TEST REPORT

1. Applicant
   - Name : ECOSENSE Co.,Ltd.
   - Brand Name : N/A
   - Address : #1414, Kolon sciencevally II, 811, Guro-dong, Guro-gu, Seoul, Korea
   - FCC ID : 2ABB8ES-WCTZ
2. Products
   - Name : EcoSensor Wattmeter CT Type Phase
   - Model/Type : ES-WCTZ / QPSK
   - Manufacturer : ECOSENSE Co.,Ltd.
3. Test Standard : FCC CFR 47 Part 15.247 Subpart C
4. Test Method : ANSI C63.10:2009
5. Test Result : Positive
6. Dates of Test : November 01, 2013 to November 06, 2013
7. Date of Issue : November 12, 2013
8. Test Laboratory : Korea Standard Quality Laboratories
   FCC Designation Number : 100384

Tested by	Approved by
	
SoonHo, Kim	SangMin, Lee
Test Engineer:	Compliance Engineer:

www.ksqlab.com
Korea Standard Quality Laboratories
Testing Laboratories for EMC and Safety Compliance
#102, Jangduk-Dong, Hwasung-City, Kyunggi-Do, KOREA

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1. GENERAL

These tests were performed using the test procedure outlined in ANSI C63.10: 2009 for intentional radiators, and in accordance with the limits set forth in FCC Part 15.247 and RSS-210 Issue 8 – Category I Equipment, Annex 8. The EUT (Equipment Under Test) has been shown to be capable of compliance with the applicable technical standards.

We attest to the accuracy of data. All measurements reported herein were performed by Korea Standard Quality Laboratories and were made under Chief Engineer''s supervision.
We assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

2. TEST SITE

Korea Standard Quality Laboratories

2.1 Location

#102, Jangduk Dong, Hwasung City, Kyunggi Do, South Korea
(FCC Registered Test Site Number: 100384)

This test site is in compliance with ISO/IEC 17025 for general requirements for the competence of testing and calibration laboratories.

2.2 Test Date

Date of Test : November 01, 2013 ~ November 06, 2013

2.3 Test Environment

See each test item''s description.

3. DESCRIPTION OF THE EQUIPMENT UNDER TEST

The product specification described herein was obtained from the product data sheet or user''s manual.

3.1 Rating and Physical Characteristics

Power source	AC 85-264V (Free)
Transmit Frequency	2405 ~ 2480 MHz (16 channels)
Antenna Type	Integral (PCB & Cable assembly Type Antenna , Gain: 4.0 dBi max.)
Type of Modulation	QPSK

3.2 Equipment Modifications

None.

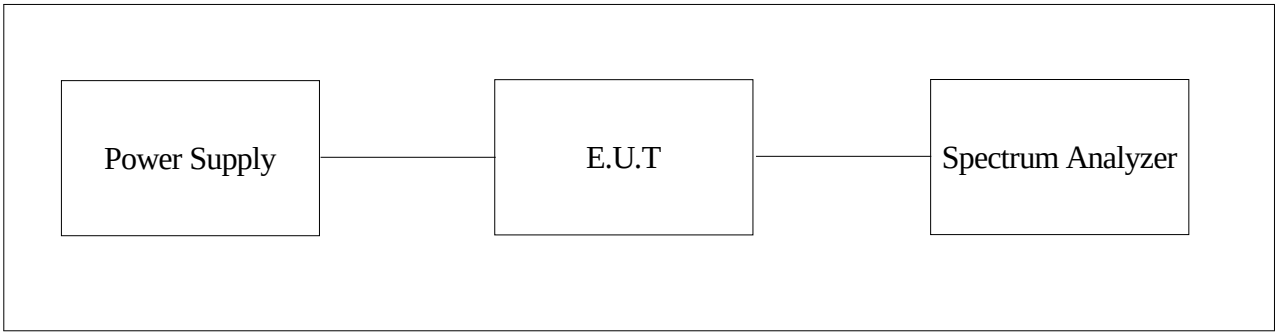
3.3 Submitted Documents

Block diagram
Schematic diagram
Antenna Specification
External photos
Test setup photos
Part List
Tune up Procedure
Label Location
User manual

4. MEASUREMENT CONDITIONS

4.1 Description of test configuration

The measurements were taken in continuous transmitting mode using the TEST MODE. For controlling the EUT as TEST MODE, the test program and the cable assembly were provided by the applicant.



[System Block Diagram of Test Configuration]

4.2 List of Peripherals

Equipment Type	Manufacturer	Model	S/N
-	-	-	-
-	-	-	-
-	-	-	-

** For control of the RF module via RS-232 interface in the EUT. For radiated spurious emission measurements, the EUT was tested as equipment with TEST JIG, setting the EUT to TEST MODE.

4.3 Type of Used Cables

#	START		END		CABLE	
	NAME	I/O PORT	NAME	I/O PORT	LENGTH(m)	SHIELDED
-	-	-	-	-	-	-
-	-	-	-	-	-	-

5. TEST AND MEASUREMENT

5.1 Summary of Test Reaults

Test Item	FCC Referance	Test Procedure	Test Result
Power line conducted emission	15.207	ANSI C63.10,2009 Clause 6.2	PASS
Radiated emission	15.205 & 15.209	ANSI C63.10,2009 Clause 6.4	PASS
Minimum 6dB Bandwidth	15.247(a)(2)	ANSI C63.10,2009 Clause 6.9	PASS
Maximum peak output power	15.247(b)	ANSI C63.10,2009 Clause 6.10.2	PASS
Power spectrum density	15.247(e)	ANSI C63.10,2009 Clause 6.11	PASS
RF Conducted Spurious Emissions	15.247(d)	ANSI C63.10 2009 Clause 6.9	PASS
Radiated Emission BandEdge	15.247(d)	ANSI C63.10,2009 Clause 6.9	PASS
Emission outside the Frequency band	15.247(d)	ANSI C63.4,2003 Clause 6.12	PASS
RF Exposure	15.247(i), 1.1307(b)(1)	-	PASS

6 Antenna Requirement

6.1 Standard requirement

15.203 requirement:

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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

15.247(b) (4) requirement:

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

EUT Antenna **PASS**

The transmitter has an integral PCB & Cable assembly Type Antenna. The directional gain of the antenna is 4.0 dBi. please refer to the EUT internal photos.

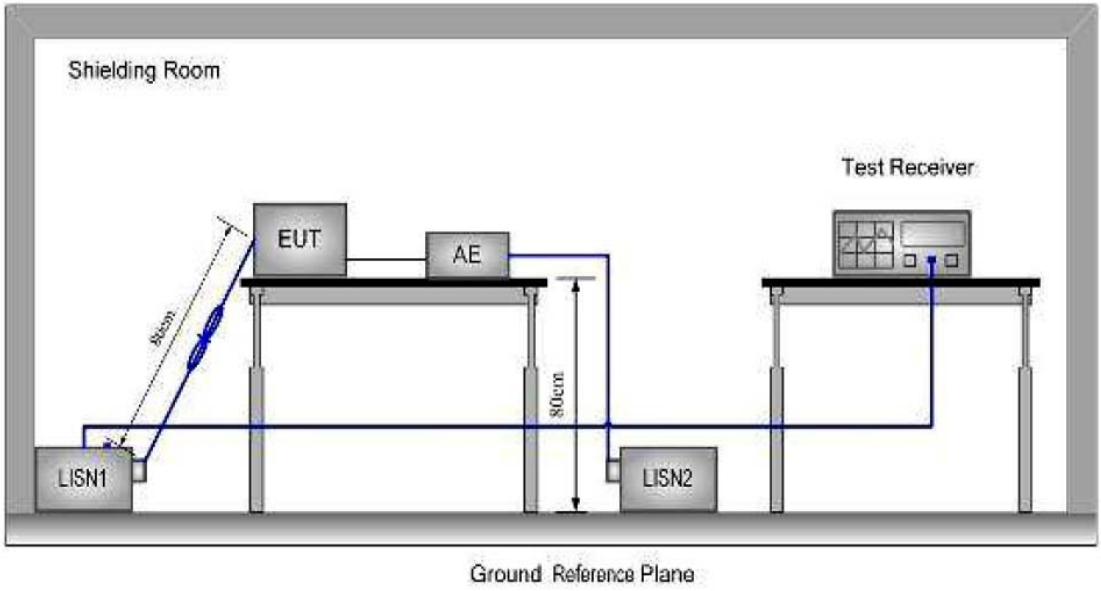
7 TEST TESULT

7.1 Conducted Emissions on Mains Terminals

Test Requirement:	FCC Part 15C, Section 15.207 RSS-Gen Issue 8 Clause 7.2.4
Test Method:	ANSI C63.10:2009 Section 6.2
Test Result:	Pass
Test Voltage:	AC 120V 60Hz
Frequency Range:	150 KHz to 30 MHz
Class/Severity:	Class B
Test mode:	Engineering mode
Limit:	

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Qausi-peak	Average
0.15 – 0.5	66 to 56 *	56 to 46 *
0.5 – 5	56	46
5 – 30	60	50
Note1: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50MHz. Note2: The lower limit is applicable at the transition frequency.		

Test Setup and Procedure:



1. The mains terminal disturbance voltage was measured with the EUT in a shielded room.
2. The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50/50μH + 5linear impedance. The power cables of all other units of the EUT was connected to a second LISN, which was bonded to the ground reference plane in the

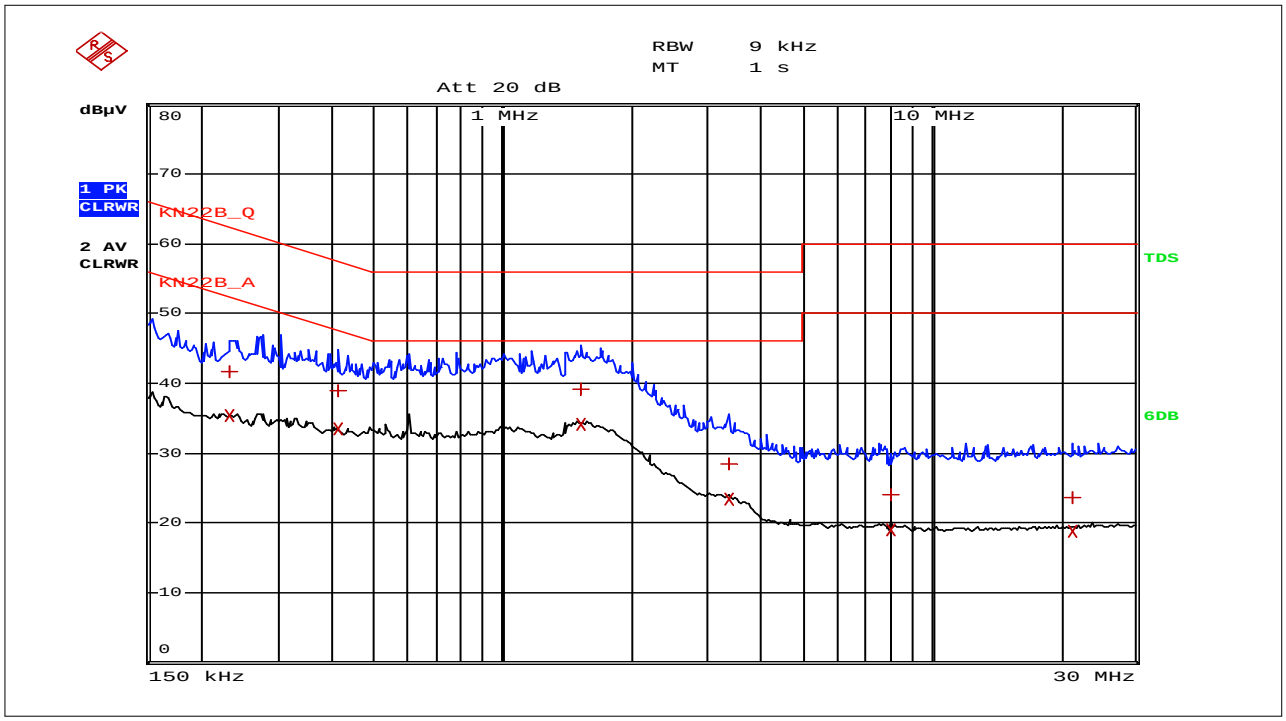
same way as the LISN for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded
3. The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, but separated from metallic contact with the ground reference plane by 0.1m of insulation.
4. The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISN mounted on top of the ground reference plane. This distance was between the closest points of the LISN and the EUT. The mains lead of EUT excess 0.8m was folded back and forth parallel to the lead so as to form a horizontal bundle with a length between 0.3m and 0.4m. All other units of the EUT and associated equipment was at least 0,8 m from the LISN.

