RF TEST REPORT

Test item	:	Motorcycle Bluetooth Communication System
Model No.	:	10U for Schuberth
Order No.	:	DTNC1503-01436, DTNC1503-01439
Date of receipt	:	2015-03-30
Test duration	:	2015-04-15 ~ 2015-04-30
Date of issue	:	2015-05-22
Use of report	:	FCC & IC Original Grant

Applicant : Sena Technologies,Inc.
210 Yangjae-dong Seocho-gu, Seoul, South Korea 137-130

Test laboratory : DT&C Co., Ltd.
42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 449-935

Test specification	:	FCC Part 15 Subpart C.247 RSS-210 Issue 8(2010-12) RSS-GEN Issue 4(2014-11)
Test environment	:	See appended test report
Test result	:	☒ Pass ☐ Fail

Tested by:

Engineer
KwiCheol Yeom

Reviewed by:

Technical Manager
HongHee Lee

Test Report Version

Test Report No.	Date	Description
DRTFCC1505-0098	May. 13, 2015	Initial issue
DRTFCC1505-0098(1)	May. 22, 2015	Add AVG Conducted Output Power

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1. GENERAL INFORMATION

Applicant	:	Sena Technologies,Inc.
Address	:	210 Yangjae-dong Seocho-gu, Seoul, South Korea 137-130
FCC ID	:	S7A-SP22
IC	:	8154A-SP22
EUT	:	Motorcycle Bluetooth Communication System
Model	:	10U for Schuberth
Additional Model(s)	:	NA
Data of Test	:	2015-04-15 ~ 2015-04-30
Contact person	:	Seunghyun KIM

2. EUT DESCRIPTION

Product	Motorcycle Bluetooth Communication System
Model Name	10U for Schuberth
Power Supply	DC 3.7 V
Battery type	Standard Battery: Lithium Ion Battery
Frequency Range	2402 ~ 2480 MHz (40 channels)
Max. RF Output Power	5.57 dBm
Modulation Type	GFSK
Antenna Specification	Antenna Type: External Antenna Gain: 0.60 dBi(PK)
Product SW/HW version	SW : 1.0 / HW : 1.0
Radio SW/HW version	SW : 1.0 / HW : 1.0
Test SW Version	2.5.0
RF power setting in TEST SW	NA

3. SUMMARY OF TESTS

FCC Part Section(s)	RSS Section(s)	Parameter	Limit	Test Condition	Status Note 1
I. Transmitter Mode (TX)					
15.247(a)	RSS-210 [A8.2]	6 dB Bandwidth	> 500 kHz	Conducted	**C**
15.247(b)	RSS-210 [A8.4]	Transmitter Output Power	< 1Watt		**C**
15.247(d)	RSS-210 [A8.5]	Out of Band Emissions / Band Edge	20dBc in any 100kHz BW		**C**
15.247(e)	RSS-210 [A8.2]	Transmitter Power Spectral Density	< 8dBm / 3kHz		**C**
-	RSS-Gen [6.6]	Occupied Bandwidth (99%)	RSS-Gen		**C**
15.205 15.209	RSS-210 [A8.5]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	< FCC 15.209 limits	Radiated	**C** Note2 / Note3
15.207	RSS-Gen [8.8]	AC Conducted Emissions	< FCC 15.207 limits	AC Line Conducted	**C**
15.203	RSS-Gen [6.7]	Antenna Requirements	FCC 15.203	-	**C**

Note 1: **C**=Comply **NC**=Not Comply **NT**=Not Tested **NA**=Not Applicable

Note 2: This test item was performed in each axis and the worst case data was reported.

Note 3 : For emission measurements above 1 GHz, the table height is 1.5 m.
Because FCC indicated test has permitted the use of the 1.5m table as an alternative.

4. TEST METHODOLOGY

Generally the tests were performed according to the KDB558074 D01v03r02. And ANSI C63.10-2009 was used to reference appropriate EUT setup and maximizing procedures of radiated spurious emission and AC line conducted emission testing.

4.1 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.

4.2 EUT EXERCISE

The EUT was operated in the test 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.

4.3 GENERAL TEST PROCEDURES

Conducted Emissions

According to the requirements in Section 6.2 of ANSI C63.10, the EUT is placed on the non-conductive table, which is 0.8 m above ground plane and the conducted emissions from the EUT are measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and Average detector.

Radiated Emissions

The EUT is placed on a non-conductive table. For emission measurements at or below 1 GHz, the table height is 80 cm. For emission measurements above 1 GHz, the table height is 1.5 m. 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 highest emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes according to the requirements in Section6.3 of ANSI C63.10

4.4 DESCRIPTION OF TEST MODES

The EUT has been tested with the operating condition for maximizing the emission characteristics. A test program is used to control the EUT for staying in continuous transmitting. The Bluetooth low energy mode and below low, middle and high channels were tested and reported.

Test Mode	Channel	Frequency [MHz]
BT LE	0	2402
	19	2440
	39	2480

5. 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.

6. FACILITIES AND ACCREDITATIONS

6.1 FACILITIES

The open area test site(OATS) or semi anechoic chamber and conducted measurement facility used to collect the radiated and conducted test data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 449-935. The site is constructed in conformance with the requirements.

- Semi anechoic chamber registration Number: 165783(FCC) & 5740A-3(IC)

6.2 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 peak, 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.”

7. 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.”

The antenna is permanently attached. (Refer to Internal photo file.)
Therefore this E.U.T Complies with the requirement of §15.203

8. TEST RESULT

8.1 6dB Bandwidth Measurement

Test Requirements and limit, §15.247(a) & RSS-210[A8.2]

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

Refer to the APPENDIX I.

▣ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer and used following test procedure of **KDB558074 D01v03r02**.

1. Set resolution bandwidth (RBW) = 100 KHz
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
   (RBW:100KHz/VBW:300KHz)
3. Detector = **Peak**.
4. Trace mode = **max hold**.
5. Sweep = **auto couple**.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

▣TEST RESULTS: Comply

Test Mode	Frequency [MHz]	Test Results [MHz]
LE	2402	0.686
	2440	0.702
	2480	0.719

▣RESULTPLOTS

6 dB Bandwidth

Test Frequency: 2402 MHz

6 dB Bandwidth

Test Frequency: 2440 MHz

6 dB Bandwidth Test Frequency: 2480 MHz

8.2 Maximum Peak Conducted Output Power

Test Requirements and limit, §15.247(b) & RSS-210[A8.4]

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

Refer to the APPENDIX I.

▣TEST CONFIGURATION:

Maximum Peak Conducted Output Power is measured using Measurement Procedure Option1 of KDB558074 D01v03r02.

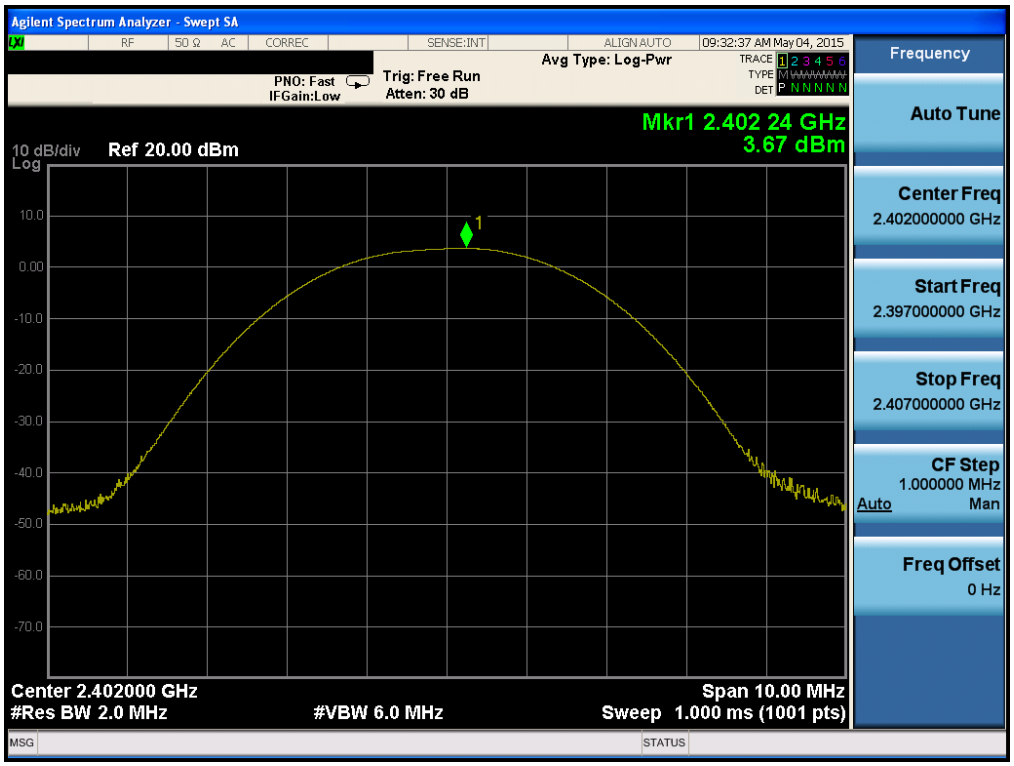
1. Set the RBW ≥ DTS bandwidth. **Actual RBW = 2 MHz**
2. Set VBW ≥ 3 x RBW. **Actual VBW = 8 MHz**
3. Set span **≥ 3 x RBW.**
4. Sweep time = **auto couple**
5. Detector = **peak**
6. Trace mode = **max hold**
7. Allow trace to fully stabilize
8. Use peak marker function to determine the peak amplitude level.

