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EMC LABORATORY

Report No: MCK/03/053 Issue 3 **Issued:** 2nd December 2003

Equipment under Test: 1900MHz UMTS Compact iBTS

Client name: Celestica Limited

Written by: ....John H. Davies.....

Authorised by: ..Trevor Haworth.....

Report copy No **Test Dates:** 13th-18th November 2003

Test Location: Celestica EMC Test Site
Kidsgrove

PRODUCT RECEIVED: 13/11/2003 **DESPATCHED:** 19/11/2003

Celestica Limited Kidsgrove EMC Facility is included under the EC Conformity Assessment Bodies list of Conformity Assessment Bodies under column "EC access to the US market" in Section V of the Sectoral Annex on Electromagnetic Compatibility (EMC). Relating to EC Decision No 3/2000 of the Joint Committee established under the Agreement on Mutual Recognition between the European Community and the United States of America related to the listing of Conformity Assessment Bodies under the Sectoral Annex on Telecommunication Equipment and the Sectoral Annex on Electromagnetic Compatibility (EMC). The facility is FCC listed, as a Conformity Assessment Body (CAB), and is a UKAS Accredited Laboratory, with quality system operating in accordance with ISO 17025: 2000. (UKAS Accreditation Number: 1149).

Table of Contents

1 GENERAL INFORMATION

1.1 Applicant

Name:	Celestica Limited
Address:	West Avenue Kidsgrove Staffordshire ST71TL UK
Contact:	Mr M Wilshaw
Telephone:	++ 44 (0) 1782 771 000 Ext 4725

1.2 Manufacturer

Nortel Networks
Parc d'activité de Magny Châteaufort
78929 Chateafort Cedex 9
FRANCE

1.3 Circulation List

Copy 1	Mr M.Wilshaw (Celestica Limited)
Copy 2	Mr M.Wilshaw (Celestica Limited)
Copy 3	Celestica EMC Lab File.

2 INTRODUCTION

This document presents the evaluation and conformance Test Report for a 1900MHz, UMTS Compact Base Transceiver Station in accordance with Federal Communications Commissions CFR 47 Part 15, Subpart B, Class B and CFR 47 Part 24, Subpart E (Personal Communications Services).

The Equipment Under Test (EUT) was a Nortel UMTS Compact iBTS. The test results reported in this document relate only to the item that was tested.

All measurements were conducted in accordance with ANSI C63.4-2001 Methods of Measurement of Radio Noise-Emissions from Low-Voltage Electrical Equipment dated 2000. The instrumentation used for the measurements conforms to ANSI C63.4 standard for EMI and Field Strength Instrumentation. Calibration checks are performed regularly on the instruments and all accessories including antenna preamplifier and cables.

All radiated emission measurements were performed manually following preliminary investigations in a semi anechoic chamber.

The radiated emissions required were performed on the 3 to10-meter test site at: Celestica Limited, West Avenue, Kidsgrove Staffordshire UK. The open-field test site is located out-of-doors in the open field. The radiated emissions test site is a concrete base on which sits the ground reference plane, which comprises of 0.5" mild steel plates continuously, welded together. The site has a 10 feet diameter remotely controlled EMCO turntable with its wiring to the control structure routed in PVC conduit underground. The site also has 1050 EMCO antenna mast. The turntable is enclosed in a 16 feet wide hexagonal Fiberglass structure, which is 10 feet high.

Site attenuation for radiated measurements had been determined for this test site using the method described in CISPR 16/ANSI C63.4-2000 Paragraphs 5.4.6 and sub paragraphs. The measured NSA's were within the specified +/-4dB of the theoretical NSA for an ideal test site.

3 MEASURING EQUIPMENT LIST

Description	Manufacturer	Model	Serial No	Calibration Date
RECEIVERS				
Receiver	CHASE	UHR 4000	6066	July 03
Spectrum Analyser	Agilent	E4407B	MY414074	Oct 03
Specrum Analyser	HP	85462E	3549A00160	Aug 03
Filter Section	HP	85460A	3427A00155	Aug 03
ANTENNAS				
Bilog	CHASE	CBL6111	2052	May 03
Horn (Double Ridged)	AH Systems	SAS-2001571	291	May 03
Horn (Standard Gain)	EMCO	3160-09	0004 -1204	Aug 03

4 TESTED SYSTEM DETAILS

The equipment tested was a -48v dc powered Base Transceiver Station for Universal Mobile Telecommunications System also considered as Information Technology Equipment. The Equipment provides Personal Communications Services in the 1930 - 1990 MHz frequency band.

5 EQUIPMENT DESCRIPTION

5.1 EUT DESCRIPTION

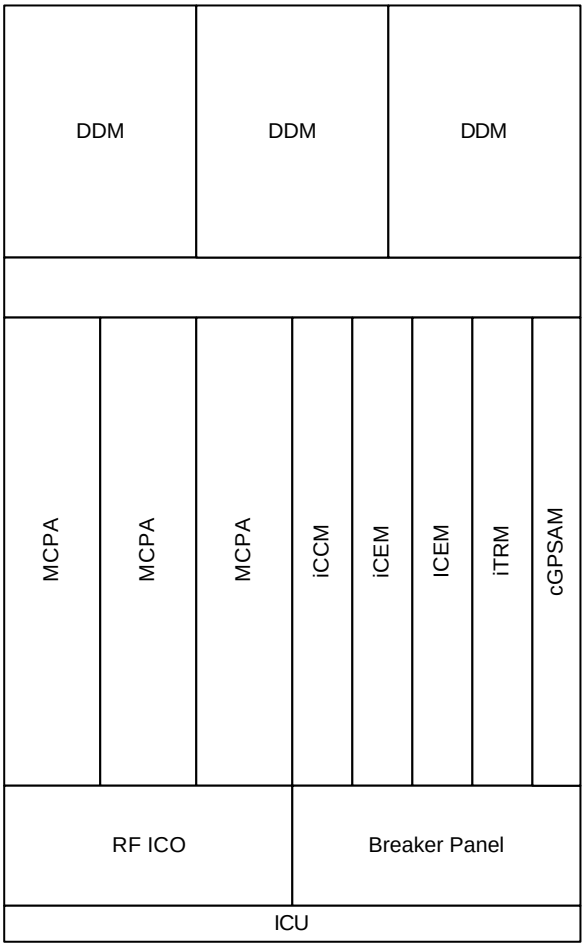
5.1.1 EUT Identification/Condition

Product Name:	1900MHz UMTS Compact iBTS
Serial Number:	Frame Number: 0D/3
Manufacturer:	Nortel Networks Parc d'activité de Magny Châteaufort 78929 Chateafort Cedex 9 FRANCE
Condition:	No damage, good condition

5.1.2 EUT Photograph

5.1.3 EUT Detailed Information

The following physical representation and table details the features of the EUT.



