FCC/IC Test Report

FOR:

Model Number: ZB24TM-Z2701

Wireless Transceiver Module

FCC ID: V24271

47 CFR Part 15.247 for DTS Systems

TEST REPORT #: EMC_CET10_137_12001_ZB24TM_FCC15.247_Rev2
DATE: 2012-09-21

FCC listed
A2LA Accredited

IC recognized #
3462B-1

***CETECOM* Inc.**
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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 no deviations were ascertained during the course of the tests performed.**

Company	Description	Model #
NEC Engineering, Ltd	Wireless Transceiver Module	ZB24TM-Z2701

Responsible for Testing Laboratory:

Date	Section	Name	Signature
2012-09-21	Compliance	Sajay Jose (Lab Manager)	

Responsible for the Report:

Date	Section	Name	Signature
2012-09-21	Compliance	Calvin Lee (EMC Engineer)	Calvin Lee Digitally signed by Calvin Lee DN: cn=Calvin Lee, c=US, o=CETECOM Inc, ou=Compliance, email=calvin.lee@cetecomusa.com Date: 2012.09.21 13:37:06 -07'00'

The test results of this test report relate exclusively to the test item specified in Section3.
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 Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
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Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
Test Lab Manager:	Sajay Jose
Test Engineer:	Calvin Lee

2.2 Identification of the Client

Applicant's Name:	NEC Engineering, Ltd
Street Address:	1753, Shimonumabe, Nakahar-ku
City/Zip Code	Kawasaki-shi, Kanagawa
Country	JAPAN
Contact Person:	Noriko Oki
Phone No.	+81-44-455-8728
Fax No.	+81-44-455-8727
e-mail:	oki@sx.jp.nec.com

2.3 Identification of the Manufacturer

Manufacturer's Name:	NEC Computertechno, Ltd
Manufacturers Address:	1088-3, Ootsucyou, Koufu-shi
City/Zip Code	Yamanashi
Country	Japan

3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Model No:	ZB24TM-Z2701
HW Revision :	02
SW Revision:	006
FCC-ID:	V24271
Product Description:	Wireless Transceiver Module
Frequency Range and mode of test:	ZigBee: 2405-2480MHz
No. of channels:	16
Type(s) of Modulation:	O-QPSK
Antenna Type and Gain:	Pattern antenna. Antenna Gain for all channels = 0dBi (As reported by the manufacturer)
Max. Output Powers:	Conducted (Measured): ZigBee: 2.24 dBm (1.67mW) Radiated EIRP (Calculated): ZigBee: 2.24 dBm (1.67mW)
Rated Power Supply:	3V DC
Rated Voltage Range:	2.2V ~ 3.6V DC
Rated Operating Temperature Range:	-20ºC to 75ºC
Prototype / Production unit:	Prototype

3.2 Identification of the Equipment under Test (EUT)

EUT #	Serial Number	HW Version	SW Version	Notes/Comments
1	None (EUT labeled #9)	02	006	Radiated Sample
2	None (EUT labeled #10)	02	006	Conducted Sample

3.3 Identification of Accessory equipment

AE #	Type	Manufacturer	Model	Serial Number
1	Digital Camera Universal AC Power Adapter	Digital Concepts	CH-1010	3104

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.

This test report is to support a request for new equipment authorization under the FCC ID: **V24271**
All testing was performed on the product referred to in Section 3 as EUT.
This test report contains full radiated and conducted testing results as per

- 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.

5 Summary of Measurement Results

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§15.247(b)(4)	Antenna Gain	Nominal	802.15.4 ZigBee	■	☐	☐	☐	Complies
§15.247(e)	Power Spectral Density	Nominal	802.15.4 ZigBee	■	☐	☐	☐	Complies
§15.247(a)(1)	Carrier Frequency Separation	Nominal	802.15.4 ZigBee	☐	☐	■	☐	-
§15.247(a)(1)	Number of Hopping Channels	Nominal	802.15.4 ZigBee	☐	☐	■	☐	-
§15.247(a)(1)(iii)	Time of occupancy	Nominal	802.15.4 ZigBee	☐	☐	■	☐	-
§15.247(a)(1)	Spectrum Bandwidth	Nominal	802.15.4 ZigBee	■	☐	☐	☐	Complies
§15.247(b)(1)	Maximum Output Power	Nominal	802.15.4 ZigBee	■	☐	☐	☐	Complies
§15.247(d)	Band edge compliance-Conducted	Nominal	802.15.4 ZigBee	☐	☐	☐	■	-
§15.247(d)	Band edge compliance-Radiated	Nominal	802.15.4 ZigBee	■	☐	☐	☐	Complies
§15.247(d)	TX Spurious emissions-Conducted	Nominal	802.15.4 ZigBee	■	☐	☐	☐	Complies
§15.247(d)	TX Spurious emissions-Radiated	Nominal	802.15.4 ZigBee	■	☐	☐	☐	Complies
§15.209(a)	TX Spurious Emissions Radiated<30MHz	Nominal	802.15.4 ZigBee	■	☐	☐	☐	Complies
§15.107(a)	Conducted Emissions <30MHz	Nominal	802.15.4 ZigBee	☐	☐	■	☐	Complies

Note: NA= Not Applicable; NP= Not Performed.

1. 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 D01: Measurement Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247, Jan 2012.

6.2 Radiated Measurement Procedure

ANSI C63.4 (2009) 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 (2009) 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: ±3dB

6.3 Sample Calculations for Radiated Measurements

6.3.1 Field Strength Measurements:

Measurements from the Spectrum Analyzer/ Receiver is used to calculate the Field Strength, taking into account the following parameters:

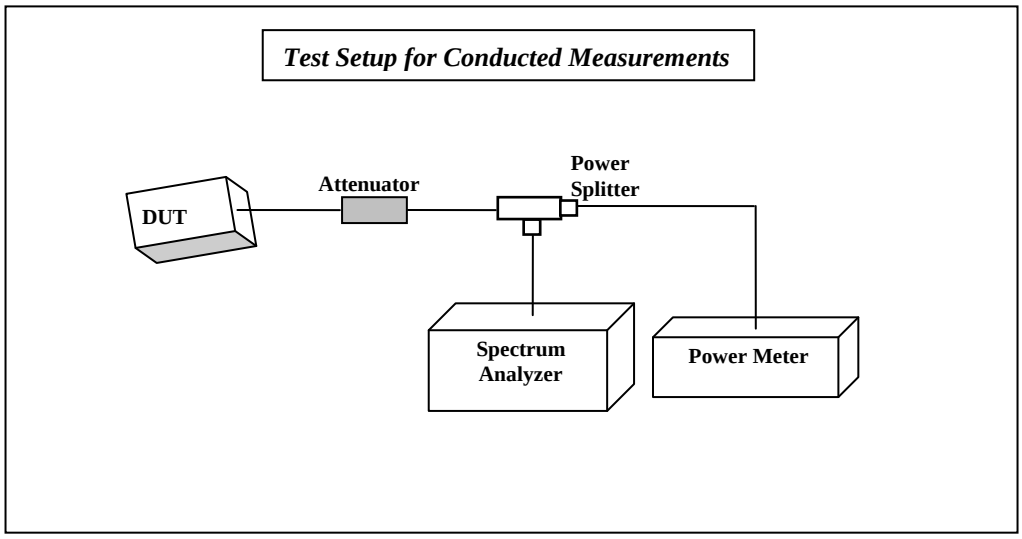
1. Measured reading in dBµV
2. Cable Loss between the receiving antenna and SA in dB and
3. Antenna Factor in dB/m

FS (dBµV/m)= Measured Value on SA (dBµV)+ Cable Loss (dB)+ Antenna Factor (dB/m)
Eg:

Frequency (MHz)	Measured SA (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Field Strength Result (dBµV/m)
1000	80.5	3.5	14	98.0

All radiated measurement plots in this report are taken from a test SW that calculates the Field Strength based on the above equation.

6.4 Conducted Measurement Procedure



1. Connect the equipment as shown in the above diagram.
2. Adjust the settings of the EUT to its maximum power at the required channel.
3. Measurements are to be performed with the EUT set to the low, middle and high channels.

Measurement uncertainty= +/-0.5dB

6.5 Fundamental Emission 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.

6.5.2 Test Conditions:

Tnom: 25°C; Vnom: 3V DC

Spectrum Analyzer settings:

RBW=5MHz, VBW=10MHz, Detector: Peak- Max Hold.
Sweep Time: Auto
Span=Zero

Reported Antenna Gain (dBi): 0dBi for all channels.

6.5.3 Test Result:

Measured Maximum Peak Conducted Output Power (dBm)			
Mode	**Frequency (MHz)**		
	2405 Channel 11	**2440 Channel 18**	**2480 Channel 26**
	Peak	Peak	Peak
802.15.4 ZigBee	2.24	1.94	1.92

Calculated Maximum Peak Radiated Output Power (dBm)			
Mode	**Frequency (MHz)**		
	2405 Channel 11	**2440 Channel 18**	**2480 Channel 26**
802.15.4 ZigBee	2.24	1.94	1.92

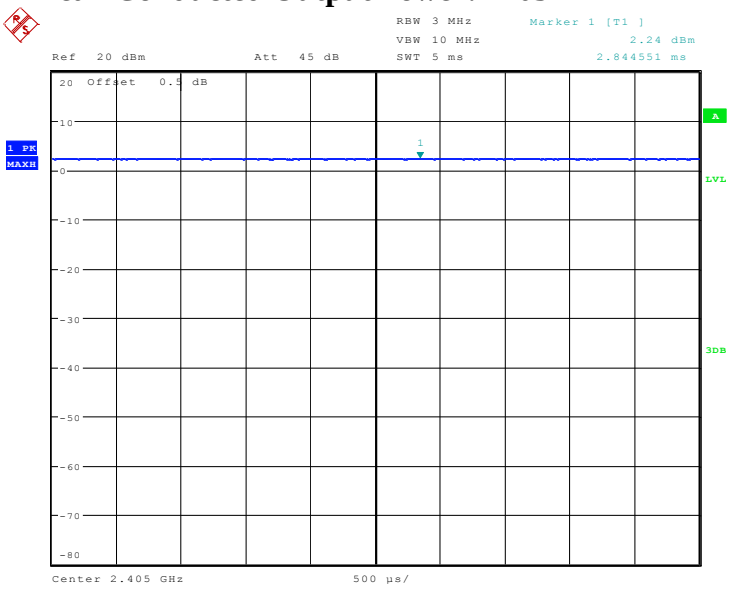
Note: Radiated EIRP is calculated as
Conducted Measurement + Antenna Gain

6.5.3.1 Measurement Result

Pass.

