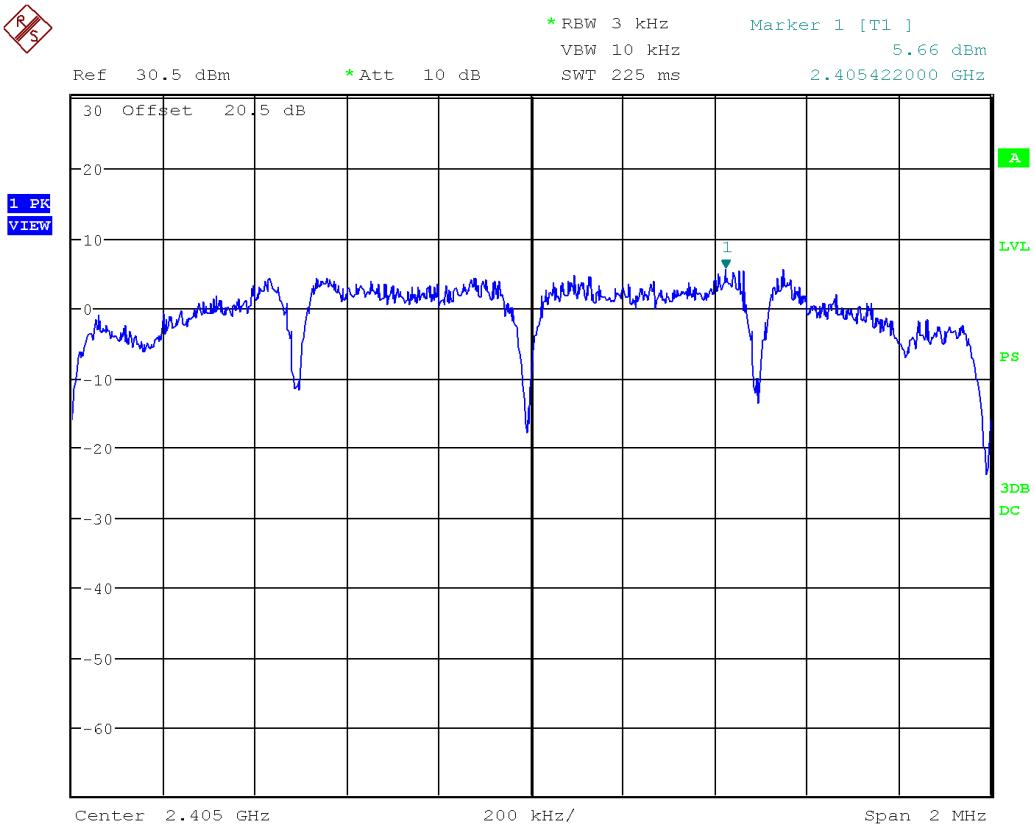
The EUT passed. Each mode was tested at low, medium, and high band. The worst case value is 5.7 dBm as measured with a 3 kHz resolution bandwidth (maximum peak conducted PSD power).

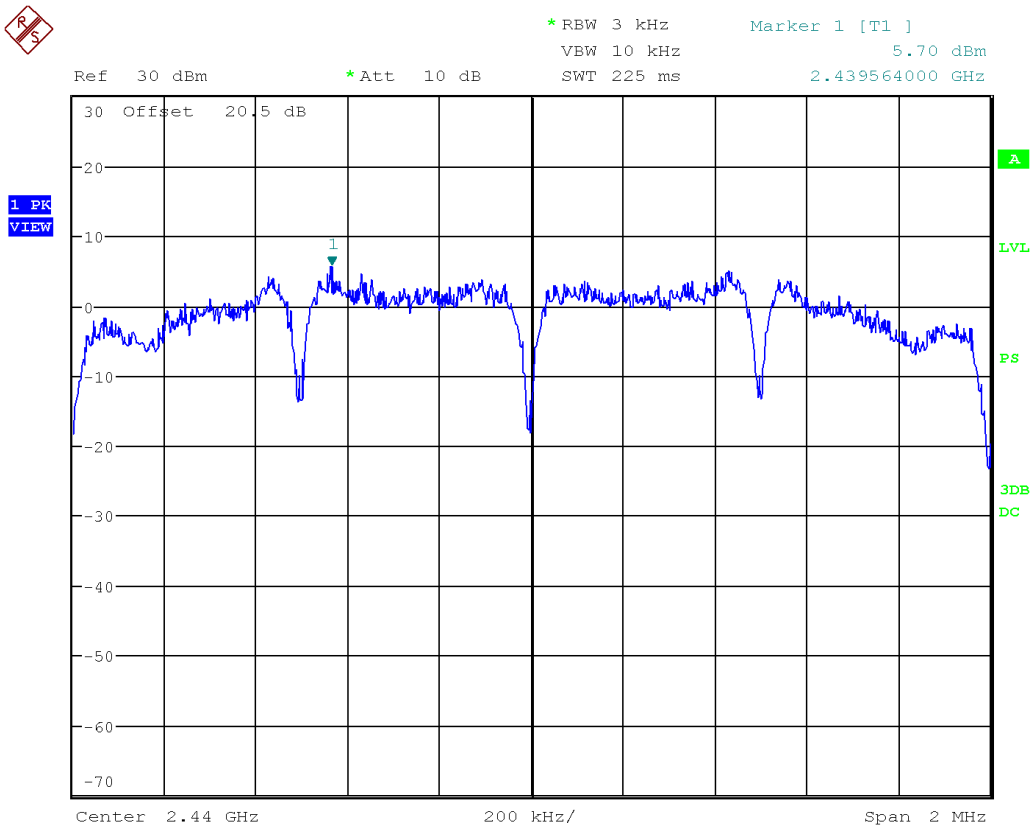
Band	Frequency (GHz)	PSD
Low	2.405	5.7
Medium	2.44	5.7
High	2.475	5.2

