RF Test Report:

Accton Wireless Broadband Corp

RG211-3.8 CPE

47CFR Part 90Z (in part)

SC_TR09_B

Prepared for:
Airspan Communications Ltd
Cambridge House
Oxford Road
Uxbridge
UB8 1UN

Circulation: Airspan Communications Ltd
AWB
Sulis Consultants Ltd

Sulis Consultants Limited
Mead House, Longwater Road, Eversley, Hampshire, RG27 0NW, UK
Registered in England & Wales, number 05466247
http://www.sulisconsultants.com

Contents

Tables

Figures

1 Revision History

Revision	Originator	Date	Comment
A	Sulis Consultants	16 July 2010	Issued as 1st release
B	Sulis Consultants	30 July 2010	CPE Antenna gain changed from 7dBi to correct value of 6dBi Test Plan SC_AIR_TP02_A modified – freq stability only on one channel

2 Purpose

This document details the preliminary RF tests performed on the AWB 3.5 GHz CPE. The tests were used to determine worst-case frequency/modulation combinations to be tested by RFI Global services under proposal 78529JD01.
These were included in Test Plan SC_AIR_TP02_A, which is included at the end of this document.

3 Reference Documents

[Ref 1]	47CFR2	Electromagnetic compatibility and Radio spectrum Matters (ERM); Telecommunications network equipment, ElectroMagnetic Compatibility (EMC) requirements
[Ref 2]	47 CRF90Z	Private Land Mobile Radio Services subpart Z – Wireless Broadband Services in the 3650 – 3700 MHz bans.
[Ref 3]	TIA-603-C	Land Mobile FM or PM – Communications Equipment – Measurement and Performance Standards

4 Product Description

The CPE supports operation with 5 MHz and 10 MHz bandwidths, comprising 512 and 1024 subcarriers respectively. Each of these subcarriers can be modulated in a number of modes:

- QPSK ½ and ¾
- 16 QAM ½ and ¾
- 64 QAM ½ and ¾

The following three modulation schemes will be used during testing:

- QPSK ¾
- 16 QAM ¾
- 64 QAM ¾

The CPE has two antennas allowing 2x transmit and 2x receive MIMO operation, however the CPE will only be deployed with 1x transmit.

5 Tests performed

Testing was carried out on 13th July 2010 by C F J Blackham BEng(Hons) CEng MIET, director of Sulis Consultants Ltd.

Part	Bandwidth	Channels	Modulation
2.1049 / 90.209 Occ bandwidth	5.0	Bottom Top	All three Worst case
	10.0	Bottom Top	All three Worst case
2.1046 / 90.1321 Peak Power density at antenna port	5.0	Bottom Top	All three Worst case
	10.0	Bottom Top	All three Worst case
2.1046 / 90.1321 RF output power in burst	5.0	Bottom Top	All three Worst case
	10.0	Bottom Top	All three Worst case
2.1051 / 90.201(n) Spectrum mask	5.0	Bottom Top	QPSK & 64QAM QPSK & 64QAM
	10.0	Bottom Top	QPSK & 64QAM QPSK & 64QAM

Table 1: Summary of tests performed

6 Test Configuration

6.1 Test sample and Operating mode

The equipment under test (EUT) was:

Configured for	Manufacturer	Name	Model Number	Serial Number
5 MHz channels	Accton Wireless Broadband Corp	WiMAX 802.16e indoor CPE	RG211-3.8	W023000022
10 MHz channels	Accton Wireless Broadband Corp	WiMAX 802.16e indoor CPE	RG211-3.8	W023000028

Table 2: Equipment under test

6.2 Support equipment

The support equipment was:

Description	Manufacturer	Name	Serial Number
Laptop	Dell	Vostro 1000	User 17
PSU	Asian Power Deivces Inc	WA1212FG	Y550209D17007281600

Table 3: Support Equipment

6.3 Test equipment

Description	Manufacturer	Name	Serial Number	Calibration certificate
Receiver	Rohde & Schwarz	FSQ 8	100206	R&S 25037
Network Analyser	Rohde & Schwarz	ZVB20		R&S 24684
Attenator	Huber+Suhner	6810.17A	Batch 751730	Calibrated in-situ using ZVB20
RF cable	Sucoflex	104	83289/4	

Table 4: Test Equipment

6.4 Equipment set-up

Equipment was configured as per figure 1:

- A telnet program running on the laptop allowed the CPE to be set into test mode using a serial lead connected to a header on the main board.
- The insertion loss of the Attenuator and Co-ax cable were measured using a Network Analyser and their path-loss was programmed into the FSQ as an offset of 11.0 dB.

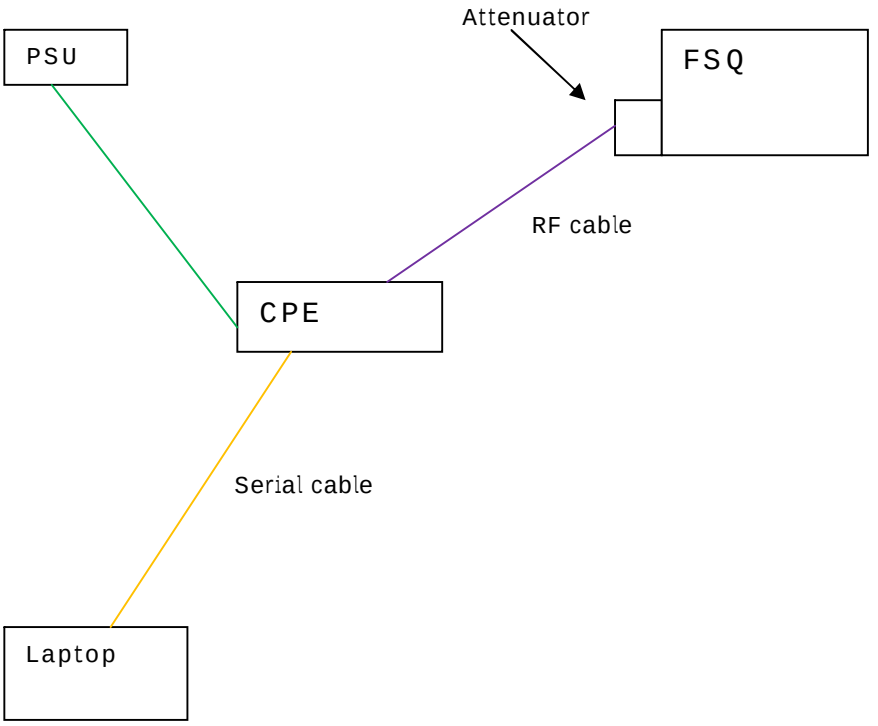

Figure 1: LI Probe test configuration: Emissions

7 Occupied Bandwidth: 47CFR2.1049 / 90.209

The occupied bandwidth was measured using the inbuilt function on the FSQ. Measurements were made on the channel/bandwidth/modulation combinations detailed in table 5 below.

Measurements were performed on bottom channel for each bandwidth, with the four modulation schemes under test. The worst case modulation scheme(s) for each bandwidth was then used for measurement on middle and top channels.

Channel	Bandwidth (MHz)	Frequency (MHz)	Modulation	Bandwidth (kHz)
Bottom	5	3652.5	QPSK ¾	4743.6
			16 QAM ¾	4743.6
			64 QAM ¾	4743.6
Top	5	3672.5	64 QAM ¾	4743.6
Bottom	10	3655.0	QPSK ¾	9294.9
			16 QAM ¾	9294.9
			64 QAM ¾	9294.9
Top	10	3670.0	64 QAM ¾	9294.9