▣TEST RESULTS: Comply

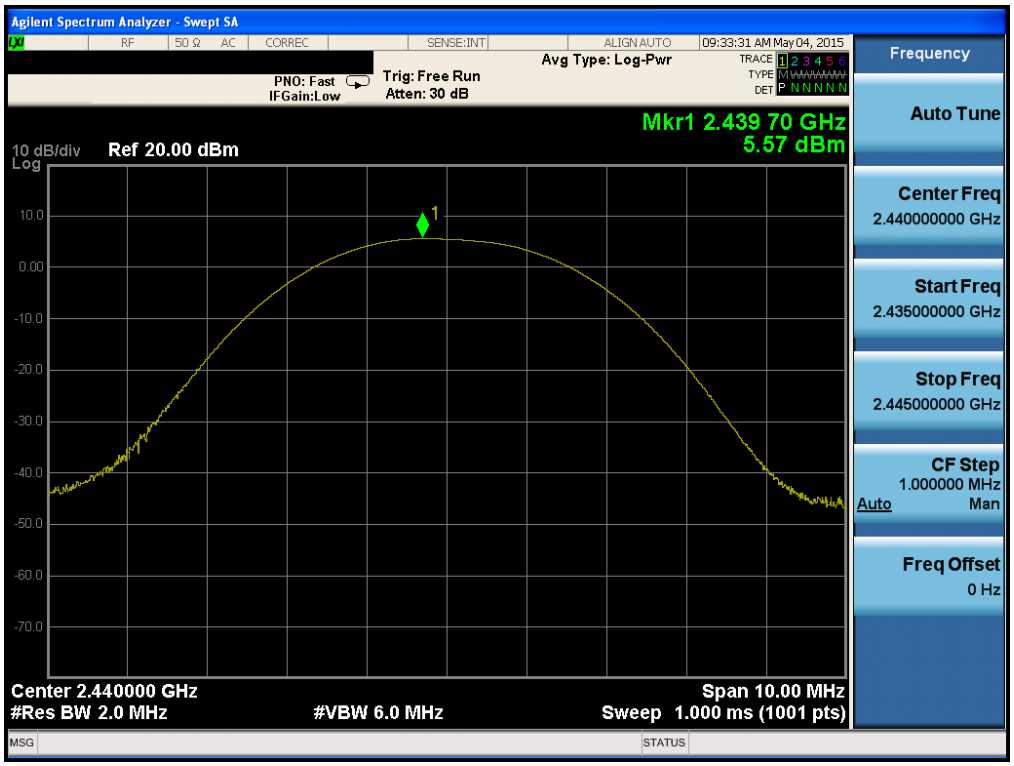
Test Mode	Test Results[dBm]		
	2402 MHz	2440 MHz	2480 MHz
LE	3.67	**5.57**	5.38

▣RESULT PLOTS

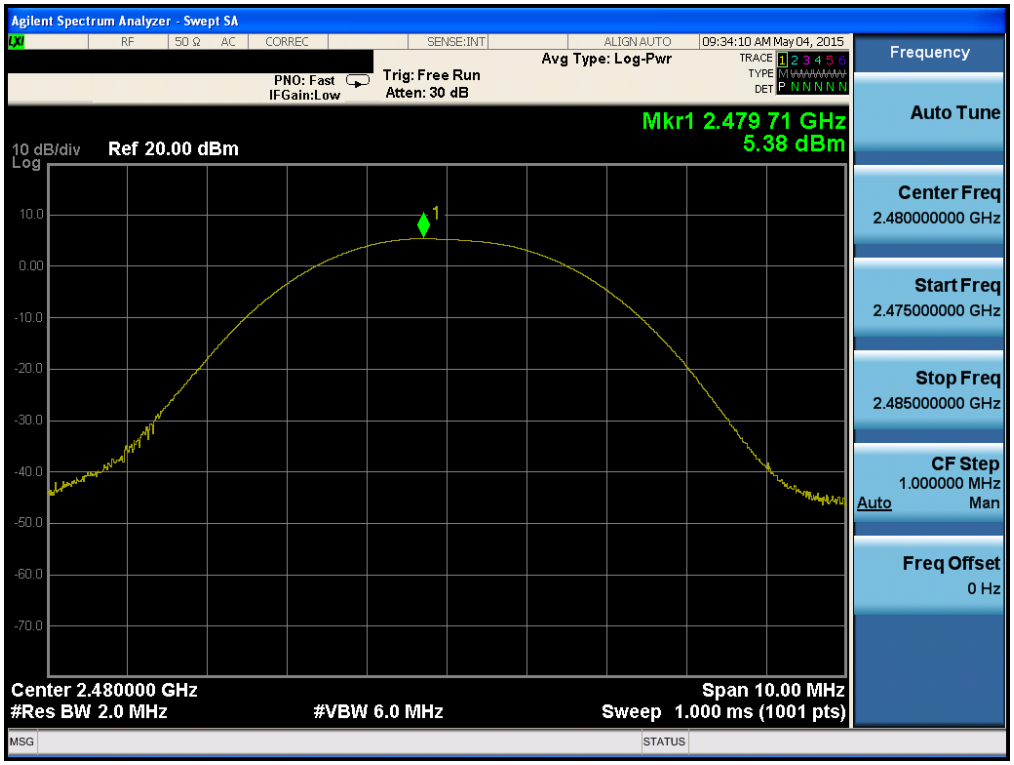
Peak Output Power Test Frequency: 2402 MHz



Peak Output Power Test Frequency: 2440 MHz



Peak Output Power Test Frequency: 2480 MHz



8.3 Maximum Power Spectral Density.

Test requirements and limit, §15.247(e) & RSS-210[A8.2]

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 –specifies a conducted power spectral density (PSD) limit of 8 dBm in any 3 kHz Band segment within the fundamental EBW during any time interval of continuous transmission.

▣TEST CONFIGURATION

Refer to the APPENDIX I.

▣TEST PROCEDURE:

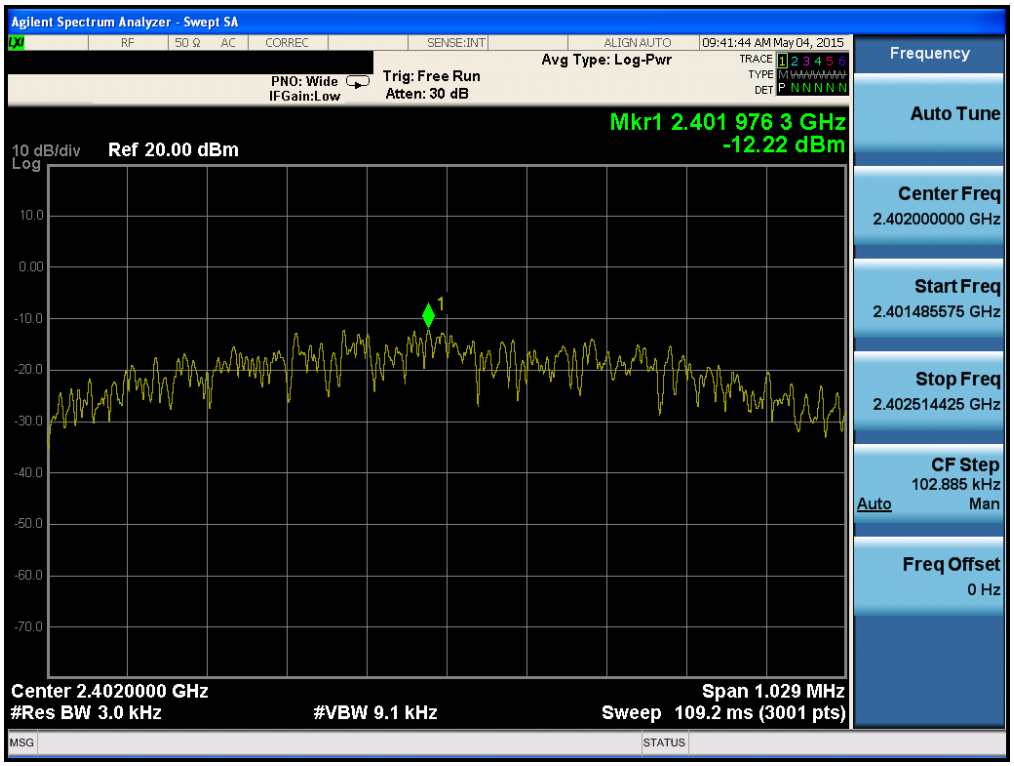
Method PKPSD of KDB558074 D01v03r02 is used.
1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to **1.5 times** the DTS bandwidth.
3. Set the RBW to: **3 kHz ≤ RBW ≤ 100 kHz**.
4. Set the VBW ≥**3 x RBW.**
5. Detector = **peak.**
6. Sweep time = **auto couple.**
7. Trace 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 kHz) and repeat.

▣TEST RESULTS: Comply

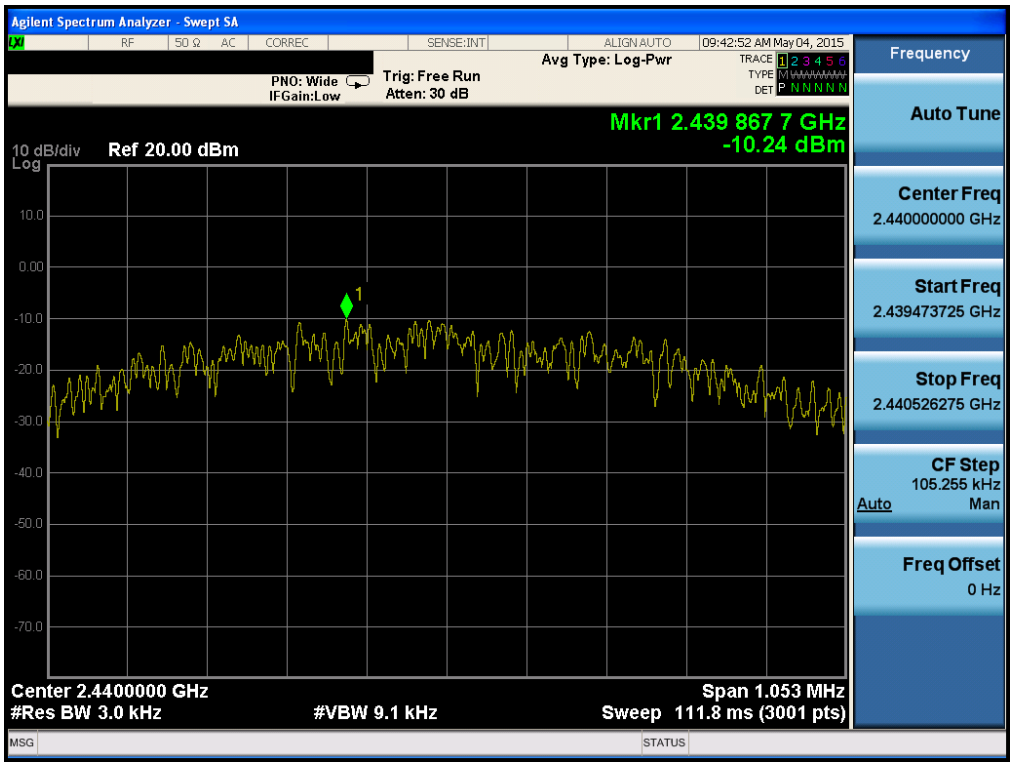
Test Mode	Frequency [MHz]	PKPSD [dBm]
LE	**2402**	-12.22
	2440	**-10.24**
	2480	-10.38

