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EMC TEST REPORT

Nr 2914-FCC

This test report applies only on equipment described hereafter.

Proposal number: 200401-2337

Date : February 2nd & 3rd, 2004
Location : SMEE **Actions Mesures** Laboratory - 38 VOIRON
Performed by : Jacques LORQUIN
Customer : **TAGSYS S.A. (M. D'ANNUNZIO)**
180, Chemin de Saint Lambert
13821 La PENNE SUR HUVEAUNE
FRANCE

Product : **Textile Rental Stack Antenna**
Type of test : **Radiated and Conducted Emission Test**

Applied standards : ANSI C63-4 (2000)
47 CFR Part 15 Subpart C

Result of tests : **Radiated Emission : Comply**
Conducted Emission : Comply

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Written by : Jacques LORQUIN

Approved by : Jacques LORQUIN



FCCID : QHKTRSTACKANTENNA

1. System test configuration

1.1. Justification

The system was configured for testing in a typical fashion (as a customer would normally use it). The Textile Rental Stack Antenna is connected to Medio L100 and Medio L100 is connected to a Personal Computer via the serial port. It has been tested with a PC HP model Vectra VLi8.

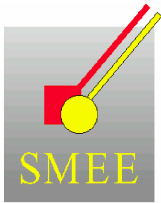
1.2. HARDWARE IDENTIFICATION:

- **Equipment under test (EUT):** FCCID: QHKTRSTACKANTENNA
- **Textile Rental Stack Antenna** sn: 01
 - Input/output: RF power input port (BNC cable)
 - Size: 400x500x10mm
- **MEDIO-L100** pn: SE10120B0 sn:M029010009
 - Input/output:
 - * 1x serial connector (DB9)
 - * 1x parallel connector (not used for this application)
 - * Ch1 BNC antenna connector
 - * Ch2 BNC antenna connector (not used for this application)
 - * Syn IN/OUT BNC connector (not used for this application)
 - * I/O ports (1,2,3,4, gnd, Vin, Vout, gnd)
 - * Power supply
 - Size: 250x300x75mm
 - Frequencies: Crystal 32.768 kHz and 14.7456 MHz
Oscillator 27.12MHz; (no clock or signal higher than 108 MHz)
Bit rate: 9600bauds.
 - Output power: Ch1: 2W.

1.3. Auxiliaries

The FCC IDs for all equipment, more description of all cables used in the tested system are :

Trade Mark - Model Number (Serial number)	FCC ID	Description	Cable description
TAG (n#24EC3526)	None	Smart label	none
HP Vectra VLi8 pn:D7963A (sn: FR94020451)	Doc of Conf	Personal computer	none unpowered tag
HP P1100 pn:D2846 (sn: JP74001000)	Doc of Conf	Color monitor	All data cables are shielded Power cord unshielded
HEWLETT PACKARD pn: C4734-60111 (sn: M971168931)	GYUR38SK	Keyboard	Video cable with ferrite at each end. Power cord unshielded
HEWLETT PACKARD pn: C4736-60101 (sn: LZA93024031)	JNZ201213	Mouse	Shielded cable



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1.4. Equipment modifications

No equipment modification has been necessary during testing to achieve compliance to FCC part 15 Subpart C requirements. The unit tested was representative to a production unit.

1.5. EUT Exercise software

The EUT exercise program (Hyper terminal.exe, running under Windows 98) used during radiated and conducted testing was designed to exercise the equipment under test in a manner similar to a typical use (read TAG in loop):

Hyper terminal parameters:

- bits per second	: 9600	- Stop bit	: 1
- Data bits	: 8	- Flow control	: none
- Parity	: none		

1.6. Special accessories

The coaxial cable (with 6 ferrites) used for compliance testing is supplied with the product.

1.7. I/O cables

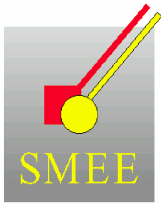
- 3x Standards power cord Length:1.8m (PC, monitor and MEDIO L100)
- 1x video cable with 2 integrated ferrite (shielded cable, length: 1.8m)
- 1x serial cable (Shielded cable, length: 5m)
- 1x coaxial cable with 6 ferrite near CH1 of the MEDIO L100, length: 3m

2. Radiated emission data

2.1. SET-UP

The EUT is placed on a non-conducting table of 80cm height. A Tag is set on the TR Stack antenna.





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Equipment configuration and running mode:

- The MEDIO-L100 is plug on serial connectors of PC;
- The MEDIO-L100 is powered by 230V/50Hz;
- Power output of MEDIO-L100: Ch1=2W;
- Antennas are connected to the Ch1 of the MEDIO-L100;
- PC and EUT are ON;
- software is running;

The installation of EUT is identical for pre-characterization measurement in a 3 meters full anechoic chamber and for measures on a 3 meters Open site.

2.2. TEST EQUIPMENT

Test Equipment up to 1GHz on 10 meters open site:

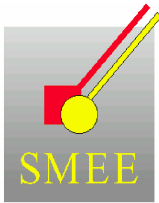
Equipment	Company	Model	Serial
Spectrum Analyzer	HP	8568B	2732A04140
Quasi-Peak adapter	HP	85650A	2811A01136
RF Pre-selector	HP	85685A	2833A00773
Biconical Antenna	EMCO	3104C	9401-4636
Log Periodic Antenna	EMCO	3146	2178
Spectrum Analyzer	HP	8593E	3409u00537
Loop antenna	Electro-metrics	EM-6879	690234
Amplifier	HP	8447F H64	3113A06394

EMCO-1050, 6 meters height antenna mast & EMCO-1060, 3 meters diameter Turntable.

A 3 meters Open site located in SMEE *Actions Mesures* - Voiron (FRANCE).