Module	PEC Code	Release	Serial Number	Comment
ITRM 1900	NTUM17BA	D1-DER AC 03 06 046	CDN200327011	136.147.37.169
ICCM Shelf	NTUM26AA	D1	CDN200247007	136.147.33.143
ICCM Board	NTUM25BA	D2	SLR200247007	
ICEM 128	NTUM00DA	D1	CDN200306027	136.147.33.109
ICEM 128	NTUM00DA	D2	CDN200316023	136.147.33.109
CGPSAM	NTA520AA	D1	NNTM7503LXHJ	
MCPA 1900	NTUM30PA	D2	PWWT03DC0N8W	Firmware 1.17
MCPA 1900	NTUM30PA	D2	PWWT03D97J8N	Firmware 1.17
MCPA 1900	NTUM30PA	D2	PWWT03DC0NF7	Firmware 1.17
DDM 1900	NTUM42AA	D1	FORM01428021	
DDM 1900	NTUM42AA	D1	FORM01428022	
DDM 1900	NTUM42AA	D1	FORM01428019	
Digital Shelf	NTA535EA	01	SNMN7500C84L	
Interco	NTA525AA	01	ANMN7500C5X3	
CICU	NTA535AA	No label with hardware release and serial number		
MCA	NTA536EA	No label with hardware release and serial number		

5.2 EUT Exercising Test Conditions

Measurements were undertaken in transmitter mode (all transmitters at maximum power 45 watts). The system is configured as follows using remote support equipment:
The PC is connected to the debug LAN and communicates with the EUT using TCP/IP. The Nortel PI Bench software executes sequences to configure the base station with the correct operating parameters. When fully configured, the LAN is disconnected and the PI Bench software closed. During Testing, The RF power output cables were terminated in 50 Ohms and the T1 Cable was connected to an E1/ T1 analyser, in order to maintain communications.

5.2.1 EUT Channels Test Configuration

5.2.1.1 FCC Part 15.109

The system was configured to transmit a radio signal corresponding to test model 1 (according to the 3GPP standard (TS 25.141). 2 Carriers at maximum power, All power amplifiers running at the same frequency (Middle)

5.2.1.2 FCC Part 24.238

FCC Part 24.238 [c] states that: "When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits".
The system was configured to transmit a radio signal corresponding to test model 1 (according to the 3GPP standard (TS 25.141). 1 carrier at maximum power. All power amplifiers operating at the same frequency. Tests were performed separately at Bottom and Top frequencies.

5.2.2 EUT Exercising Software

Software Versions:
System Modules: V03E3.0E01.5
PI Bench: v03d0403

5.2.3 EUT Support Equipment Details

All Located remotely to EUT
48 volt dc supply source
T1 analyser

5.2.4 EUT Interface Cables

Cable	**PEC Code**
PCM Cable 100Ω Length: Approx 10m	NTBY60TA
DC Power Cables: Length: Approx 10m	N/A
Feeder Cable for TMA: Length: Approx 10m	
3 RF Cables (LMR400) Length: 7.5m 50Ω termination	

5.2.5 EUT Modifications

NONE

6 CONFORMANCE STATEMENT

6.1 STANDARDS REFERENCED

PART 2: 1999	Frequency allocations and Radio Treaty Matters General Rules and Regulations
PART 15: 2002	Radio frequency devices
ANSI C63.4-2001	Standard format measurements/technical report personal computer and peripherals
PART 24 Subpart E" (2000)	Broadband Personal communications services

6.2 JUSTIFICATION

As mentioned in paragraph 4 of this report, the equipment is information technology equipment providing public mobiles services and Personal Communication Services and as it may be installed in residential commercial or light industry areas the following sub clause of the standard mentioned above are: -

- Part 15.107 and 15.109 (subpart B) for respectively conducted and radiated emission.
- Part 24.238 (subpart E) for broadband PCS emission limits

6.3 CONCLUSION

The equipment complies with the above rules of the FCC.

6.4 IMPORTANT REMARK:

Even if spurious emissions were detected in the measurement, substitution method was not performed on the EUT due to the measured margin being greater than to -20dB
The EUT Plots in section 8.3.6 shows measured noise floor levels detected while testing the EUT

7 MEASUREMENTS ACCORDING TO CFR 47 Part 15 Class B

Tests were performed by Carl Wilson and witnessed by John H Davies

7.1 Test Specifications

FCC part 15 (Sub part B) §15.107 and 15.109; 2002

7.2 Additions to, Deviations or Exclusions from the Test Specifications

NONE

7.3 Conducted Emission

Not applicable the EUT is dc powered (-48volts), FCC part 15 (Sub part B) §15.107 Only specifies requirements for "digital device that are designed to be connected to the public utility (AC) power line ".

7.4 Radiated Emission

7.4.1 Test Procedures

Before final measurements of radiated emissions were made on the open-field site, the EUT was pre-scanned in the semi anechoic at one metre distance. This was done in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to ensure that maximum emission amplitudes were attained. As Part 24 radiated requirements was tested in conjunction with the Part 15 testing. The spectrum was searched to identify emissions. A complete scan of the applicable spectrum was completed (up to lOth harmonic of fundamental). The EUT was then turned off, a complete scan of the spectrum was done and referred to as "ambient". Comparing these scans identified emissions emanating from the EUT. The identified emissions (from the transmitter) were measured and the levels recorded with the transmitter keyed on at full rated power output. (45 watts)

Final radiated emissions measurements were made, as outlined in Section 8 of the ANSI C63.4 measurement standard, on the three/ten-meter, open-field test site. The EUT was placed on a nonconductive turntable 0.1 meter above the ground plane. The iBTS was tested to the applicable limits of the FCC rules. The measurement distance between the center of the measurement antenna and the equipment under test is 10 meters (or less for frequencies above 1 GHz. At each frequency, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters in order to determine the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarizations. In the frequency range 30-1000MHz the spectrum analyzer's 6dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. In the frequency range >1GHz spectrum analyzer's 6dB bandwidth was set to 1MHz. The measurements were made using a receiver incorporating a Peak and Average Detector as specified in section 1 of CISPR Publication 16. No video filter less than 10 times the resolution bandwidth was used. Readings were measured using a measurement time of 1 second and an observation time > 20 seconds. The range of the frequency spectrum to be investigated is specified in FCC Part 15. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

7.4.2 **RESULTS (§ 15.109 class B):**

The following data tables lists the most significant emission frequencies, Field Strength which is the sum of measured level and correction factors (both cable and antenna corrections) limit and margin to the limit. The highest peaks are measured in quasi-peak detection mode at 10 meters distance, except for emissions radiated above 1 GHz where average and peak detectors with 1 MHz resolution bandwidth were used.

