1 TEST REPORT

1.1 System test configuration

1.1.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it). A typical smart card was presented to the GemEasyLink / Access 3xx contactless reader, which was itself connected to a personal computer. It has been tested with a Dell Personal computer laptop. Each ports of the contactless reader were loaded with a typical peripheral device.

1.1.2 EUT Exercise software

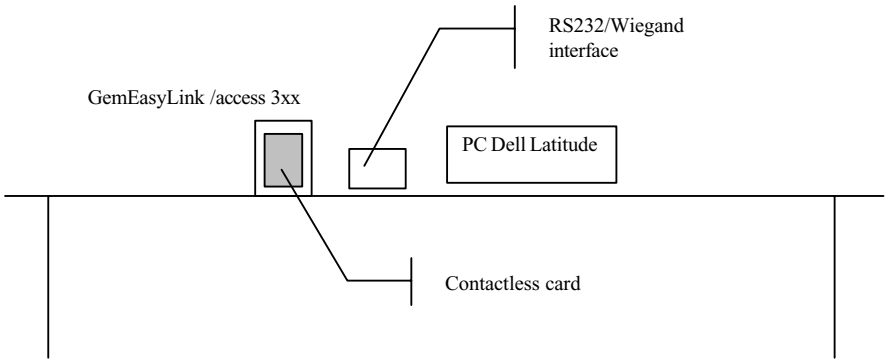
The EUT exercise program (Wiegand running under windows 98) used during radiated and conducted testing was designed to exercise the GemEasyLink / Access 3xx contactless reader in a manner similar to a typical use (reading the contactless smart card in loop)

1.1.3 Special accessories

The cable used to connect the GemEasyLink / Access contactless reader, to RS232/Wiegand ports of interface is shielded. Add on this cable a ferrite WURTH reference 742 712 22 at 45cm from the device.

The cable used to connect the RS232/Wiegand interface, to the RS232 port of the PC is shielded. It is connected to Com 1.
The smart card used with the GemEasyLink / Access 3xx contactless reader, is a Contactless Smart Card Philips D215302D, manufactured by GEMPLUS. The Power supply block used to power the GemAirLink/Access 3xx contactless reader, is a HITRON mod: HER048-316 block, for 230V/50Hz and 120V/60Hz.
As shown in Figure#1, all interfaces cables used for compliance testing are shielded as normally supplied. All these cables are normally recommended to be used with the Personal Computer.

1.1.4 Configuration of tested system



1.2 Conducted emission data

1.2.1 Test procedure

The product has been tested according to ANSI C63.4-1992 and FCC PART15, Subpart C, Section 15.207.

The product has been tested with 120V / 60Hz power line voltage and compared to the FCC PART 15, Subpart C, Section 15.207 limits. Measurement bandwidth was 9kHz from 450 kHz to 30 MHz.