Pre-scan, test Equipment up to 1GHz:

Equipment	Company	Model	Serial
EMC Analyzer	HP	8591EM	3536A00384
Amplifier	HP	8447F H64	3113A06394
Antenna (30MHz-1GHz)	CHASE	CBL6111A	1628
Loop antenna	Electro-metrics	EM-6879	690234

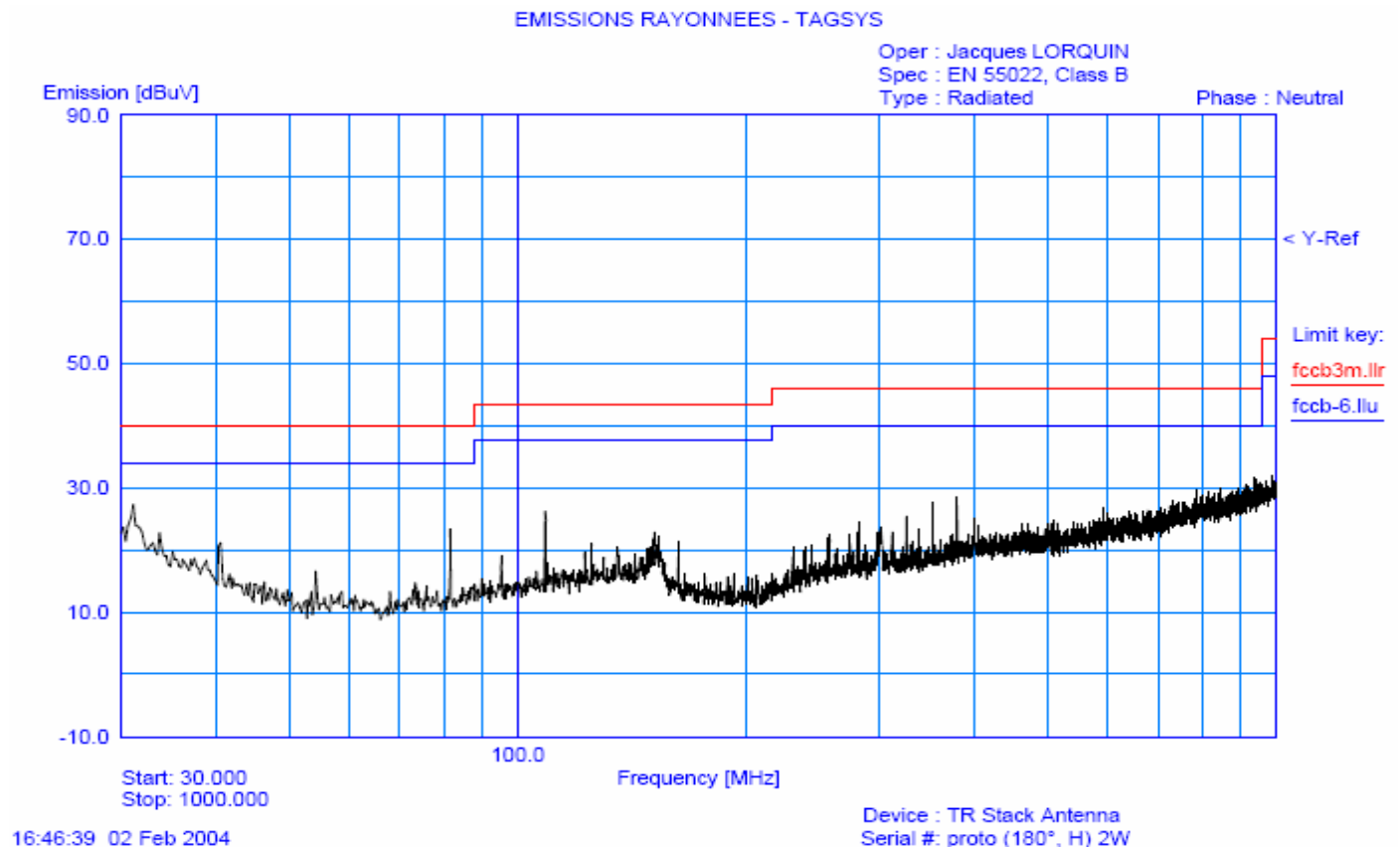


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2.3. TEST SEQUENCE AND RESULTS

2.3.1. Pre-characterization at 3 meters from 30MHz to 1GHz

A pre-scan of all the setup has been performed in a 3 meters full anechoic chamber. The distance between EUT and antenna is 3 meters. Test is performed in horizontal (H) and vertical (V) polarization, and on 4 faces of the EUT. See below for a graph example:

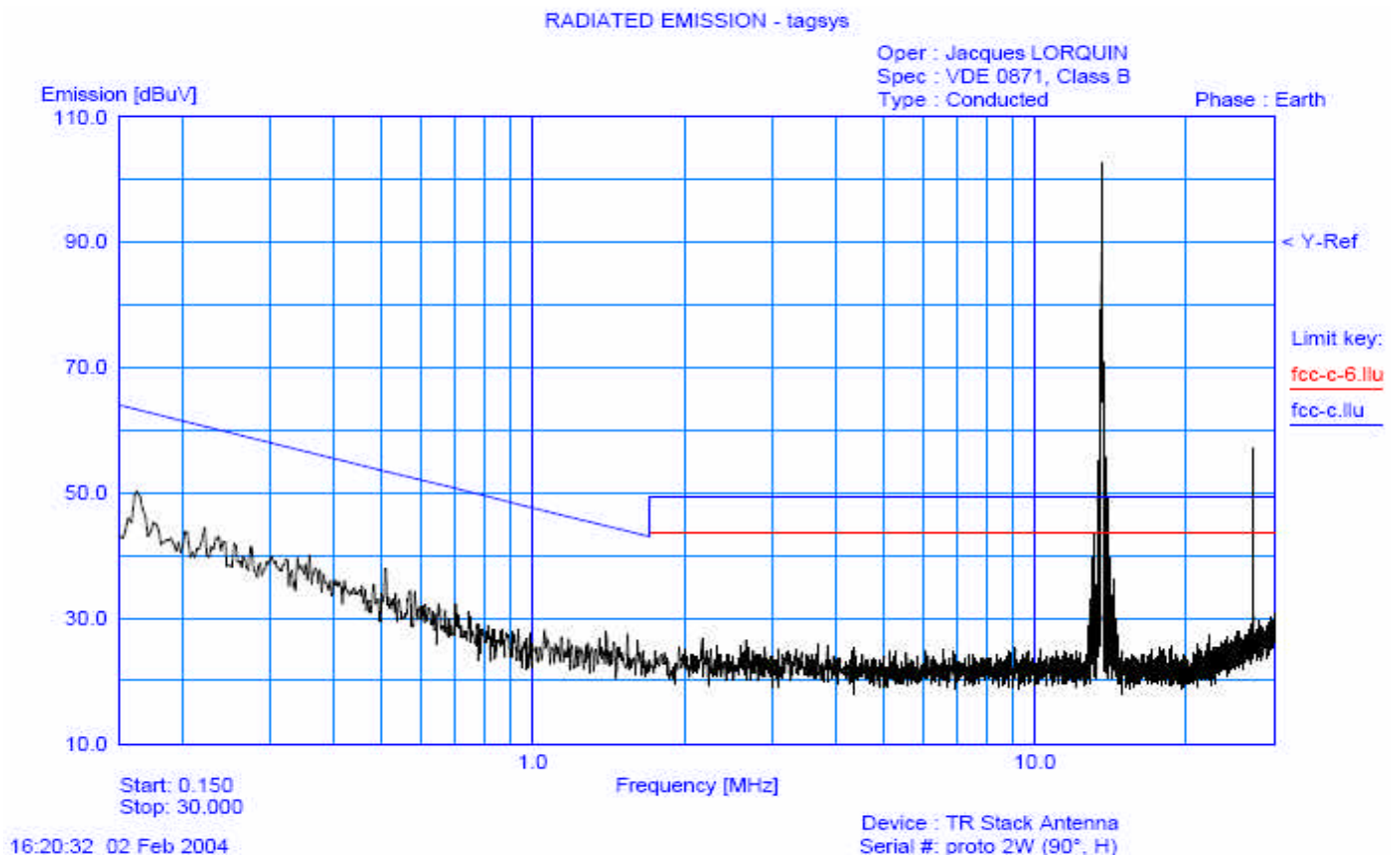




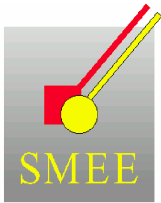
FCCID : QHKTRSTACKANTENNA

2.3.2.Pre-characterization at 3 meters below 30MHz

A pre-scan of all the setup has been performed in a 3 meters full anechoic chamber. The distance between EUT and antenna is 3 meters. Test is performed in horizontal (H) and vertical (V) axis and the loop antenna position was rotated during the test for maximized the emission measurement. See below for a graph example:



Result below 30 MHz



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2.3.3.Characterization on 3 meters open site from 30MHz to 1GHz

The product has been tested according to ANSI C63.4-(2000), FCC part 15 subpart C. Radiated Emission were measured on an open area test site. A description of the facility is on file with the FCC.

The product has been tested with 230V / 50Hz power line voltage, at a distance of 3meters from the antenna and compared to the FCC part 15 subpart C §15.209 limits. Measurement bandwidth was 120kHz from 30 MHz to 1GHz. Antenna height search was performed from 1m to 4m for both horizontal and vertical polarization. Continuous linear turntable azimuth search was performed with 360 degrees range.

Interconnecting cables and equipment's were moved to position that maximized emission. A summary of the worst case emissions found in all test configurations and modes is shown on clause 2.1.

No	Frequency (MHz)	QPeak Lmt (dBμV/m)	QPeak (dBμV/m)	QPeak-Lmt (dB)	Angle (deg)	Pol	Hgt (cm)	Tot Corr (dB)	Comments
1	40.635	40.0	29.6	-10.4	21	V	273	11.5	*
2	81.374	40.0	33.4	-6.6	339	H	395	9	*
3	108.485	43.5	39.2	-4.3	84	V	102	15.2	Measure Peak*
4	162.739	43.5	36.7	-6.8	79	V	102	17.5	*
5	189.864	43.5	38.8	-4.7	201	H	388	18.8	Measure Peak
6	216.955	46.0	38.6	-7.4	313	H	357	14.3	*
7	244.096	46.0	38.1	-7.9	281	H	370	14	*
8	255.578	46.0	35.5	-10.5	269	H	330	14.3	*
9	281.488	46.0	34.5	-11.5	91	V	237	15.6	*
10	800.039	46.0	40.8	-5.2	349	V	177	26.1	*

*: Measure have been done at 10m distance and corrected following requirements of 15.209.e)

2.3.4.Characterization on 10 meters open site below 30 MHz

The product has been tested with 230V / 50Hz power line voltage, at a distance of 10 meters from the antenna and compared to the FCC part 15 subpart C §15.209& §15.225 limits. Measurement bandwidth was 9kHz from 150kHz to 30 MHz and 100 Hz from 9 kHz to 150 kHz.

The loop antenna position was rotated to locate the orientation that maximized emission reception during testing. Antenna search was performed for both horizontal and vertical polarization. Continuous linear turntable azimuth search was performed with 360 degrees range.



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Interconnecting cables and equipment's were moved to position that maximized emission. A summary of the worst case emissions found in all test configurations and modes is shown on clause 2.1.

Frequency (MHz)	QPeak Lmt (dBμV/m)	QPeak (dBμV/m)	QPeak-Lmt (dB)	Angle EUT (deg)	Pol	Angle Ant. (deg)	Tot Corr (dB)
13.56*	84	70.8	-13.2	80	vertical	45	35.4
27.12*	29.5	22.3	-7.2	0	vertical	90	14.7

* Measure have been done at 10m distance and corrected following requirements of 15.209.e)

2.4. Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follow:

$$FS = RA + AF + CF - AG$$

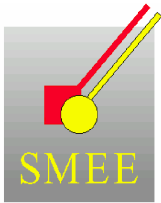
Where
 FS = Field Strength
 RA = Receiver Amplitude
 AF = Antenna Factor
 CF = Cable Factor
 AG = Amplifier Gain

Assume a receiver reading of 52.5dBμV is obtained. The antenna factor of 7.4 and a cable factor of 1.1 is added. The amplifier gain of 29dB is subtracted, giving a field strength of 32 dBμV/m.

$$FS = 52.5 + 7.4 + 1.1 - 29 = 32 \text{ dB}\mu\text{V/m}$$

The 32 dBμV/m value can be mathematically converted to its corresponding level in μV/m.

