

FCC PART 15 SUBPART E
EMI Measurement and TEST REPORT

For
Trango Systems, Inc.

973 University Ave.
Los Gatos, CA 95032

FCC ID: NCYM5300SFSU

2003-09-29

This Report Concerns: ☒ Original Report	Equipment Type: Wireless Internet Access Subscriber Unit
Test Engineer: Benjamin Jing / 	
Report No.: R0308011	
Test Date: 2003-08-25	
Reviewed By: Ling Zhang / 	
Prepared By: Bay Area Compliance Laboratory Corporation (BACL) 230 Commercial Street Sunnyvale, CA 94085 Tel: (408) 732-9162 Fax: (408) 732 9164	

Note: This test report is specially limited to the above client company and product model only. It may not be duplicated without prior written consent of Bay Area Compliance Laboratory Corporation. This report **must not** be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.

TABLE OF CONTENTS

1 - GENERAL INFORMATION.....	4
1.1 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	4
1.2 OBJECTIVE	4
1.3 RELATED SUBMITTAL(S)/GRANT(S).....	4
1.4 TEST METHODOLOGY	4
1.5 TEST FACILITY	4
1.6 TEST EQUIPMENT LIST	5
1.7 HOST SYSTEM CONFIGURATION LIST AND DETAILS	5
1.8 EXTERNAL I/O CABLING LIST AND DETAILS	5
2 - SYSTEM TEST CONFIGURATION.....	6
2.1 JUSTIFICATION	6
2.2 EUT EXERCISE SOFTWARE	6
2.3 SPECIAL ACCESSORIES.....	6
2.4 SCHEMATICS / BLOCK DIAGRAM	6
2.5 EQUIPMENT MODIFICATIONS	6
2.6 CONFIGURATION OF TEST SYSTEM.....	7
2.7 TEST SETUP BLOCK DIAGRAM	7
3 - SUMMARY OF TEST RESULTS.....	8
4 - PEAK OUTPUT POWER MEASUREMENT	9
4.1 STANDARD APPLICABLE	9
4.2 MEASUREMENT PROCEDURE [DA 02-2138] (BAND 5250 - 5350 MHz).....	9
4.3 EQUIPMENT LISTS	9
4.4 MEASUREMENT RESULT	9
5 – 26 DB BANDWIDTH	11
5.1 STANDARD APPLICABLE	11
5.2 MEASUREMENT PROCEDURE [DA 02-2138 EMISSION BANDWIDTH “B” MHz]	11
5.3 TEST EQUIPMENT	11
5.4 MEASUREMENT RESULT	11
6 - POWER SPECTRAL DENSITY	13
6.1 STANDARD APPLICABLE	13
6.2 MEASUREMENT PROCEDURE [DA 02-2138 PEAK POWER SPECTRAL DENSITY]	13
6.3 TEST EQUIPMENT	13
6.4 MEASUREMENT RESULTS.....	13
8 - PEAK EXCURSION TO AVERAGE RATIO	15
8.1 STANDARD APPLICABLE	15
8.2 TEST PROCEDURE [DA 02-2138 PEAK EXCURSION]	15
8.3 TEST EQUIPMENT	15
8.4 TEST RESULT FOR 15.407.....	15
9 - OUT OF BAND EMISSION	17
9.1 STANDARD APPLICABLE	17
9.2 TEST PROCEDURE	17
9.3 TEST RESULT	17
10 - SPURIOUS EMISSION AT ANTENNA TERMINAL.....	20
10.1 STANDARD APPLICABLE	20
10.2 MEASUREMENT PROCEDURE.....	20
10.3 MEASUREMENT RESULT	20
11 - ANTENNA REQUIREMENT.....	24
11.1 STANDARD APPLICABLE	24
11.2 ANTENNA CONNECTED CONSTRUCTION	24
12 - SPURIOUS RADIATED EMISSION.....	25

12.1 MEASUREMENT UNCERTAINTY	25
12.2 EUT SETUP	26
12.3 SPECTRUM ANALYZER SETUP	26
12.4 TEST PROCEDURE	27
12.5 CORRECTED AMPLITUDE & MARGIN CALCULATION	27
12.6 SUMMARY OF TEST RESULTS	27
13 - CONDUCTED EMISSIONS	30
13.1 MEASUREMENT UNCERTAINTY	30
13.2 EUT SETUP	30
13.3 SPECTRUM ANALYZER SETUP	30
13.4 TEST PROCEDURE	30
13.5 SUMMARY OF TEST RESULTS	31
13.6 CONDUCTED EMISSIONS TEST DATA	31
13.7 PLOT OF CONDUCTED EMISSIONS TEST DATA	31
14 - DISCONTINUE TRANSMITTING WITH ABSENCE OF DATA OR OPERATIONAL FAILURE	34
15 - FREQUENCY STABILITY	35
15.1 STANDARD APPLICABLE	35
15.2 MEASUREMENT RESULT	35

1 - GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

The *Trango Systems, Inc.* 's, model: *M5300S-FSU*, or the "EUT" as referred to in this report is a wireless internet access subscriber unit which measures approximately 6.0"L x 3.0"W x 1.5"H. The EUT will operate at the frequency range of 5260 – 5340 MHz, with the maximum conducted output power of 15.32dBm (34.04mW)

** The test data gathered are from typical production samples provided by the manufacturer.*

1.2 Objective

This type approval report is prepared on behalf of *Trango Systems, Inc.* in accordance with Part 2, Subpart J, Part 15, Subparts A , B, C, and E of the Federal Communication Commissions rules.

The objective of the manufacturer is to demonstrate the product compliance to FCC Part 15.407 when operating at 5.25-5.35GHz Band for Output Power, Antenna Requirements, 26 dB Bandwidth, Power Spectral Density, Out of Band Emission, Spurious Emission, Conducted and Spurious Radiated Emission, Discontinue Transmitting with Absence of Data or Operational Failure, Peak Excursion to Average Ratio and Frequency Stability.

1.3 Related Submittal(s)/Grant(s)

No related submittals or grants.

1.4 Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2001, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.5 Test Facility

The Open Area Test site used by BACL to collect radiated and conducted emission measurement data is located in the back parking lot of the building at 230 Commercial Street, Sunnyvale, California, USA.

Test site at BACL has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2001.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1300F2 and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The scope of the accreditation covers the FCC Method – 47 CFR Part – Digital Devices, CISPER 22: 1997: Electromagnetic Interference – Limits and Methods of Measurement of Information Technology Equipment test methods.

1.6 Test Equipment List

Item #	Manufacturer	Description	Model	Serial Number	Cal. Due Date
1	HP	Spectrum Analyzer	8568B	2517A01610	2003-10-30
2	HP	Amplifier	8447E	2944A07030	2004-06-28
3	HP	Quasi-Peak Adapter	85650A	2521A00718	2004-03-08
4	Com-Power	Biconical Antenna	AB-100	14012	2004-09-05
5	Com-Power	Log Periodic Antenna	AL-100	16005	2004-08-23
6	Com-Power	Log Periodic Antenna	AB-900	15049	2004-05-01
7	Agilent	Spectrum Analyzer (9KHz – 40GHz)	8564E	3943A01781	2004-08-01
8	Agilent	Spectrum Analyzer (9KHz – 50GHz)	8565EC	3946A00131	2004-05-03
9	HP	Amplifier (1-26.5GHz)	8449B	3147A00400	2004-03-14
10	A.H.System	Horn Antenna (700MHz-18GHz)	SAS-200/571	261	2004-05-31
11	HP	Peak Power Meter	432A	1507A	2004-09-16

* **Statement of Traceability:** Bay Area Compliance Laboratory Corp. certifies that all calibration has been performed using suitable standards traceable to the NIST.

1.7 Host System Configuration List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
ACER	Notebook	Travelmate650	N/A	DOC
HP	Printer	2225C	N/A	DOC

1.8 External I/O Cabling List and Details

Cable Description	Length (M)	Port/From	To
Ethernet Cable	1.0	RJ45Port/Notebook	RJ45Port/J Box
Ethernet Cable	1.0	RJ45Port/Notebook	ODU Port / J Box
Shielded Printer Cable	2.0	Parallel Port / Notebook PC	Printer

2 - SYSTEM TEST CONFIGURATION

2.1 Justification

The host system was configured for testing in a typical fashion (as normally used by a typical user).

The EUT was tested in the normal (native) operating mode to represent *worst-case* results during the final qualification test.

2.2 EUT Exercise Software

The EUT exercise program used during radiated and conducted testing was designed to exercise the system components in a manner similar to a typical use. The test software, provided by the customer, is started the Windows terminal program under the Windows 98/2000/ME/XP operating system.

Once loaded, set the Tx channel to low, mid and high for testing.

2.3 Special Accessories

As shown in section 2.7, all interface cables used for compliance testing are shielded. The host PC and the peripherals featured shielded metal connectors.

