HCT CO., LTD.

CERTIFICATE OF COMPLIANCE

FCC Certification

Applicant Name:
MAXFOR Technology Inc.

Address:
48, Banjeong-ro, Yangji-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea

Date of Issue:
July 25, 2014

Test Site/Location:
HCT CO., LTD., 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea

Report No.: HCT-R-1407-F040

HCT FRN: 0005866421

FCC ID	**: X6VMFG-G400**
APPLICANT	**: MAXFOR Technology Inc.**

FCC Model(s):	MFG-G400
EUT Type:	Smart Gateway
Max. RF Output Power:	5.13 dBm (3.2584 mW)
Frequency Range:	2405 MHz -2475 MHz (Zigbee Mode)
Modulation type	GFSK
FCC Classification:	Digital Transmission System(DTS)
FCC Rule Part(s):	Part 15.247

Engineering Statement:

The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them.

HCT CO., LTD. Certifies that no party to this application has subject to a denial of Federal benefits that includes FCC benefits pursuant to section 5301 of the Anti-Drug Abuse Act of 1998,21 U.S. C.853(a)

Report prepared by
: Kyung Soo Kang
Test Engineer of RF Team

Approved by
: Chang Seok Choi
Manager of RF Team

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Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-R-1407-F040	July 25, 2014	- First Approval Report

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1. GENERAL INFORMATION

Applicant: MAXFOR Technology Inc.

Address: 48, Banjeong-ro, Yangji-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea

FCC ID: X6VMFG-G400

EUT Type: Smart Gateway

Model name(s): MFG-G400

Date(s) of Tests: June 14, 2014 ~ July 18, 2014

Place of Tests: HCT Co., Ltd.
74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea
(IC Recognition No. : 5944A-3)

2. EUT DESCRIPTION

EUT Type	Smart Gateway	
FCC Model Name	MFG-G400	
Power Supply	DC 12.0 V	
Adapter Information	Manufacturer: Atron Model Name : GC990040012 Input : 100 V ~ 240 V, 50/60 Hz, 1200 mA Output : 12.0 V, 3.33 A	
Frequency Range	TX: 2405 MHz ~ 2475 MHz RX: 2405 MHz ~ 2475 MHz	
Max. RF Output Power	Peak	5.13 dBm (3.2584 mW)
	Average	4.38 dBm (2.7416 mW)
Operating Mode	Zigbee Mode	
Modulation Type	GFSK	
Antenna Specification	Manufacturer: WINiZEN Co., Ltd. Antenna type: Dipole Antenna Peak Gain : 5.496 dBi	

3. TEST METHODOLOGY

FCC KDB 558074 D01 DTS Meas Guidance v03r02 dated June 05, 2014 entitled “Guidance for Performing Compliance Measurements on Digital Transmission Systems(DTS) Operating Under §15.247” and the measurement procedure described in the American National Standard for Testing Unlicensed Wireless Devices(ANSI C63.4-2003) were used in the measurement.

3.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

3.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

3.3 GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4. (Version :2003) Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes according to the requirements in Section 13.1.4.1 of ANSI C63.4. (Version: 2003)

Conducted Antenna Terminal

See Section from 9.1 to 9.2.(KDB 558074)

3.4 DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Channel low, mid and high with highest data rate (worst case) is chosen for full testing.

4. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipments, which is traceable to recognized national standards.

5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

The SAC(Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at the 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea. The site is constructed in conformance with the requirements of ANSI C63.4. (Version :2003) and CISPR Publication 22. Detailed description of test facility was submitted to the Commission and accepted dated February 28, 2014 (Registration Number: 90661)

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements. Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.
All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

6. ANTENNA REQUIREMENTS

According to FCC 47 CFR §15.203:

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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.”

*External antenna is used a unique connector type(Reveresed sma-type).

*The E.U.T Complies with the requirement of §15.203

7. SUMMARY TEST OF RESULTS

Test Description	FCC Part Section(s)	Test Limit	Test Condition	Test Result
Duty Cycle	N/A	N/A	CONDUCTED	N/A
6 dB Bandwidth	§15.247(a)(2)	> 500 kHz		PASS
Conducted Maximum Peak Output Power	§15.247(b)(3)	< 1 Watt		PASS
Power Spectral Density	§15.247(e)	< 8 dBm / 3 kHz Band		PASS
Band Edge(Out of Band Emissions)	§15.247(d)	Conducted < 20 dBc		PASS
AC Power line Conducted Emissions	§15.207	cf. Section 8.7		PASS
Radiated Spurious Emissions	§15.205, 15.209	cf. Section 8.6.1	RADIATED	PASS
Radiated Restricted Band Edge	§15.247(d), 15.205, 15.209	cf. Section 8.6.2		PASS

8. TEST RESULT

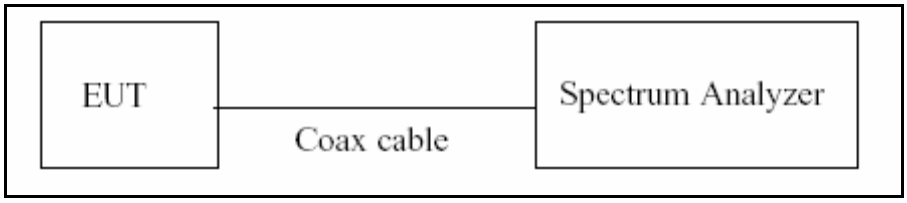
8.1 DUTY CYCLE

▣ TEST PROCEDURE

According to KDB 558074)6)b), issued 06/05/2014)

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value. Set VBW ≥ RBW. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T ≤ 16.7 microseconds.)

▣ TEST CONFIGURATION



▣ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer. We tested accroding to the zero-span measurement method, 6.0)b) in KDB 558074(issued 06/05/2014).

The largest available value of RBW is 8 MHz and VBW is 50 MHz. The zero-span method of measuring duty cycle shall not be used if T ≤ 6.25 microseconds. (50/6.25 = 8)

The zero-span method was used because all measured T data are > 6.25 microseconds and both RBW and VBW are > 50/*T*.

1. RBW = 8 MHz (the largest available value)
2. VBW = 8 MHz (≥ RBW)
3. SPAN = 0 Hz
4. Detector = Peak
5. Number of points in sweep > 100
6. Trace mode = Clear write
7. Measure T_{total} and T_{on}
8. Calculate Duty Cycle = T_{on}/ T_{total} and Duty Cycle Factor = 10*log(1/Duty Cycle)

Zigbee Mode	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor(dB)
	-	-	1	0

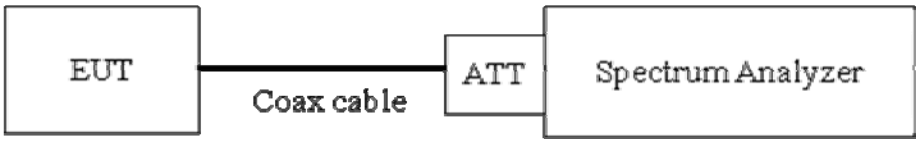
8.2 6dB BANDWIDTH MEASUREMENT

Test Requirements and limit, §15.247(a)(2)

The bandwidth at 6dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the receive antenna while the EUT is operating in transmission mode at the appropriate frequencies.

The minimum permissible 6dB bandwidth is 500 kHz.

▣ TEST CONFIGURATION



▣ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer.

The Spectrum Analyzer is set to (Page 5 in KDB 558074, issued 06/05/2014)

RBW = 100 kHz

VBW ≥ 3 x RBW

Detector = Peak

Trace mode = max hold

Sweep = auto couple

Allow the trace to stabilize

Note : We tested 6 dB bandwidth using the automatic bandwidth measurement capability of a spectrum analyzer. X dB is set 6 dB.

▣ TEST RESULTS

Zigbee Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency[MHz]	Channel No.			
2405	11	1.552	0.5	Pass
2440	18	1.563	0.5	Pass
2475	25	1.523	0.5	Pass

▣ RESULT PLOTS

6dB Bandwidth plot (Low-CH)

6dB Bandwidth plot (Mid-CH)

6dB Bandwidth plot (High-CH)

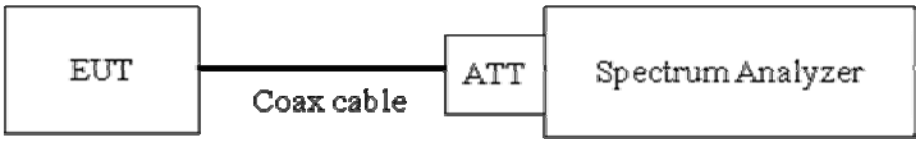
8.3 OUTPUT POWER MEASUREMENT

Test Requirements and limit, §15.247(b)(3)

A transmitter antenna terminal of EUT is connected to the input of a Spectrum Analyzer. Measurement is made while the EUT is operating in transmission mode at the appropriate frequencies.

The maximum permissible conducted output power is 1 Watt.

▣ TEST CONFIGURATION



▣ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer. We use the spectrum analyzer's integrated band power measurement function.

This EUT TX condition is 100 % duty cycle operating mode by Zigbee mode test program.

The Spectrum Analyzer is set to

- Peak Power (Procedure 9.1.1 in KDB 558074, issued 06/05/2014)

  RBW ≥ DTS Bandwidth

  VBW ≥ 3 x RBW

  SPAN ≥ 3 x RBW

  Detector Mode = Peak

  Sweep = auto couple

  Trace Mode = max hold

  Allow trace to fully stabilize.

  Use peak marker function to determine the peak amplitude level

- Average Power (Procedure 9.2.2.2 in KDB 558074, issued 06/05/2014)

  Measure the duty cycle

  Set span to at least 1.5 times the OBW

  RBW = 1-5 % of the OBW, not to exceed 1 MHz.

  VBW ≥ 3 x RBW.

  Number of points in sweep ≥ 2 x span / RBW. (This gives bin-to-bin spacing ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)

  Sweep time = auto.

  Detector = RMS(i.e., power averaging)

  Do not use sweep triggering. Allow the sweep to "free run".

  Trace average at least 100 traces in power averaging(RMS) mode.