Table 5: Occupied Bandwidth test results

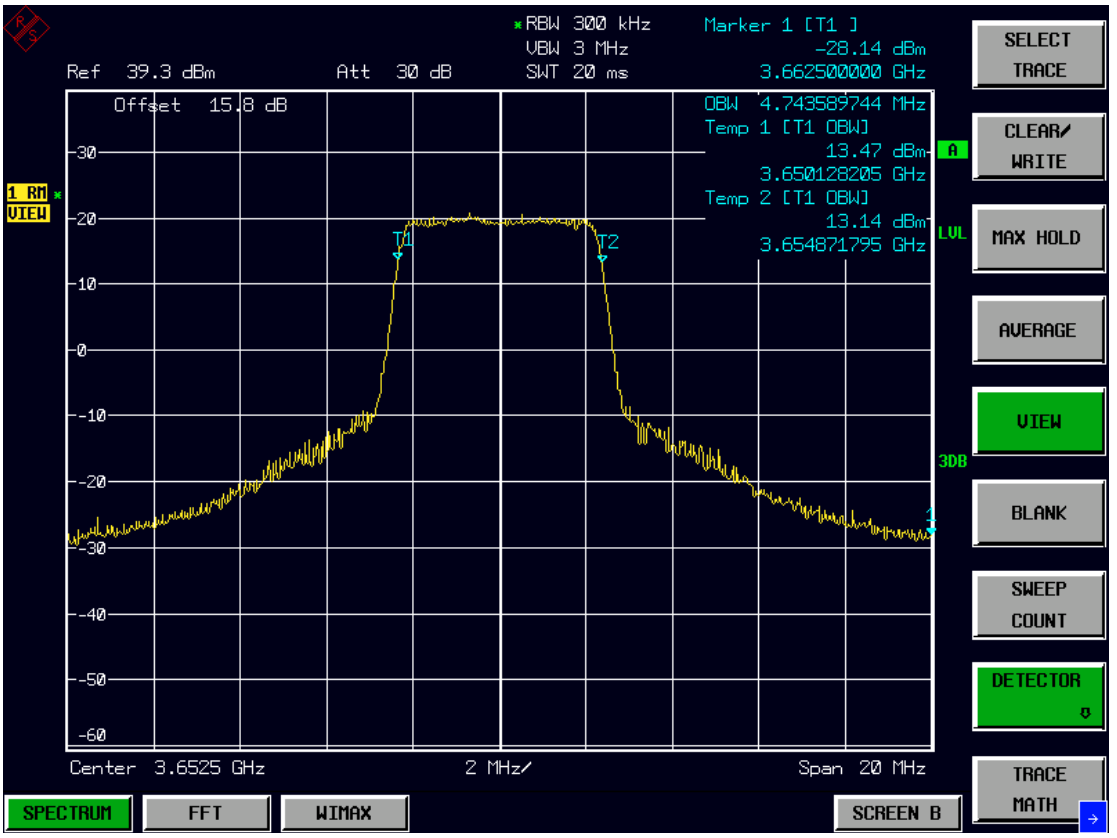

Figure 2: Occupied Bandwidth, 5MHz, 3652.5 MHz, QPSK ¾

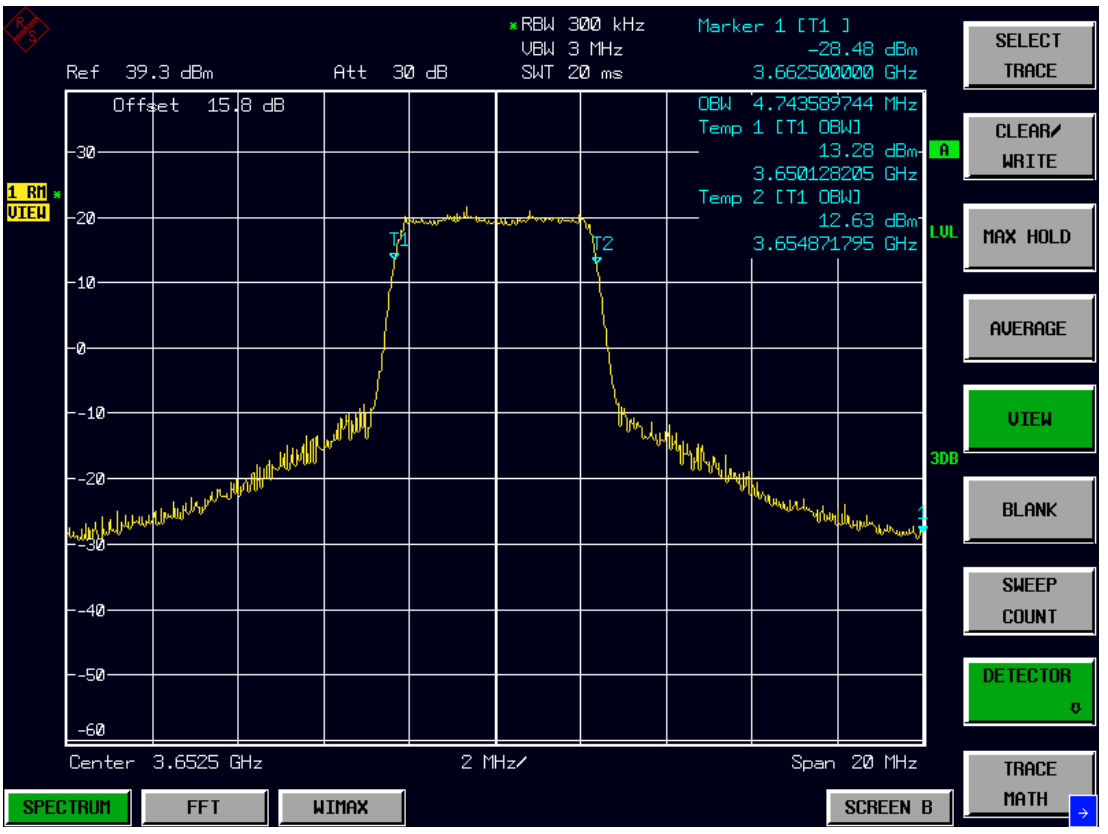

Figure 3: Occupied Bandwidth, 5MHz, 3652.5 MHz, 16 QAM ¾

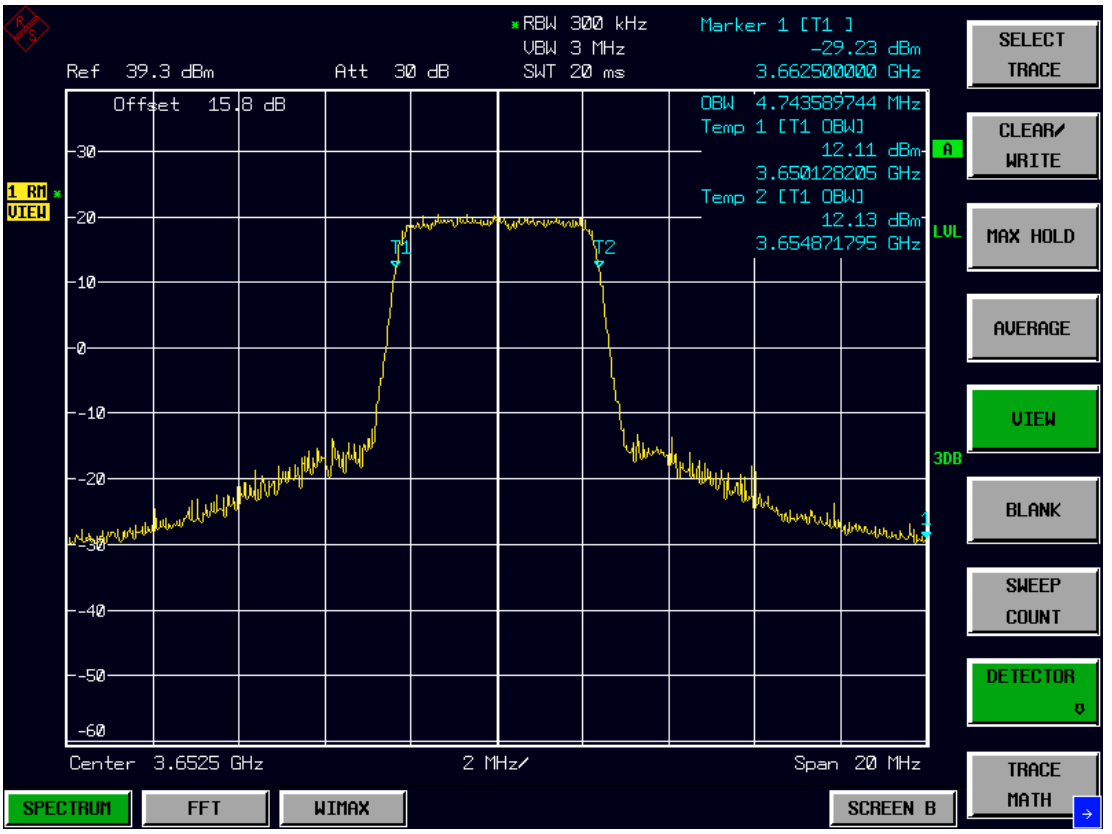

Figure 4: Occupied Bandwidth, 5MHz, 3652.5 MHz, 64 QAM ¾

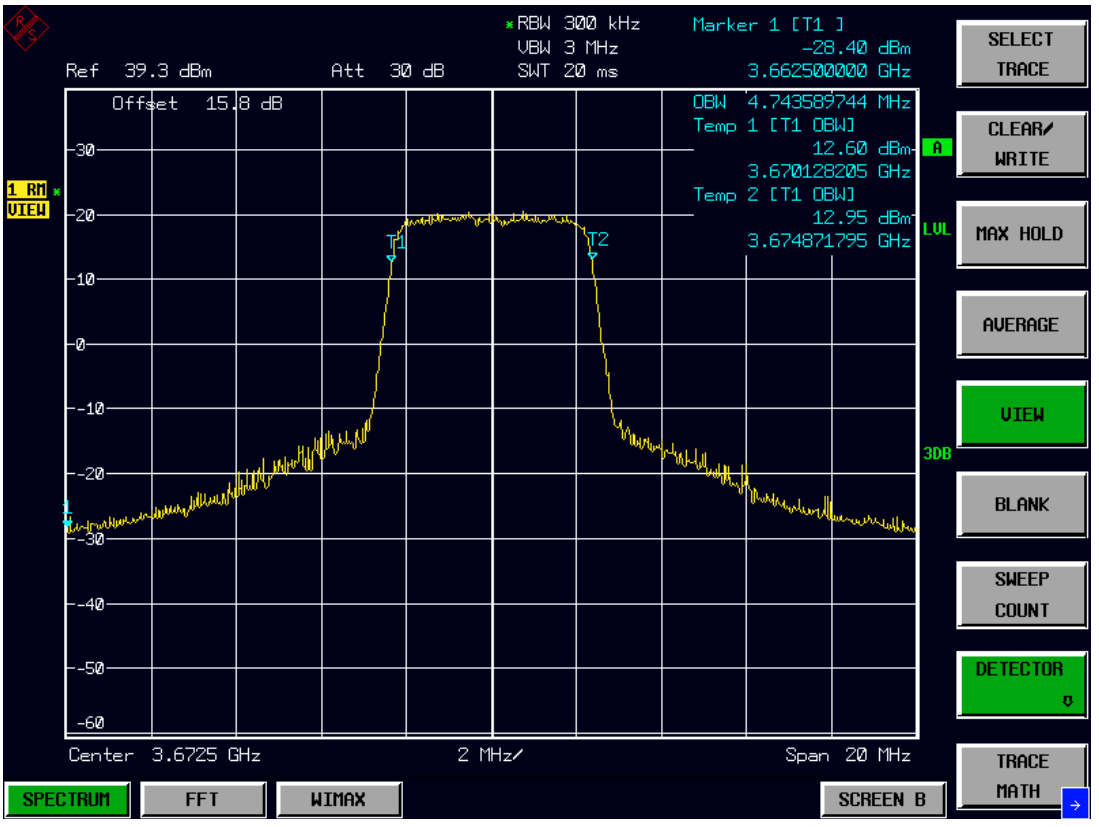

Figure 5: Occupied Bandwidth, 5MHz, 3672.5 MHz,

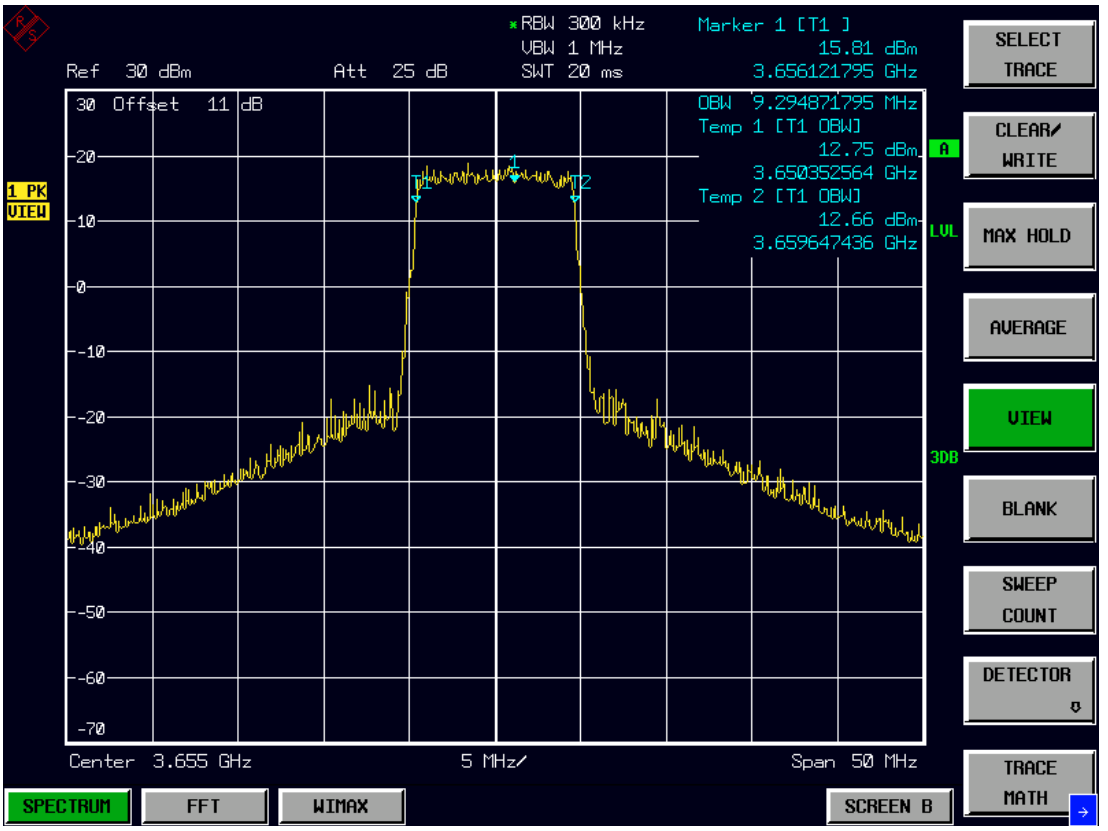

Figure 6: Occupied Bandwidth, 10MHz, 3655.0 MHz, QPSK ¾

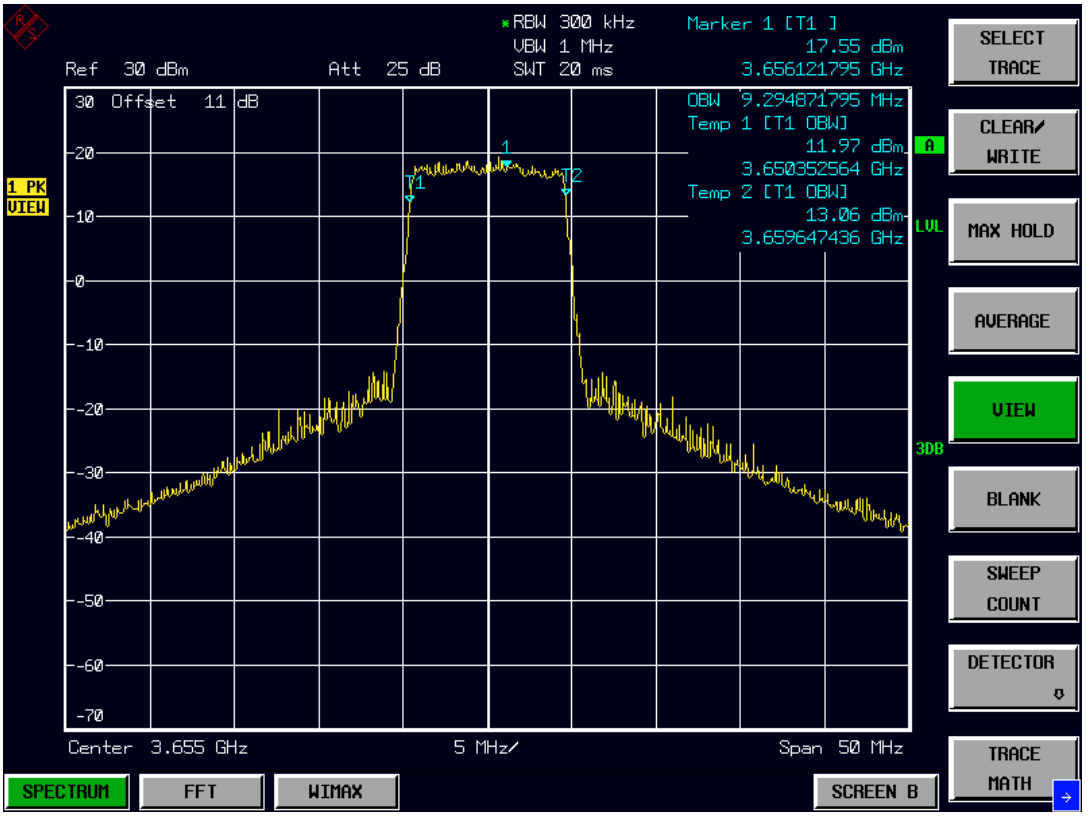

Figure 7: Occupied Bandwidth, 10MHz, 3655.0 MHz, 16 QAM ¾

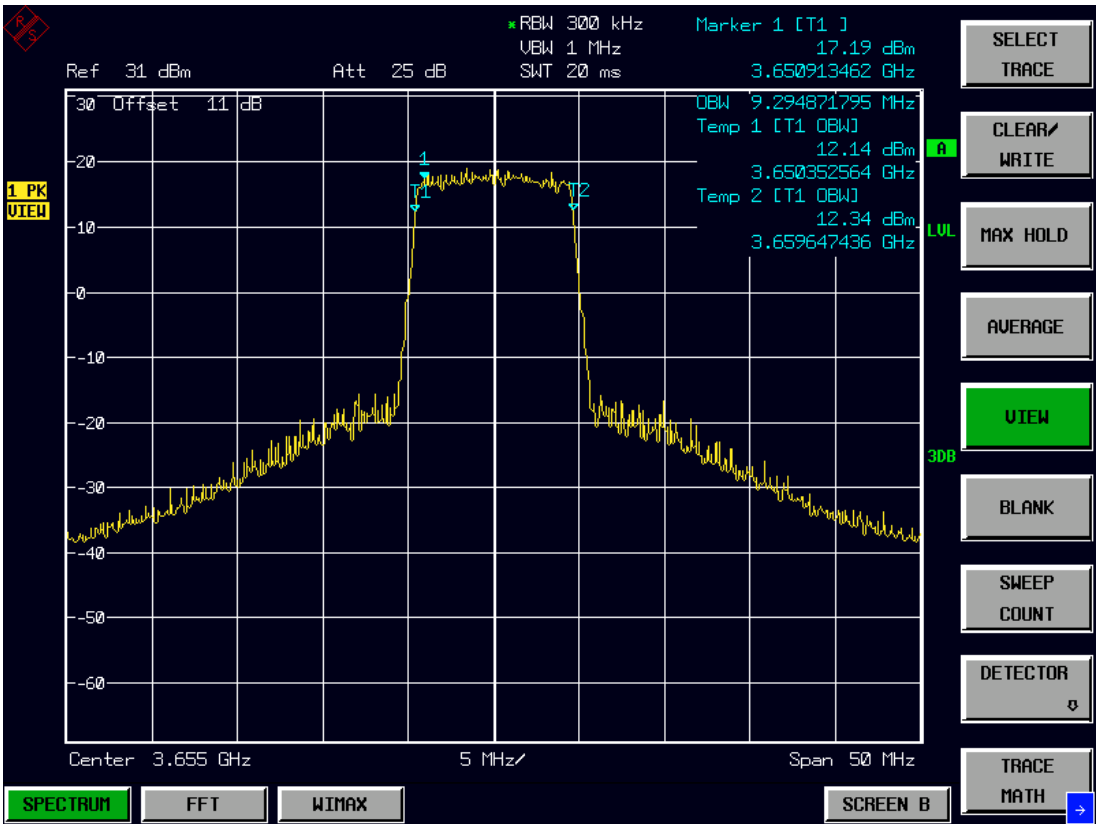

Figure 8: Occupied Bandwidth, 10MHz, 3655.0 MHz, 64 QAM ¾

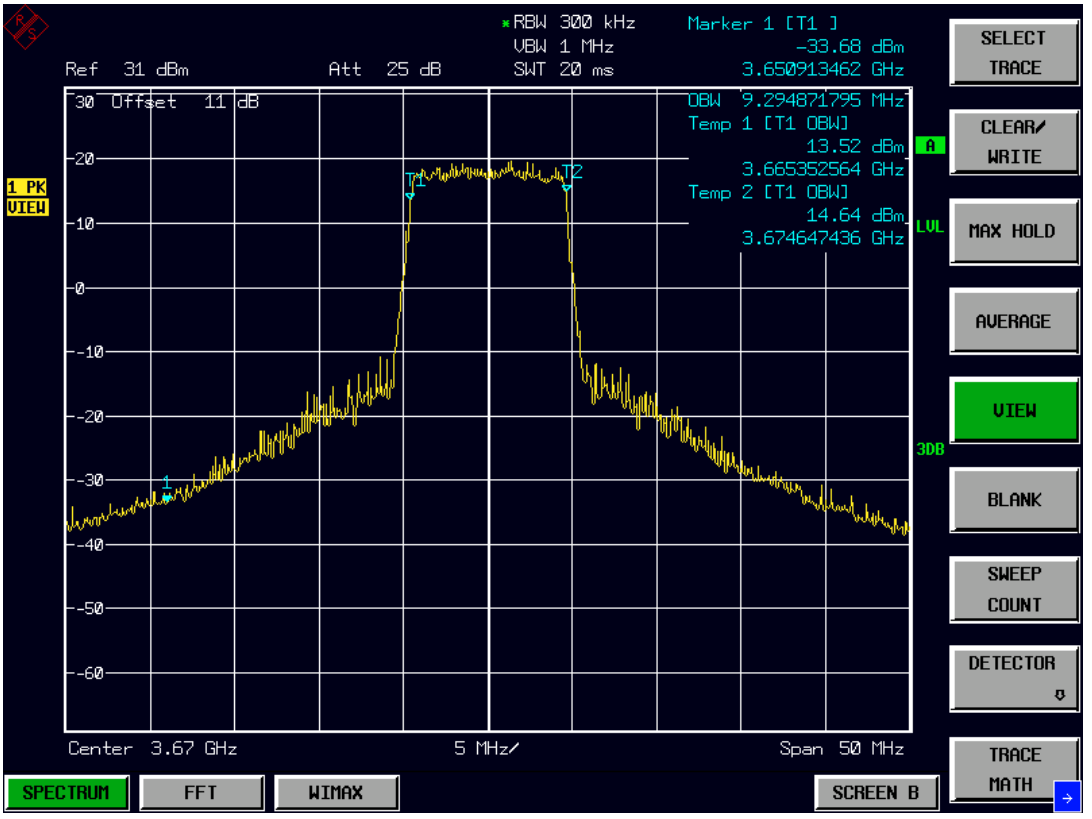

Figure 9: Occupied Bandwidth, 10MHz, 3670 MHz,

8 Transmit Peak Power density 90.1321

The equipment was configured as per figure 1 and the measurements made using the RMS detector of the FSQ.

The duty cycle of the transmitter in 10 MHz mode is 33% so a duty cycle offset of +4.8 dB was added to the 11dB cable loss offset in the analyser.

The duty cycle of the transmitter in 5 MHz mode is 38% so a duty cycle offset of +4.1 dB was added to the 11dB cable loss offset in the analyser.

TX power conducted is then converted to EIRP by adding 6.0 dBi.

Channel	Bandwidth (MHz)	Frequency (MHz)	Modulation	TX power (dBm)	EIRP (dBm)
Bottom	5	3652.5	QPSK ¾	17.79	23.79
			16 QAM ¾	18.09	24.09
			64 QAM ¾	17.99	23.99
Top	5	3672.5	16 QAM ¾	18.64	24.64
Bottom	10	3655.0	QPSK ¾	14.41	20.41
			16 QAM ¾	14.05	20.05
			64 QAM ¾	13.81	19.81
Top	10	3670.0	QPSK ¾	13.47	19.47

