

 ESTECH Co., Ltd. Rm 1015, World Venture Center 11, 426-5 Gasan-dong, Guncheon-gu, Seoul, 158-803, Korea	   	Electromagnetic Interference Test Report
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Test Report for FCC

FCC ID:U7X-MM3

Report Number		ESTF150909-003		
Applicant	Company name	M3 Mobile Co., Ltd.		
	Address	DongWon B/D, 725-30, Yeoksam-dong, Gangnam-gu, Seoul, 135-080, Korea		
	Telephone	82-2-574-0037		
Product	Product name	Portable Data Collection Terminal		
	Model No.	MM3	Manufacturer	M3 Mobile Co., Ltd.
	Serial No.	NONE	Country of origin	KOREA
Test date	2009-05-06 ~ 2009-09-17		Date of issue	17-Sep-09
Testing location	ESTECH. Co., Ltd. 97-1 Hoiuk-Ri Majang-Myon, Icheon-city, KyungKi-Do, Korea			
Standard	FCC PART 15 2008 , ANSI C 63.4 2003			
Measurement facility registration number		94696		
Tested by	Engineer J.H.Kim		(Signature)	
Reviewed by	Engineering Manager J.M.Yang		(Signature)	
Abbreviation	OK, Pass = Passed, Fail = Failed, N/A = not applicable			

- * Note
- This test report is not permitted to copy partly without our permission
 - This test result is dependent on only equipment to be used
 - This test result based on a single evaluation of one sample of the above mentioned

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Appendix 1. Spectral diagram

Appendix 2. Antenna Requirement

1. Laboratory Information

1.1 General

This EUT (Equipment Under Test) has been shown to be capable of compliance with the applicable technical standards and is tested in accordance with the measurement procedures as indicated in this report.

ESTECH Lab attests to accuracy of test data. All measurement reported herein were performed by ESTECH Co., Ltd.

ESTECH Lab assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

1.2 Test Lab.

Corporation Name : ESTECH Co., Ltd.

Head Office : Rm 1015, World Venture Center II, 426-5, Gasan-dong, Geumcheon-gu, Seoul, Korea
(Safety & Telecom. Test Lab)

EMC Test Lab : 97-1, Hoeok-ri, Majang-myun, Ichion-city, Kyonggi-do, South Korea

1.3 Official Qualification(s)

KCC : Granted Accreditation from Ministry of Information & Communication for EMC, Safety and Telecommunication

KOLAS : Accredited Lab By Korea Laboratory Accreditation Schema base on CENELEC requirements

FCC : Filed Laboratory at Federal Communications Commission

VCCI : Granted Accreditation from Voluntary Control Council for Interference from ITE

2. Description of EUT

2.1 Summary of Equipment Under Test

Product Name	: Portable Data Collection Terminal
Model Number	: MM3
Modulation Type	: WLAN(OFDM)
Transfer Rate	: 6~ 54Mbps
Serial Number	: NONE
Manufacturer	: M3 Mobile Co., Ltd.
Country of origin	: KOREA
Rating	: Adapter :(100~240) V a.c. (47~63) Hz , 0.7A : DC input : 5 Vd.c. , 5.0 A
Receipt Date	: 2009-04-09
X-tal list(s)	: 13 MHz, 20 MHz, 6 MHz, 14.75 MHz

2.2 General descriptions of EUT

This device fully compatible with the 802.11a standard to provide a wireless data rate of 54Mbps.
For the detailed features, please refer to the manufacturer's specifications or User's Manual.

3. Test Standards

Test Standard : FCC PART 15 (2008)

This Standard sets out the regulations under which an intentional, unintentional, or incidental radiator may be operated without an individual license. It also contains the technical specifications, administrative requirements and other conditions relating to the marketing of Part 15 devices.

Test Method : ANSI C 63.4 (2003)

This standard sets forth uniform methods of measurement of radio-frequency (RF) signals and noise emitted from both unintentional and intentional emitters of RF energy in the frequency range 9 kHz to 40 GHz. Methods for the measurement of radiated and AC power-line conducted radio noise are covered and may be applied to any such equipment unless otherwise specified by individual equipment requirements. These methods cover measurement of certain devices that deliberately radiate energy, such as intentional emitters, but does not cover licensed transmitters. This standard is not intended for certification/approval of avionic equipment or for industrial, scientific, and medical (ISM) equipment. These methods apply to the measurement of individual units or systems comprised of multiple units.

Summary of Test Results

Applied Standard : 47 CFR Part 15 Subpart E 15.407				
Standard	Test Type	Result	Remark	Limit
15.207	AC Power Conducted Emission	Pass	Meet the requirement	
15.247(c)	Electric Field Strength Spurious Emissions, 30MHz ~ 1000MHz	Pass	Meet the requirement	

Note: Except as provided in table(802.11a mode), other testing items were tested by quietek testing Lab.

4. Measurement Condition

4.1 EUT Operation(For 802.11a)

a. Channel

Ch.	Frequency	Ch.	Frequency
36	5180MHz	100	5500MHz
⋮	⋮	⋮	⋮
64	5320MHz	140	5700MHz
⋮	⋮	⋮	⋮

b. Measurement Channel : WLAN: Low(5180MHz), Middle(5220Mhz),High(5320MHz)

Measurement Channel : WLAN: Low(5500MHz), Middle(5600Mhz),High(5700MHz)

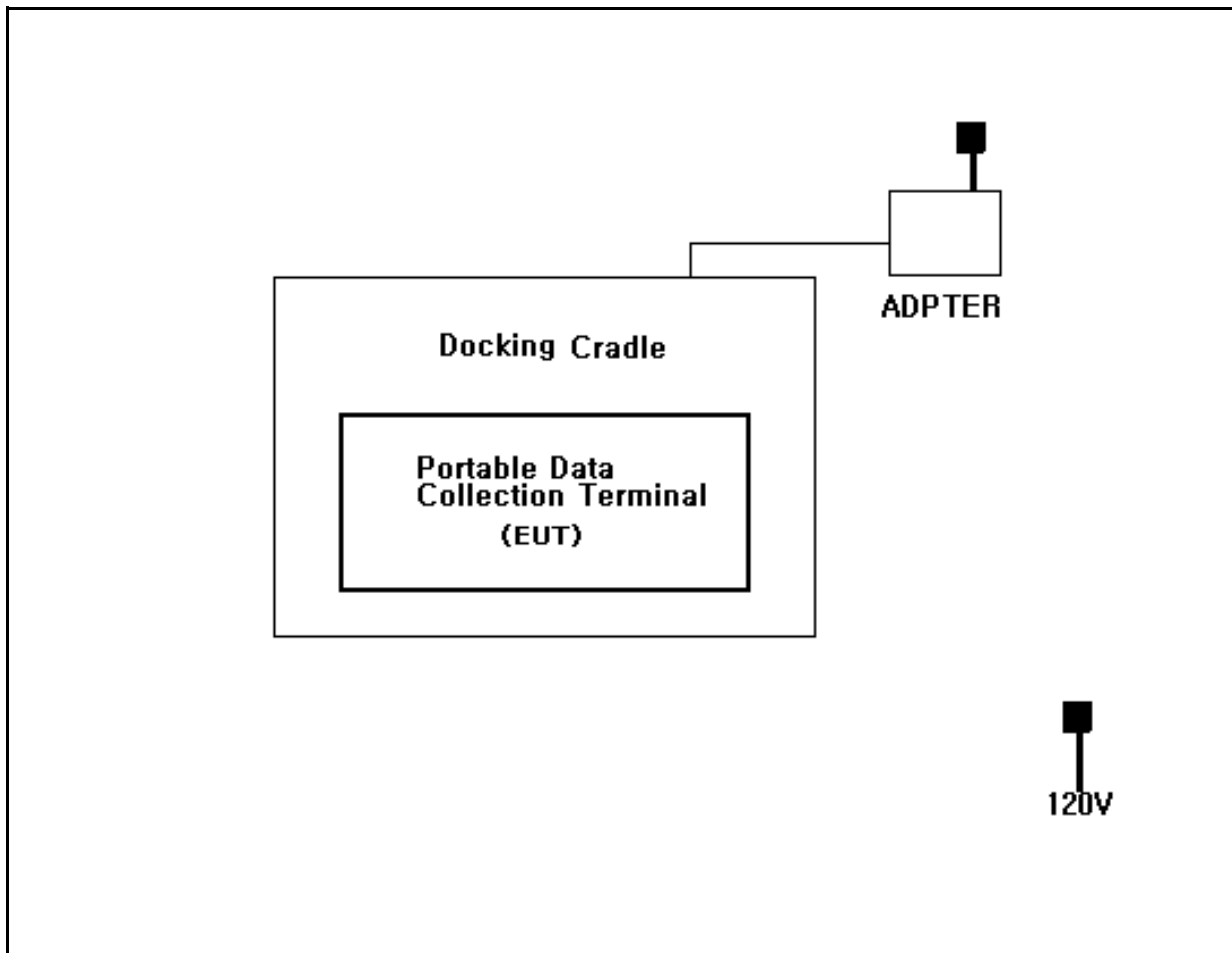
c. Test Mode : Continuous Output, OFDM

d. Test rate : the worst case of rate 802.11a(6Mbps)

4.2 EUT Operation.

- * The EUT was in the following operation mode during all testing
- * The operational conditions of the EUT was determined by the manufacturer according to the typical use of the EUT with respect to the expected highest level of emission
- * The computer system ran a test program to enable EUT under transmission/receiving condition continuously at specific channel frequency.