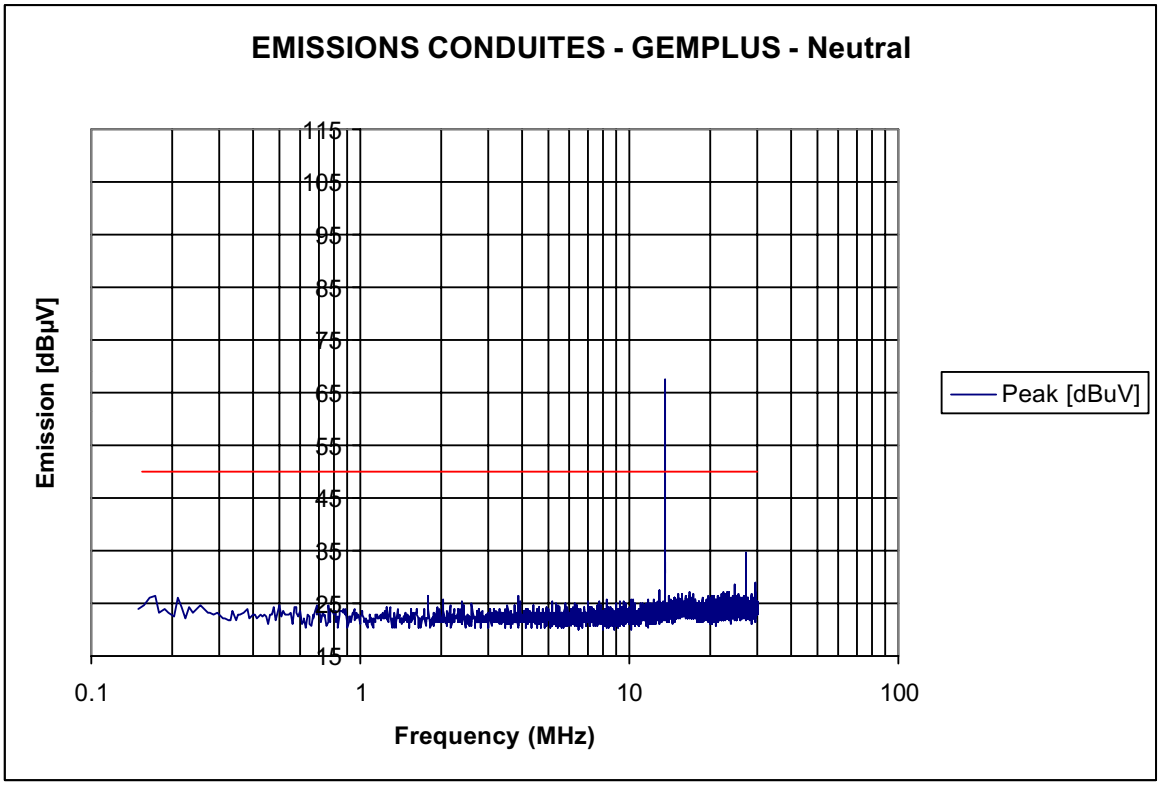
Measurement was initially made with an HP-8591EM Spectrum Analyzer in peak mode. This was followed by a Quasi-Peak, i.e. CISPR measurement with the Rohde&Schwarz ESH3 receiver for any strong signal. An Average measure has also been performed on peak exceeding the limit of 250µV.
The Peak data are shown 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.

The13.56 MHz frequency, which is the fundamental frequency, exceeds the level when tested in normal configuration. In order to show that the product's electronic isn't the cause, we had performed an other test, with the product wrapped up in a conductive aluminium foil (the antenna of the product is integrated in the board, and cannot be replaced by a dummy load). In this configuration, results are FCC compliant; Graphs are shown hereafter.

Test equipment :
HP 8591EM Spectrum Analyzer
Rhode & Schwarz ESH3 Receiver
EMCO 3810/2SH LISN N°1 (50Ω/50microhenry LISN measure)
TELEMETER NNB-2/16L LISN N°2