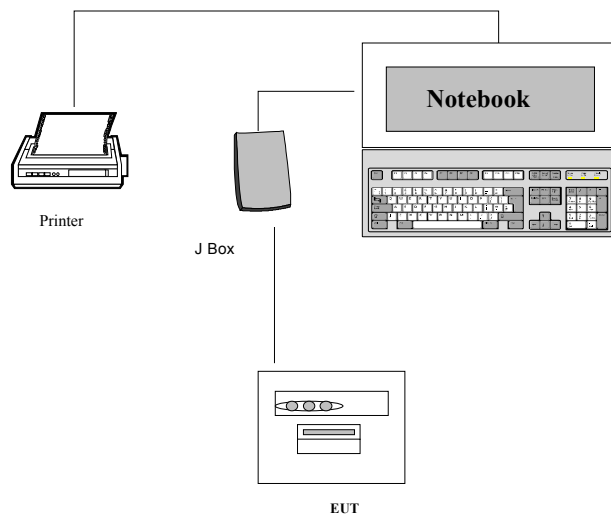
2.4 Schematics / Block Diagram

Please refer to Appendix A.

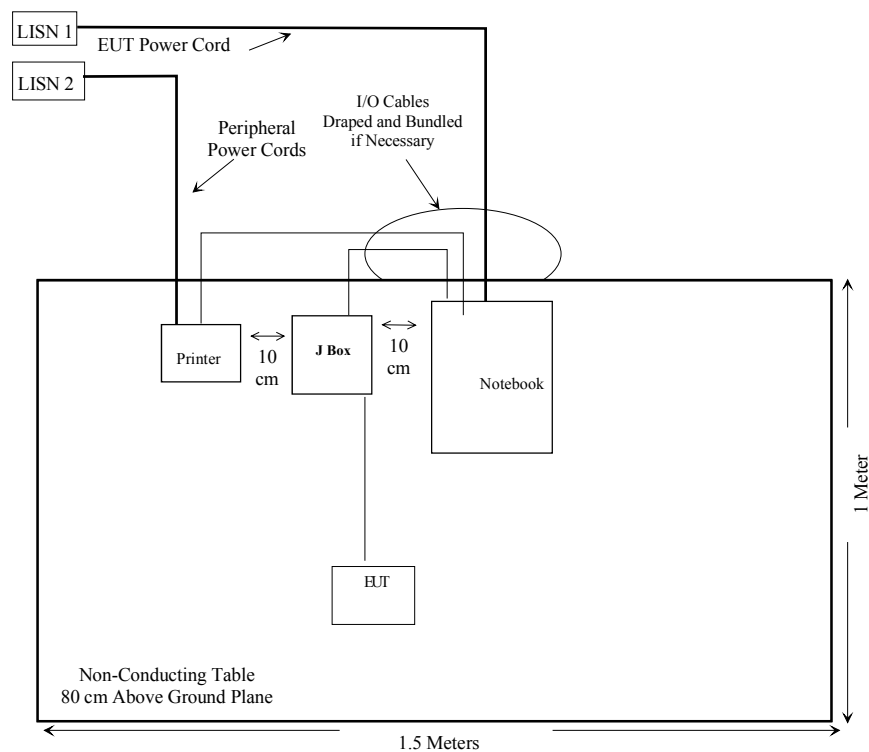
2.5 Equipment Modifications

No modifications were made by BACL to ensure the EUT to comply with the applicable limits and requirements.

2.6 Configuration of Test System



2.7 Test Setup Block Diagram



3 - SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT	REFERENCE
§15.203	Antenna Requirement	Compliant	Section 11
§ 15.205, §15.407 (b)(6)	Restricted Bands	Compliant	Section 12
§15.209 (a), §15.407 (b)(5)	Radiated Emission	Compliant	Section 12
§15.209 (f)	Spurious Emission	Compliant	Section 10
§15.407	26 dB Bandwidth	Compliant	Section 5
§15.407(a)(2)	Maximum Peak Output Power	Compliant	Section 4
§15.407 (f)	RF Exposure Requirement	Compliant	Section 16
§ 15.247 (c)	100 kHz Bandwidth of Frequency Band Edge	Compliant	Section 7
§15.407(a) (2)	Peak Power Spectral Density	Compliant	Section 6
§ 15.207 (a)	Conducted Emission	Compliant	Section 13
§ 15.407 (a)(2)	Power Spectral Density	Compliant	Section 6
§ 15.407 (a)(6)	Peak Excursion to Average Ratio	Compliant	Section 8
§ 15.407 (c)	Discontinue Transmission with Absence of Data of Failure of Operation	Compliant	See Provided Technical Manual
§ 15.407 (g)	Frequency Stability	Compliant	Section 15

4 - PEAK OUTPUT POWER MEASUREMENT

4.1 Standard Applicable

According to §15.407(a) (2), for the band 5.25~5.35 GHz, the peak power over the frequency band of operation shall not exceed the lesser of 250mW or 11dBm+10log B where B is the 26 dB emission bandwidth in MHz.

4.2 Measurement Procedure [DA 02-2138] (Band 5250 - 5350 MHz)

(DA 02-2138 Method 3 : Sweep Time > T , EBW > Largest RBW)

Connect a low loss RF cable from the EUT's antenna terminal to the spectrum analyzer , and set the analyzer as the following :

- 1) Set span to encompass the EBW of the signal.
- 2) Set sweep to free run
- 3) Set RBW = 1MHz, VBW > 1/ T
- 4) Set linear mode.
- 5) Set max hold , and then run for 60 s.
- 6) Compute power by apply correction factor : $10 \text{ Log (EBW / 1 MHz)}$.

4.3 Equipment Lists

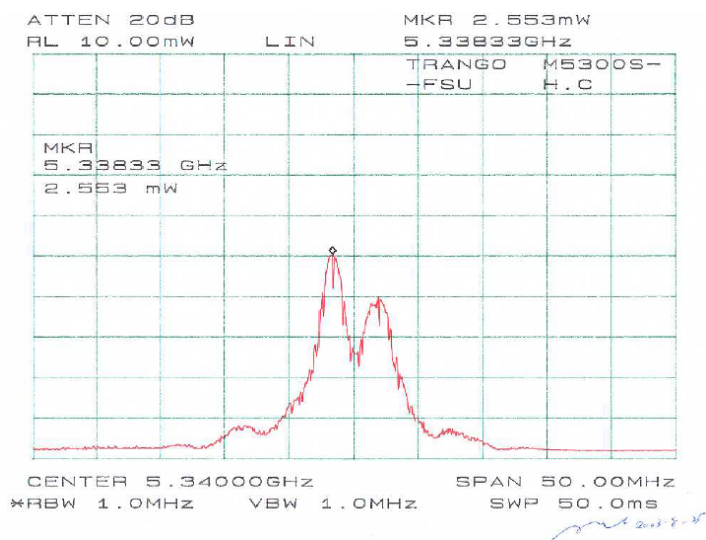
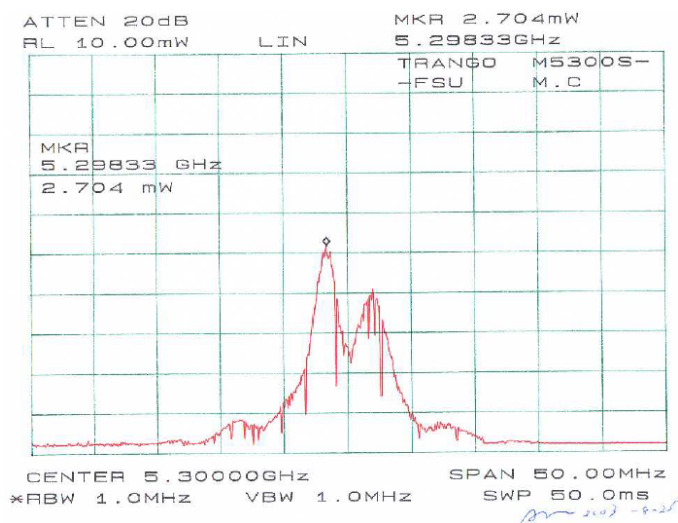
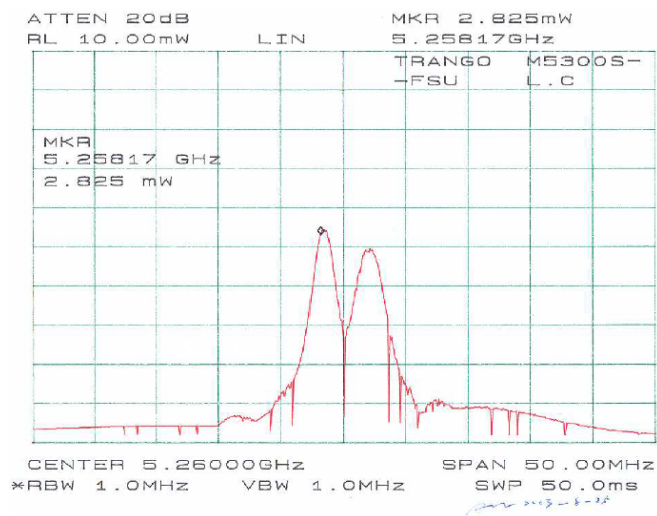
Please refer to section 1.6 of this report. Test equipments used are: 7, 8, 11.

4.4 Measurement Result

Channel	Frequency MHz	RF Power dBm	Correction Factor dB	Corrected RF Power dBm	Corrected RF Power mW	Limit (250mW or 11dBm + 10LgB)
Low	5260	4.4	12.5	16.9	48.98	223.8mW (23.5dBm)
Mid	5300	4.3	12.5	16.8	47.86	223.8mW (23.5dBm)
High	5340	4.1	12.5	16.6	45.71	223.8mW (23.5dBm)

Note 1 : Correction Factor = $10 \text{ Log (EBW / 1 MHz)} = 10 \text{ Log (17.8 / 1)} = 12.5$

Note 2 : B is the 26dB bandwidth in MHz



5 – 26 DB BANDWIDTH

5.1 Standard Applicable

According to §15.407, 26dB Bandwidth should be shown.

