TEST REPORT

of

FCC Part 15 Subpart C §15.247 / RSS-210 Issue8, RSS-Gen Issue 3

FCC ID/IC Certification : A3LXE503C32 / 649E-XE503C32

Equipment Under Test	:	SAMSUNG NOTE PC
Model Name	:	XE503C32
Applicant	:	SAMSUNG ELECTRONICS CO., LTD.
Manufacturer	:	SAMSUNG ELECTRONICS CO., LTD.
Date of Test(s)	:	2014. 02. 14 ~ 2014. 03. 07
Date of Issue	:	2014. 03. 11

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

Tested By: **Date:** **2014. 03. 11**

Wonjun Sim

Approved By: **Date:** **2014. 03. 11**

Feel Jeong

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1. General Information

1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory).
- Wireless Div. 3FL, 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 435-040

All SGS services are rendered in accordance with the applicable SGS conditions of service available on request and accessible at http://www.sgs.com/en/Terms-and-Conditions.aspx.

Phone No. : +82 31 428 5700
Fax No. : +82 31 427 2370

1.2. Details of Applicant

Applicant : SAMSUNG ELECTRONICS CO., LTD.
Address : 129, Samsung-Ro, Yeongtong-Gu, Suwon-Si, Gyeonggi-Do, Korea
Contact Person : Lee, Sang-Cheong
Phone No. : +82 31 277 4784
Fax No. : +82 31 277 9247

1.3. Description of EUT

Kind of Product		SAMGSUNG NOTE PC
Model Name		XE503C32
Power Supply		DC 7.6 V
Frequency Range		2 402 ㎒ ~ 2 480 ㎒ (BT, BT LE), 2 412 ㎒ ~ 2 462 ㎒ (11b/g/n_HT20), 2 422 ㎒ ~ 2 452 ㎒ (11n_HT40), 5 745 ㎒ ~ 5 825 ㎒ (11a/n_HT20, 11ac_VHT20), 5 755 ㎒ ~ 5 795 ㎒ (11n_HT40, 11ac_VHT40), 5 775 ㎒ (11ac_VHT80), 5 180 ㎒ ~ 5 240 ㎒ (11a/n_HT20 – Non DFS, 11ac_VHT20 – Non DFS), 5 190 ㎒ ~ 5 230 ㎒ (11n_HT40 – Non DFS, 11ac_VHT40 – Non DFS), 5 210 ㎒ (11ac_VHT80 – Non DFS), 5 260 ㎒ ~ 5 320 ㎒ (11a/n_HT20 – DFS, 11ac_VHT20 – DFS), 5 270 ㎒ ~ 5 310 ㎒ (11n_HT40 – DFS, 11ac_VHT40 – DFS), 5 290 ㎒ (11ac_VHT80 – DFS), 5 500 ㎒ ~ 5 720 ㎒ (11a/n_HT20 – DFS, 11ac_VHT20 – DFS), 5 510 ㎒ ~ 5 710 ㎒ (11n_HT40 – DFS, 11ac_VHT40 – DFS), 5 530 ㎒ ~ 5 690 ㎒ (11ac_VHT80 – DFS)
Modulation Technique		DSSS, OFDM, GFSK, π/4DQPSK, 8DPSK
Number of Channels		11 channel (11b/g/n_HT20), 7 channel (11n_HT40), 5 channel (11a/n_HT20, 11ac_VHT20), 2 channel (11n_HT40, 11ac_VHT40), 1 channel (11ac_VHT80), 4 channel (11a/n_HT20–Non DFS, 11ac_VHT20–Non DFS), 2 channel (11n_HT40 – Non DFS, 11ac_VHT40–Non DFS), 1 channel (11ac_VHT80–Non DFS), 9 channel (11a/n_HT20 – DFS, 11ac_VHT20 – DFS), 7 channel (11n_HT40 – DFS, 11ac_VHT40 – DFS), 3 channel (11ac_VHT80 – DFS), 79 channel (BT,), 40 channel (BT LE)
Antenna Type		Internal type (MIMO)
Antenna Gain	**ANT0 (Main)**	2 402 ㎒ ~ 2 480 ㎒, 2 412 ㎒ ~ 2 472 ㎒: -2.60 ㏈i, 5 180 ㎒ ~ 5 320 ㎒: -1.88 ㏈i,5 500 ㎒ ~ 5 700 ㎒: -3.55 ㏈i, 5 745 ㎒ ~ 5 805 ㎒: -3.99 ㏈i
	ANT1 (Aux)	2 402 ㎒ ~ 2 480 ㎒, 2 412 ㎒ ~ 2 472 ㎒: -3.08 ㏈i, 5 180 ㎒ ~ 5 320 ㎒: -3.29 ㏈i,5 500 ㎒ ~ 5 700 ㎒: -3.77 ㏈i, 5 745 ㎒ ~ 5 805 ㎒: -3.97 ㏈i

1.4. Declaration by the manufacturer

- N/A

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1.5. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal Date	Cal Interval	Cal Due.
Signal Generator	R&S	SMR40	100272	Aug. 23, 2013	Annual	Aug. 23, 2014
Signal Generator	R&S	8648D	3847M00534	Mar. 28, 2013	Annual	Mar. 28, 2014
Spectrum Analyzer	Agilent	N9030A	US51350132	Oct. 08, 2013	Annual	Oct. 08, 2014
Attenuator	AEROFLEX / INMET	26A-10dB	3	Apr. 05, 2013	Annual	Apr. 05, 2014
Power Divider	KRYTAR	6005265	144967	May 29, 2013	Annual	May 29, 2014
High Pass Filter	Wainwright	WHK3.0/18G-10SS	344	Jun. 08, 2013	Annual	Jun. 08, 2014
High Pass Filter	Wainwright	WHK7.5/26.5G-6SS	11	Jun. 08, 2013	Annual	Jun. 08, 2014
Low Pass Filter	Mini circuits	NLP-1200+	V8979400903-2	Mar. 30, 2013	Annual	Mar. 30, 2014
Power Sensor	R&S	NRP-Z81	100669	Apr. 05. 2013	Annual	Apr. 05. 2014
Preamplifier	H.P.	8447F	2944A03909	Jun. 28, 2013	Annual	Jun. 28, 2014
Preamplifier	R&S	SCU 18	1391123	Sep. 30, 2013	Annual	Sep. 30, 2014
Preamplifier	MITEQ Inc.	JS44-18004000-35-8P	1546891	Jun. 13, 2013	Annual	Jun. 13, 2014
Test Receiver	R&S	ESU26	100109	Mar. 04, 2014	Annual	Mar. 04, 2015
Bilog Antenna	SCHWARZBECK MESSELEKTRONIK	VULB9163	396	Jun. 07, 2013	Biennial	Jun. 07, 2015
Loop Antenna	R&S	HFH2-Z2	100118	Jul. 12, 2013	Biennial	Jul. 12, 2015
Horn Antenna	R&S	HF906	100326	Nov. 01, 2013	Biennial	Nov. 01, 2015
Horn Antenna	SCHWARZBECK MESSELEKTRONIK	BBHA9170	BBHA9170431	May 15, 2012	Biennial	May 15, 2014
Antenna Master	INN-CO	MM4000	N/A	N.C.R.	N/A	N.C.R.
Turn Table	INN-CO	DS 1200S	N/A	N.C.R.	N/A	N.C.R.
Anechoic Chamber	SY Corporation	L × W × H (6.5 m × 3.5 m × 3.5 m)	N/A	N.C.R.	N/A	N.C.R.
EMI Test Receiver	R&S	ESHSI0	863365/018	Jun, 27. 2013	Annual	Jun, 27. 2014
Two-Line V-Network	R&S	ENV216	100190	Jan. 02, 2014	Annual	Jan. 02, 2015
Anechoic Chamber	SY Corporation	L × W × H (9.6 m × 6.4 m × 6.6 m)	N/A	N.C.R.	N/A	N.C.R.

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1.6. Summary of Test Results

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part15 Subpart C § 15.247, RSS-210 Issue8, RSS-Gen Issue3			
Standard section		**Test Item(s)**	**Result**
15.205 15.209 15.247(d)	RSS-210 A8.5	Transmitter Radiated Spurious Emissions Conducted Spurious Emission	Complied
15.247(a)(2)	RSS-210 A8.2(a) RSS-Gen 4.6.1	6 ㎧ Bandwidth and 99% Occupied Bandwidth	Complied
15.247(b)(3)	RSS-210 A8.4(4)	Maximum Conducted Output Power	Complied
15.247(e)	RSS-210 A8.3(2)	Power Spectral Density	Complied
15.207	RSS-Gen 7.2.4	Transmitter AC Power Line Conducted Emission	Complied

1.7. Test Procedure(s)

The measurement procedures described in the American National Standard for Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9 ㎑ to 40 ㎓ (ANSI C63.4-2003) and the guidance provided in KDB 558074_v03r01 were used in the measurement of the DUT.