6.5.4 Test Data/plots:

Measured Maximum Peak Conducted Output Power: 2405 MHz



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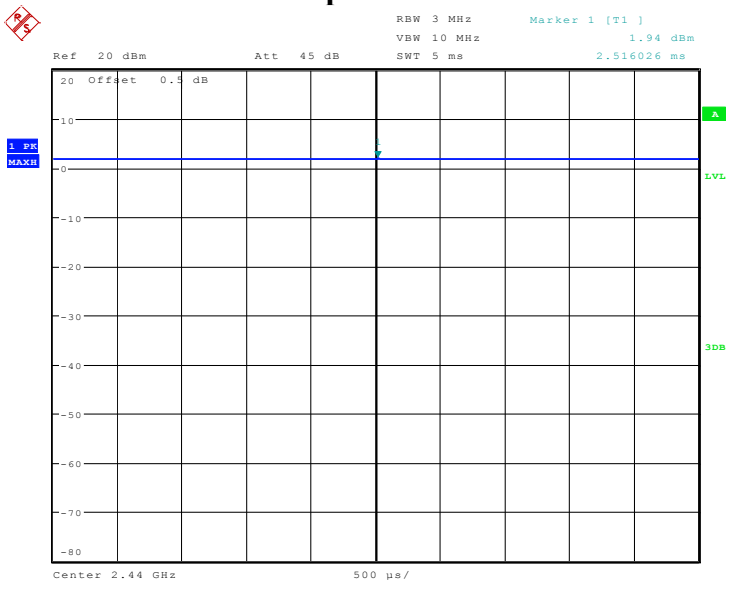
Measured Maximum Peak Conducted Output Power: 2440 MHz



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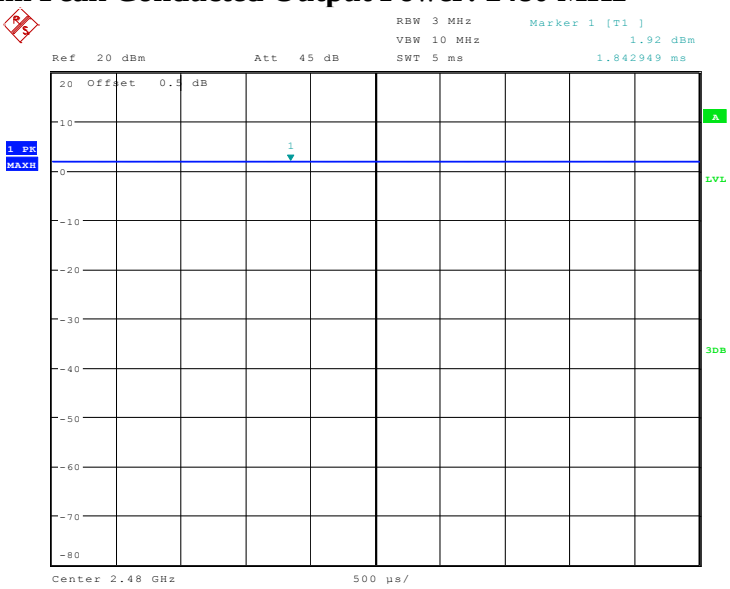
Measured Maximum Peak Conducted Output Power: 2480 MHz



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6.6 Emission Bandwidth

6.6.1 Limits:

6.6.1.1 §15.247 (a)(2)

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.

6.6.2 Test Conditions:

Tnom: 20.4°C; Vnom: 3VDC

Spectrum Analyzer settings:

RBW=10kHz, VBW=30kHz, Detector: Peak- Max hold;
Sweep Time: Auto
Span=5MHz
Measurement Uncertainty: ±100 kHz

6.6.3 Test Result:

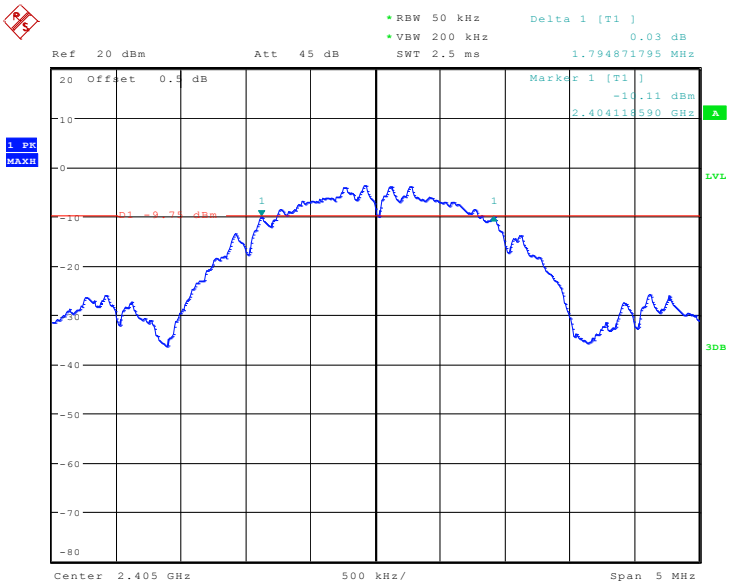
Emission Bandwidth (MHz)						
Mode	**Frequency (MHz)**					
	2405 Channel 11		**2440 Channel 18**		**2480 Channel 25**	
	6dB	**20dB/ 99%**	**6dB**	**20dB/ 99%**	**6dB**	**20dB/ 99%**
802.15.4 ZigBee	1.795	2.580	1.795	2.580	1.795	2.572

6.6.3.1 Measurement Result

Pass.

6.6.4 Test Data/plots:

6dB Bandwidth: 2405 MHz



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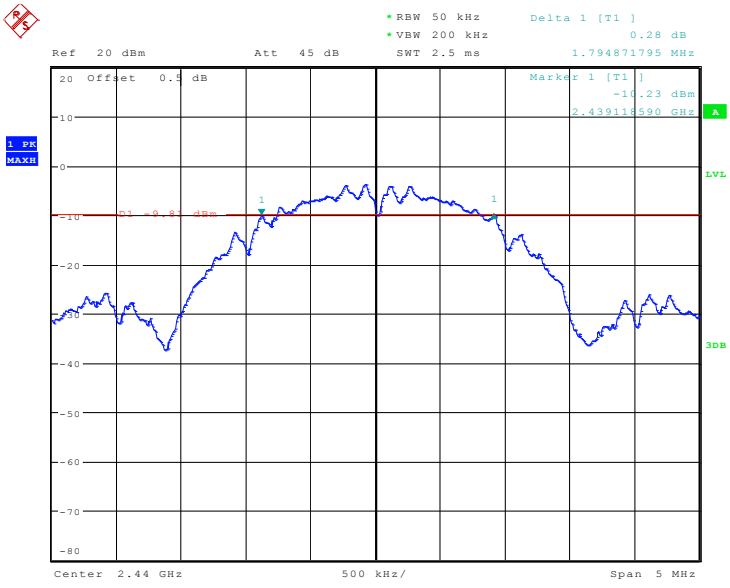
6dB Bandwidth: 2440 MHz



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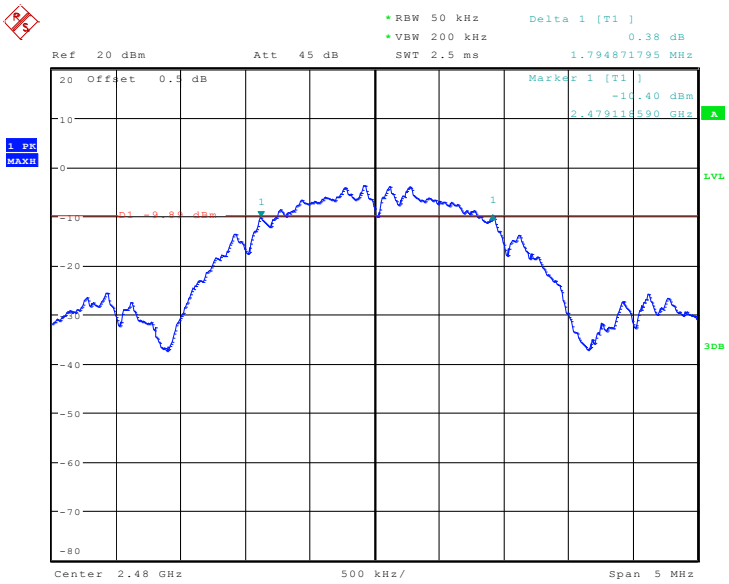
6dB Bandwidth: 2480 MHz



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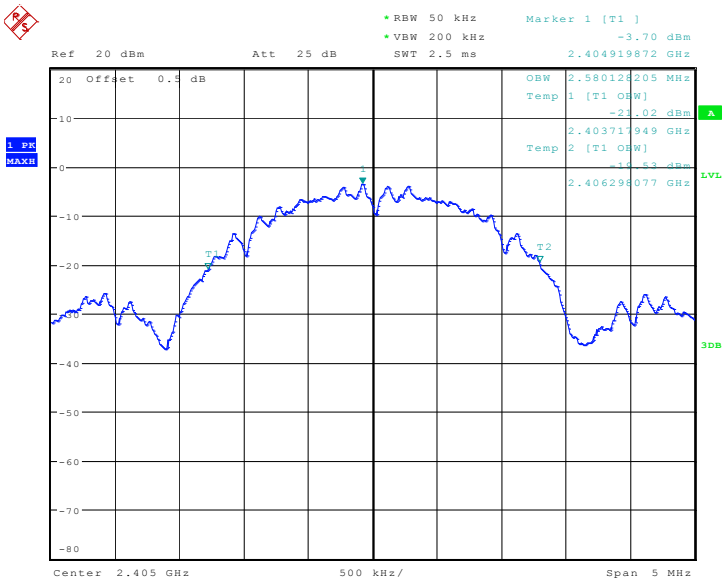
20dB Bandwidth: 2405 MHz



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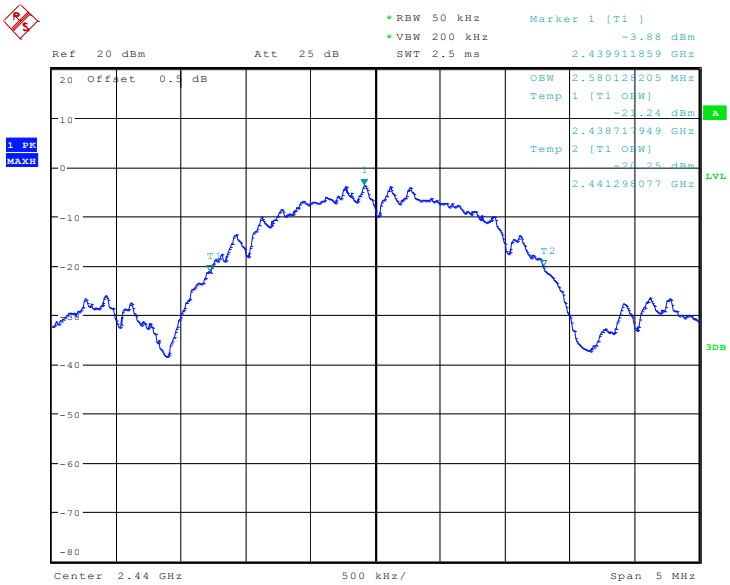
20dB Bandwidth: 2440 MHz



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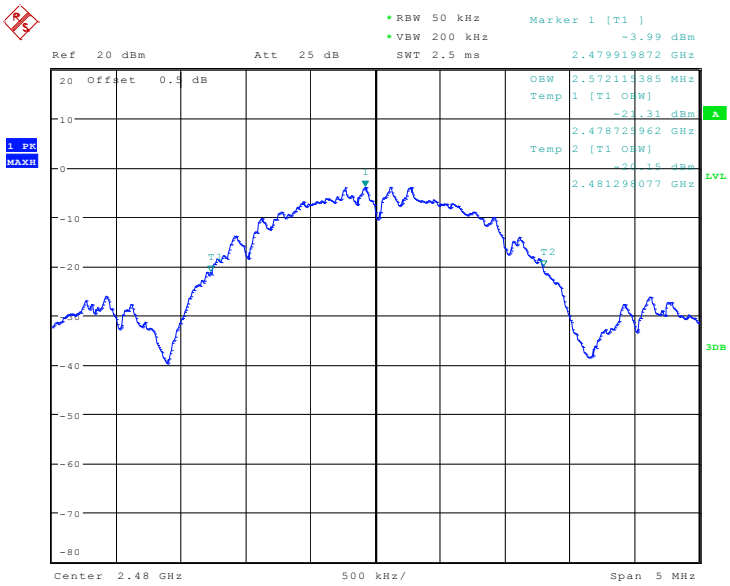
20dB Bandwidth: 2480 MHz



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6.7 Maximum Power Spectral Density Level in the Fundamental Emission

6.7.1 Limits:

6.7.1.1 § 15.247 (e)

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

6.7.2 Measurement procedure:

1. Determine the highest peak level for a sweep with RBW=100k VBW=300kHz and Span = 5-30% greater than the EBW.
2. Scale the max. observed peak power level to an equivalent level in 3 kHz by adjusting the measured power by a bandwidth correction factor (BWCF) where: BWCF = 10log (3kHz/100kHz = -15.2 dB).

