



FCC/IC Test Report

FOR:

Model Name: 1E60326G07

FCC ID: Q371E60326REB

IC ID: 4638A-1E60326REB

47 CFR Part 15.247 for DTS Systems

IC RSS-210 Issue 8

TEST REPORT #: EMC_TRANE_002_12001_DTS_Rev1

DATE: 2012-04-19



**FCC listed
A2LA Accredited**

**IC recognized #
3462B**

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CETECOM Inc. is a Delaware Corporation with Corporation number: 2113686



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1 Assessment

The following device was tested against the applicable criteria specified in FCC rules Parts 15.247 of Title 47 of the Code of Federal Regulations and Industry Canada Standards RSS 210 Issue 8 and no deviations were ascertained during the course of the tests performed.

Company	Description	Model #
Thermo King Corp. Ingersoll	Radio Expansion Board "REB" Telematics board for transport refrigeration	1E60326G07

Responsible for Testing Laboratory:

2012-04-19	Compliance	Sajay Jose (Lab Manager)	
Date	Section	Name	Signature

Responsible for the Report:

2012-04-19	Compliance	David Lang (Test Engineer)	
Date	Section	Name	Signature

The test results of this test report relate exclusively to the test item specified in Section 3. CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM Inc. USA.

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the Radio Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Address:	411 Dixon Landing Road Milpitas, CA 95035 U.S.A.
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
Test Lab Director:	Heiko Strehlow
Responsible Project Leader:	David Lang

2.2 Identification of the Client

Applicant's Name:	Thermo King Corp. Ingersoll
Street Address:	314 W 90th Street
City/Zip Code	Minneapolis, MN 55420
Country	USA
Contact Person:	Sofronio Eduardo Tan
Phone No.	952-887-3105
Fax:	---
e-mail:	eduardo_tan@irco.com

2.3 Identification of the Manufacturer

Manufacturer's Name:	Same as applicant
Manufacturers Address:	
City/Zip Code	
Country	

3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Marketing Name:	1E60326G07
HW / SW Revision :	Rev F / A010
FCC-ID / IC-ID:	Q371E60326REB / 4638A-1E60326REB
Product Description:	The REB (Radio Expansion Board) is a wireless communication platform that offers fleet owners the ability to monitor their refrigerated units. Cellular and GPS capabilities communicate with a web-based application.
Frequency Range / number of channels:	WiFi: 2412-2462MHz / 11.
Type(s) of Modulation:	WiFi: CCK, OFDM
Modes of Operation:	Tests were performed in continuous transmission mode. The duty cycle was 3%. The unit was tested in 802.11g mode due to highest conducted output power.
Antenna Type / gain / position / min. distance to other antenna (if appl):	<u>Multi Band Antenna Z3400:</u> Antenna Gain 2.3-2.6GHz with cable = 1dB (value taken from antenna specifications)
Other Radios and Modulations supported:	GSM 850: 824.2-848.8MHz / 125 Channels; PCS 1900: 1850.2-1909.8MHz / 300 Channels; Modulations: GMSK, 8PSK
Power Supply	12 VDC (Battery powered – 925- CCA wet cell)
Operating Temperature Range	-40°C to +85°C
Prototype / Production unit	Prototype

Note: The EUT includes a pre-certified GSM module (Cinterion AC65I FCC ID: QIPAC65I) and a pre-certified WiFi module (FCC ID: RUJ-LR802UKN2).

3.2 Identification of the Equipment Under Test (EUT)

EUT #	Serial Number	HW Version	SW Version	Notes
1	G0023251144REB	Rev F	A010	---
2	G0023281144REB*	Rev F	A010	Modified unit to test b/n modes.

*Note: EUT #2 is a modified sample to test b/n modes. The modifications on this unit prevented it from testing <1GHz radiated spurious emissions. The radio portion is not impacted.

Data for <1GHz RSE is taken from EUT#1 as it represents the intended configuration.

3.3 Identification of Accessory equipment

AE #	Type	Manufacturer	Model	Serial Number
1	Multi Band Antenna	PCTEL	Z3400	none

3.4 Test modes of operation:

Worst case operation was determined for these data rates and modulations.

Mode	Data rate (Mbps)	Modulation scheme
802.11b	1	CCK
802.11g	6	OFDM
802.11n	6.5	OFDM

4 Subject Of Investigation

The objective of the measurements done by Cetecom Inc. was to measure the performance of the EUT as specified by requirements listed in FCC rules Part 15.247 of Title 47 of the Code of Federal Regulations and Industry Canada rules RSS-210 Issue 8.

This test report is to support a request for new equipment authorization under the FCC ID **Q371E60326REB** and IC ID **4638A-1E60326REB**.

All testing was performed on the product referred to in Section 3 as EUT.

- 47 CFR Part 15: Title 47 of the Code of Federal Regulations: Chapter I-Federal Communications Commission subchapter A- General, Part 15- Radio Frequency Devices.
- RSS-210 Issue 8: Spectrum Management and Telecommunications- Radio Standards Specification. Low-power Licence-exempt radio communication devices (All frequency bands): Category 1 equipment.

During the testing process the EUT was tested on low, mid and high channels for all the supported modes of operation. For radiated measurements, all data in this report shows the worst case between horizontal and vertical antenna polarizations and for all 3 orthogonal orientations of the EUT.

5 Summary of Measurement Results

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§15.247(b)(4) RSS210 A8.4(2)	Antenna Gain	Nominal	802.11g	■	□	□	□	Complies
§15.247(e) RSS210 A8.2(b)	Power Spectral Density	Nominal	802.11g	□	□	□	■	Complies
§15.247(a)(1) RSS210 A8.1(b)	Carrier Frequency Separation	Nominal	802.11g	□	□	■	□	-
§15.247(a)(1) RSS210 A8.1(d)	Number of Hopping Channels	Nominal	802.11g	□	□	■	□	-
§15.247(a)(1)(iii) RSS210 A8.3(1)	Time of occupancy	Nominal	802.11g	□	□	■	□	-
§15.247(a)(1) RSS210 A8.2(a)	Spectrum Bandwidth	Nominal	802.11g	□	□	□	■	Complies
§15.247(b)(1) RSS210 A8.4(2)	Maximum Output Power	Nominal	802.11g	■	□	□	□	Complies
§15.247(d) RSS210 A8.5	Band edge compliance-Conducted	Nominal	802.11g	□	□	□	■	-
§15.247(d) RSS210 A8.5	Band edge compliance-Radiated	Nominal	802.11g	■	□	□	□	Complies
§15.247(d) RSS210 A8.5	TX Spurious emissions-Conducted	Nominal	802.11g	□	□	□	■	Complies
§15.247(d) RSS210 A8.5	TX Spurious emissions-Radiated	Nominal	802.11g	■	□	□	□	Complies
§15.209(a) RSS Gen	TX Spurious Emissions Radiated<30MHz	Nominal	802.11g	■	□	□	□	Complies

Note:

NA= Not Applicable; NP= Not Performed.

Results leveraged from Module test report # RF980624L27 issued by Bureau Veritas Consumer Products Services (H.K.) Ltd. (August 25, 2009).

Band Edge compliance-conducted is NOT PERFORMED as the device passes radiated measurement.

6 Measurements

6.1 Measurement Method:

All radiated and conducted testing is performed according to guidelines in FCC publication KDB558074: Measurement of Digital Transmission systems operating under Section 15.247, March 23, 2005.

6.2 Radiated Measurement Procedure

ANSI C63.4 (2003) Section 8.3.1.1: Exploratory radiated emission measurements

Exploratory radiated measurements shall be performed at the measurement distance or at a closer distance than that specified for compliance to determine the emission characteristics of the EUT. At near distances, for EUTs of comparably small size, it is relatively easy to determine the spectrum signature of the EUT and, if applicable, the EUT configuration that produces the maximum level of emissions. A shielded room may be used for exploratory testing, but may have anomalies that can lead to significant errors in amplitude measurements.

Broadband antennas and a spectrum analyzer or a radio-noise meter with a panoramic display are often useful in this type of testing. It is recommended that either a headset or loudspeaker be connected as an aid in detecting ambient signals and finding frequencies of significant emission from the EUT when the exploratory and final testing is performed in an OATS with strong ambient signals. Caution should be taken if either antenna height between 1 and 4 meters or EUT azimuth is not fully explored. Not fully exploring these parameters during exploratory testing may require complete testing at the OATS or semi-anechoic chamber when the final full spectrum testing is conducted.

The EUT should be set up in its typical configuration and arrangement, and operated in its various modes. For tabletop systems, cables or wires should be manipulated within the range of likely arrangements. For floor-standing equipment, the cables or wires should be located in the same manner as the user would install them and no further manipulation is made. For combination EUTs, the tabletop and floor-standing portions of the EUT shall follow the procedures for their respective setups and cable manipulation. If the manner of cable installation is not known, or if it changes with each installation, cables or wires for floor-standing equipment shall be manipulated to the extent possible to produce the maximum level of emissions.

For each mode of operation required to be tested, the frequency spectrum shall be monitored. Variations in antenna height between 1 and 4 m, antenna polarization, EUT azimuth, and cable or wire placement (each variable within bounds specified elsewhere) shall be explored to produce the emission that has the highest amplitude relative to the limit. A step-by-step technique for determining this emission can be found in Annex C.

When measuring emissions above 1 GHz, the frequencies of maximum emission shall be determined by manually positioning the antenna close to the EUT and by moving the antenna over all sides of the EUT while observing a spectral display. It will be advantageous to have prior knowledge of the frequencies of emissions above 1 GHz. If the EUT is a device with dimensions approximately equal to that of the measurement antenna beamwidth, the measurement antenna shall be aligned with the EUT.

ANSI C63.4 (2003) Section 8.3.1.2: Final radiated emission measurements

Based on the measurement results in 8.3.1.1, the one EUT, cable and wire arrangement, and mode of operation that produces the emission that has the highest amplitude relative to the limit is selected for the final measurement. The final measurement is then performed on a site meeting the requirements of 5.3, 5.4, or 5.5 as appropriate without variation of the EUT arrangement or EUT mode of operation. If the EUT is relocated from an exploratory test site to a final test site, the highest emission shall be remaximized at the final test location before final radiated emissions measurements are performed.

However, antenna height and polarity and EUT azimuth are to be varied. In addition, the full frequency spectrum (for the range to be checked for meeting compliance) shall be investigated.

This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. During the full frequency spectrum investigation, particular focus should be made on those frequencies found in exploratory testing that were used to find the final test configuration, mode of operation, and arrangement (associated with achieving the least margin with respect to the limit). This full spectrum test constitutes the compliance measurement.

For measurements above 1 GHz, use the cable, EUT arrangement, and mode of operation determined in the exploratory testing to produce the emission that has the highest amplitude relative to the limit. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the antenna in the “cone of radiation” from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response. The antenna may have to be higher or lower than the EUT, depending on the EUT’s size and mounting height, but the antenna should be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane. If the transmission line for the measurement antenna restricts its range of height and polarization, the steps needed to ensure the correct measurement of the maximum emissions, shall be described in detail in the report of measurements. Data collected shall satisfy the report requirements of Clause 10.

NOTES

1— Where limits are specified by agencies for both average and peak (or quasi-peak) detection, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.

2—Use of waveguide and flexible waveguide may be necessary at frequencies above 10 GHz to achieve usable signal-to noise ratios at required measurement distances. If so, it may be necessary to restrict the height search of the antenna, and special care should be taken to ensure that maximum emissions are correctly measured.

3—All presently known devices causing emissions above 10 GHz are physically small compared with the beam-widths of typical horn antennas used for EMC measurements. For such EUTs and frequencies, it may be preferable to vary the height and polarization of the EUT instead of the receiving antenna to maximize the measured emissions.

Measurement uncertainty for all radiated measurements: +/- 3dB



6.3 Sample Calculations for Radiated Measurements

6.3.1 Field Strength Measurements:

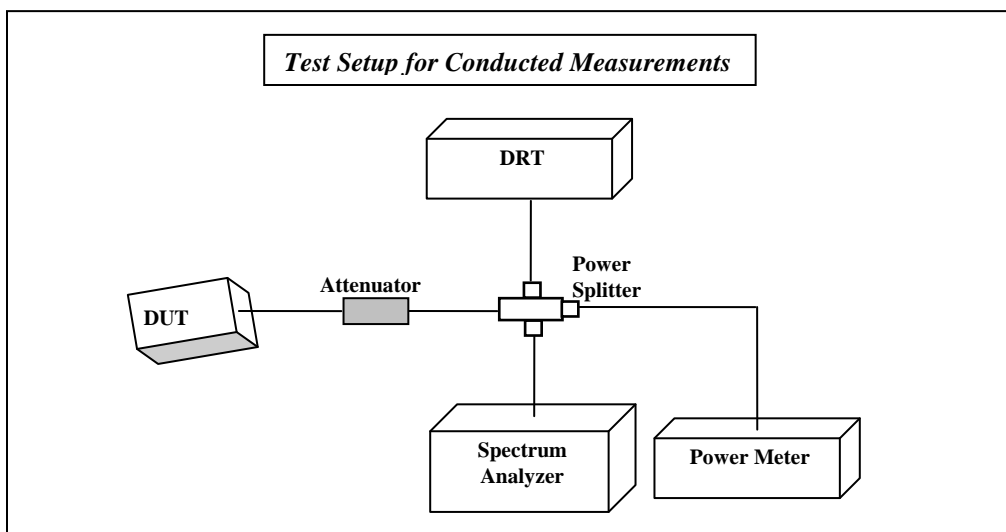
Field Strength measurements are directly taken from the Spectrum Analyzer/ Receiver, taking into account the cable loss between the Receiving Antenna and the Spectrum Analyzer/ Receiver. Antenna Factor is accounted for by the test SW.

FS (dBμV/m)= Measured Value on SA (dBμV)+ Cable Loss (dB)

Eg:

Frequency (MHz)	Measured SA (dBμV)	Cable Loss (dB)	Field Strength Result (dBμV/m)
1000	95.5	3.5	99.0

6.4 Conducted Measurement Procedure



1. Connect the equipment as shown in the above diagram.
2. Adjust the settings of the Digital Radio Communication Tester (DRT) to connect the EUT at the required channel (OR) alternatively use the EUT to set to transmit at a specific mode.
3. Measurements are to be performed with the EUT set to the low, middle and high channels.

Note: Measurement uncertainty for all conducted measurements: +/- 0.5dB

6.5 Maximum Peak Output Power

6.5.1 Limits:

6.5.1.1 §15.247 (b)(3)

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the *maximum conducted output power* is the highest total transmit power occurring in any mode.

6.5.1.2 RSS 210- A8.4(2)

Nominal Peak Output Power < 30 dBm (1W)

EIRP < 36dBm

6.5.2 Test Conditions:

Tnom: 21°C; Vnom: 12VDC

Spectrum Analyzer settings:

RBW=20MHz, VBW=30MHz, Detector: Peak- Max Hold.

