EMISSIONS TEST REPORT FOR A LICENSED TRANSMITTER

I. GENERAL INFORMATION

Requirement: Federal Communications Commissions

Test Requirements: Part 2, Part 21

Applicant: BreezeCom Ltd.
Atidim Technological Park, Bldg. #1
Tel Aviv 61131, Israel

Product ID: FCC ID: LKT-SUR-MMDS1

II. DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

The SUR customer premises transceiver made by BreezeCom is a single integrated unit design using a single antenna for both transmit and receive. The radio has a diversity system, so there are two identical antennas, but only one is active in transmit mode at any given time. The transceiver is designed to interface with Ethernet inputs:

Antennas available for this product:

Standard 3 dBi monopole
6 dBi omni directional antenna with 3m cable
8.5 dBi omni directional wall mount antenna

The SUR operates in the 2500-2586 MHz band.

Channel 1 (LOW): 2501.5 MHz
Channel 184 (HIGH): 2684.5 MHz

Maximum output power is 28 dBm.

Data rate is 1Mbps, 2Mbps, or 3Mbps
Modulation is 8FSK, 4FSK, or FSK.

III. TEST LOCATION

Frequency stability tests, power output and mask tests were performed at Breezecom .
Power output and mask tests were repeated, and all other tests were performed at:

Compliance Certification Services

561F Monterey Road
Morgan Hill, CA 95037

T.N. Cokenias
EMC Consultant/Agent for Breezecom

3 May 2001

RF Hazard Information Per Sec. 1.1307

RF Hazard Distance Calculation

mW/cm2 from Table1: 1.00

Max RF Power P, dBm	TX Antenna G, dBi	MPE Safe Distance, cm
28.0	**7.0**	**15.9**

Basis of Calculations:

E^2/3770 = S, mW/cm2
E, V/m = (Pwatts*Ggain*30)^.5/d, meters
d = ((Pwatts*G*30)/3770*S))^0.5 Pwatts*Ggain = 10^(PdBm-30+GdBi)/10)

NOTE: For mobile or fixed location transmitters, minimum separation distance is 20 cm, even if calculations indicate MPE distance is less

The SUR transceiver will be used with one of the following antennas, described in the user manual:

3 dBi monopole antenna
7 dBi wallmount panel antenna

Note: Wall mount ntenna has 4ft. of white LMR-195 or RG-58 Coax Cable with SMA or MCX Connector. Gain is 7.5 dBi – 0.5 dB cable loss = Net Gain is 7dBi.

The following statement will be included in the users manual and on a label that will be attached to the transceiver and the :

CAUTION: To comply with FCC RF exposure requirements in section 1.1307, a minimum separation distance of 20 cm is required between this antenna and all persons.

FCC CERTIFICATION INFORMATION

The following information is in accordance with FCC Rules, 47CFR Part 2.

2.1033(c)1 Applicant: BreezeCom Ltd

2.1033(c)2 FCC ID: LKT-SUR-MMDS1

2.1033(c)3 Installation instructions are found in attached document.

2.1033(c)4 Emission type is **2M00F1D**

2.1033(c)5 Frequency range: 2500-2686 MHz

2.1033(c)6 Range of Operating Power

0-28 dBm

2.1033(c)7 Maximum Power Rating

28 dBm

2.1033(c)8 Applied voltages and currents into the final transistor elements

Refer to schematics accompanying this application - attached as electronic file

2.1033(c)10 Circuit and Functional Block Diagram, Description of Circuitry

Attached as electronic file.

2.1033(c)11 FCC ID Label

Attached as electronic file.

2.1033(c)12 Product Photographs

Attached as electronic file.

2.1033(c)13 Description of Modulation System

GFSK: 1Mbps/2Mbps/3Mbps configurable

2.1033(c)14 Test Data per 2.1046 – 2.1057

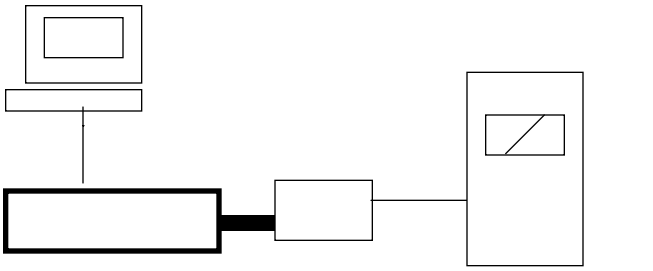
2501.5 RF Output Power Measurements

Measurement equipment used:

HP 436A RF power meter
HP 8482A RF power sensor
10 dB attenuator
Low-loss cable, cable adapters

Test Set-up

PC controller



SUR 10 dB attn HP8482A HP 436A

Test Procedures

The SUR was set to produce an 8 FSK 3Mbps signal. Power level in dBm was read off the meter.

