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FCC PART 15.247 FHSS AND IC RSS-210

TEST REPORT

Applicant	UNICATION CO., LTD.	
Address	5F, NO.6, WU-KUNG 5 RD.	
	HSINCHUANG CITY, TAIPEI TAIWAN	
FCC ID	LEA-U3-UHF-MID	
IC	3819A-U3UHFMID	
Model Number	U3UHFMID	
Product Description	UHF PTT RADIO	
Date Sample Received	10/4/2010	
Date Tested	11/3/2010	
Tested By	Nam Nguyen	
Approved By	Mario de Aranzeta	
Report Number	2352CT10TestReport.doc	
Test Results	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL

THE ATTACHED REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL
WITHOUT THE WRITTEN APPROVAL OF TIMCO ENGINEERING, INC.



Testing Certificate # 0955-01

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GENERAL REMARKS

The attached report shall not be reproduced except in full without the written permission of Timco Engineering Inc.

The test results relate only to the items tested.

Summary

The device under test does:

- fulfill the general approval requirements as identified in this test report
- not fulfill the general approval requirements as identified in this test report

Attestations

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025 requirements.



Testing Certificate # 0955-01

I attest that the necessary measurements were made, under my supervision, at:

Timco Engineering Inc.
849 NW State Road 45
Newberry, FL 32669



Authorized Signatory Name:

Mario de Aranzeta C.E.T.
Compliance Engineer/ Lab. Supervisor

Date: 11/5/2010

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GENERAL INFORMATION

DUT Specification

Applicable Standard	FCC Rules Part 15.247, IC Rules RSS-210 and RSS-GEN		
DUT Description	UHF PTT HANDHELD TRANSCEIVER WITH GPS AND BLUETOOTH		
FCC ID	LEA-U3-UHF-MID		
IC	3819A-U3UHFMID		
Operating Frequency	TX: 2402 MHz to 2480 MHz		
Number of channels	79		
DUT Power Source	<input type="checkbox"/> 110–120Vac/50– 60Hz		
	<input type="checkbox"/> DC Power		
	<input checked="" type="checkbox"/> Battery Operated Exclusively		
Test Item	<input type="checkbox"/> Prototype	<input checked="" type="checkbox"/> Pre-Production	<input type="checkbox"/> Production
Type of Equipment	<input type="checkbox"/> Fixed	<input type="checkbox"/> Mobile	<input checked="" type="checkbox"/> Portable
Antenna Connector	None		
Antenna	Internal : L-Type		
Test Facility	Timco Engineering Inc. located at 849 NW State Road 45 Newberry, FL 32669 USA.		
Test Conditions	Temperature: 26°C Relative humidity: 50%		
Test Exercise	The DUT was placed in continuous transmit mode of operation.		

Test Supporting Equipment

Supporting Device	Manufacturer	Model / FCC ID	Serial Number
N/A			

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EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	Listed 3/10/10	3/10/12
AC Voltmeter	HP	400FL	2213A14499	CAL 3/23/09	3/23/11
Antenna: Dipole Kit	Electro-Metrics	TDA-30/1-4	153	CHAR 6/10/09	6/10/11
Frequency Counter	HP	5385A	3242A07460	CAL 5/26/09	5/26/11
Hygro-Thermometer	Extech	445703	0602	CAL 1/30/09	1/30/11
Modulation Analyzer	HP	8901A	3435A06868	CAL 5/26/09	5/26/11
Digital Multimeter	Fluke	FLUKE-77-3	79510405	CAL 5/18/09	5/18/11
Analyzer Tan Tower Preamplifier	HP	8449B-H02	3008A00372	CAL 11/21/09	11/21/11
Analyzer Tan Tower Quasi-Peak Adapter	HP	85650A	3303A01690	CAL 11/22/09	11/22/11
Analyzer Tan Tower RF Preselector	HP	85685A	3221A01400	CAL 11/21/09	11/21/11
Analyzer Tan Tower Spectrum Analyzer	HP	8566B Opt 462	3138A07786 3144A20661	CAL 11/24/09	11/24/11
Temperature Chamber	Tenney Engineering	TTRC	11717-7	CHAR 4/25/10	4/25/12

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TEST PROCEDURES

Radiation Interference: ANSI C63.4-2003 using a spectrum analyzer, a preselector, a quasi-peak adapter, and an appropriate antenna. The analyzer was calibrated in dB above a microvolt at the output of the antenna. The resolution bandwidth was 100 kHz with an appropriate sweep speed and the video bandwidth was 300 kHz up to 1 GHz and 1 MHz with a video BW of 3 MHz above 1 GHz. When an emission was found, the table was rotated to produce the maximum signal strength. The antenna was placed in both the horizontal and vertical planes and the worse case emissions were reported. The spectrum was searched to at least the tenth (10) harmonic of the fundamental.

Formula Of Conversion Factors: The field strength at 3m was established by adding the meter reading of the spectrum analyzer (which is set to read in units of dBuV) to the antenna correction factor supplied by the antenna manufacturer plus the coax loss. The antenna correction factors are stated in terms of dB. The gain of the preselector was accounted for in the spectrum analyzer meter reading.

Example:

$$\begin{array}{llll}
 \text{Freq (MHz)} & \text{Meter Reading} & + \text{ACF} & + \text{CL} = \text{FS} \\
 33 & 20 \text{ dBuV} & + 10.36 \text{ dB} & + 0.5 = 30.86 \text{ dBuV/m @ 3m}
 \end{array}$$

Power Line Conducted Interference: The procedure used was ANSI C63.4-2003 using a 50uH LISN. Both lines were observed. The bandwidth of the spectrum analyzer was 10 kHz with an appropriate sweep speed. The spectrum was scanned from 0.15 to 30 MHz.

Occupied Bandwidth: A small sample of the transmitter output was fed into the spectrum analyzer and the attached plot was printed. The vertical scale is set to -10 dBm per division.

Bandwidth 6.0dB: The measurements were made with the spectrum analyzer's resolution bandwidth (RBW)=1 MHz and the video bandwidth (VBW) =3 MHz and the span set as shown on plot.

Power Output: The RF power output was measured at the antenna feed point using a peak power meter.

Antenna Conducted Emissions: The RBW=100 kHz, VBW=300 kHz and the span set to 10 MHz and the spectrum was scanned from 30 MHz to the 10th Harmonic of the fundamental. Above 1 GHz the resolution bandwidth was 1 MHz and the VBW = 3 MHz and the span to 50 MHz.

ANSI C63.4-2003 10.1 Measurement Procedures: The DUT was placed on a table 80 cm high and with dimensions of 1m by 1.5m. The DUT was placed in the center of the table (1.5m side). The table used for radiated measurements is capable of continuous rotation.

When an emission was found, the table was rotated to produce the maximum signal strength. At this point, the antenna was raised and lowered from 1m to 4m. The antenna was placed in both the horizontal and vertical planes. Emissions attenuated more than 20 dB below the permissible value are not reported.

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RADIATION INTERFERENCE

Rules Part No.: 15.247, 15.209, RSS-210 2.6

Requirements:

Frequency	Limits
Part 15.209	
9 to 490 kHz	2400/F (kHz) μ V/m @ 300 meters
490 to 1705 kHz	24000/F (kHz) μ V/m @ 30 meters
1705 kHz to 30 MHz	29.54 dB μ V/m @ 30 meters
30 – 88	40.0 dB μ V/m @ 3 meters
80 – 216	43.5 dB μ V/m @ 3 meters
216 – 960	46.0 dB μ V/m @ 3 meters
Above 960	54.0 dB μ V/m @ 3 meters
Part 15.247	
Fundamental 902 – 928 MHz	127.37 dB μ V/m @ 3 meters
Fundamental 2.4 – 2.4835 MHz	127.37 dB μ V/m @ 3 meters
Harmonics	54.0 dB μ V/m @ 3 meters

Any emissions that fall in the restricted bands (15.205) must be less than or equal to 54 dB μ V/m. Spurious emissions not in a restricted band must be 20 dBc. Harmonics were checked through the 10th harmonic.

Test Data: All values are peak unless noted.

Items mark with an * designate a frequency in a restricted band.

Tuned Frequency MHz	Emission Frequency MHz		Meter Reading dB μ V	Ant. Polarity	Coax Loss dB	Correction Factor dB/m	Field Strength dB μ V/m	Margin dB
2,402.00	2,402.00		60.8	H	3.18	32.25	96.23	31.15
2,402.00	2,402.00		63.0	V	3.18	32.25	98.43	28.95
2,402.00	4,804.00	*	7.3	V	4.90	34.10	46.30	7.70
2,402.00	4,804.00	*	9.1	H	4.90	34.10	48.10	5.90
2,402.00	7,206.00		5.3	V	5.72	36.04	47.06	6.94
2,402.00	7,206.00		6.5	H	5.72	36.04	48.26	5.74
2,441.00	2,441.00		58.5	H	3.21	32.35	94.06	33.32
2,441.00	2,441.00		59.5	V	3.21	32.35	95.06	32.32
2,441.00	4,882.00	*	6.2	H	4.94	34.10	45.24	8.76
2,441.00	4,882.00	*	7.4	V	4.94	34.10	46.44	7.56
2,441.00	7,323.00	*	6.0	H	5.79	36.06	47.85	6.15
2,441.00	7,323.00	*	6.8	V	5.79	36.06	48.65	5.35

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FCC ID: LEA-U3-UHF-MID

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TEST DATA CONTD.

