TEST REPORT

In support of the Application for Grant of Equipment Authorization of the NBT144G
GSM 1900 pico Base Station to FCC Part 24

FCC ID: QGGKU02ZZT

Report No RO611102 Revision 1 August 2003

TÜV PRODUCT SERVICE

BABT

TUV Product Service Ltd, Segensworth Road, Titchfield
Fareham, Hampshire, United Kingdom, PO15 5RH
Tel: +44(0)1329 443459, Fax: +44(0)1329 443331
www.tuvps.co.uk

Equipment:	GSM 1900 pico Base Station
Model Number:	NBT144G
FCC ID:	QGGKU02ZZT
Specification:	47 CFR 2 & 47 CFR 24
Applicant and Manufacturer:	ip access Limited Melbourn Science Park Melbourn Cambridge SG8 6HQ
Manufacturer's Representative:	Dr N Johnson
APPROVED BY	**M JENKINS** Wireless Group Leader
DATED	**19th August 2003**
Start of Test:	14th May 2003
Completion of Test:	26th May 2003

DISTRIBUTION	ip access Limited	Copy 1
	TÜV Product Service	Copy 2
		Copy No

ENGINEERING STATEMENT

I ATTEST: the measurements shown in this report were made in accordance with the procedures indicated, and that the emissions from this equipment were found to be within the applicable limits. I assume full responsibility for the accuracy and completeness of these measurements. On the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Part 2, Part 15 and Part 24 of the FCC Rules under normal use and maintenance.

S.A. Bennett
Test Engineer

A. Guy
Test Engineer

CONTENTS:-

For copyright details see Page 57 of 57

Introduction

The information contained within this report is intended to show verification of compliance of the ip access Limited NBT144G GSM 1900 pico Base Transmitter Station, to the requirements of 47 CFR 2 and 47 CFR 24.

Test Location

All testing was conducted at the premises of BABT, Segensworth Road, Fareham, Hants, PO15 5RH. Testing at BABT was carried out by BABT Personnel, S Bennett and A Guy, Test Engineers. Radiated Emissions measurements were performed in a 3 metre semi-anechoic screened room. A complete room description is on file with the FCC Laboratory Division, Registration Number: 90987.

Test Equipment and Ancillaries Used For Test

No	Instrument/Ancillary	Type	Manufacturer	Serial No.	Cal Due
1	Power Supply	6644A	Agilent	MY40000284	T/U
2	DVM	175	Fluke	80120493	14/1/04
3	Spectrum Analyser	FSEM	Rohde & Schwarz	827156/006	16/12/03
4	Attenuator	23-10-34	Weinschel	BG4169	30/5/03
5	Signal Generator	ESG 4000A	Hewlett Packard	GB37040125	21/1/04
6	Signal Generator	8673B	Hewlett Packard	2417A00437	
7	High Pass Filter	INV4468	Sematron UK Ltd	0012	T/U
8	Network Analyser	8510A	Hewlett Packard	2607A01624	
9	S Parameter Test Set	8514A	Hewlett Packard	2615A01567	
10	Climatic Chamber	VM 04/100	Hers Votch	-	19/6/03
11	Frequency Counter	53181A	Hewlett Packard	KR9120300	27/6/03
12	Attenuator	HFP - 50N	Texscan	-	
13	EMI Receiver	8542E	Hewlett Packard	3617A00165_00154	13/12/03
14	Bilog Antenna	CBL 6143	Chase	-	11/4/04
15	Turntable & Controller	HD 050	HD Gmbh	050-396	TU
16	Antenna Mast	2070	EMCO	-	TU
17	Antenna Mast Controller	2090	EMCO	-	TU
18	Screened Room 5			-	TU
19	Low Noise Amplifier (1-8GHz)	AMF-3D-001080-18-13P	Miteq	-	TU
20	Spectrum Analyser	ESIB	Rohde & Schwartz	-	4/2/04
21	Horn	3115	EMCO	96964848	29/6/03
22	Horn	3115	EMCO	97015079	29/6/03
23	Signal Generator	8672A	Hewlett Packard	2016A01097	26/2/04
24	PAD	6534-3	Marconi	2954	TU
25	8-18 GHz Amplifier	18036	CU Wave/Avantek	F13365 8452	TU

26	18-26 GHz Amplifier	21677-33	Avantek	6669	TU
27	Signal Generator	2031	Marconi	119748061	23/8/03
28	Filter	F100-3000-SR	RLC Electronics	-	TU

Table 1

Note(s)

1) All items are calibrated annually, except where labelled T/U (Traceability Unscheduled). These items are calibrated within the test configurations using calibrated equipment.
2) Throughout the test report the test equipment used for each test is referenced using the number indicated in the table above (1 to 28).

Customer's Equipment Inventory

ip access Ancillary Equipment used to exercise equipment during testing.

Instrument/Ancillary	Type	Manufacturer	Serial No.
Nokia MS	6310	Nokia	-
Nokia MS	6310	Nokia	-
Monitor	5710	Compaq	158749
PC	Deskpro	Compaq	000047
Keyboard	KNI	Compaq	KNI
Mouse	KNI	Compaq	KNI
Ethernet Switch PSU	126A	ip access	N/S
Ethernet Switch PSU	10924601	PPI for ip access	N/S (spare)
Cables (various)	-	-	-
BTS	1900 BTS	ip access	00024700

Table 2

Description of Equipment Under Test Configuration

The Pico-cell BTS was configured in a test mode to simulate worst case operating conditions. As the unit is self contained, there are no plug in options as with a normal BTS. Thus, there are no external hardware options such as duplexors, combiners etc. For conducted tests, the supplied antenna was disconnected to allow for direct connection to the transmitter output port. The supplied antenna is not replaceable by the user under normal conditions. It's connection is only accessible by opening the EUT. Under Radiated conditions, the supplied antenna was connected to the RF port. The EUT was connected to a PC to allow control of the unit to set the power levels and channel frequencies, which are described in each of the test clauses. The test modes used were selected to give the worst case results for the applicable test.

The maximum power rating of the EUT, as declared by the manufacturer, is 0.2 Watts.

The EUT was tested using a 48 V DC Supply.

List of Performed Measurements

i)	Radiated Emissions	47 CFR 2.1053, 24.238
ii)	Power Output	47 CFR 2.1046, 24.232
iii)	Modulation Characteristics	47 CFR 2.1047(d)
iv)	Occupied Bandwidth	47 CFR 2.1049, 24.238(b)
v)	Band Edge Measurements	47 CFR 24.238(b)
vi)	Conducted Emissions	47 CFR 2.1051, 24.238(a)
vii)	Frequency Stability – Temperature Variations	47 CFR 2.1055, 24.235
viii)	Frequency Stability – Voltage Variations	47 CFR 2.1055(d)(1)

Test Case: Radiated Emissions

Test Date: 25th May 2003

Rule Parts: 2.1053, 24.238(a)

Measurement Method

The EUT was set up in each of the configurations listed on page 5 in turn.

A preliminary profile of the Radiated Electric Field Emissions was obtained by operating the Equipment Under Test (EUT) on a remotely controlled turntable within a semi-anechoic chamber; measurements were taken at a 3m distance. Measurements of emissions from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations. The profiling produced a list of the worst case emissions together with the EUT azimuth and antenna polarisation.

Using the information from the preliminary profiling of the EUT, a search was made in the frequency range 30MHz to 20GHz. The list of worst case emissions was then confirmed or updated. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth. Emissions levels were then formally measured. The details of the worst case emissions were then recorded in the Job Log Book. Details of the worst case emissions are presented in Tables 2 to 7. Plots 1 to 8 are taken from the receiver in max hold while the EUT was rotated through 360 degrees.

Radiated Electric Field Emissions measurements were made using a Hewlett Packard 8542E EMI Receiver in the frequency range 30MHz to 1000MHz and an Agilent E4407B Spectrum Analyser in the frequency range 1GHz to 20GHz. Measurements in the range 30MHz to 1000MHz were made using a Peak Detector in a 120kHz bandwidth and measurements above 1GHz were made using a Peak Detector in a 1MHz bandwidth.

The level of the carrier was measured as 119.0dBµV/m. The customer declared the transmit power as 0.2W.

Therefore the limit is 119.0 – (43 + 10log(0.2)) = 119.0 – 43 + 7 = 83.0dBµV/m

Test Case: Radiated Emissions (continued)

Alternative Open Area Test Site Results: The levels of the 6 highest emissions measured in accordance with the specification are presented in Table 2 below: -

Emission Frequency	Antenna		Turntable Azimuth	Level at 3m	Cable Loss	Antenna Factor	Field Strength at 3m	Specification Limit
	Polarity	Height						
MHz	H/V	cm	degree	dBµV	dB	DB	dBµV/m	dBµV/m
3936.0	H	154	170	46.8	-	33.0	59.7	83.0
12929.0	V	131	059	52.4	-	40.6	66.0	83.0
13511.0	H	140	015	46.5	-	40.5	60.3	83.0
13511.0	V	128	036	50.4	-	40.5	64.2	83.0
13774.0	V	100	153	44.9	-	41.0	60.3	83.0
13774.0	H	128	017	47.5	-	41.0	62.9	83.0

Table 3

The margin between the specification requirements and all other emissions was 23.3dB or more below the specification limit.

ABBREVIATIONS FOR ABOVE TABLE

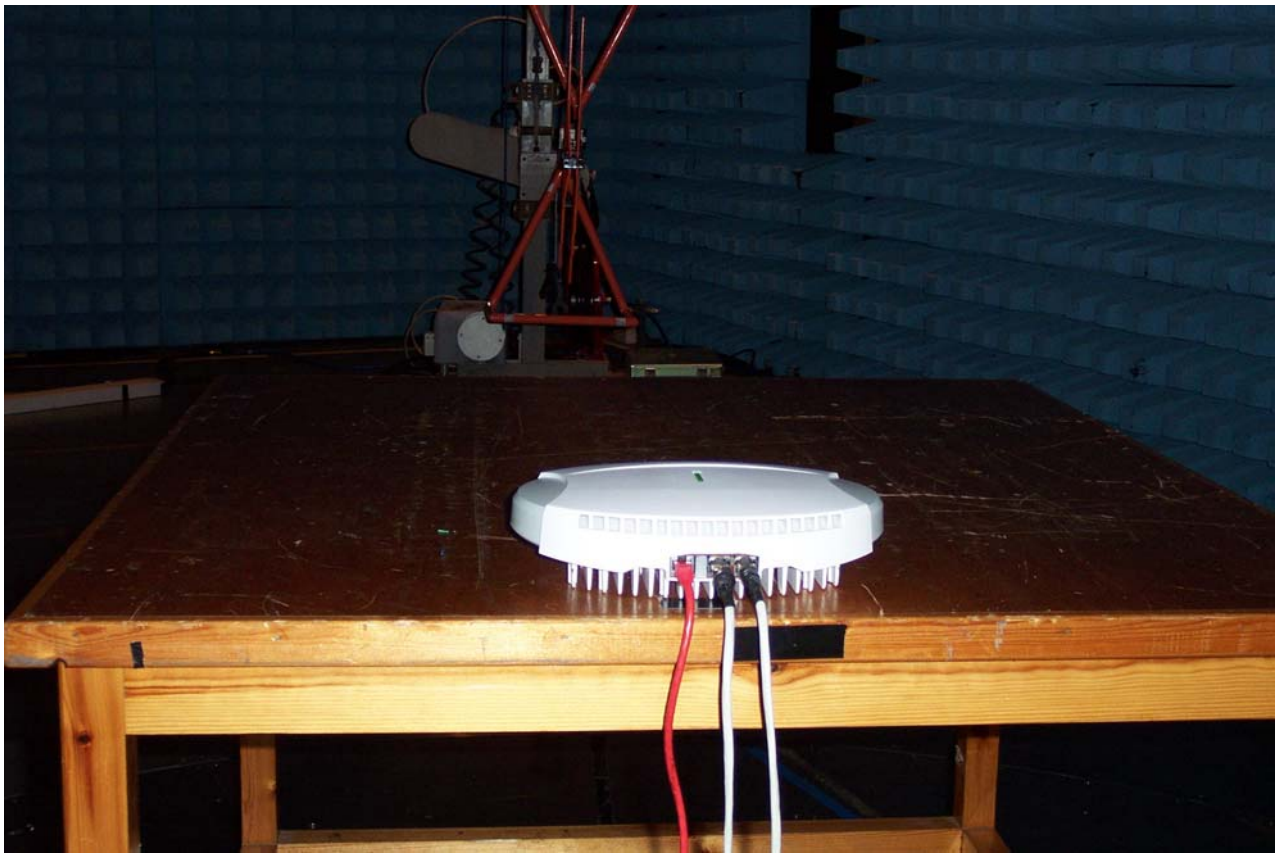
H Horizontal Polarisation V Vertical Polarisation

Procedure Test Performed in accordance with ANSI C63.4.

Test Equipment Used:

13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28

……



Photograph No 1 – Radiated Emissions – Configuration 1a

Test Case: RF Output Power

Test Date: 14th May 2003

Rule Parts: 2.1046, 24.232

Measurement Method

Using a spectrum analyser and attenuator(s), the output power of the EUT was measured at the antenna terminals.

The spectrum analyser RBW and VBW were set to 1MHz and the path loss measured and entered as a reference level offset.

Results

Power Supply 48VDC

Maximum Power - GMSK

Frequency (MHz)	Output Power (dBm)	Path Loss (dB)	Result (dBm)	Result (W)
1930.2	+12.65	10.7	+23.35	0.216
1960.0	+12.68	10.7	+23.38	0.218
1989.8	+12.84	10.7	+23.54	0.226

Power Supply 48VDC

Minimum Power - GMSK

Frequency (MHz)	Output Power (dBm)	Path Loss (dB)	Result (dBm)	Result (mW)
1930.2	-9.76	10.7	+0.94	1.242
1960.0	-9.66	10.7	+1.04	1.271
1989.8	-9.53	10.7	+1.17	1.309

Limit	<100W or <+50dBm

Remarks

EUT complies with CFR 47 2.1046 and 24.232(a). The EUT does not exceed 100W or +50dBm at the measured frequencies.

