TEST REPORT

Report Number: R14144434-E1

Applicant	:	UTX Technologies Limited 141 Omonias Avenue The Maritime Center, Block C Limassol, 3045 Cyprus
FCC ID	:	2A7A2-FNH1
EUT Description	:	Small Form Factor BTS
Test Standard(s)	:	FCC CFR 47 Part 2, and Part 27.

Date Of Issue:
2023-09-26

Prepared by:
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CERT #0751.06

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	2023-07-31	Initial Review	Noah Bennett
V2	2023-08-14	TCB Feedback Round 1: -Removed Summed Avg power column from section 8.1 as EUT is SISO only. -Updated Rule part in section 9.5.	Noah Bennett
V3	2023-09-26	Updated Section 6.1 to remove SDR references	Noah Bennett

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: UTX Technologies Limited
141 Omonias Avenue
The Maritime Center, Block C
Limassol, 3045
Cyprus

EUT DESCRIPTION: Small Form Factor BTS

SERIAL NUMBERS: SN-204A038000050

SAMPLE RECEIPT DATE: 2023-07-05

DATE TESTED: 2023-07-10 to 2023-07-12

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC CFR 47 Part 2, Part 27	Complies

UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by a2La, NIST, or any agency of the U.S. government.

Approved & Released For UL LLC By:	Prepared By:	Reviewed By:
		
Dan Coronia Operations Leader Consumer, Medical and IT Segment UL VSI	Noah Bennett Engineer Consumer, Medical, and IT Segment UL LLC	Richard Lee Staff Laboratory Engineer Consumer, Medical and IT Segment UL VSI

2. SUMMARY OF TEST RESULTS

This report contains data provided by the customer which can impact the validity of results. UL LLC. is only responsible for the validity of results after the integration of the data provided by the customer.
Below is a list of the data provided by the customer:

1. Antenna gain and type (see section 6.4)
2. Supported WWAN Configurations, power settings, and EUT orientation (see section 6.5)
3. Cable and Attenuator loss (see section 8)

Requirement Description	Band	Requirement Clause Number (FCC)	Result	Remarks
Equivalent Isotropic Radiated Power	41	27.50 (h) (1)	Complies	LTE B41 5G n41

Requirement Description	Requirement Clause Number (FCC)	Result	Remarks
Occupied Bandwidth	2.1049	Complies	None.
Band Edge and Emission Mask	2.1051, 27.53 (m)(2) & (m)(6),		
Out of Band Emissions			
Frequency Stability	2.1055 (3), 27.54		
Field Strength of Spurious Radiation	2.1053, 2.1051, 27.53 (m)(2) & (m)(6),		
Peak to Average Ratio	27.50 (a)(1)(i)(B)		

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with the following:

- ANSI C63.26:2015
- FCC CFR 47 Part 2, Part 27.
- FCC KDB 971168 D01 v03r01: Power Meas License Digital Systems
- FCC KDB 971168 D02 v02r01: Misc Rev Approv License Devices
- FCC KDB 412172 D01 v01r01. Determining ERP and EIRP

4. FACILITIES AND ACCREDITATION

UL LLC is accredited by A2LA, Certificate Number 0751.06, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

	Address	ISED CABID	ISED Company Number	FCC Registration
☒	Building 2800 Suite Perimeter Park Dr. Suite B Morrisville, NC 27560, U.S.A	US0067	27265	825374

5. DECISION RULES AND MEASUREMENT UNCERTAINTY

5.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

5.2. DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement
uncertainty is not taken into account when stating conformity with a specified requirement.)

5.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	U_{Lab}
Radio Frequency (Spectrum Analyzer)	141.2 Hz
Occupied Channel Bandwidth	1.22%
RF output power, conducted	1.3 dB (PK) 0.45 dB (AV)
Power Spectral Density, conducted	2.47 dB
Unwanted Emissions, conducted	1.94 dB
All emissions, radiated	6.01 dB
Conducted Emissions (0.150-30MHz) - LISN	3.40 dB
Temperature	0.57°C
Humidity	3.39%
DC Supply voltages	1.70%

Uncertainty figures are valid to a confidence level of 95%.

5.4. SAMPLE CALCULATION

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:
Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)
36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

6. EQUIPMENT UNDER TEST

6.1. DESCRIPTION OF EUT

Cognyte® Hive is a 6, 1Tx BTS small form factor solution, designed for urban, indoor and highly covert operational use cases. All 6Tx ports do not transmit simultaneously, and all operate in SISO mode only.

6.2. MAXIMUM OUTPUT POWER

EIRP/ERP TEST PROCEDURE

ANSI C63.26:2015
KDB 971168 D01 Section 5.6

ERP/EIRP = PMeas + GT − LC
where: ERP/EIRP = effective or equivalent radiated power, respectively (expressed in the same units as PMeas, typically dBW or dBm);
PMeas = measured transmitter output power or PSD, in dBm or dBW;
GT = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP);
LC = signal attenuation in the connecting cable between the transmitter and antenna, in dB.

For devices utilizing multiple antennas, KDB 662911 provides guidance for determining the effective array transmit antenna gain term to be used in the above equation.

LTE BAND 41

Part 27	
EIRP Limit (W)	2238.72
Antenna Gain (dBi)	6.00

Bandwidth (MHz)	Modulation	Low Frequency (MHz)	Upper Frequency (MHz)	Conducted Average (dBm)	EIRP Average (dBm)	EIRP Average (W)	99% BW (kHz)	Emission Designator
20.0	QPSK	2506.0	2680.0	18.34	24.34	0.272	18116	18M1G7W

5G BAND n41

Part 27	
EIRP Limit (W)	2238.72
Antenna Gain (dBi)	6.00

Bandwidth (MHz)	Modulation	Low Frequency (MHz)	Upper Frequency (MHz)	Conducted Average (dBm)	EIRP Average (dBm)	EIRP Average (W)	99% BW (kHz)	Emission Designator
20.0	QPSK	2506.0	2680.0	21.71	27.71	0.590	18317	18M3G7W

6.3. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was version v0.15.

6.4. MAXIMUM ANTENNA GAIN

The antenna(s) gain and type, as provided by the manufacturer' are as follows:

WWAN Bands	Frequency Range (MHz)	Peak Antenna Gain (dBi)
LTE Band 41, 5G Band n41	2496 – 2690	6dBi

6.5. WORST-CASE CONFIGURATION AND MODE

The EUT supports LTE Band 41 and 5G Band n41. The EUT only supports QPSK modulation, at 20MHz Bandwidth. LTE B41 only supports RB100-0 configuration, and 5G n41 only supports RB51-0 configuration with 30kHz SCS.

Per customer declarations, both the EUT and external antenna pack are only meant to be installed in one orientation. Therefore, all radiated testing was only performed in this orientation.

The worst-case scenario for all measurements is based on conducted average power on each antenna port. Output power measurements were measured on all ports for all channels, bands and modulations supported by the EUT. It was found that RF Port 4 was worst case for both LTE B41 and 5G n41. Therefore, all conducted antenna port testing was only performed on RF Port 4 as worst case.

Radiated spurious emissions were investigated from 9kHz to 30MHz, 30MHz-1GHz and above 1GHz. The only tests with emissions within 20dB of the limit are reported in section 10.2. Other tests in which no emissions within 20dB were observed are not reported.

6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Lenovo	T470P	NA	NA
AC Adapter	MEAN WELL	GST280A43	NA	NA

I/O CABLES

I/O Cable List						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	AC Mains	1	NEMA	unshielded	<3m	AC Mains to EUT Power Brick
2	Ethernet	1	RF45	Shielded	>3m	Used to program EUT via control PC outside of control room
3	Power	1	AWM2462	unshielded	<3m	Used to connect EUT power brick to EUT itself
4	Tx	6	SMA	Shielded	<3m	Single cable assembly that has 6 SMA connectors. They connect to each of the 6 Tx ports on the EUT.

Test Setup

The EUT was connected to the spectrum analyzer and set to transmit at the client specified max power.

Setup Diagram

See R14144434-EP1 for Setup Photos and Setup Diagrams

7. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	Common Equipment				
90410	Spectrum Analyzer	Keysight Technologies	N9030A	2023-06-14	2024-06-14
90778	RF Power Meter	Keysight Technologies	N1911A	2022-09-10	2023-09-10
90417	Peak and Avg Power Sensor, 50MHz to 18GHz	Keysight Technologies	N1921A	2023-06-26	2024-06-30
HI0091	Environmental Meter	Fisher Scientific	15-077-963	2022-07-20	2023-07-20
207726	Temp/Humid Chamber	Thermotron	SM-32-8200	2023-01-20	2024-01-20
MM0169	True RMS Multimeter	Agilent	U1232A	2022-08-03	2023-08-03
209010 S/N 1045A04231	CW-AC Power Source	Ametek	CW2501	NA	NA
SOFTEMI	Antenna Port Software	UL	Version 2022.8.16	NA	NA
90778	RF Power Meter	Keysight Technologies	N1911A	2022-09-10	2023-09-10
210642	Environmental Meter	Fisher Scientific	15-077-963	2022-08-16	2023-08-16
90417	Peak and Avg Power Sensor, 50MHz to 18GHz	Keysight Technologies	N1921A	2023-06-26	2024-06-30

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville – Chamber 2)

Equip. ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
	0.009-30MHz				
135144	Active Loop Antenna	ETS-Lindgren	6502	2023-01-17	2024-01-17
	30-1000 MHz				
90627	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2022-09-07	2023-09-07
	1-18 GHz				
88761	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2022-09-13	2023-09-13
	18-40 GHz				
78835	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2022-12-15	2023-12-15
77783	Horn Antenna, 26-40GHz	ARA	MWH-2640/B	2022-12-15	2023-12-15
	Gain-Loss Chains				
91975	Gain-loss string: 0.009-30MHz	Various	Various	2023-06-06	2024-06-06
91978	Gain-loss string: 25-1000MHz	Various	Various	2023-06-06	2024-06-06
91977	Gain-loss string: 1-18GHz	Various	Various	2023-06-06	2024-06-06
136042	Gain-loss string: 18-40GHz	Various	Various	2023-06-06	2024-06-06
	Receiver & Software				
81018	Spectrum Analyzer	Agilent	E4446A	2022-08-02	2023-08-02
90416	Spectrum Analyzer	Keysight	N9030A	2023-06-09	2024-06-30
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		
	Additional Equipment used				
231408 (BRF011)	2.495-2.690GHz notch filter, 2W, Fhigh = 18GHz	Micro-Tronics	BRM50709-01	2023-02-15	2024-02-29
150716 (LPF008)	DC-1000MHz low-pass filter	Pasternack	PE8720	2023-02-15	2024-02-29

NOTES:

1. * Testing is completed before equipment expiration date.
2. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.