Tuned Frequency MHz	Emission Frequency MHz		Meter Reading dB μ V	Ant. Polarity	Coax Loss dB	Correction Factor dB/m	Field Strength dB μ V/m	Margin dB
2,480.00	2,480.00		57.8	H	3.24	32.45	93.49	33.89
2,480.00	2,480.00		60.5	V	3.24	32.45	96.19	31.19
2,480.00	4,960.00	*	6.9	H	4.98	34.1	45.98	8.02
2,480.00	4,960.00	*	8	V	4.98	34.1	47.08	6.92
2,480.00	7,440.00	*	6.5	V	5.86	36.09	48.45	5.55
2,480.00	7,440.00	*	7.2	H	5.86	36.09	49.15	4.85

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RADIATION INTERFERENCE - CO LOCATION

Rules Part No.: 15.247, 15.209

Requirements:

Frequency	Limits
Part 15.209	
9 to 490 kHz	2400/F (kHz) μ V/m @ 300 meters
490 to 1705 kHz	24000/F (kHz) μ V/m @ 30 meters
1705 kHz to 30 MHz	29.54 dB μ V/m @ 30 meters
30 – 88	40.0 dB μ V/m @ 3 meters
80 – 216	43.5 dB μ V/m @ 3 meters
216 – 960	46.0 dB μ V/m @ 3 meters
Above 960	54.0 dB μ V/m @ 3 meters
Part 15.247	
Fundamental 902 – 928 MHz	127.37 dB μ V/m @ 3 meters
Fundamental 2.4 – 2.4835 MHz	127.37 dB μ V/m @ 3 meters
Harmonics	54.0 dB μ V/m @ 3 meters

Any emissions that fall in the restricted bands (15.205) must be less than or equal to 54 dB μ V/m. Spurious emissions not in a restricted band must be 20 dBc. Harmonics were checked through the 10th harmonic.

Test Data: The U3 is in TX mode for both UHF and Bluetooth.

All values are peak unless noted.

Items marked with an * designate a frequency in a restricted band.

No significant emissions other than those previously listed under spurious emissions.

Both the UHF transmitter and the BT transmitter were transmitting. Several channels of the UHF transmitter were checked.

APPLICANT: UNICATION CO., LTD.

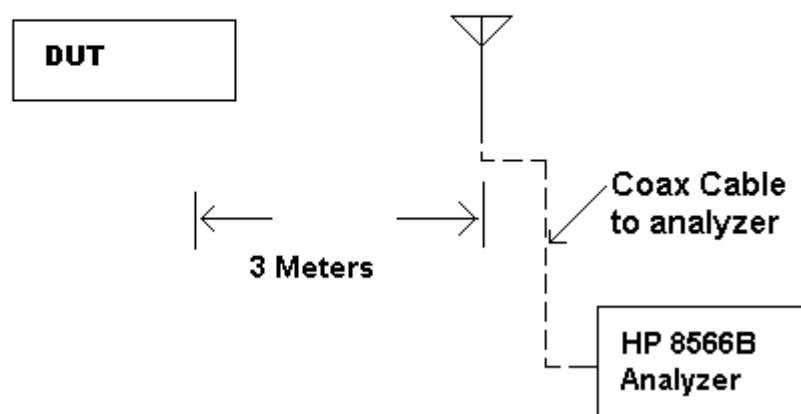
FCC ID: LEA-U3-UHF-MID

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Method of Measuring Radiated Spurious Emissions

Antenna is Calibrated
and appropriate one.
Raised from 1 to 4 M.



METHOD OF MEASUREMENT: The procedure used was ANSI standard C63.4-2003 & the FCC/OET Guidance on Measurements for Spread Spectrum Systems – Public Notice DA 00-705 dated March 30th, 2000.

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POWER LINE CONDUCTED INTERFERENCE

Rules Part No.: Part 15.207, RSS-GEN 7.2.2

Requirements:

Frequency (MHz)	Quasi Peak Limits (dB μ V)	Average Limits (dB μ V)
0.15 – 0.5	66 – 56 *	56 – 46 *
0.5 – 5.0	56	46
5.0 – 30	60	50

* Decrease with logarithm of frequency

Test Data: The following plots represent the emissions read for power line conducted. Both lines were observed.

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POWERLINE CONDUCTED PLOT – LINE 1



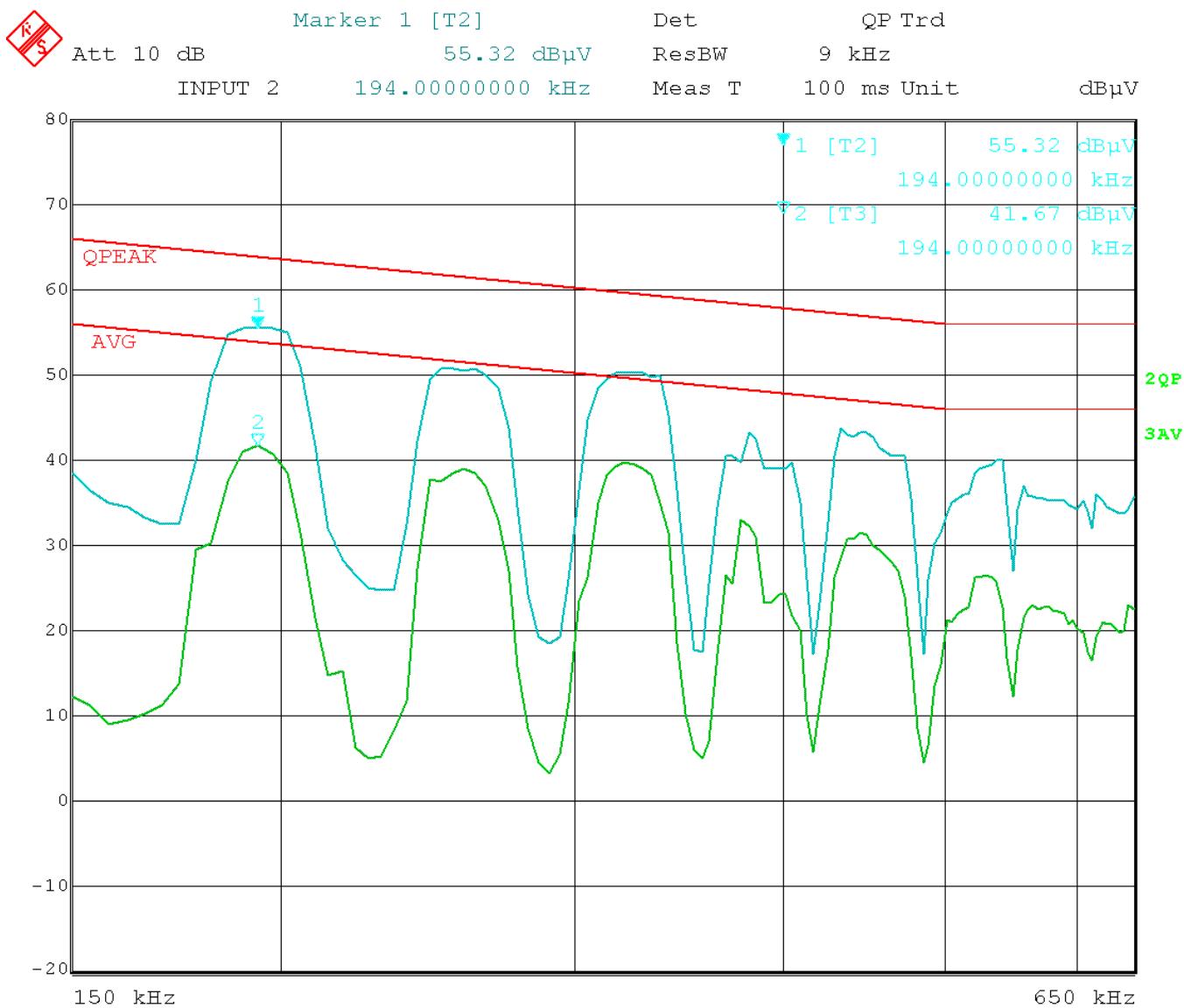
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APPLICANT: UNICATION CO., LTD.