Test Equipment Used:

1, 2, 3, 4, 5

…….

Test Case: Modulation Characteristics

Test Date: 14th May 2003

Rule Parts: 2.1047(d)

Description Of Modulation Technique

The system is designed to meet the PCS requirements as defined in the 3GPP specifications: 3GPP TS 05:01, TS 05:02 and TS 05:04 are the most relevant. To summarise the system uses time division multiplexed access (TDMA) to separate eight users on a channel and frequency multiplexing for the up and down links.

There are 299 channels on a 200kHz raster. The frequency band 1930~1990MHz is allocated to the downlink and 1850~1910MHz to the uplink. The duplex frequency is 80MHz and the up and down link is offset in time by three TDMA slots.

The bit rate is 13MHz/48 (≈270.833kHz). There are 1250 bits in a frame that contains the eight slots; one of which is allocated to each user. Therefore each slot is 156.25 bits in length and lasts ≈577μs. To allow control information to be interleaved amongst the user data there is a larger data unit comprising 26 frames called a multiframe. The existence of the multiframe and the associated timing allows extra protection against data corruption by interleaving frames.

The modulation described by TS 05:04 is a differentially encoded scheme where the data are represented by phase shifts of ±π/2 over a bit period. The modulation scheme implemented is Gaussian filtered minimum shift keying (GMSK). Minimum shift keying is a special case of frequency shift keying (FSK) with a modulation index of h = 0.5. FSK is a binary modulation scheme with each of the two logical states represented by a different offset from the nominal carrier frequency.

From the well known equation

$$h = 2*Fp*Tb$$

where h is the modulation index, Fp is the peak frequency deviation and Tb is the bit period the peak frequency deviation is shown to be ≈±67.7kHz.

Minimum shift keying has a relatively wide frequency spectrum. To improve spectral efficiency Gaussian filtering is applied to modulation source resulting in a sinusoidal, rather than instantaneous, transition between the two offset frequencies determined by the modulation data and, therefore, a reduced signal bandwidth. The 3dB bandwidth of the Gaussian filter is 81.25kHz.

A complete description of the modulation and filtering is attached in the following annex.

The differentially encoded modulating data values α_i $(\alpha_i \in \{-1,+1\})$ as represented by Dirac pulses excite a linear filter with impulse response at time t defined by:

$$g(t) = h(t) * rect\left(\frac{t}{T}\right)$$

where T is the bit period and the function *rect(x)* is defined by:

$$rect\left(\frac{t}{T}\right) = \frac{1}{T} \qquad for\ |t| < \frac{T}{2}$$

$$rect\left(\frac{t}{T}\right) = 0 \qquad otherwise$$

and * means convolution. *h(t)* is defined by:

$$h(t) = \frac{\exp\left(\frac{-t^2}{2\delta^2 T^2}\right)}{\sqrt{(2\pi)}\ .\ \delta T}$$

where $\delta = \frac{\sqrt{\ln(2)}}{2\pi BT} \qquad and\ BT = 0.3$

where B is the 3 dB bandwidth of the filter with impulse response *h(t)*.

The phase of the modulated signal is:

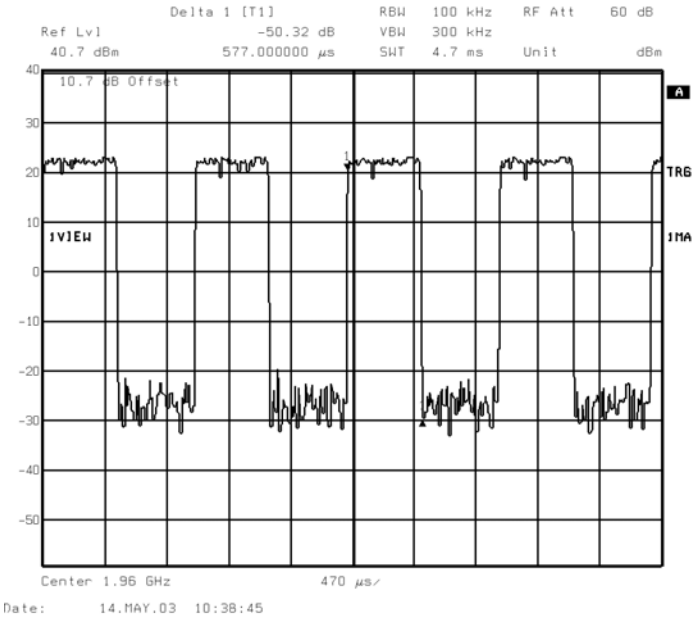
$$\varphi(t') = \sum_i \alpha_i \pi h \int_{-\infty}^{t'-iT} g(u)du$$

where the modulating index *h* is 1/2 (maximum phase change in radians is π/2 per data interval). The time reference *t′ = 0* is the start of the slot.

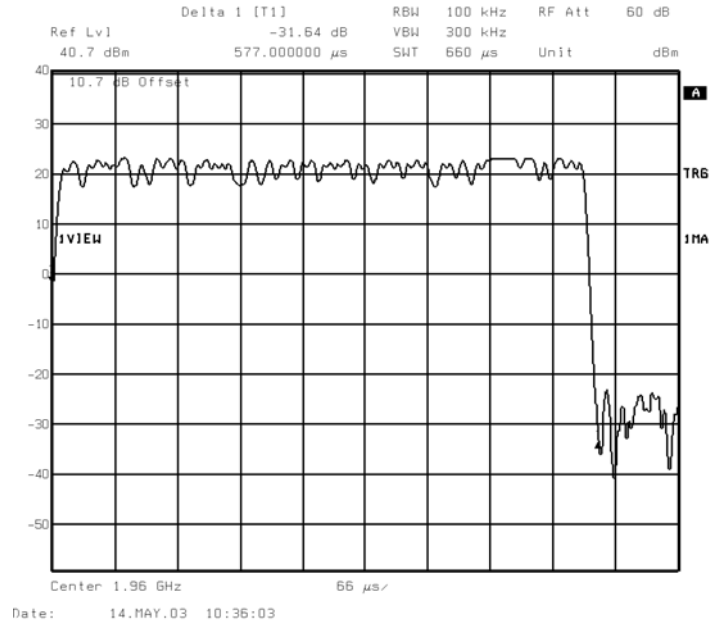
The modulated RF carrier is expressed as:

$$x(t') = \sqrt{\frac{2E_c}{T}}\ .\ \cos(2\pi f_0 t' + \varphi(t') + \varphi_0)$$

where E_c is the energy per modulating bit, f_0 is the centre frequency and φ_0 is a random phase and is constant during one burst



Plot (1)



Plot (2)

Test Equipment Used:

1, 2, 3, 4, 5

……..

Test Case: Occupied Bandwidth

Test Date: 14th May 2003

Rule Parts: 2.1049, 24.238(b)

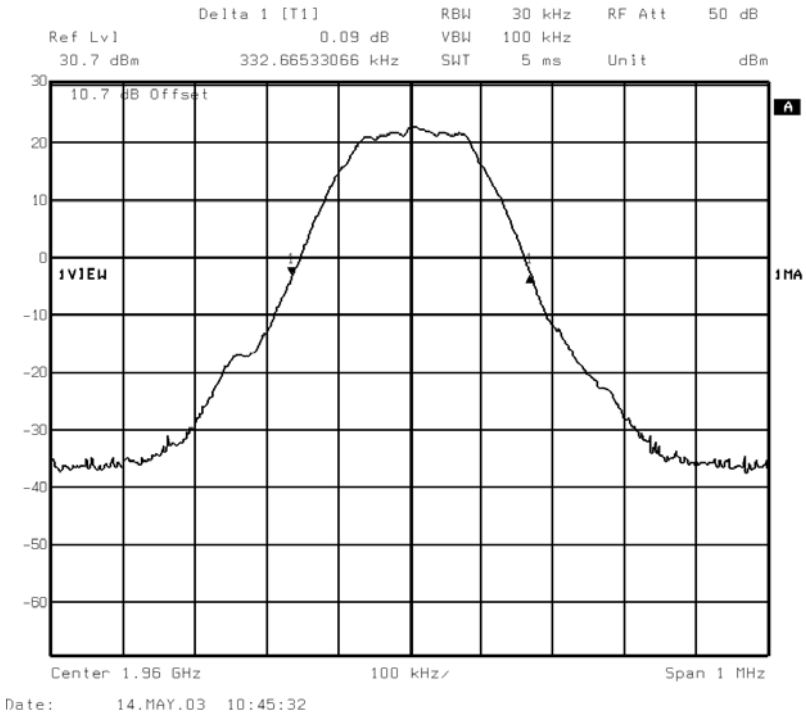
Measurement Method

The EUT was set to transmit at maximum power, modulated with all timeslots active. Using a resolution bandwidth of 30 kHz and a video bandwidth of 100 kHz, the –26dBc points were established and the emission bandwidth determined.

The plot below shows the resultant display from the Spectrum Analyser.

Occupied Bandwidth As Defined By The –26dBc Points

Maximum Power - GMSK

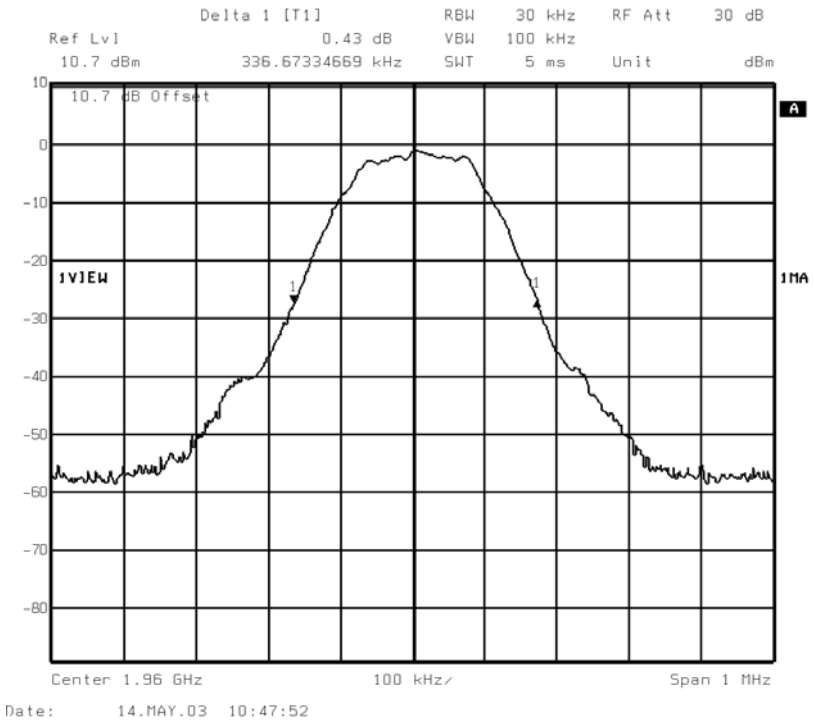


Test Equipment Used:

1, 2, 3, 4, 5

……

Minimum Power - GMSK



Test Equipment Used:

1, 2, 3, 4, 5

……

Test Case: Spurious Emissions At Antenna Terminals (+/-1MHz)

Test Date: 14th May 2003

Rule Parts: 2.1049, 24.238(b)

Measurement Method

In accordance with Part 24.238, at least 1% of the 26dB bandwidth was used for the resolution and video bandwidths up to 1MHz away from the Block Edge. At greater than 1MHz away from block edge, the resolution and video bandwidths were increased to 1MHz.

The reference power and path losses of all channels used for testing in each frequency block were measured. It was found that there was <0.3dB variation in all channels, thus the worst case reference level offset was used throughout. Having entered the reference level offset, the limit line was displayed, showing the –13dBm, (43+10logP), limit.

Below are the Frequency Blocks the EUT was tested against along with the tested channels.

Communication Channel Pair Blocks

Frequency Block (MHz)	Lower Block Edge Test Channels/Frequencies	Upper Block Edge Test Channels/Frequencies
A (1930 – 1945)	Channel : 512 Frequency : 1930.2MHz	Channel : 585 Frequency : 1944.8Hz
B (1950 – 1965)	Channel : 612 Frequency : 1950.2MHz	Channel : 685 Frequency : 1964.8MHz
C (1975 – 1990)	Channel : 737 Frequency : 1975.2MHz	Channel : 810 Frequency : 1989.8MHz
D (1945 – 1950)	Channel : 587 Frequency : 1945.2MHz	Channel : 610 Frequency : 1949.8MHz
E (1965 – 1970)	Channel : 687 Frequency : 1965.2MHz	Channel : 710 Frequency : 1969.8MHz
F (1970 – 1975)	Channel : 712 Frequency : 1970.2MHz	Channel : 735 Frequency : 1974.8Hz

Remarks

The EUT was tested at one channel in from the edge of the Frequency Blocks with the EUT transmitting on full power with modulation.

The measurement plots are shown on the following pages.

Test Equipment Used:
1, 2, 3, 4, 5
…….