8. RF OUTPUT POWER VERIFICATION

CONDUCTED OUTPUT POWER MEASUREMENT PROCEDURE

The following tests were conducted according to the test requirements outlined in section 6.2 of the 3GPP TS 36.101 specification.

UE Power Class: 3 (23 +/- 2dBm). The allowed Maximum Power Reduction (MPR) for the maximum output power due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3-1 of the 3GPP TS 36.101.

Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1, 2 and 3

Modulation	Channel bandwidth / Transmission bandwidth (N_{RB})						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2
64 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 2
64 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 3
256 QAM	≥ 1						≤ 5

The following tests were conducted according to the test requirements outlined in section 6.2 of the 3GPP TS 38.521-1 specification.

The allowed MPR for SRS, PUCCH formats 0, 1, 3 and 4, and PRACH shall be as specified for QPSK modulated DFTs-
OFDM of equivalent RB allocation. The allowed MPR for PUCCH format 2 shall be as specified for QPSK modulated CP-OFDM of equivalent RB allocation.

Table 6.2.2.3-1: Maximum power reduction (MPR) for power class 3

Modulation		MPR (dB)		
		Edge RB allocations	Outer RB allocations	Inner RB allocations
DFT-s-OFDM	Pi/2 BPSK	≤ 3.5[1]	≤ 1.2[1]	≤ 0.2[1]
		≤ 0.5[2]		0[2]
	Pi/2 BPSK w Pi/2 BPSK DMRS	≤ 0.5[2]	0[2]	
	QPSK	≤ 1		0
	16 QAM	≤ 2		≤ 1
	64 QAM	≤ 2.5		
	256 QAM	≤ 4.5		
CP-OFDM	QPSK	≤ 3		≤ 1.5
	16 QAM	≤ 3		≤ 2
	64 QAM	≤ 3.5		
	256 QAM	≤ 6.5		

NOTE 1: Applicable for UE operating in TDD mode with Pi/2 BPSK modulation and UE indicates support for UE capability *powerBoosting-pi2BPSK* and if the IE *powerBoostPi2BPSK* is set to 1 and 40 % or less slots in radio frame are used for UL transmission for bands n40, n41, n77, n78 and n79. The reference power of 0dB MPR is 26dBm.

NOTE 2: Applicable for UE operating in FDD mode, or in TDD mode in bands other than n40, n41, n77, n78 and n79 with Pi/2 BPSK modulation and if the IE *powerBoostPi2BPSK* is set to 0 and if more than 40% of slots in radio frame are used for UL transmission for bands n40, n41, n77, n78 and n79.

AVERAGE OUTPUT POWER TEST PROCEDURE

All band's conducted average power is obtained from a gated power meter. The power meter was connected to the EUT, and power was measured over the on-time of the emission only. The meter was connected to a client supplied RF cable with a customer declared 40dB of attenuation, plus additional loss from the customer provided cable harness.

PEAK OUTPUT POWER TEST PROCEDURE

All band's conducted peak power is obtained from a gated power meter. The power meter was connected to the EUT, and power was measured over the on-time of the emission only. The meter was connected to a client supplied RF cable with a customer declared 40dB of attenuation, plus additional loss from the customer provided cable harness.

RESULTS

Test Engineer ID:	27465/44389	Test Date:	2023-07-12

8.1. LTE BAND 41

8.1.1. OUTPUT POWER FOR LTE BAND 41 (20.0 MHz)

LTE Band	Bandwidth (MHz)	Modulation	Channel	Frequency (MHz)	RF1 Port 1 Measured Avg Power (dBm)	RF1 Port 2 Measured Avg Power (dBm)	RF1 Port 3 Measured Avg Power (dBm)	RF1 Port 4 Measured Avg Power (dBm)	RF1 Port 5 Measured Avg Power (dBm)	RF1 Port 6 Measured Avg Power (dBm)
41	20	QPSK	**39750**	**2506**	17.60	18.07	17.91	**18.34**	17.83	17.47
			40620	**2593**	17.74	17.80	17.44	18.20	17.86	17.68
			41490	**2680**	16.34	16.17	16.21	16.88	16.71	16.35

8.2. 5G BAND n41

8.2.1. OUTPUT POWER FOR 5G BAND n41 (20.0MHz)

5G NR Band	SCS (kHz)	Bandwidth (MHz)	Modulation	Channel	Frequency (MHz)	RF1 Port 1 Measured Avg Power (dBm)	RF1 Port 2 Measured Avg Power (dBm)	RF1 Port 3 Measured Avg Power (dBm)	RF1 Port 4 Measured Avg Power (dBm)	RF1 Port 5 Measured Avg Power (dBm)	RF1 Port 6 Measured Avg Power (dBm)
n41	30	20	QPSK	**501036**	**2505.18**	20.88	21.34	20.85	**21.71**	19.80	19.55
				518430	**2592.15**	20.46	21.24	21.00	21.31	19.87	20.23
				536160	**2680.8**	18.24	17.64	19.50	19.87	18.04	18.07

9. CONDUCTED TEST RESULTS

9.1. OCCUPIED BANDWIDTH

RULE PART(S)

FCC: §2.1049

LIMITS

For reporting purposes only.

TEST PROCEDURE

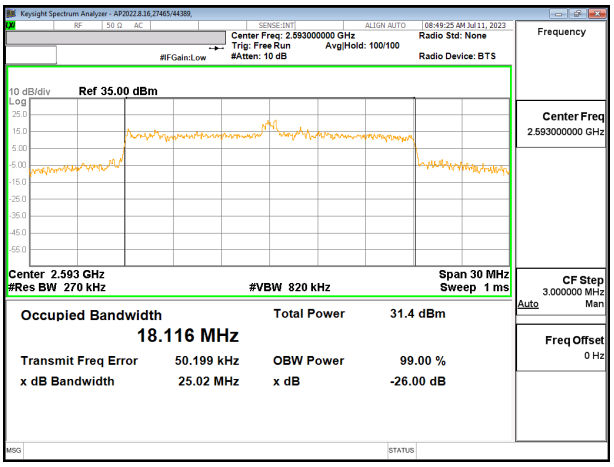
The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at the middle channel in each band. The 99% and -26dB bandwidths was also measured and recorded.

RESULTS

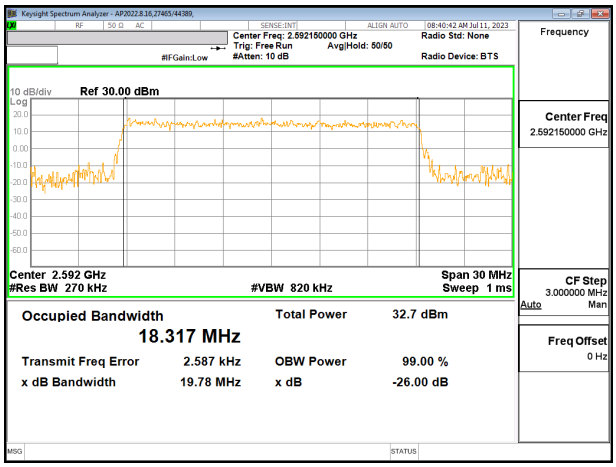
There is no limit required and power is the same for low, middle and high channel; therefore, only middle channel was tested.

Test Engineer ID:	27465/44389	Test Date:	2023-07-11

Band	Mode	RB Allocation/RB Offset	f(MHz)	99% BW (MHz)	-26dB BW (MHz)
LTE B41	20MHz, QPSK	100/0	2593.0	18.116	25.02
5G Band n41	20MHz, QPSK	51/0		18.317	19.78



LTE41 20MHz QPSK MID Ch RB100-0



5G n41 20MHz QPSK MID Ch RB51-0

9.2. OUT OF BAND EMISSIONS

LIMITS

FCC: §27.53 (m)(2)
The minimum permissible attenuation level of any spurious emissions is 43 + 10 log (P) dB where transmitting power (P) in Watts.

TEST PROCEDURE

The RF output of the transmitter was connected to a spectrum analyzer through a calibrated coaxial cable. Sufficient scans were taken to show the out-of-band Emissions, if any, up to 10th harmonic. Multiple sweeps were recorded in maximum hold mode using a peak detector to ensure that the worst-case emissions were caught.
For each out of band emissions measurement:

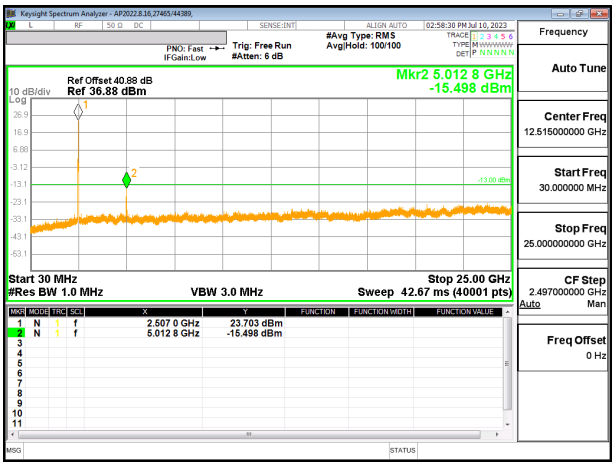
(i) Set display line at -13 dBm, according to the band Limit
(ii) Set RBW & VBW to 100 kHz for the measurement below 1 GHz, and 1 MHz for the measurement above 1 GHz. (NOTE: Worst case set RBW/VBW to 1MHz/3MHz)

RESULTS

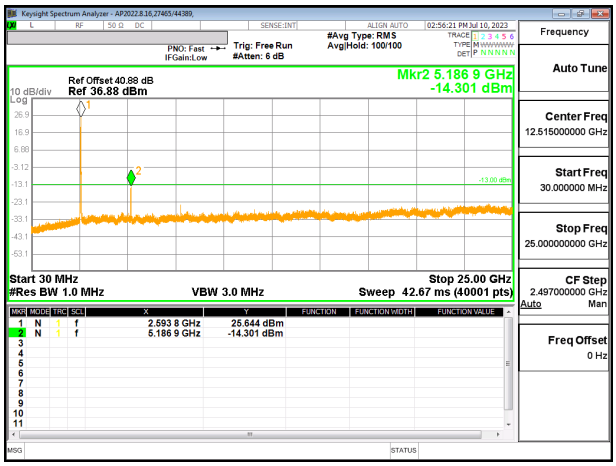
Note: Only Worst-Case antenna port is reported.