6.7.3 Test results:

Measured Conducted Power Spectral Density (dBm)			
Mode	**Frequency (MHz)**		
	2405 Channel 11	**2440 Channel 18**	**2480 Channel 25**
802.15.4 ZigBee	-2.21	-2.31	-2.34
Measurement Uncertainty: ±0.5dB			

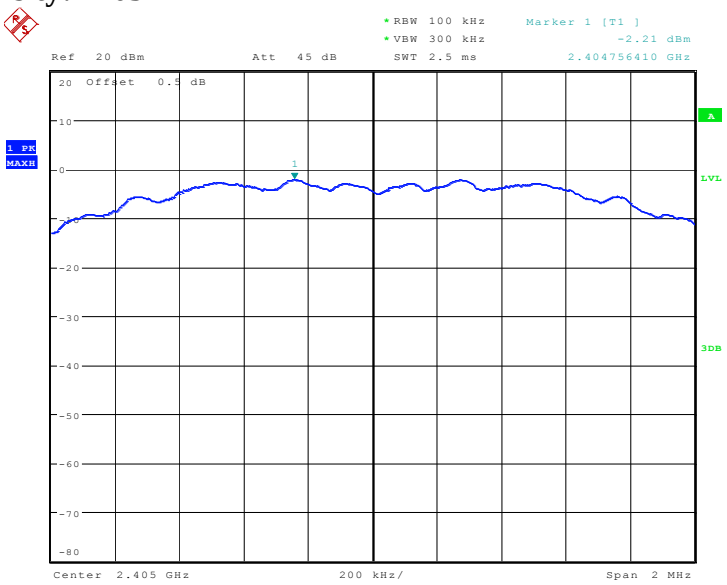
Corrected Power Spectral Density (dBm)			
Mode	**Frequency (MHz)**		
	2405 Channel 11	**2440 Channel 18**	**2480 Channel 25**
802.15.4 ZigBee	-17.41	-17.51	-17.54
Measurement Uncertainty: ±0.5dB			

6.7.3.1 Measurement Result

Pass.

6.7.4 Test Data/plots:

Power Spectral Density: 2405 MHz



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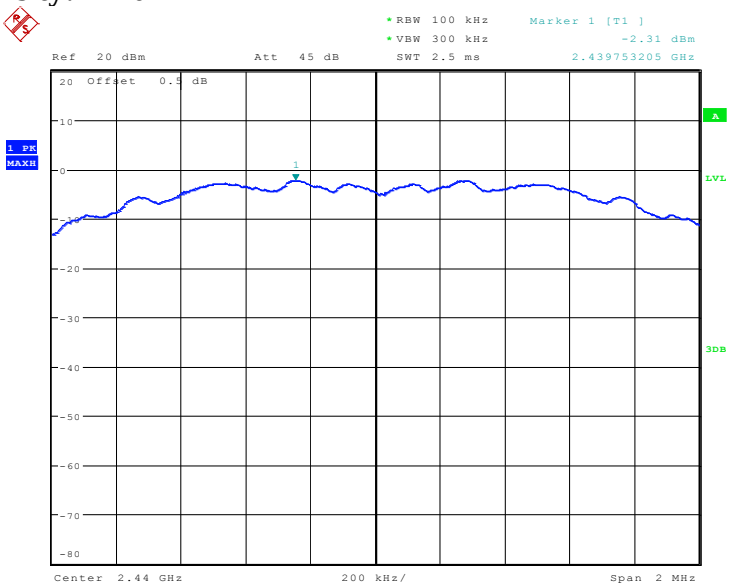
Power Spectral Density: 2440 MHz



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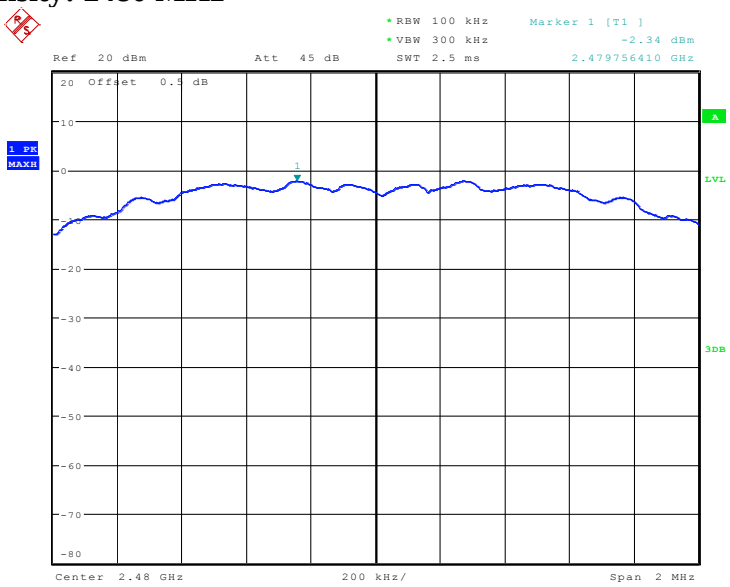
Power Spectral Density: 2480 MHz



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6.8 Unwanted Emissions into Non-Restricted Frequency Bands- Conducted

6.8.1 Reference and Limits:

6.8.1.1 § 15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced 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.
30dBm for the transmitter.
-20dBc in the frequency range 30MHz- 25GHz.

6.8.2 Test Conditions:

Spectrum Analyzer settings:
RBW=100kHz, VBW=300kHz, Detector: Peak- Max hold;
Sweep Time: Auto
Span=Full range

6.8.3 Test data/ plots:

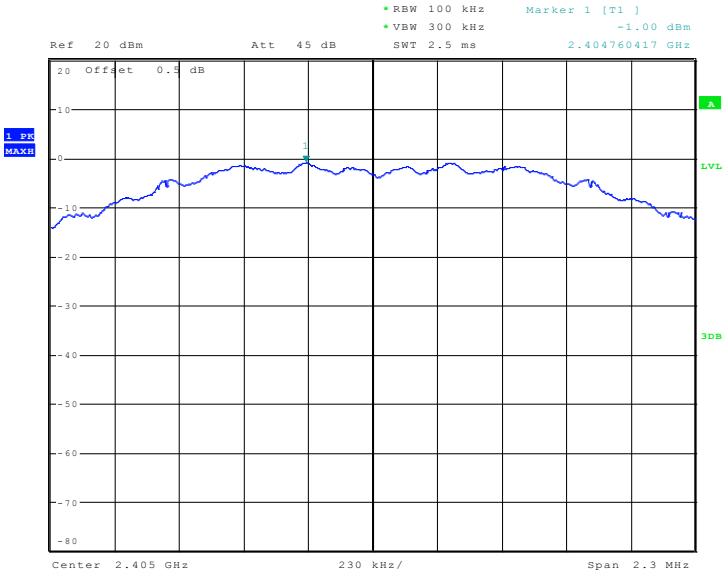
Conducted Spurious Emissions			
Channel	**Frequency (MHz)**	**Amplitude (dBm)**	**Limits**
		802.15.4 ZigBee	
Low	**2405**	-3.62	30dBm
	Spurious	All other peaks >20dB below limit	-20dBc
Mid	**2440**	-3.65	30 dBm
	Spurious	All other peaks >20dB below limit	-20dBc
High	**2480**	-3.85	30 dBm
	Spurious	All other peaks >20dB below limit	-20dBc
Measurement Uncertainty: ±1.0 dB			

6.8.3.1 Measurement Result

Pass.

6.8.4 Test data/ plots:

Conducted Spurious Emission: 2405 MHz
Reference Level Measurement



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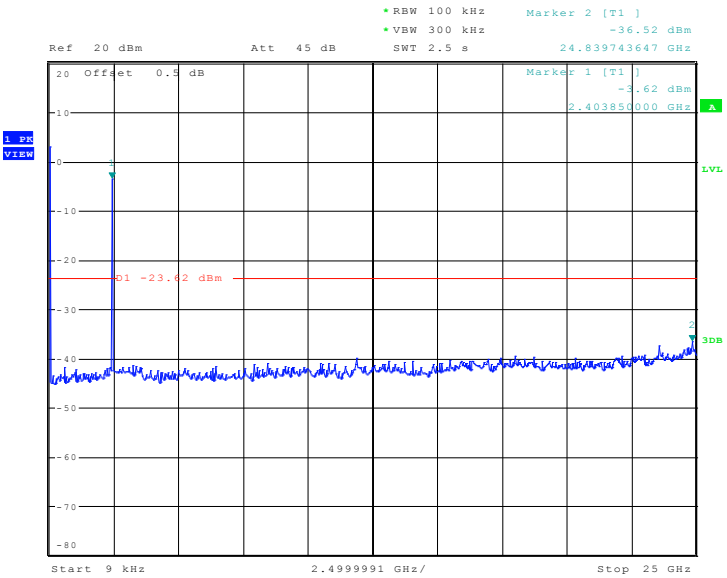
Unwanted Emissions Measurement



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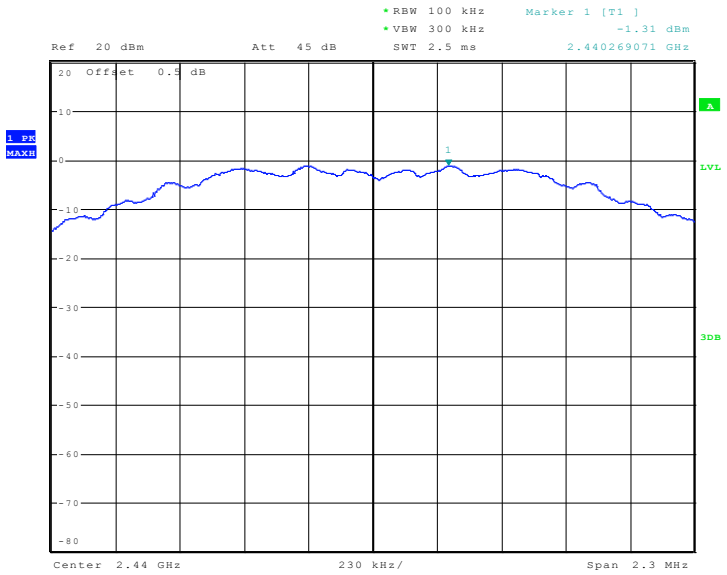
Conducted Spurious Emission: 2440 MHz
Reference Level Measurement