5.2 Measurement Procedure [DA 02-2138 Emission bandwidth “B” MHz]

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. The analyzer's RBW is set to approximately 1% of the emissions bandwidth [Due to the HP8564E analyzer's RBW step, here set RBW = 100 kHz, VBW = 1MHz]
4. Measure the frequency difference of two frequencies that were attenuated 26 dB from the reference level. Record the frequency difference as the emission bandwidth. (26 dB bandwidth for UNII)
5. Repeat above procedures until all frequencies measured were complete.

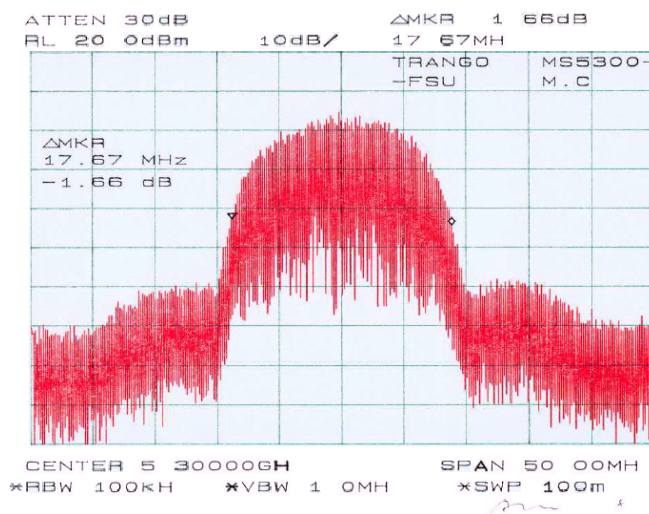
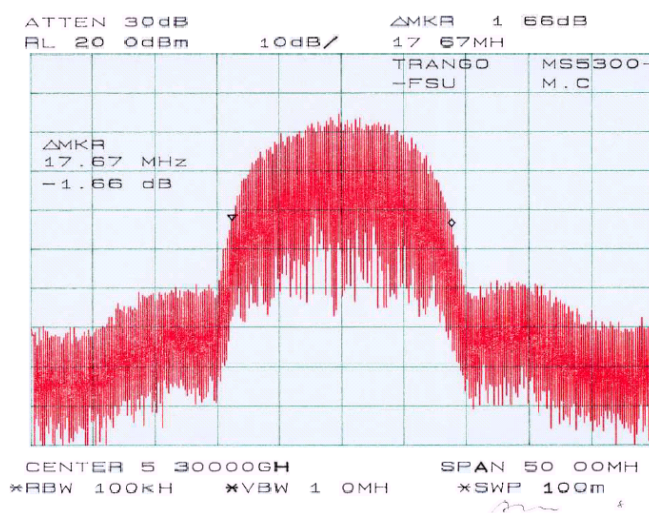
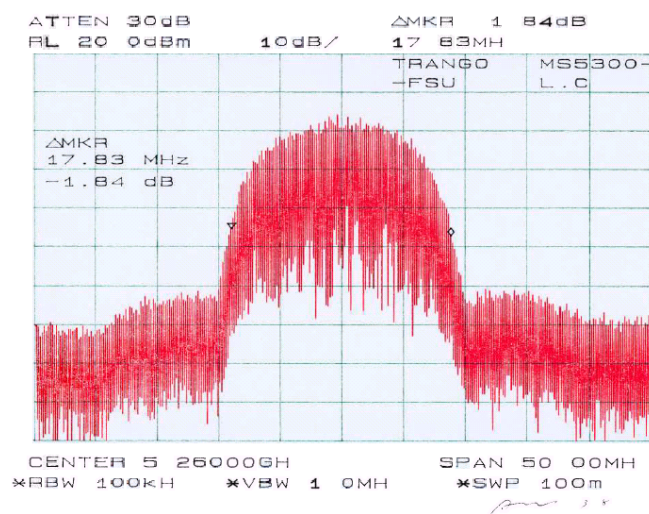
5.3 Test Equipment

Please refer to section 1.6 of this report. Test equipments used was 8.

5.4 Measurement Result

L: 17.83 MHz
M: 17.67 MHz
H: 17.83 MHz

Please refer to the plots in the following page(s).



6 - POWER SPECTRAL DENSITY

6.1 Standard Applicable

According to §15.407(a) (2), the peak power spectral density shall not exceed 11 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceed 6 dBi.

6.2 Measurement Procedure [DA 02-2138 Peak Power Spectral Density]

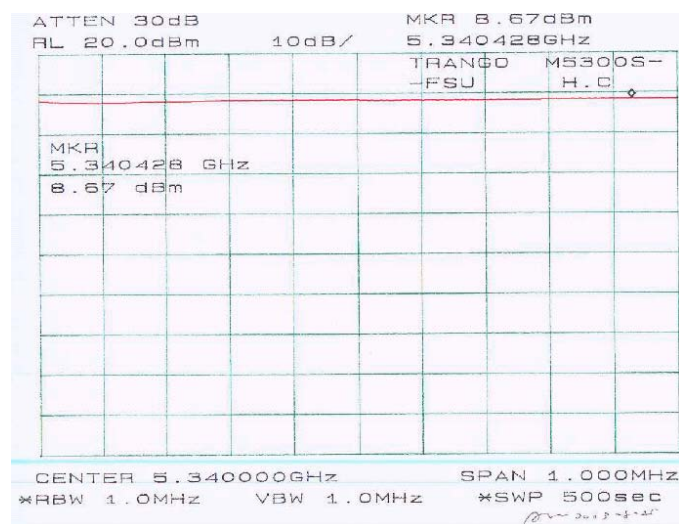
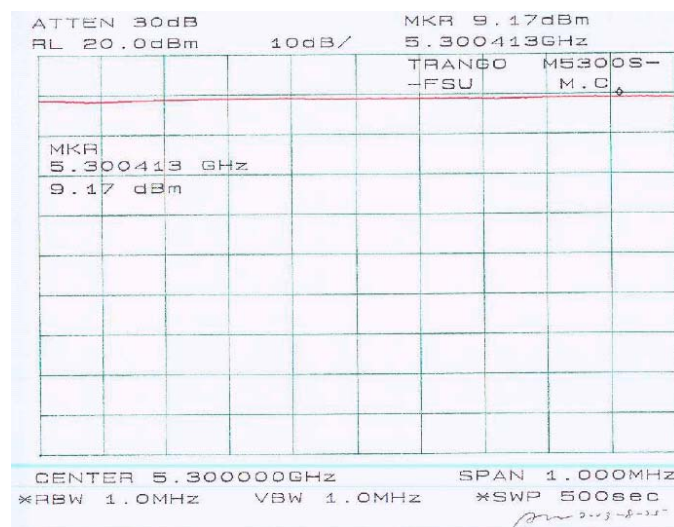
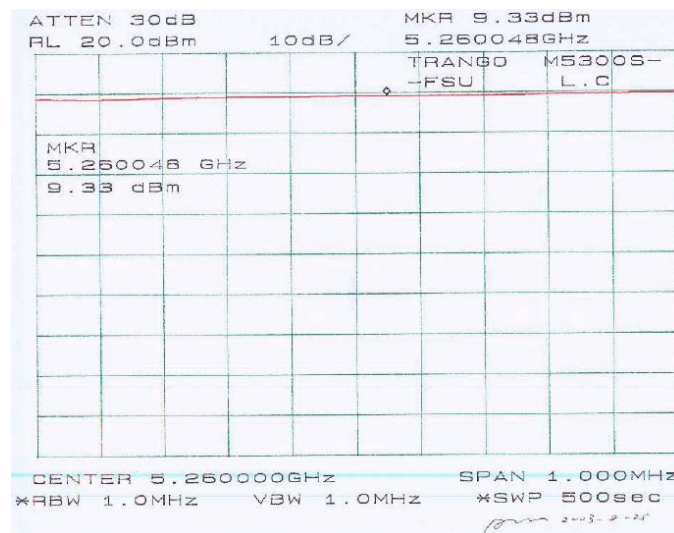
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Adjust the center frequency of SA on any frequency be measured and set SA to 1MHz span mode. And then, set RBW = 1MHz, and VBW is equal to or larger than RBW.
4. Repeat above procedures until all frequencies measured were complete.

6.3 Test Equipment

Manufacturer	Model No.	Serial No.	Calibration Due Date
HP	8564E	Spectrum Analyzer	2003-12-06

6.4 Measurement Results

Frequency (MHz)	Peak Power Spectral Density (dBm)	Standard (dBm)	Result
5260	-10.33	≤ 11	Compliant
5300	-10.00	≤ 11	Compliant
5340	-11.17	≤ 11	Compliant



8 - Peak Excursion To Average Ratio

8.1 Standard Applicable

According to §15.407(a)(6), the ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13dB across any 1MHz bandwidth or the emission bandwidth whichever is less.

8.2 Test Procedure [DA 02-2138 Peak Excursion]

For this test, the EUT's antenna was removed and replaced with a SMA jack to UMP2.0 plug test cable, so output power levels were calculated from conducted emission levels.