▣RESULT PLOTS

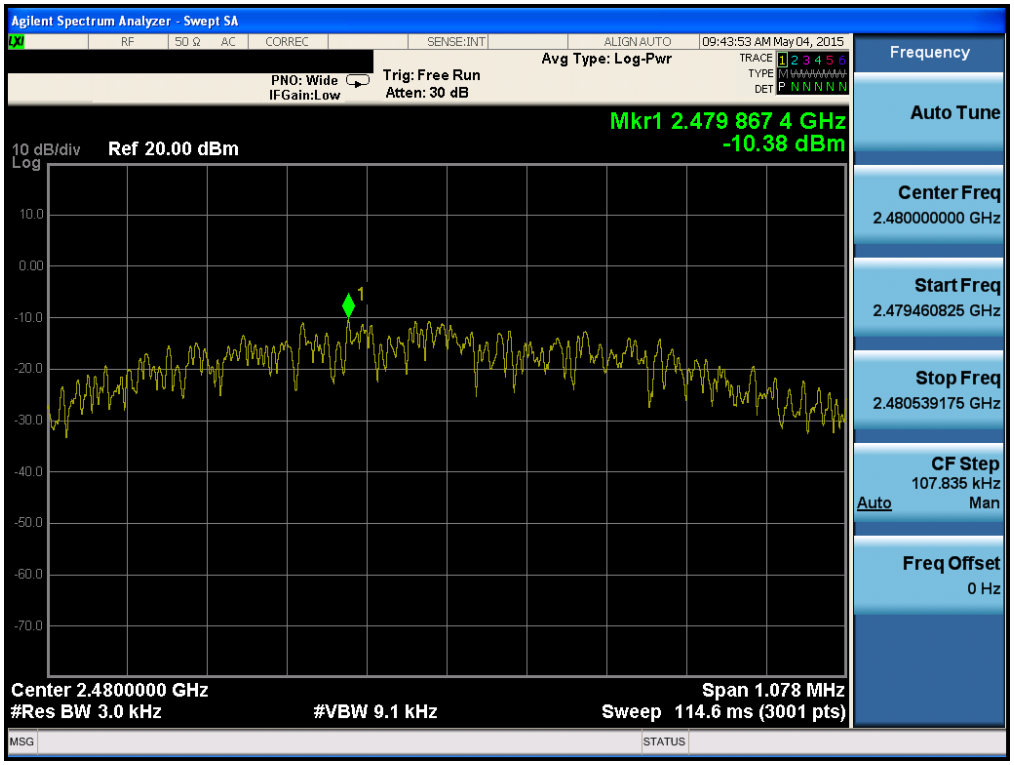
Maximum PKPSD Test Frequency: 2402 MHz



Maximum PKPSD Test Frequency: 2440 MHz



Maximum PKPSD Test Frequency: 2480 MHz



8.4 Out of Band Emissions at the Band Edge/ Conducted Spurious Emissions

Test requirements and limit, §15.247(d) & RSS-210[A8.5]

§15.247(d) specifies that in any 100 kHz bandwidth outside of the authorized frequency band, the power shall be attenuated according to the following conditions:

If **the peak output power procedure** is used to measure the fundamental emission power to demonstrate compliance to **15.247(b)(3)** requirements, then the peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated **by at least 20dB** relative to the maximum measured in-band peak PSD level.

If the average output power procedure is used to measure the fundamental emission power to demonstrate compliance to **15.247(b)(3)** requirements, then the power in any 100 kHz outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum measured inband average PSD level.

In either case, attenuation to levels below the general emission limits specified in **§15.209(a)** is not required.

▣TEST CONFIGURATION

Refer to the APPENDIX I.

▣TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer.

- Measurement Procedure 1 – Reference Level

1. Set instrument center frequency to DTS channel center frequency.
2. Set the span to ≥ 1.5 times the DTS bandwidth.
3. Set the RBW = 100 kHz.
4. Set the 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 PSD level

- Measurement Procedure 2 - Unwanted Emissions

1. Set the center frequency and span to encompass frequency range to be measured.
2. Set the RBW = **100 kHz.(Actual 1 MHz , See below note)**
3. Set the VBW **≥3 x RBW.(Actual 3 MHz, See below note)**
4. Detector = **peak**.
5. Ensure that the number of measurement points ≥ span/RBW
6. Sweep time = **auto couple.**
7. Trace mode = **max hold.**
8. **Allow the trace to stabilize** (this may take some time, depending on the extent of the span).
9. Use the peak marker function to determine the maximum amplitude level.

Note: The conducted spurious emission was tested with below settings.
Frequency range: 9 KHz ~ 30 MHz
RBW= 100kHz, VBW= 300 kHz, SWEEP TIME = AUTO, DETECTOR = PEAK, TRACE = MAX HOLD, SWEEP POINT: 40001

Frequency range: 30 MHz ~ 10 GHz, 10 GHz~25 GHz
RBW= 1MHz, VBW= 3MHz, SWEEP TIME = AUTO, DETECTOR = PEAK, TRACE = MAX HOLD, SWEEP POINT: 40001

LIMIT LINE = 20 dB below of the reference level of above measurement procedure Step 2. (RBW = 100 KHz, VBW = 300 KHz)

If the emission level with above setting was close to the limit (ie, less than 3 dB margin) then zoom scan is required using RBW = 100 KHz, VBW = 300KHz, SPAN = 100 MHz and BINS = 2001 to get accurate emission level within 100 KHz BW.

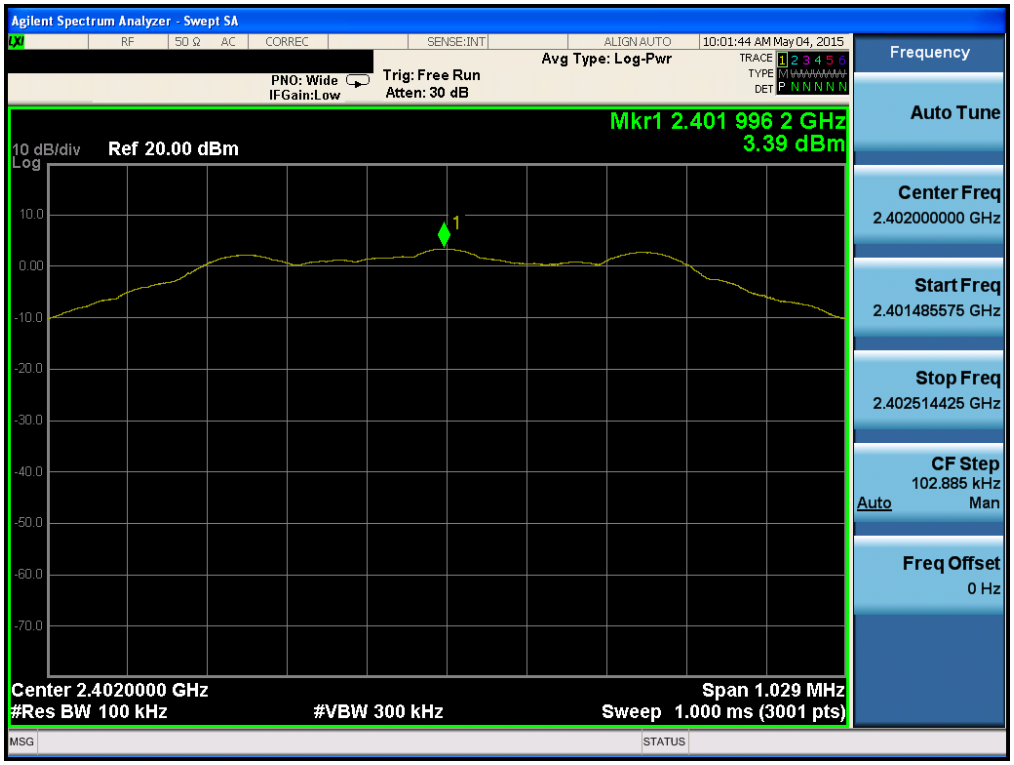
Also the path loss for conducted measurement setup was used as described on the Appendix I of this test report.