TABLE 1: 30-1000MHz

Freq MHz	Az deg	Ht cm	Pol V/H	Field Strength dBµV/m @ 10m	FCC part 15 Class B Limit dBµV/m @ 10m	Margin To Spec. dB
48.000	264	100	V	17.1	30.0	12.9
117.015	170	100	V	29.5	33.0	3.5
147.100	109	100	V	20.3	33.0	9.7
157.305	300	100	V	28.8	33.0	4.2
198.100	151	100	V	25.2	33.0	7.8
200.000	125	100	V	27.1	33.0	5.9
894.600	336	100	V	30.0	36.0	6.0

Note: The EUT meets the specification limits

TABLE 2: >1GHz

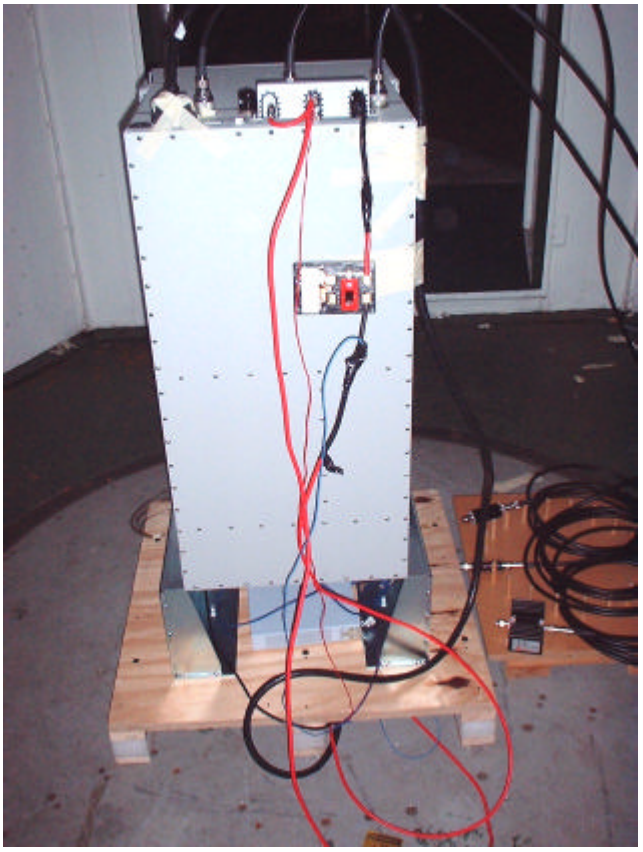
Freq GHz	Az deg	Ht cm	Pol V/H	Field Strength dBµV/m @ 3m		FCC part 15 Class B Limit dBµV/m @ 3m		Minimum Margin To Spec. dB
				Peak	Average	Peak	Average	
1.022	335	1.00	V	48.4	33.6	74.0	54.0	20.4
1.150	320	1.10	V	51.3	42.6	74.0	54.0	11.4
1.278	351	1.05	V	50.7	34.3	74.0	54.0	19.7
1.406	0	1.00	V	49.2	34.3	74.0	54.0	19.7
1.661	21	1.10	V	52.9	40.5	74.0	54.0	13.5
1.789	214	1.05	V	52.9	43.3	74.0	54.0	9.7

Only the above spurious signals were found, with an attenuation close to - 20dB below the limit , no other spurious signal found between 1.789GHz and 20 GHz
Note: The EUT meets the specification limits

TABLE 3: >1GHz. For indicative purposes only

Freq GHz	Az deg	Ht cm	Pol V/H	Field Strength dBµV/m @ 3m		Comments
				Peak	Average	
1.956	240	100	V	61.3	56.9	Transmitter
1.964	336	105	V	60.8	56.5	Transmitter

7.4.3 Photograph of Measurement Set-Up



7.4.4 Test Equipment Used

Description	*Serial Number*
HP 8542E EMI Receiver	3549A00160
HP 85420E RF Filter Section	3427A00155
Chase UHR 4000 Receiver	6066
Bilog Antenna (30 - 1000MHz) Chase CBL6111B	2052
Antenna Cable (pre Scan Only)	CABLE 03 & CABLE 07
Antenna Cable (<1GHz)	CABLE 09
Antenna Cable (>1GHz)	CABLE SMA1
Bird Attenuator 8034 (<300MHz)	01
Agilent Analyser E4407B	MY414074
AH Systems Horn Antennae SAS-200/571	291
EMCOStandard Gain Horn Antennae 3160-09	0004-1204

7.4.5 **INTERPRETATION AND REMARKS**

The equipment complies with the requirements **(§ 15.109 class B):**

8 MEASUREMENTS ACCORDING TO CFR 47 Part 24 Subpart E

Tests were performed by Carl Wilson and witnessed by John H Davies

8.1 Test Specifications

FCC part 24 (Sub part E) § 24.238 and FCC part 2 § 2.1053

8.2 Additions to, Deviations or Exclusions from the Test Specifications

NONE

8.3 Radiated Disturbance

8.3.1 Test Procedures

Before final measurements of radiated emissions were made on the open-field site, the EUT was pre-scanned in the semi anechoic at one metre distance. This was done in order to determine its emissions spectrum signature. Final measurements are done at 3m in an open area test site and maximum at all frequencies is analyzed by moving the product orientation and antenna polarization. The height of the antenna can vary from 1 m to 4 m

Measurements are done in transmitter mode (transmitters at maximum power 45Watts)

8.3.2 Transmitter Results

Measurement at transmitters' frequency for indicative purposes

Transmitter outputs connected to 50ohm resistive loads

The following data tables lists the most significant emission frequencies, Field Strength which is the sum of measured level and correction factors (both cable and antenna corrections) limit and margin to the derived limit.

Table1 1.9324GHz (bottom of band)

Freq GHz	Az deg	Ht cm	Pol V/H	Field Strength dBµV/m @ 1m	FCC part 24 Derived Limit dBµV/m @ 1m	Margin To Spec. dB
1.932377	315	100	H	74.0	93.9	19.9

Table 2 1.9876GHz (top of band)

Freq GHz	Az deg	Ht cm	Pol V/H	Field Strength dBµV/m @ 1m	FCC part 24 Derived Limit dBµV/m @ 1m	Margin To Spec. dB
1.986448	310	100	H	77.6	93.9	16.3

8.3.3 Spurious Emission Measurements (peak values) at D = 1m

Measurements were made according to the procedure outline in ANSI C63.4
The emissions were investigated up 20 GHz.
The measured level of the emissions was recorded and compared to the limit.
The reference level for spurious radiation was taken with reference to an ideal dipole antenna excited by the rated output power according to the following relationship:

E = 1/R x sqrt 30 x P x G

Where,
E = Field Strength in Volts/meter,
R = Measurement distance in meters,
P = Transmitter Rated Power in Watts (45 Watts), G= Gain of ideal Dipole (linear)

Therefore

E (V/m) = sqrt 30 x 45 x 1.64

E = *47V/m* = 153.44 *dBuV/m*

The spurious emissions must be attenuated by at least 43 +10*Log(45) := 59.5dB.
Therefore the field strength limit at 1 metre is:
E= 153.44 *dBuV/m* - 59.5 dB = 93.9 *dBuV/m*

8.3.3.1 Spurious Emission Results Transmitter

The following data tables lists the most significant emission frequencies, Field Strength which is the sum of measured level and correction factors (both cable and antenna corrections) limit and margin to the derived limit. Only Two spurious emissions, both of which were harmonics of the transmitters' frequency, were found within 20 db of the limit.