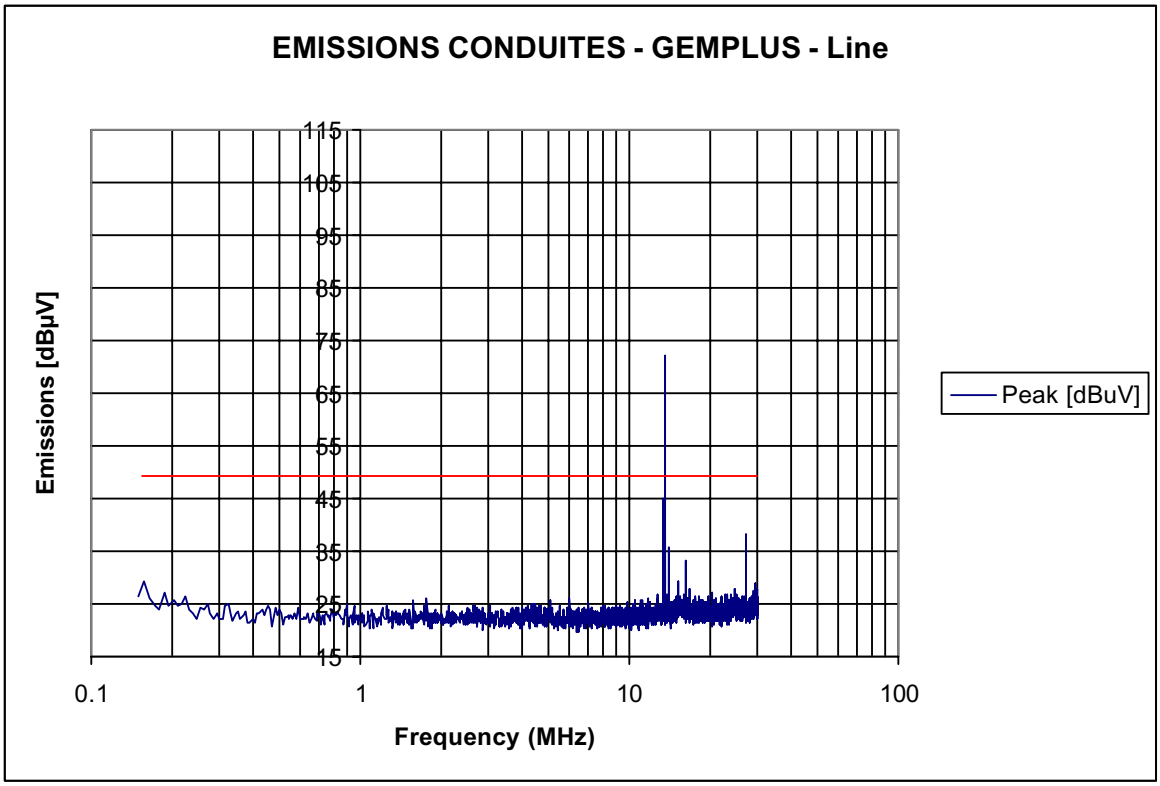
1.2.2 Neutral conducted emission data on GemEasyLink / Access 3xx contactless reader



Num.	Freq. [MHz]	Peak [dBµV]	Q-Peak [dBµV]	QP limit [dBµV]	***QP delta [dBµV]***	Average [dBµV]
1	13.57	67.93*	67.59	48	**+19.59**	63.15
2	27.12	37.97	35.15	48	**-12.85**	32.51

