

FCC Test Report - UMTS Band 5

Report ID: 03360-RF-00100

FCC ID : AZ489FT7078

Tested Model : LEX L10i

Test Date : Jan 13, 2016 ~ Feb 20, 2016

Issued Date : 26 Feb, 2016

Applicant : Motorola Solution Malaysia Sdn Bhd

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Testing Lab : Motorola Penang Adv. Comm. Laboratory

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FCC Registration: 772092

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Date: 26 Feb, 2016

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1.0. Summary of Test Results

FCC Clause	Test Item	Results	Remark
2.1046 22.913(a)(2)	Conducted RF Output Power	PASS	Meet the requirement of limit
--	Peak-to-Average Power Ratio	PASS	Meet the requirement of limit
2.1049 22.917(b)	Occupied Bandwidth (26dBc, 99%)	PASS	Meet the requirement of limit
2.1055 22.355	Frequency Stability	PASS	Meet the requirement of limit
2.1051 22.917(a)(b)	Band Edge Conducted Spurious Emission	PASS	Meet the requirement of limit
2.1051 22.917(a)(b)	Conducted Spurious Emissions	PASS	Meet the requirement of limit
22.913(a)(2)	Effective Radiated Power (ERP)	PASS	Meet the requirement of limit
2.1053 22.917(a)(b)	Radiated Spurious Emissions	PASS	Meet the requirement of limit

1.1. Measurement Uncertainty

Measurement	Frequency	Expanded Uncertainty (k=1.96) (±)
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	5.01
	200MHz ~ 1000MHz	5.01
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	5.01
	18GHz ~ 25GHz	5.01

1.2. Equipment List

Description	Model	Serial Number	Calibration Date	Calibration Due Date
POWER SUPPLY	6623A	2916A01428	3-Apr-15	3-Apr-16
Wideband Radio Communication Tester	CMW500	154550	23-Jun-15	23-Jun-16
SIGNAL ANALYZER	FSV40	101431	29-Apr-15	29-Apr-16
CHAMBER	SH-641	92002651	15-Mar-15	15-Mar-16
DRG HORN FREQ.	SAS-571	566	2-Aug-15	2-Aug-16
PREAMPLIFIER	PAM-0118P	361	NA	NA
BILOG ANTENNA	CBL6112B	2964	23-Apr-14	23-Apr-16
POWER SUPPLY	6031A	3121A02341	12-Jun-14	12-Jun-16
EMI TEST RECEIVER	ESIB26	100336	17-Jun-15	17-Jun-16
MICROWAVE SIGNAL GENERATOR	SMP04	100131	25-Jun-15	25-Jun-16
SYSTEM CONTROLLER	SC104V	050806-1	NA	NA
TURNTABLE FLUSH MOUNT 2M	FM2011	NA	NA	NA
ANTENNA POSITIONING TOWER	TLT2	NA	NA	NA
TEST RECEIVER	ESIB26	827769/009	16-Jun-15	16-Jun-16
SIGNAL ANALYZER	FSV40	101103	25-Jun-15	25-Jun-16
5m Semi-anechoic Chamber	S800-HX	J2308	29-Apr-15	29-Apr-16
BILOG ANTENNA	CBL6112B	2863	24-Jul-15	24-Jul-16
DATA LOGGER	TM320	12249289	12-Apr-15	12-Apr-16
BILOG ANTENNA	CBL6112D	25516	23-Apr-15	23-Apr-16

1.3. General Information

General Description of EUT

Product	Smart phone	
Brand	Motorola Solutions	
Test Model	LEX L10i	
Power Supply Rating	3.7Vdc (Battery), 5Vdc (Adapter)	
Mode of operation	UMTS Band 5 (RMC 12kbps, HSDPA, HSUPA)	
Modulation Type	QPSK	
Operating Frequency	UMTS Band 5	826.4MHz~846.6MHz
Max. ERP Power	UMTS Band 5	23.73dBm
Antenna Type	UMTS Band 5	Inverted-L Monopole with -0.4 to -2.2dBi gain
SW Version	LEXL10-INT-D17	
HW Version	Rev A	

Note:

- The EUT contains following accessory devices and data cable.

Item	Brand	Model or P/N	Specification
Rechargeable Lithium ion battery	MOTOROLA	PMNN4472A	3.7Vdc, 2340mAh, 8.7Wh
Rechargeable Lithium ion battery	MOTOROLA	PMNN4475A	3.7Vdc, 4560mAh, 16.9Wh
ITE Power Supply	MOTOROLA	HKTN4009A	I/P: 100-240Vac, 50-60Hz, 0.2A O/P: 5Vdc, 1.2A
USB cable (CABLE: LEX USB SYNC AND CHARGE)	N/A	CB000262A01	-
Holster	N/A	HKLN4618A	-

Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	Product	Brand	Model No.	Serial No.	FCC ID
1	Wideband Radio Communication Tester	R&S	CMW500	154550	NA

NO.	Signal Cable Description of The above Support Units
1	NA

Note:

1. All power cords of the above support units are non-shielded.
2. Item 1 acted as a communication partner to transfer data.

EUT Operating Conditions

The EUT makes a call to the communication simulator. The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency.

General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC 47 CFR Part 2

FCC 47 CFR Part 22

KDB 971168 D01 Power Meas License Digital Systems v02r02

ANSI/TIA/-603-D

NOTE: All test items have been performed and recorded as per the above standards.

1.4. Channel number and frequency info

Band	Available Channel Number	Test Channel Number			Test Channel Frequency (MHz)		
		Low Channel	Mid Channel	High Channel	Low Channel	Mid Channel	High Channel
UMTS Band 5	4132~4233	4132	4183	4233	826.4	836.6	846.6

1.5. Test Mode Applicability and Tested Channel Detail

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports.

The Radiated Emission and Effective Radiated Power (ERP) worst case was found when positioned on Y-Plane for UMTS Band 5.

