TEST REPORT

1. Applicant
   - Name Shinpoong Electronics Inc.
   - Brand Name : SEECODE
   - Address : A1107,GwangmyeongTechnoPark,60,Haan-ro, Gwangmyeong-si, Gyeonggi-do,KOREA
   - FCC ID : IBNZS2400
2. Products
   - Name : ZigBee Shoulder Speaker Microphone
   - Model/Type : ZS2400 / QPSK
   - Manufacturer : Shinpoong Electronics Inc.
3. Test Standard : FCC CFR 47 Part 15.247 Subpart C
4. Test Method : ANSI C63.4-2009
5. Test Result : Positive
6. Dates of Test : July 09, 2013 to July 16, 2013
7. Date of Issue : July 18, 2013
8. Test Laboratory : Korea Standard Quality Laboratories
   FCC Designation Number : 100384

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

Korea Standard Quality Laboratories
Testing Laboratories for EMC and Safety Compliance
www.ksqlab.com
#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 C63.4, 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: July 09, 2013 ~ July16, 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	DC 3.7 V
Transmit Frequency	2405 ~ 2480 MHz (2 MHz step, 16 channels)
Antenna Type	Integral (CHIP Antenna, Gain: 0 dBi max.)
Type of Modulation	QPSK

3.2 Equipment Modifications

None.

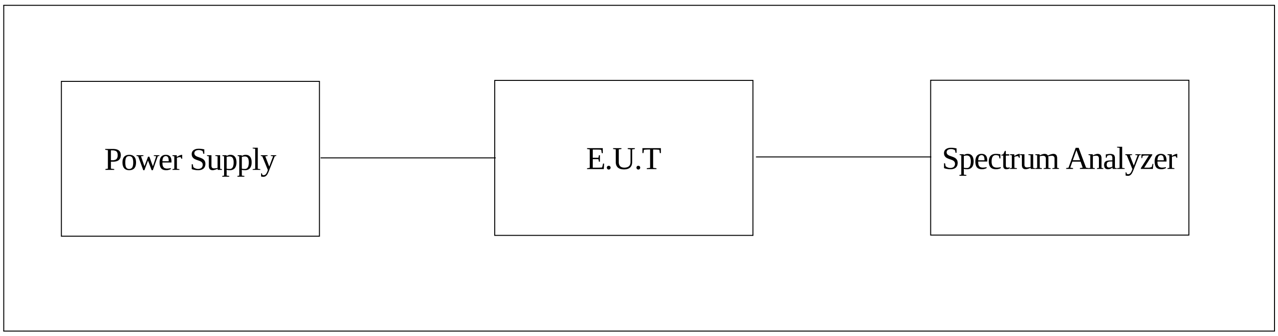
3.3 Submitted Documents

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

Summary of Test Reaults

Requirement	CFR 47 Section	Report Section	Test Result
Antenna Requirement	15.203, 15.247(b)(4)	5.1	PASS
6dB Bandwidth	15.247(a)(2)	5.2	PASS
Maximum Peak Output Power	15.247(b)(3)	5.3	PASS
Peak Power Spectral Density	15.247(e)	5.4	PASS
Spurious Emission, Band Edge, and Restricted bands	15.247(d), 15.205(a), 15.209(a)	5.5	PASS
Receiver Spurious Emissions	15.209(a)	5.7	PASS
RF Exposure	15.247(i), 1.1307(b)(1)	5.8	PASS

5.1 ANTENNA REQUIREMENT

5.1.1 Regulation

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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. 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.

And according to §15.247(b)(4), 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.

5.1.2 Result : PASS

The transmitter has an integral Chip antenna. The directional gain of the antenna is 0 dBi.

5.2. 6dB BANDWIDTH

5.2.1 Regulation

According to §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.

5.2.2. Test Condition

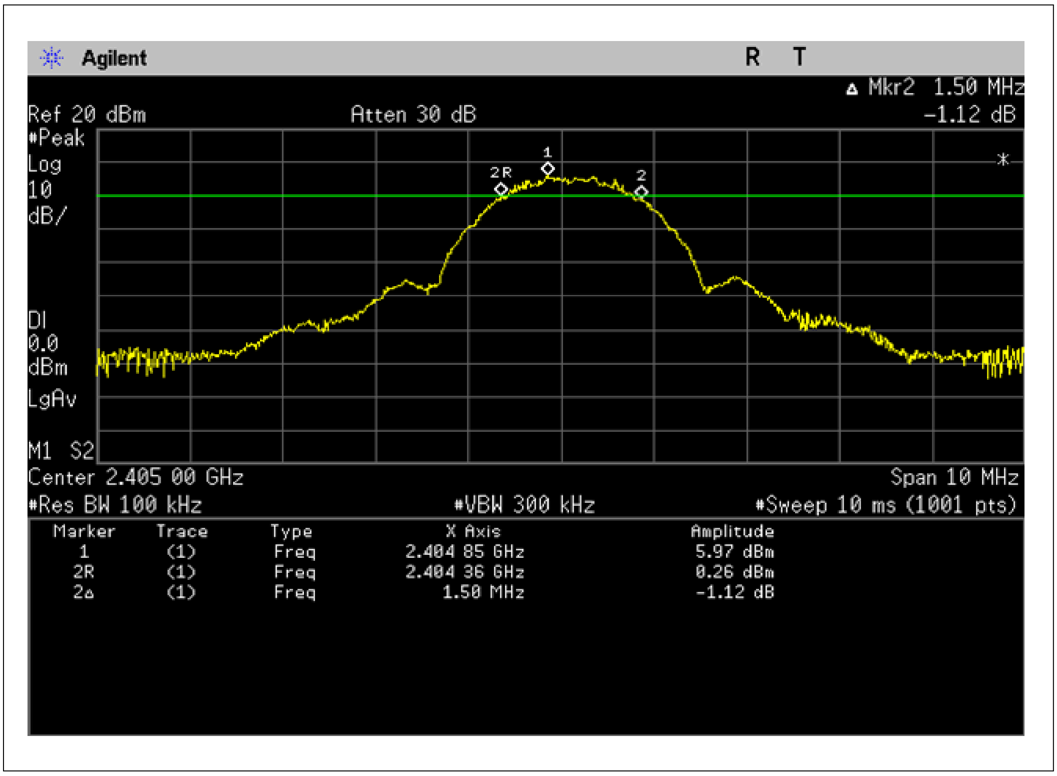
- Set RBW of Spectrum analyzer to 100 kHz, Span=10MHz, Sweep=auto
- The 6dB bandwidth is defined as the frequency range where the power is higher than the peak power minus 6dB .

5.2.3. Test result : PASS

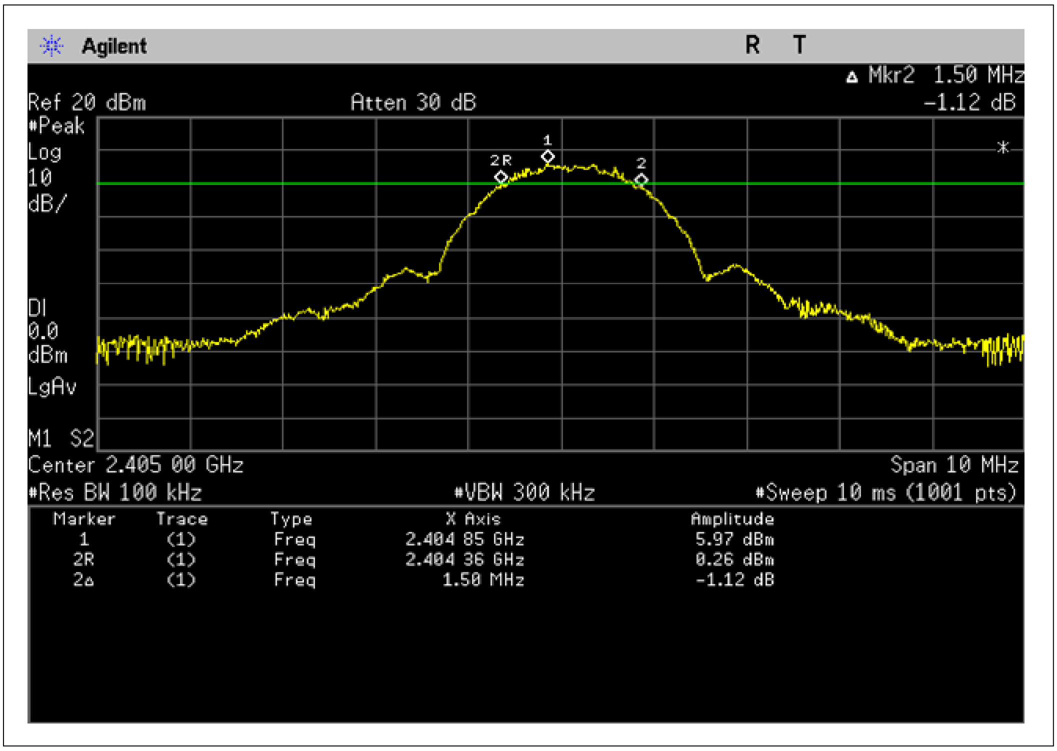
Table 1 : Measured values of the 6dB Bandwidth		
Frequency (MHz)	Result (MHz)	Verdict
2405	1.50	Pass
2440	1.51	Pass
2480	1.47	Pass