Sweep Time: Auto

Span=40MHz

Reported Antenna Gain (dBi)= 1dB (all three channels)



6.5.3 Test Result:

Measured Output Power- Conducted (dBm)			
Mode	Frequency (MHz)		
	2412 Channel 1	2437 Channel 6	2462 Channel 11
802.11b	16.38	15.88	15.14
802.11g	23.5	22.9	22.4
802.11n	22.97	20.13	20.49
Measurement Uncertainty: ±0.5dB			

Calculated Max Peak Output Power- Radiated (dBm)			
Mode	Frequency (MHz)		
	2412 Channel 1	2437 Channel 6	2462 Channel 11
802.11b	17.3	16.8	16.1
802.11g	24.5	23.9	23.4
802.11n	23.9	21.1	21.4
Measurement Uncertainty: ±3dB			

**Note: Radiated EIRP is calculated as
Conducted Measurement + Antenna Gain**

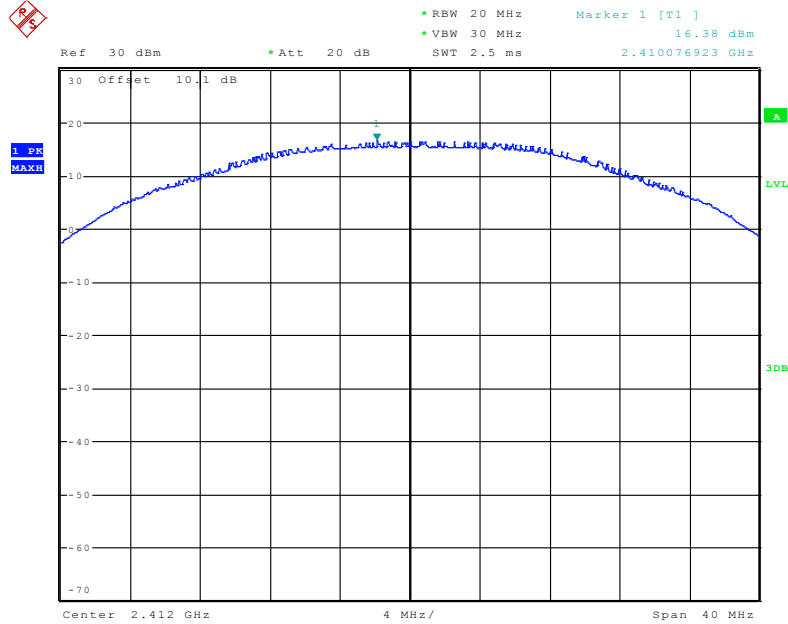


Module Output Power Verification Conducted (dBm)						
Mode	Frequency (MHz)					
	2412 Channel 1		2437 Channel 6		2462 Channel 11	
	Measured	Module Precertification data	Measured	Module Precertification data	Measured	Module Precertification data
802.11b	16.38	17.54	15.88	17.58	15.14	17.52
802.11g	23.5	20.56	22.9	20.61	22.4	20.53
802.11n	22.97	20.52	20.13	20.57	20.49	20.55
Measurement Uncertainty: ± 0.5 dB						

6.5.3.1 Measurement Result

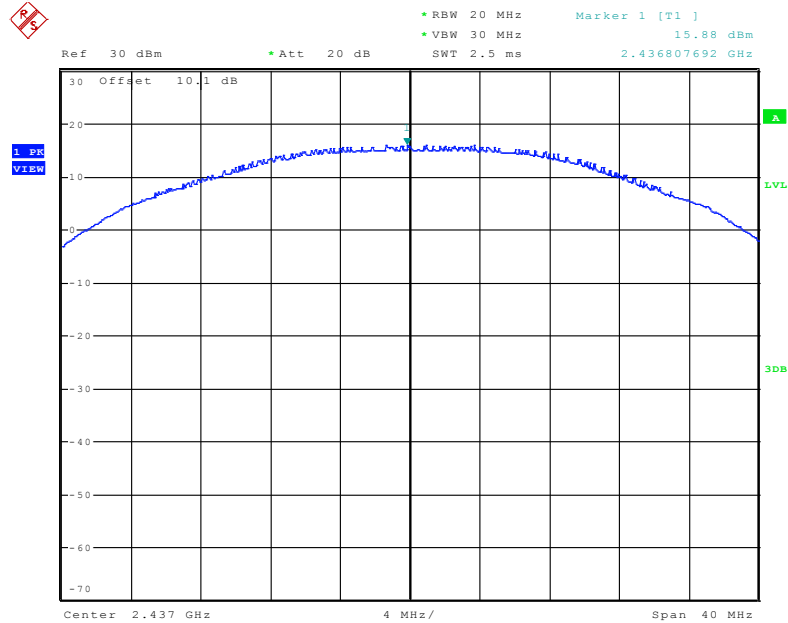
Pass.

6.5.4 Test Data/plots: Conducted Peak Power 802.11b 2412 MHz



Date: 20.MAR.2012 12:38:48

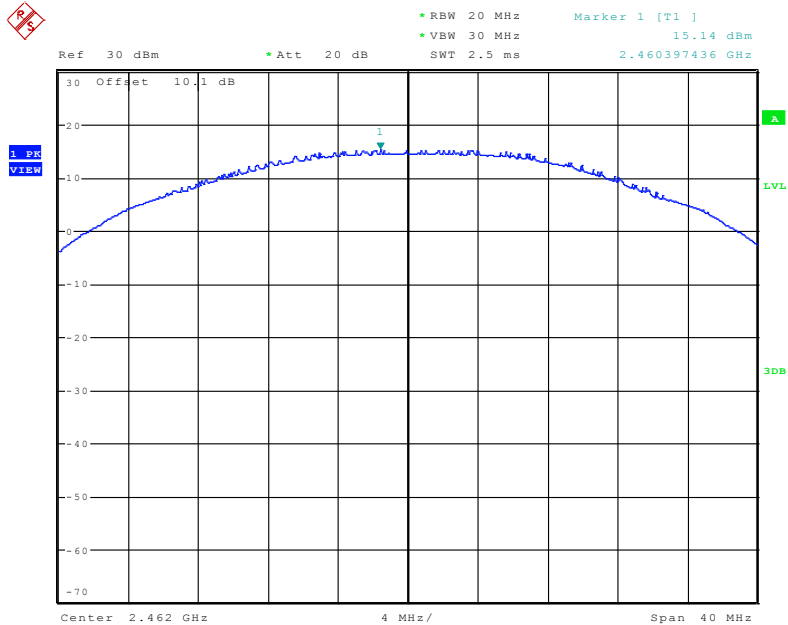
Conducted Peak Power 802.11b 2437 MHz



Date: 20.MAR.2012 12:37:30

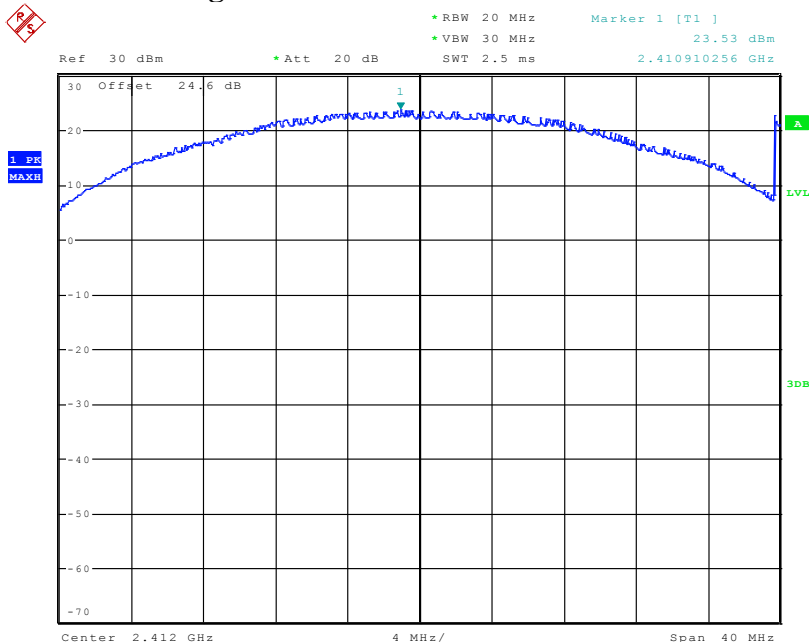


Conducted Peak Power 802.11b 2462 MHz



Date: 20.MAR.2012 12:36:27

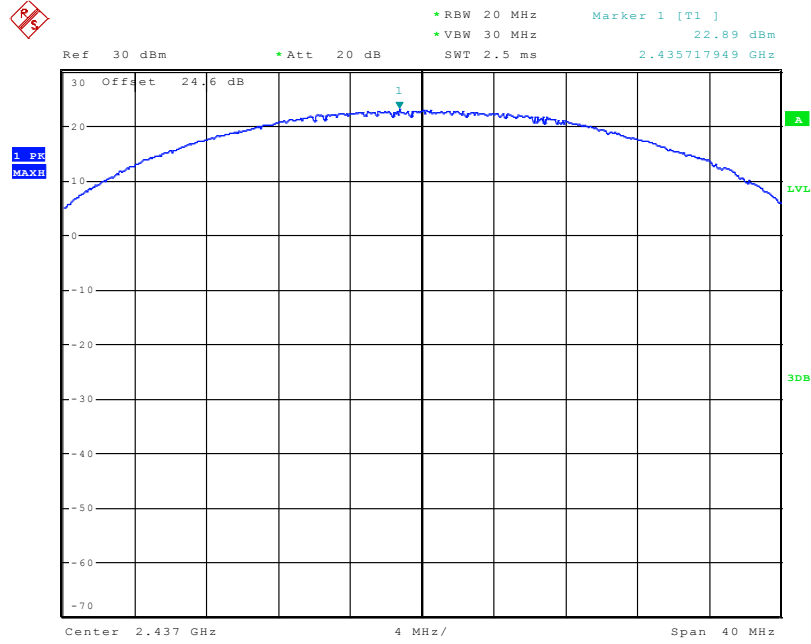
Conducted Peak Power 802.11g 2412 MHz



Date: 24.JAN.2012 16:31:31

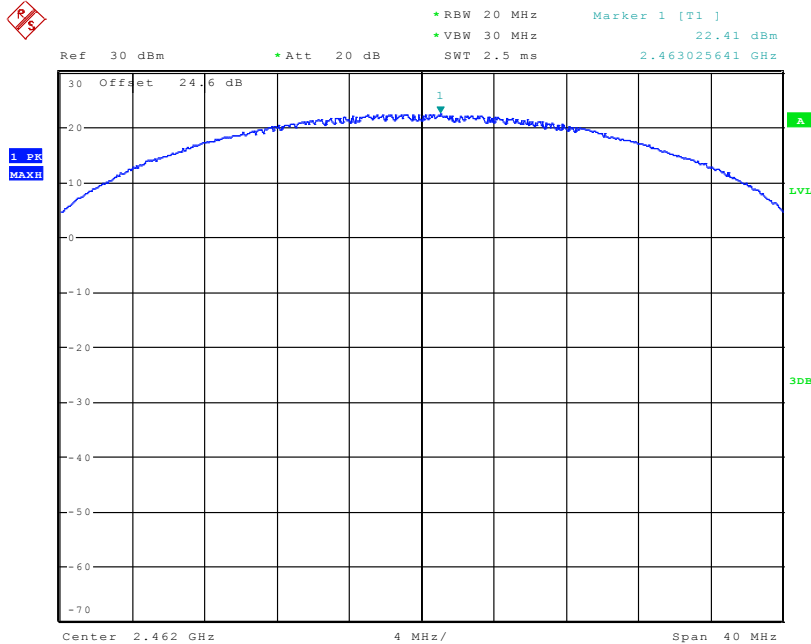


Conducted Peak Power 802.11g 2437 MHz



Date: 24.JAN.2012 16:36:43

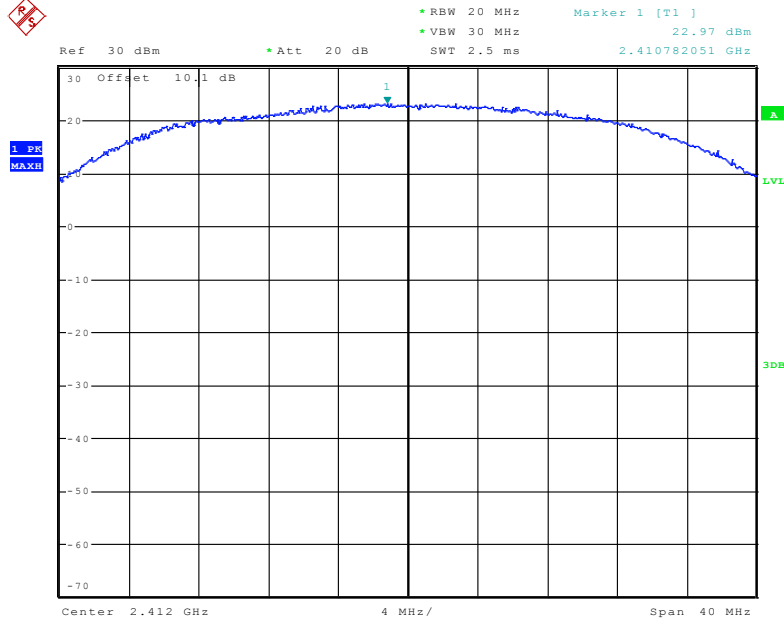
Conducted Peak Power 802.11g 2462 MHz



Date: 24.JAN.2012 16:41:49

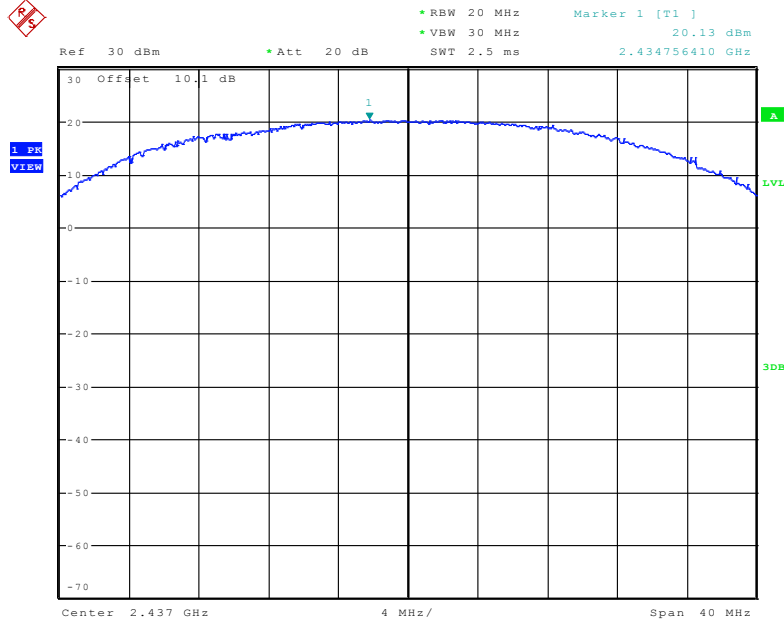


Conducted Peak Power 802.11n 2412 MHz



Date: 20.MAR.2012 14:09:15

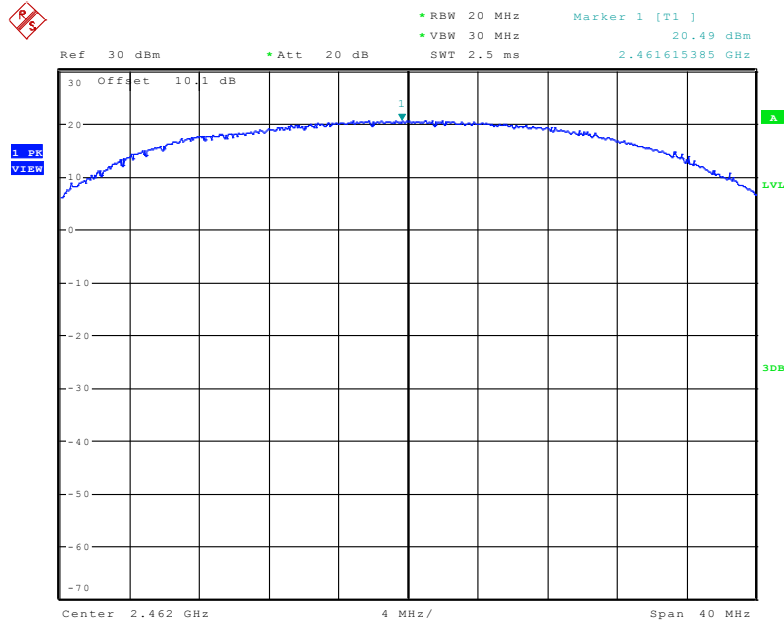
Conducted Peak Power 802.11n 2437 MHz



Date: 20.MAR.2012 14:11:58



Conducted Peak Power 802.11n 2462 MHz



Date: 20.MAR.2012 14:13:23

6.6 Restricted Band Edge Compliance

6.6.1 Limits: §15.247/15.205

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)
13.36 - 13.41			

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

6.6.2 Measurement Procedure:

Peak measurements are made using a peak detector and RBW=1MHz.