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm} [(32\text{dB}\mu\text{V/m})/20] = 39.8 \mu\text{V/m}.$$



3. Conducted emission data

The product has been tested according to ANSI C63.4-(2000) and FCC Part 15 subpart C.

The product has been tested with 110V/60Hz power line voltage and compared to the FCC Part 15 subpart C §15.207 limits. Measurement bandwidth was 9kHz from 150 kHz to 30 MHz.

Measurement was initially made with an HP-8591EM Spectrum Analyzer in peak mode. This was followed by a Quasi-Peak, i.e. CISPR measurement with the Rohde & Schwarz ESH3 receiver for any strong signal. If the average limit is met when using a Quasi-Peak detector, the EUT shall be deemed to meet both limits and measurement with the average detector is unnecessary.

The Peak data are shown on the following plots. Quasi-Peak and Average measurements are detailed in a table with frequencies and levels measured.

Interconnecting cables and equipment's were moved to position that maximized emission. A summary of the worst case emissions found in all test configurations and modes is shown on the following page.

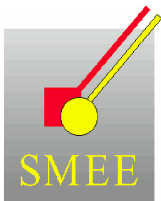
3.1. SET-UP

The EUT is placed on a non-conducting table of 80cm height. The cable of the power supply of the MEDIO L100 has been shorted to 1meter length. The MEDIO L100 is powered through the LISN (measure). The peripherals equipments are connected to a separate LISN (Monitor and PC).



Equipment configuration and running mode:

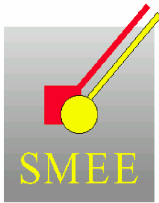
- The MEDIO-L100 is plug on serial connectors of PC;
- The MEDIO-L100 is powered by 110V/60Hz;
- Power output of MEDIO-L100: Ch1=2W;
- Antennas are connected to the Ch1 of the MEDIO-L100;
- PC and EUT are ON;
- software is running;



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3.2. TEST EQUIPMENT

Equipment	Company	Model	Serial
EMC Analyzer	HP	8591EM	3536A00384
test receiver	Rohde&Schwarz	ESH3	872079/117
Transient Limiter	HP	11947A	3107A01596
LISN(auxiliary)	EMCO	3810/2SH	9511-11821628
LISN(measure) 50Ω / 50μH	Telemeter Electronis	TGmbH NNB 2/16	0001300
Faraday room	Rayproof		4854

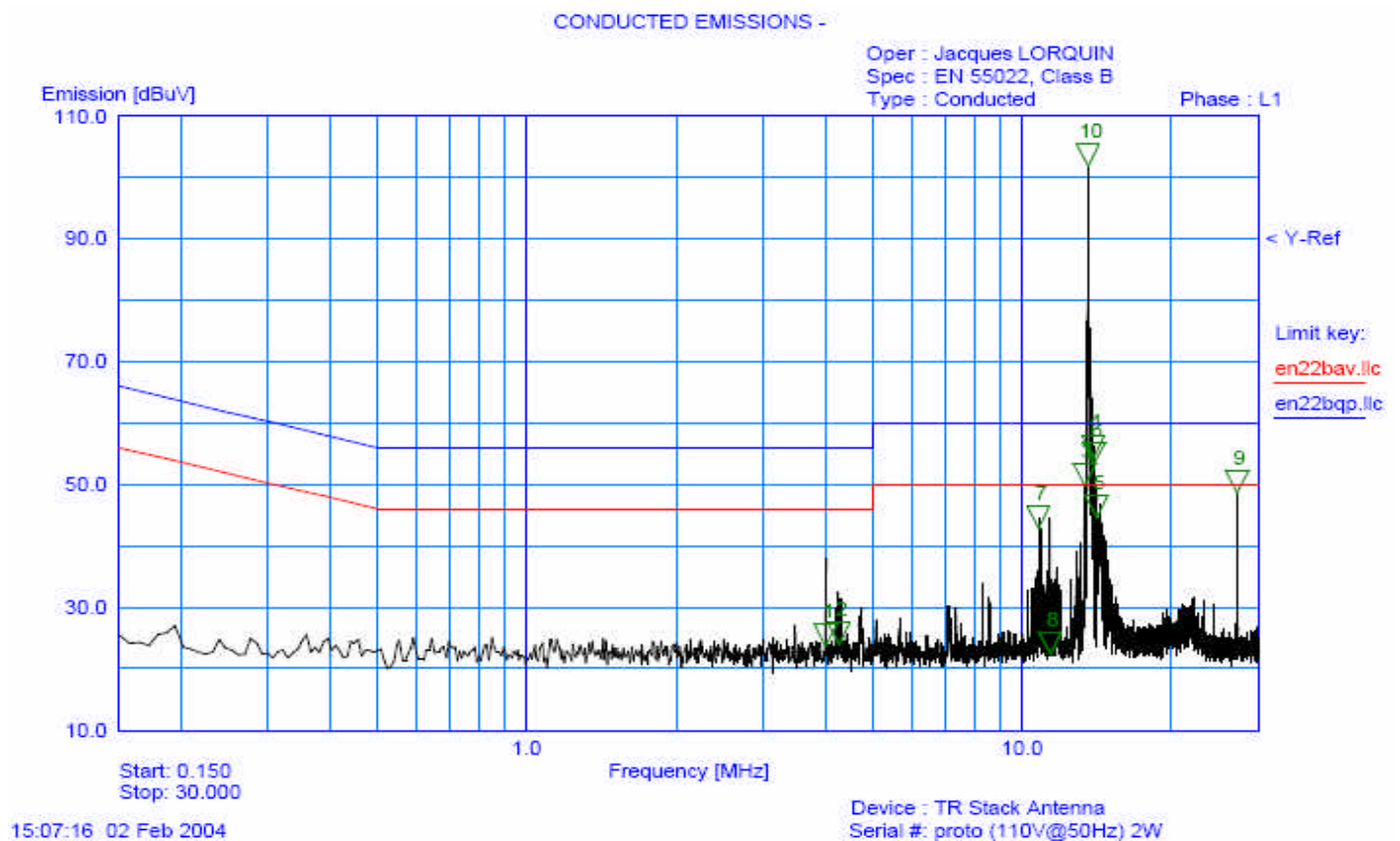


FCCID : QHKTRSTACKANTENNA

3.3. TEST SEQUENCE AND RESULTS

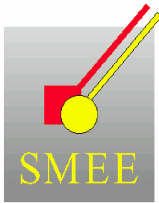
Measures are performed on line 1 and line 2 of the power supply of the equipment under test.

