



**SGS-CSTC Standards
Technical Services
(Shanghai) Co., Ltd.**

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TEST REPORT

Application No. : SHEM1209001305RF
Applicant: Kohler Co.
FCC ID: N82-KOHLER009
IC: 4554A-KOHLER009
Fundamental Frequency : 2405MHz to 2480MHz
Equipment Under Test (EUT):
Marking: Kohler
Name: Numi upgrade Integrated toilet with bidet functionality
Model No.: K-3901
Standards: FCC PART 15 SUBPART C, Section 15.247
RSS-210 Issue 8 (December 2010)
RSS-Gen Issue 3 (December 2010)
Date of Receipt: October 23, 2012
Date of Test: October 30, 2012 to March 06, 2013
Date of Issue: March 06, 2013
Test Result : **PASS ***

* In the configuration tested, the EUT complied with the standards specified above.

Jim Xu
E&E Section Head
SGS-CSTC(Shanghai) Co., Ltd.

Zenger Zhang
E&E Project Engineer
SGS-CSTC(Shanghai) Co., Ltd.

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2 Test Summary

TEST ITEM	FCC REFERANCE	IC REFERANCE	RESULT
Minimum 6dB Bandwidth	15.247(a)(2), ANSI C 63.10:2009 § 6.9.1	RSS-210 Issue 8 Annex 8.2 RSS-Gen Issue 3 Clause 4.6.1	Pass
Maximum peak output power	15.247(b)(3), KDB558074 § 8.1	RSS-210 Issue 8 Annex 8.4	Pass
Power spectrum density	15.247(e), ANSI C 63.10:2009 § 6.11.2.3	RSS-210 Issue 8 Annex 8.2	Pass
Radiated emission	15.205 & 15.209	RSS-210 Issue 8 Annex 8.5	Pass
Emission outside the Frequency band, band Edges Measurement	15.247(d), ANSI C 63.10:2009	RSS-210 Issue 8 Annex 8.5	Pass
RF Exposure Compliance Requirement	15.247(b)(4)	RSS-Gen Issue 3 Clause 5.6	Pass
Conducted Spurious Emission (30MHz to 25GHz)	15.247(d), ANSI C 63.10:2009	RSS-210 Issue 8 Annex 8.5	Pass
Radiated Spurious Emission (30MHz to 25GHz)	15.209 & 15.247(d), ANSI C 63.10:2009	RSS-210 Issue 8 Annex 8.5	Pass
Power line conducted emission	15.207	RSS-Gen Issue 8 Clause 7.2.4	Pass
Antenna Requirement	15.203, 15.247(c) (1)(i)	-	Compliance

Noted:“-” means not require in the rules.

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4 General Information

4.1 Client Information

Applicant : Kohler Co.
Applicant Address: 444 Highland Drive Kohler, WI 53044
Manufacturer: Shanghai KOHLER Electronics., Ltd.
Manufacturer Address: Building E, 18 Jindian Road, Pudong New Area, 201206 Shanghai, China

4.2 Details of E.U.T.

Marking: Kohler
Name: Numi upgrade Integrated toilet with bidet functionality
Model No.: K-3901
Power Supply: 120VAC 60Hz
Power Cord: About 1.5m
Frequency Band and Channels : 2405-2480 MHz / 16 Channels / Channel space is 5MHz.
Channel Description:

Channel of Tranmitter	Frequency(MHz)
1	2405
2	2410
...	...
9	2445
...	...
15	2475
16	2480

Tested Channel: Channel 1,9,16
Modulation Type: DSSS
Antenna Spec.: Model No.: RMA-2R450GA1(FPC)
Operating Frequency Band: 2400-2500MHz
Type: Integral
Gain: 3.0dBi
Remark: The EUT (Model No. K-3901) includes the following three wireless modules:
a, 2.4 GHz Zigbee communication module;
b, 10.525 GHz microwave detection module;
c, 2.4 GHz Bluetooth communication module.
The report is only covered 2.4 GHz Zigbee communication module.

4.3 Description of Support Units

None.

4.4 Test Location

Tests were performed at:

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd.
No.588 West Jindu Road, Songjiang District, Shanghai, China. 201612.

Tel: +86 21 6191 5666 Fax: +86 21 6191 5655

No tests were sub-contracted.

4.5 Other Information Requested by the Customer

None.

4.6 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **CNAS (No. CNAS L0599)**

CNAS has accredited SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing. Date of expiry: 2014-07-26.

- **FCC – Registration No.: 402683**

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been registered and fully described in a report filed with the Federal Communications Commission (FCC). The acceptance letter from the FCC is maintained in our files. Registration No.: 402683, Expiry Date: 2015-02-22.

- **Industry Canada (IC) – IC Assigned Code: 8617A**

The 3m Semi-anechoic chamber of SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 8617A. Expiry Date: 2014-09-20.

- **VCCI (Member No.: 3061)**

The 3m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-3868 and C-4336 respectively. Date of Registration: 2012-05-29. Date of Expiry: 2015-05-28.

5 Test Results

5.1 Test Instruments

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due date
1	EMI test receiver	Rohde & Schwarz	ESU40	100109	2012-06-03	2013-06-01
2	Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-679	2012-06-03	2013-06-01
3	Horn Antenna	Rohde & Schwarz	HF906	100284	2012-06-03	2013-06-01
4	ANTENNA	SCHWARZBECK	VULB9168	9168-313	2012-06-03	2013-06-01
5	Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA91703 73	2012-03-15	2013-03-14
6	Ultra broadband antenna	Rohde & Schwarz	HL562	100227	2012-10-09	2013-10-08
7	Atmosphere pressure meter	Shanghai ZhongXuan Electronic Co.;Ltd	BY—2009P	--	2012-10-15	2013-10-14
8	CLAMP METER	FLUKE	316	86080010	2012-06-03	2013-06-01
9	Thermo-Hygrometer	ZHICHEN	ZC1-2	01050033	2012-10-14	2013-10-13
11	High-low temperature cabinet	Shanghai YuanZhen	GW2050	--	2012-06-17	2013-06-16
12	Tunable Notch Filter	Wainwright instruments Gmbh	WRCT1800.0/ 2000.0-0.2/40- 5SSK	11	2012-06-03	2013-06-01
13	Tunable Notch Filter	Wainwright instruments Gmbh	WRCT800.0/880 .0-0.2/40-5SSK	9	2012-06-03	2013-06-01
14	High pass Filter	FSCW	HP 12/2800- 5AA2	19A45-02	2012-06-03	2013-06-01
15	Low noise amplifier	TESEQ	LNA6900	70133	2012-07-05	2013-07-04
16	EMI test receiver	Rohde & Schwarz	ESCS30	100086	2012-06-04	2013-06-03
17	Line impedance stabilization network	SCHWARZBECK	NSLK8127	8127-490	2012-06-03	2013-06-01

5.2 E.U.T. Operation

Input voltage:	AC 120V 60Hz
Operating Environment:	
Temperature:	20.0-25.0 °C
Humidity:	45-56 % RH
Atmospheric Pressure:	990-1018mbar
EUT Operation:	The EUT has been tested under operating condition. Test program was used to control the EUT for staying in continuous transmitting mode is programmed. Channel low (2405MHz) mid(2445MHz) high(2480MHz)

5.3 Test Procedure & Measurement Data

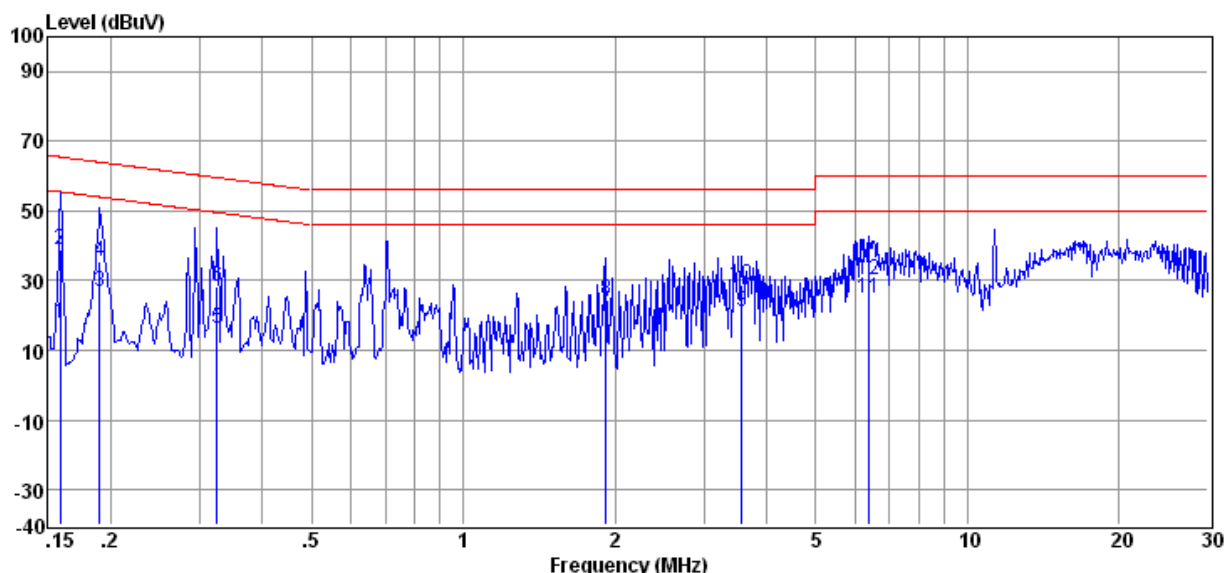
5.3.1 Conducted Emission Test

Test Requirement:	FCC Part 15 Section 15.207 RSS-Gen Issue 8 Clause 7.2.4
Test date:	October. 30, 2012
Standard Applicable	According to section 15.207,frequency 150KHz to 30MHz shall not exceed the limit table as blew.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

EUT Setup	<ol style="list-style-type: none"> 1.The conducted emission tests were performed in the test site,using the setup in accordance with the ANSI C63.10-2009. 2.EUT is charged with PC.The AC Power adaptor of PC was plug-in LISN.The rear of the EUT and periphearals were placed flushed with the rear of the tabletop. 3.The LISN was connected with 120V AC/60Hz power source.
Measurement Result	<p>Operation mode: Transmitting mode by Zigbee wireless mode.</p> <p>Note: All test modes have been tested, below show the worst plots.</p>

L line:

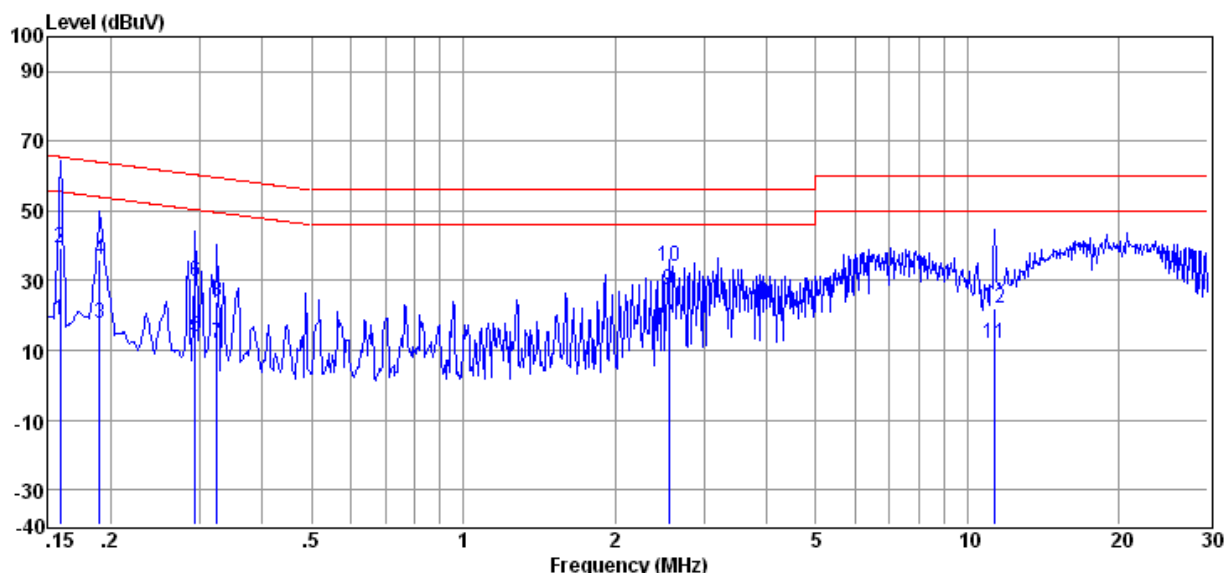


Item (Mark)	Freq (MHz)	Read Level (dBμV)	LISN Factor (dB)	Cable Loss (dB)	Level (dBμV)	Limit Line (dBμV)	Over Limit (dB)	Detector	Phase
1	0.159	17.61	0.18	0.10	17.89	55.52	-37.63	Average	LINE
2	0.159	38.67	0.18	0.10	38.95	65.52	-26.57	QP	LINE
3	0.190	26.88	0.12	0.10	27.10	54.02	-26.92	Average	LINE
4	0.190	35.22	0.12	0.10	35.44	64.02	-28.58	QP	LINE
5	0.325	16.13	0.14	0.10	16.37	49.57	-33.20	Average	LINE
6	0.325	27.85	0.14	0.10	28.09	59.57	-31.48	QP	LINE
7	1.918	20.76	0.29	0.10	21.15	46.00	-24.85	Average	LINE
8	1.918	23.95	0.29	0.10	24.34	56.00	-31.66	QP	LINE
9	3.565	20.83	0.30	0.15	21.28	46.00	-24.72	Average	LINE
10	3.565	28.30	0.30	0.15	28.75	56.00	-27.25	QP	LINE
11	6.386	24.37	0.30	0.20	24.87	50.00	-25.13	Average	LINE
12	6.386	29.82	0.30	0.20	30.32	60.00	-29.68	QP	LINE