Table1: 1.9324GHz (bottom of band)

Freq GHz	Az deg	Ht cm	Pol V/H	Field Strength dBµV/m @ 1m	FCC part 24 Derived Limit dBµV/m @ 1m	Margin To Spec. dB
5.79750	315	100	H	70.5	93.9	23.4
7.72930	315	100	H	70.8	93.9	23.1

Table2: 1.9876GHz (top of band)

Freq MHz	Az deg	Ht cm	Pol V/H	Field Strength dBµV/m @ 1m	FCC part 24 Derived Limit dBµV/m @ 1m	Margin To Spec. dB
5.96203	225	100	H	73.0	93.9	20.9
7.95047	200	100	V	72.0	93.9	21.9

8.3.4 Test Equipment Used

Description	*Serial Number*
HP 8542E EMI Receiver	3549A00160
HP 85420E RF Filter Section	3427A00155
Bilog Antenna (30 - 1000MHz) Chase CBL6111B	2052
Antenna Cable (pre Scan Only)	CABLE 03 & CABLE 07
Antenna Cable (<1GHz)	CABLE 09
Antenna Cable (>1GHz)	CABLE SMA1
Bird Attenuator 8034 (<300MHz)	01
Agilent Analyser E4407B	MY414074
AH Systems Horn Antennae SAS-200/571	291
EMCO Standard Gain Horn Antennae 3160-09	0004-1204

8.3.5 **INTERPRETATION AND REMARKS**

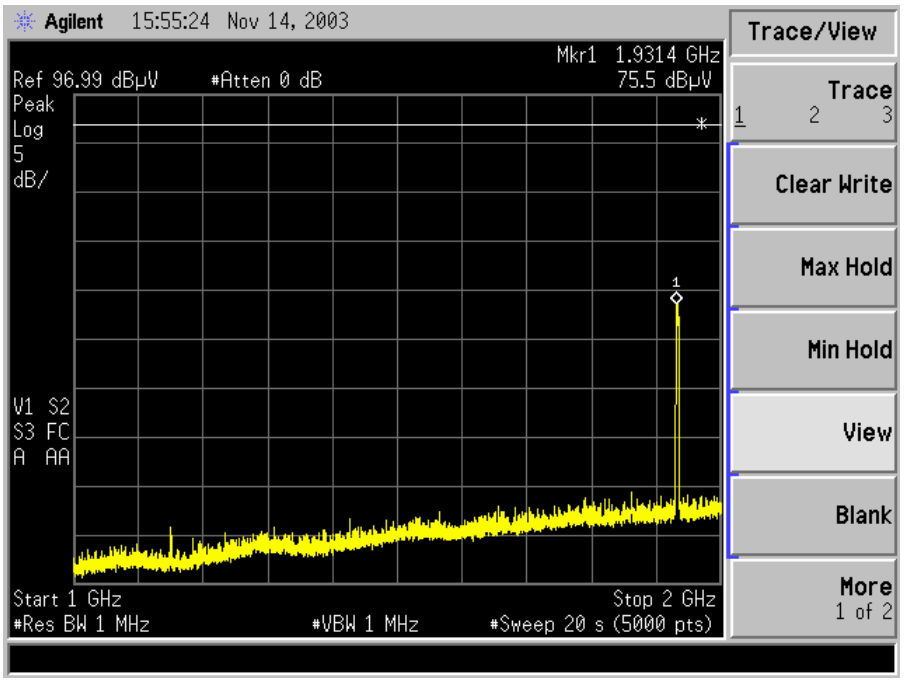
The equipment complies with the **§ 24.238 requirements**

8.3.6 **Spectrum Analysis**

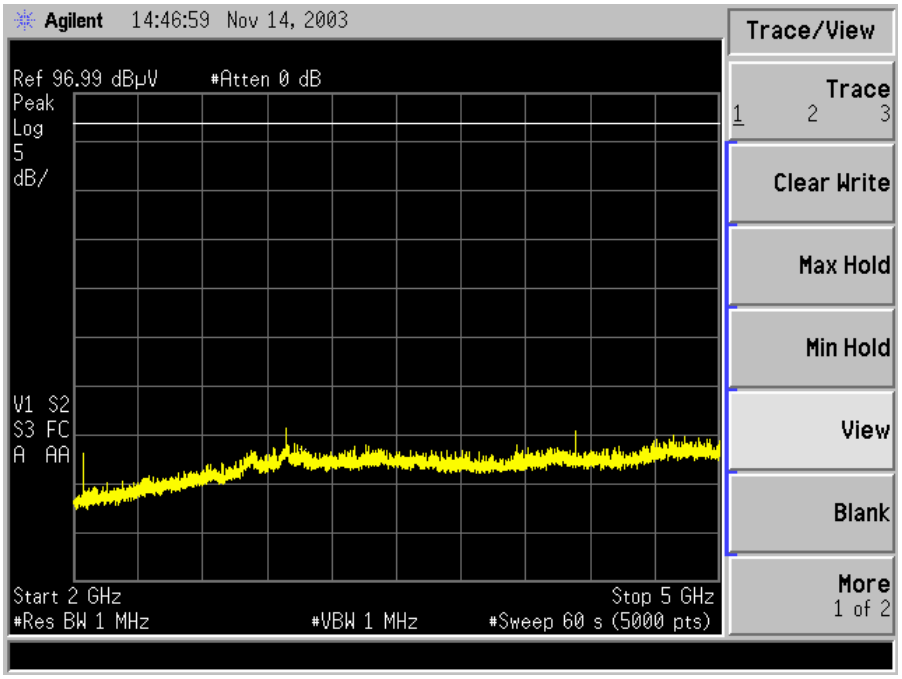
The following spectrum scans were undertaken at a measurement distance of 1metre, 360 degree rotation, both vertical and horizontal polarisations and height scans in an semi anechoic chamber. They include antenna and cable loss factors. The following pages depict the scan results.