Test Engineer ID:	27465/44389	**Test Date:**	2023-07-10

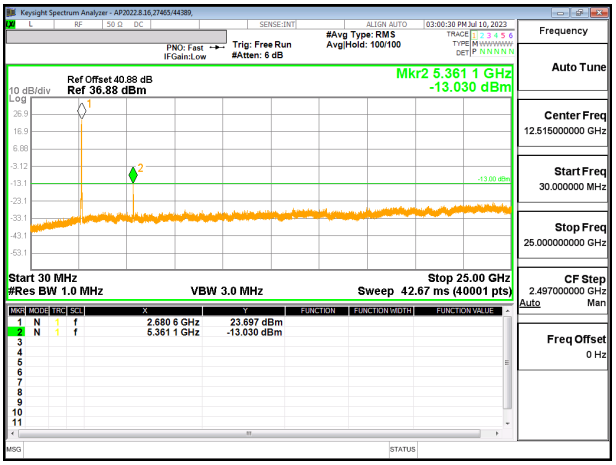
9.2.1. LTE41



LTE41 20MHz QPSK LOW Ch RB100-0



LTE41 20MHz QPSK MID Ch RB100-0



LTE41 20MHz QPSK HIGH Ch RB100-0

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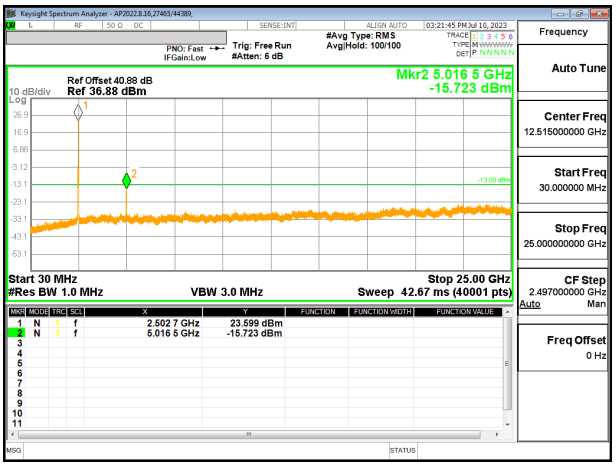
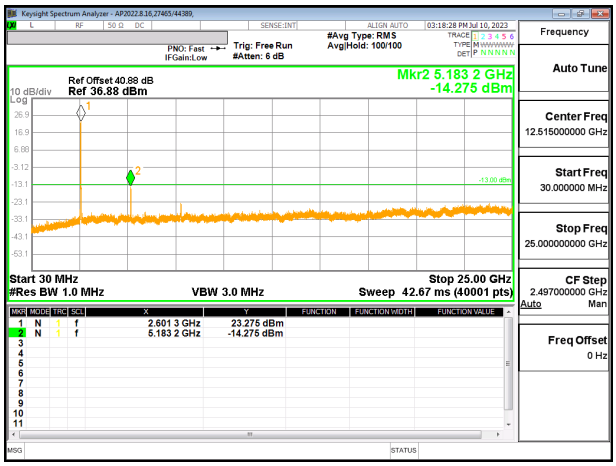
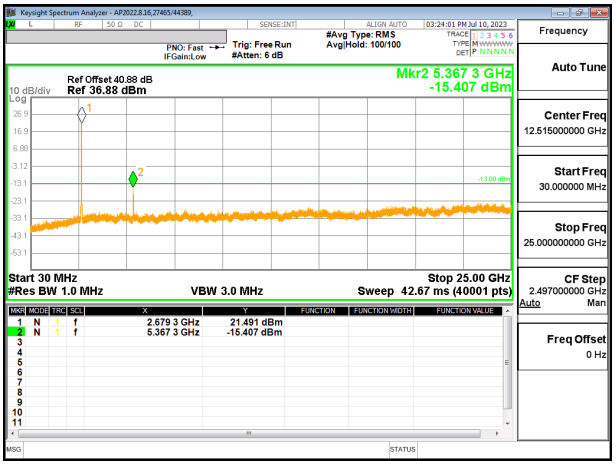
9.2.2. 5G n41



5G n41 20MHz QPSK LOW Ch RB51-0



5G n41 20MHz QPSK MID Ch RB51-0



5G n41 20MHz QPSK HIGH Ch RB51-0

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9.3. BAND EDGE AND EMISSION MASK

TEST PROCEDURE

The transmitter output was connected to a CMW500Test Set and configured to operate at maximum power. The band edge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.

For each band edge measurement:

(iii) Set the spectrum analyzer span to include the block edge frequency.
(iv) Set a marker to point the corresponding band edge frequency in each test case.
(v) Set display line at -13 dBm
(vi) Set resolution bandwidth to at least 1% of emission bandwidth.

TEST PROCEDURE (FCC LTE BAND 41)

FCC: §27.53 (m)(2)
The minimum permissible attenuation level of any spurious emissions is 43 + 10 log (P) dB where transmitting power (P) in Watts.

(m)(6) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed; for mobile digital stations, in the 1 megahertz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least two percent may be employed, except when the 1 megahertz band is 2495-2496 MHz, in which case a resolution bandwidth of at least one percent may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 megahertz or 1 percent of emission bandwidth, as specified; or 1 megahertz or 2 percent for mobile digital stations, except in the band 2495-2496 MHz). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power. With respect to television operations, measurements must be made of the separate visual and aural operating powers at sufficiently frequent intervals to ensure compliance with the rules.

RESULTS

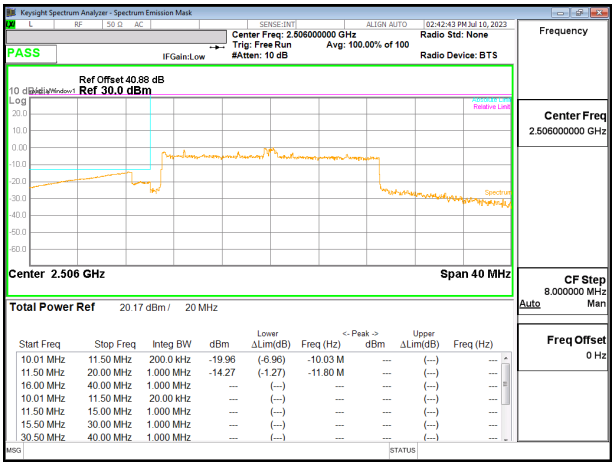
Note: Only worst-case antenna port is reported.

9.3.1. LTE41

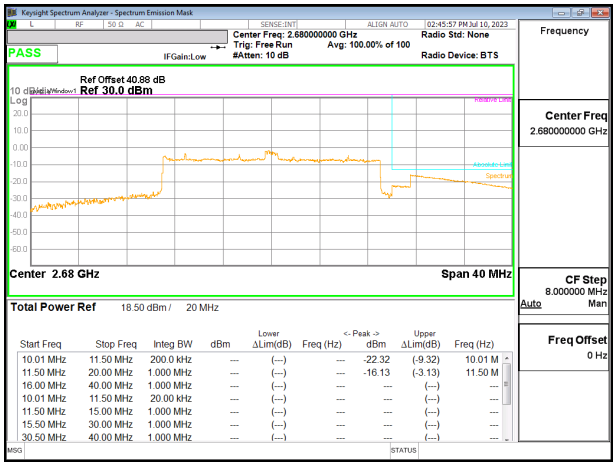
LIMITS

FCC: §27.53
(m)(2) For digital base stations, the attenuation shall be not less than 43 + 10 log (P) dB, unless a documented interference complaint is received from an adjacent channel licensee with an overlapping Geographic Service Area.

Test Engineer ID:	27465/44389	Test Date:	2023-07-10



LTE41 20MHz QPSK LOW Ch RB100-0



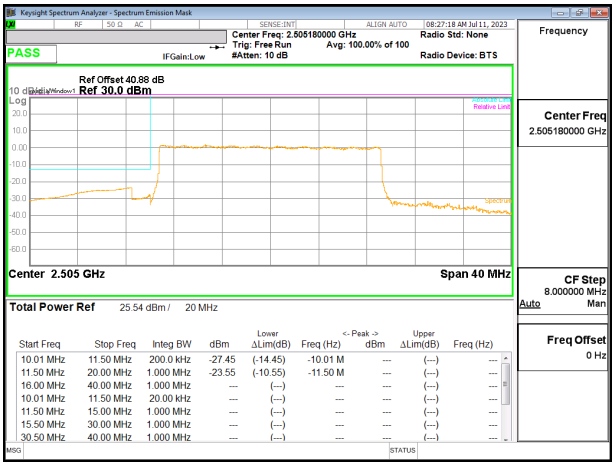
LTE41 20MHz QPSK HIGH Ch RB100-0

9.3.2. 5G n41

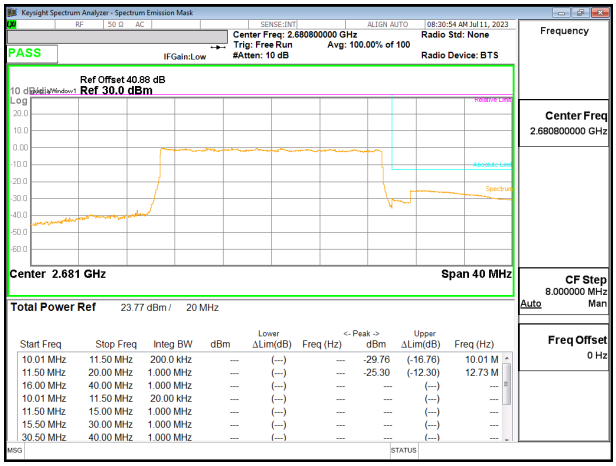
LIMITS

FCC: §27.53
(m)(2) For digital base stations, the attenuation shall be not less than 43 + 10 log (P) dB, unless a documented interference complaint is received from an adjacent channel licensee with an overlapping Geographic Service Area.

Test Engineer ID:	27465/44389	Test Date:	2023-07-11



5G n41 20MHz QPSK LOW Ch RB51-0



5G n41 20MHz QPSK HIGH Ch RB51-0

9.4. FREQUENCY STABILITY

TEST PROCEDURE

Use CMW 500 with Frequency Error measurement capability.
(vii) Temp. = 0°C to +50°C
(viii) Voltage = (85% - 115%)
Normal, 120VAC

Frequency Stability vs Temperature:
The EUT is place inside a temperature chamber. The temperature is set to 20ºC and allowed to stabilize. After sufficient soak time, the transmitting frequency error is measured. The temperature is increased by 10 degrees, allowed to stabilize, and soak, and then the measurement is repeated. This is repeated until +50ºC is reached.

Frequency Stability vs Voltage:
The peak frequency error is recorded (worst-case).