4.3 Configuration and Peripherals



4.4 EUT and Support equipment

Equipment Name	Model Name	S/N	Manufacturer	Remark (FCC ID)
Portable Data Collection Terminal	MM3	NONE	M3 Mobile Co., Ltd.	EUT
Docking Cradle	NONE	NONE	M3 Mobile Co., Ltd.	
ADAPTER	STD-0505P	NONE	Sunrise Electronics (Dongguan) Co.,Ltd.	

4.5 Cable Connecting

Start Equipment		End Equipment		Cable Standard		Remark
Name	I/O port	Name	I/O port	Length	Shielded	
Portable Data Collection Terminal	Docking	Docking Cradle	Docking	–	Unshielded	
Docking Cradle	POWER	Adapter	–	1.5	Unshielded	

5.0 Measurement of radiated disturbance

Above 30 MHz Electric Field strength was measured in accordance with FCC Part 15 (2008) & ANSI C 63.4 (2003). The test setup was made according to FCC Part 15 (2008) & ANSI C 63.4 (2003) on an open test site, which allows a 3m distance measurement. The EUT was placed in the center of wooden turntable. The height of this table was 0.8m. The measurement was conducted with both horizontal and vertical antenna polarization. The turntable has fully rotated. For further description of the configuration refer to the picture of the test setup.

5.1 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
TEST Receive	ESVS10	Rohde & Schwarz	838562/002	2010. 1. 29
TEST Receive	ESVSI7	Rohde & Schwarz	100185	2010. 8. 25
Spectrum Analyzer	R3273	ADVANTEST	110600592	2010. 6. 04
LogBicon Antenna	VULB 9160	Schwarzbeck	3142	2010. 5. 13
Amplifier	8447F	HP	2805A02972	2010. 6. 24
PREAMPLIFIER	8449B	HP	3008A00581	2010. 3. 06
Horn Antenna	BBHA 9120 D	Schwarzbeck	352	2010. 6.17
Turn Table	2087	EMCO	2129	–
Antenna Mast	2070-01	EMCO	9702-203	–
ANT Mast Controller	2090	EMCO	1535	–
Turn Table Controller	2090	EMCO	1535	–

5.2 Environmental Condition

Test Place : Open site(3m)
 Temperature (°C) : 24 °C
 Humidity (%) : 34 %

5.3-1 Test Data for wireless LAN

Test Date : 17-Sep-09

Measurement Distance : 3 m

Frequency (MHz)	Reading (dB μ V)	Position (V/H)	Height (m)	Correction Factor		Result Value		
				Ant Factor (dB)	Cable (dB)	Limit (dB μ V/m)	Result (dB μ V/m)	Margin (dB)
30.64	17.70	V	1.0	11.23	0.9	40.0	29.82	-10.18
66.20	16.50	V	1.0	10.48	1.3	40.0	28.23	-11.77
130.01	18.40	H	1.9	11.98	1.8	43.5	32.17	-11.33
166.14	15.20	V	1.0	12.23	2.1	43.5	29.57	-13.93
216.01	20.90	V	1.0	10.22	2.5	43.5	33.61	-9.89
233.03	21.40	V	1.0	10.81	2.6	46.0	34.84	-11.16
266.01	14.90	H	1.4	11.90	2.9	46.0	29.73	-16.27
300.04	13.10	V	1.0	12.95	3.2	46.0	29.23	-16.77
384.57	10.10	H	1.0	14.79	3.9	46.0	28.79	-17.21
466.14	11.30	H	1.0	16.71	4.6	46.0	32.58	-13.42
533.14	10.90	H	1.0	17.84	5.1	46.0	33.81	-12.19
827.10	7.10	H	1.0	22.43	7.1	46.0	36.60	-9.40
Remark	H : Horizontal, V : Vertical TEST MODE : 802.11a 5220MHz *Checked in all 3 axis and the maximum measured data were reported. *CL = Cable Loss-Amplifier Gain(In case of above1000Mhz) *CL = Cable Loss(In case of below1000Mhz) *The resolution bandwidth and v							

5.3-2 Test Data for wireless LAN

Test Date : 17-Sep-09

Measurement Distance : 3 m

Frequency (MHz)	Reading (dB μ V)	Position (V/H)	Height (m)	Correction Factor		Result Value		
				Ant Factor (dB)	Cable (dB)	Limit (dB μ V/m)	Result (dB μ V/m)	Margin (dB)
30.64	17.90	V	1.0	11.23	0.9	40.0	30.02	-9.98
66.20	16.60	V	1.0	10.48	1.3	40.0	28.33	-11.67
130.01	18.20	H	2.6	11.98	1.8	43.5	31.97	-11.53
166.09	16.10	V	1.0	12.23	2.1	43.5	30.47	-13.03
216.01	19.40	V	1.0	10.22	2.5	43.5	32.11	-11.39
233.03	21.20	V	1.0	10.81	2.6	46.0	34.64	-11.36
296.14	15.50	H	1.1	12.83	3.2	46.0	31.48	-14.52
333.17	11.70	V	1.0	13.65	3.5	46.0	28.88	-17.12
384.54	11.10	H	1.0	14.79	3.9	46.0	29.79	-16.21
433.15	12.00	H	1.0	16.06	4.3	46.0	32.41	-13.59
533.14	10.80	H	1.0	17.84	5.1	46.0	33.71	-12.29
828.16	6.90	H	1.0	22.45	7.1	46.0	36.42	-9.58
Remark	H : Horizontal, V : Vertical TEST MODE : 802.11a CH120 5600MHz *Checked in all 3 axis and the maximum measured data were reported. *CL = Cable Loss-Amplifier Gain(In case of above1000Mhz) *CL = Cable Loss(In case of below1000Mhz) *The resolution bandwidth and v							

5.3-3 Test Data for wireless LAN

Test Date : 17-Sep-09

Measurement Distance : 3 m

Frequency (MHz)	Reading (dB μ V)	Position (V/H)	Height (m)	Correction Factor		Result Value		
				Ant Factor (dB)	Cable (dB)	Limit (dB μ V/m)	Result (dB μ V/m)	Margin (dB)
PEAK(RBW:1Mhz VBW:1MHz)–CH36								
5179.01	65.99	H	1.2	31.67	6.9	*OB	104.58	–
5179.01	62.94	V	1.1	31.67	6.9	*OB	101.53	–
AV(RBW:1Mhz VBW:10Hz)–CH36								
5179.01	26.53	H	1.2	31.67	6.9	*OB	65.12	–
5179.01	25.27	V	1.1	31.67	6.9	*OB	63.86	–
PEAK(RBW:1Mhz VBW:1MHz)–CH44								
5219.6	65.47	H	1.1	31.69	6.8	*OB	104.00	–
5219.6	62.54	V	1.2	31.69	6.8	*OB	101.07	–
AV(RBW:1Mhz VBW:10Hz)–CH44								
5219.6	26.14	H	1.1	31.69	6.8	*OB	64.67	–
5219.6	26.40	V	1.2	31.69	6.8	*OB	64.93	–
PEAK(RBW:1Mhz VBW:1MHz)–CH64								
5323.3	65.91	H	1.1	31.72	6.8	*OB	104.47	–
5323.3	61.60	V	1.1	31.72	6.8	*OB	100.16	–
AV(RBW:1Mhz VBW:10Hz)–CH64								
5323.3	26.23	H	1.1	31.72	6.8	*OB	64.79	–
5323.3	25.47	V	1.1	31.72	6.8	*OB	64.03	–
Remark	H : Horizontal, V : Vertical TEST MODE : 802.11a *OB = Operating band *Checked in all 3 axis and the maximum measured data were reported. *CL = Cable Loss–Amplifier Gain(In case of above1000Mhz) *CL = Cable Loss(In case of below1000Mhz) *The resolution bandwidth and video bandwidth of spectrum analyzer is 1MHz and 10Hz for average detection at frequency above 1GHz. *Spurious emission above 1GHz was tested by quietek testing Lab.							