* : carrier frequency

1.2.3 Line conducted emission data on GemEasyLink / Access 3xx contactless reader

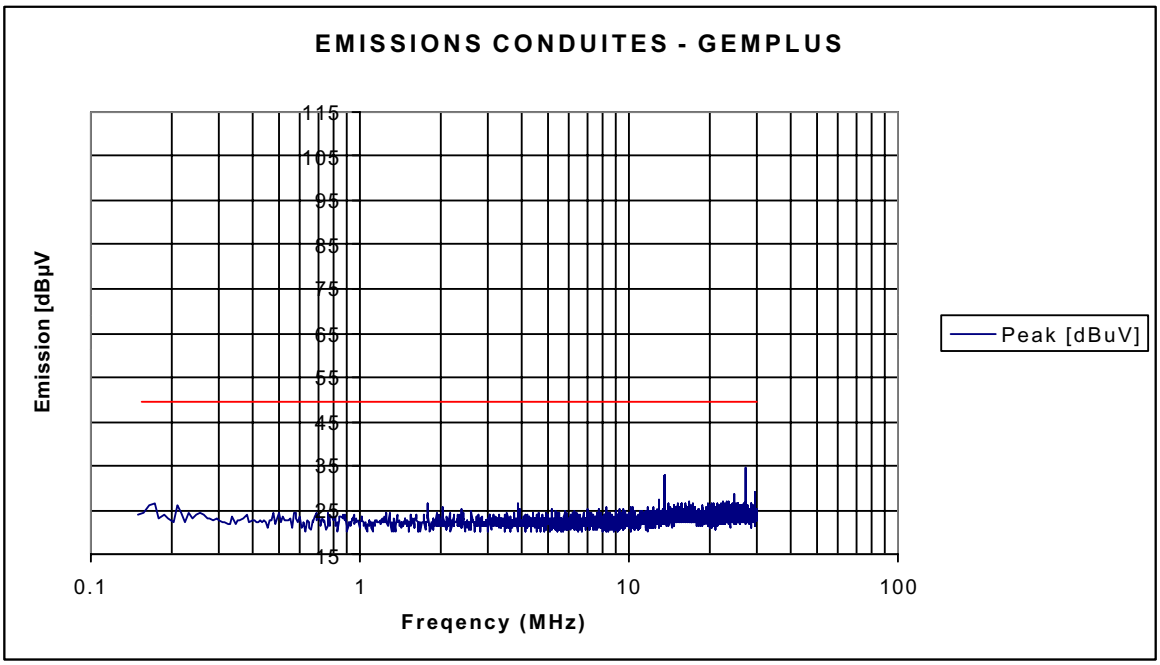


Num.	Freq. [MHz]	Peak [dBµV]	Q-Peak [dBµV]	QP limit [dBµV]	***QP delta [dBµV]***	Average [dBµV]
1	13.44	48.66	36.04	48	**-11.96**	14.78
2	13.57*	72.64	72.12	48	**+24.12**	68.02
3	27.12	43.40	41.20	48	**-6.8**	36.00

* : carrier frequency

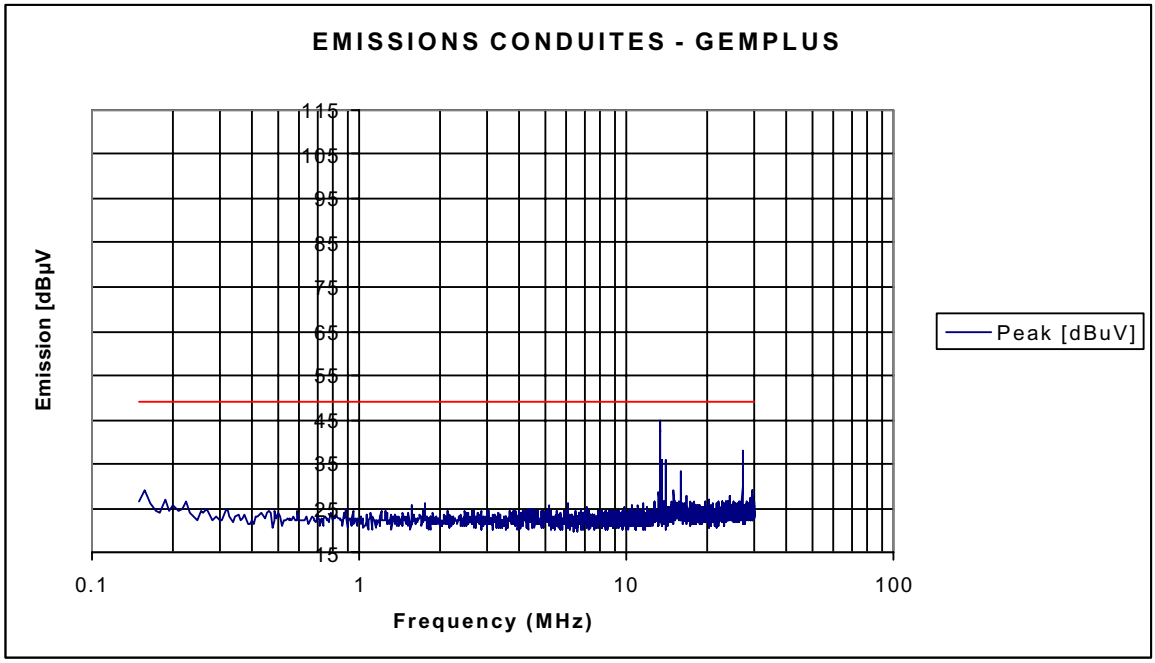
1.2.4 Neutral conducted emission data on GemEasyLink/Access 3xx contactless reader

The product is wrapped up in a conductive aluminium foil



1.2.5 Line conducted emission data on GemEasyLink /Access 3xx contactless reader

The product is wrapped up in a conductive aluminium foil



1.3 RADIATED EMISSION DATA

1.3.1 Test Procedure (15.225)

The product has been tested according to ANSI C63.4-1992 and FCC PART15, Subpart C, Section 15.225.