Measurement Data

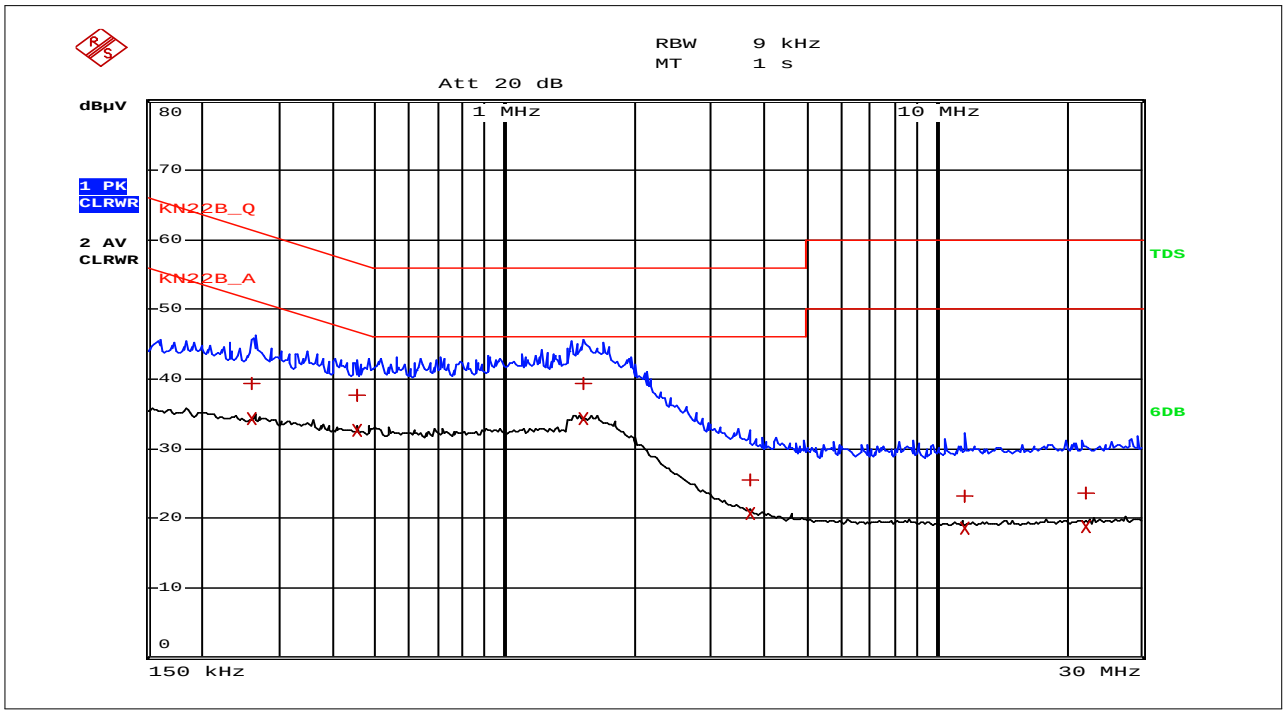
Pre-scan was performed with peak detected on all ports, Quasi-peak & average measurements were performed at the frequencies at which maximum peak emission level were detected.

Please see the attached Quasi-peak and Average test results.

Line – PE(Peak and Average detector used)



Neutral – PE(Peak and Average detector used)



Measured values of the Conducted Emissions									
Frequency (MHz)	Correction Factor		Line	Quasi-Peak			Average		
	LISN	Cable		Limit [dBuV]	Reading [dBuV]	Result [dBuV]	Limit [dBuV]	Reading [dBuV]	Result [dBuV]
0.23	0.20	0.06	H	62.45	41.41	41.67	52.45	35.17	35.43
0.26	0.32	0.06	N	61.43	39.06	39.44	51.43	33.86	34.24
0.41	0.19	0.07	H	57.65	38.78	39.04	47.65	33.27	33.53
0.45	0.31	0.08	N	56.88	37.30	37.68	46.88	32.21	32.59
1.52	0.21	0.12	H	56.00	38.88	39.21	46.00	33.87	34.20
1.53	0.33	0.12	N	56.00	38.88	39.33	46.00	33.89	34.34
3.37	0.31	0.20	H	56.00	27.86	28.37	46.00	22.87	23.38
3.70	0.45	0.22	N	56.00	24.89	25.56	46.00	20.01	20.68
8.03	0.66	0.36	H	60.00	22.94	23.96	50.00	18.04	19.06
11.70	1.09	0.41	N	60.00	21.79	23.30	50.00	17.04	18.55
21.40	1.24	0.59	H	60.00	21.85	23.68	50.00	16.90	18.73
22.25	1.37	0.61	N	60.00	21.63	23.60	50.00	16.88	18.85

7.2 6dB Occupied Bandwidth

Test Requirement:	FCC Part 15 C Section 15.247 (a)(2)
	RSS-210 Issue 8 Annex 8
Test Method:	ANSI C63.10 2009 Section 6.2
Test Result:	Pass
Final Test Mode:	Engineering mode
Limit:	150 KHz to 30 MHz
Test Procedure:	500 kHz

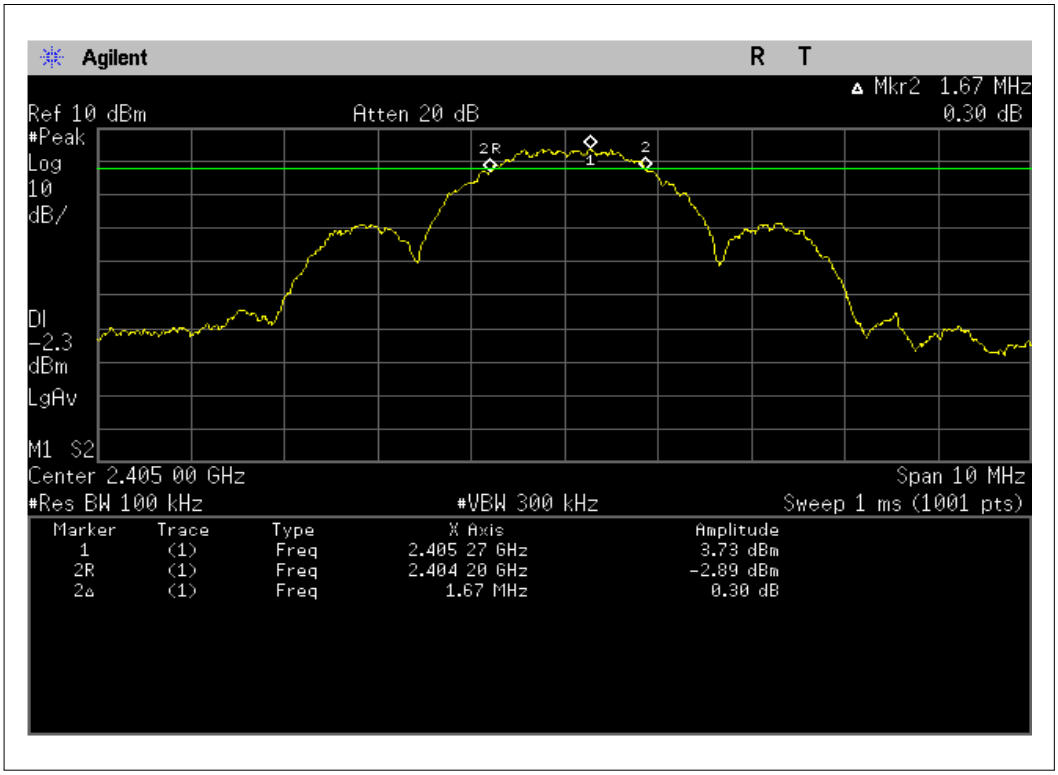
1. Place the EUT on the table and set it in Engineering mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW=100KHz, VBW =3* RBW, Span=10MHz, Sweep=auto
4. Mark the peak frequency and -6dB (upper and lower) frequency.
5. Repeat above procedures until all frequency measured was complete.

Test date:

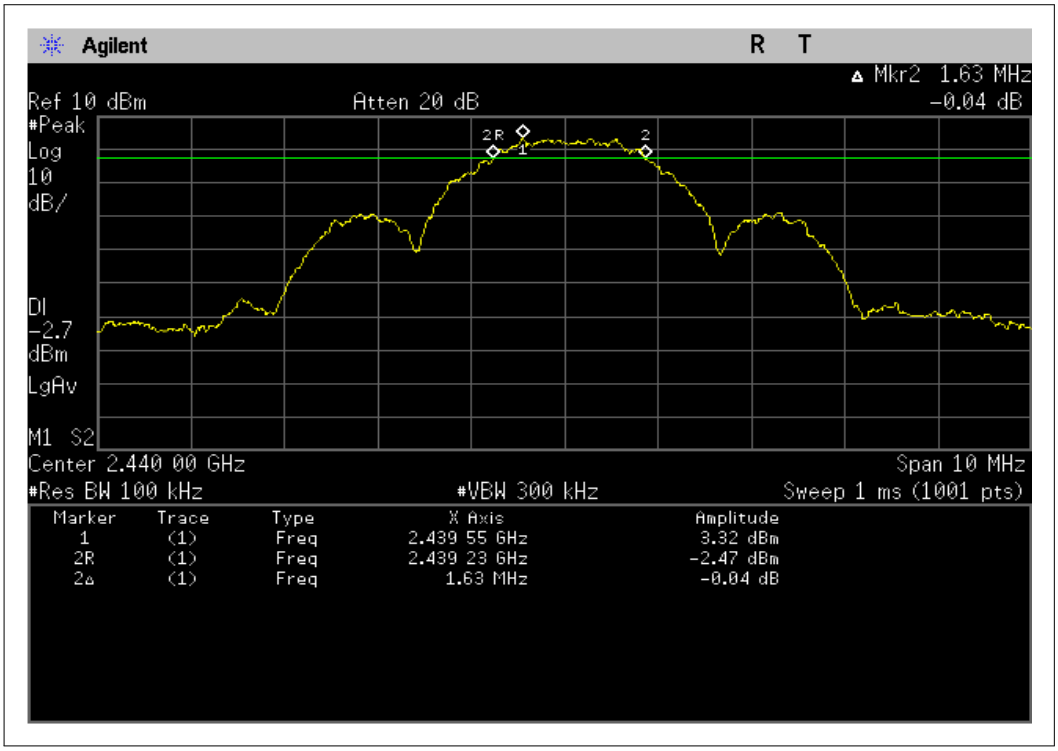
Measured values of the 6dB Occupied Bandwidth			
Frequency (MHz)	Result (MHz)	Limit (kHz)	Verdict
2405	1.67	500	Pass
2440	1.63	500	Pass
2480	1.62	500	Pass

Test plot as follows:

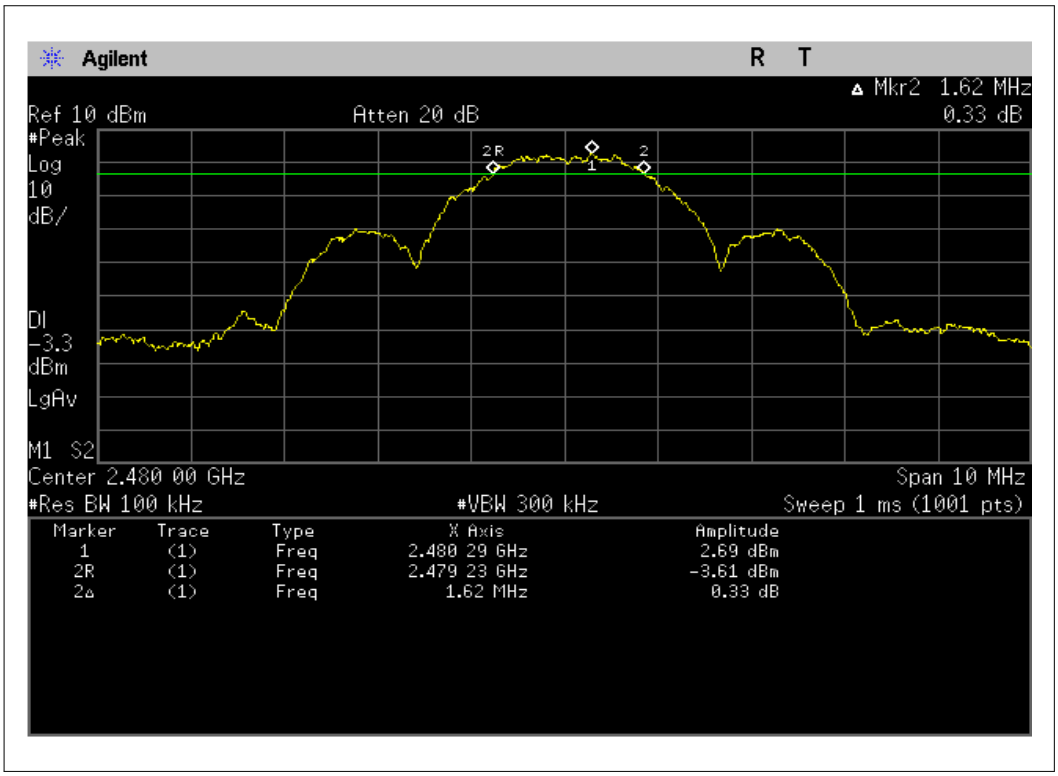
Lowest Channel (2405 MHz)



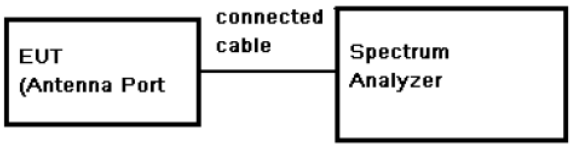
Middle Channel (2440 MHz)



Highest Channel (2480 MHz)