▣TEST RESULTS: Comply

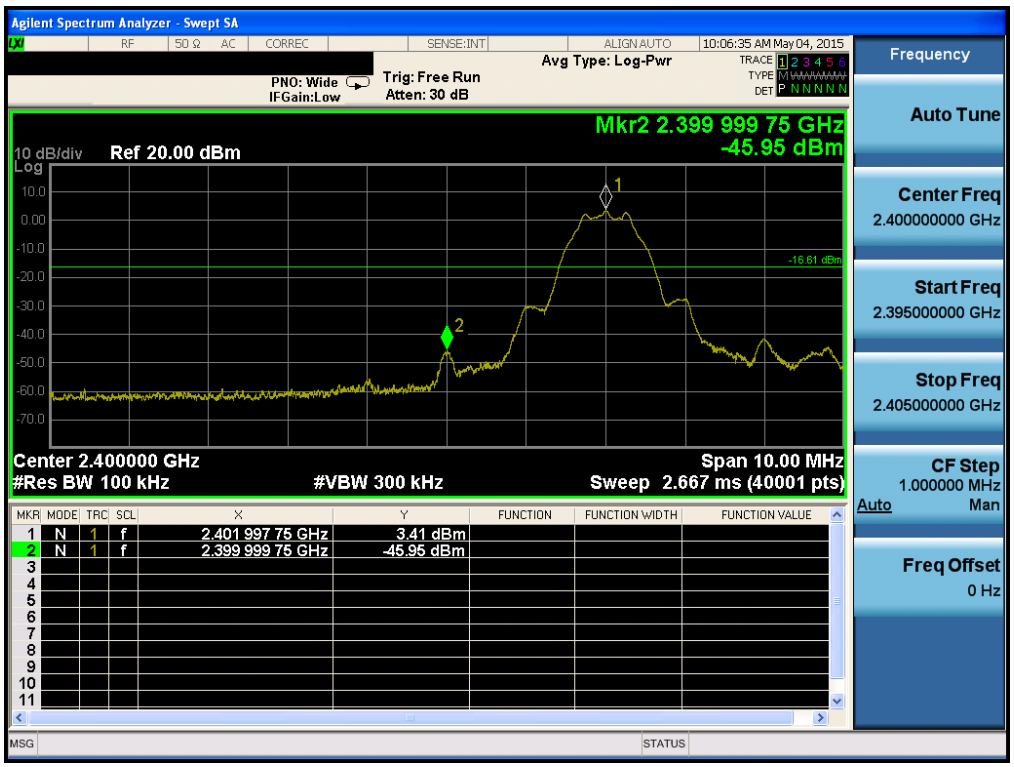
▣RESULT PLOTS

LE & 2402 MHz

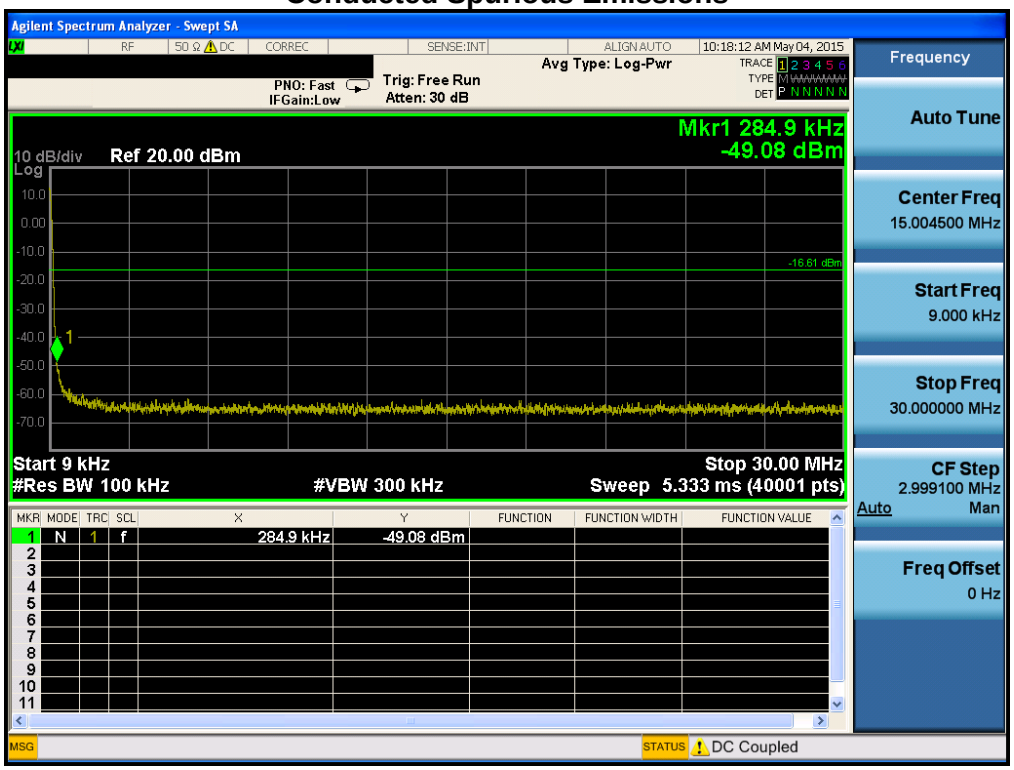
Reference

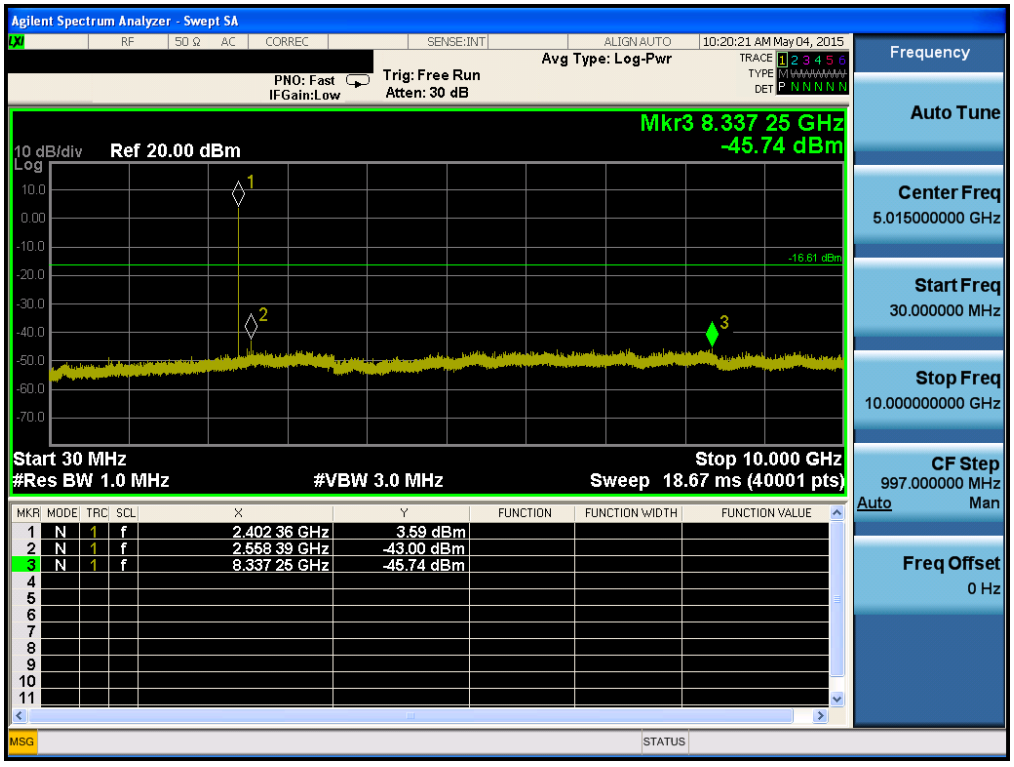


Low Band-edge

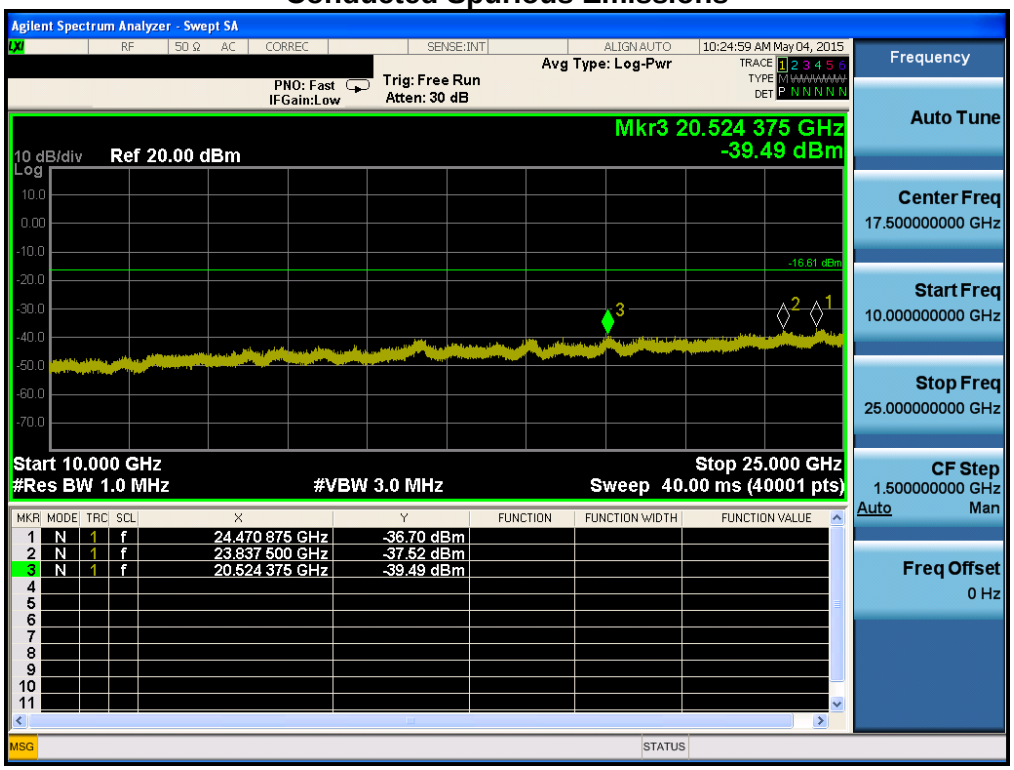


Conducted Spurious Emissions



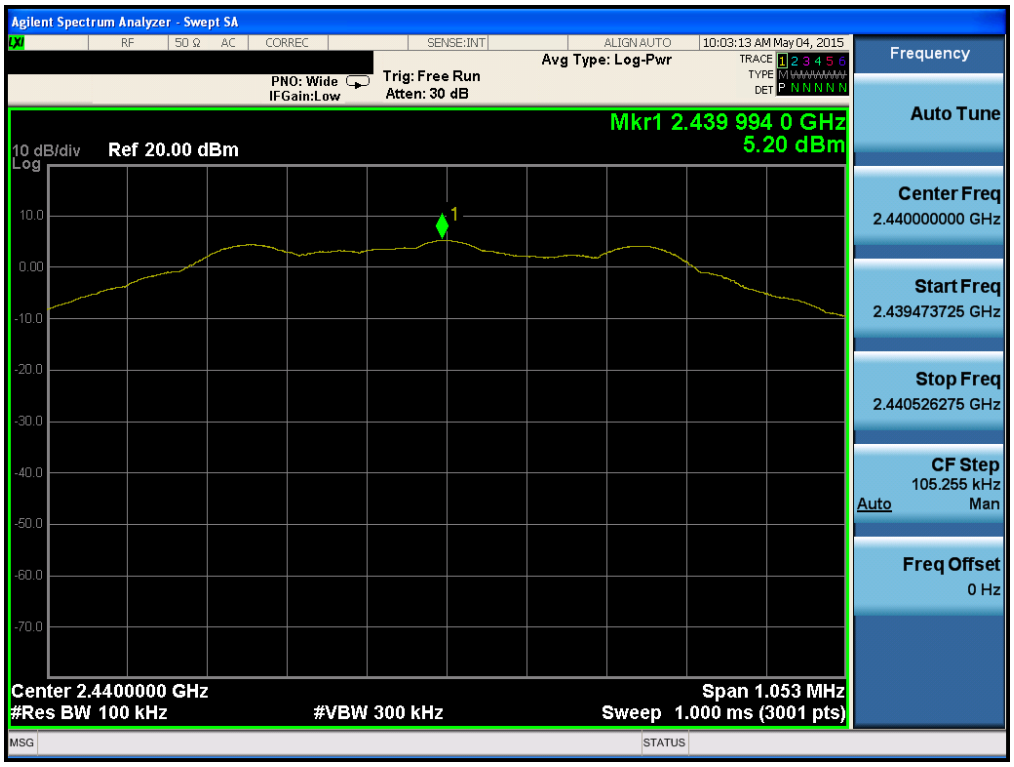


Conducted Spurious Emissions

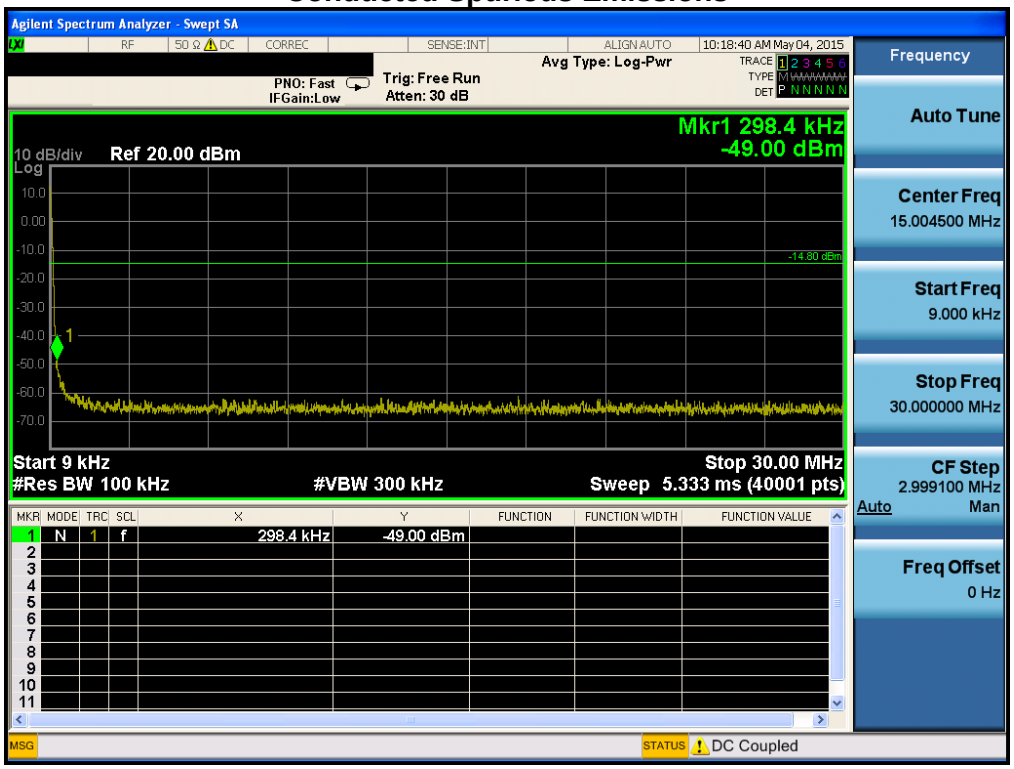


LE & 2440 MHz

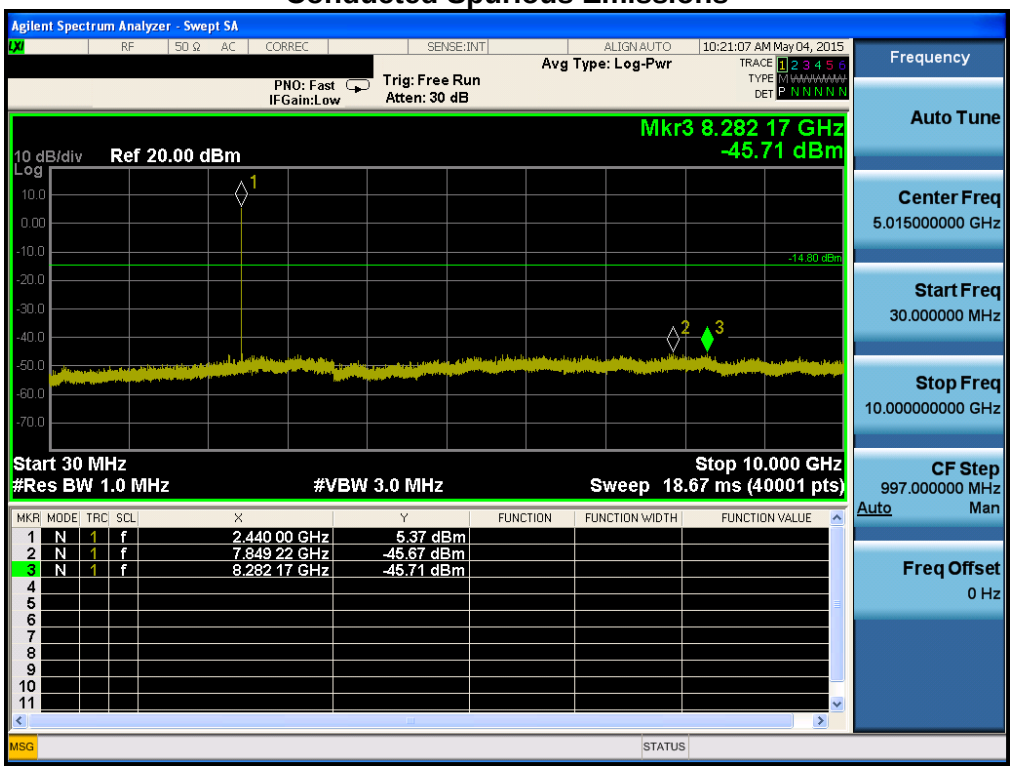
Reference