5.3-4 Test Data for wireless LAN

Test Date : 17-Sep-09

Measurement Distance : 3 m

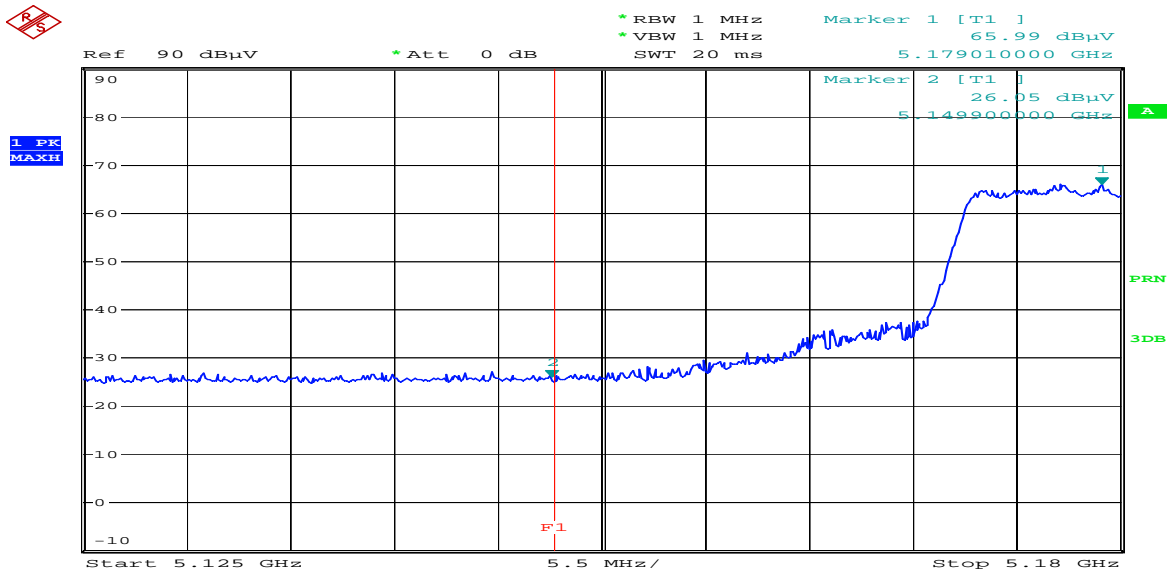
Frequency (MHz)	Reading (dB μ V)	Position (V/H)	Height (m)	Correction Factor		Result Value		
				Ant Factor (dB)	Cable (dB)	Limit (dB μ V/m)	Result (dB μ V/m)	Margin (dB)
PEAK(RBW:1Mhz VBW:1MHz)–CH100								
5496.92	58.95	H	1.2	31.88	7.2	*OB	98.01	–
5496.92	59.12	V	1.2	31.88	7.2	*OB	98.18	–
AV(RBW:1Mhz VBW:10Hz)–CH100								
5496.92	25.02	H	1.2	31.88	7.2	*OB	64.08	–
5496.92	24.42	V	1.2	31.88	7.2	*OB	63.48	–
PEAK(RBW:1Mhz VBW:1MHz)–CH120								
5599.9	59.47	H	1.2	32.03	7.2	*OB	98.68	–
5599.9	58.94	V	1.1	32.03	7.2	*OB	98.15	–
AV(RBW:1Mhz VBW:10Hz)–CH120								
5599.9	26.40	H	1.2	32.03	7.2	*OB	65.61	–
5599.9	26.24	V	1.1	32.03	7.2	*OB	65.45	–
PEAK(RBW:1Mhz VBW:1MHz)–CH140								
5703.24	60.94	H	1.1	32.22	7.2	*OB	100.36	–
5703.24	58.73	V	1.2	32.22	7.2	*OB	98.15	–
AV(RBW:1Mhz VBW:10Hz)–CH140								
5703.24	32.50	H	1.1	32.22	7.2	*OB	71.92	–
5703.24	30.26	V	1.2	32.22	7.2	*OB	69.68	–
Remark	H : Horizontal, V : Vertical TEST MODE : 802.11g – CH6(2437MHz) *The TX signal isn't detected from 3th harmonics. *OB = Operating band *Checked in all 3 axis and the maximum measured data were reported. *CL = Cable Loss–Amplifier Gain(In case of above1000Mhz) *CL = Cable Loss(In case of below1000Mhz) *The resolution bandwidth and video bandwidth of spectrum analyzer is 1MHz and 10Hz for average detection at frequency above 1GHz.							

