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Radio Test report – Radiated Emissions RRUS 32A B66A

305067-1TRFWL-R1

Date of issue: April 20, 2016

Applicant:

Ericsson Canada

Product:

RRUS 32A / AIR 32 Band 66A Transceiver

Model:

RRUS 32A B66A

Part number:

KRC 161 601/1

FCC ID:

TA8AKRC161601-1

IC Registration number:

287AB-AS1616011

Specifications/Summary:

Standard	Environmental Phenomenon	Compliance
FCC 47 CFR Part 27 – Miscellaneous Wireless Communications Services	Part §27.53 (h) AWS emission limits (Radiated)	Yes
RSS-139 – Advanced Wireless Services (AWS) Equipment Operating in the Bands 710–1780 MHz and 2110–2180 MHz	Clause 6.6 (ii) Transmitter Unwanted Emissions (Radiated)	Yes

Tested by	David Duchesne, Senior EMC/Wireless Specialist
Reviewed by	Kevin Rose, Wireless/EMC Specialist
Review date	April 20, 2016
Reviewer signature	

Test location

Company name	Nemko Canada Inc.
Address	303 River Road
City	Ottawa
Province	Ontario
Postal code	K1V 1H2
Country	Canada
Telephone	+1 613 737 9680
Facsimile	+1 613 737 9691
Toll free	+1 800 563 6336
Website	www.nemko.com
Site number	FCC test site registration number: 176392, IC: 2040A-4 (3 m semi anechoic chamber)

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.
This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

Copyright notification

Table of contents

Section 1. Report summary

1.1 Applicant and manufacturer

Company name	Ericsson Canada Inc.
Address	349 Terry Fox Drive, Ottawa, ON, Canada, K2K 2V6

1.2 Test specifications

FCC 47 CFR Part 27	Miscellaneous Wireless Communications Services Subpart L — 1695–1710 MHz, 1710–1755 MHz, 1755–1780 MHz, 2110–2155 MHz, 2155–2180 MHz, 2180–2200 MHz Bands
FCC CFR Part 2.1053, 2.1057	Frequency Allocations and Radio Treaty Matters; general rules and regulations
RSS-139 (Issue 3)	Advanced Wireless Services (AWS) Equipment Operating in the Bands 1710–1780 MHz and 2110–2180 MHz
RSS-GEN (Issue 4)	General Requirements for Compliance of Radio Apparatus

1.3 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was performed against all relevant requirements of the test standard except as noted in section 1.4 below. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See "Summary of test results" for full details.

1.4 Exclusions

As per client request the EUT was only assessed for FCC Clause §27.53(h) "AWS emission limits" and RSS Clause 6.6 (ii) "Transmitter Unwanted Emissions". All other sections of FCC Part 27 and RSS-139 were omitted.

1.5 Test report revision history

Table 1.5-1: *Test report revision history*

Revision #	Details of changes made to test report
TRF	Original report issued

Notes: None

Section 2. Summary of test results

2.1 FCC Part 27 Subpart C test results

Table 2.1-1: *FCC Part 27 – Radio Results*

Part	Test description	Verdict
§27.53 (h)	AWS emission limits (Radiated)	Pass

Notes: None

2.2 RSS-139 test results

Table 2.2-1: *RSS-139 – Radio Results*

Clause	Test description	Verdict
6.6 (ii)	Transmitter Unwanted Emissions (Radiated)	Pass

Notes: None

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	March 4, 2016
Nemko sample ID number	133-001700 (Project NEX-305068)

3.2 EUT information

Product name	RRUS 32A Band 66A Transceiver
Model	RRUS 32A B66A
Part number	KRC 161 601/1
Revision	R1A
Serial Number	D16S140661
Antenna Ports	4 TX/RX Ports
IBW	LTE: 70 MHz, WCDMA: 45 MHz
FDD	400MHz
Frequency	TX (DL) LTE: 2110 – 2180 MHz TX (DL) WCDMA: 2110 – 2155 MHz RX (UL) LTE: 1710 – 1780 MHz RX (UL) WCDMA: 1710 – 1755 MHz
Nominal O/P per Antenna Port	Single Carrier: 1 x 30 W (44.77 dBm) Multi-Carrier: 2 x 15 W (41.76 dBm) Multi-Carrier: 3 x 10 W (40 dBm) Multi-Carrier: 4 x 7.5 W (38.75 dBm)
Accuracy (Nominal):	+/- 0.1 PPM
Nominal Voltage:	-48 VDC @ 20A
RAT:	LTE: SC, MC WCDMA: SC, MC Multi RAT (W + L) MC
Modulation:	LTE: QPSK, 16 QAM, 64 QAM WCDMA: QPSK, 16 QAM, 64 QAM
Channel Bandwidth:	LTE: 5, 10, 15, 20 MHz WCDMA: 4.2 to 5 MHz
Maximum Combined OBW per Port:	70 MHz
Digital Interface	CPRI: 2.5 Gbps / 5 Gbps / 10 Gbps (Data 1, Data 2)
Channel Raster:	100 kHz for LTE, 200 kHz for WCDMA
Multi-carrier:	Single Antenna, Tx Diversity, MIMO closed loop (4x2 MIMO and 4-way receiver diversity for LTE)
Operating Temperature:	-40 to 55°C
Total Power based on IBW:	4 x 30W
Supported Carrier Configurations:	LTE: BW(MHz) = 5, 10,15 (1-4); BW= 20 (1-3)
MSR Maximum Carrier Configurations	70 MHz

3.3 EUT information, continued

Description/theory of operation	The RRUS 32A B66A (KRC 161 601/1) is a multi-standard radio forming part of Ericsson's RBS 6000 series Radio Base Station (RBS) equipment. The RRUS (Remote Radio Unit) product provides radio access for mobile and fixed devices and is intended for the outdoor environment. Classed under ITE (Information Technology Equipment), the RRUS is designed to be co-located and directly mated with a compatible antenna, specified for path loss optimization. A fibre optic interface provides the RRUS / RBS control and digital communications between the Radio and RBS. The location of the RRUS with respect to the RBS is only limited to a distance dictated by the limitations of the fibre link. The RRUS 32A B66A supports four (4) Transmit / Receive ports operating in the E-UTRA Band 66A at a Downlink (transmit) frequency from 2110 MHz to 2180 MHz and an Uplink (receive) frequency from 1710 MHz to 1780 MHz. The radio operates in FDD (Frequency Division Duplex) with a duplex spacing of 400 MHz and supports operation on multi Radio Access Transmission Standards (RATS) at transmit bandwidths up to 20 MHz. The radio operates over 4 transmit ports in Single / Multi-Carrier, Mixed Mode, and MIMO transmission with a maximum rated RF output power of 30W per port over an operational temperature of -40° C to +55° C. The RRUS is mounted directly behind a specified antenna along with a Fan Tray, which provides Forced Air Cooling. The Fan Tray is powered and controlled from the RRUS 32A via closed loop sensors to maintain radio thermals through redundant variable speed fans. Air flow is monitored and controlled through an integrated controller in the Fan Tray. To optimize air flow, a Solar Shield cover is provided over the RRUS and Fan Tray providing directional air flow and to maximize thermal performance over the operational environment. For antenna beam directional optimization, the RRUS product has an active RET (Remote Electronic Tilt) function. Power for this option is provided via the RRUS RET interface. The RRUS 32A B66A is a synthesized Transceiver designed for use in the 3GPP (Third Generation Partnership Project) for UMTS 3G (Universal Mobile Telephone System), LTE (Long Term Evolution), and WCDMA (Wideband Code Division Multiple Access).
Operational frequencies	

Clocks / Oscillators	
61.44 MHz	ADC, Surveyor
122.88 MHz	DAC, TOR
245.76 MHz	DAC DATA
983.04 MHz	ADC
614.4 (Mb/s)	CPRI E.6
2457.6 (Mb/s)	CPRI E.24
4915.2 (Mb/s)	CIPRI E.48
9.8304 (Gb/s)	CIPRI E.96
2103.4 MHz	RXIFLO1
439.04 MHz	RXIFLO2

Port description

Port	**Description**
DC Power	-48VDC, 3 Wire
Ground	Main Unit Ground
Data 1	CPRI Fiber
Data 2	CPRI Fiber
MMI	Radio Status Display
RF A/B/C/D	TX/RX Test Port to ARUS branch A-D

Physical

Dimensions	460 x 310 x 120mm [H x W x D] approximate
Weight	13.8kg
Cooling	Forced Air
Mounting	Vertical, Pole, Wall, Building…

Software details: CXP9017316%5_R62EA

3.3 EUT exercise and monitoring details

Band 66A (IBW = 70 MHz LTE/WCDMA)

TX (DL): 2110 - 2180MHz
RX (UL): 1710 – 1780MHz
Duplex Spacing: 400 MHz

Test frequencies:

LTE Single Carrier												
Bandwidth	Transmit/DL (MHz)						Receive/UL (MHz)					
MHz	B		M		T		B		M		T	
	EARFCN	Freq.	EARFCN	Freq.	EARFCN	Freq.	EARFCN	Freq.	EARFCN	Freq.	EARFCN	Freq.
5	1975	2112.5	2300	2145	2625	2177.5	19975	1712.5	20300	1745.0	20625	1777.5
10	2000	2115.0	2300	2145	2600	2175.0	20000	1715.0	20300	1745.0	20600	1775.0
15	2025	2117.5	2300	2145	2575	2172.5	20025	1717.5	20300	1745.0	20575	1772.5
20	2050	2120.0	2300	2145	2550	2170.0	20050	1720.0	20300	1745.0	20550	1770.0

LTE Multi-Carrier (Tx Power and Spurious Emissions)						
Bandwidth	Transmit / DL (MHz)					
(MHz)	EARFCN	M1	EARFCN	M2	EARFCN	M3
5	1975	2112.5	2025	2117.5	2625	2177.5
10	2000	2115.0	2100	2125.0	2600	2175.0
15	2025	2117.5	2175	2132.5	2575	2172.5
20	2050	2120.0	2250	2140.0	2550	2170.0

WCDMA Single Carrier												
Bandwidth	Transmit / DL (MHz)						Receive / UL (MHz)					
(MHz)	B		M		T		B		M		T	
	ARFCN	Freq.	ARFCN	Freq.	ARFCN	Freq.	ARFCN	Freq.	ARFCN	Freq.	ARFCN	Freq.
5	1537	2112.4	1637.5	2132.5	1738	2152.6	1312	1712.4	1412	1732.4	1513	1752.6

WCDMA Multi-Carrier		
Bandwidth	Tx / DL (MHz)	
(MHz)	M1	M2
5	2112.4	2152.60
ARFCN	1537	1738

3.4 EUT setup details

Table 3.4-1: *EUT sub assemblies*

Description	Model	Part number	Serial number	Rev.
Fan Tray	Fan Unit	BKV 106 168/2	X63R000251	R1A

Table 3.4-2: *EUT interface ports*

Description	Qty.
Power	1
Data1	1
Data2	1
MMI	1
Ground	1

Table 3.4-3: *Inter-connection cables*

Cable description	From	To	Length (m)
CPRI fiber cable	METS-LITE	EUT Data-1	20
Ground	Lab Ground	EUT Ground	2
Power, 2 wire	Lab PSU (-48VDC)	EUT Power (2w/3w Adaptor installed)	2

