



FCC Test Report

FOR

Manufacturer: CSR Technology

Model: CNS1004

Product Description: Bluetooth 4.0 Retail Shelf Tag Beacon

FCC ID: PIWCNS1004

47 CFR Part 15.247 for DTS Systems

TEST REPORT #: EMC_CSRTE-001-13001_BT_DTS

DATE: 2013-05-13



**FCC :
Accredited**

**IC recognized #
3462B**

CETECOM Inc.

411 Dixon Landing Road ♦ Milpitas, CA 95035 ♦ U.S.A.

Phone: + 1 (408) 586 6200 ♦ Fax: + 1 (408) 586 6299 ♦ E-mail: info@cetecomusa.com ♦ <http://www.cetecom.com>

CETECOM Inc. is a Delaware Corporation with Corporation number: 2905571

TABLE OF CONTENTS

1	Assessment	4
2	Administrative Data.....	5
2.1	Identification of the Testing Laboratory Issuing the Test Report.....	5
2.2	Identification of the Client.....	5
2.3	Identification of the Manufacturer.....	5
3	Equipment under Test (EUT)	6
3.1	Specification of the Equipment under Test	6
3.2	Identification of the Equipment Under Test (EUT).....	7
3.3	Identification of Accessory equipment	7
3.4	Identification of Accessory equipment (not used during test).....	7
3.5	Environmental conditions during Test:	7
3.6	Dates of Testing:.....	7
3.7	Other Testing Notes:.....	7
4	Subject of Investigation	8
5	Summary of Measurement Results.....	9
6	Measurements.....	10
6.1	Radiated Measurement Procedure	10
6.2	Measurement Method:	10
6.3	Radiated Measurement Procedure	10
6.4	Sample Calculations for Radiated Measurements	12
6.5	Conducted Measurement Procedure	13
6.6	Maximum Peak Conducted Output Power	14
6.6.1	Limits:	14
6.6.2	Test Conditions:.....	14
6.6.3	Test Procedure:	14
6.6.4	Test Results:.....	15
6.6.5	Test Data/plots:	16
6.7	Emission/Occupied Bandwidth.....	18
6.7.1	Limits:	18
6.7.2	Test Conditions:.....	18
6.7.3	Test Procedure:	18
6.7.4	Test Result:	18
6.7.5	Test Data/plots:	19
6.8	Maximum Power Spectral Density Level in the Fundamental Emission	22
6.8.1	Limits:	22
6.8.2	Test procedure:.....	22
6.8.3	Test Conditions:.....	22
6.8.4	Test results:	22
6.8.5	Test Data/plots:	23
6.9	Unwanted Emissions into Non-Restricted Frequency Bands- Conducted	25
6.9.1	Reference and Limits:	25
6.9.2	Test Conditions:.....	25
6.9.3	Test Procedure:	25
6.9.4	Test Result:	25
6.9.5	Test data/ plots:	26

6.10	Unwanted Emissions into Restricted Frequency Bands- Radiated.....	29
6.10.1	Limits:	29
6.10.2	Test Conditions:	30
6.10.3	Test Procedure:	30
6.10.4	Test Data/plots:	31
6.11	Transmitter Spurious Emissions- Radiated.....	33
6.11.1	Limits:	33
6.11.2	Test Conditions:	33
6.11.3	Test Result:	33
6.11.4	Test data/ plots:	34
6.12	AC Power Line Conducted Emissions.....	42
6.12.1	References:	42
6.12.2	Limits:	42
6.12.3	Test Conditions:	42
6.12.4	Test Results:	43
7	Test Equipment and Ancillaries used for tests.....	44
8	Test Setup Diagrams:.....	45
9	Revision History	46

1 Assessment

The following equipment (and as identified in Ch.3 of this test report) was evaluated against the applicable criteria specified in FCC CFR47 Part 15.247, 15.207, 15.209

No deviations were ascertained during the course of the tests performed.

Company	Description	Model #
CSR Technology	Bluetooth 4.0 Retail Shelf Tag Beacon	CNS1004

Responsible for Testing Laboratory:

2013-05-13	Compliance	Sajay Jose (Test Lab Manager)	
Date	Section	Name	Signature

Responsible for the Report:

2013-05-13	Compliance	Calvin Lee (EMC Engineer)	
Date	Section	Name	Signature

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
Address:	411 Dixon Landing Road Milpitas, CA 95035 U.S.A.
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

Client:	CSR Technology
Street Address:	1390 Kifer Road
City/Zip Code	Sunnyvale, CA94086
Country	United States
Contact Person:	James Machiorletti
Phone No.	+1 (408) 392-8310
Email:	JM18@CSR.com

2.3 Identification of the Manufacturer

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

3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Marketing Name:	Halcyon CNS1004
Model No:	CNS1004
Product Description:	Bluetooth 4.0 Retail Shelf Tag Beacon
FCC ID:	PIWCNS1004
Frequency Band of Operation:	ISM: 2400 – 2483.5 MHz
Mode and Frequency Range of test:	BT 4.0 LE 2402-2480 MHz
Number of channels:	40
Type(s) of Modulation:	GFSK
Antenna Type and Gain Information:	Integral F- Type dipole Manufacturer stated antenna gain= 1.6dBi
Max. Output Powers:	Conducted (Measured): -4.24 dBm Radiated –EIRP (Calculated): -2.60 dBm
Rated Operating Voltage Range (VDC):	Battery powered. Low: 2.7/ Nom: 3.0/ Max: 3.3
Rated Operating temperature range:	Low: -10°C/ Nom: 25°C / Max: 55°C
Test sample status:	Pre-Production

3.2 Identification of the Equipment Under Test (EUT)

EUT #	Serial Number	HW Version	SW Version	Model	Notes/Comments
1	274937	V5C	010A77000138FF000000000010000000000	CNS1004	Radiated Unit
2	274946	V5C	010A77000138FF000000000010000000000	CNS1004	Conducted Unit

3.3 Identification of Accessory equipment

AE #	Type	Manufacturer	Model	Comments
1	EMC Laptop	Dell	-	Only for AC conducted emission.
2	65W –AC Adapter	Dell	-	Only for AC conducted emission.
3	I/O Emulator	CSR	CNS10020V3A	Only for AC conducted emission.
4	USB Cables	-	-	Only for AC conducted emission.

3.4 Identification of Accessory equipment (not used during test)

STE #	Type	Manufacturer	Model	Serial Number
1	Laptop	Panasonic	CF-30	-

3.5 Environmental conditions during Test:

The following environmental conditions were maintained during the course of testing:

Ambient Temperature: 20-25°C

Relative humidity: 40-60%

3.6 Dates of Testing:

Apr 8-9, 2013

3.7 Other Testing Notes:

The device was configured with a manufacturer provided test SW, capable of setting the unit in different supported data rates and channels of operation at 99% duty cycle.

4 Subject of Investigation

The objective of the measurements applied by CETECOM Inc. was to establish compliance of the EUT as described under Ch. 3 of this Test Report, with the applicable criteria specified in

- FCC CFR47 Parts 15.247, 15.207, 15.209

This test report is to support a request for new equipment authorization under the FCC ID: **PIWCNS1004**.

5 Summary of Measurement Results

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§15.247(e)	Power Spectral Density	Nominal	BT LE	■	□	□	□	Complies
§15.247(a)(1)	Carrier Frequency Separation	Nominal	-	□	□	■	□	See Note 1
§15.247(a)(1)	Number of Hopping Channels	Nominal	-	□	□	■	□	See Note 1
§15.247(a)(1)(iii)	Time of occupancy	Nominal	-	□	□	■	□	See Note 1
§15.247(a)(1)	Spectrum Bandwidth	Nominal	BT LE	■	□	□	□	Complies
§15.247(b)(1)	Maximum Peak Conducted Output Power	Nominal	BT LE	■	□	□	□	Complies
§15.247(d)	Band edge compliance-Conducted	Nominal	BT LE	□	□	■	□	See Note 2
§15.247(d)	Band edge compliance-Radiated	Nominal	BT LE	■	□	□	□	Complies
§15.247(d)	TX Spurious emissions-Conducted	Nominal	BT LE	■	□	□	□	Complies
§15.247(d)	TX Spurious emissions-Radiated	Nominal	BT LE	■	□	□	□	Complies
§15.209(a)	TX Spurious Emissions Radiated<30MHz	Nominal	BT LE	■	□	□	□	Complies
§15.207(a)	AC Line Conducted Emissions<30MHz	Nominal	BT LE	■	□	□	□	Complies

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

1. Test only applicable for Frequency Hopping Systems
2. Band Edge compliance-conducted is NOT PERFORMED as the device passes radiated measurement.

6 Measurements

6.1 Radiated Measurement Procedure

6.2 Measurement Method:

All radiated and conducted testing is performed according to guidelines in FCC publication KDB558074 D01Meas Guidance v03: Measurement Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) operating under 15.247, April 9, 2013.

6.3 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 beam width, 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 re-maximized 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: $\pm 3\text{dB}$

6.4 Sample Calculations for Radiated Measurements

6.4.1.1 Field Strength Measurements:

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

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

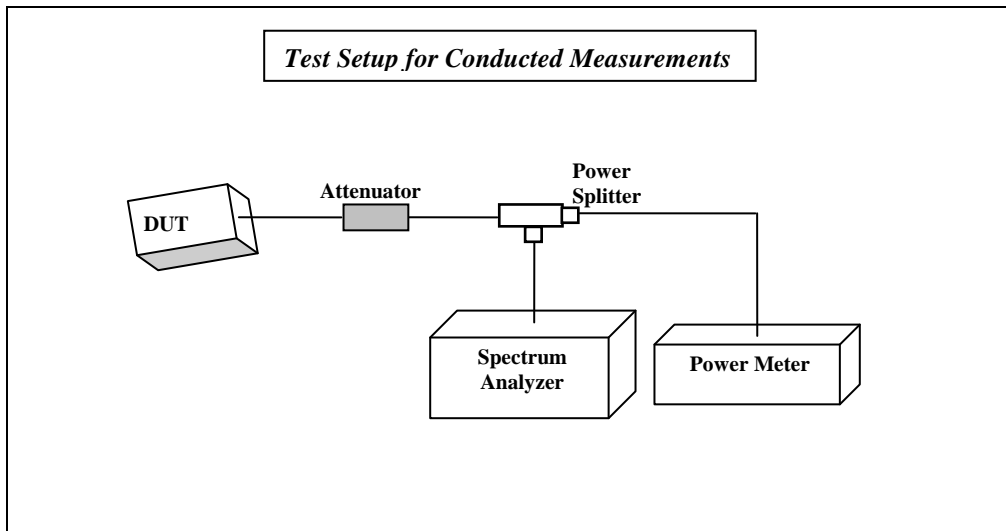
$$FS \text{ (dB}\mu\text{V/m)} = \text{Measured Value on SA (dB}\mu\text{V)} + \text{Cable Loss (dB)} + \text{Antenna Factor (dB/m)}$$

Eg:

Frequency (MHz)	Measured SA (dB μ V)	Cable Loss (dB)	Antenna Factor Correction (dB)	Field Strength Result (dB μ V/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.

6.5 Conducted Measurement Procedure



1. Connect the equipment as shown in the above diagram.
2. A test SW provided by the manufacturer is used to control the different modulations, data rates and max output power configurations.
3. Measurements are to be performed with the EUT set to the low, middle and high channels for BT 4.0 mode.

6.6 Maximum Peak Conducted Output Power

6.6.1 Limits:

§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.

6.6.2 Test Conditions:

Tnom: 20°C; Vnom: 3.0 VDC

Measurement Uncertainty= ±0.5 dB

6.6.3 Test Procedure:

Measurement according to FCC KDB 558074 D01 DTS Meas Guidance v02, section 8.1.1- Option 2

Spectrum Analyzer settings:

RBW=1MHz, VBW=3MHz, Detector: Peak- Max Hold.