5.4 Restricted Band Edges for 802.11a

Band Edges(CH Low)-ch36

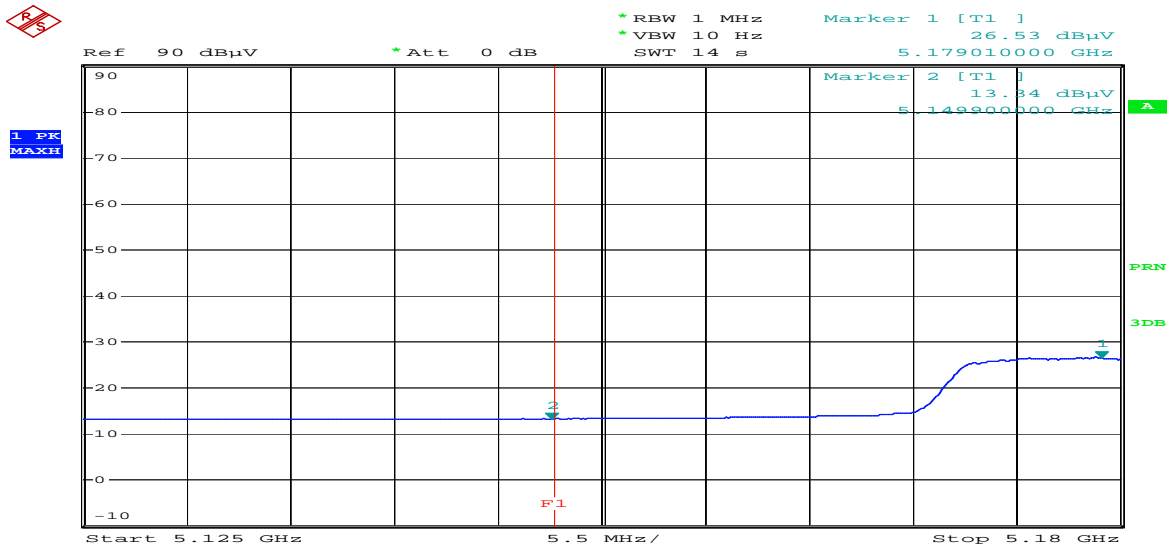
Detector mode:Peak

Polarity:Horizontal



Detector mode:Average

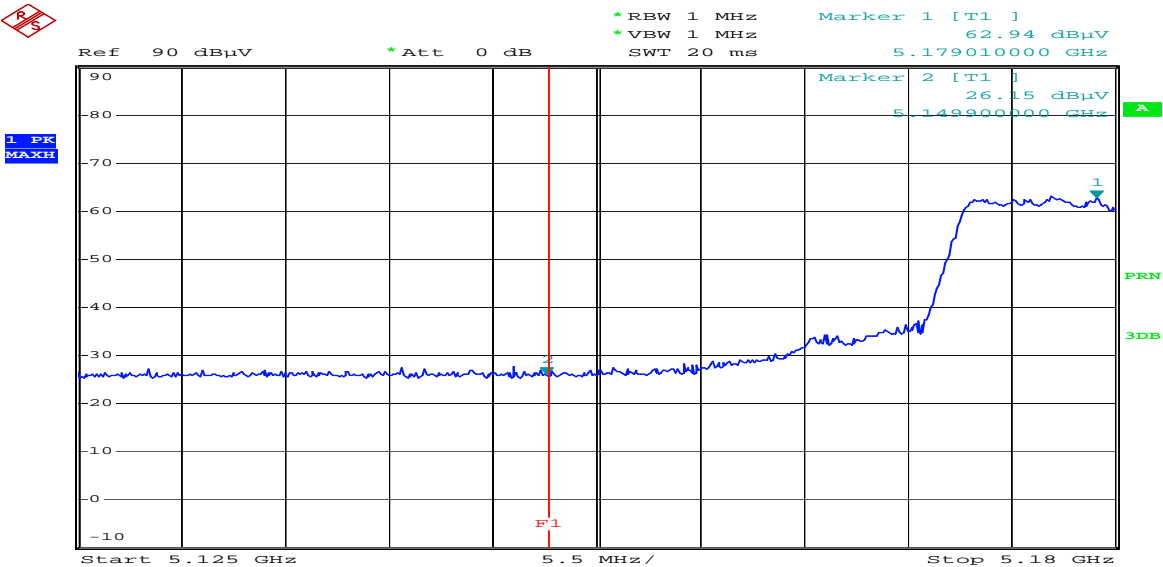
Polarity:Horizontal



Band Edges(CH Low)-ch36

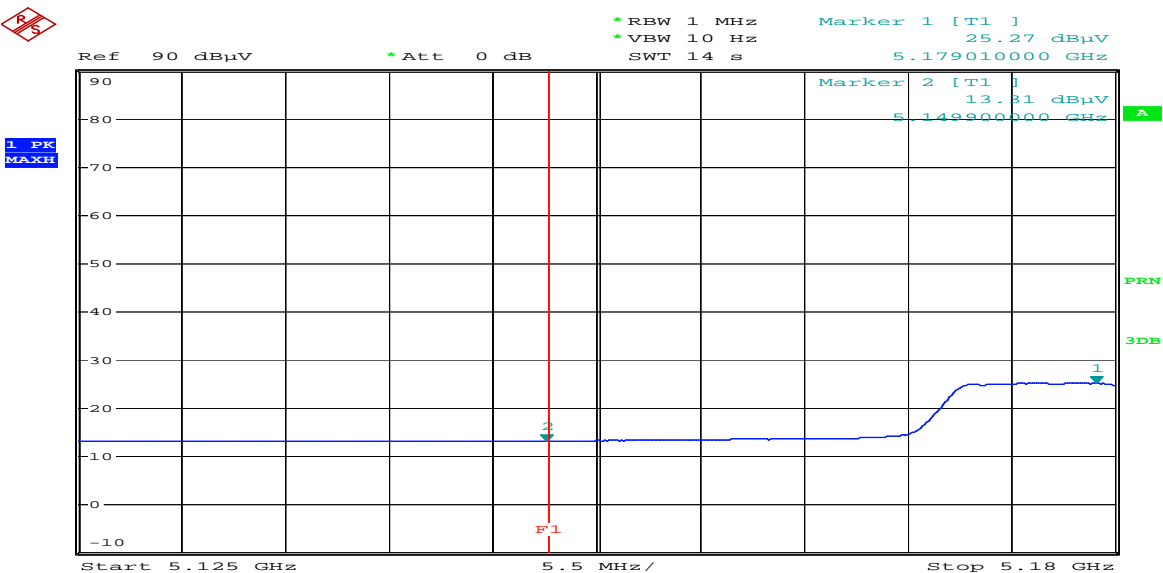
Detector mode:Peak

Polarity:Vertical



Detector mode:Average

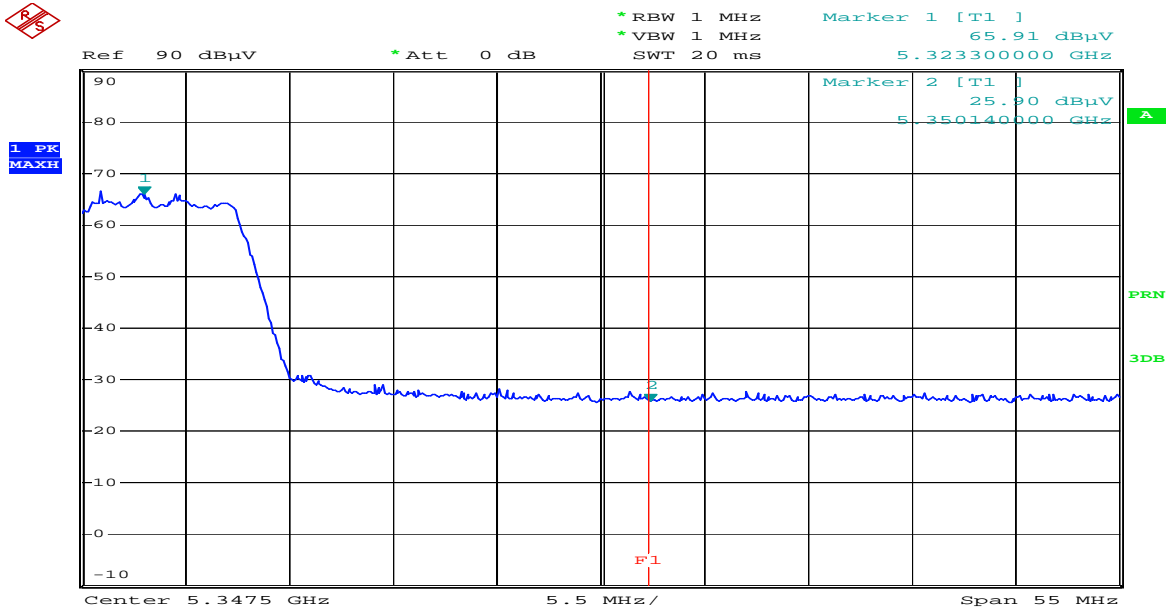
Polarity:Vertical



Band Edges(CH High)-CH 64

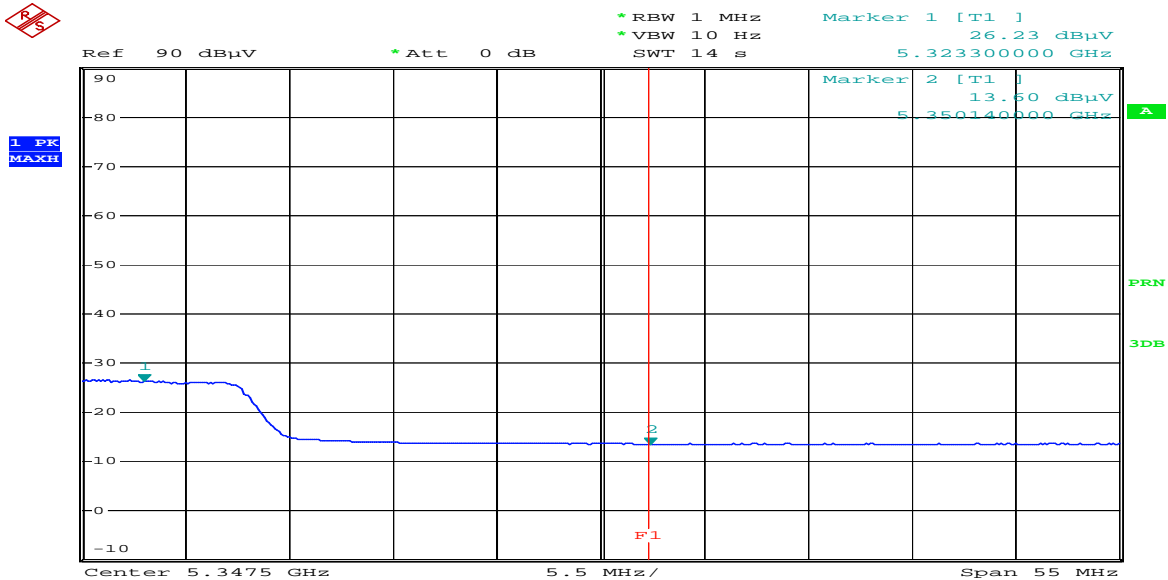
Detector mode:Peak