Test Case: Spurious Emissions At Antenna Terminals (+/-1MHz)

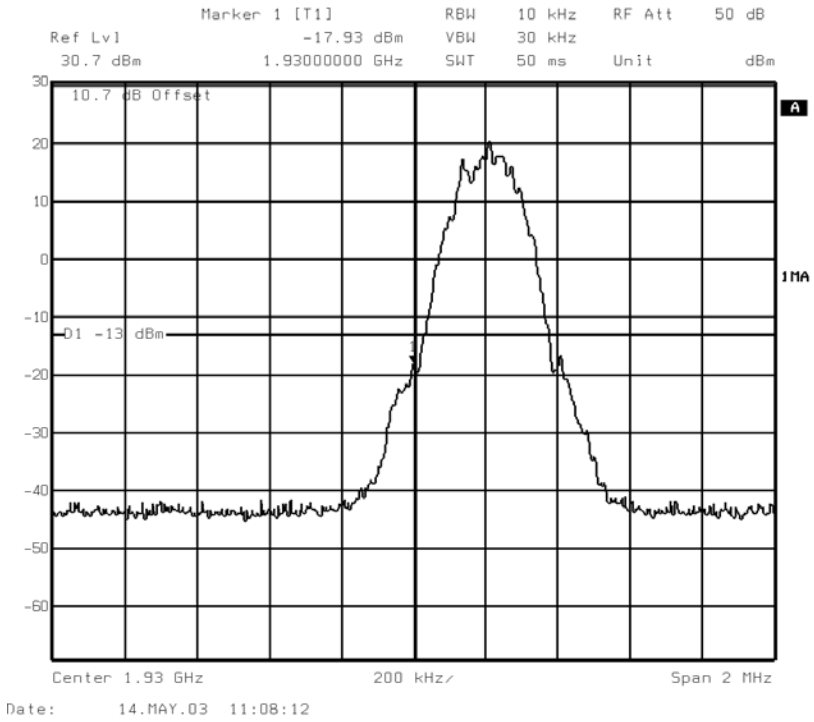
Test Date: 14th May 2003

Rule Parts: 2.1049, 24.238(b)

Block Edge Measurement With EUT Transmitting on Full Power On Channel 512, (1930.2MHz)

GMSK Modulation

Block A
1930 – 1945MHz



Remarks

All emissions are below –13dBm up to 1MHz away from the block edge.

Test Equipment Used:

1, 2, 3, 4, 5
…….

Test Case: Spurious Emissions At Antenna Terminals (+/-1MHz)

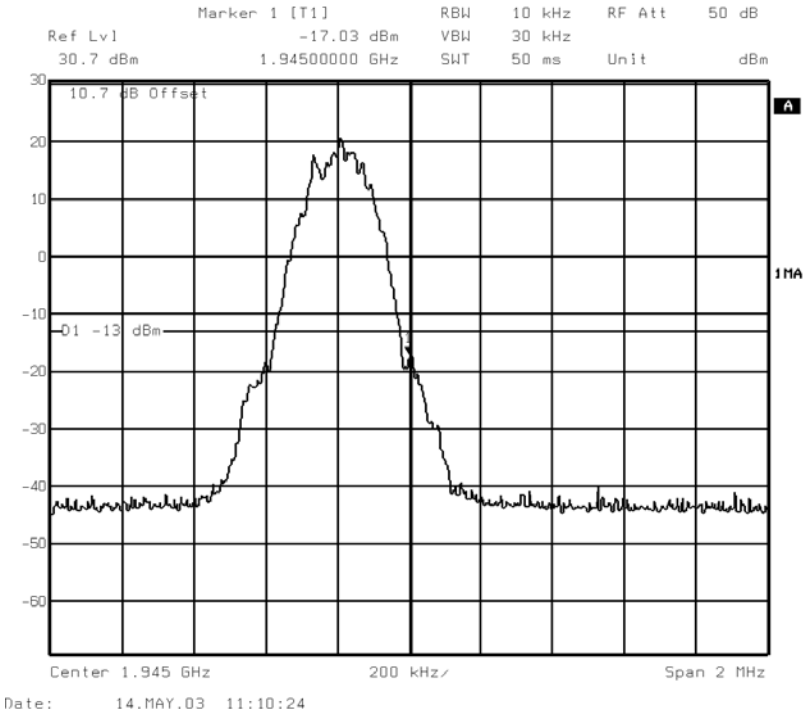
Test Date: 14th May 2003

Rule Parts: 2.1049, 24.238(b)

Block Edge Measurement With EUT Transmitting on Full Power On Channel 585, (1944.8MHz)

GMSK Modulation

Block A
1930 – 1945MHz



Remarks

All emissions are below –13dBm up to 1MHz away from the block edge.

Test Equipment Used:

1, 2, 3, 4, 5
……..

Test Case: Spurious Emissions At Antenna Terminals (+/-1MHz)

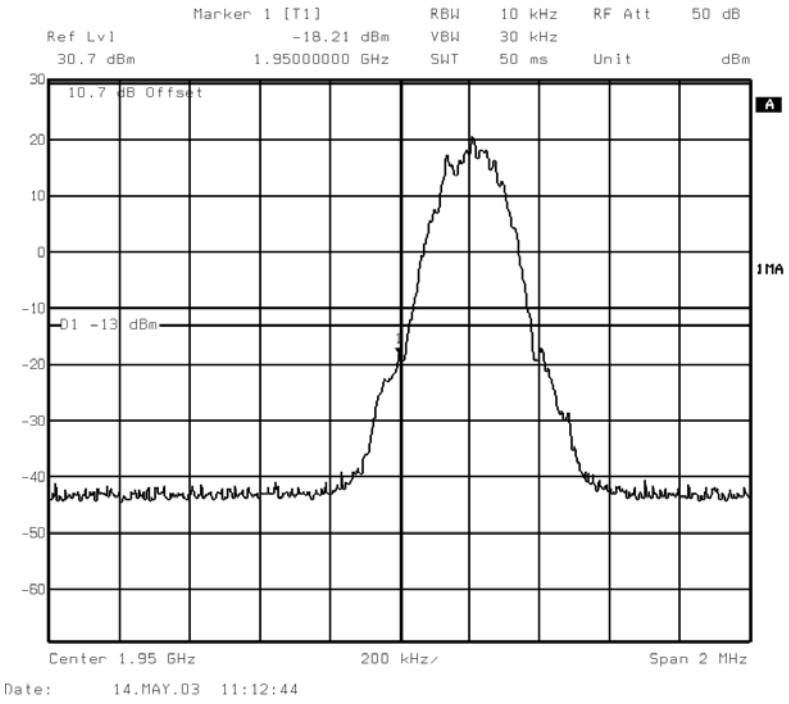
Test Date: 14th May 2003

Rule Parts: 2.1049, 24.238(b)

Block Edge Measurement With EUT Transmitting on Full Power On Channel 612, (1950.2MHz)

GMSK Modulation

Block B
1950 – 1965MHz



Remarks

All emissions are below –13dBm up to 1MHz away from the block edge.

Test Equipment Used:

1, 2, 3, 4, 5

…….

Test Case: Spurious Emissions At Antenna Terminals (+/-1MHz)

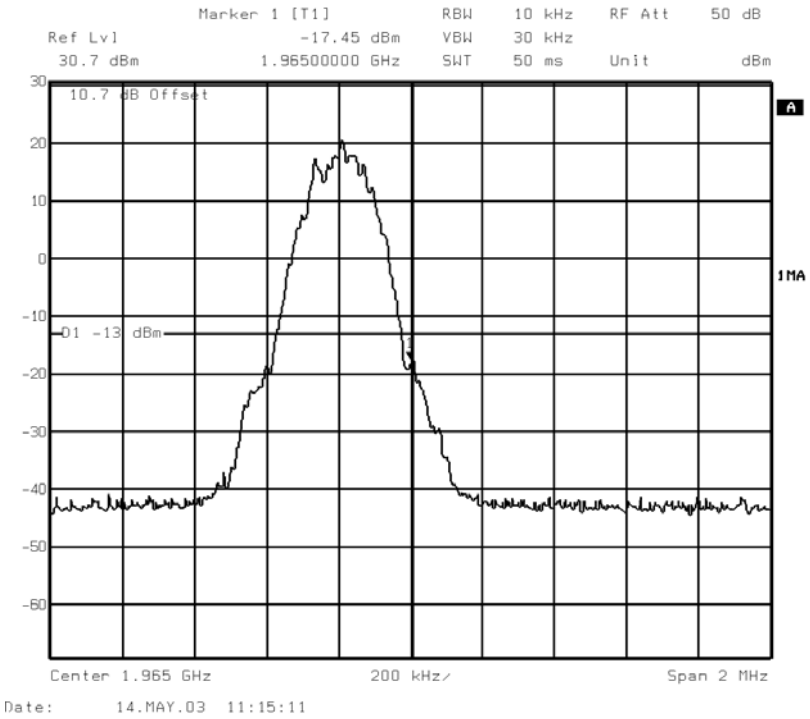
Test Date: 14th May 2003

Rule Parts: 2.1049, 24.238(b)

Block Edge Measurement With EUT Transmitting on Full Power On Channel 685 (1964.8MHz)

GMSK Modulation

Block B
1950 – 1965MHz



Remarks

All emissions are below –13dBm up to 1MHz away from the block edge.

Test Equipment Used:

1, 2, 3, 4, 5
……..

Test Case: Spurious Emissions At Antenna Terminals (+/-1MHz)

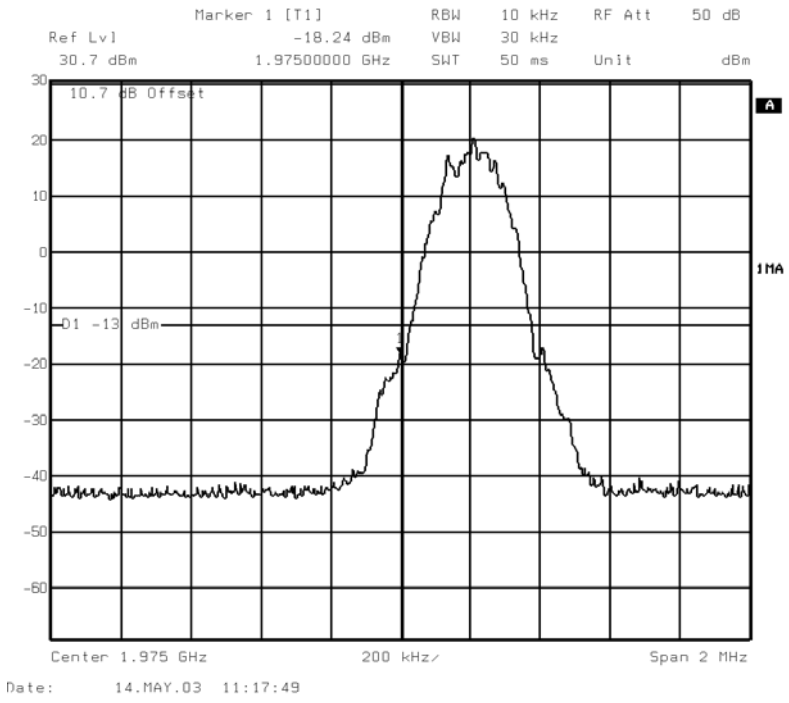
Test Date: 14th May 2003

Rule Parts: 2.1049, 24.238(b)

Block Edge Measurement With EUT Transmitting on Full Power On Channel 737, (1975.2MHz)

GMSK Modulation

Block C
1975 – 1990MHz



Remarks

All emissions are below –13dBm up to 1MHz away from the block edge.

Test Equipment Used:

1, 2, 3, 4, 5
…….

Test Case: Spurious Emissions At Antenna Terminals (+/-1MHz)

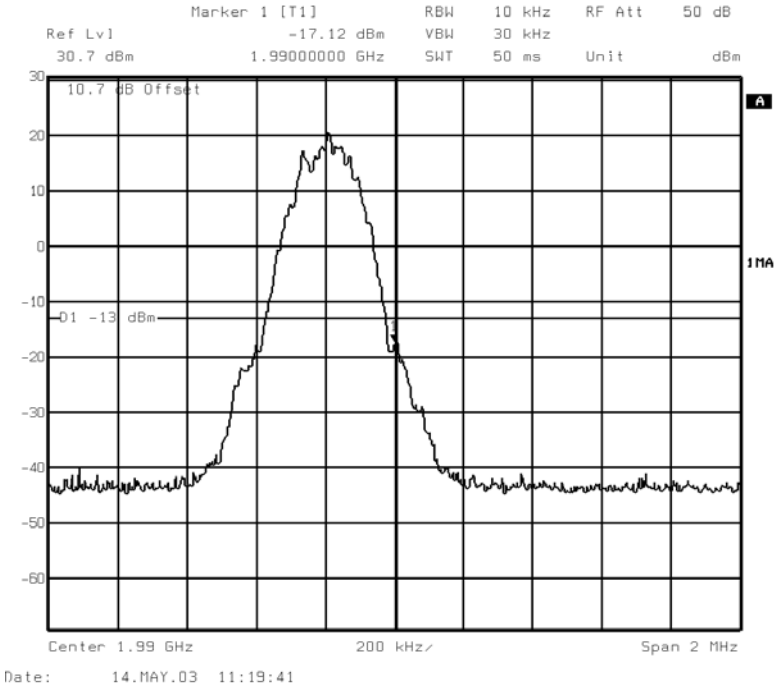
Test Date: 14th May 2003

Rule Parts: 2.1049, 24.238(b)

Block Edge Measurement With EUT Transmitting on Full Power On Channel 810, (1989.8MHz)

GMSK Modulation

Block C
1975 – 1990MHz



Remarks

All emissions are below –13dBm up to 1MHz away from the block edge.