Figure 1. Plot of the 6dB Channel Bandwidth

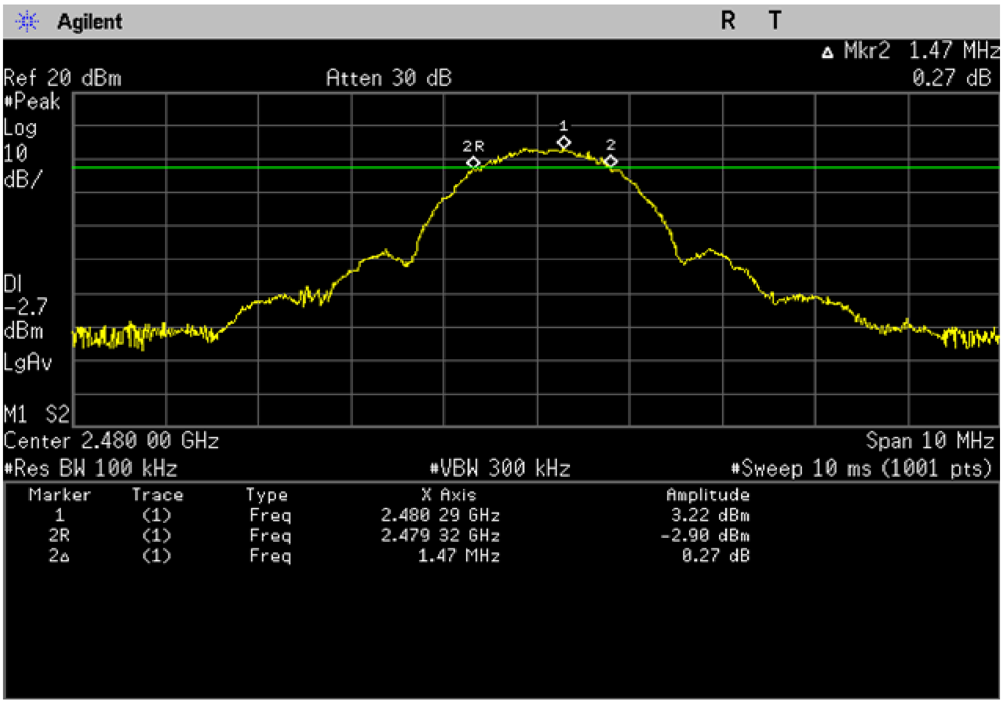
Lowest Channel (2405 MHz)



Middle Channel (2440 MHz)



Highest Channel (2480 MHz)



5.3. MAXIMUM PEAK POWER

5.3.1 Regulation

According to §15.247(b), The maximum peak conducted output power of the intentional radiator shall not exceed the following:
§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.
According to §15.247(b)(4), 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.

5.3.2 Test Condition

- Set RBW of Spectrum analyzer to 1 MHz
- The Maximum 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.

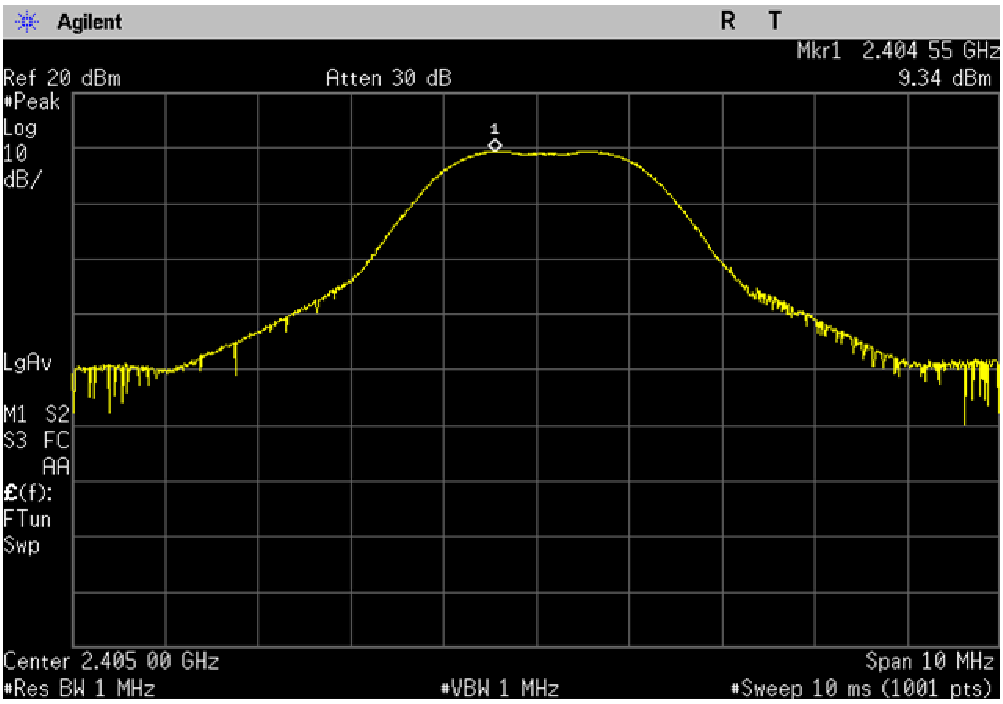
5.3.3 Test result : PASS

Table 2 : Measured values of the Maximum Peak Output Power(Conducted)

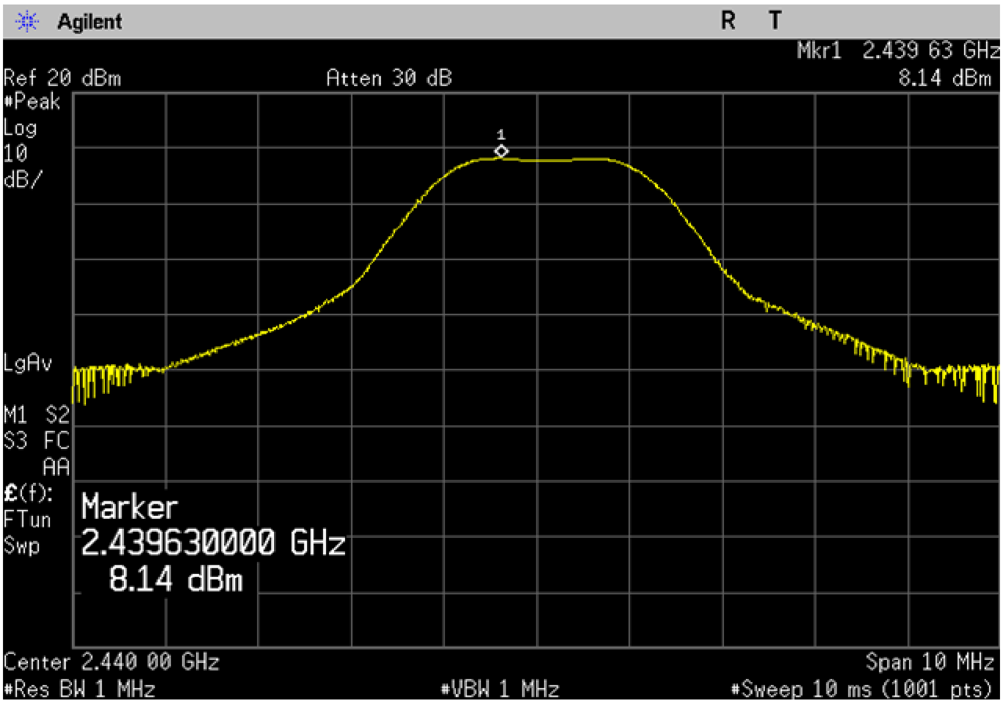
Frequency (MHz)	Reading Power (dBm)	Output Power (W)	Limit (W)	Verdict
2405	9.34	0.008	1	Pass
2440	8.14	0.006	1	Pass
2480	6.21	0.004	1	Pass

Figure 2. Plot of the Maximum Peak Output Power(Conducted)

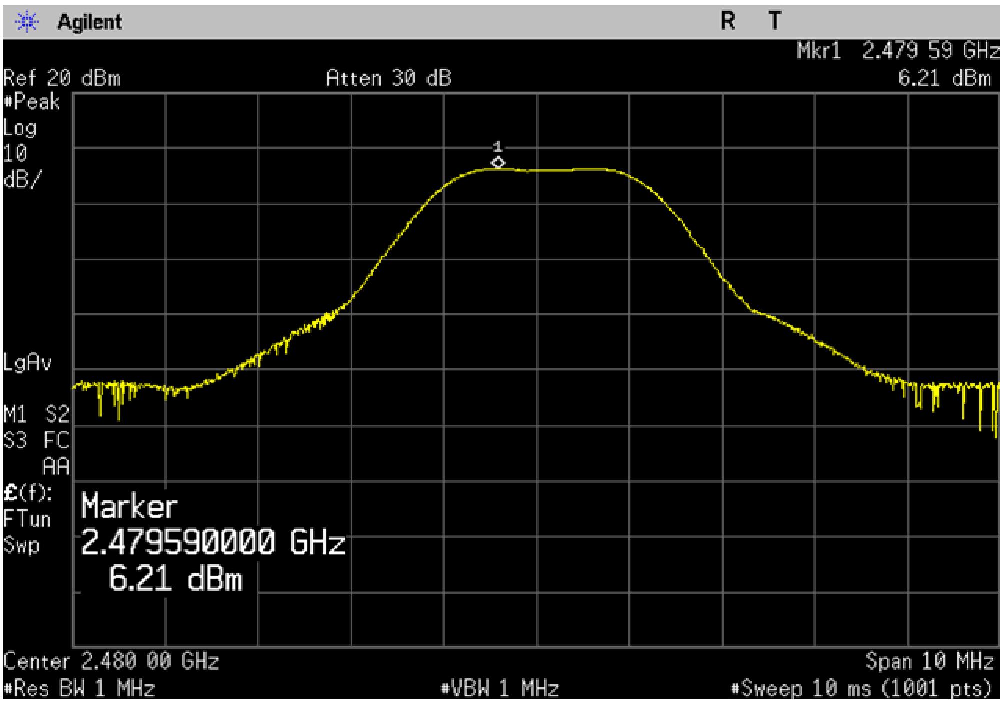
Lowest Channel (2405 MHz)



Middle Channel (2440 MHz)



Highest Channel (2480 MHz)



5.4 PEAK POWER SPECTRAL DENSITY

5.4.1 Regulation

According to §15.247(e), For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval 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 power spectral density.