Transmitter 1.9324GHz Plots

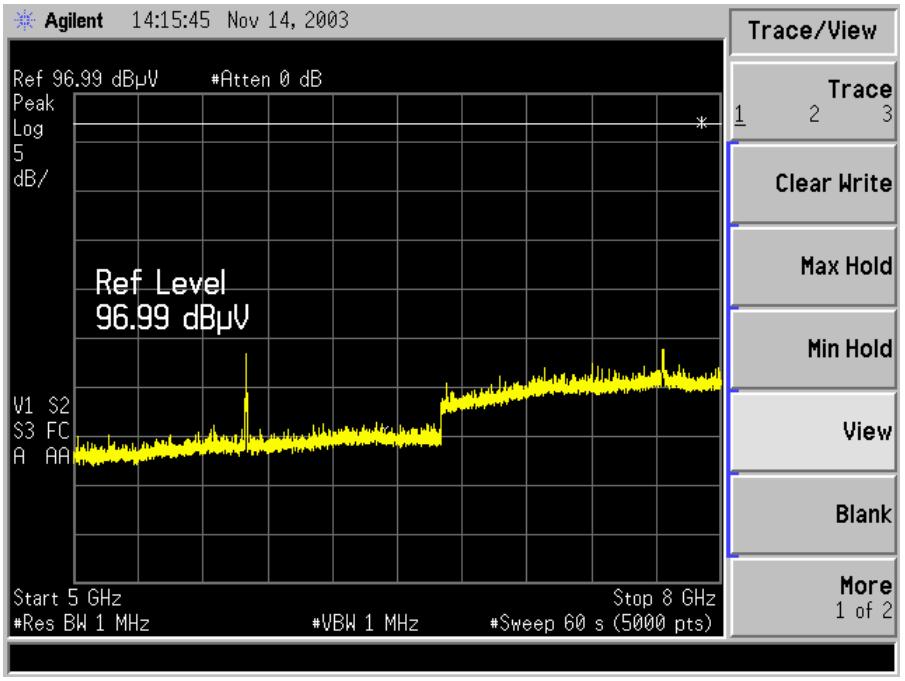
1-2 GHz

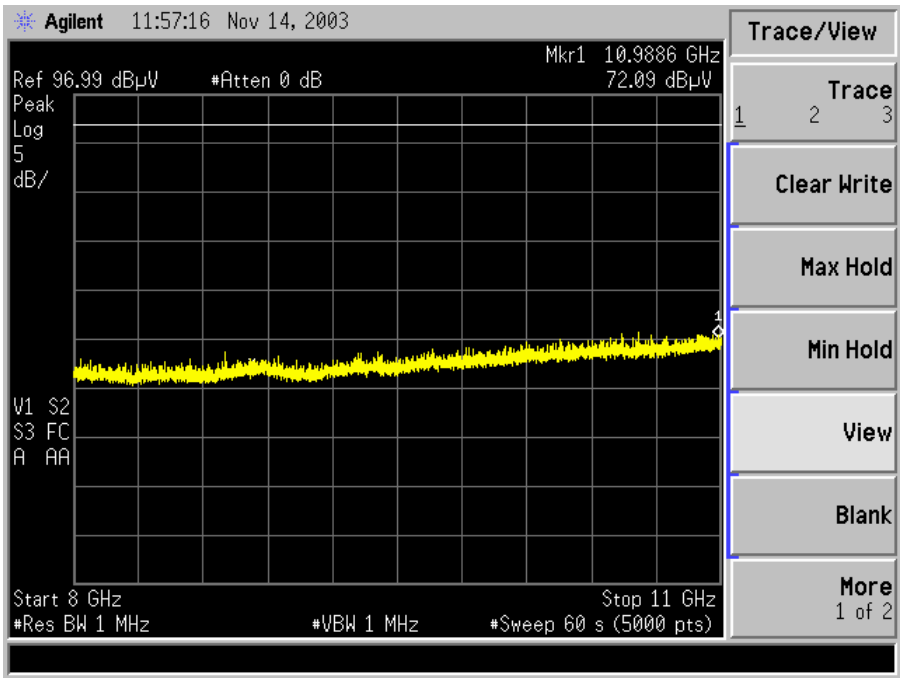


2-5 GHz

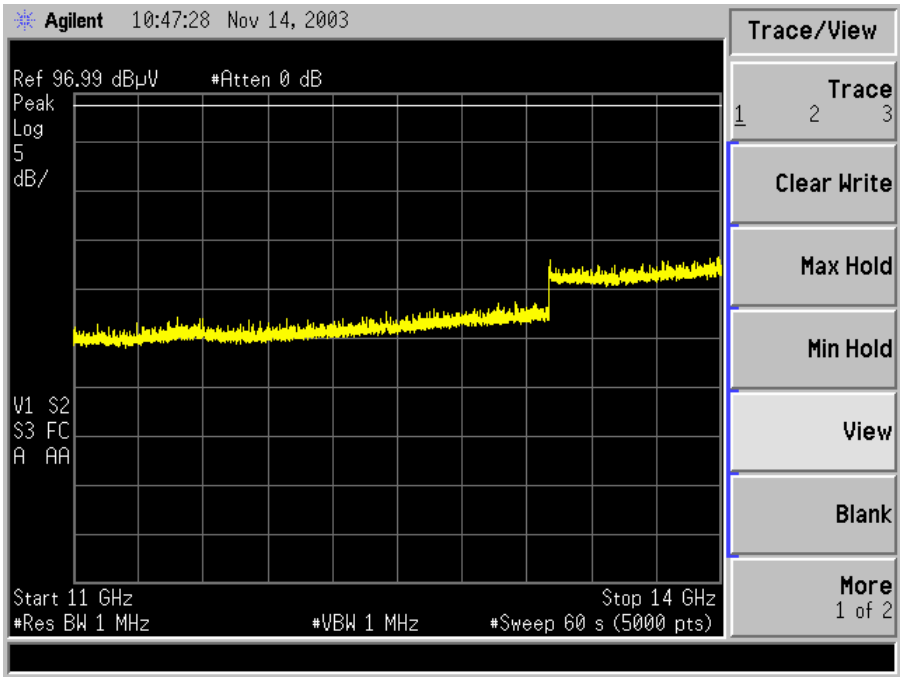


5-8 GHz

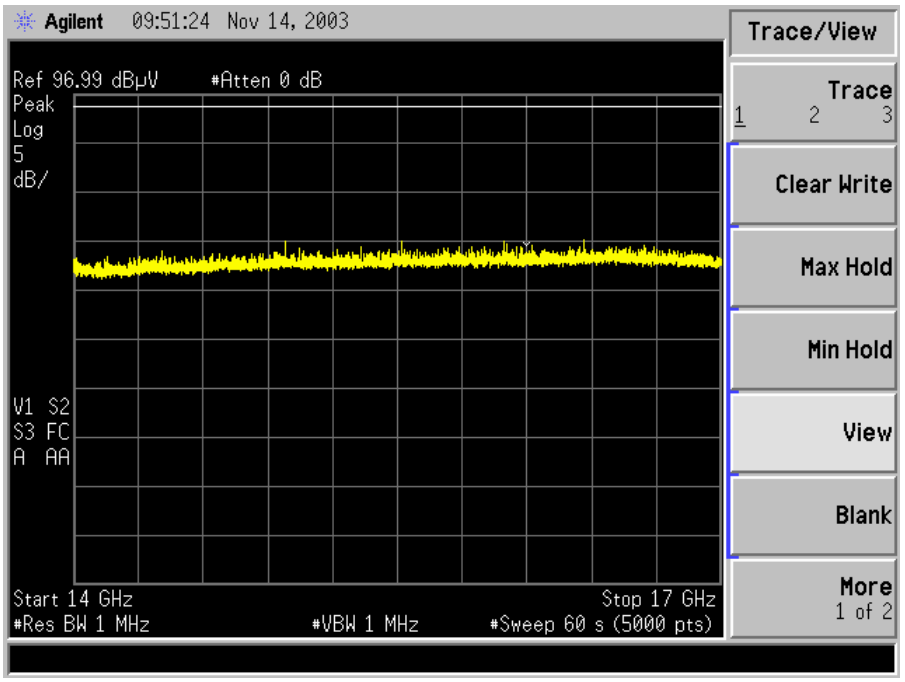