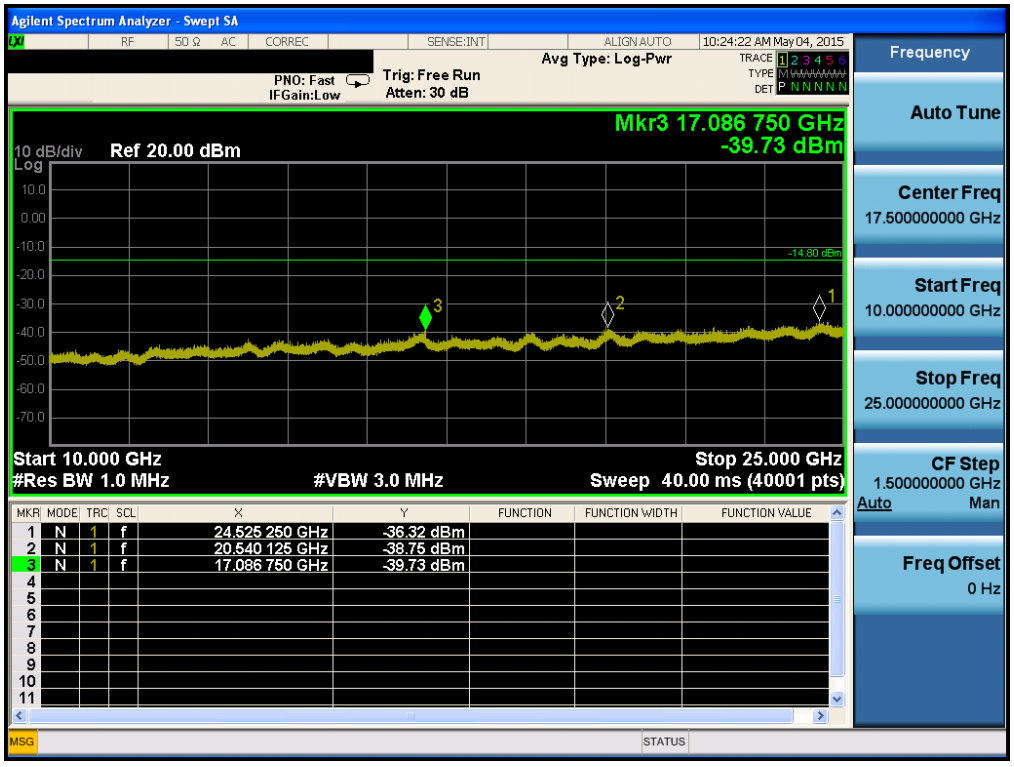


Conducted Spurious Emissions



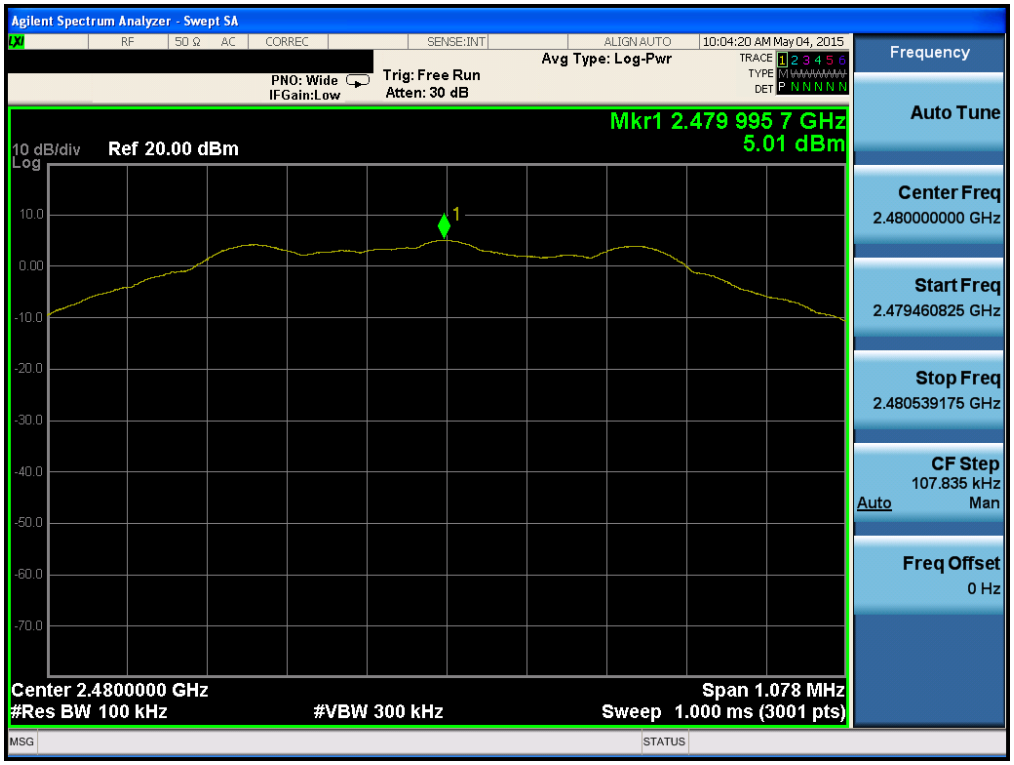
Conducted Spurious Emissions



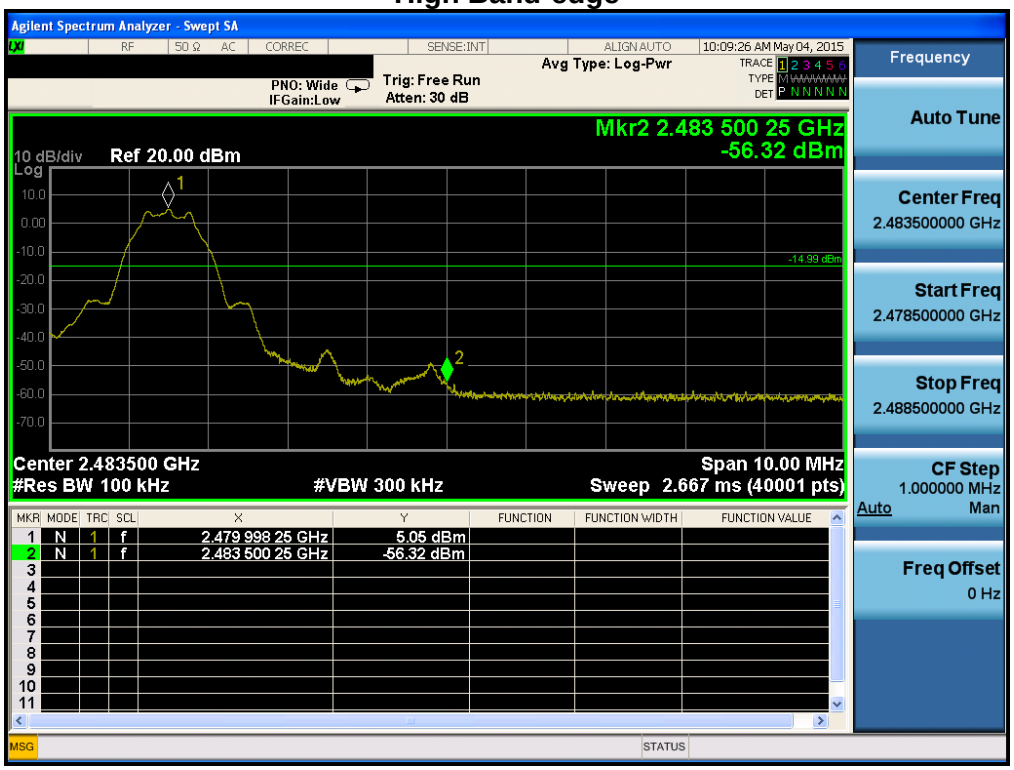


LE & 2480 MHz

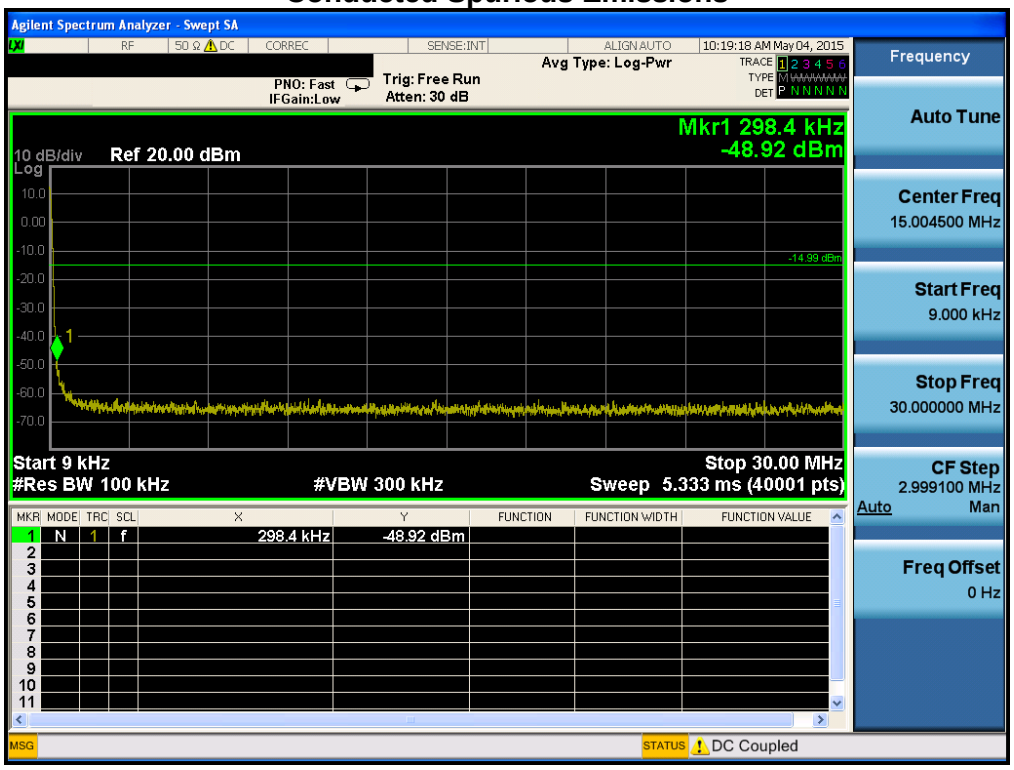
Reference

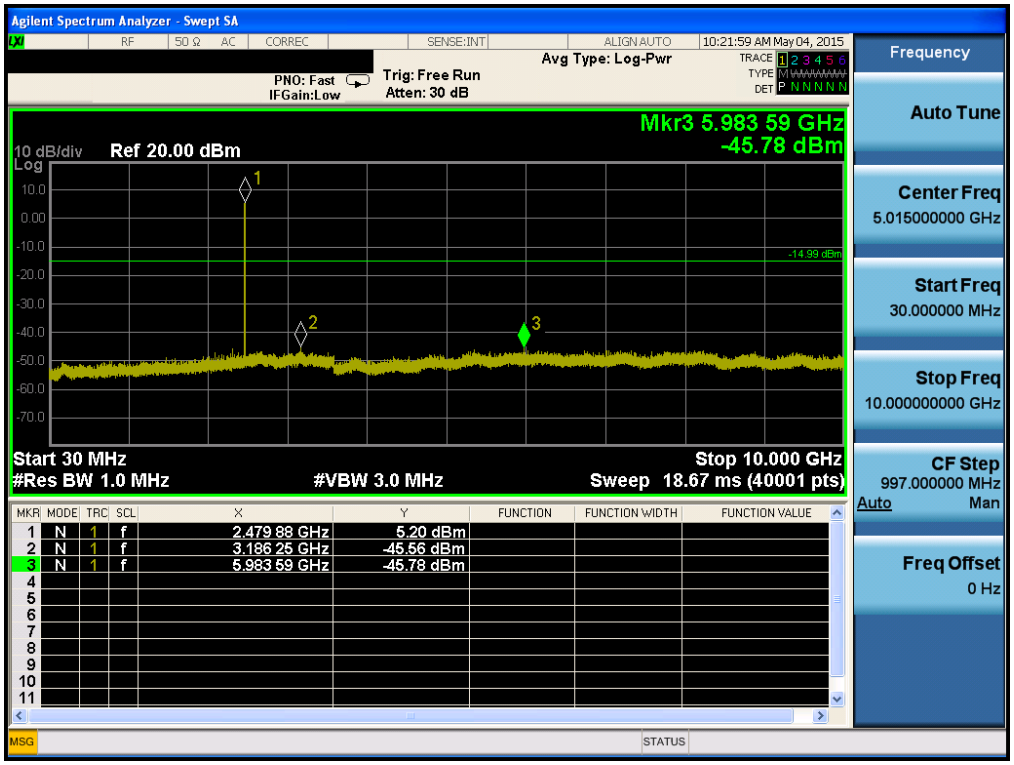


High Band-edge

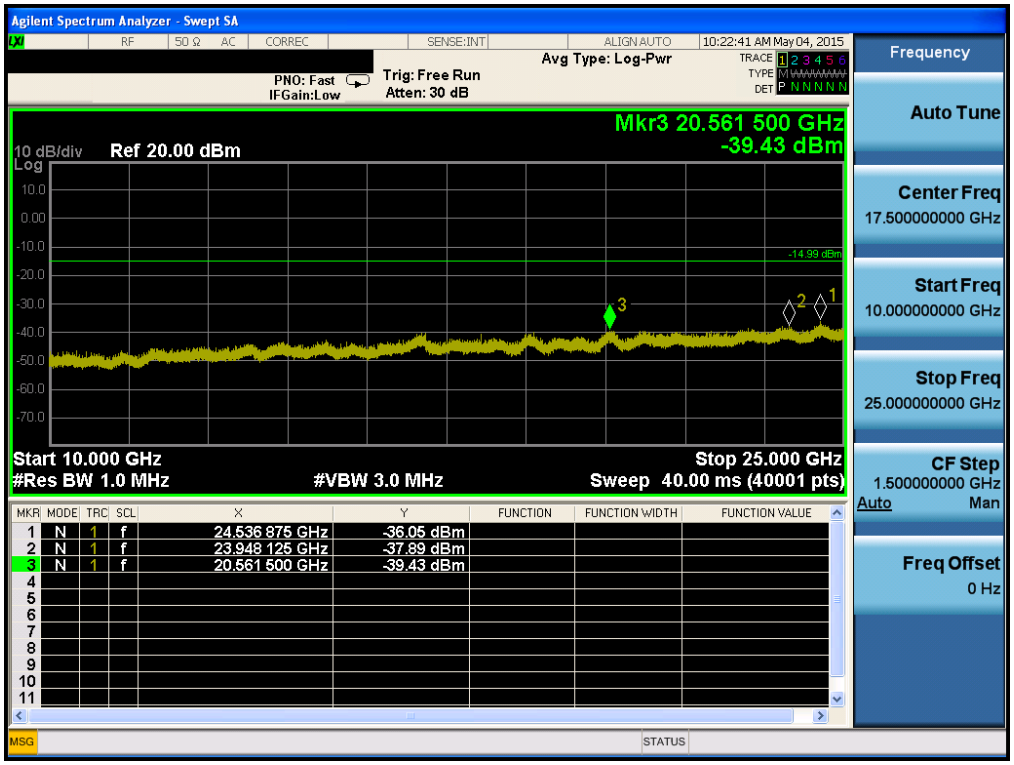


Conducted Spurious Emissions





Conducted Spurious Emissions



8.5 Radiated Measurement.

8.5.1 Radiated Spurious Emissions.

Test Requirements and limit,

§15.247(d), §15.205, §15.209 & RSS-210 [A8.5], RSS-Gen [8.9], RSS-Gen [8.10]

In any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a) and (b), then the 15.209(a) limit in the table below has to be followed

▪ **FCC Part 15.209(a) and (b)**

Frequency (MHz)	Limit (uV/m)	Measurement Distance (meter)
0.009 – 0.490	2400/F(KHz)	300
0.490 – 1.705	24000/F(KHz)	30
1.705 – 30.0	30	30
30 ~ 88	100 **	3
88 ~ 216	150 **	3
216 ~ 960	200 **	3
Above 960	500	3