5.4.2 Test Condition

- Set RBW of Spectrum analyzer to 3 kHz, Span=1MHz, Sweep=500s
- The transmitter output was connected to a spectrum analyzer and the maximum level in a 3kHz bandwidth was measured. A peak value was found over the full emission bandwidth and the frequency span reduced to obtain enhanced resolution. Sweep time ≥ span / 3kHz with video averaging turned off. The Peak Power Spectral Density is the highest level found across the emission in a 3kHz resolution bandwidth.

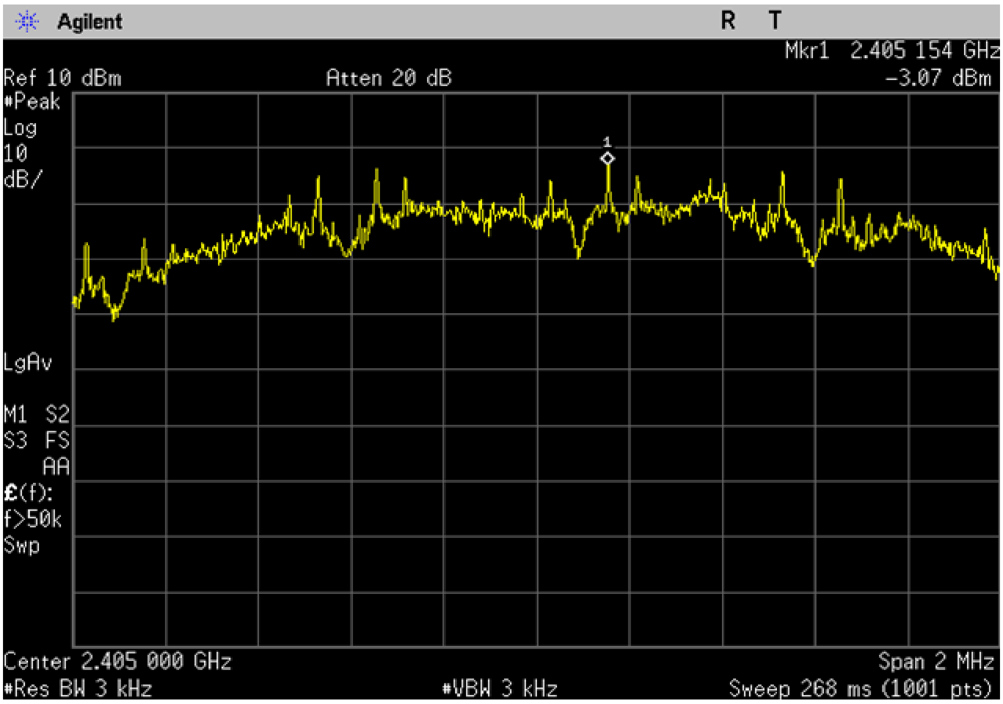
5.4.3 Test result : PASS

Table 3 : Measured values of the Peak Power Spectral Density

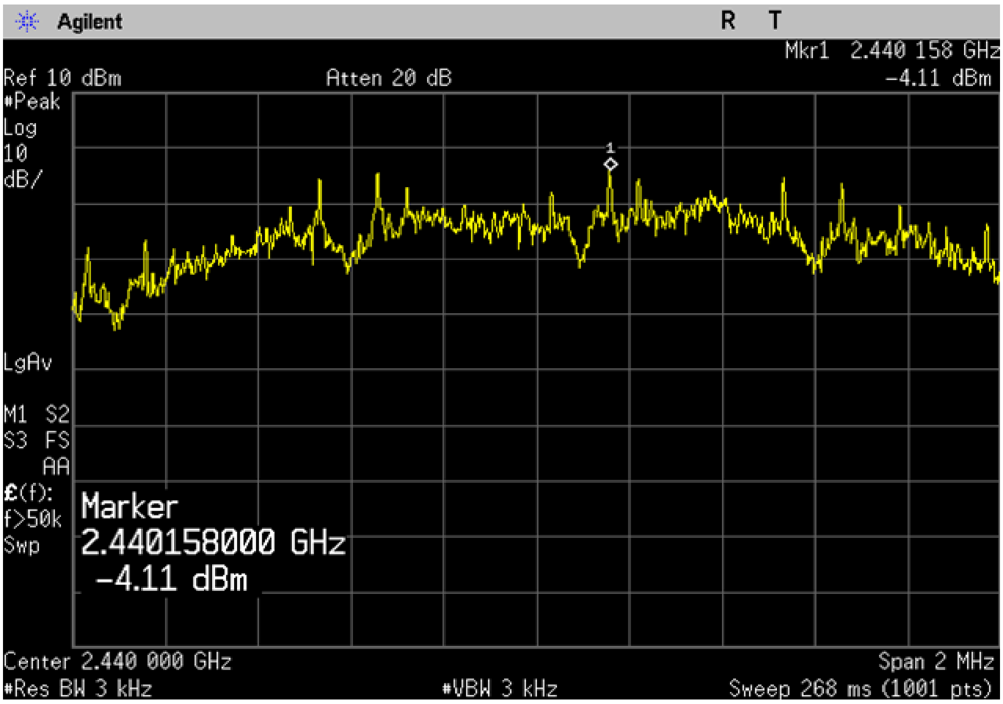
Center frequency (MHz)	Peak frequency (MHz)	Peak power Spectral Density (dBm)	Limit (dBm)	Verdict
2405	2405.154	-3.07	8	Pass
2440	2440.158	-4.11	8	Pass
2480	2480.158	-5.13	8	Pass

Figure 3. Plot of the Peak Power Spectral Density

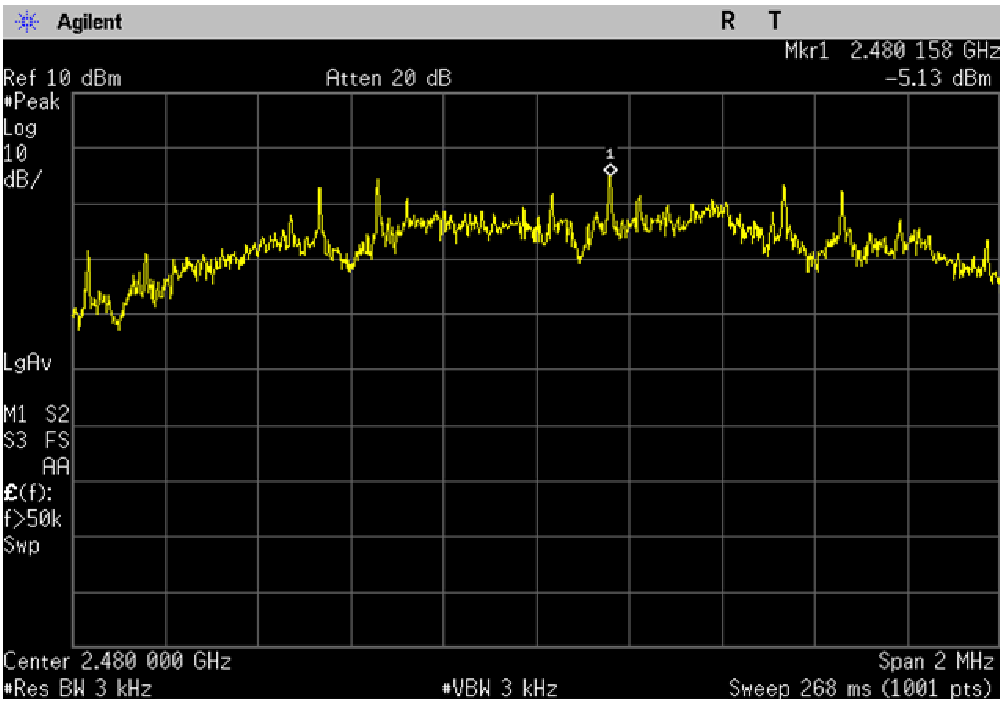
Lowest Channel (2405 MHz)



Middle Channel (2440 MHz)



Highest Channel (2480 MHz)



5.5 SPURIOUS EMISSIONS, BAND EDGE, AND RESTRICTED BANDS

5.5.1 Regulation

According to §15.247(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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. 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)).

According to §15.209(a), for an intentional device, the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the following values:

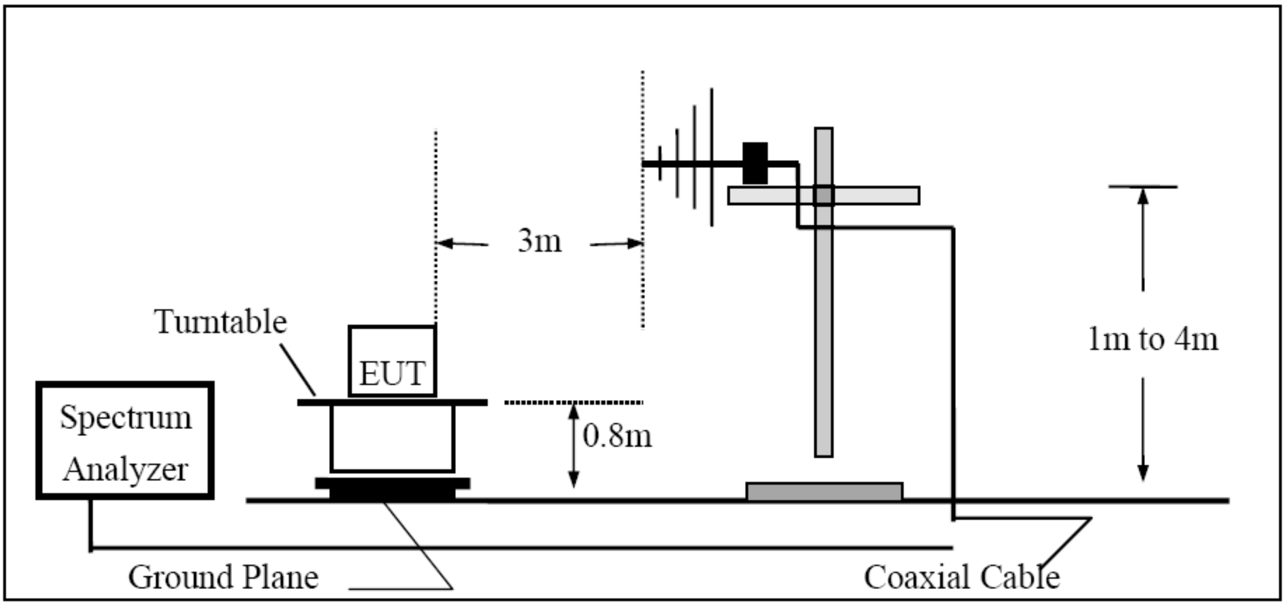
Frequency (MHz)	Field strength (µV/m @ 3m)	Field strength (dBµV/m @ 3m)
30–88	100	40.0
88–216	150	43.5
216–960	200	46.0
Above 960	500	54.0

According to §15.109(a), for an unintentional device, except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the above table.