3.3.1. Line conducted emission data on TR Stack Antenna



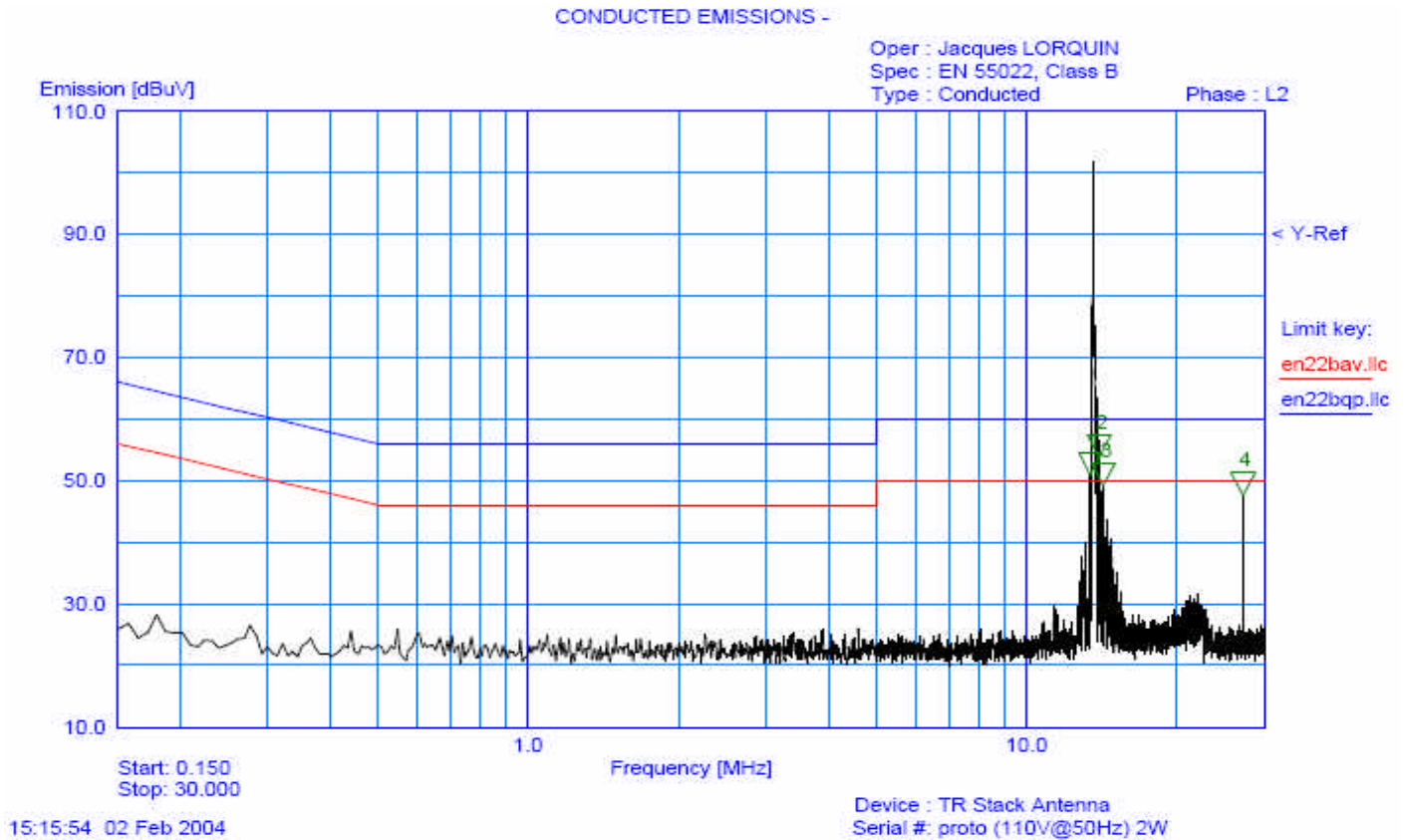
Num.	Freq. [MHz]	Peak [dBμV]	Q-Peak [dBμV]	QP limit [dBμV]	QP delta [dBμV]	Average [dBμV]	AVG Limit [dBμV]	AVG Delta [dBμV]	Comment.
1	4.01	26.02	19.71	56.0	-36.29	13.36	46.0	-32.64	
2	4.26	24.81	19.65	56.0	-36.35	13.50	46.0	-32.5	
3	13.37	55.23	49.87	60.0	-10.13	26.18	50.0	-23.82	
4	13.90	60.67	55.19	60.0	-4.81	30.35	50.0	-19.65	
5	14.12	48.56	42.91	60.0	-17.09	20.99	50.0	-29.01	
6	13.95	58.14	52.69	60.0	-7.31	28.33	50.0	-21.67	
7	10.78	26.26	20.30	60.0	-39.7	14.28	50.0	-35.72	
8	11.37	28.45	22.88	60.0	-37.12	17.43	50.0	-32.57	
9	27.12	49.23	48.78	60.0	-11.22	48.67	50.0	-1.33	
10	13.56	101.77	-	-	-	-	-	-	Carrier*

*: Carrier - §15.207(b): Limits shall not apply to carrier current systems operating as intentional radiators on frequencies below 30MHz (from 13.110 to 14.010MHz).