  Compute power by integrating the spectrum across the OBW of the signal using the instrument's band

power measurement function with band limits set equal to the OBW band edges.

▣ Sample Calculation

Output Power = Reading Value + ATT loss + Cable loss(1 ea)

Output Power = 10 dBm + 10 dB + 0.8 dB = 21.0 dBm

Note :

1. Spectrum reading values are not plot data. The power results in plot is already including the actual values of loss for the attenuator and cable combination.
2. Spectrum offset = Attenuator loss + Cable loss
3. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB. So, 10.2 dB is offset for 2.4 GHz Band.

▣ TEST RESULTS-Peak

Conducted Output Power Measurements

Zigbee Mode		Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.		
2405	11	5.13	30
2440	18	5.03	30
2475	25	4.54	30

▣ TEST RESULTS-Average

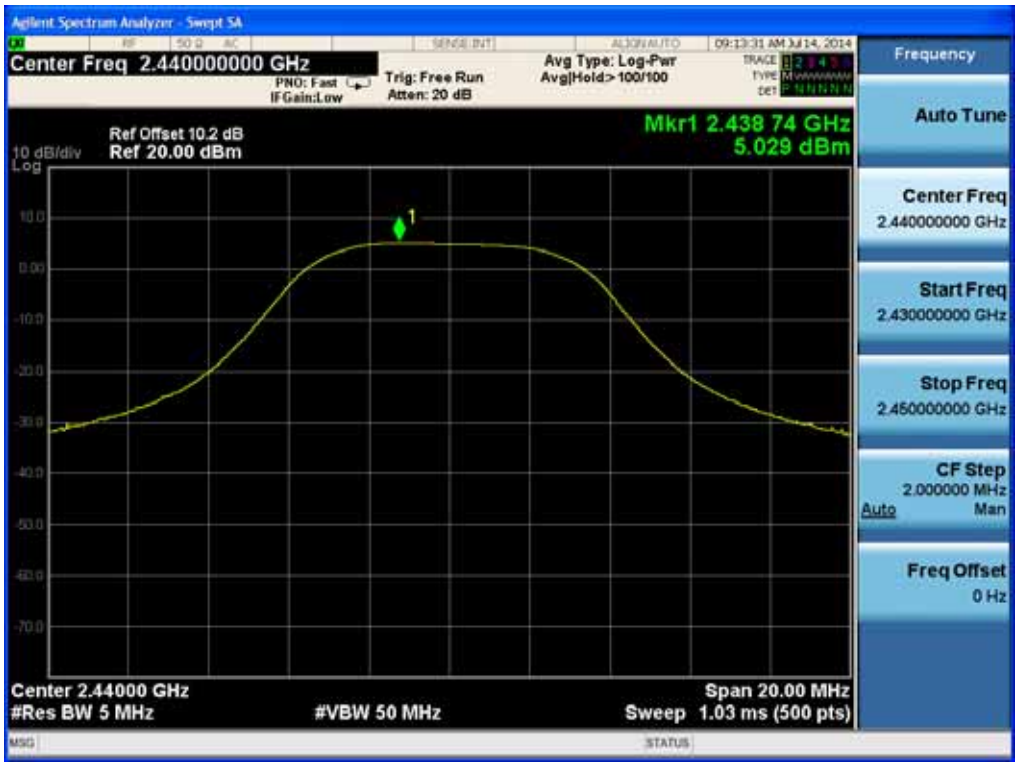
Conducted Output Power Measurements

Zigbee Mode		Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.		
2405	11	4.38	30
2440	18	4.19	30
2475	25	3.74	30

▣ RESULT PLOTS-Peak

Conducted Output Power (Low-CH)

Conducted Output Power (Mid-CH)



Conducted Output Power (High-CH)

▣ RESULT PLOTS-Average

Conducted Output Power (Low-CH)

Conducted Output Power (Mid-CH)

Conducted Output Power (High-CH)

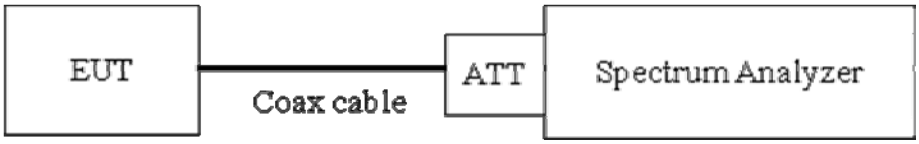
8.4 POWER SPECTRAL DENSITY

Test Requirements and limit, §15.247(e)

The peak power density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

Minimum Standard – 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.

▣ TEST CONFIGURATION



▣ TEST PROCEDURE

We tested according to Procedure 10.2 in KDB 558074, issued 06/05/2014

The spectrum analyzer is set to :

Set analyzer center frequency to DTS channel center frequency.

Span = 1.5 times the DTS channel bandwidth.

RBW = 3 kHz ≤ RBW ≤ 100 kHz.

VBW ≥ 3 x RBW.

Sweep = auto couple

Detector = peak

Trace Mode = max hold

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum amplitude level within the RBW.

If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

▣ Sample Calculation

PSD = Reading Value + ATT loss + Cable loss(1 ea)

Output Power = -5 dBm + 10 dB + 0.8 dB = 5.8 dBm

Note :

1. Spectrum reading values are not plot data. The PSD results in plot is already including the actual values of loss for the attenuator and cable combination.
2. Spectrum offset = Attenuator loss + Cable loss
3. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB. So, 10.2 dB is offset for 2.4 GHz Band.

▣ TEST RESULTS

Conducted Power Density Measurements

Zigbee Mode		Test Result		
Frequency[MHz]	Channel No.	PSD (dBm)	Limit (dBm)	Pass/Fail
2405	11	-10.330	8	Pass
2440	18	-9.910	8	Pass
2475	25	-10.490	8	Pass

▣ RESULT PLOTS

Power Spectral Density (Low-CH)

Power Spectral Density (Mid-CH)

Power Spectral Density (High-CH)

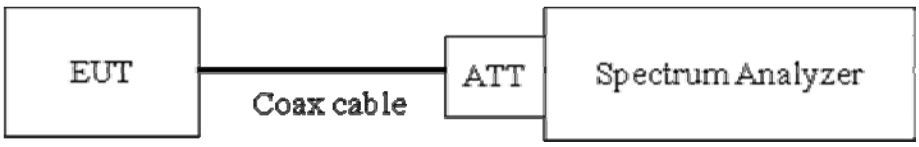
8.5 OUT OF BAND EMISSIONS AT THE BAND EDGE/ CONDUCTED SPURIOUS EMISSIONS

Test Requirements and limit, §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 § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

Limit : 20 dBc

▣ TEST CONFIGURATION



▣ TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. (Procedure 11.0 in KDB 558074, issued 06/05/2014)

RBW = 100 kHz

VBW ≥ 3 x RBW

Set span to encompass the spectrum to be examined

Detector = Peak

Trace Mode = max hold

Sweep time = auto couple

Ensure that the number of measurement points ≥ Span/RBW

Allow trace to fully stabilize.

Use peak marker function to determine the maximum amplitude level.

Measurements are made over the 30 MHz to 10th harmonic range with the transmitter set to the lowest, middle, and highest channels.

Note :

1. The band edge results in plot is already including the actual values of loss for the attenuator and cable

combination.

2. Spectrum offset = Attenuator loss + Cable loss
3. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB. So, 10.2 dB is offset for 2.4 GHz Band.
4. In case of conducted spurious emissions test, please check factors blow table.
5. In order to simplify the report, attached plots were only the worst case channel and data rate.

▣ FACTORS FOR FREQUENCY

Freq(MHz)	Factor(dB)
30	9.95
100	10.01
200	10.03
300	10.04
400	10.05
500	10.04
600	10.03
700	10.09
800	10.10
900	10.08
1000	10.11
2000	10.25
2400*	10.19
2500*	10.26
3000	10.27
4000	10.22
5000	10.48
5700*	10.42
5800*	10.48
6000	10.48
7000	10.57
8000	10.45
9000	10.50
10000	10.64
11000	10.69
12000	10.75
13000	10.92

14000	11.90
15000	11.00
16000	11.03
17000	10.93
18000	10.96
19000	10.85
20000	12.11
21000	11.17
22000	10.99
23000	11.12
24000	11.10
25000	11.42

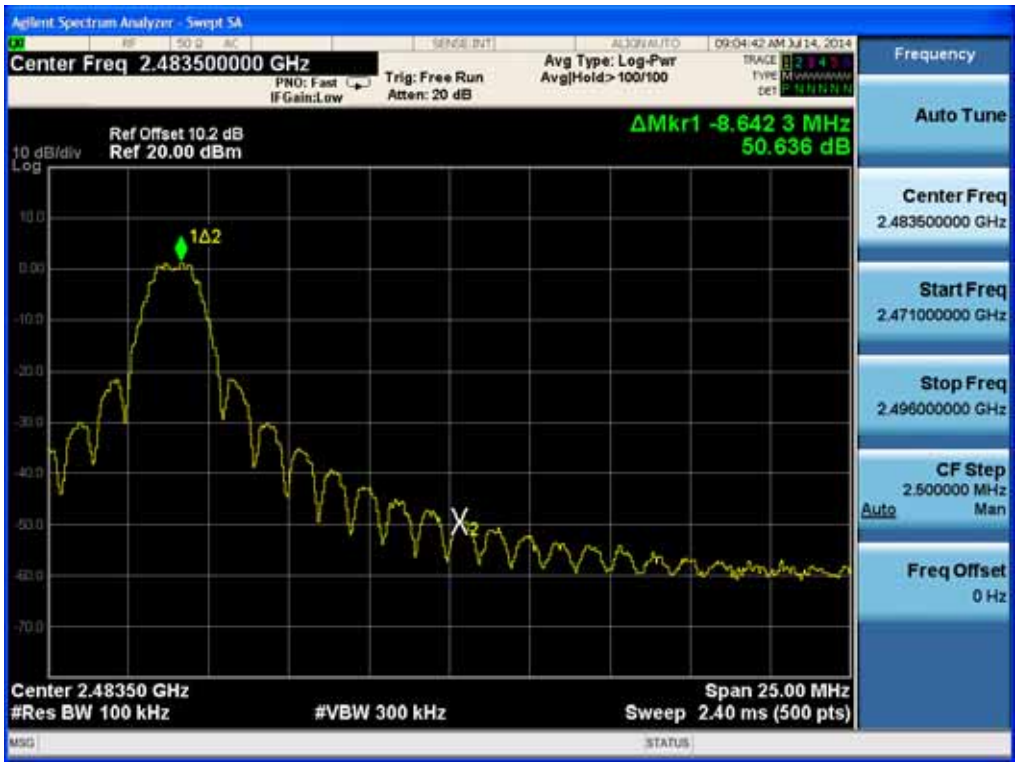
Note : 1. '*' is fundamental frequency range.