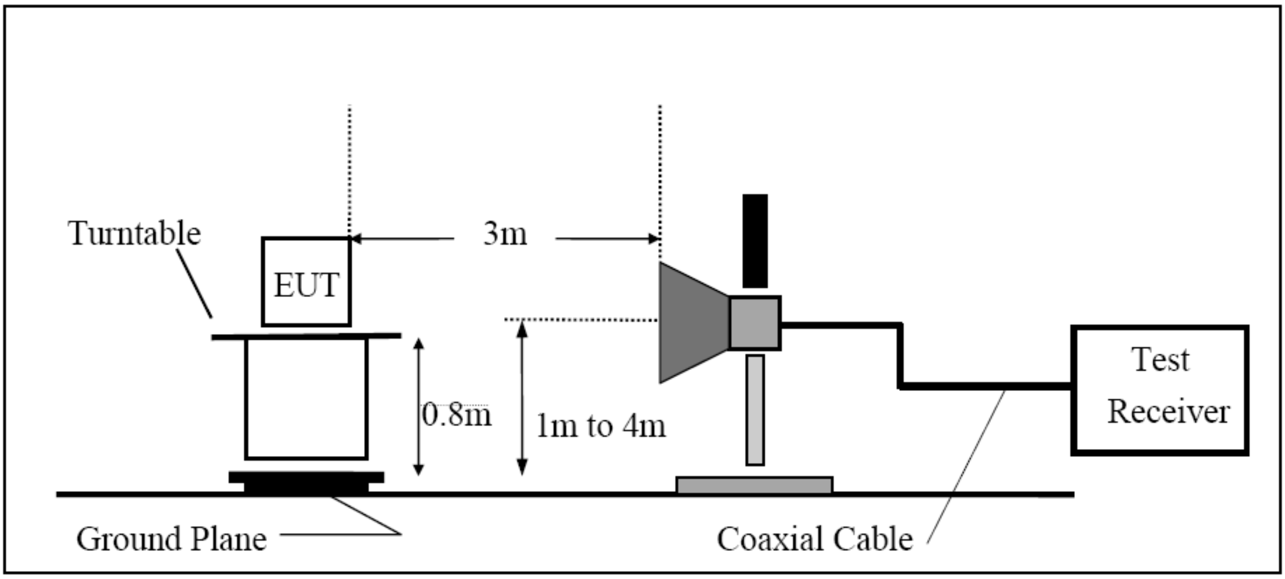
** The emission limits shown in the above table are based on measurement instrumentation employing a CISPR quasi-peak detector and above 1000 MHz are based on the average value of measured emissions.

5.5.2 Test Setup Layout

5.5.2.1 Radiated Emission Test Set-Up, Frequency Below 1000MHz



5.5.2.2 Radiated Emission Test Set-UP Frequency Over 1000MHz



5.5.3 Test Procedure

1) Band-edge Compliance of RF Conducted Emissions

1. Set the spectrum analyzer as follows:

Span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation

RBW ≥ 1% of the span

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

2. Allow the trace to stabilize. Set the marker on the emission at the band-edge, or on the highest modulation product outside of the band, if this level is greater than that at the band-edge. Enable the marker-delta function, and then use the marker-to-peak function to move the marker to the peak of the in-band emission.
3. Now, using the same instrument settings, enable the hopping function of the EUT. Allow the trace to stabilize. Follow the same procedure listed above to determine if any spurious emissions caused by the hopping function also comply with the specified limit.

2) Spurious RF Conducted Emissions:

1. Set the spectrum analyzer as follows:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.

RBW = 100 kHz

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

2. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.

3) Spurious Radiated Emissions:

1. The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions in an anechoic chamber at a distance of 3 meters for above 30 MHz, and at 1 meter distance for below 30 MHz.
2. The EUT was placed on the top of the 0.8-meter height, 1 × 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360°.

3. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 9 kHz to 30 MHz using the loop antenna, from 30 to 1000 MHz using the Trilog broadband antenna, and from 1 GHz to tenth harmonic of the highest fundamental frequency using the horn antenna.
4. To obtain the final measurement data, the EUT was arranged on a turntable situated on a 4 × 4 meter at the Open Area Test Site. The EUT was tested at a distance 3 meters.
5. Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.
6. The EUT is situated in three orthogonal planes (if appropriate)
7. The presence of ambient signals was verified by turning the EUT off. In case an ambient signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the ambient signal does not hide any emissions from the EUT.
8. If the emission on which a radiated measurement must be made is located at the edge of the authorized band of operation, then the alternative “marker-delta” method may be employed.

4) Marker-Delta Method at the edge of the authorized band of operation:

1. Perform an in-band field strength measurement of the fundamental emission using the RBW and detector function as the above Spurious Radiated Emissions test procedure.
2. Choose a spectrum analyzer span that encompasses both the peak of the fundamental emission and the band-edge emission under investigation. Set the analyzer RBW to 1% of the total span (but never less than 30 kHz) with a video bandwidth equal to or greater than the RBW. Record the peak levels of the fundamental emission and the relevant band-edge emission (i.e., run several sweeps in peak hold mode). Observe the stored trace and measure the amplitude delta between the peak of the fundamental and the peak of the band-edge emission. This is not a field strength measurement; it is only a relative measurement to determine the amount by which the emission drops at the band-edge relative to the highest fundamental emission level.
3. Subtract the delta measured in step (2) from the field strengths measured in step (1). The resultant field strengths (CISPR QP, average, or peak, as appropriate) are then used to determine band-edge compliance as required by Section 15.205.
4. The above "delta" measurement technique may be used for measuring emissions that are up to two "standard" bandwidths away from the band-edge, where a "standard" bandwidth is the bandwidth specified by C63.4 for the frequency being measured. For example, for band-edge measurements in the restricted band that begins at 2483.5 MHz, C63.4 specifies a measurement bandwidth of at least 1 MHz. Therefore you may use the "delta" technique for measuring emissions up to 2 MHz removed from the band-edge. Radiated emissions that are removed by more than two “standard” bandwidths must be measured as the above Spurious Radiated Emissions test procedure.

5.5.4 Test Results: PASS

Band-edge compliance of RF conducted/radiated emissions was shown in the Figure 4 and Figure 5

NOTE: We took the insertion loss of the cable loss into consideration within the measuring instrument.

Spurious RF conducted emissions were shown in the Figure 6

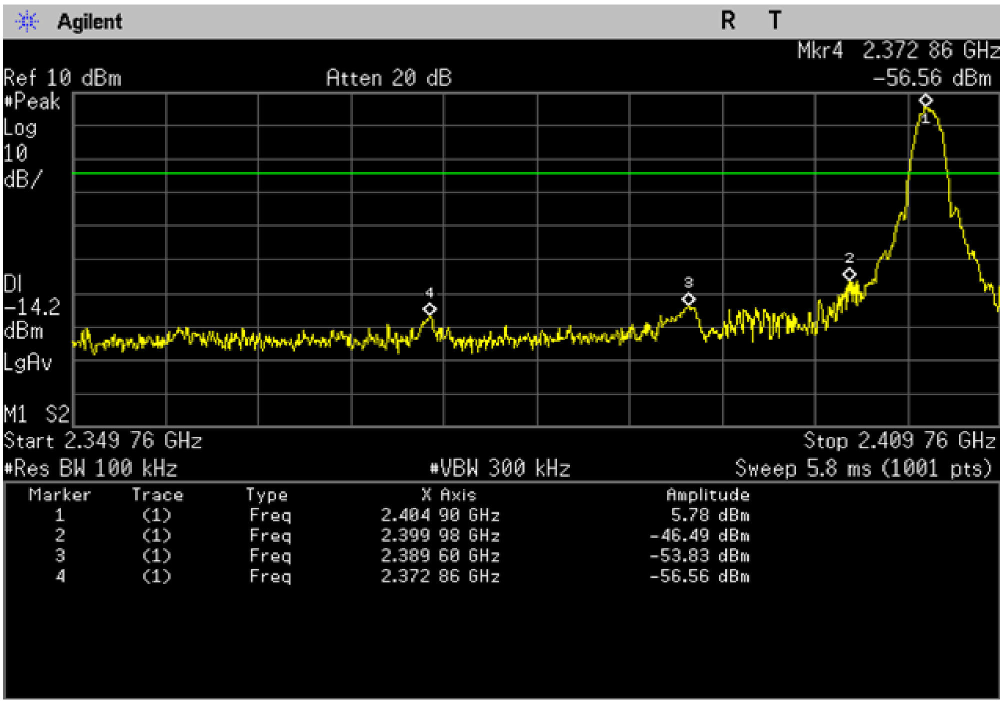
NOTE: We took the insertion loss of the cable loss into consideration within the measuring instrument.