LIMITS

§27.54 Frequency stability.
The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

RESULTS

9.4.1. LTE41

Test Engineer ID:	27465/44389	Test Date:	2023-07-11

Band	41	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		2496	2690		N/A	
		Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Temperature	Voltage					
Normal (20°C)	Normal	2505.9876	2679.9928			
Extreme (50°C)		2505.9821	2679.9874	-5435	-2.096	Yes
Extreme (40°C)		2505.9767	2679.9819	-10863	-4.189	Yes
Extreme (30°C)		2505.9816	2679.9868	-5968	-2.302	Yes
Extreme (10°C)		2505.9776	2679.9828	-9979	-3.848	Yes
Extreme (0°C)		2505.9790	2679.9842	-8596	-3.315	Yes
20°C	15%	2505.9808	2679.9861	-6728	-2.595	Yes
	-15%	2505.9822	2679.9874	-5360	-2.067	Yes

9.4.2. 5G n41

Test Engineer ID:	27465/44389	Test Date:	2023-07-11

Band	41	Frequency Range		Frequency Error Reading (Hz)	Limit	
Condition		2496	2690		N/A	
		Freq Reading @ Low End (MHz)	Freq Reading @ High End (MHz)		Frequency Stability (ppm)	Within Authorized Frequency Block (Hz)
Temperature	Voltage					
Normal (20°C)	Normal	2505.1382	2680.7581			
Extreme (50°C)		2505.0935	2680.7133	-44723	-17.248	Yes
Extreme (40°C)		2505.0984	2680.7182	-39834	-15.362	Yes
Extreme (30°C)		2505.0957	2680.7155	-42533	-16.403	Yes
Extreme (10°C)		2505.0976	2680.7174	-40640	-15.673	Yes
Extreme (0°C)		2505.0972	2680.7170	-41058	-15.834	Yes
20°C	15%	2505.0952	2680.7150	-43019	-16.590	Yes
	-15%	2505.0942	2680.7140	-44092	-17.004	Yes

9.5. PEAK TO AVERAGE RATIO

LIMITS

FCC 27.50 (a)(1)(i)(B)

The peak-to-average power ratio (PAPR) of the transmitter output power must not exceed 13 dB. The PAPR measurements should be made using either an instrument with complementary cumulative distribution function (CCDF) capabilities to determine that PAPR will not exceed 13 dB for more than 0.1 percent of the time or other Commission approved procedure. The measurement must be performed using a signal corresponding to the highest PAPR expected during periods of continuous transmission.

RESULTS

9.5.1. LTE Band 41

LTE Band	Bandwidth (MHz)	Modulation	Channel	Frequency (MHz)	RF1 Port 1 Peak to Average Ratio (dB)	RF1 Port 2 Peak to Average Ratio (dB)	RF1 Port 3 Peak to Average Ratio (dB)	RF1 Port 4 Peak to Average Ratio (dB)	RF1 Port 5 Peak to Average Ratio (dB)	RF1 Port 6 Peak to Average Ratio (dB)
B41	20	QPSK	39750	2506	4.92	4.62	5.16	4.23	6.39	6.42
			40620	2593	4.63	4.67	5.14	5.11	6.11	6.48
			41490	2680	4.76	5.01	4.94	4.89	6.68	6.71

9.5.2. 5G n41

5G NR Band	SCS (kHz)	Bandwidth (MHz)	Modulation	Channel	Frequency (MHz)	RF1 Port 1 Peak to Average Ratio (dB)	RF1 Port 2 Peak to Average Ratio (dB)	RF1 Port 3 Peak to Average Ratio (dB)	RF1 Port 4 Peak to Average Ratio (dB)	RF1 Port 5 Peak to Average Ratio (dB)	RF1 Port 6 Peak to Average Ratio (dB)
n41	30	20	QPSK	501036	2505.18	8.25	8.80	8.43	8.39	12.44	11.95
				518430	2592.15	8.26	8.44	8.12	8.18	12.18	11.61
				536160	2680.8	9.13	9.80	8.18	8.23	12.64	11.68

10. RADIATED TEST RESULTS

Radiated measurement using the Field Strength Method

Using the test configuration shown in Figure 6 below, We measure the radiated emissions directly from the EUT and convert the measured field strength or received power to ERP or EIRP, as required, for comparison to the applicable limits. As stated in 5.5.1 of ANSI C63.26-2015, the field strength measurement method using a test site validated to the requirements of ANSI C63.4 is an alternative to the substitution measurement method.

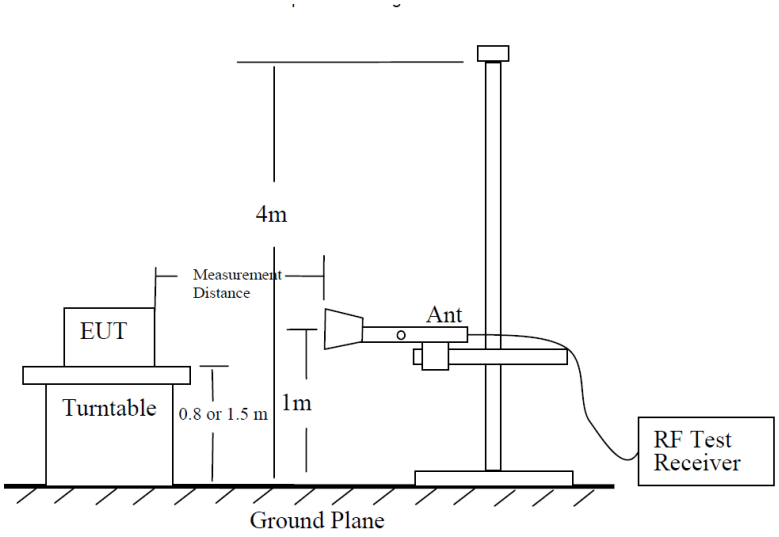


Figure 6—Test site-up for radiated ERP and/or EIRP measurements

Radiated Power Measurement Calculation According to ANSI C63.26-2015

a) E (dBμV/m) = Measured amplitude level (dBμV) + Cable Loss (dB) + Antenna Factor (dB/m).

b) E (dBμV/m) = Measured amplitude level (dBm) + 107 + Cable Loss (dB) + Antenna Factor (dB/m).

c) E (dBμV/m) = EIRP (dBm) − 20log(D) + 104.8; where D is the measurement distance (in the far field region) in m.

d) EIRP (dBm) = E (dBμV/m) + 20log(D) − 104.8; where D is the measurement distance (in the far field region) in m.

So, from d)

The measuring distance is usually at 3m, then 20*Log(3)=9.5424

Then, EIRP (dBm) = E (dBμV/m) + 9.5424 − 104.8 = E (dBμV/m) – 95.2576

Note: Confidence check of each chamber is performed daily to see if any degradation from expected/normal reading reference data. Ambient check of each chamber is performed monthly.

10.1. FIELD STRENGTH OF SPURIOUS RADIATION, ABOVE 1GHz

TEST PROCEDURE

KDB 971168 D01 v03r01/D02 v02/r01

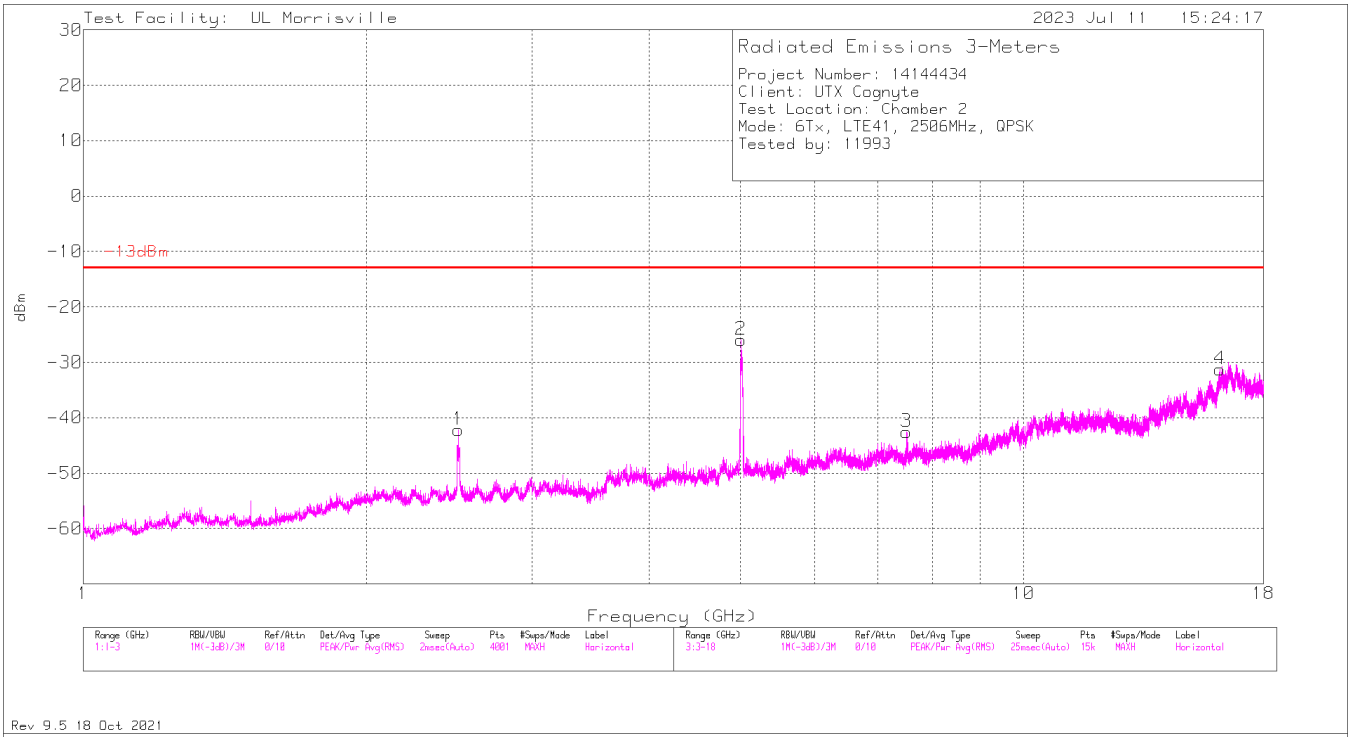
All tests above 1GHz were done with a Resolution Bandwidth of 1MHz, and a Video Bandwidth of 3MHz