Sweep Time: Auto

Span= 1 MHz (to fully encompass DTS Bandwidth)

Antenna Gain : 1.6 dBi

6.6.4 Test Results:

Measured Peak Output Power- Conducted (dBm)			
Modulation	Frequency (MHz)		
	2402 Channel 0	2440 Channel 19	2480 Channel 39
GFSK	-7.46	-5.78	-4.24

Calculated Peak Output Power- Radiated (dBm)			
Modulation	Frequency (MHz)		
	2402 Channel 0	2440 Channel 19	2480 Channel 39
GFSK	-5.82	-4.14	-2.60

Radiated EIRP is calculated as

Conducted Measurement + max. Antenna Gain (1.6dBi) + Duty Cycle Correction Factor (0.04 dB)

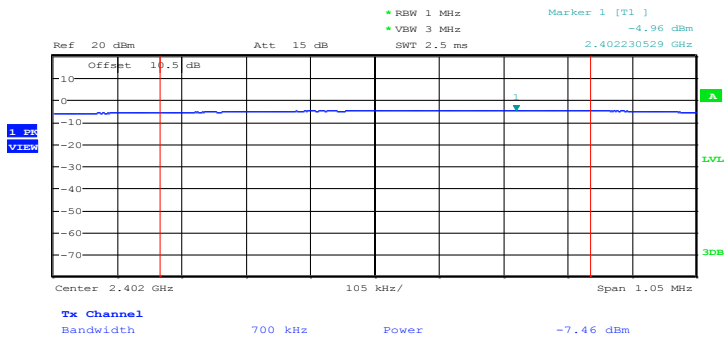
6.6.4.1 Measurement Verdict:

Pass.



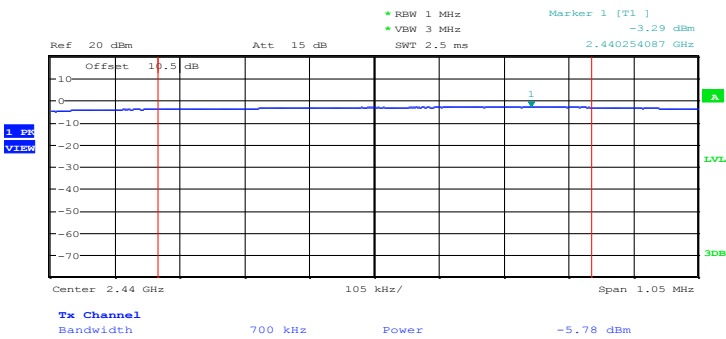
6.6.5 Test Data/plots:

Conducted Peak Power BT 4.0 2402 MHz



low
Date: 9.APR.2013 19:22:56

Conducted Peak Power BT 4.0 2440 MHz



low
Date: 9.APR.2013 19:25:28

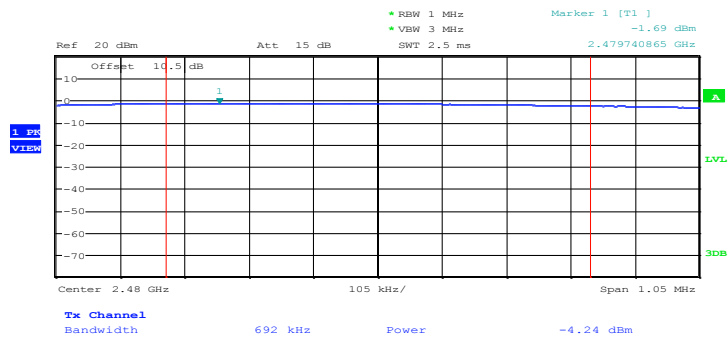
Test Report #: EMC_CSRTE-001-13001_DTS

FCC ID: PIWCNS1004

Date of Report : 2013-05-13



Conducted Peak Power BT 4.0 2480 MHz



low

Date: 9.APR.2013 19:27:45

6.7 Emission/Occupied Bandwidth

6.7.1 Limits:

§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.

6.7.2 Test Conditions:

Tnom: 20°C; Vnom: 3.0 VDC

Measurement Uncertainty= ±100 kHz

6.7.3 Test Procedure:

Measurement according to FCC KDB 558074 D01 Meas Guidance v02, section 7.1 – DTS (6dB)

Channel Bandwidth Procedure Option 1

Spectrum Analyzer settings:

DTS (6dB) and 99% Bandwidth:

RBW = 100 kHz, VBW = 300 kHz, Detector: Peak- Max hold;

Sweep Time: Auto

Span = 2 MHz

6.7.4 Test Result:

Occupied Bandwidth (MHz)						
Mode	Frequency (MHz)					
	2402 Channel 0		2440 Channel 19		2480 Channel 39	
	6dB	20dB/ 99%	6dB	20dB/ 99%	6dB	20dB/ 99%
BT 4.0	0.6987	1.0417	0.6987	1.0385	0.6923	1.1090
Measurement Uncertainty: ±100 kHz						

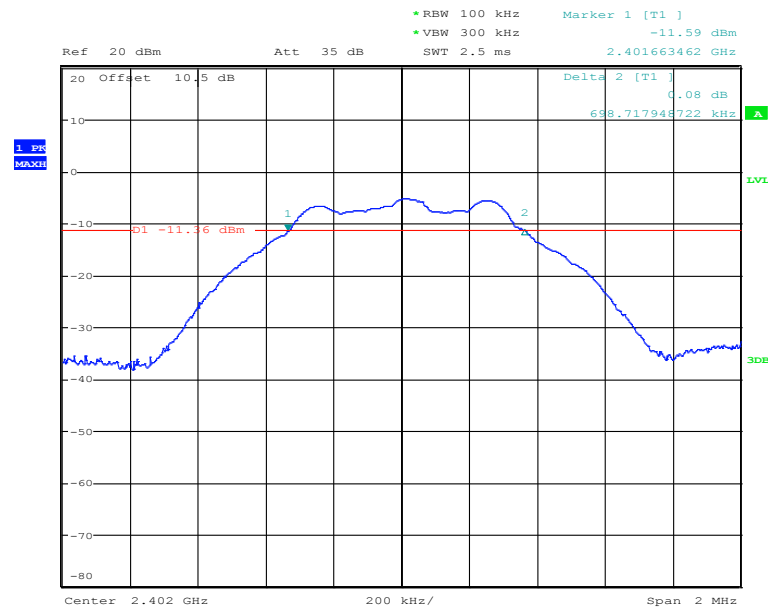
6.7.4.1 Measurement Verdict

Pass.



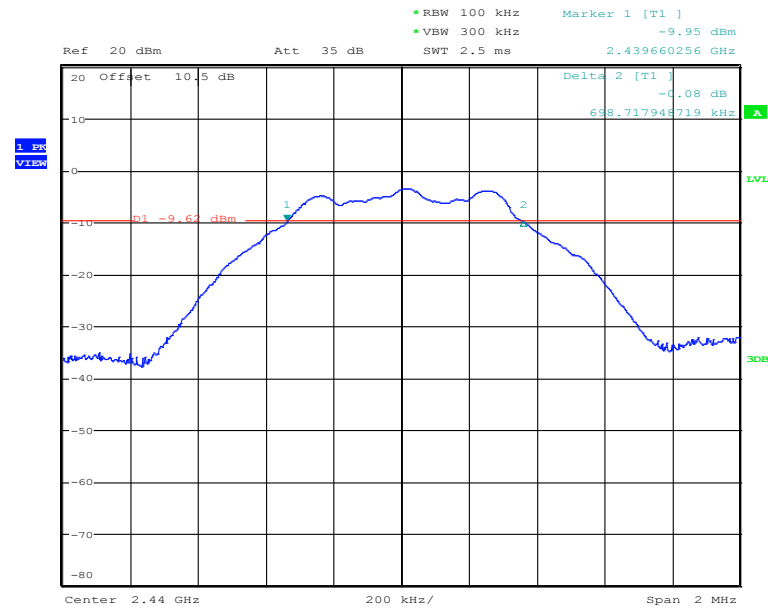
6.7.5 Test Data/plots:

6dB Bandwidth BT 4.0 Mode 2402 MHz



low
Date: 9.APR.2013 18:52:38

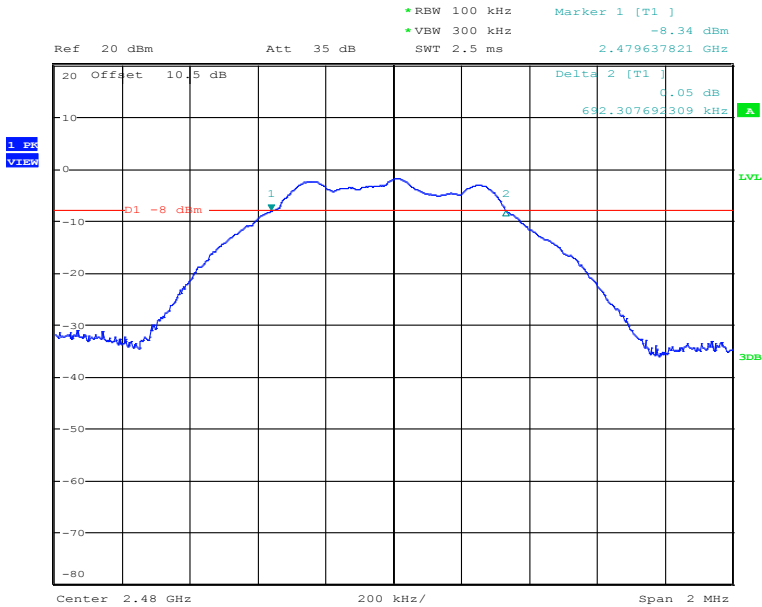
6dB Bandwidth BT 4.0 Mode 2440 MHz



low
Date: 9.APR.2013 18:56:55

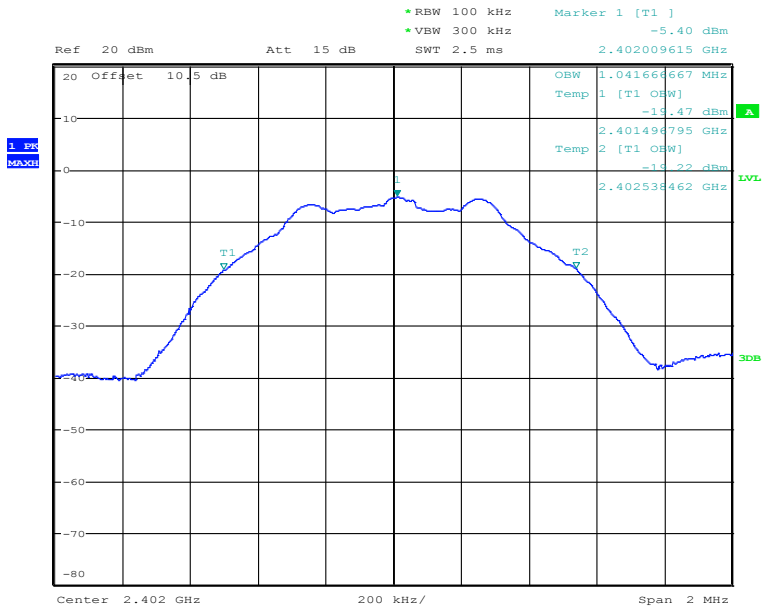


6dB Bandwidth BT 4.0 Mode 2480 MHz



low
Date: 9.APR.2013 19:00:11

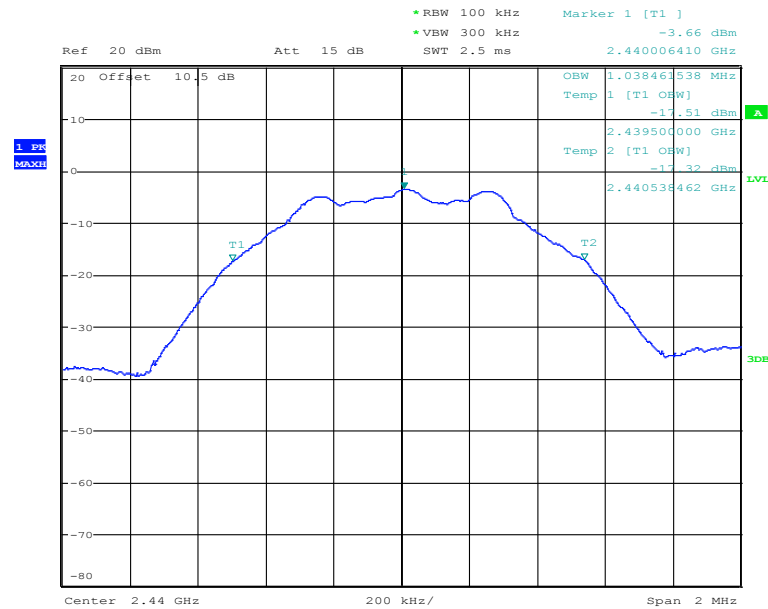
20dB Bandwidth BT 4.0 Mode 2402 MHz



low
Date: 9.APR.2013 18:54:04

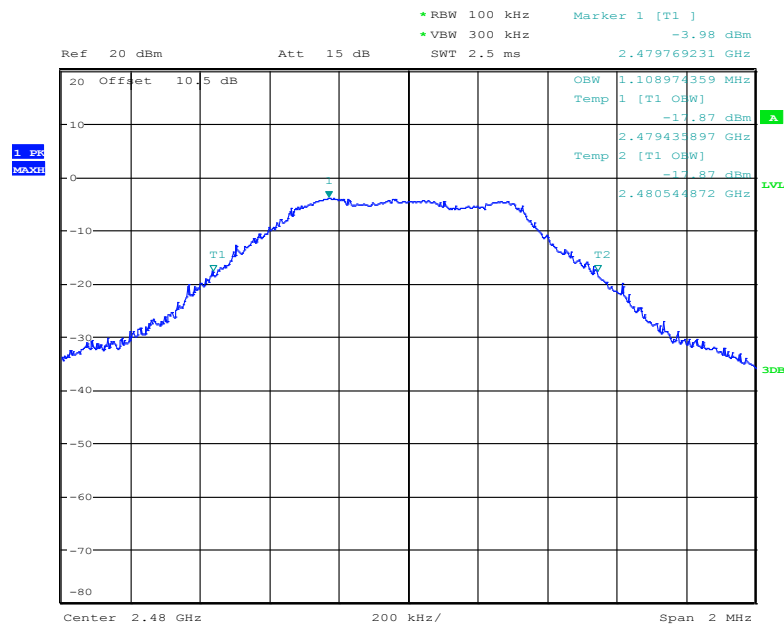


20dB Bandwidth BT 4.0 Mode 2440 MHz



low
Date: 9.APR.2013 18:57:57

20dB Bandwidth BT 4.0 Mode 2480 MHz



low
Date: 9.APR.2013 19:01:27

6.8 Maximum Power Spectral Density Level in the Fundamental Emission

6.8.1 Limits:

§ 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.

6.8.2 Test procedure:

Measurement according to FCC KDB 558074 D01 Meas Guidance v02, section 9.1 Option 1

1. Set the analyzer center frequency to DTS channel center frequency
2. Span = 1.5 x DTS channel Bandwidth
3. RBW = 3 KHz; VBW = 10 KHz; Detector: Peak – Max hold

6.8.3 Test Conditions:

Tnom: 20°C; Vnom: 3.0 VDC

Measurement Uncertainty: ±0.5dB

6.8.4 Test results:

Conducted Power Spectral Density (dBm)			
Mode	Frequency (MHz)		
	2402 Channel 0	2440 Channel 19	2480 Channel 39
BT 4.0	-21.58	-19.58	-17.98

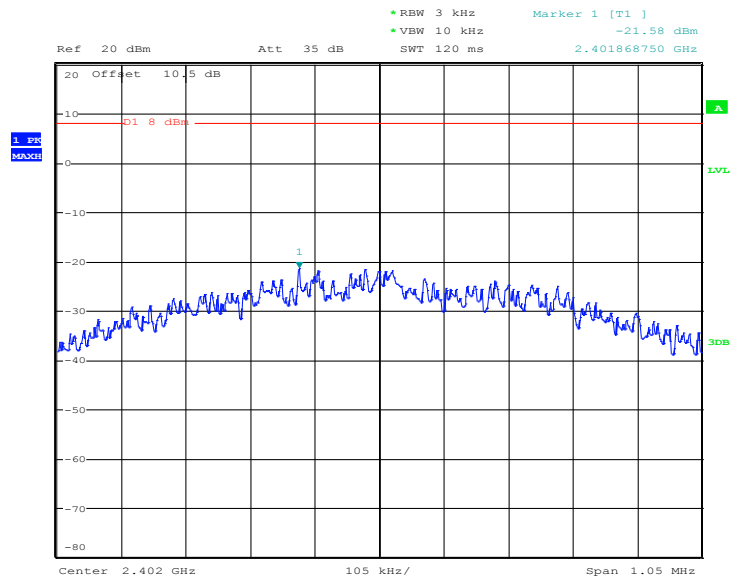
6.8.4.1 Measurement Verdict

Pass.



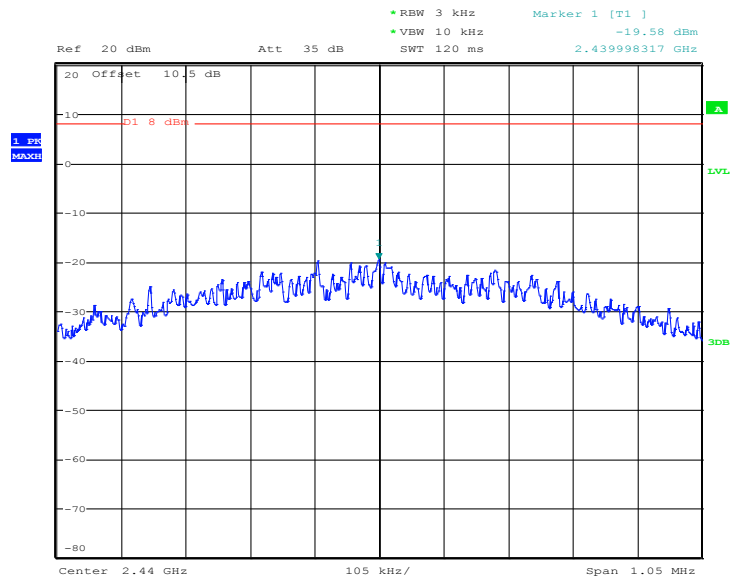
6.8.5 Test Data/plots:

Power Spectral Density BT 4.0 Mode 2402 MHz



low
Date: 9.APR.2013 19:41:47

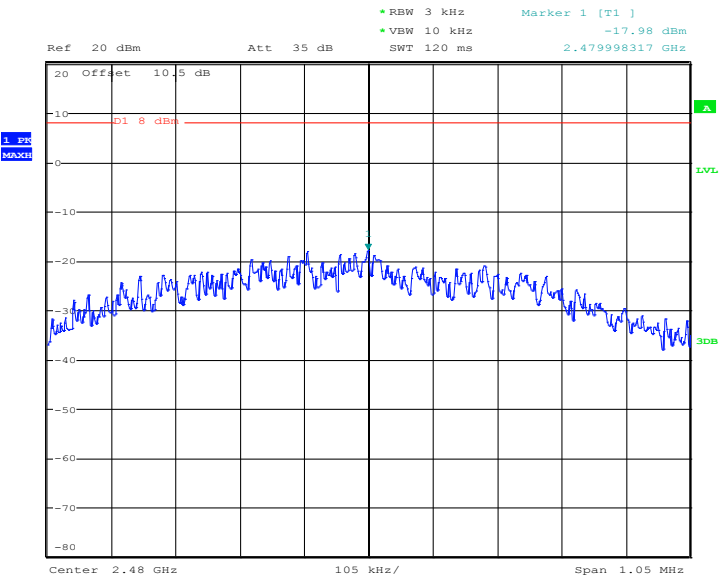
Power Spectral Density BT 4.0 Mode 2440 MHz



low
Date: 9.APR.2013 19:40:20



Power Spectral Density BT 4.0 Mode 2480 MHz



low
Date: 9.APR.2013 19:44:43

6.9 Unwanted Emissions into Non-Restricted Frequency Bands- Conducted

6.9.1 Reference and Limits:

§ 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.

-20dBc in the frequency range 30MHz- 25GHz.

6.9.2 Test Conditions:

Tnom: 20°C; Vnom: 3.0 VDC

Measurement Uncertainty: ±1.0 dB

6.9.3 Test Procedure:

Measurement according to FCC KDB 558074 D01 Meas Guidance v02, section 10.1 – Unwanted Emissions into Non-Restricted Frequency Bands

Spectrum Analyzer settings:

RBW=100 kHz, VBW=300 kHz, Detector: Peak- Max hold;

Sweep Time: Auto

Span=Full range

6.9.4 Test Result:

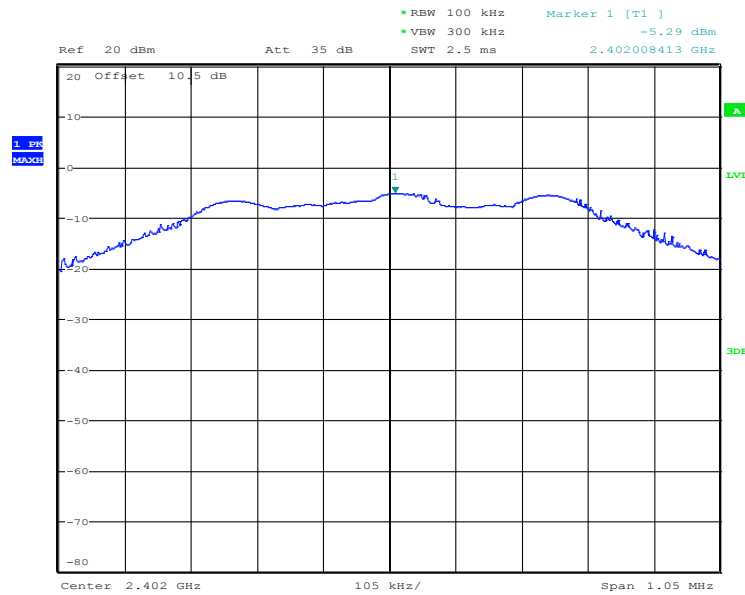
Conducted Spurious Emissions			
Channel	Frequency (MHz)	Amplitude (dBm)	Limits
		BT 4.0 Mode	
Low	2402	-5.29	
	Spurious	All other peaks >20dB below limit	-20dBc
Mid	2440	-3.64	
	Spurious	All other peaks >20dB below limit	-20dBc
High	2480	-1.95	
	Spurious	All other peaks >20dB below limit	-20dBc

6.9.4.1 Measurement Verdict:

Pass.

6.9.5 Test data/ plots:

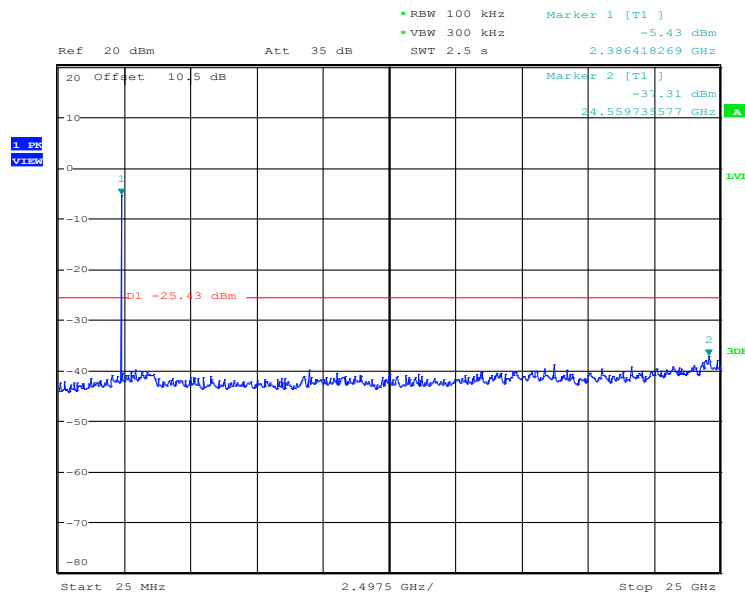
Conducted Spurious Emission BT 4.0 2402 MHz – Reference Level