Test Results

TX, MHz	TX Pout, dBm
2501.5 (Ch1)	28.0
2684.5 (Ch186)	28.0

Section 2.1047 Modulation Characteristics

Measurement Equipment Used:

HP 8593 EM spectrum analyzer, 9kHz – 26.5 GHz
10 dB attenuator
Low-loss cable, cable adapters

Test Set-up:

Test Procedures:

Out -of-band emissions limits, digital modulation, section 21.908(a):

At 6MHz channel edge: attenuated -25 dB below licensed average 6 MHz channel power
From edge to 250 kHz : attenuated along a slope to at least -40 dB
Beyond 250 kHz removed: attenuated along a slope to at least -60 dB at 3 MHz removed

Per section 21.908(e):

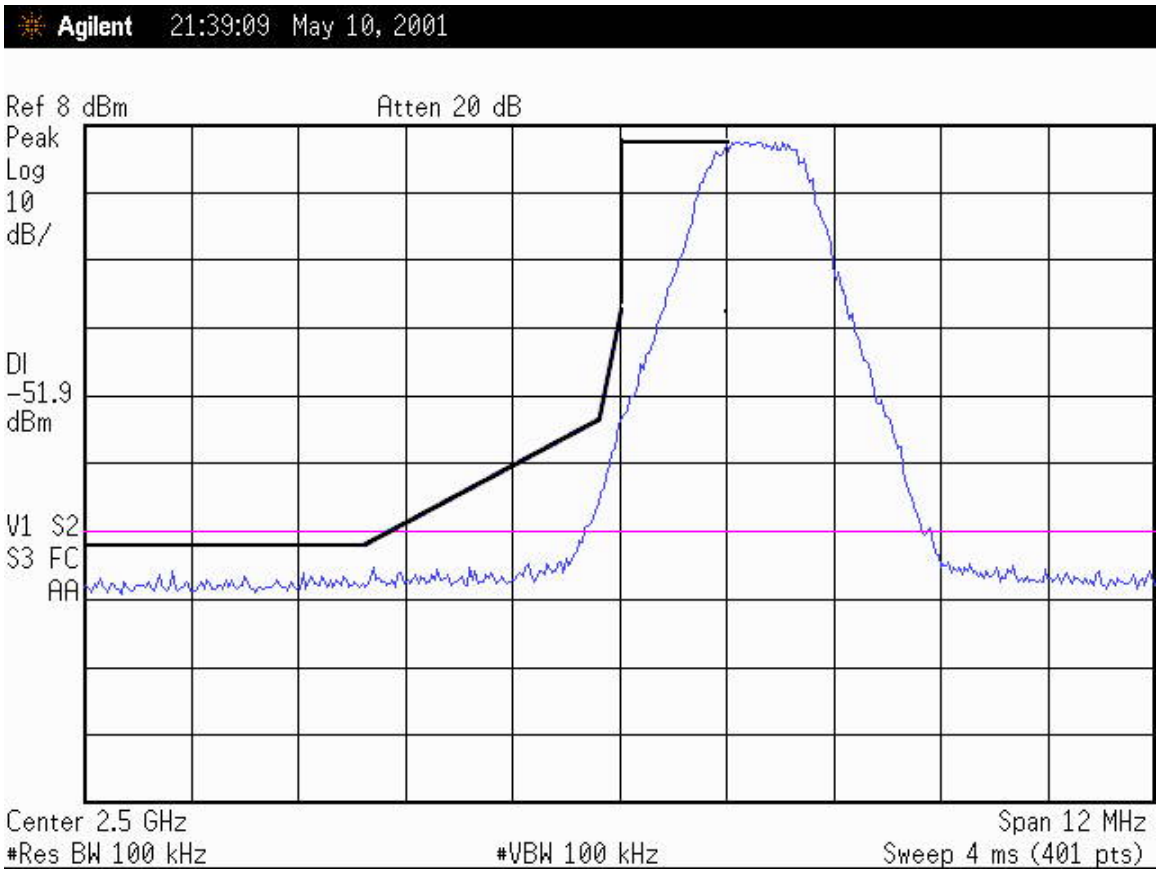
Attenuation in dB (below "flat top") = A + 10log (RBW1/RBW2)