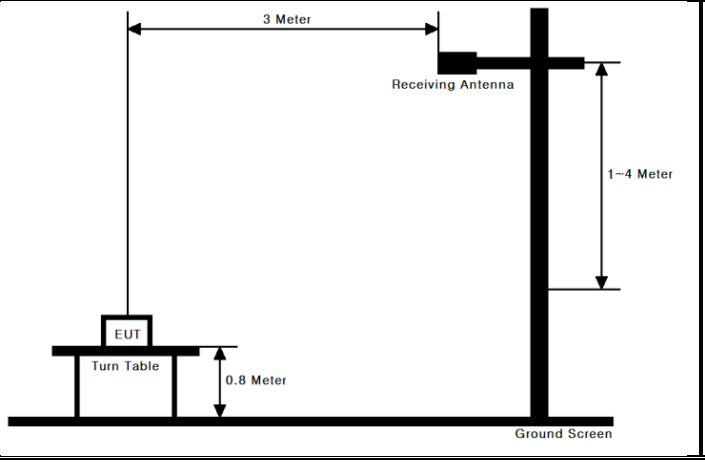
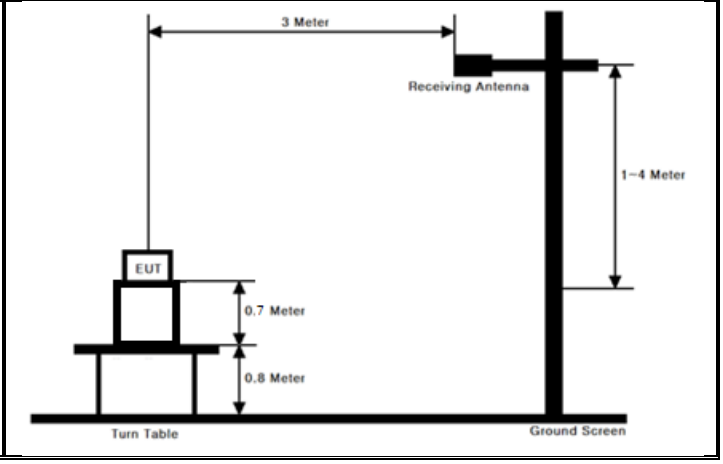
** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz.However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

▪ **FCC Part 15.205 (a):** Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	MHz	GHz	GHz
0.009 ~ 0.110	8.41425 ~ 8.41475	108 ~ 121.94	1300 ~ 1427	4.5 ~ 5.15	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1435 ~ 1626.5	5.35 ~ 5.46	15.35 ~ 16.2
2.1735 ~ 2.1905	12.51975 ~	149.9 ~ 150.05	1645.5 ~ 1646.5	7.25 ~ 7.75	17.7 ~ 21.4
4.125 ~ 4.128	12.52025	156.52475 ~	1660 ~ 1710	8.025 ~ 8.5	22.01 ~ 23.12
4.17725 ~ 4.17775	12.57675 ~	156.52525	1718.8 ~ 1722.2	9.0 ~ 9.2	23.6 ~ 24.0
4.20725 ~ 4.20775	12.57725	156.7 ~ 156.9	2200 ~ 2300	9.3 ~ 9.5	31.2 ~ 31.8
6.215 ~ 6.218	13.36 ~ 13.41	162.0125 ~ 167.17	2310 ~ 2390	10.6 ~ 12.7	36.43 ~ 36.5
6.26775 ~ 6.26825	16.42 ~ 16.423	167.72 ~ 173.2	2483.5 ~ 2500	13.25 ~ 13.4	Above 38.6
6.31175 ~ 6.31225	16.69475 ~	240 ~ 285	2655 ~ 2900		
8.291 ~ 8.294	16.69525	322 ~ 335.4	3260 ~ 3267		
8.362 ~ 8.366	16.80425 ~	399.90 ~ 410	3332 ~ 3339		
8.37625 ~ 8.38675	16.80475	608 ~ 614	3345.8 ~ 3358		
	25.5 ~ 25.67	960 ~ 1240	3600 ~ 4400		
	37.5 ~ 38.25				
	73 ~ 74.6				
	74.8 ~ 75.2				

▪ **FCC Part 15.205(b):** The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

Test Configuration

Below 1 GHz	Above 1 GHz
	

TEST PROCEDURE

1. The EUT is placed on a non-conductive table. For emission measurements at or below 1 GHz, the table height is 80 cm. For emission measurements above 1 GHz, the table height is 1.5 m.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.

Note: Measurement Instrument Setting for Radiated Emission Measurements.

1. **Frequency Range Below 1 GHz**
   RBW = 100 or 120 KHz, VBW = 3 x RBW, Detector = Peak or Quasi Peak

2. **Frequency Range > 1 GHz**

   Peak Measurement> 1 GHz
   RBW = 1MHz, VBW = 3 MHz, Detector = Peak, Sweep time = Auto, Trace mode = Max Hold until the trace stabilizes

   Average Measurement :
   1.RBW = 1 MHz (unless otherwise specified).
   2. VBW ≥ 3 x RBW.
   3. Detector = RMS (Number of points ≥ 2 x Span / RBW)
   4. Averaging type = power (i.e., RMS).
   5. Sweep time = auto.
   6. Perform a trace average of at least 100 traces.
   7. 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 4, then the applicable correction factor is 10 log(1/x), where x is the duty cycle.
      2) If linear voltage averaging mode was used in step 4, then the applicable correction factor is 20 log(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.

9 KHz ~ 25GHz Data

▪ Lowest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2375.52	Z	V	PK	50.20	0.83	51.03	74.00	22.97
2375.84	Z	V	AV	39.23	0.83	40.06	54.00	13.94
4804.67	Z	V	PK	46.49	7.78	54.27	74.00	19.73
4804.09	Z	V	AV	37.46	7.78	45.24	54.00	8.76

▪ Middle Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4879.40	Z	V	PK	46.27	7.81	54.08	74.00	19.92
4879.82	Z	V	AV	38.16	7.81	45.97	54.00	8.03

▪ Highest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2483.57	Z	V	PK	51.44	1.40	52.84	74.00	21.16
2483.65	Z	V	AV	40.33	1.40	41.73	54.00	12.27
4959.90	Z	V	PK	46.11	7.84	53.95	74.00	20.05
4959.95	Z	V	AV	35.89	7.84	43.73	54.00	10.27

Note.

1. No other spurious and harmonic emissions were reported greater than listed emissions above table.
2. Above listed point data is the worst case data.
3. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain

8.6 POWERLINE CONDUCTED EMISSIONS

Test Requirements and limit, §15.207 & RSS-Gen[8.8]

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)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency

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 for the actual connections between EUT and support equipment.

TEST PROCEDURE

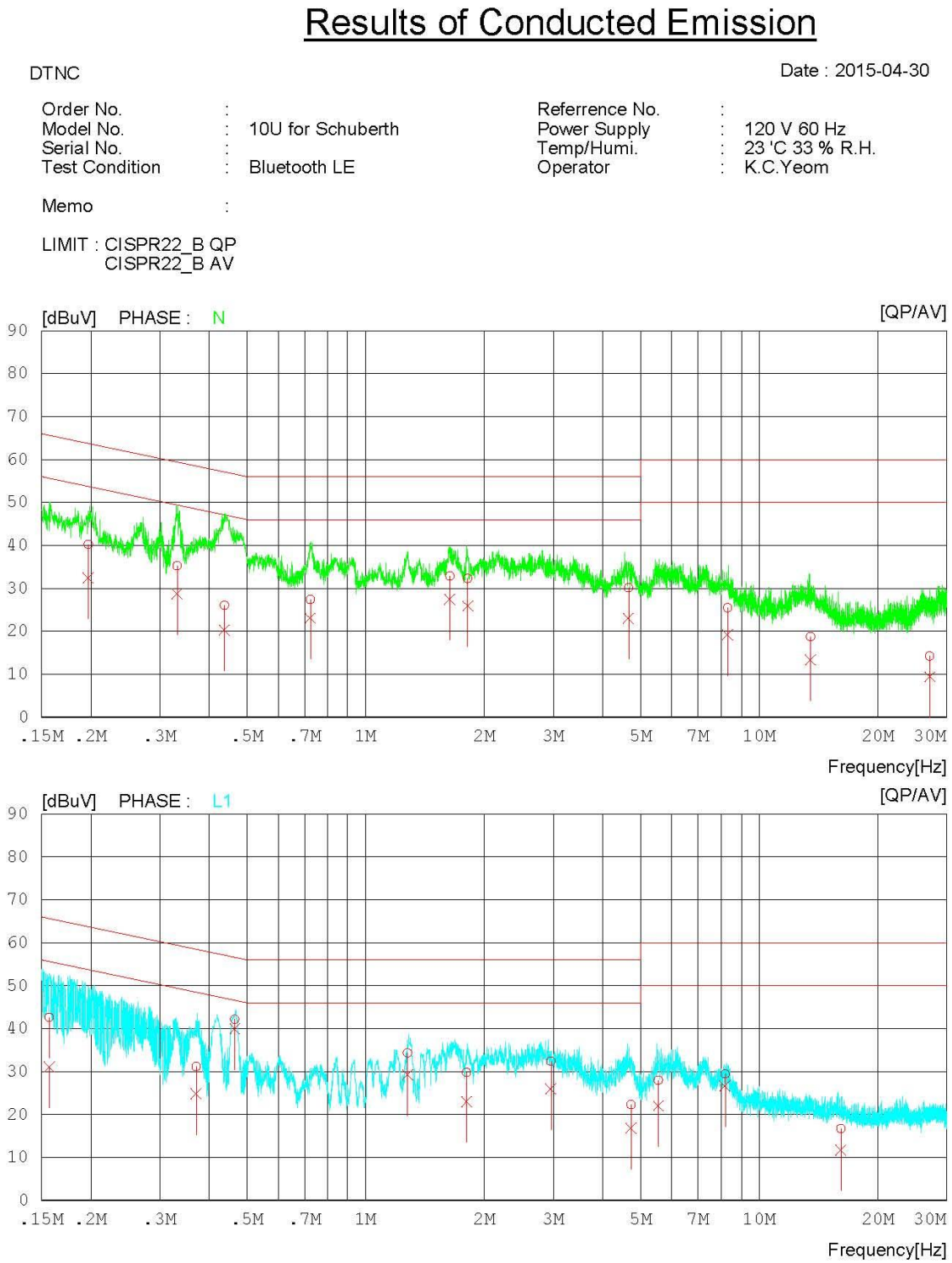
1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
2. The EUT is connected via LISN to a test power supply.
3. The measurement results are obtained as described below:
4. Detectors – Quasi Peak and Average Detector.

▣ **Test Results:** **Comply**(Refer to next page.)