Table 4 : Measured values of the Field strength of spurious emission (Transmit mode)										
Frequency (MHz)		Detect Mode	Polarization (V/H)	Turn Table (degree)	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										
		No Spurious Radiated Emissions Found								
Quasi-peak data, emissions below 1000 MHz										
		No Spurious Radiated Emissions Found								
Peak/Average data, emissions above 1000 MHz										
CH 1 (2405MHz)	4811	Peak	H	158	51.24	37.33	-23.2	65.37	74	8.63
	4811	Average	H	158	32.84	37.33	-23.2	46.97	54	7.03
	7206	Peak	H	65	45.15	43.27	-23.2	65.22	74	8.78
	7206	Average	H	65	25.5	43.27	-23.2	45.57	54	8.43
	4809	Peak	V	132	50.19	37.33	-23.2	64.32	74	9.68
	4809	Average	V	132	32.81	37.33	-23.2	46.94	54	7.06
	7211	Peak	V	74	42.05	43.27	-23.2	62.12	74	11.88
	7211	Average	V	74	28.65	43.27	-23.2	48.72	54	5.28
CH 8 (2440MHz)	4880	Peak	H	249	46.16	37.33	-23.2	60.29	74	13.71
	4880	Average	H	249	24.36	37.33	-23.2	38.49	54	15.51
	7315	Peak	H	70	48.28	43.27	-23.2	68.35	74	5.65
	7315	Average	H	70	29.74	43.27	-23.2	49.81	54	4.19
	4890	Peak	V	166	47.46	37.33	-23.2	61.59	74	12.41
	4890	Average	V	166	28.27	37.33	-23.2	42.4	54	11.6
	7318	Peak	V	41	46.33	43.27	-23.2	66.4	74	7.60
	7318	Average	V	41	26.76	43.27	-23.2	46.83	54	7.17
CH 16 (2480MHz)	4960	Peak	H	314	42.37	37.33	-23.2	56.5	74	17.5
	4960	Average	H	314	21.56	37.33	-23.2	35.69	54	18.31
	7440	Peak	H	175	40.61	43.27	-23.2	60.68	74	13.32
	7440	Average	H	175	21.28	43.27	-23.2	41.35	54	12.65
	4968	Peak	V	296	41.73	37.33	-23.2	55.86	74	18.14
	4968	Average	V	296	20.75	37.33	-23.2	34.88	54	19.12
	7440	Peak	V	138	41.82	43.27	-23.2	61.89	74	12.11
	7440	Average	V	138	21.84	43.27	-23.2	41.91	54	12.09

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

Figure 4. Plot of the Band Edge (Conducted)

Lowest Channel (2405 MHz)



Highest Channel (2480 MHz)

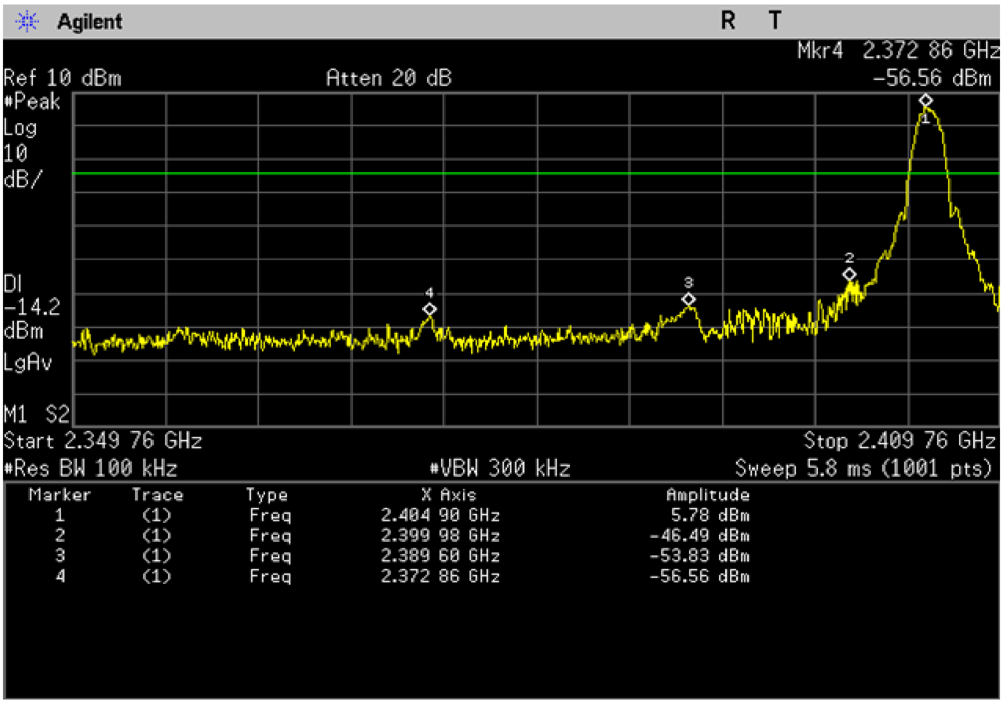
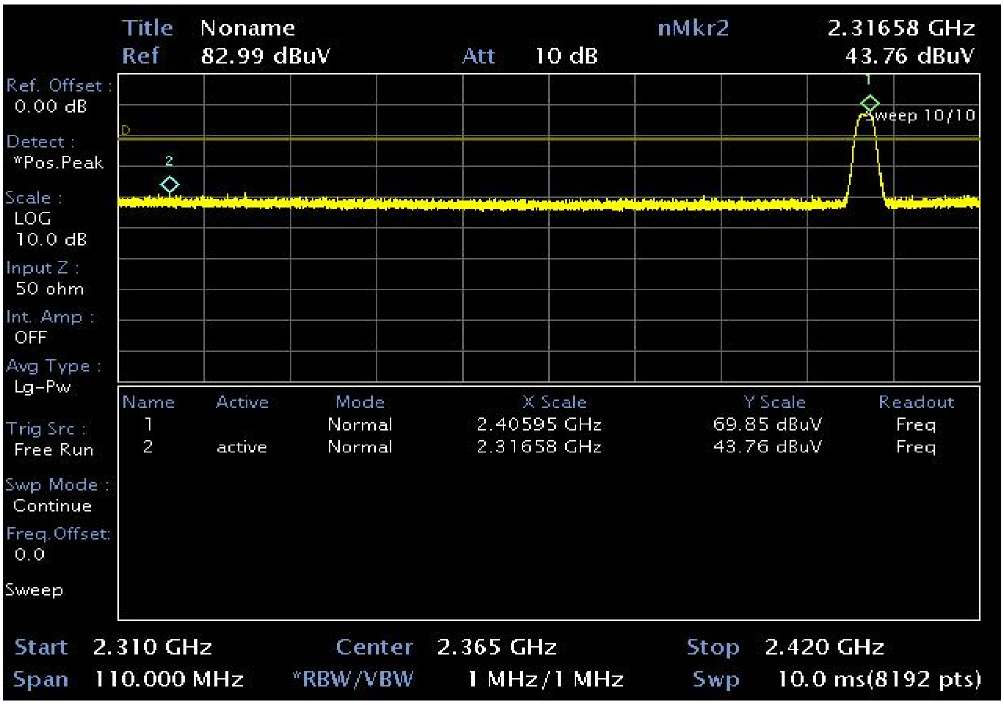


Figure 5. Plot of the Band Edge (Radiated)

Lowest Channel (2405 MHz)



Highest Channel (2480 MHz)