Average measurements performed using a peak detector and according to video averaging procedure with RBW=1MHz and VBW=10Hz.

*PEAK LIMIT= 74dBμV/m

*AVG. LIMIT= 54dBμV/m

Measurement Uncertainty: ±3.0dB

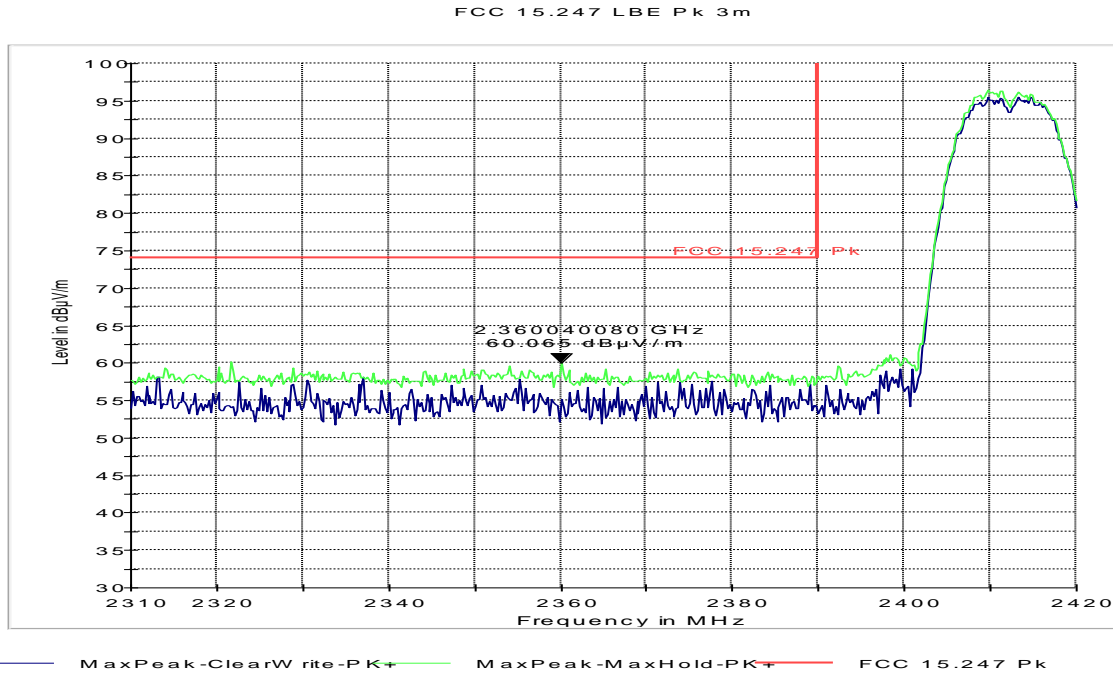
6.6.2.1 Measurement Result

Pass.