The following channel(s) was (were) selected for the final test as listed below:

UMTS Band 5

Test Item	Available Channel	Tested Channel	Modulation	Mode
Conducted RF Output Power	4132~ 4233	4132, 4183, 4233	QPSK	All Modes
Peak to Average Power Ratio	4132~ 4233	4132, 4183, 4233	QPSK	HSUPA Subtest 5
Occupied Bandwidth	4132~ 4233	4132, 4183, 4233	QPSK	RMC 12.2kbps
Frequency Stability	4132~ 4233	4183	QPSK	RMC 12.2kbps
Band Edge Conducted Spurious Emission	4132~ 4233	4132, 4233	QPSK	RMC 12.2kbps
Conducted Spurious Emission	4132~ 4233	4132, 4183, 4233	QPSK	RMC 12.2kbps
Radiated Emission	4132~ 4233	4132, 4183, 4233	QPSK	RMC 12.2kbps
Effective Radiated Power (ERP)	4132~ 4233	4132, 4183, 4233	QPSK	RMC 12.2kbps

NOTE:

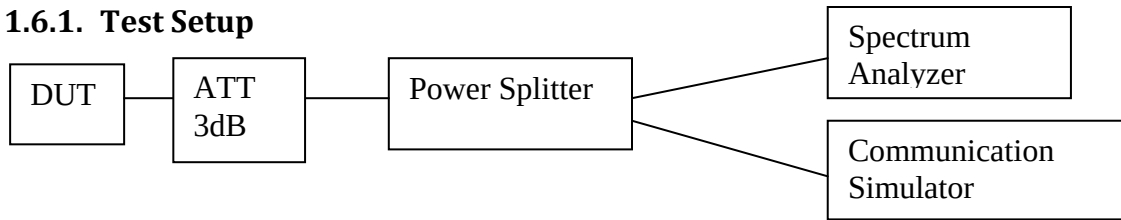
1. Pre-test was performed on Peak to Average Power ratio and HSUPA subtest 5 was selected for final Peak to Average Power ratio test because it is the worst case.
2. All other test (except Peak to average power ratio and conducted RF output power) was performed under RMC12.2kbps only because RMC12.2kbps is the worst case value from Conducted RF Output Power.

Test Condition:

Test Item	Environmental Conditions	Input Power	Tested By
Conducted RF Output Power	25°C, 50% RH	3.7V DC	ckchan
Peak-to-Average Power Ratio	25°C, 50% RH	3.7V DC	ckchan
Occupied Bandwidth	25°C, 50% RH	3.7V DC	ckchan
Frequency Stability	25°C, 50% RH	3.7V DC	ckchan
Band Edge Conducted Spurious Emission	25°C, 50% RH	3.7V DC	ckchan
Conducted Spurious Emission	25°C, 50% RH	3.7V DC	ckchan
Radiated Spurious Emission	25°C, 63.7% RH	3.7V DC	Nazrin/Qawiman
Effective Radiated Power (ERP)	25°C, 63.7% RH	3.7V DC	Nazrin/Qawiman

1.6. Conducted RF Output Power

1.6.1. Test Setup



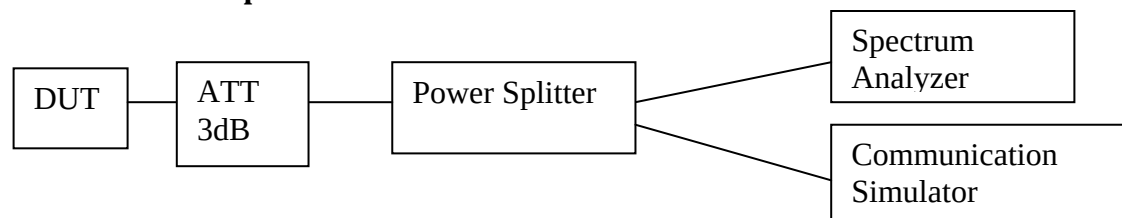
1. The DUT transmitter output port was connected to communication simulator with above setup.
2. Path loss for the measurement included.
3. Set DUT to transmit maximum power through communication simulator
4. All the measurements were done at low, mid, high channel for each band and different modulation.
5. Record the average power into the test report.

1.6.2. Conducted RF Output Power – UMTS Band 5 (824-849MHz)

	Test Mode	Conducted Output Power (dBm)		
		Low CH 4132	Mid CH 4183	High CH 4233
		826.4 MHz	836.6 MHz	846.6 MHz
RMC 12.2kbps	RMC 12.2Kbps Test Loop 1	23.155	22.924	22.780
HSDPA	Sub-test 1	22.149	21.935	21.831
	Sub-test 2	22.254	22.045	21.936
	Sub-test 3	21.783	21.459	21.356
	Sub-test 4	21.770	21.459	21.326
HSUPA	Sub-test 1	21.589	21.375	21.224
	Sub-test 2	20.735	20.942	20.855
	Sub-test 3	20.846	20.665	20.475
	Sub-test 4	21.018	20.731	20.714
	Sub-test 5	22.179	22.053	21.910

1.7. Peak-to-Average Power Ratio

1.7.1. Test Setup



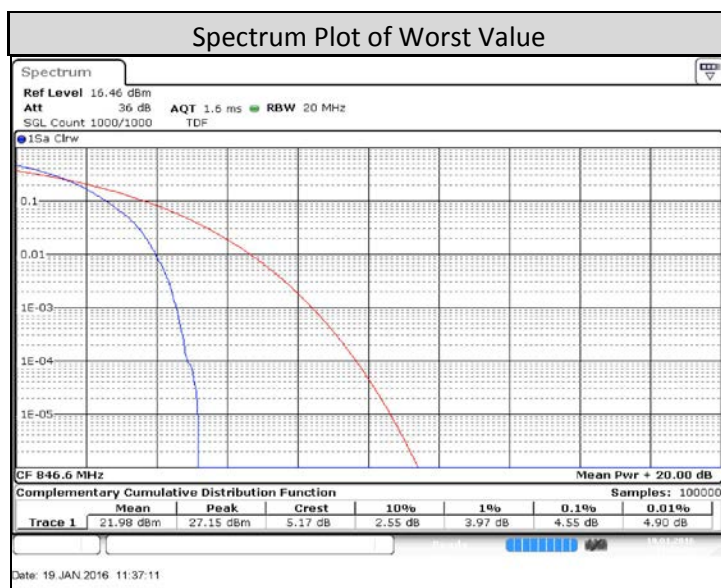
- 1) The DUT transmitter output port was connected to communication simulator with above setup.
- 2) Path loss for the measurement included.
- 3) Set DUT to transmit maximum power through communication simulator
- 4) Set the CCDF (Complementary Cumulative Distribution Function) option in the spectrum analyzer.
- 5) Spectrum Analyzer setting, RBW = 20MHz.
- 6) Recorded the maximum PAR level associated with a probability of 0.1% as Peak to Average Ratio.
- 7) All the measurements were done at low, mid, high channel for each band and different modulation.