Test Equipment Used:

1, 2, 3, 4, 5
……

Test Case: Spurious Emissions At Antenna Terminals (+/-1MHz)

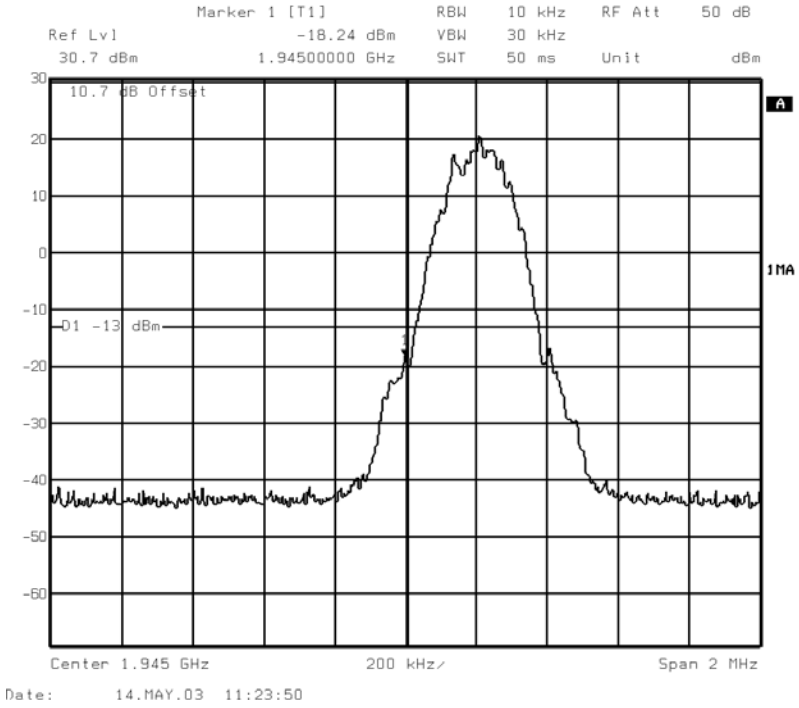
Test Date: 14th May 2003

Rule Parts: 2.1049, 24.238(b)

Block Edge Measurement With EUT Transmitting on Full Power On Channel 587, (1945.2MHz)

GMSK Modulation

Block D
1945 – 1950MHz



Remarks

All emissions are below –13dBm up to 1MHz away from the block edge.

Test Equipment Used:

1, 2, 3, 4, 5
……..

Test Case: Spurious Emissions At Antenna Terminals (+/-1MHz)

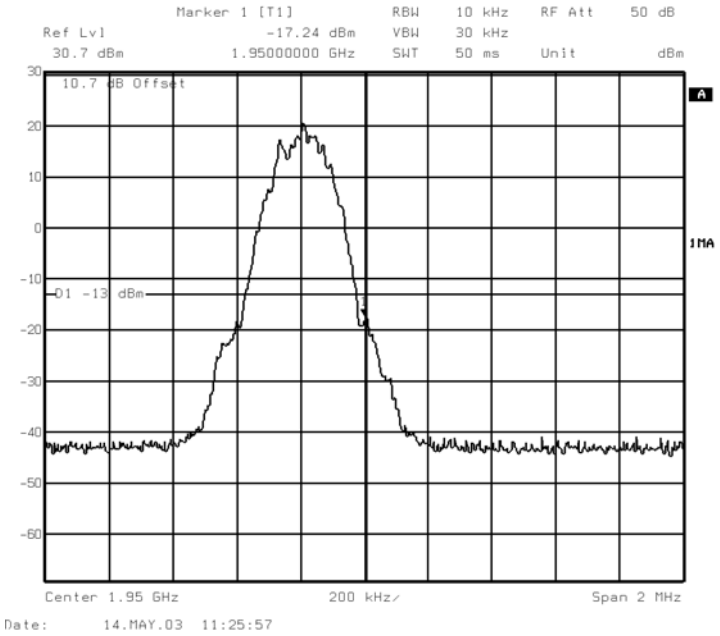
Test Date: 14th May 2003

Rule Parts: 2.1049, 24.238(b)

Block Edge Measurement With EUT Transmitting on Full Power On Channel 610, (1949.8MHz)

GMSK Modulation

Block D
1945 – 1950MHz



Remarks

All emissions are below –13dBm up to 1MHz away from the block edge.

Test Equipment Used:

1, 2, 3, 4, 5
…….

Test Case: Spurious Emissions At Antenna Terminals (+/-1MHz)

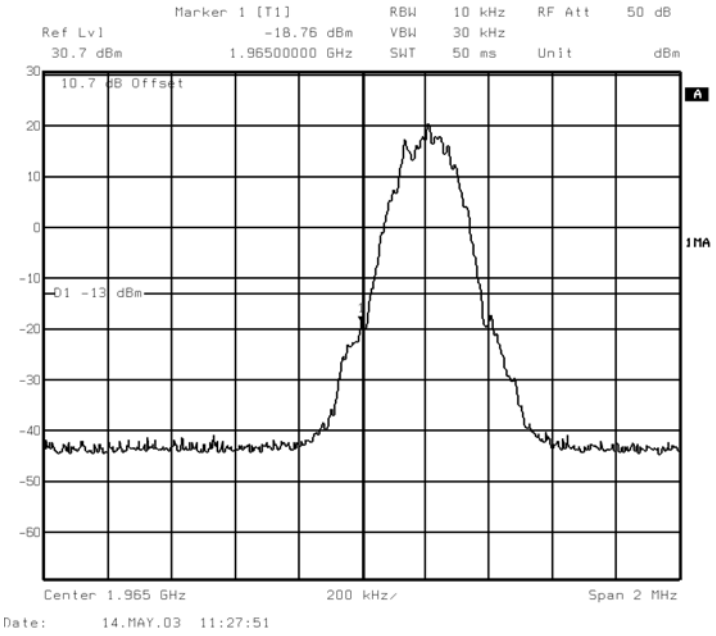
Test Date: 14th May 2003

Rule Parts: 2.1049, 24.238(b)

Block Edge Measurement With EUT Transmitting on Full Power On Channel 687, (1965.2MHz)

GMSK Modulation

Block E
1965 – 1970MHz



Remarks

All emissions are below –13dBm up to 1MHz away from the block edge.

Test Equipment Used:

1, 2, 3, 4, 5
……

Test Case: Spurious Emissions At Antenna Terminals (+/-1MHz)

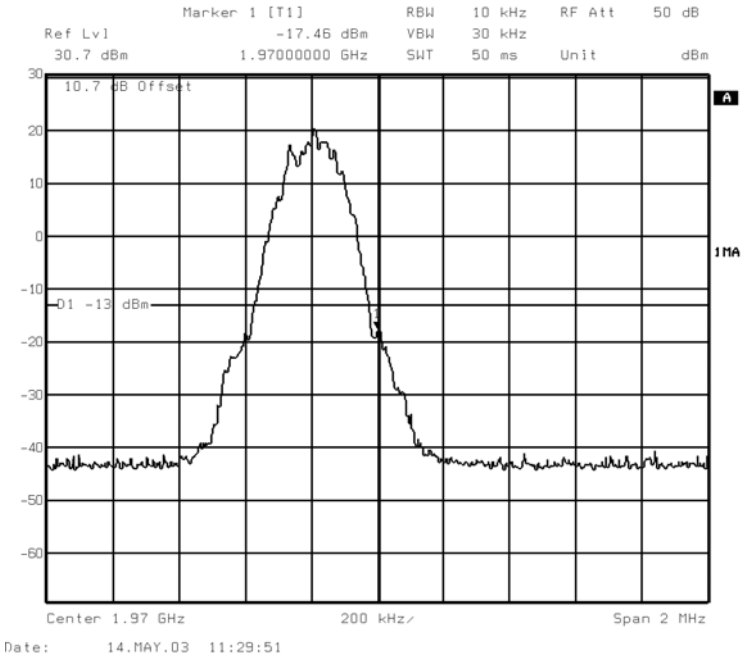
Test Date: 14th May 2003

Rule Parts: 2.1049, 24.238(b)

Block Edge Measurement With EUT Transmitting on Full Power On Channel 710, (1969.8MHz)

GMSK Modulation

Block E
1965 – 1970MHz



Remarks

All emissions are below –13dBm up to 1MHz away from the block edge.

Test Equipment Used:

1, 2, 3, 4, 5
……

Test Case: Spurious Emissions At Antenna Terminals (+/-1MHz)

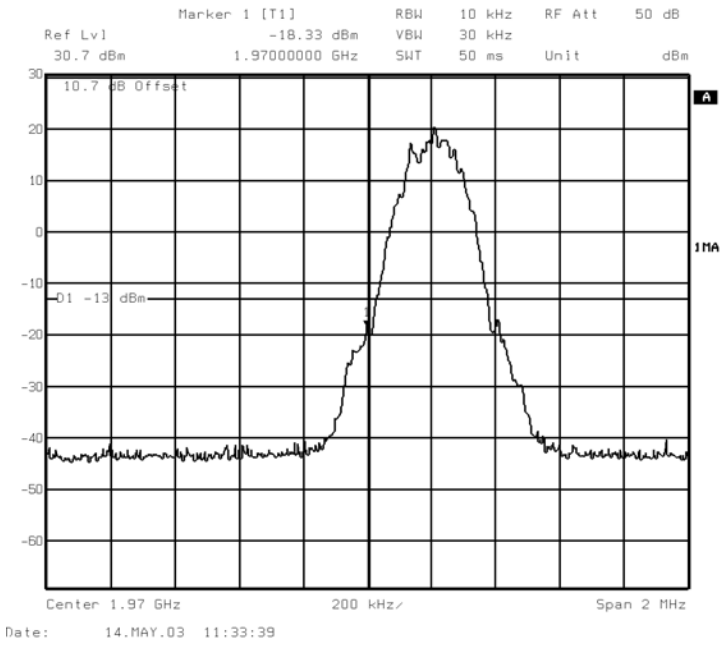
Test Date: 14th May 2003

Rule Parts: 2.1049, 24.238(b)

Block Edge Measurement With EUT Transmitting on Full Power On Channel 712, (1970.2MHz)

GMSK Modulation

Block F
1970 – 1975MHz



Remarks

All emissions are below –13dBm up to 1MHz away from the block edge.

Test Equipment Used:

1, 2, 3, 4, 5
…….

Test Case: Spurious Emissions At Antenna Terminals (+/-1MHz)

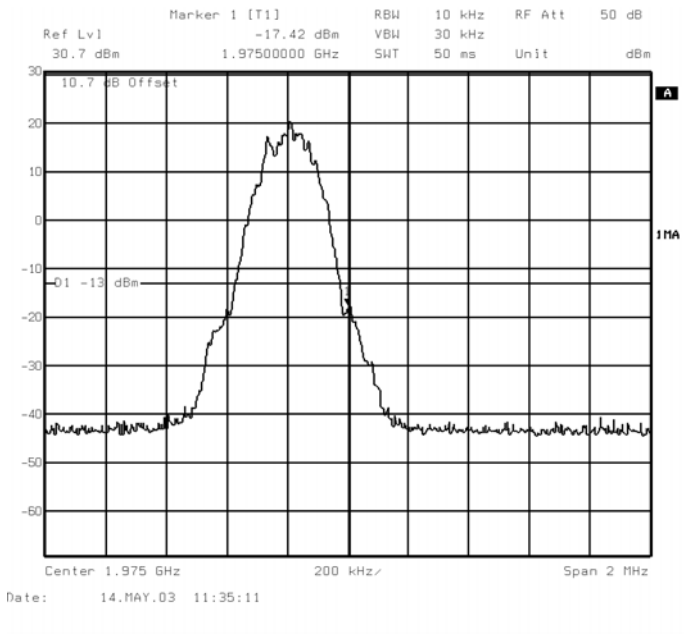
Test Date: 14th May 2003

Rule Parts: 2.1049, 24.238(b)

Block Edge Measurement With EUT Transmitting on Full Power On Channel 734, (1974.6MHz)

GMSK Modulation

Block F
1970 – 1975MHz



Remarks

All emissions are below –13dBm up to 1MHz away from the block edge.

Test Equipment Used:

1, 2, 3, 4, 5
……

Test Case: Spurious Emissions

Test Date: 14th May 2003

Rule Parts: 2.1051, 24.238(a)

Measurement Method

In accordance with Part 2.1051, the spurious emissions from the antenna terminal were measured. The transmitter output power was attenuated using a combination of filters and attenuators and the frequency spectrum investigated from 9kHz to 20 GHz. The EUT was set to transmit on full power with all timeslots active and minimum power with all timeslots active. The EUT was tested on Bottom, Middle and Top channels for both power levels. The resolution and video bandwidths were set to 1MHz in accordance with Part 24.238. The spectrum analyser detector was set to Max Hold.

From 9kHz to 4GHz, a 10dB attenuator and cables were used. This was to reduce saturation effects in the spectrum analyser. From 4.0 to 20GHz, a 10dB attenuator and a high pass filter were used.

Complete testing was carried out on the EUT with 48V DC Supply using a GMSK modulation scheme and both power levels.

The maximum path loss across the measurement band was used as the reference level offset to ensure worst case

In addition, measurements were made up to the 10^{th} harmonic of the fundamental.

Summary Of Results

No emissions were detected within 20dB of the limit – 9kHz to 20GHz

Remarks

The EUT passed the requirements laid out in 24.238.

The plots on the following pages show the frequency spectrum from 9kHz to 20GHz of the EUT.