low

Date: 9.APR.2013 19:51:01

Conducted Spurious Emission BT 4.0 2402 MHz – 25 MHz – 25 GHz

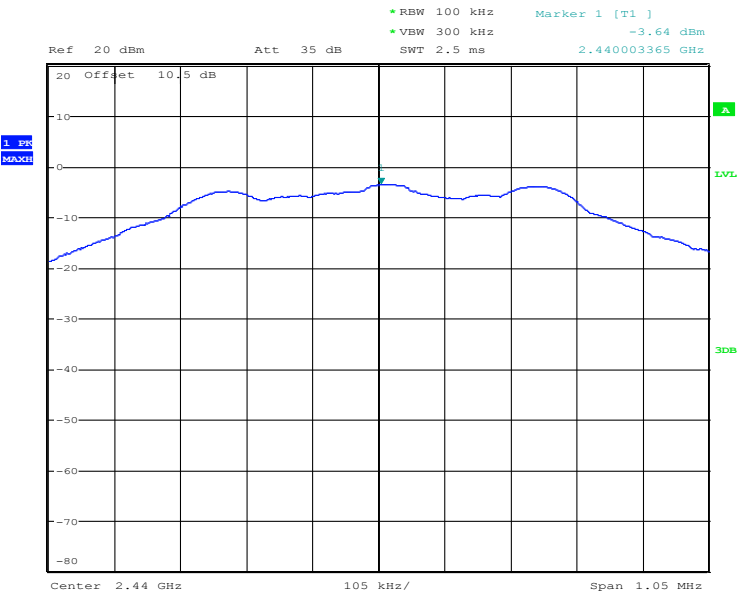


low

Date: 9.APR.2013 20:02:26

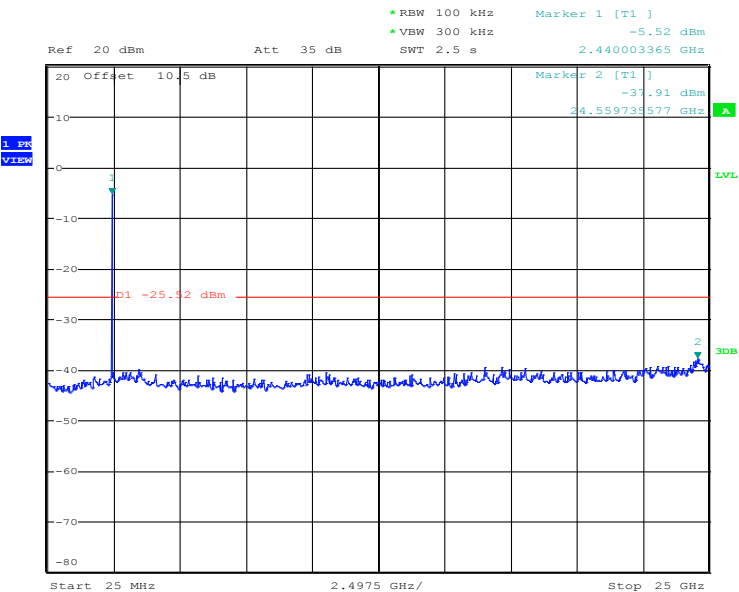


Conducted Spurious Emission BT 4.0 2440 MHz – Reference Level



low
Date: 9.APR.2013 20:16:28

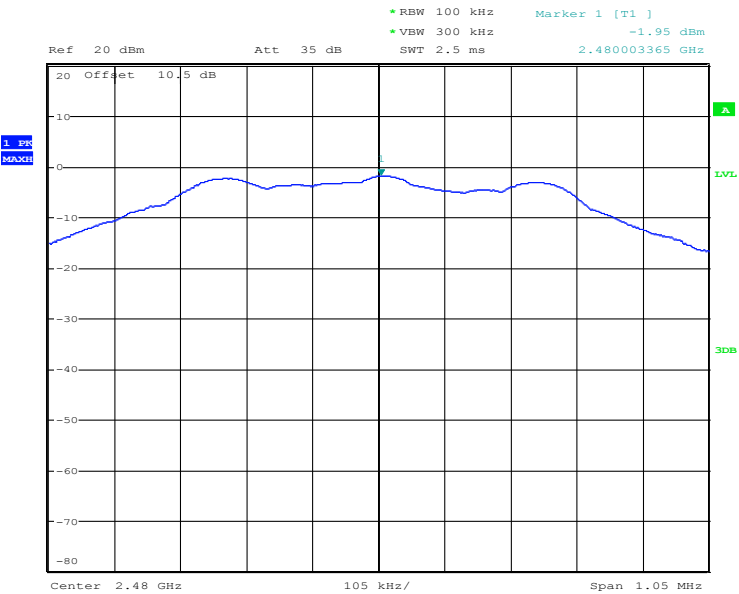
Conducted Spurious Emission BT 4.0 2440 MHz – 25 MHz – 25 GHz



low
Date: 9.APR.2013 20:18:01

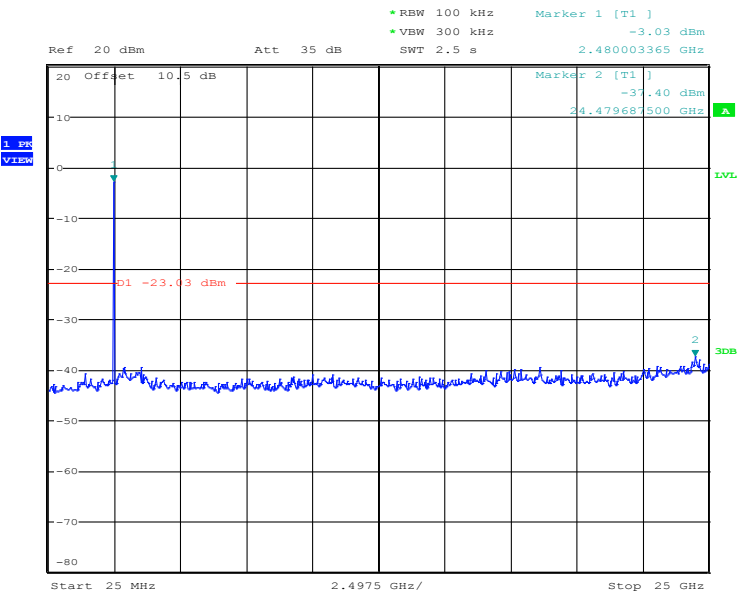


Conducted Spurious Emission BT 4.0 2480 MHz – Reference Level



low
Date: 9.APR.2013 20:20:20

Conducted Spurious Emission BT 4.0 2480 MHz – 25 MHz – 25 GHz



low
Date: 9.APR.2013 20:21:20

6.10 Unwanted Emissions into Restricted Frequency Bands- Radiated

6.10.1 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

6.10.2 Test Conditions:

Tnom: 20°C; Vnom: 3.0 VDC

6.10.3 Test Procedure:

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

*PEAK LIMIT= 74dB μ V/m

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

*AVG. LIMIT= 54dB μ V/m

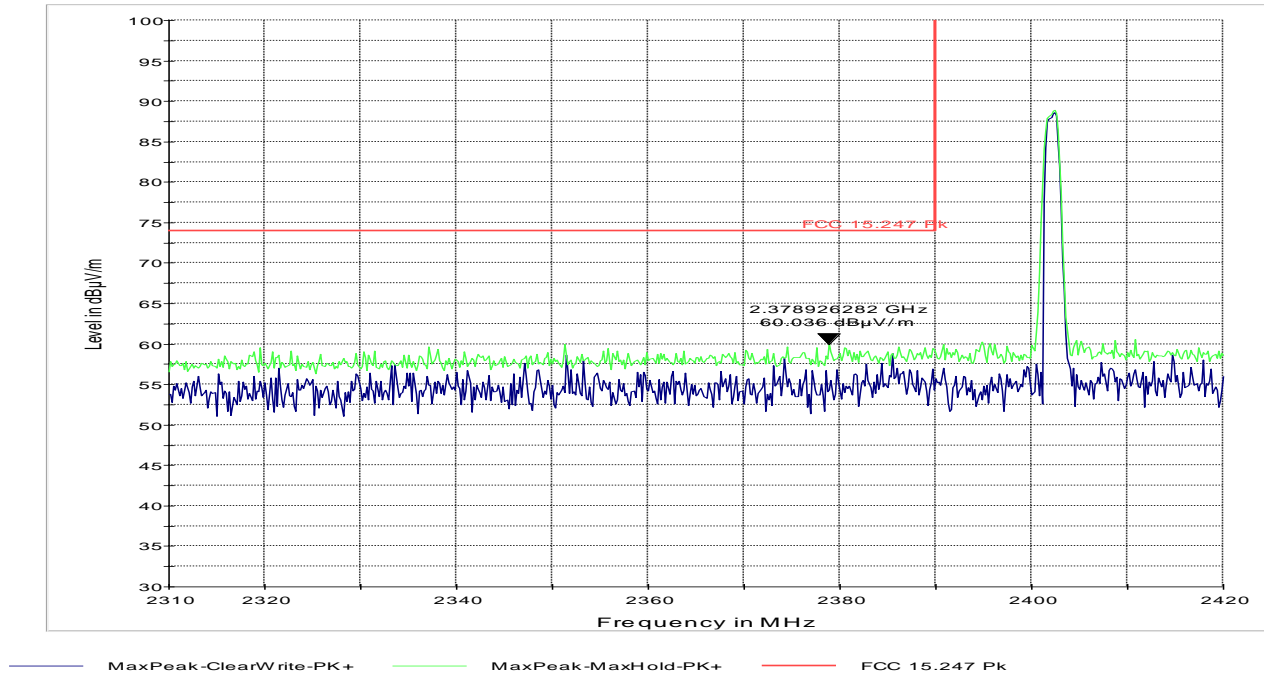
Measurement Uncertainty: ± 3.0 dB

6.10.3.1 Measurement Result

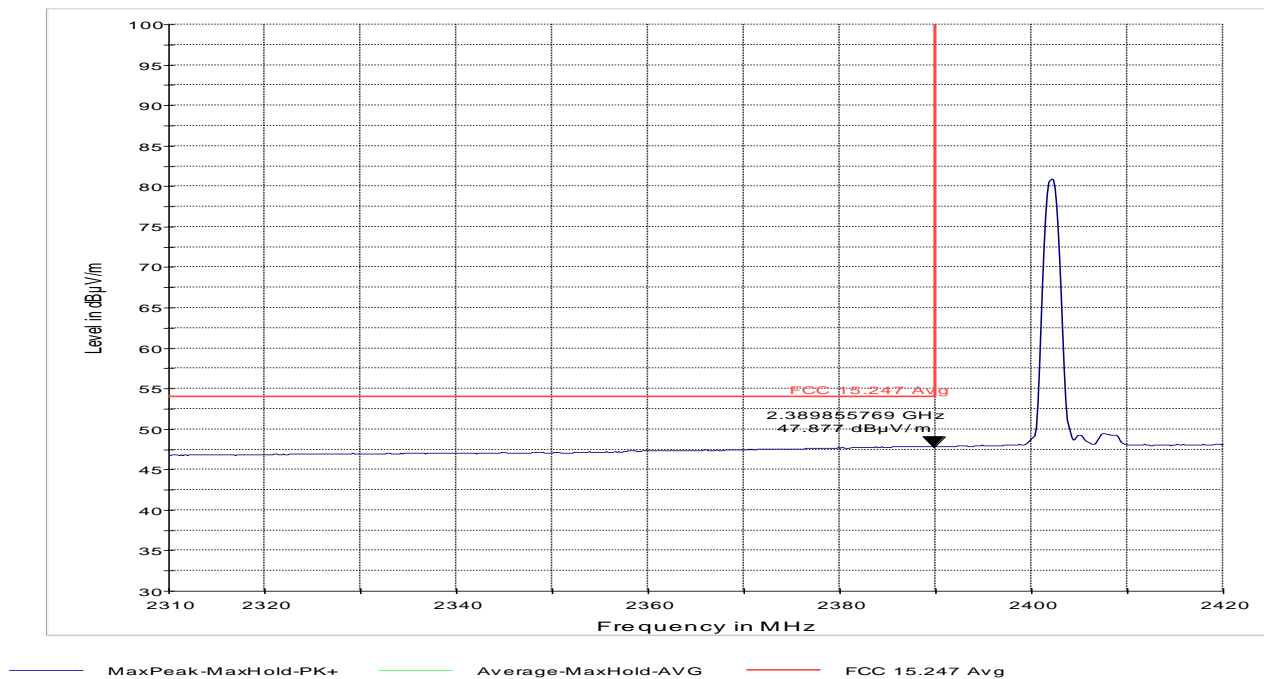
Pass.

