LTA
Laboratory for Test & Approval Co.,Ltd.

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SENA

Dates of Tests : May 13~ 22, 2013
Test Report S/N: LR500111305J
Test Site : LTA CO., LTD

CERTIFICATION OF COMPLIANCE

FCC ID	S7A-IW04
IC	8154A-IW04
APPLICANT	Sena Technologies, Inc.

Equipment Class	**:**	**Digital Transmission System (DTS)**
Manufacturing Description	**:**	**Bluetooth USB Adapter**
Manufacturer	**:**	**Sena Technologies, Inc.**
Model Name	**:**	**UD100a**
Test Device Serial No.:	**:**	**Identical prototype**
Rule Part(s)	**:**	**FCC Part 15.247 Subpart C; ANSI C-63.4-2003**
		RSS-210 and ISSUE No. :8 Date :2010
Frequency Range	**:**	**2402MHz ~ 2480MHz (BT 4.0 LE)**
Max. Output Power	**:**	**Max 8.88 dBm - Conducted**
Data of issue	**:**	**May 22, 2013**

This test report is issued under the authority of:

Kyu-Hyun Lee, Manager

The test was supervised by:

Jung-Moo Her, Test Engineer

NVLAP LAB Code.: 200723-0

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1. General information

1-1 Test Performed

Company name : LTA Co., Ltd.

Address : 243, Jubug-ri,Yangji-Myeon,Youngin-Si, Kyunggi-Do, Korea. 449-822

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Quality control in the testing laboratory is implemented as per ISO/IEC 17025 which is the “General requirements for the competents of calibration and testing laboratory”.

1-2 Accredited agencies

LTA Co., Ltd. is approved to perform EMC testing by the following agencies:

Agency	Country	Accreditation No.	Validity	Reference
NVLAP	U.S.A	200723-0	2013-09-30	ECT accredited Lab.
RRL	KOREA	KR0049	UPDATING	EMC accredited Lab.
FCC	U.S.A	610755	2014-04-27	FCC filing
FCC	U.S.A	649054	UPDATING	FCC CAB
VCCI	JAPAN	R2133(10m), C2307	2014-06-21	VCCI registration
VCCI	JAPAN	T-2009	2013-12-23	VCCI registration
VCCI	JAPAN	G-563	2015-05-28	VCCI registration
IC	CANADA	5799A-1	2015-06-21	IC filing

2. Product Information

2-1 Applicant

Company name	:	Sena Technologies, Inc.
Address	:	210 Yangjae-dong Seocho-gu Seoul 137-130 Korea
Tel / Fax	:	+82-2-571-8283 / +82-2-573-7710

2-2 Equipment Under Test (EUT)

Trade name	:	SENA
Model name	:	UD100a
Date of receipt	:	May 13, 2013
EUT condition	:	Pre-production, not damaged
Antenna type	:	Dipole antenna (M/N: AN2400-3306RS) Max Gain 1.4 dBi
		Dipole antenna (M/N: R-AN2400-5801RS) Max Gain 3.17 dBi
		Dipole antenna (M/N: R-AN2400-1901RS) Max Gain 5.37 dBi
Frequency Range	:	2402MHz ~ 2480MHz (BT 4.0LE)
RF output power	:	Max 8.88 dBm - Conducted
Number of channels	:	40
Type of Modulation	:	GFSK
Channel spacing	:	2MHz
Power Source	:	DC 5.0V
Firmware Version	:	V2.0.1

2-3 Tested frequency

	LOW	MID	HIGH
Frequency (MHz)	2402	2442	2480

2-4 Ancillary Equipment

Equipment	Model No.	Serial No.	Manufacturer
NOTEBOOK	PP37L	29705283757	DELL

3. Test Report

3.1 Summary of tests

FCC Part Section(s)	Parameter	Limit	Test Condition	Status (note 1)
15.247(a)	6 dB Bandwidth	> 500kHz	Conducted	C
15.247(b)	Transmitter Peak Output Power	< 1Watt		C
15.247(d)	Transmitter Power Spectral Density	< 8dBm @ 3kHz		C
15.247(d)	Band Edge & Spurious	> 20 dBc		C
15.209	Field Strength of Harmonics	Emissions	Radiated	C
15.109	Field Strength	-		C
15.207	AC Conducted Emissions	Emissions	Conducted	C
15.203	Antenna requirement	-	-	C

Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable

Note 2: The data in this test report are traceable to the national or international standards.

→ Antenna Requirement
The **Sena Technologies**, FCC ID: **S7A-IW04** unit complies with the requirement of §15.203.
The antenna connector is reverse polarity SMA type, Antenna type is Dipole.

The sample was tested according to the following specification:
*FCC Parts 15.247; ANSI C-63.4-2003
*FCC KDB Publication No. 558074 D01 DTS Meas. Guidance V01
*FCC TCB Workshop 2012, April

3.2 Technical Characteristics Test

3.2.1 DTS Bandwidth

Procedure:

*The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance and TCB Workshop 2012, April.

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

After the trace being stable, Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 6dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 6 dB bandwidth of the emission.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 100 kHz

Span = 10 MHz

VBW = 300 kHz (VBW ≥ 3x RBW)

Sweep = auto

Trace = max hold

Detector function = peak

Measurement Data:

Frequency (MHz)	Channel No.	Test Results(MHz)	
		6dB Bandwidth	99% Bandwidth
2412	0	0.724	3.560
2442	20	0.709	3.734
2480	39	0.709	3.719

Minimum Standard:

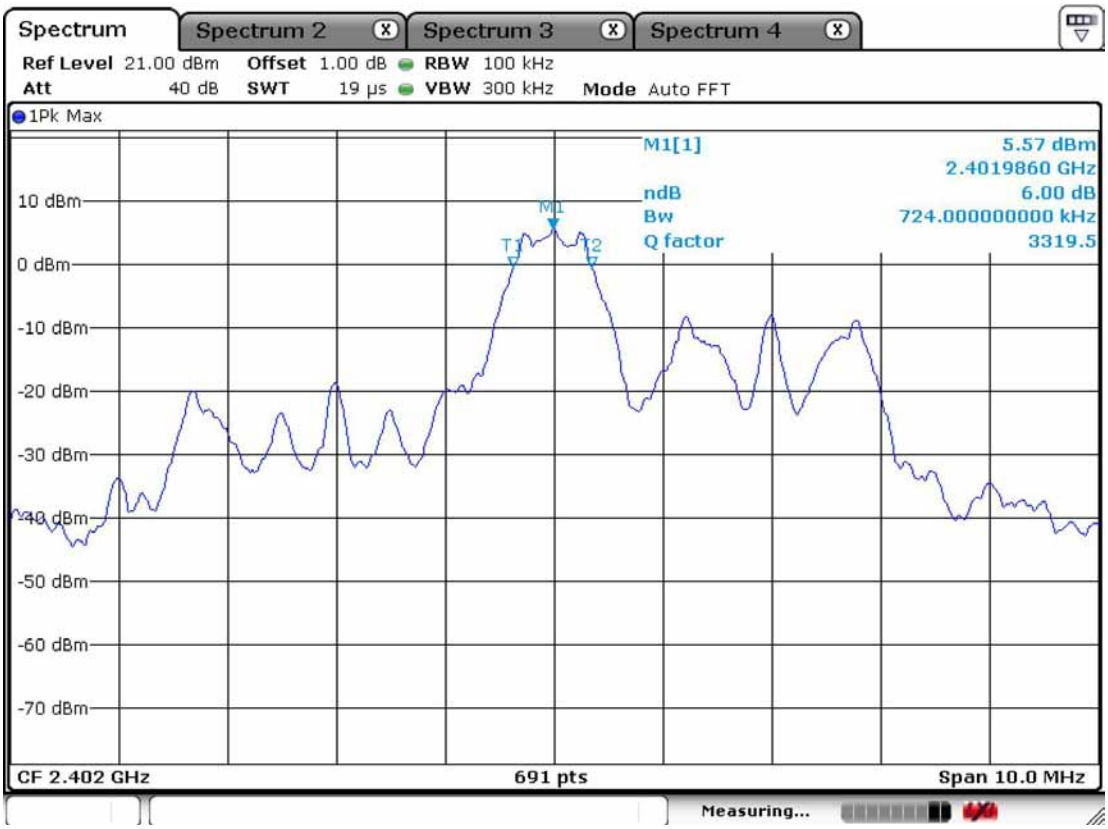
6 dB Bandwidth > 500kHz

Measurement Setup

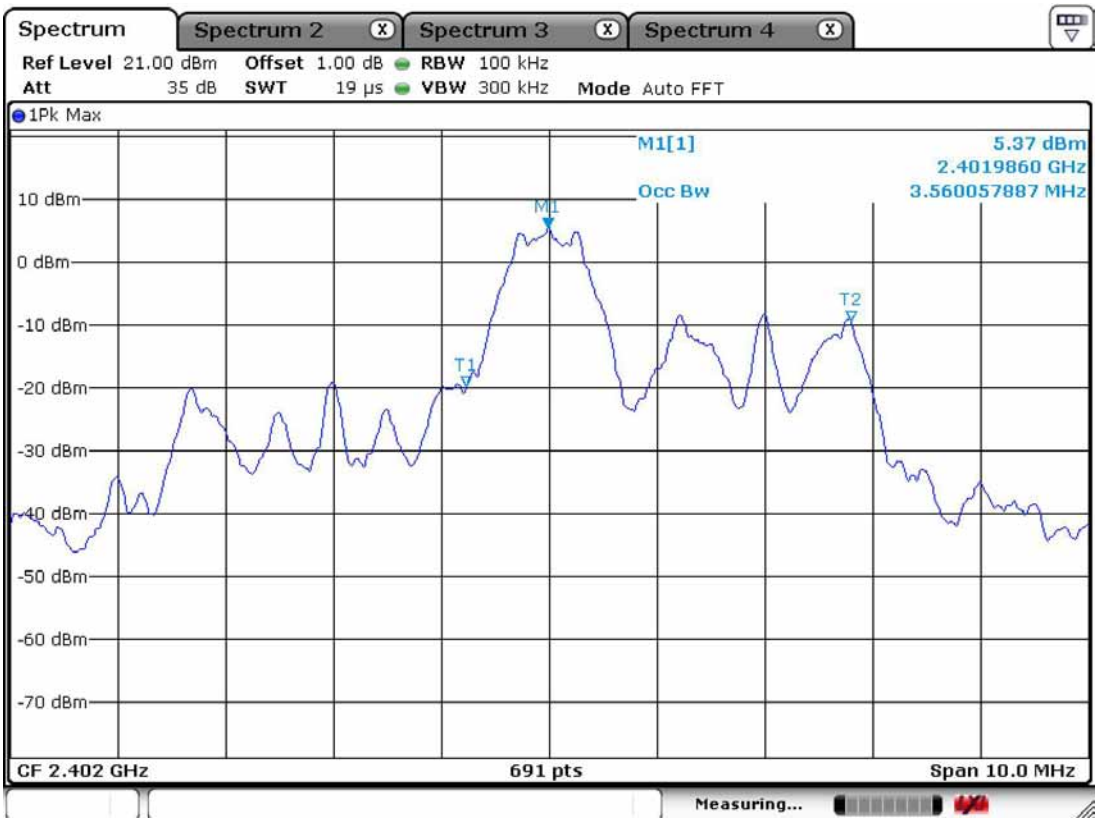
Same as the Chapter 3.2.1 (Figure 1)