Table 6: Transmit Power Density test results

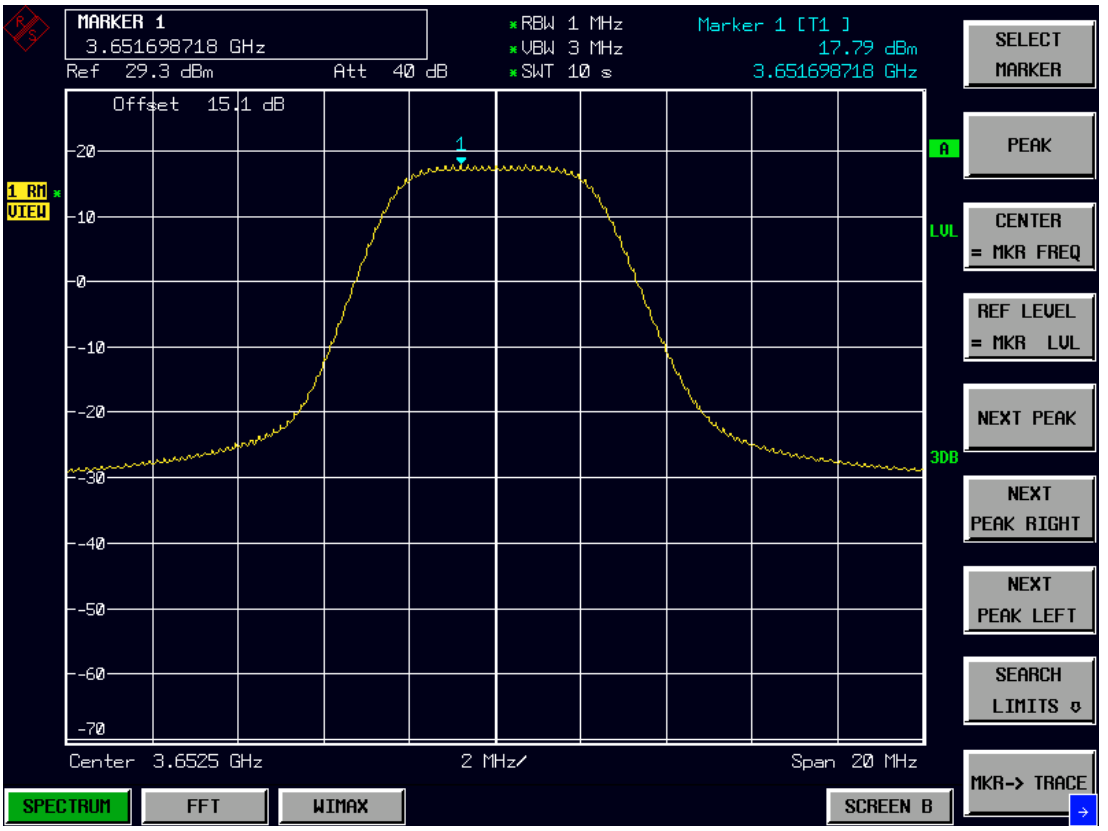

Figure 10: TX power density, 5MHz, 3652.5 MHz, QPSK ¾

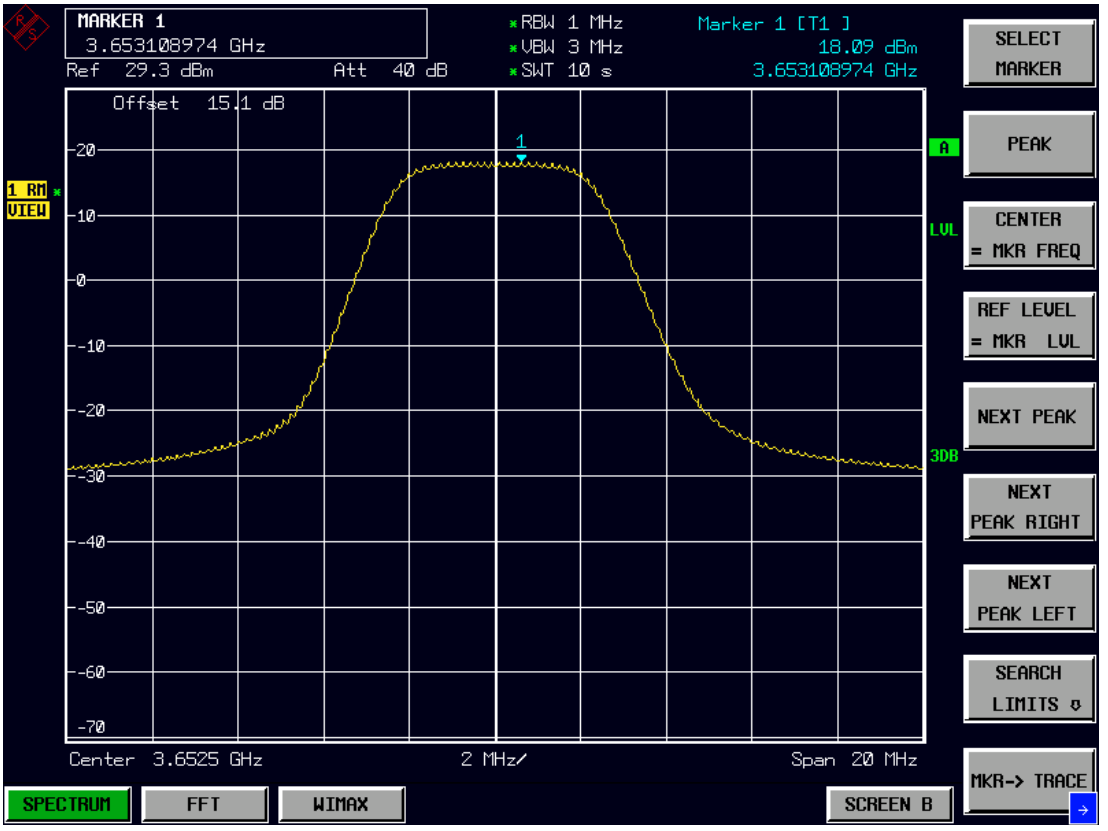

Figure 11: TX power density, 5MHz, 3652.5 MHz, 16 QAM ¾

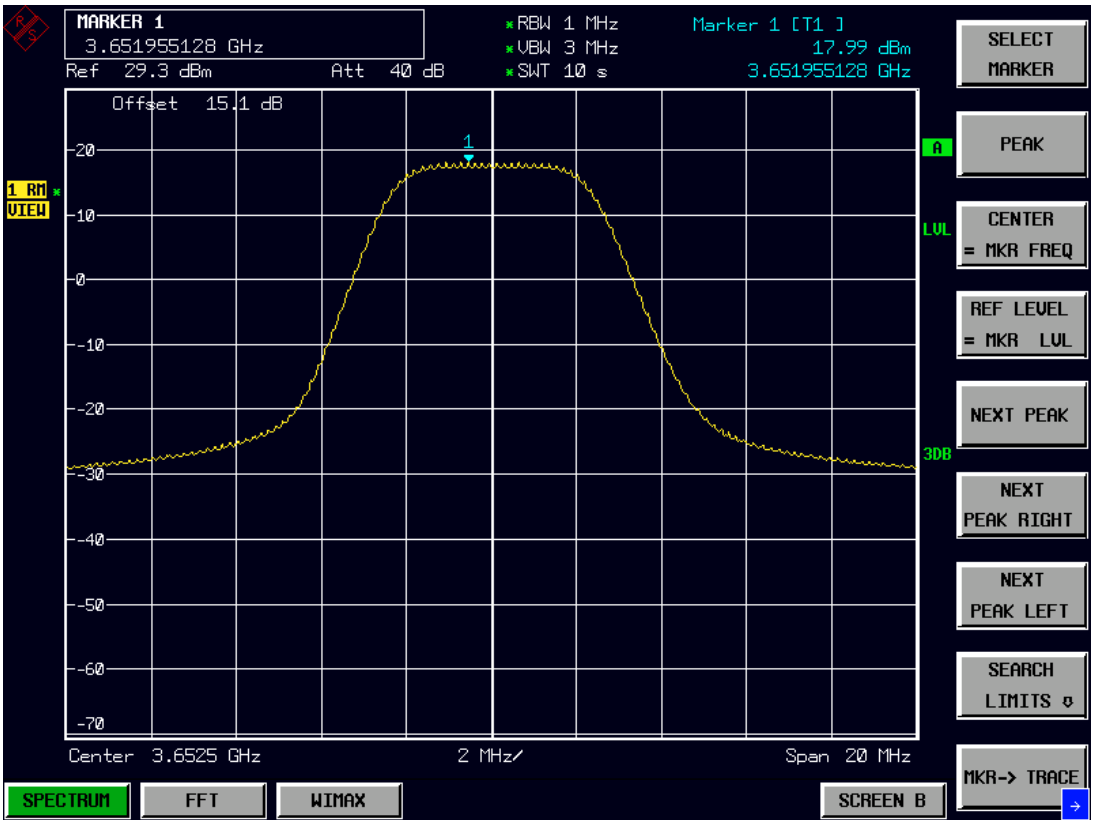

Figure 12: TX power density, 5MHz, 3652.5 MHz, 64 QAM ¾

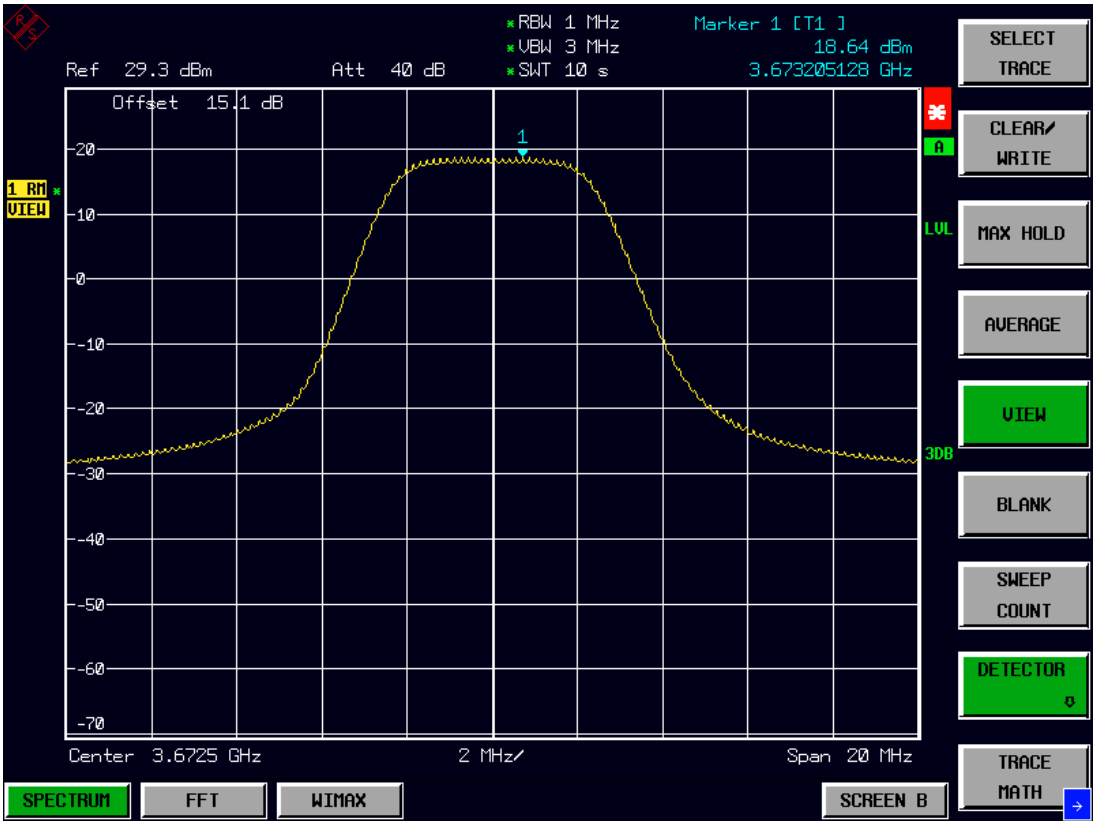

Figure 13: TX power density, 5MHz, 3672.5 MHz,

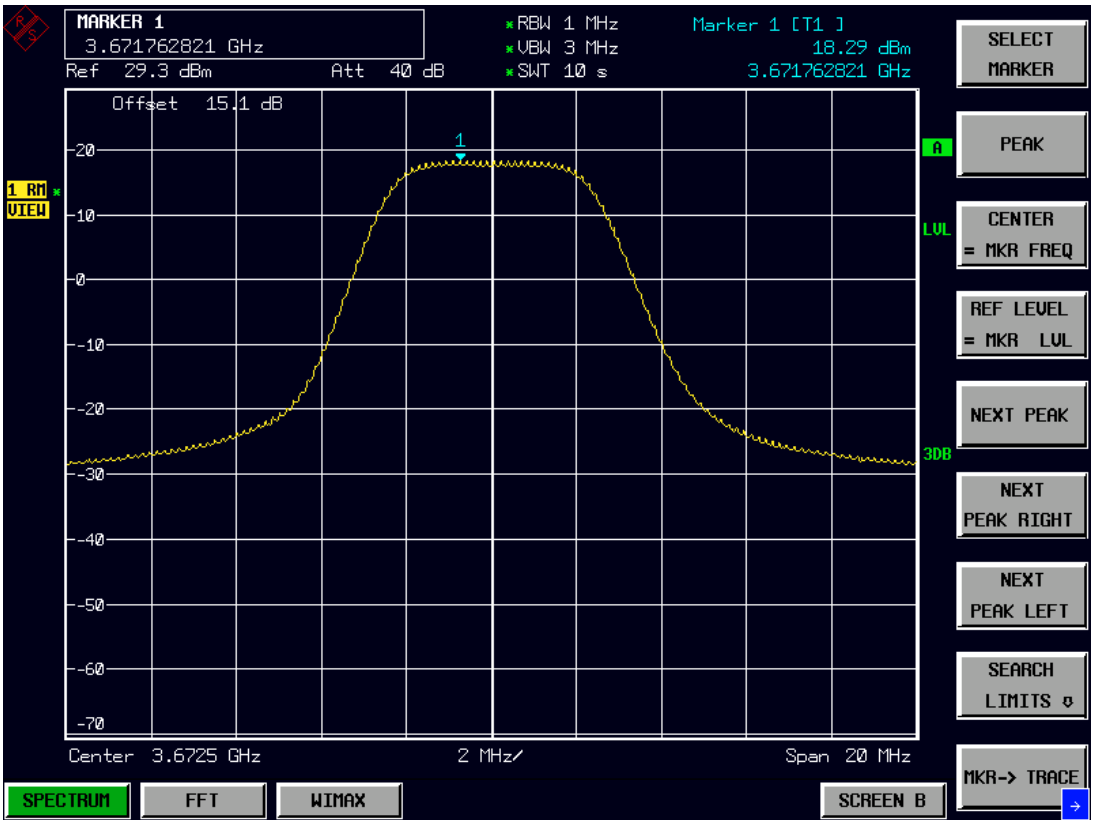

Figure 14: TX power density, 10MHz, 3655.0 MHz, QPSK ¾

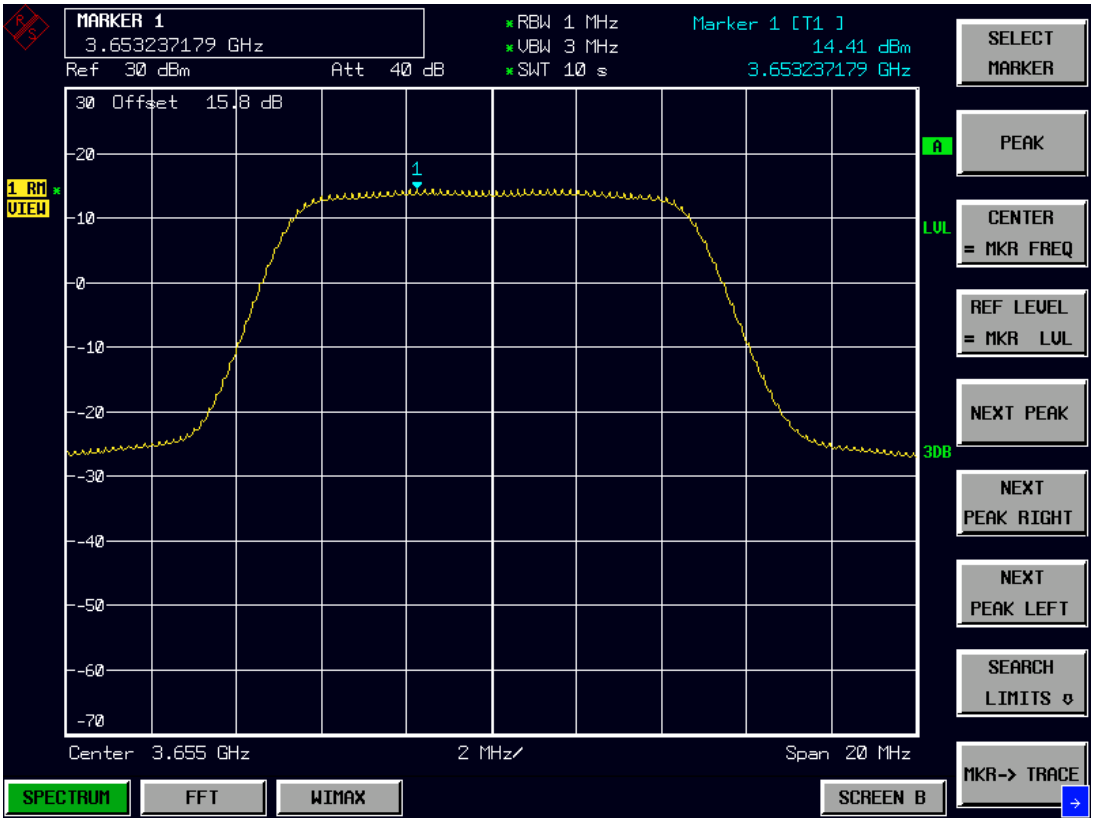

Figure 15: TX power density, 10MHz, 3655.0 MHz, 16 QAM ¾

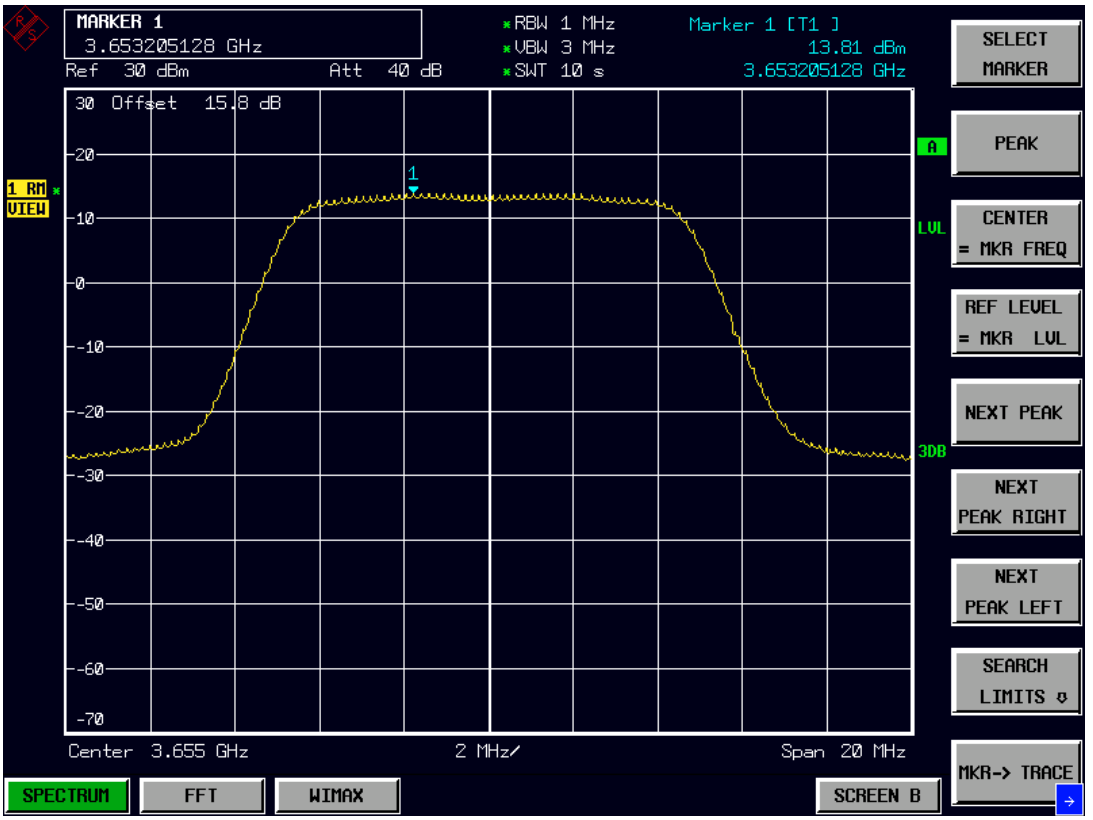

Figure 16: TX power density, 10MHz, 3655.0 MHz, 64 QAM ¾

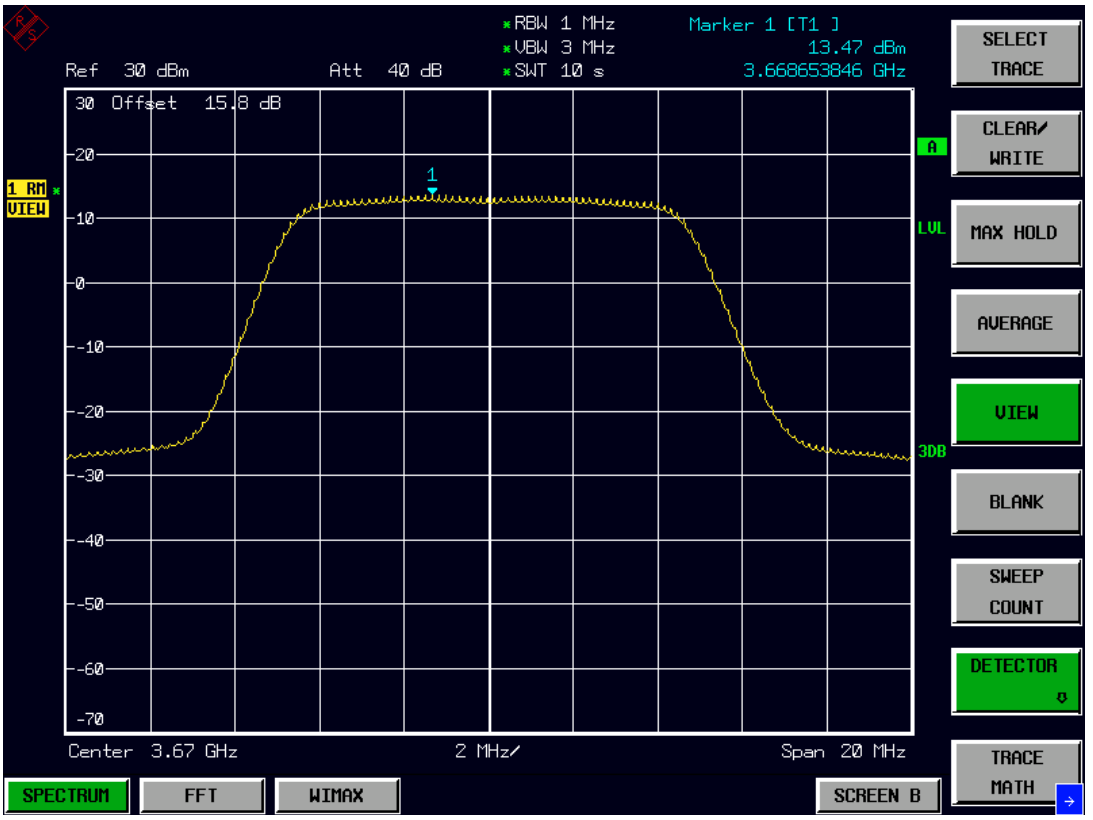

Figure 17: TX power density, 10MHz, 3670.0 MHz,

9 Transmit Carrier Output Power 90.1321 / 2.1046

The equipment was configured as per figure 1 and the measurements made using the RMS detector of the FSQ.

The duty cycle of the transmitter in 10 MHz channel mode is 33% so a duty cycle offset of +4.8 dB was added to the 11dB cable loss offset in the analyser.

The duty cycle of the transmitter in 5 MHz channel mode is 38% so a duty cycle offset of +4.1 dB should be used. However 4.8dB was added in error so this is corrected by subtracting 0.7dB from measured value.

Measured antenna port was then converted to EIRP by adding 6.0 dBi.

Channel	Bandwidth (MHz)	Frequency (MHz)	Modulation	TX power (dBm)	Corrected TX power (dBm)	EIRP (dBm)
Bottom	5	3652.5	QPSK ¾	24.23	23.53	29.53
			16 QAM ¾	24.18	23.48	29.48
			64 QAM ¾	24.01	23.31	29.31
Top	5	3672.5	QPSK ¾	24.60	23.90	29.90
Bottom	10	3655.0	QPSK ¾	21.92	N/A	27.92
			16 QAM ¾	21.88	N/A	27.88
			64 QAM ¾	21.90	N/A	27.90
Top	10	3670.0	64 QAM ¾	22.17	N/A	28.17