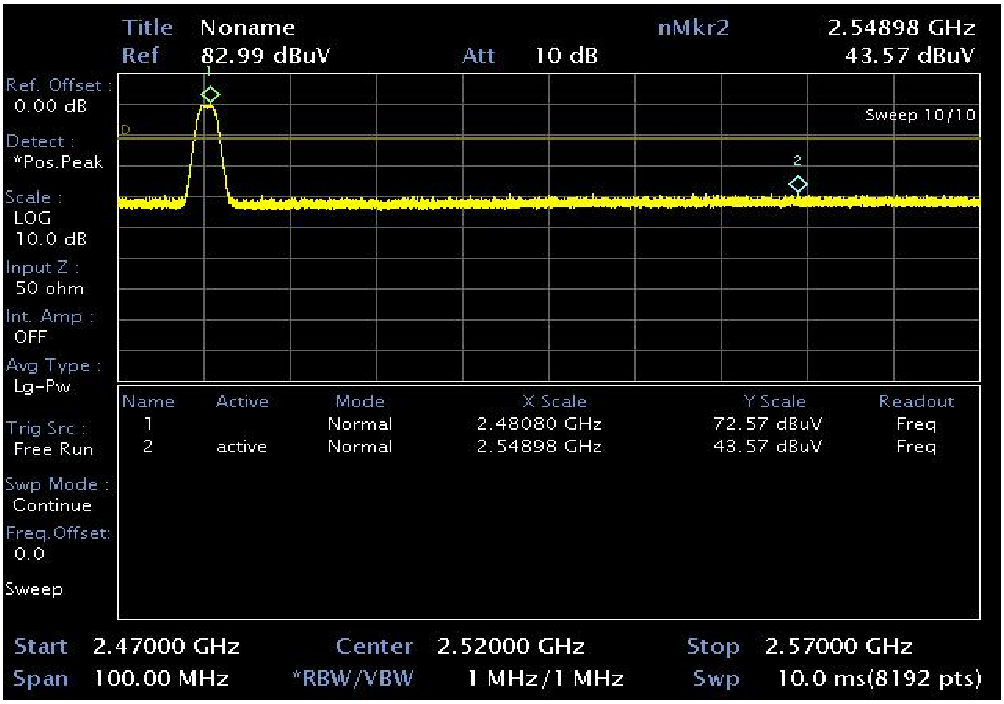
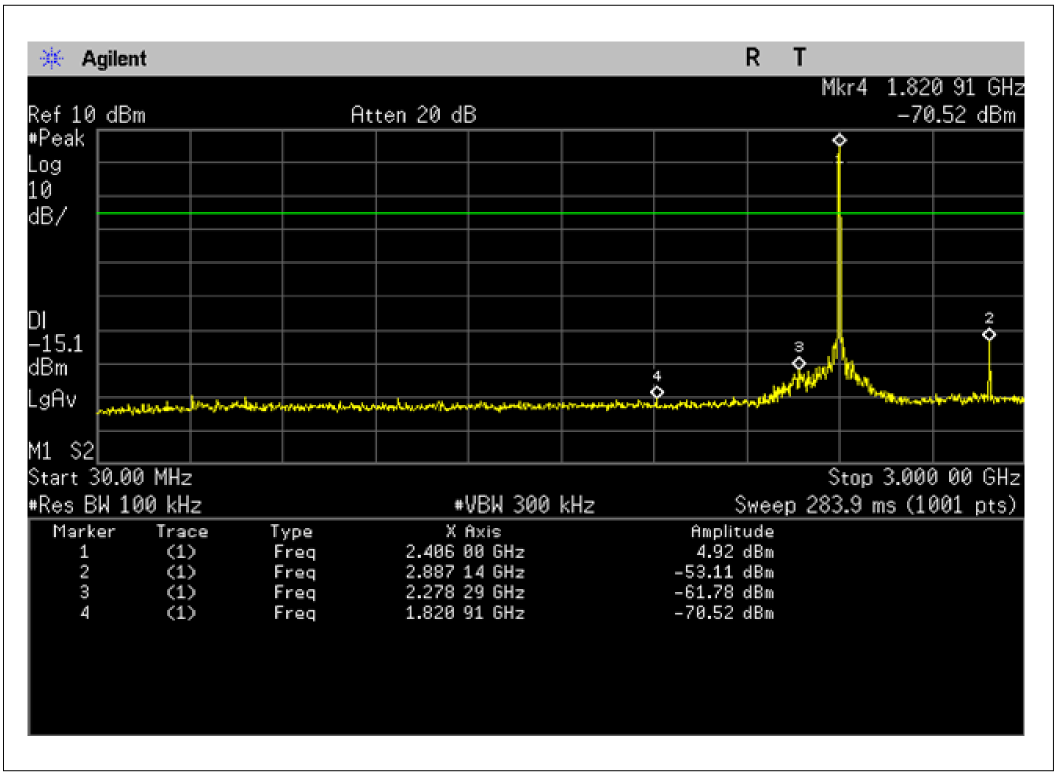
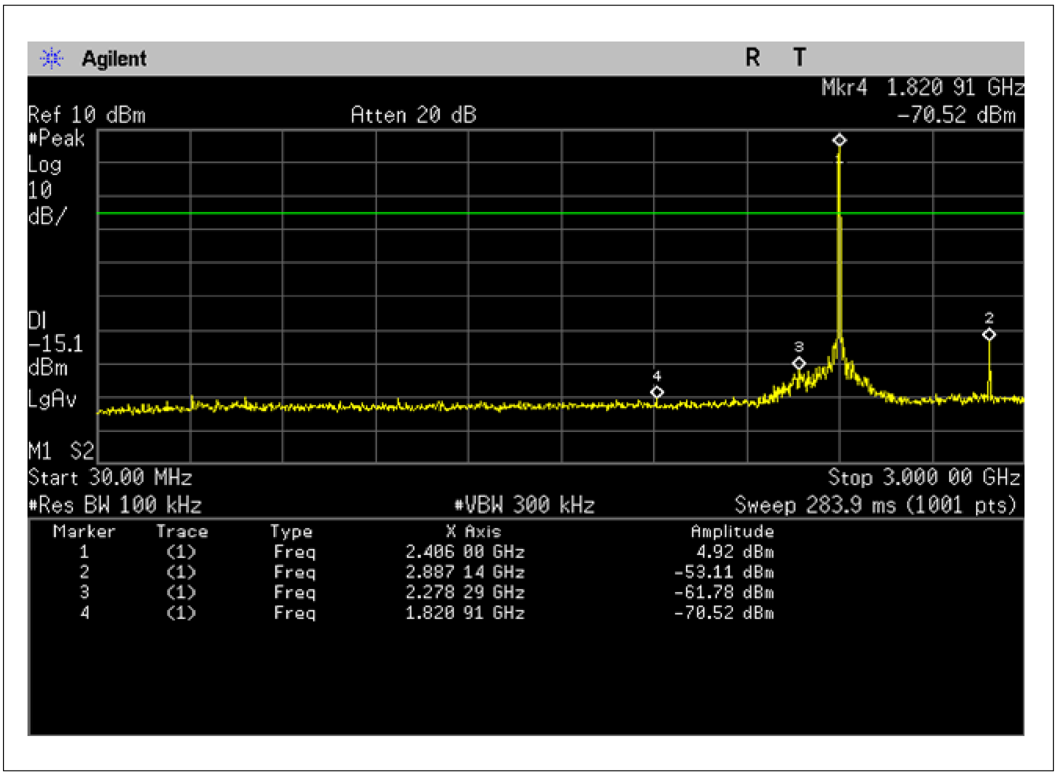


Figure 6. Plot of the Spurious RF conducted emissions

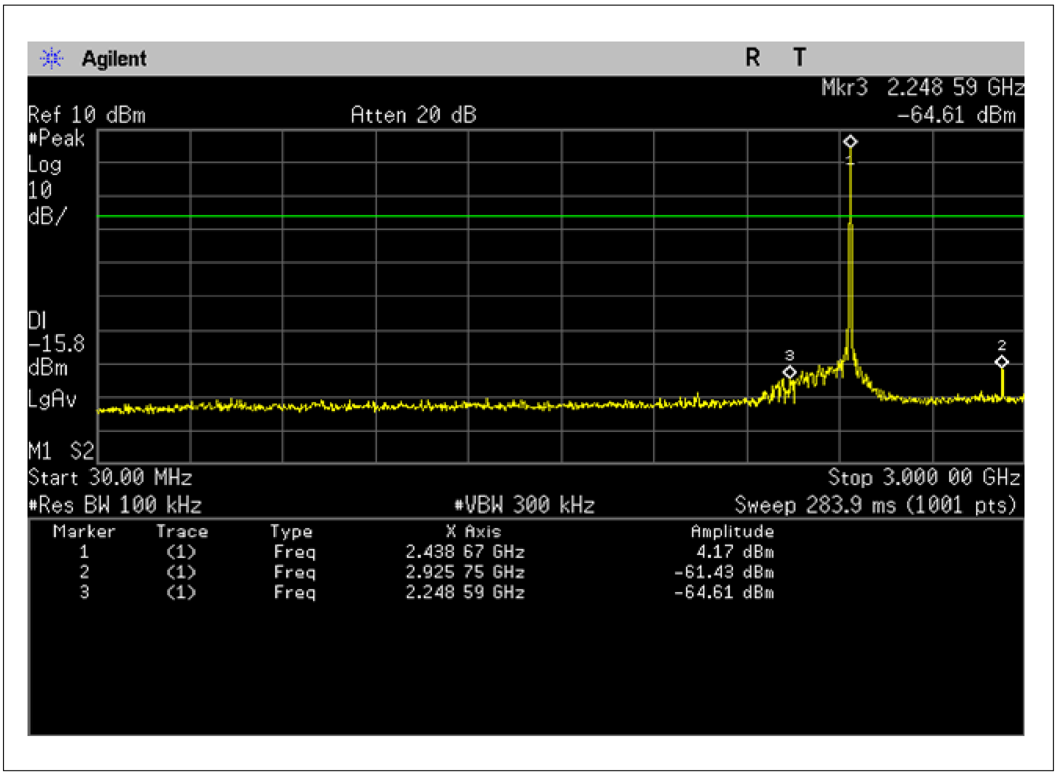
Lowest Channel (2405 MHz) : 30MHz ~ 3GHz



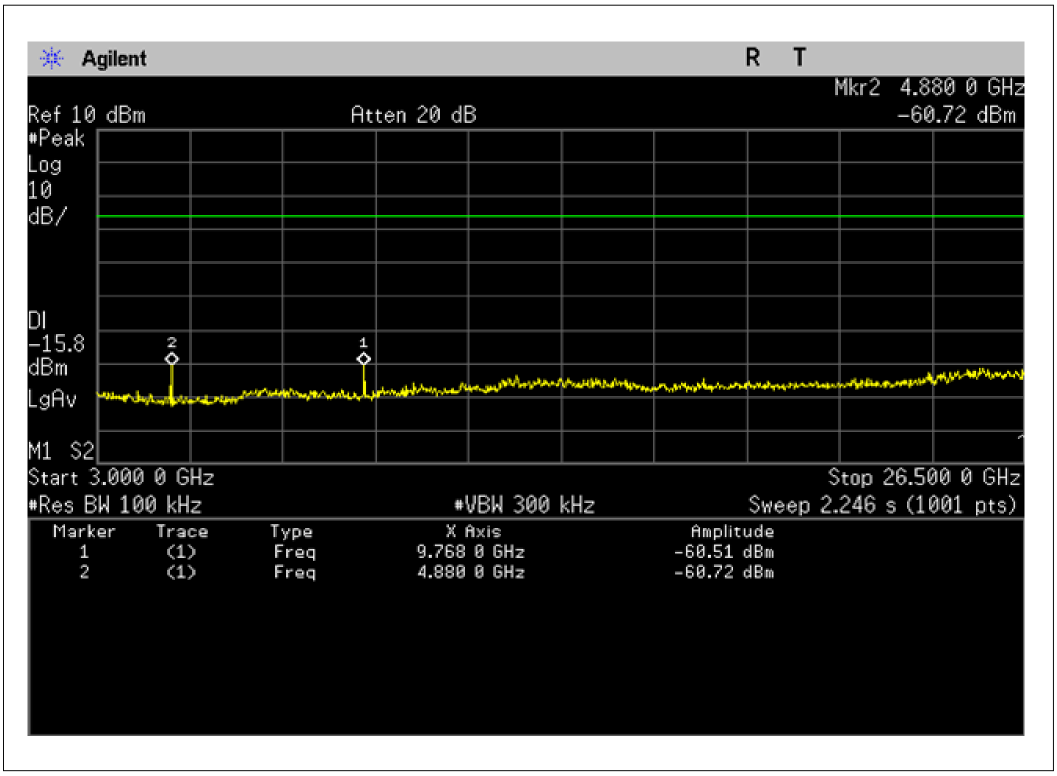
Lowest Channel (2405 MHz) : 3GHz ~ 26GHz