7.3 Conducted Peak Output Power

Test Requirement:	FCC Part 15.247 Section 15.247(b)(3) RSS-210 Issue 8 Annex 8
Test Method:	ANSI C63.10 2009 Section 6.10
Test Result:	Pass
Test Limit:	30dBm
Final Test Mode:	Engineering mode
Test Configuration:	

Test Procedure:

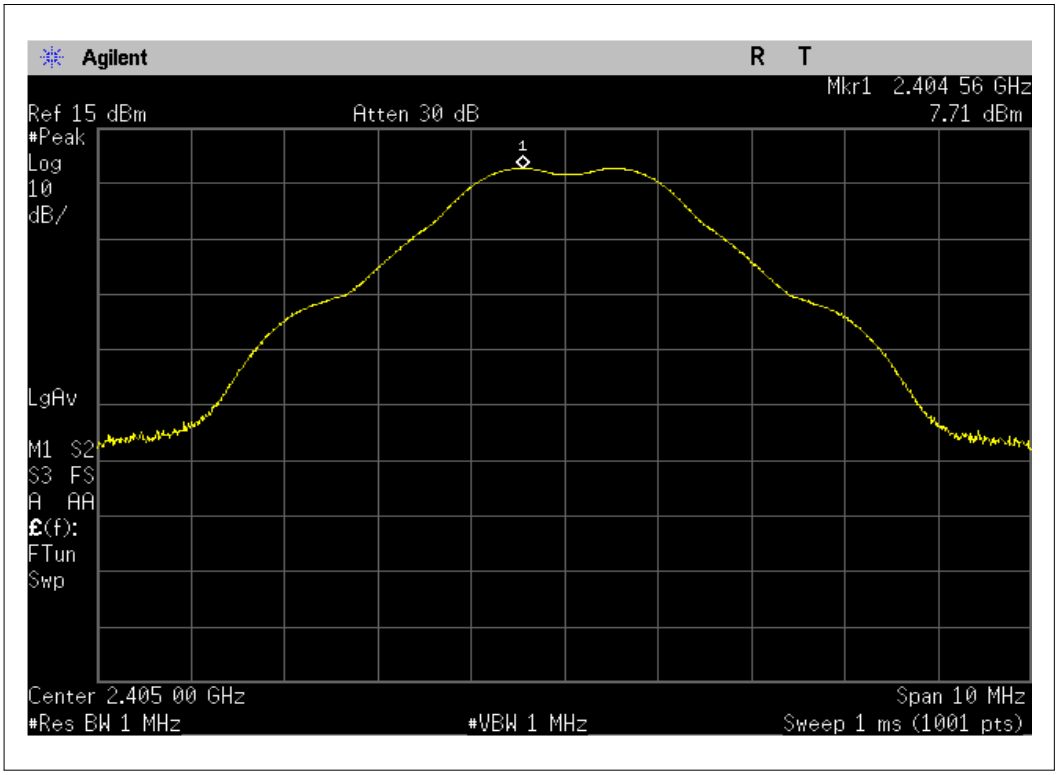
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 3 MHz. VBW = 3 MHz. Span= fully encompass the bandwidth, Sweep = auto; Detector Function = Peak Trace mode=max hold
3. Use the spectrum analyzer' channel power measurement function with the band limits set equal to the bandwidth edges.
4. Keep the EUT in transmitting at lowest, middle and highest channel individually. Record the max value.

Test Results record:

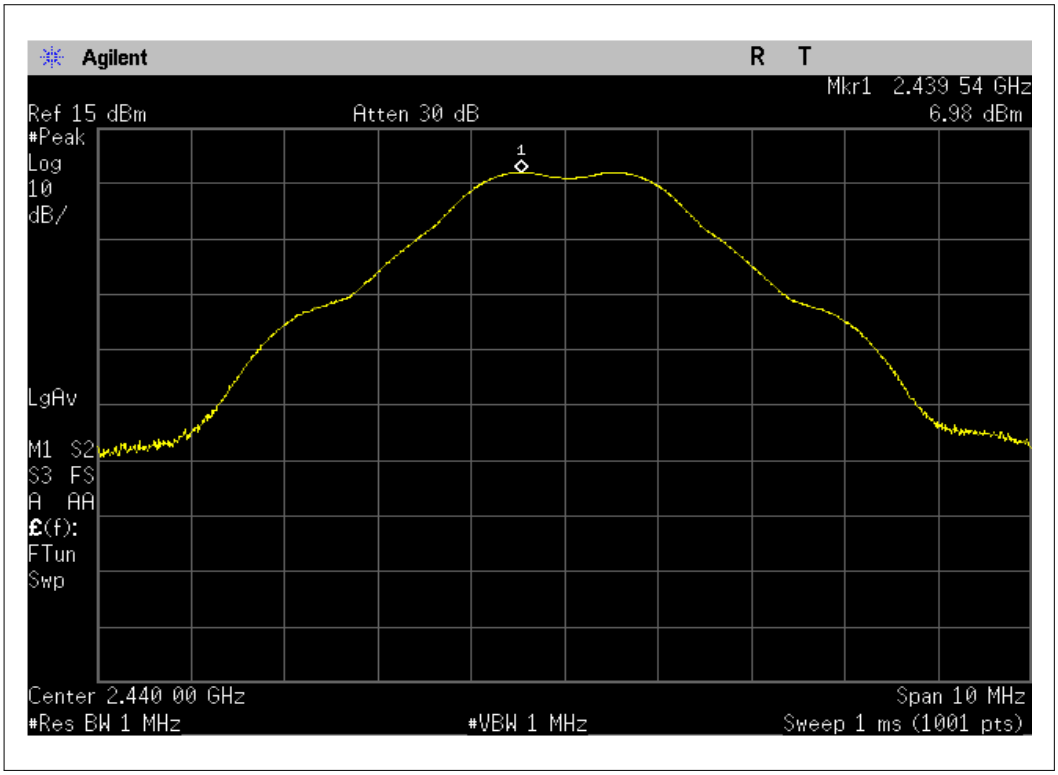
Measured values of the Conducted Peak Output Power(Conducted)				
Frequency (MHz)	Reading Power (dBm)	Output Power (W)	Limit (W)	Verdict
2405	7.71	0.0059	1	Pass
2440	6.98	0.0049	1	Pass
2480	6.25	0.0042	1	Pass

Measured values of the Conducted Peak Output Power(Conducted)

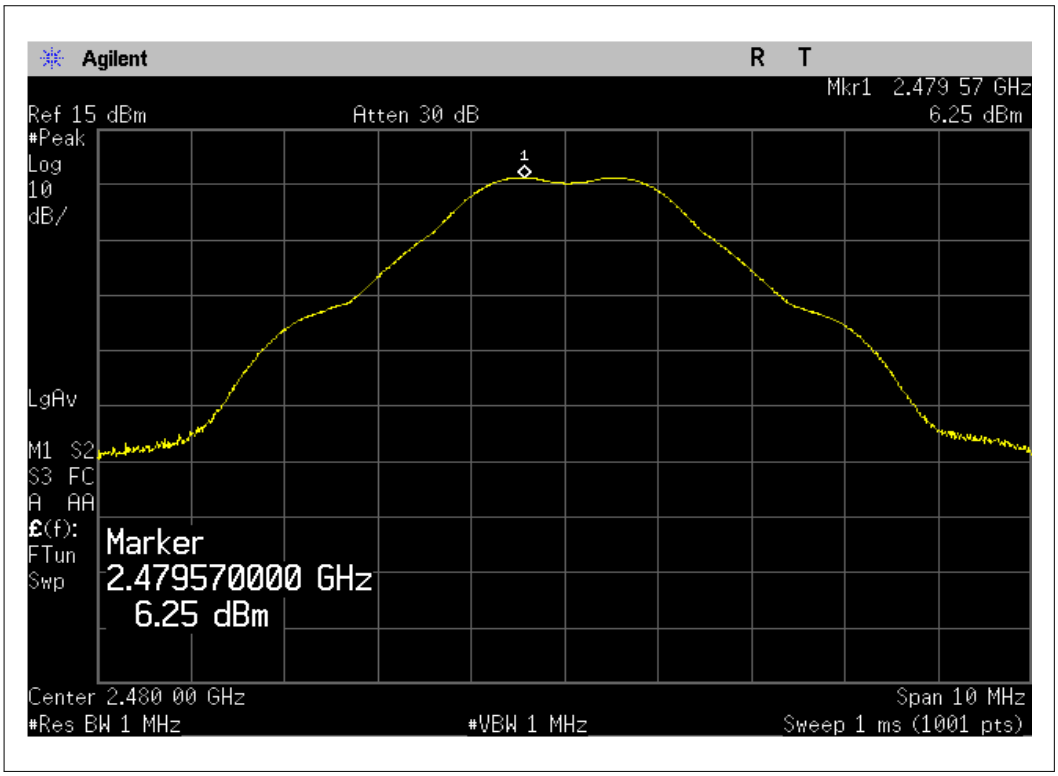
Lowest Channel (2405 MHz)



Middle Channel (2440 MHz)



Highest Channel (2480 MHz)



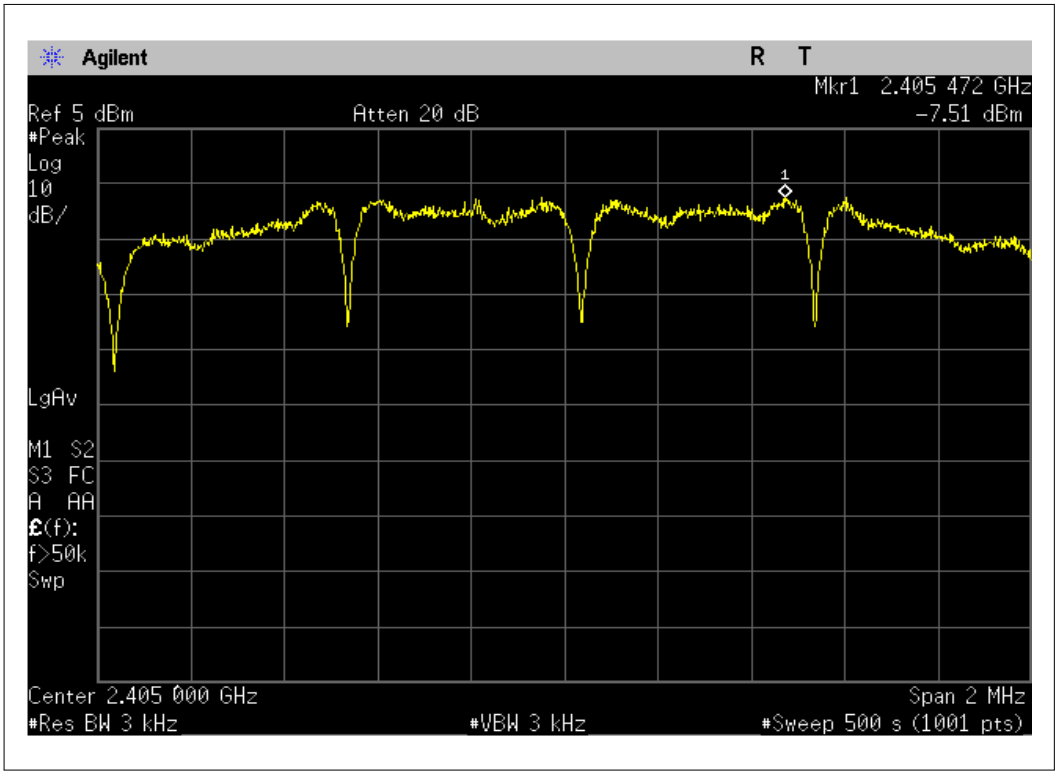
7.4 Peak Power Spectral Density

Test Requirement:	FCC Part 15, Subpart C Section 15.247 (e) RSS-210 Issue 8 Annex 8
Test Method:	ANSI C63.10,2009 Section 6.11.2
Test Result:	Pass
Test Limit:	8dBm/3kHz
Final Test Mode:	Engineering mode
Measurement Procedure	1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum. 2. Set the spectrum analyzer: Center Frequency= Channel Frequency, RBW = 3 kHz VBW = 10 kHz. Span= fully encompass the bandwidth, Sweep = auto; Detector Function = Peak Trace mode=max hold, 3. Set MKR=Center Frequency, Trace=Clear Write. 4. Adjust the Span = 300 kHz, Sweep Time=100s, Trace=Max hold, MKR=Peak Search. 5. Record the marker level for the particular mode.
:	6. Repeat these steps for other channel and device modes.