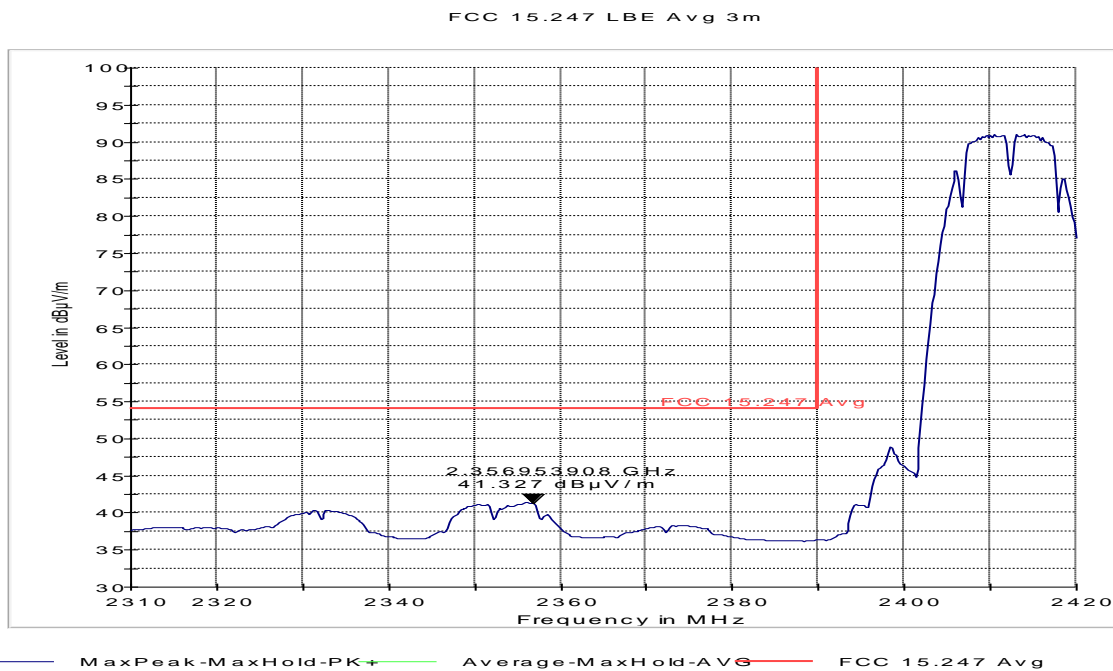


6.6.3 Test Data/plots:

Lower band edge peak – 802.11b mode

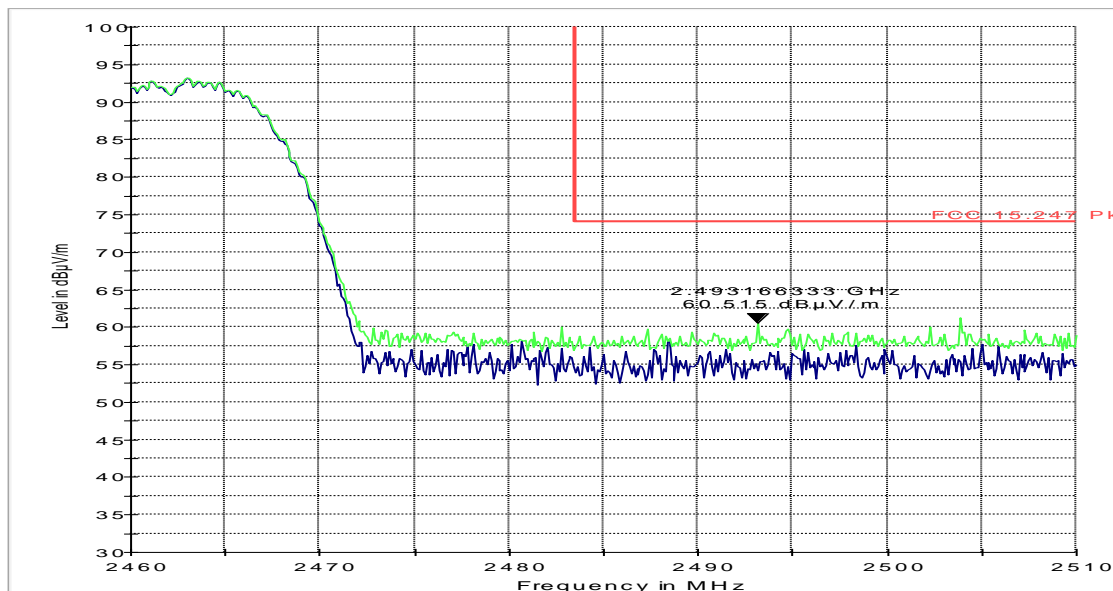


Lower band edge average -802.11b mode



Higher band edge peak -802.11b mode

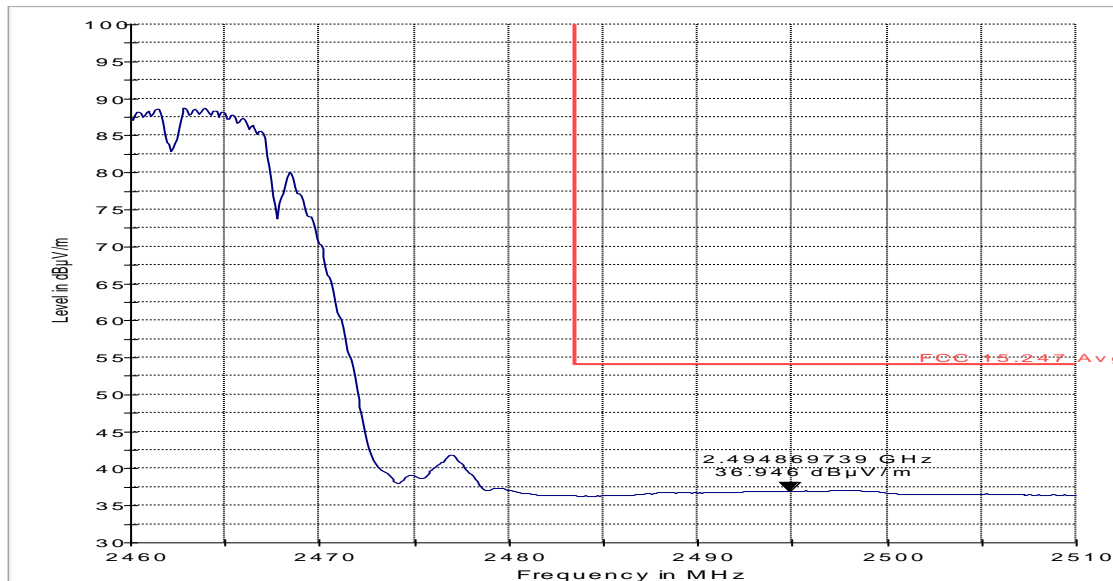
FCC 15.247 HBE Pk 3m



MaxPeak-ClearWrite-PK MaxPeak-MaxHold-PK FCC 15.247 Pk

Higher band edge average -802.11b mode

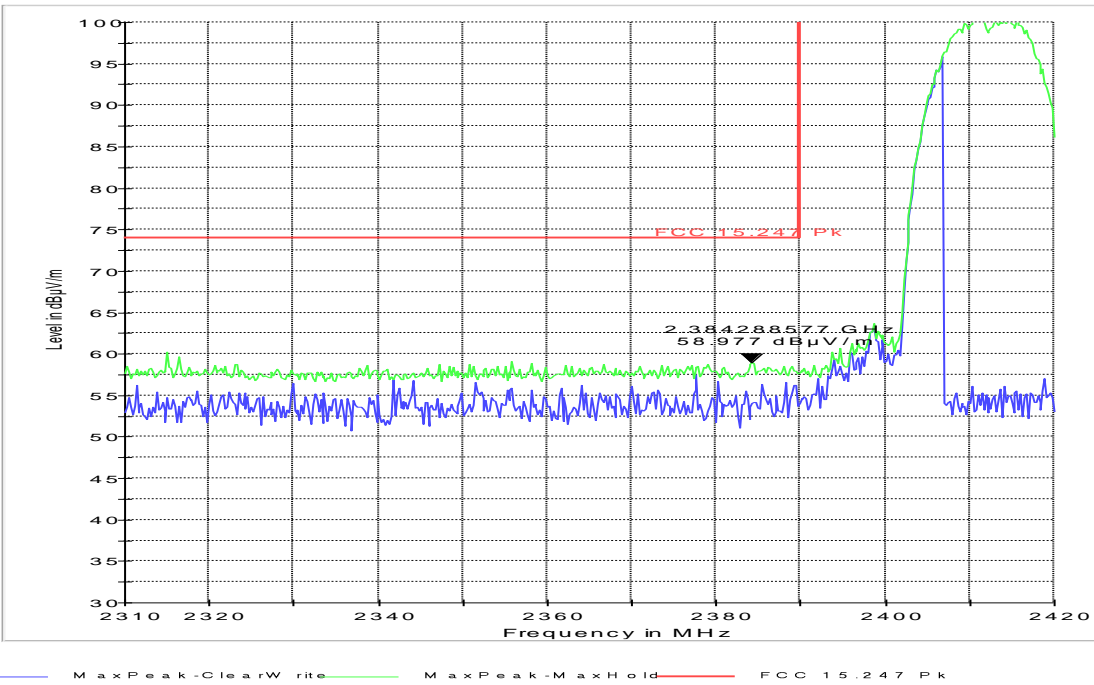
FCC 15.247 HBE Avg 3m



MaxPeak-MaxHold-PK FCC 15.247 Avg

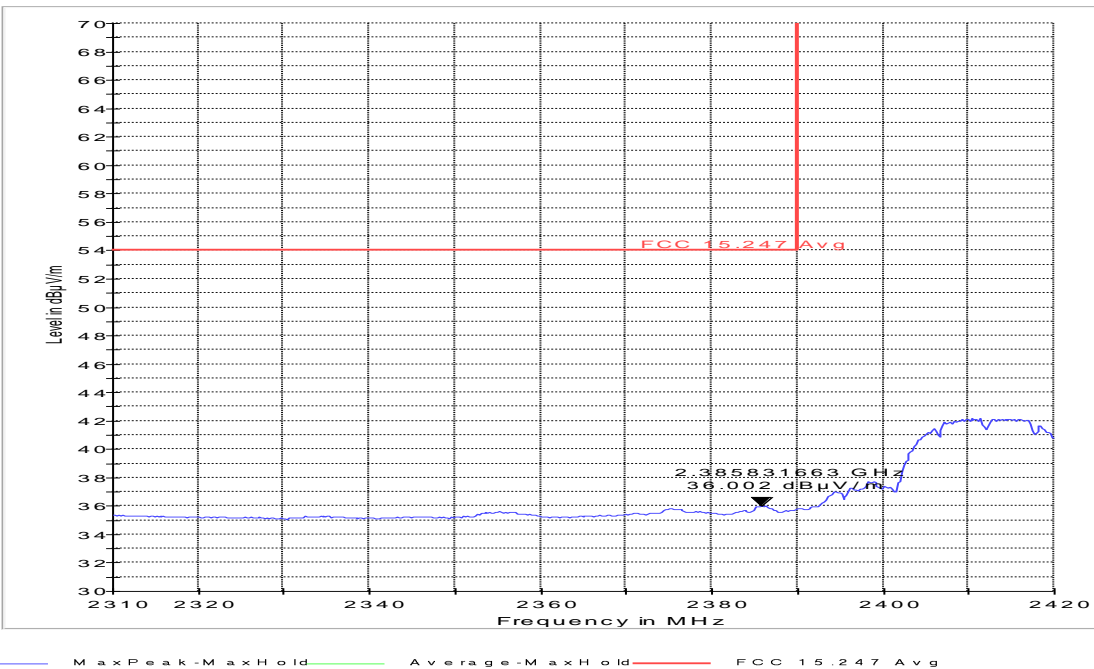
Lower band edge peak – 802.11g mode

FCC 15.247 LBE Pk 3m



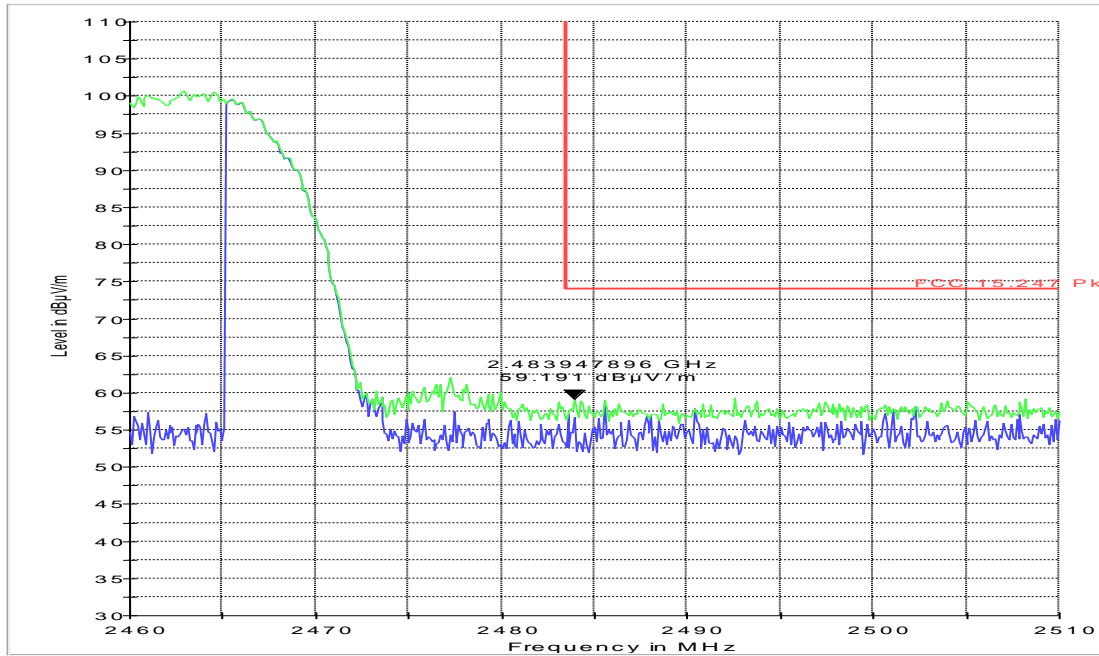
Lower band edge average -802.11g mode

FCC 15.247 LBE Avg 3m



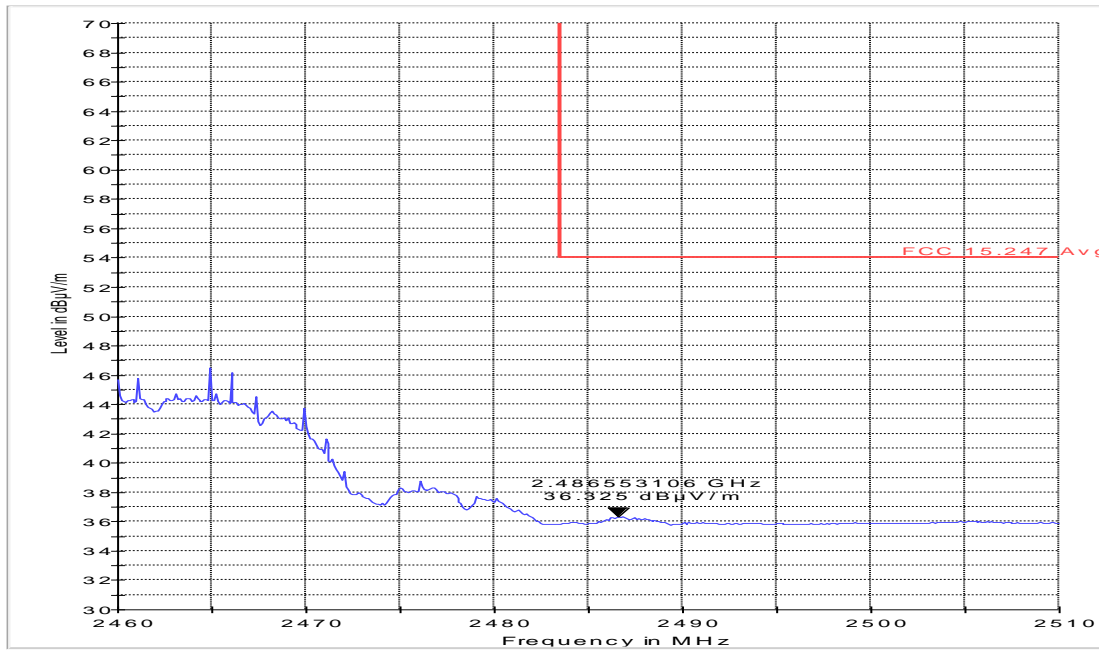
Higher band edge peak -802.11g mode

FCC 15.247 HBE Pk 3m



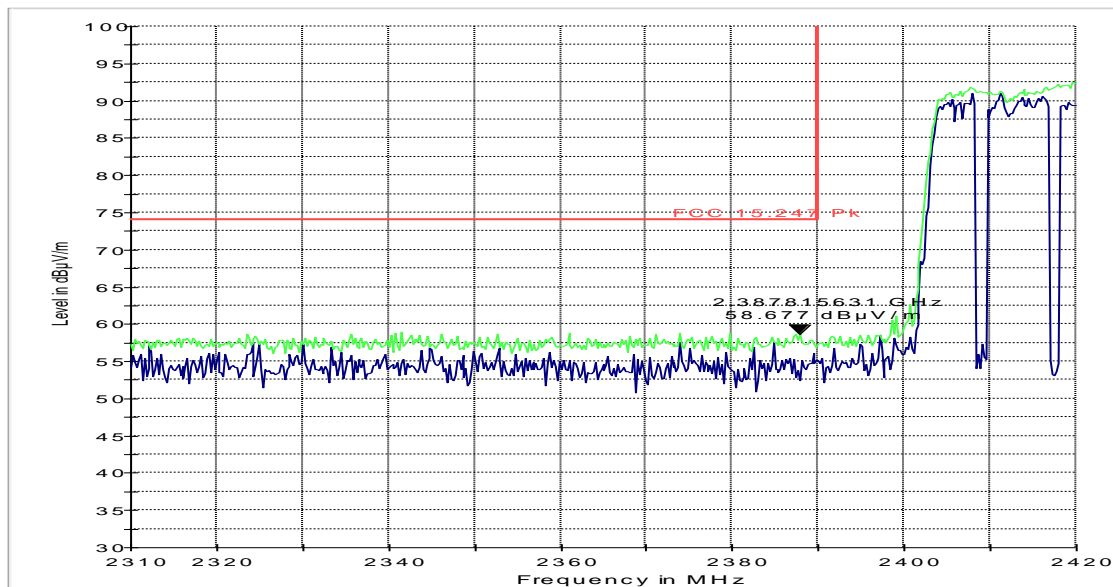
Higher band edge average- 802.11g mode

FCC 15.247 HBE Avg 3m



Lower band edge peak – 802.11n mode

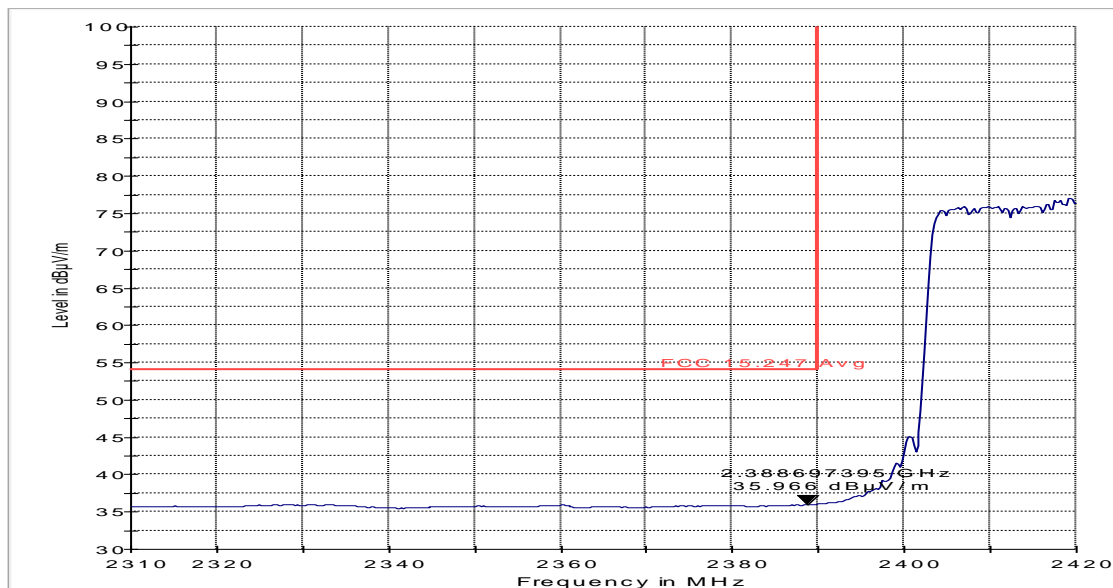
FCC 15.247 LBE Pk 3m



MaxPeak-ClearWrite-PK+ MaxPeak-MaxHold-PK+ FCC 15.247 Pk

Lower band edge average -802.11n mode

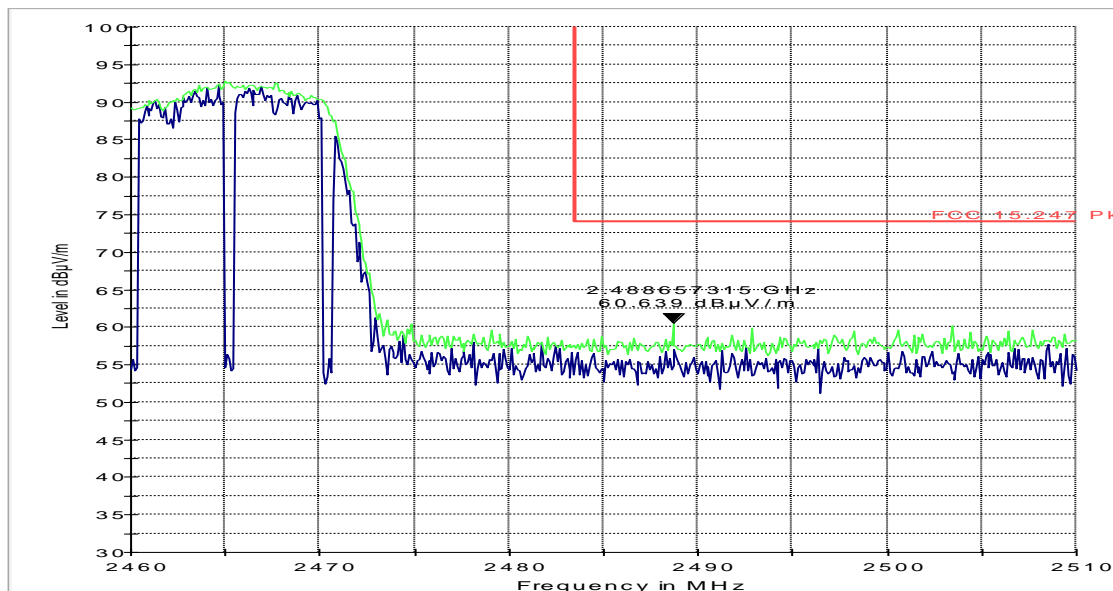
FCC 15.247 LBE Avg 3m



MaxPeak-MaxHold-PK+ Average-MaxHold-AVG FCC 15.247 Avg

Higher band edge peak -802.11n mode

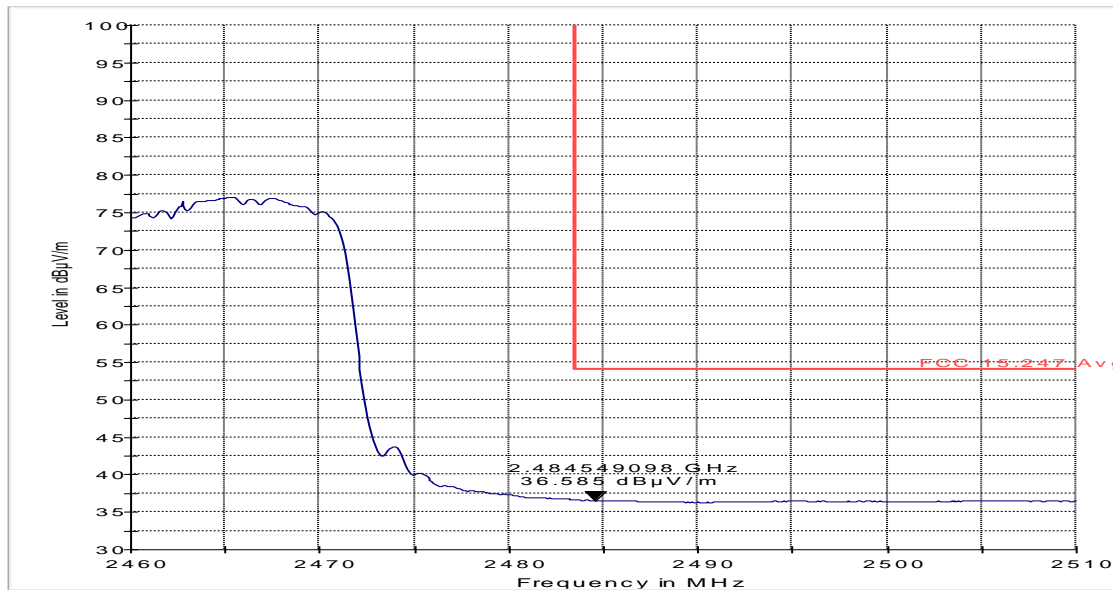
FCC 15.247 HBE Pk 3m



MaxPeak-ClearWrite-PK MaxPeak-MaxHold-PK FCC 15.247 Pk

Higher band edge average -802.11n mode

FCC 15.247 HBE Avg 3m



MaxPeak-MaxHold-PK FCC 15.247 Avg



6.7 Transmitter Spurious Emissions- Radiated

**6.7.1 Limits:
 §15.247/15.205
 RSS 210-A8.5**

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)
13.36 - 13.41			

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under Section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB.