FCC ID: LEA-U3-UHF-MID

IC: 3819A-U3UHFMID

REPORT: U\UNICATION TWN\2352CT10\2352CT10TestReport.doc



Date: 4.NOV.2010 10:06:33

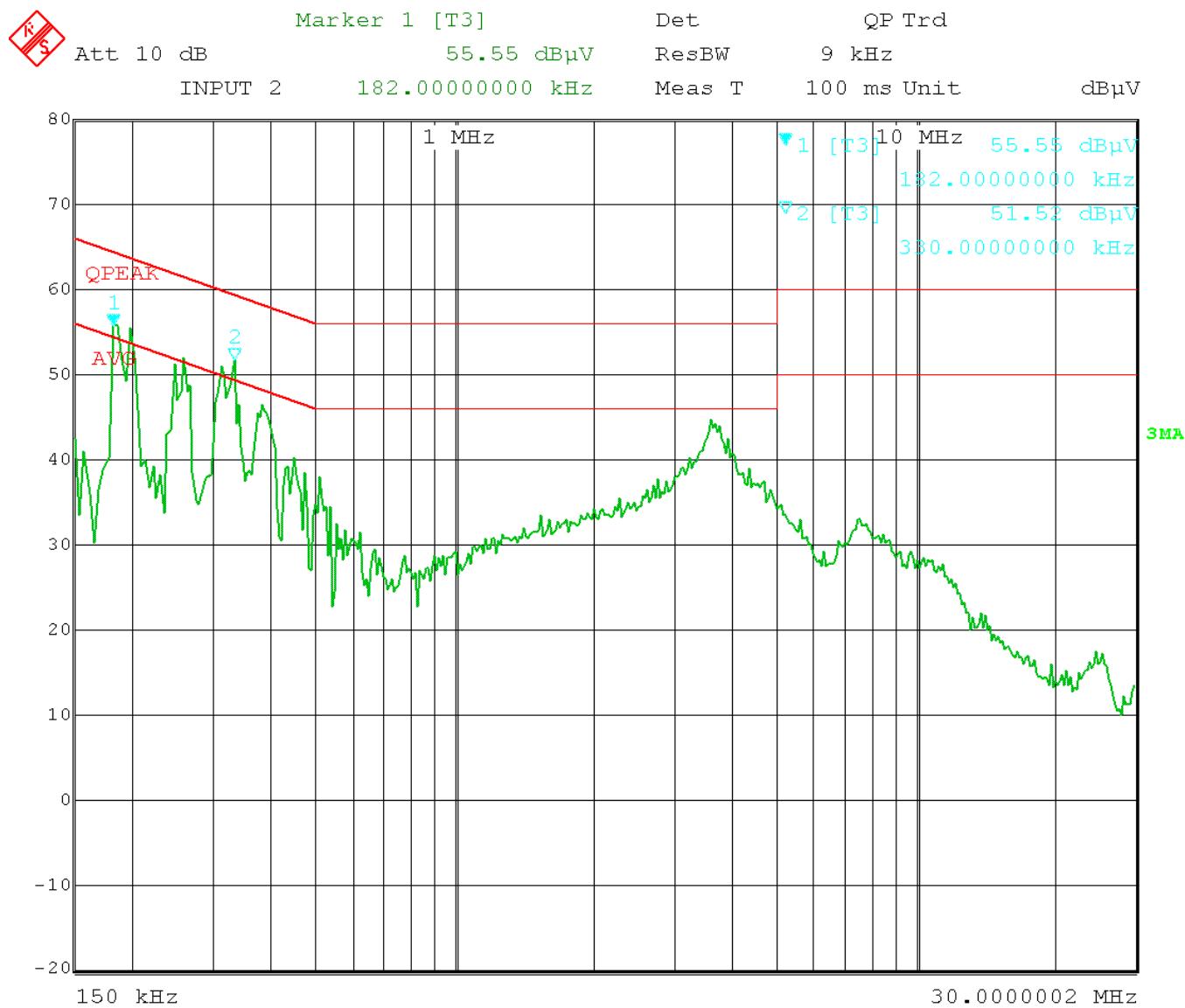
APPLICANT: UNICATION CO., LTD.

FCC ID: LEA-U3-UHF-MID

IC: 3819A-U3UHFMID

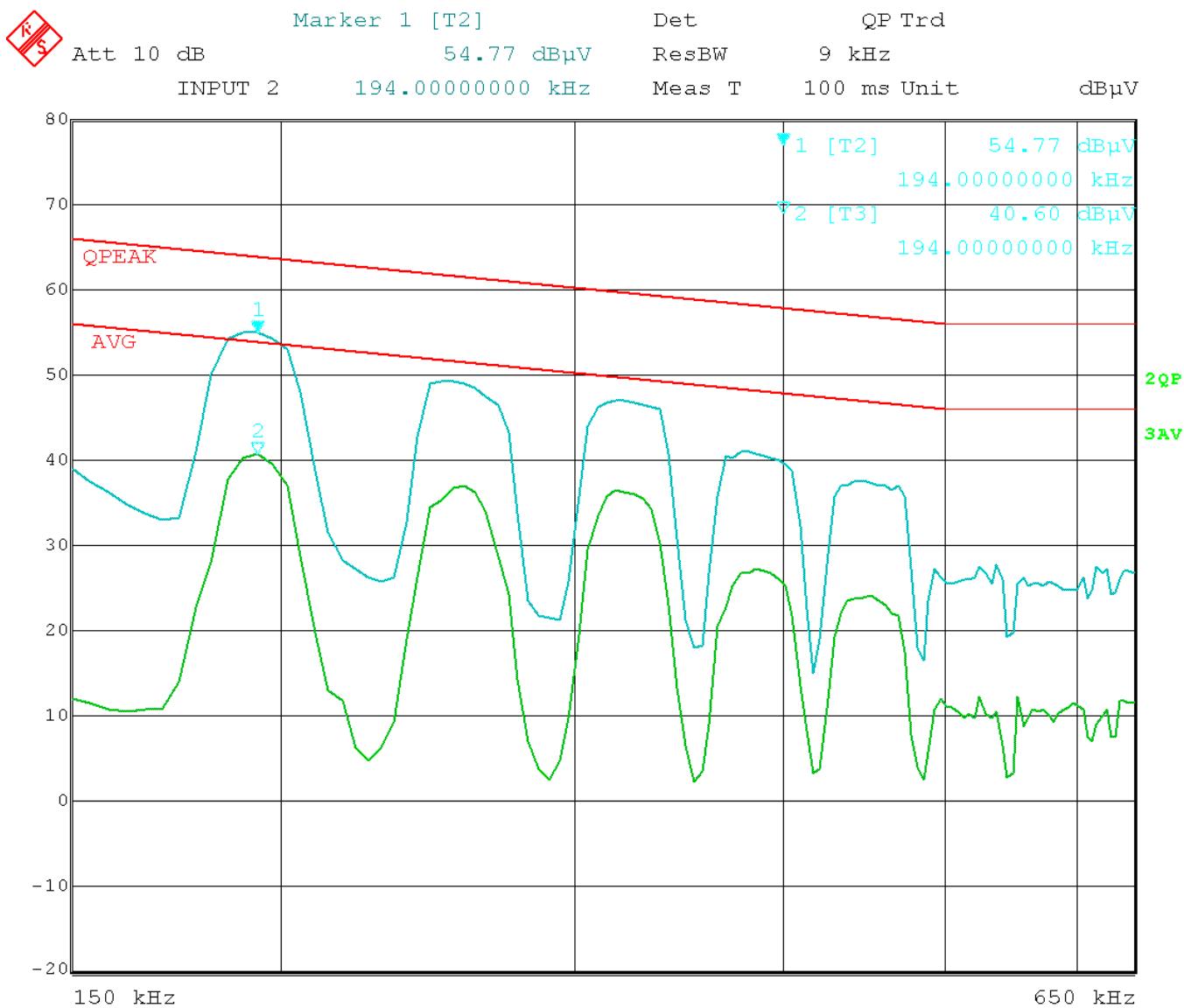
REPORT: U\UNICATION TWN\2352CT10\2352CT10TestReport.doc

POWERLINE CONDUCTED PLOT – LINE 2



Date: 4.NOV.2010 09:58:32

APPLICANT: UNICATION CO., LTD.
 FCC ID: LEA-U3-UHF-MID
 IC: 3819A-U3UHFMID
 REPORT: U\UNICATION TWN\2352CT10\2352CT10TestReport.doc



Date: 4.NOV.2010 10:03:08

APPLICANT: UNICATION CO., LTD.

FCC ID: LEA-U3-UHF-MID

IC: 3819A-U3UHFMID

REPORT: U\UNICATION TWN\2352CT10\2352CT10TestReport.doc

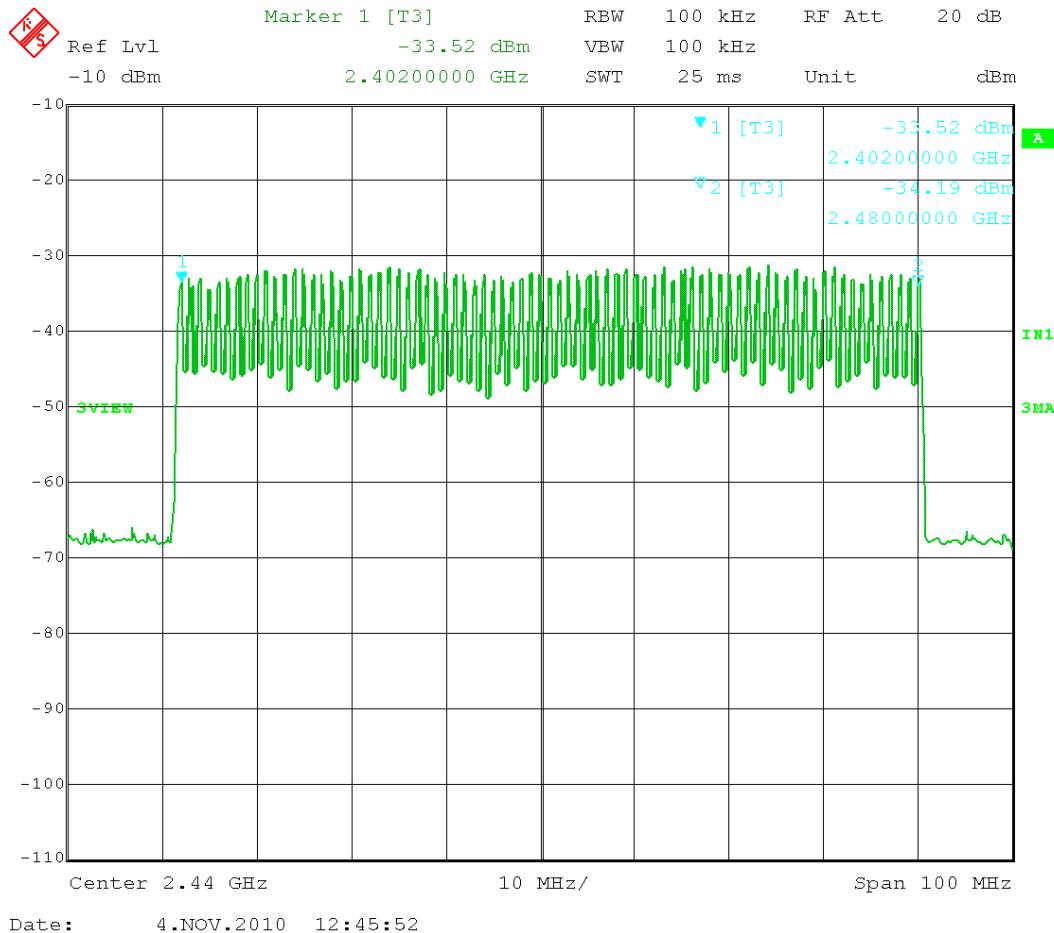
NUMBER OF HOPPING CHANNELS

Rules Part No.: 15.247(a)(1), RSS-210

Requirements:

902-928 MHz	If the 20 dB bandwidth is < 250 kHz, the system shall use at least 50 hopping frequencies.
	If the 20 dB bandwidth is 250 kHz or greater, the system shall use at least 25 hopping frequencies.
2400-2483.5 MHz	At least 15 channels
5725-5850 MHz	At least 75 channels

Test Data: There are 79 hopping channels



APPLICANT: UNICATION CO., LTD.