A = attenuation specified (25, 40, 60 dB)
RBW1 = Resolution bandwidth for flat top measurement (relative)
RBW2 = Resolution bandwidth for spectral point measurement (relative)

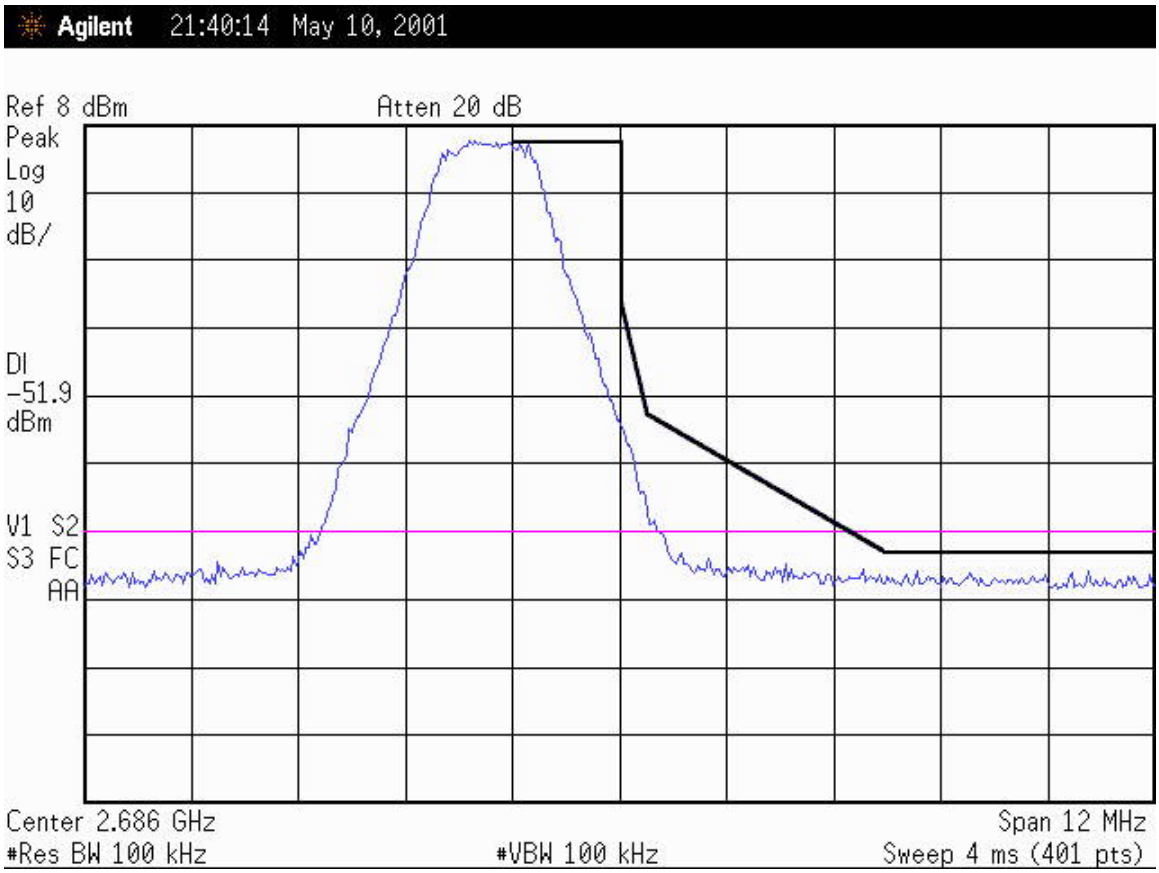
The transmitter was set to produce a 3Mbps data rate.

Test Results

Refer to attached plots.