Channel 0

6dB Bandwidth

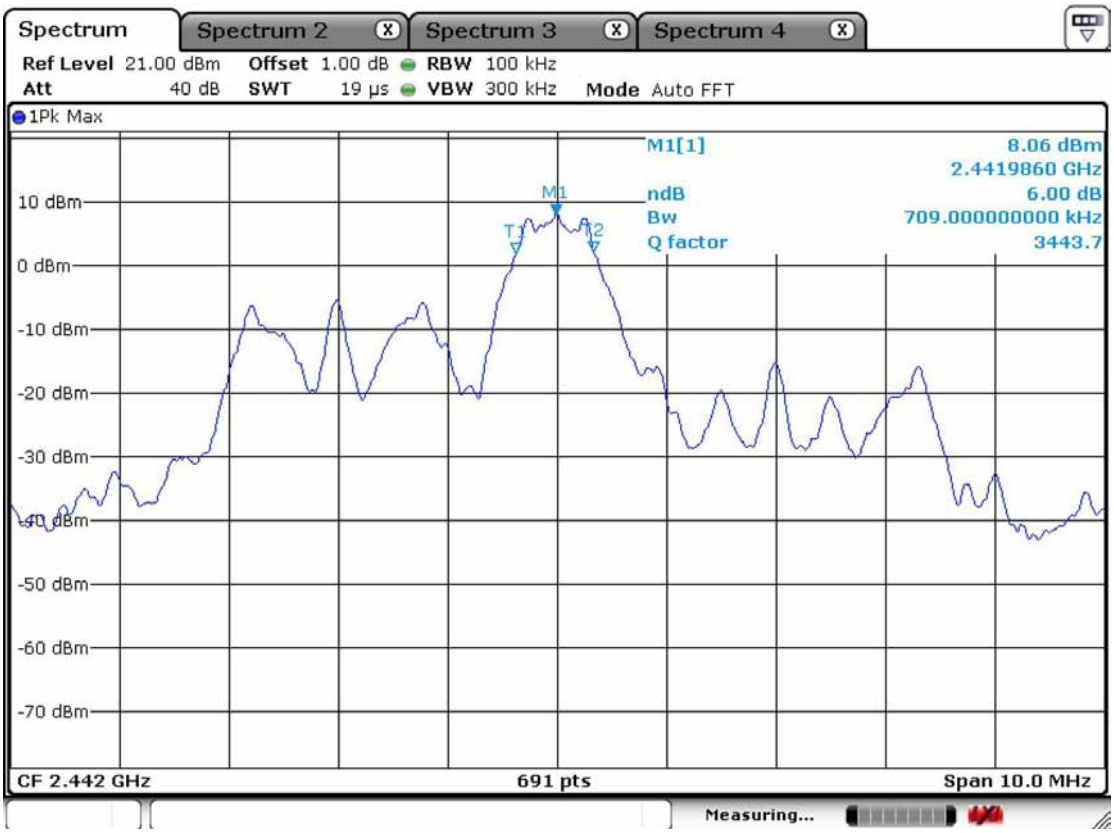


99% Bandwidth

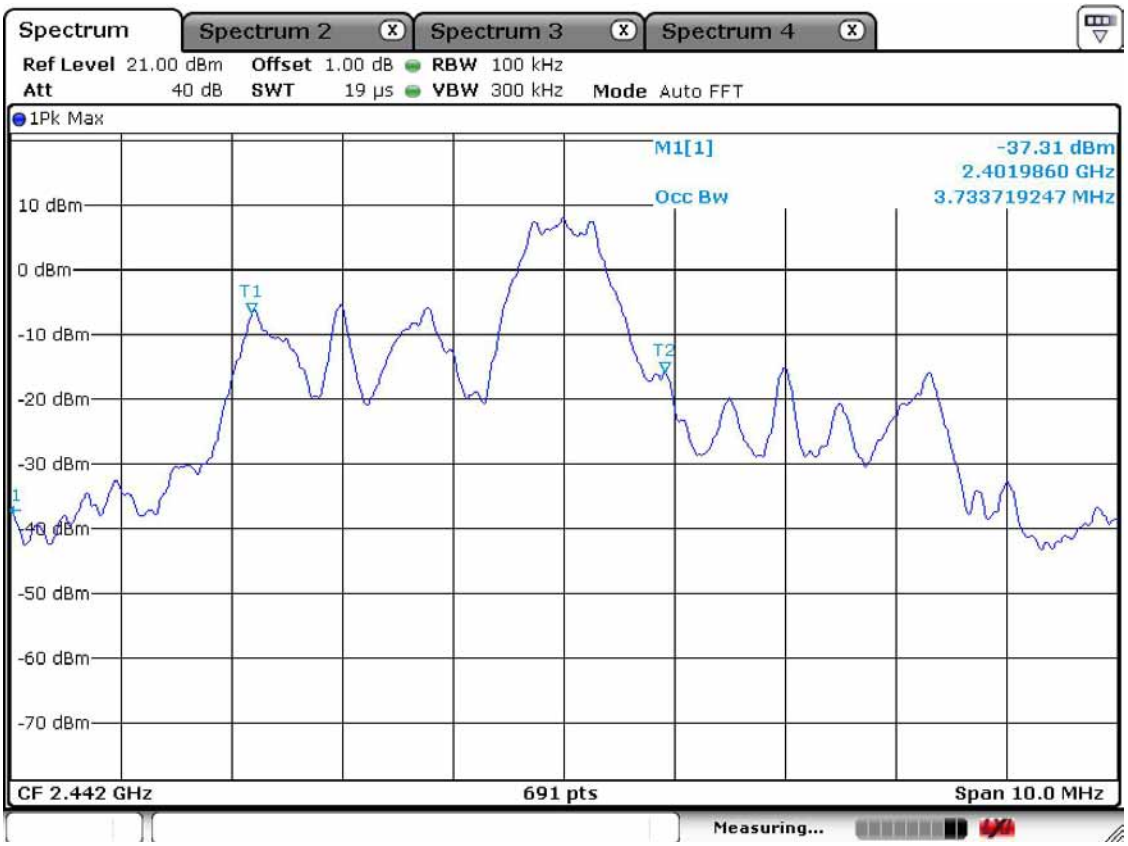


Channel 20

6 dB Bandwidth

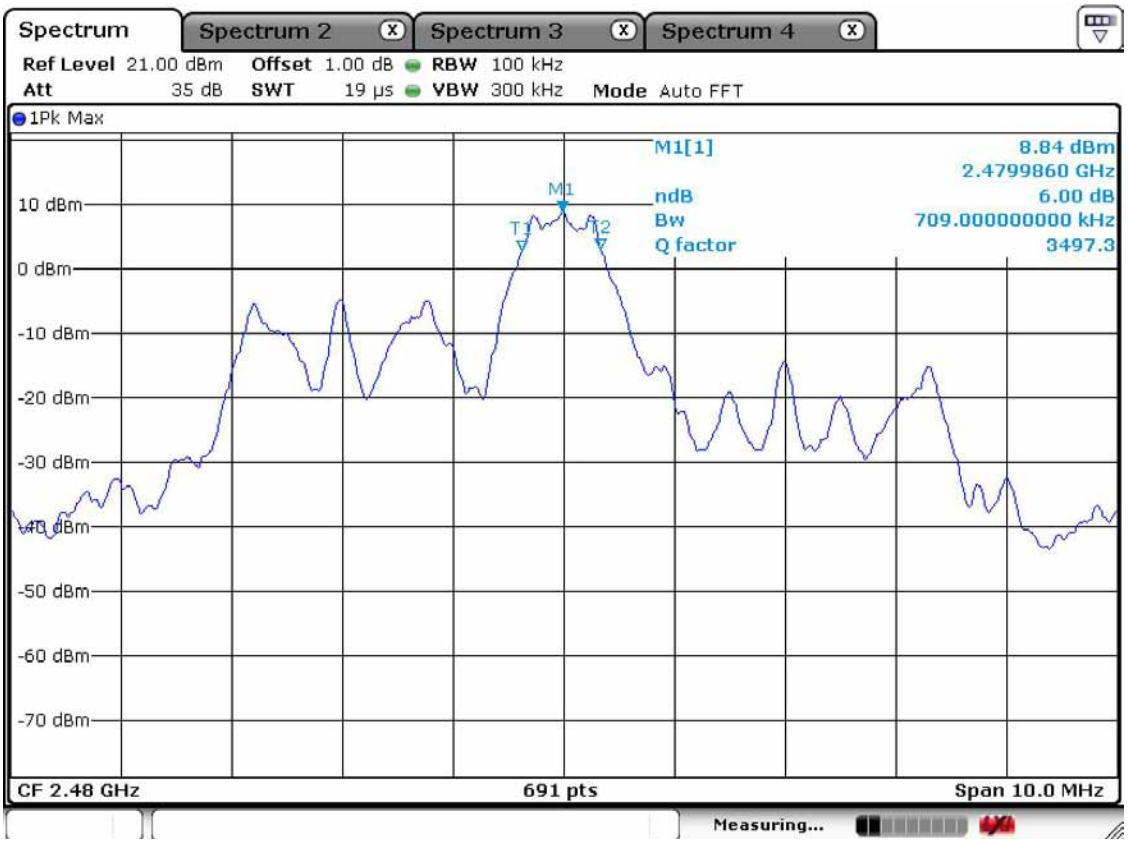


99% Bandwidth

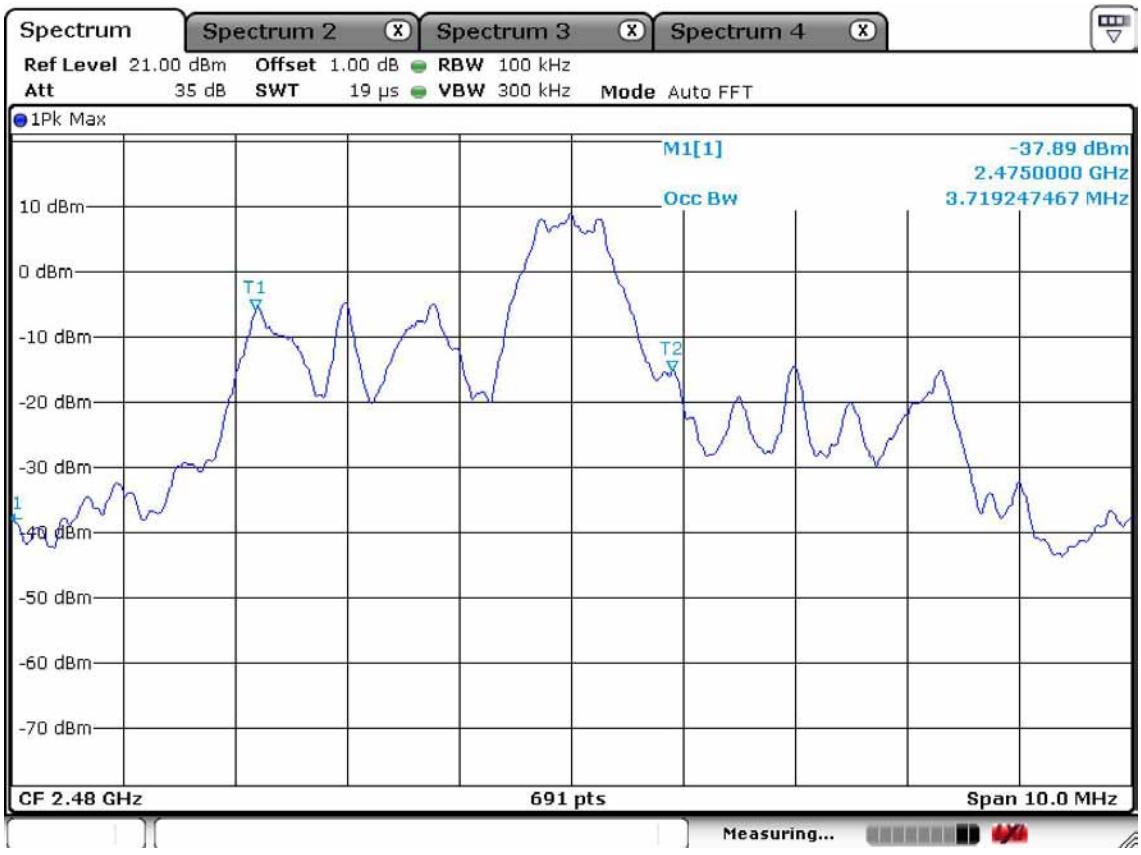


Channel 39

6 dB Bandwidth



99% Bandwidth



3.2.2 Peak Output Power Measurement

Procedure:

*The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance and TCB Workshop 2012, April. The maximum peak output power was measured with the spectrum analyzer connected to the antenna output of the EUT. The spectrum analyzer's internal channel power integration function is used to integrate the power over a bandwidth greater than or equal to the 99% bandwidth. The EUT was operating in transmit mode at the appropriate center frequency.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 1MHz

Span = 1.5 x DTS bandwidth

VBW = 3MHz (VBW ≥ 3x RBW)

Sweep = auto

Detector function = peak

Measurement Data:

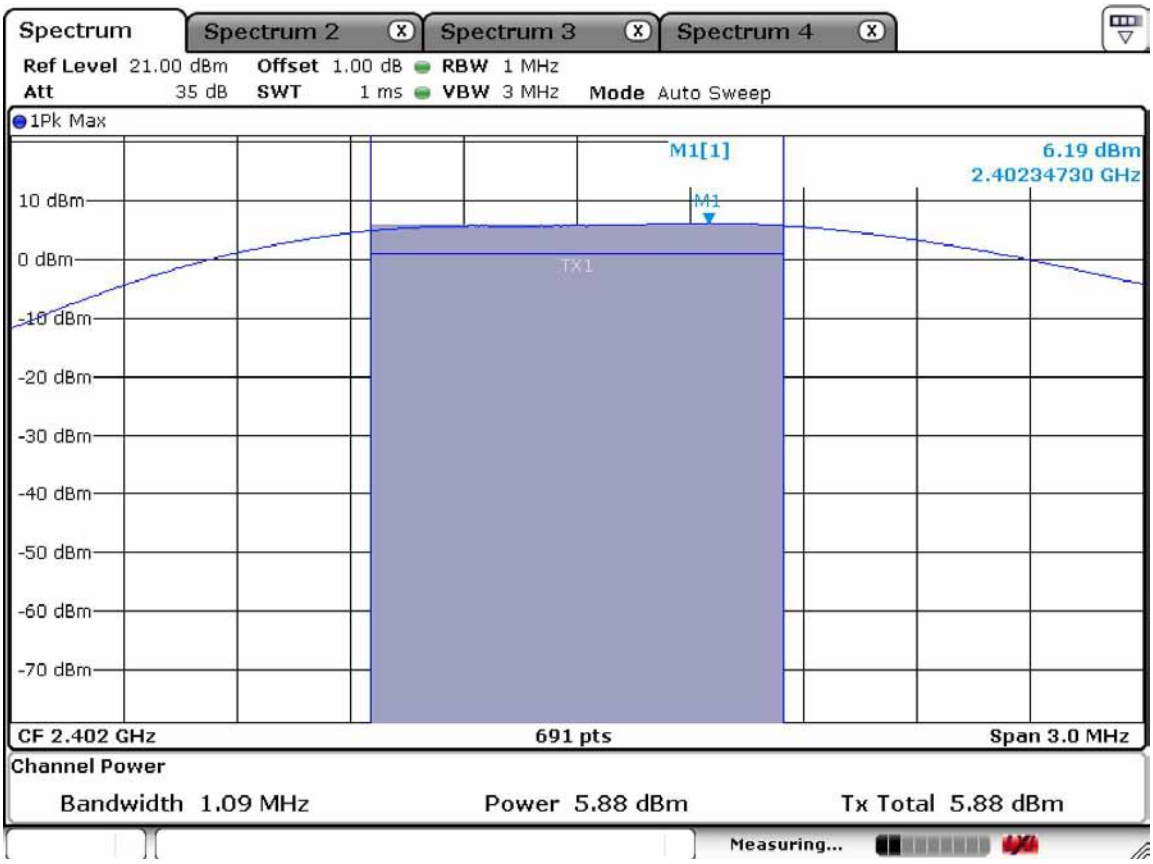
Frequency (MHz)	Channel No.	Test Results		
		Measured Data (dBm)	Measured Data (mW)	Result
2402	**0**	**5.88**	**3.87**	Complies
2442	**20**	**8.21**	**6.62**	Complies
2480	**39**	**8.88**	**7.73**	Complies

- See next pages for actual measured spectrum plots.

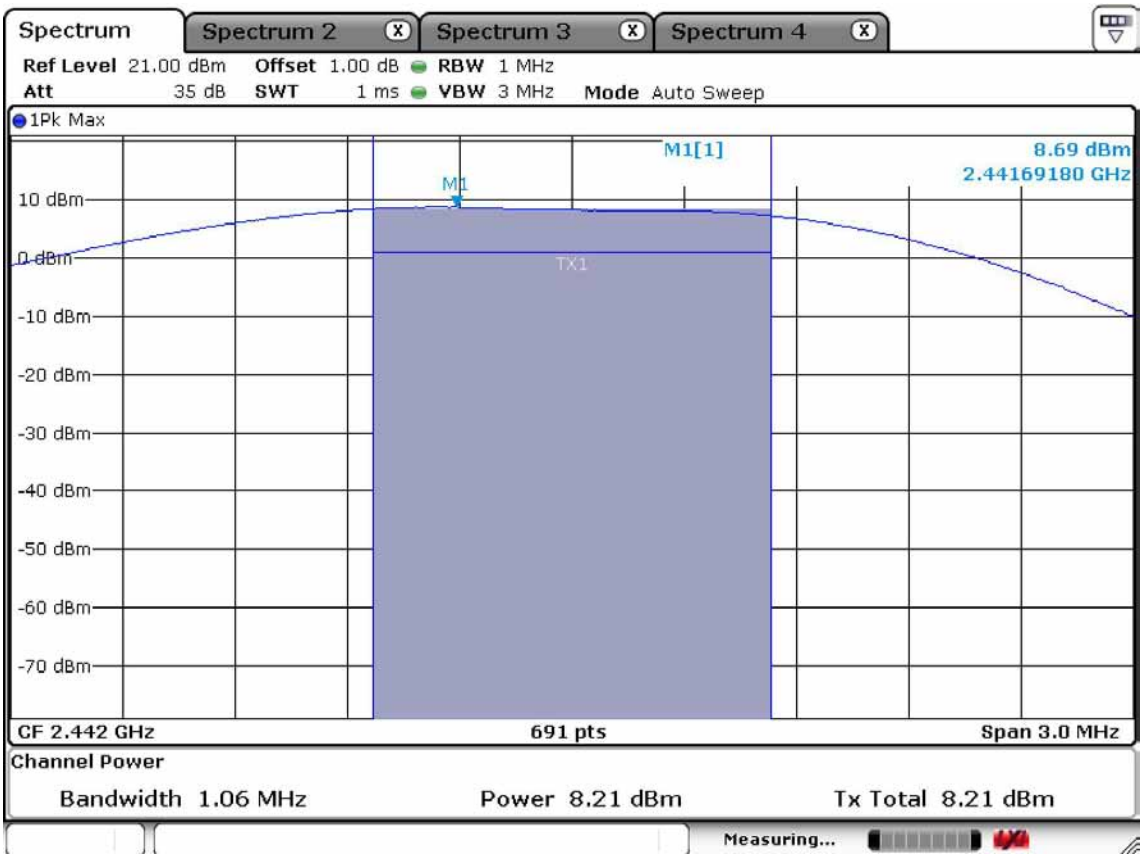
Minimum Standard:

Peak output power	< 1W

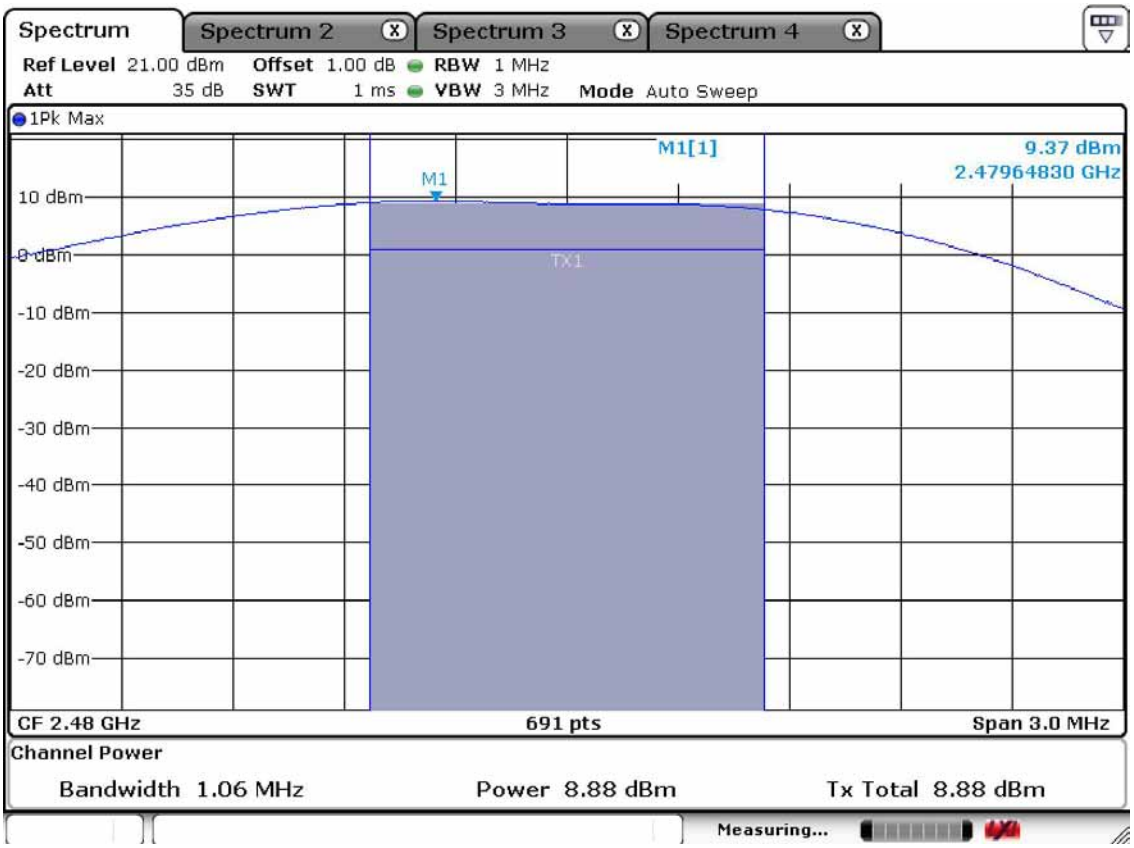
CH 0



CH 20



CH 39


Spectrum
Spectrum 2
Spectrum 3
Spectrum 4
Ref Level 21.00 dBm
Offset 1.00 dB
RBW 1 MHz
Att 35 dB
SWT 1 ms
VBW 3 MHz
Mode Auto Sweep
1Pk Max
M1[1]
9.37 dBm
2.47964830 GHz
M1
TX1
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
CF 2.48 GHz
691 pts
Span 3.0 MHz
Channel Power
Bandwidth 1.06 MHz
Power 8.88 dBm
Tx Total 8.88 dBm
Measuring...

3.2.3 Peak Power Spectral Density

Procedure:

*The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance and TCB Workshop 2012, April. 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.

The spectrum analyzer is set to:

RBW = 3 kHz (3kHz ≤ RBW ≤ 100kHz) Span = 1.5 times the DTS bandwidth

VBW = 3 kHz (VBW ≥ 3x RBW) Sweep = auto

Detector function = peak Trace = max hold

Measurement Data:

Frequency (MHz)	Ch.	Test Results	
		dBm	Result
2402	**0**	**-10.11**	Complies
2442	**20**	**-7.65**	Complies
2480	**39**	**-6.59**	Complies

- See next pages for actual measured spectrum plots.

Minimum Standard:

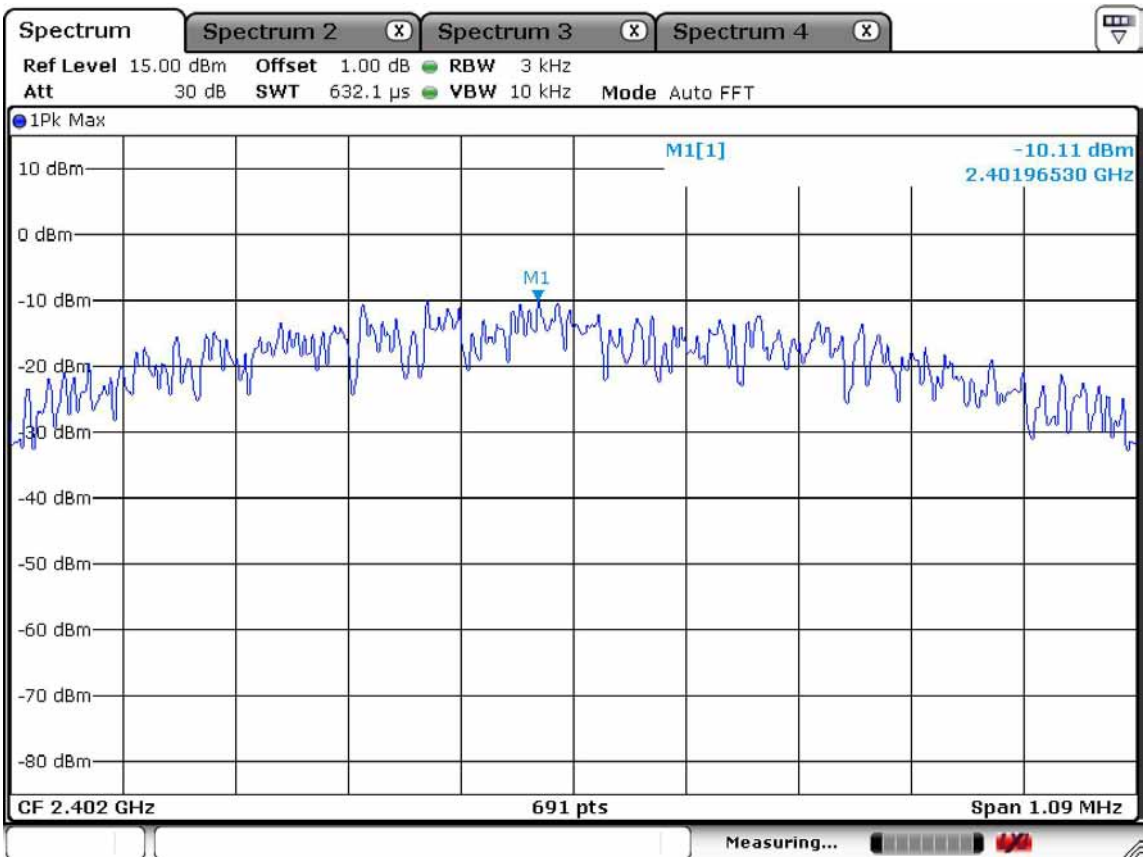
Power Spectral Density	< 8dBm @ 3kHz BW

Measurement Setup

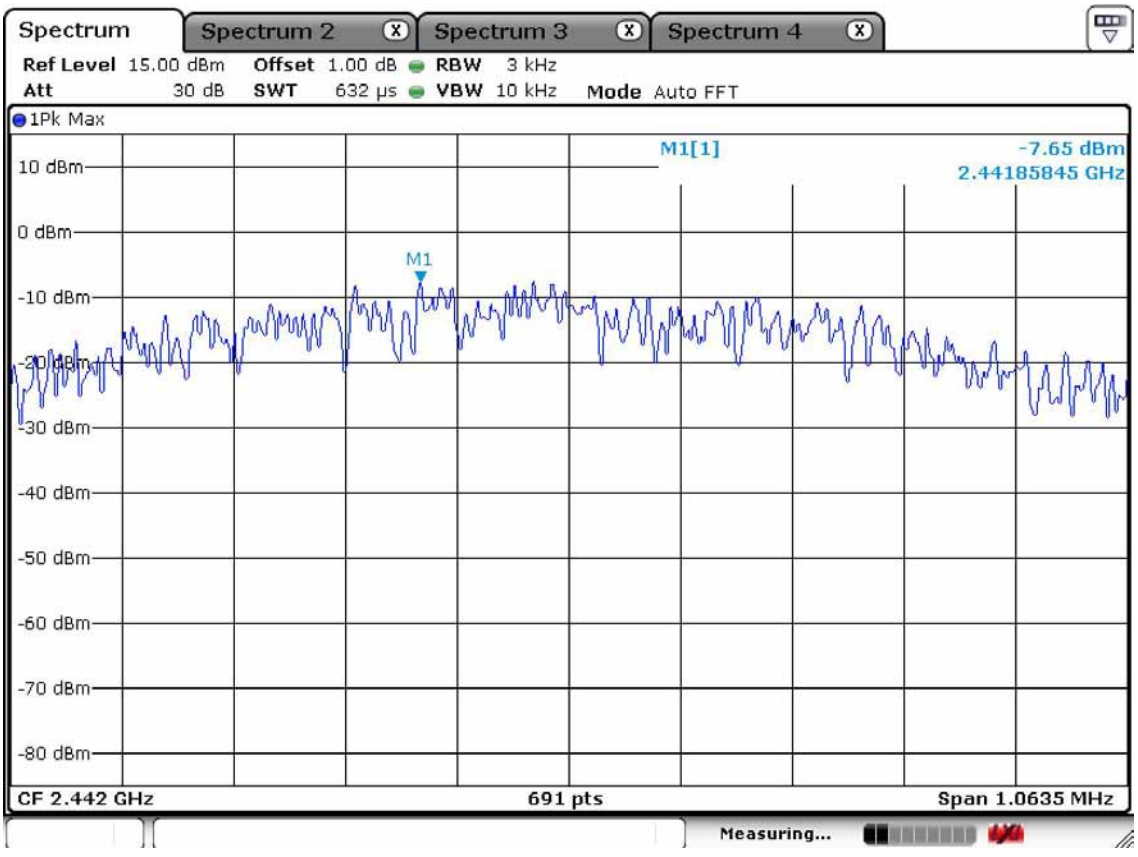
Same as the Chapter 3.2.1 (Figure 1)

Peak Power Density Measurement

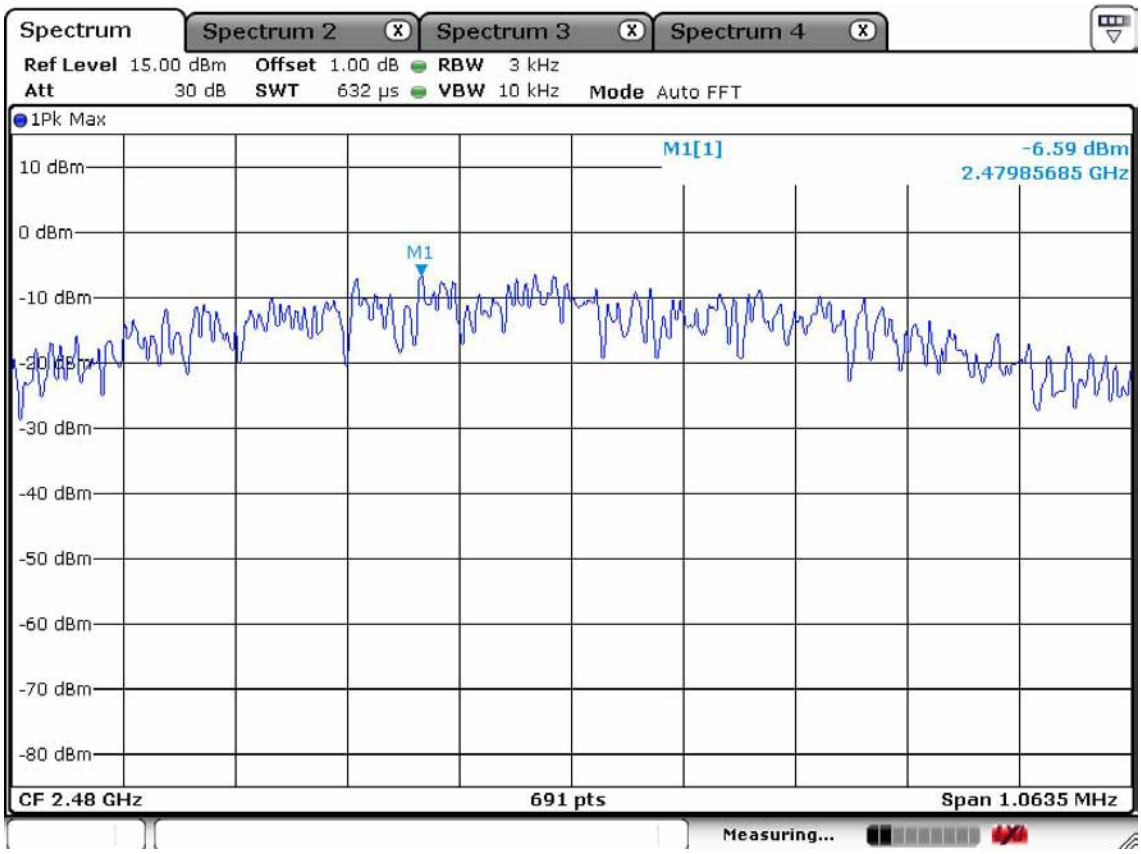
CH 0



CH 20



CH 39


Spectrum
Spectrum 2
Spectrum 3
Spectrum 4
Ref Level 15.00 dBm
Offset 1.00 dB
RBW 3 kHz
Att 30 dB
SWT 632 µs
VBW 10 kHz
Mode Auto FFT
1Pk Max
M1[1]
-6.59 dBm
2.47985685 GHz
M1
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.48 GHz
691 pts
Span 1.0635 MHz
Measuring...

3.2.4 Band - edge & Spurious

Procedure:

*The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance and TCB Workshop 2012, April.

The bandwidth at 20dB down from the highest inband spectral density is measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels.