Test Equipment Used:

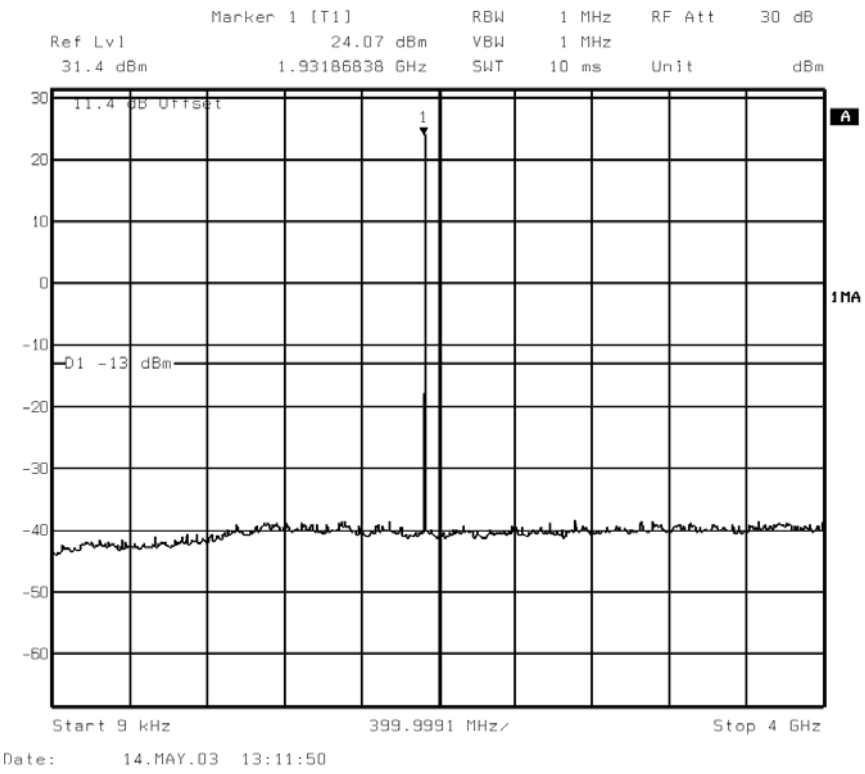
1, 2, 3, 4, 5, 6, 8, 9
……

Test Case: Spurious Emissions

Test Date: 14th May 2003

Rule Parts: 2.1051, 24.238(a)

Spurious Emissions (9kHz – 4GHz)
Channel 512, (1930.2MHz) – Maximum Power - GMSK
Power Supply 48V DC



Test Equipment Used:

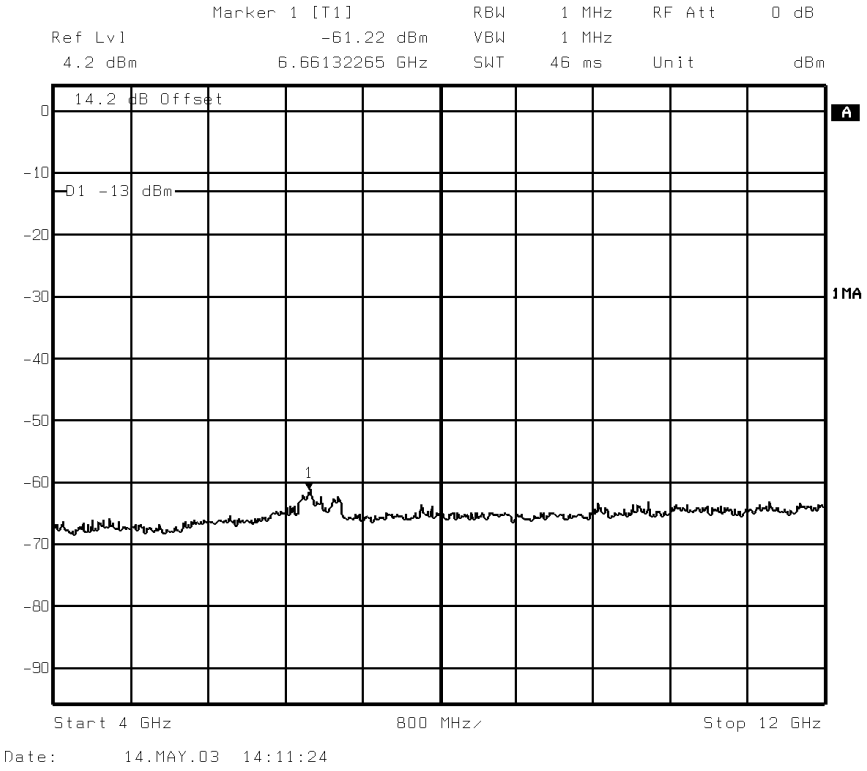
1, 2, 3, 4, 5
……

Test Case: Spurious Emissions

Test Date: 14th May 2003

Rule Parts: 2.1051, 24.238(a)

Spurious Emissions (4GHz – 12GHz)
Channel 512, (1930.2MHz) – Maximum Power - GMSK
Power Supply 48V DC



Test Equipment Used:

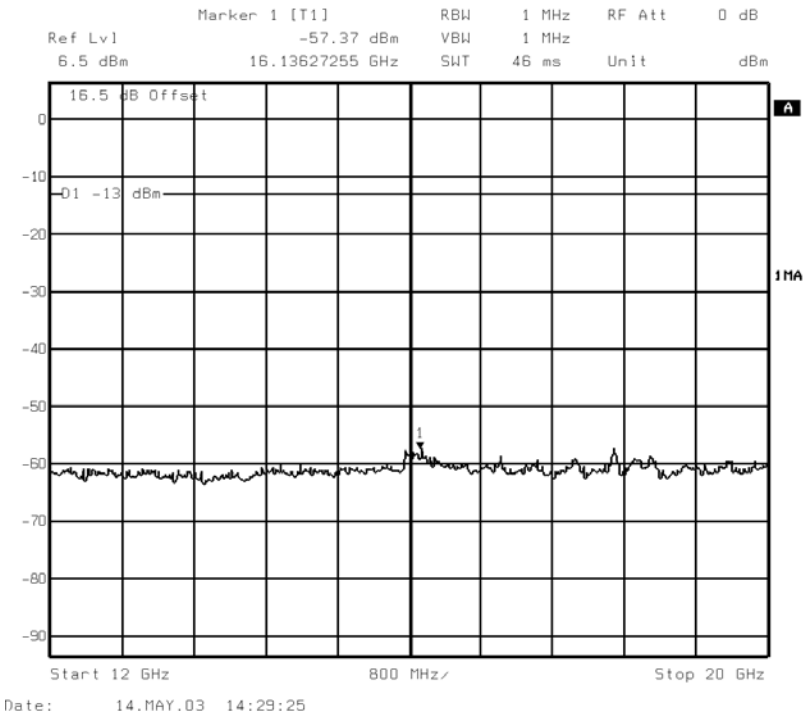
1, 2, 3, 4, 7, 8, 9
……..

Test Case: Spurious Emissions

Test Date: 14th May 2003

Rule Parts: 2.1051, 24.238(a)

Spurious Emissions (12GHz – 20GHz)
Channel 512, (1930.2MHz) – Maximum Power - GMSK
Power Supply 48V DC



Test Equipment Used:

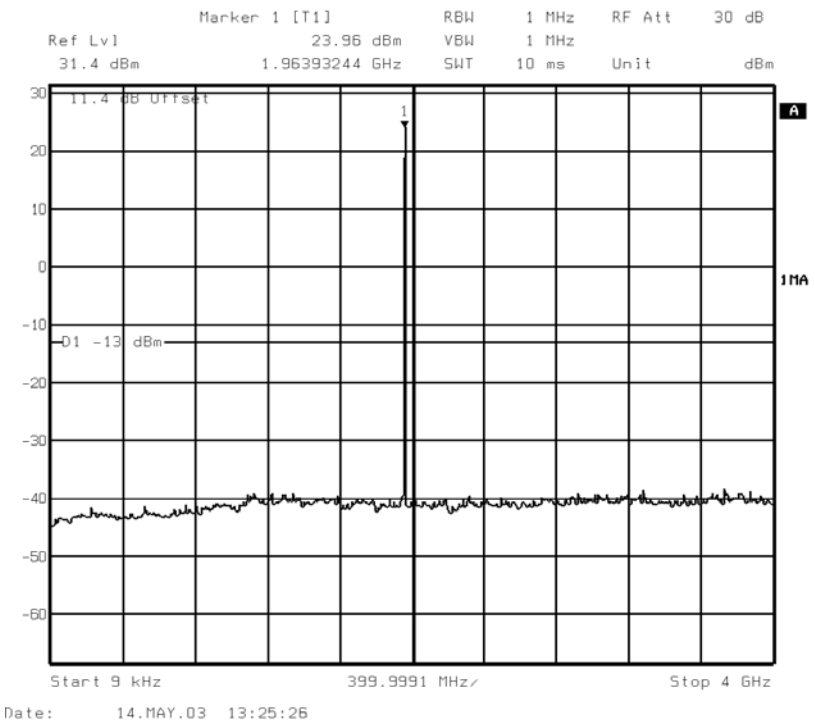
1, 2, 3, 4, 6, 7, 8, 9
……..

Test Case: Spurious Emissions

Test Date: 14th May 2003

Rule Parts: 2.1051, 24.238(a)

Spurious Emissions (9kHz – 4GHz)
Channel 661, (1960.0MHz) – Maximum Power - GMSK
Power Supply 48V DC



Test Equipment Used:

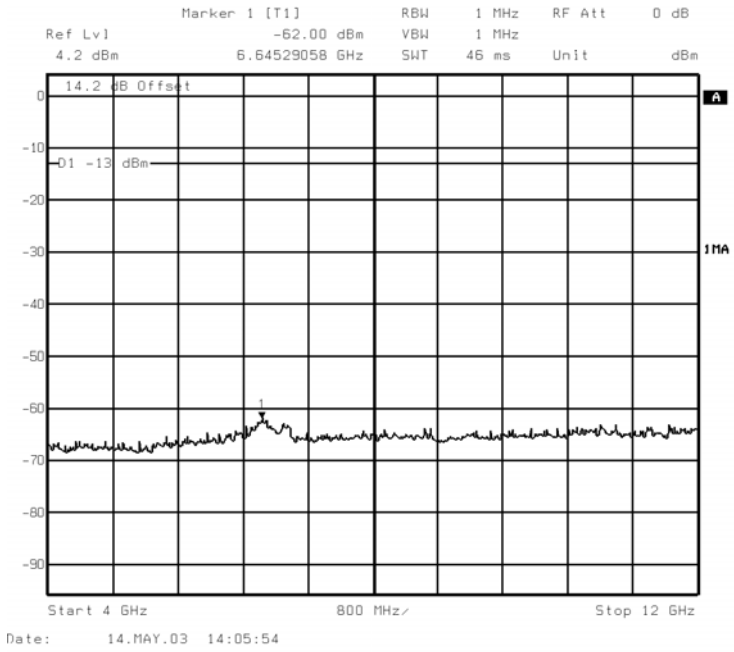
1, 2, 3, 4, 5
…….

Test Case: Spurious Emissions

Test Date: 14th May 2003

Rule Parts: 2.1051, 24.238(a)

Spurious Emissions (4GHz – 12GHz)
Channel 661, (1960.0MHz) – Maximum Power - GMSK
Power Supply 48V DC



Test Equipment Used:

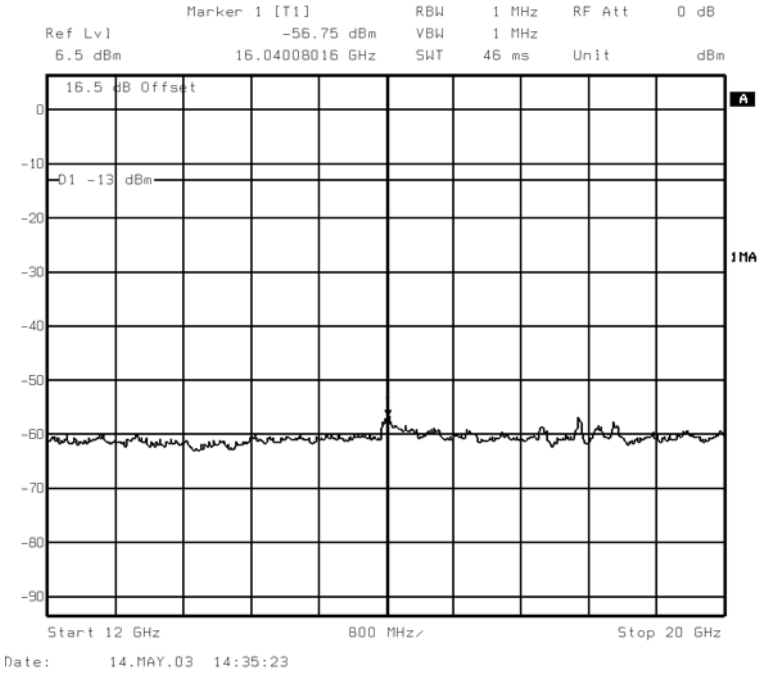
1, 2, 3, 4, 7, 8, 9
……..

Test Case: Spurious Emissions

Test Date: 14th May 2003

Rule Parts: 2.1051, 24.238(a)

Spurious Emissions (12GHz – 20GHz)
Channel 661, (1960.0MHz) – Maximum Power - GMSK
Power Supply 48V DC



Test Equipment Used:

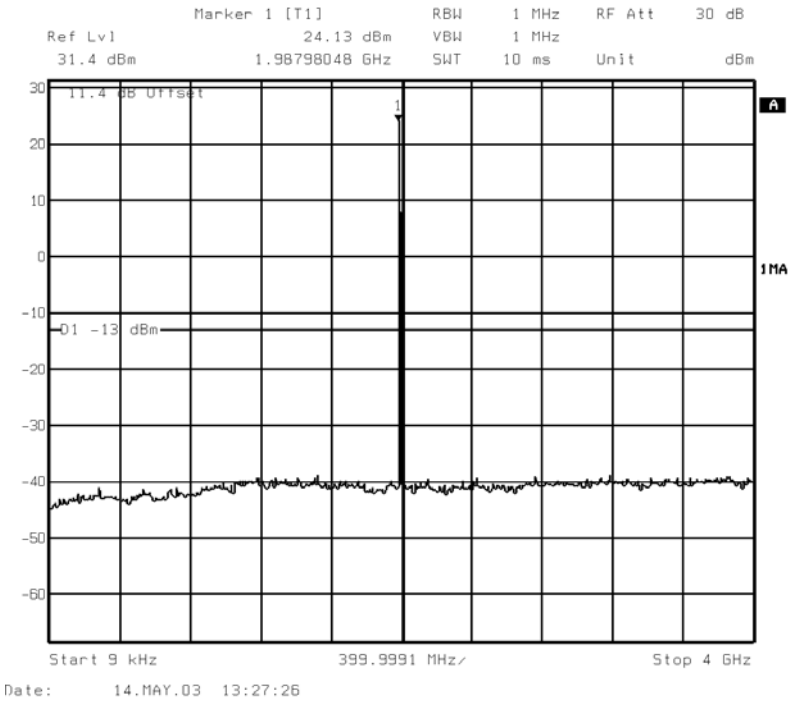
1, 2, 3, 4, 6, 7, 8, 9
……..