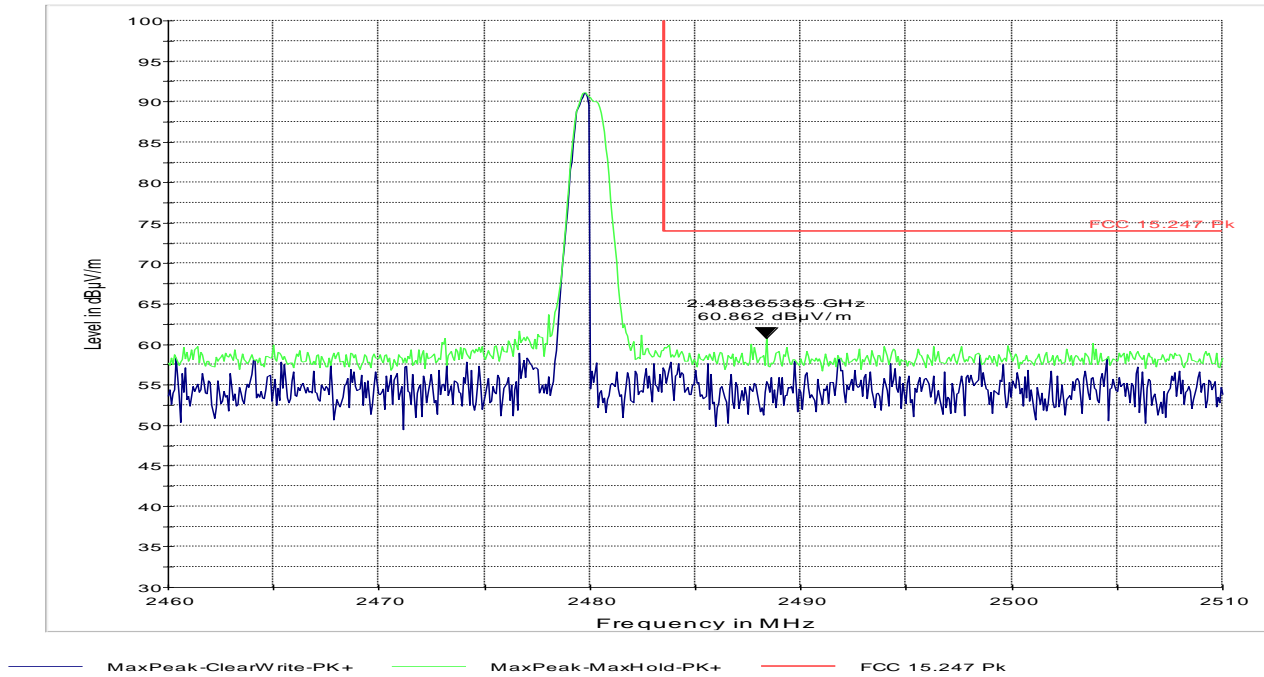
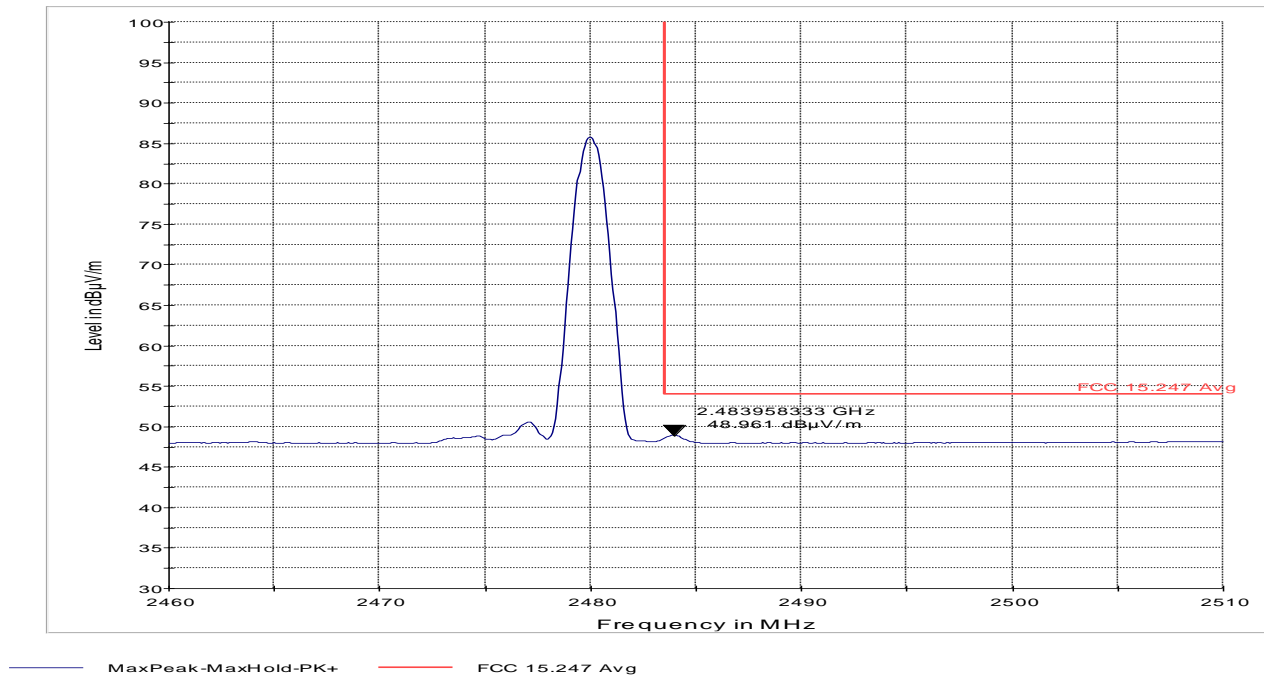
6.10.4 Test Data/plots:

Lower band edge peak BT 4.0 Ch. 0



Lower band edge average BT 4.0 Ch. 0



Higher band edge peak BT 4.0 Mode Ch. 39**Higher band edge average BT 4.0 Mode Ch. 39**

6.11 Transmitter Spurious Emissions- Radiated

6.11.1 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)

6.11.2 Test Conditions:

Tnom: 20°C; Vnom: 3.0 VDC

6.11.3 Test Result:

Test Mode: BT 4.0

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

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

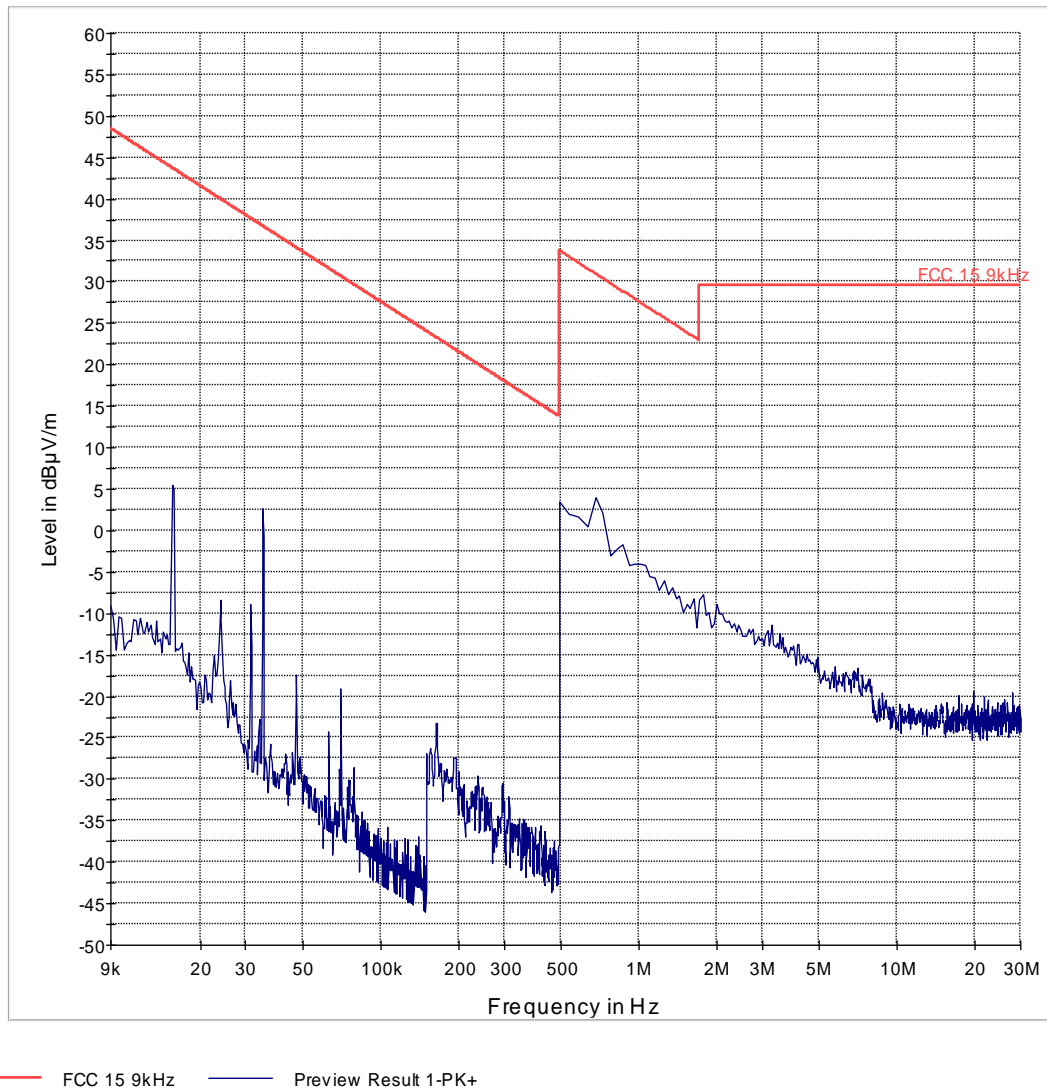
Measurement Uncertainty: ±3.0dB

6.11.3.1 Measurement Verdict

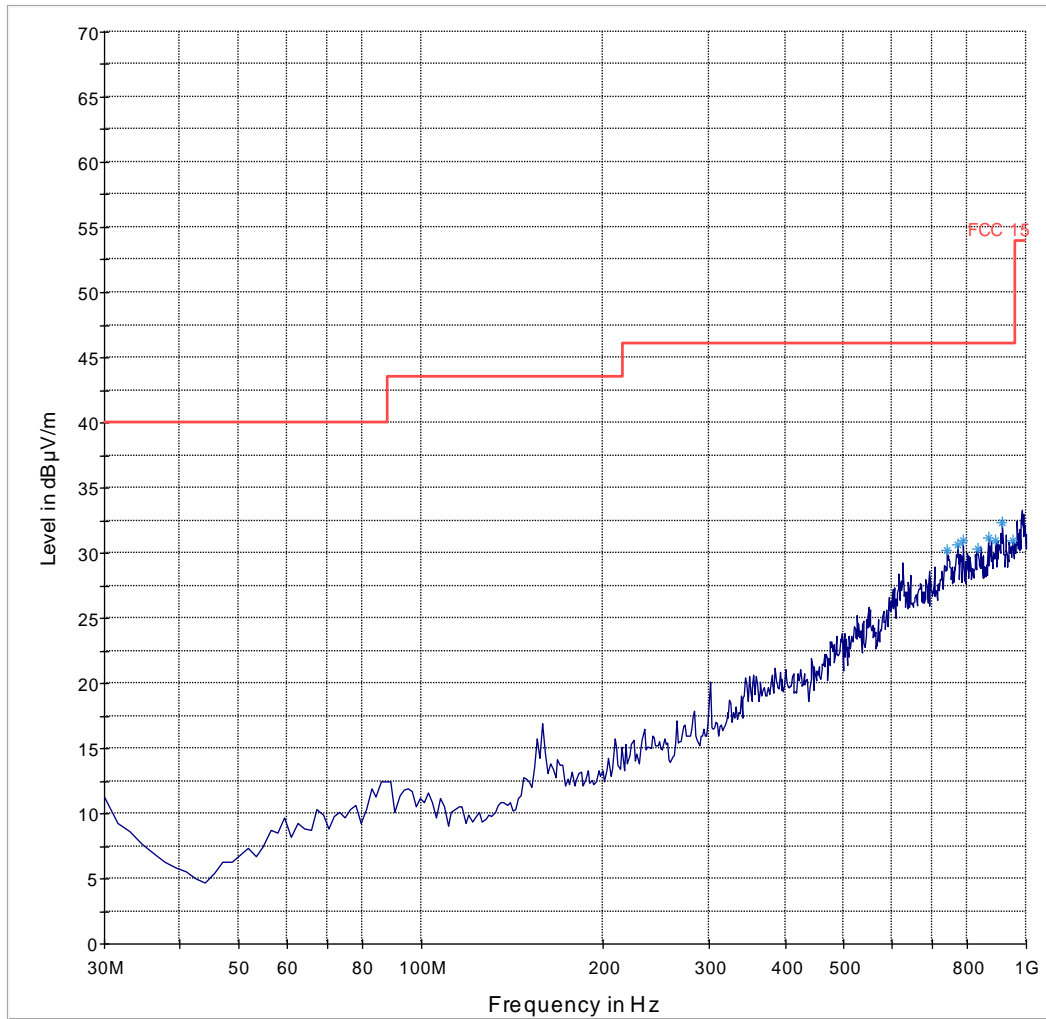
Pass.