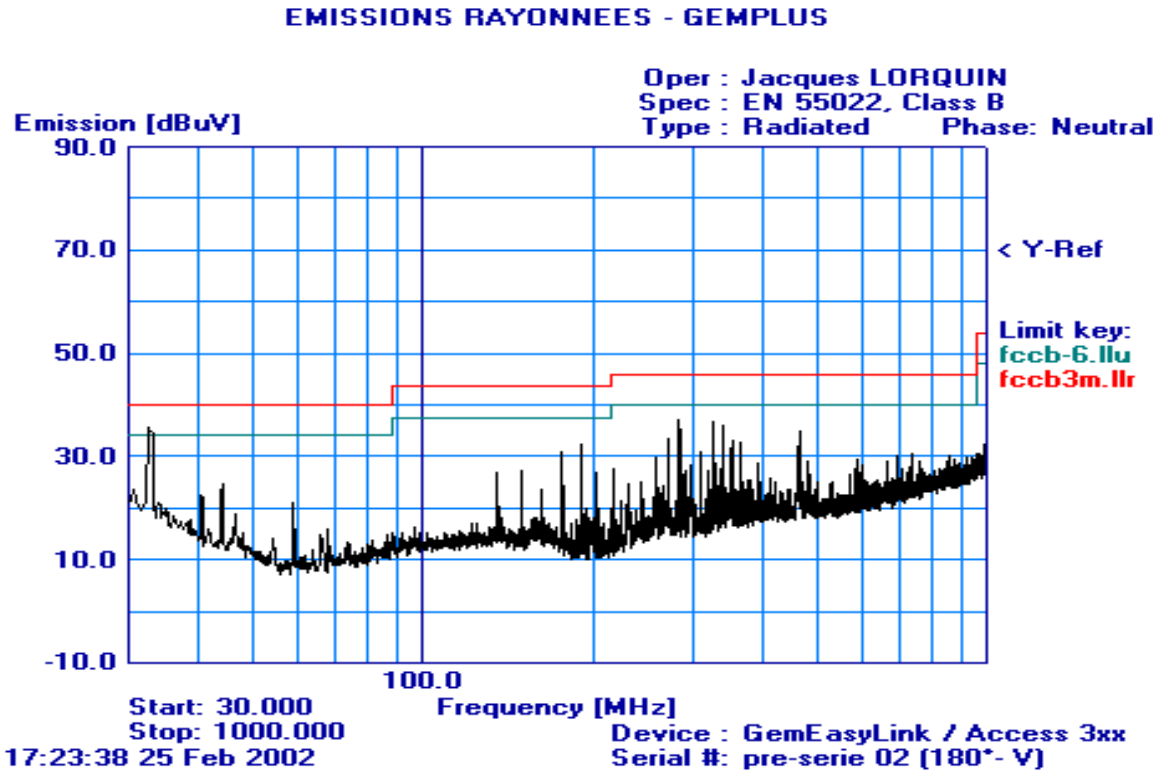
The product has been tested with 230V / 50Hz power line voltage, at a distance of 3 meters from the antenna and compared to the FCC PART15, Subpart C, Section 15.225 limits. Measurement bandwidth was 120 kHz from 30 MHz to 1 GHz, and 9kHz below 30 MHz. Requirements of 15.209 e) have been observed.
Above 30MHz, 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.

Below 30MHz, a loop antenna has been used in 2 polarization (horizontal and vertical axis), according provisions of ANSI C63.4 (measurements distance is 10 meters and then extrapolated to 30 meters). 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.