1.8. Sample calculation

Where relevant, the following sample calculation is provided:

1.8.1. Conducted test

Offset value (㎧) = Attenuator (㎧) + Cable loss (㎧)

1.8.2. Radiation test

Field strength level (㎧㎶/m) = Measured level (㎧㎶) + Antenna factor (㎧) + Cable loss (㎧) - amplifier (㎧)

1.9. Test report revision

Revision	Report number	Description
0	F690501/RF-RTL007477	Initial

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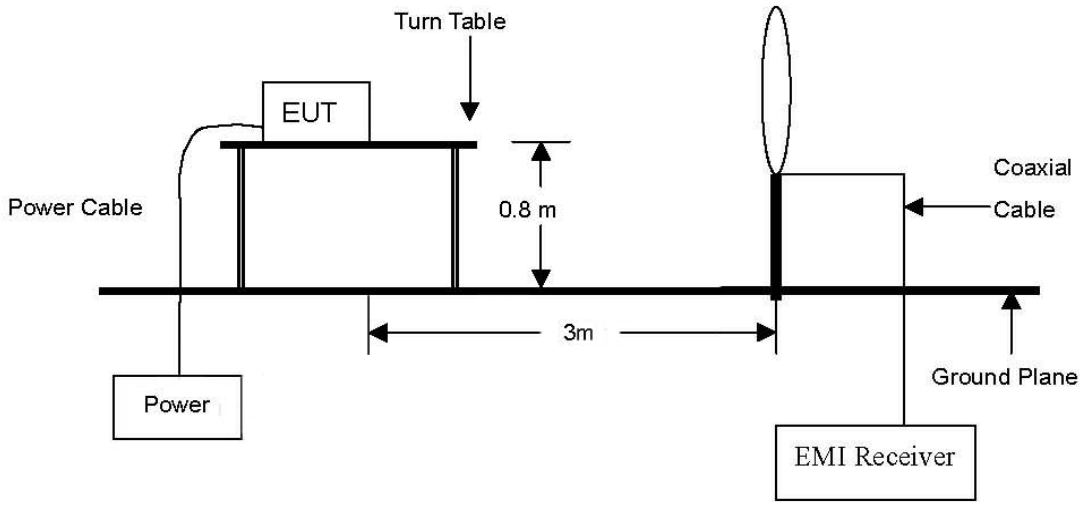
2. Transmitter Radiated Spurious Emissions and Conducted Spurious Emission

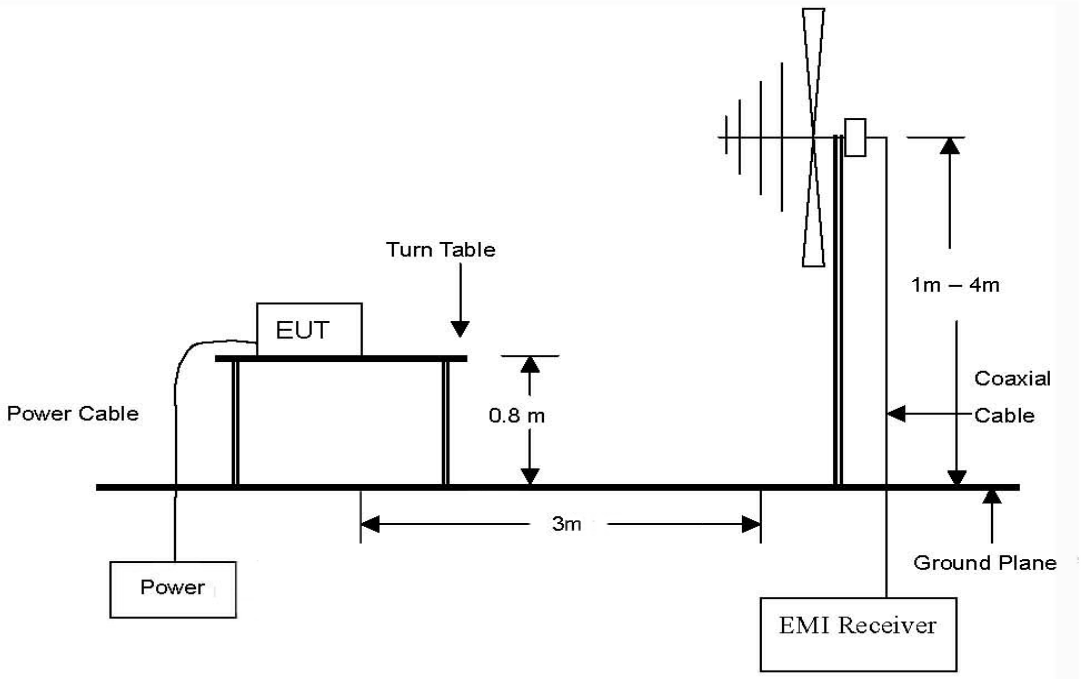
2.1. Test Setup

2.1.1. Transmitter Radiated Spurious Emissions

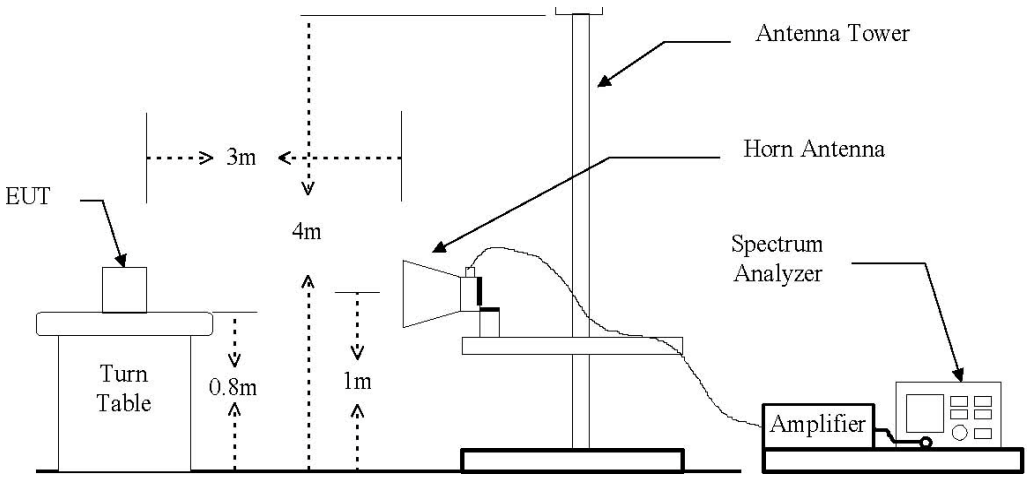
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions.



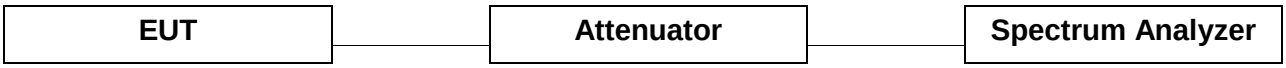
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission .The spurious emissions were investigated form 1 ㎓ to the 10th harmonic of the highest fundamental frequency or 40 ㎓, whichever is lower.



2.1.2. Conducted Spurious Emissions



2.2. Limit

According to §15.247(d), in any 100 ㎑ 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 ㏈ below that in the 100 ㎑ 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 ㏈ instead of 20 ㏈. Attenuation below the general limits specified in section §15.209(a) is not required. In addition, radiated emission which in the restricted band, as define in section §15.205(a), must also comply the radiated emission limits specified in section §15.209(a) (see section §15.205(c))

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According to § 15.209(a), Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table：

Frequency (㎒)	Distance (Meters)	Field Strength (㏈μV/m)	Field Strength (μV/m)
30 - 88	3	40.0	100
88 – 216	3	43.5	150
216 – 960	3	46.0	200
Above 960	3	54.0	500

2.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates in section 11.0 & 12.0 of KDB 558074_v03r01

2.3.1. Test Procedures for Radiated Spurious Emissions

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 ㎓, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 ㎓, the EUT was set 3 meter away from the interference-receiving antenna.
3. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10 ㏈ lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 ㏈ margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

NOTE;

All data rates and modes were investigated for radiated spurious emissions. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

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1. Unwanted Emissions into Non-Restricted Frequency Bands
- The Reference Level Measurement refer to section 11.2
  Set analyzer center frequency to DTS channel center frequency, SPAN ≥ 1.5 times the DTS channel bandwidth, the RBW = 100 ㎑ and VBW ≥ 3 x RBW, Detector = Peak, Sweep time = Auto couple, Trace = Max hold

- Unwanted Emissions Level Measurement refer to section 11.3
  Set the center frequency and span to encompass frequency range to be measured, the RBW = 100 ㎑ and VBW ≥ 3 x RBW, Detector = Peak, Ensure that the number of measurement points ≥span/RBW, Sweep time = Auto couple, Trace = Max hold

2. Unwanted Emissions into Restricted Frequency Bands
- Peak Power measurement procedure refer to section 12.2.4
  Set RBW = 1 ㎒, VBW ≥ 3 x RBW, SPAN ≥ RBW, Detector = Peak, Sweep time = Auto couple, Trace = Max hold

-Average Power measurements procedure refer to section 12.2.5.2
  The EUT shall be configured to operate at the maximum achievable duty cycle. Measure the duty cycle x, RBW = 1 ㎒, VBW ≥ 3 x RBW, Detector = RMS, if span/(# of points in sweep) ≤(RBW/2). Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied then the detector mode shall be set to peak, Averaging type = power(i.e., RMS). 1) As an alternative the detector and averaging type may be set for linear voltage averaging.