- *PEAK LIMIT= 74dB μ V/m
- *AVG. LIMIT= 54dB μ V/m

Table 1:

Frequency of emission (MHz)	Field strength ($\mu\text{V/m}$)
30–88	100 (40dB $\mu\text{V/m}$)
88–216	150 (43.5 dB $\mu\text{V/m}$)
216–960	200 (46 dB $\mu\text{V/m}$)
Above 960	500 (54 dB $\mu\text{V/m}$)

Table 2:

Frequency of emission (MHz)	Field strength ($\mu\text{V/m}$)	Measurement Distance (m)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30

6.7.2 Test Result:

Test mode: *Modulation:* 802.11g and 802.11n- since highest conducted power

Unless mentioned otherwise, the emissions outside the limit lines in the plots are from the transmit signal.

Plots reported here represent the worse case emissions for horizontal and vertical antenna polarizations and for three orientations of the EUT.

To maintain a continuous transmission (test mode) in b- and n-mode it was necessary to connect the EUT#2 to a PC and control it using a host software provided by the manufacturer. The connection was established using a 1,5m USB cable. Since this connection causes disturbance in the 30MHz to 1GHz range this report contains <1GHz RSE data from EUT#1 in g-mode, as it represents the intended configuration.

Measurement Uncertainty: $\pm 3.0\text{dB}$

6.7.2.1 Measurement Result

Pass.

6.7.3 Test data/ plots:

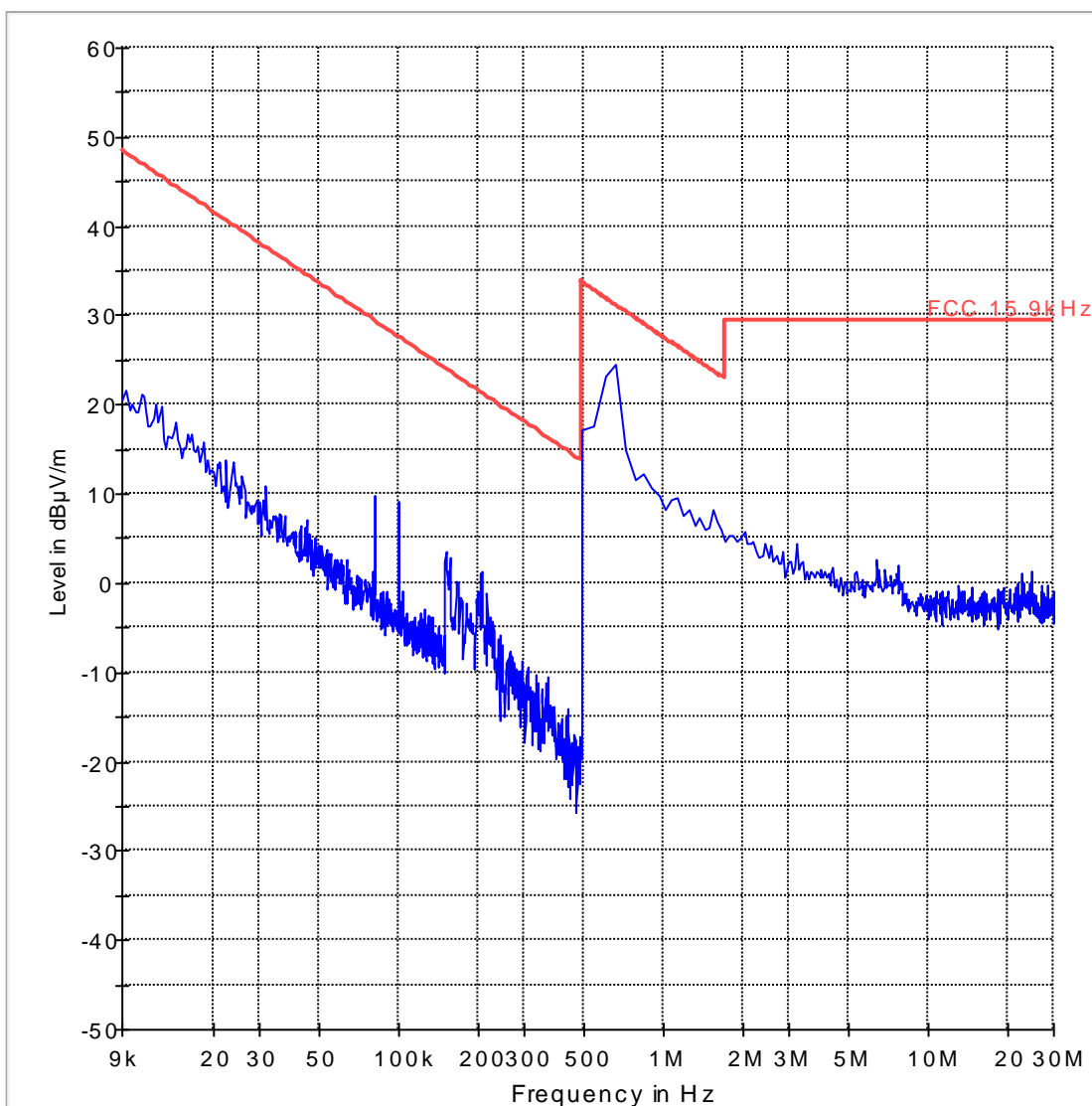
Transmitter Radiated Spurious Emission:<30MHz

Note: Worst case representation for all modes of operation in this frequency range-
Limits adjusted for 3m measurement.

Description:

EUT Name: 1E60326G07
Manufacturer: Thermoking
Serial: G0023251144REB
Comment: Battery-New Cable antenna

FCC 15 9kHz - 30 MHz



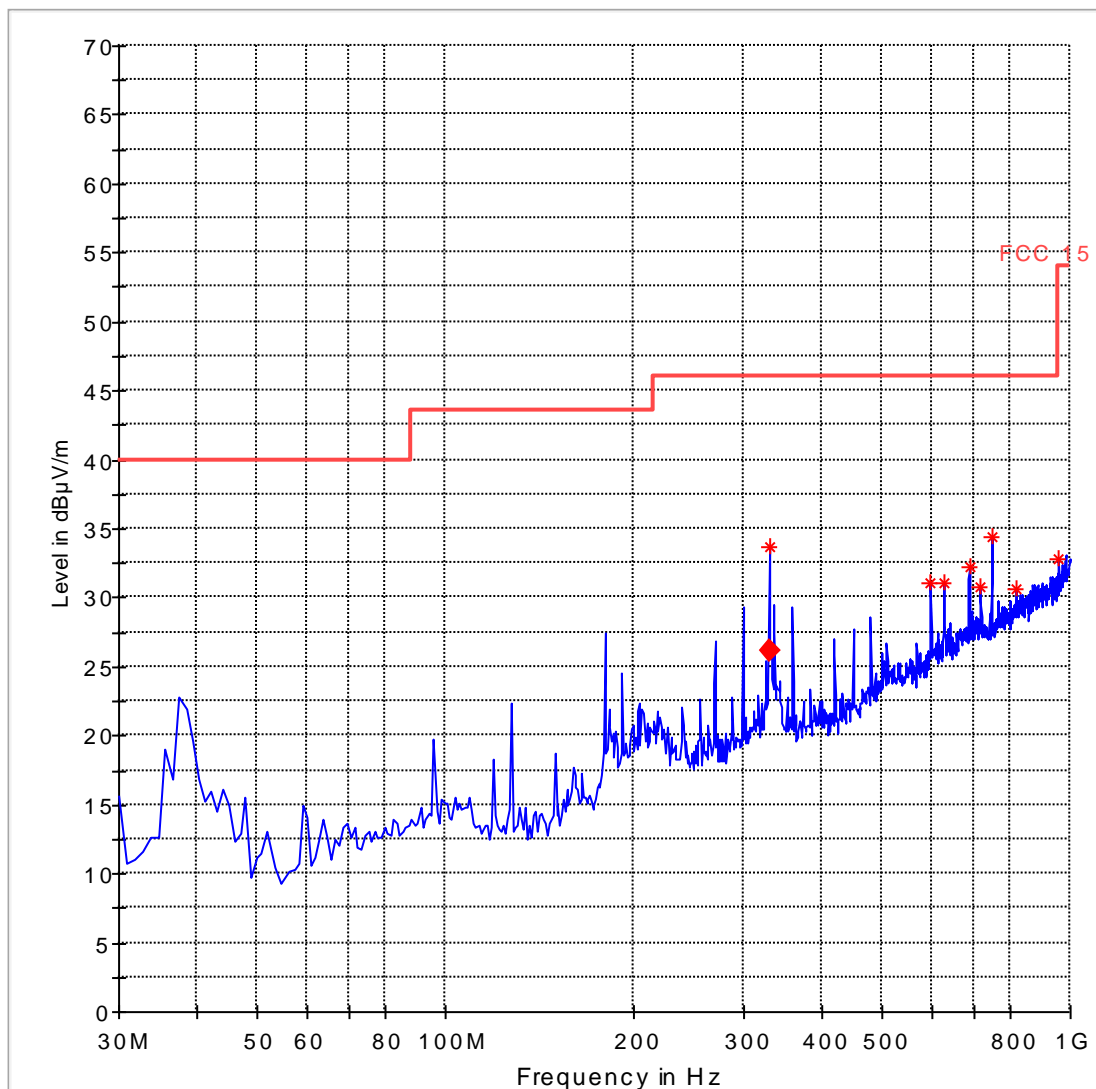
— FCC 15.9kHz Limit Line — Preview Result 1

Transmitter Radiated Spurious Emission- Ch1- g-mode - 30M-1GHz

Description:

EUT Name: 1E60326G07
Manufacturer: Thermoking
Serial: G0023251144REB
Comment: Battery-New Cable antenna

FCC 15 30-1000MHz



— FCC 15 Limit Line — Preview Result 1
* Data Reduction Result 1 [3] ◆ Final Measurement Result 1

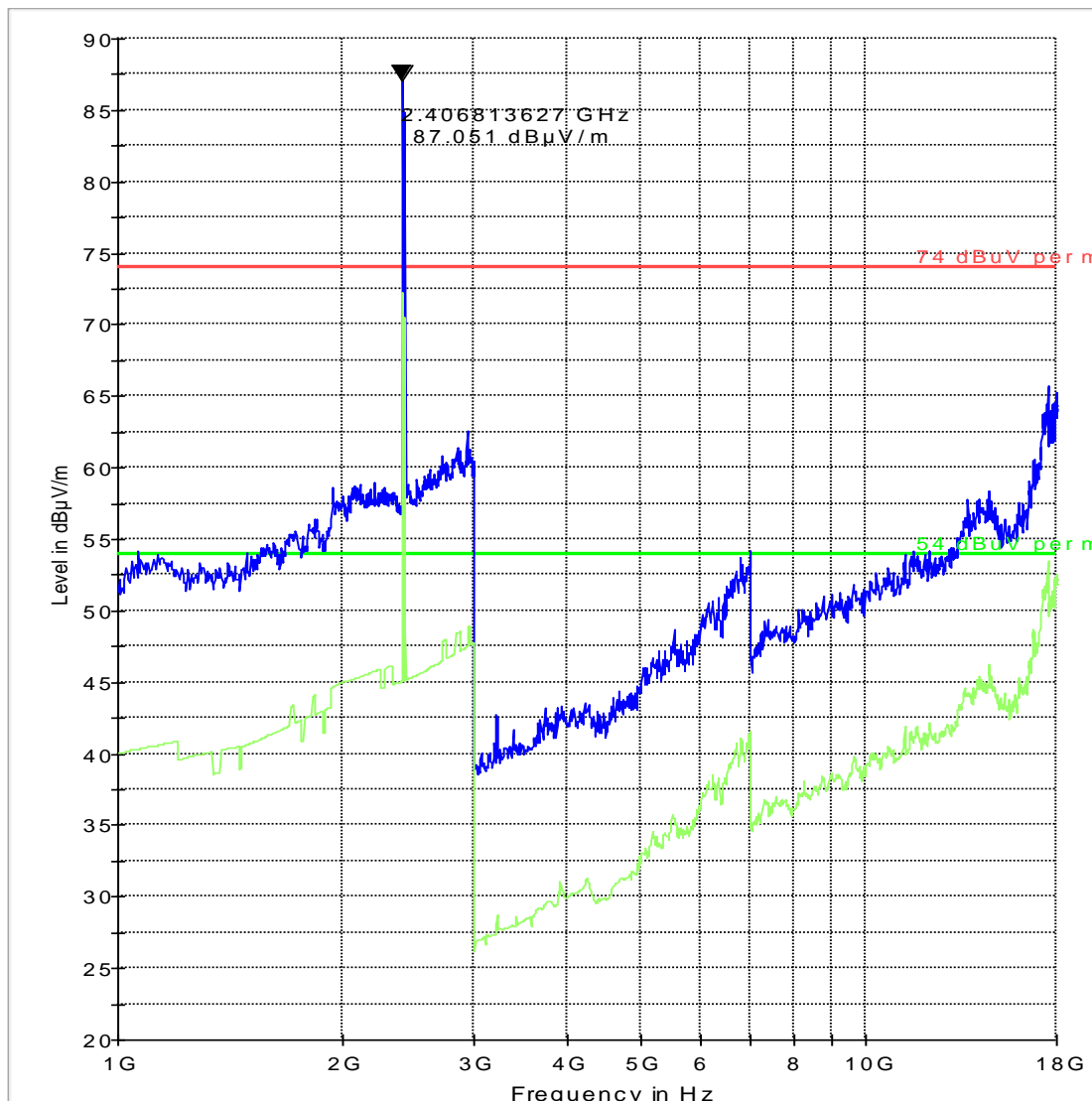


Transmitter Radiated Spurious Emission- Ch1- g-mode - 1G-18GHz

Description:

EUT Name: 1E60326G07
Manufacturer: Thermoking
Serial: G0023251144REB
Comment: Battery-New Cable antenna