Polarity:Horizontal



Detector mode:Average

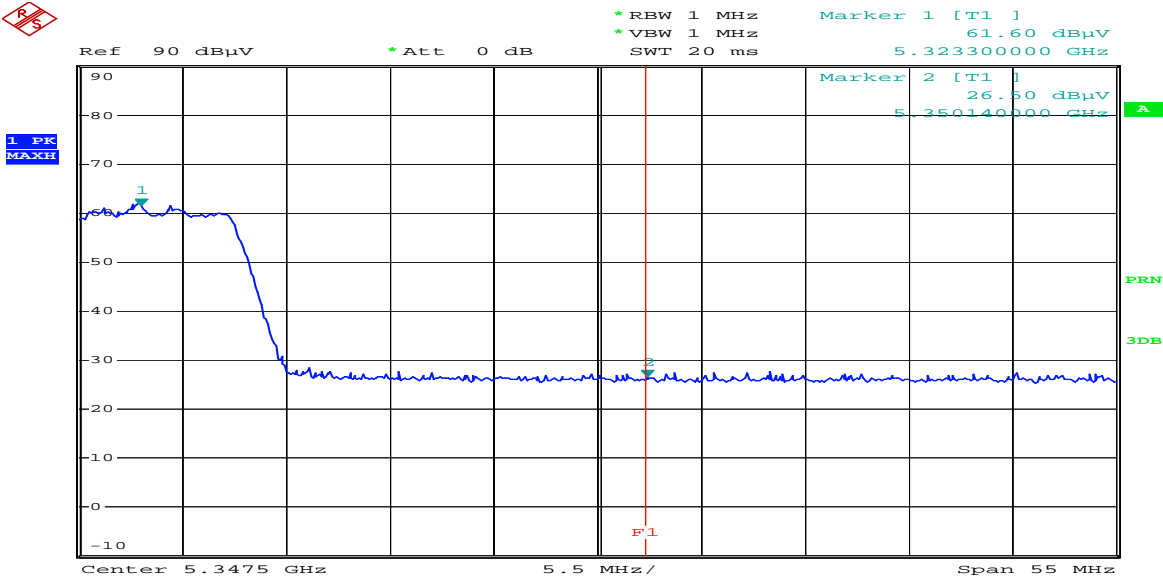
Polarity:Horizontal



Band Edges(CH High)-ch64

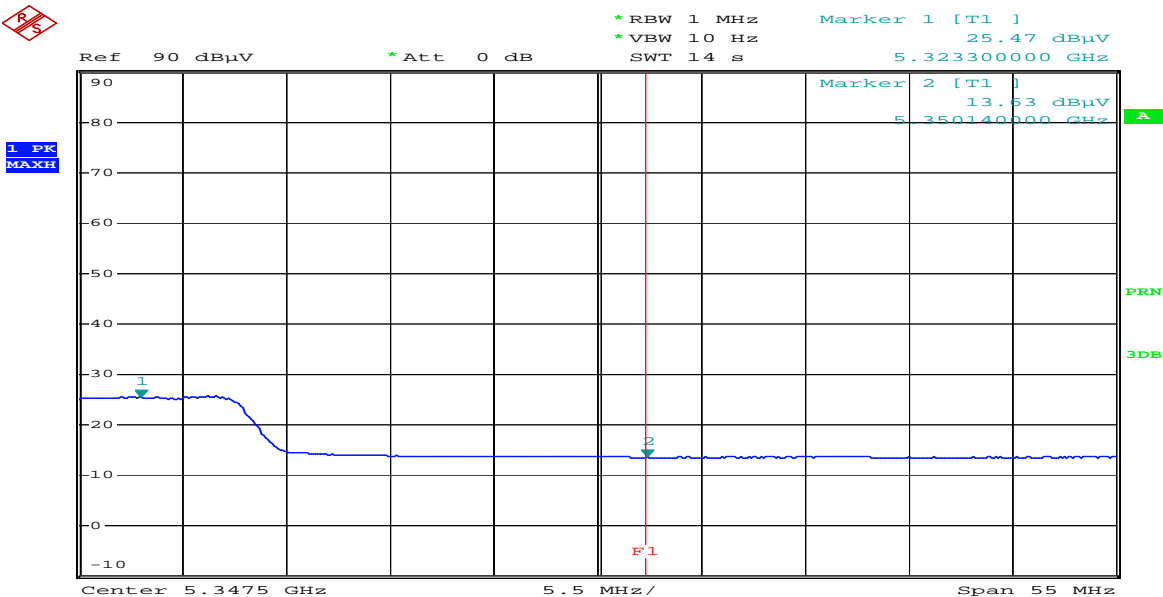
Detector mode:Peak

Polarity:Vertical



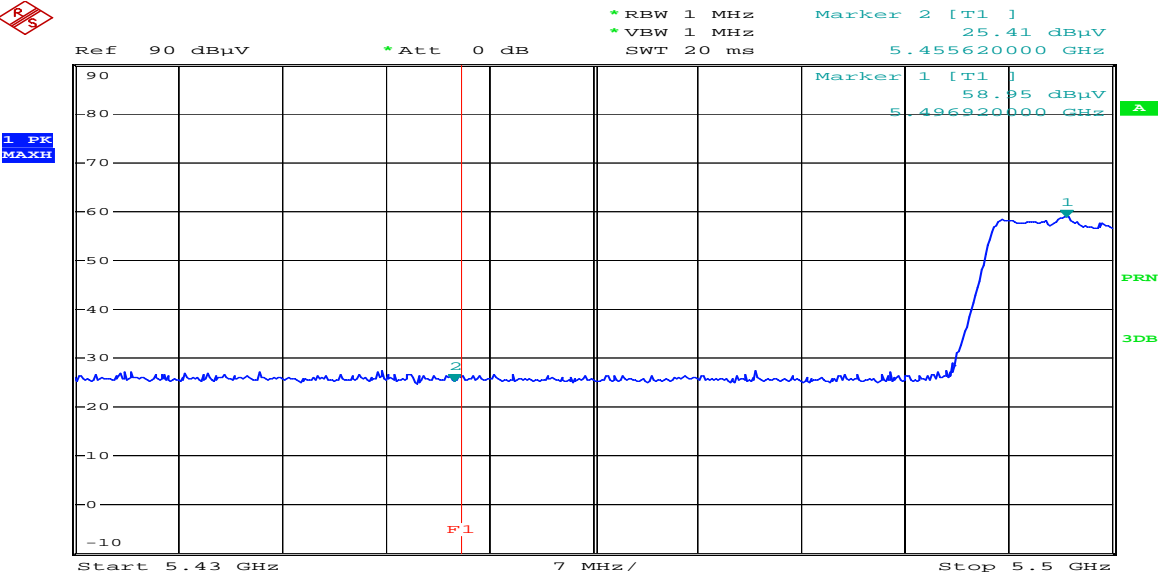
Detector mode:Average

Polarity:Vertical

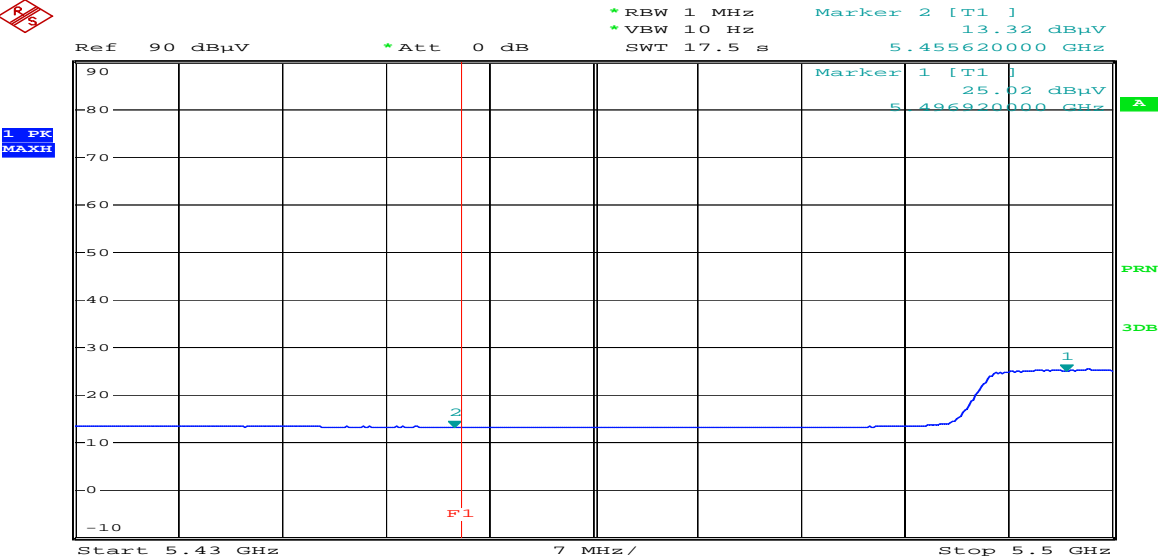


Band Edges(CH Low)-ch100

Detector mode:Peak Polarity:Horizontal



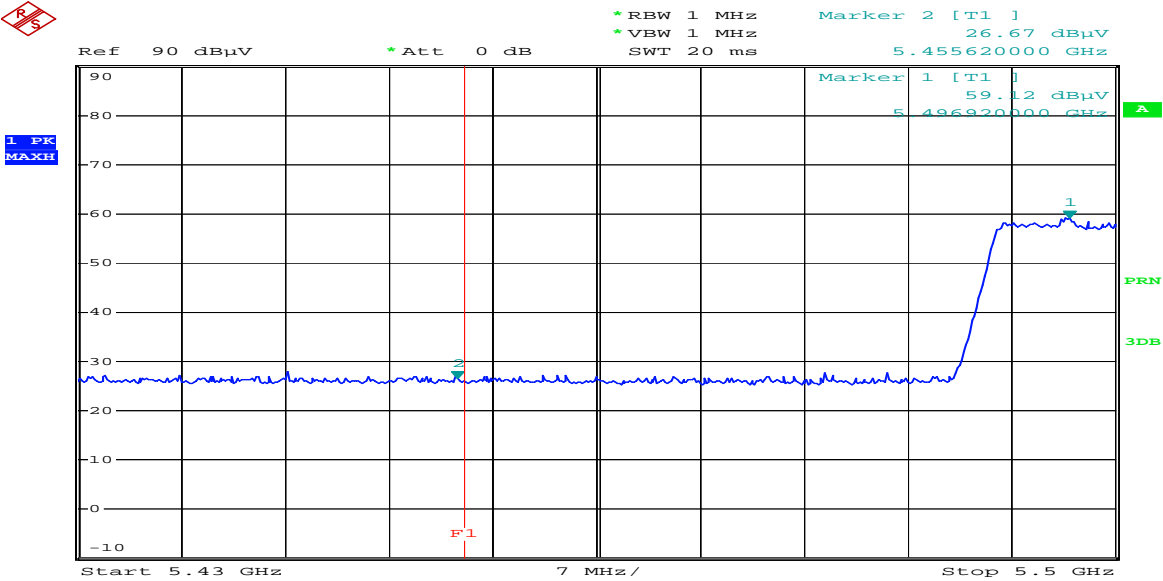
Detector mode:Average Polarity:Horizontal