Some instruments require linear display mode in order to use linear voltage averaging. Log or �dB averaging shall not be used. Sweep time = auto, Perform a trace average of at least 100 traces.
A correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:

1) If power averaging(RMS) mode was used in step f), then the applicable correction factor is 10log(1/x), where x is the duty cycle.
2) If linear voltage averaging mode was used in step f), then the applicable correction factor is 20log(1/x), where x is the duty cycle.
3) If a specific emission is demonstrated to be continuous (≥98 percent duty cycle) rather than turning on and off with the transmit cycle, then no duty cycle correction is required for that emission.

3. To get a maximum emission level from the EUT, the EUT is manipulated through three orthogonal planes.

2.3.2. Test Procedures for Conducted Spurious Emissions

All data rates and modes were investigated for conducted spurious emissions. Only the conducted emissions of the configuration that produced the worst case emissions are reported in this section.

Per the guidance of KDB 558074_v03r01, section 11.1 & 11.2, the reference level for out of band emissions is established from the plots of this section since the band edge emissions are measured with a RBW of 100 ㎑. This reference level is then used as the limit in subsequent plots for out of band spurious emissions shown in section 2.4.3. The limit for out of band spurious emission at the band edge is 20 ㎑ or 30 ㎑ below the fundamental emission level measured in a 100 ㎑ bandwidth.

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2.4. Test Results

Ambient temperature : (23 ± 2) ℃
Relative humidity : 47 % R.H.

2.4.1. Spurious Radiated Emission (Worst case configuration_GFSK, Middle channel)

The frequency spectrum from 9 ㎑ to 1 000 ㎒ was investigated. Emission levels are not reported much lower than the limits by over 30 ㏈. All reading values are peak values.

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (㏈㎶)	Detect Mode	Pol.	AF (㏈/m)	AMP + CL (㏈)	Actual (㏈㎶/m)	Limit (㏈㎶/m)	Margin (㏈)
162.32	41.10	Peak	H	8.44	-25.64	23.90	43.50	19.60
243.48	46.16	Peak	H	13.59	-25.05	34.70	46.00	11.30
400.02	44.36	Peak	H	16.78	-25.14	36.00	46.00	10.00
639.36	35.12	Peak	V	20.22	-25.14	30.20	46.00	15.80
988.00	35.36	Peak	V	23.57	-23.33	35.60	54.00	18.40
Above 1 000.00	Not detected	-	-	-	-	-	-	-

Remark:

1. Actual = Reading + AF + AMP + CL

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2.4.2. Spurious Radiated Emission

The frequency spectrum above 1 000 ㎒ was investigated. Emission levels are not reported much lower than the limits by over 30 ㏈.

Operating Mode: GFSK(1 Mbps)

A. Low Channel (2 402 ㎒)

Radiated Emissions			Ant	Correction Factors			Total	FCC Limit	
Frequency (㎒)	Reading (㏈㎶)	Detect Mode	Pol.	AF (㏈/m)	CL (㏈)	Duty factor (㏈)	Actual (㏈㎶/m)	Limit (㏈㎶/m)	Margin (㏈)
*2 390.00	25.42	Peak	V	28.05	6.25	-	59.72	74.00	14.28
*2 390.00	15.63	Average	V	28.05	6.25	2.15	49.93	54.00	4.07

Radiated Emissions			Ant	Correction Factors			Total	FCC Limit	
Frequency (㎒)	Reading (㏈㎶)	Detect Mode	Pol.	AF (㏈/m)	AMP+ CL (㏈)	Duty factor (㏈)	Actual (㏈㎶/m)	Limit (㏈㎶/m)	Margin (㏈)
*4 804.12	54.38	Peak	V	32.28	-28.16	-	58.50	74.00	15.50
*4 804.12	44.92	Average	V	32.28	-28.16	2.15	49.04	54.00	4.96
Above 4 900.00	Not detected	-	-	-	-	-	-	-	-

B. Middle Channel (2 440 ㎒)

Radiated Emissions			Ant	Correction Factors			Total	FCC Limit	
Frequency (㎒)	Reading (㏈㎶)	Detect Mode	Pol.	AF (㏈/m)	AMP+ CL (㏈)	Duty factor (㏈)	Actual (㏈㎶/m)	Limit (㏈㎶/m)	Margin (㏈)
*4 880.36	53.31	Peak	V	32.84	-27.43	-	58.72	74.00	15.28
*4 880.36	45.06	Average	V	32.84	-27.43	2.15	50.47	54.00	3.53
Above 4 900.00	Not detected	-	-	-	-	-	-	-	-

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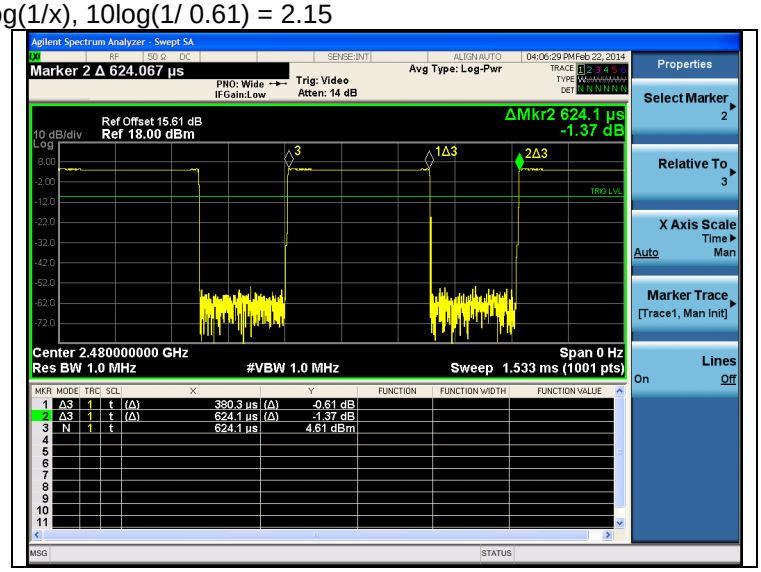
C. High Channel (2 480 ㎒)

Radiated Emissions			Ant	Correction Factors			Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Duty factor (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*2 483.50	29.01	Peak	V	28.31	6.27	-	63.59	74.00	10.41
*2 483.50	14.95	Average	V	28.31	6.27	2.15	49.53	54.00	4.47

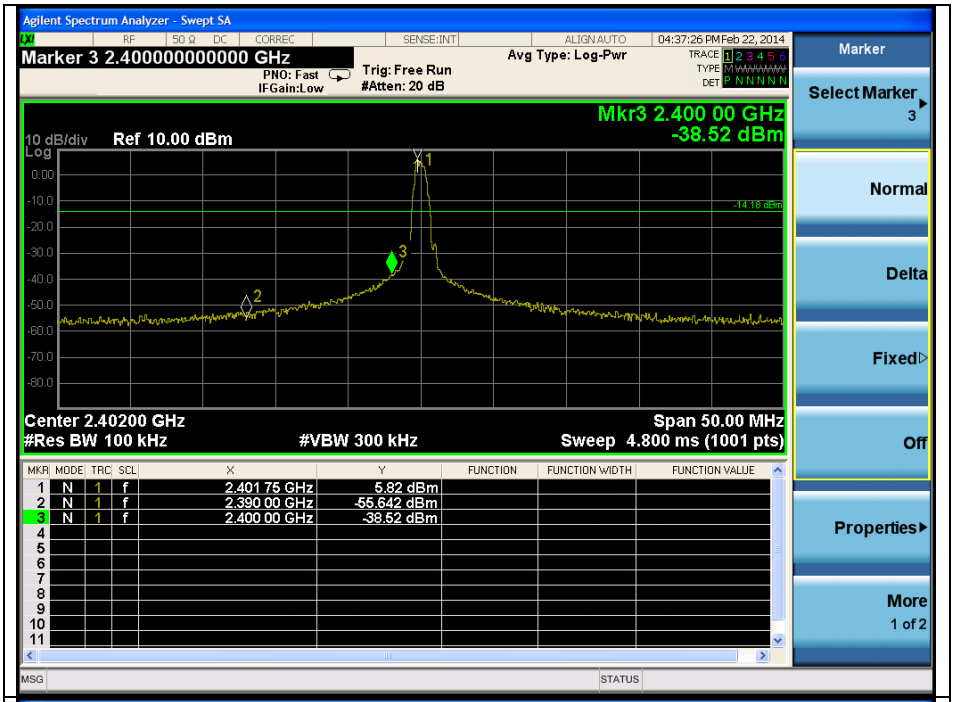
Radiated Emissions			Ant	Correction Factors			Total	FCC Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+ CL (dB)	Duty factor (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
*4 960.22	52.55	Peak	V	33.31	-28.14	-	57.72	74.00	16.28
*4 960.22	44.42	Average	V	33.31	-28.14	2.15	49.59	54.00	4.41
Above 5 000.00	Not detected	-	-	-	-	-	-	-	-