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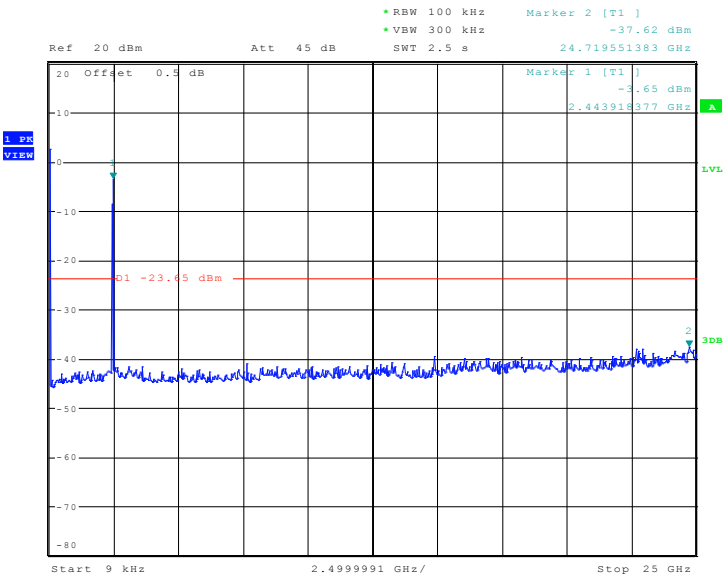
Unwanted Emissions Measurement



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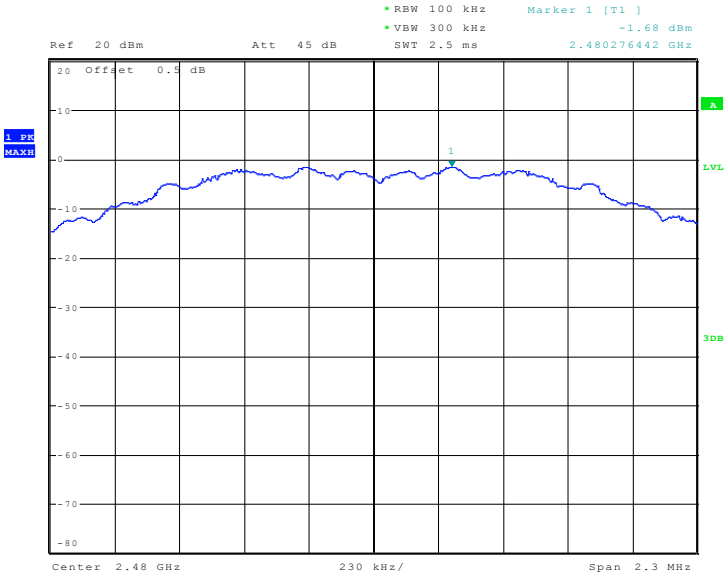
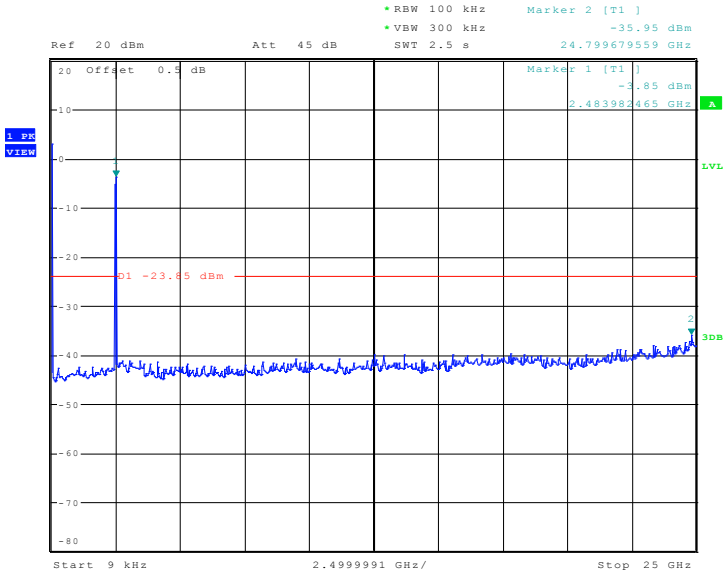
Conducted Spurious Emission: 2480 MHz
Reference Level Measurement



Date: 13.JUN.2012 11:24:00

Unwanted Emissions Measurement



Date: 13.JUN.2012 11:25:47

6.9 Unwanted Emissions into Restricted Frequency Bands- Radiated

6.9.1 Limits: §15.247/15.205

15.247 (d) Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

15.205 (a) 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			

15.209 (a) Emission Limits:

The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (m)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100**	3
88–216	150**	3
216–960	200**	3
Above 960	500	3

6.9.2 Measurement Procedure:

Peak measurements are made using a peak detector and RBW=1MHz.
*PEAK LIMIT= 74dBµV/m

Average measurements performed using a peak detector and according to video averaging procedure with RBW=1MHz and VBW=10Hz.
*AVG. LIMIT= 54dBµV/m

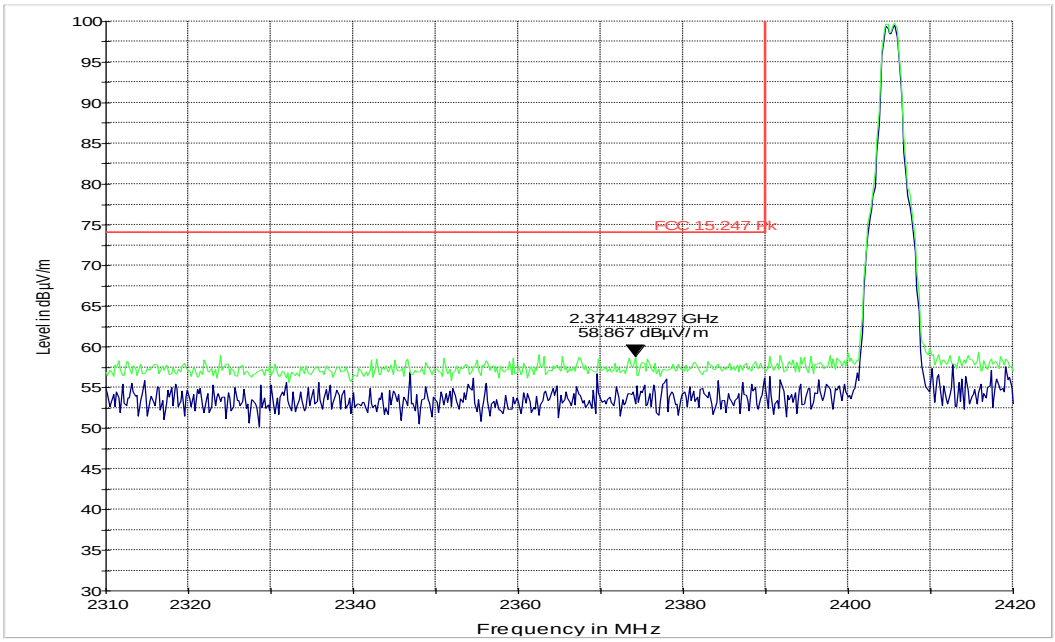
Measurement Uncertainty: ±3.0dB

6.9.2.1 Measurement Result

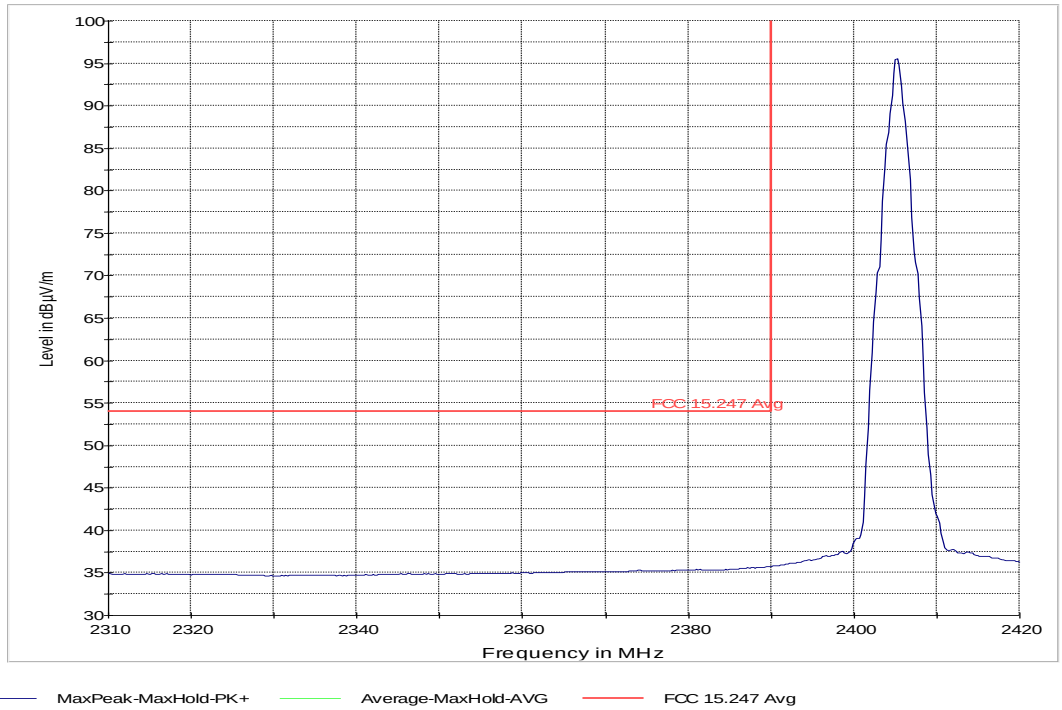
Pass.

6.9.3 Test Data/plots:

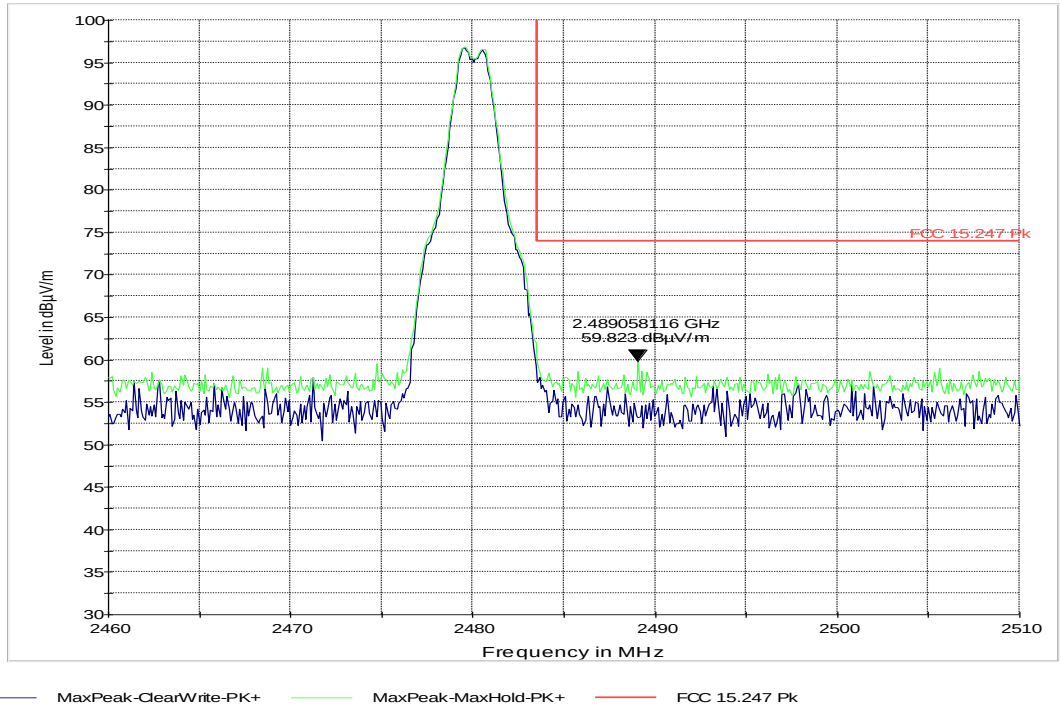
Lower band edge peak – Zigbee mode: 2405 MHz