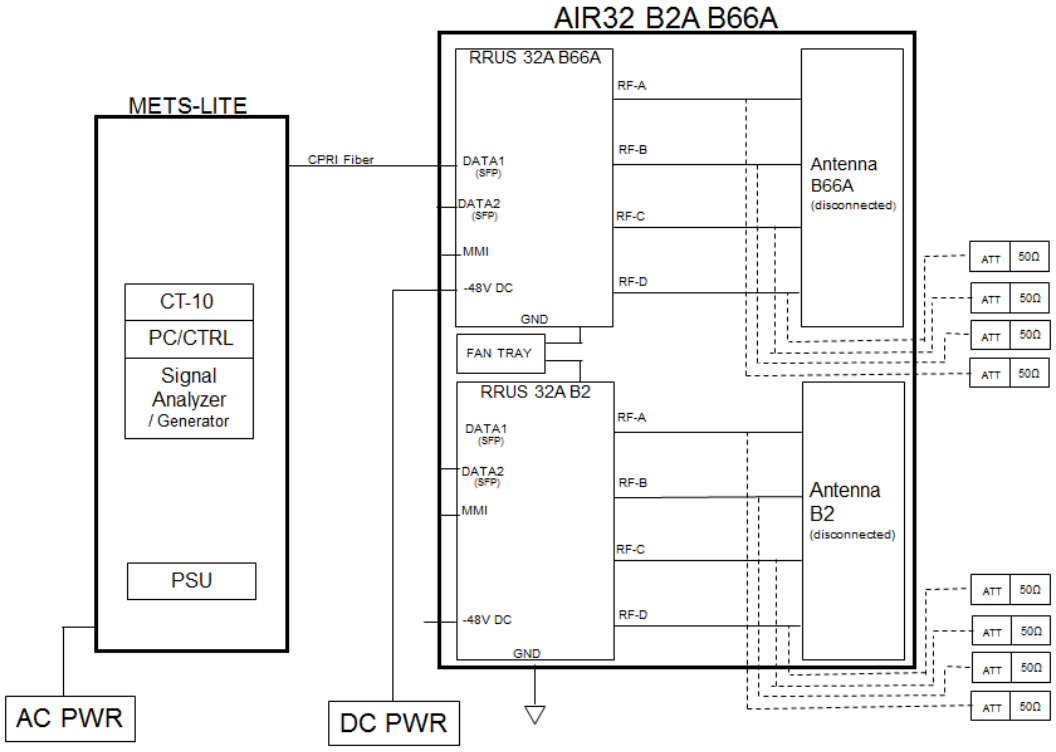


Figure 3.4-1: *Setup diagram – RRUS 32A B66A with Fan Tray*

3.5 Support equipment, details

Support equipment	METS Lite Test System – Anritsu MS 2691 VSA/Sig Gen – HP Laptop – CT10 LTE, WCDMA, and GSM Test and Verification Platform

Section 4. Engineering considerations

4.1 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

4.2 Technical judgment

None

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5. Test conditions

5.1 Atmospheric conditions

Temperature	15–30 °C
Relative humidity	20–75 %
Air pressure	860–1060 mbar

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

5.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ±5 %, for which the equipment was designed.

Section 6. Measurement uncertainty

6.1 Uncertainty of measurement

Measurement uncertainty budgets for the tests are detailed below. Measurement uncertainty calculations assume a coverage factor of K = 2 with 95% certainty.

Test name	Measurement uncertainty, dB
Radiated spurious emissions	3.78

Section 7. Test equipment

7.1 Test equipment list

Table 7.1-1: *Equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
3 m EMI test chamber	TDK	SAC-3	FA002047	1 year	Dec. 01/16
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 26	FA002043	1 year	Jan. 07/17
Bilog antenna (20–3000 MHz)	Sunol	JB3	FA002108	1 year	Apr. 12/16
Spectrum analyzer	Rohde & Schwarz	FSU	FA001877	1 year	Mar. 27/16
Horn antenna (1–18 GHz)	EMCO	3115	FA000825	1 year	Apr. 01/16
Horn antenna (18–40 GHz)	EMCO	3116	FA002487	2 year	July 9/16
Pre-amplifier (1–18 GHz)	JCA	JCA118-503	FA002091	1 year	May 05/16
Pre-amplifier (18–26 GHz)	Narda	BBS-1826N612	FA001550	—	VOU
Pre-amplifier (26–40 GHz)	Narda	DBL-2640N610	FA001556	—	VOU

Notes: VOU - verify on use

Table 7.1-2: Test software details

Test description	Manufacturer of Software	Details
Radiated emissions	Rhode & Schwarz	EMC32, Software for EMC Measurements, Version 8.53.0

Notes: None

Section 8. Testing data

8.1 FCC Part 27 Clause 27.53 (h) AWS emission limits and RSS-139 Clause 6.6 (ii) Transmitter Unwanted Emissions (Radiated)

8.1.1 Definitions and limits

PART 27—MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES
Subpart C—Technical Standards

§27.53 Emission limits

(h) AWS emission limits—(1) General protection levels. Except as otherwise specified below, for operations in the 1695–1710 MHz, 1710–1755 MHz, 1755–1780 MHz, 1915–1920 MHz, 1995–2000 MHz, 2000–2020 MHz, 2110–2155 MHz, 2155–2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 log10 (P) dB. **or** −13 dBm

RSS-139 — Advanced Wireless Services (AWS) Equipment Operating in the Bands 1710–1780 MHz and 2110–2180 MHz

6.6 Transmitter Unwanted Emissions

ii. After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least $43 + 10 \log_{10} p$ (watts) dB.

8.1.2 Test summary

Verdict	Pass				
Test date	March 7, 2016	Test engineer	David Duchesne		
Temperature	22.2 °C	Relative humidity	42 %	Air pressure	974.3 mbar

8.1.3 Observations, settings and special notes

- The following test cases were verified as per client test plan see Table 8.1–1.
- The spectral plots are a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators.

Table 8.1-1: *Test cases*

Test Case	Description
1W + 1L	1 WCDMA Middle Channel Carrier and 1 LTE Middle Channel Carrier
LTE_1Carrier_B_5M_QPSK	1 LTE Bottom Channel Carrier, 5 MHz Bandwidth, QPSK Modulation
LTE_1Carrier_M_5M_QPSK	1 LTE Middle Channel Carrier, 5 MHz Bandwidth, QPSK Modulation
LTE_1Carrier_T_5M_QPSK	1 LTE Top Channel Carrier, 5 MHz Bandwidth, QPSK Modulation
LTE_2Carrier_M_5M_QPSK	2 LTE Middle Channel Carriers, 5 MHz Bandwidth, QPSK Modulation
WCDMA_1Carrier_M_16QAM	1 WCDMA Middle Channel Carrier, 16QAM Modulation

Notes:

Spectrum analyzer settings

Frequency range	30 MHz to 10th harmonic
Detector mode	Peak
Resolution bandwidth	100 kHz (below 1 GHz), 1000 kHz (above 1 GHz)
Video bandwidth	>RBW
Trace mode	Max Hold