1.7.2. Test Limit

The peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

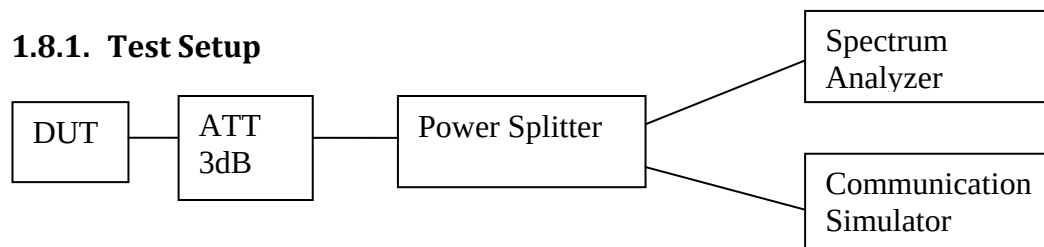
1.7.3. Peak To Average Power Ratio – UMTS Band 5 (824-849MHz)

Mode	Channel Number	Tx Frequency (MHz)	Peak To Average (dB)
HSUPA Subtest 5	Low CH 4132	826.4 MHz	4.23
	Mid CH 4183	836.6 MHz	4.35
	High CH 4233	846.6 MHz	4.55



1.8. Occupied Bandwidth

1.8.1. Test Setup



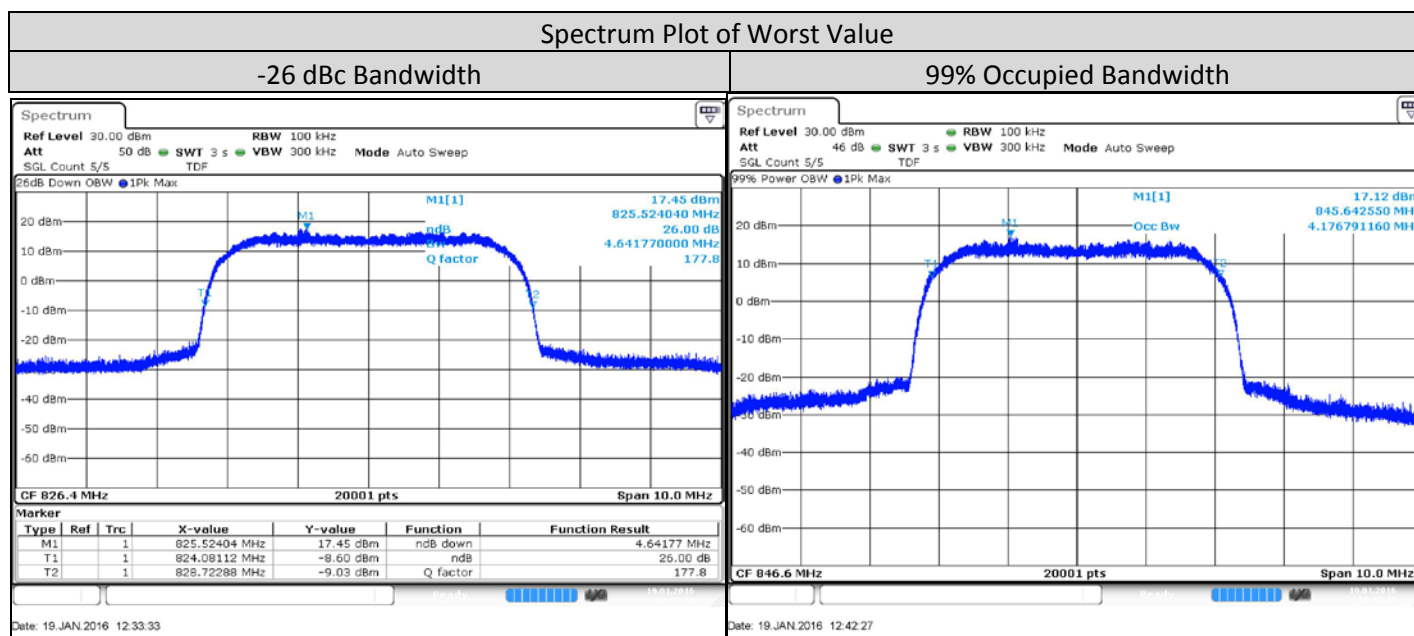
- 1) The DUT transmitter output port was connected to communication simulator with above setup.
- 2) Path loss for the measurement included.
- 3) For UMTS measurement, set DUT to transmit maximum power & full RB size through communication simulator.
- 4) For UMTS measurement, set DUT to transmit maximum power through communication simulator.
- 5) Spectrum Analyzer setting, RBW = 100 kHz, VBW = 300 kHz.
- 6) Measure & record -26dBc and 99% occupied bandwidth (BW).
- 7) All the measurement was done at low, mid, high channel for each band and different modulation.