Note: 1. Level = Read Level + LISN Factor + Cable loss

2. If QP Result comply with AV limit, AV Result is deemed to comply with AV limit

N Line:



Item (Mark)	Freq (MHz)	Read Level (dBμV)	LISN Factor (dB)	Cable Loss (dB)	Level (dBμV)	Limit Line (dBμV)	Over Limit (dB)	Detector	Phase
1	0.159	18.63	0.18	0.10	18.91	55.52	-36.61	Average	NEUTRAL
2	0.159	39.28	0.18	0.10	39.56	65.52	-25.96	QP	NEUTRAL
3	0.190	17.48	0.12	0.10	17.70	54.02	-36.32	Average	NEUTRAL
4	0.190	35.59	0.12	0.10	35.81	64.02	-28.21	QP	NEUTRAL
5	0.294	13.74	0.13	0.10	13.97	50.41	-36.44	Average	NEUTRAL
6	0.294	29.65	0.13	0.10	29.88	60.41	-30.53	QP	NEUTRAL
7	0.325	11.93	0.14	0.10	12.17	49.57	-37.40	Average	NEUTRAL
8	0.325	23.78	0.14	0.10	24.02	59.57	-35.55	QP	NEUTRAL
9	2.554	26.70	0.30	0.12	27.12	46.00	-18.88	Average	NEUTRAL
10	2.554	33.78	0.30	0.12	34.20	56.00	-21.80	QP	NEUTRAL
11	11.317	11.02	0.60	0.10	11.72	50.00	-38.28	Average	NEUTRAL
12	11.317	21.25	0.60	0.10	21.95	60.00	-38.05	QP	NEUTRAL

Note: 1. Level = Read Level + LISN Factor + Cable loss

2. If QP Result comply with AV limit, AV Result is deemed to comply with AV limit

5.3.2 Peak Output Power Measurement

Test Requirement: 15.247(b)(3), KDB558074 § 8.1
RSS-210 Issue 8 Annex 8.4

Test date Mar. 06, 2013

Standard Applicable: According to section 15.247(a)(2),(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.

Measurement Procedure

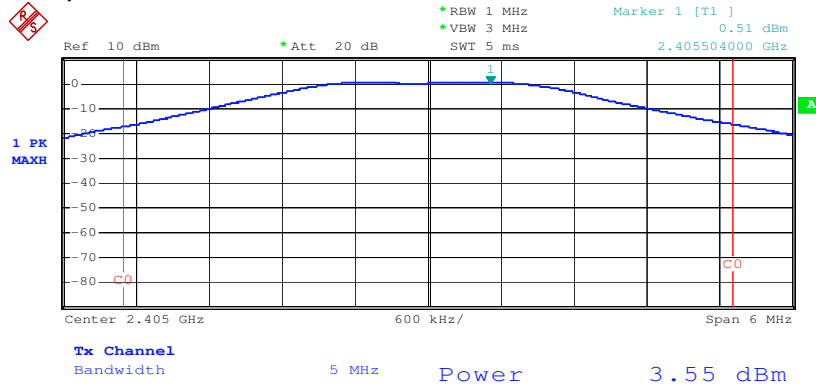
1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum.
3. Set the occur band to the entire emission bandwidth of the signal.
4. Record the max.channel power reading
5. Repeat above procedures until all the frequency measured were complete.

Measurement Result:

CH	Frequency (MHz)	Reading Power(dBm)	Cable Loss (dB)	Peak Output Power (dBm)	Limit (dBm)	Result
LOW	2405	3.55	0.5	4.05	30	PASS
MID	2445	2.68	0.5	3.18	30	PASS
HIGH	2480	2.84	0.5	3.34	30	PASS

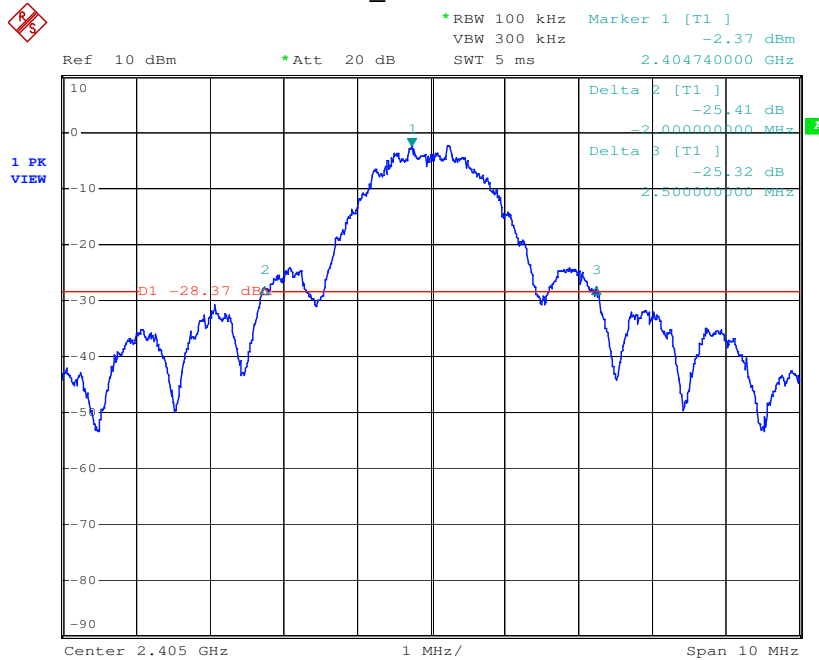
Remark: Peak Output Power = Reading Power + Cable Loss

Peak Power Output Data Plot:
 Low Channel (2405MHz)



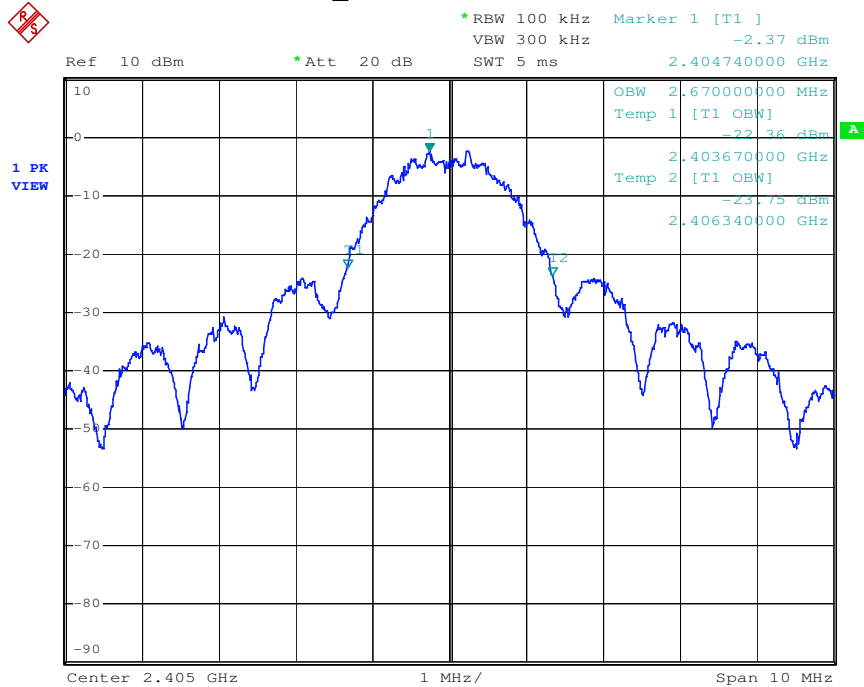
Date: 6.MAR.2013 14:09:14

Additional Test Plot _26dB bandwidth = 4.50MHz



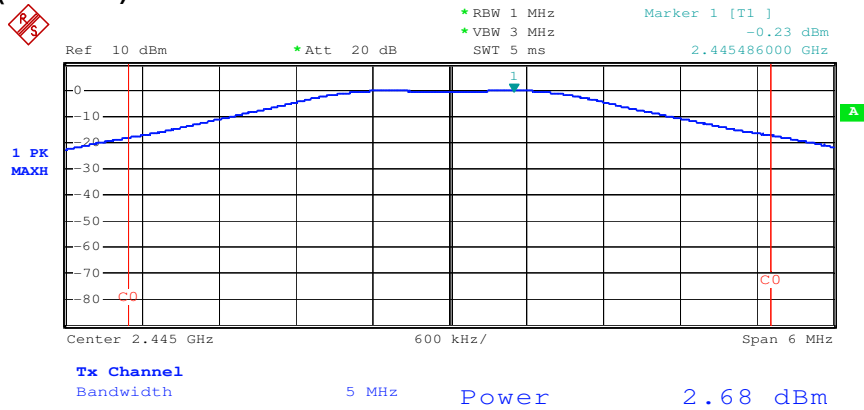
Date: 6.MAR.2013 13:27:04

Additional Test Plot _99% emission bandwidth = 2.67MHz



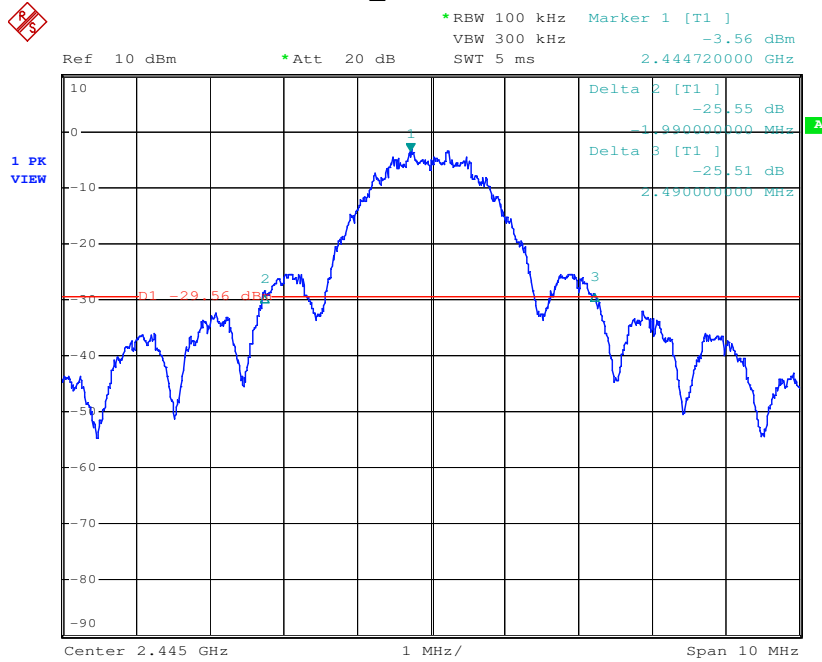
Date: 6.MAR.2013 13:27:49

Middle Channel (2445MHz)