After the trace being stable, Use the marker-to-peak function to measure 20 dB down both sides of the intentional emission.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 100 kHz	VBW = 100 kHz
Span = 40-50 MHz	Detector function = peak
Trace = max hold	Sweep = auto

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)

The spectrum analyzer is set to:

Frequency = the highest, middle and the lowest channels

PEAK:	RBW = VBW = 1MHz, Sweep=Auto
Average:	RBW = 1MHz, VBW=10Hz, Sweep=Auto
Measurement Distance:	3m
Polarization:	Horizontal / Vertical

Measurement Data: Complies

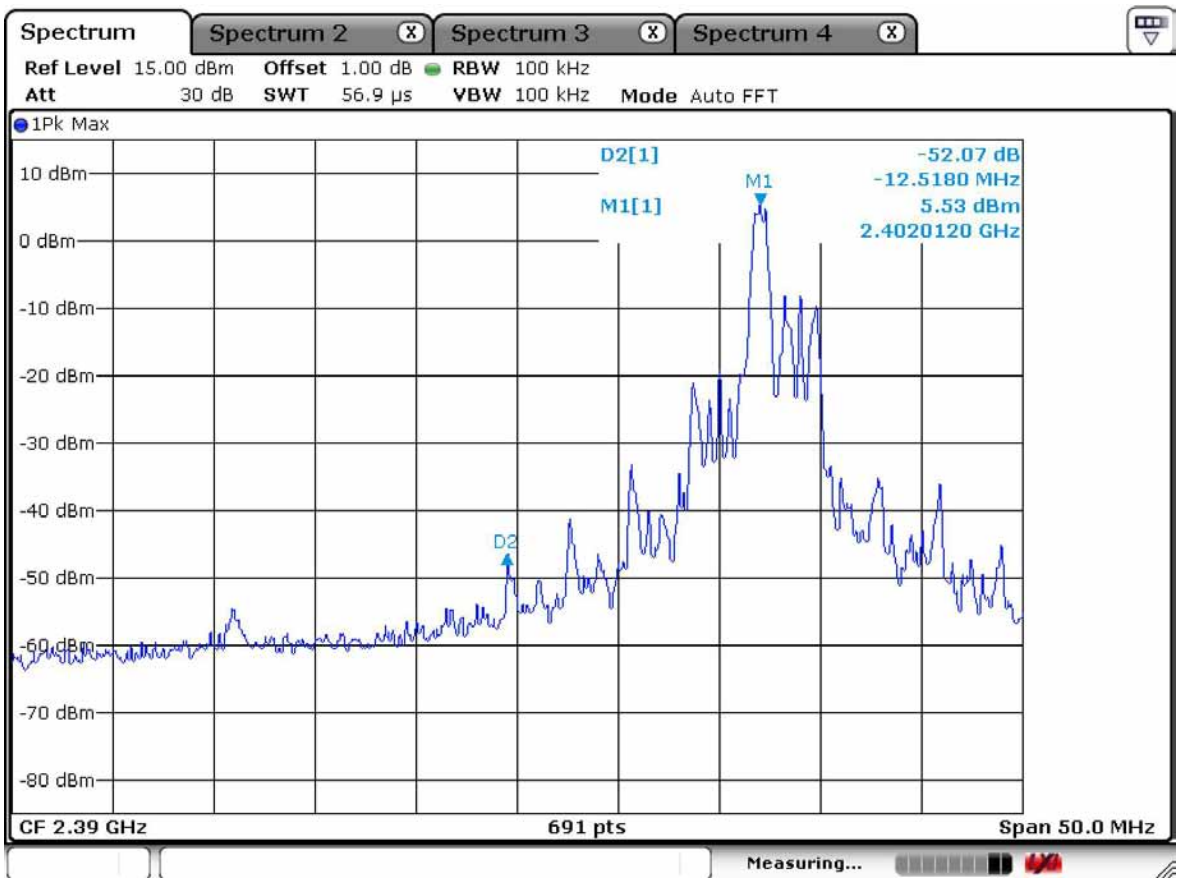
- All conducted emission in any 100kHz bandwidth outside of the spread spectrum band was at least 20dB lower than the highest inband spectral density. Therefore the applying equipment meets the requirement.
- See next pages for actual measured spectrum plots.

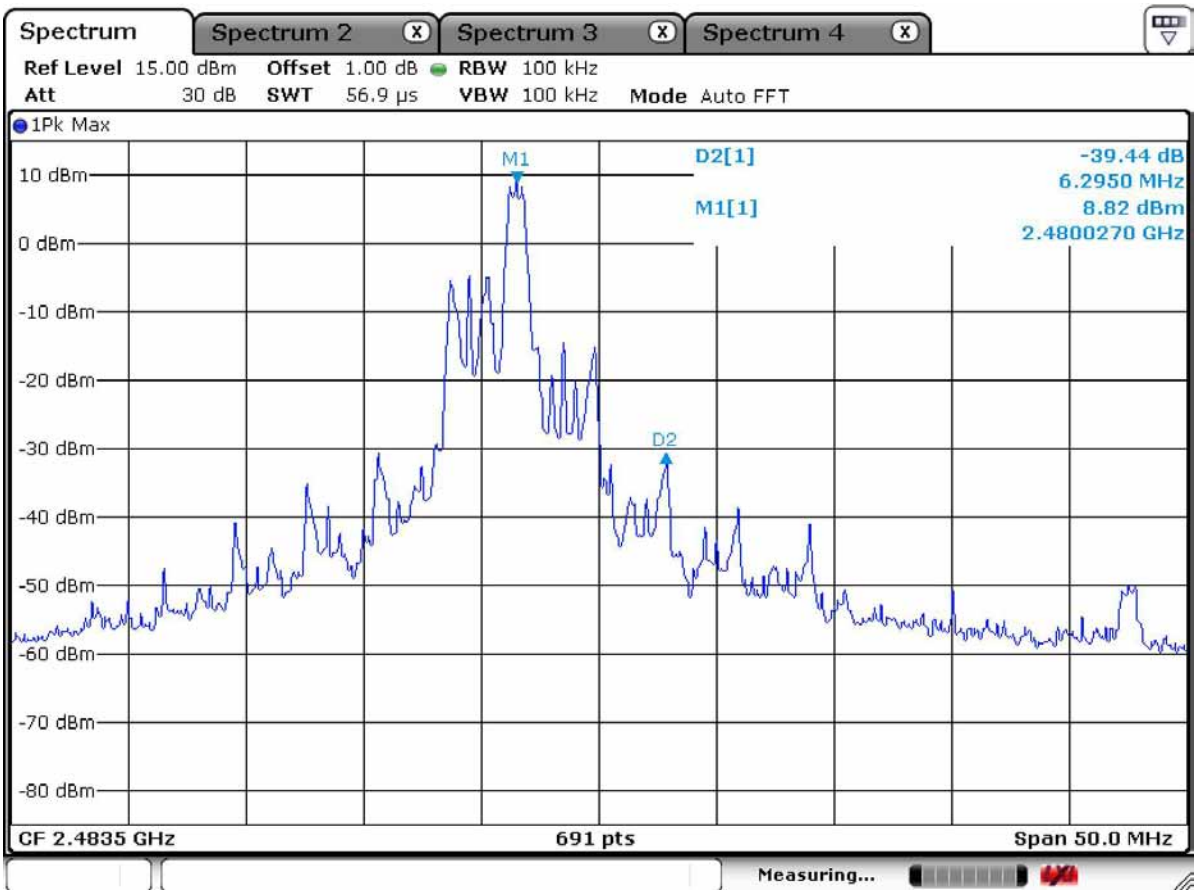
Minimum Standard:	> 20 dBc

Measurement Setup

Same as the Chapter 3.2.1 (Figure 1)

Band–edge : Conducted Measurements





Band-edges in the restricted band 2310-2390 MHz measurement (Ant M/N: AN2400-3306RS)

Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Correction Factor Antenna	Correction Factor Amp. Gain+CableLoss	Limits [dBuV/m] AV / Peak		Result [dBuV/m] AV / Peak		Margin [dB] AV / Peak	
2389.2	36.4	49.9	V	29.1	24.4	54.0	74.0	41.1	54.6	12.9	19.4

Band-edges in the restricted band 2483.5-2500 MHz measurement (Ant M/N: AN2400-3306RS)

Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Correction Factor Antenna	Correction Factor Amp. Gain+CableLoss	Limits [dBuV/m] AV / Peak		Result [dBuV/m] AV / Peak		Margin [dB] [MHz]	
2483.5	39.2	52.1	V	29.1	24.4	54.0	74.0	43.9	56.8	10.1	17.2

Band-edges in the restricted band 2310-2390 MHz measurement (Ant M/N: R-AN2400-5801RS)

Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Correction Factor Antenna	Correction Factor Amp. Gain+CableLoss	Limits [dBuV/m] AV / Peak		Result [dBuV/m] AV / Peak		Margin [dB] AV / Peak	
2389.9	38.2	49.8	V	29.1	24.4	54.0	74.0	42.9	54.5	11.1	19.5

Band-edges in the restricted band 2483.5-2500 MHz measurement (Ant M/N: R-AN2400-5801RS)

Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Correction Factor Antenna	Correction Factor Amp. Gain+CableLoss	Limits [dBuV/m] AV / Peak		Result [dBuV/m] AV / Peak		Margin [dB] [MHz]	
2483.5	40.1	53.6	V	29.1	24.4	54.0	74.0	44.8	58.3	9.2	15.7

Band-edges in the restricted band 2310-2390 MHz measurement (Ant M/N: R-AN2400-1901RS)

Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Correction Factor Antenna	Correction Factor Amp. Gain+CableLoss	Limits [dBuV/m] AV / Peak		Result [dBuV/m] AV / Peak		Margin [dB] AV / Peak	
2389.9	35.5	46.2	V	29.1	24.4	54.0	74.0	40.2	50.9	13.8	23.1

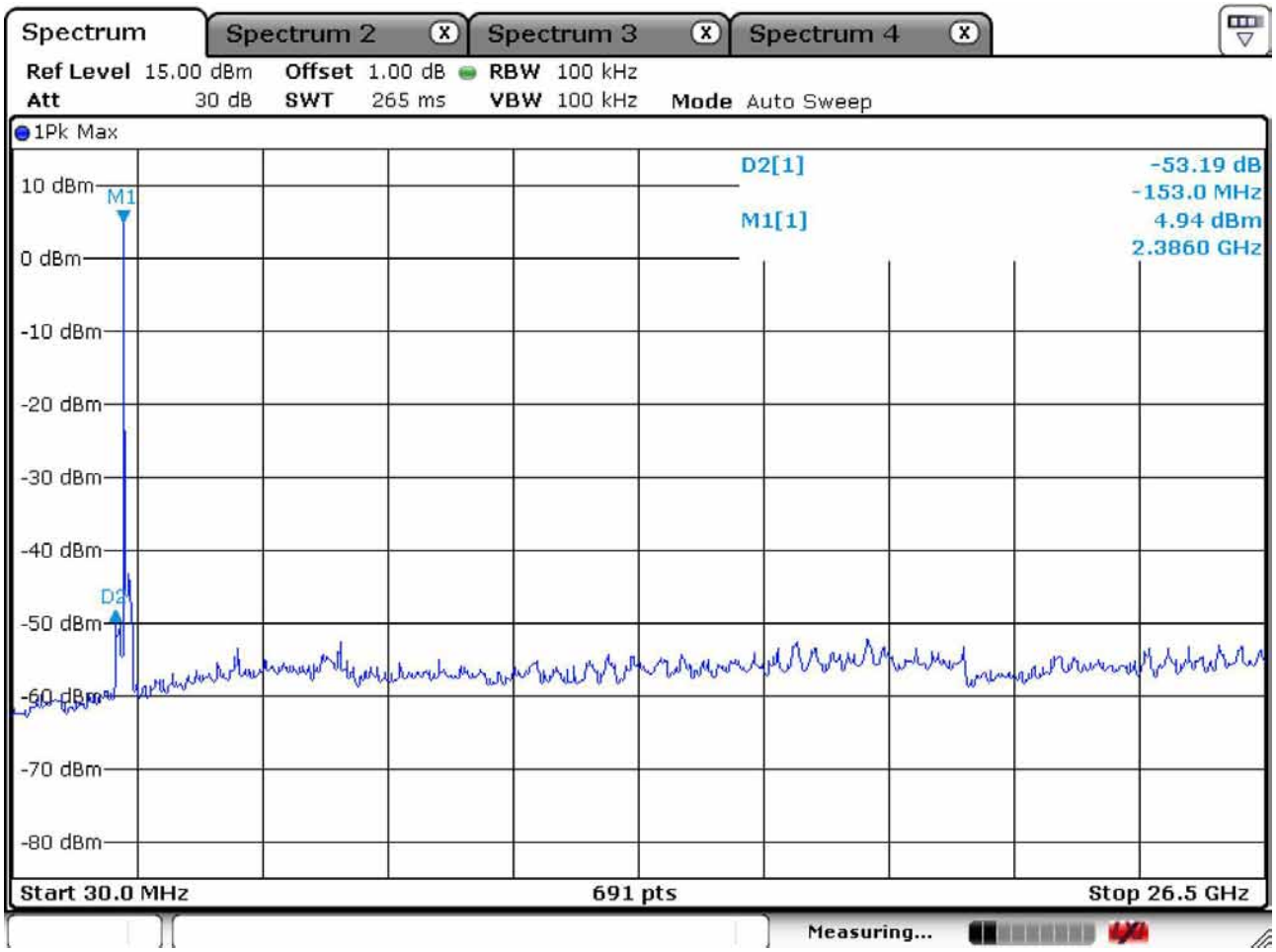
Band-edges in the restricted band 2483.5-2500 MHz measurement (Ant M/N: R-AN2400-1901RS)

Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Correction Factor Antenna	Correction Factor Amp. Gain+CableLoss	Limits [dBuV/m] AV / Peak		Result [dBuV/m] AV / Peak		Margin [dB] [MHz]	
2483.5	43.0	56.5	V	29.1	24.4	54.0	74.0	47.7	61.2	6.3	12.8

Note : This EUT was tested in 3 orthogonal positions and the worst-case data was presented.