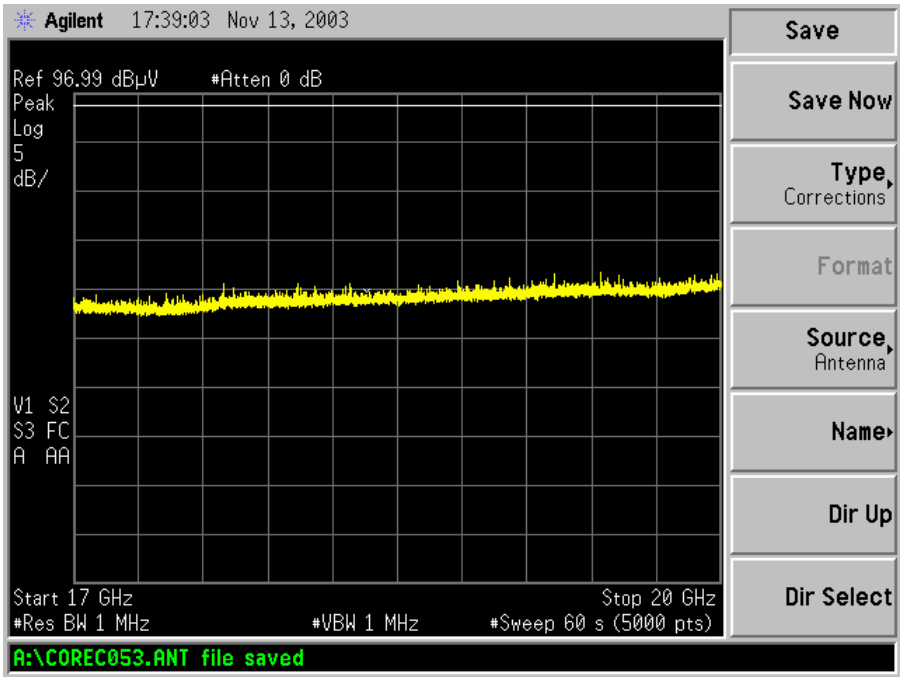
8-11 GHz



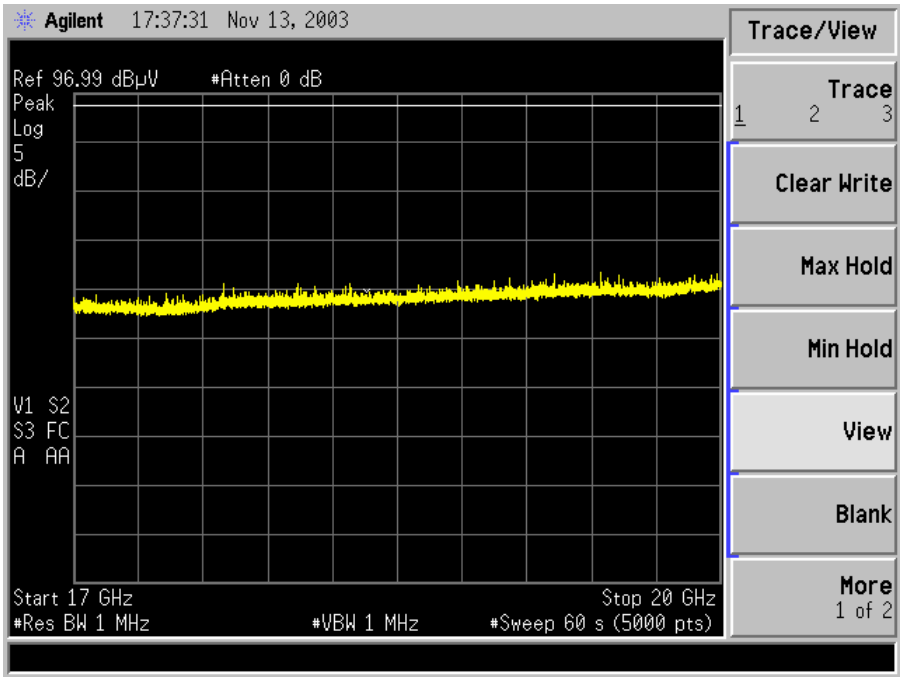
11-14 GHz



14-17 GHz

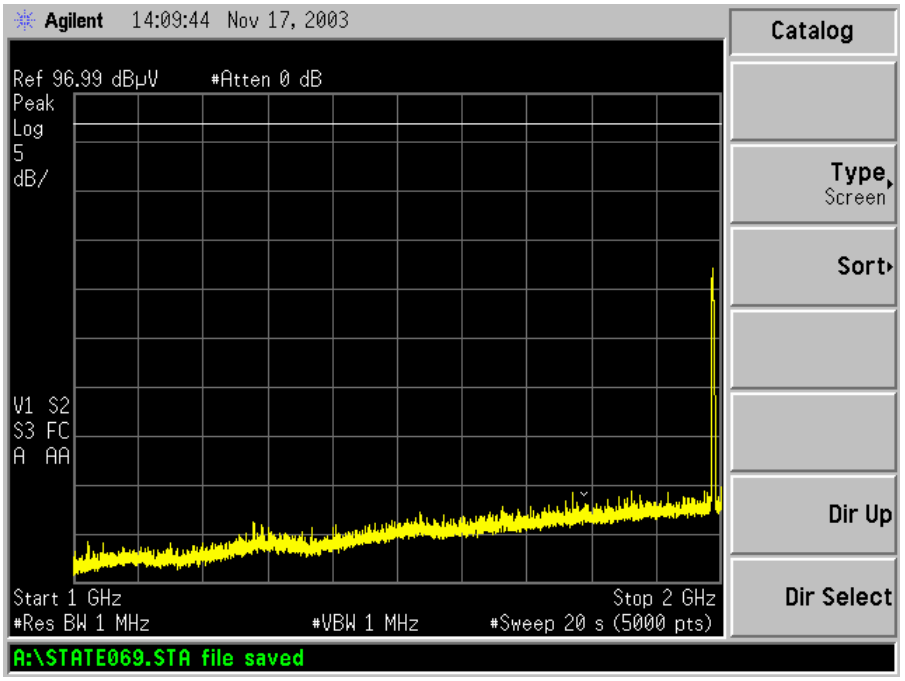


17-20 GHz (Horizontal polarisation only)