1.8.2. Test Limit

The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

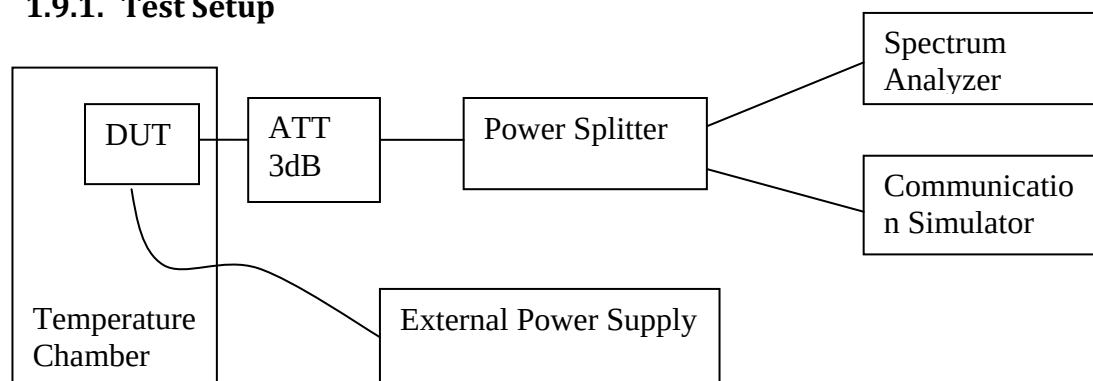
1.8.3. Occupied Bandwidth - UMTS Band 5 (824-849MHz)

Mode	Channel Number	Tx Frequency (MHz)	-26 dBc Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
RMC 12.2kbps	Low CH 4132	826.4 MHz	4.6418	4.1753
	Mid CH 4183	836.6 MHz	4.6398	4.1733
	High CH 4233	846.6 MHz	4.6418	4.1768



1.9. Frequency Stability

1.9.1. Test Setup



- 1) The DUT is placed in the temperature chamber and DUT is power up by external power supply to control the DC input voltage.
- 2) The temperature chamber could control the temperature and humidity and external power supply could control the test voltage range from minimum to maximum operating voltage.
- 3) Measured frequency error from the communication simulator by vary below step :
 - i. Vary temperature of the temperature chamber from -10 ~ 60 deg C (10 deg C / Step)** and set external supply voltage constant at nominal voltage.
 - ii. Vary external supply voltage from minimum to maximum operation voltage support by DUT and set temperature chamber constant at room temp.
- 4) All the measurement was done at mid channel for each band.

1.9.2. Test Limit

The carrier frequency shall not depart from the reference frequency in excess of ± 2.5 ppm for mobile stations and ± 1.5 ppm for base stations.

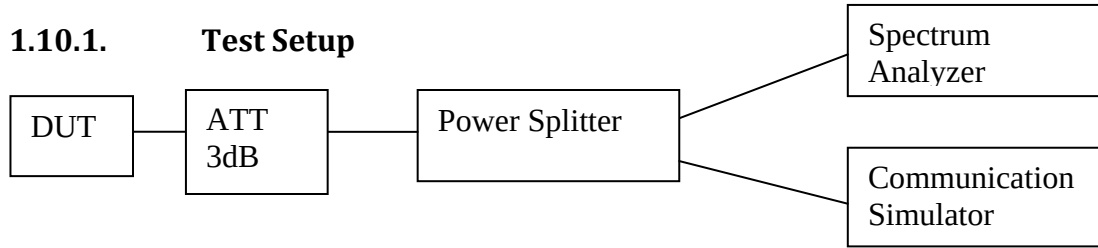
1.9.3. Frequency Stability - UMTS Band 5 (824-849MHz)

Band	Frequency Error VS Temperature	
	Temp (Deg C)	Frequency Error (ppm)
		RMC 12.2kbps
UMTS Band 5	60	0.0040
	50	0.0047
	40	0.0035
	30	-0.0032
	20	-0.0037
	10	0.0105
	0	-0.0037
	-10	-0.0035
	-20	0.0098
	-30	0.0039

Band	Frequency Error VS Voltage	
	Voltage (V)	Frequency Error (ppm)
		RMC 12.2kbps
UMTS Band 5	4.1	0.0112
	3.7	0.0188
	3.5	0.0197

1.10. Band Edge Conducted Spurious Emission

1.10.1. Test Setup

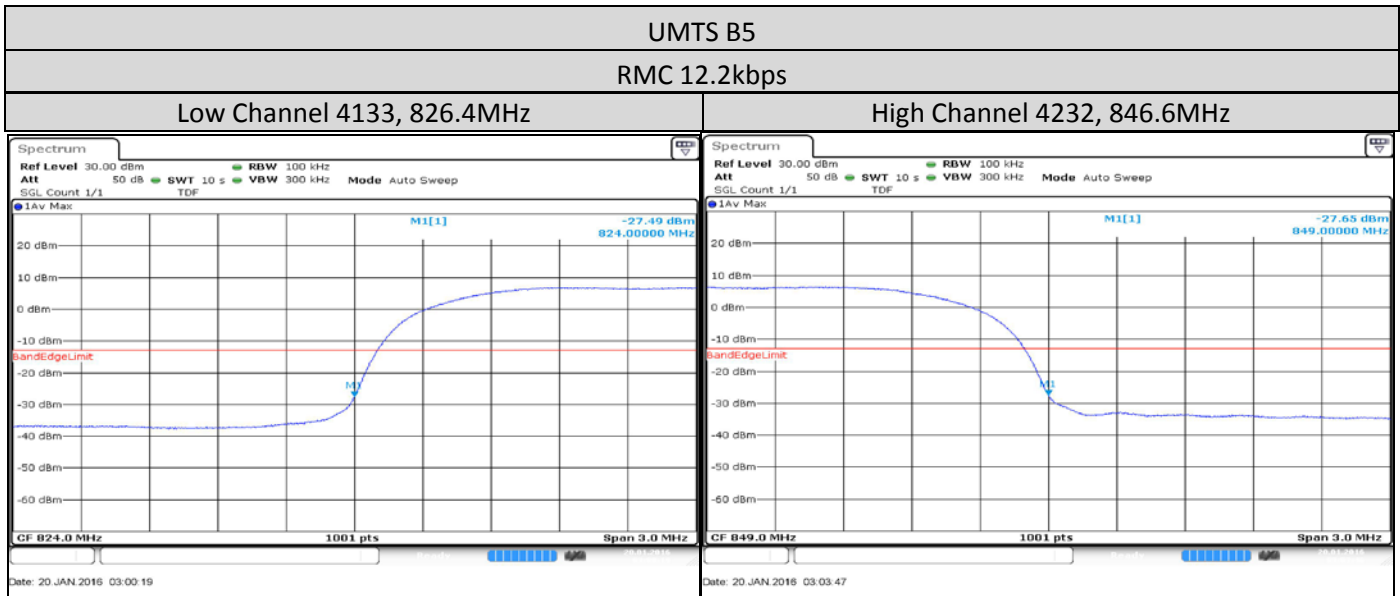


- 1) The DUT transmitter output port was connected to communication simulator with above setup.
- 2) Path loss for the measurement included.
- 3) Set DUT to transmit maximum power through communication simulator.
- 4) The band edges of lowest and highest channels with the highest RF powers were measured.
- 5) The center frequency of spectrum is the band edge frequency, span is 3MHz, RBW is 1~3% of OBW and VBW is 3 times of RBW.
- 6) Record the maximum trace plot into the test report.