FCC ID: LEA-U3-UHF-MID

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DWELL TIME OF A HOPPING CHANNEL

RULES PART NO.: 15.247(a)(1)(i)

REQUIREMENTS:

902-928 MHz	If 20 dB bandwidth is < 250 kHz, average time of occupancy of any frequency shall not exceed 0.4 sec in 20 seconds. If 20 dB bandwidth is 250 kHz or greater, dwell time ≤ 0.4 seconds in a 10 second period.
2400-2483.5 MHz	≤ 0.4 seconds in a 0.4 seconds multiplied the number of hopping channels employed.
5725-5850 MHz	≤ 0.4 seconds in a 30 second period.

Test Procedure:

The EUT output antenna port was connected to the spectrum analyzer. Set RBW of spectrum analyzer to 1MHz and VBW to 1MHz, and the frequency span to 0 Hz, measure the maximum time duration of one single pulse.

The EUT was set for DH5, DH3 and DH1 packet transmitting.

DH5 Packet permit maximum 1600 / 79 / 6 hops per second in each channel (5 time slots RX, 1 time slot TX).

DH3 Packet permit maximum 1600 / 79 / 4 hops per second in each channel (3 time slots RX, 1 time slot TX).

DH1 Packet permit maximum 1600 / 79 / 2 hops per second in each channel (1 time slot RX, 1 time slot TX).

So, the Dwell Time can be calculated as follows:

Note : Mkr Delta is once pulse time .

TEST DATA: Please refer to the below photos for more details.

Data Packet	Dwell Time(s)
DH5	$1600/79/6*31.6*(MkrDelta)/1000$
DH3	$1600/79/4*31.6*(MkrDelta)/1000$
DH1	$1600/79/2*31.6*(MkrDelta)/1000$

Note : Mkr Delta is once pulse time .

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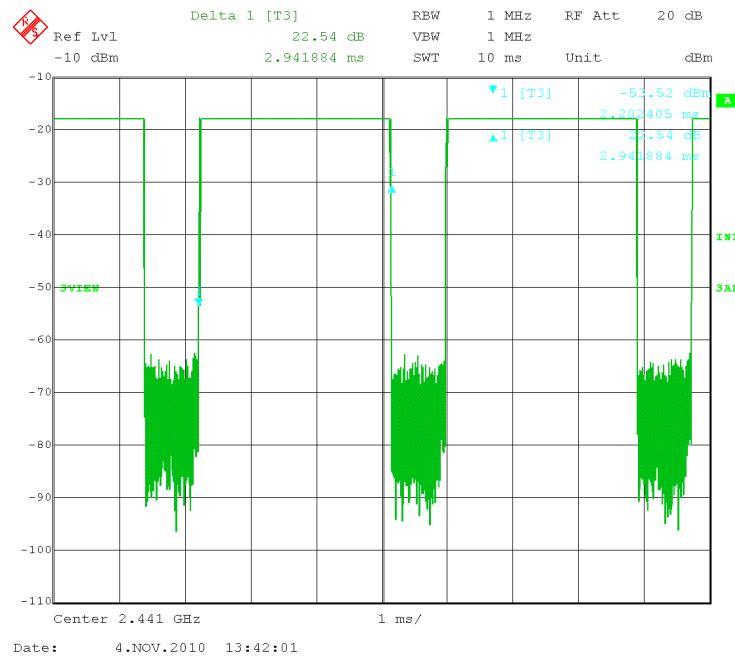
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Basic Data Rate (BDR):

Three places in the band were measured and the worst case presented

Data Packet	Frequency	Mkr Delta(ms)	Dwell Time(s)	Limits(s)
DH5	2441 MHz	2.942	0.314	0.400
DH3	2441 MHz	1.679	0.269	0.400
DH1	2441 MHz	0.431	0.138	0.400

Channel 2441 MHz DH5

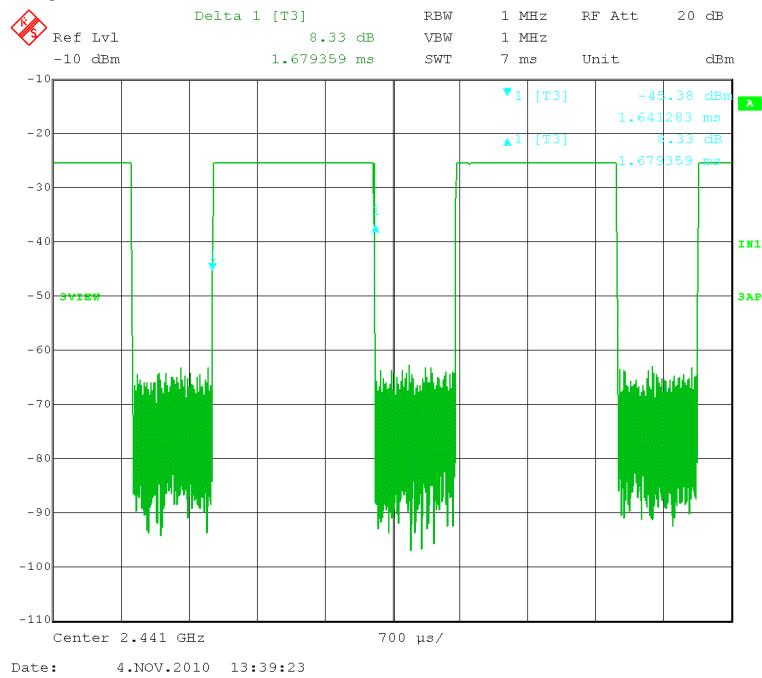
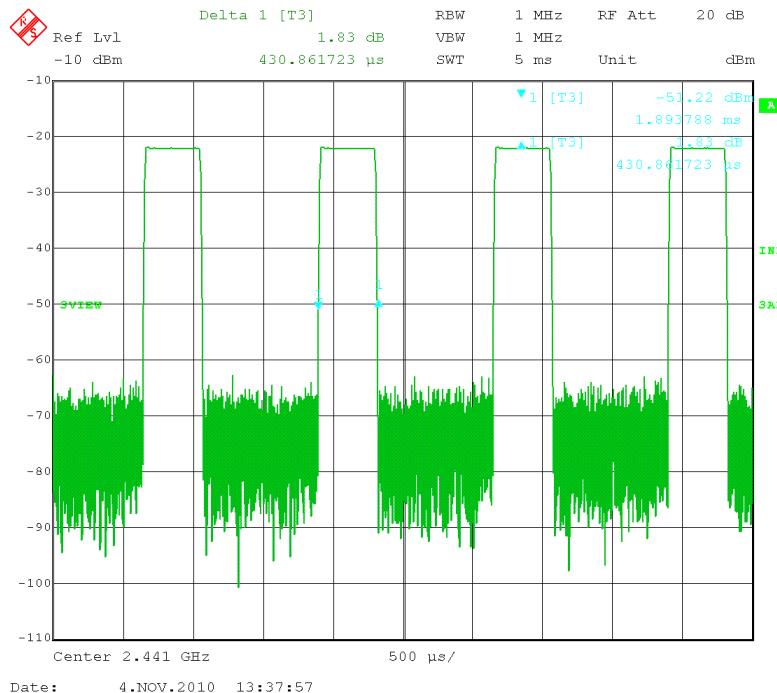


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Channel 2441 MHz DH3

Channel 2441 MHz DH1


APPLICANT: UNICATION CO., LTD.