6.11.4 Test data/ plots:**Transmitter Radiated Spurious Emission:<30MHz**

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

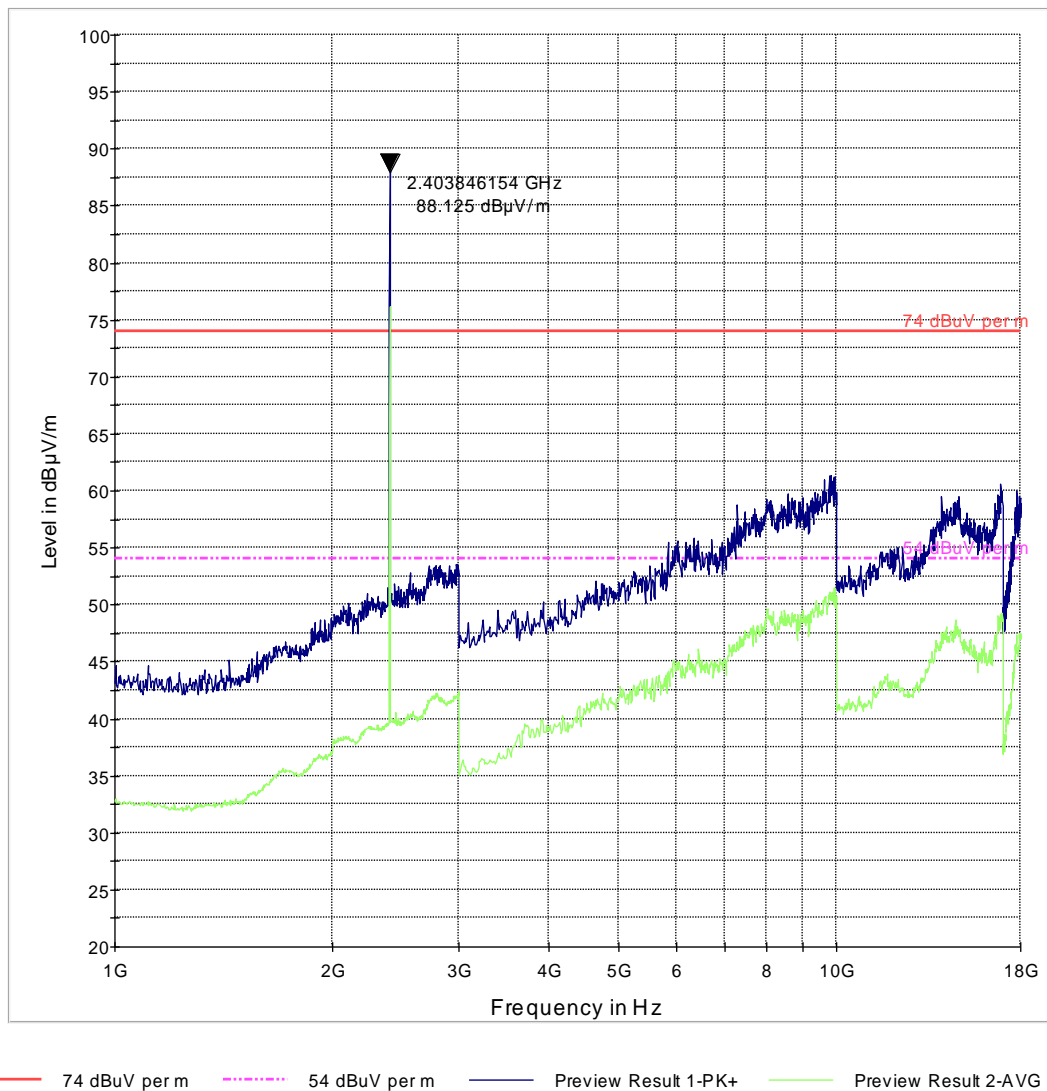


Transmitter Radiated Spurious Emission - 30M-1GHz – BT 4.0 Mode – 2402MHz

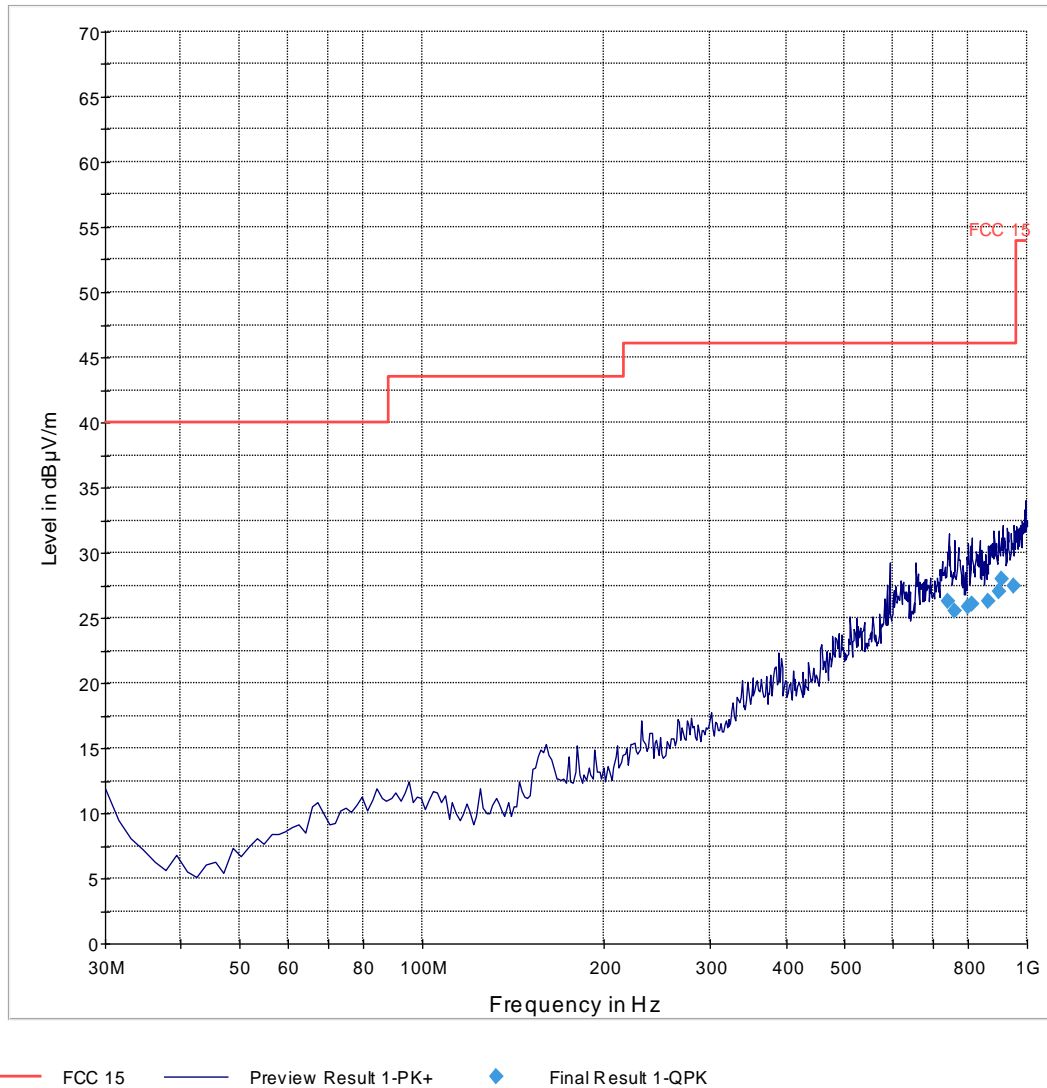


— FCC 15 — Preview Result 1-PK+ * Data Reduction Result 1 [3]-PK+

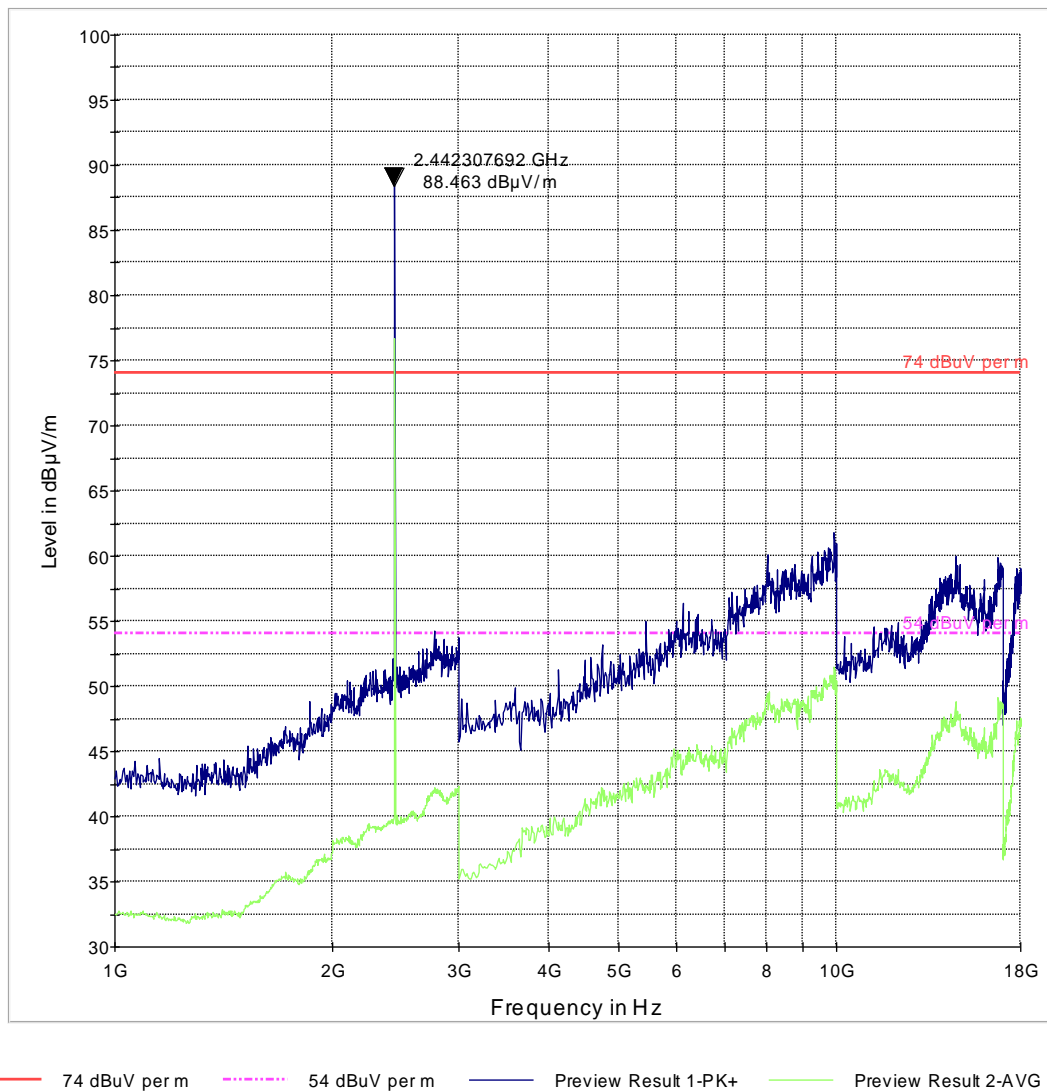
Transmitter Radiated Spurious Emission - 1G-18GHz – BT 4.0 Mode - 2402MHz