1.10.2. Test Limit

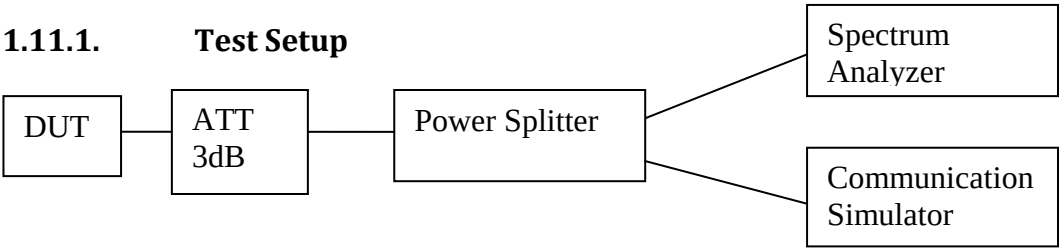
The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

1.10.3. Band Edge Conducted Spurious Emission - UMTS Band 5 (824-849MHz)



1.11. Conducted Spurious Emission

1.11.1. Test Setup

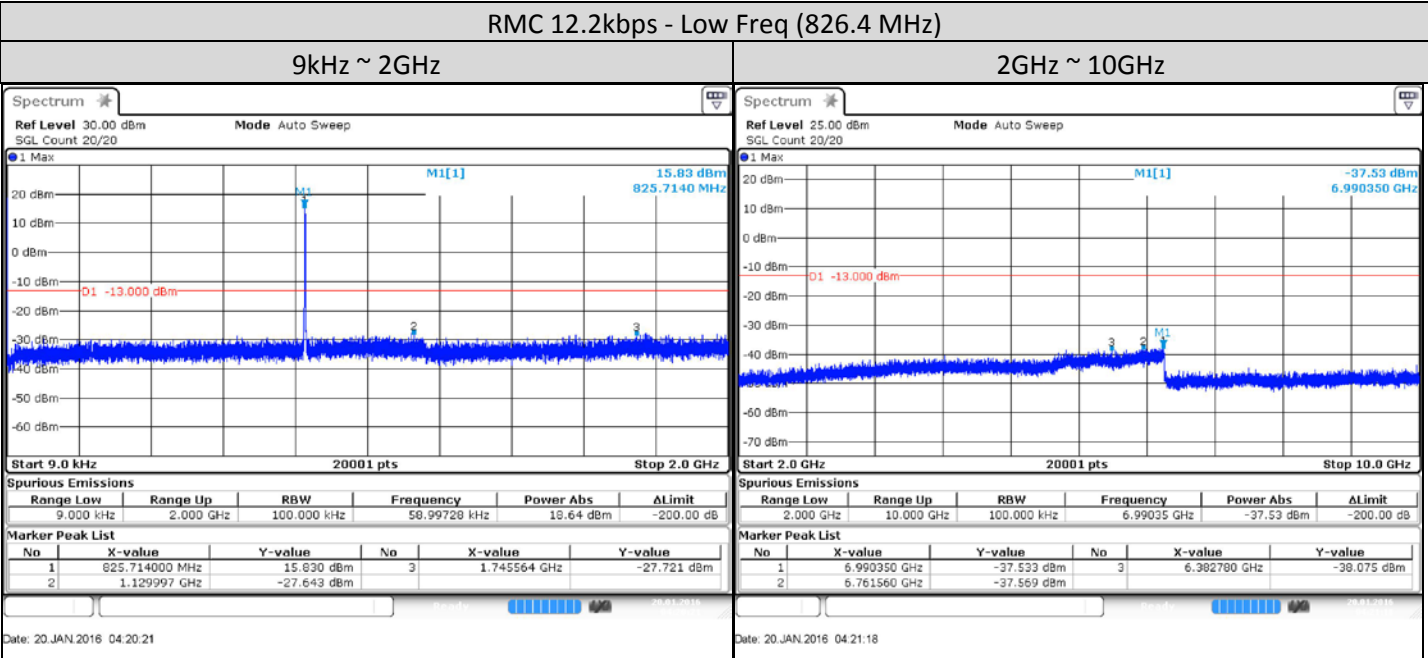


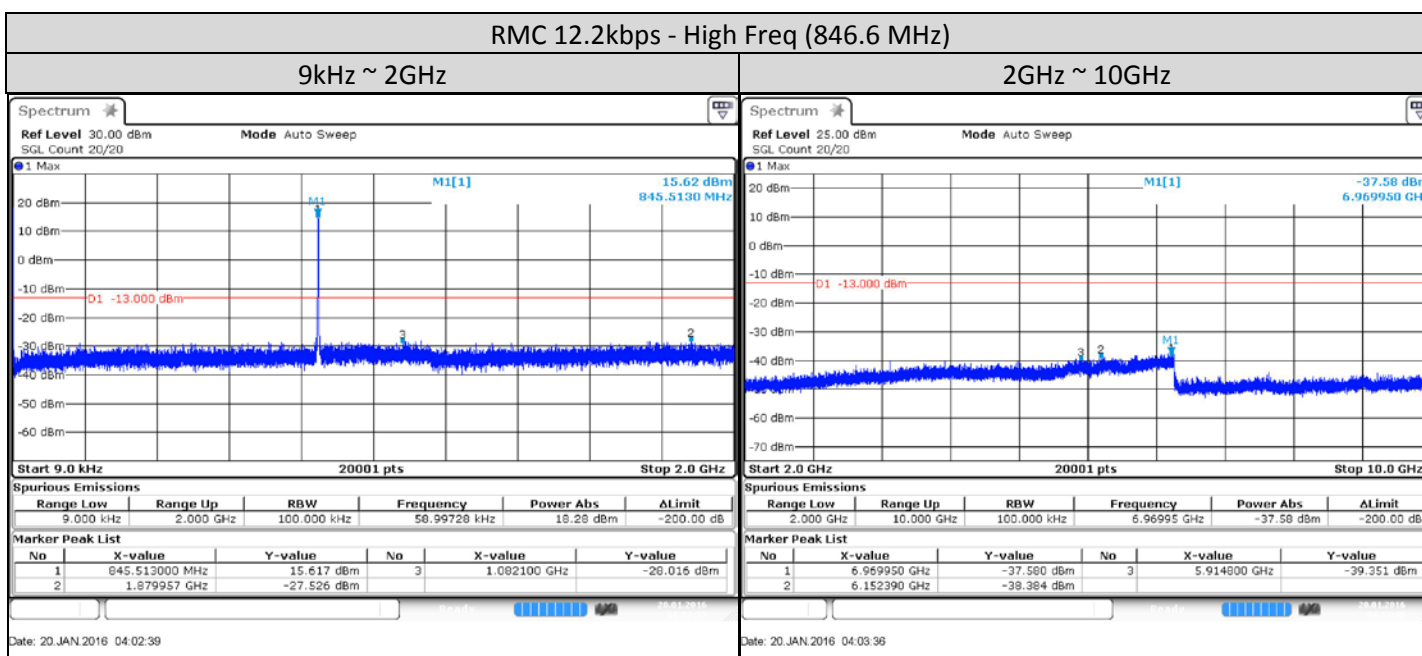
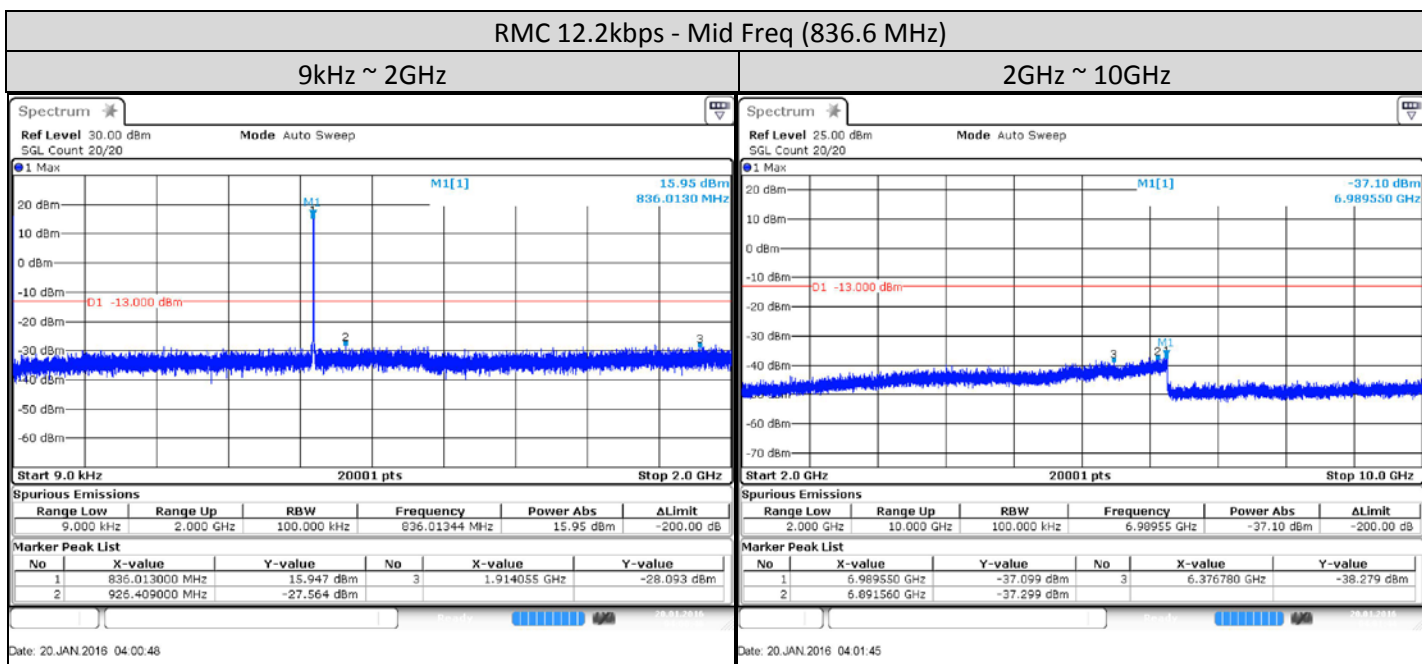
- 1) The DUT transmitter output port was connected to communication simulator with above setup.
- 2) Path loss for the measurement included.
- 3) Set DUT to transmit maximum power through communication simulator.
- 4) Spectrum Analyzer setting, RBW = 100 kHz, VBW = 300 kHz.
- 5) The spurious emission of lowest, middle and highest channels with the highest RF powers were measured.
- 6) Record the maximum trace plot into the test report.