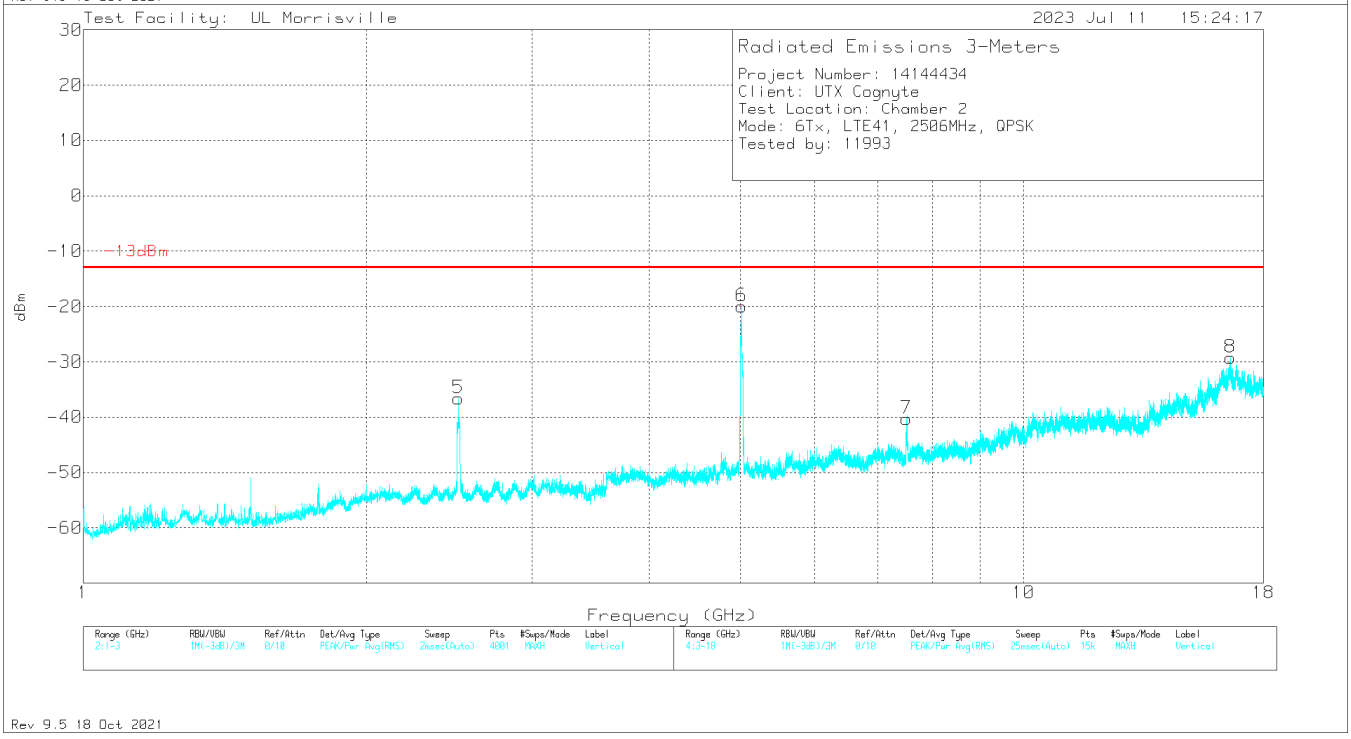
RESULTS

10.1.1. LTE BAND 41

FCC: §27.53 (m)(2)
The minimum permissible attenuation level of any spurious emissions is 43 + 10 log (P) dB where transmitting power (P) in Watts.

QPSK LTE41(20MHz, Low Channel)



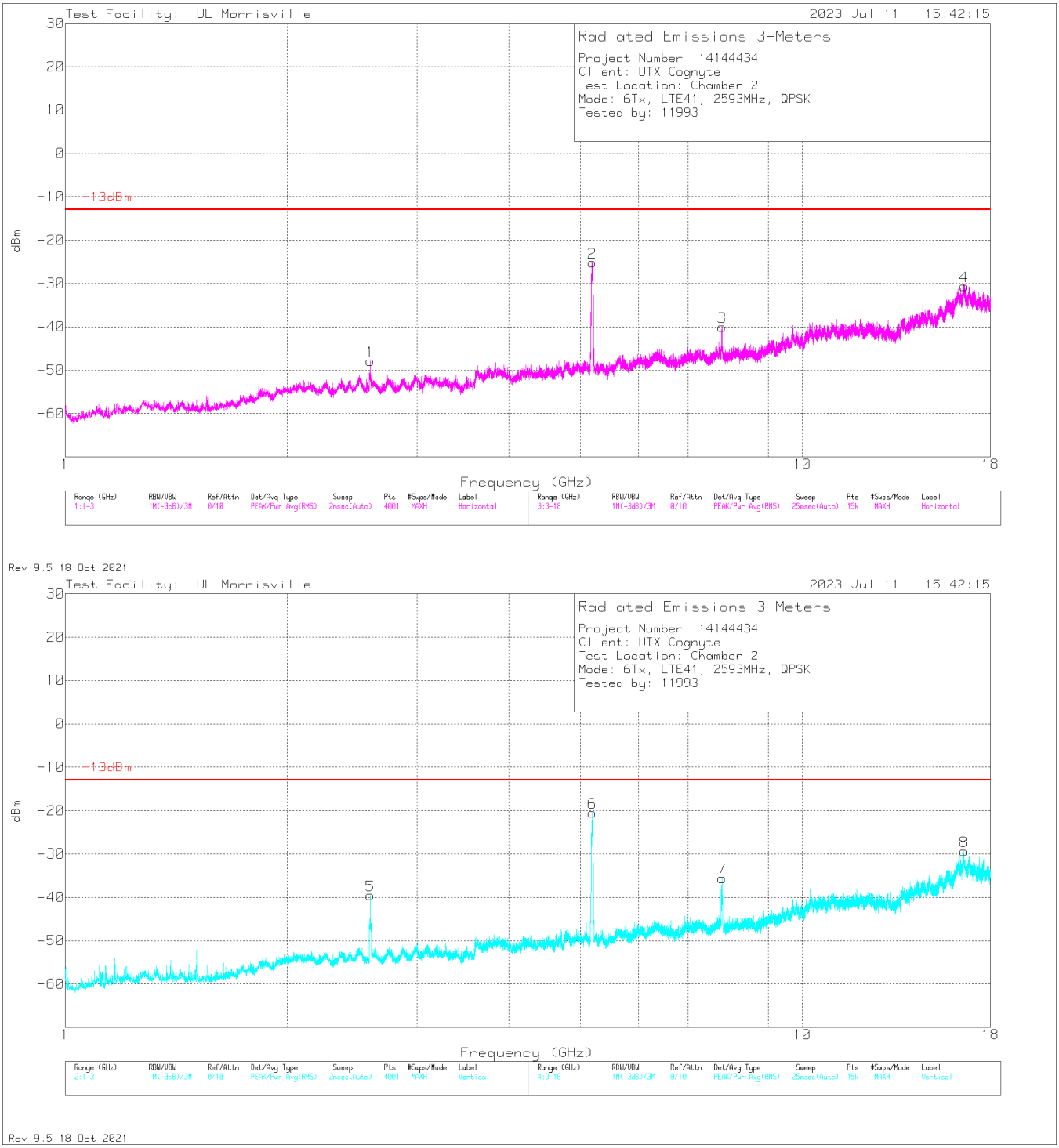


Marker	Frequency (GHz)	Meter Reading (dBm)	Det	88761 (dB/m)	Gain/Loss (dB)	CF (dB)	Filter (dB)	Corrected Reading dBm	-13dBm	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2.507 (DL)	-53.83	Pk	32.4	-33.8	11.8	1.2	-42.23	-	-	0-360	300	H
5	2.5075 (DL)	-48.26	Pk	32.4	-33.8	11.8	1.2	-36.66	-	-	0-360	200	V
2	5.01	-41.5	Pk	34	-30.6	11.8	.3	-26	-13	-13	0-360	300	H
6	5.012	-35.51	Pk	34	-30.6	11.8	.3	-20.01	-13	-7.01	0-360	199	V
7	7.503	-60.88	Pk	35.6	-27.2	11.8	.4	-40.28	-13	-27.28	0-360	199	V
3	7.508	-63.48	Pk	35.6	-26.9	11.8	.4	-42.58	-13	-29.58	0-360	200	H
4	16.181	-65.48	Pk	40.8	-19.3	11.8	.9	-31.28	-13	-18.28	0-360	101	H
8	16.594	-65.71	Pk	41.4	-17.9	11.8	1.2	-29.21	-13	-16.21	0-360	101	V

Pk - Peak detector

DL – EUT Downlink

QPSK LTE41(20MHz, Mid Channel)