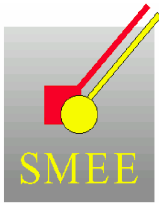
FCCID : QHKTRSTACKANTENNA

3.3.2. Neutral conducted emission data on TR Stack Antenna



Num.	Freq. [MHz]	Peak [dBμV]	Q-Peak [dBμV]	QP limit [dBμV]	QP delta [dBμV]	Average [dBμV]	AVG Limit [dBμV]	AVG Delta [dBμV]	Comment.
1	13.39	55.06	49.54	60.0	-23.04	25.85	50.0	-13.46	
2	13.95	58.28	52.86	60.0	-19.82	28.16	50.0	-10.24	
3	14.24	49.99	44.69	60.0	-19.99	22.29	50.0	-10.42	
4	27.12	48.31	47.81	60.0	-13.23	47.68	50.0	-4.15	
5	13.56	100	-	-	-	-	-	-	Carrier*

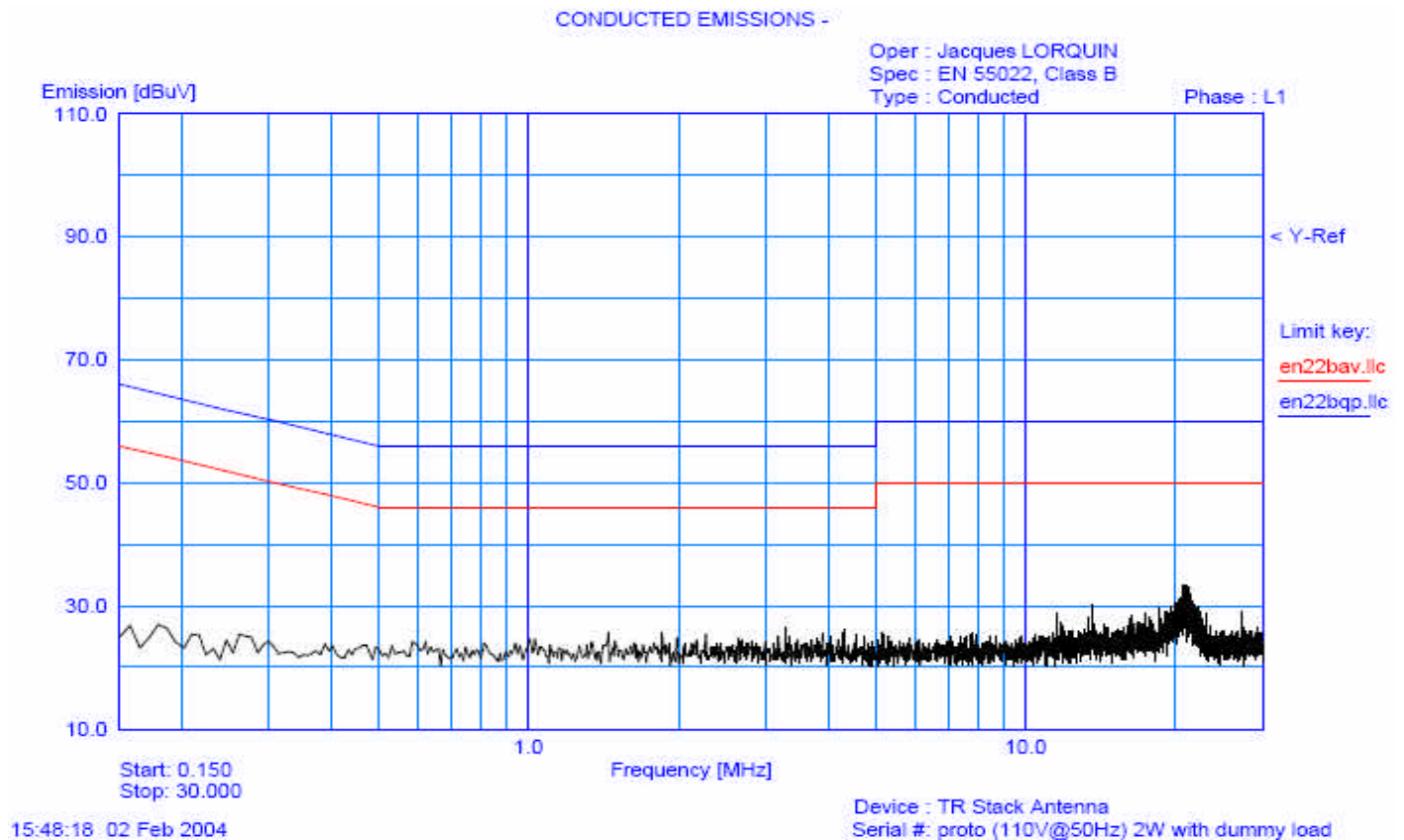
*: Carrier - §15.207(b): Limits shall not apply to carrier current systems operating as intentional radiators on frequencies below 30MHz.



FCCID : QHKTRSTACKANTENNA

3.3.3. Line conducted emission data on TR Stack antenna with dummy load

Antenna is replaced by dummy load.