1.11.2. Test Limit

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

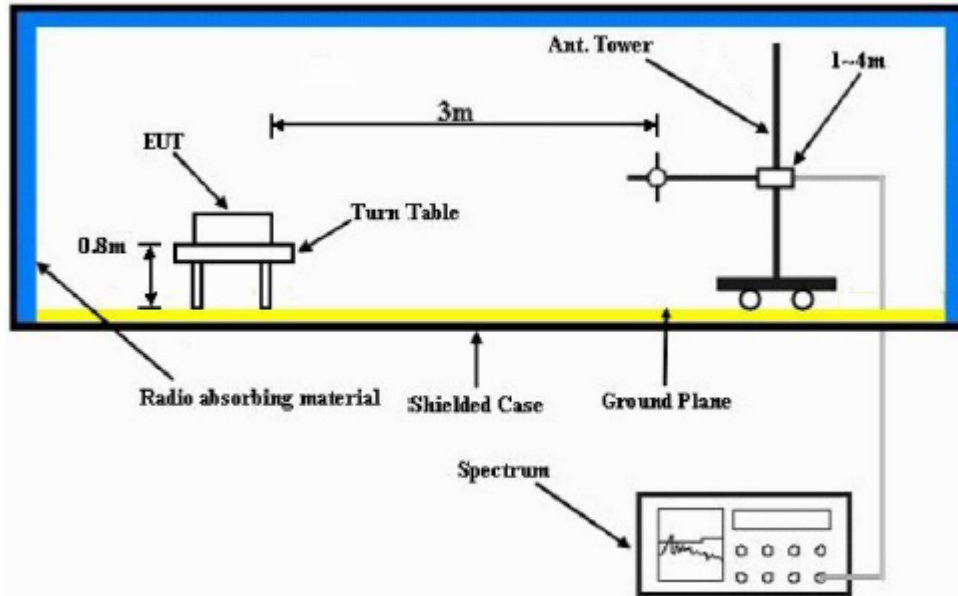
1.11.3. Conducted Spurious Emission - UMTS Band 5 (824-849MHz)





1.12. Radiated Spurious Emission

1.12.1. Test Setup



- 1) The spectrum setting for scanning Radiated Emission below 1 GHz is RBW = 100 kHz, VBW = 300 kHz and above 1 GHz is RBW = 1MHz, VBW = 3MHz. Detector mode is positive peak.
- 2) In the semi-anechoic chamber, setup as illustrated above the EUT placed on the 0.8m height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power. The “Read Value” is the spectrum reading the maximum power value.
- 3) The substitution antenna is substituted for EUT at the same position and signals generator (S.G) export the CW signal to the substitution antenna via a TX cable. The receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum radiation power. Record the power level of maximum radiation power from spectrum. So, the measured substitution value = Ref level of S.G + TX cables loss – Substituted Antenna Gain.
- 4) Final Radiated Spurious Emission = “Read Value” + Measured substitution value.

1.12.2. Test Limit

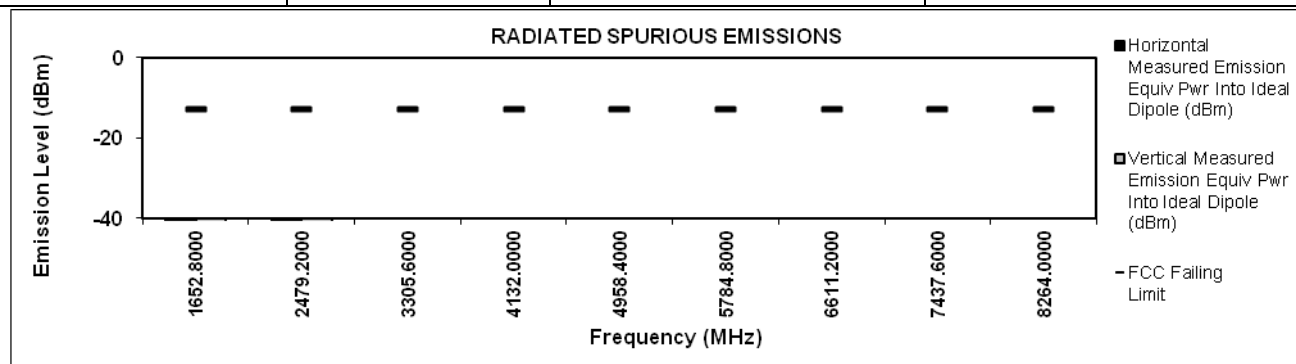
The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

Battery : PMNN4472A, Accy : 3360-HKTN4009A-3, 3360-CB000262A01-3

826.4 MHz

0.2512 Watt(s)/Max Power

S/N: 171PRQ1569

[illegible]

Temp(Deg): 24.8 Hum(%RH): 64.9

Remarks:

Passed Results	Marginal Results	Failed Results
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LINK MODE RADIATED SPURIOUS EMISSIONS

MODEL #: LEX L10i

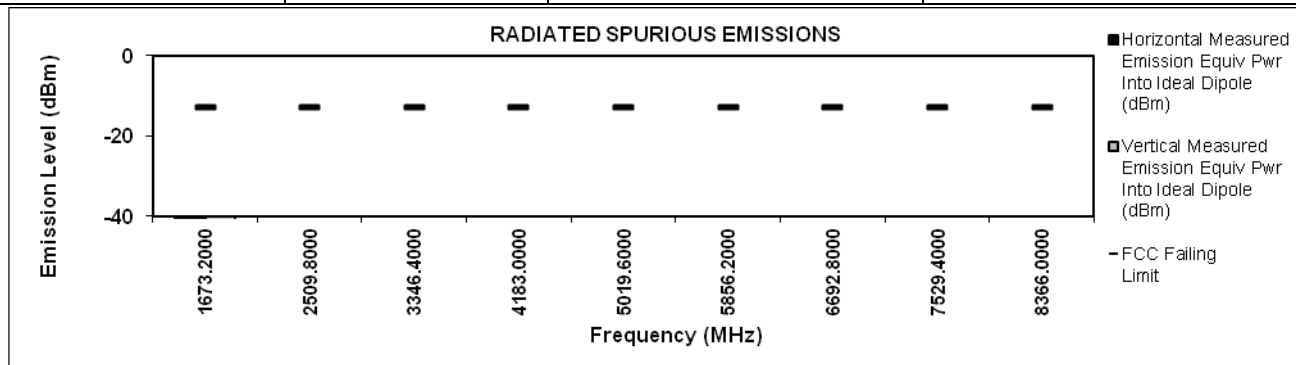
Battery : PMNN4472A, Accy : 3360-HKTN4009A-3, 3360-CB000262A01-3

Band 5 (Mid)

836.6 MHz

0.2512 Watt(s)/Max Power

S/N: 171PRO1569

[illegible]

The data presented here was taken using the substitution method as found in the TIA/EIA-603 document.