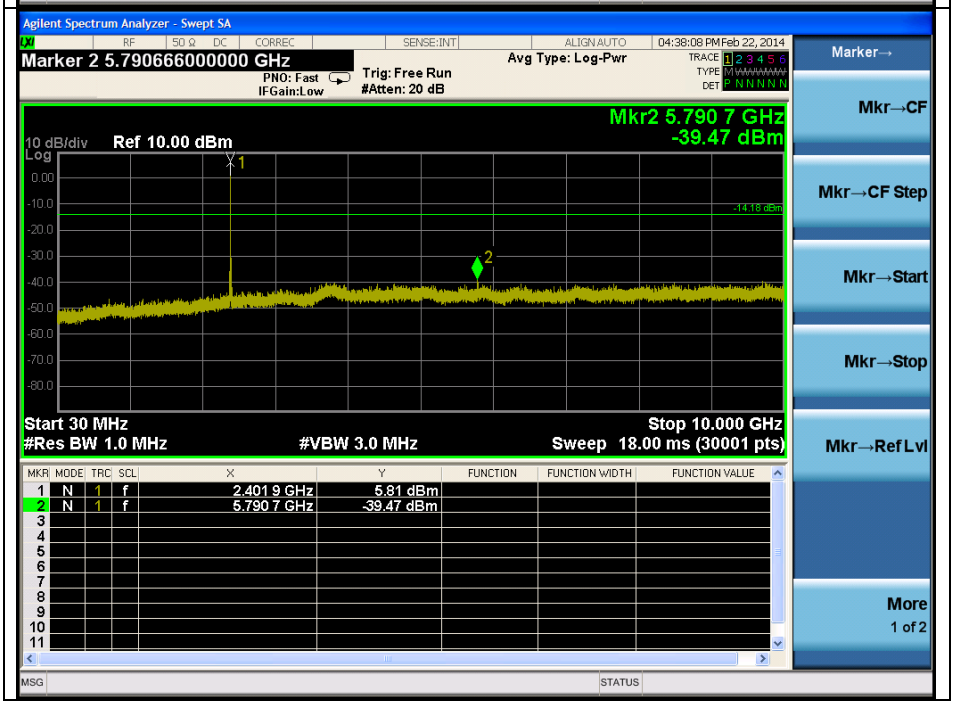
Remarks;
1. "*" means the restricted band.
2. Measuring frequencies from 1 ㎓ to the 10th harmonic of highest fundamental Frequency.
3. Radiated emissions measured in frequency above 1 000 ㎒ were made with an instrument using peak/average detector mode.
4. Average test would be performed if the peak result were greater than the average limit.
5. Actual = Reading + AF + AMP + CL
6. Duty cycle (x) = Tx(on) / Tx(on+off) = 0.61
7. Duty factor = 10log(1/x), 10log(1/ 0.61) = 2.15