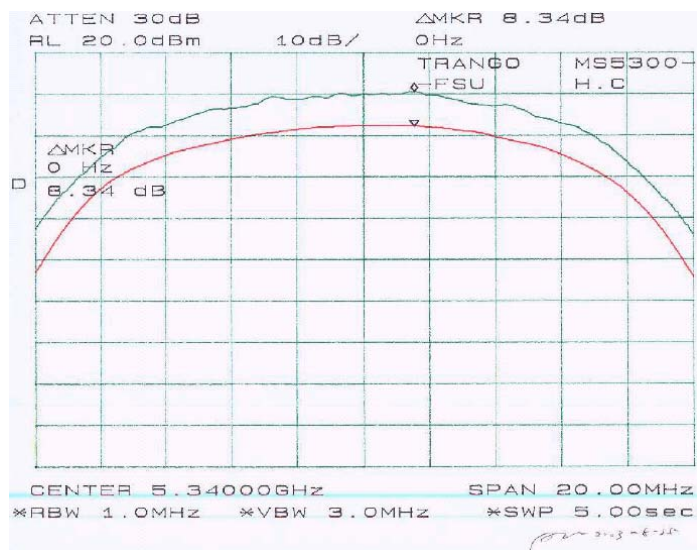
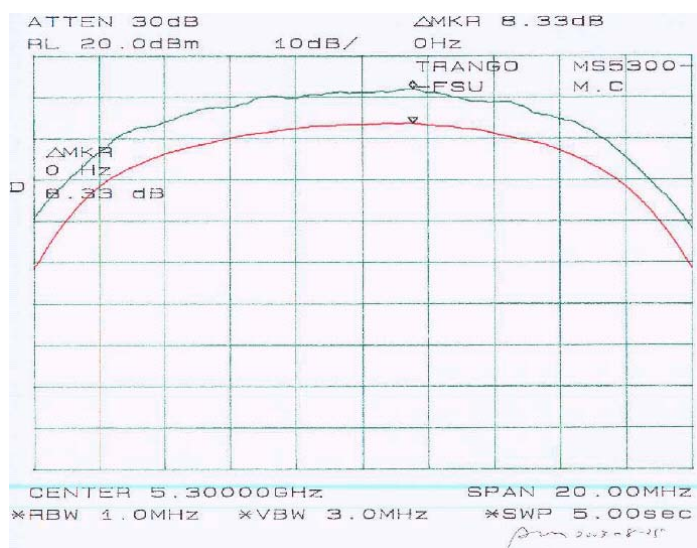
For trace A, set RBW = 1MHz, VBW $\geq$ 3MHz with peak detector and max-hold. For trace B, set average mode.

8.3 Test Equipment

Please refer to section 1.6 of this report. Test equipments used was 8.

8.4 Test Result for 15.407

Please refer to the following plots.



9 - Out Of Band Emission

9.1 Standard Applicable

§15.407 (b), undesirable emission limits: except as shown in paragraph (b)(6) of this section, the peak emission outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

§15.407 (b)(2), for transmitters operating in the 5.25 – 5.35 GHz band: all emissions outside of the 5.15 – 5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz. Devices operating in the 5.25 – 5.35 GHz band that generate emissions in the 5.15 – 5.25 GHz band must meet all applicable technical requirements for operation in the 5.15 – 5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of –27 dBm/MHz in the 5.15 – 5.25 GHz band.

9.2 Test Procedure

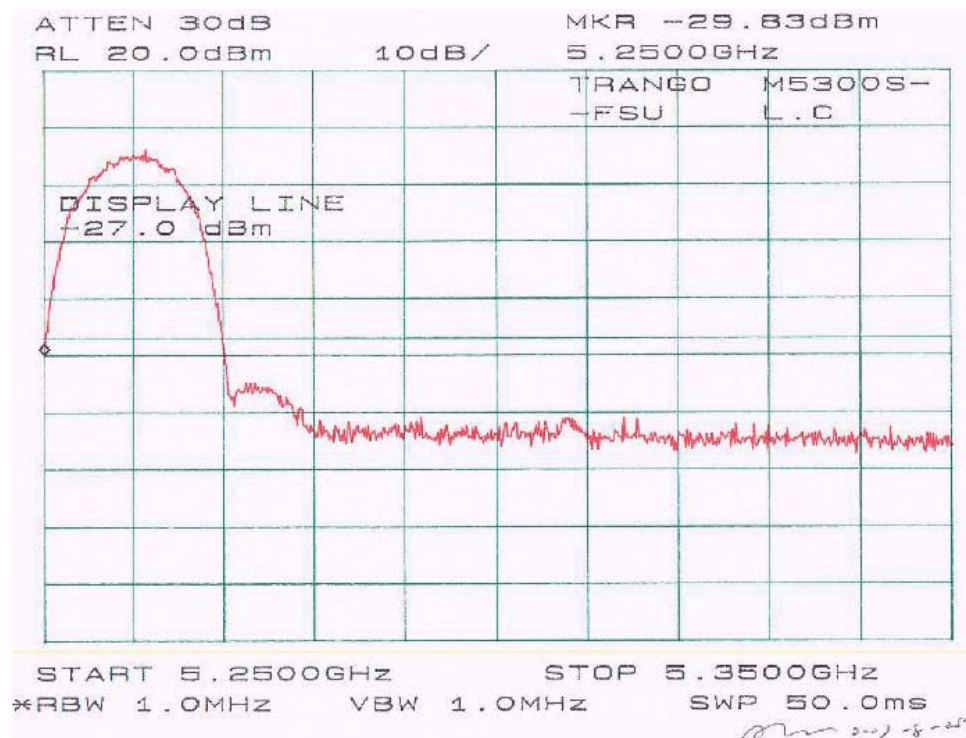
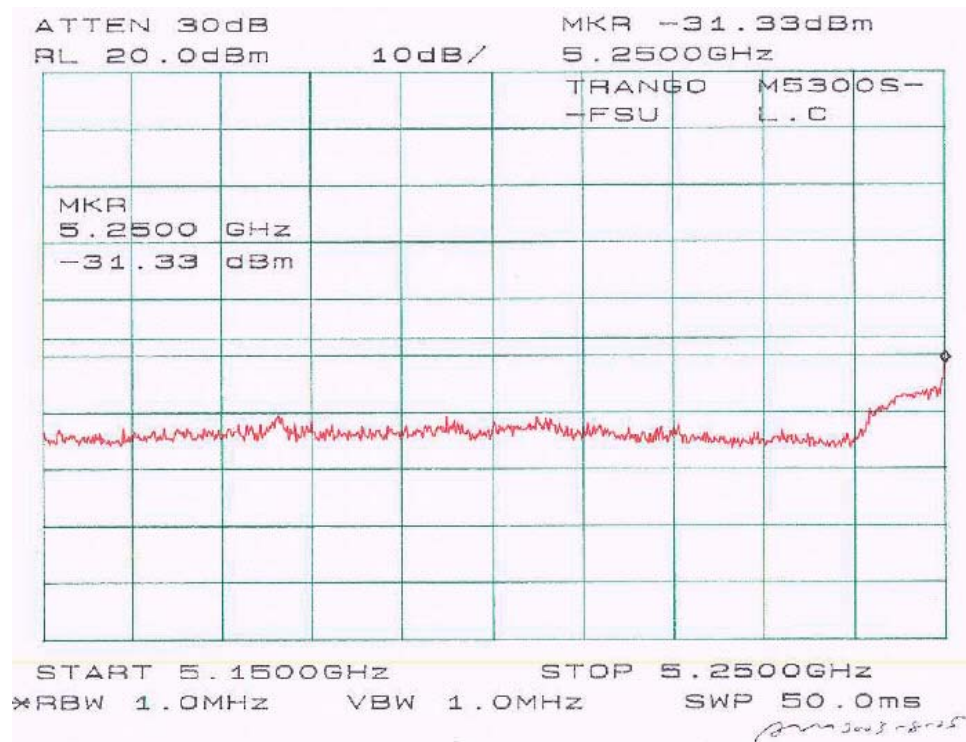
For this test, the EUT's antenna was removed and replaced with a low loss cable, so output power levels were calculated from conducted emission levels.