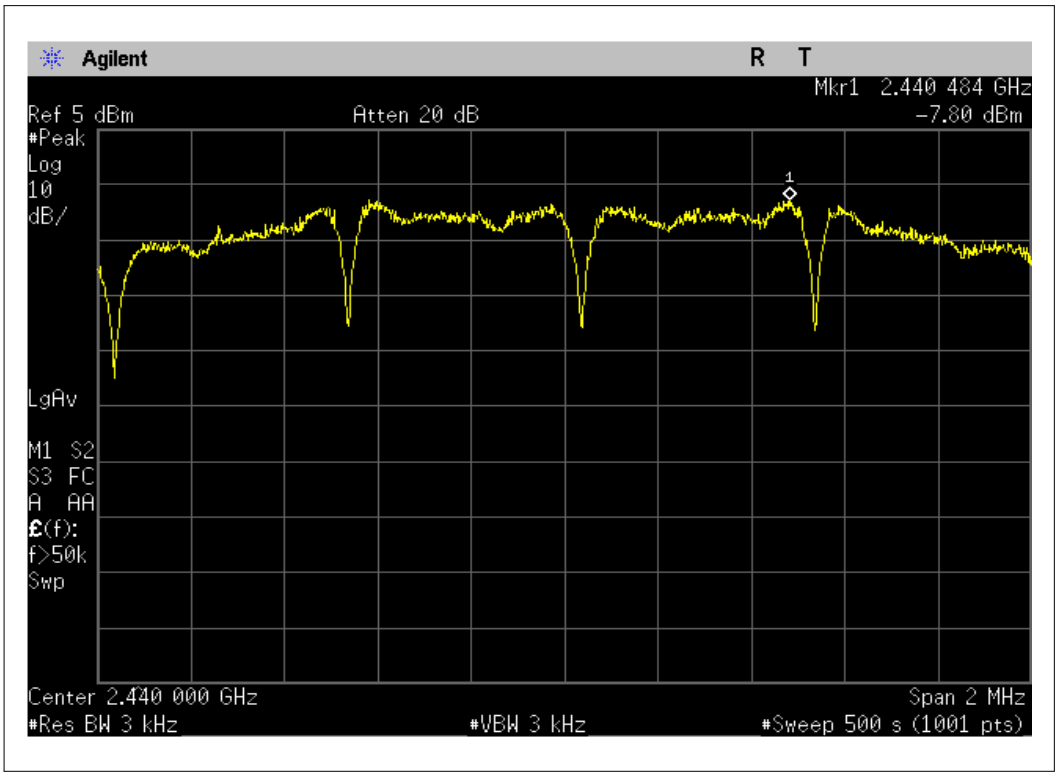
Test Results record:

Measured values of the Peak Power Spectral Density				
Center frequency (MHz)	Peak frequency (MHz)	Peak power Spectral Density (dBm)	Limit (dBm)	Verdict
2405	2405.472	-7.51	8	Pass
2440	2440.484	-7.80	8	Pass
2480	2480.470	-7.96	8	Pass

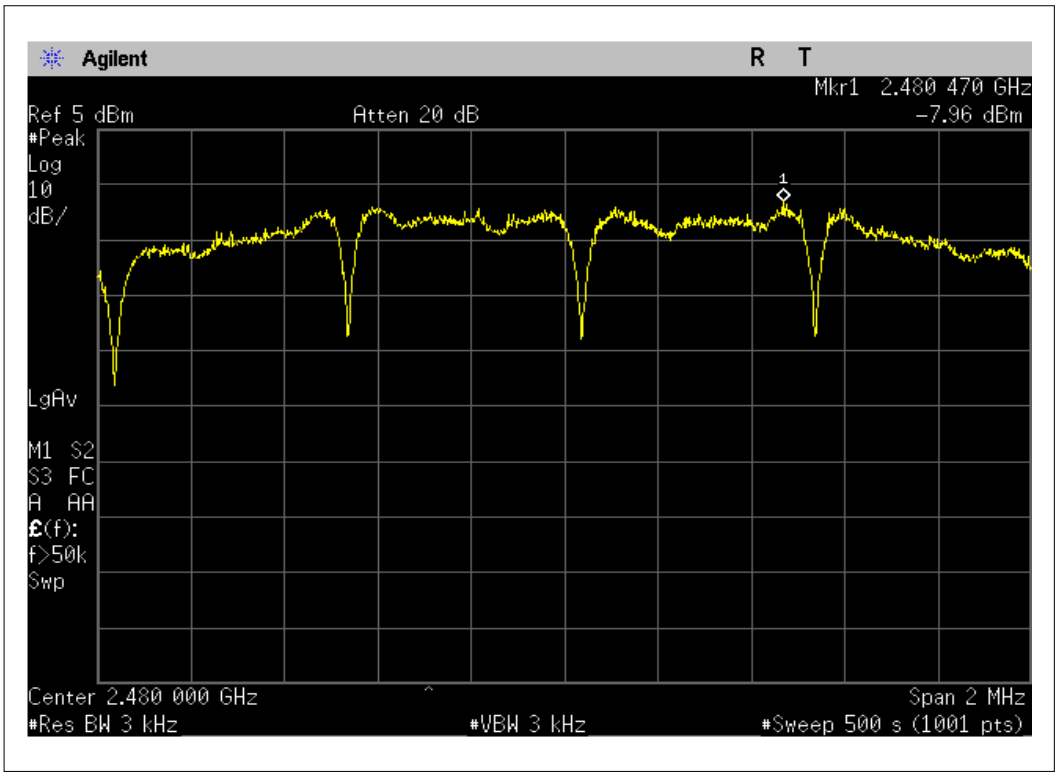
Lowest Channel (2405 MHz)



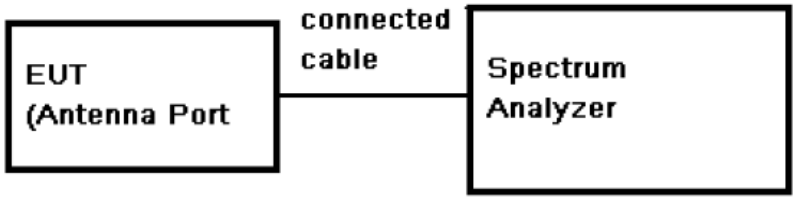
Middle Channel (2440 MHz)



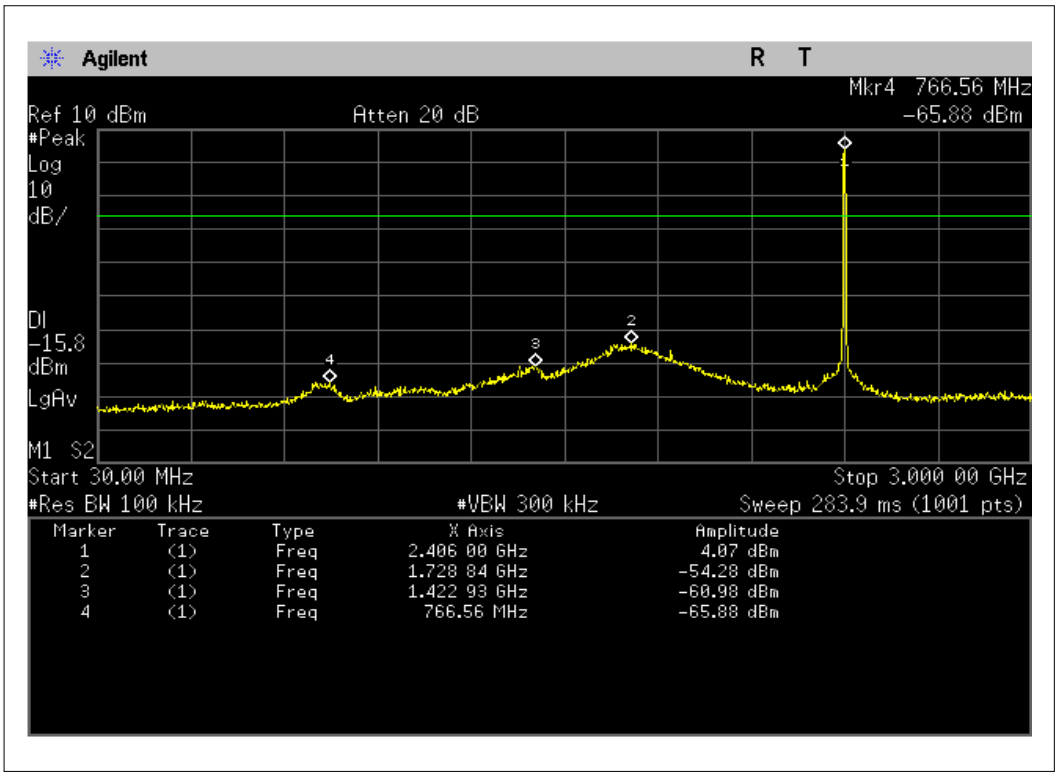
Highest Channel (2480 MHz)



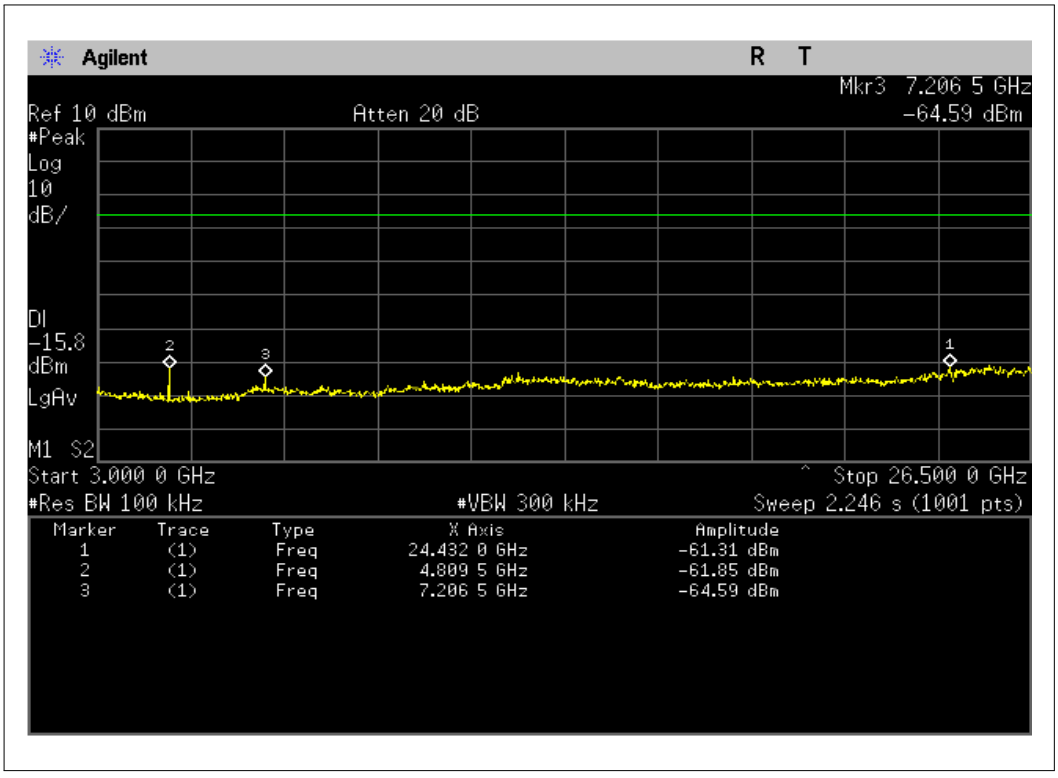
7.5 Conducted Spurious Emissions

Test Requirement:	FCC Part 15 Section 15.247(d) RSS-210 Issue 8 Annex 8
Test Method:	ANSI C63.10:2009 Clause 7.7.10
Test Result:	Pass
Limit:	(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating. The radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. Based on either an RF conducted or a radiated measurement. Provided the transmitter demonstrates compliance with the peak conducted power limits.
Final Test Mode:	Engineering mode
Test Configuration:	
Test Procedure:	1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum. 2. Set the spectrum analyzer: RBW = 100KHz. VBW >= RBW. Sweep = auto; Detector Function = Peak (Max. hold).