2. Factor = Cable loss + Attenuator loss

▣ RESULT PLOTS

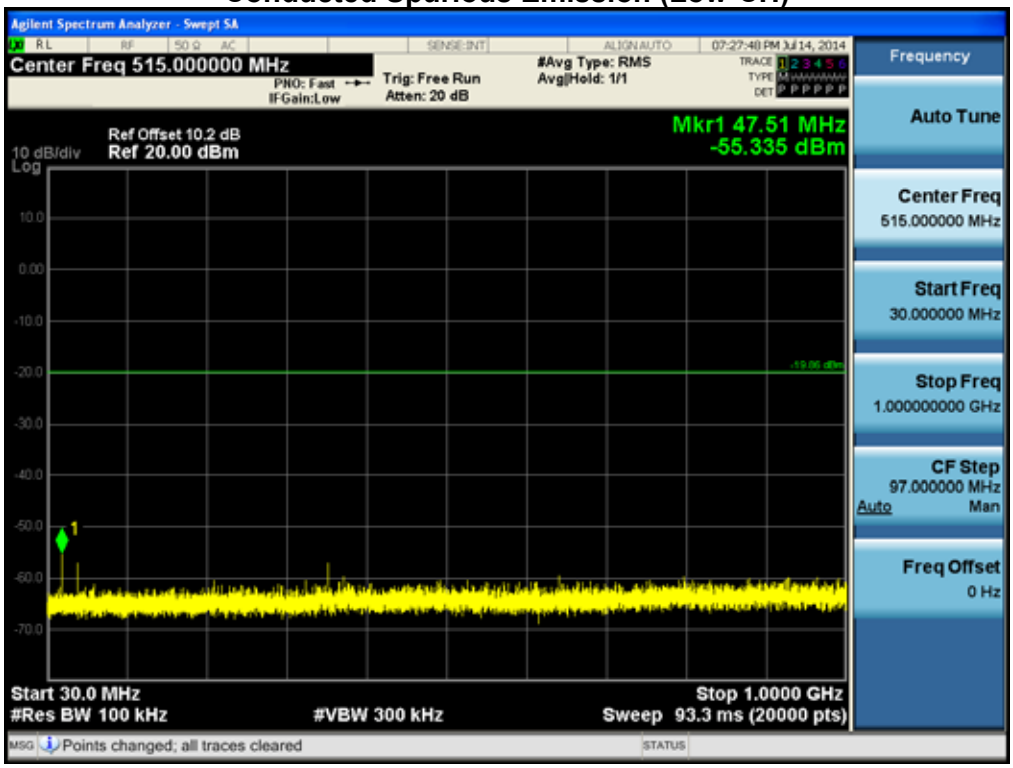
BandEdge (Low-CH)

BandEdge (High-CH)



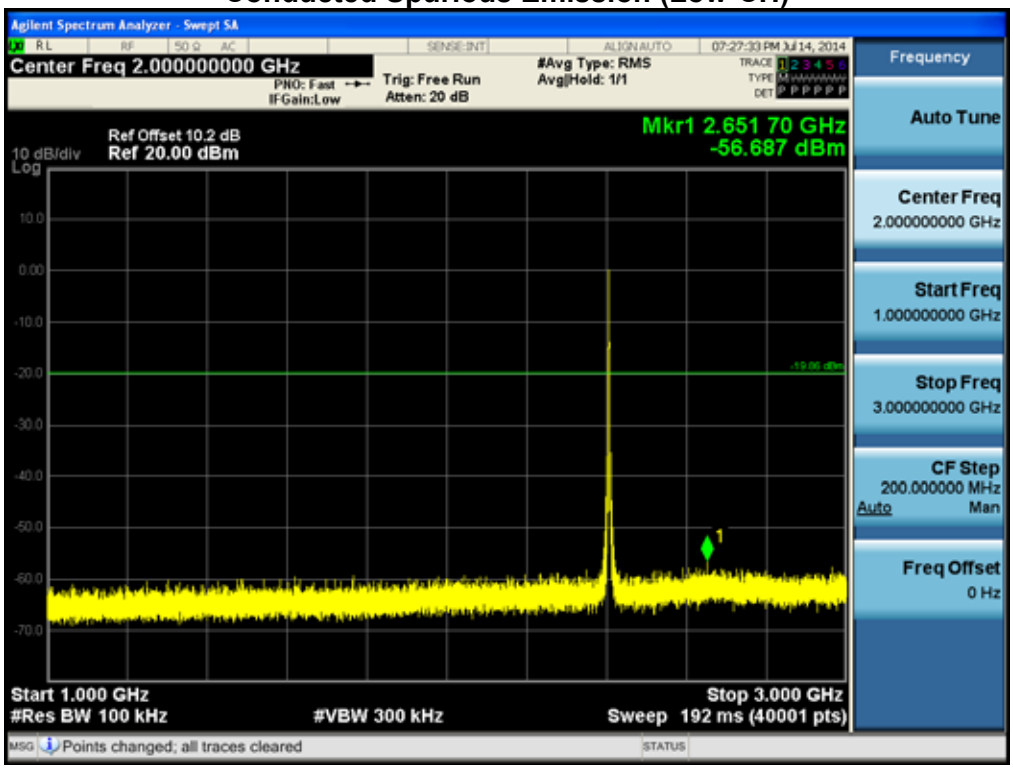
30 MHz ~ 1 GHz

Conducted Spurious Emission (Low-CH)



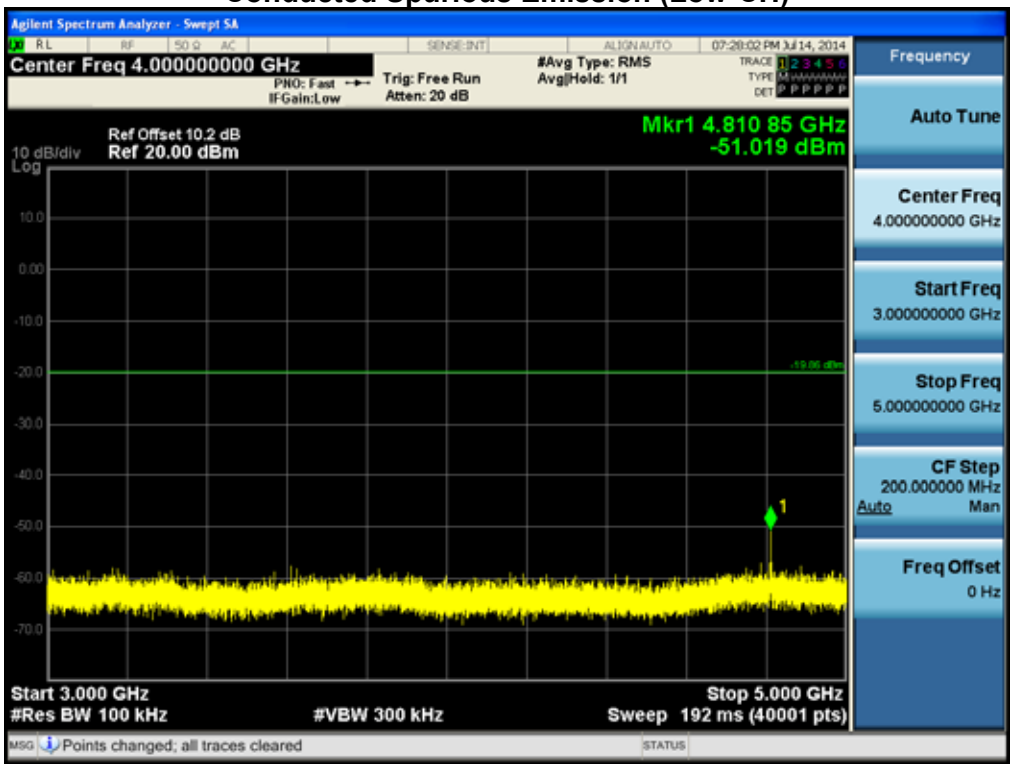
1 GHz ~ 3 GHz

Conducted Spurious Emission (Low-CH)