FCC ID: LEA-U3-UHF-MID

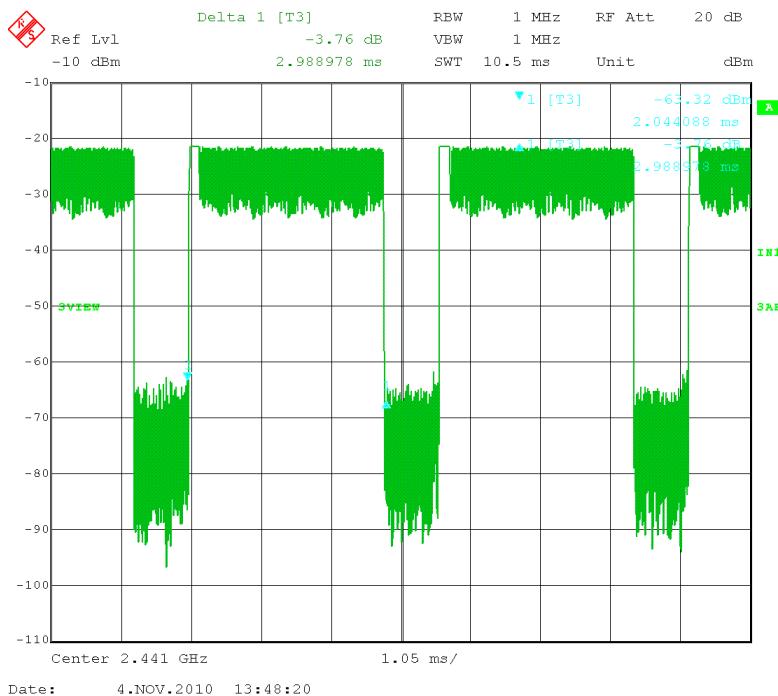
IC: 3819A-U3UHFMID

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Enhanced Data Rate (EDR):

Three places in the band were measured and the worst case presented

Data Packet	Frequency	Mkr Delta(ms)	Dwell Time(s)	Limits(s)
2DH5	2441 MHz	2.989	0.319	0.400
2DH1	2441 MHz	0.443	0.142	0.400
3DH5	2441 MHz	2.964	0.316	0.400
3DH1	2441 MHz	0.439	0.140	0.400

Channel 2441 MHz 2DH5


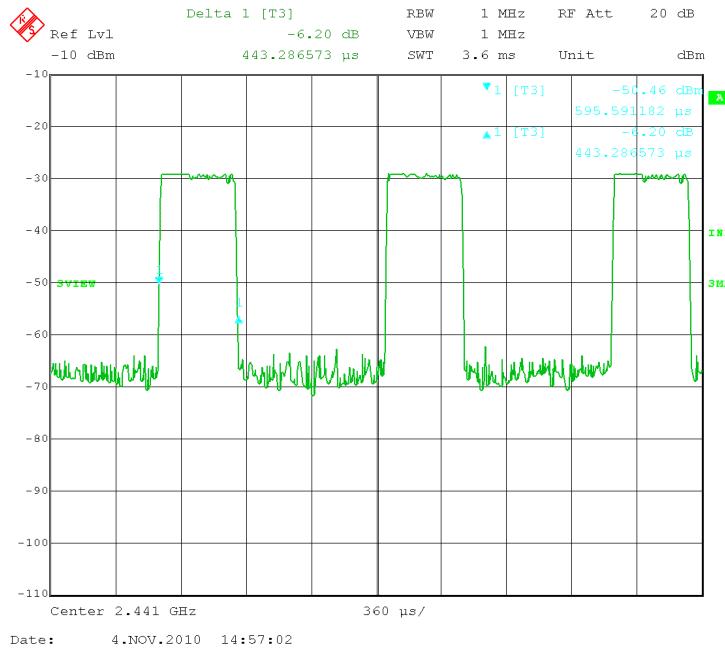
APPLICANT: UNICATION CO., LTD.

FCC ID: LEA-U3-UHF-MID

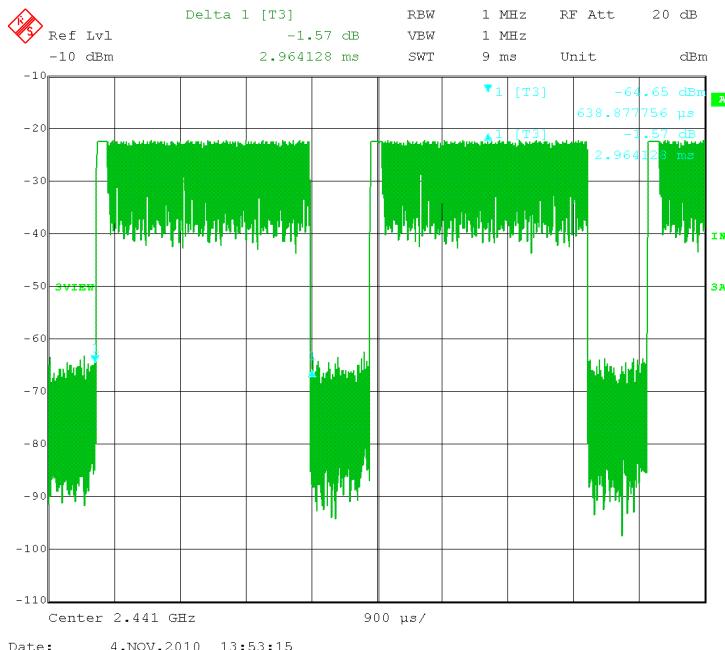
IC: 3819A-U3UHFMID

REPORT: U\UNICATION TWN\2352CT10\2352CT10TestReport.doc

Channel 2441 MHz 2DH1



Channel 2441 MHz 3DH5

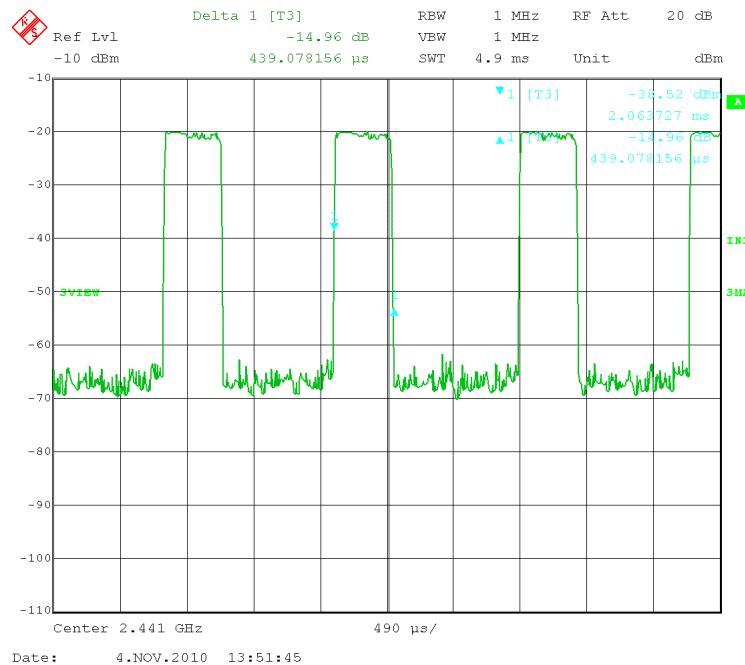


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Channel 2441 MHz 3DH1

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FCC ID: LEA-U3-UHF-MID

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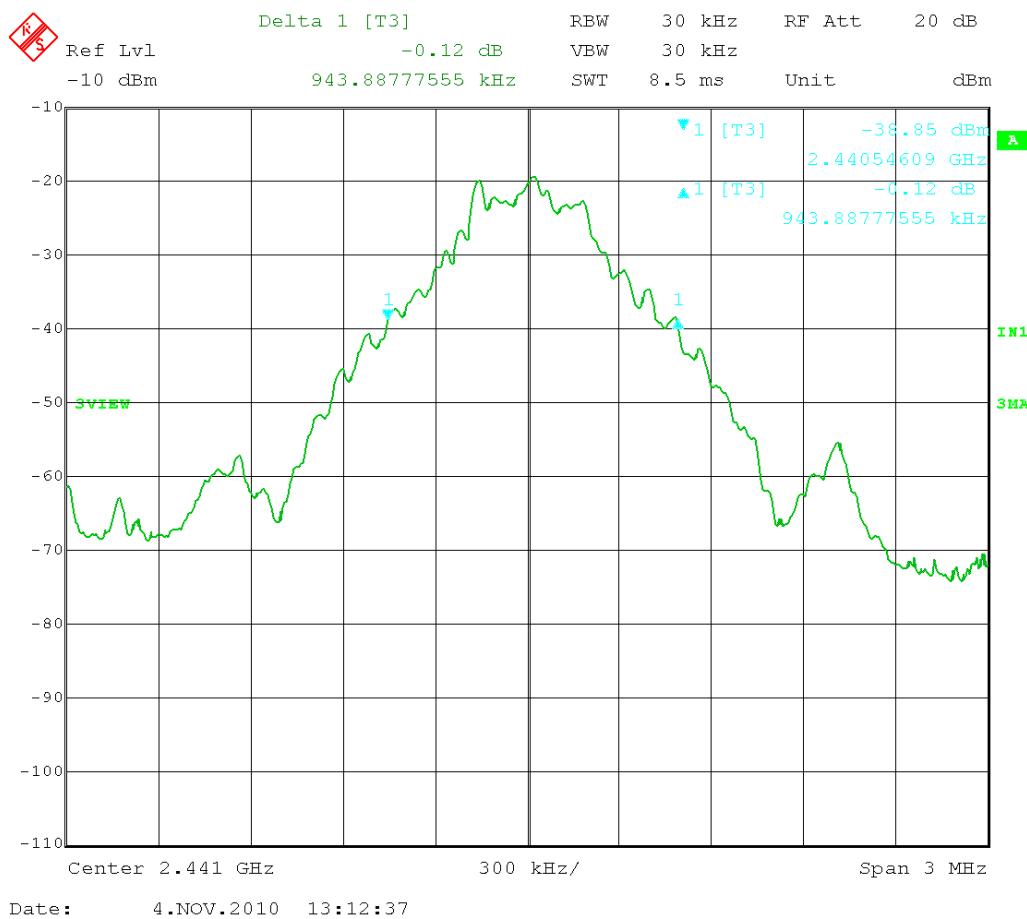
20 dB OCCUPIED BANDWIDTH

Rules Part No.: 15.247(a)(2), RSS-210 A8.2

Test Data: (950 kHz) 20 dB

Three places in the band were measured and the worst case reported.