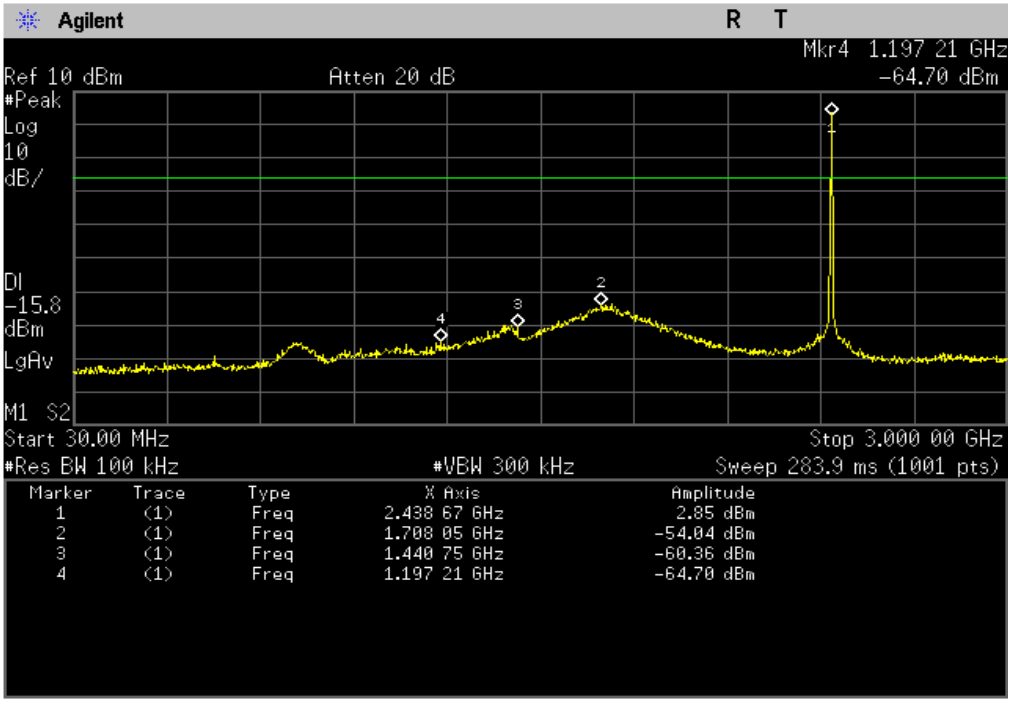
Lowest Channel (2405 MHz) : 30MHz ~ 3GHz



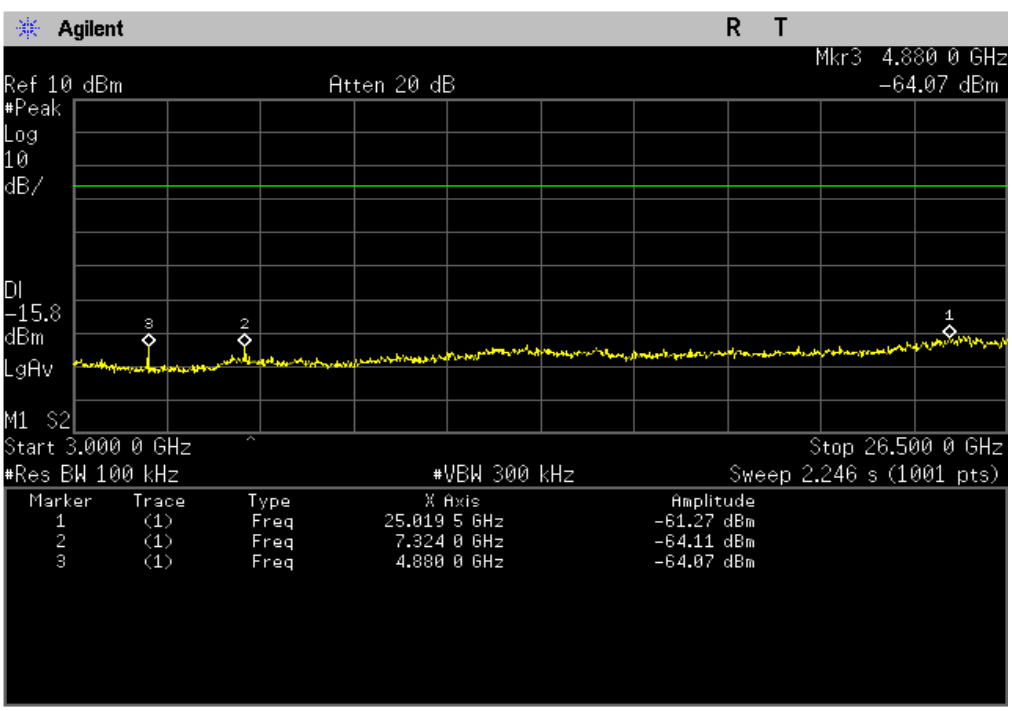
Lowest Channel (2405 MHz) : 3GHz ~ 26GHz



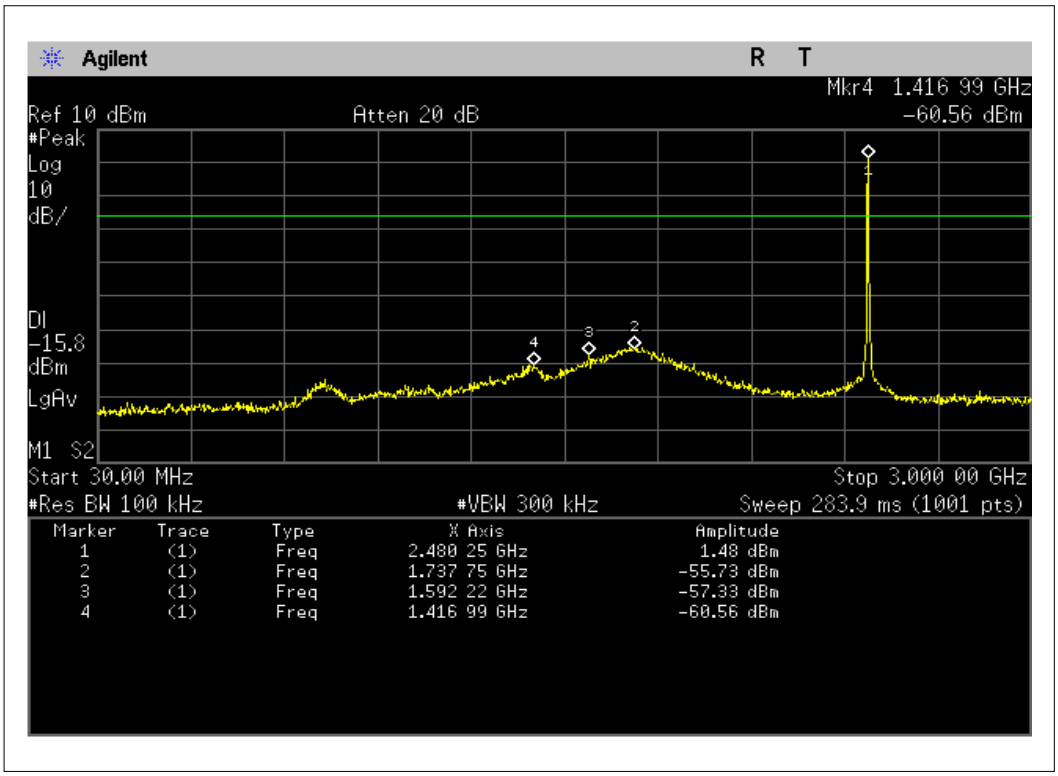
Middle Channel (2440 MHz) : 30MHz ~ 3GHz



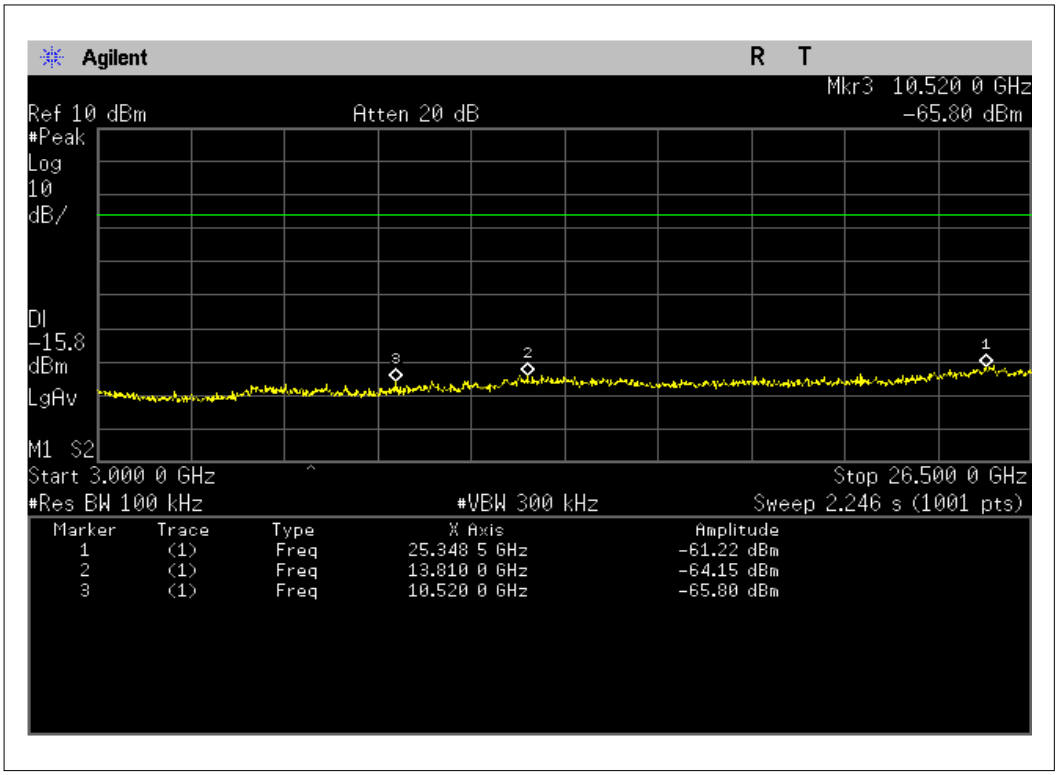
Middle Channel (2440 MHz) : 3GHz ~ 26GHz



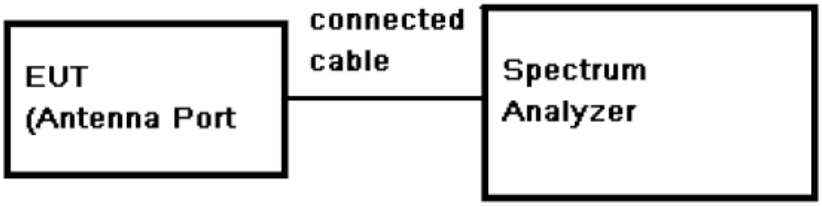
Highest Channel (2480 MHz) : 30MHz ~ 3GHz



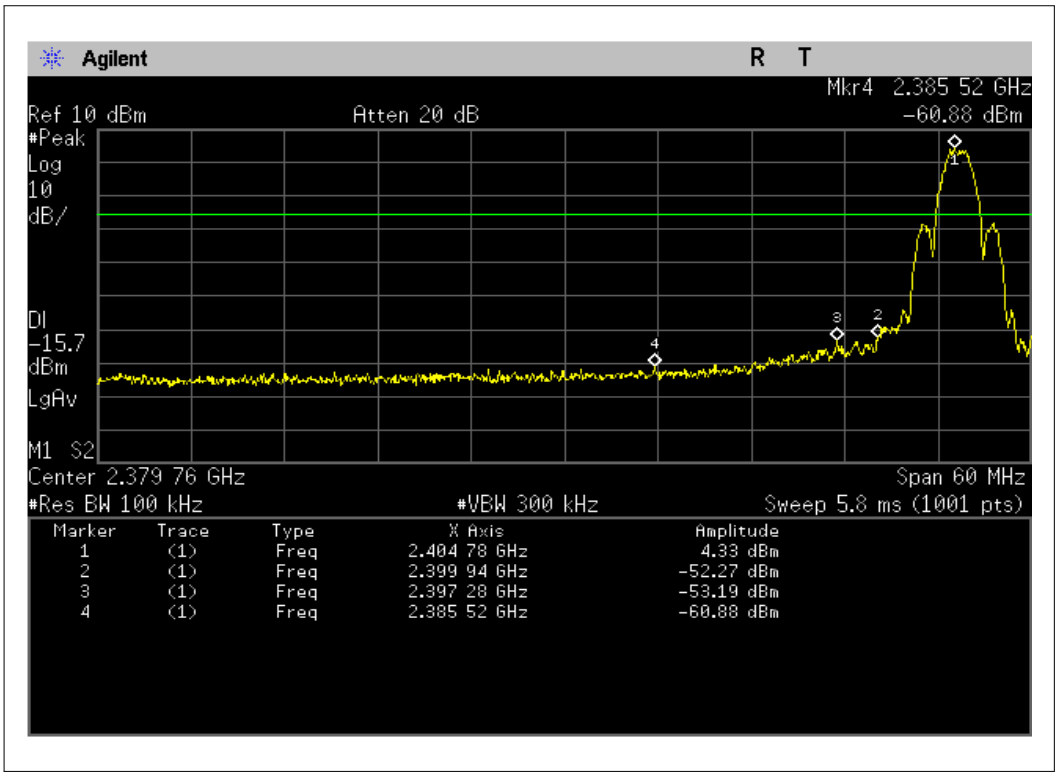
Highest Channel (2480 MHz) : 3GHz ~ 26GHz



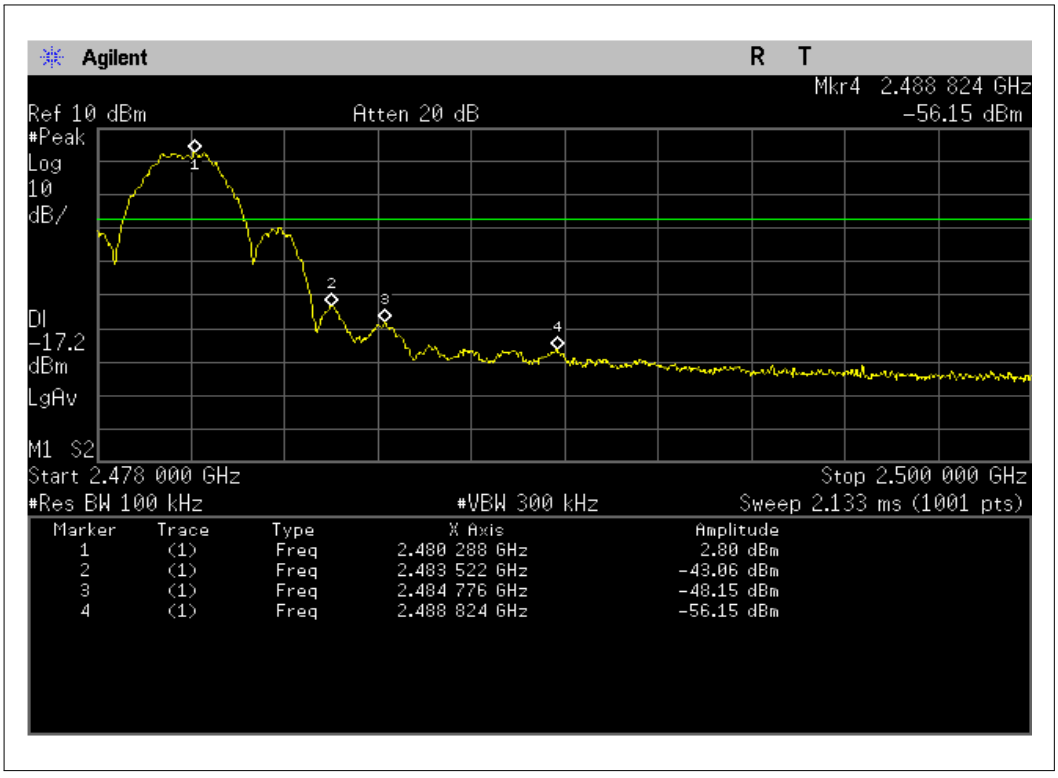
7.6 Conducted Band-edge

Test Requirement:	FCC Part 15 Section 15.247(d) RSS-210 Issue 8 Annex 8
Test Method:	ANSI C63.10:2009 Clause 7.7.10
Test Result:	Pass
Limit:	(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating. the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. based on either an RF conducted or a radiated measurement. provided the transmitter demonstrates compliance with the peak conducted power limits.
Final Test Mode:	Engineering mode
Test Configuration:	
Test Procedure:	1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum. 2. Set the spectrum analyzer: RBW = 100KHz. VBW >= RBW. Sweep = auto; Detector Function = Peak (Max. hold).