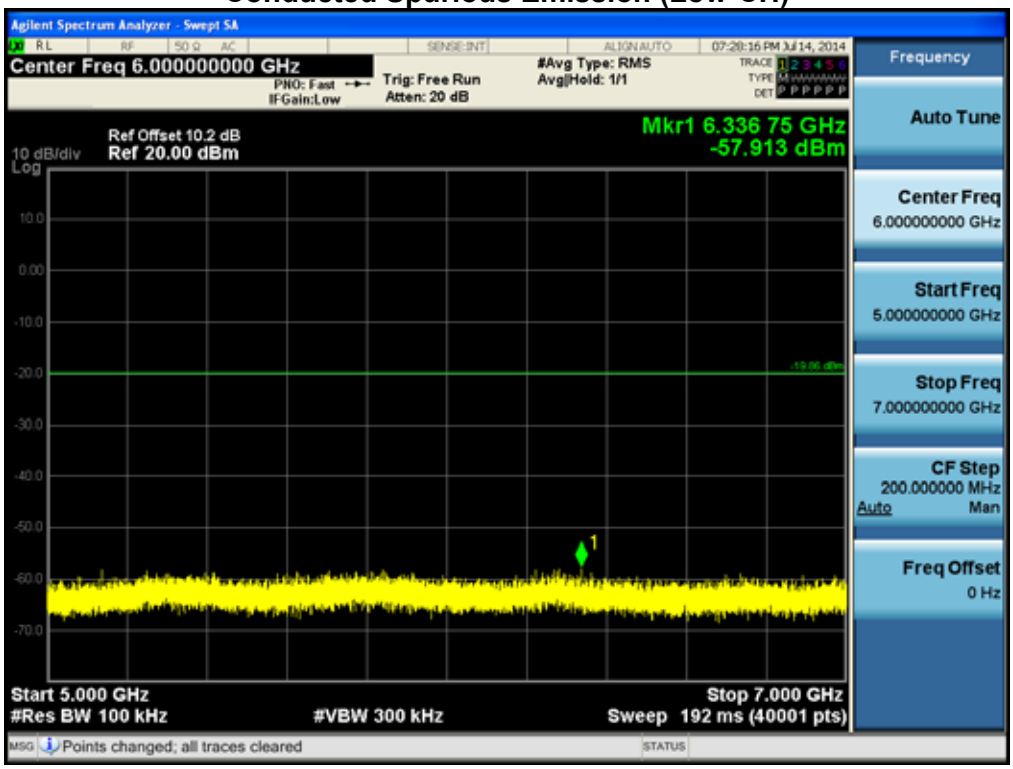
3 GHz ~ 5 GHz

Conducted Spurious Emission (Low-CH)



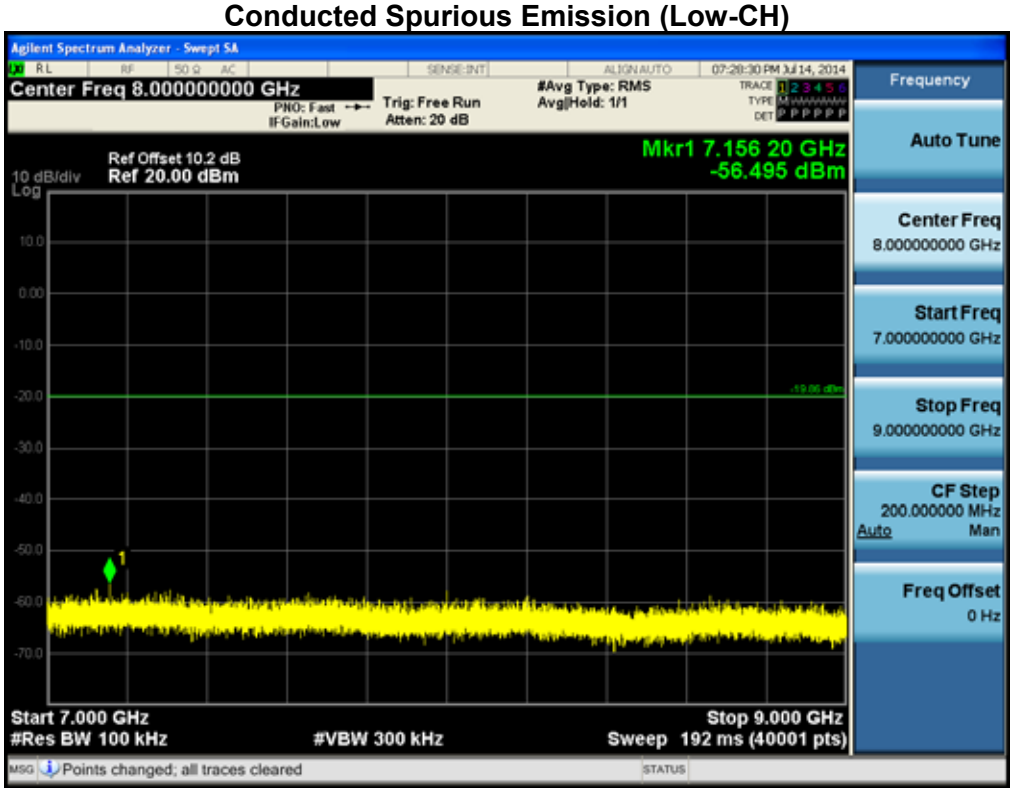
5 GHz ~ 7 GHz

Conducted Spurious Emission (Low-CH)



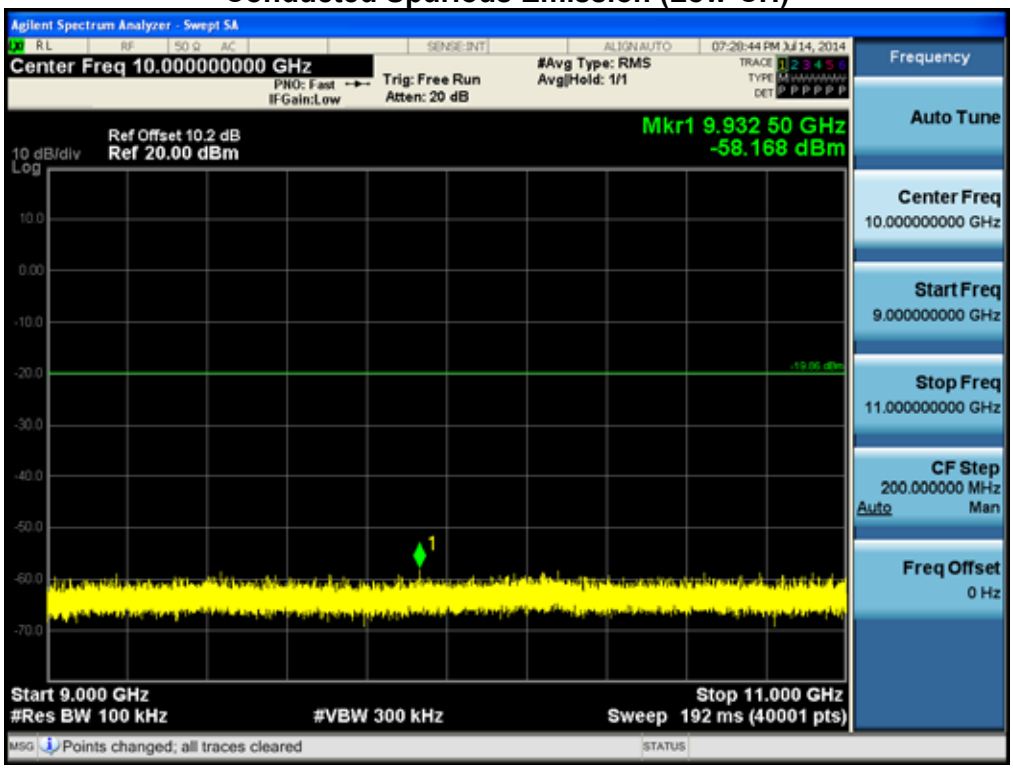
7 GHz ~ 9 GHz

Conducted Spurious Emission (Low-CH)



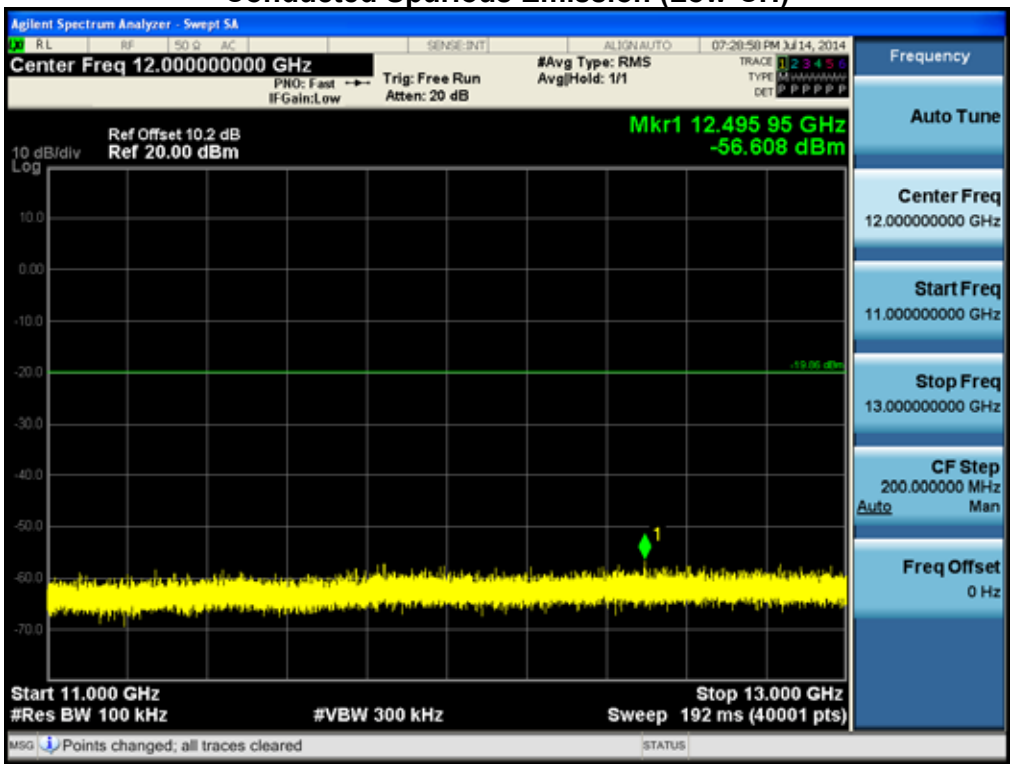
9 GHz ~ 11 GHz

Conducted Spurious Emission (Low-CH)