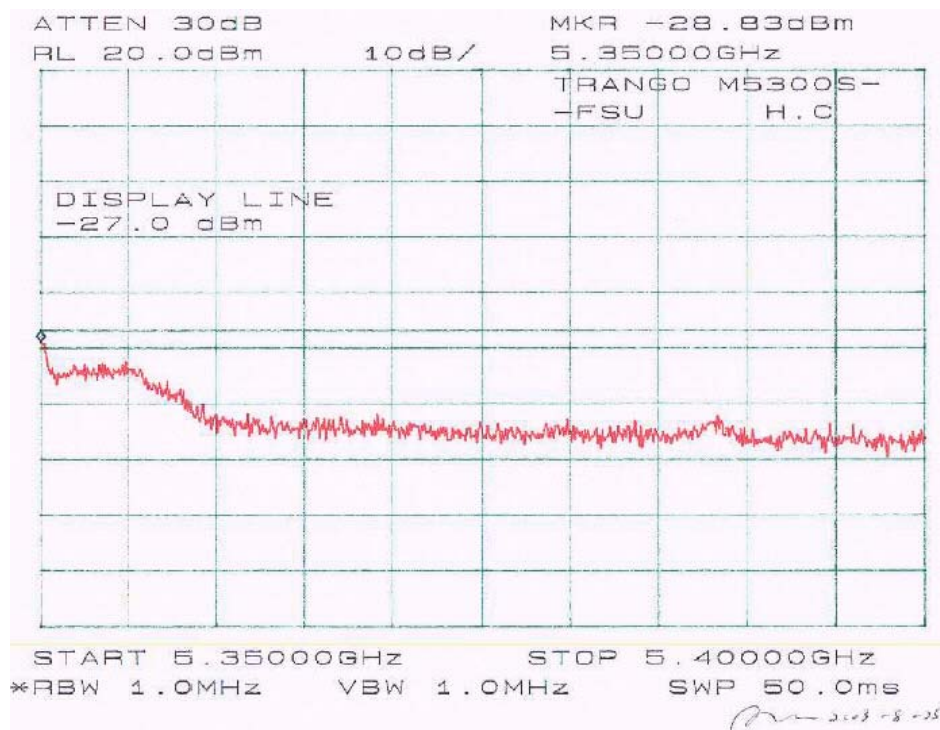
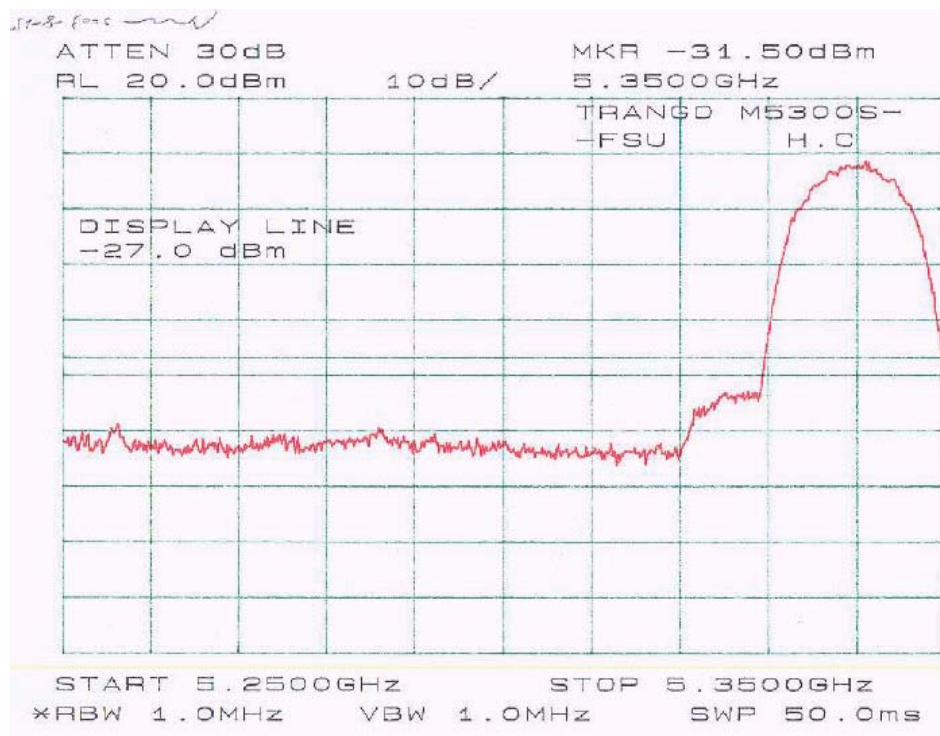
The analyzer center frequency was set to the EUT carrier frequency. The analyzer resolution and video bandwidth were set to 1MHz. The entire band from 30kHz to 40GHz was investigated.

Every suspected signal was also investigated through radiated emission. Refer to section 15.205 restricted bands of operation.

9.3 Test Result

Please refer to the following plots.





10 - SPURIOUS EMISSION AT ANTENNA TERMINAL

10.1 Standard Applicable

Requirements: CFR 47, §2.1051.

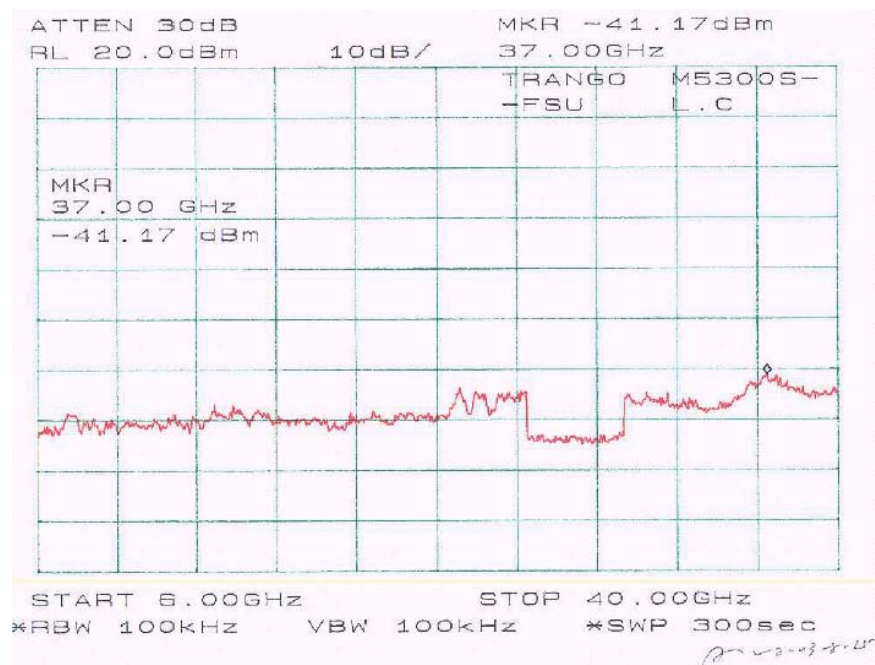
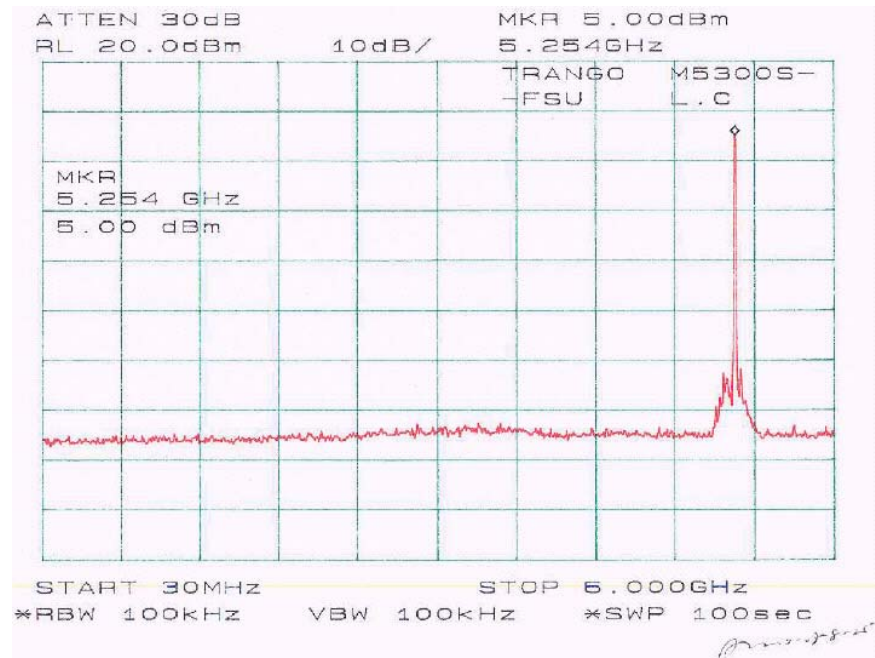
The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in §2.1057.