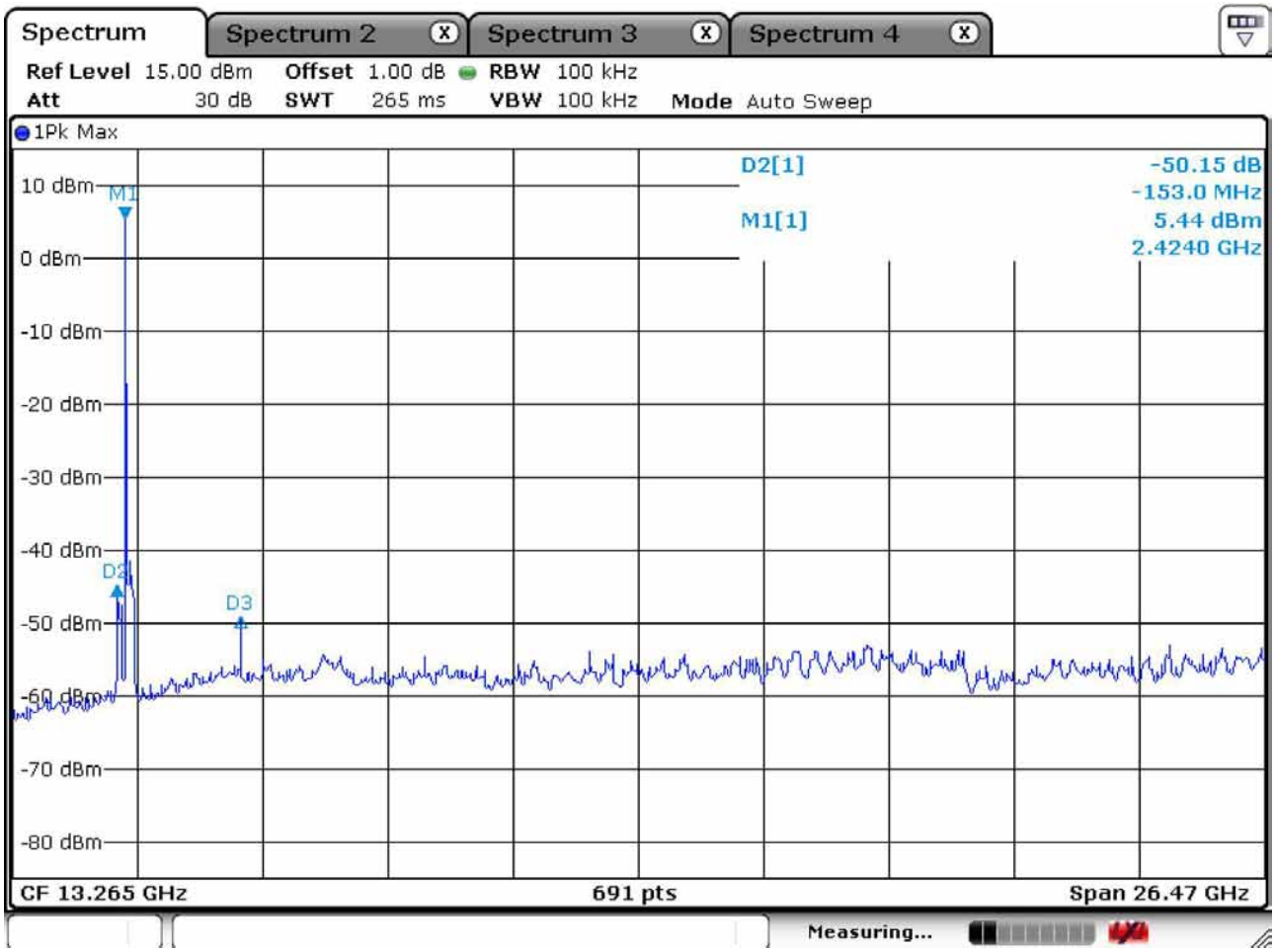
Low channel

Frequency Range = 30 MHz ~ 10th harmonic.



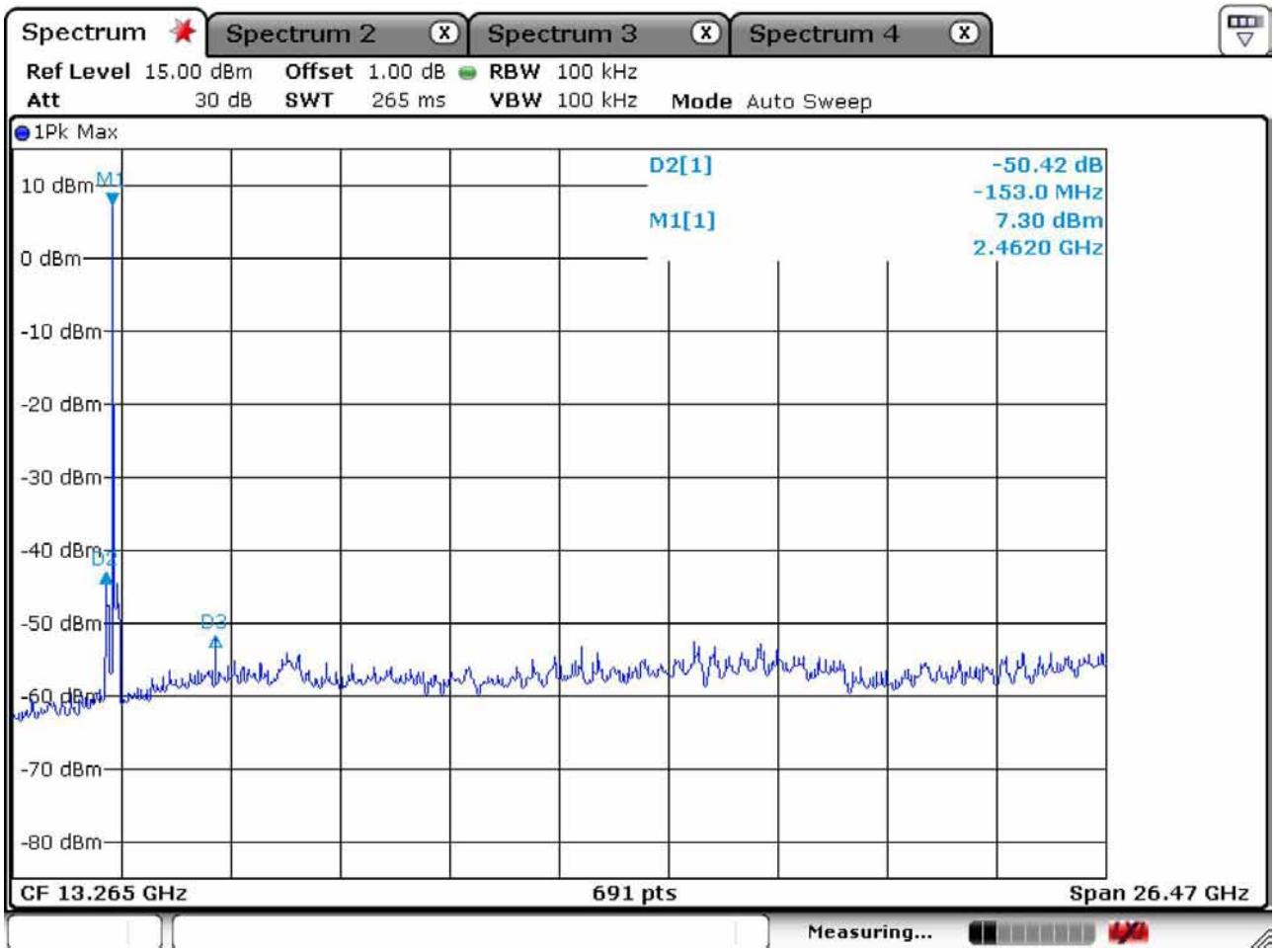
Mid channel

Frequency Range = 30 MHz ~ 10th harmonic.



High channel

Frequency Range = 30 MHz ~ 10th harmonic.



3.2.5 Field Strength of Harmonics-Transmitter

Procedure:

*The testing follows TCB Workshop 2012, April and fulfills ANSI C63.4-2003 and the guidelines in ANSI C63.10-2009 test requirement. The EUT was placed on a 0.8m high wooden table inside a shielded enclosure. An antenna was placed near the EUT and measurements of frequencies and amplitudes of field strengths were recorded for reference during final measurements. For final radiated testing, measurements were performed in OATS. Measurements were performed with the EUT oriented in 3 orthogonal axis and rotated 360 degrees to determine worst-case orientation for maximum emissions.

The spectrum analyzer is set to:

Center frequency = the worst channel

Frequency Range = 9 KHz ~ 10^{th} harmonic.

RBW = 120 kHz (9 KHz ~ 1 GHz) Peak:VBW ≥ RBW

= 1 MHz (1 GHz ~ 10^{th} harmonic) Average:VBW=10Hz

Span = 100 MHz Detector function = Peak and Average

Trace = max hold Sweep = auto

Measurement Data: Complies

- Refer to the next page.
- No other emissions were detected at a level greater than 20dB below limit.
- The three antennas were used with this EUT during the Testing.

Minimum Standard: FCC Part 15.209(a)

Frequency (MHz)	Limit (uV/m) @ 3m
0.009 ~ 0.490	2400/F (kHz) @ 300m
0.490 ~ 1.705	24000/F (kHz) @ 30m
1.705 ~ 30	30 @ 30m
30 ~ 88	100 **
88 ~ 216	150 **
216 ~ 960	200 **
Above 960	500

** 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, 76-88MHz, 174-216MHz or 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

Measurement Data : (Above 1GHz) Antenna M/N: AN2400-3306RS

Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Correction Factor		D.C.F	Limits [dBuV/m] AV/Peak		Result [dBuV/m] AV/Peak		Margin [dB] AV / Peak	
				Antenna	Amp.Gain+Cable							
4804	51.4	60.6	V	29.8	21.6	-30.43	54.0	74.0	29.2	38.4	24.8	35.6
Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Correction Factor		D.C.F	Limits [dBuV/m] AV/Peak		Result [dBuV/m] AV/Peak		Margin [dB] AV / Peak	
				Antenna	Amp.Gain+Cable							
4882.0	53.0	62.5	V	29.8	21.6	-30.43	54.0	74.0	30.8	40.3	23.2	33.7
Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Correction Factor		D.C.F	Limits [dBuV/m] AV/Peak		Result [dBuV/m] AV/Peak		Margin [dB] AV / Peak	
				Antenna	Amp.Gain+Cable							
4960.0	52.2	60.5	V	29.8	21.6	-30.43	54.0	74.0	30.0	38.3	24.0	35.7

- No other emissions were detected at a level greater than 20dB below limit.

- D.C.F (Duty Cycle Correction Factor) = 20log(The worst Case DWELL Time/100ms)

= 20log(3.007ms/100ms) = -30.43

Measurement Data: (9kHz - 30MHz)

Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Correction Factor		Limits [dBuV/m] AV / Peak		Result [dBuV/m] AV / Peak		Margin [dB] AV / Peak	
				Antenna	Amp.Gain+Cable						
-	-	-	-	-	-	-	-	-	-	-	-
No emissions were detected at a level greater than 20dB below limit.											
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-

*No emissions were detected at a level greater than 20dB below limit.

Measurement Data : (Above 1GHz) Antenna M/N: R-AN2400-5801RS

Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Correction Factor		D.C.F	Limits [dBuV/m] AV/Peak		Result [dBuV/m] AV/Peak		Margin [dB] AV / Peak	
				Antenna	Amp.Gain+Cable							
4804	55.1	63.8	V	29.8	21.6	-30.43	54.0	74.0	32.9	41.6	21.1	32.4
Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Correction Factor		D.C.F	Limits [dBuV/m] AV/Peak		Result [dBuV/m] AV/Peak		Margin [dB] AV / Peak	
				Antenna	Amp.Gain+Cable							
4882.0	54.6	64.9	V	29.8	21.6	-30.43	54.0	74.0	32.4	42.7	21.6	31.3
Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Correction Factor		D.C.F	Limits [dBuV/m] AV/Peak		Result [dBuV/m] AV/Peak		Margin [dB] AV / Peak	
				Antenna	Amp.Gain+Cable							
4960.0	53.8	61.1	V	29.8	21.6	-30.43	54.0	74.0	31.6	38.9	22.4	35.1

- No other emissions were detected at a level greater than 20dB below limit.

- D.C.F (Duty Cycle Correction Factor) = 20log(The worst Case DWELL Time/100ms)

= 20log(3.007ms/100ms) = -30.43

Measurement Data: (9kHz - 30MHz)

Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Correction Factor		Limits [dBuV/m] AV / Peak		Result [dBuV/m] AV / Peak		Margin [dB] AV / Peak	
				Antenna	Amp.Gain+Cable						
-	-	-	-	-	-	-	-	-	-	-	-
No emissions were detected at a level greater than 20dB below limit.											
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-

*No emissions were detected at a level greater than 20dB below limit.

Measurement Data : (Above 1GHz) Antenna M/N: R-AN2400-1901RS

Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Correction Factor		D.C.F	Limits [dBuV/m] AV/Peak		Result [dBuV/m] AV/Peak		Margin [dB] AV / Peak	
				Antenna	Amp.Gain+Cable							
4804	54.3	63.1	V	29.8	21.6	-30.43	54.0	74.0	32.1	40.9	21.9	33.1
Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Correction Factor		D.C.F	Limits [dBuV/m] AV/Peak		Result [dBuV/m] AV/Peak		Margin [dB] AV / Peak	
				Antenna	Amp.Gain+Cable							
4882.0	53.6	64.4	V	29.8	21.6	-30.43	54.0	74.0	31.4	42.2	22.6	31.8
Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Correction Factor		D.C.F	Limits [dBuV/m] AV/Peak		Result [dBuV/m] AV/Peak		Margin [dB] AV / Peak	
				Antenna	Amp.Gain+Cable							
4959.0	51.2	60.3	V	29.8	21.6	-30.43	54.0	74.0	29.0	38.1	25.0	35.9

- No other emissions were detected at a level greater than 20dB below limit.

- D.C.F (Duty Cycle Correction Factor) = 20log(The worst Case DWELL Time/100ms)

= 20log(3.007ms/100ms) = -30.43

Measurement Data: (9kHz - 30MHz)

Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Correction Factor		Limits [dBuV/m] AV / Peak		Result [dBuV/m] AV / Peak		Margin [dB] AV / Peak	
				Antenna	Amp.Gain+Cable						
-	-	-	-	-	-	-	-	-	-	-	-
No emissions were detected at a level greater than 20dB below limit.											
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-

*No emissions were detected at a level greater than 20dB below limit.