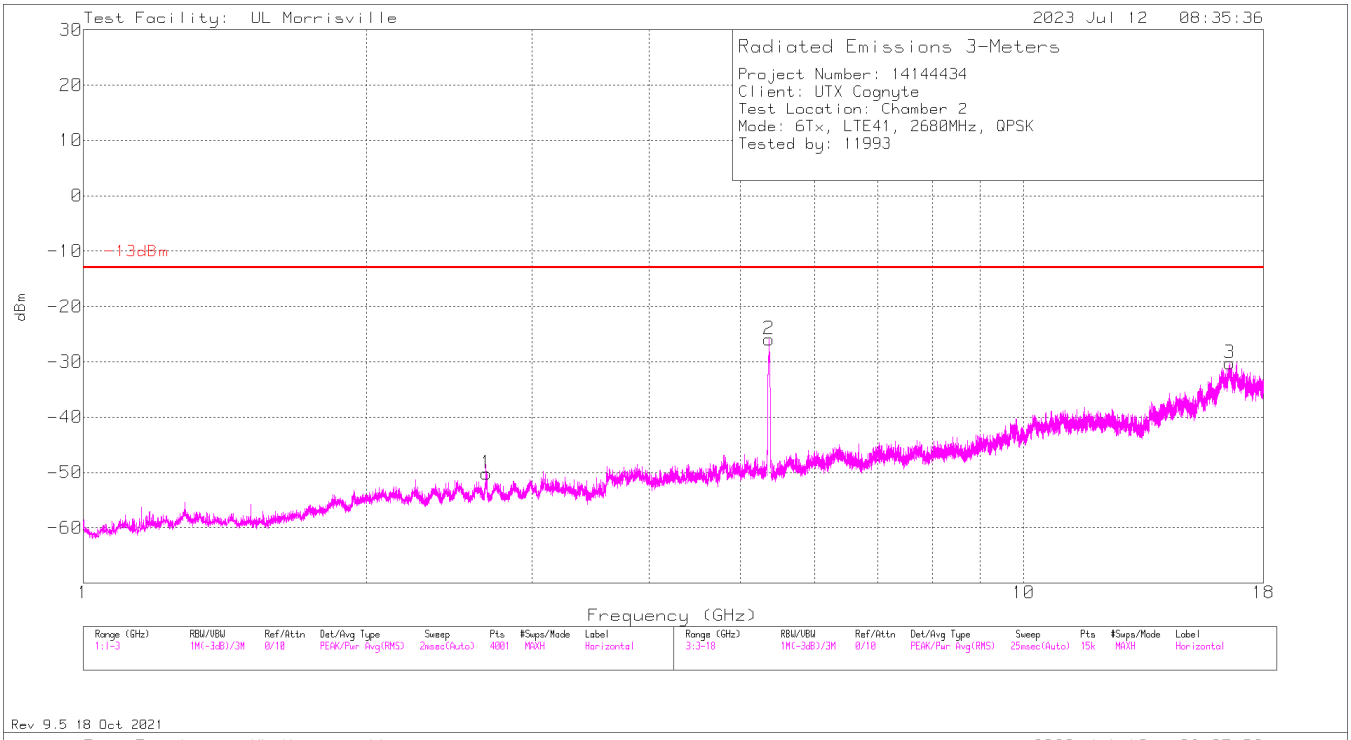


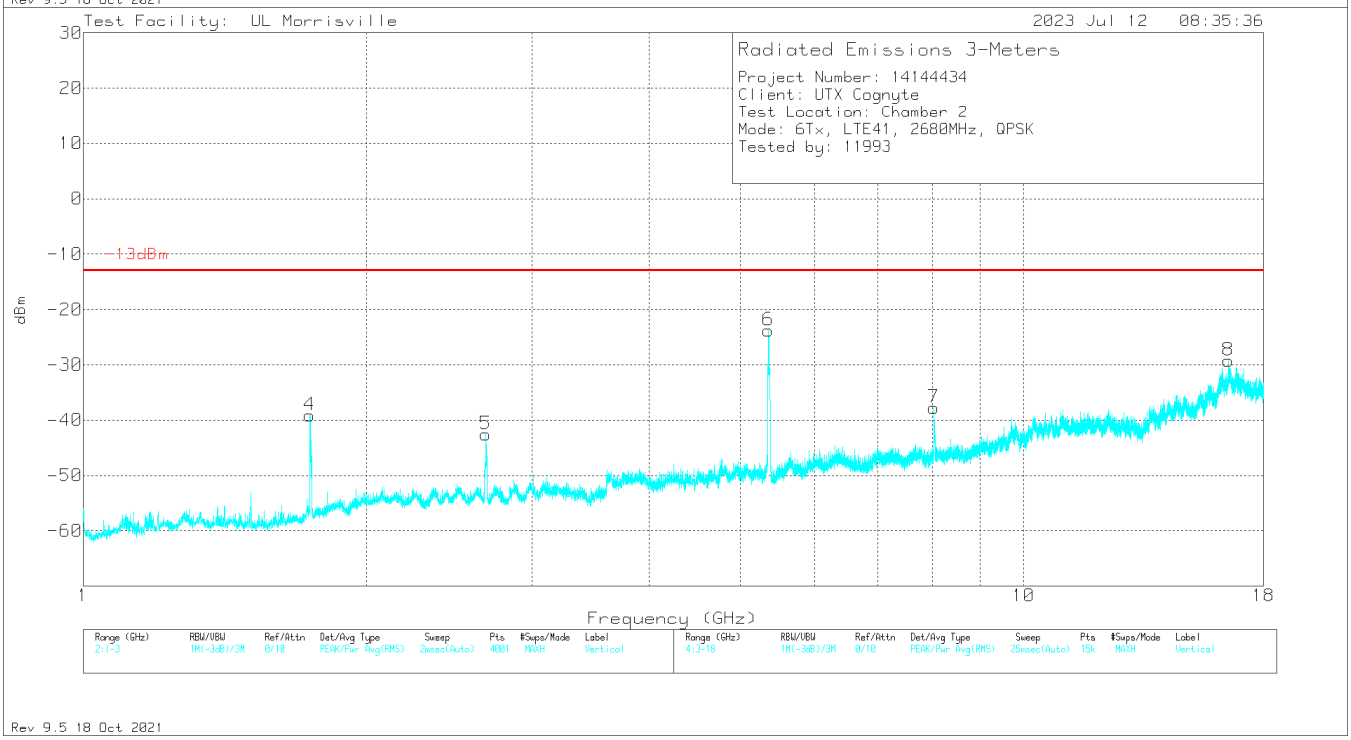
Marker	Frequency (GHz)	Meter Reading (dBm)	Det	88761 (dB/m)	Gain/Loss (dB)	CF (dB)	Filter (dB)	Corrected Reading dBm	-13dBm	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
5	2.594 (DL)	-50.86	Pk	32.1	-33.8	11.8	1.2	-39.56	-	-	0-360	200	V
1	2.5945 (DL)	-59.15	Pk	32.1	-33.8	11.8	1.2	-47.85	-	-	0-360	100	H
6	5.187	-36.63	Pk	34.1	-30.5	11.8	.8	-20.43	-13	-7.43	0-360	300	V
2	5.188	-41.35	Pk	34.1	-30.5	11.8	.8	-25.15	-13	-12.15	0-360	300	H
7	7.779	-57.25	Pk	35.8	-26.3	11.8	.4	-35.55	-13	-22.55	0-360	300	V
3	7.783	-61.7	Pk	35.8	-26.3	11.8	.4	-40	-13	-27	0-360	199	H
4	16.564	-67.09	Pk	41.3	-18.1	11.8	1.4	-30.69	-13	-17.69	0-360	199	H
8	16.577	-65.49	Pk	41.4	-18.4	11.8	1.3	-29.39	-13	-16.39	0-360	300	V

Pk - Peak detector

DL – EUT Downlink

QPSK LTE41(20MHz, High Channel)





Marker	Frequency (GHz)	Meter Reading (dBm)	Det	88761 (dB/m)	Gain/Loss (dB)	CF (dB)	Filter (dB)	Corrected Reading dBm	-13dBm	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	1.7425	-46.66	Pk	29.3	-34.4	11.8	.8	-39.16	-13	-26.16	0-360	200	V
5	2.6815 (DL)	-54.02	Pk	32.2	-33.8	11.8	1.2	-42.62	-	-	0-360	200	V
1	2.682 (DL)	-61.55	Pk	32.2	-33.8	11.8	1.2	-50.15	-	-	0-360	300	H
6	5.353	-42.03	Pk	34.3	-28.6	11.8	.8	-23.73	-13	-10.73	0-360	299	V
2	5.361	-44.06	Pk	34.3	-28.8	11.8	.8	-25.96	-13	-12.96	0-360	101	H
7	8.029	-59.28	Pk	35.8	-26.5	11.8	.4	-37.78	-13	-24.78	0-360	200	V
8	16.52	-65.39	Pk	41.2	-18.1	11.8	1.2	-29.29	-13	-16.29	0-360	200	V
3	16.577	-66.34	Pk	41.4	-18.4	11.8	1.3	-30.24	-13	-17.24	0-360	101	H