Test Case: Spurious Emissions

Test Date: 14th May 2003

Rule Parts: 2.1051, 24.238(a)

Spurious Emissions (9kHz – 4GHz)
Channel 810, (1989.8MHz) – Maximum Power - GMSK
Power Supply 48V DC



Test Equipment Used:

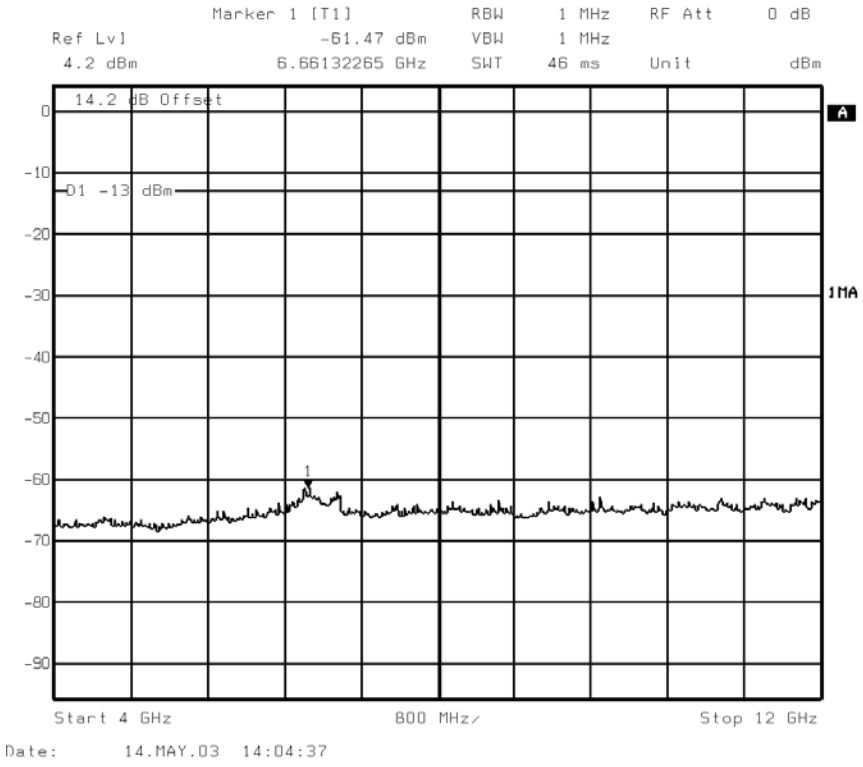
1, 2, 3, 4, 5
……..

Test Case: Spurious Emissions

Test Date: 14th May 2003

Rule Parts: 2.1051, 24.238(a)

Spurious Emissions (4GHz – 12GHz)
Channel 810, (1989.8MHz) – Maximum Power - GMSK
Power Supply 48V DC



Test Equipment Used:

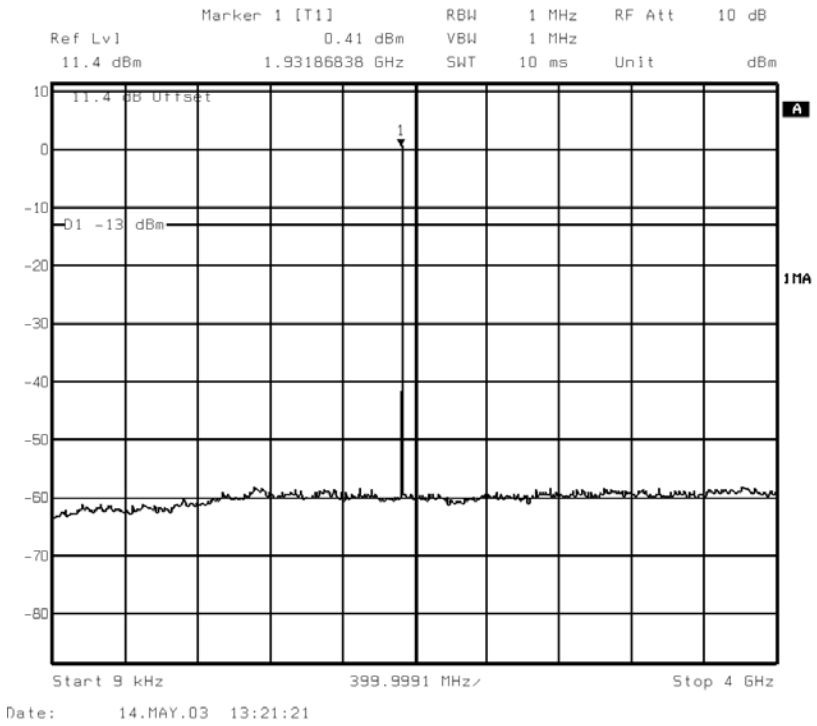
1, 2, 3, 4, 7, 8, 9
……..

Test Case: Spurious Emissions

Test Date: 14th May 2003

Rule Parts: 2.1051, 24.238(a)

Spurious Emissions (9kHz – 4GHz)
Channel 512, (1930.2MHz) – Minimum Power - GMSK
Power Supply 48V DC



Test Equipment Used:

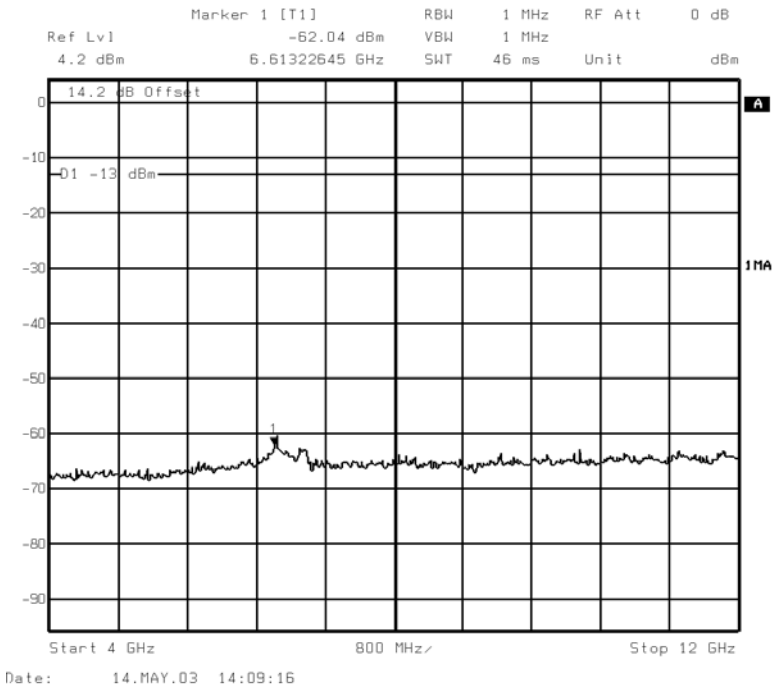
1, 2, 3, 4, 5
…….

Test Case: Spurious Emissions

Test Date: 14th May 2003

Rule Parts: 2.1051, 24.238(a)

Spurious Emissions (4GHz – 12GHz)
Channel 512, (1930.2MHz) – Minimum Power - GMSK
Power Supply 48V DC



Test Equipment Used:

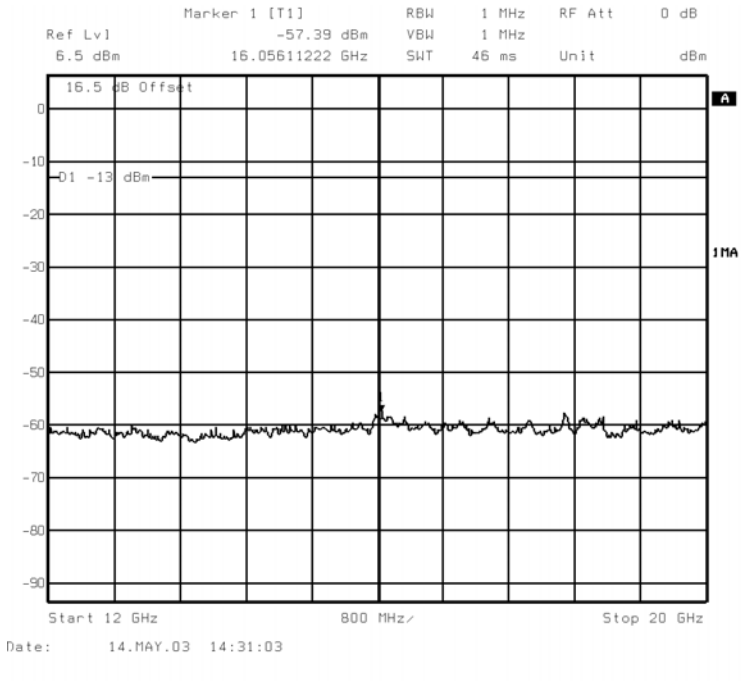
1, 2, 3, 4, 7, 8, 9
…….

Test Case: Spurious Emissions

Test Date: 14th May 2003

Rule Parts: 2.1051, 24.238(a)

Spurious Emissions (12GHz – 20GHz)
Channel 512, (1930.2MHz) – Minimum Power - GMSK
Power Supply 48V DC



Test Equipment Used:

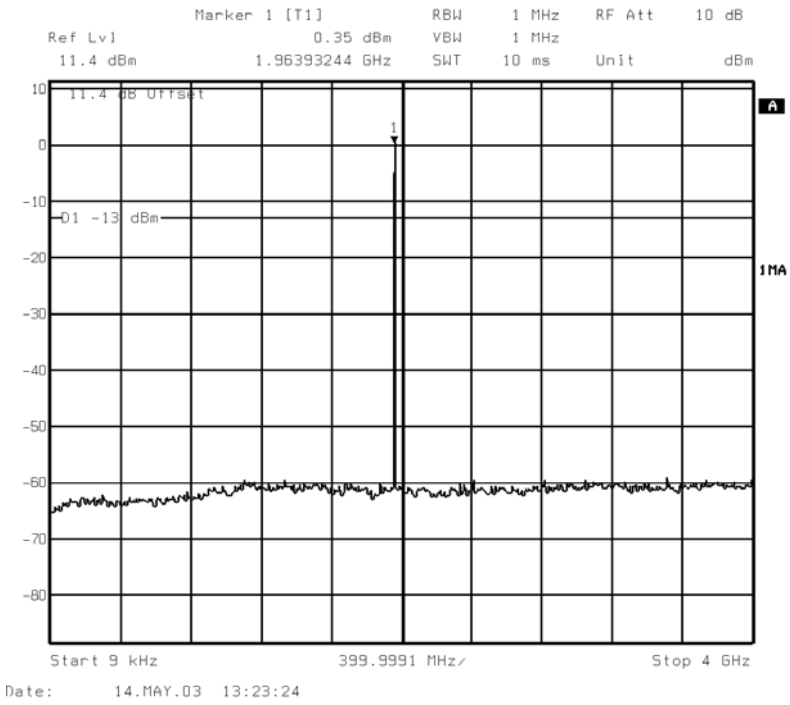
1, 2, 3, 4, 6, 7, 8, 9
……

Test Case: Spurious Emissions

Test Date: 14th May 2003

Rule Parts: 2.1051, 24.238(a)

Spurious Emissions (9kHz – 4GHz)
Channel 661, (1960.0MHz) – Minimum Power - GMSK
Power Supply 48V DC



Test Equipment Used:

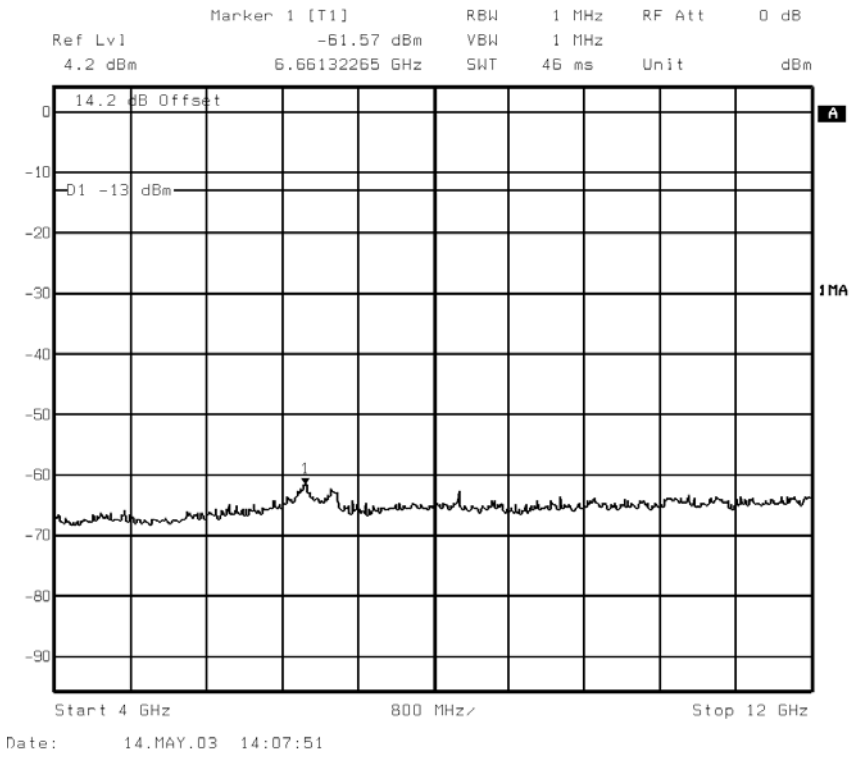
1, 2, 3, 4, 5
……

Test Case: Spurious Emissions

Test Date: 14th May 2003

Rule Parts: 2.1051, 24.238(a)

Spurious Emissions (4GHz –12GHz)
Channel 661, (1960.0MHz) – Minimum Power - GMSK
Power Supply 48V DC



Test Equipment Used:

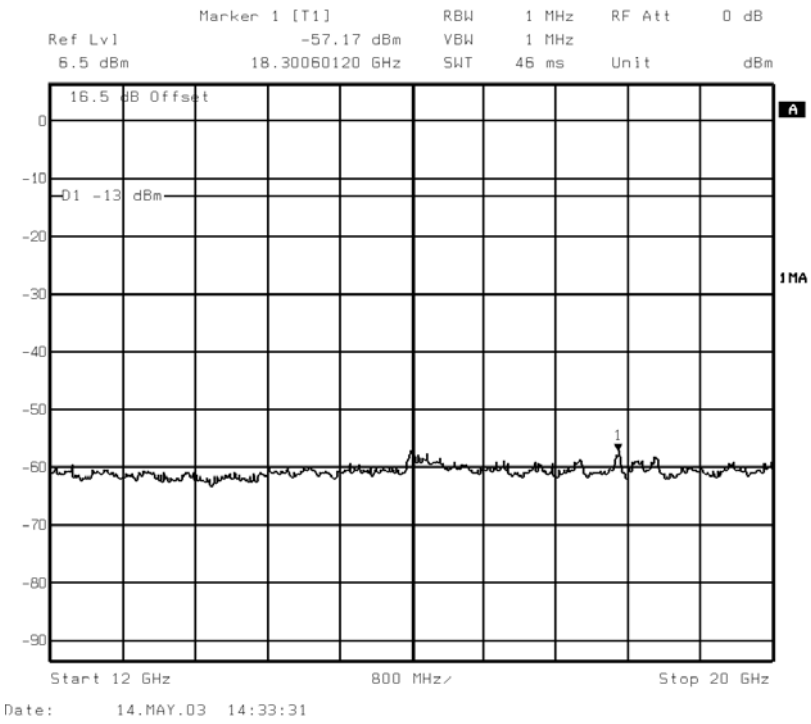
1, 2, 3, 4, 7, 8, 9
……

Test Case: Spurious Emissions

Test Date: 14th May 2003

Rule Parts: 2.1051, 24.238(a)

Spurious Emissions (12GHz – 20GHz)
Channel 661, (1960.0MHz) – Minimum Power - GMSK
Power Supply 48V DC



Test Equipment Used:

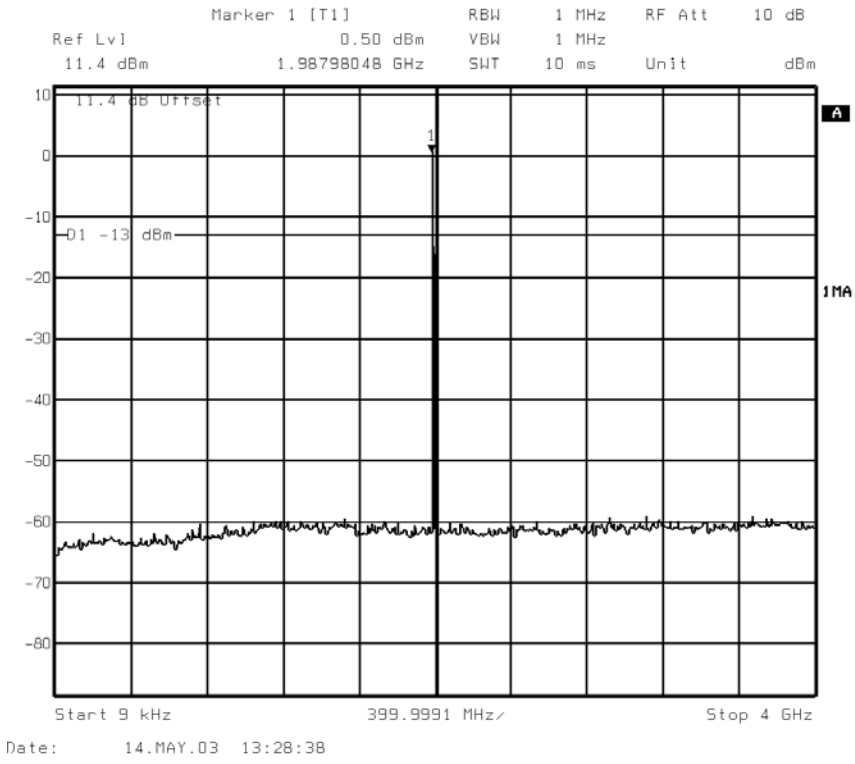
1, 2, 3, 4, 6, 7, 8, 9
……..

Test Case: Spurious Emissions

Test Date: 14th May 2003

Rule Parts: 2.1051, 24.238(a)

Spurious Emissions (9kHz – 4GHz)
Channel 810, (1989.8MHz) – Minimum Power - GMSK
Power Supply 48V DC



Test Equipment Used:

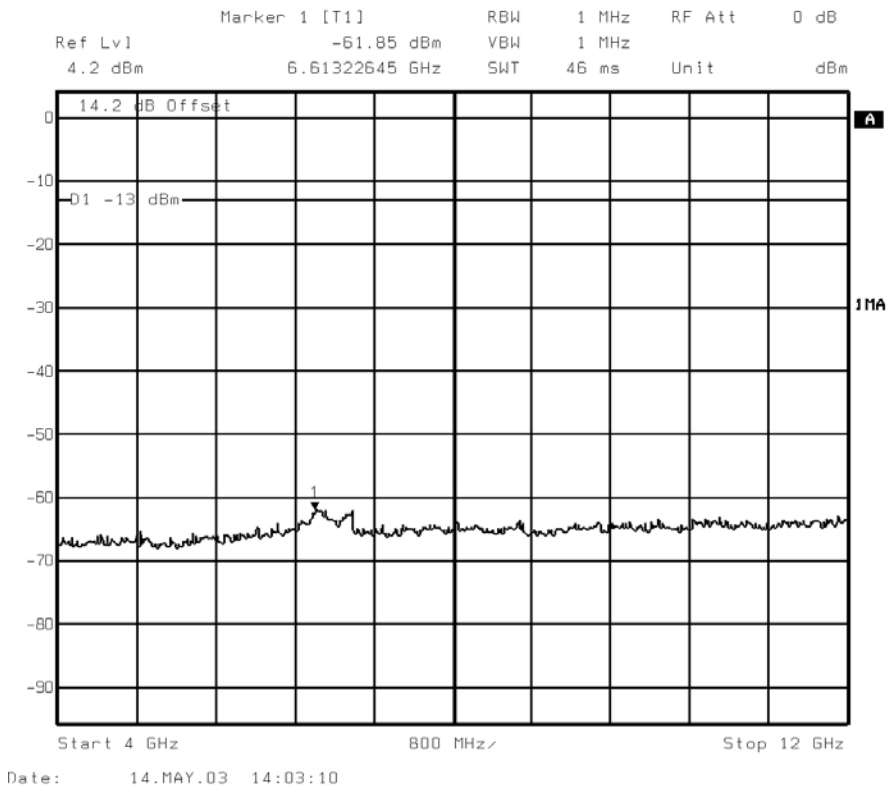
1, 2, 3, 4, 5
…….

Test Case: Spurious Emissions

Test Date: 14th May 2003

Rule Parts: 2.1051, 24.238(a)

Spurious Emissions (4GHz – 12GHz)
Channel 810, (1989.8MHz) – Minimum Power - GMSK
Power Supply 48V DC



Test Equipment Used:

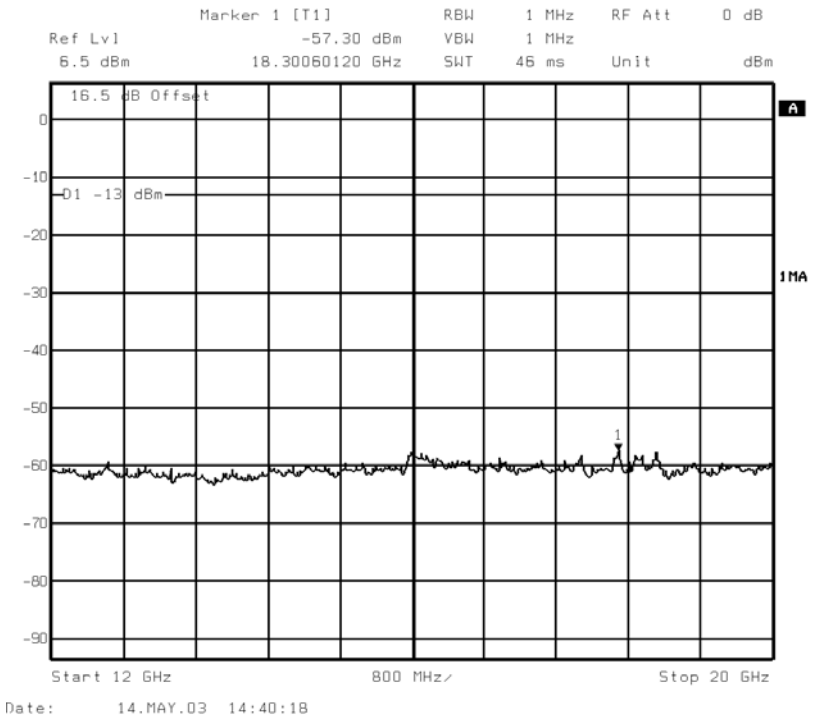
1, 2, 3, 4, 7, 8, 9
……

Test Case: Spurious Emissions

Test Date: 14th May 2003

Rule Parts: 2.1051, 24.238(a)

Spurious Emissions (12GHz – 20GHz)
Channel 810, (1989.8MHz) – Minimum Power - GMSK
Power Supply 48V DC



Test Equipment Used:

1, 2, 3, 4, 6, 7, 8, 9
……

Test Case: Spurious Emissions

Test Date: 14th May 2002

Rule Parts: 2.1051, 24.238(a)

Harmonic Emissions — Channel 512, (1930.2MHz) – Maximum Power

Frequency (GHz)	Raw Result (dBm)	Path Loss (dB)	Corrected Result (dBm)	Limit (dBm)
3.8604	69.42	12.4	-57.02	-13
5.7906	80.2*	12.3	-67.90	-13
7.7208	80.2*	12.8	-67.40	-13
9.6510	77.74*	13.0	-64.74	-13
11.5812	79.12*	13.4	-65.72	-13
13.5114	78.25*	15.6	-62.65	-13
15.4416	77.21*	13.9	-63.31	-13
17.3718	76.87*	14.1	-62.77	-13
19.3002	78.12*	15.2	-62.92	-13

*Instrumentation Noise Floor

Harmonic Emissions — Channel 661, (1960.0MHz) – Maximum Power

Frequency (GHz)	Raw Result (dBm)	Path Loss (dB)	Corrected Result (dBm)	Limit (dBm)
3.9200	-73.03	12.8	-60.23	-13
5.8800	-79.96*	12.5	-67.46	-13
7.8400	-78.99*	13.5	-65.49	-13
9.8000	-79.36*	13.3	-66.06	-13
11.7600	-78.99*	13.5	-65.49	-13
13.7200	-78.45*	13.5	-64.95	-13
15.6800	-76.86*	15.0	-61.86	-13
17.6400	-78.57*	13.8	-64.77	-13
19.6000	-77.09*	14.9	-62.19	-13

*Instrumentation Noise Floor

Test Case: Spurious Emissions (continued)

Test Date: 14th May 2002

Rule Parts: 2.1051, 24.238(a)

Harmonic Emissions — Channel 810, (1989.8MHz) – Maximum Power

Frequency (GHz)	Raw Result (dBm)	Path Loss (dB)	Corrected Result (dBm)	Limit (dBm)
3.9796	-65.64	13.7	-52.54	-13
5.9694	-81.13*	12.7	-68.43	-13
7.9592	-79.22*	14.5	-64.72	-13
9.9949	-79.00*	13.7	-65.30	-13
11.9388	-78.79*	13.5	-65.29	-13
13.9286	-77.73*	14.3	-63.43	-13
15.9184	-77.94*	14.1	-63.84	-13
17.9082	-78.21*	14.6	-63.61	-13
19.8980	-75.84*	13.9	-61.94	-13

*Instrumentation Noise Floor

Test Equipment Used:
1, 2, 3, 4, 6, 7
……

Test Case: Spurious Emissions

Test Date: 14th May 2002

Rule Parts: 2.1051, 24.238(a)

Harmonic Emissions — Channel 512, (1930.2MHz) – Minimum Power

Frequency (GHz)	Raw Result (dBm)	Path Loss (dB)	Corrected Result (dBm)	Limit (dBm)
3.8604	-81.31	12.4	-68.91	-13
5.7906	-81.04*	12.3	-68.74	-13
7.7208	-79.79*	12.8	-66.99	-13
9.6510	-78.24*	13.0	-65.42	-13
11.5812	-78.33*	13.4	-64.93	-13
13.5114	-78.48*	15.6	-62.88	-13
15.4416	-77.87*	13.9	-63.97	-13
17.3718	-76.96*	14.1	-62.86	-13
19.3002	-78.39*	15.2	-63.19	-13

*Instrumentation Noise Floor

Harmonic Emissions — Channel 661, (1960.0MHz) – Minimum Power

Frequency (GHz)	Raw Result (dBm)	Path Loss (dB)	Corrected Result (dBm)	Limit (dBm)
3.9200	-81.79*	12.8	-68.99	-13
5.8800	-79.69*	12.5	-67.19	-13
7.8400	-79.66*	13.5	-66.16	-13
9.8000	-79.78*	13.3	-66.48	-13
11.7600	-78.21*	13.5	-64.71	-13
13.7200	-78.41*	13.5	-64.91	-13
15.6800	-77.19*	15.0	-62.19	-13
17.6400	-76.92*	13.8	-63.12	-13
19.6000	-76.55*	14.9	-61.65	-13

*Instrumentation Noise Floor

Test Case: Spurious Emissions (continued)

Test Date: 14th May 2002

Rule Parts: 2.1051, 24.238(a)

Harmonic Emissions — Channel 810, (1989.8MHz) – Minimum Power

Frequency (GHz)	Raw Result (dBm)	Path Loss (dB)	Corrected Result (dBm)	Limit (dBm)
3.9796	-81.42*	13.1	-68.32	-13
5.9694	-79.76*	12.7	-67.06	-13
7.9592	-79.25*	14.5	-64.75	-13
9.9949	-78.57*	13.7	-64.87	-13
11.9388	-77.79*	13.5	-64.29	-13
13.9286	-79.16*	14.3	-64.86	-13
15.9184	-78.05*	14.1	-63.95	-13
17.9082	-77.49*	14.6	-62.89	-13
19.8980	-77.21*	13.9	-63.31	-13

*Instrumentation Noise Floor

Test Equipment Used:
1, 2, 3, 4, 6, 7
……

Test Case: Frequency Stability Under Temperature Variations

Test Date: 15th May 2003

Rule Parts: 2.1055, 24.235

Measurement Method

The EUT was set to transmit on maximum power with all timeslots active. A frequency counter, was used to measure the frequency error. The temperature was adjusted between –30ºC and +50ºC in 10º steps as per 2.1055.