Basic Data Rate (BDR)

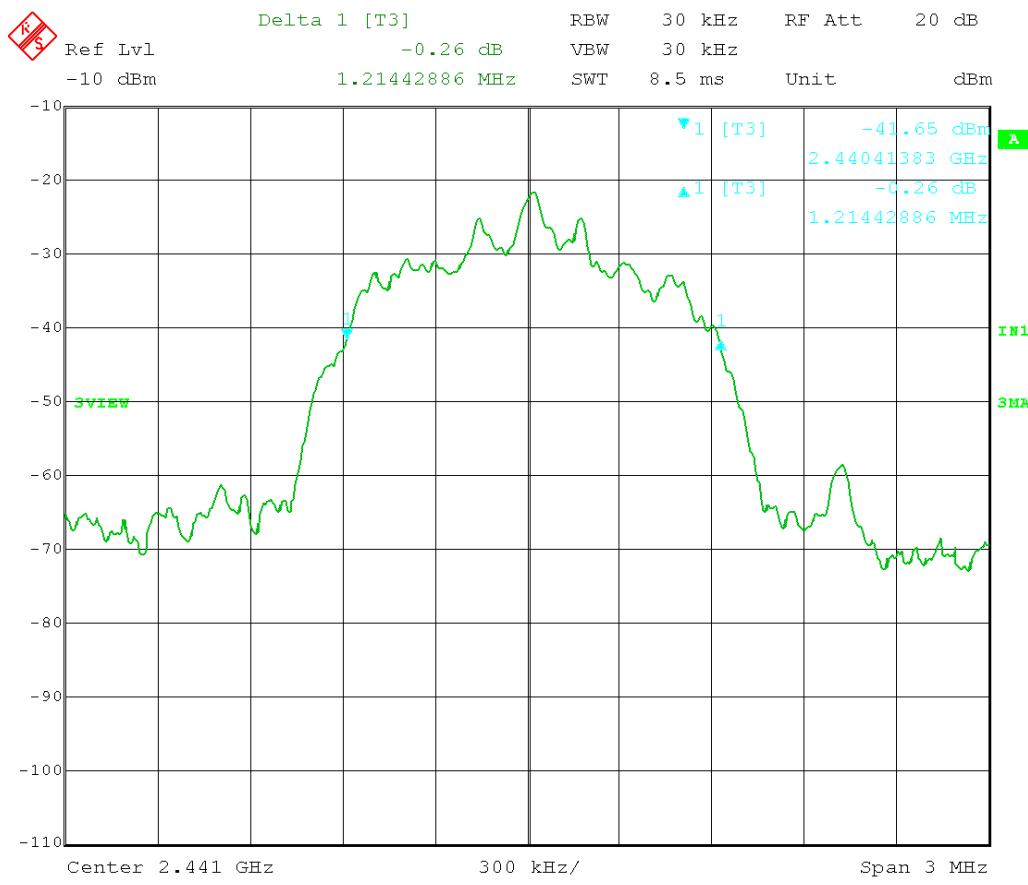


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Enhanced Data Rate (EDR)


APPLICANT: UNICATION CO., LTD.

FCC ID: LEA-U3-UHF-MID

IC: 3819A-U3UHFMID

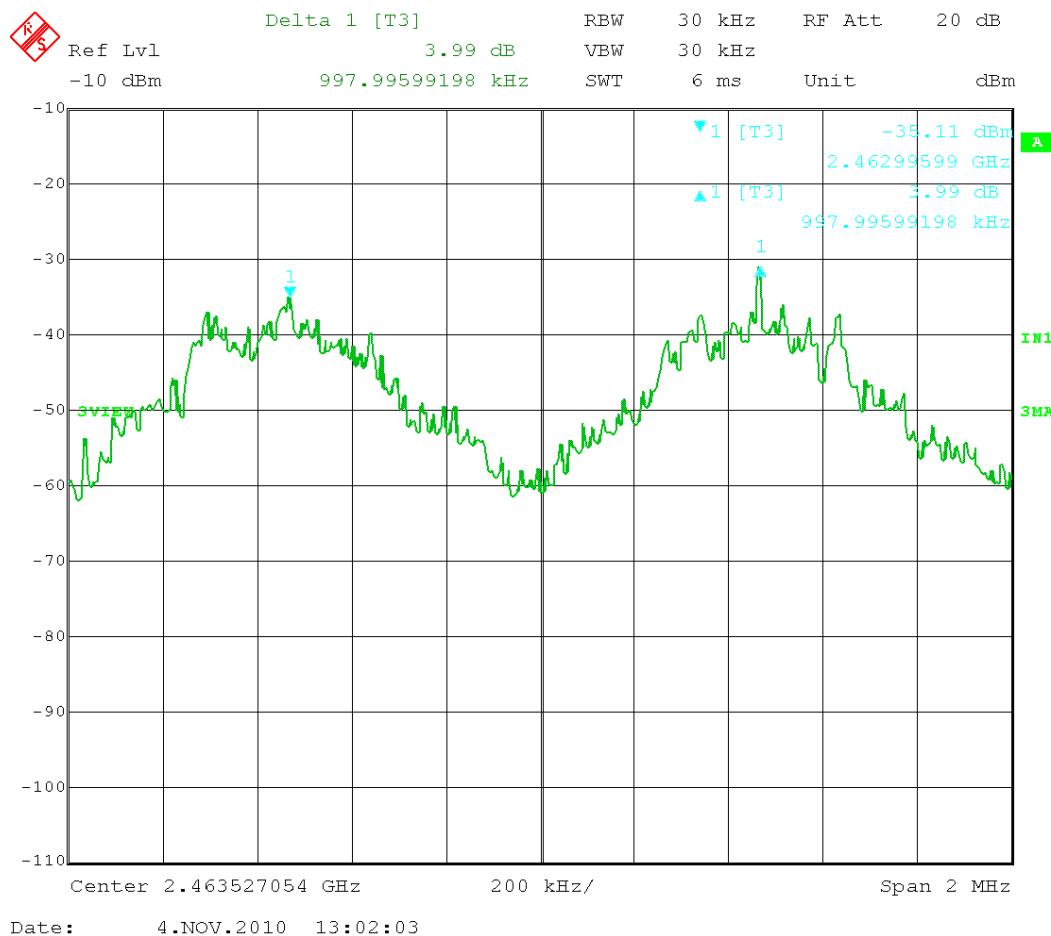
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CARRIER FREQUENCY SEPARATION

RULES PART NO.: 15.247(a)(2)

REQUIREMENTS: The hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

TEST DATA: See the following plot. (1.0 MHz)



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POWER OUTPUT

Rules Part #: 15.247(b), RSS-210 A8.5(4) - 1 Watt conducted, 4W ERP

The device has no antenna connector. The power output was measured radiated.

Test Results: Equivalent conducted power (assumes unity gain antenna)

Frequency MHz	Po (ERP) dBm	Po (ERP) mWatts
2402.00	1.0	1.26
2441.00	-2.3	0.59
2480.00	-1.2	0.76

APPLICANT: UNICATION CO., LTD.

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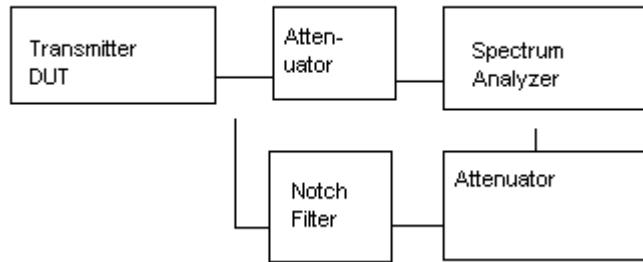
SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Requirements: Emissions must be at least 20dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.

Test Data:

N/A, Device has permanently attached antenna and no antenna connector.

15.247(c) Method of Measuring RF Conducted Spurious Emissions



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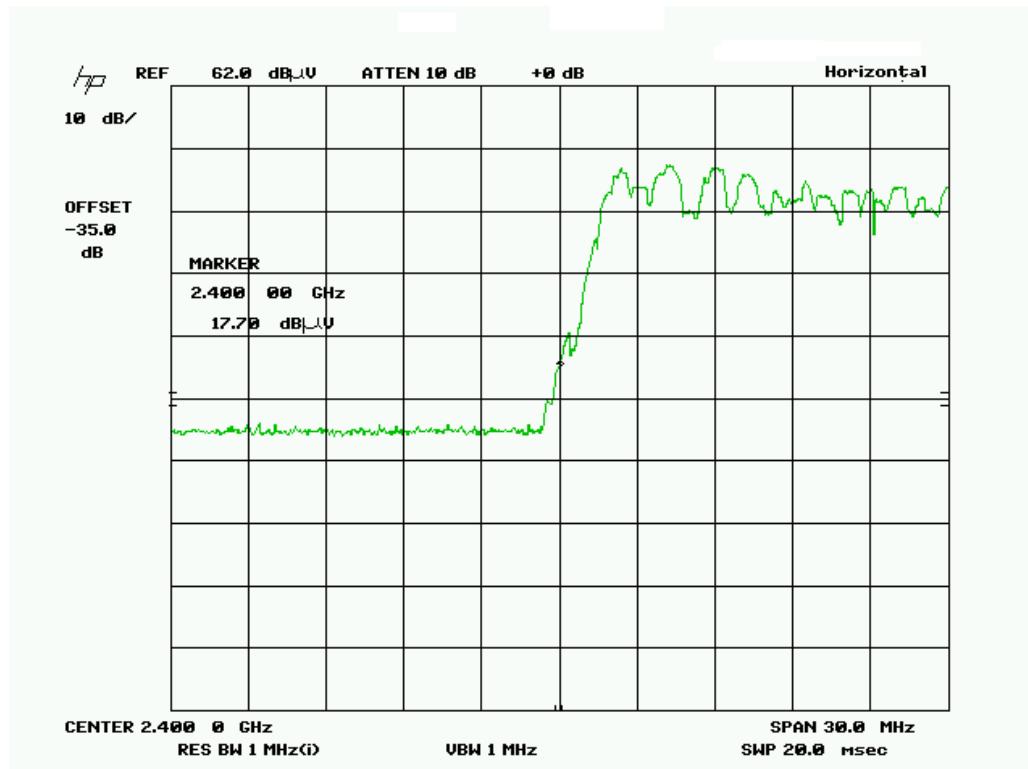
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RADIATED SPURIOUS EMISSIONS INTO ADJACENT RESTRICTED BAND

Requirements: Emissions that fall in the restricted bands (15.205), RSS-210 2.2 and 2.7. These emissions must be less than or equal to 500 uV/m (54 dBuV/m).