Table 7: Transmit Power Density test results

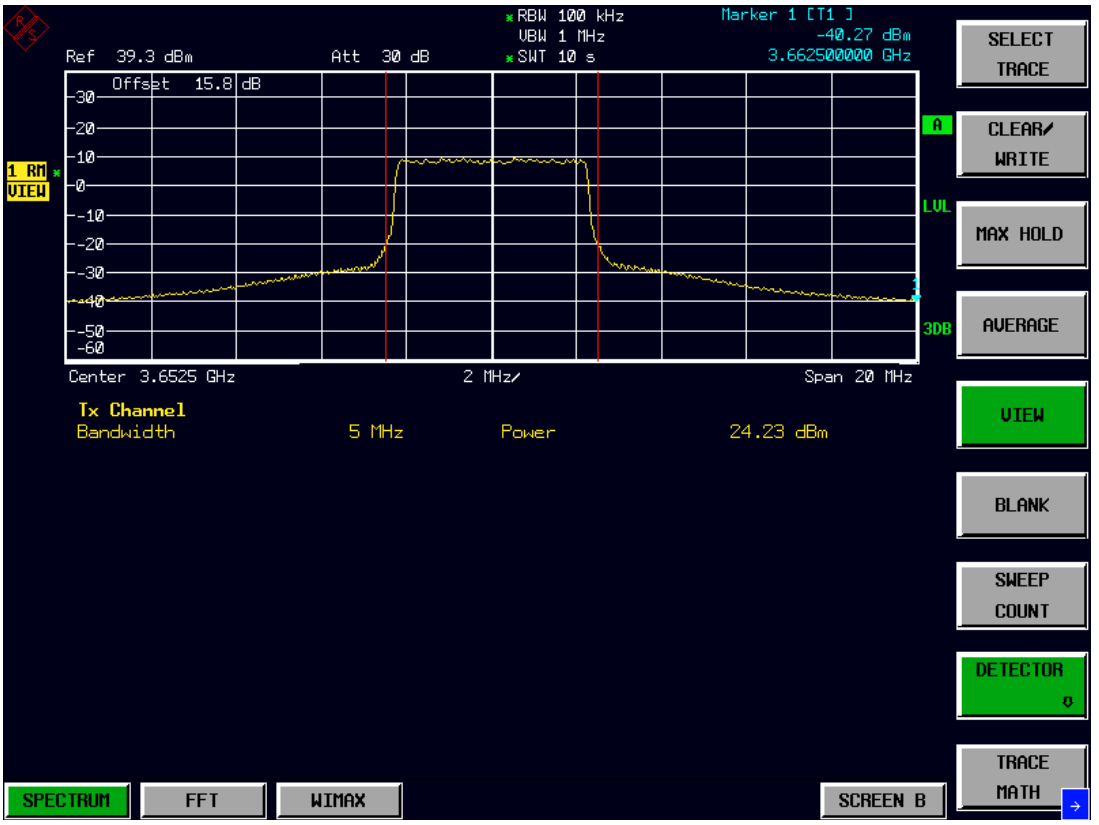

Figure 18: TX Burst Power, 5MHz, 3652.5 MHz, QPSK ¾

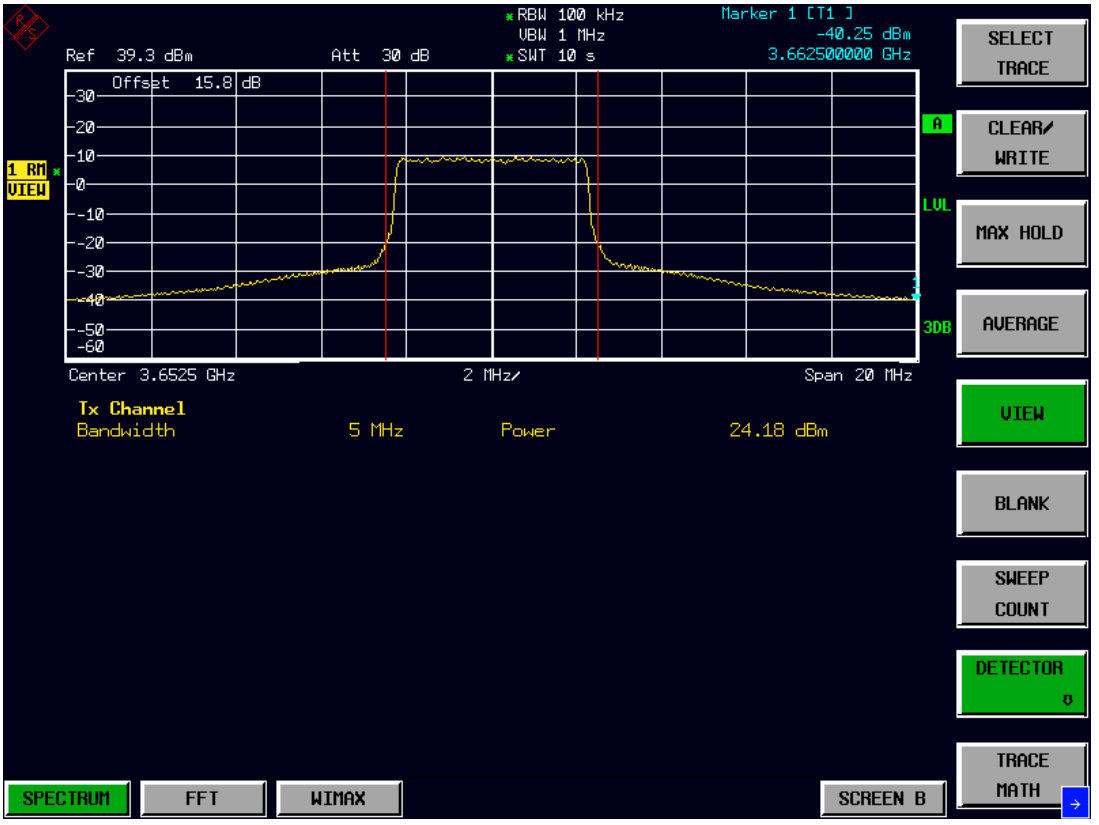

Figure 19: TX Burst Power, 5MHz, 3652.5 MHz, 16 QAM ¾

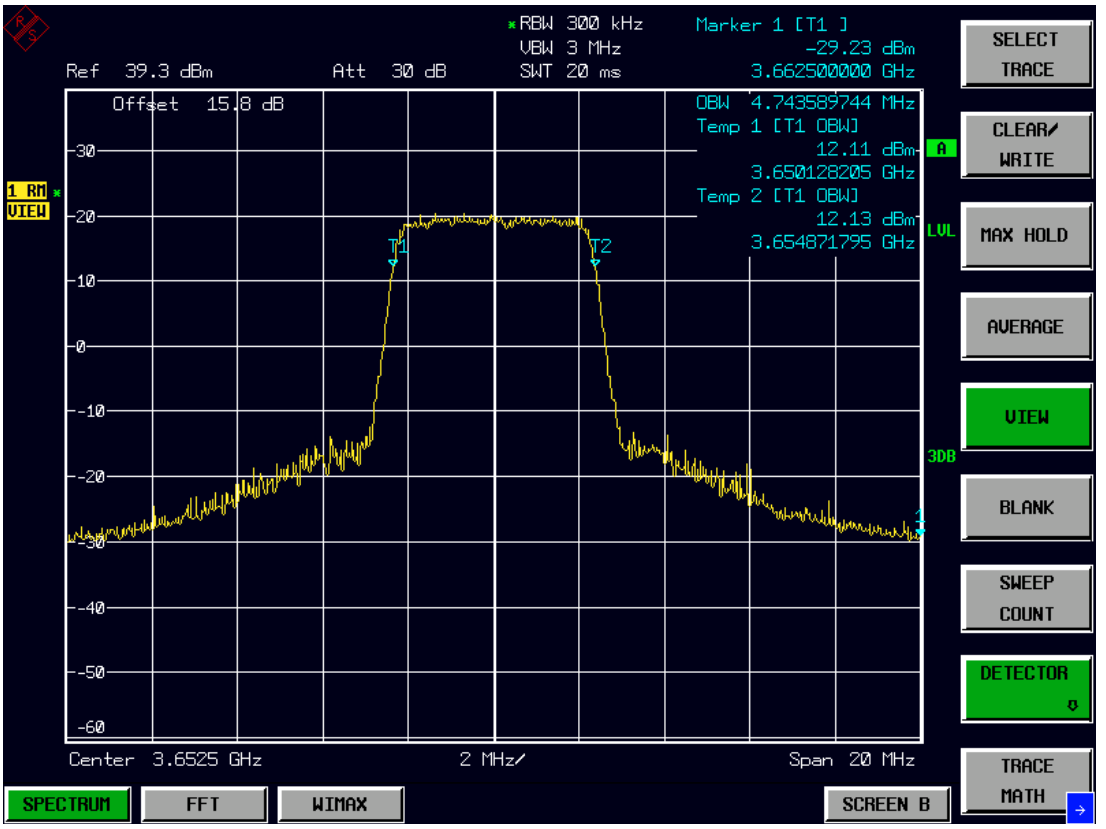

Figure 20: TX Burst Power, 5MHz, 3652.5 MHz, 64 QAM ¾

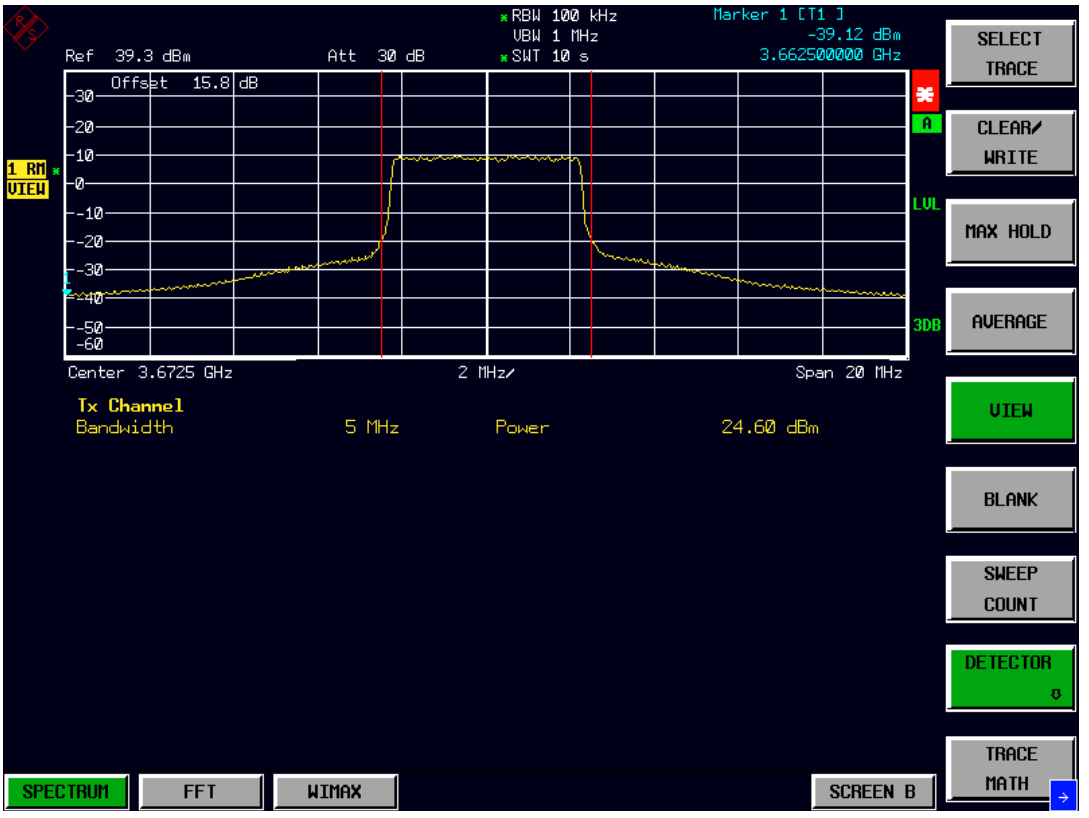

Figure 21: TX Burst Power, 5MHz, 3672.5 MHz, QPSK ¾

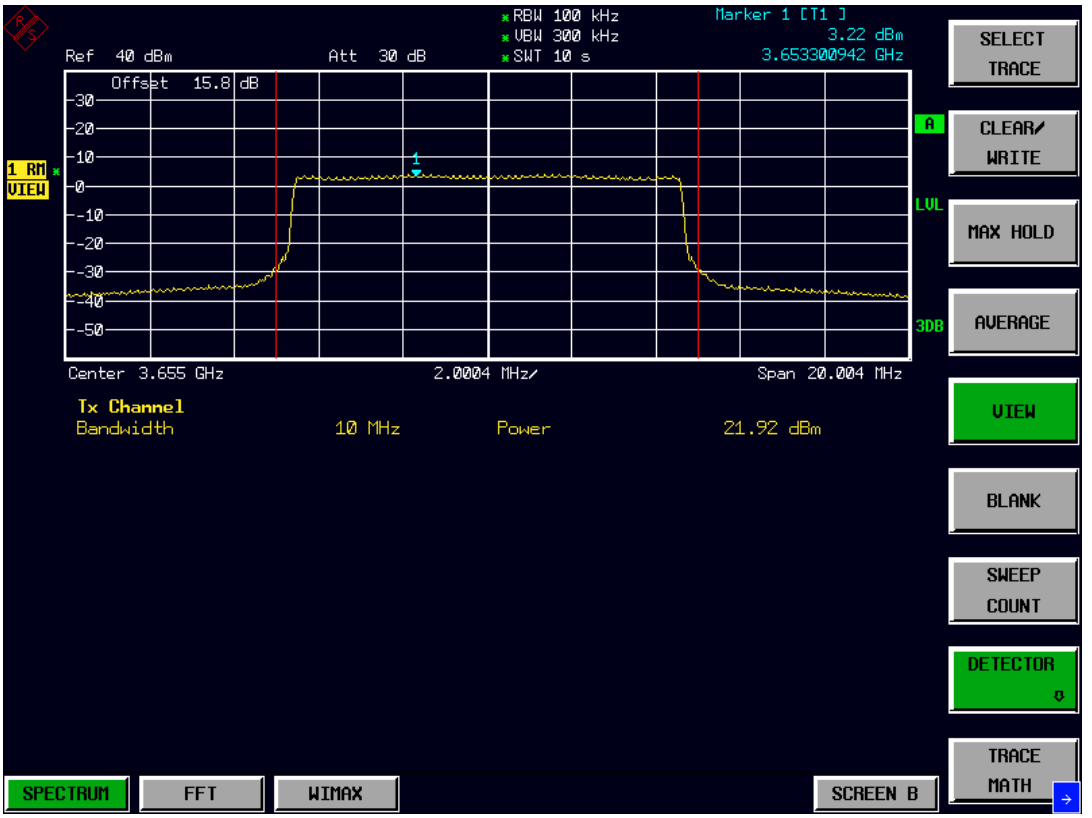

Figure 22: TX Burst Power, 10MHz, 3655.0 MHz, QPSK ¾

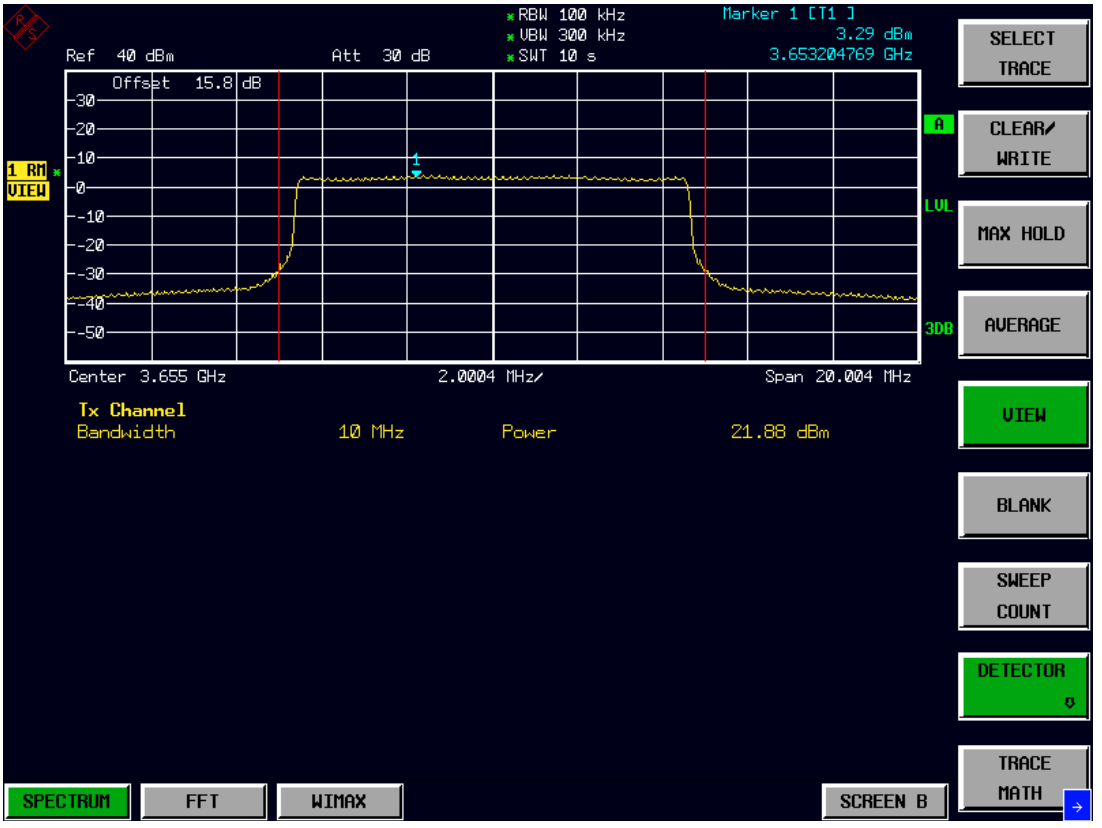

Figure 23: TX Burst Power, 10MHz, 3655.0 MHz, 16 QAM ¾

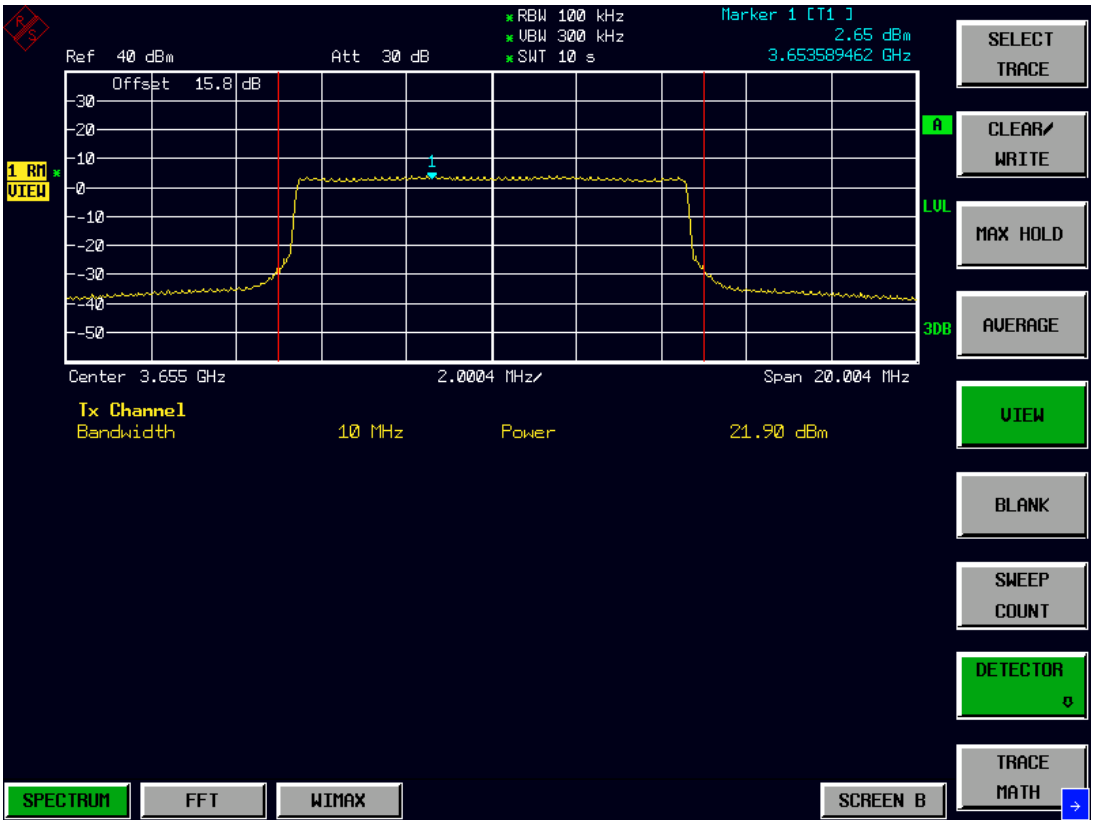

Figure 24: TX Burst Power, 10MHz, 3655.0 MHz, 64 QAM ¾

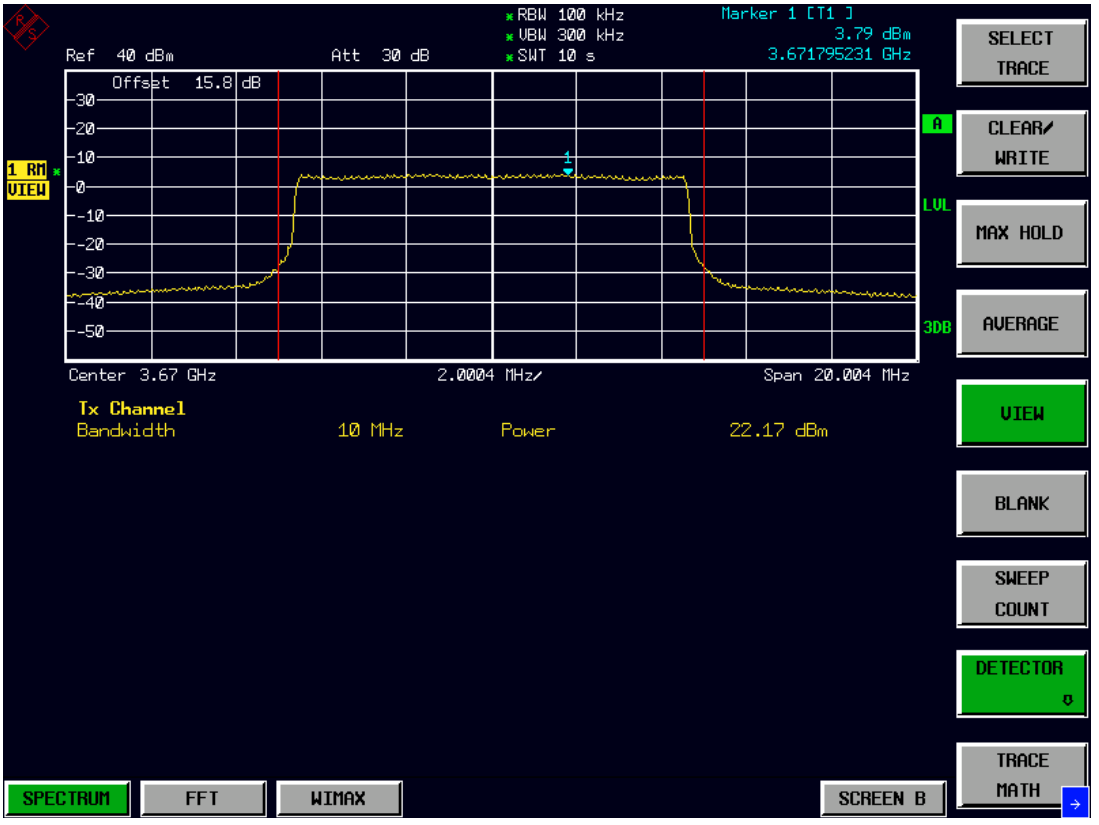

Figure 25: TX Burst Power, 10MHz, 3670.0 MHz, 64 QAM ¾

10 Spectrum Mask – 47CFR90.201(n)

This test was used to determine worst case modulation schemes to be tested by RFI.