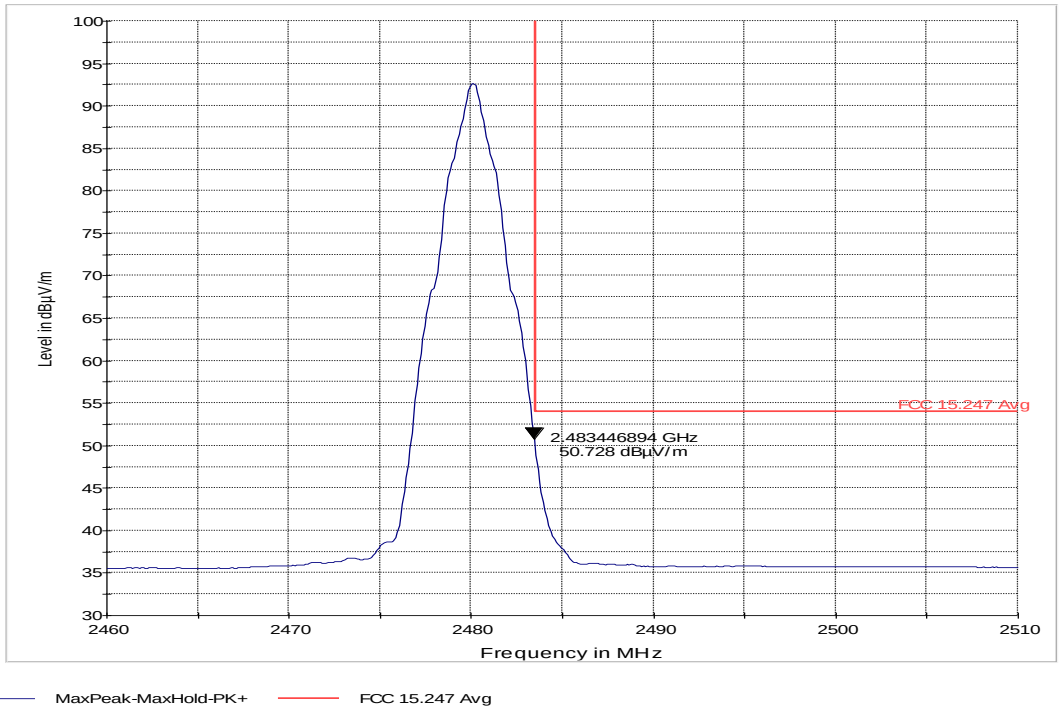
Lower band edge average –Zigbee mode: 2405 MHz



Higher band edge peak –Zigbee mode: 2480 MHz



Higher band edge average-Zigbee mode: 2480 MHz



6.10 Transmitter Spurious Emissions- Radiated

6.10.1 Limits:

§15.247/15.205

Frequency of emission (MHz)	Field strength (µV/m)	Measurement Distance (m)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30

Frequency of emission (MHz)	Field strength (µV/m)
30–88	100 (40dBµV/m)
88–216	150 (43.5 dBµV/m)
216–960	200 (46 dBµV/m)
Above 960	500 (54 dBµV/m)

6.10.2 Test Result:

Test mode: *Modulation:* Zigbee Mode

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.

Measurement Uncertainty: ±3.0dB

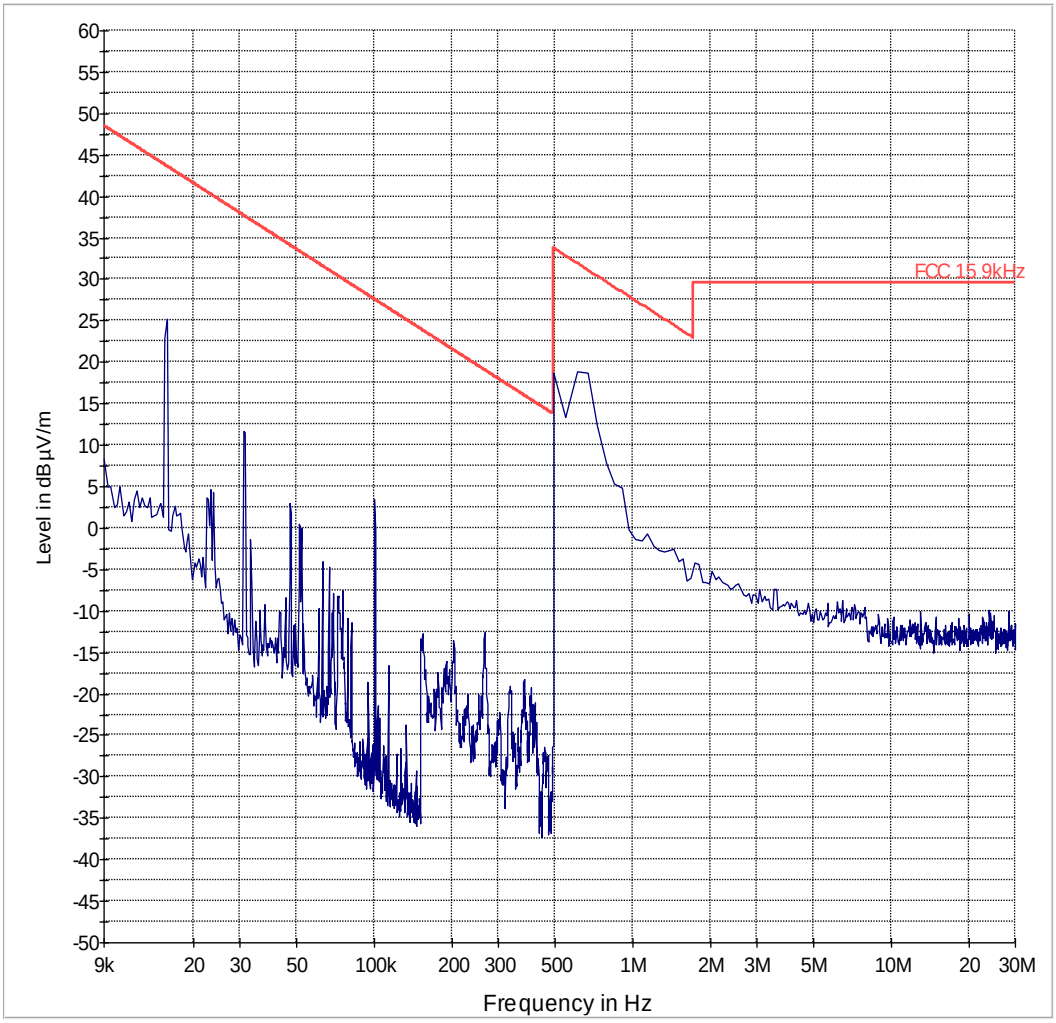
6.10.2.1 Measurement Result

Pass.

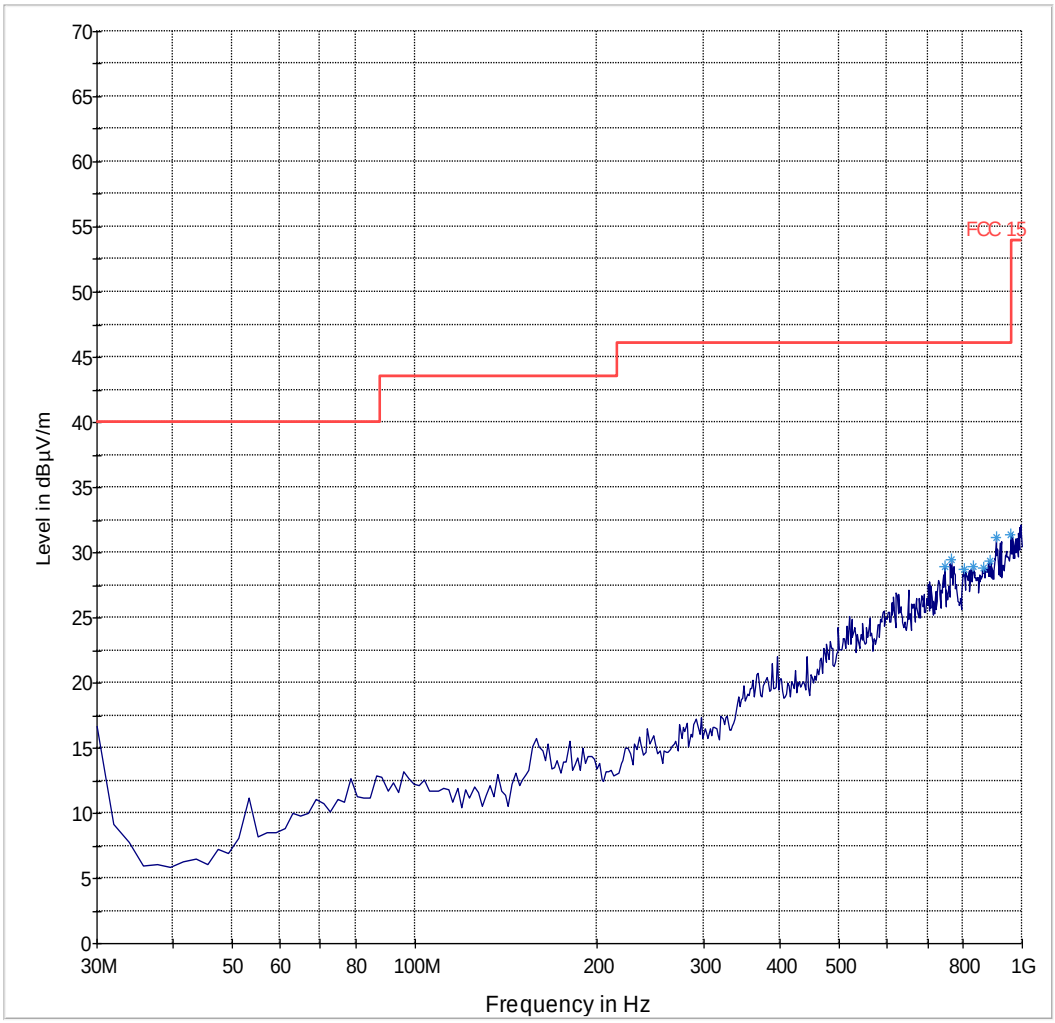
6.10.3 Test data/ plots:

Transmitter Radiated Spurious Emission:<30MHz

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

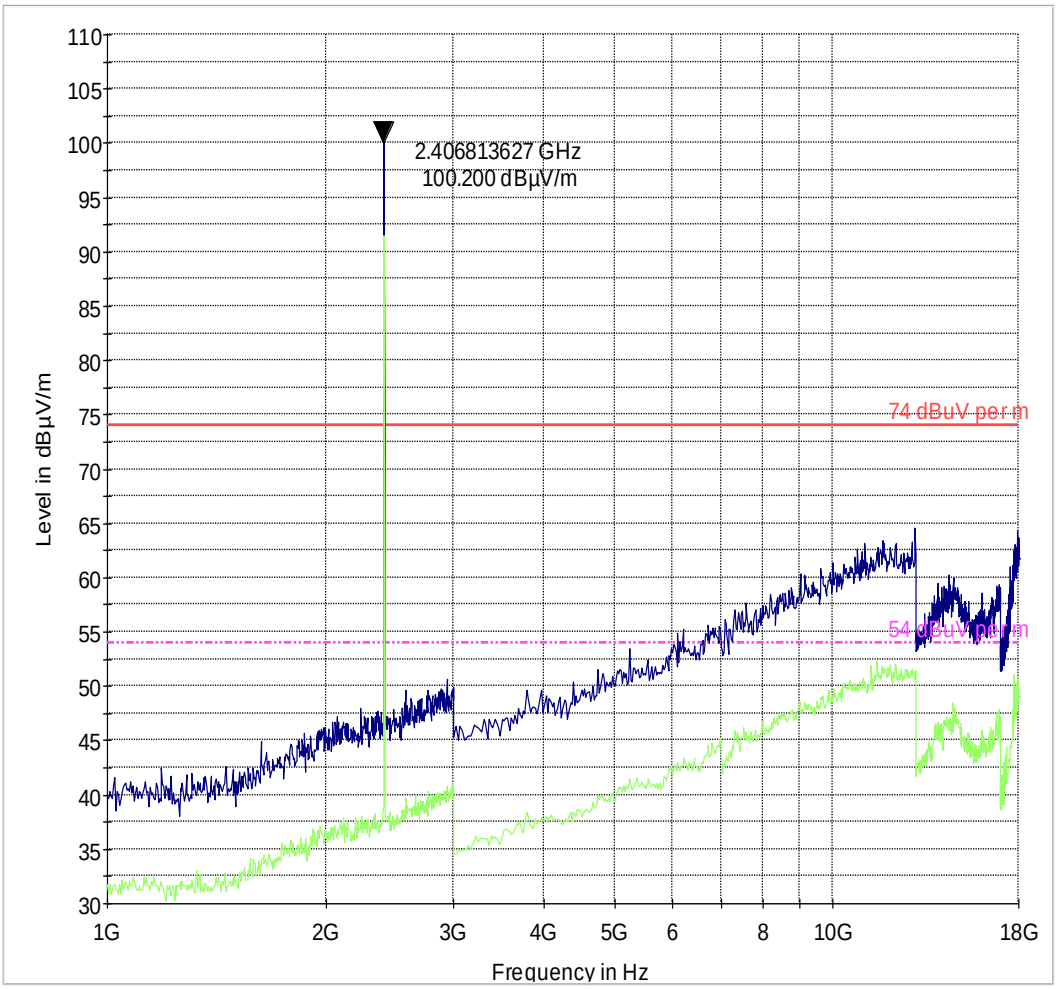


Transmitter Radiated Spurious Emission- Ch11 (2405 MHz): 30M-1GHz

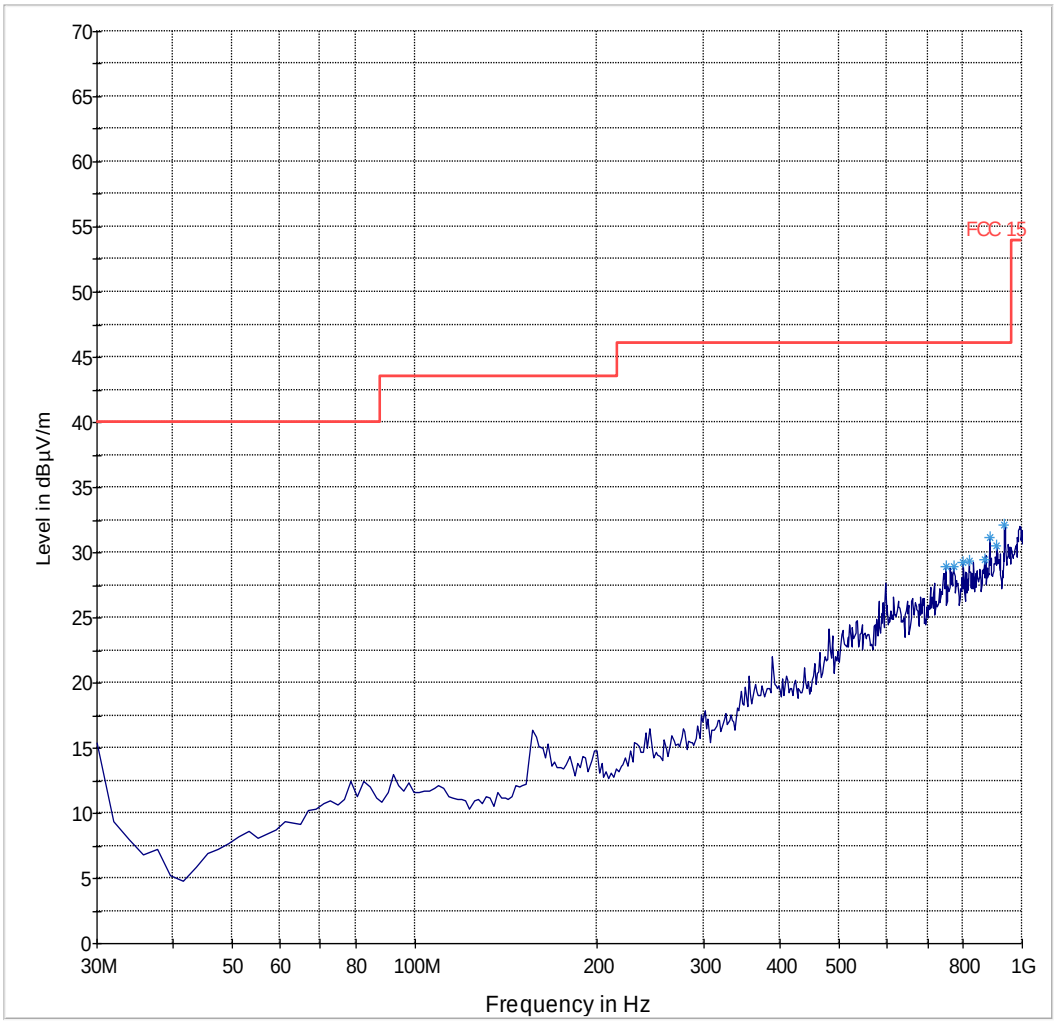


Transmitter Radiated Spurious Emission- Ch11 (2405 MHz): 1G-18GHz

Emission above the limit line from the transmitter.