Lowest Channel (2405 MHz)



Highest Channel (2480 MHz)

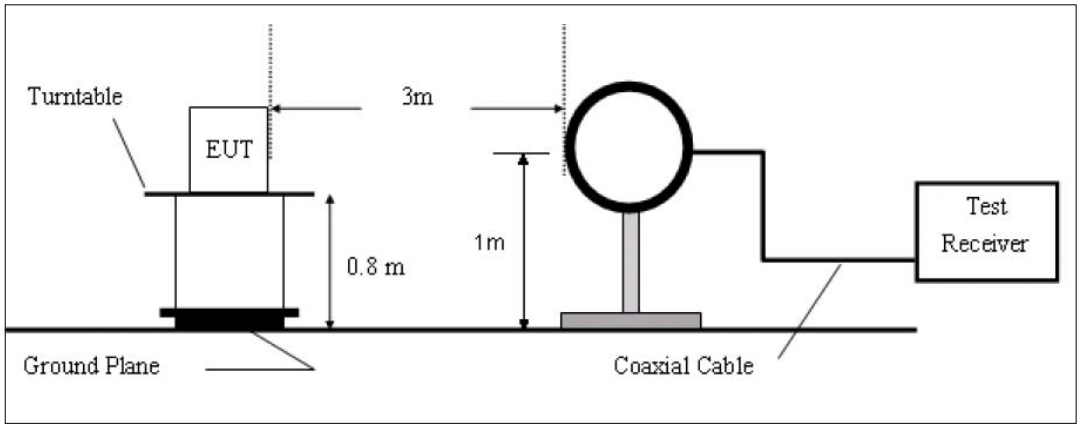


7.7 Radiated Spurious Emissions

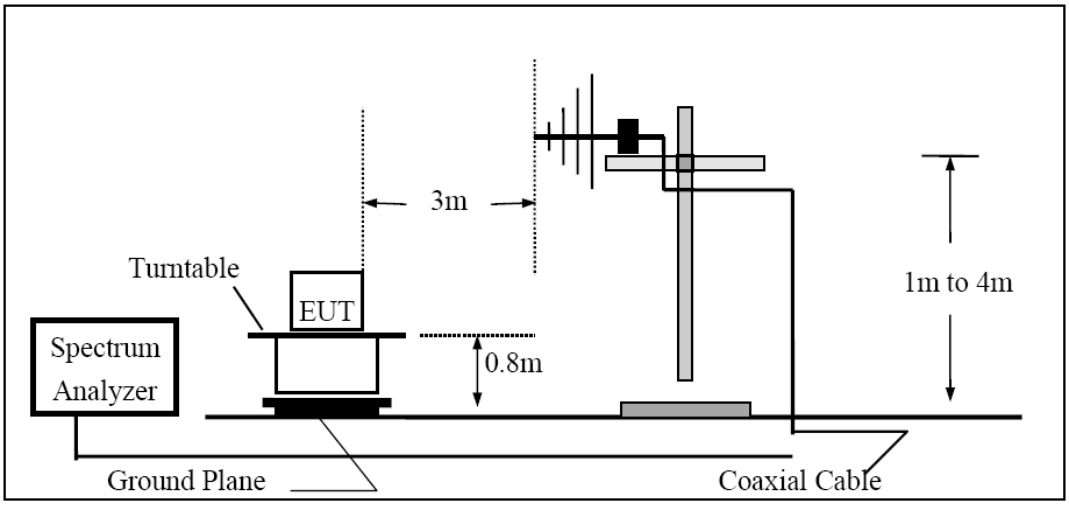
Test Requirement:	FCC Part 15 Section 15.209 and Section 15.205 RSS-210 Issue 8 Annex 8
Test Method:	ANSI C63.10:2009 Clause 6.12
Test Result:	Pass
Final Test Mode:	Engineering mode
Test site/setup:	Measurement Distance: 3m (Semi-Anechoic Chamber) Test instrumentation resolution bandwidth 200 Hz and Quasi-Peak detector applies (9 KHz –150 KHz). Test instrumentation resolution bandwidth 9 KHz and Quasi-Peak detector applies (150 KHz - 30 MHz). Test instrumentation resolution bandwidth 120 kHz and Quasi-Peak detector applies (30 MHz - 1000 MHz). For PK value: RBW = 1 MHz for f ³ 1 GHz; VBW ³ RBW; Sweep = auto Detector function = peak Trace = max hold For AV value: RBW = 1 MHz for f ³ 1 GHz VBW =10Hz; Sweep = auto Detector function = peak Trace = max hold Receive antenna scan height 1 m - 4 m. polarization Vertical / Horizontal
15.209 Limit:	40.0 dBµV/m between 30MHz & 88MHz 43.5 dBµV/m between 88MHz & 216MHz 46.0 dBµV/m between 216MHz & 960MHz 54.0 dBµV/m above 960MHz

Test Configuration:

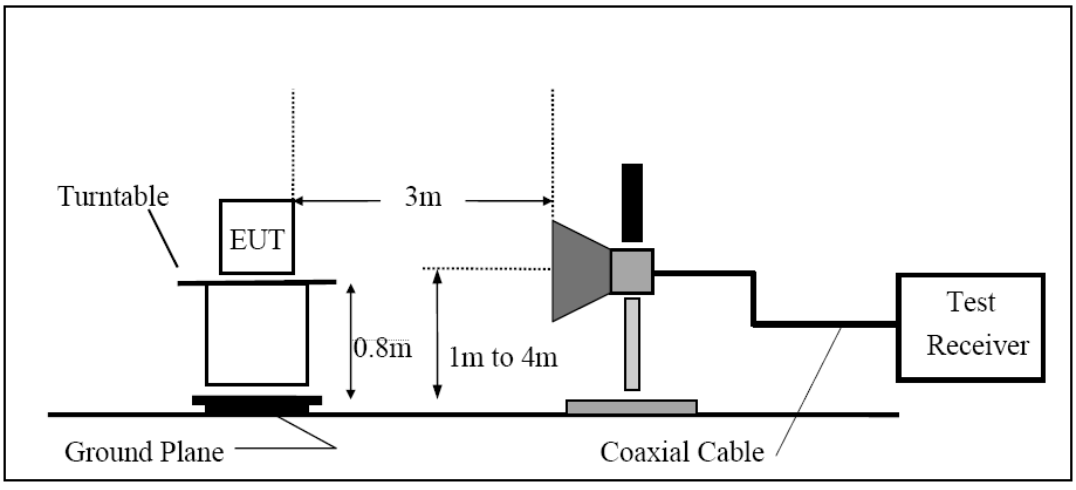
Radiated Emission Test Set-Up, Frequency 9 KHz to 30 MHz



Radiated Emission Test Set-Up, Frequency Below 1000MHz



Radiated Emission Test Set-UP Frequency Above 1000MHz



Test Procedure:

The procedure used was ANSI Standard C63.10:2009. The receiver was scanned from 9KHz to 25GHz.When an emission was found, the table was rotated to produce the maximum signal strength. An initial pre-scan was performed for in peak detection mode using the receiver. The EUT was measured for both the Horizontal and Vertical polarities and performed a pre-test three orthogonal planes. For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. The worst case emissions were reported.

Low noise amplifier was used below 1GHz, High pass Filter was used above 3GHz. Between 1G and 3GHz, we did not use any amplifier or filter.

1) For this intentional radiator operates below 25 GHz. the spectrum shall be investigated to the tenth harmonic of the highest fundamental frequency. And above the third harmonic of this intentional radiator, the disturbance is very low. So the test result only displays to 5rd harmonic.

As shown in Section, for frequencies above 1000 MHz. the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

The test only perform the EUT in transmitting status since the test frequencies were over 1GHz only required transmitting status.

Test Result of Radiated Emission

Measured values of the Field strength of spurious emission (Transmit mode)										
Frequency (MHz)		Detect Mode	Polarization (V/H)	High (m)	Measured Value (dBμV)	Antenna Factor + Cable Loss (dB/m)	Amplifier Gain (dB)	Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Average/Peak/Quasi-peak data, emissions below 30 MHz										
9KHz-30MHz the measurements were greater than 20dB below the limit.										
Quasi-peak data, emissions below 1000 MHz										
CH 1 (2405MHz)	66.35	QP	H	2.9	9.87	10.33	-	20.20	40	19.80
	47.64	QP	V	3.2	18.60	13.10	-	31.70	40	8.30
	260.33	QP	V	2.1	20.96	14.61	-	35.57	46	10.43
CH 8 (2440MHz)	135.86	QP	H	2.4	23.68	14.45	-	38.13	43.5	5.37
	260.33	QP	V	2.1	21.97	14.61	-	36.58	46	9.42
	404.92	QP	V	2.9	19.92	19.05	-	38.97	46	7.03
CH 16 (2480MHz)	47.64	QP	V	3.2	19.13	13.11	-	32.23	40	7.77
	261.04	QP	V	2.1	20.72	14.64	-	35.36	46	10.64
Peak/Average data, emissions above 1000 MHz										
CH 1 (2405MHz)	1631	Peak	H	1.5	45.13	28.87	-23.2	50.8	74	23.2
	1631	Average	H	1.5	31.07	28.87	-23.2	36.74	54	17.26
	1813	Peak	V	1.4	39.22	29.57	-23.2	45.59	74	28.41
	1813	Average	V	1.4	26.64	29.57	-23.2	33.01	54	20.99
CH 8 (2440MHz)	1647	Peak	H	1.5	36.66	28.87	-23.2	42.33	74	31.67
	1647	Average	H	1.5	28.33	28.87	-23.2	34	54	20.00
	5574	Peak	V	1.2	46.39	38.67	-23.2	61.86	74	12.14
	5574	Average	V	1.2	20.04	38.67	-23.2	35.51	54	18.49
CH 16 (2480MHz)	3784	Peak	H	1.3	47.16	34.87	-23.2	58.83	74	15.17
	3784	Average	H	1.3	30.34	34.87	-23.2	42.01	54	11.99
	6660	Peak	V	1.2	45.30	40.80	-23.2	62.90	74	11.10
	6660	Average	V	1.2	29.13	40.80	-23.2	46.73	54	7.27