Radiated Emissions – BT 4.0 LE mode (Ant M/N: AN2400-3306RS)

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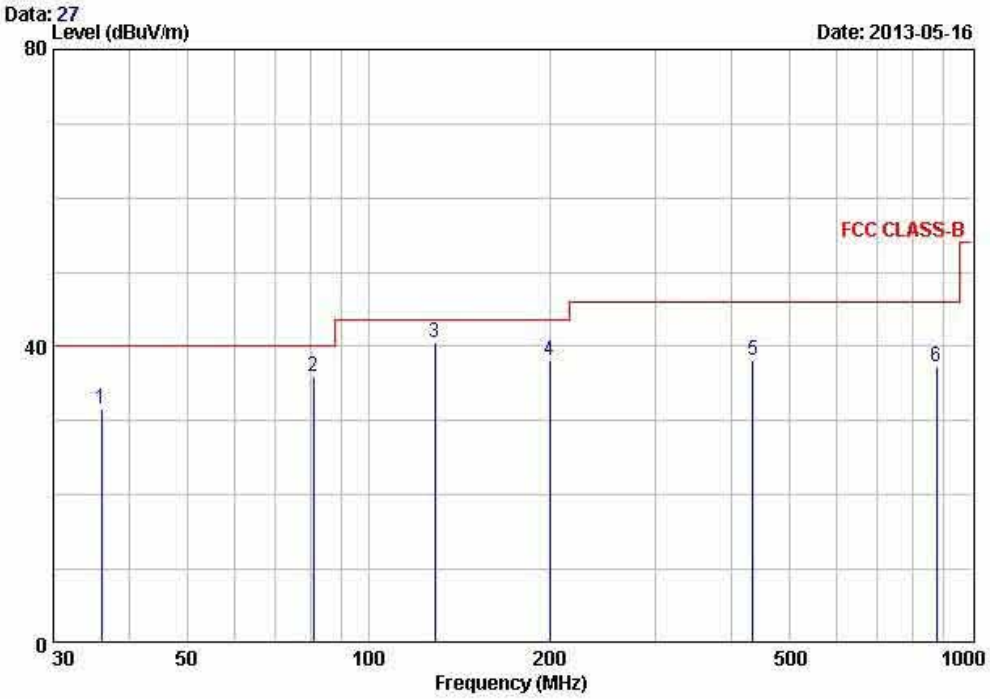
EUT/Model No.: UD100a TEST MODE: Bluetooth mode

Temp Humi : 23 / 46 Tested by: PARK H W



	Freq	Reading	C.F	Result	Limit QP	Margin	Height	Angle	Polarity
	MHz	dBuV/m	dB/m	dBuV/m	dBuV/m	dB	cm	deg	
1	36.02	48.50	-16.86	31.64	40.00	8.36	100	215	VERTICAL
2	81.18	55.60	-19.66	35.94	40.00	4.06	332	169	HORIZONTAL
3	128.84	55.30	-14.86	40.44	43.50	3.06	349	254	HORIZONTAL
4	200.14	54.30	-16.25	38.05	43.50	5.45	374	29	HORIZONTAL
5	434.12	46.50	-8.43	38.07	46.00	7.93	294	155	HORIZONTAL
6	876.32	35.70	1.59	37.29	46.00	8.71	135	208	VERTICAL

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

Radiated Emissions – BT 4.0 LE mode (Ant M/N: R-AN2400-5801RS)

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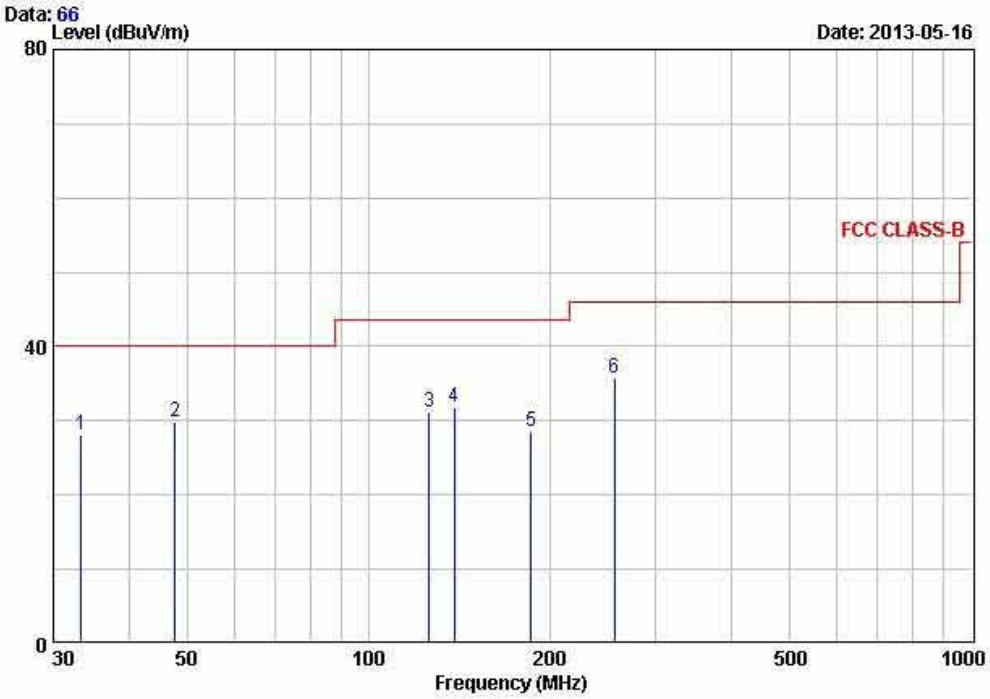
EUT/Model No.: UD100a (2) TEST MODE: Bluetooth mode

Temp Humi : 22 / 46 Tested by: PARK H W



	Freq	Reading	C.F	Result	Limit QP	Margin	Height	Angle	Polarity
	MHz	dBuV/m	dB/m	dBuV/m	dBuV/m	dB	cm	deg	
1	33.41	44.90	-16.79	28.11	40.00	11.89	100	105	VERTICAL
2	47.82	45.30	-15.46	29.84	40.00	10.16	100	153	VERTICAL
3	126.34	46.80	-15.59	31.21	43.50	12.29	155	27	HORIZONTAL
4	138.66	45.30	-13.54	31.76	43.50	11.74	117	215	VERTICAL
5	186.51	43.00	-14.44	28.56	43.50	14.94	115	241	HORIZONTAL
6	256.32	48.20	-12.46	35.74	46.00	10.26	168	234	HORIZONTAL

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

Radiated Emissions – BT 4.0 LE mode (Ant M/N: R-AN2400-1901RS)

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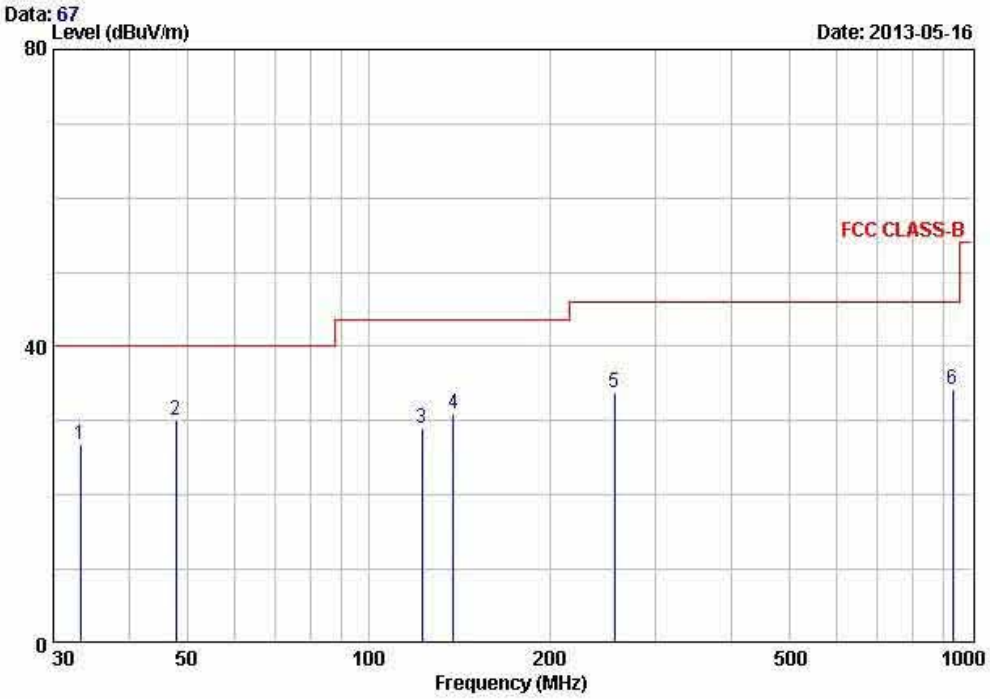
EUT/Model No.: UD100a (3) TEST MODE: Bluetooth mode

Temp Humi : 22 / 46 Tested by: PARK H W



	Freq	Reading	C.F	Result	Limit QP	Margin	Height	Angle	Polarity
	MHz	dBuV/m	dB/m	dBuV/m	dBuV/m	dB	cm	deg	
1	33.27	43.50	-16.79	26.71	40.00	13.29	100	321	VERTICAL
2	47.86	45.50	-15.46	30.04	40.00	9.96	100	171	VERTICAL
3	122.51	45.30	-16.27	29.03	43.50	14.47	116	28	VERTICAL
4	138.52	44.60	-13.56	31.04	43.50	12.46	138	150	HORIZONTAL
5	256.44	46.20	-12.45	33.75	46.00	12.25	127	55	HORIZONTAL
6	932.55	30.10	4.07	34.17	46.00	11.83	100	2	HORIZONTAL

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

3.2.6 Field Strength of Harmonics - Receivers

Definition:

The field strength of emissions from intentional radiators was measured. In case of the air temperature of the test site is out of the range is 10 to 40°C before the testing proceeds the warm-up time of EUT maintain adequately

Test method	:	FCC Part 15.209
Frequency Range	:	9 KHz ~ 10th harmonic.
Bandwidth	:	120 kHz (F < 1GHz) 1 MHz (F > 1GHz)
Distance of antenna	:	3 meters
Test mode	:	Rx mode
Result	:	**Complies**

Measurement Data:

- Refer to the next page.
- No other emissions were detected at a level greater than 20dB below limit
- It gave the worse case emissions.

Field Strength Limit

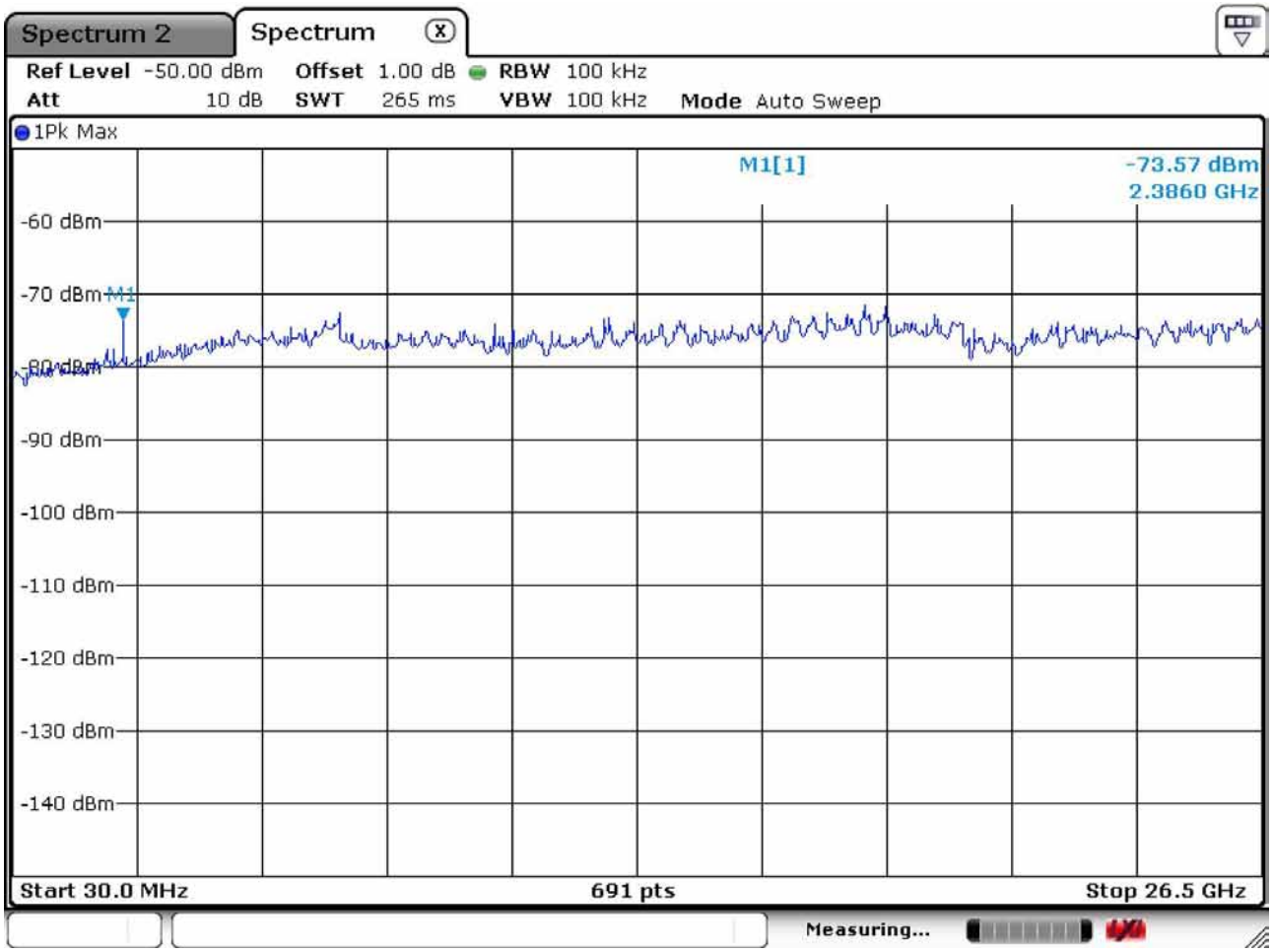
Part 15.209 LIMIT:

Frequency (MHz)	Limit (uV/m) @ 3m
0.009 ~ 0.490	2400/F(kHz)
0.490 ~ 1.705	24000/F(kHz)
1.705 ~ 30	30
30 ~ 88	100 **
88 ~ 216	150 **
216 ~ 960	200 **
Above 960	500

** 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, 76-88MHz, 174-216MHz or 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