Mask, 2501.5 MHz (Ch1)



Mask, 2684.5 MHz (Ch 184)

Section 2.1049 Occupied Bandwidth

Measurement Equipment Used:

HP 8593 EM spectrum analyzer, 9kHz – 26.5 GHz
10 dB attenuator
Low-loss cable, cable adapters

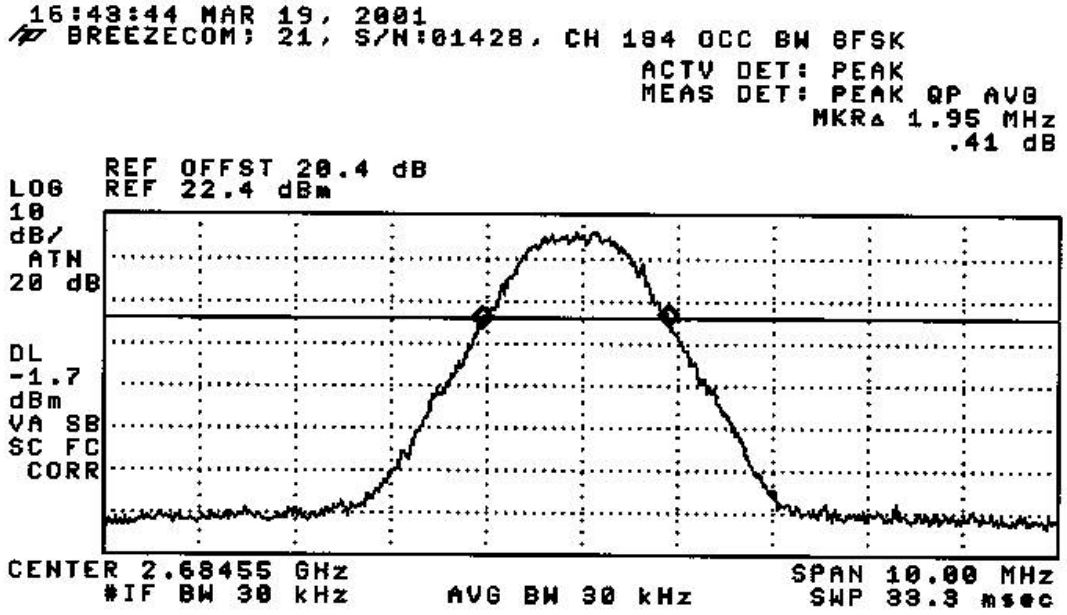
Test Set-up:

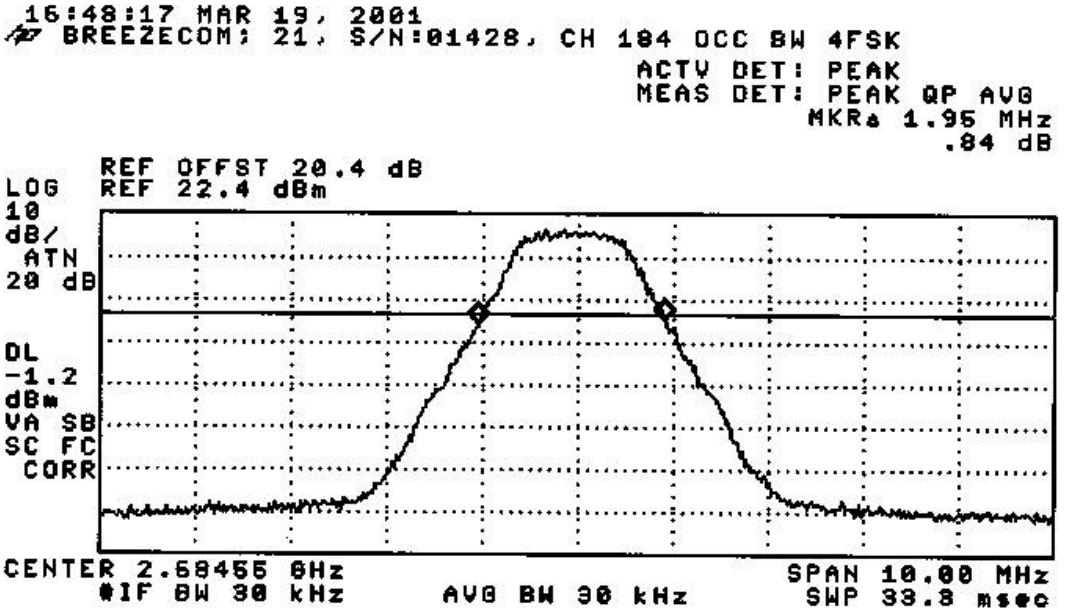
Test Procedures:

The PC programmed the SUR to transmit packets at a 3Mbps rate. The resultant spectrum analyzer signal was recorded.