Ref level offset of 15.8 dBm included duty cycle offset for 10 MHz channels and 15.1 dBm included duty cycle offset for 5 MHz channels. An RMS detector was used.

The measurement was made using 100kHz bandwidth and the FCC mask was lowered onto the spectrum so that the "band edge" requirement was still 25dB down on maximum emission.

This test was performed with two test modulation schemes for both bandwidths at top and bottom of the band.

In a deviation to FCC test method, the emission mask was placed directly onto the maximum emission measured with a 100kHz bandwidth, rather than being placed at a point 10dB down on peak level measured with full 5 or 10 MHz bandwidth. This gives a worse case measurement suitable for pre-testing.

Channel	Bandwidth (MHz)	Frequency (MHz)	Modulation	Result
Bottom	5	3652.5	QPSK ¾	Pass
			64 QAM ¾	Pass
Top	5	3672.5	QPSK ¾	Pass
			64 QAM ¾	Pass
Bottom	10	3655.0	QPSK ¾	Pass
			64 QAM ¾	Pass
Bottom	10	3670.0	QPSK ¾	Pass
			64 QAM ¾	Pass

Table 8: Spectrum Mask

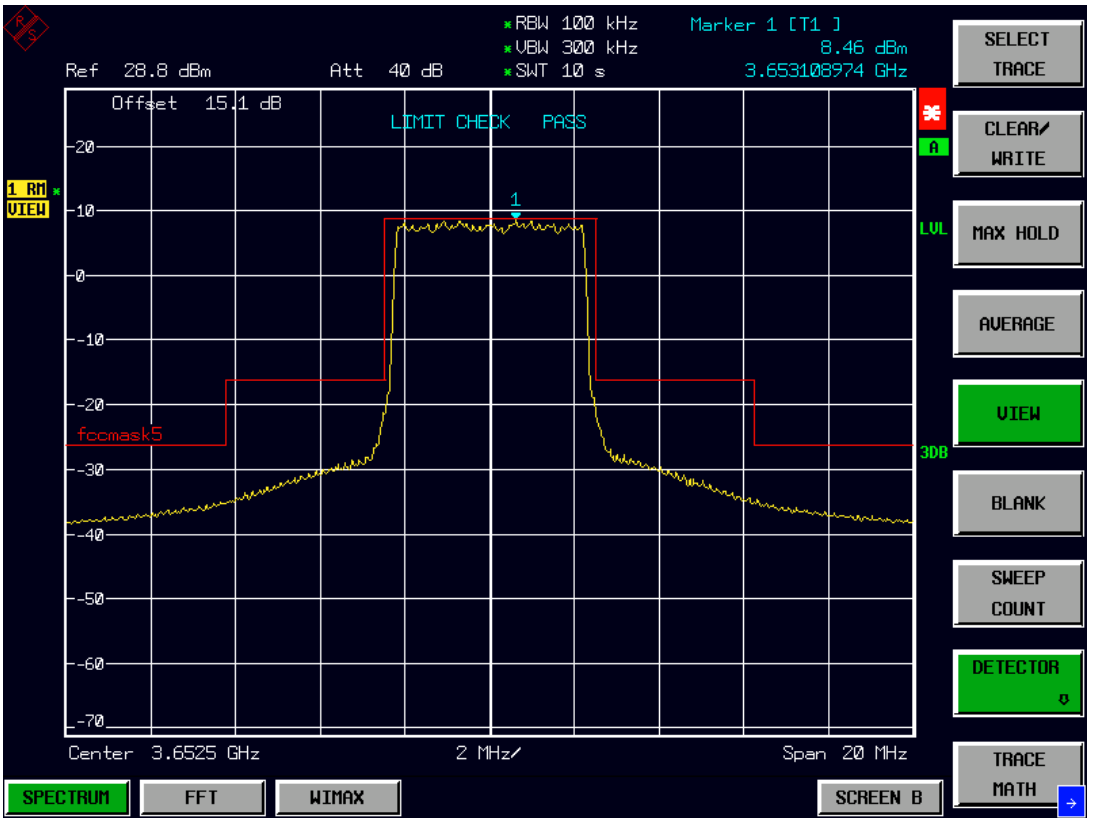

Figure 26: Spectrum Mask, 5MHz, 3652.5 MHz, QPSK ¾

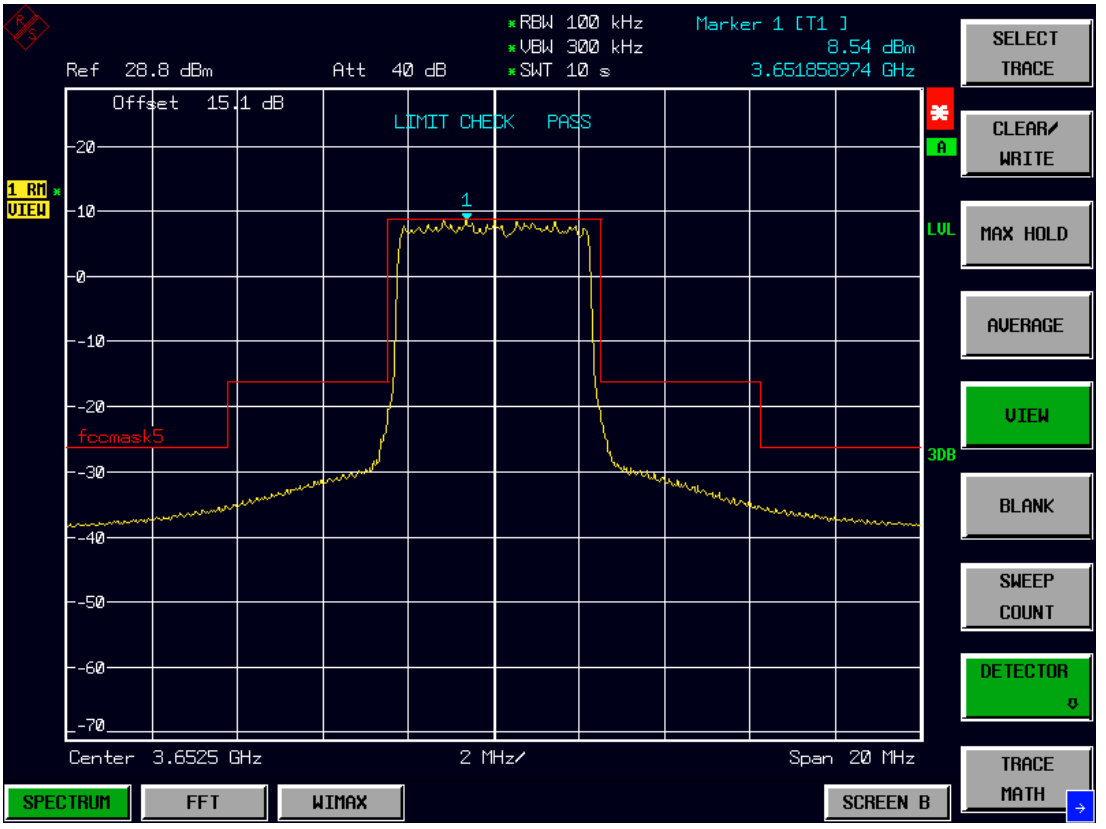

Figure 27: Spectrum Mask, 5MHz, 3652.5 MHz, 64 QAM ¾

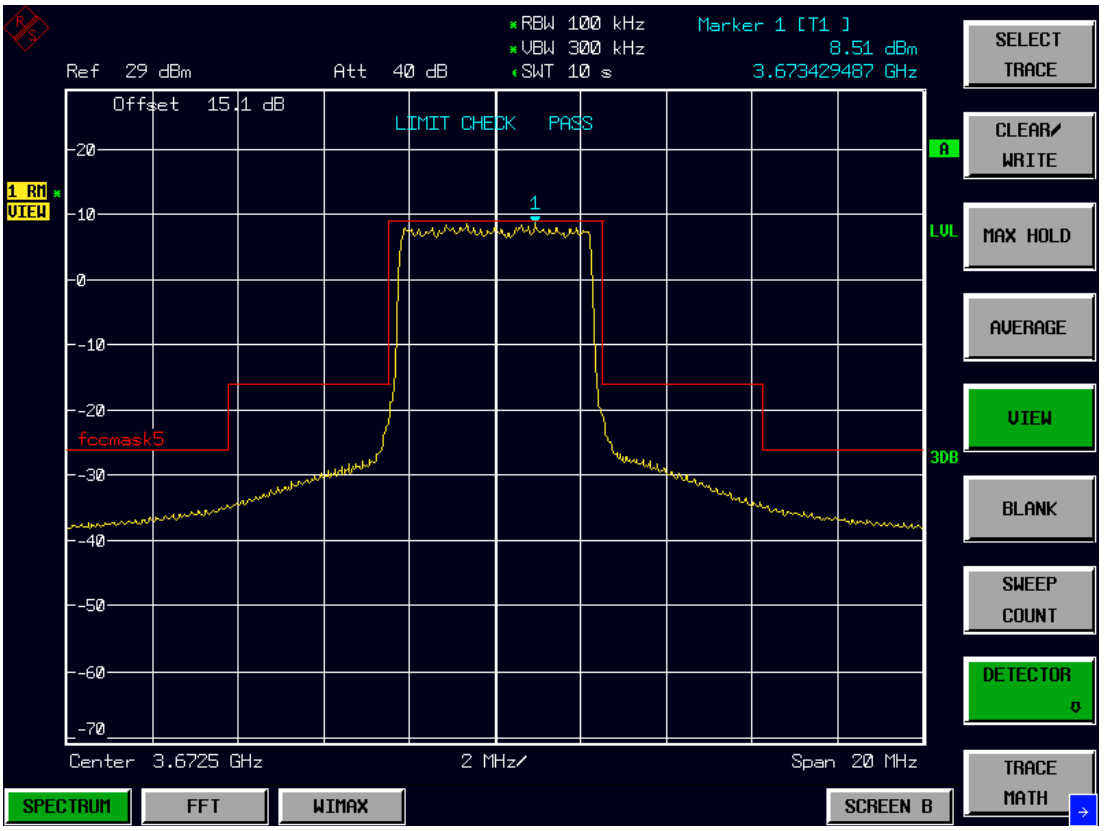

Figure 28: Spectrum Mask, 5MHz, 3672.5 MHz, QPSK ¾

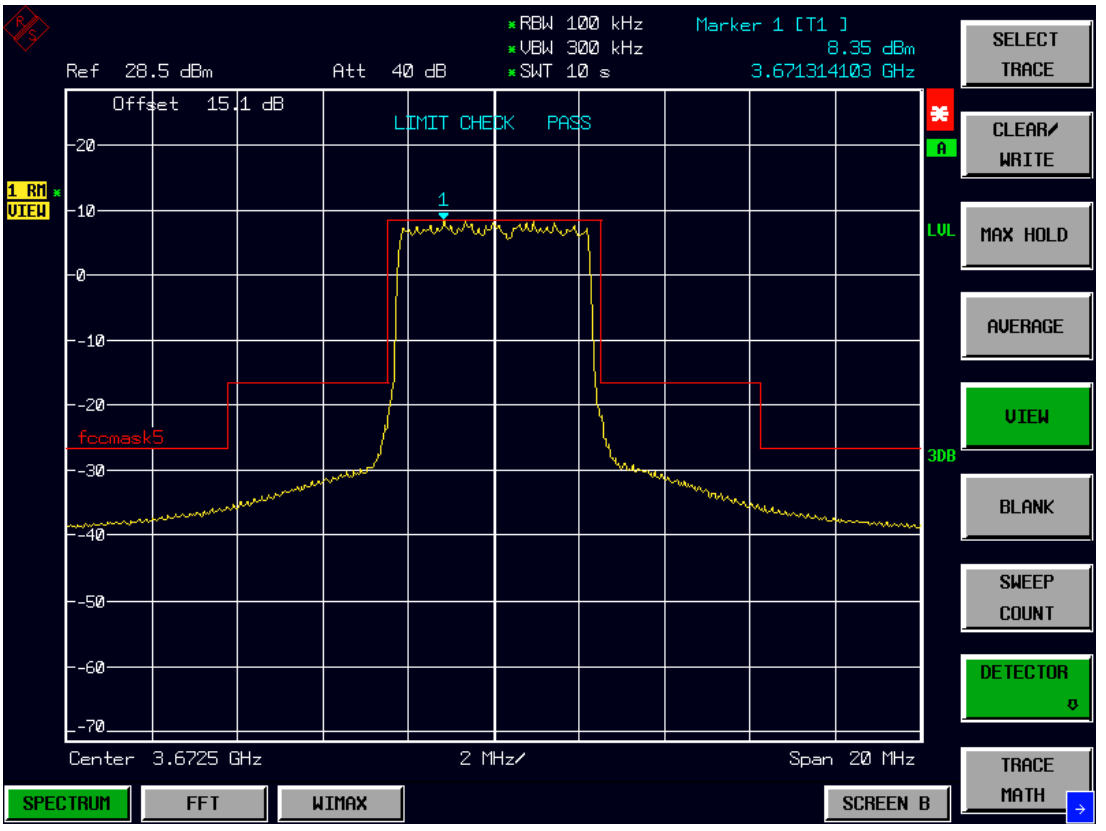

Figure 29: Spectrum Mask, 5MHz, 3672.5 MHz, 64 QAM ¾

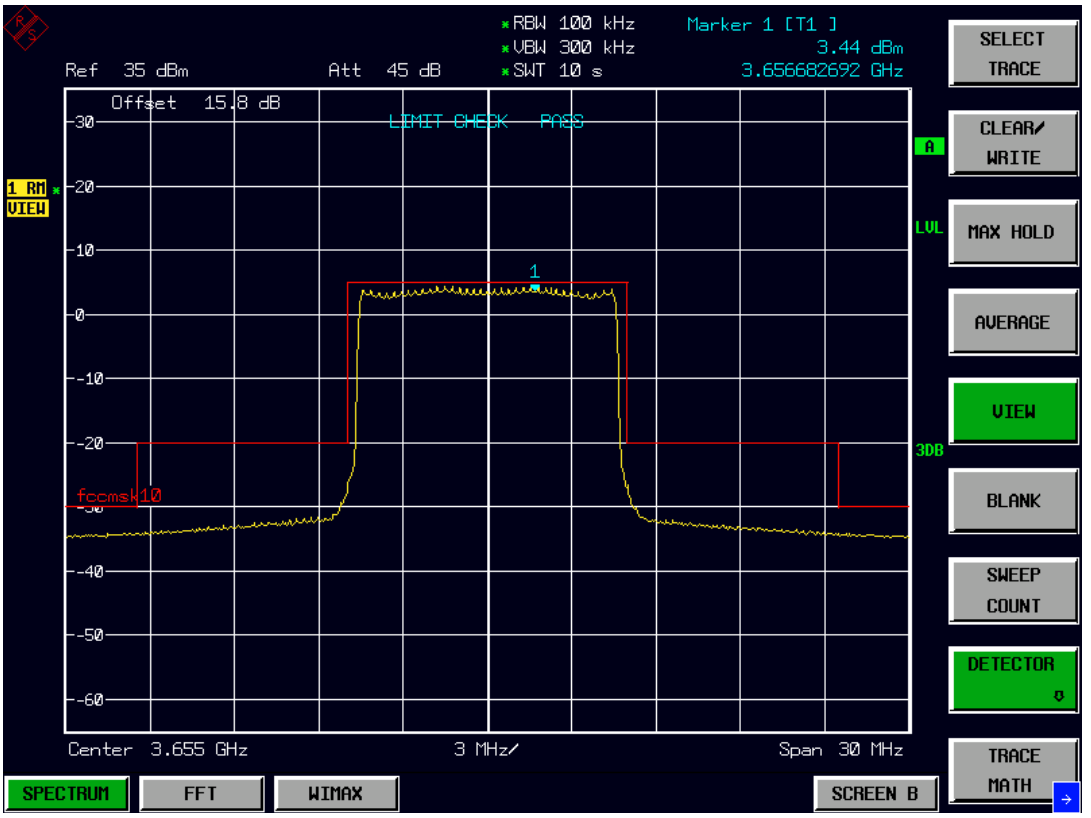