Graph(s)

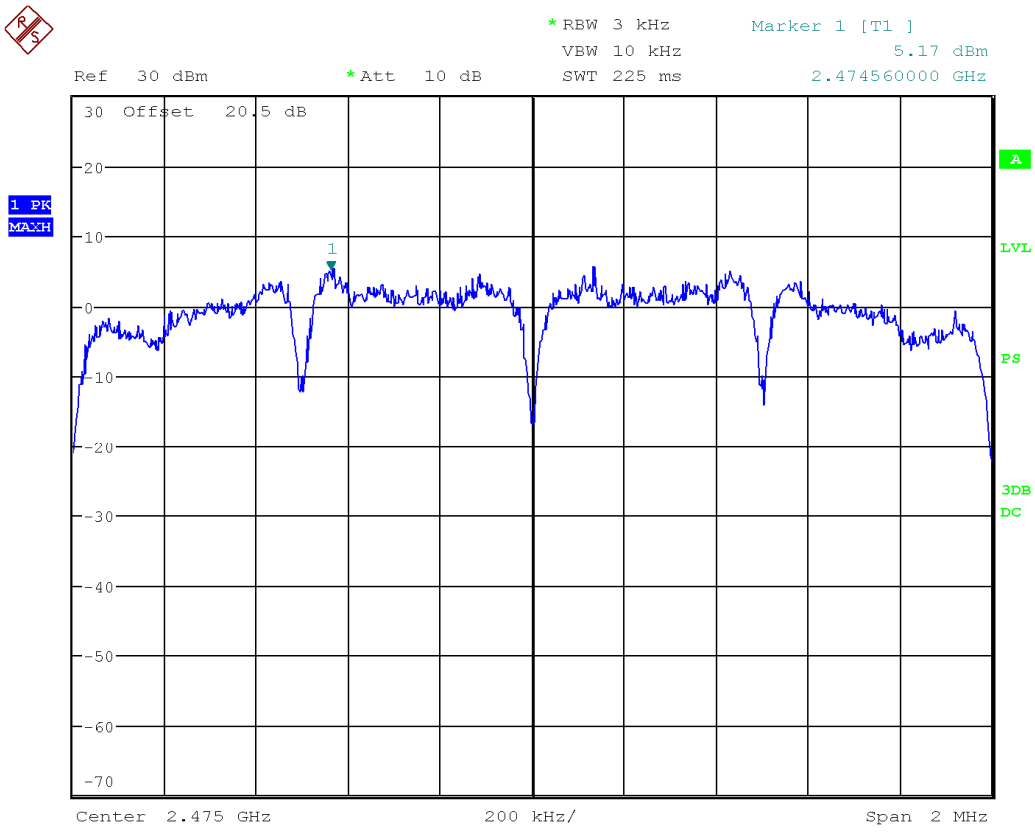
The graphs shown below show the power spectral density of the device during the conducted measurement operation of the EUT. Low, middle, and high channel was investigated in each mode, with the worst case being presented.