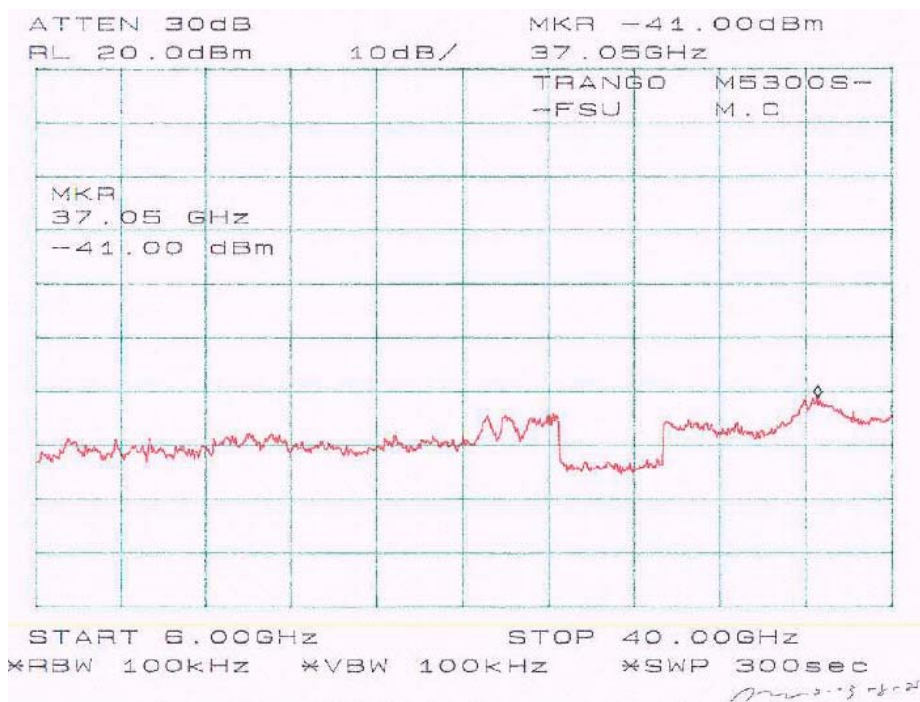
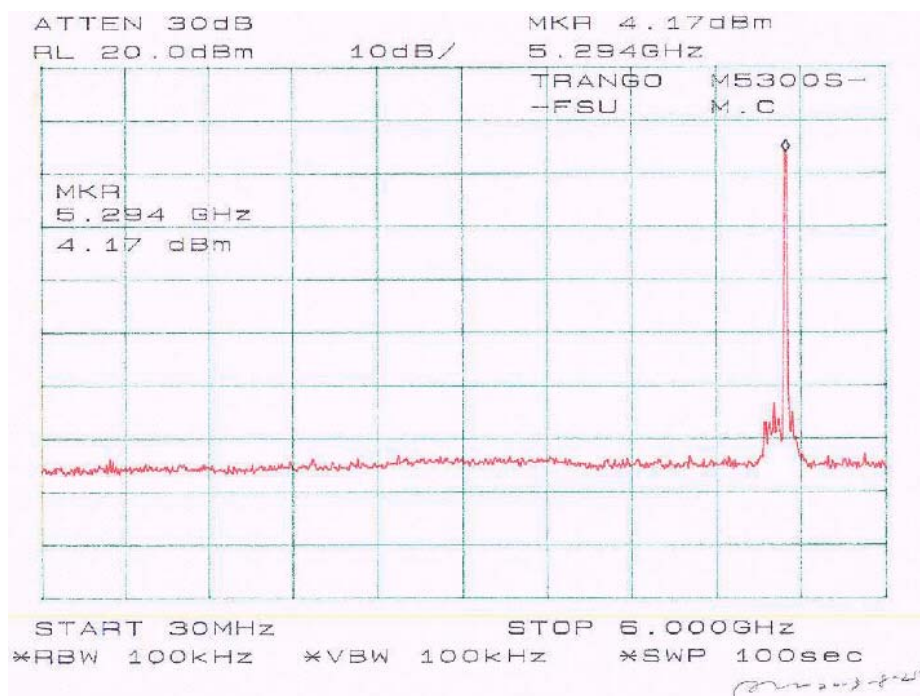
10.2 Measurement Procedure

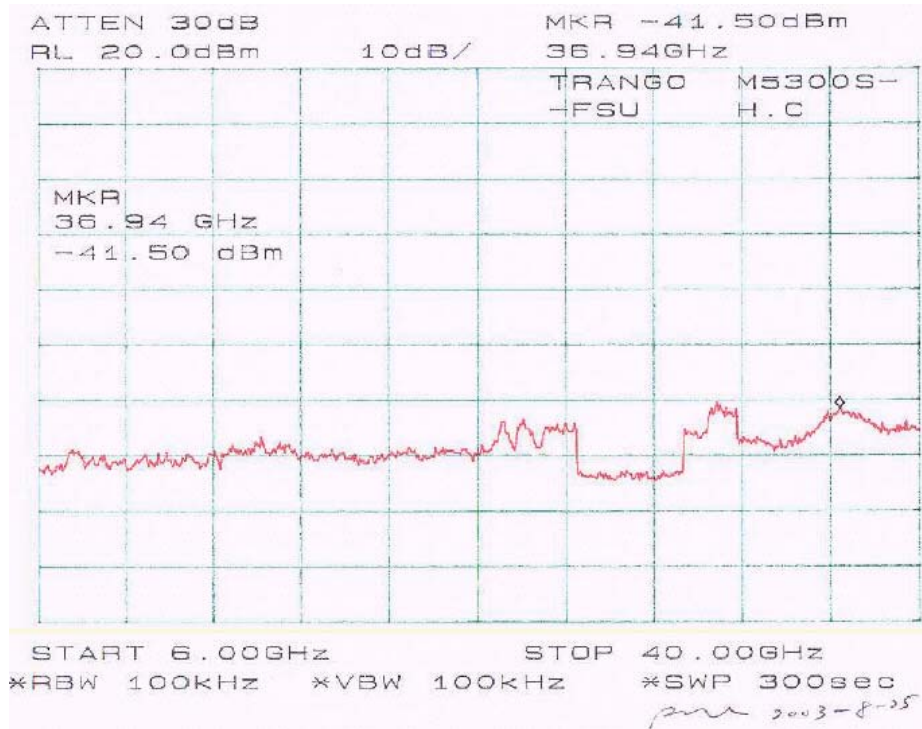
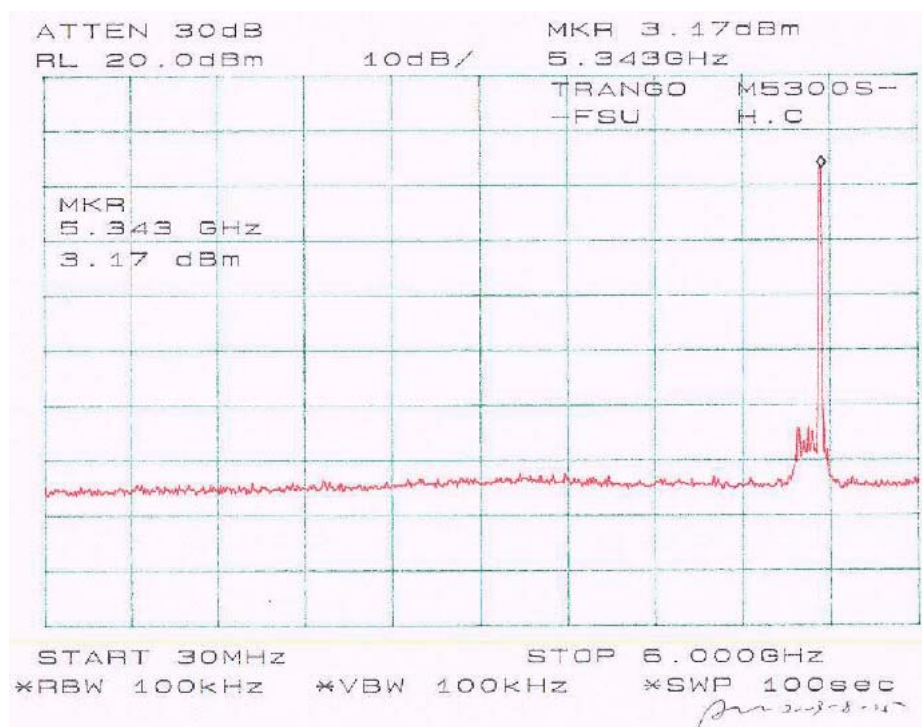
1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 4 without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set the SA on Max-Hold Mode, and then keep the EUT in transmitting mode. Record all the signals from each channel until each one has been recorded.
4. Set the SA on View mode and then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

10.3 Measurement Result

Please refer to following pages for plots of spurious emission.







11 - ANTENNA REQUIREMENT

11.1 Standard Applicable

For intentional device, according to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

11.2 Antenna Connected Construction

The directional gain of antenna used for transmitting is 15 dBi. The antenna is integrated with the circuit board. There is no consideration of replacement.

12 - SPURIOUS RADIATED EMISSION

12.1 Measurement Uncertainty

All measurements involve certain levels of uncertainties. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at BACL is ± 4.0 dB.

According to §15.205, except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	399.9 – 410	4.5 – 5.15
¹ 0.495 – 0.505	16.69475 – 16.69525	608 – 614	5.35 – 5.46
2.1735 – 2.1905	16.80425 – 16.80475	960 – 1240	7.25 – 7.75
4.125 – 4.128	25.5 – 25.67	1300 – 1427	8.025 – 8.5
4.17725 – 4.17775	37.5 – 38.25	1435 – 1626.5	9.0 – 9.2
4.20725 – 4.20775	73 – 74.6	1645.5 – 1646.5	9.3 – 9.5
6.215 – 6.218	74.8 – 75.2	1660 – 1710	10.6 – 12.7
6.26775 – 6.26825	108 – 121.94	1718.8 – 1722.2	13.25 – 13.4
6.31175 – 6.31225	123 – 138	2200 – 2300	14.47 – 14.5
8.291 – 8.294	149.9 – 150.05	2310 – 2390	15.35 – 16.2
8.362 – 8.366	156.52475 – 156.52525	2483.5 – 2500	17.7 – 21.4
8.37625 – 8.38675	156.7 – 156.9	2655 – 2900	22.01 – 23.12
8.41425 – 8.41475	162.0125 – 167.17	3260 – 3267	23.6 – 24.0
12.29 – 12.293	167.72 – 173.2	3332 – 3339	31.2 – 31.8
12.51975 – 12.57725	240 – 285	3345.8 – 3358	36.43 – 36.5
13.36 – 13.41	322 – 335.4	3600 – 4400	(²)

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510MHz

² Above 38.6

Except as provided in paragraph (d) and (e), the filed strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

According to §15.209, the device shall meet radiated emission general requirements.