Results

Power Supply 48V DC Supply - GMSK Modulation

Temperature Interval (ºC)	Test Frequency (GHz)	Deviation (Hz)	Limit (kHz)
-30	1.96	+35	±1.96
-20	1.96	+31	±1.96
-10	1.96	+25	±1.96
0	1.96	+20	±1.96
+10	1.96	+14	±1.96
+20	1.96	+8	±1.96
+30	1.96	+2	±1.96
+40	1.96	-6	±1.96
+50	1.96	-11	±1.96

Remarks

EUT complies with CFR 47 Part 24.235. The frequency stability of the EUT is sufficient to keep it within the authorized frequency blocks at any temperature interval across the measured range.

Test Equipment Used:

1, 2, 10, 11, 12
……

Test Case: Frequency Stability Under Voltage Variations

Test Date: 15th May 2003

Rule Parts: 24.135(a)

Measurement Method

The EUT was set to transmit on maximum power with all timeslots active. A Frequency Counter, was used to measure the frequency error.

Power Supply 48V DC

The supply voltage was adjusted between 85 and 115% of the nominal declared operating voltage as specified by the manufacturer using a power supply in conjunction with a DVM.

Results

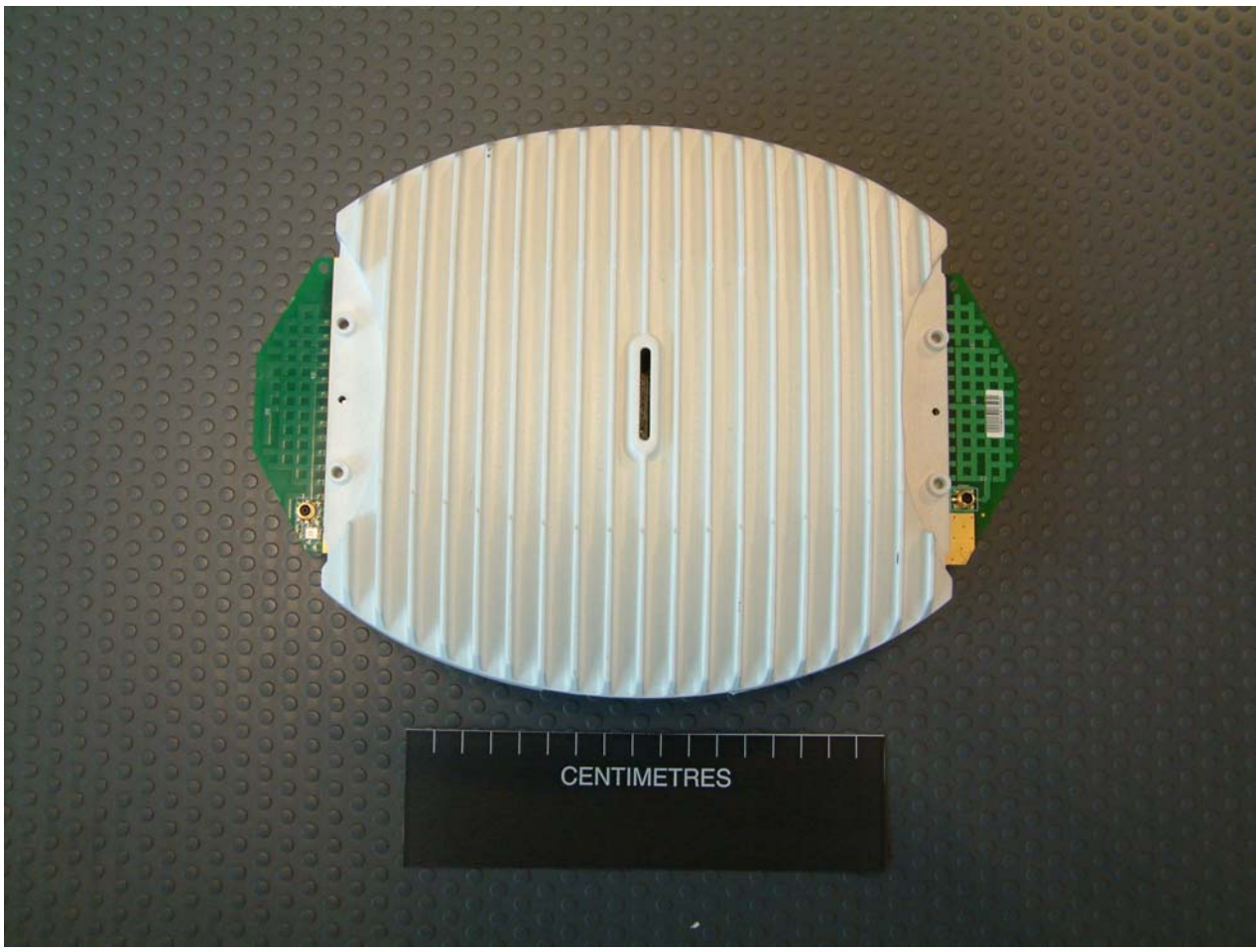
Supply Variation (%)	DC Voltage (V)	Test Frequency (GHz)	Deviation (Hz)	Deviation Limit (kHz)
			GMSK	
85	40.8	1.96	0	±1.96
0	48	1.96	0	±1.96
115	55.2	1.96	0	±1.96

Test Equipment Used:

1, 2, 10, 11, 12

……

TEST SAMPLE PHOTOGRAPHS

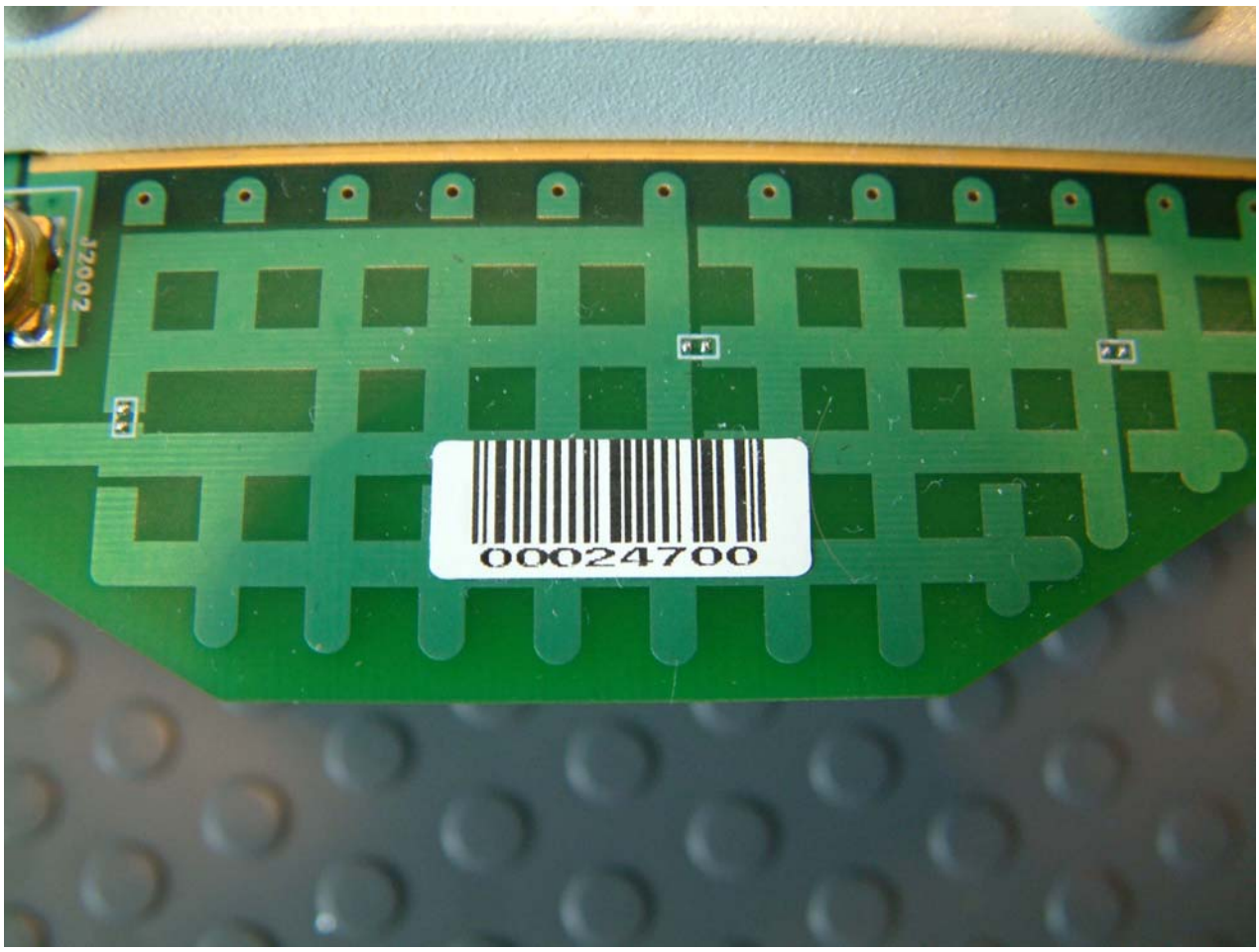


Photograph 1: Top view

TEST SAMPLE PHOTOGRAPHS (continued)

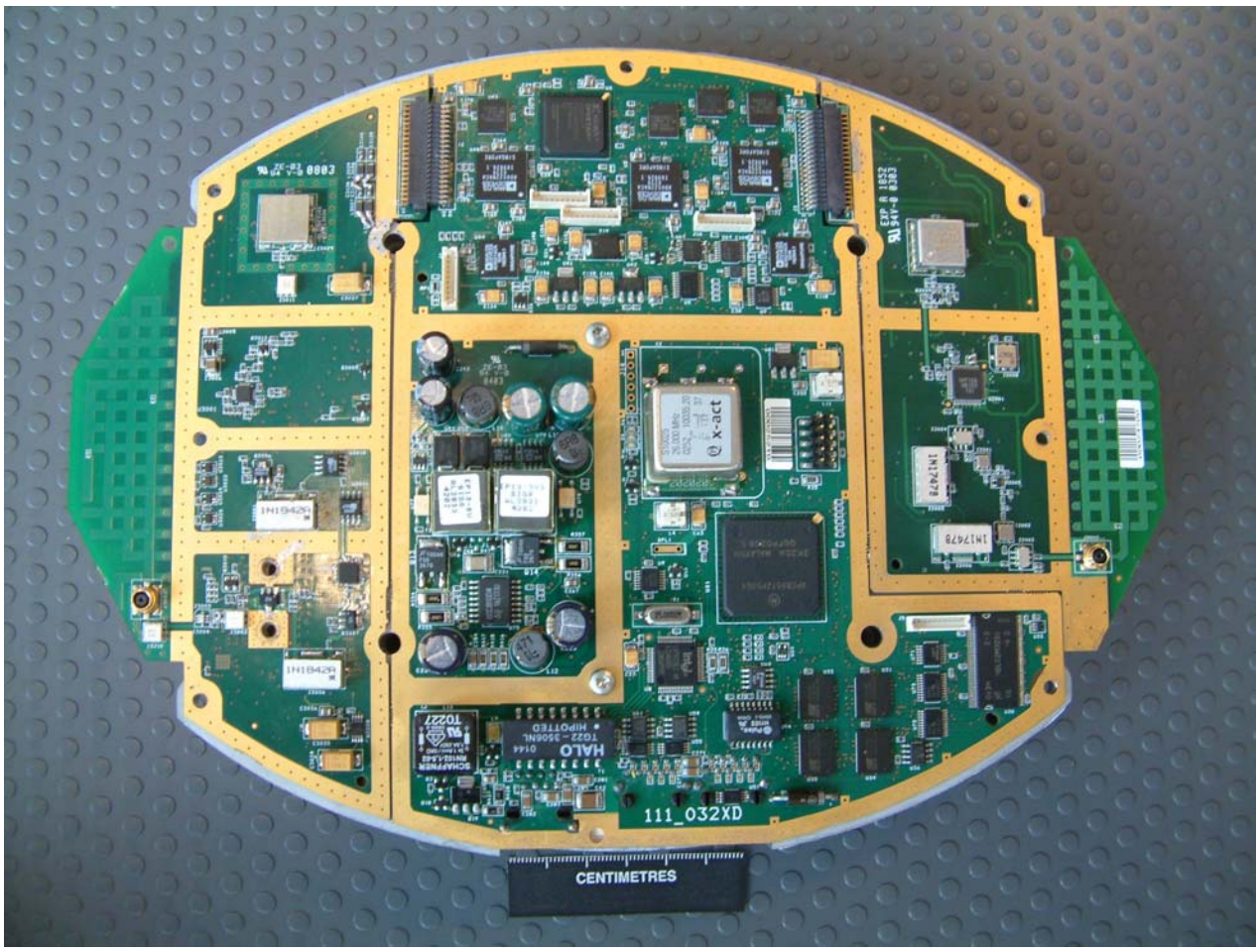
Photograph 2: Front view

TEST SAMPLE PHOTOGRAPHS (continued)



Photograph 3: Label view

TEST SAMPLE PHOTOGRAPHS (continued)



Photograph 4: Interior view

0141
Group

This report relates only to the actual item/items tested.

UKAS Accreditations do not cover opinions and interpretations and any expressed herein are outside the scope of any UKAS Accreditation.

Results of tests not yet included in our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).