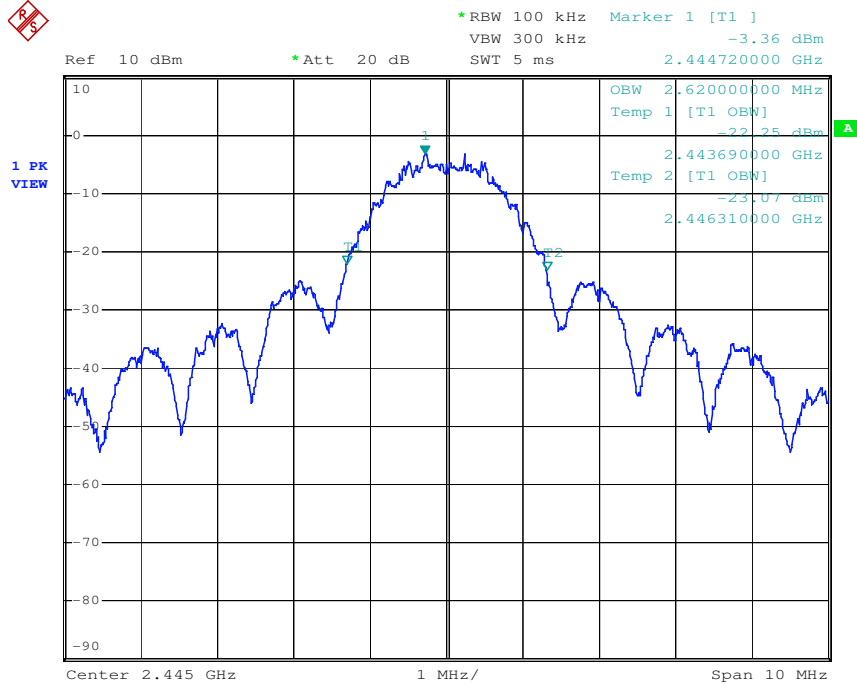
Date: 6.MAR.2013 13:57:04

Additional Test Plot _26dB bandwidth = 4.48MHz



Date: 6.MAR.2013 13:31:02

Additional Test Plot _99% emission bandwidth = 2.62MHz

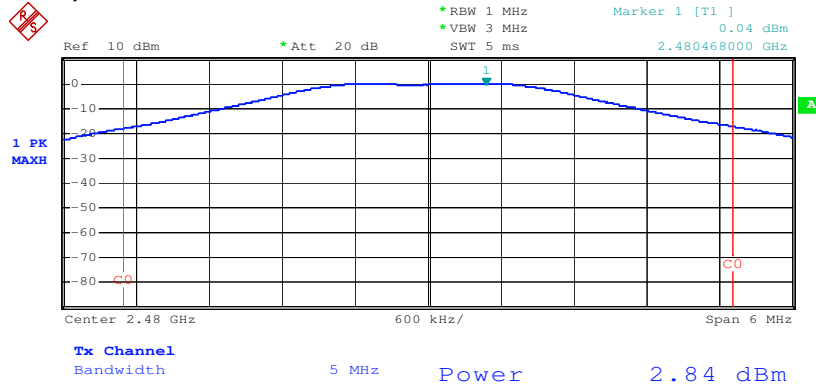


Date: 6.MAR.2013 13:28:30

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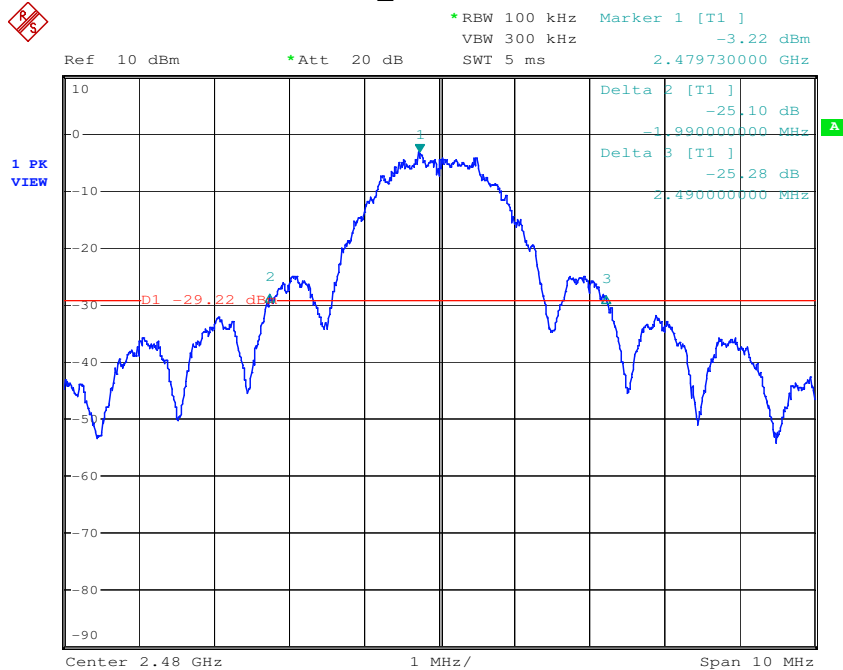
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High Channel (2480MHz)



Date: 6.MAR.2013 14:10:17

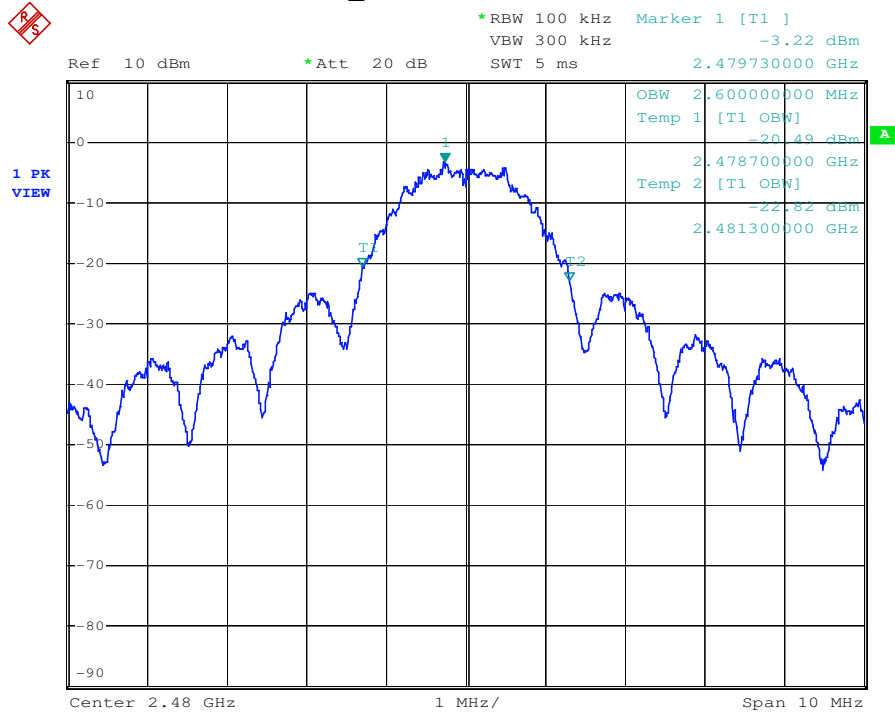
Additional Test Plot _26dB bandwidth = 4.48MHz



Date: 6.MAR.2013 13:31:54

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Additional Test Plot _99% emission bandwidth = 2.60MHz



Date: 6.MAR.2013 13:32:20

5.3.3 6dB Bandwidth

- Test Requirement:** FCC Part15 Section 247(a)(2), ANSI C 63.10:2009 § 6.9.1
RSS-210 Issue 8 Annex 8.2, RSS-Gen Issue 3 Clause 4.6.1
- Test date:** Feb. 27, 2013
- Standard Applicable:** According to section 15.247(a)(2), Systems using digital modulation techniques may operate in the 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz bands. The minimum 6dB bandwidth shall be at least 500KHz.
- Measurement Procedure:**
1. Place the EUT on the table and set it in transmitting mode.
 2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
 3. Set the spectrum analyzer as RBW=1% to 5% of the 6dB bandwidth (set 30kHz), VBW \geq 3RBW (set 100kHz), Span=approximately 2 to 5 times the 6dB bandwidth (set 5MHz), Sweep=auto
 4. Mark the peak frequency and -6dB (upper and lower) frequency.
 5. Repeat above procedures until all frequency measured were complete.

Measurement Result:

CH	Frequency (MHz)	Bandwidth (MHz)	Limit Bandwidth (KHz)	Result
LOW	2405	1.53	500	PASS
MID	2445	1.55	500	PASS
HIGH	2480	1.53	500	PASS

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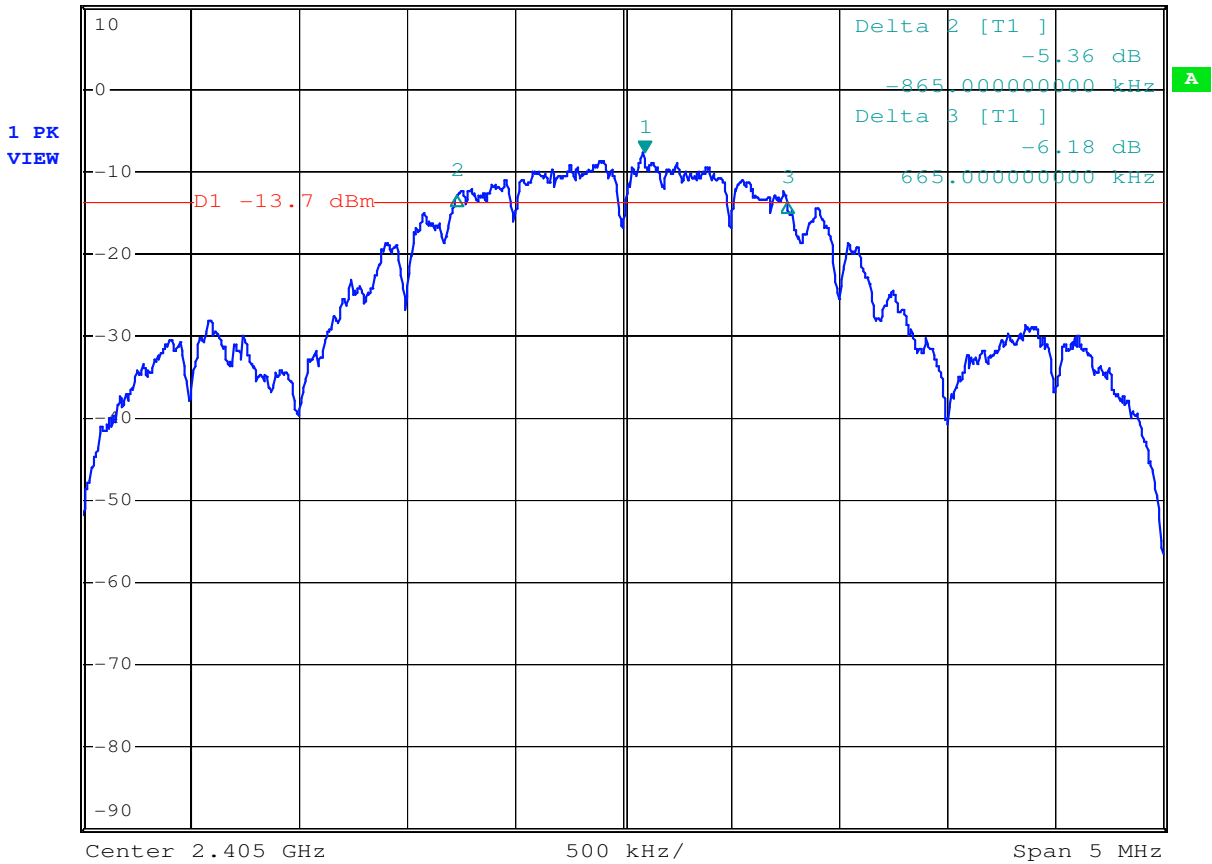
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6dB Bandwidth Test Plot

CH-Low 2405MHz



Ref 10 dBm *Att 20 dB *RBW 30 kHz Marker 1 [T1]
 *VBW 100 kHz -7.70 dBm
 SWT 10 ms 2.405095000 GHz



Date: 27.FEB.2013 09:25:39

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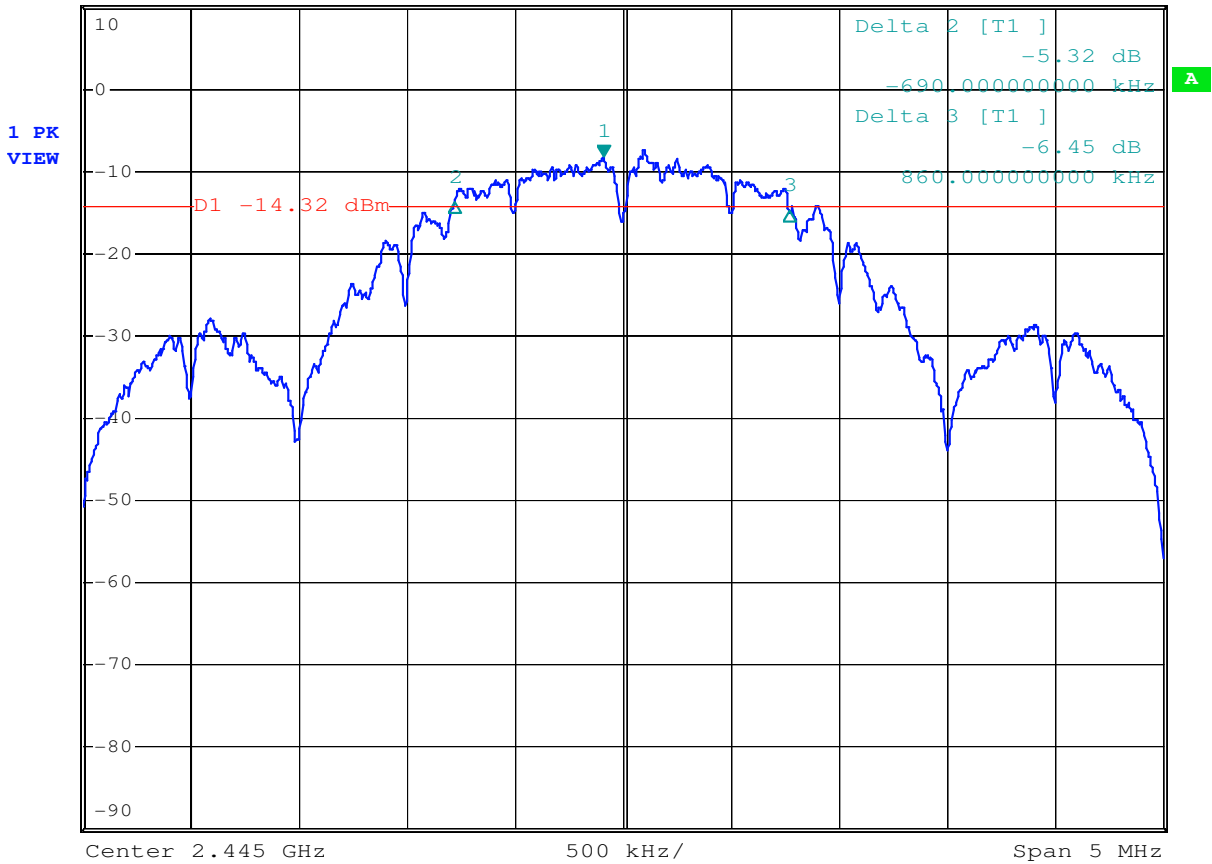
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6dB Bandwidth Test Plot:

CH-Mid 2445MHz



Ref 10 dBm *Att 20 dB *RBW 30 kHz Marker 1 [T1]
 *VBW 100 kHz -8.32 dBm
 SWT 10 ms 2.444910000 GHz



Date: 27.FEB.2013 09:27:01

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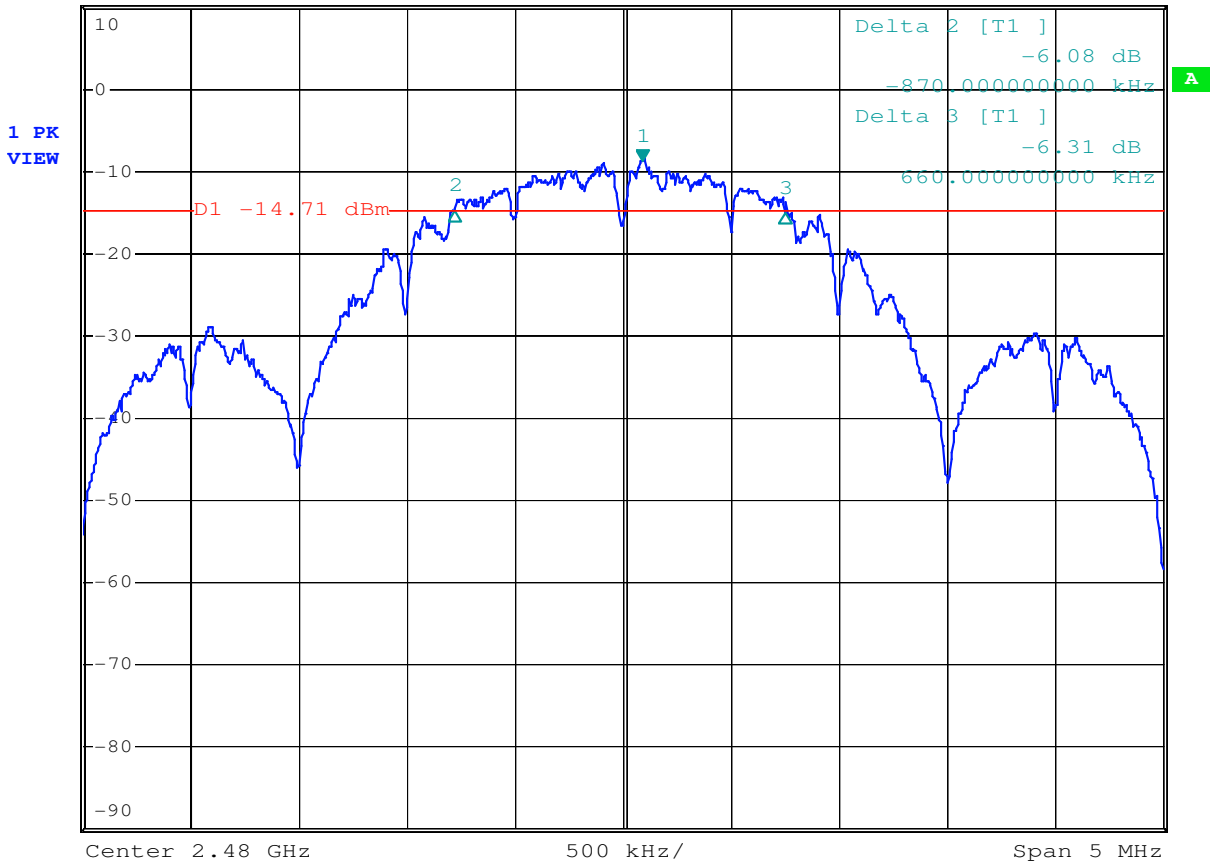
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6dB Bandwidth Test Plot:

CH-High 2480MHz



Ref 10 dBm *Att 20 dB *RBW 30 kHz Marker 1 [T1]
 *VBW 100 kHz -8.71 dBm
 SWT 10 ms 2.480090000 GHz



Date: 27.FEB.2013 09:28:05

5.3.4 Radiated Emission Band Edge

Test Requirement: 15.247(d), ANSI C 63.10:2009

RSS-210 Issue 8 Annex 8.5

Test date: Feb. 25, 2013

Standard Applicable: According to section 15.247(c), in any 100KHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100KHz bandwidth within the band that contains the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in section 15.205(a), must also comply with the radiated emission limits specified in 15.209(a).

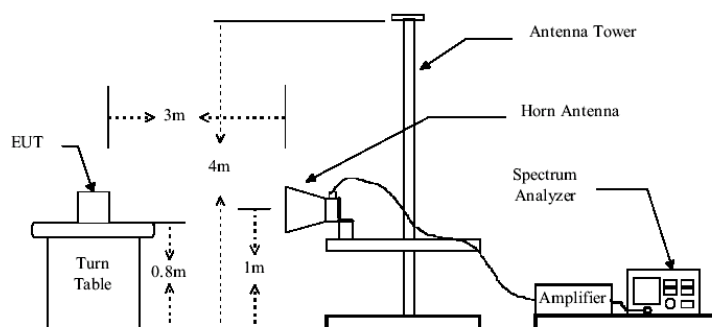
Measurement Procedure: The EUT was setup according to ANSI 63.10,2009 and tested according to DTS test procedure of KDB558074 for compliance to FCC 47 CFR 15.247 requirements. The EUT is placed on a turn table which is 0.8 m above ground. The turn table is rotated 360 degrees to determine to the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters. The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSIC 63.10:2009 on radiated measurement.

Spectrum analyzer parameters setting as shown below:

(a) PEAK: RBW=VBW=1MHz / Sweep=AUTO

(b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO

Radiated Emission Test Set-up Frequency Over 1GHz

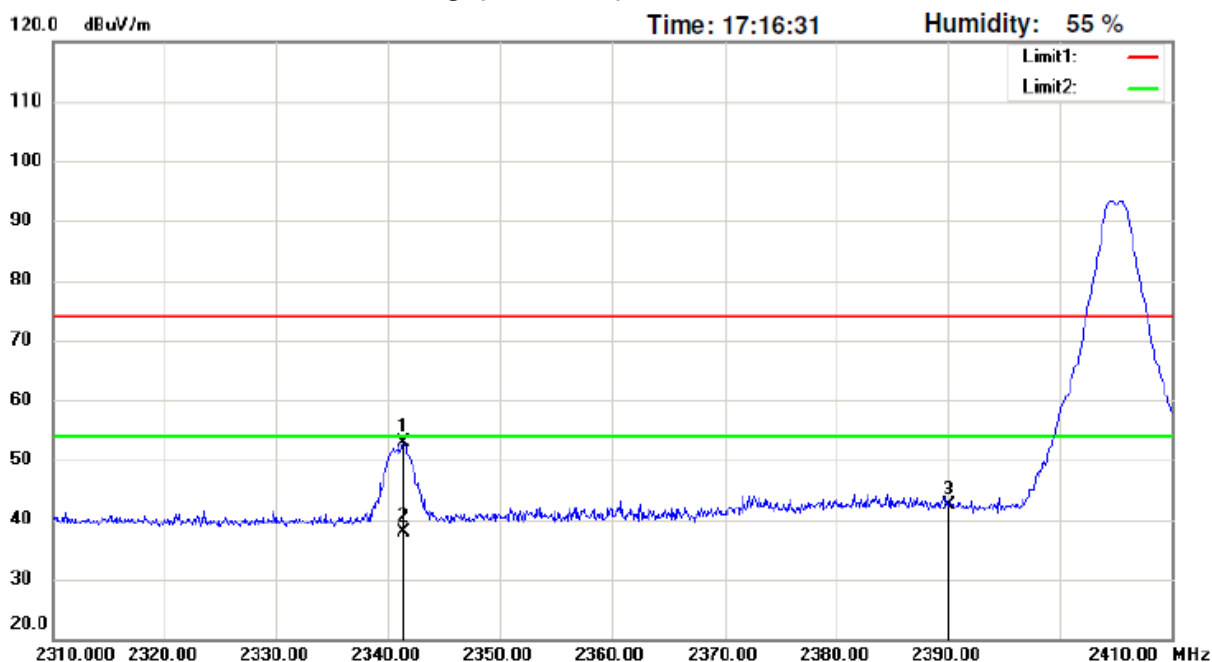


The field strength is calculated by adding the Antenna Factor, Preamplifier Factor & Cable loss. The basic equation with a sample calculation is as follows:

Final Test Level = Receiver Reading + Antenna Factor + Cable Loss - Preamplifier Factor

Measurement Result:

CH Low 2405MHz Radiated Bandedge(Horizontal)



Horizontal, Peak & AV Detector:

Mk.	Frequency (MHz)	Reading (dBuV/m)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	2341.400	59.50	peak	-6.63	52.87	74.00	-21.13
2	2341.400	44.52	AVG	-6.63	37.89	54.00	-16.11
3	2390.000	48.99	peak	-6.55	42.44	74.00	-31.56

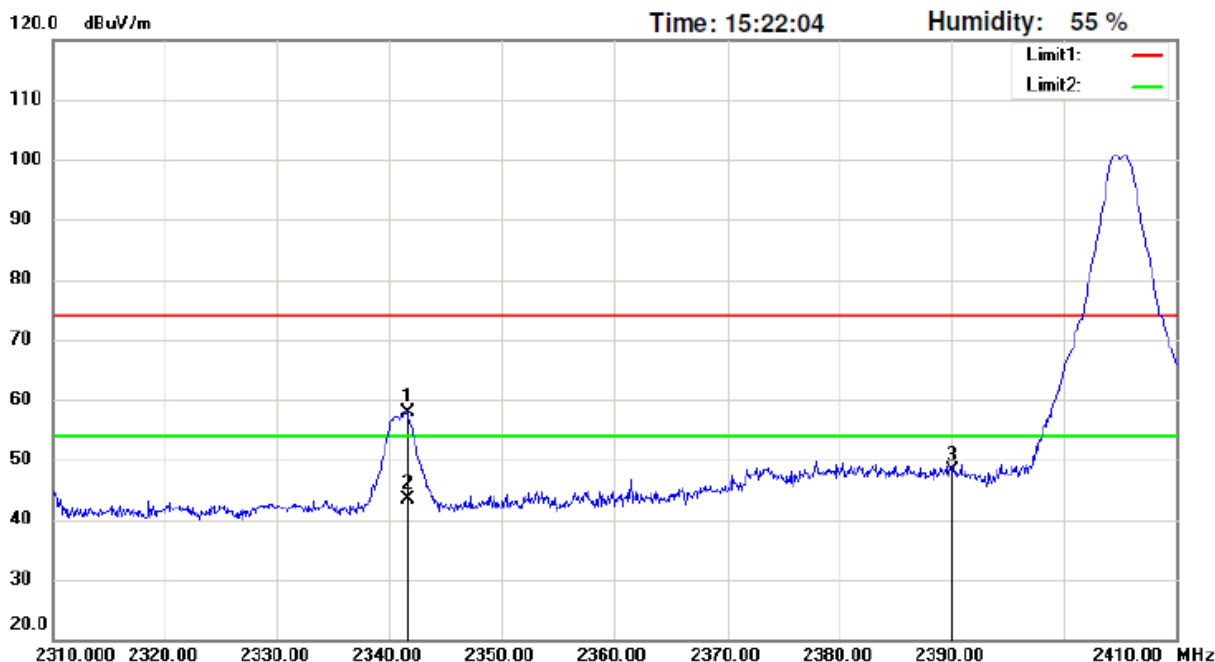
Remark 1: Corrected factor = Antenna Factor + Cable Loss - Preamplifier Factor

Result = Reading + Corrected factor

Margin = Result - Limit

Remark 2: If the PK measured value complies with the AV limits, it is unnecessary to perform an AV measurement.