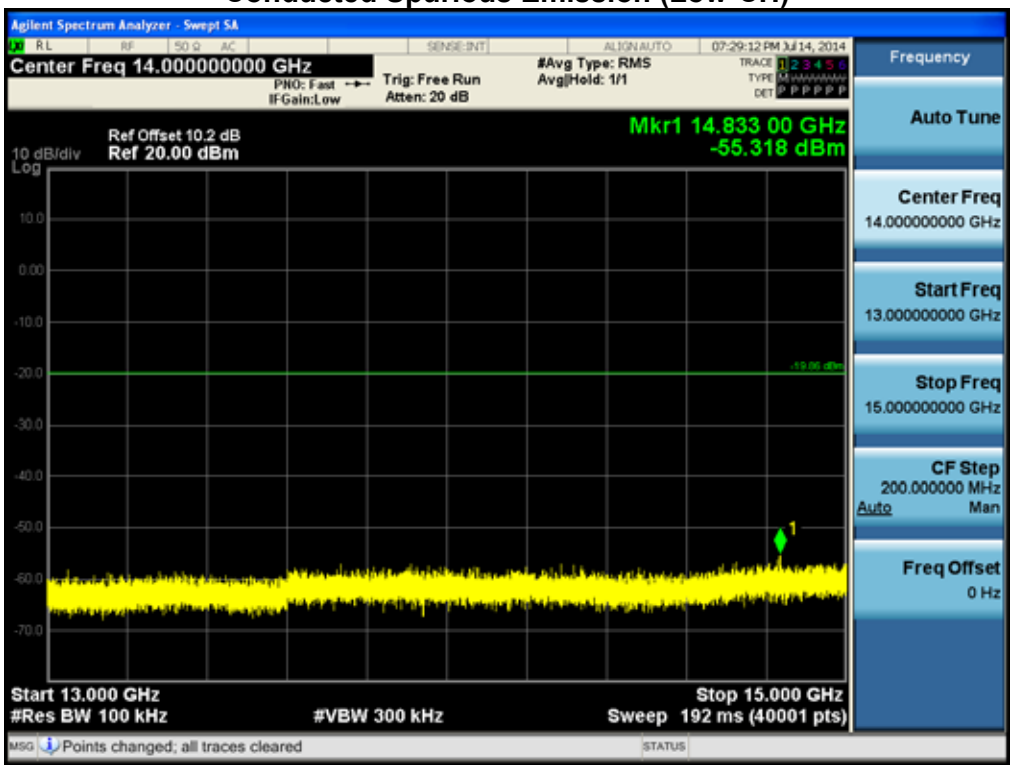
11 GHz ~ 13 GHz

Conducted Spurious Emission (Low-CH)



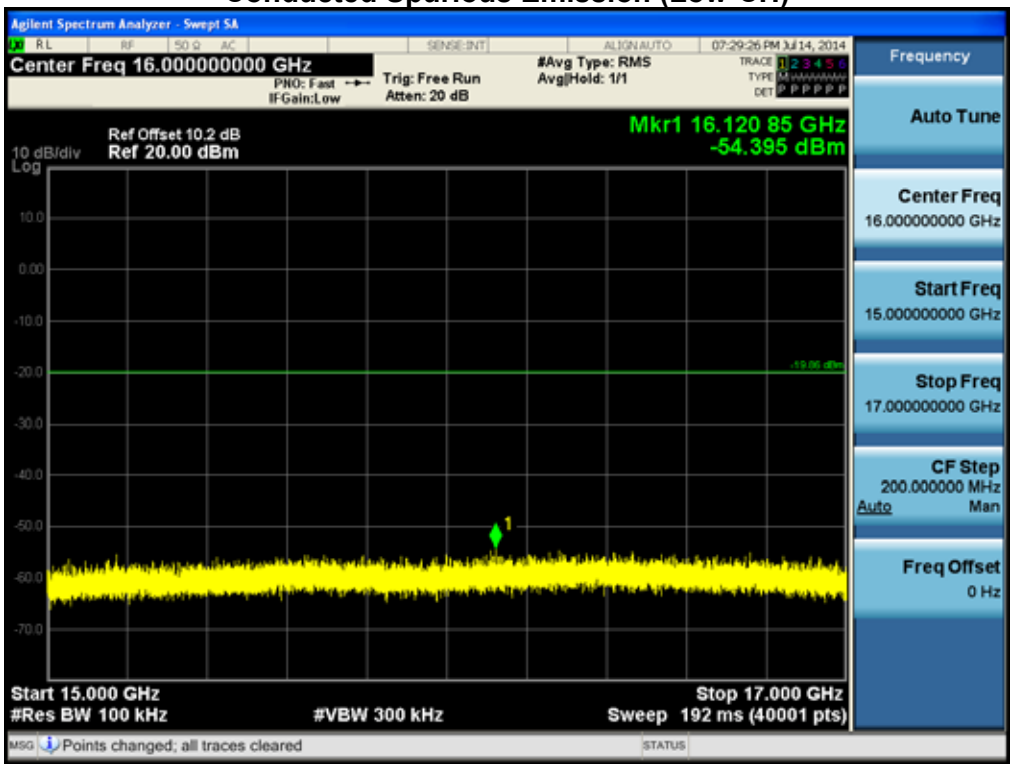
13 GHz ~ 15 GHz

Conducted Spurious Emission (Low-CH)



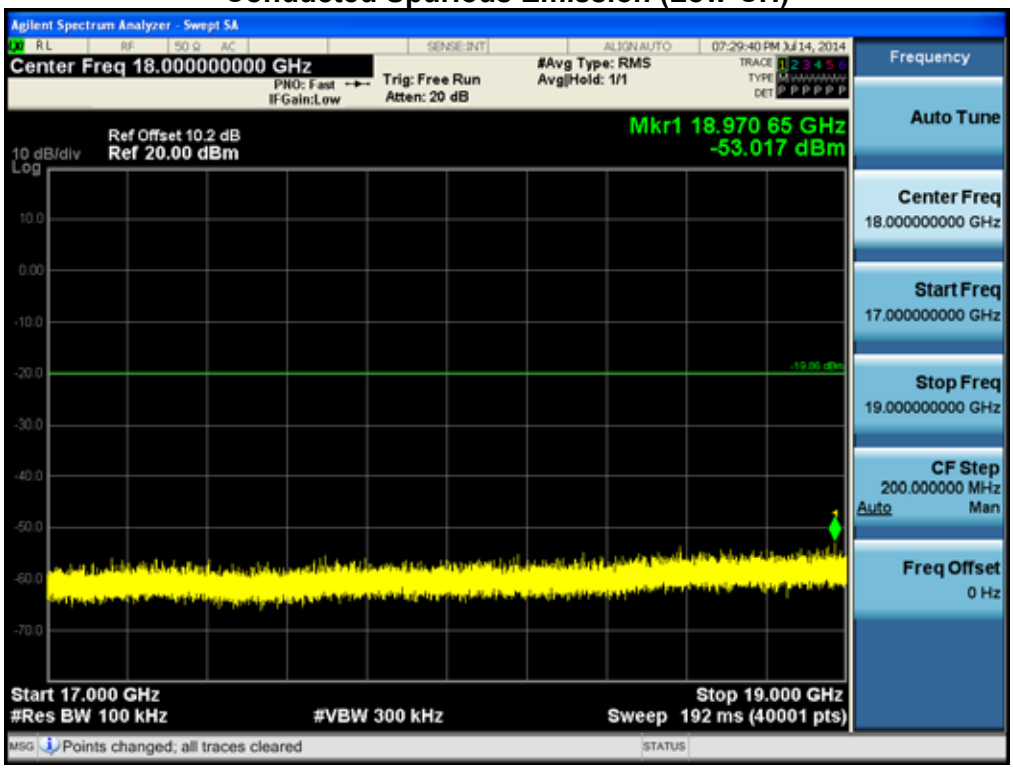
15 GHz ~ 17 GHz

Conducted Spurious Emission (Low-CH)



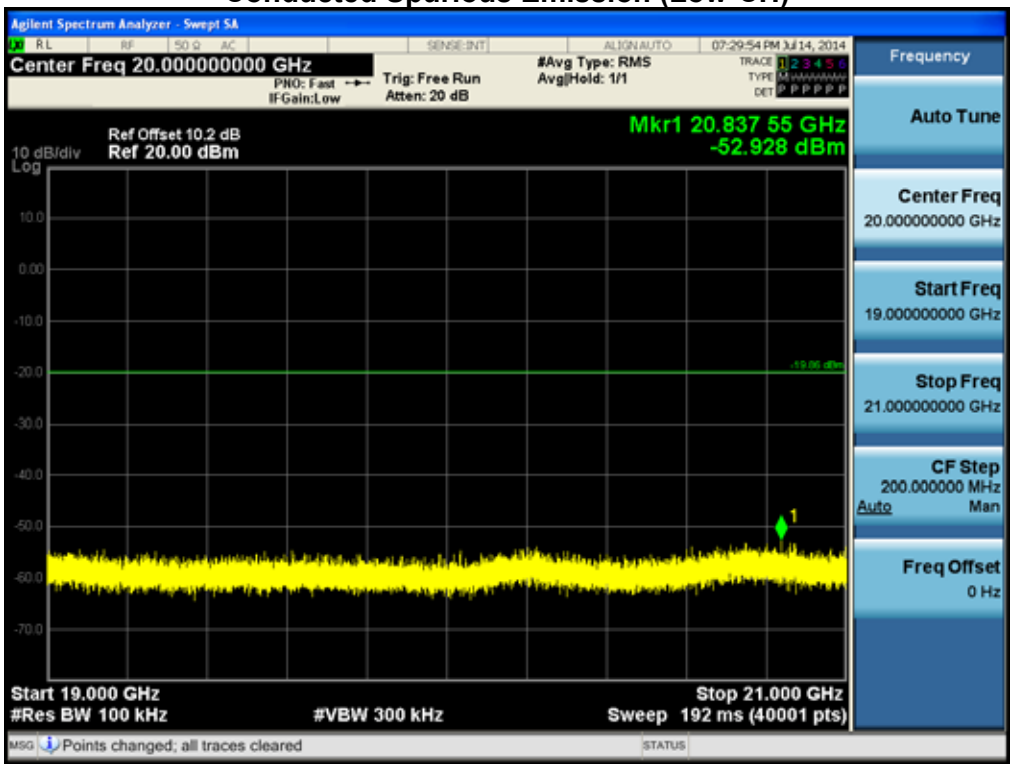
17 GHz ~ 19 GHz

Conducted Spurious Emission (Low-CH)