▣RESULT PLOTS

AC Line Conducted Emissions (Graph)

Test Mode: LE & 2440MHz



AC Line Conducted Emissions (List)

Test Mode: LE & 2440MHz

Results of Conducted Emission

DTNC Date : 2015-04-30

Order No.	:		Referrence No.	:	
Model No.	:	10U for Schuberth	Power Supply	:	120 V 60 Hz
Serial No.	:		Temp/Humi.	:	23 'C 33 % R.H.
Test Condition	:	Bluetooth LE	Operator	:	K.C.Yeom

Memo :

LIMIT : CISPR22_B QP
CISPR22_B AV

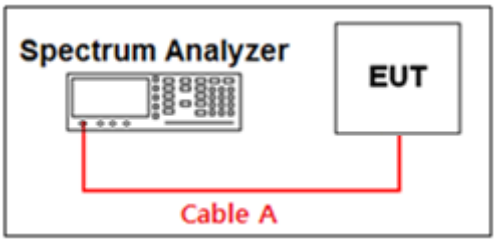
NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.19725	30.4	22.5	9.9	40.3	32.4	63.7	53.7	23.4	21.3	N
2	0.33140	25.3	18.7	10.0	35.3	28.7	59.4	49.4	24.1	20.7	N
3	0.43756	15.9	10.2	10.1	26.0	20.3	57.1	47.1	31.1	26.8	N
4	0.72276	17.3	13.0	10.1	27.4	23.1	56.0	46.0	28.6	22.9	N
5	1.63780	22.8	17.3	10.1	32.9	27.4	56.0	46.0	23.1	18.6	N
6	1.81720	22.1	15.8	10.1	32.2	25.9	56.0	46.0	23.8	20.1	N
7	4.65220	20.0	12.9	10.1	30.1	23.0	56.0	46.0	25.9	23.0	N
8	8.31540	15.0	8.7	10.4	25.4	19.1	60.0	50.0	34.6	30.9	N
9	13.51080	8.3	2.8	10.5	18.8	13.3	60.0	50.0	41.2	36.7	N
10	27.15960	3.4	-1.4	10.8	14.2	9.4	60.0	50.0	45.8	40.6	N
11	0.15723	32.6	21.1	10.0	42.6	31.1	65.6	55.6	23.0	24.5	L1
12	0.37062	21.0	14.7	10.1	31.1	24.8	58.5	48.5	27.4	23.7	L1
13	0.46496	32.1	29.9	10.0	42.1	39.9	56.6	46.6	14.5	6.7	L1
14	1.27840	24.1	19.2	10.1	34.2	29.3	56.0	46.0	21.8	16.7	L1
15	1.80540	19.6	12.9	10.1	29.7	23.0	56.0	46.0	26.3	23.0	L1
16	2.95680	22.2	15.7	10.2	32.4	25.9	56.0	46.0	23.6	20.1	L1
17	4.72160	11.9	6.4	10.3	22.2	16.7	56.0	46.0	33.8	29.3	L1
18	5.54540	17.5	11.6	10.4	27.9	22.0	60.0	50.0	32.1	28.0	L1
19	8.20020	18.8	16.0	10.6	29.4	26.6	60.0	50.0	30.6	23.4	L1
20	16.11860	5.9	0.9	10.8	16.7	11.7	60.0	50.0	43.3	38.3	L1

8.7 Occupied Bandwidth

Test Requirements, RSS-Gen [6.6]

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.

▣TEST CONFIGURATION



▣TEST PROCEDURE

- The 99% power bandwidth was measured with a calibrated spectrum analyzer.
- Spectrum analyzer plots are included on the following pages.

▣TEST RESULTS: Comply

Ambient temperature : 24 °C
Relative humidity : 36 %

Test Mode	Tested Channel	Test Results (MHz)
GFSK	**Lowest**	1.022
	Middle	1.022
	Highest	1.025

Occupied Bandwidth (99%) Lowest Frequency & 8DPSK

Occupied Bandwidth (99%) Middle Frequency & 8DPSK

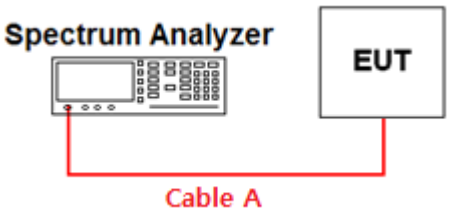
Occupied Bandwidth (99%) Highest Frequency & 8DPSK

9. LIST OF TEST EQUIPMENT

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
MXA Signal Analyzer	Agilent	N9020A	14/09/15	15/09/15	MY50200834
DIGITAL MULTIMETER	Agilent	34401A	15/01/06	16/01/06	US36099541
Dynamic Measurement DC Source	Agilent	66332A	14/10/7	15/10/07	US37473305
Signal Generator	Rohde Schwarz	SMF100A	14/07/01	15/07/01	102341
Vector Signal Generator	Rohde Schwarz	SMBV100A	15/01/06	16/01/06	255571
Thermohygrometer	BODYCOM	BJ5478	14/05/13	15/05/13	120612-2
Power Meter & Wide Bandwidth Sensor	Anritsu	ML2495A/ MA2490A	15/03/26	16/03/26	1306007/ 1249001
PreAmplifier	Agilent	8449B	15/02/26	16/02/26	3008A00370
LOOP Antenna	Schwarzbeck	FMZB1513	14/04/29	16/04/29	1513-128
Double-Ridged Guide Antenna	ETS	3117	14/05/12	16/05/12	140394
TRILOG Broadband Test-Antenna	Schwarzbeck	VULB 9160	14/04/30	16/04/30	3358
Amplifier	H.P	8447E	15/01/06	16/01/06	2945A02865
EMI TEST RECEIVER	Rohde Schwarz	ESU	15/01/06	16/01/06	100014
High-pass filter	Wainwright Instruments	WHKX3.0	15/01/06	16/01/06	12
Horn Antenna(18~40GHz)	A.H.Systems Inc.	SAS-574	13/05/27	15/05/27	155
FREQUENCY CONVERTER	Taejin Electronic	CVCF	14/09/11	15/09/11	ZU0033
ARTIFICIAL MAINS NETWORK	Narda S.T.S. / PMM	PMM L2-16B	14/06/26	15/06/26	000WX20305
EMI TEST RECEIVER	Rohde Schwarz	ESCI	15/02/25	16/02/25	100364

APPENDIX I
Conducted Test set up Diagram & Path loss Information

▪**Conducted Measurement**



Path loss information

Frequency (GHz)	Path Loss (dB)	Frequency (GHz)	Path Loss (dB)
0.03	0.22	15	4.8
1	1.16	20	5.46
2.402 & 2.441 & 2.480	1.8	25	6.18
5	2.56	-	-
10	3.74	-	-

Note. 1: The path loss from EUT to Spectrum analyzer were measured and used for test.
Path loss = Cable A

APPENDIX II
Duty cycle plots

▣ **TEST PROCEDURE**

Duty Cycle measured using **section 6.0 b) of KDB558074 D01v03r02:**

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.

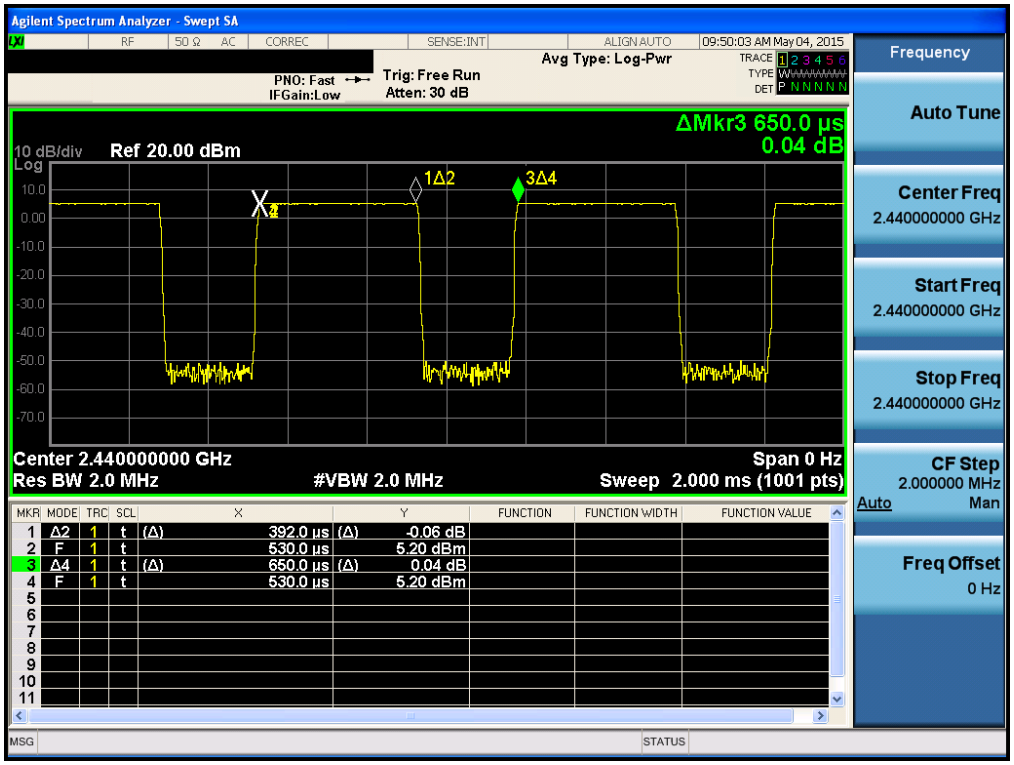
The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T ≤ 16.7 microseconds.)

Measurement set-up of RBW

Test Mode	T	50/T	RBW (≤VBW)
LE	0.392 ms	128 kHz	2 MHz
-	-	-	-

Test Plots :

Duty Cycle Test Mode: BT LE & 2440 MHz



Duty Cycle = T_{on} / (T_{on} + T_{off}) =0.392 ms / 0.650 ms = 60.3 %

APPENDIX III
AVG Conducted Output Power

▣ **TEST PROCEDURE**

1. Instruments and EUT were connected like Figure 1
2. Enter LE mode in EUT and operate it.
   When it is operating, The EUT is transmitting at maximum power level and duty cycle fixed.
3. The average conducted output powers of LE and each frequency can measurement according to setting program in EUT.
4. Power levels were measured by a Power Meter.

The average conducted output powers of Bluetooth were measured using following test setup and a wideband gated RF power meter when the EUT is transmitting at its maximum power level.

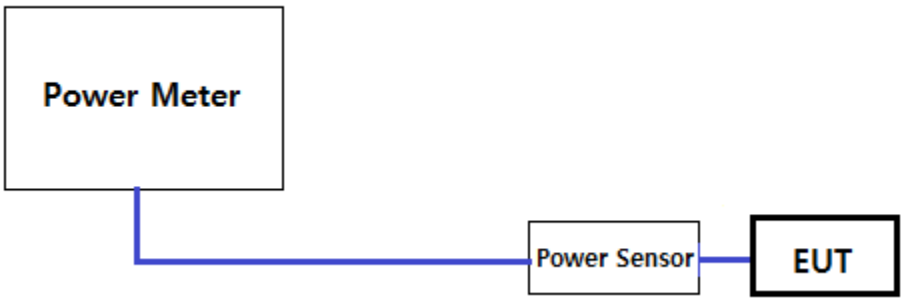


Figure 1

Channel	Frequency	Frame AVG Output Power (LE)	
	(MHz)	(dBm)	(mW)
Low	2402	1.86	1.53
Mid	2441	**3.23**	**2.10**
High	2480	3.04	2.01