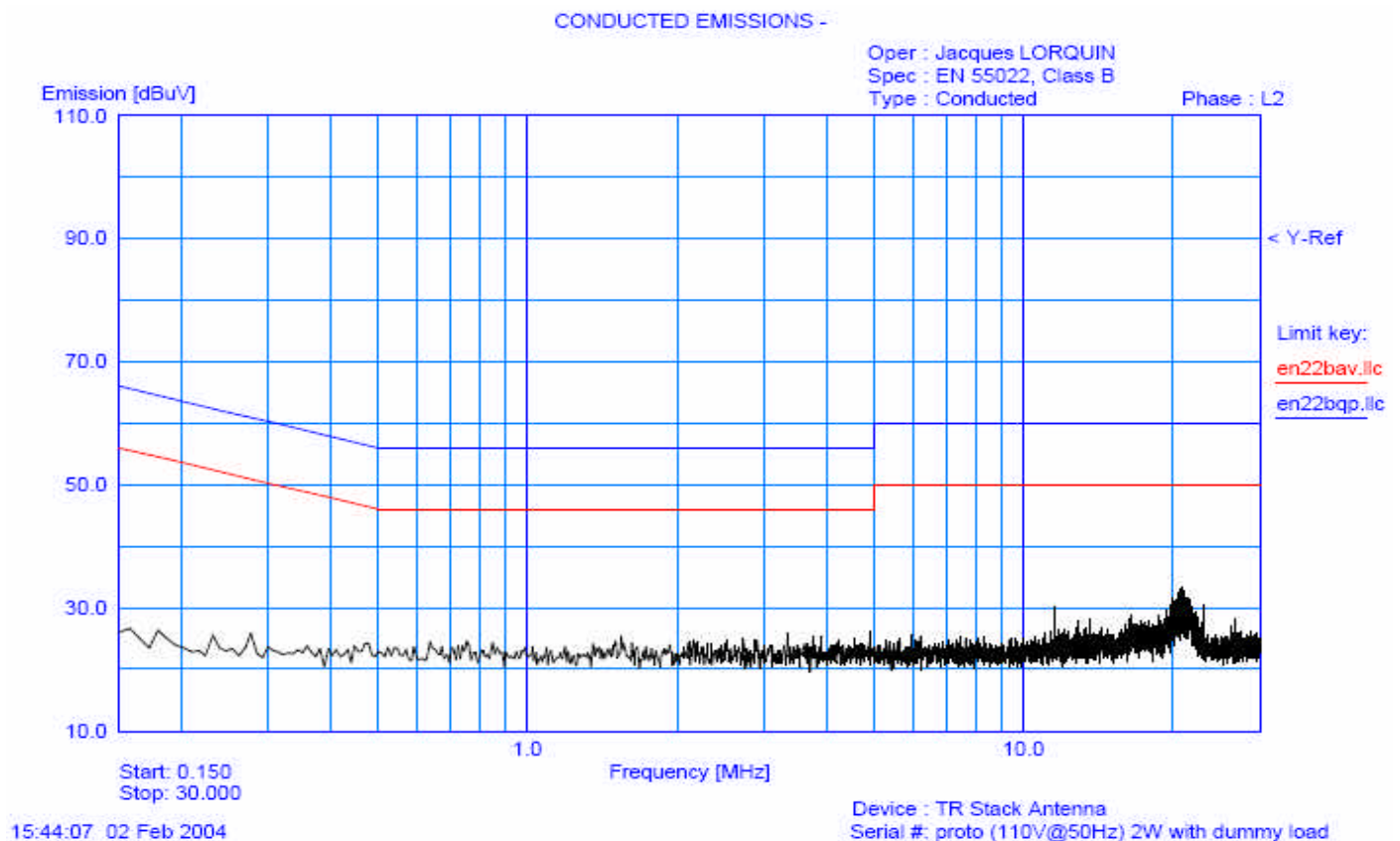


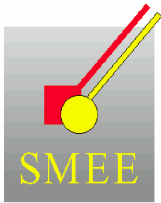


FCCID : QHKTRSTACKANTENNA

3.3.4. Neutral conducted emission data TR Stack antenna with dummy load

Antenna is replaced by dummy load.





4. Field strength of fundamental §15.225(a)

The polarization of the measurements for the larger power level is vertical (the test is performed for both vertical and horizontal axis, and the loop antenna position was rotated during the test for maximized the emission measurement.) Measure have been done at 10m distance and corrected following requirements of 15.209.e)

Frequency (MHz)	QPeak Lmt (dBμV/m)	QPeak (dBμV/m)	QPeak-Lmt (dB)	Angle EUT (deg)	Pol	Angle Ant. (deg)	Tot Corr (dB)
13.56	84	70.8	-13.2	80	vertical	45	35.4

No significantly variation of the fundamental amplitude during voltage variation testing per 15.31(e). Maximum deviation under extreme test condition (voltage variation from 85% to 115%): **0.12dBc**

Limits Subclause §15.225(a): Operation within the band 13.110-14.010MHz

Frequency (MHz)	Field strength (μV/m)	Measurement distance (m)
13.553-13.567	15 848 84dBμV/m	30
13.410-13.553 13.567-13.710	334 50.5dBμV/m	30
13.110-13.410 13.710-14.010	106 50.5dBμV/m	30

5. Fundamental frequency tolerance (15.225.c)

The frequency tolerance of the carrier signal shall be maintained within +/-0.01% of the operating frequency.

5.1. Voltage fluctuation

Power supply has been set at 85% and 115% of nominal voltage, at 20°C.

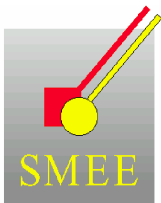
Nominal voltage: 110V-240V@60Hz

Frequency of carrier: 13.56 MHz

Upper limit: 13.561356 MHz

Lower limit: 13.558644 MHz

Voltage	93.5V	110V-240V	276V
Frequency (MHz)	13.559873	13.559940	13.559918
Result	Pass	-	Pass