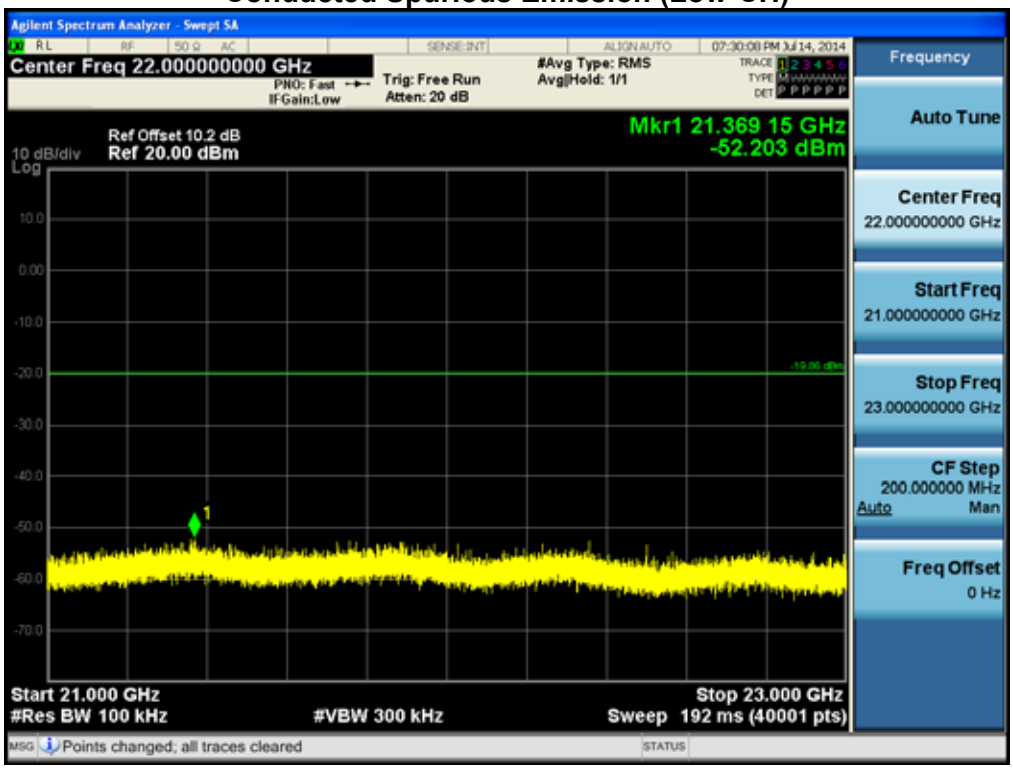
19 GHz ~ 21 GHz

Conducted Spurious Emission (Low-CH)



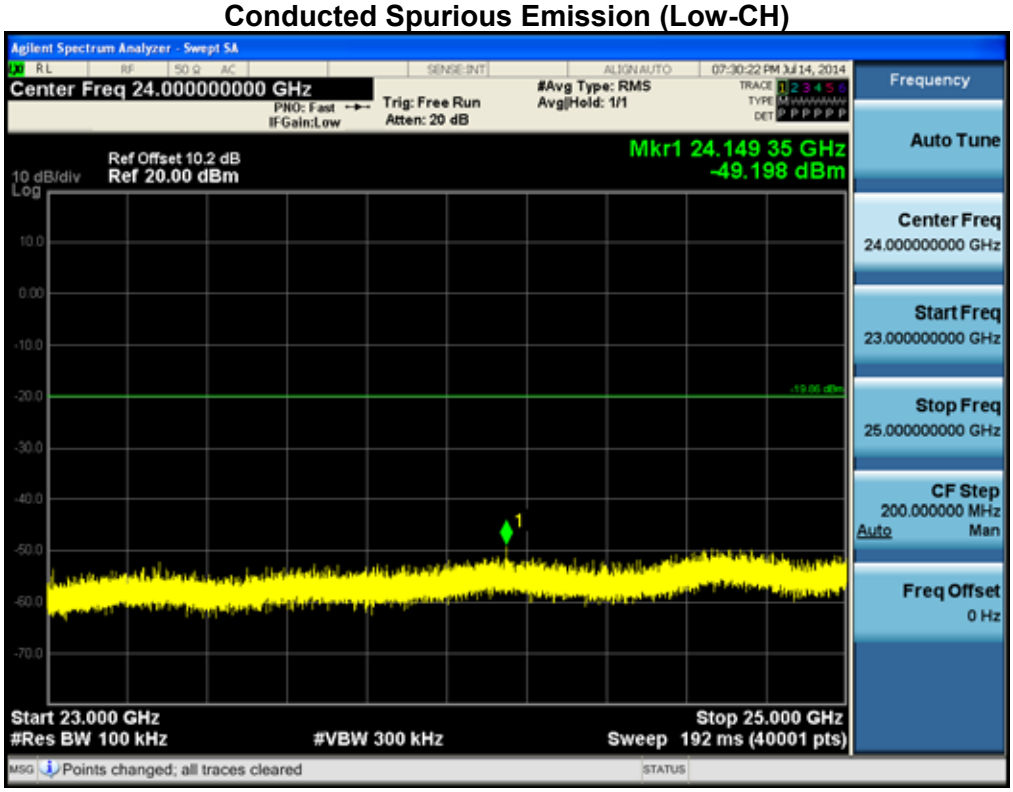
21 GHz ~ 23 GHz

Conducted Spurious Emission (Low-CH)



23 GHz ~ 25 GHz

Conducted Spurious Emission (Low-CH)



8.6 RADIATED MEASUREMENT.

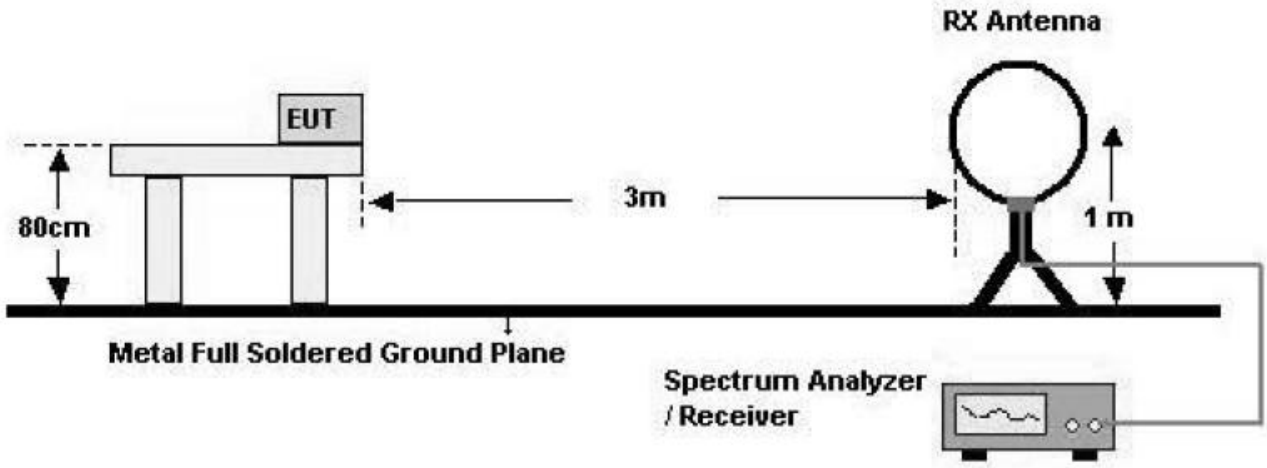
8.6.1 RADIATED SPURIOUS EMISSIONS.

Test Requirements and limit, §15.205, §15.209

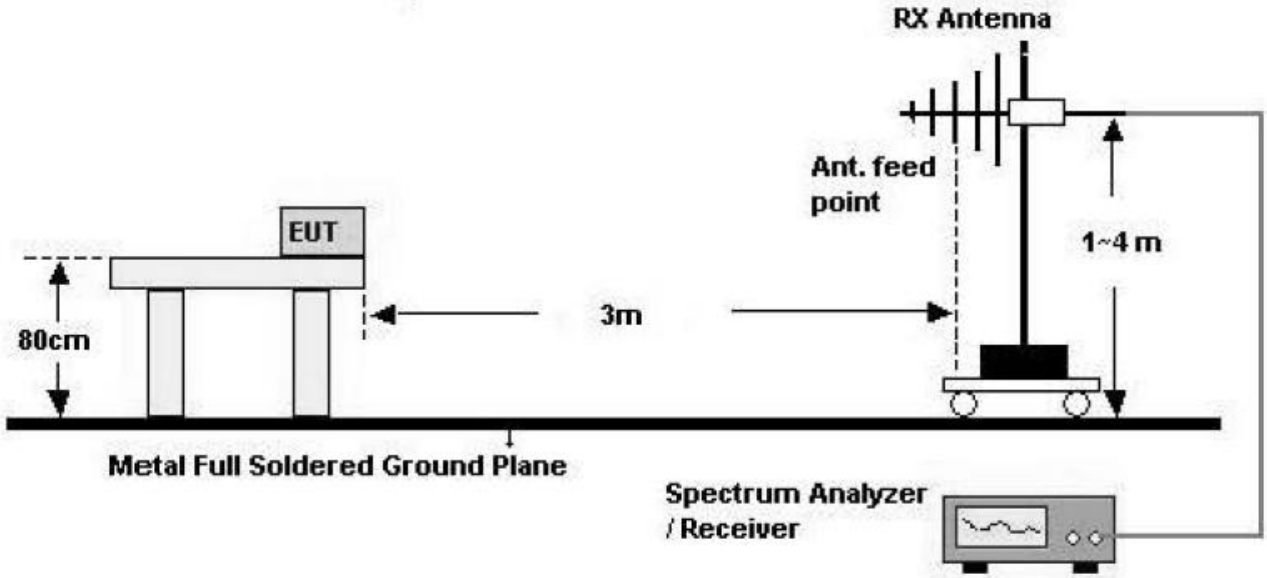
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Configuration