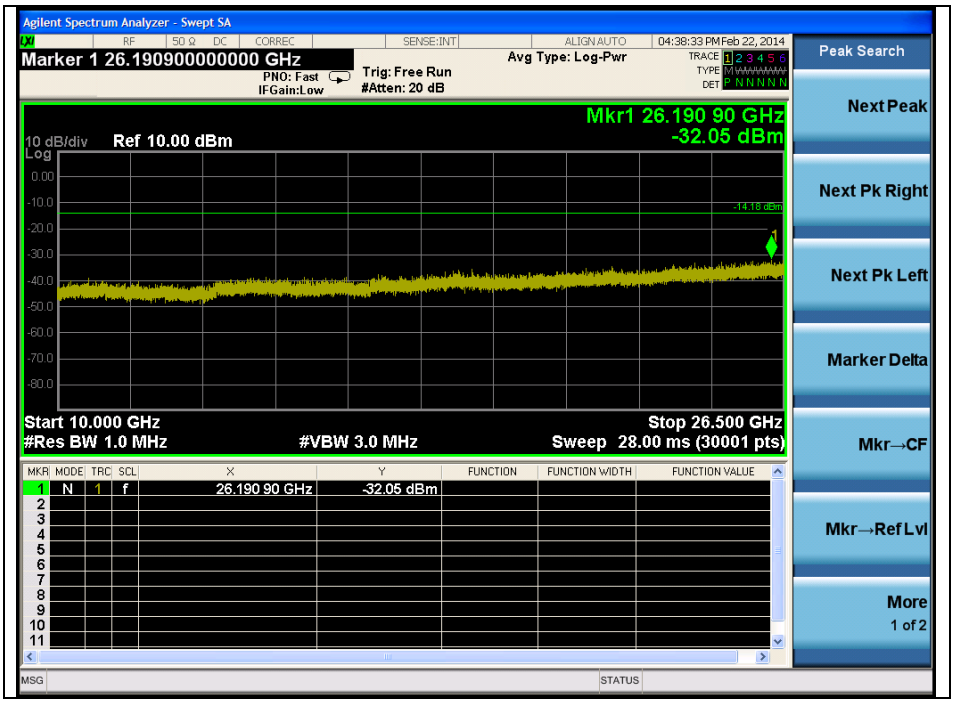


2.4.3. Spurious RF Conducted Emissions: Plot of Spurious RF Conducted Emission
Operating Mode: GFSK(1 Mbps)

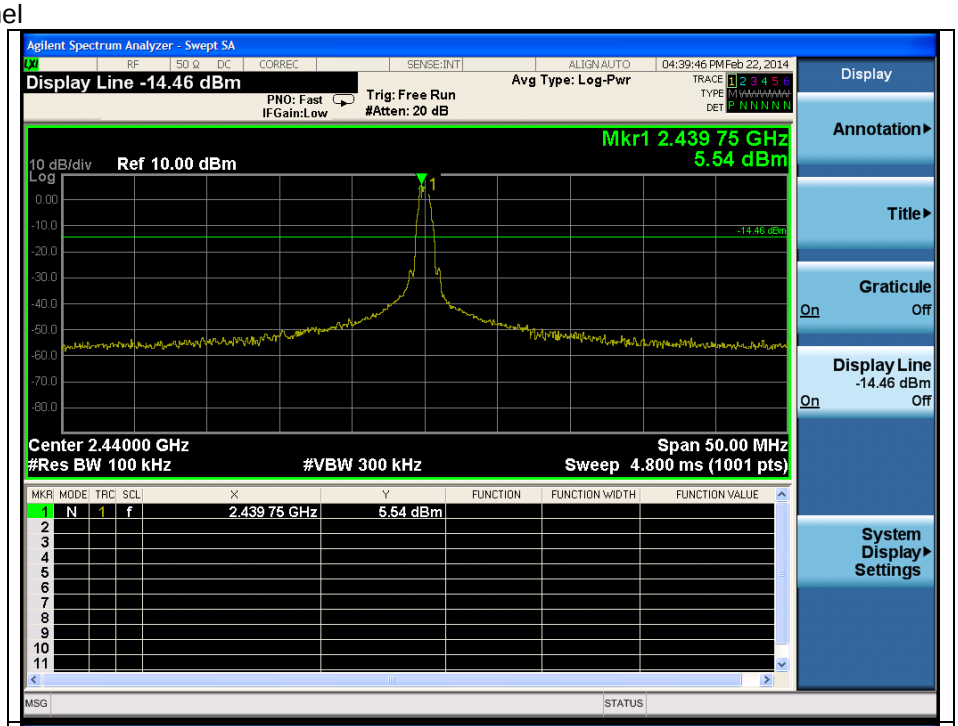
Low Channel

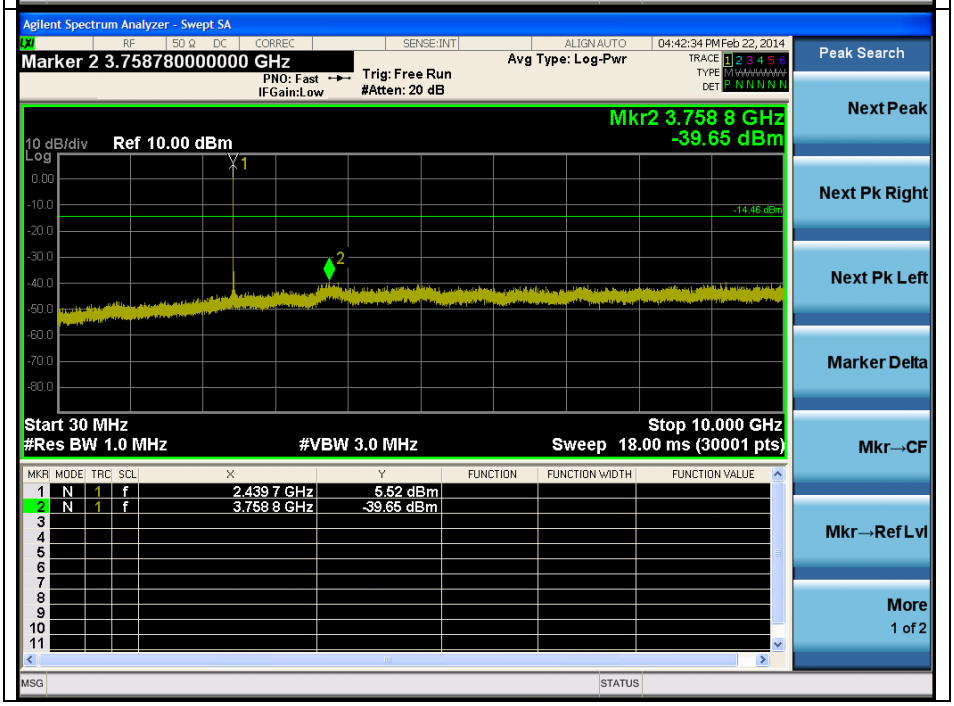


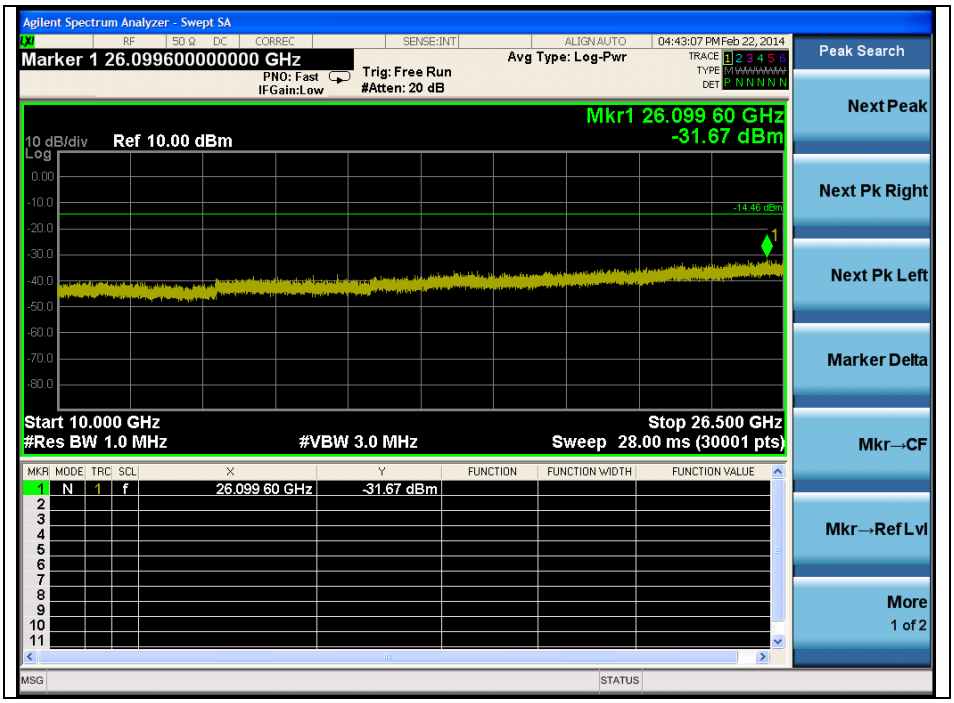



Agilent Spectrum Analyzer - Swept SA
Marker 1 26.190900000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
04:38:33 PM Feb 22, 2014
Mkr1 26.190 90 GHz
-32.05 dBm
10 dB/div
Ref 10.00 dBm
Log
-14.18 dBm
Start 10.000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 26.500 GHz
Sweep 28.00 ms (30001 pts)
1 N 1 f 26.190 90 GHz -32.05 dBm
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

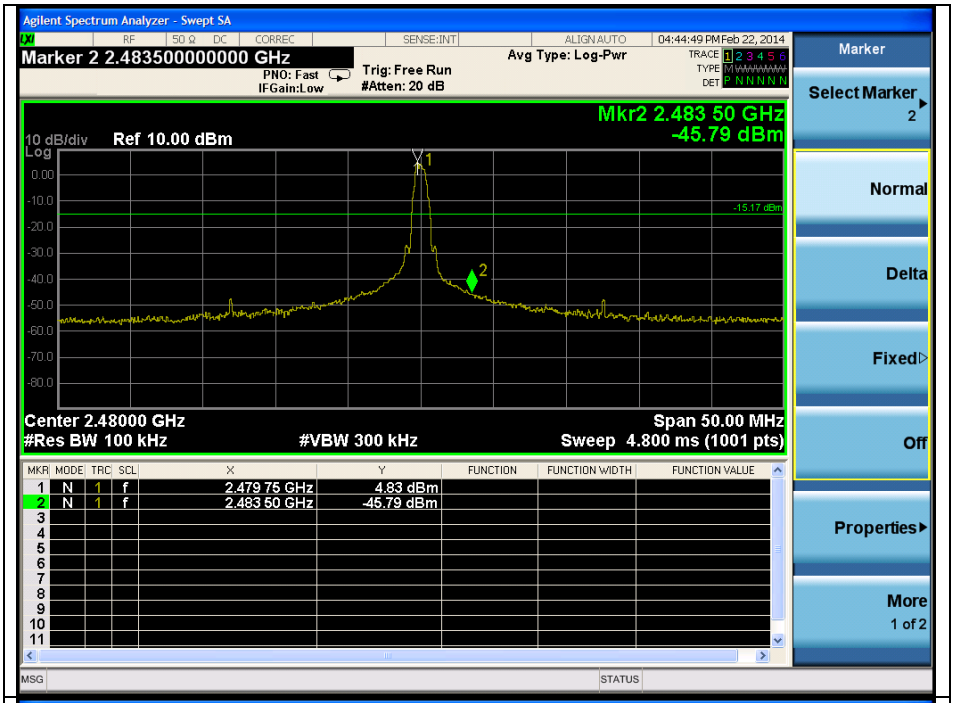
Middle Channel

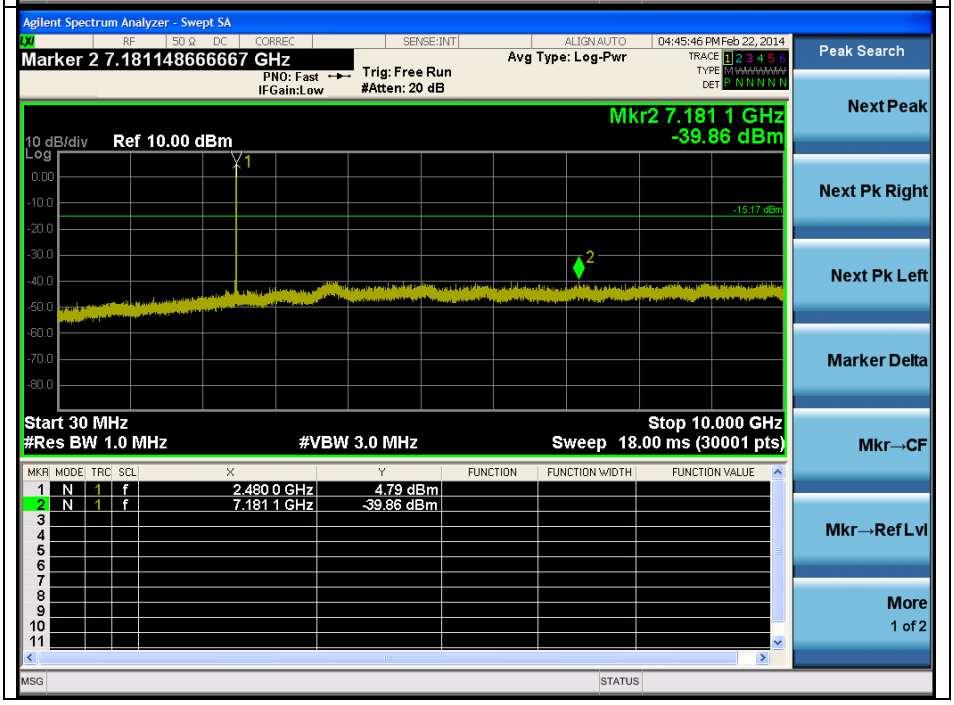


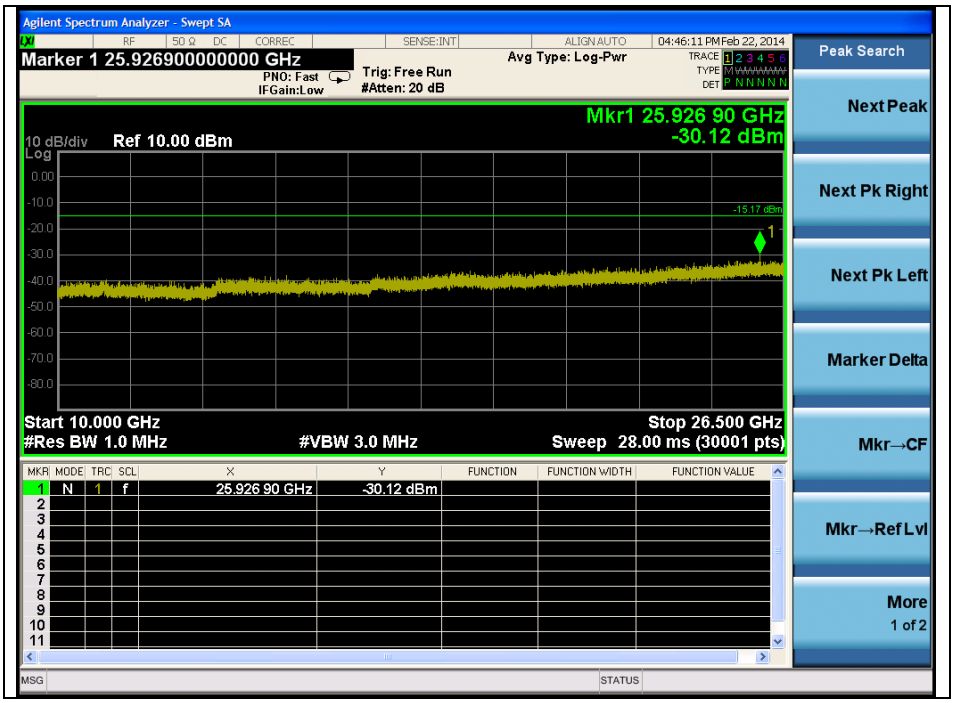



Agilent Spectrum Analyzer - Swept SA
Marker 1 26.099600000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
04:43:07 PM Feb 22, 2014
Mkr1 26.099 60 GHz
-31.67 dBm
10 dB/div
Ref 10.00 dBm
Log
-14.46 dBm
Start 10.000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 26.500 GHz
Sweep 28.00 ms (30001 pts)
1 N 1 f 26.099 60 GHz -31.67 dBm
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