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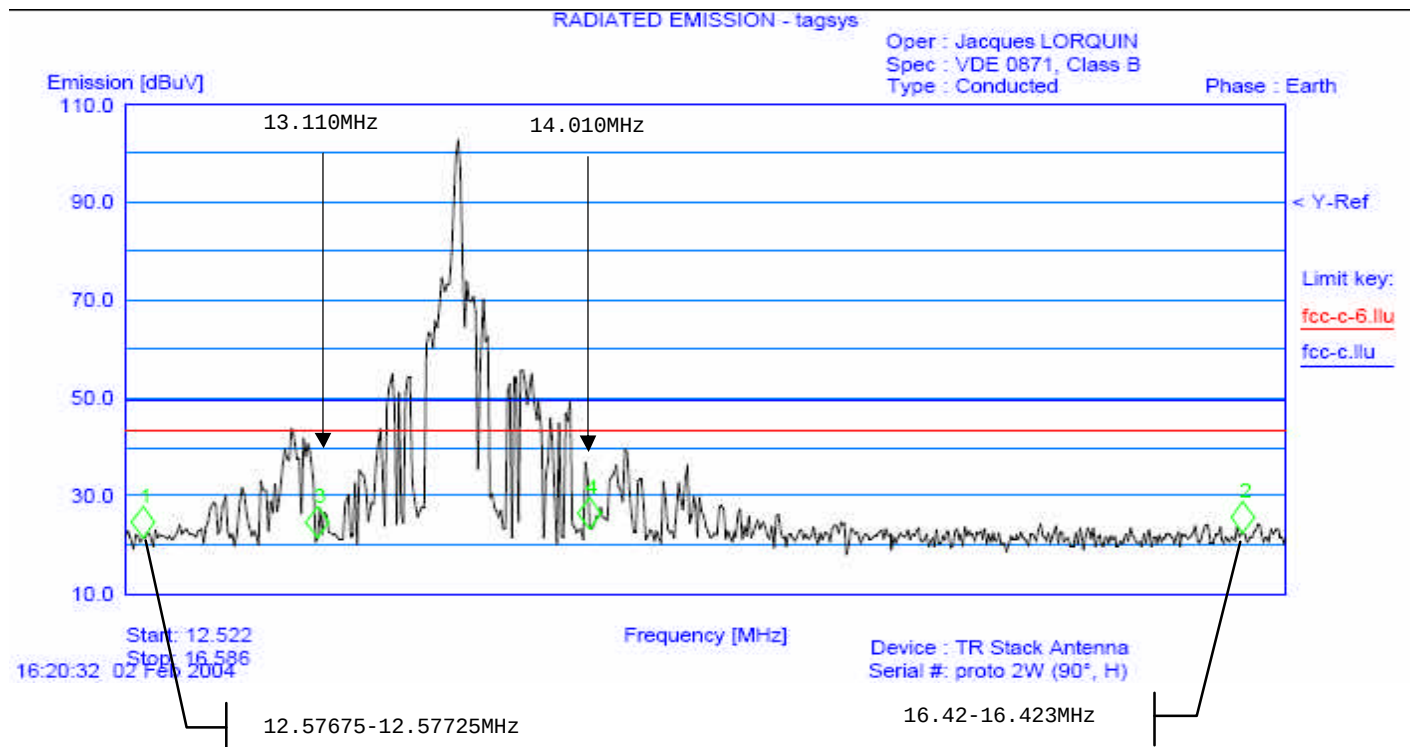
5.2. Temperature

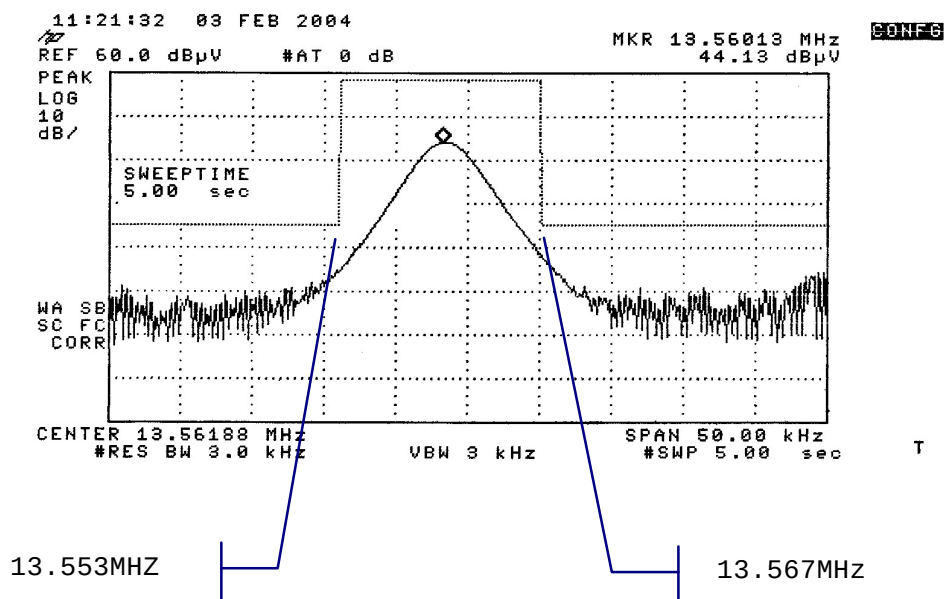
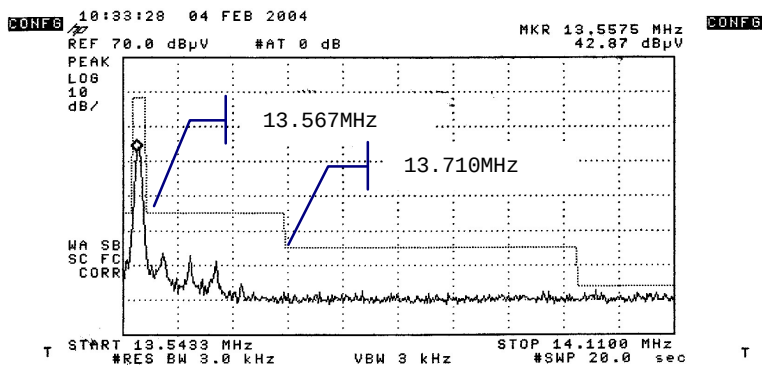
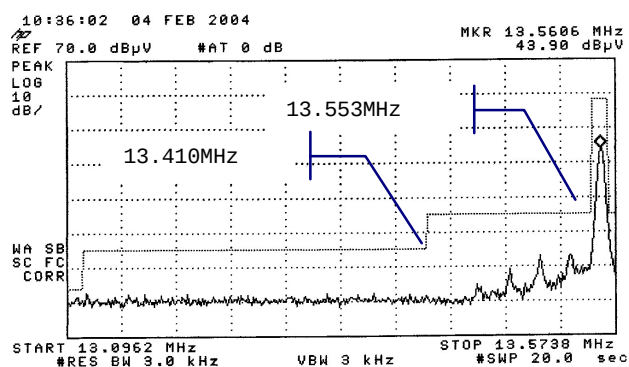
Temperature has been set at -20°C and $+50^{\circ}\text{C}$ at nominal voltage 110V@60Hz.
 Frequency of carrier: 13.56 MHz
 Upper limit: 13.561356 MHz
 Lower limit: 13.558644 MHz

Voltage	-20°C	20°C	$+50^{\circ}\text{C}$
Frequency (MHz)	13.559855	13.559940	13.559855
Result	Pass	-	Pass

6. Occupied bandwidth §15.205

Here is a plot of the occupied bandwidth, which show that, 12.57MHz and 16.42MHz restricted bands are free of carrier signal.



**7. Band-edge compliance §15.209****End of Tests**