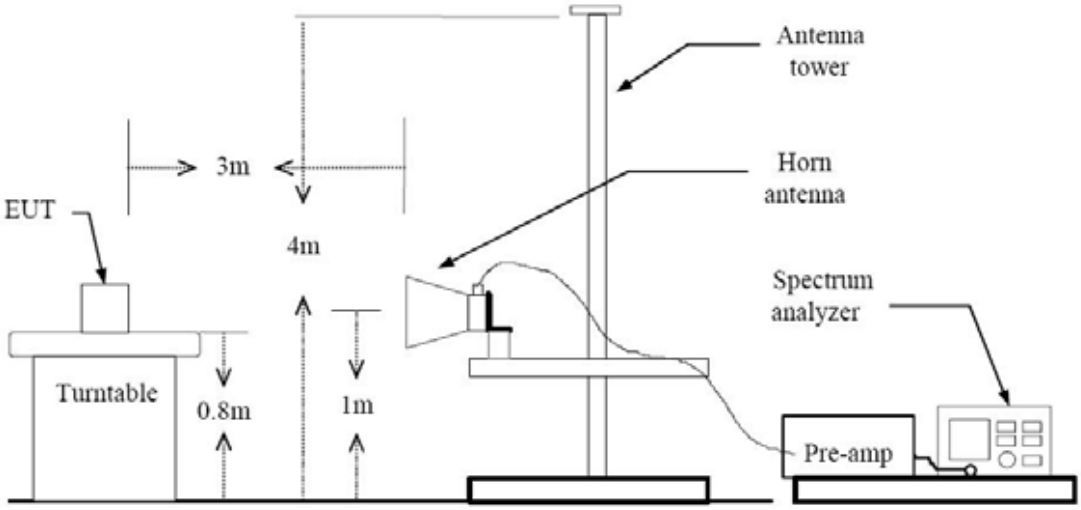
Below 30 MHz



30 MHz - 1 GHz



Above 1 GHz



TEST PROCEDURE USED

Method 12.2.4 in KDB 558074, issued 06/05/2014

Spectrum Setting

- Peak

Peak emission levels are measured by setting the instrument as follows:

RBW = cf. Table 1.

VBW ≥ 3 x RBW.

Detector = Peak.

Sweep time = auto.

Trace mode = max hold.

Allow sweeps to continue until the trace stabilizes.

(Note that the required measurement time may be longer for low duty cycle applications).

Table 1 —RBW as a function of frequency

Frequency	RBW
9-150 kHz	200-300 Hz
0.15-30 MHz	9-10 kHz
30-1000 MHz	100-120 kHz
> 1000 MHz	1 MHz

- Average

Set RBW = 1 MHz

Set VBW ≥ 1/T.(at least 100 times less than the resolution bandwidth, but no less than 10 Hz.)

Select spectrum analyzer linear display mode.

Detector = Peak.

Sweep time = auto.

Trace mode = max hold.

Note :

1. We used the case 1 for Zigbee mode to perform the average filed strength measurements for RSE and radiated band edge test.

TEST RESULTS

9 kHz – 30MHz

Operation Mode: Normal Mode

Frequency	Reading	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
MHz	dBμV/m	dBm /m	dBm	(H/V)	dBμV/m	dBμV/m	dB
No Critical peaks found							

Notes:

1. Measuring frequencies from 9 kHz to the 30MHz.
2. The reading of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to be measured.
3. Distance extrapolation factor = 40 log (specific distance / test distance) (dB)
4. Limit line = specific Limits (dBuV) + Distance extrapolation factor
5. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

TEST RESULTS

Below 1 GHz

Operation Mode: Normal Mode

Frequency	Reading	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
MHz	dBμV/m	dBm /m	dBm	(H/V)	dBμV/m	dBμV/m	dB
No Critical peaks found							

Notes:

1. Measuring frequencies from 30 MHz to the 1 GHz.
2. Radiated emissions measured in frequency range from 30 MHz to 1000 MHz were made with an instrument using Quasi peak detector mode.
3. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

Above 1 GHz

Operation Mode: CH Low

Frequency [MHz]	Reading [dBuV/m]	AN.+CL-AMP G [dBm]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4810	62.05	-2.16	V	59.89	73.98	14.09	PK
4810	52.57	-2.16	V	50.41	53.98	3.57	AV
7215	48.56	7.31	V	55.87	73.98	18.11	PK
7215	36.73	7.31	V	44.04	53.98	9.94	AV
4810	57.45	-2.16	H	55.29	73.98	18.69	PK
4810	47.62	-2.16	H	45.46	53.98	8.52	AV
7215	47.48	7.31	H	54.79	73.98	19.19	PK
7215	34.24	7.31	H	41.55	53.98	12.43	AV

Operation Mode: CH Mid

Frequency [MHz]	Reading [dBuV/m]	AN.+CL-AMP G [dBm]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4880	58.43	-1.95	V	56.48	73.98	17.50	PK
4880	48.40	-1.95	V	46.45	53.98	7.53	AV
7320	49.54	7.34	V	56.88	73.98	17.10	PK
7320	37.45	7.34	V	44.79	53.98	9.19	AV
4880	53.87	-1.95	H	51.92	73.98	22.06	PK
4880	43.59	-1.95	H	41.64	53.98	12.34	AV
7320	48.43	7.34	H	55.77	73.98	18.21	PK
7320	34.92	7.34	H	42.26	53.98	11.72	AV

Operation Mode: CH High

Frequency [MHz]	Reading [dBuV/m]	AN.+CL-AMP G [dBm]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4950	57.66	-1.84	V	55.82	73.98	18.16	PK
4950	47.59	-1.84	V	45.75	53.98	8.23	AV
7425	48.23	7.13	V	55.36	73.98	18.62	PK
7425	35.74	7.13	V	42.87	53.98	11.11	AV
4950	52.97	-1.84	H	51.13	73.98	22.85	PK
4950	42.69	-1.84	H	40.85	53.98	13.13	AV
7425	46.13	7.13	H	53.26	73.98	20.72	PK
7425	32.30	7.13	H	39.43	53.98	14.55	AV

Notes:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain
5. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

8.6.2 RADIATED RESTRICTED BAND EDGES

Test Requirements and limit, §15.247(d) §15.205, §15.209

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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. 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)).

Internal Antenna

Operation Mode	Zigbee Mode
Operating Frequency	2405 MHz, 2475 MHz
Channel No	11 Ch, 25 Ch

Frequency [MHz]	Reading [dBuV/m]	A.F.+CL [dBm]	Ant. Pol. [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
2390.0	25.36	31.47	H	56.83	73.98	17.15	PK
2390.0	12.05	31.47	H	43.52	53.98	10.46	AV
2390.0	25.97	31.47	V	57.44	73.98	16.54	PK
2390.0	13.35	31.47	V	44.82	53.98	9.16	AV
2483.5	29.87	31.46	H	61.33	73.98	12.65	PK
2483.5	16.93	31.46	H	48.39	53.98	5.59	AV
2483.5	31.20	31.46	V	62.66	73.98	11.32	PK
2483.5	18.86	31.46	V	50.32	53.98	3.66	AV

Notes:

1. Total = Reading Value + Antenna Factor + Cable Loss
2. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

8.7 POWERLINE CONDUCTED EMISSIONS

Test Requirements and limit, §15.207

For an intentional radiator which 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 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

Frequency Range (MHz)	Limits (dBµV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

Test Configuration

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

TEST PROCEDURE

1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
2. The EUT is connected via LISN to a test power supply.
3. The measurement results are obtained as described below:
4. Detectors – Quasi Peak and Average Detector.
5. We are performed the AC Power Line Conducted Emission test for Ch.1 on Zigbee mode. Because Ch.1 on Zigbee mode is worst case.

▣ RESULT PLOTS

Conducted Emissions (Line 1)

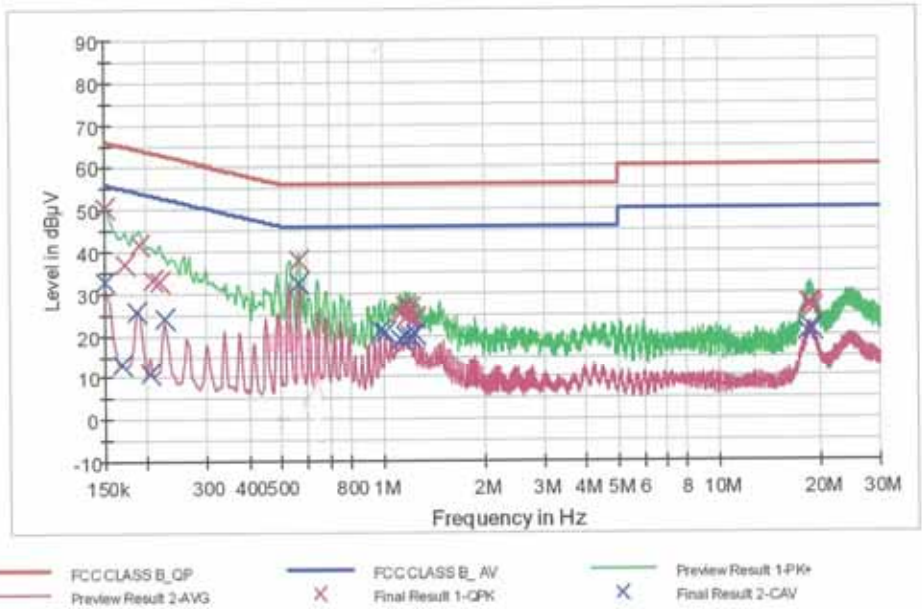
EMI Auto Test(2) 1 / 2

HCT TEST Report

Common Information

EUT:	MFG-G400
Manufacturer:	MAXFOR
Test Site:	SHIELD ROOM
Operating Conditions:	ZIGBEE MODE
Operator Name:	K.S. KANG