CH Low 2405MHz Radiated Bandedge(Vertical)



Vertical, Peak & AV Detector:

Mk.	Frequency (MHz)	Reading (dBuV/m)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	2341.600	64.45	peak	-6.63	57.82	74.00	-16.18
2	2341.600	50.07	AVG	-6.63	43.44	54.00	-10.56
3	2390.000	54.76	peak	-6.55	48.21	74.00	-25.79

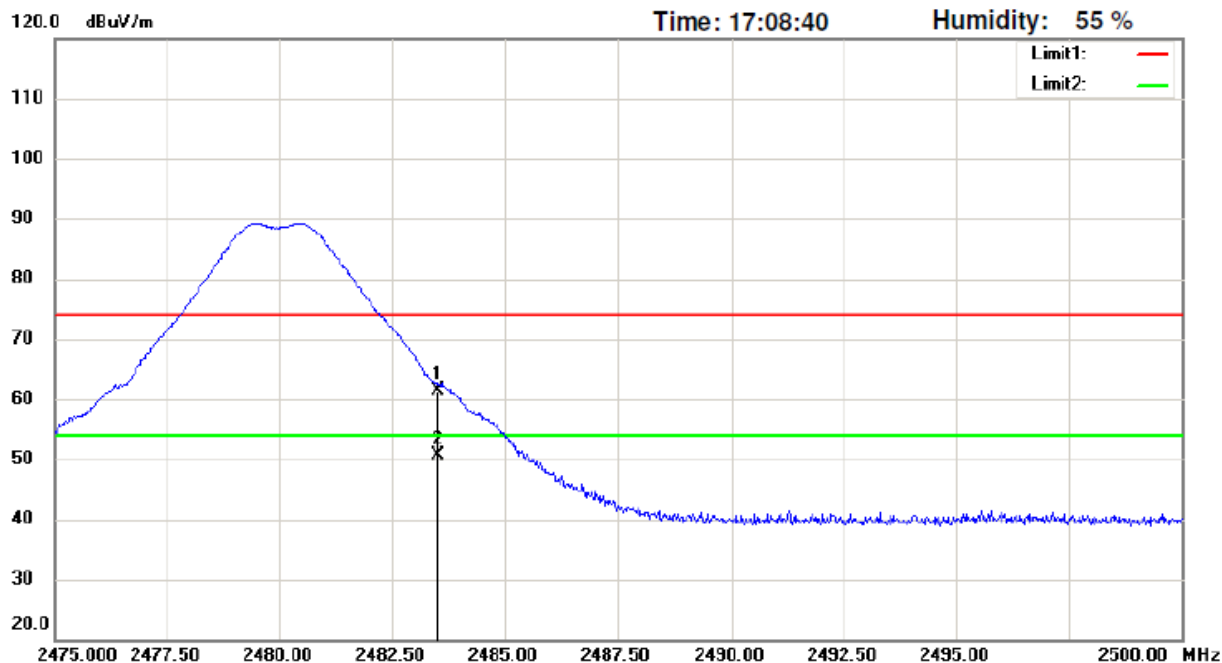
Remark 1: Corrected factor = Antenna Factor + Cable Loss - Preamplifier Factor

Result = Reading + Corrected factor

Margin = Result - Limit

Remark 2: If the PK measured value complies with the AV limits, it is unnecessary to perform an AV measurement.

CH High 2480MHz Radiated Bandedge(Horizontal)



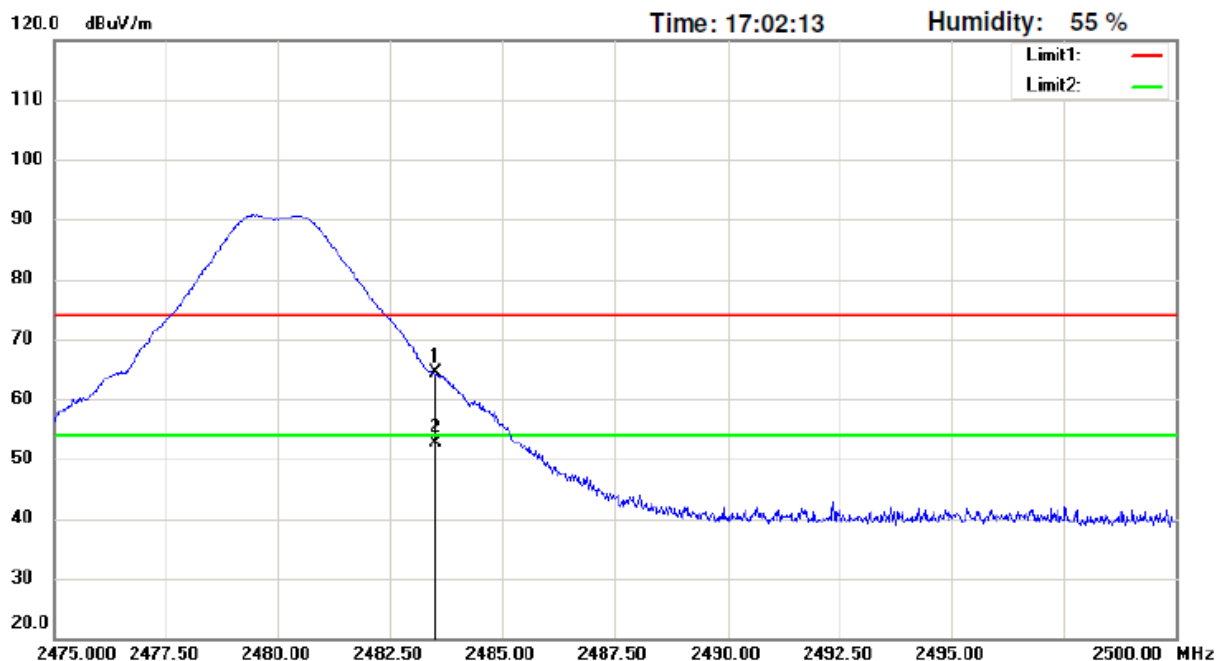
Horizontal, Peak & AV Detector:

Mk.	Frequency (MHz)	Reading (dBuV/m)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	2483.500	67.82	peak	-6.41	61.41	74.00	-12.59
2	2483.520	57.05	AVG	-6.41	50.64	54.00	-3.36

Remark 1: Corrected factor = Antenna Factor + Cable Loss - Preamplifier Factor
 Result = Reading + Corrected factor
 Margin = Result - Limit

Remark 2: If the PK measured value complies with the AV limits, it is unnecessary to perform an AV measurement.

CH High 2480MHz Radiated Bandedge(Vertical)



Vertical, Peak & AV Detector:

Mk.	Frequency (MHz)	Reading (dBuV/m)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	2483.500	70.70	peak	-6.41	64.29	74.00	-9.71
2	2483.500	58.94	AVG	-6.41	52.53	54.00	-1.47

Remark 1: Corrected factor = Antenna Factor + Cable Loss - Preamplifier Factor

Result = Reading + Corrected factor

Margin = Result - Limit

Remark 2: If the PK measured value complies with the AV limits, it is unnecessary to perform an AV measurement.

5.3.5 Conducted Spurious Emission Test

Test Requirement: FCC Part15 247(d), ANSI C 63.10:2009
RSS-210 Issue 8 Annex 8.5

Test date: Feb. 25, 2013

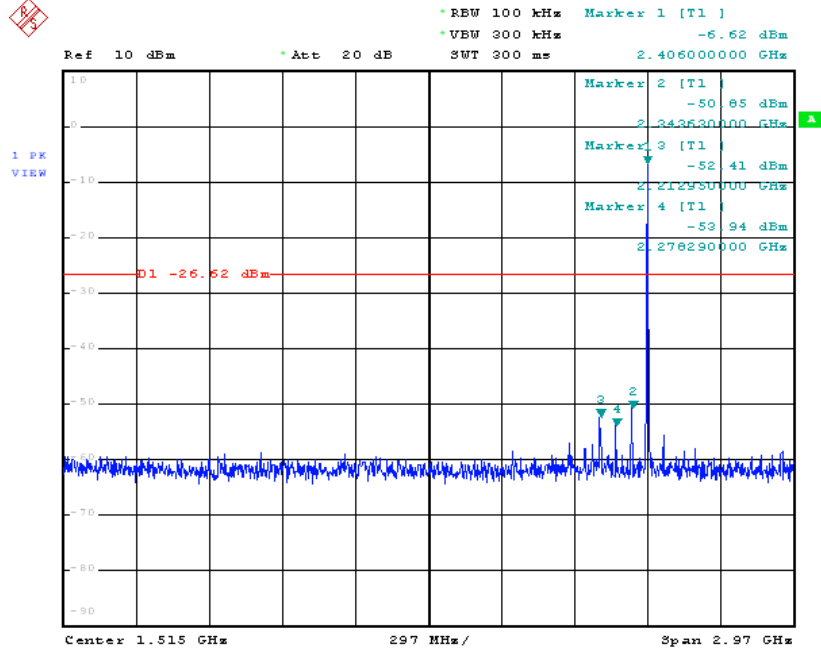
Standard Applicable: According to section 15.247(d),in any 100KHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating,the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100KHz bandwidth within the band that contains the highest level of the desired power,In addition,radiated emissions which fall in the restricted bands,as defined in section 15.205(a),must also comply with the radiated emission limits specified in 15.209(a).

Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW=100KHz, VBW=300KHz, Sweep = auto
6. Repeat above procedures until all frequency measured were complete.

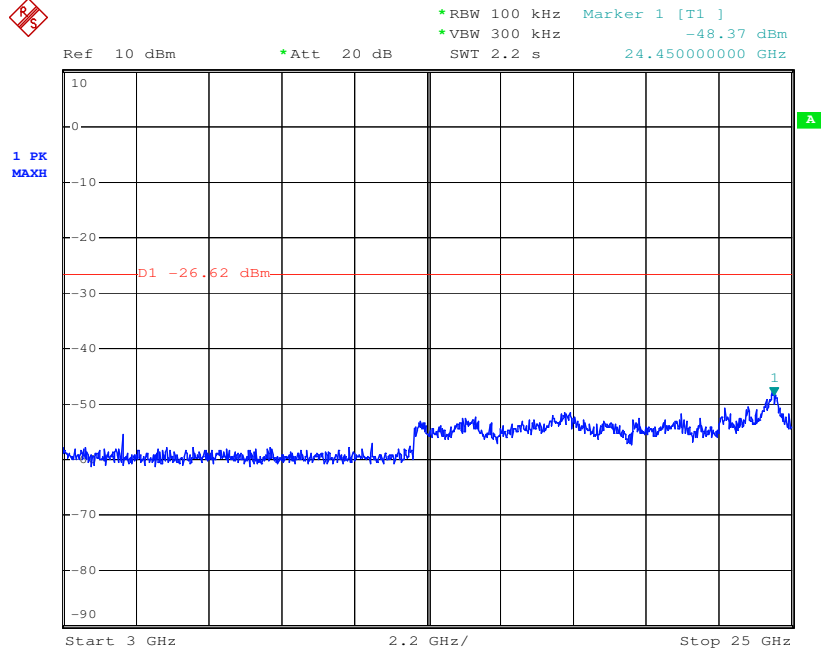
Measurement Result:
Conducted spurious Emission Measurement Result