Test Equipment: HP-8574A E.M.I Receiver
HP-8568B Analyzer + HP-85650 Quasi-Peak adapter + HP-85685A RF Preselector.
EMCO 3104C Biconical Antenna & EMCO 3146 Log Periodic Antenna
EMCO-1050, 6 meters height antenna mast & EMCO-1060, 3 meters diameter Turntable.
HP-8591EM Spectrum analyzer
CHASE CBL6111A Antenna, 30-1000MHz
SIDEN - TELEC loop antenna, 150kHz-30MHz

1.3.2 Radiated emission data (15.209) from 30 to 1000MHz

Final result 30-1000 MHz

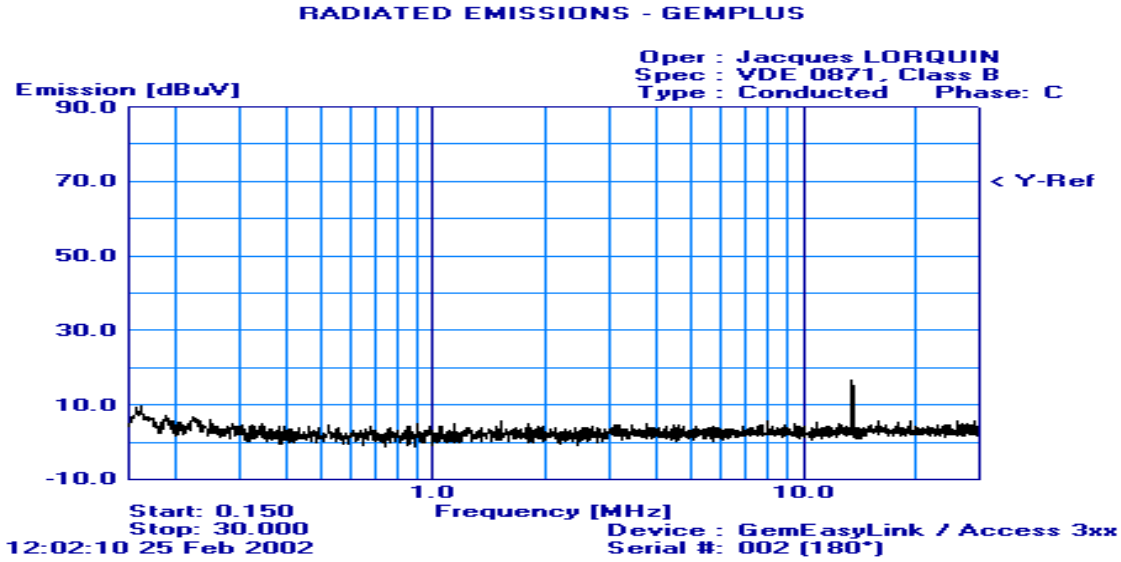


Graph example - 30-1000MHz

Frequency (MHz)	QPeak Lmt (dBµV/m)	QPeak (dBµV/m)	QPeak-Lmt (dB)	Angle (deg)	Pol	Hgt (cm)	Tot Corr (dB)
33.204	40	35.8	-4.2	131	V	128	12.4
135.590	43.5	37.3	-6.2	270	H	384	15.1
149.162	43.5	31.2	-12.3	177	V	104	15.6
162.736	43.5	37.5	-6	77	V	104	17.6
176.299	43.5	39.1	-4.4	84	V	110	18.4
189.844	43.5	38.9	-4.6	275	V	108	19.3
203.396	43.5	35.6	-7.9	246	V	122	14.1
216.979	46	38.7	-7.3	278	V	104	14.4
230.549	46	36.7	-9.3	267	V	102	14.8
244.056	46	41.0	-5	329	V	103	15.1
271.222	46	44.8	-1.2	175	V	123	16.3
284.752	46	43.0	-3	203	V	103	16.9
325.442	46	38.4	-7.6	351	V	316	18.0
339.023	46	39.5	-6.5	3	V	109	18.2
352.577	46	39.3	-6.7	37	V	106	18.4
366.097	46	40.4	-5.6	20	V	353	18.7
420.364	46	40.1	-5.9	272	V	102	19.6

1.3.3 Radiated emission data (below 30MHz) using a loop antenna

- **Final result below 30 MHz**



Graph abstract – below 30MHz (3 meters measurements in full anechoic chamber)

- **Final result below 30 MHz measured on open site at 10 meters using loop antenna.**

Due to the levels measured at 3 meters in full anechoic chamber, only the fundamental frequency has been measured on the open site.