FCC CLASS B



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	50.4	9.000	Off	L1	9.6	15.6	66.0
0.172500	37.0	9.000	Off	L1	9.6	27.8	64.8
0.190500	41.8	9.000	Off	L1	9.6	22.2	64.0
0.208500	33.1	9.000	Off	L1	9.6	30.2	63.3
0.217500	32.7	9.000	Off	L1	9.6	30.2	62.9
0.563000	38.1	9.000	Off	L1	9.6	17.9	56.0
1.130000	25.1	9.000	Off	L1	9.7	30.9	56.0
1.166000	26.8	9.000	Off	L1	9.7	29.2	56.0
1.184000	24.3	9.000	Off	L1	9.7	31.7	56.0
1.197500	24.9	9.000	Off	L1	9.7	31.1	56.0
1.206500	26.5	9.000	Off	L1	9.7	29.5	56.0
1.247000	24.2	9.000	Off	L1	9.7	31.8	56.0
18.428000	27.5	9.000	Off	L1	10.4	32.5	60.0
18.576500	27.1	9.000	Off	L1	10.4	32.9	60.0
18.608000	27.3	9.000	Off	L1	10.4	32.7	60.0
18.653000	27.5	9.000	Off	L1	10.4	32.5	60.0

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EMI Auto Test(2) 2 / 2

Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
18.680000	27.5	9.000	Off	L1	10.4	32.5	60.0
18.833000	26.3	9.000	Off	L1	10.4	33.7	60.0

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	32.7	9.000	Off	L1	9.6	23.3	56.0
0.168000	13.0	9.000	Off	L1	9.6	42.1	55.1
0.186000	25.9	9.000	Off	L1	9.6	28.3	54.2
0.204000	11.1	9.000	Off	L1	9.6	42.3	53.4
0.226500	24.0	9.000	Off	L1	9.6	28.6	52.6
0.563000	32.3	9.000	Off	L1	9.6	13.7	46.0
0.977000	21.1	9.000	Off	L1	9.7	24.9	46.0
1.017500	20.8	9.000	Off	L1	9.7	25.2	46.0
1.130000	19.0	9.000	Off	L1	9.7	27.0	46.0
1.166000	20.0	9.000	Off	L1	9.7	26.0	46.0
1.202000	19.9	9.000	Off	L1	9.7	26.1	46.0
1.242500	20.4	9.000	Off	L1	9.7	25.6	46.0
18.261500	20.9	9.000	Off	L1	10.4	29.1	50.0
18.576500	21.5	9.000	Off	L1	10.4	28.5	50.0
18.608000	21.5	9.000	Off	L1	10.4	28.5	50.0
18.653000	21.4	9.000	Off	L1	10.4	28.6	50.0
18.680000	21.4	9.000	Off	L1	10.4	28.6	50.0
18.833000	21.0	9.000	Off	L1	10.4	29.0	50.0

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Conducted Emissions (Line 2)

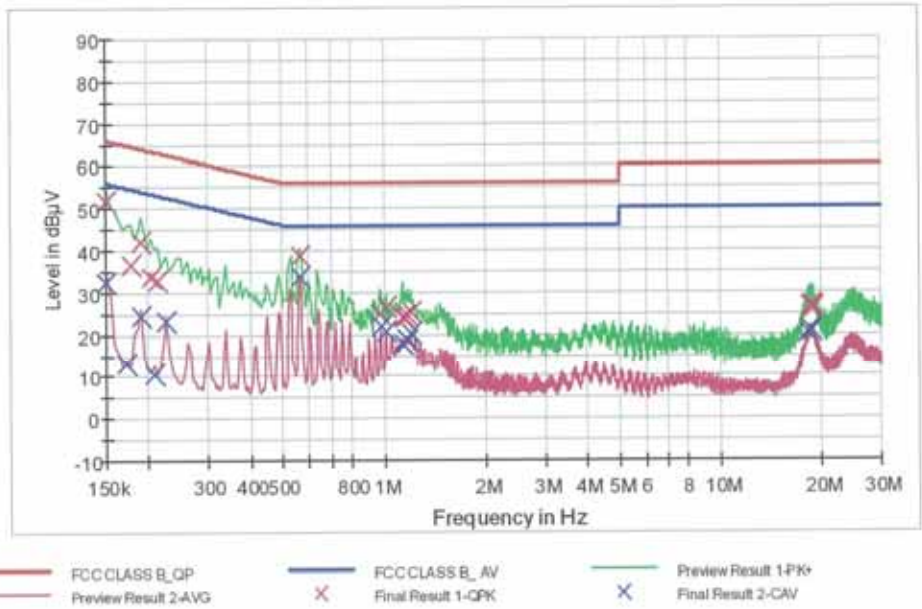
EMI Auto Test(2) 1 / 2

HCT TEST Report

Common Information

EUT:	MFG-G400
Manufacturer:	MAXFOR
Test Site:	SHIELD ROOM
Operating Conditions:	ZIGBEE MODE
Operator Name:	K.S. KANG

FCC CLASS B



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	51.6	9.000	Off	N	9.6	14.4	66.0
0.177000	36.7	9.000	Off	N	9.7	27.9	64.6
0.190500	42.0	9.000	Off	N	9.7	22.0	64.0
0.204000	33.9	9.000	Off	N	9.7	29.5	63.4
0.213000	32.7	9.000	Off	N	9.7	30.4	63.1
0.563000	38.6	9.000	Off	N	9.7	17.4	56.0
0.972500	24.7	9.000	Off	N	9.7	31.3	56.0
1.017500	26.5	9.000	Off	N	9.7	29.5	56.0
1.134500	24.2	9.000	Off	N	9.7	31.8	56.0
1.157000	24.1	9.000	Off	N	9.7	31.9	56.0
1.179500	24.5	9.000	Off	N	9.7	31.5	56.0
1.206500	25.4	9.000	Off	N	9.7	30.6	56.0
18.405500	26.4	9.000	Off	N	10.3	33.6	60.0
18.599000	26.9	9.000	Off	N	10.3	33.1	60.0
18.617000	27.0	9.000	Off	N	10.3	33.0	60.0
18.653000	26.7	9.000	Off	N	10.3	33.3	60.0

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EMI Auto Test(2) 2 / 2

Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
18.671000	26.9	9.000	Off	N	10.3	33.1	60.0
18.810500	26.0	9.000	Off	N	10.3	34.0	60.0

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	32.3	9.000	Off	N	9.6	23.7	56.0
0.172500	13.3	9.000	Off	N	9.7	41.6	54.8
0.190500	24.5	9.000	Off	N	9.7	29.5	54.0
0.208500	10.6	9.000	Off	N	9.7	42.7	53.3
0.226500	23.2	9.000	Off	N	9.7	29.4	52.6
0.563000	33.8	9.000	Off	N	9.7	12.2	46.0
0.977000	21.7	9.000	Off	N	9.7	24.3	46.0
1.017500	20.9	9.000	Off	N	9.7	25.1	46.0
1.139000	17.9	9.000	Off	N	9.7	28.1	46.0
1.161500	19.0	9.000	Off	N	9.7	27.0	46.0
1.175000	18.5	9.000	Off	N	9.7	27.5	46.0
1.202000	20.1	9.000	Off	N	9.7	25.9	46.0
18.284000	20.1	9.000	Off	N	10.3	29.9	50.0
18.405500	20.9	9.000	Off	N	10.3	29.1	50.0
18.513500	20.9	9.000	Off	N	10.3	29.1	50.0
18.545000	20.8	9.000	Off	N	10.3	29.2	50.0
18.563000	20.9	9.000	Off	N	10.3	29.1	50.0
18.617000	20.8	9.000	Off	N	10.3	29.2	50.0

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9. LIST OF TEST EQUIPMENT

9.1 LIST OF TEST EQUIPMENT(Conducted Test)

Manufacturer	Model / Equipment	Calibration Date	Calibration Interval	Calibration Due	Serial No.
Rohde & Schwarz	ENV216/ LISN	01/29/2014	Annual	01/29/2015	100073
Agilent	E4440A/ Spectrum Analyzer	04/09/2014	Annual	04/09/2015	US45303008
Agilent	N9020A/ SIGNAL ANALYZER	05/23/2014	Annual	05/23/2015	MY51110063
Agilent	N1911A/Power Meter	01/24/2014	Annual	01/24/2015	MY45100523
*Agilent	*N1921A /POWER SENSOR	07/09/2014	Annual	07/09/2015	MY45241059
DIGITAL	EP-3010 /DC POWER SUPPLY	10/29/2013	Annual	10/29/2014	3110117
ITECH	IT6720 / DC POWER SUPPLY	11/05/2013	Annual	11/05/2014	010002156287001199
Agilent	8493C / Attenuator(10 dB)	07/24/2013	Annual	07/24/2014	76649

9.2 LIST OF TEST EQUIPMENT(Radiated Test)

Manufacturer	Model / Equipment	Calibration Date	Calibration Interval	Calibration Due	Serial No.
Schwarzbeck	VULB 9160/ TRILOG Antenna	12/17/2012	Biennial	12/17/2014	3150
Rohde & Schwarz	ESCI / EMI TEST RECEIVER	01/24/2014	Annual	01/24/2015	100584
HD	MA240/ Antenna Position Tower	N/A	N/A	N/A	556
EMCO	1050/ Turn Table	N/A	N/A	N/A	114
HD GmbH	HD 100/ Controller	N/A	N/A	N/A	13
HD GmbH	KMS 560/ SlideBar	N/A	N/A	N/A	12
Rohde & Schwarz	SCU-18/ Signal Conditioning Unit	09/10/2013	Annual	09/10/2014	10094
CERNEX	CBL18265035 / POWER AMP	07/24/2013	Annual	07/24/2014	22966
Schwarzbeck	BBHA 9120D/ Horn Antenna	07/05/2013	Biennial	07/05/2015	1151
Schwarzbeck	BBHA9170 / Horn Antenna(15 GHz ~ 40 GHz)	10/30/2012	Biennial	10/30/2014	BBHA9170124
Rohde & Schwarz	FSP / Spectrum Analyzer	01/24/2014	Annual	01/24/2015	839117/011
Wainwright Instrument	WHF3.0/18G-10EF / High Pass Filter	02/03/2014	Annual	02/03/2015	F6
Wainwright Instrument	WRCJ2400/2483.5-2370/2520-60/14SS / Band Reject Filter	06/17/2014	Annual	06/17/2015	1
Rohde & Schwarz	LOOP ANTENNA	08/14/2012	Biennial	08/14/2014	100179
CERNEX	CBLU1183540 / POWER AMP	07/24/2013	Annual	07/24/2014	22964