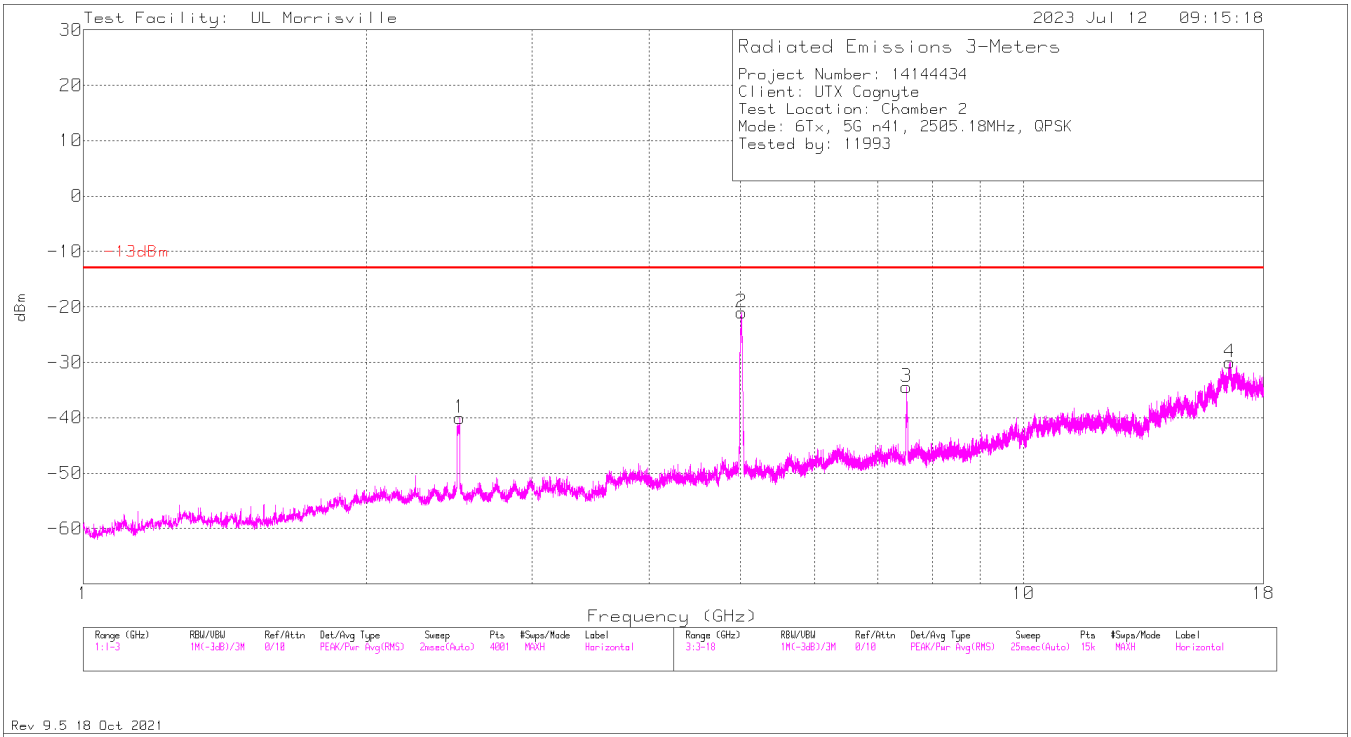
Pk - Peak detector

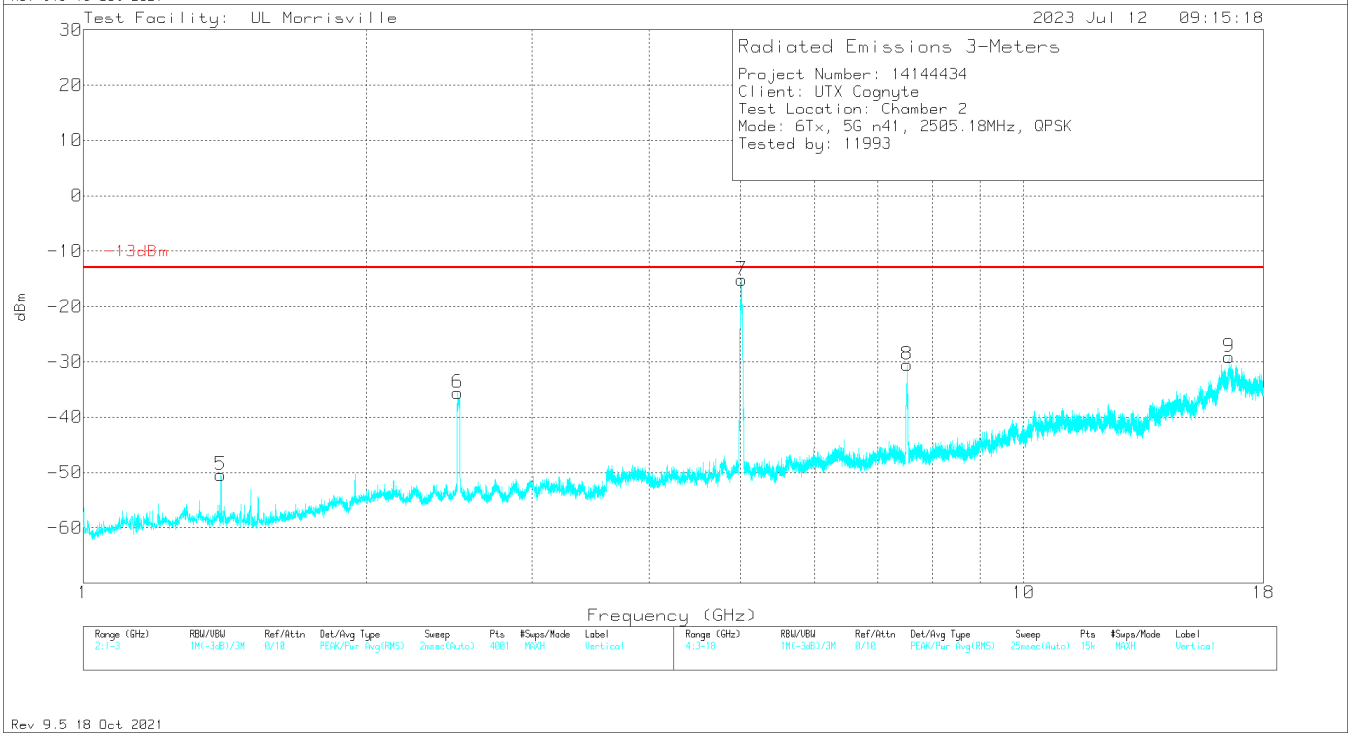
DL – EUT Downlink

10.1.2. 5G n41

FCC: §27.53 (m)(2)
The minimum permissible attenuation level of any spurious emissions is 43 + 10 log (P) dB where transmitting power (P) in Watts.

QPSK n41(20MHz, Low Channel)



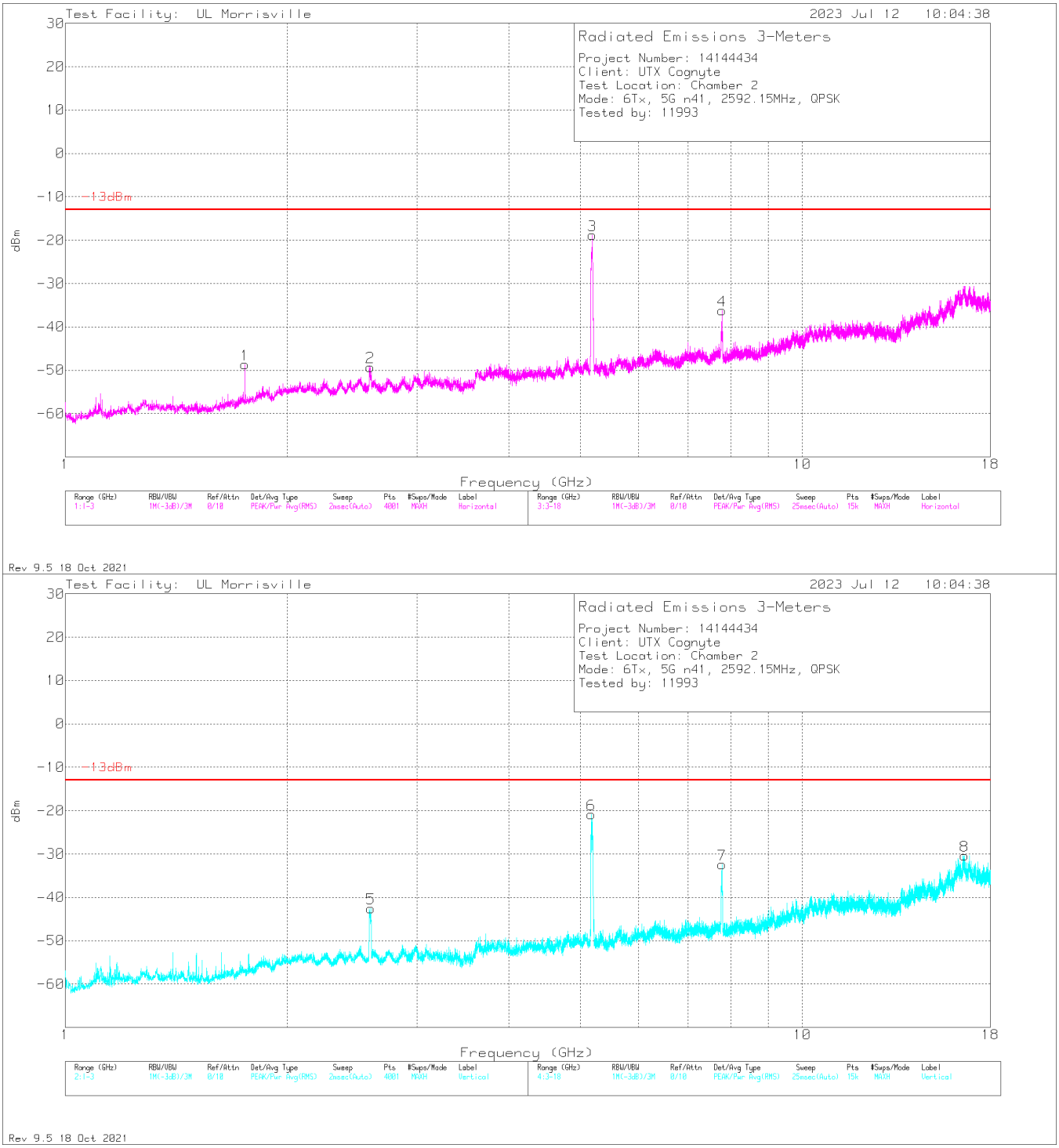


Marker	Frequency (GHz)	Meter Reading (dBm)	Det	88761 (dB/m)	Gain/Loss (dB)	CF (dB)	Filter (dB)	Corrected Reading dBm	-13dBm	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
5	1.401	-56	Pk	28.2	-34.9	11.8	.4	-50.5	-13	-37.5	0-360	101	V
6	2.503 (DL)	-47.08	Pk	32.4	-33.9	11.8	1.2	-35.58	-	-	0-360	200	V
1	2.514 (DL)	-51.88	Pk	32.4	-33.6	11.8	1.2	-40.08	-	-	0-360	399	H
7	5.01178	-29.75	Pk	34	-30.6	11.8	.3	-14.25	-13	-1.25	212	341	V
2	5.016	-36.58	Pk	34	-30.6	11.8	.4	-20.98	-13	-7.98	0-360	300	H
3	7.515	-55.27	Pk	35.6	-27	11.8	.4	-34.47	-13	-21.47	0-360	300	H
8	7.525	-51.2	Pk	35.6	-27.1	11.8	.4	-30.5	-13	-17.5	0-360	101	V
9	16.549	-65.28	Pk	41.3	-18.2	11.8	1.3	-29.08	-13	-16.08	0-360	101	V
4	16.571	-66.17	Pk	41.3	-18.3	11.8	1.4	-29.97	-13	-16.97	0-360	300	H

Pk - Peak detector

DL – EUT Downlink

QPSK n41(20MHz, Mid Channel)