FCC 15 1-18GHz



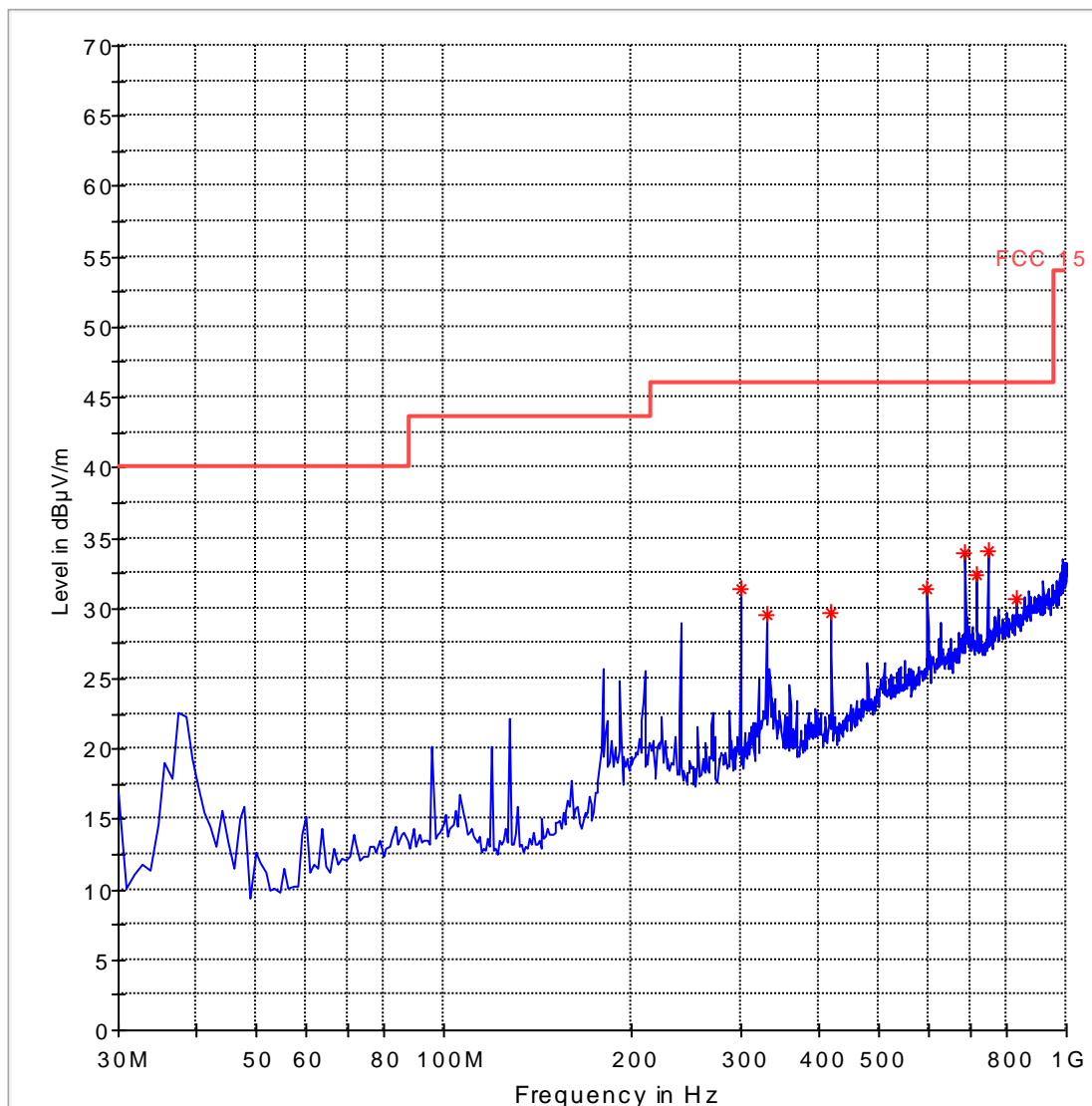
74 dBuV per m Limit Line 54 dBuV per m Limit Line
Preview Result 1 Preview Result 2

Transmitter Radiated Spurious Emission- Ch6- g-mode - 30M-1GHz

Description:

EUT Name: 1E60326G07
Manufacturer: Thermoking
Serial: G0023251144REB
Comment: Battery-New Cable antenna

FCC 15 30-1000MHz



— FCC 15 Limit Line — Preview Result 1 * Data Reduction Result 1 [3]

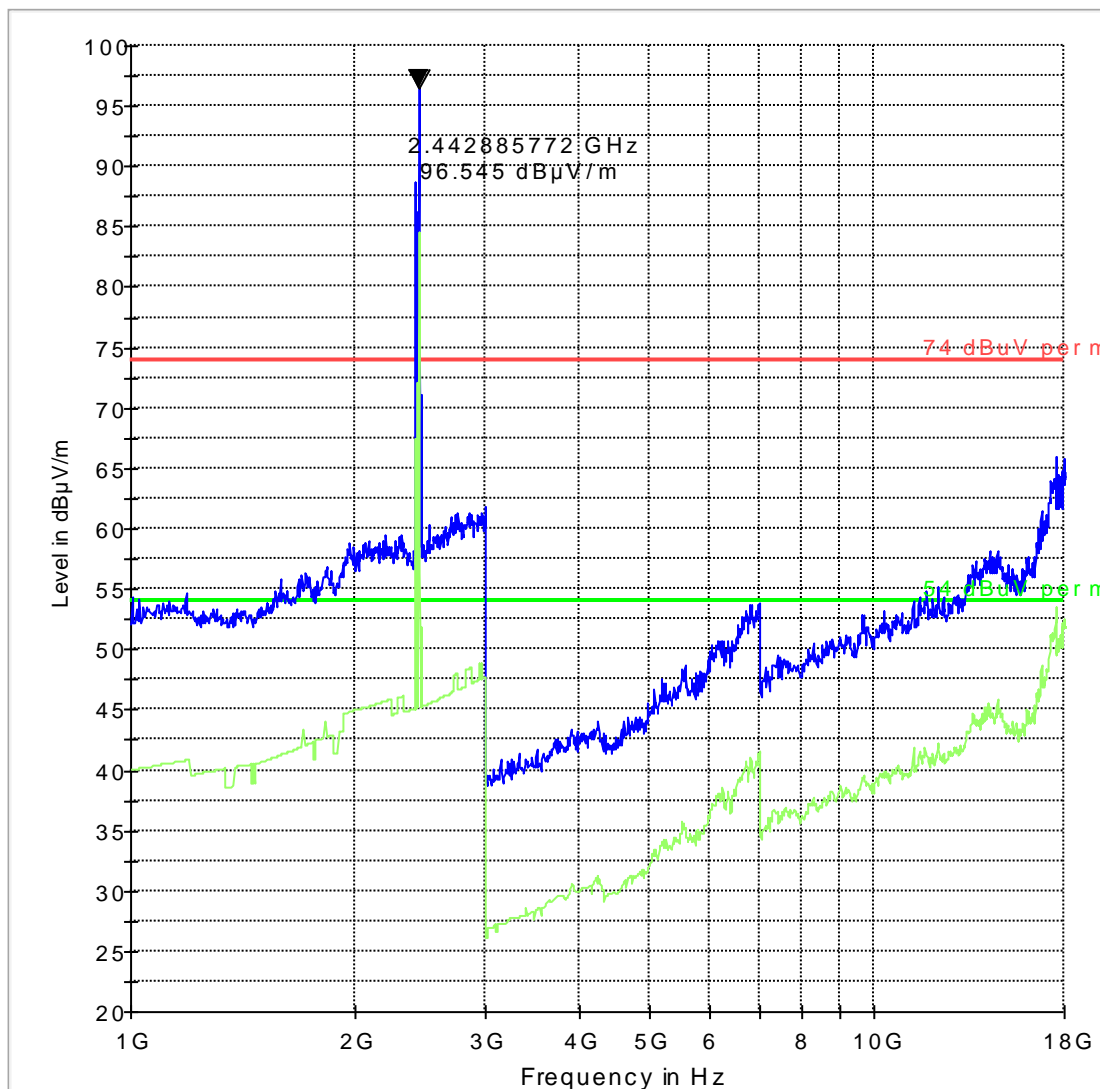


Transmitter Radiated Spurious Emission- Ch6- g-mode - 1G-18GHz

Description:

EUT Name: 1E60326G07
Manufacturer: Thermoking
Serial: G0023251144REB
Comment: Battery-New Cable antenna

FCC 15 1-18GHz



74 dBµV per m. Limit Line 54 dBµV per m. Limit Line
Preview Result 1 Preview Result 2



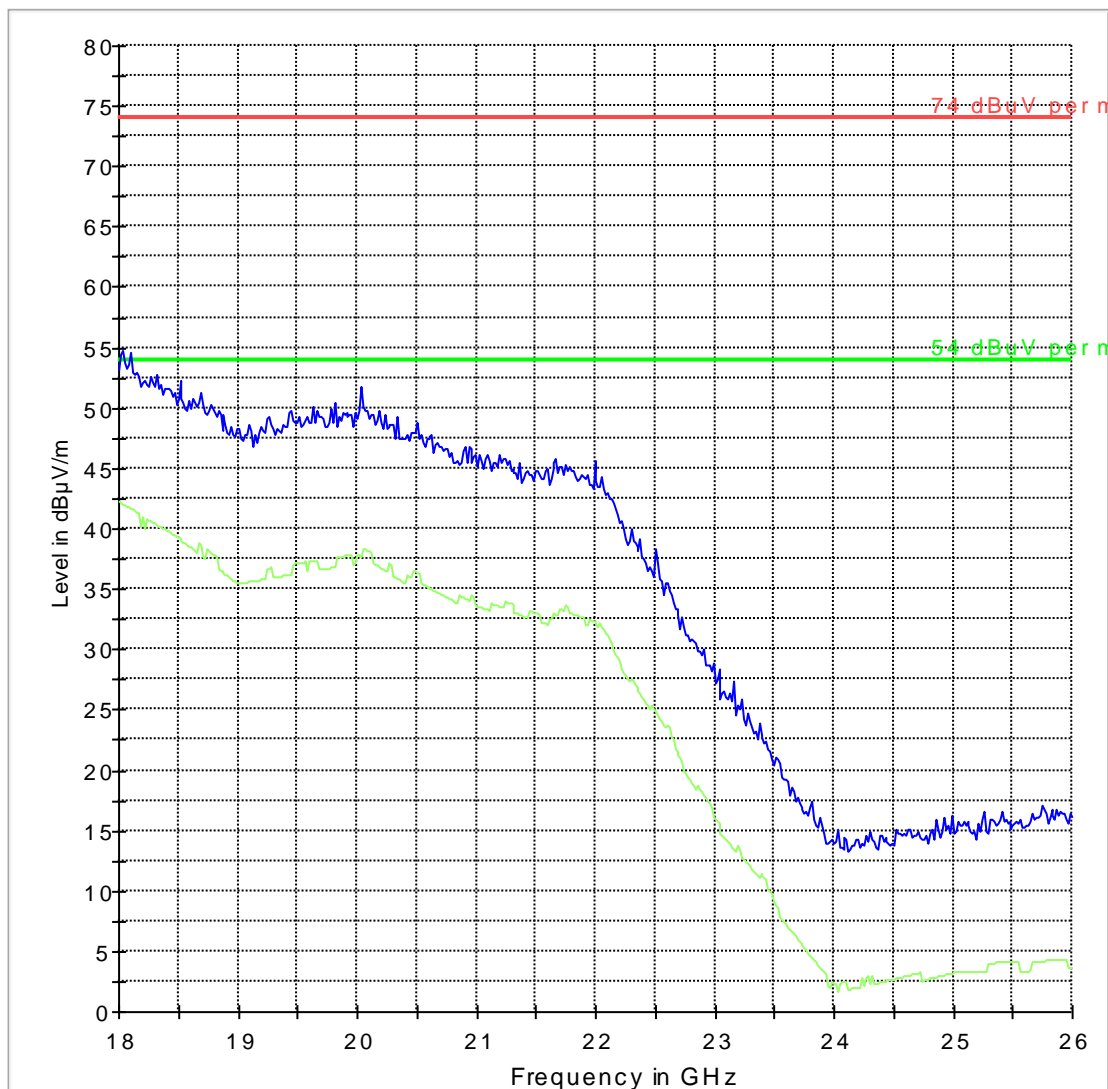
Transmitter Radiated Spurious Emission- Ch6- g-mode – 18-26GHz

Note: Worst case representation for all modes of operation in this frequency range.

Description:

EUT Name: 1E60326G07
Manufacturer: Thermoking
Serial: G0023251144REB
Comment: Battery-New Cable antenna

FCC 15 18-26GHz



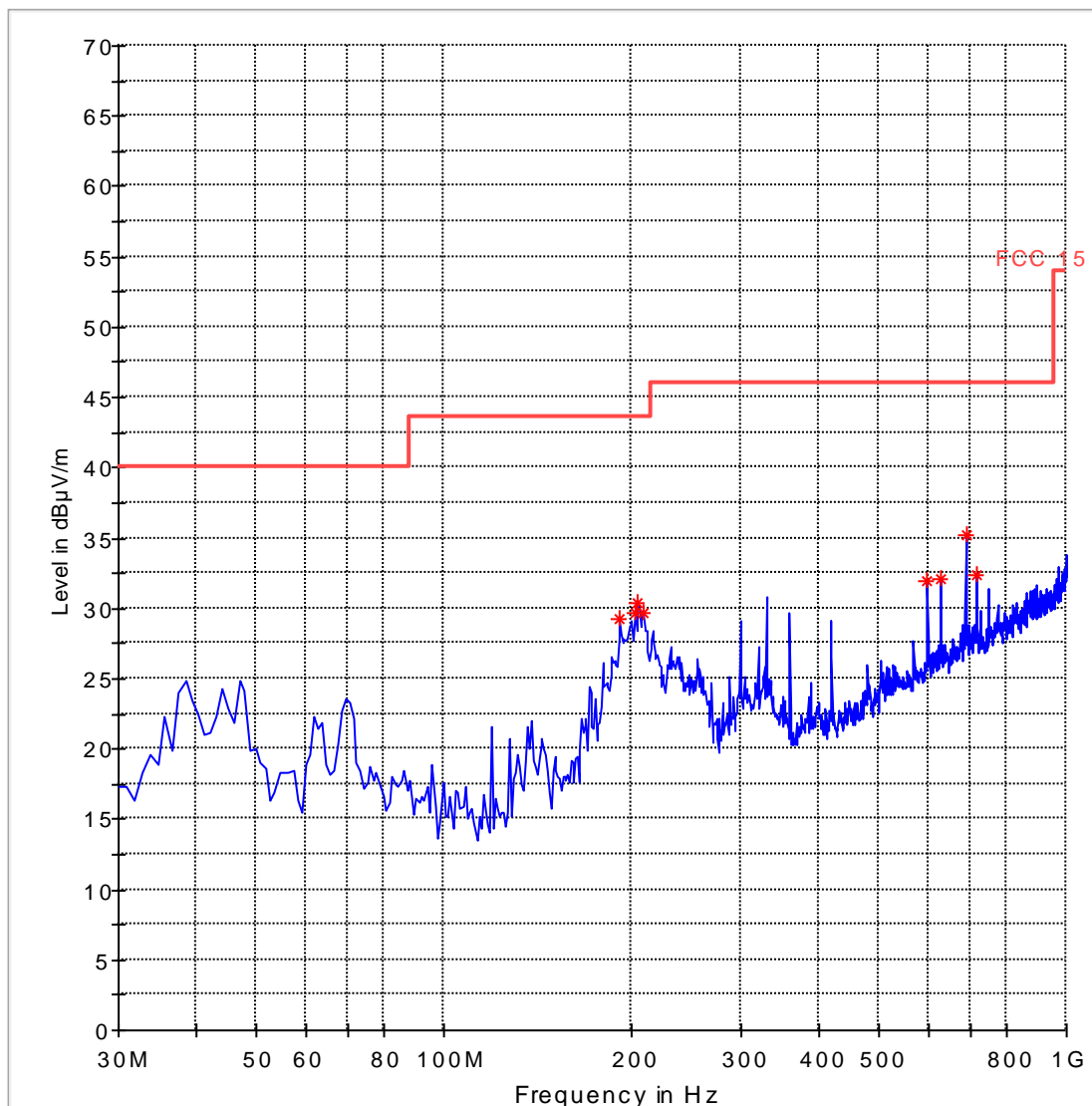
74 dBµV per m. Limit Line 54 dBµV per m. Limit Line
Preview Result 1 Preview Result 2