High Channel






Agilent Spectrum Analyzer - Swept SA
Marker 1 25.926900000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
04:46:11 PM Feb 22, 2014
Mkr1 25.926 90 GHz
-30.12 dBm
10 dB/div
Ref 10.00 dBm
Start 10.000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 26.500 GHz
Sweep 28.00 ms (30001 pts)
1 N 1 f 25.926 90 GHz -30.12 dBm
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

3. 6 ㏈ Bandwidth Measurement and 99% Occupied Bandwidth

3.1. Test Setup

EUT	—	Attenuator	—	Spectrum Analyzer

3.2. Limit

According to §15.247(a)(2), systems using digital modulation techniques may operate in the 902 ~928 ㎒, 2 400 ~ 2 483.5 ㎒, and 5 725 ~ 5 825 ㎒ bands. The minimum of 6 ㏈ Bandwidth shall be at least 500 ㎑

3.3. Test Procedure

3.3.1. 6 ㏈ Bandwidth

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.

The test follows section 8.0 of FCC KDB Publication 558074_v03r01
Tests performed using section 8.2 Option 2

- Option 2:
The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW ≥ 3 RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.

3.3.2. 99% Bandwidth

The test follows section 4.6.1 of RSS-Gen

1. Set the spectrum analyzer as SPAN = 2 or 3 times necessary bandwidth
2. RBW = approximately 1 % of the SPAN
3. VBW is set to 3 times RBW
4. Detector = Sample
5. Trace mode = max hold.
6. Measure lowest and highest frequencies are placed in a running sum until 0.5 % and 99.5 % of the total is reached.
7. Record 99% occupied bandwidth between the lowest and the highest frequencies repeat measurement for all the test channels.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

3.4. Test Results

Ambient temperature : (23 ± 2) ℃
Relative humidity : 47 % R.H.

Operation Mode	Channel	Channel Frequency (㎒)	Data Rate (Mbps)	6 ㏈ Bandwidth (㎒)	99 % Bandwidth (㎒)
GFSK	Low	2 402	1	0.654	1.006
	Middle	2 440	1	0.652	1.004
	High	2 480	1	0.652	1.006

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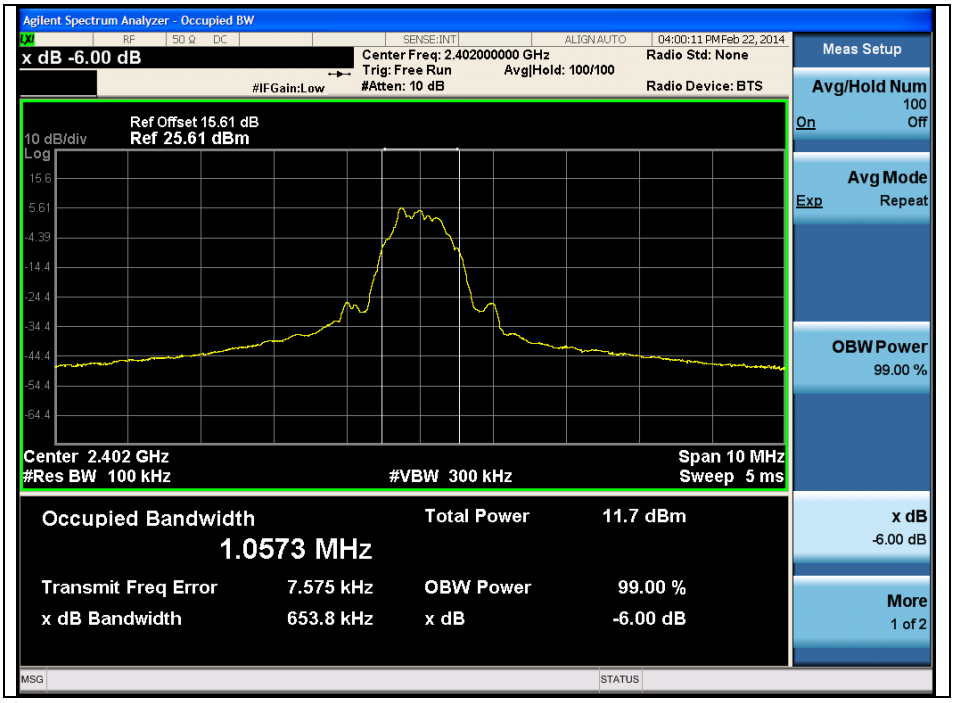
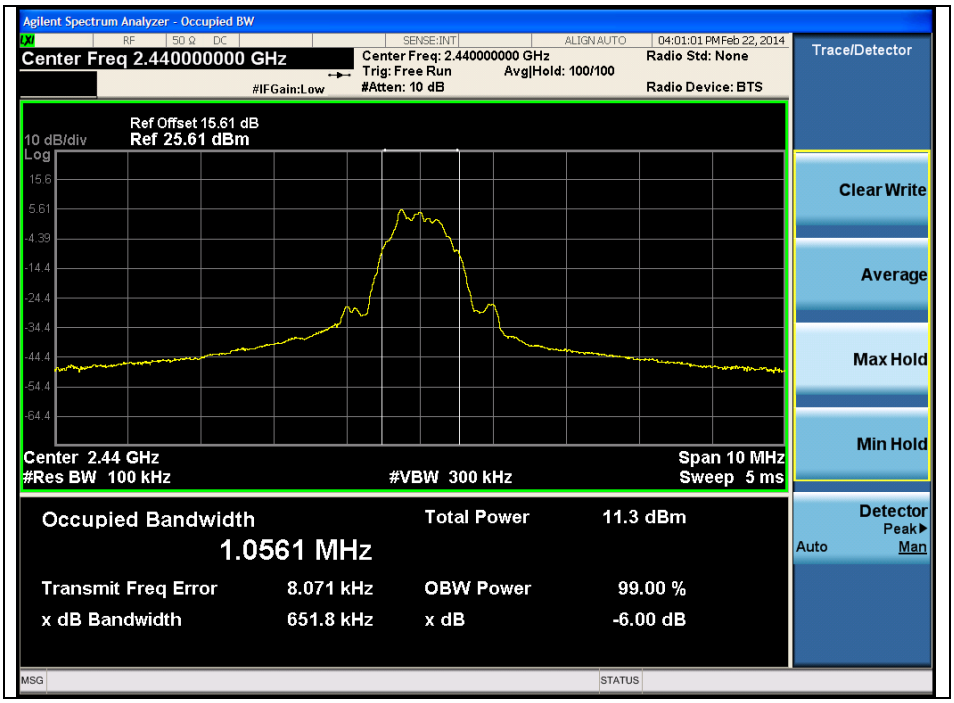
6 dB Bandwidth