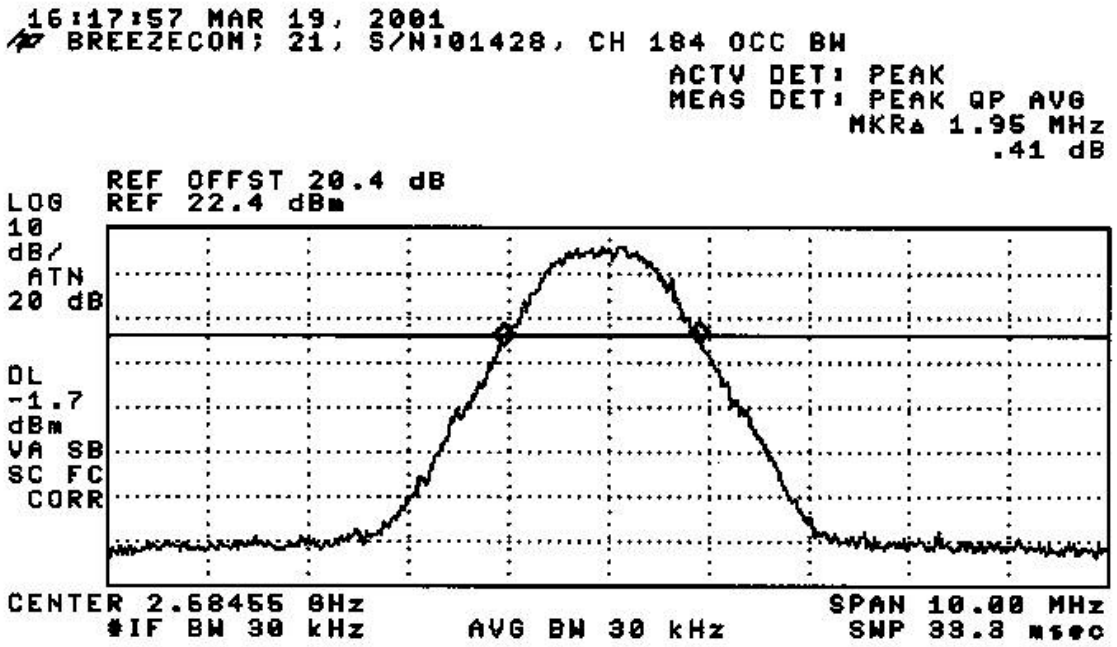
Test Results

Refer to attached plots.





8FSK and 4FSK Modulations



FSK Modulation

Section 2.1051 Spurious and Harmonic Emissions at Antenna Terminals

Measurement Equipment Used:

HP 8593 EM spectrum analyzer, 9kHz – 26.5 GHz
10 dB attenuator
Low-loss cable, cable adapters