Transmitter Radiated Spurious Emission- Ch11- g-mode - 30M-1GHz

Description:

EUT Name: 1E60326G07
Manufacturer: Thermoking
Serial: G0023251144REB
Comment: Battery-New Cable antenna

FCC 15 30-1000MHz



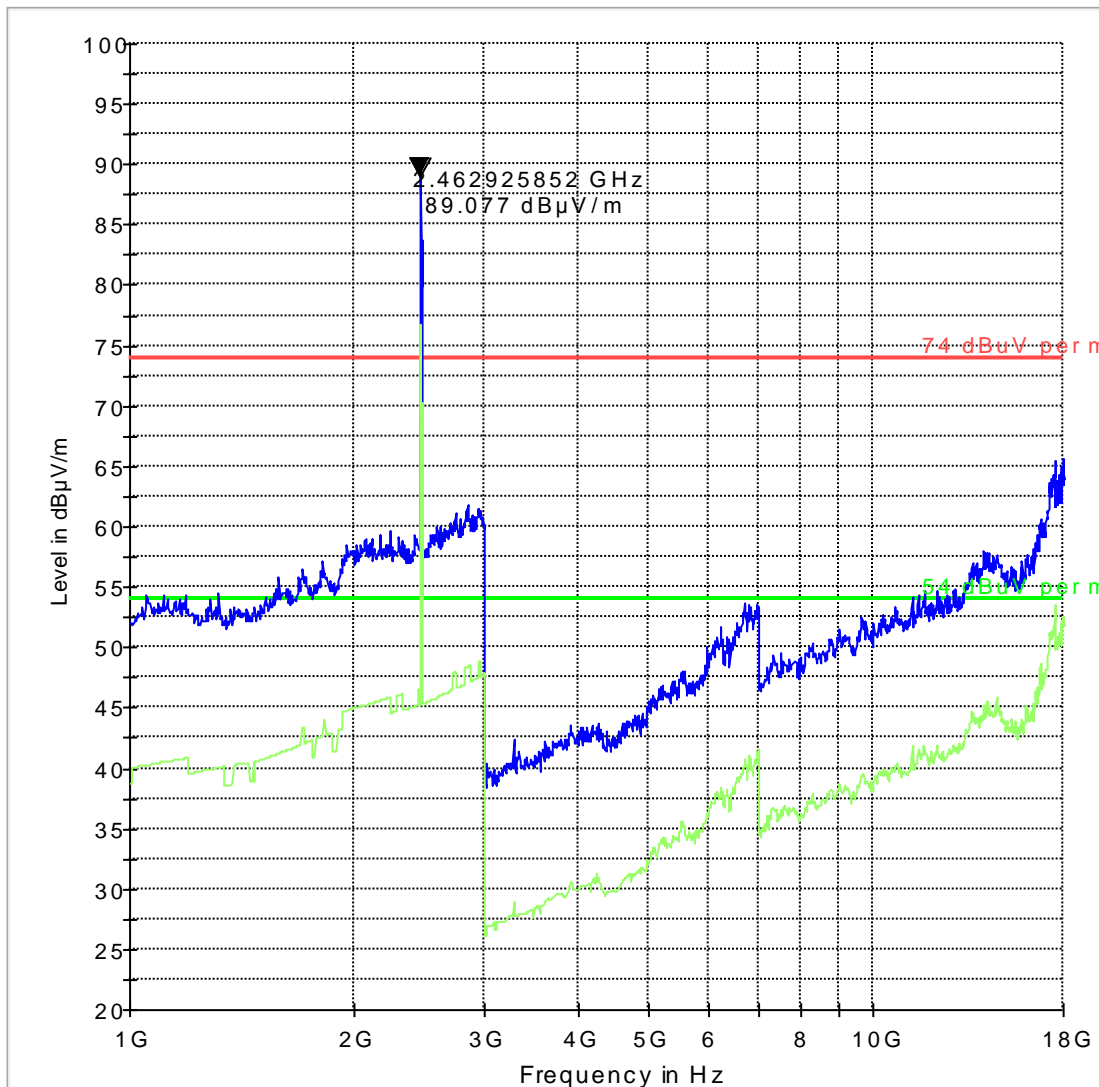
— FCC 15 Limit Line — Preview Result 1 * Data Reduction Result 1 [3]

Transmitter Radiated Spurious Emission- Ch11- g-mode - 1G-18GHz

Description:

EUT Name: 1E60326G07
Manufacturer: Thermoking
Serial: G0023251144REB
Comment: Battery-New Cable antenna

FCC 15 1-18GHz



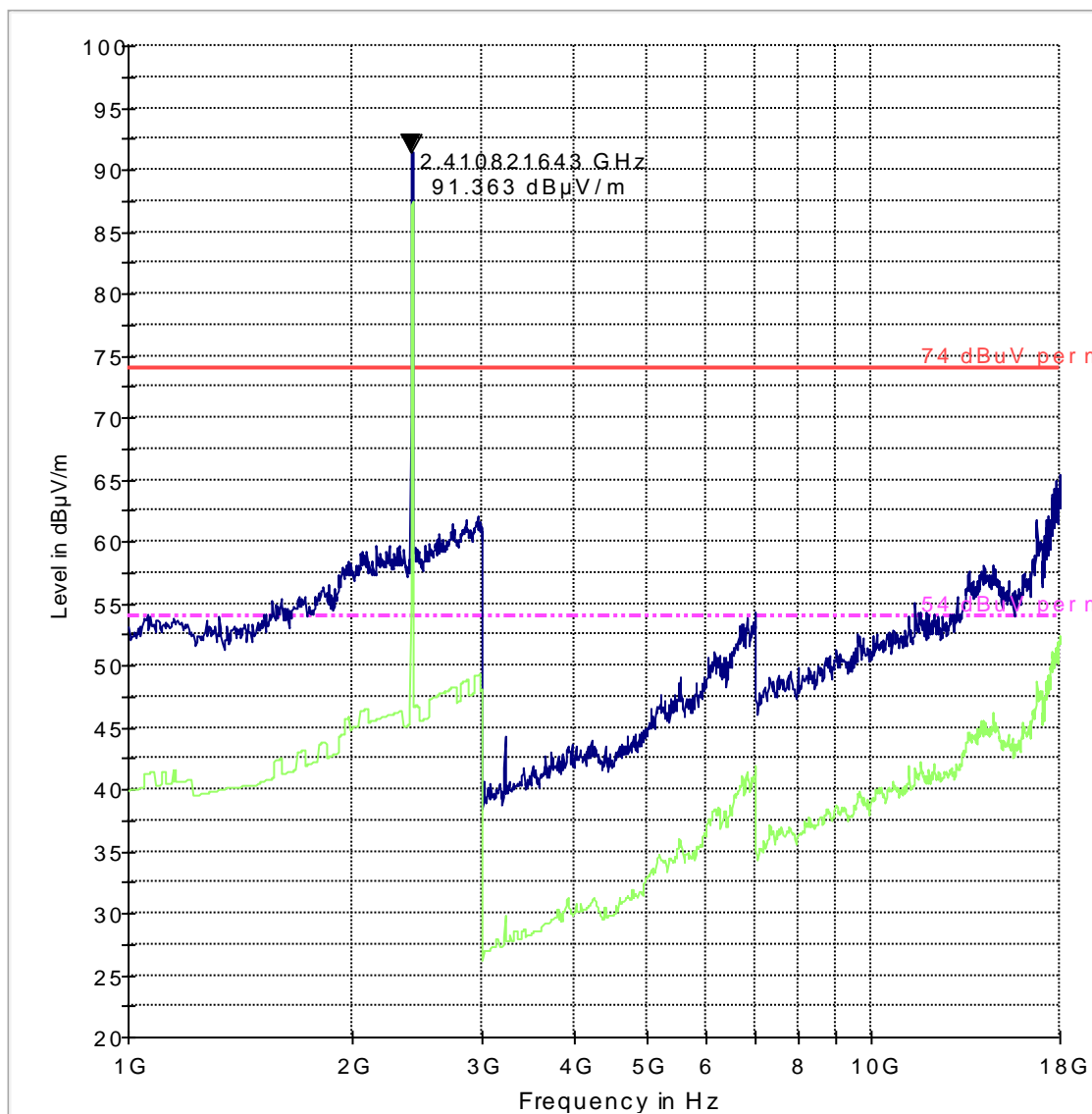
— 74 dBµV per m. Limit Line — 54 dBµV per m. Limit Line
— Preview Result 1 — Preview Result 2



Transmitter Radiated Spurious Emission- Ch1- n-mode - 1G-18GHz

EUT Name: 1E60326G07
Manufacturer: Thermoking
Serial: G0023281144REB
Comment: Car battery

FCC 15 1-18GHz

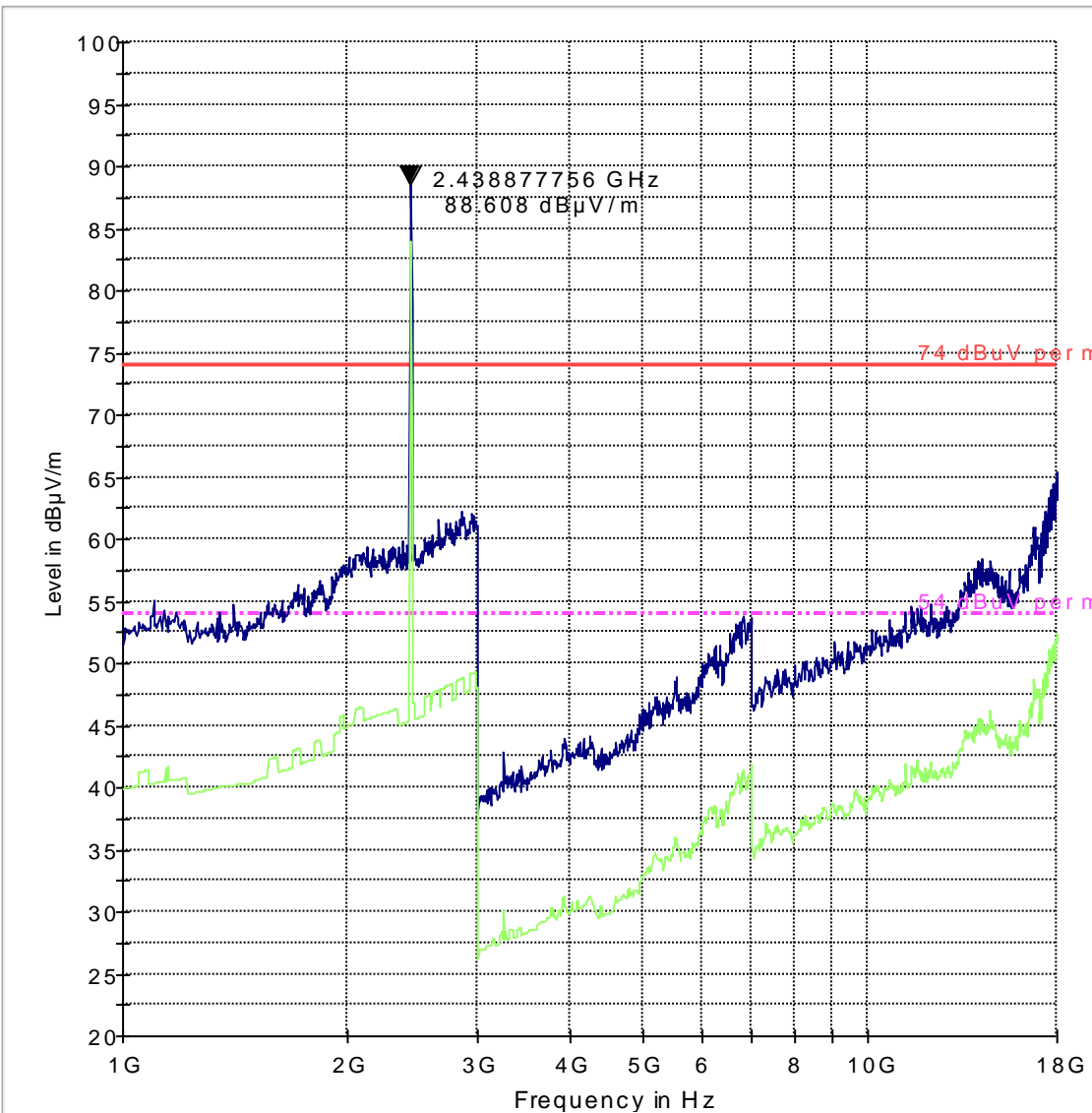


— 74 dBuV per m - - - - 54 dBuV per m
— Preview Result 1-PK+ — Preview Result 2-AVG

Transmitter Radiated Spurious Emission- Ch6- n-mode - 1G-18GHz

EUT Name: 1E60326G07
Manufacturer: Thermoking
Serial: G0023281144REB
Comment: Car battery

FCC 15 1-18GHz



— 74 dBuV per m - - - - 54 dBuV per m
— Preview Result 1-PK+ — Preview Result 2-AVG