8.1.4 Test data

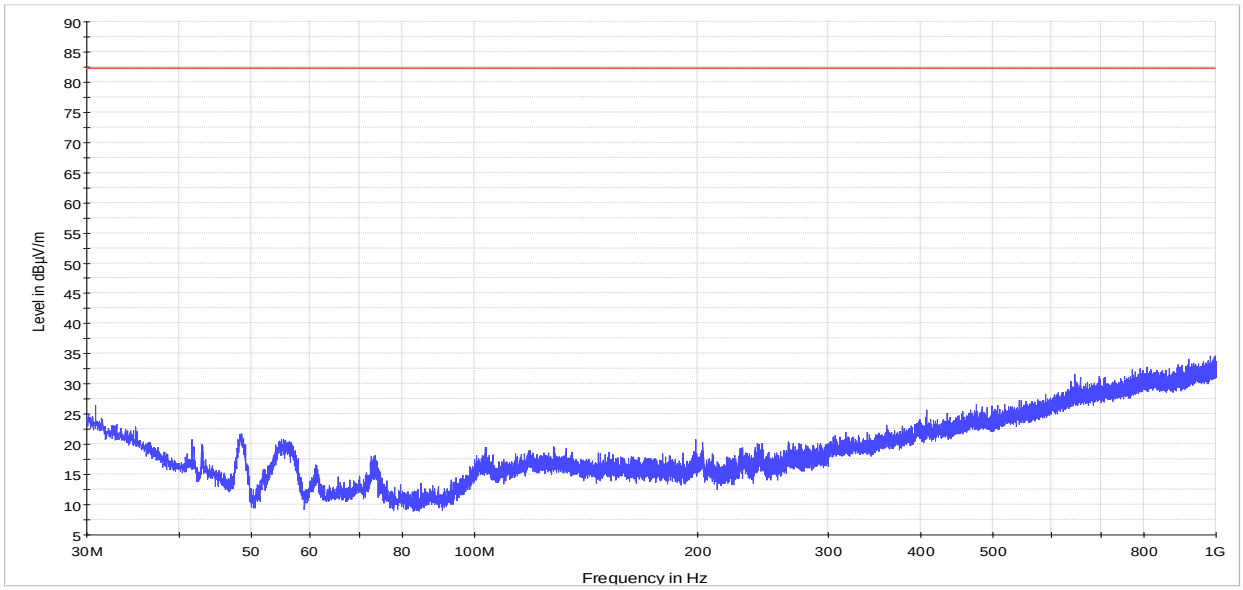


Figure 8.1-1: *30 to 1000 MHz – 1W + 1L*

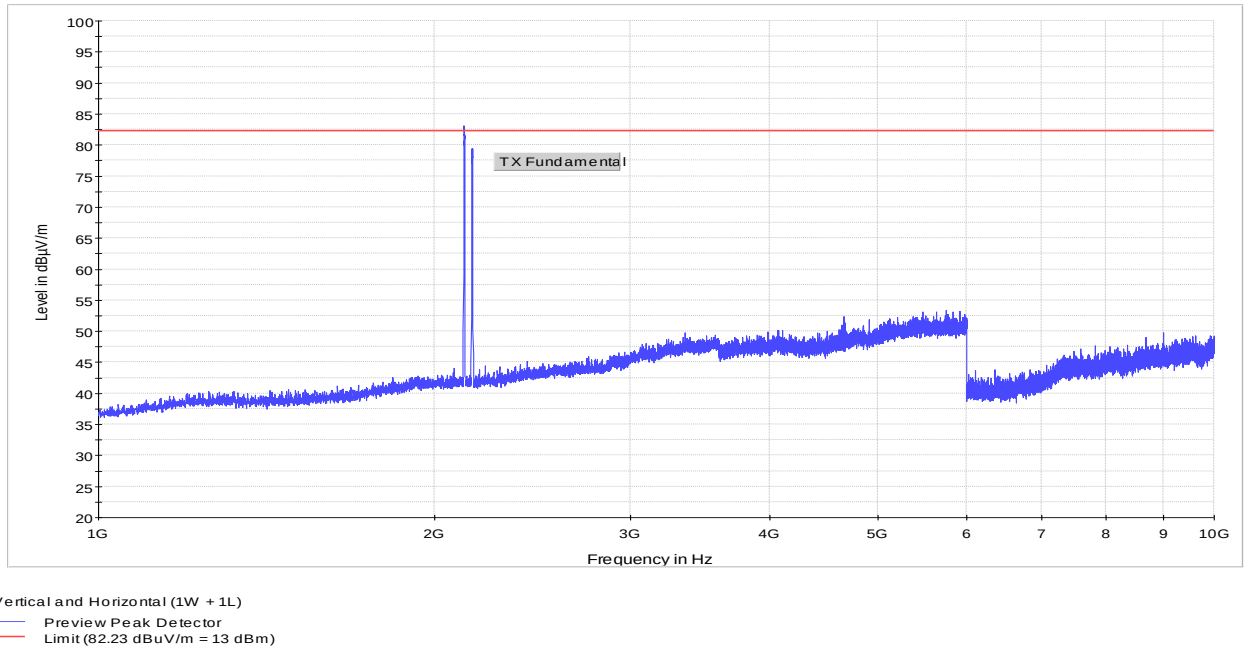


Figure 8.1-2: *1 to 10 GHz – 1W + 1L*

8.1.4 Test data, continued

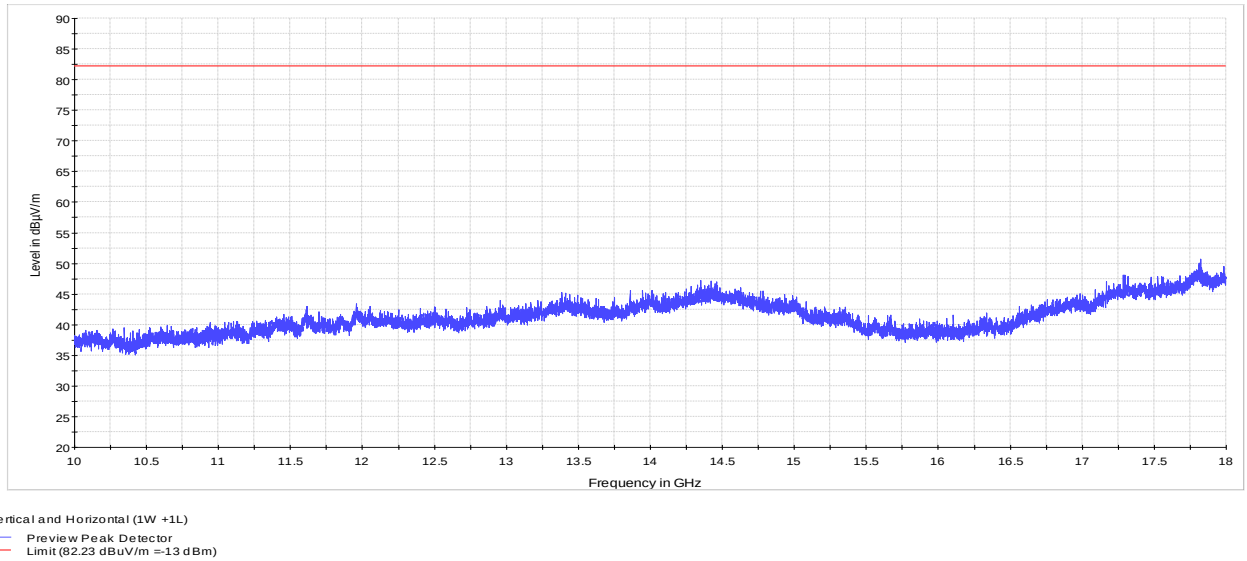
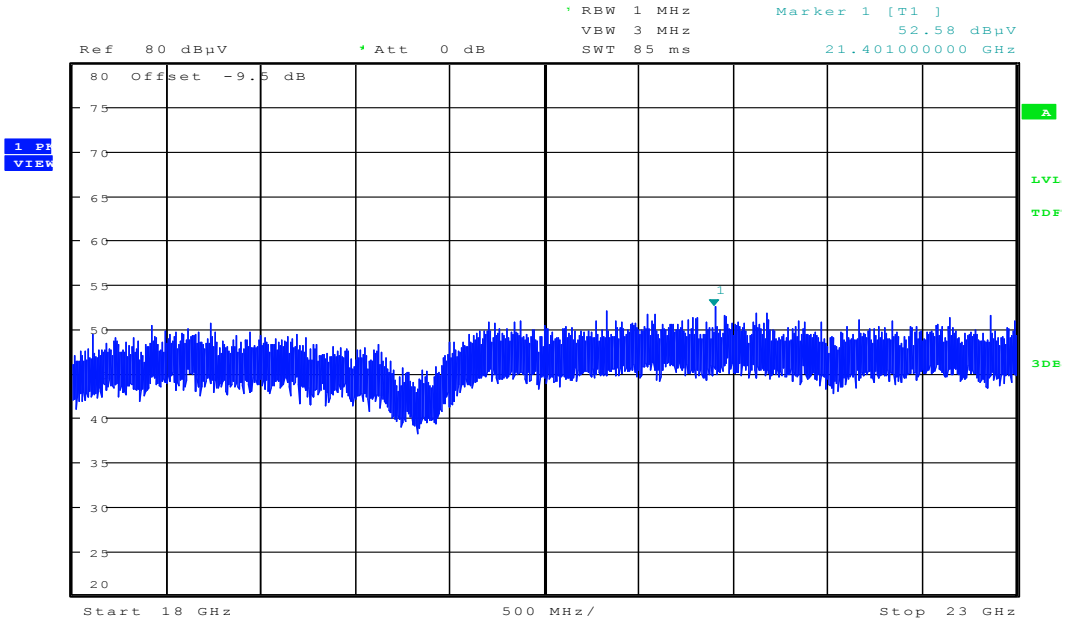


Figure 8.1-3: *10 to 18 GHz – 1W + 1L*



Note: (Limit = 82.23 dBuV= -13 dBm)