Operating Mode: GFSK

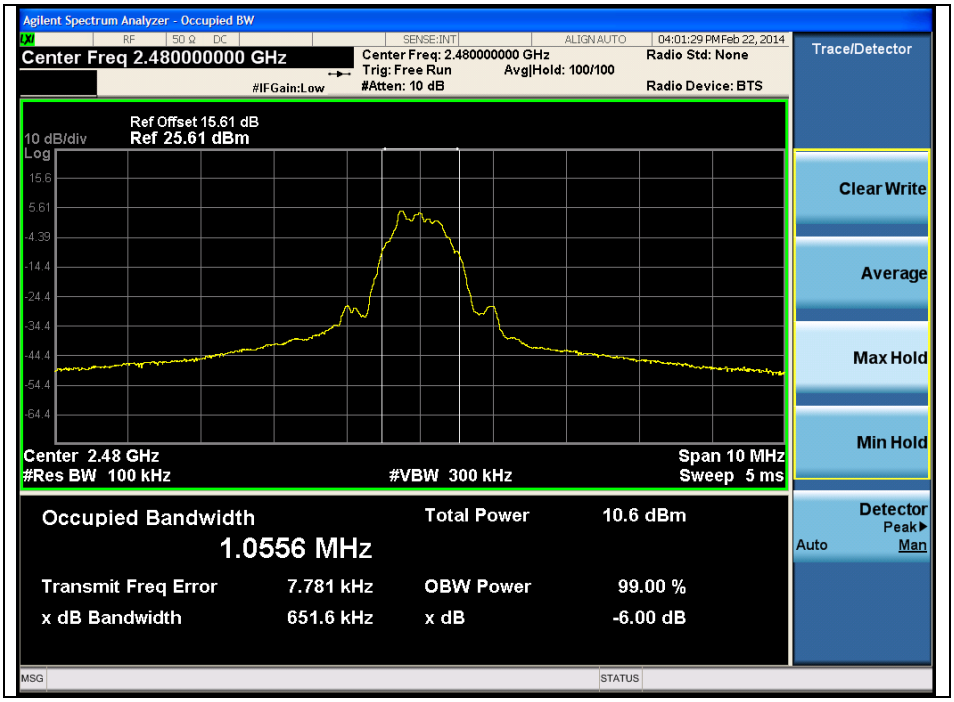
Low Channel



Middle Channel



High Channel



99% Bandwidth

Operating Mode: GFSK

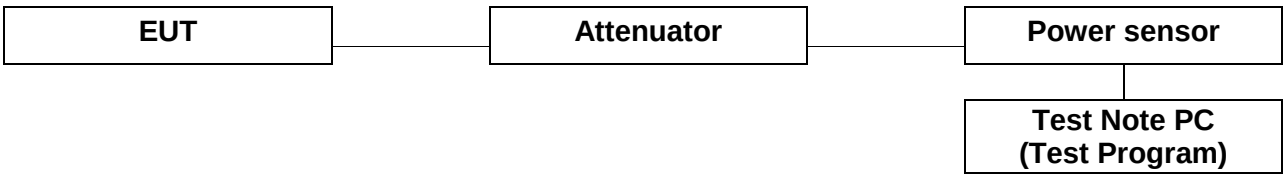
Low Channel

Middle Channel

High Channel

4. Maximum Conducted Output Power

4.1. Test Setup



4.2. Limit

According to §15.247(b)(3), for systems using digital modulation in the 902 ~ 928 ㎒, 2 400 ~2 483.5 ㎒, and 5 725 ~ 5 850 ㎒ band: 1 Watt. As an alternative to a peak power measurement, compliance with the one watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antenna elements. The average must not include any intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.
According to §15.247(b)(4), the conducted output power limit specified in paragraph(b) of this section is based on the use of antenna with directional gains that do not exceed 6 ㏈i. Except as shown in paragraph(c) of this section, if transmitting antenna of directional gain greater than 6 ㏈i are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraph (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in ㏈ that the directional gain of the antenna exceeds 6㏈i.

4.3. Test Procedure

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.

The test follows section 9.1.3 & 9.2.3 of FCC KDB Publication 558074_v03r01

- Peak power meter method

-The maximum peak conducted output power can be measured using a broad band peak RF power meter. The power meter must have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast, average-responding diode type detector.

- Average power meter method

- Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied.

1) The EUT is configured to transmit continuously, of to transmit with a constant duty factor.
2) At all times when the EUT is transmitting, it shall be transmitting at its maximum power control level.
3) The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

If the transmitter does not transmit continuously, measure the duty cycle (x) of the transmitter output signal as described in Section 6.0 of KDB 558074_v03r01.

Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.

Adjust the measurement in ㎧ m by adding 10 log(1/x), where x is the duty cycle to the measurement result.

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the broadband power meter and power sensor. The power sensor employs a VBW = 30 ㎒ which is greater than the DTS bandwidth
3. Measure peak & average power each channel.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

4.4. Test Results

Ambient temperature : (23 ± 2) ℃
Relative humidity : 47 % R.H.

Mode	Channel	Channel Frequency (㎒)	Data Rate (Mbps)	Attenuator + Cable offset (㏈)	Average power Result (㏈m)			Peak Power Result (㏈m)
					Reading	Duty factor	Result	
GFSK	Low	2 402	1	15.31	4.69	2.15	6.84	7.41
	Middle	2 440	1	15.33	4.48	2.15	6.63	7.28
	High	2 480	1	15.35	3.99	2.15	6.14	6.73

Note;
Average power result = Reading + Duty factor
Duty factor = 10log(1/x), x = Duty cycle

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

5. Power Spectral Density measurement

5.1. Test Setup

EUT	Attenuator	Spectrum Analyzer

5.2. Limit

§15.247(e) For digitally modulated system, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 �dB m in any 3 ㎑ band 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.

5.3. Test Procedure

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.

The measurements are recorded using the PKPSD measurement procedure in section 10.2 of KDB 558074_v03r01.

- This procedure shall be used of maximum peak conducted output power was used to demonstrate compliance, and is optional if the maximum conducted (average) output power was used to demonstrate compliance.

1. Set instrument center frequency to DTS channel center frequency.
2. Set span to at least 1.5 times the DTS bandwidth.
3. Set RBW to: 3 ㎑ ≤ RBW ≤ 100 ㎑.
4. Set VBW ≥ 3 x RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 ㎑) and repeat

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

5.4. Test Results

Ambient temperature : (23 ± 2) ℃
Relative humidity : 47 % R.H.

Mode	Channel	Frequency	Data Rate (Mbps)	Measured PSD (dB m)	Maximum Limit (dB m)
GFSK	Low	2 402 ㎒	1	5.632	8
	Middle	2 440 ㎒	1	5.380	8
	High	2 480 ㎒	1	4.639	8

Power spectral density measurement
Operating Mode: GFSK
Low Channel

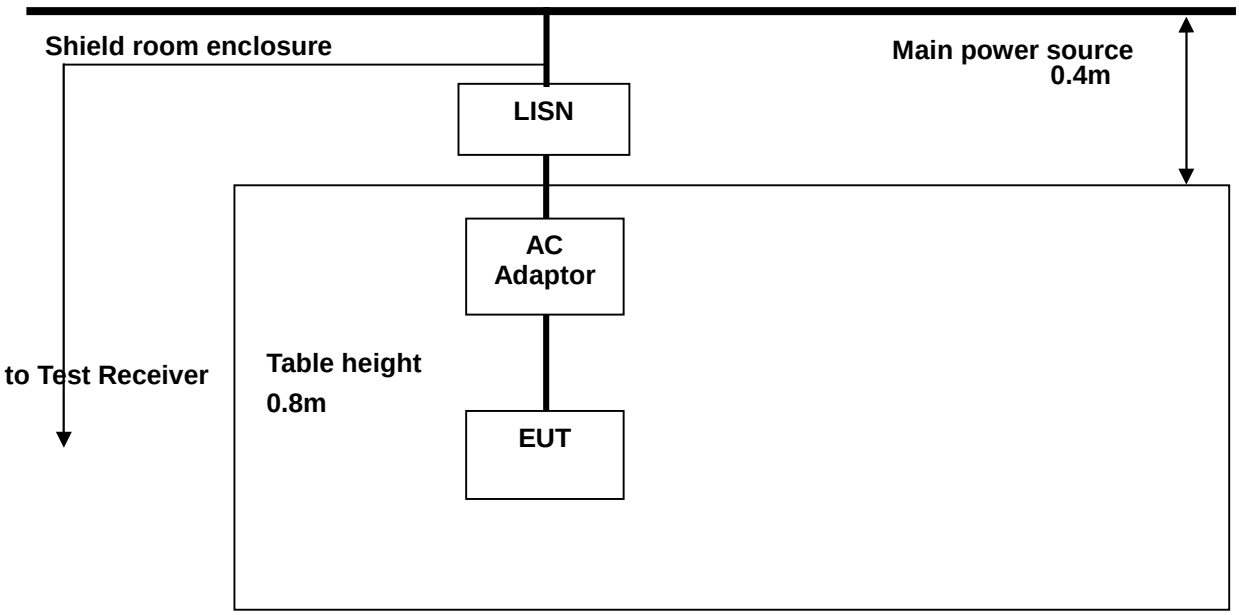
Middle Channel

High Channel

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

6. Transmitter AC Power Line Conducted Emission

6.1. Test Setup



6.2. Limit

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 ㎑ to 30 ㎒, shall not exceed the limits in the following table, as measured using a 50 uH/50 ohm line impedance stabilization network(LISN).
Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

Frequency of Emission (㎒)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15 – 0.50	66 - 56*	56 - 46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

* Decreases with the logarithm of the frequency.

6.3. Test Procedures

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.
AC line conducted emissions from the EUT were measured according to the dictates of ANSI C63.4-2003

1. The test procedure is performed in a 6.5m × 3.6m× 3.6m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m(W)× 1.5 m(L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
3. The excess power cable between the EUT and the LISN was bundled. All connecting cables of EUT were moved to find the maximum emission.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

6.4. Test Results (Worst case configuration_ GFSK, Middle channel)

The following table shows the highest levels of conducted emissions on both phase of Hot and Neutral line.

Ambient temperature : (23 ± 2) ℃
Relative humidity : 47 % R.H.