Except for Class A device, the filed strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency of Emission (MHz)	Field Strength (Microvolts/meter)	dB (dBμV/meter)
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

According to §15.247(c), attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the §15.209(a) limits.

12.2 EUT Setup

The radiated emission tests were performed in the open area 3-meter test site, using the setup in accordance with the ANSI C63.4-2001. The specification used was the FCC 15 SUBPART E limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

The notebook PC was connected with 120Vac/60Hz power source.

12.3 Spectrum Analyzer Setup

According to FCC CFR 47, Section 15.31, the EUT was tested to 50GHz. During the radiated emission test, the spectrum analyzer was set with the following configurations:

Start Frequency 30 MHz
 Stop Frequency 50GHz
 Sweep Speed Auto
 IF Bandwidth 1 MHz
 Video Bandwidth 1 MHz
 Quasi-Peak Adapter Bandwidth 120 kHz
 Quasi-Peak Adapter Mode Normal
 Resolution Bandwidth 1MHz

12.4 Test Procedure

For the radiated emissions test, the Host PC system power cord was connected to the AC floor outlet since the power supply used in the EUT did not provide an accessory power outlet.

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations. All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dB μ V of specification limits), and are distinguished with a "Qp" in the data table.

12.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB μ V means the emission is 7dB μ V below the maximum limit for SUBPART E. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{SUBPART E Limit}$$

12.6 Summary of Test Results

According to the data in section 11.7, the EUT complied with the FCC Title 47, Part 15, SUBPART E, section 15.205, 15.207 and 15.407, and had the worst margin of:

-10.6 dB at 5256.00 MHz in the Vertical polarization, Low Channel

-8.7 dB at 5186.00 MHz in the Horizontal polarization, Middle Channel

-6.2 dB at 5355.00 MHz in the Horizontal polarization, High Channel

-12.9dB at 150.68 MHz in the Vertical polarization, Unwanted Emission

12.6.1 Final test data

INDICATED			TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 15 SUBPART E	
Frequency MHz	Ampl. dBμV/m	Comments	Angle Degree	Height Meter	Polar H/ V	Antenna dBμV/m	Cable DB	Amp. DB	Corr. Ampl. dBμV/m	Limit dBμV/m	Margin dB
Low Channel, 1-50GHz, Normal Mode CH. 5											
5260.00	93.2	Fund/Peak	0	1.2	v	33.9	5.2	35.2	97.1		
5260.00	97.4	Fund/Peak	0	1.5	h	33.9	5.2	35.2	101.3		
5260.00	84.5	Fund/Ave	0	1.2	v	33.9	5.2	35.2	88.4		
5260.00	89.9	Fund/Ave	0	1.5	h	33.9	5.2	35.2	93.8		
5256.00	37.8	Ave	270	1.5	v	33.9	5.2	33.5	43.4	54	-10.6
5256.00	37.5	Ave	210	1.2	h	33.9	5.2	33.5	43.1	54	-10.9
10520.00	32.5	Ave	90	1.3	h	35.1	5.6	33.0	40.2	54	-13.8
10520.00	32.1	Ave	90	1.5	v	35.1	5.6	33.0	39.8	54	-14.2
10520.00	44.3	Peak	60	1.3	h	35.1	5.6	33.0	52.0	74	-22.0
10520.00	43.9	Peak	90	1.5	v	35.1	5.6	33.0	51.6	74	-22.4
5256.00	45.5	Peak	270	1.5	v	33.9	5.2	33.5	51.1	74	-22.9
5256.00	45.1	Peak	210	1.2	h	33.9	5.2	33.5	50.7	74	-23.3
Middle Channel, 1-50GHz, Normal Mode CH. 9											
5300.00	92.9	Fund/Peak	0	1.2	v	33.9	5.2	35.2	96.8		
5300.00	94.6	Fund/Peak	0	1.2	h	33.9	5.2	35.2	98.5		
5300.00	86.3	Fund/Ave	0	1.2	v	33.9	5.2	35.2	90.2		
5300.00	87.5	Fund/Ave	0	1.2	h	33.9	5.2	35.2	91.4		
5186.00	39.7	Ave	270	1.5	h	33.9	5.2	33.5	45.3	54	-8.7
5186.00	38.8	Ave	230	1.2	v	33.9	5.2	33.5	44.4	54	-9.6
10600.00	32.5	Ave	150	1.3	h	35.1	5.6	33.0	40.2	54	-13.8
10600.00	31.7	Ave	120	1.5	v	35.1	5.6	33.0	39.4	54	-14.6
5186.00	47.3	Peak	270	1.5	h	33.9	5.2	33.5	52.9	74	-21.1
5186.00	46.5	Peak	230	1.2	v	33.9	5.2	33.5	52.1	74	-21.9
10600.00	44.2	Peak	150	1.3	h	35.1	5.6	33.0	51.9	74	-22.1
10600.00	43.3	Peak	120	1.5	v	35.1	5.6	33.0	51.0	74	-23.0
High Channel, 1-50GHz, Normal Mode CH. 11											
5340.00	94.2	Fund/Peak	0	1.5	v	33.9	5.2	35.2	98.1		
5340.00	94.7	Fund/Peak	0	1.5	h	33.9	5.2	35.2	98.6		
5340.00	85.5	Fund/Ave	0	1.5	v	33.9	5.2	35.2	89.4		
5340.00	85.9	Fund/Ave	0	1.5	h	33.9	5.2	35.2	89.8		
5355.00	42.2	Ave	180	1.5	h	33.9	5.2	33.5	47.8	54	-6.2
5355.00	41.7	Ave	90	1.2	v	33.9	5.2	33.5	47.3	54	-6.7
10680.00	32.2	Ave	180	1.5	h	35.1	5.6	33.0	39.9	54	-14.1
10680.00	31.9	Ave	110	1.2	v	35.1	5.6	33.0	39.6	54	-14.4
5355.00	49.1	Peak	180	1.5	h	33.9	5.2	33.5	54.7	74	-19.3
5355.00	48.8	Peak	90	1.2	v	33.9	5.2	33.5	54.4	74	-19.6
10680.00	44.1	Peak	180	1.5	h	35.1	5.6	33.0	51.8	74	-22.2
10680.00	43.5	Peak	110	1.2	v	35.1	5.6	33.0	51.2	74	-22.8

Unintentional Emission

Frequency MHz	Indicated		Table Height Meter	Antenna		Correction Factor			FCC 15 Subpart B	
	Ampl. dB μ V/m	Direction Degree		Polar H/V	Antenna dB μ V/m	Cable Loss dB μ V/m	Amp. dB	Corr. Ampl. dB μ V/m	Limit dB μ V/m	Margin dB
150.68	41.2	0	1.5	v	12.7	1.7	25.0	30.6	43.5	-12.9
450.03	34.9	270	1.5	h	17.1	3.0	25.0	30.0	46	-16.0
124.77	38.5	160	1.5	v	11.7	1.6	25.0	26.8	43.5	-16.7
75.34	36.2	210	1.2	v	9.4	1.2	25.0	21.7	40	-18.3
250.08	34.6	310	1.2	h	13.3	2.2	25.0	25.1	46	-20.9

Note:

FUND = Fundamental
AVG = average

13 - CONDUCTED EMISSIONS

13.1 Measurement Uncertainty

All measurements involve certain levels of uncertainties. The factors contributing to uncertainties are spectrum analyzer, cable loss, and LISN.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at BACL is ± 2.4 dB.

13.2 EUT Setup

The measurement was performed in the shield room, using the same setup per ANSI C63.4-2001 measurement procedure. The specification used was FCC 15 Subpart B limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

The notebook PC was connected with 120Vac/60Hz power source.

13.3 Spectrum Analyzer Setup

The spectrum analyzer was set with the following configurations during the conduction test:

Start Frequency.....	150 kHz
Stop Frequency.....	30 MHz
Sweep Speed.....	Auto
IF Bandwidth.....	10 kHz
Video Bandwidth.....	10 kHz
Quasi-Peak Adapter Bandwidth.....	9 kHz
Quasi-Peak Adapter Mode.....	Normal

13.4 Test Procedure

During the conducted emission test, the power cord of the host system was connected to the auxiliary outlet of the first LISN.

Maximizing procedure was performed on the six (6) highest emissions of each modes tested to ensure EUT is compliant with all installation combination.

All data was recorded in the peak detection mode. Quasi-peak readings were only performed when an emission was found to be marginal (within -4 dB μ V of specification limits). Quasi-peak readings are distinguished with a "Qp".

13.5 Summary of Test Results

According to the data in section 13.6, the EUT complies with the FCC Conducted margin for a Class B device, with the *worst* margin reading of:

-4.6 dB μ V at 0.150 MHz in the Neutral mode

13.6 Conducted Emissions Test Data

LINE CONDUCTED EMISSIONS				FCC PART 15 CLASS B	
Frequency MHz	Amplitude dB μ V	Detector Qp/Ave/Peak	Phase Line/Neutral	Limit dB μ V	Margin dB
0.150	61.4	QP	Neutral	66	-4.6
0.150	60.8	QP	Line	66	-5.2
1.000	44.7	QP	Neutral	56	-11.3
17.400	35.5	AVG	Neutral	50	-14.5
17.400	35.2	AVG	Line	50	-14.8
1.000	29.7	AVG	Neutral	46	-16.3
1.000	38.8	QP	Line	56	-17.2
17.400	42.1	QP	Neutral	60	-17.9
17.400	37.5	QP	Line	60	-22.5
1.000	22.8	AVG	Line	46	-23.2
0.150	29.6	AVG	Neutral	56	-26.4
0.150	28.5	AVG	Line	56	-27.5

13.7 Plot of Conducted Emissions Test Data

Plot(s) of Conducted Emissions Test Data is presented hereinafter as reference.