1. Margin (dB) = Limit − Emission Level
2. H = Horizontal, V = Vertical Polarization

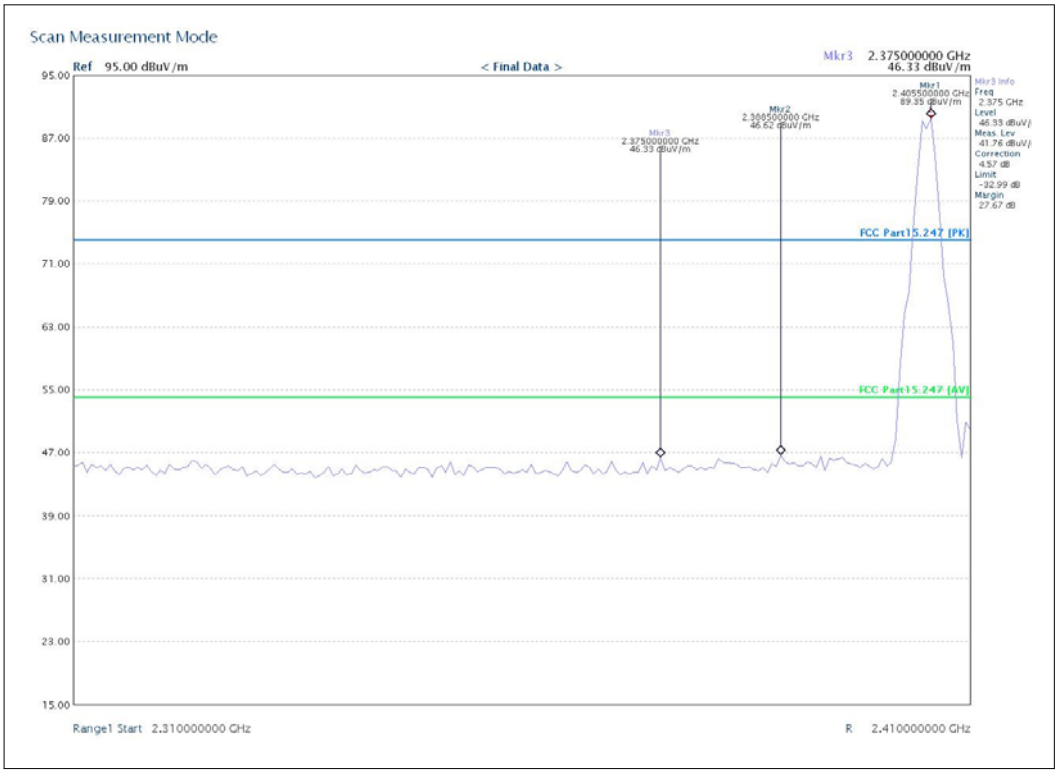
7.8 Band edge (Radiated Emission)

Test Requirement:	Section 15.247(d) 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 Section 15.209(a) (see Section 15.205(c).
Test Method:	ANSI 63.10:2009 Clause 6.12
Test Result:	Pass
Measurement Distance:	3m (Semi-Anechoic Chamber)
Limit:	40.0 dBµV/m between 30MHz & 88MHz; 43.5 dBµV/m between 88MHz & 216MHz; 46.0 dBµV/m between 216MHz & 960MHz; 54.0 dBµV/m above 960MHz.
Detector:	For PK value: RBW = 1 MHz for f ³ 1 GHz VBW ³ RBW; Sweep = auto Detector function = peak Trace = max hold For AV value: RBW = 1 MHz for f ³ 1 GHz VBW =10Hz; Sweep = auto Detector function = peak Trace = max hold

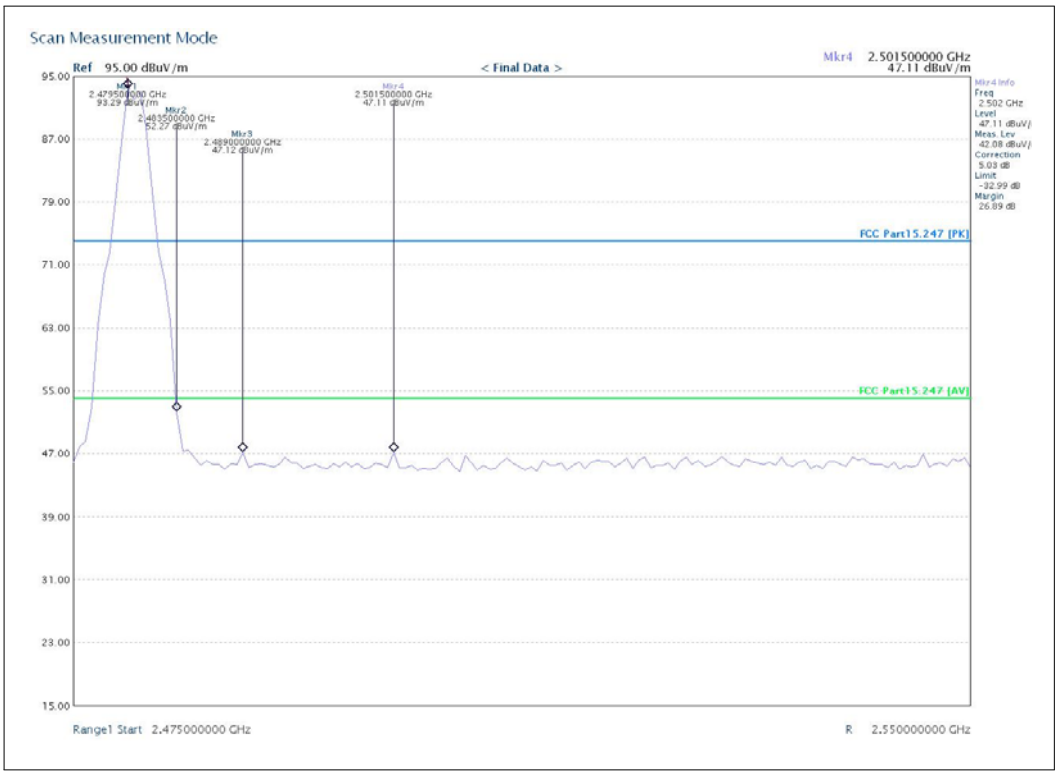
According to section 15.35(b) for frequencies above 1000 MHz. the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

Measurement Result:

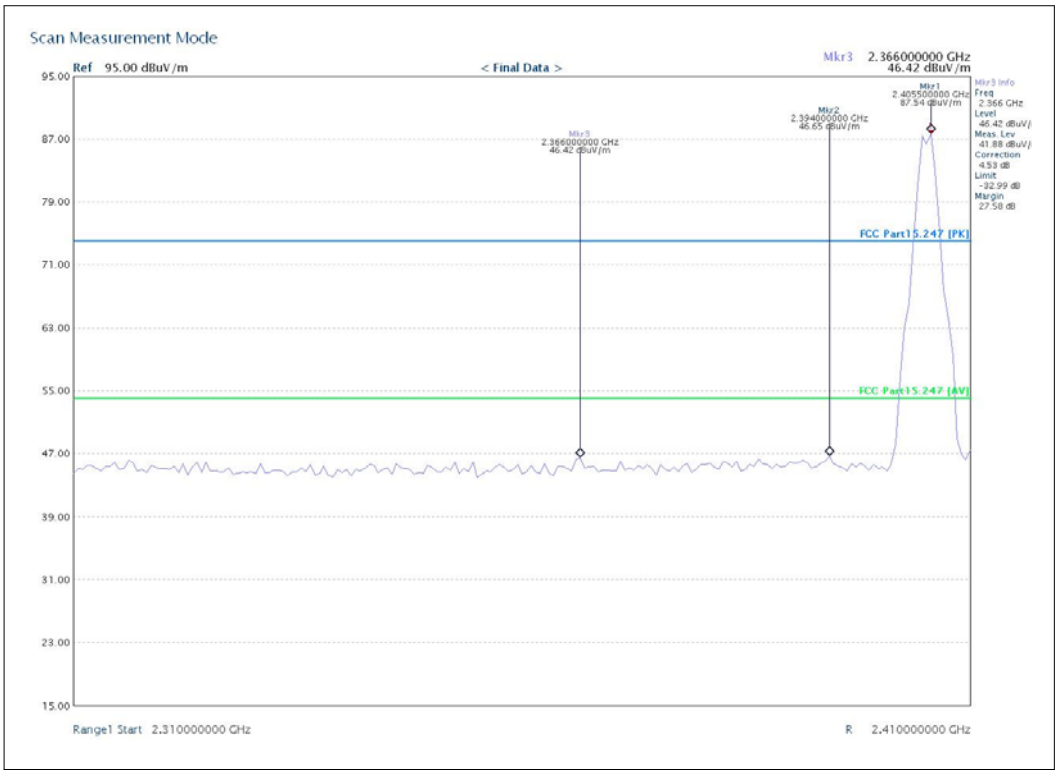
Low Channel (2405 MHz) , Horizontal , Peak Detector



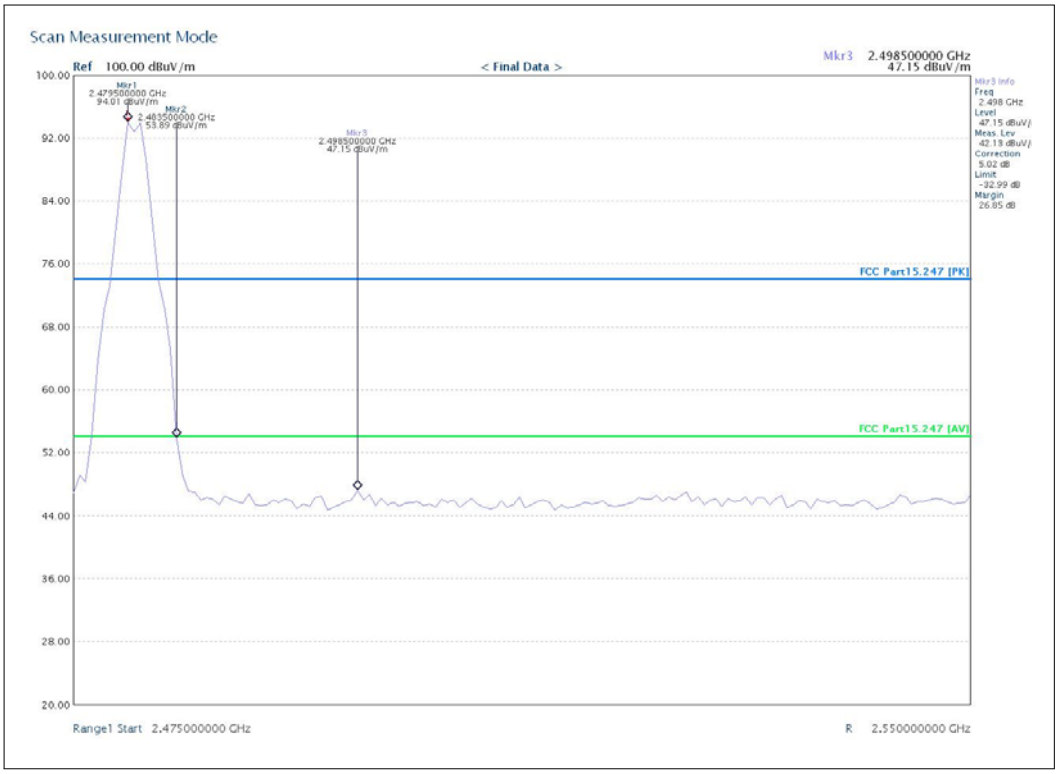
High Channel (2480MHz) , Horizontal , Peak Detector



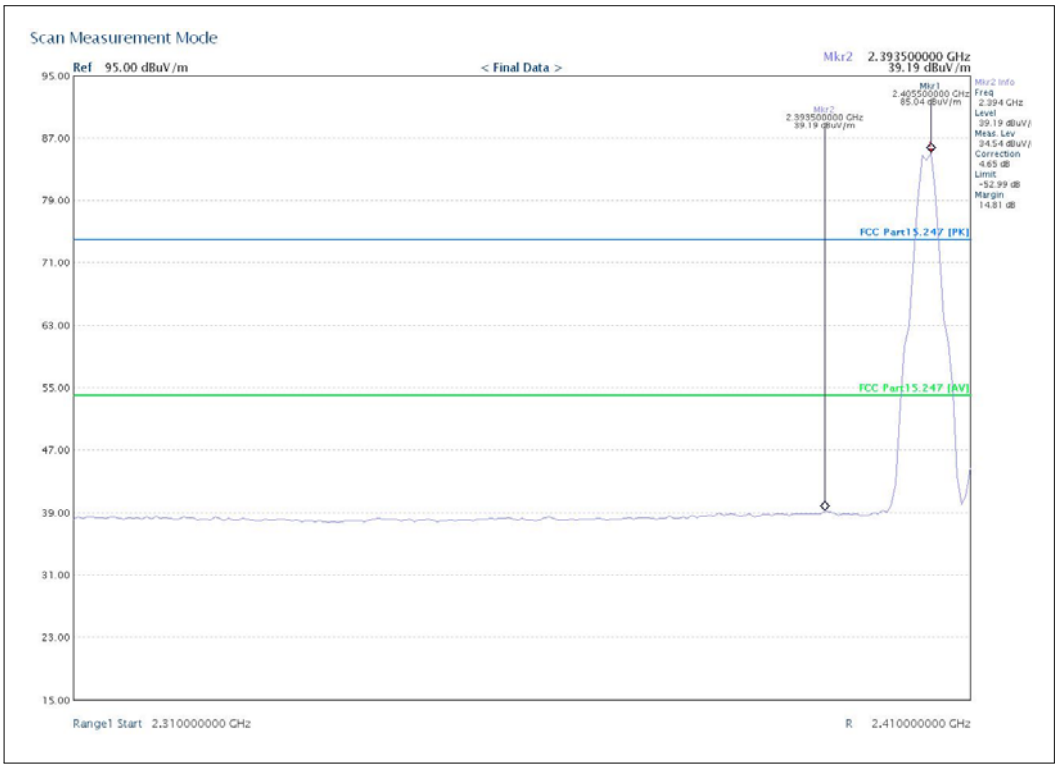
Low Channel (2405 MHz) , Vertical , Peak Detector