CH Low (2405MHz): 30MHz-3GHz



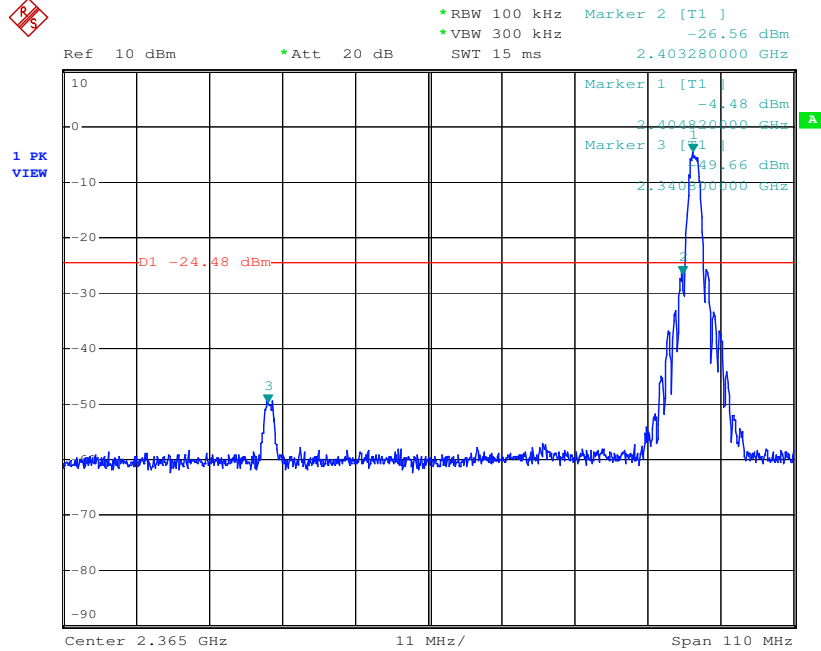
Date: 25.FEB.2013 14:51:27

CH Low (2405MHz): 3GHz-25GHz



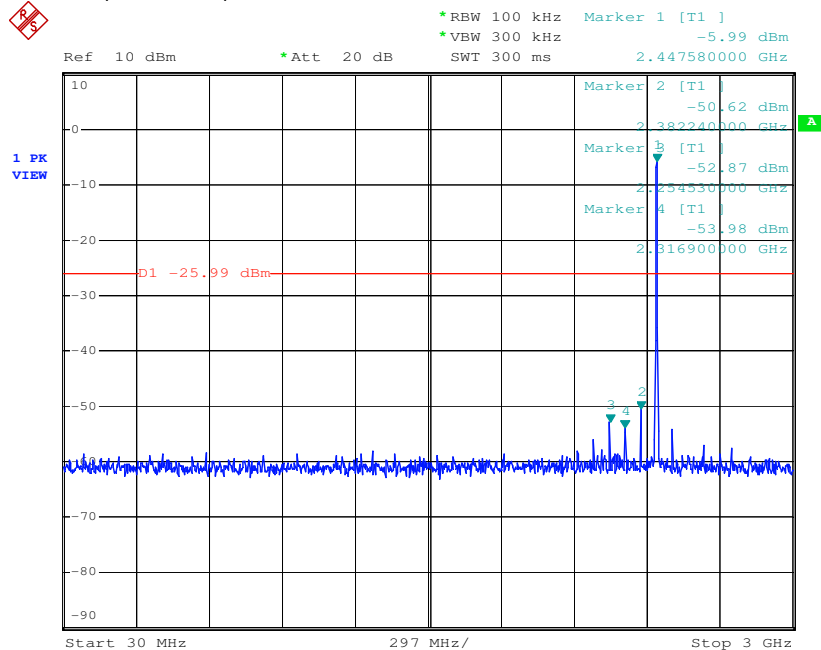
Date: 25.FEB.2013 14:52:01

Band Edge (Conducted Mode)



Date: 25.FEB.2013 14:57:24

Ch Mid (2445MHz): 30MHz-3GHz

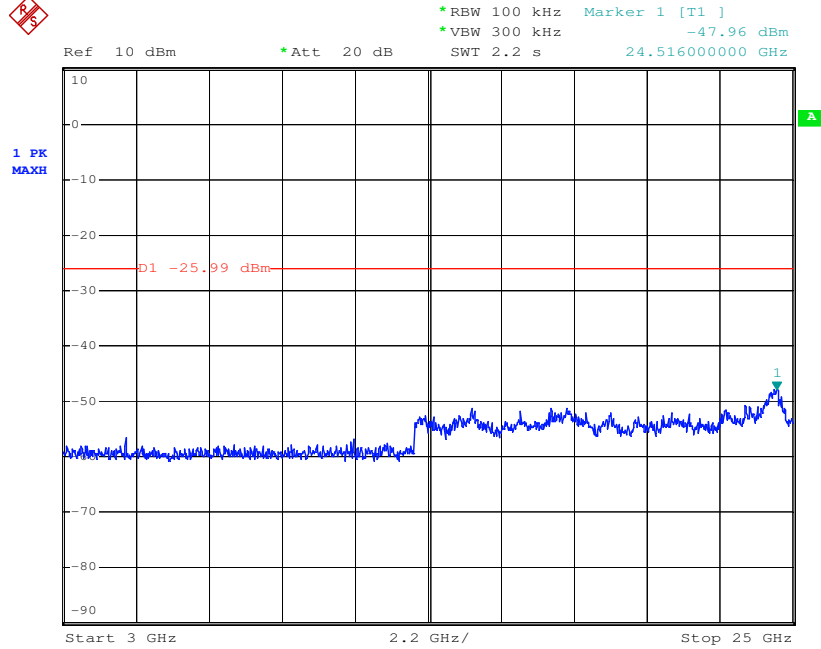


Date: 25.FEB.2013 14:46:49

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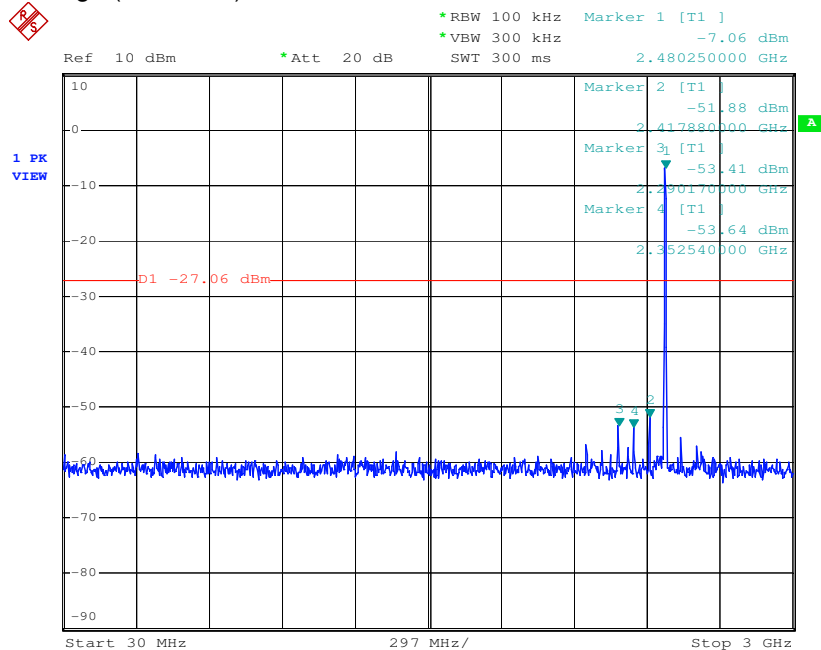
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CH Mid (2445MHz): 3GHz-25GHz



Date: 25.FEB.2013 14:47:52

Ch High (2480MHz): 30MHz-3GHz



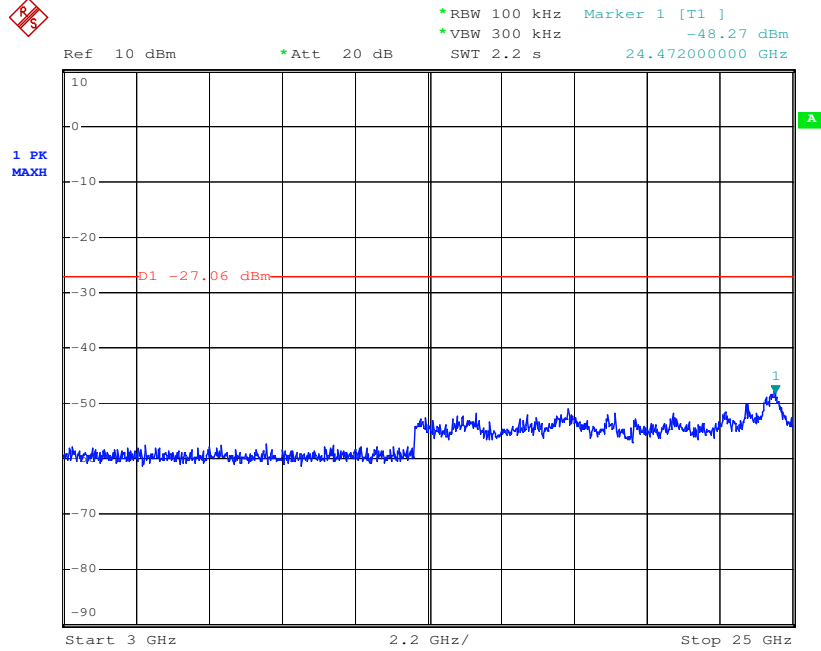
Date: 25.FEB.2013 14:49:44

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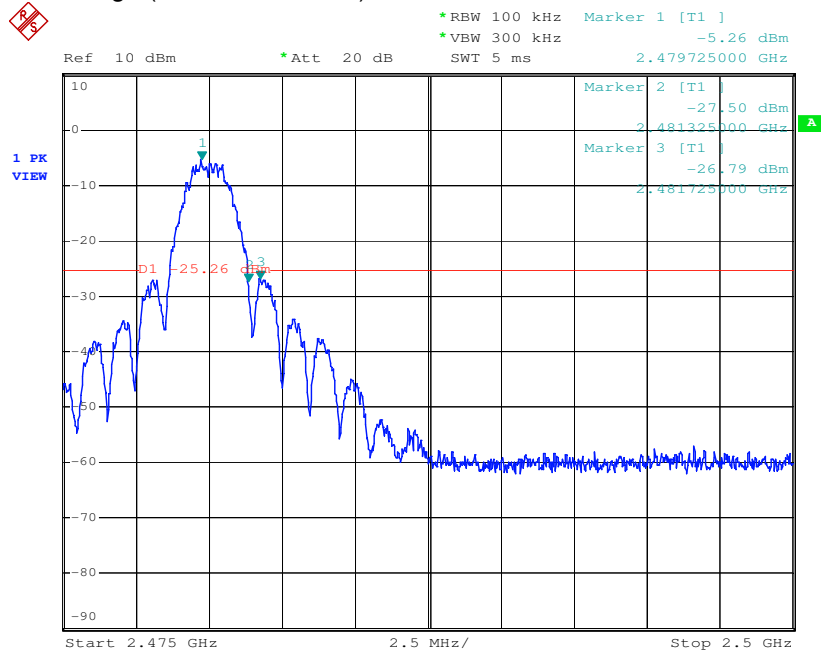
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CH High (2480MHz): 3GHz-25GHz



Date: 25.FEB.2013 14:50:19

Band Edge (Conducted Mode)



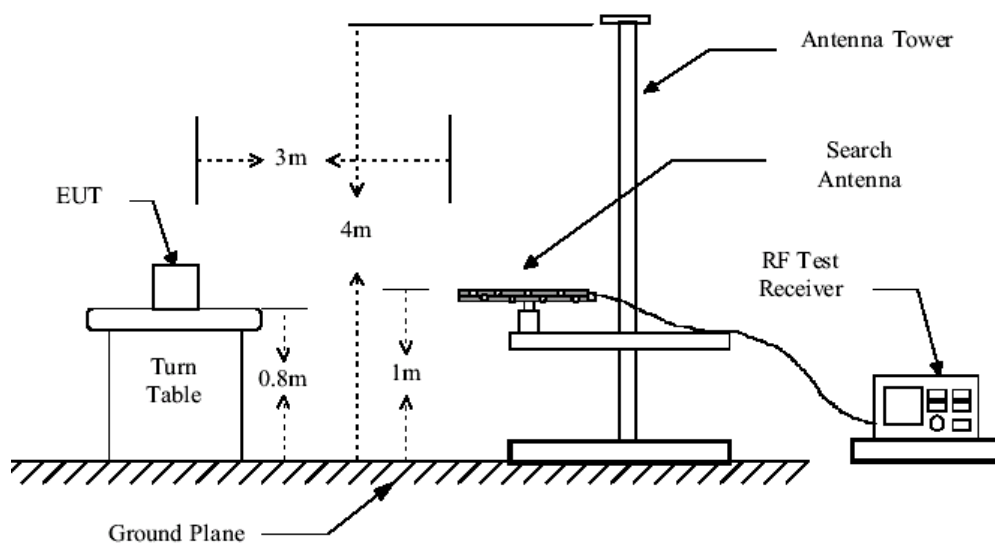
Date: 25.FEB.2013 15:02:01

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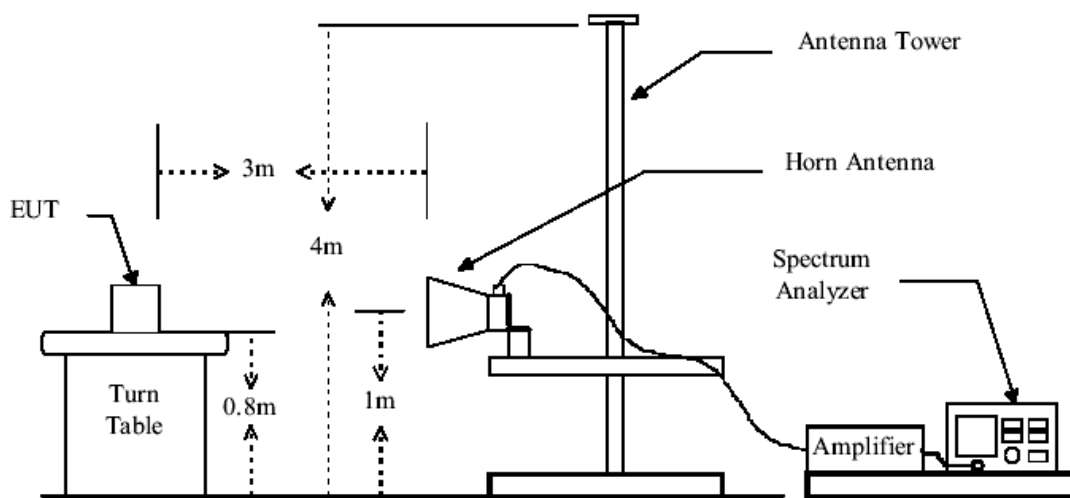
5.3.6 Spurious Radiated Emission Test