Figure 8.1-4: *18 to 23 GHz – 1W + 1L*

8.1.4 Test data, continued

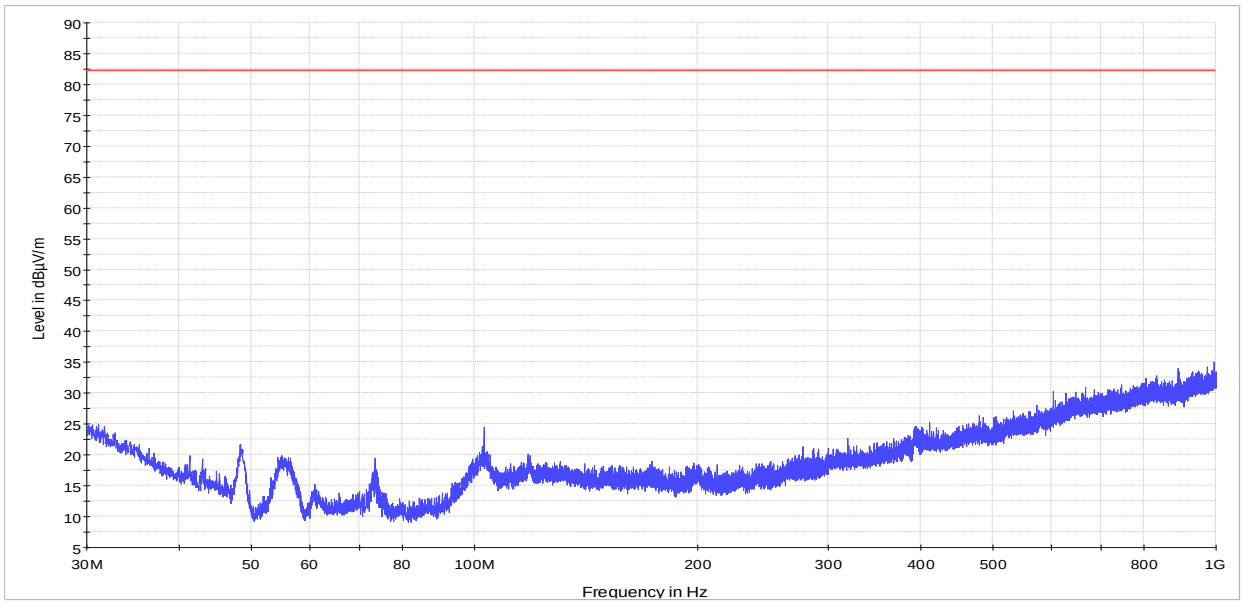


Figure 8.1-5: *30 to 1000 MHz – LTE_1Carrier_B_ 5M _QPSK*

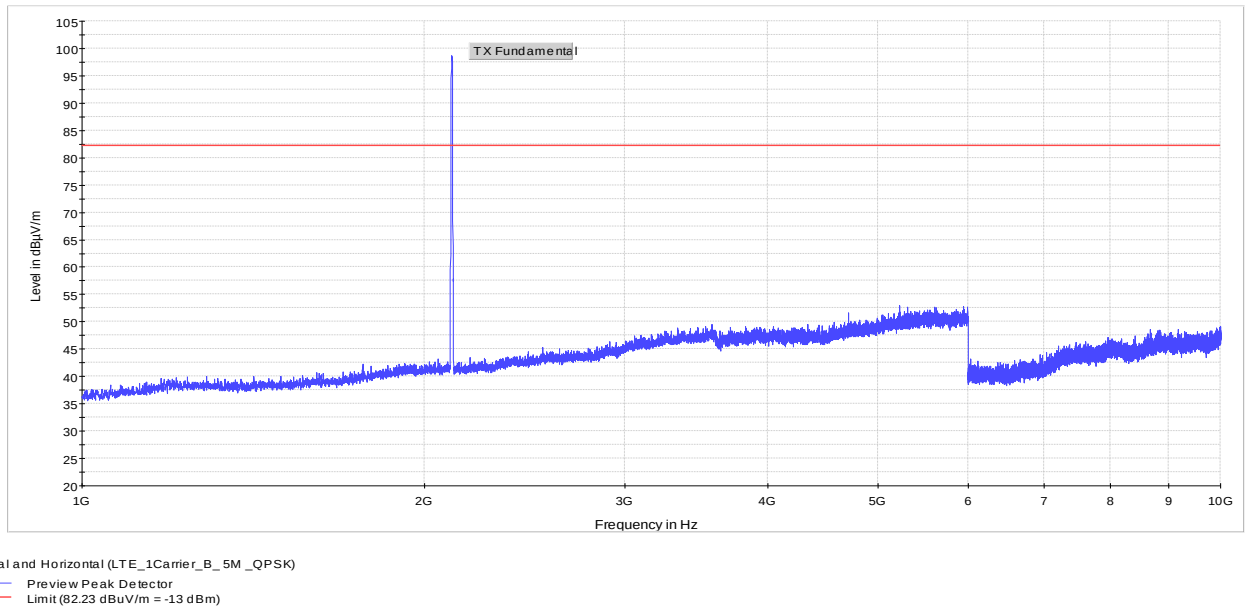


Figure 8.1-6: *1 to 10 GHz – LTE_1Carrier_B_ 5M _QPSK*

8.1.4 Test data, continued

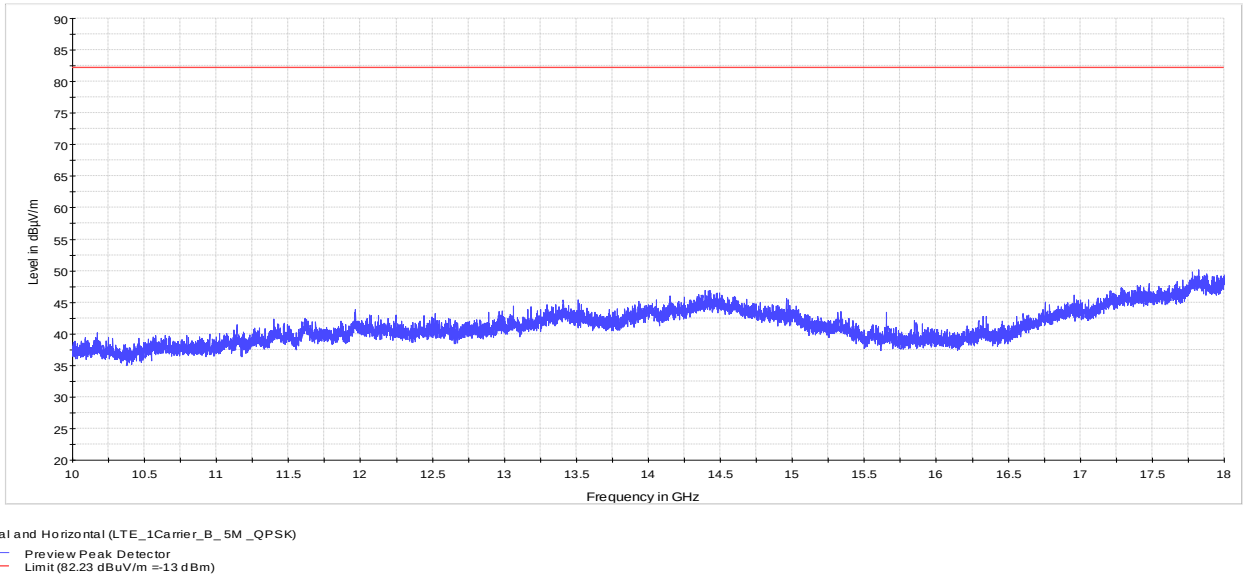
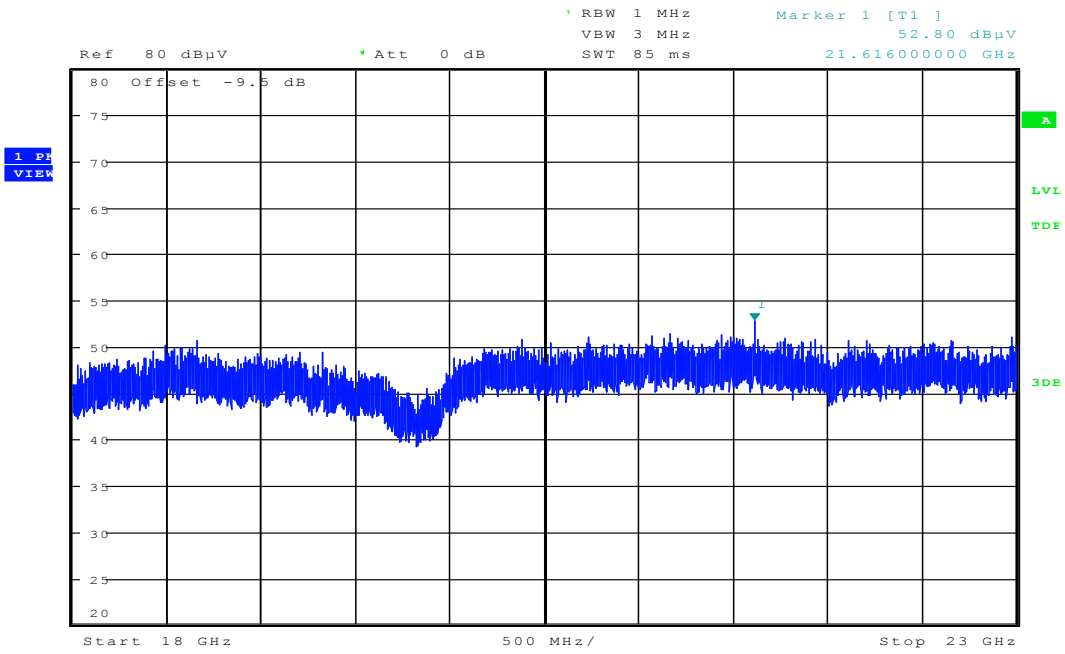


Figure 8.1-7: *10 to 18 GHz – LTE_1Carrier_B_ 5M _QPSK*



Note: (Limit = 82.23 dBuV= -13 dBm)