Frequency (MHz)	QPeak Lmt (dBµV/m)	QPeak (dBµV/m)	QPeak-Lmt (dB)	Angle (deg)	Pol	Hgt (cm)	Tot Corr (dB)
13.56*	90	49.86	-40.14	272	Vertical	123	35.5

* Fundamental frequency measured at 10 meters

1.3.4 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 dBµV/m

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

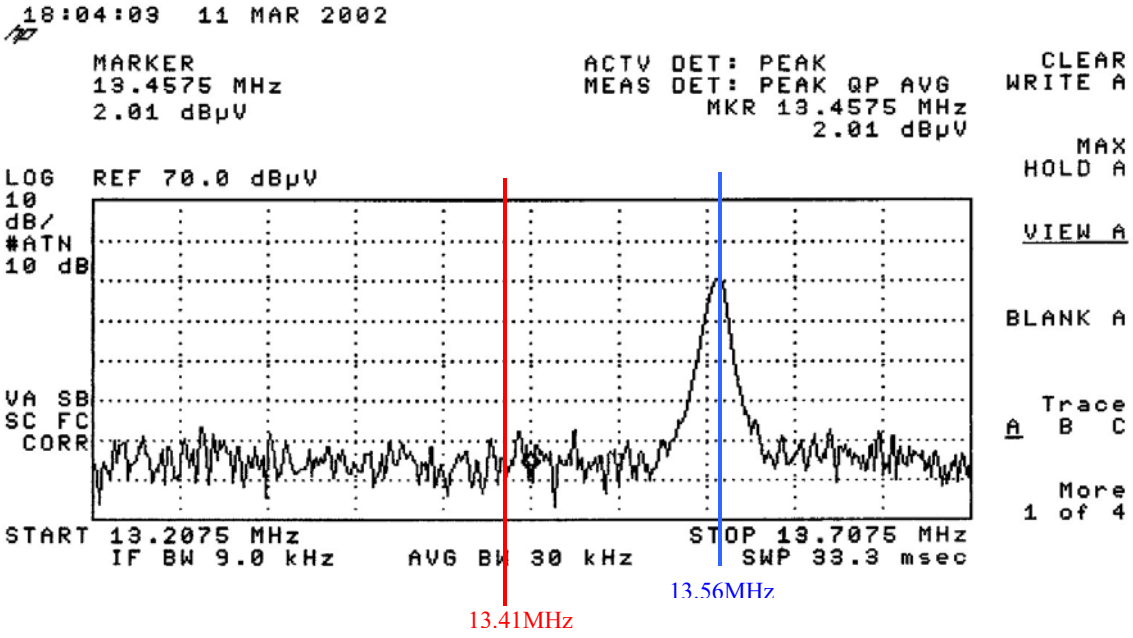
Level in µV/m = Common Antilogarithm [(32dBµV/m)/20] = 39.8 µV/m.

1.4 Fundamental field strength (15.225.a)

Fundamental frequency	Measured level	Limit level (at 30m)
13.56 MHz	**99µV/m**	10000µV/m

1.5 Occupied bandwidth

Here is a plot of the occupied bandwidth, which show that , 13.36MHz - 13.41MHz restricted band is free of spurious emission.



1.6 Fundamental frequency tolerance (15.225.c)

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

1.6.1 Voltage fluctuation

Power supply has been set at 85% and 115% of nominal voltage, at 20°C.
Frequency of carrier: 13.56 MHz
Upper limit: 13.561356 MHz
Lower limit: 13.558644 MHz

Voltage	10.2Vdc	12Vdc	13.8Vdc
Frequency (MHz)	13.560065	13.560098	13.560048
Result	Pass	-	Pass

1.6.2 temperature

Temperature has been set at –20°C and +50°C at nominal voltage (12Vdc).
Frequency of carrier: 13.56 MHz
Upper limit: 13.561356 MHz
Lower limit: 13.558644 MHz

Voltage	-20°C	20°C	+50°C
Frequency (MHz)	13.560050	13.560098	13.560165
Result	Pass	-	Pass