Low channel





Mid 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 #
Spectrum Analyzer	ESU-40	R&S	2017-04-20	2019-04-20	4092
RF Cable 0.5m	LMR-400-0.5M-50OHM-MN-MN	LexTec	1-28-16	1-28-18	4029

Appendix A – EUT Summary

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

Client Details	
Organization / Address	Kaba 7301 Decarie Blvd. Montreal QC Canada
Contact	Michael Mosca
Phone	514-735-5410 ext. 749
Email	michael.mosca@kaba.com
EUT (Equipment Under Test) Details	
EUT Name (for report title)	Zigbee Gen 2 Module
Equipment category	Module
EUT is powered using	DC from host
Host details	The representative host used was: Model name: Quantun II Model number: QP1-11AAOAOLANA
Input voltage range(s) (V)	5VDC
Frequency range(s) (Hz)	NA
Rated input current (A)	500mA
Nominal power consumption (W)	2.5W
Number of power supplies in EUT	0
Transmits RF energy? (describe)	Yes Zigbee
Basic EUT functionality description	Zigbee module
Modes of operation	
Customer to setup EUT on site?	Yes
I/O cable description Specify length and type	N/A
Peripherals required to exercise EUT Ex. Signal generator	Sample host.

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'.Note the EUT is considered to have been received the

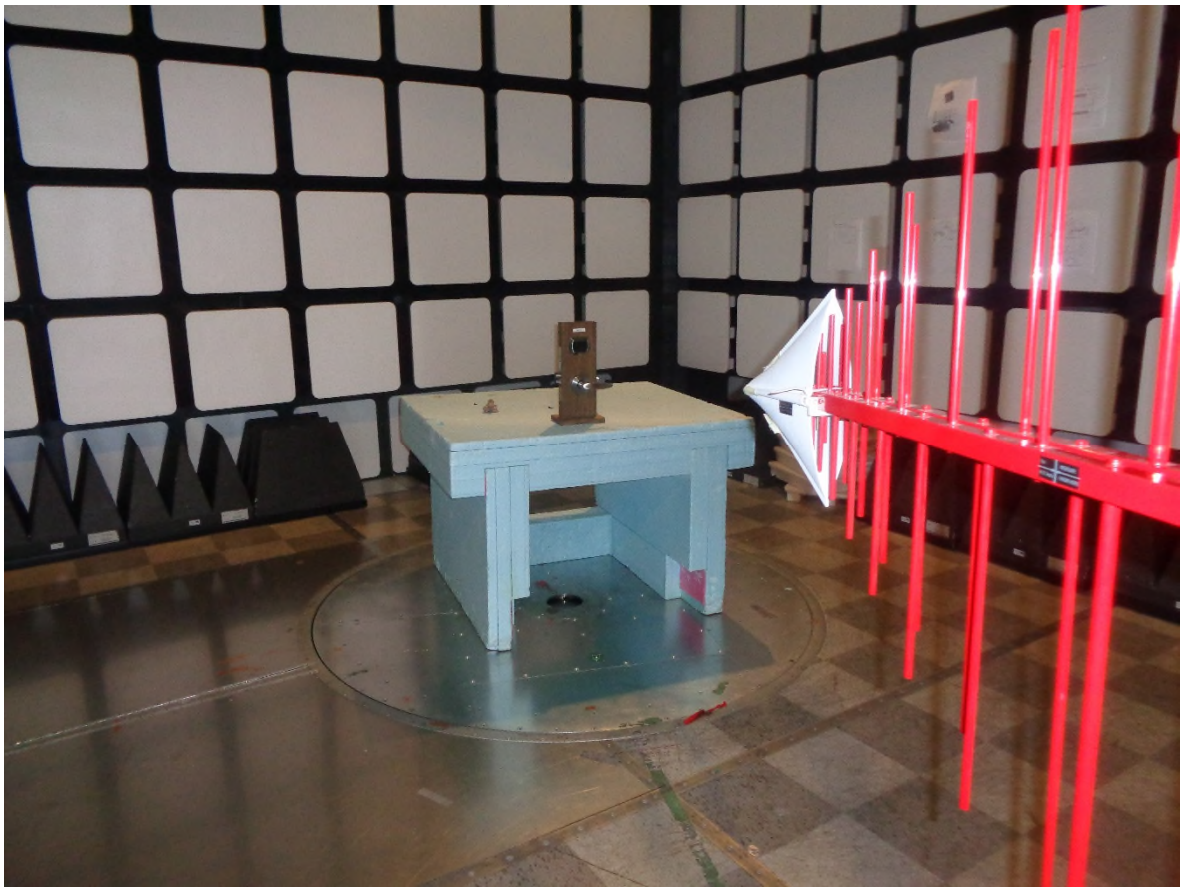
date of the commencement of the first test, unless otherwise stated. For a close-up picture of the EUT, see 'Appendix B – EUT & Test Setup Photographs'.

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.

Radiated Emissions Below 30 MHz

Radiated Emissions 30 MHz to 1 GHz



Radiated Emissions above 1 GHz

Antenna Conducted