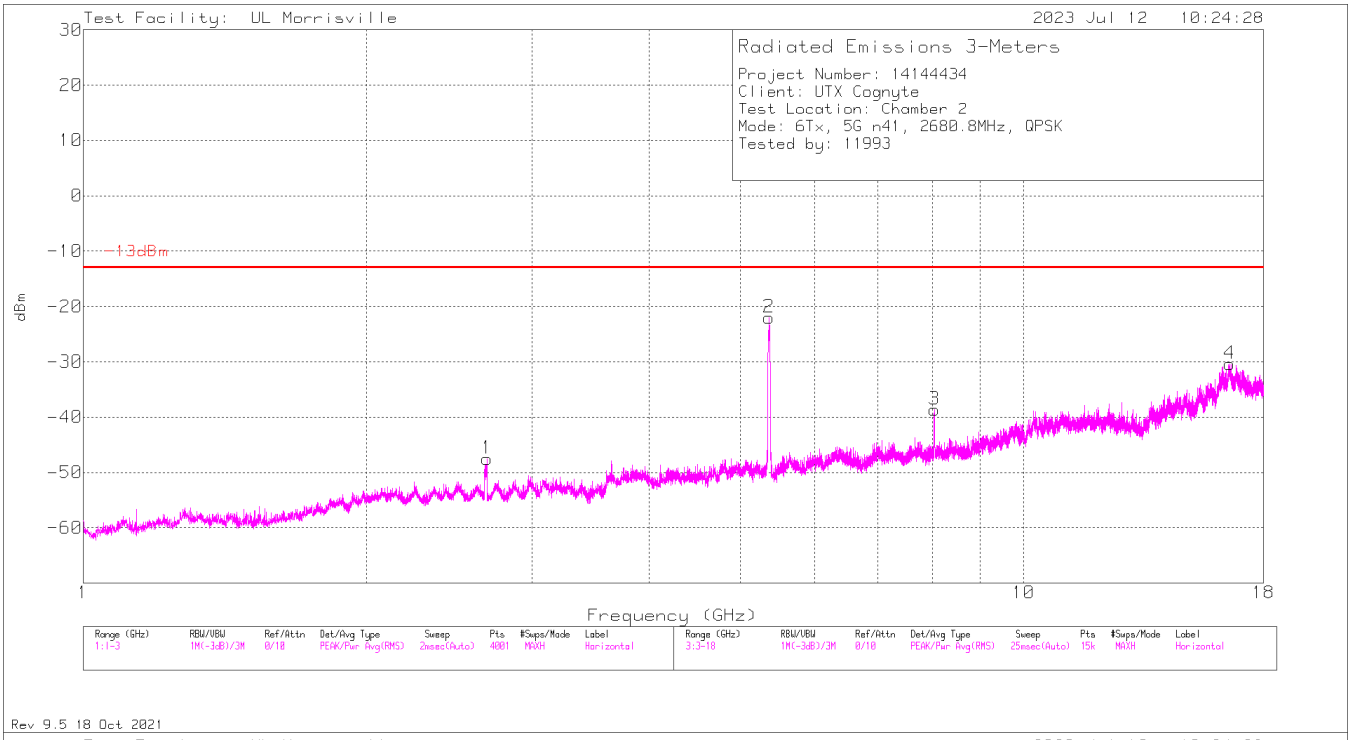


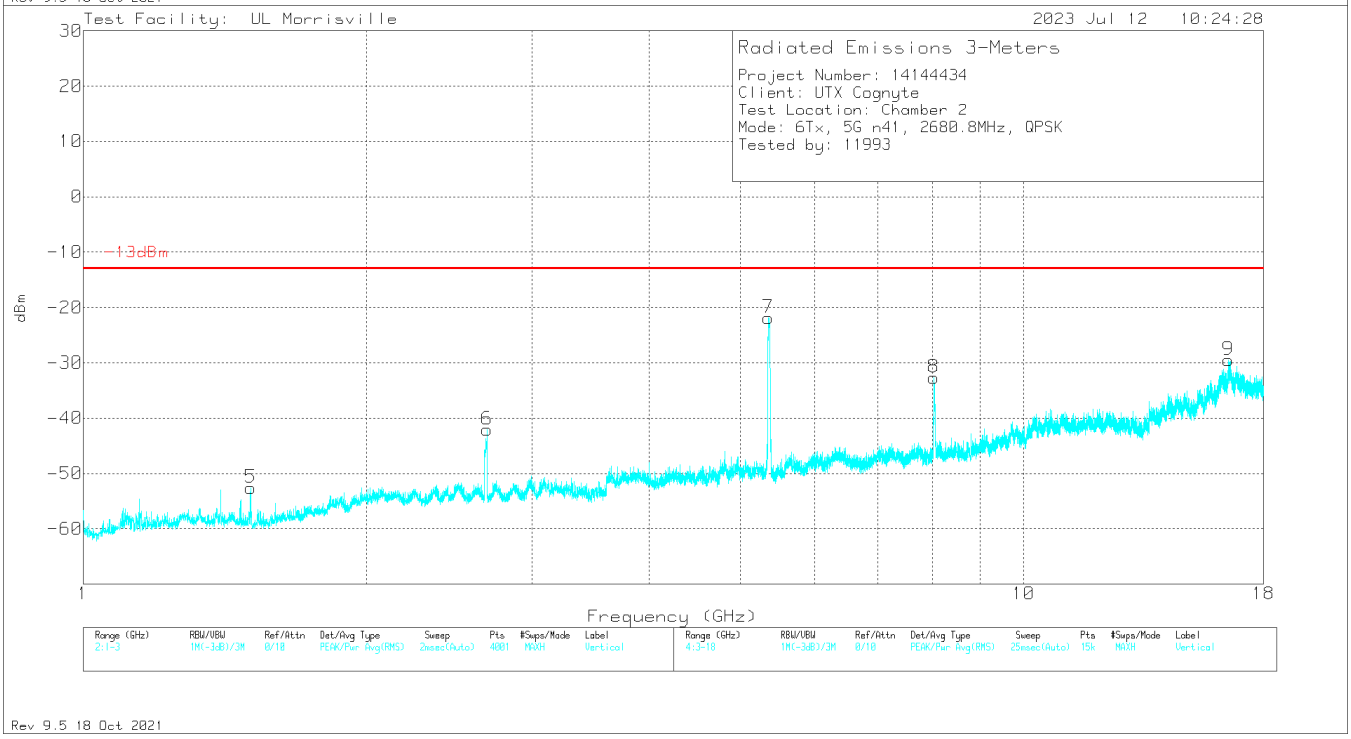
Marker	Frequency (GHz)	Meter Reading (dBm)	Det	88761 (dB/m)	Gain/Loss (dB)	CF (dB)	Filter (dB)	Corrected Reading dBm	-13dBm	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.753	-56.16	Pk	29.4	-34.5	11.8	.8	-48.66	-13	-35.66	0-360	101	H
2(DL)	2.5935	-60.54	Pk	32.1	-33.8	11.8	1.2	-49.24	-	-	0-360	299	H
5(DL)	2.596	-53.71	Pk	32.1	-33.9	11.8	1.2	-42.51	-	-	0-360	199	V
6	5.177	-36.81	Pk	34.1	-30.6	11.8	.7	-20.81	-13	-7.81	0-360	199	V
3	5.18964	-31.99	Pk	34.1	-30.4	11.8	.8	-15.69	-13	-2.69	200	304	H
4	7.782	-57.92	Pk	35.8	-26.3	11.8	.4	-36.22	-13	-23.22	0-360	300	H
7	7.783	-54.1	Pk	35.8	-26.3	11.8	.4	-32.4	-13	-19.4	0-360	199	V
8	16.605	-66.44	Pk	41.4	-18.3	11.8	1.1	-30.44	-13	-17.44	0-360	199	V

Pk - Peak detector

DL – EUT Downlink

QPSK n41(20MHz, High Channel)





Marker	Frequency (GHz)	Meter Reading (dBm)	Det	88761 (dB/m)	Gain/Loss (dB)	CF (dB)	Filter (dB)	Corrected Reading dBm	-13dBm	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
5	1.506	-58.02	Pk	27.8	-34.7	11.8	.5	-52.62	-13	-39.62	0-360	101	V
1	2.6885 (DL)	-58.78	Pk	32.1	-33.8	11.8	1.2	-47.48	-	-	0-360	101	H
6	2.689 (DL)	-53.37	Pk	32.1	-33.8	11.8	1.2	-42.07	-	-	0-360	199	V
7	5.357	-40.07	Pk	34.3	-28.7	11.8	.8	-21.87	-13	-8.87	0-360	300	V
2	5.367	-39.99	Pk	34.3	-28.9	11.8	.8	-21.99	-13	-8.99	0-360	101	H
8	8.032	-54.27	Pk	35.8	-26.4	11.8	.4	-32.67	-13	-19.67	0-360	200	V
3	8.04	-59.99	Pk	35.8	-26.7	11.8	.4	-38.69	-13	-25.69	0-360	101	H
9	16.518	-65.33	Pk	41.2	-18.3	11.8	1.1	-29.53	-13	-16.53	0-360	200	V
4	16.576	-66.53	Pk	41.4	-18.4	11.8	1.3	-30.43	-13	-17.43	0-360	300	H

Pk - Peak detector
DL – EUT Downlink

10.2. WORST CASE EMISSIONS

RULE PART(S)
FCC: §2.1053, §27.53.

LIMITS
FCC: §27.53 (m)(2)
The minimum permissible attenuation level of any spurious emissions is 43 + 10 log (P) dB where transmitting power (P) in Watts.

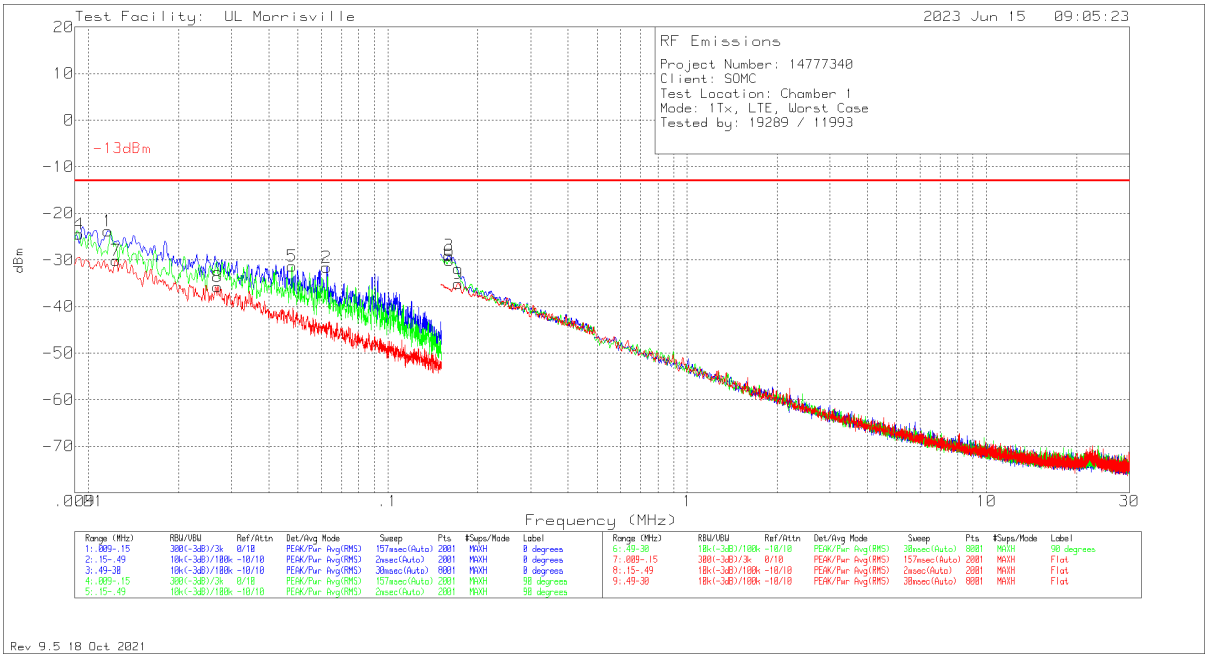
TEST PROCEDURE
KDB 971168 D01 v02r02/D02 v01

RESULTS

Note2: Only Test data with emissions <20dB from the limit are reported.

10.2.1. Worst-Case Emissions for LTE B41

Spurious below 30MHz



Marker	Frequency (MHz)	Meter Reading (dBm)	Det	135144 (dB/m)	Gain/Loss (dB)	Conversion Factor (dB)	Corrected Reading dBm	-13dBm	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Loop Angle
4	.00928	-56.17	Pk	19.8	.1	11.8	-24.47	-13	-11.47	0-360	404	90 degs
1	.01163	-54.24	Pk	18.6	.1	11.8	-23.74	-13	-10.74	0-360	404	0 degs
7	.01234	-60.31	Pk	18.3	.1	11.8	-30.11	-13	-17.11	0-360	404	Flat
8	.02703	-62.01	Pk	14.4	.1	11.8	-35.71	-13	-22.71	0-360	404	Flat
5	.04791	-56.02	Pk	12.8	.1	11.8	-31.32	-13	-18.32	0-360	404	90 degs
2	.06253	-55.91	Pk	12.4	.1	11.8	-31.61	-13	-18.61	0-360	404	0 degs
3	.15995	-53.08	Pk	12.2	.1	11.8	-28.98	-13	-15.98	0-360	404	0 degs
6	.16037	-54.24	Pk	12.2	.1	11.8	-30.14	-13	-17.14	0-360	404	90 degs
9	.17159	-59.13	Pk	12.2	.1	11.8	-35.03	-13	-22.03	0-360	404	Flat

Pk - Peak detector

11. SETUP PHOTOS

See R14777340-EP9 for Setup Photos.

END OF REPORT