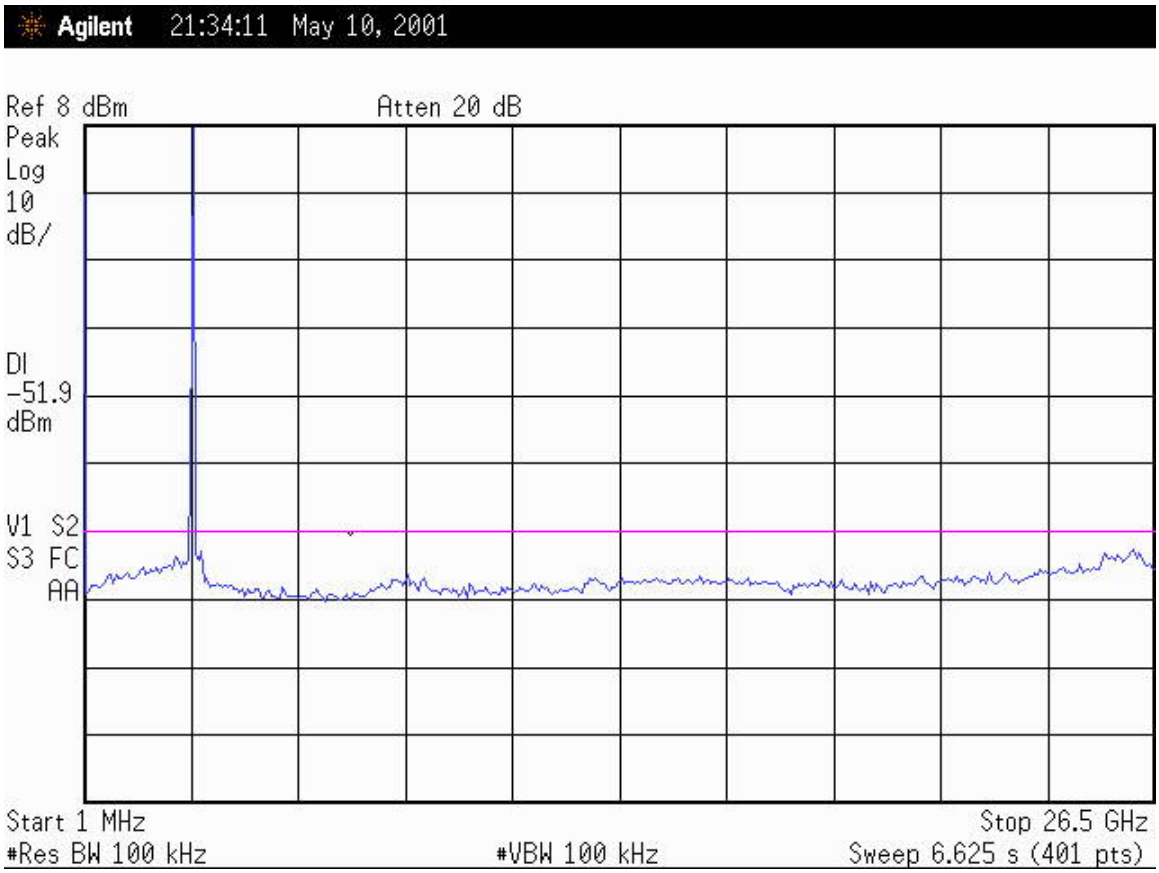
Test Procedures

The relative power measurement method described in Section 21.908(e) is followed:

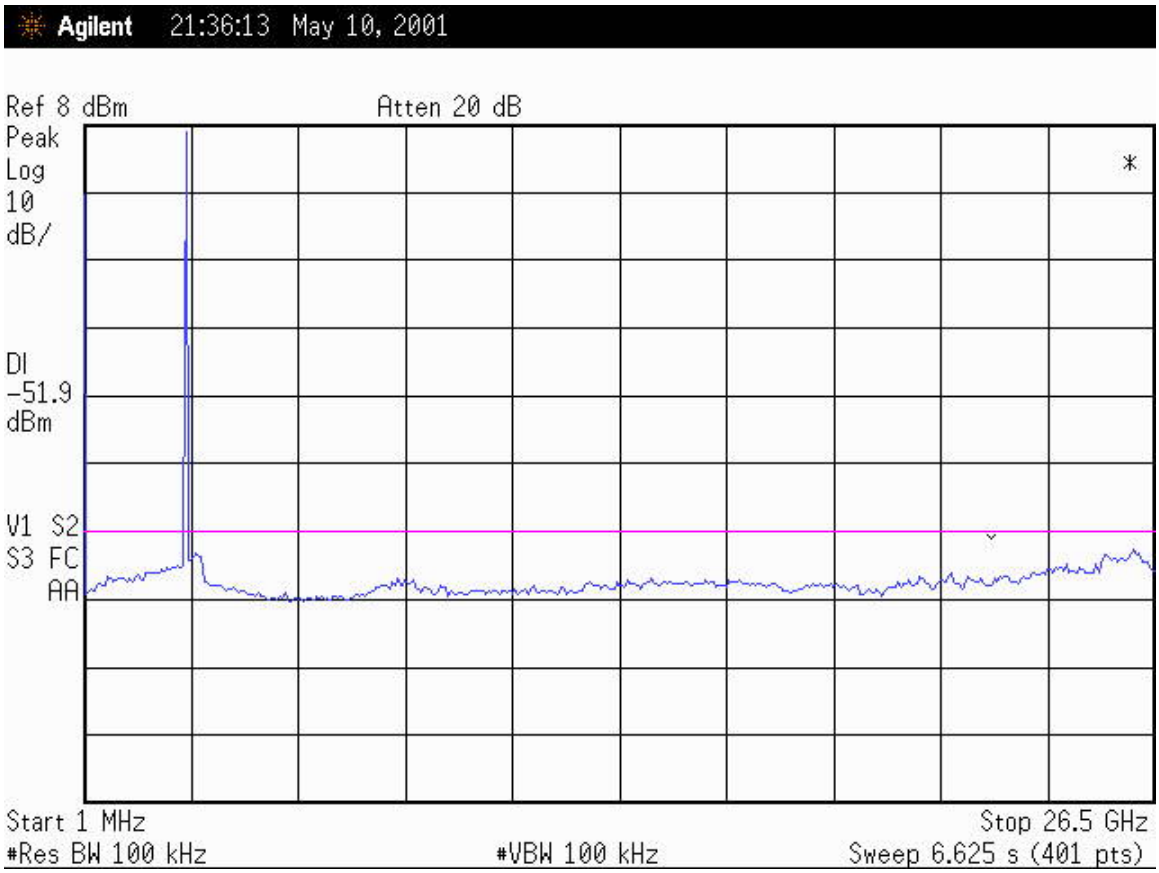
1. Set spectrum analyzer to TX output center frequency, RES BW = 100 kHz, VID BW = 100 kHz.
2. Use analyzer PEAK SEARCH to find flat top peak.
3. Set DISPLAY LINE to a level 60 dB below flat top peak
4. Record transmitter output spectrum from 1 MHz to 10^{th} harmonic of TX output frequency
5. Plot/photograph spectrum analyzer data