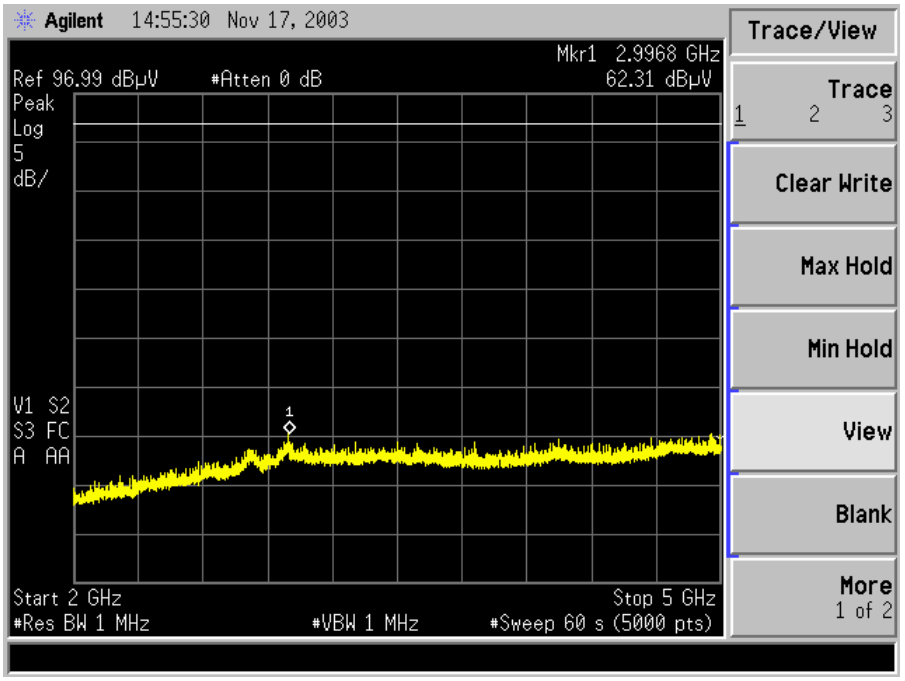


17-20GHz (Vertical polarisation only)