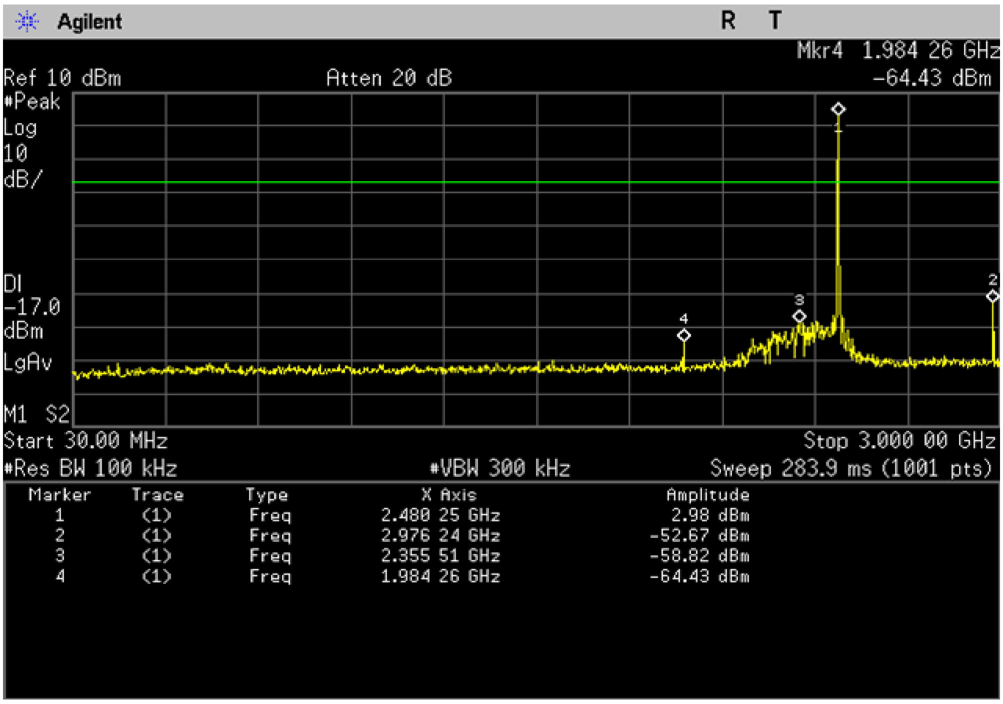
Middle Channel (2440 MHz) : 30MHz ~ 3GHz



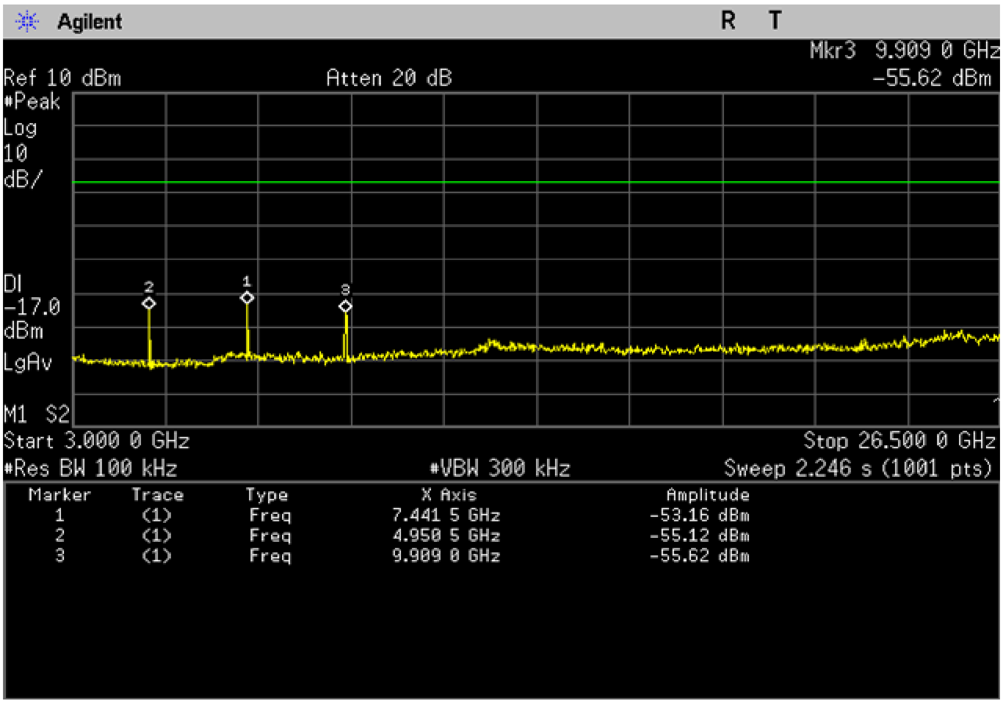
Middle Channel (2440 MHz) : 3GHz ~ 26GHz



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



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



5.6 AC POWER LINE CONDUCTED EMISSIONS

5.6.1 Regulation

According to §15.207(a), 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, as measured using a 50µH/50Ω 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.

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

* Decreases with the logarithm of the frequency.

According to §15.107(a), for unintentional device, except for Class A digital devices, line conducted emission limits are the same as the above table.

5.6.2 Test Procedure

1. The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5m away from the side wall of the shielded room.
2. Each current-carrying conductor of the EUT power cord was individually connected through a 50Ω/50µH LISN, which is an input transducer to a Spectrum Analyzer or an EMI/Field Intensity Meter, to the input power source.
3. Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
4. The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.
5. The measurements were made with the detector set to PEAK amplitude within a bandwidth of 10 kHz or to QUASI-PEAK and AVERAGE within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

5.6.3 Test Results: PASS

Table 5 : Measured values of the Conducted Emissions

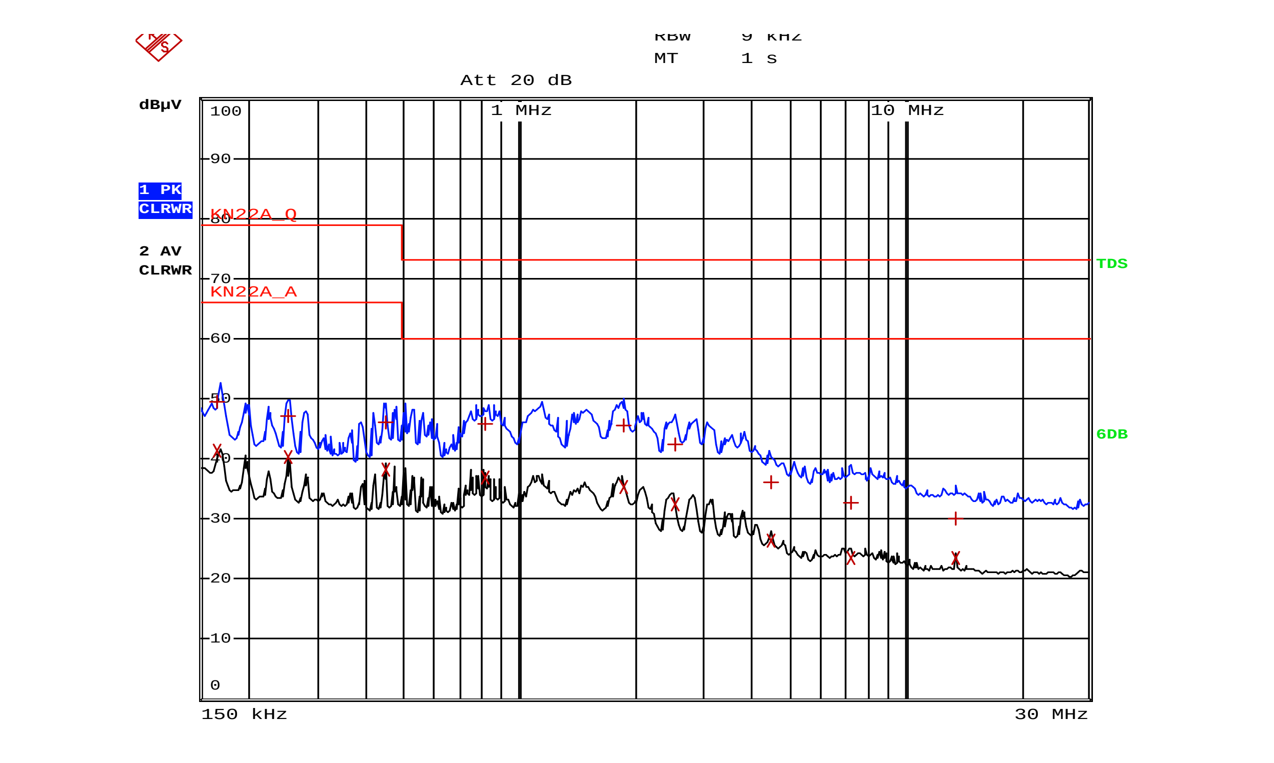
Frequency (MHz)	Correction Factor		Line	Quasi-Peak			Average		
	LISN	Cable		Limit [dBuV]	Reading [dBuV]	Result [dBuV]	Limit [dBuV]	Reading [dBuV]	Result [dBuV]
0.16	0.23	0.04	H	65.46	49.16	49.43	55.46	41.18	41.45
0.16	0.23	0.04	H	65.46	49.16	49.43	55.46	41.18	41.45
0.22	0.33	0.06	N	62.82	45.81	46.20	52.82	36.93	37.32
0.25	0.20	0.06	H	61.76	46.87	47.13	51.76	40.04	40.30
0.44	0.19	0.07	H	57.06	45.73	45.99	47.06	37.89	38.15
0.47	0.31	0.08	N	56.51	44.64	45.03	46.51	35.22	35.61
0.80	0.31	0.07	N	56.00	45.64	46.02	46.00	35.37	35.75
0.81	0.19	0.07	H	56.00	45.58	45.84	46.00	36.63	36.89
1.13	0.32	0.10	N	56.00	45.12	45.54	46.00	35.19	35.61
1.86	0.23	0.13	H	56.00	45.06	45.42	46.00	35.06	35.42
2.52	0.25	0.17	H	56.00	41.87	42.29	46.00	32.10	32.52
3.87	0.46	0.23	N	56.00	39.15	39.84	46.00	28.22	28.91
4.51	0.39	0.26	H	56.00	35.31	35.96	46.00	25.62	26.27
6.44	0.67	0.33	N	60.00	30.24	31.24	50.00	21.67	22.67
7.27	0.60	0.35	H	60.00	31.80	32.75	50.00	22.53	23.48
14.45	1.22	0.46	N	60.00	26.27	27.95	50.00	19.05	20.73
24.03	1.38	0.64	N	60.00	24.24	26.26	50.00	20.01	22.03