Band Edges(CH Low)-ch100

Detector mode:Peak

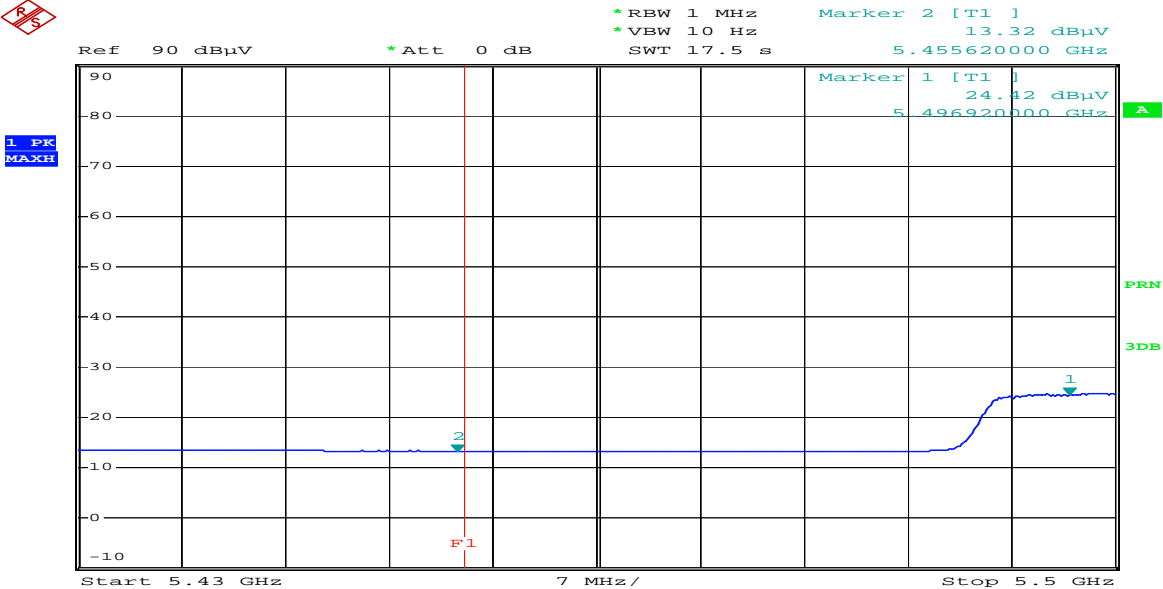
Polarity:Vertical



Comment: MM3 801.11a 100CH PK VER
Date: 24.AUG.2009 20:10:53

Detector mode:Average

Polarity:Vertical

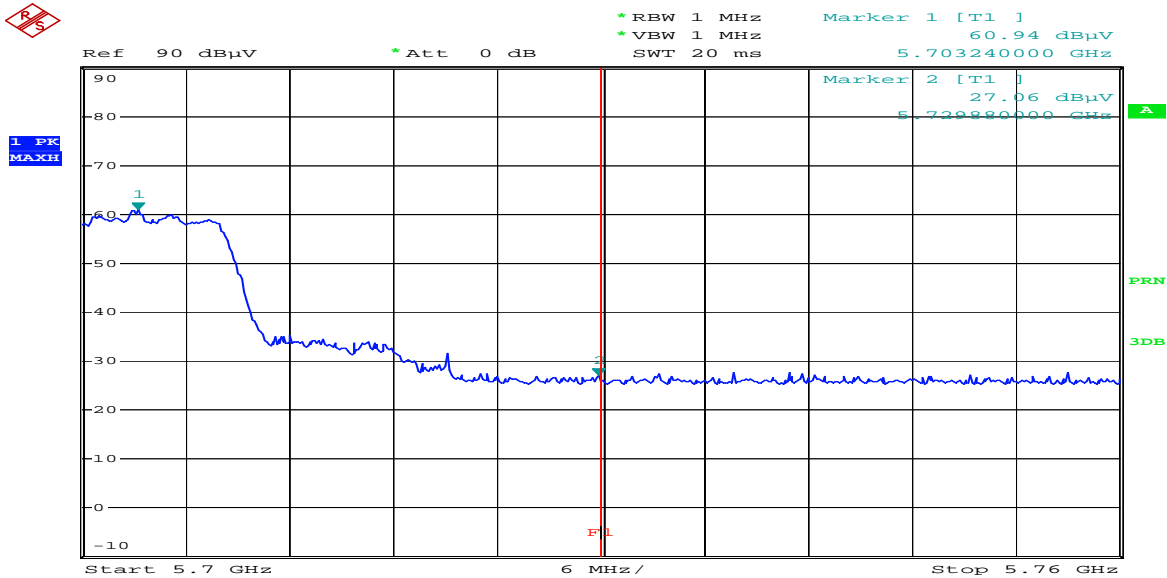


Comment: MM3 801.11a 100CH AV VER
Date: 24.AUG.2009 20:15:21

Band Edges(CH High)-ch140

Detector mode:Peak

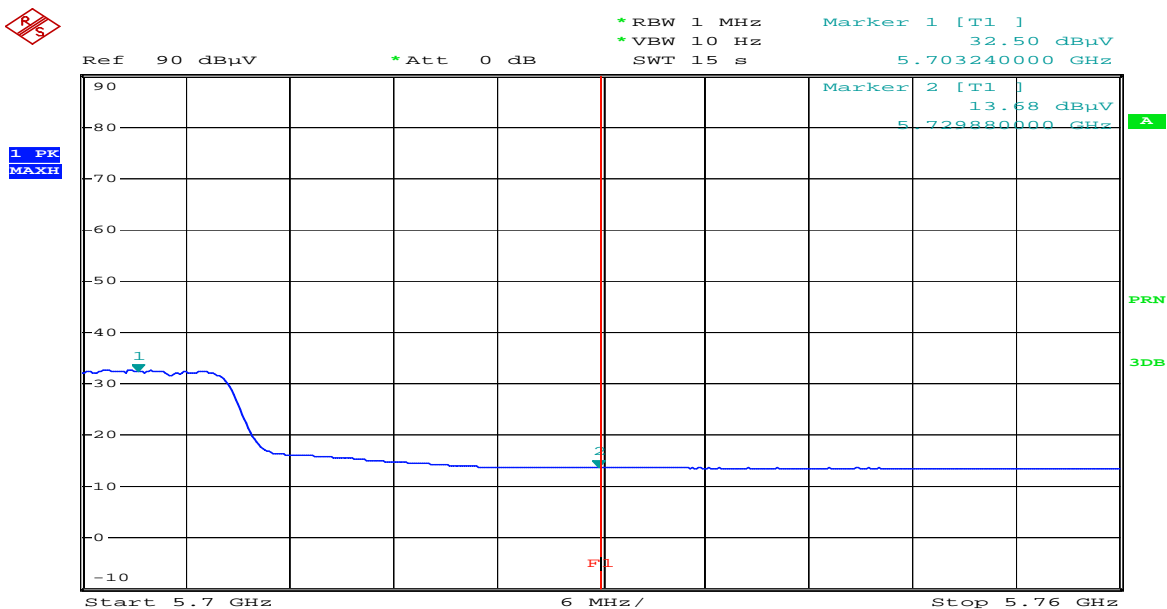
Polarity:Horizontal



Comment: MM3 801.11a 140CH PK HOR
Date: 24.AUG.2009 20:31:01

Detector mode:Average

Polarity:Horizontal

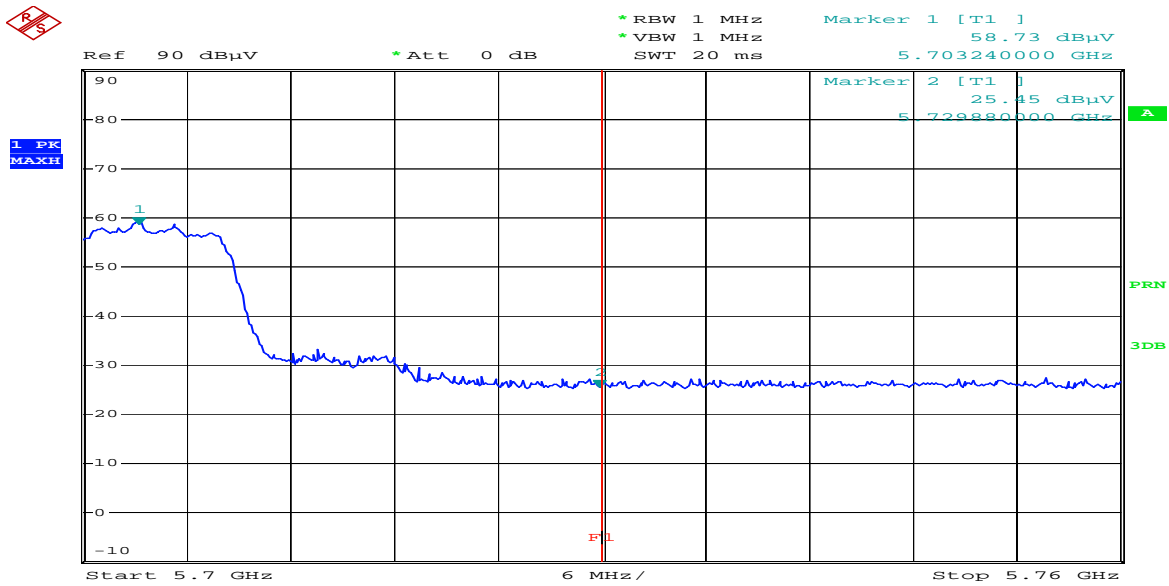


Comment: MM3 801.11a 140CH AV HOR
Date: 24.AUG.2009 20:36:17

Band Edges(CH High)-ch140

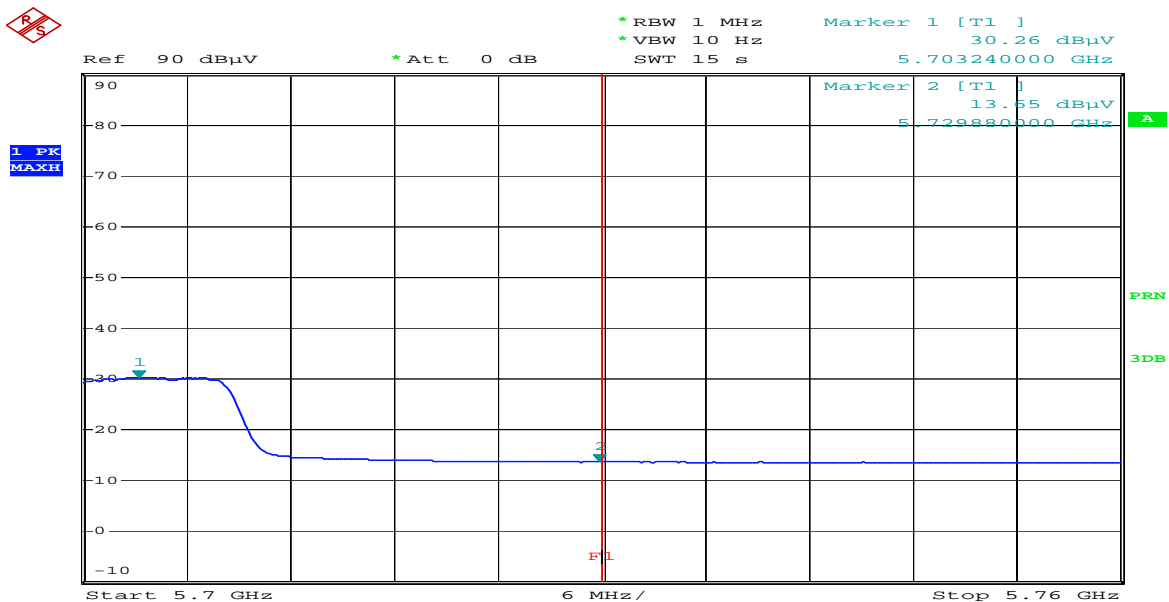
Detector mode:Peak

Polarity:Vertical



Detector mode:Average

Polarity:Vertical



6 Measurement of conducted disturbance

The continuous disturbance voltage of AC Mains in the frequency from 0.15 to 30 MHz was measured in accordance to FCC Part 15 (2008) & ANSI C 63.4 (2003). The test setup was made according to FCC Part 15 (2008) & ANSI C 63.4 (2003) in a shielded. The EUT was placed on a non-conductive table at least 80 above the ground plan. A grounded vertical reference plane was positioned in a distance of 40cm from the EUT. The distance from the EUT to other metal surfaces was at least 0.8m. The EUT was only earthen by its power cord through the line impedance stabilizing network. The power cord has been bundled to a length of 1.0m.. The test receiver with Quasi Peak detector complies with CISPR 16.

6.1 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
LISN	ESH3-Z5	Schwarzbeck	838979/010	2010. 2. 21
LISN	NNLA8120A	Schwarzbeck	8120161	2010. 2. 21
TEST Receiver	ESPI7	Rohde & Schwarz	100185	2009. 8. 27
Pulse Limiter	ESH3Z2	Rohde & Schwarz	NONE	2009.9.09

6.2 Environmental Condition

Test Place : Shield Room
 Temperature (°C) : 20 °C
 Humidity (%) : 41 %

6.3-1 Test Data for wireless LAN

Test Date : 17-Sep-09

Frequency (MHz)	Correction Factor		Line (H/N)	Quasi-peak Value			Average Value		
	Lisn (dB)	Cable (dB)		Limit (dB μ V)	Reading (dB μ V)	Result (dB μ V)	Limit (dB μ V)	Reading (dB μ V)	Result (dB)
0.19	0.09	0.2	N	63.86	46.56	46.88	53.86	34.79	35.11