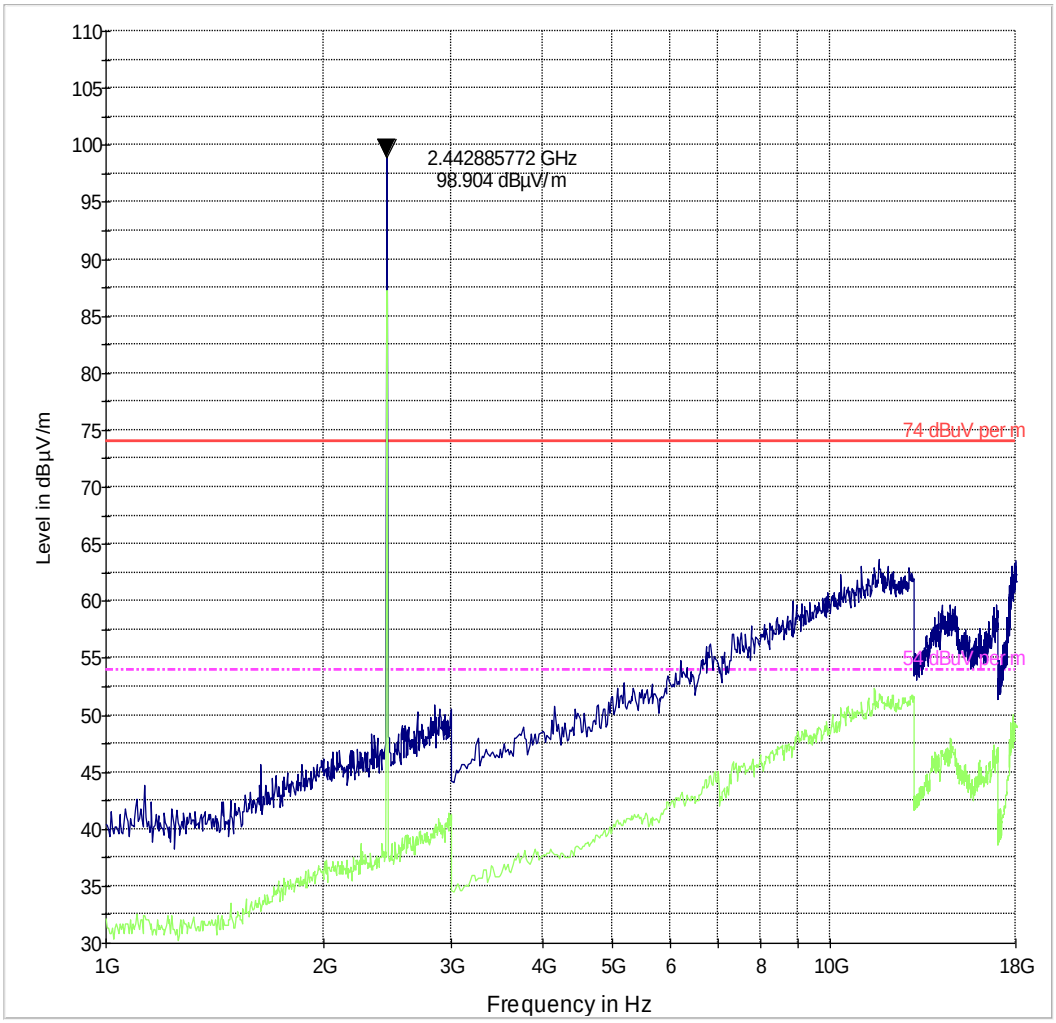


Transmitter Radiated Spurious Emission- Ch18 (2440 MHz): 30M-1GHz



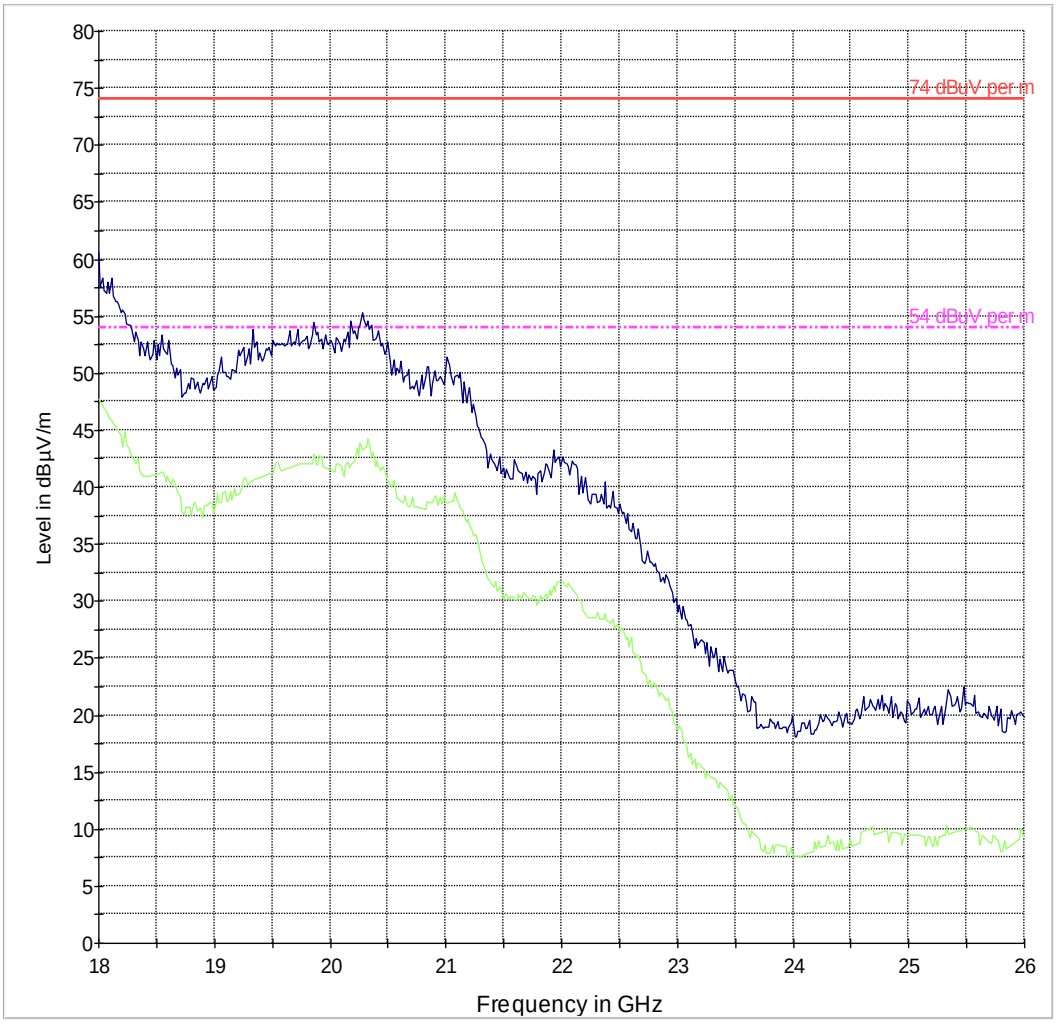
Transmitter Radiated Spurious Emission- Ch18(2440 MHz): 1G-18GHz

Emission above the limit line from the transmitter.

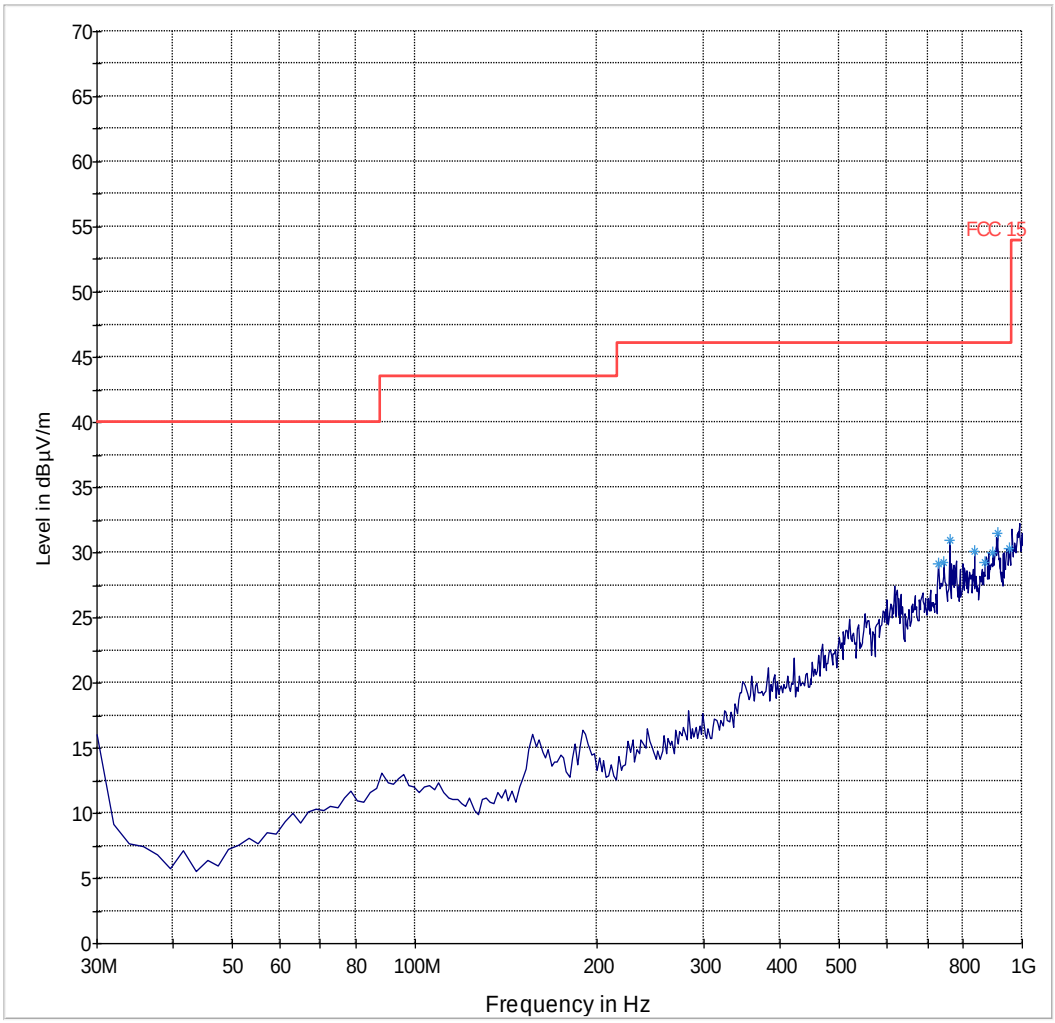


Transmitter Radiated Spurious Emission- Ch18 (2440 MHz): 18G-26GHz

Note: Worst case representation of all channels

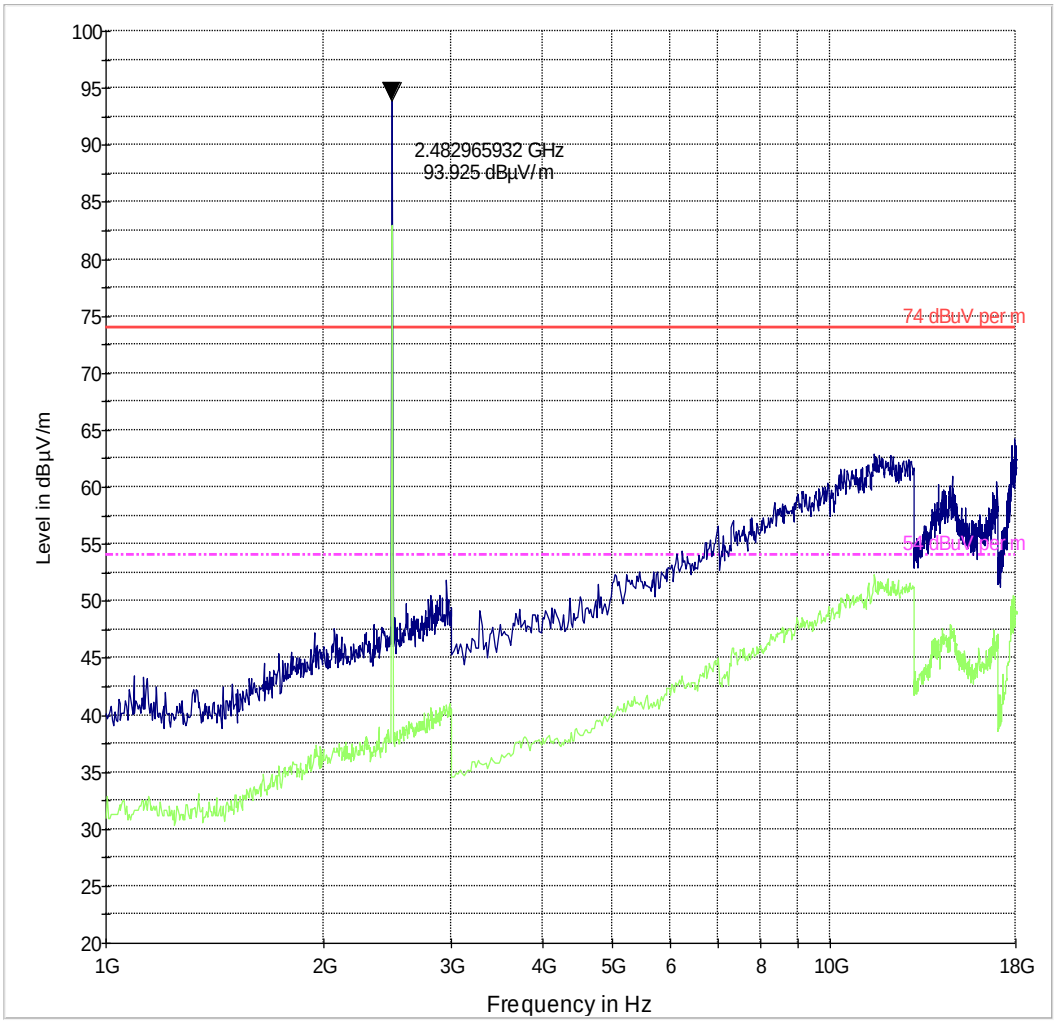


Transmitter Radiated Spurious Emission- Ch25 (2480 MHz): 30M-1GHz



Transmitter Radiated Spurious Emission- Ch25 (2480 MHz): 1G-18GHz

Emission above the limit line from the transmitter.



6.11 AC Power Line Conducted Emissions

6.11.1 References:

FCC: CFR Part 15.207
IC: RSS-Gen Section 7.2.2
The purpose of this test is to measure unwanted radio frequency currents induced in any AC conductor external to the equipment which could conduct interference to other equipment via the AC electrical network.

6.11.2 Limits:

6.11.2.1 §15.207 Conducted limits- Intentional Radiators:

(a) Except as shown in paragraphs (b) and (c) of this section of the CFR, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table (1), as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

6.11.2.2 RSS-Gen 7.2.2

Except when the requirements applicable to a given device state otherwise, for any licence-exempt radiocommunication device equipped to operate from the public utility AC power supply, either directly or indirectly, the radio frequency voltage that is conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown below. The tighter limit applies at the frequency range boundaries.

Table 1:

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*Decreases with the logarithm of the frequency.