Margin (dB) = Limit − Emission Level

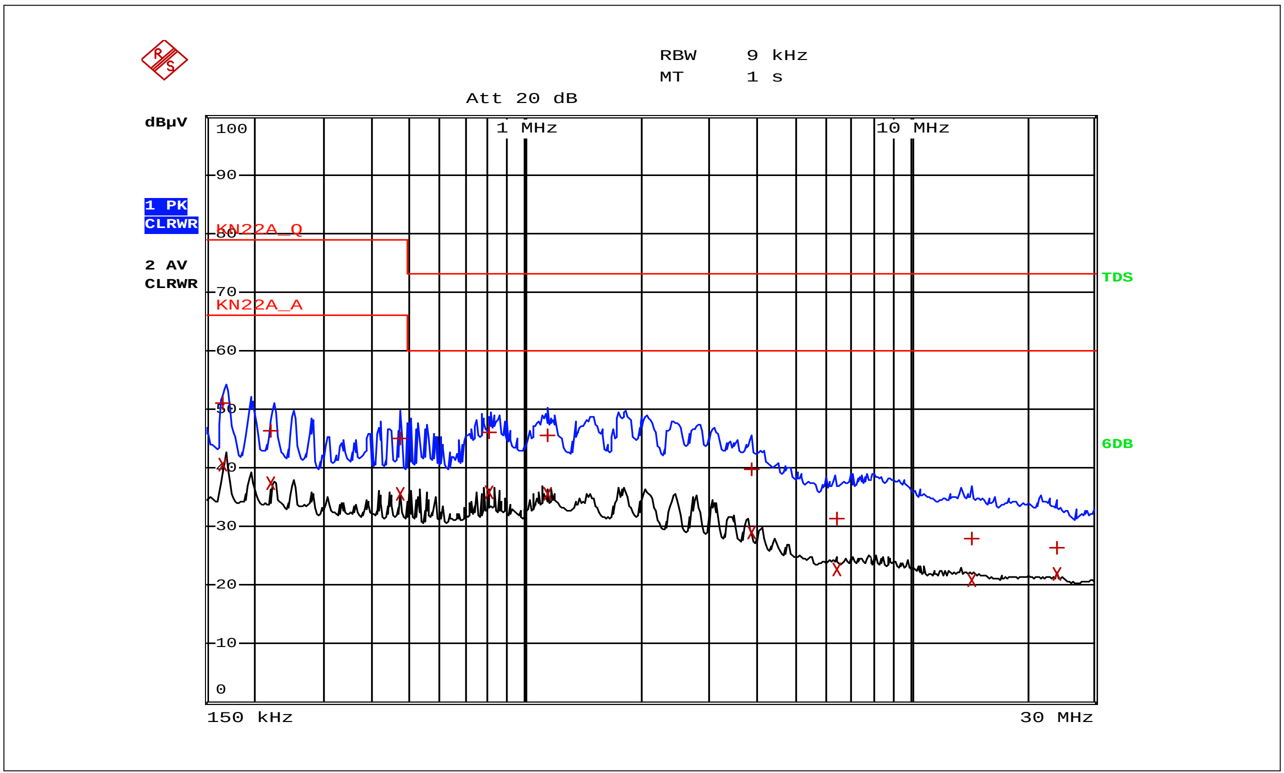
[Emission Level = Measured Value + CF + CL]

Figure 7. Plot of the AC Power Line Conducted Emissions

Line – PE(Peak and Average detector used)



Neutral – PE(Peak and Average detector used)



5.7 RECEIVER SPURIOUS EMISSIONS

5.7.1 Regulation

The following receiver spurious emission limits shall be complied with:

(a) If a radiated measurement is made, all spurious emissions shall comply with the limits of Table 1. The resolution bandwidth of the spectrum analyzer shall be 100 kHz for spurious emission measurements below 1.0 GHz, and 1.0 MHz for measurements above 1.0 GHz.

Spurious Emission Limit for Receivers

Frequency (MHz)	Field strength (μV/m @ 3m)	Field strength (dBμV/m @ 3m)
30–88	100	40.0
88–216	150	43.5
216–960	200	46.0
Above 960	500	54.0

* Use quasi-peak below 1000 MHz and averaging meter above 1000 MHz.

5.7.2 Test Results: PASS

Table 6 : Measured values of the Receiver Spurious Emissions									
Frequency (MHz)	Detect Mode	Polarization (V/H)	Turn Table (degree)	Measured Value (dBµV)	Antenna Factor + Cable Loss (dB/m)	Amplifier Gain (dB)	Emission Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Quasi-peak data, emissions below 1000 MHz									
No Spurious Radiated Emissions Found									
Peak/Average data, emissions above 1000 MHz									
No Spurious Radiated Emissions Found									

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

5.8 RADIO FREQUENCY EXPOSURE PROCEDURES

5.8.1 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	9.34	8.59	0	1.00

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]
· [√f(GHz)] = 8.59/25*√2.405 = 0.532 ≤ 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.

6. TEST EQUIPMENTS

APPENDIX

TEST EQUIPMENT USED FOR TESTS

No.	Description	Manufacturer	Model No.	Specifications	Next Cal. Data	Used equipment
1	EMI Test Receiver	LIG Nex1	LSA-265	1kHz~26.5GHz	13.12.24	■
2	Bi-log Antenna	Schwarzbeck	VULB9160	30~1GHz	13.11.17	■
3	Bi-log Antenna	Schaffner-Chase EMC Ltd.	CBL6140A	50V, 5A	N/A	□
4	Turn Table	KEI	KEI-TURN	1500×1000×800	N/A	■
5	Turn Table	KEI	KEI-TURN	1500×1000×800	N/A	■
6	Loop ANT.	Com-Power	AL-130	9kHz~30MHz	15.04.26	■
7	Spectrum Analyzer	Agilent	E4440A	3Hz~26.5GHz	14.02.21	■
8	Function Generator	Agilent	33120A	15MHz sine&square	14.06.08	□
9	Frequency Counter	HP	5350B	10Hz~20GHz	14.06.08	■
10	Modulation Analyzer	Agilent	8901B	10MHz~1.3GHz	14.06.08	□
11	Audio Analyaer	Agilent	8903B	20Hz~100kHz	14.06.08	□
12	Attenuator	Agilent	8494B	0~11dB, 18GHz	14.06.08	□
13	Attenuator	Agilent	8496B	0~110dB, 18GHz	14.06.08	□
14	Attenuator	Agilent	8495B	0~70dB, 18GHz	14.06.08	□
15	Attenuator	TAE SUNG	SMA-2	6dB	14.06.08	□
16	Power Meter	Agilent	E4418B	100kHz~110GHz, 0.0001uW~25100mW	14.06.08	□
17	Power Sensor	HP	8485A	50MHz~26.5GHz	14.06.08	□
18	Vibration Tester	Gana	GNV-400	10~60Hz, 0~4mm	14.06.21	□
19	RF Cable	Gigalane	SMS-LL280-SMS-1.5M	1.5m	N/A	■
20	Temp & Humidity Chamber	Seoksan Tech	SE-CT-02	-40~150℃, 30~98%	14.06.08	□
21	Signal Generator	Leader Electronics	3220	100kHz~1.3GHz	14.06.08	■
22	Oscilloscope	Tektronix	TDS-350	200MHz	14.06.08	□
23	Drop Tester	Self-made	KSQ-01	150cm	N/A	□
24	Pre Amplifier	GTC	GA-1825A	0.1~18GHz	N/A	■
25	Continuous operation tester	GTC	CT-100	Local Control	14.06.08	□
26	CW Generator	HP	83711B	1~20GHz	14.06.08	■
27	POWER DIVIDER	Agilent	11636B	26.5GHz	14.06.08	□
28	Power Sensor	Agilent	8482B	100kHz ~ 4.2GHz	14.06.08	□
29	Attenuator	Winswell	53-30-33	dc-2.5GHz, 500W	14.06.08	□
30	DC Power Supply	Hanil	HPS-505A	50V, 5A	14.06.08	□
31	Slidacs	Hanchang	5KV	5kW, 300V	14.06.08	□
32	Termination	Kwang Yeok	KYTE-NJ-150W	150W	14.06.08	□
33	Band-limited filter	MITECH	KSQ-02	600Ω	14.06.08	□
34	Signal Generator	WILTRON	6759B	10MHz ~ 26.5GHz	14.06.08	□
35	Digital Multimeter	DONG HWA	DM-300A	AC/DC 500V Max,320mA Max	14.06.08	■
36	Horn ANT.	SCHWARZBECK	BBHA 9120D	700MHz ~ 18GHz	14.07.12	■
37	Horn ANT.	A.H. SYSTEMS	SAS-572	18GHz ~ 26.5GHz	13.09.07	■
38	DC Power Supply	ALINCO	DM-340MW	15V, 30A	14.06.08	■
39	LISN	Electro Metrics	ANS-25/2	2535	14.06.08	■
40	LISN	Kyoritsu	KNW-407	8-1010-14	14.06.08	□
41	Pulse Limiter	LIG Nex1	EPL-30	N/A	14.06.08	□

APPENDIX

1. EUT photo