Transmitter Radiated Spurious Emission - 30M-1GHz – BT 4.0 Mode - 2440MHz

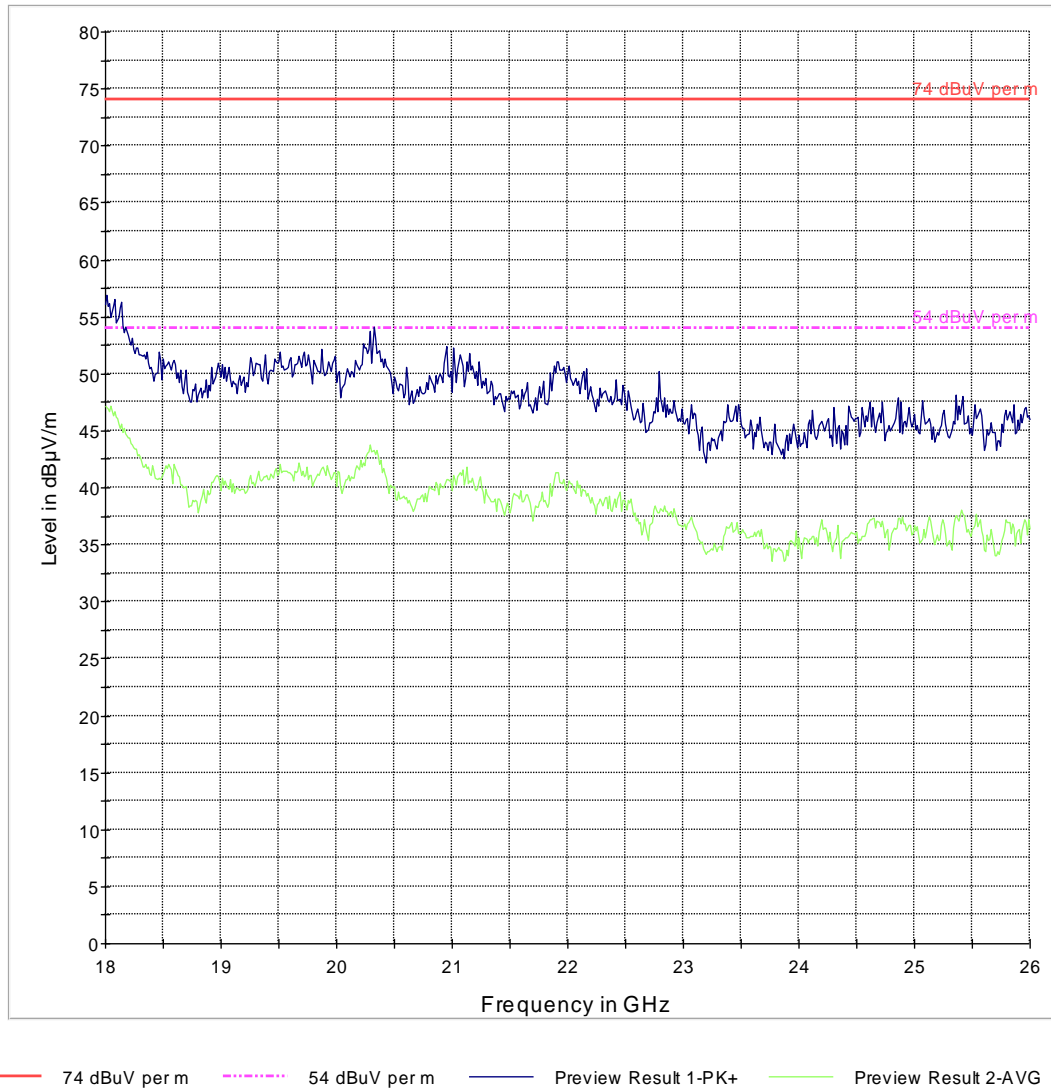


Transmitter Radiated Spurious Emission - 1G-18GHz – BT 4.0 Mode - 2440MHz

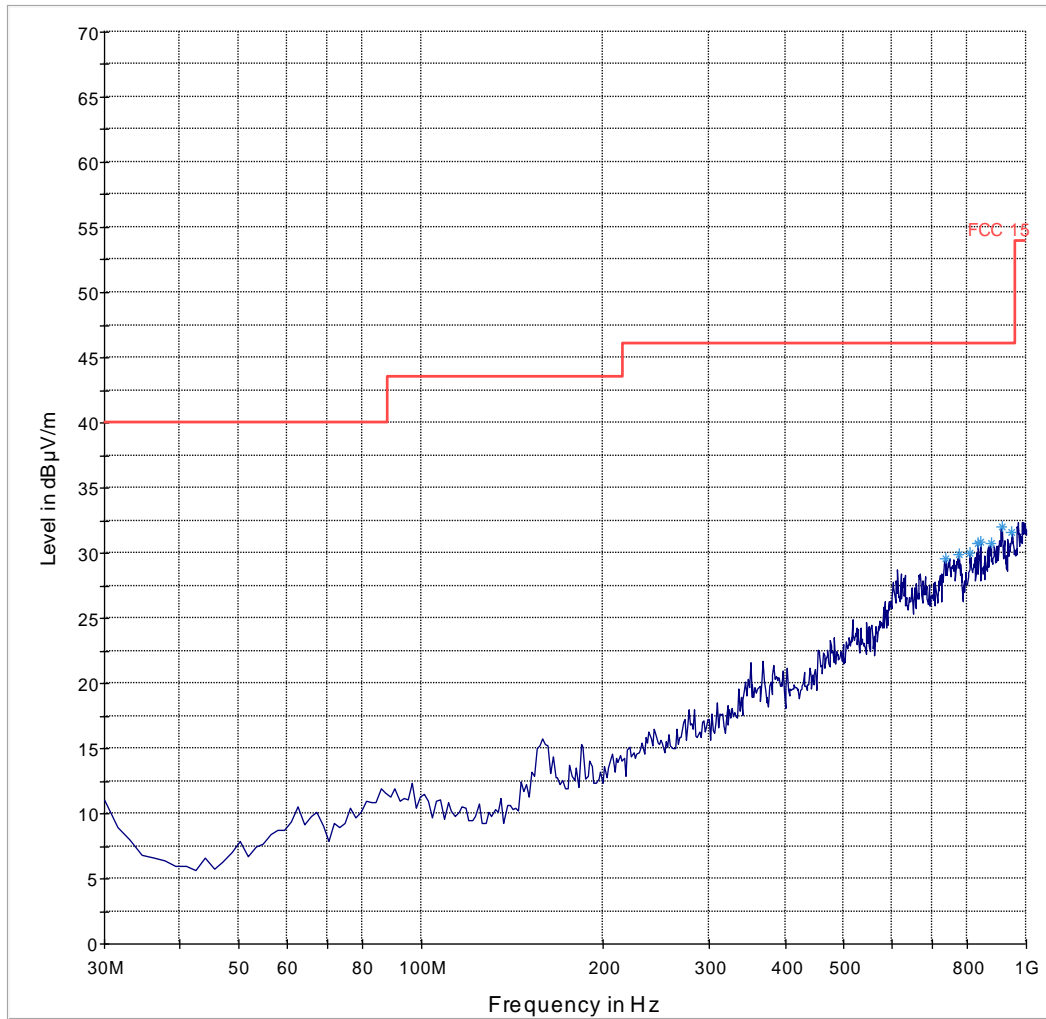


Transmitter Radiated Spurious Emission - 18G-26GHz – BT 4.0 Mode - 2440MHz

NOTE: Worst case for all channels in this frequency band.

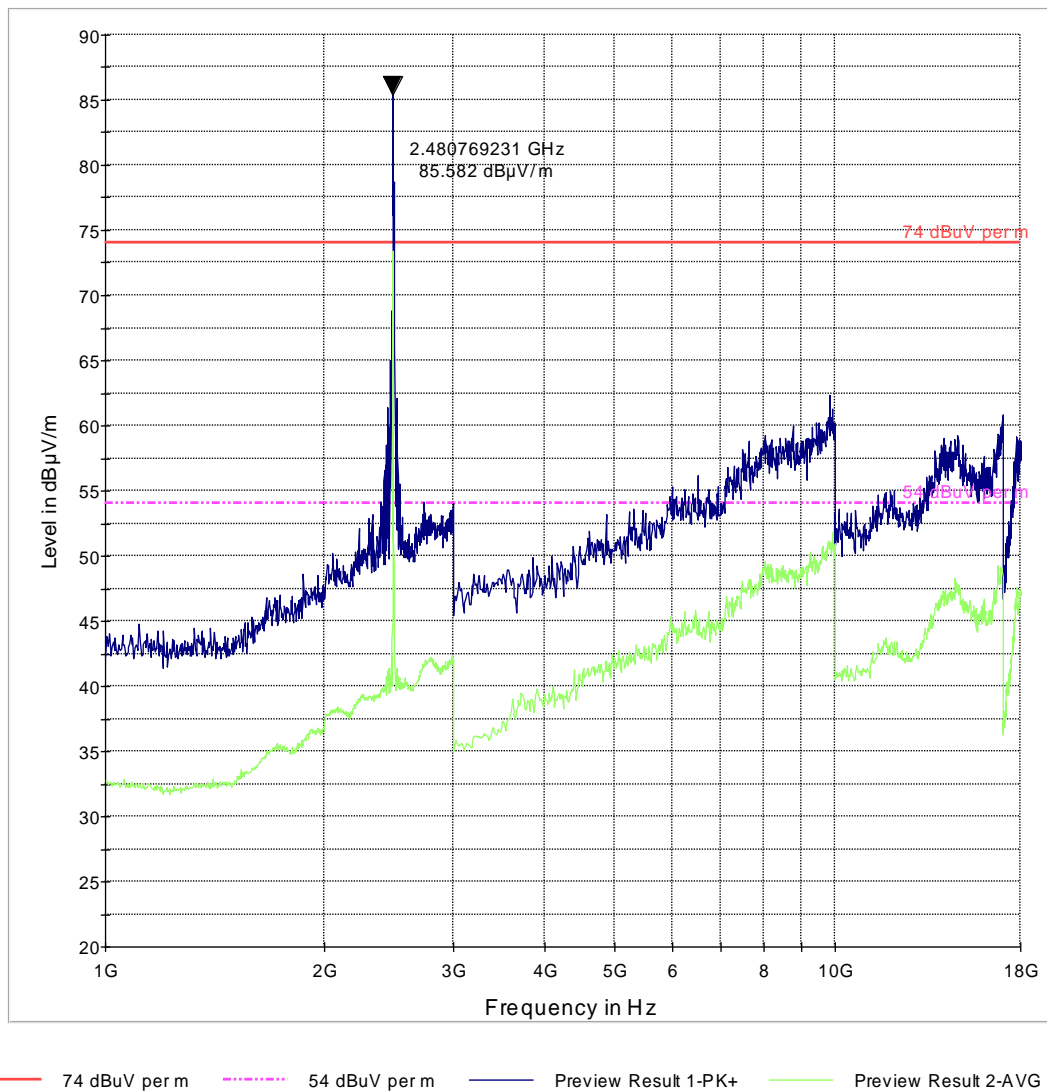


Transmitter Radiated Spurious Emission - 30M-1GHz – BT 4.0 Mode - 2480MHz



— FCC 15 — Preview Result 1-PK+ * Data Reduction Result 1 [3]-PK+

Transmitter Radiated Spurious Emission - 1G-18GHz – BT 4.0 Mode - 2480MHz



6.12 AC Power Line Conducted Emissions

6.12.1 References:

FCC: CFR Part 15.207

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.

6.12.2 Limits:

6.12.2.1 §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 μ H/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.

Table 1:

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	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- 9 KHz.