- Test Requirement:** FCC Part 15.205 & 15.209,
RSS-210 Issue 8 Annex 8.5
- Test date:** Feb. 25, 2013
- Standard Applicable:** According to section 15.247(d), all other emissions outside these bands shall not exceed the general radiated emission limits specified in section 15.209(a). And according to section 15.33(a)(1), for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, which is lower.
- Measurement Procedure:**
1. The EUT was placed on a turn table which is 0.8m above ground plane.
 2. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
 3. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
Test instrumentation resolution bandwidth 120 kHz and Quasi-Peak detector applies (30 MHz - 1000 MHz). 1MHz resolution bandwidth and Peak detector apply (1000 MHz – 25GHz)
Above 1GHz
(a) PEAK: RBW=VBW=1MHz / Sweep=AUTO
(b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO.
 4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
 5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
 6. Repeat above procedures until all frequency measured were complete.
 7. The field strength of spurious emission was measured in the following position: EUT satnd-up position (Z axis), lie-down position (X, Y axis) .The worst emission was found in lie-down postion(X axis) and the wrost case was recored.

**Radiated Test Set-up:
Radiated Emission Test Set-up, Frequency Below 1000MHz**



Radiated Emission Test Set-up Frequency Over 1GHz



Low noise amplifier was used below 1GHz, High pass Filter was used above 1GHz.

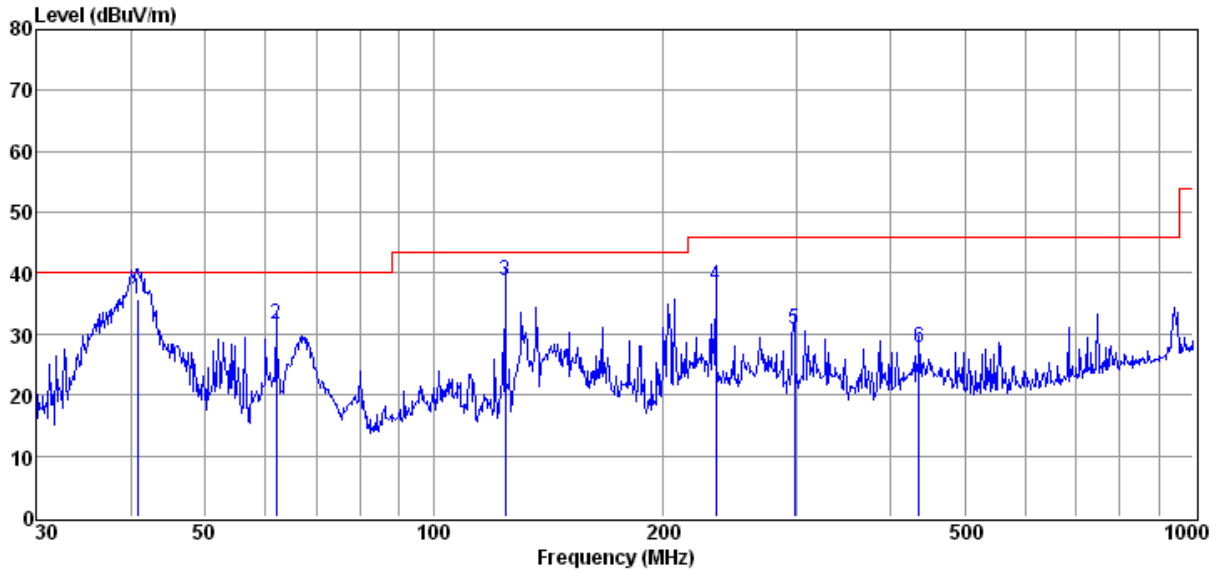
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Test Data:

30MHz~1GHz Spurious Emissions.Quasi-Peak Measurement

Vertical:



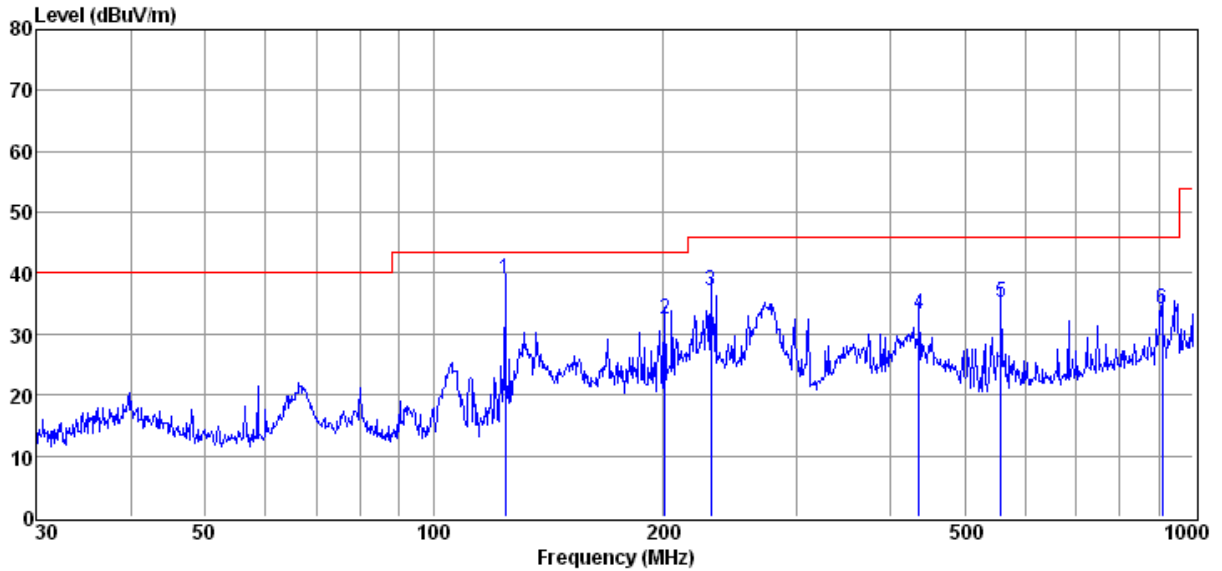
Item (Mark)	Freq. (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	Preamp Factor (dB)	Cable Loss (dB)	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	40.70	46.50	13.27	24.70	0.57	35.64	40.00	-4.36	QP	VERTICAL
2	62.00	43.64	11.92	24.70	0.74	31.60	40.00	-8.40	QP	VERTICAL
3	124.13	52.04	10.37	24.70	1.16	38.87	43.50	-4.63	QP	VERTICAL
4	234.99	50.97	9.85	24.55	1.66	37.93	46.00	-8.07	QP	VERTICAL
5	298.27	41.14	12.35	24.50	1.94	30.93	46.00	-15.07	QP	VERTICAL
6	435.59	33.94	15.74	24.40	2.40	27.68	46.00	-18.32	QP	VERTICAL

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss - Preamp Factor
2. If Peak Result comply with QP limit, QP Result is deemed to comply with QP limit

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Horizontal:



Item (Mark)	Freq. (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	Preamp Factor (dB)	Cable Loss (dB)	Result Level (dBUV/m)	Limit Line (dBUV/m)	Over Limit (dB)	Detector	Polarization
1	124.18	51.19	11.37	24.70	1.16	39.02	43.50	-4.48	QP	HORIZONTAL
2	201.39	46.18	9.29	24.60	1.52	32.39	43.50	-11.11	QP	HORIZONTAL
3	231.72	50.51	9.49	24.58	1.65	37.07	46.00	-8.93	QP	HORIZONTAL
4	435.59	39.58	15.74	24.40	2.40	33.32	46.00	-12.68	QP	HORIZONTAL
5	558.73	38.63	18.14	24.27	2.78	35.28	46.00	-10.72	QP	HORIZONTAL
6	909.67	31.26	23.09	23.80	3.68	34.23	46.00	-11.77	QP	HORIZONTAL

- Note: 1. Result Level = Read Level + Antenna Factor + Cable loss - Preamp Factor
 2. If Peak Result comply with QP limit, QP Result is deemed to comply with QP limit

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1~25 GHz Harmonics & Spurious Emissions. Peak & Average Measurement:

Operation Mode: TX Low CH (2405MHz)

Vertical:

Mk.	Frequency (MHz)	Reading (dBuV/m)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	4810.000	59.04	peak	-0.15	58.89	74.00	-15.11
2	4810.000	46.36	AVG	-0.15	46.21	54.00	-7.79
3	7215.000	42.64	peak	6.29	48.93	74.00	-25.07
4	9383.500	37.93	peak	11.45	49.38	74.00	-24.62
5	9620.000	37.63	peak	11.74	49.37	74.00	-24.63
6	11430.500	38.66	peak	9.28	47.94	74.00	-26.06
7	11925.000	39.60	peak	8.91	48.51	74.00	-25.49

Horizontal:

Mk.	Frequency (MHz)	Reading (dBuV/m)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	4810.000	57.64	peak	-0.15	57.49	74.00	-16.51
2	4810.000	43.02	AVG	-0.15	42.87	54.00	-11.13
3	7215.000	42.41	peak	6.29	48.70	74.00	-25.30
4	8348.500	38.74	peak	8.26	47.00	74.00	-27.00
5	9360.500	37.93	peak	11.36	49.29	74.00	-24.71
6	9620.000	37.27	peak	11.74	49.01	74.00	-24.99
7	11189.000	39.06	peak	9.68	48.74	74.00	-25.26
8	11994.000	40.55	peak	8.87	49.42	74.00	-24.58

Remark 1: Corrected factor = Antenna Factor + Cable Loss - Preamplifier Factor

Result = Reading + Corrected factor

Margin = Result - Limit

Remark 2: If the PK measured value complies with the AV limits, it is unnecessary to perform an AV measurement.

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1~25 GHz Harmonics & Spurious Emissions. Peak & Average Measurement:

Operation Mode: TX Mid CH (2445MHz)

Vertical:

Mk.	Frequency (MHz)	Reading (dBuV/m)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	4890.000	54.46	peak	0.17	54.63	74.00	-19.37
2	4890.000	40.52	AVG	0.17	40.69	54.00	-13.31
3	7335.000	42.60	peak	6.89	49.49	74.00	-24.51
4	9590.500	37.69	peak	11.78	49.47	74.00	-24.53
5	9780.000	37.90	peak	11.49	49.39	74.00	-24.61
6	11166.000	38.86	peak	9.71	48.57	74.00	-25.43
7	11902.000	39.54	peak	8.91	48.45	74.00	-25.55

Horizontal:

Mk.	Frequency (MHz)	Reading (dBuV/m)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	4890.000	56.58	peak	0.17	56.75	74.00	-17.25
2	4890.000	47.69	AVG	0.17	47.86	54.00	-6.14
3	7335.000	40.13	peak	6.89	47.02	74.00	-26.98
4	7532.000	39.67	peak	7.73	47.40	74.00	-26.60
5	9780.000	37.47	peak	11.49	48.96	74.00	-25.04
6	10119.500	38.13	peak	11.03	49.16	74.00	-24.84
7	11166.000	38.48	peak	9.71	48.19	74.00	-25.81

Remark 1: Corrected factor = Antenna Factor + Cable Loss - Preamplifier Factor

Result = Reading + Corrected factor

Margin = Result - Limit

Remark 2: If the PK measured value complies with the AV limits, it is unnecessary to perform an AV measurement.