0.26	0.09	0.2	N	61.50	38.53	38.85	51.50	34.23	34.55
0.32	0.09	0.2	N	59.73	35.38	35.71	49.73	32.81	33.14
0.39	0.09	0.3	H	58.13	33.18	33.56	48.13	31.73	32.11
0.45	0.10	0.3	N	56.84	34.14	34.57	46.84	33.03	33.46
0.65	0.10	0.4	H	56.00	34.69	35.17	46.00	33.37	33.85
0.97	0.11	0.5	H	56.00	32.99	33.59	46.00	32.34	32.94
1.10	0.11	0.5	H	56.00	33.51	34.12	46.00	32.33	32.94
1.35	0.12	0.5	N	56.00	36.86	37.46	46.00	35.52	36.12
2.32	0.15	0.4	H	56.00	26.24	26.83	46.00	22.51	23.10
3.61	0.19	0.5	H	56.00	23.32	24.04	46.00	20.00	20.72
12.06	0.50	0.9	N	60.00	21.30	22.71	50.00	15.73	17.14
18.56	0.76	1.1	H	60.00	27.80	29.64	50.00	20.80	22.64
21.98	0.83	1.2	H	60.00	34.26	36.28	50.00	27.53	29.55
25.92	0.88	1.3	N	60.00	31.04	33.24	50.00	23.31	25.51
Remark	H : Hot Line, N : Neutral Line TEST MODE : 802.11a 5220MHz								

6.3-2 Test Data for wireless LAN

Test Date : 17-Sep-09

Frequency (MHz)	Correction Factor		Line (H/N)	Quasi-peak Value			Average Value		
	Lisn (dB)	Cable (dB)		Limit (dB μ V)	Reading (dB μ V)	Result (dB μ V)	Limit (dB μ V)	Reading (dB μ V)	Result (dB)
0.19	0.09	0.2	H	63.91	44.76	45.08	53.91	37.84	38.16
0.26	0.09	0.2	H	61.53	37.75	38.07	51.53	34.02	34.34
0.32	0.09	0.2	H	59.73	32.07	32.40	49.73	29.76	30.09
0.39	0.09	0.3	H	58.13	35.50	35.88	48.13	34.27	34.65
0.45	0.10	0.3	H	56.84	34.62	35.05	46.84	33.81	34.24
0.58	0.10	0.4	N	56.00	36.07	36.54	46.00	35.45	35.92
0.65	0.10	0.4	H	56.00	37.27	37.75	46.00	36.03	36.51
0.77	0.11	0.4	H	56.00	35.31	35.82	46.00	34.78	35.29
0.90	0.11	0.5	H	56.00	35.66	36.23	46.00	35.07	35.64
1.16	0.11	0.5	H	56.00	35.55	36.16	46.00	34.80	35.41
1.35	0.12	0.5	N	56.00	35.96	36.56	46.00	35.21	35.81
1.61	0.13	0.5	H	56.00	32.90	33.48	46.00	31.95	32.53
2.32	0.15	0.4	H	56.00	28.45	29.04	46.00	24.97	25.56
4.77	0.22	0.6	H	56.00	23.92	24.75	46.00	19.08	19.91
19.00	0.77	1.1	N	60.00	29.28	31.15	50.00	21.92	23.79
22.10	0.83	1.2	N	60.00	35.56	37.59	50.00	28.55	30.58
22.61	0.84	1.2	H	60.00	35.68	37.74	50.00	29.39	31.45
Remark	H : Hot Line, N : Neutral Line TEST MODE : 802.11a 5600MHz								

7. Photographs of test setup

7.1. Setup for Radiated Test : 30 ~ 1000 MHz

[Front]



[Rear]



7.2. Setup for Conducted Test : 0.15 ~ 30 MHz

[Front]



[Rear]



7.3. Photographs of EUT

[Front]