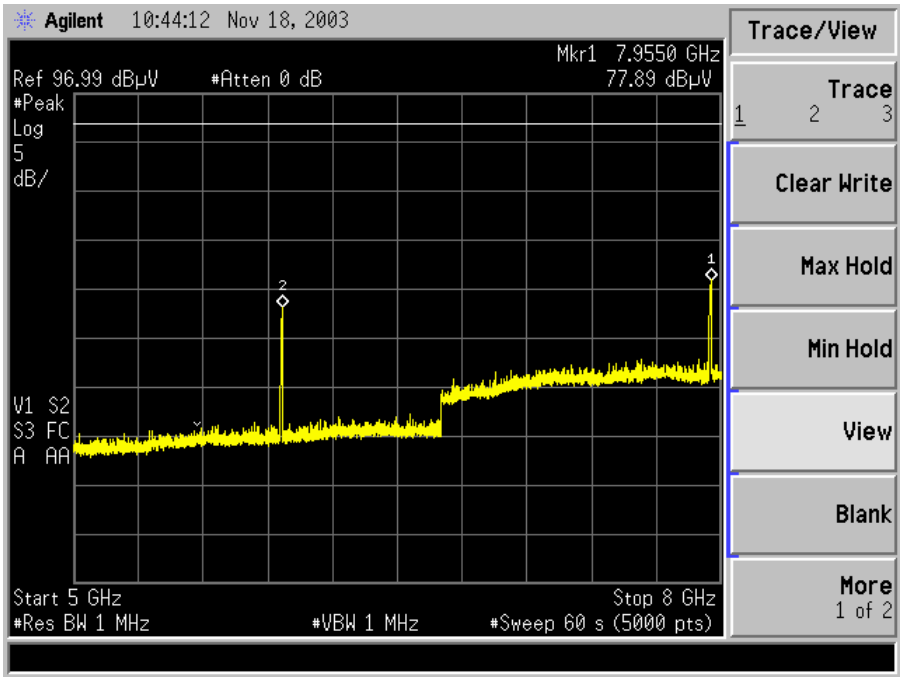
Transmitter 1.9876GHz Plots



1-2 GHz

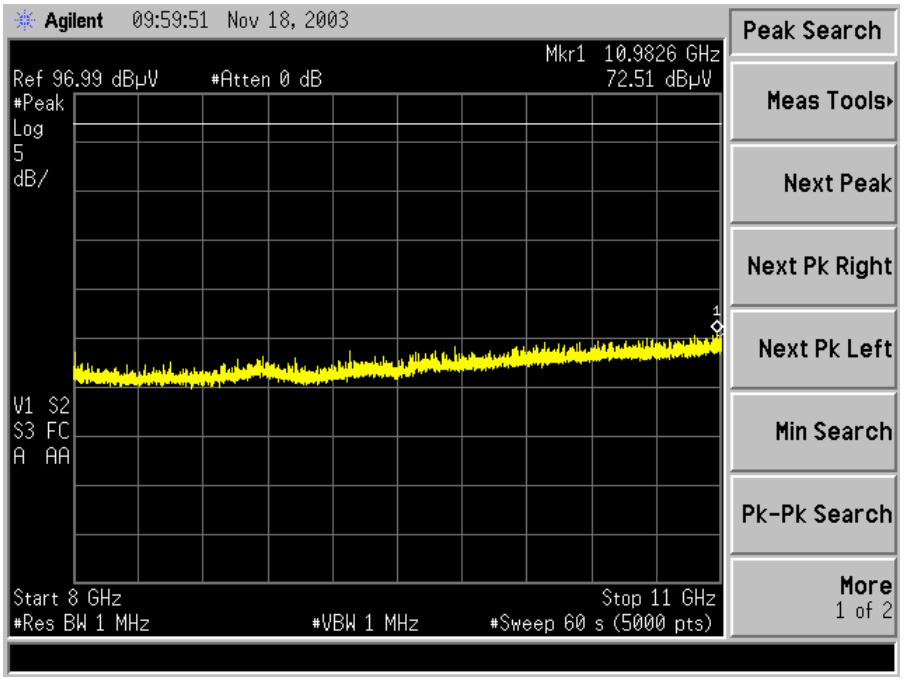


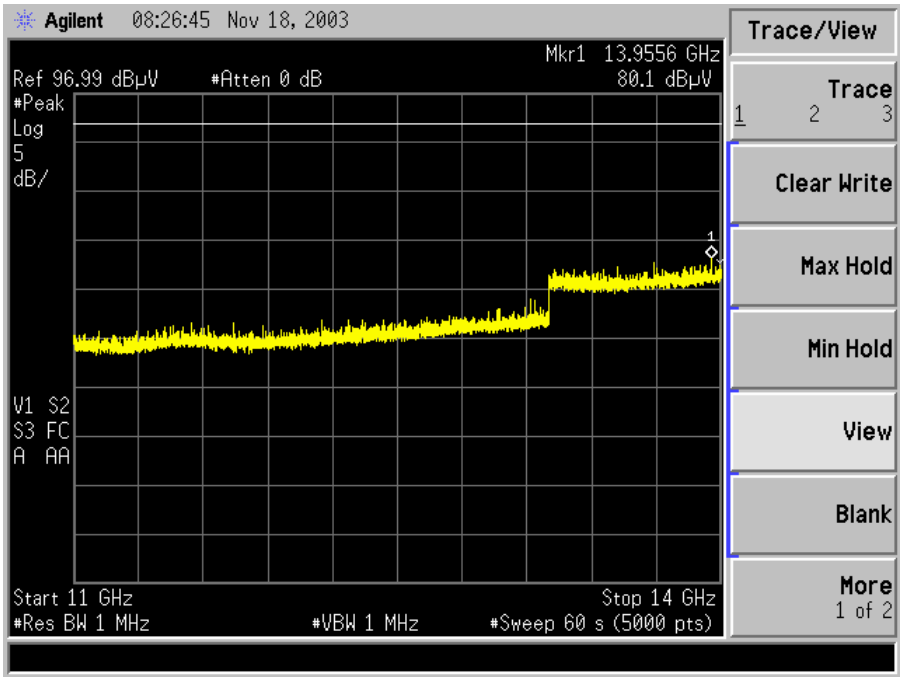
2-5 GHz



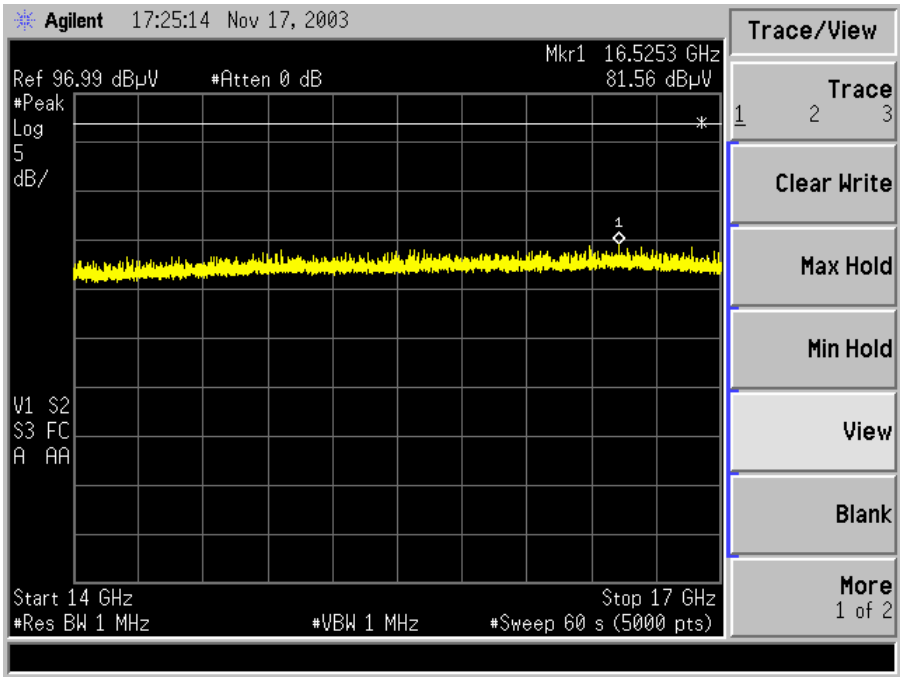
5-8 GHz

8-11 GHz



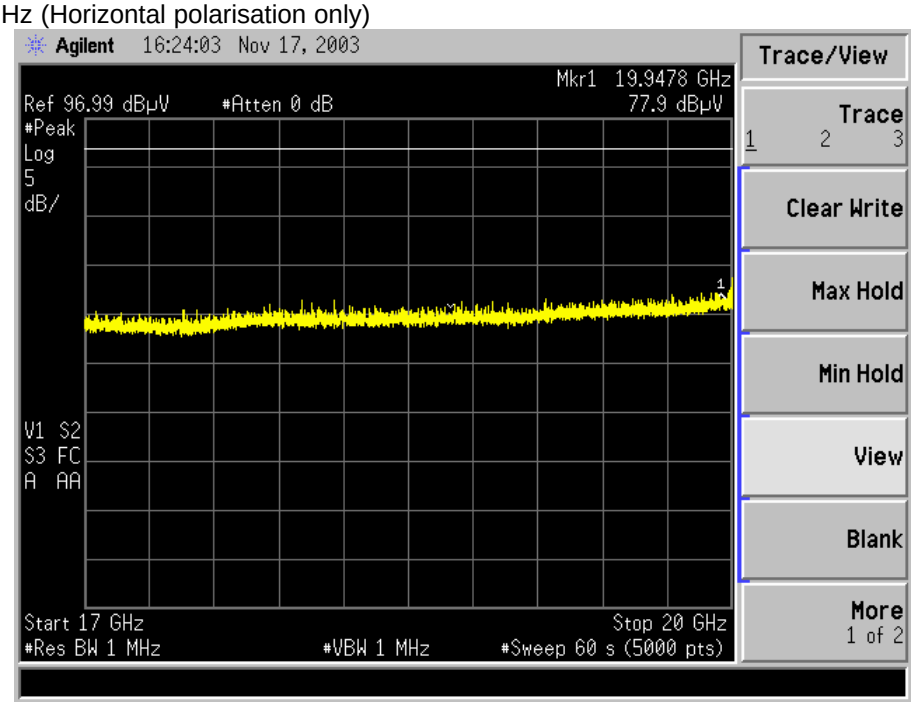


11-14 GHz



14-17 GHz

17-20 GHz (Horizontal polarisation only)



17-20GHz (Vertical polarisation only)