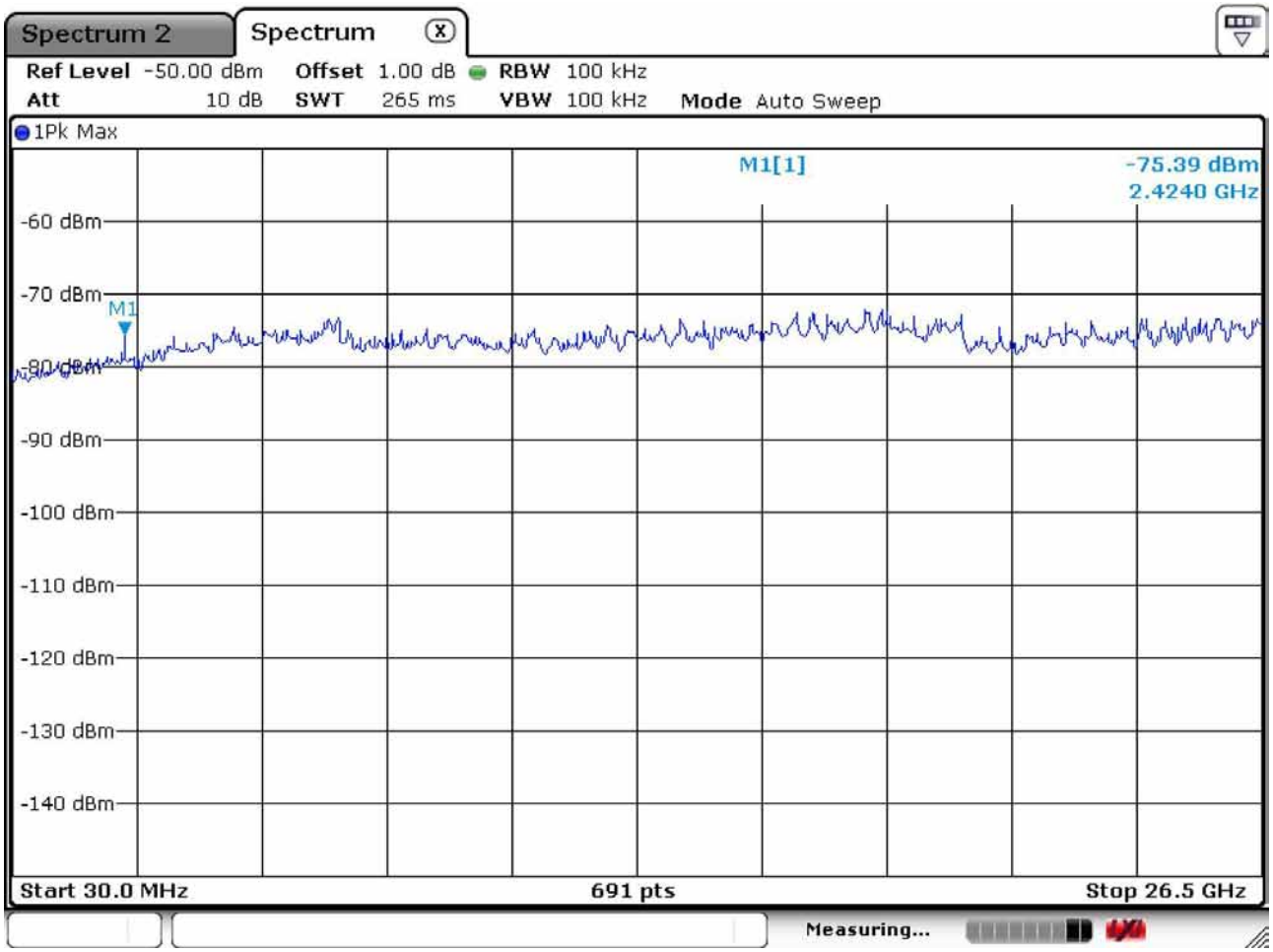
Conducted Emission – Low channel

Frequency Range = 30 MHz ~ 26.5 GHz



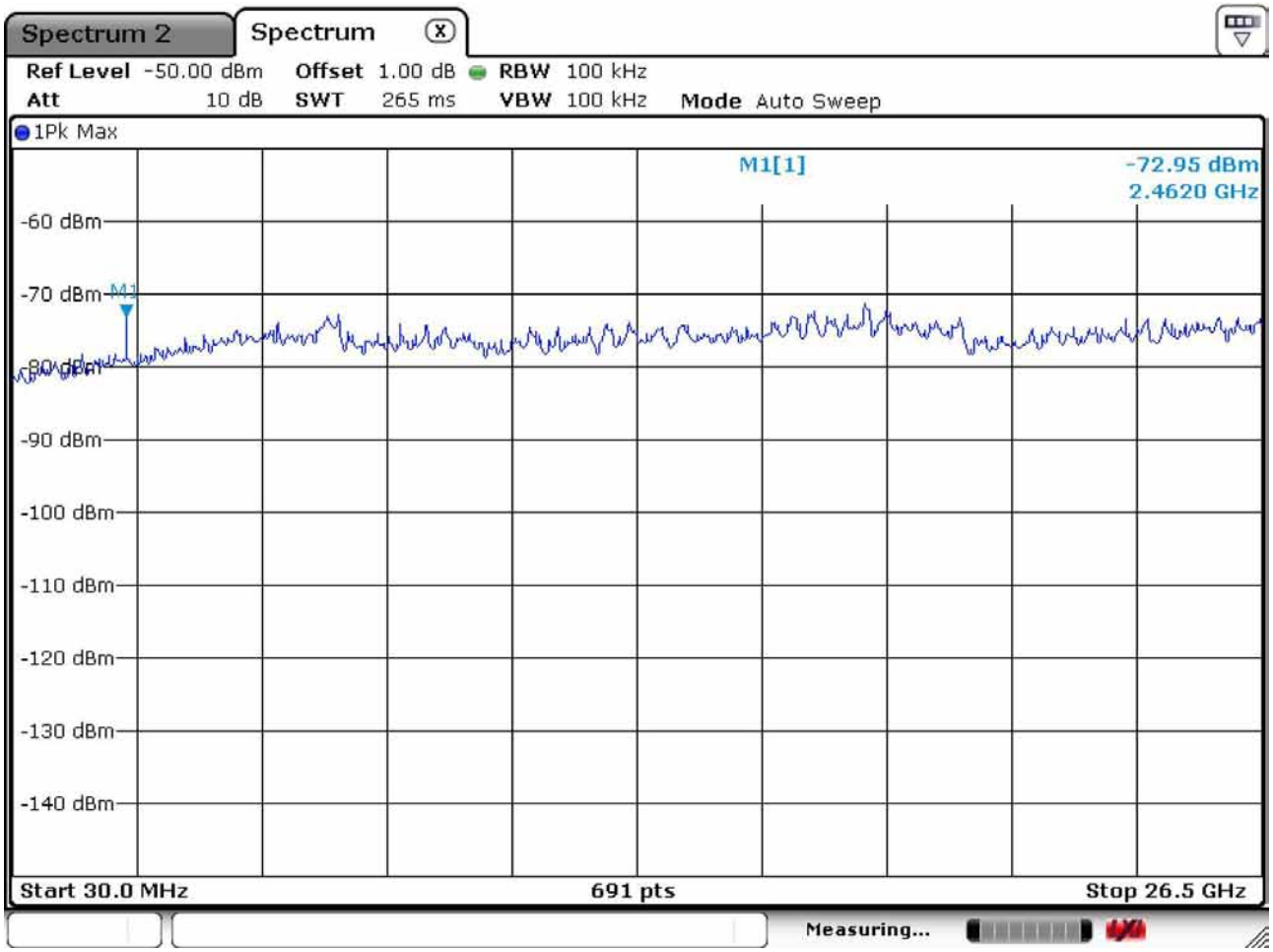
Conduceted Emission – Middle channel

Frequency Range = 30 MHz ~ 26.5 GHz



Conduceted Emission – High channel

Frequency Range = 30 MHz ~ 26.5 GHz



Measurement Data: (30MHz ~ 10th harmonic.)

Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Correction Factor Antenna	Correction Factor Amp. Gain +Cable	Limits [dBuV/m] AV / Peak		Result [dBuV/m] AV / Peak		Margin [dB] AV / Peak	
No emissions were detected at a level greater than 20dB below limit.											

Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Correction Factor Antenna	Correction Factor Amp. Gain +Cable	Limits [dBuV/m] AV / Peak		Result [dBuV/m] AV / Peak		Margin [dB] AV / Peak	
No emissions were detected at a level greater than 20dB below limit.											

Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Correction Factor Antenna	Correction Factor Amp. Gain +Cable	Limits [dBuV/m] AV / Peak		Result [dBuV/m] AV / Peak		Margin [dB] AV / Peak	
No emissions were detected at a level greater than 20dB below limit.											

Measurement Data: (9kHz - 30MHz)

Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Correction Factor Antenna	Correction Factor Amp.Gain+Cable	Limits [dBuV/m] AV / Peak		Result [dBuV/m] AV / Peak		Margin [dB] AV / Peak	
-	-	-	-	-	-	-	-	-	-	-	-
No emissions were detected at a level greater than 20dB below limit.											
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-

*No emissions were detected at a level greater than 20dB below limit.

3.2.7 AC Conducted Emissions

Procedure:

*The testing follows the guidelines in ANSI C63.4-2003 and ANSI C63.10-2009. The conducted emissions are measured in the shielded room with a spectrum analyzer in peak hold. While the measurement, EUT had its hopping function disabled at the middle channels in line with Section 15.31(m). Emissions closest to the limit are measured in the quasi-peak mode (QP) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation and Exerciser operation. The highest emissions relative to the limit are listed.

Measurement Data: Complies

- See next pages for actual measured spectrum plots.
- No emissions were detected at a level greater than 20dB below limit.

Minimum Standard: FCC Part 15.207(a)/EN 55022

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

Conducted Emissions – BT mode – LINE (Ant M/N: AN2400-3306RS)

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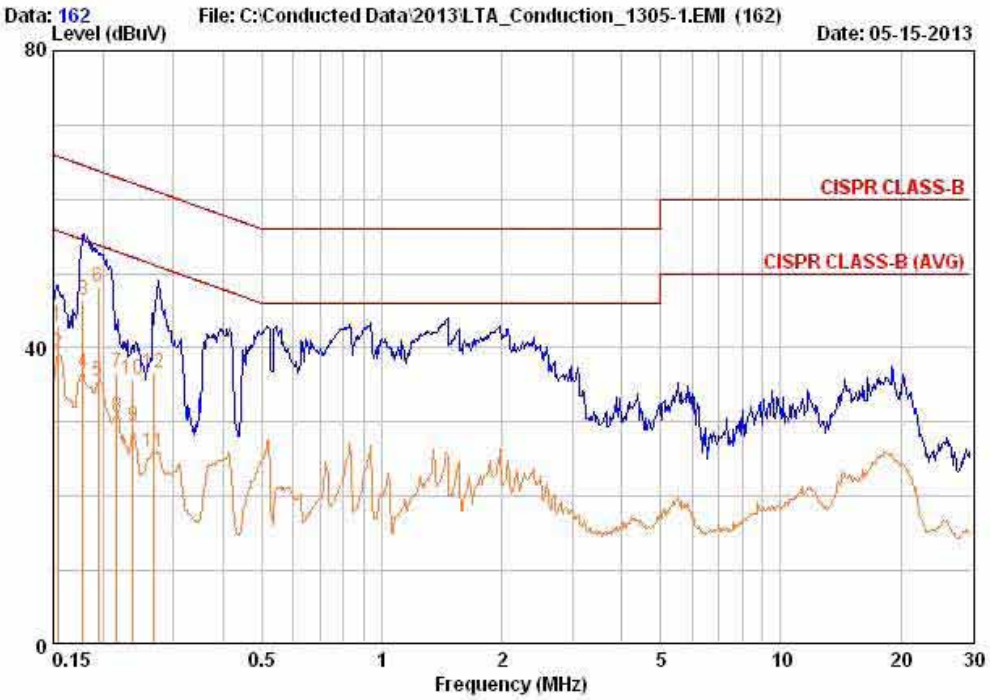
EUT / Model No.	: UD100a	Phase	: LINE
Test Mode	: Bluetooth mode	Test Power	: 120 / 60
Temp./Humi.	: 23 / 56	Test Engineer	: PARK.H.W



Freq	RD QP	RD AV	C.F	Result QP	Result AV	Limit QP	Limit AV	Margin QP	Margin AV
MHz	dBuV	dBuV	dB	dBuV	dBuV	dBuV	dBuV	dB	dB
0.154	33.34	29.64	9.58	42.92	39.22	65.78	55.78	22.86	16.56
0.178	36.85	26.95	9.58	46.43	36.53	64.58	54.58	18.15	18.05
0.194	38.65	25.95	9.58	48.23	35.53	63.86	53.86	15.63	18.33
0.216	27.15	21.15	9.58	36.73	30.73	62.97	52.97	26.24	22.24
0.238	26.15	19.95	9.58	35.73	29.53	62.17	52.17	26.44	22.64
0.268	27.15	16.35	9.58	36.73	25.93	61.18	51.18	24.45	25.25

Remarks: C.F (Correction Factor) = Insertion loss + Cable loss

Conducted Emissions – BT mode – NEUTRAL (Ant M/N: AN2400-3306RS)

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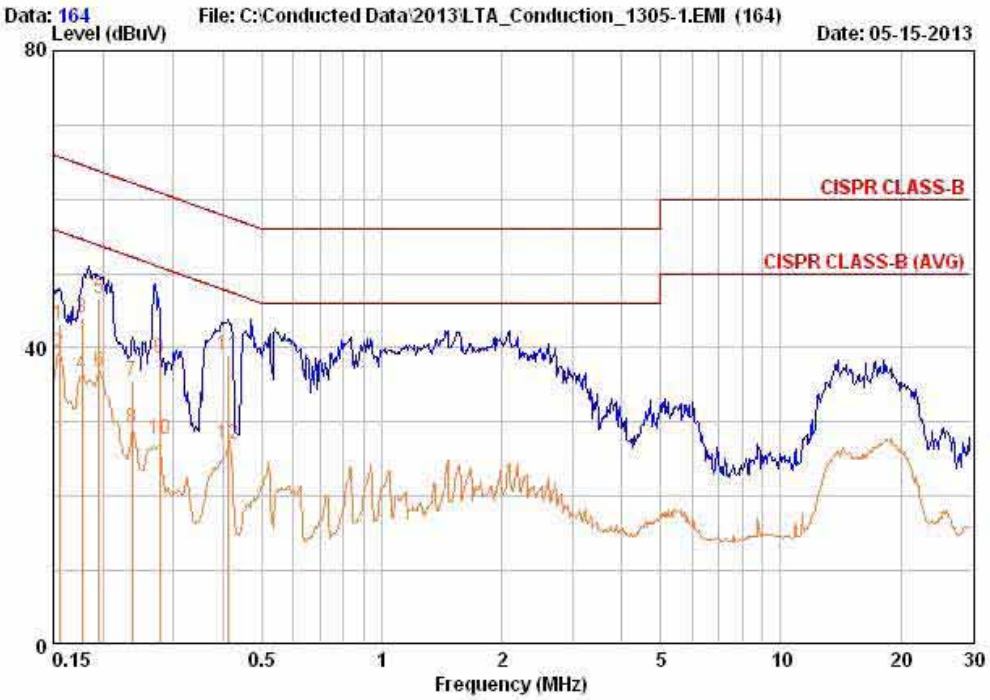
EUT / Model No.	: UD100a	Phase	: NEUTRAL
Test Mode	: Bluetooth mode	Test Power	: 120 / 60
Temp./Humi.	: 23 / 56	Test Engineer	: PARK.H.W



Freq	RD QP	RD AV	C.F	Result QP	Result AV	Limit QP	Limit AV	Margin QP	Margin AV
MHz	dBuV	dBuV	dB	dBuV	dBuV	dBuV	dBuV	dB	dB
0.155	33.44	29.64	9.62	43.06	39.26	65.73	55.73	22.67	16.47
0.177	34.35	26.85	9.59	43.94	36.44	64.63	54.63	20.69	18.19
0.195	37.05	27.35	9.58	46.62	36.92	63.82	53.82	17.20	16.90
0.237	25.85	19.55	9.58	35.43	29.13	62.20	52.20	26.77	23.07
0.277	29.05	18.05	9.58	38.63	27.63	60.91	50.91	22.27	23.27
0.413	29.35	17.45	9.61	38.96	27.06	57.59	47.59	18.63	20.53

Remarks: C.F (Correction Factor) = Insertion loss + Cable loss

Conducted Emissions – BT mode – LINE (Ant M/N: R-AN2400-5801RS)