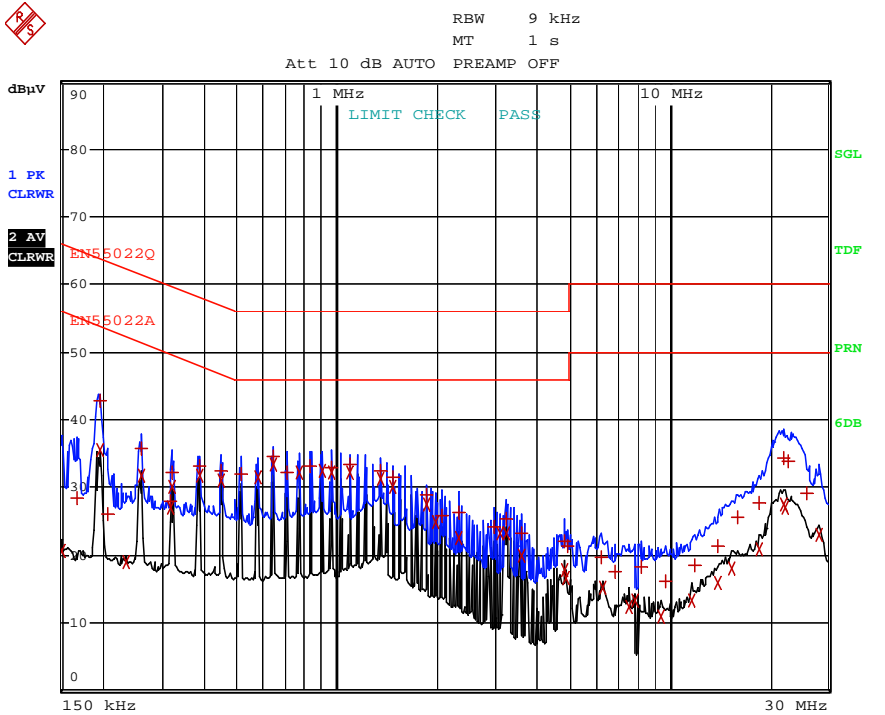
[Rear]



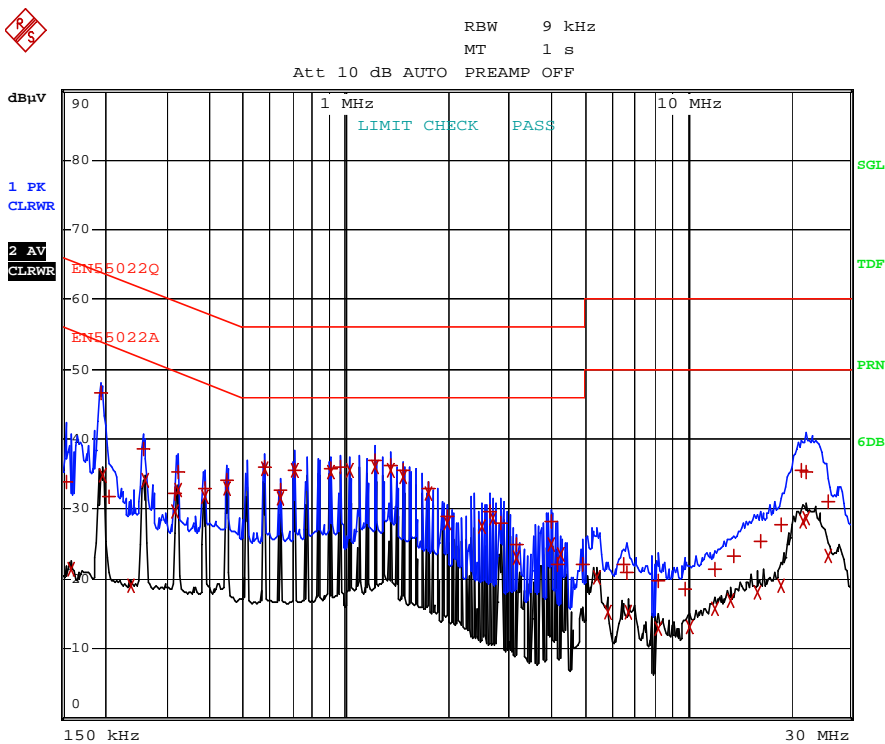
Appendix 1. Spectral diagram for Wireless LAN

802.11a - CH 44

*HOT



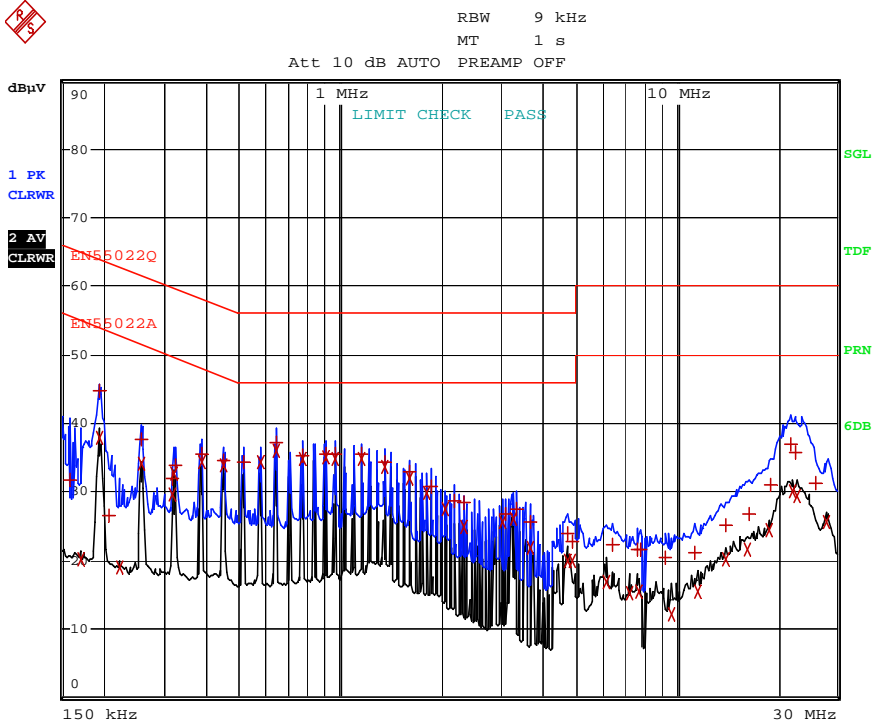
*NEUTRAL



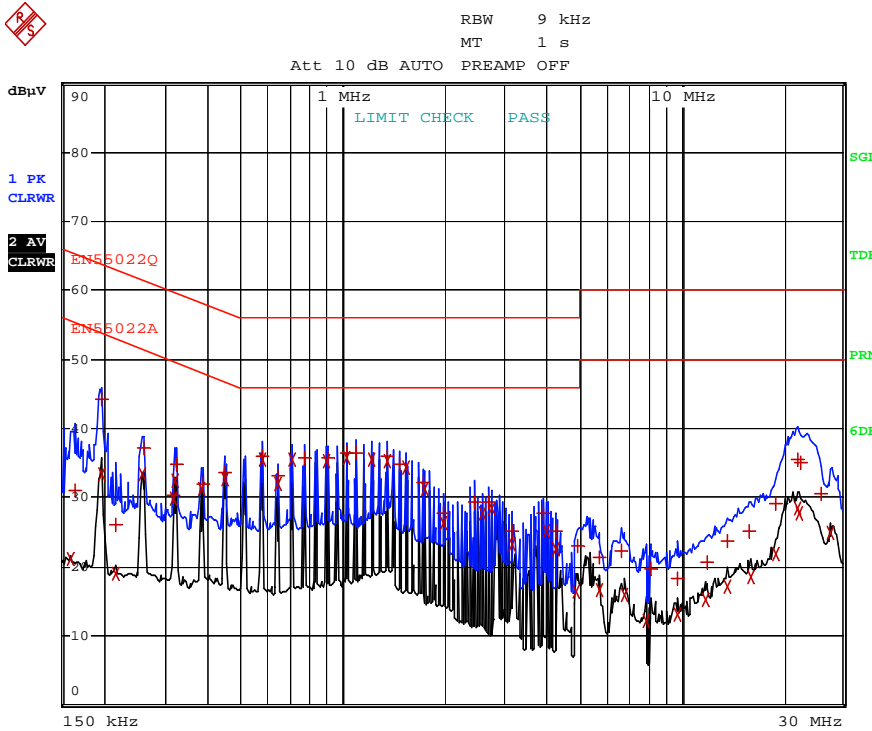
Appendix 1. Spectral diagram for Wireless LAN

802.11a - CH 120

*HOT



*NEUTRAL



Appendix 2. Antenna Requirement

1. Antenna Requirement

1.1 Standard Applicable

For intentional device, according to FCC 47 CFR Section 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.

And according to FCC 47 CFR Section 15.24

1.2 Antenna Connected Construction

The antenna types used in this product are Intergrated Sandwich antenna . The maximum Gain of 5GHz antenna is -0.13dBi