Figure 8.1-8: *18 to 23 GHz – LTE_1Carrier_B_ 5M _QPSK*

8.1.4 Test data, continued

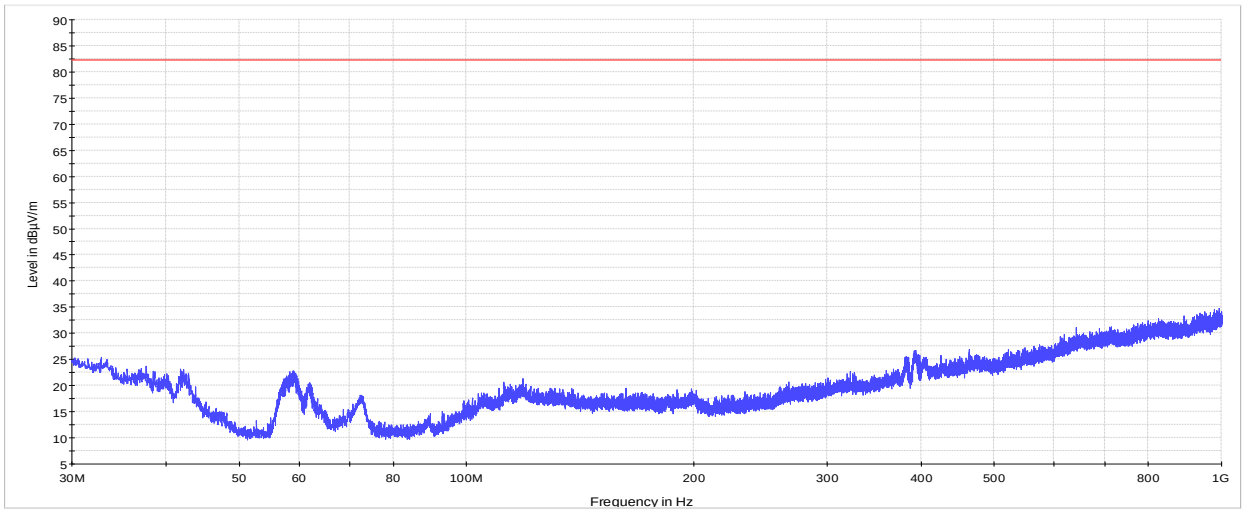


Figure 8.1-9: *30 to 1000 MHz – LTE_1Carrier_M_ 5M _QPSK*

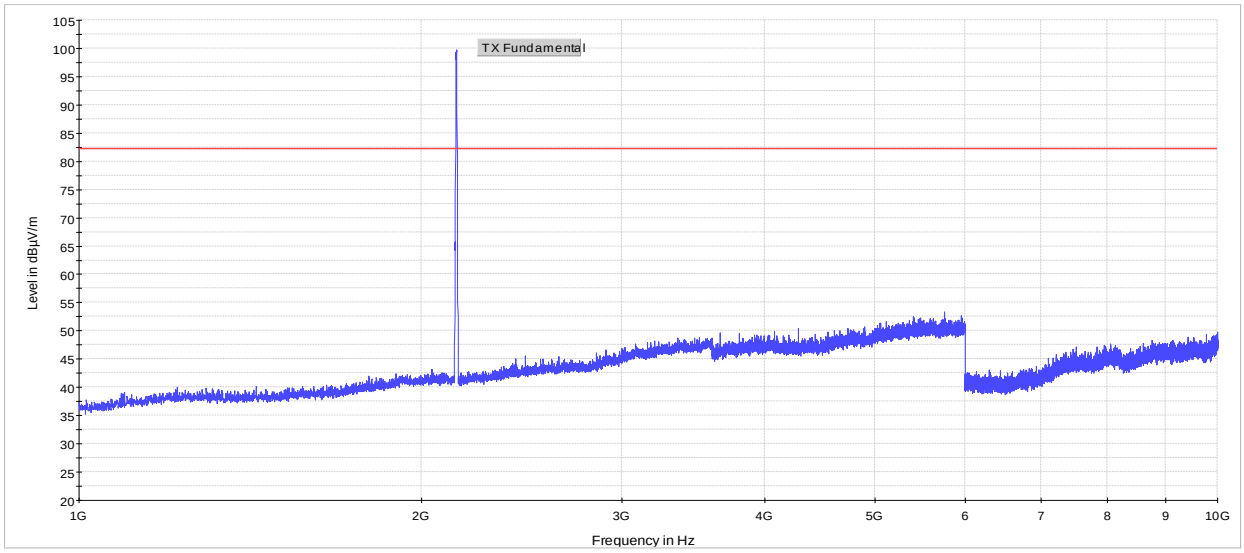


Figure 8.1-10: *1 to 10 GHz – LTE_1Carrier_M_ 5M _QPSK*

8.1.4 Test data, continued

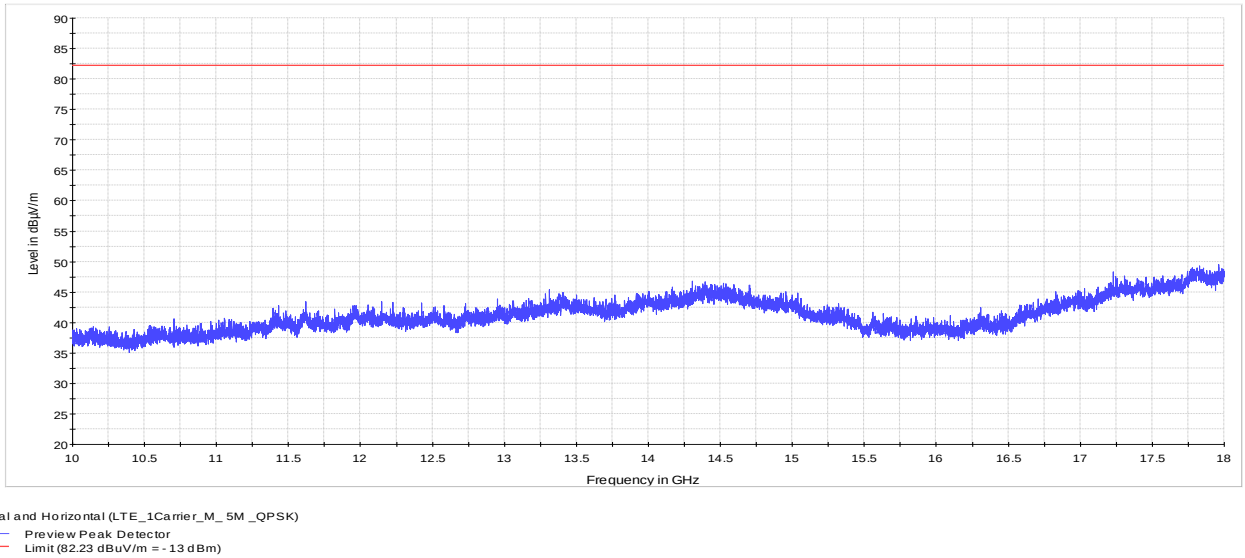
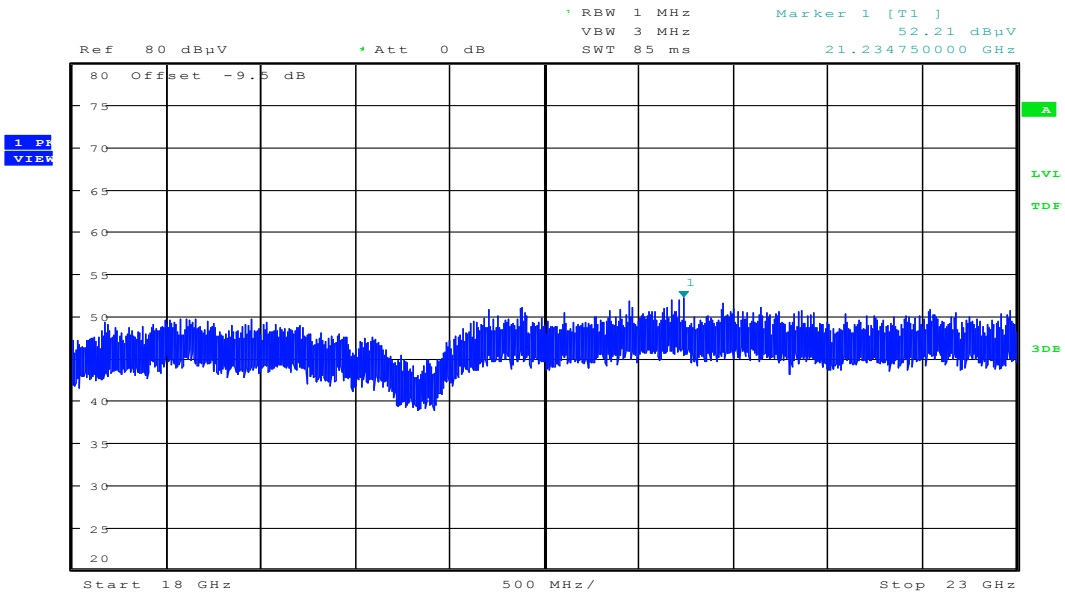


Figure 8.1-11: *10 to 18 GHz – LTE_1Carrier_M_ 5M _QPSK*



Note: (Limit = 82.23 dBuV= -13 dBm)

Figure 8.1-12: *18 to 23 GHz – LTE_1Carrier_M_ 5M _QPSK*

8.1.4 Test data, continued

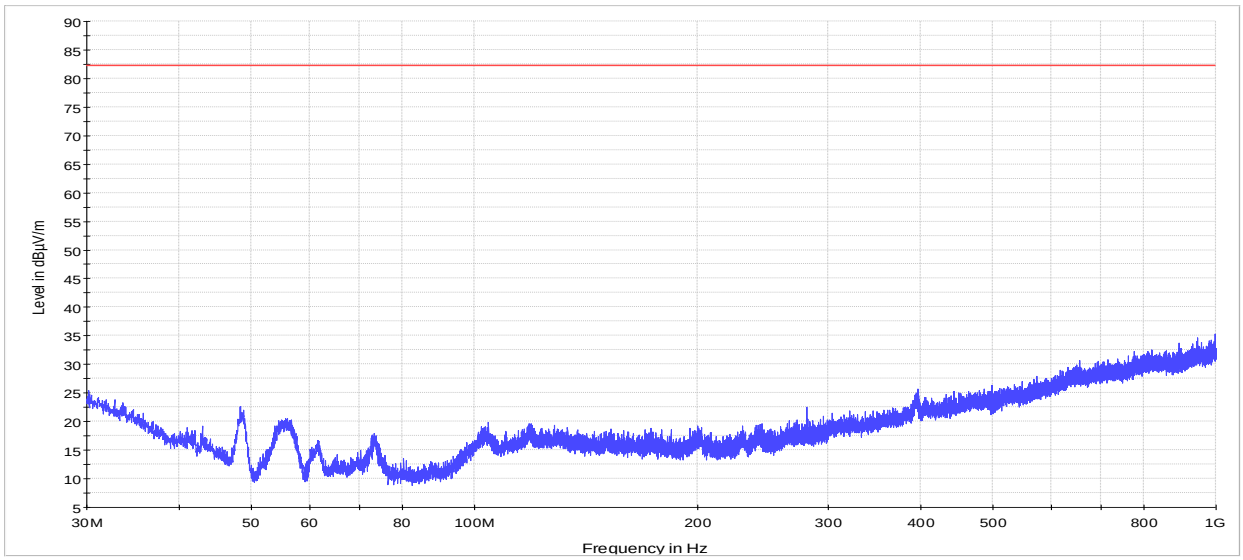


Figure 8.1-13: *30 to 1000 MHz – LTE_1Carrier_T_ 5M _QPSK*

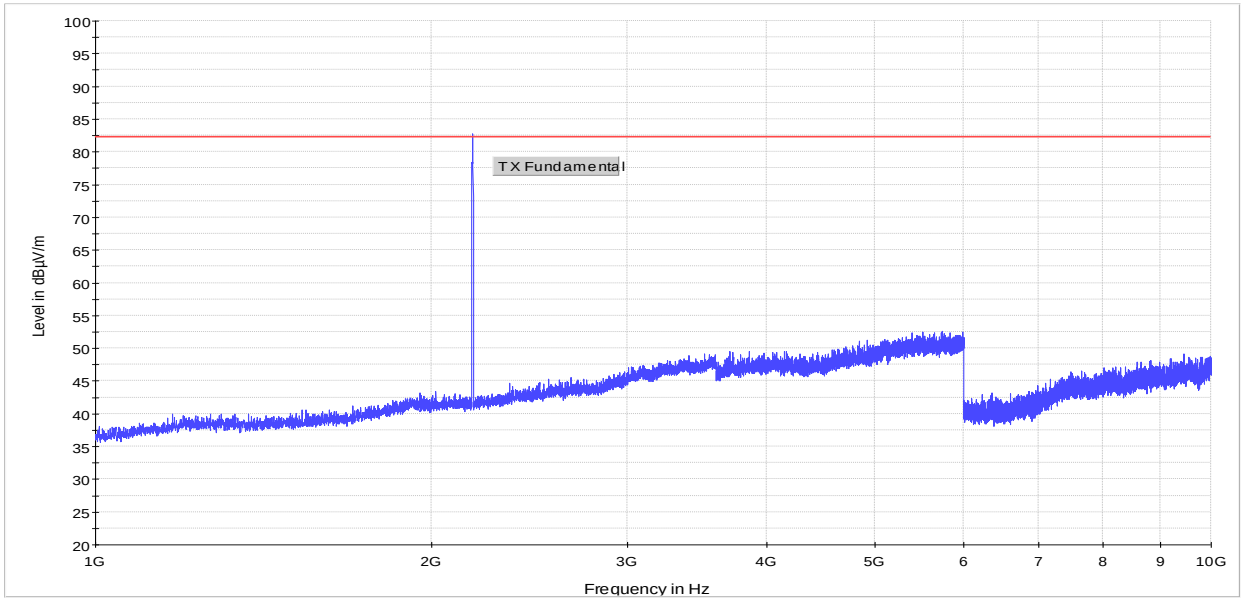


Figure 8.1-14: *1 to 10 GHz – LTE_1Carrier_T_ 5M _QPSK*

8.1.4 Test data, continued

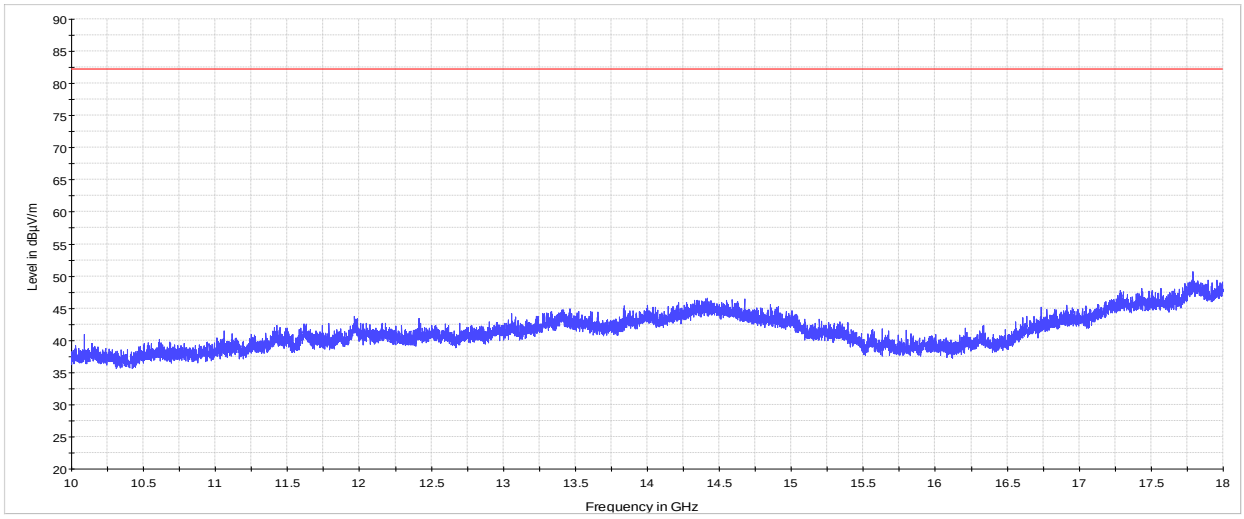
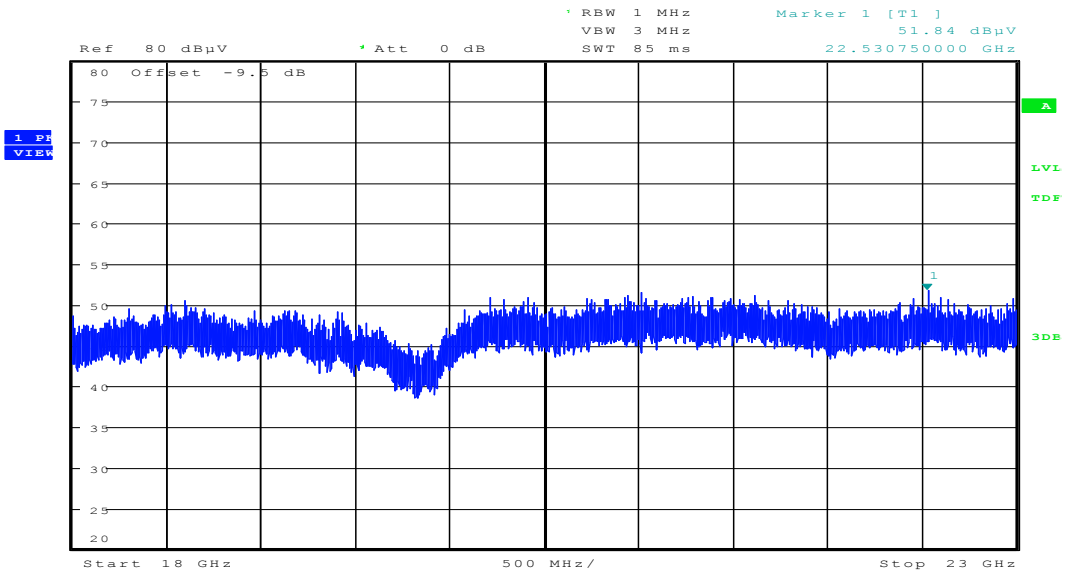