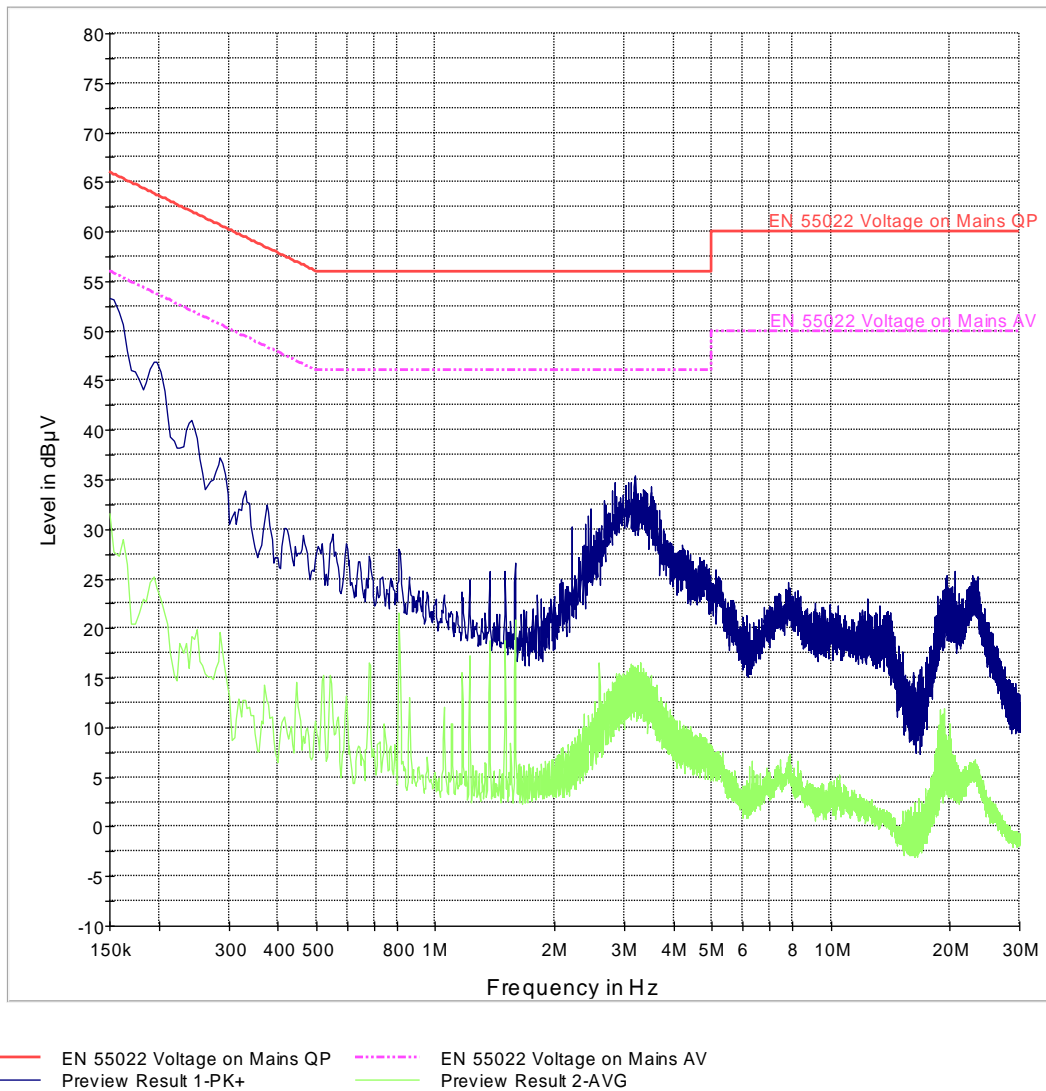
6.12.3 Test Conditions:

Modulation: BT 4.0 LE mode.

Measurement Uncertainty: ± 3.0 dB

Note: Plots shown here represent the combined worse case emissions for power lines, phases and neutral line.

6.12.4 Test Results:



7 Test Equipment and Ancillaries used for tests

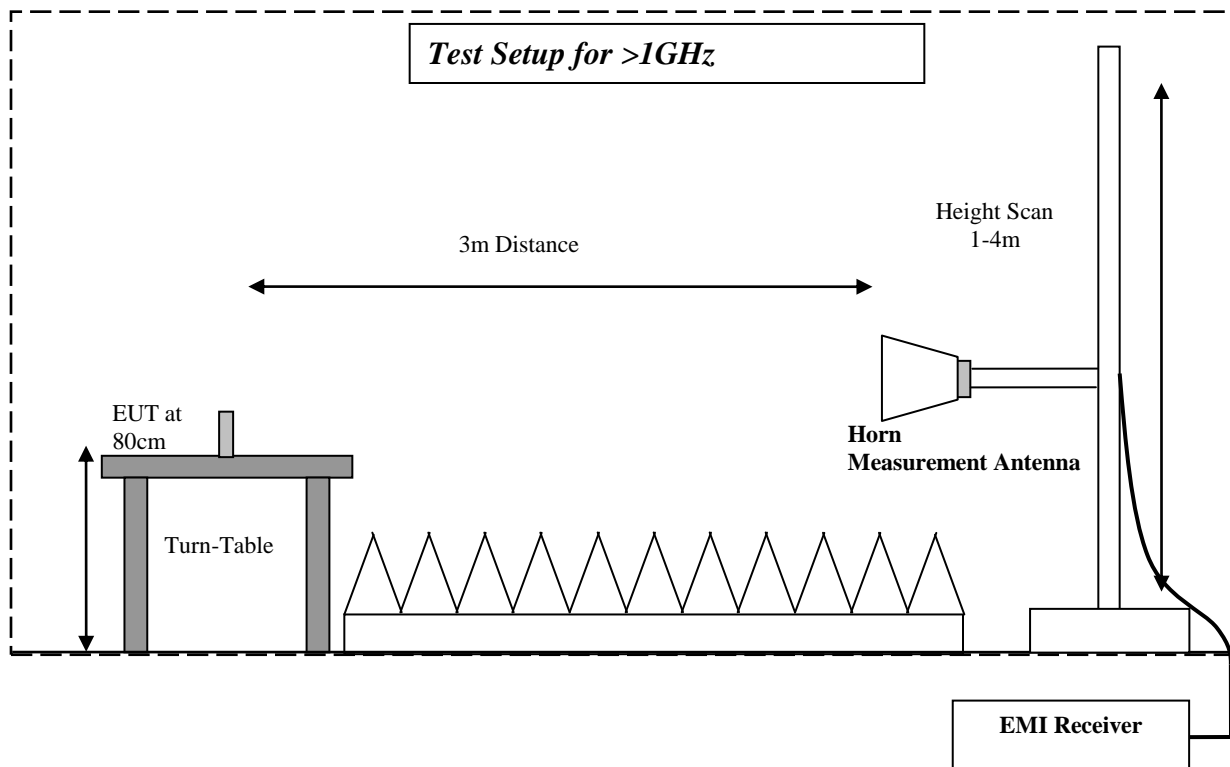
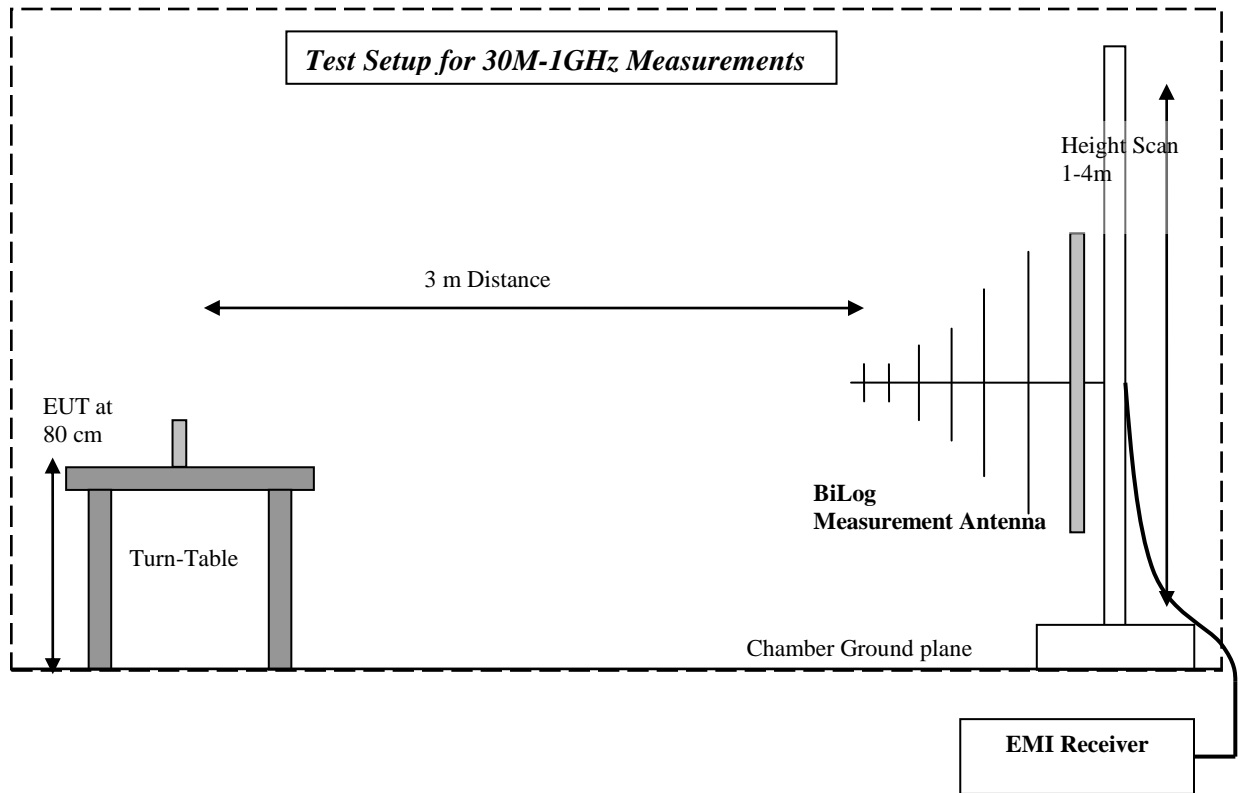
No.	Equipment Name	Manufacturer	Type/model	Serial No.	Cal Date	Cal Interval
3m Semi- Anechoic Chamber:						
	Turn table	EMCO	2075	N/A	N/A	N/A
	MAPS Position Controller	ETS Lindgren	2092	0004-1510	N/A	N/A
	Antenna Mast	EMCO	2075	N/A	N/A	N/A
	Relay Switch Unit	Rohde&Schwarz	RSU	338964/001	N/A	N/A
	EMI Receiver/Analyzer	Rohde&Schwarz	ESU 40	100251	May 2012	1 Year
	Spectrum Analyzer	Rohde&Schwarz	FSU	200302	May 2011	2 Years
	1500MHz HP Filter	Filtek	HP12/1700	14c48	N/A	N/A
	2800 MHz HP Filter	Filtek	HP12/2800	14C47	N/A	N/A
	Pre-Amplifier	Miteq	JS40010260	340125	N/A	N/A
	Binconilog Antenna	EMCO	3141	0005-1186	Apr 2012	3 Years
	Binconilog Antenna	ETS	3149	J000123908	Feb 2012	3 years
	Horn Antenna	EMCO	3115	35114	Mar 2012	3 Years
	LISN	FCC	50-25-2-08	08014	Jul 2012	1 Year
Ancillary equipment						
	Multimeter	Klein Tools	MM200	001	Apr 2011	2 Years
	Humidity Temperature Logger	Dickson	TM320	03280063	Apr 2013	1 Year
	Digital Barometer	VWR	35519-055	91119547	Nov 2011	2 Years
	DC Power Supply	HP	E3610A	KR83023316	N/A	N/A
	DC Power Supply	Protek	3003B	H012771	N/A	N/A
	Communication Antenna	IBP5-900/1940	Kathrein	N/A	N/A	N/A

Equipment used meets the measurement uncertainty requirements as required per applicable standards for 95% confidence levels.

Calibration due dates, unless defined specifically, falls on the last day of the month.

Items indicated "N/A" for cal status either do not specifically require calibration or is internally characterized before use.

8 Test Setup Diagrams:



Test Report #: EMC_CSRTE-001-13001_DTS

FCC ID: PIWCNS1004

Date of Report : 2013-05-13



9 Revision History

Date	Report Name	Changes to report	Report prepared by
2013-05-13	EMC_CSRTE-001-13001_DTS	First Version	C Lee