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1~25 GHz Harmonics & Spurious Emissions. Peak & Average Measurement:

Operation Mode: TX High CH (2480MHz)

Vertical:

Mk.	Frequency (MHz)	Reading (dBuV/m)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	4954.580	42.90	AVG	0.43	43.33	54.00	-10.67
2	4960.000	54.89	peak	0.45	55.34	74.00	-18.66
3	6968.500	40.53	peak	5.10	45.63	74.00	-28.37
4	7440.000	40.47	peak	7.43	47.90	74.00	-26.10
5	9659.500	37.62	peak	11.67	49.29	74.00	-24.71
6	9920.000	36.71	peak	11.29	48.00	74.00	-26.00
7	11166.000	38.72	peak	9.71	48.43	74.00	-25.57

Horizontal:

Mk.	Frequency (MHz)	Reading (dBuV/m)	Detector	Corrected factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	4960.000	56.14	peak	0.45	56.59	74.00	-17.41
2	4960.000	41.89	AVG	0.45	42.34	54.00	-11.66
3	6566.000	41.10	peak	3.72	44.82	74.00	-29.18
4	7440.000	39.10	peak	7.43	46.53	74.00	-27.47
5	7808.000	39.14	peak	7.73	46.87	74.00	-27.13
6	9521.500	36.60	peak	11.89	48.49	74.00	-25.51
7	9920.000	36.38	peak	11.29	47.67	74.00	-26.33

Remark 1: Corrected factor = Antenna Factor + Cable Loss - Preamplifier Factor

Result = Reading + Corrected factor

Margin = Result - Limit

Remark 2: If the PK measured value complies with the AV limits, it is unnecessary to perform an AV measurement.

5.3.7 Peak Power Spectral Density

Test Requirement: FCC Part 15 247(e), ANSI C 63.10:2009 § 6.11.2.3
RSS-210 Issue 8 Annex 8.2

Test date: Feb. 27, 2013

Standard Applicable: According to section 15.247(e), For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dB in any 3KHz band during any time in terval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph(b) of this section. The same method of determining the conducted output power shall be used to determine the powr spectral density.

Measurement Procedure: The EUT was tested according to ANSI C 63.10:2009 § 6.11.2.3 requiremnts.
Pre-test setup:
Set RBW=3KHz, Set VBW=10KHz, Span=20MHz, Sweep time=AUTO, Set detector=Peak detector. Reference Level = 20dBm
Final test setup:
Set RBW=3KHz, Set VBW=10KHz, Span=300kHz, Sweep time=100s, Set detector=Peak detector. Reference Level = 20dBm

Measurement Result:

CH	Frequency (MHz)	Reading (dBm)	Cable Loss (dB)	Power Spectral Density (dBm)	Limit (dBm)	Result
LOW	2405	-17.42	0.5	-16.92	8	PASS
MID	2445	-17.04	0.5	-16.54	8	PASS
HIGH	2480	-17.58	0.5	-17.08	8	PASS

Remark: Power Spectral Density = Reading + Cable Loss

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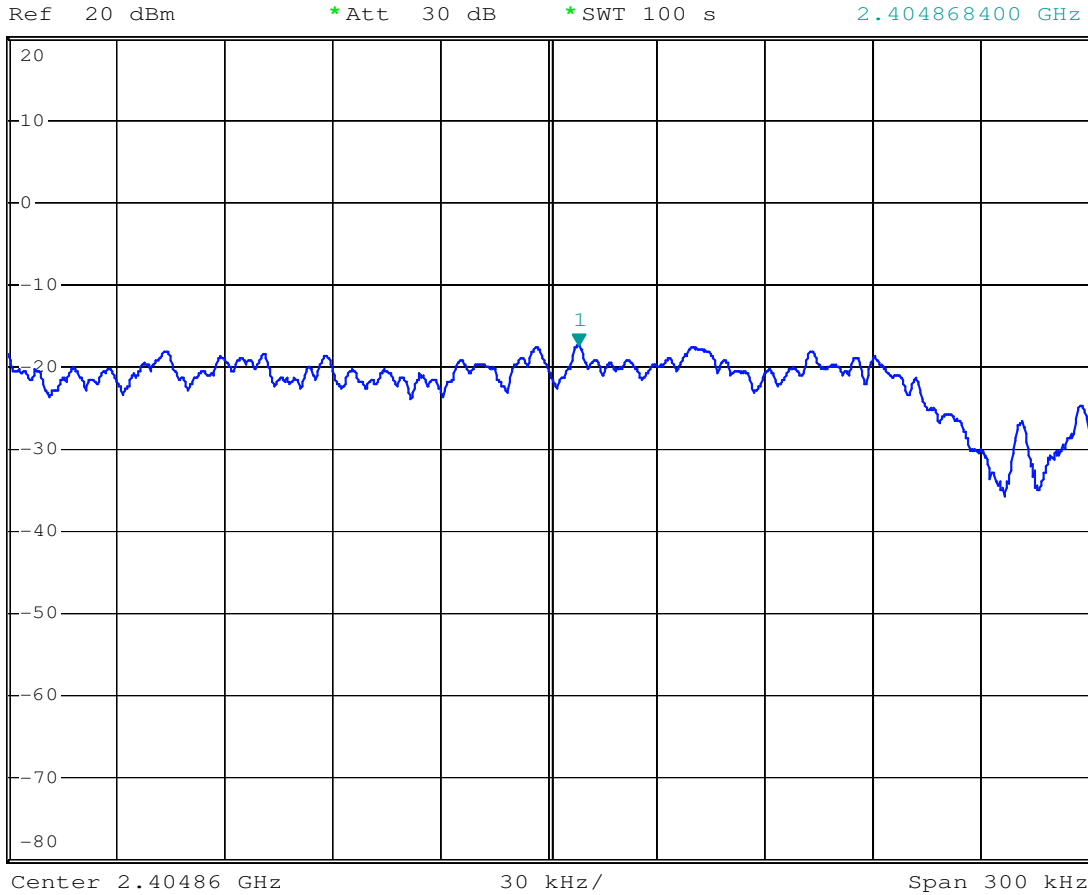
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Test Plot:

Power Spectral Density (CH-Low 2405MHz)



*RBW 3 kHz Marker 1 [T1]
*VBW 10 kHz -17.42 dBm
*SWT 100 s 2.404868400 GHz



Date: 27.FEB.2013 09:46:29

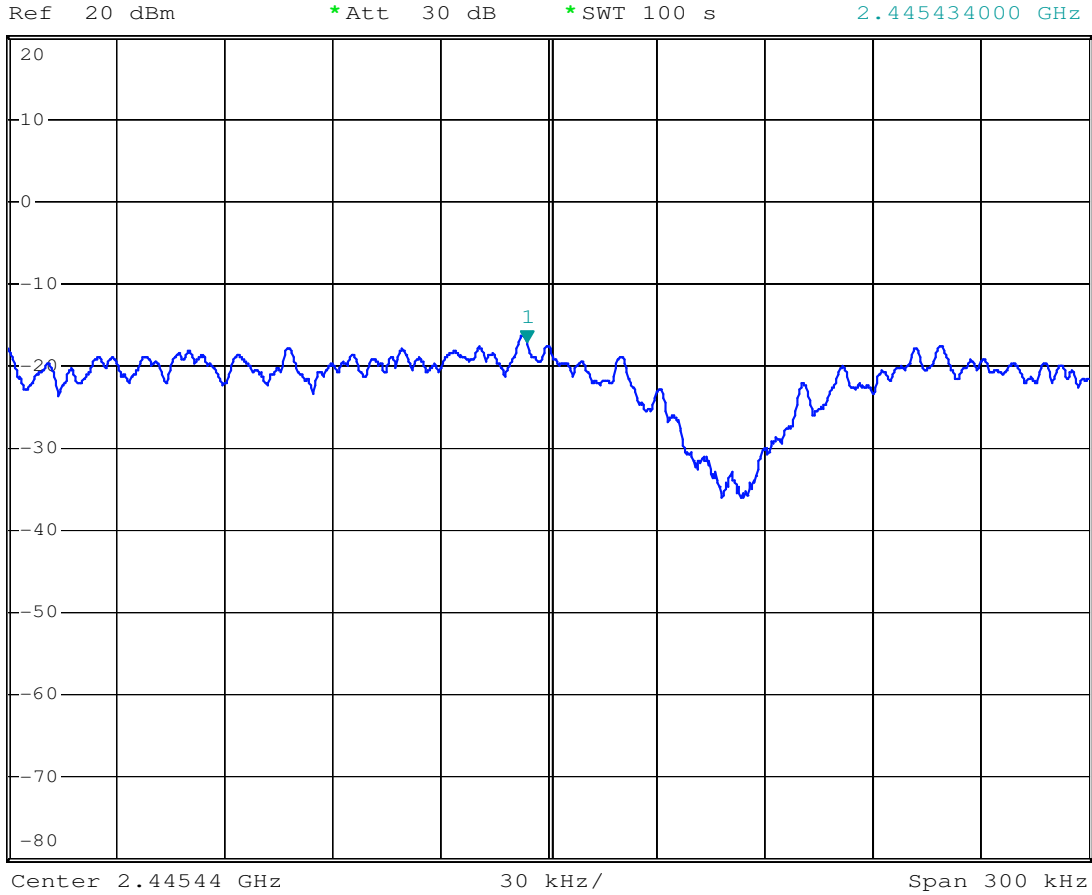
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Power Spectral Density (CH-Mid 2445MHz)



*RBW 3 kHz Marker 1 [T1]
*VBW 10 kHz -17.04 dBm
*SWT 100 s 2.445434000 GHz



Date: 27.FEB.2013 09:54:25

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Power Spectral Density (CH-High 2480MHz)

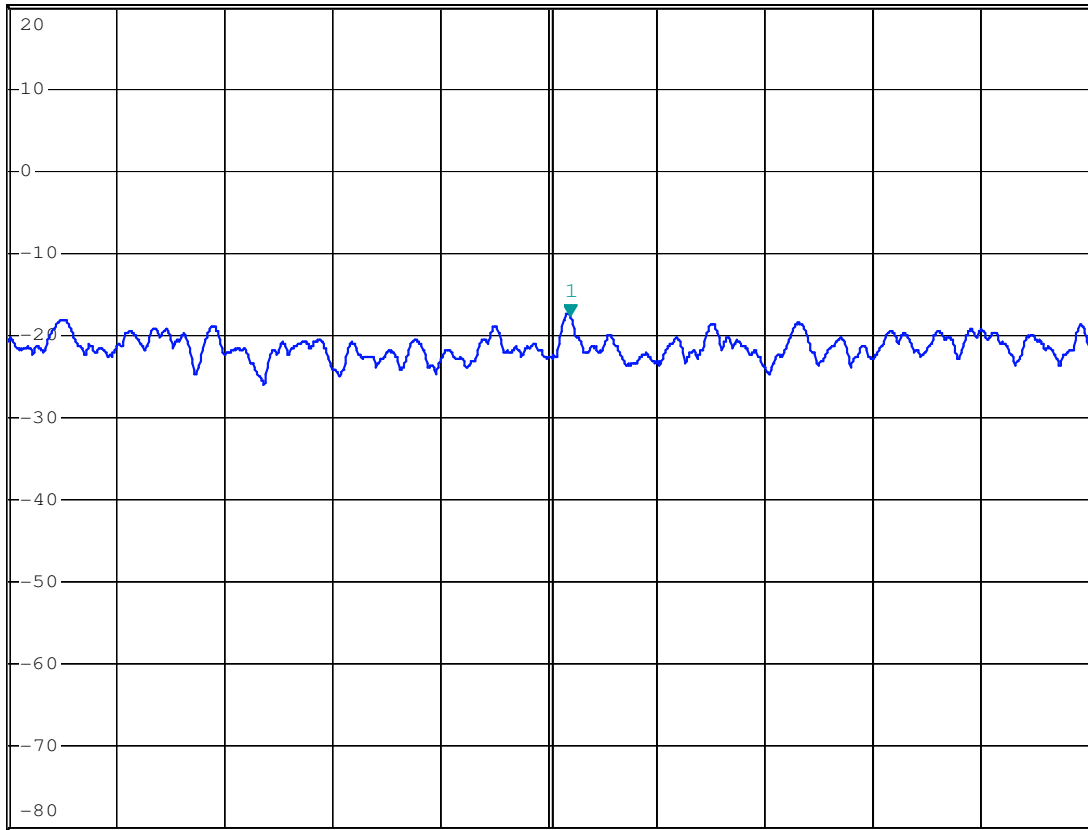


*RBW 3 kHz Marker 1 [T1]
*VBW 10 kHz -17.58 dBm
*SWT 100 s 2.480226000 GHz

Ref 20 dBm

*Att 30 dB

1 PK
MAXH



Center 2.48022 GHz

30 kHz/

Span 300 kHz

Date: 27.FEB.2013 09:58:41

5.3.8 RF Exposure Compliance Requirement

Please refer to the separate RF Exposure Evaluation Report SHEM120900130504.

5.3.9 Antenna Requirement

Test Requirement: FCC Part 15.203, 15.247(c) (1)(i)

5.3.7.1 Standard Requirement

15.203 requirement:

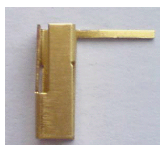
For intentional device, according to 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

15.247(c) (1)(i) requirement:

(i) Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

5.3.7.3 Result

The directional gains of antenna remote transmitter used for transmitting is 3.0dBi. The RF transmitter uses an integrate antenna without connector, the antenna is not consideration of replacement. Please refer to the following picture. So, the EUT does meet the FCC requirements.



End of the Report