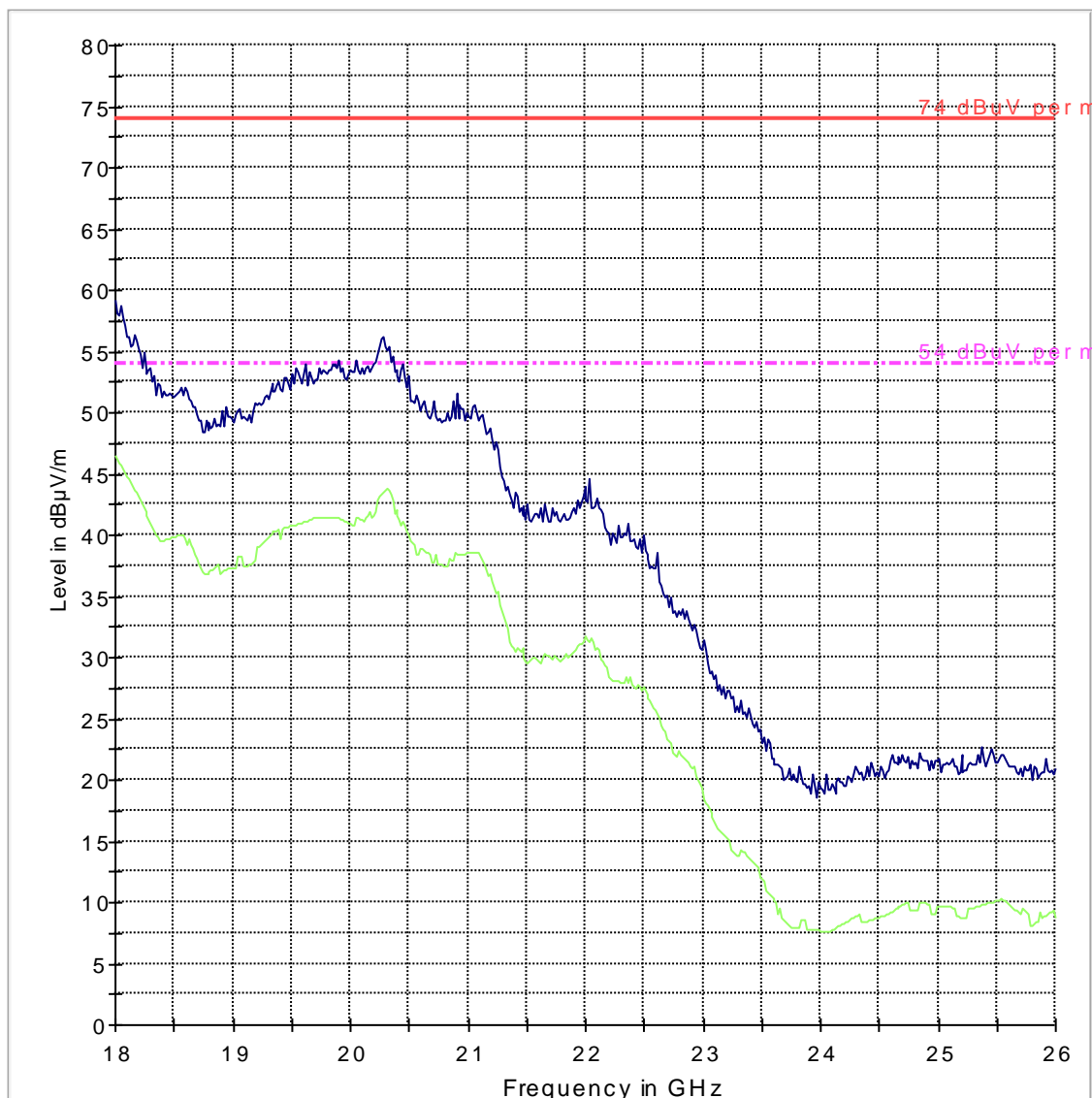


Transmitter Radiated Spurious Emission- Ch6- n-mode – 18-26GHz

Note: Worst case representation for all modes of operation in this frequency range.

EUT Name: 1E60326G07
Manufacturer: Thermoking
Serial: G0023281144REB
Comment: Car battery

FCC 15 18-26GHz



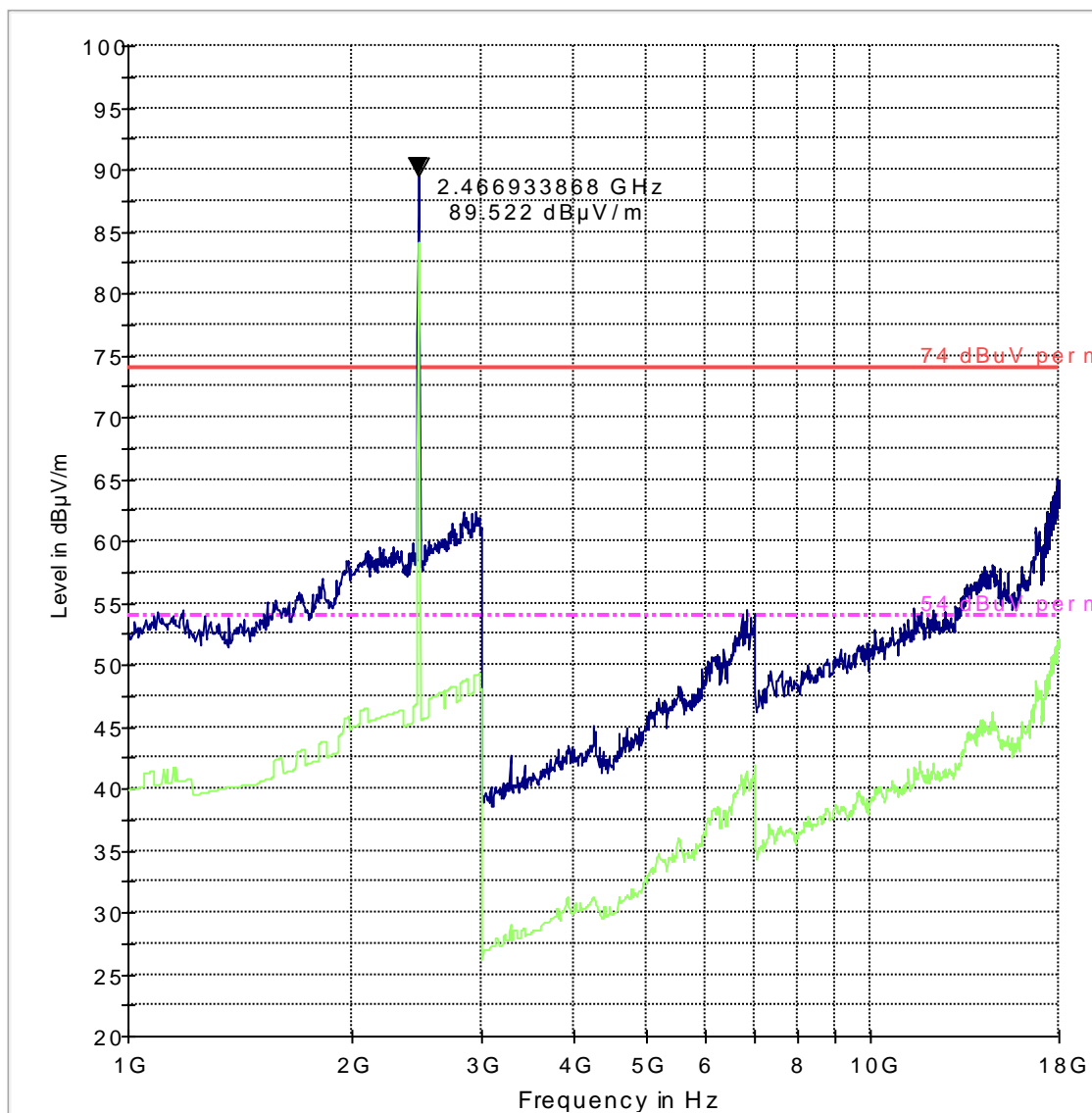
— 74 dBµV per m - - - - 54 dBµV per m
— Preview Result 1-PK+ — Preview Result 2-AVG



Transmitter Radiated Spurious Emission- Ch11- n-mode - 1G-18GHz

EUT Name: 1E60326G07
Manufacturer: Thermoking
Serial: G0023281144REB
Comment: Car battery

FCC 15 1-18GHz

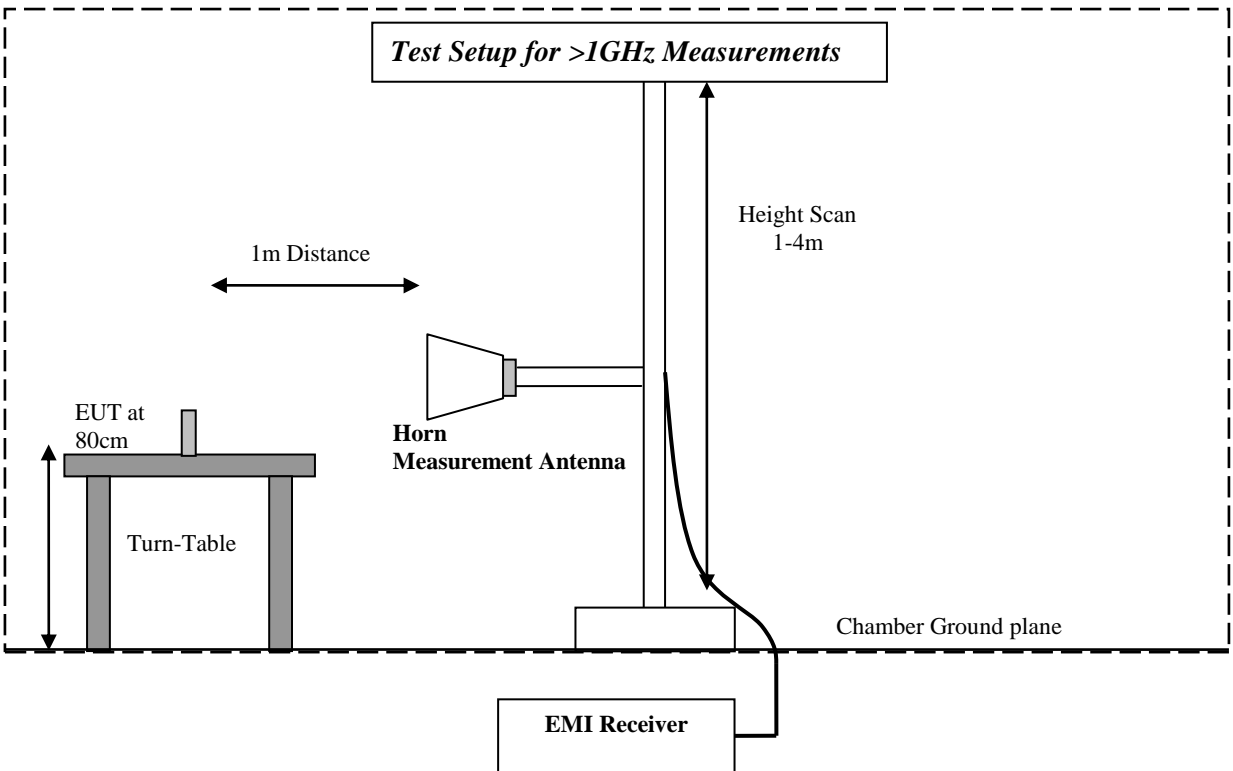
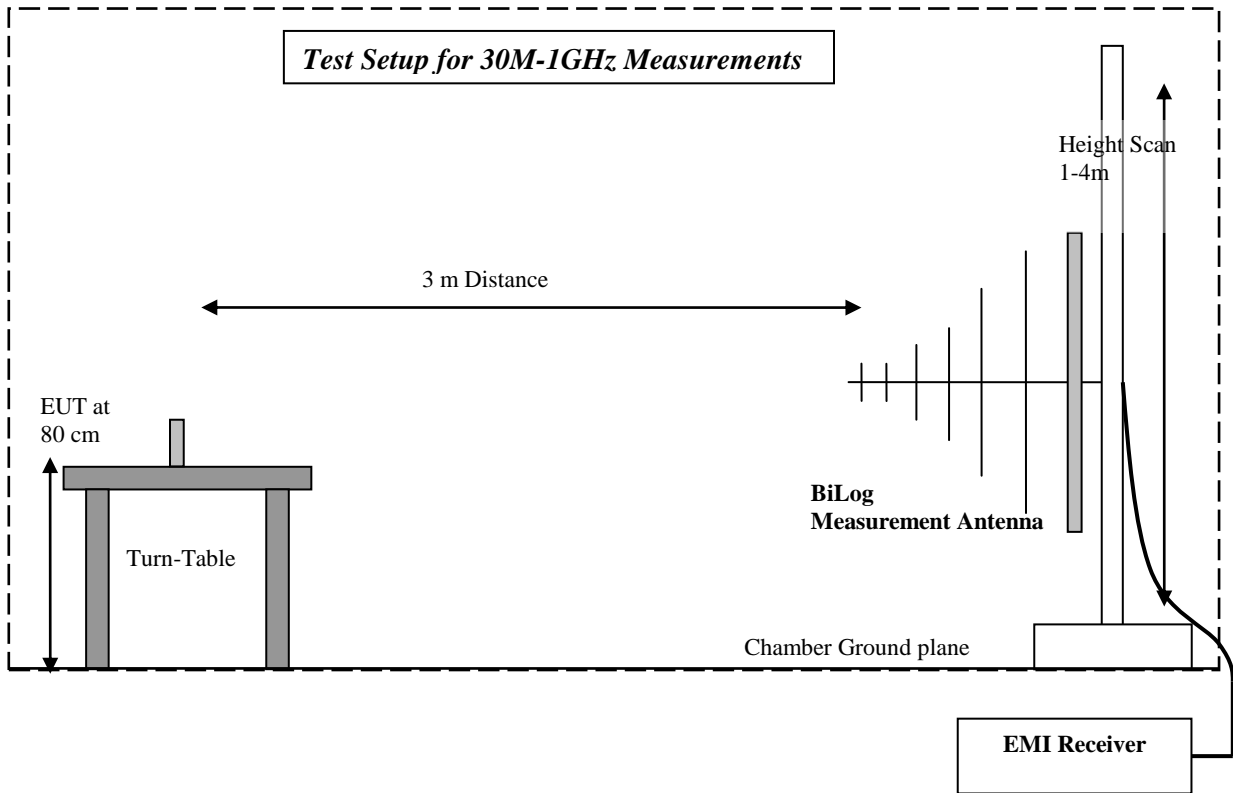


— 74 dBuV per m - - - - 54 dBuV per m
— Preview Result 1-PK+ — Preview Result 2-AVG

7 Test Equipment and Ancillaries used for tests

Instrument/Ancillary	Model	Manufacturer	Serial No.	Cal Date	Cal Interval
EMI Receiver/Analyzer	ESIB 40	Rohde & Schwarz	100107	May 2011	2 Years
Spectrum Analyzer	FSU	Rohde & Schwarz	200302	May 2011	2 Years
Loop Antenna	6512	EMCO	00049838	Aug 2011	3 years
Biconilog Antenna	3141	EMCO	0005-1186	Apr 2012	3 years
Horn Antenna (1-18GHz)	3115	ETS	00035111	Apr 2012	3 years
Horn Antenna (1-18GHz)	3115	ETS	00035114	Mar 2012	3 years
Horn Antenna (18-40GHz)	3116	ETS	00070497	Aug 2011	3 years
Communication Antenna	IBP5-900/1940	Kathrein	n/a	n/a	n/a
High Pass Filter	5HC2700	Trilithic Inc.	9926013	Part of system calibration	
High Pass Filter	4HC1600	Trilithic Inc.	9922307	Part of system calibration	
6GHz High Pass Filter	HPM50106	Microtronics	001	Part of system calibration	
Pre-Amplifier	JS4-00102600	Miteq	00616	Part of system calibration	
LISN	50-25-2-08	FCC	08014	Jan 2012	1 year
Power Smart Sensor	R&S	NRP-Z81	100161	May 2011	2 Years
DC Power Supply	E3610A	Hewlett Packard	KR83021224	n/a	n/a
Multimeter	MM200	Klein	N/A	Apr 2011	2 Years
Temp Hum Logger	TM320	Dickson	03280063	Feb 2012	1 Year
Temp Hum Logger	TM325	Dickson	5285354	Feb 2012	1 Year

8 **Block Diagrams**





9 Revision History

Date	Report Name	Changes to report	Report prepared by
2012-04-11	EMC_TRANE_002_12001_DTS	First Version	D.Lang
2012-04-19	EMC_TRANE_002_12001_DTS_Rev1	Added reference to measurement method: Sec 6.1, Page 9.	D Lang