Test Results

Refer to attached plots.



2.6845 MHz (Ch 184): High Channel Spurious



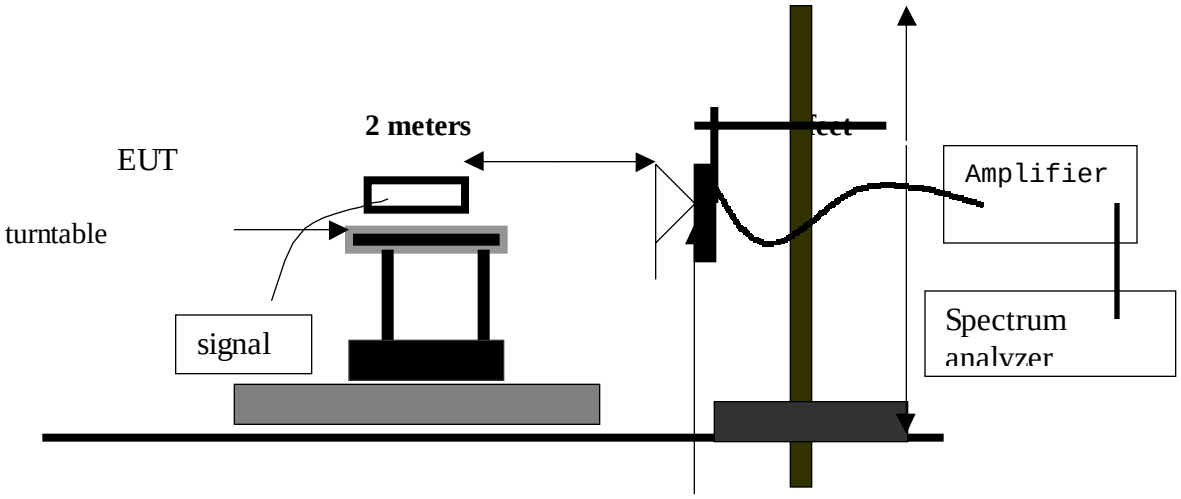
2.5015 MHz (Ch1): Low Channel Spurious

Section 2.1053 Field Strength of Spurious and Harmonic Radiation (Substitution Method)

Measurement Equipment Used:

HP 8593 EM Spectrum Analyzer 9kHz – 26.5 GHz
HP 8449 B Microwave pre-amplifier
EMCO 3115 Horn antenna, 1 - 18 GHz
QIM "The Workhorse" low loss cable, 9 ft (loss: 0.85 dB/ft@ 26 GHz
ARA Horn antenna 18-26GHz

Test setup:



Horn antenna

Radiated Emissions Configuration

Minimum Requirement:

Section 22.917(e):

The magnitude of each spurious and harmonic emissions detected as being radiated from the EUT must be at a level no greater than 60 dB below average channel power.

Limit: 28 dBm - 60dB = -32 dBm.