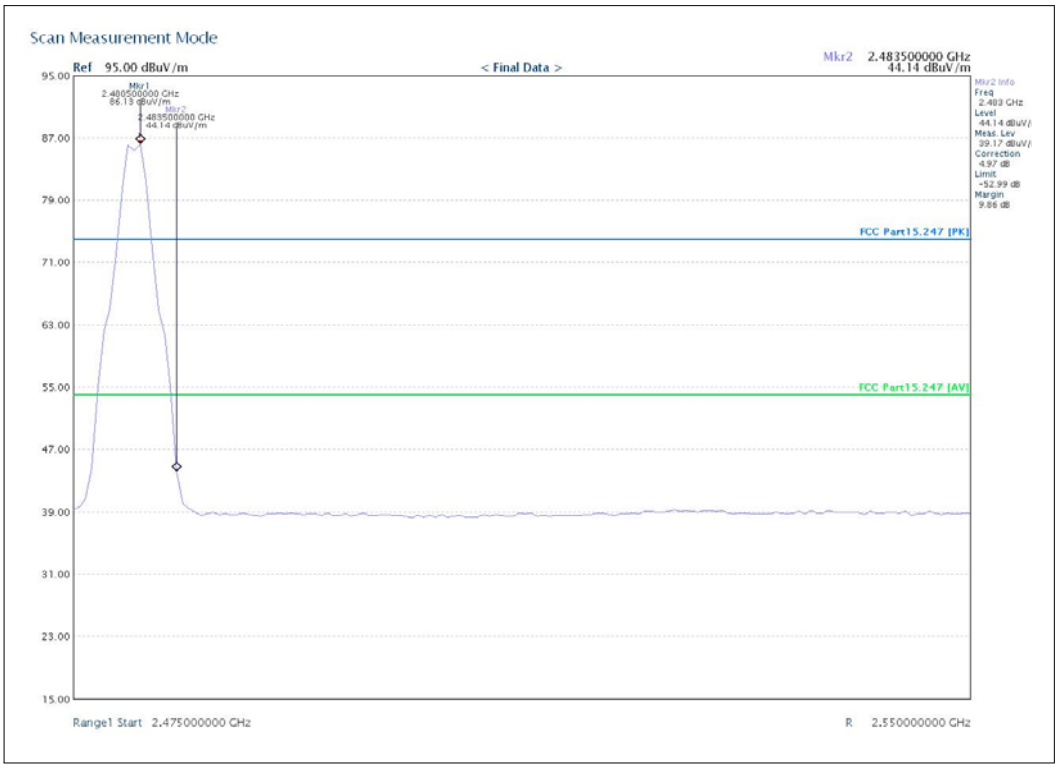
High Channel (2480MHz) , Vertical , Peak Detector



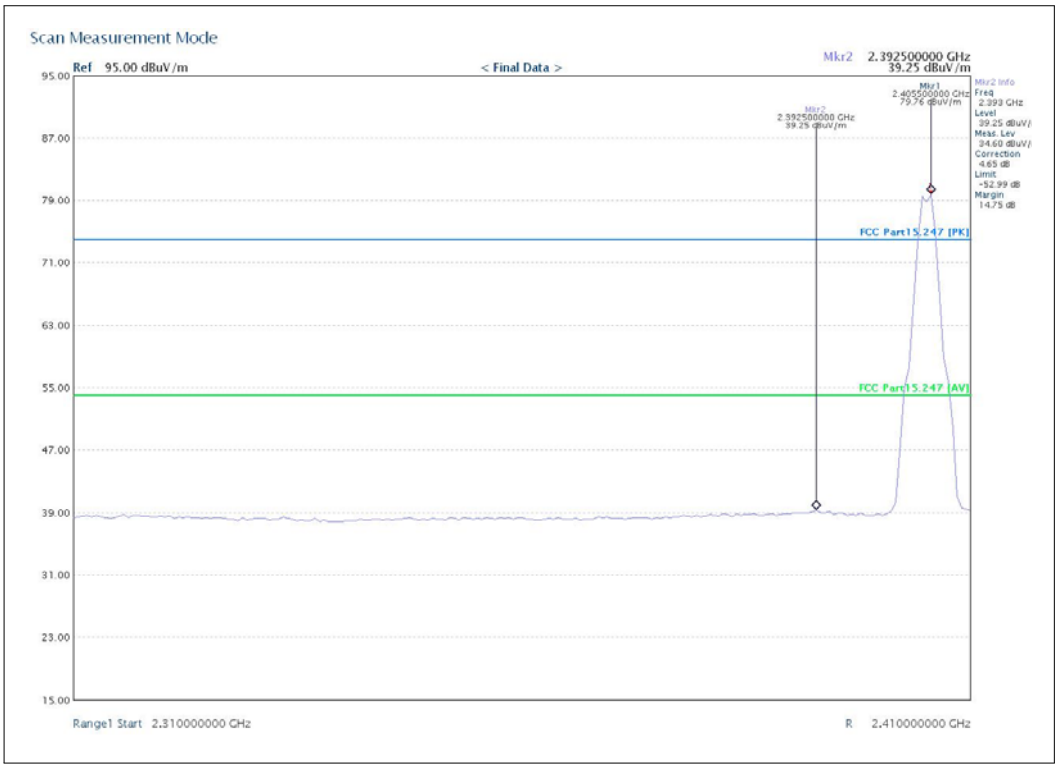
Low Channel (2405 MHz) , Horizontal , Average Detector



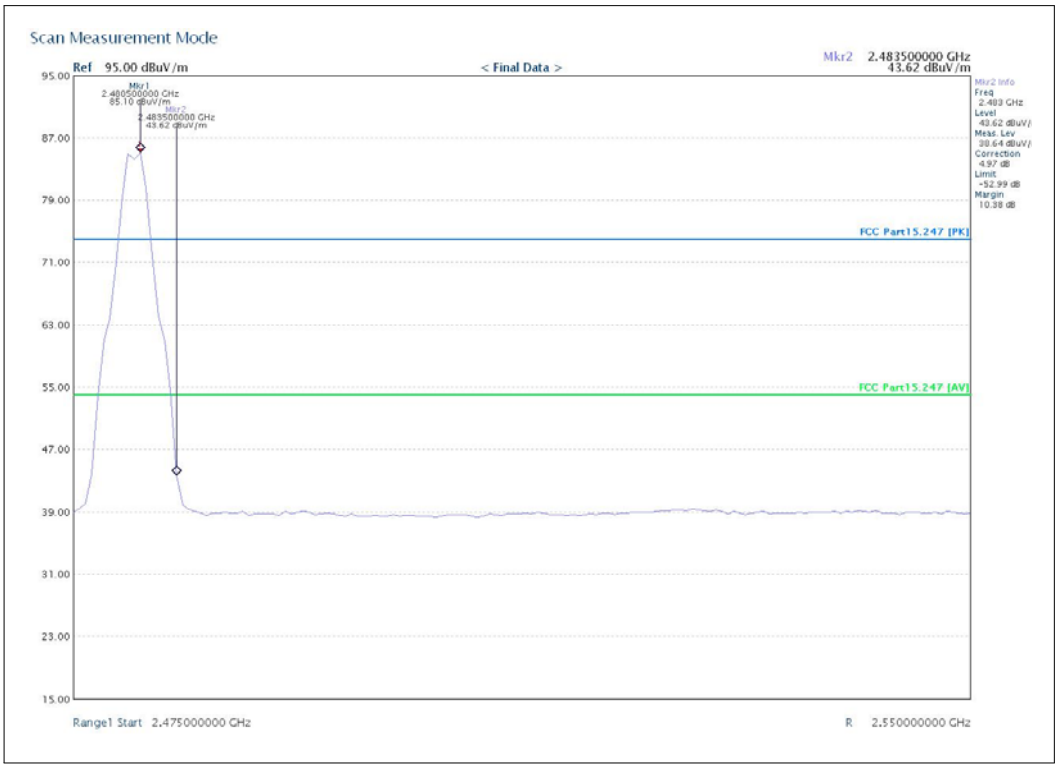
High Channel (2480MHz) , Horizontal , Average Detector



Low Channel (2405 MHz) , Vertical , Average Detector



High Channel (2480MHz) , Vertical , Average Detector



7.9 Radio Frequency Exposure Procedures

Regulation

According to §15.247(i) and § 1.1307(b)(1) , systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

KDB 447498 D01: Approximate SAR test exclusion power thresholds at selected frequencies and test separation distances are illustrated in the following table:

MHz	5	10	15	20	25	mm
150	39	77	116	155	194	SAR Test Exclusion Threshold (mW)
300	27	55	82	110	137	
450	22	45	67	89	112	
835	16	33	49	66	82	
900	16	32	47	63	79	
1500	12	24	37	49	61	
1900	11	22	33	44	54	
2450	10	19	29	38	48	
3600	8	16	24	32	40	
5200	7	13	20	26	33	
5400	6	13	19	26	32	
5800	6	12	19	25	31	

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

Maximum Measured Transmitter Power:

Channel Frequency (MHz)	Maximum Peak Conducted Output Power		Max Antenna Gain (dBi)	Numeric antenna gain (mW)
	(dBm)	(mW)		
2405	7.71	5.90	4.0	2.51

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]

· [√f(GHz)] = 5.90/25*√2.405 = 0.365 ≤ 3.0

Threshold at which no SAR required is 48mW and ≤ 3.0 for 1-g SAR, Separation distance is 25mm.

Conclusion : The SAR measurement is exempt.

8. TEST EQUIPMENTS

APPENDIX
TEST EQUIPMENT USED FOR TESTS

No.	Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Data	Used equipment
1	EMI Test Receiver	LIG Nex1	LSA-265	L07098033	12.12.24	13.12.24	■
2	Bi-log Antenna	Schwarzbeck	VULB9160	3311	13.10.16	15.10.16	■
3	Turn Table	KEI	KEI-TURN	9210	N/A	N/A	■
4	Turn Table	KEI	KEI-TURN	N/A	N/A	N/A	■
5	Loop ANT.	EMCO	6502/1	9801-3191	2012.02.02	2014.02.02	■
6	Spectrum Analyzer	Agilent	E4440A	MY45304715	2013.02.21	14.02.21	■
7	Function Generator	Agilent	33120A	US36026465	13.06.08	14.06.08	□
8	Frequency Counter	HP	5350B	3049A05530	13.06.08	14.06.08	■
9	Modulation Analyzer	Agilent	8901B	3438A05099	13.06.08	14.06.08	□
10	Audio Analyaer	Agilent	8903B	3729A18576	13.06.08	14.06.08	□
11	Attenuator	Agilent	8494B	MY41110204	13.06.08	14.06.08	□
12	Attenuator	Agilent	8496B	US40152183	13.06.08	14.06.08	□
13	Attenuator	Agilent	8495B	3308A17660	13.06.08	14.06.08	□
14	Attenuator	TAE SUNG	SMA-2	N/A	13.06.08	14.06.08	□
15	Power Meter	Agilent	E4418B	GB43312894	13.06.08	14.06.08	□
16	Power Sensor	HP	8485A	3316A14708	13.06.08	14.06.08	□
17	Vibration Tester	Gana	GNV-400		13.06.21	14.06.21	□
18	RF Cable	Gigalane	SMS-LL280-SMS-1.5M	SMS105-LL280-SMS105-1.5M	N/A	N/A	■
19	Temp & Humidity Chamber	Seoksan Tech	SE-CT-02	S7400JD5340618	13.06.08	14.06.08	■
20	Signal Generator	Leader Electronics	3220	0137231	13.06.08	14.06.08	■
21	Oscilloscope	Tektronix	TDS-350	B031902	13.06.08	14.06.08	□
22	Drop Tester	Self-made	KSQ-01	N/A	13.06.08	N/A	□
23	Pre Amplifier	GTC	GA-1825A	GT0929/003		N/A	■
24	Continuous operation tester	GTC	CT-100	GT0929/001	N/A	N/A	□
25	CW Generator	HP	83711B	US34490158	13.06.08	14.06.08	■
26	POWER DIVIDER	Agilent	11636B	54381	13.06.08	14.06.08	□
27	Power Sensor	Agilent	8482B	N/A	13.06.08	14.06.08	□

28	Attenuator	Winswell	53-30-33	N/A	13.06.08	14.06.08	□
29	DC Power Supply	Hanil	HPS-505A	0606123	13.06.08	14.06.08	□
30	Slidacs	Hanchang	5KV	N/A	13.06.08	14.06.08	■
31	Termination	Kwang Yeok	KYTE-NJ-150W	2040004	13.06.08	14.06.08	□
32	Band-limited filter	MITECH	KSQ-02	N/A	13.06.08	14.06.08	□
33	Horn ANT.	SCHWARZBECK	BBHA 9120D	9120D-679	12.07.12	14.07.12	■
34	Horn ANT.	A.H. SYSTEMS	SAS-572	100284	13.09.07	15.09.07	■
35	DC Power Supply	ALINCO	DM-340MW	F001015	13.06.08	14.06.08	□
36	LISN	Electro Metrics	ANS-25/2	2535	13.04.25	14.04.25	■
37	LISN	Kyoritsu	KNW-407	8-1010-14	13.06.08	14.06.08	□
38	Pulse Limiter	LIG Nex1	EPL-30	N/A	13.06.08	14.06.08	■

APPENDIX

1. EUT photo