Frequency range : 0.15 ㎒ – 30 ㎒
Measured Bandwidth : 9 ㎑

FREQ.	LEVEL(dBμV)		LINE	LIMIT(dBμV)		MARGIN(dB)	
(㎒)	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.15	53.4	32.0	H	66.0	56.0	12.6	24.0
0.42	37.4	28.9	H	57.5	47.5	20.1	18.6
2.06	32.0	21.9	H	56.0	46.0	24.0	24.1
15.05	34.1	22.7	H	60.0	50.0	25.9	27.3
21.27	36.5	23.1	H	60.0	50.0	23.5	26.9
0.15	53.7	31.7	N	66.0	56.0	12.3	24.3
0.42	37.1	28.4	N	57.5	47.5	20.4	19.1
2.02	30.5	20.5	N	56.0	46.0	25.5	25.5
15.40	32.7	22.9	N	60.0	50.0	27.3	27.1
21.34	36.5	22.8	N	60.0	50.0	23.5	27.2

Note ;

1. Line (H): Hot, Line (N): Neutral
2. The limit for Class B device(s) from 150 ㎑ to 30 ㎒ are specified in Section of the Title 47 CFR.
3. Traces shown in plot mad using a peak detector and average detector
4. Deviations to the Specifications: None.

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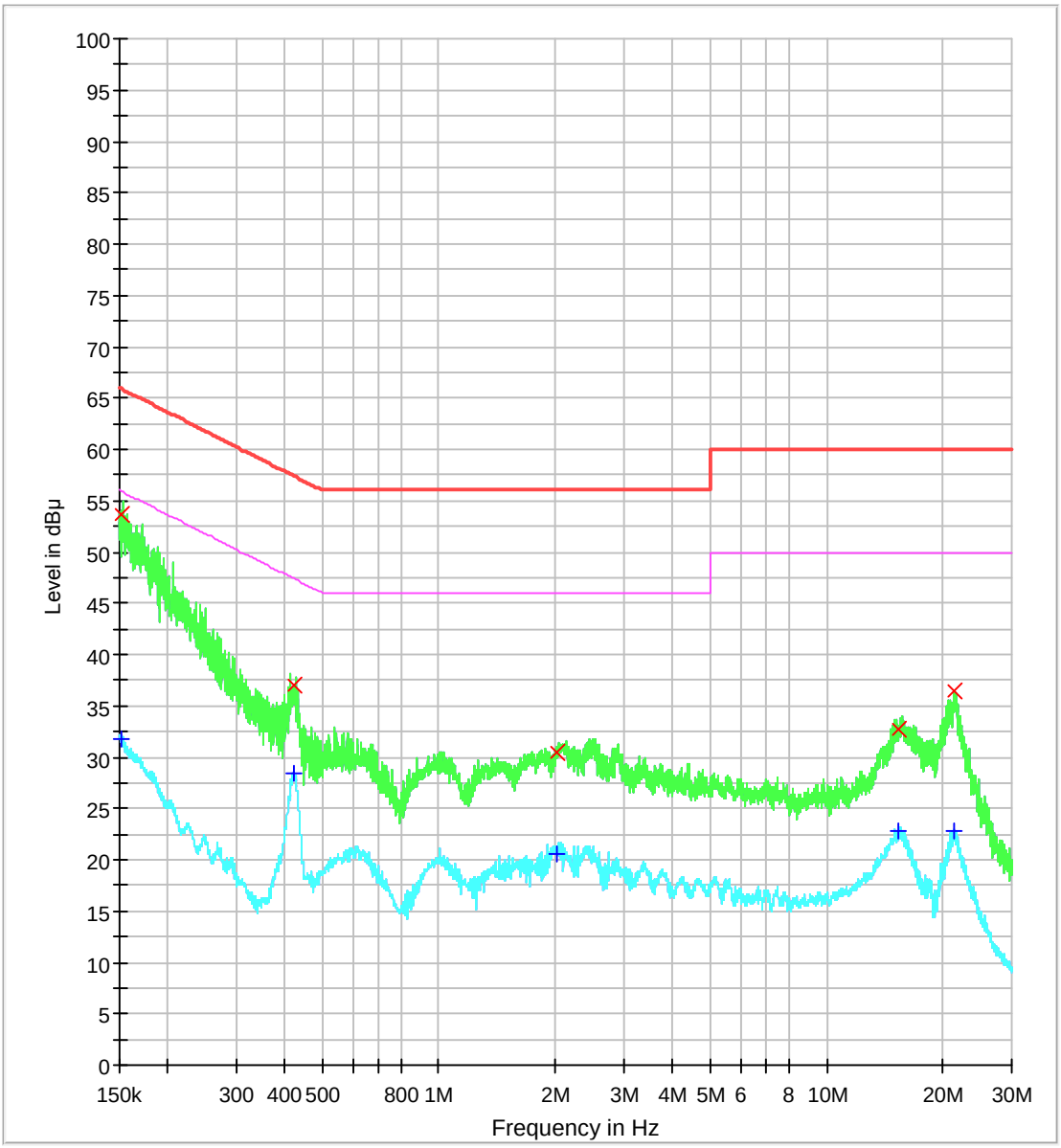
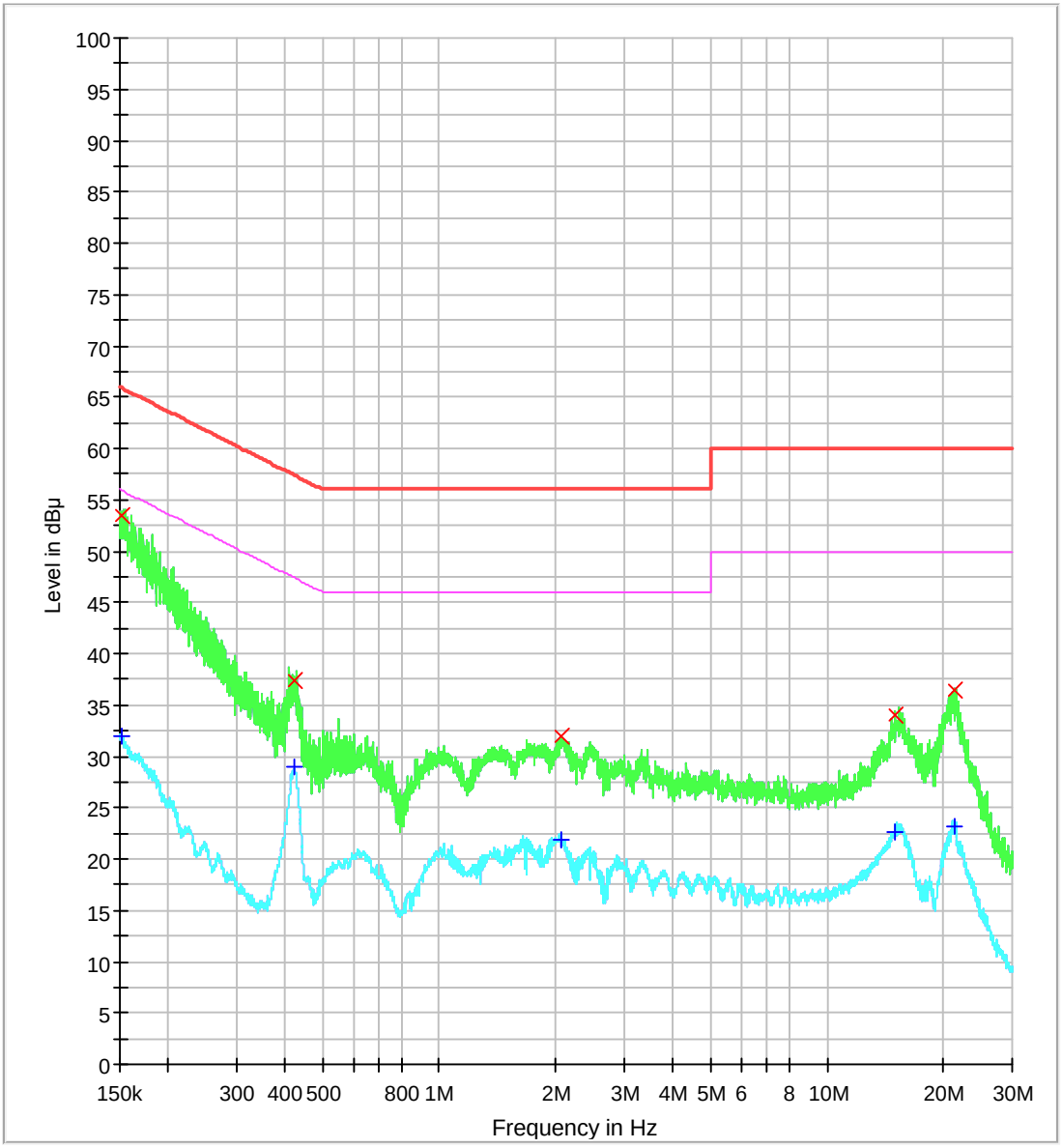
Plots of Conducted Power line

Test mode: (Neutral)



Test mode: (Hot)



7. Antenna Requirement

7.1. Standard Applicable

For intentional device, according to FCC 47 CFR Section §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. And according to FCC 47 CFR Section §15.247 (b) if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the gain of the antenna exceeds 6 dBi.

7.2. Antenna Connected Construction

Antenna used in this product is Integral type with gain of -3.08 dBi.

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