Figure 8.1-15: *10 to 18 GHz – LTE_1Carrier_T_ 5M _QPSK*



Note: (Limit = 82.23 dBuV= -13 dBm)

Figure 8.1-16: *18 to 23 GHz – LTE_1Carrier_T_ 5M _QPSK*

8.1.4 Test data, continued

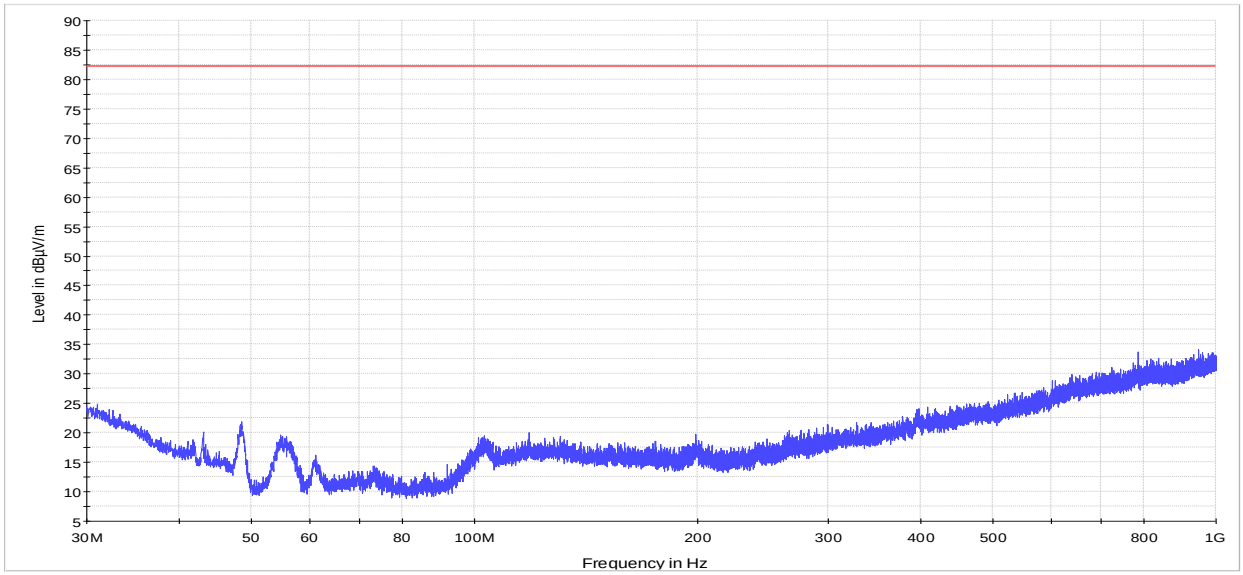


Figure 8.1-17: *30 to 1000 MHz – LTE_2Carrier_M_ 5M _QPSK*

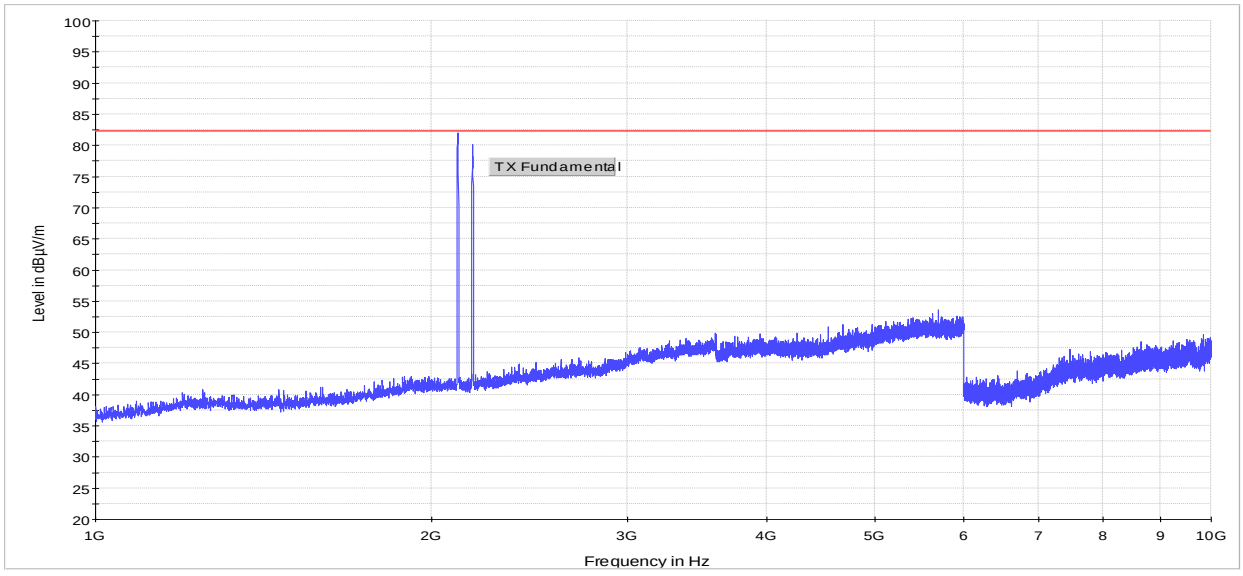


Figure 8.1-18: *1 to 10 GHz – LTE_2Carrier_M_ 5M _QPSK*

8.1.4 Test data, continued

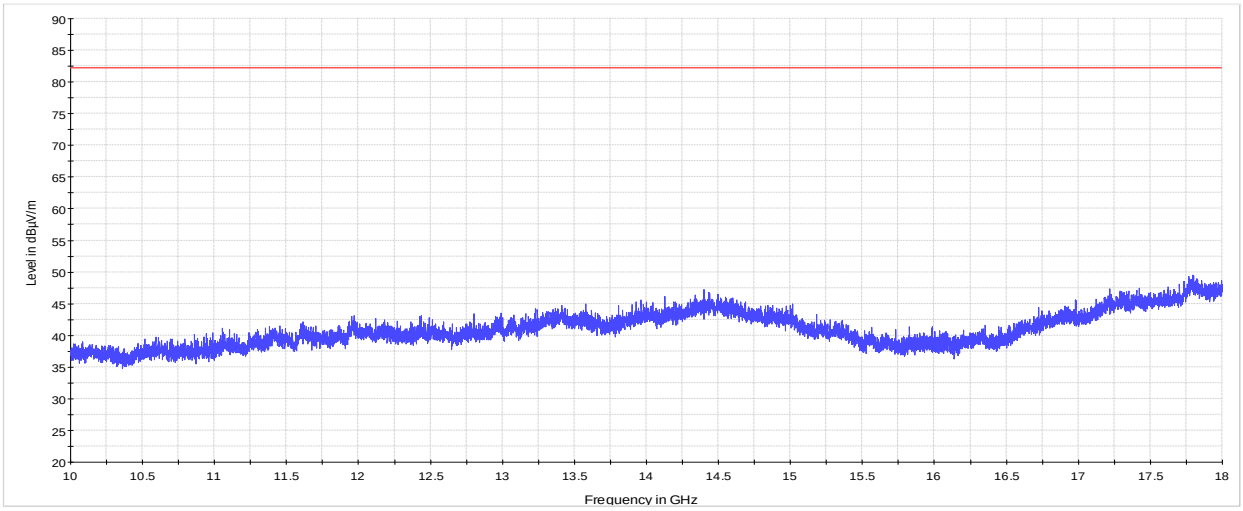
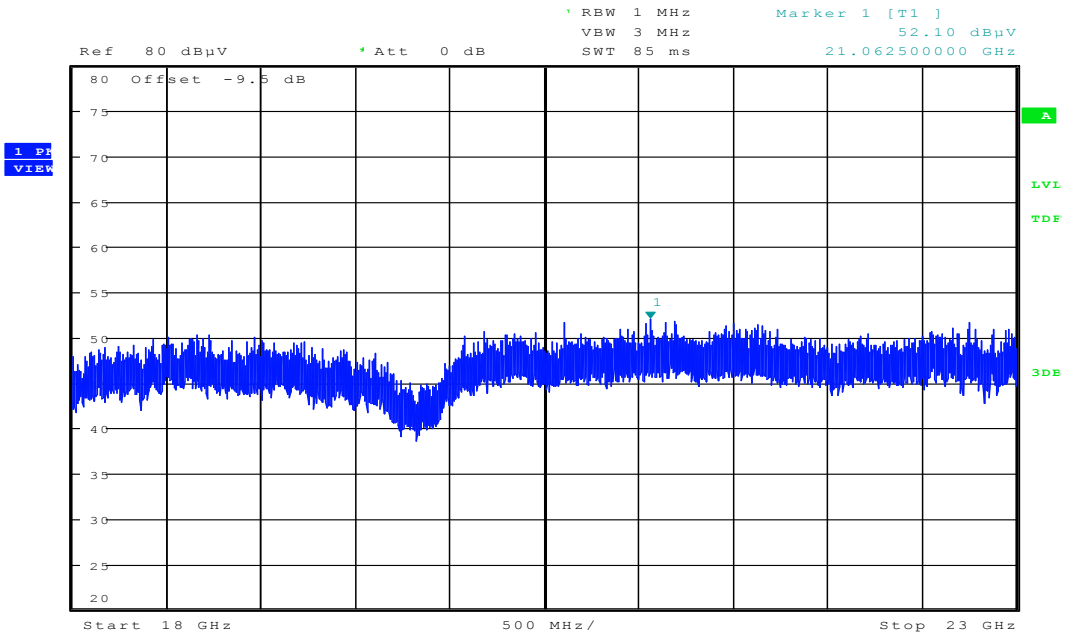


Figure 8.1-19: *10 to 18 GHz – LTE_2Carrier_M_ 5M _QPSK*



Note: (Limit = 82.23 dBuV= -13 dBm)