Analyzer Settings: CISPR Bandwidth: 9KHz

6.11.3 Test Conditions:

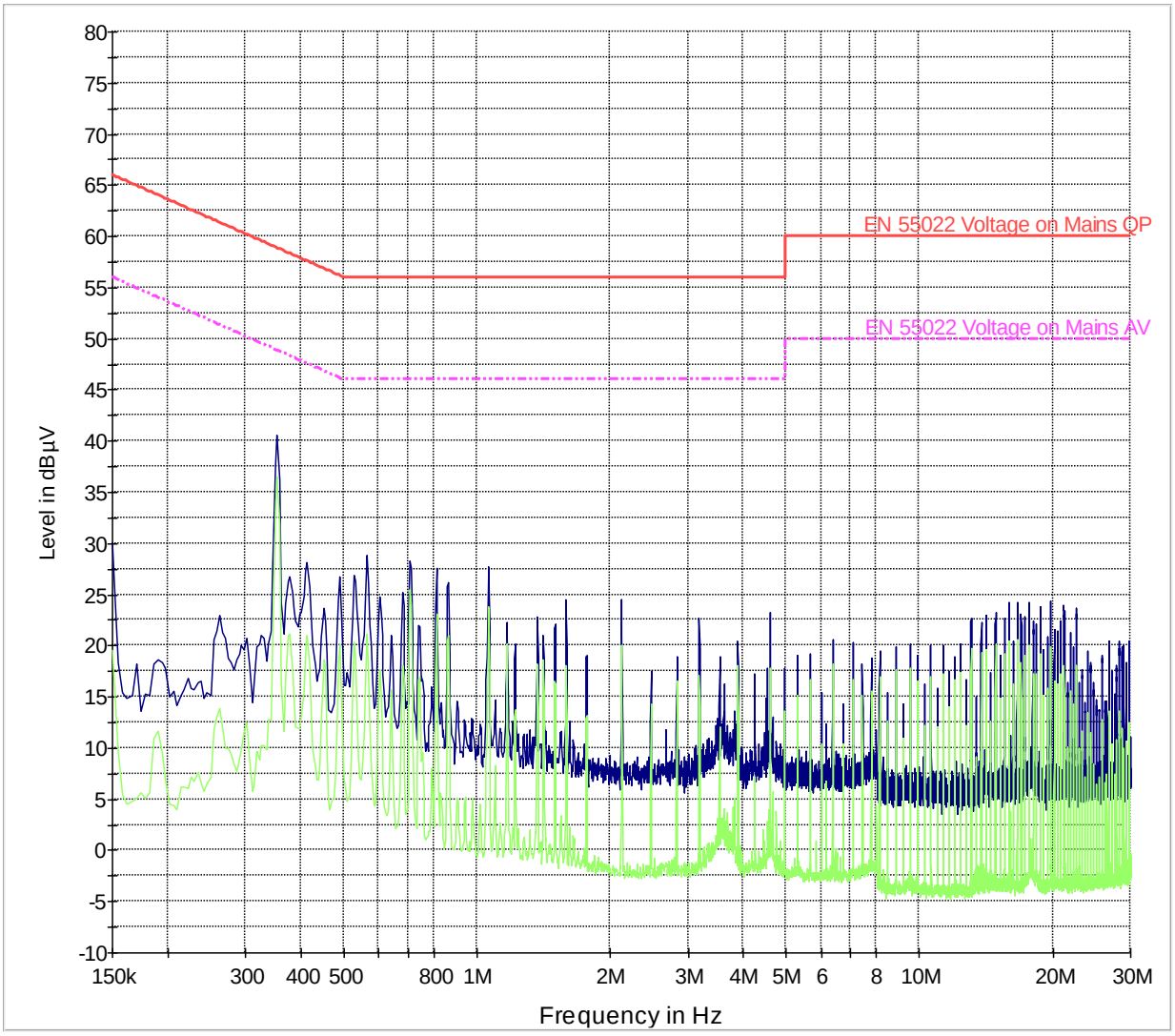
Modulation: 802.15- Transmit mode of operation
Measurement Uncertainty: ±3.0dB

6.11.4 Measurement Result

Pass.

6.11.5 Test Results:

Plots shown here represent the combined worse case emissions for power lines, phases and neutral line. Test performed with an off-the-shelf AC adapter as identified in Sec 3.3.

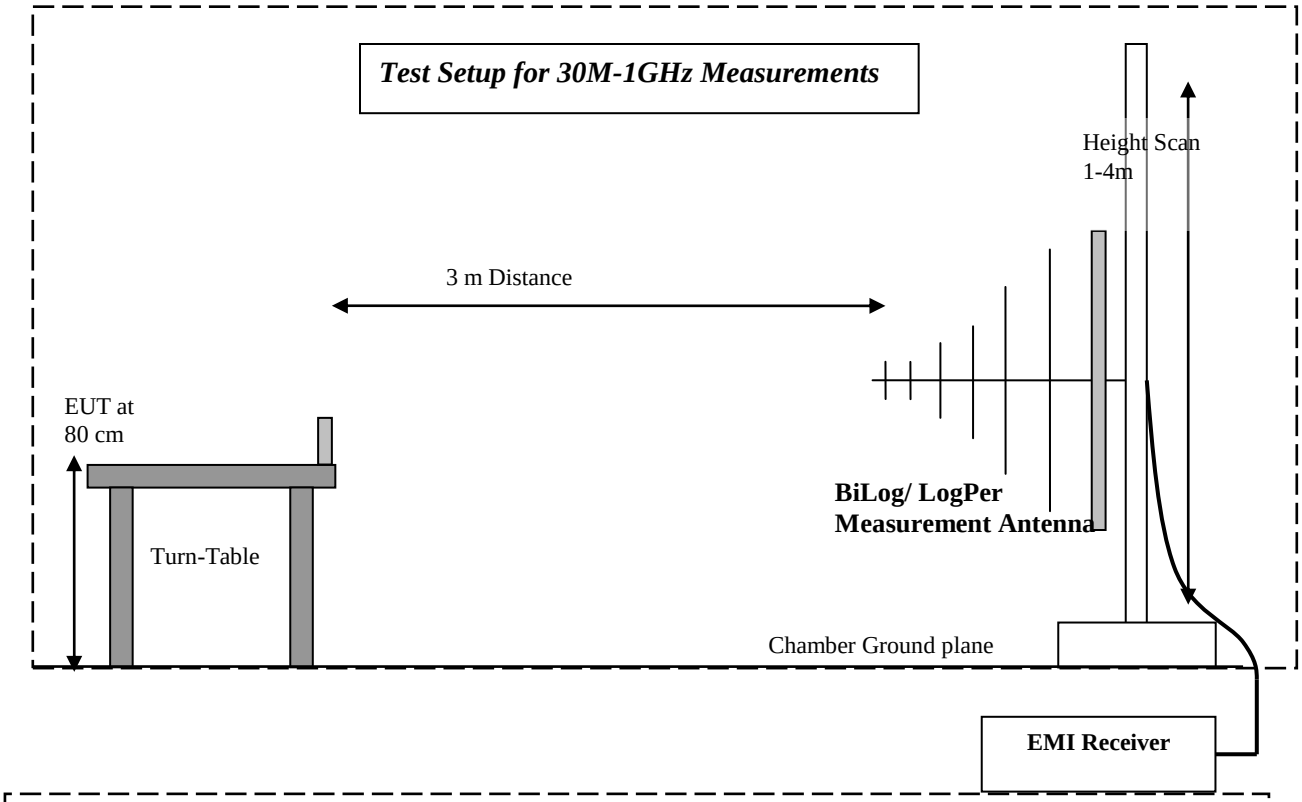


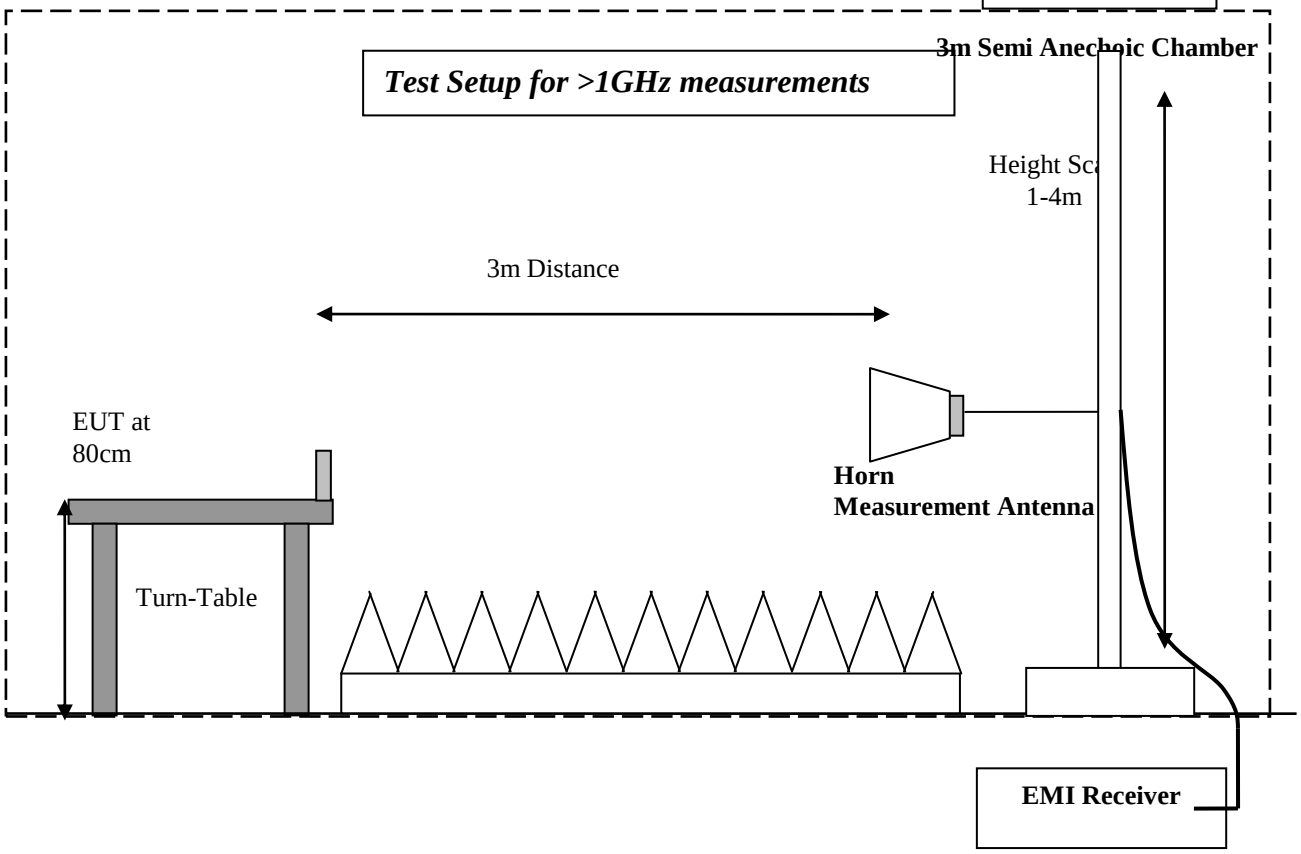
EN 55022 Voltage on Mains QP
Preview Result 1-PK+
EN 55022 Voltage on Mains AV
Preview Result 2-AVG

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
EMI Receiver/Analyzer	ESU 40	Rohde & Schwarz	100251	Aug 2012	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	Mar 2012	1 Year
Temp Hum Logger	TM325	Dickson	5285354	Mar 2012	1 Year

8 Block Diagrams





9 Revision History

Date	Report Name	Changes to report	Report prepared by
2012-06-18	CET10_137_038_12001_ZB24TM_FCC15.247	First Version	Calvin Lee
2012-07-03	CET10_137_038_12001_ZB24TM_FCC15.247_Rev1	Added the Manufacturer Information in Sec. 2.3	Calvin Lee
2012-09-21	CET10_137_038_12001_ZB24TM_FCC15.247_Rev2	Corrected a typo in Table 6.6.3 and added AC Line conducted emissions test result in Sec. 6.11.	Calvin Lee