Test Procedure: An in band field strength measurement of the fundamental Emission using the RBW and detector function required by C63.4-2000 and FCC Rules. The procedure was repeated with an average detector and a plot made. The calculated field strength in the adjacent restricted band is presented below.

Lower adjacent restricted band – channel 2402 (Peak)



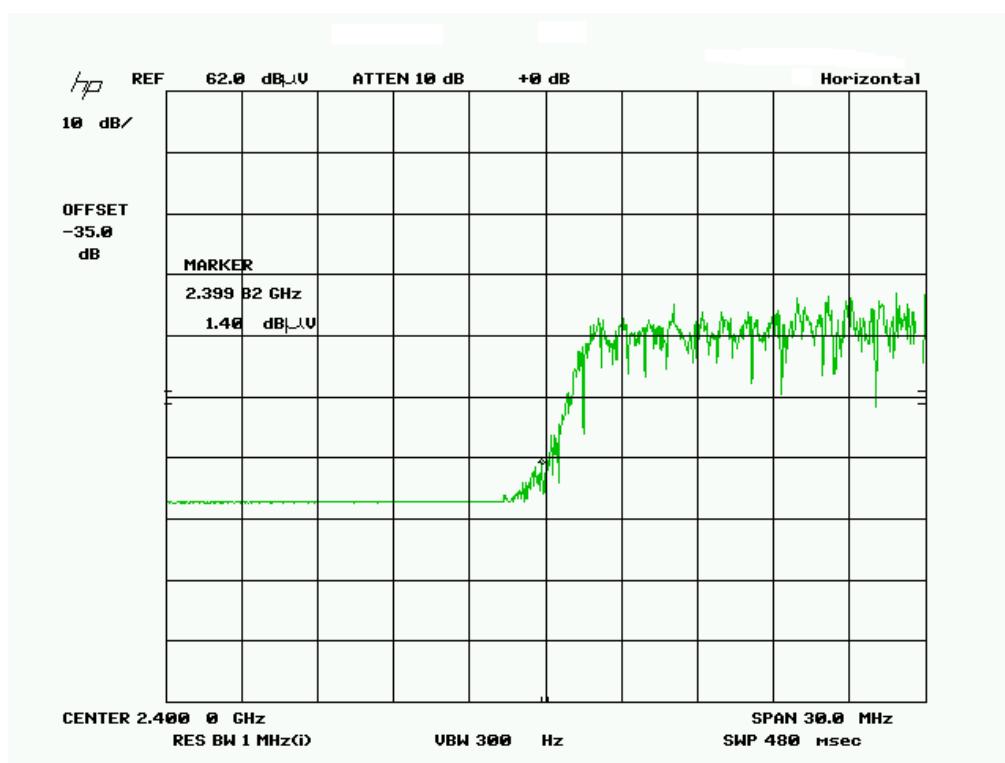
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Average



Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Polarity	Detector	Coax Loss dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB
2,402.00	2,400.00	27.7	H	Peak	3.18	32.24	63.12	10.88
2,402.00	2,400.00	11.4	H	Avg	3.18	32.24	46.82	7.18

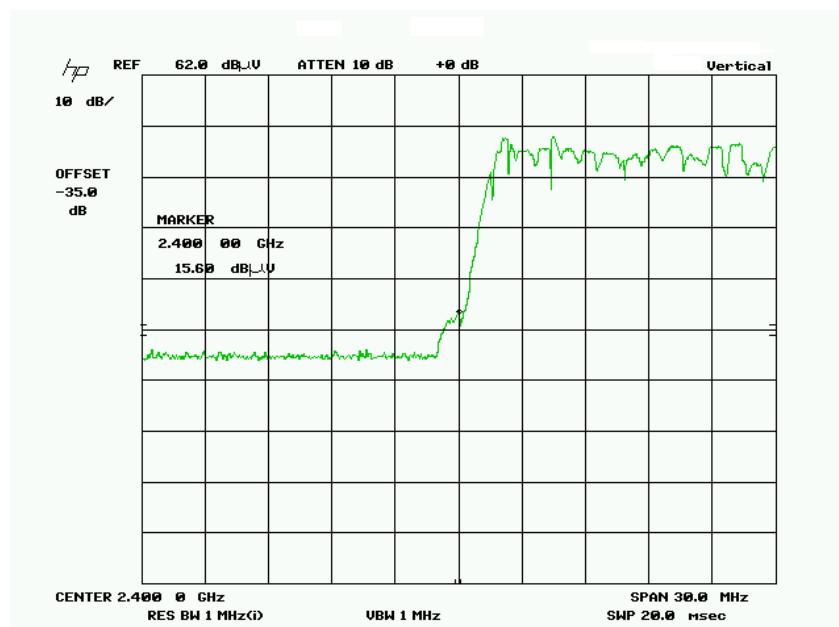
APPLICANT: UNICATION CO., LTD.

FCC ID: LEA-U3-UHF-MID

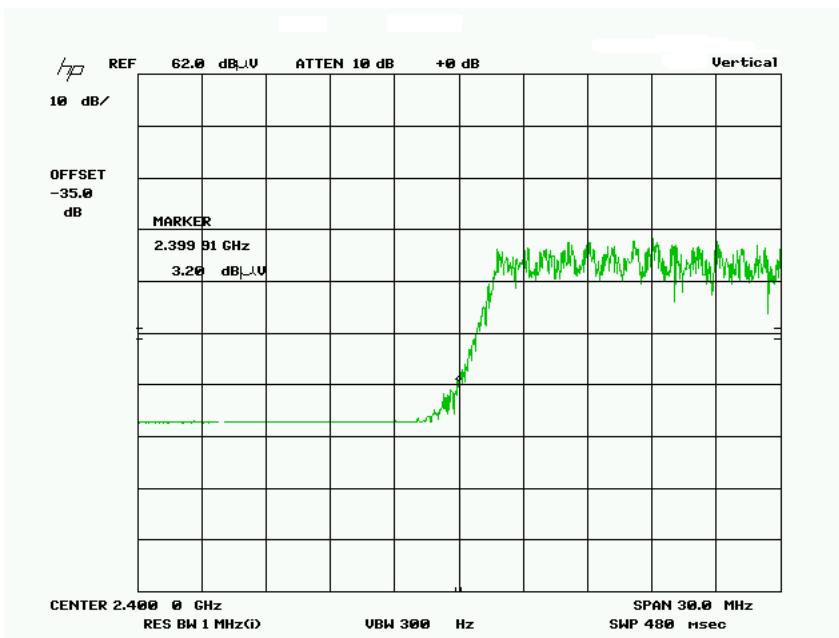
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Peak



Average



Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBm	Ant. Polarity	Detector	Coax Loss dB	Correction Factor dB/m	Field Strength dBm	Margin dB
2,402.00	2,400.00	25.6	H	Peak	3.18	32.24	61.02	12.98
2,402.00	2,400.00	13.2	H	Avg	3.18	32.24	48.62	5.38

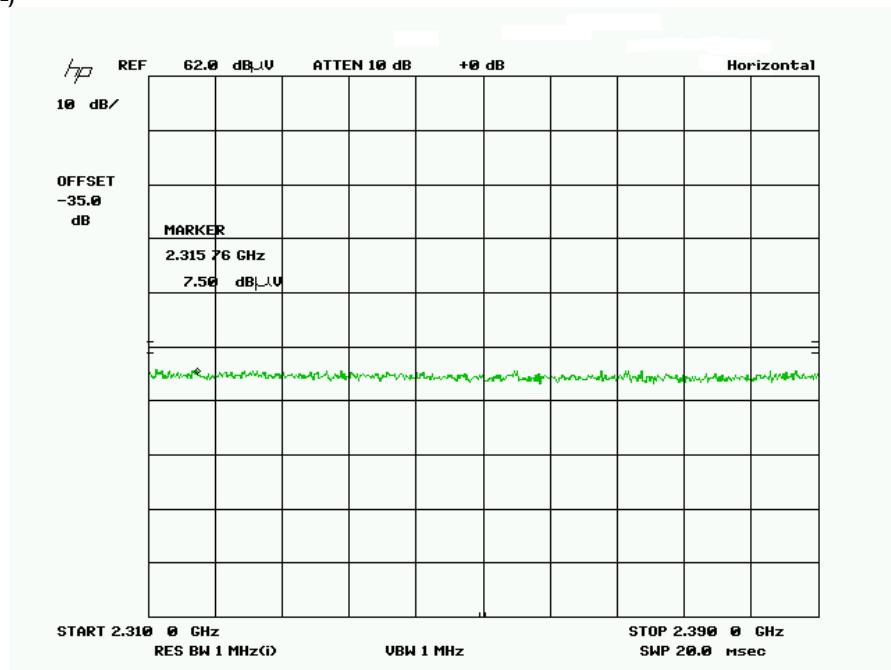
APPLICANT: UNICATION CO., LTD.