Figure 8.1-20: *18 to 23 GHz – LTE_2Carrier_M_ 5M _QPSK*

8.1.4 Test data, continued

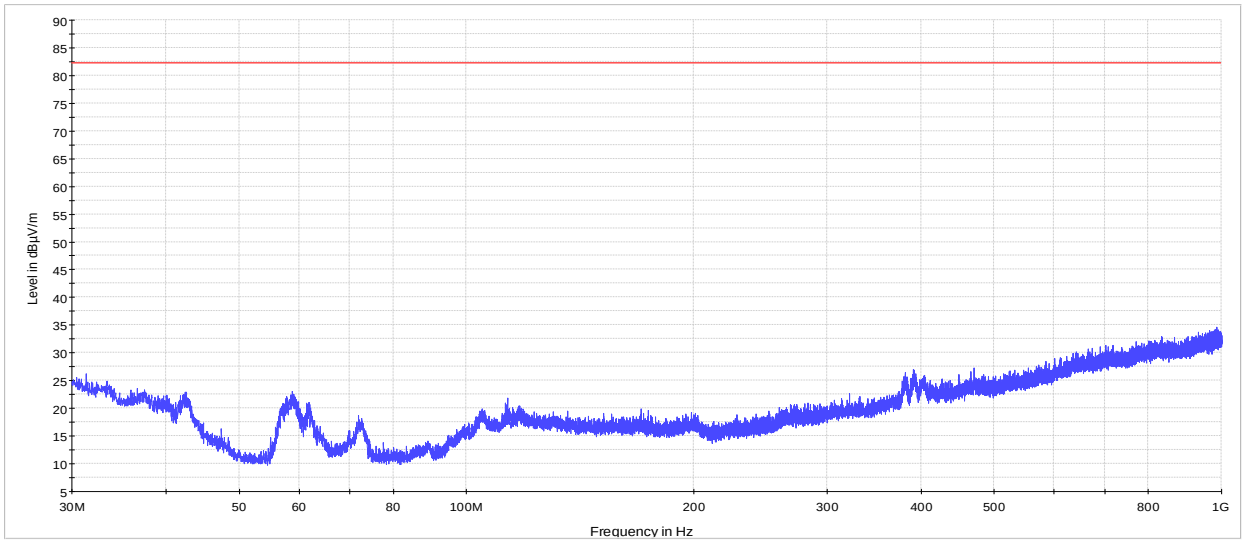


Figure 8.1-21: *30 to 1000 MHz – WCDMA_1Carrier_M_ 16QAM*

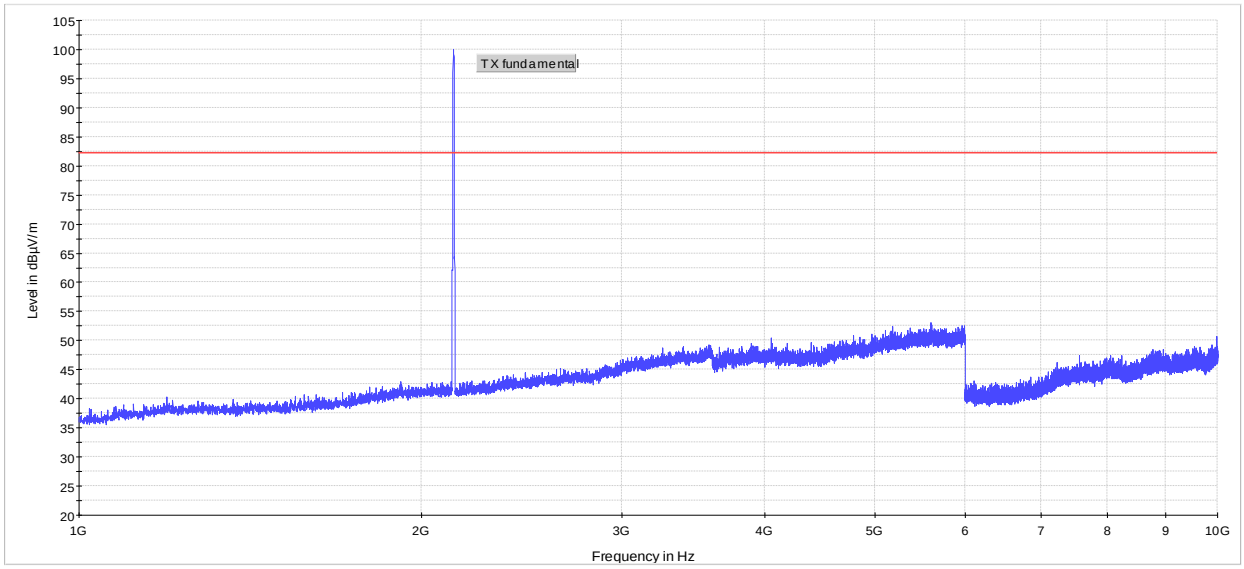


Figure 8.1-22: *1 to 10 GHz – WCDMA_1Carrier_M_ 16QAM*

8.1.4 Test data, continued

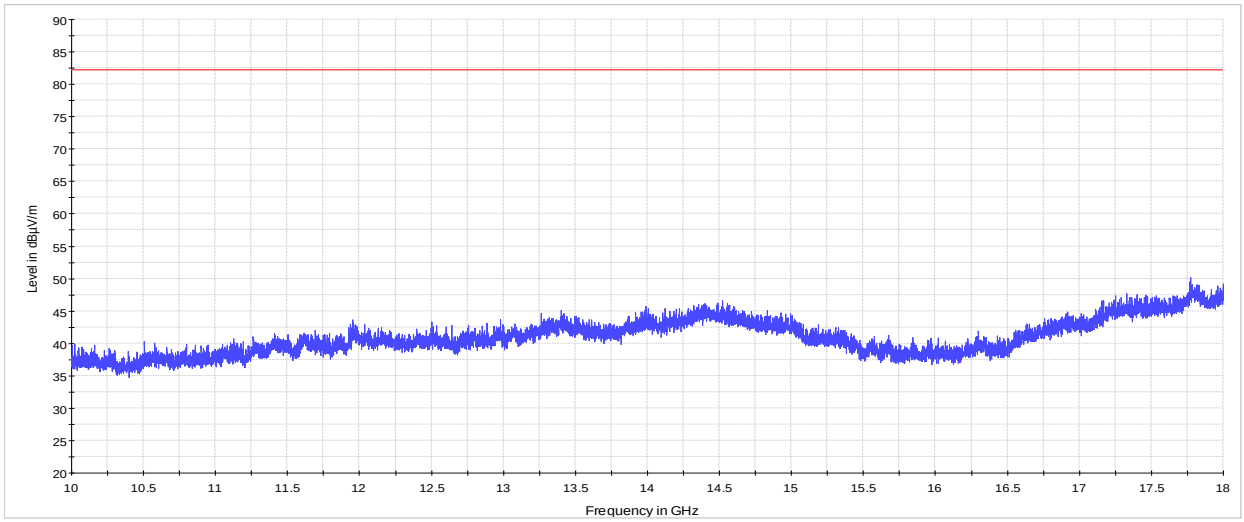
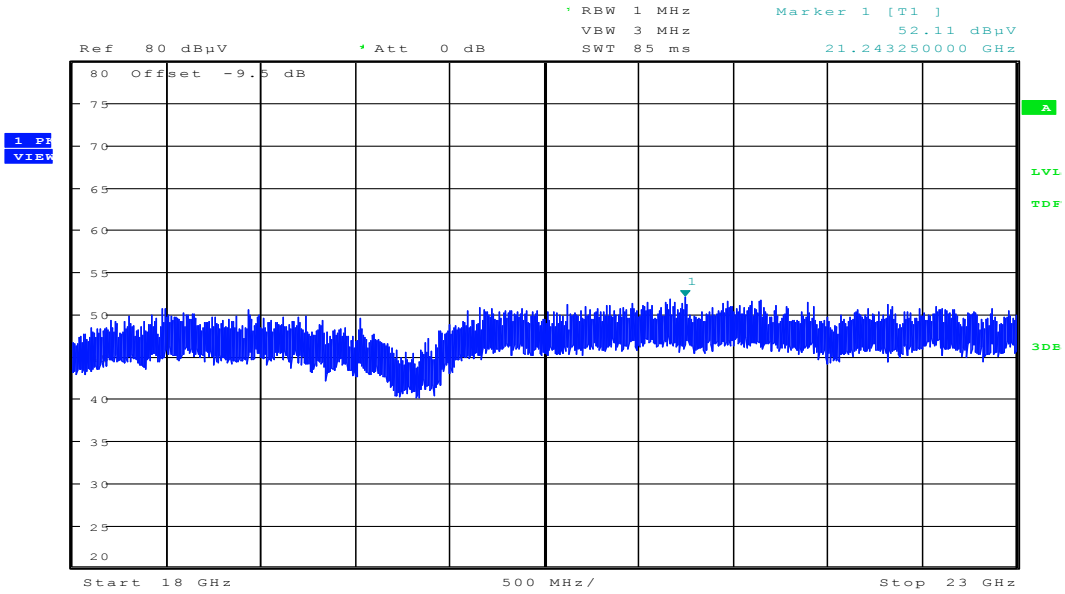


Figure 8.1-23: *10 to 18 GHz – WCDMA_1Carrier_M_ 16QAM*



Note: (Limit = 82.23 dBuV= -13 dBm)