Test procedure:

EUT antenna output was terminated with a 50-ohm load. The EUT was placed on a outdoors-wooden table. The search antenna placed 1m from the EUT. With the transmitter operating at full power the turntable was slowly rotated to locate the direction of maximum emission.
Once maximum direction is determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

The EUT was removed from the turntable and replaced with a linearly polarized antenna (horn antenna) connected to a calibrated RF signal generator. The RF generator was set to a measured emission frequency and the search antenna was raised and lowered to produce a maximum receiver reading. The generator output was increased to match the radiated emission reading measured previously, and the result expressed in dB EIRP or ERP, correcting for substitution antenna gain at each frequency.

Test Result:
Measurements were performed at Compliance Certification Services in Morgan Hill, California. Please refer to spreadsheet below.

Compliance Certification Services
Radiated Emissions
21.908(a)

3/20/01
A-Site (1 meter)
Kerwin Corpuz

BREEZECOM
2501.5 - 2684.5 MHz MDS, S/N: 01428

frequency (MHz)	SA reading (dBuV)	SG reading (dBm)	CL (dB)	Gain (dBi)	Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)
2501.5								
5003V	47.4	-60.1	1.89	11.2	9.05	-52.94	-35	-17.94
5003H	46.8	-64.1	1.89	11.2	9.05	-56.94	-35	-21.94
7504V	53.3	-47	2.33	10.6	8.45	-40.88	-35	-5.88
7504H	50	-50.3	2.33	10.6	8.45	-44.18	-35	-9.18
10006V	43.8	-51.6	2.76	12.3	10.15	-44.21	-35	-9.21
10006H	48.6	-48.6	2.76	12.3	10.15	-41.21	-35	-6.21
12507*	34.7	-77	3.09	12.8	10.65	-69.44	-35	-34.44
15009*	38.4	-77	3.57	13.8	11.65	-68.92	-35	-33.92
2684.5								
5369V	37	-72.6	1.97	11	8.85	-65.72	-35	-30.72
5369H	40.3	-64	1.97	11	8.85	-57.12	-35	-22.12
8053*	33.9	-77	2.41	11.4	9.25	-70.16	-35	-35.16
10738*	34.2	-77	2.85	12.6	10.45	-69.4	-35	-34.4

NOTE: SA reading are average measurements
*** Measured noise floor (worse case vertical); H=horizontal and V=vertical**
SA: Spectrum Analyzer, HP 8593EM, S/N: 3710A00205
SG: Signal Generator, HP83732B, S/N: US34490599
CL: cable loss (6ft), FLEXCO
TX Antenna: EMCO 3115, S/N: 9001-3245 (dBi)
RX Antenna: EMCO 3115, S/N: 2238
Pre-Amp: HP 8449B, S/N: 3008A00369

Gain (dBd) = gain(dBi) - 2.15
ERP = SG reading - CL + Gain (dBd)
Margin = EPR - Limit

2.1055 Frequency Tolerance (Performed at Breezecom)

Temperature	Frequency [MHz]	Frequency offset [KHz]	PPM
-30°C	2500.015	15	6.0
-20°C	2500.015	15	6.0
-10°C	2500.015	15	6.0
0°C	2500.014	14	5.6
+10°C	2500.012	12	4.8
+20°C	2500.011	11	4.4
+30°C	2500.01	10	4.0
+40°C	2500.011	11	4.4
+50°C	2500.011	11	4.4
+55°C	2500.011	11	4.4
-30°C	2600.015	15	5.8
-20°C	2600.015	15	5.8
-10°C	2600.015	15	5.8
0°C	2600.014	14	5.4
+10°C	2600.012	12	4.6
+20°C	2600.011	11	4.2
+30°C	2600.01	10	3.8
+40°C	2600.011	11	4.2
+50°C	2600.011	11	4.2
+55°C	2600.011	11	4.2
-30°C	2686.015	15	5.6
-20°C	2686.015	15	5.6
-10°C	2686.015	15	5.6
0°C	2686.014	14	5.2
+10°C	2686.012	12	4.5
+20°C	2686.011	11	4.1
+30°C	2686.01	10	3.7
+40°C	2686.011	11	4.1
+50°C	2686.011	11	4.1
+55°C	2686.011	11	4.1

Test configuration

The MMDS One box high power (SU-R) tested in a temperature chamber from -30°C to+55°C for frequency stability.
The table above gives the frequency stability Vs. Temperature.
There is no change Vs. AC power input from 95VAC up to 252VAC

The unit was tested in a THERMOTRON chamber (Model S-1.2C), The frequency measurement was done using an AGILENT spectrum analyzer (model E4405B) applying the frequency count function.