Motorola Penang EMC Lab - Test Performed by: Qawiman/Nazrin

January 13, 2016

FCC Registration: 772092

Industry Canada: 109AK

Remarks:** Indicates the spurious emission could not be detected due to noise limitations or ambients.

*Pursuant to CFR 47 Part 2.1057 (c), emissions attenuated more than 20 dB below the permissible limit are not reported

Temp(Deg): 24.8 Hum(%RH): 64.9

Remarks:

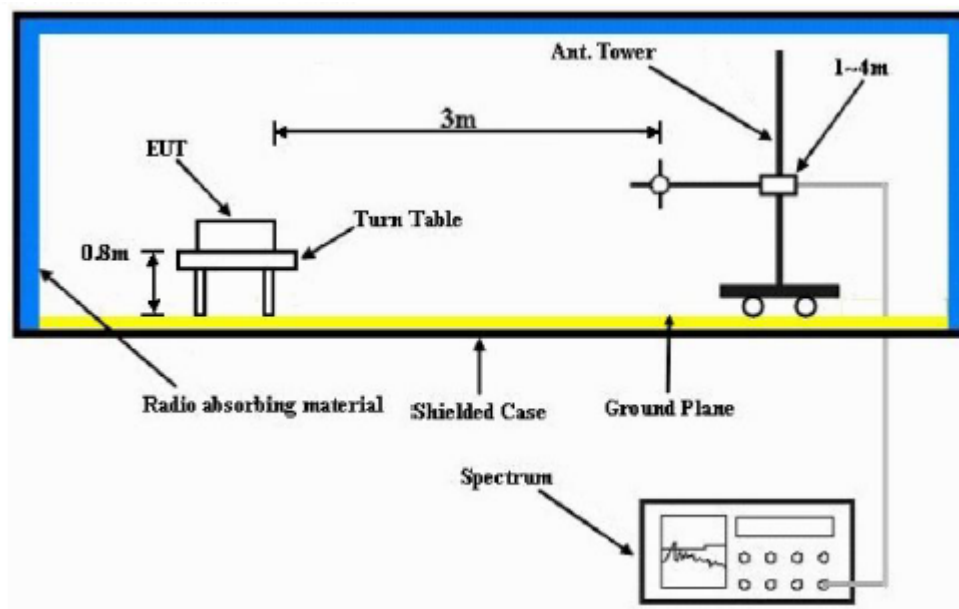
Passed Results

Marginal Results

Failed Results

1.13. Effective Radiated Power (ERP)

1.13.1. Test Setup



- 1) The spectrum setting for Effective Radiated Power (ERP) is RBW = 100 kHz, VBW = 300 kHz. Detector Mode is RMS.
- 2) In the semi-anechoic chamber, setup as illustrated above the EUT placed on the 0.8m height of Turn Table, rotated the table 45 degree each interval to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power for each degree interval. The "Read Value" is the spectrum reading of maximum power value.
- 3) The substitution antenna is substituted for EUT at the same position and signals generator (S.G) export the CW signal to the substitution antenna via a TX cable. The receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum radiation power. Record the power level of maximum radiation power from spectrum. So, the Measured substitution value = Ref level of S.G + TX cables loss – Substituted Antenna Gain.
- 4) $ERP = \text{"Read Value"} + \text{Measured substitution value.}$

1.13.2. Test Limit

The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

1.13.3. Effective Radiated Power (ERP) – UMTS Band 5 (824-849MHz)

RMC 12.2kbps - Low Freq (826.4 MHz)

ERP

S/N: 171PRQ1568
Antenna: NA
Band 5

Tx Power: 0.2512 Watts

	Frequency	Turn Table Deg.	ERP (dBm)
Horiz.	826.4	0	15.38
Horiz.	826.4	45	21.87
Horiz.	826.4	90	20.19
Horiz.	826.4	135	18.46
Horiz.	826.4	180	17.5
Horiz.	826.4	225	18.95
Horiz.	826.4	270	20.38
Horiz.	826.4	315	14.06
Vert.	826.4	0	13.52
Vert.	826.4	45	13.92
Vert.	826.4	90	16.46
Vert.	826.4	135	8.72
Vert.	826.4	180	10.03
Vert.	826.4	225	12.44
Vert.	826.4	270	9.69
Vert.	826.4	315	12.8

RMC 12.2kbps - Mid Freq (836.6 MHz)

ERP

S/N: 171PRQ1568 Tx Power: 0.2512 Watts
Antenna: NA
Band 5

	Frequency	Turn Table Deg.	ERP (dBm)
Horiz.	836.6	0	18.7
Horiz.	836.6	45	21.58
Horiz.	836.6	90	19.69
Horiz.	836.6	135	15.83
Horiz.	836.6	180	16.91
Horiz.	836.6	225	17.66
Horiz.	836.6	270	20.61
Horiz.	836.6	315	9.59
Vert.	836.6	0	13.3
Vert.	836.6	45	13.41
Vert.	836.6	90	17.88
Vert.	836.6	135	10.71
Vert.	836.6	180	10.47
Vert.	836.6	225	10.98
Vert.	836.6	270	8.46
Vert.	836.6	315	14.09

RMC 12.2kbps - High Freq (846.6 MHz)

ERP

S/N: 171PRQ1568 Tx Power: 0.2512 Watts
Antenna: NA
Band 5

	Frequency	Turn Table Deg.	ERP (dBm)
Horiz.	846.6	0	19.33
Horiz.	846.6	45	14.14
Horiz.	846.6	90	20.43
Horiz.	846.6	135	23.73
Horiz.	846.6	180	13.68
Horiz.	846.6	225	9.89
Horiz.	846.6	270	11.6
Horiz.	846.6	315	18.93
Vert.	846.6	0	10
Vert.	846.6	45	12.51
Vert.	846.6	90	13.37
Vert.	846.6	135	13.73
Vert.	846.6	180	15.72
Vert.	846.6	225	9.38
Vert.	846.6	270	10.47
Vert.	846.6	315	9.25