FCC ID: LEA-U3-UHF-MID

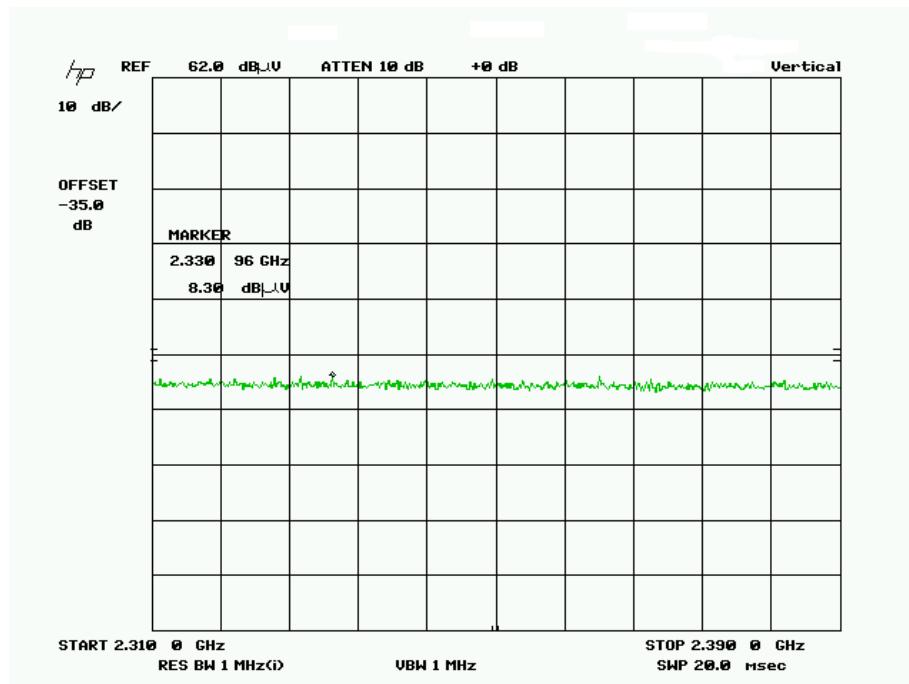
IC: 3819A-U3UHFMID

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Lower restricted band – From 2310 MHz to 2390 MHz
 Horizontal (Peak)



Lower restricted band – From 2310 MHz to 2390 MHz
 Vertical (Peak)



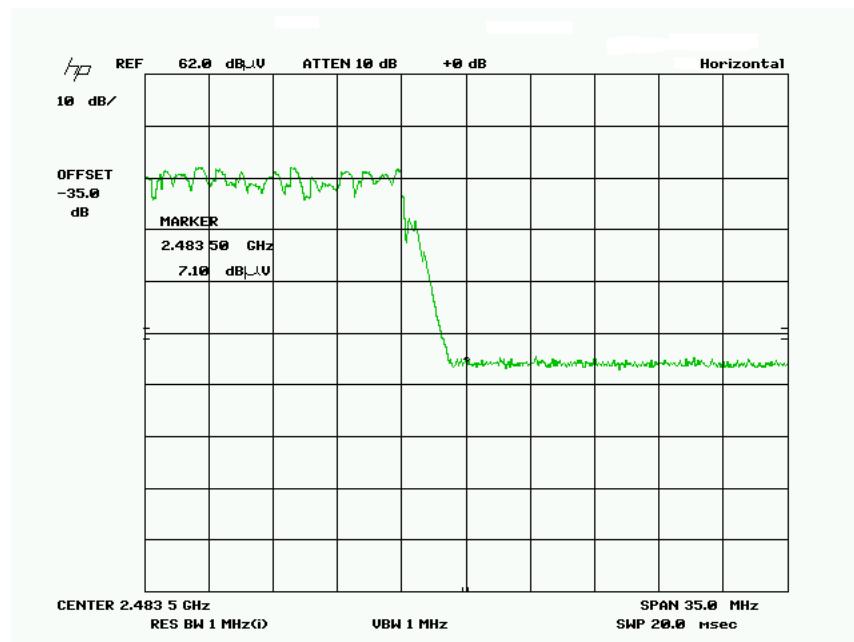
APPLICANT: UNICATION CO., LTD.

FCC ID: LEA-U3-UHF-MID

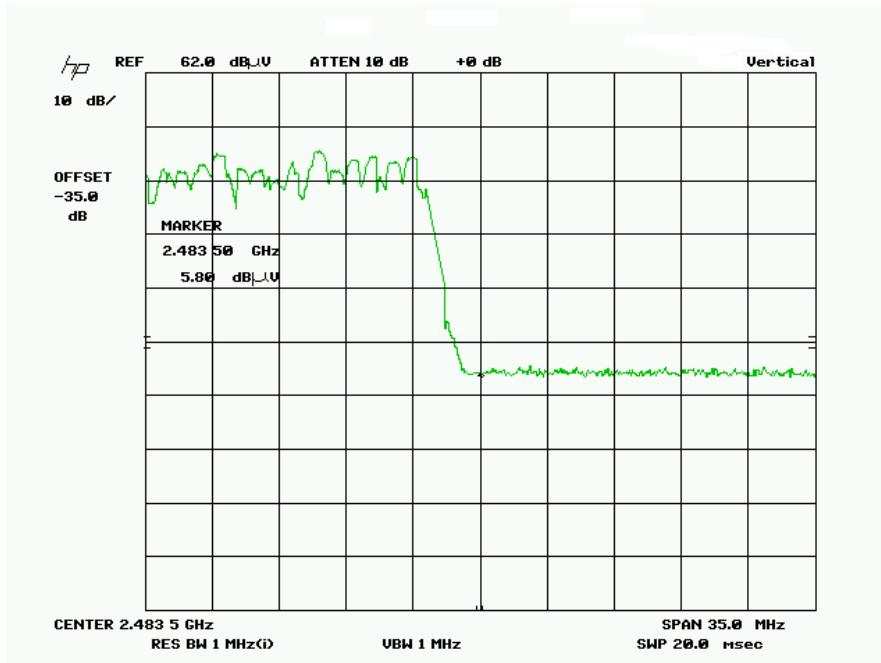
IC: 3819A-U3UHFMID

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Upper adjacent restricted band – channel 2480
 Peak - Horiz.



Upper adjacent restricted band - channel 2480
 Peak – Vert.



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Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Polarity	Detector	Coax Loss dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB
2,480.00	2,483.50	15.8	V	Peak	3.24	32.46	51.5	2.5
2,480.00	2,483.50	17.1	H	Peak	3.24	32.46	52.8	1.2

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Polarity	Detector	Coax Loss dB	Correction Factor dB/m	Field Strength dBuV/m	Margin dB
2,402.00	2,315.76	17.5	H	Peak	3.14	32.02	52.64	1.36
2,402.00	2,330.96	18.3	V	Peak	3.12	32.06	53.49	0.51

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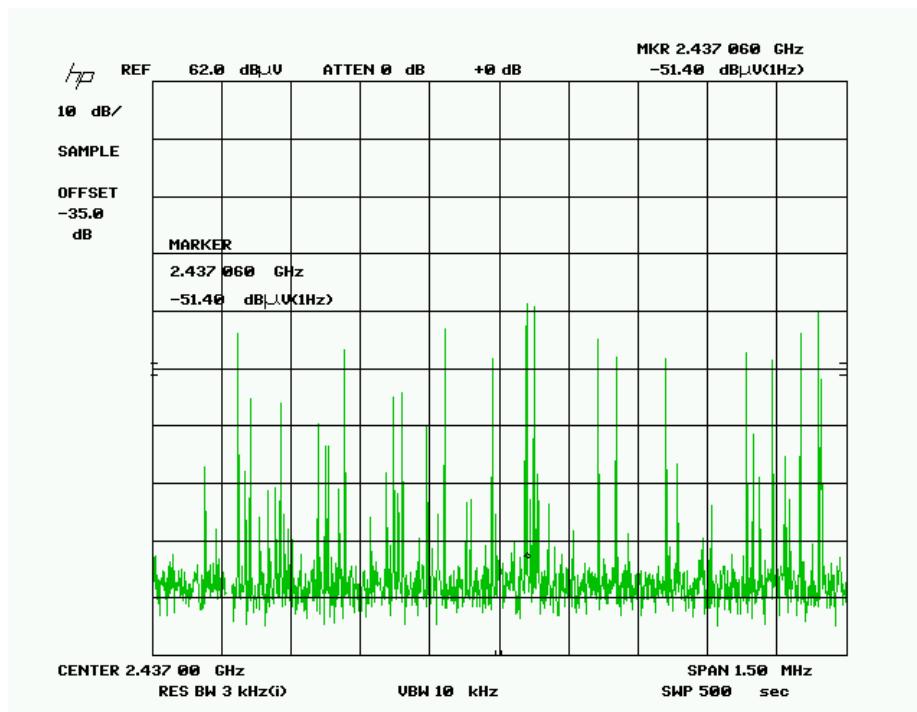
POWER SPECTRAL DENSITY

Rules Part No.: 15.247(d), RSS-210 A8.2

Requirements: The peak level measured must be less than +8.0 dBm.

Test Data: SEE THE FOLLOWING PLOTS

The total power output of the device is less than the 8 dBm spectral density limit.



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