Figure 8.1-24: *18 to 23 GHz – WCDMA_1Carrier_M_ 16QAM*

8.1.5 Setup photos

Figure 8.1-25: *Setup photo – 30 to 1000 MHz*

Figure 8.1-26: *Setup photo – 30 to 1000 MHz*

8.1.5 Setup photos, continued

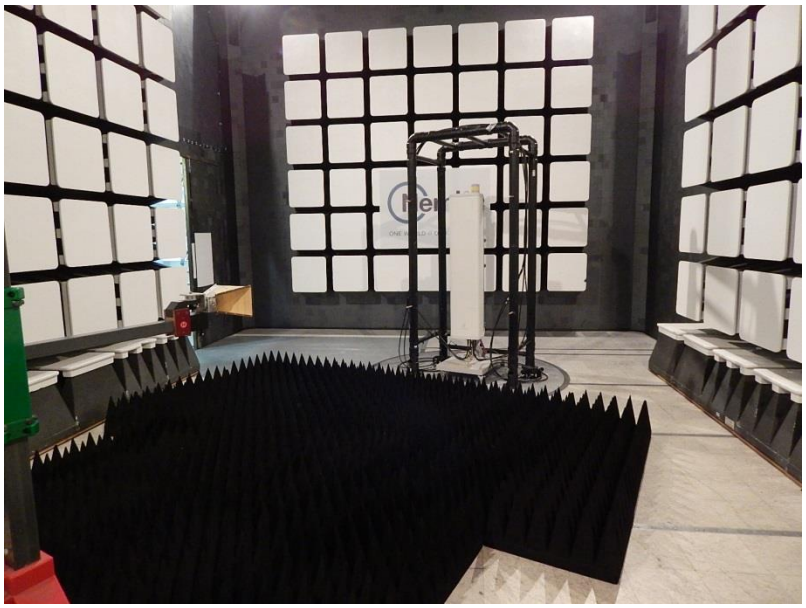


Figure 8.1-27: *Setup photo – above 1 GHz*

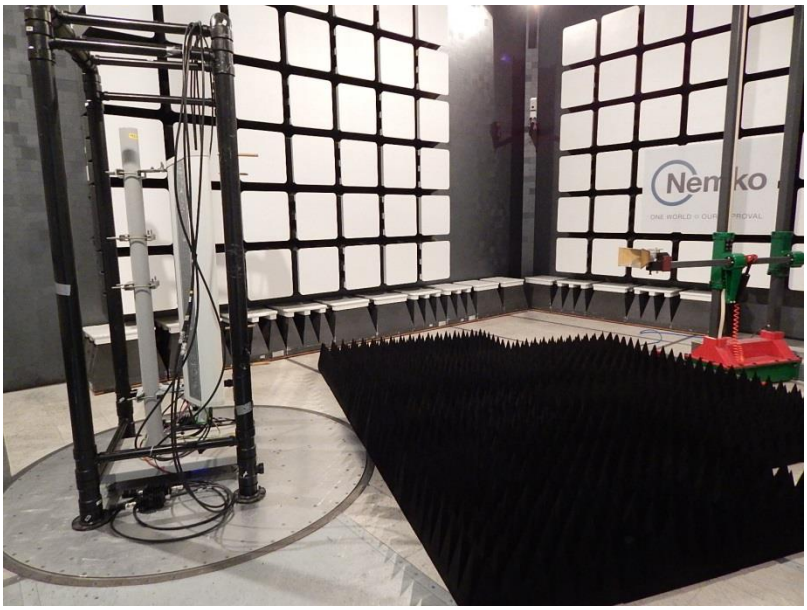
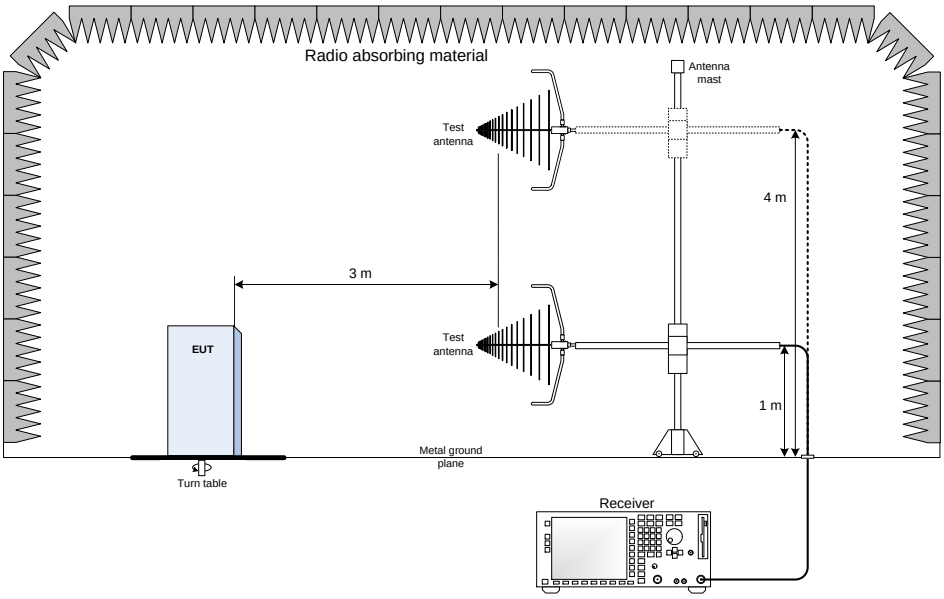


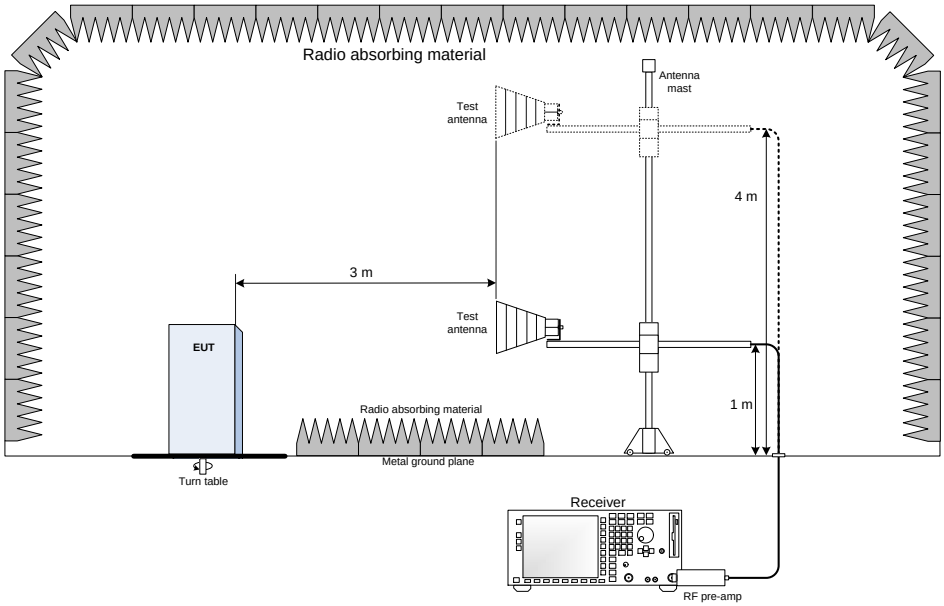
Figure 8.1-28: *Setup photo – above 1 GHz*

Section 9. Block diagrams of test set-ups

9.1 Radiated emissions set-up 30 to 1000 MHz



9.2 Radiated emissions set-up above 1 GHz



Section 10. EUT Photos

10.1 External photos

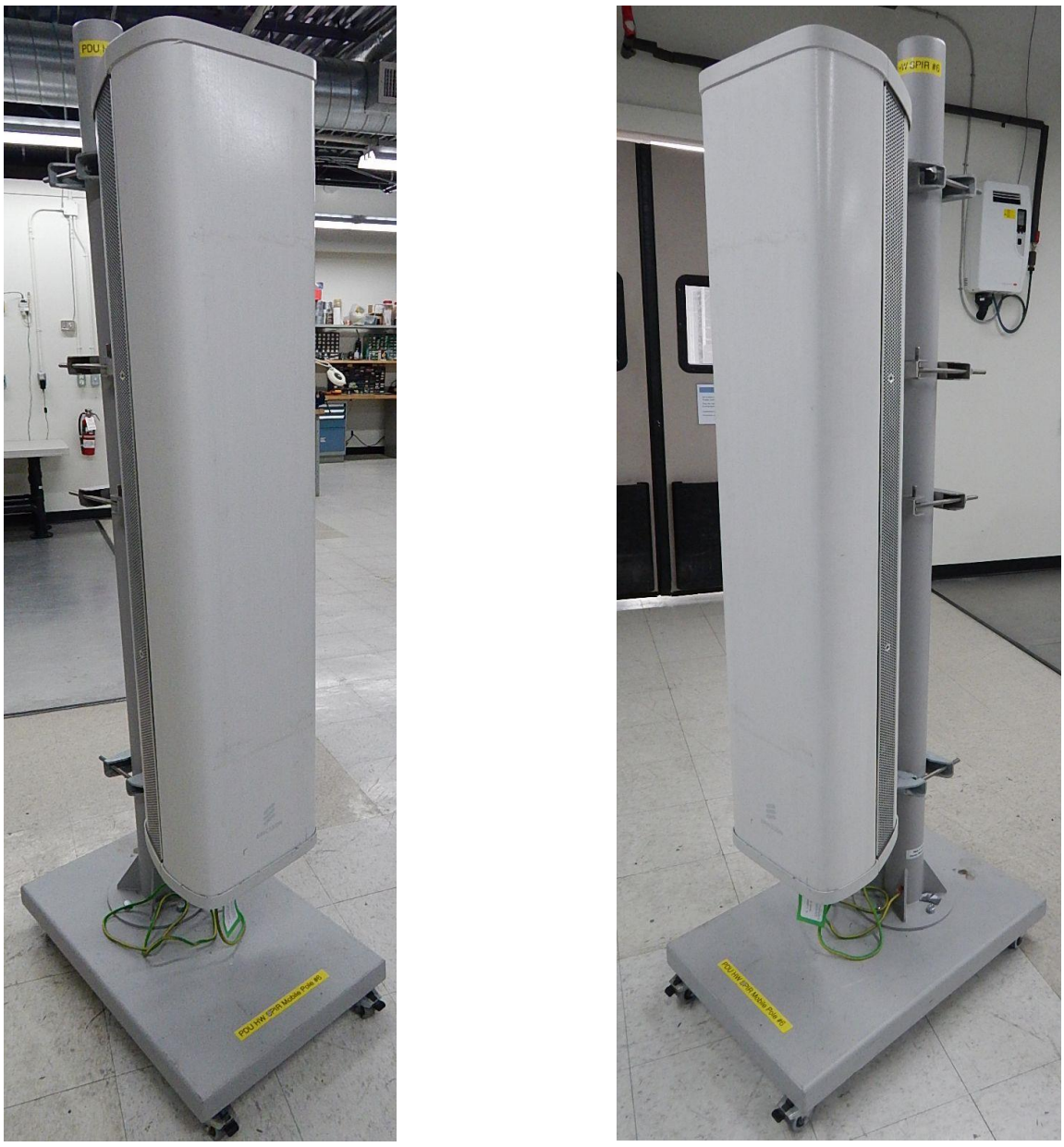


Figure 10.1-1: *Front views*

Figure 10.1-2: *Rear views*

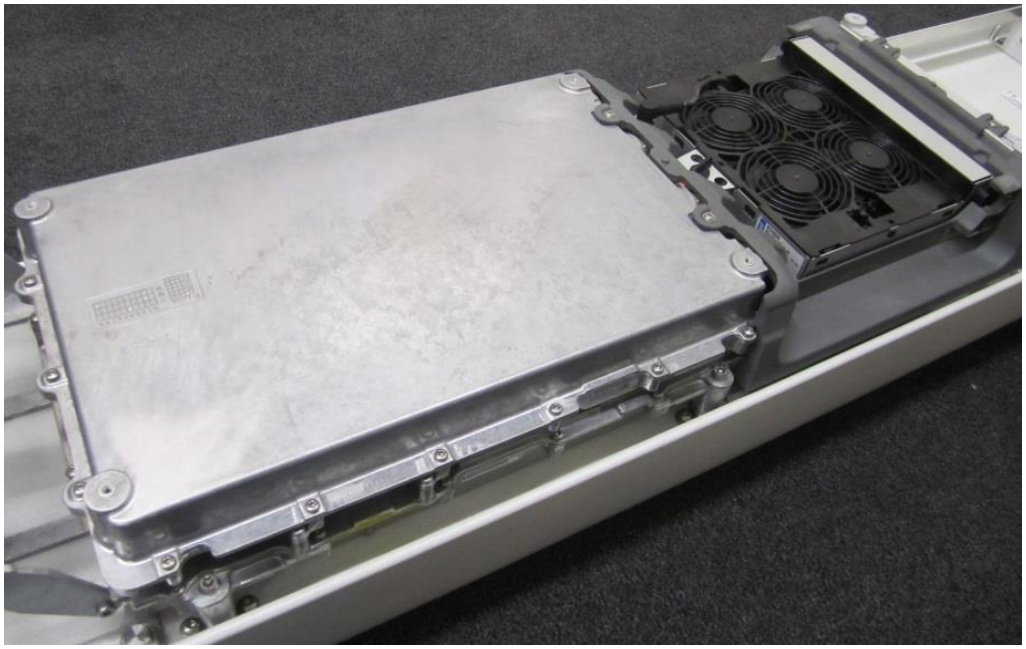


Figure 10.1-3: *RRUS 32A B66A with Fan Tray*