Figure 30: Spectrum Mask, 10MHz, 3655.0 MHz, QPSK ¾

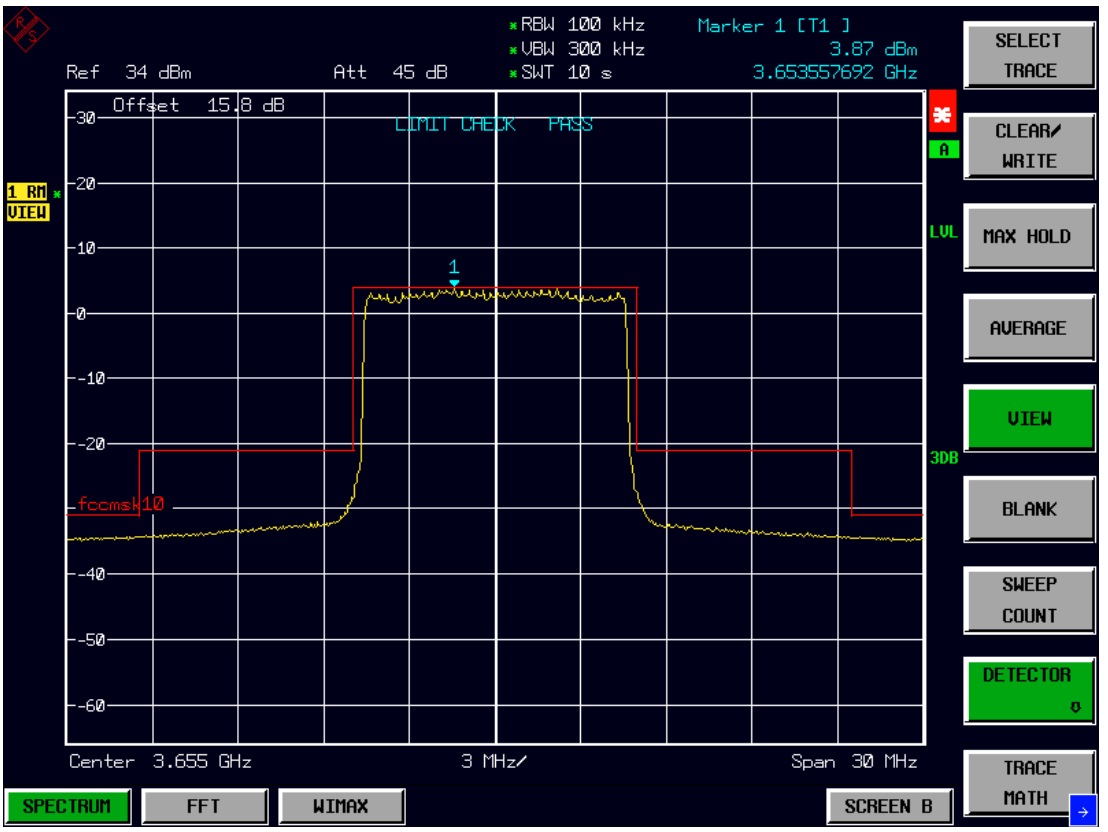

Figure 31: Spectrum Mask, 10MHz, 3655.0 MHz, 64 QAM ¾

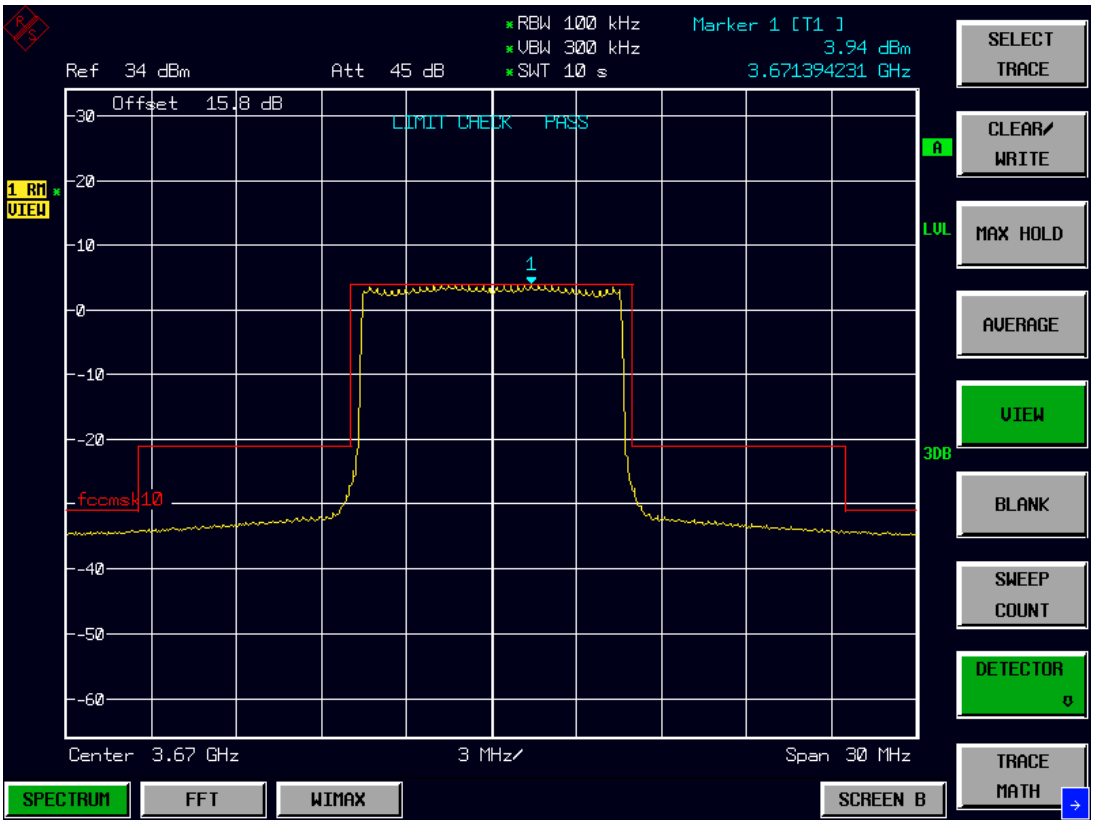

Figure 32: Spectrum Mask, 10MHz, 3670.0 MHz, QPSK ¾

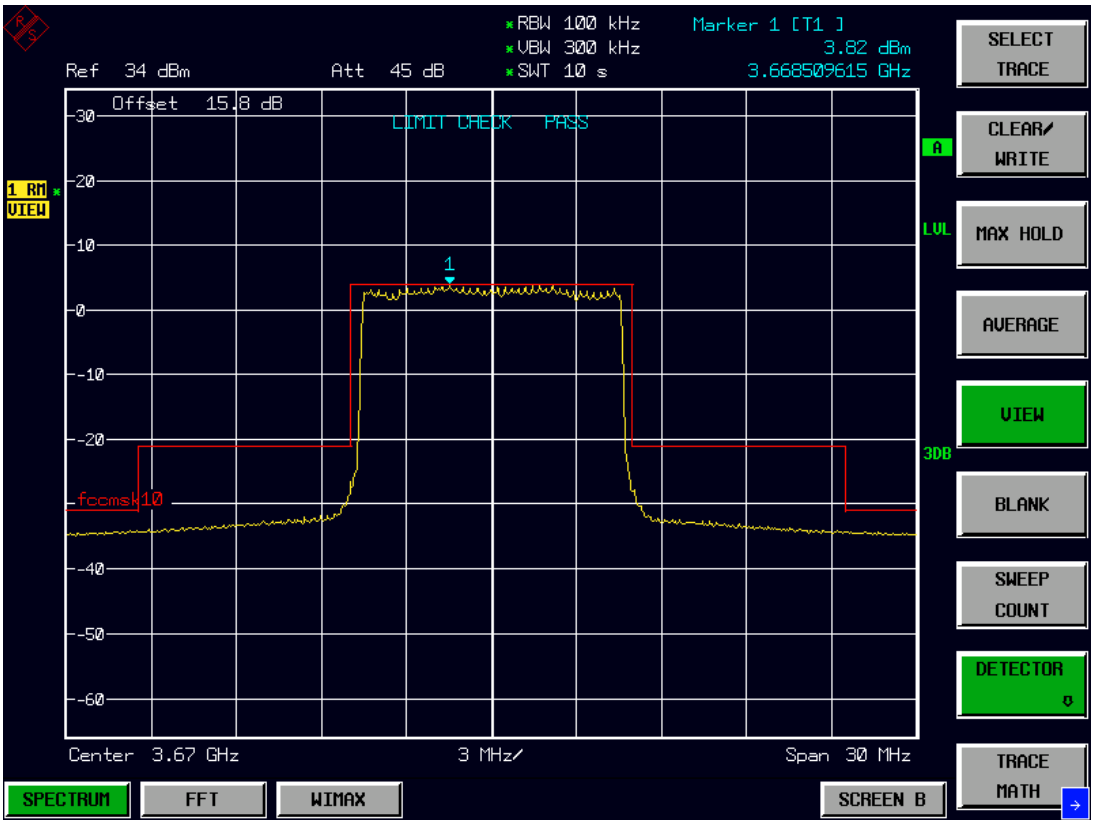

Figure 33: Spectrum Mask, 10MHz, 3670.0 MHz, 64 QAM ¾

11 Test Plan SC_AIR_TP02_A

Following pre-testing, the following tests shall be performed at RFI

Rule	Description	Limit	Test Frequencies (MHz)	Bandwidth	Modulation
2.1046 90.1321	RF power output	25W/25 MHz EIRP	3652..5 3672.5 3655.0 3570.0	5 5 10 10	QPSK ¾ QPSK ¾ 64 QAM ¾ 64 QAM ¾
2.1046 90.1321	RF power output density	1W/MHz EIRP	3652..5 3672.5 3655.0 3570.0	5 5 10 10	16 QAM ¾ 16 QAM ¾ QPSK ¾ QPSK ¾
2.1049 90.209	Occupied Bandwidth	10 MHz / 5MHz as appropriate	3652..5 3672.5 3655.0 3570.0	5 5 10 10	64 QAM ¾ 64 QAM ¾ 64 QAM ¾ 64 QAM ¾
2.1051 90.210(n)	Spectrum mask	Comply with mask B	3652..5 3672.5 3655.0 3570.0	5 5 10 10	QPSK ¾ 64 QAM ¾ QPSK ¾ 64 QAM ¾
2.1051 90.1323	Spurious Emissions at antenna terminals	Out of band power at least 43 + 10*log(P) db below wanted signal	3652..5 3570.0	5 10	QPSK ¾ 64 QAM ¾
2.1053 90.1323	Spurious Emissions field strength		3652..5 3570.0	5 10	QPSK ¾ 64 QAM ¾
2.1055 90.213	Frequency Stability – temp and voltage	No limit specified – results shall be provided for information	3652..5	5	QPSK ¾

Table 9: Summary of tests to be performed at RFI