Ray Area Compliance Laboratory Corp
CLASS B

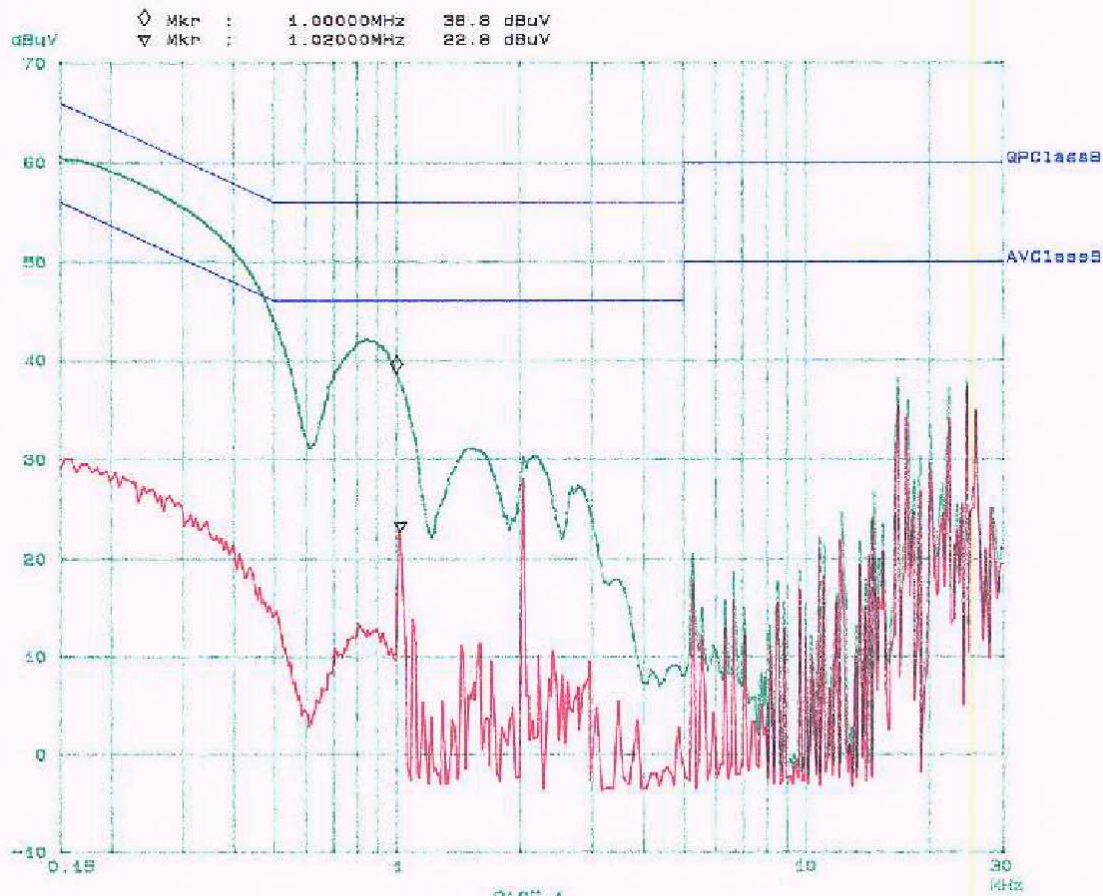
25. Aug 03 15:22

EUT: MS300S-PAD
Manuf: Trango
Sp. Cond: Normal
Operator: Ben
Comment: L

Scan Settings (3 Ranges)

Start	Stop	Step	IF BW	Detector	S-Time	Atten	Preamp
150K	1M	5K	9K	QP+AV	20ms	10dB LN	OFF
1M	3M	10K	9K	QP+AV	1ms	10dB LN	OFF
3M	30M	100K	9K	QP+AV	1ms	10dB LN	OFF

Final Measurement: x QP / + AV
Meas Time: 1 s
Subranges: 25
Acc Margin: 6dB



BACL Corp.
CLASS B

25. Aug 03 16:03

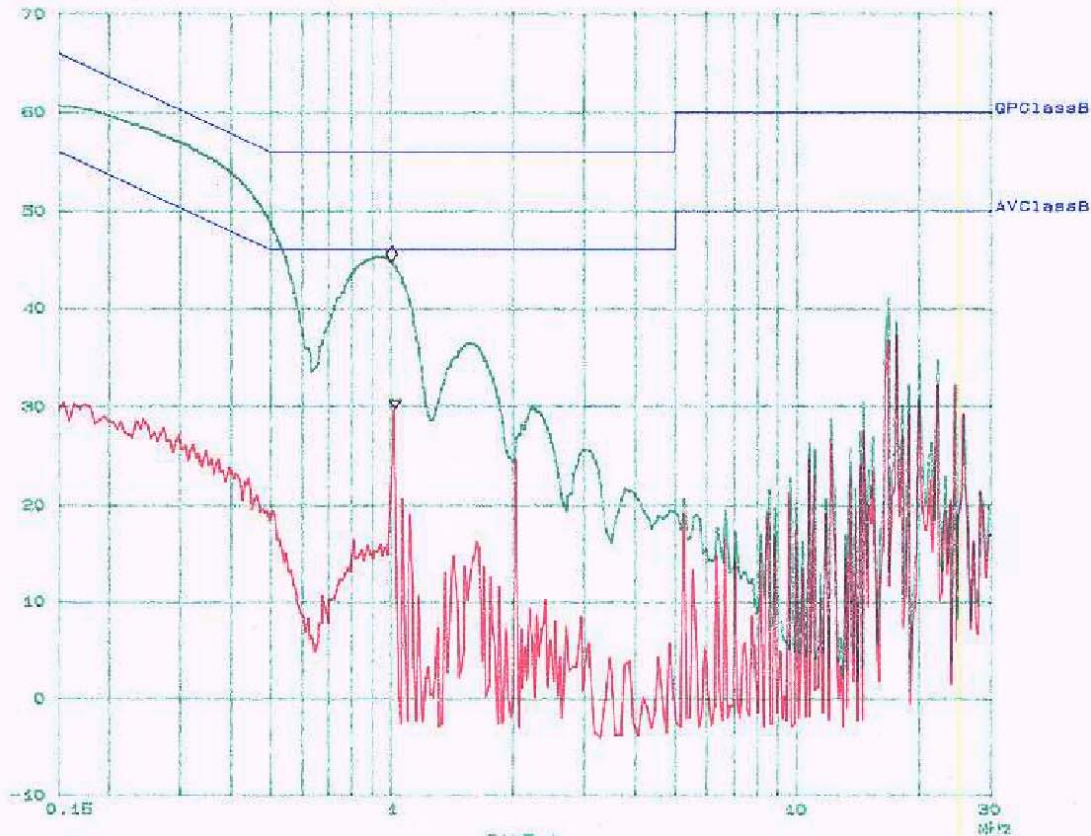
EUT: M5300S-FSU
Manuf: Trango
Op Cond: Normal
Operator: Ben
Comment: N

Scan Settings (3 Ranges)

Frequency			Receiver Settings				
Start	Stop	Step	IF BW	Detection	M-Time	Atten	Preamp
150k	1M	5k	9k	QP+AV	20ms	10dB LN	OFF
1M	3M	10k	9k	QP+AV	1ms	10dB LN	OFF
3M	50M	100k	9k	QP+AV	1ms	10dB LN	OFF

Final Measurements: X QP / + AV
Meas Time: 1 s
Subranges: 25
Acc Margin: 6dB

◇ Mkr : 1.00000MHz 44.7 dBuV
▽ Mkr : 1.02000MHz 29.7 dBuV



14 - Discontinue Transmitting With Absence Of Data Or Operational Failure

According to § 15.407 (c), the device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude the transmission of control or signaling information or the user of repetitive codes used by certain digital technologies to complete frame or burst intervals. Applicants shall include in their application a description of how this requirement is met.

Please refer to respective technical description.

15 - Frequency Stability

15.1 Standard Applicable

According to §15.407 (g), manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation .

15.2 Measurement Result

Reference Frequency: 5300 MHz, Limit: +/- 0.02%			
Environment Temperature (°C)	Power Supplied Vac	Frequency Measure with time Elapsed	
		MCF	Error
		MHz	%
50	110	5300.0093	0.0002
40	110	5300.0017	0.0001
30	110	5300.0017	0.0001
20	110	5300	0
10	110	5300	0
0	110	5300	0
-10	110	5299.9927	-0.0001
-20	110	5299.9927	-0.0001
-30	110	5299.9877	-0.0002

Reference Frequency: 5300 MHz, Limit: +/- 0.02%						
Power Supplied Vac	Frequency Measure with Time Elapsed					
	2 Minutes		5 Minutes		10 Minutes	
	Frequency	%	Frequency	%	Frequency	%
126.5	5300	0	5299.9927	-0.0001	5299.9927	-0.0001
110	5300	0	5300	0	5300	0
93.5	5300	0	5300.0017	0.0001	5300.0017	0.0001