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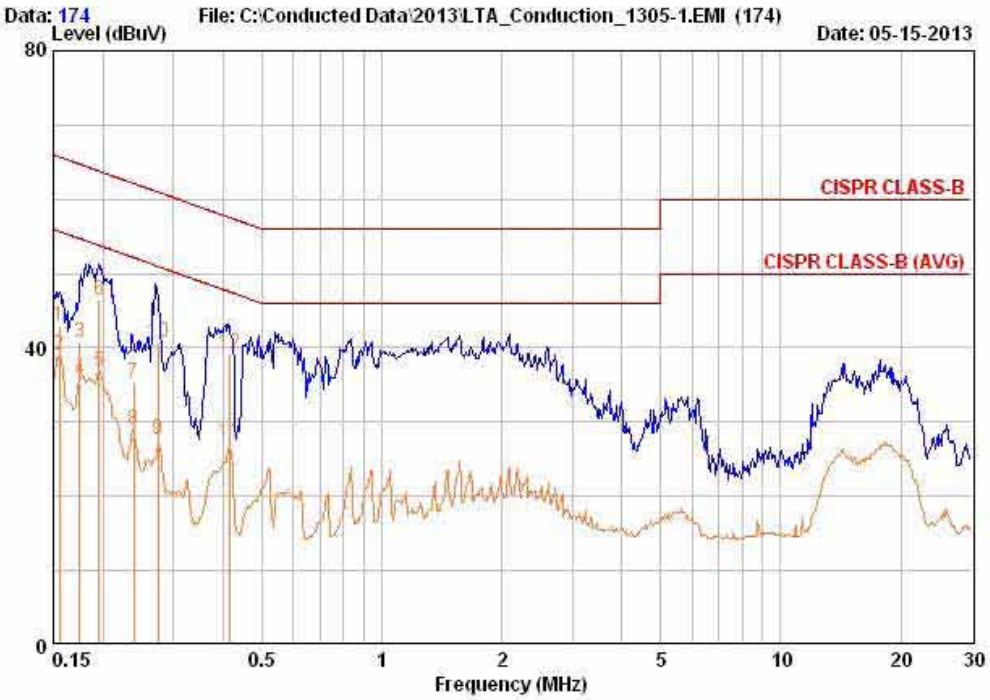
EUT / Model No.	: UD100a (2)	Phase	: LINE
Test Mode	: Bluetooth mode	Test Power	: 120 / 60
Temp./Humi.	: 23 / 56	Test Engineer	: PARK.H.W



Freq	RD QP	RD AV	C.F	Result QP	Result AV	Limit QP	Limit AV	Margin QP	Margin AV
MHz	dBuV	dBuV	dB	dBuV	dBuV	dBuV	dBuV	dB	dB
0.155	33.34	29.44	9.58	42.92	39.02	65.73	55.73	22.81	16.71
0.175	31.25	26.15	9.58	40.83	35.73	64.72	54.72	23.89	18.99
0.195	36.85	27.35	9.58	46.43	36.93	63.82	53.82	17.39	16.89
0.239	25.65	19.45	9.58	35.23	29.03	62.13	52.13	26.90	23.10
0.275	31.15	18.15	9.58	40.73	27.73	60.97	50.97	20.24	23.24
0.417	29.65	17.65	9.58	39.23	27.23	57.51	47.51	18.28	20.28

Remarks: C.F (Correction Factor) = Insertion loss + Cable loss

Conducted Emissions – BT mode – NEUTRAL (Ant M/N: R-AN2400-5801RS)

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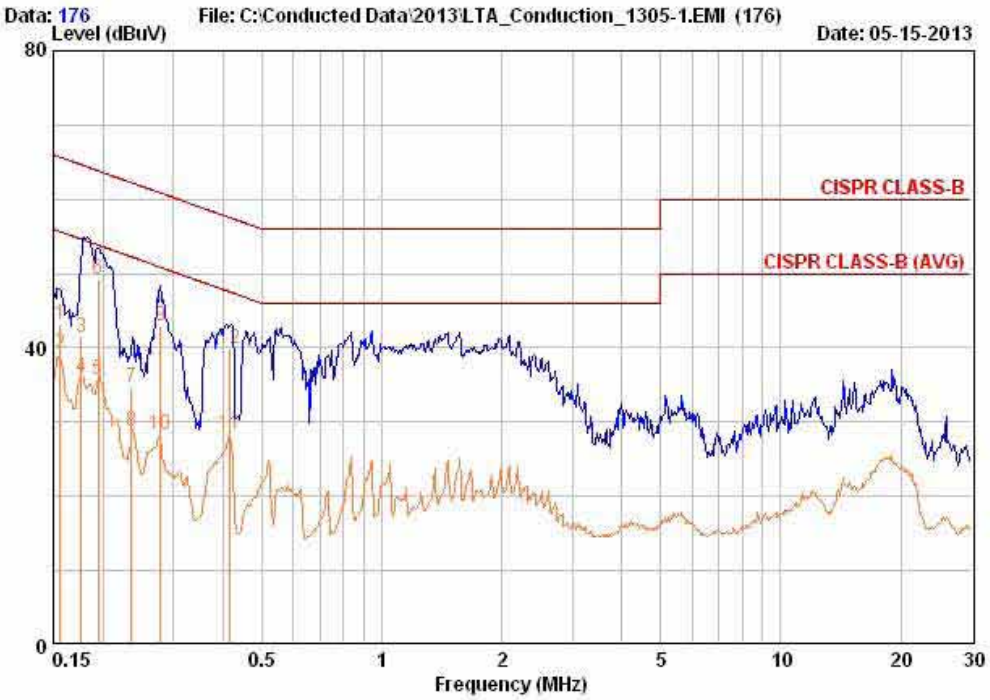
EUT / Model No.	: UD100a (2)	Phase	: NEUTRAL
Test Mode	: Bluetooth mode	Test Power	: 120 / 60
Temp./Humi.	: 23 / 56	Test Engineer	: PARK.H.W



Freq	RD QP	RD AV	C.F	Result QP	Result AV	Limit QP	Limit AV	Margin QP	Margin AV
MHz	dBuV	dBuV	dB	dBuV	dBuV	dBuV	dBuV	dB	dB
0.156	33.44	29.54	9.61	43.06	39.16	65.67	55.67	22.62	16.52
0.176	31.85	26.35	9.59	41.44	35.94	64.67	54.67	23.23	18.73
0.194	39.75	26.15	9.58	49.32	35.72	63.86	53.86	14.54	18.14
0.236	25.15	19.15	9.58	34.73	28.73	62.24	52.24	27.51	23.51
0.278	33.45	18.65	9.58	43.03	28.23	60.88	50.88	17.84	22.64
0.414	30.35	18.75	9.61	39.96	28.36	57.57	47.57	17.61	19.21

Remarks: C.F (Correction Factor) = Insertion loss + Cable loss

Conducted Emissions – BT mode – LINE (Ant M/N: R-AN2400-1901RS)

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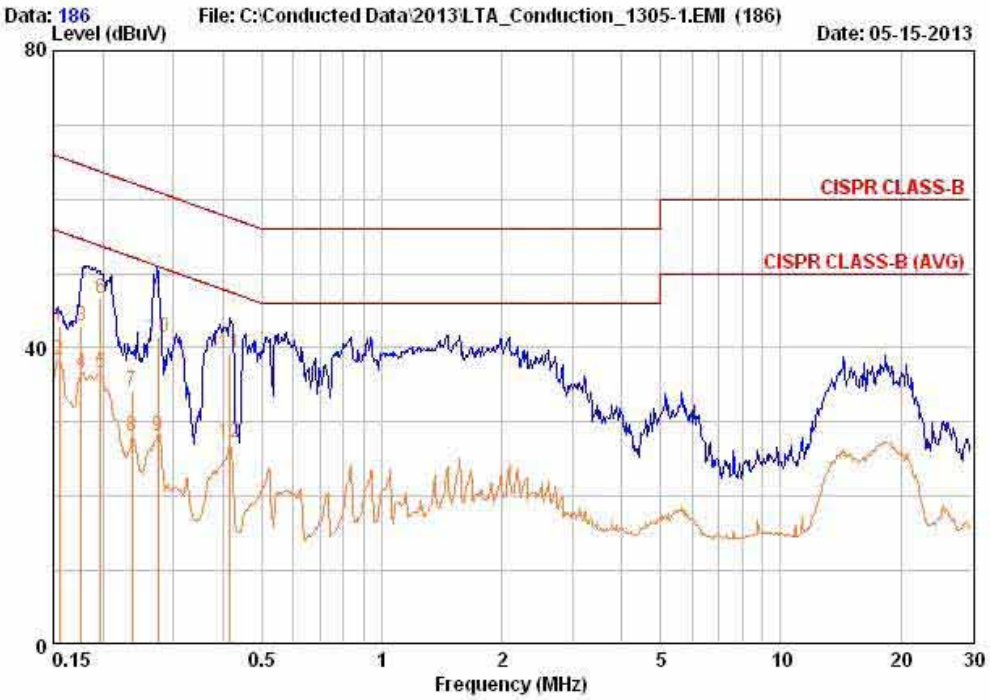
EUT / Model No.	: UD100a (3)	Phase	: LINE
Test Mode	: Bluetooth mode	Test Power	: 120 / 60
Temp./Humi.	: 23 / 56	Test Engineer	: PARK.H.W



Freq	RD QP	RD AV	C.F	Result QP	Result AV	Limit QP	Limit AV	Margin QP	Margin AV
MHz	dBuV	dBuV	dB	dBuV	dBuV	dBuV	dBuV	dB	dB
0.155	33.44	28.84	9.58	43.02	38.42	65.73	55.73	22.71	17.31
0.176	33.35	27.15	9.58	42.93	36.73	64.67	54.67	21.75	17.95
0.197	37.05	27.15	9.58	46.63	36.73	63.74	53.74	17.11	17.01
0.237	24.65	18.45	9.58	34.23	28.03	62.20	52.20	27.97	24.17
0.275	31.85	18.45	9.58	41.43	28.03	60.97	50.97	19.54	22.94
0.417	29.65	17.75	9.58	39.23	27.33	57.51	47.51	18.28	20.18

Remarks: C.F (Correction Factor) = Insertion loss + Cable loss

Conducted Emissions – BT mode – NEUTRAL (Ant M/N: R-AN2400-1901RS)

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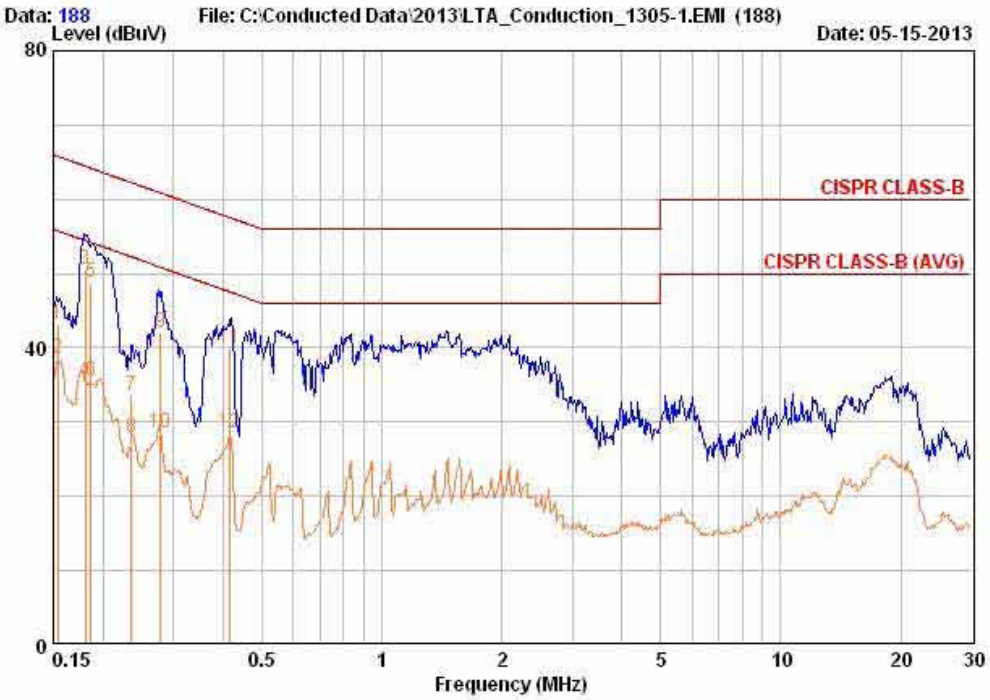
EUT / Model No.	: UD100a (3)	Phase	: NEUTRAL
Test Mode	: Bluetooth mode	Test Power	: 120 / 60
Temp./Humi.	: 23 / 56	Test Engineer	: PARK.H.W



Freq	RD QP	RD AV	C.F	Result QP	Result AV	Limit QP	Limit AV	Margin QP	Margin AV
MHz	dBuV	dBuV	dB	dBuV	dBuV	dBuV	dBuV	dB	dB
0.154	33.54	28.94	9.62	43.16	38.56	65.78	55.78	22.62	17.22
0.180	40.95	26.05	9.59	50.54	35.64	64.49	54.49	13.95	18.85
0.186	39.15	25.85	9.58	48.73	35.43	64.21	54.21	15.48	18.78
0.235	23.95	18.25	9.58	33.53	27.83	62.27	52.27	28.75	24.45
0.278	32.45	19.05	9.58	42.03	28.63	60.88	50.88	18.84	22.24
0.415	30.35	18.95	9.61	39.96	28.56	57.55	47.55	17.59	18.99

Remarks: C.F (Correction Factor) = Insertion loss + Cable loss

APPENDIX

TEST EQUIPMENT USED FOR TESTS

	Description	Model No.	Serial No.	Manufacturer	Expiration date of Calibration
1	Spectrum Analyzer (~30GHz)	FSV-30	100757	R&S	2014-01-15
2	Spectrum Analyzer (~2.9GHz)	8594E	3649A03649	HP	2014-03-26
3	Signal Generator (~3.2GHz)	8648C	3623A02597	HP	2014-03-25
4	Signal Generator (1~20GHz)	83711B	US34490456	HP	2014-03-25
5	Attenuator (3dB)	8491A	37822	HP	2014-09-22
6	Attenuator (10dB)	8491A	63196	HP	2014-09-22
7	Test Receiver (~30MHz)	ESHS10	828404/009	R&S	2014-03-25
8	EMI Test Receiver (~7GHz)	ESCI7	100722	R&S	2013-09-22
9	RF Amplifier (~1.3GHz)	8447D	2439A09058	HP	2014-09-22
10	RF Amplifier (1~18GHz)	8449B	3008A02126	HP	2014-03-26
11	Horn Antenna (1~18GHz)	BBHA 9120D	9120D122	SCHWARZBECK	2014-12-21
12	Horn Antenna (18 ~ 40GHz)	SAS-574	154	SCHWARZBECK	2014-03-15
13	Horn Antenna (18 ~ 40GHz)	SAS-574	155	SCHWARZBECK	2014-03-15
14	TRILOG Antenna	VULB 9160	9160-3172	SCHWARZBECK	2014-09-20
15	Hygro-Thermograph	THB-36	0041557-01	ISUZU	2013-09-26
16	Splitter (SMA)	ZFSC-2-2500	SF617800326	Mini-Circuits	-
17	Power Divider	11636A	6243	HP	2014-09-22
18	DC Power Supply	6622A	3448A03079	HP	-
19	Frequency Counter	5342A	2826A12411	HP	2014-03-25
20	Power Meter	EPM-441A	GB32481702	HP	2014-03-25
21	Power Sensor	8481A	US41030291	HP	2013-09-22
22	Audio Analyzer	8903B	3729A18901	HP	2013-09-22
23	Modulation Analyzer	8901B	3749A05878	HP	2013-09-22
24	TEMP & HUMIDITY Chamber	YJ-500	LTAS06041	JinYoung Tech	2013-09-22
25	Stop Watch	HS-3	601Q09R	CASIO	2014-03-26
26	LISN	ENV216	100408	R&S	2013-09-22
27	UNIVERSAL RADIO COMMUNICATION TESTER	CMU200	106243	R&S	2014-06-27
28	Highpass Filter	WHKX1.5/15G-10SS	74	Wainwright Instruments	-
29	Highpass Filter	WHKX3.0/18G-10SS	118	Wainwright Instruments	-
30	Active Loop Antenna	FMZB 1519	1519-031	SCHWARZBECK	2014-12-14